

6. MID-TERM ACTION PLAN

6.1 Overall Plan on Operation of the Anzali Wetland Management Committee

In this chapter, concrete plan for implementing necessary actions and activities by various stakeholders for different aspects and subjects of the Anzali Wetland are described based on the current status and mid-term goals and objectives for ten years between 2020 and 2030 after finishing the plan period of the master plan and completing the Anzali Wetland Ecological Management Project - Phase II (Phase II Project), mentioned in the previous chapters.

In the first section, operation of the AWMC is mentioned, which is indispensable intuitional system to realize the necessary actions and activities through the integrated management with coordination among various stakeholders. After the first section, the mid-term action plans for different aspects and subjects are explained.

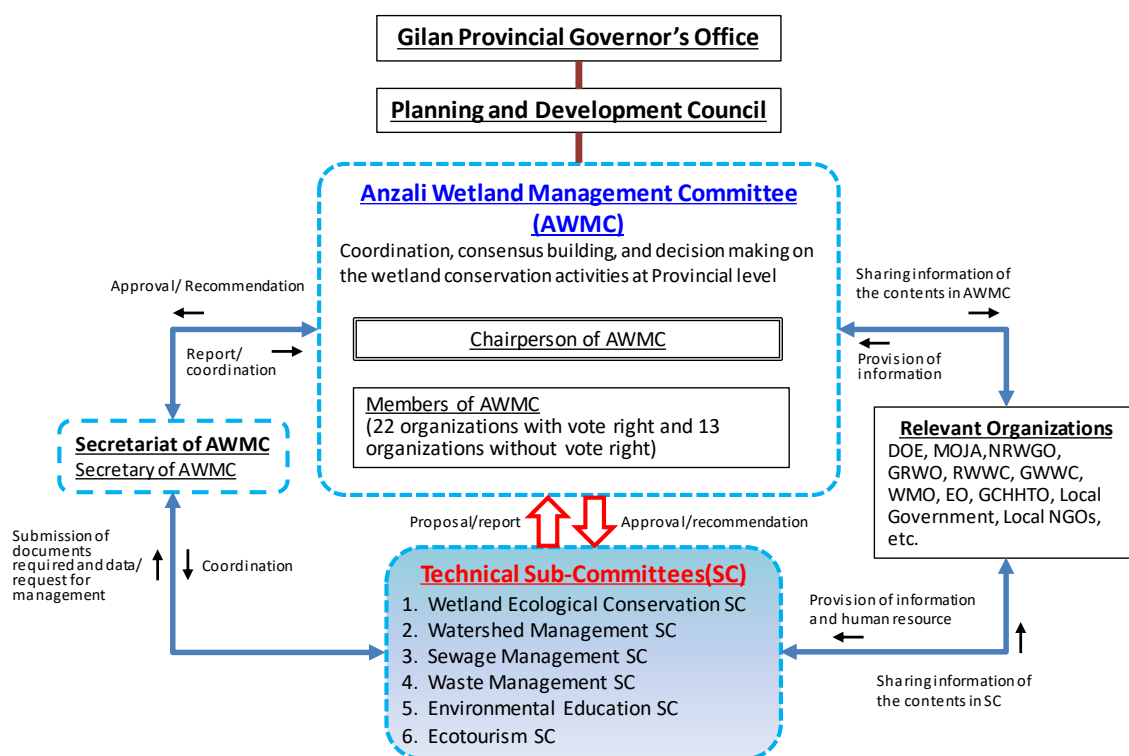
6.1.1 Current Status on AWMC

After establishment of the AWMC in 2011 based on the provincial decree which was prepared and legalized with support under the Phase I Project, the AWMC was not operated well though the framework of the AWMC is considered necessary to realize the integrated management and conservation of the Anzali Wetland with adequate coordination among various stakeholders related to the Anzali Wetland. To improve such situation, Phase II Project has been implemented to enhance capacity of the AWMC operation as one of the project outcome. Structure of the AWMC is shown in Figure 6.1-1.

In the 1st year of the project, the activities started out smoothly during May to June 2014 by establishing the Technical Sub-committees (SCs) and assigning personnel from the counterpart organizations. This is mainly because the Provincial Governor's office put the project a high priority and instructed relevant governmental organizations to engage in the project.

Six technical sub-committee under the AWMC (SCs) were established to discuss technical issues and measures on six main subject areas on conservation of the Anzali Wetland; 1) Wetland ecosystem conservation, 2) Watershed management, 3) Sewage management, 4) Waste management, 5) Ecotourism, and 6) Environmental education. SC member organizations were officially designated by the Gilan Provincial Governor's Office as shown in Table 6.1-1. One or two personnel was/were appointed from the SC member organizations.

Under the Wetland Ecosystem Conservation SC, three working groups (WGs) were established since different organizations are involved in three major subjects in the SC; 1) Wetland Conservation and Restoration WG, 2) Monitoring WG, and 3) Environmental Zoning and Land Use Management WG as shown in Table 6.1-2.



Source: JICA Expert Team

Figure 6.1-1 Structure of the AWMC

Table 6.1-1 Member Organizations of the Technical Sub-committees

Name of SC	Member Organization
(1) Wetland Ecosystem Conservation SC	1) DOE Gilan, 2) MOJA Gilan, 3) Shilat (Fishery Organization), 4) National Inland Water and Aquaculture Institute (NIWAI), 5) Port and Maritime Organizations (PMO), 6) Gilan Regional Water Corporation (GRWC), 7) Gilan Water and Wastewater Corporation (GWWC), 8) Rural Water and Wastewater Corporation (RWWC), 9) Natural Resources and Watershed Management Office (NRWGO), 10) Housing Foundation, 11) Documents and Property Registry Office, 12) Road and Urban Planning Organization, 13) Gilan Cultural Heritage, Handicraft, and Tourism Organization (GCHHTO), 14) Municipalities, 15) Ab-bandan Owners Union, 16) Scientist related to wetland ecosystem, 17) NGOs
(2) Watershed Management SC	1) DOE Gilan, 2) NRWGO, 3) GRWC, 4) MOJA Gilan, 5) Metrological Organization (MO)
(3) Sewage Management SC	1) DOE Gilan, 2) GWWC, 3) RWWC
(4) Solid Waste Management SC	1) DOE Gilan, 2) Gilan WMO, 3) Rural Affairs Office
(5) Ecotourism SC	1) DOE Gilan, 2) GCHHTO
(6) Environmental Education SC	1) DOE Gilan, 2) Gilan Educational Organization (EO Gilan)

Note: Underlined organizations are responsible organizations for each SC.

Source: JICA Expert Team

Table 6.1-2 Working Group under the Wetland Ecosystem Conservation SC

Working Groups	1) Wetland Conservation and Restoration WG	2) Monitoring WG (Water and Ecological Management)	3) Environmental Zoning and Land Use Management WG
(1) DOE Gilan	✓	✓	✓
(2) MOJA Gilan	✓	-	✓
(3) Shilat (Fishery Organization)	✓	-	✓
(4) NIWAI	✓	-	-
(5) PMO	-	✓	
(6) GRWC	-	✓	✓
(7) GWWC	-	✓	-
(8) RWWC	-	✓	-
(9) NRWGO	-	-	✓
(10) Housing foundation	-	-	✓
(11) Documents and Property Registry Office	-	-	✓
(12) Road and Urban Planning Organization	-	-	✓
(13) GCHHTO	-	-	✓
(14) Municipalities	-	-	✓
(15) Ab-bandan Owners Union	-	-	✓
(16) Scientist related to wetland ecosystem	✓	✓	✓
(17) NGOs	✓	-	-

Source: JICA Expert Team

During the Phase II Project, thanks to understanding and efforts of the former Deputy Provincial Governor as acting chairperson of the AWMC, the AWMC meetings have been held more often from the 1st year of the project to 4th year of the project. In addition, it was reminded by the former Deputy Provincial Governor to the AWMC member organizations that all the issued, subjects, and activities related to the Anzali Wetland should be examined well under the respective technical sub-committees of the AWMC. Though it seems that the AWMC meeting has been improved for its operation with member organizations, AWMC meeting has not been organized after the former Deputy Provincial Governor retired. In addition, SCs actively worked during the Phase II Project, especially in implementing the Joint Pilot Activities, it seems no arrangement be made to hold the SC meeting anymore after finishing the Phase II Project, though necessary conservation actions and activities need to continuously be examined and implemented.

6.1.2 Long Term Target

Long term target for the integrated management of the Anzali Wetland is that all the decision making be made only under the Anzali Wetland Management Committee on conservation and wise-use subjects of the Anzali Wetland after examining such subjects by the respective Technical Sub-committees with attendance of relevant stakeholders from governmental organizations and residents and users of the Anzali Wetland.

6.1.3 Mid-term target

As a mid-term target, the AWMC meeting should be held at least once three months which are stipulated in the Provincial Decree on the AWMC. In the AWMC meeting, implementation status of the Mid-term Plan is required to be reported from all the SCs as well as any issues on the Anzali Wetland, which are found after the previous AWMC meeting.

6.1.4 Issues and Requirements

- (1) Establishment of New Section or Appointment of Staff in charge of the Wetland Conservation under the DOE Gilan

Currently, there is no specific section and/or personnel in charge of the wetland conservation, including that for the Anzali Wetland, under DOE Gilan office, though it was continuously suggested by the JICA Expert Team during the project. Therefore, each issue on the wetland has individually been tackled on a day-to-day basis ununiformly without coordination and accumulation of the knowledge and experience. Under such situation, the AWMC meeting is usually arranged several days before, even one day of the meeting by DOE Gilan as secretariat of the AWMC, without any systematic way.

Thus, there is no institutional structure to implement the comprehensive wetland conservation. Under such situation, Establishment of a specific section for the wetland conservation in DOE Gilan should be discussed between DOE HQ and DOE Gilan office, including preparation of legal document which appoint and define mandate of such wetland conservation section and/or personnel in charge of the wetland conservation with securing necessary budget for operation.

Technical support and instruction from the Wetland Ecosystem Office of DOE HQ to DOE Gilan is required.

- (2) Systematic Arrangement of the AWMC Meeting by Secretariat of AWMC

In addition to the institutional issue above on the DOE Gilan as AWMC Secretariat, there is no systematic procedure to hold the AWMC meeting. It is recommended to introduce some templates which can be utilised not only the secretariat of the AWMC, but also member organizations of the AWMC. Some example of the templates to be utilised are shown below.

Table 6.1-3 Suggested Template (1) for Mandate of the Technical Sub-committee

Anzali Wetland Management Committee	
Form No. XX: Budget Request for Sub-committee	
Role and Responsibility for Sub-committee	
Date	
Name of Sub-committee	
Main role of the SC	
Responsibility of the SC	
Activities under the SC	
Core members	
Role and responsibility of the SC members	(1) Member 1 (2) Member 2 (3) Member 3

Source: JICA Expert Team

Table 6.1-4 Suggested Template (2) for Proposal on Conservation Activity of the Anzali Wetland

Anzali Wetland Management Committee	
Form No. XX: Proposal by Sub-committee	
Proposal by Sub-committee	
Date of the proposal	
Name of Sub-committee	
Title of the proposal	
Objective of the proposal	
Summary of the proposal	
Location	(map to be attached)
Timeframe	
Cost	Total (Breakdown of the cost shall be attached.)
Possible source of budget	
Responsible body	
Implementation body	
Effect to Anzali Wetland conservation	
Environmental impact	
Economic impact	

Source: JICA Expert Team

Table 6.1-5 Suggested Template (3) for Budget Request Application for Sub-Committee

Anzali Wetland Management Committee	
Form No. XX: Budget Request for Sub-committee	
Budget Request Application for Sub-committee	
Date	
Name of Sub-committee	
Name of Proposed Activity	
Outline of Implementation Plan	
Breakdown of Annual Expenses	

Source: JICA Expert Team

6.2 Wetland Ecosystem Conservation

6.2.1 Current Situation

Current situation of the ecosystem of the Anzali Wetland is described in Chapter 3.

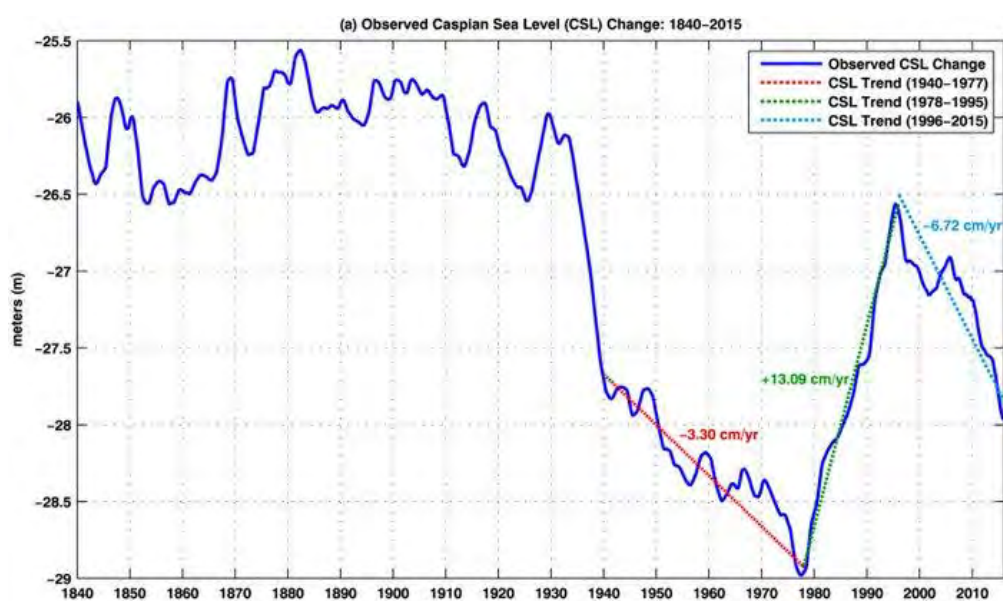
6.2.2 Long-term Goal

Appropriate comprehensive ecosystem surveys every six years and annual monitoring of natural indicators will be implemented. Based on the result of the surveys and monitoring, necessary scientific adaptive management or/and restoration activities will be implemented to conserve biodiversity, habitat of important species, ecological network and ecosystem of the Anzali Wetland including catchment area of it.

As a result of above-mentioned activities, the ecological character of the Anzali Wetland must be maintained forever to meet eight Ramsar Criteria for identifying Wetlands of International Importance.

6.2.3 Prior Conditions of Mid-term Goal

The water level of Anzali Wetland except Siahkesim protected area is affected by the water level of the Caspian Sea. The sea level of the Caspian Sea is currently on a declining trend over the long term as shown in Figure 6.2-1. As the declining trend continues, Anzali Wetlands dry, promoting the succession of vegetation. However, it is very difficult to predict the future change in the Caspian status, it is impossible to control it. Therefore, this unpredictable Caspian Sea level is considered a given condition in this mid-term plan.



Source: Jianli Chen/Geophysical Research Letters/AGU

Figure 6.2-1 Caspian Sea Level Change

One of the general methodologies for setting ecological goals is to set past times that had a good state of ecosystem. It is the fact that the environmental factors of Anzali Wetlands had been changed as time passed, for example, area of water area, depth of water, components of vegetation, invasive alien species and so on. However, due to lack of monitoring activities, there is little information on ecosystems. In the Anzali Wetland Ecological Management Project Phase II, part of comprehensive ecosystem surveys has been conducted. Based on the result of such surveys, the current condition of the ecosystem of the Anzali Wetland is good as wildlife habitat. Based on the nine criteria for identifying Wetlands of International Importance, the Anzali Wetland meets eight criteria as of 2018. It means the Anzali Wetland has still significant value of the wetland ecosystem internationally. Therefore, the Anzali Wetland should be basically kept as current situation as of 2018 as a goal.

6.2.4 Mid-term Goal

Mid-term goals of wetland ecosystem conservation are summarized below, which target on 2020 to 2030.

(1) **Comprehensive Ecosystem Survey and Monitoring**

In order to grasp the baseline information to manage the Anzali Wetland all of items of comprehensive ecosystem survey in 2021 - 2022 (Iranian Year 1400 - 1411) must be implemented. Monitoring must be implemented in order to implement adaptive management of the Wetland. The RIS must be updated by 2022 (COP14) as next turn.

(2) **Conservation and Restoration of Ecosystem**

Based on the results of the surveys and monitoring, necessary scientific adaptive management or/and restoration activities will be implemented to conserve biodiversity, habitat of important species, ecological network and ecosystem of the Anzali Wetland including catchment area of it.

1) **Conservation of Open Water Surface**

Same area (6,200 ha) of open water as of 2018 must be conserved. If it will be changed, conservation/restoration activity must be planed based on the scientific aspect and implemented based on the plan.

2) **Conservation of Variety and Cline of Water Depth**

Variety and cline of the water depth as of 2018 must be conserved. If it will be changed, conservation/restoration activity must be planed based on the scientific aspect and implemented based on the plan.

3) Conservation of Reed Bed and the Other Aquatic Plant Community

Same area (9,200 ha) of Reed bed and the other aquatic plant community as of 2018 must be conserved as a component of mosaic habitat. If the reed bed will succedes to Forest vegetation.

4) Conservation of Toll Forest

Tall tree forest in Ghalamgdeh island must be conserved as a protected area.

5) Construction of Fish Way and Securement of Maintenance Flow

The all of dams in Pasikhan River, Siadarbijan River, Masar River and Khalkai River must be installed fishway to restore the ecological network.

In parallel with fish way construction, maintenance flow water must be secured to conserve the river ecosystem by stopping water overuse from the rivers for irrigation.

(3) Protection and Conservation of Endangered Species and other Important Species

Endangered species and the other important species must be protected or conserved.

(4) Control of Invasive Alien Species

All of invasive alien species must be monitored and controlled to prevent to change the original ecosystem of the Anzali Wetland.

6.2.5 Implementation Plan and Schedule

Implementation plan and schedule are described below.

(1) Comprehensive Ecosystem Survey and Monitoring

1) Implementation Plan

RIS of the Anzali Wetland must be updated at least every six years based on the Resolution VI.13 of the Ramsar Convention. The RIS of the Anzali Wetland was recently updated in June 2018 with the support of JICA just before COP13. Therefore, in order to grasp the baseline information to manage the Anzali Wetland all of items of comprehensive ecosystem survey must be implemented every 6 years. Monitoring must be implemented in order to implement adaptive management of the wetland. The RIS must be updated by 2024 (COP15) as next turn.

In the Project, DOE Gilan did not implement the comprehensive ecosystem survey very well. However, the baseline of the ecosystem is the most important information to manage the Anzali Wetland. Iranian organization including DOE Gilan often say as following. “The surveys have already been implemented very much, therefore no need to survey any more. Now is the time to implement actions.” It is completely wrong. According to the result of review by JICA Expert Team, there are many papers written by scientist about the Anzali Wetland independently. These papers are not useful to manage the wetland ecosystem, because these papers had the other academic purpose for scientist. In order to manage the wetland ecosystem, DOE Gilan should

have ecosystem survey based on their own plan (this MTP) in cooperation with relevant organization such as NIWAI.

(a) Comprehensive Ecosystem Survey

Implementation plan of comprehensive survey is shown in the following table.

Table 6.2-1 Implementation Plan of Comprehensive Ecosystem Survey

No	Class	Item	Area	Frequency	Methodology	Output
<i>a</i>	Plant	Macrophyte and vegetation	Inside of Ramsar Boundary	Spring, Summer, Autumn	Sampling Line transects	Checklist Chart of line transect GIS Map of Endangered Species, Alien Species Vegetation map Herbarium Photos
<i>b</i>		Phytoplankton	Waterbody in Ramsar Boundary	4 seasons	Sampling (Plankton net)	Checklist
<i>c</i>	Animal	Mammal	Inside of Ramsar Boundary	4 seasons	Field sign Camera trap Trapping	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>d</i>		Bird	Inside of Ramsar Boundary	12 months	Line senses Point senses	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>e</i>		Reptile and Amphibian	Inside of Ramsar Boundary	Spring, Summer, Autumn	Line senses Sampling Trapping	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>f</i>		Fish	Inside of Ramsar Boundary and Inflowing rivers	4 seasons	Electro shocker Trapping (Gillnet, Cast net etc.) Interview to fisherman	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>g</i>		Insect	Inside of Ramsar Boundary	Spring, Summer, Autumn	Sampling Trapping (Light trap, pitfall trap, etc.)	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>h</i>		Benthos and Zooplankton	Inside of Ramsar Boundary and Inflowing rivers	4 seasons	Sampling (Plankton net, server net, D-shape net, Ekman Berge or Smith-McIntyre bottom sampler)	Checklist GIS Map of Endangered Species, Alien Species Photos
<i>i</i>	Physical Environment	Hydrology	Inside of Ramsar Boundary and Inflowing rivers	Rainy and dry seasons	Bathymetry survey Water level Water flow	GIS map Bathymetry map

Source: JICA Expert Team

(b) Monitoring

a) Indicator Monitoring

In order to grasp easily the current situation of wetland ecosystem, some indicator species should be selected based on the result of comprehensive ecosystem survey.

DOE has been implemented the “International Waterbird Census (IWC)” based on the protocol of Wetland International. It is very important information to check a health of the wetland

ecosystem as wintering bird habitat. Some of questionnaires of RIS can be filled by using result of this IWC monitoring. IWC monitoring must be implemented every mid-winter.

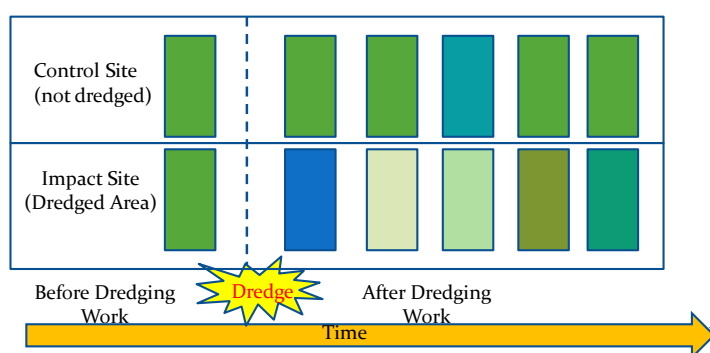
The other indicators such as umbrella species of wetland ecosystem such as White-tailed Eagle *Haliaeetus albicilla* should be monitored. White-tailed Eagle breeds in the forest in Ghalamgdeh Island and the forest near Espand Guard Station. Eurasian Otter *Lutra lutra* is also good indicator as umbrella species of wetland. Whiskered Tern is summer visitor bird in the Anzali Wetland which has breeding population more than 1% of global population. It is also important indicator as Ramsar site.

b) Alien Species Monitoring

Invasive alien species including potential one, should be monitored to prevent the expansion and invasion of native ecosystem. It is necessary to detect the latest situation. DOE guards should check the invasive alien species in their daily patrol.

c) Restoration Activity Monitoring

Wetland ecosystems are very complicated. Nobody knows how ecosystem would respond particularly to restoration/conservation activities such as dredging. Adaptive management is an organized system of learning designed to reduce uncertainty in ecosystem management. Dredging site has many various environmental factors such as vegetation, water depth. Correlation between environment factors and biodiversity factor by analyzing the monitoring data, DOE can make adaptive management plan. In such case, BACI (Before-After, Control-Impact) design monitoring is very useful for the monitoring and analysis of impact and effectiveness of restoration or the other development activity. In order to separate changes by the activity from the other factors, not only impact site but also control site should be selected based on BACI design for monitoring.



Source: JICA Expert Team

Figure 6.2-2 Concept of “BACI Design”

d) The Other Necessary Indicator Monitoring

Depends on the latest situations of the Anzali Wetland and results of various surveys, necessary indicator monitoring should be added.

Implementation plan of ecosystem monitoring is shown in the following table.

Table 6.2-2 Implementation Plan of Ecosystem Monitoring

No	Category	Item	Area	Frequency	Methodology	Output
a	Indicator species	Waterbird	Inside of Ramsar Boundary	Yearly (mid-winter)	Based on “International Waterbird Census (Wetland International)	Checklist Number of waterbird
b		Breeding Birds (White-tailed Eagle, Whiskered Tern, Pygmy Cormorant)	Inside of Ramsar Boundary	2-3 times on breeding season every year	Breeding area census Nest counting	Map of breeding area(nests) Number of nests
c		Otter	Inside of Ramsar Boundary	Monthly	Field sign survey Camera trap	Map of distribution Photos
d	Alien Species	Alien Species (Water Hyacinth, Azolla, other)	Inside of Ramsar Boundary, (Watershed)	Monthly	Patrol (including DOE Guard patrol)	Map of distribution Control Plan
e	Restoration Activities	Dredging area of Selkeh WR	Selkeh WR and the other restored area	4 seasons	Hydrology (water level, depth) Aquatic Plant, Vegetation Bird, fish, etc.	Effectiveness of the restoration Impact of the restoration
f	The other necessary indicator monitoring	To be considered based on the latest situation				

Source: JICA Expert Team

(c) Update of Ramsar Information Sheet (RIS)

Focal person of Ramsar Convention in DOE HQ should update the RIS on the Ramsar Convention website based on the report of DOE Gilan about the comprehensive ecosystem survey and the monitoring in 2024 (before COP15) and 2030 (before COP17). Update of RIS is not easy work, therefore expert should analyze and compile the result of all of the latest result of comprehensive ecosystem survey and monitoring.

a) Schedule of Comprehensive Ecosystem Survey and Indicator Monitoring

Schedule of comprehensive ecosystem survey and indicator monitoring are shown in the following table.

Table 6.2-3 Schedule of Comprehensive Ecosystem Survey and Indicator Survey

Items	(2019)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks		
(1) Comprehensive Ecosystem Survey	←		2nd turn				→	←		3rd turn			→	1st turn was 2015-2018	
(a) Macrophyte	■							■							
(b) Phytoplankton	■							■							
(c) Mammal			■							■				previous survey 2015	
(d) Bird			■							■				previous survey 2015	
(e) Reptile and Amphibian				■							■			previous survey 2018	
(f) Fish				■							■			previous survey 2017	
(g) Insect	■							■							
(h) Benthos and Zooplankton	■							■							
(j) Hydrological Study of All of the Wetland	■							■							
(2) Indicator Monitoring	■	■													
(a) Winter Bird		●	●	●	●	●	●	●	●	●	●	●	●	●	Midwinter Bird Counting
(b) Breeding Bird		●	●	●	●	●	●	●	●	●	●	●	●		
(c) Otter	■	■	■	■	■	■	■	■	■	■	■	■	■		
(d) Alien Species	■	■	■	■	■	■	■	■	■	■	■	■	■		
(e) Restored Area (ex. Selkeh)	■	■	■	■	■	■	■	■	■	■	■	■	■		
(e) The other indicator species	■	■	■	■	■	■	■	■	■	■	■	■	■	should be selected based on the latest survey	
(2) Update of Ramsar Information Sheet (RIS)						●						●		Just before COP15 and COP17	
(Ramsar Conference of Parties)			COP14			COP15			COP16			COP17		Last update of RIS was 2018	

Source: JICA Expert Team

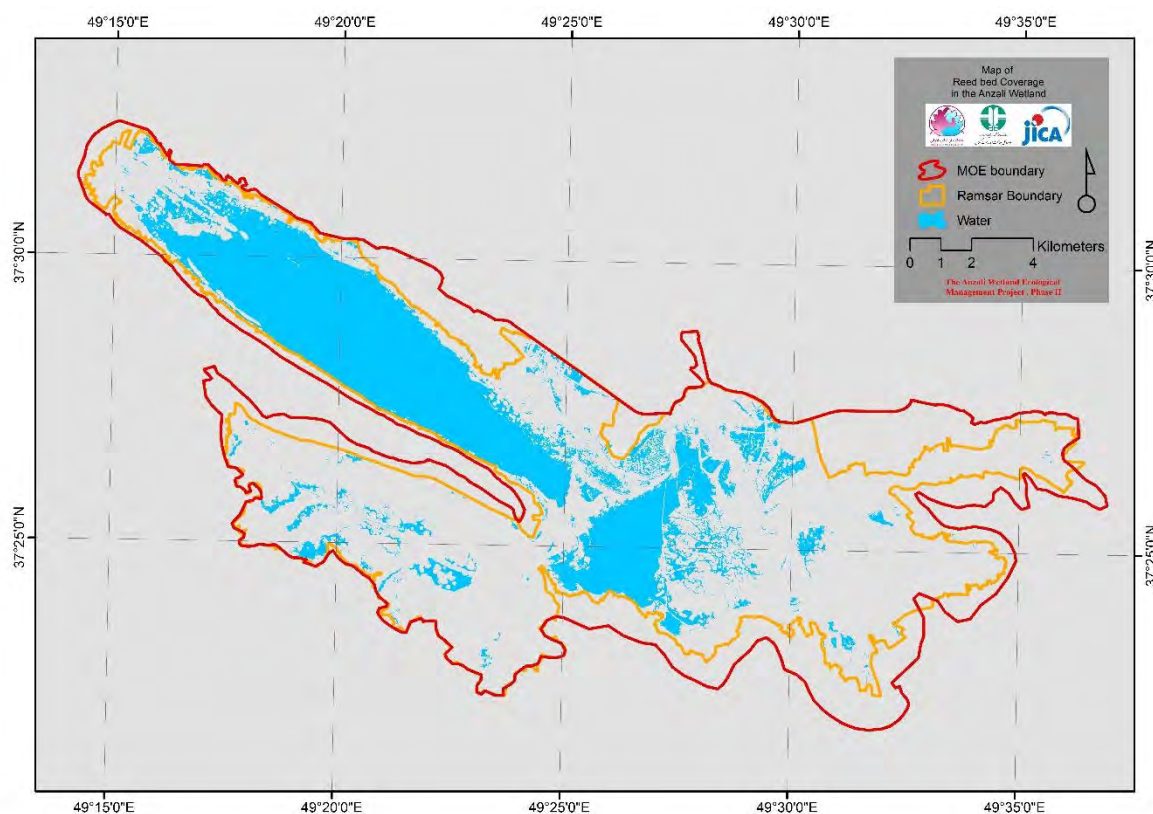
(2) Conservation and Restoration of Ecosystem

Based on the results of the surveys and monitoring, necessary scientific adaptive management or/and restoration activities will be implemented to conserve biodiversity, habitat of important species, ecological network and ecosystem of the Anzali Wetland including catchment area of it.

1) Implementation plan

(a) Conservation of Open Water Surface

The open water area which doesn't have over water vegetation (ex. West lagoon, middle of the Sorkhankol Wildlife Refuge) is important for water bird as safe place from mammals as predator. Same area (6,200 ha) of open water as of 2018 must be conserved shown as following map. If it will be changed, conservation/restoration activity must be planned based on the scientific aspect and implemented based on the plan.



Source: JICA Expert Team

Figure 6.2-3 Water Area of the Anzali Wetland as of 2018

Caspian Sea Level is under decreasing trend as of 2018. If the trend will be continued, shallow water area will be dried up. Especially, marginal area of Sorkhankol Wildlife Refuge may be dried up because of decreasing of Caspian See Level decreasing. Dried up area should be restored as open shallow (not deep) water area by dredging or dam up.

(b) Conservation of Variety and Cline of Water Depth

The water depth and hydrological characteristics of the Wetland is very important as diversity of habitat. Each depth of the wetland has original function as variety of habitat. Deep water is very important for big fish. On the other hand, shallow water is essential for small fish as nursery and many waterbirds as feeding habitat of the Anzali Wetland Ecosystem. Variety and cline of the water depth as of 2018 must be conserved. If it will be changed, conservation/restoration activity must be planed based on the scientific aspect and implemented based on the plan.

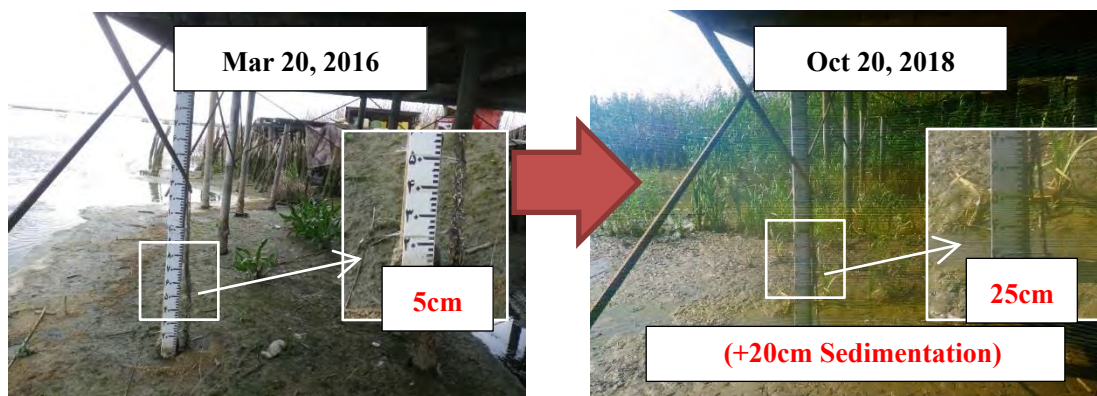
a) Dredging of Sedimentation Area

River delta forms from deposition of sediment that is carried by a river as the flow leaves its mouth and enters stagnant water. The Anzali Wetland has several river mouths and such area has been deposited sedimentations.

In addition, DOE Gilan have dredged to make water way in Sorkhankol Wildlife Refuge and West Lagoon around summer 2016 that have made new river delta to accelerate sediment

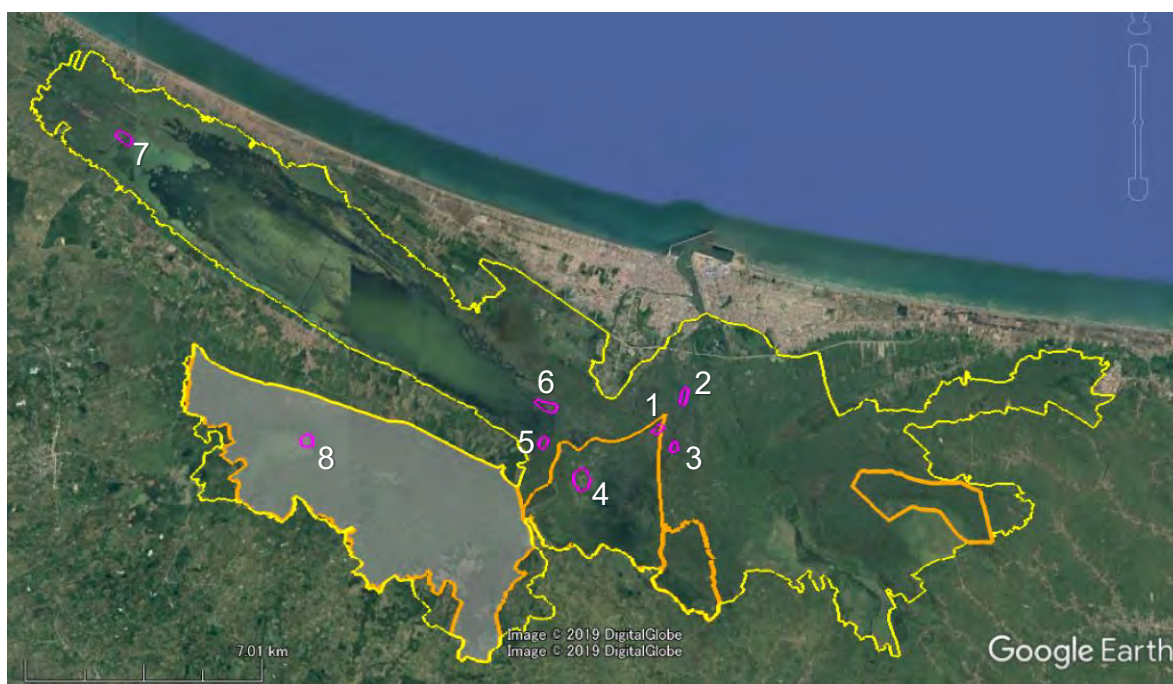
deposition. Such areas are hot spots of sedimentation. A spot at Sorkankol Wildlife Refuge GS has been deposited the 20 cm sedimentation deposit from Nahang Roga River as shown in Figure 6.2-4.

Such hot spots of sedimentation deposit should be dredged to keep water depth as shown in Figure 6.2-5(1)-(5).



Source: JICA Expert Team

Figure 6.2-4 Sedimentation Deposit at Sorkhankol GS after DOE Dredging Canal



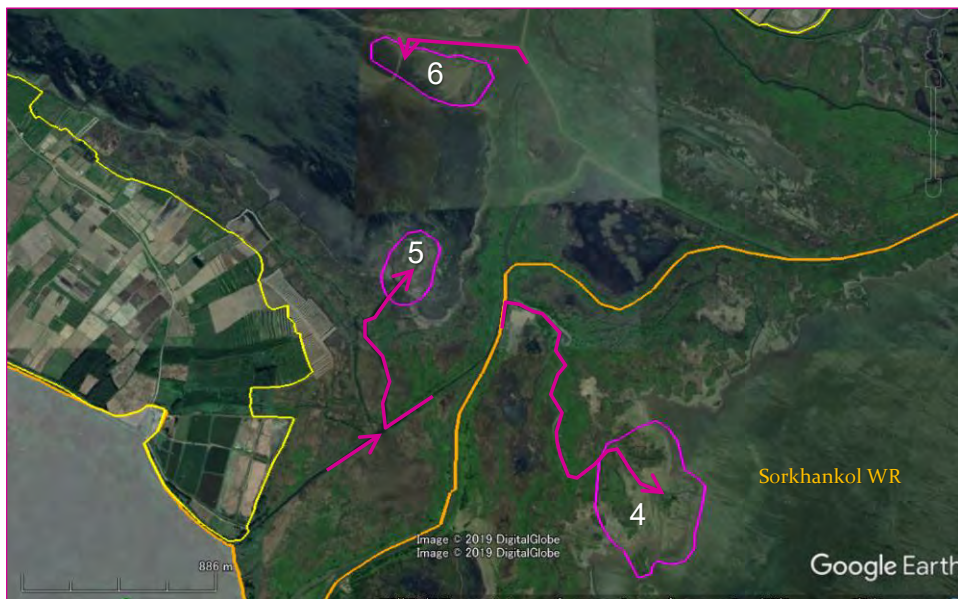
Source: JICA Expert Team

Figure 6.2-5 (1) Recommended Dredging Areas (all)



Source: JICA Expert Team

Figure 6.2-5 (2) Recommended Dredging Areas (North of Sorkhankol WR)



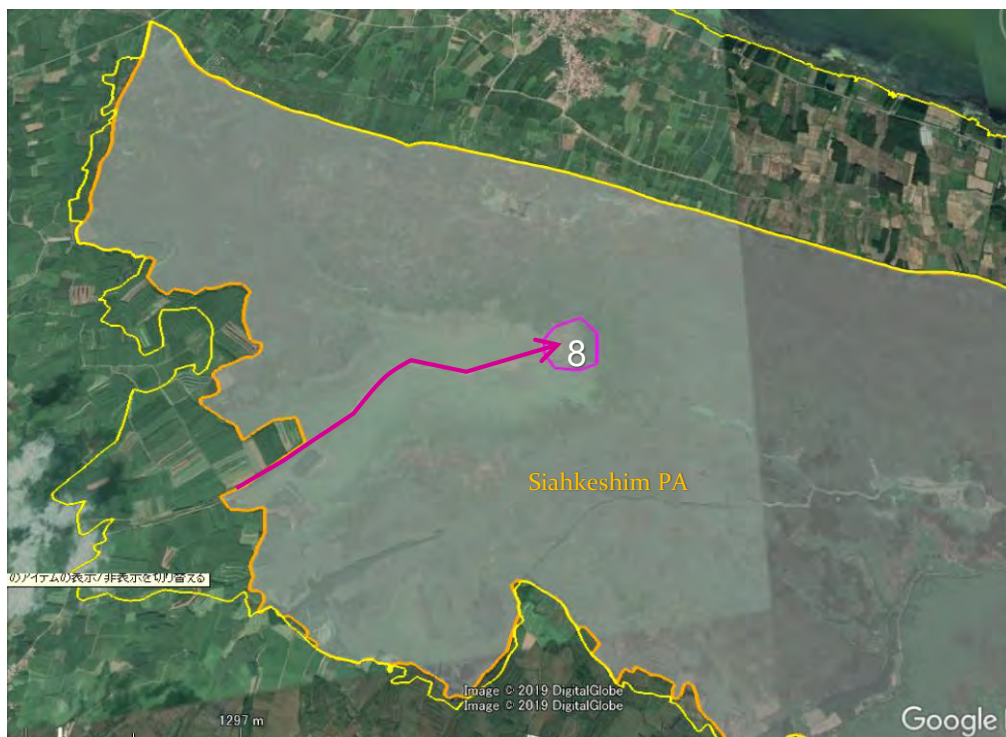
Source: JICA Expert Team

**Figure 6.2-5 (3) Recommended Dredging Areas
(East of West Lagoon and West of Sorkhankol Wildlife Refuge)**



Source: JICA Expert Team

Figure 6.2-5 (4) Recommended Dredging Areas (West of West Lagoon)



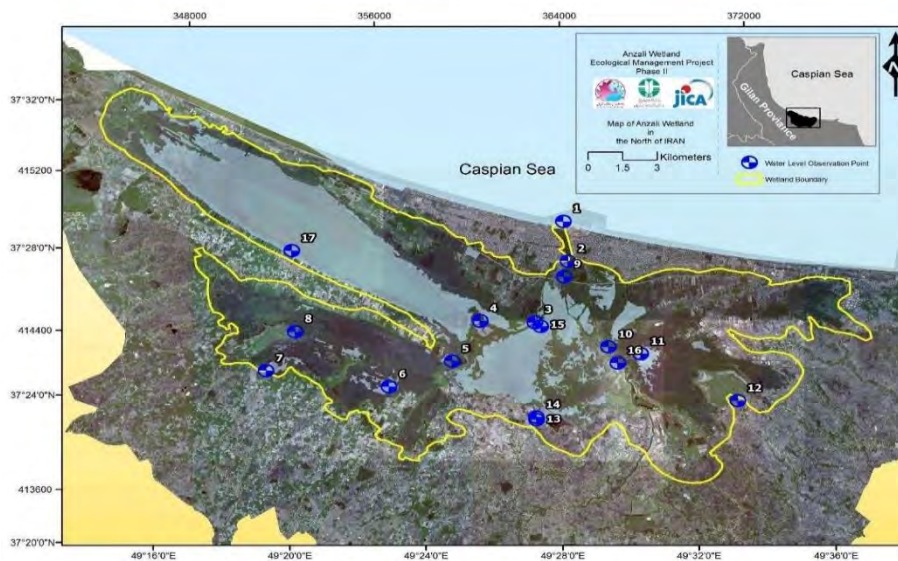
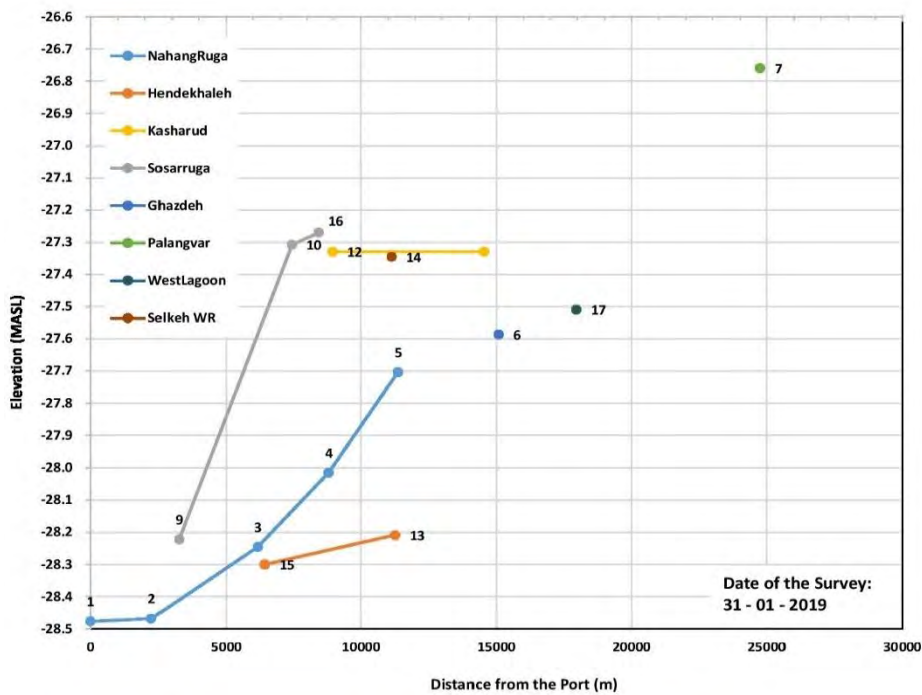
Source: JICA Expert Team

Figure 6.2-5 (5) Recommended Dredging Areas (Siahkesim Protected Area)

b) To keep Hydrology of Siakeshim Protected Area

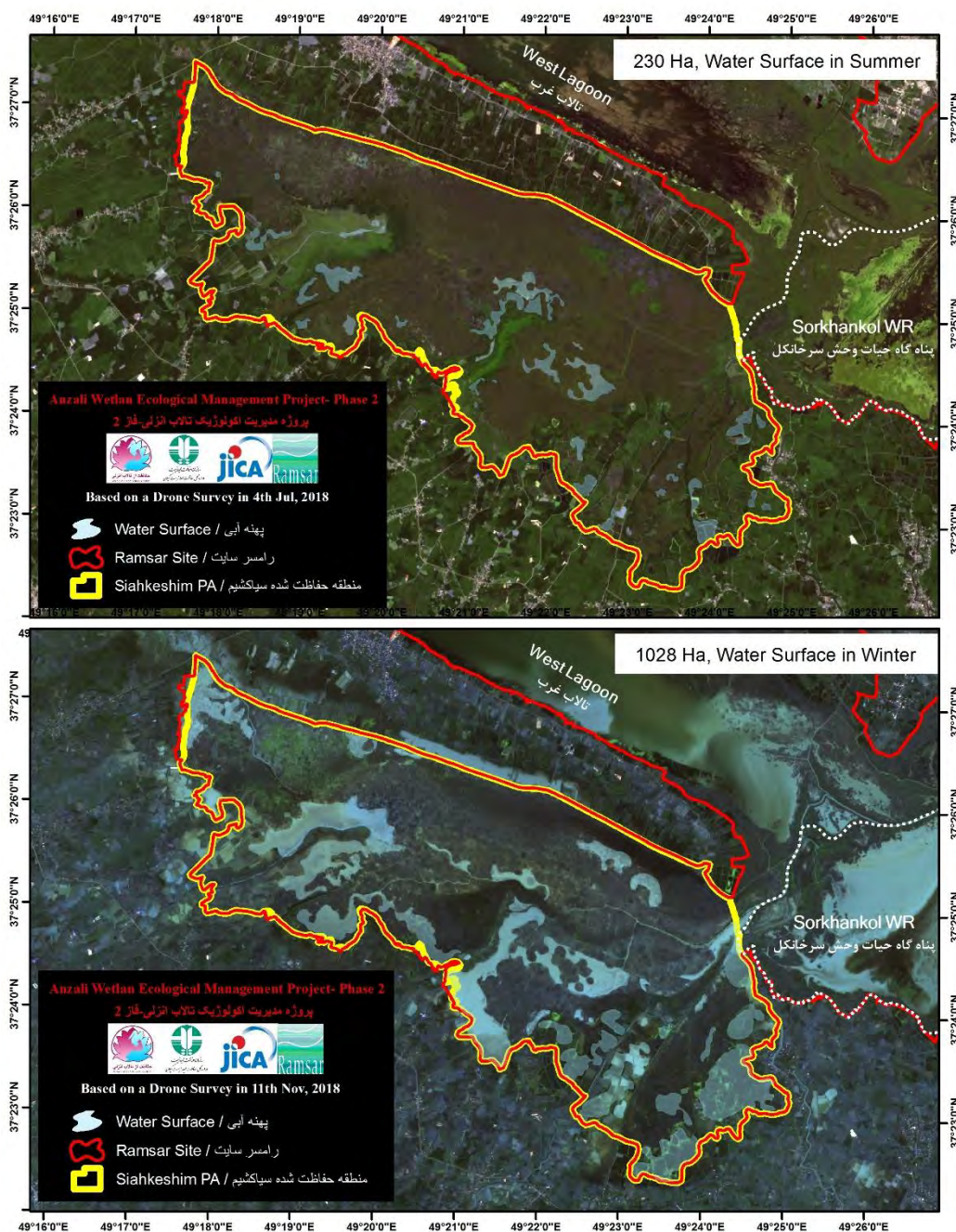
In Siakehism Protected Area is almost covered by Reedbed. Therefore, its ecological importance was sometimes thought as lower than the other wildlife refuges. It is wrong. Reedbed has important habitat for the Anzali Wetland Ecosystem. In addition, seasonal expanded water area should be focused on as wintering waterbirds habitat in Siakehism Protected Area. The elevation of Siakehism Protected Area is about 1.5 m higher than Caspian

Sea Level (CSL) as shown in Figure 6.2-6. Therefore, most of the Siakehism PA was dried up in summer as dry season. However, its water area is expanded in winter as rainy season because it impound much water after rain and keep for long time based on its hydrological characteristics as shown in Figure 6.2-7. It means the Siakehism PA would became more important after CSL decreasing in future. Because Siakehism PA would not be affected by CSL in winter. Therefore, hydrological characteristics of bad drainage should be kept as the current condition. Change of hydrology such as smooth drainage by dredging existing river and water way must be avoided. As one of improvement activities, make dike at east area of Siakehism PA for damming up can be considered for improvement of expanding water area.



Source: JICA Expert Team

Figure 6.2-6 Water Level of Siakeshim PA



Source: JICA Expert Team

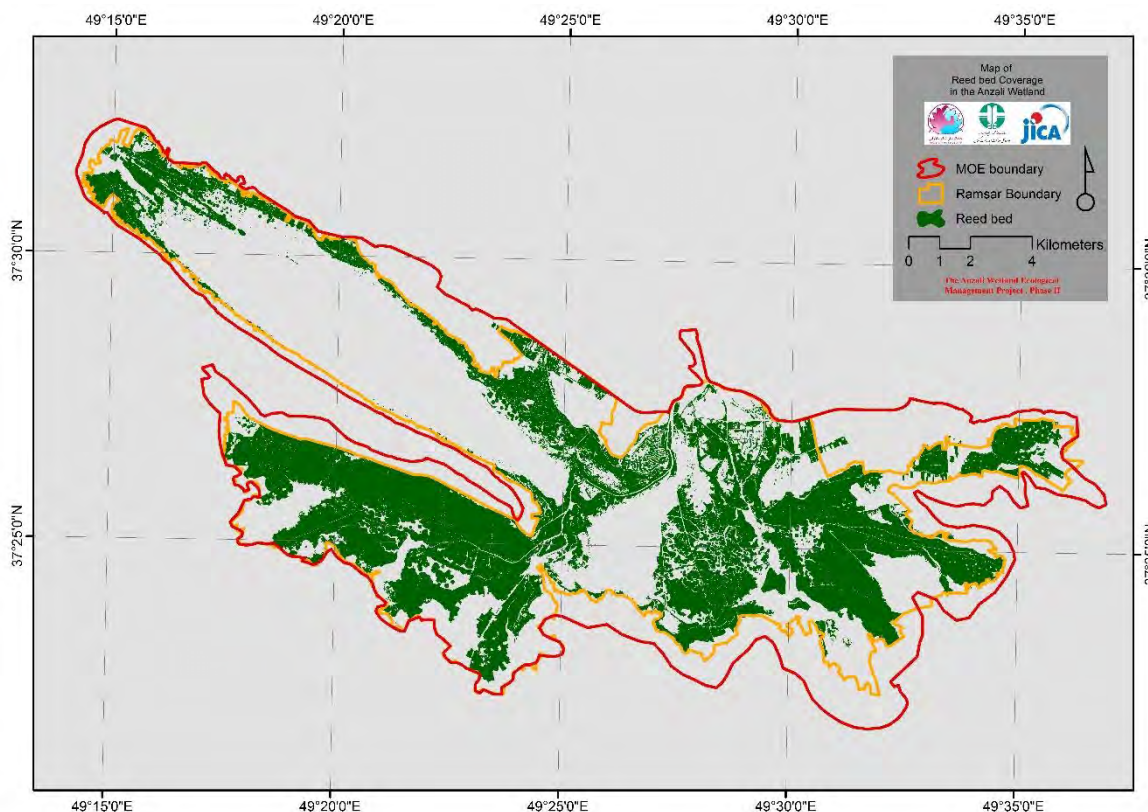
Figure 6.2-7 Seasonal Change of Water Area of Siakeshim PA

(c) Conservation of Reed Bed and the Other Aquatic Plant Community

Reed bed is one of the most important habitats of the Anzali Wetland. Almost half of the wetland is reed bed. Sometimes reed bed is considered as indicator of drying. However, reed bed is one of the most important habitats of the Anzali Wetland. For example, Marsh Harrier, Purple Heron and Purple Swamphen are breeding in Reed bed. Same area (9,200 ha) of Reed bed and the other aquatic plant community as of 2018 must be conserved as a component of mosaic habitat as shown in Figure 6.2-8. If the reed bed will successes to forest vegetation, forest should be cut

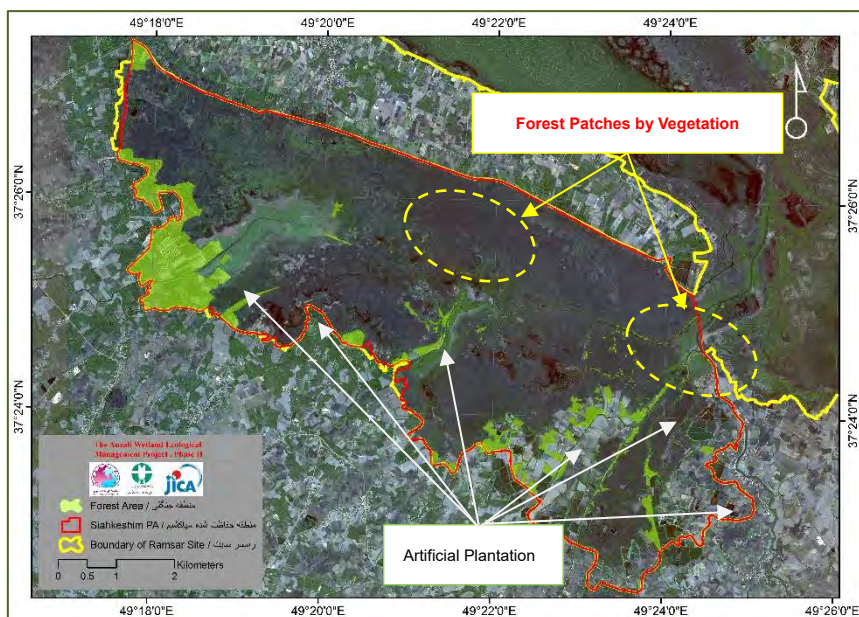
or removed. For example, there are some forestation of reed bed in Siakeshim PA in Figures 6.2-9 and 10.

Because expanded forest is not a part of wetland ecosystem and indicator of terrestrial habitat expansion. Only limited area of forest should be conserved mentioned in next chapter. However, the other expansion of forest should be controlled.



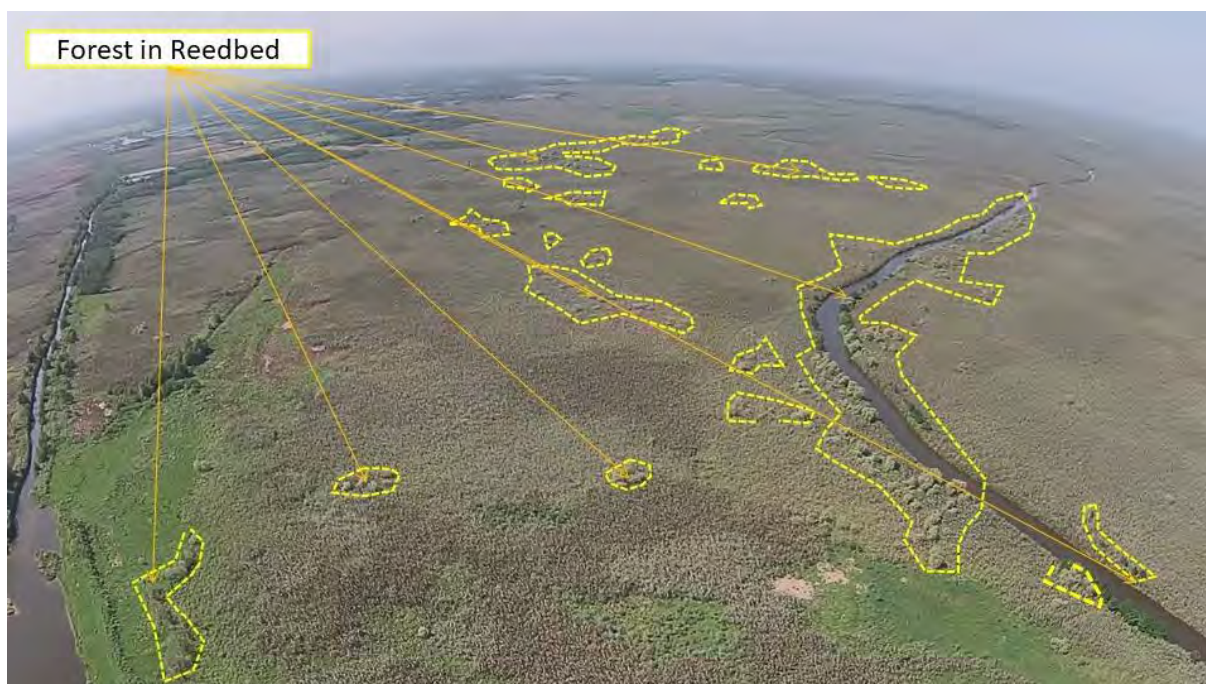
Source: JICA Expert Team

Figure 6.2-8 Reedbed of the Anzali Wetland as of 2018



Source: JICA Expert Team

Figure 6.2-9 Map of Forest in Reedbed of Siahkeshim PA as of 2018



Source: JICA Expert Team

Figure 6.2-10 Vegetation Succession to Forest from Reedbed in Siahkeshim PA (11th Sep, 2014)

(d) Conservation of Toll Forest

In the wetland ecosystem, forest is sometimes indicator of drying wetland. However, the forest with high tree became very important habitat for wildlife.

The forest in Ghalamgdeh island is very unique ecosystem because of its the tallest forest in/around the Anzali Wetland. There are the nest of White-tailed Eagle and colony of Egrets

and Herons. The other forest wildlife such as mammals, birds, reptiles and insects often occur there. Tall tree forest in Ghalamgdeh island must be conserved as a protected area. Development activities with change or cutting of forest should be prohibited.



Source: JICA Expert Team

Figure 6.2-11 Toll Forest in Ghalamgdeh Island as of 2018



Source: JICA Expert Team

Figure 6.2-12 Important Habitats of Forest in Ghalamgdeh Island

(e) Construction of Fish Way and Securement of Maintenance Flow

There are many dams including irrigation dams in the catchment area of the Anzali Wetland. Especially rivers from central to west such as Pasikhan River, Siadarbijan River, Masar River and Khalkai River have many dams as following figure.



Source: JICA Expert Team

Figure 6.2-13 Examples of Dam in Anzali Wetland Watershed

Such dams in the inflowing rivers into the Anzali Wetland are interrupting to migrate anadromous fish species such as Caspian Kutum (*Rutilus kutum*), Caspian Vimba (*Vimba vimba persa*), and Danube Bleak (*Alburnus chalcoides*), to spawning sites upstream as shown in following figure.



Source: JICA Expert Team and Dr. Abbasi in NIWAI

Figure 6.2-14 Anadromous Fish of Anzali Wetland

Fish way is one of the most effective method to restore an ecological network of the Anzali Wetland watershed. Fishway is a structure on artificial barriers (such as dams) to enable migratory fish to go upstream. The all of dams in Pasikhan River, Siadarbijan River, Masar River and Khalkai River must be installed fishway to restore the ecological network.

In addition, river water was taken for irrigation from spring to summer very much in catchment area of the Anzali Wetland. Sometimes 100% of river water was taken for irrigation such as from Pasikhan River. In parallel with fish way construction, maintenance flow water must be secured to conserve the river ecosystem by stopping water overuse from the rivers for irrigation.

a) Schedule of Conservation and Restoration of Ecosystem

Schedule of comprehensive ecosystem survey and indicator monitoring are shown in the following table.

Table 6.2-4 Schedule of Conservation and Restoration of Ecosystem

Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
(a) Conservation of Open Water Surface												
Plan	■	■					■	■				Based on the result of Hydrological Study
Implementation			■	■					■	■		
(b) Conservation of Variety and Cline of Water Depth												
Plan	■	■					■	■				Based on the result of Hydrological Study
Implementation			■	■	■				■	■	■	
(c) Conservation of Reed Bed and the Other Aquatic Plant Community												
Plan	■						■					Based on the result of vegetation survey
Implementation		■	■					■	■			
(d) Conservation of Toll Forest												
Monitoring	←											→ If action is necessary based on monitoring, restoration should be implemented.
(e) Construction of Fish Way and Securement of Maintenance Flow	●	●	●	●	●	●	●	●	●	●	●	
Plan	■											
Discharge of Maintenance Flow		■	■	■	■	■	■	■	■	■	■	
Construction and installation of Fish way		■	■	■	■	■	■	■	■	■	■	

Source: JICA Expert Team

(3) Protection and Conservation of Endangered Species and Other Important Species

1) Implementation Plan

A list of international endangered species and other important species is shown as Table 6.2-5. These international endangered species and the other important species must be protected or conserve. The methodology of protection and conservation is shown in Table 6.2-6. Protection and conservation plan of several remarkable species are described as following.

Table 6.2-5 List of International Endangered Species and Other Important Species

No	Class	Scientific name*	Common name	Ramsar Criteria								IUCN RL	CITES Apx.I	CMS Apx.I	Remarks	
				2	3	4	5	6	7	8						
1	Mammal	<i>Lutra lutra</i>	European Otter	✓								NT	✓		Umbrella species of the Anzali Wetland ecosystem.	
2	Bird	<i>Anas crecca</i>	Eurasian Teal				✓	✓				LC			Winter migrant	
3		<i>Anas platyrhynchos</i>	Mallard		✓	✓	✓	✓					LC			Breeding in the site.
4		<i>Anas strepera</i>	Gadwall				✓	✓					LC			Winter migrant
5		<i>Aquila clanga</i>	Greater Spotted Eagle	✓									VU		✓	Winter migrant
6		<i>Aquila heliaca</i>	Eastern Imperial Eagle	✓									VU	✓	✓	Winter migrant
7		<i>Aquila nipalensis</i>	Steppe Eagle	✓									EN		✓	Winter migrant
8		<i>Aythya ferina</i>	Common Pochard	✓			✓						VU			Winter migrant
9		<i>Aythya nyroca</i>	Ferruginous Duck	✓		✓	✓						NT		✓	Recently small number of Ferruginous Duck is breeding in the site.
10		<i>Chlidonias hybrida</i>	Whiskered Tern			✓		✓					LC			Summer migrant. More than 1% of global population is breeding in Anzali Wetland
11		<i>Cygnus cygnus</i>	Whooper Swan				✓	✓					LC			Winter migrant
12		<i>Falco cherrug</i>	Saker Falcon	✓									EN		✓	Passing migrant
13		<i>Falco naumanni</i>	Lesser Kestrel	✓									LC		✓	Summer migrant
14		<i>Falco pelegrinoides</i>	Barbary Falcon	✓									NE	✓		Winter migrant
15		<i>Falco peregrinus</i>	Peregrine Falcon	✓									LC	✓		Winter migrant. Small number of Coot probably breeds in Anzali Wetland.
16		<i>Fulica atra</i>	Eurasian Coot				✓						LC			Winter migrant
17		<i>Haliaeetus albicilla</i>	White-tailed Eagle	✓		✓							LC	✓	✓	more than two pairs of the species breed in the wetland. also the wetland is a important area for wintering of it.
18	<i>Microcarbo pygmeus</i>	Pygmy Cormorant			✓	✓	✓					LC			Very common resident birds in Anzali Wetland.	
19	<i>Oxyura leucocephala</i>	White-headed Duck	✓			✓						EN		✓	Winter migrant	
20	<i>Pelecanus crispus</i>	Dalmatian Pelican	✓			✓	✓					NT	✓	✓	Winter migrant. More than 1% of global population is wintering in Anzali Wetland	
21	<i>Pelecanus onocrotalus</i>	Great White Pelican	✓			✓						LC		✓	Winter migrant	
22	<i>Phalacrocorax carbo</i>	Great Cormorant			✓	✓	✓					LC			Very common resident birds in Anzali Wetland.	
23	<i>Podiceps auritus</i>	Horned Grebe	✓									VU			Winter migrant	
24	<i>Vanellus gregarius</i>	Sociable Lapwing	✓									CR		✓	Passing migrant	
25	Reptile	<i>Emys orbicularis</i>	European Pond Turtle	✓								NT			Very common in Anzali Wetland.	
26	Fish	<i>Acipenser stellatus</i>	Star sturgeon	✓						✓		CR			There are records of this Sturgeon in the Anzali Wetland. However, the field survey did not find the fish in 2016-2017.	
27		<i>Alburnus filippii</i>	Kura bleak		✓							LC			The species is endemic to the Kura-South Caspian Drainages.	
28		<i>Cyprinus carpio</i>	Common Carp	✓							✓	VU				
29		<i>Luciobarbus capito</i>	Bulat-mai Barbel	✓							✓	VU				
30		<i>Rutilus kutum</i>	Caspian Kutum							✓	✓	NE				Autumn spawning population is more important.

Ramsar Criterion/ Species which contributes the Ramsar Criteria (The nine criteria for identifying Wetlands of International Importance)

IUCN RL/ IUCN Red List/ CR:critically endangered, VU:vulnerable, NT: near threaten, LC: least concern NE: not evaluated

CITES Apx.I/ Species listed in Appendix.I on Convention on International Trade in Endangered Species of Wild Fauna and Flora

CMS Apx.I/ Species listed in Appendix.I on Convention on the Conservation of Migratory Species of Wild Animals

attention/ This table does not mention about plant, insects, benthos, planktons. Survey of these taxon have not been completed recently.

Source: JICA Expert Team

Table 6.2-6 Methodology of International Important Species

No	Common name	Methodology of Protection and Conservation
1	European Otter	Prevention of bycatch by fishing net. Prevention of roadkill. Hunting control by DOE guard. (see next chapter)
2	Eurasian Teal	Hunting control by DOE guard
3	Mallard	Hunting control by DOE guard. Protection and conservation of breeding habitat.
4	Gadwall	Hunting control by DOE guard
5	Greater Spotted Eagle	Ditto
6	Eastern Imperial Eagle	Ditto
7	Steppe Eagle	Ditto
8	Common Pochard	Ditto
9	Ferruginous Duck	Ditto
10	Whiskered Tern	Protection and conservation of breeding habitat. Bout tourist control. (see next chapter)
11	Whooper Swan	Hunting control by DOE guard.
12	Saker Falcon	Ditto
13	Lesser Kestrel	Ditto
14	Barbary Falcon	Ditto
15	Peregrine Falcon	Ditto
16	Eurasian Coot	Hunting control by DOE guard. Protection and conservation of breeding habitat.
17	White-tailed Eagle	Hunting control by DOE guard. Protection and conservation of breeding habitat (tall trees and nests).
18	Pygmy Cormorant	Hunting control by DOE guard. Protection and conservation of breeding habitat as colony site.
19	White-headed Duck	Hunting control by DOE guard.
20	Dalmatian Pelican	Hunting control by DOE guard. (see next chapter)
21	Great White Pelican	Ditto
22	Great Cormorant	Hunting control by DOE guard. Protection and conservation of breeding habitat as colony site.
23	Horned Grebe	Hunting control by DOE guard.
24	Sociable Lapwing	Hunting control by DOE guard.
25	European Pond Turtle	No need of special activities for this species on current situation. Very common in Anzali Wetland.
26	Star sturgeon	Fishing control by DOE and Shilat.
27	Kura bleak	Fishing control by DOE and Shilat.
28	Common Carp	Fishing control by DOE and Shilat. Artificial reproduction and releasing.
29	Bulat-mai Barbel	Fishing control by DOE and Shilat.
30	Caspian Kutum	Fishing control by DOE and Shilat. Construction of Fish Way and Securement of Maintenance Flow on inflowing rivers of watershed. Artificial reproduction and releasing. (see next chapter)

Source: JICA Expert Team

(a) Common Otter (*Lutra lutra*) IUCN Red List/ Near Threaten

Despite of presence of Common Otter in/around the Anzali Wetland, there are many threats for its population and habitat: habitat destruction and fragmentation, killing as a predator of aquaculture and fish ponds, capturing by fisherman as a bycatch, etc. Accidental deaths of Otter by fisherman's bycatch are serious problem. As the result of the mammal survey supported by JICA Expert Team in 2015, several carcasses of Otter were found that caught in crab net as bycatch.

Otter swims into the net because Otter is attracted by the trapped fish and prawns. After that Otter cannot exit from the net and is trapped. At last Otter die from a drowning. It is not difficult to prevent such bycatch. Just to prevent to enter to the net is alright. The structure of fishing net

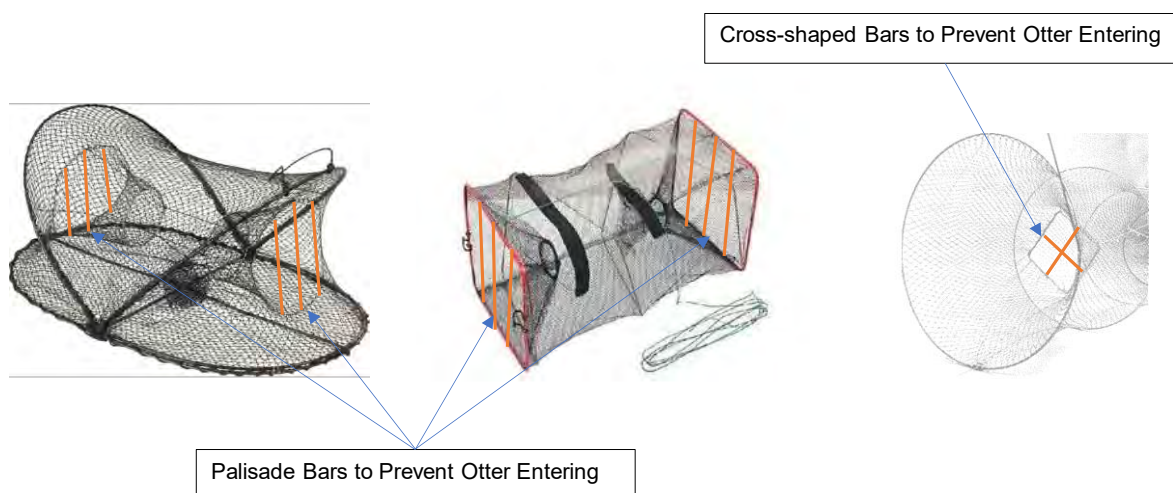
should be improved by adding simple bycatch reduction devices at the entrance of net as shown in Figure 6.2-15.

In addition, environmental education program for fisherman and fish pond owner should be implemented to prevent to kill Common Otter for protection of fish in their fish pond.



Source: JICA Expert Team

Figure 6.2-15 Camera-trapped Common Otter in Anzali Wetland



Source: JICA Expert Team modified Motokazu Ando (2008) The Japanese Otter

Figure 6.2-16 Otter Bycatch Reduction Devices

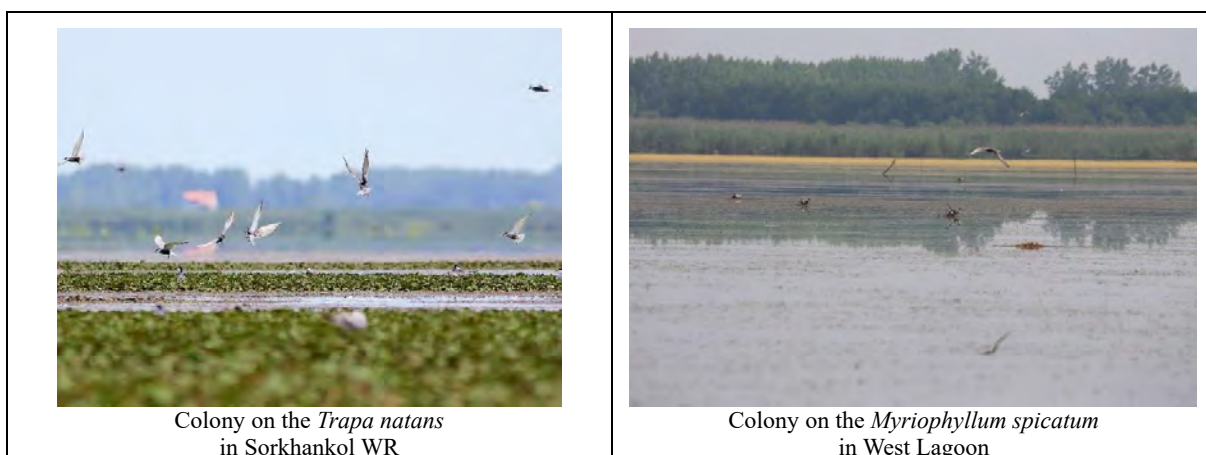
a) Whiskered Tern (*Chlidonias hybrida*) Ramsar Criteria 4,6

Whiskered Tern is summer migrant bird in the Anzali Wetland which has breeding population more than 1% of global population. More than 2,000 pairs are breeding in the Anzali Wetland. It makes nest on the aquatic plants such as floating-leaf plant *Trapa natans* and submerged plant *Myriophyllum spicatum*. It is necessary to less than about 1 m depth water body for such aquatic plants. Recently, water level decline due to Caspian Sea Level and exuberance growth of

Myriophyllum spicatum have been happened in West Lagoon. Therefore, West Lagoon is the largest breeding habitat of Whiskered Tern in Anzali Wetland. Sorkhankol WR is the second largest breeding habitat. Whiskered Tern makes nest on the leaf of *Trapa natans*. The density of nest is obviously higher than on *Myriophyllum spicatum*. Selkeh WR is the small breeding habitat of Whiskered Tern. Water body of Selkhe WR was restored by dredging, damming up and pumping up. In the breeding season, Selkeh WR became much shallow and local cattle such as cows entered and disturbing the WR. Therefore, only few Whiskered Terns bred in Selkeh WR.

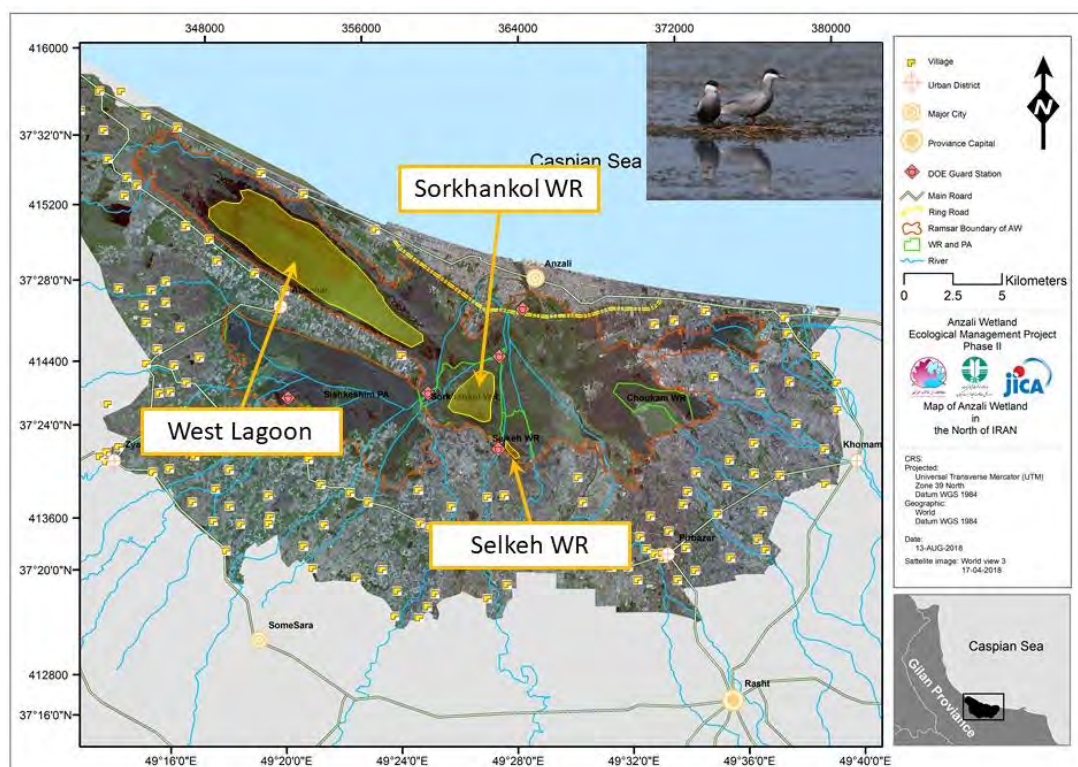
DOE implements dredging work in various wetland. However, shallow water with aquatic plants is very important for Whiskered Tern. Dredging work should be prohibited in the breeding habitat of Whiskered Tern especially breeding season (April to July).

In Selkeh WR, pumping up should be implemented to increase water depth around 50-80cm in the breeding season.



Source: JICA Expert Team

Figure 6.2-17 Breeding Habitat of Whiskered Tern



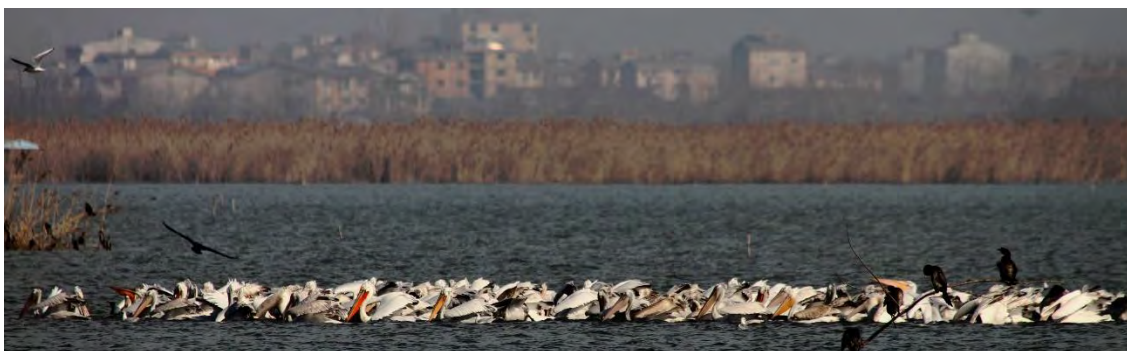
Source: JICA Expert Team

Figure 6.2-18 Potential Breeding Habitat of Whiskered Tern

b) Dalmatian Pelican (*Pelecanus crispus*) IUCN Red List/ Near Threaten, Ramsar Criteria 5,6
 Average number (2013-2017) of wintering Dalmatian Pelican was 924. It has been almost stable. Population 1% level of South-west Asia & South Asia (win) is 150 (Wetland International 2018), 6.2% of the population wintered to meet criterion 6. Furthermore, 22,050-26,800 is world population size (Wetlands International 2018). About 3-4% of world population winters in the site. Four satellite tagged Dalmatian Pelicans migrated to Ghizil-Agaj State Reserve in Azerbaijan and Volga Delta in Russia from the Anzali Wetland.

Therefore, following activities are needed.

- Wintering habitat conservation (water body with aquatic plant as feeding habitat, small reedbed island as roosting site) should be implemented
- Patrol of Dalmatian Pelican habitat (Sorkhankol WR, Selkeh WR and West Lagoon) by DOE guards to prevent illegal hunting
- Conservation of network of littoral wetlands of the Caspian Sea to Conserve unique ecosystem through international transboundary cooperation
- In addition, environmental education program for fish pond owner should be implemented to prevent to kill Pelican for protection of fish in their fish pond.



Source: JICA Expert Team

Figure 6.2-19 Dalmatian Pelicans in Sorkhankol WR

c) Caspian Kutum (*Rutilus kutum*) Ramsar Criteria 5,6

The Caspian Kutum is endemic in the Caspian Sea which that tributaries from Volga bight to Miankale Creek Bay, Black Sea and Azov Sea and their rivers. (Ghasemi et al (2009)) The Kutum is one of the economically valuable species of Caspian Sea. The Anzali Wetland is one of centers of distribution area of the fish. Two different races of this fish exist in the Caspian Sea, the spring race and the autumn race. The spring race is main population which spawn in small rivers or streams with heavy current on gravel bottom in spring. The autumn race rarely spawns on submerged plant in wetland. The spring race is widely distributed along the Caspian Sea including Anzali Wetland. However, autumn race is much rarer than spring race and autumn race is distributed only in Anzali Wetland. Ghasemi et al (2009) reported the result of genetic analysis showed spring and autumn races of Kutum in two regions of southern part of Caspian Sea are two independent populations. It showed possibility of genetic differentiation between spring race and autumn race of Kutum on process in Anzali Wetland. Artificial reproduction technology of main spring race has been established. On the other hand, it for rarer autumn race has not been established.

It is necessary to preserve and conserve genetic diversity of different races of *Rutilus kutum* and prevent the extinction of autumn race of Kutum (Valipour and Khanipour (2009)). Therefore, following activities are needed.

- Artificially breed the autumn form of *Rutilus kutum* for the rehabilitation of stocks and increase the productivity of the Caspian Sea
- Aquatic plants as spawning habitat of autumn race should be identified. Identified habitat must be protected in autumn.
- Fishway construction to able to migrate to spawning habitats for spring race (above-mentioned)



Source: JICA Expert Team

Figure 6.2-20 Caspian Kutum Captured in Siahkesim PA

2) Schedule of Protection and Conservation of Endangered Species and Other Important Species

Table 6.2-7 Schedule of Protection and Conservation of Endangered Species and Other Important Species

Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
Protection and Conservation of Endangered Species												To be implemented if necessary based on the monitoring.
Monitoring	←											
Implementation	←											

Source: JICA Expert Team

(4) Control of Invasive Alien Species

1) Implementation Plan

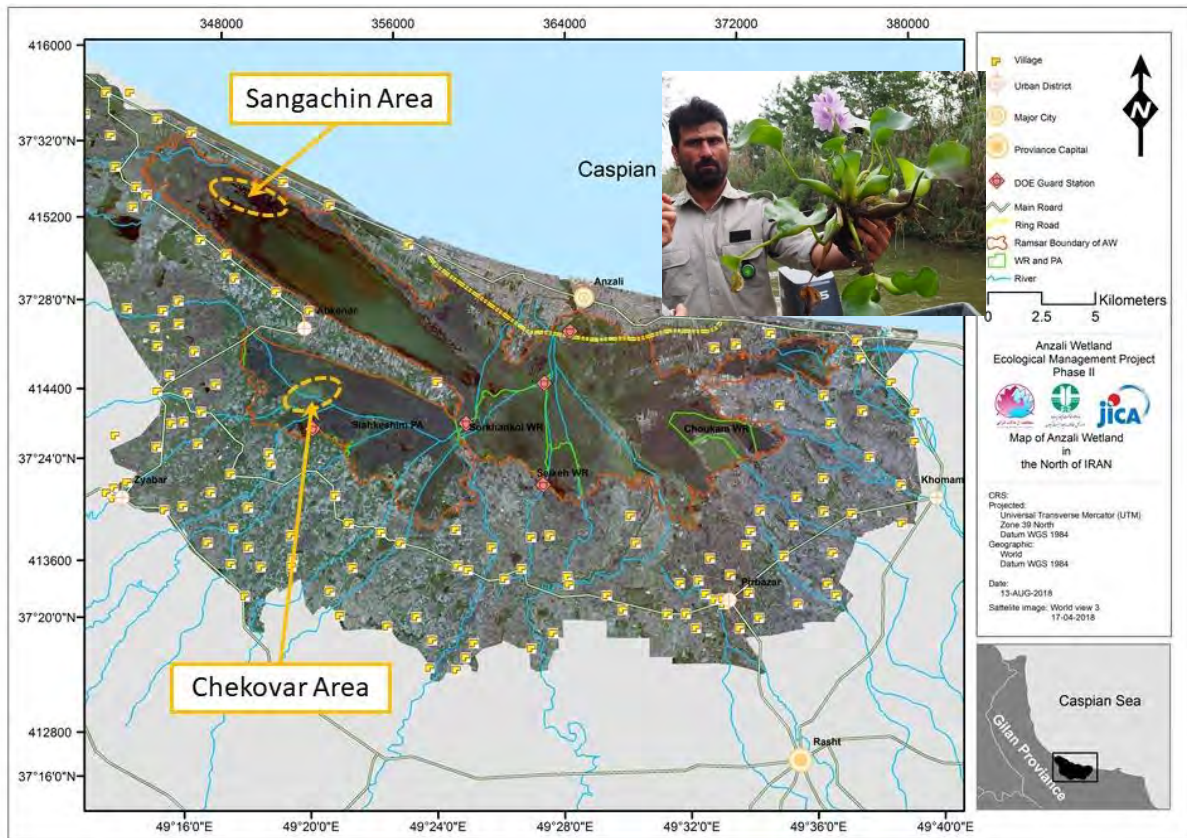
(a) 100 of The World’s Worst Invasive Alien Species (IUCN) in Anzali Wetland

IUCN listed “100 of the World’s Worst Invasive Alien Species” which illustrates the incredible variety of species that have the ability, not just to travel in ingenious ways, but also to establish, thrive and dominate in new places. Today, alien invasion is second only to habitat loss as a cause of species endangerment and extinction. Following 3 species of the 100 of the World’s Worst Invasive Alien Species were introduced or potentially introduced to the Anzali Wetland.

a) Water Hyacinth (*Eichhornia crassipes*)

Water Hyacinth is an exotic free-floating aquatic plant from the Amazon River basin in tropical South America. It was firstly found Chekoval area in the Anzali Wetland in July, 2015. It had possibility to cause many problems not only to the ecosystem but also to human life. Water Hyacinths were quickly spread in West Lagoon and Siahkeshim Protected Area and Central Area. And then many removal activities have been implemented by DOE and relevant organizations in cooperation with JICA Expert Team. NIWAI researched effective control method of the WH removal activities. Small number of Water Hyacinth is still remained in Chekovar area and Sangachin area as of 2018 as shown in Figure 6.2-21. It is not easy to

eradicate WH completely, however it is not so difficult to manage as low-density situation. WH must be very low-density situation by frequent monitoring and removal. Considering this condition, the most effective and efficient method of Water Hyacinth in this situation is manual removal. If WH will be increased too much to remove by hand, the aquatic plant harvester of DOE and excavator are effective to collect and remove as shown in Figure 6.2-22. However, the best way is frequent monitoring and small scale removal with low cost.



