Supporting Report H

INSTITUTION AND ORGANIZATION

THE STUDY
ON
INTEGRATED BASIN MANAGEMENT FOCUSED ON FLOOD CONTROL
IN
MEJERDA RIVER
IN
THE REPUBLIC OF TUNISIA

FINAL REPORT

Supporting Report H: Institution and Organization

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CHAPTER H1 PRESENT INSTITUTION AND ORGANIZATION FOR INTEGRATED FLOOD MANAGEMENT

H1.1 General

This supporting report deals with the institutional and organizational development required for the integrated flood management of the Mejerda River basin as a part of the integrated water resources management in order to effectively and efficiently materialize the master plan on integrated basin management focused on flood control in the Mejerda River from a planning stage to an operation and maintenance stage.

The Republic of Tunisia is situated in the centre of the North African seaboard and bordered by the Mediterranean to the North and the East, to the South by Libya, and to the West by Algeria. It covers 162,155 km^2 with a population of about 10,000,000, and is an ancient political entity of the Maghreb. Its capital is Tunis.

The Mejerda River flows from the south-west to the north-east over a distance of 312 km in Tunisia, and represents the country's single perennial river (refer to **the location map** of the flyleaf). The Mejerda River basin is located almost entirely in the climatic zone where the average annual rainfall ranges between 400 and 600 mm, and covers a total area of 23,700 km^2, of which 7,870 km^2 (33%) are located in Algeria. The extreme north and the north areas of Tunisia wherein the Mejerda River basin is located can be distinguished by mild and wet winter, and hot and dry summer. The average annual rainfall exceeds 1,000 mm in the northwest part of the study area, whereas the southern part has a rainfall as low as 300 mm/year.

Population within the Mejerda River basin was estimated to be 1,330 thousand in 2004. While the basin occupies 9.8% of the land area of Tunisia, the population of the basin accounted for 13.4% of the total population in Tunisia. The population density of the basin (84.0 per km^2) was higher than the national average of 61.1 per km^2.

The densely populated areas are located mainly on the plains along the main stream of the Mejerda River, particularly on the alluvial plain near the river mouth, such as Tunis, and Ariana and Manouba Governorates. The river system diagram, **Figure H1.1** shows the location of the major stream gauging stations, the tributaries, dams, cities and towns. **Figure H1.2** illustrates dams and water systems of the Majerda River basin. **Figure H1.3** illustrates the dams and water transfer schemes of the Extreme North.

H1.2 Organizational Structure and Competence of MARH[1]

H1.2.1 Central Directions of MARH

The Ministry of Agriculture and Hydraulic Resources (MARH) is entrusted with the water management according to the Article 2 of the updated Decree N° 2001-419 dated on 13 February 2001 (JORT). The organizational structure of the MARH is shown in

[1] The information in this chapter was adopted mainly from Chapter 23, "MEDROPLAN Guidelines, Technical Annex" (draft, May 2006), Louati M.H., Bergaoui Med., Lebdi F., Methlouthi., Fl Euchi L. & Mellouli H.J.

Figure H1.4. Duties of the MARH are managed by its different directions and departments under the legal framework defined in the updated Decree N° 2001-420 dated on 13 February 2001 (JORT).

Central directions, that have extensive competencies on water resources management field, are the General Direction of Dams and Large Hydraulic Works (DGBGTH),the General Direction of Water Resources (DGRE) and the General Direction of Rural Engineering and Water Exploitation (DGGREE). On the other hand, the General Direction of Planning, Management and Conservation of Agricultural Lands (DGACTA) is involved in the natural resources evaluation and preservation as wall as in the hydrological and hydro-geological aspects linked to the water resources.

The organizational structure of the DGBGTH is shown in **Data H1**. The DGBGTH is responsible for water resources planning and management through the following competencies:

- Elaboration of hydraulic studies,
- Elaboration of master plan on surface water resources,
- Elaboration of water mobilizations studies,
- Making up dams and lakes building studies,
- Elaboration of important water planning studies for surface water resources mobilization (big dams, water transfer, etc.)
- Control and maintenance of dams,
- Realization of planning and large hydraulic works related to rural and agricultural zone protection against floods,
- Insuring a platform for all the areas to encompass flood prevention and disaster management, and
- Supervising drought management system.

The organizational structure of the DGRE is shown in **Data H2**. The DGRE is responsible for:

- Mounting and management of measurement and observation networks related to all country water resources components (Water data and information system and flood early warning, etc.),
- Elaboration of basic and applied studies on water resources evaluation and setting their general balance,
- Drawing principal and specific methods for water resources management, according to supply and demand,
- Promotion of research and experimental activities related to conventional and non conventional water uses[2], and
- Finalizing and perfecting different ground of water mobilizations planning and their exploitation.

The organizational structure of the DGGREE is shown in **Data H3**. The attributions of

[2] The non-conventional water uses include brackish water and recycled water of sewerage.

the DGGREE are:

- Realization of strategic studies and elaboration of political plans related to rural engineering and agricultural water exploitation,
- Attending and evaluation of irrigated area planning, equipping, soil sweetening and drainage, management of irrigation water exploitation, maintenance of hydraulic works and equipment, and conceiving appropriate technical and economical management of irrigated areas,
- Optimizing water use and valorisation of reclaimed used water, attending all NGO (GIC), and implementing management and balance of water demand and supply in agricultural sector,
- Coordination of rural and urban domestic water supply programs, and elaboration of water supply planning and projects and attending them, and
- Coordination of rural infrastructures and basic equipment, and studying technological and economical aspects related to agriculture mechanization promotion.

The DGACTA is involved in the natural resources management by realizing the following missions:

- Elaboration of plans and orientations related to natural resources (soil, vegetal, and water),
- Proposition, elaboration and promotion of measures insuring optimization of natural resources utilization,
- Soil resources evaluation (vocation and agricultural aptitude). The geographical information system and remote sensing technique are used,
- Realization of research on soil sciences, using advanced techniques and equipped soil and water analysis laboratories,
- Control of soil evolution under different exploitations modes, and their protection (against salinity, degradation, desertification, etc.),
- Coordination between all parties working on soil and water conservation,
- Elaboration of basins planning, and drawing out the anti-erosive studies and implementing them,
- Control and attending soil and water conservation projects realization,
- Evaluation of soil and water conservation planning and programs,
- Setting and promotion of approaches targeting on the natural use optimization and preservation and associating all operators in the preservation process, and
- Insuring the valorization and exploitation of soil and water conservation infrastructures and planning works to be realized.

The Bureau of Water Planning and Hydraulic Equilibriums (BPEH), directly attached to the Cabinet (departmental staff) of the Minister of the MARH, is continually in relation with all organizations and institutions involved in water resources management in the country. Consequently, an important database on the water resources is continually collected and updated. The competencies assigned to this bureau are:

- Mapping the conventional and non conventional water resources.

- Identifying the different socio-economic water needs (demands).
- Collecting available and exploitable water resources information.
- Collecting and analyzing all data related to the water demand.
- Proposition of plans and programs on water resources allowance for all users, according to supply and demand.

H1.2.2 Regional Directions of MARH

The MARH is involved in all the agricultural activities (i.e., natural resources, food production, vegetal and forestry domains, economic aspect, etc.), but it entrusts regional activities to each governorate (24 governorates) by regional services or district departments within the framework of the Tunisian decentralization policy. Its administrative and technical structure is called as the Regional Commissaries of Agricultural Development (CRDA) or the Regional District Department of the MARH. The CRDAs are established by the law that was successively updated in March 1989 (Law N ° 89-44, JORT) and in October 1992 and October 1994.

Each CRDA supervises the agricultural activities and their promotion by technical, administrative, legislative, and financial issues and by vulgarization of new agricultural technologies enhancing the related regional domain. Each CRDA has technical and administrative services (Arrondissement). The CRDAs are the representatives of the central directions and realize their duties in the regional level. On the other hand, the Soil and Water Conservation Service (A/CES) is linked to the water management process. The organization structure of Siliana CRDA and that of Beja CRDA are shown in **Data H4** and **Data H5** respectively as examples of the CRDAs.

The CRDAs are entrusted with numerous responsibilities targeting on realization of all operations related to the regional agricultural development and natural resources valorizations, particularly:

- Application of legislation and regulation related to soil protection, forest and water management, supervising plant protection, and caring animal health,
- Insurance of forest resources development and protection, soil land water conservation and agricultural land and basin planning,
- Regional hydraulic system and forest domain management, and conservation of the natural resources,
- Realization of hydraulic planning and hydro agricultural infrastructure valorization,
- Hydro agricultural infrastructures management and maintenance, and achieving the water supply network management, and
- Encouraging farmers' initiatives for adequate structure creations that are targeted on the regional agricultural development process.

H1.2.3 Institutions Supervised by MARH

The Water Exploitation and Distribution National Company (SONEDE), established by the law N° 68-33 (2 July 1968, JORT), is an autonomous institution under the umbrella of the MARH authorities, and it insures the management of the domestic water and also the industrial and other (non agricultural) uses in the country. Organized by several directions,

the SONEDE is responsible for the quantitative and qualitative fresh water management. It should realize the water network exploitation, maintenance, transportation (transfer and canalization), and all activities related to the domestic water sector including water treatment for normalized qualities (physical, chemical, biological and bacteriological) and its equitable distribution.

The North Water Canal, Adductions (auxiliary facilities) and System Management Company (SECADENORD), established by the law N° 84-26 (14 May 1984, JORT), has its financial autonomy under the authority of the MARH. It insures the management and maintenance of the part of North West water network transfer: i.e., the north water canal, and the adduction for the canalization of water from the Sidi Salem Dam, Ichkeul zone, and the extreme North West for the users in the North East, Centre and South of the country where there is a fresh water shortage.

The MARH also supervises the Agricultural Research and Higher Education (IRESA), the Direction of Scientific Information Processing (DTIS), the National Water Council (CNE), the Animal Husbandry and Pasture Agency (OEP), the Cereal Agency (OC), the Agricultural Vulgarization and Training Agency (AVFA), a number of Collective Interest Associations (GIC) for domestic water supply and agricultural activities. The MARH supports Tunisian Farmers Association (UTAP) and a NGO professional association[3].

H1.3 Legislation for Water Resources and Natural Disaster

H1.3.1 Water Code and IWRM

Tunisia focused its policy on the water mobilization that is conceived with inter annual volume regulation approach and with inter-basins and within-basin water transfer system. Integrated water resources management (IWRM) has been implemented as policy instruments based on the Water Code (Law N° 75-16, 31 March 1975).

All the legislative texts concerning water resources management made during the French colonization period (1881 - 1956) were updated as the Water Code in 1975 in order to identify the competencies of all operators and users in the water sector, to preserve the water resources and to insure the equitable allocations. Since 1975 the water code was continually updated by modification of some legislation and supplement of new ones regarding socio-economic development, the water demand evolution, and the environmental issues required to preserve the natural resources. The last update was made in November 2001[4].

The Water Code updated as of 1997 is composed of the following nine chapters:

CHAPTER I. PUBLIC HYDRAULIC DOMAIN
CHAPTER II. CONSERVATION AND WATER POLICY OF THE PUBLIC HYDRAULIC DOMAIN

[3] For further details of those organizations refer to the section of Organizational Component, "MEDROPLAN Guidelines, Technical Annex " (Draft, May 2006), Chapter 23

[4] The 1997 updated version is available but the latest version updated in November 2001 is not published in the public yet. The National Water Council replaced the National Water Committe by Decree No. 2001-2606 of November 9th, 2001.

CHAPTER III.	WATER RIGHT
CHAPTER IV.	OBLIGATIONS
CHAPTER V.	AUTHORIZATION OR CONCESSIONS RELATED TO THE WATERS OF THE PUBLIC HYDRAULIC DOMAIN
CHAPTER VI.	USEFULL EFFECTS OF WATER
CHAPTER VII.	DETRIMENTAL EFFECTS OF WATER
CHAPTER VIII.	WATER USERS ASSOCIATIONS
CHAPER IX.	JURISDICTIONS AND PENALTIES

The Soil and Water Conservation Code (1995) and the Forest Code (1993) are also the basic laws related to IWRM.

H1.3.2 National Water Council

The Water Code attributes to the National Water Council (CNE) several competencies on water resources in the country. The CNE examines and evaluates the general issues related to the water planning and management as an advisory body. Data on supply and demand, population, natural characteristics, etc. are all used in the evaluation process. The President of the CNE is the Minister of the MARH, and the members are composed of the representatives of the Ministries linked to water resources management: i.e., Justice, Interior, Finance, Equipment, Development and International Cooperation, Public Health, Industry Energy, and Communication Technologies and Transport (Law N° 78-419 - 15 April 1978). The regional authority is associated when the subject discussed is related to its region.

H1.3.3 National and Regional Disaster Commissions

(1) Commissions for Disaster Management

The regional office of the Civil Protection (Ministry of Interior) is responsible for flood warning, flood fighting and evacuation activities in cooperation with the national guard (Ministry of Interior), the police and the military (Ministry of National Defense) in the regional level. Flood warning is announced at first from the Minister of Interior (National Disaster Commission) to the regional governor (Regional Disaster Commission), then from the governor to the regional Civil Protection, and finally to residents in the region. The regional governor instructs the Civil Protection relevant flood fighting activities.

The National Disaster Commission is the supreme organization of the country for disaster management and is chaired by the Minister of Interior (Decree No.942-1993 and No.2723-2004). The Commission consists of the chairman and 18 representatives selected from the concerned Ministries. The representatives are selected in each case depending on the type of disaster.

The Regional Disaster Commission is the supreme organ of each governorate for disaster management and is chaired by the regional governor (Decree No.942-1993 and No.2723-2004). The Commission consists of the chairman and 17 representatives selected from the regional offices of the concerned Ministries. The representatives are also selected in each case depending on the type of disaster.

(2) Law No.39-1991 on disaster management and organization (June 8, 1991)

The law stipulates 16 articles; 1) definition of disaster, 2) national and regional disaster management plans, 3) national and regional disaster commissions, 4) coordination between the Minister of Interior and the respective governors, 5) comprehensive statistics of equipment and human resources available for disaster management activities, 6) instruction to implement the national and regional disaster management plans, 7) to 15) requisition of equipment and human resources in times of disaster, and 16) repeal of previous provisions.

(3) Decree No.942-1993 on national and regional disaster management plans and the commission (April 26, 1993) and Decree No.2723-2004 on the modification of the Decree No. 942-1993 (December 21, 2004)

These Decrees stipulate 16 articles; 1) means of implementing the national and regional disaster management plans and the commissions, 2) consideration matters in formulating plans, 3) drafting and approval of the plans, 4) orientation of regional plan in national plan, 5) approval of regional plan and submission to National Disaster Commission, 6) intended disaster, 7) specific gradual operations, 8) commencement of implementation, 9) holding of prior meetings with special officers, 10) empowerment of orders, 11) order of working termination, 12) members of National Disaster Commission, 13) meeting of National Disaster Commission, 14) members of Regional Disaster Commission, 15) meeting of Regional Disaster Commission, and 16) implementation of this decree.

H1.4 Water Resources Management Policy and IWRM

H1.4.1 IWRM and Water Master Plans

The natural resources management policy of Tunisia has an objective to achieve the sustainable natural resources management until 2025[5]. The IWRM has been viewed as a national water resources management policy of the republic, and it has been updated by national studies and also by international cooperation programs. In most of the Mediterranean countries, water management planning is based on Water Master Plans (Plans Directeurs des eaux).

The planning for drought for moving from crisis to a risk management dates only from the late 1980s. The DGBGTH achieved the “Water 2000 project / EAU 2000” in 1992 with collaboration of KFW (German Bank). This project established planning study linked to water investment and mobilization until 2010. Water sector studies up to 1998 were elaborated in 1999. The diverse subjects of IWRM covered the water demand, supply, cost, legislative and institutional water management system, pollution and different water origins and uses. The GEORE (Optimum Management of Water Resources) Project set a target on establishment of an integrated water resources management policy[6].

[5] DGPDA (1996). “Etude sur la Strategie des Ressources Naturelles en Tunisie”. SCET, Tunisie & BDPA-SCETAGRI, France

[6] DGBGTH/GTZ, 2001: Project GEORE “Gestion Optimal des Ressources en Eau”, 9 Volumes

The Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN 2005) is the latest plan for the drought management system in Tunisia. At present the DGBGTH is reviewing EAU XXI (the target year 2030) made in 1998 to set up a new national water resources management policy for the target year 2050.

H1.4.2 Integration of Water Resources Management Unit

In Tunisia, water plans depend on basins boundaries. As consequences, the water resources planning process has been compelled to balance between two main constraints. First, the target water use regions are generally different from those mobilized for actual uses resulting in imperative water transfer that reached 300 km. Second, water resources management planning were conducted on basins units, contrary to their planned supply programs in the social and economic development national plans depending on the administrative units (governorate and departments). Nevertheless basins and administrative units didn't have common boundaries, and eventually, the precise evaluation of Water Master Plans is hampered by such structural divergences.

In order to overcome the above constraints, the hydraulic-unit concept has been adopted as an approach in water resources planning and management. Since identified water resources (surface water and groundwater) are to be reserved or mobilized to meet seasonal demand fluctuation and regional demand distribution, their management links to "stocks management" not as "random resources". This is the challenge in water resources system in Tunisia. The management of each reservoir or a group of reservoirs could be realized in normal period as well as with interaction with the remainder system components, particularly during extreme situations (drought or floods).

H1.5 Drought Management

H1.5.1 Framework of Drought Management

In Tunisia the drought management process is based on the drought announcement and Minister's decisions to cope with drought. The Minister of the MARH promulgates several decisions related to the different drought committees. The drought management is executed in three major successive phases, 'before', 'during' and 'after' as defined below[7].

Phase 1 Before (preparedness and early warning before drought)

i) Drought announcement

With reference to meteorological, hydrological and agricultural indicators as observed in the different regions affected by drought and transmitted by the agricultural, economic, and hydrologic districts relevant to the MARH, a drought announcement is established by a circumstance memorandum.

ii) Warning

The announcement, qualified as warning note, is transmitted to the MARH Minister,

[7] Louati M.H., Mellouli H.J & Fl Euchi M.L., (2005) - Mediterranean Drought Preparedness and Mitigating Planning" (MEDROPLAN Project) – Option Mediterraneennes, Series B, N°51.

who proposes a scheduled operation plan to the National Commission which is composed of decision makers and beneficiaries.

Phase 2 During (drought management to mitigate drought effects)

iii) Action implementation

The National Commission takes charge of supervision and execution of all the operation actions with strong collaboration of the regional and specialized committees.

Phase 3 After (aftercare to start normal operation)

iv) Subsequent measures

The National Commission supervises also all necessary operations required after the drought is over.

H1.5.2 Drought Committees

In order to insure an efficient drought management, the MARH nominates three types of committees, the Drought National Commission (CNS), the Drought Regional Commission (CRS) and the Drought Specialized Commission (CSS). The duties and activities of these committees are summarized below.

i) Drought National Commission (CNS)

The members of the CNS are representatives from the MARH and the Ministries of Interior, Economic Development, Finances, Commerce, Transport, and Public Health. Its responsible activities are principally, (i) to keep track of the drought circumstance, (ii) to elaborate the measures and provisions against the drought situation (intensity, duration, etc.) according to regional and national indices analysis and (iii) to coordinate the execution of drought mitigation operation programs. This commission is supported by the specialized sectors commissions (CSS) in the national level and by the regional commissions (CRS) in each province (governorate).

ii) Drought Regional Commission (CRS)

Twenty four governorates have each CRS. The members belong to the Regional Departments of all Ministries involved in drought mitigation. The United Farmers Organization (UTAP) is associated. The main task of CRS is to present the situation of the different sectors and to inform the national authorities about the necessary measures for drought management if observed in their regions. They work in collaboration with CNS and CSS.

iii) Drought Specialized Sector Commission (CSS)

The CSS(s) are responsible for preparation of the drought indicators observed in each field. They propose an operation planning and scenarios for mitigation of the different eventual drought events. The CSS(s) are Water Resources Management Committee, Livestock Safeguard Committee, Cereal Sector Management

Committee, Arboriculture Sector Committee[8].

There is communication and information coordination among Ministries, regional directives and offices for drought management activities, flood control activities, and data and information networks as illustrated in **Figure H1.5**.

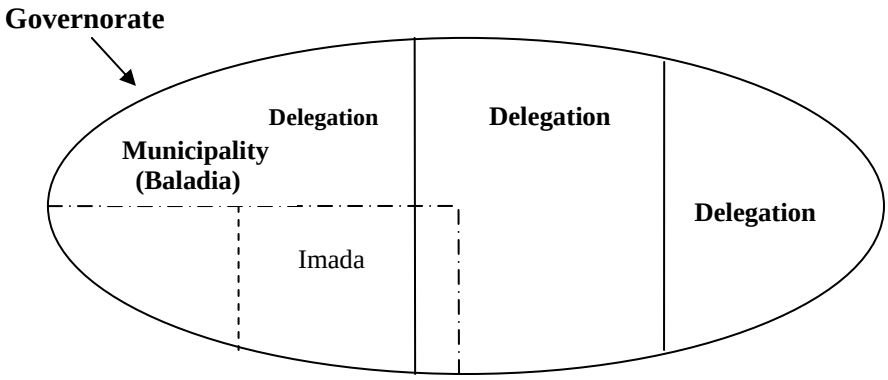
H1.6 National Policy for Decentralization and Agrarian Reform

H1.6.1 Regional Administrative Structure

Under the President there are 24 Governorates[9] which are at the highest hierarchy of the regional administration in the Republic of Tunisia as shown below.

Administrative Unit	Representative
Nation	President
Governorate	Governor (appointed by the president)
Delegation	Delegate (appointed by the president)
Imada	Omda (appointed by the president)

The regional boundary called District covers several Governorates, but it is not an administrative unit. The Governorate is divided into Deligations, and the Deligation is further divided into Imadas. There are municipalities called Baladia in the urban areas. It is an autonomous body which is independent of the administrative structure of the Government. The mayor of a municipality is selected by the public election. There is one Regional Commissary of Agricultural Development (CRDA) in principle under the direction of the Governor in a Governorate.



[8] For further details of these committees refer to the section of The Drought Committees, "MEDROPLAN Guidelines, Technical Annex " (Draft, May 2006), Chapter 23

[9] Governorate corresponds to Prefecture in Japan.

H1.6.2 Administrative Power of CRDA under Decentralization

Regional Commissaries of Agricultural Development (CRDAs) were founded in 1980s in place of old OMVs (Office des Mise en Valeur; Irrigation Area Development Agency), and they are regional institutions in charge of agricultural orientation work in the IPA (Irrigated Public Areas) which distribute water to farm owners. The role of CRDAs grew bigger with the introduction of the administrative decentralization law introduced in 1989. The CRDA is ranked at the same level as the General Directorates of the MARH, and the range of its competence matches with the governorates, which are regional administrative structures. There are 23 (this number is to be confirmed) CRDAs scattered all over the country covering 24 Governorates, while there were only 11 branch offices of these OMVs working in highly centralized environment during the old OMV organizational structure. The CRDAs are made up circumscriptions representing the majority of the national General Directions that administratively depend on the Commissioner but "thematically" on their original Direction. The DGBGTH and the National Water Company, SONEDE, are partially the only exception by not being directly under the regional commissary. The CRDA's Water Resources Circumscription is in charge of supervising the application of the rules. The Water police drafts warning statements in case they notice a violation of the law is committed, and then the infraction case will be handled under civil jurisdiction.

CHAPTER H2 PROBLEMS, NEEDS AND CONSTRAINTS IN INSTITUTION AND ORGANIZATION

H2.1 Competence of IWRM in Tunisia

Though water use management is the main trunk, integrated water resources management (IWRM) has been in practice in the Republic of Tunisia. Among the four key management components of IWRM, water use, flood control and watershed are under jurisdiction of the Ministry of Agriculture and Hydraulic Resources (MARH). Management of water environment (water quality and aquatic ecology) is under the Ministry of Environment and Sustainable Development (MESD). The present condition of IWRM has been reviewed in this chapter with reference to the framework illustrated in **Figure H2.1**.

H2.2 Problems and Needs in Water Supply Management

H2.2.1 Practice in Integrated Water Management

Water use management in Tunisia is well executed focusing on drought management by integrating the following issues:

- Competence of different water uses (agriculture 82%, domestic water 10%, industrial water 5%, sightseeing 2%, ecology 1%),
- Organizational linkage among Ministries, regional offices and other stakeholders,
- Disproportionate spatial distribution of natural water resources (surface water and groundwater) and disproportionate spatial distribution of water demands,
- Seasonal fluctuation of available water and water demand,
- Balance of supply and demand with a risk concept, and
- Sustainability (appropriate balance between development and conservation).

H2.2.2 Planning Guidelines and Standards for Water Supply Master Plan

All drought mitigation actions undertaken before 1999 in Tunisia are basically characterized by an ‘adaptive measures’ that are linked to emergency intervention. However, those actions were rarely integrated.

The integrated water resources management system in Tunisia considers a climatic reality that is taken into account on the development plan programs. In 1999, Tunisia published its first drought guideline of drought management, ‘Guide pratique de a gestion de la secheresse en Tunisie’ (Louati et al., 1999). However, this guideline covers mainly emergency activities to save farmers and livestocks, water saving and supply control and delivery of potable water by water tanks, and other salvation activities and coordination among stakeholders during consecutive severe draught. It does not include planning guidelines nor standards for river basin and regional water supply plans. The planning methodology that was applied to ‘Water 2000 project/ EAU 2000 (1992) and

'MEDROPLAN 2005' was not such a method applied to formulate master plans in European countries and Japan.

H2.2.3 Target Security Level of Water Supply

The drought management policy of the MARH prefers a high security level of water supply (water supply guarantee level). However, there is no written criterion for the target security level of water supply at present. No specific planning target security level was set for Water 2000 (Eau 2000). Three consecutive drought years are referred for emergency drought management and fighting activities. The occurrence probability of the three consecutive dry years is evaluated to be one time during one century (1/100) in the north and 2 to 3 times in the central and the south (1/50 ~ 1/33)[10].

In Japan the planning target for security level of water supply[11] is generally 1/10 (recurrence probability of once in 10 years). A risk level of only 1/5 is applied to the Tone River- Arakawa River basin which is the main water source of the Tokyo metropolitan area due to shortage of supply capacity in the water region. Examples of planned and actual security level of water use for major river basins and cities in Japan, USA and England are shown in the following table. The planned target is not high in Japan, 1/5 (80%) ~ 1/10 (90%), but difference between planned target and actual risk of supply failure is relatively small. The planning target is high in USA (San Francisco) and England, but the difference from reality is very large.

Examples of Planned and Actual Security Level of Water Supply for Major River Basins and Cities in Japan, USA and England

River Basin/City	Planned Security Level (target)	Present Occurrence Probability
Tone River-Arakawa River (Tokyo Region)	1/5 (80%)	1/2 ~ 1/3
Kiso River (Japan)	1/10 (90%)	1/3
Yodo River (Japan)	1/10 (90%)	1/3
Chikugo River	1/10 (90%)	1/2
San Francisco	Recorded Maximum	1/3
New York	Recorded Maximum	1/11
London	1/50 (98%)	1/15

H2.3 Problems and Needs in Flood Control and Management

H2.3.1 Characteristics of Floods in the Mejerda River

In Tunisia, the cities and urban areas are historically located on hills instead of lands in lower altitude, namely flood plains. People who have suffered significant flooding are identified inside the public hydraulic domain near road bridges (Jendouba City, Bou Salem City) and the confluences of the mainstream of the Mejerda River and its tributaries (Bou Salem City) upstream the Sidi Salem Dam. Those poor people started to

[10] Refer to Chapter 23, "MEDROPLAN Guidelines, Technical Annex " (Draft, May 2006).
[11] In Japan water supply security is defined as water use security.

construct their houses illegally inside the domain about 10 years ago due to population increase in the urban areas. Flood plain is not prominent in the upstream areas of the Sidi Salem Dam, but a part of the agricultural lands experienced flood inundation.

Significant part of the alluvial plains downstream of the Sidi Salem Dam is flood prone areas. These inundation areas are partly agricultural lands with high production reclaimed in the delta of the Mejerda River during French occupation and partly salty wet lands called 'Sebkhas'.

The flow area of the river cannels and the drainage systems are seriously reduced and constrained not only by the existing old bridges but also by the expanding road systems in both rural and urban areas. In particular, a number of flood overflow at road bridges across the public hydraulic domain are reported. A number of disconnection of the existing drainage systems by new road systems in the wet lands and flood plains are also reported. Damaging activities to the existing drainage systems were also reported as a cause of increasing floods in the flood plains in many countries.

The major past floods did not directly claim life of people in the Mejerda River basin due to fairly long propagation time of flood discharges, low river bed gradient (about 1/1700 around Jendouba city) and little people in the urban flood prone areas. The velocity of flood discharge is some 2 ~ 7 km/hour except the stretch downstream of K13 (9 ~ 11 km/hour). The propagation time of flood discharges from the upstream to the downstream is summarized below.

Flood Discharge Propagation Period in the Mejerda River Basin

Departure Station	Arrival Station	Distance (km)	Duration of Flood Propagation (hours)	Flood Velocity (km/hour)
Station K13	Mellegue	45	4-5	9 ~ 11.3
Mellegue dam	Bou Salem Station	71	10-12	5.9 ~ 7.1
Gardimaou Station	Jendouba Station	72	11-13	5.5 ~ 6.5
Jendouba Station	Bou Salem Station	40	6-8	5 ~ 6.7
Sidi Median Sation	Bou Salem Station	40	8	5
Bou Heurtma dam	Bou Salem Station	31	7-8	3.8 ~ 4.4
Bou Salem Station	Sidi Salem dam	40	14-16	2.5 ~ 2.9
Siliana dam	Slouguia Station	90	20-22	4.2 ~4.5
Sidi Salem dam	Slouguia Station	15	5-6	2.5 ~ 3
Slouguia Station	Medjez El Bab	12	6-7	1.7 ~2
Medjez El Bab	Laaroussia	30	6-12	2.5 ~ 5
Sidi Salem dam	Laaroussia dam	57	20-23	2.5 ~ 2.9
Laaroussia dam	Jedayda	40	8-10	4 ~ 5

Source: DGBGTH

H2.3.2 Flood Mitigation Activities by MARH

Floods in the rural area and agricultural lands have been managed by the MARH with advisory of the National Water Council while floods in the urban area have been managed by the Ministry of Equipment, Housing and Country Planning (MEHAT). Administrative territory of urban and rural areas is clearly defined. The flood mitigation and protection activities under the MEHAT are principally limited to the excess water

management due to storm rainfalls inside city territories.

The following structural and non-structural measures were done in the Mejerda River:

- Construction of reservoirs, dikes, a flood way, a retarding basin, river channel excavation and improvement;
- Effective use of flood excess water to minimize direct discharge to the sea;
- Resettlement of illegal residents from the public hydraulic domain; and
- Provision of flood forecasting, warning and evacuation system.

Flood forecasting and warning activities will be technically strengthened in the Mejerda River basin after completion of the test operation of the basin wide telemeter system of rainfall and discharges established in DGRE in March 2007. The on-line telemeter system connects the CRDA rainfall and discharge gauging stations, the dam operation offices and the calling centre at DGRE in which hourly and/or 30-minnutes water level information is available among the stations by on-call basis.

H2.3.3 Reinforcement of Public Hydraulic Domain

Definition, conservation and water policy of the public hydraulic domain is stipulated in Chapter I and Chapter II of the Water Code. The articles in Section II Fight against Inundation of Chapter VII are the basis of flood management related to the public hydraulic domain. The public hydraulic domain (PHD) defines legally the river area. The Water Code defines the Minister of the MARH as the Administrator of the public hydraulic domain. However, the PHD inside the urban areas is managed in practice by regional offices of the MEHAT as well as flood control and drainage works in the urban areas. Management of the PHD plays a very important role in various aspects in Tunisia. Its capacity improvement covering the following components would be effective:

- Flood control,
- Control of sediment discharge,
- Control of domestic waste water and solid waste from the public,
- Control of road and bridges across the public hydraulic domain, and
- Forestation along the public hydraulic domain.

H2.3.4 Reinforcement of Planning and Design Standards and Reservoir Operation Rules

Flood control requires prompt and timely operation management of inflow and outflow. The concerned information is the spatial distribution of rainfall upstream and downstream, flood discharges inside the river channels, reservoir high water levels upstream and downstream, flood water levels in the river channels, and flood inundation upstream and downstream.

Introduction of a target security level for flood control plan will be necessary in addition to the target security level for river basin water supply plan. Appropriate key management factors and planning and design parameters are also to be sought out for the flood control

management: for example, the reservoir water level before the wet season and that during large floods, the design high water level (or design hydrograph) during large floods for the river channels.

H2.3.5 Flood Forecasting, Warning and Evacuation Activities

The Ministry of Interior takes charge of flood warning and evacuation activities provided with flood discharge data and forecasting information from the MARH and support from relevant Ministries, agencies and NGOs as a part of national security control. Community based flood fighting and evacuation activities were not very active. In the Mejerda River basin, flood protection and evacuation activities are expected to be much improved by the effective use of the telemeter system of rainfall and discharges completed in the DGRE in March 2007.

H2.4 Problems and Needs in Watershed Management and Trans Boundary Cooperation

H2.4.1 Watershed Management

Sediment production, discharge and deposition in the river channels and the reservoirs would be one of the most significant issues in terms of both flood control and sustainability of the river and reservoir water supply system in the Mejerda River basin.

Sediment control inside the river channel could be improved with integration of the watershed management and the management of the public hydraulic domain.

H2.4.2 Trans-boundary Cooperation for River Basin Management

Since 1980s, a joint technical committee meeting has been held annually to discuss about water resources and environment of the shared (trans-boundary) river basins between Tunisia (MARH) and Algeria under the supervision of the Ministry of Foreign Affairs of both countries. The agenda for the committee meeting is opened for any kind regarding water resources and environment in principle: for example, domestic water supply, water pollution, underground water, etc. There were no agreement on the agenda discussed, but the minutes of meetings were signed. Current agenda included future large dam construction plans in the shared river concerned.

At present the storm rainfall and flood discharge data observed hourly at the major stations inside the Algerian territory are not promptly made available to the MARH of Tunisia for flood forecasting and warning due to technical and financial constraints to access to international telephones and to equip telecommunication and computer systems at the meteorological and hydrological stations at site.

H2.5 Summary of Problems, Needs and Constrains

The identified problems, needs and constraints concerning the river basin planning and management focusing flood control are summarized as follows.

a) There are no permanent division or service for flood control activities and management in the central and regional directions except services for risk and flood announcement.

b) There are no documented technical guidelines or standards for flood control and water supply planning and design, and reservoir operation rule.
c) The competence of flood control is separated: the MARH for rural and agriculture areas, and the MEHAT for urban areas.
d) The competence of flood fighting activities is separated: forecasting and announcing by the MARH, and warning, fighting and evacuation activities by Civil Protection, the Ministry of Interior.
e) Sediment control in watersheds is insufficient: sedimentation inside river channels and reservoirs becomes a significant factor of causing floods.
f) Cooperation with Algeria for river basin management is insufficient: in particular rainfall and discharge data necessary for flood forecasting and warning.

CHAPTER H3 ALTERNATIVES AND EXAMPLES FOR RATIONAL FLOOD MANAGEMENT

H3.1 General

Based on the analysis of problems, needs and constraints identified in Chapter H2, the following two measures are to be introduced for rational flood management as one of alternative solutions:

a) To establish permanent divisions or services for flood control activities and management in the central and regional directions, and

b) To establish documented technical planning and design guidelines and standards for flood control plan, river basin water supply plan, and reservoir operation rule.

Examples of international practices concerning rational flood management are introduced hereinafter to provide an image of rational flood management.

H3.2 Permanent Organization for Flood Control and Management

"Prompt, timely and effective" are key words for successful flood control activities and management. If a relevant organization is established occasionally after a significant flood incident, flood control activities will be limited to passive actions required after occurrence of flood disasters. A comprehensive and rational flood control planning and management system may not be established in a short period. Establishment of permanent divisions or service sections in the relevant organizations in both of the central and regional directives will enable to deploy positive actions and continued improvement of flood control planning and activities based on a cycle management (feedback of plan, do, check, action). A short term and long term roadmap to the national goal can be generally established only by permanent organizations. Most of European countries, U.S.A and Japan have established permanent organizations (refer to Section H3.5.1).

H3.3 Technical Planning and Design Guidelines and Standards

H3.3.1 Unified and Documented Guidelines and Standards

Use of unified planning and design guidelines, standards and practices and reservoir operation rules is effective to achieve efficiently and effectively activities of planning, design, construction, operation and maintenance of the river and flood control/water supply facilities.

Documentation of unified planning and design guidelines and standards, and reservoir operation rules is also effective to establish integrated flood control management and activities among multiple ministries and agencies concerned.

H3.3.2 Key Planning and Design Criteria

Water supply security level

There are two types of planning criteria in terms of water supply security level. One is for

a single purpose and/or a multiple purpose dam project. The other is for a basin master plan and/or a regional master plan.

Project Plan/Basin Plan	Water Supply Security Level
Single/Multipurpose Dam Project Plan (Feasibility Study)	Varies by sector Irrigation: 1/2~1/5 Municipal water supply: 1/20 ~ 1/50 Hydropower: 1/20 ~ 1/60
River Basin Master Plan (Water Allocation Master Plan)	Japan: 1/5 ~ 1/10[*1] London/New York: 1/50 ~ Recorded Maximum

*1: Refer to Section H2.2.3, and the Technical Guideline for River and Sabo Works, Japan, the article for normal maintenance flow.

It is generally very costly to establish a low risk water supply security level in arid areas where dry season water demand is much higher than the water supply capacity. Appropriate combination of water supply security level, emergency intervention/salvation programs, crop insurance is generally sought out to determine the target water supply security level taking into considerations local conditions including cost, benefit, natural and social environments.

Design flood

There are two types of planning criteria for design flood in terms of flood protection level. One is the design flood for safety of dam body, in other words the design flood discharge for spillway and /or outlet facilities. One is the design high water level (or design flood hydrograph) for river basin flood control plan to protect people and assets in the flood prone areas. In Japan the design high water level (or design flood hydrograph) constitutes the foundation of a flood control plan. The effectiveness of a flood control plan is ensured against the design hydrograph.

River maintenance flow

Most of the EU countries, the USA and Japan have a planning criterion to allocate the minimum amount of river maintenance flow in a water supply master plan. It is called as essential flow, environmental flow or ecological flow depending on nation's water environment management policy. The amount of flow varies depends on the local conditions. In Tunisia such concept does not exist at present.

H3.3.3 Linkage between Water Master Plan and Water Use Right

In Tunisia ownership of water resources and planning competence of water resources belong to the national government. The existing water users have rights of water use both for surface water and ground water, but water use permit is not issued at present. Those water use rights are not tradable. The SONEDE and the SECADENORD are distributors who have delegation from the national government to distribute water to users. There is no linkage between the reservoir storage volume of the existing dams and the existing water use right under the present legislation.

In most of the EU countries, the USA and Japan a river basin water supply master plan is a technical basis of water use rights allocation. Reservoir storage allocation for water users (stakeholders) is the legal basis for water use rights including customary water

rights. Therefore, the reservoir storage allocation of the existing dams can be changed only when compensation volume is confirmed as follow:

i) The existing water right is cancelled,

ii) Surplus storage is available by new reservoir construction, etc., and

iii) Reduction of existing water use is possible by saving measures.

H3.4 Rational Method for Flood Control Planning

H3.4.1 Rational Method of Flood Control

A flood control master plan represents the national and regional flood control policy. It will require a comprehensive approach to establish a rational approach and method for flood control planning and management. The methodology is closely tied with:

i) Laws,

ii) Administrative organizations, and

iii) Organizations for measurement and transmission of flood data and information, and forecasting and warning system.

