REPUBLIC OF TUNISIA
MINSTRY OF AGRICALTURE
DIRECTORATE GENERAL FOR DAMS AND MAJOR HYDRAULIC WORKS

PREPARATORY SURVEY ON INTEGRATED BASIN MANAGEMENT AND FLOOD CONTROL PROJECT FOR MEJERDA RIVER: DEVELOPMENT OF FLOOD PREVENTION MEASURES

RESOURCE DOCUMENT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD

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1.1 Team Members and Dates of Government-Based Study

1.1.1Explanation of Inception Report

1) Members

Name	TOR	Position
Yusuke AMANO	General	Senior Advisor, Global Environment Dept.
Yukio TANAKA	Flood Control	Water Resources Management Div. I, Global Environment Dept.

2) Dates

August 11 - 15, 2012

1.1.2 Fact Finding Mission

1) Members

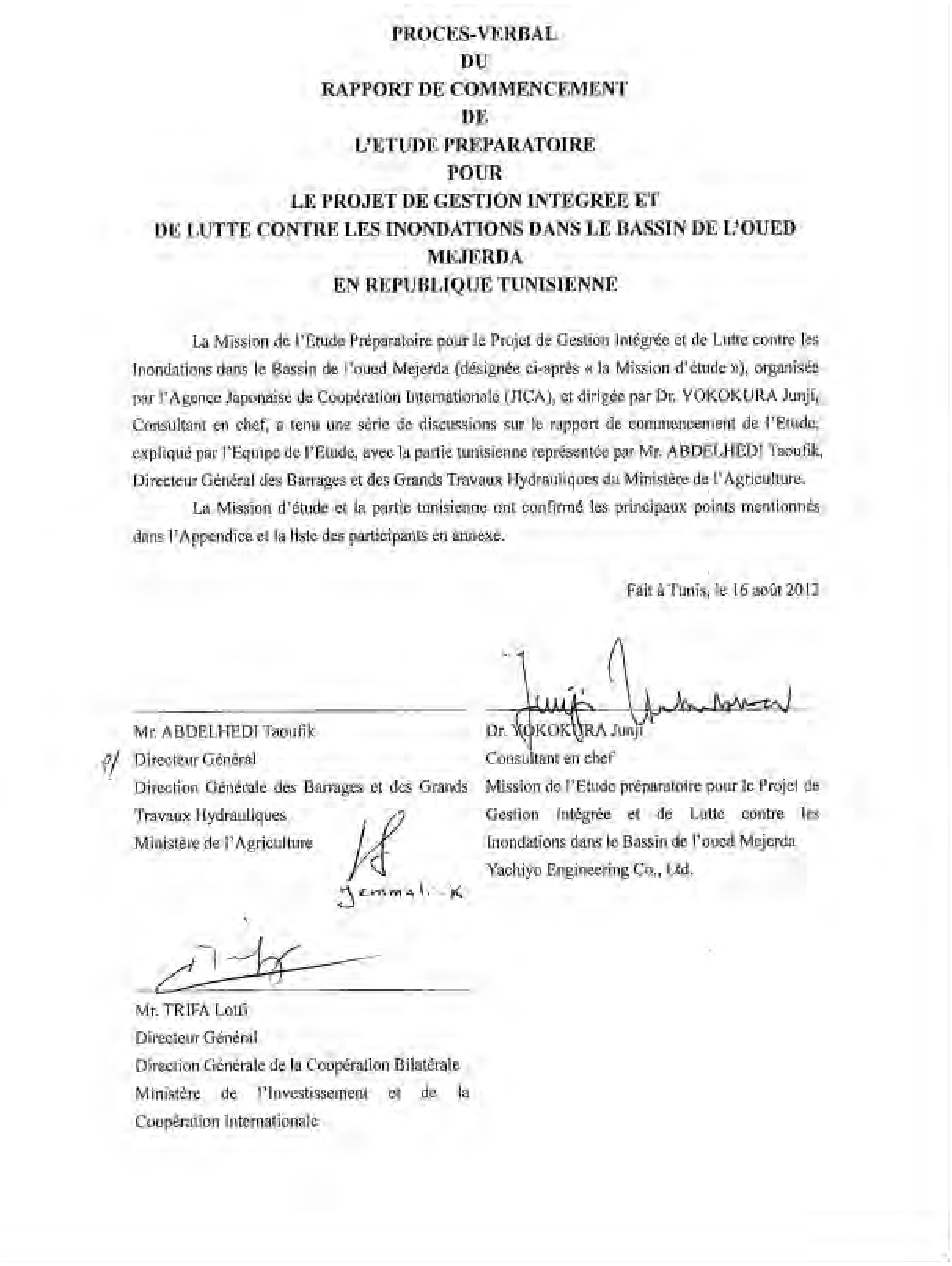
Name	TOR	Position
Yusuke AMANO	General	Senior Advisor, Global Environment Dept.
Yukio TANAKA	Flood Control	Water Resources Management Div. 1, Global Environment Dept.
Naohiro NOZAKA	Cooperation Planning	Middle East Div. 1, Middle East and Europe Dept.

2) Dates

September 4 - 8, 2012

1.2 Consultation Minutes of the Site Survey

1.2.1 Minutes about the explanation of Inception Report (August 16, 2012)



PROCES-VERBAL
DU
RAPPORT DE COMMENCEMENT
DE
L'ETUDE PREPARATOIRE
POUR
LE PROJET DE GESTION INTEGREE ET
DE LUTTE CONTRE LES INONDATIONS DANS LE BASSIN DE L'OUED MEJERDA
EN REPUBLIQUE TUNISIENNE

La Mission de l'Etude Préparatoire pour le Projet de Gestion Intégrée et de Lutte contre les Inondations dans le Bassin de l'oued Mejerda (désignée ci-après « la Mission d'étude »), organisée par l'Agence Japonaise de Coopération Internationale (JICA), et dirigée par Dr. YOKOKURA Junji, Consultant en chef, a tenu une série de discussions sur le rapport de commencement de l'Etude, expliqué par l'Equipe de l'Etude, avec la partie tunisienne représentée par Mr. ABDELHEDI Taoufik, Directeur Général des Barrages et des Grands Travaux Hydrauliques du Ministère de l'Agriculture.

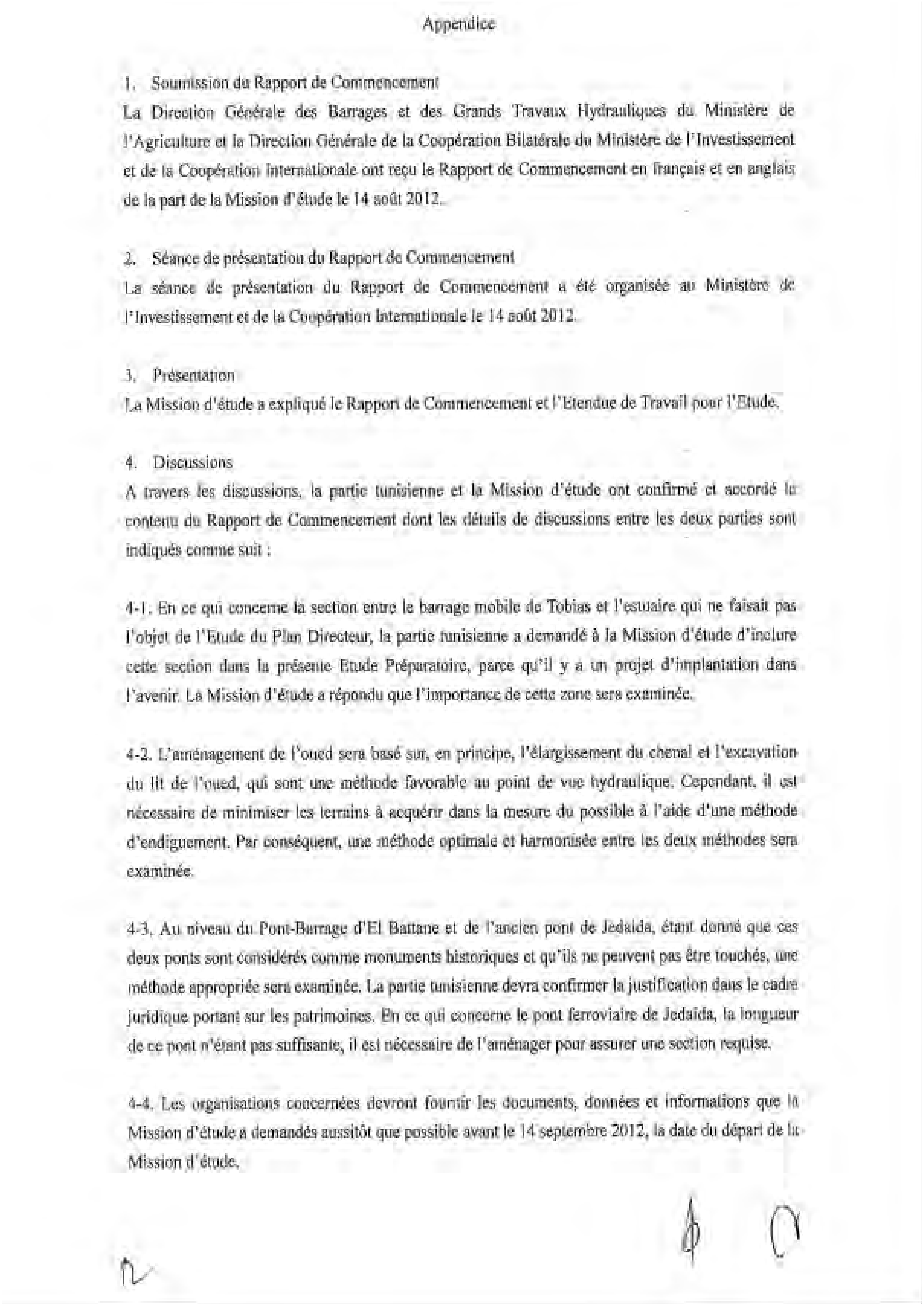
La Mission d'étude et la partie tunisienne ont confirmé les principaux points mentionnés dans l'Appendice et la liste des participants en annexe.

Fait à Tunis, le 16 août 2012

Mr. ABDELHEDI Taoufik
P/ Directeur Général
Direction Générale des Barrages et des Grands Travaux Hydrauliques
Ministère de l'Agriculture
Jemmali. K

Junji Yokokura
Dr. YOKOKURA Junji
Consultant en chef
Mission de l'Etude préparatoire pour le Projet de Gestion Intégrée et de Lutte contre les Inondations dans le Bassin de l'oued Mejerda
Yachiyo Engineering Co., Ltd.

Mr. TRIFA Lotfi
Directeur Général
Direction Générale de la Coopération Bilatérale
Ministère de l'Investissement et de la Coopération Internationale



Appendice

1. Soumission du Rapport de Commencement

La Direction Générale des Barrages et des Grands Travaux Hydrauliques du Ministère de l'Agriculture et la Direction Générale de la Coopération Bilatérale du Ministère de l'Investissement et de la Coopération Internationale ont reçu le Rapport de Commencement en français et en anglais de la part de la Mission d'étude le 14 août 2012.

2. Séance de présentation du Rapport de Commencement

La séance de présentation du Rapport de Commencement a été organisée au Ministère de l'Investissement et de la Coopération Internationale le 14 août 2012.

3. Présentation

La Mission d'étude a expliqué le Rapport de Commencement et l'Etendue de Travail pour l'Etude.

4. Discussions

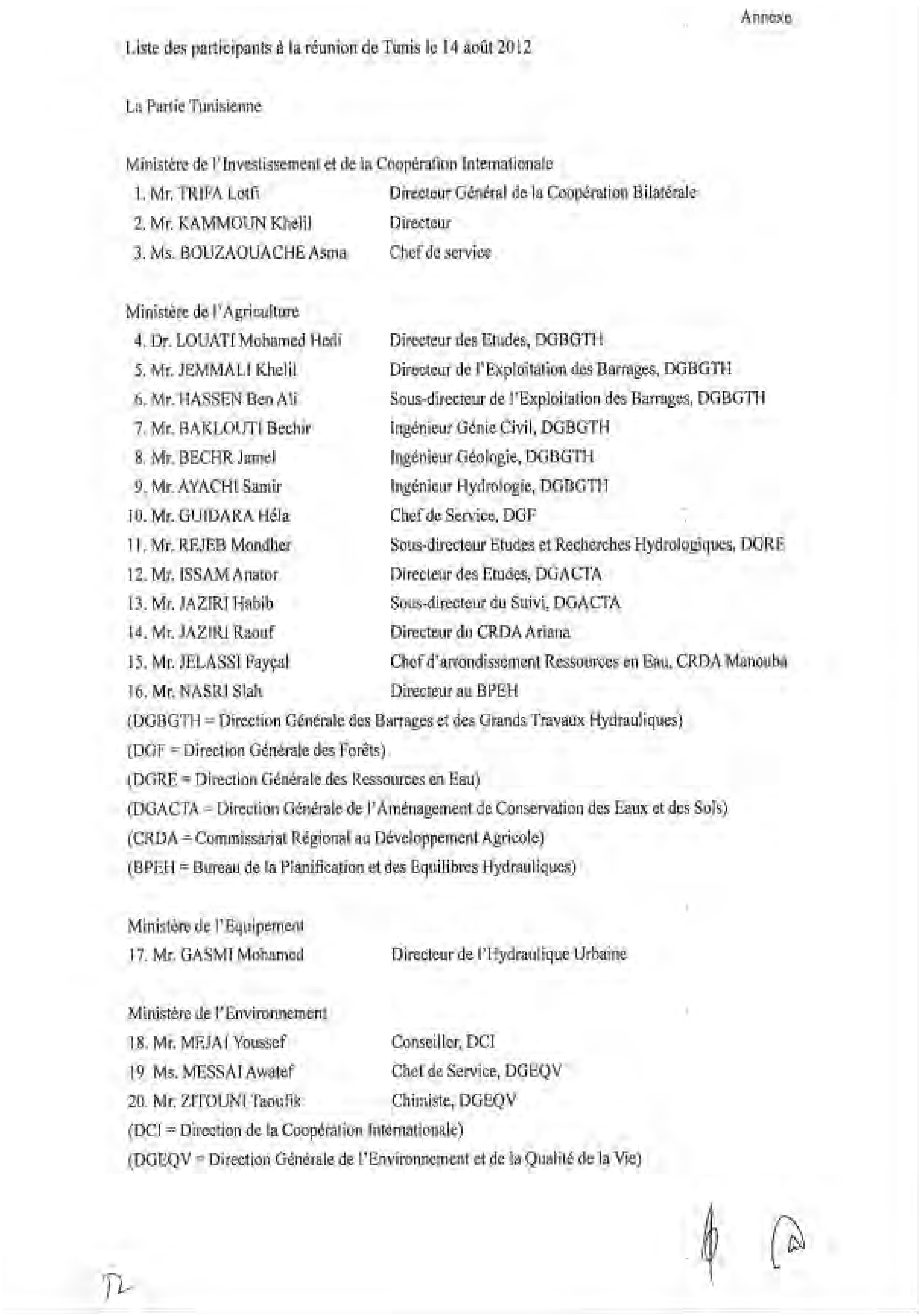
A travers les discussions, la partie tunisienne et la Mission d'étude ont confirmé et accordé le contenu du Rapport de Commencement dont les détails de discussions entre les deux parties sont indiqués comme suit :

4-1. En ce qui concerne la section entre le barrage mobile de Tobias et l'estuaire qui ne faisait pas l'objet de l'Etude du Plan Directeur, la partie tunisienne a demandé à la Mission d'étude d'inclure cette section dans la présente Etude Préparatoire, parce qu'il y a un projet d'implantation dans l'avenir. La Mission d'étude a répondu que l'importance de cette zone sera examinée.

4-2. L'aménagement de l'oued sera basé sur, en principe, l'élargissement du chenal et l'excavation du lit de l'oued, qui sont une méthode favorable au point de vue hydraulique. Cependant, il est nécessaire de minimiser les terrains à acquérir dans la mesure du possible à l'aide d'une méthode d'endiguement. Par conséquent, une méthode optimale et harmonisée entre les deux méthodes sera examinée.

4-3. Au niveau du Pont-Barrage d'El Battane et de l'ancien pont de Jedaida, étant donné que ces deux ponts sont considérés comme monuments historiques et qu'ils ne peuvent pas être touchés, une méthode appropriée sera examinée. La partie tunisienne devra confirmer la justification dans le cadre juridique portant sur les patrimoines. En ce qui concerne le pont ferroviaire de Jedaida, la longueur de ce pont n'étant pas suffisante, il est nécessaire de l'aménager pour assurer une section requise.

4-4. Les organisations concernées devront fournir les documents, données et informations que la Mission d'étude a demandés aussitôt que possible avant le 14 septembre 2012, la date du départ de la Mission d'étude.



Annexe

Liste des participants à la réunion de Tunis le 14 août 2012

La Partie Tunisienne

Ministère de l'Investissement et de la Coopération Internationale

1. Mr. TRIFA Lotfi	Directeur Général de la Coopération Bilatérale
2. Mr. KAMMOUN Khelil	Directeur
3. Ms. BOUZAOUACHE Asma	Chef de service

Ministère de l'Agriculture

4. Dr. LOUATI Mohamed Hedi	Directeur des Etudes, DGBGTH
5. Mr. JEMMALI Khelil	Directeur de l'Exploitation des Barrages, DGBGTH
6. Mr. HASSEN Ben Ali	Sous-directeur de l'Exploitation des Barrages, DGBGTH
7. Mr. BAKLOUTI Bechir	Ingénieur Génie Civil, DGBGTH
8. Mr. BECHR Jamel	Ingénieur Géologie, DGBGTH
9. Mr. AYACHI Samir	Ingénieur Hydrologie, DGBGTH
10. Mr. GUIDARA Héla	Chef de Service, DGF
11. Mr. REJEB Mondher	Sous-directeur Etudes et Recherches Hydrologiques, DGRE
12. Mr. ISSAM Anator	Directeur des Etudes, DGACTA
13. Mr. JAZIRI Habib	Sous-directeur du Suivi, DGACTA
14. Mr. JAZIRI Raouf	Directeur du CRDA Ariana
15. Mr. JELASSI Fayçal	Chef d'arondissement Ressources en Eau, CRDA Manouba
16. Mr. NASRI Slah	Directeur au BPEH

(DGBGTH = Direction Générale des Barrages et des Grands Travaux Hydrauliques)
(DGF = Direction Générale des Forêts)
(DGRE = Direction Générale des Ressources en Eau)
(DGACTA = Direction Générale de l'Aménagement de Conservation des Eaux et des Sols)
(CRDA = Commissariat Régional au Développement Agricole)
(BPEH = Bureau de la Planification et des Equilibres Hydrauliques)

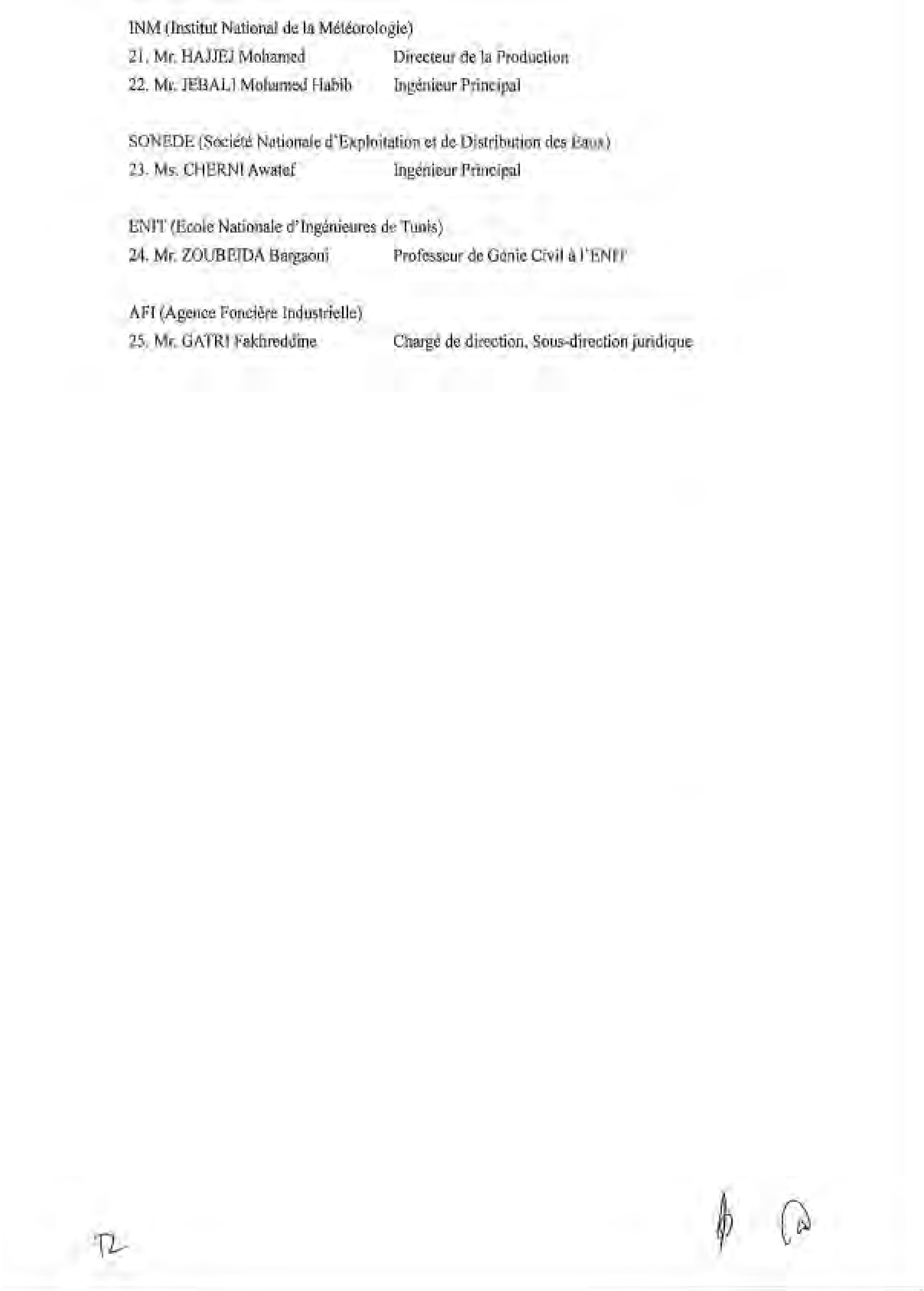
Ministère de l'Equipement

17. Mr. GASMI Mohamed	Directeur de l'Hydraulique Urbaine

Ministère de l'Environnement

18. Mr. MEJAI Youssef	Conseiller, DCI
19 Ms. MESSAI Awatef	Chef de Service, DGEQV
20. Mr. ZITOUNI Taoufik	Chimiste, DGEQV

(DCI = Direction de la Coopération Internationale)
(DGEQV = Direction Générale de l'Environnement et de la Qualité de la Vie)



INM (Institut National de la Météorologie)

21. Mr. HAJJEJ Mohamed	Directeur de la Production
22. Mr. JEBALI Mohamed Habib	Ingénieur Principal

SONEDE (Société Nationale d'Exploitation et de Distribution des Eaux)

23. Ms. CHERNI Awatef	Ingénieur Principal

ENIT (Ecole Nationale d'Ingénieures de Tunis)

24. Mr. ZOUBEIDA Bargaoui	Professeur de Génie Civil à l'ENIT

AFI (Agence Foncière Industrielle)

25. Mr. GATRI Fakhreddine	Chargé de direction, Sous-direction juridique

La Partie Japonaise

Ambassade du Japon en Tunisie

1. Mr. TANAKA Toshiki	Troisième Secrétaire, chargé de l'économie et de la coopération technique et économique

Agence Japonaise de Coopération Internationale (JICA

2. Mr. AMANO Yusuke	Conseiller, Département de l'Environnement Global, Siège de la JICA
3. Mr. TANAKA Yukio	Première Division de la Gestion des Ressources en Eau, Département de l'Environnement Global, Siège de la JICA
4. Mr. TOMIZAWA Ryuichi	Directeur Général, Bureau de la JICA en Tunisie
5. Ms. HARA Naomi	Représentante
6. Ms. TANIGUCHI Sayaka	Chargée de Mission de Suivi des Projets YEN
7. Ms. KEFI Karima	Chargée de projets

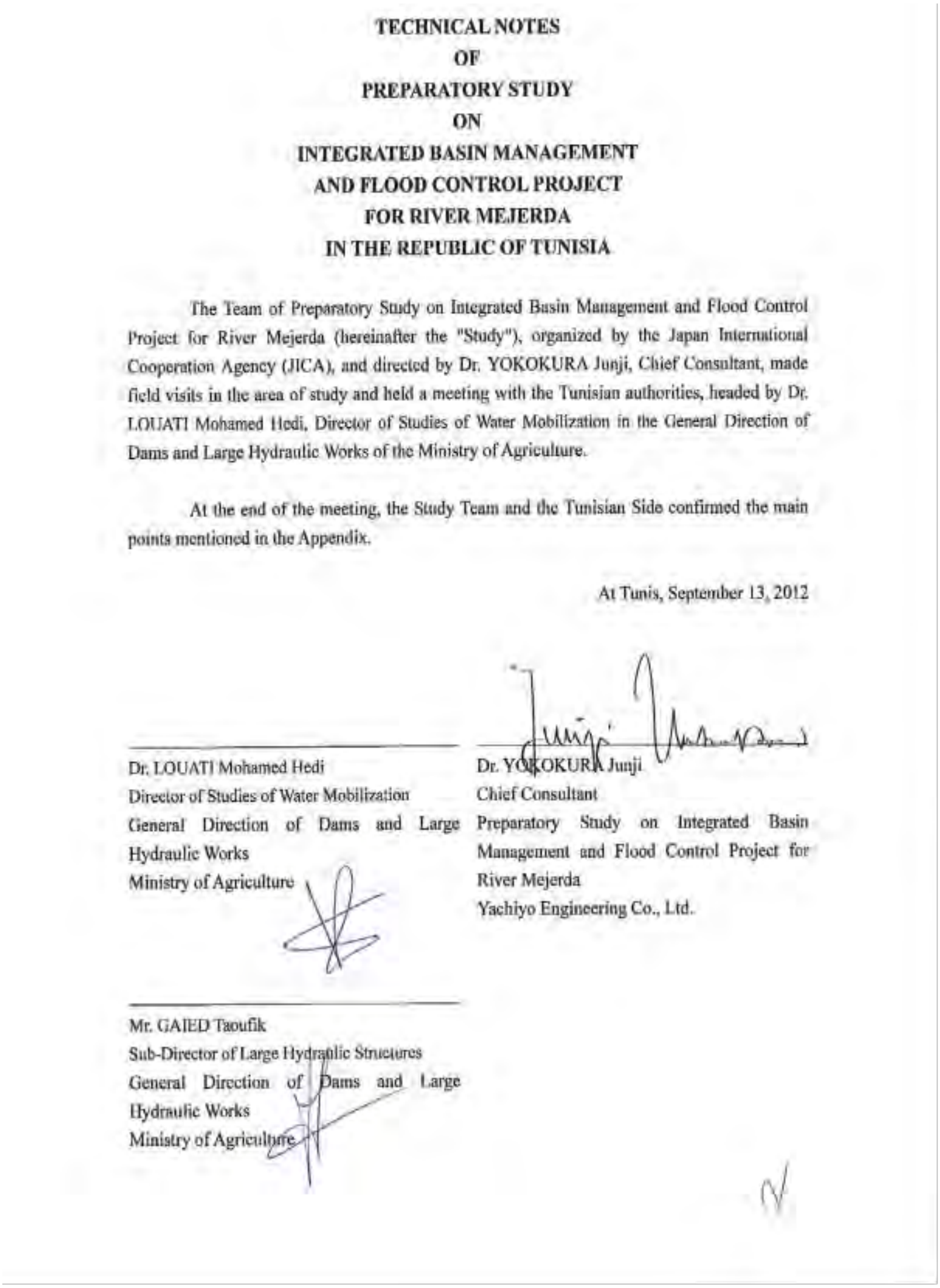
Equipe de l'Université de Tokyo

8. Dr. KOIKE Toshio	Professeur de l'Université de Tokyo
9. Dr. TSUJIMOTO Kumiko	Professeur Assistant
10. Dr. SHIBUO Yoshihiro	Professeur Assistant
11. Ms. HASEGAWA Izumi	Chercheuse
12. Mr. SAWADA Yohei	Etudiant en Maître, 2ème année
13. Mr. OKADA Noboru	Interprète français-japonais

Equipe du Consultant (Yachiyo Engineering Co., Ltd.)

14. Dr. YOKOKURA Junji	Consultant en chef
15. Mr. SATO Tadafumi	Etude hydrologique
16. Mr. OURA Hisashi	Analyses topographique, géologique et géotechnique
17. Mr. KITANO Masahiro	Analyse hydraulique
18. Mr. TAKAHASHI Toru	Gestion du Bassin / Plan de contrôle de l'inondation (1)
19. Mr. KANAMURA Hidetoshi	Analyse économique et financière
20. Mr. YABE Yoshio	Economie du contrôle des inondations
21. Ms. MATSUO Yui	Considérations environnementales et sociales
22. Mr. RU Ying	Assistant Plan de contrôle de l'inondation (2) / Coordination
23. Mr. SOMEYA Akira	Coordination de l'Equipe du Consultant
24. Mr. SUZUKI Gentaro	Interprète français-japonais

1.2.2 Technical notes of Site Survey (September 13, 2012)



TECHNICAL NOTES
OF
PREPARATORY STUDY
ON
INTEGRATED BASIN MANAGEMENT
AND FLOOD CONTROL PROJECT
FOR RIVER MEJERDA
IN THE REPUBLIC OF TUNISIA

The Team of Preparatory Study on Integrated Basin Management and Flood Control Project for River Mejerda (hereinafter the "Study"), organized by the Japan International Cooperation Agency (JICA), and directed by Dr. YOKOKURA Junji, Chief Consultant, made field visits in the area of study and held a meeting with the Tunisian authorities, headed by Dr. LOUATI Mohamed Hedi, Director of Studies of Water Mobilization in the General Direction of Dams and Large Hydraulic Works of the Ministry of Agriculture.

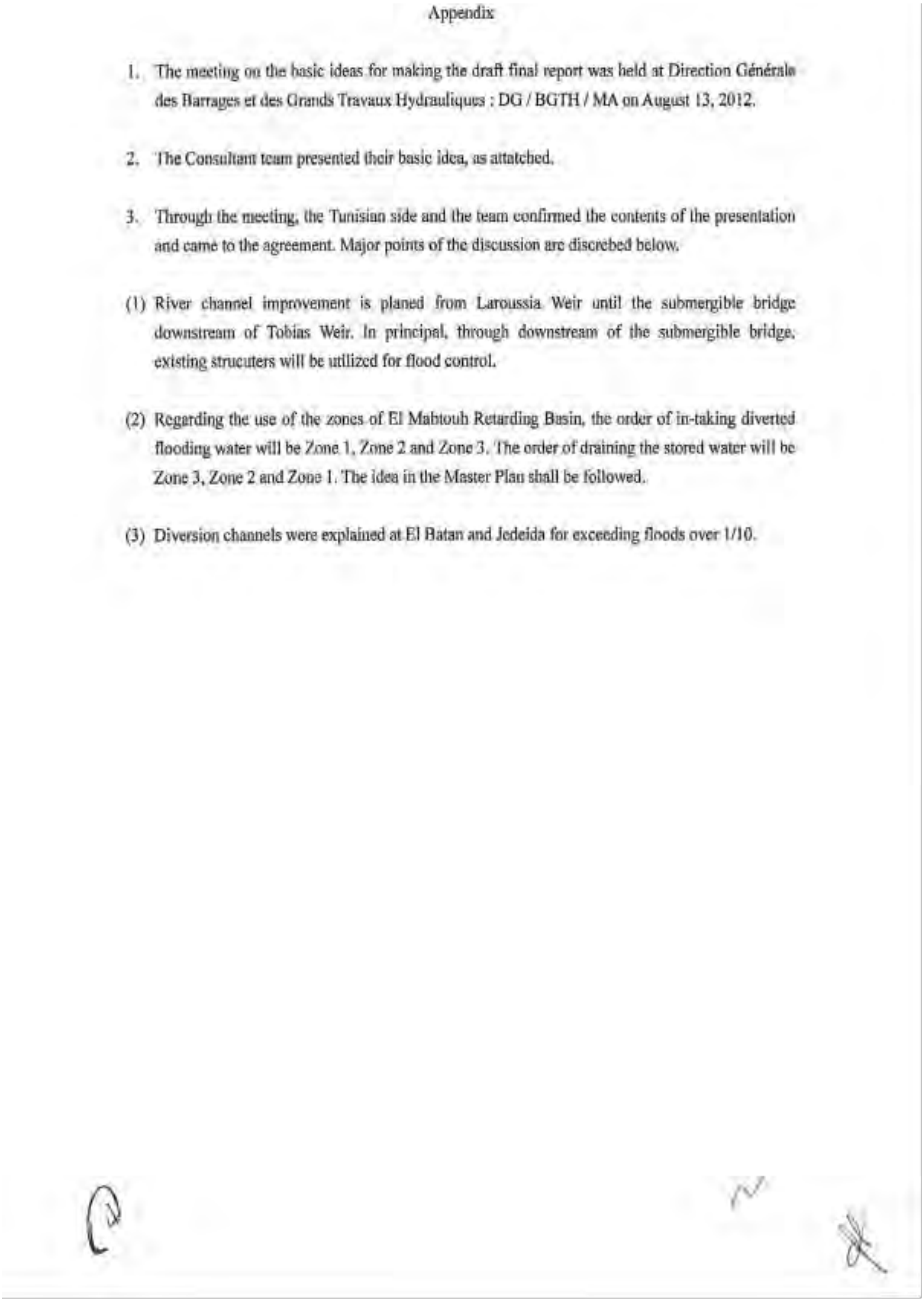
At the end of the meeting, the Study Team and the Tunisian Side confirmed the main points mentioned in the Appendix.

At Tunis, September 13, 2012

Dr. LOUATI Mohamed Hedi
Director of Studies of Water Mobilization
General Direction of Dams and Large Hydraulic Works
Ministry of Agriculture

Dr. YOKOKURA Junji
Chief Consultant
Preparatory Study on Integrated Basin Management and Flood Control Project for River Mejerda
Yachiyo Engineering Co., Ltd.

Mr. GAIED Taoufik
Sub-Director of Large Hydraulic Structures
General Direction of Dams and Large Hydraulic Works
Ministry of Agriculture



Appendix

1. The meeting on the basic ideas for making the draft final report was held at Direction Générale des Barrages et des Grands Travaux Hydrauliques : DG / BGTH / MA on August 13, 2012.

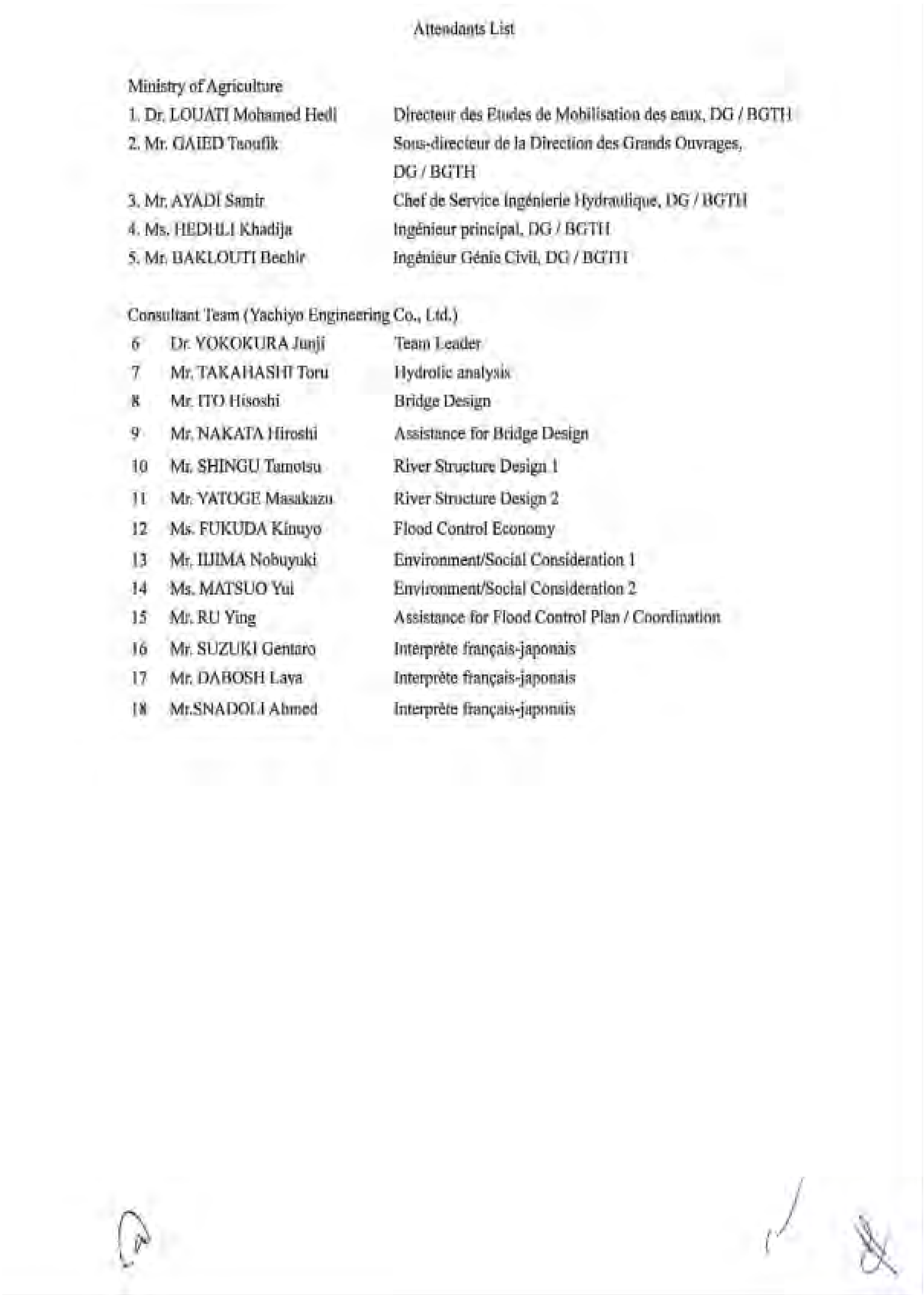
2. The Consultant team presented their basic idea, as attatched.

3. Through the meeting, the Tunisian side and the team confirmed the contents of the presentation and came to the agreement. Major points of the discussion are discrebed below.

(1) River channel improvement is planed from Laroussia Weir until the submergible bridge downstream of Tobias Weir. In principal, through downstream of the submergible bridge, existing strucuters will be utilized for flood control.

(2) Regarding the use of the zones of El Mabtouh Retarding Basin, the order of in-taking diverted flooding water will be Zone 1, Zone 2 and Zone 3. The order of draining the stored water will be Zone 3, Zone 2 and Zone 1. The idea in the Master Plan shall be followed.

(3) Diversion channels were explained at El Batan and Jedeida for exceeding floods over 1/10.



Attendants List

Ministry of Agriculture

1. Dr. LOUATI Mohamed Hedi	Directeur des Etudes de Mobilisation des eaux, DG / BGTH
2. Mr. GAIED Taoufik	Sous-directeur de la Direction des Grands Ouvrages, DG / BGTH
3. Mr. AYADI Samir	Chef de Service Ingénierie Hydraulique, DG / BGTH
4. Ms. HEDHLI Khadija	Ingénieur principal, DG / BGTH
5. Mr. BAKLOUTI Bechir	Ingénieur Génie Civil, DG / BGTH

Consultant Team (Yachiyo Engineering Co., Ltd.)

6	Dr. YOKOKURA Junji	Team Leader
7	Mr. TAKAHASHI Toru	Hydrolic analysis
8	Mr. ITO Hisoshi	Bridge Design
9	Mr. NAKATA Hiroshi	Assistance for Bridge Design
10	Mr. SHINGU Tamotsu	River Structure Design 1
11	Mr. YATOGE Masakazu	River Structure Design 2
12	Ms. FUKUDA Kinuyo	Flood Control Economy
13	Mr. IIJIMA Nobuyuki	Environment/Social Consideration 1
14	Ms. MATSUO Yui	Environment/Social Consideration 2
15	Mr. RU Ying	Assistance for Flood Control Plan / Coordination
16	Mr. SUZUKI Gentaro	Interprète français-japonais
17	Mr. DABOSH Laya	Interprète français-japonais
18	Mr.SNADOLI Ahmed	Interprète français-japonais

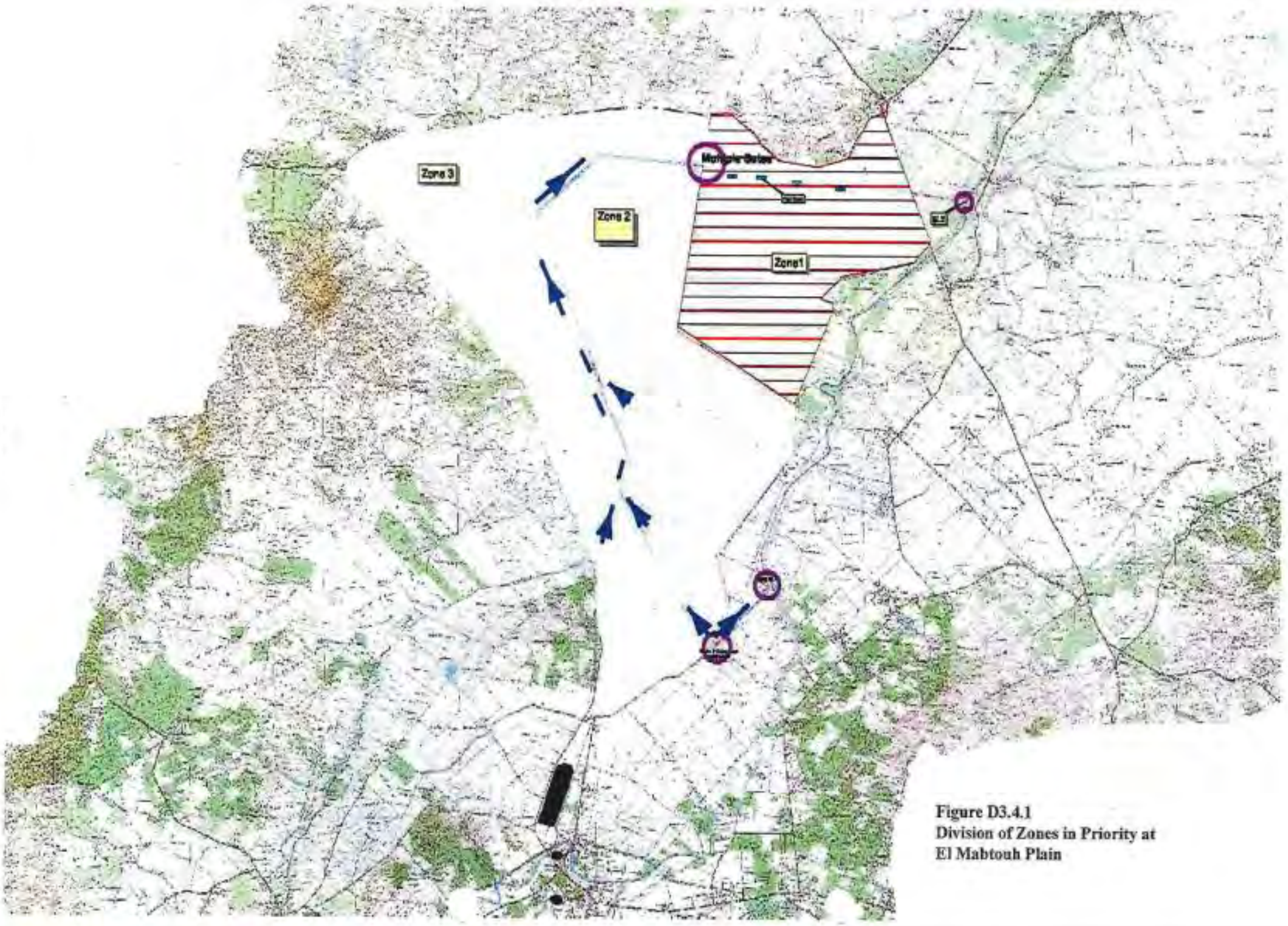
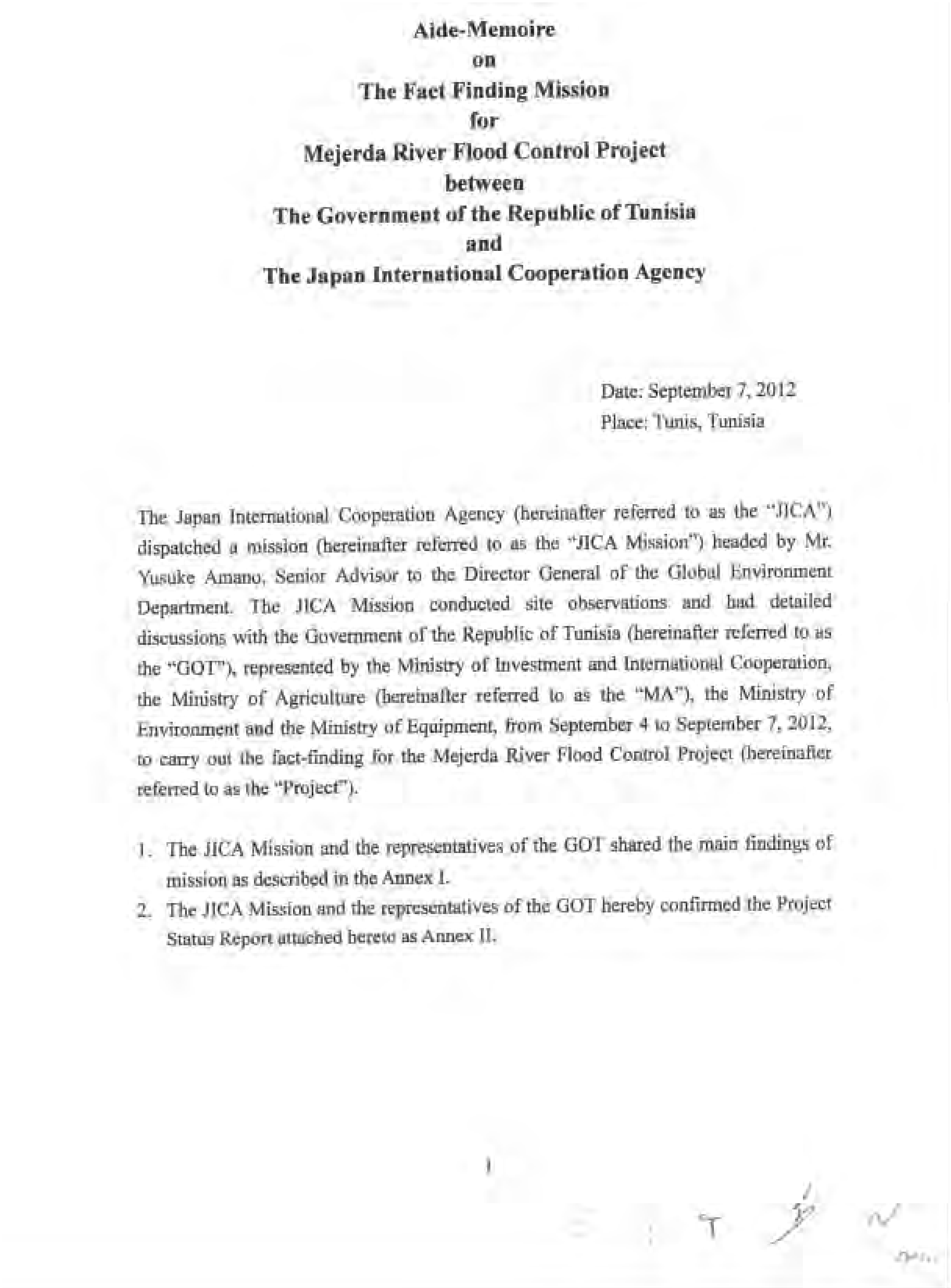


Figure D3.4.1
Division of Zones in Priority at
El Mabtouh Plain

1.2.3 Aid-Memorie from Fact Finding Mission (September 7, 2012)



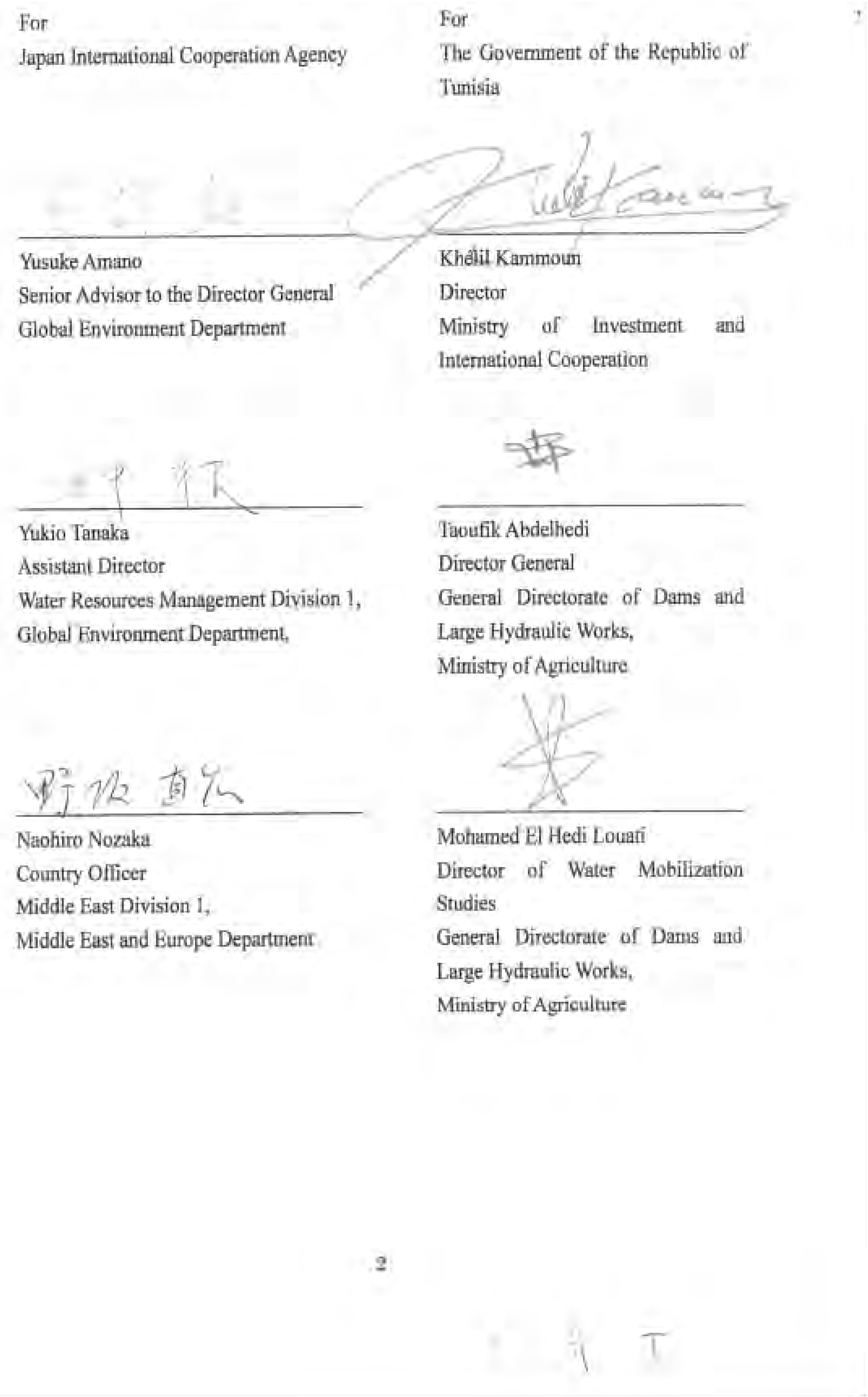
Aide-Memoire
on
The Fact Finding Mission
for
Mejerda River Flood Control Project
between
The Government of the Republic of Tunisia
and
The Japan International Cooperation Agency

Date: September 7, 2012
Place: Tunis, Tunisia

The Japan International Cooperation Agency (hereinafter referred to as the "JICA") dispatched a mission (hereinafter referred to as the "JICA Mission") headed by Mr. Yusuke Amano, Senior Advisor to the Director General of the Global Environment Department. The JICA Mission conducted site observations and had detailed discussions with the Government of the Republic of Tunisia (hereinafter referred to as the "GOT"), represented by the Ministry of Investment and International Cooperation, the Ministry of Agriculture (hereinafter referred to as the "MA"), the Ministry of Environment and the Ministry of Equipment, from September 4 to September 7, 2012, to carry out the fact-finding for the Mejerda River Flood Control Project (hereinafter referred to as the "Project").

1. The JICA Mission and the representatives of the GOT shared the main findings of mission as described in the Annex I.
2. The JICA Mission and the representatives of the GOT hereby confirmed the Project Status Report attached hereto as Annex II.

1

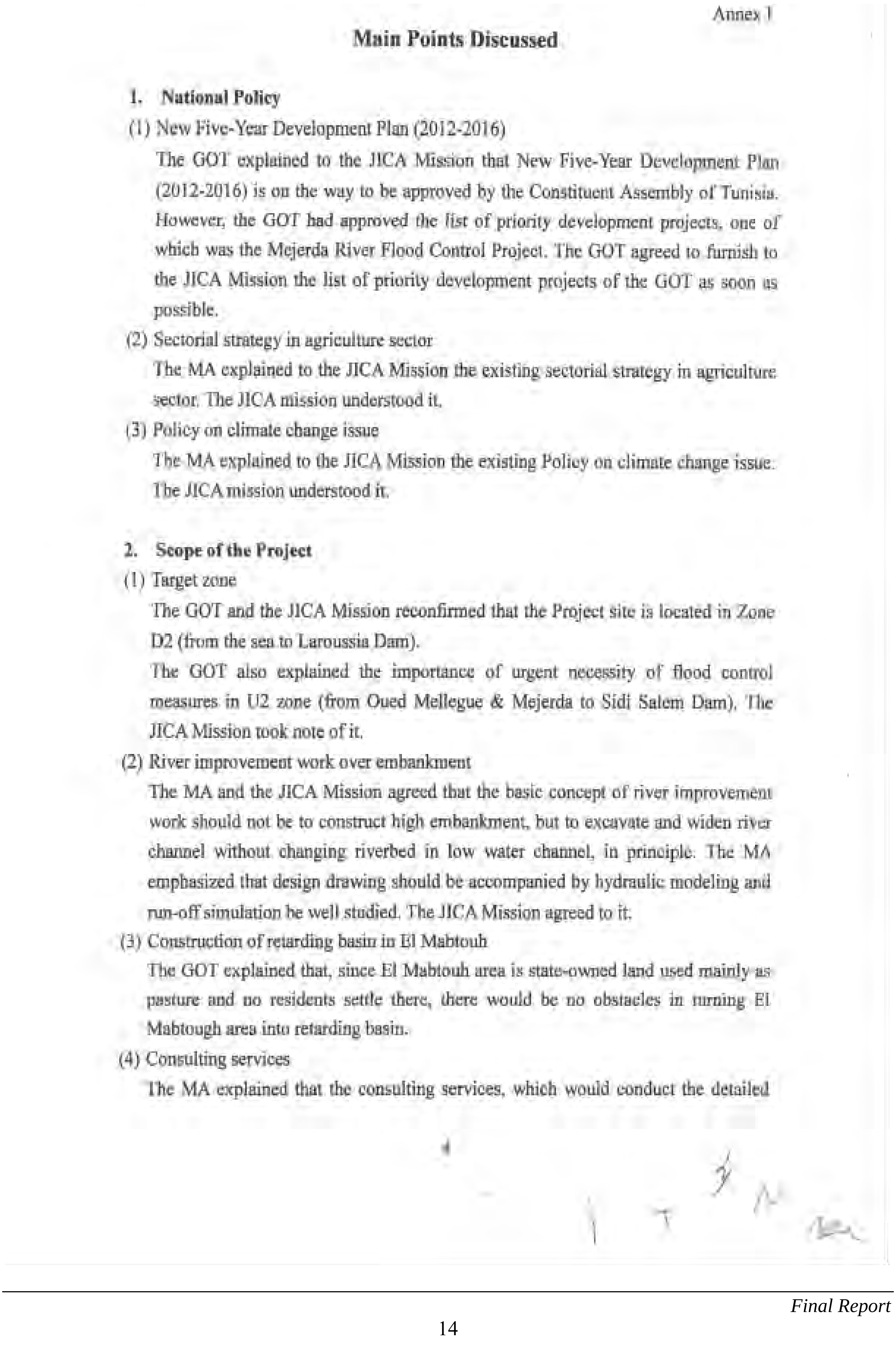


For Japan International Cooperation Agency	For The Government of the Republic of Tunisia
Yusuke Amano Senior Advisor to the Director General Global Environment Department	Khélil Kammoun Director Ministry of Investment and International Cooperation
Yukio Tanaka Assistant Director Water Resources Management Division 1, Global Environment Department,	Taoufik Abdelhedi Director General General Directorate of Dams and Large Hydraulic Works, Ministry of Agriculture
野坂 直弘 Naohiro Nozaka Country Officer Middle East Division 1, Middle East and Europe Department	Mohamed El Hedi Louati Director of Water Mobilization Studies General Directorate of Dams and Large Hydraulic Works, Ministry of Agriculture

2

Annex I:	Main Points Discussed
Annex II:	Project Status Report (as of September 2012)

Attachment 1	Steering committee of the complementary study (in Arabic)
Attachment 2:	Environmental screening form and environmental checklist dated September 29, 2011
Attachment 3:	Land Acquisition Law of Tunisia (in Arabic)



Annex 1

Main Points Discussed

1. National Policy

(1) New Five-Year Development Plan (2012-2016)

The GOT explained to the JICA Mission that New Five-Year Development Plan (2012-2016) is on the way to be approved by the Constituent Assembly of Tunisia. However, the GOT had approved the list of priority development projects, one of which was the Mejerda River Flood Control Project. The GOT agreed to furnish to the JICA Mission the list of priority development projects of the GOT as soon as possible.