Source: JICA Expert Team

Figure 6.2-21 Important Areas for Water Hyacinth Control in the Anzali Wetland



Source: JICA Expert Team

Figure 6.2-22 Aquatic Plant Harvester of DOE for Water Hyacinth Removal

b) Domestic Cat (*Felis catus*)

Domestic Cat is often forgettable to consider as notable predators which threaten native birdlife and other fauna. Especially, crossbreeding with free-ranging Domestic Cats is supposed to threaten the genetic integrity of Asiatic Wildcat (*Felis silvestris*) population. However, genetic study of Asiatic Wildcat in the Anzali Wetland has not been implemented, therefore the information is not enough for conservation of Asiatic Wildcat population. There are many Domestic Cat in the Anzali Wetland including protected areas. The genetic study should be implemented as soon as possible.



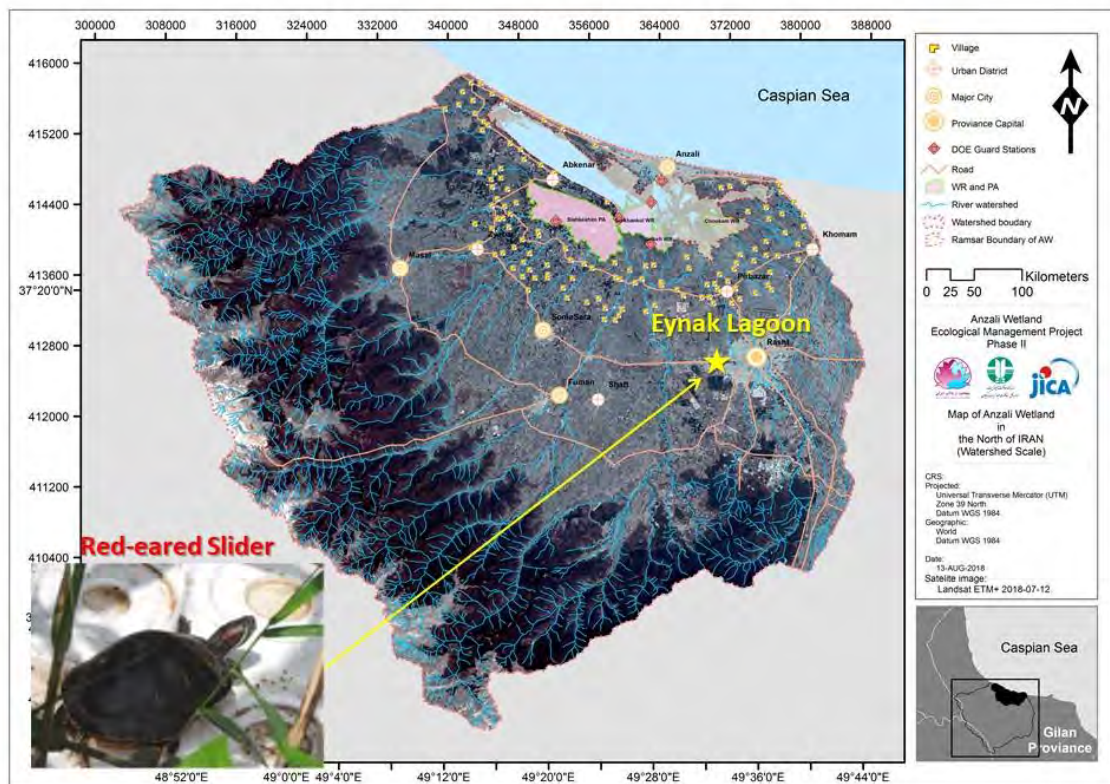
Source: JICA Expert Team

Figure 6.2-23 Camera-trapped Domestic Cat in Selkeh Wildlife Refuge

c) Red-eared Slider (*Trachemys scripta*)

Terrible Invasive Alien reptile, Red-eared Slider was found in Eynak Lagoon, catchment area of the Anzali Wetland in 2018 as shown in Figure 6.2-24. Red-eared Slider was listed up on the worst 100 alien species of IUCN. It is very high potential threat of native turtles in the Anzali Wetland. Fortunately, Red-eared Slider was not recorded in our reptile survey in the Anzali Wetland in 2018. On the other hand, there is unconfirmed report that Red-eared Slider has been

observed in Anzali Wetland. Red-eared Slider must be removed from the entire area of the Anzali Wetland basin.



Source: JICA Expert Team (photo by Omid Mozaffari (2018))

Figure 6.2-24 Map of Eynak Lagoon Red-eared Slider (*Trachemys scripta*)

(b) The Other Alien Species

a) *Azolla* (*Azolla filiculoides*)

Water fern, *Azolla* was introduced into Caspian Sea wetlands by rice-farmers in 1970s. *Azolla* covered much of the water surface within the reedbed and lotus community and open water surface for long time with periodic increasing and decreasing. Surprisingly *Azolla* was dramatically decreased in summer of 2017 without any removal measures. In Sangachin area, west part of the west lagoon, very small amount of *Azolla* was remained. The *Azolla* would be increased again from the small remained flocks. After that the signs of *Azolla*'s increasing were found in West Lagoon and Sorkhankol Wildlife Refuge again. Therefore, it is very difficult to completely remove *Azolla* from the Anzali Wetland. Monitoring must be continued and the utilization of *Azolla* paper production and feed for livestock such as Ostrich should be considered and started.



Source: JICA Expert Team

Figure 6.2-25 Azolla in Sangachin Area of the Anzali Wetland

b) Water Pennyworth (*Hydrocotyle ranunculoides*)

Water Pennyworth were introduced to the Anzali Wetland and spread out widely. *H. ranunculoides* competes with many native aquatic plant species. In addition, its body is very green in winter. Therefore, it makes very unnatural landscape and scenery in winter. This plant should be removed. However, it is spread too widely to remove from Anzali Wetland. As first pilot activity, Selkeh Wildlife Refuge is appropriate site to remove it.



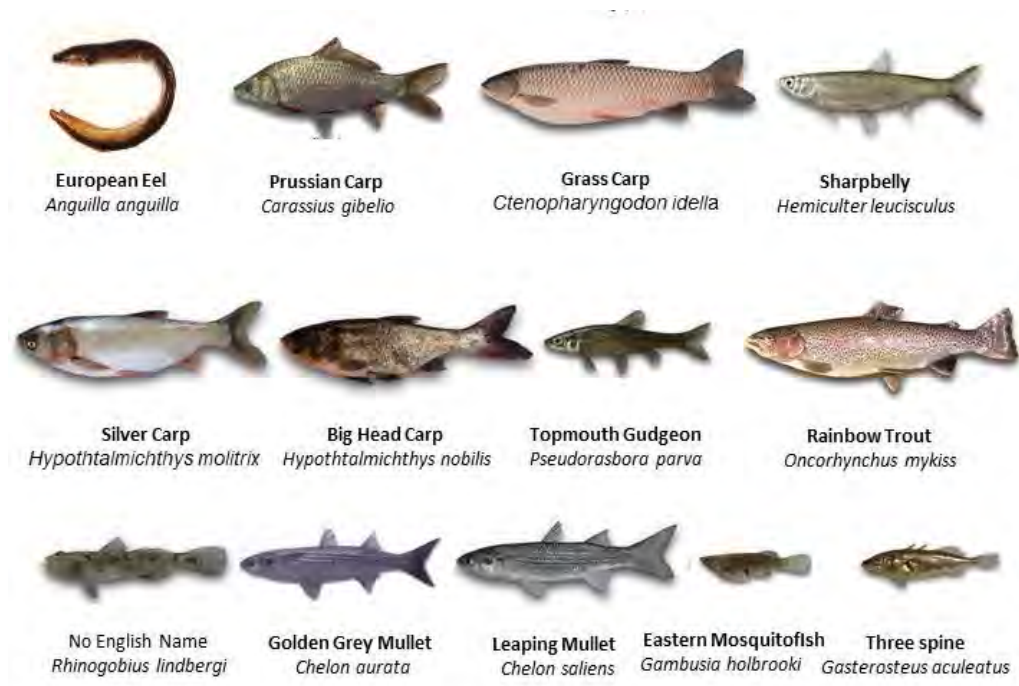
Source: JICA Expert Team

Figure 6.2-26 Water Pennyworth (*Hydrocotyle ranunculoides*)

c) Alien Fish

Many species including commercial fish were introduced and recorded to Anzali Wetland as shown in Figure 6.2-27. In addition to these species, aquarium fish was released to the Anzali Wetland such as Guppy (*Poecilia reticulata*), Giant Snakehead (*Channa micropeltes*), Giant pangasius (*Pangasius sanitwongsei*) and Common Pleco (*Hypostomus plecostomus*). Owners of aquarium fish should be educated not to release them when they get them at the aquarium shop.

The information is not enough to manage these fish species. Monitoring should be implemented. And the introduction of commercial fish should be very careful.



Source: Keyvan Abbasi et al (2019) Anzali Wetland Basin Fishes, Abdoli and Naderi (2009) Biodiversity of Fishes of the Southern Basin of the Caspian Sea,

Figure 6.2-27 Alien Fish Species

d) Oriental River Prawn (*Macrobrachium nipponense*)

Oriental River Prawn has been introduced and spread out widely as well.



Source: JICA Expert Team

Figure 6.2-28 Oriental River Prawn (*Macrobrachium nipponense*)

2) Scheduler of Control of Invasive Alien Species

The schedule of control of invasive alien species is shown below.

Table 6.2-8 Schedule of Control of Alien Species

Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
Control of Invasive Alien Species												To be implemented if necessary based on the monitoring.
Monitoring	←										→	
Water Hyacinth Removal												
Domestic Cat Control												
Red Slider Removal												
Azolla Control												
Water Penny Worth Removal												

Source: JICA Expert Team

6.2.6 Division of Roles

(1) Comprehensive Ecosystem Survey and Monitoring

The role of each organization is listed below.

Table 6.2-9 Roles of Each Organization of Comprehensive Ecosystem Survey and Monitoring

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Implementation of comprehensive ecosystem survey. Monitoring Monitoring of restoration activities.
NIWAI	<ul style="list-style-type: none"> Implementation of fish, benthos and planktons survey as a part of comprehensive survey in cooperation with DOE Gilan. Indicator monitoring of fish, benthos and planktons.
Shilat (or NIWAI)	<ul style="list-style-type: none"> Monitoring of volume of fish catches from Anzali Wetland.
DOE HQ	<ul style="list-style-type: none"> Update of RIS.

Source: JICA Expert Team

1) Conservation and Restoration of Ecosystem

(a) Conservation of Open Water Surface

The role of each organization is listed below.

Table 6.2-10 Roles of Each Organization of Conservation of Open Water Surface

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Monitoring of open water area and vegetation succession Removal of expanded Reedbed area(Only expanded after 2018)

Source: JICA Expert Team

(b) Conservation of Variety and Cline of Water Depth

The role of each organization is listed below.

Table 6.2-11 Roles of Each Organization of Conservation of Variety and Cline of Water Depth

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Monitoring of variety and cline of the water depth Dredging of typical sedimented area To keep hydrological characteristics
GRWC	<ul style="list-style-type: none"> Preventing over dredging to make canal to keep hydrological characteristics.
MOJA	<ul style="list-style-type: none"> Preventing over dredging to make canal to keep hydrological characteristics.

Source: JICA Expert Team

(c) Conservation of Reed Bed and the Other Aquatic Plant Community

The role of each organization is listed below.

Table 6.2-12 Roles of Each Organization of Reed Bed and the Other Aquatic Plant Community

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Monitoring of Reedbed Dredging of expanded Reedbed area Management of forestation of Reedbed (cutting forest)

Source: JICA Expert Team

(d) Conservation of Toll Forest

The role of each organization is listed below.

Table 6.2-13 Roles of Each Organization of Conservation of Toll Forest

Organization	Role
DOE Gilan	Protection of tall tree forest as habitat manager (to conserve habitat such as nest of White-tailed Eagle, colony of Herons, the other forest mammals, birds, reptiles and insects)
Shilat	Protection of tall tree forest as land owner

Source: JICA Expert Team

(e) Construction of Fish Way and Securement of Maintenance Flow

The role of each organization is listed below.

Table 6.2-14 Roles of Each Organization of Construction of Fish Way and Securement of Maintenance Flow

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Supervision of the fishway plan Patrol of illegal fishing at fishways
NIWAI	<ul style="list-style-type: none"> Baseline survey and monitoring of migratory fish Planning of fishway plan
GRWC	<ul style="list-style-type: none"> Installation of fishway on dams which managed by GRWC Discharge of maintenance flow to under dams
MOJA	<ul style="list-style-type: none"> Installation of fishway on dams managed by MOJA Discharge of maintenance flow to under dams

Source: JICA Expert Team

(2) Protection and Conservation of Endangered Species and other Important Species

The role of each organization is listed below.

Table 6.2-15 Roles of Each Organization of Protection and Conservation of Endangered Species

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> Monitoring of endangered species and the other important species. Planning of protection and conservation of them. Implementation of conservation activity of them including various environmental education activities.
NIWAI/Shilat	<ul style="list-style-type: none"> Monitoring of endangered fish and the other important fish. Planning of protection and conservation of them. Implementation of conservation activity of them including environmental education for fisherman and fishpond owner to prevent to kill the Common Otter.

Source: JICA Expert Team

(3) Control of Invasive Alien Species

The role of each organization is listed below.

Table 6.2-16 Roles of Each Organization of Control of Alien Species

Organization	Role
DOE Gilan	Monitoring of all of invasive alien species
NIWAI	Monitoring of invasive alien fish and aquatic creatures
Shilat	NOT introduce potential invasive alien fish species to Anzali Wetland

Source: JICA Expert Team

6.2.7 Budget

The budget plan of Wetland Ecosystem Conservation (2020-2030) is shown in Table 6.2-17.

Total budget is 5,648 thousand USD. (Comprehensive ecosystem survey and monitoring is seamless continuous activity. Therefore, it includes 2019 budget.)

This budget plan was prepared based on the current situation as of March 2019. Therefore, the required budget will be changed based on the result of the surveys and the situation of the wetland. However, this budget plan is useful for budgetary request in advance.

Table 6.2-17 Budget Plan of Wetland Ecosystem Conservation(2020-2030)

Items	(2019)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Remarks
(1) Comprehensive Ecosystem Survey and Monitoring														
Comprehensive Ecosystem Survey														
(a) Macrophyte	50						50						100	
(b) Phytoplankton	50						50						100	
(c) Mammal			50						50				100	
(d) Bird			50						50				100	
(e) Reptile and Amphibian				20						20			40	
(f) Fish				50						50			100	
(g) Insect	50						50						100	
(h) Benthos and Zooplankton	50						50						100	
(j) Hydrological Study of All of the Wetland	150						150						300	
Subtotal of comprehensive ecosystem survey	350	0	100	70	0	0	350	0	100	70	0	0	1,040	
Indicator Monitoring														
(a) Winter Bird	1	1	1	1	1	1	1	1	1	1	1	1	12	Midwinter Bird Counting by DOE Expert
(b) Breeding Bird	10	10	10	10	10	10	10	10	10	10	10	10	120	
(c) Otter	10	10	10	10	10	10	10	10	10	10	10	10	120	by DOE Expert
(d) Alien Species													0	Monitoring by DOE Guard
(e) Restored Area (ex.Selkeh)	50	50	50	50	50	50	50	50	50	50	50	50	600	
(e) The other indicator species	30	30	30	30	30	30	30	30	30	30	30	30	360	
(2) Update of Ramsar Information Sheet(RIS)						10						10	20	Analysis of Reports
Subtotal of monitoring	101	101	101	101	101	111	101	101	101	101	101	111	1,232	
Sub Total of (1)	451	101	201	171	101	111	451	101	201	171	101	111	2,272	
(2) Conservation and Restoration of Ecosystem														
(a) Conservation of Open Water Surface														
Planning		2	2					2	2				8	
Implementation				58	58					58	58		232	5.8 thousand USD/ha
(b) Conservation of Variety and Cline of Water Depth														
Planning		2	2					2	2				8	
Implementation				275	275	275	275			275	275	275	1925	
(c) Conservation of Reed Bed and the Other Aquatic Plant Community														
Planning		2						2					4	
Implementation			6	6					6	6			24	6 thousand USD/ha
(d) Conservation of Toll Forest														
Monitoring													0	Monitored by DOE guards
(e)Construction of Fish Way and Securement of Maintenance Flow														
Planning		5											5	
Construction and installation of Fish way including regular maintenance			10	10	10	10	10	10	10	10	10	10	100	including maintenance
Sub Total of (2)	11	20	349	343	285	285	16	20	349	343	285	2,306		
(3) Protection and Conservation of Endangered Species and other Important Species														
Implementation		10	10	10	10	10	10	10	10	10	10	10	110	
Sub Total of (3)	10	10	10	10	10	10	10	10	10	10	10	10	110	
(4) Invasive Alien Species Control														
Water Hyacinth Removal		10	10	10	10	10	10	10	10	10	10	10	110	
Azolla Control		50	10	10	10	10	10	10	10	10	10	10	150	
Water Penny Worth Removal		50	50	50	50	50	50	50	50	50	50	50	550	
Red Slider Removal		50	10	10	10	10	10	10	10	10	10	10	150	
Sub Total of (4)	160	80	80	80	80	80	80	80	80	80	80	80	960	
Grand Total	451	282	311	610	534	486	826	207	311	610	534	486	5,648	

Unit: thousand USD

Source: JICA Expert Team

6.2.8 Supposed Problems

(1) Lack of Understandings of Importance of Baseline Survey and Monitoring

DOE Gilan as a main responsible organization of Anzali Wetland ecosystem conservation does not understand the importance of baseline ecosystem surveys, planning based on the result of baseline surveys and monitoring very much. DOE Gilan should understand that these surveys and monitoring are not academic activities and it is to get baseline information for management. The items should be simple and repeated as above-mentioned. DOE HQ, MPO Gilan and Provincial Governor should allocate the budget for such activities.

(2) Constant Unpredictable Change of Ecosystem of the Anzali Wetland

Above-mentioned plans are based on the current situation as of 2018. The ecosystem of the Anzali Wetland is constantly changing due to whether natural or artificial factor. Above-mentioned plans are very basic plans. Therefore, each conservation and restoration plan should be planned in detail carefully just before the implementation based on the baselines survey as an adaptive management of ecosystem.

6.3 Monitoring of Water and Sediment

6.3.1 Current Situation

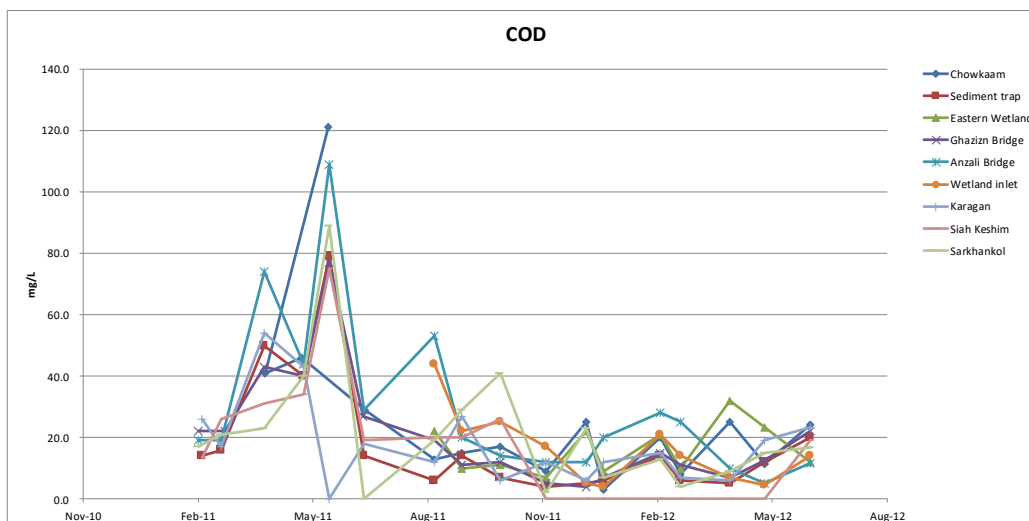
(1) Background

Anzali Wetland is one of the most important water bodies in Gilan, and it is internationally known as a Ramsar site – a wetland of international importance. However, in 1993, the wetland was enlisted in the Montreux Record of the Ramsar Convention due to eutrophication and fluctuating water levels. Since then various efforts have been made to improve water quality of the wetland and rivers in the basin, such as commencement of development of sewerage in Rasht and Anzali. Similarly, large structural measures, such as construction of sediment traps and dredging in the wetland, have been implemented in response to shallowing of the wetland. Nevertheless, these measures have been implemented without proper monitoring, and it is difficult to evaluate whether these measures with significant investments have been effective in improving the wetland environment, e.g., whether the water pollution in the wetland is getting better or not, whether the sediment traps and dredging have stopped the shallowing trend of the wetland. This way, it is impossible to use the budget and other resources in the most effective and efficient manner. Furthermore, the situation surrounding the wetland environment is changing rapidly, due to, e.g., the fluctuating Caspian Sea level, extreme weather, urbanization, etc., and one has to adjust to such changes. In order to manage the wetland effectively and efficiently, and in order to adjust to such changes, it is very important to regularly monitor the situation of the wetland environment and effectiveness of various management actions.

(2) Review of Related Data and Information

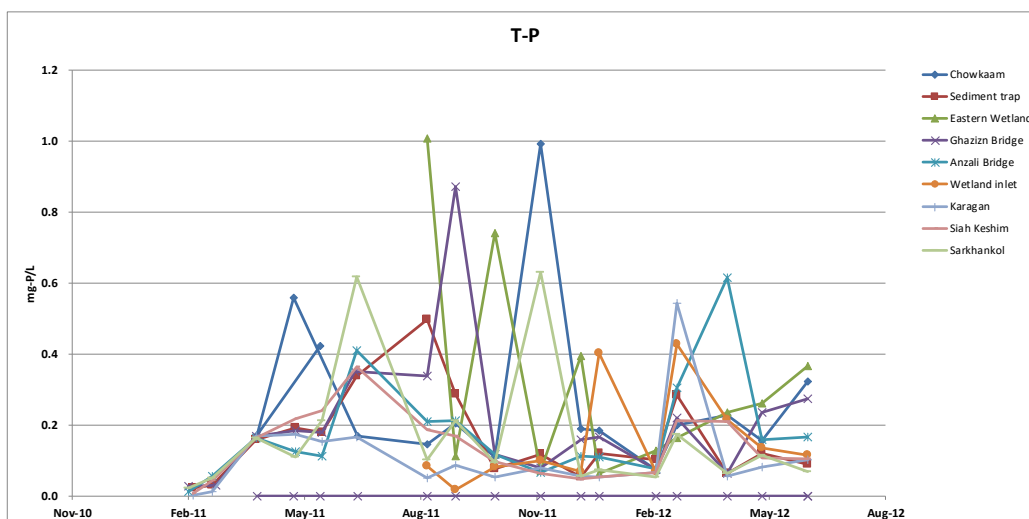
At the beginning of the project, data and information related to environmental monitoring were reviewed. They include monitoring data during the JICA M/P and the Phase 1 Project.

Figure 6.3-1 and Figure 6.3-2 show the seasonal variations of COD and T-P concentrations monitored in 2011 – 2012 during the Phase 1 Project. There was no doubt that DOE Gilan made a significant effort to implement the monitoring in this period. Nevertheless, it seemed the data was plagued with various errors and artifacts, and as the result it was impossible to interpret environmental conditions of the wetland based on the data. For example, COD showed a peak in May 2011, but such peak was not observed in May 2012 for unknown reason. Similarly, T-P data varied widely throughout the period. It was suspected that the T-P level was too elevated judging from the level of eutrophication in the wetland, though the reason was not clear.



Source: JICA Expert Team

Figure 6.3-1 Historical Monitoring Data of COD (2011-2012)



Source: JICA Expert Team

Figure 6.3-2 Historical Monitoring Data of T-P (2011-2012)

In order to interpret environmental conditions of the wetland and provide scientific basis of environmental management, DOE Gilan needed more reliable dataset.

(3) Implementation of Tentative Monitoring Program

A monitoring program was proposed during the Phase 1 Project, but after the Phase 1 Project, the monitoring was suspended. Thus, it was decided to resume the monitoring program proposed in the Phase 1 Project as the tentative monitoring program. Table 6.3-1 summarizes the tentative monitoring program.

Table 6.3-1 Tentative Monitoring Program

Survey	Media	Parameters	Sampling Points	Frequency (per year)	Total Sample
Regular					
Rivers	Water	Water temp., air temp., EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, total coliform, fecal coliform, total Zn, dissolved Cu	8	12	96
		As, Cd, Pb, Zn, Hg, CN, pesticides	8	4 (every 3months)	32
	Sediment	Particle size distribution, total organic carbon, Cd, Pb, Zn, As, Hg, Cu, Ni, pesticides	8	1	8
Wetland	Water	Flow rate (GRWC), water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, chlorophyll a, total coliform, fecal coliform, total Zn, dissolved Cu	8	12	96
		As, Cd, Pb, Zn, Hg, CN, pesticides	8	4 (every 3months)	32
	Sediment	Particle size distribution, total organic carbon, Cd, Pb, Zn, As, Hg, Cu, Ni, pesticides	8	1	8
Pollution Sources	Leachate and Wastewater	Flow rate, water temp., air temp., EC, DO, pH, SS, turbidity, BOD, COD, T-P, NH ₄ -N, T-N, oil & grease, total coliform, fecal coliform, As, Cd, Pb, Zn, Hg, CN, pesticides	40	2	80
	Sludge	Total organic carbon, Cd, Pb, Zn, As, Hg, Cu, Ni, pesticides	15	1	15
Non-regular					
Rivers and Wetland	Water	Flow rate (GRWC), water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, chlorophyll a, total coliform, fecal coliform, total Zn, dissolved Cu, As, Cd, Pb, Zn, Hg, CN, pesticides	20	1	20
	Sediment	Particle size distribution, total organic carbon, Cd, Pb, Zn, As, Hg, Cu, Ni, pesticides	2	1	2
Pollution sources	Water	Flow rate, water temp., air temp., EC, DO, pH, SS, turbidity, BOD, COD, T-P, NH ₄ -N, T-N, oil & grease, total coliform, fecal coliform, As, Cd, Pb, Zn, Hg, CN, pesticides	50	1	50
	Industrial sludge	Total organic carbon, Cd, Pb, Zn, As, Hg, Cu, Ni, pesticides	20	1	20

Source: JICA Expert Team

This program was presented as part of the Action Plan of the JPA and approved at the JCC/AWMC in May 2015. However, from the onset, implementation of the tentative monitoring program faced serious difficulties. In Iranian FY2015 ((July 2015 – June 2016), the Iranian side did not allocate the budget for the JPA activity. This was partially because the budget had to be ear-marked during the previous fiscal year. However, the main problem was the lack of general will to implement monitoring – many stakeholders believed that there were enough environmental data and the budget should be spent on other activities, especially physical restoration works.

Faced with the lack of the budget and wide support, it was decided to implement an activity that could be implemented without significant Iranian budget. A cross-examination (a comparative analysis) of water samples from the wetland (Sorkhankol), a river (Pirbazar River upstream of the sediment trap) and a sewage outfall (outfall in Anzali City) was selected as it would help the laboratories to improve analytical reliability. Six laboratories in the area (DOE Gilan, DOE-Anzali, GWWC, RWWC, NIWAI, a private laboratory in Rasht) participated in this activity. Table below summarizes the results for EC, COD, BOD, T-P and T-N.

Table 6.3-2 Ranges of Concentrations of Water Quality Parameters in Comparative Analysis of Environmental Samples in May 2015

Parameter	Unit	Wetland (Sorkhankol)	River (Pirbazar)	Sewage (Anzali)
EC	µS/cm	10 - 1080	1089 - 1477	834 - 1574
COD	mg/L	6 - 43	12 - 77	32 - 220
BOD	mg/L	2 - 24	6 - 31	60 - 117
T-P	mg/L	0.13 - 0.88	0.43 - 3.77	0.48 - 35.2
T-N	mg/L	0.5 - 7.6	2.7 - 11.1	4.7 - 22.2

Source: JICA Expert Team

The results revealed existence of significant inter-laboratory variations, and it was difficult to determine results of which laboratories were close to the true concentrations of these parameters. Some extreme values were caused by simple errors in calculation or similar reasons, while it was suspected that other factors, such as difference in analytical methodologies and contamination of equipment and apparatus, also played some roles in the variations.

To examine these problems more closely, the same six laboratories implemented another comparative analysis in October 2015. This time synthetic reference samples with known concentrations of pollutants, prepared by mixing different amounts of reagents, was used for the comparison, and the laboratories analyzed them without knowing the expected concentrations. The results are shown in Table 6.3-3.

Table 6.3-3 Ranges and Actual Concentrations of Water Quality Parameters in Comparative Analysis of Synthetic Reference Samples in October 2015

Parameter	Unit	Actual Conc.	Results
NO ₂ -N	mg/L	0.02	0.000 - 0.030
		0.10	0.080 - 0.200
		1.0	0.19 - 1.00
NO ₃ -N	mg/L	1.0	0.40 - 1.40
		5.0	1.2 - 5.9
		15	10 - 18
NH ₄ -N	mg/L	0.5	0.44 - 0.80
		5.0	3.7 - 10.2
		15	10.3 - 15.9
PO ₄ -P	mg/L	0.1	0.00 - 0.51
		1.0	0.97 - 1.40
		5.0	4.50 - 6.00
COD	mg/L	20	17 - 42
		100	50 - 110
		200	150 - 208

Source: JICA Expert Team

The results were much better this time, but this is partly because the reference samples were free of interfering substances that exist in real environmental samples. Even with these reference samples, an error of 10% to 30% was not unusual.

(4) Review of the Monitoring Data and Preparation of the Monitoring Reports

As explained above, DOE Gilan could not implement the tentative monitoring program as planned. Hence, the results of the comparative analyses were reviewed, and summarized in the Progress Report No.2.

(5) Revision of the Monitoring Program

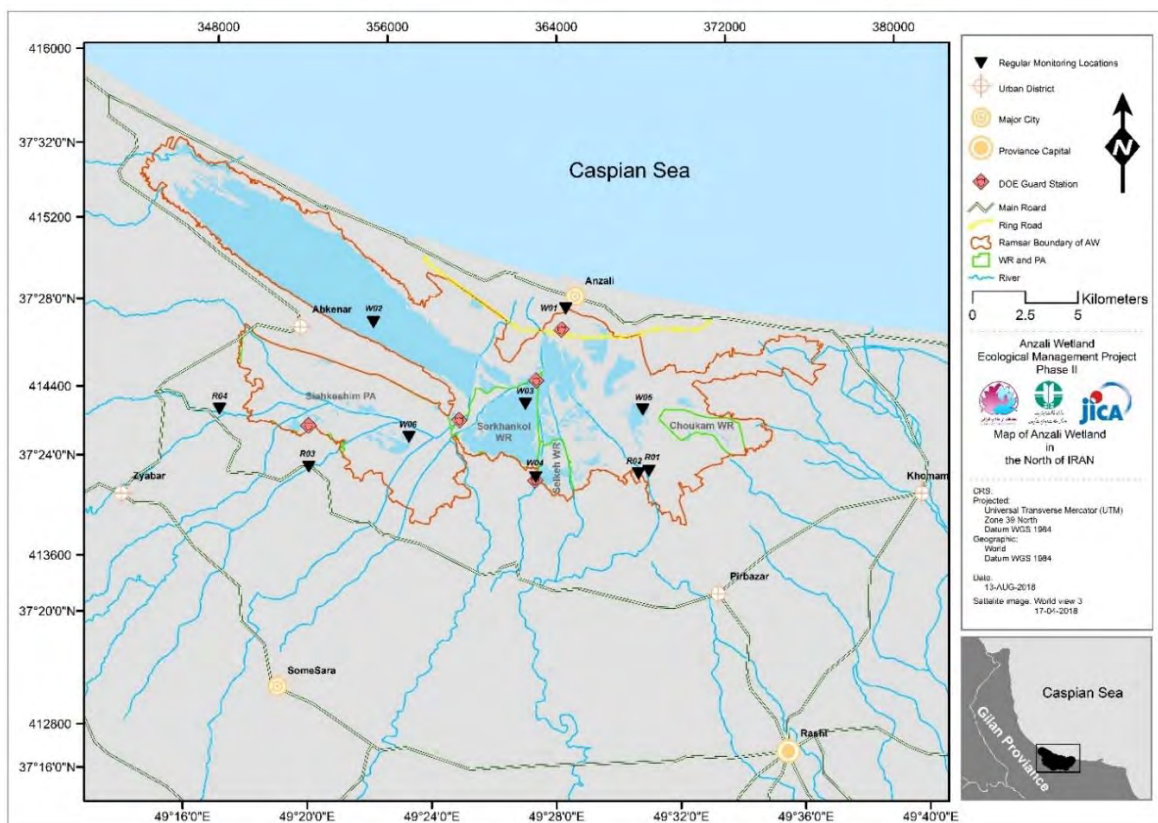
In March 2016, the monitoring program was revised significantly based on the results of the activities in the Iranian FY2015. Considering the budget problem encountered, the work load of the monthly monitoring program was significantly reduced from 16 locations to 7 locations. Also, the sediment monitoring proposed in the JPA was removed from the JPA as DOE Gilan decided to implement a separate sediment survey to develop sediment dredging plans. On the other hand, a program of salinity monitoring was added, as such information was deemed crucial to evaluate environmental conditions of the Anzali Wetland. Table 6.3-4 and Table 6.3-5 summarize the sampling locations, frequency, analytical items and the objectives of the revised regular monitoring program and the salinity monitoring program. The maps of the monitoring locations of these programs are given in Figure 6.3-3 and Figure 6.3-4.

Table 6.3-4 Revised Regular Monitoring Program

Category	Sampling Locations	Frequency	Analytical items	Main objective
Anzali Wetland	3 locations (Port (W01), Lagoon (W02), Sorkhankol (W03))	Monthly	Water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, phenols, chlorophyll a, total coliform, fecal coliform, total (dissolved) Zn, dissolved Cu	<ul style="list-style-type: none"> - To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term - To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not - To evaluate water quality condition of wildlife refuge
	3 locations (Siakhesim (W05), Selke (W04), Chokum (W06))	Quarterly	Water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, phenols, chlorophyll a, total coliform, fecal coliform, total (dissolved) Zn, dissolved Cu	<ul style="list-style-type: none"> - To evaluate water quality condition of wildlife refuges and protected area
Rivers	4 locations (Pirbazar (R01), Pasikhan (R02), Palangvar (R03), Khalkai (R04))	Monthly	Water temp., air temp., EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, phenols, total coliform, fecal coliform, total (dissolved) Zn, dissolved Cu	<ul style="list-style-type: none"> - To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not

Note: items with “ ” were proposed in the regular monitoring program developed in March 2016, but were not implemented in September 2016.

Source: JICA Expert Team



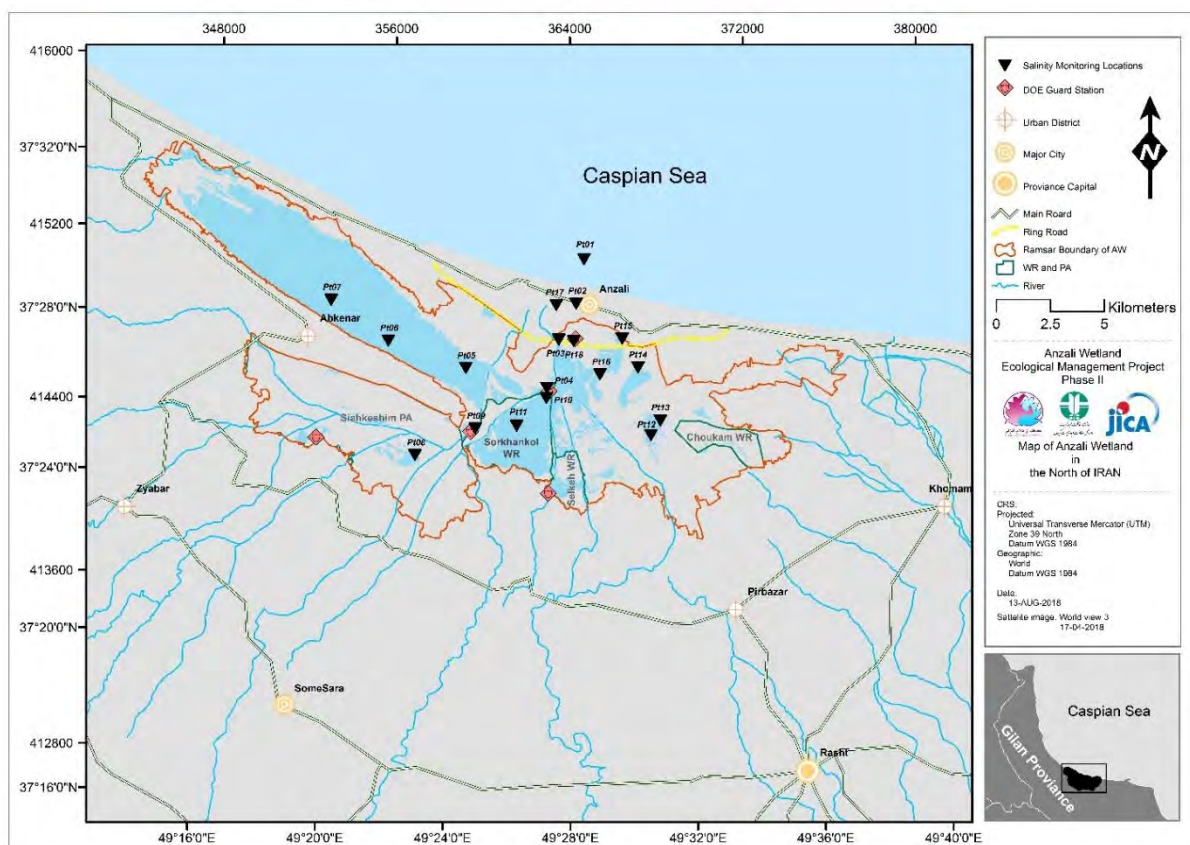
Source: JICA Expert Team

Figure 6.3-3 Sampling Locations of Regular Monitoring Program

Table 6.3-5 Salinity Monitoring Program

Category	Sampling Locations	Date	Analytical Items	Main Objective
Wetland	18 locations (top 50 cm and other depth if water is deep)	As needed	Water temp, air temp., DO, EC, salinity (portable water quality meter)	- To evaluate whether there is significant mixing of the Caspian Sea water with water of the Anzali Wetland t

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-4 Sampling Locations of Salinity Monitoring Program

This revised programs (including the salinity monitoring and the monitoring of sediment) were explained in Progress Report No.2 and was officially adopted at the 4th JCC on 6 June 2016.

(6) Implementation of the Revised Monitoring Program

The JPA continued to face difficulty in securing the Iranian budget, and various efforts were made to improve the situation, which included discussions at the SC meetings as well as discussions with DOE HQ on budgeting and DOE’s mandate. However, the budget was never made available largely because the management of DOE Gilan eluded the responsibility and never committed to regular monitoring of the wetland. The available budget was believed to be channelled to other activities. Thus, the monitoring activities were implemented in an ad hoc manner only when possible and cajoled by JICA Expert Team. The revised program required monthly sampling in accordance with the environmental standard of Iran issued by DOE, but

the monitoring was implemented only nine times over the last 30 months since July 2016 until December 2018 – in September and December 2016, January-March, August and December 2017, and March and November 2018.

These activities, except the last monitoring in November 2018, were implemented by a staff of DOE Gilan (sampling) and the main laboratory of DOE Gilan (laboratory analysis). The last monitoring in November 2018 was implemented by the members of Anzali Wetland Monitoring Office (AWMO).

1) Quality Control

The comparative analyses among laboratories in the region in 2015 (see Section (3)) revealed existence of large inter-laboratory variabilities, and it was difficult to have full confidence in analytical data of some parameters, such as phosphorus, which is arguably the most important pollutant determining the level of eutrophication in the wetland. The laboratory of DOE Gilan tried to pinpoint the problem. However, it was following the protocol of the manufacturer of the analytical equipment, and the issue of data reliability could not be resolved easily.

To obtain reliable data, thus, more comparative analyses were carried out in March 2017 and August 2017, this time with laboratories in Japan, the Netherlands and Gilan. The results are given in Table 6.3-6.

Table 6.3-6 Comparative Analyses of Environmental Samples in March and August 2017

Sampling Date		8 March 2017			20 Aug. 2017		
Category	Location	COD (mg/L)	T-P (mg/L)	T-N (mg/L)	COD (mg/L)	T-P (mg/L)	Total IN* / T-N (mg/L)
Anzali Wetland	Lagoon	18 (12) [<10]	0.07 (0.041) [<0.10]	- (0.68) [0.44]	32.8 (33) {31.4}	0.08 (0.045) {0.051}	1.65 (1.1)
	Sorkhankol	9.9 (8.1) [<10]	0.06 (0.072) [0.16]	- (1.2) [1.3]	53.7 (60) {65.7}	0.11 (0.15) {0.084}	0.702 (1.3)
River	Pirbazar	375 (19) [23.9]	0.18 (0.30) [0.34]	- (4) [3.8]	33.05 (37) {39.5}	2.12 (1.9) {2.09}	18.0 (10)
	Khalkai	9.1 (5.7) [<10]	0.05 (0.089) [0.24]	- (1.8) [3.3]	4.87 (8) {11}	0.068 (0.0469) {0.046}	1.67 (1.0)

Note: number in () was measure at Japanese laboratory using JIS K 0102 20.1 (COD), 45.4 (T-N) and 46.3.1 (T-P)

Note: number in [] was measured at Dutch laboratory using NENISO 15705 (COD), NEN 6646 (T-N) and ISO 6878/15923-1 (T-P)

Note: number in { } was measured at Environmental Research Institute in Rasht, Iran using Standard Methods for the Examination of Water and Wastewater, 5220 (COD), 4500-N (T-N) and 4500-P (T-P)

Note: * - DOE's data are sum of nitrate, nitrite and ammonia nitrogens; Japanese data are T-N

Source: DOE Gilan and JICA Expert Team

Because analytical methodologies are not the same across the laboratories, these data cannot be compared strictly. Nevertheless, the results were more or less consistent, and it was concluded that the results of the monitoring in March and August 2017 were reliable within the variability. In 2014, when the project started, there were no reliable data, and it was not possible to evaluate the pollution of the wetland. The project finally obtained reliable data that could be used as reference data for future monitoring activities.

2) Monitoring in August 2017

In this section, the results of the monitoring in August 2017 are summarized. The monitoring results of this month was selected because (i) in this month, both the regular monitoring and the salinity monitoring proposed in the JPA were implemented, and (ii) an additional sediment monitoring was implemented to evaluate the levels of toxic substances in the wetland. The regular monitoring was implemented in total nine times, but the results of other monitoring activities are not reported in this report as their reliability needs to be scrutinized further.

(a) Regular Monitoring

a) Objectives

The regular monitoring program is the core program of the JPA designed to fulfill the following objectives:

- To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term (in the order of decades)
- To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not
- To evaluate water quality condition of wildlife refuges and protected area
- To determine whether there are significant spatial differences in water quality of the Anzali Wetland or not, and to evaluate the cause of such spatial differences.
- To determine whether there is significant pollution of the wetland sediment by heavy metals and other organic chemicals

The program focused on capturing the situation of organic pollution and eutrophication in the wetland.

b) Methodologies

Table 6.3-7 summarizes the sampling locations and analytical items of the regular monitoring in August 2017.

Table 6.3-7 Program of Regular Monitoring in August 2017

Category	Sampling Locations	Date	Analytical Items	Main Objectives
Anzali Wetland	3 locations (Port, Lagoon, Sorkhankol)	20 th Aug. 2017 20 th Aug. 2017	Analysis at DOE: Water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, phenols , chlorophyll a, total coliform, fecal coliform, total (dissolved) Zn, dissolved Cu	<ul style="list-style-type: none"> - To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term - To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not - To evaluate water quality condition of wildlife refuge
Rivers	2 locations (Pirbazar, Khalkai)		Analysis at DOE: Water temp., air temp., transparency, EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, phenols , chlorophyll a, total coliform, fecal coliform, total (dissolved) Zn, dissolved Cu	

Note: parameters indicated by “ ” are proposed in the regular monitoring program amended in 2016, but were not measure in August 2017.

Source: JICA Expert Team

Table 6.3-8 summarize the analytical methodologies adopted by DOE Gilan.

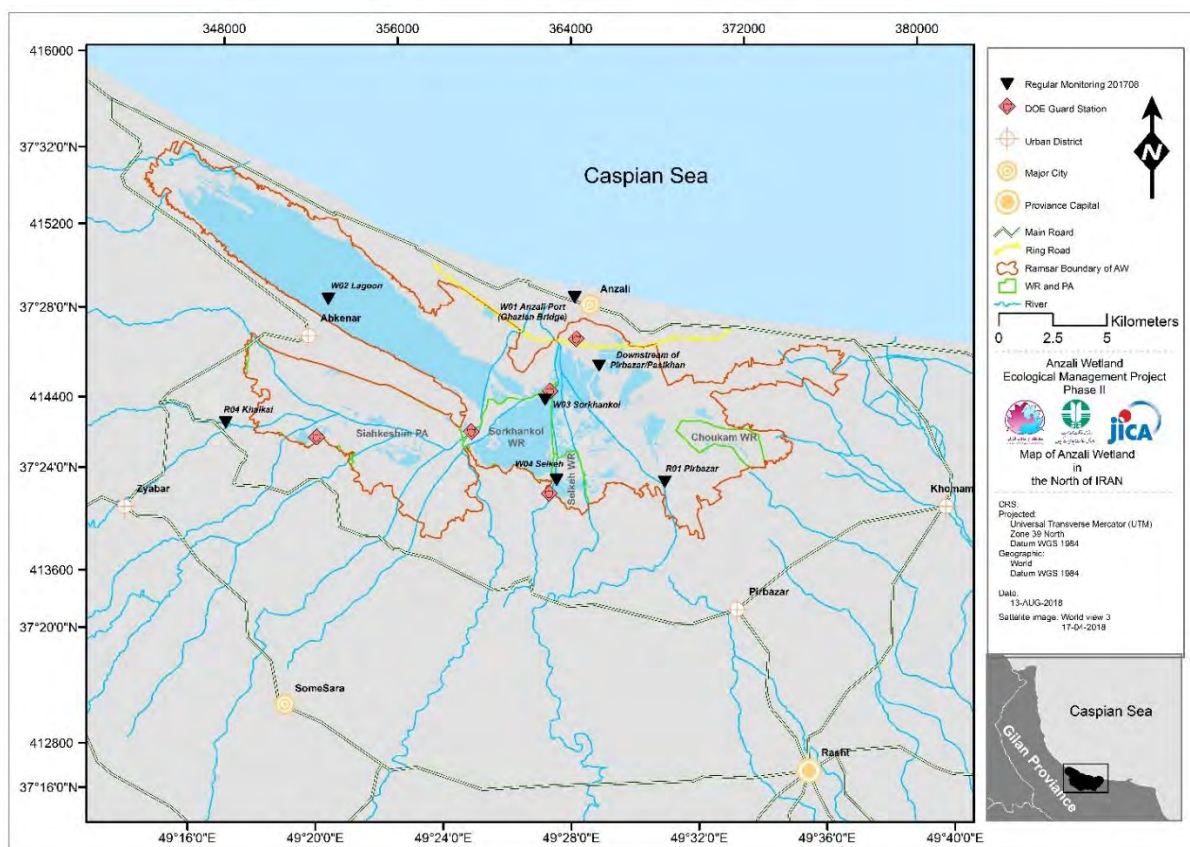
Table 6.3-8 Analytical Methodologies Used by DOE

Parameter	Methodology	Parameter	Methodology
Water temp., air temp.	Thermometer	NO ₂ -N	Method 10019
Transparency	Secci disk	NH ₄ -N	Method 10031
EC, salinity DO, pH	HACH 40d Portable Water Quality Meter	T-N	Method 10071
COD	Method 8000	Total coliform	MPN
BOD	BOD Sensor	Fecal coliform	MPN
Ortho-PO ₄	Method 8000	Chlorophyll a	APHA 10200
Total P	Method 8190	Total Zn	AA
NO ₃ -N	Method 8171	Dissolved Cu	AA

Note: Methodologies to be confirmed by DOE Gilan

Source: DOE Gilan

The sampling locations and their coordinates are shown in Figure 6.3-5 and Table 6.3-9. The samples were collected from the locations set in the original monitoring program. If the sites were too shallow and not accessible, they were collected at locations as close to the original positions as possible. As this regular monitoring was implemented together with the monitoring of toxic substances (explained below), locations of the monitoring of toxic substances (water and sediment) are also shown in the map.



Source: JICA Expert Team

Figure 6.3-5 Sampling Locations of Regular Monitoring in August 2017

Table 6.3-9 Coordinates of Sampling Locations in August 2017

Category	Location Name	Point	Easting (UTM)	Northing (UTM)	Lab (Water Quality)	Lab (Sediment Quality)
Anzali Wetland	Anzali Port (Ghazian Bridge)	W01	364179E	4148589 N	DOE	-
	Lagoon	W02	352797 E	4148512 N	DOE, Japan, ERI	Netherlands
	Sorkhankol	W03	362817 E	4143857 N	DOE, Japan, ERI	Netherlands
	Selkeh	W04	363343 E	4140154 N	-	Netherlands
	Downstream of Pirbazar/Pasikhan	-	365311 E	4145428 N	-	Netherlands
Rivers	Pirbazar	R01	368345 E	4140068 N	DOE, Japan, ERI	Netherlands
	Khalkai	R04	348056 E	4142815 N	DOE, Japan, ERI	Netherlands

Source: JICA Expert Team

The sampling was implemented on 20th August 2017 except for sediment sampling at Selkeh, which was implemented on 19th August 2017. The weather was fine, and there had been no major storm event prior to the sampling.

c) Results

Table 6.3-10 summarizes the field data of the regular water quality monitoring conducted on 20th August 2017. Measurements were made at around 50 cm from the surface, except for the Sorkhankol site, where the measurement was done at around 20 cm from the surface, as the water was too shallow (about 50 cm deep).

Table 6.3-10 Field parameters of Regular Water Quality Monitoring in August 2017

Category	Location	Date and Time	Water Temp. (°C)	Air Temp. (°C)	EC (mS/cm)	Salinity (ppt)	pH	DO (mg/L) and DO Percent
Iranian Standard			-	-	-	-	6-9	8 mg/L (at least 50% of time) 5 mg/L (100% of time)
Anzali Wetland	Port	20 th Aug., 2017 10:20	-	-	11.81	6.08	8.27	10.52 (137.9%)
	Lagoon	20 th Aug., 2017 11:10	28.6	29.0	5.34	2.66	7.49	1.12 (14.7%)
	Sorkhankol	20 th Aug., 2017 11:55	30.6	30.0	8.32	4.10	8.85	5.21 (70.0%)
River	Pirbazar	20 th Aug., 2017 12:23	30.5	30.0	1.23	0.55	7.64	1.57 (20.2%)
	Khalkai	20 th Aug., 2017 15:10	28.3	29.0	0.84	0.38	8.06	8.67 (113.1%)

Note 1: The values of temperature, pH, EC, Salinity and DO were measured on-site using thermometers and a portable water quality analysis.

Source: JICA Expert Team

The analytical results of general water quality parameters by DOE Gilan are summarized in the following table together with the results by Environmental Research Institute and the Japanese laboratory.

Table 6.3-11 Results of Water Quality Analysis by DOE in August 2017

Category	Location	Date and Time	DO (Lab) (mg/L)	pH (Lab)	EC (Lab) (mS/cm)	TSS (mg/L)	Turbidity (NTU)
Iranian Standard			8 mg/L (at least 50% of time) 5 mg/L (100% of time)	6-9	-	25	-
Anzali Wetland	Port	20 th Aug., 2017 10:20	5.73	8.65	8.610	80.1	19.3
	Lagoon	20 th Aug., 2017 11:10	1.105	7.59 [7.3]	4.390	12.4	6.71
	Sorkhankol	20 th Aug., 2017 11:55	4.49	8.72 [7.26]	5.890	36.5	14.6
River	Pirbazar	20 th Aug., 2017 12:23	0.303	7.51 [7.68]	1.133	35.5	13.8
	Khalkai	20 th Aug., 2017 15:10	3.87	7.92 [8.3]	0.774	8.6	9.8

Category	Location	Date and Time	BOD (mg/L)	COD (mg/L)	T-P (mg/L)	NO ₃ -N (mg/L)	NO ₂ -N (mg/L)	NH ₄ -N (mg/L)
Iranian Standard			6	-	0.13	-	0.03	1
Anzali Wetland	Port	20 th Aug., 2017 10:20	19	42.8	0.55	2.3	0.101	4.1
	Lagoon	20 th Aug., 2017 11:10	11	32.8 (33) [31.4]	0.08 (0.045) [0.051]	1.2 [0.78]	0.006	0.44
	Sorkhankol	20 th Aug., 2017 11:55	14	53.7 (60) [65.7]	0.11 (0.15) [0.084]	0.5 [1.01]	0.002	0.2
River	Pirbazar	20 th Aug., 2017 12:23	21	33.05 (37) [39.5]	2.12 (1.9) [2.09]	1 [2.87]	0.004	17
	Khalkai	20 th Aug., 2017 15:10	3	4.87 (8) [11]	0.068 (0.0469) [0.046]	1.6 [0.65]	ND	0.07

Category	Location	Date and Time	Sum of NO ₃ /NO ₂ /NH ₄ -N	Chl-a (mg/L)	Total Coliform (MPN)	Fecal Coliform (MPN)	Dissolved Zn	Dissolved Cu	IRWQI _{Sc}
Iranian Standard			-	-	10000 (indirect, max permissible)	4000 (indirect, max permissible)	1 mg/L as total Zn assuming total hardness 100 mg/L	0.04 assuming total hardness 50-100 mg/L	
Anzali Wetland	Port	20 th Aug., 2017 10:20	6.50	254.6	≥24000	4600	0.035	0.0287	14.0
	Lagoon	20 th Aug., 2017 11:10	1.65 (1.1)	19.6	1500	40	0.082	0.0189	35.5
	Sorkhankol	20 th Aug., 2017 11:55	0.702 (1.3)	63.2	480	≤3	0.032	0.0019	38.8
River	Pirbazar	20 th Aug., 2017 12:23	18.0 (10)	-	≥24000	≥2400	0.023	0.0156	15.8
	Khalkai	20 th Aug., 2017 15:10	1.67 (1.0)	-	≥24000	4600	ND	0.0279	49.7

Note: number in [] was measured at Environmental Research Institute

Note: number in () was measure at Japanese laboratory

Source: JICA Expert Team based on data from DOE

The results were summarized as follows:

EC and Salinity

- EC and salinity were very high in the wetland due to intrusion of Caspian Sea water. Please see the section on the salinity monitoring below for the result of salinity monitoring conducted on 14th August 2017.

pH

- pH in the Caspian Sea is known to be as high as 8.5, and the result at the Anzali Port, 8.27, was consistent with this. The reason for very high pH at Sorkhankol site may be partially explained by a combination of intrusion of the Caspian Sea water and extensive algal activity in summer, which raises pH by consuming carbonate in water.

DO

- DO level was low at the Pirbazar River, Sorkhankol and the Lagoon. Pirbazar River site receives sewage from Rasht, and this seems to be the reason for low DO. With respect to Sorkhankol and the Lagoon, DO in the surface layer may be significantly higher due to algal activity, especially in summer. However, these water bodies are very shallow, and apparently the decomposition of organic matter in the bottom sediment affected the results.

TSS

- TSS in August 2017 was high at Port, Sorkhankol and Pirbazar River sites, and exceeded the Iranian Standard at these sites. High TSS at Sorkhankol is presumably due to high algal activity in the wetland. High TSS in Pirbazar River is most likely due to inflow of sewage and sediment from its basin.

BOD and COD

- BOD exceeded the Iranian standard at all stations but Khalkai River. High BOD in the Lagoon and Sorkhankol in August 2017 is attributed to high algal activity in summer. Behavior of COD is similar to that of BOD, as expected.
- High BOD in Pirbazar is most likely due to inflow of sewage. COD at Pirbazar in March 2017 was lower presumably because the sample was taken after a storm event.
- High BOD and COD at the Port is presumably due to combination of sewage and algal activity. It was suspected that, in addition to the water from Pirbazar River, a significant amount of domestic sewage from Anzali ends up in the Port via different channels. This needs more study.

Phosphorus

- T-P in August 2017 was near the Iranian Standard in Sorkhankol and exceeded the national standard in Pirbazar River and the Port.
- High T-P in Pirbazar River is most likely due to the inflow of domestic sewage from Rasht. Similarly, high T-P in the Port is largely due to inflow of domestic sewage from Rasht (via Pirbazar River) and Anzali (via channels in Anzali).
- Phosphorus is one of the most important water quality parameters in the wetland, because it often becomes the limiting factor of eutrophication. Thus, dynamics of phosphorus over time should be monitored carefully. It was noted that T-P in Sorkhankol in August 2017 was higher than in March 2017. Similar phenomenon has been observed in a eutrophic lake in Japan (Kasumigaura Lake), which was attributed to release of dissolved-form phosphorous from bottom sediment during rapid decomposition of the sediment under high temperature. This is also possible in Anzali Wetland, but in Anzali, other mechanisms, such as intrusion of the Caspian Sea water, mysterious disappearance of Azolla, etc., are at play. Thus, it is premature to comment on the dynamics of phosphorus in the Anzali Wetland.

Nitrogen

- NO₂ and NH₄ are toxic to many aquatic species. According to the results, concentrations of NH₄ exceeded the Iranian standard in Pirbazar River and the Port. It is suspected that this is largely due to inflow of sewage from Rasht and Anzali.
- Although T-N is not regulated in Iran, the concentrations of T-N in Sorkhankol and the Lagoon are around the environmental standard in Japan (1.0 mg/L). According to the March 2017 data, the ratio T-N/T-P of Anzali Wetland was around 17 or higher, and it has been assumed that the Anzali Wetland is phosphorous-limiting. Nevertheless, the T-N/T-P ratio in August 2017 was much lower in Sorkhankol and much higher in the lagoon. More close examination of water quality along with

a plankton survey is recommended.

Chlorophyll a

- Chlorophyll-a values are all extremely high. It seems there was a systematic error in determination.

Total Coliform and Fecal Coliform

- In August 2017, total coliform and fecal coliform exceeded the Iranian standard in the Port, Pirbazar River and Khalkai River. However, levels of these parameters were lower in the wetland. The reason is not clear.

IRWQUI_{SC}

- DOE developed Iran’s surface water resources quality index (IRWQUI_{SC}) in 2014, and the index values were calculated based on concentrations of fecal coliform, BOD, nitrate, DO, EC, COD, NH₄, PO₄, turbidity, and pH. The results are shown in the last column of Table 11, and Table 12 shows how the results are interpreted. According to the results, water quality of Port was rated as “Very Bad” with scores less than 15, Pirbazar as “Bad”, Lagoon and Sorkhankol as “Relatively Bad” and Khalkai as “Average”.

Table 6.3-12 IRWQUI_{SC} Values and Water Quality

Description	IRWQUI _{SC} Values
Very Bad	Less than 15
Bad	15-29.9
Relatively Bad	30-44.9
Average	45-55
Relatively Good	55.1-70
Good	70.1-85
Very Good	More than 85

Source: DOE

With respect to the four objectives set for the regular monitoring, the following conclusions were drawn based on the results of the monitoring conducted in August 2017.

Table 6.3-13 Conclusions of Regular Water Quality Monitoring in August 2017

Objective	Conclusions based on monitoring in August 2017
To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not	<ul style="list-style-type: none"> • According to the results in August 2017, the water quality of the Anzali Wetland (Sorkhankol, Lagoon) does not satisfy the Iranian Standard for DO, BOD, and possibly TSS, T-P and total Zn. The level of T-N was also high compared with the Japanese standard. The results are consistent with the eutrophic condition of the wetland. Zn appears to be high for a natural reason. • The Port and Pirbazar River are more polluted than the Anzali Wetland presumably due to inflow of domestic sewage. The water quality of Pirbazar River does not meet the standard for DO, TSS, BOD, T-P, NH₄-N, and total and fecal coliforms. • The values of DOE’s new water quality index (IRWQUI_{SC}) were calculated from concentrations of fecal coliform, BOD, nitrate, DO, EC, COD, NH₄, PO₄, turbidity, and pH. According to the results, water quality of Port was rated as “Very Bad” with scores less than 15, Pirbazar as “Bad”, Lagoon and Sorkhankol as “Relatively Bad” and Khalkai as “Average”. • With respect to heavy metals and toxic organic chemicals, the results of the water and sediment quality data in the wetland (Sorkhankol and Lagoon) generally did not indicate significant pollution with respect to these parameters. It seems background concentrations of some heavy metals, such as Cr, Ni and Zn, in the region are somewhat high, though sizable influence of human activities is also possible, for example in Pirbazar River. PCBs, chlorinated pesticides and other pesticides, were not detected this time. However, it should be noted that aquatic

Objective	Conclusions based on monitoring in August 2017
	<p>biotas are often extremely sensitive to such toxic substances. For the impact of low-level pollution by such substances, more focused investigation is needed.</p>
<p>To evaluate water quality condition of wildlife refuges and protected area</p>	<ul style="list-style-type: none"> • In August 2017, water quality of only Sorkhankol wildlife refuge was examined. Water qualities of Chokum, Siakheshim and Selke were not examined this time because the water levels were too shallow. • With respect to sediment, the conditions of Sorkhankol and Selkeh were examined. The results showed that the levels of heavy metals and toxic organic chemicals are not extremely high in these areas. However, one should note that the levels of heavy metals, such as Cr, Ni and Zn, are not very low, either.
<p>To determine whether there are significant spatial differences in water quality of the Anzali Wetland or not, and to evaluate the cause of such spatial differences.</p>	<ul style="list-style-type: none"> • The number of samples is too limited to make any detailed assessment of spatial differences in water quality, but available water quality data seem to support existence of spatial variability in the wetland. • Pirbazar River is the most polluted water course in the area due to the inflow of wastewater from Rasht. • Judging from the water and the sediment quality data, Sorkhankol appears to be more polluted than other parts of the wetland because it is the lowest area in the wetland, and pollution tends to accumulate in Sorkhankol. Also, it is a large water body, and the water residence time is larger than most other parts of the wetland. However, detailed mechanism of how waters from different parts of the wetland, including Pirbazar/Pasikhan Rivers, eastern part, Siah Darvisian/Siakheshim, the Lagoon, and the Caspian Sea, flow into Sorkhankol and how internal mechanism within Sorkhankol affects water quality of Sorkhankol are not clear. • The lagoon is another major water body in the wetland, but environmentally it is significantly different from Sorkhankol. Though the Caspian Sea water seems to intrude into the lagoon in summer, it is relatively isolated from other parts of the wetland and has its own dynamics. Water and sediment quality appear to be better in the lagoon. • Other areas, such as Siakheshim and the eastern part of the wetland (e.g., Chokum) are also isolated from other parts of the wetland, though the Caspian Sea water appears to intrude into the eastern part. These areas are covered by thick reed bed, which probably filters and absorbs pollutants, and help self-purify water. Water courses in these areas are too shallow for boat access, and monitoring data are very limited.
<p>To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term (in the order of decades)</p>	<p>This is a long-term objective of the regular monitoring, and at this point, data are too limited to make inference about long-term change in water quality.</p>

Source: JICA Expert Team

(b) Salinity Monitoring

The Anzali Wetland is hydrologically connected to the Caspian Sea, and the unique environmental character of the wetland is believed to be strongly influenced by the intrusion of the Caspian Sea water. However, the intrusion of the Caspian Sea water into the wetland had not been investigated in the past. Therefore, the salinity monitoring was included in the JPA.

a) Objective

The objective of the salinity monitoring is:

- To evaluate whether there is significant mixing of the Caspian Sea water with the water of the Anzali Wetland

Observation of salinity/electric conductivity in the wetland was a part of the monthly regular monitoring, but the monitoring locations in the wetland is limited to three locations, and this is not sufficient to capture the mechanism of intrusion of the Caspian Sea water. Thus, this

program was designed separately to get a snapshot of salinity/electric conductivity at many locations in the wetland.

b) Methodologies

Table 6.3-14 summarizes the number of sampling locations, date of sampling, analytical items, and main objectives of the salinity monitoring. The parameters were measured by DOE's portable water quality meter (HACH 40d). Salinity reported in this program is the read out from the portable water quality meter, though it has been pointed out that the EC-salinity conversion for the Caspian Sea may be different from the conventional conversion based on Practical Salinity Scale 1978 (PSS-78).

Table 6.3-14 Program of Salinity Monitoring

Category	Sampling Locations	Date	Analytical items	Main objective
Wetland	19 locations (top 50 cm and other depth if water is deep)	14 th August 2017	Water temp, air temp., DO, EC, salinity (portable water quality meter)	To evaluate whether there is significant mixing of the Caspian Sea water with water of the Anzali Wetland

Source: JICA Expert Team

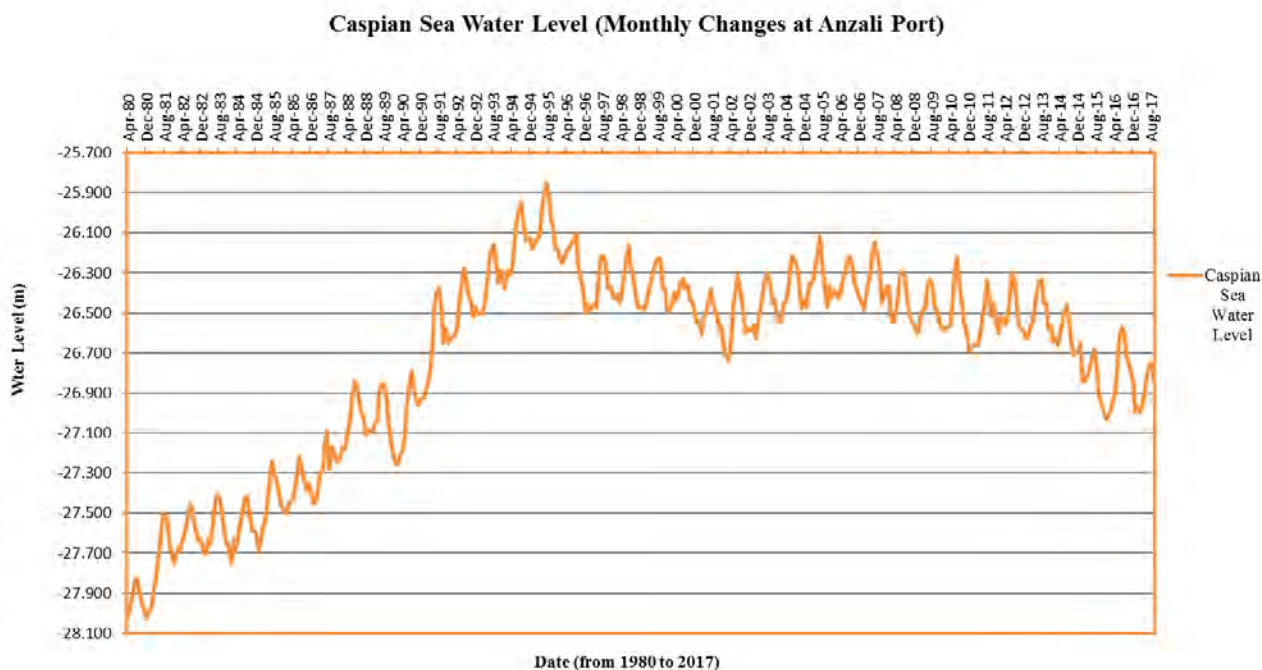
The monitoring was implemented at 19 locations in the wetland. Chokum (Pt12) was too shallow and was not accessible this time. For the map of the locations, please see the result section below.

Table 6.3-15 Locations of Salinity Monitoring

No.	Location	Easting (UTM)	Northing (UTM)
Pt01	Caspian Sea (pt01)	364742	4150292
Pt02	Port (pt02)	364179	4148589
Pt03	Mian Poshteh bridge (pt03)	363482	4146650
Pt04	Nearby Sorkhankol (pt04; W12)	362944	4144395
Pt05	Eastern Lagoon (pt05; W10)	359187	4145324
Pt06	Middle of Lagoon (pt 06; W17)	355547	4146558
Pt07	Westen Lagoon (pt07; W18)	352797	4148512
Pt08	Siahkeshim (pt08; W06)	357113	4141908
Pt09	Siahdarvishan (pt09; W15)	359636	4142549
Pt10	Sorkhankol (pt10; W03)	362817	4143857
Pt11	Sorkhankol (pt11; W14)	361614	4142629
Pt12	Chokum	-	-
Pt13	Downstream of Chokum River (pt13; W13)	367580	4142840
Pt14	Water reservoirs Shalkuhy (pt14; Hasan Bekandeh)	367168	4145344
Pt15	Sosar Roga (pt15; W08)	366419	4146676
Pt16	(pt16; W13)	365398	4145027
Pt17	(pt17; W07)	363430	4148220
Pt18	(pt18; W11)	364193	4146554
Pt19	(Pt19; -)	362179	4143213
Pt20	(Pt20; -)	361252	4142283

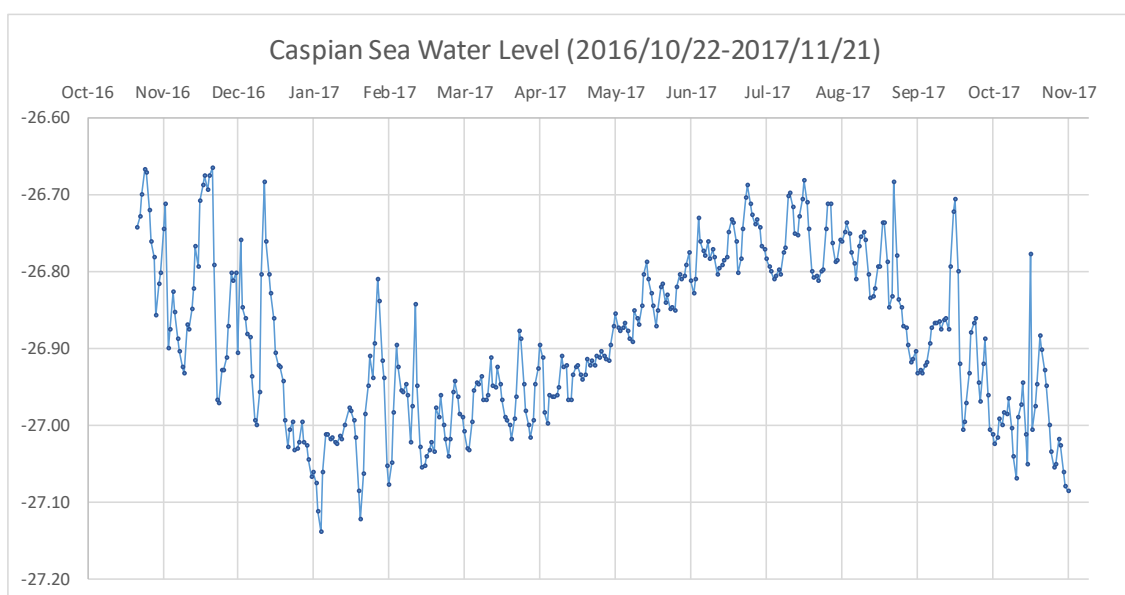
Source: JICA Expert Team

The monitoring was carried out on 14th August 2017. Figures below show the long-term (1980-2017) and an annual (2016-2017) fluctuation of the water level in the Anzali Port (Though the water level of the Caspian Sea is the main factor determining the water level at this station, it is somewhat affected by river flow from the wetland). This was the time that the water level of the Caspian Sea was the highest. As for the water levels in the wetland, the water level meters had not been re-calibrated, and thus no water level data were available. The weather was fine, and there had been no major storm event prior to the day of monitoring.



Source: JICA Expert Team

Figure 6.3-6 Changes in Water Level at Anzali Port (1980-2017)



Source: JICA Expert Team based on information from PMO

Figure 6.3-7 Changes in Water Level at Anzali Port

c) Results

Table 6.3-16 and Figure 6.3-8 summarize the results of the salinity monitoring in August 2017.

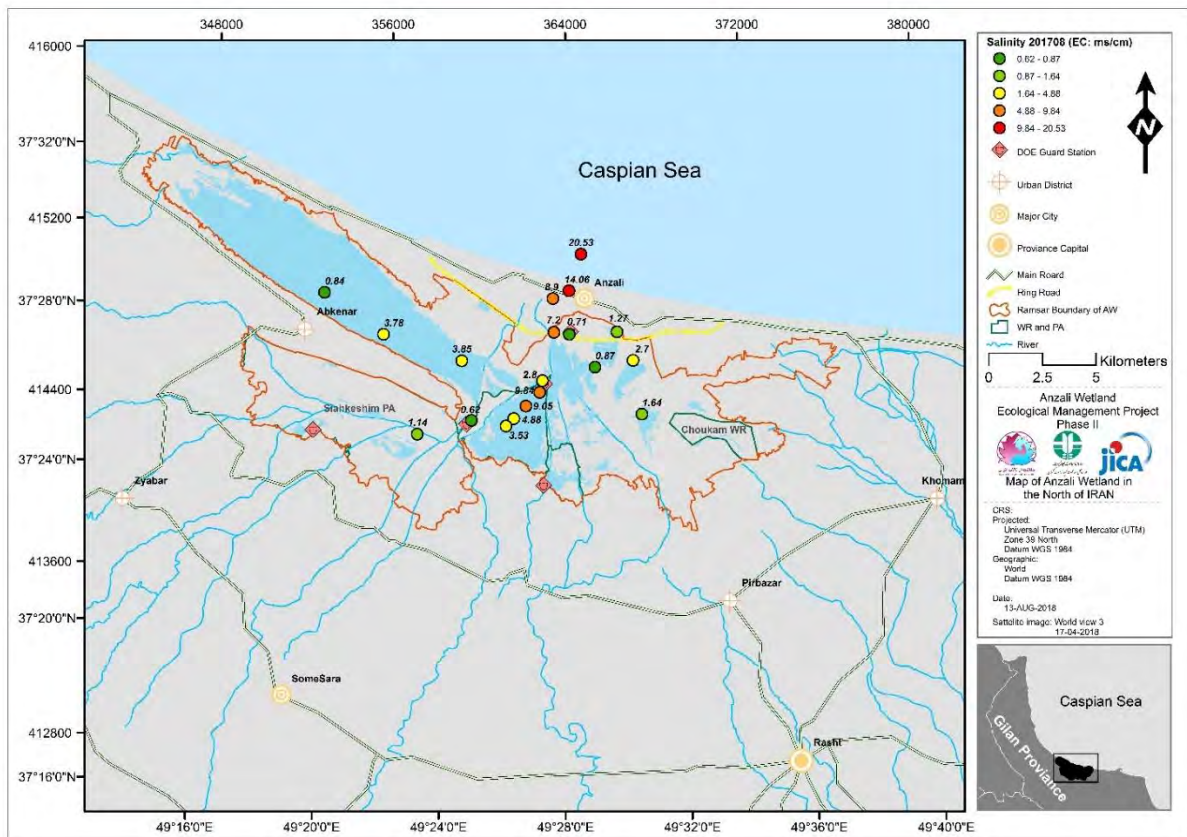
Table 6.3-16 Results of Salinity Monitoring in August 2017

Location	Date and Time	Water Temp. (°C)	EC (mS/cm) at 50 cm Depth	EC (mS/cm) at different Depth	Salinity (ppt) at 50 cm Depth	Salinity (ppt) at different Depth (about 50 cm from bottom)	DO (mg/L) and DO Percent
Pt 01 (Caspian Sea)	14 th Aug., 2017 10:05	30.0	20.53	20.67 at 5m Depth	11.04	11.25 at 5m Depth	7.61 101.07%
Pt 02 (Port)	14 th Aug., 2017 10:08	29.5	14.06	10.51 at 1.5m Depth	7.40	5.34 at 1.5m Depth	3.06 40.4%
Pt 03 (Mian Poshteh bridge)	14 th Aug., 2017 12:30	29.9	7.20	5.02 at 7.5m Depth	3.57	2.51 at 7.5m Depth	8.36 112.2%
Pt 04 (Nearby Sorkhankol)	14 th Aug., 2017 11:25	27.9	2.80	0.754 at 3.3m Depth	1.36	0.35 at 3.3m Depth	4.04 52.0%
Pt 05 (Eastern Lagoon)	14 th Aug., 2017 10:20	28.5	-	3.85 at 40cm Depth	-	1.89 at 40 cm Depth	5.72 74.5%
Pt 06 (Middle of Lagoon)	14 th Aug., 2017 10:33	27.8	3.78	4.18 at 1.04m Depth	1.88	2.12 at 1.04 m Depth	0.50 6.5%
Pt 07 (Westen Lagoon)	14 th Aug., 2017 10:43	29.6	0.844	0.689 at 1.4m Depth	0.38	0.31 at 1.4m Depth	9.23 121.7%
Pt 08 (Siakhsheshim)	14 th Aug., 2017 11:12	28.9	1.137	-	0.52	-	1.60 21.0%
Pt 09 (Siahdarvishan)	14 th Aug., 2017 11:00	28.2	0.620	0.434 at 1.8m Depth	0.28	0.20 at 1.8 m Depth	5.74 74.4%
Pt 10 (Sorkhankol)	14 th Aug., 2017 11:33	30.1	9.84	-	4.97	-	7.13 94.7%
Pt19 (Before pt 11)	14 th Aug., 2017 11:37	30.0	9.05	-	4.56	-	4.31 57.1%
Pt 11 (Sorkhankol)	14 th Aug., 2017 11:40	28.3	4.88	-	2.43	-	2.61 33.9%
Pt 20 (After pt 11)	14 th Aug., 2017 11:43	28.3	3.53	-	1.73	-	2.35 30.5%
Pt13 (pt 12 (Chokum) and pt 13 (Downstream of Chokum river))	14 th Aug., 2017 12:05	30.1	1.637	-	0.74	-	8.17 109.4%
Pt 14 (Water reservoirs Shalkuhy)	14 th Aug., 2017 12:15	29.6	2.70	13.6 at 2.3m Depth	1.27	6.93 at 2.3m Depth	12.57 167.1%
Pt 15 (Sosar Roga)	14 th Aug., 2017 12:20	29.0	1.272	16.17 at 2.95m Depth	0.58	8.66 at 2.95m Depth	2.91 38.0%
Pt 16	14 th Aug., 2017 11:56	28.7	0.874	0.870 at 2.8m Depth	0.40	0.39 at 2.8m Depth	0.52 6.8%
Pt 17	14 th Aug., 2017 10:10	29.4	8.90	8.08 at 1.6m Depth	4.52	4.08 at 1.6m Depth	2.87 37.6%
Pt 18	14 th Aug., 2017 12:37	28.7	0.714	0.727 at 1.6m Depth	0.32	0.33 at 1.6m Depth	2.69 35.1%

Note 1: The values of temperature, EC, Salinity and DO were measured on-site using thermometers and a portable water quality analysis.

Note 2: The floodwater came in wetland, two days ago.

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-8 Spatial Distributions of Electrical Conductivity (mS/cm, 50 cm from surface) in the Wetland

EC and Salinity

- EC of the Caspian Sea outside of the Anzali Port at the depth of 50 cm was 20.53 mS/cm, and the salinity was 11.04 ppt (according to the portable water quality meter) or roughly 1/3 of the oceans. These numbers are consistent with historical data.
- The results showed that EC and salinity in the Anzali Wetland were significantly higher in the downstream area, indicating intrusion of the Caspian Sea water. This is particularly true for Sorkhankol, which is the lowest area in the wetland, where the salinity was as high as 5 ppt or nearly half of the Caspian Sea. EC and salinity were high even in the eastern part of the lagoon.
- EC and salinity in the major channels in the wetland were much lower because they are the main pathways of fresh river waters into the Caspian Sea.
- It was noted that EC and salinity in the surface layer (50 cm) are higher than the deeper layer at many locations in the wetland. This is counter-intuitive because saline water is generally heavier than freshwater. The field record was double-checked, but apparently this was not a systematic error in copying numbers. It was hypothesized that this is because hot saline water in the surface layer (around 30 °C) of the wetland floated on the cooler freshwater (groundwater) discharged from the basin. Unfortunately, the temperatures of the bottom layers were not measured, and it is not possible to prove this hypothesis.

- While the data clearly showed intrusion of the Caspian Sea water into the wetland, the exact mechanism of saltwater intrusion and the reason why EC and salinity of the surface layer were higher are not clear at the moment.

With respect to the objective set for the salinity monitoring, the following conclusions can be made:

Table 6.3-17 Conclusions of Salinity Monitoring in August 2017

Objective	Conclusions based on monitoring in August 2017
To evaluate whether there is significant mixing of the Caspian Sea water with water of the Anzali Wetland	<p>The results clearly showed that there is a significant exchange of the Caspian Sea water and the water of the Anzali Wetland. On 14th August 2017, the salinity in Sorkhankol was roughly half of the Caspian Sea.</p> <p>Intrusion of the Caspian Sea water is a very important ecological character of the Anzali Wetland, though further research is needed to elucidate how the intrusion occurs and what are the ecological impacts of the intrusion.</p>

Source: JICA Expert Team

(c) Monitoring of Toxic Substances

In this section, the results of analysis of heavy metals and toxic organic substances in both water and sediment conducted in March and August 2017 are presented. Monitoring of toxic substances was not included in the revised monitoring program because DOE Gilan decided to implement a sediment survey separately from the JPA. Nevertheless, evaluation of levels of toxic substances was considered critical in understanding the environmental status of the wetland, as aquatic life, such as fish, benthos and planktons are often very sensitive to such stresses. There are many historical studies on pollution of the Anzali Wetland with toxic substances, but reliability of some of them is questionable, and it was of interest to confirm levels of these pollutants in the wetland.

a) Objectives

The monitoring of toxic substances was implemented in March and August 2017 with the objective of:

- To confirm the levels of heavy metals, pesticides and PCBs in water and sediments.

b) Methodologies

The monitoring of sediment was implemented twice, in March 2017 and August 2017. The monitoring of water was implemented in August 2017.