Approach of rational flood control generally deals with the following subjects:

i) Appropriate combination of structural measures and non-structural measures (zoning for flood prone areas, FFWS, flood fighting program, flood insurance),

ii) Appropriate flood control level to protect people and assets in flood prone areas from damages: it depends on the level of regional economic development,

iii) Appropriate economic evaluation of planned flood control measures,

iv) Appropriate hydrological indices for flood scale (the highest flood water level, flood duration, river channel discharge capacity, flood peak time, statistic recurrence interval), and

v) Impact of human activities on the flood scale and occurrence frequency inside a river basin (human activities include construction of water and river facilities, roads and bridges).

H3.4.2 Impact of Drought Damage and Flood Damage

In Tunisia, farmers' population represents about 27% and agricultural sector contributes to 13 to 16% of the GDP. Drop of 9.9% in the agricultural GDP (dry season 1994) resulted in 3.3% slowdown of the GDP growth rate. The impact of drought damage might be larger than that of flood damage on socio-economy, though the impact of flood damage on the national and regional economy is not quantified yet. Those impacts are generally taken into consideration in determining the planning criteria.

H3.4.3 Adoptive Flood Control Plan

Flood Control shall be planned so that various facilities and measures which are constructed and provided by this plan against design flood hydrograph (or the design high

water level) will be mutually harmonious technically and economically throughout the river system, and can satisfactorily accomplish the functions which are aimed at in the plan. Further, overall examination shall be made on such functions of the river as flood control, water utilization and environment in formulating the flood control plan.

Following three matters are to be clarified in the flood control plan:

i) To forecast the models of occurrence of excess flood and those of damages arising from it,

ii) To clarify to the related regional society the maximum limit of the flood that can be coped with by the flood control plan and the method of how to cope with the flood, thereby, obtaining prior adequate measures against the occurrence of excess floods, and

iii) To provide a plan which can disperse as far as possible the damage due to the excess flood within the scope of technical and economical feasibility.

It is technically and financially not feasible to protect all people and assets from flood damage by structural measures only, because of financial constraints of the government. Appropriate institutional and organizational framework is to be sought out to establish adoptive flood control plan covering:

i) Appropriate combination of structural measures, land use control, FFWS, emergency salvation, insurance, operation and maintenance, and

ii) Adaptive target flood control level based on a cost benefit concept.

H3.5 Examples of Flood Control Management

In order to facilitate appropriate discussion among Tunisian counterparts about screening of necessary arrangements for an institutional and organizational framework for the rational flood control planning and management presented in Section H3.4, some examples practiced in the EU countries, the USA and Japan are introduced in this section[12].

H3.5.1 Example of Administrative Organization for Flood Control

There are three types of administrative organization to manage flood control as set out below. Those organizations were established as permanent.

Type of Administrative Organization	Countries
1. Administrative organization with limited flood control function	France, Germany, Greece, Romania, Switzerland
2. Public corporation specially established	Austria, Finland, England, Netherlands, USA
3. Relevant administrative organization (ministry, department, etc.) plus permanent flood control committee	Russia, Czech Republic, Italy, Portuguese, Japan

[12] Adopted from United Nations (1976): Rational Method of Flood Control Planning in River Basin Development, (Japanese translated version 1988, Infrastructure Research Institute, Ministry of Construction, ISSN 0386-5878)

H3.5.2 Example of Laws/ Regulation for Flood Control

There are three types of basic laws for flood control administration: water law, river law and specific laws. In Tunisia the Water Code governs flood control and river management though its contents is limited.

Type of Law and Related Regulation	Countries Concerned
-Water law/Water code -Water Law + Regulations for flood control	Finland, Hungary, Portuguese, Russia Germany, Czech Republic, Spain
-River law + Domestic navigation law -River law +Technical guideline for river and sabo works	France, Netherlands Japan
-Specific law (flood control for navigable rivers, Hurricane, insurance) -Land drainage law + Regulations	USA (1936) England

H3.5.3 Example of Land Use Control in Flood Prone Areas

Before 1970s, land use in flood prone areas (FPA) was enhanced with combination of flood control structural measures in the USA and some EU countries to meet population and economic growth. However, increase of flood damage predominated in spite of a huge amount of investments to the structural measures. Zoning of FPA with classification of risk of inundation has been introduced in some countries at present. Restriction or prohibit of land use is a type of zoning. Land use control inside the public hydraulic domain in Tunisia is a type of zoning.

Type of Land Use Policy of Flood Prone Areas	Countries
1. Enhance Land Use in Flood Prone Area	Finland, Japan
2. Restrict/Prohibit Land Use in FPA	Restrict: Portuguese Prohibit: Austria, Switzerland
3. Zoning of FPA with risk of inundation	Russia, USA, Czech Republic

H3.5.4 Example of Flood Insurance

Flood insurance is practiced in Russia, Portuguese, France, USA, and England.

Insurance conditions are different among countries: for example,

- Flood damage on houses and properties of residents are covered by flood insurance but industrial and agricultural products and assets are not generally covered by flood insurance,
- Base of flood insurance fund and/or reinsurance system is established by a government,
- Higher premium in the areas with higher flood risks with reference to flood zoning,
- Fixed premium is applied if insurance is responsible for the residents in the specified flood risk areas, and
- Public flood reinsurance guarantees payment of insurance by insurance companies in case of extreme large damages.

Crop insurance may cover both drought and flood damage. Crop insurance is considered to be better-off in case large impacts on regional socio-economy.

H3.5.5 Example of Trans-boundary Treaty/Agreement for Flood Control

There are various international agreements or treaties for flood control of the shared river basins (trans-boundary river).

Type of Agreement	Countries Concerned
Special Commission for River Basin established by multiple nations	-Water Use Commission for the Rhine River (France, Austria, Switzerland, Germany) -International joint commission + legislative organization (USA-Canada)
Treaty/Agreement/ Convention	-Treaty for international waters (Austria-Hungary-Czech Republic-etc.) -Agreement for flood control (Germany- Czech Republic) -Treaty for international waters (USA-Canada) - Treaty for flood control (USA-Mexico)
International Coordination	-Proposal Directives of the European Parliament and of the Council on the agreement and management of flood control (2006): coordination within shared river basins

H3.5.6 Example of Target Flood Control Level

Some European countries establish a fixed target flood control level for different land uses such as urban area, industrial area, rural area or agricultural land. In Japan the rivers are divided into five classes (A~E) depending on the size of rivers and degree of their importance. A rough reference guide for the target flood control level (the criteria of scale of design rainfall) ranges from more than recurrence interval of 200 years to 10 years depending on the class. Some countries has no target flood control level but the flood control level and the feasibility of structural flood control measures is determined based on a cost benefit analysis: i.e., flood control benefit shall be at least larger than project cost. At present Czech Republic applies cost benefit analysis but the historical target flood control level for large towns: 1/100 is also kept.

Fixed Target Flood Control Level	Countries Concerned
-Urban 1/100~1/1,000 -Industry 1/100~1/500 -Rural/Agriculture 1/10~1/50	Russia, Finland, Greece, Turkey, Hungary, Czech (Large town min. 1/100)
-Class A river < 1/200 -Class B river 1/100~1/200 -Class C river 1/50~1/100 -Class D river 1/10~1/50 -Class E river >1/10	Japan

Comparison of Cost and Benefit	Countries Concerned
-Benefit › Cost + importance of socio-economy	France, Netherlands, USA, Portuguese, Czech

H3.5.7 Example of Design Flood Standard for Safety of Dam Body

Each national congress on large dams establishes respective design standard for safety of dam body (spillway design). International Congress on Large Dam (ICOLD) introduced an example in 1988, as follows:

Category	Hazard	Design Flood Range
A	High	PMF to 10,000 year
B	Significant	10,000 to 1,000 year
C	Low	1,000 to 100 year

CHAPTER H4 INSTITUTIONAL AND ORGANIZATIONAL CAPACITY DEVELOPMENT PLAN

H4.1 Organizational Framework of Integrated Flood Management

H4.1.1 General

In Tunisia flood control management has been executed occasionally and incidentally depending on the conditions of floods. The JICA Study proposes a broader concept of "Integrated Flood Management" covering various structural measures and non-structural measures as a part of the Master Plan. The capacity development plan for institution and organization discussed in this study based on the concept aims to materialize the Master Plan effectively and efficiently from a stage of planning to a stage of operation and maintenance.

H4.1.2 National Policy for Institutional and Organizational Framework

The Government of the Republic of Tunisia (GOT) is on a way of agrarian reform applied to the agriculture sector under the structural adjustment program after 1986, and privatization of collective lands since 1971[13]. The decentralization law was issued in 1989. Since the 1990's, the State headed towards the policies of decentralization and of transfer of responsibilities to local associations and communities. The present GOT envisages establishment of small governments in central and regional level under those policies. Hence the capacity development plan in this study is formulated keeping the existing institutional and organizational framework unchanged as much as practicable on the truck of the decentralization policy.

H4.1.3 Framework of Integrated Flood Management

(1) Institutional Integration between Flood Control Measures and River Administration

The prospective institutional integration has three fold:

- Integrated river administration and management of flood control activities among organizations concerned,
- Integrated planning and implementation of flood control measures among organizations concerned, and
- Integrated operation and maintenance of the Mejerda River basin.

Appropriate combination of flood control measures is expected to be implemented by well managed administration and vertical and horizontal coordination among different agencies and organizations. The JICA Study has identified the following three categories for empowerment through the consultation and needs surveys:

- Empowerment of river administration and management under MARH related to the Water Code,

[13] Claire Géroudet, Institut National Agronomique, France – Grignon (December 2004), "Demography and Agrarian History in the Catchment Basin of Merguellil River in Central Tunisia, Part II: Agricultural Policies and Land Ownership Structures"

- Empowerment of organizational coordination for effective and efficient planning and implementation, and
- Empowerment of integrated operation and maintenance of the Mejerda River basin.

The current organizational framework is reviewed in terms of flood control measures and integrated river administration to achieve the institutional integration for the IFM as illustrated below.

Management / **Measures**	**Integrated River Administration**		
	Administration of River Regime, River Course and Water Resources	Integrated Planning and Implementation	Integrated Operation and Maintenance
Structural Measures	○	○	○
Non-structural Measures	○	○	○

○: requirement of integration

The attributes of structural measures and non-structural measures are linked with the attributes of the river administration classified into three fold. Those are mutually correlated and are to be integrated. This institutional integration is defined to be the bottom-up approach in this study. Various structural and non-structural measures studied for the comprehensive flood control of the Mejerda River are broadly classified as set out below.

Structural Measures

Storing and Regulating Flood Runoff		River Channel Improvement		
a)Construction of dams* & retarding basins	b)Improvement of reservoir operation(partly non-structural)	a)Dikes	b)Channel excavation &widening	c)Bypass channels, flood ways

Non-Structural Measures

Basin Preservation		Flood Plain Management		
a)Forest management* b)Land use management*	c)Soil erosion management	a)Land use control (zoning) b)Flood insurance, crop insurance, tax adjustment	c)Flood forecasting and announcing system d)Flood warning, evacuation, fighting activities e)Education and dissemination of people	f)Water proofing (heightening of houses, building& foundation, etc)

*: Measures not covered by JICA Study for the Master Plan

The prospective organizational framework for the IFM is illustrated in **Figure H4.1**. The attributes of these structural measures and non-structural measures are linked with the attributes of the river administration illustrated in the left half of **Figure 4H.1**. The organizational integration between the related institutions is illustrated in the right half of **Figure H4.1**.

(2) Organizational Integration between Institutions Concerned

The organizational integration illustrated in **Figure H4.1** is explained below.

1) Relation between MARH and CRDAs

The MARH sends representatives of the General Directions to the Regional Commissaries for Agricultural Development (CRDAs) for the regional administration of the agriculture and hydraulic works except the General Direction of Dams and Large Hydraulic Works (DGBGTH). The DGBGTH assigns its representatives to the dam operation offices.

2) Storing and regulating flood runoff

All large dams and hill dams in the country are under the management of the DGBGTH at all stages from the planning and design stages to the construction, operation and maintenance stages. Establishment of a new control center for integrated reservoir operation and preparation of documented guidelines, design standards and reservoir operation rules (dry season, wet season, flood control, emergency operation) can be managed under the jurisdiction of the DGBGTH, MARH. The National Water Council (CNE) is in a position of advisory to the Minister of the MARH. The National Institute of Meteorology (INM) provides only the meteorological information to the MARH. There are no dams planned by a concept of public private partnership in the country.

3) River channel improvement

River channel improvement works, such as retarding basins, dikes, river channel excavation and widening, flood ways, or bypass channels can be implemented within the jurisdiction of the MARH. The DGBGTH takes charge of planning, design and construction of large and inter-regional river projects while the CRDAs take charge of the small river projects inside respective governorates (refer to Sub-section H4.2.2 (1)). The operation and maintenance of the river works are devoted to the CRDAs.

4) Basin preservation

The MARH takes charge of the basin preservation, such as forest management, land use management and soil erosion management by the joint coordination of the CRDAs, the General Direction of Forests (DGF), and the General Direction of Development and Preservation of Agricultural Lands (DGACTA). The DGF manages the forest areas while the DGACTA manages the areas outside the forest areas. The DGACTA also supports the CRDAs for planning. The National Agency for Protection of Environment (ANPE) manages the environmental preservation of the watershed. The Institute of Agricultural Research and Education (IRESA) takes charge of researches in the field of basin preservation.

5) Flood plain management

Flood plain management is executed by the coordination among the General Direction of Water Resources (DGRE), the DGBGTH, the DGF, the INM and the IRESA. The INM provides the necessary rainfall data and the IRESA provides the data base services.

6) Land use control

The CRDAs take charge of the land use control and restriction inside the Public Hydraulic Domain and the zoning for flood control under the direction of the DGF, MARH. The Ministry of Interior manages change of the registered land use.

In case of a large flood event, a special committee is occasionally established by the chairman, the Governor concerned, and an inundation map for the event is made supported by relevant regional organizations. There are no flood hazard maps at present in the country.

7) Flood forecasting system

The DGRE takes charge of the flood forecasting and flood announcement with strong collaboration of the INA and the IRESA. The flood forecast and announcement is transmitted to the civil protection of the Ministry of Interior.

8) Flood warning, evacuation and fighting activities

The civil protections in Governorates take charge of the flood warning, evacuation and fighting activities with collaboration of the CRDAs.

9) Flood insurance

All insurances are under the legislation of the Ministry of Finance (MF). The General Direction of Financing, Investment and Professional Organisms (DGFIOP) is responsible of protection of farmers from damages. The existing agricultural insurance covers damages by fire, drought, hail, floods, etc.

The MF examines the application if new flood insurance is requested from the DGFIOP or a relevant ministry.

10) Education and dissemination of people against floods

The CDRAs are responsible of education and dissemination of people against floods in the rural and urban areas under the guidance of the Ministry of Equipment, Housing and Country Planning (MEHAT) and/ or the MARH.

11) Water proofing

Water proofing is a measure to protect buildings, houses and roads from flood inundation by raising foundations. Technical guidance to the CRDAs is effective from the MARH and /or the MEHAT.

H4.2 Requirement of Organizational Empowerment for Integrated Flood Management

H4.2.1 Empowerment of River Administration under MARH

(1) River Administrator and River Area

The Water Code (1975, modified1997) and related decrees prescribe the river administration which manages the river area (Chapter I), water course (Chapters II, V), water right (Chapter III), and flood control (Chapter VII, Section II). The Minister of the

MARH is the administrator of the public hydraulic domain (PHD) assisted by the National Water Council and the Public Hydraulic Domain Commission[14]. The PHD corresponds to the river area[15]. The basic instrument to achieve IFM is administrative power of managing the river area.

(2) Needs of One Management for One River Basin

It is expected to resolve the existing problems such as illegal issue of residence permits inside the PHD, construction of obstructive structures against river water flow inside the river course, construction of bridge abutments and piers confining flood flow inside the river area, damaging the existing drainage channels by road construction, and insufficient maintenance of the river course. These issues are related to the administration of the PHD, river course, flood control (fighting against flood), and water rights.

Empowerment of the river administrator, MARH, based on a principle of one management for one river basin, will reinforce the river administration effectively and efficiently as is in international practices (refer to Sub-sections H3.5.1 and H3.5.2).

(3) Needs of Permanent Organization

Establishment of permanent divisions or services for flood control activities and their management in the central and regional directions will provide a foundation for Integrated Flood Management (IFM). Permanent organizations would empower:

a) Regulatory communication and coordination with relevant organizations to clarify the river administration and existing issues,

b) Continuous and integrated cycle management from the planning and design stages to the construction, operation and maintenance stages, and

c) Stable budgetary arrangement for new measures and sustainable operation and maintenance.

(4) Mission of IFM for National Water Council

The National Water Council (CNE) replaced the National Water Committee[16] in November 2001. The naming was changed but it is still an occasional organization and its task is basically same[17]. The mission of the CNE is limited to advisory[18], thus it has no responsibility on the Integrated River Basin Management including flood management. The role of the CNE in Tunisia is different from that in other countries such as the USA, the UK and the other EU countries. The CNE also has no independent permanent secretary office. It is expected to supplement the Integrated Flood Management (IFM) to the mission of CNE.

[14] Refer to Chapter I, Article 4, the Water Code (1997).
[15] Refer to Chapter I, Articles 1 ~ 7, the Water Code (1997).
[16] Refer to Article 2 of Decree No. 2001-2606 of November 9th, 2001.
[17] Refer to the Water Code (1997), Chapter II, Article 19 -The National Water Committee shall have as a mission giving opinions on general questions relating to the management and planning of waters, on management and water distribution projects of national aspect as well as large-scale regional management. It can equally be consulted on questions relating to the conservation and protection of waters.
[18] Refer to the mission in Article one.

(5) Basin-wide Environmental Management and Monitoring

To ensure compliance of project activities with the legal and social procedures and standards, a basin-wide environmental management, monitoring and evaluation system is necessary.

H4.2.2 Empowerment for Integrated Planning and Implementation

(1) Implementation under Decentralization Policy

1) Planning Stage

Flood control projects should be supervised by a Project Steering Committee (PSC) established under the General Direction of Dams and Large Hydraulic Works (DGBGTH) or the Regional Commissary for Agricultural Development (CRDA) at the project preparation and planning stage. The role of PSC is to materialize the integrated flood control plan to ensure effective coordination between concerned ministries and their line agencies in the governorates, including the DGRE, the DGACTA, the DGF, the National Agency for the Protection of the Environment (ANPE), the DGDD of the Ministry of Environment, the Ministry of Interior, and the Ministry of Equipment (MEHAT), among others. The PSC is desirable to continue monitoring during design and construction stages to ensure effective coordination.

2) Design and construction stages

Under the present organization based on the decentralization policy of the country, the role of central government (MARH) and the role of regional governments (Governorates) are well allocated for implementing structural measures at design and construction stages. The DGBGTH takes charge of implementation of dams, large hydraulic structures and inter-regional hydraulic structures. The CRDAs take charge of small hydraulic structures which can be managed inside one CRDA's administration area. A project management unit (PMU) is to be established within the DGBGTH or the CRDA to manage construction and liaison activities on a daily basis.

(2) Strengthening Coordination Power of MARH with Relevant Organization

It is necessary to strengthen coordination capacity with relevant organizations such as Ministry of Equipment, Housing and Country Planning (MEHAT), Ministry of Interior, INM, etc. for effective and efficient planning, implementation, operation and maintenance of structural measures (storing and retarding flood runoff, river channel improvement) and non-structural measures (basin preservation, flood plain management). For example, land use control, management of PHD, flood control projects and urban and rural drainage projects require coordination with the MEHAT[19].

(3) Documented Technical Guidelines and Standards

Documented and unified technical guidelines, standards, manuals or operation rules will be useful for integrated implementation of flood control projects effectively and

[19] MARH for rural and agricultural areas and MEHAT for Urban areas

efficiently from the planning and design stages to the construction, operation and maintenance stages both inside and outside the MARH. The river administration covering the structural measures and the non-structural measures for flood control is all closely related, and also those measures all requires highly complex technology and management. The technical guidelines and standards will form a foundation of the rational approach and method for flood control planning and management in the country (refer to Sections H3.3 and H3.4).

(4) Arrangement of Flood Insurance

Flood insurance is basically a supplemental instrument to the flood control structural measures, and thus a system of flood insurance is to be introduced as a part of non-structural measures (refer to details in Section H4.4).

H4.2.3 Empowerment for Sustainable Operation and Maintenance of Mejerda River Basin

(1) Water Supply System

The operation and maintenance of the water supply system in the Mejerda River basin, which is composed of dams, intake facilities, pumping facilities and transfer pipeline-canal systems, has been well managed by the DGBGTH, the SONEDE (Water Exploitation and Distribution National Company), the SECADENORD (The North Water Canal, Adductions and System Management Company), and the CRDAs under the MARH. However, empowerment of the maintenance of the operating large dams is anticipated as planned in the 11th development plan: 2007 – 2011[20].

(2) River Banks, Dikes, River Channels and Flood Control Facilities

Operation and maintenance of the river banks, dikes, river channels and flood control facilities has not been done properly at present. The CRDAs are responsible of operation and maintenance of the river facilities under the decentralization policy, but the CRDAs in the Mjerda River do not have sufficient capacity to continue their task due to financial and technical constraints. It is anticipated to establish an organization to take charge of the operation and maintenance of the Mejerda River basin permanently.

(3) Information Management System

The MARH has a policy to establish a national information management system supported by a comprehensive data system. The flood forecasting and warning system is operational in the Mejerda River for flood announcement supported by the basin wide telemeter system of rainfall and discharges since March 2007 under the DGRE. Empowerment of the new system is necessary to operate it effectively and efficiently.

(4) Operation Center for Integrated Operation of Reservoirs

The number of dams is planned to increase from 6 to 14 in the future (refer to **Figure H1.1**). Each dam reservoir is operated independently during large flood events based on the instruction from the direction of dam exploitation of the DGBGTH which follows the

[20] Refer to The 11th Development Plan: 2007 – 2011, Republic of Tunisia 2007, page 17.

decision of the National Water Council (CNE). The CNE is established in case of an unusually large flood event. It is expected to establish one control center for managing reservoir operation of all the dams in the Mejerda River in order to ensure the safety of dams and to control large floods effectively and efficiently.

H4.2.4 Others

(1) Empowerment for Environmental Management and Monitoring

1) Proposed basin-wide environmental management

To ensure compliance of project activities with the legal and social procedures and norms, a comprehensive monitoring and evaluation system is necessary.

Expected negative impacts on the natural (physical and biological) and social environments should be avoided or properly mitigated when flood control projects are implemented under a basin-wide environmental management system. The proposed basin-wide environmental management system is composed of adequate mitigation measures and monitoring activities. Mitigation measures are to be undertaken through three approaches: technical approach, socio-economic approach, and institutional approach.

Technical approach is the one to minimize the impacts by engineering and/or technology. Socio-economic approach is the one to mitigate the impacts by such actions as dissemination, consultation, and compensation, etc. Institutional approach is the one to mitigate the impacts in cooperation with government institutions by enforcement of environmental monitoring and evaluation of the impacts.

2) Environmental monitoring and evaluation

A monitoring and evaluation unit (MEU) is to be established within the Project Management Unit (PMU). One of the responsibilities of the MEU is to implement the environmental monitoring system and to monitor the environmental impacts of a project. The MEU which is composed of several staff members is responsible to collect and analyse the data relating to the geography and morphology of active river channels, quality of water, soils and groundwater depth and quality. The MEU is also responsible to carry out monitoring of dust, noise, and other constructions nuisances during the execution of a project.

3) Community awareness programme

It will be effective for affected people and socially weak people in a project area to organize a community awareness programme by the PMU together with communities' representatives. The program aims to assist social understanding of the project, identifying and recording problems, and solving potential grievances, assisting livelihood of the affected population.

(2) Empowerment for Land Acquisition and Compensation

1) Issues in land acquisition and compensation

Several issues were identified concerning the present expropriation procedure of private lands involved in the public water works, and the payment procedures for compensation including the compensation price in the second stakeholders meetings held in January 2008. The expropriation procedure of private lands and the compensation standard and procedure for private lands are subject to review and improvement.

2) Compensation Procedure for Lands under Public Domain

The legal compensation procedure for resettlement should be clarified for the residents in the public lands because the rights of the residents in the pubic lands are ambiguous under the present laws in case of resettlement.

There are two types of lands under the public domain. One is the public lands (state domain) historically related to the agrarian reform, such as the colonial lands, the collective lands, and the lands owned by the agricultural cooperatives. The other is the public hydraulic domain (PHD) which corresponds to the river area administrated by the MARH. The public lands are managed by the Public Land Management Agency (OTD; Office des Terres Domaniales) in collaboration with the Agrarian Reform Agency (ARA; l'Agence de Reforme Agraire).

3) Empowerment of Expropriation Procedure

Land acquisition is coordinated by a committee established by the governor which conducts its tasks according to the guidelines governed by the Water Code and by the Law No. 76/85 of 11/08.1976, as amended and supplemented by the Law No. 2003-26 of 14 April 2003 for the Acquisition of Land for Construction in the Public Interest.

The compensation of the private lands to owners is examined by this committee which consists of the following representatives: i) the chief of Deligation (Delegate), a committee chairman; ii) chiefs of administrative sectors, Imada (Omdas), a committee vice-chairmen; iii) the CRDA, a member; iv) 3 representatives of DGBTH of the MARH, who have the Power of Attorney of the Minister; v) members of the compensation and expropriation regional committee, consisting of the chiefs of Land Tenure Section, Vegetal Production Section, the CES Section and the Soil and Water Resource Section of CRDA; vi) a representative of the local section of the Tunisian Union for Agriculture and Fisheries (ULAP), and ; (vii) 3 representatives of the project beneficiaries. The costs of acquisition and compensation are paid by the DGBGTH (MARH) or by the responsible CRDA depending on the type of project.

The committee is responsible for: (i) conducting surveys of land, buildings, crops, and other objects to be acquired; ii) itemizing the legal status of land to be acquired; iii) assessing and proposing the amount for compensation of land; iv) conducting a public information program and providing counselling to landholders regarding the plans and objectives of land acquisition; v) facilitating deliberations between landholders and government agencies to arrive at final estimates and forms of compensation; vi) witnessing the handing over of compensation to holders of land titles and rights to buildings, plants, and other objects on the land; and (vii) providing official reports

regarding the relinquishing of land titles.

Empowerment of the committee will resolve the issue identified.

H4.3 New Organization for Integrated Operation and Maintenance of Mejerda River Basin

H4.3.1 Operation and Maintenance of River Course and Flood Control Facilities

(1) Establishment of New Organization for O&M of Mejerda River

Sustainable operation and maintenance (O&M) of a river basin with the concept of Integrated Flood Management can be achieved effectively and efficiently by a principle of 'one unit of management'. It is anticipated to establish one permanent river basin unit for the O&M of the river banks, dikes, river channels and flood control facilities in the Mejerda River under the direction of the DGBGTH. At present there is no permanent unit in charge of O&M of the river works of the Mejerda River as a whole. The organization structures of the DGBGTH and the DGRE are shown in **Data H1** and **Data H2**. The missions of the DGBGTH and the DGRE and the tasks of respective directorates stipulated in the decree[21] are illustrated in **Data H6** and **Data H7**.

There are three organizational options for a prospective unit for the O&M of the Mejerda River. One option is to establish it as one division specialized for the O&M of the river works inside the Direction of Large Hydraulic Works of the DGBGTH. The second option is to establish a new Direction inside the DGBGTH. The third option is to establish it outside the DGBGTH as a financially independent agency under the MARH supported by the CNE. The third option is a typical type adopted in some EU countries, the USA and Japan. The Japan Water Agency is an example of this type established as an incorporated administrative agency.

Strengthening the staffs of the DGBGTH and the budgetary arrangement for O&M is a major component of empowerment. Ensuring maintenance of the dikes and river bank protective works adequately will minimize erosion and loss of land along the affected rivers, thereby yielding significant benefits in flood control and environmental conservation.

The mission of the prospective Mejerda River basin agency is first, O&M of the river works, and second, authority to coordinate competing interests among stakeholders including ministries, CRDAs, municipalities, associations, companies, residents, etc. The coordination authority is expected to be empowered by the Minister of MARH and the CNE. Financial sustainability of O&M is an important subject to continue consistently and effectively. The O&M cost of a public corporation type will be covered by both the subsidy from the MARH and the revenues from the beneficiaries, such as CRDAs, municipalities, the SONEDE, the SECADENORDE, farmers, etc.

[21] Decree No. 2001-420, 13 February 2001(JORT), Article 34 for DGRE and Article 36 for DGBGTH

(2) Establishment of New control Center for Reservoir Operation of Mejerda River

Control and decision by 'one point management' only enables the best coordination of multiple reservoirs in the Mejerda River to achieve safety of dams and effective and safety flood control. It is necessary to establish one control center for the Mejerda River under the direction of dam exploitation of the DGBGTH with support by the CNE. The control center accesses to all necessary information through the on-line information system. The information includes discharges at gauging stations, current status and operations at all dams, discharge forecast and rainfall forecast. The decision of each reservoir operation at the control center is made considering comprehensively both inflows into respective reservoirs and all hydrological conditions in the whole Mejerda River basin. Under this system each dam operator usually follows only the decision from the control center instead of each local condition at dam site. The operators, however, are responsible to prepare their own operation plan by themselves based on all available information at the site in a case where the on-line system to the control center is disconnected.

H4.3.2 Operation and Maintenance of Information Management System

(1) Flood Forecasting and Warning System

Capacity development of the flood forecasting and warning system will be composed of first, upgrading of the telemeter system of rainfall and discharges to improve accuracy of forecast and to confirm timely operation, and second, organizational and personnel empowerment to operate it effectively and efficiently together with the Civil Protection, the CRDAs, the INM and other relevant organizations. The empowerment programs are presented in Supporting Report G: FFWS and Evacuation/Flood Fighting.

(2) Cooperation with Algeria for River Basin Management

At present the storm rainfall and flood discharge data observed hourly at the major stations inside the Algerian territory are not promptly made available to the MARH for flood forecasting and warning due to technical and financial constraints in the Algerian side. It is expected to strengthen cooperation with Algeria for the river basin management: rainfall, discharge, reservoir operation, and dam construction plans.

H4.4 Flood Insurance Program

H4.4.1 General

Structural measures for flood control aim to protect all the people and properties inside the subject flood prone area regardless of private, public, agriculture or industry. The flood control, however, may not be realized by the structural measures only because of various constraints, such as financial and technical feasibility and social and environmental impacts. Flood insurance (or flood damage insurance) is an effective instrument in a case where all the people and the properties in the flood prone areas can not be totally protected with a low risk of flood inundation by structural measures only.

Public flood insurance generally aims to mitigate a risk of financial damage to the private

property of residents necessary for basic human needs. Houses and home properties of residents are generally subject to coverage of insurance, but industrial and agricultural products, industrial and agricultural assets, and private assets for investment_are not subject to coverage[22].

Flood insurance can be realized when basic institutional arrangements are made available and also the national consensus is established. In Tunisia, introduction of a flood insurance system is expected to be arranged in line with the state policy to improve the agricultural insurance system and to develop the insurance culture (mentality) among farmers [23] within the framework of agricultural investment promotion.

H4.4.2 Examples of Flood Insurance Programs

(1) Private Insurance and Public Insurance

In some EU countries, such as Germany, Czech Republic, England and Austria flood insurance is served by private insurance companies (refer to Sub-section H3.5.4). There are some public support programs for the people who suffer serious flood damages in those countries. In France and the USA the national government initiated a nationwide public flood insurance system.

(2) Natural Disaster Compensation System in France

In 1982 the responsibility of the central government against the natural disasters was clarified in France, and Natural Disaster Compensation System (Catastryophas Naturelles) was established after long term discussion. This system charges compulsory and uniform premium (12%) to the citizen in addition to the existing property insurance such as fire, car accident and robbery insurances. Insurance compensation is provided in the case where the French Government acknowledges an event as the natural disasters (except wind disasters and fire)[24].

(3) National Flood Insurance Program in USA[25]

1) Purpose of the program

After late 1960s the Federal Government of the USA changed its flood control policy from weighting on structural measures to weighting on soft measures (non-structural) together with nationwide publicity of flood risk to the people. The Federal Insurance Agency (FIA) under Federal Emergency Management Agency (FEMA) started National Flood Insurance Program (NFIP) in 1969 based on the National Flood Insurance Act (1968). Under this program the insured is a unit of community (autonomous body) instead of individual household or person. The program pays insurance compensation to the people suffered flood damage with 100 % assurance of the federal government.

[22] Flood damages against agricultural products or assets are subject to agriculture insurance (or crop insurance).
[23] Refer to The 11th Development Plan: 2007 – 2011, Republic of Tunisia 2007, page 17.
[24] Source: River Environment Management Foundation, Japan, Study Mission Report on 2002 Floods in Europe, February 2002 (Japanese), Chapter 7.
[25] Source: Wikipedia, National Flood Insurance Program, NFIP (Japanese) and NFIP-Flood Insurance Manual, May 2005, FEMA, USA.

This program aims not only to help people from flood damage but also to enhance community activities to protect and to mitigate flood damages.

2) Community based insurance

All the community joined the insurance, therefore, have a responsibility to execute various flood protection and mitigation measures in this program. This program is closely linked with land use control in the flood prone areas and various community-based flood protection and mitigation activities.

In 1973 all the autonomies inside the high flood risk areas were required legally to join the NFIP by the Flood disaster Protection Act of 1973.

3) Flood hazard boundary maps

The autonomies were required to determine to join the program or not, with reference to the Flood Hazard Boundary Maps prepared by the FEMA, where flood inundation areas are divided into two: areas with a risk of 100 year probable flood and areas with a risk of 500 year flood (special flood hazard area). The maps were made by the FIA, the US Army Corps of Engineers, the US Geological Survey and US Soil Preservation Agency upon the survey request by respective autonomy.

4) Coverage of damage and variable premium rates

This program covers only buildings with a roof and exterior walls and movable assets. It does not cover animals, crops, exterior facilities and cars.

In 1983 the Write Your Own Program was introduced and private insurance companies started to sell flood insurance with 100% guarantee of insurance by the federal government under a special agreement with the FIA. In 1991 the Community Rating System, in which insurance rates was reduced depending on the progress of flood protection measures, was introduced in order to give an incentive to community's flood risk mitigation activities.

5) Number of communities insured

In 2003 there were about 4.4 million insurance agreements in the USA: about 1.8 millions in Florida, about 46,000 in Texas, 38,000 in Louisiana and 1.78 millions in other states. Total annual insurance fee amounted at about 1.8 billion US dollars in 2003.

H4.4.3 Alternative Type of Flood Insurance

In order to realize a flood insurance system the following three large barriers should be eliminated or weakened:

i) Failure of a rule of majority (flood events occur simultaneously in a broad area, and an occurrence probability is not uniform,

ii) Difficulty of securing subscribers by reverse selection by an insurance company (majority of insurance subscribers tend to live in high risk flood prone areas),

iii) Instability of an insurance system in an occasion of a large scale disaster (bankruptcy or instability of an insurance system caused by payment of a large amount of insurance to the beneficiaries).

Various types of insurance systems were developed in some of the EU countries, the USA and China in order to eliminate or to minimize those barriers. Four types of insurances and respective solutions for the three barriers are summarized below.

Type of Barrier **Type of Insurance**	**Failure of Rule of Majority**	**Difficulty of Securing subscribers**	**Instability of Insurance System**
Private Insurance (Germany, Czech Republic)	No provision	No provision: rate of entry to the insurance is very low (about 10%)	No reinsurance in Germany, Reinsuranc[26] by foreign private insurance companies in Czech
Compulsory Property Insurance: Natural Disaster Compensation System, (France since 1982)	Compulsory to a private property insurance for fire, car accident, robbery	A compulsory and uniform premium rate (12%) charged to the property insurance	Reinsurance by the Government (national reinsurance finance corporation)
Municipality-Community-based Public Flood Insurance: National Flood Insurance Program (USA since 1969)	Reduce flood damage risks by enforcing the municipality to control land use and to provide flood mitigation measures	Admittance only by a unit of municipality instead of individuals (residents cannot buy the policy if the municipality does not join the program)	Reinsurance system by Federal Government (100% payment guarantee)
Public Flood Damage Compensation Pilot Program: for all private and agricultural assets (China in 1988 ~ 1992)	Applied to a retarding basin area only as a compensation program to avoid resettlement	Reduction of a premium rate to farmers by subsidy: Governments-70% and farmer-30%	100% payment guarantee by the central and provincial governments

H4.4.4 National Flood Insurance Program

(1) Policy of Flood Insurance

National flood insurance is now at the trial stage to materialize the state policy on insurances for floods and natural disasters. The policy to enhance flood insurance will be:

i) Live with a risk of flood and natural disasters,

ii) Beneficiary's pay principle, and

iii) Acquire insurance culture.

[26] Reinsurance is a system to prevent bankruptcy of insurance companies or an insurance system guaranteed financially by the third party.

(2) Foundation to Build-up National Flood Insurance

Establishment of a national flood insurance program will be financially and technically feasible because the recurrence interval of large flood events and the amount of flood damage expectancy is not very high in the country. Either a public type or a private type will be technically viable with appropriate support by the Government. However, appropriate institutional means should be developed for solving the three large barriers mentioned in the foregoing section to build up a stable and effective flood insurance system in the Republic. The following measures are expected to be well arranged:

Failure of Rule of Majority	**Difficulty of Securing subscribers**	**Instability of Insurance System**
	i)To establish public or private reinsurance system	i)To establish public or private reinsurance system
i)To control land use inside the public hydraulic domain and the flood prone areas with high inundation risk	ii)To develop the insurance culture among farmers and people in the rural and urban areas	
ii)To encourage the regional government to provide appropriate flood control measures (both structural and non-structural measures) to reduce risk of flood damages in his governorate	iii)To prepare flood hazard boundary maps and flood insurance rate maps[27]	

Establishment of a reliable reinsurance system by the public or private will provide a stable foundation to encourage public or private insurance companies to develop attractive flood insurance programs, and to encourage people to buy own flood insurance with a reasonable premium rate. Provision of effective land use control and appropriate flood control measures will reduce a risk of the failure of a rule of majority by raising non-damage provability in the insured areas, and it will also reduce the insurance premium rate to a reasonable level. Development of insurance culture and dissemination of flood hazard maps and flood insurance rate maps will encourage people to buy own insurance.

(3) Institutional Arrangement for Flood Insurance

The orientations of the national flood insurance program will be materialized by the following institutional arrangements:

i) To clarify the national policy on the flood control,

ii) To review of the legal framework relating to flood insurance so as to allow wider interventions, and

iii) To empower management capacity of the relevant organizations.

[27] Regional distribution of present and future flood inundation risk is quantitatively clarified by: a comprehensive master plan for flood control, flood zoning and hazard risk maps, land use zoning and control, value of assets and lands.

H4.5 Draft Plan on Organizational Capacity Development for Mejerda River Basin

H4.5.1 Draft Plan on Organizational Capacity Development

An organizational capacity development plan for the Mejerda River basin ris drafted for discussion to materialize the necessary actions identified in Sections H4.2 and H4.3. This draft plan consists eleven programs proposed for the organizational empowerment in terms of the three attributes delineated in **Figure H4.1**: namely, the river administration, the integrated planning and implementation, the integrated operations and maintenance (O&M). These programs are summarized below.