(2) Sectorial strategy in agriculture sector

The MA explained to the JICA Mission the existing sectorial strategy in agriculture sector. The JICA mission understood it.

(3) Policy on climate change issue

The MA explained to the JICA Mission the existing Policy on climate change issue. The JICA mission understood it.

2. Scope of the Project

(1) Target zone

The GOT and the JICA Mission reconfirmed that the Project site is located in Zone D2 (from the sea to Laroussia Dam).

The GOT also explained the importance of urgent necessity of flood control measures in U2 zone (from Oued Mellegue & Mejerda to Sidi Salem Dam). The JICA Mission took note of it.

(2) River improvement work over embankment

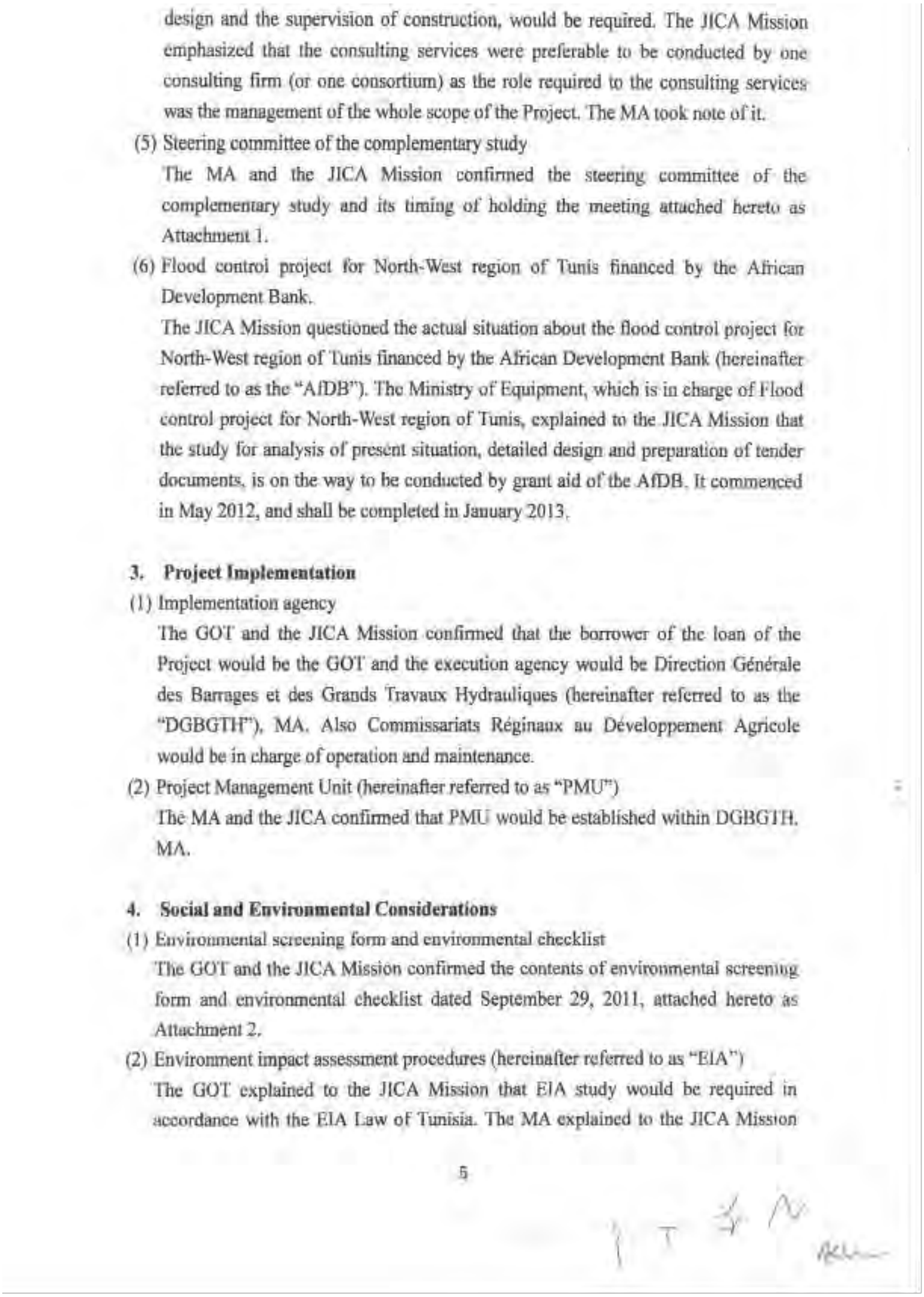
The MA and the JICA Mission agreed that the basic concept of river improvement work should not be to construct high embankment, but to excavate and widen river channel without changing riverbed in low water channel, in principle. The MA emphasized that design drawing should be accompanied by hydraulic modeling and run-off simulation be well studied. The JICA Mission agreed to it.

(3) Construction of retarding basin in El Mabtouh

The GOT explained that, since El Mabtouh area is state-owned land used mainly as pasture and no residents settle there, there would be no obstacles in turning El Mabtough area into retarding basin.

(4) Consulting services

The MA explained that the consulting services, which would conduct the detailed



design and the supervision of construction, would be required. The JICA Mission emphasized that the consulting services were preferable to be conducted by one consulting firm (or one consortium) as the role required to the consulting services was the management of the whole scope of the Project. The MA took note of it.

(5) Steering committee of the complementary study

The MA and the JICA Mission confirmed the steering committee of the complementary study and its timing of holding the meeting attached hereto as Attachment 1.

(6) Flood control project for North-West region of Tunis financed by the African Development Bank.

The JICA Mission questioned the actual situation about the flood control project for North-West region of Tunis financed by the African Development Bank (hereinafter referred to as the "AfDB"). The Ministry of Equipment, which is in charge of Flood control project for North-West region of Tunis, explained to the JICA Mission that the study for analysis of present situation, detailed design and preparation of tender documents, is on the way to be conducted by grant aid of the AfDB. It commenced in May 2012, and shall be completed in January 2013.

3. Project Implementation

(1) Implementation agency

The GOT and the JICA Mission confirmed that the borrower of the loan of the Project would be the GOT and the execution agency would be Direction Générale des Barrages et des Grands Travaux Hydrauliques (hereinafter referred to as the "DGBGTH"), MA. Also Commissariats Réginaux au Développement Agricole would be in charge of operation and maintenance.

(2) Project Management Unit (hereinafter referred to as "PMU")

The MA and the JICA confirmed that PMU would be established within DGBGTH, MA.

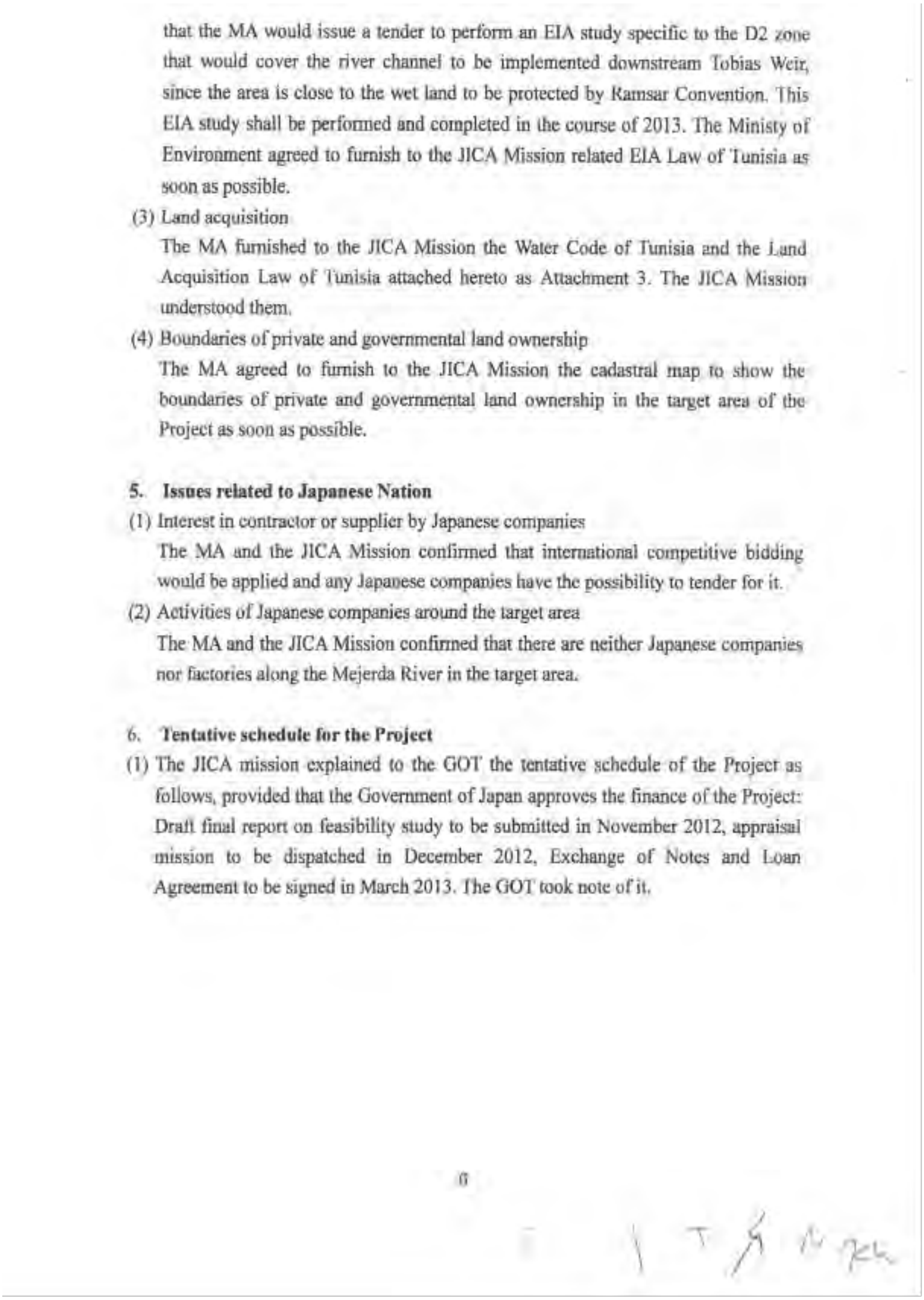
4. Social and Environmental Considerations

(1) Environmental screening form and environmental checklist

The GOT and the JICA Mission confirmed the contents of environmental screening form and environmental checklist dated September 29, 2011, attached hereto as Attachment 2.

(2) Environment impact assessment procedures (hereinafter referred to as "EIA")

The GOT explained to the JICA Mission that EIA study would be required in accordance with the EIA Law of Tunisia. The MA explained to the JICA Mission



that the MA would issue a tender to perform an EIA study specific to the D2 zone that would cover the river channel to be implemented downstream Tobias Weir, since the area is close to the wet land to be protected by Ramsar Convention. This EIA study shall be performed and completed in the course of 2013. The Ministy of Environment agreed to furnish to the JICA Mission related EIA Law of Tunisia as soon as possible.

(3) Land acquisition

The MA furnished to the JICA Mission the Water Code of Tunisia and the Land Acquisition Law of Tunisia attached hereto as Attachment 3. The JICA Mission understood them.

(4) Boundaries of private and governmental land ownership

The MA agreed to furnish to the JICA Mission the cadastral map to show the boundaries of private and governmental land ownership in the target area of the Project as soon as possible.

5. Issues related to Japanese Nation

(1) Interest in contractor or supplier by Japanese companies

The MA and the JICA Mission confirmed that international competitive bidding would be applied and any Japanese companies have the possibility to tender for it.

(2) Activities of Japanese companies around the target area

The MA and the JICA Mission confirmed that there are neither Japanese companies nor factories along the Mejerda River in the target area.

6. Tentative schedule for the Project

(1) The JICA mission explained to the GOT the tentative schedule of the Project as follows, provided that the Government of Japan approves the finance of the Project: Draft final report on feasibility study to be submitted in November 2012, appraisal mission to be dispatched in December 2012, Exchange of Notes and Loan Agreement to be signed in March 2013. The GOT took note of it.

AnnexII The following Annex is omitted

1.2.4 Technical notes of interim report of Draft Final Report (February 5, 2013)

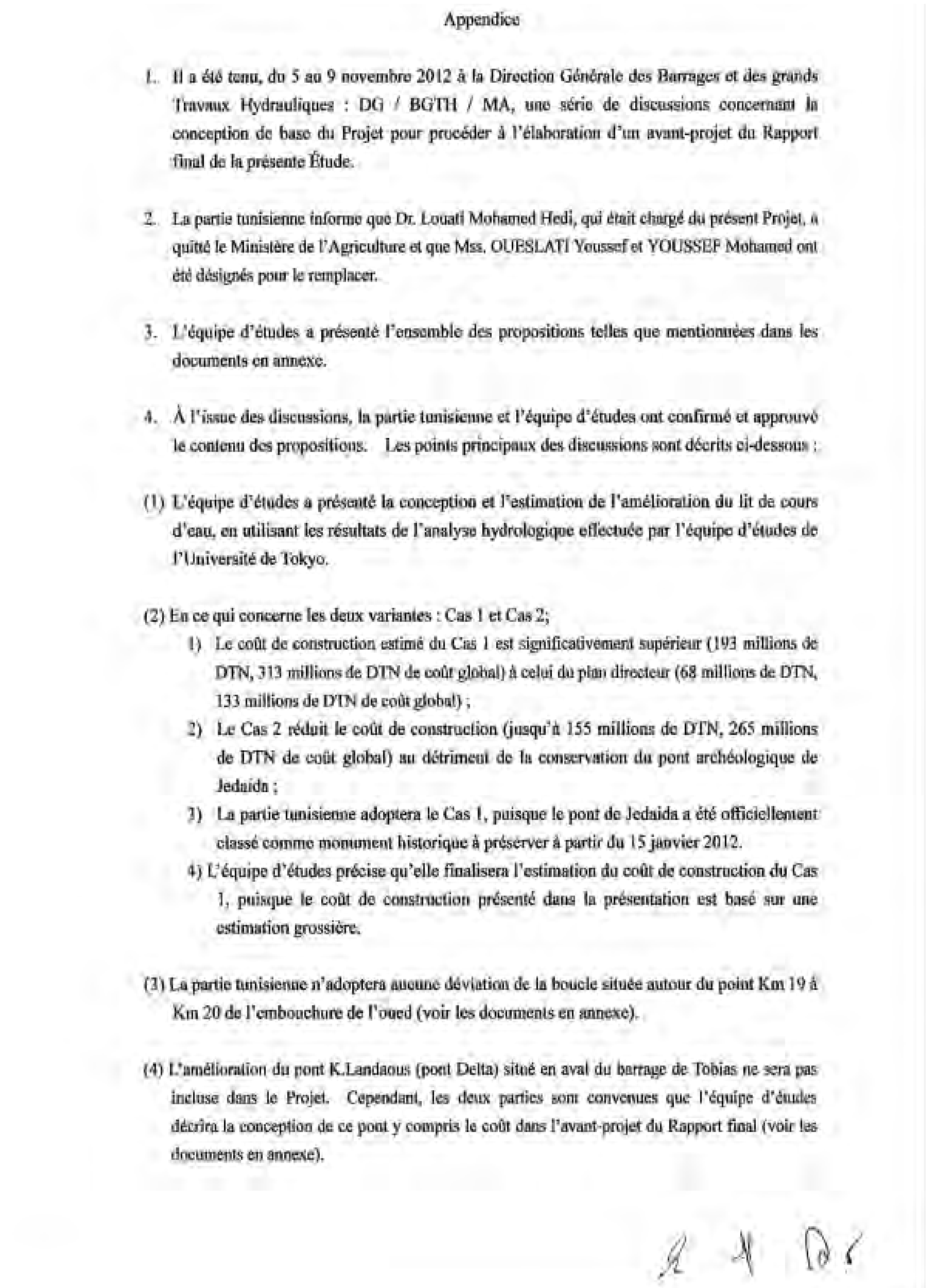
PROCÈS-VERBAL DES DISCUSSIONS
SUR
L'ÉTUDE PRÉPARATOIRE POUR LE PROJET DE GESTION INTÉGRÉE DU BASSIN ET DE CONTRÔLE DES INONDATIONS DE L'OUED MEJERDA
(DÉVELOPPEMENT DES MESURES PRÉVENTIVES CONTRE LES INONDATIONS)
EN RÉPUBLIQUE TUNISIENNE

L'équipe d'études chargée de l'Étude Préparatoire pour le Projet de Gestion Intégrée du Bassin et de Contrôle des Inondations de l'oued Mejerda : Développement des Mesures Préventives contre les Inondations (désignée ci-après l'« Étude »), organisée par l'Agence Japonaise de Coopération Internationale (JICA), et dirigée par Dr. YOKOKURA Junji, Consultant en chef, a tenu une série de discussions sur l'Étude avec la partie tunisienne représentée par Mr. Taoufik ABDELHEDI, Directeur Général des Barrages et des Grands Travaux Hydrauliques du Ministère de l'Agriculture.

L'équipe d'études et la partie tunisienne ont confirmé les principaux points mentionnés dans l'Appendice et la liste des participants en annexe.

Fait à Tunis, le 9 novembre 2012

Mr. OUESLATI Youssef Sous-directeur de la Géologie et du Laboratoire des Barrages Direction Générale des Barrages et des Grands Travaux Hydrauliques Ministère de l'Agriculture	Dr. YOKOKURA Junji Chef d'équipe Étude Préparatoire pour le Projet de Gestion Intégrée du Bassin et de Contrôle des Inondations de l'oued Mejerda : Développement des mesures préventives contre les inondations Yachiyo Engineering Co., Ltd.
Mr. GAIED Taoufik Sous-directeur des Grands Ouvrages Direction Générale des Barrages et des Grands Travaux Hydrauliques Ministère de l'Agriculture	Mr. YOUSSEF Mohamed Sous-directeur des Études d'exécution Direction Générale des Barrages et des Grands Travaux Hydrauliques Ministère de l'Agriculture



Appendice

1. Il a été tenu, du 5 au 9 novembre 2012 à la Direction Générale des Barrages et des grands Travaux Hydrauliques : DG / BGTH / MA, une série de discussions concernant la conception de base du Projet pour procéder à l'élaboration d'un avant-projet du Rapport final de la présente Étude.

2. La partie tunisienne informe que Dr. Louati Mohamed Hedi, qui était chargé du présent Projet, a quitté le Ministère de l'Agriculture et que Mss. OUESLATI Youssef et YOUSSEF Mohamed ont été désignés pour le remplacer.

3. L'équipe d'études a présenté l'ensemble des propositions telles que mentionnées dans les documents en annexe.

4. À l'issue des discussions, la partie tunisienne et l'équipe d'études ont confirmé et approuvé le contenu des propositions. Les points principaux des discussions sont décrits ci-dessous :

(1) L'équipe d'études a présenté la conception et l'estimation de l'amélioration du lit de cours d'eau, en utilisant les résultats de l'analyse hydrologique effectuée par l'équipe d'études de l'Université de Tokyo.

(2) En ce qui concerne les deux variantes : Cas 1 et Cas 2;

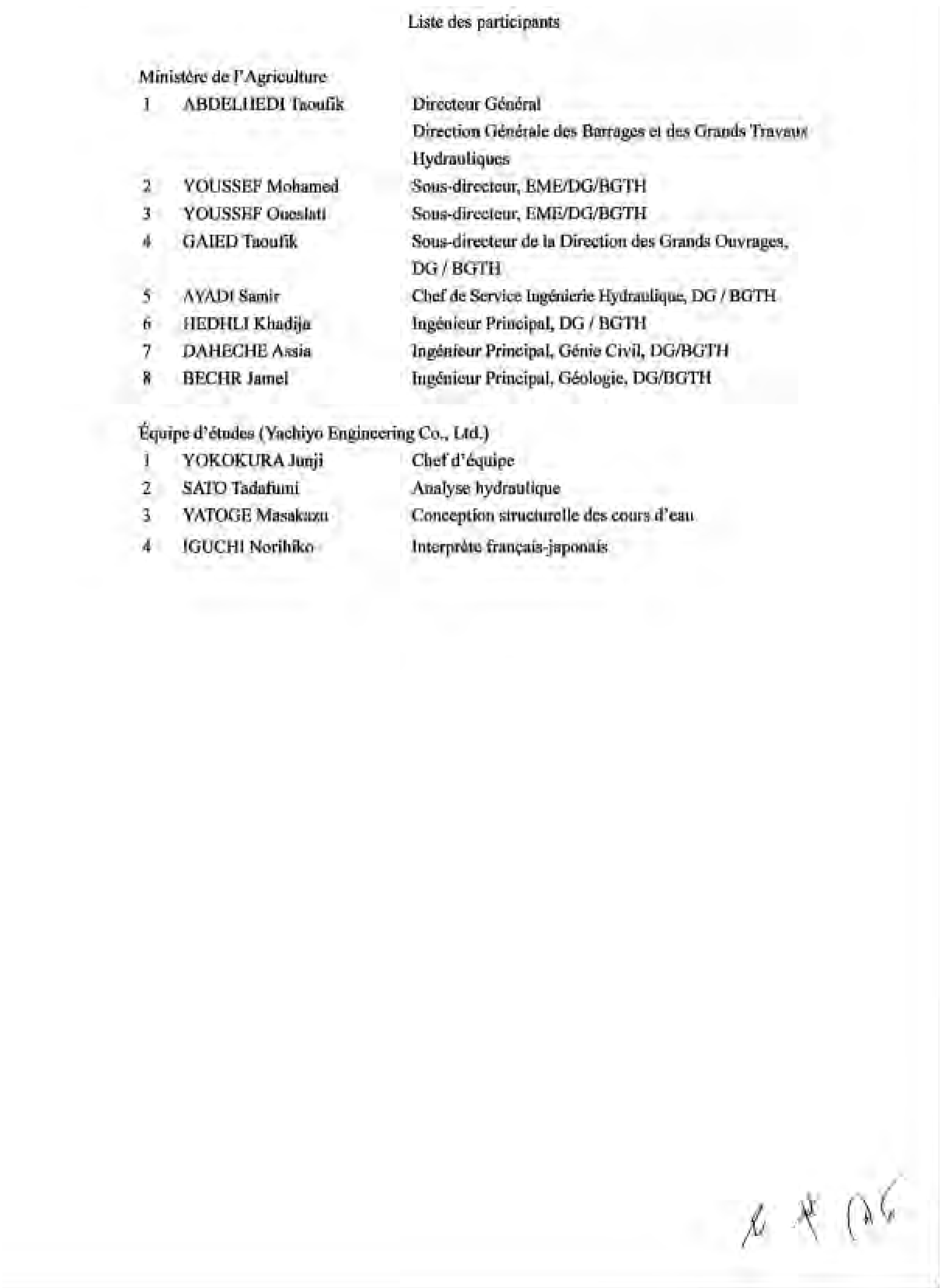
1) Le coût de construction estimé du Cas 1 est significativement supérieur (193 millions de DTN, 313 millions de DTN de coût global) à celui du plan directeur (68 millions de DTN, 133 millions de DTN de coût global) ;
2) Le Cas 2 réduit le coût de construction (jusqu'à 155 millions de DTN, 265 millions de DTN de coût global) au détriment de la conservation du pont archéologique de Jedaida ;
3) La partie tunisienne adoptera le Cas 1, puisque le pont de Jedaida a été officiellement classé comme monument historique à préserver à partir du 15 janvier 2012.
4) L'équipe d'études précise qu'elle finalisera l'estimation du coût de construction du Cas 1, puisque le coût de construction présenté dans la présentation est basé sur une estimation grossière.

(3) La partie tunisienne n'adoptera aucune déviation de la boucle située autour du point Km 19 à Km 20 de l'embouchure de l'oued (voir les documents en annexe).

(4) L'amélioration du pont K.Landaous (pont Delta) situé en aval du barrage de Tobias ne sera pas incluse dans le Projet. Cependant, les deux parties sont convenues que l'équipe d'études décrira la conception de ce pont y compris le coût dans l'avant-projet du Rapport final (voir les documents en annexe).

(5) La partie tunisienne partage son avis avec l’équipe d’études qui suggère que la digue intérieure existante entre le barrage de Tobias et le dit pont sera démolie dans les travaux d’excavation du lit de l’oued. Il est toutefois exprimé par la partie tunisienne la nécessité de construction d’une autre digue moins élevée d’environ 1,5 m que la digue extérieure dans le but de maintenir la fonction originale du système. L’équipe d’études convient qu’elle évaluera la faisabilité de cette nouvelle digue dans l’avant-projet du Rapport final de la présente Étude (voir les documents en annexe).

(6) La partie tunisienne accepte le calendrier mis à jour pour la réalisation de l’Étude tel que joint à la présente.



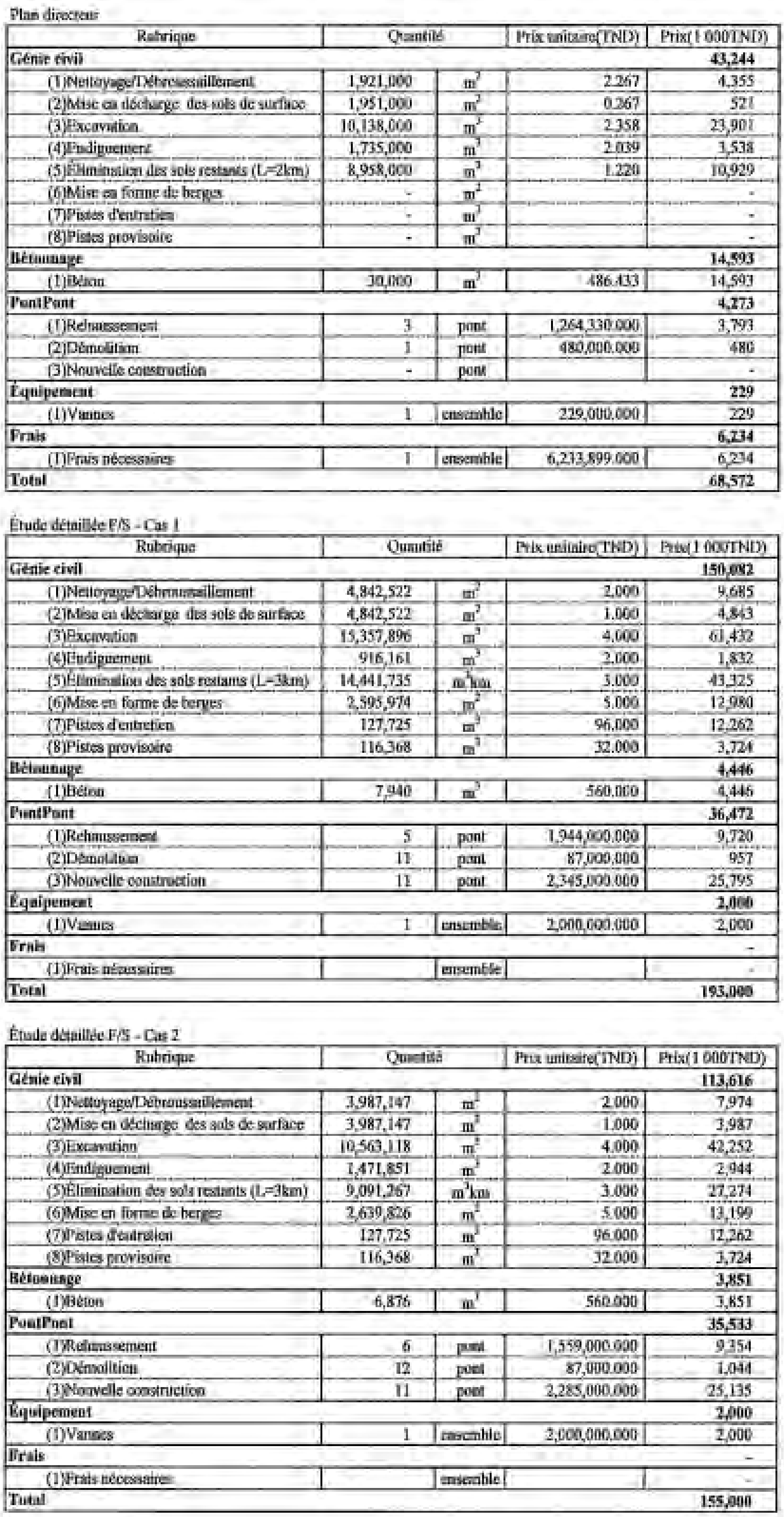
Liste des participants

Ministère de l'Agriculture

1	ABDELHEDI Taoufik	Directeur Général Direction Générale des Barrages et des Grands Travaux Hydrauliques
2	YOUSSEF Mohamed	Sous-directeur, EME/DG/BGTH
3	YOUSSEF Oueslati	Sous-directeur, EME/DG/BGTH
4	GAIED Taoufik	Sous-directeur de la Direction des Grands Ouvrages, DG / BGTH
5	AYADI Samir	Chef de Service Ingénierie Hydraulique, DG / BGTH
6	HEDHLI Khadija	Ingénieur Principal, DG / BGTH
7	DAHECHE Assia	Ingénieur Principal, Génie Civil, DG/BGTH
8	BECHR Jamel	Ingénieur Principal, Géologie, DG/BGTH

Équipe d'études (Yachiyo Engineering Co., Ltd.)

1	YOKOKURA Junji	Chef d'équipe
2	SATO Tadafumi	Analyse hydraulique
3	YATOGE Masakazu	Conception structurelle des cours d'eau
4	IGUCHI Norihiko	Interprète français-japonais



Plan directeur

Rubrique	Quantité		Prix unitaire(TND)	Prix(1 000TND)
Génie civil				**43,244**
(1)Nettoyage/Débroussaillement	1,921,000	m²	2.267	4,355
(2)Mise en décharge des sols de surface	1,951,000	m²	0.267	521
(3)Excavation	10,138,000	m³	2.358	23,901
(4)Endiguement	1,735,000	m³	2.039	3,538
(5)Élimination des sols restants (L=2km)	8,958,000	m³	1.220	10,929
(6)Mise en forme de berges	-	m²		-
(7)Pistes d'entretien	-	m³		-
(8)Pistes provisoire	-	m³		-
Bétonnage				**14,593**
(1)Béton	30,000	m³	486.433	14,593
PontPont				**4,273**
(1)Rehaussement	3	pont	1,264,330.000	3,793
(2)Démolition	1	pont	480,000.000	480
(3)Nouvelle construction	-	pont		-
Équipement				**229**
(1)Vannes	1	ensemble	229,000.000	229
Frais				**6,234**
(1)Frais nécessaires	1	ensemble	6,233,899.000	6,234
Total				**68,572**

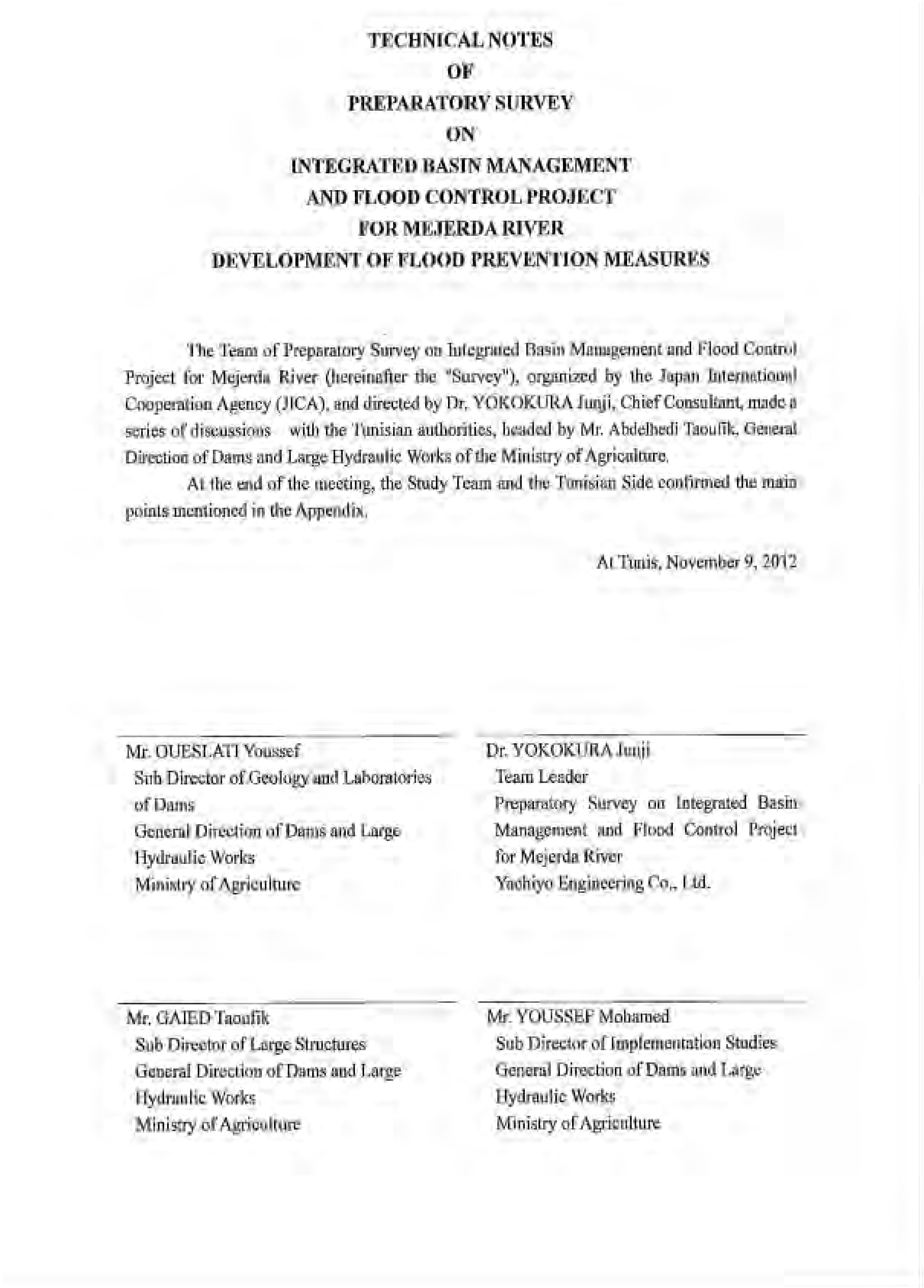
Étude détaillée F/S - Cas 1

Rubrique	Quantité		Prix unitaire(TND)	Prix(1 000TND)
Génie civil				**150,082**
(1)Nettoyage/Débroussaillement	4,842,522	m²	2.000	9,685
(2)Mise en décharge des sols de surface	4,842,522	m²	1.000	4,843
(3)Excavation	15,357,896	m³	4.000	61,432
(4)Endiguement	916,161	m³	2.000	1,832
(5)Élimination des sols restants (L=3km)	14,441,735	m³km	3.000	43,325
(6)Mise en forme de berges	2,595,974	m²	5.000	12,980
(7)Pistes d'entretien	127,725	m³	96.000	12,262
(8)Pistes provisoire	116,368	m³	32.000	3,724
Bétonnage				**4,446**
(1)Béton	7,940	m³	560.000	4,446
PontPont				**36,472**
(1)Rehaussement	5	pont	1,944,000.000	9,720
(2)Démolition	11	pont	87,000.000	957
(3)Nouvelle construction	11	pont	2,345,000.000	25,795
Équipement				**2,000**
(1)Vannes	1	ensemble	2,000,000.000	2,000
Frais				-
(1)Frais nécessaires		ensemble		-
Total				**193,000**

Étude détaillée F/S - Cas 2

Rubrique	Quantité		Prix unitaire(TND)	Prix(1 000TND)
Génie civil				**113,616**
(1)Nettoyage/Débroussaillement	3,987,147	m²	2.000	7,974
(2)Mise en décharge des sols de surface	3,987,147	m²	1.000	3,987
(3)Excavation	10,563,118	m³	4.000	42,252
(4)Endiguement	1,471,851	m³	2.000	2,944
(5)Élimination des sols restants (L=3km)	9,091,267	m³km	3.000	27,274
(6)Mise en forme de berges	2,639,826	m²	5.000	13,199
(7)Pistes d'entretien	127,725	m³	96.000	12,262
(8)Pistes provisoire	116,368	m³	32.000	3,724
Bétonnage				**3,851**
(1)Béton	6,876	m³	560.000	3,851
PontPont				**35,533**
(1)Rehaussement	6	pont	1,559,000.000	9,354
(2)Démolition	12	pont	87,000.000	1,044
(3)Nouvelle construction	11	pont	2,285,000.000	25,135
Équipement				**2,000**
(1)Vannes	1	ensemble	2,000,000.000	2,000
Frais				-
(1)Frais nécessaires		ensemble		-
Total				**155,000**

（English Translation）



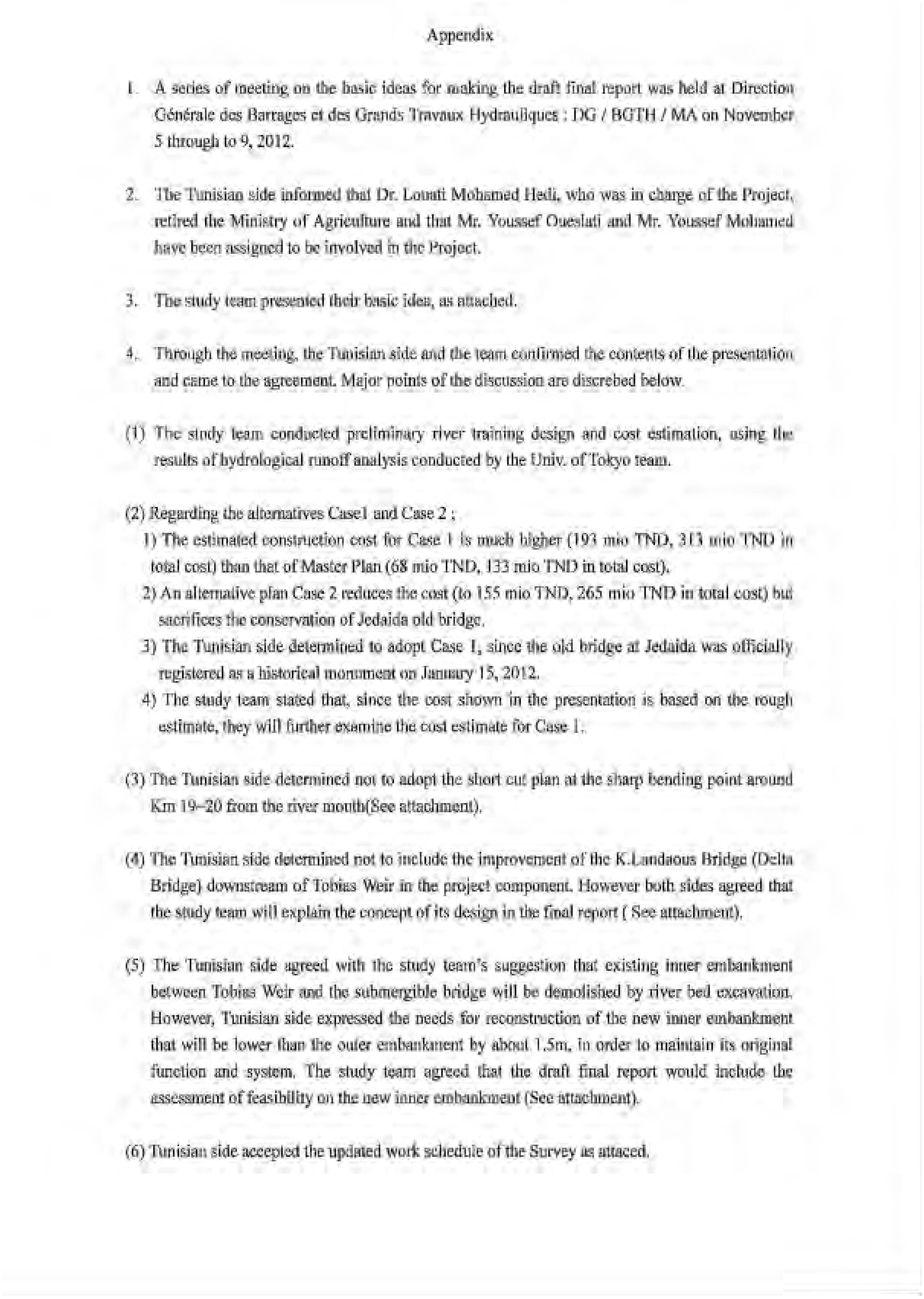
TECHNICAL NOTES
OF
PREPARATORY SURVEY
ON
INTEGRATED BASIN MANAGEMENT
AND FLOOD CONTROL PROJECT
FOR MEJERDA RIVER
DEVELOPMENT OF FLOOD PREVENTION MEASURES

The Team of Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River (hereinafter the "Survey"), organized by the Japan International Cooperation Agency (JICA), and directed by Dr. YOKOKURA Junji, Chief Consultant, made a series of discussions with the Tunisian authorities, headed by Mr. Abdelhedi Taoufik, General Direction of Dams and Large Hydraulic Works of the Ministry of Agriculture.

At the end of the meeting, the Study Team and the Tunisian Side confirmed the main points mentioned in the Appendix.

At Tunis, November 9, 2012

Mr. OUESLATI Youssef Sub Director of Geology and Laboratories of Dams General Direction of Dams and Large Hydraulic Works Ministry of Agriculture	Dr. YOKOKURA Junji Team Leader Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River Yachiyo Engineering Co., Ltd.
Mr. GAIED Taoufik Sub Director of Large Structures General Direction of Dams and Large Hydraulic Works Ministry of Agriculture	Mr. YOUSSEF Mohamed Sub Director of Implementation Studies General Direction of Dams and Large Hydraulic Works Ministry of Agriculture



Appendix

1. A series of meeting on the basic ideas for making the draft final report was held at Direction Générale des Barrages et des Grands Travaux Hydrauliques : DG / BGTH / MA on November 5 through to 9, 2012.

2. The Tunisian side informed that Dr. Louati Mohamed Hedi, who was in charge of the Project, retired the Ministry of Agriculture and that Mr. Youssef Oueslati and Mr. Youssef Mohamed have been assigned to be involved in the Project.

3. The study team presented their basic idea, as attached.

4. Through the meeting, the Tunisian side and the team confirmed the contents of the presentation and came to the agreement. Major points of the discussion are discrebed below.

(1) The study team conducted preliminary river training design and cost estimation, using the results of hydrological runoff analysis conducted by the Univ. of Tokyo team.

(2) Regarding the alternatives Case1 and Case 2 ;
  1) The estimated construction cost for Case 1 is much higher (193 mio TND, 313 mio TND in total cost) than that of Master Plan (68 mio TND, 133 mio TND in total cost).
  2) An alternative plan Case 2 reduces the cost (to 155 mio TND, 265 mio TND in total cost) but sacrifices the conservation of Jedaida old bridge.
  3) The Tunisian side determined to adopt Case 1, since the old bridge at Jedaida was officially registered as a historical monument on January 15, 2012.
  4) The study team stated that, since the cost shown in the presentation is based on the rough estimate, they will further examine the cost estimate for Case 1.

(3) The Tunisian side determined not to adopt the short cut plan at the sharp bending point around Km 19~20 from the river mouth(See attachment).

(4) The Tunisian side determined not to include the improvement of the K.Landaous Bridge (Delta Bridge) downstream of Tobias Weir in the project component. However both sides agreed that the study team will explain the concept of its design in the final report (See attachment).

(5) The Tunisian side agreed with the study team's suggestion that existing inner embankment between Tobias Weir and the submergible bridge will be demolished by river bed excavation. However, Tunisian side expressed the needs for reconstruction of the new inner embankment that will be lower than the outer embankment by about 1.5m, in order to maintain its original function and system. The study team agreed that the draft final report would include the assessment of feasibility on the new inner embankment (See attachment).

(6) Tunisian side accepted the updated work schedule of the Survey as attaced.

Attendants List

Ministry of Agriculture

1	Mr ABDELHEDI Taoufik	General Director , Dams and Large Hydraulic Works, Ministry of Agriculture
2	Mr. YOUSSEF Mohamed	Sub. Director, EME/DG/BGTH
3	Mr. YOUSSEF Oueslati	Sub. Director, EME/DG/BGTH
4	Mr. GAIED Taoufik	Sub-Director of Large Hydraulic Structures / DG / BGTH
5	Mr. AYADI Samir	Chief of Hydraulic Engineering Service, DG / BGTH
6	Ms. HEDHLI Khadija	Senior Evgineer, DG / BGTH
7	Ms. DAHECHE Assia	Senior Engineer Civil, DG/BGTH
8	Mr. BECHR Jamel	Senior Engineer Geologic, DG/BGTH

DG / BGTH: General Direction of Dams and Large Hydraulic Works (Direction Générale des Barrages et des Grands Travaux Hydrauliques)

EME: Study for Water Mobilization (Etude pour Mobilization de Eau)

Consultant Team (Yachiyo Engineering Co., Ltd.)

1	Dr. YOKOKURA Junji	Team Leader
2	Mr. SATO Hidefumi	Hydrological analysis
3	Mr. YATOGE Masakazu	River Structure Design
4	Mr. IGUCHI Norihiko	Interprète français-japonais

1.2.5 Minutes of Discussion of explanation of Draft Final Report (February 5, 2013)

MINUTES OF MEETING
OF
PREPARATORY SURVEY
ON
INTEGRATED BASIN MANAGEMENT
AND FLOOD CONTROL PROJECT
FOR MEJERDA RIVER DEVELOPMENT
OF FLOOD PREVENTION MEASURES

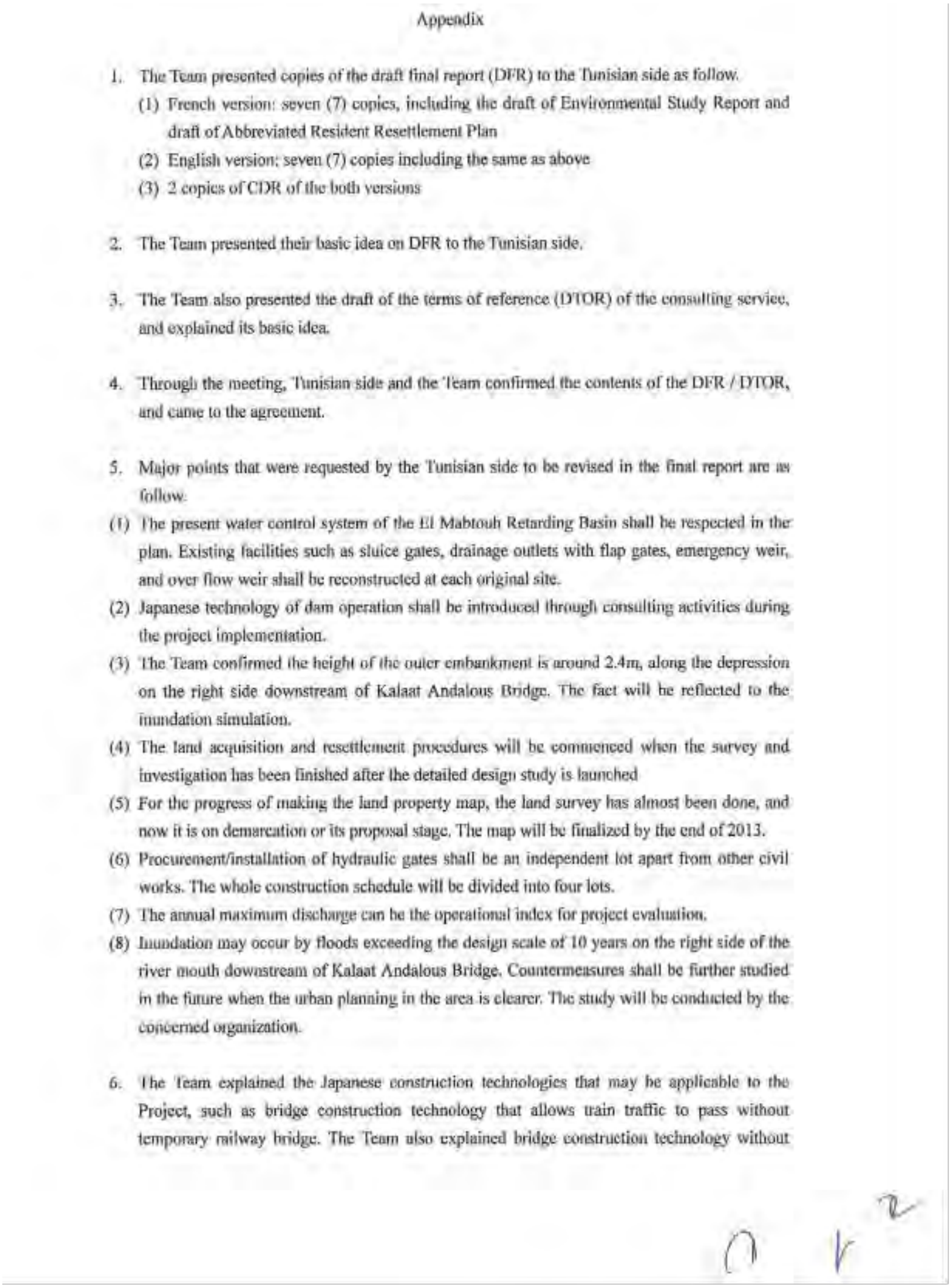
The Team of Preparatory Survey on Integrated Basin Management and Flood Control Project (hereinafter the "Project") for Mejerda River, organized by the Japan International Cooperation Agency (JICA), and directed by Dr. YOKOKURA Junji, made a series of discussions with the Tunisian authorities, headed by Mr. ABDELHEDI Taoufik, General Direction of Dams and Large Hydraulic Works of the Ministry of Agriculture, on the draft final report of the project. At the end of the meeting, the survey team (hereinafter the "Team") and the Tunisian side confirmed the main points mentioned in the Appendix.

At Tunis
February 6, 2013

Mr. ABDELHEDI Taoufik
Director General
Dams and Large Hydraulic Works
Ministry of Agriculture

Dr. YOKOKURA Junji
Team Leader of the Preparatory Survey
Yachiyo Engineering Co., Ltd.

Mr. Lotfi TRIFA
Director General
Bilateral Cooperation
Ministry of Investment and International Cooperation



Appendix

1. The Team presented copies of the draft final report (DFR) to the Tunisian side as follow.
   (1) French version: seven (7) copies, including the draft of Environmental Study Report and draft of Abbreviated Resident Resettlement Plan
   (2) English version: seven (7) copies including the same as above
   (3) 2 copies of CDR of the both versions

2. The Team presented their basic idea on DFR to the Tunisian side.

3. The Team also presented the draft of the terms of reference (DTOR) of the consulting service, and explained its basic idea.

4. Through the meeting, Tunisian side and the Team confirmed the contents of the DFR / DTOR, and came to the agreement.

5. Major points that were requested by the Tunisian side to be revised in the final report are as follow.
   (1) The present water control system of the El Mabtouh Retarding Basin shall be respected in the plan. Existing facilities such as sluice gates, drainage outlets with flap gates, emergency weir, and over flow weir shall be reconstructed at each original site.
   (2) Japanese technology of dam operation shall be introduced through consulting activities during the project implementation.
   (3) The Team confirmed the height of the outer embankment is around 2.4m, along the depression on the right side downstream of Kalaat Andalous Bridge. The fact will be reflected to the inundation simulation.
   (4) The land acquisition and resettlement procedures will be commenced when the survey and investigation has been finished after the detailed design study is launched
   (5) For the progress of making the land property map, the land survey has almost been done, and now it is on demarcation or its proposal stage. The map will be finalized by the end of 2013.
   (6) Procurement/installation of hydraulic gates shall be an independent lot apart from other civil works. The whole construction schedule will be divided into four lots.
   (7) The annual maximum discharge can be the operational index for project evaluation.
   (8) Inundation may occur by floods exceeding the design scale of 10 years on the right side of the river mouth downstream of Kalaat Andalous Bridge. Countermeasures shall be further studied in the future when the urban planning in the area is clearer. The study will be conducted by the concerned organization.

6. The Team explained the Japanese construction technologies that may be applicable to the Project, such as bridge construction technology that allows train traffic to pass without temporary railway bridge. The Team also explained bridge construction technology without

temporary stages. Tunisian side took note of those.

7. The Tunisian side mentioned that the rehabilitation of flood forecasting and warning system (SYCOHTRAC) shall not be included in the project as mentioned in DFR.

8. The Team explained that Japanese side can offer assistance to shorten the period for procurement of the consultants. The assistance will be dispatching expert experienced in tendering process, so that period may be shortened by 6 months. However, Tunisian side mentioned the 2 years will remain as it is in the designed schedule.

9. Tunisia side mentioned as follow regarding the DTOR

(1) The environmental monitoring activities that are suggested by the Team shall be incorporated in the TOR.

(2) The required experience period of the consultants can be 10 years at maximum.

10. Steering committee was held on 31 of January. Major points confirmed during the steering committee are described below. Attendants list of the steering committee is as attached.

(1) The design scale of the flood was determined as 10 years during the master plan. The design scale was determined most effective with economic evaluation. The scale has been agreed by both governmentsand this DFR followed the policy. Enlarging the design scale will lead to the rise of project cost.

(2) To reduce the disaster risk of the area, the project shall be urgently implemented.

11. Tunisian side will present their comments on DFR and DTOR to Japanese side by 23 February 2013.

Ru Ying	idem	River engineer
Yui Matsuo	Franchir	ConsidérationEnvironnemnt/sociale
Interprête		
Dabboussi Rabah		Interprète
Ahmed Snadli		idem
Norihiko Iguchi	Franchir	idem

2 An Overview of the Basin and Flood Damage

2.1 Topographical Survey Data

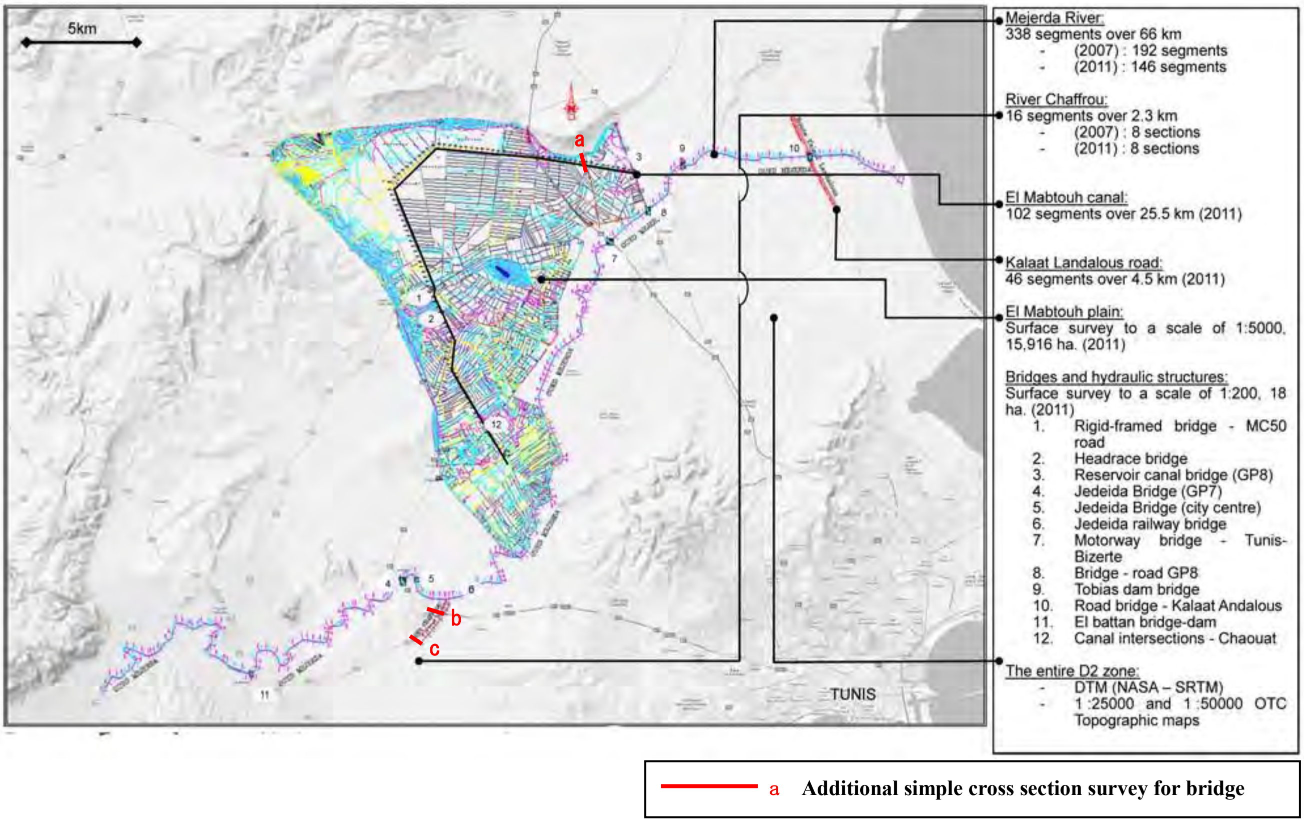
The existing topographical survey data shown in Table 2.2.1-2 was obtained, and sluice way and pipe survey of river improvement candidate part and simple cross section survey (leveling) of the bridge improvement candidate part were carried out in this preparatory survey. The location of topographical survey is shown in **Figure 2-1**.

