

## Inundation Protection Project

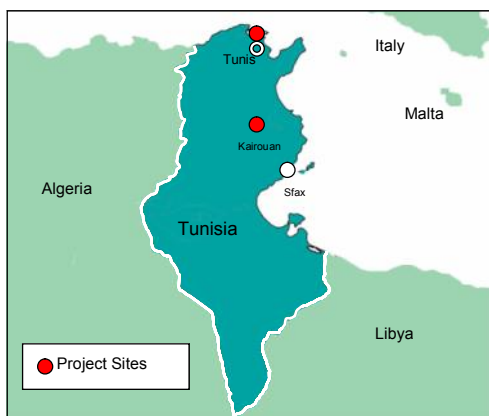
External Evaluator: Hajime Onishi

Mitsubishi UFJ Research & Consulting Co., Ltd.

### 0. Summary

This project is highly consistent with government policies and no problem with the operation and maintenance (O&M) systems can be found. Owing to various inundation protection facilities constructed under this project, no serious flood damage has occurred since the completion of disbursement of loans from JICA in 2008, which means this project has achieved its targets as of now. Although there still remains flood occurrence risk associated with the existence of the uncompleted section in a certain project portion where land purchase has not been completed, the executing agency continues to earnestly make efforts contributable to financial sustainability. This project makes a certain contribution to the improvement of the local business environment through reduced flood risk, and brings about indirect effects such as conversion from a river floodplain to agricultural land. In addition, in terms of efficiency, although the project period was longer than planned, the project cost was kept within the planned amount. In light of the above, this project is evaluated to be satisfactory.

### 1. Project Description



Map of Project Area



(Clockwise from upper left) Retarding Basin in Ariana, Concrete Channel in Ariana, New Diversion on Merguellil River and City Center in Kairouan

#### 1.1 Background

Except for the northern and coastal areas, most of the land in Tunisia belongs to the semiarid zone. In the rainy season from September to March, however, Tunisia experiences many torrential rains and flooding of the dried-up river (wadi) has frequently caused flood damages. Especially in 1998 when the appraisal was conducted, accelerated urbanization and

development in the Greater Tunis Area and local cities exacerbated the extent of flood damages in river floodplains.

Ariana near Tunis has been urbanized more drastically in comparison to the other cities in the vicinity of Tunis.<sup>1</sup> The poor capacity of existing drainage facilities have caused frequent floods and inconvenience to the residents' lives.<sup>2</sup>

Kairouan, 160km south of Tunis, is located in the middle of the Kairouan Plain and has achieved prosperity as a key intersection of traffic flow in the region. On the other hand, when it rains, a considerable amount of river water from the surrounding mountains flow into the plain and frequently causes floods. As such, Kairouan is called "a city with the highest flood risk in Tunisia."<sup>3</sup>

Under these circumstances, the reduction of flood damages and improvement of the living environment in Ariana near Tunis (as well as in Kairouan) were the issues to be solved by Tunisian government urgently at that time. Accordingly, swift implementation of comprehensive flood control measures, including construction of drainage and embankments, was desired.

## 1.2 Project Outline

The objective of this project is to reduce flood damage and to improve the environment of the areas concerned in Ariana Governorate and around the city of Kairouan at risk by constructing flood control facilities, thereby contributing to promote social and economic development of the target areas.

Loan Amount / Disbursed Amount	3,130 million yen / 2,374 million yen
Exchange of Notes / Loan Agreement Signing Date	March 1998 / March 1998
Terms and Conditions	Interest Rate:2.50% (0.75% for Consulting Services) Repayment Period:25 years (40 years for Consulting Services) (Grace Period:7 years (10 years for Consulting Services) Conditions for Procurement: General Untied (Bilateral Tied for Consulting Services)

<sup>1</sup> The Greater Tunis Area consists of four administrative districts: Tunis, Ariana, Manouba, and Ben Arous.

<sup>2</sup> In 1998, Ariana had a population of 460,000. Once it rained, a considerable amount of river water flowed from hills and caused frequent floods, which affected the life of the residents.

<sup>3</sup> In 1998, Kairouan had a population of 530,000. Some flood control measures including the construction of the embankment surrounding the urban area (called the "old embankment" hereafter) and the upstream Sidi Saad dam have been taken since the beginning of the 1970s. Since it is expected that development within the old embankment will reach its limit due to accelerated urbanization, however, development outside the old embankment has become urgent need. Further outside the old embankment, potential agricultural lands of about 28,000ha has been left as river floodplain since Great flood in 1969 (as detailed later). Effective utilization of this river floodplain is also desired.

Borrower / Executing Agencies	Government of the Republic of Tunisia / Ministère de l'Équipement et de l'Habitat, MEH, (Ministère de l'Équipement, ME at present)
Final Disbursement Date	May 2008
Main Contractors (over 1 billion yen)	N.A.
Main Consultant (over 100 million yen)	N.A.
Feasibility Studies, etc.	1982 Feasibility Study (by the Canadian Government, for Kairouan) 1994 Master Plan Study and Feasibility Study (by JICA, for Ariana in Greater Tunis)
Related Projects, etc.	Greater Tunis Flood Control Project (Loan Agreement: March 2008)

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Hajime Onishi (Mitsubishi UFJ Research & Consulting)

### 2.2 Duration of Evaluation Study

Duration of the Study: December, 2010 – December, 2011

Duration of the Field Study: May 29, 2011 – June 6, 2011 / September 13, 2011 – September 19, 2011

### 2.3 Constraints during the Evaluation Study

None.

## 3. Result of the Evaluation (Overall Rating: B<sup>4</sup>)

### 3.1 Relevance (Rating: ③<sup>5</sup>)

#### 3.1.1 Relevance with the Development Plan of Morocco

##### Relevance with the national policies

Under the “9<sup>th</sup> Five-year Development Program” (1997 to 2001), the Tunisian government set two strategic targets, which are (1) enhancement of industrial competitiveness by promoting private investment and (2) well-balanced development of the urban and local areas, to intend further implementation of economic infrastructure and development of local cities

<sup>4</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>5</sup> ③: High, ②: Fair, ①: Low

which contribute to promotion of private investment. Especially higher priority was given to the flood control measures contributable to the promotion of private investment against flood damage frequently caused by torrential rains during the rainy season.

Now in the “11<sup>th</sup> Five-year Development Program” (2007 to 2011), the government still lists the implementation of water supply and sewerage as well as flood control measure as issue to be solved by priority with the view of correcting the difference among regions, improving the living standard of local residents, and preserving the environment. Under the program, special attention is focused on flood control measures in the urban areas, for which the implementation of storm drains, the cleanup of existing drainage, and other flood control measures in the urban area are planned.

Therefore, for both program planning and ex-post evaluation, flood control measures have been assigned high priority; especially flood control measure operations in the urban areas have been listed as a national policy. Thus, consistency between this project’s objective of “reducing flood damage and improving the living standards in the target areas” and the national policy is very high.

#### Relevance with the sector policies

Though no clear sector policy was set at the time of the appraisal in 1998, the Five-year Development Program as described above indicated that the flood control measure in Ariana was a matter of great urgency. Beside, with view of promoting private investment in Ariana, high priority was given to the implementation of the flood control measures. In addition, for Kairouan, under the above Five-year Development Program, high priority was given to implementation of the food control measures and development of the urban area as a part of local development promotion.