Proposed Programs for Organizational Empowerment

River Administration for HPD	Integrated Planning and Implementation	Integrated Operation and Maintenance (O&M)
1.One management for one river basin (Mejerda River)	5.integrated planning of structural and non-structural measures including zoning and flood insurance	10.Strengthnig of O&M of the exiting water supply system and large dams
2.Permanent organization for IFM	6.Coordination by Project Steering Committee under DGBGTH	11.Establish new agency for O&M of river course and river facilities of Mejerda River
3.Supplement IFM to Mission of National Water Council	7.Coordination and implementation by PMU under DGBGTH	
4.Basin-wide environmental management and monitoring	8.Documented technical guidelines, standards and rules	
	9.Arrangement of flood insurance	

Among these programs it is significant to establish a new unit or a new agency for the integrated O&M of the Majerda River basin. Four sub-programs are proposed for the new agency program as listed below.

Proposed Sub-programs for O&M of Mejerda River Basin

River Course and Flood Control Facilities	Information Management System
1.Establishment of new organization for O&M	3.Capacity development of FFWS
2.Establishment of new control center for overall reservoir operation in the basin	4.Coorporation with Algeria for the river basin management

H4.5.2 Stage-wise Implementation of Organizational Capacity Development

It is realistic to materialize the drafted organizational capacity development plan composed of 11 programs by step-wise, for example in three stages because there are limited experiences and practices of flood management and O&M of the river works in the Republic of Tunisia.

First stage: to establish a permanent division or a directorate inside the DGBGTH for the Mejerda River basin: 1) to initiate the proposed programs and the integrated operation and maintenance, 2) to sound feasibility of a pilot project, 3) to test the 10 programs above for the integrated O&M of the Mejerda River basin.

Second stage: to conduct a pilot project for the Mejerda River basin demonstrating project cycle management of various flood control measures from the planning stage to the operation and maintenance stage.

Third stage: to establish an agency in charge of the O&M of the Mejerda River basin if the pilot project justifies the viability of the agency.

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16) The 11th Development Plan: 2007 – 2011, Republic of Tunisia 2007

17) United Nations (1976), Rational Method of Flood Control Planning in River Basin Development, (Japanese translated version 1988, Infrastructure Research Institute, Ministry of Construction, ISSN 0386-5878)

18) Wikipedia, National Flood Insurance Program, NFIP (Japanese), 2007

Figures

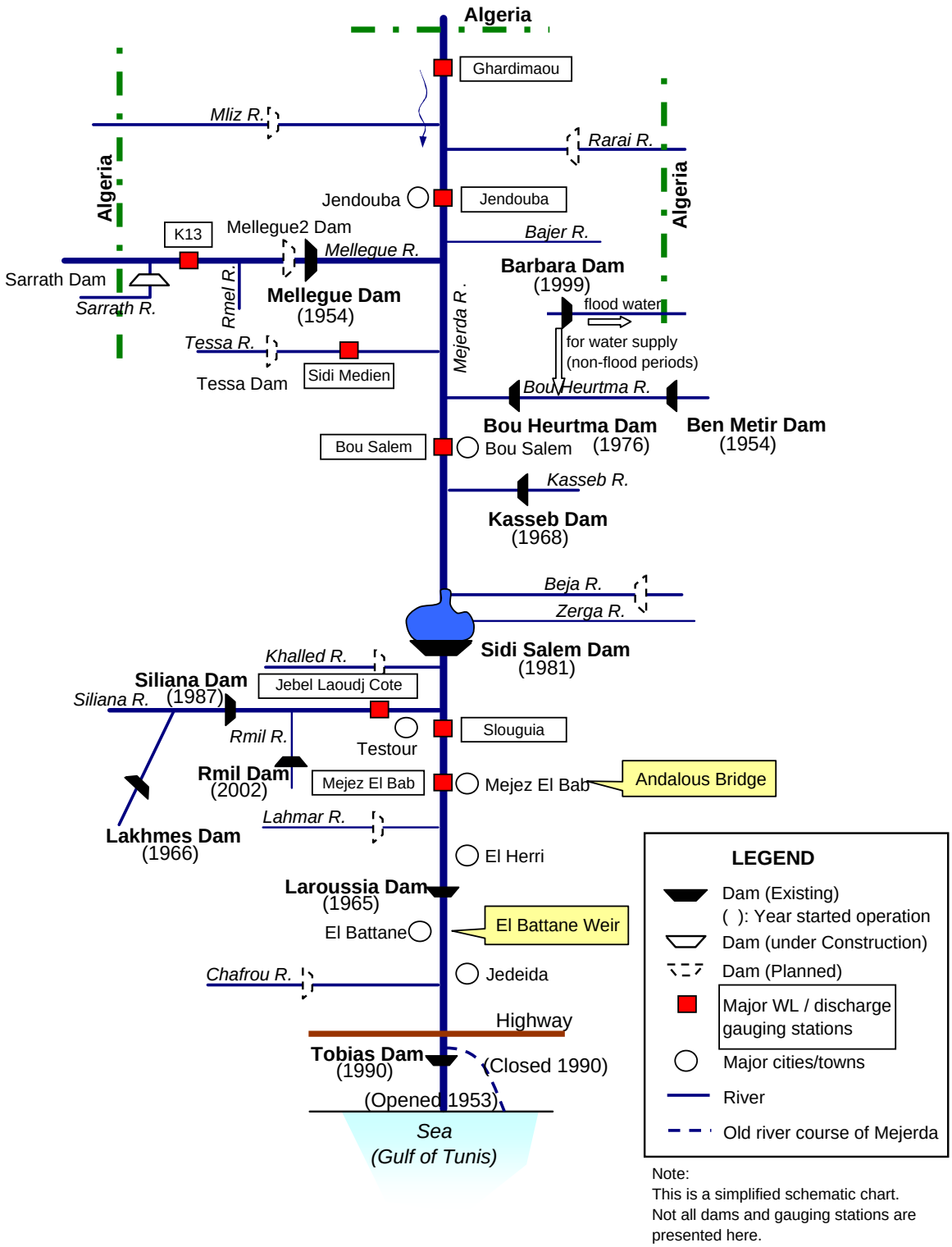

Figure H1.1 Schematic Locations of Major Stream Gauging Stations, Tributaries, Dams and Cities/Towns

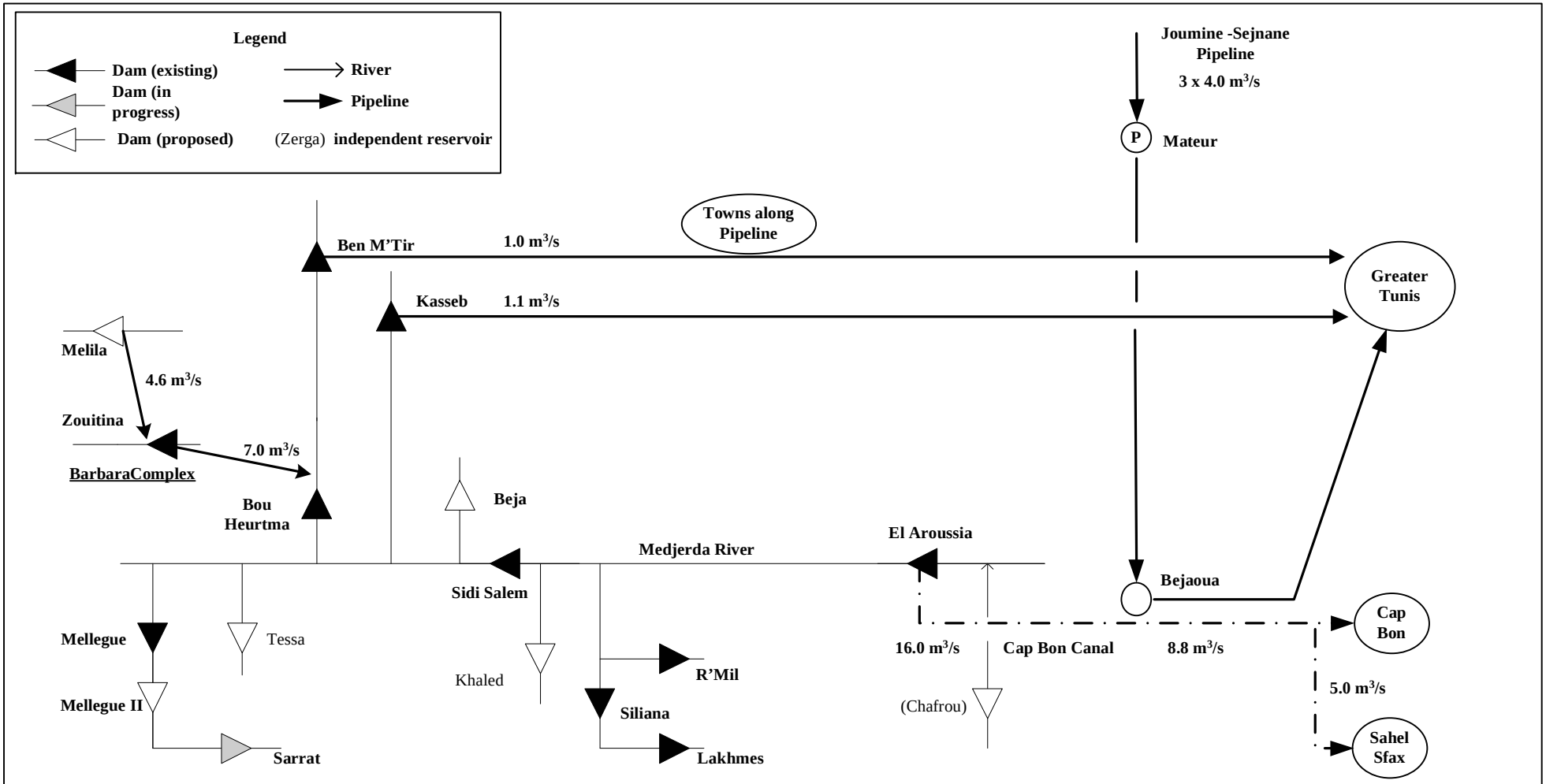

Figure H1.2 Schematic Diagram of Dams and Water Transfer Schemes of the Mejerda River Basin

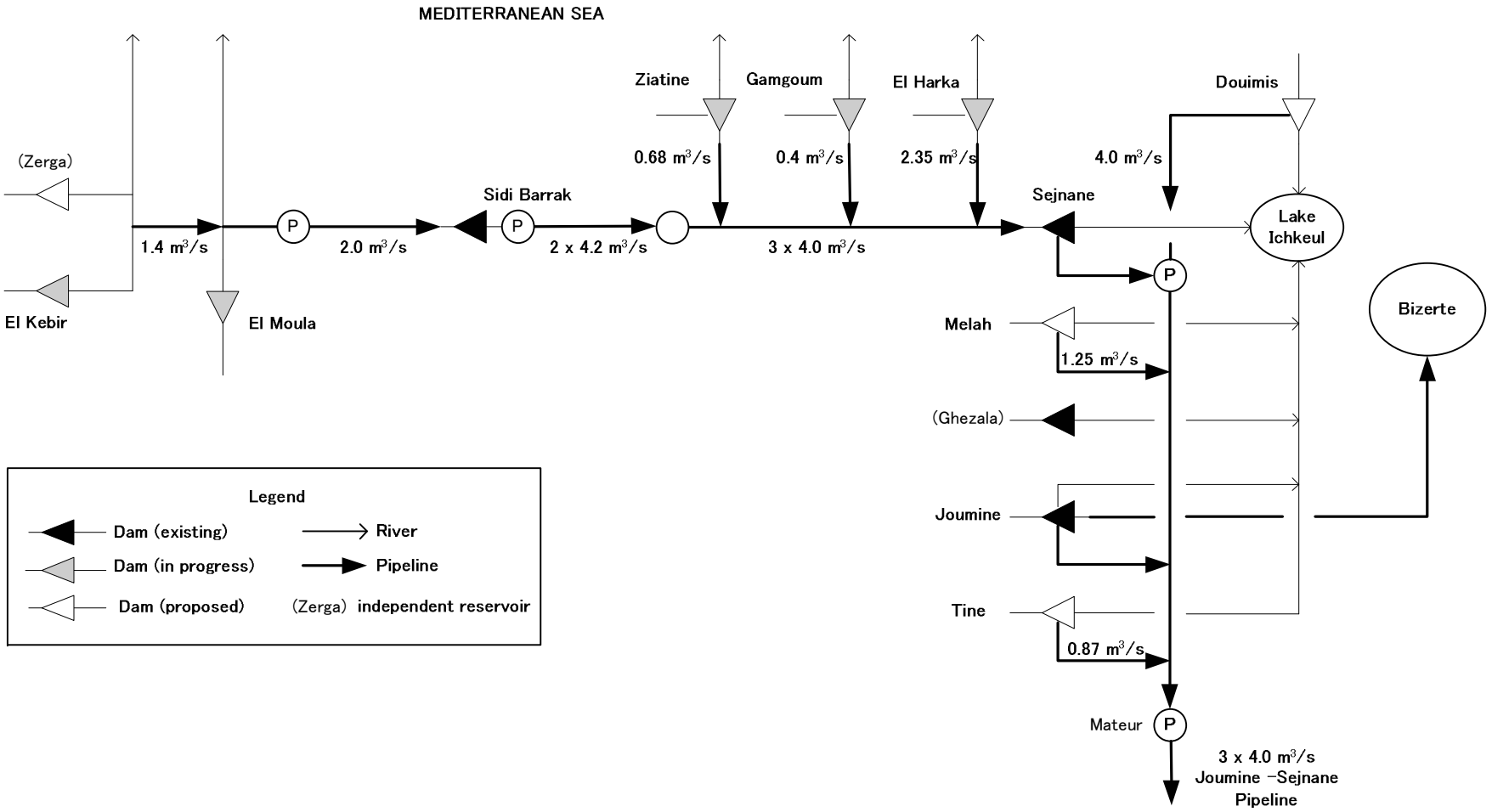

Figure H1.3 Schematic Diagram of Dams and Water Transfer Schemes of the Extreme North

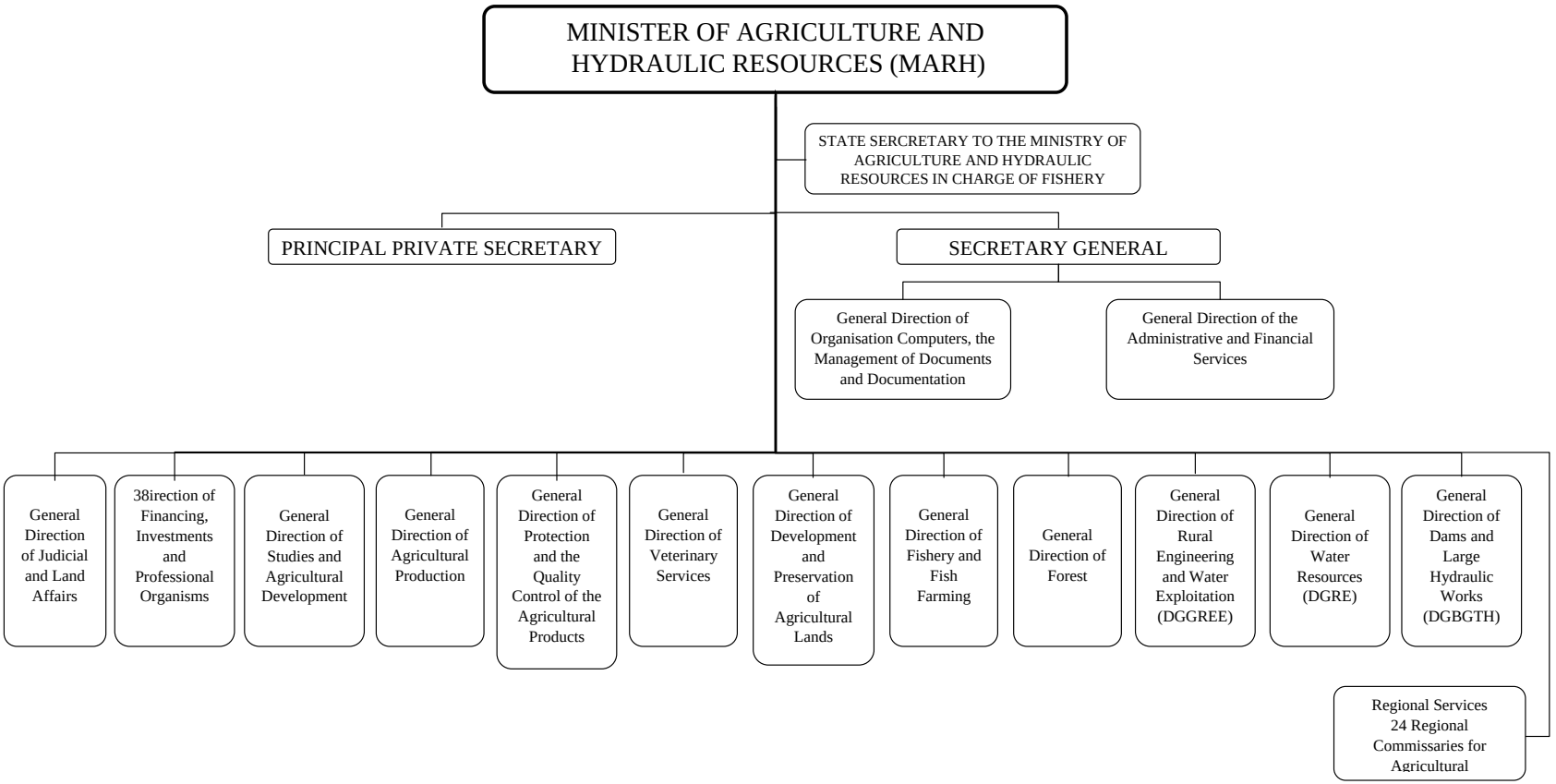

Figure H1.4 Organizational Structure of Ministry of Agriculture and Hydraulic Resources (MARH)

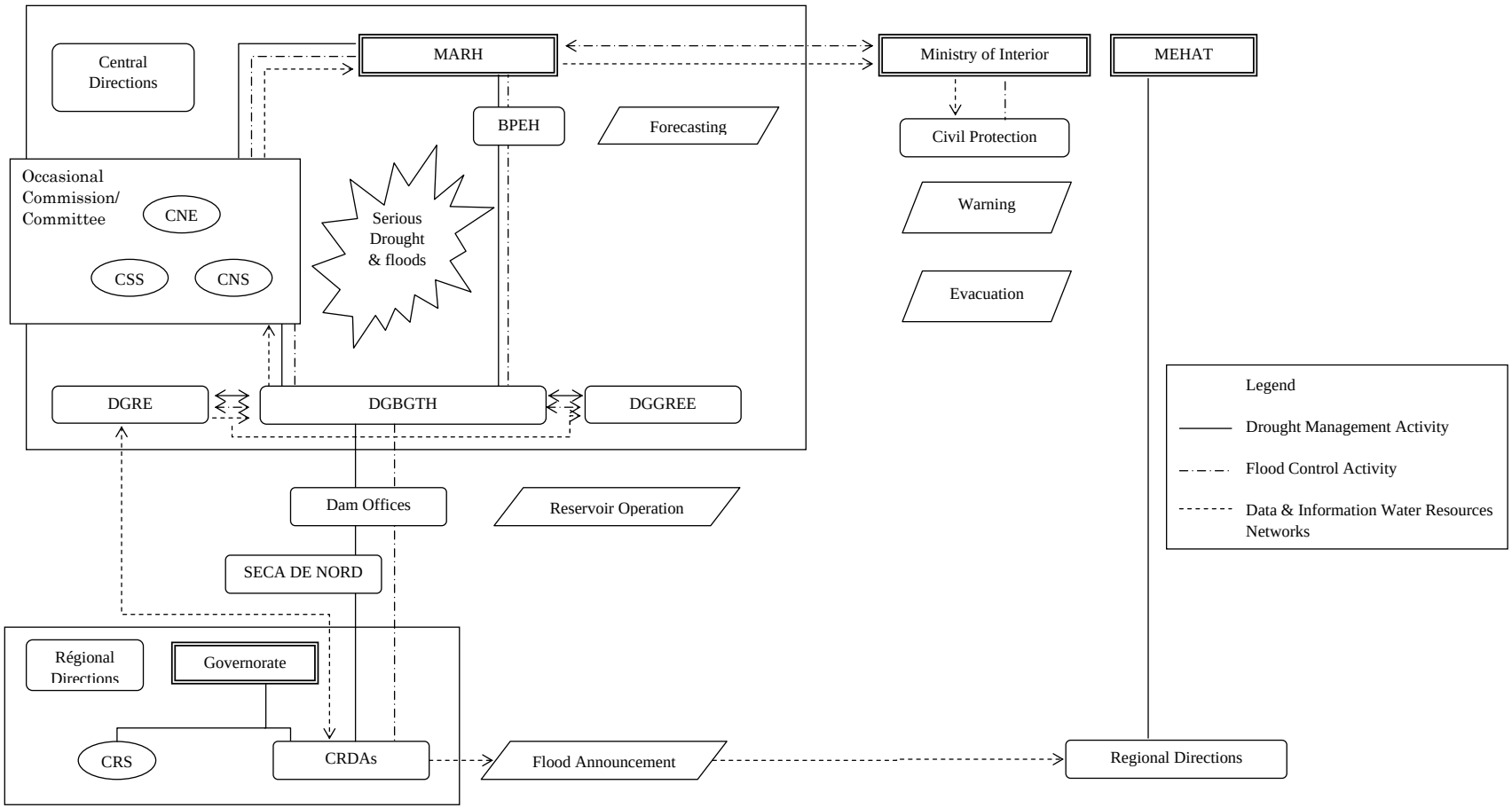

Figure H1.5 Ministerial and Regional Links in Case of Drought Management and Flood Control

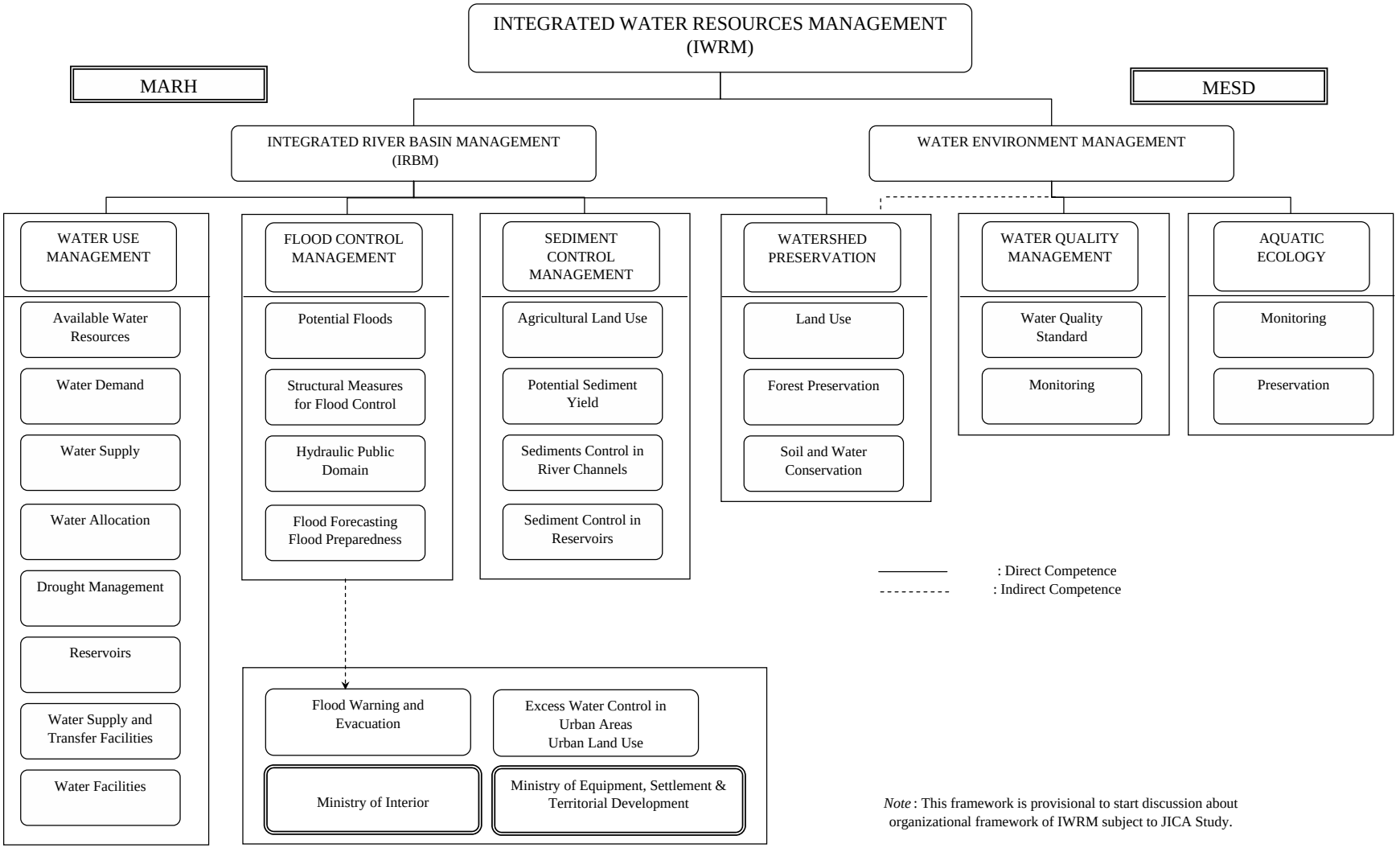

Figure H2.1 Framework of Integrated Water Resources Management (IWRM)

Figure H4.1 Organizational Framework for Integated Flood Management

	Management / Measures	River Administration			Organizations Concerned			
		River Area, River Course, Water (DGRE)	Integrated Planning and Implementation	Integrated Operation and Maintenance	MARH (Rural)	MEHAT (Urban)	Minsiry of Interior	Others
Structural Measures	**Storing and Regulating Flood Runoff**				DGBGTH: dams, large inter-regional projects			INM: informa-tion
	a) construction of dams & retarding basins	○	○	○	DGBGTH			
	b) improvement of reservoir operation	○	○	○	DGBGTH			INM
	River Channel Improvement				DGBGTH: large, inter-regional project, CRDA: small projects in a region			
	a) Dike	○	○	○	DGBGTH, CRDA			
	b) Channel excavation & widening	○	○	○				
	c) Bypass channel, flood ways	○	○	○				
Non-Structural Measures	**Basin Preservation**				DGF: forst area, DGACTA: outside forest area, planning for CRDAs			ANPE: environment, IRESA: research only
	a) Forest management	○	○	○	DGF, CRDA, DGACTA			ANPE, IRESA
	b) Land use management	○	○	○				
	c) Soil erosion management	○	○	○				
	Flood Plain Management				Coordination among DGRE, DGBGTH, DGF, CRDAs			INM: rainfall, IREA: data base
	a) Land use control (zoning)	○	○	○	DGF, CRDA	○	Change of land Use	
	b) Flood forecasting system		○	○	DGRE		○	INM, IRESA, Algeria
	c) Flood warning, evacuation & fighting activities	○	○	○	CRDAs		Civll Protection	
	d) Flood insurance, crop insurance, tax adjustment	○	○	○	DGFIOP: Protection against damages			MF (upon request)
	e) Education and dissemination of people	○	○	○	CRDAs	○		
	f) Water proofing	○	○	○		○		

Notes: ○ subject to integrated management,

MARH: Ministry of Agriculture and Hydraulic Resources, DGRE: General Direction of Water Resources, DGBGTH: General Direction of Dams and Large Hydraulic Works, DGACTA: General Direction of Development and Preservation of Agricultural Lands, DGF: General Direction of Forests, DGFIOP: General Direction of Financing, Investments and Professional Organisms, CDRA: Regional Commissary for Agricultural Development, MEHAT: Ministry of Equipment, Housing and Country Planning, ANPE: National Agency for the Protection of the Environment, IRESA: Institute of Agricultural Research and Education, INM: National Institute of Meteorology, MF: Ministey of Finance,

Supporting Report I

ECONOMICS AND FINANCE

THE STUDY
ON
INTEGRATED BASIN MANAGEMENT FOCUSED ON FLOOD CONTROL
IN
MEJERDA RIVER
IN
THE REPUBLIC OF TUNISIA

FINAL REPORT

Supporting Report I : Economics and Finance

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CHAPTER I1 ECONOMIC EVALUATION OF THE PROJECT

I1.1 General

Economic evaluation aims at measuring the "economic" impact through about on country by implementing a project from a viewpoint of national economy. Economic analysis was made for the whole flood control project along the Mejerda River basin in Tunisia as well as individual flood control projects for each zone (zones D1, D2, U1+M and U2). The zoning of the Mejerda River basin is discussed in Supporting Report D.

The economic evaluation of the project was undertaken in real terms using constant prices in June 2008. All prices and costs are expressed in Tunisian Dinar (TND). The other currencies costs are converted to TND using exchange rates of 1.171 TND per U.S Dollar and 10.965 TND per 1,000 Japanese Yen[*1]. Project benefits and costs, estimated in financial terms, have been converted to economic values. Cash flow of the individual projects was evaluated up to 50 years after completion of the projects, which is commonly applied to a flood control project.

I1.2 Economic Cost of the Project

Market values are usually distorted with transfer payments such as taxes and subsidies. These transfer payments are transferred to the government that acts on behalf of the society. Then, they should not be treated as costs. These have to be eliminated from market values of cost and benefit as a whole. Following the principals, tax and price contingency were excluded from economic cost, and also the local portion of every project cost was set to be converted applying a conversion factor of 0.88, which is commonly applied to economic analysis in Tunisia.

I1.2.1 Capital Costs

The financial costs of the individual projects were estimated at TND 109 million (zone U1+M) to TND 274 million (zone U2), which include a) the cost for river improvement, b) the project cost of the newly constructed dams[*2], and c) the cost for strengthening flood control function of reservoirs, d) the cost for organizational capacity development, e) the cost for strengthening evacuation and flood fighting system, f) the cost for strengthening flood forecasting and warning system (FFWS), and g) the cost for flood plain regulation/ management.

Also, each cost component consists of i) direct construction cost, ii) land acquisition cost, iii) government administration cost, iv) engineering service cost, v) physical and price contingency, and vi) taxes.

After deducting price contingency and taxes, and adopting a standard conversion factor of 0.88 for local cost portion, the economic cost of the individual projects was calculated to

[1] Average exchange rate of June 2008, National Institute Statistics, Tunisia
[2] Construction costs of the existing dams, including the Sidi Salem Dam, and the Sarrah Dam (under construction) were regarded as sunk cost, and thus not included in construction cost of the Projects. The Mellegue II Dam and the Tessam Dam are planned to be constructed as a multipurpose dam (mainly, water supply, irrigation and flood control), will be completed in 2020 and 2030, respectively. Partial costs of these dams were included as the costs (see Supporting Report D for allocation of cost only for flood control purpose).

be 61.9 million TND (zone U1+M) to 163.6 TND million (zone U2), as shown in the following table.

Financial and Economic Costs of Projects (1,000TND)

		Zone D1	Zone D2	Zone U1+M	Zone U2
Financial	- River Improvement	173,657	133,574	60,079	186,475
	- New Dam Construction	-	-	47,253	84,116
	- Soft Components	3,622	17,799	1,368	3,863
	- Total	177,279	151,373	108,700	274,454
Economic	- River Improvement	83,097	88,225	27,300	104,410
	- Dam Construction	-	-	33,502	56,100
	- Soft Components	2,862	14,067	1,081	3,053
	- Total	85,959	102,292	61,883	163,563

Source: the Study Team

Note: Soft components include i) strengthening flood control function of reservoirs, ii) organizational capacity development, iii) strengthening evacuation and flood fighting system, iv) strengthening flood forecasting and warning system (FFWS), and v) flood plain regulation/management.

I1.2.2 Operation and Maintenance Costs

(1) Operation and Maintenance Costs for Civil Structures

The operation and maintenance (O&M) costs for civil structures and various equipment are required annually during the evaluation period of the projects. Such recurrent O&M cost includes costs of daily operation and maintenance activities, and was assumed to be 0.5% of a direct construction cost. Estimated fixed O&M costs were varied from TND 0.31 million/year (the zone U1+M) to TND 0.82 million/year (the zone U2).

O&M costs of civil structures were assumed to be generated not only after the completion of construction works, but also during the construction stage depending upon accumulated investment of civil works.

(2) Tree Cutting and Grubbing Costs

In order to facilitate smooth river flow, grubbing and cutting of trees (mainly Tamarix) as well as clearing of grasses/bushes in the river channel will be required even after the completion of construction works. Annual maintenance costs for cutting of various plants including Tamarix were estimated to be from 0.01 million TND/year (zone U1+M) to 0.24 million TND/year (zone U2).

In addition, grabbing of trees is assumed to be required every five years. The cost of such periodic maintenance work is estimated to be from 0.01 million TND (zone U1+M) to 0.18 million TND (zone U2).

Maintenance Costs for Tree Cutting and Grubbing

Zone	Total area (1,000 m^2)	Annual maintenance*1		Periodical maintenance*2	
		Target area (1,000 m^2)	Amount (1,000TND)	Target area (1,000 m^2)	Amount (1,000 TND)
D1	4,230.7	2,115.3	148.1	423.1	113.0
D2	3,871.2	1,935.6	135.5	387.1	103.4
U1+M	330.4	165.2	11.6	33	8.9
U2	6,827.7	3,413.8	239.0	682.8	182.3

*1: Assumed 50% of total area, a unit rate of 0.07 TND/m^2 was applied.
*2: Assumed 20% of target area for annual maintenance, a unit rate of 0.267 TND/m^2 was applied.

(3) Cost for Sediment Removal

Sediment removal is also required after the completion of the respective river improvement projects. Such cost was estimated based on the river bed fluctuation analysis as follows. The cost was assumed to be generated annually after the completion of the river improvement projects. The sediment removal cost was estimated to be from 0.30 million TND/year (zone D2) to 0.81 million TND/year (zone D1), as shown below.

Cost for Sediment Removal

Zone	Excavation volume (m^3/year)*1	Unit rate (TND/m^3)	Amount (TND1,000 /year)
Zone D1	350,000	2.300	805
Zone D2	130,000	2.300	299
Zone U1+M	220,000	2.300	506
Zone U2	340,000	2.300	782

Note: *1= Estimated based on the results of river bed fluctuation analysis along the Mejerda mainstream

I1.3 Definition and Methodology for Calculation of Economic Benefit of the Project

I1.3.1 Definition of Economic Benefits

The benefit to be obtained by implementing the flood control project is defined as the reduction of damage resulting from flood. Herein, the flood control project includes river improvement, new dam construction, strengthening flood control function of reservoirs, and other soft components. Reduction of flood damage in each zone was estimated based on "with" and "without" the flood control project in the concerned zones.

Project damage can be broadly divided into direct and indirect damage. In the Study, direct damage refers to primarily damaged amount resulting from flood, while indirect damage refers to secondary damaged amount resulting during a flood period and even after the flood period. The table below shows direct and indirect damage calculated in the Study.

Direct and In-direct Damage Calculated under the Study

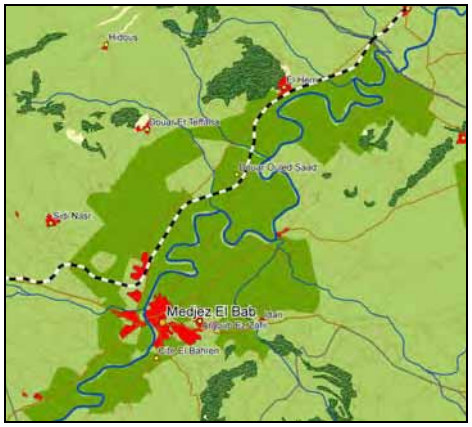
Direct Damage	In-direct Damage
- Damage to Residential Buildings - Damage to Household Effects - Damage to Agricultural Crops - Damage to Depreciable Assets and Stock Inventories of Business Establishments - Damage to Infrastructure	- Emergency Cleaning Cost - Loss of Interruption of Business Activities - Indirect Damage to Food Processing and Related Industries

I1.3.2 General Methodology

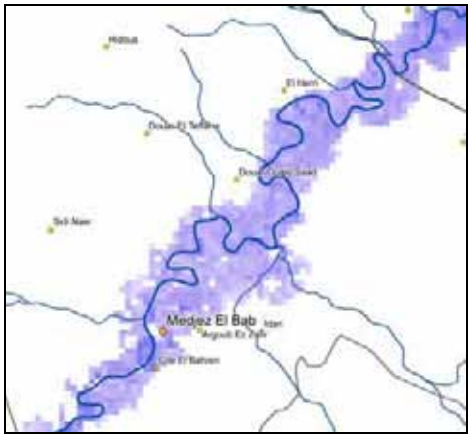
(1) Calculation of Inundation Area by Land Use Type and by Inundation Depth

Values of direct and indirect damage under with and without the flood control project were analyzed by using a result of hydrological simulation study on flood inundation and land use data, which are stored in the GIS.

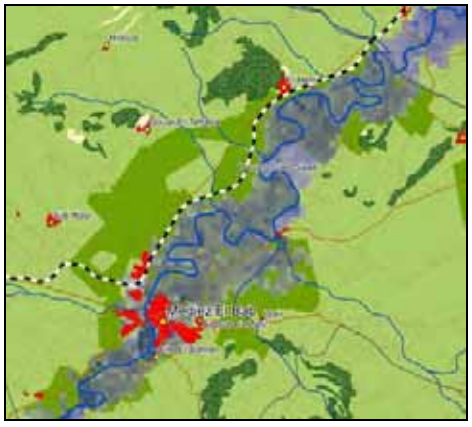
Data of probable flood inundation area were transferred to a GIS (Geophysical Information System) database as layers and overlaid with land use layer data, which were provided by MARH (The figures in the right show the sample image of the GIS database).



Land Use Data Layer



Inundation Area Layer


Land Use with Inundation Area

Then, the inundated area was calculated by land use type (urban area, non-irrigated agricultural area, irrigated area, forest, and others), by inundation depth in each probable flood case (return periods of 5, 10, 20, 50 and 100 years), and by delegation. Through this method, the area of each land use type and probable inundation area in each delegation was determined (see Tables DI1-1 ~ DI1-12 in Data Book).

(2) Estimation of Flood Damage

Flood damage is a function of the characteristics of flood, such as depth, duration and flow velocity of flood inundation. Since the depth and duration are the critical determinants of extent of flood damage, it is usual to prepare a damage rate[*3] for different types of assets by inundation depth and by duration of inundation.

Flood damage can be estimated by multiplying values of damageable assets/products and damage rates. However, such data sets are not available in Tunisia. Thus, the damage rates for various types of assets were quoted from "The Manual of Economical Investigation of Flood Disaster", which was developed by the Ministry of Land, Infrastructure and Transportation, Japan.

On the other hand, values of assets and products in a inundation area were estimated based on statistical data collected from MARH and INS. Detailed assumptions and methodology adopted for estimating flood damage are explained in "I1.4 Determination of Direct Damage" and "I1.5 Determination of Indirect Damage".

[3] Damage rate refers to the ratio of damaged amount to original asset value

(3) Calculation of Economic Benefit

After computation of flood damage by return period and by zone under with and without project conditions, an annual average of averted flood damage is calculated taking probabilities of flood occurrence into consideration. An annual economic benefit is defined as the expected value of annual averted flood damage, and it is calculated as the sum of "B_i", "B_{ii}", "B_{iii}", "B_{iv}", and "B_v", shown in the following table.