Table 2-1: Existing Topographic Survey Data and Supplemental Single Survey

Topographic Survey data	Description	Source
Topographical map	Scale:1/25,000 & 1/50,000	Office de la Topographie et de la Cartographie
DEM data	76m x 76m mesh altitude data	NASA SRTM3 remote sensing data
Mejerda River longitudinal section and cross section (1)	From Sidi Salem dam to estuary 150km of longitudinal section and 447cross sections (375 cross sections + 72 detail cross sections) , cross section interval: 400m	MARHP (MA) 2007
Mejeruda River longitudinal section and cross section (2)	From Sidi Salem upstream to boundary of Argeria 180km of longitudinal section and 360cross sections, cross section interval: 500m	M/P Study Survey 2008
Branch Rivers longitudinal section and cross section	Main branch rivers of upstream of Sidi Salem dam (O. Mellege, O. Tessa, O.Raghai, O.Bajer, O.Bou Heurtma, O. Kasseb and O. Beja) 141km of longitudinal section and 476 cross sections	M/P Study 2008
Flood control structure candidate places (at M/P Study) longitudinal section and cross section	55km of longitudinal section and 72cross sections	M/P Study 2008
Mejeruda River longitudinal section and cross section (Supplemental survey)	Longitudinal section and cross sections added to the interstitial sections of the MARHP 2007 survey Additional 66km of longitudinal section and 146 cross sections	Former Preparatory Survey 2010
El Mabtouh retarding basin plane survey	Scale: 1/5,000, 15.916ha	Former Preparatory Survey 2010
El Mabtouh channel longitudinal section and cross section	25.5km of longitudinal section and 102 cross sections	Former Preparatory Survey 2010
Plane survey of surrounding area of inlet and outlet in El Mabtouh retarding basin	Scale: 1/200, 12 structures 18ha	Former Preparatory Survey 2010
Kalaat Landalous road longitudinal section and cross section	4.5km of longitudinal section and 46 cross sections	Former Preparatory Survey 2010

Topographic Survey data	Description	Source
Chaffrou River longitudinal section and cross section	Longitudinal section and cross sections added to the interstitial sections of the MARHP 2007 survey Additional 2.3km of longitudinal section and 8 cross sections	Former Preparatory Survey 2010
Survey data of sluice ways and pipes D2 zone river improvement candidate part	Survey table of structure location and dimension	This Preparatory Survey 2012
Simple cross section survey of D2 zone bridge improvement candidate plart	Bridge portions of El Mabtouh channel and Chaffrou River, 3 smple cross sections	This Preparatory Survey 2012

(Source: Arrangement based on former preparatory survey report)



Mejerda River:
338 segments over 66 km
- (2007) : 192 segments
- (2011) : 146 segments

River Chaffrou:
16 segments over 2.3 km
- (2007) : 8 sections
- (2011) : 8 sections

El Mabtouh canal:
102 segments over 25.5 km (2011)

Kalaat Landalous road:
46 segments over 4.5 km (2011)

El Mabtouh plain:
Surface survey to a scale of 1:5000, 15,916 ha. (2011)

Bridges and hydraulic structures:
Surface survey to a scale of 1:200, 18 ha. (2011)

1. Rigid-framed bridge - MC50 road
2. Headrace bridge
3. Reservoir canal bridge (GP8)
4. Jedeida Bridge (GP7)
5. Jedeida Bridge (city centre)
6. Jedeida railway bridge
7. Motorway bridge - Tunis-Bizerte
8. Bridge - road GP8
9. Tobias dam bridge
10. Road bridge - Kalaat Andalous
11. El battan bridge-dam
12. Canal intersections - Chaouat

The entire D2 zone:
- DTM (NASA – SRTM)
- 1 :25000 and 1 :50000 OTC Topographic maps

a **Additional simple cross section survey for bridge**

(Source: Former preparatory survey report, additional description in this report)

Figure 2-1: Location of Survey Data

2.2 Geographic Coordinate System Used in this Study

The decree declared on February 10, 2009 by the Tunisian Department of Defense determines the official geographic coordinate system of Tunisia[1]. This coordinate system and its data consist of the following:

- Geodetic survey system: NTT (New Triangulation of Tunisia) system — Combining Spheroids: French Clarke 1880 (Clarke IGN).
- Projection: UTM (Universal Transverse Mercator's projection) cylindrical projection — Zone 32N

This coordinate system replaces the old STT (Topographical Survey Service of Tunisia) by revising the system. The parameters of this system are as follows.

---

[1] A. Ben Hadj Salem. OTC (Office of Topography and Cadastre). "Bridging the Gap between Cultures" Chapter 13, "Unifying Tunisia's Geodetic Survey System", Technology Summit hosted in Marrakesh, Morocco on May 18 - 22, 2011

Table 2-2: NTT (New Triangulation of Tunisia) Data + UTM (Universal Transverse Mercator's projection)

Ellipsoid	French Clarke 1880 IGN			
	a (m)	6378249.2	dx (toward WGS84) (m)	-263
	b (m)	6356515	dy (toward WGS84) (m)	6
	f	293.466021	dz (toward WGS84) (m)	431
	e	0.082483257	rx (toward WGS84)	0
			ry (toward WGS84)	0
			rz (toward WGS84)	0
			n (linear measure)	0
Official Projection	UTM (Universal Transverse Mercator's projection)—Zone 32N			
Other Projections	Lambert Projection of Northern Tunisia (Lambert conical projection) (Reference point: Carthage)			
	X0 (m)	500000	First standard parallel (Contortion coefficient of length = 1 latitude line)	38.25
	Y0 (m)	300000	Second standard parallel (Contortion coefficient of length = 1 latitude line)	41.75
	Unit of length	Meters	Lambda of origin	0.172787596
	Longitude of origin	11	Longitude of origin	0.628318531
	Latitude of origin	40	phi1	0.600829595
	Linear measure	0.999625769	phi2	0.655807466
	Unit of angle	Degree		
Leveling Ellipsoid	NGT (Leveling Datum for Tunisia)			
	Reference point (Altitude reference)		Tunis, Port de France monument (Altitude: 7,000m)	

This survey uses the following geographic coordinate system.

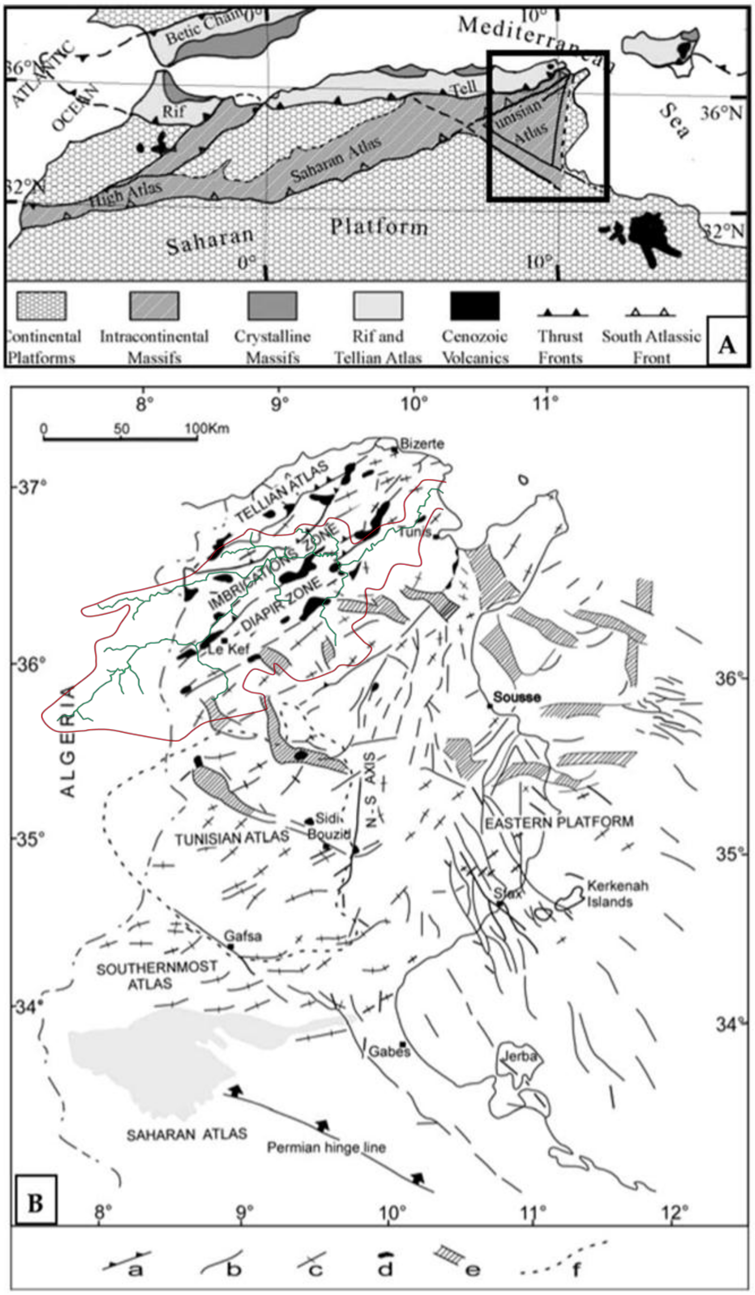
- Tunisia's coordinate system above: Topographic data used in 1D and 2D flood models (MIKE Flood) as well as GIS (Geographic Information System established for this project).

WGS84 coordinate system (GPS coordinate system): Google Earth Pro, positioning on site, and other methods.

2.3 Geological Conditions of the D2 Zone

(1) Geology of Medjerda River Basin and Study Area (D2 Zone)

As shown in **Figure 2-2**, the Medjerda river originates northeast Saharan Atlas, and flows to Golfe de Tunis. In broad tectonic zone classification, the basin locates mainly Diapir Zone, and Imbrication Zone in part. The thrust faults lifted from the northwest side to the southeast side exist in the boundaries of tectonic zones. In the midway, the fold configuration extended in the direction of southwest-northeast is developed. There is tendency that ridgeline part of mountains and hills forms anticline.

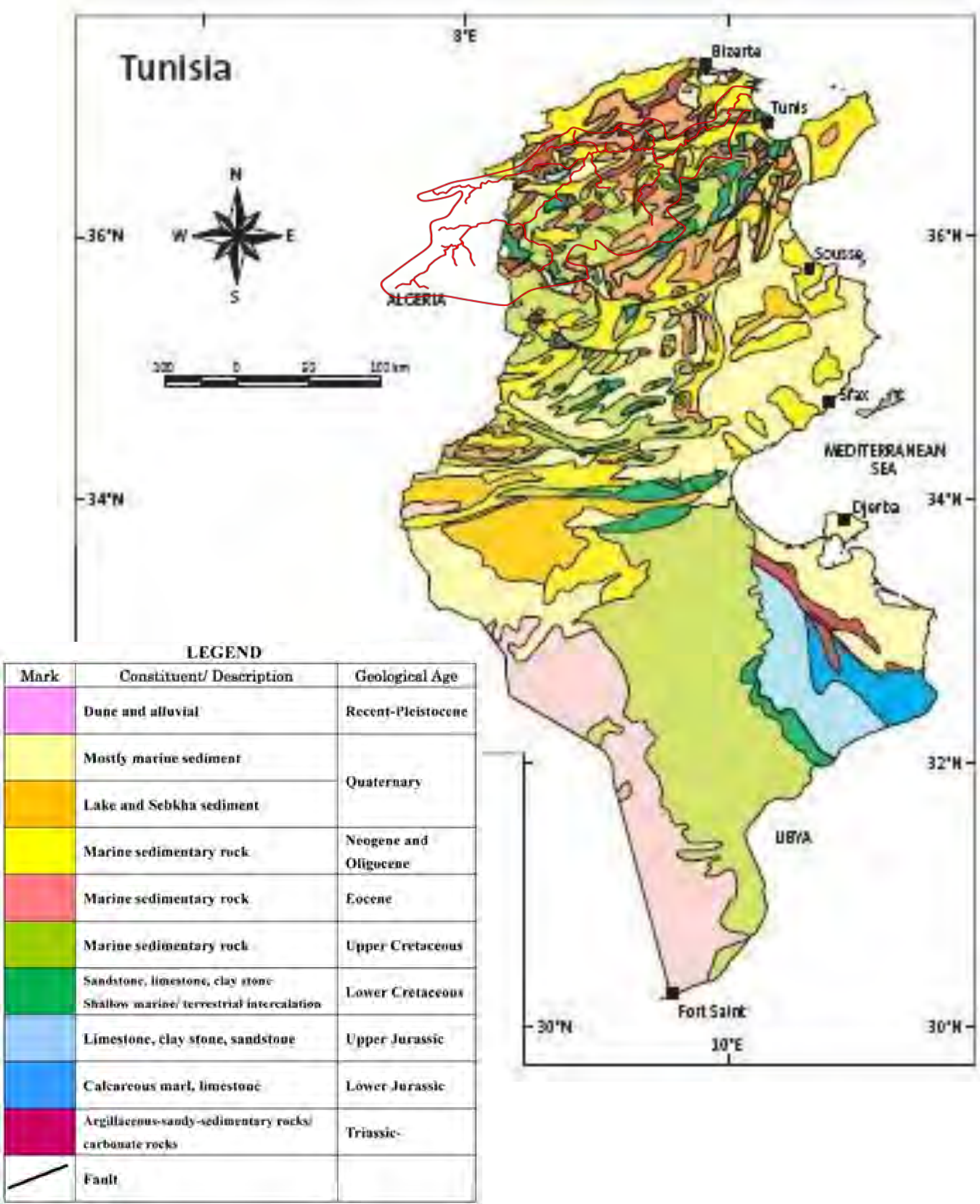


A: General context, B: Schematic tectonic map, a: Major thrust, b: Major faults, c: Major anticlines, d: Trias, e: Graben, f: Limit of Kasserine Island

(Source: Tunisian Transtensive Basin in Tethyan Geodynamic Context and Their Post-Tortonian Inversion)

Figure 2-2: Tectonics of the Mejerda Basin

The geology of the Medjerda basin consists of sedimentary rocks (limestone, dolomite, marl, sandstone, shale, evaporite) of Mesozoic era Triassic, Jurassic, Cretaceous periods and Cenozoic era Eocene, Oligocene, Miocene, Pliocene epocks in highland and hill part as shown in **Figure 2-3**. In the lowland part, sedimentary layers such as sand and clay of Quaternary Pleistocene and Holocene ages are distributed



LEGEND

Mark	Constituent/ Description	Geological Age
🟪	Dune and alluvial	Recent-Pleistocene
🟨	Mostly marine sediment	Quaternary
🟧	Lake and Sebkha sediment	
🟨	Marine sedimentary rock	Neogene and Oligocene
🟥	Marine sedimentary rock	Eocene
🟩	Marine sedimentary rock	Upper Cretaceous
🟩	Sandstone, limestone, clay stone Shallow marine/ terrestrial intercalation	Lower Cretaceous
🟦	Limestone, clay stone, sandstone	Upper Jurassic
🟦	Calcareous marl, limestone	Lower Jurassic
🟥	Argillaceous-sandy-sedimentary rocks/ carbonate rocks	Triassic-
—	Fault	

(Source : Material prepared by MA, editing of legend and addition of Mejerda river basin in this report)

Figure 2-3: Geological Summary Map of Tunisia

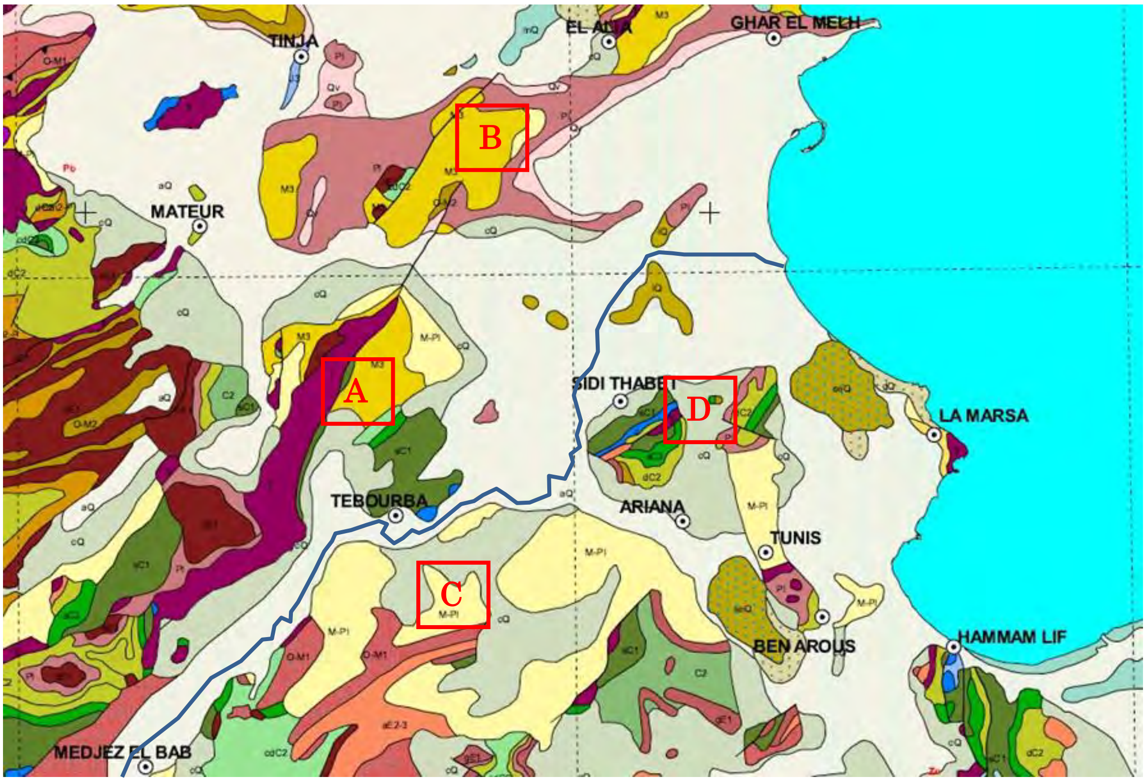
As shown in Figure 2-4, the following geological distribution is found around the study area (D2 zone).

i) A-highland elongates in the direction of southwest-northeast at the northwest side of Laroussia dam - Tebourba downstream. Triassic system (claystone, dolomite, sandstone, evaporite, etc.), Cretaceous system (marl, limestone, etc.), and Tertiary system (limestone, flint, sandstone, claystone, marl, etc.) are mainly distributed.

ii) B hill elongates in the direction of southwest-northeast from north side of El Mabtouh to the seashore. Miocene-Pliocene series (congromerate, sandstone, claystone, marl) is mainly distributed.

iii) C hill forms wide low hill in the south of Laroussia dam to Jedeida. Miocene-Pliocene series (congromerate, sandstone, claystone) is mainly distributed. In the upper stream side, the altitude of hill increases, and Cretaceous system, Eocene and Oligocene seies are distributed.

iv) D hill forms small isolated hills in the north side of Tunis. Cretaceous system (marl, limestone, etc.), and partly Eocene, Oligocene, Miocene and Pliocene are distributed.



LEGEND

Cenozoic/ Quaternary

aQ	aQ:	Alluvium recent and current
dQ	dQ:	Dunes and ergs
lQ	lQ:	Aeolian deposit (fenster) endorheic depressions recent and current
seQ	seQ:	Sebkhas limnic (endorheic basins)
mQ	mQ:	Middle and Upper Pleistocene marine (mainly Tyrrhenian) coastal beaches and dunes consolidated
cQ	cQ:	Middle and Upper Pleistocene continental, Old alluvium, limestone and gypsum
Qv	Qv:	Pleistocene interims to Pliocene: Villafranchien conglomerates and red layers

Cenozoic/ Tertiary

Pl	Pl:	Pliocene marine: marl and sandstone
M-Pl	M-Pl:	Mio-Pliocene continental conglomerates, sands and clays
ysM3 M3	M3:	Upper Miocene: Clays, sandstones and conglomerates (Mejerda)
O-M1	O-M1:	Oligocene-Aquitanian: flysch clayey sandstone (Numidian)
E2-3 aE2-3	aE2-3:	Lutetian Priabonian: Marnes to "yellow balls"
E1 nE1	nE1:	Ypresian: Globigerina limestone and flint

Msozoic/ Cretaceous

C2	C2:	Cretaceous undivided
cdC2 dC2 cC2	cdC2: dC2:	Senonian unsubdivided/ Upper Senonian: chalky white limestone
🟩	aC2:	Lower Senonian: calcareous marl intercalation (KEF)
sC1	sC1:	Upper Cretaceous: marl, limestone alternation

Mesozoic/ Jurasic

🟦	J:	Jurassic unsubdivided
J3	J3:	Malm: nodular limestone, marl, limestone

Mesozoic/ Traisic

🟪	T:	Trias: Clays, dolomites, sandstones and evaporites

Source: Former preparatory survey report, Origin: Geological Map of Tunisia 1/500,000 （Office National des Mines (ONM), Editing in this report

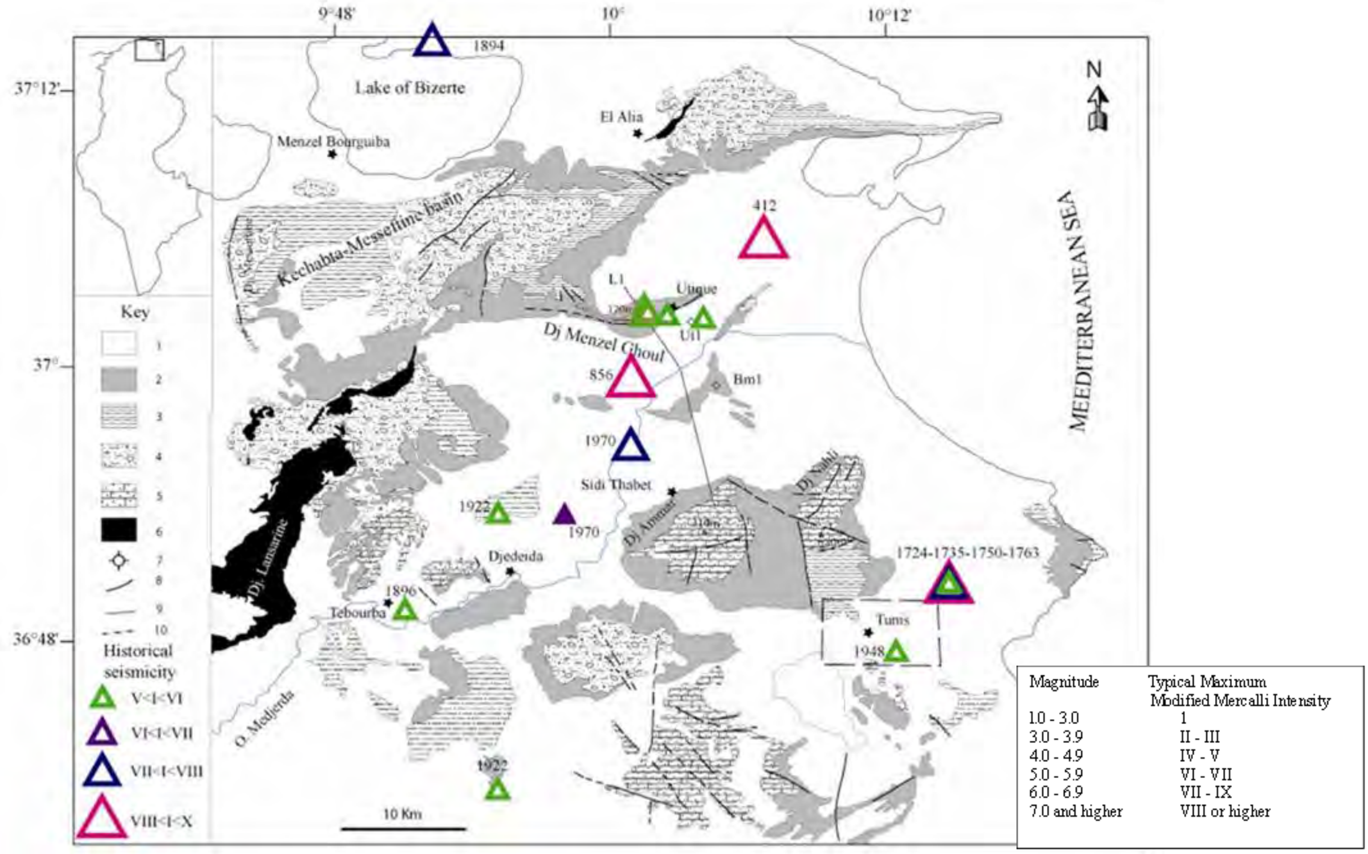
Figure 2-4: Geological Map of Surrounding Study Area (D2 Zone)

The stratigraphy of the circumference of D2 zone is summarized as shown in **Figure 2-5**. Main geological composition and the formation thickness are shown in **Table 2-3**. Hard rocks are restricted to the calcareous rocks before Mesozoic era, and the distribution is narrow.

Table 2-3: Major Geological Composition of Surrounding Study Area

Era	Period/ Epoch	Formation	Lithology, Soil	Thickness(Max.)
Cenozoic	Quaternary		Clay, Silt, Sand, Gravel	60m
	Pliocene	Proto-Farina	Sandstone	300m
		Raf-Raf	Calcareous claystone, Sandstone	300m
	Miocene	Oued Bel Khedim	Evaporite, Continental/Lagoonal shale, Limestone	300m
		Kechabta	Continental/Lagoonal shale, Sandstone	200m
		Qued El Melah	Claystone, Gypsum, Dolomite, Limestone	150m
		Mellaha	Evaporite, Claystone, Unhydrite, Dolomite	350m
Mesozoic	Cretaceous		Marl, Claystone, Sandstone, Dolomite	
	Triassic		Dolomite, Claystone, Arenite, Pitchstone	

(Source: Editing based on"Evidence of Quaternary active folding near Utique (NE Tunisia) from tectonic observations and a seismic profile")



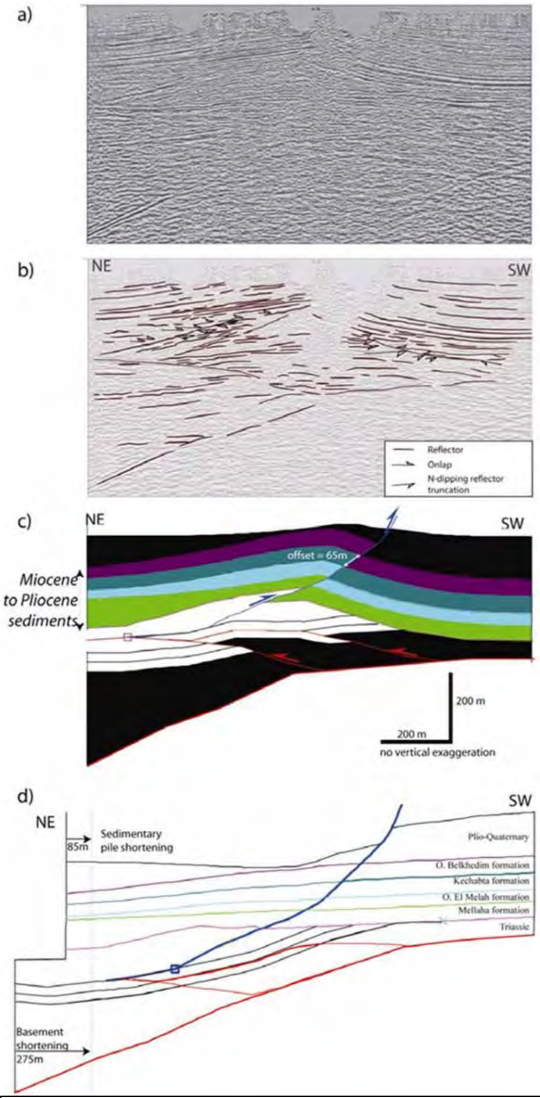
Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 - 3.0	1
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII or higher

1: Upper Quaternary, 2: Lower Quaternary, 3: Pliocene, 4: Miocene, 5: Cretaceous, 6: Trias, 7: Oil well, 8: Fault, 9: Seismic line, 10: Administrative boundary
Seismicity from the historical catalog covers the period between412AD and 1975AD

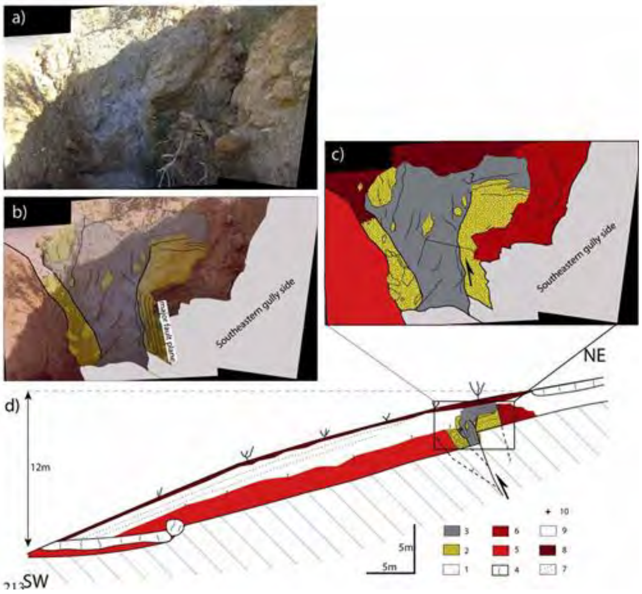
(Source: Evidence of Quaternary active folding near Utique (NE Tunisia) from tectonic observations and a seismic profile)

Figure 2-5: Geology, Major Fault and Historical Earthquake of Surrounding Study Area

Existence of a thrust fault is presumed by seismic survey in the Menzel Ghoul mountain of the above figure. As shown in **Figure 2-6**, the analysis result shows the activity by early Quaternary, and namely it is a Quaternary fault. It is suggested that the same dislocation structure exists in the highland and the hill around the study area. In the plain area around the Medjerda river where is covered with Quaternary strata, the dislocation is not confirmed. Moreover, it has not appeared in landform feature.



a) Seismic profile, b) Interpretation, c) Estimated cross section, d) Unfolding cross section back to lowermost Miocene



a) Photo of the main fault, b) c) Interpretation,
d) Cross section of the fault
1) Gully basement, 2) Sandstone and conglomerate (Pliocene materials), 3) Grey clay, 4) Calcareous crust, 5) Red clay, 6) Recent conglomerate,
7) Colluvium wedge, 8) Soil, 9) Undetermined,
10) Potterv location

(Source: Evidence of Quaternary active folding near Utique (NE Tunisia) from tectonic observations and a seismic profile)

Figure 2-6: Analysis Result of Seismic Survey and Outcrop Observation of Utique Fault

(2) Earthquake of Surrounding Study Area (D2 Zone)

Earthquake damage is not generated in Tunisia in 1980 and afterwards (Prevention Web data). the past earthquake is recorded as shown in **Table 2-4**. In surrounding study area, historical earthquakes containing more than Magnitude 7 or more are recorded as shown in **Table 2-4**.

Table 2-4: Past Earthquake Reord of Tunisia

Date	Epicenter	Magnitude	Comment
1758 Jan.	Constantine and Tunis		Sebral dead
1941 Dec. 27	Tunis	6.8	

(Source: Earthquake Risk in Africa - A community leader's guide-, University of Science & Technology Houari Boumediene (USTHB), Algeria)

2.4 Ground Conditions in Zone D2

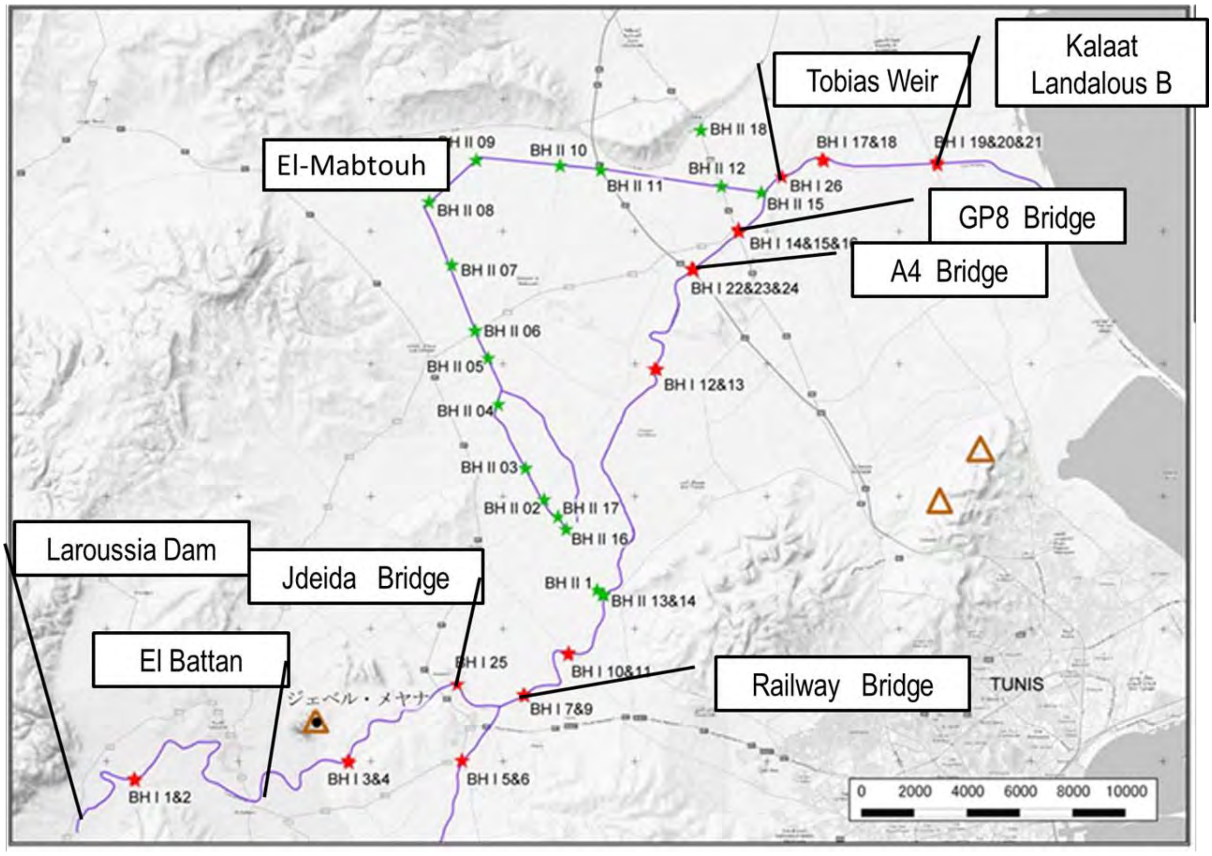
(1) Existing Geotechnical Survey of the Study Area

In former preparatory survey, boring survey (All coring), pressure meter test (at main boring points), standard penetration test (selected boring points), soil tests using collected core samples (moisture content test, sand equivalent test, grain size analysis, density test, consolidation test, box shear test) were carried out. The boring dimension and test quantity are shown in **Table 2-5**, and location of boring points are shown in **Figure 2-11**.

Table 2-5: Dimension and Quantity of Boring Survey and Soil Tests

Boring No.	Depth (m)			Coordinate (UTM)			Soil test quantity							Remarks
	Core	PMT	SPT	E(m)	N(m)	Altitude (m)	③	②	③	④	⑤	⑥	⑦	
BH I 01	6.0	-	-	571043	4074333	35.6	-	-	-	-	-	-	-	Mejerda A , left
BH I 02	6.0	-	-	571088	4074267	27.4	-	-	-	-	-	-	-	Mejerda A, right
BH I 03	6.0	-	-	579139	4075019	20.2	-	-	-	-	-	-	-	Mejerda A, left
BH I 04	6.0	-	-	579179	4074933	26.8	1	-	1	1	-	-	-	Mejerda A, right
BH I 05	6.0	-	-	583442	4075024	20.0	-	-	-	-	-	-	-	Chaffrou, left
BH I 06	6.0	-	-	583466	4075008	20.2	2	-	2	2	-	-	-	Chaffrou, right
BH I 07	33.0	33.0	33.0	585785	4077510	20.2	5	1	5	5	-	-	-	Railway Bridge
BH I 08														Unused Number
BH I 09	30.0	30.0	30.0	585836	4077454	20.2	3	-	3	3	1	1	-	Railway Bridge
BH I 10	6.0	-	-	587464	4079015	18.2	-	-	-	-	-	-	-	Mejerda B, left
BH I 11	6.0	-	-	587495	4079091	14.8	-	-	-	-	-	-	-	Mejerda B, right
BH I 12	6.0	-	-	590742	4089797	11.6	-	-	-	-	-	-	-	Mejerda B, left
BH I 13	6.0	-	-	590840	4089779	15.1	-	-	-	-	-	-	-	Mejerda B, right
BH I 14	45.0	45.0	45.0	593916	4095069	8.5	5	-	5	5	1	1	-	GP8 road bridge
BH I 15	45.0	45.0	45.0	593935	4095019	7.0	6	-	6	6	1	1	-	GP8 road bridge
BH I 16	41.0	45.0	45.0	593959	4094963	8.8	6	-	6	6	1	1	-	GP8 road bridge
BH I 17	6.0	12.0	-	597090	4097709	4.2	1	-	1	1	1	1	1	Mejerda C, left
BH I 18	6.0	12.0	-	597164	4097642	4.7	1	-	1	1	1	1	1	Mejerda C, right
BH I 19	45.0	45.0	-	601419	4097618	1.6	5	-	5	5	1	1	-	K. Landalous bridge
BH I 20	45.0	45.0	-	601453	4097534	1.3	6	-	6	6	1	1	-	K. Landalous bridge
BH I 21	45.0	45.0	45.0	601468	4097497	2.8	7	-	7	7	1	1	-	K. Landalous bridge
BH I 22	45.0	45.0	45.0	592153	4093588	8.4	6	-	6	6	1	1	-	Highway bridge
BH I 23	30.0	45.0	45.0	592187	4093561	7.6	4	-	4	4	1	1	-	Highway bridge
BH I 24	30.0	45.0	45.0	592241	4093533	8.6	4	-	4	4	1	1	-	Highway bridge
BH I 25	30.0	30.0	30.0	583274	4077893	18.8	5	5	5	5	-	-	-	Jedeida bridge
BH I 26	50.0	50.0	-	595569	4097043	7.3	-	-	-	-	-	-	-	Tobias bridge
BH II 01	15.0	-	-	588568	4081457	15.5	-	-	-	-	-	-	-	El Mabtouh channel
BH II 02	15.0	-	-	586559	4084863	12.7	-	-	-	-	-	-	-	El Mabtouh channel
BH II 03	15.0	-	-	585859	4086048	12.1	-	-	-	-	-	-	-	El Mabtouh channel
BH II 04	15.0	-	-	584824	4088459	10.5	-	-	-	-	-	-	-	El Mabtouh channel
BH II 05	15.0	-	-	584439	4090210	10.3	-	-	-	-	-	-	-	El Mabtouh channel
BH II 06	30.0	30.0	30.0	583955	4091244	10.3	1	-	1	1	1	1	-	El M. Retarding basin
BH II 07	8.0	-	-	583066	4093721	8.0	2	-	2	2	2	-	2	El M. Retarding basin
BH II 08	8.0	-	-	582207	4096094	8.2	1	-	1	1	1	-	1	El M. Retarding basin
BH II 09	8.0	-	-	583996	4097674	8.4	2	-	2	2	2	-	2	El M. Retarding basin
BH II 10	12.0	12.0	-	587166	4097465	8.9	-	-	-	-	-	-	-	El M. Structure
BH II 11	8.0	-	-	588709	4097295	8.0	-	-	-	-	-	-	-	El Mabtouh channel
BH II 12	8.0	-	-	593275	4096692	7.3	2	-	2	2	-	-	-	El Mabtouh channel
BH II 13	12.0	12.0	-	588764	4081285	14.2	-	-	-	-	-	-	-	El Mabtouh channel
BH II 14	12.0	12.0	-	588835	4081265	14.6	-	-	-	-	-	-	-	El Mabtouh intake
BH II 15	12.0	-	-	594788	4096449	8.9	-	-	-	-	-	-	-	El Mabtouh channel
BH II 16	12.0	-	-	587398	4083746	14.5	-	-	-	-	-	-	-	El M. bridge
BH II 17	12.0	-	-	587090	4084218	13.3	-	-	-	-	-	-	-	El M. Structure
BH II 18	30.0	-	-	592501	4098802	8.2	10	-	10	10	8	8	2	Zana Utique

Remarks; PMT: Pressure meter test (1m interval), SPT: Standard penetration test (1m interval), Soil test: ①: Water content test, ②: Sand equivalent test, ③: Liquid and plastic limit test, ④: Grain size analysis test, ⑤: Density test, ⑥: Consolidation test, ⑦: Box shear test, Mejerda A: Laroussia Dam-Tebourba downstream, Mejerda B: Tebourba downstream-Tobias weir, Mejerda C: Tobias weir-Estuary
(Source: Preparation based on former preparatory survey report)



Remarks; Red star mark: Boring point of Mejerda main river and Chaffrou river, Green star mark: Boring point of retarding basin, Brown triangle mark: Sampling place of aggregate test in Former Preparatory Survey
(Source: Former preparatory survey report, additional description in this report)

Figure 2-7: Location of Boring Survey of Former Preparatory Survey

(2) Foundation of Study Area (Constitution and Structure)

The result of the boring survey (all core sampling) and in-situ tests (pressure meter test and standard penetration test) carried out by the former preparatory survey are summarized as follows. Although soil naming is based on core observation result of the former preparatory survey report, since it became complicated, in geotechnical sections of this report, soil name is unified with similar soil group and is summarized to silty clay, sandy clay, muddy clay, sand and base rock (Refer to **Figure 2-8**).

1) Foundation along Main River (Refer to **Figure 2-9** and **Figure 2-10**)

(a) Upstream Side

The following soil composition is presumed from Jedeida bridge BHI25 (total depth 30m) and railway bridge BHI07 (33m), BHI09 (30m), etc.

a) Sandy clay, partly silty caly (thickness: 5~15m)
b) Sand (medium grain, partly fine grain, thickness 5~15m)
c) Silty clay – sandy clay at lower part, partly alternation of sand and clay, and base rock (sandstone, weathered sandstone and weathered alternation)

BHI25 shows that base rock appears under depth 13m. At upstream side from midpoint between Tebourba and Jedeida, it is presumed base rock is shallow closing Jbel Mayana from northern side and low hills from southern side. At railway bridge BHI07 and BHI09 of directly downstream, base rock is not encountered up to depth 33m.

(b) Downstream Side

The following soil composition is presumed from the highway bridge BHI22-24, GP8 road bridge BHI14-16, Tobias bridge BHI26, and Kalaat Landalous bridge BHI19-21, etc.

a) Sandy clay, partly sand and silty clay (thickness 5-10m)
b) Sandy clay and silty clay, muddy clay at downstream, partly clay (thickness 25-30m)
c) Sandy clay, partly silty clay (thickness 15-20m, it is unconfirmed under depth 45-50m)

(c) Soft Ground (Refer to **Figure 2-12**, **Figure 2-13**)

Soft ground (Clayey soil with N value 4 or less) is recognized continuously from highway bridge to Kalaat Landalous bridge. The thickness shows 15-27m. It lies in upper part of b) layer at upstream side, and also lies in almost all of b) layer at downstream side with tendency to become thicker to downstream side.

2) Foundation of Jedeida Bridge and Railway Bridge (Refer to **Figure 2-14**)

(a) Jedeida Bridge Part

The following soil composition is recognized from BHI25.

a) Sandy clay (thickness 3m)
b) Sand (fine to medium grain, thickness 10m)
c) Base rock (sandstone, alternation of weathered sandstone and shale, distribution less than depth 13m)

(b) Railway Bridge Part

The following soil composition is recognized from BHI07 and BHI09.

a) Embankment (thickness 3m)
b) Sand (medium grain, thickness 3-6m)
c) Silty clay (thickness 14-22m)
d) Alternation of sand and clay, and sandy clay

3) Foundation of Highway Bridge Part (Refer to **Figure 2-15 and Figure 2-16**)

The following soil composition is recognized from BHI22, BHI23 and BHI24.

a) Sandy clay, partly silty clay (thickness 2-3m)
b) Sand (medium grain, partly coarse grain, thickness 2-6m)
c) Silty clay, Muddy clay, partly sandy clay (thickness 20-25m)
d) Sand (fine grain, partly coarse grain, thickness 1-3m)
e) Sandy clay and silty clay (thickness 18mand more)
f) Soft ground lies in depth 8-13m to depth 24-27m in upper to middle part of c) layer muddy clay to sandy clay, and thickness is 15-19m.

4) Foundation of GP8 Road Bridge (Refer to **Figure 2-17** and **Figure 2-18**)

The following soil composition is recognized from BHI14, BHI15 and BHI16.

a) Sandy clay (thickness 4m)

b) Sand (medium grain, thickness 2-4ｍ)
c) Sandy clay, and silty clay in part and left side bank (thickness 38m and more)

Soft ground lies in depth 7-8m to depth 21-24ｍ in upper part of b)layer (sandy clay to silty clay), and the thickness is 13-16m.

5) Foundation of Tobias Bridge and Its Directly Downstream Part (Refer to **Figure 2-19** and **Figure 2-20**)

The following soil composition is recognized from BHI26, BHI17 and BHI18.

a) Silty clay, sandy clay in middle to lower part of downstream side (thickness 24m, it is unconfirmed under 12m at downstream side)
b) Muddy clay, partly clay (thickness 14m)
c) Sand and silty clay (thickness 14m and more)

Soft ground lies in depth 1-6m to 4-14m in upper part of a)layer (silty clay, partly sandy clay), and the thickness is 3-8ｍ. It becomes thinner at downstream side, but locates in shallow part directly under surface soil.

6) Foundation of Kalaat Landalous Bridge Part (Refer to **Figure 2-21** and **Figure 2-22**)

The following soil composition is recognized from BHI19, BHI20 and BHI21.

a) Sandy silt, partly silty clay (thickness 1-6m)
b) Muddy clay, sandy clay at left side (thickness 27-32m)
c) Sandy clay, partly sand (thickness 17m and more)

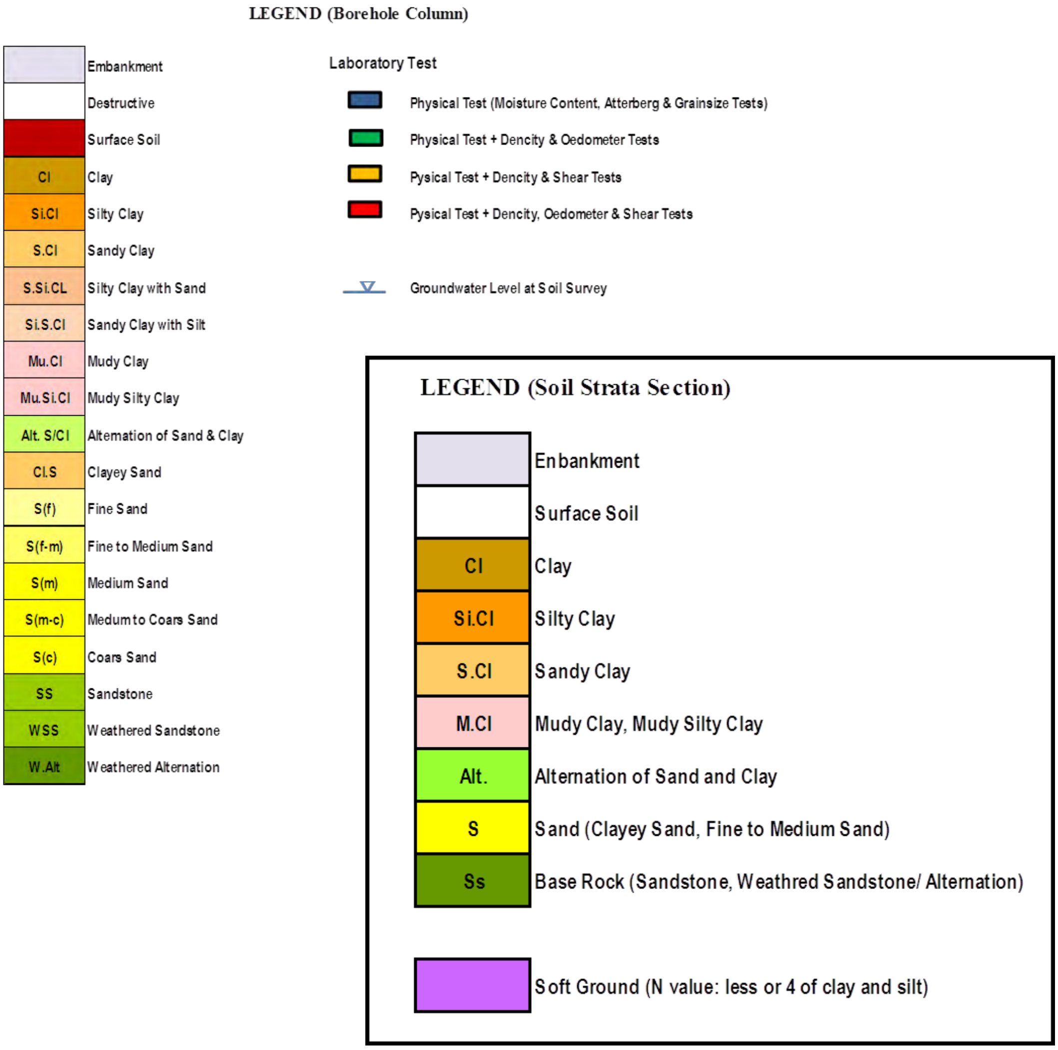
Soft ground lies in depth 1-7m to depth 25-34m in 80% of b) layer, and the thickness is 24-30m. Upper boundary of soft ground locates in shallow part directly under surface soil (thickness 1-2m) at both banks, and locates in slightly deep part with depth 7m or more at right side.

7) Foundation of El Mabtouh Retarding Basin (Refer to **Figure 2-23** and **Figure 2-24**)

The soil composition of driving channel, retarding basin and discharge channel of El Mabtouh is presumed as follows.

a) Silty clay and sandy clay (thickness 8-12m)
b) Silty clay, partly sandy clay and sand (medium grain, thickness 18m and more)

Soft ground leis in depth 10-15m and 17-20m at BHI06, it is presumed to continue from Tobias bridge BHI26, and to become thinner to upstream part, and to disappear at more upstream part.