As of 2011 as well, the competent authority, Direction del’Hydraulique Urbaine of the Ministère de l’Equipeement (ME) has established an investment plan (2007 to 2011) associated with the flood control project in the urban area according to the above 11<sup>th</sup> Five-year Development Program and expects investment of 210 million Tunisia Dinars (TND) in total for five years. Also in 2006, utilizing experience of the flood in 2003 that caused serious damage in the capital, Direction de l’Hydraulique Urbaine of the former Ministère de l’Equipeement et de l’Habitat (ME at present) conducted the “investigation on flood control measures in the Greater Tunis Area” and updated the master plan for the flood control measures in the Greater Tunis Area accordingly.

Therefore, for both program planning and ex-post evaluation, flood control measures for Ariana and Kairouan have been assigned high priority in sector policies. Thus consistency between this project’s objective and sector policy is very high.

### 3.1.2 Relevance with the Development Needs of Tunisia

Since the appraisal of this project (1998), Tunisia has frequently experienced torrential rains, which is considered to be an effect of climate change.

In 2000, 2001, 2003, and 2007, for example, torrential rains caused large-scaled flood damages in the Greater Tunis Area as well as downstream areas of nearby rivers.<sup>6</sup> Above all, the torrential rain that occurred in September 2003 was identified as a once in a century rain. It killed four people and its damage amounted to about 45 billion yen. Tunis suffered the greatest damage on record. The capital ceased to function for more than two days because of large-scaled flooding in the waterfront area near Tunis and traffic blockage due to flooded roads. Also the torrential rain in October 2007 recorded an average rainfall of 108 mm over the three days<sup>7</sup>, and northern Tunis including Ariana, the target area of this project, as well as southern Tunis suffered from damages due to the flood. At that time, 13 people were reported as either dead or missing.

In Kairouan, no such serious flood damage has been reported since the appraisal of this project, though some minor damages including flooded roads occurred. However, it is expected that the frequency of torrential rain occurring in Tunisia will become higher than ever before.

As described above, the frequency of flood occurring in Tunisia is expected to continuously increase since the appraisal of this project due to climate change and other factors. It is an urgent task to reduce flood damage by providing flood control facilities such as drainage, retarding basins, and embankments. Thus there still remains the need for inundation protection.<sup>8</sup>

### 3.1.3 Relevance with Japan's ODA Policy

In the Overseas Economic Cooperation Operation Enforcement Policy (2005 to 2007), the former Japan Bank for International Cooperation emphasized “implementation of infrastructure for sustainable growth” and “support of global issues and peace building” as important sector on the whole. Also it referred to the “action for preservation of environment” for Tunisia. Thus this project is extremely consistent with Japan's aid policies with respect to the reduction of flood damage through construction of drainage facilities and improvement of the living environment of local residents.

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<sup>6</sup> Besides, reclamation of dried-up rivers for road construction and building of houses in areas with high risk of flood damage associated with recent accelerated urbanization and development cause further flood damage.

<sup>7</sup> The average annual rainfall in Tunisia is about 450 mm.

<sup>8</sup> Especially as for the flood occurring in northern Tunis in 2007, the facilities built under this project made a large contribution to reduction of flood damage, as described in the Effectiveness section later. Unless this project were implemented, the flood damage in 2007 (13 dead) would expand.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy; therefore its relevance is high.

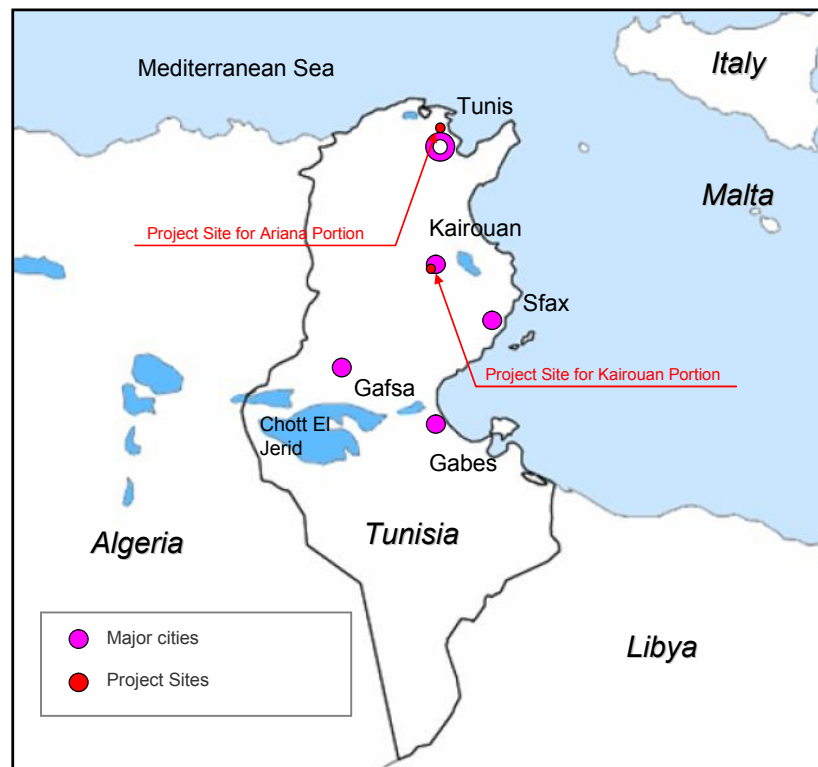


Figure-1: Location of the Project Site

### 3.2 Efficiency (Rating: ②)

#### 3.2.1 Project Outputs

Comparison between outputs planned and actual performance is shown in Table 1 below. Some outputs show an increase or decrease due to several reviews of the Detailed Design. In the Kairouan portion, the uncompleted section still exists. Also in the Ariana portion, the facility output has increased for the enhancement of flood protection capacity, which was intended based on the large flood in the Greater Tunis Area in 2003.

On the other hand, the above factors have indirectly made the project period considerably longer. However, this is a positive result of timely action under the varying external conditions and can be highly evaluated in respect of effectiveness and financial sustainability.

In the Ariana portion of the Greater Tunis Area, two of four retarding basins were cancelled while other two basins were added (that is, the total number remained four as planned). This change was made because a plan to extend some roads in the project target area was found at the review of Detailed Design (D/D).<sup>9</sup> This plan led to the decrease of estimated catchment

<sup>9</sup> **Background of the implementation of Detailed Design (D/D) and effects on final outputs:** For Ariana,

area, which required a reconsideration of the number and locations of retarding basins. The increase of outputs associated with the improvement of the Ennkhilet River was caused by extensive design change for enhancement of flood protection capacity in Ariana, which was intended based on the large flood in the Greater Tunis Area in 2003 and its damage.<sup>10</sup> As a result, a total length of box culverts and concrete revetments was considerably increased.