Expected Value of Annual Averted Flood Damage

Return Period	Flood Damage			Interval Probability	Annual Average Averted Flood Damage
	Without Project (a)	With Project (b)	Averted Damage by Project (a) – (b)		
1 year	0	0	$D_1= 0$	1 – 1/5= 0.80	$B_i= (D_1+D_5)/2*0.80$
5 years	d_{5a}	d_{5b}	$D_5= d_{5a} - d_{5b}$	1/5 – 1/10= 0.10	$B_{ii}= (D_5+D_{10})/2*0.10$
10 years	d_{10a}	d_{10b}	$D_{10}= d_{10a} – d_{10b}$	1/10 – 1/20= 0.05	$B_{iii}= (D_{10}+D_{20})/2*0.05$
20 years	d_{20a}	d_{20b}	$D_{20}= d_{20a} – d_{20b}$	1/20 – 1/50= 0.03	$B_{iv}= (D_{20}+D_{50})/2*0.03$
50 years	d_{50a}	d_{50b}	$D_{50}= d_{50a} - d_{50b}$	1/50 – 1/100= 0.01	$B_v= (D_{50}+D_{100})/2*0.01$
100 years	d_{100a}	d_{100b}	$D_{100}= d_{100a} – d_{100b}$		

Source: the Study Team

I1.4 Determination of Direct Damage

I1.4.1 Damage to Residential Buildings

Currently, an average value of residential building is not known. Therefore, some broad assumptions have been to be made. Based on interviews with concerned personnel, the values of residential building per m^2 of floor area were assumed to be 150 TND in a rural area and 400 TND in an urban area.

The average floor area of residential building in each governorate was calculated based on INS's CENSUS 2004. Given assumptions, the value of residential building was estimated as in the next table.

Values of Residential Building by Governorate

	Beja	Jendouba	Bizerte	Kef	Ariana	Manouba
Average Floor Area (Unit: m^2/building)	78.3	78.0	95.2	90.6	114.1	101.5
Value of Residential Building in Rural Area (Unit: TND/ building)	11,700	11,700	14,300	13,600	17,100	15,200
Value of Residential Building in Urban Area (Unit: TND/ building)	31,300	31,200	38,100	36,200	45,700	40,600

Source: the Study Team (Calculated based on CENSUS 2004 data)
Note: Above figures were rounded nearest 1,000 TND

The number of inundated residential buildings was estimated by urban area and rural area using population density data, the number of personnel in a household, and inundated areas as well as land use data stored in GIS. In calculating population density in urban and rural areas of each delegation, wetlands, water covered areas, and irrigated areas were

excluded, because they are not considered as an inhabitable area. Under such assumptions, delegation-wise population densities were computed by urban area and rural area.

Flood damage to residential buildings can be calculated by multiplying the values of residential building and damage rates by inundation depth, and was estimated using following formula.

Damage to Residential Buildings =

$$\sum_{g}\sum_{d}\left\{(VR_g^u \times IA_{gd}^u \times \frac{PD_g^u}{FM_g^u} + VR_g^r \times IA_{gd}^r \times \frac{PD_g^r}{FM_g^r}) \times DR_d\right\}$$

Where

Dr= total damage to residential in governorate "g"

PD^u_g= population density of urban area in governorate "g" (5.1 – 91.5 per ha, Source: the Study Team)

FM^u_g= average number of personnel in a household in urban area of governorate "g" (3.36 ~ 4.82, Source: INS)

PD^r_g= population density of rural area in governorate "g" (0.4 ~ 4.1 per ha, Source: the Study Team)

FM^r_g= average number of personnel in a household in rural area of governorate "g" (3.78 ~ 5.32, Source: INS)

IA^u_{gd}= inundated area of urban area in governorate "g" with inundation depth of "d"

IA^r_{gd}= inundated area of rural area in governorate "g" with inundation depth of "d"

DR= damage rate of residential building in inundation depth of "d" (see the table below)

VR^u_g= average value of residential building in urban area (31,200 ~ 45,700 TND per building, see the lower table in Page I1-5)

VR^r_g= average value of residential building in rural area (11,700 ~ 15,200 TND per building, see the lower table in Page I1-5)

Damage Rate for Residential Building by Inundation Depth

Inundation Depth	< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
Residential Building	0.092	0.119	0.266	0.380	0.834

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April

I1.4.2 Damage to Household Effects

Ownership of certain types of household appliances (telephone, TV, refrigerator, radio, and video, etc.) in Tunisia was surveyed during the population census in 2004. However, a total asset value of household effects cannot be estimated only from household appliances, because it includes not only household appliances but also furniture, clothes, table ware, motorbike, car, etc. For this reason, the Study adopted a rough assumption, that the value of household effects and per capita GDP have a proportional relation between Tunisia and Japan. Following such a rough assumption, the average value of household effects in a residential building of Tunisia was estimated to be 16,300 TND as shown below.

Estimation of Value of Household Effects

	Per Capita GDP (US$ in 2007)*1	Household Effects (US$ in 2007 Price)	Household Effects (TND in June 2008 price)
Japan	34,023	122,827*2	-
Tunisia	3,313	11,962*3	16,300*4

Source: the Study Team

Note:*1: World Economic Outlook Database, October 2007, International Monetary Fund

*2: Ministry of Land, Infrastructure and Transportation, Japan, 2007 (14,927,000 JPY, @ exchange rate used: 121.5 JPY per US$)

*3: 122,827 US$ × 3,313 US$ per capita ÷ 34,023 US$ per capita

*4: Consumer price index used: 122.8 (2007, INS), 128.5 (June, 2008, INS), Exchange rate used 1.304 TND/US$ (2007, INS), and then rounded nearest 100 TND

Flood damage to household effects in residential buildings was estimated using following formula.

$$\text{Damage to Household Effects} = \sum_g \sum_d \left\{ \left(IA^u_{gd} \times \frac{PD^u_g}{FM^u_g} + IA^r_{gd} \times \frac{PD^r_g}{FM^r_g} \right) \times DR_d \times HE \right\}$$

Where

PD^u_g= population density of urban area in governorate "g"

FM^u_g= average number of personnel of a household in urban area of governorate "g"

PD^r_g= population density of rural area in governorate "g"

FM^r_g= average number of personnel of a household in rural area of governorate "g"

IA^u_{gd}= inundated area of urban area in governorate "g" with inundation depth of "d"

IA^r_{gd}= inundated area of rural area in governorate "g" with inundation depth of "d"

DR= damage rate of residential building in inundation depth of "d" (see the table below)

HE=value of household effects per household (16,300 TND per a residential building, see the lower table in Page I1-6)

Damage Rate for Household Assets by Inundation Depth

Inundation Depth	< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
Household Effects	0.145	0.326	0.508	0.928	0.991

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April

I1.4.3 Damage to Agricultural Crops

The crops subject to flood damage were based on governorate-wise statistics, and include solid wheat, soft wheat, barley, rye, olive, citrus, grapes, almond, apricot, apple, pear, potato, tomato, artichoke, pepper, melon, bean, and tobacco.

Values of agricultural products per hectare were calculated by multiplying unit yields of major crops (2007 data, unit: ton/ha) and their farm gate prices (2007 data, unit: TND/ton), which are collected from MARH. Also, values of agricultural products were calculated for irrigated land and for non-irrigated farm land of each governorate as follows.

Values of Agricultural Products per Hectare of Irrigated and Non-irrigated Farm Land

(unit: TND/ha)

Land Type \ Governorate	Baja	Jendouba	KEF	Ariana	Manouba	Bizerte
Irrigated Land	4,370	4,350	2,338	5,980	4,530	4,990
Non-irrigated Farm Land	1,340	810	480	1,270	1,390	1,100

Source: the Study Team

Flood damage to agricultural crops was estimated using following formula.

$$\text{Damage to Agricultural Crops} = \sum_{g}\sum_{d}\sum_{t}\left\{(IA^{i}_{gdt} \times VP^{i}_{g} + IA^{c}_{gd} \times VP^{c}_{g}) \times DR_{dt}\right\}$$

Where

IA^{i}_{gdt}= inundated area of irrigated land in governorate "g" with inundation depth of "d" and inundation period "t"

VP^{i}_{g}= value of agricultural product in irrigated land of governorate "g" (refer to the lower table in Page I1-7)

IA^{c}_{gdt}= inundated area of non-irrigated farm land in governorate "g" with inundation depth of "d" and inundation period "t"

VP^{c}_{g}= value of agricultural product in non-irrigated farm land of governorate "g" (refer to the lower table in Page I1-7)

DR_{dt}= damage rate of agricultural product in inundation depth of "d" and inundation period "t" (refer to the table below)

Damage Rates of Agricultural Products by Inundation Depth and Period

Inundation Period \ Depth	< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
1 to 2 days	0.24	0.30	0.44	0.44	0.44
3 to 4 days	0.36	0.46	0.61	0.61	0.61
5 to 6 days	0.45	0.59	0.73	0.73	0.73
More than 7 days	0.59	0.73	0.83	0.83	0.83

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April (Average damage rates of low land crop and up land crop)

I1.4.4 Damage to Business Establishments

Direct damage to business establishments can be broadly divided into two categories: namely damage to depreciable assets and damage to stock inventories. The former refer to any property owned by a business establishment that is subject to depreciation for tax purposes (such as building, machines and equipment). The latter are current assets held for sale, or for processing and subsequent re-sale.

In the Study, depreciable assets and stock inventories per employee in Tunisia were estimated by industry type based on the same indicator used in Japan taking difference of per capita GDP between Tunisia and Japan into consideration (see the table below).

Estimation of Stock Inventories and Depreciable Assets of Business Establishments

Industry Type \ Country	Japan*a (1,000 JPY/employee in 2007)		Tunisia*b (TND/ employee in June 2008)	
	Depreciable Assets	Stock Inventories	Depreciable Assets	Stock Inventories
Mines	9,248	2,415	10,099	2,637
Construction	1,390	4,169	1,518	4,552
Manufacturing	4,350	5,071	4,750	5,537
Gas, petroleum, water and electricity	125,211	2,314	136,728	2,527
Transport and Communication	7,627	658	8,329	719
Commerce	2,176	2,727	2,376	2,978
Banking and Finance	3,667	465	4,004	508
Real Estate	19,893	12,093	21,723	13,205
Service	3,667	465	4,004	508
Public	3,667	465	4,004	508

Source: *a= Ministry of Land, Infrastructure and Transportation, Japan, 2007

*b= the Study Team, Per capita correction coefficient of 0.0974 (Tunisia: US$ 3,313per capita GDP ÷ Japan: US$ 34,023 US$ per capita GDP), exchange rate used of 93.17 JPY/TND in 2007, Consumer price index used: 122.8 (2007, INS), 128.5 (June, 2008, INS)

Then, average depreciable assets and stock inventories per employee in each governorate were estimated based on the following formula;

$$SI_g = \frac{\sum_i NE_{ig} \times SI_i}{\sum_i NE_{ig}}, \quad DA_g = \frac{\sum_i NE_{ig} \times SI_i}{\sum_i NE_{ig}}$$

Where

SI_g = average value of stock inventories in governorate "g" per employee

DA_g = average value of depreciable assets in governorate "g" per employee

NE_{ig} = number of employee of industrial type "i" in governorate "g" (quoted from the INS's CENSUS in 2004)

SI_i = average value of stock inventories in Tunisia per employee of industrial type "i" (refer to the lower table in Page I1-8)

DA_i = average value of depreciable assets in Tunisia per employee of industrial type "i" (refer to the lower table in Page I1-8)

Estimated average depreciable assets and stock inventories per employee in each governorate are shown in the table below.

Estimated Stock Inventories & Depreciable Assets of Business Establishments by Governorate

(unit: TND/Employee)

	Ariana	Manouba	Bizerte	Béja	Jendouba	Le Kef
Depreciable Assets	7,300	6,900	6,400	5,900	5,700	5,700
Stock Inventories	3,600	3,500	3,700	3,100	3,100	2,800

Source: the Study Team

Note: Above figures were rounded nearest 100 TND

Flood damage to business establishments was estimated using following formula.

Damage to Business Establishment =

$$\sum_{g}\sum_{d}\left\{\left(PD_{g}^{u}\times IA^{u}{}_{gd}+PD_{g}^{r}\times IA_{gd}^{r}\right)\times LP_{g}\times\left(DR_{d}^{a}\times DA_{g}+DR_{d}^{s}\times SI_{g}\right)\right\}$$

Where

PD^{u}_{g}= population density of urban area in governorate "g"
PD^{r}_{g}= population density of rural area in governorate "g"
LP_{g}= labor participation rate in governorate "g" (26.5% ~ 35.2%, Source: INS)
IA^{u}_{gd}= inundated area of urban area in governorate "g" with inundation depth of "d"
IA^{r}_{gd}= inundated area of rural area in governorate "g" with inundation depth of "d"
DR^{a}_{d}= damage rate of depreciable assets in inundation depth of "d" (refer to the table below)
DA_{g}= value of depreciable assets of business establishments per employee in governorate "g"
DR^{s}_{d}= damage rate of stock inventories in inundation depth of "d" (refer to the table below)
SI_{g}= value of stock inventories of business establishments per employee in governorate "g"

Damage Rate by Inundation Depth for Depreciable Assets and Stock Inventories of Business Establishments

Item \ Depth	< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
Depreciable Assets	0.232	0.453	0.789	0.966	0.995
Stock Inventories	0.128	0.267	0.586	0.897	0.982

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April

I1.4.5 Damage to Infrastructure

The damage to infrastructure is assumed to be that to irrigation networks, rural road networks, irrigation pumps, drainage networks, drinking water supply facilities and pumping stations, etc, and were calculated using a unit value of 400 TND/ha only for inundated areas regardless of depth and duration of inundation. The unit value was estimated based on the past actual damage to infrastructure in Ariana Governorate during the January 2003 flood (1,626,000 TND, estimated flood area of 4,000 ha). Following simple formula was adopted in calculating damage to infrastructure.

$$\text{Damage to Infrastructure} = \sum_{d}\left(IA_{d}\times VI\right)$$

Where

IA_{d}= inundated area with inundation depth of "d"
VI= unit value of damage to infrastructure (400 TND/ha)

I1.5 Determination of Indirect Damage

I1.5.1 Emergency Cleaning Cost

Emergency cleaning cost is the cost needed to clean up damage from flood. This cost is estimated from the product of the period expended, unit cost and the number of buildings cleaned.

The opportunity cost of cleaning work is assumed to be 15.12 TND per day, base on an average monthly salary of public employee in Tunisia (excluding management position) of 453.6 TND[*4] divided by 30 days. The expended periods of emergency cleaning for

[4] Calculated based on 420.1 TND per month in 2006 and adjustment using consumer price index (2006: 119.0 and June

various inundation depths are taken from the Japanese manual of economy of flood disaster and are tabulated below. The emergency cleaning cost was estimated using following formula.

$$\text{Emergency Cleaning Cost} = \sum_g \sum_d \left\{ \left(IA^u_{gd} \times \frac{PD^u_g}{FM^u_g} + IA^r_{gd} \times \frac{PD^r_g}{FM^r_g} \right) \times DR_d \times CC \right\}$$

Where

PD^u_g= population density of urban area in governorate "g"

FM^u_g= average number of personnel of a household in urban area of governorate "g"

PD^r_g= population density of rural area in governorate "g"

FM^r_g= average number of personnel of a household in rural area of governorate "g"

IA^u_{gd}= inundated area of urban area in governorate "g" with inundation depth of "d"

IA^r_{gd}= inundated area of rural area in governorate "g" with inundation depth of "d"

DR_d= time required for cleaning the residential building after the flooding in inundation depth of "d" (refer to the table below)

CC=cleaning cost of residential building (15.12 TND/day)

Expended Period for Emergency Cleaning by Inundation Depth

Item / Depth	< 0.5 m	0.5- 1.0 m	1.0 - 2.0m	2.0 - 3.0 m	3.0 m <
Works for Emergency Cleaning (day)	7.5	13.3	26.1	42.4	50.1

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April

I1.5.2 Loss of Interruption of Business Activities

The loss of production through interruption of economic activity caused by flood was estimated from the added value of major industrial activities per employee multiplied by the number of employees affected in urban areas.

Since governorate -wise GDP data is not available, the added value per employee in each governorate was estimated based on the following formula;

$$\text{Average Added Value per Employee per Day in Governorate "g"} = \frac{\sum_i NE_{ig} \times AV_i}{\sum_i NE_{ig} \times 365}$$

Where:

NE_{ig}= number of employee of industrial type "i" in governorate "g" (quoted from the INS's CENSUS in 2004)

AV = average added value per employee of industrial type "i" in Tunisia (quoted from the INS's statistics 2007)

Estimated added values per employee in each governorate were shown in the following table;

Average Added Value per Employee by Governorate

	Beja	Jendouba	Bizerte	Kef	Ariana	Manouba
Average Added Value per Employee (TND/day)	20.29	22.11	26.14	23.87	31.41	26.27

Source: Estimated by the Study Team

The periods of interruption of business activities for various levels of inundation depth are taken from the Japanese manual of economy of flood disaster, and are as shown in Table below.

2008), Source: Institute of National Statistics

Period of Stoppage of Business Operation by Inundation Depth

Item \ Depth	< 0.5 m	0.5- 1.0 m	1.0 - 2.0m	2.0 - 3.0 m	3.0 m <
Stoppage of Business Operation (day)	6.6	9.5	15.5	25.2	33.9

Source: The Manual of Economical Investigation of Flood Disaster, Ministry of Land, Infrastructure and Transportation, Japan, 2005 April

Loss of interruption of business activities were calculated using following formula.

Loss of Interruption of Business Activities =

$$\sum_g \sum_d \left\{ (IA^u_{gd} \times PD^u_g + IA^r_{gd} \times PD^r_g) \times LP_g \times DR_d \times AV_g \right\}$$

Where

PD^u_g= population density of urban area in governorate "g"

PD^r_g= population density of rural area in governorate "g"

LP_g= labor participation rate in governorate "g"

IA^u_{gd}= inundated area of urban area in governorate "g" with inundation depth of "d"

IA^r_{gd}= inundated area of rural area in governorate "g" with inundation depth of "d"

DR_d= duration of stoppage of business activities in inundation depth of "d" (refer to the table above)

AV_g= average added value per employ in governorate "g"(see the lower table in Page I1-10)

I1.5.3 Indirect Damage to Food Processing and Related Industries

There are various types of food processing industries located in Tunisia. Some of them rely heavily on agricultural production in the Mejerda River Basin as an important source of raw materials.

Flood damage on agricultural products badly affects food processing and related industries even outside the inundated area subsequently. Such damage was estimated using the input-output table of Tunisian Economy 2006 published by INS. The input-output table indicates inter-industry relations in an economy, depicting how the output of one industry goes to another industry, where it serves as an input, and thereby makes one industry dependent on other both as a customer of outputs and as a supplier of inputs (refer to Table DI1-13 in Data Book). Then, based on this Input and Output table the [I-(I-M)A]-1 type inverse matrix was calculated as shown in Table DI1-14 in Data Book). The indirect damage to food processing and related industries was estimated based on following formula;

Indirect Damage to Food Processing and Related Industries =

$$DA \times \sum_i \left\{ IM^{10}_i \times \frac{(1 - IC_i)}{GP_i} \right\} \times SR$$

Where:

DA= Direct damage to agricultural products (refer to the page I1-7)

IM^{10}_i = Inverse matrix coefficient "increase in the final demand of agricultural crops" and "induced effect of industrial type "i" (refer to the Table I1-4-2)

GP_i = Total output of industrial sector "i" (refer to the Table I1-4-1)

IC_i = Total Intermediate Consumption for industrial type "i" (refer to the Table I1-4-1)

SR = Self-sufficiency ratio of agricultural products in Tunisia (85.94%, INS Tunisia 2006)

I1.6 Economic Benefit in Aggregate

The next table shows a summary of economic benefit of the flood control project (including the river improvement, strengthening flood control function of reservoirs and

other soft components) in each zone based on asset value of 2008, which is equal to expected value of reduction of flood damage.

As shown in the table below, the reduction in direct damage accounts for 84% of total economic benefit, while the reduction in in-direct damage accounts for 16%. Since the Mejerda River basin is rich in agricultural products, damage reduction of agricultural products (22.4 million TND/year) occupies 29% of the total economic benefit.

From the view point of zone-wise economic benefit, the zone D2 shows the highest benefit (47.6 million TND/year, equal to 62.2% of total economic benefit) because of the greater reduction in inundated areas and greater concentration of assets, agricultural production, and economic activities.

Summary of Economic Benefits in Each Zone Based on 2008 Price Level

(1,000 TND/year)

Item \ Zone		Zone D1	Zone D2	Zone U1+M	Zone U2	Total	% to Total
Direct Effects	Residential Building	1,836	3,494	650	1,955	7,934	10.4%
	Household Effects	2,221	7,115	967	2,574	12,876	16.8%
	Depreciable Assets	1,938	8,414	627	1,623	12,603	16.5%
	Stock Inventories	638	2,286	203	535	3,661	4.8%
	Agricultural Products	3,921	14,831	674	2,999	22,424	29.3%
	Infrastructure	784	3,513	177	558	5,031	6.6%
	Sub-total	11,338	39,652	3,297	10,242	64,529	84.4%
In-direct Effects	Loss of Business Opportunity	633	2,419	187	292	3,531	4.6%
	Emergency Cleaning	106	327	34	119	585	0.8%
	Indirect Effect to Industries	1,372	5,191	236	1,050	7,848	10.3%
	Sub-total	2,111	7,936	457	1,460	11,965	15.6%
Grand Total		13,449	47,588	3,754	11,702	76,494	100.0%

Source: the Study Team

I1.7 Results of Economic Analysis

I1.7.1 Economic Analysis for Assessing Project Priority

Economic benefit of the Project is assumed to be increased in real terms year by year following the anticipated GDP growth, because the damageable assets/products are deemed to be increased in real terms along the economic development. In this economic analysis, the GDP growth in real terms was assumed to be 5.5% per year during 2009 – 2011 (the same assumption of country's 11th national development plan 2007-11), 4.0% during 2012 - 2021, and 3.0% during from 2022 onwards. On the other hand, the project cost remains unchanged in real terms. For this reason, an economic internal rate of return (EIRR) is varied depending upon the timing of project implementation.

In order to judge the order of superiority of economic viability of the project in each zone, EIRR has been calculated for each project using the same project commencement year[*5]. Therefore, economic analysis was made for each zone on condition that the river improvement project will start in 2011.

[5] Since the project implementation schedule of new dam projects are already fixed, only the commencement year of river improvement projects is assumed to be 2011.

The table below shows a summary of economic analysis results (also, refer to Tables DI1-15 ~ DI1-18 in Data Book). The zone D2 shows the highest EIRR of 33.7%, and followed by the zone D1 (20.3%), the zone U2 (12.1%), and the zone U1+M (10.0%).

Summary of Economic Analysis (river improvement projects start in 2011)

	Zone D1	Zone D2	Zone U1+M	Zone U2
EIRR	20.3%	33.7%	10.0%	12.1%
NPV (million TND)	42.23	230.31	-8.02	1.04
B/C Ratio	2.14	5.83	0.76	1.01

Source: the Study Team
Note: discount rate of 12% was adopted

I1.7.2 Economic Analysis for the Flood Control Project

The implementation schedule of the flood control project in each zone was determined taking the results of above-mentioned economic analysis as well as a basic rule/theory of river improvement works and project priority based on flood damage risk into consideration, of which the details are mentioned in Supporting Report D.

Economic analysis of each zone as well as the whole project was finalized following the implementation schedule. Economic costs and benefits during the evaluation period are shown as an annual stream in Table I1.7.1 (whole project only) and in Tables DI1-19 ~ DI1-23 in Data Book. The EIRRs of the whole project as well as individual projects in each zone were calculated, ranging between 12.1% and 33.7%, and are above the economic discount rate of 12.0%. In addition, the economic net present value (ENPV) and benefit-cost ratio (B/C) adopting 12.0% of discount rate exceeds “0” and “1”, respectively.

Summary of Economic Analysis
(river improvement project start on implementation schedule)

	Zone D1	Zone D2	Zone U1+M	Zone U2	Whole Projects
EIRR	20.5%	33.7%	12.1%	14.6%	25.0%
ENPV (million TND)	19.96	230.31	0.29	13.60	264.16
B/C Ratio	2.73	5.83	1.01	1.28	3.04

Source: the Study Team
Note: discount rate of 12% was adopted

These calculation results have proved that all the proposed flood control projects are feasible from the economic point of view.

I1.7. 3 Sensitivity Analysis

The values of variables used for the economic analysis are estimated based on the most probable forecasts, which cover a long period of time. These variables for the most probable outcome scenario are usually influenced by a great number of factors, and the actual values may differ considerably from the forecasted values, depending on future developments/changes.

The sensitivity of the EIRR and ENPV to several adverse movements in project cost was computed to access the robustness of the economic viability of the project. A switching

value analysis was also made to ascertain the cost required to reduce ENPV to 0 and the minus benefit to make the EIRR equal to economic opportunity cost of 12.0%.

Summary of Sensitivity Analysis

	Adverse Scenarios	EIRR	ENPV (million TND)	Switching Value
Zone D1	Base Case	20.5%	20.0	-
	a. Capital Cost Increase 20%	18.9%	17.7	+ 175%
	b. Flood Control Effect by -20%	18.5%	13.7	- 63%
	c. GDP Growth - 1% point	18.1%	11.8	-
	d. a + b + c	14.5%	4.8	-
Zone D2	Base Case	33.7%	230.3	-
	a. Capital Cost Increase 20%	30.7%	220.9	+ 487%
	b. Flood Control Effect by -20%	30.1%	174.7	- 83%
	c. GDP Growth - 1% point	31.9%	185.3	-
	d. a + b + c	25.5%	129.3	-
Zone U1+M	Base Case	12.1%	0.3	-
	a. Capital Cost Increase 20%	10.7%	-4.3	1.4%
	b. Flood Control Effect by -20%	10.4%	-4.0	1.4%
	c. GDP Growth - 1% point	10.5%	-3.5	-
	d. a + b + c	7.6%	-11.3	-
Zone U2	Base Case	14.6%	13.6	-
	a. Capital Cost Increase 20%	12.6%	3.9	+ 28%
	b. Flood Control Effect by -20%	12.2%	1.1	- 22%
	c. GDP Growth - 1% point	12.5%	2.2	-
	d. a + b + c	8.7%	-17.8	-
Whole Project	Base Case	25.0%	264.2	-
	a. Capital Cost Increase 20%	22.4%	238.3	+ 204%
	b. Flood Control Effect by -20%	21.8%	185.4	- 67%
	c. GDP Growth - 1% point	23.1%	195.8	-
	d. a + b + c	17.6%	105.0	-

Source: the Study Team

As shown in the above table, the sensitivity analysis shows that the economic viability of the proposed flood control projects in the zone D1, D2 as well as the whole project are robust under the various adverse assumptions.

Also, economic viability of the zone U2 has sufficient robustness, when overrun of capital cost is within the range of 28% to the base case or decrease in the economic benefit within minus 22% to the base case, the project sustains its economic viability.

However, in the case of zone U1+M, if only an assumption moves to an adverse direction, the project easily lost its economic viability.

I1.7. 4 Conclusion

The whole flood control project as well as individual projects in each zone were judged to be economically viable, and thus all the proposed flood control projects are worthwhile implementation.

Also, the economic viability of the whole project as well as individual projects was

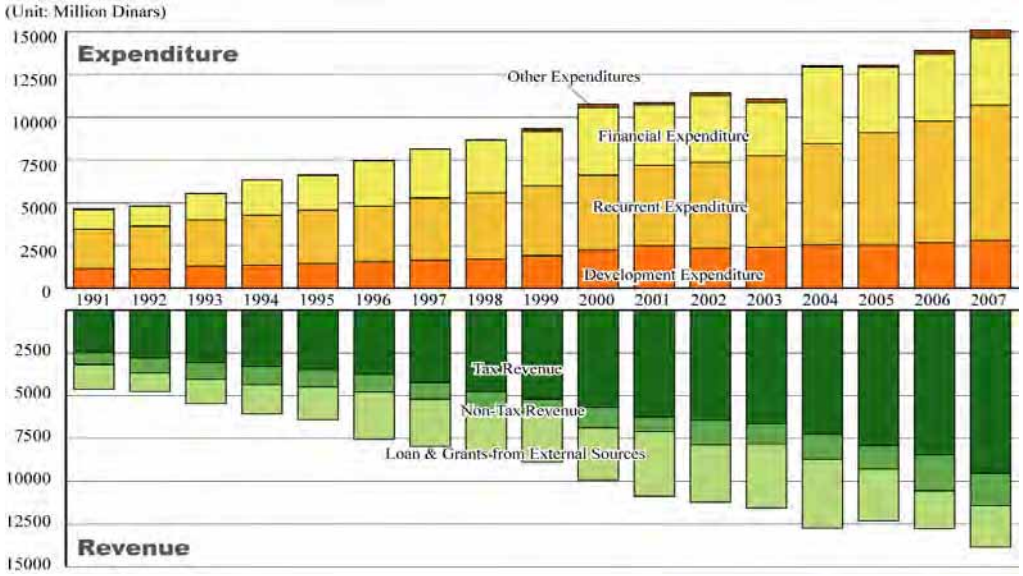
sufficiently robust, with the exception of the zone U1+M. In the case of the project in the zone U1+M, since the project implementation is scheduled to start in 2026, it is recommended to execute economic analysis again before the implementation taking the change in the economic development in the zone as well as the asset values in the probable flood area in to consideration.

CHAPTER I2 FUNDING ARRANGEMENTS FOR THE PROJECT

I2.1 Review of Budget Allocation of the Tunisian Government

The figure given below illustrates revenue and expenditure of the Tunisian Government during 1991 – 2007. The general account budget of the Tunisian Government was 15.1 billion TND in 2007. On the other hand, the governmental revenue stood at 13.9 billion TND, and thus resulted in excess of expenditure of 1.2 billion TND. Primary balance*1 of Tunisia has also been in negative throughout the period from 1991 to 2007.

During the past decade, the governmental revenue consists of tax revenue (57 ~ 69%), and non-tax revenue (7~10%), and remaining 17～32% is made up of the national bond, grant and loan from the bilateral/multilateral development agencies. On the other hand, development expenditures occupied 20 ~ 23% of total general account expenditures of Tunisia.



Source: Institute National de la Statistique, Tunisia

Revenue and Expenditure for Tunisian Government during 1991- 2007

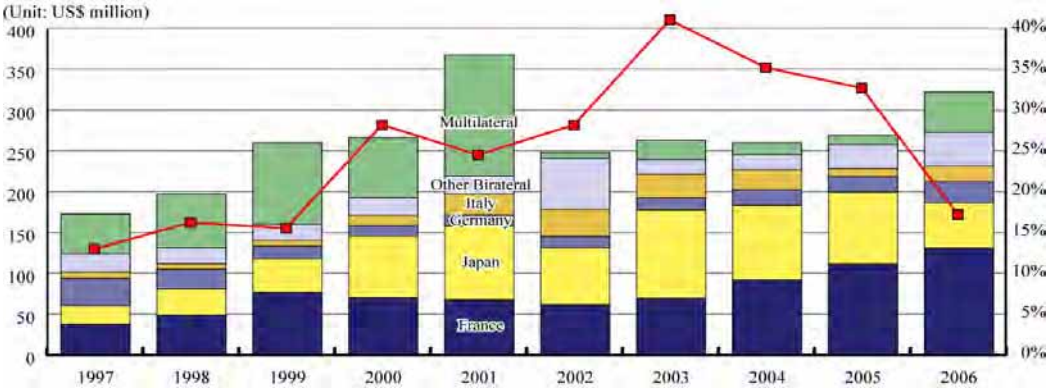
Percentage of financial expenditure (such as principal and interest payment of existing debts and redeeming of national bond to the total general account budget) has been gradually reducing during the last decade (from 35% in 1998 to 28% in 2007). Also, the ratio of total external debt (including both short-term debt and long-term debt) to GDP was reduced from 65% in 2002 to 55% in 2007*2. The Tunisian Government aims to reduce a total external debt up to 51% of GDP by the end of the XIth Plan. To achieve such target, the Tunisian Government intends to continue to limit reliance on external assistance at a reasonable level.

[1] Primary balance describes the condition where expenditures (excluding principal payment of external loans and redeeming of national bond) are covered by tax and non-tax revenues.
[2] Source: International Monetary Fund

I2.2 Amount of Financial Assistance Received from the Major Donors

Major donors providing financial and technical assistance to Tunisia are France, Japan, Germany and Italy as well as the multilateral development agencies of World Bank, EU and African Development Bank. The amount of foreign assistance received was between US$ 460 million and US$ 660 million per year during the last 5 years (2002 ~ 2006). In recent years, the amount of loan assistance received was almost the same as the amount of grant assistance.

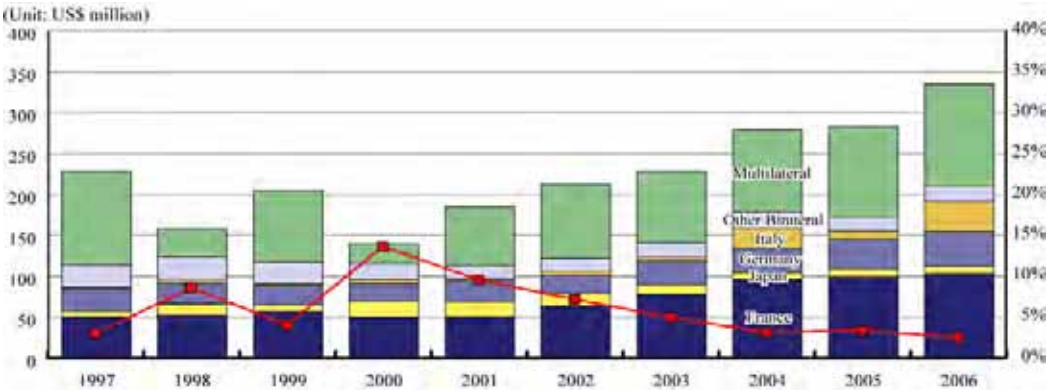
The French Government is the biggest donor of Tunisia in terms of an aid amount of both grant and loan assistance. The aid amount of loan assistance from the French Government was US$ 61 ~ 131 million per year during the past 5years, and occupied 25 ~ 41% of total loan assistance received. Also the amount of grant assistance from the French Government was US$ 63 ~ 103 million, and accounted for 27 ~ 38% of the total grant assistance received.



Source: Development Assistance Committee, OECD

Note: Red line indicates percentage of Japanese loan assistance to total loan assistance.

Amount of Foreign Assistance Received by Funding Sources (Loan)



Source: Development Assistance Committee, OECD

Note: Red line indicates percentage of Japanese grant assistance to total grant assistance.

Amount of Foreign Assistance Received by Funding Sources (Grant)

In case of the Japanese Government, during the past 5 years, the amount of grant assistance occupied only 3 ~ 7% of total grant assistance received by Tunisia, while that of loan assistance occupied 17 ~ 41%.

Since the sum of loan assistance from the French and the Japanese Governments accounted for 53% ~74% of total loan assistance received during 2002 ~ 2006, loans from the both countries are considered to be important fund sources for Tunisia in executing large-scale infrastructure projects.

I2.3 Donor's Assistance Strategy for Tunisia

I2.3.1 Multilateral Development Agencies

Financial assistance received from the multilateral development agencies was US$ 100 ~ 175 million per year during the past 5 years. Most of financial assistance from multilateral development agencies are on a grant basis. Since the amount of loan assistance was relatively small (US$ 8 ~ 49 million per year during the past 5 years), there is not much hope for receiving financial assistance on a large-scale infrastructure project.

Assistance strategies of major multilateral development agencies for Tunisia are as compiled below. Their priority sectors include neither disaster prevention projects nor flood control projects.

Assistant Strategy and Priority Sectors of Major Donor Agencies

	Priority Sectors
World Bank	1) Strengthen the business environment, to support the development of a more competitive, internationally integrated private sector, and improve competitiveness of the Tunisian economy. 2) Enhance skills and employment potential of graduates, and the labor force in a knowledge economy. 3) Improve the quality of social services, through enhanced efficiency of public expenditures. Source: Country Assistance Strategy (CAS) for Tunisia, World Bank, June 2004
EU	1) Creation of the right conditions for private investment, the development of competitive SMEs (small and medium enterprises), growth, a reduction in unemployment and sustainable rural development; 2) Developing education and training, higher education and scientific research as vital building blocks of the knowledge-based society; 3) Facilitating trade in goods and services, approximation of technical regulations and conformity assessment procedures and standards; 4) Developing transport based on safety and security, reinforcing national and regional infrastructures and their inter-connection with the Trans-European Transport Network; developing the energy and information society sectors. Source: Country Strategy Paper 2007-13, EU
African Development Bank	1) The reinforcement of macroeconomic policies and acceleration of reforms addresses the need to improve the business environment and is geared towards consolidating the reform programs. 2) The modernization of infrastructure and consolidation of the productive sector is a strategic option for speeding up growth. 3) The consolidation of human capital focuses on creating employment, in particular by consolidating the linkages between training, research and production; supporting the development of technological centers that give concrete form to such linkages; and ensuring balanced regional development. Source: Country Strategy Paper 2007-11, African Development Bank
Islamic Development Bank	Assistance strategy and priority areas for Tunisia are not clear. Islamic development bank has been providing assistance for industrialization, capacity building for public sector, rural development, agricultural sector, and financial sector.

I2.3.2 France

France's development co-operation strategy is constructed around three main threads:

- It follows the Millennium Development Goals (MDGs) with particular focus on good governance and the consolidation of the state of law.
- Putting special emphasis on culture, education and research through cultural programs and scientific partnerships, it promotes a French understanding of development co-operation.
- It stresses the importance of managing public funds efficiently, putting more efforts into monitoring and co-operation with other donors.

For each recipient country, the sector strategies are incorporated into partnership frameworks (document cadre de partenariat - DCP). According to the DCP 2006-2010 prepared by the Inter- ministerial committee for international cooperation and development (CICID), their strategic assistance areas for Tunisia are; 1) modernization of industries and strengthening of their competitiveness (including loan assistance for participants of modernization program, modernization of vocational training programs for manufacturing, tourism, and agricultural sectors, and infrastructure development), 2) improvement of living standard (urban development by mainly sewage improvement projects, and rural development through mainly water supply projects), and 3) sustainable environment (conservation of natural resources, conservation of energy resources).

I2.3. 3 Germany

The amount of loan assistant provided for Tunisia has been in an increasing tendency, and was between US$ 14 million and 25 million per year for the recent 5 years. In 2001, two priority areas for future cooperation were agreed between the German and the Tunisian Governments, namely: 1) Environmental protection and resource conservation, and 2) Economic development

"1) Environmental protection and resource conservation" includes; construction of landfill sites and sewage disposable plants, establishment of monitoring and control system for the hazardous waste area, provision of finance to private companies for air pollution control measures and also waste and recycling plants, and assistance for anti-erosion measures and enhancement of water catchments capacity through afforestation and encouraging the sustainable use of agricultural land.

"2) Economic development" includes; providing two-step loan for modernization measures for companies, provision of advice to a selected number of small and medium-sized enterprises

Additional priority areas of activity of financial cooperation in the past included rural development, especially with regard to irrigation farming and rural water supply.

I2.3. 4 Japan

The Japanese Government has been providing loan assistance mainly for irrigation, communication, transport, and water supply sectors. The total amount of loan assistance for Tunisia stood at 224 billion Japanese yen or about US$ 2 billion (as of the end of 2006). During the past 5 years, loan assistance for Tunisia was between US$ 65 million and 119 million per year.

According to the country assistance strategy for Tunisia announced by the Ministry of Foreign Affairs of Japan, following 6 issues were selected as the major problems to be addressed; 1) strengthen of competitiveness of industries, 2) water resource management/ development, 3) modernization of agriculture and fishery industries, 4) tourism sector development, 5) environmental conservation, and 6) alleviation of regional disparity.

Out of which, 1) strengthen of competitiveness of industries, 2) water resource management/ development, and 5) environmental conservation were selected as priority areas for Japanese assistance from mid to long term perspective.

"2) water resource management/ development" aims to provide not only water resource development project but also demand side management projects, and comprehensive water resource management projects with fully utilizing Japanese technologies and experiences on the fields.