(Source: Editing based on geotechnical survey report of former preparatory survey)

Figure 2-8: Legend of Boring Columnar and Legend of Geotechnical Longitudinal Section and Cross Section

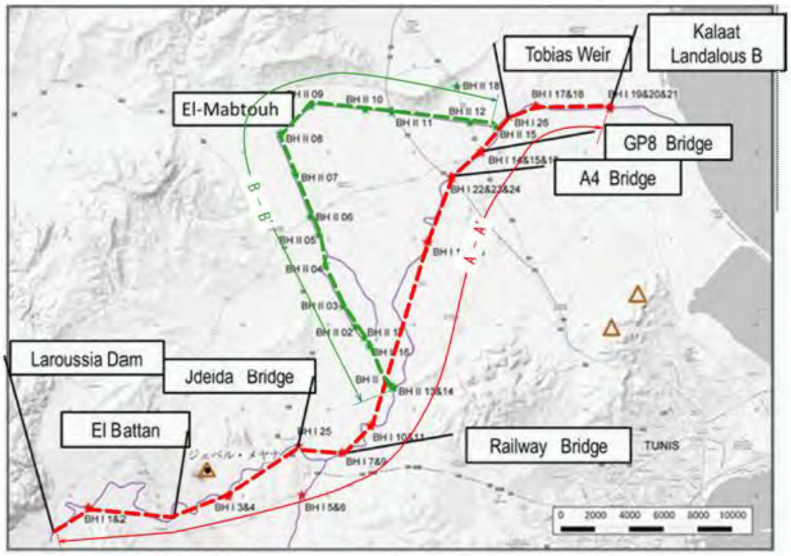
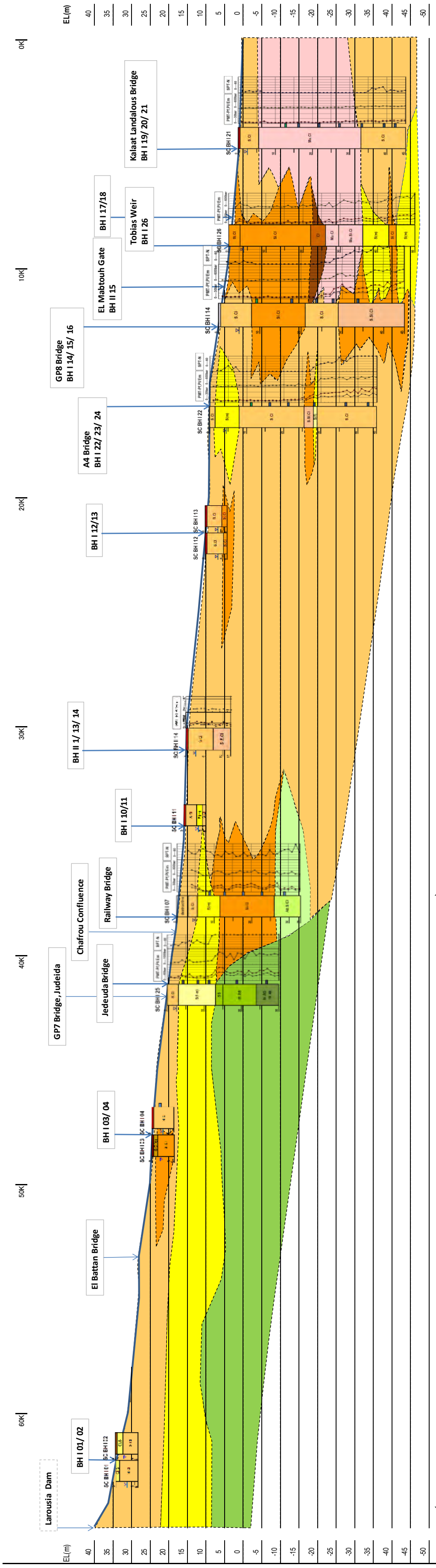
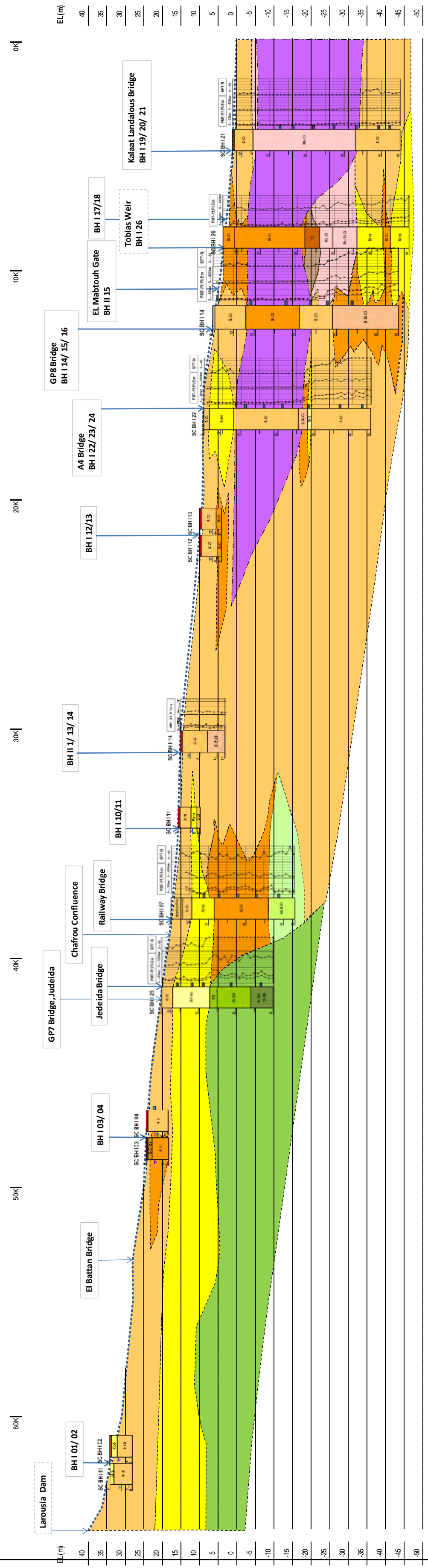


Figure 2-9: Location of Soil Layer Profiles



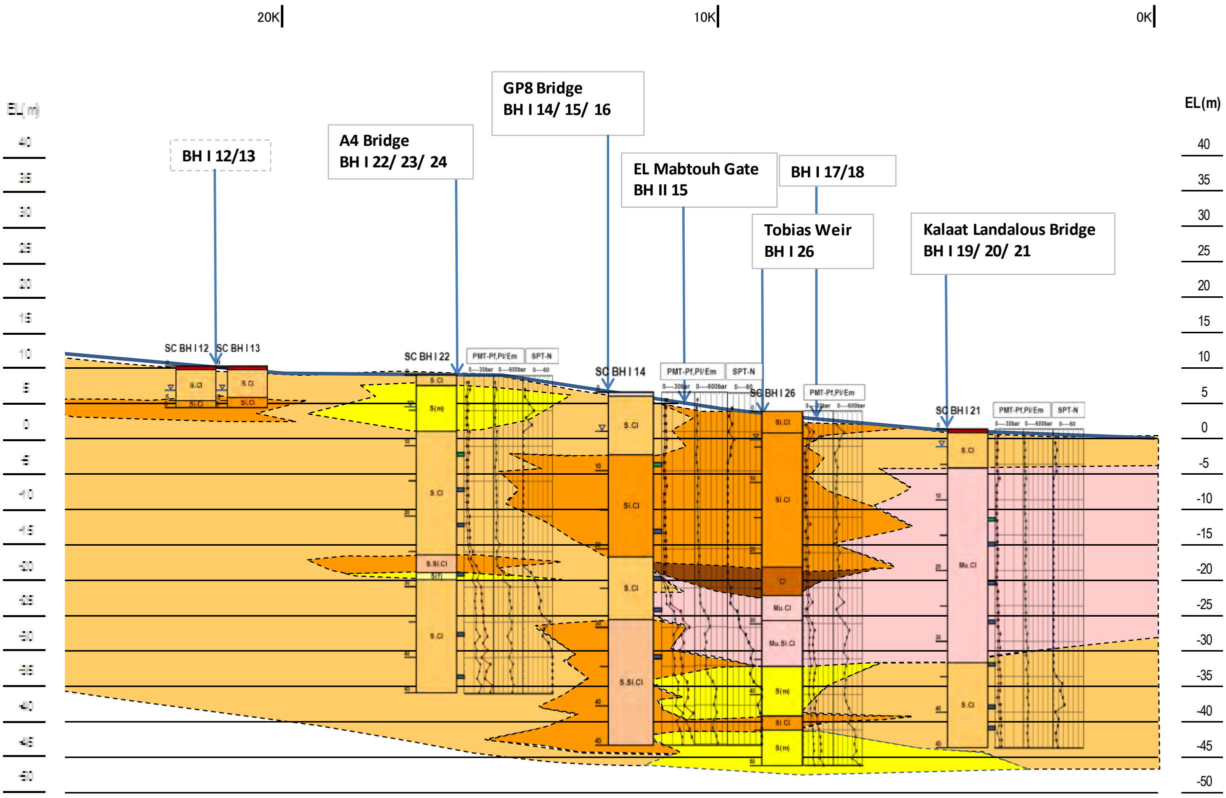
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-10 Geotechnical Longitudinal Section along Main Mejerda River (A-A')



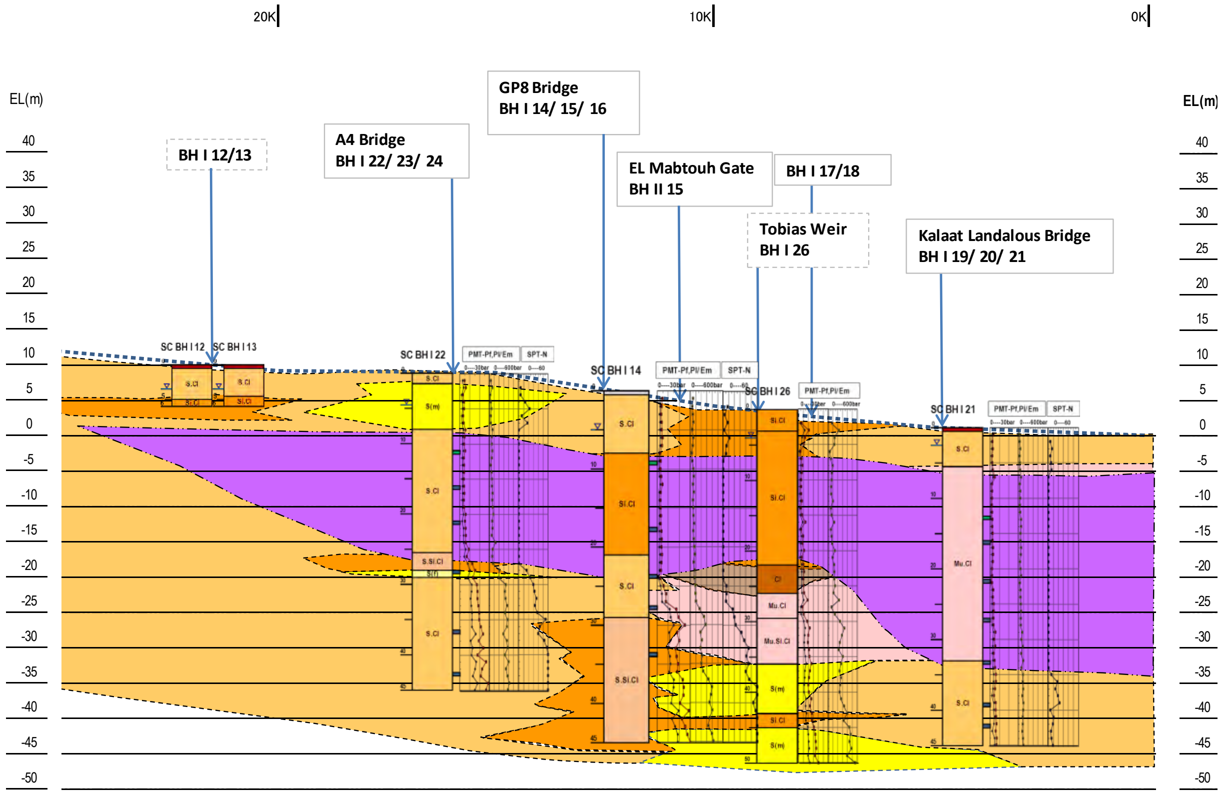
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-11: Geotechnical Longitudinal Section along Main Mejerda River (Indication of Soft Ground) (A-A')



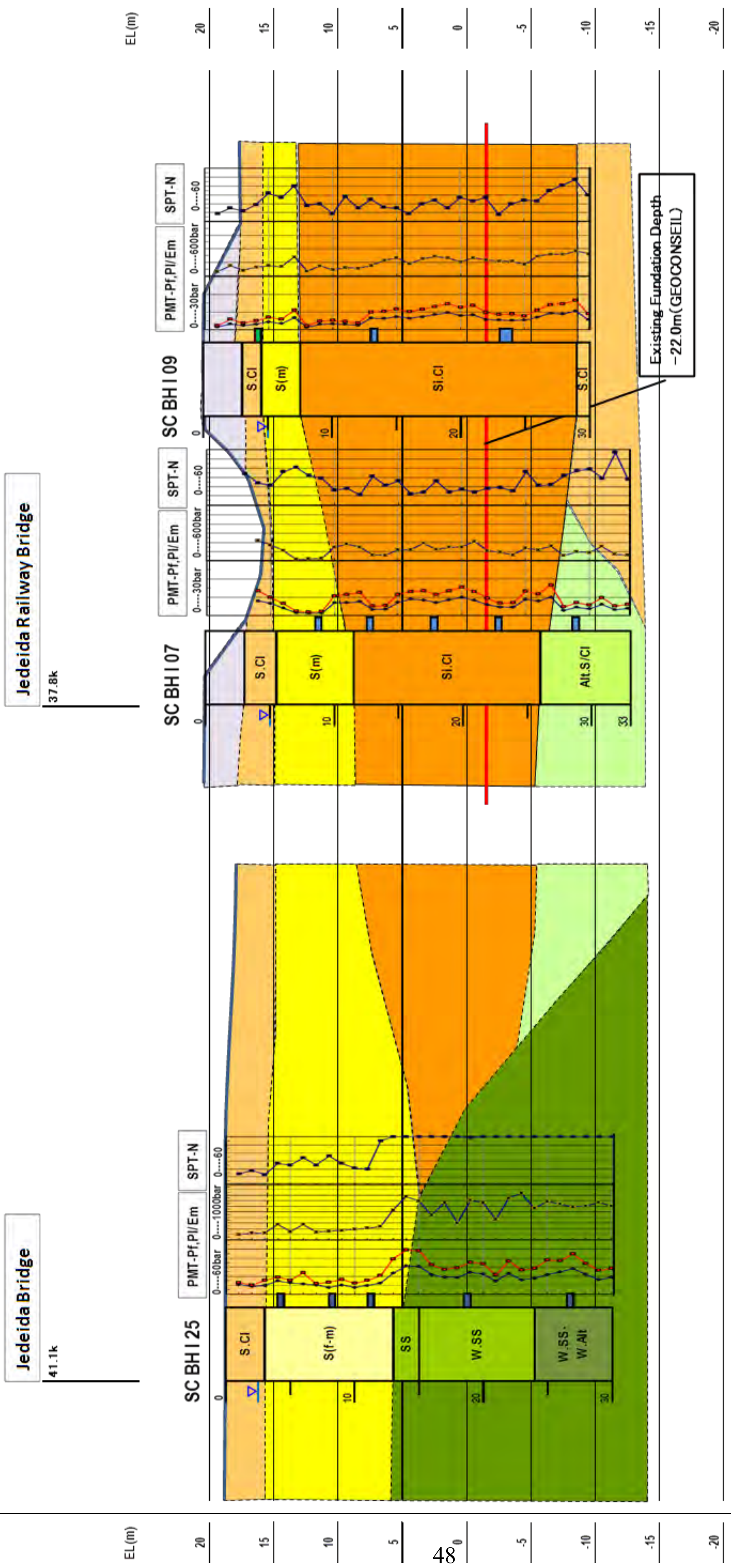
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-12: Geotechnical Longitudinal Section along Main Mejerda River Downstream (A-1)



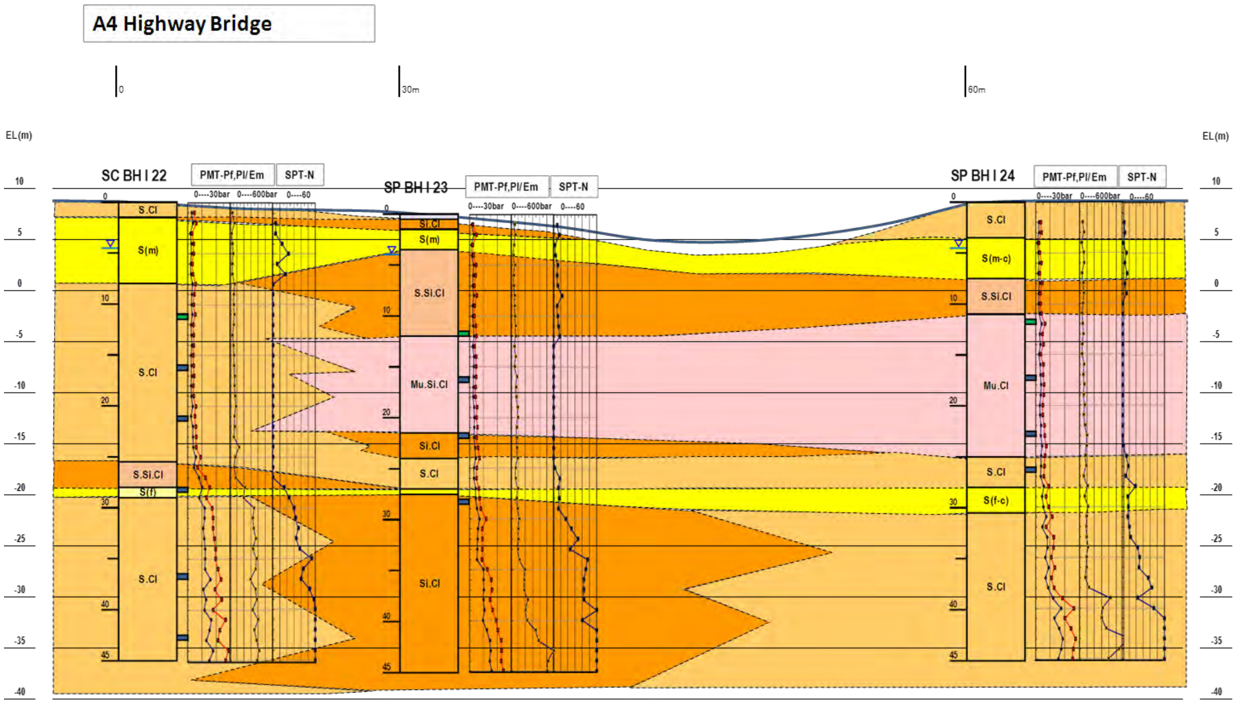
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-13: Geotechnical Longitudinal Section along Main Mejerda River Downstream (Indication of Soft Ground) (A-1)



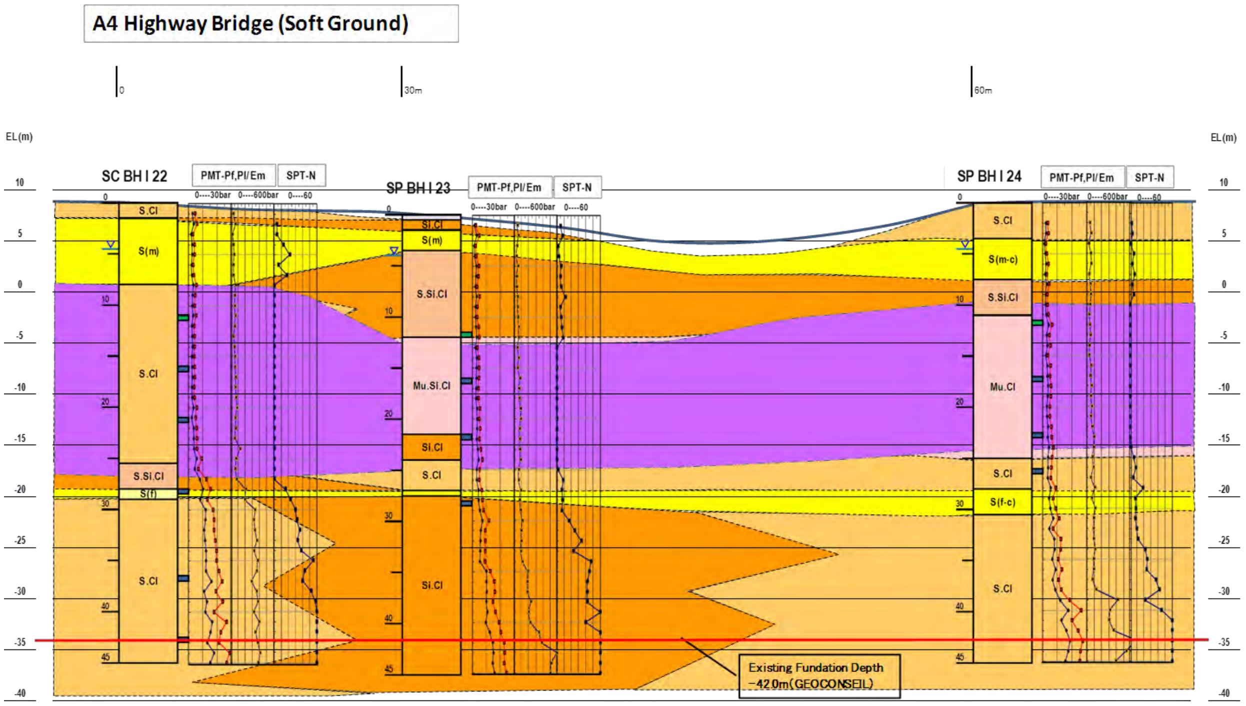
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-14 Geotechnical Longitudinal Section of Jedeida Bridge and Cross Section of Railway Bridge (A-3)



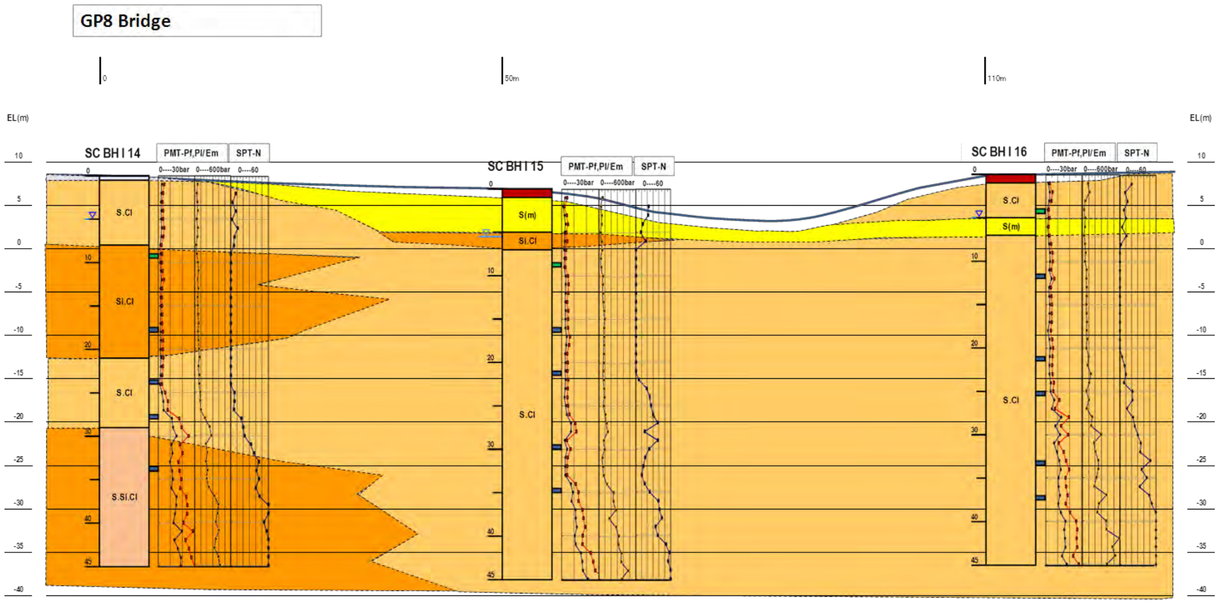
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-15: Geotechnical Cross Section of Highway Bridge Part (C)



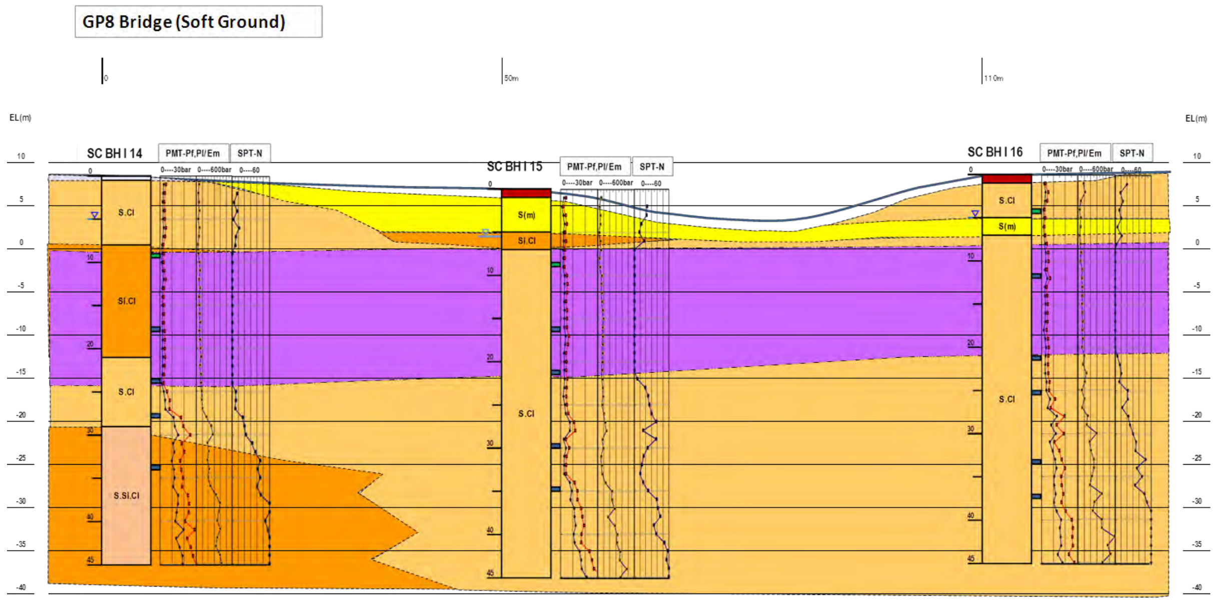
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-16: Geotechnical Cross Section of Highway Bridge Part (Indication of Soft Ground) (C)



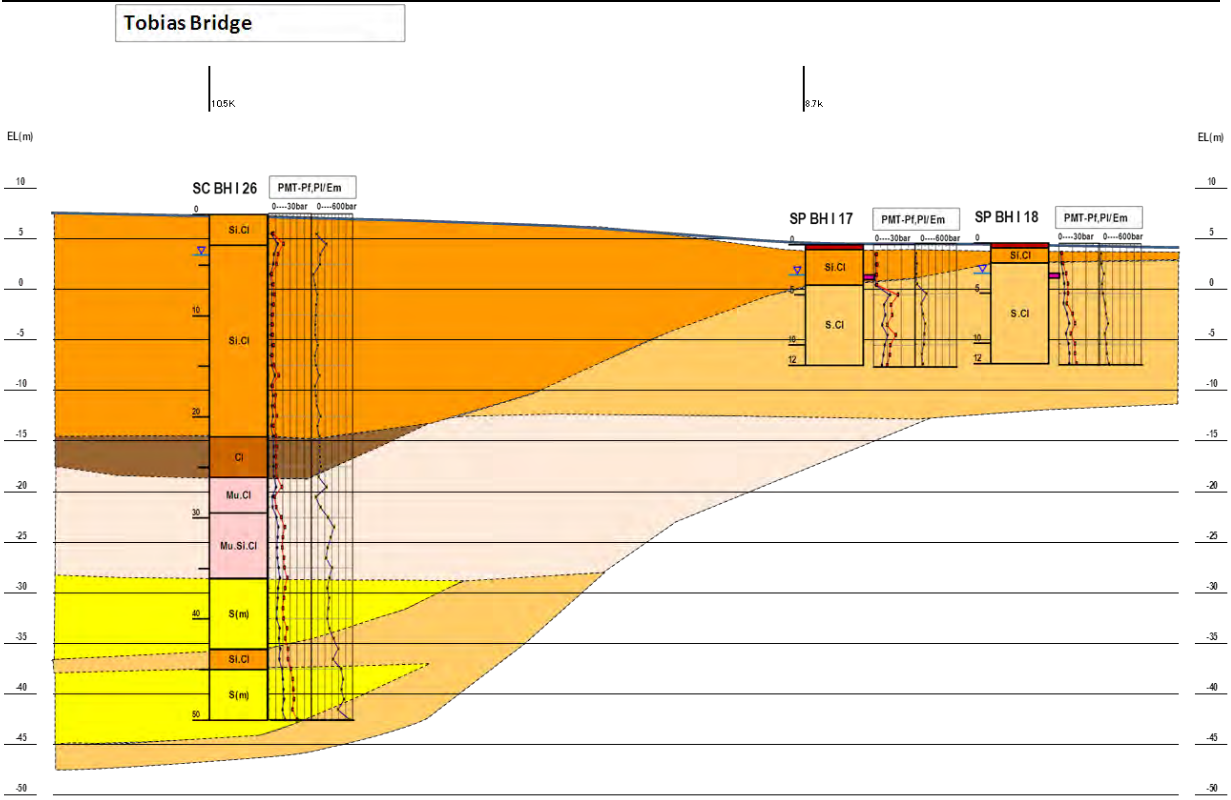
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-17: Geotechnical Cross Section of GP8 Road Bridge Part (D)



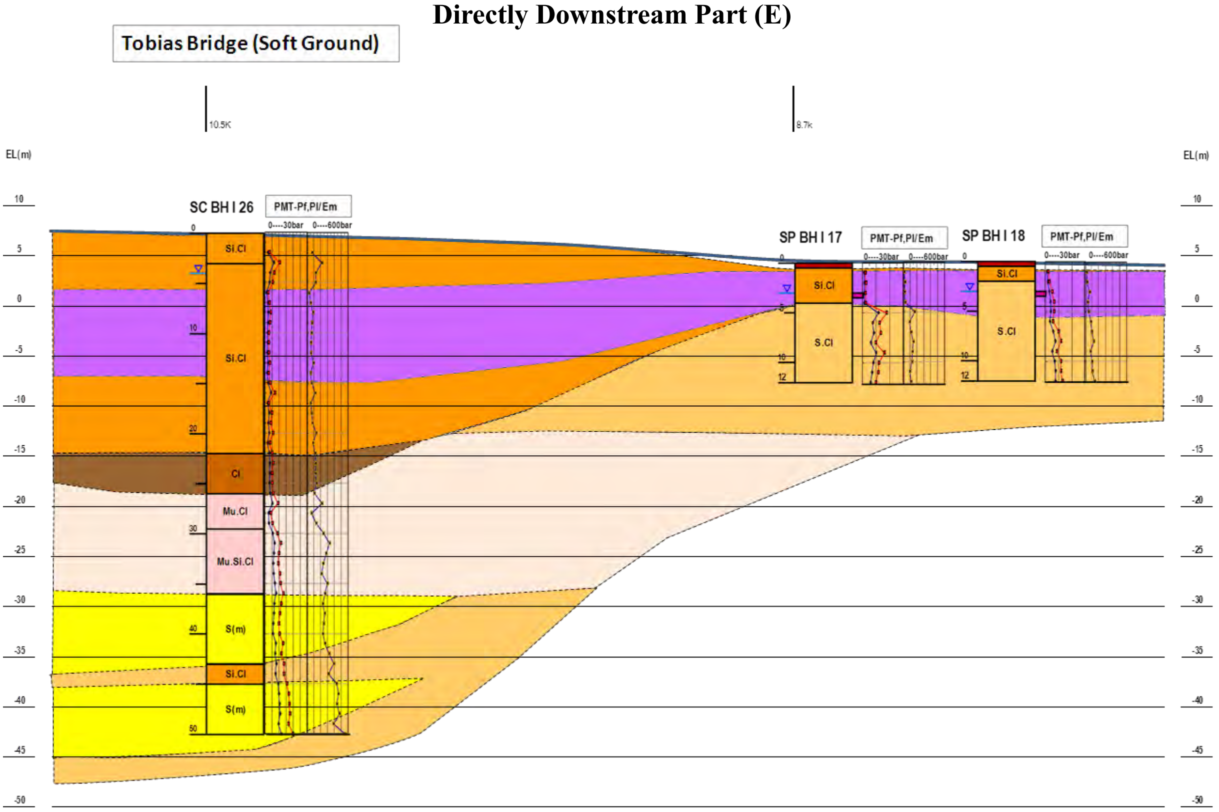
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-18: Geotechnical Cross Section of GP8 Road Bridge Part (Indication of Soft Ground) (D)



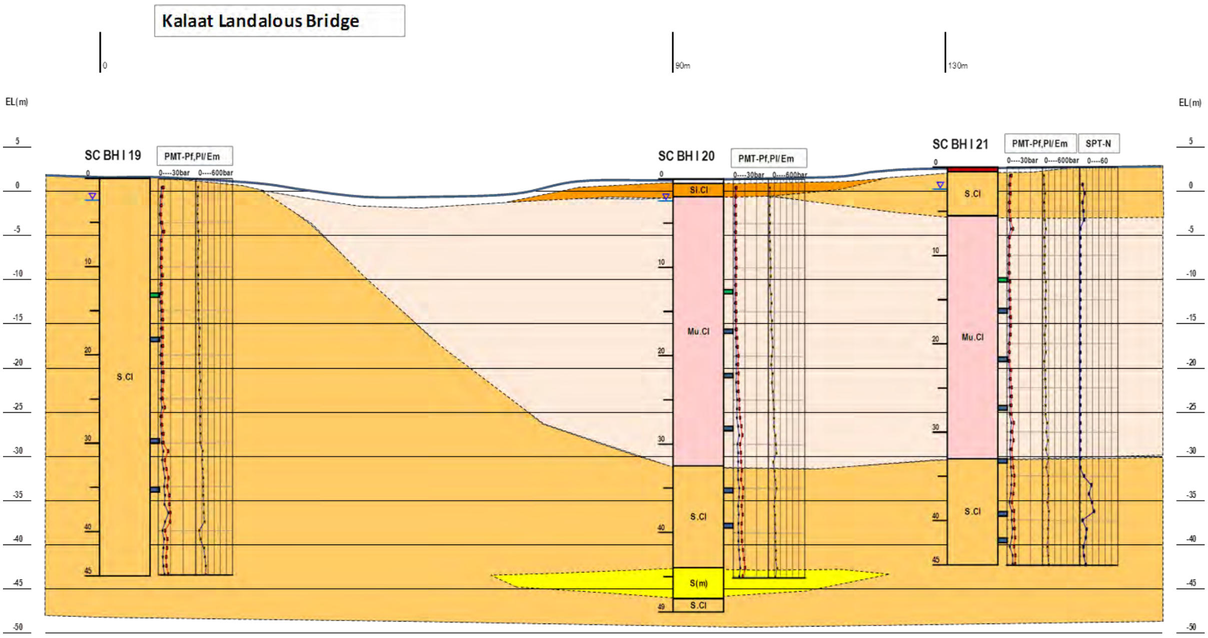
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-19: Geotechnical Longitudinal Section of Tobias Road Bridge and Directly Downstream Part (E)



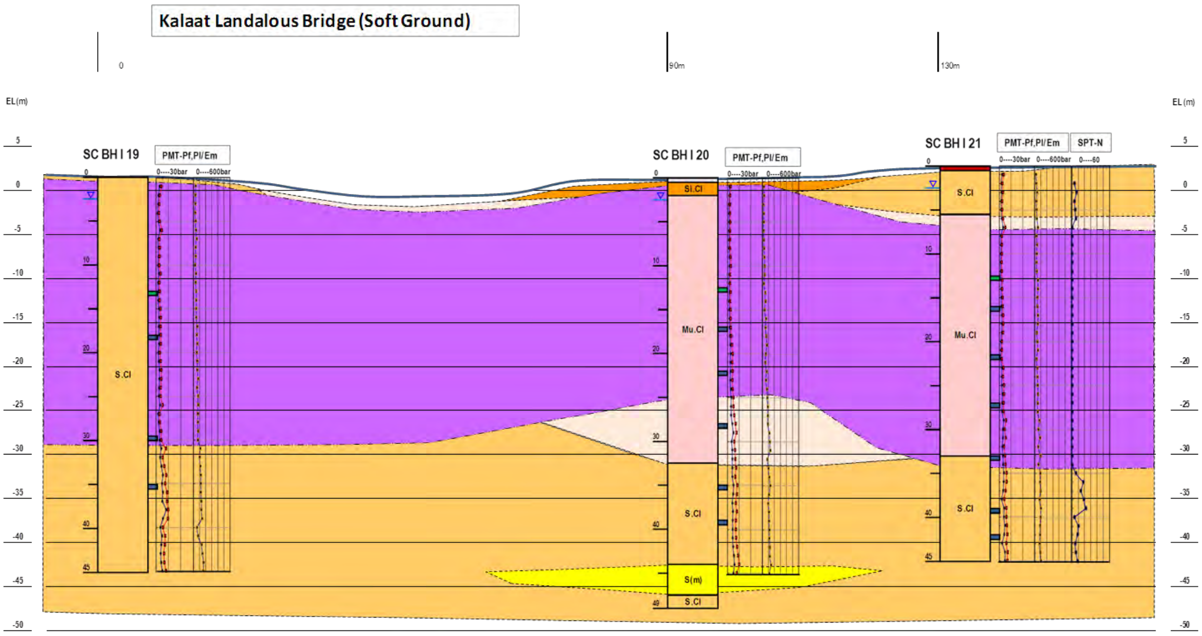
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-20: Geotechnical Longitudinal Section of Tobias Road Bridge and Directly Downstream Part (Indication of Soft Ground) (E)



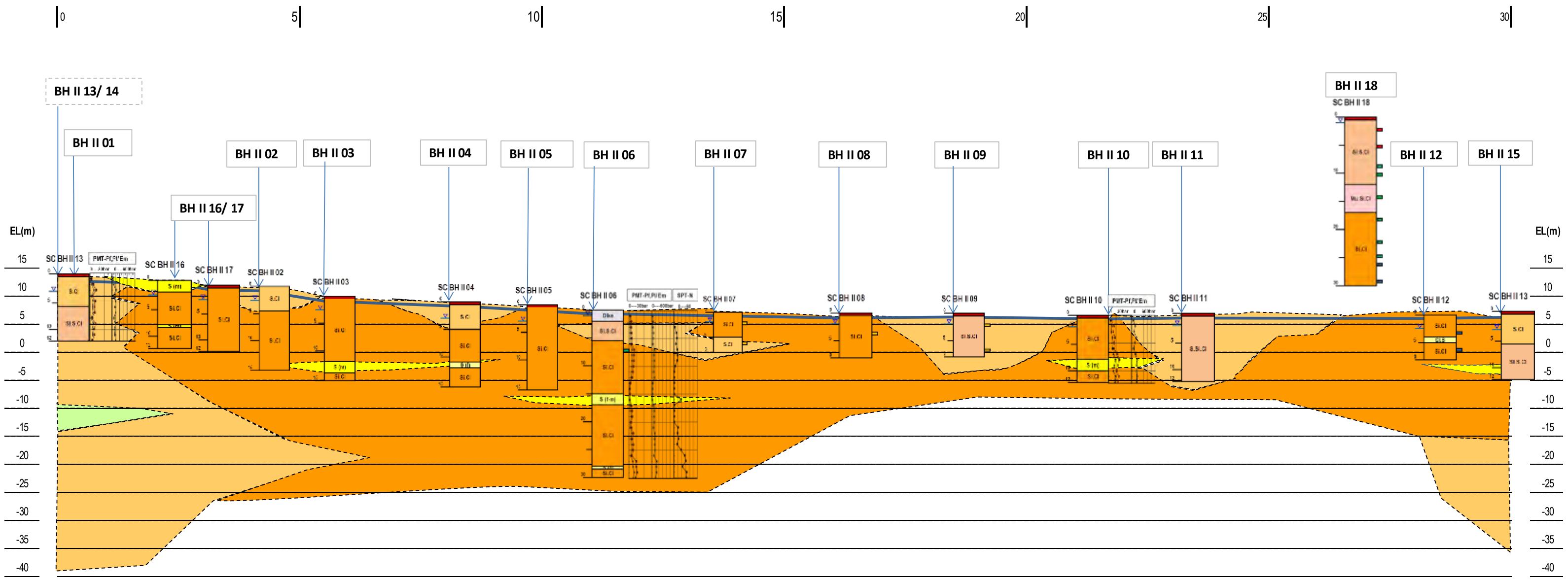
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-21: Geotechnical Cross Section of Kalaat Landalous Road Bridge Part (F)



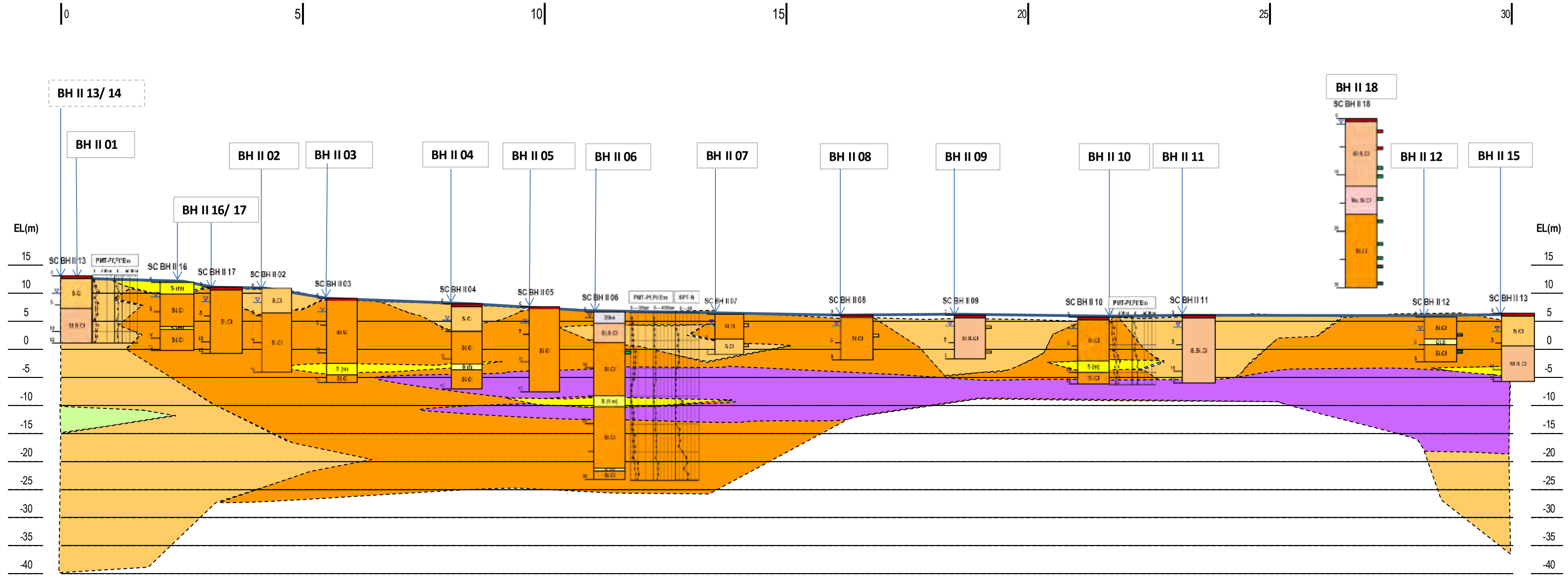
(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-22: Geotechnical Cross Section of Kalaat Landalous Road Bridge Part (Indication of Soft Ground) (F)



(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-23: Geotechnical Longitudinal Section of Driving Channel, Retarding Basin and Drainage Channel of El Mabtouh (B-B')



(Source: Drawing based on soil survey report of former preparatory survey)

Figure 2-24: Geotechnical Longitudinal Section of Driving Channel, Retarding Basin and Drainage Channel of El Mabtouh (Indication of Soft Ground) (B-B')

(3) Summary of Existing In-situ Test and Soil Test Results

Result of existing in-situ test and soil test carried out in the former preparatory survey is summarized as follows.

1) Relation of SPT N Value and PMT Creep Stress, Limit stress, Deformation Modulus

Result of standard penetration test (SPT) N value and pressure meter test (PMT) creep stress (Pf), limit stress (Pl), deformation modulus (Em) is summarized as shown in **Table 2-6**. The average, minimum, maximum of each soil layer are calculated, and it is divided into 2 categories, namely all and shallow group with depth 10m or less.

Table 2-6: Results of SPT and PMT

(A)All soil layer

Classification	Sample No.		SPT_N	PMT_Pf (bar)	PMT_Pl (bar)	PMT_Em (bar)
Embankment	2	Min	9	1.5	2.3	32
		Max	15	3.2	5.8	75
		Ave.	12	2.4	4.1	54
Sand	43	Min	0	0.9	1.5	17
		Max	55	14.7	23.7	278
		Ave.	19	4.9	7.7	95
Alternation	8	Min	21	2.8	4.7	58
		Max	57	10	16.6	161
		Ave.	33	5.2	8.4	103
Sandy clay	179	Min	0	1.3	2.3	23
		Max	60	21	35.1	675
		Ave.	20	6.5	10.2	152
Silty clay	111	Min	0	1	1	22
		Max	60	19.5	30.2	597
		Ave.	24	6.9	10.9	143
Muddy clay	66	Min	0	1.1	1.9	22
		Max	9	7.9	12.4	98
		Ave.	0.4	2.5	4.1	54
Rock	18	Min	59	14.6	21.4	303
		Max	60	31.2	49.2	834
		Ave.	60	21.9	34.4	617

(B)Shallow soil layer with depth 10m and less

Classification	Sample No.		SPT_N	PMT_Pf (bar)	PMT_Pl (bar)	PMT_Em (bar)
Embankment	2	Min	9	1.5	2.3	32
		Max	15	3.2	5.8	75
		Ave.	12	2.4	4.1	54
Sand	33	Min	2	1.1	1.8	19
		Max	41	14.7	23.7	278
		Ave.	19	4.5	7.1	84
Sandy clay	35	Min	0	1.4	2.3	23
		Max	24	10.5	13.5	221
		Ave.	7	3.1	4.8	57
Silty clay	21	Min	0	1	2	23
		Max	20	4.4	7	73
		Ave.	8	2.7	4.2	47
Muddy clay	8	Min	0	1.3	2	22
		Max	6	3.2	5.1	53
		Ave.	1	1.8	2.9	37

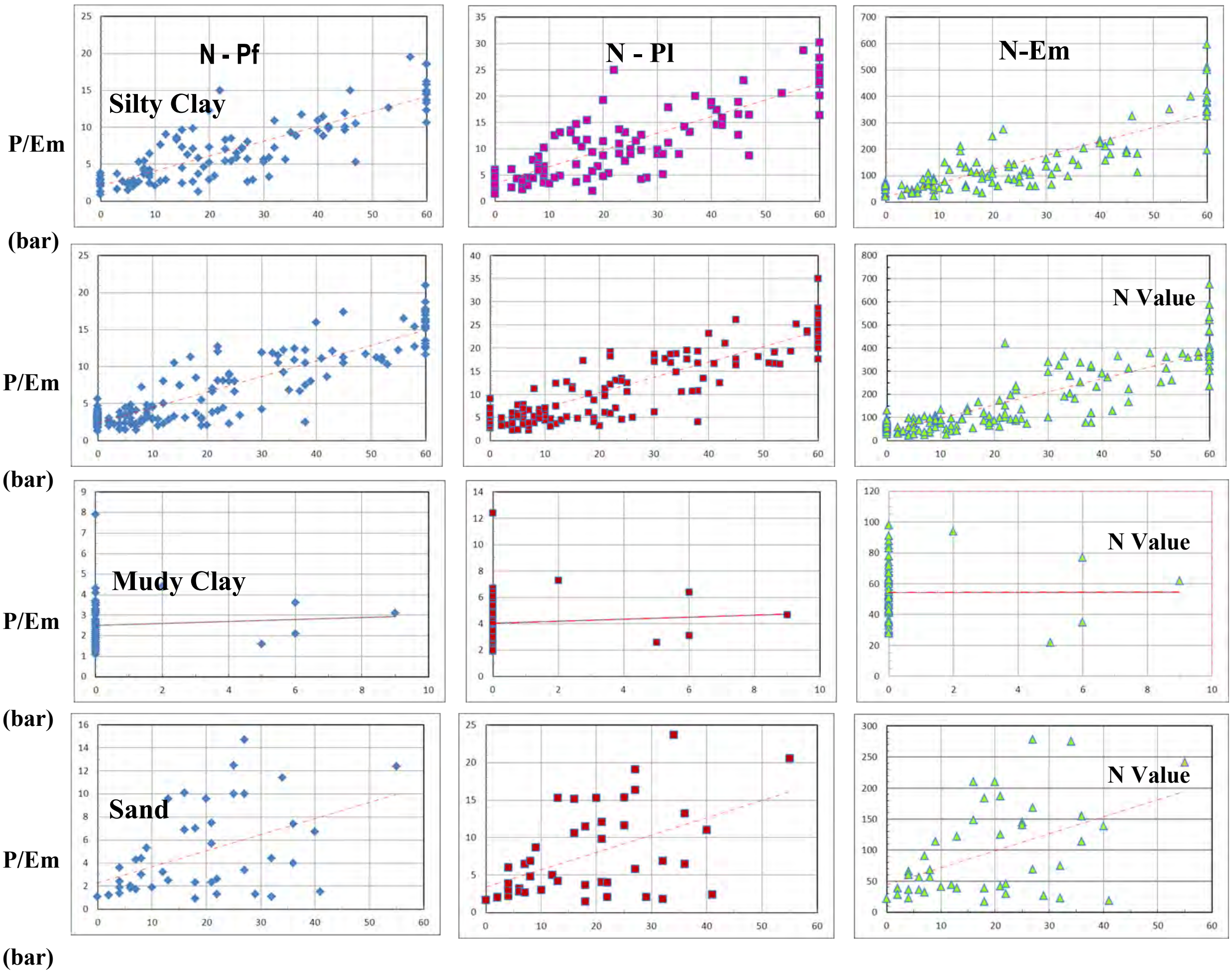
(Source: Preparation based on geotechnical survey report data of former preparatory survey)

Relation of SPT N value and PMT creep stress (Pf), limit stress (Pl), deformation modulus (Em) of each soil layer is shown in Figure 2-25. Relations are summarized as follows.

i) Silty clay and Sandy clay have high correlation between SPT-N and PMT-Pf, Pl, Em comparing with sand.

ii) Renges of PMT-Pf,Pl toward SPT-N of silty clay and sandy clay are similar. There is a tendency that PMT-Em toward SPT-N of sandy clay is slightly higher than silty clay.

iii) PMT-Pf of soft ground (clayey soil with N value 0-4) is almost 5bar (500kN/m2) or less in each soil layer. PMT-Pl of soft ground is 6 bar (600kN/m2) or less in silty clay, 10 bar (1000kN/m2) or less in sandy clay and muddy clay. PMT-Em of soft ground is almost 100bar (1000kN/m2) or less in each soil layer.



(Source: Preparation based on geotechnical survey report data of former preparatory survey)

Figure 2-25: Relation of SPT-N value and PMT Creep Stress (Pf), Limit Stress (Pl), Deformation Modulus (Em) in Each Soil Layer

2) Soil Classification

Toward soil classification by core observation, soil classification based on Unified Soil Classification System (USCS) using soil test results of soil classification items such as water content test, liquid and plastic limit test, and grain size analysis test are carried out, and are shown in **Table 2-7**.

90% or more of silty clay and sandy clay are classified to CH (typical soil names such as high plastic clay, silty clay, etc. are contained), and soils classified to CL (typical soil names such as low plastic clay, sandy clay. etc. are contained) are rather rare. Therefore, in the coverage area of soil test implementation, the downstream area from the railway bridge is almost occupied by clayey soil, and almost all of the clayey soil is classified CH.

Meanwhile, sand distribution is very narrow. Although number of soil test is little, 50% of sand is classified to SM (typical soil names such as silty sand, etc. are contained), 17% of sand is classified to SP (typical soil names such as not well sorting sand, gravely sand etc. are contained), and 33% of sand is intermediate. Sand of the study area is rather fine, but includes fine grain to coarse grain.

Table 2-7: USCS Soil Classification toward Each Soil Layer Classified by Core Observation

Classification by Core			USCS Classification		
Major Division	No. Samples	Components	Soil Class.	No. Samples	Typical Names
Silty Clay	22	Cl. Si.Cl, S.Si.Cl	CH CL SM	20 (91.0%) 1 (4.5%) 1 (4.5%)	Highly plastic clay, Silty clay Clay of low plasticity, Sandy clay (Silty sand)
Sandy Clay	42	S. Cl, Si. S. Cl	CH CL	39 (92.9%) 3 (7.1%)	Highly plastic clay, Silty clay Clay of low plasticity, Sandy clay
Muddy Clay.	13	Mu.Cl, Mu.Si.Cl	CH	13 (100%)	Highly plastic clay, Silty clay
Sand	6	Si.S, S(f)-S(c)	SM SP SP-SM	3 (50.0%) 1 (16.7%) 2 (33.3%)	Silty sand Poorly graded sand, Gravelly sand SP SM mixture

USCS: Unified Soil Classification System
(Source: Preparation from geotechnical survey report data of former preparatory survey)

3) Density

Average, minimum and maximum of dry density and wet density in each soil layer obtained from density test is shown in **Table 2-8**. Density test result is summarized as follows.

i) Moisture content shows range 21.4-42.1%, average 32.2%, and the order shows sandy clay < silty clay < Muddy clay.

ii) Dry density shows range 1.21-1.70g/cm3, average 1.44g/cm3, wet density range 1.69-1.20g/cm3, average 1.90g/cm3, and it shows order of sandy clay >= silty clay > muddy clay. Results of density test are rather large compared with alluvium and diluvium clays in Japan.

Table 2-8: Summary of Density Test Result

Category	Sanple No.	Moisture content W (%)			Dry density γd (g/cm3)			Wet density γh (g/cm3)		
		Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
Sandy clay	10	21.4	39.2	29.9	1.33	1.70	1.49	1.85	2.06	1.93
Silty clay	7	26.0	40.1	31.4	1.27	1.59	1.47	1.78	2.01	1.93
Muddy clay	4	33.6	42.1	39.2	1.21	1.40	1.28	1.69	1.87	1.78
All	21	21.4	42.1	32.2	1.21	1.70	1.44	1.69	2.06	1.90

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

4) Consolidation Parameter

Consolidation test result is shown in **Table 2-9**. The consolidation parameter obtained as consolidation test result, which is divided 2 groups of soil layer and N value grade, is summarized in **Table 2-10**. Test results are as follows.

i) The void ratio shows range 0.08-0.35, average 0.22, and the consolidation index shows range 0.42-0.95, average 0.76, and the compression coefficient shows range 6.34E-05~ 6.17E-03 , average 1.88E-03. It shows general order of sandy clay < silty clay < muddy clay. The compression coeffcient also shows same order of sandy clay < silty clay < muddy clay, and the result is reversed in comparison with the weak grade generally presumed from strengh, etc.

ii) According to N value grade, the soft ground (clayey soil with N value 4 or less) shows the void ratio average of 0.85, compaction index average of 0.24 and compression coefficient average of 3.53E-03. As compared with the average value of the muddy clay, the consolidation index is small and the compression coefficient is large. It shows that average of muddy clay is softer than others.

Table 2-9: Consolidation Test Result

Borehole No.	Depth	Soil Classification		SPT	PMT			Compaction Parameter		
		Core	USCS	N Value	Pf (kN/cm2)	Pl (kN/cm2)	Em (kN/cm2)	e_0	Cc	Cv (cm3/s)
BH I 09	4.00-4.50	S.Cl	CH	19	440	690	7500	0.47	0.14	3.16E-03
BH I 15	8.50-9.00	S.Cl	CH	0	210	350	3600	0.88	0.24	1.95E-03
BH I 16	4.00-4.50	S.Cl	CH	13	140	230	2400	0.65	0.18	2.05E-03
BH I 17	3.00-3.50	S.Cl	CH	-	130	210	2400	0.86	0.27	1.23E-03
BH I 19	13.00-13.50	S.Cl	CH	-	180	290	4200	0.92	0.26	3.14E-04
BH I 22	11.00-11.50	S.Cl	CH	0	320	520	6300	0.70	0.21	5.83E-03
BH II 18	2.00-2.50	S.Cl	CH	-	-	-	-	0.63	0.15	5.18E-04
BH II 18	5.00-5.50	S.Cl	CH	-	-	-	-	0.69	0.18	3.60E-04
BH II 18	8.50-9.00	S.Cl	CH	-	-	-	-	0.85	0.19	3.32E-05
BH II 18	10.00-10.50	S.Cl	CH	-	-	-	-	0.60	0.11	2.09E-03
Sub-average								0.73	0.19	1.75E-03
BH I 14	9.00-9.50	Si.Cl	CH	0	170	310	5200	0.85	0.24	6.17E-03
BH I 18	4.00-4.50	Si.Cl	CH	-	390	650	4600	0.67	0.18	6.30E-04
BH I 23	11.50-12.00	Si.Cl	CH	9	310	470	6200	1.09	0.35	6.34E-05
BH II 06	6.50-7.00	Si.Cl	CH	5	440	700	6300	0.73	0.23	1.24E-03
BH II 18	18.00-18.50	Si.Cl	CH	-	-	-	-	0.72	0.18	2.83E-03
BH II 18	22.00-22.50	Si.Cl	CH	-	-	-	-	0.61	0.18	1.90E-03
BH II 18	24.50-25.00	Si.Cl	CH	-	-	-	-	0.42	0.08	2.26E-04
Sub-average								0.73	0.21	1.87E-03
BH I 20	12.50-13.00	Mu.Cl	CH	-	140	220	2600	0.95	0.35	3.03E-03
BH I 21	12.50-13.00	Mu.Cl	CH	0	110	200	4900	0.94	0.26	3.38E-03
BH I 24	11.50-12.00	Mu.Cl	CH	0	410	640	4300	0.89	0.26	2.98E-04
BH II 18	14.00-14.50	Mu.Cl	CH	-	-	-	-	0.84	0.32	9.84E-04
Sub-average								0.91	0.30	1.92E-03
Average								0.76	0.22	1.82E-03

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

Table 2-10: Consolidation Parameter of Consolidation Test

Category	Sanple No.	Initial void ratio e0			Preconsolidation stress σ'p (kN/m2)			Compression Index Cc			Coefficient of consolidation Cv(cm3/s)		
		Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
Sandy clay	10	0.47	0.92	0.73	63	148	116	0.11	0.27	0.19	3.14 E-04	5.83 E-03	1.75 E-03
Silty clay	6	0.42	1.09	0.74	75	253	165	0.08	0.35	0.21	6.34 E-05	6.17 E-03	1.87 E-03
Muddy clay	4	0.84	0.95	0.91	83	173	118	0.26	0.35	0.30	2.98 E-03	3.38 E-03	1.92 E-03
All	20	0.42	1.09	0.76	63	253	131	0.08	0.35	0.22	6.34 E-05	6.17 E03	1.88 E-03
N 値 N=0-4	5	0.70	0.94	0.85	83	173	120	0.21	0.26	0.24	2.98 E-04	6.17 E-03	3.53 E-03
N値N=5-19	4	0.47	1.09	0.73	75	121	109	0.14	0.35	0.23	6.34 E-05	3.16 E-3	1.63 E-03
All	9	0.47	1.09	0.80	75	173	115	0.14	0.35	0.23	6.34 E-05	6.17 E-03	2.68 E-03

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

5) Shear Strength

The shear strength (cohesion and inner friction angle) obtained as box shear test result is shown in **Table 2-11**. The **s**ummary of each soil layer is shown in **Table 2-12**.

i) There are few examinations and the examination part has deviation. Adhesion shows 10-146 kN/m2 and average of 77kN/m2, and internal friction angle shows 3 to 23 degrees, and average of 14 degrees. The tendency of the order of sandy clay > silty clay is shown.

ii) It seems that the shear strength of clayey soils obtained from test result has high intensity compared with alluvium and diluvium clays in Japan. The examination may have been done in the good part of core state. In addition, the depth 3.0-3.5m (weak ground part) of BHI17 shows adhesion 10kN/m2 and 3 degrees of internal friction angle, and is low intensity compared with others.