Table-1: Changes in Output

Project Components	Original	Actual	Differences
I. Ariana Portion			
i) Construction of retarding basins	4 retarding basins in total	The same	As planned (locations were changed in 2 basin.)
ii) Improvement works for Ennkhilet River	4,398m in total	13,100m in total	298% of original plan
• Embankment	1,195m	Cancelled	
• Concrete open channel	1,095m	3,700m	
• Box culvert	2,108m	9,400m	
iii) Construction and rehabilitation of drainage	9,671m in total	10,440m in total	108% of original plan
II. Kairouan Portion			
i) Merguellil River section			
• Construction of new diversion	Approx. 8.7km	9.3km in total (0.7km: Not completed, Left bank: Cancelled)	94% of original plan incl. uncompleted sections)
• Construction of new embankment	120m	The same	As planned
• Construction of bridges	Not specified	4 bridges	
ii) Zeroud River section			
• Construction of new embankment (in the downstream, for left bank only)	6,678m	Approx. 7km	Mostly as planned
• Construction of new embankment (in the upstream)	5,170m in total	Cancelled	
III. Consulting Services			
• Consulting Service M/M	53 M/M in total (Foreign:22 M/M, Local: 31 M/M)	72.82 M/M in total (Not known by foreign and	137% of original plan

a two-phase plan was proposed at the F/S investigation time of the JICA master plan: construction of flood control facilities based on once a decade flood volume (Phase I) as an emergency plan and that based on once a century flood volume (Phase II) as a whole plan. Then at the appraisal time, the 2-phase plan was changed into a one-phase plan based on once two-decade flood volume, considering Tunisia's comment on the implementation level. For Kairouan, though the original plan was based on once a ten thousand flood volume, which is an unrealistic level, new plans have been made based on once two-decade flood volume for the Merguellil River, and based on once a century flood volume for the Zeroud River after discussion with Tunisia. In response to these changes, it was required to reset a planned flood water level (high water level) based on the simulated flood flowing calculation, and to re-examine some design elements including embankment height accordingly. At the time of the appraisal, it was decided that "Tunisia would do these tasks by making consideration during the current Detailed Design and including design review in TOR of the consultant employed for this project." Therefore, D/D review and some changes were made by the consultant of this project.

<sup>10</sup> In September to October 2003, it rained heavily in northern Tunisia, and serious flood damage occurred in Ariana and nearby areas. Then judging that the flood control facilities under construction should be reinforced, surplus loan was used to do additional construction (expansion of retarding basins, addition of drainage, etc.)

Project Components	Original	Actual	Differences
• Consulting Service TOR	Tender documents review, Tender evaluation support, Construction supervision, Training program for ME engineers, etc.	local) Tender evaluation support : Cancelled Review of D/D for Ariana Portion: Added	

Source: JICA internal documents, answers to the questionnaire to ME and results of interviews

In the Kairouan portion, as for the construction of new drainage associated with inundation protection of Merguellil river, there still exists an uncompleted section of about 700 m on the left bank. As described in the Project Period section later, the land has not been acquired yet, which prevents construction from commencing. (For more details, refer to the Project Period section.) Construction of the embankments on the right bank of Merguellil River and at the upstream of the Zeroud River was cancelled because these embankments were judged unnecessary after the review of the Detailed Design.

Regarding consulting services, consultant input increased by 137% over the original estimate. The reasons for this increase are an increase in the work hours of consultants against the backgrounds of design change associated with the flood in 2003 (as described above) and action required for the uncompleted section in the Kairouan portion. As for the contents of the consulting services, the executing agency ME will be directly in charge of tender evaluation while the original TOR was cancelled. Furthermore, the design change operation in the Ariana portion (associated with the flood in 2003) was added.

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total cost of the project was originally 4,173 million yen (the Japanese ODA loan share was 3,130 million yen) but the actual project cost was 3,377 million yen (as of June 2011, the Japanese ODA loan share was 2,374 million yen), which was equivalent to 81% of the original plan.

The total project cost was considerably reduced mainly because of (1) decrease of the Tunisian Dinar against the Japanese Yen in currency value (decrease by 17% compared to that at the time of the project appraisal) and (2) effective ordering through competitive tendering. The foreign currency portion was widely decreased compared to the original estimation, while the local currency portion slightly exceeded the original estimated plan. The decrease of the foreign currency portion and the increase of the local currency portion were caused by the fact that all consultants and contractors were sourced from local companies and therefore every procurement activity was made within the country.

As described in the Efficiency section, the embankment in the Kairouan portion includes an

uncompleted section of about 700m. The executing agency ME estimated the construction cost of the uncompleted section amounted to about 1 million Tunisian Dinars (about 60 million yen at the current rate). This figure was reported and recorded as an official requested budget amount to Tunisian Ministere des Finances every year.<sup>11</sup>

### 3.2.2.2 Project Period

The project period was longer than planned.

The project was scheduled from March 1998 to October 2003, a period of 68 months, but it still continues due to the existence of the uncompleted section as described before. On the other hand, the loan from JICA was completed in May 2008, and the agreement with contractors was completed in November 2008. Assuming the project was completed in November 2008, the project period was about five years (61 months) longer than planned.

The main causes of the delay include (1) the delay in consultant selection (six months),<sup>12</sup> (2) the re-review of Detailed Design and execution of additional construction associated with the large flood in northern Tunisia in September 2003 (nine months for additional construction),<sup>13</sup> (3) the delay of contractor arrangement for the Ariana construction (about 30 months),<sup>14</sup> and (4) the delay of land acquisition in the Kairouan portion and its resultant construction stop (about 27 months).<sup>15</sup>

Table-2: Comparison of Project Periods

Task	Original Schedule (months)		Actual (months)		Differences (months)
Consultant Selection / Contract	Mar. 1998 – Jun. 1999	(16.0)	Mar. 1998 – Dec. 1999	(22.0)	+ 6.0
Consulting Service	Jul. 1999 – Oct. 2003	(52.0)	Jan. 2000 – Mar. 2008	(99.0)	+ 47.0
Tender / Contract / Procurement	Oct. 1999 – Oct. 2000	(13.0)	Jan. 2000 – May. 2002	(29.0)	+ 16.0
Civil Works	Dec. 2000 – Oct. 2003	(35.0)	Aug. 2002 – Nov. 2008	(76.0)	+ 41.0
Total <sup>1)</sup>	Mar. 1998 – Oct. 2003	(68.0)	Mar. 1998 – Nov. 2008	(129.0)	+ 61.0

Source: JICA internal documents, answers to the questionnaire to ME and results of interviews

Note-1): Project commencement was defined as the date of L/A conclusion (Mar.1998). For the definition of the date of project completion, Nov.2008 was tentatively applied.

<sup>11</sup> Source: Result of the interview with an financial officer of ME Direction de l'Hydraulique Urbaine

<sup>12</sup> The main cause was delay in passage of the resolution relating to the selection of a consultant which was in charge of the Higher Commission, the authorization agency for consultant procurement process and other procurement issues.

<sup>13</sup> As described above, in response to the heavy rain in 2003, the flood control facilities in the Ariana portion were reinforced while re-review of the Detailed Design by the consultant as well as associated additional construction (expansion of retarding basins and addition of drainage) were executed. The period of the additional construction was September 2004 to June 2005, nine months. (Source: JICA internal document and hearing from ME)

<sup>14</sup> In addition to the delay of acknowledgement of the contractor agreement by the Higher Commission as described above, the breach of the former JBIC procurement guideline caused the procurement procedure for Ariana construction work lot 1 to be considerably delayed, which postponed the construction start by about 30 months. (Source: Same as above)

<sup>15</sup> The delay of land acquisition caused the construction in the Kairouan portion to be stopped between April 2004 and June 2006. (Source: Same as above)

Regarding the uncompleted section, ME, the executing agency, said “If the land acquisition problem is solved, the embankment construction in the uncompleted section will complete in about seven months.”