Table 6.3-18 Water Samples Analyzed in Japan in August 2017

Category	Sampling Locations	Date	Analytical items	Main objective
Anzali Wetland	3 locations (Port, Lagoon, Sorkhankol)	20 th Aug. 2017	COD, T-P, T-N, Cd, Pb, Zn, chlropyrifos, butachlor, diazinon	<ul style="list-style-type: none"> - To confirm the results of water quality monitoring by DOE - To confirm the levels of heavy metals and pesticides in water.
Rivers	2 locations (Pirbazar, Khalkai)	20 th Aug. 2017		

Source: JICA Expert Team

Table 6.3-19 Sediment Samples Analyzed in the Netherlands in August 2017

Category	Sampling Locations	Date	Analytical items	Main objective
Anzali Wetland	4 locations (Lagoon, Sorkhankol, downstream of Pirbazar/Pasikhan, and Selkeh)	20 th Aug. 2017 (Selkeh 19 th Aug. 2017)	As, Cr, Cu, Pb, Ni, Zn, Hg, PCBs, chlorinated pesticides, butachlor, diazinon, chlorpyrifos	- To confirm the levels of heavy metals, pesticides and PCBs in sediments.
Rivers	2 locations (Pirbazar, Khalkai)	20 th Aug. 2017		

Source: JICA Expert Team

The analytical methodologies are summarized in Table 6.3-20

Table 6.3-20 Analytical Methodologies Used by Laboratory in Japan

Parameter	Methodology	Parameter	Methodology
COD	JIS K 0102 20.1	Zn	JIS K 0102 53.4 (ICP/MS) (as Total Zn)
T-N	JIS K 0102 45.4	Chlorpyrifos	GC/MC
T-P	JIS K 0102 46.3.1	Butachlor	GC/MS
Cd	JIS K 0102 55.4 (ICP/MS)	Diazinon	LC/MS
Pb	JIS K 0102 54.4 (ICP/MS)		

Source: JICA Expert Team based in information from the laboratory in Japan

Table 6.3-20 Analytical Methods Used by Laboratory in the Netherlands

Parameter	Methodology	Parameter	Methodology
As	NEN 6961/NEN 6966 C1	Hg	NEN 6961 / NEN-ISO 16772
Cr	NEN 6961/NEN 6966 C1	PCBs	CMA/3/I
Cu	NEN 6961/NEN 6966 C1	Chlorinated Pesticides	CMA/3/I
Pb	NEN 6961/NEN 6966 C1	Chlorpyrifos	SPE/ LV-GC-MS (SOP M 886)
Ni	NEN 6961/NEN 6966 C1	Butachlor	LC-MS/MS (DIN38406-38)
Zn (non volatile)	NEN 6961/NEN 6966 C1	Diazinon	LC-MS/MS (DIN38406-38)

Note 1: Tested PCBs are No. 28, 52, 101, 118, 138, 153 and 180

Note 2: Tested chlorinated pesticides are α -HCH, β -HCH, lindane, γ -HCH, heptachlorine, α -endosulfan, β -endosulfan, endosulfansulfate, adlrin, dieldrin, endrin, isodrin, cis-heptachlor epoxid, trans-heptachlor epoxid, cis-chlordane, trans-chlordane, o,p-DDD, p,p-DDD, o,p-DDE, p,p-DDE, o,p-DDT, and p,p-DDT.

Source: JICA Expert Team based on information from the laboratory in the Netherlands

c) Results

Table 6.3-21 lists the results of water quality analysis in Japan in August 2017. The results can be summarized as follows:

- With respect to heavy metals in water, concentrations were generally low, except Zn in the wetland, which exceeded the Japanese environmental standard and the Canadian guideline value for protection of aquatic life. It seems the background concentration of Zn is high in the area, but more study is needed to confirm this.
- None of the common pesticides analyzed in August 2017 were detected.

Table 6.3-21 Results of Water Quality Analysis in August 2017 in Japan

Category	Location	Cd (mg/L)	Pb (mg/L)	Total Zn (mg/L) 1 mg/L assuming hardness 100 mg/L	Chlorpyrifos	Butachlor	Diazinon
Iranian Standard		-	-		-	-	-
Japanese Standard		0.003	0.01	0.03	2×10^{-6}	-	-
Canadian Guidelines		9×10^{-5}	0.00318	0.03	<0.001	<0.001	<0.0007
Anzali Wetland	Lagoon	<0.001	<0.005	0.032	<0.001	<0.001	<0.0007
	Sorkhankol	<0.001	<0.005	0.014	<0.001	<0.001	<0.0007
River	Pirbazar	<0.001	<0.005	<0.006	<0.001	<0.001	<0.0007
	Khalkai	<0.001	<0.005	<0.009			

Note: Japanese Standard: T-N and T-P for Fishery 3rd grade; metals for protection of human health; total Zn for protection of aquatic life

Canadian Standard: Water Quality Guidelines for Protection of Aquatic Life (long-term)

Source: JICA Expert Team

Table 6.3-22 summarizes the results of sediment analyses in March and August 2017. The results are as follows:

- The concentrations of heavy metals in the sediment in the region are generally not extremely low presumably due to geological reason. However, none of the metal concentrations exceeded the PELs (probable effect levels) of Canadian Sediment Quality Guideline values for protection of aquatic life.
- None of the toxic organic substances were detected above the reporting limits, and it appears that the levels of pollution with such chemicals are generally not high. However, PELs of Canadian Sediment Quality Guidelines values for organic chemicals are generally extremely low and reporting limits for routine analysis employed this time were often higher than PELs.

Table 6.3-22 Results of Sediment Quality Analysis in March and August 2017 in the Netherlands

Category	Location	As (mg/kg DW)	Cd (mg/kg DW)	Cr (mg/kg DW)	Cu (mg/kg DW)	Pb (mg/kg DW)	Ni (mg/kg DW)	Zn (mg/kg DW)	Hg (mg/kg DW)
Iranian Standard		-	-	-	-	-	-	-	-
Canadian Guidelines		17	3.5	90	197	91.3	-	315	0.486
Anzali Wetland	Lagoon	7.0 (8.0)	- (0.47)	42	34	15 (22)	35	62 (97)	0.06 (0.099)
	Sorkhankol	14 (12)	- (0.35)	61	41	20 (15)	48	98 (84)	0.074 (0.070)
	Selkeh	8.6	-	41	21	14 (24)	33	55	<0.050
	Downstream of Pirbazar/Pasikhan	14	-	55	45	20	42	140	0.10
River	Pirbazar	14 (12)	- (0.40)	69	43	19 (13)	55	97 (360)	0.068 (0.17)
	Khalkai	7.1 (12)	- (0.32)	56	25	<10	51	74 (94)	<0.050 (<0.05)

Category	Location	PCBs (mg/kg DW)	Chlorinated Pesticides (mg/kg DW)	Butachlor (mg/kg DW)	Diazinon (mg/kg DW)	Chlorpyrifos (mg/kg DW)
Iranian Standard		-	-	-	-	-
Canadian Guidelines		0.277	0.00138 – 0.624	-	-	-
Anzali Wetland	Lagoon	< 0.10 (< 0.010)	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05
	Sorkhankol	< 0.10 (< 0.010)	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05
	Selkeh	< 0.10	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05
	Downstream of Pirbazar/Pasikhan	< 0.10	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05
River	Pirbazar	< 0.10 (< 0.010)	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05
	Khalkai	< 0.10 (< 0.010)	<0.10 and <0.20 (< 0.01)	<0.05	<0.05	<0.05

Note: Numbers in () are results of monitoring in March 2017. Others are results in August 2017.

Note 2: Detection Limit for chlorinated pesticides: 0.10 mg/kg for α -HCH, β -HCH, lindane, γ -HCH, heptachlorine, α -endosulfan, β -endosulfan, endosulfansulfate, adlrin, dieldrin, isodrin, cis-heptachlor epoxid, trans-heptachlor epoxid, cis-chlordane, trans-chlordane, o,p-DDD, p,p-DDD, o,p-DDE, p,p-DDE, o,p-DDT, and p,p-DDT; 0.20 mg/kg for endrin.

Note 3: Canadian guideline values for PCBs is PEL for total PCBs

Note 4: Canadian standard for chlorinated pesticides is PEL for individual chlorinated pesticide for which PEL is available

Source: JICA Expert Team

The results of the monitoring of toxic substances in March and August 2017 are summarized as follows:

Table 6.3-23 Conclusions of Monitoring of Toxic Substances in March and August 2017

Objective	Conclusions based on monitoring in March and August 2017
To confirm the levels of heavy metals, pesticides and PCBs in water and sediments	<ul style="list-style-type: none"> The results did not indicate any serious pollution by toxic substances. However, the levels of heavy metals, such as Zn, are relatively high presumably due to geological reason. Also, the plain area of the watershed is agricultural area, and use of pesticides is not uncommon. Thus, further investigation of toxic substances is recommended.

Source: JICA Expert Team

3) Monitoring of Water Levels

This section explains the activity of monitoring of water level, which was newly added to the activity of this JPA in 2016.

(a) Installation of Water Level Meters

Water level is one of the most important environmental parameters that determines the ecological character of the Anzali Wetland. For example, intrusion of the Caspian Sea is probably dictated by the difference in the water levels in the wetland and the Caspian Sea. Moreover, shallowing/drying of the Anzali Wetland, which is arguably the most serious environmental problem of the Anzali Wetland, may be caused by the decreasing Caspian Sea level in recent years, and not by sediment inflow or accumulation of organic matter. If this is

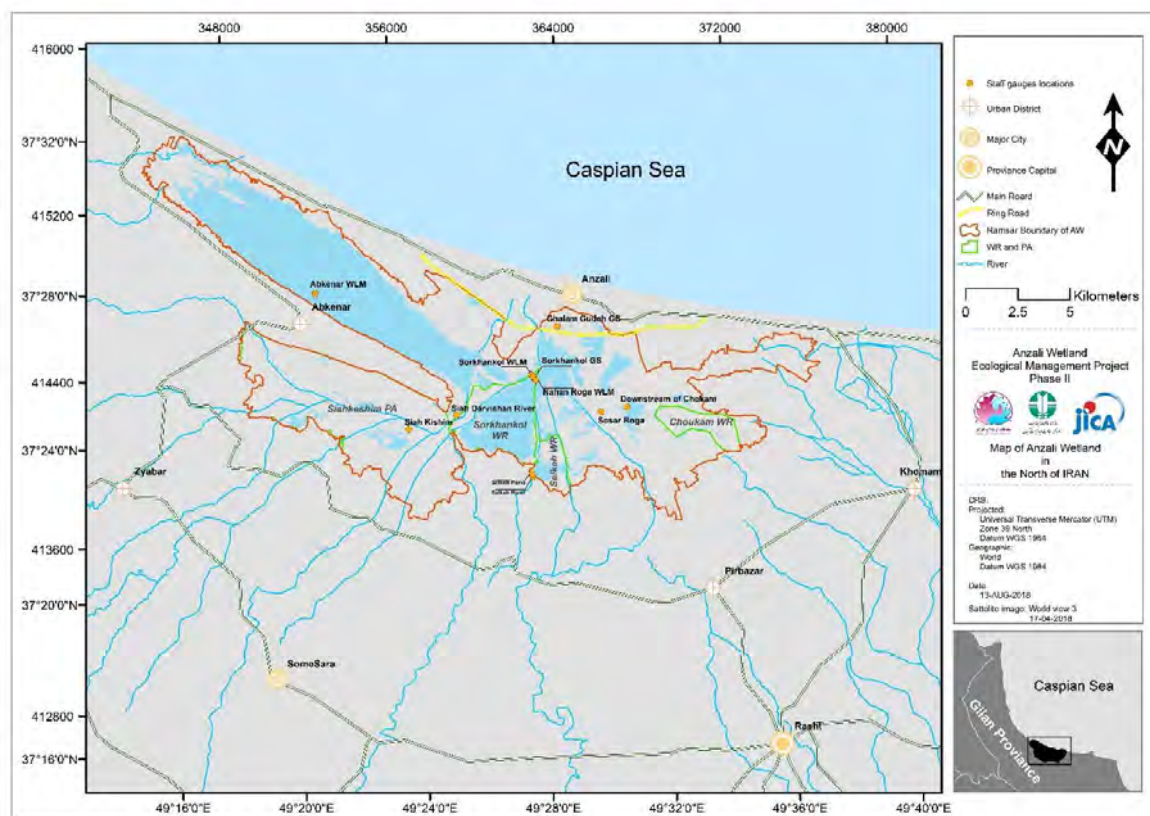
the case, sediment traps and dredging have limited effectiveness in controlling the trend, and it could get worse if the Caspian Sea level retreats further with climate change. However, there were no historical data of water levels in the Anzali Wetland.

Thus, four float-type WLMs with radio transmitter were installed in Nahan Roga, Sorkhankol, Ab Kenar and Sosa Roga in 2014-2015, and monitoring was started in 2016. The locations of the WLMs are given in Table 6.3-24 and Figure 6.3-9. Photographs of the WLMs are given in Figure 6.3-10.

Table 6.3-24 Locations of Water Level Meters

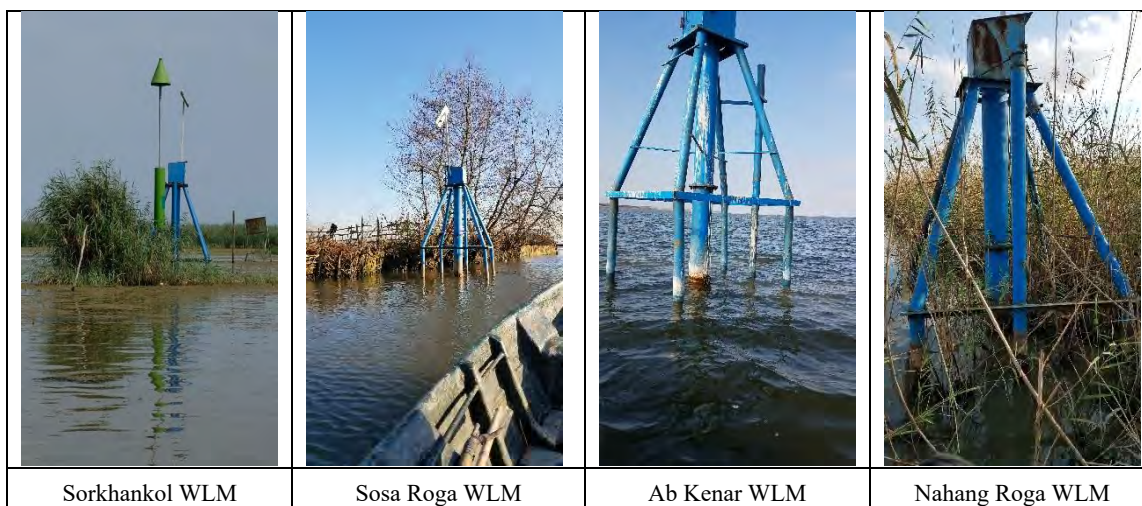
No.	Location	Easting (UTM)	Northing (UTM)
2	Nahan Roga WLM	362955.00	4144381.00
4	Abkenar WLM	352596.84	4148267.85
6	Sorkhankol WLM	363164.59	4144110.29
7	Sosar Roga WLM	366299.30	4142595.81

Source: JICA Expert Team



Source: JICA Expert Team

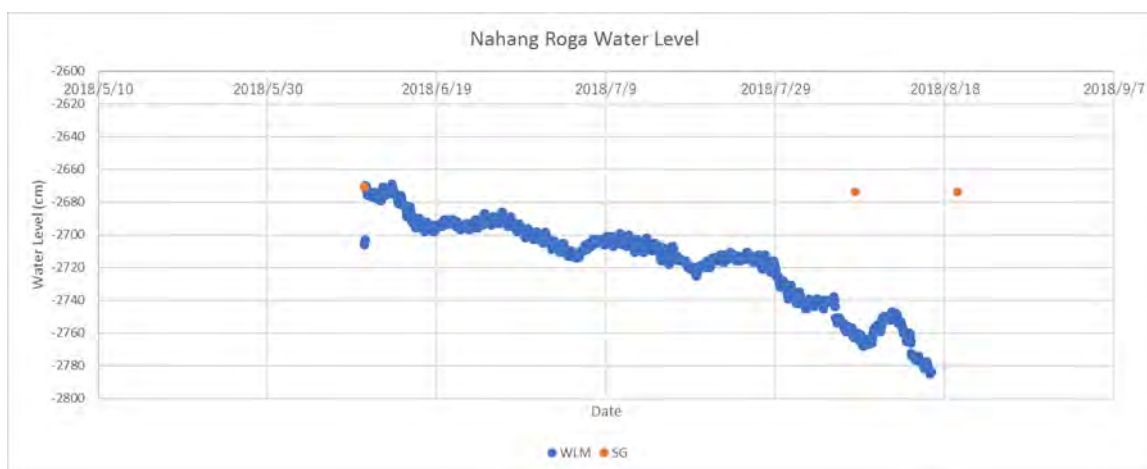
Figure 6.3-9 Locations of Water Level Meters and Staff Gauges



Source: JICA Expert Team

Figure 6.3-10 Photographs of Water Level Meters

Unfortunately, these meters did not stabilize, and the location of Sosa Roga dried up. The meters at Nahang Roga, Sorkhankol and Ab Kenar were recalibrated in June 2018. But the meters continued to malfunction, as shown in Figure 6.3-11, where the water level data of Nahang Roga WLM, after the calibration in June, is drifting downward from the data of the staff gauge (SG) installed at the same site. Thus, they were repaired in February 2019.



Source: JICA Expert Team

Figure 6.3-11 Drifting of Data of Nahang Roga WLM

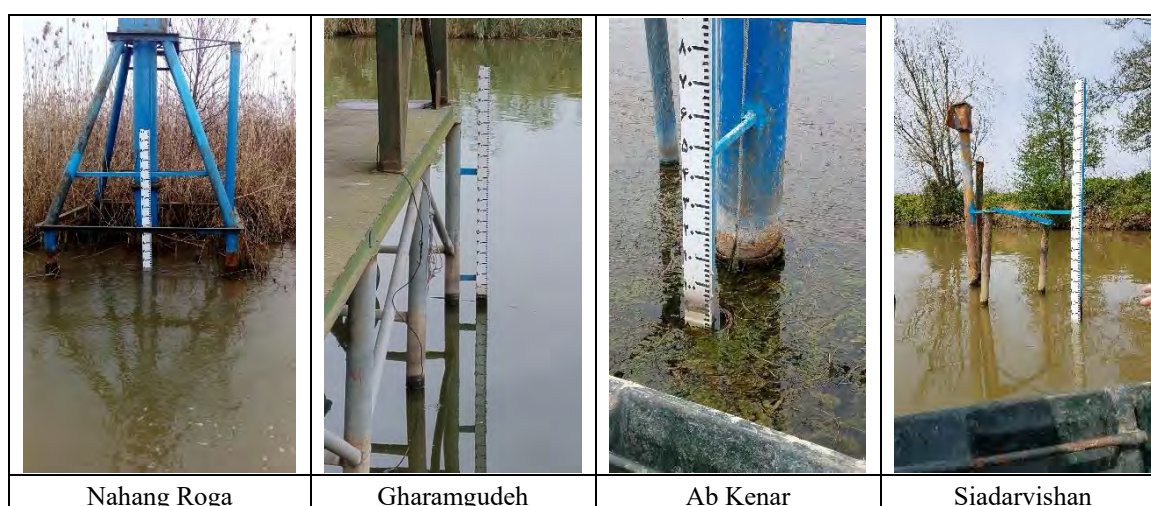
(b) Installation of Staff Gauges

As the WLMs were not reliable, in total 11 staff gauges were installed in spring of 2018 to monitor water levels manually. The locations of the gauges are given in Figure 6.3-9 and Table 6.3-26. Photographs of selected gauges are given in Figure 6.3-12.

Table 6.3-25 Locations of Staff Gauges

No.	Location	Height of Gauge (m)	Easting (UTM)	Northing (UTM)	Elevation of Top of Gauge (m) (to be confirmed)
1	Ghalam Gudeh GS	3	364211.00	4146702.65	-24.531
2	Nahan Roga WLM	2	362955.00	4144381.00	-25.337
3	Sorkhankol GS	2	363053.92	4144282.84	-25.331
4	Abkenar WLM	3	352596.84	4148267.85	-24.562
5	Siah Darvishan River	3	359368.37	4142439.98	-24.724
6	Sorkhankol WLM	3	363164.59	4144110.29	-24.769
7	Sosar Roga	3	366299.30	4142595.81	-24.598
8	Selkeh River	2	363021.89	4139503.37	-25.341
9	Selkeh Pond	2	362998.00	4139621.00	-24.583
10	Downstream of Chokam	2	367544.69	4142826.58	-25.498
11	Siah Kishim	2	357079.46	4141777.85	-24.740

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-12 Photographs of Selected Staff Gauges

Unfortunately, the levelling survey of these gauges (and the water level meters) has not been as straightforward as a similar survey on a dry land because access in the wetland is limited, view is obstructed by tall reeds, and the ground is soft. Thus, elevations of these gauges are yet to be reconfirmed.

(c) Monitoring of Water Levels

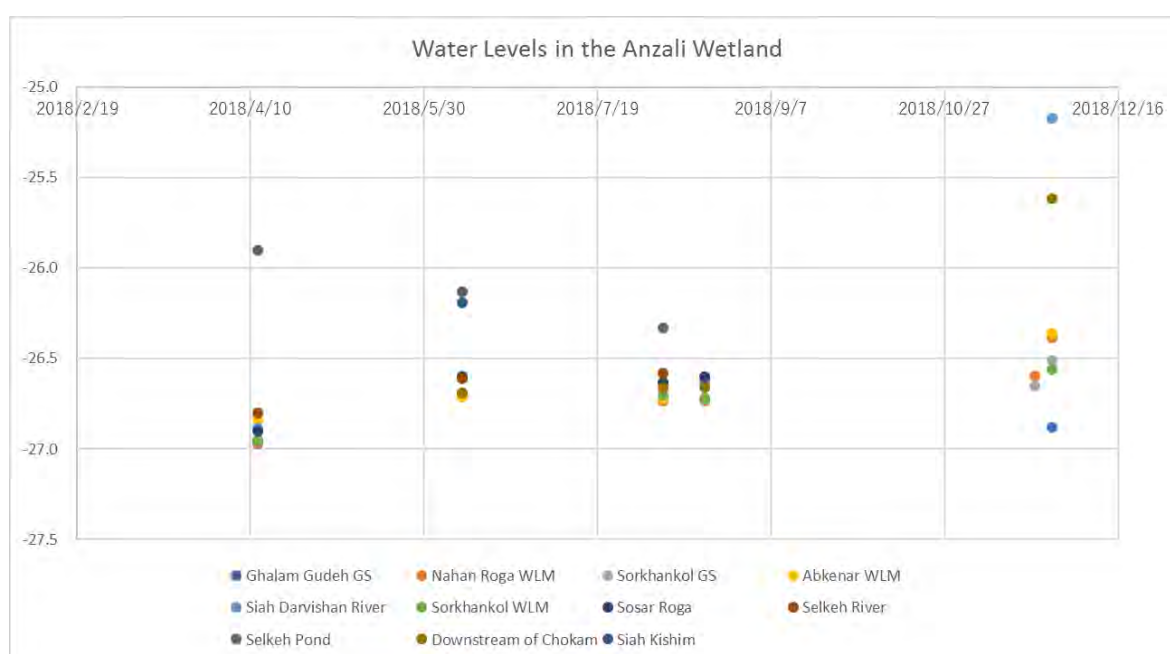
Table 6.3-26 and Figure 6.3-13 show the changes in the water levels in the Anzali Wetland during April – August 2018. As explained above, the elevations of these have to be verified, and the data should be considered tentative.

Table 6.3-26 Water Levels (meters) in the Wetland (Staff Gauges)

No.	Gauge Location	2018/4/12	2018/6/10	2018/8/7	2018/8/19	2018/11/22	2018/11/27
1	Ghalam Gudeh GS	-26.97	-26.69	-26.72	-26.73	-	-26.88
2	Nahan Roga WLM	-26.97	-26.71	-26.74	-26.74	-26.60	-26.39
3	Sorkhankol GS	-26.95	-26.70	-26.72	-26.73	-26.65	-26.51
4	Abkenar WLM	-26.84	-26.71	-26.72	-26.64	-	-26.36
5	Siah Darvishan River	-26.88	-26.59	-26.63	-26.62	-	-25.17
6	Sorkhankol WLM	-26.95	-26.69	-26.70	-26.72	-	-26.56
7	Sosar Roga	-26.90	-26.60	-26.63	-26.60	-	above gauge
8	Selkeh River	-26.80	-26.61	-26.58	-	-	
9	Selkeh Pond	-25.90	-26.13	-26.33	-	-	
10	Downstream of Chokam	-	-26.69	-26.66	-26.66	-	-25.62
11	Siahkishim	-	-26.19	TSA	TSA	-	above gauge

Note: -: not monitored; TSA: too shallow to access

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-13 Changes in Water Levels (To Be Verified) in the Anzali Wetland (April – November 2018)

Dynamics of water level in the wetland is very complex, as it is determined by the mass balance of inflowing surface water from rivers, inflowing groundwater, direct precipitation, evapotranspiration, outflowing surface water, and outflowing groundwater, and it is also influenced by the Caspian Sea level.

It seems the long-term fluctuation of the water level in the wetland is largely dictated by the water level of the Caspian Sea. This appears to be the reason why the wetland was very shallow in the 1980s when the water level was very low, became deeper in the late 1990s to early 2000s following the increase in the Caspian Sea water level, and became shallower again in recent years, as the Caspian Sea level is retreating (see Figure 6.3-6). Also, the water level of the

wetland appears to be influenced by the annual cycle of the Caspian Sea level, which is high in early summer and low in winter, as affected largely by the inflow from the Volga River. This seems to explain the observation in Figure 6.3-13 where the water levels in most locations in the wetland were lower in April 2018 and they went up in June – August 2018.

However, the Caspian Sea level is not the only factor determining the water level in the wetland, and this is making the interpretation of the water level difficult. On 27 November 2018, right after a heavy rain event, the water levels in many locations in the wetland were significantly higher than in August, especially in upstream areas within the wetland, such as Siakhisim, Siah Darvishan River (near the Siah Darvishan GS), Sosar Roga and downstream of Chokum. This appears to be a short-term rise in water level due to flooding, and the impact is less pronounced in the downstream and/or large water bodies, such as Ghalam Gudeh, Nahang Roga and Sorkhankol and the lagoon. Most likely the water level in these areas will subside within several days.

Overall the limited observation using the staff gauges seem to support the hypothesis that the Caspian Sea level has significant impact on the long-term water level of the wetland. Nevertheless, the water level data are too scarce to make any conclusions. To understand such dynamics, water levels have to be monitored more closely, perhaps hourly. To enable such frequent monitoring at different locations in the wetland, the water level meters should be repaired as soon as possible, and DOE Gilan needs to assign the monitoring tasks to guards and the staff of AWMO.

4) Establishment of AWMO

In late 2017, DOE-Gilan established the Anzali Wetland Monitoring Office (AWMO) in order to implement water and sediment quality monitoring in the Anzali Wetland. Table below summarizes the status of the AWMO as of November 2018.

Table 6.3-27 Status of Anzali Wetland Monitoring Office as of November 2018

Category	Condition
Name	Anzali Wetland Monitoring Office
Location	Adjacent to DOE-Anzali Office
Staff	8
Tasks	Monitoring of water and sediment qualities in the wetland
Many Equipment	Hach spectrophotometer (visible only), pH meter, DO meter, EC meter, ovens, incubator, autoclave (most equipment is outdated and need repair/replacement)
Reagent	Limited
Transportation	No car is available for monitoring

Source: JICA Expert Team

6.3.2 Long-Term Goal

Appropriate monitoring of water and sediment quality are regularly implemented as a scientific baseline for the adaptive management of the Anzali Wetland.

6.3.3 Prior Condition of Midterm Goal

(1) Target Period

The target period of this mid-term plan is 2020 – 2030.

(2) Technical Requirements

DOE Gilan is legally responsible for environmental monitoring of wetlands, rivers and lakes in Gilan, and should be able to answer to basic questions on environmental quality of the Anzali Wetland (and other water bodies in the province), such as those listed in Table 6.3-28. The mid-term plan presented here was developed considering such requirements.

Table 6.3-28 Typical Questions Raised by Stakeholders

Stakeholder	Question
General public	<ul style="list-style-type: none"> - Is the water quality of the wetland and feeding rivers satisfactory from environmental point of view? - Is the wetland becoming shallow?
Decision makers	<ul style="list-style-type: none"> - Is pollution of the wetland and rivers serious enough to require urgent measures to improve water quality, such as expansion of the sewerage systems in Rasht? - Have recent governmental interventions, such as development of sewerage systems and control of industrial/agricultural pollution, contributed to improving the water quality of the wetland? - Which of the following mechanisms is the main cause of the shallowing of the wetland: deposition of the incoming sediment, accumulation of organic matter, or lowering of the Caspian Sea level?
DOE-HQ	<ul style="list-style-type: none"> - Has the water quality of the Anzali Wetland improved to the level that allows Ramsar Convention to remove the wetland from the Montreux Record? - How are the water qualities of the nationally protected areas? - How is the water level in the wetland changing?

Source: JICA Expert Team

It is important to note that environmental conditions of the wetland are extremely complex, as it fluctuates dynamically in space and time influenced by fluctuation of river flows, water level of the Caspian Sea, algal activities, levels of external/internal pollutants, and other factors. To examine such phenomena, frequent and highly sophisticated research programs are required. However, DOE Gilan is not a research institution, and it has neither resources nor mandate to implement esoteric monitoring programs. Thus, the scope of DOE Gilan’s monitoring proposed in this Mid-term Plan is limited to the following basic programs:

- Regular water quality monitoring
- Monitoring of water levels

- Monitoring of salinity
- Monitoring of toxic substances

Details of these programs are explained in the next section. Monitoring beyond these programs may be implemented as required. Nevertheless, DOE Gilan was not able to regularly implement similar programs in the last 4 years. Most likely it cannot sustain a large monitoring program. It is also important to note that getting limited but regular and reliable monitoring data is much better than getting a large amount of dubious results. Thus, it is suggested to start from these basic programs.

(3) Regulatory Requirements

The monitoring program should be consistent with regulatory requirements and official guidelines. The analytical parameters and sampling frequencies of the proposed monitoring program (regular monitoring) were decided based on the requirements of “National Water Quality Standards of Iran” issued by DOE. Another important technical document is “Manual of Surface Water Quality Monitoring” issued by Ministry of Energy. This document was also referred to whenever possible.

(4) Resource Requirements

In late 2017, DOE Gilan established the Anzali Wetland Monitoring Office (AWMO), and it is assumed that AWMO takes the responsibility of monitoring programs. Thus, the monitoring programs need to be designed considering the resources available or to be available at AWMO. Table 6.3-29 summarizes the resources available at AWMO as of November 2018.

Table 6.3-29 Resources of Anzali Wetland Monitoring Office (November 2018)

Category	Condition
Name	Anzali Wetland Monitoring Office
Location	Adjacent to DOE-Anzali Office
Staff	8
Tasks	Monitoring of water and sediment qualities in the wetland
Main Equipment	Hach spectrophotometer (visible only), pH meter, DO meter, EC meter, ovens, incubator, autoclave (most equipment is outdated and need repair/replacement)
Reagent	Limited
Transportation	No car is available for monitoring

Source: JICA Expert Team

At the moment, AWMO is not fully functional and more resources, such as some analytical equipment, a vehicle, and sufficient budget, should be provided by DOE Gilan to implement the proposed monitoring programs. The required budget and other resources are discussed in Section (1).

6.3.4 Mid-Term Goal

(1) Regular Monitoring

This program is a basic water quality monitoring program in line with the requirements of the national water quality standard. The objectives of the regular monitoring are:

- To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term (in the order of decades)
- To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not
- To evaluate water quality condition of wildlife refuges and protected area

(2) Monitoring of Water Level

Water level may not be a water quality parameter, but it is included in the monitoring as it is one of the most important parameters related to environmental conditions of the Anzali Wetland. Also, it is deeply related to water quality, and it is not difficult to monitor. The objective of monitoring of water levels is:

- To monitor fluctuations of water levels in different parts of the Anzali Wetland

(3) Salinity Monitoring

In summer, water from the Caspian Sea intrudes into the Anzali Wetland, and makes the water in the wetland brackish. This mixing, which is influenced by the fluctuation of the water levels in the wetland, makes the ecosystem of the wetland unique, and it should be monitored regularly. The objective of the salinity monitoring is:

- To record mixing of the Caspian Sea water with water of the Anzali Wetland

(4) Monitoring of Toxic Substances

The results of monitoring during the Phase II Project did not show any sign of serious problems with toxic substances, such as heavy metals, PCBs and pesticides. Nevertheless, levels of some heavy metals, such as Cr, Ni and Zn, are somewhat high, and it is important to regularly monitor the concentrations of toxic substances in the wetland. The objective of the monitoring of toxic substances is, thus:

- To monitor levels of different toxic substances in the wetland

6.3.5 Implementation Plan and Schedule

(1) Regular Monitoring

1) Monitoring Program

Table below summarizes the number of sampling locations, monitoring frequency, analytical items, and main objectives of the regular monitoring. The parameters and the frequency are consistent with the national water quality standard, and the program is the same as the regular monitoring program in the Phase II Project.

Table 6.3-30 Program of Regular Monitoring

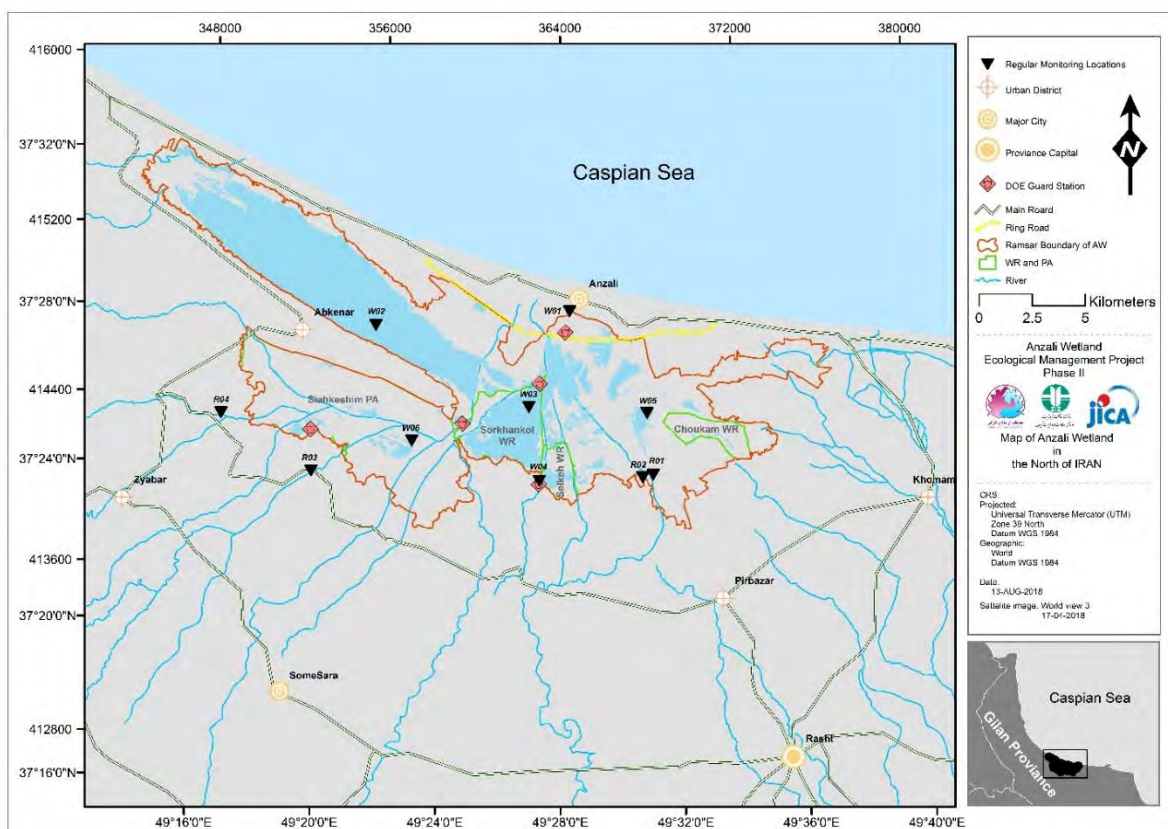
Category	Sampling Locations	Frequency	Analytical items	Main objective
Anzali Wetland	3 locations (Port, Lagoon, Sorkhankol)	Monthly (12 times/year)	Water temp., air temp., transparency, EC/salinity, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, chlorophyll a, total coliform, fecal coliform, total Zn, dissolved Cu, and IRWQISC.	<ul style="list-style-type: none"> - To determine whether the water quality of the Anzali Wetland is improving or deteriorating in long-term - To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not - To evaluate water quality condition of wildlife refuge
	3 locations (Siakhesim, Selke, Chokum)	Quarterly (January, April, August, November)	Water temp., air temp., transparency, EC/salinity, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, chlorophyll a, total coliform, fecal coliform, total Zn, dissolved Cu, and IRWQISC.	<ul style="list-style-type: none"> - To evaluate water quality condition of wildlife refuges and protected area
Rivers	4 locations (Pirbazar, Pasikhan, Palangvar, Khalkai)	Monthly	Water temp., air temp., EC, DO, pH, SS, turbidity, BOD, COD, o-phosphate-P, T-P, NO ₃ -N, NO ₂ -N, NH ₄ -N, T-N, oil & grease, total coliform, fecal coliform, total Zn, dissolved Cu, and IRWQISC.	<ul style="list-style-type: none"> - To determine whether water qualities of the Anzali Wetland and feeding rivers satisfy the national environmental standards or not

Note: IRWQISC: Iran’s water quality index for surface water defined by DOE

Source: JICA Expert Team

As equipment available at AWMO is limited, some parameters, such as total Zn and dissolved Cu, may be omitted from the monitoring.

Figure and table below summarize the sampling locations of the regular monitoring program.



Source: JICA Expert Team

Figure 6.3-14 Sampling Locations of Regular Monitoring

Table 6.3-31 Geographical Coordinates of Sampling Locations

Category	Location Name	Point	Easting (UTM)	Northing (UTM)
Anzali Wetland	Anzali Port	W01	364457 E	4147668 N
	Lagoon	W02	355336 E	4147023 N
	Sorkhankol	W03	362538 E	4143158 N
	Selke	W04	363026 E	4139688 N
	Downstream of Chokum	W05	368104 E	4142880 N
	Siakhesim	W06	357023 E	4141584 N
Rivers	Pirbazar	R01	368392 E	4139974 N
	Pasikhan	R02	367903 E	4139848 N
	Palangvar	R03	352270 E	4140172 N
	Khalkai	R04	348039 E	4142916 N

Source: JICA Expert Team

The monitoring is to be implemented in one day by one team. However, if this is difficult, it could be implemented by two teams (e.g., a boat team and a car team) in one day or in two days by one team. Some sites (e.g., W06_Siakhesim and W05_Chokum) may not be accessible in some seasons.

2) Quality Control

Reliability of data has been one of the main issues in environmental monitoring in the Anzali Wetland. During the Phase 2 Project, comparative analyses of the same samples by six

laboratories in the area were performed, and the results showed significant variabilities among laboratories, though these laboratories generally followed the protocols recommended by manufacturers of equipment. Unfortunately, there are no official protocols for environmental sampling, analysis and QA/QC in Iran, and it is quite difficult to pinpoint the exact cause of the variability as the protocols vary from laboratory to laboratory. The variability depends on parameters, but may be significantly large if one wants to discern relatively small yet ecologically significant variation in water quality, such as those caused by rain event, seasonal change, etc. Thus, every effort should be made to ensure reliability of data. In principle, AWMO is suggested to adopt a set of QA/QC protocols based on international methodologies, including the “Standard Methods for the Examination of Water and Wastewater”. Among some of practical suggestions include:

- Plan the monitoring activities in advance so that those who are involved in the monitoring can be well-prepared for the monitoring
- Thoroughly wash sample containers and apparatus before analysis to minimize contamination.
- Make sure to collect a representative sample. Minimize influence of stirred sediment and other factors.
- Regularly use external and/or internal standard to confirm reliability of analysis as drift in analytical equipment, interference by matrix, etc. This is particularly important with simplified methodologies, such as pre-programmed Hach methodologies.
- Analyze duplicate and blind samples to diagnose quality control issues
- Participate in a proficiency program. If not available, request a third-party laboratory to cross-examine results

3) Reporting

Reporting is one of the most important aspects of monitoring that has been overlooked so long. AWMO is responsible for preparing the following reports based on the monitoring results.

- Monthly reports (12 times)
- Annual report (1 time)

Table 6.3-32 Reports of Regular Monitoring Program to be Prepared by AWMO

Name	Contents	Frequency	Recipient
Monthly Report	Results of regular monitoring (date and time of sampling, sampling locations, concentrations of pollutants, comparison with the standard)	Monthly	DOE-Gilan AWMC
Annual Report	Summary of monitoring activities conducted in the year (overall summary, objectives, methodologies, simple statistics, spatial and temporal trends, comparison with the standard, major findings, suggested measures to control pollution)	Annual	DOE-Gilan AWMC DOE-HQ

Source: JICA Expert Team

The monthly reports are essentially analytical bulletins summarizing the analytical data of the month. The Annual Report should describe all details of the monitoring activities in the year, including the summary, methodologies, as well as the findings with respect to the objectives set out for each monitoring program. These reports should be submitted to the Director General of DOE-Gilan first. The monthly report should be shared with AWMC, and the yearly report should be sent to DOE-HQ and the AWMC.

(2) Monitoring of Water Level

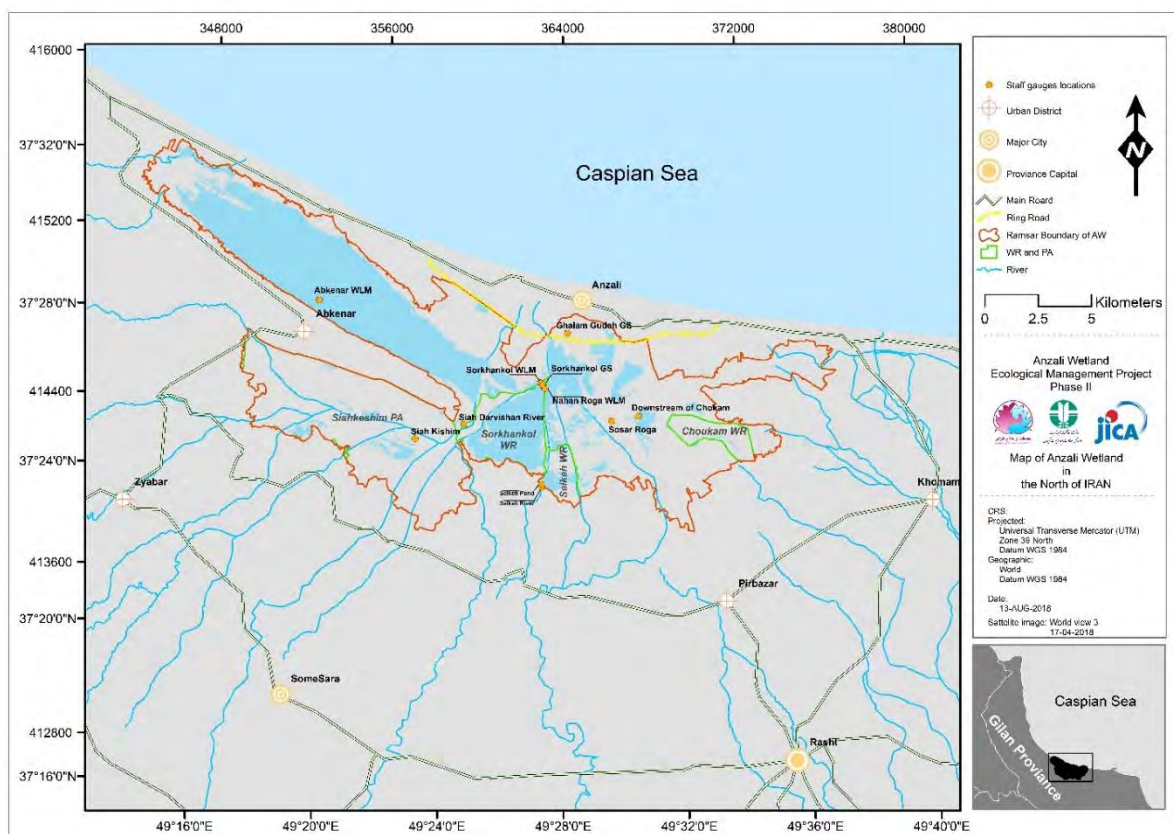
1) Monitoring Program

Table 6.3-33 summarizes the program of monitoring of water level, and Figure 6.3-15 summarizes the monitoring locations. There are 11 staff gauges and 3 water level meters installed at different locations in the wetland. In addition, the PMO’s water level data at the Anzali Port (Ghazian Bridge) should be collected and compared.

Table 6.3-33 Program of Monitoring of Water Level

Category	Monitoring Locations	Frequency	Monitoring item	Main objective
Anzali Wetland	11 locations in the wetland (Ghalam Gudeh GS, Nahan Roga WLM, Sorkhankol GS, Abkenar WLM, Siah Darvishan River, Sorkhankol WLM, Sosar Roga WLM, Selkeh River, Selkeh Pond, Downstream of Chokam, Siah Kishim) and Ghazian Bridge data from PMO	GSS: daily Others: by-weekly	Water level	To monitor fluctuations of water levels in different parts of the Anzali Wetland

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-15 Monitoring Locations of Water Levels

The staff gauges at Ghulam Gudeh GS, Sorkhankol GS and Selkeh GS are easy to access by DOE Gilan guards, and the guards should take photographs of the gauges and send them to the staff of AWMO together with the readings. Other gauges need a boat to access, and they should be monitored by the staff of AWMO. WLM data can be downloaded from the website, but it is essential to regularly maintain the WLMs, and confirm data against the staff gauge data. Also, it is suggested to re-calibrate/replace all meters and gauges in every 5 years or so, as the ground in the wetland is soft and the gauges and meters might sink and/or tilt.

2) Reporting

The results of water level monitoring should be reported as summarized below. They can be combined with the regular monitoring reports.

Table 6.3-34 Reports of Monitoring of Water Level to be Prepared by AWMO

Name	Contents	Frequency	Recipient
Monthly Report	Water levels of each gauge/meter	Monthly	DOE Gilan AWMC
Annual Report	A report explaining the objective, methodology, results, and interpretation of the results.	Annual	DOE Gilan AWMC DOE-HQ

Source: JICA Expert Team

(3) Salinity Monitoring

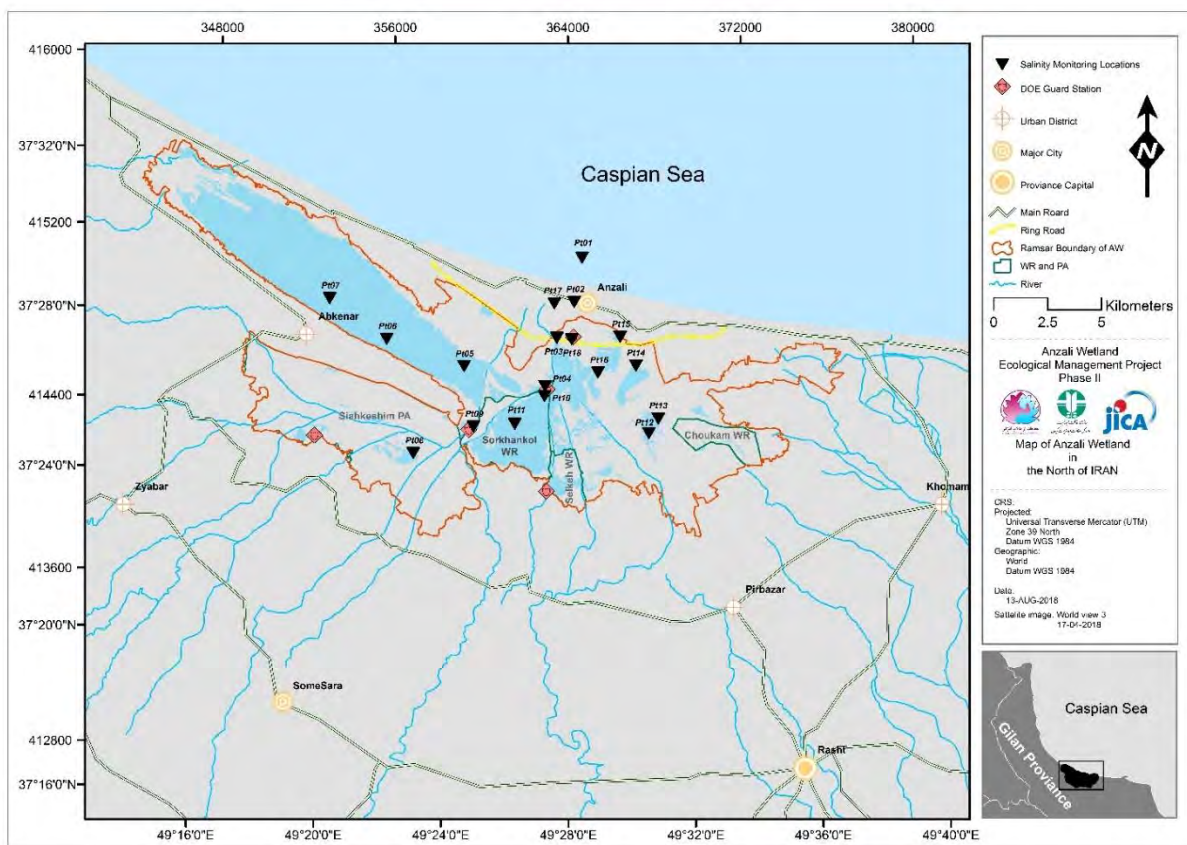
1) Monitoring Program

Table 6.3-36 summarizes the number of sampling locations, monitoring frequency, analytical items, and main objective of the salinity monitoring. The suggested monitoring locations are given in Table 6.3-37 and Figure 6.3-16.

Table 6.3-35 Program of Salinity Monitoring

Category	Sampling Locations	Frequency	Analytical items	Main objective
Anzali Wetland	18 locations (top 50cm and bottom 50cm if water is deeper than 1.5 m.)	April July Nov January	Temperature, DO, EC, salinity (portable water quality meter)	To record mixing of the Caspian Sea water with water of the Anzali Wetland

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-16 Suggested Monitoring Locations of Salinity Monitoring

Table 6.3-36 Geographical Coordinates of Monitoring Locations of Salinity Monitoring

No.	Location	Easting (UTM)	Northing (UTM)
Pt01	Caspian Sea	364658E	4150343N
Pt02	Port	364293E	4148296N
Pt03	Mian Poshteh bridge	363488E	4146632N
Pt04	Nahan Roga	362945E	4144398N
Pt05	Eastern Lagoon	359188E	4145324N
Pt06	Middle of Lagoon	355604E	4146587N
Pt07	Westen Lagoon	352956E	4148471N
Pt08	Siahkeshim	356832E	4141305N
Pt09	Siahdarvishan	359617E	4142527N
Pt10	Sorkhankol	362918E	4143938N
Pt11	Sorkhankol	361540E	4142656N
Pt12	Chokum	367755E	4142218N
Pt13	Downstream of Chokum River	368192E	4142894N
Pt14	Water Reservoirs Shalkuhy	367157E	4145349N
Pt15	Sosar Roga	366426E	4146682N
Pt16	Downstream of Pasikhan River	365399E	4145028N
Pt17	Anzali Canal	363375E	4148232N
Pt18	Upstream of Ghalam Gudeh	364179E	4146571N

Source: JICA Expert Team

While EC and salinity are part of the parameters of the Regular Monitoring Program, the sampling locations in the Regular Monitoring Program are too limited, and it is not possible to capture the spatial pattern of saltwater intrusion. Thus, the Salinity Monitoring Program is implemented separately.

This survey should be implemented on a fine day, and not after a heavy rain event to avoid impact of rain on water quality. To capture the mechanism of intrusion, the monitoring locations may be further optimized considering how the sea water intrudes into the wetland. There may be stratification of water, and salinity of bottom layers should be checked at locations where water depth is larger than about 1.5 m.

2) Reporting

The results of salinity monitoring should be reported as summarized below.

Table 6.3-37 Reports of Salinity Monitoring to be Prepared by AWMO

Name	Contents	Frequency	Recipient
Annual Report	A report explaining the fluctuation of EC in the wetland, mechanism of the Caspian Sea water intrusion, relation with the water level, etc.	Annual	DOE Gilan AWMC DOE-HQ

Source: JICA Expert Team

(4) Monitoring of Toxic Substances

1) Monitoring Program

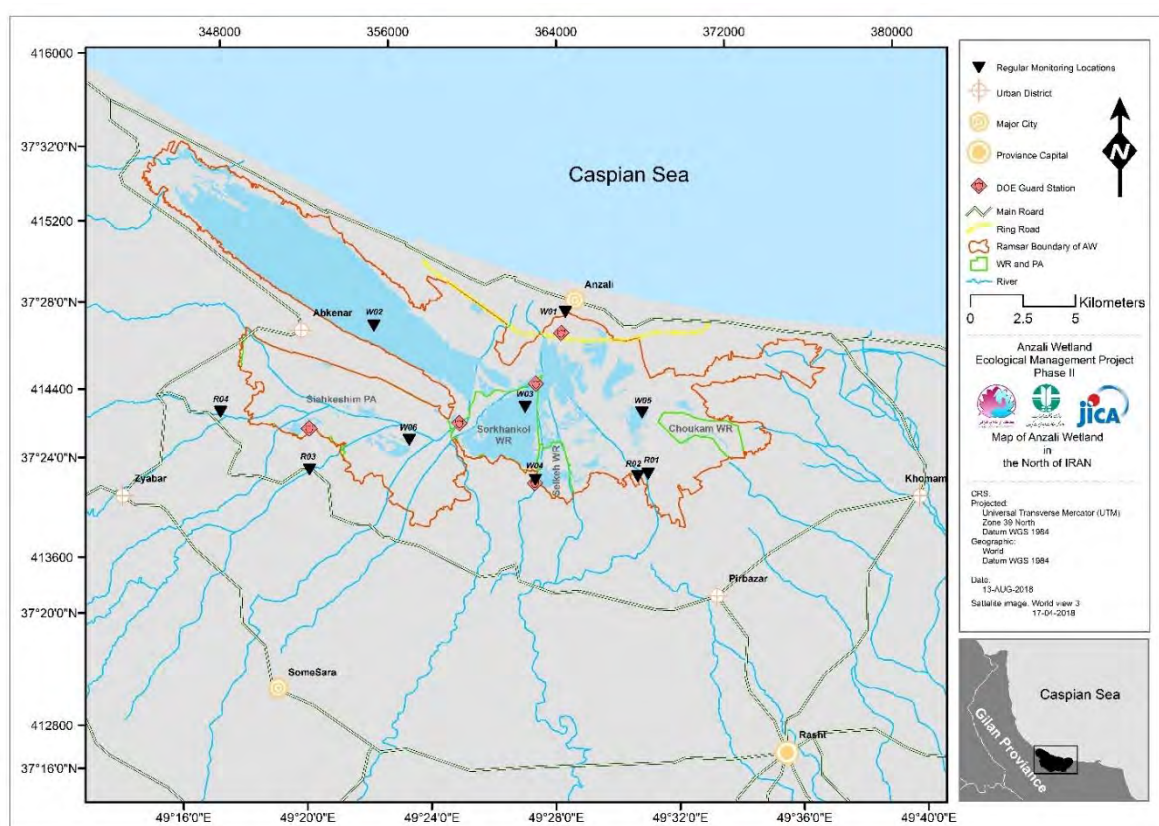
Table 6.3-38 summarizes the number of sampling locations, monitoring frequency, analytical items, and main objective of the toxic substances monitoring. The suggested monitoring locations are given in Figure 6.3-17, which are the same as the Regular Monitoring Program.

Toxic substances tend to accumulate in sediment, and sampling of sediment should be implemented in parallel to sampling of the waters.

Table 6.3-38 Program of Toxic Substances Monitoring

Category	Sampling Locations	Frequency	Analytical items	Main objective
Anzali Wetland	Same as the regular monitoring	Every 2 years	To be decided: Water (heavy metals (e.g., Pb, Zn, Cd, Cr, As, Ni and Hg), PCBs, selected pesticides) Sediment (e.g., particle size distribution, organic matter, heavy metals (e.g., Pb, Zn, Cd, Cr, As, Ni and Hg), PCBs, selected pesticides)	To monitor levels of different toxic substances in the wetland

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.3-17 Monitoring Locations for Monitoring of Toxic Substances

It should be noted that this program is designed to routinely check the situation of pollution by toxic substances. Should any specific concern about pollution by a toxic substance arise, a more specific investigation program should be developed and implemented.

Because AWMO does not have equipment to monitor toxic substances, it is suggested that the analysis is contracted out to a reliable laboratory, perhaps a reputable international laboratory, and cross-checked by the DOE laboratory in Rasht for parameters that DOE Gilan can analyze.

As for pesticides, it is suggested to monitor levels of highly toxic chlorinated pesticides (e.g., DDT, aldrin, dieldrin, etc.) and pesticides commonly used in the area (e.g., butachlor, diazinon and chlorpyrifos). Pesticide concentrations are usually very low, and can be detected only right after application. Thus, the parameters and timing of sampling should be decided based on a discussion with agricultural experts in the area.

2) Quality Control

Analysis of toxic substances requires expertise and special equipment, and it is expensive. Thus, it is important to practice proper quality and obtain reliable data. Taking representative samples, avoiding contamination and loss to degradation/absorption during transport, and selecting a reliable laboratory are among important measures to ensure data reliability.

3) Reporting

The results of the monitoring of toxic substances should be reported after each monitoring as summarized below.

Table 6.3-39 Report of Monitoring of Toxic Substances to be Prepared by AWMO

Name	Contents	Frequency	Recipient
Annual Report	A report explaining the summary, background, methodology, situation of pollution by toxic substances, comparison with international guidelines (e.g., Canadian guideline for protection of aquatic biota), needs for actions, etc.	Annual	DOE Gilan AWMC DOE-HQ

Source: JICA Expert Team

6.3.6 Division of Roles

Table 6.3-41 summarizes the responsibilities of water and sediment quality monitoring related to management of the Anzali Wetland. Aside from DOE Gilan, NIWAI, GRWC, GWWC and RWWC all have different responsibilities for monitoring water and sediment quality in the wetland, rivers, and pollution sources.

Table 6.3-40 Responsibilities of Water and Sediment Quality Monitoring

Organization	Responsibility of Water/Sediment Quality Monitoring Related to Management of the Anzali Wetland	Location	Example of Monitoring Items
DOE	Monitoring of environmental conditions of major wetland and rivers and compliance monitoring of pollution sources	Wetland, rivers	Compliance with environmental standard, eutrophication (e.g., COD, T-P, T-N, chlorophyll a, transparency), levels of toxic substances (e.g., heavy metals and pesticides), safety for water-related activities (e.g., coliform)
NIWAI	Monitoring of aquatic environment related to aquaculture	Wetland, rivers	Eutrophic level (e.g., T-N, T-P), Toxicity to fish (e.g., DO, sulfide, NH ₄ , NO ₂ , heavy metals and toxic organic substances)
GRWC	Monitoring of condition of river, especially hydrology, sediment transport, and other aspects	Rivers	River flow, sediment transport/bed materials, compliance with environmental standard, parameters related to hydrogeology (e.g., major ions)
GWWC	Monitoring of water as water sources and pollution associated with sewerage systems in urban areas	Sewerage, rivers	Compliance with drinking/raw water standard, raw wastewater and treated wastewater quality (e.g., BOD/COD, coliform, T-N, T-P)
RWWC	Monitoring of water as water sources and pollution associated with domestic wastewater in rural areas	Treatment unit, rivers	Compliance with drinking/raw water standard, raw wastewater and treated wastewater quality (e.g., BOD/COD, coliform, T-N, T-P)

Source: JICA Expert Team

Among these monitoring activities, this mid-term plan focuses on monitoring of the wetland and rivers by DOE Gilan because they are directly related to ecological management of the wetland. Other monitoring activities are also highly relevant to management of the wetland, but their main objectives are different from management of the wetland. Thus, they are not covered here.

6.3.7 Budget

(1) Anticipated Cost and Other Resources for Monitoring

1) Human Resources

The monitoring is to be implemented by the staff of AWMO. The proposed members of AWMO are as summarized below.

Table 6.3-41 Proposed Staff of AWMO

Position	Number	Job Description
Manager	1	Overall management, report writing
Analytical Chemist	2-3	Chemical analysis, report writing
Microbiologist	2-3	Microbial analysis, report writing
Sampling Expert	1-2	Sampling, on-site measurement, reading of water level gauges
Driver/Field Assistant	1-2	Operation of vehicle, sampling, on-site measurement, reading of water level gauges
Total	Around 8	-

Source: JICA Expert Team

DOE Gilan should assign appropriate personnel to AWMO.

2) Office and Equipment

It is assumed that the laboratory space currently used by AWMO is continued to be used by AWMO. Selected equipment required to implement the monitoring is as summarized in Table 6.3-43. In short, equipment comparable to the laboratory at the current DOE Gilan central laboratory in Rasht would be necessary, and at least this level of equipment should be maintained at AWMO.

Table 6.3-42 Equipment Required at AWMO

Equipment	Number	Use
Portable water quality meter	1-2	On-site measurement of water temp., DO, EC/salinity, pH
pH meter	2	Measurement/adjustment of pH in the laboratory
EC meter	2	Measurement/adjustment of EC in the laboratory
UV-vis Spectrophotometers	1-2	General chemical analysis
Microscopes	1	Planktons
Incubators	2	Microbial analysis
Autoclaves	1	Microbial analysis
Oven	1	Desiccation
Chemical balance	2	Weighing reagent
Pure water production system	1	Production of contamination-free water
Refrigerator	1	Storage of samples and chemicals
Freezer	1	Storage of samples and chemicals
Cooler box	2	Sampling
GPS	1	Field survey
Personal Computer	8-10	Preparation of report, operation of equipment
Printer	2	General office use
Copier	1	General office use

Source: JICA Expert Team

In the future, an atomic absorption spectroscopy (or ICP) for heavy metal analysis, a gas chromatograph (and/or HPLC) for analysis of pesticides, and other specialized equipment for more advanced monitoring should be procured. However, such equipment is expensive to procure and maintain. Thus, such advanced monitoring could be outsourced for now.

3) Transportation

A vehicle should be made available for sampling and other uses.

Table 6.3-43 Vehicle for Transportation Required at AMWO

Name	Number	Use
Vehicle (a pickup truck or a van for four passengers and sampling equipment)	1	Transportation of samples and sampling equipment

Source: JICA Expert Team

In addition, a boat is needed for monitoring. It is suggested that the boat is operated and maintained by DOE Ghalam Gudeh Guard Station. Because many sections of the wetland are too shallow to be accessed by a regular boat, it is suggested to consider this limitation in procuring a boat.

4) Cost

Table below summarizes the anticipated costs for different monitoring programs at 2018 price. The investment cost covers procurement of basic equipment, especially those listed in Table 6.3-43, and they will be replaced every several years. The investment cost does not cover large new equipment, such as vehicles, ICP, GC-MS, etc. The O&M cost covers the reagents, consumables and fuels, and it does not include the remuneration, utilities, and cost for office space. Other costs should be estimated separately as needed. It is the responsibility of DOE Gilan to make more detailed cost estimate and make the budget available for monitoring by AWMO every year from a recurrent source.

Table 6.3-44 Estimated Costs for Investment and O&M Costs at AMMO (2020-2030)

Year	Investment (USD)	O&M (USD)	Total (USD)
2020	10,000	20,000	30,000
2021	15,000	20,000	35,000
2022	15,000	20,000	35,000
2023	20,000	25,000	45,000
2024	20,000	25,000	45,000
2025	25,000	25,000	50,000
2026	25,000	25,000	50,000
2027	25,000	25,000	50,000
2028	25,000	25,000	50,000
2029	25,000	30,000	55,000
2030	30,000	30,000	60,000
Total	235,000	270,000	505,000

Source: JICA Expert Team

6.3.8 Supported Problem

(1) Implementation of Monitoring Programs Proposed in the Mid-term Plan

Monitoring is essential for environmental management, and it is a legal mandate of DOE. However, during the project, DOE Gilan was not able to implement the monitoring activities regularly. DOE is strongly urged to adopt the monitoring programs suggested in the Mid-term Plan as its official monitoring programs and implement the monitoring according to the programs. DOE Gilan established AWMO in late 2017, but as of late 2018, it still does not have enough resources to implement the proposed programs. DOE Gilan needs to allocate a recurrent

budget and other resources to AWMO (see Mid-term Plan for details of minimal resources required) and ensure that the monitoring is implemented according to the programs.

(2) Adoption of QA/QC

Unlike raw wastewater, ambient concentrations of pollutants in the Anzali Wetland are generally fairly low, and detecting small changes in water quality with sufficient confidence is not easy, though such analytical capability is essential in understanding ecological dynamics, such as seasonal changes, impacts of river flow, intrusion of the Caspian Sea water, and spatial distribution of pollutants in the wetland. Blindly following analytical methodologies is not sufficient, and one needs to actively control reliability of analysis. DOE is strongly recommended to adopt full QA/QC protocols suggested in the Mid-term Plan, including internal quality control routines, participation in an inter-laboratory analytical competency program, etc.

(3) Monitoring Activities with Academic Institutions

Ecosystem of the Anzali Wetland is very complex, and without in-depth scientific knowledge, it is not possible to interpret monitoring data. For this, DOE is suggested to work with academic experts specialized in the following areas: (i) eutrophication, including algal dynamics, (ii) surface water hydrology and hydrodynamics, (iii) environmental analysis of heavy metals and toxic organic substances, (iv) other areas of interest.

(4) Integrated Monitoring of Different Environmental Items

This chapter has focused on monitoring of water and sediment qualities. However, DOE Gilan needs to monitor other factors, such as conditions of plants, mammals, birds, fishes, reptiles, amphibians, benthos and planktons, land use/encroachment, hydrology, sedimentation, and other items. These should be integrated under a unified framework for monitoring of the Anzali Wetland. It is suggested to expand the scope of AWMO, which is currently limited to monitoring of water and sediment qualities, to include all of these monitoring items. As the human resources of DOE are limited, some monitoring items may be contracted out to external experts. Nevertheless, DOE Gilan needs to put together all the monitoring programs, and to explain how different factors are interacting with each other and shaping the unique ecological character of the Anzali Wetland. Such programs should be developed within the overall scope of DOE Gilan's environmental monitoring programs for the whole province.

(5) Decision-making through Monitoring

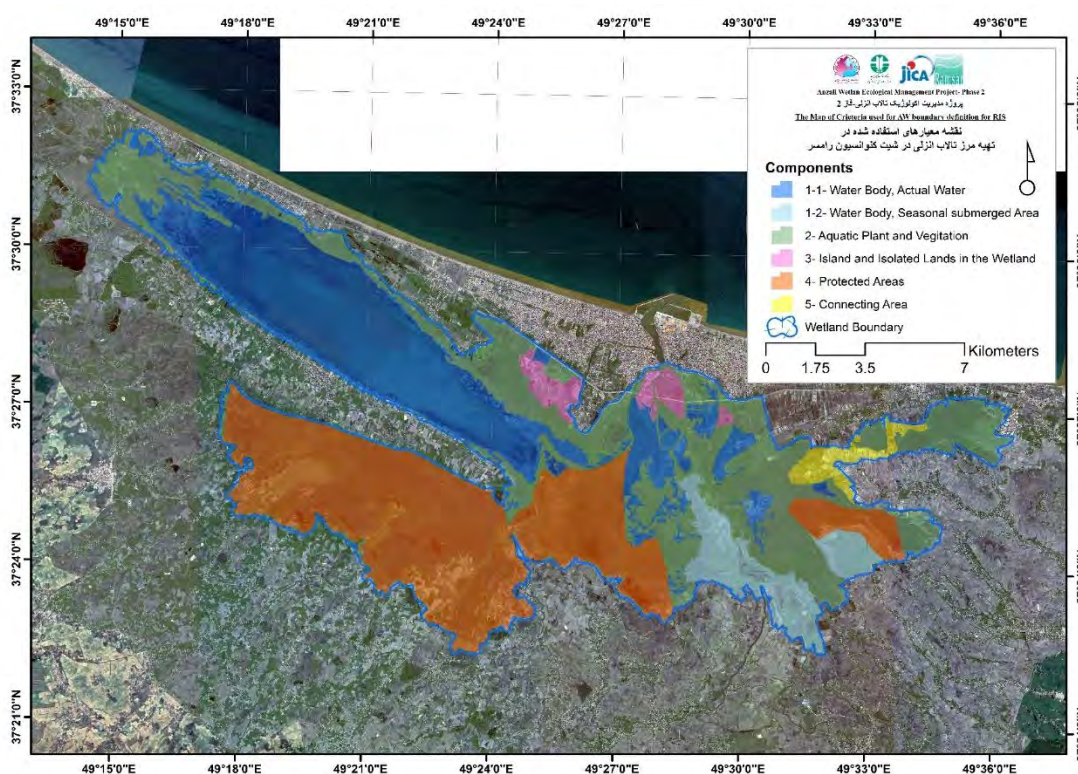
As explained above, DOE Gilan was not able to implement regular monitoring throughout the project period. This is partly because many stakeholders, both DOE Gilan and other organizations, tend to place too much emphasis on short-term, highly-visible outcomes, and overlook the importance of proper planning, progress monitoring, evaluation of effectiveness and follow-up activities. As the result, many activities are implemented without monitoring,

without feed-back mechanisms to optimize effectiveness and accountability of activities. For example, dredging in the wetland has been implemented without monitoring of the water level, sediment traps have been constructed without monitoring of accumulating sediment, and sewerage systems have been constructed in Rasht and Anzali without regular monitoring of water quality in the Anzali Wetland. To build feed-back mechanisms into the activities, DOE HQ, the provincial government, and PBO are urged to require proper planning, progress monitoring, evaluation of effectiveness and follow-up activities in authorizing any major activities.

Table 6.4-1 Criteria of Ramsar Site Boundary of Anzali Wetland

No	Criteria
1	Actual water body and seasonal submerged land
2	Aquatic plant vegetations (reedbed, lotus community and the other emerged plant community)
3	Island and isolated land in wetland
4	Protected Areas (Selkeh, Sorkhankol and Choukam Wildlife Refuges and Siahkesim Protected Area)
5	Area to connect main wetland with eastern isolated wetland as ecological network

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.4-2 New Ramsar Boundary and Components

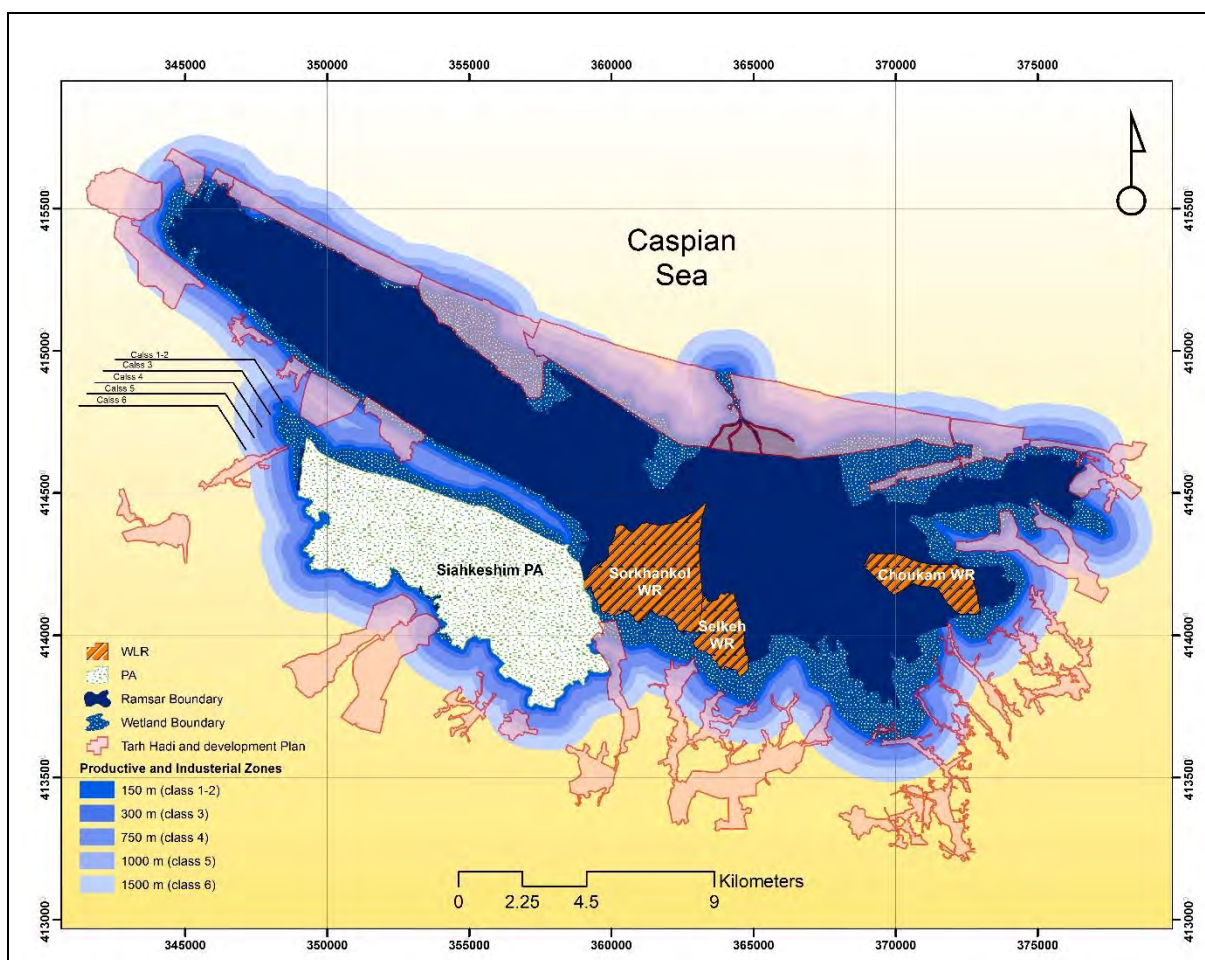
(2) Related Laws and Regulations

There are many related laws and regulations related to manage the land use in/around the wetland as shown as Table 6.4-2 and Figure 6.4-3. These laws and regulations are very strict. Therefore, the Anzali Wetland must be protected very well with less human activity if all laws and regulations are complied. In fact, there are many illegal and gray land use and activities in these areas. They caused many conflicts between laws and local people.

Table 6.4-2 Laws and Regulations Related to Land Use Management of the Anzali Wetland

No.	Laws and Regulations	Related Area or Matter	Responsible Organization
1	Hunting and Fishing Law	Wildlife Refuge Protected Area	DOE
2	Law on Equitable Water Distribution	Boundary of wetland Buffer of wetland	Ministry of Energy(MOE)
3	Industrial and Productive Activities and Units Construction Criteria and Regulation	Class 1,2,3,4,5,6 for Industrial and Productive Activities and Units Construction	DOE
4	Tarhe Hadi Plan	Construction Area	Housing Foundation

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.4-3 Map of Areas Related Laws and Regulations

The boundary of wetland by MOE is one of the most important area for the Anzali Wetland Conservation and life of local people.

“Boundary of wetland” based on the Law on Equitable Water Distribution was finalized and published by Ministry of Energy (MOE) on 17 Oct. 2017 It is larger than the Ramsar boundary and includes residential area and farmlands. MOE’s wetland boundary was delimited to

control flood. It made many conflictions with local people and local governments because of land use limitation. There are actually many plans and zones based on various laws and guidelines. They caused many conflictions to be solved.

(3) Protected Area Management

Three wildlife refuges (WRs) and one protected area (PA) were established in the Anzali Wetland as shown in Table 6.4-X and Figure 6.4-X. These areas are strictly protected based on the Hunting and Fishing Law. Total area of these WRs and PA is 6,510 ha, it is 33.4% of the Anzali Wetland (19,485 ha).

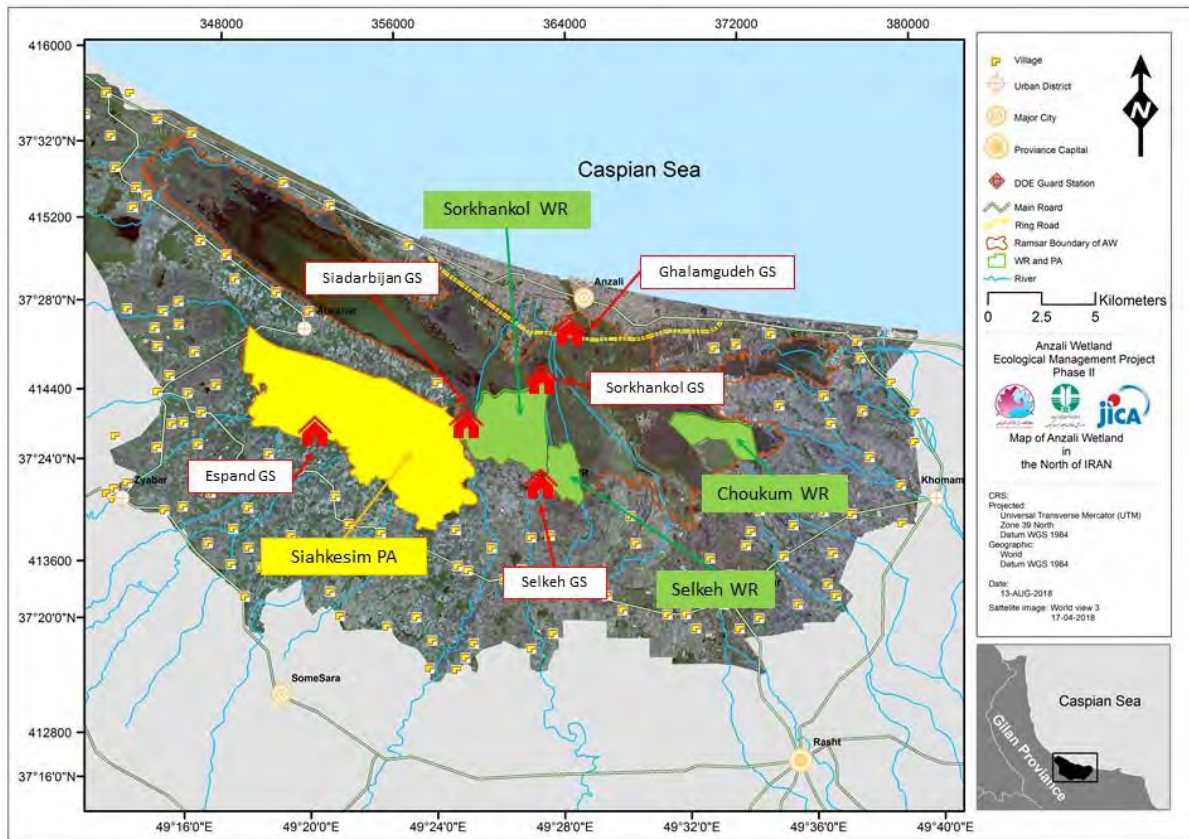
Anzali Wetland has five guard stations (GSs) of DOE as shown in Table 6.4-3 and Figure 6.4-4. The DOE guards cover all of WRs, PA and the other Anzali Wetland. The number of guards are not e

There are 48 warning signboards on the boundaries of these WRs and PA (42 signboards were installed by JICA Expert Team under Anzali Wetland Ecological Management Project PhaseII) as shown in Figure 6.4-5

Table 6.4-3 Protected Areas in the Anzali Wetland

No	Protected Area	Area(ha)	Establishment
1	Selkeh Wildlife Refuge	360	1970
2	Siahkeshim Protected Area	4,498	1978
3	Sorkhankol Wildlife Refuge	1,209	2002
4	Choukum Wildlife Refuge	443	2006
	Total	6,510	

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.4-4 Protected Areas and Guard Stations in the Anzali Wetland



Source: JICA Expert Team

Figure 6.4-5 Installed Warning Signboards on the Boundaries of WRs and PAs

The Anzali Wetland has 5 GSs to manage the Anzali Wetland including WRs and PA as shown in Figure 6.4-6 and Table 6.4-4. In total, 30 DOE guard are in charge of patrol and management of Anzali Wetland including WRs and PA in 48 hours shift. These GSs have played a certain

role in the protected area management. However, the number of guards have been not enough to cover huge whole Anzali Wetland.

Table 6.4-4 DOE Guard Stations in the Anzali Wetland

No	Protected Area	DOE Branch	Number of guards	Territory
1	Ghalamgudeh GS	Anzali	7	Sorkhankol WR, West Lagoon
2	Sorkhankol GS	Anzali	5	Sorkhankol WR
3	Selkhe GS	Somesara	6	Selkeh WR, Sorkhankol WR (south part)
4	Siadarbijan GS	Somesara	6	Siahkesim PA, Sorkhankol WR (south part)
5	Espand GS	Somesara	6	Siahkesim PA
	Total		30	

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.4-6 Guard Stations in the Anzali Wetland

(4) Land Use

The south margin of the Anzali Wetland is almost farmland. Paddy field is the largest farmland. There are several large pastures for livestock and fish ponds for aquaculture as well. In addition, villages as residential areas are scattered. On the other hand, the north margin of the wetland is highly developed as urban area of Anzali city.

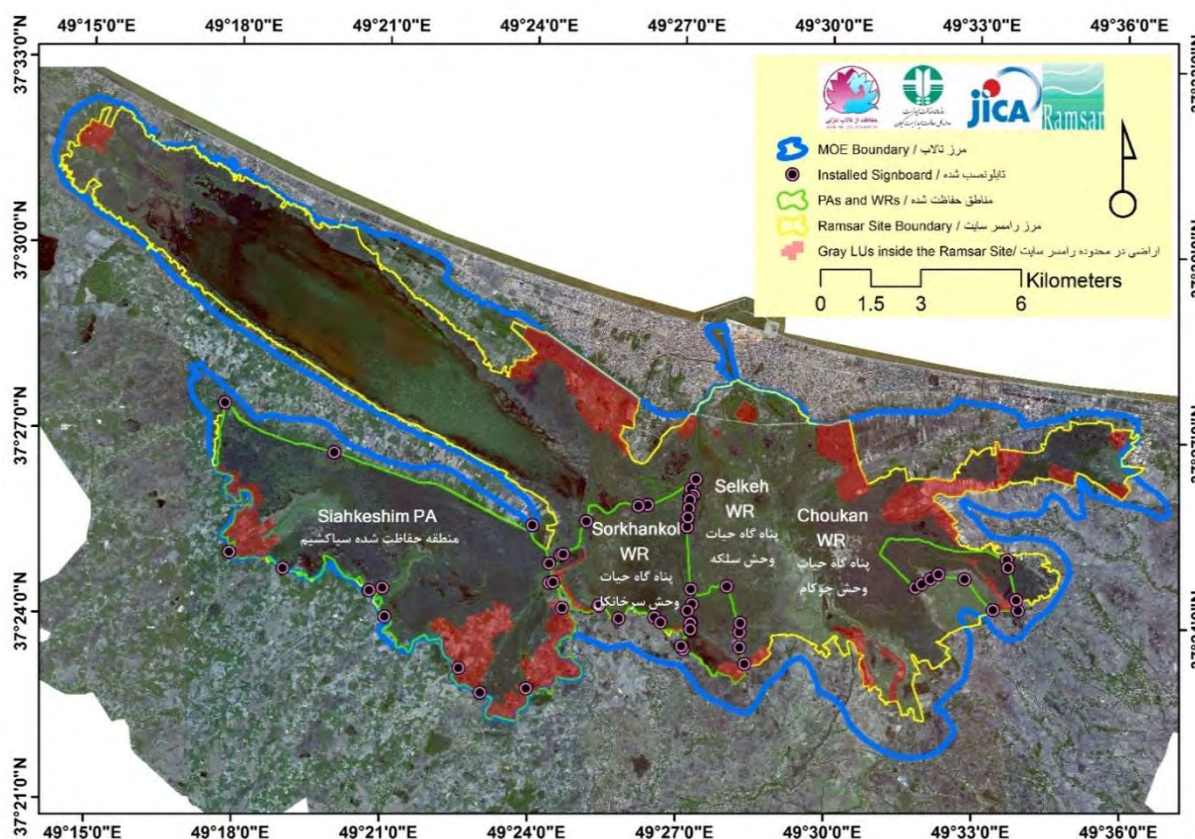
There are many land use in the Ramsar site boundary including WRs and PA. Many of them in WRs and PA is illegal land use such as farmland, plantation, pasture and *Abbandan* as shown in Table 6.4-5 and Figure 6.4-7. Totally 1,353 ha (20.7%) in WRs and PA were detected based on the satellite image.

Some of land use in WRs and PA have been permitted from relevant organization due to ignorance, misunderstanding, lack of communication among relevant organizations, etc. Therefore, sometimes they are difficult to identify whether illegal or legal. Actually, court fights are often occurred about illegal land occupation.