Table 2-11: Shear Test Result

Borehole No.	Depth	Soil Classification		SPT	PMT			Shear Test	
		Core	USCS	N Value	Pf (kN/cm2)	Pl (kN/cm2)	Em (kN/cm2)	Cu (kN/cm2)	φ (deg)
BH I 17	3.00-3.50	S.Cl	CH	-	130	210	2400	10.00	3
BH II 07	6.00-6.50	S.Cl	CH	-	-	-	-	31.00	13
BH II 09	2.00-2.50	S.Cl	CH	-	-	-	-	119.00	23
BH II 09	6.50-7.00	S.Cl	CH	-	-	-	-	146.00	16
BH II 18	2.00-2.50	S.Cl	CH	-	-	-	-	76.00	15
BH II 18	5.00-5.50	S.Cl	CH	-	-	-	-	130.00	19
Sub-average								85.0	14
BH I 18	4.00-4.50	Si.Cl	CH	-	390	650	4600	59.00	8
BH II 07	2.00-2.50	Si.Cl	CH	-	-	-	-	76.00	15
BH II 08	3.50-4.00	Si.Cl	CH	-	-	-	-	47.00	10
Sub-average								61.00	8
Average								77.00	14

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

Table 2-12: Summary of Shear Strength

Category	Sanple No.	Adhesion (Undrained) Cu (bar)			Internal friction angle φ (degree)		
		Min.	Max.	Ave.	Min.	Max.	Ave.
Sandy clay	6	10	146	85	3	23	14
Silty clay	3	47	76	62	8	15	8
All	7	10	146	77	3	23	14

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

(4) Foundation Analysis

1) Geotechnical Soil Parameter on Foundation Analysis

The Geotechnical soil parameter for examination of the foundation stability and consolidation analysis is shown in **Table 2-13**.

Table 2-13: Geotechnical Soil Parameter for Foundation Analysis

Category	Density		Shear Srength		Compaction Parameater		
	γh (g/cm3)	γ' (g /cm3)	Cu (kN/m2)	φ (Degree)	e0	Cc	Cv (cm3/s)
Embankmemt	1.60	-	43	0			
Surface soil	1.93	0.93	43	9	0.75	0.21	8.74E-04
River deposit	1.70	0.70	0	25	-	-	-
Sandy clay	1.93	0.93	31	13	0.73	0.19	1.75E-03
Silty clay	1.93	0.93	47	10	0.74	0.21	1.87E-03
Muddy clay	1.78	0.78	21	0	0.91	0.31	1.92E-03
Sand	1.80	0.80	0	30	-	-	-
Soft ground	1.78	0.78	10	3	0.91	0.31	1.92E-03

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

The setup of the parameter was carried out as follows.

i) Wet density is applied the average value of each soil layer. In addition, many of muddy clay portions are soft ground, and the wet density of muddy clay is applied as the wet density of soft ground. Underwater weight deducts the unit volume weight of water from wet weight as 1tf/m3 (9.8kN/m3).

ii) As the shear strength of soft ground, the test result of BHI17 is applied. Since the shear strength of each soil layer has brought a high result at the whole, the minimum value of each soil layer except for soft ground portion is applied.

iii) The consolidation parameter uses the average value obtained in each soil layer. In addition, the soft ground uses the average value of the muddy clay.

iv) Since surface soil is mainly sandy clay in many cases, the average value of BHI17 (3.0 to 3.5 m depth), and BHII18 (2.0 to 2.5 m depth) of the surface of sandy clay is applied.

v) About the following soil layers, since the shear test is not carried out, the intensity is presumed from the empirical equation by N value (refer to **Table 2-14**).

- Sandy soil: The value with smaller one of Peck; phi=27+0.3N (degree) and Dunham; phi=root(12N)+ (15 to 20) (degree)
- Clayey soil: the value of the smaller one of Terzaghi-Peck; C=qu/2= (N/0.8) /2x10 (kN/m2), and Osaki; C=qu/2=(4+N/2)2x10 (kN/m2)
- Embankment: Calculation from the minimum of N values of 2 samples

- River deposit: It is thought that river bed sediment strength is smaller than the average of the sand of shallow portion, and the calculation from the average of N value of a)the minimum N values and b)average of N value of shallow portion.
- Muddy clay: Calculation from the average of N value of muddy clay
- Sand: Calculation from the average of N values of the whole sand layer

Table 2-14: Presumption of Adhesion of Clayey Soil and Internal Friction Angle of Sandy Soil by Empirical Equation (Source: Arrangement based on geotechnical survey report data of former preparatory survey)

(A) Whole Soil Layer

Classification	Sample No.		SPT_N	Sand (φ, dgree)		Clay (Cu, kN/m2)	
				Peck	Dunham	Terzagi-Peck	Osaki
Embankment	2	Min	9	-	-	56	43
		Max	15	-	-	94	58
		Ave.	12	-	-	75	50
Sand	43	Min	0	27	15	-	-
		Max	55	44	41	-	-
		Ave.	19	33	30	-	-
Sandy clay	179	Min	0	-	-	0	20
		Max	60	-	-	375	170
		Ave.	20	-	-	122	69
Silty clay	111	Min	0	-	-	0	20
		Max	60	-	-	375	170
		Ave.	24	-	-	148	79
Muddy clay	66	Min	0	-	-	0	20
		Max	9	-	-	56	43
		Ave.	0.4	-	-	3	21

(B) Shallow Soil Layer with Depth 10m or less

Classification	Sample No.		SPT_N	Sand (φ, dgree)		Clay (Cu, kN/m2)	
				Peck	Dunham	Terzagi-Peck	Osaki
Embankment	2	Min	9			56	43
		Max	15			94	58
		Ave.	12			75	50
Sand	33	Min	2	28	20		
		Max	41	39	37		
		Ave.	19	33	30		
Sandy clay	35	Min	0			0	20
		Max	24			150	80
		Ave.	7			45	38
Silty clay	21	Min	0			0	20
		Max	20			125	70
		Ave.	8			49	40
Muddy clay	8	Min	0			0	20
		Max	6			38	35
		Ave.	1			9	23

2) Distribution of Soft Ground

Distribution of soft ground is summarized as shown in Table 2-15. The soft ground is the clayey soil portion with N value 0 to 4. In the part which is not carried out the standard penetration test, the extension portion of soft ground with weak strength on pressure meter test (5 or less bar of creep pressure, 10 or less bar of limit pressure, and 100 or less bar of deformation modulus as shown in (3) (a) iii) clause) is treated as soft ground.

Table 2-15: Distribution of Soft Ground

Location	Boring No.		Depth (m)		Thickness (m)	Remarks
	SPT	PMT (Presumption)	Surface	Bottom		
Highway Bridge	BHI22,23,24	—	8-12	24-27	13-19	
GP8 Road Bridge	BHI14,15,16	_	7-9	22-24	13-15	
Tobias Bridge	BHI26	—	6	14	8	
Downstreem of Tobias	_	BHI17,18	1	4-6	3-5	Soft ground locates just under surface soil.
K.Landalous Bridge	BHI21	BHI19,20	1-7	25-34	24-30	At BHI19 and 20, Soft ground locates just under surface soil.
El Mabtouh reterding basin	BHII06	—	10	20	5 and 3 (2 layers)	Soft ground separates 2 layers intercalating thin sand layer.

(Source: Preparation based on geotechnical survey report data of former preparatory survey)

The soft ground is located in the lower part covered by some shallow soil layers with depth 5 to 12 m in many parts. In the area from the Tobias bridge downstream BHI17 and BHI18 to the Kalaat Landalous bridge BHI19 and BHI20, the soft ground is located directly under a thin surface soil layer (thickness 1 to 2 m) and will easily appear on the surface of the earth.

3) Excavation Gradient on Channel Expantion

The planned excavation gradient in channel expannsion is 1:2 (height 1: horizontal distance 2), and has the 3m wide banquette in 5m in height. The calculation result of minimum safety ratio of rotational slip for the excavation with total height 8m is shown in **Table 2-16**.

In case of soft ground, the minimum safety ratio is set to 0.46, and it collapses. In case of sandy clay and silty clay except for soft ground, even if the minimum strength obtained by the geotechnical soil survey of the former preparatory survey is used, the calculated safety ratio is large. In excavation of the upper part of the water surface in dry season, it is stable (refer to **Figure 2-26**). Moreover, from reverse calculation result, if clay monolayer has the shear strength (C=32kN/m2, phi= 0 degree) or more and sand monolayer has the shear strength (C=0kN/m2, phi= 27 degrees) and over, the safety ratio of 1 or more can be secured (Refer to **Figure 2-27**).

Table 2-16: Safety Ratio of Planned Excavation Gradient(Ordinary condition)

Soil Condition	**Adhesion C (kN/m2)**	**Internal Friction Angle φ (°)**	**Minimum Safty Factor**	**Remarks**
Soft Ground (Single layer)	10	3	0.480	
Soft Ground(Sand intercalation)	(Sand: 0)	(Sand: 30)	0.808	Sandy clay in bottom layer
Silty Clay(Single layer)	47	10	1.934	Minimum strength without soft ground
Silty Clay(Sand intercalation)	(Sand: 0)	(Sand: 30)	1.821	Ditto
Sandy Clay(Single layer)	31	13	1.588	Minimum strength without soft ground
Sandy Clay(Sand intercalation)	(Sand: 0)	(Sand:30)	1.544	Ditto

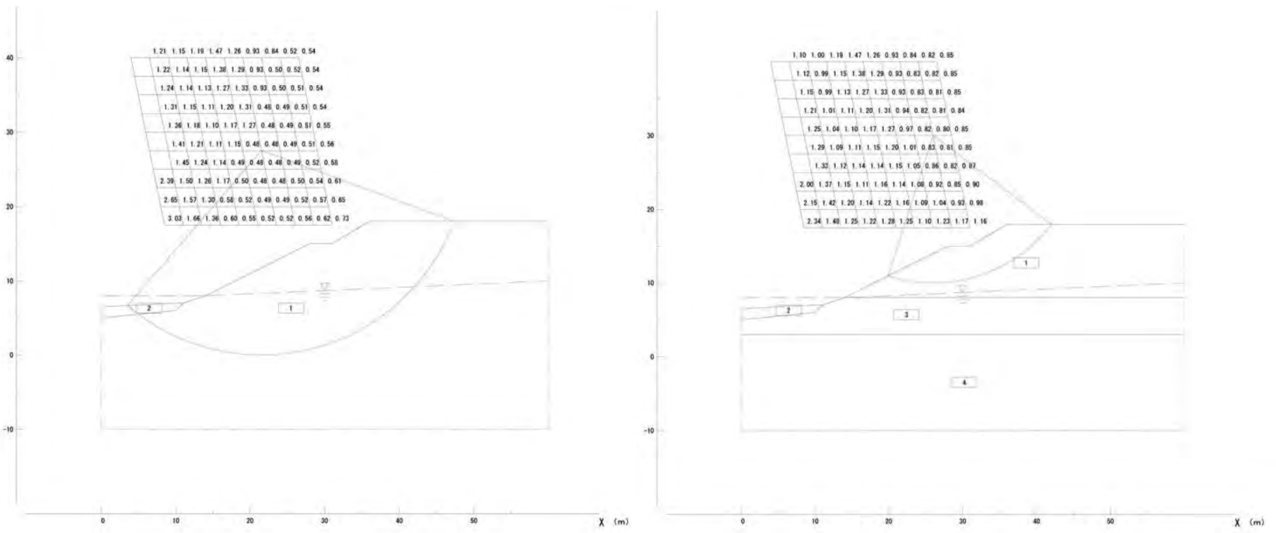
(Source: Preparation of this preparatory survey)

Moreover, the safety ratio of 5m height excavation calculated changing slope gradient is shown in **Table 2-17** and **Figure 2-28**. Except soft ground and sand layer, even if the excavation is carried out with steep slope in the upper part of the water surface in the dry season, it is safe. However, it is examination from the test result of the geotechnical soil survey of the former preparatory survey. In silty clay layer and sandy clay layer, the part, which shows less than the minimum strength set up now, may appear. In case of excavation by steep slope, it is necessary to design and construct after conducting detailed check.

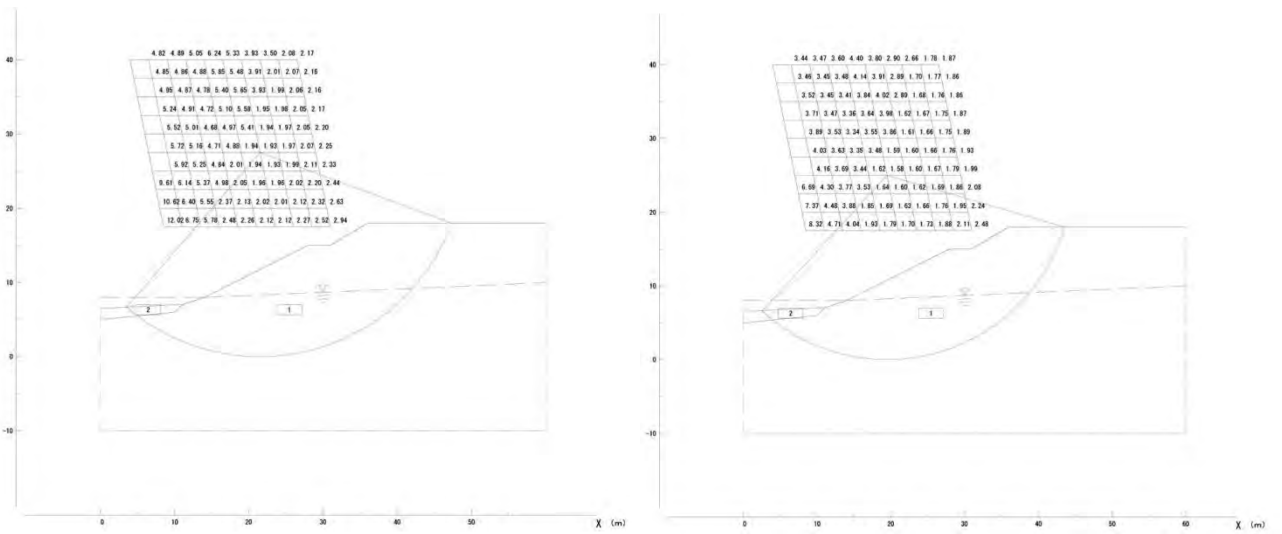
Table 2-17: Minimum Safety Ratio of 5m Height Excavation on Gradient Change (Ordinary condition)

Gradient	Safty Factor				Remarks
	Soft Ground	Silty Clay	Sndy Clay	Sand	
1 : 0.25	0.578	2.625	1.945	0.460	
1 : 0.50	0.662	–	–	0.608	Calculation of intermediate two items is omitted because of high safety factor.
1 : 0.75	0.737	–	–	0.727	
1 : 1.0	0.809	–	–	0.776	
1 : 1.5	0.945	–	–	0.944	
1 : 2.0	1.066	–	–	1.166	
1 : 2.5	1.203	–	–	1.386	

(Source: Preparation of this preparatory survey)



(A) Soft Ground (Monolayer) **(B) Soft Ground (Intercalation of Sand)**

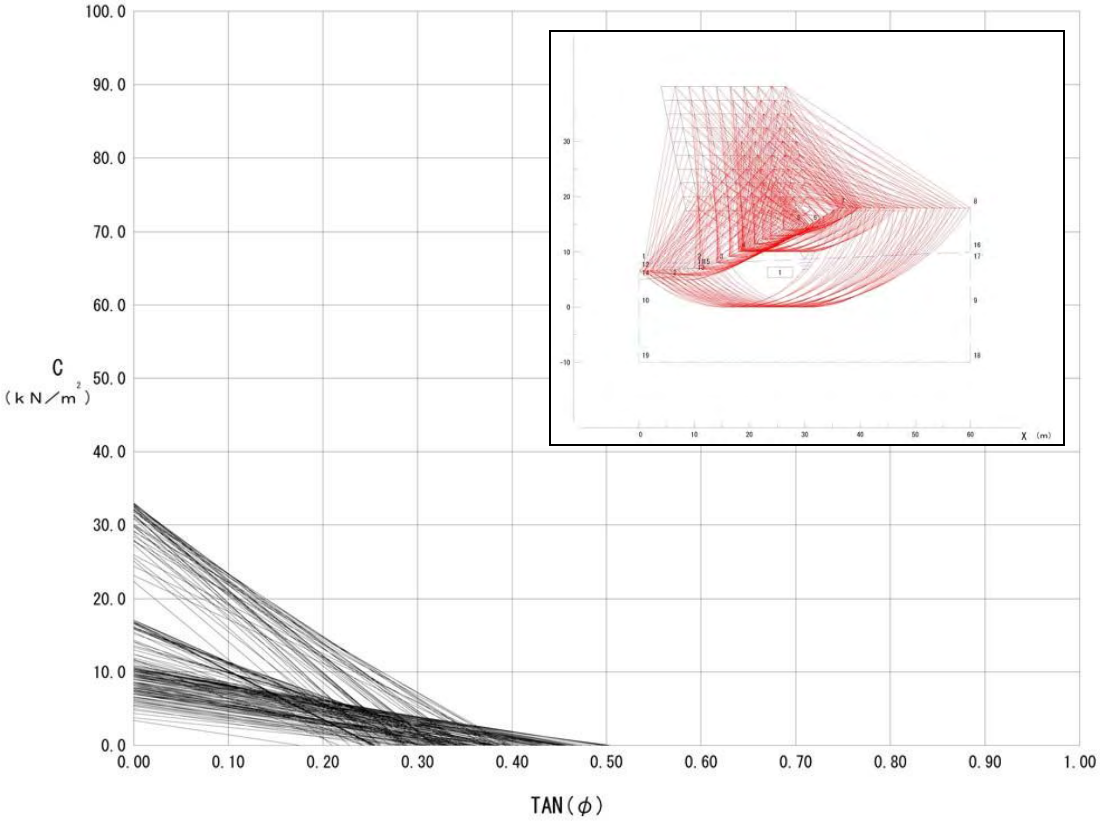


(C) Silty Clay (Monolayer) **(D) Sandy Clay (Monolayer)**

(Source: Preparation of this preparatory survey)

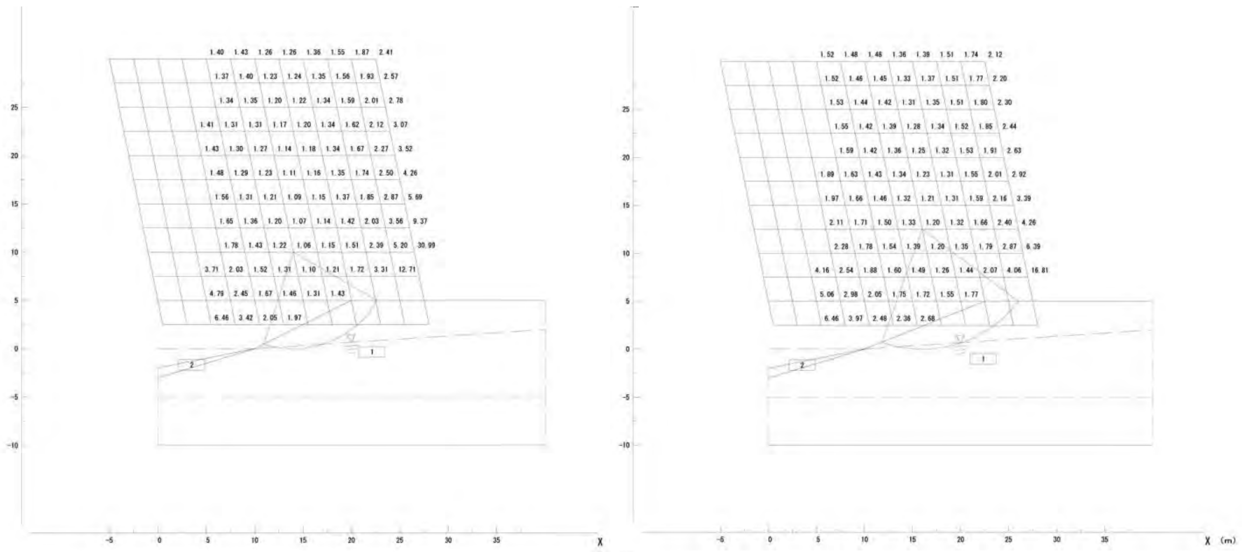
Figure 2-26: Minimum Safety Ratio of River Bank Excavation

(Height:8m, Gradient: 1:2, Banquette width: 3m)


(A) Reverse Calculation Result **(B) Reverse Calculation Sliding Surface**

(Source: Preparation of this preparatory survey)

Figure 2-27: Reverse Calculation for Excavation of River Bank (Height: 8m, Gradient: 1:2, Banquette width: 3m)Obtained Safety Ratio 1.00

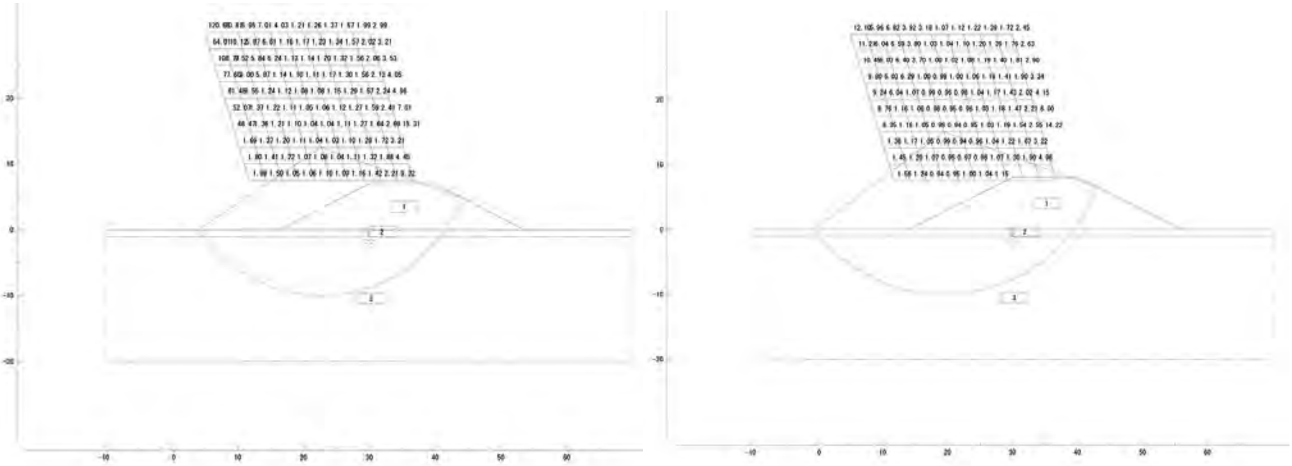

(A) Gradient 1:2 **(B) Gradient 1:2.5**

(Source: Preparation of this preparatory survey)

Figure 2-28: Minimum Safety Ratio of River Bank Excavation (Soft Ground, Height: 5m)

4) Stability of Dike Embankment

In case that soft ground exists directly under surface soil layer, the stability of dike embankment (embankment height: 3m and 5m, upper surface width 10m, slope gradient 1:2) is examined by rotation slip calculation. The calculated minimum safety ratio shows 1.159 in 6m embankment height, 1.037 in 7m height, and 0.944 in 8m height. Bank embankment will become unstable if the embankment height exceeds 7m (Refer to **Figure 2-29**). In addition, the influence of shape modification by subsidence of soft ground and riverbank slope condition etc. is not taken into consideration. Detailed examination united with each part is required.



(A) Embankment height 7m **(B) Embankment height 8m**

(Source: Preparation of this preparatory survey)

Figure 2-29: Examination for Stability of Embankment on Soft Ground

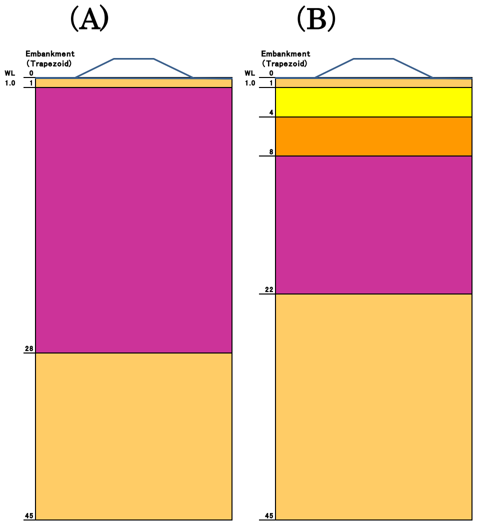
5) Subsidence of Dike Embankment

The outline examination result of the amount of subsidence and the subsidence time in case of dike embankment on the part including thick soft ground layer is as follows. The embankment height 5m, upper surface width 10m and under surface width 30m, and traffic load 1 tf/m2 (9.8kN/m2) are set up.

The amount of subsidence and the time directly under a trapezoid center (Osterberg influence coefficient application) are calculated on normal consolidation and double-sided drainage condition (Refer to **Figure 2-30**).

i) Kalaat Landalous Bridge Part: Amount of subsidence: 88.4cm, Subsidence time: 309 months (90% of compaction index)

ii) GP8 Highway Bridge Part: Amount of subsidence: 45.3cm Subsidence time: 246 months (90% of compaction index)



(A) K. Landalous bridge part
(B) GP8 road bridge part
(Source: Preparation based on the geotechnical soil survey data of the former preparatory survey)

Figure 2-30: Type Soil Column for Examination of Subsidence

(however, in case of ii), If it takes into consideration that the subsidence amount of soft ground layer and the lowermost part layer (sandy clay) are small, the actual subsidence time will become short.)
If soft ground layer becomes thick, subsidence will take time. Examination for measure such as preload or sand drain method, etc. against the subsidence time is needed.

Table 2-18: Outline Examination for Subsidence of Embankment (Kalaat Landalous Bridge Part)

Soil Layer	Wet Weight	Weight in water	Initial void ratio	Consolidation index	Consolidation Coefficient	Thickness	Initial vertical load	Contact pressure	Influence coefficient	Increase pressure	Sinkage	Subsidence time	
	γt (t/m3)	γ' (t/m3)	e_0	Cc	Cv (cm2/s)	H (cm)	P_0 (tf/m2)	q (tf/m2)	I	$\Delta P=\sigma z$ (tf/m2)	S (cm)	Compaction 80% (month)	Compaction 90% (month)
Surface soil	1.93	0.93	0.75	0.21	8.74E-04	100	0.965	9	0.99	8.91	12.1	1	1
Soft ground	1.78	0.78	0.91	0.31	1.92E-03	3000	13.54	9	0.64	5.76	67.5	208	309
Sandy clay	1.93	0.93	0.73	0.19	1.75E-03	2900	41.08	9	0.38	3.42	6.5	90	134
Total											86.1	208	309

(Source: Preparation based on the geotechnical survey report data of the former preparatory survey)

Table 2-19: Outline Examination for Subsidence of Embankment (GP8 Road Bridge Part)

Soil Layer	Wet Weight	Weight in water	Initial void ratio	Consolidation index	Consolidation Coefficient	Thickness	Initial vertical load	Contact pressure	Influence coefficient	Increase pressure	Sinkage	Subsidence time	
	γt (t/m3)	γ' (t/m3)	e_0	Cc	Cv (cm2/s)	H (cm)	P_0 (tf/m2)	q (tf/m2)	I	$\Delta P=\sigma z$ (tf/m2)	S (cm)	Compaction 80% (month)	Compaction 90% (month)
Surface Soil	1.92	0.92	0.75	0.21	8.74E-04	100	0.96	9	0.99	8.91	12.1	1	1
sand	1.8	0.8	0.6	－	－	400	5.52	9	0.46	4.14	－	－	－
Silty Clay	1.93	0.93	0.73	0.21	1.87E-03	500	10.445	9	0.42	8.91	12.1	5	7
Soft Ground	1.78	0.78	0.91	0.3	1.92E-03	1500	18.62	9	0.29	2.61	12.5	56	83
Sandy Clay	1.93	0.93	0.73	0.19	1.75E-03	2500	36.095	9	0.16	1.44	4.3	165	246
Total											41.0	165	246

(Source: Preparation based on the geotechnical survey report data of the former preparatory survey)

6) Bearing Layer of Structure Foundation

The bearing layers which become the foundation of structure are summarized as shown in **Table 2-20**.
In the Kalaat Landalous bridge part, the bearing layer is not encountered up to depth 45m of boring bottom, and the confirmation of the deeper part is required. Moreover, in El Mabtouh retarding basin BHII06, the silty clay layer with N values 20 or more which can become bearing layer is thin. It is in the state where bearing layer are not confirmed. The confirmation of the depth is required when the pile foundation is needed by bridge improvement.

Table 2-20: Bearing Layer

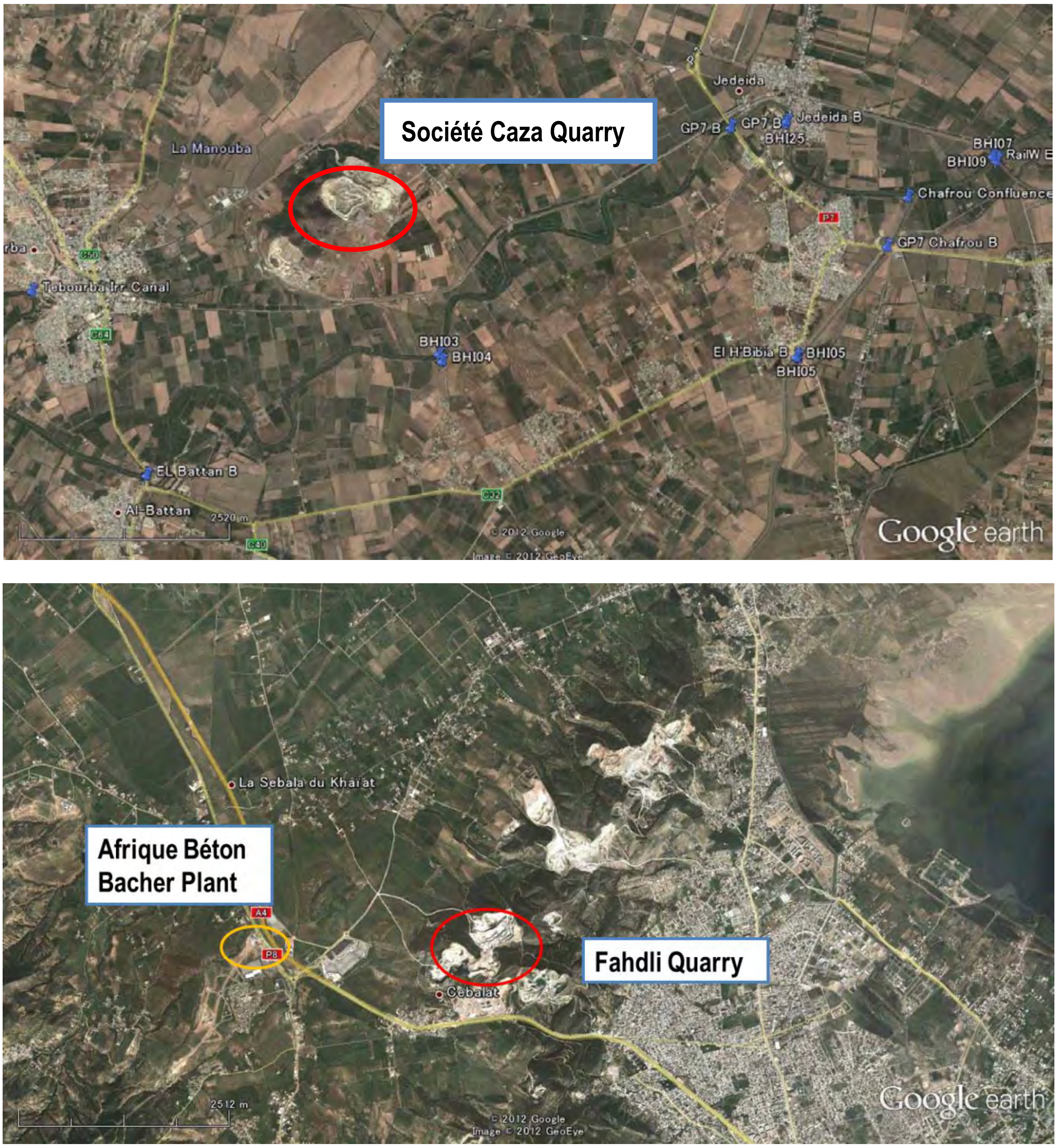
Location	Boring	Soil	N Value	Bearing Layer(ｍ)		
				Surface Depth	Bottom Depth	Thickness
Jedeida Bridge	BHI25	Sand,Base rock	Sand50 & more,Rock 60 & more	13	30(bottom)	17 & more
Railway Bridge	BHI07 (L.bank)	Alternation	30 & more	28	33(bottom)	5 & more
	BHI09 (R.bank)	Silty clay, Sandy clay	20 & more	25	30(bottom)	5 & more
Highway Bridge	BHI22(L. bank)	Sandy clay	20 & more (50 & more	29 38	45(bottom) 45(bottom)	16 & more 7 & more)
	BHI23(L.bank)	Silty clay	20 & more (50 & more	31 41	45(bottom) 45(bottom)	14 & more 4 & more)
	BHI24(R.bank)	Sandy clay	20 & more (50 & more	34 41	45(bottom) 45(bottom)	11 & more 4 & more)
GP8 Road Bridge	BHI14(L.bank)	Silty clay	20 & more (50 & more	29 38	45(bottom) 45(bottom)	16 & more 7 & more)
	BHI15(L.bank)	Sandy clay	20 & more (50 & more	35 41	45(bottom) 45(bottom)	10 & more 4 & more)
	BHI16(R.bank)	Sandy clay	20 & more (50 & more	28 38	45(bottom) 45(bottom)	17 & more 7 & more)
Tobias Bridge	BHI26(R.bank)	Silty clay, Sand	30 & more	42	50(bottom)	18
K. Landalous Bridge	BHI21(R.bank)	Sandy Clay	10 & less (40-45m)	No bearing layer up to 45m (Boring bottom)		
El Mabtouh Reterding Basin	BHII06	Silty Clay	20 & more (26-27m) 30 & more (29-30m)	No confirmation of bearing layer up to 30ｍ (Boring bottom)		

(Source: Preparation based on the geotechnical survey report data of the former preparatory survey)

According to the geotechnical soil survey report of the former preparatory survey, the existing foundation depth of the railway bridge was set to 22m and the highway bridge to 42m. From the examination result in this report, it is considered that the foundation depth of the railway bridge is slightly shallow and the foundation of the highway bridge is installed in sufficiently safe position.

(5) Examination of Structure Materials

In order to examine the proposed site for structure aggregate, quarry sites in Tebouraba and Ariana and concrete plant of Ariana were visited. Their locations are shown in **Fig. 2.1.3-24**. The outline of each facility is shown in **Table 2-21**. All are possible for procurement of required materials.



(Source: Preparation using Google Earth 2012 as base map)

Figure 2-31: Location of Quarry and Concrete Plant

(A) Caza Quarry **(B) Fahdli Quarry**

(Source: This preparatory survey, taking photo in August, 2012)

Figure 2-32: Crushing Equipment and Raw Stone of Caza Quarry and Fahdli Quarry

Table 2-21: Outline of Quarry and Concrete Plant

	Société Caza Quarry(Tebourba)	**Fadhli Quarry (Ariana)**	**Afrique Béton Concrete Plant (Ariana)**
Operation and End Year	1982 (Full operation from 1989) – 2030 (Plan)	1999(Full operation from 2002)- 2016 (Application)	1992(as Construction company), Plant operation from 2001
Area	14ha	18ha	
Material	Marl, Limestone	Marl	Limestone (Transportation from Jebel El Errssas)
Production	3000t/day(12hr in Ramadan period), Ordinary 12-16hr	3000t/day(10hr in Ramadan period) Ordinary 12-16hr	700-750m3/day
Main equipment	Impact Crusher 1 Jaw Crusher 1	Impact Crusher 1	Mixing Car(7-11m3)28, Pump placement car 3
Supply Destination	General civil work, Road, Building, Bridge	General civil work, Road, Building, Bridge	Building, Bridge
Quality Test	Head office, CTEC (Company)	Public organization at application procedure	Laboratory in the plant
Others	Truck scale	Having schedule of truck scale installation	ISO9001 Obtain

(Source: Preparation of this preparatory survey)

About the quality of concrete aggregate, a part of aggregate tests and reference collection are performed by the former preparatory survey. The result is shown in **Table 2-22**.

Table 2-22: Aggregate Test Result of the Former Preparatory Survey

Aggregates	Quarry-run Gravel 0/20	Gravel 4/15	Gravel 14/16	Gravel 20/30	Gravel 14/25
Quarry Location	Jbel Mayana(Eastern Teboruba)				Aliana (Northern Tunis)
Laboratory	Former Preparatory Study (GEOCONSEIL)				LCAE
Density ρ(g/cm3)		2.60	2.56	2.50	
Water absorption ab(%)		2.56	2.54	2.68	
Sand equivalent ES(%)／Liquid limit LL(%)	63.5／20.7				
Los Ageles Test, Abrasion LA(%)	26	20	21	22	24
Micro-Deval Test, Abrasion dry condition (%)／ Abrasion wet condition (%)	29／12				
Deval Test, Abrasion (%)					2.9
Modified Proctor Test, Dry density γd(g/cm3)／Optimum Moisture content Wopt (%)	2,26／6				
Adhesion to bitumen	87				

Remarks; Los Angeles Test based on NT21.21(1990), Micro-Deval Test based on NT21.08(1984), Deval Test based on NF P 18.577, LCAE: Laboratoire Central d'Analyses et d'Essais
(Source: Arrangement from the geotechnical survey report of the former preparatory survey)

From the aggregate test result of the former preparatory survey and the this preparatory survey results, marl and limestone in part are mainly quarried around the study area, and marl shows slightly large abrasion and has the tendency of slightly soft and easily breaking (Refer to **Figure 2-32**). When some improved structure needs high intensity, it is necessary to receive from the quarry produces more hard limestone or to make severe the quality control such as strict sorting of use aggregates and frequent conducting of concrete strength test. In addition, dolomitic limestone sometimes shows alkali aggregate reaction, and it is necessary to check by alkali aggregate reaction examination and to cope with mixing alkali aggregate.

Moreover, in the study area, although there are few sand layers, the sand equivalent test is performed in BHI07 and BHI25 by the geotechnical soil survey of the former preparatory survey. As the result, 5 samples show 46-49% and 1 sample shows 82% among 6 samples. The sand materials of sand layers have rather high content of fine particle, and are not suitable as fine aggregate for concrete. It is necessary to obtain sand produced in quarry.

2.5 Overview of the River in Zone D2

Distance Mark	0 km
Site Name	River Mouth
Photo	Direction: Upstream
Details	

Distance Mark	4 km
Site Name	Delta Bridge Outlet
Photo	Direction: Downstream
Details	View is further downstream than the Delta Bridge

Distance Mark	11 km
Site Name	Tobias Barrage
Photo	Direction: Downstream
Details	River condition after overflowing the Tobias Barrage

Distance Mark	14 km
Site Name	GP8 Bridge Area
Photo	Direction: Downstream
Details	View is downstream from the bridge

Distance Mark	17 km
Site Name	Left bank at 17k
Photo	Direction: Upstream
Details	View is upstream from the left bank

Distance Mark	32 km
Site Name	Left bank at 32k
Photo	Direction: Downstream
Details	Near diversion facility project

Distance Mark	38 km
Site Name	Jedeida Railroad Bridge area
Photo	Direction: Downstream
Details	View is downstream from the bridge

Distance Mark	41 km
Site Name	Jedeida Road Bridge area
Photo	Direction: Downstream
Details	

Distance Mark	42 km
Site Name	Jedeida GP7 Road Bridge area
Photo	Direction: Downstream
Details	View is downstream from the bridge

Distance Mark	57 km
Site Name	Waterway Bridge area
Photo	Direction: Downstream
Details	Relative height of left bank is high, the right bank is low

Distance Mark	65 km
Site Name	Laroussia Dam
Photo	Direction: Downstream
Details	View is downstream from the crown of dam

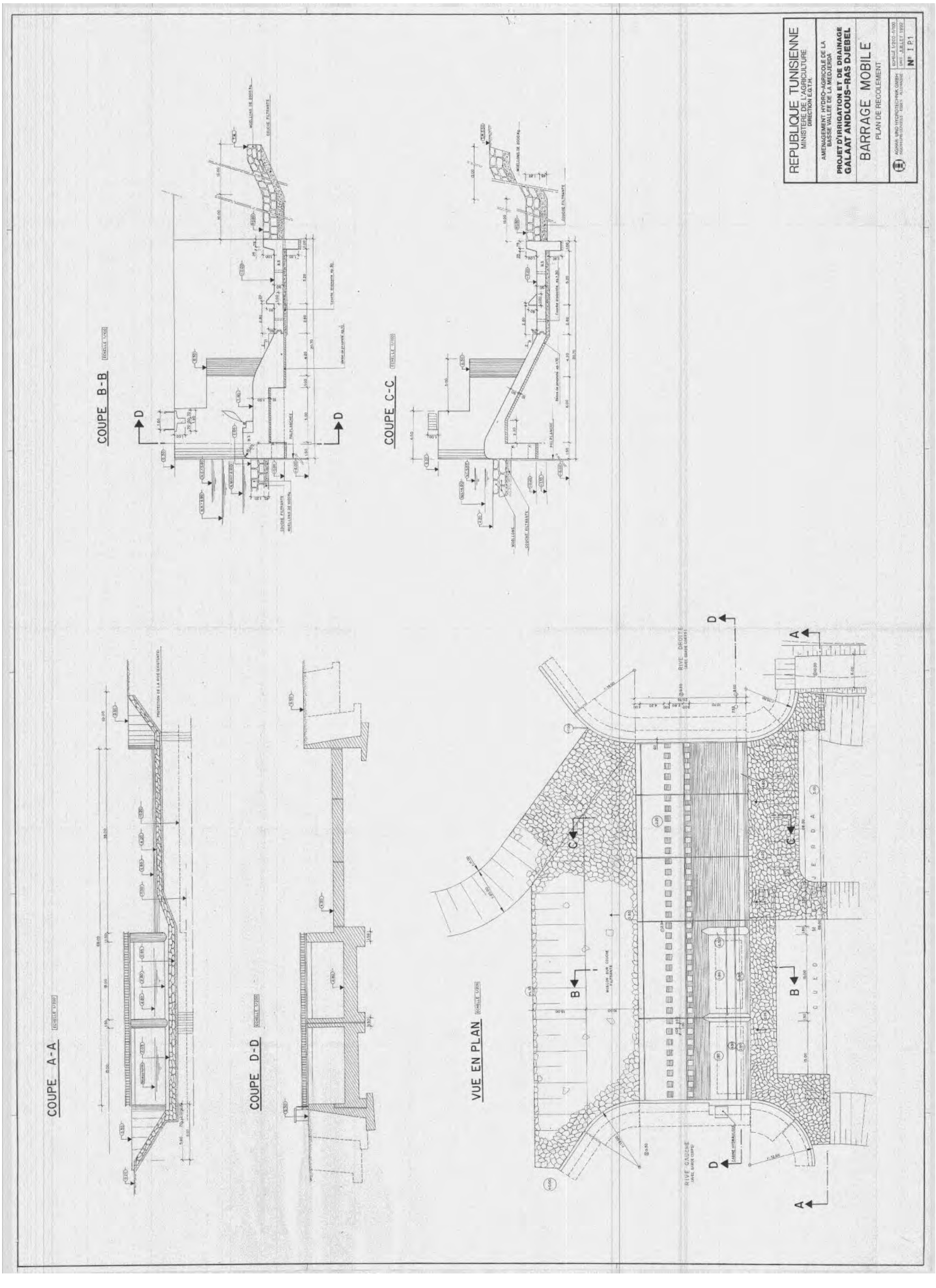
2.6 Overview of Dams in the D2 Zone

(1) Tobias Barrage

<table>
<tr><th colspan="2">Facility Name Tobias Dam MD416 (10.836km)</th></tr>
<tr><td></td><td>・2 tumble gates for left bank
・Fixed weir installed on right bank</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>・Current condition of tumble weir</td></tr>
</table>

	・Current condition of fixed weir
	・Water pump station of intake facility immediately upstream
	・Water intake of intake facility Intake facility upstream of Tobias/water is taken in depending on water level of afflux.

(General Drawing of Tobias Barrage)



(2) Laroussia Dam

Facility Name: **Laroussia Dam** **MD252(64.974km)**	
	・Panorama of upstream region
	・Panorama of downstream region
	・Current flood condition of the upstream region ・Channel installed in upstream region to reuse water for irrigation.

	・Current flood condition of the upstream region

2.7 Current Condition of Bridges in Zone D2

No.1 K.LANDAOUS BRIDGE	
	
・Submersible bridge ・Not covered in this project	

No.2 TOBIAS BRIDGE	
	
・The old bridge is still intact, but because the new bridge and pier are not aligned, it obstructs the cross sectional area ・Constructed in 2011, condition is good; blueprints available (attached to Resource Document)	

No.9 JEDEIDA RAILWAY BRIDGE

・The old bridge (right) is still intact, but because the new bridge and pier are not aligned, it obstructs the cross sectional area

・Vestiges of the afflux during floods on the girder suggest the clearance for the river is insufficient

・Constructed in 1982, blueprints available (attached to Appendix)

No.10 JEDEIDA BRIDGE

・Along with the narrow river channel, there are private houses and schools.

・Constructed in 2011, condition is good, blueprint available (attached to Appendix)

No.11 JEDEIDA OLD BRIDGE

・Constructed of a stone arch and steel railway arch, the stone part is a historically significant structure.

・The stone part located on the narrow river channel particularly obstructs the cross sectional area, remarkably accumulates earth and sand.

No.13	**EL BATTAN BRIDGE**
	

・Historically significant structure
・Largely obstructs the cross sectional area and remarkably accumulates earth and sand

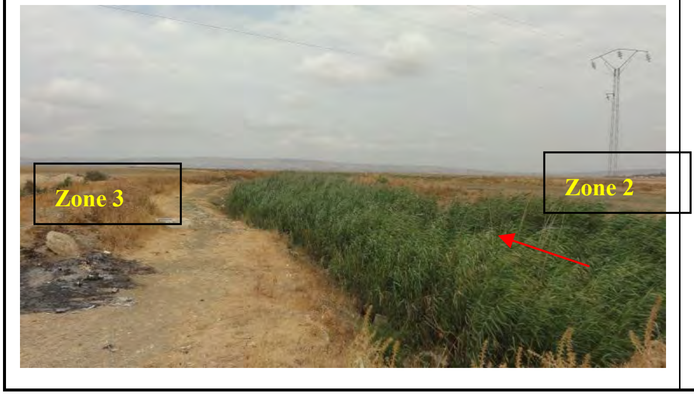
No.15	**GP7 BRIDGE ON CHAFUROU**
	

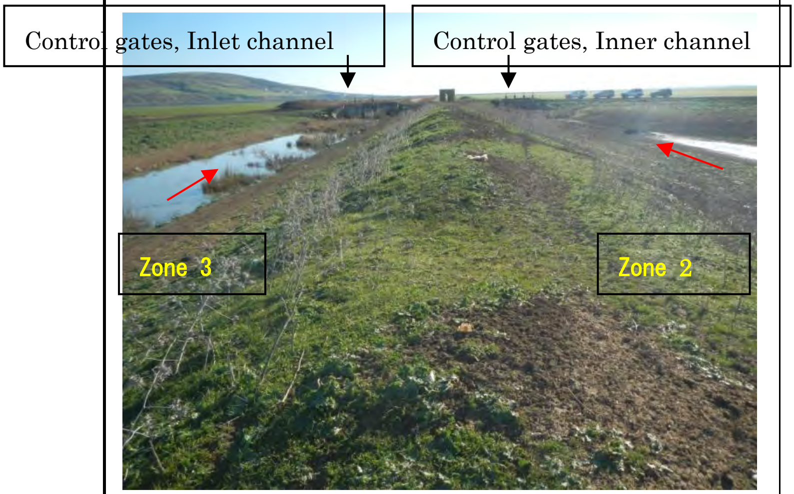
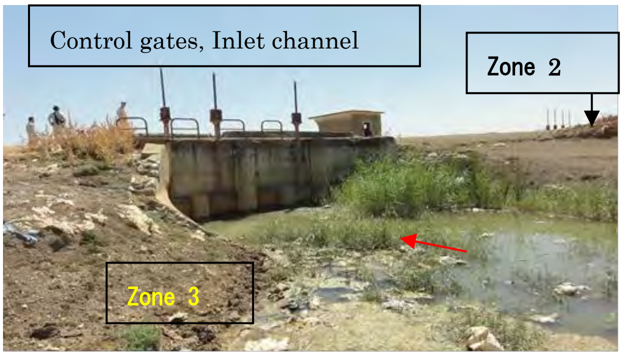
・The old bridge (right) is still intact, but because the new bridge and pier are not aligned, it obstructs the cross sectional area
・The abutment and dike are not aligned, so they obstruct the cross sectional area.

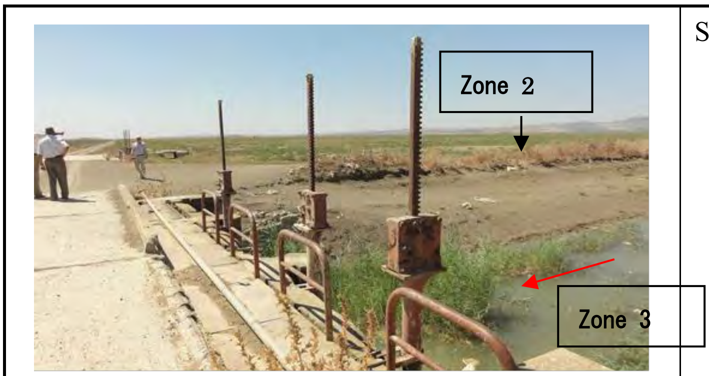
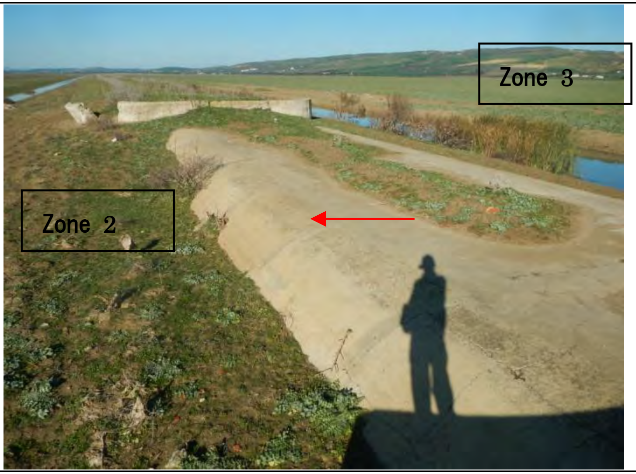
No.21	**FARM BRIDGE**
	

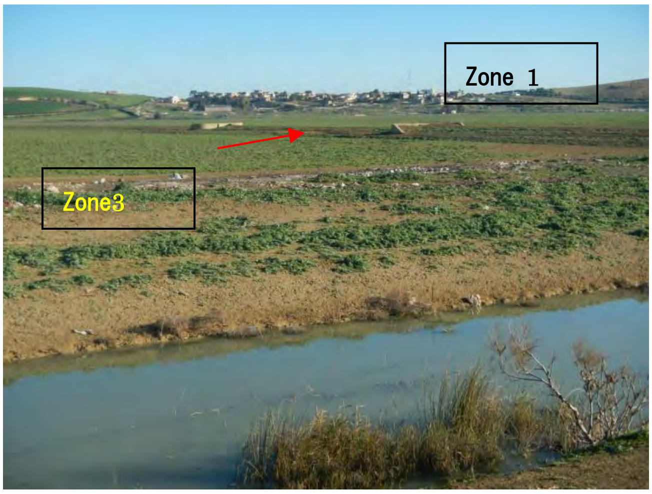
- This small-scale farm bridge located in El Mabtouh appears old
- There are many similar bridges

2.8 Overview of Major Structures in El Mabtouh Retarding Basin

Facility Name	**Inlet channel**
	・An inlet channel established to receive the outflow from the mountainous district of the west bank. ・The water channel is an unsupported excavation.

Facility Name	**Flow control facilities**
	Control gates, Inlet channel (Left, Zone 3) and Control gates, Inner channel (Right, Zone 2)
	・Control gates, Inlet Channel ・It is used to adjust the flow rate of flood effluent retained in Zone 3 ・The three installed gates are currently nonfunctional and not being used. ・There are Control gates, Inner Channel on the other side. It is used to adjust the flow rate of effluent retained in Zone 2 to the drainage.

	Same as above
Facility Name	**Overflow dike facilities**
	Overflow weir and overflow weir with control gates
	Overflow weir

	Overflow weir with control gates
	Fuse levee

Facility Name:	**Box culvert crossing the highway**
	・ The motorway has become an embankment, and a box culvert and bridge are installed where the water channel crosses.

Facility Name	**Outlet channel (crossing the highway)**
	・The outlet channel crosses the highway at the bridge.

Facility Name:	**Outlet channel (crossing the road)**
	・The outlet channel cross the road at the bridge.

Facility Name:	**Confluence facilities to Mejerda river**
	・Backflow prevention gates are installed at confluence points to the main river.

	Same as above
	・Gates are nonfunctional and are currently not being opened and closed. ・The gates are slightly open.
	・A high water channel is established on the foundation height to the side of the water gate facilities (newer than facilities), water overflows to merge with the main river.

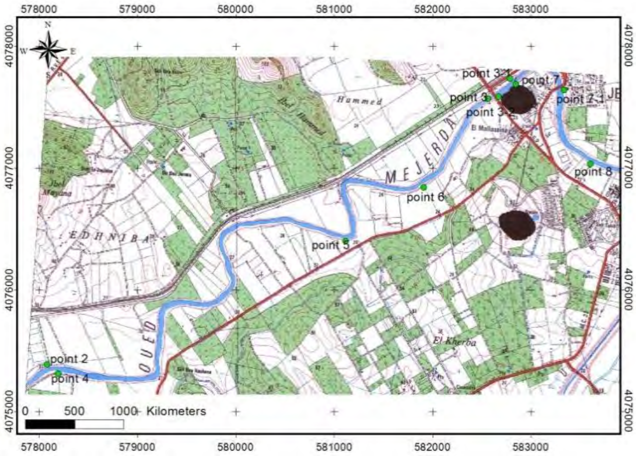
Facility Name	**Flap Gate and Sluice way**
	Sluiceways are installed along the course from diversion channel to drainage channel in Retarding Basin to drain water off the Zone 2 or Zone 3 into waterways under embankment. Flap gate is installed on the side of waterways.
	View from behind the same flap gate.
	In case the scale of sluiceway is large, box culvert is adopted for the structure. Although gates are not installed on the outlet side, it would be necessary to install a sluice gate in case of renewal.