#### Background and current situation of the uncompleted section in the Kairouan portion

On the left bank of the Merguellil River, a section of about 700m still remains uncompleted. This is because the land acquisition has not been completed yet. One land owner in particular still refuses to sell his agricultural land.

He once accepted selling his land at the time of Detailed Design (D/D), and exchanged an agreement with ME. Then from 2003 to 2005, he received 43,000 Dinars as compensation (about four million yen, as a price for buying a pump for the irrigation of agricultural lands). When the construction started, however, he changed his mind and has consistently refused since then.

As of 2011, ME tries to solve this problem in cooperation with Ministère des Domaines de l'Etat and la Commission Régionale d'investigation et de réconciliation. Though traditionally forcible land expropriation had not been done in Tunisia, a new land expropriation law established in August 14, 2007 (Decree 2007/2103) allows for forcible expropriation. However, trials should be held to execute expropriation. Though this case has been down for trial twice and ME won on each trial, the land owner appealed to the Supreme Court. In January 2011 during the appeal, the Revolution occurred. Subsequently the situation including the process of the trial is now uncertain.

Although the project cost was lower than planned, the project period was longer than planned (190% of the original plan); therefore the efficiency of the project is fair.

### **3.3 Effectiveness (Rating: ②)**

#### **3.3.1 Quantitative Effects**

##### **3.3.1.1 Results from Operation and Effect Indicators**

The operation and effect indicators of this project include (1) discharge capacity at flood control observation points, (2) annual maximum flow, (3) annual highest water level, (4) annual maximum flooded area, (5) annual maximum number of flooded houses, (6) annual reduction times of flood damage, and (7) annual maximum amount of flood-related damage.<sup>16</sup> However, the field investigation results showed the executing agency ME had only limited types of data, and did not systematically collect quantitative data before and after the project.

Therefore, it was found difficult to understand the degree of performance and target achievement degree regarding this project from a quantitative perspective. Thus evaluation

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<sup>16</sup> Note that the operation and effect indicators were not set at the time of project appraisal.

and judgment of effectiveness was based not on quantitative evaluation using operation and effect indicators, but on qualitative analysis using the result of a beneficiary survey. (For details, refer to 3.3.2 or later sections.)

As for quantitative data including discharge capacity, and annual maximum flow and annual highest water level at flood control observation points, ME decided “to collect and monitor these data only when water exceeds a given warning level”.<sup>17</sup>

### 3.3.1.2 Results of Calculation of Internal Rates of Return (IRR)

When recalculating the economic internal rate of return (EIRR), it is necessary to clarify the quantitative effects, such as cost reduction in reconstruction in case of floods, transport cost reduction by the decrease in inundated time, an increase in agriculture production, etc. as input data. The EIRR was not able to be calculated because the critical information to quantitatively estimate the above input data was not obtained through the study.

### 3.3.2 Qualitative Effects

#### (1) Decrease in Damage by Flood Occurrence in the Target Areas

##### Physical Damage by Flood

In the Greater Tunis Area, Ariana suffered serious flood damages in September to October 2003 and in October 2007, as shown in Table 3. In case of the flood in 2007, however, it was observed that the facilities already constructed under this project (including retarding basins, drainage, and box culverts) functioned properly as planned and helped minimize flood damage, as described in the Relevance and other sections.<sup>18</sup>

In Kairouan, serious floods occurred in 1969 and 1973. Furthermore, local roads in the city such as GP1 and GP2 were frequently flooded before this project was completed.<sup>19</sup> After the project was completed, however, no serious flood damage was found as shown in Table 3.

Table-3: Major Floods in the Target Areas and Physical Damage and Personal Suffering

Year of Occurrences	Locations	Scale of Flood	Dead / Missing	Details of Physical Damage
1969	Kairouan	Equal to a one-hundred-year flood	Not known	6.5 million TND (45 million TND in 1994 prices) <sup>20</sup>
1973	Kairouan	Not known	Not known	National highway No.12 was disconnected and some diversion was necessary until 1998.

<sup>17</sup> However, the performance of each facility should be periodically checked. If performance is lowered or is expected to be lowered due to degradation of the facility, a countermeasure should be promptly considered and reflected on the operation and maintenance activity.

<sup>18</sup> Source: Result of the in-depth interview with Ariana residents by ME Direction de l’Hydraulique Urbaine

<sup>19</sup> Source: Result of hearing from ME Kairouan local construction office

<sup>20</sup> Three Kairouan residents who actually experienced the flood were interviewed. They pointed out (1) inundation above floor level at their houses (about 40 days), (2) damage of train rails, (3) blackouts, and (4) insufficient food supply after flood as a result of flood damage.

Year of Occurrences	Locations	Scale of Flood	Dead / Missing	Details of Physical Damage
Sep. to Oct. 2003	Northern Tunisia	Not known	Dead: 4	Total financial damage: Equivalent to 45 billion Japanese yen Lakeshore area in the suburban of Tunis: Heavily inundated City function of Tunis was severely disturbed for two days or longer, due to the malfunction in traffic by floods in road, etc.
Oct. 2007	Northern and Southern Tunisia	Equal to a one-hundred -year flood Rainfall in 3 days: 108 mm	13 persons in total	Houses and offices: Heavily inundated Traffic: Disturbed
Oct. 2009	Northern Tunisia	Not known	Not known	Houses and offices: Partly inundated due to heavy rains Traffic: Disturbed by floods in road
Winter 2010	Kairouan	Not known	Not known	Floods in road and associated traffic disturbance, etc.

Source: JICA internal documents, results of interview with ME and in-depth interview with beneficiaries, etc.

The beneficiary survey<sup>21</sup> was conducted regarding flood frequency and flood damage. As shown in the two tables below, it was found both flood frequency and flood damage were considerably reduced compared to pre-project in the target areas of this project (Ariana in the Greater Tunis Area and Kairouan).

Table-4: Beneficiary's Recognition on Frequency of Flood before/after the Project

Answers from Beneficiaries	Ariana		Kairouan	
	No. of Res.	%	No. of Res.	%
After the Project, the frequency of flood occurrence was greatly reduced.	64	85.3%	49	72.0%
After the Project, the frequency of flood occurrence was reduced to some extent.	10	13.3%	18	26.5%
There are no changes in the frequency of flood.	1	1.3%	1	1.5%
Total	75	100.0%	68	100.0%

Source: Beneficiary survey

Note): The number of beneficiaries who experienced some floods and inundation before the Project implementation: 75 beneficiaries for Ariana and 68 beneficiaries for Kairouan

Table-5: Degree of Damage Mitigation By the Project (Multiple Answers)

Detailed Type of Physical Damages by Flood Occurrence	Ariana: No. of Res.			Kairouan: No. of Res.		
	Before	After	Reduction (%)	Before	After	Reduction (%)
House yard / Factory / Office / Cultivated land was inundated.	20	1	95%	23	3	87%
Furniture / Equipment / Instruments / Livestock / Agricultural products was damaged.	3	1	67%	23	3	87%
Neighborhood roads were closed / Transportation service was interrupted.	70	10	86%	68	20	71%
Electricity supply / Water supply / Gas supply was stopped.	0	0	n.a.	68	20	71%
Daily life / Business activities / Agricultural work was interrupted for a period of time.	50	6	88%	68	20	71%
No damages were/are experienced.	0	64	n.a.	0	56	n.a.