Table 6.4-5 Illegal and Grey Land Use in WRs and PA in Anzali Wetland(2018)

No	Name of PA	Total Area (ha)	Farmland (ha)	Abbandan (ha)	Pasture (ha)	Plantation (ha)	Total LU (ha(%))
1	Selkeh WR	360	32	20	0	<1	53 (14.7%)
2	Sorkhankol WR	1,209	45	28	0	<5	78 (6.5%)
3	Choukam WR	443	29	5	91	<1	126(28.4%)
4	Siahkeshim PA	4,498	560	N/A	196	340	1,096(24.3%)
Total		6,510	666	53	287	347	1,353(20.7%)

Source: JICA Expert Team



Source: JICA Expert Team

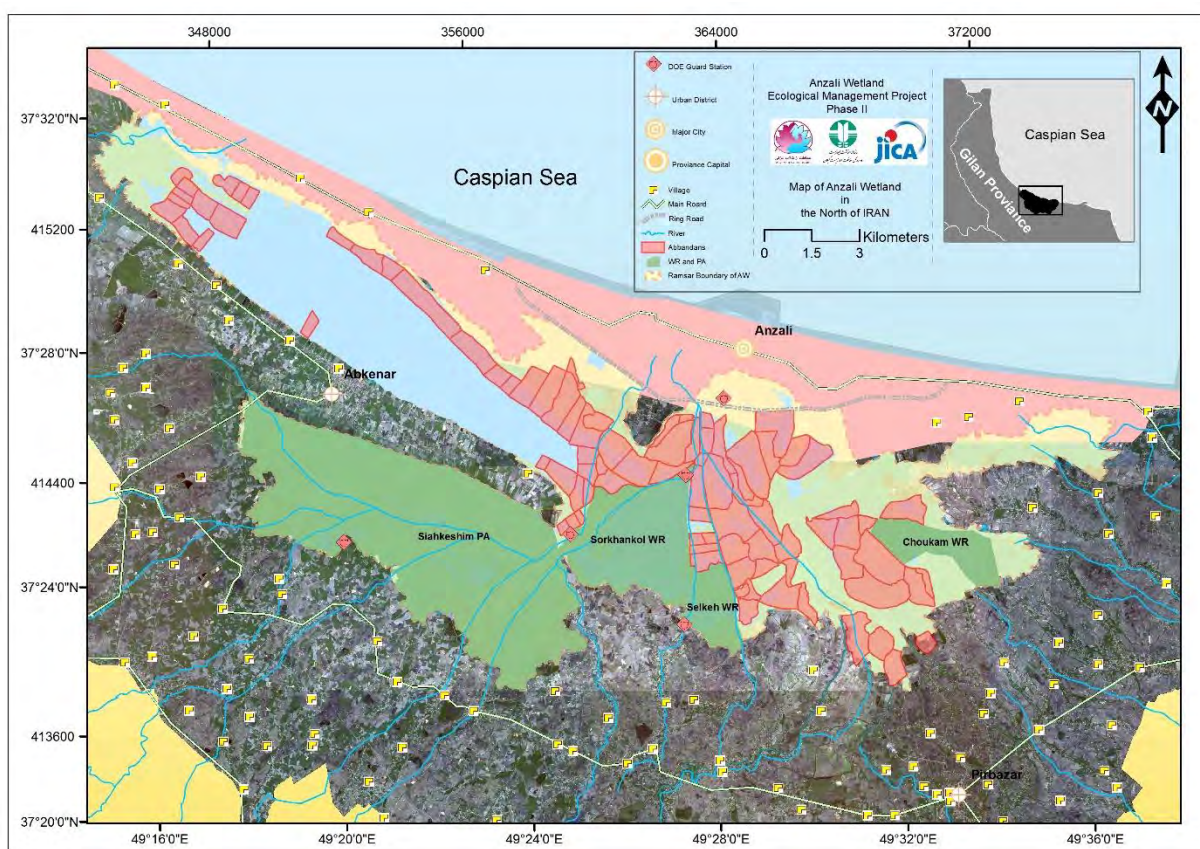
Figure 6.4-7 Potential Illegal Land Use in Ramsar Boundary of the Anzali Wetland

(5) Abbandan-dari

“Abbandan-dari” is a system of customary management practiced among the communities around the wetland, it characterize the local traditional culture of the Anzali Wetland.

"*Abbandan*" is water area in the Anzali Wetland for hunting and fishing. The customary *Abbandan-dari* system is practiced by a group of local people. Since 1971, *Abbandan-dari* practices have been undertaken under the supervision of the DOE. Areas are rented to groups of local people in winter, and conservation conditions are built in to the rental agreements. Kinds of waterbirds, number, days for hunting were limited based on the agreement. 90 *Abbandans* which range in size from 8 to 160 hectares were rented in 2018 winter as shown in Figure 6.4-8. Many licensed owners constructed simple cottage in *Abbandan* as shown in Figure 6.4-9.

The concept of *Abbandan-dari* is a wise use of Wetland. However, the sustainable hunting and fishing are not controlled very well. Over hunting and fishing are sometimes occurred in *Abbandans*.



Source: JICA Expert Team

Figure 6.4-8 Abbandans Licensed by DOE Gilan in the Anzali Wetland (2018 winter)



Source: JICA Expert Team

Figure 6.4-9 Abbandan with Cottage in the Anzali Wetland

(6) Boat Tourism

Boat tourism is recently increasing very much than before. Especially lotus flower season is peak of boat tourism from May to September. Sorkhankol WR and West Lagoon are the good sites for Lotus tourism. Sorkhankol WR is basically prohibited to enter by public people including tourist. It is allowed only in Lotus flower season. They are very good income resource for local people. However, manner of boat tourism became bad. For example, many boat make high speed more than 50 km/h. It is possible to make accident. And some boat operators set loud music speakers on their boat and make unappropriated music sound in the nature.



Source: JICA Expert Team

Figure 6.4-10 Tourist Boats in Sorkhankol WR

6.4.2 Long-term Goal

Appropriate conservation and wise-use by protected area management and land use management in/around the Anzali Wetland must be implemented to maintain the ecological characteristics of the Anzali Wetland.

6.4.3 Prior Conditions

There are many related laws and regulations related to manage the land use in/around the wetland. These laws and regulations are very strict. Therefore, the Anzali Wetland must be

protected very well with less human activity if all laws and regulations are complied. In fact, there are many illegal and gray land use and activities in these areas. They caused many conflicts between laws and local people. These laws and regulations are not realistic to solve many land use issues. Because it is impossible to exclude all existing local people activities and land use. Therefore, these situations are thought as a prior condition. First priority of the Mid-term Plan should be to prevent further destruction of the Anzali Wetland. (Of course, obvious illegal activities and land use must be controlled strictly.)

Especially developed areas between inside of the MOE's boundary of wetland and outside of Ramsar boundary should be treated flexibly, for example to get legal permission of existing land use based on the laws and regulations. Gilan province side including DOE Gilan and the central government side (MOE, WRMC and DOE HQ) side have discussed about revision of the boundary of wetland based on the law on equitable water distribution without solution for long time. DOE Gilan has tried to shrink the boundary of wetland to exclude some developed areas. However, the purpose of the law on equitable water distribution and the wetland protection and conservation as DOE mandate are totally different. It is the fact the current boundary of wetland is not realistic to manage the existing land use. However, it can not be solved if MOE and WRMC changed the boundary of wetland to exclude some developed areas. Because there will be still remained difference between the Ramsar Boundary and the Ramsar boundary. The land use in this area between them should be justified based on a environmental zoning plan and land use guideline based on all relevant the laws and the regulations.

6.4.4 Mid-term Goal

Mid-term goals of Environmental Zoning and Land Use Management are summarized below, which target on 2020 to 2030.

- 1) Appropriate Protected Areas Management with Enhancement DOE Guard Station

Hunting and Fishing must be controlled to achieve sustainable use by enhancement of DOE guard station.

- 2) Appropriate Land Use Management based on Zoning Plan and Land Use Guideline

Appropriate land use management must be implemented by collaboration with all of relevant organization based on Environmental Zoning Plan and Land Use guidelines. They must be formulated by 2020 (Iranian Year 1399).

6.4.5 Implementation Plan and Schedule

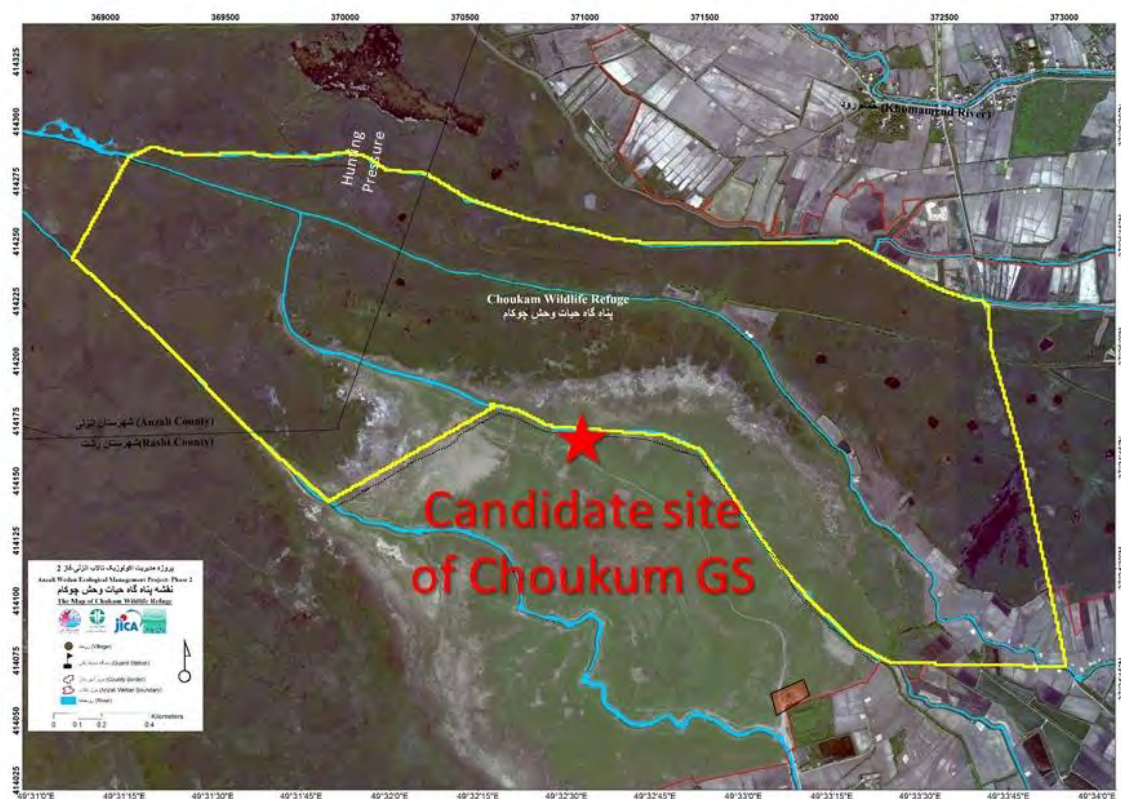
(1) Appropriate Protected Areas Management with Enhancement DOE Guard Station

1) Implementation Plan

(a) Establishment of New Guard Stations

a) Choukum GS

Choukum Wildlife Refuge was established in 2006. DOE Gilan tried to establish GS. Local people did not understand the necessity of GS. Therefore, there has not been any GS for the Choukum GS. Many illegal hunting and land use have been occurred in this area. There is an urgent to establish the Choukum GS. The GS should be near the hot spot of illegal hunting and land use site as close as possible for effective WR management. Candidate site is shown in Figure 6.4-11. The GS should be established in 2021. At first, public consultations for villagers should be held to get understanding of local people.



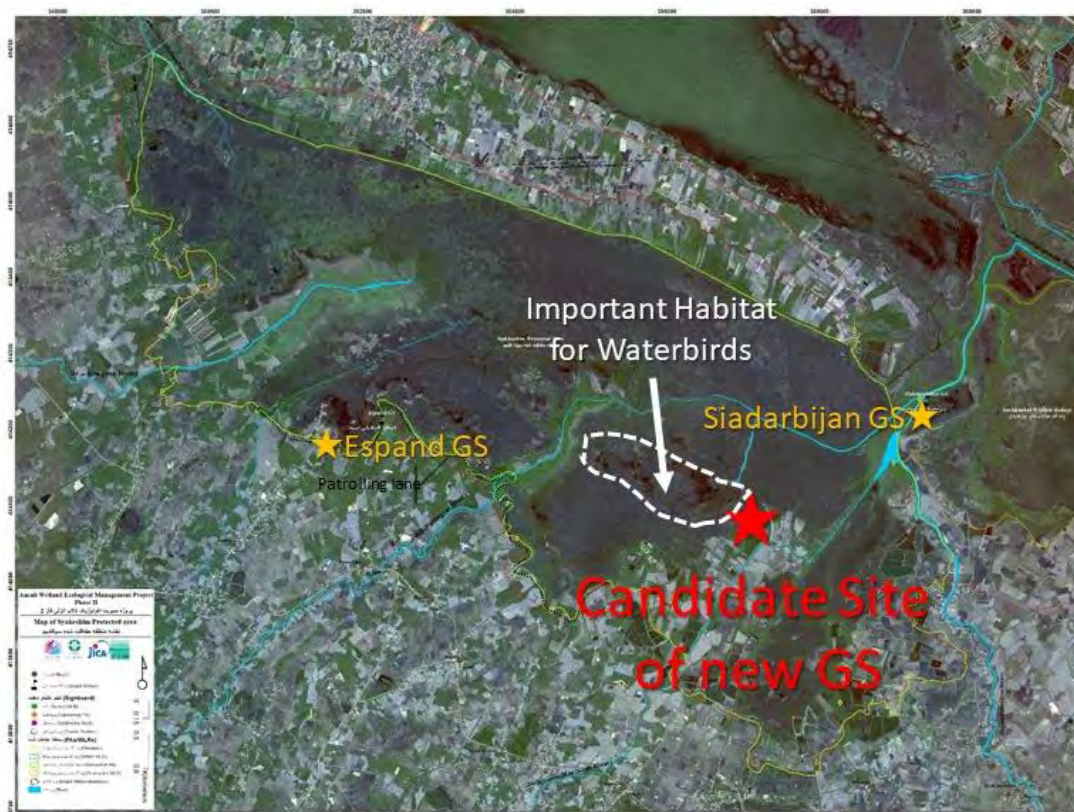
Source: JICA Expert Team

Figure 6.4-11 Candidate Site of Choukum GS

b) Chomesghal Guard Station

Siahkesim Protected Area (PA) has Espand GS and Siadarbijan GS. These two GSs could not cover all Siahkesim PA due to very huge area and reedbed cover. There is very good water body as waterbird’s habitat in east part of the Siahkesim PA as shown in Figure 6.4-12. There has not

been less waterbirds in this area due to high hunting pressure in winter. Therefore, new GS should be established in this area. The GS should be near the hot spot of illegal hunting and land use site as close as possible for effective PA management. Candidate site is shown in Figure 6.4-12. The GS should be established in 2022. At first, public consultations for villagers should be held to get understanding of local people.



Source: JICA Expert Team

Figure 6.4-12 Candidate Site of Chomesghal GS

(b) Enhancement of Guard Station Functions

a) Increasing Number of DOE Guards

The Anzali Wetland has 5 GSs to manage the Anzali Wetland including WRs and PA. In total, 30 DOE guard are in charge of patrol and management of Anzali Wetland including WRs and PA in 48 hours shift. Actually, the number of guards is not enough to cover huge entire Anzali Wetland. Unfortunately, many illegal hunting, fishing and land use were not controlled especially far from GSs. Therefore, the number of DOE Guards should be at least doubled as soon as possible.

b) Enhancement of Facility and Equipment

To enhance the DOE guards, facility and equipment should be enhanced as well as increasing number of DOE guards.

At first, multi-copter is very effective tool for protected management. Anzali Wetland is very huge and partially covered by dense reed bed. Therefore, it is very difficult to detect illegal hunting sites. Multi-copter is very useful tool to find such illegal hunting site. Each one multi-copter should be equipped. JICA Expert Team supported to patrol by using multi-copter from 2018 to 2019. Many illegal hunting sites have been detected. It meant multi-copter can enhance the capacity of illegal hunting patrol.



Source: JICA Expert Team

Figure 6.4-13 Illegal Hunting Patrol by Using Multi-copter and Detected Illegal Hunting Site

Facility and equipment enhancement plan is shown in Table 6.4-6.

Some of equipment has been already provided by JICA.

Table 6.4-6 Facility and Equipment Enhancement Plan of DOE GS

Item	Proposal	Remarks
Equipment	<ul style="list-style-type: none"> • GPS receiver • Binocular and telescope • Digital camera with tele-lens • Small one-person hovercraft to approach the shallow water area. • Motorbike • Internet connection and laptop PC at GS 	These items should be introduced to control illegal hunting and fishing.
Facilities	<ul style="list-style-type: none"> • Patrol pass should be constructed to be easy to access the boundary of protected areas. • Fence should be constructed to prevent livestock entrance to WRs and PAs. • More number of signboards should be installed on the boundary of 	South of Sorkhankol is good place to construct a patrol path as pilot. Selkeh WR is good candidate place to construct fence as pilot.
Budget	<ul style="list-style-type: none"> • More budget should be secured for fuel, etc. 	Amount of fuel is not now enough for daily patrol

Source: JICA Expert Team

(c) Improvement of Abbandan-dari System

Abbandan-dari in the Anzali Wetland has big potential to implement the concept ICCA (Indigenous Community Conserves Area). There are some *Abbandans* which conserved waterbirds very well. On the other hand, there is some *Abbandans* which cannot be seen the waterbirds because of excessive hunting pressure. Impact and effectiveness of *Abbandan-dari* system are unclear because of lack of information of operation of *Abbandan-dari*. Non-noticed

inspection of each *Abbandan* should be implemented by DOE guard. In addition, the monitoring of number of species and individuals of waterbirds should be implemented in midwinter. If any good practices of *Abbandan* such as sustainable hunting method by local owner will be found in the monitoring, they can be clarified as good example of ICCA to be shared.

2) Scheduler of Appropriate Protected Areas Management with Enhancement DOE Guard Station

The Schedule of Appropriate Protected Areas Management with Enhancement DOE Guard Station is shown below.

Table 6.4-7 Schedule of Appropriate Protected Areas Management with Enhancement DOE Guard Station

Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
a) Establishment of New Two Guard Stations												
(1) Choukam WR GS												
Planning												
Discussion with Local People												
Construction												
Operation												
(2) Siahkeshim New GS												
Planning												
Discussion with Local People												
Construction												
Operation												
b) Enhancement of Guard Station Functions												
Increasing Number of Guards												
Facility (Patrol Path and Fence)												
Provision of Equipment												
c) Improvement of Abbandan-dari System												
Monitoring and Inspection												
Training of Abbandan Owner												
Sharing the Good Practice												

Source: JICA Expert Team

(2) Appropriate Land Use Management based on Zoning Plan and Land Use Guideline

1) Implementation Plan

(a) Environmental Zoning

a) Objective of Zoning

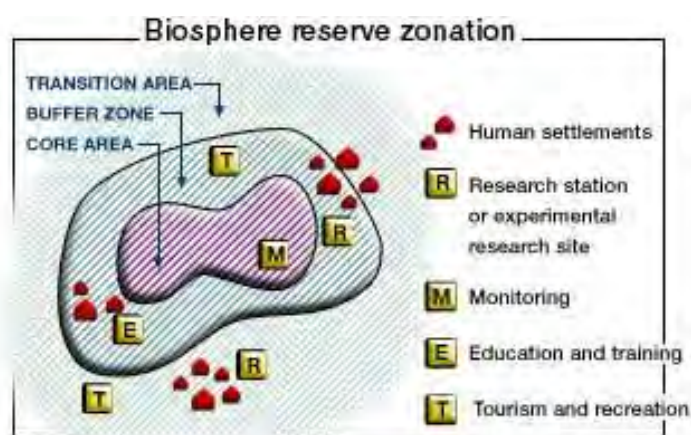
- To ensure the appropriate and sustainable use of the wetland, otherwise referred to as its 'wise use'.
- To prevent unnecessary destruction of nature and conflict among DOE/MOE(GRWC)/other relevant organizations and local people.

b) Basic Concept of Zoning

In order to accomplish coexistence of conservation of the Anzali Wetland and human activities, zoning can play an important role in minimizing user conflicts by separating potentially conflicting activities.

- Based on International Standard (Biosphere MAB Program)
The entire wetland has been designated as a Ramsar site. Therefore, the zoning plan of the Anzali Wetland should be based on international standards.
To carry out complementary activities of nature conservation and using the natural resources, Biosphere Reserves, some of which are also Ramsar Sites, are areas of terrestrial and coastal ecosystems that are internationally recognized within the framework of UNESCO’s Man and the Biosphere Program (MAB). Biosphere Reserves are organized into three interrelated zones, known as the core zone, the buffer zone and the transition zone.
In the Anzali Wetland, three main zones have been defined as follows:

- 1) Wetland Zone(Core Zone), 2)Buffer Zone, 3)Transition Zone



Source: UNESCO MAB Program

Figure 6.4-14 Concept of Biosphere Reserve Zoning of UNESCO MAB Program

In addition, the concepts of zoning plan are based on IUCN Guideline, SATOYAMA Initiative and ICCA.

- Covering the Existing Rules and Regulations
Zoning regulation should comply with existing laws and regulations. New and effective regulations should be introduced as New Zoning Plan in addition to existing regulations.
There are so many activities in/around the wetland which have been already permitted. The zoning regulations should NOT prohibit such activities, while it should prohibit all illegal activities after approval of the zoning plan by the AAWMC and exclude illegal activities from the zones.
- Promotion of Wise Use
The wetland has been used by local people and communities for a long time. Local people have close relationship with the Anzali Wetland. Therefore, the new zoning plan should promote wise use of the wetland. Wise use of the wetlands is the

maintenance of their ecological character, achieved through implementation of ecosystem approaches, within the context of sustainable development.

New zoning regulations should permit low impact ecotourism, environmental education, and research activities (including monitoring) without destruction of the wetland. In addition, new zoning regulations should permit restoration project for improvement of wetland quality, and low impact small-scale facilities for ecotourism and environmental education. Basically, other activities should not be permitted in the Wetland Zone.

- Promotion of SATOYAMA Initiative
SATOYAMA Initiative aims to conserve sustainable human-influenced natural environments (Socio-Ecological Production Landscapes; SEPL) through broader global recognition of their value. Inside/around the Anzali Wetland is SEPL. Therefore, the zoning plan should promote SATOYAMA Initiative.
- Promotion of ICCA Concept
In fact, in each historical era the mechanisms and institutional structure of this system (*Abbandan-dar*) was in the direct relation and compatible with their social structure as well as with their customary and official ownership systems. Nowadays this system is still alive and sustainable as a kind of Indigenous Community Conserves Area (ICCA) system. Therefore, the zoning plan should promote the ICCA concept.
- Screening Development Plans by AWMC
Basically, prohibited activities by zoning regulations should not be permitted, but requisite activities inside zones can be made by getting permission from the AWMC. Even permitted activities needs Environmental Impact Assessment and mitigation to minimize the environmental impact to the wetland.
- Adaptive Management
The zoning plan should be updated based on the present conditions of the wetland by using monitoring data.

c) Regulations of Basic Zones of the Anzali Wetland

Establishment of a zoning scheme should normally involve stakeholders' participation in drawing the lines between the conflicting zones. Agreeing on the zoning and the management objectives for each zone (and hence what activities should and should not be permitted within each zone) is an important part of the process of establishing close involvement of local communities and other stakeholders in the management of the wetland. It is therefore proposed that the zones and the regulations for their use should be discussed in Environmental Zoning and Land Use Management WG Committee of Wetland Ecosystem Conservation SC and then approved by the AWMC. After that the plan and regulations should be disseminated to the wider

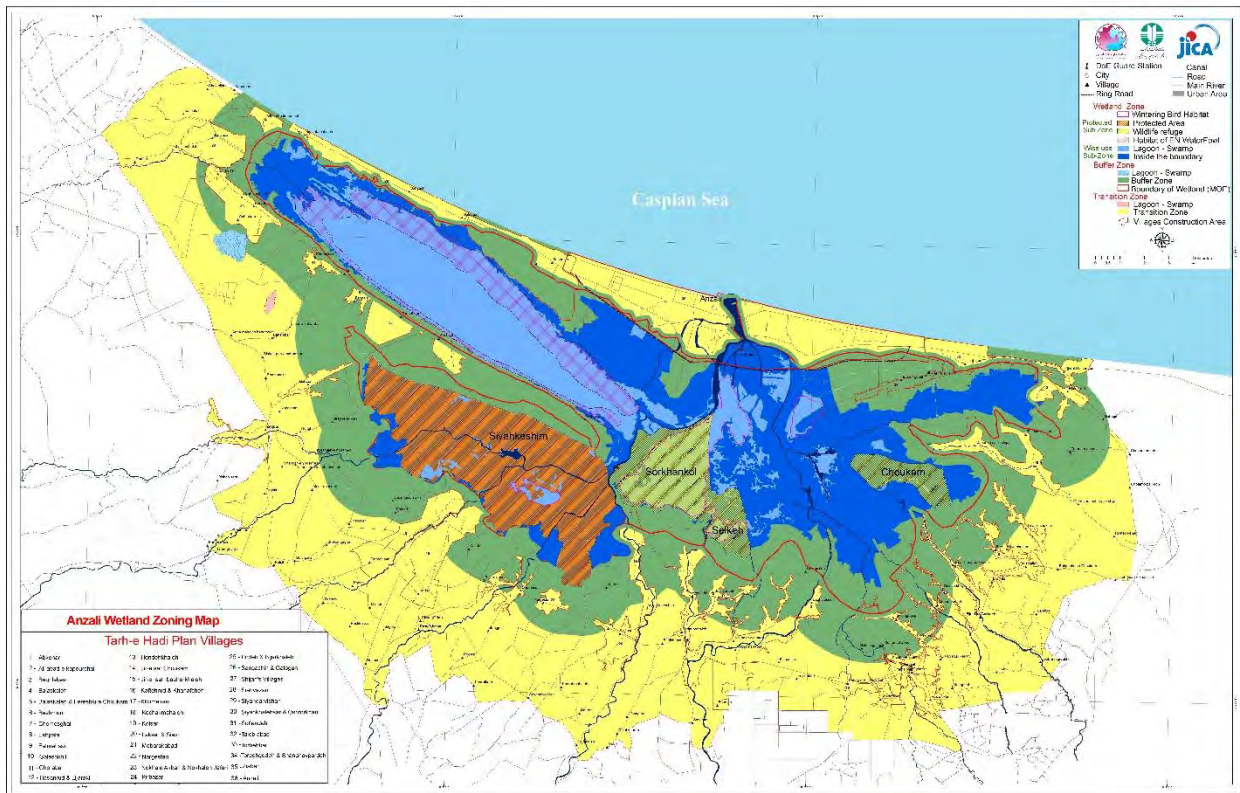
public with the use of maps and presentations in the surrounding communities. The presentations should include the rationale for establishing and delineating the zones, and a concise description of the functions of, and restrictions applied, within each zone.

The three basic zones of the Anzali Wetland are defined shown as Table 6.4-8. The basic zones map is shown as Figure 6.4-15. These plans should be finalized and approved in AWMC as soon as possible.

Table 6.4-8 Definition of Basic Zones of the Anzali Wetland

Zone	Sub Zone	Definition
Wetland Zone (Core Zone)	Protected Sub Zone	Protected sub zone must be protected strictly to maintain the ecological characteristics of the Anzali Wetland. All of the protected areas (Siakheshim Protected Area, Selkeh, Sorkhankol and Choukam Wildlife Refuges) are included within this Sub Zone.
	Wise-Use Sub Zone	Wise-use sub zone must be utilized for Wise Use (low impact and sustainably use) to maintain the ecological characteristics of the Anzali Wetland. The Wetland Zone is essentially the Anzali Ramsar Site, comprising the waterbody, seasonal wetland, aquatic plant communities and an area to connect main wetland with eastern isolated wetland as ecological network. This area includes <i>Abbandan-dar</i> System.
Buffer Zone		Buffer Zone surrounds the Wetland Zone. This is the area that surrounds the wetland within which land use activities may directly affect the ecological character of the wetland itself, and therefore need to be controlled. The Buffer Zone includes the area within which seasonal or longer-term water level rises may be experienced. Thus, it is an eco-tone where the aquatic ecosystem blends into the terrestrial ecosystem, and as such may be a highly diverse and productive habitat. Some of land uses and activities should be allowed with condition such as flood measure and low impacted method. This area in inside of the boundary of wetland based on the Law on Equitable Water Distribution (including buffer zone of this boundary). This zone includes the area defined by “Industrial and Productive Activities and Units Construction Criteria” so that industrial facilities are classified and allowed depends on the distance from the wetland.
Transition Zone		Transition Zone surrounds the Buffer Zone. This zone is a transition area from conservation of ecosystem to local economic activities. The Transition Zone includes the Tarhe-Hadi Plan and about 2km-wide band from the Buffer Zone. The boundary of the transition zone may be varied locally to take account of existing features on the ground. Most of the transition zone is under agricultural use, either as paddy fields, livestock and pasture or fish ponds.

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.4-15 Basic Zoning Map of the Anzali Wetland

(b) Detailed Land Use Guideline with detailed Zoning Plan

Based on the above-mentioned basic zoning plan, more detailed zoning plan and land use guideline should be formulated. Unfortunately, some necessary information did not provide to JICA Expert Team, therefore the JICA Expert Team could not support to complete and finalize the land use guideline. Basic concept and plan to prepare them are described below. Iranian side need to finalize and operate the land use guideline.

a) Operation of the Boundary of Wetland Based on as the Law on Equitable Water Distribution as Buffer Zone of the Anzali Wetland Zoning Plan

There is conflict between Gilan province side including DOE Gilan and the central government side (MOE, WRMC and DOE HQ) side about the boundary of Wetland Based on as the Law on Equitable Water Distribution. The law is very strict as following.

The Law on Equitable Water Distribution (Ministry of Energy)

【Article 2 Note3】 Any construction, excavation, and occupation in the boundaries of the rivers, natural streams, public canals, watercourses, lagoons and brooks are prohibited, unless permitted by Ministry of Energy.

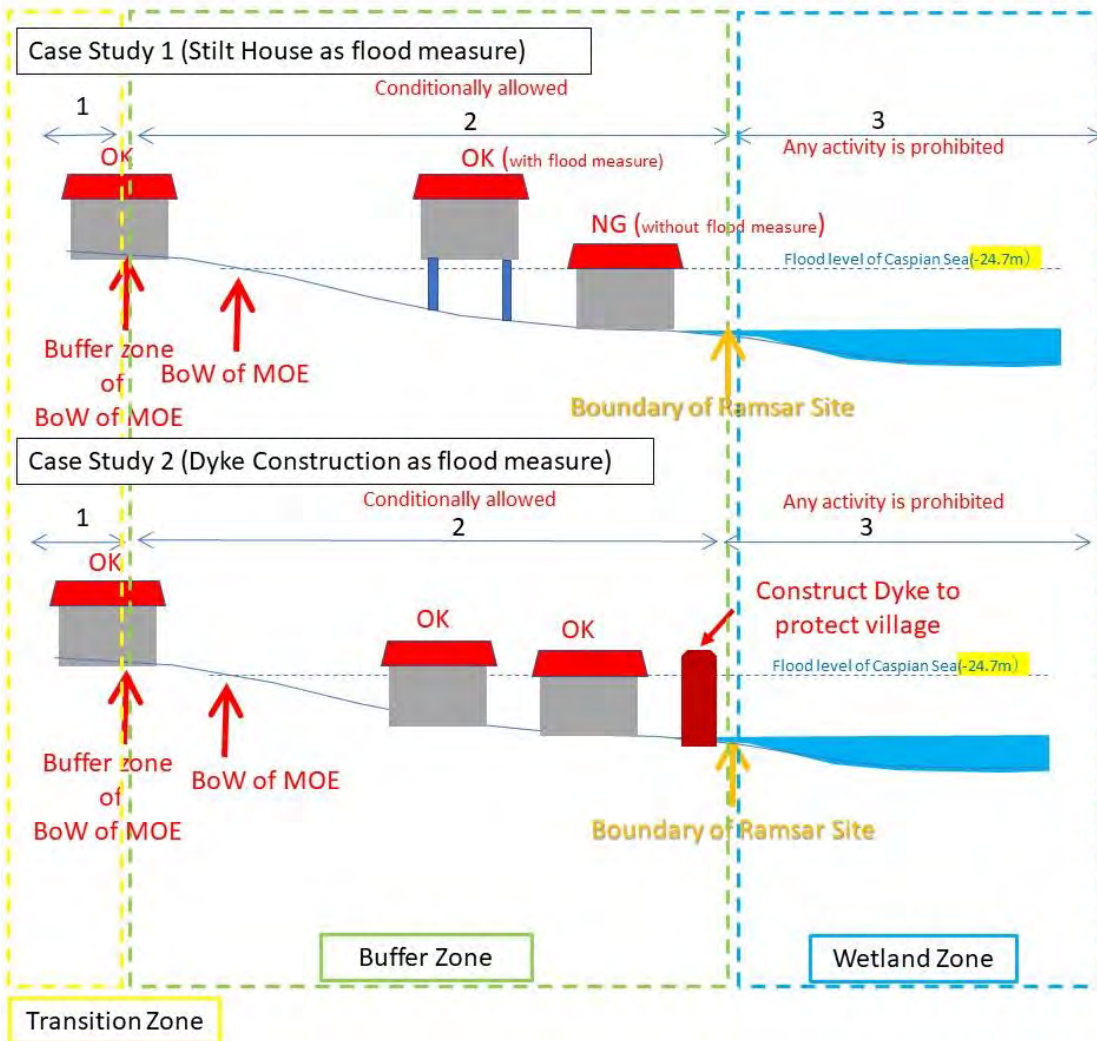
There are many land uses in boundary of Wetland based on the law. The law aims to protect local people’s livelihood and their property from flood. MOE should issue permissions with some conditions such as flood control measure for existing land use to protect people’s

livelihood and properties. It is the fact the current boundary of wetland is not realistic to manage the existing land use. In addition, it cannot be solved if MOE changed the boundary of wetland to exclude some developed areas. Because there will be still many differences between the Ramsar Boundary and the Ramsar boundary. The land use in this area between them should be justified based on an environmental zoning plan and land use guideline based on all relevant the laws and the regulations.

A pattern diagram of Concept of Land Use Guideline of Buffer Zone (Area between Boundary of Wetland and Boundary of Ramsar Site) is shown in Figure 6.4-16. Proposal of Detailed Zoning Plan of Anzali City (Torbeh gudeh & Shanghay Parteh village and Ghalamgude, Pil-Ali Bagh and Cheragh-Poshtan area) is shown in Figure 6.4-17.

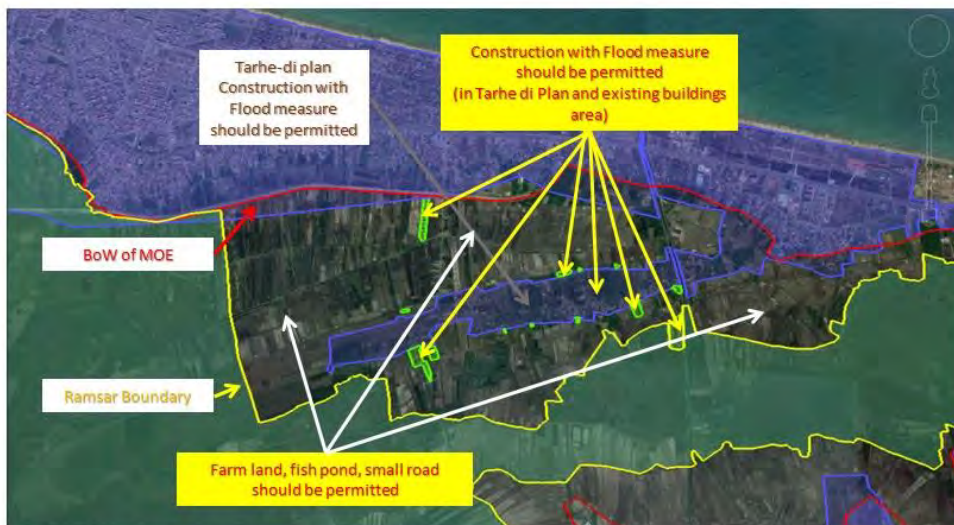
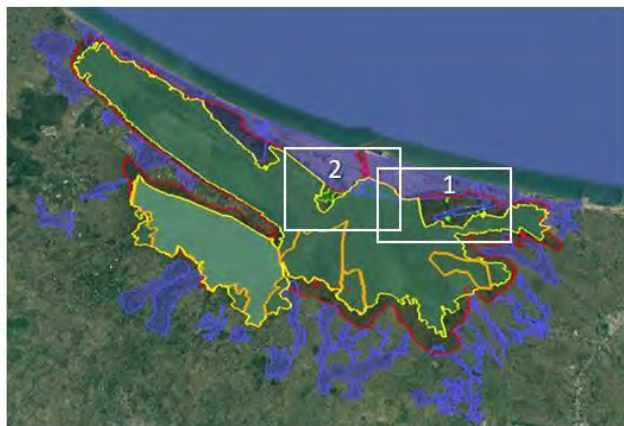
These detailed zoning plans of two areas should be finalized based on the accurate and the latest situation of these areas. These detailed zoning plan should be delineated in the other area as well. Issuing of these permissions by MOE in accordance with detailed zoning plan and land use guideline can minimize minimizing confliction between governmental organization and local people. Promotion of sustainable use of the Buffer Zone can be promoted as well.

No	Zone	Land Use and Flood Control
1	In Wetland Boundary by MOE and In Ramsar boundary (Wetland Zone (Core Zone))	➤ Land Use is basically <u>prohibited</u>
2	In Wetland Boundary by MOE and Out of Ramsar Boundary (Buffer Zone)	➤ Land Use is conditionally available ➤ Flood control measure is necessary
3	Out of Wetland Boundary by MOE (Transition Zone)	➤ Land Use is available

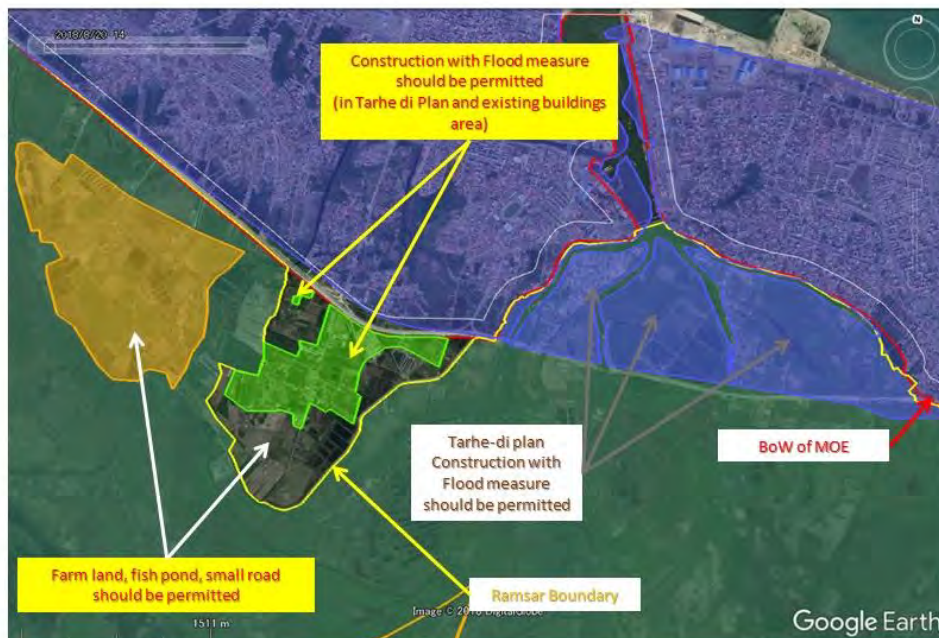


Source: JICA Expert Team

Figure 6.4-16 Concept of Land Use Guideline of Buffer Zone (Area between Boundary of Wetland and Boundary of Ramsar Site)



1. Proposal of Detailed Zoning Plan of Torbeh gudeh & Shanghay Parteh village



2. Proposal of Detailed Zoning Plan for Ghalamgude, Pil-Ali Bagh and Cheragh-Poshtan

Source: JICA Expert Team

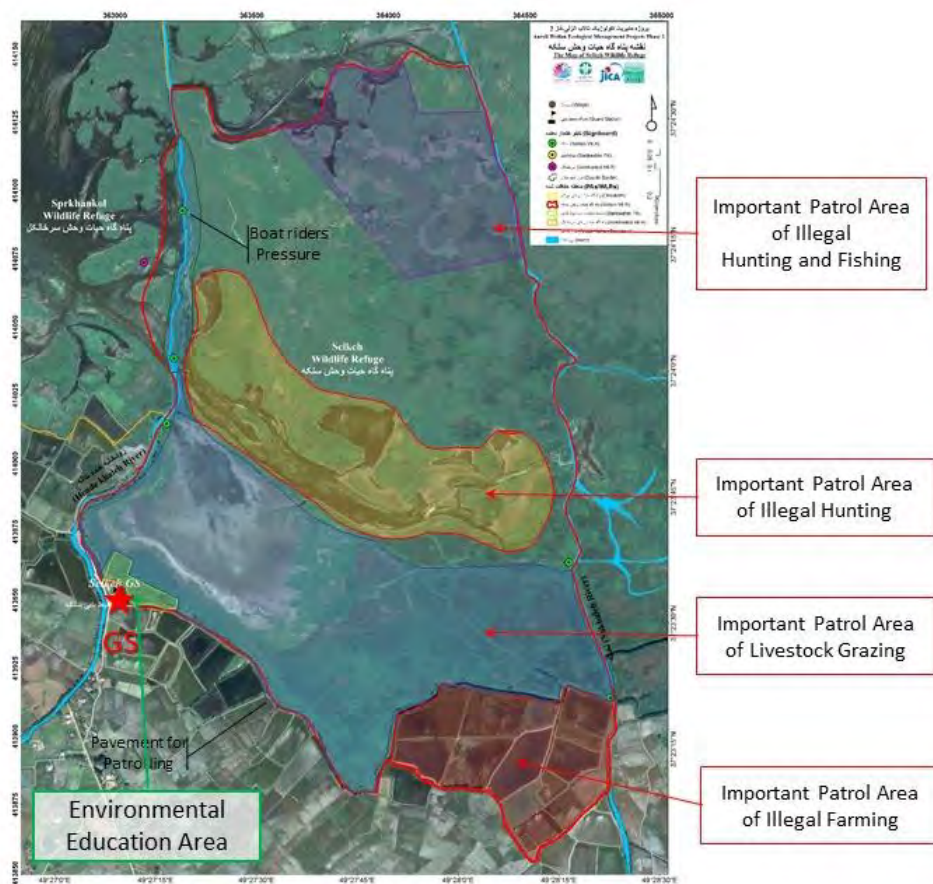
Figure 6.4-17 Proposal of Detailed Zoning Plan of Anzali City

b) Detailed Zoning Plan in WRs and PA

Three Wildlife Refuges and a Protected Area is the protected sub zone in the core zone of the Anzali Wetland. The protected sub zone should be strictly protected. However, some areas in protected sub zone should be utilized for environmental education and ecotourism to promote the wise use and CEPA activities. In addition, there are many illegal land uses in protected sub zone. Therefore, detailed zoning plan should be delineated for appropriate land use management of the protected sub zone as following.

[Selkeh Wildlife Refuge]

Proposal of detailed zoning plan of Selkeh WR is shown in Figure 6.4-18.



Source: JICA Expert Team

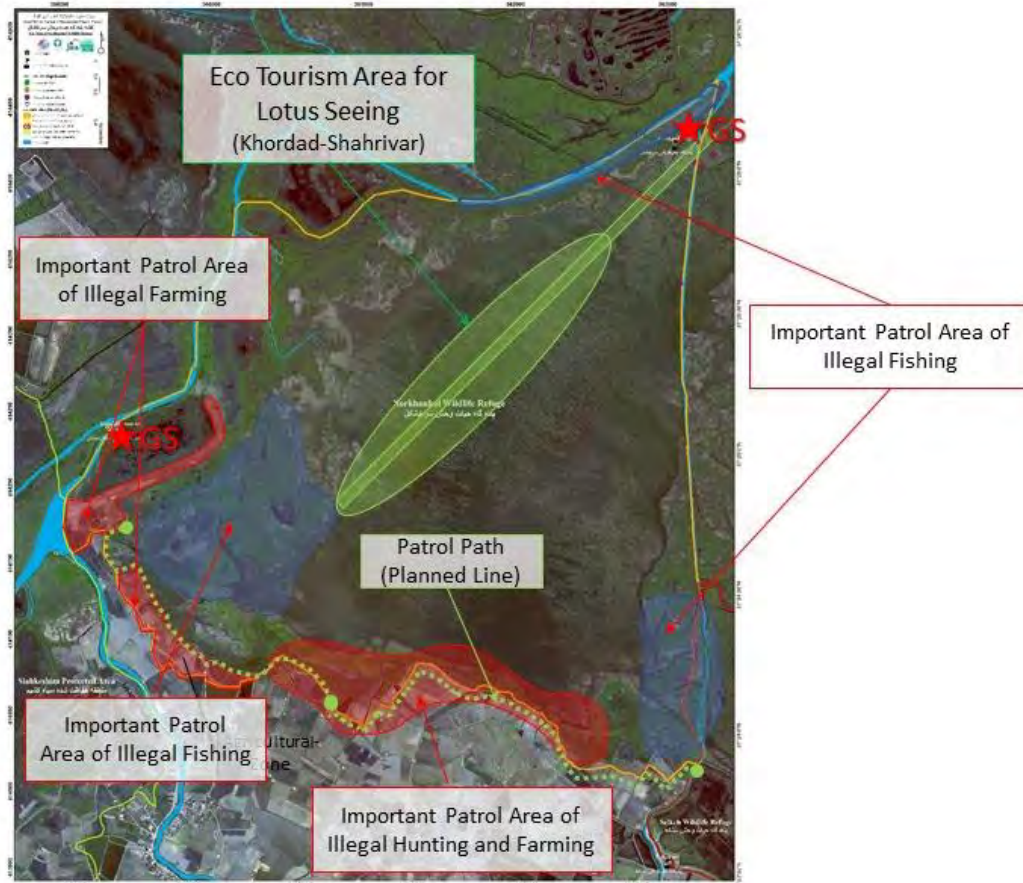
Figure 6.4-18 Proposal of Detailed Zoning Plan of Selkeh WR

- **Environmental Education Area**
Selkeh Wildlife Refuge has the Anzali Wetland Environmental Education Center with experience-based education facilities such as bird hide, boardwalk, observation deck and biotope near the GS. This area should be utilized for promotion for CEPA activity while conserving wetland ecosystem. Detailed activities in the EE area are described in the chapter of environmental education.

- Important Patrol Area for Livestock Grazing
There are many illegal and grey land use in the WR. Local livestock grazing is big pressure for wetland ecosystem. Livestock such as cows is destroying the habitat of wetland. For example, WR near the GS is very good habitat for breeding birds such as Black-winged Stilt and Whiskered Tern. Livestock crashes the nests of these birds. Livestock should be kept away from the WR. Fencing to surround the WR is the one way to keep livestock away.
- Important Patrol Area for Illegal Hunting.
There have been detected many illegal nets to hunt birds in reed bed of this area. Patrol should be enhanced in this area.
- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol by DOE guard should be enhanced in this area.
- Important Patrol Area for Illegal Farming
There have been used as farmland and fish pond in this area. The local land owners may have permission from seven persons committee just after revolution long time ago. Legal situation should be clarified and further land use should be controlled in this area.

[Sorkhankol Wildlife Refuge]

Proposal of detailed zoning plan of Sorkhankol WR is shown in Figure 6.4-19.



Source: JICA Expert Team

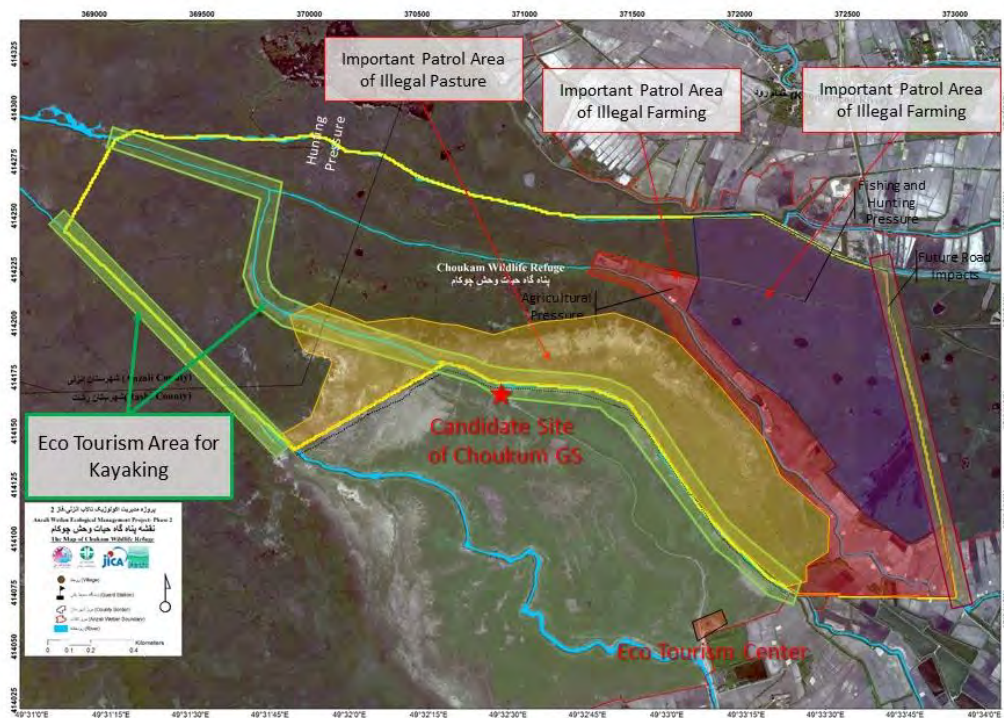
Figure 6.4-19 Proposal of Detailed Zoning Plan of Sorkhankol WR

- Ecotourism Area for Lotus Seeing
There is large Lotus community in Sorkhankol Wildlife Refuge. It is very famous sightseeing place of Lotus flower seeing. Only this area should be opened for local boat operators and tourists from Khordad to Shahrivar (Flower season of Lotus/ the end of May to the end of September). The speed of boat should be limited as 20km/h for safety management. Using loud speaker for music should be prohibited. Taking plant body of Lotus and any the other creatures should be prohibited. Nature guide training for boat driver should be implemented to educate tourists.
- Important Patrol Area for Illegal Hunting
There have been detected many illegal nets, ponds as trap to hunt birds in reed bed of this area. Patrol should be enhanced in this area.
- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol should be enhanced in this area.

- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol by DOE guard should be enhanced in this area.
- Important Patrol Area for Illegal Farming
There have been used as farmland in this area. Some of local land owners may have permission from the governmental organization. Legal situation should be clarified, and further land use should be controlled in this area. If obvious illegal land use will be detected, these farmlands should be restored as the wetland.
- Patrol Path Construction
Along the south coast of the WR, the narrow patrol path should be constructed. DOE guard can patrol the illegal hunting activity and farming by using motorbike.

[Choukam Wildlife Refuge]

Proposal of detailed zoning plan of Choukam WR is shown in Figure 6.4-20.



Source: JICA Expert Team

Figure 6.4-20 Proposal of Detailed Zoning Plan of Choukam WR

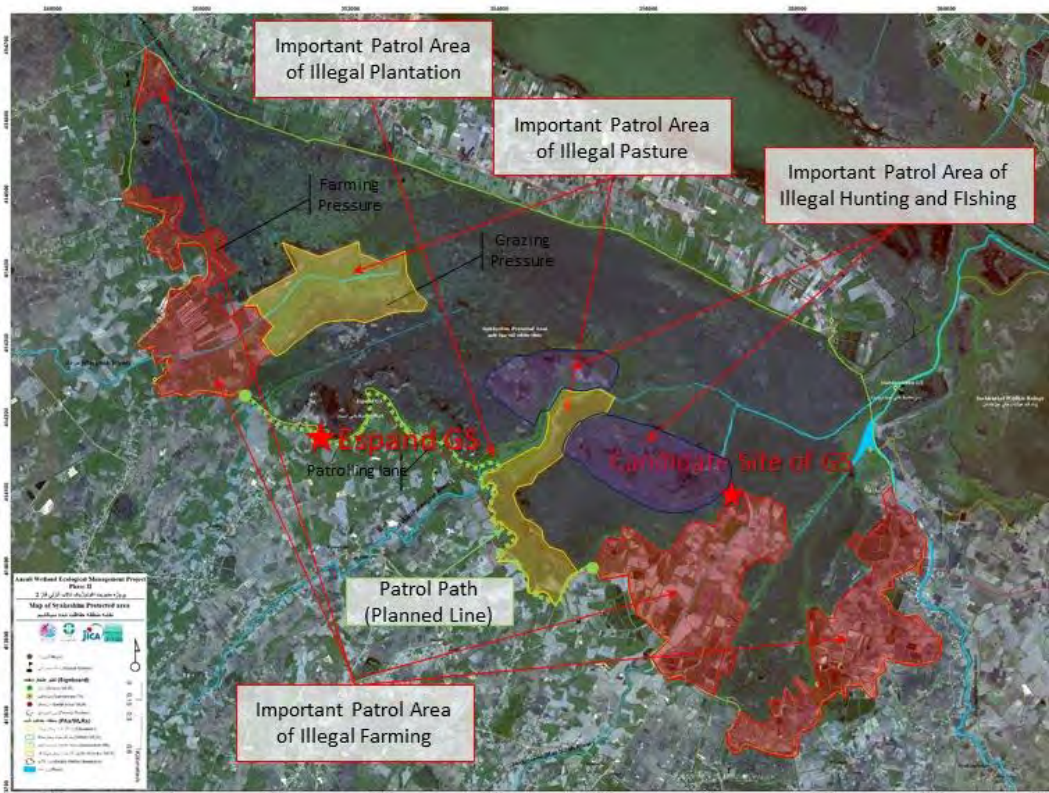
- Important Patrol Area for Illegal Farming
There has been used as farmland in this area. This area has been recently developed and expanded. Almost of farmlands are illegal. Legal situation should be clarified as soon as possible, and further land use should be controlled in this area. If

obvious illegal land use will be detected, these farmlands should be restored as the wetland.

- Important Patrol Area for Pasture
There is huge pasture developed by local villager. A part of the pasture out of the WR was developed based on the pasture plan under NRWGO. However, the pasture is illegally expanding and invaded inside of the WR. Patrol should be enhanced in this area. If obvious illegal pasture will be clarified, the illegal pasture area should be restored as the wetland.
- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol should be enhanced in this area.
- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol should be enhanced in this area.

[Siahkesim Protected Area]

Proposal of detailed zoning plan of Siahkesim PA is shown in Figure 6.4-21.



Source: JICA Expert Team

Figure 6.4-21 Proposal of Detailed Zoning Plan of Siahkesim PA

- Important Patrol Area for Illegal Farming
There are huge farmlands in the PA and still expanding. Many of farmlands are illegal. Legal situation should be clarified as soon as possible, and further land use should be controlled in this area. If obvious illegal land use will be detected, these farmlands should be restored as the wetland.
- Important Patrol Area for Pasture
There are huge pastures developed by local villager. The pasture is illegally expanding and invaded inside of the PA. Patrol should be enhanced in this area. If obvious illegal pasture will be clarified, the illegal pasture area should be restored as the wetland.
- Important Patrol Area for Illegal Hunting and Fishing.
There have been detected illegal *abbandans* to hunt and fish. Patrol should be enhanced in this area. The hunting pressure is very high in this area. New GS should control this area appropriately.
- Important Patrol Area for Illegal Plantation.
There are some illegal plantations in the PA. If obvious illegal plantation will be clarified, the illegal plantation area should be restored as the wetland.
- Patrol Path Construction
Along the south boundary of the PA, the narrow patrol path should be constructed. DOE guard can patrol the illegal hunting, pasture, plantation and farming by using motorbike.

c) Land Use Guideline

There are many complicated land uses and activities in the Anzali Wetland. It is impossible to solve completely these conflicts by some revision of boundaries of related laws and regulations. Detailed zoning plan and detailed land use guidelines should be prepared to promote wise uses and to solve conflicts based on the current situation. Land use guideline matrix is shown in Table6.4-9.

And the zoning map and GIS based on the zones in the table and the detailed zoning map should be also prepared, discussed and finalized as soon as possible.

They should be permitted and legalized by responsible organizations based on related laws.

Table 6.4-9 Land Use Guideline Matrix

No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Basic Zoning	Wetland Zone/Core Zone																										
	Protected SZ	Wise Use SZ				WZ				Wz				Transition Zone				Buffer Zone				Transition Zone					
Zones	Wildlife Refuge /Protected Area	in	in	in	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out
	Ramsar Site	in	in	in	in	in	in	in	in	in	in	in	out	out	out	out	out	out	out	out	out	out	out	out	out	out	out
	Equitable Water Distribution (Boundary of Wetland)	in	bf	out	in	in	bf	bf	out	out	out	out	in	in	bf	bf	out	out	out	out	out	out	out	out	out	out	out
	Tarhe-Hadi Plan	out	out	out	out	in	out	in	out	out	in	in	out	in	in	out	out	out	out	out	out	out	in	in	in	in	in
	Construction Criteria (Class)	out	out	out	out	out	1,2	1,2	3	4	3	4	out	out	1,2	1,2	3	4	5	6	out	3	4	5	6	out	out
Construction Activities based on Construction Criteria and Regulations	Class 1 Food Factory	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Class 2 Loom Factory	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Class 3 Leather Factory	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Class 4 Cellulose Factory	No	No	No	No	No	No	No	No	Yes	No	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	
	Class 5 Meta Factory	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	
	Class 6 Non-Metal Factory	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Activities with construction works or land cover change works	Electrical power line	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Sewage Treatment Plant	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Road	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Railroad	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Restaurant	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Resident	No	No	No	Zone Flood	Yes Flood	Zone	Yes	Zone	Zone	Yes	Yes	Zone Flood	Yes Flood	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Farmland	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Pasture	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Livestock raising	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Plantation	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Cutting Tree	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Cutting Reed	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Canal Construction	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Fish Pond	No	No	No	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Canal Maintenance (including dredging)	Zone	Zone	Zone	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Ecosystem Restoration Work	Zone	Zone	Zone	Zone	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Activities without any construction work	Fishing	No	No	No	Yes	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Hunting	No	No	No	Yes	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Ab-Bandan	No	No	No	Yes	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Mass-tourism	No	No	No	Yes	Yes	Zone	Yes	Zone	Zone	Yes	Yes	Zone	Yes	Yes	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Activities for wetland conservation	Reserch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Monitring	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Environmental Education	Zone	Zone	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Eco-tourism	Zone	Zone	Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Removal of Alien Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Guard Station	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			

bf buffer zone of the boundary of wetland based on the law on equitable water distribution

Yes Activity is allowed
 No Activity is not allowed
 Zone Depends on detailed zoning plan
 Flood Flood measure is necessary

Source: JICA Expert Team

2) Schedule of Appropriate Land Use Management based on Zoning Plan and Land Use Guideline

The Schedule of Appropriate Land Use Management based on Zoning Plan and Land Use Guideline is shown below.

Table 6.4-10 Schedule of Appropriate Land Use Management based on Zoning Plan and Land Use Guideline

Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
a) Environmental Zoning												
Latest Necessary Information Collection												
Approval of Basic Zoning Plan												
Operation of Basic Zoning Plan												
Review of Basic Zoning Plan												
Amendment of Basic Zoning Plan												
Approval of Amended Basic Zoning Plan												
Operation of Amended Basic Zoning Plan												
b) Detailed Land Use Guideline with Detailed Zoning Plan												
Latest Necessary Information Collection												
Detailed Zoning Plan												
Discussion in Sub Committee												
Preparation of Detailed Land Use Guideline with Detailed Zoning Plan												
Approval of DZP and DLUG												
Operation of DZP and DLUG												
Review of DZP and DLUG												
Amendment of DZP and DLUG												
Approval of Amended DZP and DLUG												
Operation of Amended DZP and DLUG												

Source: JICA Expert Team

6.4.6 Division of Roles

(1) Appropriate Protected Areas Management with Enhancement DOE Guard Station

The role of each organization is listed below.

Table 6.4-11 Roles of Each Organization of Enhancement of Protected Area Management

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> New two Guard Stations (GSs) must be constructed by 2021. Guard station function must be enhanced by increasing the number of guards, introduction of equipment and facilities. Number of permitted hunting bird for hunter and for Ab-bandan must be reduced based on the result of bird monitoring. Patrol of illegal hunting and fishing.
Shilat	<ul style="list-style-type: none"> Management of volume of fish catchment.
NIWAI	<ul style="list-style-type: none"> Setting up an adequate volume for sustainable use of fish resource.

Source: JICA Expert Team

1) Appropriate Land Use Management based on Zoning Plan and Land Use Guideline

The role of each organization is listed below.

Table 6.4-12 Roles of Land Use Management based on Environmental Zoning and Land Use Guideline

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> • Formulation of Zoning and Land Use Guideline (LUG) by 2020. • Enough number of signboards must be installed to show the boundaries of PAs by 2022. • Patrol of illegal land use.
GRWC (WRMC and MOE)	<ul style="list-style-type: none"> • Management of land use in boundary of wetland and its buffer zone. • Enough number of signboards must be installed to show the boundaries of wetland by 2022. • Permission of land use based on the Zoning and LUG
Provincial Governor's Office	<ul style="list-style-type: none"> • Zoning and LUG must be authorized in provincial level.
DPRO	<ul style="list-style-type: none"> • Issuance of permission of land use and land ownership must be based on the Zoning and LUG .
Judiciary Office	<ul style="list-style-type: none"> • Management of legal matter related to land ownership and land use based on the Zoning and LUG .
NRWGO	<ul style="list-style-type: none"> • Issuance of permission of land use must be based on the Zoning and LUG .
Housing Foundation	<ul style="list-style-type: none"> • Village plan should be updated based on the Zoning and LUG.
GCHHTO	<ul style="list-style-type: none"> • Tourism activities must be managed based on the Zoning and LUG.
MOJA	<ul style="list-style-type: none"> • Farmland and related facilities must be managed based on the Zoning and LUG.
Shilat	<ul style="list-style-type: none"> • Fish pond, aquaculture and fishing activities must be managed based on the Zoning and LUG.
PMO	<ul style="list-style-type: none"> • Water way must be managed based on the Zoning and LUG.
Urban Planning Office	<ul style="list-style-type: none"> • Road construction and urban development must be managed based on the Zoning and LUG
Municipalities	<ul style="list-style-type: none"> • Local activity and land use must be managed based on the Zoning and LUG.
All of above related organizations	<ul style="list-style-type: none"> • All necessary information must be shared among all of members of zoning and land use SC. • Zoning and land use SC must be functioned as a platform to achieve the adequate land use management of the Anzali Wetland.

Source: JICA Expert Team

6.4.7 Budget

The budget plan of Wetland Ecosystem Conservation (2020-2030) is shown in Table 6.4-13.

Total budget is 2,931 thousand USD.

This budget plan was prepared based on the current situation as of March 2019. Therefore, the required budget will be changed based on the result of the surveys and the situation of the wetland. However, this budget plan is useful for budgetary request in advance.

Table 6.4-13 Budget Plan of Environmental Zoning and Land Use Guideline (2020-2030)

Items	(2019)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Remarks
(1) Appropriate Protected Areas Management with Enhancement DOE Guard Station														
a) Establishment of New Two Guard Stations														
(1) Choukam WR GS														
Planning		3											3	
Construction			100										100	
Operation				60	60	60	60	60	60	60	60	60	540	Including wage of gurads
(2) Siahkeshim New GS														
Planning		3											3	
Construction			100										100	
Operation				60	60	60	60	60	60	60	60	60	480	Including wage of gurads
b) Enhancement of Guard Station Functions														
Increasing Number of Guards														
		120	120	120	120	120	120	120	120	120	120	120	1320	Including wage of increased gurads
Facility (Patrol Path and Fence)														
			20	20	20	10	10	10	5	5	5	5	110	
Provision of Equipment														
				20	10	10	10	10	5	5	5	5	80	by DOE Expert
c) Improvement of Abbandan-dari System														
Monitoring and Inspection														
		10	10	1	1	1	1	1	1	1	1	1	29	
Training of Abbandan Owner														
			1	1	1	1	1	1	1	1	1	1	10	
Sharing the Good Practice														
			1	1	1	1	1	1	1	1	1	1	10	Analysis of Reports
Sub Total of (1)														
		136	252	323	273	263	263	263	253	253	253	253	2,785	
(2) Appropriate Land Use Management based on Zoning Plan and Land Use Guideline														
a) Environmental Zoning														
Latest Necessary Information Collection														
		1											1	
Operation of Basic Zoning Plan														
			1	1	1	1							4	
Review of Basic Zoning Plan														
						5	5						10	
Amendment of Basic Zoning Plan														
							10						10	
Operation of Amended Basic Zoning Plan														
								5	5	5	5	5	25	
b) Detailed Land Use Guideline with Detailed Zoning Plan														
Latest Necessary Information Collection														
		1											1	
Preparation of Detailed Zoning Plan														
		10											10	
Preparation of Detailed Land Use Guideline with Detailed Zoning Plan														
			20										20	
Operation of DZP and DLUG														
			5	5	5	5							20	
Review of DZP and DLUG														
						5	5						10	
Amendment of DZP and DLUG														
							10						10	
Operation of Amended DZP and DLUG														
								5	5	5	5	5	25	
Sub Total of (2)														
		12	26	6	6	16	30	10	10	10	10	10	146	
Grand Total (1)+(2)														
		148	278	329	279	279	293	273	263	263	263	263	2,931	

Unit: thousand USD

Source: JICA Expert Team

6.4.8 Supposed Problems

(1) Lack of Information Sharing among the Relevant Organization

The land use management need to cooperate among many relevant organizations. Most of the issues about illegal land use was the lack of information sharing. All necessary information must be shared among all of members of zoning and land use SC. Zoning and land use SC must be functioned as a platform to achieve the adequate land use management of the Anzali Wetland in future. The Zoning map to describe the boundary of each zone should be opened not only for relevant organizations but also public.

(2) Caspian Sea Level Decline

The water level of Anzali Wetland is affected by the water level of the Caspian Sea. The sea level of the Caspian Sea is currently on a declining trend over the long term. As the declining

trend continues, Anzali Wetlands will be dry. The land use pressure by local people will become very high. If the dried area will be occurred and expanded in future, any occupation and land use by local people should not be allowed. There dried area should keep for restoration. In long term of Caspian Sea level fluctuation, it has possibility to change the trend and raise the sea level again as 1978.

(3) Securement of the Budget for DOE Guard Station Function

The resource of DOE guard including budget, human resource, facility and equipment is short of the level needed to control and manage the huge Anzali Wetland. The enhancement of the GSs are essential. Provincial governor's office and PBO Gilan should secure the budget.

6.5 Watershed Management

The sediment flowing into the Anzali Wetland is produced at mountain area and main river course, then flowing into the wetland via main river course. To reduce the sediment from its source which is produced at mountain area and main river course, is the most effective solution for decreasing the sediment flowing into the Anzali Wetland. From its perspective, an integrated plan in the Masal River Basin as model river basin was prepared to control the sediment flowing into the Anzali Wetland in cooperation with the members of Watershed Management Subcommittee. Based on the integrated plan, designing, constructing and maintenance works were implemented at Alenze mountain area which was selected as the most sediment production area. The technical transfer was conducted through the above activities. Based on the activities, a Mid-term Plan was prepared for planning activities at mountain area and main river course from 2020 to 2030.

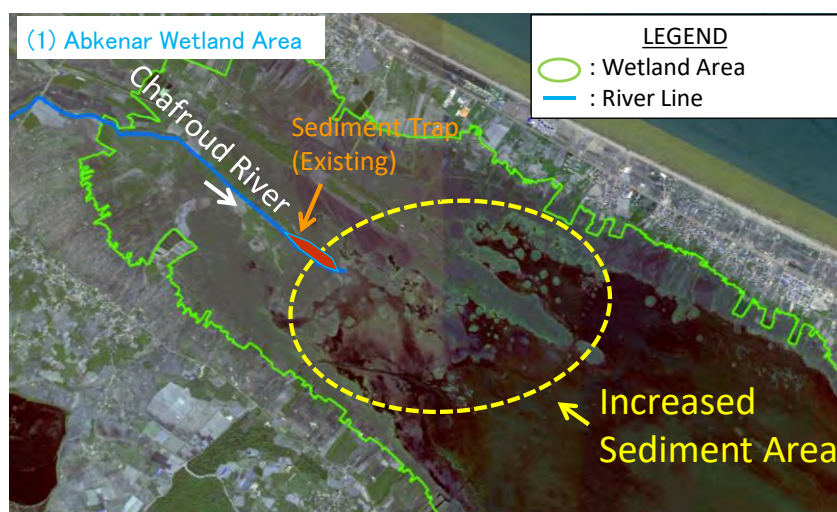
In addition, the planning methodology of mountain area is different with that of main river course. The sediment control planning at mountain area is completed at each branch basin area. On the other hand, the one at main river course is studied totally from upstream to downstream with considering mutual influence. Therefore, the plan of mountain area and main river course were prepared separately. The plan of main river course is described in Section 6.5.1 and mountain area in Section 6.5.2.

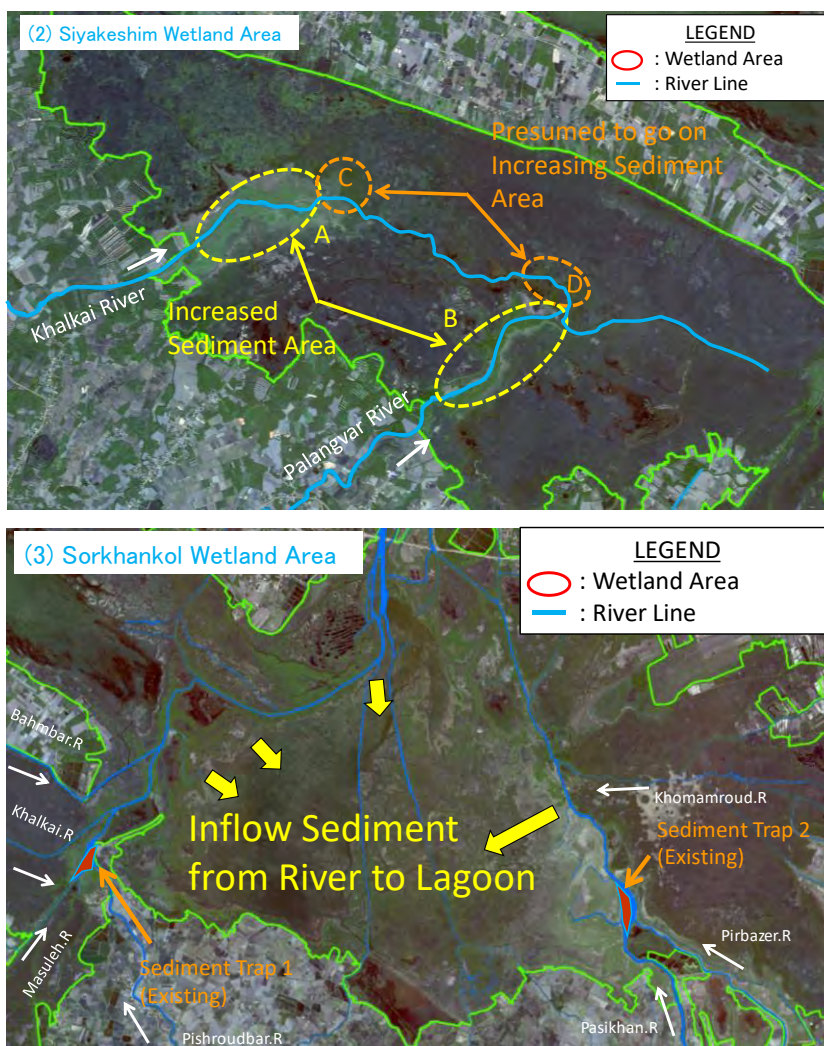
6.5.1 Sediment Management Plan in Main River Course

(1) Current Conditions and Issues

1) Current Issues at Wetland Area

The sediment depositions at the entrance areas of inflowing rivers are found in the satellite images. Especially, the water body at Siahkeshim wetland area remains a little area and dryness is most advanced than other areas. The sediment countermeasure is urgent issue at Siahkeshim wetland area.



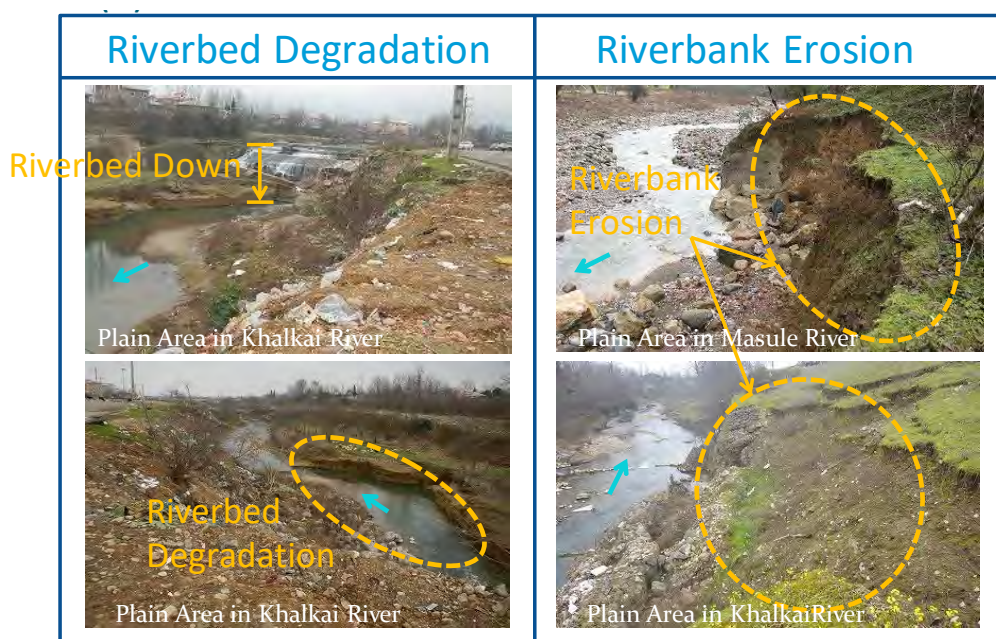


Source: JICA Expert Team by using the satellite image: World View 3 (Apr. 2018)

Figure 6.5-1 Current Condition and Issues at Wetland Area

2) Current Issues at Main River Course

The sediment production at numerous places was found in main river course due to riverbank erosion and riverbed degradation. The progression of riverbed degradation is presumed due to changing of sediment balance by installing some cross-river structures. In association with the riverbed degradation, the riverbanks were collapsed by eroding the foot of slope. It becomes urgent issue.



Source: JICA Expert Team

Figure 6.5-2 Sediment Issues in Main River Course

In the second year of the JICA Phase II Project, the integrated plan survey in Morghak and Khalkai Rivers was implemented to control the sediment flowing into the Anzali Wetland. According to the result of survey, the rates of sediment production were 78% in mountain area and 22% in main river course. The annual volume at $117 \times 10^3 \text{ m}^3$ of sediment production was estimated in the main river course. Because of finding of numerous volume of sediment production, reducing of sediment production in main river course is considered an urgent issue.

Table 6.5-1 Annual Sediment Production

River	Sediment Production			
	Mountainous Area (ton/year)	Main River Course		Total (ton/year)
		m ³ /year	ton/year ¹⁾	
Khalkai	219,121	75,564	98,233	317,354
Morghak	309,020	41,174	53,526	362,546
Total	528,141 (78%) ²⁾	116,738	151,759 (22%) ²⁾	679,900

Notes: 1) Conversion 1.3 ton/m³ based on JICA Study 2004

2) Percentage of the total with Mountainous Area and Main River Course

Source: Integrated Planning Survey for Preparation of Countermeasures to Control the Sediment Flowing into the Anzali Wetland (Integrated Planning Survey 2015)

(2) Policy of Sediment Control

Based on the sediment issues, the policy of sediment control in main river course for wetland conservation was defined as described below.

1) Balancing of Sediment

- The main reason of riverbed degradation and riverbank erosion is attributable to changing balance of sediment dynamic due to installation of cross-river structures such as intake weir.
- Accordingly, some drop structures should newly be installed to keep the longitudinal slope to stabilize the river channel by using existing cross-river structures for balancing the sediment.

2) Stabilization of River

- The new drop structures should be installed sequentially from the edge of downstream to upstream, because the drop structures cause the riverbed degradation toward the downstream.
- Certain period is required for stabilizing the riverbed. The stabilization of riverbed should be monitored by implementing cross section survey at annual basis after construction. A new drop structure should be installed in upstream after confirmation of river stabilization.
- The fishways should be installed on the drop structures including existing ones for migrating the fishes over the structure.

3) Countermeasure for Riverbank Erosion

- Reduce the sediment production at riverbank erosion by installing revetment.
- In case of installation of a new drop structure at downstream, the construction of revetment should be started after confirmation of riverbed stabilization.

4) Improvement of Existing Structures

- In case of occurring riverbed degradation at the existing riverbed protection under the bridge, the existing riverbed protection should be replaced with considering the stable longitudinal slope.
- In case of collapsing or flow out of riverbed protection of an existing intake weir, a new riverbed protection should be installed.

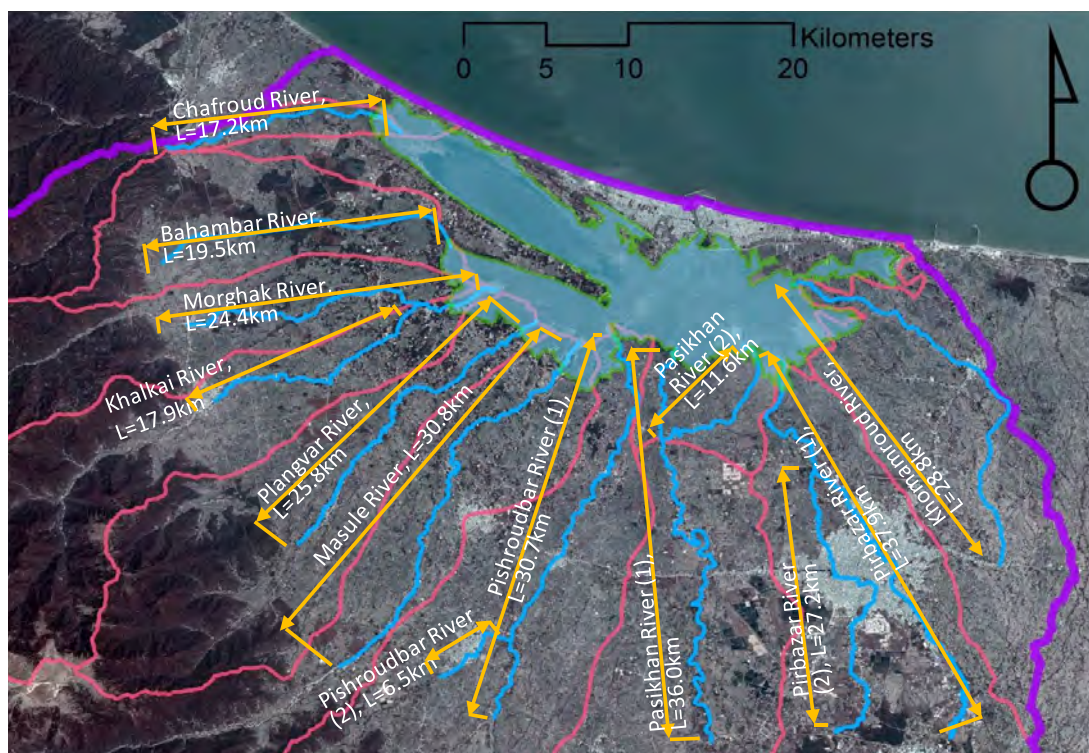
The period of river improvement needs many years, since the total river length at 314.3 km of ten rivers flowing into the Anzali Wetland is so long. Therefore, after a Long-term Plan for ten rivers should be established at first, necessary activities between 2020 and 2030 should be planned in the Mid-term Plan. The Long-term Plan is firstly described in the next section.

(3) Long-Term Plan in Main River Course

1) Target Section of River

The main rivers flowing into the Anzali Wetland are ten rivers as shown in the figure below. As mentioned in the previous section, the reason of changing sediment balance is attributable the installation of cross-river structures such as intake weir. The cross-river structures are installed

at plain area mainly. Therefore, the target sections in main river course were selected in the plain area for restoring the river channel stabilization. The total river length of ten rivers is 314.3km.



Source: JICA Expert Team (Satellite image: Land Sat ETM (Feb. 2016))

Figure 6.5-3 Planning Target Section in Main River Course

Table 6.5-2 Target Rivers and River Length

No.	River	Length	No.	River	Length
1	Morghak River	24.4 km	7	Pasikhan River (1)	36.0 km
2	Khalkai River	17.9 km		Pasikhan River (2)	11.6 km
3	Palangvar River	25.8 km	8	Pishroudbar River (1)	30.7 km
4	Bahambar River	19.5 km		Pishroudbar River (2)	6.5 km
5	Pirbazar River (1)	37.9 km	9	Masuleh River	30.8 km
	Pirbazar River (2)	27.2 km	10	Khomamroud River	28.8 km
6	Chafroud River	17.2 km		Total Length	314.3 km

Source: JICA Expert Team

2) Policy of Long-Term Plan

- As targeted at ten rivers flowing into the Anzali Wetland, a Long-Term Plan is establish based on the above-mentioned policy.
- As the integrated plan of Morghak and Khalkai in second year of the JICA Phase II Project, the other rivers should also be planned, and go ahead to prepare the detailed design and to implement construction based on the integrated plan.

- The addressing sequence of river improvement should be based on the river priority to be described below.
- Monitoring for evaluating the effect of river improvement is continued periodically, by incorporating the monitoring to the Long-Term Plan.

3) Objective Number of Long-Term Plan in Main River Course

At the second year on the JICA Phase II Project, the integrated plan in Morghak and Khalkai Rivers to control the sediment flowing into the Anzali Wetland was prepared. According to the result of survey for planning, the annual volume of sediment production was estimated at $117 \times 10^3 \text{ m}^3$ in the main river course. As shown in the table below, the total sediment production of all ten rivers was estimated at $867 \times 10^3 \text{ m}^3$ by using rate of river length between total length of ten rivers and Morghak/ Khalkai Rivers. The objective number of sediment reduction was set as $867 \times 10^3 \text{ m}^3$, since the Long-Term Plan aims at reducing sediment production at a maximum. But reducing the sediment production completely is not possible in a factual manner. Where in, verify the effective volume rate of sediment reduction through the monitoring, then update the objective number periodically.

Table 6.5-3 Objective Number of Annual Sediment Reduction of Long-Term Plan

River	Length of River	Goal of Sediment Reduction in Main River Course
Morghak and Khalkai	42.3 km	$116,738 \text{ m}^3/\text{year}^1$
Ten Rivers	314.3 km	$867,394 \text{ m}^3/\text{year}^2$

Notes: 1) Sourced from report of integrated plan in 2015.

2) Estimated from volume of Morghak and Khalkai by using rate of river length

Source: JICA Expert Team

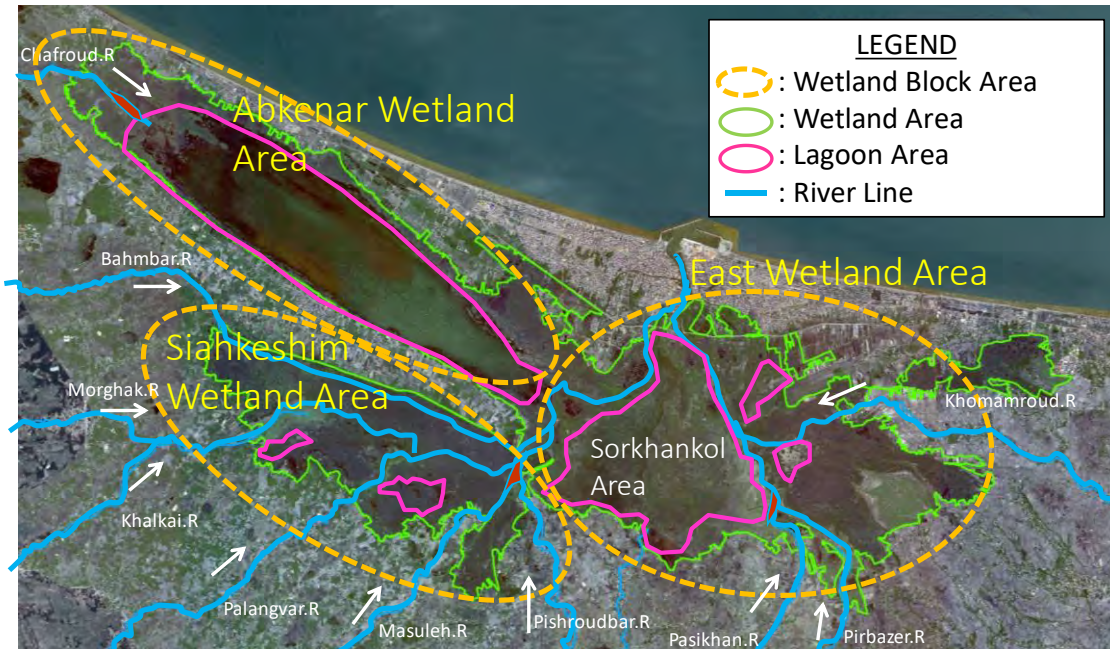
4) Priority Sequence of River Basin

The priority sequence of river basins for going ahead the sediment control project had been studied as mentioned below.

i) Emergency of Wetland Areas

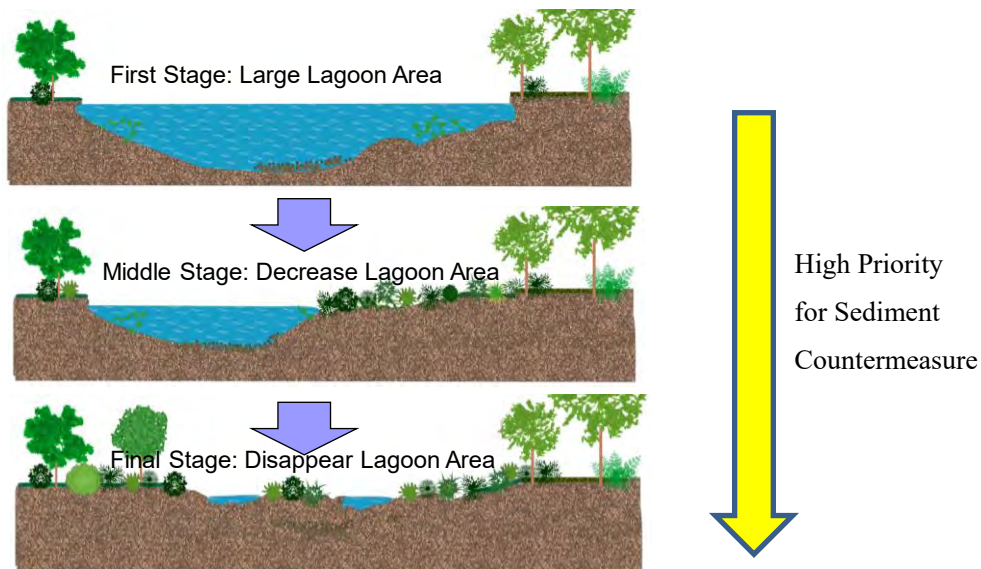
The emergency of wetland area is critical indicator since the sediment control project aims at wetland conservation. The wetland area is divided into three wetland areas, Siahkeshim, East Wetland and Abkenar, as shown in the figure below. The East Wetland area includes Sorkhankol wetland area indicated by purple line as lagoon area. The water body at Siahkeshim wetland area remains little area and advancing of dryland is the earliest. The East Wetland area remains the water body less than half. The Abkenar Wetland area remains almost rate of water body. The emergency of wetland area had been set by focusing the degree of dryland progress. The Siahkeshim Wetland area is evaluated as the most advance area on the dryland progress and assessed as final stage. The Sorkhankol Wetland area is assessed as next high emergency, then

the Abkenar Wetland area follows as next one. Therefore, the river basins flowing into the Siahkeshim Wetland area were decided as top priority for going ahead the sediment control project. At next stage, address the river basins flowing into the East Wetland area, then Chafroud River flowing into the Abkenar Wetland area will be started at the end.