On the other hand, according to terms and conditions of Japanese Yen loan effective as from October 1 2007, terms and conditions of yen loan for middle income countries (gross national income per capita of US$ 1,736 ~ 3,595 in 2006 price) and upper-middle income countries (US$ 3,596 ~ 6,275)[*3] are as follows;

[3] Ministry of foreign affairs of Japan adopted the same definition of thresholds of country class categorization as the World Bank's definition. Definition shown above is the latest available definition (2006).

Terms and Conditions of Japanese Yen Loan

			Interest Rate (%)	Repayment Period (years)	Grace Period (years)
Middle Income Countries (US$ 1,736 –3,595)	General Terms	Standard	1.40	25	7
		Option 1	0.95	20	6
		Option 2	0.80	15	5
	Preferential Terms	Standard	0.65	40	10
		Option 1	0.55	30	10
		Option 2	0.50	20	6
		Option 3	0.40	15	5
	STEP (Special Terms for Economic Partnership)	Standard	0.20	40	10
		Option 1	0.10	30	10
Upper-middle Income Countries (US$ 3,596 – 6,275)	General Terms	Standard	1,70	25	7
		Option 1	1.60	20	6
		Option 2	1.50	15	5
	Preferential Terms	Standard	1.20	25	7
		Option 1	1.00	20	6
		Option 2	0.60	15	5

Source: Japan Bank for International Corporation (effective from October 1, 2007)
Note: An interest rate for consulting services will be minimal (0.01%)
To strengthen the assistance for efforts to recover from emergent disasters, interest rates for projects for such recoveries will be minimal (0.01%), and repayment and grace periods will be 40 years and 10 years, respectively.

The gross national income (GNI) per capita of Tunisia was increased from US$ 2,090 in 2000 to US$ 2,970 in 2006. Accordingly, Tunisia will be classified into upper-middle income countries in the near future.

Sectors and fields of assistance for upper-middle income countries is in principal limited to environment, human resource development, anti-seismic measures and measures to reduce disparities in low-income regions. Here, “anti-seismic measures” includes disaster protection and recovery measures, which deems to include also a flood control project.

Although a flood control project is subject to loan assistance even in the future, terms and conditions of loan for upper-middle income countries are stricter than those for middle income countries. Thus, the Tunisian Government needs to consider strategic utilization of Japanese loan assistance before belonging to upper-middle income countries.

I2.4 Expected Funding Arrangements for the Project

I2.4.1 Capital Cost for River Improvement Works

The total capital cost of the flood control project through river improvement works proposed in the master plan study is about 554 million TND. Of which, zone D2 and zone U2, having higher priority for implementation, need capital costs of 134 million TND and 186 million TND, respectively. Annual funds requirements are expected to be varied from 22 to 44 million TND during construction period.

Since the river improvement works need sizable capital investment, it is hoping that part of the capital cost is covered by loan assistance from the donor agencies. On the other hand, as a result of general review on the assistance strategies as well as amounts of past loan assistance of the major donors, it is deemed that except for the French and the

Japanese Governments, sizable assistance for a flood control project cannot be expected.

Even if the Tunisian Government successfully receives loan assistance from international development agencies, the government generally needs to allocate about 20 ~ 30% of the capital cost (4 million ~ 13 million TND per year).

I2.4.2 Soft Components of Flood Control Project

The costs of soft components proposed in this master plan study, composed of strengthening flood control function of reservoirs, strengthening flood forecasting and warning system, organizational capacity development, strengthening evacuation and flood fighting system and flood plain regulation/management, is about 27 million TND in aggregate.

The soft components consist mainly of technical assistance activities, and thus need relatively smaller capital expenditure. Accordingly, the soft components are considered to be suitable for grant based technical cooperation projects.

I2.4. 3 Budget for Maintenance Activities

In order to properly maintain flood control function of and to achieve sustainable effects of the flood control project, adequate financing for maintenance cost will be required. Routine maintenance cost -such as cost for maintenance of civil structures, tree/grass cutting, sediment removal- for each zone is estimated to be 0.3 ~ 1.1 million TND per year. In addition, 0.01 ~ 1.8 million TND will be required for every 5 years as periodic maintenance costs in order to grub trees in and along the river channel.

Allocation of necessary budget should be made thorough recurrent budget of MARH and/or CRDAs of the governorate concerned.

Tables

Table I1.7.1 Calculation of Economic Internal Rate of Return (Whole Project)

(unit: 1,000 TND)

	Cost					Benefit					Net
	D1	D2	U1+M	U2	Total	D1	D2	U1+M	U2	Total	Benefit
2008	0	0	309	206	516	0	0	0	0	0	-516
2009	0	0	1,160	1,774	2,935	0	0	0	0	0	-2,935
2010	0	0	2,033	2,353	4,386	0	0	0	0	0	-4,386
2011	1,239	7,248	2,020	2,359	12,866	0	0	0	0	0	-12,866
2012	801	7,702	7,117	5,387	21,007	0	0	0	0	0	-21,007
2013	835	14,856	8,721	6,476	30,888	0	0	0	0	0	-30,888
2014	14	21,840	8,181	5,449	35,484	0	0	0	0	0	-35,484
2015	14	24,552	5,568	7,655	37,789	0	0	0	0	0	-37,789
2016	14	19,380	173	5,491	25,058	0	0	4,211	9,172	13,383	-11,675
2017	14	8,049	173	9,507	17,744	0	0	4,401	9,584	13,985	-3,758
2018	14	647	173	10,237	11,072	0	76,046	4,599	10,016	90,660	79,589
2019	14	647	173	18,565	19,399	0	79,468	4,806	10,466	94,740	75,341
2020	14	647	173	25,167	26,001	0	83,044	5,022	10,937	99,003	73,002
2021	14	647	173	25,036	25,870	0	86,781	5,248	11,430	103,458	77,589
2022	14	750	173	22,695	23,632	0	89,384	5,406	11,772	106,562	82,930
2023	1,242	647	173	18,607	20,669	0	92,066	5,568	12,126	109,759	89,090
2024	3,320	647	173	1,057	5,196	0	94,828	5,735	23,319	123,882	118,685
2025	13,235	647	173	1,057	15,111	0	97,673	5,907	24,019	127,598	112,487
2026	24,144	647	173	1,057	26,020	0	100,603	6,084	24,740	131,426	105,406
2027	23,280	750	1,510	1,057	26,598	0	103,621	6,266	25,482	135,369	108,771
2028	18,613	647	8,498	1,239	28,997	0	106,729	6,454	26,246	139,430	110,433
2029	578	647	13,092	1,057	15,374	31,067	109,931	6,648	27,034	174,680	159,306
2030	578	647	5,182	1,057	7,464	31,999	113,229	6,848	27,845	179,920	172,457
2031	578	647	321	1,057	2,603	32,959	116,626	9,200	28,680	187,465	184,862
2032	578	750	321	1,057	2,706	33,948	120,125	9,476	29,540	193,089	190,383
2033	691	647	321	1,239	2,898	34,966	123,729	9,760	30,427	198,882	195,984
2034	578	647	321	1,057	2,603	36,015	127,440	10,053	31,339	204,848	202,245
2035	578	647	330	1,057	2,612	37,096	131,264	10,355	32,279	210,993	208,382
2036	578	647	321	1,057	2,603	38,208	135,202	10,665	33,248	217,323	214,721
2037	578	750	321	1,057	2,706	39,355	139,258	10,985	34,245	223,843	221,137
2038	691	647	321	1,239	2,898	40,535	143,435	11,315	35,273	230,558	227,660
2039	578	647	321	1,057	2,603	41,751	147,738	11,654	36,331	237,475	234,872
2040	578	647	330	1,057	2,612	43,004	152,171	12,004	37,421	244,599	241,988
2041	578	647	321	1,057	2,603	44,294	156,736	12,364	38,543	251,937	249,335
2042	578	750	321	1,057	2,706	45,623	161,438	12,735	39,700	259,495	256,789
2043	691	647	321	1,239	2,898	46,992	166,281	13,117	40,891	267,280	264,382
2044	578	647	321	1,057	2,603	48,401	171,269	13,511	42,117	275,299	272,696
2045	578	647	330	1,057	2,612	49,853	176,407	13,916	43,381	283,558	280,946
2046	578	647	321	1,057	2,603	51,349	181,700	14,333	44,682	292,064	289,462
2047	578	750	321	1,057	2,706	52,889	187,151	14,763	46,023	300,826	298,120
2048	691	647	321	1,239	2,898	54,476	192,765	15,206	47,404	309,851	306,953
2049	578	647	321	1,057	2,603	56,110	198,548	15,663	48,826	319,147	316,544
2050	578	647	330	1,057	2,612	57,794	204,505	16,132	50,290	328,721	326,109
2051	578	647	321	1,057	2,603	59,527	210,640	16,616	51,799	338,583	335,980
2052	578	750	321	1,057	2,706	61,313	216,959	17,115	53,353	348,740	346,034
2053	691	647	321	1,239	2,898	63,153	223,468	17,628	54,954	359,202	356,304
2054	578	647	321	1,057	2,603	65,047	230,172	18,157	56,602	369,978	367,376
2055	578	647	330	1,057	2,612	66,999	237,077	18,702	58,300	381,078	378,466
2056	578	647	321	1,057	2,603	69,009	244,189	19,263	60,049	392,510	389,907
2057	578	750	321	1,057	2,706	71,079	251,515	19,841	61,851	404,285	401,579
2058	691	647	321	1,239	2,898	73,211	259,060	20,436	63,706	416,414	413,516
2059	578	647	321	1,057	2,603	75,408	266,832	21,049	65,618	428,906	426,304
2060	578	647	330	1,057	2,612	77,670	274,837	21,681	67,586	441,774	439,162
2061	578	647	321	1,057	2,603	80,000	283,082	22,331	69,614	455,027	452,424
2062	578	750	321	1,057	2,706	82,400	291,575	23,001	71,702	468,678	465,971
2063	691	647	321	1,239	2,898	84,872	300,322	23,691	73,853	482,738	479,840
2064	578	647	321	1,057	2,603	87,418	309,332	24,402	76,069	497,220	494,617
2065	578	647	330	1,057	2,612	90,041	318,611	25,134	78,351	512,137	509,525
2066	578	647	321	1,057	2,603	92,742	328,170	25,888	80,701	527,501	524,898
2067	578	750	321	1,057	2,706	95,524	338,015	26,664	83,122	543,326	540,620
2068	691	0	321	1,239	2,251	98,390	0	27,464	85,616	211,470	209,219
2069	578	0	321	1,057	1,956	101,342	0	28,288	88,184	217,814	215,859
2070	578	0	330	1,057	1,965	104,382	0	29,137	90,830	224,349	222,384
2071	578	0	321	1,057	1,956	107,513	0	30,011	93,555	231,079	229,123
2072	578	0	321	1,057	1,956	110,739	0	30,911	96,362	238,012	236,056
2073	691	0	321	1,239	2,251	114,061	0	31,839	99,252	245,152	242,901
2074	578	0	321	0	899	117,483	0	32,794	0	150,276	149,378
2075	578	0	330	0	908	121,007	0	33,778	0	154,785	153,877
2076	578	0	321	0	899	124,637	0	34,791	0	159,428	158,529
2077	578	0	321	0	899	128,376	0	35,835	0	164,211	163,312
2078	691	0	321	0	1,012	132,228	0	36,910	0	169,137	168,126
2079	0	0	321	0	321	0	0	38,017	0	38,017	37,696
2080	0	0	330	0	330	0	0	39,158	0	39,158	38,828

EIRR = 25.0%

Supporting Report J

ENVIRONMENTAL AND SOCIAL CONSIDERATION

THE STUDY
ON
INTEGRATED BASIN MANAGEMENT FOCUSED ON FLOOD CONTROL
IN
MEJERDA RIVER
IN
THE REPUBLIC OF TUNISIA

FINAL REPORT

Supporting Report J : Environmental and Social Considerations

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CHAPTER J1 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS IN TUNISIA

J1.1 Legal Framework of Environmental and Social Considerations

J1.1.1 General

Up to date at the national level, the existing legislations related to environmental management count numerous laws and decrees on the protection and conservation of natural resources. Major laws concerning the environment are listed in **Table J1.1.1**. Among these, different codes and decrees include land tenure system, disaster prevention, forest conservation, hunting, air, waste and water, mining, fishery, etc.

At the international level, Tunisia has signed several global, regional, bilateral and multilateral conventions, dealing with the protection of nature and species, maritime ecosystem and nuisances. Among these, the followings can be cited: Protection of World Cultural Heritage, Ramsar on wetlands, Biological diversity, Climatic change, UN Convention on sea rights, African Convention on nature and natural resources conservation, Convention on the cooperation for the protection and use of sea resources and the coastal area of the Mediterranean, Bâle Convention on toxic wastes and their disposal, International Convention on desertification, Vienna Convention on the protection of the Ozone layer, Montreal Agreement on substances affecting the Ozone layer, Bonn Convention on the conservation of migratory species of the wild fauna, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and many more.

Within the framework of international cooperation, much analysis has been done on environmental issues for Tunisia, most notably on issues of desertification and land degradation. Many actors are involved in assisting the country address a broad agenda of environmental challenges, namely, UNSO, UNDP, the Governments of Germany and France, the World Bank and IUCN.

J1.1.2 Legal Framework of Environmental Impact Assessment (EIA) Study in Tunisia

Following the promulgation of the law no.88-91 enacted in Aug. 2, 1991 creating the National Agency for Protection of the Environment (ANPE), the EIA study was introduced for industrial, agricultural and commercial projects.

This law was modified by the law no.14-2001 enacted in January 30, 2001, which includes the simplification of the administrative procedures related to the authorizations delivered by the ministry in charge of the environment.

The decree no.362-91 of March 31, 1991 regulating the procedures of the elaboration and approval of the impact study was modified by the decree no.1991-2005 of July 11, 2005, related to EIA studies, which specifies the facilities and/or projects subjected to such studies and the facilities and/or projects subjected to the Terms and Conditions procedure. The Terms and Conditions procedure fixes the environmental measures that a project

owner or petitioner must abide by.

The decree enacted by the Ministry of Environment and Sustainable Development (MEDD) in March 17, 2006 approved the Terms and Conditions procedure to be subjected to the facilities and/or projects listed in Appendix 2 of the decree no.1991-2005 of July 11, 2005.

A dam construction project is listed in Appendix 1 as Category B project (item no. 21); a canal construction project is listed in Appendix 2 as item no.3 (refer to **Annex J1.1.1**). Projects listed in Appendix 2 are considered not much disruptive of the environment and are simply subjected to the Terms and Conditions procedure. This procedure fixes the environmental measures that a project owner or petitioner must abide by. A "rough description" of the project is required in the procedure, which will allow the ANPE to have an idea on its potential harmful nature and require, if necessary, a full impact study or approve the project. An example of the document of the Terms and Conditions procedure for canal construction is shown in **Data J1**.

The construction of embankment and excavation of riverbed, which are structural measures proposed by this study, are not listed in any of the Appendices of the decree. Therefore, the said measure was confirmed with the ANPE, which suggested that no document is required for the above measure. In fact, it was informed to the JICA Study Team (the Team) that this type of installation or action is subjected neither to an EIA nor to the Terms and Conditions procedure. The ANPE would, however, wish to be involved at the time of selection of the alternatives for a matter of good guidance to the owner or the proponent of the project.

The following table summarizes the decree no.1991-2005 of July 11, 2005 and the categories of facilities and/or projects subjected to EIA study and those subjected to the Terms and Conditions procedure.

Category of Facilities and/or Projects subjected to EIA Study or to the Terms and Conditions Procedure

Category		Duty of EIA execution and Period of Examination	Items cited in the list as related to construction work for river improvement
Appendix 1	A	In case possibility of negative impact to environment is recognized, execution of EIA is necessary. Period of examination of EIA is 21 days. In case additional consideration is necessary, 3 months are required.	None
	B	In case possibility of negative impact to environment is recognized, execution of EIA is necessary. Period of examination of EIA is 3 months.	Construction of Big Dam
Appendix 2		Project outline report shall be submitted to the related agency (ANPE).	Construction of Canal

Source: the Study Team

J1.2 Environmental Aspect Pertaining to the Study Area and Neighbouring Areas

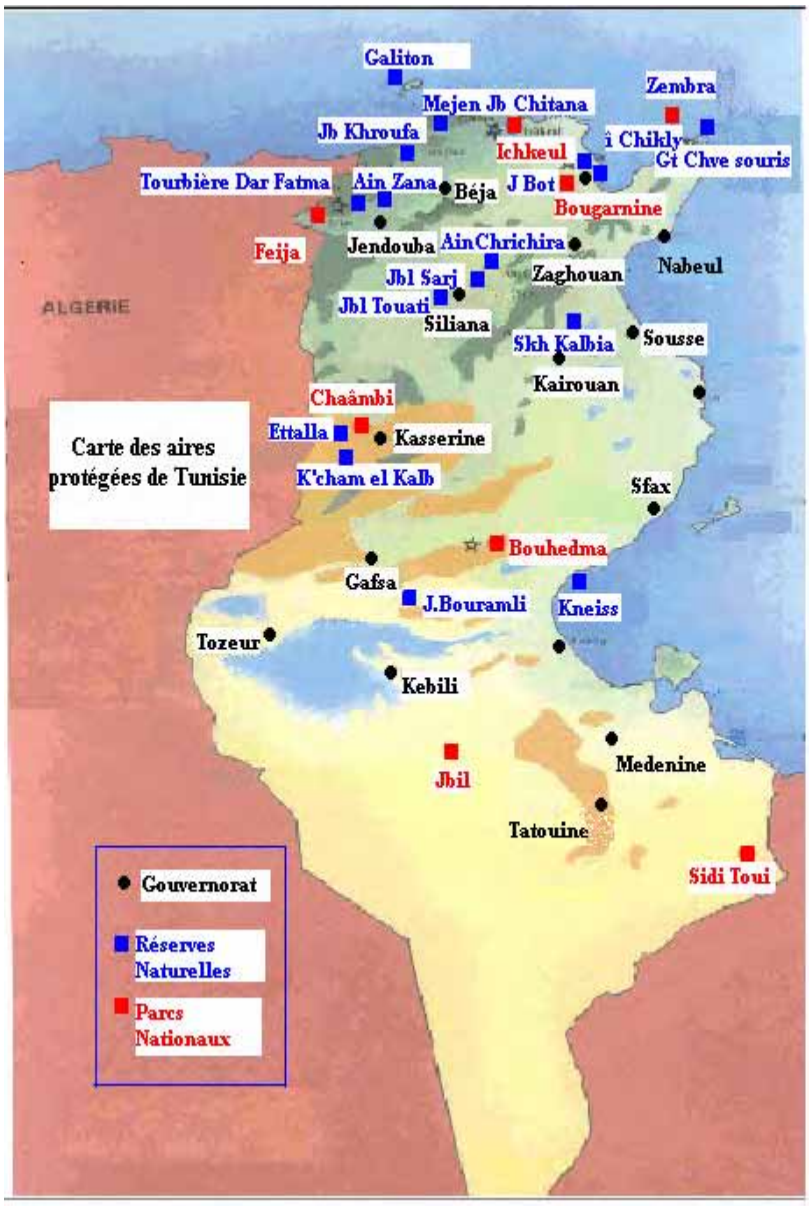
J1.2.1 National Parks, Natural Reserves, Forests and Protected Domains

According to the Forest Code "Law n°88-20 of April 13, 1988, one understands by:

- National park, a relatively wide territory which presents one or more ecosystems generally barely or not at all transformed by exploitation and human occupation, and where the vegetal and animal species, geomorphologic sites and habitats offer an special interest from the viewpoint of science, education, and recreation, or in which there exist natural landscapes of great aesthetic value.
- Natural Reserve, a site not very wide, having for goal the maintenance of the existence of individual species or groups of natural, animal or vegetal species and their habitat and the conservation of species of migrating fauna of national or international importance.

The creation of a National park is decided by decree, as well as the Natural Reserves, of the Minister in charge of Agriculture. Another ministerial decree fixes the measures to be taken at each site so as to ensure the conservation of its natural state. All the reserves and all the parks are created on the public forest domain.

There are presently eight (8) national parks and sixteen (16) natural reserves in Tunisia as illustrated in the following figure and table.



Source: MEDD

Map indicating the location of protected areas in Tunisia

Area occupied by National Parks and Natural Reserves

National Parks			Natural Reserves			Total		
Nber	% of total country area	Area (ha)	Nber	% of total country area	Area (ha)	Nber	% of total country area	Total area (ha)
8	1.23	201,752	16	0.1	16,136	24	1.33	217,888

Source: MEDD

Several of these sites represent an international interest and are listed in international conventions.

Out of these, one (1) national park namely «Feija » is located in the Mejerda River basin, which was designated in 1990 with an area of 2,632 ha. The Feija Park is located on the

left bank of the Mejerda River in the plateau dominating the basin at an altitude of 550-1150 m at a distance far away from the flood prone areas. The vegetal cover of the park is constituted with a mosaic of different vegetation formations which are rich in species and diversified in structures.

Among the forest tree species, one can cite the green Oak (Quercus faginea or Quercus canariensis) and cork Oak (Quercus suber). There are various small tree species such as the arbutus (Arbutus unedo) and the myrtle (Myrtus communist) and some endangered species such as the holly (IIex aquifolium) and bay (Laurus nobilis) trees. The park also gives shelter to great many species of animals, some of which are endemic to North Africa. The protected and endangered species are mentioned in the table below.

Protected and Endangered Species at Feija National Park

Item	Protected species	Endangered species
Birds	34	-
Mammals	16	10
Amphibia	4	4

Source: Country Profile on Environment, Tunisia, Feb 2002, JICA

The park seems to be secured from big floods of the Mejerda River considering its distance from that river and its high elevation. However, forest fires and land slide need to be closely monitored to avoid reduction of the forest tree resources here, which could cause land degradation and increased sedimentation in Mejerda River due to runoff, considering the steep slopes observed in this area.

Another national park of environmental concern in the area is the National Park of Ichkeul. This park is not located in the immediate neighbourhood of the study area, but its important value made it earn a registration in three (3) international conventions: World Heritage of UNESCO, Reserve of the Biosphere (UNESCO, 1977), and Ramsar Convention. It was listed as a national park in 1980. It is located 75 km to the north of Tunis and covers an area of 12,600 ha with three landscapes components: Ichkeul Lake (area about 90 km^2), wetlands (30 km^2) and a limestone mountain (height of 511m).

The lake is supplied with fresh water by a catchment area of 2,080 km^2 and is connected to the sea via Bizerte Lake through the Tinja canal (5 km in length). The ecological interest of the park lies in its being a habitat for water birds coming for wintering from the countries of the North. It is famous for its plants species; namely the water beet, Potamogeton pectinatus, (growing in salt and fresh water), which constitutes a good feed for the birds.

The salinity of the lake can be 40 g/l toward the end of summer and 10 g/l at the end of spring. Its ecological richness provides shelter to 229 different animal species, including fishes mainly mullets and eels, and 550 plants species.

The wetlands or swamps cover 3,000 ha and are the largest in Maghreb, providing habitat to migrating birds and water buffalos.

The mountain presents a rich grass cover with predominant rain-fed olive trees and millet. It also provides shelter to numerous bird species.

The National Park of Ichkeul is the main component of a major program to mobilize water resources from the extreme north of Tunisia, including water from the Mejerda River, for drinking water supply to Tunis and other coastal cities, as well as for agricultural purposes. Accordingly, the program comprises the construction of six (6) dams, of which three (3) are already in operation: Joumine (1983), Ghazala (1984) and Sajnene (1994). The water structures constructed have contributed in resolving the problems after they have been a source of the ecological misbalance experience by the ecosystems of the lake during the 1990's.

In the framework of this study centered in flood control, Ichkeul seems not to be greatly affected; being guaranteed an equal annual water quota as the other 2 users of the Extreme North waters, namely cities potable water and irrigation.

The concerns for Ichkeul would rather come from populations living around it as their poor agricultural practices may in the long run drastically affect water quality through the uncontrolled use of fertilizers and agrochemicals and also contribute in sedimentation due to the lack of terraces in the sloping mountainous cropping areas. Such concerns are already being voiced at the ministry in charge of environment where it is said that Ichkeul Lake is endangered by sediments and illegal pesticides used by the riparians.

Concerning other forests areas and protected domains in the study area, none apart the Feija National Park is listed. However, Jendouba Governorate is famous for the importance of its forest resources, namely around Ain Draham and Tabarka where important forests and protected domains exist. In these areas, land reclamation, grazing, and illegal deforestation have brought about decrease of forest resources, erosion and destruction of the vegetation. Special attention should be paid to this, as one knows that sedimentation has greatly decreased the flow capacity of the Mejerda River and is said to contribute greatly to the flood observed these last few years.

It is observed that sedimentation in the Mejerda River comes mainly from the right bank where there are fewer forests than the left bank. Our field trip has confirmed that sedimentation in northern dams such as Sejnene, located in the left bank, is still at a normal level as a result of the presence of more forests and the lack of inhabitants there.

J1.2.2 Endangered Species of Flora and Fauna and Indigenous People

From the reports collected from the ministry in charge of environment, one can note that among the 870 species of plants in North Africa, which are rare, endangered or endemic, about 150 are in Tunisia. Also, there are presently about 80 species of mammals, 362 birds' species and more than 500 species of reptiles and fishes identified by IUCN in the country. All the big mammals, except the wild boars, are considered as endangered.

Endangered species of flora and fauna are not however confirmed in the flood plain and irrigable areas of the Mejerda River basin. Indigenous people are also not confirmed in this basin.

J1.2.3 Historical Remains and Archaeological Sites

In the study area there are no historical remains or archaeological sites listed as a World Heritage, but several bridges of cultural assets exist along the Mejerda River, namely at Medjes el Bab (Beja), Jedeida (Manouba) and at Bizerte. It is thought that the narrow cross sections of these bridges contributed to the floods in 2003. Through additional survey with the populations of these localities and with the Ministry of Culture, the importance of these assets in considering the flood protection measures was confirmed.

In Jendouba governorate, the vestiges of an old roman city famous for its marble quarry in the antiquities were found at Chemtou, which is located between Jendouba city and Oued Mliz (22 km). Also an important archaeological site of an important city with well conserved ruins was found at Bulla Regia, between Jendouba and Fernana (6 km). There are also some archeological ruins discovered in Utique in Bizerte Governorate (15 km). All of these sites are far away from the Mejerda River basin.

J1.3 Protective Measures for Conservation of Environment

J1.3.1 Protection of the Main Forest Areas

Several protected forests are observed in the study area and its neighbouring areas. The role played by these forests is very important for preservation of the environment, conservation of water resources and for firewood. In the formulation of the master plan, the preservation of these protected forests should be taken into consideration in the selection of flood control measures and the promotion of sustainable development.

J1.3.2 Protection of Main Species of Fauna and Flora

Though an exhaustive study of fauna and flora was not carried out along the Mejerda River basin, it is confirmed by the Team that several fish species were introduced in the reservoirs of many dams that were built over the years. It is therefore evident that several fish species are living in the Mejerda River and the Sidi Salem Reservoir. Among these, one can cite the berbel (Barbus callensis), which is endemic in North Africa, the common Tilapia (Cyprinus carpis), several species of mullets and the catfish. Conserving these fish species for fishing activity of the riparians is important as many live off such activity. A minimum water flow is necessary in the Mejerda River, as well as a minimum water quality for the fish populations.

J1.3.3 Protection of Soil against Erosion

The cropping areas located in the flood plain of the Mejerda River are considered as relatively posing fewer problems than those in the plateau, which are generally located on hillside. Soil protection ought to be an important problem to be considered on projects dealing with cultivable land development and implementation of good cultural practices. It is recommended to plant trees where dams or structural measures are implemented in order to avoid soil sedimentation caused by erosion.

J1.3.4 Protection of Soil against Excessive Use of Agrochemicals

The introduction of modern cultural practices will replace the traditional system of slash

and burn cultivation, which is proven to damage the environment. The contamination of soil through the over-use of agrochemicals could affect the quality of water in the river. Therefore, in order to protect the environment, it would be desirable to use fairly effective and recommendable products, which would allow using them at a minimum rate.

J1.3.5 Steady Flow of Mejerda River

The river water is used for domestic purposes in the urban and rural areas, as well as for agriculture and industry. To maintain a steady level of water in the river is also important for fishes and animals. As a result, it would be good to maintain a minimum water level in the river.

CHAPTER J2 JICA GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

JICA introduced new guidelines for environmental and social considerations in April 2004 and required that cooperation projects considered by the agency for clearance must follow the new guidelines in line with laws, ordinances and standards relating to environmental and social considerations established by the recipient governments that have jurisdiction over the project site. What follows gives an essence of the guidelines for an understanding of their contents and for ensuring environmental and social considerations when implementing projects.

J2.1 Basic Policy

In line with the principles of human rights and good governance, the measures for environmental and social considerations are implemented by involving a meaningful participation of the stakeholders concerned and by ensuring efficiency and transparency in decision-making through information disclosure. The governments bear responsibility for accountability and at the same time stakeholders are also responsible for their comments.

Under the above views, JICA considers the environmental and social impacts when implementing cooperation projects.

J2.2 Definitions

(1) "Environmental and social considerations" means considering environmental impacts on air, water, soil, ecosystem, fauna and flora as well as social impacts including involuntary resettlement and respect for human rights of indigenous people and so on.

(2) "Environmental impact assessment (EIA)" means evaluating environmental and social impacts that projects are likely to have, analyzing alternative plans and preparing adequate mitigation measures and monitoring plans in accordance with laws or guidelines of the recipient governments.

(3) "Strategic environmental assessment (SEA)" means an assessment being implemented at the policy, planning and program level rather than a project-level EIA.

(4) "Screening" means deciding whether proposed projects are likely to have impacts that should be assessed by conducting environmental and social considerations studies according to project description and site description.

(5) "Scoping" means deciding alternatives to be analyzed, a range of significant and likely significant impacts, and study methods.

(6) "Local stakeholders" means affected individuals or groups including squatters and local NGOs, and "stakeholders" means individuals or groups who have views about cooperation projects, including local stakeholders.

(7) "Environmental Impact Assessment (EIA) level study" means a study including analysis of alternative plans, prediction and assessment of environmental impacts, and preparation of mitigation measures and monitoring plans on the basis of detailed field surveys.

(8) "Initial Environmental Examination (IEE) level study" means a study including analysis of alternative plans, prediction and assessment of environmental impacts, and preparation of mitigation measures and monitoring plans on the basis of secondary data and simple field surveys.

J2.3 Basic Principles

JICA recognizes the following seven principles to be very important for ensuring environmental and social considerations.

(1) A wide range of impacts to be addressed is covered. The types of impacts addressed by JICA cover a wide range of the environmental and social impacts.

(2) Measures for environmental and social considerations are implemented at an early stage. JICA introduces the concept of Strategic Environmental Assessment (SEA) when conducting Master Plan studies, etc., and works with the recipient governments to address a wide range of environmental and social factors from an early stage. JICA makes an effort to include an analysis of alternatives on such occasions.

(3) Follow-up activities are carried out after cooperation projects are terminated. JICA asks the recipient governments to incorporate the outcome of environmental and social considerations in the implementation of projects after cooperation is terminated. JICA offers cooperation projects in accordance with other requests, when necessary.

(4) JICA is responsible for accountability when implementing cooperation projects. JICA pays attention to accountability and transparency when implementing cooperation projects.

(5) JICA asks stakeholders for their participation. JICA incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations, and JICA ensures the meaningful participation of stakeholders in order to take consideration of environmental and social factors and to reach a consensus accordingly. Stakeholders participating in meetings are responsible for what they say.

(6) JICA discloses information. JICA itself discloses information on environmental and social considerations in collaboration with the recipient governments, in order to ensure accountability and to promote participation of various stakeholders.

(7) JICA enhances organizational capacity. JICA makes an effort to enhance the comprehensive capacity of organizations and operations to consider environmental and social factors appropriately and effectively at all times.

J2.4 Requirements of the Recipient Governments

(1) The recipient governments are required to incorporate the outcome of environmental and social considerations studies into their planning and decision-making process once they receive authorization for a project's implementation.

(2) When JICA considers either the selection of proposed projects or the support for an examination of environmental and social considerations, JICA examines how the recipient governments meet the requirements of JICA

(3) Various documents prepared through the EIA process and reports (EIA documents) must be written in official languages or in languages familiar to people within the host countries. Documents written in understandable languages and forms destined to local people must be prepared and explained to them.

(4) It is requested that EIA documents be made open to local stakeholders including local people. In addition, EIA documents should be available for public reading at all times, and the making of copies of these for the local stakeholders should be permitted.

J2.5 Procedures of Environmental and Social Considerations

Projects considered by JICA for clearance should follow the guidelines for environmental and social considerations. According to the guidelines, projects are "screened" and categorized into three based on the extent of environmental and social impacts. The categorization takes into consideration the outline of the project, the scale, the site condition, and the environmental impact assessment scheme in the host country. The categories are:

(1) Category A

Projects which are likely to cause significant adverse, complicated, unprecedented impacts which are difficult to assess, irreversible, and wide range of impacts on the environment and society, fall into this category.

Projects requiring a detailed environmental impact assessment by environmental laws and standards of the recipient governments also belong to Category A. Category A also includes in principle projects in sensitive areas (i.e., characteristics that are liable to cause adverse environmental impacts) and projects located in or near sensitive areas.

(2) Category B

Projects under this category are liable to cause less adverse impacts on the environment and society than Category A projects and are generally site-specific. Most are not irreversible and in general normal mitigation measures are adequate.

(3) Category C

These projects are likely to have only minimal or little adverse impacts on the

environment and society.

(4) Requirements

The Study on Integrated Basin Management Focused on Flood Control in Mejerda River in the Republic of Tunisia (the Study) is categorized as a Category B project.

JICA Guidelines require that projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the host country. Since the Tunisian government has its own EIA system, the proposed projects will be subjected to an approval by the ANPE before implementation. Our personal conversation with this Agency has confirmed that because projects considered in the Study serve to protect people and infrastructure against flood damage, they would be most likely not disruptive of the environment and would be simply subjected to the Terms and Conditions procedure (referred to as " Cahier des Charges" in French), which fixes the environmental measures that a project owner or petitioner must abide by. In this case, a "rough description" or an IEE-level environmental and social considerations study of the projects is required in the procedure, and would be enough to allow the ANPE to have an idea on the projects potential harmful nature and require, if necessary, a full impact study or approve them.

The IEE document is also to be submitted to JICA for review, seeing to what extent the environmental and social considerations have been taken into account in the Study.

CHAPTER J3 TOOLS OF STRATEGIC ENVIRONMENTAL ASSESSMENT IN THIS STUDY

J3.1 Interview Survey on Public Acceptance of Flood Risk

J3.1.1 Purpose

As part of public involvement in the early stages of the decision making process, a survey on residents' acceptance of flood risk was undertaken in this field work of the Study on Integrated Basin Management Focused on Flood Control in Majerda River (the Study). The survey is based on a detailed questionnaire designed for localities along the Mejerda River that have experienced flood damages. The 2003 flood is taken as a reference because it is still vivid in people memory, and caused more damage in recent time. The questionnaire is designed to grasp the views and opinions of the populations on the flood risk in the Mejerda River basin. It is to help measure people perception on flood danger so as to find out whether they can live with flood or how afraid of it they are. In countries such as Indonesia in Asia, people are very afraid of floods because they may occur every year and cause a lot of damage. Therefore, people in Asia (Indonesia, Bangladesh or Thailand) may be more motivated; participating in flood protection activity because flood occurs frequently. In Africa, it may be a different feeling because people may experience flood very rarely and are not therefore afraid of it so much. They may not be willing to participate in structural measures or be responsible enough for them.

That is why the survey wants to make sure about people perception of flood risk so that one can plan adequately the necessary measures for protection. The results are to be used as information for decision making process for the plan formulation, especially to determine the level of flood risk to be applied to the flood control plan for the Mejerda River basin.

(1) Items of the questionnaire

The detailed questionnaire is shown in **Annex J3.1.1**. It includes questions on general data as related to location and social profile of the respondent and several detailed questions measuring the respondent perception on flood risk, which are itemized as follows:

1) General data (Question 1 to Question 3)
2) Social profile of the respondent (Question 4)
3) Experience and Type of flood damage (Question 5)
4) Fear of flood (Question 6)
5) Perception of flood risk (Question 7)
6) Acceptability of flood damage risk (Question 8)
7) Structural measures for reducing flood damage (Question 9)
8) Non structural measures for reducing flood damage (Question 10)
9) Reliance on government for reducing flood damage (Question 11)
10) Appreciation of self-responsibility to flood damage risk (Question 12)

11) Priority to structural and non structural measures to flood damage risk (Question 13).

Some items of interest in the questionnaire deal particularly with:

1) The acceptability of flood damage risk to help one adequately plan the level of flood risk to be applied to the flood control plan for the Mejerda River basin.
2) The appreciation of self-responsibility to flood damage risk to measure the willingness of people to participate in flood control measures or be responsible enough for them and to plan adequately for measures to raise the level of awareness of self-responsibility, if needed
3) The level of reliance on agencies concerned with flood control as these agencies alone cannot solve all the problems related to especially rare flood events. All parties concerned should play their designated roles in order to mitigate flood risk and damage. Proper measures involving capacity building of parties concerned and good coordination work should be planned for effective control of the damage due to these rare flood events such as those in 2003.

J3.1.2 Sample Survey

The Survey was based on a sample reasoned by quota. This type of sample is generally used in the studies of planning to obtain data valid for the programming. It is distinguished from the other types of sampling by its flexibility with the execution and its cost relatively low. It is based on quotas determined in advance, and which take account of the diversity of the social groups to investigate (farmers, residents, tradesmen, craftsmen, employees, etc).

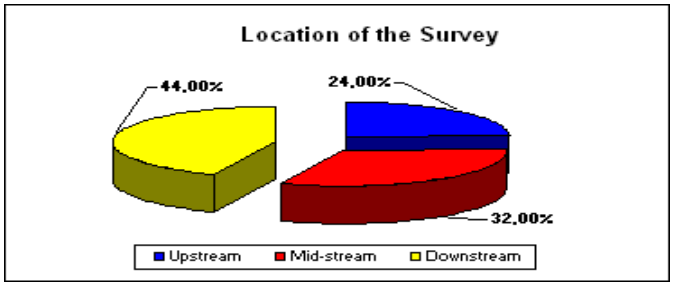
The sample survey consists of 400 persons residing in the localities belonging to the three sectors of the Mejerda River (upstream, mid-stream and downstream stretches). Twenty four (24) localities were surveyed. In each locality, 16 persons were surveyed.

The really surveyed sample is distributed between the 3 sectors of the valley of the Mejerda River, as the table indicates it below.

Location of the survey in the Mejerda River Basin

Type	Respondents	%
Upstream	96	24.00
Mid-stream	128	32.00
Downstream	176	44.00
Total	**400**	**100**

Question: 1.a



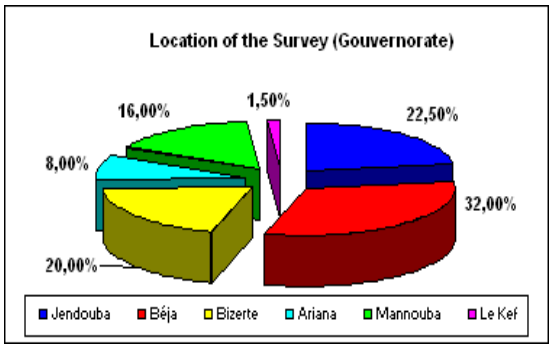
The downstream is the most important in a number of localities; this is why the Survey accounted for 44% of the sample there.