Source: Beneficiary survey

Note): The number of beneficiaries who experienced some floods and inundation before the Project implementation: 75 beneficiaries for Ariana and 68 beneficiaries for Kairouan

<sup>21</sup> Beneficiary survey implementation overview:

Locations: Target area of this project (Ariana in the Greater Tunis Area and Kairouan)

Subjects: Local residents, farmers, and private companies (manufacturers, merchants, service agencies, etc.)

Total sample: 150 (75 samples in Ariana and 75 samples in Kairouan), segmented two-stage random sampling

Data collection method: Face-to-face interview

The results of the beneficiary survey above show that flood frequency was more reduced in Ariana. Though this area suffered serious flood damages in 2003 and 2007, it was observed that the facilities already constructed under this project (including retarding basins, drainage, and box culverts) properly functioned as planned to minimize flood damage in case of the 2007 flood.<sup>22</sup>

Also in Kairouan, no serious flood damage was found after the project was completed. Especially the frequency of inundation of roads was further decreased. This means the project has made a large contribution to the industrial activities of Kairouan, which is an important place for traffic-flow.

#### Flood occurring risk and flood damage risk associated with the uncompleted section

As described above, a section of about 700m on the left bank of the Merguellil River remains uncompleted. In the left embankment with a total length of 8.6km, a section of about 700m positioned slightly upstream from the middle point is still uncompleted. It cannot be denied that if a serious flood occurred, water would flow into the urban area of Kairouan via this uncompleted section and cause some damage.<sup>23</sup> Though such a serious flood has not occurred until now, if this section is kept uncompleted, the facility performance expected at the time of Detailed Design (D/D) will not be available and flood occurring risk in some parts of southwest Kairouan will not be reduced.<sup>24</sup>

When an in-depth interview was made with seven farmers who lived near the uncompleted section, all of them claimed that the uncompleted section of 700m on the left bank of the Merguellil River generates a flood risk as well as ruins their benefits (common benefits people living in the vicinity could obtain, such as more accessibility to agricultural land).

#### (2) Beneficiary's Fear for Flood Occurrence

Given below are the results of the beneficiary survey regarding fear about flood damage.

When residents answering "No fear at all" in the table above were further asked their reasons, all of them (59 residents in Ariana and 45 residents in Kairouan) mentioned the existence of this project. This indicates that the residents' recognition about flood damage was changed upon completion of this project.

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<sup>22</sup> Source: JICA internal document

<sup>23</sup> As for the central area of Kairouan, the old embankment constructed in 1963 (which surrounds the central part of Kairouan) as well as two dams (Sidi Saad dam and El Houareb dam) as described in the footnote below helped minimize flood damage risk.

<sup>24</sup> On the other hand, a hydraulic analysis specialist of ME Direction de l'Hydraulique Urbaine said "Though a flood occurring risk actually still exists, Sidi Saad dam constructed upstream of Zeroud river in 1982 and El Houareb dam constructed upstream of Merguellil river in 1989 help control water volume in case of flood in some degree. So a probability that a serious flood occurs is low." Additionally, he said, "The result of hydraulic simulation shows the flood damage risk associated with the uncompleted section is very low. The estimated flooded zone is only the agricultural land in the southwest part of Kairouan."

Table-6: Beneficiary's Level of Fear for Flood Occurring After the Project (N=150)

Answers from Beneficiaries	Ariana		Kairouan	
	No. of Res. <sup>1)</sup>	%	No. of Res. <sup>1)</sup>	%
There are still serious fear for possibility of having damages by flood occurring.	0	0.0%	3	4.0%
There are still some fear for possibility of having damages by flood occurring.	16	21.3%	27	36.0%
There are no fear for possibility of having damages by flood occurring.	59	78.7%	45	60.0%
Total	75	100.0%	75	100.0%

Source: Beneficiary survey

Note): The number of beneficiaries who experienced some floods and inundation before the Project implementation: 75 beneficiaries for Ariana and 68 beneficiaries for Kairouan

### 3.3.3 Conclusion of Effectiveness

Since the completion of this project in 2008, various flood control facilities constructed under this project have prevented serious flood damage. Further it was observed, in case of the 2007 flood in Greater Tunis, the facilities that had already constructed under this project properly functioned as planned and minimized flood damage. In Kairouan, the frequency of road flooding has been greatly reduced since the completion of this project. Judging from facility performance until 2011, the project facilities are properly functioning as planned. Therefore, their effectiveness is very high.

On the other hand, potential flood damage risk associated with the uncompleted section in Kairouan is another story. As long as the section remains uncompleted, flood occurring risk will not be reduced in some areas. Though ME Direction de l'Hydraulique Urbaine judges flood damage risk to be very low as a result of hydraulic simulation, the fact that the expected facility performance is not achieved still exists, as such, this partially prevents the achievement of effectiveness.

Therefore, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

## 3.4 Impact

### 3.4.1 Intended Impacts

#### (1) Impact on Business Environment and Industrial Promotion

Regarding change in the business environment after project completion, the following responses were obtained from a total of 52 private companies in the beneficiary survey.

Table-7: Business Environment before/after the Project (N=52, Multiple Answers)

Answers by Private Companies	Ariana	Kairouan	Total
Production / sales / profit were drastically increased after construction of flood control facilities.	6	6	12 out of 52
Production / sales / profit were increased to some extent after construction of flood control facilities.	7	15	22 out of 52
The construction of flood control facilities and my company' s production / sales / profit were not correlated. / No answers	11	7	18 out of 52
Total	24	28	52

Source: Results of beneficiary survey (for 52 private companies)

Note): Type of business: Manufacturing (food processing, construction materials, etc.), retailers and

service sector (warehouse, grocery retailing, foods, machine repairing, restaurant, pharmacy, etc.)

Regarding the tendency of agricultural production and the change of agricultural business environment after the completion of this project, the following responses were obtained from 25 households in total subject to the beneficiary survey in Kairouan.

Table-8: Environment After the Project for Farmers in Kairouan (N=25, Multiple Answers)

Answers by Farmers	No. of Res.	Detailed Reasons for Increase in Agricultural Production (Multiple Answers)	Total
After the Project, the amount of agricultural production was increased.	17	The agricultural land is now protected from flooding and the area of agricultural land was drastically increased because of this Project.	5 out of 17
After the Project, the amount of agricultural production was not increased.	8	Access to the agricultural land by large agricultural machine can become possible, because of new access road (new embankment) to the land, which was constructed by this Project.	17 out of 17
		Because of newly constructed access road (new embankment), it becomes possible to transport the agricultural products to the assembly warehouse much faster than before.	17 out of 17
Total	25		

Source: Beneficiary survey for 25 famers in Kairouan

Further as described in the Effectiveness section, an in-depth interview was conducted with seven farmers living near the Merguellil River in Kairouan to obtain the following comments as direct effect of the completion of this project.