Source: Prepared by JICA Expert Team using the Satellite image: Land Sat ETM (Feb. 2016), World View 3 (Apr. 2018)

Figure 6.5-4 Water Body Area at each Wetland Area



Source: JICA Expert Team

Figure 6.5-5 Wetland Progress of Dryland and Emergency of Sediment Countermeasure

ii) Priority of River Basin at each Wetland Area

The river basin flowing into the Abkenar Wetland area. On the other hand, two priority sequences of river basins flowing into the Siahkeshim and East Wetland area should be evaluated, since the two wetland areas have several river basins. Since the sediment flow volume of river basin is critical indicator, three indexes, sediment discharge, catchment area and NRWGO conservation area were assessed comprehensively as shown in the table below.

Table 6.5-4 Priority Sequence of River Basins at each Wetland Area
(Siahkeshim Wetland Area)

Evaluation Index	Bahmbar.R Basin	Masal.R Basin	Palangvar.R Basin	Masuleh.R Basin	Pishroodbar .R Basin
(1) Sediment Discharge from the River *1 (ton/year)	12.3 × 10 ³	134.5 × 10 ³	34.7 × 10 ³	86.0 × 10 ³	82.9 × 10 ³
(1) Priority Assessment for Wetland Conservation *2	△	⊙	△	○	○
(2) Catchment Area (km ²)	151	639	227	389	442
(2) Priority Assessment for Wetland Conservation *2	○	⊙	○	○	○
(3) NRWGO conservation area (km ²)	--	149	41	99	--
(3) Priority Assessment for Wetland Conservation *2	△	⊙	○	⊙	△
Overall Assessment of Priority for Wetland Conservation	5	1	4	2	3

1) Source: Water Resources Atlas, GRWC 2006

2) ⊙: High Priority, ○: Middle Priority, △: Low Priority

(Sorkhankol Wetland Area)

Evaluation Index	Khomam R. Basin	Pirbazar R. Basin	Pasikhan R. Basin
(1) Sediment Discharge from the River *1 (ton/year)	--	78 × 10 ³	127 × 10 ³
(1) Priority Assessment for Wetland Conservation *2	--	⊙	⊙
(2) Catchment Area (km ²)	70	286	799
(2) Priority Assessment for Wetland Conservation *2	△	○	⊙
(3) NRWGO conservation area (km ²)	--	20	154
(3) Priority Assessment for Wetland Conservation *2	△	△	⊙
Overall Assessment of Priority for Wetland Conservation	3	2	1

1) Source: Water Resources Atlas, GRWC 2006

2) ⊙: High Priority, ○: Middle Priority, △: Low Priority

Source: JICA Expert Team

iii) Priority of All River basins

As noted above, the priority sequence of wetland areas for addressing sediment control project was decided, then priority sequence of river basins flowing into each wetland area was evaluated. Consequently, a priority sequence of all ten river basins was fixed as shown in the table below. The river improvement should be addressed based on the priority sequence.

Table 6.5-5 Priority Sequence of Ten River Basins

Wetland Area	Seq.	River Basin	Seq.	River
Siyakeshim	1	Masal	1	Morghak River ¹⁾
			2	Khalkai River ¹⁾
	2	Masuleh	3	Masuleh River
	3	Pishroudbar	4	Pishroudbar River (1) Pishroudbar River (2)
	4	Palangvar	5	Palangvar River
	5	Bahmbar	6	Bahmbar River
East Wetland	6	Pasikhan	7	Pasikhan River (1) Pasikhan River (2)
	7	Pirbazar	8	Pirbazar River (1) Pirbazar River (2)
	8	Khomamroud	9	Khomamroud River
Abkenar	9	Chafroud	10	Chafroud River

1) Morghak River was set as sequence No.1 with comparing river length (Morghak 24.4km, Khalkai 17.9km)

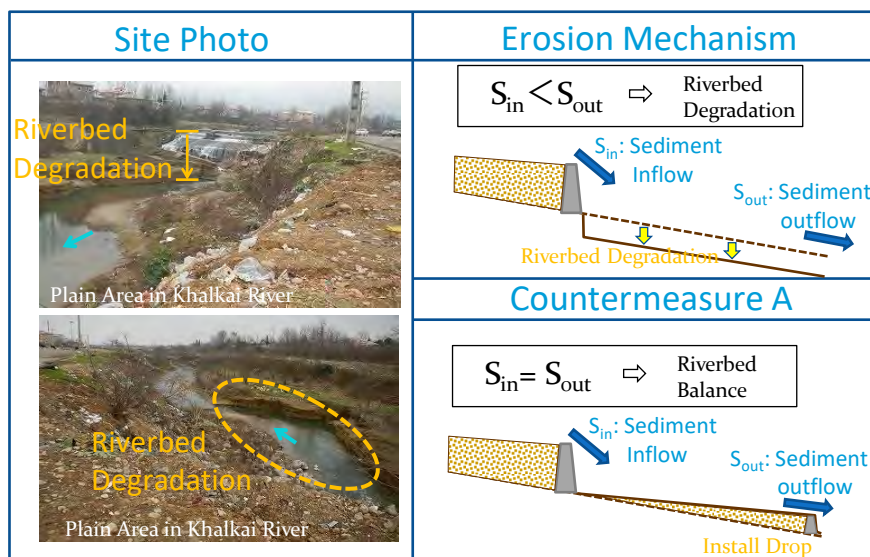
Source: JICA Expert Team

5) Methodology of Sediment Control

The mechanism of erosion in main river course and countermeasure with considering the mechanism were wrote a detailed description as follows.

i) Balance of Sediment Dynamic

The main reason of riverbed degradation is attributable to changing balance of sediment dynamic due to installing of cross-river structure such as an intake weir. As indicated in the figure below, the sediment inflow S_{in} is decreased due to changing longitudinal slope at upstream by installing of cross-river structure. On the other hand, the sediment outflow S_{out} is not changed, since the longitudinal slope at downstream is the same as previous one before installing of cross-river structure. Then, the riverbed degradation is occurred due to the disbalance $S_{in} < S_{out}$ of sediment dynamic. As countermeasure for the disbalance issue, restore the balance $S_{in} = S_{out}$ of sediment dynamic by changing longitudinal slope to low-gradient and decreasing of sediment outflow S_{out} by installing a new drop at downstream. The setting method of longitudinal slope was mentioned precisely in the next section ii) River Stabilization.



Source: JICA Expert Team

Figure 6.5-6 Balance of Sediment Dynamic

ii) River Stabilization

A typical empiric formula of river stability to estimate width and slope of river is shown in the figure below. The stable width and slope of river are fixed as provided in average of annual maximum discharge Q and representative grain-diameter D_{50} . In the case of mentioned above, the grain-diameter of inflow sediment at downstream of cross-river structure changes small one due to changing longitudinal slope low at upstream. Therefore, the riverbed degradation should be restored by keeping the riverbed stable by lowing the longitudinal slope at downstream by referring to the formula of river stability.

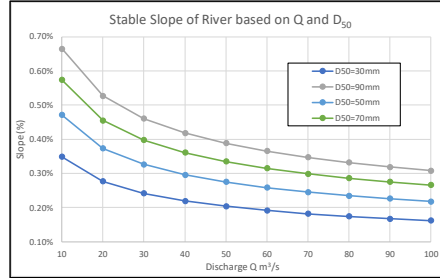
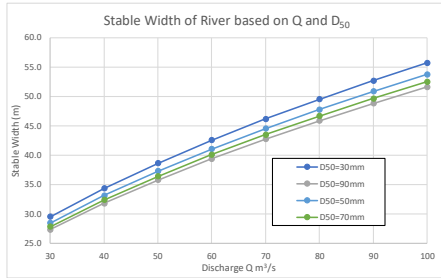
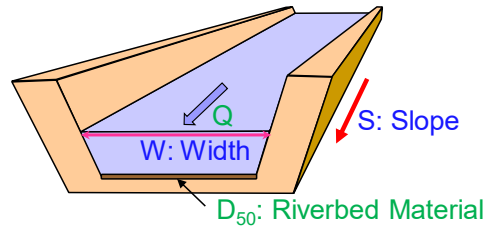
The stable longitudinal slopes in Morghak and Khalkai had been estimated based on the formula of river stability in the second year of the Project. The estimated stable longitudinal slopes were shown in the table below. The longitudinal profiles in Morghak and Khalkai had been prepared for restoring the river stable by changing longitudinal slope closely to the estimated slope by installing some new drops as shown in Attachment 6.5.-1. The other rivers should be prepared as is the case in Morghak and Khalkai River.

Formula of River Stability:

$$W = 2.08 Q^{0.528} D_{50}^{-0.07}$$

$$S = 0.0965 Q^{-0.334} D_{50}^{0.586}$$

Note: Formula of the Best-Fit Method
All Units are in British Unit



Source: JICA Expert Team

Figure 6.5-7 Width and Longitudinal Slope of Stable River

Table 6.5-6 Estimated Result of Stable Longitudinal Slope in Morghak River

Row	Distance of Upstream From	Distance of Upstream To	D ₅₀ (mm)	D ₇₅ (mm)	D ₉₀ (mm)	pre-discharge (m³/sec)	discharge (m³/sec)	Leopold's Method (m³/sec)	Magdack's Method (m³/sec)	50 Threshold (m³/sec)	75 Threshold (m³/sec)	Kellerhals Method	Parker's Method	the best-fit method	Existing Slope	Selected Slope	Row	Parker's Method	the best-fit method	Existing Slope	Selected Slope
1	0+000	0+970	110.0	154.0	176.0	0+005.0	0+970.0	0.1891.0	0.01284.0	0.0042	0.0182	0.0049	0.0270	0.005	2	0.0182	0.0049	0.0270	0.005		
2	0+970	2+482	93.3	154.7	168.2	0+975.0	2+482.0	0.16593.3	0.01094.7	0.0040	0.0165	0.0045	0.0215	0.005	30	0.0165	0.0045	0.0215	0.005		
3	2+482	4+602	116.7	151.7	172.7	2+485.0	4+602.0	0.19916.7	0.01289.7	0.0041	0.0189	0.0051	0.0185	0.005	31	0.0189	0.0051	0.0185	0.005		
4	4+602	9+634	98.3	130.0	143.6	4+605.0	9+634.0	0.17298.3	0.01039.0	0.0035	0.0170	0.0046	0.0160	0.004	35	0.0170	0.0046	0.0160	0.004		
5	9+634	10+779	81.0	115.0	138.0	9+636.0	10+779.0	0.14781.0	0.00889.0	0.0034	0.0151	0.0041	0.0126	0.004	34	0.0151	0.0041	0.0126	0.004		
6	10+779	12+923	94.5	128.0	144.0	10+779.0	12+923.0	0.16794.5	0.01028.0	0.0035	0.0166	0.0045	0.0081	0.004	35	0.0166	0.0045	0.0081	0.004		
7	12+923	15+770	57.5	81.0	98.5	12+925.0	15+770.0	0.11057.5	0.00839.0	0.0025	0.0122	0.0034	0.0071	0.003	25	0.0122	0.0034	0.0071	0.003		
8	15+770	16+768	32.0	50.0	59.0	15+775.0	16+768.0	0.06832.0	0.00594.0	0.0018	0.0085	0.0024	0.0022	0.003	18	0.0085	0.0024	0.0022	0.003		
9	16+768	17+452	47.0	67.0	72.9	16+775.0	17+452.0	0.09347.0	0.00622.0	0.0021	0.0108	0.0030	0.0044	0.003	21	0.0108	0.0030	0.0044	0.003		
10	17+452	19+215	69.0	69.0	101.0	17+452.0	19+215.0	0.12869.0	0.00683.0	0.0025	0.0137	0.0037	0.0032	0.003	25	0.0137	0.0037	0.0032	0.003		
11	19+215	21+217	57.5	84.0	103.5	19+235.0	21+217.0	0.11057.5	0.0054.0	0.0026	0.0122	0.0034	0.0028	0.002	36	0.0122	0.0034	0.0028	0.002		
12	21+217	22+728	37.0	53.5	77.5	21+235.0	22+728.0	0.07637.0	0.0053.5	0.0017	0.0093	0.0026	0.0027	0.002	17	0.0093	0.0026	0.0027	0.002		
13	22+728	32+055	22.0	34.0	44.0	22+735.0	32+055.0	0.05022.0	0.0034.0	0.0012	0.0068	0.0019	0.0015	0.0015	2	0.0068	0.0019	0.0015	0.0015		
14	32+055	37+462	4.0	10.0	15.0	32+055.0	37+462.0	0.0124.0	0.0006.0	0.0004	0.0019	0.0006	0.0004	0.0004	34	0.0019	0.0006	0.0004	0.0004		

Source: Report of integrated plan in 2015

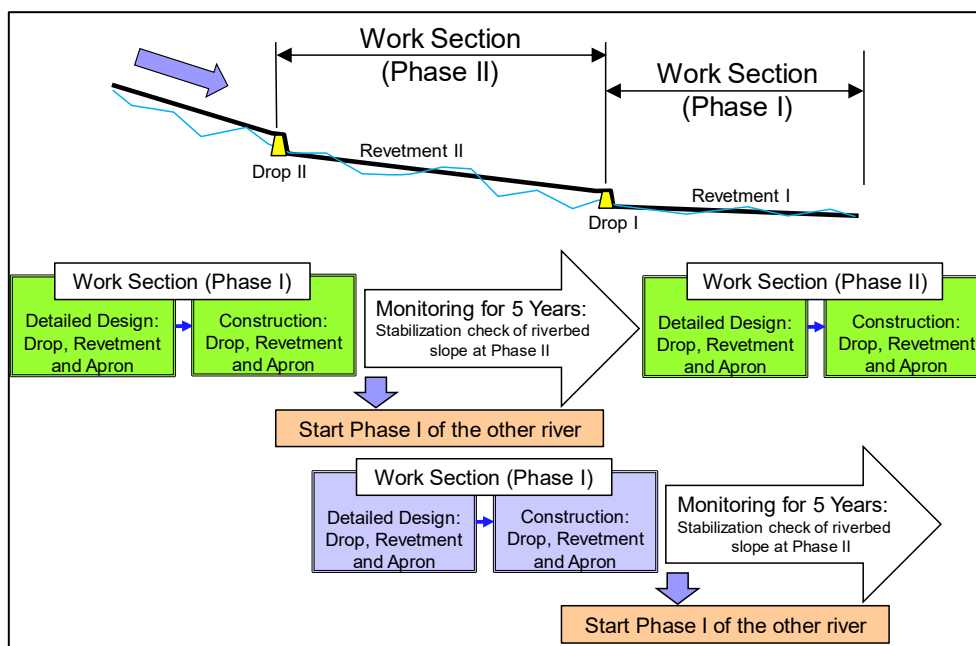
Table 6.5-7 Estimated Result of Stable Longitudinal Slope in Khalkai River

Row	Distance of Upstream From	Distance of Upstream To	D ₅₀ (mm)	D ₇₅ (mm)	D ₉₀ (mm)	pre-discharge (m³/sec)	discharge (m³/sec)	Leopold's Method (m³/sec)	Magdack's Method (m³/sec)	50 Threshold (m³/sec)	75 Threshold (m³/sec)	Kellerhals Method	Parker's Method	the best-fit method	Existing Slope	Selected Slope	Row	Parker's Method	the best-fit method	Existing Slope	Selected Slope
1	0+000	3+078	85.0	123.4	147.5	0+000.0	3+078.0	0.14985.0	0.00823.4	0.0034	0.0147	0.0040	0.0165	0.004	4	0.0147	0.0040	0.0165	0.004		
2	3+078	8+190	78.6	107.0	128.1	3+078.0	8+190.0	0.14078.6	0.00751.0	0.0030	0.0140	0.0039	0.0120	0.004	0	0.0140	0.0039	0.0120	0.004		
3	8+190	10+950	78.4	110.0	127.2	8+190.0	10+950.0	0.14078.4	0.00751.0	0.0030	0.0140	0.0039	0.0120	0.004	0	0.0140	0.0039	0.0120	0.004		
4	10+950	12+240	63.5	89.0	107.0	10+950.0	12+240.0	0.11763.5	0.00589.0	0.0025	0.0123	0.0034	0.0062	0.003	5	0.0123	0.0034	0.0062	0.003		
5	12+240	14+870	46.0	65.0	78.6	12+240.0	14+870.0	0.09046.0	0.00552.0	0.0019	0.0101	0.0028	0.0034	0.003	9	0.0101	0.0028	0.0034	0.003		
6	14+870	18+530	64.7	84.7	98.6	14+870.0	18+530.0	0.11964.7	0.00582.7	0.0023	0.0125	0.0035	0.0035	0.003	3	0.0125	0.0035	0.0035	0.003		
7	18+530	28+420	35.0	45.0	54.0	18+530.0	28+420.0	0.07135.0	0.00269.0	0.0013	0.0085	0.0024	0.0023	0.002	3	0.0085	0.0024	0.0023	0.002		
8	28+420	30+492	30.0	36.0	40.8	28+420.0	30+492.0	0.06330.0	0.00261.0	0.0010	0.0078	0.0022	0.0017	0.002	0	0.0078	0.0022	0.0017	0.002		

Source: Report of integrated plan in 2015

The procedure to go ahead river improvement for restoring river stable is indicated in the figure below. Setting a section between two new drops as one phase and install the new drops in sequence from downstream to upstream. Since it needs a period of time for becoming stable of riverbed, the stabilization of riverbed should be monitored by implementing cross section survey

on an annual basis after installation of new drop. During the monitoring of river stabilization, improvement of the other rivers should be gone ahead in parallel for keeping the project efficient and steadily.

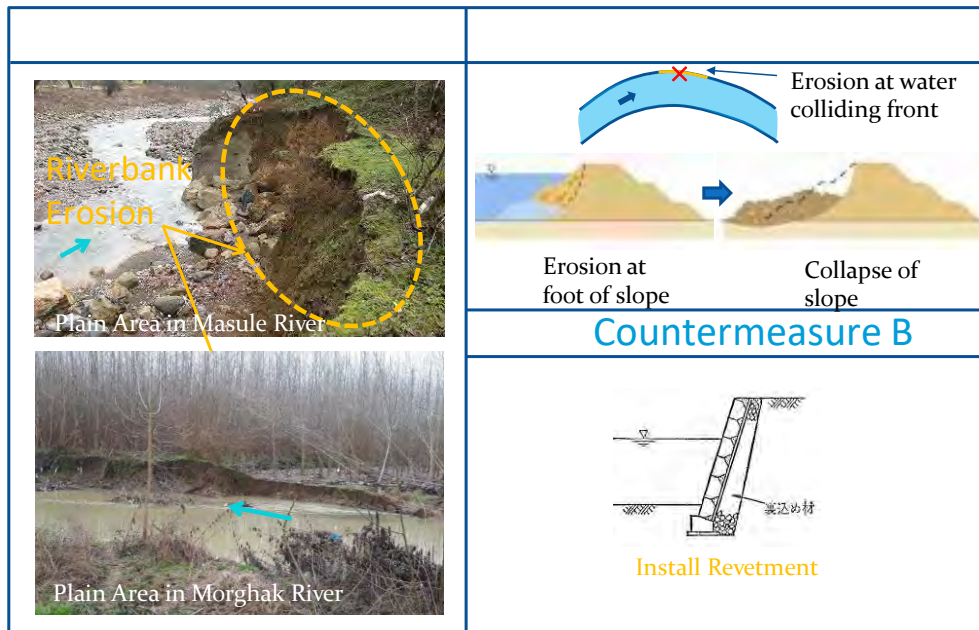


Source: JICA Expert Team

Figure 6.5-8 Procedure of River Improvement with Considering River Stabilization

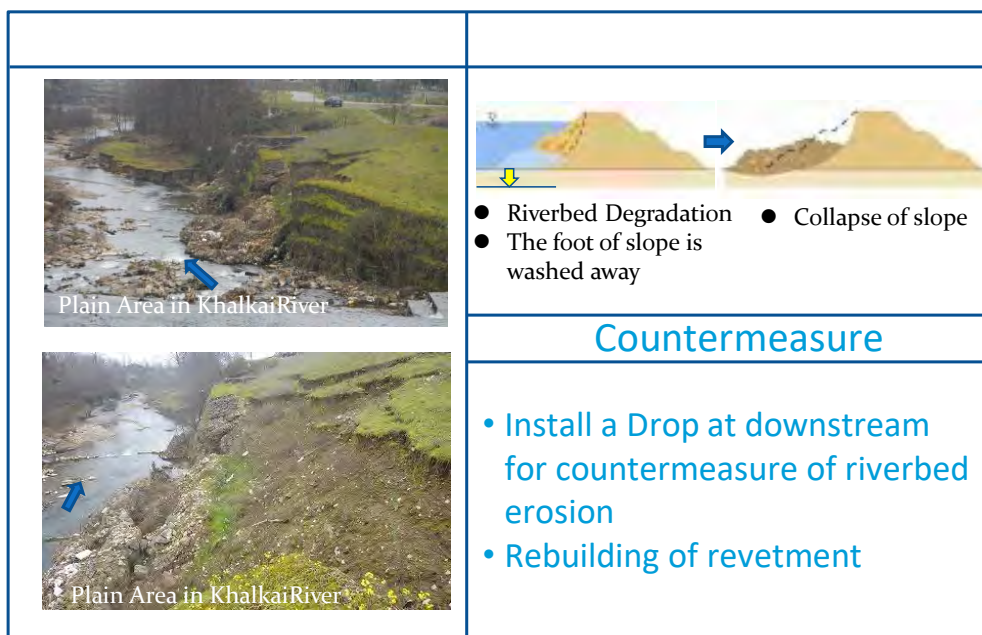
iii) Countermeasure for Riverbank Erosion

Some places of river bank erosion had been found such as water colliding front of curved river and riverbed degradation section at downstream of cross-river structure. At the colliding front of curved river, the flow velocity increases high and the foot of riverbank slope is eroded, then the riverbank is collapsed due to loss of bearing capacity. At the riverbed degradation section, the foot of riverbank slope is eroded due to riverbed degradation, then the riverbank reaches to collapse. Therefore, revetment should be installed for protecting the riverbank, and in a case of riverbed degradation section, restoring the riverbed should be implemented. When a new drop is installed at downstream of the revetment, detailed design and construction of the revetment should be started after confirmation of river stabilization.



Source: JICA Expert Team

Figure 6.5-9 Mechanism of Riverbank Erosion and Countermeasure at Water Colliding of Curved River



Source: JICA Expert Team

Figure 6.5-10 Mechanism of Riverbank Erosion and Countermeasure at Riverbed Degradation Section

iv) Improvement of Existing Structures

Some local scourings of riverbed at downstream of existing intake weir and bridge had been found. The mechanism is presumed that the riverbed at the toe of riverbed protection was eroded by dropping flow water due to riverbed degradation, and the ground sand under the riverbed

protection had flowed out, then the riverbed protection reached to collapse due to loss of bearing capacity. The riverbed degradation should be restored by keeping balance of sediment dynamic as mentioned previously, and a new riverbed protection should be replaced with the appropriate elevation which is estimated by stable longitudinal profile. The method of improvement above is possible to avoid the local scouring at the toe of riverbed protection, and keep the existing structure safe.

Existing Cross River Structures



Source: JICA Expert Team

Figure 6.5-11 Local Scouring at Downstream of Cross-River Structure in Khalkai River

The existing structures which were judged as necessity of replacement of riverbed protection due to occurrence such as riverbed degradation and local scouring at downstream of cross-river structures, are listed as shown in the table below.

Table 6.5-8 Existing Cross-River Structures Required Replacement of Riverbed Protection

Morghak River		Khalkai River	
No.	Name of Structure	No.	Name of Structure
1	Intake Weir 2	1	Intake Weir 2
2	Intake Weir 3	2	Drop 1
3	Intake Weir 4	3	Bridge with irrigation under pass
4	Intake Weir 5	4	Intake Weir 4
5	Bridge with irrigation under pass	—	—
6	Intake Weir 6	—	—

Source: Report of integrated plan in 2015

6) Quantity and Cost of Structures of Long-Term Plan in Main River Course

The longitudinal profiles and plan drawings in Morghak and Khalkai River, established based on the methodology described above are shown in Attachment F 6.5.1-1. The estimated costs based on the plan are shown in Attachment T 6.5.1-1. The total cost of Long-Term Plan was estimated as 3,142 billion Rial. The procedure and method of cost estimation are described below.

- The costs of detailed design and monitoring by cross section survey were estimated based on the PBO guideline ‘Guideline to Determine the Wage of Water Engineering Services 2006.7.30, No:100/80981, Planning and Budget Organization’ published by Planning and Budget Organization.
- The construction costs were applied the ones which had been estimated in the integrated plan in Morghak and Khalkai ‘Integrated Planning Survey for Preparation of Countermeasures to Control the Sediment Flow into Anzali Wetland, April, 2016’.
- The costs of the other 8 rivers were estimated by using average cost of each structure as indicated in the table below. The quantities of structures were estimated by using rate of river length.
- The costs for preparing integrated plan of the other 8 rivers were estimated by referring to the previous sublet work of integrated planning in Morghak and Khalkai river in the second year of the Project. The costs were converted by using rate of river length.

Table 6.5-9 Costs and Average Unit in Morghak and Khalkai River

Program	Khalkai River		Morghak River		Total		Unit		
	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	
Integrated Planning	17.9 km	1.0 bil. Rial	24.4 km	1.4 bil. Rial	42.3 km	2.4 bil. Rial	-	57 mil.R/ km	
Detail design	New Drop ¹⁾	7 Sites	1.6 bil. Rial	16 Sites	3.1 bil. Rial	23 Sites	4.7 bil. Rial	0.55 Sites/km	205 mil.R/Site
	Existing Str(1) ²⁾	4 Sites	0.2 bil. Rial	7 Sites	0.3 bil. Rial	11 Sites	0.5 bil. Rial	0.27 Sites/km	46 mil.R/Site
	Existing Str(2) ³⁾	4 Sites	0.3 bil. Rial	6 Sites	0.3 bil. Rial	10 Sites	0.6 bil. Rial	0.24 Sites/km	60 mil.R/Site
	Revetment	2135 m	2.0 bil. Rial	3663 m	2.6 bil. Rial	5798 m	4.6 bil. Rial	138 m/km	0.8 mil.R/m
	Apron	6 Sites	0.4 bil. Rial	6 Sites	0.3 bil. Rial	12 Sites	0.7 bil. Rial	0.29 Sites/km	59 mil.R/Site
	Sub-total		4.5 bil. Rial		6.6 bil. Rial		11.1 bil. Rial		-
Constr uction	New Drop ¹⁾	7 Sites	56.3 bil. Rial	16 Sites	108.5 bil. Rial	23 Sites	164.8 bil. Rial	0.55 Sites/km	7166 mil.R/Site
	Existing Str(1) ²⁾	4 Sites	7.4 bil. Rial	7 Sites	11.0 bil. Rial	11 Sites	18.4 bil. Rial	0.27 Sites/km	1673 mil.R/Site
	Existing Str(2) ³⁾	4 Sites	9.9 bil. Rial	6 Sites	11.9 bil. Rial	10 Sites	21.8 bil. Rial	0.24 Sites/km	2180 mil.R/Site
	Revetment	2135 m	70.5 bil. Rial	3663 m	91.8 bil. Rial	5798 m	162.3 bil. Rial	138 m/km	28.0 mil.R/m
	Apron	6 Sites	12.6 bil. Rial	6 Sites	9.4 bil. Rial	12 Sites	22.0 bil. Rial	0.29 Sites/km	1834 mil.R/Site
	Sub-total		156.7 bil. Rial		232.6 bil. Rial		389.3 bil. Rial		-
Monitoring ⁴⁾	448 Sections	3.1 bil. Rial	610 Sections	4.3 bil. Rial	1058 Sections	7.4 bil. Rial	25 Sections/km	6.9 mil.R/Section	
Total		164.3 bil. Rial		243.5 bil. Rial		407.8 bil. Rial		-	

Note: 1) Install of new drop including fish way

2) Improvement of existing cross-river structures for installing fish way

3) Maintenance of river bed protection work for existing cross-river structures

4) Cross section survey at 200m interval and each year for 5 years, 25 Sections/km=1,000m/200m × 6years

Source: JICA Expert Team

7) Implementation Schedule of Long-Term Plan in Main River Course

The implementation schedule for planning, detailed design and construction was prepared based on the river priority described previously, and indicated in Attachment F 6.5.1-2. The period of riverbed stabilization after installation of drop was set as general 5 years, and monitoring of riverbed stabilization will be conducted until the end of stabilization of riverbed. The detailed design and construction of the next prior river will be started in parallel during the monitoring.

The project of Long-Term Plan needs to spend more than 100 years, but the project is expected steadily effect by reducing of sourced sediment production which flows into the wetland.

(4) Mid-Term Plan in Main River Course

The activities for 11 years from 2020 to 2030 of Long-Term Plan were situated as Mid-Term Plan. The activities of Mid-Term Plan were described below.

1) Policy of Mid-Term Plan in Main River Course

- The activities from 2020 to 2030 of Long-Term Plan is situated as Mid-Term Plan, then go ahead the project of sediment control for river stabilization.
- As with the integrated plan of Morghak and Khalkai in second year of the Project, the other rivers also should be planned, and go ahead the detailed design and construction based on the integrated plan.
- The addressing sequence of river improvement should be based on the river priority was mentioned in the Long-Term Plan.
- Continue the monitoring for evaluating the effect of river improvement periodically, by incorporating the monitoring to the Mid-Term Plan.

2) Objective Number of Mid-Term Plan in Main River Course

Based on the objective number of Long-Term Plan, the objective number of Mid-Term Plan was converted by using rate of project total cost between both plans as shown in the table below. But the same as Long-Term Plan, to reduce the sediment production completely is not possible in a factual manner. Where in, verify the effective volume rate of sediment reduction through the monitoring, then update the objective number periodically.

Table 6.5-10 Objective Number of Annual Sediment Reduction of Mid-Term Plan

Item	Long-Term Plan	Mid-Term Plan
Project Cost	3,142 bil. Rial	375 bil. Rial
Goal of Reducing Sediment Production	867,394 m ³ /year	103,524 m ³ /year ¹⁾

Note: 1) Estimated from volume of Long-Term Plan by using rate of Project Cost

Source: JICA Expert Team

3) Specification of Mid-Term Plan in Main River Course

The projects of Long-Term Plan from 2020 to 2030 were picked up as Mid-term Plan and summarized in the table below. Integrated plans of 8 rivers except the Morghak and Khalkai River should be prepared. The projects of sediment control should be gone ahead by installing new 17 drops and 4.5 km revetment in total.

Table 6.5-11 Specification of Mid-term Plan in Main River Course

Project Name: Mid-Term Plan of Sediment Control Project in Main River Course				
1. Implementing Agency	GRWC (Gilan Regional Water Company)			
2. Aim	To reduce sediment flow into Siahkeshim Wetland			
3. Policy	Reduce sediment production in main river course by stabilizing river with installing river structures			
4. Specification	Morghak	Khalkai	Masuleh	Pishroudbar
(1) Target River Length	4.6 km	10.3 km	2.9 km	4.9 km
(2) Period	2020-2030	2020-2030	2020-2030	2021-2030
(3) Programs				
1) Integrated Plan	Completed	Completed	1 River	1 River
2) Detail Design				
New Drop	2 Sites	2 Sites	2 Sites	4 Sites
Existing Structure ⁽¹⁾	1 Site	3 Sites	1 Site	2 Sites
Existing Structure ⁽²⁾	—	1 Site	1 Site	2 Sites
Revetment	341 m	1,264 m	401 m	677 m
Apron under Bridge	1 Site	4 Sites	1 Site	2 Sites
2) Construction Work				
New Drop	2 Sites	2 Sites	2 Sites	4 Sites
Existing Structure ⁽¹⁾	1 Site	3 Sites	1 Site	2 Sites
Existing Structure ⁽²⁾	—	1 Site	1 Site	2 Sites
Revetment	341 m	1,264 m	401 m	677 m
Apron under Bridge	1 Site	4 Sites	1 Site	2 Sites
3) Monitoring ⁽³⁾				
Cross Section Survey	115 Sections	258 Sections	73 Sections	123 Sections
4. Specification	Palangvar	Bahmbar	Pasikhan	Pirbazar
(1) Target River Length	2.2 km	2.3 km	4.0 km	1.8 km
(2) Period	2022-2030	2022-2030	2023-2030	2024-2030
(3) Programs				
1) Integrated Plan	1 River	1 River	1 River	1 River
2) Detail Design				
New Drop	2 Sites	2 Sites	2 Sites	1 Site
Existing Structure ⁽¹⁾	1 Site	1 Site	2 Sites	1 Site
Existing Structure ⁽²⁾	1 Site	1 Site	1 Site	1 Site
Revetment	304 m	318 m	552 m	249 m
Apron under Bridge	1 Site	1 Site	2 Sites	1 Site
2) Construction Work				
New Drop	1 Site	1 Site	2 Sites	1 Site
Existing Structure ⁽¹⁾	1 Site	1 Site	2 Sites	1 Site
Existing Structure ⁽²⁾	1 Site	1 Site	1 Site	1 Site
Revetment	304 m	318 m	552 m	249 m
Apron under Bridge	1 Site	1 Site	2 Sites	1 Site
3) Monitoring ⁽³⁾				
Cross Section Survey	55 Sections	58 Sections	100 Sections	45 Sections
4. Specification	Khomamroud	Chafroud	Total	
(1) Target River Length	1.6 km	1.5 km	36.4 km	
(2) Period	2025-2030	2025-2030	2020-2030	
(3) Programs				
1) Integrated Plan	1 River	1 River	8 Rivers	
2) Detail Design				
New Drop	1 Site	1 Site	19 Sites	
Existing Structure ⁽¹⁾	1 Site	1 Site	14 Sites	

Project Name: Mid-Term Plan of Sediment Control Project in Main River Course			
Existing Structure ⁽²⁾	1 Site	1 Site	10 Sites
Revetment	221 m	207 m	4,534 m
Apron under Bridge	1 Site	1 Site	15 Sites
2) Construction Work			
New Drop	1 Site	1 Site	17 Sites
Existing Structure ⁽¹⁾	1 Site	1 Site	14 Sites
Existing Structure ⁽²⁾	1 Site	1 Site	10 Sites
Revetment	221 m	207 m	4,534 m
Apron under Bridge	1 Site	1 Site	15 Sites
3) Monitoring ⁽³⁾			
Cross Section Survey	40 Sections	38 Sections	903 Sections

Notes: 1) Improvement of existing drop for installing fish way

2) Maintenance of river bed protection work for existing cross-river structures

3) Cross section survey at 200 m interval and each year for 5 years

Source: JICA Expert Team

4) Cost of Mid-Term Plan in Main River Course

The cost of Mid-Term Plan was estimated as shown in Attachment T 6.5.1-1. The total cost of Mid-Term Plan was estimated as 375 billion Rial. The average of annual cost was calculated as 34 billion Rial. The procedure and method of cost estimation are described below.

- The quantities in Morghak and Khalkai River such as detailed design and construction were picked up from Long-Term Plan, and the costs in the two rivers were estimated.
- The target river length of the other 8 rivers for Mid-Term Plan were estimated by using rate of period with comparing to Long-Term Plan as indicated in the table below.
- The quantities of structures of the other 8 rivers for Mid-Term Plan were estimated by using the rate of river length.
- The total costs of the other 8 rivers were estimated by multiplying the quantities of structures and by average unit cost in Morghak and Khalkai river.

Table 6.5-12 Estimation of Target River Length for Mid-Term Plan

	Period (year)		(3) Rate of Period (2)/(3)	River Length (km)	
	(1) Long-Term Plan	(2) Mid-term Plan		(4) Long-Term Plan	(5) Mid-term Plan (3) × (4)
Masuleh River	120 year	11 year	9.2%	30.8 km	2.9 km
Pishroudbar River (1)	120 year	10 year	8.3%	30.7 km	2.6 km
Pishroudbar River (2)	29 year	10 year	34.5%	6.5 km	2.3 km
Palangvar River	106 year	9 year	8.5%	25.8 km	2.2 km
Bahmbar River	78 year	9 year	11.5%	19.5 km	2.3 km
Pasikhan River (1)	141 year	8 year	5.7%	36.0 km	2.1 km
Pasikhan River (2)	50 year	8 year	16.0%	11.6 km	1.9 km
Pirbazar River (1)	148 year	7 year	4.7%	37.9 km	1.8 km
Pirbazar River (2)	105 year	—	—	27.2 km	—
Khomamroud River	113 year	6 year	5.3%	28.8 km	1.6 km
Chafroud River	71 year	6 year	8.5%	17.2 km	1.5 km

Source: JICA Expert Team

5) Implementation Schedule of Mid-Term Plan in Main River Course

The implementation Schedule of Mid-Term Plan are shown in the table below. The Morghak and Khalkai River are the highest priority and the detailed design and construction of the rivers will be started at the first. The monitoring of cross section survey will be conducted after the construction of new drop, after confirmation of river stabilization at the first phase, the installation of new drop at next upstream phase will be started. During the monitoring of Morghak and Khalkai River, the detailed design and construction of Palangvar and bahmbar River which are the next high priority ones will be started. The integrated plan of the other rivers except Morghak and Khalkai River will be started from Palangvar and bahmbar River which are the highest priority of 8 rivers, then the integrated plan of all 10 rivers will be completed by 2025.

River length, Drop Num.	Program	2020										2030
		0	1	2	3	4	5	6	7	8	9	
Morghak River L=24.4km	Integrated Plan Detailed Design Construction	Completed in 2015										
16 Drops	Monitoring											
Khalkai River L=17.9km	Integrated Plan Detailed Design Construction	Completed in 2015										
7 Drops	Monitoring											
Masuleh River L=30.8km	Integrated Plan Detailed Design Construction											
17 Drops	Monitoring											
Pishroudbar River (1) L=30.7km	Integrated Plan Detailed Design Construction											
17 Drops	Monitoring											
Pishroudbar River (2) L=6.5km	Integrated Plan Detailed Design Construction											
4 Drops	Monitoring											
Palangvar River L=25.8km	Integrated Plan Detailed Design Construction											
15 Drops	Monitoring											
Bahmbar River L=19.5km	Integrated Plan Detailed Design Construction											
11 Drops	Monitoring											
Pasikhan River (1) L=36.0km	Integrated Plan Detailed Design Construction											
20 Drops	Monitoring											
Pasikhan River (2) L=11.6km	Integrated Plan Detailed Design Construction											
7 Drops	Monitoring											
Pirbazar River (1) L=37.9km	Integrated Plan Detailed Design Construction											
21 Drops	Monitoring											
Pirbazar River (2) L=27.2 km	Integrated Plan Detailed Design Construction											
15 Drops	Monitoring											
Khomamroud River L=28.8km	Integrated Plan Detailed Design Construction											
16 Drops	Monitoring											
Chafroud River L=17.2km	Integrated Plan Detailed Design Construction											
10 Drops	Monitoring											

Notes: Integrated Planning Survey for Preparation of Countermeasures to Control the Sediment Flow into Azali Wetland
 Detailed Design including three types of structures; Drops, Revetments and Aprons
 Construction including three types of structures; Drops, Revetments and Aprons
 Monitoring the river stability for 5 years after construction of each drop

Source: JICA Expert Team

Figure 6.5-12 Implementation Schedule of Mid-Term Plan in Main River Course

6.5.2 Sediment Management Plan in Mountain Area

(1) Current conditions and problems

1) Erosion condition in mountainous area

The sediment generated in the mountain area is transported through rivers and going into Anzali Wetland. The conditions in the wetland area was described in Section 6.5.2, 1). In this part, the conditions and problems in the mountain area is described.

The mountain area is the biggest sediment generation source and most of the sediment is generated from mountain slopes and transported through mountain streams. Some of sediment which flows in the streams eroded the stream bank and bed; some of them piled in the stream and eroded again by water flow. The sediment generation can be classified as table below.

Table 6.5-13 Classification of Erosion Conditions in Mountain Area

Place	Sub-place	Sediment generation
1. Mountain slope area	1) steep slope located on more than 2000 m (forest limitation)	Slope failure, erosion (gully erosion, sheet erosion)
	2) slope located under forest limitation (normal slope)	Slope failure, erosion (gully erosion, sheet erosion)
	3) grass land, most of the cases are grazing land	Slope erosion (rill erosion, gully erosion and sheet erosion)
2. Mountain stream area	1) upper stream	Generally, this segment is eroded by the eroded soil flow and water from upper side mountain slope.
	2) middle stream	This segment has some gentle slope angle and transported sediment is piled in such places. After piling, the soil block is eroded by water flow mainly.
	3) lower stream	Most of stream bank and bed of this segment are eroded by water flow. Unstable stream bank by erosion leads further slope failure.

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.5-13 Typical Erosion Condition in Mountainous Area

2) Huge areas to be tackle

The mountain area in Anzali Wetland basin is estimated 1,649.7 km² (164,970 ha) in total Anzali Wetland basin (3,820.0 km² = 382,000 ha)².

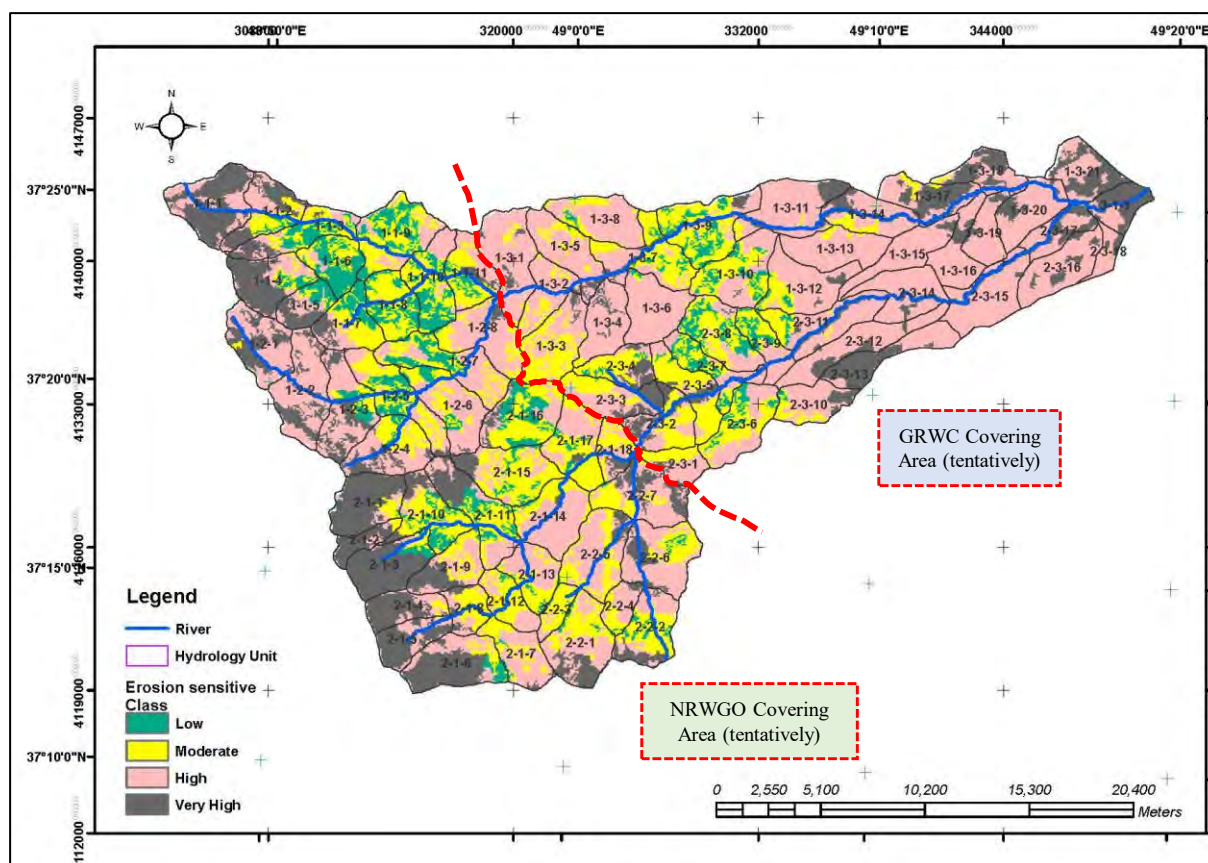
Based on the Integrated study at Masal River basin, there are 84 sub-basins and 44 sub-basins under NRWGO management (the mountain area; it was estimated by JICA Expert Team tentatively) and 40 sub-basins under GRWC. In the NRWGO (mountainous area), the number of very high-risk sub-basin is 6 and 6% of the river basin area. The number of high erosion risk area is 22 and the area is 28%. Total area of “very high” and “high” risk sub-basins is approx. 22,800 ha. Just In case of assuming 30% of the “very high” and “high” risk area will be taken as the target area, approx. 6,800 ha becomes the target area. It is still too huge area.

Table 6.5-14 Sub-Basin wise Erosion Risk Classification of Masal River Basin

Classification	Erosion Risk	Number of sub-basin	Area (ha)	% of Total Area
NRWGO Covering Area (Mountain)	Very High	6	4,270.72	6.5
	High	22	18,585.31	28.5
	Moderate	16	12,567.73	19.2
	Total	44	35,423.76	(54.2)
GRWC Covering Area	Very High	4	2,482.13	3.8
	High	28	20,802.43	31.9
	Moderate	8	6,614.85	10.1
	Total	40	29,899.41	(45.8)
Total	Very High	10	6,752.85	10.3
	High	50	39,387.74	60.4
	Moderate	24	19,182.58	29.3
	Total	84	65,323.17	100.0

Source: Based on the Integrated Study Report, JICA Expert Team prepared.

² Reference: GIS Survey for Anzali Wetland Ecological Management Project Phase-II, 2015, JICA



Source: Based on the Integrated Study Report, JICA Expert Team prepared.

Figure 6.5-14 Sub-Basin-wise Erosion Risk Classification of Masal River Basin

Due to no studies on the other major river basins except Masule mountain, the erosion risk areas in whole Anzali Wetland Basin is estimated by the proportional distribution method below based on the ratio of catchment area of Masal and the other river basins.

Table 6.5-15 Estimated Erosion Risky Area in Anzali Wetland Basin

River Basin	Catchment Area (km ²)	Ratio of area	Estimated Erosion Risky area (ha)
Masal	639	1	6,800
Khomam	70	11%	748
Pirbazar	286	45%	3,060
Pasikhan	799	125%	8,500
Pishroodbar	442	69%	4,692
Masuleh	389	61%	4,148
Bahambar	151	24%	1,632
Palangvar	227	36%	2,448
Total			25,228

Source: Based on the Integrated Study Report, JICA Expert Team prepared.

Based on the estimation, the area where NRWGO Gilan shall tackle is estimated approx. 25,228ha in Anzali Wetland basin in total.

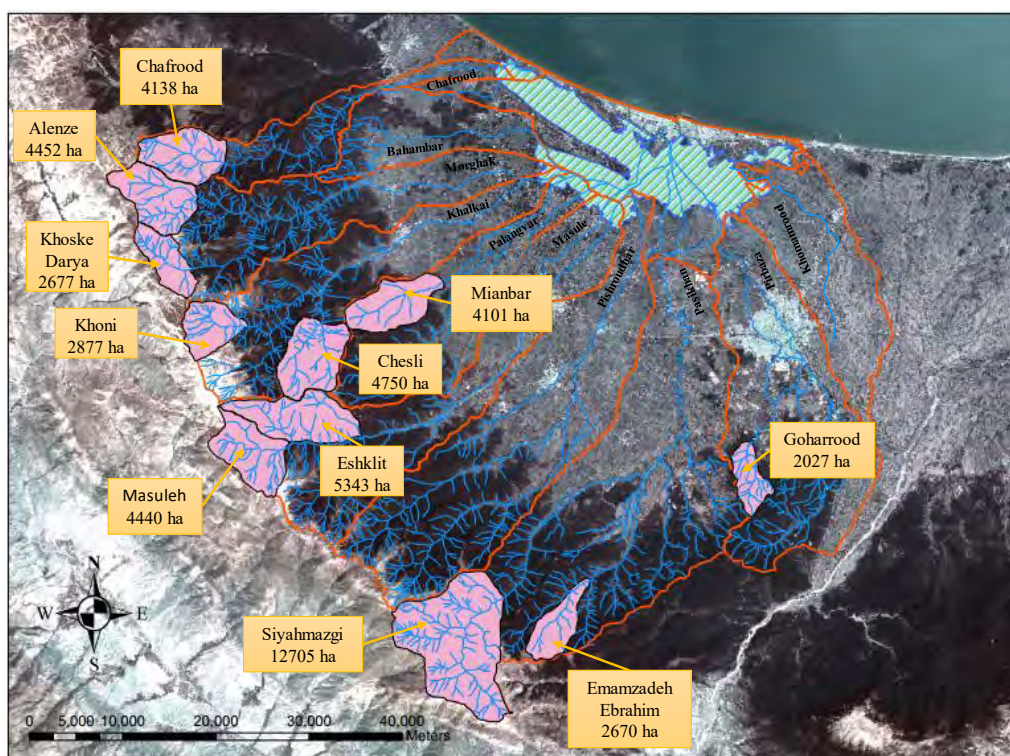
3) NRWGO Prior Area

NRWGO Gilan has established mountain conservation prior areas. The table below shows NRWGO’s 10 prior areas (totally 41,627 ha), where are estimated as erosion risky areas. NRWGO Gilan’s targets are good but these are set from the perspective of mountain area conservation. It is noted that the Mid-Term-Plan here is prepared in order to conserve Anzali Wetland. Therefore, the prior of areas in the Mid-Term-Plan are difference from the NRWGO prior area.

Table 6.5-16 List of NRWGO Prior Area in Anzali Wetland Basin

River Basin	Sub-Basin	NRWGO Prior Area	Area (ha)
Masal	Morghak R.	Alenze	4,452
		Khoske Darya	2,677
	Khalkai R.	Khoni	2,877
		Chesli	4,750
Masule		Eshklit	5,343
		Masuleh	4,440
Pishroudbar		-	-
Palangvar		-	-
Bahambar		-	-
Pasikhan		Siyahmazgi	12,705
		Emamzadeh Ebrahim	2,670
Pribazar		Goharrood	2,027
Khonamroud		-	-
Chafroud		Chafroud	4,138
Total			41,627

Source: Based on the NRWGO Gilan’s data, JICA Expert Team prepared.



Source: Based on data of NRWGO Gilan, JICA Expert Team prepared using Satellite image: Land Sat ETM (Feb. 2016)

Figure 6.5-15 NRWGO Prior Area in Anzali Wetland Basin

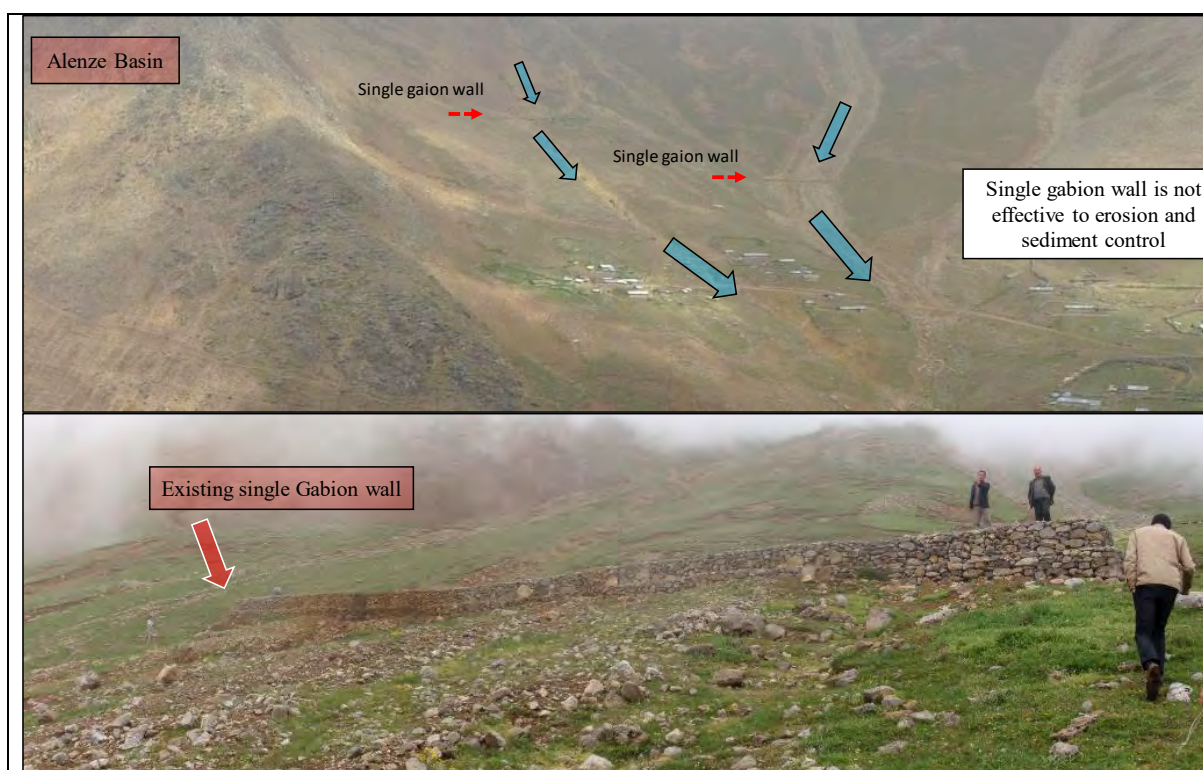
4) Capacity of NRWGO Gilan

NRWGO Gilan has responsibility for erosion and sediment control then, they need conserve the mountainous area. However, unfortunately their usual implementation amount has not been enough to resolve the problem and it makes not easy to reduce the erosion and sediment control in the mountainous area.

Table 6.5-17 Major Problems of NRWGO’s Project Implementation

Major Problem	What causes the Problem	What will Happen as the Result
1. Not understand the erosion mechanism and take conventional measures only	Due to not enough NRWGO experts’ capacity and none-pliable mind set	Inefficient countermeasures are taken and not work well.
2. Targeting limited places and do not take measures for whole phenomenon	Not enough and unstable budget allocation influences to this. However, also, NRWGO staff members’ low capacity is related because they usually focus in just a part of erosion phenomenon.	The implemented countermeasures don’t work well because upper-side or/and lower side of target are not treated. Treated place can be stop erosion, but the place will be degraded by the following sediment and water by upper stream or erosion on the lower-side.
3. No maintenance: no repair, no additional construction on once implemented place	First, NRWGO doesn’t have such budget. And they don’t have right knowledge of monitoring and maintenance work on the existing structures.	Most of the materials used for the mountainous countermeasures are stone, bush, log, fence, etc. and they are aged and degraded after some years. They will be broken easily after some years because no maintenance. Only small additional work can help to keep the structures longer time though.

Source: JICA Expert Team



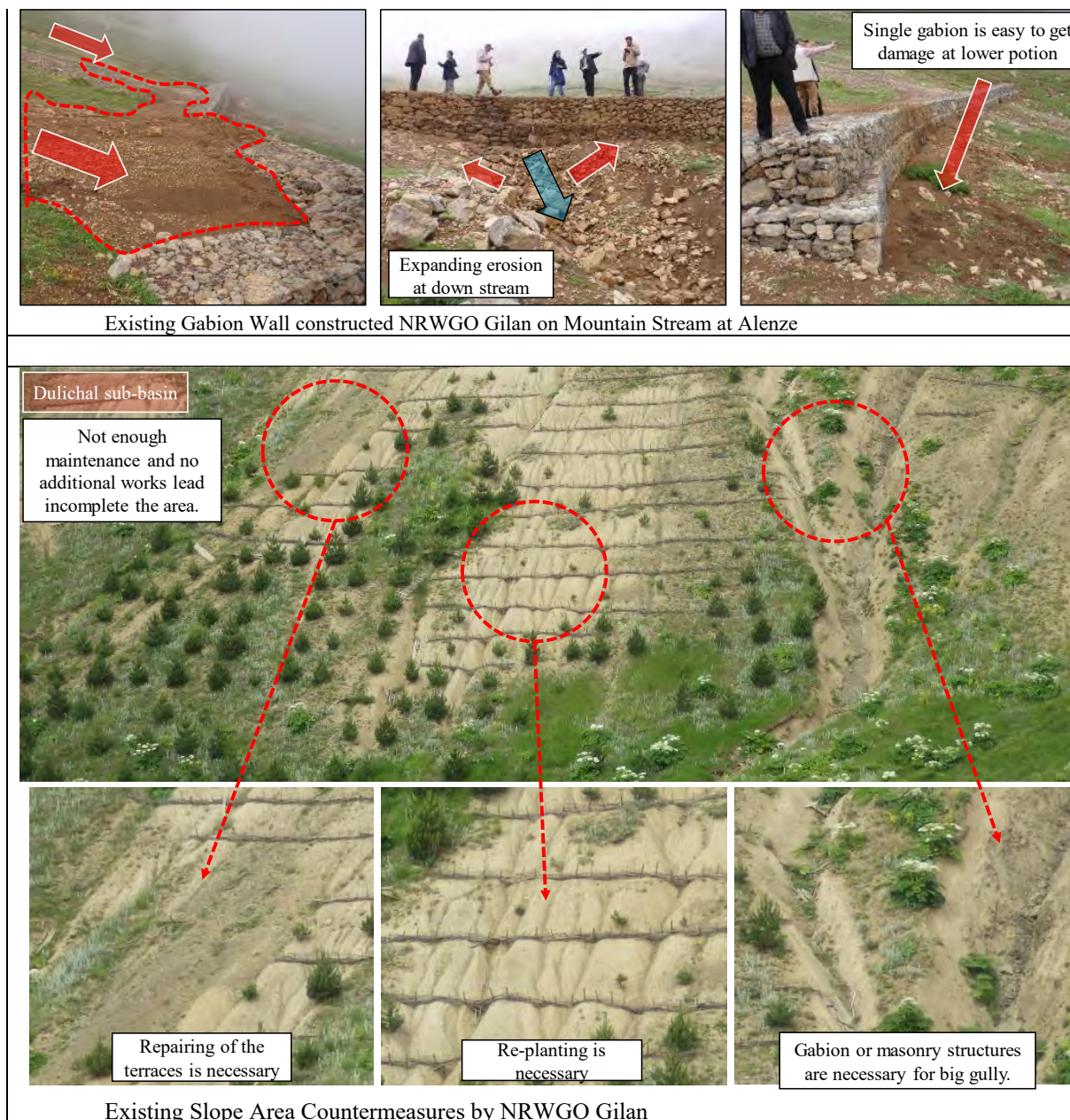


Figure 6.5-16 Typical Problems of NRWGO Gilan’s Countermeasures

5) Project implementation capacity of NRWGO Gilan

The achievement of study, DD survey, construction project by the NRWGO Gilan recent years is confidential but the outline of the number of project and total budget amount per year was provided below.

- Average of number of projects per year: 13 [Projects]
- Average of budget per project: 729 [Million Rial]

The number of project per year is much variety from 6 to 28 and each project’s budget is too from 10 million Rial to 7 billion Rial. However, most of the project budget is small, just a few

big budget projects increase the average. The construction scale can be shown by the project amount and the JPA 2017 at Alenze costed about 7 Billion Rial without DD survey and construction Supervision. If these are included, the project total cost was about 10 Billion Rial per year.

On the other hand, the covering area by the JPA 2017 at Alenze is only a part of necessary areas in the target area, 100 ha. There are 16 project areas in the target area and 2 project areas can be carried out per year. Therefore, 10 Billion Rial can cover only 1/8 of 100 ha, it comes about 13 ha.

If the sever eroded area will be recovered fully, such large amount of budget is required. And in Anzali Wetland basin, there are 25 thousand ha of such erosion risky areas.

It is very clear that “Based on the current” NRWGO Gilan’s capacity, both capacities of implementation and budget are not enough.

(2) Issues and solution to resolve the problems above

The capacity development of NRWGO Gilan was considered to be necessary to resolve the problems described above (1).

Therefore, the JICA Project has tried to develop and improve the C/Ps capacity through JPAs. The JPAs aimed to assist Iran C/Ps capacity building step-wise approach such as, i) integrated study on a model river basin, ii) selection of prior areas, iii) whole countermeasure planning of the selected area, iv) detailed survey on the target area, v) construction implementation and supervision of construction, and vi) monitoring and maintenance work. The series of JPAs can be said as “Alenze Model” which shows direction and details of study, planning, design, construction, supervision and maintenance. All the works have been described in detail by “Completion Report on Construction Work for Mountainous Erosion Control at Alenze Sub-Basin of Masal River Basin in 2017”, which was prepared by NRWGO Gilan and Nippon Koei, submitted to the Project board on May 2018 as a part of the progress report.

(3) Policy of Erosion and sediment control at mountainous area

Based on the analysis above, the basic policy of the mid-term plan for the mountainous area is described below.

1) Capacity development of NRWGO Gilan is the first priority

As described above, the area where NRWGO Gilan shall tackle is too huge compared to the “current NRWGO Gilan’s capacity” and preparation of the Mid-Term-Plan based on the necessary amount doesn’t make sense, because the gap between necessary areas/amount and available amount by NRWGO Gilan is too much.

However, during the JICA technical cooperation project, some of C/Ps' capacity was been developed and they can take systematic project implementation if they will follow the Alenze model which is described in Chapter 6.5.2 (5). The trained C/P of NRWGO Gilan and also the WSM-SM members can help the other NRWGO staff members to implement the future projects by following the Alenze model.

Thus, the period of the mid-term plan (2020 to 2030) will be used for the capacity development of the staff members of NRWGO Gilan by the trained C/Ps of the JICA Project.

The possible project implementation amount shall be developed by the capacity development of the staff members. Therefore, the implementation amount of the project in this mid-term plan (2020-2030) can be revised at the end of the period based on the achievement of 10 years from 2020.

In this reason, the target amount to be recovered by the plan is prepared base on the “current capacity of NRWGO Gilan”.

- 2) Planning and design making based on well understanding of the erosion and sediment flow mechanism

The Alenze JPA 2017 shows good example for this. The soil block located upper side of the road was estimated to be transported from upper stream and piled with not consolidated condition. Therefore, the it was eroded much by water and sediment flow by every rainfall. By the Alenze model, all structures were designed to control water and sediment flow and succeeded. If a conventional structure distribution such as single check dam only, it can't control the water flow and erosion on the soil block would be expanded, and finally, the check dam would be broken by unstable basis. Therefore, “cause analysis” is one of the most important consideration.

- 3) Whole area covering

The stream area extends from lower to upper. If the lower and upper segments of JPA 2017 will not treated, the constructed area will get damage much and finally it will be degraded and broken. The structures will function by series of structures from lower to upper.

The slope area was divided into 6 areas based on the possible construction area but all the divided areas are connected. If only one block will be constructed, the erosion on the non-treated areas will develop continuously.

Once we start the construction to control erosion and sediment, whole target area shall be treated completely even if it takes several years.

- 4) Keep monitoring on the constructed structures

The structures are always facing to the natural power such as unusual flash flood, hard run-off. Then, most of the cases, once the structures function against such natural phenomenon, the

structures would get damage. Especially, due to necessity of keeping sustainability, most of the material for the structures are not strong one, which can be supplied normally. Therefore, all structures cannot escape from damage. Based on understanding this, once any damages will be found, the structure shall be repaired or some structures shall be added to keep the stability.

Monitoring after the construction is quite important in this regard.

5) Concentration on target area

When we checked the achievements of NRWGO Gilan, there are many small scaled projects such as, only a few gabion check dams. The scale of JPA 2017 at Alenze was one of the biggest projects but even JPA 2017 scale 8 years will be necessary to complete one sub-basin. And as described above, once treatment will start at an area, whole countermeasures shall be completed, otherwise, remaining area will damage on the constructed structures.

Thus, in the Mid-Term Plan, scattered small projects will not planned but small number of areas will be covered.

6) Systematic work, using out source

Also, related the construction work, pre-construction (DD survey), construction supervision (SV) are necessary. And NRWGO Gilan has been working for all by own staff members for these. However, JPA 2017 Alenze showed and obtained proof of the efficiency by using out sources, the procurement of the consultants with much expertise can realize accurate works. the task of the NRWGO Gilan staff member is supervise the whole works at the higher view point. If all works in this plan will be implemented by the staff members of NRWGO Gilan directly, after the senior experts will retired, NRWGO will not able to implement the works. however, if they will follow the Alenze model, using out source, they can expand the amount and quality of the works.

(4) Planned implementation amount

Based on the principle policy described above, the planned implementation amount is estimated below.

- The maximum number of target river basin is three (3) per year.
- At the beginning of treatment on one river basin, the integrated planning study shall be carried out. The study will be carried out by NRWGO or GRWC with assistants by the WSM-SC.
- After the selection of the target area, DD survey shall be implemented by NRWGO and the construction documents shall be prepared.
- During the construction, also the supervision work shall be taken by out-source.
- The project area per one target area per year is about 1 to 2 ha.

- The project budget includes DD survey, construction, and supervision work, and the yearly project cost is approx. 10 Billion Rials.

The outline of the Mid-Term-Plan (mountainous area) implementation schedule is shown below.

River Basin	Target Area	JICA Project				19	Mid-term plan												
		15	16	17	18		20	21	22	23	24	25	26	27	28	29	30		
Masal	Alenze	ITG	DD	1	2	3	4	5	6	7	8								
Masule	Dulichal		ITG		DD	1	2	3	4	5	6	7	8						
Pishroudbar	**						ITG	DD	1	2	3	4	5	6	7	8			
Palangvar	**										ITG	DD	1	2	3	4	5		
Bahambar													ITG	DD	1	2	3		
Pasikhan															ITG	DD	1		
Pribazar																			
Khonamroud																			
Chafroud																			

Note: ITG= Integrated Planning Study, DD= Detailed design survey, 1~8: Construction No.1 ~No.8
 Source: Based on the discussion and agreement by WSM-SC members, JICA Expert Team prepared.

Figure 6.5-17 Outline of Implementation Schedule of Mid-Term Plan (Mountain Area)

(5) Alenze Model

The JPA 2017 at Alenze was construction activity but the integrated study, prior area selection, detailed design (DD) survey were carried out before that and maintenance work was done after constructions. When Iranian side will take erosion and sediment control in mountainous area, the all activities related to the JPA Alenze 2017 is very good practice. Therefore, the JICA project prepared the completion report of JPA Alenze 2017, which can be referred at any stages.

In this regards, all series of activities from the integrated study until monitoring is designated as “Alenze Model” in this report. The Alenze model is described below.

1) Procedure of planning, design and implementation

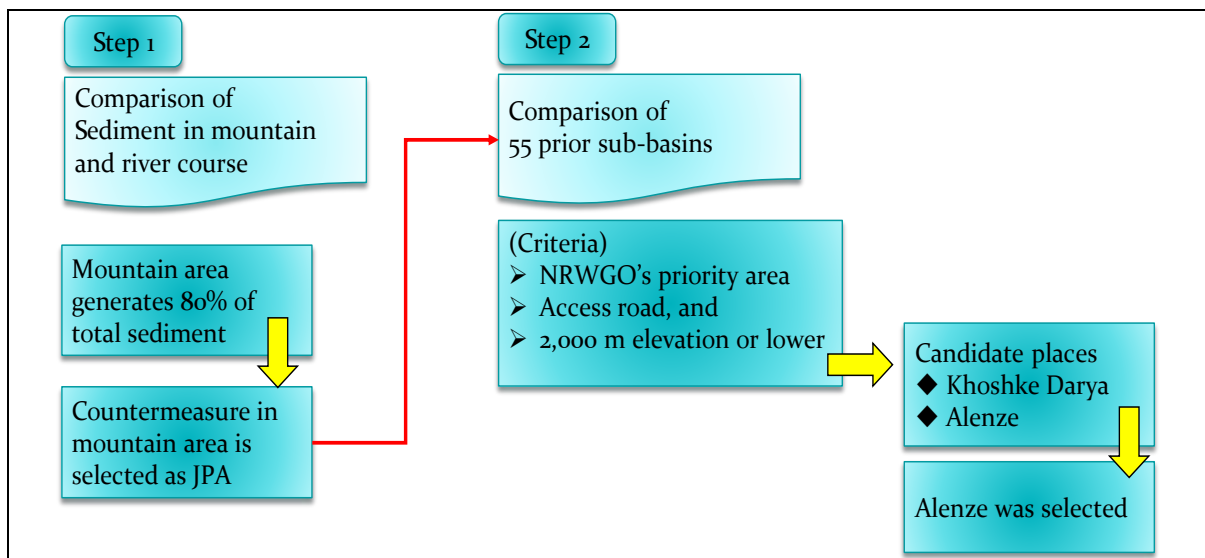
The procedure of planning, design and implementation (construction) of Alenze model is described below.

(a) Integrated study

The integrated planning study aims to i) collect information in the target river basin include erosion and sediment amount, ii) analyze mechanism of sediment generation and discharge, and classify all sub-basins’ risk of erosion and sediment discharge, iii) prepare basic countermeasure policy to erosion and sediment control for the whole basin, iv) prepare basic countermeasure policy for characteristic divisions, v) prepare structure planning for whole area, and identify priority of sub-basins, vi) prepare cost estimation, and vii) prepare long/ mid/ short term planning. The integrated study on Masal River Basin which was carried out by the JICA Project can become a good practice.

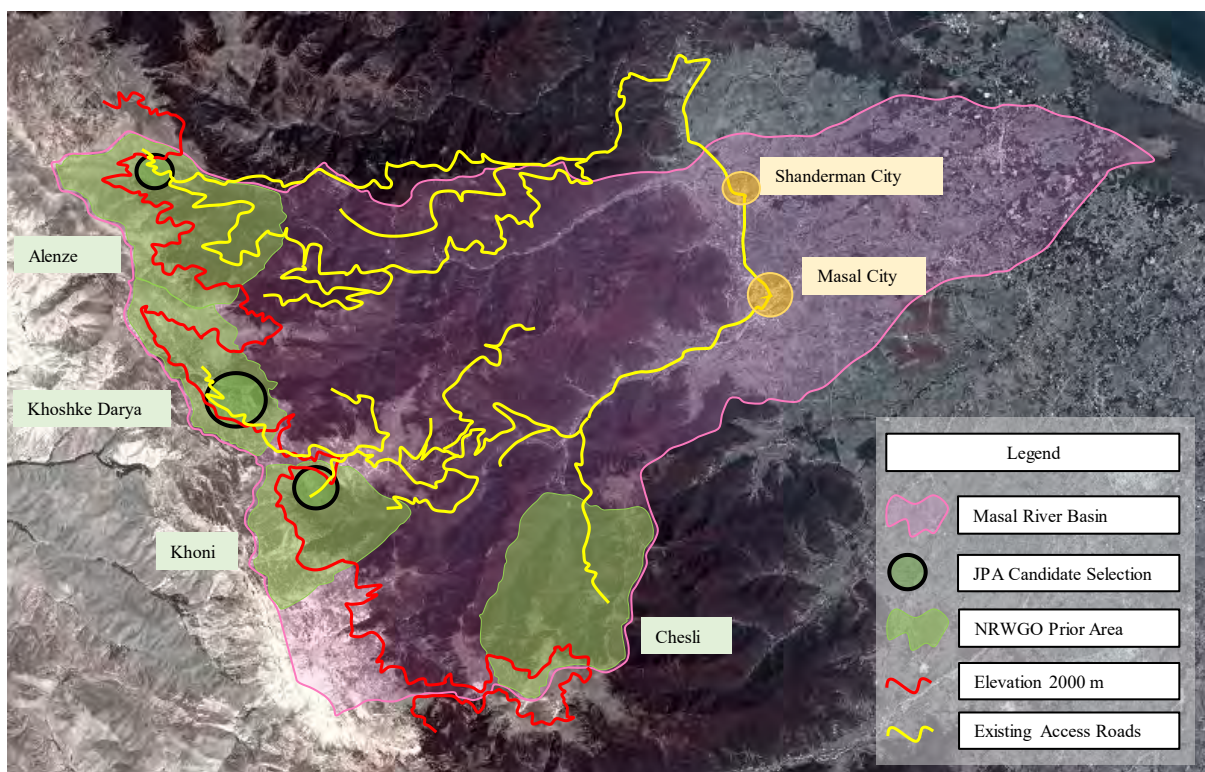
(b) Picking up prior area

After the integrated study above, WSM-SC considered which areas we would need to take countermeasures. The WSM-SC used some criteria for selection, selected three prior areas, took several site visits on the prior area to confirm the condition, and select the first prior **sub-basin (Alenze)**. The procedure of selection the prior area was shown below.



Source: JICA Expert Team

Figure 6.5-18 Process of Selection of the First Target area

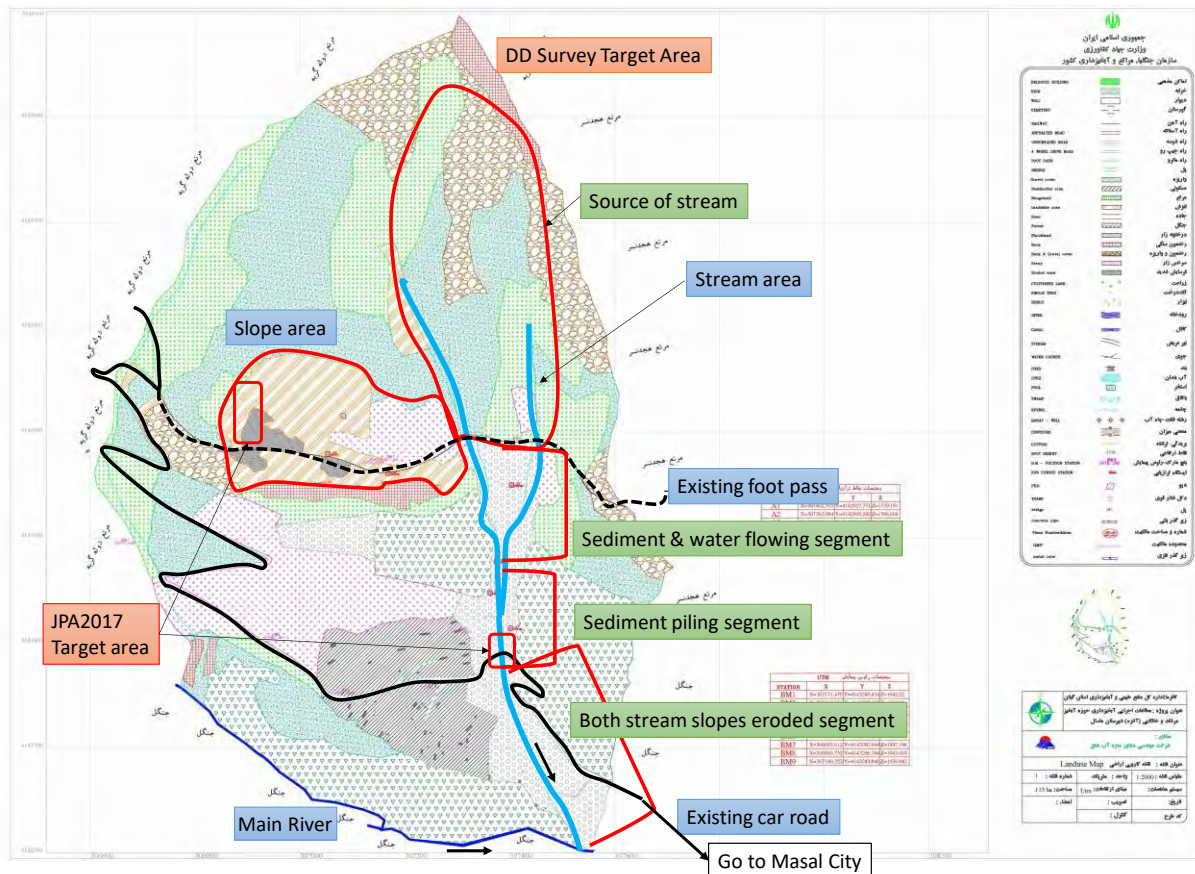


Source: Prepared by JICA Expert Team using Satellite Image: Land Sat ETM (Feb. 2016)

Figure 6.5-19 Candidates of Target Area in Masal Basin

(c) Whole planning on Alenze sub-basin

The whole planning was included in the detailed design survey (DD), which was carried out in 2016, one year before the construction. The target areas can be divided into two areas, the slope area and the stream area. The stream area extends from upper stream to the downstream and it was divided into 4 segments based on its erosion and sediment flow character. The design policy, which describe what countermeasure would be necessary for each, was considered. Then, outline of structures distribution was prepared on the drawings. That was reported by the Detailed design survey, which was carried out by NRWGO Gilan’s supervision and budget.



Source: Prepared by JICA Expert Team using the base map, which was prepared by the DD survey in 2016.

Figure 6.5-20 Classification of Slope Area & Stream Area

(d) Prioritization of each segment and yearly construction area

The stream area was divided into 4 types of segments and prioritized as table below.

Table 6.5-18 Construction Priority of each Segment in Stream Area

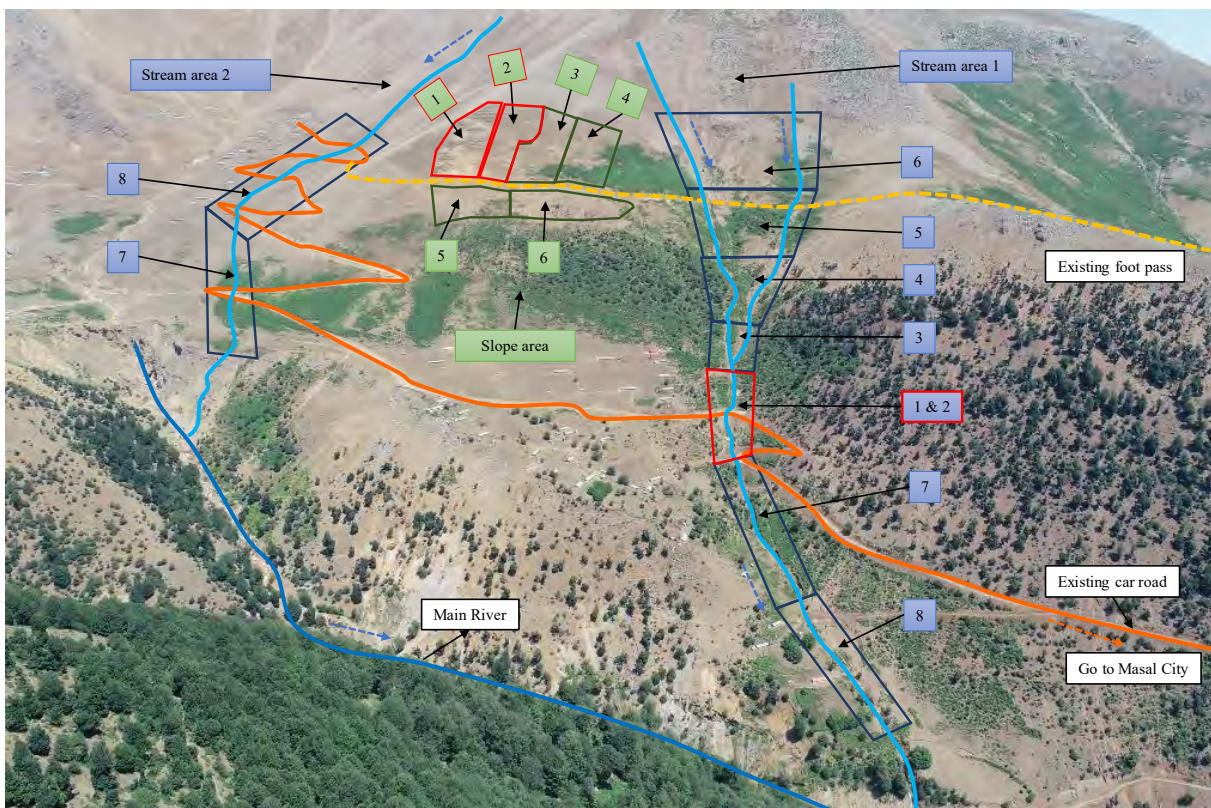
Segment	Priority (A>B>C)	Reason of priority
(1) Source of stream	C	Annual erosion amount is not much. The cost performance is not good due to bad workability. The countermeasures on the lower portion of the stream can reduce the amount of sediment.
(2) Water/ sediment flowing segment	B	This segment is second priority from the aspect of workability.
(3) Sediment piling segment	A	Urgency and erosion risk are much high. Piled soil is always eroded and the soil block itself is going to be unstable.
(4) Both slope eroded segment	C	Urgency is slightly high. But the erosion reducing is expected by the countermeasures at the upper stream area.

Source: JICA Expert Team

(e) Yearly construction planning

There are 2 streams and 1 slope area. Yearly plans are considered as below.

- Stream 1 is divided into 8 yearly plans,
- Stream 2 is divided into 2 yearly plans, and
- Slope area is divided into 6 yearly plans.



Source: JICA Expert Team (Picture: JICA Expert Team took the photograph by drone.)