The distribution by governorate is presented by the following table and graph:

Location of the Survey (Governorate)

Governorate	Respondents	%
Jendouba	90	22.50
Béja	128	32.00
Bizerte	80	20.00
Ariana	32	8.00
Mannouba	64	16.00
Le Kef	6	1.50
Total	**400**	**100**

Question: 1.b



It is the governorate of Beja which is the most important (32%) because it counts 8 localities.

J3.1.3 Social Profile of Surveyed Persons

The surveyed people are divided into:

- 329 men: 82%
- 71 women: 18%

The age of surveyed people varies from less than 30 years to 70 years and more, but the most important age is that ranging between 41 and 60 years; it accounts for 53%.

The average age of surveyed people is 49.6 years

It is a relatively old population (see the table hereafter).

Group of age

Group of age	Respondents	%
Lower than 30 years	24	6.00
31 to 40 years	86	21.50
41 to 50 years	116	29.00
51 to 60 years	96	24.00
60 years and more	78	19.50
Total	**400**	**100**
Average age of surveyed persons	**49.6**	*Question: 4.5.b*

The surveyed people are distributed on several social categories that were affected by the floods:

- Residents
- Tradesmen, industrialists and craftsmen
- Farmers and stockbreeders
- Men of education and health and government employees

Status / Occupation

Status/Occupation	Respondents	%
Chief of locality	25	6.25
Residents	108	27.00
Traders (various)	23	5.75
Craftsmen/Industrials	27	6.75
Farmers/Stockbreeders	156	39.00
Education Staff	27	6.75
Health Staff	14	3.50
Government Staff	20	5.00
Total	**400**	**100**

Question: 4.6

The table above shows the distribution of the persons surveyed by category. It appears that the farmers represent the relative majority (39%), followed by the residents (27%); the other categories are represented in a proportion varying from 3 to 7%.

The surveyed families are rather broad, with an average by family of 5.7 people.

They are divided into 3 categories of family:

- Families with children: 73.5%
- Families without children: 2.5%
- Widened families (traditional): 24.0%

The surveyed people live at a distance which varies from 10 m to more than 3,000 m from the nearest river; but those who live at a distance less than 200 m represent nearly 40%; and those who live at a distance ranging between 200 to 1000 m account for 47%; those which live at a distance greater than 1 km account for only 13% on the whole (see the table hereafter)

Distance from the nearest river

Distance	Respondents	%
Lower than 50 m	68	17.00
51 to 100 m	43	10.75
101 to 200 m	44	11.00
201 to 500 m	85	21.25
501 to 1000 m	104	26.00
1001 to 1500 m	11	2.75
1501 to 2000 m	30	7.50
2001 to 2500 m	5	1.25
2501 to 3000 m	7	1.75
Higher than 3000 m	3	0.75
Total	**400**	**100**
Average distance (in m)	**650**	*Question: 4.9.b*

Detailed analysis of some items of interest of the interview survey results are discussed below.

J3.1.4 Achievements of the Interview Survey

(1) Items of discussion

Detailed analysis for Question 8 of the interview survey:" Acceptability of flood damage risk", Question 11:"Reliance on government for reducing flood damage" and Question 12: "Appreciation of self-responsibility to flood damage risk" will be presented here as they represent special interest for the Team to understand the general tendency of people opinions and reactions related to these items which will be of value in the planning process. The analysis of the remaining questions of the interview survey will be summarized in "(5) Summary and Conclusions" in Subsection J3.1.4 along with the above mentioned items of interest. These remaining questions include: 1) the experience of flood damage; 2) the type of damage; 3) the relief from the government; 4) the fear of flood; 5) the perception of flood risk; 6) the structural and non structural measures for reducing flood damage and their priority as to measures for reducing flood damage risk.

(2) Acceptability of flood damage risk

Questioned if they can cohabit with a level of risk due to the future floods, 77.5% of the questioned people reject this possibility, considering that the tolerance level is reduced to 0 flood.

However, a rather important minority of 22.5% thinks that it can live with a minimum of risk due to the floods to come.

The number of tolerable floods for them is 1 time per year (3% of the cases), 1 time every two years (3%), once every 5 to 20 years (8%) and 8.5% only once in more than 20 years.

It is foreseeable within sight of these results that the acceptability of the risks of the floods is very low. The fear of the floods and the risks which they generate is dominant (see the table hereafter).

Frequency of Tolerable Floods

Frequency	Answers	%
None	310	77.50
Once in every year	12	3.00
Once in 2 years	12	3.00
Once in 5 years	6	1.50
Once in 10 years	13	3.25
Once in 20 years	13	3.25
Once in more than 20 years	34	8.50
Total	**400**	**100**

Question: 8.1

The inundation depth tolerable in houses and the cultivated lands should not exceed 0.2 m (max) (62% of the cases); it could reach 0.3 m to 0.5 m (max) for 38% of the remaining cases.

The period of tolerable flood should not exceed in the worst case the 3 days (97% of the

cases).

For the tolerable damage, they should not exceed the 400 TND for 89% of the questioned cases.

(3) Reliance on government for reducing flood damage

Questioned if the government will take necessary measures to protect the population during the future floods, 58.5% believe that it will take them, while 37.25% are not persuaded of it and 4.25% are undecided and do not have a clear idea (see the table hereafter).

The Government and Necessary Measures for Flood Protection

Choices	Answers	%
The Government will take necessary measures	234	58.50
The Government will not take necessary measures	149	37.25
No idea	17	4.25
Total	**400**	**100**

Question: 11.1

The great majority of those who estimate that the Government will not take necessary measures allot this failure to the budgetary constraints of the Government which does not find the funds necessary to take such measures.

A small minority (8%) thinks that the Government does not understand the necessity for such measures and an even smaller minority believes that it has other priorities (see the table hereafter).

Reasons for the Government's Failure in Taking Necessary Measures

Reasons	Answers	%
Seems not to understand necessity	12	8.05
Budgetary constraints	131	87.92
It has other priorities	3	2.01
Others	3	2.01
Total	**149**	**100**

Question: 11.2

Questioned if the structural and non-structural measures shown in the interview survey are in harmony with the expectations of the population, about two thirds of the surveyed people answer in affirmative (64%), while the remaining 1/3 (33.75%) think that they are not in harmony with their expectations (see the table hereafter).

Measures and Expectations of the Population

Choices	Answers	%
In harmony	256	64.00
Not in harmony	135	33.75
No idea	9	2.25
Total	**400**	**100**

Question: 11.3

Questioned on the supplementary measures that they propose, the questioned people insisted in particular on a better monitoring of the level of water in the dams which should be released in a timely and planned manner, avoiding the combined effects with strong precipitations (51.1% of the cases); others estimate that people would have to be helped to move far from the river (7.4%) or people would have to be better helped to evacuate their houses and lands at the time of floods (see the table hereafter).

Supplementary Measures to be Envisaged

Measures	Answers	%
Help for evacuation	9	6.67
Supervising the dams	69	51.11
Concrete protection	4	2.96
No idea	43	31.85
House/land far from oued	10	7.41
Total	**135**	**100**

Question: 11.4

Nevertheless, a very important minority (31. 9%) expresses its dissatisfaction of the measures suggested but cannot specify alternative measures

Questioned if people are awaiting the assistance of the Government to face future floods, almost the totality of the questioned people, except for 10 people (2.5%), answer in the affirmative, which means that people have much hope on the Government, although they do not have completely confidence in its firm decision to take necessary measures at the appropriate time, as that appears above (see the table hereafter).

Expectation of Relief from the Government

Expectation	Answers	%
Expect a relief	390	97.50
Do not expect	10	2.50
Total	**400**	**100**

Question: 11.5

People expected especially money to compensate for their losses (28% of the questioned cases), food, clothing and mobilization of support staff.

The large majority of the questioned people (77.4%) do not want to evaluate now how much money would be necessary for compensation; they estimate that they can evaluate it based upon only the real damage recorded at the future floods.

(4) Appreciation of self-responsibility to flood damage risk

Questioned if people have to assume a share of responsibility due to the dangers of the future floods, surveyed persons are divided in two almost equal parts: 51.3% are laid out to assume the self-responsibility and 47% do not want to assume it. (see the table hereafter)

Self-responsibility to Flood Damage Risk

Self-responsibility	Answers	%
Share the responsibility	205	51.25
Do not share the responsibility	188	47.00
No idea	7	1.75
Total	**400**	**100**

Question: 12.1

As to what are the reasons of the refusal to assume the self-responsibility, more than half of the people concerned with this question estimate that the management of the floods and their damage concerns strictly the government and not the individuals (51.6%), while 44.7% estimate that the individuals cannot do anything against the phenomenon of the floods. A very small minority of 3.7% considers that the floods do not disturb them. (See table hereafter)

The reasons for refusal of self responsibility

Reasons	Answers	%
Responsibility lies with government	97	51,60
Do not mind having inundation	7	3,72
Cannot do anything against inundation	84	44,68
Total	**188**	**100**

Question: 12.2

A to what are the measures that the people who are willing to assume responsibilities will take, the measure most important to take is to raise the level of house so as to be able to take refuge there at the time of flood (36.3% of the cases), more than 24% are laid out to shelter the family from flood disaster and more than 12% are voluntary to contribute to the construction of levees.

About cultivated lands, an important proportion among the people concerned will make the decision to cultivate outside the flooding periods, while another minority rather important will contribute to the construction of levees around the cultivated lands.

As to What is the amount of money that the people who are willing to assume the self-responsibility during the future floods are laid out to pay, the great majority do not want to come to a conclusion about the amount which they agree to pay (60.5%) and estimate that they will make the decision later at the time of the advent of floods, 16.6% are laid out to pay 100 DT, 8.8% less than 100 Dinars and nearly 9% are laid out to pay 500 Dinars and more (see the table hereafter).

Willingness to Pay and Amount

Amount (TND)	Answers	%
0 Dinar	10	4,88
That depends on the possibilities	124	60,49
Less than 100 DT	18	8,78
100 Dinars	34	16,59
500 Dinars	10	4,88
1000 Dinars	7	3,41
2000 Dinars	2	0,98
More than 2000 DT	0	0,00
Total	**205**	**100**

Question: 12.4

(5) Summary and conclusions

The survey on the acceptance of flood risk was carried out in the Mejerda River basin (upper, middle and lower) with 400 sampled respondents.

1) The people affected by the 2003 flood represent 90% of the people surveyed, and those who have experience of other floods, apart from those of 2003, account for 55% of the sample.
   The principal floods they knew, apart from 2003, are those of 1973 and 2004.
   More than 40% of the surveyed people knew only one flood and more than 50% knew 2 to 3 floods
2) The undergone damage is characterized by the rise of water to unusual heights.
   The inundation depth exceeded 50cm in at least 70% of the cases.
   The duration of the flood was rather long, in particular in 2003 and to a lesser extent in 1973; indeed, the duration of flood longer than 10 days was encountered by 60% of the respondents in 2003 and by 40% of them in 1973.
   The known damage was especially high in 2003, since the damage higher than TND4,000 accounted for 47% of the cases of damage undergone against 45% in 1973
3) The government provided assistance to the victims of the floods; this help was varied, it included compensations in money for the undergone damage but also food, clothing and the mobilization of support staff; however, the surveyed people, in their great majority estimate that this help is insufficient and does not satisfy them because it does not cover the totality of the damage which they suffered.
4) Almost the totality of the surveyed people, except for 3 people, has declared frightened by the return of the floods. The imperative reasons of this fear are especially explained by fear that necessary measures are not taken to protect them.

Fears relate to the destruction of the property, the destruction of the houses and the losses in human lives.
   This fear results in the largely widespread belief (more than 84% of the cases) that serious floods are foreseeable in the future.

5) Indeed, 88.3% of the surveyed people believe that there will be risks in future floods. Only a small minority of 5% feels quiet because it is persuaded that necessary

measures are taken to face the future floods.

Questioned on the causes of the risks of floods to come, the surveyed people are especially worried because they are in the fear that necessary measures are not taken (40.7% of the questioned cases) or because there are many houses and cultivated lands in the lower areas.

People tend to in general believe that the next flood will be more catastrophic, considering necessary measures are not taken.

6) Questioned if they can cohabit with a certain level of risk, the great majority of the questioned people reject this possibility, considering that the tolerance level is equal to zero flood. However, a minority of more than 20% thinks that it can live with a minimum of risk.

   Thus, the acceptability of the risks of floods is very low. The fear of flood and the risks which they generate is dominant in the population.

7) People know the majority of structural measures, in particular improvement of riverbeds, dams and levees. However, they know much less about a retarding basin.

   In their great majority, they believe that these measures should be applied.

   The minority which does not believe in this need considers that it was not convinced of the effects of these measures in the past.

   Those who believe on the contrary in the need for these measures want to live in safety, to reduce the damage and to preserve their sources of income.

8) People know well some non-structural measures and less better some others. They know more about alarm systems and to a lesser extent about the lawful control of land use. They know much less about the systems of fighting against floods with participation of population and an insurance flood system.

   An important majority slightly higher than that for the structural measures considers that it is necessary to apply non-structural measures, while a minority of 23% does not see the need of it, convinced of their low effectiveness.

9) Questioned if the Government will take necessary measures to protect the population during future floods, a simple majority believes that it will take them, while nearly 40% are not persuaded of it. They are persuaded that the Government has budgetary constraints which prevent it from taking such measures.

10) Structural and non structural measures shown in the survey are in harmony with the expectation of two thirds of the surveyed people, while the remaining 1/3 estimate that they are not completely in harmony with their expectations and propose supplementary measures, in particular a better monitoring of reservoir water level and a better help of evacuation.

11) People are relying much on the assistance of the Government; this means that they have high hopes on the Government, although they do not have complete confidence in its firm decision to take necessary measures at the appropriate time.

12) Half of people surveyed are laid out to assume a share of responsibility with respect to the dangers of future floods, while about the other half is not laid out yet to assume this responsibility

    As to what are the reasons for refusal to assume the self-responsibility, more than half

of people estimate that the management of floods concerns the Government strictly, while the others estimate that the individuals cannot do anything against the phenomenon of floods.

The great majority do not want to come to a conclusion about the amount of money which they agree to pay and estimate that they will make the decision at the time of the advent of flood and a minority is laid out to pay less than 100 DT; another minority more than 100 Dinars.

13) Concerning structural measures to apply, the surveyed people gave the absolute priority to the improvement of riverbeds and the construction of farm roads to avoid being surrounded in the event of floods; they also estimate that the establishment of rules of more rigorous management at the reservoir water level is desirable.
14) Concerning non-structural measures, the surveyed people give the priority to the regulation which would prohibit constructions in low zones to escape the dangers from the floods; they are also persuaded of the importance of the alarm systems for the evacuation at the time of the floods.

People do not seem to be familiar with hazard maps, houses resistant to floods, systems of flood fighting with community participation and especially a flood insurance system.

J3.2 First Stakeholders' Meetings

J3.2.1 Achievements of the First Stakeholders' Meetings

(1) Presentation

In line with the JICA's position on "Strategic Environmental Assessment" and the JICA's Guidelines for Environmental and Social Considerations, public participation is promoted in early part of decision making process since the opinions of inhabitants should be heard and taken into account in the plan formulation. Within the framework of the Study, the DGBGTH and the Team organized public consultations with the inhabitants of the areas threatened by floods in the localities of Mejerda River basin.

Three days were planned as follow:

1) First day with the inhabitants of the upper area, involving the governorates of Jendouba and Le Kef, with Bousalem Agricultural Centre selected as the venue,
2) Second day with the inhabitants of the middle area, involving the governorate of Beja, with Testour Agricultural Center selected as the venue, and
3) Third day with the inhabitants of the lower area, involving the governorates of Bizerte, Manouba and Ariana, with Sidi Thabet Agricultural Centre selected as the venue.

(2) Objectives

Public consultations, in addition to providing access to the public in decision making process, are designed specially for public involvement and exchanges with the Team, the executing agency, DGBTH, and other various stakeholders concerned with the Study. These exchanges had already started with an interview or questionnaire survey, which involved the whole Mejerda River basin from the upper to lower areas and was designed

to sound the perception of the public against flood risks. Preliminary results of the questionnaire survey were summarized (see Section J3.1) and served as a basis for the discussions in the first stakeholders' meetings

(3) Participants

The level of participation was fair in Bousalem and satisfactory in Testour and Sidi Thabet the three respective venues.

The number of the participants was as follows according to the areas:

	Bousalem	**Testour**	**Sidi Thabet**
Central Administration	1	1	1
Regional Administration	1	6	3
JICA-Team and the subcontractor, EUREKA	5	4	5
Representatives of the population	21	42	48

The smaller attendance in Bousalem is due essentially to the difficulties of some Omdas, to mobilize people. It is to be noted that the Ramadan period which coincided with these meetings was a big constraint for the people.

(4) Topics of the days

1) Presentation of the Study
2) Background of the Study
3) Objectives of the Study
4) Scope and Schedule of the Study
5) Public Consultations or Stakeholders' Meetings
6) Items of the Survey
7) Preliminary Results of the Questionnaire Survey
   - Social profile of respondents
   - Experience and type of flood damage
   - People affected by flood inundation
   - Fear of floods
   - Risk of damage due to future floods
   - Acceptability of flood damage risk
   - Structural and non structural measures for reducing flood damage
   - Self-responsibility to flood damage risk
   - Willingness of payment for measures
   - Priority structural measures
   - Priority non structural measures
   - Summary conclusions
8) Non structural measures
9) Structural measures
10) Issues related to flood control measures
11) Groups discussions.

(5) Individual interventions

Following the presentation of the topics, the participants were invited to intervene, whose level of participation was as a whole satisfactory; indeed, 27 people intervened during the 3 meetings, as follows: Bousalem with 7 people; Testour with 10 people, and; Sidi Thabet with 10 people.

(6) Groups' discussions

Following the individual interventions, four groups' discussions were formed in each area. These groups chose one or two topics among the 7 following topics which were proposed to them:

1) Which is the level of acceptance of the risks of flood damage, up to which point the population could live with a certain level of risk of damage due to the floods?
2) Structural measures and socio-environmental impact
3) Non-structural measures and their degree of effectiveness
4) The reliance on the authorities and the level of self responsibility
5) Civil protection and prevention on the occurrence of flood: do the participants know that civil protection gives messages of alarm during floods, ever received messages of evacuation given by civil Protection, how they received these messages and which is their contents and finally, are the participants convinced that the intervention of civil Protection could reduce the effects of the damage.
6) Necessary coordination between the various administrations to correctly deal with the risk damage of floods.
7) Historical monuments all along the Mejerda River and suitable measures to adopt.

In each area, the groups reflected on the topics suggested and formulated, specific proposals that the representative of each group read in front of the participants.

The written notes were gathered and their contents were used in the drafting of this report.

The different interventions and participants' interactions help identify key issues and alternatives for flood control, which are presented in **Data J2**. What follows can be a reminder of what can be retained from the problems and issues identified:

(7) As regards non-Structural Measures

1) Populations have pointed out insufficiency of these measures and have suggested that the good management of reservoir water release should not be cumulated with big floods or strong rainfalls considering that the decreased capacity of the Mejerda River could not longer accommodate big discharges, sedimentation being one of the main causes.
2) They have stressed a failed civil protection measure, which is too late and slow to act; therefore it needs strengthening and good coordination to help reduce the extent of flood damage.
3) Other non-structural measures to be implemented include development of an optimum level of coordination between the various administrations to avoid disorderly and counter-productive actions such as the authorizations delivered by

local government to allow building houses, factories or projects in the public hydraulic domains. These measures also include prohibiting the plantation of the trees in river channels under the pretext of fixing the soil as well as the disorderly construction of dykes in river channels, obstructing the flow and also deteriorating proper function of automatic water level gauge.

4) Follow-up measures, such as the information of public and sensitization campaigns, would be necessary at the time of major decisions to establish confidence between the administration and the populations.

All of these raised issues suggest that a good organizational and institutional strengthening and capacity building program is necessary in the plan formulation before any sustainable implementation of the measures is ensured.

(8) As regards Structural Measures

1) As most urgent structural measures, river widening and river course cleaning to remove its sediment and anarchical vegetation growing inside river courses have been suggested. The building of farm roads or rehabilitation of existing ones, which are non-functional, are suggested to prevent people from being surrounded by water in time of floods. This measure has been an opinion widely expressed in the interview survey and public consultations.
2) The construction of a shortcut channel to correct the route of the Mejerda River has also been suggested to avoid meandering of river which invades the cultivated lands and make them easily flooded.
3) The construction of a bypass channel to control big discharge during floods has been highly suggested as well.
4) The populations are unanimous to preserve the historical monuments and to find friendly solutions so as not to put in danger the historical inheritance of Tunisia, referring particularly to the Muradi bridge (built in 1088; 11th century 1088) of Medjez el Bab. A bypass channel or floodway constructed outside of the city has been suggested.
5) Most of the populations denounced the anarchical behaviours of people who build in flood prone areas, destroy levees which protect against floods and throw wastes into rivers. Any implementation of structural measures should first deal with these people and find way through sensitization or other means to correct these problems, some of which, such as building houses in the hydraulic public domain, are very complex issues considering the involvement of some local authorities.

J3.3 Second Stakeholders' Meetings

J3.3.1 General

As part of the Study, DGBGTH (MARH) and the JICA Study Team organized, for the second stakeholders' meetings, the following three days of information and consultation with the residents of the areas having been threatened by the floods in the localities of the Mejerda River basin:

(1) the first day (22 February 2008) at Bou Salem for the inhabitants of the upper areas: Jendouba and Le Kef Governorates,

(2) the second day (24 February 2008) at Testour for the inhabitants of the middle areas: Beja Governorate, and

(3) the third day (26 February 2008) at Sidi Thabet for the inhabitants of the lower areas: Bizerte, Manouba and Ariana Governorates.

These days of information and consultation enabled the public to access to the decision-making process and engage in the exchange of ideas with the Team, the administration concerned, namely DGBGTH, and other stakeholders of the Study.

The level of participation was satisfactory in all three locations above. The meetings were more important than the first stakeholders' meetings held in September 2007, especially at Testour and Bou Salem. The numbers of participants are as follows according to the locations:

	Bou Salem	**Testour**	**Sidi Thabet**	**Total**
Central Administration	2	1	1	**4**
Regional Administration	4	2	0	**6**
Chiefs of localities (Omdas)	0	11	4	**15**
JICA Team and Survey Assistants	5	3	3	**11**
Representatives of the population	34	74	43	**151**
Total	**45**	**91**	**51**	**187**

The days focused on the presentation of the conceivable river improvement works (see **Table J3.3.1, Figure J3.3.1**) which have been envisaged by the Study Team as some of the structural measures for flood control of the Mejerda River. These measures are summarized as stated below:

(1) Construction of bypass channels at, Bou Salem and Mejez El Bab,

(2) Improvement of the Mellegue lower riverbed/riverbank and the Mejerda riverbed/riverbank in and around Jendouba, Bou Salem, Sidi Ismail, Mejez El Bab, El Battane, Jedeida and El Mabtouh,

(3) Construction of dyke to protect the people and low lands that are facing serious flood damage along the Mejerda River,

(4) Construction of a retarding basin in the area of El Mabtouh.

Following the presentation of the envisaged structural measures, the participants were invited to participate in debate and express their opinions. The level of the participation was generally satisfactory; in fact, 38 people in total intervened during the consultation days, as follows:

Places	**Number**
Bou Salem	8
Testour	18
Sidi Thabet	12

J3.3.2 Debates and Conclusions

The stakeholders' meetings were very important and much appreciated by the people. The attendance rate during this session and especially the rate of participation in the discussions were much higher than that during the first stakeholders' meetings held in September 2007.

Many speakers demanded that this kind of meeting for information and consultation with the population be generalized to all localities, especially prior to commencement of construction works in order to allow the people of each locality to express their expectations and take precautions in advance.

A large majority of over 80% understood the nature of the structural measures and the environmental and social impacts that could result.

However, an equally large majority expressed its concern at the impact of the measures on the socio-economic life in particular. Indeed, the farmers and breeders who live on the edge of the Mejerda River are concerned that the construction works related to the measures take too long, which could negatively influence their sources of income that are depending on the water of the Mejerda River: irrigation of agricultural land and water for livestock.

The fear of water pollution is the main source of concern, especially in the middle and lower areas of the Mejerda River basin.

A large majority gave their approval to the presented structural measures (85%), but 17.7% of them did agree only if there were no serious repercussions of the structural measures advocated.

It is also important to take into account the 15% minority who refuses the measures or who do not understand them well enough.

Their refusal resulted mainly from the fear that compensation would not be applied fairly.

To pacify the population, it is necessary to attach great importance to dialogue and to implement the laws on compensation and give the compensation before carrying out the construction works related to the measures.

At the regional level, the understanding and adherence to the structural measures is not homogeneous; there are different levels depending on the locations of meetings.

At Bou Salem, the level of understanding and adherence is very satisfactory; it is gratifying at Sidi Thabet and quite satisfying at Testour. This is due to three reasons:

(1) First reason: At Testour and Sidi Thabet, it is noted that there are large numbers of farmers and breeders who live mainly on the use of the water of the Mejerda River for irrigated agriculture and for livestock. These people are worried about their sources of income which would be affected if the construction works took a long time to be completed. At Bou Salem, it is noted that there are large numbers of residents (employees, officials, etc.) who suffered especially due to the urban

flooding that destroyed their homes.

(2) Second reason: At Bou Salem, the participants felt that the structural measures would adequately meet their expectations; to the contrary at Testour and Sidi Thabet, there are localities, such as Slouguia, Mastouta, Sidi Thabet and Kalat landalous which felt that the measures had not taken into consideration their localities.

(3) Third reason: At Testour, some participants felt that in the past they had not been adequately compensated for the construction of the Sidi Salem Dam. They are afraid that the bad experience would be repeated in the future

Some speakers in the three regions where the meetings were held have raised some deficiencies in structural measures envisaged by the Study and wanted to incorporate areas that have not been taken into consideration, which include:

(1) Ezzouhour-city in Ghardimaou, near the main bridge of Ghardimaou (Jendouba Governorate),

(2) Ouljet-Slouguia (Testour, Beja Governorate) where productive agricultural lands have been threatened by flooding, and

(3) Sidi Thabet (Ariana Governorate).

Some other speakers suggested that measures to improve the Mejerda riverbed should also include tributaries which drain into the Mejerda River, including:

(1) Boujarine and Khoulene rivers, North of Bousalem,

(2) Bourzam, Sâadane and El Meleh rivers, at the MC 64 near Ghar El Meleh, and

(3) Rivers off Jbel Ammar- Gouazine (Béjaoua 1) (Governorate of Ariana).

The comments, suggestions and proposals recorded in the meetings are compiled in **Data J3**.

CHAPTER J4 INITIAL ENVIRONMENTAL EXAMINATION (IEE) STUDY

EIA in the planning stage is not legally required in Tunisia. The Study, however, is required to execute Initial Environmental Examination (IEE) in planning stage in accordance with the JICA's position on "Strategic Environmental Assessment" and the JICA's Guidelines for Environmental and Social Consideration. IEE is the first review of reasonably foreseeable effects of the proposed actions of flood control on the natural and social environment. There is a possibility that structural and non-structural measures proposed through the Study may have a risk to induce adverse effects to local people and environment to some extent. IEE has been undertaken to identify key issues that require full investigation and screen out issues that are not likely to be significant based on the measures. The Study has followed the basic concept and procedures of the environmental laws and decrees relating to EIA in Tunisia. The following describes the results of the IEE undertaken in the Study.

J4.1 Purpose of IEE

The main purposes of the IEE are:

(1) To grasp the current physical, natural and socio-economic conditions in the Mejerda River basin and its surrounding areas;

(2) To examine likely environmental and social impacts to be caused by implementation of the river improvement works envisaged as the structural measures in the master plan for flood control of the Mejerda River; and

(3) To develop an outline of environmental management plan, including mitigation measures and monitoring plan, to be integrated into the master plan.

J4.2 Study Area

The study area basically covers the whole of the Mejerda River basin, which has a total area of 23,700 km^2, of which 7,870 km^2 (33%) is located in Algeria. The part of the basin located in Tunisia can be subdivided into 3 sub-basins.

The upper catchment spreads from the Ghardimaou City, on the boundary with Algeria, to the Sidi Salem Dam and includes the right bank tributaries: Mellegue (10,790 km^2), Tessa (2,420 km^2), the left bank tributaries: Rarai (350 km^2), Bou Heurtma (610 km^2), Kasseb (280 km^2), Beja (340 km^2) and Zarga (220 km^2).

The middle catchment spreads from the Sidi Salem Dam to the Laaroussia Dam and includes the Khalled, the Siliana and the Lahmar tributaries.

The lower catchment spreads from the Laaroussia Dam to the estuary at Ghar El Melh and includes the Chafrou tributary (610 km^2).

(1) Basin topography and geology

The upper catchment is generally mountainous with extensive areas of hilly uplands and forests mainly located in the left bank of the Mejerda River. The middle catchment tends

to be marked by a more undulating topography with a predominance of plains and plateaus. The lower catchment covers the fertile alluvial floodplains about 50 km wide; lying between the middle catchment reaches and the Mediterranean Sea, and covering the coastal plains constituted of stream, rivers and sea deposits which are predominantly clays and silt layers often more than 50 m deep.

(2) Climate

The extreme north and the north areas of Tunisia, where the Mejerda River basin is located, can be distinguished by mild and wet winter, and hot and dry summer. Average annual rainfall and temperature shows decrease and increase trends respectively towards the south in the study area. The average annual rainfall exceeds 1,000 mm in the northwest part of the study area, whereas the southern part has a rainfall as low as 300 mm/year. Usually, temperature, evaporation, and sunshine duration reach their maximums in July and August in the study area, whilst humidity as well as precipitation becomes the smallest during these months. The annual average temperature in the study area ranges from 17 to 20 ^{o}C, and the annual mean relative humidity is from 60 to 68%. The annual average evaporation varies from 1,300 to 1,800mm.

(3) Groundwater resources

The map of the water resources of Tunisia collected in this study suggests that groundwater resources are poorly developed in the alluvial plains near the delta as a result of the important clay and silt deposits of the Mejerda River accumulated over the years, which have rendered the plains quasi impervious to percolation of flood water and recharge of the aquifers. These resources are on the other hand well developed in the upstream area around Jendouba Governorate due to the proximity of the Sidi Salem Reservoir and other reservoirs located upstream of Sidi Salem and the contribution of the rich forest reserves observed on the left bank, which drastically reduce the runoff rate, and consequently recharge the aquifers. This suggests that the Mejerda flood water contributes less to the recharge of the groundwater resources which depends mainly on lakes and reservoirs and the forest reserves as the map shows.

(4) Water quality

The river and river bank activities include laundering, bathing, livestock grazing, fishing, garbage and waste disposal, as well as catchments clearing and cropping practices. These activities contribute to high sediment, nutrient, chemical and bacterial loads. The water quality deteriorates during the dry season because the flow decreases and the concentrations of pollutants become higher.

(5) Soils

The river floodplains consist of alluvial deposits largely composed of clay and silt.

(6) Important forests

Concerning forests and protected domains in the project area, none apart the Feija National Park is listed. The park seems to be secured from the floods of the Mejerda

River, being located in a high mountain area. However, Jendouba Governorate is famous for the importance of its forest resources, namely around Ain Draham and Tabarka where important forests and protected domains exist. In these areas, land reclamation, grazing, and illegal deforestation have brought about decrease of forest resources, erosion and destruction of the vegetation. Special attention should be paid to this, as one knows that sedimentation has greatly decreased the flow capacity of the Mejerda River and is said to contribute greatly to the flood observed these last few years.

It is observed that sedimentation in the Mejerda River comes mainly from the right bank, where there are fewer forests than the left bank. Our field trip has confirmed that sedimentation in northern dams such as Sejnene, located in the left bank, is still at a normal level as a result of the presence of more forests and the lack of inhabitants there.

(7) Important flora and fauna

Though IUCN has presently identified about 80 species of mammals, 362 birds' species and more than 500 species of reptiles and fishes in the country, endangered species of flora and fauna are not confirmed in the flood plain and irrigable areas of the Mejerda River basin. However, the Team has confirmed that several fish species were introduced in the reservoirs of the many dams that were built over the years. It is therefore evident that several fish species are living in the Mejerda River and the Sidi Salem Reservoir. Among these, one can cite the berbel (*Barbus callensis*), which is endemic in North Africa, the common Tilapia (*Cyprinus carpis*), several species of mullets and the catfish. Conserving these fish species for the fishing activity of the riparians is important as many live off such activity. A minimum water flow is necessary in the Mejerda River, as well as a minimum water quality for the fish populations.

(8) Socioeconomic characteristics

(a) Demography

Population within the Mejerda River basin was estimated to be 1,330 thousand in 2004. While the basin occupies 9.8% of the land area of Tunisia, the population of the basin accounted for 13.4% of the total population in Tunisia. The population density of the basin (84.0 per km^2) was higher than the national average of 61.1 per km^2.

The densely populated areas are located mainly on the plains along the main stream of the Mejerda River. The population density in the basin is particularly higher on the alluvial plain near the river mouth, such as Tunis, Ariana and Manouba Governorates.

(b) Economy

According to the 2004 CENUS, the labor force in Tunisia by sector was as follows: services 48.9%, manufacturing industry 19.4%, non-manufacturing industry 14.5% and agriculture 16.2%.

The agriculture sector is still the mainstay of the economy in the study area and absorbs substantial labor force (87.5 thousand). Shares of agricultural labor force to total labor force are especially high at Jendouba Governorate (39.2%) and Beja Governorate

(37.3%).

The agricultural sector in the basin is endowed with rich rainfall and fertile land. A vast agricultural area consists of dry farm land of 10,392 km^2 (65.6% of total land area of the basin), and irrigated areas of 1,489 km^2 (9.4%). The irrigated areas are located mostly on the plains along the main stream of the Mejerda River.

(c) Historical remain and archeological sites

Though there are no historical remains or archeological sites listed as a World heritage in the project area, several bridges of cultural assets exist along the Mejerda River, namely at Medjes el Bab, El Battane, Jedeida and Bizerte.

It is believed that the section of these bridges contributed to the floods in 2003.

In Jendouba Governorate, the vestiges of an old roman city famous for its marble quarry in the antiquities were found at Chemtou, which is located between Jendouba city and Oued Mliz (22 km). Also an important archeological site of an important City with well conserved ruins was found at Bulla Regia, between Jendouba and Fernana (6 km). There are also some archeological ruins discovered in Utique in Bizerte Governorate (15 km). All of these sites are far away from the Mejerda River basin.

J4.3 Structural Measures

The structural measures envisaged in the river improvement works for the master plan of flood control of the Mejerda River comprise the following four categories, including "No action considered for flood control":

- Measures for the upper area (Jendouba, Le Kef Governorates and West part of Beja Governorate),
- Measures for the middle area (East part of Beja Governorate),
- Measures for the lower area (Ariana, Manouba and Bizerte Governorates), and
- No action for flood control.

An outline of the structural measures planned for each of the areas mentioned above, including some conceivable impacts, and locations are described in **Table J3.3.1** and **Figure J3.3.1**. Detailed descriptions of the measures and their conceivable impacts are given below.

(1) Description of structural measures and conceivable impacts

Conceivable impacts to be caused by implementation of the above structural measures are examined at three stages: pre-construction, construction and operation and maintenance stages. The examination results are itemized in **Tables J4.3.1 to J4.3.3**. The following is a description of the measures and their impacts.

1) Measures for the upstream area (Jendouba, Le Kef Governorates and West part of Beja Governorate) (See **Table J4.3.1**)

Localities much concerned: Jendouba City (Jendouba Delegation), Ghardimaou

(Ghardimaou Delegation), Chemtou (Jendouba Nord Delegation), Mellegue (Nebbeur Delegation) and Bou Salem (Bou Salem Delegation)

(a) Zone A: Jendouba City and Upstream

Measure A: River improvement for Zone A

These works will be undertaken along the Mejerda upper reaches between 63.9 km to 158.3 km from the upper end of the Sidi Salem Reservoir; they will be located on the river course around and upstream of Jendouba City. The river improvement works will consist of excavation to get rid of sediments; increasing river capacity, and revetment works to protect river bank slope and against erosion. The total length of river improvement is 48.8 km. The river channel width after the improvement works will be 70 m between tops of the riverbank slopes on the left and right sides. These works will increase river capacity; enabling it to accommodate higher discharge rates at the end of the works. Similar improvement works were requested by the populations for Ghardimaou city during the stakeholders' meeting held at Bou Salem on 24th Jan. 2008.

The works aim to mitigate flood inundation damage with the protection of residents and farmlands on both banks of the river, allowing floods to discharge smoothly, stabilizing the river behaviour, and controlling the river bank variation. The protection of habitations and farmlands will minimize economic losses and personal casualties. The river improvement work is aimed at removing sediment deposits, improving the river capacity to accommodate big flood discharges. Revetment works will protect against erosion of river banks; allowing for smooth discharge of flood water without any delay in the flow and consequently reducing the occurrence of flood. The possible impacts are negative ones during construction works, including impacts on air quality (dust and emission gas), noise, water quality and traffic accidents and transportation. But, the magnitude of the impacts is rather small because the size of the works is small and is confined to an area near the banks of the river. They are less significant impacts, which are easier to manage except for the procurement of spoil bank in which the excavated material is to be disposed of. The magnitude of impact therefore depends on the possibility of procurement of spoil bank at nearby area of planned improvement site.

(b) Zone B: Mellegue Lower Reaches

Measure B: Dyke construction and river improvement for Zone B

These works will be undertaken along the Mellegue lower reaches between 0 km and 12.9 km from the confluence area of the Mellegue River with the Mejerda River; they will be located on the Mellegue river course upstream of the above mentioned confluence zone. The river improvement works will consist of excavation to get rid of sediments; increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect cultivated lands. Topographic survey along the river sections have been completed to decide on the location of the dyke. The total length of river improvement is 12.9 km. The river channel width after the improvement works will be 75 m between tops of the riverbank slopes on

the left and right sides. The planned dyke height is 2.0 m with a length of 7.4 km, which will be the total length on the right and left river banks. These works will increase river capacity; enabling it to accommodate higher discharge rates at the end of the works.

This measure has the function to mitigate flood inundation in the areas along the Mellegue lower reaches (cultivated land spreading in the left low land areas of the river reaches). The possible impacts are the same as the previous case but more insignificant as the scale of the works is much smaller.

(c) Zone C: Mellegue Confluence to Bou Salem

Measure C1: Bypass Channel including bridges construction for Bou Salem

The bypass channel will be located south of Bou Salem City covering the Mejerda upper reaches between 30.5 km and 47.8 km from the upper end of the Sidi Salem Reservoir. The channel will be crossed by 5 new bridges located respectively on main and secondary roads running along and across the Mejerda plains and plateaus and will drain excess flood water back to the Mejerda River at around 30.5 km from the upper end of the Sidi Salem Reservoir. To protect these bridges structures, 8 groundsill structures are constructed at adequate locations along the route of the Channel. The total length of the channel will be 7.7 km with a width of 80 m between tops of side slopes on the left and right sides. It is designed to limit peak floods on the Mejerda River and has a design discharge of 700 m^3/s; requiring a volume of excavated materials of 3.2 M. m^3 for its construction. The bypass channel will not affect the regular flow of the Mejerda River with its canal bed constructed 1 m above that of the Mejerda River. Its function will be to only drain excess water from major floods.

The possible impacts are negative ones during construction works, including impacts on air quality (dust and emission gas), noise, water quality and traffic accidents and transportation. Local people's unrest will be minor because the structure is confined within an area belonging to the government, which does not require land acquisition along the planned alignment of the channel. However, the 2nd stakeholders' meeting has revealed that people may hold owners' titles in public lands because some officials have given or sold lands to ordinary citizens or given them a permit to occupy. These issues have to be clarified and solved during the pre-construction stage.