2.9 Survey of Sluiceways Established on the Mejerda Main River in Zone D2

Record of Sluiceway Survey

No.: 3		Name	
Coordinate	N: 4077827.03	E: 582562.24	Altitude

Photos

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway
	

Description

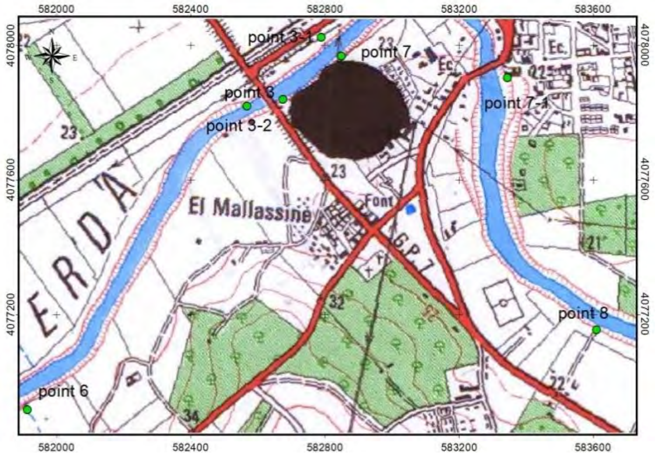
Sluiceway which is not used now

Record of Sluiceway Survey

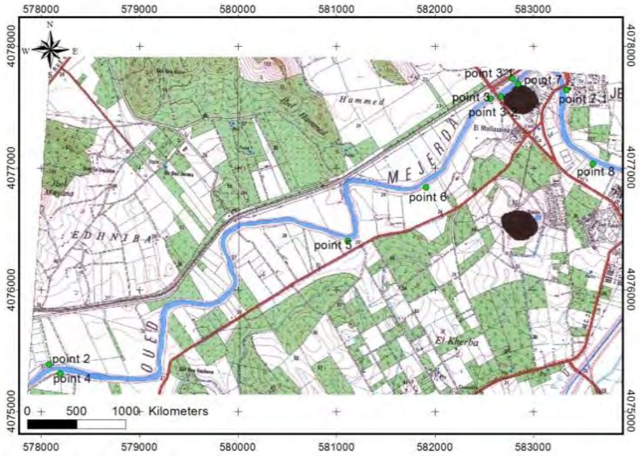
No.: 3-1		Name	
Coordinate	N: 4078024.42	E: 582788.99	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway



Description

Waste water of jdeida city

Diameter pipe is 500 mm

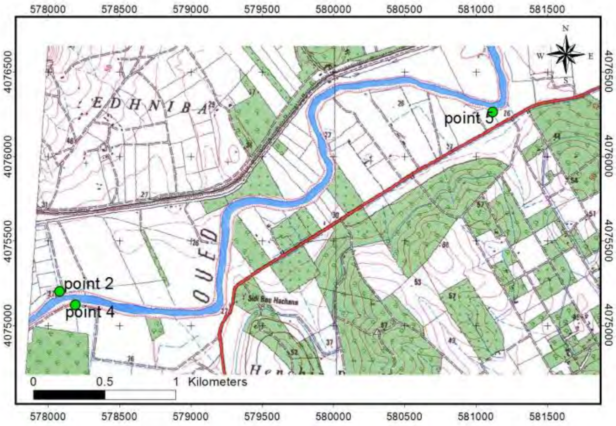
Record of Sluiceway Survey

No.: 4		Name	
Coordinate	N:	E:	Altitude

Photos

Sketch of Mouth Portion and Size Survey

Diagrammatic Sketch of Access to the Sluiceway

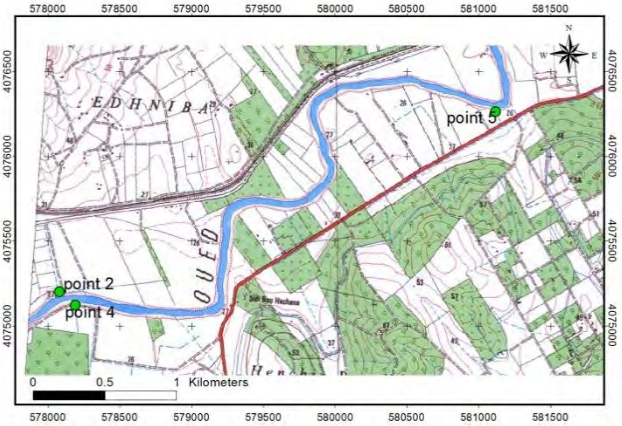
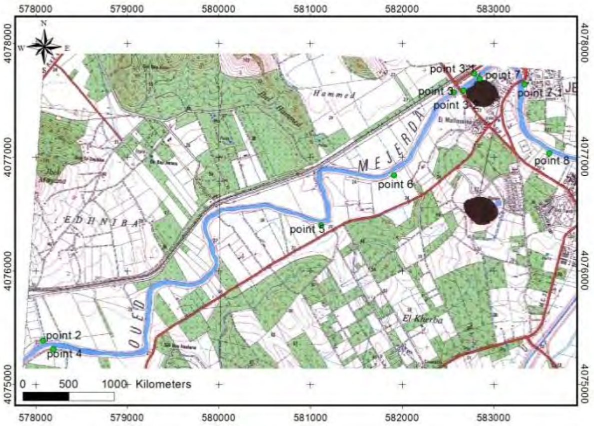


Description

Record of Sluiceway Survey

No.: 5		Name	
Coordinate	N: 76383.10	E: 581116.73	Altitude

Photos

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway
	

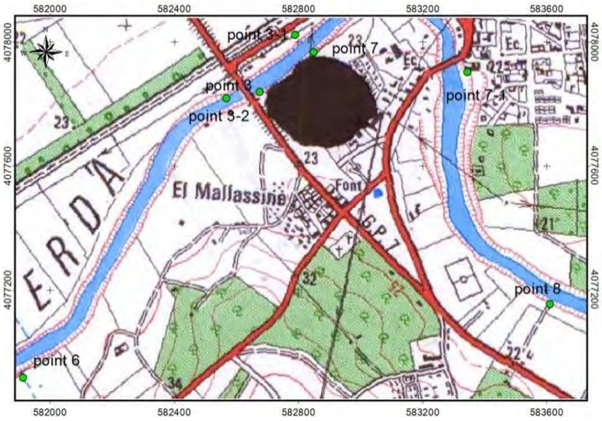
Description

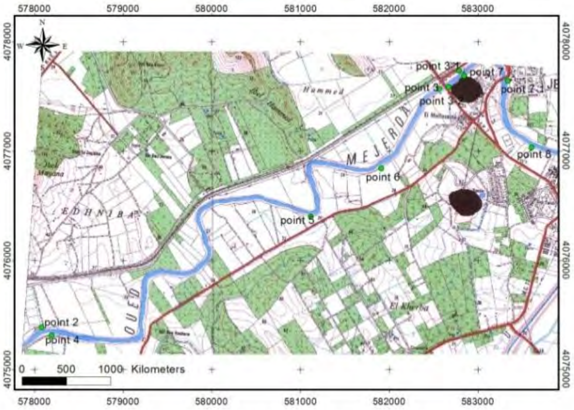
Record of Sluiceway Survey

No.: 7		Name	
Coordinate	N: 4077970.58	E:582839.56	Altitude

Photos

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway





Description

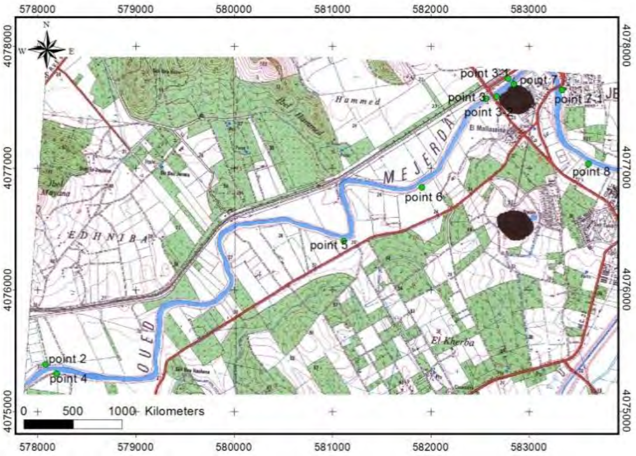
Record of Sluiceway Survey

No.: 8		Name	
Coordinate	N:	E:	Altitude

Photos

Sketch of Mouth Portion and Size Survey

Diagrammatic Sketch of Access to the Sluiceway



Description

Old sluiceway form waste water of Jdeida city
Acording to the habitants it is not used now

Record of Sluiceway Survey

No.: 10		Name	
Coordinate	N: 4079015.530	E: 588177.85	Altitude

Photos

Sketch of Mouth Portion and Size Survey

Diagrammatic Sketch of Access to the Sluiceway

Description

Bridge with two passes

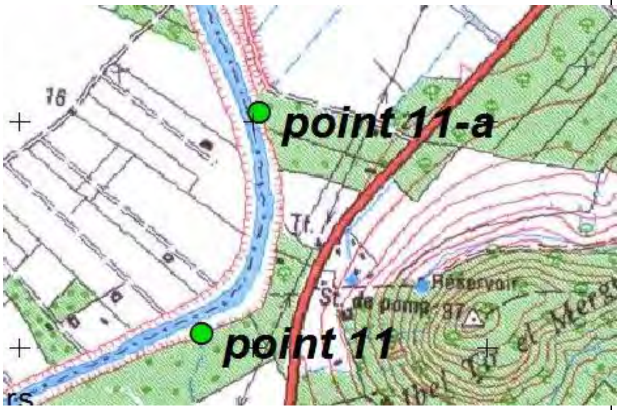
Dimensions: 3.20×1.20

Record of Sluiceway Survey

No.: 11		Name	
Coordinate	N: 4081537.00	E: 589381.55	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway

Description

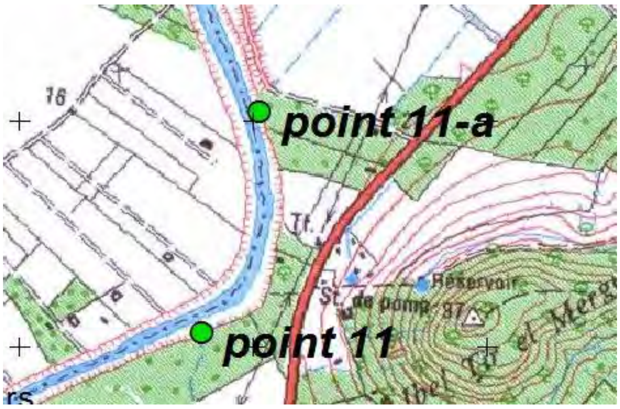
Drainage of water. Dimension: 1.04*0.8

Record of Sluiceway Survey

No.: 11-a		Name	
Coordinate	N: 40482029.64	E: 585910.17	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway

Description

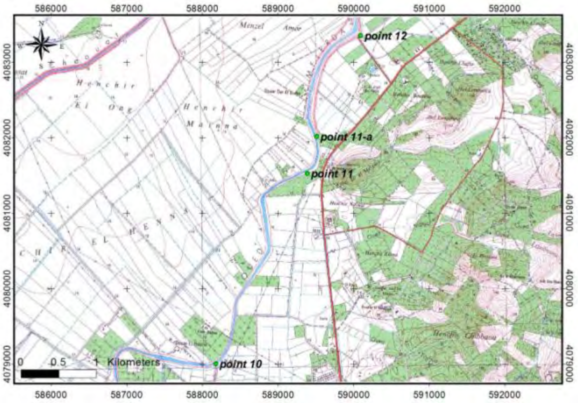
Natural water way serving for evacuating excess water form a reservoir located at the upstream.

Record of Sluiceway Survey

No.:12		Name	
Coordinate	N: 40833369.250	E: 590080.480	Altitude

Photos

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway



Description

A gate for an old channel which was used for irrigation. The network isn't used now for irrigation. We can observe waste water from a tomate manufactory
Dimension : (2.2*1.20)m2

Record of Sluiceway Survey

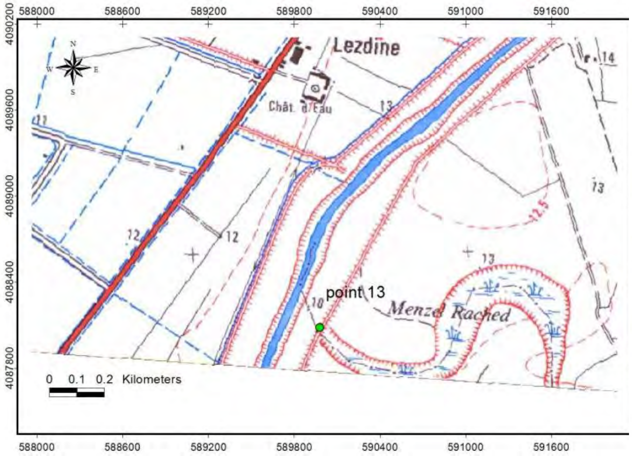
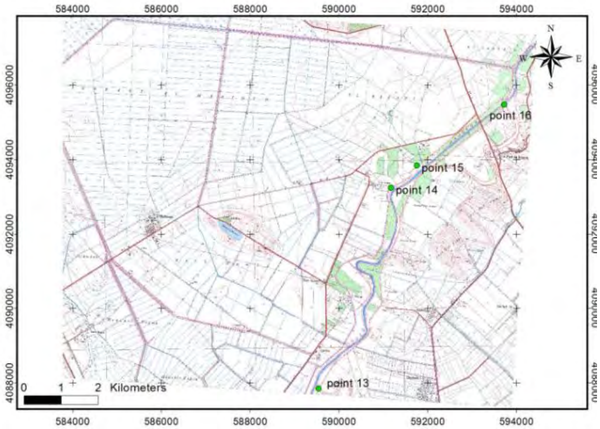
No.: 13		Name	
Coordinate	N: 4087860.83	E: 589609.3	Altitude

Photos


11/08/2012


11/08/2012


11/08/2012

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway
	

Description

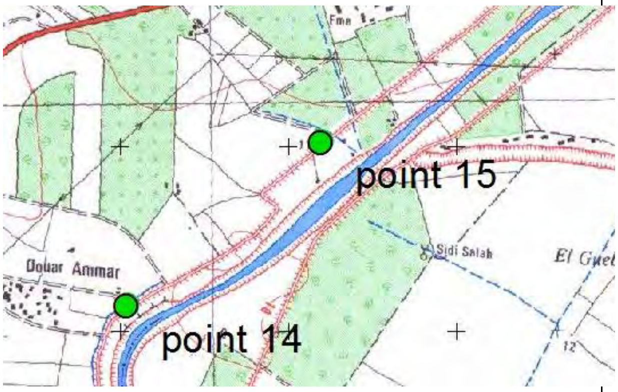
Old trace of Mejerda River
A cutting meander was done in this zone

Record of Sluiceway Survey

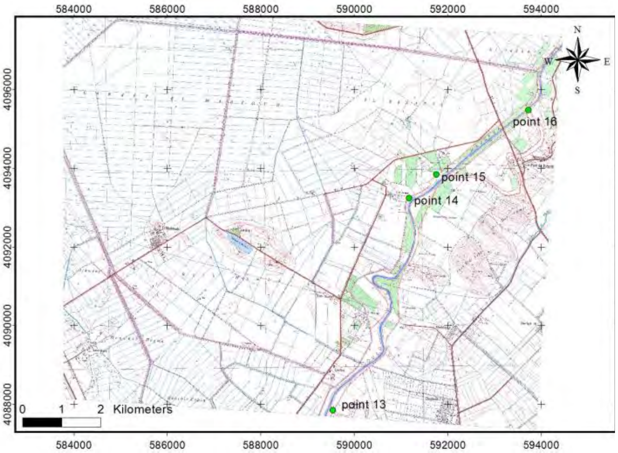
No.: 14		Name	
Coordinate	N: 4093253.62	E:591561.8	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway



Description

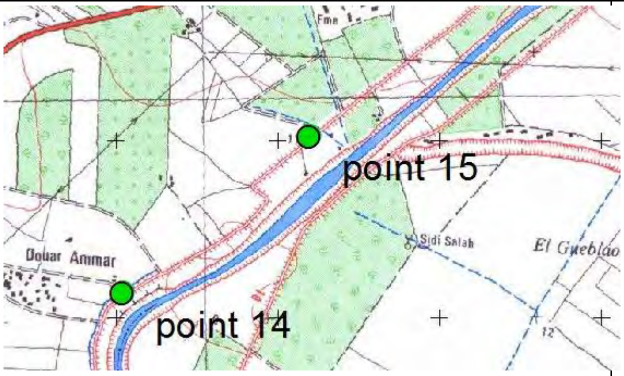
The meander was stabilized by a digue some gabion structure during the seventeenth, and a part of the large bed of the river is cultivated. We can observe a sluiceway pipe from channel irrigation

Record of Sluiceway Survey

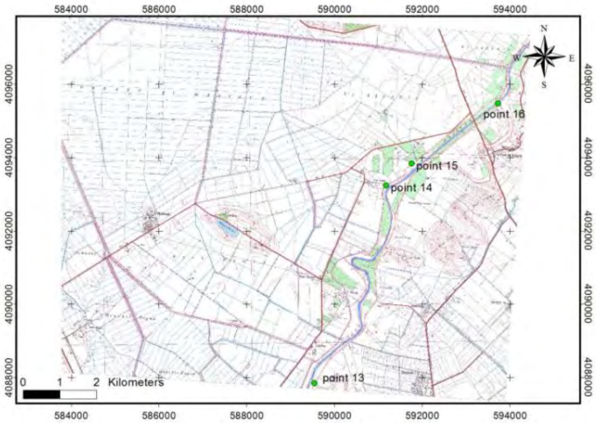
No.: 15		Name	
Coordinate	N: 4093837.200	E: 592246.260	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway

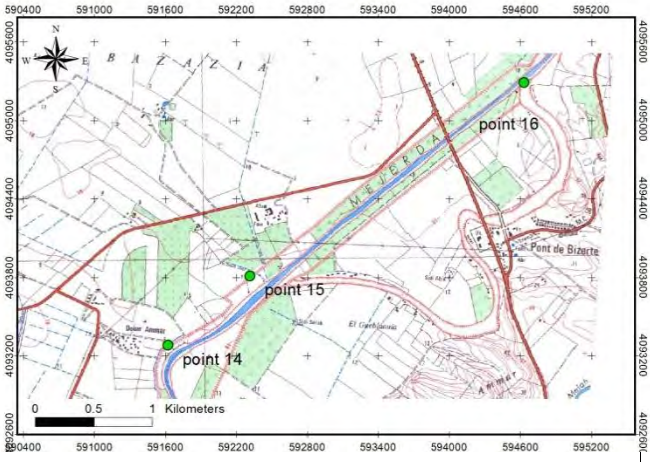


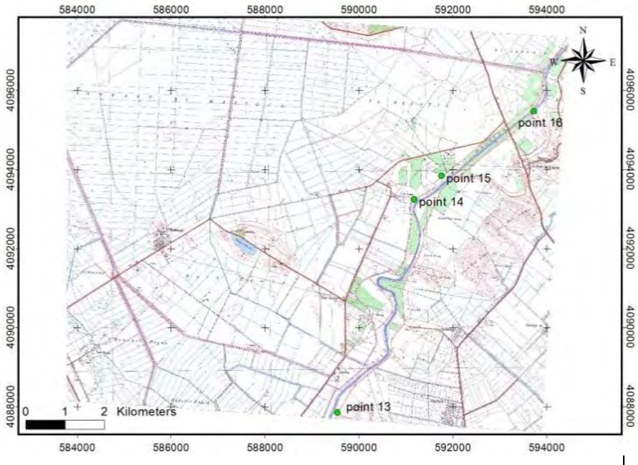
Description

Old water way which is condemned by a dike on the left side of Mejerda

Record of Sluiceway Survey

No.: 16		Name	
Coordinate	N: 4487.10	E: 594584.21	Altitude
Photos			
None			
Sketch of Mouth Portion and Size Survey		Diagrammatic Sketch of Access to the Sluiceway	





Description

The endpoint of cutting meander

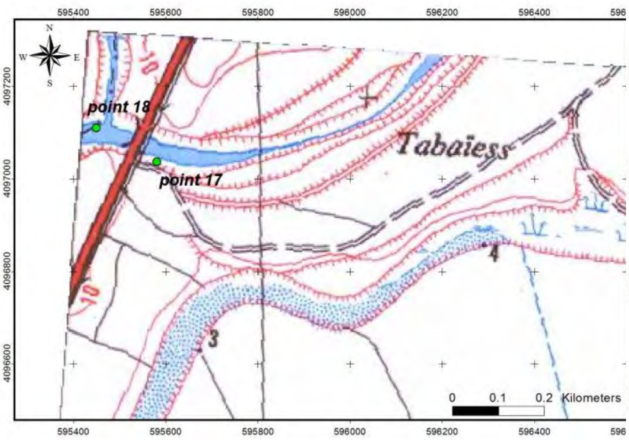
We can see also the old water way

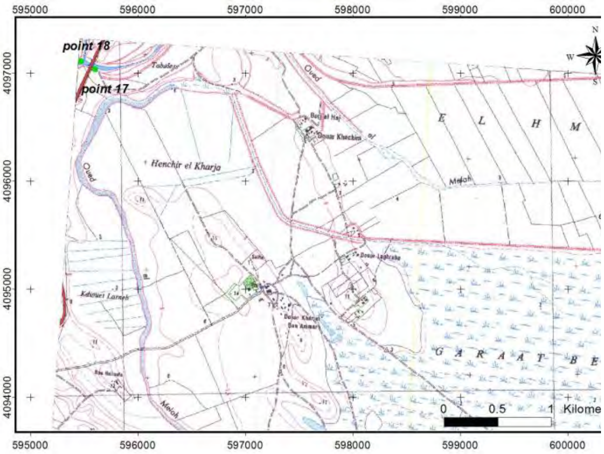
Record of Sluiceway Survey

No.: 17		Name	
Coordinate	N: 4097039.67	E: 4097039.17	Altitude

Photos

Sketch of Mouth Portion and Size Survey	Diagrammatic Sketch of Access to the Sluiceway





Description

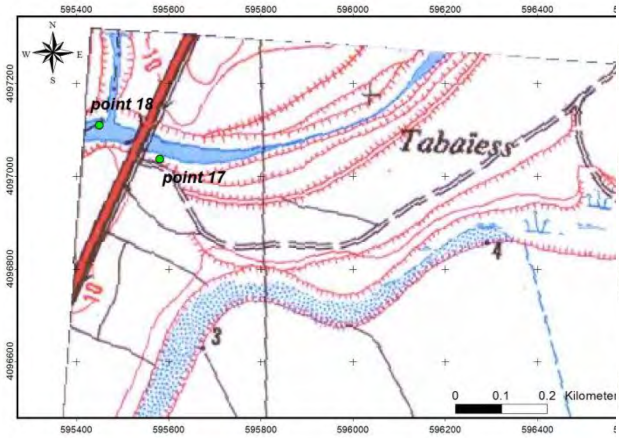
Tobias weir

Record of Sluiceway Survey

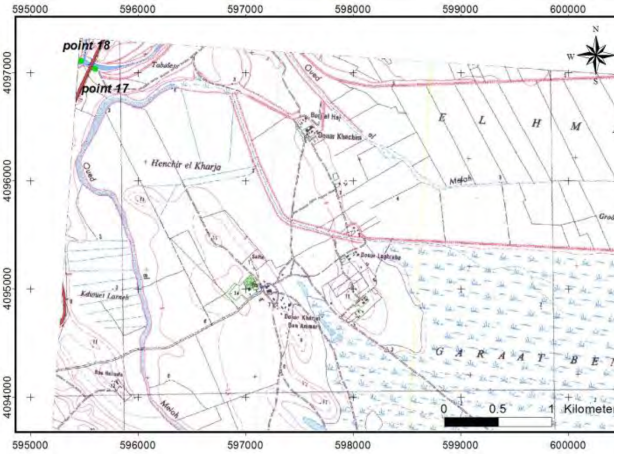
No. 18		Name	
Coordinate	N: 4097115.86	E: 595607.17	Altitude

Photos

Sketch of Mouth Portion and Size Survey



Diagrammatic Sketch of Access to the Sluiceway



Description

The old sluiceway before construction of Tobias weir.

3 Related Documents of Chapter 3 (Current State of Flood Control Measures)

3.1 Donor Field of Water Application Activities in Tunisia

(1) World Bank

The World Bank has aided Tunisia in many ways to date. In the water sector, their greatest contribution was establishing a water supply and network of water and sewerage. Their major projects implemented to date are listed below.

Project Name	Implementation Period	Cost	Project Details
Greater Tunis Sewerage and Reuse Project	1997-2005	107 mil. USD	Improve services by the National Sanitation Utility (ONAS) and the Ministry of Agriculture, Hydraulic Resources and Fisheries (MARHP) by constructing facilities to reinforce the sewerage network and reuse wastewater.
Water Sector Investment Project Phase I (PISEAU1)	2000-2007	258 mil. USD	MARHP constructed a water resource management system to protect water resources and conserve the environment. A joint investment between the World Bank (103 mil. USD) and KfW (17.5 mil. USD) (note:: Water Sector Investment Project Phase II (PISEAU II), see AfDB)
Water Supply & Sewerage Project	1994-2003	110.9 mil. USD	Manages the needs of the National Water Distribution Utility (SONEDE) and ONAS, and reinforces management capability.
Northwest Mountainous Areas Development Project	1993-2001	50.7 mil. USD	The project addresses the important problems of rural poverty and natural resource degradation. Increase agricultural production and income, and reduce sediment in reservoirs.
Urban Water Supply Project	2005-2012	47.15 mil. USD	SONEDE project to improve the water supply system to Tunis and other urban areas.
Tunis West Sewerage Project	2006-2011	71.9 mil. USD	ONAS project to create a sewerage network for western districts in Tunis.
Second Water and Sewerage Sector Project	2009-2015	162.95 mil. USD	Project to increase the demand for drinking water, take measures against the reduction of water resources, and increase access to drinking water by the farming region. Joint investment between AFD and AfDB.
Northern Tunis Wastewater Project	2010-2015	68.6 mil. USD	Project to increase wastewater treatment in the northern districts of Tunis and adeptly reuse effluent.

(2) German Agency for International Cooperation (GIZ)

GIZ has been providing aid to Tunisia since 1975, and currently focuses on economic growth and environmental conservation as an organization. From 1995 to 2004, GIZ implemented a large-scale project named GEORE that coordinates water resources, supervised by the Ministry of Agriculture. The projects below are currently active.

Project Name	Project Details
AERE (Effective Administration of Water Resources) Project - General Coordination of Water Resources	Derivation from the GEORE Project.
Water Measuring Project at the Algerian Border Zone	Implemented by an investment from NEPAD, this project measured water quality and volumes on the Tunisian side of the border.
PISEAU (Water Sector Investment) Project	The main purpose is to newly construct a weather measurement station for the weather and water of the Mejerda River. Joint investment between AFD, World Bank, GITZ, and other organizations.

(3) French Development Agency (AFD)

French Development Agency (AFD) has been active in Tunisia since 1992 and has particularly focused on the field of water use including drinking water for farms and sewerage. AFD has invested a total of 244 million Euro in the field of water use. In recent years, they have been financing at an annual rate of 35 to 40 million Euro.

1) Field of Drinking Water for Farms

AFD has implemented the projects below starting in 1998.

Project Name	Implementation Period	Cost	Project Details
Reliable Supply of Drinking Water to Sahel[2] and Sfax through a Direct Loan to SONEDE Guaranteed by the Government	2001	25 mil. Euro	The capacity for the supply of water between Belli[3] and Sousse[4] doubled, and the water consumption of southlands stabilized during peak periods due to the construction of multiple reservoirs.
Water Supply Financed by Returned Loans as Subsidiary Aid First Project	1998-2004	19 mil. Euro	(Water supply to farming area 9) Drinking water was made suppliable to the 168,000 residents of the farming area. The provision rate to farming areas rose from 75% in April 1999 to 83.3%.
Water Supply Financed by Returned Loans as Subsidiary Aid Second Project	2003-2009	33 mil. Euro	(Water supply to farming area 10) With the goal of supplying drinking water to 124 000 residents, this was continued as a part of the Tenth Project.
Water Supply Financed by Returned Loans as Subsidiary Aid Third Project	2008-2014	21.4 mil. Euro	(Water supply to farming area 11)
Water Sector Investment Project Phase I (PISEAU 1)	2002-2007		Joint investment between AFD, World Bank, and KfW.
Water Sector Investment Project Phase II (PISEAU 2)	2009-2013	102.3 mil.	Contributions made by AfDB: 19.22 mil. Euro, World Bank: 31 mil. USD, and AFD: 61 mil. USD. Of the total, 31.76 mil. Euro went towards the "Water Supply to Farming Areas" component, and 57.46 mil. Euro to Irrigation Work.

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[2] Sahel
[3] Belli
[4] Belli

2) Field of Water and Sewerage

French Development Agency (AFD) gave funds to ONAS to repair and expand existing sewerage facilities for low-income neighborhoods to enlarge farming areas. The following projects were implemented.

a) National Sanitation Project for Low-Income Neighborhoods (PNAQP)

Continuing the national project for socio-economic development, this project was implemented from 1989-2013. In the end, 1,008 districts were serviced with a sewerage network, benefitting 208,000 households and 1.4 million people. These investment projects mobilize a total of 200,004,500 TND (134 million Euro). Active projects include pilot programs to service 15 settlements with sewerage.

b) Repair and Expansion Projects

The following two projects were constructed to meet the need to repair saturated wastewater purification plants and sewerage networks.

	Relevant Projects	Details
1	Facility Maintenance for the Expansion of Sewerage Capacity	Agreed to finance 80 million Euro during 2007-2012.
2	Wastewater Purification Plant (STEP) Maintenance for the Expansion of Sewerage Capacity	In December 2008, a joint investment of 18.5 million Euro between KfW and the European Commission Neighborhood Investment Facility was approved by the AFD National Committee.

c) Lowering Interest Rates on Loans for Installing Corporate Decontamination Equipment

To lower the interest rates on loans for installing corporate decontamination equipment in 2007, the KfW cooperated with the European Commission to establish a 40 million Euro ceiling on loans for the three banks in Tunisia. These loans supplement the decontamination fund FODEP, which urge private enterprises to curb corporate activities that impact the environment (water, atmosphere, solid waste) through this investment[5].

3) Supporting the Government Body of Tunisia as a Partner

AFD works to support the coordination of water resource management with the following three partners.

a) Ministry of Agriculture

Supported the Ministry of Agriculture (MOA) by contributing to the Water Sector Investment Project (PISEAU) (45 million Euro), a joint investment between AfDB and World Bank as well as the River Basin Management Project (40 million Euro). These projects improve the supply and effects of water on agriculture, monitors water resource conditions, and preserves Tunisian basins from negative influences.

b) ONAS

Supported ONAS in the national project to manage wastewater of common residential areas and to expand and repair sewerage networks.

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[5] Source: AFD Resource: Tunisian Water Sector: Challenge and Education

c) SONEDE

Supported SONEDE by managing the water network in farming areas and national project to reinforce the productive competence of SONEDE.

4) Role of French Global Environment Facility (FFEM)

The role of the FFEM should be noted. The AFD serves as their secretariat, and they focus on water saving agriculture and the maintenance of systems.

(4) African Development Bank (AfDB)

AfDB has invested in various projects in Tunisia in the field of water use, as noted in the following.

1) Water Sector Investment Project Phase II (PISEAU II)

Started in 2009, this project is scheduled to be implemented over five years. Project costs total to 102.3 million Euro, of which the AfDB has contributed 19.22 million Euro.

2) "EAU2050" Project based on the long-term outlook of water demand in Tunisia

This long-term strategy is associated with PISEAU II, and is an opportunity to tackle the issues of technology, capital, human resources, and system necessary Tunisia to resolve water shortage. The project implementation period is 3 years, and the total cost is estimated to be 1.52 million Euro. The African Facility for Water will fund 78% of that total. The main details of the project are as follows.

a) Create an implementation framework
b) Establishing a prospect and strategy for 2050
c) Creating a TOR, master plan, and action plan
d) Project management

(5) European Funds

Two European Funds - European Investment Bank(EIB/BEI) and Neighborhood Investment Facility (NIF, FIV in French) - are active in Tunisia.

1) European Investment Bank (EIB/BEI)

EIB has financed the relevant projects below.

	Relevant Projects	Fund Period	Fund Amount
1	3 projects to supply water to Sahel and the eastern coast of Sfax (SONEDE)	2001	95 million Euro
2	Project with the objective to treat collected wastewater in each urban area - "ONAS 4"	2006	90 million Euro

2) Neighborhood Investment Facility (NIF/FIV)

NIF is a financial mechanism that was started in May 2008 as a European Neighborhood Policy (ENP). It aims to finance capital-intensive infrastructure projects in the EU covered by the ENP in sectors such as transport, energy, the environment, and social issues through grants and loans, and also supports the development of the private sector (particularly smaller enterprises). The main project and implemented period is as follows.

Relevant Project	Implementation Period	Amount	Details
Repair and expansion of 19 purification plants and 130 pump stations	2008 - 2009	8 million Euro (grant aid)	Project to improve the living environment of residents by protecting water quality and the environment from pollution. (Note: Project Leader: KfW, Other contributor: AFD, Total project cost: 127.8 million Euro)

(Details: http://ec.europa.eu/europeaid/where/neighbourhood/regionalcooperation/irc/investment_fr.htm)

(6) Arab Fund for Economic and Social Development (FADES)

FADES has provided a large sum in funds towards dam construction. Projects are specifically listed as follows.

	Relevant Projects	Implementation Period	Fund Amount
1	Constructed 6 large scale dams with a total capacity of 77 Mm^3 (Rmil, Breck[6], El Hma[7], El Abid[8], Zerga[9], Sfisfa[10])	2000 - 2006	120 million USD
2	Constructed 6 large scale dams with a total capacity of 117 Mm^3 (Gamgoum[11], El Harka[12], Melah[13], Tine[14], Douimis[15], Ziatine[16])	2002 - 2011	

Source: High level conference on water for agriculture and energy in Africa

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[6] Breck
[7] El Hma
[8] El Abid
[9] Zerga
[10] Sfisifa
[11] Breck
[11] El Hma
[11] El Abid
[11] Zerga
[11] Sfisifa
[11] Gamgoum
[12] El Harka
[13] Melah
[14] Tine
[15] Douimis
[16] Ziatine

(7) Japan International Cooperation Agency (JICA)

Entered a LA as loan assistance to implement the renovation project of the water supply network of suburban areas in 2011. Also entered an exchange of notes as grant aid for the desalination of underground water in southlands project in 2009.

JICA has also entered LAs for the Jendouba Water Supply Project in 2006 and the Water Conveyance to Northern Regions Project in 2003.

Renovation Project of Water Supply Network in Suburban Areas	National Water Distribution Utility (SONEDE)	2011 LA	609.4 billion yen	Loan Assistance
Contributed to the revitalization of regional economy and improved living conditions by improving the 32 existing water supply facilities in the suburban areas of Tunisia to increase supply capacity for water demands in the future and improve stability. Civil engineering work was done and materials were procured for the repair and expansion of existing water supply facilities throughout Tunisia.				
Desalination of Underground Water in Southlands Project		2009 LA	1 billion yen	Grant Aid
Constructed plant to desalinate pumped underground water high in salinity by using reverse osmosis membrane to secure a stable water supply for the Ben Gardane district, a southern Tunisian town with a remarkable shortage of water.				
Jendouba Water Supply Project	Ministry of Agriculture	2006 LA	5.412 billion yen	Loan Assistance
Aimed to improve living conditions and revitalize the regional economy by supplying water though water conveyance and drainage networks to the northwestern farming region of Tunisia, where the rate of water supply is lowest. Loans associated with this project was allocated towards the water supply facility and procurement of related equipment (pumps, drainage pipes, etc.).				
Water Conveyance to Northern Regions Project		2003 LA	8.026 billion yen	Loan Assistance
Provided the necessary capital for channel construction (extended approx. 90 meters) and expansion of existing pump stations in the northern part of Tunisia to create a supply of superior drinking water, industrial water, and irrigation water for Greater Tunis, the capital of Tunisia, and surrounding areas. Implementing this project should increase the population supplied with water as it has improved from 4.4 million people (2002) to 5.6 million people (2010).				

4 Related Documents of Chapter 4 (Basic Design of Bridge)

4.1 Specifications of current bridges

No.	Bridge Name	Channel		Route	Bridge Length	Bridge Width	Remarks
		Name	Distance				
1	K.LANDAOUS BRIDGE	Medjerda	4.664	Rue Sadok Belhadi	19.600	8.750	
2	TOBIAS BRIDGE	Medjerda	10.828	MC50	87.400	10.500	
3	TOBIAS OLD BRIDGE	Medjerda	10.836	MC50	81.400	5.100	New bridge and location of piers do not match up
4	GP8 BRIDGE OVER OUED MEJERDA	Medjerda	13.728	GP8	145.200	9.040	
5	A4 MOTORWAY BRIDGE	Medjerda	16.017	MOTORWAY A4	126.500	14.500	
6	FOOTBRIDGE	Medjerda		Sidewalk	60.000	1.200	Wooden suspension bridge
7	WATER PIPE BRIDGE	Medjerda	34.440	Water supply	-	5.540	
8	JEDEIDA RAILWAY OLD BRIDGE	Medjerda	37.848	RAILWAY	60.500	4.160	New bridge and location of piers do not match up
9	JEDEIDA RAILWAY BRIDGE	Medjerda	37.834	RAILWAY	63.000	10.000	Girders show evidence of afflux from flooding
10	JEDEIDA BRIDGE	Medjerda	41.071	RVE507	87.200	12.000	
11	JEDEIDA OLD BRIDGE	Medjerda	41.091	RVE507	64.500	5.600	Historical bridge over narrow channel
12	JEDEIDA BRIDGE ON GP7	Medjerda	41.926	GP7	73.600	11.300	
13	EL BATTAN BRIDGE	Medjerda	53.111	MC64	94.070	8.500	Historical bridge
14	TEBOURBA IRRIGATION CANALS BRIDGE	Medjerda	56.899	IRRIGATION CANALS	125.000	5.540	
15	GP7 BRIDGE ON CHAFUROU	Chafurou		GP7	38.200	11.000	Bridge abutments located in flood channel
16	GP7 OLD BRIDGE ON CHAFUROU	Chafurou		GP7	-	-	New bridge and location of piers do not match up
17	EL H'BIBIA BRIDGE	Chafurou		Local Road	16.900	8.140	
18	Bridge on the local road	Mabtouh		Local Road	20.700	5.700	
19	FARM BRIDGE ON Driving CHANNEL	Mabtouh		Farm Road	-	-	Bridge for small farm road
20	FARM BRIDGE ON Driving CHANNEL	Mabtouh		Farm Road	-	-	Bridge for small farm road
21	FARM BRIDGE	Mabtouh		Farm Road	-	-	Bridge for small farm road
22	MC50 EL MABTOUH BRIDGE	Mabtouh		MC50	20.460	14.610	
23	FARM BRIDGE ON Oued Mabtouh	Mabtouh		Farm Road	-	-	Bridge for small farm road
24	A4 BRIDGE OVER Mabtouh	Mabtouh		MOTORWAY A4	52.600	14.000	
25	FARM BRIDGE ON Oued Mabtouh	Mabtouh		Farm Road	-	-	Bridge for small farm road
26	FARM BRIDGE ON Oued Mabtouh	Mabtouh		Farm Road	-	-	Bridge for small farm road
27	GP8 BRIDGE AND ROAD OVER Mabtouh	Mabtouh		GP8	36.500	9.900	
28	FARM BRIDGE ON Oued Mabtouh	Mabtouh		Farm Road	-	-	Bridge for small farm road
29	FARM BRIDGE ON Oued Mabtouh	Mabtouh		Farm Road	-	-	Bridge for small farm road

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

					Decision
No. Name		1. K.LANDAOUS BRIDGE	Maximum span	6.20 (m)	Verification digit margin
			Total width	8.75 (m)	NG
Route Name		RueSadok Belhadi	Effective width	8.20 (m)	Plan for renovation
Location		QaL'at al Andalus	Planar shape	right bridge	☐ No measures
Year of const.		unknown	Type of pavement	Asphalt	☐ Demolish
Structure format		Reinforced concrete box culvert	Pavement thickness	unknown (mm)	■ Reconstruction
			Substructures	5 (substructures)	☐ Improvement
Bridge length		19.6 (m)	Purpose of the bridge	Main road	☐ Other
Spans		4 (spans)	Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Medjerda	Surrounding environment Purpose	Arable land	☐ Excavation
	distance	4.664 (km)	Detour	No	■ widening
	H.W.L (NGT) 10 years	3.67	Historical value	No	☐ banking
	100 years	6.20	Road surface	1.93 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	660	Lower surface of the deck	1.33 (NGT)	☐ Other
	100 years	780	Margin	-2.34 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	■ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	■ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	■ Full	☐ Other
	Main girder	The number of girder	1	Height (m)	0.30	
	Angle	Skew (deg.)	73	Crossing (deg.)	-	
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	■ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar (m)	Longitudinal	0.37	Transverse	unknown	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	■ Other		
	Height (m)	Parapet	-	Wall	-	
	Width of abutment (m)	unknown				

Location map

Deterioration & damage	Condition	Good
Main Deterioration	無し	

Construction Overview

1.Widening channel & Reconstruction

Other Important Issues

冠水橋のため架け替え

Pictures of Site


Picture-1 Deck surface


Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

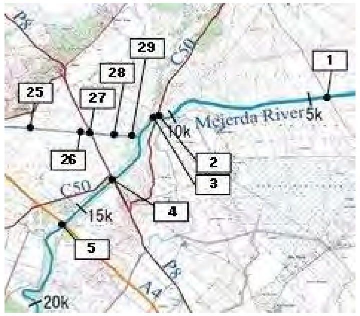
Basics

					Decision
No. Name		2. TOBIAS BRIDGE	Maximum span	29.10 (m)	Verification digit margin
			Total width	10.50 (m)	OK
Route Name		MC50	Effective width	9.80 (m)	Plan for renovation
Location		El Kantara	Planar shape	right bridge	■ No measures
Year of const.		2011	Type of pavement	Asphalt	☐ Demolish
Structure format		Precast I-girders with on-site concrete slab 3 isostatic spans	Pavement thickness	90.00 (mm)	☐ Reconstruction
			Substructures	4 (substructures)	☐ Improvement
Bridge length		87.4 (m)	Purpose of the bridge	Main road	☐ Other
Spans		3 (spans)	Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Medjerda	environ Purpose	Arable land	■ Excavation
	distance	10.828 (km)	Detour	No	☐ widening
	H.W.L (NGT) 10 years	7.09	Historical value	No	☐ banking
	100 years	9.85	Road surface	12.43 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	660	Lower surface of the deck	9.68 (NGT)	☐ Other
	100 years	1100	Margin	2.59 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	■ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	4	Height (m)	1.80	
	Angle	Skew (deg.)	90	Crossing (deg.)	-	
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	φ1.0	Transverse	φ1.0×3	
	Height (m)	Pier	8.55	beam	1.20	
Abutment	Material	■ RC	☐ Stone	☐ Other		
	Form	■ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet	2.26	Wall	1.20	
	Width of abutment (m)	10.50				

Location map



Deterioration & damage	Condition	Good
Main Deterioration	Nothing	

Construction Overview

1.Excavation & Corrosion measures

Other Important Issues

2011架設の新設橋である。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		3. TOBIAS OLD BRIDGE		Maximum span	15.20 (m)	Verification digit margin
				Total width	5.10 (m)	unknown
Route Name		MC50		Effective width	3.60 (m)	Plan for renovation
Location		El Kantara		Planar shape	right bridge	☐ No measures
Year of const.		Berore 1948		Type of pavement	Concrete	☐ Demolish
Structure format		Girder type reinforcrd concrete bridge with 5 spans		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	6 (substructures)	☐ Improvement
Bridge length		81.4 (m)		Purpose of the bridge	Nonuse	☐ Other
Spans		5 (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Medjerda		environ Purpose	Arable land	■ Excavation
	distance	10.836 (km)		environ Detour	No	☐ widening
	H.W.L (NGT)	10 years	7.10	Historical value	No	☐ banking
		100 years	9.85	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	660	Lower surface of the deck	unknown (NGT)	☐ Other
		100 years	1100	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	■ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	2		Height (m)	3.30
	Angle	Skew (deg.)	90		Crossing (deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	■ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	0.50	Transverse	5.10	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet	unknown	Wall	unknown	
	Width of abutment (m)	5.10				

Location map

Deterioration & damage	Condition	Not good
Main Deterioration	路面のひび割れ、滞水、鋼製高欄の劣化	

Construction Overview

1. Demolish

Other Important Issues

①桁下に添架管有り(未使用)。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name	4.	GP8 BRIDGE OVER OUED MEJERDA	Maximum span	16.10 (m)	Decision	Verification digit margin
			Total width	9.04 (m)		OK
Route Name	GP8		Effective width	8.50 (m)		Plan for renovation
Location	El Kantara		Planar shape	skew bridge		☐ No measures
Year of const.	Berore 1973		Type of pavement	Asphalt		☐ Demolish
Structure format	9 isostatic reinforced concrete spans		Pavement thickness	90.00 (mm)		■ Reconstruction
			Substructures	10 (substructures)		☐ Improvement
Bridge length	145.2 (m)		Purpose of the bridge	Main road		☐ Other
Spans	9 (spans)		Sidewalk	Yes		Plan for improvement of channel
Intersection property: channel	Medjerda		environ: Purpose	Arable land		■ Excavation
distance	13.728 (km)		environ: Detour	No		☐ widening
H.W.L (NGT)	10 years	8.54	Historical value	No		☐ banking
	100 years	11.40	Road surface	12.38 (NGT)		☐ Removal of sediment
Discharge (m^3/sec)	10 years	660	Lower surface of the deck	10.11 (NGT)		☐ Other
	100 years	600	Margin	1.57 (m) (10 years)		☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone		
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other		
	Cross-sectional shape	☐ I beam	■ T beam	☐ Box/Hollow	☐ Full	☐ Other		
	Main girder	The number of girder	2	Height (m)	3.30			
	Angle	Skew (deg.)	75	Crossing (deg.)	-			
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other		
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	■ Rahmen	☐ Other		
	Width of Pillar (m)	Longitudinal	0.60	Transverse	0.6×2			
	Height (m)	Pier	unknown	beam	unknown			
Abutment	Material	■ RC	☐ Stone	☐ Other				
	Form	☐ Inverted T type	☐ Gravity type	■ Other				
	Height (m)	Parapet	unknown	Wall	unknown			
	Width of abutment (m)	8.20						

Location map

Deterioration & damage	Condition	Not good
Main Deterioration	支間中央の曲げひびわれ、支点付近のせん断ひびわれ、コンクリート剥離、鉄筋露出、鋼材腐食	

Construction Overview

1. Excavation
2. Reconstruction(1.のみでは困難の場合)

Other Important Issues

①劣化･損傷程度が大きい。
②交通量が多く、架け替え時は仮橋が必要。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		5. A4 MOTORWAY BRIDGE		Maximum span	22.50 (m)	Verification digit margin
				Total width	14.50 (m)	OK
Route Name		MOTORWAY A4		Effective width	14.00 (m)	Plan for renovation
Location		El Kantara		Planar shape	skew bridge	■ No measures
Year of const.		2002		Type of pavement	Asphalt	□ Demolish
Structure format		6 isostatic reinforced concrete spans		Pavement thickness	unknown (mm)	□ Reconstruction
				Substructures	7 (substructures)	□ Improvement
Bridge length		126.5 (m)		Purpose of the bridge	MOTORWAY	□ Other
Spans		6 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Medjerda		environ Purpose	Arable land	■ Excavation
	distance	16.017 (km)		environ Detour	No	□ widening
	H.W.L (NGT)	10 years	9.69	Historical value	No	□ banking
		100 years	12.05	Road surface	13.98 (NGT)	□ Removal of sediment
	Discharge (m^3/sec)	10 years	660	Lower surface of the deck	11.98 (NGT)	□ Other
		100 years	600	Margin	2.29 (m) (10 years)	□ No measures

Bridge survey

Superstructure	Material	■ PC	□ RC	□ Metal	□ Composite	□ Stone
	Form	□ Simple	■ Continuous	□ Culvert	□ Arch	□ Other
	Cross-sectional shape	■ I beam	□ T beam	□ Box/Hollow	□ Full	□ Other
	Main girder	The number of girder	14		Height (m)	1.80
	Angle	Skew (deg.)	78		Crossing (deg.)	-
Peir	Material	■ RC	□ Metal	□ Composite	□ Stone	□ Other
	Form	□ Single column	□ Bearing wall	■ Pile bent	□ Rahmen	□ Other
	Width of Pillar (m)	Longitudinal	φ2.0	Transverse	φ2.0×4	
	Height (m)	Pier	unknown	beam	unknown	
Abutment	Material	■ RC	□ Stone		□ Other	
	Form	■ Inverted T type	□ Gravity type		□ Other	
	Height (m)	Parapet	2.10		Wall	unknown
	Width of abutment (m)	12.00				

Location map

Deterioration & damage	Condition	Good
Main Deterioration	1999-2002架設の新橋のため、損傷なし。	

Construction Overview

1.Excavation

Other Important Issues

①1999-2002架設
②上下線分離の橋梁である。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		6. SOUTHERN FOOTBRIDGE		Maximum span	unknown (m)	**Decision** Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Sidewalk		Effective width	unknown (m)	Plan for renovation
Location		Sidi Thabet		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	No pavement	■ Demolish
Structure format		Simple footbridge?		Pavement thickness	0.00 (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Side Walk	☐ Other
Spans		unknown (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Medjerda	environ	Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	No	☐ widening
	H.W.L (NGT)	10 years 17.51		Historical value	No	☐ banking
		100 years 19.40		Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years 660		Lower surface of the deck	unknown (NGT)	■ Other
		100 years 950		Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder			Height (m)	
	Angle	Skew (deg.)			Crossing (deg.)	
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC		☐ Stone		☐ Other
	Form	☐ Inverted T type		☐ Gravity type		☐ Other
	Height (m)	Parapet			Wall	
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

No measures

Other Important Issues

おそらく単純桁で再利用不可のため、詳細調査は不要、橋長、幅員の計測のみ

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

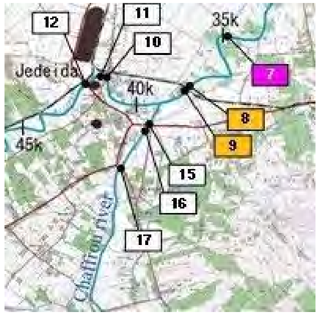
Basics

					Decision
No. Name	7.	WATER PIPE BRIDGE	Maximum span	unknown (m)	Verification digit margin
			Total width	5.54 (m)	unknown
Route Name	Water supply		Effective width	unknown (m)	Plan for renovation
Location	Jedeida		Planar shape	unknown	☐ No measures
Year of const.	unknown		Type of pavement	-	☐ Demolish
Structure format	Pipe Bridge		Pavement thickness	- (mm)	☐ Reconstruction
			Substructures	6 (substructures)	☐ Improvement
Bridge length	unknown (m)		Purpose of the bridge	Irrigation Canals	■ Other
Spans	5 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property channel	Medjerda		environ Purpose	Arable land	■ Excavation
distance	34.44 (km)		environ Detour	No	☐ widening
H.W.L (NGT)	10 years	17.79	Historical value	No	☐ banking
	100 years	20.20	Road surface	unknown (NGT)	☐ Removal of sediment
Discharge (m^3/sec)	10 years	860	Lower surface of the deck	unknown (NGT)	☐ Other
	100 years	950	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	■ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	■ Other
	Main girder	The number of girder	3	Height (m)	unknown	
	Angle	Skew (deg.)	90	Crossing (deg.)	-	
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	unknown	Transverse	unknown	
	Height (m)	Pier	unknown	beam	unknown	
Abutment	Material	■ RC	☐ Stone	☐ Other		
	Form	■ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet	unknown	Wall	unknown	
	Width of abutment (m)	unknown				

Location map



Deterioration & damage	Condition	Good
Main Deterioration	特になし	

Construction Overview

Excavation

Other Important Issues

3連の水管橋である。左岸側橋台位置は各々異なる。

Pictures of Site


Picture-1 Deck surface

Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure

Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

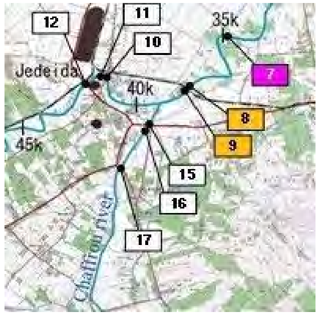
Basics

No. Name		8. JEDEIDA RAILWAY OLD BRIDGE	Maximum span	30.25 (m)	**Decision** Verification digit margin
			Total width	4.16 (m)	unknown
Route Name		RAILWAY	Effective width	4.00 (m)	**Plan for renovation**
Location		Jedeida	Planar shape	right bridge	☐ No measures
Year of const.		More than 50 years ago	Type of pavement	-	■ Demolish
Structure format		2 spans continuous steel truss girder	Pavement thickness	0.00 (mm)	☐ Reconstruction
			Substructures	3 (substructures)	☐ Improvement
Bridge length		60.5 (m)	Purpose of the bridge	Nonuse	☐ Other
Spans		2 (spans)	Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Medjerda	environ Purpose	Arable land	■ Excavation
	distance	37.848 (km)	environ Detour	No	☐ widening
	H.W.L (NGT) 10 years	19.28	Historical value	No	☐ banking
	H.W.L (NGT) 100 years	22.65	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	860	Lower surface of the deck	unknown (NGT)	☐ Other
	Discharge (m^3/sec) 100 years	950	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	■ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	■ Other
	Main girder	The number of girder	2		Height (m)	unknown
	Angle	Skew (deg.)	90		Crossing (deg.)	-
Peir	Material	☐ RC	☐ Metal	☐ Composite	■ Stone	☐ Other
	Form	☐ Single column	■ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	2.28	Transverse	6.50	
	Height (m)	Pier	unknown	beam	unknown	
Abutment	Material	☐ RC		■ Stone		☐ Other
	Form	☐ Inverted T type		☐ Gravity type		■ Other
	Height (m)	Parapet	unknown		Wall	unknown
	Width of abutment (m)	6.00				

Location map



Deterioration & damage	Condition	Not good
Main Deterioration	①鋼材腐食	

Construction Overview

Demolish

Other Important Issues

①鋼2径間連続下路式トラス橋である。
②桁側面(上流側)に添架管有り。
③鉄道は2011年に新橋に移設済み。
④新設とスパン長が異なり、流下を阻害している。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

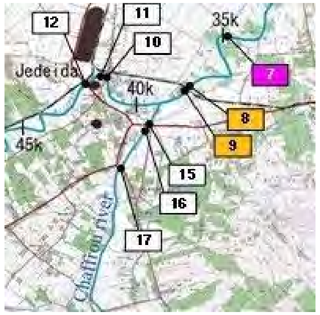
Basics

No. Name		9. JEDEIDA RAILWAY BRIDGE	Maximum span	21.00 (m)	**Decision** Verification digit margin
			Total width	10.00 (m)	NG
Route Name		RAILWAY	Effective width	9.40 (m)	**Plan for renovation**
Location		Jedeida	Planar shape	right bridge	■ No measures
Year of const.		1982	Type of pavement	ballast	☐ Demolish
Structure format		3 isostatic spans reinforced concrete section	Pavement thickness	30.00 (mm)	☐ Reconstruction
			Substructures	4 (substructures)	☐ Improvement
Bridge length		63 (m)	Purpose of the bridge	Railway	☐ Other
Spans		3 (spans)	Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Medjerda	environ Purpose	Arable land	■ Excavation
	distance	37.834 (km)	environ Detour	No	☐ widening
	H.W.L (NGT) 10 years	19.27	Historical value	No	☐ banking
	H.W.L (NGT) 100 years	22.65	Road surface	21.00 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	860	Lower surface of the deck	19.20 (NGT)	☐ Other
	Discharge (m^3/sec) 100 years	950	Margin	-0.07 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	■ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	4	Height (m)		1.70
	Angle	Skew (deg.)	90	Crossing (deg.)		-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	■ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	1.00	Transverse	10.00	
	Height (m)	Pier	9.60	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet	2.20	Wall	1.00	
	Width of abutment (m)	10.30				

Location map



Deterioration & damage	Condition	Mild damage
Main Deterioration	①衝突によるコンクリート剥離・鉄筋露出(橋脚)	

Construction Overview

Excavation(底版上面までの掘削) & Constracticting of by-pass

Other Important Issues

①鉄道橋であり、嵩上げの場合は影響範囲が大きくなる。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

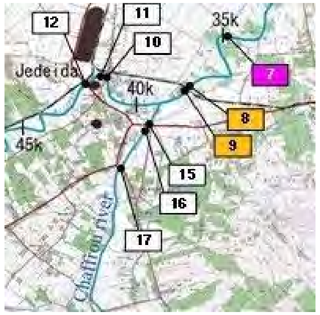
Basics

						Decision
No. Name		10. JEDEIDA BRIDGE	Maximum span	28.00 (m)		Verification digit margin
			Total width	12.00 (m)		OK
Route Name		RVE507	Effective width	11.40 (m)		Plan for renovation
Location		Jedeida	Planar shape	right bridge		■ No measures
Year of const.		2011	Type of pavement	Asphalt		☐ Demolish
Structure format		Precast I-girders with on-site concrete slab 3 isostatic spans	Pavement thickness	80.00 (mm)		☐ Reconstruction
			Substructures	4 (substructures)		☐ Improvement
Bridge length		87.2 (m)	Purpose of the bridge	General road		☐ Other
Spans		3 (spans)	Sidewalk	Yes		Plan for improvement of channel
Intersection property	channel	Medjerda	environ Purpose	urban area		■ Excavation
	distance	41.071 (km)	Detour	No		☐ widening
	H.W.L (NGT)	10 years 20.85	Historical value	No		☐ banking
		100 years 23.95	Road surface	24.04	(NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years 780	Lower surface of the deck	21.40	(NGT)	☐ Other
		100 years 1000	Margin	0.55 (m)	(10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	■ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	4		Height (m)	1.80
	Angle	Skew (deg.)	90		Crossing (deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	ϕ1.0	Transverse	ϕ1.0×4	
	Height (m)	Pier	7.30	beam	1.20	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet	2.10	Wall	1.20	
	Width of abutment (m)	12.00				

Location map



Deterioration & damage		Condition	Good
Main Deterioration	2011架設の新橋のため、なし。		

Construction Overview

1. removing of sediment
2. constracticting of by-pass

Other Important Issues

①2011架設
②周辺宅地のため、河積不足の場合は掘削が望ましい。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

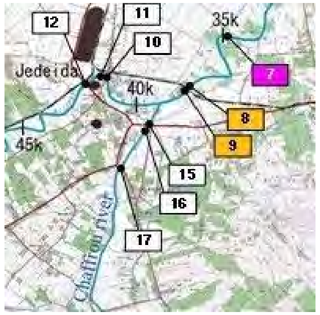
Basics

						Decision
No. Name		11. JEDEIDA OLD BRIDGE		Maximum span	33.50 (m)	Verification digit margin
				Total width	5.60 (m)	unknown
Route Name		RVE507		Effective width	5.00 (m)	Plan for renovation
Location		Jedeida		Planar shape	right bridge	☐ No measures
Year of const.		the 16th century		Type of pavement	Asphalt	■ Demolish
Structure format		Steel upper arch type truss girder on the main span, Massive stone arch bridge for		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	5 (substructures)	☐ Improvement
Bridge length		64.5 (m)		Purpose of the bridge	Nonuse	☐ Other
Spans		4 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Medjerda		environ Purpose	urban area	■ Excavation
	distance	41.091 (km)		Detour	No	☐ widening
	H.W.L (NGT)	10 years	20.86	Historical value	Yes	☐ banking
		100 years	23.95	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	780	Lower surface of the deck	unknown (NGT)	☐ Other
		100 years	1000	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	■ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	■ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	■ Other
	Main girder	The number of girder	2	Height (m)	unknown	
	Angle	Skew (deg.)	90	Crossing (deg.)	-	
Peir	Material	☐ RC	☐ Metal	☐ Composite	■ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar (m)	Longitudinal	4.70	Transverse	11.70	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	☐ RC	■ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	■ Other		
	Height (m)	Parapet	unknown	Wall	unknown	
	Width of abutment (m)	5.60				

Location map



Deterioration & damage	Condition	Not good
Main Deterioration	①舗装のひび割れ、滞水 ②主径間の深刻な損傷 ③土砂堆積による部分的な河道閉塞	

Construction Overview

1. removing of sediment
2. constracticting of by-pass

Other Important Issues

Because of historical biridge, removing bridge is difficult.