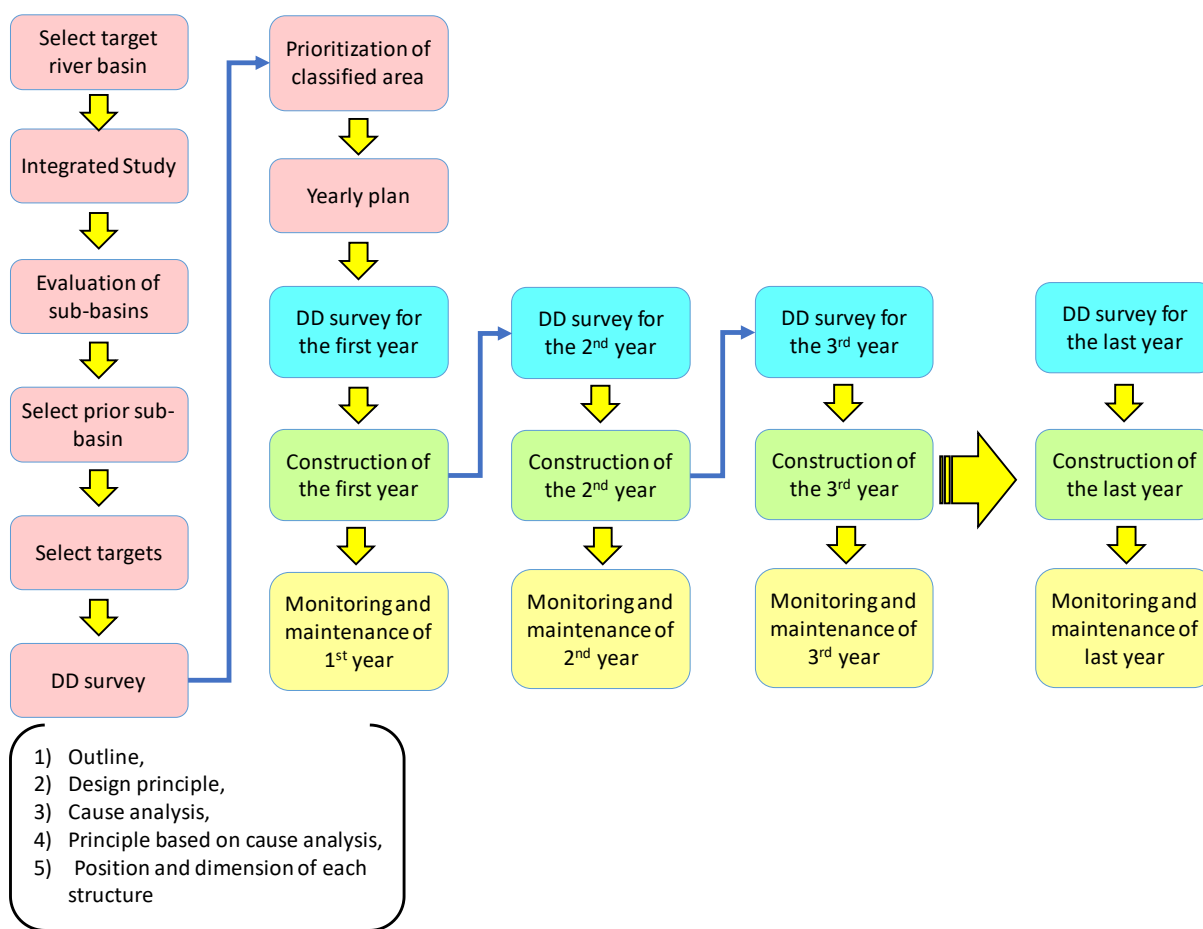
Figure 6.5-21 Yearly Plan of Whole Alenze Area

(f) Detailed design survey for each year

The DD survey is composed with 1) outline, 2) design principle, 3) cause analysis, 4) principle based on cause analysis, and position and dimension of each structure. These considerations are required for every DD survey. And drawings, volume calculation, and cost estimation will be carried out. In addition, when dimension of the structures design, some calculation such as stream discharge analysis, wall stabilization calculation shall be carried out.

1) Structure and cycle of Alenze Model

Alenze model is one of guideline of works for erosion and sediment control at the mountainous area. The procedure of Alenze model is shown in figure below.



Source: JICA Expert Team

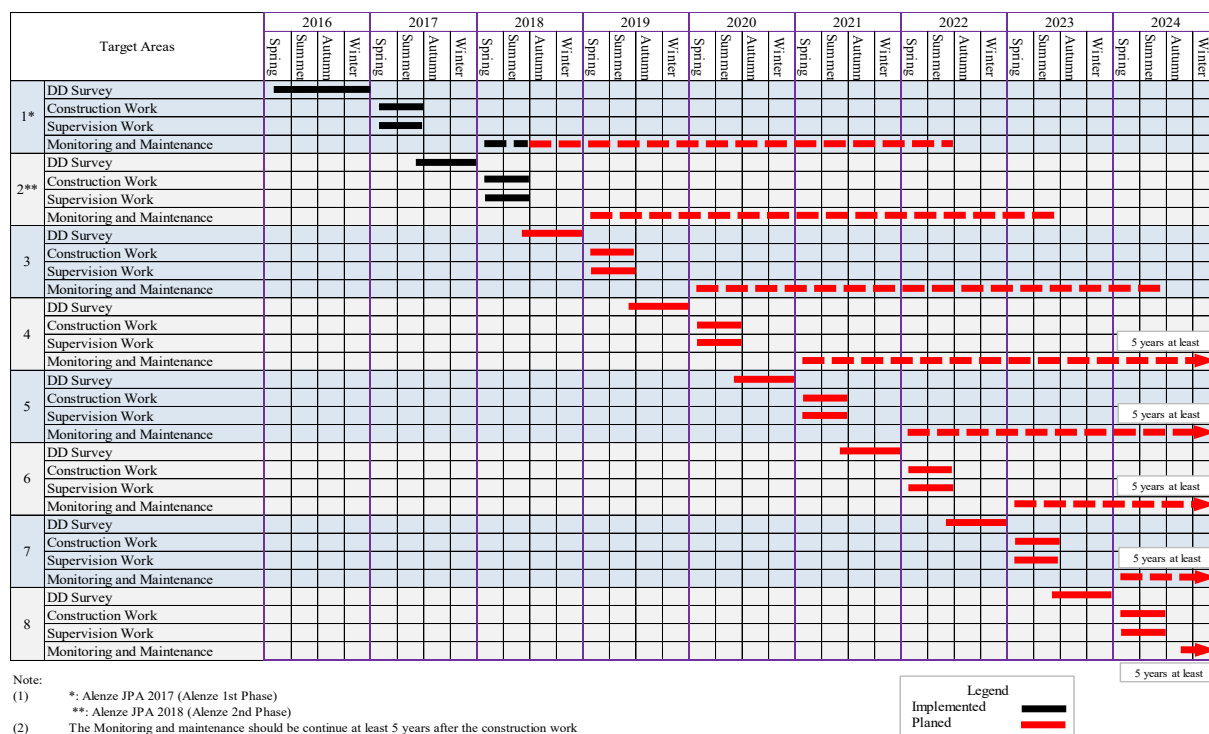
Figure 6.5-22 Alenze Model Procedure

2) Plan of Alenze Model

The Alenze model has started in 2015. The integrated study was carried out followed by the DD survey of i) the whole target area and ii) construction documents of the stream area-1 No. 1 & slope area No. 1. In 2017, the construction was carried out with supervision work and during the construction, the DD survey for the next year was carried out. It is noted that the condition at the site will change every year; therefore, the DD survey for the next year construction shall be taken during the construction. After finishing the construction on the No. 6 of the slope area

and No. 6 of the stream area-1, No. 7 of stream area-1 and No. 1 of stream area-2 will be implemented and finally, No. 8 of stream area-1 and No. 2 of stream are-2 will be carried out in 2024. Then, it can be said that the target areas of Alenze sub-basin will be completed.

The detailed schedule of Alenze model is shown below.



Source: JICA Expert Team

Figure 6.5-23 Alenze Model Implementation plan

(6) Mid-Term-Plan for Mountain Area

1) Priority sequence on 10 river basins

Based on the outline of Implementation Schedule of Mid-Term Plan (Mountain Area) (Table6.5-19) and Figure above, whole implementation schedule is prepared in AttachmentF6.5.2-1. The order of priority of 10 river basins is shown in Table 6.5.1-5. The table is shown here again.

Wetland Area	Seq.	River Basin	Remarks
Siahkeshim	1	Masal	Morghak River basin and Khalkai River basin
	2	Masule	
	3	Pishroudbar	
	4	Palangvar	
	5	Bahambar	
East Wetland	6	Pasikhan	
	7	Pirbazar	
	8	Khomamroud	
Abkenar	9	Chafroud	

Source: JICA Expert Team

The priority order of the river basins above is used for the mountain area too. In the aspect of mountainous area conservation, different priority order was proposed by NRWGO Gilan. However, the Mid-Term-Plan is prepared for the Anzali Wetland conservation but not for the mountainous area conservation. As the results of the WSM-SC discussion, the priority order shall be considered by the wetland conservation aspect. Therefore, the order above is used for the mountain area plan too but in case of not much erosion risky area in the planned river basin will be found, the mid-term plan shall be considered to be revised.

2) Policy of Mid-Term Plan in Mountain Area

The policy of Erosion and sediment control at mountainous area, which is described in Chapter 6.5.2 (3) above is also used for the policy of Mid-Term-Plan. The policy is summarized below.

➤ **Capacity development of NRWGO Gilan is the first priority**

The main purpose of the Mid-Term-Plan in mountain area is NRWGO's capacity development, which can realize the acceleration of implementation of countermeasures in the mountain area in the next decade.

➤ **Planning and design making based on well understanding of the erosion and sediment flow mechanism**

Previous NRWGO's planning, design and construction were carried out based on the experts' experiences but not well understanding on the erosion mechanism. Therefore, in the Mid-Term-Plan, each planning and design shall be prepared with well-understanding of the mechanism.

➤ **Whole area covering**

NRWGO Gilan shall continue the implementation on a target area until whole planned countermeasures will be completed.

➤ **Keep monitoring on the constructed structures**

After construction, the monitoring and repair works shall be taken if any at least 5 years to keep the structures work.

➤ **Concentration on target area**

In order to complete the target area, scattered small projects are not used. Such as Alenze model, yearly work amount shall be kept at the site.

➤ **Systematic work, using out source**

Systematic work such as step-wise work flow; integrated study, prior area selection, whole planning of the target area, DD survey, construction with supervision work, and monitoring. The series of works shall be taken for each target area. And the study, DD

survey, construction and supervision shall be carried out by out-sources. The direct implementation of the project by the NRWGO Gilan experts has limitation and it is not possible to expand the work amount.

3) Objectives of the Mid-Term-Plan in mountain area

As the first point of the policy, the main purpose of the Mid-Term-Plan is set as NRWGO Gilan staff members capacity development through actual project implementation using Alenze model and assistants by developed C/Ps and WSM-SC during the JICA technical cooperation project.

The areas where the erosion and sediment control shall be taken in Anzali Wetland basin is too large and objective target amount doesn't make sense based on the current situation. Therefore, after the Mid-Term-Plan duration (2020-2030), with enough capacity will be developed and objective target amount for the next mid-term-plan will be considered.

4) Countermeasures of Mid-Term-Plan in mountain area

The countermeasures aim to control and reduce the erosion and control the sediment flow including water flow control. There structures distribution will be considered based on the erosion and sediment condition at the site. The plan aims to develop NRWGO Glans's capacity, the erosion mechanism understanding during the planning and design is the most important. Most of the case, the erosion is cause by water flow, run-off and snow moving or melted snow. NRWGO Gilan shall refer to the Alenze model and prepare the plan and design.

Also, the construction material will be developed in order to keep the structures longer than previous time. Most of the structures are constructed by gabion currently but masonry structures usage will be considered much more than before in the Mid-Term-Plan period.

5) Cost of Mid-Term-Plan in Mountain Area

Based on the achievement of Alenze and Masule area construction, each cost for the project is estimated below. The unit cost of the Mid-Term-Plan is estimated including 38% price escalation. 38% is calculated based on the average rate of price escalation (7% per year).

Table 6.5-19 List of Unit Cost of Mid-Term-Plan in Mountain Area

Item	Cost (Achievement): Base unit cost	Cost (Plan) [Million Rial]
Integrated Study	5 billion Rial	6,900
DD survey for whole target area (100 ha)	600 million Rial	828
DD survey for every year	200 million Rial	276
Construction foe every year	8 billion Rial	11,040
Supervision work for construction	600 million Rial	828
Monitoring and Maintenance	200 million Rial	276

Source: JICA Expert Team

The total cost of the Mid-Term-Plan is estimated about 393 billion Rial. The detailed cost estimation is prepared based on the outline of implementation schedule using the unit cost above. The detailed cost estimation is shown in Attachment T 6.5.2-1. Table below shows the summary.

Table 6.5-20 Summary of Cost of Mid-Term-Plan in Mountain Area

(Unit: million Rial)

River Basin	Year: 2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Masal	12,420	12,420	12,420	12,420	12,144	276	276	276	276	276	0	63,204
Masule	12,420	12,420	12,420	12,420	12,420	12,420	12,144	276	276	276	276	87,768
Pishroudbar	6,900	1,104	12,144	12,420	12,420	12,420	12,420	12,420	12,420	12,144	276	107,088
Palangvar	0	0	0	0	6,900	1,104	12,144	12,420	12,420	12,420	12,420	69,828
Bahambar	0	0	0	0	0	0	6,900	1,104	12,144	12,420	12,420	44,988
Pasikhan	0	0	0	0	0	0	0	0	6,900	1,104	12,144	20,148
Total	31,740	25,944	36,984	37,260	43,884	26,220	43,884	26,496	44,436	38,640	37,536	393,024

Source: JICA Expert Team

6.5.3 Role of WSM-SC and the members

(1) Performed Role and Future Tasks of WSM-SC

The Anzali Wetland basin can be classified into 3 main area, mountain area, main river course and wetland area. Table 6.5.3.-1 to 3 show 1) the roles which the implementation agencies, WSM-SC, SC members and JICA Expert Team played for some projects, which was conducted under the WSM-SC, 2) review results of them, and 3) recommendations based on the review results. The summaries of the tables are shown below.

I) Mountainous area

Implementation agency (I.P. A)	NRWGO
Project purpose	Sediment generation and sediment control in the mountainous area
Role of I.P.A.	Explanation of study results, plan, etc. to the WSM-SC
Role of WSM-SC	Examination and verification of the projects by each member except DOE
Role of JICA Expert Team	Technical advice and facilitation of the discussion
Review results	All members played own roles properly except DEO
Recommendation	Functions of current WSM-SC shall be kept and improved. Examination and verification of the projects from the aspect of environment by DEO shall be strengthened. NRWGO is the I.P.A.; therefore, it is not appropriate that NRWGO will examine and verify the project. The third party/ person, who has same or much technology capacity as same as I.P.A., is required to join to WSM-SC instead of JICA Expert Team.

II) Main river course

Implementation agency (I.P. A)	GRWC
Project purpose	Sediment generation and sediment control in the main river course
Role of I.P.A.	Explanation of study results, plan, etc. to the WSM-SC
Role of WSM-SC	Examination and verification of the projects by each member except DOE
Role of JICA Expert Team	Technical advice and facilitation of the discussion
Review results	All members played own roles properly except DEO
Recommendation	<p>Functions of current WSM-SC shall be kept and improved. Examination and verification of the projects from the aspect of environment by DEO shall be strengthened. GRWC is the I.P.A.; therefore, it is not appropriate that GRWC will examine and verify the project. The third party/ person, who has same or much technology capacity as same as I.P.A., is required to join to WSM-SC instead of JICA Expert Team.</p>

III) Wetland area

Implementation agency (I.P. A)	DOE Gilan
Project purpose	Sediment control into the wetland area
Role of I.P.A.	Explanation of study results, plan, etc. to the WSM-SC
Role of WSM-SC	Examination and verification of the projects by each member
Role of JICA Expert Team	Technical advice and facilitation of the discussion
Review results	All members played own roles properly except DEO
Recommendation	<p>Functions of current WSM-SC shall be kept and improved. The WSM-SC is recommended to discuss the options and decide the most appropriate way from them: i) DOE will procure some excellent experts for the civil engineering work, ii) the WSM-SC members will provide special support or iii) the other organizations will implement the project. The most important DOE's roles are i) decide the direction of conservation and development of the wetland and ii) monitoring the results of the projects.</p>

Table 6.5-21(1) Achievements, Role of Implementation Agency, WSM-SC, SC Members and JET, Review & Evaluation, Recommendation 1 (Projects implemented by NRWGO)

Target Area: Mountainous area, Implementation agency: NRWGO

Achievements during JICA Project	Review and Evaluation	Recommendation
Major Activities		
<p>(Projects under JICA Contract): Integrated watershed planning study for erosion and sediment control in Masal River basin Construction and construction supervision of structures for erosion and sediment control in Alenze (Phase-I) (Projects under NRWGO) DD survey of Alenze (Phase I & II) Construction and construction supervision of structures for erosion and sediment control in Alenze (Phase-II) DD survey in Masule area (Another project) Mid-Term-Plan preparation. 10 years plan preparation of the mountainous areas in Anzali Wetland Basin</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The erosion and sediment control plan based on the mechanism of erosion and sediment flow was prepared. It was the first time to prepare the integrated watershed plan in Anzali Wetland Basin. Erosion and sediment control construction in the Mountainous area of Alenze: the important procedure such as starting by target are selection, outline structures distribution plan, DD of the target year, construction, monitoring and maintenance, was shown clearly. It was transferred to Iranian side by the JICA Expert Team experts. Mid-Term-Plan: The huge gap between the necessary amount of implementation and estimated actual capacity of NRWGO was recognized for the next decade. Therefore, the enhancement of NRWGO's capacity is set as the main target under the plan. And also, their enhanced capacity will be able to realize the next 10 years activities. The Mid-Term-Plan shows the roadmap for next 10 year.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: It was the first time to prepare the plan in Anzali Wetland Basin and it shows a model of erosion and sediment control. It can be trusted the meaningfulness of the planning. Same planning for remaining river basins shall be implemented referring to the model. 1) All the procedures (steps) such as, starting by study flowed by planning, DD survey, construction, monitoring, maintenance, show the focusing method from macro view point to micro. 2) the construction supervision method shows the way of the effective construction, and 3) the monitoring and maintenance shows how to keep and fulfill the functions of the structures. All these procedures, methods shall be established and improved. The Mid-Term-Plan shall be implemented with some modification if any.</p>
Roles fulfilled by Implementation Agency (NRWGO)		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: verify the results of the study, discussion of the results with the consultant Construction and construction supervision of structures for erosion and sediment control at Alenze (Phase-I & II): Preparation of plan, design, and construction. Explanation of the plan of Phase-II to the WSM-SC independently and referred the evaluation results by the SC into the project. Mid-Term-Plan (MTP): Plan of erosion and sediment control in the mountainous area for next 10 years with JICA Expert Team advising.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The study TOR was prepared by NRWGO and GRWC mainly with JICA Expert Team advising. NRWGO and GRWC acquired the skill of identification of the problem and issues and solution on the view point of whole watershed through TOR preparation and study implementation. Construction and construction supervision of structures for erosion and sediment control at Alenze: The important image of concentrated investigation on one selected prior area and mostly completed condition was fostered. It was highly evaluated that the Iranian side implemented the DD, construction, construction supervision for Phase-II by themselves. The roles of NRWGO during next 10 year was shown in the MTP, and it was understood by the WSM-SC members.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: NRWGO is expected to own the responsibility of study, design at the mountainous area, also to verify the matters technically. By the improvement of NRWGO's capacity through the JPAs at Alenze, more effective structures distribution has been available. At the first, it is expected to concentrate on Alenze and finish the area mostly. For the project at Masule area, improvement and establishment of the techniques of erosion and sediment control referring to the Alenze project are expected. It is expected that NRWGO will improve both of their work quality and quantity by securing the step-by-step procedure, which was leaned through JICA project.</p>
Roles fulfilled by WSM-SC		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: SC verified and discussed the results of study, then confirmed the appropriateness of them. Alenze Construction (Phase-I and II): SC discussed the countermeasures, method of</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The discussion tended to be only between NRWGO (mountainous are) and GRWC (River course) but the other members joined with its specialty such as recommendation on the aspect of geology by the Geo-Center. Such discussion using their specialty was highly evaluated.</p>	<p>The discussion and verification by the WSM-SC using each members' specialty is recommended to be continued. The environmental and social impact consideration on the construction was carried out by NRWGO with advising by JICA Expert Team. However, the other members, especially DOE, which</p>

Achievements during JICA Project	Review and Evaluation	Recommendation
<p>supervision of the construction and method of quality securement on each stage from design to construction. WSM-SC contributed to the success of the construction based on the verification of appropriateness of the project. Especially, the WSM-SC explained the project appropriateness of the Phase-II based on the effects of Phase-I to AWMC and contributed to budget securement of Phase-II. The WSM-SC verified the method of plan preparation of MTP in the mountainous area.</p>	<p>Alenze Construction: The environment and social impact consideration was explained by NRWGO as follows. 1) The project tries recovery the natural environment; therefore, the project would not cause the natural environment impact, and 2) the stakeholders' meeting was held with the people using the grazing area in the target area as the social impact consideration. And there were no objections from them. The WSM-SC confirmed effectiveness of the project at Alenze and necessity of continuing it; therefore, WSM-SC explained the necessity of the project Phase-II and projects after it to AWMC. MTP: WSM members understood the Gap between work amount, which NRWGO shall carry out, and their capacity. Then, they understood the gap correctly. It is very meaningful.</p>	<p>responsible organization, didn't take the responsibility. It was evaluated much bad and shall be improved. The WSM-SC will verify the appropriateness of a project related to the sediment control in the case of request by AWMC. This basic concept was understood by the SC members through the JICA project. The basic role of the WSM-SC shall be continued. It is expected for the WSM-SC members to continue understanding the problems and issues of the Mid-Term-Plan (mountain area).</p>
<p>Roles fulfilled by SC members</p>		
<p>GRWC: hydraulic & structural verification, verification of structure distribution plan in the main river course / MOJA: Structural verification These 2 organizations verified and recommended based on their own experience. Geo-center: geological verification</p>	<p>Verification and recommendation by GRWC, MOJA and Geo-Center with their own specialty are much evaluated. DOE shall be criticized severely, because DOE has never fulfilled their role of environment and social consideration on the projects.</p>	<p>It is highly recommended that each SC members fulfill each role with their specialty. The role which DOE didn't fulfill shall be improved much. In case DOE has no capacity, it is recommended to introduce the third organization and its verification.</p>
<p>Role fulfilled by JICA Expert Team</p>		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: 1) Technical supports the implementation agencies (NRWGO & GRWC), i) TOR preparation, ii) management of study, iii) inspection of the results. 2) Facilitation of the discussion Alenze Construction: technical supports planning of the whole target area, yearly planning, the series of works (plan – design – construction & supervision - inspection) Support Mid-Term-Plan Preparation</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The study based on the understanding the sediment aspect has not been carried out before the Study. The importance of study was understood by the WSM-SC members and it is highly evaluated. It is estimated that the SC will able to continue this type of study. The technical support on the Alenze construction was much effective. It was worthy of high praise that NRWGO implemented the Phase-II by themselves. The setting the main purpose of Mid-Term-Plan, which capacity development of NRWGO, based on objective evaluation of NRWGO's capacity is highly evaluated.</p>	<p>JICA Expert Team kept the neutral position in the WSM-SC and facilitated the discussion. NRWGO will take over the position after the JICA project. On the other hand, it is difficult for NRWGO to keep the neutral position for the verification of the NRWGO project. Therefore, introducing the third party which will fill the position of JICA Expert Team and facilitate the discussion is highly recommended. For each project verification, introducing some appropriate technical experts instead of JICA Expert Team is highly recommended.</p>

Source: JICA Expert Team

Table 6.5-21(2) Achievements, Role of Implementation Agency, WSM-SC, SC Members and JET, Review & Evaluation, Recommendation 2(Projects implemented by GRWC)

Target Area: main river course, Implementation agency: GRWC

Achievements During JICA Project	Review and Evaluation	Recommendation
Major Activities		
<p>(Projects under JICA Contract): Integrated watershed planning study for erosion and sediment control in Masal River basin (Projects under GRWC): planned DD survey of Morgahk River Basin (Another project) Mid-Term-Plan (MTP) preparation. 10 years plan preparation of the main river course in Anzali Wetland Basin</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The erosion and sediment control plan based on the mechanism of erosion and sediment flow was prepared. It was the first time to prepare the integrated watershed plan in Anzali Wetland Basin. DD survey of Morgahk River Basin: following contents were considered and prepared; i) design policy, ii) structures distribution plan for whole course, iii) appropriate construction amount per year, iv) division of construction segments, v) construction order, vi) construction segment for the first year, vii) TOR of DD survey for the first-year construction. The works above are much effective for GRWC to carry out the main river course development to control the sediment in near future. Also, GRWC's capacity was much developed through this work. MTP: The Long-Term-Plan shows all necessary structures amount for all river basins, necessary amount of the study, DD survey, and construction were estimated. The MTP shows the amount for coming 10 years. Such road map has never been prepared before; therefore, MTP is highly evaluated.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: It was the first time to prepare the plan in Anzali Wetland Basin and it shows a model of erosion and sediment control. It can be trusted the meaningfulness of the planning. Same planning for remaining river basins shall be implemented referring to the model. DD survey of Morgahk River Basin: GRWC will able to prepare the DD and construction plan using the prepared TOR. It is recommended to keep such method and established in GRWC. It is recommended that GRWC will proceed the river source development certainly.</p>
Roles fulfilled by Implementation Agency (GRWC)		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: verify the results of the study, discussion of the results with the consultant DD survey of Morgahk River Basin: following contents were prepared under JICA Expert Team technical advice; i) design policy, ii) structures distribution plan for whole course, iii) appropriate construction amount per year, iv) division of construction segments, v) construction order, vi) construction segment for the first year, vii) TOR of DD survey for the first-year construction, and report to SC MTP: The 10 years plan of the main river course was prepared with JICA Expert Team support.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The study TOR was prepared by NRWGO and GRWC mainly with JICA Expert Team advising. NRWGO and GRWC acquired the skill of identification of the problem and issues and solution on the view point of whole watershed through TOR preparation and study implementation. DD survey of Morgahk River Basin: Previously, GRWC has never prepared such sediment control plan for whole river basin. They constructed the structures at specific points. As the results, the problems such as inordinate sedimentation at upper-stream or huge erosion at lower-stream of the structures were common. Also, damages on the structures or structure destroying caused by such phenomenon were common too. such problems would be resolved by the method, which construction from the lowest point to upper side. GRWC learned the method and will be able to take appropriate actions after JICA project. This is evaluated as dramatically improvement for GRWC and it is worthy of praise. GRWC explained this to WSM-SC, the multiplied effects to the other members were confirmed. GRWC explained MTP to SC members and the roles of GRWC for 10 years were</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: GRWC is expected to own the responsibility of the planning of the main river course and to verify the study results technically. DD survey of Morgahk River Basin: The procedure and steps for preparation of this shall be used for the other river basins. Correct and effective TOR for the DD survey will be prepared, DD will be prepared based on the TOR, and GRWC will carry out the constructions effectively in order. MTP: It is recommended for GRWC to implement the necessary works following the plan certainly.</p>

Achievements During JICA Project	Review and Evaluation	Recommendation
	understood by the members.	
Roles fulfilled by WSM-SC		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: SC discussed and verified the study results, and confirmed the appropriateness.</p> <p>DD survey of Morgahk River Basin: SC confirmed the necessity of the whole river planning and rationality of the method, construction from the lowest point and move up. SC recognized the necessity of the DD and reported it to AWMC and explained the appropriateness of budget request by GRWC.</p> <p>MTP: SC verified it.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The discussion tended to be only between NRWGO (mountainous are) and GRWC (River course) but the other members joined with its specialty such as recommendation on the aspect of geology by the Geo-Center. Such discussion using their specialty was highly evaluated.</p> <p>DD survey of Morgahk River Basin: Confirming the necessity and appropriateness of the project and recommend the budget allocation for the project to AWMC is quite correct for the technical SC. It is worthy of praise.</p> <p>On the other hand, regrettably much, DOE as the secretariat of AWMC stopped the request of GRWC and recommendation by WSM-SC and there have never submitted to AWMC. It loses good and healthy functions of AWMC and SC completely, DOE shall be criticized. Also, DOE didn't take their major role of environmental consideration. It is also much regrettable.</p> <p>MTP: WSM members understood the Gap between work amount, which GRWC shall carry out, and their capacity. Then, they understood the gap correctly. It is very meaningful.</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: Discussion and verification of the project shall be continued.</p> <p>The environmental and social impact consideration on the project was not carried out by DOE, which responsible organization, didn't take the responsibility. It was evaluated much bad and shall be improved.</p> <p>Report & Recommendation to AWMC by the SC shall be continued.</p> <p>It is expected for the WSM-SC members to continue understanding the problems and issues of the Mid-Term-Plan (main river course).</p>
Roles fulfilled by SC members		
<p>NRWGO & MOJA: Structural verification These 2 organizations verified and recommended based on their own experience.</p> <p>Geo-center: geological verification</p>	<p>Verification and recommendation by NRWGO, MOJA and Geo-Center with their own specialty are much evaluated.</p> <p>DOE shall be criticized severely, because DOE has never fulfilled their role of environment and social consideration on the projects.</p>	<p>It is highly recommended that each SC members fulfill each role with their specialty.</p> <p>The role which DOE didn't fulfill shall be improved much. In case DOE has no capacity, it is recommended to introduce the third organization and its verification.</p>
Role fulfilled by JICA Expert Team		
<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: 1) Technical supports the implementation agencies (NRWGO & GRWC), i) TOR preparation, ii) management of study, iii) inspection of the results. 2) Facilitation of the discussion</p> <p>DD survey of Morghak River Basin: technical supports on TOR preparation.</p> <p>Support Mid-Term-Plan Preparation</p>	<p>Integrated watershed planning study for erosion and sediment control in Masal River basin: The study based on the understanding the sediment aspect has not been carried out before the Study. The importance of study was understood by the WSM-SC members and it is highly evaluated. It is estimated that the SC will able to continue this type of study.</p> <p>The technical transportation, 1) planning of whole river sections, 2) design & construction from the lowest point and move to up, which have never been taken by GRWC, was highly evaluated.</p>	<p>For each project verification, introducing some appropriate technical experts instead of JICA Expert Team is highly recommended.</p>

Source: JICA Expert Team

Table 6.5-21(3) Achievements, Role of Implementation Agency, WSM-SC, SC Members and JET, Review & Evaluation, Recommendation 3 (Projects implemented by DOE Gilan)

Target Area: wetland area, Implementation agency: DOE Gilan

Achievements During JICA Project	Review and Evaluation	Recommendation
Major Activities		
Plan of sediment trap construction at Pasikhan River Plan of dredging on the existing sediment trap and new sediment trap construction	Plan of sediment trap construction at Pasikhan River: Based on consideration and verification of the report which was prepared by the consultant procured by DOE, it was judged no effects to control the sediment into the wetland by the plan. Plan of dredging on the existing sediment trap and new sediment trap construction at : The results of research and plan of dredging and construction of some new sediment traps which were prepared by the consultant procured by DOE have many logical bankruptcy and lack of technical and scientific basis. It was judged that the plan based on the report can't control the sediment at all. Furthermore, DOE has never considered the environmental and social consideration of the project. The plan of dumping place of excavated soil, impact on the natural environment of the wetland by the big scaled construction, social impact on fisheries were never considered by DOE.	Plan of sediment trap construction at Pasikhan River: This plan was stopped. Plan of dredging on the existing sediment trap and new sediment trap construction: DOE shall order to revise the report properly, otherwise stop the plan is recommended.
Roles fulfilled by Implementation Agency (DOE)		
Study, planning	The consultant procured by DOE could not answer properly to the questions and pointing out based on the scientific verification by WSM-SC and JICA Expert Team at all. DOE has never taken environmental and social consideration by the project.	The study report and plan prepared by the consultant procured by DOE a lot of technical lack and logical bankruptcy. However, the consultant could not recognize them, could not understand them, and never pointed them and order revision to the consultant. It is quite clear that the consultant procured by DOE doesn't have enough capacity of civil engineering work. Regrettably, also, it shall be said that DOE could not supervise these civil engineering projects properly. DOE needs to consider the environmental and social impact by the project.
Roles fulfilled by WSM-SC		
Review of the study and plan by DOE, pointed out logical inconsistency and scientific lack correctively. Then, stop the plan of sediment trap at Pasikhan River.	[Pasikhan project] It is worthy of praise that WSM-SC recommended stop the project. [Shahdarvishan project] As of November 2018, WSM-SC has pointed lack of appropriateness of the planned project at Shahdarvishan River by DOE and recommended another sediment trap plan. Such activities based on the technical consideration and verification is quite correct and is worthy of praise.	It is assumed that there are some options to resolve the problem as below: i) DOE will procure some excellent experts for the civil engineering work, ii) the WSM-SC members will provide special support or iii) the other organizations will implement the project. It is recommended that WSM-SC will discuss how they will resolve the problem.
Roles fulfilled by SC members		
Following verification were taken by SC Verification of boring test results (method of boring test, method of grain analysis) Verification of sedimentation mechanism of small grain	Same as above	Same as above The most important roles of DOE are; i) decide the direction of conservation and development of the wetland and ii) monitoring the results of the projects in the wetland.

Achievements During JICA Project	Review and Evaluation	Recommendation
Geo-center proposes sediment sampling and grain analysis.		
Role fulfilled by JICA Expert Team		
Advice to SC verification with neutral position	Advising by technical and environmental aspects, and monitoring issues	The third party is recommended who can advise with neutral position.

Source: JICA Expert Team

6.5.4 Future Issues and Recommendation

(1) Technical Standpoint

1) Mountain Area

NRWGO Gilan's capacity of erosion and sediment control in the mountainous area can be evaluated as standard level but there are some problems below:

- i) The target area selection method by focusing from macro to micro view based on understanding the erosion and sediment flow mechanism was not understood.
- ii) Due to no understanding of necessity of monitoring and maintenance of the constructed structures, these important activities have never been taken before.
- iii) DD surveys were seldom carried out and standard drawing was used in most of the cases. The supervision experts of NRWGO Gilan order the detailed points at the site.
- iv) Most of the construction supervisions were controlled by the senior engineers directly without out-sourcing. Then, the possible construction amount was quite limited.

The following technical transfers were taken under JICA project.

- i) Implementation, supervision and verification of the study of integrated planning study at Masal River Basin
- ii) method of monitoring, verification of damage causes assessment, maintenance of damaged structures by OJT during July to September 2018. The damages caused by the natural disaster (debris flow) happened on July 2018, when almost after one year from the construction (Phase-I) completion.
- iii) followings were transferred a) DD drawing preparation for construction, b) ground-breaking survey and design changes based on it, c) construction and inspection based on the changed design. There were transferred by OJT through planning of the target area (Alenze), and DD of Phase-I & II.
- iv) Detailed and accurate construction supervision work by OJT through implementation of Alenze Phase-I and II.

These important technical transfers were taken by OJT to the C/P of NRWGO, and his capacity was developed much.

In the near future, NRWGO Gilan is recommended to expand the transferred techniques which was transferred to the C/P to the other experts. It is strongly recommended that the other experts will implement the remaining works at Alenze and the other planning of the whole target areas with instruction by the C/P who received the technical transfer. This can realize the transferred techniques by JICA Project can be expanded to other experts of NRWGO Gilan and it can modify and develop the techniques by themselves. It is the most effective way to implement the Mid-Term-plan which aims capacity development of NRWGO Gilan. It is strongly recommended to the top management of NRWGO Gilan not to C/P.

2) Main River Course

GRWC has basic technical skill for constructing river structures, since they have some experiences of installing such as intake weir and revetment. Unfortunately, GRWC had installed some cross-river structures at the sites in a random manner in times past, then the sediment dynamic had lost balance at the sites, and riverbed degradation and river bank erosion had occurred, then a lot of sediment had been produced. Therefore, it is important future task that an integrated plan to control sediment flowing into wetland at each river basin should be established as with the prepared plan in Masal basin on this project, then river improvement should be gone ahead based on the established plans.

If any installations of intake weirs will be needed, the installations should be added in the integrated plan and go ahead the integrated plan. By going ahead the river improvement based on the integrated plan, it is expected that the river can be kept stable, the river structures can be kept safe, continuous using of the river structures must be possible, then efficient and effective river improvement must be available.

3) Wetland Area

2 projects by DOE, sediment trap and dredging work at the existing sediment trap at Pasikhan River and Masule (Shahdarvishan River), were discussed and verified by the WSM-SC. The project at Pasikhan River was stopped because the WSM-SC could not find enough evidence to proof the adequate effects to reduce the sediment influence on the wetland by the plan.

The project at Masule (Shahadarvishan River) was carefully reviewed based on the research results and plan based the research. However, the consultant who took the research and prepared the plan could not answer to all questions and comments by the WSM-SC and JICA Expert Team. It was also judged that the plan can't reduce the sediment influence on the wetland.

With the consideration of the situation above, it is assumed that there are three options to resolve the problems; i) DOE will procure some excellent experts for the civil engineering work, ii) the WSM-SC members will provide special support or iii) the other organizations will implement the project. It is recommended that WSM-SC will discuss how they will resolve the problems.

(2) Standpoint of Organization

It is important that the implementation agencies and SC member will fulfil their responsibilities based on the roles as mentioned above, then all projects related sediment control will be taken appropriately and continuously. Since the projects of sediment control needs a long time improvement, it is required that the projects of sediment control will go ahead steadily by the management system by AWMC WSM-SC. Therefore, it is recommended that the committee organization should be established for fulfilling their responsibility, by defining the role of WSM-SC which was described in the tables above.

As the results of review and verification above, the JICA Expert Team's functions were discussion facilitation and advising technically as the third party with the neutral position. For example, GRWC and MOJA could give the structural recommendation but they don't have specialty of erosion and sediment mechanism in the mountainous area. NRWGO has such specialty but it is the implementation agency; therefore, it is difficult for them to judge the project technically. If possible, it is said that NRWGO would like to proceed the project; therefore, they would not give negative judgement on the project and can't possible to judge correctly. In this regard, after JICA project, the third party or expert who has same technical capacity as the implementation agency shall be procured.

Also, it is strongly recommended that the secretariat of AWMC (DOE) shall i) respect the decision of WSM-SC and ii) shall report the decision by the SC to the AWMC without any screening. The decision will be done by AWMC and SC supports them from the technical point of view. Therefore, the secretariat' screening is considered too much interfere to the committee system.

At the end, the most important function and roles of DEO as the management organization of the wetland are considered below: i) decide the direction of conservation and development of the wetland and ii) monitoring the results of the projects in the wetland. The implementation of the construction is out of their roles. It is highly recommended to DOE to recognize their functions and roles and take correct actions.

Attachment F 6.5.2-1 Detailed Implementation Schedule of Mid-Term-Plan of Mountain Area

River Basin	Target Area	Work Item	Mid-term plan																	
			2015	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Masal	Alenze	ITG																		
		DD-wole	DD																	
		DD-next year	JPA 2017	JPA 2018	Const-4	Const-4	Const-5	Const-6	Const-7	Const-8										
		Construction	JPA 2017	JPA 2018	Const-3	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8									
		SV work	JPA 2017	JPA 2018	Const-3	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8									
		Monitoring	at least 5 years for one project																	
Masale	Dulhehal	ITG	ITG																	
		DD-wole			JPA 2018															
		DD-next year			Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8								
		Construction				Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8							
		SV work				Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8							
		Monitoring	at least 5 years for one project																	
Pshroudhar	**	ITG					ITG													
		DD-wole					DD													
		DD-next year					Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8						
		Construction						Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8					
		SV work							Const-1	Const-2	Const-3	Const-4	Const-5	Const-6	Const-7	Const-8				
		Monitoring	at least 5 years for one project																	
Palangvar	**	ITG							ITG											
		DD-wole								DD										
		DD-next year									Const-1	Const-2	Const-3	Const-4	Const-5	Const-6				
		Construction									Const-1	Const-2	Const-3	Const-4	Const-5	Const-6				
		SV work									Const-1	Const-2	Const-3	Const-4	Const-5	Const-6				
		Monitoring	at least 5 years for one project																	
Bahambar	**	ITG								ITG										
		DD-wole										DD								
		DD-next year										Const-1	Const-2	Const-3	Const-4					
		Construction										Const-1	Const-2	Const-3	Const-4					
		SV work										Const-1	Const-2	Const-3	Const-4					
		Monitoring	at least 5 years for one project																	
Pasikhan	**	ITG																		
		DD-wole													ITG					
		DD-next year													DD					
		Construction													Const-1	Const-2				
		SV work													Const-1	Const-2				
		Monitoring	at least 5 years for one project																	
Pribazar																				
Khonmroud																				
Chafroud																				

Source: JICA Expert Team

6.6 Wastewater Management

6.6.1 Current Situation

(1) Water Quality Issues in the Anzali Wetland and Its Watershed

1) Wetland

Water quality monitoring of the Anzali Wetland has been implemented by DOE as well as NIWAI and academic institutions. However, these efforts have been generally sporadic and isolated, and it is not easy to evaluate the status of water quality of the Anzali Wetland. Some of the most comprehensive studies of the water quality of the wetland have been implemented by the JICA M/P (2003-2005) and the subsequent Phase I Project (2007-2008, 2011-2012). The results of these water quality investigations in 2003 as part of the M/P study and 2011-12 as part of the Phase I Project are compared here.

Table 6.6-1 summarizes the average values of BOD, COD, T-N, T-P and Chlorophyll-A together with 25% and 75% percentile values in 2011-2012.

Table 6.6-1 Water Qualities of the Anzali Wetland in the Previous Studies

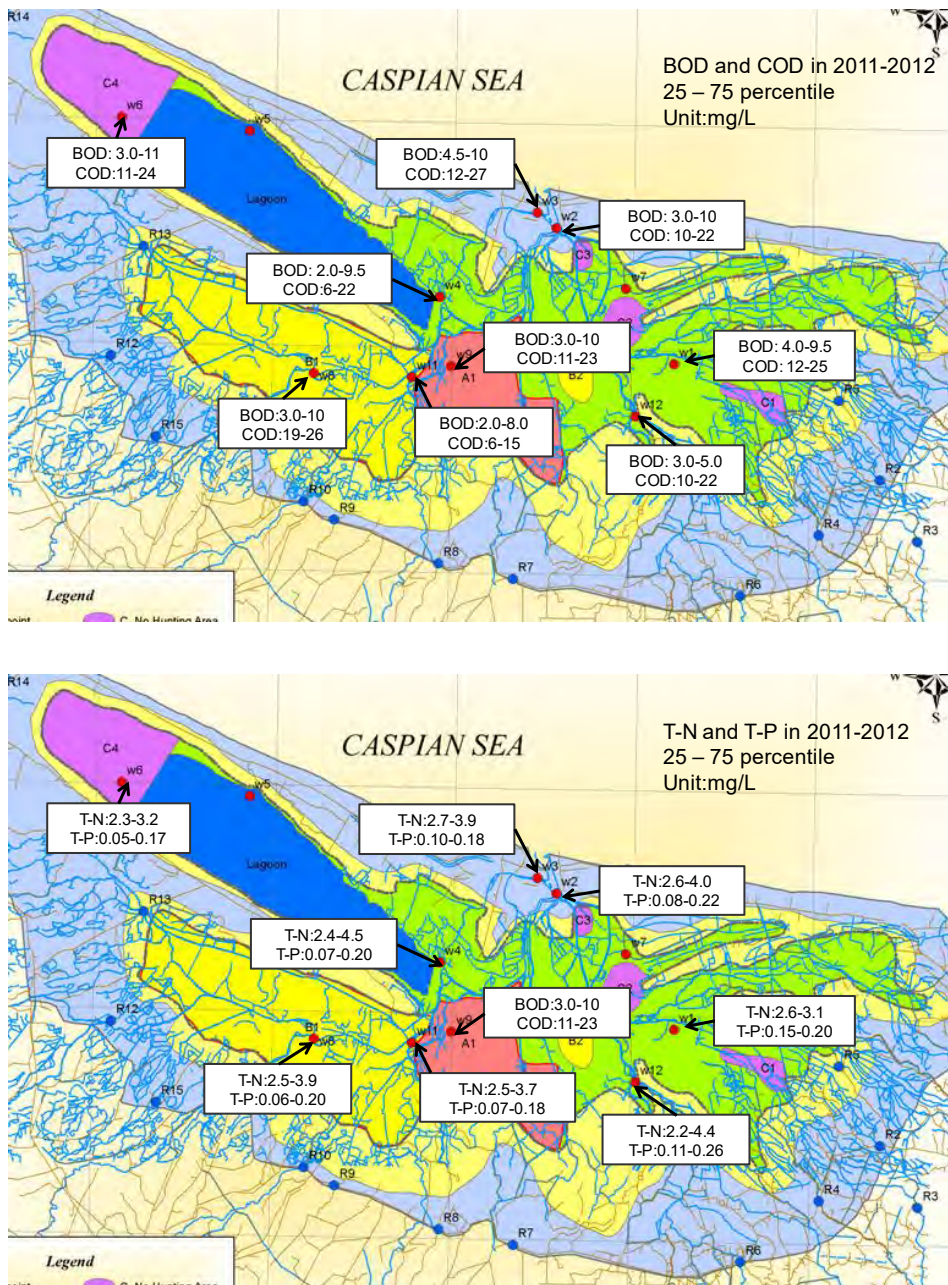
Item	Average in 2011-2012 (P25-P75)	Iranian Standard	Japanese Standard
COD (mg/L)	18.2 (9.5-23)	-	< 1-8 (Lake)
BOD (mg/L)	6.1 (3.0-10.0)	< 6	< 1-10 (River)
T-P (mg/L)	0.17 (0.07-0.21)	<0.13	< 0.005 - 0.1
T-N (mg/L)	3.6 (2.6-4.1)	-	< 0.1 - 1
Chl-A (mg/L)	14 (1.9-16)	-	

Note: There were some extreme values in 2011-2012 data which were removed before analysis.

Source: JICA Expert Team

Evidently the water quality of the wetland generally does not satisfy the Iranian standard.

Figure 6.6-1 shows the distributions of BOD, COD, T-N and T-P in the Anzali Wetland.



Source: DOE (JICA Phase-I Project Data)

Figure 6.6-1 Distributions of BOD, COD, T-N and T-P in the Anzali Wetland

The water quality in the wetland is expected to be worse in the channels and rivers downstream of major cities, such as Pirbazar River downstream of Rasht; it is expected to be better in areas isolated from direct impact of such channels and rivers. However, such a trend is not clear from the results of the monitoring. Further investigation of water qualities in the wetland is needed to clearly characterize the water qualities in the wetland.

2) Surface Waters in the Watershed

Water quality monitoring of the rivers and canals located in the Anzali Wetland watershed has been implemented by DOE in the Phase I Project (2007-2008, 2011-2012). Table 6.6-2 summarizes the average values of BOD, COD, T-N and T-P in 2011-2012.

Table 6.6-2 Water Qualities of Rivers in the Anzali Wetland Watershed in 2011 and 2012

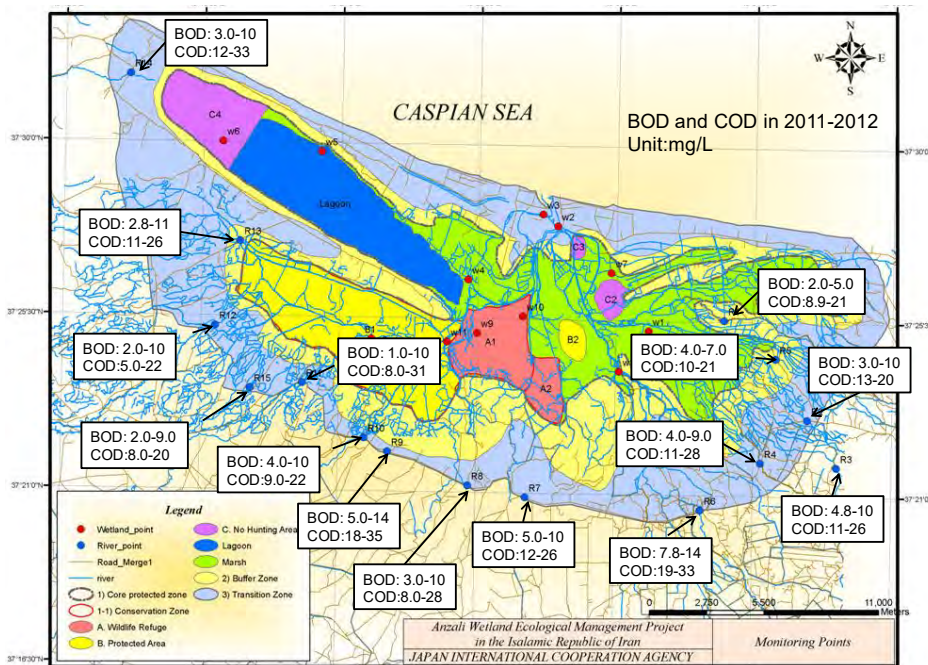
Item	Average in 2011-2012 (P25-P75)	Iranian Standard	Japanese Standard
COD (mg/L)	23.0 (10.0-27.0)	-	< 1-8 (Lake)
BOD (mg/L)	7.4 (3.0-10.0)	< 6	< 1-10 (River)
T-P (mg/L)	0.19 (0.07-0.24)	<0.13	< 0.005 - 0.1
T-N (mg/L)	3.2 (2.2-3.7)	-	< 0.1 - 1

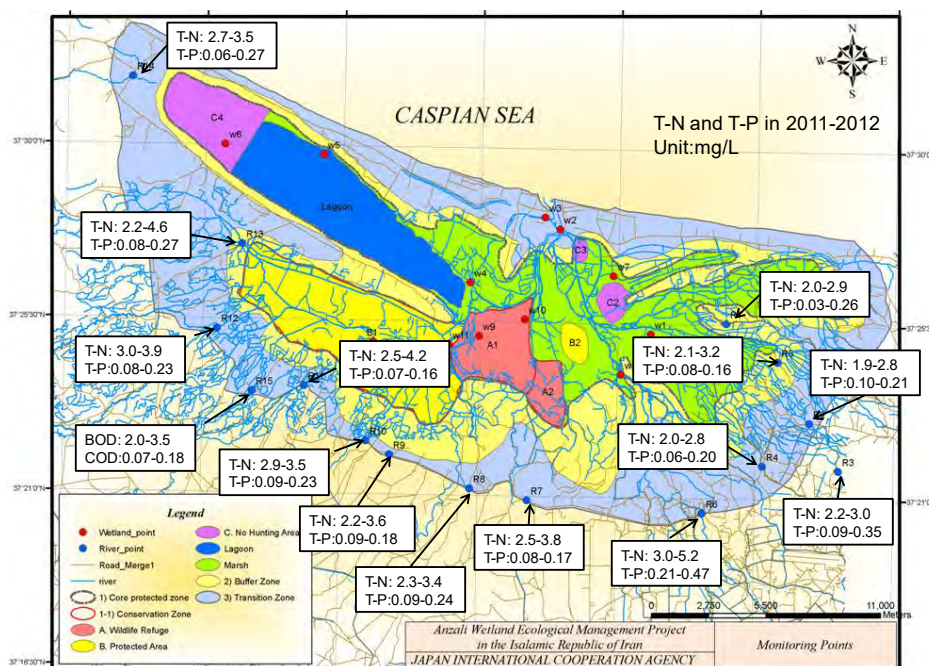
Note: There were some extreme values in 2011-2012 data which were removed before analysis.

Source: DOE (JICA Phase-I Project Data)

The average value of each monitoring parameters does not meet the Iranian standard, and many rivers in the watershed are probably not suitable for recreational activities, for a source of drinking water and for fishery.

Figure 6.6-2 shows the distributions of BOD, COD, T-N and T-P in the rivers and canals located in the Anzali Wetland Watershed. In general, water quality is worse downstream of Rasht, but again more investigation is needed to clarify the situation of water quality in rivers.





Source: DOE (JICA Phase-I Project Data)

Figure 6.6-2 Distributions of BOD, COD, T-N and T-P in the Anzali Wetland Watershed

(2) Pollution Sources in the Anzali Wetland and Its Watershed

The sources of water pollution are classified into point sources and non-point sources, and the point sources are categorized into domestic sewage, industrial effluent and livestock wastewater; the non-point sources are categorized into pollution from farmland, forest and so on.

In the JICA M/P Study (2005), pollution loads from different sub- watersheds were analyzed using the information on population, industrial wastewater generation, numbers of domestic animals, and land uses in 2003. Thus, a similar analysis of pollution loads was attempted using the population in 2011 and other information on pollution sources around 2011. The land use data were taken from the temporary result of the on-going satellite image analysis for 2003 and 2013. Tables 6.6-3 and 6.6-4 summarize the basic data and the calculation results of pollution loads.

Table 6.6-3 Population, domestic animals and land uses in 2003

		Population			Industrial wastewater generation (m ³ /d)	Number of Domestic Animals				Area of Non-Point Source (ha)					
		Total	Urban	Rural		Cows	Buffalo	Sheep	Goat	Farmland	Forest	Orchard	Rangeland	Urban	Other
Basic Data of Basin	Total	1,137,118	742,819	394,299	6,615	268,179	15,082	417,276	119,907	99,679	192,541	6,328	10,266	18,769	16,916
	Unit	-	130 g/p/d	40 g/p/d	50 mg/L	26 g/p/d	26 g/p/d	6.5 g/p/d	6.5 g/p/d	107 kg/ha/y	47 kg/ha/y	47 kg/ha/y	10 kg/ha/y	250 kg/ha/y	20 kg/ha/y
COD Load	Sub-Total (ton/year)	-	35,247	5,757	121	2,545	143	990	284	10,666	9,049	297	103	4,692	338
	Total (ton/year)	70,232													
T-N Load	Unit	-	11.0 g/p/d	3.3 g/p/d	30 mg/L	2.9 g/p/d	2.9 g/p/d	0.73 g/p/d	0.73 g/p/d	14.3 kg/ha/y	5.7 kg/ha/y	8.0 kg/ha/y	3.0 kg/ha/y	14.0 kg/ha/y	2.2 kg/ha/y
	Sub-Total (ton/year)	-	2,982	475	72	284	16	111	32	1,425	1,096	51	31	263	36
T-P Load	Unit	-	1.8 g/p/d	0.5 g/p/d	6 mg/L	0.5 g/p/d	0.5 g/p/d	0.125 g/p/d	0.125 g/p/d	1.0 kg/ha/y	0.11 kg/ha/y	0.6 kg/ha/y	0.03 kg/ha/y	0.7 kg/ha/y	0.4 kg/ha/y
	Sub-Total (ton/year)	-	488	72	14	49	3	19	5	98	21	4	0	13	7
Total (ton/year)		793													

Source: DOE and JICA Expert Team

Table 6.6-4 Population, domestic animals and land uses in 2011

		Population			Industrial wastewater generation (m ³ /d)	Number of Domestic Animals				Area of Non-Point Source (ha)					
		Total	Urban	Rural		Cows	Buffalo	Sheep	Goat	Farmland	Forest	Orchard	Rangeland	Urban	Other
Basic Data of Basin	Total	1,254,371	879,757	374,614	5,059	148,446	1,595	164,482	29,145	77,334	170,045	26,985	14,227	24,083	31,827
	Unit	-	130 g/p/d	40 g/p/d	50 mg/L	26 g/p/d	26 g/p/d	6.5 g/p/d	6.5 g/p/d	107 kg/ha/y	47 kg/ha/y	47 kg/ha/y	10 kg/ha/y	250 kg/ha/y	20 kg/ha/y
COD Load	Sub-Total (ton/year)	-	41,744	5,469	92	1,409	15	390	69	8,275	7,992	1,268	142	6,021	637
	Total (ton/year)	73,523													
T-N Load	Unit	-	11.0 g/p/d	3.3 g/p/d	30 mg/L	2.9 g/p/d	2.9 g/p/d	0.73 g/p/d	0.73 g/p/d	14.3 kg/ha/y	5.7 kg/ha/y	8.0 kg/ha/y	3.0 kg/ha/y	14.0 kg/ha/y	2.2 kg/ha/y
	Sub-Total (ton/year)	-	3,532	451	55	157	2	44	8	1,106	968	216	43	337	69
T-P Load	Unit	-	1.8 g/p/d	0.5 g/p/d	6 mg/L	0.5 g/p/d	0.5 g/p/d	0.125 g/p/d	0.125 g/p/d	1.0 kg/ha/y	0.11 kg/ha/y	0.6 kg/ha/y	0.03 kg/ha/y	0.7 kg/ha/y	0.4 kg/ha/y
	Sub-Total (ton/year)	-	578	68	11	27	0	8	1	76	19	17	0	17	14
Total (ton/year)		836													

Source: DOE and JICA Expert Team

Overall, the total pollution loads of COD, T-N and T-P did not change substantially during the period of 2003 and 2011, and the increases are 5%, 8% and 5%, respectively. However, closer examination reveals some interesting changes over the last eight years.

During the last eight years, the population in the watershed has increased from about 1,137,000 to about 1,254,000 or about 10%. In particular, the urban population has increased as much as 18%, while the rural population has decreased slowly about 5%. Therefore, water pollution caused by the urban population has increased drastically, and the proportion of COD load caused by urban domestic sewage to the total COD load has changed from 50% to 57%. The urbanization has also caused a significant increase in pollution load from urban surfaces.

On the other hand, the pollution load from livestock has decreased rapidly largely because the numbers of animals have decreased. Similarly, the decrease in the farmland has decreased the pollution load from farmland as non-point source.

The proportion of COD load from industrial activities to the total COD load is estimated to be less than 1%, which can be evaluated as the pollution load from industrial activities is not serious with respect to organics. This is because the amount of wastewater generated in industrial activities is relatively limited, about 3% of the sewage from domestic sources. Nevertheless, industrial activities can be a significant source of some pollutants, such as heavy metals and toxic organic chemicals.

While the analysis in this section provided interesting insights into contributions of different pollution sources in the watershed, the analysis is still very crude. For example, the impacts of the sewage treatment plants in Rasht and Anzali, which are now in operation, are not accounted for. Hence, further analysis will be attempted as part of the project activities in near future.

(3) Existing Pollution Control Measures

1) Sewage Management in Urban Area

As of the time of beginning of the Project, Gilan Water & Wastewater Company (hereinafter called GWWC) has already commenced the development projects of sewerage systems in Rasht and Anzali, and has started treating sewage using their own STPs. However, the sewerage systems in Rasht and Anzali have not been completed, and development of sewerage systems in other cities in the Anzali Wetland watershed have not yet commenced. Therefore, it will take more than seven years to complete the development projects of sewerage systems in Rasht, Anzali, Somesara and Fouman.

The current situation and future prospect of the development of sewerage system in each city of the Anzali Wetland watershed are detailed below.

(a) Sewerage System in Rasht

a) Past Activities

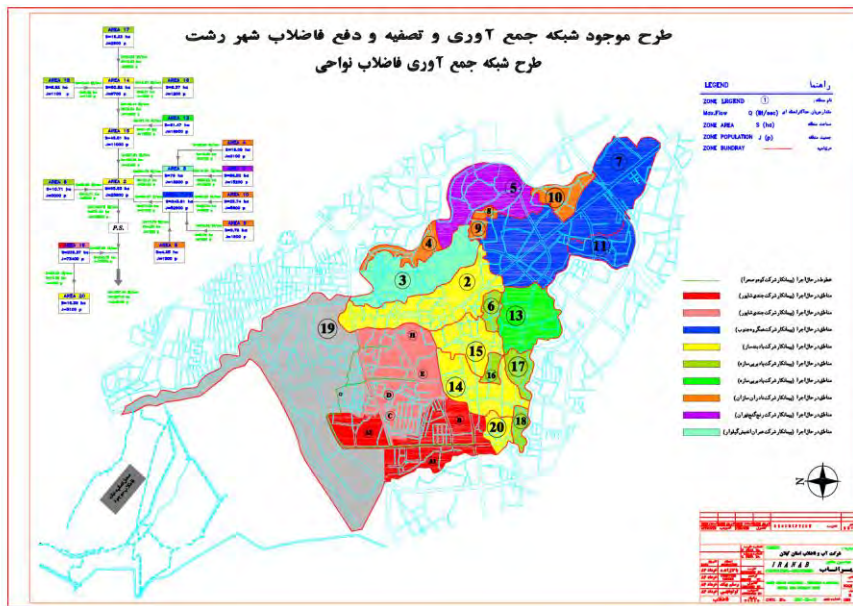
In 2004 GWWC completed the feasibility study for development project of the sewerage system in Rasht, and implemented some parts of the project from 2005 to 2010 with the World Bank's fund. However, the funding was terminated at the time of 87% of payment by the World Bank. Accordingly, GWWC is continuing the project with the national fund.

b) Outline

Rasht is divided into three zones with Zarjub River and Gowhar Rud River as natural boundaries. The zones are named the central zone, the eastern zone, and the western zone. GWWC has a plan to develop one centralized STP at the north of Rasht, to collect the whole domestic sewage to the centralized STP, and to discharge the treated sewage to Zarjub River. GWWC has already completed a part of the STP and the sewer pipelines in the central zone.

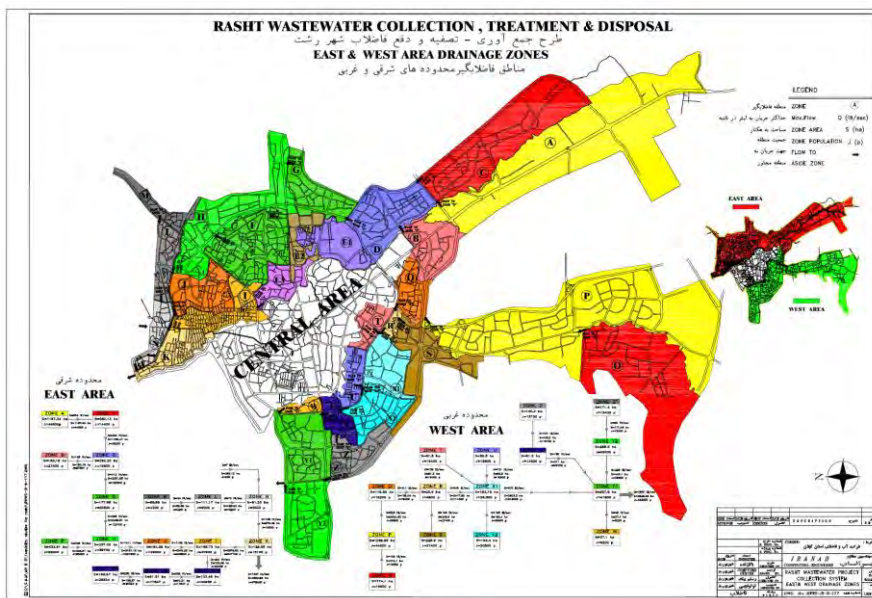
GWWC has a plan to develop the separated sewerage system in whole Rasht and connect all households and buildings to newly-installed sewer pipelines. However, currently most of households and buildings are connected to the existing drainage pipes and trenches discharging to rivers, and it will take a great deal of time to switch the whole connections of households and buildings to newly-installed sewer pipelines. Therefore, GWWC has been installing interceptor pipes to develop a temporary combined sewerage system to be used until the separated sewer network becomes available.

Figures 6.6-3 and 6.6-4 present the target areas of the sewerage system in Rasht.



Source: GWWC

Figure 6.6-3 Central Zone of Rasht Sewerage System



Source: GWWC

Figure 6.6-4 Eastern Zone and Western Zone of Rasht Sewerage System

c) Current Status of Sewage Treatment

The planned values and the current statuses of the sewerage development project in Rasht are summarized in Table 6.6-5.

Table 6.6-5 Summary of Sewerage System in Rasht

Item	Planned Value	Status as of 2014
Population served	956,600	95,000*
Capacity of STP (m ³ /d)	200,500	63,000
Treated sewage amount (m ³ /d)	200,500	20,000
Length of main sewer pipeline (km)	874	412
Number of pump station	45	4
Ratio of household connected to drainpipe (%)	-	90

Note: *: Calculated with planned population served and treated sewage amount by JICA Expert Team

Source: GWWC

Although a STP with 63,000 m³/d of sewage treatment capacity is working, according to GWWC, only 20,000 m³/d of sewage is being treated in this STP because of the delay of development of sewer pipelines and pump stations.

In addition, the sewage treatment process of the existing STP is the conventional activated sludge process which consists of the grit chamber, the primary sedimentation tank, the aeration tank, the final sedimentation tank and the disinfection tank. Therefore, while the existing STP can remove the organic matter loading to meet the effluent standard, the sufficient nutrient removal cannot be expected.

GWWC has a plan to expand the sewage treatment capacity of this STP to 200,500m³/d ultimately in accordance with the anticipated sewage generation in the future.

(b) Sewerage System in Anzali

a) Past Activities

Similar to Rasht, GWWC has completed the feasibility study of the sewerage system in Anzali in 2004 and implemented some parts of the project from 2005 to 2010 with the World Bank's fund. However, the funding was terminated at the time of 87% of payment by the World Bank. Accordingly, GWWC is continuing the project with the national fund.

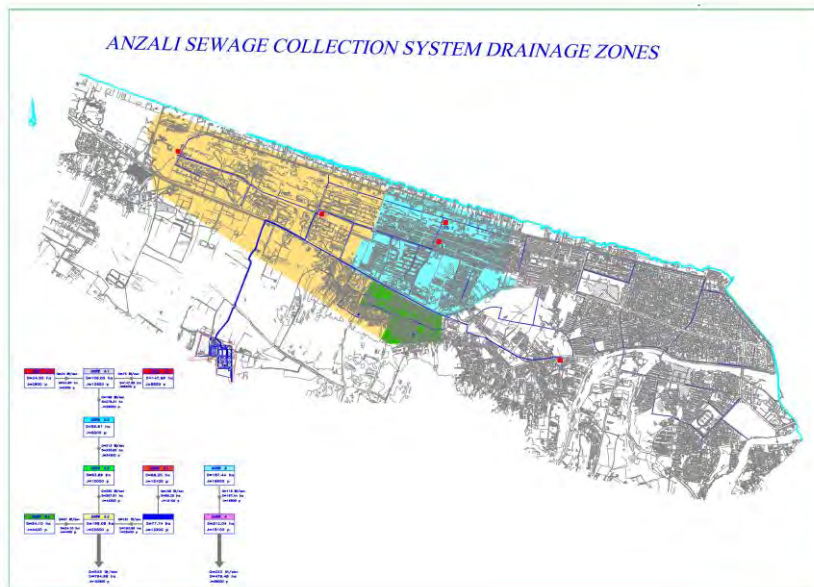
b) Outline

Anzali is divided into the eastern zone and the western zone separated by Sefid River, which is the outlet to Caspian Sea from the Anzali Wetland. GWWC has a plan to develop two STPs, one in the eastern zone and another in the western zone respectively, and GWWC has already completed construction of a part of these two STPs and the sewer pipelines. The treated sewage of the western Anzali STP will be discharged to the Anzali Wetland directly, and the treated sewage of the eastern Anzali STP will be discharged to Caspian Sea through Taleb Abad River.

GWWC has a plan to develop the separated sewerage system in whole Anzali and connect all households and buildings to newly-installed sewer pipelines. However, currently most of households and buildings are connected to the existing drainage pipes and trenches discharging to rivers and the Anzali Wetland, and it will take a great deal of time to switch the whole

connections of households and buildings to newly-installed sewer pipelines. Therefore, GWWC has been installing the interceptor pipes to develop a temporary combined sewerage system to be used until the separated sewer networks become available.

Figures 6.6-5 and 6.6-6 present the target areas of the sewerage system in Anzali.



Source: GWWC

Figure 6.6-5 Western Zone of Anzali Sewerage System



Source: GWWC

Figure 6.6-6 Eastern Zone of Anzali Sewerage System

c) Current Status of Sewage Treatment

The planned values and the current statuses of the sewerage development project in Anzali are summarized in Table 6.6-6.

Table 6.6-6 Summary of Sewerage System in Anzali

Item	Planned Value	Status as of 2014
Population served	252,000	9,000*
Capacity of STP (m ³ /d)	60,000	20,000
Treated sewage amount (m ³ /d)	51,160	2,000
Length of main sewer pipeline (km)	623	188
Number of pump station	26	1
Number of household connected to sewer pipe	70,400	1,669
Ratio of household connected to drainpipe (%)	-	90

Note: * - Calculated with planned population served and treated sewage amount by JICA Expert Team

Source: GWWC

Although the western Anzali STP with 20,000 m³/d of sewage treatment capacity is working, according to GWWC, only 2,000 m³/d of sewage is being treated in this STP because of the delay of development of sewer pipelines and pump stations. The eastern Anzali STP with 12,000m³/d of sewage treatment capacity is under construction and about 80% of construction works have been completed as of 2014.

The sewage treatment process of both the western and eastern Anzali STPs is the conventional activated sludge process which consists of the grit chamber, the primary sedimentation tank, the aeration tank, the final sedimentation tank and the disinfection tank. Therefore, while these STPs in Anzali can remove organic matter loading to meet the effluent standard, the sufficient nutrient removal cannot be expected.

Moreover, GWWC has a plan to expand the total sewage treatment capacity of the two STPs to 60,000m³/d ultimately in accordance with the anticipated sewage generation in the future.





Source: JICA Expert Team

Figure 6.6-7 Existing STP in Western Zone of Anzali

(c) Sewerage System in Somesara

As of 2018, there is no STP in Somesara and GWWC is working on the preparatory work to develop a STP and pump stations. GWWC has already installed a part of the main sewer pipelines. The planned values and the current statuses of the sewerage development project in Somesara are summarized in Table 6.6-7.

Table 6.6-7 Summary of Sewerage System in Somesara

Item	Planned Value	Status as of 2018
Population served	31,000*	0
Capacity of STP (m ³ /d)	6,350	0
Length of main sewer pipeline (km)	63.1	10.1
Number of pump station	0	0

Note: * - Calculated with planned population served and treated sewage amount by JICA Expert Team

Source: GWWC

(d) Sewerage System in Fuman

As of 2018, there is no STP in Fuman and GWWC is working on the preparatory work to develop a STP and pump stations. GWWC has already installed a part of the main sewer

pipelines. The planned values and the current status of the sewerage development project in Fuman are summarized in Table 6.6-8.

Table 6.6-8 Summary of Sewerage System in Fuman

Item	Planned Value	Status as of 2018
Population served	31,000*	0
Capacity of STP (m ³ /d)	7,000	0
Length of main sewer pipeline (km)	54.7	4.9
Number of pump station	5	0

Note: *: Calculated with planned population served and treated sewage amount by JICA Expert Team

Source: GWWC

(e) Sewerage System in Other Cities

Currently there is no existing sewage treatment facilities and development plan of sewerage system in other cities. GWWC will develop sewerage systems in other cities after the completion of construction of systems in Rasht, Anzali, Somesara and Fuman

(4) Sewage Management in Rural Area

Until recent years Rural Water & Wastewater Company (hereinafter called RWWC) has focused on development of water supply works in rural areas of Gilan Province, and sewage management in the rural areas has not been tackled. However, in 2006 the National Water & Wastewater Company (NWWC), which is the central government organization in charge of water and wastewater management, issued a national policy requiring development of sewage treatment system in every village with more than 100 households. Currently there are 980 villages with more than 100 households in Gilan Province, and RWWC is required to develop the sewage treatment systems in these villages step by step based on the national policy. Accordingly, RWWC implemented a pilot activity to develop on-site sewage treatment system in Mobarak Abad Village, which is located close to Anzali Wetland in the JICA Project.

After the JICA Project completes, RWWC intends to expand the installation of on-site sewage treatment unit to whole rural areas of Gilan Province. However, RWWC has faced with a difficulty in obtaining a fund for construction of additional on-site sewage treatment units. Therefore, it will take a long time to expand the on-site sewage treatment system to whole rural areas in Gilan Province.



Source: JICA Expert Team

Figure 6.6-8 On-site Sewage Treatment Unit in Mobarak Abad Village

6.6.2 Long-term Goal

(1) Urban Area

As discussed in the “Section 6.6.1 (2) Pollution Sources in the Anzali Wetland and Its Watershed”, the urban population has increased rapidly in recent years, and accordingly, the pollution load caused by urban domestic sewage has increased rapidly. Therefore, it is necessary to develop the sewerage systems in urban areas step by step in order to mitigate the pollution load and improve the water qualities in the Anzali Wetland and its watershed.

As the long-term goal of wastewater management in urban areas to improve the water quality in the Anzali Wetland watershed including several rivers flowing to the Anzali Wetland, it is necessary for GWWC to complete the whole development projects of sewage collection and treatment systems in all urban areas located in the Anzali Wetland watershed.

Based on the project information provided by GWWC in 2014, GWWC required approximately USD 300 million totally to complete the development projects of sewage collection and treatment systems in Rasht, Anzali, Somesara and Fuman cities. Considering the price escalation from 2014 to 2018, approximately USD 460 million is necessary for GWWC to complete these development projects as of 2018, which is described in Table 6.6-9.

Table 6.6-9 Outline of Required Budget for Development Projects of Sewerage System in Urban Area in the Anzali Wetland Watershed

City	Required Budget as of 2014 (million USD)	Required Budget as of 2018 (million USD)
Rasht	215	325
Anzali	35	55
Somesara	25	40
Fuman	25	40
Total	300	460

Source: JICA Expert Team calculated and converted based on GWWC’s information and the consumer price index.

(2) Rural Area

As discussed in the “Section 6.6.1 (4) Sewage Management in Rural Area”, RWWC commenced the development of sewage treatment system in rural area in accordance with the national policy issued by NWWC, and RWWC implemented a joint pilot activity in the JICA Project to develop on-site sewage treatment system in Mobarak Abad Village, which is located close to Anzali Wetland.

As the long-term goal of wastewater management in rural areas to improve the water quality in the Anzali Wetland watershed, it is necessary to expand the development of on-site sewage treatment systems to whole rural areas in the Anzali Wetland watershed.

According to the information about the national policy provided by RWWC in 2014, RWWC is required to develop sewage treatment system in every village with more than 100 households. Currently there are 980 villages with more than 100 households in Gilan Province, and RWWC prioritized 109 villages to develop the sewage treatment system from the 980 villages in Gilan Province. The following 28 villages of the prioritized 109 villages are located in the Anzali Wetland watershed, therefore it is necessary for RWWC to complete the whole development project of on-site sewage treatment projects in the 28 villages in the Anzali Wetland watershed.

Additionally, RWWC required approximately USD 100 million totally to complete the development projects of on-site sewage treatment system in the target 28 villages, which is estimated based on the actual cost of the joint pilot activity of the JICA Project in Mobarak Abad Village described in the following Table 6.6-10.

Table 6.6-10 List of Target 28 Villages in the Anzali Wetland Watershed and Its Estimated Project Cost

Item	Village	County	Population	Household	Project Cost (Million USD)
1	Lijarky	Bandar Anzali	3,210	559	4
2	Abkenar	Bandar Anzali	2,994	982	7
3	Nokhaleh Akbary	Some'e Sara	2,393	625	4
4	Nokhaleh Jafary	Some'e Sara	2,353	661	5
5	Hendekhale	Some'e Sara	2,189	614	4
6	Natyan	Some'e Sara	3,339	769	5
7	Taleb Abad	Bandar Anzali	2,025	575	4
8	Hasanroud	Anzali	1,266	391	3
9	Pounel	Rezvanshahr	2,420	582	4
10	Sokam	Rezvanshahr	417	112	1
11	Sheikh Mahale	Rezvanshahr	431	108	1
12	Chekchek Posht	Rezvanshahr	978	221	2
13	Talam Seshanbe	Rasht	3,007	880	6
14	Tajergurab	Some'e Sara	1,317	369	3
15	Horian	Rezvanshahr	1,703	410	3
16	Ardejan	Rezvanshahr	5,641	1,444	10
17	Markleh	Some'e Sara	1,628	417	3
18	Shankaver	Rezvanshahr	910	233	2
19	Kasma	Some'e Sara	1,790	500	4
20	Janbeh Sara	Rezvanshahr	757	167	1
21	Bashman	Anzali	1,405	416	3
22	Poshtir	Some'e Sara	2,190	568	4
23	Abatar	Some'e Sara	1,822	528	4
24	Kalashoma Paeen	Some'e Sara	807	215	2
25	Vaqe'e Sara	Some'e Sara	496	133	1
26	Darsare	Rezvanshahr	624	193	1
27	Sangachin	Anzali	2,421	708	5
28	Roudbar Sara	Rezvanshahr	2,358	582	4
TOTAL			52,891	13,962	100

Source: JICA Expert Team calculated based on RWWC's information and the cost of joint pilot project.

6.6.3 Mid-term Goal

Mid-term goals of wastewater management in urban area and rural area are summarized below, which target on 2020 to 2030.

(1) Urban Area

Rasht has about 70% of population in the urban areas of Anzali Wetland watershed, accordingly, untreated domestic sewage generated from Rasht City is one of the biggest pollution load on the Anzali Wetland and its watershed. Therefore, before anything else, GWWC should focus on completing the development of sewage collection and treatment system in Rasht City by 2030. After GWWC completes the development project in Rasht, it is expected that approximately 40% of total COD load, 35% of total T-N load and 45% of total T-P load on the Anzali Wetland and its watershed can be removed based on the data described in Table 6.6-4. Then the water environment in the Anzali Wetland and its watershed are expected to be improved drastically, furthermore people can develop familiarity with the Anzali Wetland much more than now.

(2) Rural Area

Development of on-site sewage treatment systems for the prioritized 28 villages is proposed as the long-term goal, however, it is difficult to complete the development in the all 28 prioritized villages by 2030 based on the current budget situation of RWWC. Therefore, JICA Expert Team proposes that first, RWWC will implement the development of on-site sewage system in one or two villages per year. And if RWWC can get additional budget, RWWC should implement the development project in additional villages in one year.

6.6.4 Prior Conditions

Prior conditions area summarized below.

(1) Urban Area

International donor including JICA will support the development project of sewerage system in Rasht financially.

(2) Rural Area

Gilan provincial government and/or the central government (NWWC) will make a subsidy for the on-site sewage treatment project of RWWC every year continuously.

6.6.5 Implementation Plan and Schedule

Implementation plan and schedule are described below.

(1) Urban Area

JICA Expert Team proposes the implementation plan of the development project of sewerage system in Rasht based on the examples of JICA’s ODA projects.

- 1) The latest feasibility study of the development project of sewerage system in Rasht was prepared in 2004, which is too old. Therefore, update and modification of the feasibility study is necessary to implement the project with the loan of international donor, which will take about one year.
- 2) After the update and modification of the feasibility study, it will take about two years until the detailed design and the selection of contractors are completed.
- 3) All of construction works are planned to be completed by 2030.

Implementation schedule is described in Figure 6.6-9.

Works	Fiscal Year										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Update and Modification of Feasibility Study by International Donor	■										
Loan Agreement between Iranian Government and the International Donor		■									
Selection of Engineering Consultant		■									
Detailed Design and Preparation of Bidding Documents			■								
Selection of the Contractors				■							
Construction and/or Expansion of the Central STP					■	■	■				
Construction of Sewer Network in the Central Zone					■	■	■	■	■		
Construction of Sewer Network in the Eastern Zone						■	■	■	■	■	
Construction of Sewer Network in the Western Zone							■	■	■	■	■
Construction of Sewage Sludge Treatment Facilities					■	■					
House Connection					■	■	■	■	■	■	■

Source: JICA Expert Team

Figure 6.6-9 Proposed Implementation Schedule of the Development Project of Sewerage System in Rasht

(2) Rural Area

JICA Expert Team proposes the implementation plan of the development project of on-site sewage treatment in rural areas in the Anzali Wetland watershed under the assumption that RWWC will implement the development of on-site sewage system in two villages per year.

Implementation schedule is described in Figure 6.6-10.

Works	Fiscal Year										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Development of on-site sewage treatment system in two prioritized villages (1st year)	■										
Development of on-site sewage treatment system in two prioritized villages (2nd year)		■									
Development of on-site sewage treatment system in two prioritized villages (3rd year)			■								
Development of on-site sewage treatment system in two prioritized villages (4th year)				■							
Development of on-site sewage treatment system in two prioritized villages (5th year)					■						
Development of on-site sewage treatment system in two prioritized villages (6th year)						■					
Development of on-site sewage treatment system in two prioritized villages (7th year)							■				
Development of on-site sewage treatment system in two prioritized villages (8th year)								■			
Development of on-site sewage treatment system in two prioritized villages (9th year)									■		
Development of on-site sewage treatment system in two prioritized villages (10th year)										■	
Development of on-site sewage treatment system in two prioritized villages (11th year)											■

Source: JICA Expert Team

Figure 6.6-10 Proposed Implementation Schedule of the Development Project of On-site Sewage Treatment System in Rural Area

6.6.6 Division of Roles

The role of each organization is listed below.

■ GWWC

GWWC is the implementation agency of domestic sewage management in urban areas of Gilan Province through development, operation and maintenance of sewerage systems.

■ RWWC

RWWC is the implementation agency of domestic sewage management in rural areas of Gilan Province through development, operation and maintenance of on-site sewage treatment facilities.

6.6.7 Budget

(1) Urban Area

As described in Table 6.6-9 in the “Section 6.6.2 Long-term Goal, the estimated construction cost” is USD 325 million. And the necessary total budget for the development project of sewerage system in Rasht is estimated in Table 6.6-11, which is based on the examples of JICA’s ODA projects. And JICA Expert Team estimated the price escalation based on the condition that the consumer price index of Iran has been increasing about 10% per year from 2014 to 2018.

Table 6.6-11 Estimated Cost for the Development Project of Sewerage System in Rasht

No.	Item	Estimated Cost (million USD)	Remarks
1	Construction cost	325	
2	Consultant service cost	33	10% of construction cost
3	Administration cost	36	10% of ((1) + (2))
4	Contingency	36	10% of ((1) + (2))
5	Price escalation	251	70% of ((1) + (2)), based on the actual situation of price escalation
TOTAL		681	

Source: JICA Expert Team

(2) Rural Area

Based on the estimated project cost described in Table 6.6-10 in the Section 6.6.2 Long-term Goal, the average project cost for the 28 prioritized villages is calculated to be about USD 4 million. Therefore, the annual necessary budget is estimated to be USD 8 million to cover two villages per year, and the total budget from 2020 to 2030 is estimated to be USD 88 million.

6.6.8 Supposed Problems

■ GWWC is operating a STP in Rasht City and two STP in Anzali City, accordingly, GWWC has already been familiar to the operation and maintenance work of STP. Also, while RWWC is operating the on-site sewage treatment units that were installed in Mobarak Abad Village in the joint pilot project, RWWC has already learnt how to operate and maintain on-site sewage treatment unit. Therefore, there is almost no concern in operation and maintenance of sewage treatment facilities.

- The greatest concern is that there is a possibility of budget shortfall because of the inflation beyond the supposed one or the stop of subsidy from Gilan provincial government and NWWC.

6.7 Waste Management

6.7.1 Current situation

There are six townships, eleven cities and many villages in the watershed of the Anzali Wetland. Each city and village have responsibility of solid waste management in its jurisdiction. The current condition of solid waste management in the areas was surveyed in aspects of legal institutional framework, waste generation, collection and transportation, intermediate treatment, final disposal, and so on.

(1) Legal and Institutional Framework

1) National Level

The fundamental legislation regarding solid waste management in Iran are “Solid Waste Management Act (2004)” and its bylaw “Executive Regulations for Waste Management (2005)”. Based on these law and bylaw, regulations on municipal waste, hazardous and non-hazardous industrial wastes, construction waste, medical waste, agricultural waste, electronic waste, and asbestos and radioactive waste, have been established. The responsible organization of municipal solid waste management at the national level is Municipality and Rural Management Organization (MRMO) in the Ministry of Interior. As for management of medical, agricultural and industrial wastes, Ministry of Health, Ministry of Jihad and Agriculture (MOJA) and Ministry of Industry, Mine and Trade are in charge. DOE is responsible for waste management from the environmental point of view.

2) Provincial or Local Level

In Gilan Province, there is no specific regulation or standard on solid waste management and the solid waste management systems in Gilan Province follows the national law and regulations. Gilan Province is preparing a master plan on solid waste management in the Province, but it has not been officially approved.

The responsibilities of concerned organizations on solid waste management is very complex as summarized in Table 6.7-1. In the provincial level, Gilan Waste Management Organization (WMO) under the Urban Affairs Office has the overall responsibility on solid waste management in Gilan Province, such as establishment of legal framework and strategic planning. The implementation bodies of municipal waste management are WMO at the level of municipality or urban affairs office in municipalities, and some of them contract out waste management services, e.g., collection and transportation of waste as well as operation and management of related facilities, such as composting plant and landfill, to private companies. Industrial waste is managed by industries under the supervision of Department of Industry. Agricultural waste is managed by farmers under the supervision of MOJA. Medical waste is managed by hospitals and other medical institutions under the supervision of Department of

Health. DOE has the responsibility to monitor all kinds of wastes, including hazardous, industrial, medical wastes, and control waste management from environmental aspects.

Table 6.7-1 Organization Related to Solid Waste Management in Gilan Province

Organization	Responsibility
Provincial governor office	Delivering the rules, regulations and legal guidelines to the municipal waste management executive organizations and civil councils. Preparing the database for municipal and agricultural waste management and offer to DOE for completing the Wastes Comprehensive Database. Determining landfills for municipal waste in accordance with environmental regulations in coordination of DOE, NRWGO and MOJA. Preparing guidelines for signing contracts and assigning authorized natural and legal persons for waste management operation. Preparing executive guidelines for organizing natural and legal persons who were active in the waste management operations before the approval of law and regulations. Cooperation with the health and medical education organization for preparing guidelines subject to the article 5 of the Act. (Waste management regulation).
Development affairs department of Gilan Governor's office	Holding waste management committee at the level of province with presence of all organizations involved in waste management. Head of the department is the head of Provincial WMO.
Urban Affairs Office of Gilan Governor Office	Secretary of the Provincial waste management committee. Spending the budget provided by MRMO in urban areas under Gilan WMO.
Rural Affairs Office of Gilan Governor Office	Secretary of the Provincial waste management committee Spending the budget provided by MRMO in rural areas
Gilan WMO	Organization's objective is to implement waste management plans in the urban areas based on the waste management regulation, also preparing necessary infrastructures for utmost cooperation, attracting investment by private sector, expansion of public cooperation and raising public awareness by means of education and announcement. The budget for such plans is provided by MRMO.
DOE Gilan	Member of waste management committee at provincial level Studying the environmental destruction and pollution factors Using eco-friendly technologies and providing environmental instructions to identify suitable locations for large industrial and agricultural plants and human settlements Developing criteria and environmental standards for management and utilization of water, soil and air resources, also for management of municipal, industrial and agricultural waste in urban and rural areas Raising environmental awareness Supervision and legal intervention to prevent and prohibit contaminants from entering the environmental resources
Dept. Industry	Member of waste management committee at provincial level Identifying, reporting and perusing the violations related to waste management regulation
MOJA	Promoting waste reduction among producers and farmers involved in agricultural industry Identifying, reporting and following up the violations related to waste management regulation.
Shahrestan (township)	Holding waste management committee at the level of township (Shahrestan) Distributing the budget provided by Provincial governor's office
Baksh (district)	The executive management of all types of municipal waste outside the boundaries of cities and villages including collection and transportation
Shahr (municipality/city)	The executive management of all types of municipal waste within boundaries of cities including collection and transportation
Dehstan (village cluster)	Administrative office under Bakhshdari (District office)
Deh (village)	The executive management of all types of municipal waste within boundaries of villages including collection and transportation

Source: JICA Expert Team

(2) Waste Generation

1) Waste Classification

According to the Solid Waste Management Act (2004), solid waste is categorized into the following five groups as shown in Table 6.7-2.