Measure C2: Dyke construction and river improvement for Zone C

These works will be undertaken along the Mejerda upper reaches between 30.1 km and 63.9 km from the upper end of the Sidi Salem Reservoir. The river improvement works will consist of excavation to get rid of sediments; increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect habitations and cultivated lands. Topographic survey along the river sections has been completed to decide on the location of the dyke. The total length of river improvement is 33.8 km. The river channel width after the improvement works will be 120 m between tops of the riverbank slopes on the left and right sides. The planned dyke height is 3.0 m with a length of 31.5 km, which will be the total length on

the right and left river banks. These works will increase river capacity; enabling it to accommodate higher discharge rates at the end of the works. Similar improvement works were requested by the populations for two tributaries of the Bou Heurtma Rivers located north of Bou Salem, namely Boujarine and Khoulene during the stakeholders' meeting held at Bou Salem on 24th Jan. 2008.

This measure has the function to mitigate flood inundation damage in the Bou Salem city proper and its upstream/downstream stretches. The possible impacts are almost the same as those of the dike construction and river improvement for the Mellegue lower reaches, except that they would be bigger here as the length of river improvement and planned dike length are much longer.

(d) Zone D: Upstream of Sidi Salem Dam up to Bou Salem

Measure D: Dyke and river improvement for Zone D

These works will be undertaken along the Mejerda upper reaches between 0 km and 30.1 km from the upper end of the Sidi Salem Reservoir; they will be located on the river course between Sidi Salem Reservoir and Bou Salem. The river improvement works will consist of excavation to get rid of sediments, increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect habitations and cultivated lands. Topographic survey along the river sections has been completed to decide on the location of the dyke. The total length of river improvement is 30.1 km. The river channel width after the improvement works will be 200 m between tops of the riverbank slopes on the left and right sides. The planned dyke height is 4.0 m with a length of 49.5 km, which will be the total length on the right and left river banks. These works will increase river capacity, enabling it to accommodate higher discharge rates at the end of the works.

These measures have the function to mitigate flood inundation in the areas along the river reaches that are suffering from the progress of sedimentation adjacently upstream of Sidi Salem Dam; protecting cultivated land along the river reaches. The possible impacts are almost the same as the above measure as the scale of the works is similar.

(2) Measures for the mid-stream area (East part of Beja Governorate) (See Table J4.3.2)

Localities much concerned: Testour, Slouguia (Testour Delegation), Medjez El Bab, El Matis, Grich El Oued and El Herry (Medjez El Bab Delegation)

(a) Zone E: Downstream of Sidi Salem Dam to Larrousia Dam

Measure E1: Bypass Channel including bridges construction for Mejez El Bab

The bypass channel will be located north of Medjez El Bab City covering the Mejerda lower middle reaches between 105.3 km and 110.6 km from the estuary. The channel will be crossed by 4 new bridges located on the main roads running along and across the plains and plateaus of the Mejerda River, and it will drain the excess flood water. To protect these bridges structures, 4 groundsill structures are constructed after the bridges at adequate locations along the route of the channel. The total length of the channel will be

4.5 km with a width of 60 m between tops of side slopes on the right and left sides. It is designed to limit peak floods on the Mejerda River and has a design discharge of 400 m^3/s; requiring a volume of excavated materials of 2.7 M. of m^3 for its construction. The bypass channel will not affect the regular flow of the Mejerda River with its canal bed constructed 1 m above that of the Mejerda River; its function is only to drain excess water from major floods.

This measure, though satisfactory for many because of solving the problem of not destroying the historical bridge of the city, might cause local people's unrest and some conflict and/or opposition against it before construction as it may require land acquisition from farmers. In addition, it is necessary to procure the area for disposal of excavated material spawned by channelling, requiring more land. However, no resettlement is anticipated because the measure avoids passing through dwellings.

Impacts during construction works are similar to those of other cases of bypass channels and include topographic and geologic change, which is minor, waste of excavated material, air quality and noise, local traffic accidents and transportation. On the other hand, employment of local residents for civil works and increase of income can be expected as a positive impact.

During operation stage, because the bypass channel is conceived to divert extra flood water from the Mejerda River without affecting its regular flow, it may discharge more turbid water back to the Mejerda River downstream that might increase Suspended Solids (SS) of the river more than the existing situation during regular floods, which might impact on aquatic organisms. Furthermore, due to the change of river flow regime brought about by the diversion structure, flood water may be increased downstream of the channel outlet where extra flood water will be discharged. However, the effects of river improvement planned by the project in these areas will carefully address this matter.

Measure E2: Dyke construction and river improvement for Zone E

These works will be undertaken along the Mejerda lower middle reaches between 67.3 km and 148.5 km from the estuary. The river improvement works will consist of excavation to get rid of sediments, increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect habitations and cultivated lands. Topographic survey along the river sections has been completed to decide on the location of the dyke. The total length of river improvement is 81.2 km. The river channel width after the improvement works will be 90 m between tops of the riverbank slopes on the left and right sides. The planned dyke height is 1.0 m with a length of 70.6 km, which will be the total length on the right and left river banks. These works will increase river capacity, enabling it to accommodate higher discharge rates at the end of the works. The improvement works were requested by the populations of Testour, Sloughia and Ouljat Sloughia to protect their fields against inundation damages during the 2nd stakeholders' meeting held at Testour on the 26th Jan. 2008.

Similarly to the previous measure, this measure has the function to mitigate flood

inundation damage in Medjez El Bab City proper and to conserve historical vestiges; namely an old Muradi bridge dating from the 17th century, whose destruction or relocation seem to be very much opposed by the populations. The possible impacts are almost the same as those of similar cases and are closer to those of Zone C improvement works because equal in scale.

(3) Measures for the downstream area (Manouba, Ariana and Bizerte Governorates)

(See Table J4.3.3)

Localities much concerned: Borj Ettoumi, El Battane (El Battane Delegation), Tebourba (Tebourba Delegation), Jedeida (Jedeida Delegation), Sidi Thabet (Sidi Thabet Delegation), Kalaat El Andalous (Kalaat El Andalous Delegation), Mabtouh, Bach Hamba, Utique (Utique Delegation), Zouaouine and Ghar El Meleh (Ghar El Meleh Delegation)

(a) Zone F: El Battane

Measure F: River improvement for Zone F

These works will be undertaken along the Mejerda lower reaches between 48.5 km and 67.3 km from the estuary. The river improvement works will consist of excavation to get rid of sediments, increasing river capacity, and revetment works to protect river banks against erosion. The total length of river improvement is 18.8 km. The river channel width after the improvement works will be 80 m between tops of the riverbank slopes on the left and right sides. These works will increase river capacity, enabling it to accommodate higher discharge rates at the end of the works.

(b) Zone G: Jedeida

Measure G: Dyke construction and river improvement for Zone G

These works will be undertaken along the Mejerda lower reaches between 31.3 km and 48.6 km from the estuary; they will be located on the river course at locations where erosion of the banks and sedimentation are important. The river improvement works will consist of excavation to get rid of sediments, increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect habitations and cultivated lands. Topographic survey along the river sections have been completed to decide on the location of the dyke. The total length of river improvement is 17.3 km. The river channel width after the improvement works will be 110 m between tops of the riverbank slopes on the left and right sides. The planned dyke height is 1.0 m with a length of 15.5 km, which will be the total length on the right and left river banks. These works will increase river capacity, enabling it to accommodate higher discharge rates at the end of the works.

This measure has the function to mitigate flood inundation damage in and around Jedeida City proper. The possible impacts are almost the same as those of similar cases and are closer to those of Medjez El Bab improvement works because similar in scale.

(c) Zone H: El Mabtouh- Estuary of Mejerda River

Measure H1: Dyke construction and river improvement for Zone H

These works will be undertaken along the Mejerda extreme lower reaches between 0 km and 31.3 km from the estuary; they will be located on the river course at locations where erosion of the banks and sedimentation are important. The river improvement works will consist of excavation to get rid of sediments, increasing river capacity, and revetment works to protect river banks against erosion. The dyke will be constructed along the river bank at lower areas to protect habitations and cultivated lands. Topographic survey along the river sections have been completed to decide on the location of the dyke. The total length of river improvement is 31.3 km. The river channel width after the improvement works will be 170 m between tops of the riverbank slopes on the left and right sides. The planned dyke height is 2.0 m with a length of 40.3 km, which will be the total length on the right and left river banks. These works will increase river capacity, enabling it to accommodate without damage to the natural environment higher discharge rates at the end of the works.

The possible impacts are the same as similar cases and include the negative ones during construction works, such as impact on air quality (dust and emission gas), noise, and traffic accidents and transportation. As the scale of the dike construction would be quite large, 40.3 km, these impacts would be therefore more significant. But the spatial extent of the impacts is limited in the vicinity of the river estuary, which is rarely inhabited and far from the settlement area.

Measure H2: Retarding basin for Zone H

This structure will act as a reservoir to temporarily store extra flood water in time of major floods. It will be built on the Mejerda extreme lower stretches at 11.8 km and 31.1 km of the estuary and will cover a total surface area of 2230 ha with a planned inundation depth of 3 m. Accompanying works will include, the construction of a new drainage canal to convey flood water from the Mejerda River to an existing drainage canal that will serve as the inlet canal to the basin, and, the modification of the existing drainage canal to drain water from the retarding basin and neighbouring fields back into the Mejerda River. Other modification works will involve the rehabilitation of the existing sluice gate facilities and the raising of a bridge. The length of the new drainage canal is 2.8 km. The length of the existing drainage canal to be modified is 27.0 km. Raising of the existing bridge will include raising of the approach road toward that bridge. The structure of the retarding basin includes a surrounding dike of length 10.1 km.

This measure, which applies only to the estuary area of the Mejerda River, is used to temporarily store excess flood water from the river into a reservoir covering 2230 ha, which is drained back into that river after the flooding period. In spite of the large scale of the reservoir, the retarding basin is located in pasture land (unused land) and unsuitable for agriculture, this status reducing sensibly the magnitude of the natural and socioeconomic impacts it might have if it were closer to habitations or located on productive agricultural lands. Its construction would be much cheaper than constructing dikes on the protected agricultural lands along the Mejerda River that would have been

inundated during floods.

During operation period, some outside accidents may cause adverse impacts on the retarding basin's water quality, e.g., accidental discharge of sewage upstream, traffic accidents causing hazardous material to be spilled, resulting in large financial loss.

J4.4 Observations on Negative Impacts

(1) Impacts on physical and biological environment

The impacts of the structural measures on the physical environment will be minor and will mainly occur during construction. Soil disturbance will occur during construction, with the greatest disturbance in areas where new structures are to be built. This will lead to temporary and local incidence of high turbidity levels, especially during the dry season, in local watercourses, and to increase dust in the air. Once the works are stabilized, the impacts will be negligible over the long period of time.

Localized, minor permanent changes to the landform will occur with the new constructions of bypass channels; however, the bridges that are planned to improve access along the structures will alleviate the negative impacts.

The impacts on terrestrial vegetation and fauna will be restricted to the riparian areas adjacent to the rivers or to the areas neighbouring the new structures where the constructions will require removal of vegetation. Although these areas support planted vegetation, there will be minor losses of scattered remnant natural vegetation. In the long run, re-vegetating the dikes and afforesting some of the path of the channels and canals will restore vegetation to be cleared during construction.

Any increase in river turbidity levels or other pollutants (oils, etc) during construction will have a temporary impact on aquatic biota, including fish. Following the construction, it is expected that disturbed areas will quickly become re-colonized.

Borrow areas will be required for the works, and will pose potential impacts regarding erosion, dust and aesthetics. Spoil disposal will be required in certain areas where the amount of excavation is anticipated to exceed that needed for construction.

(2) Socioeconomic impacts

The main impact of the measures will be on socioeconomic conditions. The size of the structures to be built might cause local people's unrest and some conflict and/or opposition against them before the construction works. In addition, it is necessary to procure the areas for disposal of excavated material spawned by channelling, which may require land acquisition. Most of the impacts will occur during the pre-construction period.

In addition, during construction there is likely to be temporary disruption and minor losses to local agricultural communities from the reduced access to the dike areas and sections of the floodplains used for agricultural activities and livestock grazing. There will also be temporary localized disruptions to road transport in the vicinity of the construction sites. In the long term, however, there will be significant benefits to

transportation from flood protection.

Minor health and safety impacts are also likely to occur during construction, with noise and dust affecting communities adjacent to work sites, particularly when heavy equipment is in use.

The proposed measures will not affect any historical or archaeological sites.

During operation stage of the bypass channel, discharge of excess flood water back into the Mejerda River downstream of the channel would increase water flow more in the said downstream areas, which might cause flood problems on agricultural lands or habitations in those areas. Proper measures will be considered in this Project.

For the retarding basin, there might be some impacts on surrounding agricultural lands due to flood inundations.

J4.5 Evaluation of the Impacts

Conceivable impacts to be caused by implementation of the structural measures are evaluated by using Impact Matrix. The magnitude of impacts is ranked in the following grades: negligible, minor, medium and significant based on the scale of the structures and the natural conditions surrounding them.

The results of the evaluation are compiled in **Table J4.5.1** and summarized as follows with the outline of natural and social conditions in the upper, middle and lower areas:

(1) The upper area of the Mejerda River includes Jendouba City and the western part of Jendouba Governorate, the Mellegue lower reaches, Bou Salem City and the upstream of Sidi Salem Dam, covering the whole area between Sidi Ismail to Bou Salem City. The area is generally mountainous in the upper catchment reaches of the river with extensive areas of hilly uplands and forests located in the left bank of the Mejerda River. The ground water resources are well developed in the upstream area around Jendouba Governorate due, on the one hand, to the proximity of the Sidi Salem Reservoir and other reservoirs located upstream of the reservoir and due to the contribution of the rich forest reserves observed on the left bank, which include the Feija National Park which seems to be secured from the floods of the Mejerda River, being located in high lands. The area is essentially agricultural with some vestiges of old roman city and some archaeological sites around Jendouba City which are, however, far away from the river basin. The structural measures applied for the upper area aim to mitigate flood inundation damages with the protection of residents and farmlands on both banks of the river, minimizing economic losses and personal casualties. These structural measures show negative impacts ranging from negligible to minor and medium with no significant ones. Medium negative impacts are observed during the construction works with the noises and vibrations and the generation by the works of too much spoil material waste to be disposed of, with the exception of Mellegue improvement works of smaller scale. The bypass channel at Bou Salem, where the path of the channel crosses public land, scores only minor negative impacts for the people unrest.

Furthermore, medium negative impacts are anticipated in water quality near the watercourses during construction of the bypass channel. Positive impacts of the measures are anticipated in the reduction of soil erosion through the dike construction and river improvement works and in the increase of income of the riparian populations who can be offered jobs during construction.

(2) The middle area covers parts of the Mejerda lower reaches, including essentially the Medjez El Bab City on the eastern part of Beja Governorate. The area is marked by a more undulating relief dominated by plains and plateaus, resulting in its dominant agricultural characteristic. The structural measures applied for the middle area aim to mitigate flood damage in Medjez El Bab City and to conserve an historical property (an old bridge dating from the 17th century) of which the destruction or relocation seems difficult. These measures would cause relatively medium negative impacts for the noises and vibrations during construction. Also for the planned bypass channel at Mejez El Bab, the magnitude of adverse impacts would be medium, including the following elements: waste, water quality, aquatic organisms, land acquisition and people's unrest and conflict/opposition. Positive impacts include erosion control through the dikes construction and river improvement works and job acquisition during construction works.

(3) The lower area of the Mejerda River includes the lowest reaches of the river, covering the cities of El Battane, Jedeida and the vast plains of El Mabtouh down to the estuary area. It covers the fertile alluvial floodplains about 50 km wide, lying between the middle area and the Mediterranean Sea, and covering the coastal plains constituted of streams, rivers and sea deposits which are dominantly clays and silt layers often more than 50 m deep, which have rendered the plains quasi impervious to the percolation of flood water and recharge of the groundwater. The population density is particularly higher in the plains near the river mouth. The structural measures applied for the lower area aim to principally mitigate flood inundation damage and to conserve the vast agricultural land spreading along the Mejerda lowest reaches, including specially the El Mabtouh area, to protect against flood damage in and around El Battane and Jedeida Cities and to conserve historical vestiges (El Battane weir dating from the 17th century) of which the destruction or relocation seems difficult. Similarly to the above two areas, noises and vibrations during construction would cause medium negative impacts for the measures applied for the lower area, namely El Battane, Jedeida and El Mabtouh areas. For the retarding basin in El Mabtouh, all adverse impacts are minor. Positive impacts of the measures are anticipated in the reduction of soil erosion through the dike construction and river improvement works and in the increase of income of the riparian populations who can be offered jobs during construction.

No action (no river improvement) would leave the existing problem of sedimentation as it is in the river courses and the incapability of the Mejerda River to accommodate big floods, which can cause huge economic losses.

J4.6 Conclusion and Recommendations

Through IEE for the structural measures envisaged in the Master Plan, every conceivable environmental and social impact was described and evaluated at pre-construction, construction and operation and maintenance stages. It was shown that there would be several negative impacts whose magnitude is negligible, minor or medium as shown in **Table J4.5.1**. On the other hand, "no action" for existing erosion and sedimentation would further reduce the capacity of the Mejerda River to accommodate big floods as seen in recent times, causing huge economic losses.

All the structural measures are evaluated from the environmental and social points of view, and the results are shown in **Table J4.6.1**. As a result of IEE, the following conclusion and recommendations were obtained:

As for the structural measures planned for the upper area, the Mellegue Improvement Works are recommended because of causing the least negative environmental and social impacts due to its smaller scale. All other measures are recommendable because their negative medium impacts can be controlled through adequate mitigation measures and proper monitoring (see **Table J4.7.1**).

As for the structural measures planned for the middle area, all measures are also recommendable considering that proper mitigation and monitoring measures (see **Table J4.7.1**)can alleviate their negative medium impacts.

The same thing as above can be said for the structural measures planned for the lower area. However, regarding the El Mabtouh Improvement Works and Retarding Basin, only minor impacts are anticipated on the natural and social environment, requiring less mitigation and monitoring measures than the other measures. It is, however, recommended during construction and operation of the basin to strictly execute supervisor control system, guarantee construction quality, effectively manage sewage discharge upstream during abundant water period, patrol the reservoir, and detect problems to be solved on time.

J4.7 Environmental Management and Monitoring

(1) Framework of environmental management

As described in the previous sections as regards the structural measures and conceivable impacts, there would be un-negligible negative impacts. These negative impacts should be properly mitigated when the project is implemented. As for the negative impacts whose magnitude is estimated to be medium, the anticipated negative impacts should be well minimized by adequate mitigation measures and monitoring activities.

Mitigation measures are to be undertaken through the following three approaches:

1) Technical approach

2) Socio-economic approach, and

3) Institutional approach

The technical approach is the one to minimize the impacts by engineering and/or technology. The socio-economic approach is the one to mitigate the impacts by such actions as dissemination, consultation, and compensation, etc. The institutional approach is the one to mitigate the impacts in cooperation with government institutions by enforcement of environmental monitoring and evaluation of the impacts.

Table J4.7.1 shows the necessary mitigation measures and monitoring activities for negative impacts whose magnitude would be medium.

(2) Mitigation measures on the natural and biological environment

During a preconstruction stage, there will not be any significant impacts on the natural and biological environment as this period will be devoted to land acquisition and compensation programme. However, detailed plans will be prepared before construction starts to deal with re-vegetation, and soil and water management at the construction sites and borrow areas. Environmental conditions will be included in the tender documents to ensure that contractors to be selected follow environmentally sound construction practises.

During a construction stage, water quality safeguards will ensure that vehicle fuelling and maintenance areas are bounded, isolated or remote and located at least 50 m from any watercourse. To minimize or avoid temporary disruption to local access to rivers and crossings, selected access points will be preserved during the construction period through consultation with the relevant populations.

The contractors will be required to progressively rehabilitate the work areas to ensure that disturbed sites, which are susceptible to erosion, will not remain exposed for a long period. To the extent possible, the work will be done in the dry season to minimize erosion of new dike banks pending their stabilization. The topsoil will be stockpiled for later use in re-vegetating river banks. All the work areas will be clearly delineated by markers to avoid unnecessary clearing of vegetation and to minimize the impacts on landowners with cultivation areas adjacent to the work areas.

To mitigate the construction impacts on local communities, continuous liaison with those communities will be assured by the implementing agencies, and such measures as traffic control and regular watering of unsealed roads to suppress dust will be carried out.

Borrow and spoil disposal areas will be selected to cause the minimum possible impacts. Following the excavation of construction materials, the sites will be rehabilitated. Spoil dumps will be contoured, or else the spoil will be spread in locations that will allow to be converted to productive uses, and vegetation will be planted to avoid erosion problems and to blend the dumps with the surrounding environs.

During an operation stage of the works, the major mitigation measures will involve regular maintenance of structures to address the dynamic nature of the river; quickly repairing them when broken and re-vegetating the dikes to limit erosion.

(3) Mitigation measures on the social environment

To avoid conflicts with the local community and social unrest, compensation for temporarily and permanently acquired lands will be fair, based on the existing laws and regulations in vigour.

The initial year of the project will involve implementation of land acquisition plans before the start of construction. This will include the following actions in chronological order:

(a) Forming the Land Acquisition Committee to oversee land acquisition and compensation;

(b) Implementing extensive public information programme to promote public understanding of the project, its objectives, procedures and benefits;

(c) Undertaking a definitive survey of affected people, land, trees, crops, under supervision of the Land Acquisition Committee, and gathering baseline data for monitoring purposes;

(d) Holding detailed discussions with affected families about the kind and the amount of compensation, and reaching final agreement; and

(e) Providing compensation and beginning acquisition

Alternative sources of livelihood will be provided for the people who will lose land. In addition, monitoring will be undertaken to ensure that the local community does not suffer economic losses as a result of the measures.

(4) Institutional requirements

The implementation of the project will be coordinated and managed by DGBGTH, General Direction of Dams and Large Hydraulic Works, for the central level. A Project Steering Committee of the type established during project preparation is proposed to continue functioning during project implementation to ensure effective coordination between concerned ministries and their line agencies in the governorates, including DGRE, DGACTA, the forest department, the National Agency for the Protection of the Environment, ANPE, the DGDD of the Ministry of Environment, the Ministry of Interior, and the Ministry of Equipment and Public Works, among others. A project management office (PMO) will be established within DGBGTH to manage project activities on a daily basis. Several project implementation units, one in each governorate concerned by the project, will be responsible for project implementation activities in their areas, and maintaining liaison with the PMO, local administration, and the beneficiaries.

Land acquisition will be coordinated by a committee, established by the Governor, which will carry out its tasks according to the guidelines governed by the Water Code and by the Law No. 76/85 of 11/08.1976, as amended and supplemented by the Law No. 2003-26 of 14 April 2003 regarding the Expropriation for public utility (Please refer to the document attached in **Annex J4.7.1** supplied by the Ministry of Agriculture). The compensation of the land owners will be examined by this committee which will consist of the following representatives: i) District chief (Delegate), a committee chairman; ii) chiefs of

administrative sectors (Omdas), a committee vice-chairmen; iii) CRDA, a member; iv) 3 representatives of DGBGTH representing MARH, who have the Power of Attorney of the Minister; v) members of the compensation and expropriation regional committee, consisting of the chiefs of Land Tenure Section, Vegetal Production Section, CES (Water and Soil Conservation) Section and Soil and Water Resource Section of CRDA; vi) a representative of the local section of the Tunisian Union for Agriculture and Fisheries (ULAP), and ; (vii) 3 representatives of the project beneficiaries. The costs of acquisition and compensation will be paid by the Ministry of Agriculture.

The committee will be responsible for: (i) conducting surveys of land, buildings, crops, and other objects to be acquired; itemizing the legal status of land to be acquired; iii) assessing and proposing the amount for compensation of land; iv) conducting a public information program and providing counselling to landholders regarding the plans and objectives of land acquisition; v) facilitating deliberations between landholders and government agencies to arrive at final estimates and forms of compensation; vi) witnessing the handing over of compensation to holders of land titles and rights to buildings, plants, and other objects on the land; and (vii) providing official reports regarding the relinquishing of land titles.

A community awareness programme will be conducted by the project, with communities' representatives, assisting affected families in understanding the project and recording and solving potential grievances raised by them.

A major component of the project will involve strengthening the staffs of CRDA in operation and maintenance (O&M). Ensuring that dikes and riverbank protective works are adequately maintained will minimize erosion and loss of land along the affected rivers, thereby having a significant environmental benefit.

Detailed environmental management plans will be prepared based on the mitigation measures prepared in the previous paragraphs. The responsibility for implementing the plans will rest with DGBGTH and the PMO that will coordinate and implement the necessary works with the governorates concerned and the contractors in charge of the construction.

(5) Environmental monitoring

A monitoring and evaluation (M&E) unit will be established within the PMO. One of the responsibilities of M&E unit will be to implement the environmental monitoring system and to monitor the environmental impacts of the project.

The M&E unit will have three staff members. They will collect and analyse the data relating to the geography and morphology of active river channels, quality of water, soils and groundwater depth and quality.

The M&E unit will also be responsible to carry out monitoring of dust, noise, and other construction nuisances during execution of the project.

To ensure compliance of the project activities with agreed procedures and standards, a

comprehensive monitoring and evaluation system would be established, keeping in view the following objectives.

(a) To ascertain whether or not the land acquisition and compensation activities are on schedule, the liaison and public information campaigns are effective, the support is being provided to affected families during the land acquisition period, and the agreements are upheld and completed on time, among others. The socioeconomic of affected families following land acquisition will continue to be monitored for at least one year after all land acquisition has been completed. Any difficulties encountered during monitoring will be identified in the reports, along with recommended corrective actions to be taken by DGBGTH and local government;

(b) To select key indicators and to keep record of the environmental changes caused by the project during construction and operation phases;

(c) To keep record of the morphology, hydrology, and sedimentation during and after construction in and after flooding seasons;

(d) To keep monthly record of the fluctuation of and quality of groundwater;

(e) To keep record of the damages done by flooding, and duration of flood water that stays in the area;

(f) To keep record of the flood aftermaths, including creation of ponds/marshes;

(g) To keep record of human health;

(h) To monitor water quality on a regular basis as a component of the O&M program. This will include water sampling at sites of stream gauges, and specific monitoring of water quality in the floodplain after the retarding basin. The results will be made available to the national water quality data base and will also be available to serve as the basis for future management of water quality in the project's rivers as needed; and

(i) To monitor the impact of construction activities on access to the rivers by residents.

The contractors will be required to provide quarterly progress reports to DGBGTH. These reports will include a section on environmental mitigation describing (a) environmental measures achieved versus those planned, (b) problems which have arisen and how they have been dealt with (or proposed solutions), and (c) planned activities for the coming quarter. Annual environmental reports with a similar content will also be submitted to DGBGTH. DGBGTH should keep quarterly reports on land acquisition and compensation issues during the first year, and annual reports after the first year.

The Ministry in charge of environment, other environment-related authorities, and its subordinate offices at regional levels would undertake compliance monitoring and inspection of environmental mitigation measures in accordance with Tunisian laws and regulations on environmental monitoring.

Tables

Table J1.1.1 Major Environmental Laws and Regulations (1/2)

Laws and Relevant Regulations	Name of Law and Regulation	Authority concerned
No.66-27, April 1960	Work code including the chapter for hazardous establishment, insalubrities and incommodes	Ministry of Social Affairs
No.75-16, March 1975	Water code regulating the management and consumption of water in public domain	Ministry of Agriculture
No.82.1355, Oct.16,1982	Decree relative to the recuperation of used oil	Ministry of Industry
No.83-87, Nov.11,1983	Law on agricultural land protection	Ministry of Agriculture
No.85-86, Jan.2, 1985	Decree relative to the regulation of discharging in receiving area	Ministry of Agriculture
No.86-35, May 9, 1986	Law for the protection of archaeological, historical, natural and urban sites	Ministry of Culture
No.83-87,Nov.11, 1987	Law relative to the land protection	Ministry of Agriculture
No.66-60, July 4, 1966 No.88-20, April 1988	Forest code	Ministry of Agriculture
No.88-91, Aug.2, 1988	Law for the creation of the National Agency for the Protection of Environment	ANPE
No.106-002, July 20,1989	Decree relative to the Tunisian norms of effluent discharging in the hydraulic areas	ANPE
No.89-20, Feb.1989	Law relative to the exploitation of quarries	Ministry of Environment
No.90-2273, Dec.25,1990	Decree on the status of controller and expert of National Agency for the Protection of Nature	ANPE
No.66-27, Apr.30, 1991	Decree on the environmental impact assessment study	Ministry of environment
No.91-39, June 8, 1991	Decree related to the combat of disasters and their prevention and urgency organizations	Ministry of Interior
No.122-92, Dec.29,1992	Law related to land protection	ANPE
No.92-72, Aug.3, 1992	Law for plants protection	Ministry of Agriculture
No.93-120, Dec.27,1993	Investment code	Ministry of Industry
No.93-2055, Oct.34,1993	Decree relative to the annual prize of the President of Republic for nature and environmental protection	Ministry of Environment

Source: the Study Team

Table J1.1.1 Major Environmental Laws and Regulations (2/2)

Laws and Relevant Regulations	Name of Law and Regulation	Authority concerned
No.93-3903 and 304, Feb.1,1993	Decree fixing the attribution and organization of the Ministry of Environment	Ministry of Environment
No.94-16, Jan31,1994	Law on specifications related to the management of industrial areas	Ministry of Industry
No.95-72, July 24, 1995	Law for the creation of the National Agency for the Protection and Development of the Littoral	APAL
No.95-98, July 24,1995	Law for organic communes relative to the collection and elimination of solid wastes for local communities	Ministry of Environment
No.73-95, July24,1995	Law relative to the Public Maritime Domain	APAL
No.29-96, Apr.3, 1996	Law relative to the rapid intervention in combating marine pollution	ANPE
No.94-96, June 10,1996	Decree on the solid waste: control, management and elimination	ANPE
No.97.1102, June 2, 1997	Decree relative to the conditions and modalities of resumption and management of packaging sacks (Eco-life)	ANPE
No.769-99, Apr.5, 1999	Decree relative to the creation of the National Agency for Sanitary and Environmental Control of Products	Ministry of Health
No.2339, Oct.10, 2000	Decree relative to the fixation of hazardous wastes	ANPE
No. 2000, Oct.10, 2000	Hydrocarbons code	Ministry of Industry

Source: the Study Team

Table J3.3.1 List of River Improvement Works Planned for Flood Control (1/3)

Location	No.	Zone/area name	River name	Structural measures	Location[*1]	Target/extent/effect of flood protection	Tentative scale of structural measures (Principal dimensions)		Probable impacts on the environment	Remarks
Upper Area	A	Jendouba and Upstream	Mejerda (Upper reaches)	River improvement (excavation, revetment works, etc.)	63.9 Km - 158.3 Km	Mitigation of flood inundation damage in Jendouba City proper and its upstream	Length of river improvement	48.8 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	70 m		
							Planned dike height	2.0 m		
							Planned dike length (total of right and left river banks)	5.1 km		
	B	Mellegue Lower Reaches	Mellegue (Lower reaches)	Dike construction + river improvement (excavation, revetment works, etc.)	0 Km - 12.9 Km	Protection from flood inundation in the areas along the Mellegue lower reaches (cultivated land spreading in the left low land areas of the river reaches)	Length of river improvement	12.9 m	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	75 m		
							Planned dike height	2.0 m		
							Planned dike length (total of right and left river banks)	7.4 km		
	C	Mellegue Confluence to Bou Salem	Mejerda (Upper reaches)	Bypass channel at Bou Salem, incl. bridge construction	30.5 Km - 47.8Km	Mitigation of flood inundation damage in Bou Salem City and its upstream	Total length of bypass channel	7.7 km	Change of river flow regime, securing appropriate spoil disposal areas	It is expected that the land acquisition will not be required because the land along the planned alignment of bypass channel belongs to the government
							Channel width (between tops of side slopes on the right and left sides)	60 m		
							Design discharge (provisional)	700 m^3/s		
							Excavation volume	3.2 $mil.m^3$		
				Dike construction + river improvement (excavation, revetment works, etc.)	30.1 Km - 63.9 Km		Length of river improvement	33.8 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	The stakeholder meeting was held in Bou Salem in September 2007.
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	120 m		
							Planned dike height	3.0 m		
							Planned dike length (total of right and left river banks)	31.5 km		
	D	Upstream of Sidi Salem Dam (Up to Bou Salem)	Mejerda (Upper reaches)	River improvement (excavation, revetment works, etc.)	0 Km- 30.1 Km	Protection from flood inundation in the areas along the river reaches suffering from progress of sedimentation adjacently upstream of Sidi Salem Dam (cultivated land along the river reaches)	Length of river improvement	30.1 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	200 m		
							Planned dike height	4.0 m		
							Planned dike length (total of right and left river banks)	49.5 km		

Table J3.3.1 List of River Improvement Works Planned for Flood Control (2/3)

Location	No.	Zone/area name	River name	Structural measures	Location[*1]	Target/extent/effect of flood protection	Tentative scale of structural measures (Principal dimensions)		Probable impacts on the environment	Remarks
Middle Area	E	Downstream of Sidi Salem Dam to Larrousia Dam	Mejerda (Lower reaches)	Bypass channel at mejez El Bab, incl. bridge construction	105.3 Km - 110.6 Km	Mitigation of flood inundation damage in the zone including Mejez El Bab City proper, conservation of historical property (old bridge dating from the 17th century) of which the destruction or relocation seems difficult)	Total length of bypass channel	4.5 km	Change of river flow regime, land acquisition, securing appropriate spoil disposal areas	The channel passes through mainly agricultural lands, avoiding dwellings and the risks of resettlement
							Channel width (between tops of side slopes on the right and left sides)	60 m		
							Design discharge (provisional)	200 m^3/s		
							Excavation volume	2.65 $mil.m^3$		
				Dike construction + river improvement (excavation, revetment works, etc.)	67.3 Km - 148.5 Km		Length of river improvement	81.2 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	90 m		
							Planned dike height	1.0 m		
							Planned dike length (total of right and left river banks)	70.6 km		
Lower Area	F	El Battane	Mejerda (Lower reaches)	River improvement (excavation, revetment works, etc.)	48.5 Km - 67.3 Km	Mitigation of flood inundation damage in and around El Battane City proper, conservation of historical property (El Battane weir dating from the 17th century) of which the destruction or relocation seems difficult) and its downstream	Length of river improvement	18.8 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	95 m		
							Planned dike height	2.0 m		
							Planned dike length (total of right and left river banks)	0.5 km		
	G	Jedeida (up to confluence of Chafrou River)	Mejerda (Lower reaches)	Dike construction + river improvement (excavation, revetment works, etc.)	31.3 Km - 48.6Km	Mitigation of flood inundation damage in and around Jedeida City proper	Length of river improvement	17.3 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	110 m		
							Planned dike height	1.0 m		
							Planned dike length (total of right and left river banks)	15.5 km		
	H	El Mabtouh - Estuary of Mejerda River	Mejerda (Lower reaches)	Dike construction + river improvement (excavation, revetment works, etc.)	0 Km - 31.3 Km	Mitigation of flood inundation damage in agricultural land spreading along the Mejerda lowest reaches and conservation of the agricultural land	Length of river improvement	31.3 km	Impacts on river environment due to change of river flow regime, land acquisition, securing appropriate spoil disposal areas	The stakeholder meeting was held in Sidi Thabet in September 2007.
							River channel width after improvement works (between tops of riverbank slopes on the right and left sides)	170 m		
							Planned dike height	2.0 m		
							Planned dike length (total of right and left river banks)	40.3 km		

Table J3.3.1 List of River Improvement Works Planned for Flood Control (3/3)

Location	No.	Zone/area name	River name	Structural measures	Location*1	Target/extent/effect of flood protection	Tentative scale of structural measures (Principal dimensions)		Probable impacts on the environment	Remarks
Lower Area	H	El Mabtouh - Estuary of Mejerda River	Mejerda (Lower reaches)	Retarding basin	11.8 Km - 31.1 Km	Mitigation of flood inundation damage in agricultural land spreading along the Mejerda lowest reaches and conservation of the agricultural land	Total surface area of retarding basin	2230 ha	Impacts on surrounding agricultural land due to flood inundation (during floods)	The candidate area for retarding basin is pasture land (unused land) and unsuitable for agriculture, which is used currently as a natural retarding basin in a rainy season
							Planned inundation depth in retarding basin	3.0 m		
				Modification of existing drainage canal to convey some flood water to the retarding basin	11.8 Km - 31.1 Km		Length of new drainage canal	2.77 km	Securing appropriate spoil disposal areas	
							Length of existing drainage canal to be modified	27.01 km		
				Modification of existing facilities (gates structures, raising bridge)	11.8 Km - 31.1 Km		Sluice at outlet of drainage canal to be modified	23 sites	Land acquisition for raising bridge	Demolition of existing facilities and construction of new ones
							Raising bridge (incl. raising approach road)	6 bridges		

Note: *1 A, C, D: distance from upper end of Sidi Salem Reservoir, E to H: distance from estuary of Mejerda River, B: distance from confluence of Mellegue River with Mejerda River

Table J4.3.1 Description of Impact Factor and Conceivable Impacts due to Structural Measures for the Upstream Area (1/2)

Stage	Impact factor/Conceivable Impact	**Measure A** River improvement	**Measure B** Dike construction + river improvement	**Measure C1** Bypass channel, incl. bridge construction at Bou Salem	**Measure C2** Dike construction + river improvement	**Measure D** Dike construction + river improvement
(1) Impact factor (Impact induced activity)						
Pre-construction	Sensitization of local people on project structural measures	○	○	○	○	○
	Identification of affected people in land acquisition	○	○	○*	○	○
	Employment of local people for construction works	○	○	○	○	○
	Set-up of access road for mobilization and construction works	○	○	○	○	○
	Procurement of land, borrow site, spoil bank area and/or disposal lands of excavated material	○	○	○*	○	○
	Payment of necessary compensation fees	○	○	○*	○	○
Construction	Construction works (mobilization of equipments and construction machinery, transportation of construction material, excavation work, construction work of new facilities, etc.	○	○	○	○	○
	Transport and dumping of excavated material	○	○	○	○	○
Operation and Maintenance	Operation of new facility	○	○	○	○	○
	Maintenance work of removal of debris	○	○	○	○	○
(2) Conceivable impacts						
Pre-construction	People's unrest for new facility	○	○	○	○	○
	Land acquisition for construction, spoil bank and dumping of excavated material	○	○	○*	○	○
Construction	Increase of income by working as construction worker	○	○	○	○	○

Note: "○" means that there would be a relationship between the measure as a subproject component and factor or impact
A: refers to Jendouba and Upstream; B: refers to Mellegue lower reaches; C: refers to Mellegue Confluence to Bou Salem; D: refers to upstream of Sidi Salem Dam up to Bou Salem
*It is expected that land acquisition at Bou Salem will not be required because the land along the planned alignment of bypass channel belongs to the government. However, the 2nd stakeholders meeting has revealed that people may have owners' titles in public lands because some officials have sold lands to them or have given them a permit to occupy. These issues have to be clarified and solved prior to construction

Table J4.3.1 Description of Impact Factor and Conceivable Impacts due to Structural Measures for the Upstream Area (2/2)