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

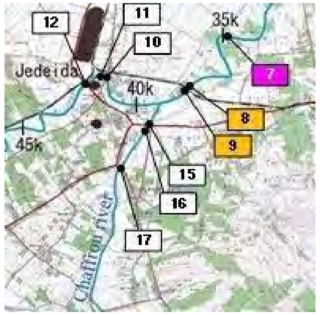
Basics

						Decision
No. Name		12. JEDEIDA BRIDGE ON GP7		Maximum span	31.80 (m)	Verification digit margin
				Total width	11.30 (m)	OK
Route Name		GP7		Effective width	10.50 (m)	Plan for renovation
Location		Jedeida		Planar shape	right bridge	■ No measures
Year of const.		1945(repairing2009)		Type of pavement	Asphalt	☐ Demolish
Structure format		Concrete gerder beam bridge		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	6 (substructures)	☐ Improvement
Bridge length		73.6 (m)		Purpose of the bridge	Main road	☐ Other
Spans		5 (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Medjerda		environ Purpose	Arable land	■ Excavation
	distance	41.926 (km)		environ Detour	No	☐ widening
	H.W.L (NGT)	10 years	21.28	Historical value	No	☐ banking
		100 years	24.55	Road surface	26.70 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	780	Lower surface of the deck	25.13 (NGT)	☐ Other
		100 years	1000	Margin	3.85(m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	■ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	unknown		Height(m)	1.50
	Angle	Skew(deg.)	90		Crossing(deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	■ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal	2.00	Transverse	12.00	
	Height(m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height(m)	Parapet	unknown	Wall	unknown	
	Width of abutment(m)	11.10				

Location map



Deterioration & damage	Condition	Good
Main Deterioration	①橋梁本体に損傷は確認できない。 ②側径間の橋脚～橋台間に土砂堆積がある。	

Construction Overview

1.Excavation

Other Important Issues

①中央径間の橋脚はパイルベント式橋脚である。
②近接橋として、水管橋がある(Picture-6)。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

							Decision
No. Name	13.	EL BATTAN BRIDGE		Maximum span	5.11	(m)	Verification digit margin
				Total width	8.50	(m)	unknown
Route Name	MC64			Effective width	8.00	(m)	Plan for renovation
Location	Al Battan			Planar shape	right bridge		☐ No measures
Year of const.	More than 100 years ago			Type of pavement	Asphalt		☐ Demolish
Structure format	Ancient arch type stone bridge			Pavement thickness	unknown	(mm)	☐ Reconstruction
				Substructures	21	(substructures)	☐ Improvement
Bridge length	94.07	(m)		Purpose of the bridge	Main road		■ Other
Spans	20	(spans)		Sidewalk	Yes		Plan for improvement of channel
Intersection property	channel	Medjerda		environ Purpose	Residential area		☐ Excavation
	distance	53.111	(km)	environ Detour	No		☐ widening
	H.W.L (NGT)	10 years	unknown	Historical value	Yes		☐ banking
		100 years	30.40	Road surface	29.10	(NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	780	Lower surface of the deck	28.05	(NGT)	■ Other
		100 years	1200	Margin	unknown	(10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	■ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	■ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	■ Full	☐ Other
	Main girder	The number of girder	1		Height(m)	unknown
	Angle	Skew(deg.)	90		Crossing(deg.)	-
Peir	Material	☐ RC	☐ Metal	☐ Composite	■ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar(m)	Longitudinal	2.24	Transverse	unknown	
	Height(m)	Pier	unknown	beam	-	
Abutment	Material	☐ RC		■ Stone	☐ Other	
	Form	☐ Inverted T type		☐ Gravity type	■ Other	
	Height(m)	Parapet	-	Wall	-	
	Width of abutment(m)	-				

Location map

Deterioration & damage	Condition	Good
Main Deterioration	1. water stagnation of surface 2. Preventing water flow brought Tamarix vegetation 3. Narrowness of gates call for jamming of debris	

Construction Overview

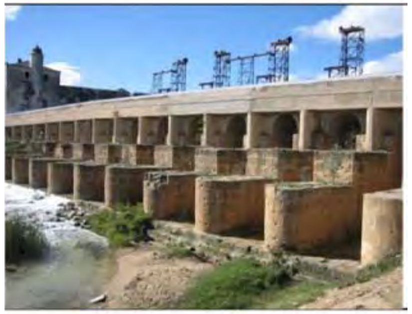
1. Removing of sediment
2. Constracticting of by-pass

Other Important Issues

Because of historical biridge, removing bridge is difficult.

Pictures of Site


Picture-1 Deck surface


Picture-2 Side

Picture-3 The underside of the beam


Picture-4 Substructure

Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		14.	TEBOURBA IRRIGATION CANALS BRIDGE	Maximum span	unknown (m)		
				Total width	5.54 (m)		
Route Name		IRRIGATION CANALS		Effective width	unknown (m)		
Location		Tebourba		Planar shape	unknown		
Year of const.		Before 1958		Type of pavement	-		
Structure format		Reinforced concrete structure		Pavement thickness	- (mm)		
				Substructures	5 (substructures)		
Bridge length		125 (m)		Purpose of the bridge	Irrigation Canals		
Spans		4 (spans)		Sidewalk	No		
Intersection property	channel	Medjerda		environ	Purpose	Residential area	
	distance	56.899 (km)			Detour	No	
	H.W.L (NGT)	10 years	unknown	Historical value		No	
		100 years	33.00	Road surface		33.93 (NGT)	
	Discharge (m^3/sec)	10 years	780	Lower surface of the deck		unknown (NGT)	
		100 years	1930	Margin		unknown (10 years)	

Decision

Verification digit margin
unknown
Plan for renovation
☐ No measures
☐ Demolish
☐ Reconstruction
☐ Improvement
■ Other
Plan for improvement of channel
☐ Excavation
■ widening
☐ banking
☐ Removal of sediment
☐ Other
☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	■ Other
	Main girder	The number of girder	1		Height (m)	unknown
	Angle	Skew (deg.)	90		Crossing (deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	■ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	unknown	Transverse	unknown	
	Height (m)	Pier	unknown	beam	unknown	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet	unknown		Wall	unknown
	Width of abutment (m)	unknown				

Location map

Deterioration & damage	Condition	Not good
Main Deterioration	①水漏れ	

Construction Overview

Excavation

Other Important Issues

①水漏れ対策が必要。
②左岸側は市街地、右岸側は農地
③谷がやや深い

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

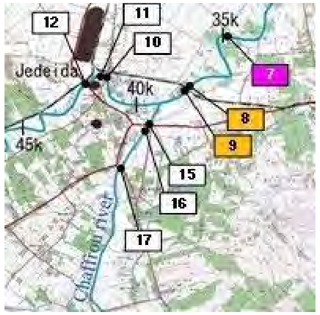
Basics

						Decision
No. Name		15. GP7 BRIDGE ON CHAFUROU		Maximum span	unknown (m)	Verification digit margin
				Total width	11.00 (m)	OK
Route Name		GP7		Effective width	unknown (m)	Plan for renovation
Location		Jedeida		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Asphalt	☐ Demolish
Structure format		3 spans continuous reinforced concrete slab bridge		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	4 (substructures)	☐ Improvement
Bridge length		38.2 (m)		Purpose of the bridge	Main road	☐ Other
Spans		3 (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Chafurou	environ	Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	No	■ widening
	H.W.L (NGT)	10 years	19.80	Historical value	No	☐ banking
		100 years	23.25	Road surface	22.41 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	50	Lower surface of the deck	21.41 (NGT)	☐ Other
		100 years	120	Margin	1.61 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	■ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	1	Height (m)	unknown	
	Angle	Skew (deg.)	unknown	Crossing (deg.)	-	
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	unknown	Transverse	unknown	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone	☐ Other		
	Form	■ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet	-	Wall	-	
	Width of abutment (m)	unknown				

Location map



Deterioration & damage	Condition	Good
Main Deterioration	特になし。	

Construction Overview

No measures

Other Important Issues

①水理評価のため断面の把握(測量)が必要。
②旧橋には添架管有り。
③近接して水路橋？がある。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

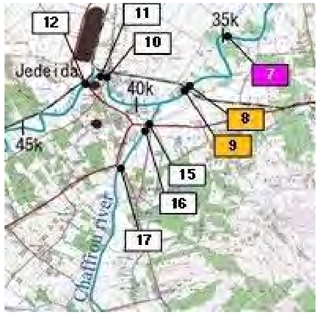
Basics

						Decision
No. Name		16. GP7 BRIDGE ON CHAFUROU		Maximum span	unknown (m)	Verification digit margin
				Total width	11.00 (m)	OK
Route Name		GP7		Effective width	unknown (m)	Plan for renovation
Location		Jedeida		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Asphalt	☐ Demolish
Structure format		3 spans continuous reinforced concrete slab bridge		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	4 (substructures)	☐ Improvement
Bridge length		38.2 (m)		Purpose of the bridge	Main road	☐ Other
Spans		3 (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Chafurou		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	No	■ widening
	H.W.L (NGT)	10 years	19.80	Historical value	No	☐ banking
		100 years	23.25	Road surface	22.41 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	50	Lower surface of the deck	21.41 (NGT)	☐ Other
		100 years	120	Margin	1.61 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	■ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	1	Height (m)		unknown
	Angle	Skew (deg.)	unknown	Crossing (deg.)		-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal	unknown	Transverse	unknown	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet	-	Wall	-	
	Width of abutment (m)	unknown				

Location map



Deterioration & damage	Condition	Good
Main Deterioration	特になし。	

Construction Overview

No measures

Other Important Issues

①水理評価のため断面の把握(測量)が必要。
②旧橋には添架管有り。
③近接して水路橋？がある。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

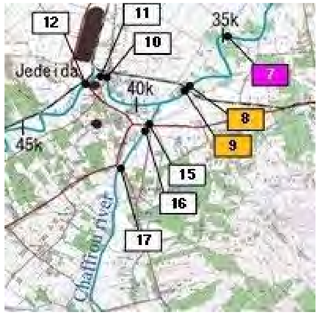
Basics

						Decision
No. Name		17. EL H'BIBIA BRIDGE	Maximum span		4.50 (m)	Verification digit margin
			Total width		8.14 (m)	OK
Route Name		Local Road	Effective width		unknown (m)	Plan for renovation
Location		Jedeida	Planar shape		unknown	☐ No measures
Year of const.		unknown	Type of pavement		Asphalt	☐ Demolish
Structure format		4 spans reinforced concrete box culvert	Pavement thickness		unknown (mm)	■ Reconstruction
			Substructures		5 (substructures)	☐ Improvement
Bridge length		16.9 (m)	Purpose of the bridge		General road	☐ Other
Spans		4 (spans)	Sidewalk		No	Plan for improvement of channel
Intersection property	channel	Chafurou	environ	Purpose	Wasteland	☐ Excavation
	distance	- (km)		Detour	Yes	■ widening
	H.W.L (NGT) 10 years	19.80	Historical value		No	☐ banking
	100 years	23.50	Road surface		21.53 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	50	Lower surface of the deck		20.40 (NGT)	☐ Other
	100 years	120	Margin		0.60 (m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	■ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	■ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	■ Full	☐ Other
	Main girder	The number of girder	1		Height (m)	unknown
	Angle	Skew (deg.)	unknown		Crossing (deg.)	-
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	■ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar (m)	Longitudinal	unknown	Transverse	unknown	
	Height (m)	Pier	unknown	beam	-	
Abutment	Material	■ RC		☐ Stone		☐ Other
	Form	☐ Inverted T type		☐ Gravity type		■ Other
	Height (m)	Parapet	-		Wall	-
	Width of abutment (m)	unknown				

Location map



Deterioration & damage	Condition	Not good
Main Deterioration	全体的に良くない。	

Construction Overview

No measures

Other Important Issues

①水理評価のため断面の把握(測量)が必要。

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		18. Bridge on the local road		Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Local Road		Effective width	unknown (m)	Plan for renovation
Location		El Kantara		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Asphalt	☐ Demolish
Structure format		unknown		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Main road	■ Other
Spans		unknown (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Driving		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	No	☐ widening
	H.W.L (NGT)	10 years	13.71	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	300	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		19. FARM BRIDGE ON Driving CHANNEL		Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		Shuwat		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Concrete	☐ Demolish
Structure format		unknown		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Farm road	■ Other
Spans		unknown (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Driving		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	13.10	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	300	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone		☐ Other	
	Form	☐ Inverted T type	☐ Gravity type		☐ Other	
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		20. FARM BRIDGE ON Driving CHANNEL		Maximum span	unknown (m)	
				Total width	unknown (m)	
Route Name		Farm Road		Effective width	unknown (m)	
Location		Shuwat		Planar shape	unknown	
Year of const.		unknown		Type of pavement	Concrete	
Structure format		unknown		Pavement thickness	unknown (mm)	
				Substructures	unknown (substructures)	
Bridge length		unknown (m)		Purpose of the bridge	Farm road	
Spans		unknown (spans)		Sidewalk	No	
Intersection property	channel	Driving		environ Purpose	Arable land	
	distance	– (km)		Detour	Yes	
	H.W.L (NGT)	10 years	11.82	Historical value	No	
		100 years	unknown	Road surface	unknown (NGT)	
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	unknown (NGT)	
		100 years	300	Margin	unknown (10 years)	

Decision

Verification digit margin
unknown
Plan for renovation
☐ No measures
☐ Demolish
☐ Reconstruction
☐ Improvement
■ Other
Plan for improvement of channel
☐ Excavation
☐ widening
☐ banking
☐ Removal of sediment
■ Other
☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		21. FARM BRIDGE		Maximum span	unknown (m)	Verification digit margin
				Total width	5.70 (m)	NG
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		Dawwar Guerfdjana		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Concrete	☐ Demolish
Structure format		Single span reinforced concrete slab		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	2 (substructures)	☐ Improvement
Bridge length		20.7 (m)		Purpose of the bridge	Farm road	☐ Other
Spans		1 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Driving		environ Purpose	Arable land	■ Excavation
	distance	- (km)		environ Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	10.97	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	-10.91 (NGT)	☐ Other
		100 years	300	Margin	-21.88(m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	■ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	■ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	■ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	2	Height(m)	unknown	
	Angle	Skew(deg.)	90	Crossing(deg.)	-	
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal	-	Transverse	-	
	Height(m)	Pier	-	beam	-	
Abutment	Material	■ RC	☐ Stone	☐ Other		
	Form	■ Inverted T type	☐ Gravity type	☐ Other		
	Height(m)	Parapet	unknown	Wall	unknown	
	Width of abutment(m)	unknown				

Location map

Deterioration & damage	Condition	Mild damage
Main Deterioration	①排水装置の欠陥	

Construction Overview

Reconstruction
（既存水路50m3/sから200m3/sへの改修のため、断面不足は明らか）

Other Important Issues

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		22. MC50 EL MABTOUH BRIDGE		Maximum span	unknown (m)	Verification digit margin
				Total width	14.61 (m)	NG
Route Name		MC50		Effective width	unknown (m)	Plan for renovation
Location		Dawwar Guerfdjana		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Asphalt	☐ Demolish
Structure format		6 spans reinforced concrete box culvert		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	7 (substructures)	☐ Improvement
Bridge length		20.46 (m)		Purpose of the bridge	Main road	☐ Other
Spans		6 (spans)		Sidewalk	Yes	Plan for improvement of channel
Intersection property	channel	Driving		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	No	■ widening
	H.W.L (NGT)	10 years	10.44	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	-10.75 (NGT)	☐ Other
		100 years	300	Margin	-21.19(m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	■ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	■ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	■ Full	☐ Other
	Main girder	The number of girder	1		Height(m)	unknown
	Angle	Skew(deg.)	unknown		Crossing(deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar(m)	Longitudinal	unknown	Transverse	unknown	
	Height(m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	☐ Inverted T type	☐ Gravity type		■ Other	
	Height(m)	Parapet	-		Wall	-
	Width of abutment(m)	unknown				

Location map

Deterioration & damage	Condition	Good
Main Deterioration	特になし	

Construction Overview

1.Reconstruction
（既存水路50m3/sから200m3/sへの改修のため、断面不足は明らか）

Other Important Issues

平面図と側面図·写真が不一致（平面図は単純の桁橋、写真は6径間のBoxCulvert）

Pictures of Site


Picture-1 Deck surface


Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		23. FARM BRIDGE ON Oued Mabtouh		Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		Almoubaraka		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Concrete	☐ Demolish
Structure format		unknown		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Farm road	■ Other
Spans		unknown (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Mabtouh		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	7.19	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	125	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		24. A4 BRIDGE OVER Mabtouh		Maximum span	unknown (m)	Verification digit margin
				Total width	14.00 (m)	OK
Route Name		MOTORWAY A4		Effective width	unknown (m)	Plan for renovation
Location		El Kantara		Planar shape	unknown	■ No measures
Year of const.		2002		Type of pavement	Asphalt	☐ Demolish
Structure format		2径間連続PCT桁(想定)		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	3 (substructures)	☐ Improvement
Bridge length		52.6 (m)		Purpose of the bridge	MOTORWAY	☐ Other
Spans		2 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Mabtouh		environ Purpose	Arable land	■ Excavation
	distance	- (km)		Detour	No	☐ widening
	H.W.L (NGT)	10 years	7.13	Historical value	No	☐ banking
		100 years	11.15	Road surface	13.50 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	11.30 (NGT)	☐ Other
		100 years	125	Margin	4.17(m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	■ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	■ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	■ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder	unknown		Height(m)	unknown
	Angle	Skew(deg.)	unknown		Crossing(deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	■ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal	unknown	Transverse	unknown	
	Height(m)	Pier	unknown	beam	-	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	■ Inverted T type	☐ Gravity type		☐ Other	
	Height(m)	Parapet	-	Wall	-	
	Width of abutment(m)	unknown				

Location map

Deterioration & damage	Condition	Good
Main Deterioration	特になし	

Construction Overview

No measures

Other Important Issues

橋梁の詳細が不明のため、測量を実施する必要がある。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		25. FARM BRIDGE ON Oued Mabtouh	Maximum span	unknown (m)		**Decision** Verification digit margin
			Total width	unknown (m)		unknown
Route Name		Farm Road	Effective width	unknown (m)		**Plan for renovation**
Location		El Kantara	Planar shape	unknown		☐ No measures
Year of const.		unknown	Type of pavement	Concrete		☐ Demolish
Structure format		unknown	Pavement thickness	unknown (mm)		☐ Reconstruction
			Substructures	unknown (substructures)		☐ Improvement
Bridge length		unknown (m)	Purpose of the bridge	Farm road		■ Other
Spans		unknown (spans)	Sidewalk	No		Plan for improvement of channel
Intersection property	channel	Mabtouh	environ Purpose	Arable land		☐ Excavation
	distance	- (km)	Detour	Yes		☐ widening
	H.W.L (NGT)	10 years 6.55	Historical value	No		☐ banking
		100 years unknown	Road surface	unknown (NGT)		☐ Removal of sediment
	Discharge (m^3/sec)	10 years 30	Lower surface of the deck	unknown (NGT)		■ Other
		100 years 125	Margin	unknown (10 years)		☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height(m)		
	Angle	Skew(deg.)		Crossing(deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal		Transverse		
	Height(m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height(m)	Parapet		Wall		
	Width of abutment(m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface	Picture-2 Side
Picture-3 The underside of the beam	Picture-4 Substructure
Picture-5 Bearing or Attachment	Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name	26.	FARM BRIDGE ON Oued Mabtouh	Maximum span	unknown (m)	
			Total width	unknown (m)	
Route Name	Farm Road		Effective width	unknown (m)	
Location	Shuwat		Planar shape	unknown	
Year of const.	unknown		Type of pavement	Concrete	
Structure format	unknown		Pavement thickness	unknown (mm)	
			Substructures	unknown (substructures)	
Bridge length	unknown (m)		Purpose of the bridge	Farm road	
Spans	unknown (spans)		Sidewalk	No	
Intersection property	channel	Mabtouh	environ	Purpose	Arable land
	distance	- (km)		Detour	Yes
	H.W.L (NGT)	10 years	6.14	Historical value	No
		100 years	unknown	Road surface	unknown (NGT)
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	unknown (NGT)
		100 years	125	Margin	unknown (10 years)

Decision

Verification digit margin
unknown
Plan for renovation
☐ No measures
☐ Demolish
☐ Reconstruction
☐ Improvement
■ Other
Plan for improvement of channel
☐ Excavation
☐ widening
☐ banking
☐ Removal of sediment
■ Other
☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height(m)		
	Angle	Skew(deg.)		Crossing(deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal		Transverse		
	Height(m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height(m)	Parapet		Wall		
	Width of abutment(m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface	Picture-2 Side
Picture-3 The underside of the beam	Picture-4 Substructure
Picture-5 Bearing or Attachment	Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		27. GP8 BRIDGE AND ROAD OVER Mabtouh		Maximum span	8.90 (m)	Verification digit margin
				Total width	9.90 (m)	OK
Route Name		GP8		Effective width	9.40 (m)	Plan for renovation
Location		El Kantara		Planar shape	skew bridge	☐ No measures
Year of const.		unknown		Type of pavement	Asphalt	☐ Demolish
Structure format		4 spans reinforced concrete box culvert		Pavement thickness	unknown (mm)	■ Reconstruction
				Substructures	5 (substructures)	☐ Improvement
Bridge length		36.5 (m)		Purpose of the bridge	Main road	☐ Other
Spans		4 (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Mabtouh		environ Purpose	Arable land	☐ Excavation
	distance	-	(km)	Detour	No	■ widening
	H.W.L (NGT)	10 years	7.58	Historical value	No	☐ banking
		100 years	11.15	Road surface	8.68 (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	7.68 (NGT)	☐ Other
		100 years	125	Margin	0.10(m) (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	■ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	■ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	■ Full	☐ Other
	Main girder	The number of girder	1		Height(m)	0.80
	Angle	Skew(deg.)	62.5		Crossing(deg.)	-
Peir	Material	■ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	■ Other
	Width of Pillar(m)	Longitudinal	0.90	Transverse	11.70	
	Height(m)	Pier	unknown	beam	unknown	
Abutment	Material	■ RC	☐ Stone		☐ Other	
	Form	☐ Inverted T type	☐ Gravity type		■ Other	
	Height(m)	Parapet	-	Wall	-	
	Width of abutment(m)	10.80				

Location map

Deterioration & damage	Condition	Mild damage
Main Deterioration	①伸縮装置の劣化 ②排水装置の欠陥	

Construction Overview

No measures

Other Important Issues

①河床を掘削する場合は掛け替えとなる。
②側面に添架管有り。

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure


Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		28. FARM BRIDGE ON Oued Mabtouh		Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		Shuwat		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Concrete	☐ Demolish
Structure format		unknown		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Farm road	■ Other
Spans		unknown (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Mabtouh		environ Purpose	Arable land	☐ Excavation
	distance	– (km)		Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	7.58	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	125	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height(m)		
	Angle	Skew(deg.)		Crossing(deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar(m)	Longitudinal		Transverse		
	Height(m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height(m)	Parapet		Wall		
	Width of abutment(m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		29. FARM BRIDGE ON Oued Mabtouh		Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		unknown		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	Concrete	☐ Demolish
Structure format		unknown		Pavement thickness	unknown (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Farm road	■ Other
Spans		unknown (spans)		Sidewalk	No	Plan for improvement of channel
Intersection property	channel	Mabtouh		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	7.58	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	30	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	125	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

Pictures of Site


Picture-1 Deck surface


Picture-2 Side


Picture-3 The underside of the beam


Picture-4 Substructure

Picture-5 Bearing or Attachment


Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

						Decision
No. Name		30. FARM BRIDGE (NEW)	Maximum span	–	(m)	Verification digit margin
			Total width	–	(m)	NG
Route Name		Farm Road	Effective width	–	(m)	Plan for renovation
Location		Shuwat	Planar shape	–		☐ No measures
Year of const.		unknown	Type of pavement	–		☐ Demolish
Structure format		No structure	Pavement thickness	–	(mm)	☐ Reconstruction
			Substructures	–	(substructures)	☐ Improvement
Bridge length		– (m)	Purpose of the bridge	Farm road		■ Other
Spans		– (spans)	Sidewalk	–		Plan for improvement of channel
Intersection property	channel	Driving	environ Purpose	Arable land		■ Excavation
	distance	– (km)	Detour	Yes		☐ widening
	H.W.L (NGT) 10 years	14.50	Historical value	No		☐ banking
	100 years	unknown	Road surface	unknown	(NGT)	☐ Removal of sediment
	Discharge (m^3/sec) 10 years	200	Lower surface of the deck	-15.61	(NGT)	☐ Other
	100 years	300	Margin	-30.11(m)	(10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder			Height (m)	
	Angle	Skew (deg.)			Crossing (deg.)	
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

New Construction

Other Important Issues

現況構造無し

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name	31.	FARM BRIDGE (NEW)	Maximum span	-	(m)	Verification digit margin
			Total width	-	(m)	unknown
Route Name	Farm Road		Effective width	-	(m)	**Plan for renovation**
Location	Shuwat		Planar shape	-		☐ No measures
Year of const.	unknown		Type of pavement	-		☐ Demolish
Structure format	No structure		Pavement thickness	- (mm)		☐ Reconstruction
			Substructures	- (substructures)		☐ Improvement
Bridge length	-	(m)	Purpose of the bridge	Farm road		■ Other
Spans		- (spans)	Sidewalk	-		Plan for improvement of channel
Intersection property channel	Driving		environ Purpose	Arable land		■ Excavation
distance	-	(km)	Detour	Yes		☐ widening
H.W.L (NGT)	10 years	14.35	Historical value	No		☐ banking
	100 years	unknown	Road surface	unknown	(NGT)	☐ Removal of sediment
Discharge (m^3/sec)	10 years	200	Lower surface of the deck	unknown	(NGT)	☐ Other
	100 years	300	Margin	unknown	(10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

New Construction

Other Important Issues

現況構造無し

Pictures of Site

Picture-1 Deck surface

Picture-2 Side

Picture-3 The underside of the beam

Picture-4 Substructure

Picture-5 Bearing or Attachment

Picture-6 Enviroment

List record field survey and renovation policy decision(1)

Creation Date	2012/8/8
Revised Date	
Shooting Date	2012/9/1

Basics

No. Name		32.	FARM BRIDGE (NEW)	Maximum span	unknown (m)	Verification digit margin
				Total width	unknown (m)	unknown
Route Name		Farm Road		Effective width	unknown (m)	Plan for renovation
Location		Almoubaraka		Planar shape	unknown	☐ No measures
Year of const.		unknown		Type of pavement	-	☐ Demolish
Structure format		unknown		Pavement thickness	- (mm)	☐ Reconstruction
				Substructures	unknown (substructures)	☐ Improvement
Bridge length		unknown (m)		Purpose of the bridge	Farm road	■ Other
Spans		unknown (spans)		Sidewalk	-	Plan for improvement of channel
Intersection property	channel	Driving		environ Purpose	Arable land	☐ Excavation
	distance	- (km)		environ Detour	Yes	☐ widening
	H.W.L (NGT)	10 years	14.08	Historical value	No	☐ banking
		100 years	unknown	Road surface	unknown (NGT)	☐ Removal of sediment
	Discharge (m^3/sec)	10 years	200	Lower surface of the deck	unknown (NGT)	■ Other
		100 years	300	Margin	unknown (10 years)	☐ No measures

Bridge survey

Superstructure	Material	☐ PC	☐ RC	☐ Metal	☐ Composite	☐ Stone
	Form	☐ Simple	☐ Continuous	☐ Culvert	☐ Arch	☐ Other
	Cross-sectional shape	☐ I beam	☐ T beam	☐ Box/Hollow	☐ Full	☐ Other
	Main girder	The number of girder		Height (m)		
	Angle	Skew (deg.)		Crossing (deg.)		
Peir	Material	☐ RC	☐ Metal	☐ Composite	☐ Stone	☐ Other
	Form	☐ Single column	☐ Bearing wall	☐ Pile bent	☐ Rahmen	☐ Other
	Width of Pillar (m)	Longitudinal		Transverse		
	Height (m)	Pier		beam		
Abutment	Material	☐ RC	☐ Stone	☐ Other		
	Form	☐ Inverted T type	☐ Gravity type	☐ Other		
	Height (m)	Parapet		Wall		
	Width of abutment (m)					

Location map

Deterioration & damage	Condition	Good
Main Deterioration		

Construction Overview

Other Important Issues

未調査

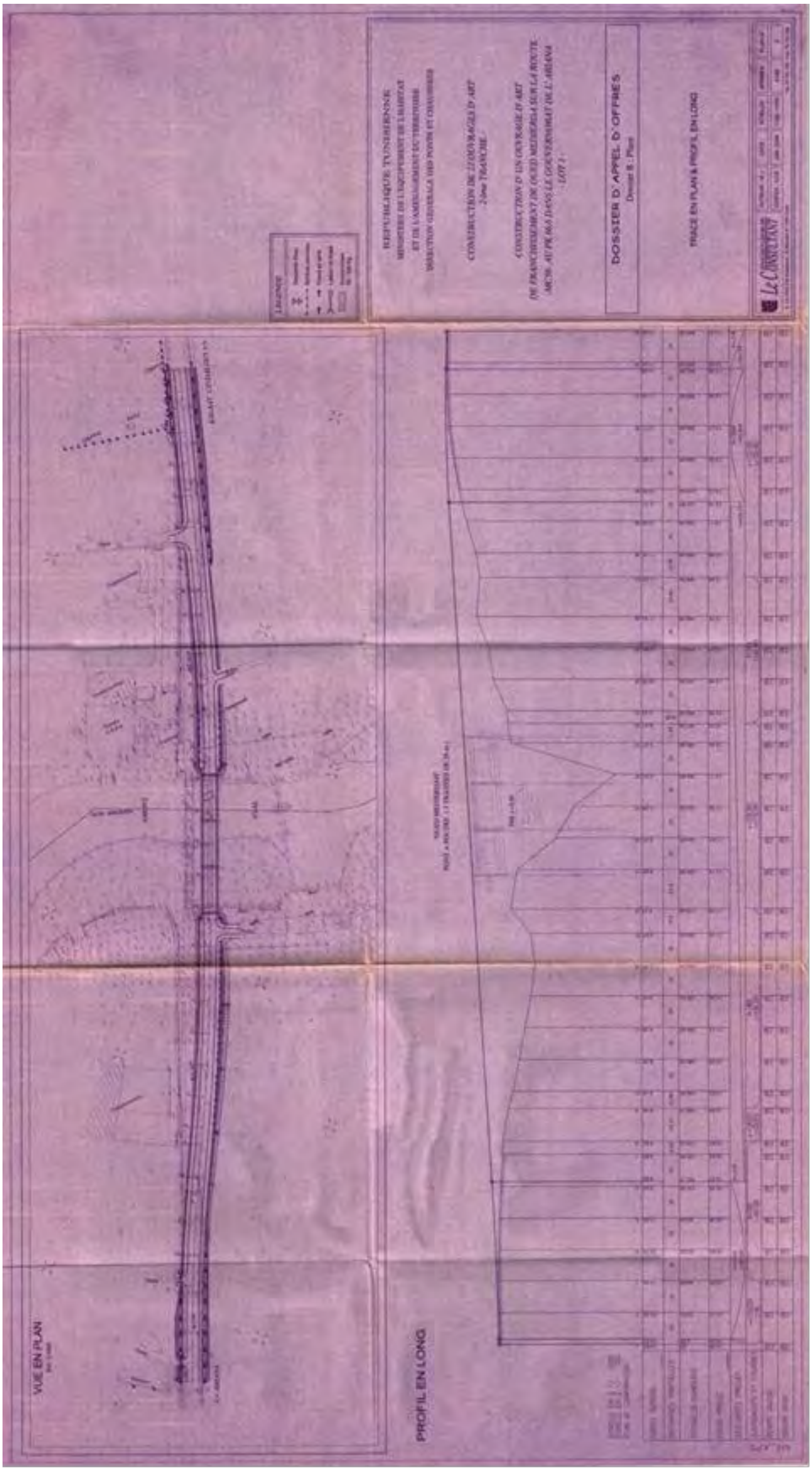
Pictures of Site

Picture-1 Deck surface	Picture-2 Side
Picture-3 The underside of the beam	Picture-4 Substructure
Picture-5 Bearing or Attachment	Picture-6 Enviroment

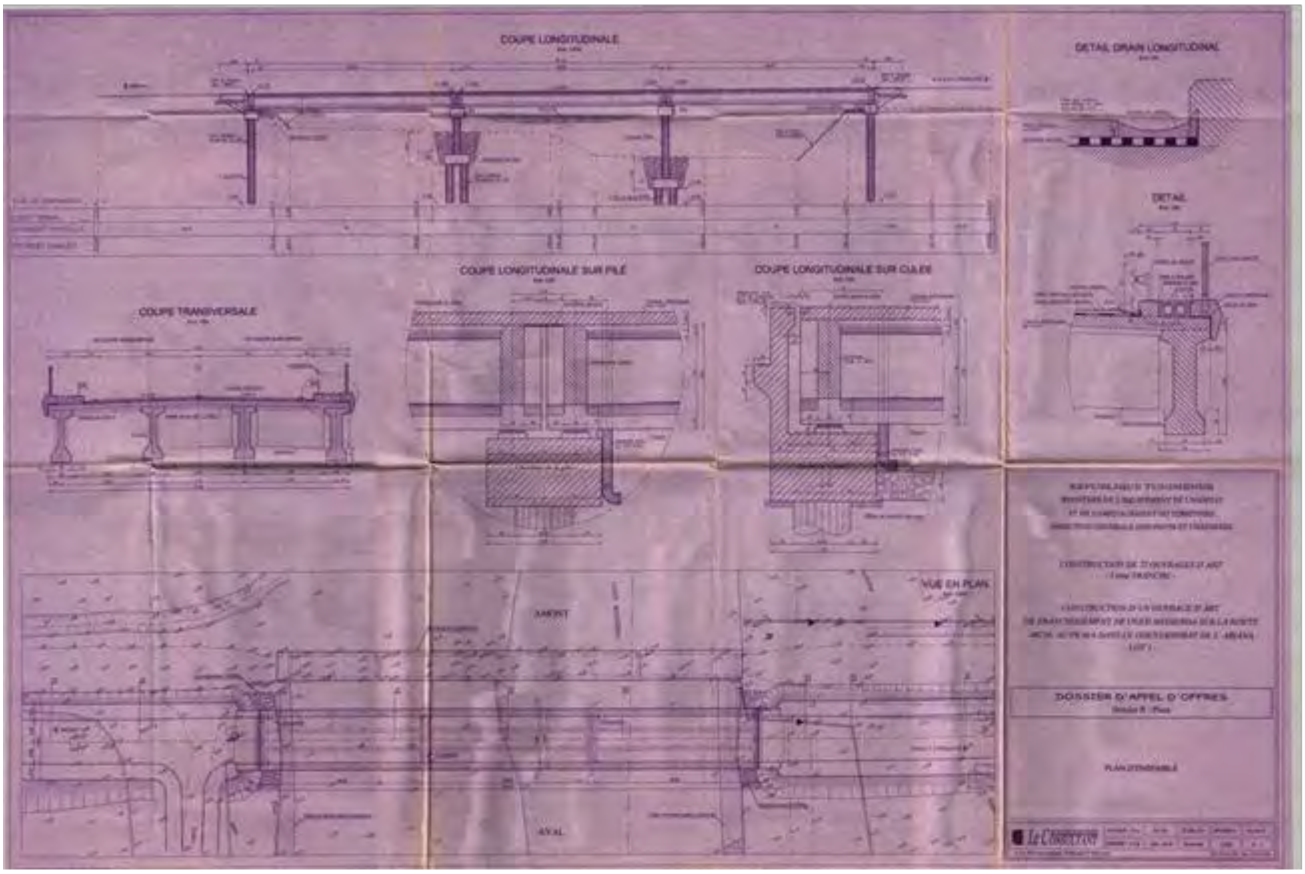
4.2 Studies of Existing Bridges

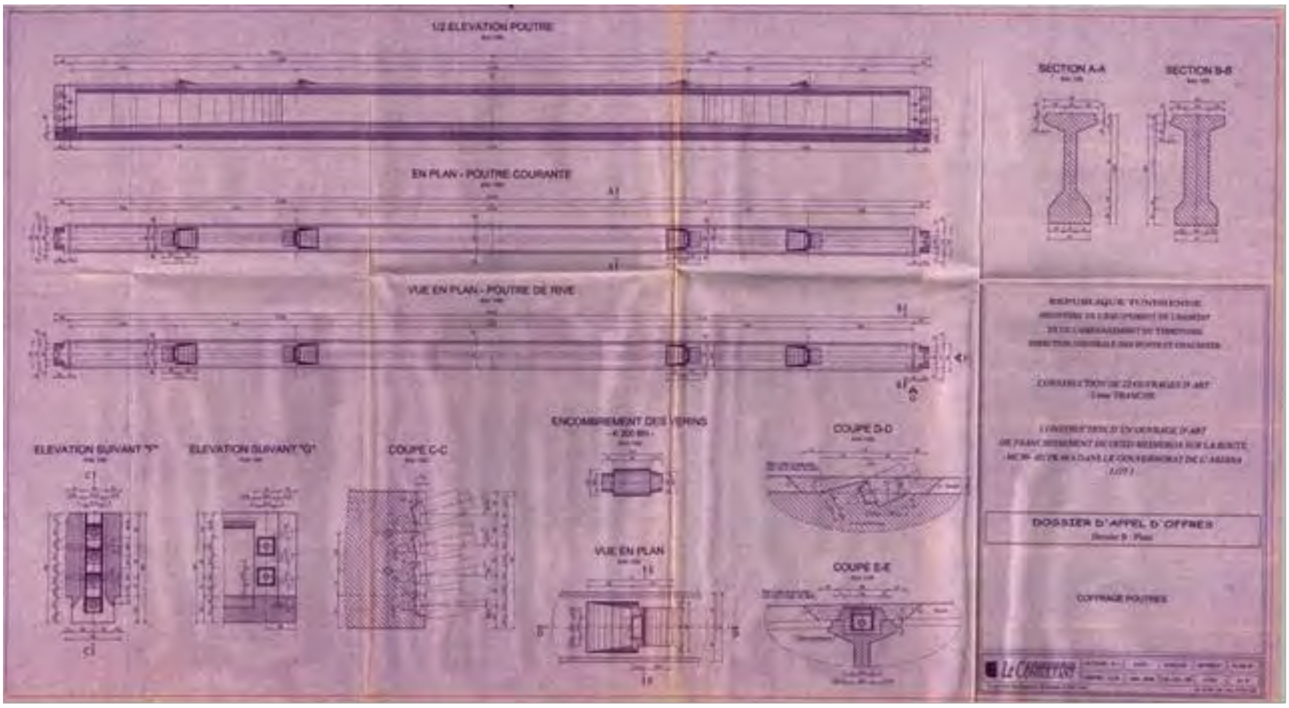
No.	Name	Drawings
2	TOBIAS BRIDGE	13 structural and other drawings
10	JEDEIDA BRIDGE	Overall drawings
9	JEDEIDA RAILWAY BRIDGE	Seven overall and other drawings

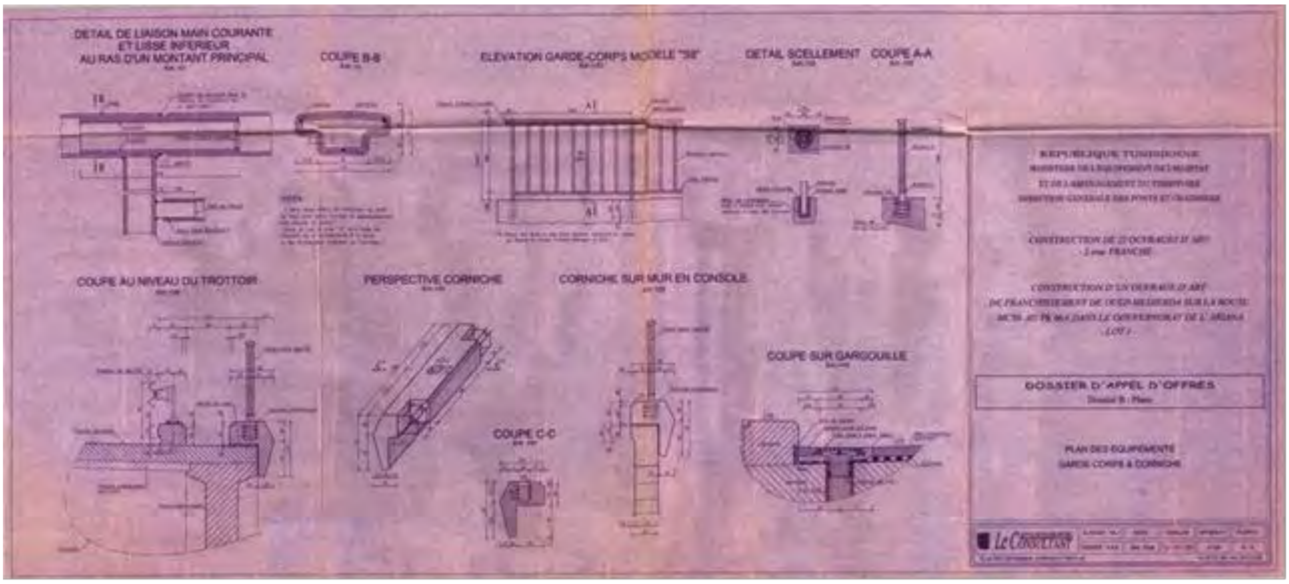
(1) TOBIAS BRIDGE

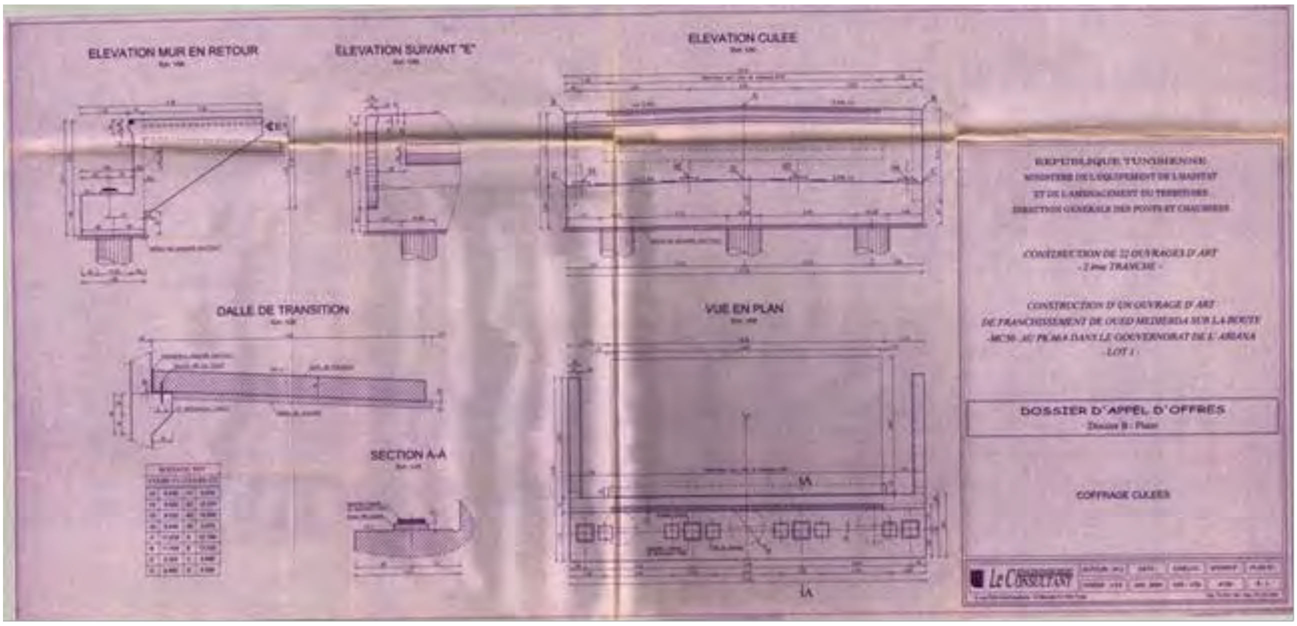


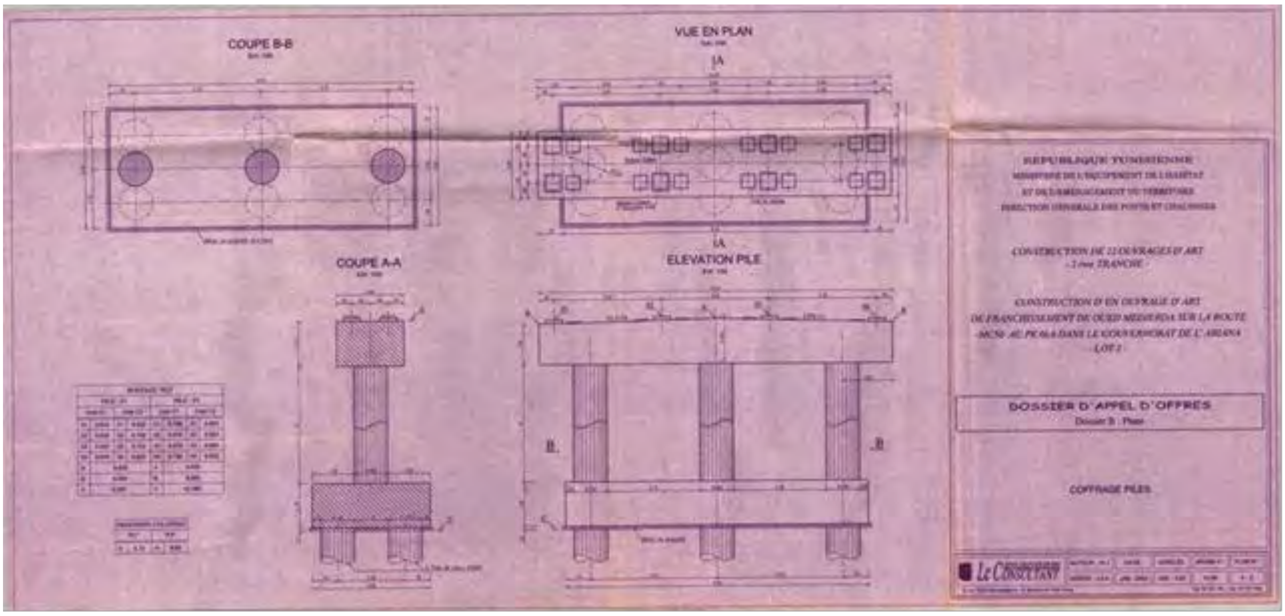

REPUBLIQUE TUNISIENNE
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
-MC50- AU PK 66.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
PLAN DE SITUATION
Le CONSULTANT

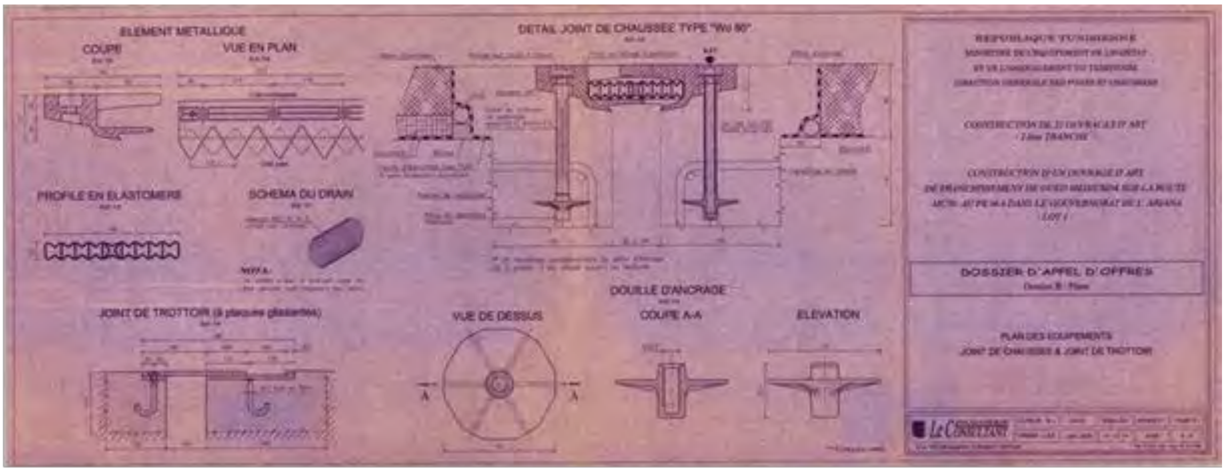

COUPE LONGITUDINALE
DETAIL DRAIN LONGITUDINAL
DETAIL
COUPE LONGITUDINALE SUR PILE
COUPE LONGITUDINALE SUR CULEE
COUPE TRANSVERSALE
VUE EN PLAN
AMONT
AVAL
REPUBLIQUE TUNISIENNE
DOSSIER D'APPEL D'OFFRES
Le CONSULTANT


1/2 ELEVATION POUTRE
SECTION A-A
SECTION B-B
EN PLAN - POUTRE COURANTE
VUE EN PLAN - POUTRE DE RIVE
ELEVATION SUIVANT "F"
ELEVATION SUIVANT "G"
COUPE C-C
ENCOMBREMENT DES VERINS
COUPE D-D
VUE EN PLAN
COUPE E-E
REPUBLIQUE TUNISIENNE
DOSSIER D'APPEL D'OFFRES
COFFRAGE POUTRES
Le CONSULTANT


DETAIL DE LIAISON MAIN COURANTE ET LISSE INFERIEUR AU RAS D'UN MONTANT PRINCIPAL
COUPE B-B
ELEVATION GARDE-CORPS MODELE "S8"
DETAIL SCELLEMENT
COUPE A-A
COUPE AU NIVEAU DU TROTTOIR
PERSPECTIVE CORNICHE
CORNICHE SUR MUR EN CONSOLE
COUPE C-C
COUPE SUR GARGOUILLE
REPUBLIQUE TUNISIENNE
DOSSIER D'APPEL D'OFFRES
PLAN DES EQUIPEMENTS
GARDE CORPS & CORNICHE
Le CONSULTANT


ELEVATION MUR EN RETOUR
ELEVATION SUIVANT "E"
ELEVATION CULEE
DALLE DE TRANSITION
VUE EN PLAN
SECTION A-A
REPUBLIQUE TUNISIENNE
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2 ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
-MC50- AU PK6.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
COFFRAGE CULEES
Le CONSULTANT