Table-9: Impact on Agriculture Business by the Project (N=7, Multiple Answers)

Answers from Selected Farmers	No. of Respondent
After the Project, irrigation scheme was introduced near my farm, and then transformation from rain-fed agriculture to irrigation agriculture can become possible at my land.	1 farmer
Because of access road (new embankment) construction, it become much easier to access to the own land, and it become possible to transport the agricultural products by a larger vehicle (truck, etc.)	5 farmers
After the Project, water supply facilities were newly introduced, which truly contributed to secure the safe drinking water much more than before.	1 farmer
There is still a certain level of fear of flood occurring because of the uncompleted section of 700m at the left bank of Merguerill river. This also ruins related farmers' common benefits such as improvement of accessibility to the market.	7 farmers

Source: Results of in-depth interview with the farmers in the vicinity of the Merguellil River in Kairouan

The results of a series of beneficiary survey and in-depth interviews above show the reduced flood risk associated with the completion of this project had various positive impacts on local companies and contributed to an improved business environment. Especially in Kairouan, conversion from river floodplain to agricultural land, as described later, allowed the agricultural lands of some farmers near the left embankment of the Merguellil River to expand greatly and agriculture production to increase. Furthermore the left embankment operates as access road for nearby farmers, which partially contributed to an improvement of the business environment in such cases as when large agricultural machines are brought in or agricultural produce are carried out.

Regarding the uncompleted section of 700m on the left bank of the Merguellil River in the Kairouan portion, many farmers have fears about flood risk, as described in the Effectiveness section. Furthermore it is pointed out that delayed completion of the embankment prevents nearby farmers from obtaining potential common benefits (improved accessibility to agricultural lands and its resultant increase of agricultural income).

## (2) Changes in Land Price

Regarding change of land price before and after the implementation of this project, the results shown in Table 10 and Table 11 were obtained from the beneficiary survey. According to the survey, nearby residents recognized that land price was increased after the implementation of this project. Thus it was thought that this implementation had made some contribution towards this.

Since the increase in land price depends on various factors including increase in consumer price index, we cannot say it is due to the impact of this project only. Especially in Ariana, however, 75% of the residents thought the impact of inundation protection under this project contributed to increase in land price.

Table-10: Beneficiary's Recognition on Changes in Land Price After the Project

Answers from Beneficiaries	Ariana		Kairouan	
	No. of Res.	%	No. of Res.	%
Compared to 3 years before, the price of land near my house/office was increased.	43	57.3%	75	100.0%
Compared to 3 years before, the price of land near my house/office was not so increased.	11	14.7%	0	0.0%
Don't know / No answers	21	28.0%	0	0.0%
Total	75	100.0%	75	100.0%

Source: Beneficiary survey

Table-11: Reasons for Increase in Land Price

Answers from Beneficiaries	Ariana		Kairouan	
	No. of Res.	%	No. of Res.	%
Flood protection by the Project was greatly contributed to increase in land price.	11	25.6%	10	13.3%
Flood protection by the Project was contributed to increase in land price, to some extent.	32	74.4%	29	38.7%
There is no explicit correlation between the Project and increase in land price.	0	0%	36	48.0%
Total	43	100.0%	75	100.0%

Source: Beneficiary survey

In addition to the above results, many retail shops, restaurants, auto repair shops, drug stores, and other service-related companies were located intensively along the local road near the Merguellil River in Kairouan (Route GP2) after the completion of this project. From interviews with people who had located their service-related companies in this area, it was pointed out such intensive location allowed the land price to considerably increase.<sup>25</sup>

<sup>25</sup> Though the land price was 0.5 to 1.0 Tunisian Dinars per square meter before this project, it reached 25 to 30 Tunisian Dinars after the project. (Source: Result of the in-depth interview with people engaged in service business near the embankment of Merguellil river in Kairouan))

Therefore, it is thought that a considerable reduction of flood damage risk associated with the completion of this project largely contributed to the increase in land price in some areas.

### (3) Conversion of the River Floodplain to New Agricultural Land

In the Kairouan portion, it was observed that of the 28,000ha of land that had been left as a river floodplain before this project, the land of 23,000ha was converted to agricultural land.<sup>26</sup> The implementation of this project led to the conversion from a river floodplain to agricultural land in the vicinity of Kairouan.

Since Tunisia falls in a semiarid zone, the expansion of agricultural land by securing irrigation water has been one of the most important political issues for past governments. As a whole, we can say conversion from river floodplain to agricultural land under this project is not only contribution to agriculture production, but very significant enterprise for Tunisian government.

### 3.4.2 Other Impacts

#### 3.4.2.1 Impact on Natural Environment

##### (1) Implementation status of EIA and Environmental Monitoring during Construction

At the time of appraisal of this project in 1998, Tunisia law required neither execution of an EIA nor a report to the National Environmental Protection Agency (ANPE). According to the “Guidelines for Environmental Consideration” of the Overseas Economic Cooperation Fund (present JICA), however, external consultants were employed to execute an EIA by the time of the appraisal.<sup>27</sup>

Since the EIA report showed that the impact on the environment was small, environmental monitoring was not conducted during construction work except for strategy for smooth transportation in the Ariana portion.<sup>28</sup> Also for noise and vibration on nearby residents during construction work, very little impact was reported in the Ariana portion and almost no impact was reported in the Kairouan portion.<sup>29</sup> Thus there occurred no special impact of the construction work on the environment.

##### (2) Impact on Natural Environment by Constructed Facilities

No special impact on the natural environment surrounding the locations of various facilities (retarding basins, drainage, embankments, etc.) constructed under this project is observed. Wadi river, which is subject to this project in both Ariana and Kairouan, is a river where water

<sup>26</sup> Source: Kairouan Operation and Maintenance (O& M) office of ME Direction de l’Hydraulique Urbaine

<sup>27</sup> Now to carry out a similar-sized flood control project in the urban area, execution of EIA is required by law. (Source: ME Direction de l’Hydraulique Urbaine)

<sup>28</sup> Since construction of box culverts affected traffic flow on local roads, a countermeasure for smooth traffic flow was taken during the construction period. (Same as above)

<sup>29</sup> Source: Responses of the questionnaire and results of hearing delivered to ME

only flows during the rainy season and floods, and where fish and animals are rarely seen. Thus no special impact on the natural environment was reported.<sup>30</sup>

### 3.4.2.2 Implementation Status of Resettlement and Land Acquisition

The project involved land acquisition and resettlement of local residents upon the construction work. Table 12 shows the scale and process of the resettlement.

No particular problem can be seen in the resettlement and land acquisition process<sup>31</sup> except for one household still opposing land acquisition. To three households subject to resettlement, compensation was paid prior to construction work. Resettlement was implemented smoothly, and residents concerned moved voluntarily after compensation payment.<sup>32</sup> In Ariana, there was no resettlement.

Negotiation with the land owner still opposing is in deadlock partially because of the confused judicial system after the Revolution in January 2011, as described in the Efficiency and Project Period sections.<sup>33</sup> ME is making some efforts<sup>34</sup> to resume negotiations.