Table 6.7-2 Categorization of Solid Waste in Iran

Type of Waste	Definition
Ordinary Wastes	Any wastes which are commonly generated as a result of man's life process inside and outside cities and villages such as household and demolition wastes.
Medical (Health Care) wastes	Any infectious and harmful wastes generated by hospitals, health and treatment facilities, medical laboratories and other similar facilities. Other harmless hospital wastes are not included.
Special wastes	Any wastes requiring special care due to containing at least one of the hazardous components of poisonous, pathogenesis, explosiveness, inflammability, corrosiveness and the likes. Those medical wastes, as well as some part of ordinary, industrial, and agricultural wastes which needs to special management, are included as specific wastes.
Agricultural wastes	Any wastes resulted from productive activities in the agricultural section including animal refuse, animal corps (cattle, poultry, and aquatic animals), decayed or unusable agricultural products.
Industrial wastes	Any wastes resulted from mine and industrial operations and gas, oil, petrochemistry refinery and power stations wastes and the likes, such as filings, slag and industrial sludge.

Source: Solid Waste Management Act (2004)

2) Waste Generation

Table 6.7-3 summarizes the population of six Shahrestans in the watershed of the Anzali Wetland. The total population in these Shahrestans is about 1.39 million in 2011, of which 926 thousand or about 67% are urban population. Some part (e.g., Khoshkebihar and Kuchesfahan) of Rasht is outside of the watershed of the Anzali Wetland, and the population in the watershed is estimated at about 1.25 million in 2011.

Table 6.7-3 Population of Six Townships in the watershed of the Anzali Wetland

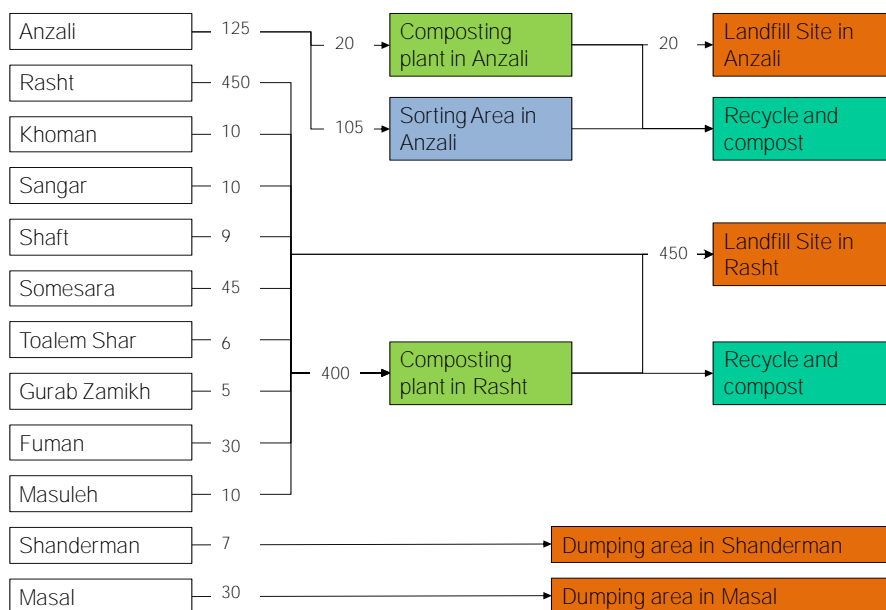
Shaharestan	Urban	Rural	Total
Anzali	116,664	21,337	138,001
Rasht	698,014	220,431	918,445
Shaft	8,879	49,664	58,543
Somesara	52,037	75,720	127,757
Fuman	31,176	62,561	93,737
Masal	19,182	33,314	52,496
Total	925,952	463,027	1,388,979

Source: Statistical Book of Gilan Province (2012/1392)

According to Master Plan for Central Region of Gilan (2010), the average waste generation per capita is estimated at 900 to 1000 gram/day in urban areas (especially in Rasht) and 300gram/day in rural areas. The total generation of municipal waste is estimated at 900 ton/day in urban area and 112 ton/day in rural area.

3) Waste Stream

Figure 6.7-1 summarizes the current waste stream in urban area of the watershed of the Anzali Wetland.



Note: Unit: ton/day

Source: DOE

Figure 6.7-1 Current Waste Stream in Urban Area in Anzali Watershed

Rasht is by far the biggest source of solid waste accounting for roughly a half of the waste generated in the area. The next largest source is Anzali, as expected from its population size. Anzali has its own composting plant as well as a waste disposal site, and municipal waste generated in Anzali is disposed of within Anzali. Most of other municipalities are sharing the composting plant in Rasht and the Saravan landfill. Masal and Shanderman are using a small dumping site in Masal. In most of rural area, generated waste is disposed in their backyard, surrounding area including rivers.

(3) Collection and Transportation

In the watershed of the Anzali Wetland, SWM services are provided only around 50% of the total population. Even in Rasht or Anzali municipality, solid waste collection services are provided to around 90% of the population. In other cities, the waste collection coverage is only around 70%.

In the serviced areas, curb-side collection, in which those who discharge waste place their waste along the road for collection, is common in commercial area and densely populated area. Waste collection box is installed in less-densely populated area or suburban area. In many areas, collection is provided as many as 6 or 7 days a week, and the time of collection varies. Rasht Municipality collects their wastes at night.

Table 6.7-4 summarizes the collection system, type of vehicle and number of trip of each municipality. Unfortunately, information on collection equipment is limited, but Rasht has 65 vehicles and Anzali has 21 vehicles. Other municipalities have only a few vehicles.

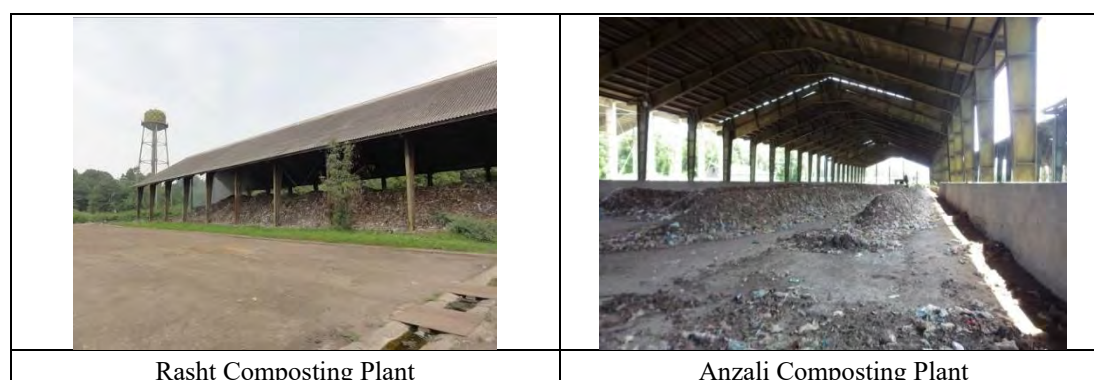
Table 6.7-4 Collection Systems and Equipment of Municipalities in the Project Area

Name of municipality	Collection system	Type of vehicle	Number of trip per day
Bandar Anzali	Partly privatized	Compactor vehicle, pickup truck, dump truck, etc.	46
Rasht	Partly privatized	Compactor, dump truck, etc.	-
Khomam	Partly privatized	Pickup truck, dump truck, etc.	4
Sangar	Public	Compactor, pickup truck, etc.	-
Shaft	-	-	-
Some'esara	Public	Dump truck, pickup truck	7
Tolam Shar	Public	Pickup truck	3
Gurab Zarmikh	Partly privatized	Compactor vehicle, dump truck	2
Fuman	Public	Compactor vehicle, pickup truck, dump truck, etc.	6
Masuleu	-	-	-
Masal	Partly privatized	Compactor vehicle, dump truck, etc.	6
Shanderman	Public	Dump truck, Pickup	4

Source: DOE Gilan

(4) Intermediate Treatment

Intermediate treatment is processes in which collected solid waste is sorted, composted, processed to make RDF or incinerated in order to separate recyclables, produce compost, recover energy, and reduce the amount of waste to be landfilled. There are composting plants in Rasht and Anzali as shown in Figure 6.7-2, but there are no other intermediate treatment facilities in the watershed of the Anzali Wetland.



Source: JICA Expert Team

Figure 6.7-2 Composting Plants in the Watershed of the Anzali Wetland

1) Composting Plant in Rasht

There is a composting plant in Lakarn in Rasht municipality. The design capacity of the compost plant is 500 ton/day and current hauled waste is 400 ton/day. The biodegradable waste of approximately 80 ton/day is segregated in the sorting area and sorted by a trommel. In the sorting area, 10 to 20 sorters are sorting recyclables such as plastic, metals, glass bottles, and so on. Segregated recyclable waste is sold to recycling companies.

2) Composting Plant in Anzali

Anzali municipality developed the composting plant in 2006 and started its operation in 2012. The compost plant is operated by a private company and most of its profit is generated from selling recyclable waste. The process includes separation of non-organic waste, fermentation for 8 weeks, curing and packing.

(5) Final Disposal

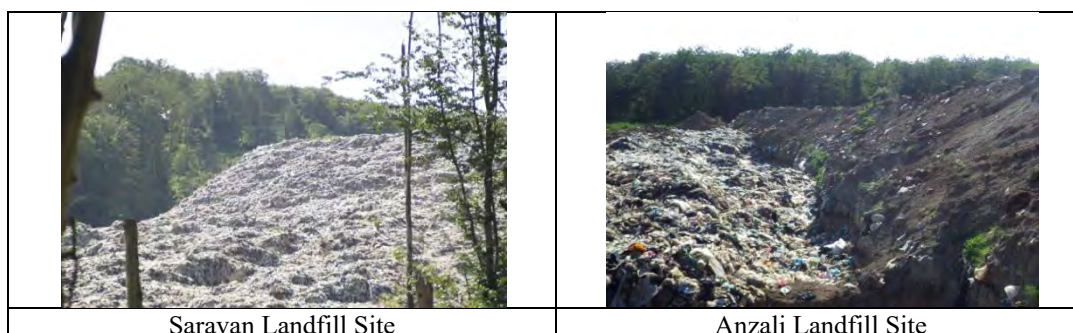
Final disposal in Anzali watershed is implemented in the following sites and their photos are shown in Figure 6.7-3.

1) Saravan Landfill Site

The Saravan Landfill Site is designed as a valley-filling type semi-controlled dump site, but most of the area is used as an open dump site. Though some area of the site is covered by soil and compacted, there is no embankment, and waste is just dumped into the valley without soil cover. Gas ventilation pipes have been installed, but the amount of gas flux is not so much. There is no liner system and no surface water drainage. The generated leachate is discharged without any treatment and it is causing pollution in the downstream area and possibly the groundwater contamination.

2) Landfill Site in Anzali.

The landfill in Anzali is an open dump site in a flat area near the Anzali Wetland. The landfill site has embankment, but there is no liner sheet at the bottom of the landfill, and there is no leachate collection and treatment system. The amount of disposed waste is approximately 65ton/day.



Source: JICA Expert Team

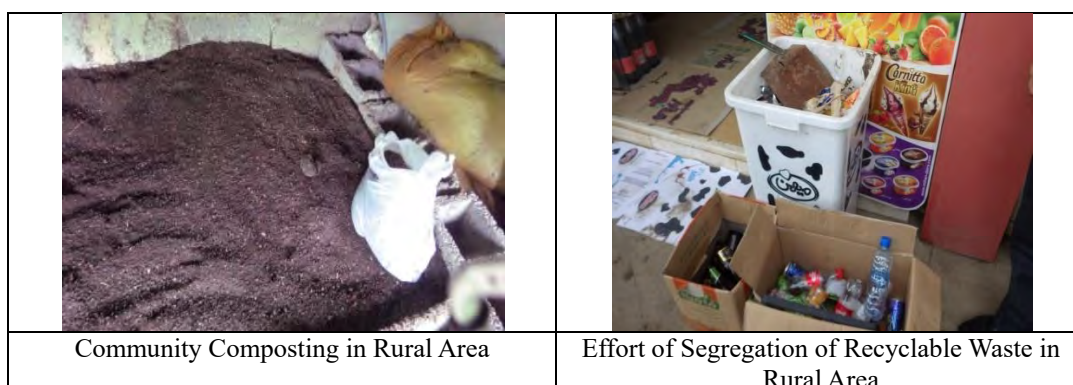
Figure 6.7-3 Landfill Sites in the Watershed of the Anzali Wetland

3) Other Dumping Sites

There are dumping sites in Masal and Shanderman to dispose of waste generated in the areas. The dumping site in Masal is located near Masal River, which is not an ideal location as waste materials and leachate from the site could cause pollution in the river.

(6) Municipal Waste Management in Rural Area

Municipal waste management in rural area is quite different from that in urban area. In rural area, population density is generally too sparse to introduce a house-to-house collection in cost-effective manner, and most villages do not have enough budget and other resources, such as collection vehicles, to provide frequent collection services. Thus, organic waste is often self-disposed. Disposal of plastics poses some difficulty as plastics are not biodegradable. Also, villagers need collection of recyclables, such as glass, metals and PET. Under the support from Rural Affairs Office of Gilan Province Governor Office, some NGOs in the watershed are making effort to organize recycling by coordinating with private recyclers. Such program is often coupled with an initiative to promote high-quality vermi-compositing to manage organic waste as shown in Figure 6.7-4.



Source: JICA Expert Team

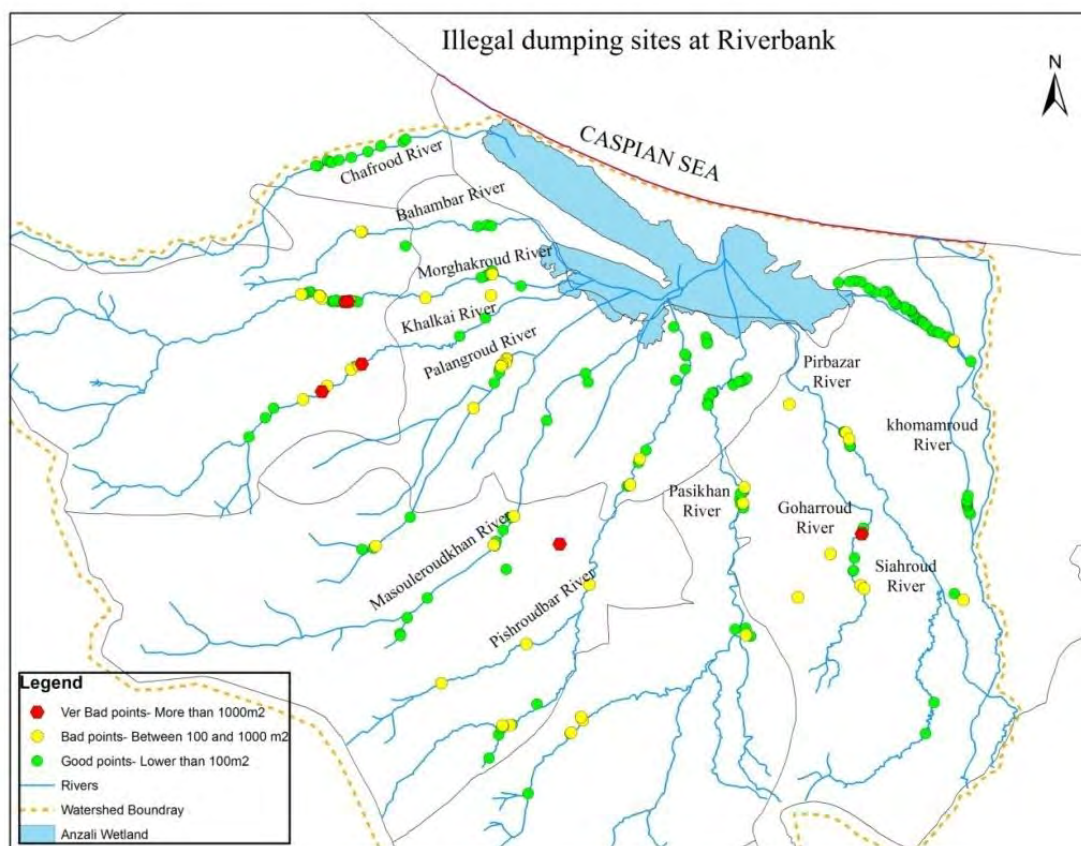
Figure 6.7-4 Waste Management Activities in Shaft Village in the Anzali Watershed

During the JICA project, JICA Expert Team conducted a questionnaire survey for residents in some villages. Based on the survey, 50% of respondents did not receive waste collection service in villages. This indicates that shortage of waste collection service causes waste scattering in road and rivers. Above all, for villages that have waste collection service, around 17.6% of families claim that frequency of collection service is 1 time in a week and 8.8 % families claim trashes are collected just 1 time in a month.

(7) Illegal Dumping

Despite the efforts to manage waste in both urban and rural areas, illegal dumping is ubiquitous in the watershed. Because there is essentially no information on illegal dumping, JICA Expert Team conducted a survey of illegal dumping along major rivers in late 2014 and the locations

of dumping place are shown in Figure 6.7-5. According to the survey, there are many and large dumping places near Kalkai, Morghakroud and Goharroud rivers which are polluted. Comparatively, Chafroud or Bahambar river is not so polluted by dumped waste. In these area, because there is no waste collection service, residents don't have any choice except releasing waste into the rivers, burning and in some case burying in their backyard. In addition to this, most of the residents do not have enough knowledge on composting or recyclable waste.



Source: JICA Expert Team

Figure 6.7-5 Map of Illegal Dumping Along Main Rivers in Anzali Watershed

(8) Other Wastes

1) Medical waste

According to the waste analysis in Gilan's waste management master plan, total non-infectious medical waste generated in Gilan province is 7,176 kg/day and total infectious medical waste is 3,869 kg/day, which is generated in various hospitals and health centers of the province. Based on the same studies, medical waste management varies from one hospital to the other, depending on the available waste management facilities including autoclave or incinerator. In some cities, non-infectious medical waste is segregated from infectious medical waste, and then the infectious waste is disinfected by incinerator or autoclave. (i.e. Rasul-e Akram hospital in Rasht and Shahid Beheshti hospital in Anzali manage the infectious waste by incinerator.) However,

in other cities like Tolam and Gurabzarmikh, the medical waste is transferred and disposed together with municipal waste.

2) Industrial waste

According to Gilan's waste management M/P, all 1976 industrial units in Gilan generate around 150,000 ton/year, however there is no specific waste management plan for industrial waste in the province. The amount of hazardous industrial waste depends on the industry (e.g. 80% of the waste generated in medical/chemical industry and 5% of the waste generated in food industry are hazardous). According to the legislation, the generator of industrial waste is responsible for its waste management and treatment. The average rate of hazardous industrial waste treatment is less than 5%. Regardless of being hazardous or non-hazardous, 50.4% of industrial waste in Gilan province is disposed illegally in the nature, 14.3% is burnt, 23.5% is sold out and 11.6% is delivered to the municipality to be managed with municipal waste. Moreover, the situation of construction waste is similar to that of industrial waste. Not to mention that construction waste in Iran is not categorized as industrial waste rather it is considered municipal waste.

3) Agricultural waste

Agricultural industry in Gilan is divided into 5 major categories. Rice, bean, peanut, vegetable and olive production. More than 90% of the waste in rice, bean and peanut production industry is converted to other products or is used for feeding domestic animals, while this rate is 100% in vegetable production. 20% of rice straw waste is used for vermi-composting.

There are some reports of burning the rice straws after the harvesting season, however according to an interview to Mr. Borji, head of DOE Gilan, burning straws were decreased by 70% in the province due to legal intervention and supervision of DOE to prevent environmental pollution. (IRNA)

6.7.2 Long term vision

Solid waste scattered in Anzali Wetland has been considered as one of the major environmental issues for conservation of the wetland. Some of the waste scattered in the wetland is discharged by people who visit the wetland, while a large part of the waste in the wetland comes from the upstream areas through the rivers. Such waste gives negative impacts to the wetland, which include not only the deterioration of aesthetic value of the wetland, but also a range of environmental problems such as offensive odor, water pollution, soil contamination, degradation of habitat of living creatures in the wetland.

In principle, each municipality/city (Shahr) and village (Deh) have responsibility on solid waste management in its jurisdiction and boundary, and township (Shahrestan) and district (Baksh) are responsible for its supervision according to the policy set by Gilan Province. There exist waste management plans at the regional and municipality levels in Anzali Wetland watershed,

of which examples are followings, although most of them have not been officially approved and implemented.

- Gilan Province Waste Management Master Plan (2010)
- Central Gilan Waste Management Master Plan (2006, 2010)
- Anzali Comprehensive Waste Management Plan (2009)
- Somesara Source Segregation Plan (2014)

The overall policy on solid waste management in Gilan Province and the municipalities in the province shall be formulated in the above mentioned plans. Therefore, the Mid-term Action Plan on Waste Management for Anzali Wetland Conservation shall be formulated with the long-term goal “**to prevent deterioration of habitat due to excessive inflow of waste in the wetland,**” as well to supplement and support improvement of solid waste management in the Province in accordance with the above mentioned plans.

6.7.3 Mid-term goal

The fundamental approach proposed for the Mid-term Action Plan on Waste Management is to expand the activities implemented under the project by reflecting the lessons learnt from the JPA practices. Among the JPAs implemented or examined under the project, the waste bring-back awareness raising activity and the river waste collection activity would directly contribute to prevention of waste inflow in the Wetland. On the other hand, the recyclable waste recovery activity and the organic waste composting and in-house treatment activity would also contribute to improvement of waste management in the community and enhance awareness of residents on waste management issue.

The mid-term goal of the Mid-term Action Plan on Waste Management for 2020 – 2030 is set as followings.

I. Waste bring-back awareness raising activity

- To conduct awareness raising campaign for tourist and fishermen at boat stations in the wetland.

(Target: **100 times** during the planning period)

- To install designed awareness raising signboards in villages and municipalities within the wetland basin.

(Target: **100 locations** during the planning period)

II. River waste collection activity

To install and manage waste net in rivers in the wetland basin.

(Target: **100 locations** during the planning period)

III. Recyclable waste recovery activity

- To start and operate recyclable waste recovery activity in villages and municipalities within the wetland basin.

(Target: **50 villages/municipalities** during the planning period)

IV. Organic waste home composting and in-house treatment activity

- To start and operate organic waste home composting and in-house treatment activity with volunteer households in villages and municipalities within the wetland basin.

(Target: **1,000 households** during the planning period)

6.7.4 Pre-condition

Pre-conditions to implement the mid-term action plan and achieve the set targets are identified as followings:

- Budget allocation
Anzali Wetland Management Committee (AWMC) in coordination with DOE, RAO, WMO shall allocate and disburse planned budget on time.
- Appointment of staff
AWMC shall appoint and assign technical staff in charge of implementation of planned activities.
- Cooperation of stakeholders
It is necessary that concerned stakeholders such as village and municipalities, villagers and citizens, boat station operators, fishermen and tourists will cooperate and collaborate on preparation and implementation of the planned activities.

6.7.5 Implementation plan

(1) Waste bring-back awareness raising activity

1) Planned awareness raising activity

Waste littering is one of the major issue on solid waste management in Anzali Wetland and raising awareness of tourists and fishermen who are visiting the wetland as well as residents in the wetland basin is important. Therefore, the following activities on waste bring-back awareness raising were planned to prevent waste littering in the basin and inflow of waste to the wetland.

- Awareness raising campaign for tourists and fishermen using the boat stations in the wetland
- Installation of awareness raising signboards

2) Waste bring-back campaign

Waste Management Sub-committee shall implement waste bring-back campaign in collaboration with the boat stations in the wetland. Tourists and fisherman are asked to bring-back their waste discharged during their visit to the wetland by putting into waste bags provided

by Waste Management Sub-committee. It will be effective to install awareness raising signboards and banners at boat stations and install waste containers to dispose collected waste. Besides, it is recommended to conduct monitoring to grasp cooperation rate of visitors on bringing back waste as well as amount of collected waste to examine performance of the activity. Figure 6.7-6 shows the scenery of waste bring-back campaigns implemented under the JPA.



Source: JICA Expert Team

Figure 6.7-6 Scenery of Waste Bring-Back Campaigns in the JPA

3) Installation of awareness raising signboard

Waste Management Sub-committee shall also promote installation of awareness raising signboards with message encouraging residents to bring back and not littering waste at appropriate locations in the wetland basin. The examples of signboard designs prepared and installed in the JPA are presented in Figure 6.7-7. These signboard designs can be utilized and updated as necessary in implementation of the planned activity.



Source: JICA Expert Team

Figure 6.7-7 Examples of Signboard Design Developed in the JPA

The example of installed awareness raising signboards in Hendekhaleh village and Jirsar Bagher Khaleh village are presented in Figure 6.7-8.



Source: JICA Expert Team

Figure 6.7-8 Examples of Signboard Design Developed in the JPA

- (2) River waste collection activity
 - 1) River waste collection methods

In order to prevent inflow of waste into the wetland, awareness raising activity on bringing back and not littering waste should be promoted as the first priority activity. However, considering the current situation in the wetland basin and considering that effect of awareness raising activity

can be brought in long term, collection of removal activity of waste flowing in the river and wetland is also necessary. There are several types of river waste collection methods as shown in Figure 6.7-9. An appropriate method at each location should be applied considering technical feasibility, social acceptability, required budget, and so on.



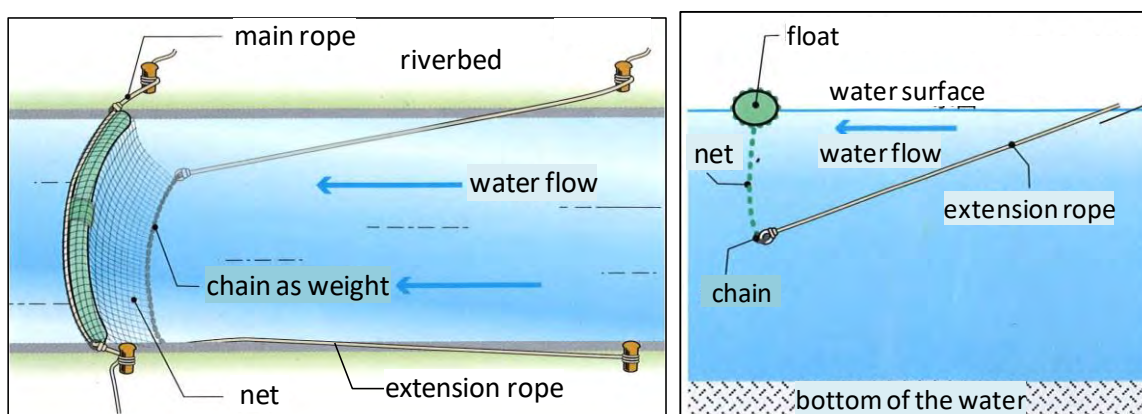
Source: JICA Expert Team and Osaka Prefecture (<http://www.pref.osaka.lg.jp/ne/kanri/gyouseikasennseisou.html>, <http://www.pref.osaka.lg.jp/kasenkankyo/tokusyoku/onchi-gomi.html>)

Figure 6.7-9 Examples of River Waste Trapping and Collection Methods

2) Installation of river waste trapping net

As construction of river waste trapping structure require curved river structure and adequate space for trapping, it is considered this trapping structure cannot be applied in many locations in the wetland. Besides, it will require some civil engineering work and considerable amount of budget, so it should be planned and implemented by DOE in coordination with relevant authorities as well as waste collection ship activity. Hence, the mid-term plan will aim to promote river waste trapping net activity in collaboration with municipalities/cities and villages.

When promoting the river waste trapping net activity, it will be important to understand that the net will not be a permanent infrastructure to trap waste inflowing to the wetland. The net will be easily damaged and sometimes flown by flood, therefore, careful and frequent maintenance of the net will be necessary. Without being overconfident on the stability of the river waste trapping net, it will be appropriate to regard the activity as a tool for awareness raising on river waste issue. An example of proposed installation method of river waste trapping net is shown in Figure 6.7-10.



Source: Taniguchi Shokai Co., Ltd.

Figure 6.7-10 Example of River Waste Trapping Net Installation Method

River waste trapping nets installed in DSS and JBK villages under the JPA were presented in Figure 6.7-11. The length of the nets was 20 m considering the width of the rivers, and the height of the net was 50 cm and Styrofoam floater was equipped so as to trap floating waste.



Source: JICA Expert Team

Figure 6.7-11 River Waste Trapping Net Installed in the Wetland

3) Combination with river cleaning up campaign

As explained, river waste trapping net cannot be a permanent infrastructure and maintenance of the net will be at most importance for sustainable operation of the activity. Therefore, it is considered to be effective to combine maintenance work of river waste trapping net with river cleaning up campaign with residents. By conducting river cleaning up campaign in periodical manner, removal of waste trapped by the net and maintenance of the net can be done at the same time with the campaigns. Some examples of river waste cleaning up campaign scenery in Japan is presented in Figure 6.7-12.



Source: Osaka Prefecture (<http://www.pref.osaka.lg.jp/kasenkankyo/tokusyoku/onchi-gomi.html>)

Figure 6.7-12 Examples of River Cleaning Up Campaign

4) Recyclable waste recovery activity

(a) Construction of recycling station

After selection of target areas of the activity, a station of recyclable materials shall be constructed with financial support from Waste Management Sub-committee. The examples of recycling stations are presented in Figure 6.7-13.



Recycling Station in Rasht City

Recycling Station in Khomam District

Recycling Station in DSS Village constructed under the JPA

Source: JICA Expert Team

Figure 6.7-13 Examples of Recycling Station in Anzali Wetland Basin

The construction cost required for recycling station in DSS village was IRR 631.7 million in 2016 as shown in Table 6.7-5. As it is not a small amount of investment cost for villages, it is necessary that Waste Management SC will be responsible for construction of recycling stations. As in the case in Rasht City, it is possible to implement recyclable waste recovery activity with only the recyclable collection container, which costs IRR 136.6 million in 2016, so as to minimize initial cost required for the activity.

Table 6.7-5 Construction Cost Required for Recycling Station in DSS Village

Facility	Cost (million IRR)	Specification
Recyclable collection container	136.6	3 m * 7 m
Storage container	112.4	3 m * 4 m
Office container	67.0	2 m * 2 m
Composting yard	189.2	
General area	38.0	
Fence	88.6	
Total	631.7	

Source: JICA Expert Team

(b) Procurement of collection vehicle

It is also necessary for Waste Management Sub-committee to procure a vehicle to collect recyclable materials from residents in target area. In the case of JPA implemented in DSS village, a waste collection truck was procured by RAO with the cost of IRR 560 million in 2017. During the practice of JPA, it was found that expected amount of recyclable waste collected from a village is not large, and it will be appropriate to use farming tractor, which costs about IRR 16 million in 2017, so as to minimize initial cost required for the activity. The examples of recyclable waste collection vehicles are shown in Figure 6.7-14.

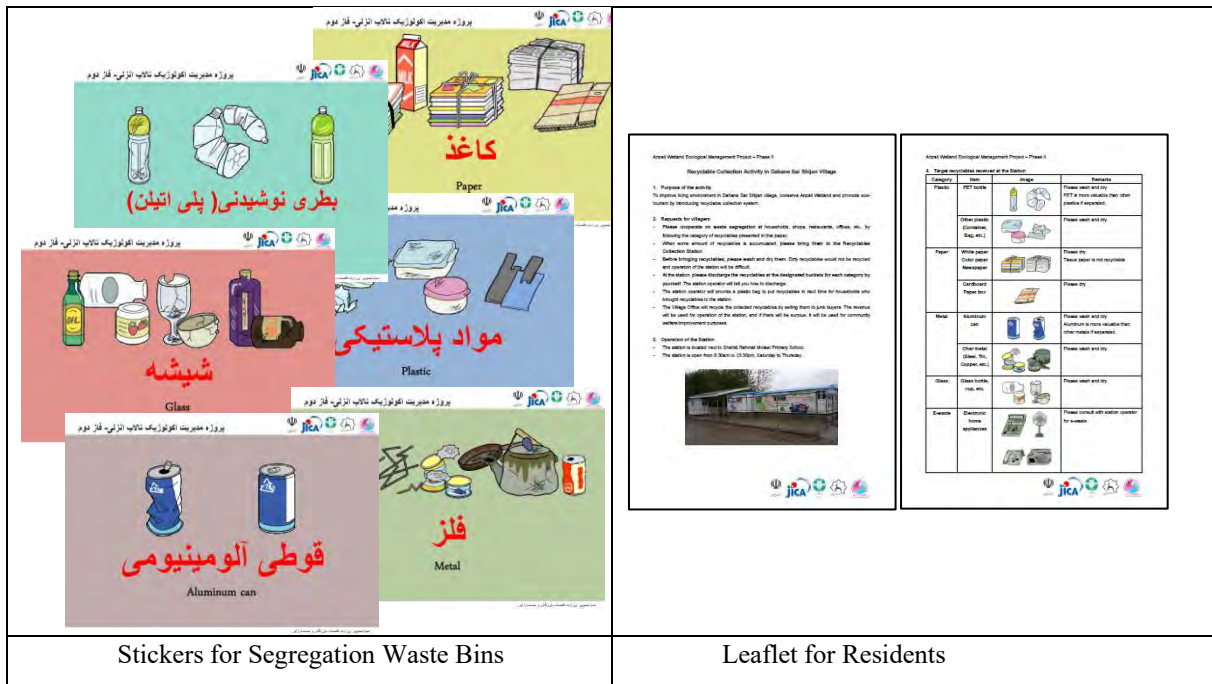


Source: JICA Expert Team

Figure 6.7-14 Examples of Recyclable Waste Collection Vehicles

5) Development of instruction materials

The stickers to put on waste segregation bins illustrating the target recyclable materials and the leaflet explaining purpose and methodology of the recyclable waste collection activity were designed and prepared in the JPA under the Project as presented in Figure 6.7-15. These instruction materials can be utilized and updated as necessary in implementation of the planned activity.



Source: JICA Expert Team

Figure 6.7-15 Instruction Materials Developed in the JPA

6) Promotion and dissemination to residents

The key for successful implementation of recyclable waste recovery activity is cooperation of residents for segregation of their waste. Hence, it is important to continuously encourage residents to participate in the activity. Variety of promotion and dissemination activities shall be implemented by Waste Management Sub-committee in collaboration with the concerned organizations. Figure 6.7-16 presents examples of promotion and dissemination tools designed and prepared in the JPA under the Project. These tools can be utilized and updated as necessary in implementation of the planned activity.



Source: JICA Expert Team

Figure 6.7-16 Examples of Promotion and Dissemination Tools Developed in the JPA

In addition, holding workshops with residents will be effective and essential to ask for cooperation on segregation of waste. The scenery of workshop with villages and students in DSS village during the JPA was presented in Figure 6.7-17.



Source: JICA Expert Team

Figure 6.7-17 Workshops Held During the JPA

7) Transaction of collected recyclable materials

The sale of collected recyclables is one of the important tasks and it is desired to increase the sales proceed as much as possible in order to operate the activities in sustainable manner. Finding buyers who offers more favourable conditions (purchasing price) during operation of the activity is necessary, and it is desirable that Waste Management Sub-committee shall accumulate information of recyclable material buyers and share the information to concerned organizations. The scenery of transaction of collected recyclables in DSS village under the JPA is presented in Figure 6.7-18.



Measurement of Collected Recyclables

Price Negotiation with Buyer

Source: JICA Expert Team

Figure 6.7-18 Sales of Collected Recyclables During the JPA

8) Monitoring and evaluation of performance

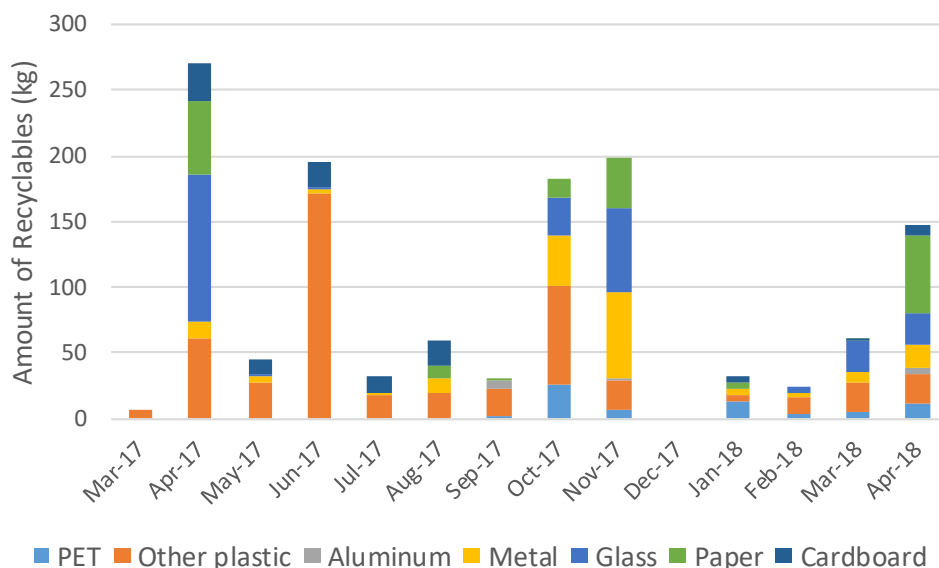
Periodical monitoring and evaluation of performance is necessary to continuously improve the activity. It is important to monitor and supervise cooperativeness of residents on segregated waste discharge and communicate with residents to identify obstacles and difficulty for cooperation on the activity. Based on consultations with residents, interventions to induce more cooperation from residents can be examined. Figure 6.7-19 shows the scenery of monitoring in DSS village under the JPA.



Source: JICA Expert Team

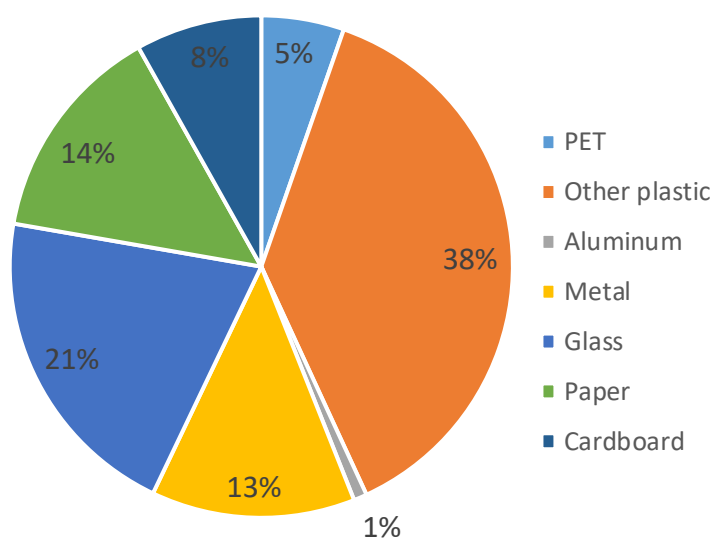
Figure 6.7-19 Scenery of Monitoring under the JPA

It is also important to monitor amount and composition of collected recyclable materials, as well as operational cost and revenue by selling recyclable materials in order to evaluate performance of the activity. Amount of collected recyclable materials is an indicator to show impact of the activity, that is reduction of amount of waste disposal. Composition of collected recyclable materials can be utilized to examine operational arrangement, such as number of items to be segregated. Operational cost and revenue by selling recyclable materials is essential information to evaluate financial sustainability of the activity. The examples of performance monitoring in DSS village under the JPA are presented in Figure 6.7-20, Figure 6.7-21 and Figure 6.7-22.



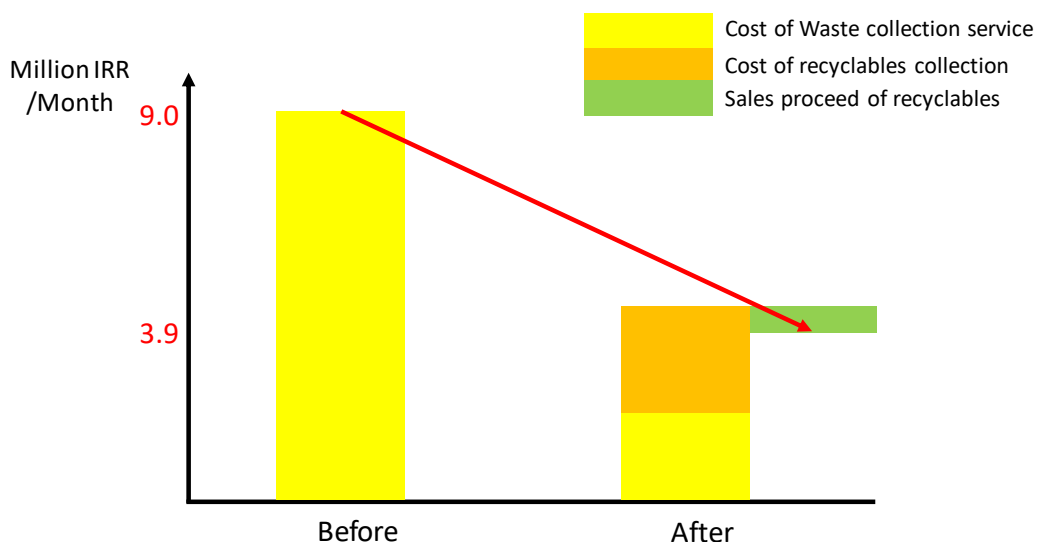
Source: JICA Expert Team

Figure 6.7-20 Amount of Collected Recyclable Materials under the JPA



Source: JICA Expert Team

Figure 6.7-21 Composition of Collected Recyclable Materials under the JPA



Source: JICA Expert Team

Figure 6.7-22 Evaluation of Financial Performance of the JPA

(3) Organic waste home composting and in-house treatment activity

1) Trial with volunteer households

After recruiting volunteer households who are interested in producing compost, Waste Management Sub-committee shall provide technical instructions and support on home composting and in-house treatment of organic waste. Households who do not have enough garden space can try home composting by using Styrofoam boxes and compost bed to be provided by Waste Management Sub-committee. Households who have garden space can try in-house treatment of kitchen waste by mixing with fallen leaves in their garden or farmland. Also, using household kitchen waste for feeding livestock and pets is recommended for reduction of waste. The scenery of home composting activity in DSS village under the JPA is presented in Figure 6.7-23.



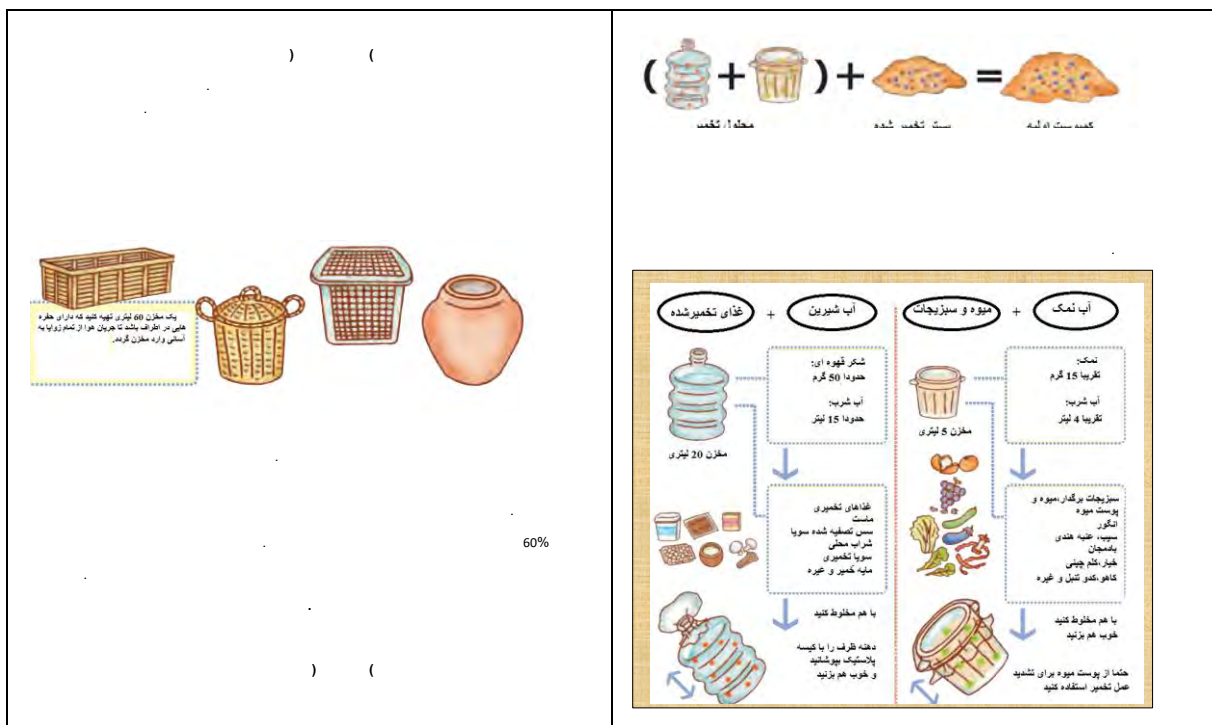


Source: JICA Expert Team

Figure 6.7-23 Scenery of Home Composting and In-house Treatment in the JPA

2) Development of operational manual

The operational manual explaining purpose and methodology of the organic waste home composting and in-house treatment activity was prepared in the JPA under the Project as presented in Figure 6.7-24. This manual can be utilized and updated as necessary in implementation of the planned activity.



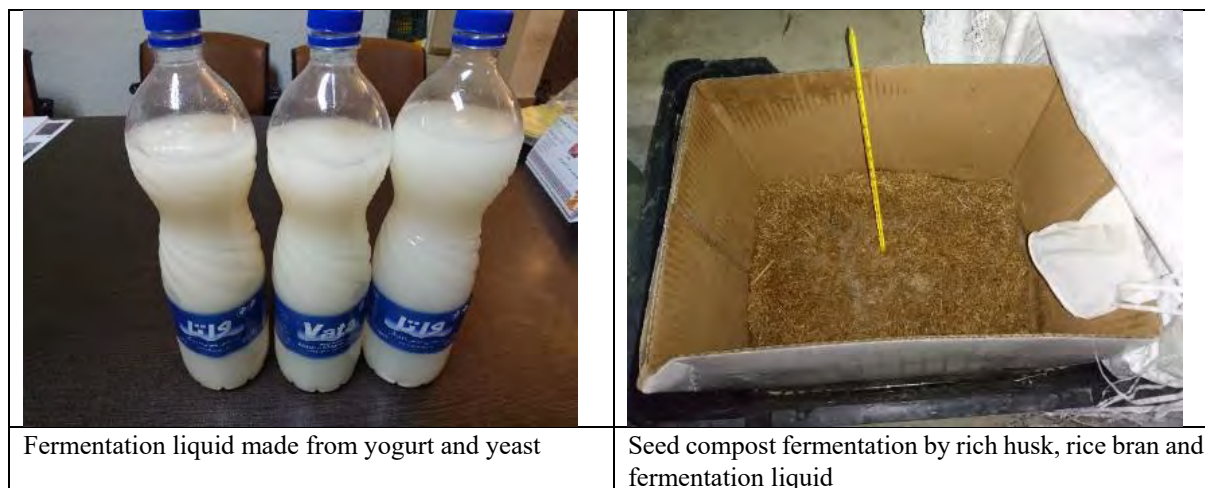
Source: JICA Expert Team

Figure 6.7-24 Operational Manual of Home Composting Developed in the JPA

3) Seed compost production by Takakura Method

When introducing home composting activity, it is usually observed that fermentation process is not well promoted in some households because of insufficient management. In such cases, it is

recommended for Waste Management Sub-committee to produce seed compost by Takakura Method and distributed it to households as a promoter of fermentation process. The methodology to produce seed compost is described in the operational manual and Figure 6.7-25 shows the process of seed compost production.



Fermentation liquid made from yogurt and yeast

Seed compost fermentation by rich husk, rice bran and fermentation liquid

Source: JICA Expert Team

Figure 6.7-25 Trial on Seed Compost Production by Takakura Method

4) Monitoring and evaluation of performance

It is necessary to monitor the number of households participated in the activity in order to evaluate performance of the activity. Home composting and in-house treatment of organic waste will contribute to about 70% reduction of solid waste in each household. Therefore, the activity can bring not negligible impact on waste reduction, even though number of volunteer households is not large. Besides, it should be noted that the activity will also contribute to raising awareness of residents on solid waste management issue.

Besides, it is also important to monitor implementation cost of the activity. In the case of the JPA in DSS village in 2017, the activity costed IRR 209,000 for each household as shown in Table 6.7-6.

Table 6.7-6 Procurement Cost for Home Composting in the JPA

Item	Unit	Cost (IRR)
Compost container (Styrofoam box)	1 box	150,000
Compost bed (Vermi compost)	3 kg	60,000
Thermometer	1 unit	30,000
Shovel	1 unit	20,000
Glove	1 unit	30,000
Total		290,000

Source: JICA Expert Team

6.7.6 Demarcation of roles

The demarcation of roles for each organization of Waste Management Sub-committee members is specified as followings:

- RAO
In charge of implementation and supervision of the planned activities in rural area of the wetland basin, as well as provision of technical advises on implementation of the activities to districts and villages.
- WMO
In charge of implementation and supervision of the planned activities in urban area of the wetland basin, as well as provision of technical advises on implementation of the activities to districts and municipalities/cities.
- DOE
In charge of coordination of Waste Management Sub-committee, as well as provision of technical advises on implementation of the activities from environmental viewpoint.
- Municipality/city (Shahr) and village (Deh), district (Baksh)
In charge of implementation of the planned activities in coordination with concerned organizations and residents, as well as Waste Management Sub-Committee.

6.7.7 Implementation schedule

The implementation schedule of waste management mid-term action plan was set as shown in Table 6.7-7, so as to achieve the mid-term goal. It was scheduled to gradually increase the work volume of the activities in the first 2-3 years (2020 – 2022) so that concerned organizations will be able to acquire and enhance capacity to operate the activities.

Table 6.7-7 Implementation Schedule of Waste Management Mid-term Action Plan

Activity	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
I Waste bring-back awareness raising activity - campaign at boat stations - installation of signboards	time location	5	5	10	10	10	10	10	10	10	10	10	100
II River waste collection activity	location	5	5	10	10	10	10	10	10	10	10	10	100
III Recyclable waste recovery activity	village	3	3	4	5	5	5	5	5	5	5	5	50
IV Organic waste composting and in-house treatment activity	households	50	50	100	100	100	100	100	100	100	100	100	1000

Source: JICA Expert Team

6.7.8 Implementation cost and budget allocation

The unit costs of each planned activity were estimated as shown in Table 6.7-8 based on the actual expenses in the Joint Pilot Activities (JPA) conducted under the JICA Project. 10% a year price escalation was set considering that the consumer price index of Iran has been increasing about 10% per year from 2014 to 2018.

Table 6.7-8 Unit Cost of Activity Estimated based on the JPA in the Project

(Unit: million IRR)

Activity	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
I	Waste bring-back awareness raising activity										
Campaign goods/materials	13	15	16	18	19	21	24	26	29	31	35
Staff for campaign (3 staff * 10 days)	30	33	36	40	44	48	53	58	64	71	78
Design and installation of signboard	11	12	13	15	16	18	19	21	24	26	28
II	River waste collection activity										
Waste net	22	25	27	30	33	36	40	44	48	53	58
Staff for river waste collection (5 staff * 1 day + 1 staff * 12 day)	17	19	21	23	25	27	30	33	36	40	44
III	Recyclable waste recovery activity										
Recyclable station container (3 m * 7 m)	201	221	243	267	294	323	355	391	430	473	520
Recyclable collection tractor	23	26	28	31	34	38	41	46	50	55	61
Operation cost can be covered by villages	0	0	0	0	0	0	0	0	0	0	0
IV	Organic waste composting and in-house treatment activity										
Home composting tools/materials	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0
Operational cost can be covered by villages	0	0	0	0	0	0	0	0	0	0	0

Source: JICA Expert Team

Based on the set targets of planned activities and the unit cost, the implementation cost of the waste management mid-term action plan in each year was estimated as shown in Table 6.7-9.

Table 6.7-9 Implementation Cost of Waste Management Mid-term Action Plan

(Unit: million IRR)

Activity		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
I	Waste bring-back awareness raising activity	271	299	657	723	795	874	962	1,058	1,164	1,280	1,408	9,491
II	River waste collection activity	197	217	477	524	577	634	698	768	844	929	1,022	6,885
III	Recyclable waste recovery activity	672	739	1,084	1,491	1,640	1,804	1,984	2,183	2,401	2,641	2,905	19,544
IV	Organic waste composting and in-house treatment activity	20	44	97	159	234	322	424	545	685	847	1,036	4,412
Total		1,160	1,298	2,314	2,897	3,245	3,634	4,068	4,553	5,094	5,697	6,370	40,332

Source: JICA Expert Team

The total cost of the waste management mid-term action plan was estimated at IRR40,332million for 11 years of planning period. AWMC shall be responsible for allocation of necessary budget to the Waste Management SC, so as to achieve the set targets by steady implementation of the planned activities.

6.7.9 Issues

- It is necessary for smooth implement the planned activities to utilize the experience and know-how obtained through the JPAs implemented under the Project. Waste Management Sub-committee shall provide such lessons learnt from the JPA to villages, municipalities/cities which will newly start the activities. It will be effective to hold workshops and study tours to share the experience of JPAs under the Project by inviting those villages.
- Waste Management Sub-committee shall well communicate and coordinate with Anzali Wetland Management Committee (AWMC) to secure budget allocation required for implementation of the planned activities. For this purpose, Waste Management Sub-committee shall be responsible for formulation of implementation, monitoring and supervision system of the planned activities, so as to report performance and achievement of the activities to AWMC.

6.8 Ecotourism

6.8.1 Introduction

The Anzali Wetland was registered as a Ramsar site in June 1975 in accordance with the convention on wetlands of international importance. However, due to deteriorated water quality and natural environment of the wetland, the parties of the Convention decided to list the wetland on the Montreux Record in 1993.

Despite the environmental degradation, abundant natural resources still remain in the wetland. During the winter, a number of birds rest in the wetland and lotus flower's blooms covers the wetland in spring. The beautiful scenery of paddy fields in local villages around the wetland can fascinate any visitors. It is expected that the resources in/ around the wetland could attract more tourists, so a proper utilization of these resources can be necessary. Mass-tourism which damages natural and social environments is no longer desired. Developing ecotourism in/around the Anzali Wetland can reach this goal, through environmental awareness raising among local people and tourists which can lead to improving natural and social conditions in/around the Anzali Wetland.

6.8.2 Basic Understanding of Ecotourism

(1) General Concept of Ecotourism

Ecotourism is one of the types of tourism in which, tourists experience natural and social environments without causing any adverse impacts on them. By participating in ecotours, tourists can learn and appreciate local nature, history and culture, and understand the value of them. Experience of ecotours motivates tourists to take an action in environmental conservation. On the other hand, through participation in ecotourism, local people re-discover the value of their natural and cultural resources. The re-discovery motivates them to conserve their resources. Developing ecotourism can also contribute to economic benefits for the local communities, through providing more alternative jobs for the locals. Ecotourism is a social system which is accomplished by a local initiative and the support of different local stakeholders, i.e. government officials, local residents, tourism industries, tourists, etc. Without their mutual cooperation, development of ecotourism could not be successful.

(2) National Definition of Ecotourism

The national definition of ecotourism is described in the Ecotourism Regulations (March 2006) as “meeting the wise needs of ecotourists in a natural, cultural educational, and non-consumptive environment sustainably, by considering the appropriate capacity and the minimum negative impacts on the natural and cultural areas, based on the conditions and regulations which not only protect the environment, the traditional culture and the values, but also will provide the economical local improvements.” The Second Article of the regulation is

deciding the members of the national ecotourism committee in order to make the policies and arrangements for ecotourism development, and facilitate conducting the activities or the contained affairs in this regulation, the ecotourism committee consist of the Deputies of Ministry of Jihad-e-Agriculture (MOJA), Department of Environment (DOE) and Iran Cultural Heritage, Handicrafts and Tourism Organization (ICHHTO) and Ecotourism Expert in the country who is suggested by the ICHHTO and approved by the deputies of the two related organizations. (The First article of the Ecotourism Regulations, March 2006)

Strategies of Ecotourism in Iran:

- 1) Providing enough facilities for an appropriate number of visitors
- 2) Using an ecotourism developmental method with the least negative impacts
- 3) Developing a sustainable conservation, in order to prevent any negative impacts

Plans:

- 1) Using ecologically sustainable methods
- 2) Completing the regional plans
- 3) Improving the natural resources
- 4) Improving the collaboration between the ecotourism management and natural resources, through determining the transportation methods, the entrance zones, and providing permissions and certificates.
- 5) Providing appropriate regulations such as the recognition of the private sector
- 6) Determining fundamental requirements such as providing fundamental information
- 7) Monitoring the visitors' impacts
- 8) Preparing and improving the basic database such as providing a tourism attractions database
- 9) Marketing guidance such as creating market for the tourism destinations

6.8.3 Current Situation

- (1) The Current Issues in and around the Anzali Wetland Areas

The following issues related to tourism, conservation activities around the Anzali Wetland are as follows.

Illegal Activities:

- 1) Illegal activities such as hunting and fishing by locals and outsiders (tourists),
- 2) Illegal waste dumping by locals and tourists,
- 3) Illegal land use.

Environmental Awareness:

- 1) Lack of environmental education for people in Gilan,
- 2) Lack of conservation support from local tourism groups,
- 3) Lack of educational facilities which can provide the knowledge of wetland's conservation for locals and tourists.

Economic Benefits:

- 1) Lack of business opportunities for locals, tour agents, nature and culture guides and other tourism related business owners in Gilan,
- 2) Not enough benefit for villagers around the Anzali Wetland.

Tourists' Satisfaction:

- 1) Lack of tourism activities which can attract and educate tourists in Gilan,
- 2) Lack of facilities for ecotourism activities,
- 3) Lack of professional guides who can introduce the values of nature and culture of the Anzali Wetland.

Ecotourism Understanding:

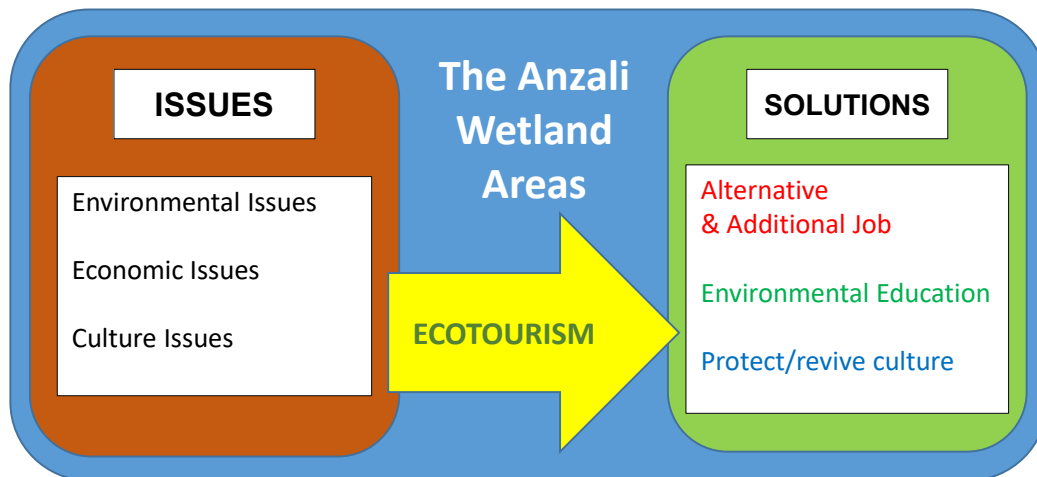
- 1) Lack of understanding and knowledge about ecotourism (confusion between Nature Tours and Ecotourism),
- 2) Lack of cooperation among stakeholders relate to tourism and ecotourism activities,
- 3) Lack of sharing common policies and guidelines for tourism and ecotourism activities.

Keep and Revive a Traditional Culture:

- 1) Loss of younger generations as they have to go to work in the cities,
- 2) Fear of loss of the traditional culture, etc.

(2) Possible Solutions for Solving the Current Issues in and around the Anzali Wetland Areas

Even though ecotourism is a universal idea for solving natural and cultural issues, the approaches toward the issues will be different depending on the areas. The following are the possible solutions toward issues in the Anzali Wetland through ecotourism.



Source: JICA Expert Team and Ecotourism SC

Figure 6.8-1 Ecotourism: Solutions for Solving the Current Issues

- 1) Alternative jobs instead of Illegal Activities
 - a) Provide alternative job opportunities for locals to work, such as being the bird watching and catch and release fishing tour guides, instead of hunting. They will not use their environment to have a short-term benefit, when they understand that, the wise use of the resources can lead to a more sustainable business. Moreover, they will patrol the area themselves in order to prevent illegal hunting.
 - b) Protect the nature sites and clean their village areas in order to have better reputations from outsiders.
- 2) Environmental Awareness
 - a) Provide environmental education through ecotourism training.
 - b) Develop educational center in order to provide the information of wetland conservation.
- 3) Economic Benefits
 - a) Provide job opportunities for locals, especially young ones who are willing to live and work in their village.
- 4) Tourists' Satisfaction
 - a) Provide more places to visit such as, a community-based ecotourism site.
 - b) Provide interpretation training programs for local guides and tour guides who can introduce the values of nature and culture of the Anzali Wetland to tourists.
- 5) Ecotourism Understanding
 - a) Provide workshops and trainings to stakeholders (DOE, GCHHTO, NRWGO, Tour Agents Association, Tour Guides Association, locals, etc.)
 - b) Participate promotional events.

- c) Develop ecotourism policies and guidelines and promote them.
- 6) Keep and Revive a Traditional Culture
 - a) Provide culture-based job opportunities for locals so they can stay in their village.
 - b) Through the ecotourism activities, young locals will appreciate their culture and nature more, and they will be prouder of their own culture and nature.

6.8.4 Key Elements to Success Ecotourism

The following are the key elements to success ecotourism in general.

Structure (System):

Generally, the structure is a hierarchical arrangement of lines of authority, communication rights and duties of organization. Organizational structure determines how the roles, power and responsibilities are assigned, controlled, and coordinated, and how information flows between the different levels of management.

Plans:

It is a future course of action aimed at achieving specific and clear goals within a specific timeframe. It can help all stakeholders understand the goal, steps of activities, costs, expected outcomes and other detail information.

People's Participation:

Even though the good structure and plans exist, ecotourism will not success without people's participation. Especially local participation is the key to success it. Therefore, it always needs to make consideration for locals on a priority bases to make any decisions.

Places:

Places mean the areas or sites where ecotour activities are implemented. They can be rivers, grasslands, community centers, visitor centers, local houses, etc. Selection of the areas and sites must be careful considering legality, safety, accessibility, satisfiability of tourists, locals and governments.

Products:

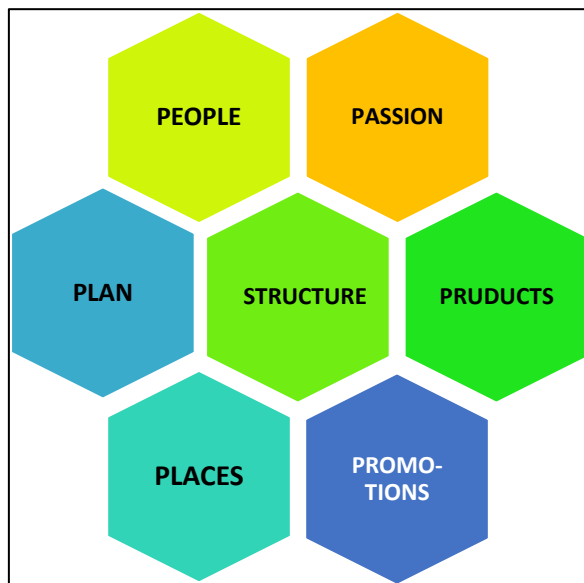
These are the ecotours that the local and tour guides provide for their tourists. Without high-quality interpretation and unique products, it will be difficult to sell to tour agents and tourists.

Promotions:

Having good ecotour products is necessary, but also effective marketing and promotion is a "must" to success ecotourism. The promotional tools will be different depending on the targets, therefore, the careful selections of tools will be necessary.

Passion:

The most important key to success ecotourism is “passion.”

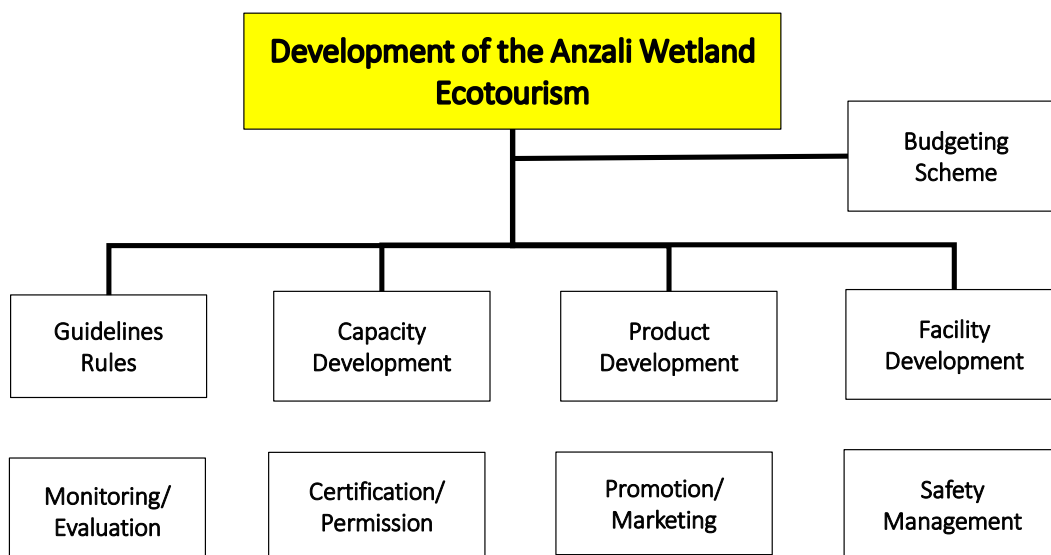


Source: JICA Expert Team and Ecotourism SC

Figure 6.8-2 Key Elements to Success Ecotourism

6.8.5 Components of the Development of the Anzali Wetland Ecotourism

Anzali Wetland Ecotourism consists of various components as shown in Figure 6.8-3 For successful development of the ecotourism, all of the components must be linked to one another closely based on the involvement of the local communities.



Source: JICA Expert Team and Ecotourism SC

Figure 6.8-3 Components for Development of the Anzali Wetland Ecotourism

6.8.6 Institutional Structure in the Anzali Wetland Ecotourism

Institutional structure in the Anzali Wetland Ecotourism shown in Figure 6.8-4.

(1) Ecotourism National Committee

The Committee consists of:

- a) Natural Deputy of DOE
- b) Tourism Deputy of ICHHTO
- c) The Head Director of NRWGO, who is also the Deputy of the Minister of Agriculture

(2) Gilan Ecotourism Committee

The Committee consists of:

- a) Director General of GCHHTO
- b) Director General of DOE Gilan
- c) Director General of NRWGO

Meetings of this committee are held in Gilan Province and the Director General of the mentioned organizations or their legal representatives will participate in the meeting. The meetings are managed by the Director General of GCHHTO. Gilan Ecotourism Committee is following the decisions of the National Ecotourism Committee in Tehran. However, the National Ecotourism Committee hasn't been active, and as a result Gilan Ecotourism Committee also hasn't been active.

(3) Ecotourism Sub-Committee under AWMC

The Anzali Wetland Management Committee (AWMC) has been established under the Provincial Governor's office and the technical support of JICA expert team, which consists of 6 different sub-committees. Ecotourism SC is one of the six SCs consists of the representatives of DOE Gilan, GCHHTO, NRWGO and the Director General of Rural Affairs Department of Gilan Governor's office. The Ecotourism SC will continue ecotourism development activities not only the Anzali Wetland areas but also other areas of Gilan following the decision of Gilan Ecotourism Committee and AWMC.

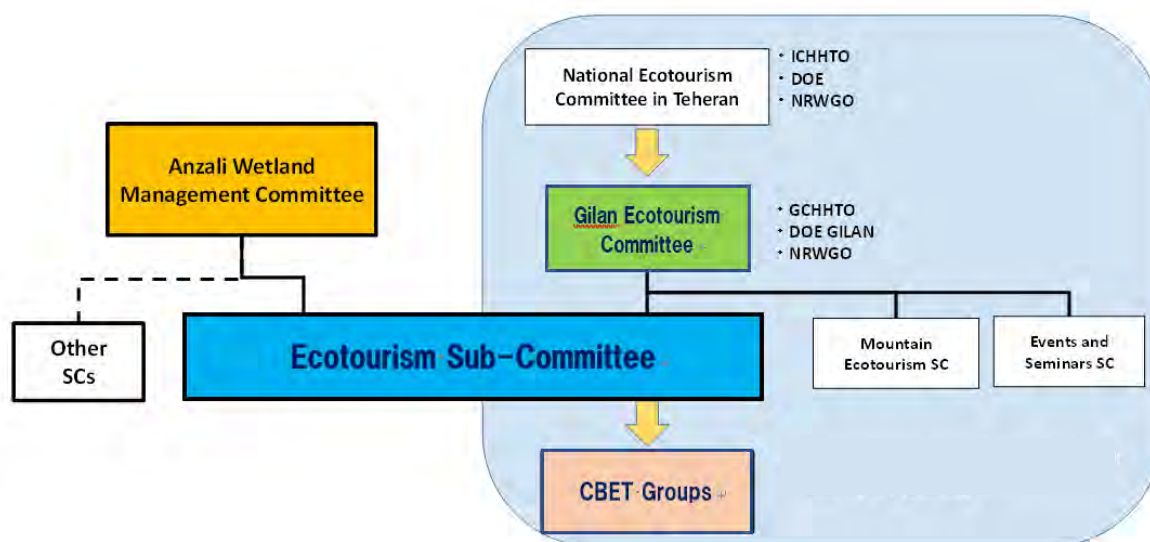
Demarcations of roles of each organization are as follows:

- 1) Applying sustainable ecological methods (DOE)
- 2) Conducting Ecotourism fundamental studies (GCHHTO)
- 3) Transferring some of the natural landownership to the private sectors, in order to develop ecotourism activities (GCHHTO and NRWGO)

- 4) Developing and improving the basic database such as developing a tourism attraction database (GCHHTO)

(4) Community-based Ecotourism Group

The community-based Ecotourism (CBET) Group will be established in order to arrange the ecotourism activities in the villages. At least one of the members of village council will be the members of this working group. The other members will be selected based on the necessity. The working group will be changed in to an association later on supported by tourism and environmental related association.



Source: JICA Expert Team and Ecotourism SC

Figure 6.8-4 Institutional Structure in the Anzali Wetland Ecotourism

6.8.7 Long-term Goal and Mid-term Goal

(1) Long-term Goals

Improving the water quality of the Anzali Wetland in order to preserve the landscape and the rich biodiversity around it, where local communities can use its resources wisely as a natural heritage and enhance cooperation among the related organizations.

(2) Mid-term Goals (Fiscal Year 2020 – 2030)

Develop fifteen CBET model villages with ecotourism centers for implementing nature and culture ecotourism activities in order to make the Anzali Wetland as one of the successful ecotourism models in Iran and in the world.

6.8.8 Implementation Plan

The main activities of the Anzali Wetland Ecotourism Mid-term Plan will be as follows.

(1) Institutional Structure Development

There is no clear institutional structure related to the Anzali Wetland Ecotourism. Without this structure, it will be impossible to success any ecotourism activities in the Anzali Wetland areas. Hold meetings with Gilan Ecotourism Committee every 6 months and meetings with Anzali Wetland Ecotourism Secretariat every 3 months. The final decisions will be made under the Gilan Ecotourism Committee, and the approvals will be followed by the Anzali Wetland Ecotourism Secretariat in order to develop a concrete structure.

(2) Review the Mid-term Plan

The Mid-term Plan includes all activities, responsibilities and budgets which are going to be implemented under the AWMC from Fiscal 2020 to 2030. It should be followed step by step. The Action Plan can be reviewed any time when it's necessary.

(3) Select Fifteen CBET Model Villages

In order to have different models of CBET in Gilan province, especially in and around the Anzali Wetland, it is better to select different areas such as mountain area, Caspian Sea areas, forest areas, etc. Try not to develop many village sites at the same time but focus and spend more time and energy to the small numbers of sites. Once completed a few different good model sites, it is very easy to develop new sites referring to the model sites. In that case, local CBET groups can be trainers for groups coming from new villages for having study tours.

The numbers of selected villages at each phase will be as follows.

- Phase 1 (2021-2023): 3 villages
- Phase 2 (2024-2026): 5 villages
- Phase 3 (2027-2030): 7 villages

The Criteria of Selection of JBK village as a model: (Village Selection Criteria is shown in Attachment 6.8-1)

- The villager demonstrates strong willingness to engage in conservation and ecotourism activities.
- The villager is in or surrounded by wetland.
- The villager has high dependence on wetland.
- The villager is a high prevalence of poverty.
- The villager has good linkages with other villages, e.g., the village has a market and/or other facilities and services that attract people from surrounding villages.
- There is some local organization with strong leadership.

- The organization demonstrates willingness to perform better.
- Local has a good performance record of activities in wetland area.
- Containing a rich cultural and natural resources.
- Accessibility to the important tourism target market such as Rasht or Anzali.
- Containing related handicrafts to the Anzali Wetland
- Possibility of constructing basic utilities or catering the tourists in local houses.
- Having appropriate space for constructing the community center in village.

(4) CBET Resource Database (Interpretation Data) Survey

Once selected the model village sites, implement the CBET resource database survey in and around the sites by hearing locals and collecting the resource materials and reviewed by specialists. Interpretation Database is shown in Attachment 6.8-2

(5) CBET Product Development

Products, also called programs, are the ecotours provided by local trained ecotour guides. The products will be developed within the fifteen selected villages and their surrounding areas by 2030. The products need to be enjoyable and educational with safety experiences. They should have educational nature information and also traditional culture information for protecting the Anzali Wetland. In order to success ecotourism, it is necessary to involve local villagers from the beginning stages of products development, so locals will appreciate and respect them as their own products. And also, it is very important to have experienced ecotourism guide trainers.

(6) Trainings and Workshops

Main training targeting local guides will be “interpretation training” providing environmental conservation and culture preservation messages to visitors by local guides. Additionally, safety and risk management training for all guides must be seriously provided. It is also necessary to support developing the CBET groups for the sustainable management of ecotourism activities and use of the centers through workshops.

(7) Ecotourism Center Development in Villages

The ecotourism centers act as ecotourism meeting sites, program sites in case of adverse weather conditions, cultural experience sites, interpretive information display sites, and community meeting sites. The center can be built new, renovated, or used existed one depending on the situation of the selected villages. Its designing must be traditional with the support of experts. And it is recommended to hire some local skilful carpenters who can develop traditional building with local youngers, so they can learn the skills from the elders, appreciate their own culture and maintain the centers easily.

(8) Guidelines of CBET Activities

Guidelines include rules, regulations, and zonings for ecotourism relating activities. The information in the guidelines must be different depending on the targets such as tourists, guides, and tour agents. Safety of wildlife environment, local socio-culture, and tourists must be the priority focus of guidelines for sustainable uses of Anzali Wetland areas. It is necessary to involve local villagers from the beginning stages of making guidelines for the sustainable management by locals.

(9) Marketing and Promotion

Even though the ecotour products will be ready for sale, it will be very difficult to sell the products without proper marketing and promotions. In order not to lose the local people's interest, marketing and promotion should be consider at the same time of the product development and training. Showing the process of ecotourism development by using Social Networks can attract future guests with low budget.

(10) Monitoring and Evaluation

In order to have sustainable CBET activities in the villages, the monitoring and evaluation will be implemented by Ecotourism SC every three months.

(11) The Anzali Wetland Visitor Center in Anzali City as an Ecotourism Hub

The primary purpose of the Anzali Wetland Visitor Center in Anzali City is providing interpretive information to both tourists and locals about the safe and enjoyable usage of the Anzali Wetland areas and sharing information to protect the environment and the culture of surrounding areas. This center also acts as a hub of all ecotourism activities in and around the Anzali Wetland including selected villages and Anzali Wetland Environmental Education Center (Selkeh Wildlife Refuge).

6.8.9 Implementation Schedule of Mid-term Plan

The implementation schedule of Ecotourism Mid-term Plan is set as shown below. Sample of Action Plan is shown in Attachment 6.8-3,

Table 6.8-1 Implementation Schedule of Ecotourism Mid-term Action Plan

Phase	Activity	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Pre. Phase	Institutional Structure	■										
	Review Mid-term Plan	■										
	Select Model Sites	■										
Phase 1 (3 villages)	Database Survey		■									
	Product Development		■	■								
	Trainings		■	■								
	Center Development			■								
	Guidelines				■							
	Marketing/Promotion			■	■							
	Monitoring/Evaluation				■	■	■	■	■	■	■	■
Phase 2 (5 villages)	Database Survey				■							
	Product Development				■	■						
	Trainings				■	■						
	Center Development					■						
	Guidelines						■					
	Marketing/Promotion					■	■					
	Monitoring/Evaluation						■	■	■	■	■	■
Phase 3 (7 villages)	Database Survey							■				
	Product Development							■	■			
	Trainings							■	■			
	Center Development								■			
	Guidelines									■		
	Marketing/Promotion								■	■		
	Monitoring/Evaluation									■	■	■

Source: JICA Expert Team and Ecotourism SC

6.8.10 Implementation Cost and Budget Allocation

Approximate costs for the activities are estimated as shown in the following table.

Table 6.8-2 Implementation Cost and Budget Allocation


No.	Item	Estimated Cost (USD)			Remarks
		unit	#	Total	
1	Survey Cost	5,000	15	75,000	hiring specialists
2	Equipment Cost	10,000	15	150,000	
3	Training Cost	5,000	15	75,000	professional trainers, study tours
4	Center Cost	30,000	15	450,000	center development cost
5	Promotion Cost	5,000	15	75,000	events, materials, test tours
TOTAL		55,000	15	825,000	

Source: JICA Expert Team and Ecotourism SC

6.8.11 Case Study (Jirsar Bagherkhaleh CBET Model)

The following is the model case of CBET development in Jirsar Bagherkhaleh village under the JICA Anzali Wetland Ecological Management Project-Phases II (2014-2019).

Successful Steps of Ecotourism Development:

- 1) Interpretation Data Survey
 - 2) Village Site Survey
 - 3) Action Plan Development
 - 4) Official Selection of the Pilot Village
 - 5) CBET Product Development
 - 6) CBET Guide Trainings
 - 7) Ecotourism Center Development
 - 8) Promotion
 - 9) CBET Management Workshops
 - 10) CBET Guidelines Development
 - 11) Monitoring
- 

(1) Interpretive Data Survey (1st Year: 6 months)

In order to develop ecotourism activities, basic information and unique stories which were available in and around the Anzali Wetland, were collected before starting any activities or even selecting sites, as this data can be used for program development, guide training, displays for visitor centers, etc. Try to find the unique local stories which has strong message for conservation and preservation of traditional culture. Some of the local stories might not be scientifically correct, it is very important to be reviewed by local experts. Interpretation Database is shown in Attachment 6.8-2.

(2) Village Site Survey (1st Year: 6 months)

In order to select the pilot villages, the research team visited 42 villages around the Anzali Wetland at the same time of the interpretive data collection. This village selection survey had been conducted based on the criteria developed by JICA expert team. The key factors of successful ecotourism in any village areas are simply “sites” and “people”. The views and resources of sites are not attractive enough, the project will fail. If there is no strong willingness of villagers and no responsibility of villagers for the future management of the activities, it also fails. Never pretend to help somebody and pull the ladder away from under him/her. You might develop deeper conflicts between locals and government and new environmental issues created by new tourism activities. Village Site Survey is shown in Attachment 6.8-3.

(3) Action Plan Development (1st Year)

Developed the Action Plan working together with Ecotourism SC. The plan helps your vision into reality and describes the way will meet its objectives through detailed action steps how and when these steps will be taken by who. It should not be just a dream, but as realistic as possible.

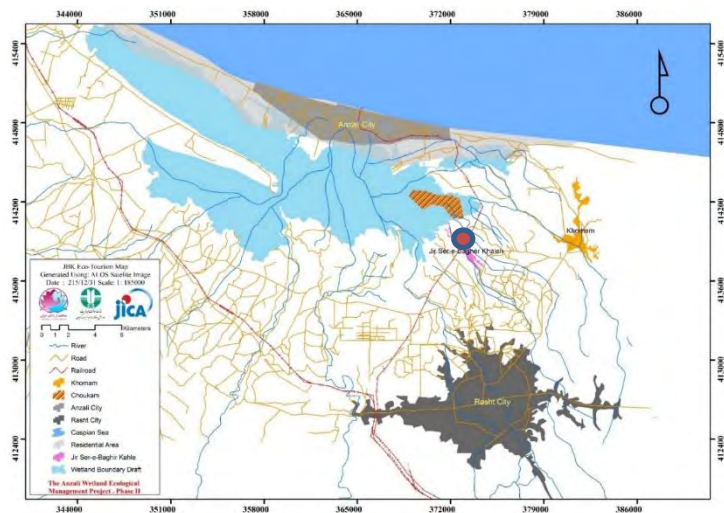
(4) Official Selection of the Pilot Village (Early 2nd Year)

Based on the criteria, Jirsar Bagherkhaleh village was selected mainly because of the unique resources including pasture areas, rivers and bird species and accessibility from the city and the hospitality of the villagers.

In order to follow the official process of developing CBET in Jirsar Bagherkhaleh village, it was necessary to receive the required approvals of the three head directors of related organizations (DOE Gilan, GCHHTO, NRWGO). A meeting was held as the first Gilan ecotourism committee meeting on 6th July 2015, during this meeting, the village was approved as the first pilot village for developing ecotourism activities. Suggested possible activities such as kayaking, traditional cooking, handicraft and bird watching, were discussed in this meeting.

Following items were approved under the meeting: Minutes of Meeting is shown in Attachment6.8-4.

- 1) Approving Jirsar Bagherkhaleh village in Khomam district as the pilot village for developing CBET activities.
- 2) NRWGO will support the project in Jirsar Bagherkhaleh village through providing necessary information or available studies of the area, in order to develop CBET activities in Jirsar Bagherkhaleh village.
- 3) NRWGO agreed on transferring the 6-hectare pasture area of Jirsar Bagherkhaleh village for developing CBET activities under the prepared NRWGO pasture plan of this organization and CBET plan prepared by Ecotourism SC which has been approved on January 02, 2016.



Source: JICA Expert Team

Figure 6.8-5 Location of Pasture Area of Jirsar Bagherkhaleh Village

(5) CBET Product Development (2nd and 3rd Year: 2 years)

CBET products, also called programs, are the ecotours provided for the tourists by local guides. The products need to be enjoyable and educational experiences with safety. The guides should provide educational nature information and also traditional culture information for protecting the Anzali Wetland. In order to make ecotourism successful, it is necessary to involve locals from the beginning stage of the activities, including products development, so locals will appreciate and respect them as their own products.

In order to develop ecotourism activities in the village, first more detailed feasibility studies were conducted. During these studies all the possible ecotourism activities were checked, based on the available potentials of the village and villagers' motivation activities such as kayaking, bird watching, handicraft and traditional cooking were the selected activities under the SC. During the feasibility study, people who were interested in joining training activities were also identified.

(6) CBET Guide Trainings (2nd to 4th Year: 3 years)

After checked carefully the villagers' motivation of joining CBET activities, training plans for locals had been determined. As all these activities were going to be conducted for empowering locals and creating more jobs in the future, locals needed to learn how to conduct each activity correctly and safely.