Stage	Impact factor/Conceivable Impact	**Measure A** River improvement	**Measure B** Dike construction + river improvement	**Measure C1** Bypass channel, incl. bridge construction at Bou Salem	**Measure C2** Dike construction + river improvement	**Measure D** Dike construction + river improvement
(2) Conceivable impacts						
Construction	Impacts during construction work (noise, dust, emission gas, turbid water flow, etc.)	○	○	○	○	○
	Impacts during transportation and dumping of excavated material (noise, dust, emission gas, traffic accidents, etc.)	○	○	○	○	○
	Temporary stoppage of water flow and intake during construction work	○	○		○	○
Operation and Maintenance	Maintenance waste disposal of removed debris at channels and water courses	○	○	○	○	○
	Impacts of dumping of dredged material to spoil bank	○	○		○	○
	Better water flow and intake	○	○		○	○
	Better transport system			○		
	Better control of inundation	○	○	○	○	○

Note: "○" means that there would be a relationship between the measure as a subproject component and factor or impact
A: refers to Jendouba and Upstream; B: refers to Mellegue lower reaches; C: refers to Mellegue Confluence to Bou Salem; D: refers to upstream of Sidi Salem Dam up to Bou Salem

Table J4.3.2 Description of Impact Factor and Conceivable Impacts due to Structural Measures for the Mid-Stream Area

Stage	Impact factor/Conceivable Impact	**Measure E1** Bypass channel, incl. bridge construction at Mejez El Bab	**Measure E2** Dike construction + river improvement
(1) Impact factor (Impact induced activity)			
Pre-construction	Sensitization of local people on project structural measures	○	○
	Identification of affected people in land acquisition	○	○
	Employment of local people for construction works	○	○
	Set-up of access road for mobilization and construction works	○	○
	Procurement of land, borrow site, spoil bank area and/or disposal lands of excavated material	○	○
	Payment of necessary compensation fees	○	○
Construction	Construction works (mobilization of equipments and construction machinery, transportation of construction material, excavation work, construction work of new facilities, etc.	○	○
	Transport and dumping of excavated material	○	○
Operation and Maintenance	Operation of new facility	○	○
	Maintenance work of removal of debris	○	○
(2) Conceivable impacts			
Pre-construction	People's unrest for new facility	○	○
	Land acquisition for construction, borrow pits, spoil bank and dumping of excavated material	○	○
Construction	Increase of income by working as construction worker	○	○
	Impacts during construction work (noise, dust, emission gas, turbid water flow, etc.)	○	○
	Impacts during transportation and dumping of excavated material (noise, dust, emission gas, traffic accidents, etc.)	○	○
	Temporary stoppage of water flow and intake during construction work		○
Operation and Maintenance	Maintenance waste disposal of removed debris at channels and water courses	○	○
	Impacts of dumping of dredged material to spoil bank		○
	Better water flow and intake		○
	Better transport system	○	
	Better control of inundation	○	○

Note: "○" means that there would be a relationship between the measure as a subproject component and factor or impact
E: refers to downstream of Sidi Salem Dam to Larrousia Dam

Table J4.3.3 Description of Impact Factor and Conceivable Impacts due to Structural Measures for the Downstream Area (1/2)

Stage	Impact factor/Conceivable Impact	**Measure F** River improvement	**Measure G** Dike construction + river improvement	**Measure H1** Dike construction + river improvement	**Measure H2** Retarding basin and modification of canals, gates structures and raising bridges
(1) Impact factor (Impact induced activity)					
Pre-construction	Sensitization of local people on project structural measures	○	○	○	○
	Identification of affected people in land acquisition	○	○	○	○
	Employment of local people for construction works	○	○	○	○
	Set-up of access road for mobilization and construction works	○	○	○	○
	Procurement of land, borrow site, spoil bank area and/or disposal lands of excavated material	○	○	○	○
	Payment of necessary compensation fees	○	○	○	○
Construction	Construction works (mobilization of equipments and construction machinery, transportation of construction material, excavation work, construction work of new facilities, etc.	○	○	○	○
	Transport and dumping of excavated material	○	○	○	○
Operation and Maintenance	Operation of new facility	○	○	○	○
	Maintenance work of removal of debris	○	○	○	○
(2) Conceivable impacts					
Pre-construction	People's unrest for new facility	○	○	○	○
	Land acquisition for construction, spoil bank and dumping of excavated material	○	○	○	○
Construction	Increase of income by working as construction worker	○	○	○	○

Note: "○" means that there would be a relationship between the measure as a subproject component and factor or impact
F: refers to the El Battane area; G: refers to Jedeida up to confluence of Chafrou River; H: refers to the El Mabtouh to the estuary of the Mejerda River

Table J4.3.3 Description of Impact Factor and Conceivable Impacts due to Structural Measures for the Upstream Area (2/2)

Stage	Impact factor/Conceivable Impact	**Measure F** River improvement	**Measure G** Dike construction + river improvement	**Measure H1** Dike construction + river improvement	**Measure H2** Retarding basin and modification of canals, gates structures and raising bridges
(2) Conceivable impacts					
Construction	Impacts during construction work (noise, dust, emission gas, turbid water flow, etc.)	○	○	○	○
	Impacts during transportation and dumping of excavated material (noise, dust, emission gas, traffic accidents, etc.)	○	○	○	○
	Temporary stoppage of water flow and intake during construction work	○	○	○	○
Operation and Maintenance	Maintenance waste disposal of removed debris at channels and water courses	○	○	○	○
	Impacts of dumping of dredged material to spoil bank	○	○	○	○
	Better water flow and intake	○	○	○	
	Better transport system				
	Better control of inundation	○	○	○	○

Note: "○" means that there would be a relationship between the measure as a subproject component and factor or impact
F: refers to the El Battane area; G: refers to Jedeida up to confluence of Chafrou River; H: refers to the El Mabtouh to the estuary of the Mejerda River

Table J4.5.1 Impact Matrix for Project Structural Measures Envisaged in the Master Plan

Environment Elements / Project Structural Measures		Physical Environment								Natural Environment			Socio-economic Environment					
		Topography and Geology	Soil Erosion	Waste (Dredged/excavated material)	Groundwater (well water use)	Water quality Mejerda River	Water quality Retarding Basin	Air quality (emission gas, dust)	Noise and vibration	Terrestrial flora and fauna	Aquatic flora and fauna	Protected species and areas	Land acquisition	People 's unrest and conflict / opposition	Change of income/livelihood	Impact on agriculture, forestry and fishery	Impacts on downstream area	Traffic and transportation
1) Measures for the upper area (Jendouba, Le Kef Governorates, west part of Beja Governorate)	Measure A: Jendouba & U/s Improvement Works	-	+1	-1	-	-1		-1	-2	-			-1	-1	+1	-1	-	-1
	Measure B: Mellegue Improvement Works	-	+1	-	-	-1		-1	-1	-			-	-	+	-	-	-
	Measure C1: Bou Salem Bypass Channel	-1		-2	-	-2		-1	-2		-2		-1	-1	+3	-1	-	-1
	Measure C2: Bou Salem & U/s Improvement Works	-	+1	-2	-	-1		-1	-2	-1			-	-	+2	-1	-	-1
	Measure D: Improvement Works D/s of Bou Salem up to Sidi Salem Reservoir	-	+1	-2	-	-1		-1	-2	-1			-	-	+2	-1	-	-1
2) Measures for the mid-stream area (east part of Beja Governorate)	Measure E1:Mez El Bab Bypass Channel	-1		-2	-	-2		-1	-2		-2		-2	-2	+2	-1	-	-1
	Measure E2: Improvement Works D/s of Sidi Salem Dam up to Larrousia Dam	-	+1	-1	-	-1		-1	-2	-			-1	-1	+1	-1	-	-1
3) Measures for the downstream area (Ariana, Manouba,and Bizerte Governorates)	Measure F: El Battane Improvement Works	-	+1	-1	-	-1		-1	-2	-			-1	-1	+1	-1	-	-1
	Measure G: Jedeida Improvement Works	-	+1	-1	-	-1		-1	-2	-			-1	-1	+1	-1	-	-1
	Measure H1: Mabtouh Improvement Works	-	+1	-1	-	-1		-1	-1	-			-1	-1	+1	-1	-	-1
	Measure H2:Mabtouh Retarding Basin			-1		-1	-1	-1	-1				-1	-	+1	-1	-	-1
4) No Action	No measures applied		-3			-3				-3	-3				-3	-3	-3	

Note) " -": Negligible negative impact, " -1" : Minor negative impact, " -2": Medium negative impact, " -3": Significant negative impact
" +" Negligible positive impact, " +1" : Minor positive impact, " +2" : Medium positive impact, " +3" : Significant positive impact

Table J4.6.1 Evaluation of Structural Measures in the Master Plan

1) Measures for the upper area

Structural measures	Negative Impact			Positive Impact	Evaluation
	Pre-construction	Construction	Operation	All stages	
Jendouba & U/s Improvement Works	-1	-2		+1	○
Mellegue Improvement Works	-	-1		+	◎
Bou Salem Bypass Channel	-1	-2	-2	+3	○
Bou Salem & U/s Improvement Works	-	-2		+2	○
Improvement Works D/s of Bou Salem up to Sidi Salem Reservoir	-	-2		+2	○

2) Measures for the middle area

Structural measures	Negative Impact			Positive Impact	Evaluation
	Pre-construction	Construction	Operation	All stages	
Mez El Bab Bypass Channel	- 2	-2	-2	+2	○
Improvement Works D/s of Sidi Salem Dam up to Larrousia Dam	-1	-2		+1	○

3) Measures for the lower area

Structural measures	Negative Impact			Positive Impact	Evaluation
	Pre-construction	Construction	Operation	All stages	
El Battane Improvement Works	-1	-2		+1	○
Jedeida Improvement Works	-1	-2		+1	○
Mabtouh Improvement Works	-1	-1		+1	○
Mabtouh Retarding Basin	-1	-1	-1	+1	○

Note) " -": Negligible negative impact, " -1" : Minor negative impact, " -2": Medium negative impact, " -3": Significant negative impact, " +" Negligible positive impact, " +1" : Minor positive impact, " +2" : Medium positive impact, " +3" : Significant positive impact
○: Recommendable, ◎: Recommended

Table J4.7.1 Framework of Environmental Management for Mitigation and Monitoring (1/2)

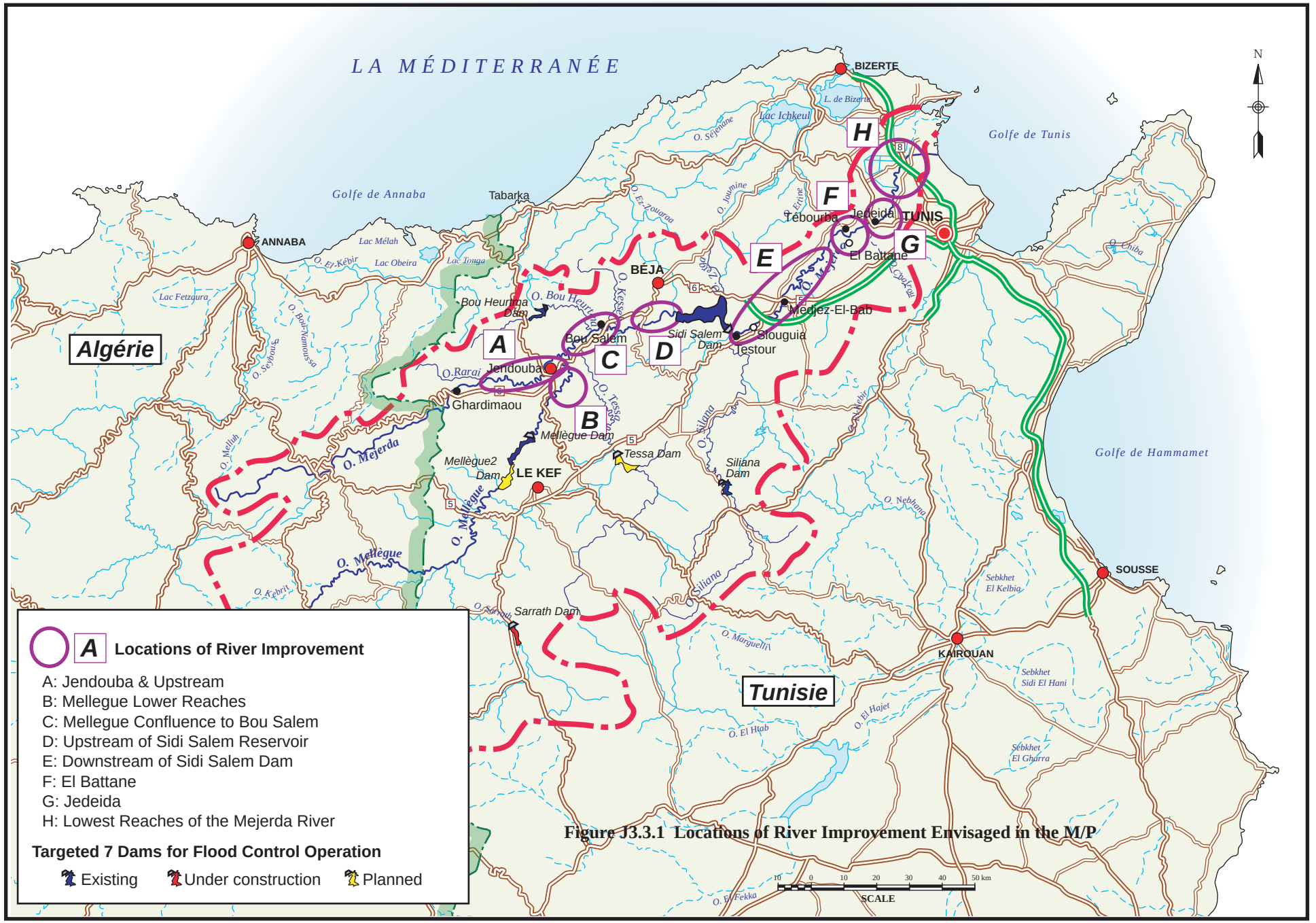
Project structural measures	Impacts with medium magnitude	Conceivable mitigation measures	Necessary monitoring item
Jendouba and Upstream Improvement Work	Noises and vibrations during construction period	Prohibit transportation of material near localities and sensitive facilities such as school, clinic etc, gear down vehicles, and ban all horn use	Noise and vibration levels along the transportation road and in settlement area.
Bou Salem Bypass Channel	Land acquisition and social problem at pre-construction	Dissemination of necessity of the project. According to relevant regulation and policies, provide adequate compensation fees	Complaint from local people
	People's unrest and conflict/opposition	Dissemination of necessity of bypass channel, including possible impacts and benefits. Compensation for inconvenience of daily life	Comments and complaints from local residents
	Noises and vibrations during construction period	Prohibit transportation of material near localities and sensitive facilities such as school, clinic etc, gear down vehicles, and ban all horn use	Noise and vibration levels along the transportation road and in settlement area.
	Earthwork fill, spoil and oil wastewater will affect the Mejerda water quality during construction	Strengthen environmental management, and reduce disturbance to the water bodies Maintain and clean machinery and vehicles in a fixed area away from the riverbanks. Build simple, seep resistant lavatory and septic tank, and sanitize and clean up refuge. Build an earth bank along the river to prevent wastewater discharge into the river	Water quality in Mejerda River, Impacts on aquatic organisms
	Generation of waste (Dredged/excavated)	Land acquisition with proper method and compensation for procurement of spoil bank area. Proper management for dumped material not to discharge to surrounding area	Condition of spoil bank, Complaint from local residents
Bou Salem and Upstream Improvement Works	Noises and vibrations during construction period	Same as the case of Jendouba Improvement Works	Noise and vibration levels along the transportation road and in settlement area.
	Generation of waste (Dredged/excavated)	Same as the case of Jendouba Improvement Works	Condition of spoil bank, Complaint from local residents

Table J4.7.1 Framework of Environmental Management for Mitigation and Monitoring (2/2)

Project structural measures	Impacts with medium magnitude	Conceivable mitigation measures	Necessary monitoring item
Improvement Works Downstream of Bou Salem up to Sidi Salem Reservoir	Noises and vibrations during construction period	Same as the case of Bou Salem Improvement Works	Noise and vibration levels along the transportation road and in settlement area.
	Generation of waste (Dredged/excavated)	Same as the case of Bou Salem Improvement Works	Condition of spoil bank, Complaint from local residents
Mez El Bab Bypass Channel	Land acquisition and social problem at pre-construction	Same as the case of Bou Salem bypass channel	Complaint from local people
	People's unrest and conflict/opposition	Same as the case of Bou Salem bypass channel	Comments and complaints from local residents
	Noises and vibrations during construction period	Same as the case of Bou Salem bypass channel	Noise and vibration levels along the transportation road and in settlement area.
	Earthwork fill, spoil and oil wastewater will affect the Mejerda water quality during construction	Same as the case of Bou Salem bypass channel	Water quality in Mejerda River, Impacts on aquatic organisms
	Generation of waste (Dredged/excavated)	Same as the case of BouSalem bypass channel	Condition of spoil bank, Complaint from local residents
Improvement Works Downstream of Sidi Salem Dam up to Larrousia Dam	Noises and vibrations during construction period	Same as the case of Bou Salem Improvement Works	Noise and vibration levels along the transportation road and in settlement area.
El Battane Improvement Works	Noises and vibrations during construction period	Same as the case of Mez El Bab Improvement Works	Noise and vibration levels along the transportation road and in settlement area.
Jedeida Improvement Works	Noises and vibrations during construction period	Same as the case of El Battane Improvement Works	Noise and vibration levels along the transportation road and in settlement area.

Source: the Study Team

Figures



A **Locations of River Improvement**

A: Jendouba & Upstream
B: Mellegue Lower Reaches
C: Mellegue Confluence to Bou Salem
D: Upstream of Sidi Salem Reservoir
E: Downstream of Sidi Salem Dam
F: El Battane
G: Jedeida
H: Lowest Reaches of the Mejerda River

Targeted 7 Dams for Flood Control Operation

Existing Under construction Planned

Figure J3.3.1 Locations of River Improvement Envisaged in the M/P

Annexes

APPENDIX 1

Units (facilities and/or projects) obligatorily submitted to an Impact Study on the Environment (EIA)

Category A: Units which require a consulting period which does not exceed 21 working days

1) Units of domestic and assimilated waste with a capacity that does not exceed 20 tons per day.
2) Units of treatment and manufacture of building materials of ceramics and glass
3) Units of drugs manufacturing
4) Units of manufacturing non ferrous metals
5) Units of metal treatment and surface treatment
6) project of exploration and extraction of oil and natural gas
7) Industrial quarries of ballast and sand which output do not exceed 300000 tons per year, and the industrial quarries of clay and marble stones.
8) Manufacturing unit of sugar refinery and yeast
9) Unit of thread textile dyeing, of clothing, knitting and jeans fading and completion
10) Project of development of industrial areas the surface of which does not exceed five (5) hectares
11) Project of urban allotment which surface is comprised between five (5) and twenty (20) hectares
12) Project of development of tourist areas the surface of which is comprised between ten (10) and thirty (30) hectares
13) Manufacturing units of mineral fibre
14) Units of manufacturing, transformation, conditioning and conservation of foodstuff
15) Slaughterhouses
16) Manufacturing or construction unit of car, lorries or their motors
17) Shipyard projects
18) Project of manufacturing and maintenance of aircraft
19) Units of shellfish farming
20) Water desalination units in industrial and tourist units
21) Units of spa and hydrotherapy industry
22) Hotel units with a capacity exceeding three hundred beds (300)
23) Manufacturing unit of paper and cardboard
24) Manufacturing unit of elastomer and peroxide

Source: ANPE, MEDD

ANNEX J1.1.1

Category B: Units which require a consulting period that does not exceed three working months (3 months)

1) Unit of raw oil refinery and installation of gasification and liquefaction of at least 500 tons of coal or bituminous schist oil per day
2) Unit of electricity manufacturing with at least a capacity of three hundred MW
3) Units of domestic and assimilated waste with a capacity that does not exceed 20 tons per day.
4) Unit of management of hazardous wastes
5) Manufacturing unit of concrete, whitewash and gypsum
6) Manufacturing unit of chemicals, pesticides, painting, polish and bleach category 2 according to the nomenclature of establishments known as hazardous, unhealthy and inconvenient.
7) Steel units
8) Industrial quarries of ballast and sand which output do not exceed 300000 tons per year, and the extraction of water resources.
9) Manufacturing unit of paper pulp and treatment of cellulose
10) Project of construction of railways, motorways, express roads, bridges and grade separation
11) Project of airport construction with a takeoff and landing track longer than two thousand one hundred meter (2100).
12) Project of commercial, fishing and pleasure ports
13) Project of development of industrial areas with a surface exceeding five (5) hectares
14) Project of urban allotment with a surface that does not exceed twenty (20) hectares
15) Project of development of tourist areas the surface of which exceeds thirty hectares (30)
16) Transport facilities of raw oil and gas
17) Units of treatment of urban waste water
18) Collective units of treatment of industrial waste water
19) Units of tannery and tanning
20) Project of irrigated areas through treated waste water
21) Projects of big dams
22) Aquaculture project not mentioned in category A of Appendix 1
23) Desalination unit of drinking water supply in urban areas
24) Project of vacation village with a capacity exceeding one thousand bed (1000)
25) Units of extraction, treatment, and washing of mineral and non mineral products
26) Units of phosphate transformation and its by products

Source: ANPE, MEDD

ANNEX J1.1.1

APPENDIX 2

Units (facilities and/or projects) submitted to Terms and Conditions

1) Projects of urban allotment with a surface area which does not exceed five (5) hectares and projects of tourist area with a surface area which does not exceed ten (10) hectares
2) Projects of construction of schools and teaching establishments
3) Projects of construction of canals for water conveyance or diversion
4) Projects of energy transport which are not mentioned in Appendix 1 and which do not cross legally protected areas such as natural and significant areas
5) Project of costal development not mentioned in Appendix 1
6) Oil mil units
7) Units of animal and vegetal oil extraction
8) Units classified of animal breeding
9) Unit of textile industry not mentioned in Appendix 1
10) Unit of stamping,, cutting and big metal parts
11) Units of storage, hydrocarbon distribution or the stations of washing and greasing vehicles
12) Manufacturing units of starchy
13) Traditional quarries
14) Units of storage of gas and chemical products
15) Boiler making industry, tank construction and other parts of sheet-metal works
16) Laundries using water for washing clothes and blankets
17) Lake occurring between hills
18) Manufacturing units of toiletries and vitamins

Source: ANPE, MEDD

ANNEX J3.1.1

Ministry of Agriculture And water Resources
General Direction of Dams and Large Hydraulic Works

Japan International Cooperation Agency

The Study on Integrated Basin Management
Focused on Flood Control in Mejerda River

Questionnaire for Survey on Residents' Acceptance of Flood Risk

Questionnaire N° :----------
Name of Interviewer :----------
-

N°	Questions	Responses	Jump to question	Observations
	General data			
Q1	**Place of Interview**	Governorate----------Delegation----------Locality----------		
Q2	**Date of Interview**	DJ----- Month --------- Year 2007		
Q3	**Time of Interview**	Start----------End----------		
Q4	**Profil of respondent**			
4.1	Name of respondent (N° Cel.)			
4.2	**Place of residence**			
4.2.1	Addresse (Indicate the locality)			
4.2.2	Coordinate (GPS)	N----------E----------		
4.3	Living period at the above residence	---------- years		
4.4	Sex	a. Male b. Female		
4.5	Age	---------- years		
4.6	Status/ Occupation	a. Chief of Locality b. Resident (M-F) c. Traders (various) d. Craftsmen/Industrials e. Farmers/Livestock breeders f. Educational staff g. Health staff h. Government Staff i. Others		
4.7	Size of Family	----------persons		
4.8	Structure of family	a. Wife b. Husband c. Children (no.)---------- d. Others (to indicate)----------		
4.9	Distance from the nearest river	---------- m		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
Q5	**Experience of flood damage**			
5.1	Were you and/or your family affected by the flood inundation in 2003?	a. Yes b. No		
5.2	Do you have experience of suffering other flood damage?	a. Yes b. No →	**If answer is « No », jump to Q6**	
5.3	**If answer is « yes », ask question 5.3.1 and following**			
5.3.1	Which flood did the flood damage to you ?	a. 1973 Flood (March 1973) b. 2000 Flood (May 2000) c. 2004 Flood (Dec. 03/Feb. 04) d. 2005 Flood (Jan.Feb. 2005) e.Others (state flood year) ----------		(Select one or more.)
5.3.2	**Type of flood damage**			
a.	Flood year	----------		
1)	Inundations			
i)	House yard/Business/place	i)-1 Inundation depth___ m (max) i)-2 Inundation period___ day(s) i)-3 Damage ___ TND		
ii)	Cultivated land(s)	ii)-1 Inundation depth___ m (max) ii)-2 Inundation period___ day(s) ii)-3 Damage ___ TND		
iii)	Damage to livestock	Bovine---------- Ovine----------		
2)	Closure of road	i) Inundation depth___ m (max) ii) Period of closure --------days		
3)	Shortage of drinking water	---------- days		
4)	Disease	i) Name ---------- ii) Medical expense ---------- TND		
5)	Work interruption	i) Period ----------days ii) Loss ---------- TND		
b.	Flood year	----------		
1)	Inundations			
i)	House yard/Business/place	i)-1 Inundation depth___ m (max) i)-2 Inundation period___ day(s) i)-3 Damage ___ TND		
ii)	Cultivated land(s)	ii)-1 Inundation depth___ m (max) ii)-2 Inundation period___ day(s) ii)-3 Damage ___ TND		
iii)	Damage to livestock	Bovine---------- Ovine----------		
2)	Closure of road	i) Inundation depth___ m (max) ii) Period of closure --------days		
3)	Shortage of drinking water	---------- days		
4)	Disease	i) Name ---------- ii) Medical expense ---------- TND		
5)	Work interruption	i) Period ----------days ii) Loss ---------- TND		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
c.	Flood year	----------		
1)	Inundations			
i)	House yard/Business/place	i)-1 Inundation depth___ m (max) i)-2 Inundation period___ day(s) i)-3 Damage ___ TND		
ii)	Cultivated land(s)	ii)-1 Inundation depth___ m (max) ii)-2 Inundation period___ day(s) ii)-3 Damage ___ TND		
iii)	Damage to livestock	Bovine---------- Ovine----------		
2)	Closure of road	i) Inundation depth___ m (max) ii) Period of closure --------days		
3)	Shortage of drinking water	---------- days		
4)	Disease	i) Name ---------- ii) Medical expense ---------- TND		
5)	Work interruption	i) Period ----------days ii) Loss ---------- TND		
5.3.3	Did you receive any relief to the above flood damage from the central/local government(s) ?	a. Yes b. No →	**If answer is« no », jump to Q6**	
5.3.4	**If answer is« yes », ask question (1) and following**			
(1)	What was the relief you received from the central/local government(s) ?	a. Food b. Medicine c. Clothes /Blankets d. Money ---------- TND e. Tents f. Mobilization of support staff g. Others (state)----------		
(2)	Were you satisfied by the relief from the central/local government(s)	a. Yes → b. No	**If answer is « yes», jump to Q6**	
(3)	How can the relief effort be improved?	a. Compensate all my losses b. Reasonably compensate me c. Channel the relief through existing organizations d. Others (state)----------		
Q6	**Fear of flood**			
6.1	Are you afraid of flood?	a. Yes b. No → c. No idea	**If answer is« b or c », jump to Q7**	
6.2	Why are you afraid of flood ?	a. It may cause a great loss of life. b. It may wash out a lot of houses. c. It may cause widespread destruction of property due to house yard inundation. d. It may cause serious loss due to inundation over cultivated land(s). e. It can destroy the livestock f. I am afraid of leaving the house f. Others (state)----------		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
Q7	**Perception of flood risk**			
7.1	Do you think serious floods will occur near your house and/or your land(s) in future ?	a. Yes b. No → c. No idea	**if answer is « b ou c », jump to Q8**	
7.2	**If answer is « yes », ask question 7.2.1 and following**			
7.2.1	Do you think the measures for the future floods have been fully taken near your house/your business and/or your land(s)/	a. Yes b. No c. No idea		
7.2.2	Do you think there is any danger of damage to your house/your business and/or your land(s) due to the future floods	a. Yes → b. No c. No idea ↓	**If answer is « yes », jump to Q : 7.2.4**	
7.2.3	Why do you think there is no danger of damage?	_____ _____		**Open answer**
7.2.4	**If answer is « yes », ask question (1) and following**			
(1)	Why do you think there is any danger of damage to your house/your business and/or your land(s) due to the future floods ?	a. It seems that the present river flow capacity is not so high compared to flood flow. b. My house and/or land(s) are situated in low land area(s). c. A large amount of water has been frequently released from dam(s) during flood. d. No or incomplete measures for flood prevention are provided near my house and/or land(s). e. Others : (state)---------- ----------		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
(2)	What do you think would be the damage to you, your family, your house and/or your land(s) due to the future floods?			
1)	Inundation			
i)	House yard/Business/place	i)-1 Inundation depth____ m (max) i)-2 Inundation period____ day(s) i)-3 Damage ____ TND		
ii)	Cultivated land(s)	ii)-1 Inundation depth____ m (max) ii)-2 Inundation period____ day(s) ii)-3 Damage ____ TND		
iii)	Damage to livestock	Bovine---------- Ovine----------		
2)	Closure of road	i) Inundation depth____ m (max) ii) Period of closure --------days		
3)	Shortage of drinking water	---------- days		
4)	Disease	i) Name ---------- ii) Medical expense ---------- TND		
5)	Work interruption	i) Period ----------days ii) Loss ---------- TND		
Q8	**Acceptability of flood damage risk**			
8.1	What would be, according to you, the frequency of flood inundation one could tolerate ?	a. None b. once in every year c. once in 2 years d. once in 5 years e. once in 10 years f. once in 20 years g. once in more than 20 year		
8.2	Flood damage that would be acceptable to one			
1)	Inundation			
i)	House yard/Business/place	i)-1 Inundation depth____ m (max) i)-2 Inundation period____ day(s) i)-3 Damage ____ TND		
ii)	Cultivated land(s)	ii)-1 Inundation depth____ m (max) ii)-2 Inundation period____ day(s) ii)-3 Damage ____ TND		
iii)	Damage to livestock	Bovine---------- Ovine----------		
2)	Closure of road	i) Inundation depth____ m (max) ii) Period of closure --------days		
3)	Shortage of drinking water	---------- days		
4)	Disease	i) Name ---------- ii) Medical expense ---------- TND		
5)	Work interruption	i) Period ----------days ii) Loss ---------- TND		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
Q9	**Structural measures for reducing flood damage**			
9.1	What do you know as the structural measures for reducing flood damage ?	a. Dam b. River channel c. Levee d. Retarding basin* e. Others (state) ---------- ----------		* Facilities to temporarily store floods for reducing flood peak discharge
9.2	Do you think it is necessary to construct one or more of the above structures for reducing flood damage near your house and/or land(s) ?	a. Yes ⟶ b. No c. No idea	**If answer is « yes », jump to Q : 9.4**	
9.3	Why do you think it is not necessary to construct one or more of the above structures?	a. I cannot see the effect of the structures for reducing flood damage. b. The construction costs of the structures seem very high, compared with their effect. c. I do not feel a problem with flood because flood inundation does not cause a serious problem. d. Others (state)---------- ----------	**Jump to question 10**	
9.4	Why do you think it is necessary to construct the above structures for reducing flood damage ?	a. To live, my family and I, with a sense of security and in safety without fear of flood owing to the effect of the structures on flood damage reduction. b. To preserve our income sources c. Others (state)---------- ----------		
Q10	**Non-structural measures for reducing flood damage**			
10.1	What do you know as the non-structural measures for reducing flood damage?	a. Flood forecasting/warning system b. Announcement system for evacuation c. Flood fighting activities d. Preparation and dissemination of hazard map* e. Land use control by regulation/ordinance f. Promotion of water-resistant house g. Flood insurance h. Do not know any measures		* Showing flood inundation areas and evacuation routes/sites during dangerous floods

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
10.2	Do you think it is necessary to take one or more of the above mentioned non-structural measures for reducing flood damage for you and your family ?	a. Yes ⟶ b. No c. No idea	**If answer is « yes », jump to Q : 10.4**	
10.3	Why do you think it is not necessary to take one or more of the above mentioned non-structural measures?	a. The effect of the measures on flood damage reduction seems rather small. b. I do not feel a problem with flood because flood inundation does not cause a serious problem. c. Others (state)----------	**Go to question 11**	
10.4	Why do you think it is necessary to take one or more of the above non-structural measures for reducing flood damage for you and your family ?	a. Effective preventive measures are expected to be properly adopted before actual occurrence of dangerous flood. b. To preserve our income sources c. Others (state)----------		
Q11	**Reliance on central/local government(s) for reducing flood damage**			
11.1	Do you think the central/local government(s) will take the above-mentioned structural and/or non-structural measures in the near future so as to prevent flood damage to you, your family, your house/your business and/or your land ?	a. Yes ⟶ b. No c. No idea	**If answer is « yes », jump to question 11.**3	
11.2	Why do you think the central/local government(s) will not take the above-mentioned structural and/or non-structural measures ?	a. The government(s) seem/s not to understand the necessity of taking the measures b. It seems to be difficult for the government(s) to procure the fund for the measures due to the budgetary constraint. c. Others (state)----------		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
11.3	Are the above structural and/or non-structural measures in harmony with your expectations concerning the prevention of flood damage to you, your family, your house and/or your land(s) by the officials?	a. Yes ⟶ b. No	**If answer is «yes », jump to question 11.**5	
11.4	If "No", what other measures do you have in mind ?	_____ _____		
11.5	Do you expect to receive any relief from the central/local government(s) when you suffer any flood damage ?	a. Yes b. No ⟶	**If answer is « no », jump to question 12**	
11.6	What is the relief you expect to receive from the central/local government(s) when you suffer any flood damage ?	a. Food b. Medicine c. Clothes /Blankets d. Tents e. Money---------- TND f. Forage, seeds, Livestock g. Mobilization of support staff h. Drinking water i. Place for evacuation j. Others (state)----------		
Q12	**Appreciation of self-responsibility to flood damage risk**			
12.1	Do you think the measures for flood damage prevention need to be taken to some extent on your own responsibility?	a. Yes ⟶ b. No c No idea	**If answer is « yes »,jump to question 12.3**	
12.2	Why do you think the measures for flood damage prevention need not to be taken to some extent on your own responsibility ?	a. The responsibility for the flood damage risk lies with the central/local government(s). b. I do not mind having inundation of my house/ my business and/or land(s) c. I cannot do anything against inundations d. Others (state)----------		

ANNEX J3.1.1

N°	Questions	Responses	jump to question	Observations
12.3	What do you think you need to take on your own responsibility as the measures for reducing flood damage risk ?	**a. House/business/place** i) construction of levee around your house /business/place ii) Rearrangement of household goods to higher positions iii) Raising your house /business iv) Movement of your house/business/place to higher site v) Sheltering a disaster stricken family vi) Others (state)---------- **b. Land(s)** i) Cultivation of crops resistant to flood inundation ii) Cultivation of crops during non-flood periods iii) Construction of levee around your land(s) iv) Movement of your land(s) v) Others (state)----------		
12.4	How much are you willing to pay at maximum for the measures which need to be taken on your own responsibility for reducing flood damage risk ?	a. 0 TND b. according to my means c. less than 100TND d. 100 TND e. 500 TND f. 1000 TND g. 2000 TND h. more than 2,000TND		

ANNEX J3.1.1

N°	Questions	Responses	Jump to question	Observations
Q13	**Priority as to measures for reducing flood damage risk**			
13.1	Among the following structural and non-structural measures, which do you think need to be taken with high priority for reducing flood damage risk to you, your family, your house and your land(s)?	a. Structural measures: a-1. Formulation of optimum reservoir operation rule at existing dams for flood control to minimize flood peak discharge released from the dams a-2. River channel improvement to enhance flood conveyance capacity, including construction of levee a-3. Construction of retarding basin(s) to temporarily store floods for reducing flood peak discharge a-4. Construction of farm roads b. Non-structural measures b-1. Development of flood forecasting/warning system for preparation of evacuation activities before dangerous floods b-2. Establishment of flood announcement system for evacuation b-3. Establishment of flood fighting system during floods under community participation b-4. Preparation and dissemination of flood hazard map b-5. Land use control by regulation/ordinance b-6. Preventing people from building in lower areas b-7. Promotion of water-resistant house b-8. Establishment of flood insurance system		(Select one or more with priority order)

ANNEX J4.7.1

Expropriation for public utility

Detailed steps and procedures

The steps and procedures for the expropriation in the public interest during the construction of water projects are governed by the Water Code and by Law No. 76/85 of 11/08/1976, as amended and supplemented by Law n ° 2003-26 of 14 April 2003.

N°	Action	Concerned Organisation
1	Selection of the site, its location on a map, defining the area needed for the project and information of the Ministry of the State Land and Property	Ministry of Agriculture (Directorate-General in charge of the project)
2	Launching a tender to recruit a Study company for the completion of a detailed plan of the parcel of land needed for the project and the list of landowners	Ministry of Agriculture (Directorate-General in charge of the project)
3	Send a copy of the detailed plan of the parcel of land and the list of landowners to CRDA and the regional authorities concerned and to the regional representative of the Ministry of the State Land and Property : (Directorate General of the Acquisition and Delimitation and the Directorate General of Expertise)	Ministry of Agriculture (Directorate-General in charge of the project)
4	Study of the situation at the project site and information to farmers affected by the usefulness of the proposed project, registering their suggestions and proposals.	Governorate, Delegation, CRDA, Commission on Recognition and Reconciliation created by Article 10 of Law No. 2003-26 of 14 April 2003
5	Establishment of a specialized technical committee under the leadership of Governor (or delegate) and the Regional Commissioner (CRDA) and consisting of all the parties concerned (Representative of the Directorate-General concerned by the project, the CRDA concerned, the members of the regional commission responsible for assessing the value of farmland and the farmers' representatives). The commission assesses the damage that might result from the creation of the project and evaluates the value of agricultural land to be expropriated per hectare. The commission study all technical and social data about the scheduled project: engineering drawings, lists, titles, current prices. It moves on site to observe the situation and record all remarks	Governorate, Delegation, Commission on Recognition and Reconciliation created by Article 10 of Law No. 2003-26 of 14 April 2003

ANNEX J4.7.1

N°	Action	Concerned Organisation
6	Classification of plots of land to be expropriated into several categories depending on the soil conditions, the location of the plot and its specificities. Following this expertise, a report is prepared with the agreement of all members of the commission and the delineation of the area covered by the work on the site, so that each farmer knows the part that will be expropriated and the remainder in its property.	Delegation, CRDA, Representative of Ministry of the State Land and Property , Commission on Recognition and Reconciliation created by Article 10 of Law No. 2003-26 of 14 April 2003
7	Damage assessment that the farmer may suffer in terms of its seasonal revenue and establishing a detailed list of all recipients and the total value of compensation.	Delegation, CRDA, Representative of Ministry of the State Land and Property , Commission on Recognition and Reconciliation created by Article 10 of Law No. 2003-26 of 14 April 2003
8	Invitation of those affected by the expropriation and negotiating with them on the value of compensation that have been fixed as a result of expertise, taking into consideration the current prices in the region, so as to come with them to an amicable settlement. If the person accepts the offer out of court, a contract is signed by the interested person and then by the Ministry of the State Land and Property. If the person refuses to an amicable agreement, the Commission for Conciliation and Recognition which is chaired by a judge makes a judgement involving the value of compensation to allocate to that person.	Commission on Recognition and Reconciliation created by Article 10 of Law No. 2003-26 of 14 April 2003
9	The Ministry of the State Land and Property establishes an expropriation decree to be implemented.	Ministry of the State Land and Property
10	Information of the persons concerned of the decision of expropriation and compensation and preparation of transfer and registration of related contracts.	Ministry of the State Land and Property
11	The expropriation allowances are paid directly to the person concerned by the Ministry of Agriculture.	Ministry of Agriculture and concerned CRDA

Source : Ministry of Agriculture