Table-12: Status of Resettlement and Land Acquisition of the Project

Item	Ariana	Kairouan
Project-Affected Families (PAFs)	7 households	147 households
Number of Resettled Households among PAFs	None	3 households
Total Compensations Paid to Resettled Households	n.a.	138,223 TD
Number of Households for Land Acquisition among PAFs	7 households	147 households <sup>1)</sup>
Total Area of Land Acquisition	0.32 ha	191 ha
Total Expenses for Land Acquisition	51,535 TND	2.2 million TND
Detailed Process of Land Acquisition:		
<ul style="list-style-type: none"> <li>• Boundary identification of land for acquisition (implemented by ME through outsourcing to private contractors)</li> <li>• Land price evaluation by the Ministry of State Domain &amp; Land Affairs</li> <li>• Negotiation with land owners through the Commission of Arbitration</li> <li>• Exchange of oaths when agreed, then transfer of compensation from ME to the owner, etc.</li> </ul>		

Source: Answers to the questionnaire to ME and results of interview

Note-1): Including three resettled households

As a result, this project somewhat helped to improve the business environment of beneficial companies by reducing flood risk, and had indirect effects including increased land

<sup>30</sup> Source: Results of hearing delivered to ME Direction de l'Hydraulique Urbaine

<sup>31</sup> Regarding the stakeholder meetings relating to land acquisition, the meeting and discussion were appropriately held with the PAFs. (Source: Results of hearing delivered to ME Direction de l'Hydraulique Urbaine and stakeholder farmers)

<sup>32</sup> At the appraisal, it was reported that the land of 55ha was to be acquired in Ariana and that only a few households in Ariana were subject to resettlement. As described in the Efficiency section, however, the scale of land acquisition became smaller because constructions of two retarding basins (both planned in private land) were cancelled and other two retarding basins were constructed in public lands (both assigned free of charge) (Same as above)

<sup>33</sup> It seems that the Tunisian government has strictly enforced a rule about implementation of public projects that a project should not start until land acquisition is complete since 2006. In south Tunisia, historically land owners are not clear (owners do not have title certificates or other documents in most cases), it is said land acquisition is always difficult to achieve. (Source: JICA ex-post evaluation report of "Sewage System Development Project in Four Cities in Tunisia") Although this project covers the northern middle part of Tunisia, the same situation occurs.

<sup>34</sup> For details, refer to the paragraph 3.5.4.

price and conversion from a river floodplain to agricultural land. Therefore, it can be said that the implementation of this project has generated many positive impacts.

### 3.5 Sustainability (Rating: ③)

#### 3.5.1 Structural Aspect of Operation and Maintenance

Direction de l'Hydraulique Urbaine of the executing agency ME<sup>35</sup> is responsible for operation and maintenance (called O&M hereafter) of the related facilities that were built under this project and holds three O&M offices: in Sfax, Nabeul, and Ariana in Greater Tunis Area. The Ariana O&M office as described above is in charge of O&M activities of the related facilities in the Ariana portion, while ME Direction de l'Hydraulique Urbaine is directly in charge of those of the related facilities in the Kairouan portion.

The detailed system of O&M activities is shown in Table 13 below. The O&M activities of the project related facilities are under direct control of ME Direction de l'Hydraulique Urbaine or under control of its Ariana O&M office. Their control scopes are clearly distinguished.

Table-13: Responsibility Matrix of Operation and Maintenance Activities of Project Facilities

O&M in Charge	Facilities in Ariana		Facilities in Kairouan	
	Ariana Office of Direction de l'Hydraulique Urbaine		Direction de l'Hydraulique Urbaine	
Stage/Category of Maintenance Activities	Planning	Preparation of Tender Documents	Implementation	Supervision
Daily Maintenance <sup>1)</sup>	Not conducted	Not conducted	Not conducted	Not conducted
Periodical Maintenance	ME <sup>2)</sup>	ME <sup>2)</sup>	Contractors <sup>3)</sup>	ME <sup>2)</sup>
Large Scale Maintenance	Not decided	Not decided	Not decided	Not decided

Source: Answers to the questionnaire to ME and results of interview

Note-1): Daily maintenance activities were not conducted because of no need.

Note-2): "ME" shown in the table refers to the Ariana Office of Direction de l'Hydraulique Urbaine for the facilities in Ariana, and that does to Direction de l'Hydraulique Urbaine for the facilities in Kairouan.

Note-3): Direction de l'Hydraulique Urbaine is in charge for some cases.

Daily maintenance activities are not conducted because they were judged unnecessary. Periodical maintenance activities including periodical cleaning of box culverts and drainage (in Ariana) and overlaying of roads on the embankment (in Kairouan) are outsourced to contractors. Large-scale rehabilitation is not planned yet because only about three years has passed since the operation start of the facilities.

As of the end of 2010, Direction de l'Hydraulique Urbaine has 74 staff in total, of which 18 engineers are engaged in O&M activities (who are in charge of planning of flood control projects, construction management, and maintenance for cities in Tunisia). Then 10 O&M staff work for the related facilities in the Ariana portion (same number as that of staff at

<sup>35</sup> In response to Revolution in January 2011 and its subsequent political change, Ministère de l'Équipement et de l'Habitat (MEH) was reorganized into Ministère de l'Équipement (ME).

Ariana O&M office), while engineers are dispatched from ME Direction de l'Hydraulique Urbaine as necessary in the Kairouan portion. There seems to be no problem with the O&M structure due to sufficient human resources.

Table-14: Number of Staff of ME Direction de l'Hydraulique Urbaine

Year	Direction de l'Hydraulique Urbaine	O&M Staff in Direction de l'Hydraulique Urbaine	Staff in Ariana Office in Direction de l'Hydraulique Urbaine
1998	70	12	Not provided
2006	70	12	7
2007	68	12	8
2008	68	14	10
2009	74	14	10
2010	74	18	10

Source: Prepared from the answers to the questionnaire to ME and documents provided by ME

To sum up, there are clear demarcations between O&M related divisions and it seems that the appropriate number of the staff was appointed and no problems can be found in the institutional structure of O&M implementation.

### 3.5.2 Technical Aspects of Operation and Maintenance

#### Technical skills of engineers and workers

As described above, the number of staff engaged in O&M activities in ME Direction de l'Hydraulique Urbaine is 18 in total (as of the end of 2010), while the number of full-time employees is 39. They have around an average of 10-year O&M experience collectively.

As shown in Table 14, the total number of staff at Direction de l'Hydraulique Urbaine, the number of staff engaged in O&M activities, and the number of staff working at Ariana O&M office have been intentionally increased since 2008 and an appropriate number of staff has been continuously secured. ME Direction de l'Hydraulique Urbaine has many similar flood control facilities in Tunisia and is amply accumulating O&M skills through the operation of these facilities. It appears that there is no problem with the quantity and quality of engineering and technical staff.

#### Training programs provided by contractors of the Project and JICA

No training has been conducted by contractors because O&M activities at the related facilities do not require any special techniques or skills (one of the main activities is the cleaning of drainage). On the other hand, senior staff members from ME Direction de l'Hydraulique Urbaine have earnestly given younger staff on-the-job training (OJT) regarding O&M activities.

Further according to the JICA Japan Training Program, four staff members from ME Direction de l'Hydraulique Urbaine were sent to Japan and duly given training in a variety of

programs, which much satisfies the trainees.<sup>36</sup>

### 3.5.3 Financial Aspects of Operation and Maintenance

Table 15 shows the expenditure of O&M for the project facilities. The annual expenditure of O&M has been growing since 2008, with that of 2010 increased by 25% compared to 2008, of which the expenditure of O&M for Ariana accounts for 80%. On the other hand, budgets are approved as requested every year, as shown in the table below. Thus enough financial sources for O&M activities have been secured.