1) Kayak Training:

In order to attract tourists, there is definitely necessary to have unique attraction comparing with other areas. The strong selling points of Jirsar Bagherkhaleh village are two beautiful rivers in the pasture connected to the Anzali Wetland, next to the village. And the rivers are not so deep

and wide in for visitors to enjoy the kayaking safely. In fact, the kayak tour for general public is the first time in Gilan province.

a) Basic Kayak Training

Safety management of kayaking is extremely important, so at first local people were introduced with the general activity during the feasibility study phase. And after different meetings and discussions among SC members, the deputy of Anzali recreational boat riding association, had been selected for kayak training in JBK village. The basics of paddling and controlling kayak has been trained many times. One of the local trained people were selected as the head of kayaking group, in order to manage the activity during the ecotours in future. Therefore, we selected a kayaking activity as the main ecotour activity in the village.

b) Advance Training

Without protecting him/her self as a guide, it is impossible to protect his/her guests. Therefore, provided two preparatory swimming training courses by local experts. And Six of all kayak member s certified 3 days safety management training workshop in Qazvin under National Boating Federation.



Source: JICA Expert Team

Figure 6.8-6 Photos of Kayak Training

c) **Setting Up Kayak Platform and Storage**



Source: JICA Expert Team

Figure 6.8-7 Photos of Kayak Jetty and Storage

2) **Handicraft Training**

As traditional handicraft products are one of the tourist attractions in Anzali Wetland and areas around it, most of the local people in this region make handicrafts from different wetland plants. In recent years most of the products are looking the same, and there is less innovation and new ideas in making crafts. In order to develop handicraft activity in JBK village, as one of the income sources for the locals, and attract more attention on beauties of the wetland and its useable plants, ecotourism SC decided to conduct some training workshops in which people can learn different skills of craft making, and its renovation. A handicraft trainer was hired for conducting this activity, after having some discussions and meetings about the goal of the project and the concept of interpretation. As the start of the activity trainer hold a general introduction meeting with interested local people, and two level's checking sessions, in order to evaluate the potentials of local people. Trainer planned to conduct more than 20 training sessions for the locals in order to teach the basic skills of craft making to the local interested people.



Source: JICA Expert Team

Figure 6.8-8 Photos of Handicraft Training

3) Cooking Training

Serving traditional foods and selling local products can attract many tourists and provide many jobs for local ladies. Until the completion of Ecotourism Center, local ladies sold their food products such as pickles, sauces like tomato or pomegranate, vegetable, eggs, traditional bread, cookies, sweets at the entrance of Jirsar Bagherkhaleh village. This activity can help them to improve their cooking skills, hospitality skills following the feedback from customers visited to the market. After the completion of the center, we train them by local experts especially for serving tea and traditional foods at the restaurant areas. Making test tours inviting tourists and agents are good way to improve their skills.



Source: JICA Expert Team

Figure 6.8-9 Photos of Local Cooking Training and Program

(7) Ecotourism Center Development (2nd and 3rd Year: 2 years)

The Ecotourism Centers act as village CBET meeting sites, program sites in case of adverse weather conditions, cultural experience sites, interpretive information display sites, and community meeting sites. The design must be traditional with the support of experts. It is recommended to hire some local skilful carpenters who can develop traditional buildings with local young ones, so they can learn the skills and appreciate their own culture.

All Community Based Ecotourism (CBET) related activities such as kayaking and bird watching in the pasture area and ecotourism center activities such as cooking and crafting are managed by local villagers supervised by DOE, GCHHTO and NRWGO.

Main Purpose of the Ecotourism Center: To provide job opportunities for local villagers at Jirsar Bagherkhaleh village through following CBET activities.

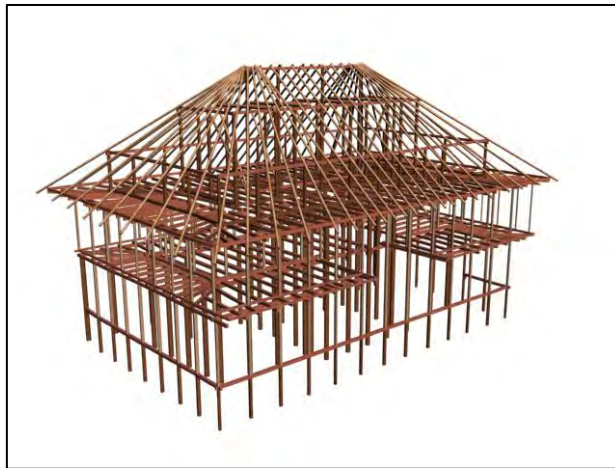
- 1) Cultural CBET activities: serving traditional foods and snacks, selling traditional crafts, teaching how to make traditional foods and crafts to visitors, etc.
- 2) Nature CBET activities: safety management lectures and dressing rooms for kayaking participants, lectures of bird watching before and after the tours, etc.
- 3) Information and Interpretation: maps of the pasture, safety rules, guidelines of CBET activities, pictures of birds, other necessary cultural items, etc.

Contents of Ecotourism Center:

- 1st floor: multipurpose hall (serving foods and drinks, selling local food products, gathering area, etc.)
- 2nd floor: Changing rooms, Craft room, etc.
- Balconies: 1st and 2nd floors
- Kitchen: small annex
- Gazebos
- Toilets
- Garden

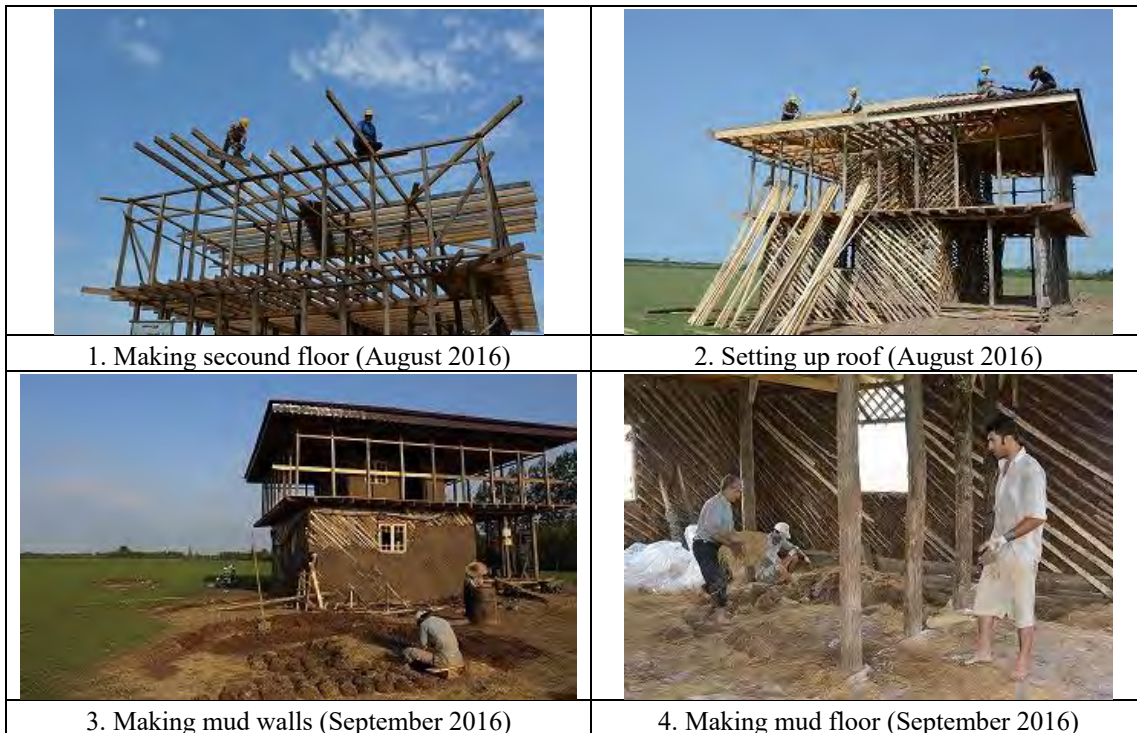
Guidelines of Designing the Ecotourism Center:

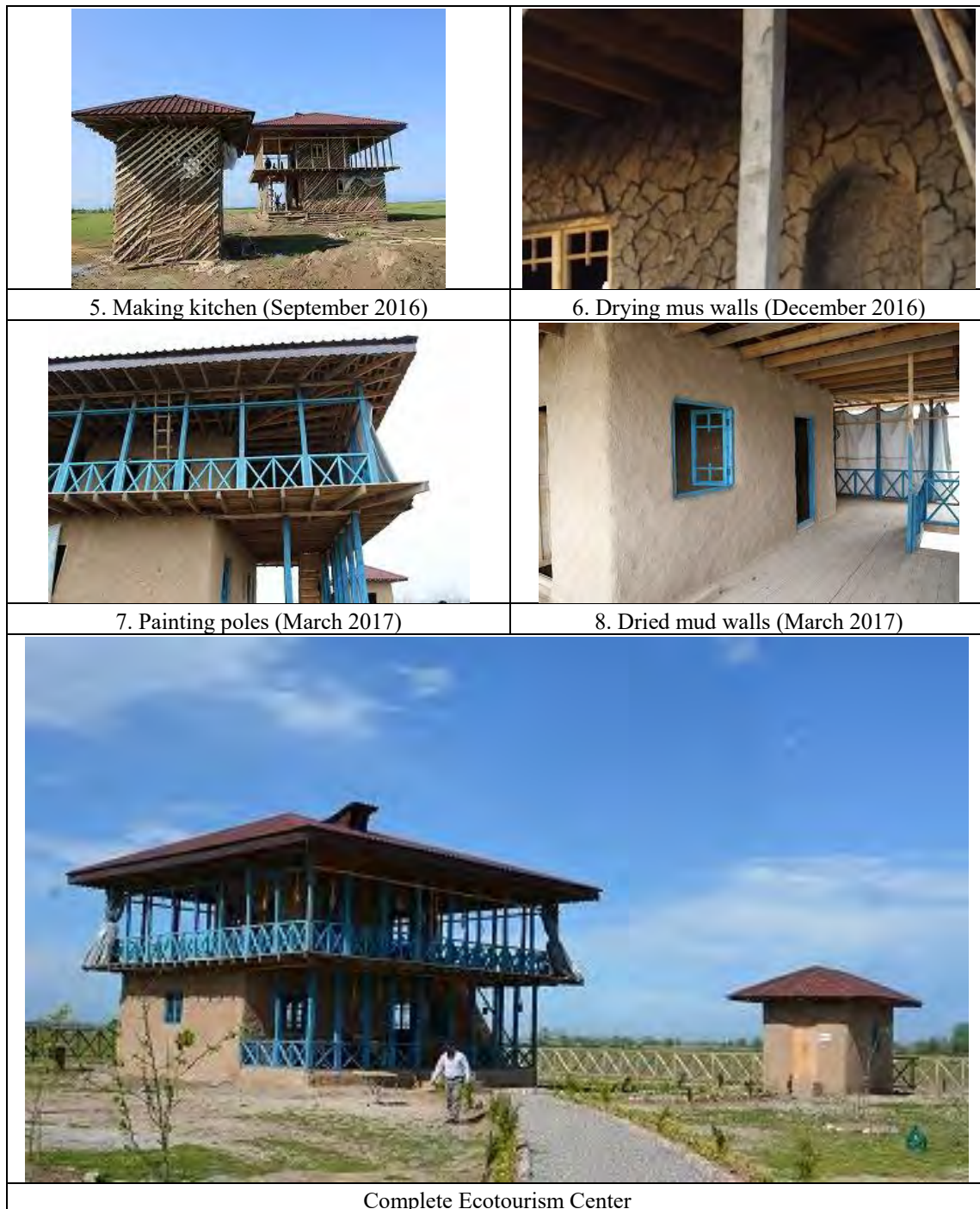
- Design of the building must be a simple dimetric two-story building.
- Size of the building must be within 100 m² (200 m² in two floors).
- Design of the building must be a traditional style of houses around the Anzali Wetland.
- Traditional materials must be used for the construction of the building.
- Environmentally friendly materials must be used in order not to have a negative impact on the pasture.
- The easily maintained materials must be selected for sustainable use.
- The color of building must follow the traditional manner.
- Local villagers must be employed as part-time construction workers to provide job opportunities.



Source: JICA Expert Team

Figure 6.8-10 Preliminary Image and Design of Ecotourism Center





Source: JICA Expert Team

Figure 6.8-11 Photos of Construction of the Ecotourism Center

1) Local Participations

(a) Fencing

In order to keep livestock and illegal intruders from coming to the Ecotourism Center, the fence encompassing the center was constructed. Local ladies supported painting the fence voluntarily.



Source: JICA Expert Team

Figure 6.8-12 Photos of Fencing Work by Villagers

(b) Gardening

The garden of the center was made by villagers voluntarily assisted by local experts.



Source: JICA Expert Team

Figure 6.8-13 Photos of Gardening Work by Villagers and Planting Ceremony

(c) Cleaning event

In order to clean the village and surrounded area of the enter, Cleaning Even was conducted.



Source: JICA Expert Team

Figure 6.8-14 Photos of Cleaning Campaign in collaboration with NGO

(8) Promotion (3rd and 4th Year: 2 years)

Tourism Exhibition:

On 25th and 26th January 2018, two local members of CBET and JICA Expert Team joined the 11th International Tourism Exhibition in Tehran, supported by Iran Culture, Heritage, and Tourism Organization. Brochures and banners for the exhibition were prepared in order to promote the activities of CBET. Because of the great appearance of the members dressed in local clothes, more than 1,000 visitors visited our booth. Visitors are so appreciate the locals' challenges of protecting Anzali Wetland and reviving traditional culture in the village through ecotourism activities.



Source: JICA Expert Team

Figure 6.8-15 Photos of Tourism Exhibition

Designing the Promotional Tags for Local Products:

To improve the sales of food products, cooking group uses good jars for better packaging with design attractive tags. All food products and crafts are with the tags together with the conservation message “Keep Nature and Traditional Culture for Next Generation!”



Source: JICA Expert Team

Figure 6.8-16 Photos of Labeling on the Local Products

(9) CBET Management Workshops (3rd and 4th Year: 1 and half years)

One of the main challenges of community-based ecotourism is a capacity building of local villagers. Without their participation, it is impossible to sustain the ecotourism activities in any villages. JICA project continued conducting ecotour skill trainings for local training participants for handicraft, cooking (traditional markets), and kayaking and additionally management workshops targeting “working group,” the selected 3 leaders from each activity who can be the future leaders of ecotourism activities in Jirsar Bagherkhaleh village. They discussed together with Dehyar and village council members about the difficulties and solutions for managing the center in addition to make policy, budget plan, determine the responsibilities of each group, marketing, maintain the center, etc. One of the most critical decisions was to collect 10% of all income through CBET activities as a management fee for hiring guards and purchasing equipment. Now they became officially Management Group for all ecotourism related activities in the village. If we give local people more decision making, more deeply local people take responsibility for the work.



Source: JICA Expert Team

Figure 6.8-17 Photos of CBET Management Workshop

(10) CBET Guidelines Development (4th Year: 1 year)

Guideline is the written form of management system for all CBET activities including integrated management of all CBET activities, CBET group rules, the responsibilities of members and stakeholders, etc. After the completing of guideline, it was attached to the final MoM and agreed by all relevant stakeholders.



Source: JICA Expert Team

Figure 6.8-18 Photos of Meeting for CBET Guidelines Preparation

(11) Monitoring

In order to have sustainable ecotourism activities, monitoring is necessary by government organization. Since DOE Gilan, GCHHTO, NRWGO agreed to assist JBK CBET activities after JICA project, we are hoping all organizations to support their activities for their sustainable future.

6.8.12 Necessary Arrangement

The following will be required for implementation of the Mid-term Plan for the Ecotourism in the Anzali Wetland.

(1) Institutional Structure

The directors of three organizations, DOE Gilan, GCHHTO and NRWGO must agree to support all ecotourism activities under the Mid-term Plan and reinforce the construction of the Anzali Wetland Ecotourism.

It is suggested that the Ecotourism SC under the Anzali Wetland Management Committee must also act as main implementers under the Gilan Ecotourism Committee in order to make ecotourism activities more active and sustainable.

The responsible government organization of all the related CBET activities must be clarified, and they must have a continuous support.

(2) Facilities

The land ownership issues and other legal issues of all ecotourism activities must be solved before implementing any activities. Making written agreements among relevant organizations are necessary.

(3) Outsourcing

It is necessary to have a system to outsource an environmental and/or tourism association to support CBET development activities such as trainings and workshops.

6.9 Environmental Education

6.9.1 Current Situation

Before JICA Project, Environmental education in Gilan Province had been sporadically conducted with DOE Gilan environmental education section, DOE branch offices, and NGOs as a point of contact, events and visiting lectures in school and so on. An agreement between the Ministry of Education and DOE for cooperation for environmental education was established on March 9, 2014. After that, the environmental education activities were promoted. However, these activities have been focused on themes such as waste management and wildlife conservation, and not include conservation of the Anzali Wetland.

The importance of the Anzali Wetland is not doubted not only in Gilan province but also the whole of Iran and global level. Therefore, it is very important for a wide range of people, including residents and students, to learn the importance of the Anzali Wetland through EE program.

JET has been implemented following activities in cooperation with the DOE Gilan environmental education section, EO, Kanoon (Institute for the Intellectual Development of Children and Young Adults) and NGO etc., with the aim of incorporating environmental education focused on the conservation of the Anzali Wetland into regional education with a more experiential program;

(1) Anzali Wetland Environmental Education (AWEE) Center in Selkeh Wildlife Refuge

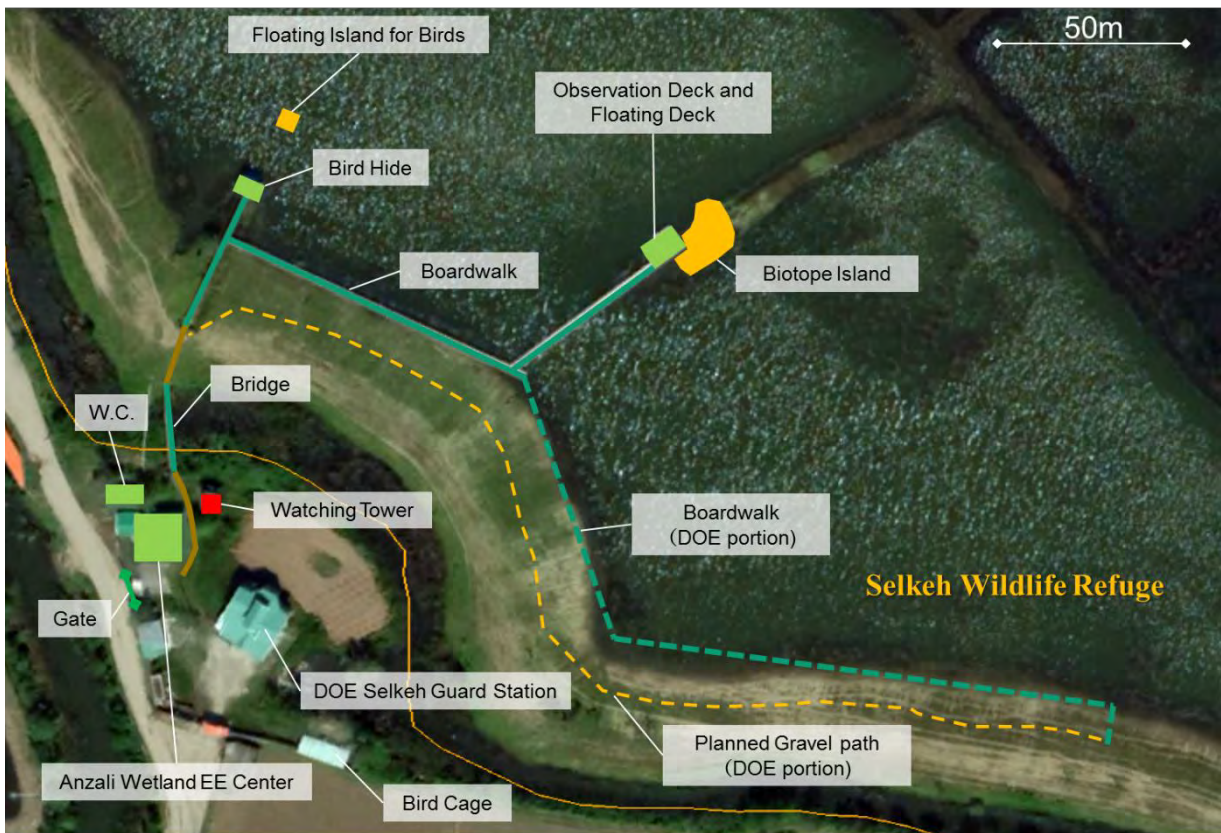
1) Renovation and Enhancement of AWEEC Facilities

Renovation of the EE center is shown in the following table. Some part of them were repaired and installed by Japanese budget. The AWEEC is located in Selkeh Wildlife Refuge, was constructed by JICA in 2004 to promote education activities to understand the importance of the wetland conservation through the experience-based EE program by its facility and equipment. The Center consists of the Center main building, bird watching tower, bird hide, and boardwalk. During 2016-2018, these facilities were renovated by the Phase II Project. In addition, new boardwalk and biotope, observation deck with floating deck, piles, floating island for birds were constructed in the wetland. These renovation/repair works were done by Japanese budget in 2017-2019. DOE Gilan also constructed additional new boardwalk connect to existing wooden path in 2018. This facility is a very attractive facility for visitors. Facilities of the AWEEC is shown in Table 6.9-2 and Figure 6.9-1.

These repair/renovation works are carried out based on the renovation plan discussed at EE Sub-Committee. Repair/Renovation plan and implementation status of the AWEEC is shown in Table 6.9-2. During the JPA phase, most of repair/renovation was implemented by Japanese budget.

In March 2019 at the end of the Project period, Mr. Taghipour was assigned as a manager of the AWEEC of DOE. He is the first DOE manager of AWEEC. He started to manage the center and to educate regularly students and visitors in cooperation with EE expert of DOE and nature guides in NGOs. It was a great step to promote the experience-based EE activity by using AWEEC.





Source: JICA Expert Team

Figure 6.9-1 Facilities and Facility Map of AWEEC

Table 6.9-1 Repair/Renovation Plan of the AWEEC and Existing Status

Location	No	Item	Existing status	
			Already Done	Not yet
EE Center Building	1	Renovation of the Center (Repainting, Repair f Ceiling, Electric Wiring, Smoothing Wall etc.)	X	
	2	Painting Bird Hide and Roof Repair	X	
	3	Renovation of Bird Watching Tower (repainting and renewal of timbers)	X	
	4	Renovation of Bridge (repainting and renewal of timbers)	X	
	5	Renovation of Toilet	X	
	6	Renovation of Map Signboards	X	
	7	Construction of New Side Gate beside the Center	X	
	8	Installation of Septic Tank for Toilet	X	
	9	Guide Signboards Installation along the Road to the Center	X	
Wetland	1	Renovation the Bird Hide (renewal of roof, painting the floor)	X	
	2	Renovation the Boardwalk to the Bird Hide (repainting and renewal of timbers)	X	
	3	Construction of Small Island as Biotope	X	
	4	Construction of New Boardwalk to the Biotope	X	
	5	Construction of Observation Deck including Floating Deck	X	
	6	Signboards Installation on the Handrail of Boardwalk	X	
	7	Installation of Piles for Birds	X	
	8	Installation of Floating Wood Island for Birds	X	
	9	Construction of New Boardwalk (DOE Portion)	X	
	10	Construction of New Gravel Path (DOE Portion)		X

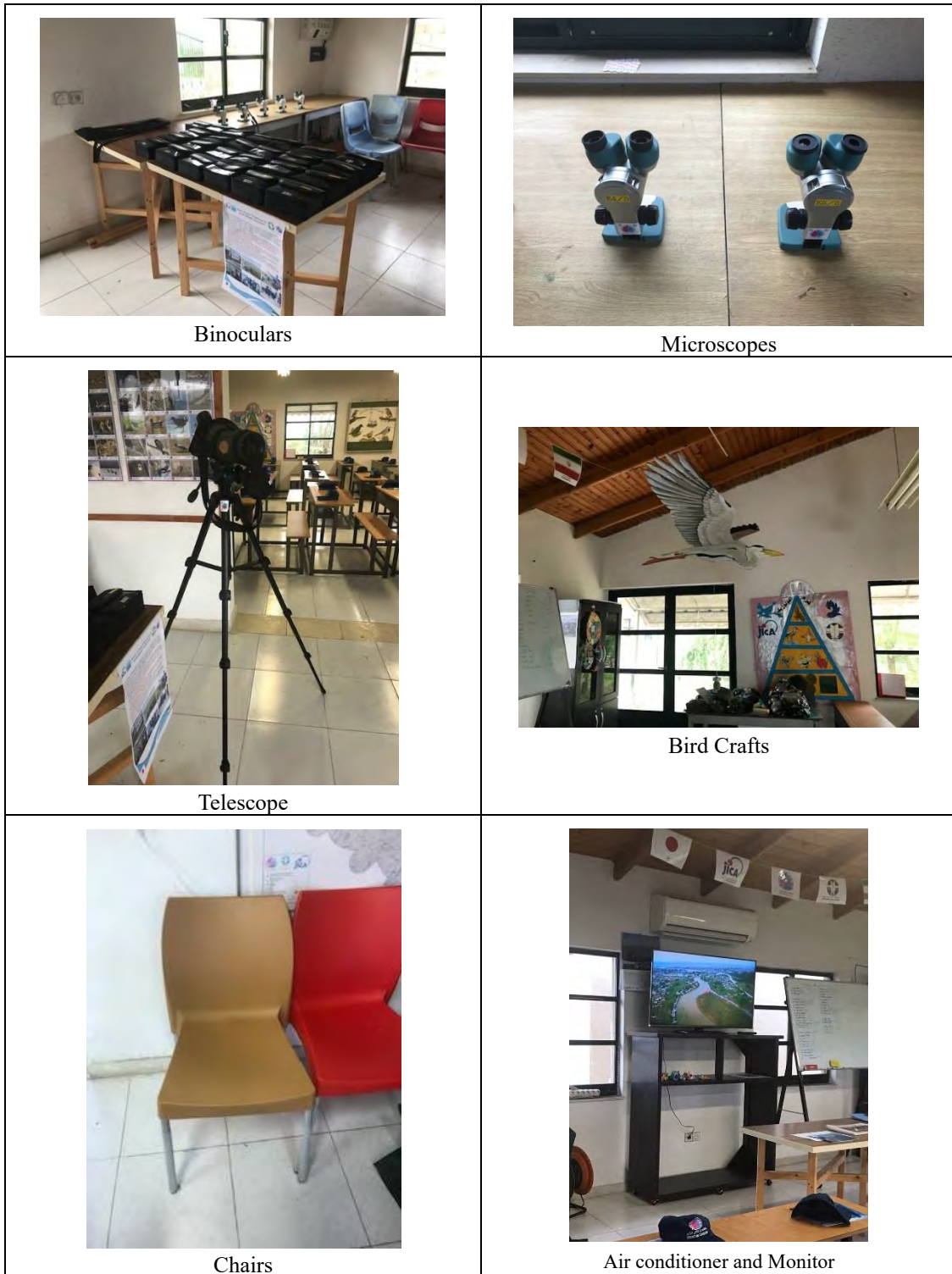
Note: All items except DOE portion have been done by JICA budget

Source: JICA Expert Team

Environmental education equipment such as 40 binoculars, 5 microscopes, and 3 telescopes, 3 bird crafts, etc. was installed in the AWEEC for experience-based EE program in 2017-2018. The facilities and equipment support the participant to feel 'real nature' such as watching many birds, turtles, fish, dragonfly, aquatic plants and touching water. Moreover, inside of the AWEEC have exhibited bird craft and the pictures/crafts related to the Anzali Wetland which prepared by WWD described later to make the visitors enjoy. The list of environmental education equipment of AWEEC is shown in Table 6.9-3 and Table 6.9-4.

During the latest 5 years, DOE Gilan environmental education section, EO, Kanoon, and NGOs implemented the experienced-based EE program using the facilities/equipment for students, resident, member of NGOs which came from whole of Iran, and others. More than 2,000 visitors learned the importance of the Anzali Wetland in the AWEEC through the experience-based program in the latest 5 years.

The equipment, facilities and fixtures will be handed over from JICA Expert Team to DOE Gilan. The equipment facilities, and fixtures must strictly be utilized only for the EE activities in the AWEEC, but not for any other purpose and location. DOE Gilan should manage the number and status of them carefully and permanently under the Minutes of Meeting (MM) between JICA Expert Team and DOE Gilan in the Project. The MM is shown in attached.



Source: JICA Expert Team

Figure 6.9-2 Environmental Education Equipment Photos for AWEEC

Table 6.9-2 List of Environmental Education Equipment for AWEEC Prepared by JICA Expert Team

No.	Name of Equipment	Number of Equipment
1	Binocular (KOWA YF30-6)	38*
2	Telescope (KOWA TSN601) with tripod	3
3	Microscope (NIKON Nature Scope “Fabre-mini”)	5
4	TV monitor (Sony Bravia 55X8500E)	1
5	Hydro Glass	2
6	Air Conditioner	1
7	Chair	30
8	Cabinet	2
9	Laminator	1
10	Refrigerator	1
11	Kitchen Stove	1
12	Fire extinguisher	1
13	Bird Craft	4
14	Books (ex. filed guidebook)	1 set

Note: * - Though JICA Expert Team prepared 40 binoculars in 2016, two of them have been lost in activities until 22nd Feb, 2019 during the EE Activities.

Source: JICA Expert Team

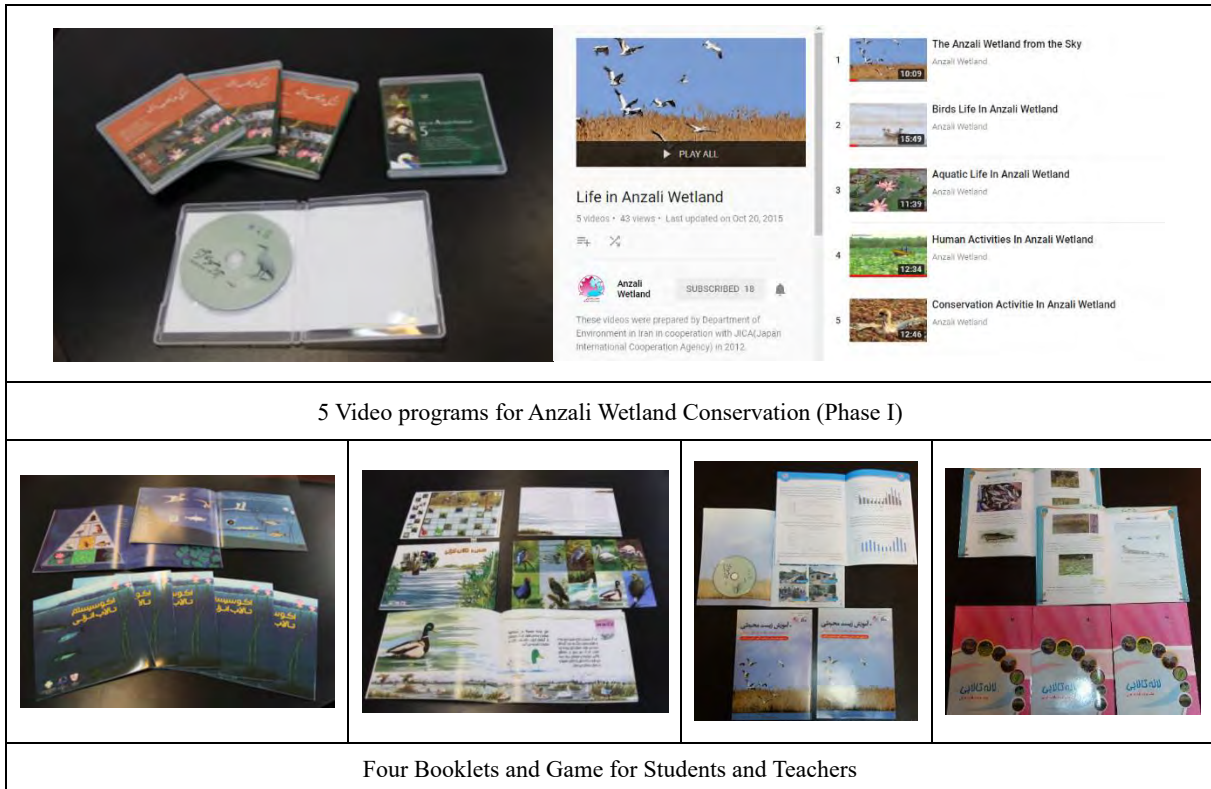
2) Regular EE program for School Student by DOE Gilan, EO, and Kanoon

EO and Kanoon implemented the experience-based EE program regularly for students from Rasht City, Anzali City, and Somesara District during both of summer and winter long holiday seasons. As the regular EE program in the AWEEC, participants attended a lecture of the importance of the Anzali Wetland and its ecosystem. After the lecture, they learned how to use equipment of AWEEC and experienced ‘real nature’ using the equipment in biotope and bird watching tower. Most of participant enjoyed the activity as their first experience-based EE program. In addition to the above-mentioned regular EE activities, the EE Center accepted students based on school’s request even during periods other than long-term vacation. During the Project period from 2014 to Feb 5, 2019, 134 EE programs were implemented and 3,167 participant ,who is mainly students and teachers, participated in the EE program in AWEEC and learned about the ecosystem of the Anzali Wetland and its role.

For the EE program, JICA Expert Team prepared education materials based on Communication, Education, Participation and Awareness (CEPA) philosophy for each level student (Primary and lower/higher secondary level) , teachers and local people. Some of the materials were prepared from Phase I of the project.

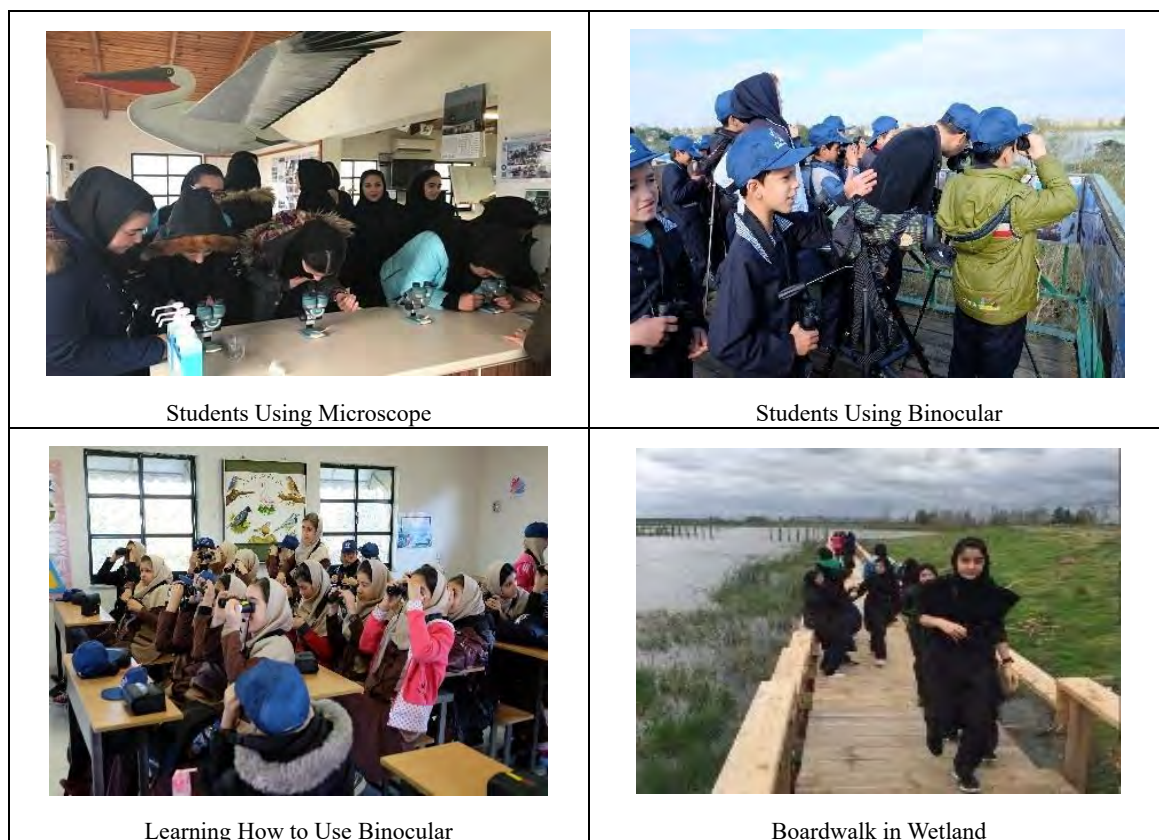
From the end of 2018, DOE Gilan assigned one EE expert on the AWEEC for these activities. The assignment of the responsible person for environmental education is epoch-making and very effective for the continuous implementation of the EE activity in the AWEEC. In addition, the personnel's ability is highly appreciated.

However, it is supposed that one person in charge will be not enough as systems of accepting of student due to increasing number of participants. Therefore, it was necessary to limit the number of times the EE program during 2018-2019 despite many schools wanting to participate the EE program. As a solution, All EE expert of DOE Gilan EE section should learn how to guide experience-based EE programs in AWEEC to accept more students can participate in the EE activity.



Source: JICA Expert Team

Figure 6.9-3 Education materials of the AWEEC



Source: JICA Expert Team

Figure 6.9-4 Regular EE Activity in the AWEEC

3) Public Open of Anzali Wetland Environmental Education Center for Visitors

To conserve the wetland ecosystem, people should feel the importance of wetland at first. Because knowing the beauty and value of wetland motivate people to conserve the wetland. However, there is not good site except Selkeh to see the Anzali Wetland even though the Anzali Wetland is very huge.

Environmental Education SC under AWMC decided to start “public open” in order to let people know the importance of wetland. In addition, Environmental Education SC decided to introduce a trained NGO guide system as first advanced attempt in Iran.

Sometimes people say that in order to protect the ecosystem, protected area should be untouchable and let it be without any human impact. It is completely wrong. Because such methodology made human forget the importance of wetland. Wise-use, one of the pillars of Ramsar Convention, is important.

The activities have been conducted by support of three NGOs; i) Gilan Women against Environmental Pollution Society (GWEPS), ii) Gilan Women and Youths Environmentalist Society (GWYES), and iii) Sarzamin-e -ideal ma Environmental Institute (SEI). After the trial public open, the activity has continued in every Friday based on discussion with EE Sub-Committee until now.

For appropriate public open, JICA Expert Team implemented nature guide training course for management of the AWEEC to members of Kanoon/ three selected NGOs and environmental experts of DOE Gilan. After attendance of the training course, trainees tried to pass a final examination related to management of the Center and got certificate. Members of three NGOs were trained very well as co-manager and nature guide of the EE Center. The EE Center has been opened every weekend since February 2018. 2,309 visitors participated in the public open programs which were guided by licensed NGO staff until Feb 1,2019. Visitors came not only from Gilan Province but also from Tehran and neighbouring provinces.

DOE AWEEC manager and Nature Guides of NGO should implement the public open based on the guideline as described below.



Source: JICA Expert Team

Figure 6.9-5 Public Open in AWEEC

Rules for the AWEEC Usage

General Prohibition

- Don't eat and no drinking outside the EE Center (Bird Watching Tower, Bird Hide, and Boardwalk). You can eat something in the EE Center, but please bring your garbage home.
- No Smoking in reserved areas (including the EE Center).
- Do not run, sing or shout at the wood road or the bird watching tower (Birds will be surprised your action!)

- Don't take plants and animals out of permitted place (Biotope) inside protected areas or bring them from outside.
- Do not enter inside the wetland, you should walk just wooden path.

Request for Safety Use

- All children must be accompanied by parents.
- Binoculars are used by everyone. Please use it carefully and return it to the EE Center in a clean condition. If you drop or break it accidentally, please don't hesitate to tell the staff.
- Please be careful on the wooding path and Bird Watching Tower. If you found a dangerous place in this equipment, please tell the staff. Staff will inform DOE guards.

(2) Anzali Wetland Naturel School (AWNS)

Through JPA activities, the operating ratio of the AWEEC has been increased year by year. For future environmental education on the wetland, it is desirable to establish a facility with the same function as the Anzali EE Center to be able to implement EE program more flexibly/actively for student around the Anzali Wetland.

An old school owned by Student Association (SA) of Anzali City which is an EO subsidiary is located in forest along the Nahang Roga river in Beheshte Island of Anzali City. It has facilities such as a hall, cabins and toilets. The facilities have not been currently used due to deterioration as aging. JET, EO and DOE Gilan conducted a field survey of them and discussed how to renovate and utilize the facility as an experience-based environmental education facility for the Anzali Wetland conservation. Under the agreement of EE Sub-Committee, EO and SA started renovation works from July 2018 for development of the Anzali Wetland Nature School (AWNS) for learning of importance of the wetland conservation through the experience-based program.

The renovation work of AWNS includes renovation of main hall and toilet, construction of small watching tower, wooden deck, work deck with desk/chair, and other facilities which are shown in below table.



Source: JICA Expert Team

Figure 6.9-6 Experience-based Education Facilities in AWNS

Table 6.9-3 Renovation works for Anzali Wetland Nature School

No.	Item	Number	Remarks
1	Wooden Open Deck	1	New construction
2	Workshop Deck (with table and chair)	4	New construction
3	Stage for Practice Field	1	New construction
4	Observation Tower	1	New construction
5	Map Signboard	1	New construction
6	Quiz Board	10	New construction
7	Main Hall and Toilet	1	Renovation of existing facilities
8	Covering the Well	1	Covering Work of existing well for safety
9	Fence around the Heron's Forest	1	New construction
10	Forest Walk	1	New construction
11	Biotope (Artificial Pond)	1	New construction
12	Swing	1	New construction on the wooden open deck

Source: JICA Expert Team

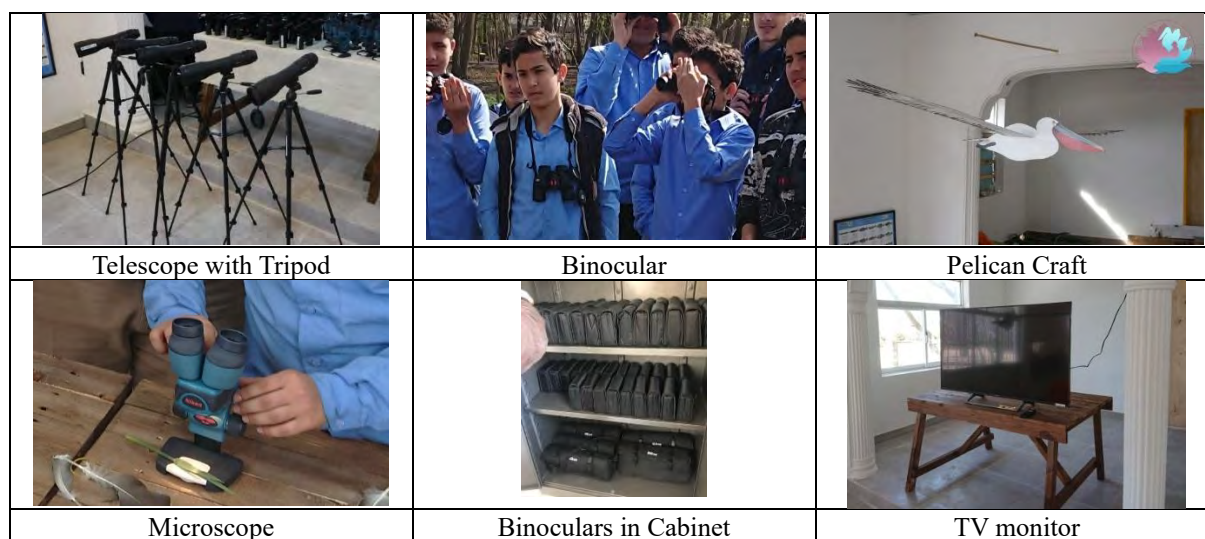
The renovation works have finished by the middle of February 2019. The opening ceremony of AWNS was implemented on 24th February 2019 by EO and SA. In the AWNS, JICA Expert Team and Student Association signed MM for continually management and operation of AWNS at the ceremony and equipment such as binoculars, telescopes, and microscopes for experienced-based EE program have been handed-over from JICA Expert Team to student association.

After Iran's New Year vacation in the middle of March 2019, EO and Student Association will start the EE program using the facilities seriously.

Table 6.9-4 List of Environmental Education Equipment for AWNS

No.	Name of Equipment	Number of Equipment
1	Binocular (KOWA YF30-6)	50
2	Telescope (NIKON PROSTAFF3)	5
3	Microscope (NIKON Nature Scope “Fabre”)	10
4	TV monitor (Sony Bravia 55X8500E)	1
5	Chair	70
6	Cabinet	1
7	Other material (Book, Poster, Bird craft, etc.)	-

Source: JICA Expert Team



Source: JICA Expert Team

Figure 6.9-7 Equipment for Educational Program in AWNS



Tape cutting

Handing Over to EO/SA from JICA Expert Team

Opening Ceremony of AWNS

Source: JICA Expert Team

Figure 6.9-8 Photos of Opening Ceremony of AWNS on 24th Feb, 2019

(3) Environmental Education Program for Wetland Conservation at ‘Human and Environment’ Curriculum

From autumn of 2017, ‘Human and Environment’ curriculum was started official curriculum in Gilan Province for 9th grade student officially. This curriculum is obliged to teach about the relationship between humans and the environment. As a part of this curriculum, EO and JET prepared a learning course for student about the history and relationship between the Anzali Wetland and surrounding people live around the Wetland, and importance of the ecosystem. As first step, text for teacher training in 2017, ‘Lotus Booklet’ for both of teacher and student in 2018, were prepared as education materials to learn the Anzali Wetland conservation under DOE Gilan, EO and JET supervision. Total 25,000 copies of booklet “Lotus” which describes the Anzali Wetland for secondary school students was printed and started to utilize for the class

“human and environment”. In addition, training program, which using the Lotus Booklet and “Life in Anzali Wetland (videos)” for the Anzali Wetland conservation, was implemented for secondary school teachers. Around 70 teachers participated from whole Gilan Province, however, the number is very limited. EO should continue the teacher training program for all teachers in charge of ‘Human and Environment’ curriculum as well.



The Lotus Booklet

Teacher training program for Human and Environment

Source: JICA Expert Team

Figure 6.9-9 Booklet “Lotus” and Teacher training for Human and Environment

- (4) Implementation of Broader Environmental Education Program
 - 1) Implementation of Broader Environmental Education Program in Cooperation with Kanoon

Kanoon(Institute for the Intellectual Development of Children and Young Adult) have held World Wetland Day’s Event in the project to promote educational activities to understand importance of the wetland conservation for students in February 2016- 2018 continually in facilities belong of the Kanoon with cooperation with DOE GILAN EE section and other NGOs. At the WWD event, Kanoon and environmental NGOs exhibited booths related EE activities and a lot of painting, photos and crafts related to the Anzali Wetland were displayed. Students and the public could learn about the environment of the Wetland conservation by experiencing

nature games and their exhibits. In parallel with the exhibition, a skit and ceremony by students, a site visit of the Anzali Wetland, exhibition of contest of paintings and photographs were held by Kanoon. Over 500 students participated in the event every year, and the number of participants increases year by year.



Source: JICA Expert Team

Figure 6.9-10 WWD Event managed by Kanoon

As other activities managed by Kanoon, Photo and painting contest related to the Anzali Wetland and World Wetland Day’s Event were implemented. About 200 works were entered in the photo and painting contests from July to August 2017, and an award ceremony was held in 2nd September 2017. Excellent works were brought to Japan, and these were exhibited at the ward office of Kushiro City from 21st October 2017 for the public in Kushiro City. The opening ceremony were held with the mayor of Kushiro City and the trainees of training in Japan.



Source: JICA Expert Team

Figure 6.9-11 Photo and Painting Contest for Wetland Conservation

2) Internet Student Conference between Anzali Wetland and Kushiro Wetland

In commemoration of the World Wetland Day, in February of 2017 and 2018, DOE GILAN, EO and JET conducted student internet conference between students of Anzali City and Kushiro City. In the student internet conferences, Iranian and Japanese students introduced each other about their school, life, culture and ecology of each wetland (Anzali and Kushiro Wetlands) while having the Skype audio-video internet connection. These activities made students familiar with the importance of wetland and promoted the friendship between the two countries. The first conference was held between Mirzakoochak Khan secondary school (Iran) and Shibecha secondary school (Japan) on 2nd February 2017. The second one was held between Sharaf secondary school (Iran) and Koryo secondary school (Japan) on 6th February 2018.

In addition, February 2019, NGOs of both of Kushiro City and Rasht City implemented internet conference same as 2017-2018 supported by JICA Expert Team, KIWC and EO.

It is expected that the internet communication of Each pair of secondary schools will be continued by themselves.



Source: JICA Expert Team

Figure 6.9-12 Internet Conference between Kushiro and Anzali Wetland

3) NGOs Activities

As mentioned above, three NGOs (GWEPS, GWYES, and SEI) worked deeply in cooperation with this project. As activities other than public open activity, GWEPS and GWYES educated local farmers and students about the importance of wetlands through games and lectures in the AWEEC. Although there were times when these two NGOs could not operate smoothly depending on local conditions, activities continued mainly on public open in the AWEEC.

SEI similarly supported public open activity. In addition, in 2017, SEI worked on the challenge of water hyacinth as alien species and carried out removal work and public awareness program for local communities in 2017 are located around the Anzali Wetland.



Source: JICA Expert Team

Figure 6.9-13 NGOs Activities

6.9.2 Long-term Goal

Environmental education, particularly for students, plays an important role in conservation of the Anzali Wetlands because the activity works directly with many public people who live in and around the Wetland. In the future, all students need to learn the Anzali Wetland from scientific knowledge.

The fundamental approach proposed for the Long-term Goal on Environmental Education is to continue the activities implemented under the project by reflecting the lessons learned from the JPA practices. The Long-term Goals on Environmental Education is set as followings.

1. Promotion of Experience-based CEPA Program by Using AWEEC
 AWEEC is effectively functioned as experience-based CEPA (Communication, Education and Public Awareness) facility, utilized for programs for students and local people especially in Hendekhaleh village and opened for public people in holidays.
2. Promotion of Experience-based CEPA Program by Using AWNS and Anzali Wetland Visitor Center
 Anzali Wetland Visitor Center and Anzali Wetland Nature School are utilized as bases of experience-based CEPA facilities.

3. Anzali Wetland Conservation Study on the Human and Environment Curriculum
The secondary school students around the Anzali Wetland study the Anzali Wetland in the curriculum "Human and Environment" by using the material "Lotus booklet" and videos of "Life in Anzali Wetland."
4. Promotion of Further CEPA Activity for Anzali Wetland Conservation by DOE
DOE Gilan supports all of CEPA activities related to the Anzali Wetland conservation.
5. Promotion of Broader CEPA Activities by Kanoon and NGOs
Kanoon and NGOs regularly implement the broader CEPA activity related to the Anzali Wetland Conservation in collaboration with EO and DOE Gilan.

6.9.3 Mid-term Goal

The fundamental approach proposed for the Mid-term Plan for EE SC is to continue the activities implemented under JPA of the project. In currently, environmental education activities already have become active, and it is desirable to expand and continue the active situation. Based on the proposed Long-term plan as described above, mid-term plan (2020-2030) and roles of each EE SC members were proposed by every five goals which were proposed in the Long-term plan is set as follows;

- (1) Promotion of Experience-based CEPA Program by Using AWEEC
 - 1) To prepare a proper management plan and budget plan of AWEEC for continued use under DOE Gilan environmental education section and DOE Somesara
 - 2) To implement experienced-based EE program in AWEEC regularly
 - 3) To implement regular public open activities of AWEEC in collaboration with NGOs
- (2) Promotion of Experience-based CEPA Program by Using AWNS and Anzali Wetland Visitor Center

To prepare and implement EE program in Anzali Wetland Visitor Center (AWVC)

- 1) AWNS
 - 1) To prepare proper management plan and budget plan of AWNS for continuous utilization under EO
 - 2) To implement experience-based EE program in the AWNS regularly for students
 - 3) To develop an experience-based education program for students to promote CEPA
 - 4) To develop the new facilities such as cabins to expand the experience-based education program

- 2) AWVC
 - 1) To develop experience-based environmental education programs in combination with boat tour operator, AWNS and AWEEC
 - 2) To implement EE program in the AWVC regularly for visitors and students.
- (3) Anzali Wetland Conservation Study on the Human and Environment Curriculum
 - 1) To prepare a regular training program for teachers of the Anzali Wetland in the ‘Human and Environment’ curriculum at secondary schools around the Anzali Wetland.
 - 2) To implement a routine of learning about the Anzali Wetland in the ‘Human and Environment’ curriculum at secondary schools around the Anzali Wetland.
- (4) Promotion of Further CEPA Activity for Anzali Wetland Conservation by DOE
 - 1) To promote of CEPA activities for the Anzali Wetland by DOE Gilan
 - 2) To prepare materials of the Anzali Wetland such as poster, book, booklet, videos by DOE Gilan
 - 3) To share the result of monitoring of the Anzali Wetland
 - 4) To Establish the Experience-based Education Facility around the Anzali Wetland
- (5) Promotion of Broader CEPA Activities by Kanoon and NGOs
 - 1) To carry out WWD event routinely on Anzali Wetland conservation by Kanoon in collaboration with DOE Gilan and EO.
 - 2) To hold regular public open of AWEEC in collaboration with trained NGOs through collaboration with DOE Gilan.

6.9.4 Prior Conditions

Prior conditions to implement the mid-term action plan and achieve the set goals are identified as followings:

- Budget allocation

Gilan provincial governor’s office shall allocate an appropriate budget for environmental education through Anzali Wetland Management Committee (AWMC) on time. The budget should include maintenance fee for the AWEEC, AWNS, and other facilities, transportation fee for schools which coming the AWEEC, and necessary fee for NGOs which support to Public Open of AWEEC.

- Cooperation of stakeholders

It is necessary that concerned stakeholders such as DOE Gilan, EO including SA, Kanoon, NGOs, villagers, citizens, schools around the Anzali Wetland, and tourist will cooperate and collaborate on preparation and implementation of the future activities.

- Guaranteeing activities by existing trained NGOs

In the 5 year's activities of the Project, 3 selected NGOs have been cooperated with DOE Gilan for EE activity in AWEEC. The members of the NGOs were trained by JICA Expert Team as EE expert in the AWEEC and had rich experience for the EE activity. For the continuous success of the EE activity in AWEEC, DOE Gilan is recommended to guarantee for the NGOs in AWEEC officially.

- Appointment of staffs

DOE Gilan and EO shall appoint and assign technical staffs in charge of implementation of EE program in the facilities which function as a base for environmental education such as the AWEEC, AWNS and Anzali Wetland Visitor Center.

6.9.5 Implementation Plan

As above mentioned, the implementation plan for the Mid-term Plan for EE SC is to continue the activities implemented under JPAs of the project during 2014-2019. In currently, environmental education activities already have become active, and it is desirable to expand and continue the active situation. Implementation plan and schedule are described below.

- (1) Promotion of Experience-based CEPA Program by Using AWEEC

- 1) To implement experienced-based EE program in AWEEC regularly

The plan is for permanent use of the AWEEC. DOE Somesara should properly manage the Center and its facilities annually until 2030. In addition, DOE Somesara should secure a consolidated budget on a regular basis (every four years). The budget will use for repairing EE facilities and installing necessary additional EE facilities. DOE environmental education section, EO, Kanoon, and NGOs shall support to ongoing implementation of the experienced-based EE program using the EE facilities in AWEEC. The remained future repair/renovation plan such as construction of gravel path should be implemented by the Iranian budget.

Regular experience-based EE programs for students and local people should be implanted regularly by DOE manager of AWEEC and EE experts for mainly secondary and primary school student mainly in Somesara, Rasht and the cities in the watershed. At least 100 programs should be implemented, and 2000 student should participate in a year. EO should support to arrange the programs in AWEEC, At the last year (2030) of the Mid-term Plan, 200 programs should be implemented, and 4000 students should participate in a year.

2) To implement regular public open activities of AWEEC in collaboration with NGOs

➤ Purpose of Public Open of AWEEC

To conserve the wetland ecosystem, people should feel the importance of wetland at first. Because knowing the beauty and value of wetland motivate people to conserve the wetland.

Environmental Education SC under AWMC decided to start “public open” to let people know the importance of wetland. In addition, Environmental Education SC decided to introduce a nature guide system as trained NGO’s staffs as first advanced attempt in Iran.

➤ Implementation

The current public open activity should be continued for a long time. If the capacity of the nature guide is not enough, it is better to increase the number of nature guide. The nature guide is a person who trained by JET, and from now, existing guides will educate new personnel as a new guide continually.

DOE AWEEC manager and Nature Guides of NGO should implement the public open based on the guideline as attached.

➤ Role of Nature Guide

- ✧ Nature guide should let visitors know the beauty, the value of the Anzali Wetland.
- ✧ Nature guide should instruct how to use equipment (binocular, telescope, microscope, hydro glass, etc.).
- ✧ Nature guide should manage the safety of visitors.
- ✧ Nature guide should prevent that the visitor damage the wetland ecosystem.
- ✧ Nature guide should teach visitors how to conserve the wetland ecosystem.
- ✧ Nature guide should keep clean the center and outdoor facilities.
- ✧ Nature guide should manage the facilities and equipment of AWEEC.

➤ Rules for the AWEEC Usage

General Prohibition

- Don’t eat and no drinking outside the EE Center (Bird Watching Tower, Bird Hide, and Boardwalk). You can eat something in the EE Center, but please bring your garbage home.
- No Smoking in reserved areas (including the EE Center).
- Do not run, sing or shout at the wood road or the bird watching tower (Birds will be surprised by your action!)
- Don’t take plants and animals out of permitted place (Biotope) inside protected areas or bring them from outside.
- Do not enter inside the wetland; you should walk just wooden path.

Request for Safety Use

- ○ All children must be accompanied by parents.
- ○ Binoculars are used by everyone. Please use it carefully and return it to the EE Center in a clean condition. If you drop or break it accidentally, please don't hesitate to tell the staff.
 - Please be careful on the wooding path and Bird Watching Tower. If you found dangerous place in this equipment, please tell the staff. Staff will inform DOE guards.

Table 6.9-5 Roles of Each Organization for AWEEC

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> ➤ Operation, maintenance and improvement of AWEEC facility, equipment and programs ➤ Utilization of AWEEC Center in cooperation with EO, Kanoon, NGOs, Local communities
EO	<ul style="list-style-type: none"> ➤ Implementation of experience-based EE programs for primary and secondary school student around the Anzali Wetland
Kanoon	<ul style="list-style-type: none"> ➤ Implementation of experience-based EE programs for Kanoon members around the Anzali Wetland
NGOs	<ul style="list-style-type: none"> ➤ Implementation of public open and development and improvement of experience-based EE programs

Source: JICA Expert Team

(2) Promotion of Experience-based CEPA Program by Using AWNS and AWVC

1) AWNS

- To prepare proper management plan and budget plan of AWNS for continuous utilization under EO

AWNS was opened in Feb 2019. In the first year, EO formulates AWNS's budget and adequate management plan of the AWNS. Anzali City and EO/SA will propose experienced-based EE programs at these facilities and implement the programs regularly and continuously.

- To develop experience-based education program for students to promote CEPA

As a first step, necessary faucitis and equipment for experience-based education program were developed and prepared. However, the experience-based education program as software has not been developed well. JICA Expert Team implemented the trial of the experience-based education program and training program for instructor of SA. Some programs to utilize the facilities, equipment and environments (Nahang Roga river, Heron's forest etc.) should be developed and improved by SA instructors in cooperation with DOE and NGOs.

Table 6.9-6 Basic Experience-based Education Programs in AWNS

	Programs	Contents
1	Bird Watching	Student watches the water birds from the observation tower and terrestrial bird in the forest from anywhere by using binocular and telescope.
2	Nature Games	Various nature games can be implemented on the open wooden deck, practice field.
3	Micro World Adventure	Students collect anything from AWNS such as plant, insects, stones, etc. which they want to see by using microscope.
4	Quiz Board Rally	Students go to the ten quiz board sites and study about the Anzali Wetland.
5	Ground Water Observation	Students observe real ground water level at the covered well and biotope pond. They can recognize the AWNS is inside the wetland because the ground water level is very high.
6	Biotope Observation	Students observe the biotope (small wetland). They can see aquatic plants such as Reed, Lotus and Frogs, etc.
7	Nature Walking and Observation	Students walk under forest and observe annual ring of tree in the forest, and various plants and animals in AWNS.
8	Group Work	Many programs can be implemented by student group. AWNS has four group workshop decks. They can be separated and competed in various program.
9	Indoor Program	Students study the Anzali Wetland by using the prepared five video program by using the

Source: JICA Expert Team





Source: JICA Expert Team

Figure 6.9-14 Photos of Basic Experience-based Education Programs in AWNS

- To implement experience-based EE program in the AWNS regularly for students

Regular experience-based EE programs for students should be implanted regularly for mainly secondary and primary school student in Anzali City and Rasht City including member of SA.

At least 100 programs should be implemented, and 2000 student should participate in a year as first step. EO should support to arrange the programs in AWNS, At the last year (2030) of the Mid-term Plan, 200 programs should be implemented, and 4,000 students should participate in a year.

- To develop the new facilities such as cabins to expand the experience-based education program

AWNS has old cabins and open spaces in its land. To expand the experience-based education program, the cabins should be renovated for camping and the open space should be prepared as a practice field. However, AWNS have natural forest as Heron's colony and the purpose of the AWNS is to promote the experience-based education program for the Anzali Wetland conservation. The new facility development plan should be low impacted for the wetland nature.

2) AWVC

AWVC was developed under the Ecotourism SC and detailed development plan and management plan was prepared by Ecotourism SC. In this chapter, the EE programs by using AWVC is described from the viewpoint of EE SC.

- To develop experience-based environmental education programs in combination with boat tour operator, AWNS and AWEEC

AWVC is good facility to study about the importance of the Anzali Wetland by using the excellent exhibitions. It will be very effective the AWVC program combine with experience-based education program in AWNS, AWEEC and boat tour.

AWVC is located very near the jetty for the boat tour of Anzali Wetland. Many tourists visited the wetland by motor boat such as Lotus flower watching. However, such boat tour is just for enjoy the speed and beauty of flower. It can make synergy effect if the tourists go to the wetland by boat to see the real nature of the Anzali Wetland after studying the importance of the Anzali Wetland at AWVC. Thus, the combination program should be developed. If such new boat tour can go to the AWEEC in Selkeh, only 8 km from AWVC, the excellent experience-based education program can be developed. In addition, the AWNS is very near the AWVC. Students can study both the AWVC and the AWNS at once.

- To implement EE program in the AWVC regularly for visitors and students.

Regular experience-based EE programs for students and tourists should be implanted regularly for students and tourists by using the developed combination program with AWNS, AWEEC and boat tours.

Table 6.9-7 Roles of Each Organization for AWNS and AWVC

Organization	Role
DOE Gilan	➤ Dispatch of EE expert as instructors to AWVC and AWNS
EO and Student Association	<ul style="list-style-type: none"> ➤ Operation, maintenance and improvement of AWNS facility, equipment and programs ➤ Implementation of experience-based EE programs for primary and secondary school students around the Anzali Wetland
Kanoon	➤ Implementation of experience-based EE programs for Kanoon members around the Anzali Wetland
NGOs	➤ Support of Implementation of experience-based EE programs by using AWVC and AWNS
Anzali City	<ul style="list-style-type: none"> ➤ Operation and maintenance of AWVC facility, equipment and programs ➤ Development of the program with boat tour operator

Source: JICA Expert Team

(3) Anzali Wetland Conservation Study on the Human and Environment Curriculum

The plan aims to make students understand the importance of the Anzali Wetland broadly in the curriculum of 'Human and Environment' in the secondary school around the Anzali Wetland by 2030. EO will continuously implement the teacher's training, and the educated teachers will conduct the curriculum for targeted school students. With regard to the teaching materials, EO should periodically review and update data in cooperation with DOE Gilan and related organizations.

- To prepare regular training program for teachers of the Anzali Wetland in the 'Human and Environment' curriculum at secondary schools around the Anzali Wetland.

JICA Expert Team and EO prepared the “Lotus Booklet” for the 'Human and Environment' curriculum as shown in Table 6.9-8. 25,000 copies were printed. Some training course has been implemented for teachers until the end of the Project. Actually, it is not enough number of teachers. The additional training program should be implemented for teachers how to utilize the booklet “Lotus” in cooperation with DOE experts.

In addition, the five videos “Life in Anzali Wetland “were prepared in phase I project. It is still valuable to study about the importance of the Anzali Wetland. The videos can be used for the 'Human and Environment' curriculum. It is effective just show some of videos and ask students to discuss about the how should you do for the Anzali Wetland conservation. These videos can be seen on “the Aparat” website.

- To implement a class about the Anzali Wetland in the ‘Human and Environment’ curriculum at secondary schools around the Anzali Wetland.

The class environmental education for the Anzali Wetland conservation should be implemented on the ‘Human and Environment' curriculum for secondary school students in whole Gilan province by using the “Lotus Booklet” or videos of “Life in Anzali Wetland.” Normally, school teacher should teach their students by using these materials. DOE expert sometimes can support the class as special class.

Table 6.9-8 Roles of Each Organization for Human and Environment Curriculum

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> ➤ To train the teachers how to educate students for Anzali Wetland conservation ➤ Dispatch of EE expert as instructors to the schools
EO	<ul style="list-style-type: none"> ➤ Implementation of the curriculum "Human and Environment" by using the material "Lotus booklet" and videos of "Life in Anzali Wetland." ➤ Continues teacher training for Human and Environment"

Source: JICA Expert Team

(4) Promotion of Further CEPA Activity for Anzali Wetland Conservation by DOE

The plan aims to clarify what DOE Gilan should take responsibility in environmental education related to the Anzali Wetland conservation by 2030.

Based on the principles of Communication, Education, and Public Awareness (CEPA), DOE Gilan should support a wide range of environmental education related to the Anzali Wetland, and periodically prepare and update EE materials. The responsibility is not only an environmental education section, but also other related sections of DOE Gilan especially DOE branch offices in the Watershed of the Anzali Wetland such as DOE Anzali, Somesara, Rasht, Fuman, Shaft, Masar etc.

On the other hand, DOE Gilan should share the experiences of the EE program in the Anzali Wetland with other organizations and DOE branch office in other provinces. DOE Gilan is requested to spread EE activities in the Anzali Wetland over a wide range.

- To promote of CEPA activities for the Anzali Wetland by DOE Gilan

In order to promote the CEPA for the Anzali Wetland conservation, various events, and programs should be planned and implemented. For example, the World Wetland Day is one of the most important day to promote the wetland conservation. DOE should implement not its own event for the wetland conservation. In addition, DOE should support to implement the such event by the other organization and schools by dispatch instructors.

- To prepare materials of the Anzali Wetland such as poster, book, booklet, videos by DOE Gilan

In order to promote the CEPA for the Anzali Wetland conservation, various material such as posters, booklets, calendars, videos and website should be prepared and shared for students, local people and tourists. For example, DOE has two public screens in front of DOE Gilan and the square of the center of Rasht. Thus DOE should show some short videos about the beauty and importance of the Anzali Wetland at the public screen.

- To share the result of monitoring of the Anzali Wetland

There is less correct information about the Anzali Wetland. Only negative news about the Anzali Wetland is often published in TV news, newspaper and SNS. Therefore, some people misunderstand that any conservation activities is not necessary because of already death of the Anzali Wetland. It is completely wrong. The Anzali Wetland has still very significant value as described in Chapter 3. The balance of the news is important. Positive information about the Anzali Wetland should be share as well. Based on the plan of Sections 6.2 and 6.3, the comprehensive ecosystem survey and monitoring activities will be implemented. The result of the such monitoring should be shared in various ways.

- To Establish the Experience-based Education Facility around the Anzali Wetland

There are four hubs of CEPA activity such as AWEEC, AWNS, AWVC and the Anzali Wetland Ecotourism Center. Considering the size of the Anzali Wetland and the number of the human population, it is not enough to educate the local people. The other extra new experience-based facility should be established. Education classroom, boardwalk, tower etc. are effective for CEPA. For example, Siadarbijan village, Espand village and Abkenal town are candidate place to establish the experience-based facility. In case of the construction of such facilities, the education program as software should be developed as well as AWEEC.

Table 6.9-9 Roles for Further CEPA Activity for Anzali Wetland Conservation

Organization	Role
DOE Gilan	<ul style="list-style-type: none"> ➤ Promotion of CEPA activities for the Anzali Wetland ➤ Preparation of materials of the Anzali Wetland such as book, booklet, videos ➤ Sharing of the result of monitoring of the Anzali Wetland ➤ Construction of new experience-based facility like AWEEC

Source: JICA Expert Team

(5) Promotion of Broader CEPA Activities by Kanoon and NGOs

The plan clarifies the EE activities of relevant organizations other than DOEi Gilan.

Kanoon and NGO cooperate with DOE Gilan and EO will make continuous EE activities by utilizing the experience of the project.

Kanoon will continuously carry out various EE program related to wetland conservation such as World Wetland Day Event in February every year, and EE activities at AWEEC. NGOs will continuously carry out various environmental education related to wetland conservation focusing on Public Open of the AWEEC in cooperation with DOE Gilan.

- To carry out WWD event routinely on the Anzali Wetland conservation by Kanoon in collaboration with DOE Gilan and EO.

Kanoon has so implemented the events for World Wetland Day every year. They were very effective to educate the students including the member of Kanoon. The WWD event should be implemented every year.

Kanoon has implemented also summer camp for students. Camping event for the Anzali Wetland conservation should be implemented in the AWEEC and the AWNS.

In addition, painting and photo competition event should be implemented about the Anzali Wetland.

- To implement broader EE programs for students, local people, house wives for the Anzali Wetland conservation by various NGOs

There are many EE programs implemented by various NGOs until now. For example, waste collection campaign, removal of the alien species and education program for local house wives have been implemented.

In the Project, three NGOs (GWYES, GWPES and SEI) have implemented many EE activities as members of EE SC. They submitted their proposal of EE activities at the beginning of the Project in 2014. They have had already many experiences of EE through the Project activities. Thus, they can share the experiences with the other NGOs including NGOs registered to DOE Gilan. In the Mid-term Plan period, many NGOs in addition to three NGOs should join the EE activities for the Anzali Wetland conservation. NGOs have free hand, flexibility, mobility. Thus, they can plan, develop

and implement the new programs based on their original ideas. However, the NGOs have budget problem and human resource problem. DOE should support the NGOs including three NGOs by various ways such as legal permission to them, information sharing and budget support.

NGOs also should support DOE, EO, Kanoon and the other related organization and municipalities. All the stakeholders should cooperate with each other for a common purpose, the Anzali Wetland conservation.

Table 6.9-10 Roles of Each Organization for Broader CEPA Activities

Organization	Role
Kanoon	➤ Implementation of broader EE programs for Kanoon members for the Anzali Wetland conservation such as camping program, World Wetland Day event
NGOs	➤ Implementation of broader EE programs for students, local people, house wives for the Anzali Wetland conservation based on originally developed program by themselves

Source: JICA Expert Team

Table 6.9-11 Implementation Plan of EE activities 2019-2030

Items	(2019)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Remarks
(1) Promotion of Experience-based CEPA Program by Using AWEEC													
1) To implement experienced-base EE program in AWEEC													
Construction of the gravel path													
Management and maintenance of facilities													
Large scale maintenance and repair													Every 4-5 years
Implementation of regular programs													
2) To implement regular public open activities													
Implementation on every Friday													every Friday
Implementation on the other holidays													in cooperation with new NGO
(2)Promotion of Experience-based CEPA Program by Using AWNS and AWVC													
1) Anazali Wetland Nature School (AWNS)													
To prepare proper management plan and budget plan													
To develop experience-based education program													
To implement experience-based EE program													
To develop the new facilities													
2) Anazali Wetland Visitor Center (AWVC)													
To develop experience-based EE programs													with boat tour operator, AWNS and AWEEC
To implement EE program in the AWVC regularly													
(3) Anzali Wetland Conservation Study on the Human and Environment Curriculum													
1)To prepare regular training program for teachers													
2)To implement a class about the Anzali wetland in the 'Human and Environment'													
(4)Promotion of Further CEPA Activity by DOE													
1)To promote of CEPA activities													
2)To prepare materials of the Anzali wetland such as poster, book, booklet, videos													
3)To share the result of monitoring of the the Anzali Wetland													
4)To Establish the New Experience-based Education Facility													
(5)Promotion of Broader CEPA Activities by Kanoon and NGOs													
1)To carry out WWD even by Kanoon	●	●	●	●	●	●	●	●	●	●	●	●	WWD is Feb 2
2)To carry out EE activities by Kanoon													
3)To implement broader EE programs by NGOs													

Source: JICA Expert Team

6.9.6 Demarcation of Main Roles

Above mentioned in Section 6.9.3, each organization which belongs to Environmental Education Sub-committee members have each role for by each Mid-term goal. The demarcation of main roles for each organization is mentioned as following;

(1) Environmental Education Section of DOE Gilan

In charge of the coordination of Environmental Education Sub-committee, implementation and supervision of EE activities in AWEEC in coordination with concerned organizations, assign enough staffs in the AWEEC, and provision of technical advises on implementation of the activities to other EE activities from environmental education viewpoint

(2) DOE Somesara / Selkeh Guard Station

In charge of maintenance of AWEEC and surrounding equipment, as well as support to NGOs working on Public Open of AWEEC

(3) Education Organization

In charge of implementation of EE activities in AWEEC, implementation, supervision, and management of the AWNS, as well as supervision and educate the Anzali Wetland conservation through Human and Environment curriculum of 9th grade student,

(4) Kanoon

In charge of plan and implementation of broad EE events related to the wetland conservation such as World Wetland Day, Lotus festival and others in cooperation with DOE Gilan.

(5) NGOs (GWEPS/GWYES/Sarzamin-e-Sabzema) and the other NGOs

In charge of plan and implementation of broad EE events related to the wetland conservation such as Public Open of the AWEEC, as well as EE programs for local people in cooperation with DOE Gilan EE section. The other NGOs can join the broader EE program. However, the new NGO member should be trained if they want to join the public open program of AWEEC.

6.9.7 Budget

The annual budget for each of the above mentioned five goals until 2030 is shown in the table below.

Table 6.9-12 Preliminarily Estimated Cost for EE Activities to 2030

Items	(2019)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Remarks
(1) Promotion of Experience-based CEPA Program by Using AWEEC														
1) To implement experience-base EE program in AWEEC														
Construction of the gravel path		3												3
Management and maintenance of facilities	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Large scale maintenance and repair				20				20					20	60
Implementation of regular programs	2	2	2	2	2	2	2	2	2	2	2	2	2	24
2) To implement regular public open activities														
Implementation on every Friday	1	1	1	1	1	1	1	1	1	1	1	1	1	12
Implementation on the other holidays			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5
Annual Sub total	8	5	5.5	25.5	5.5	5.5	5.5	25.5	5.5	5.5	5.5	25.5	128	
(2)Promotion of Experience-based CEPA Program by Using AWNS and AWVC														
1) Anazeli Wetland Nature School (AWNS)														
To prepare proper management plan and budget plan	1							1						2
Management and maintenance of facilities	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Large scale maintenance and repair				10				10					10	30
To develop experience-based education program	2	2	2				2							8
To implement experience-based EE program	10	10	10	10	10	10	10	10	10	10	10	10	10	120
To develop the new facilities		20	20	20										60
2) Anazeli Wetland Visitor Center (AWVC)														
To develop experience-based EE programs	2	2	2											6
To implement EE program in the AWVC regularly	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Annual Sub total	17	36	36	42	12	12	15	22	12	12	12	12	22	250
(3) Anzali Wetland Conservation Study on the Human and Environment Curriculum														
1)To prepare regular training program for teachers	5	5	5											15
2)To implement a class about the Anzali wetland in the 'Human and Environment'	10	10	10	10	10	10	10	10	10	10	10	10	10	120
Annual Sub total	15	15	15	10	10	10	10	10	10	10	10	10	10	571
(4)Promotion of Further CEPA Activity by DOE														
1)To promote of CEPA activities														
2)To prepare materials of the Anzali wetland such as poster, book, booklet, videos	10	10	10	10	10	10								60
3)To share the result of monitoring of the the Anzali Wetland	1	1	1	1	1	1								6
4)To Establish the New Experience-based Education Facility		50	50		50	50			50	50				300
Annual Sub total	11	61	61	11	61	61	0	0	50	50	0	0	366	
(5)Promotion of Broader CEPA Activities by Kanoon and NGOs														
1)To carry out WWD even by Kanoon	5	5	5	5	5	5	5	5	5	5	5	5	5	60
2)To carry out EE activities by Kanoon	5	5	5	5	5	5	5	5	5	5	5	5	5	60
3)To implement broader EE programs by NGOs	3	3	3	3	3	3	3	3	3	3	3	3	3	36
Annual Sub total	13	13	13	13	13	13	13	13	13	13	13	13	13	156
Annual Total	64	130	130.5	101.5	101.5	101.5	43.5	70.5	90.5	90.5	40.5	70.5	1,471	

Unit: Thousand USD

Source: JICA Expert Team

6.9.8 Supposed Problems

(1) Lack of Continual Budget Allocation

As described above, EE activities strongly required continuous budget allocation such as maintenance and administration fee of the AWEEC, transportation cost to the AWEEC for joining school student EE program, payment of overhead expenses to three NGOs.

However, currently, Gilan Province did not arrange any budget for the EE program for Wetland conservation. For ongoing EE activities, AWMC and other related authorities should discuss and continue budget allocation should be done.

(2) Lack of Management System for Environmental Education Facilities

As of November 2019, three facilities; AWEEC in Selkeh Wildlife Refuge, AWNS during renovation, the Visitor Center under construction are located around the Anzali Wetland as EE facilities. The administrator of AWEEC is DOE Somesara, AWNS belong to Student Organization, and the AWVC will belong to Anzali City. EE activity is mainly implemented for students and public people. Proper management of facilities and necessary repair for aging are important from the viewpoint of safety management. In current situation, construction of AWEEC's facilities and the renewal of existing facilities are implemented by JICA Expert Team funds. Facility management of Iran side should be carried out including regular budget allocation independently.

Meanwhile, at the end of the project, JICA has transferred a lot of equipment such as binoculars and microscopes for EE activity in the AWEEC. The education materials are limited in purpose for use in EE program conducted in the Anzali EE Center. In order not to dissipate the education materials, sufficient consideration should also be given to the equipment management.

Based on the above, it is urgently considerable that establishment of a responsible management system by DOE Gilan Environmental education section / DOE Somesara.

(3) Shortage of Environmental Education Expert Who Has Enough Skill

Currently, among the members belonging to the DOE Gilan environmental education section, the personnel who can implement the EE program in the AWEEC is very limited number. Under these circumstances, it is impossible to implement EE programs with sufficient frequency in response to requests from EO, schools, Kanoon and others. Essentially, whole of expert of DOE GILAN EE section including environmental education experts belonging to the DOE branch office around the Anzali Wetland should master the EE program and implement the EE program by their own hand in future.

In the other hand, Staffs of three NGOs which supporting public open currently have already taken training programs for using AWEECs, and the staffs have certain knowledge with experienced -based EE program. In the future, when human resources of NGOs are required to replace, new human resources should be continuously educated about the Anzali Wetland by experienced members. In addition, when new NGOs are added to the Public Open activities due to the withdrawal of current NGOs the new NGOs and their members must also learn about the Anzali Wetland, the AWEEC and experienced-based EE program in advance same as current NGOs.

(4) Guarantee of Cooperative Relationship between DOE Gilan and NGOs as Nature Guide

Currently, three NGOs have been supported Public Open activities in AWEEC regularly. They have been very cooperative to DOE Gilan and have given a good impression to the visitors with

proper correspondence. As mentioned above, the staff of these NGOs has already taken training programs by JICA Expert Team for using the AWEEC and passed the examination. The NGOs work as nature guide is now completely voluntary. NGOs needs the cost of transportation. In addition, cleaning cost of toilet is also necessary. Recently, small donation system has already introduced. Many visitors voluntarily donated to NGOs as nature guide. It is not very enough, however the donation could cover almost the transportation cost and cleaning cost. If the donation cannot function to cover the transportation and cleaning cost, DOE should cover these costs or introduce the entrance fee system.

6.10 International Cooperation for Networking of Littoral Wetlands of the Caspian Sea

6.10.1 Current Situation

International cooperation is one of the important pillars of the Ramsar Convention. JICA played important role for the Anzali Wetland conservation under international technical cooperation scheme.

Under the Project, the necessity of the networking of littoral wetlands of the Caspian Sea to conserve unique ecosystem through international transboundary cooperation was identified.

The Caspian Sea is the largest enclosed body of water on earth, which has over 300 endemic species under its unique and isolated ecosystem. Ten Ramsar Sites have been designated in total in five countries which face to the Caspian Sea. Littoral wetlands can be considered as important part of the ecosystem in the Caspian Sea to be conserved with high priority.

According to the Strategic Goal 2 in the Fourth Ramsar Strategic Plan 2016-2024, which states that the Ramsar Site network effectively be conserved and managed, a Ramsar Site network, formed by the littoral wetlands of the Caspian Sea Region, need to be conserved effectively.

Unique regional characteristics are seen in the Caspian Sea such as existence of a number of endemic species, and long-term water fluctuation. Therefore, it is imperative for the littoral countries of the Caspian Sea to manage the littoral wetlands with information sharing and united efforts.

In addition, under the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (also called as the Tehran Convention), protected areas of Caspian Sea (PACS) are supposed to be established, which need international cooperation among the littoral countries. Though the Ramsar Sites can play core role for the PACS, this point has not clearly recognized yet.

For example, a satellite tracking survey of migratory bird is being conducted as a joint pilot activity under the Anzali Wetland Ecological Management Project - Phase II in Iran, which is supported by the Japan International Cooperation Agency (JICA) under technical cooperation scheme. As results of the survey, it was observed that Dalmatian Pelican (*Pelecanus crispus*) and Purple Heron (*Ardea purpurea*) move among the Ramsar Sites in the littoral countries such as Anzali Wetland in Iran, Ghizil-Agaj in Azerbaijan, and Volga Delta in Russian Federation. This finding shows international and transboundary cooperation be effective for conservation of the migratory birds.

JICA Expert Team arranged a side event in COP13 in Dubai in 2018 to provide a first opportunity to discuss for establishing implementation system for cooperation in conservation of the littoral wetlands in the Caspian Sea region, through sharing information on current status, management

system, and conservation efforts on the littoral wetlands by personnel in charge of wetland conservation in respective littoral countries of the Caspian Sea.

However, several problems about the arrangement, littoral countries of the Caspian Sea including Iran could not attend the side event in COP13.



Source: JICA Expert Team

Figure 6.10-1 Ramsar Sites around the Caspian Sea and Route of Migratory Birds

6.10.2 Long-term Goal

The all wetlands around the Caspian Sea including all Ramsar Sites should be conserved as very well in cooperation with all littoral countries.

6.10.3 Mid-term Goal

As a first step, information sharing about current status, management system, and conservation efforts, wise use and CEPA activities on the littoral wetlands should be implemented through the international events.

6.10.4 Implementation Plan

Ramsar COP is held every three years. COP14, COP15, COP16 will be held in 2021, 2024, 2028 in Mid-term Plan period. The side event as COP 13 “The Networking of Littoral Wetlands

of the Caspian Sea to Conserve Unique Ecosystem through International Transboundary Cooperation” should be arranged and implemented. The personnel in charge of wetland conservation in respective littoral countries of the Caspian Sea should be contacted and invited.

The focal person of Ramsar Convention in DOE HQ should arrange the events in cooperation with DOE Gilan and Ministry of Foreign Affair.

Not only Ramsar COPs, but also the other international workshop, seminar, symposium and meetings about the Tehran Convention is good opportunity to share the information about the wetlands. As a first step, information sharing and communication between the littoral countries should be promoted.

6.10.5 Supposed Problem

The arrangement of the international events is very difficult. Because, DOE staff cannot contact the foreign person directly. The person of the Ministry of Foreign Affair (MOFA) can contact them. However, the person of MOFA does not know the detail information about the wetland very well. It is very difficult to communicate the necessity of international cooperation among the littoral countries. To avoid such thing, DOE HQ should communicate with the person in charge of Ramsar Convention and Tehran Convention of MOFA very well in advance.

6.11 Further Activity

6.11.1 Legal Sub Committee

This Mid-term plan is prepared based on the current six technical Sub Committees. In 2017, legal Sub Committee has been established as seventh SC. Actually, JICA Expert Team doesn't have enough information about the SC. Therefore, the Mid-term plan does not include the plan of Legal Sub Committee.

However, all technical Sub Committees need sometimes to discuss and consider about the legal matters. For example, the environmental zoning and land use guideline should examine about the legal validity of the plan. Legal authority can advise and solve such matters.

Iranian side should prepare the Mid-term Plan of Legal Sub Committee as soon as possible.

6.11.2 Agriculture Sub Committee

The project has not covered the agricultural aspects related to the Anzali Wetland. Agricultural matters such as pesticide and fertilizer use, encroachment by farmland and pasture and over use of water is necessary to manage and control for the Anzali Wetland conservation. It is better to establish the new Agriculture Sub Committee to solve such matters as a part of the integrated management of the Anzali Wetland. MOJA and NRWGO can play main important role in agricultural matters.



Ramsar



<http://anzaliwetland.com>