Table-15: O&M Budget of ME Direction de l'Hydraulique Urbaine

Unit: Thousand Tunisia Dinar (TND)

Year	O&M Budget Requested	O&M Budget Approved	O&M Budget for Ariana	O&M Budget for Kairouan
2008	200	200	200	0
2009	220	220	200	20
2010	250	250	200	50

Source: Answers to the questionnaire to ME and results of the interview

The total amount of the 2010 O&M budget in ME is 57 million Tunisian Dinars, of which the O&M budget related to this project accounts for only 0.4% only. Neither Ariana nor Kairouan is engaged in O&M activities for the project facilities.<sup>37</sup>

### 3.5.4 Current Status of Operation and Maintenance

The utilization status and O&M of the various facilities under the administration of ME Direction de l'Hydraulique Urbaine (such as drainage, retarding basins, diversions, and embankments) are good and no major problem has occurred to date.

In the case of the heavy rain which occurred in the northern part of Tunisia during October 2007 (equivalent to a once in a century flood volume), as described before, the project facilities in Ariana properly functioned as planned and helped minimize flood damage. This was partly because the scale of the 2003 flood was promptly analyzed and effectively reflected on the Detailed Design of this project. As a result, the original Detailed Design was reviewed twice, which indirectly caused a considerable delay of the project period, but finally helped to achieve the goal of this project.

Regarding the flood damage risk associated with the uncompleted section on the left bank of the Merguellil River in Kairouan, there are some fears about floods occurring and flood damage, as described in the Impact section. To solve the problem promptly, ME is considering

<sup>36</sup> The training period is three months. The training includes i) lectures (hydraulics, disaster prevention theory, etc.) and ii) field tour to facilities related to disaster prevention. (Source: Result of the interview with staff receiving the training)

<sup>37</sup> However, there are some exceptions; Ariana Municipal Council is in charge of some O&M activities for a detour around the retarding basin newly constructed under this project in Ariana.

some measures for land acquisition.<sup>38</sup> Besides, as described in the Efficiency section, the construction of the uncompleted section is appropriately budgeted at the beginning of each year. Though the court trial in progress is unclear because of the confused judicial system, which was caused by the Revolution in January 2011, ME is steadily executing possible options as executing agency. This can be evaluated as effort contributable to financial sustainability.

As described in the Effectiveness section, ME does not periodically collect quantitative data including discharge capacity and annual highest water level, as there is no problem regarding the recognition of flood risk without such data. Thus ME intends to “collect and monitor data only when the river water exceeds a warning level.” At least in the rainy season, however, it is thought ME should perform any monitoring activity.

As a result, no major problem has been observed in the operation and maintenance system. In Ariana, the constructed facilities have no problem about the O&M, and show performance as expected. Although flood occurrence risk still exists associated with the uncompleted section in the Kairouan portion, the executing agency ME is making efforts contributable to financial sustainability including proper measures for land acquisition and securing of necessary budget. Given these, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

This project is highly consistent with government policies and no problem with the operation and maintenance (O&M) systems can be found. Owing to various inundation protection facilities constructed under this project, no serious flood damage has occurred since the completion of disbursement of loans from JICA in 2008, which means this project has achieved its targets as of now. Although there still remains flood occurrence risk associated with the existence of the uncompleted section in a certain project portion where land purchase has not been completed, the executing agency continues to earnestly make efforts contributable to financial sustainability. This project makes a certain contribution to the improvement of the local business environment through reduced flood risk, and brings about indirect effects such as conversion from a river floodplain to agricultural land. In addition, in terms of efficiency, although the project period was longer than planned, the project cost was kept within the planned amount.

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<sup>38</sup> For example, ME suggested increase of price to Ministry of State Domain & Land Affairs, which is responsible for deciding land acquisition price. (Source: Result of the interview with an officer of ME Direction de l’Hydraulique Urbaine)

In light of the above, this project is evaluated to be satisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations for Executing Agency**

Regarding the uncompleted section of the embankment (700m) on the left bank of the Merguellil River in the Kairouan portion, many of the farmers concerned have expressed fears regarding flood risk. Besides, the delayed construction of the embankment somewhat diminishes the common benefits that local farmers might be able to obtain (improved accessibility to their agricultural lands and its resultant increase of agriculture income). Though the court trial in progress is uncertain due to the Revolution in January 2011, the executing agency is requested to continuously make efforts for land acquisition to complete the uncompleted section as soon as possible. For example, it is desired that the executing agency may swiftly take some measures to solve the current land acquisition problem while starting and continuing periodical monitoring of this area in the rainy season.

### **4.2.2 Recommendations for JICA**

It can be recommended that JICA observes ME's periodical monitoring and try to identify risks associated with the uncompleted section of the embankment on the left bank of the Merguellil River in advance. Furthermore, JICA is advised to take all necessary actions including re-organization and/or enhancement of the communication channel with ME.

## **4.3 Lessons Learned**

From the 2007 flood, it was found that the flood control facilities constructed in Ariana under this project functioned properly, and helped minimize physical damage. This is partly because the scale of the 2003 flood was appropriately analyzed and effectively reflected on the Detailed Design of this project. As a result, the original Detailed Design was reviewed more than once, which made the project period much longer. However, positive impact outweighing this negative impact (delay) was generated. This is an excellent example of flexible and timely project management according to the change of external factors and conditions.

## Comparison of Original and Actual Scope

Item	Plan	Actual
<b>A) Output</b>		
<b>I. Ariana Portion</b>		
1.1 Construction of retarding basins	4 retarding basin in total (A, G, I and J1)	4 retarding basin in total (A, G, BE-15 and BE-18) (BE-15 and BE-18 were additionally constructed.)
1.2 Improvement works for the Ennkhilet River	4,398m in total	13,100m in total (298% of original plan)
• Embankment	1,195m	Not constructed
• Concrete Channel (Open)	1,095m	3,700m
• Box culvert	2,108m	9,400m
1.3 Construction and rehabilitation of drainage	9,671m in total	10,440m in total (108% of original plan)
<b>II. Kairouan Portion</b>		
1.4 Merguellil River section		
• Construction of new diversion (DM1)	Approx. 8.7km in total (8.7km for left bank, 4.9km for right bank)	9.3km in total (8.6km for left bank, 0.7km of uncompleted section), Cancellation of left bank diversion
• Construction of new embankment (DM1-G)	120m	As planned
• Construction of bridges	Not specified	4 bridges
1.5 Zeroud River section		
• Construction of new embankment (in the downstream, for left bank only)	DZ1-A (left bank): 4,961m DZ1-B (left bank): 1,717m	DZA & DZB (left bank): Approx 7km in total, mostly as planned
• Construction of new embankment (in the upstream)	5,170m in total	Cancelled
1.6 Consulting Service		
• Consulting Service M/M	53 M/M in total (Foreign:22 M/M, Local: 31 M/M)	72.82 M/M in total (Not known by foreign and local)
• Consulting Service TOR	Tender documents review, Tender evaluation support, Construction supervision, Training program for MTH (current ME) engineers, etc.	Tender evaluation support : Cancelled Review of D/D for Ariana Portion: Added after the 2003 Flood
<b>B) Project Period</b>	Mar. 1998 – Oct. 2003 (68 months)	Mar. 1998 – Nov. 2008 (129 months)
<b>C) Project Cost</b>		
Foreign currency	1,783 million yen	102 million yen
Local currency	21,729 thousand TND	36,843 thousand TND
Total	4,173 million yen	3,377 million yen
Japanese ODA loan portion	3,130 million yen	2,374 million yen
Exchange rate	1 TND = 110 yen (July 1997)	1 TND = 12.80 yen (Average between 2000 and 2011)