COUPE B-B
VUE EN PLAN
COUPE A-A
ELEVATION PILE
REPUBLIQUE TUNISIENNE
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2 ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
-MC50- AU PK6.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
COFFRAGE PILES
Le CONSULTANT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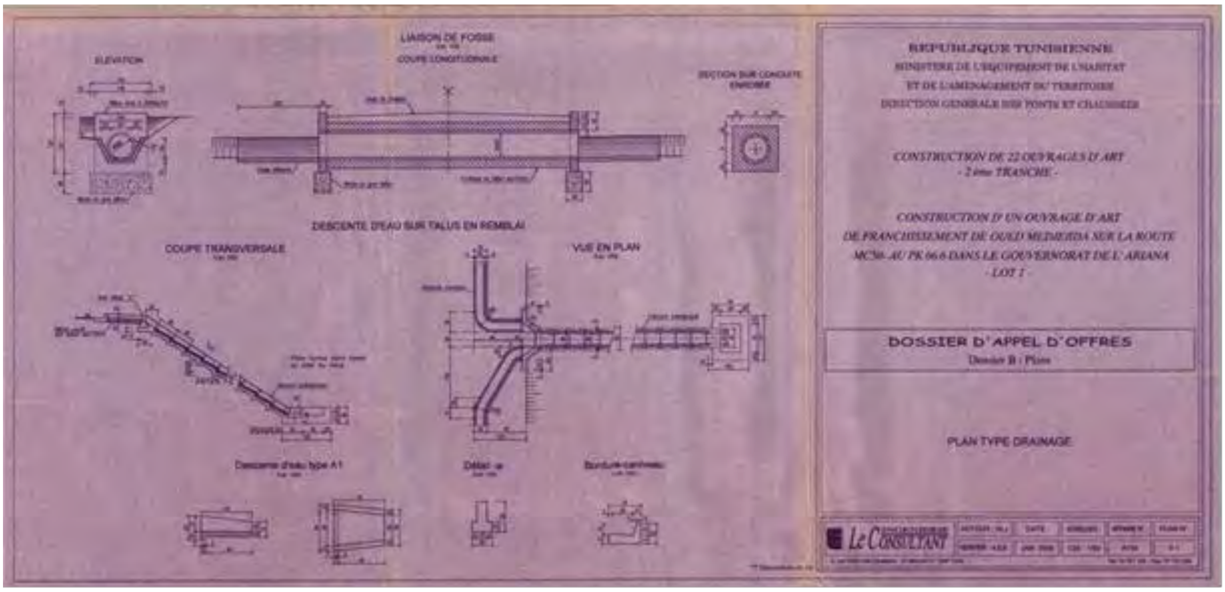
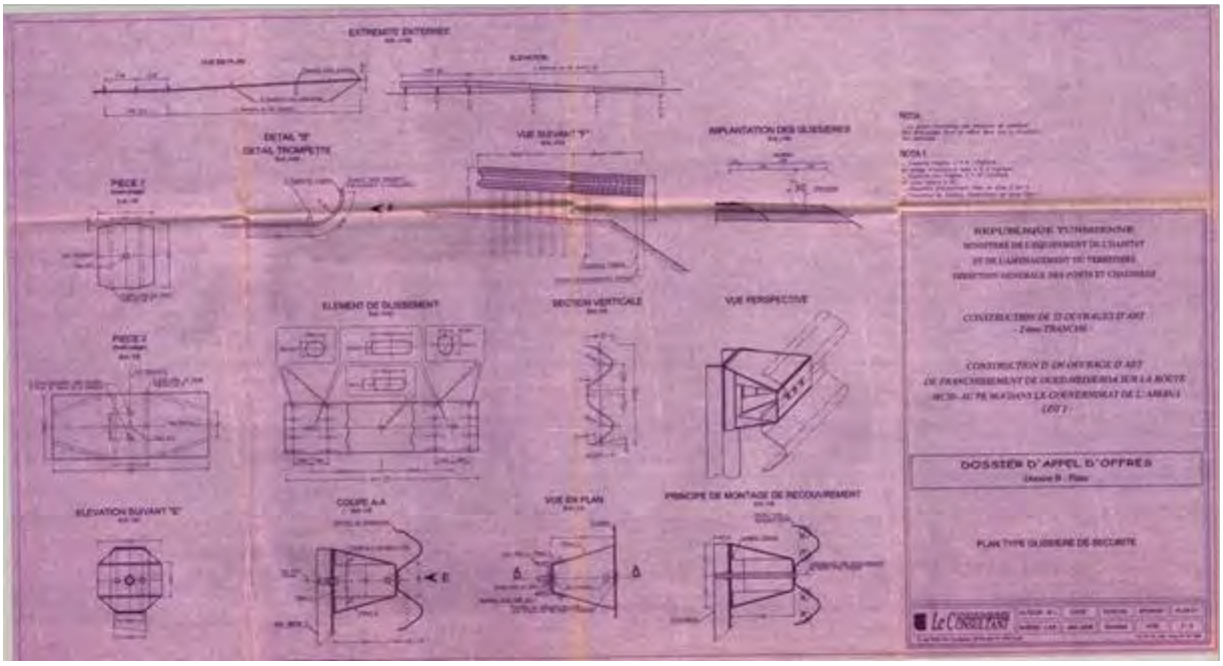
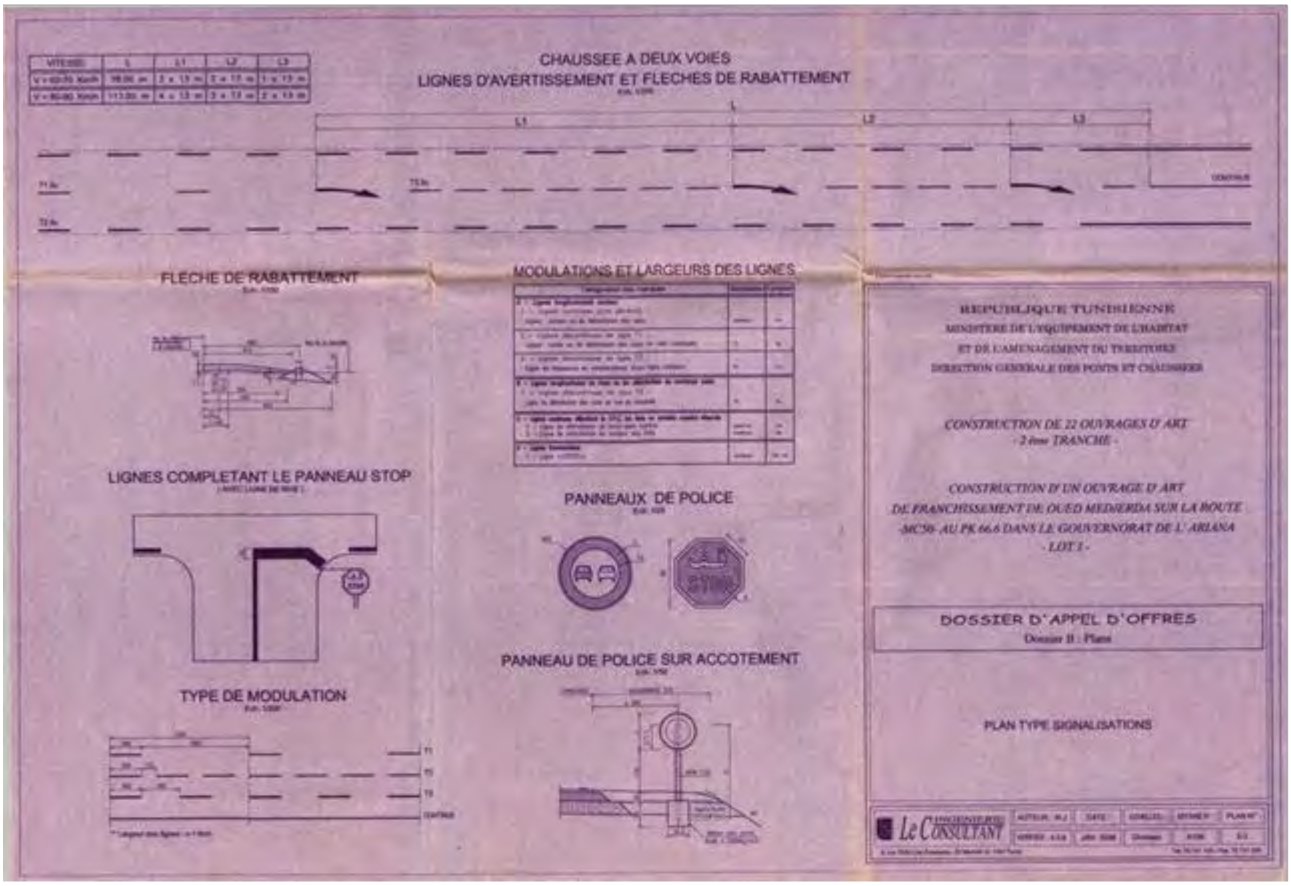
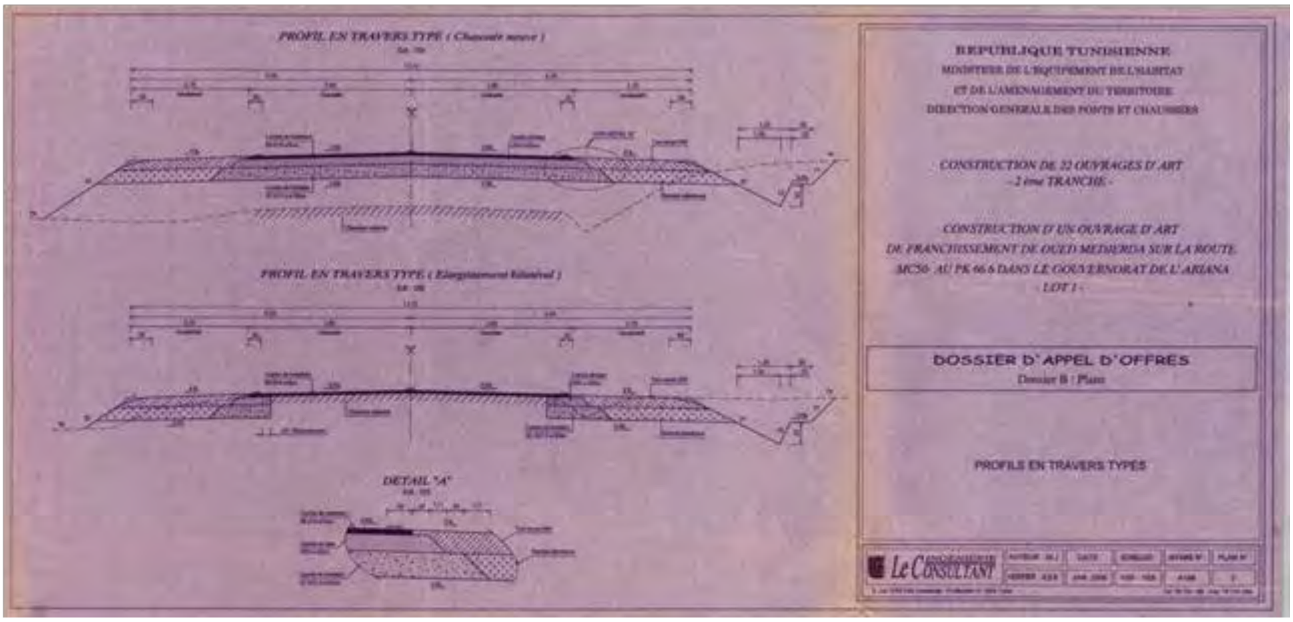
COUPE
VUE EN PLAN
DETAIL JOINT DE CHAUSSEE TYPE "Wd 80"
PROFILE EN ELASTOMERE
SCHEMA DU DRAIN
NOTA :
JOINT DE TROTTOIR (à plaques glissantes)
DOUILLE D'ANCRAGE
VUE DE DESSUS
COUPE A-A
ELEVATION
A
A
REPUBLIQUE TUNISIENNE
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2ème TRANCHE -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
PLAN DES EQUIPEMENTS
JOINT DE CHAUSSEE & JOINT DE TROTTOIR
Le CONSULTANT


LIAISON DE FOSSE
COUPE LONGITUDINALE
ELEVATION
SECTION SUR CONDUITE ENROBEE
DESCENTE D'EAU SUR TALUS EN REMBLAI
COUPE TRANSVERSALE
VUE EN PLAN
Descente d'eau type A1
Détail
Bordure-caniveau
REPUBLIQUE TUNISIENNE
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
MC50- AU PK 66.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
PLAN TYPE DRAINAGE
Le CONSULTANT
DATE


EXTREMITE ENTERREE
VUE EN PLAN
ELEVATION
DETAIL "B"
DETAIL TROMPETTE
VUE SUIVANT "F"
IMPLANTATION DES GLISSIERES
NOTA
NOTA 1
PIECE 1
PIECE 2
ELEMENT DE GLISSEMENT
SECTION VERTICALE
VUE PERSPECTIVE
ELEVATION SUIVANT "E"
COUPE A-A
VUE EN PLAN
PRINCIPE DE MONTAGE DE RECOUVREMENT
REPUBLIQUE TUNISIENNE
DOSSIER D'APPEL D'OFFRES
PLAN TYPE GLISSIERE DE SECURITE
Le CONSULTANT


CHAUSSEE A DEUX VOIES
LIGNES D'AVERTISSEMENT ET FLECHES DE RABATTEMENT
L
L1
L2
L3
FLECHE DE RABATTEMENT
MODULATIONS ET LARGEURS DES LIGNES
LIGNES COMPLETANT LE PANNEAU STOP
PANNEAUX DE POLICE
STOP
PANNEAU DE POLICE SUR ACCOTEMENT
TYPE DE MODULATION
T1
T2
T3
REPUBLIQUE TUNISIENNE
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2 ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
-MC50- AU PK 66.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier II : Plans
PLAN TYPE SIGNALISATIONS
Le CONSULTANT


PROFIL EN TRAVERS TYPE (Chaussée neuve)
PROFIL EN TRAVERS TYPE (Elargissement bilatéral)
DETAIL "A"
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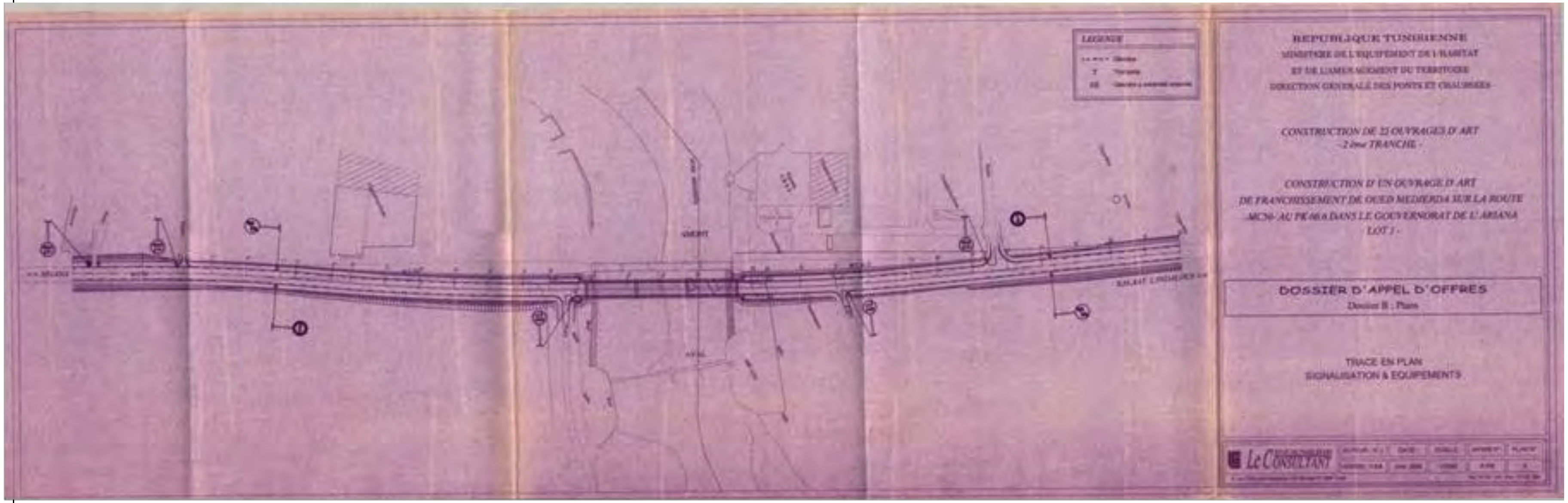
MINISTERE DE L'EQUIPEMENT DE L'HABITAT
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
- 2 ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
MC50 AU PK 66.6 DANS LE GOUVERNORAT DE L'ARIANA
- LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
PROFILS EN TRAVERS TYPES
Le CONSULTANT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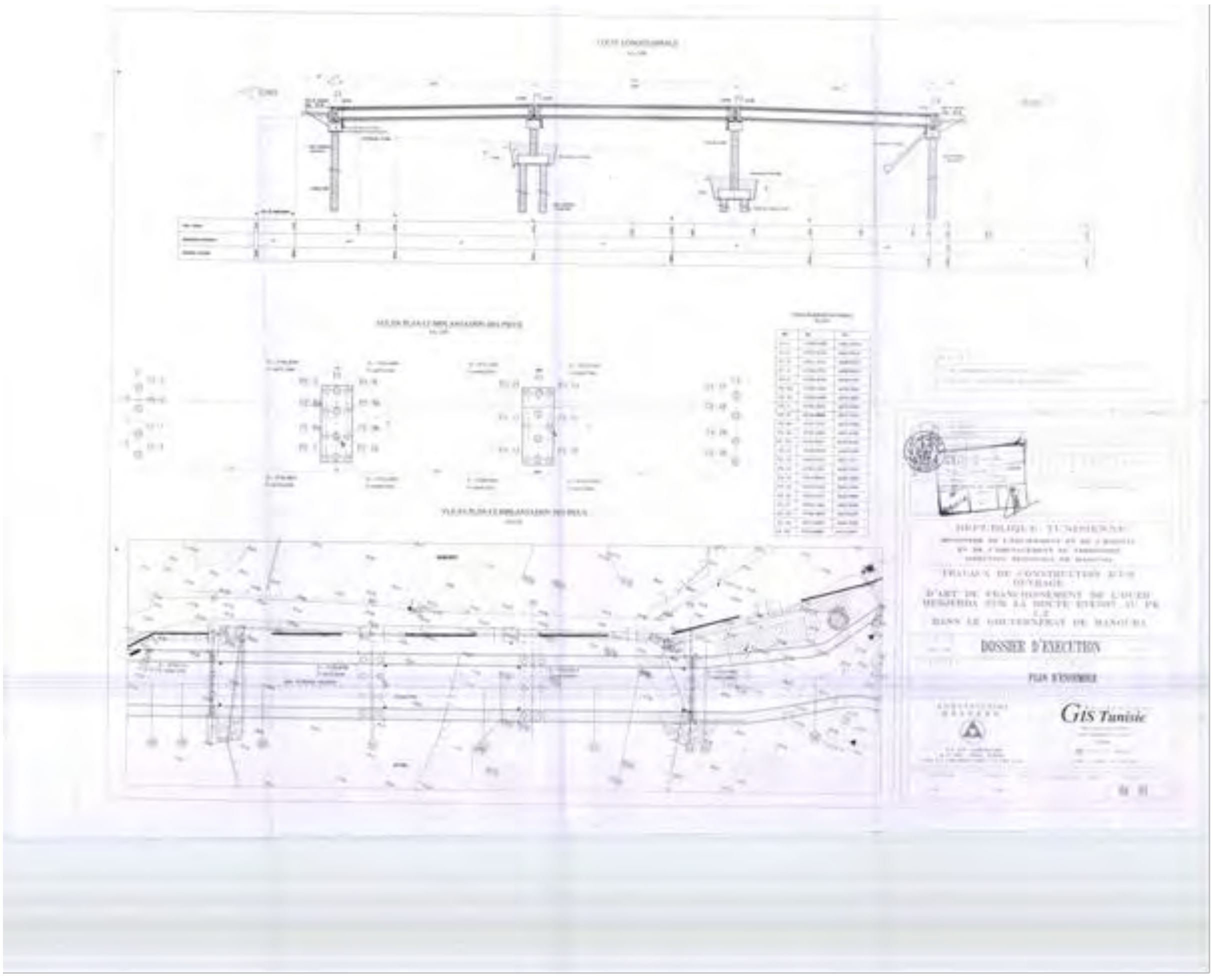
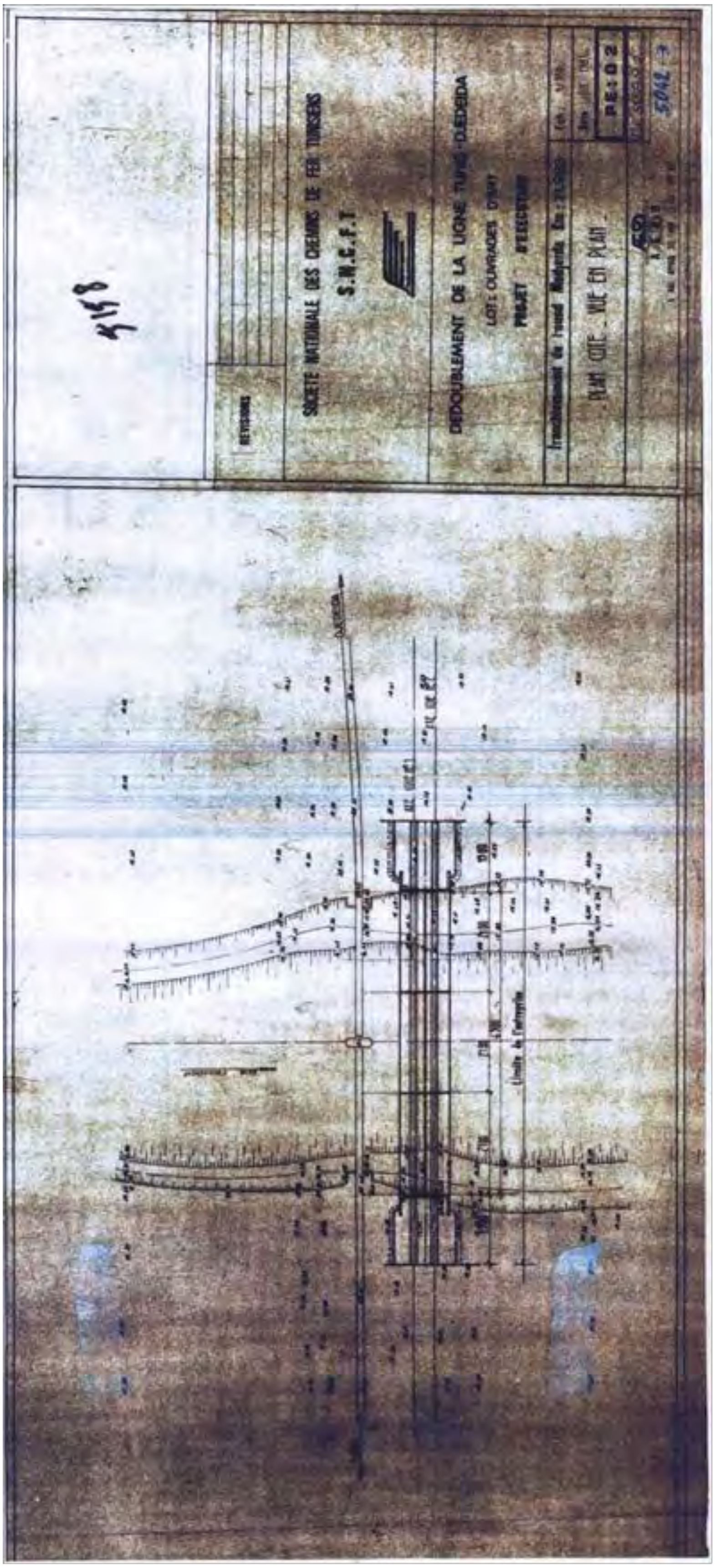
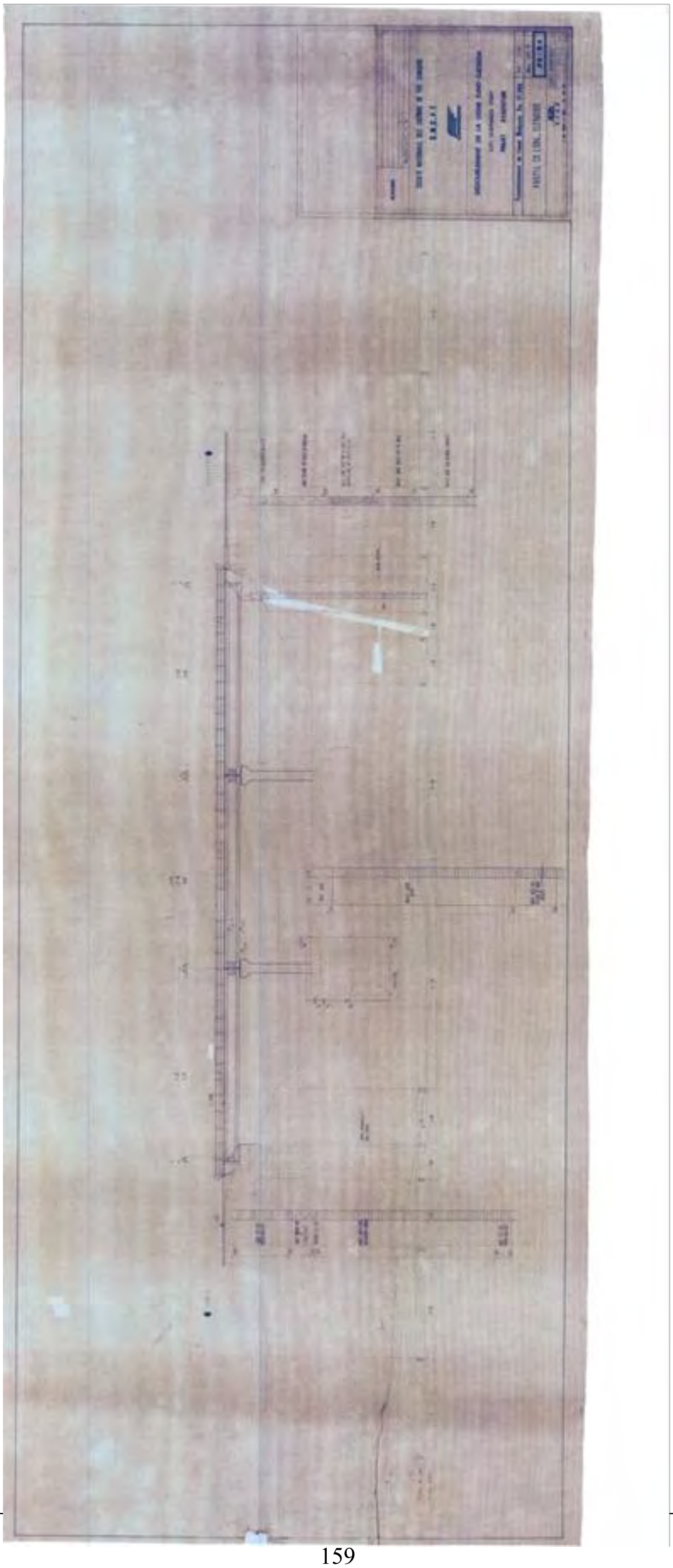
ET DE L'AMENAGEMENT DU TERRITOIRE
DIRECTION GENERALE DES PONTS ET CHAUSSEES
CONSTRUCTION DE 22 OUVRAGES D'ART
-2 ème TRANCHE -
CONSTRUCTION D'UN OUVRAGE D'ART
DE FRANCHISSEMENT DE OUED MEDJERDA SUR LA ROUTE
-MC50- AU PK 66.6 DANS LE GOUVERNORAT DE L'ARIANA
LOT 1 -
DOSSIER D'APPEL D'OFFRES
Dossier B : Plans
TRACE EN PLAN
SIGNALISATION & EQUIPEMENTS
Le CONSULTANT

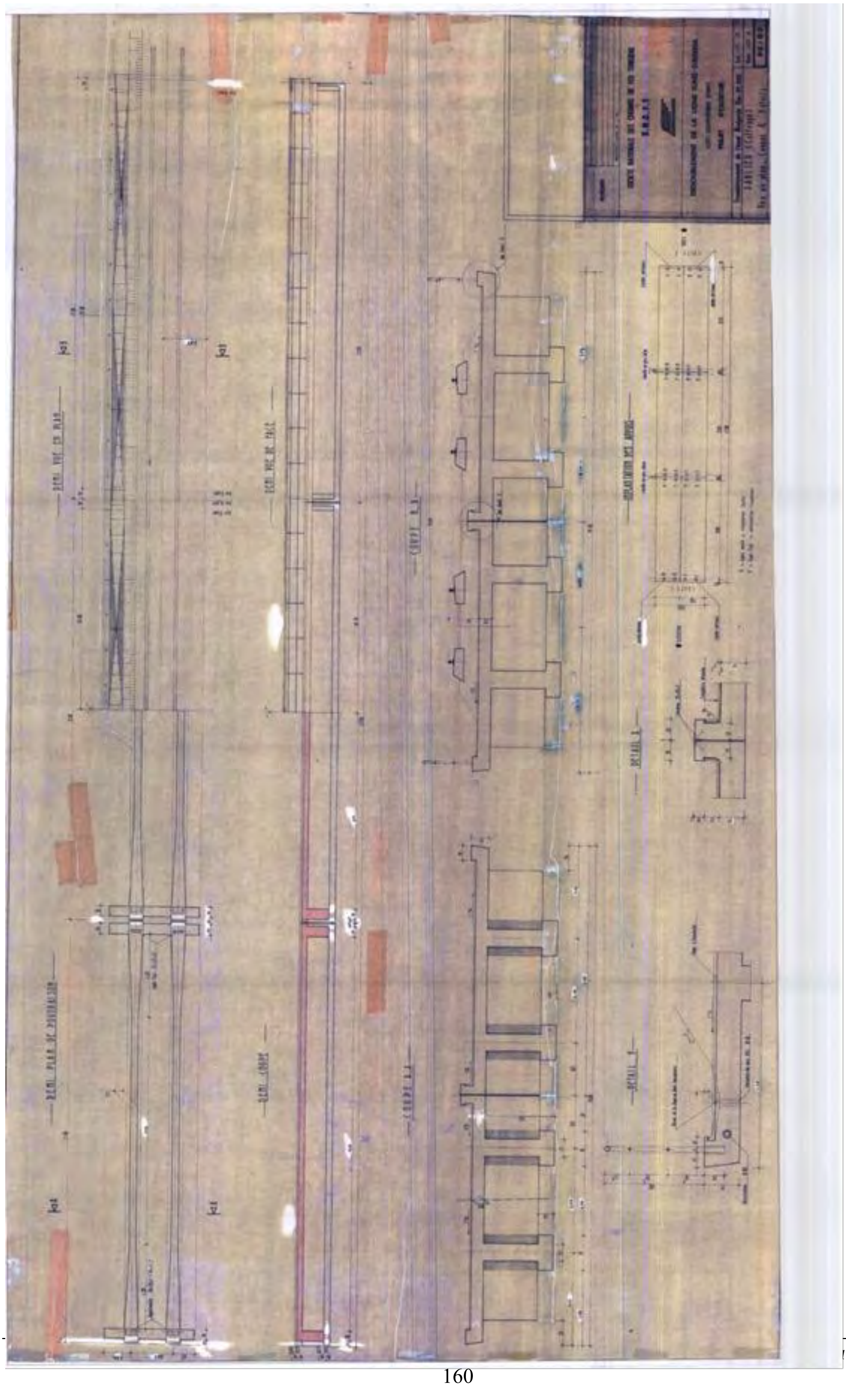
(2) JEDEIDA BRIDGE

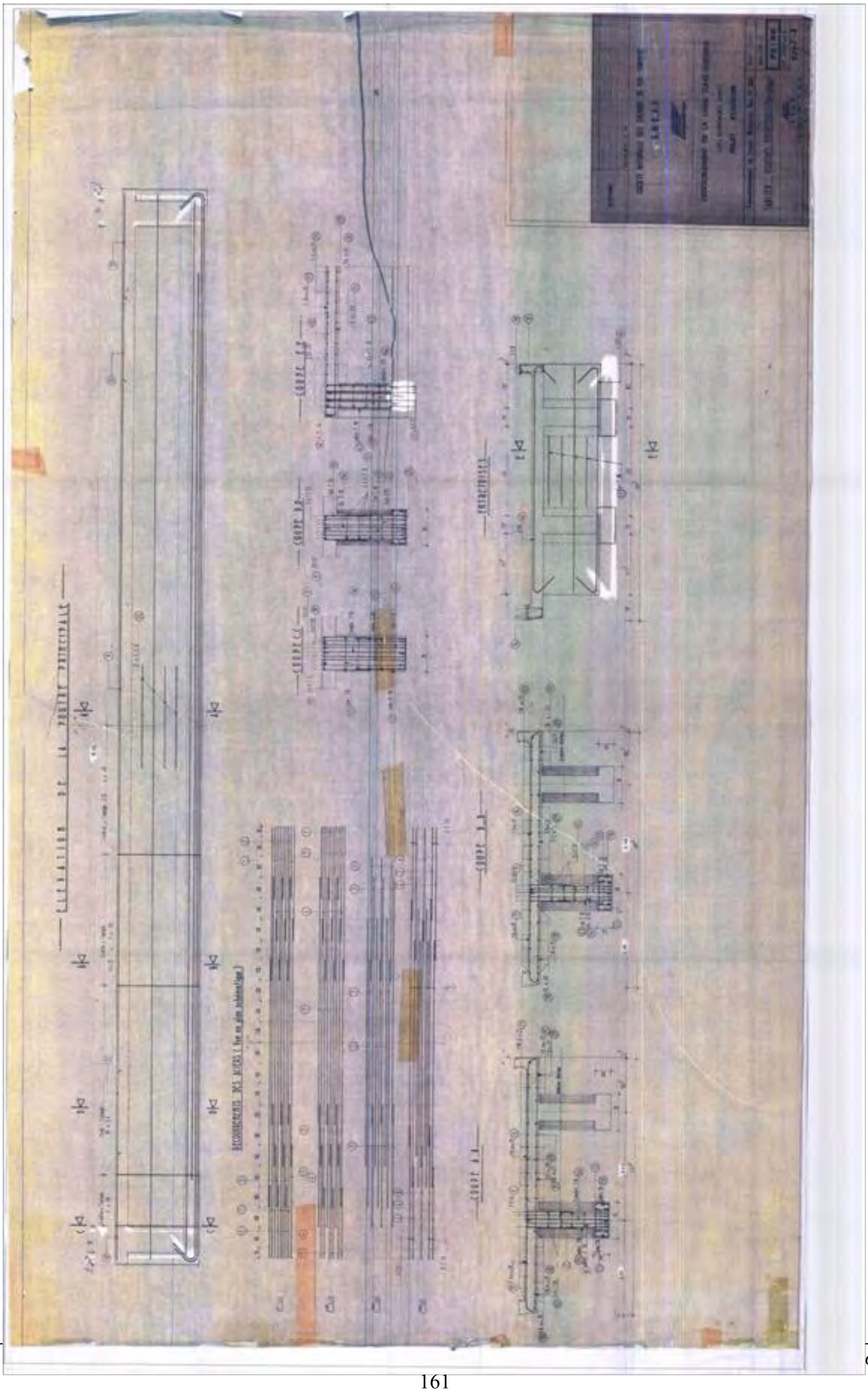


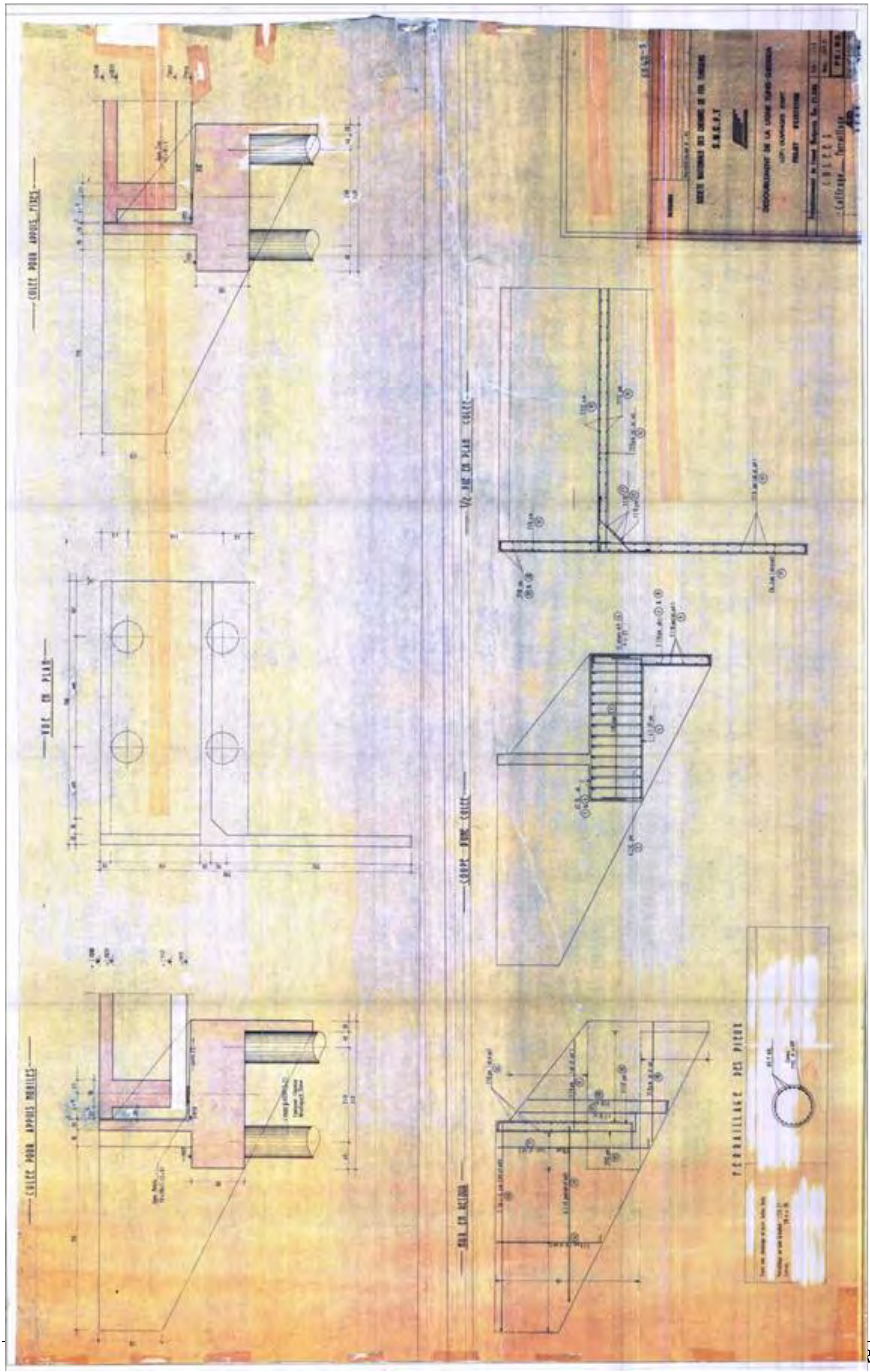
(3) JEDEIDA RAILWAY BRIDGE






DEMI VUE EN PLAN
DEMI VUE DE FACE
COUPE B-B
REPARTITION DES APPUIS
DETAIL A
DEMI PLAN DE POUTRAISON
DEMI COUPE
COUPE A-A
DETAIL B


ELEVATION DE LA POUTRE PRINCIPALE
COUPE A-A
COUPE B-B
COUPE C-C
COUPE D-D
ENTRETOISES
DECOUPAGE DES ACIERS (Vue en plan schématique)


CULEE POUR APPUIS FIXES
VUE EN PLAN
CULEE POUR APPUIS MOBILES
1/2 VUE EN PLAN CULEE
COUPE DANS CULEE
FERRAILLAGE DES PIEUX
S.N.C.F.T

4.3 Railway Bridge Renovation Project

(1) Study conditions for the railway bridge renovation

1) Design requirement for the bridge

Item	Content
Bridge Length	L=63.0m(21.0+21.0+21.0m)
Vertical alignment	Level （Rail Level 21.0m）
Horizontal alignment	R=∞
Elevation of Orbit	Rail Level～Slab Level＝0.600m
Superstructure Type	Simple PCT girder ×3 span Girder Heights H=1.650m（Slab t=0.250m）

2) Conditions of the river

Item	Content	
River	Mejerda	
Position	37.834km	
River Width	Existing	W=58.92m
	Plan	W=86.43m（+27.51m）
Elevation of Levee	Right：20.9m , Left：21.2m	

3) Amount of raise

Item		Content
Elevation	Rail Level	21.0m
	Bottom of Girder	19.200m
	HWL	20.056m
Heights	HWL～Bottom of Girder	1.0m～
	New Girder	2.250m
	Rail Level～Slab Level	0.600m
Raising Amount		3.0m
	Rail Level 23.906m ～ Raising Amount 2.906m → 3.0m	

4) Temporary railway installation conditions

Item	Content
Horizontal alignment	R=160m ～
Relaxation curve length	L＝400.000m
Longitudinal gradient	ｉ＝9.0‰
Horizontal alignment	R=2000m

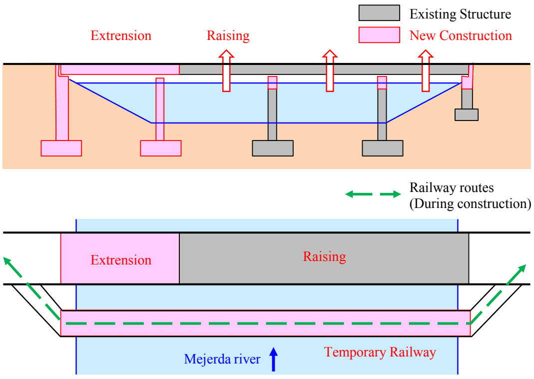
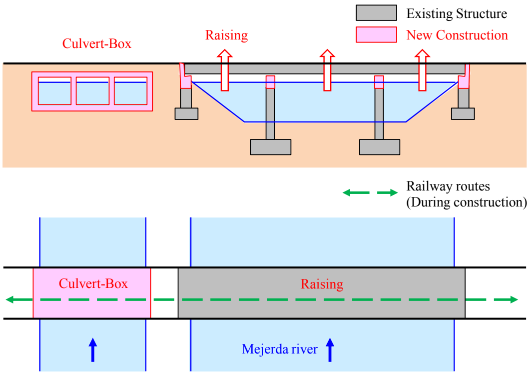
(2) Renovation plan

1) Renovation plan

Under given study conditions, normally the Plan A “Detour with temporally railway & Bridge renovation” is excellent in most economic. The detour with temporally railway, however, results longer distance than existing and it may cause larger impact on the surrounding environment.

Therefore, as an alternative solution, Plan B is compared with Plan A. This method is to construct culvert box covering river flow area in its box without interfering with railway operations. HEP&JES method is one of the typical. (For more detailed information, see 6.4.1 (1) in the main text).

As a result of comparing the two planes, adopt Plan A “Detour with temporally railway & Bridge renovation”.

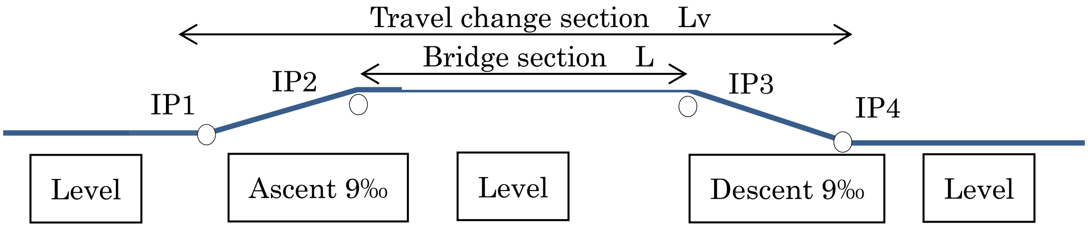
	Image	Cost(million yen)			
		item	Quantity	Cost	
Plan A	 * For demolition and construction substructure, plan temporary railway	Structure	1 Unit	95	○
		Excavation	---	---	
		Approach	775m	37	
		Temporary railway	366m	8	
		TOTAL		140 (1.00)	
Plan B		Structure	1 Unit	154	×
		Excavation	90,000m³	32	
		Approach	748m	36	
		Temporary railway	---	---	
		TOTAL		222 (1.59)	

Extension of the railway

a) Estimation of railway track extension by elevation change

Estimate railway track extension distance by elevation change.

1. Raising height ΔH = 3.0m
2. Raising distance Plan A: L = 90m (Span 27+21+21+21m)
   Plan B: L = 63m (Span 21+21+21m)
3. Travel slope i = 9%

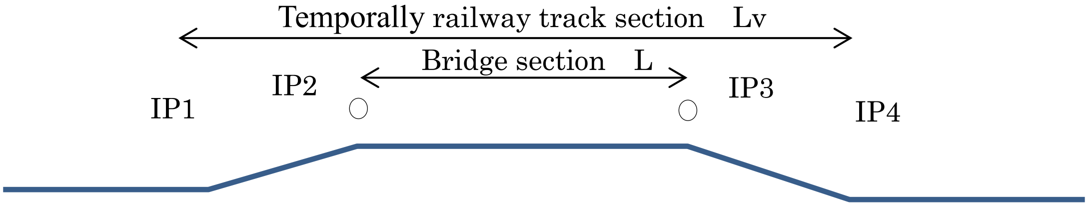


4. Railway track construction total distance Plan A: L = 775 m
   Plan B: L = 748 m

b) Estimation of railway track extension by temporally detour

Estimate railway track extension distance by temporally detour.

1. Parallel movement distance ΔB = 12.0m
2. Straight temporary railway track extension distance L = 63m
3. Branch angle 4° 46' (Slope = 8.33%)
4. Track transition curveNone



4. Total railway track distance Plan A: L = 366m

5 Related Documents of Chapter 8 (Environmental Social Considerations)

5.1 EIA Study Report (Draft)

Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River: Development of Flood Prevention Measures

Environmental Study Report (Draft)

January 2013

Japan International Cooperation Agency

Yachiyo Engineering Co., Ltd.

Table of Contents

Chapter 1. Background of the survey

1.1 Background and purpose of the survey

1.1.1 Background

The Mejerda River is an international river through Algeria and Tunisia with a total channel length of 460 km and a basin area of 23,700 sq. km. With 312 km of the channel length (68%) and 15,830 sq. km. (67%) of the basin area within Tunisian territory, it is the largest basin area in the country. In the northern part of Tunisia where the river runs through, the rainy season is from September to March. Frequent flooding during this period has obstructed land use in the flood plain of the lower basin.

The Sidi Salem Dam was constructed in 1981 as part of the flood control measures in the lower basin. In the 22 years since its construction, there has been no flooding downstream from the dam. With a relative abundance of rainfall and fertile lands in Tunisia over this period, agricultural development boomed and grew into a driving force for the economy of the lower basin. In 2003, however, discharged water from the dam caused a seriously damaging flood. It caused severe damage with submerging duration of more than a month, 10 deaths, 27,000 evacuees, damaging field crops and houses and blocking area access. Further floods caused by discharges from Sidi Salem Dam in 2004, 2005, 2009 and 2012 have resulted in similar socioeconomic damage and increased poverty. These factors are impeding the continuous development that Tunisia has achieved. The area is in urgent need of comprehensive flood measures as existing flood safeguards are low standard.

Upon request from the Tunisia government to improve these conditions, JICA conducted the Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River: Development of Flood Prevention Measures (hereinafter referred to as the “Development Survey”) over 26 months from 2006 to 2008. As a result of the Development Survey, they devised a master plan for integrated basin management focused on preventing flooding of the Mejerda River. The master plan comprised levees, flood control basins and other structural measures, as well as non-structural measures, including flood forecasting warning system, flood fighting and evacuation system, organization skill building, and land use restriction management in the flood plain. In 2009, the Tunisia government then requested a feasibility survey (FS) for the project proposed in the Development Survey. JICA responded by conducting the Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River (hereinafter the “Preparatory Survey”) from September 2010 to May 2012. To collect basic information and review basic countermeasures, the Preparatory Survey focused on the lowest basin, Zone D2. This area was regarded in the master plan as that with the biggest economic effect.

1.1.2 Purpose

Based on the Preparatory Survey and the Climate Change Impact Analysis separately conducted by JICA, we will conduct a feasibility survey for the Integrated Basin Management and Flood Control Project for Mejerda River in order to facilitate implementation of the Project. This survey is to complement and complete the findings of the Preparatory Survey.

Chapter 2. Project Overview

2.1 Project Overview

2.1.1 Overview of the Overall Project Plan

The Mejerda River Flood Control Project is to carry out river improvement works to prevent inundation damage in Jedeida and Tebourba in the downstream and farmland on both sides of the river. The river improvement works will be carried out in a 60.4-kilometer section from the Kalaat el Andalous Bridge to the Laroussia Weir in the upstream. At the time of flooding, water will be diverted at a speed of 200 m^3 /s (part of the design flood discharge at a speed of 800m^3/s) and temporarily stored in the El Mabtouh Retarding Basin. As measures against flood exceeding the designed level and flood caused by global warming, a flood forecasting warning system, a dam management system and a flood fighting and evacuation system shall be established at the same time as structural measures of the river improvement works.

2.1.2 Contents of Construction Works

(1) River Improvement and Retarding Basin Works (Structural Measures)

For the Mejerda river projects, sufficient cross section has been secured for the design flow of 600~800m^3/s with a design scale based on the return period of 10 years. The structural measures of the Mejerda River Flood Control Project are river improvements (levee construction and river-bed excavation) necessary for the design flow, construction of a retarding basin for diversion and storage of design flood discharge, construction of discharge channels to the retarding basin and drainage channels from the basin to the Mejerda River, and construction of appurtenant structures of the discharge and drainage channels.

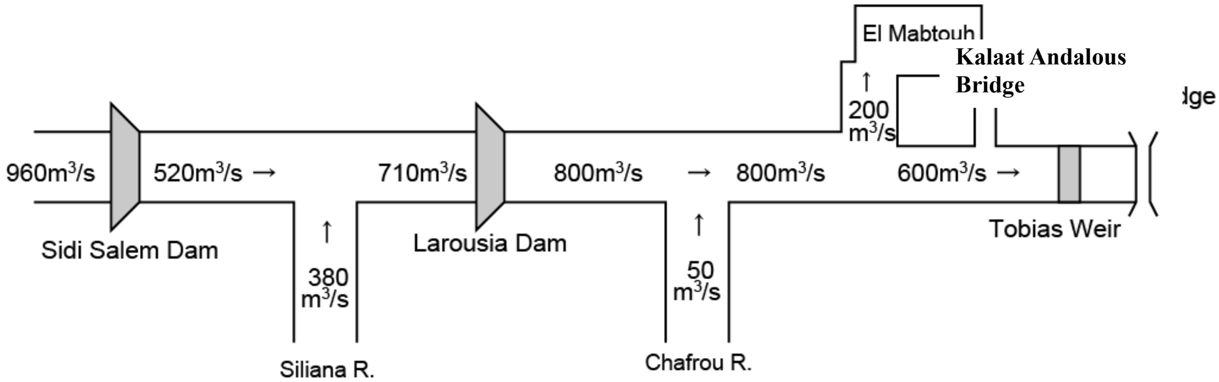


Figure 1: Assignment of Design Flood Discharge (D2 Zone: Laroussia Dam – Kalaat Andalous Bridge)

14 bridges over the Mejerda River, 3 bridges over the Chaffrou River, a tributary of the Mejerda River, (in total 17 bridges in Construction Zones I and II) and 15 bridges over discharge channels from the El Mabtouh Retarding Basin will be reconstructed or newly constructed. The following table shows the overview of the target facilities, number of bridges, major river structures etc.

Table 1: Overview of River Improvement and Retarding Basin Works of the Mejerda River Flood Control Project

Classification	Works	Unit	River Improvement I	River Improvement II	River Improvement III	Total
Length		Km	34.1	31.2	26.1	91.4
River Improvement						
	Excavation	1000m3	5,659	2,361	2,048	10,068
	Embankment	1000m3	508	525	73	1,106
	Removal	1000m3	5,151	1,815	1,975	8,941
River Facilities						
El Mabtouh						
	Inflow Weir	Unit	-	1	-	1
	Discharge Control	Unit	-	1	-	1
	Outflow Gate	Unit	-	1	-	1
	Overflow Weir	Unit	-	1	-	1
Mejerda River						
	Sluiceway	Unit	5	0	4	9
Bridges			9	15	8	32
	Reconstruction	Bridge	2	6	2	10
	Construction	Bridge	0	3	0	3
	Raising	Bridge	1	0	1	2
	Demolish	Bridge	2	0	1	3
	No Measures	Bridge	4	6	4	14

The following map shows the target areas of river improvement and retarding basin works and the locations of reconstruction and construction of bridges.

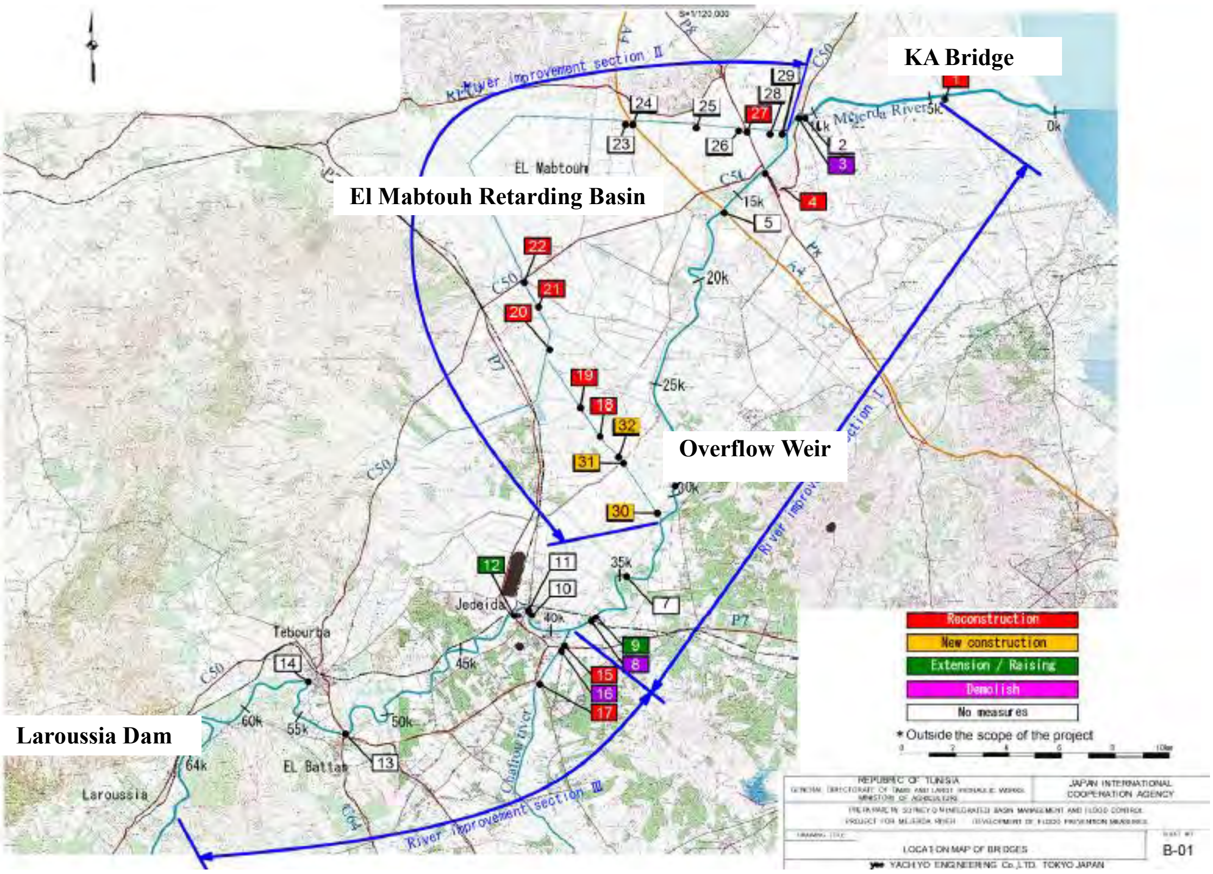


Figure 2: Target Areas of River Improvement and Retarding Basin Works (Construction Zones and Locations of Bridges)

(2) Nonstructural Measures

(3) Nonstructural measures play complementary roles as measures against flood exceeding the design flood level and also as adaptation measures against climate changes with such characteristics as smaller investment cost than structural measures and usefulness as short-term responses and measures. Listed below are the nonstructural measures to be carried out in the Mejerda River Flood Control Project.

Table 2: Contents of the Nonstructural Measures to Be Carried Out in the Mejerda River Flood Control Project

No.	Envisioned Non-structural Measures	Relative Agencies/Bodies	Project Area
1	Dam Flood Management System	DGBGTH	Sidi Salem Dam
2	Warning Information System and Flood Fighting Activities Plan	MA ONPC CRDA	Mejerda River (D2 Zone)
3	Strengthening of Organization and Capacity Development for Flood Management System	MA (DGRE, DGBGTH) MEq	Mejerda River

Source: JICA Survey Team

2.2 Project and EIA Implementing Schedule

2.2.1 Project Implementing Schedule

We set the project implementing schedule after considering the major processes listed below. The following table shows processes and time periods required for processes concerning the project implementation such as major loan procedures, planning survey, environment impact assessment (EIA), detailed design, estimate of accumulation, bidding and construction management. We assume the pledge will be made in March 2013 and 24 months will be required for the selection of the consultant.

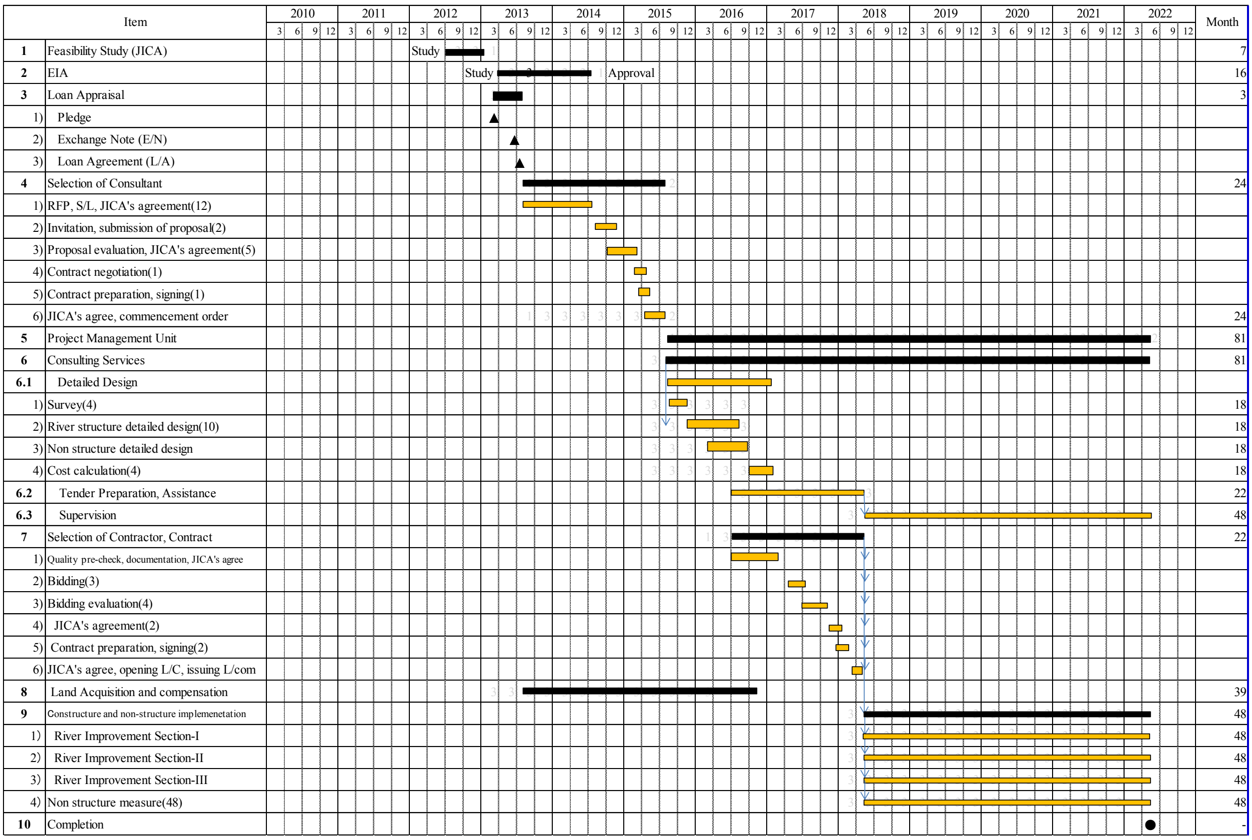
Table 3: Time Periods Required for Major Processes and their Contents

No.	Process	Required time period	Contents
1	Yen loan procedures	4 months	Mar 2013 Pledge Jun 2013 Conclusion of E/N Jul 2013 Conclusion of L/A
2	Environment Impact Assessment (EIA)	(16 months)	Selection of consultant: 5 months Local survey: 4 months Report to and examination by the National Environment Protection Agency (ANPE): 6 months Approval from ANPE: 1 month
3	Land acquisition	22 months	After the completion of EIA and detailed design and before the start of construction
4	Selection of consultants	24 months	Creation of RFP and short list and consent of JICA: 12 months Invitation and submittal of proposal: 2 months Evaluation of the proposal and consent of JICA: 5 months Contract negotiation: 2 months Preparation and conclusion of contract: 1 month Consent of JICA on contract and notice to commence: 2 months
5	Detailed design	18 months	Location survey and research: 4 months Detailed design related to river improvement, bridges and river structures: 10 months (including 8 months for design of nonstructural objects) Volume calculation and estimation of accumulation: 4 months Preparation of bidding documents: 3 months
6	Selection of contractors	22 months	Prequalification of bidders, creation of bidding documents and consent of JICA: 8 months Bidding: 3 months Bidding evaluation: 4 months Consent of JICA: 2 months Negotiation and conclusion of contract: 2 months JICA's consent to contract, opening of L/C and issue of L/Com: 2 months
7	Implementation of main construction works and nonstructural measures	48 months	River improvement of River-I, II, III, construction of bridges and a retarding basin River-I (48), River-II (48), River-III (48) Implementation of programs related to nonstructural measures
8	Completion of construction and delivery	-	Completion of facilities and delivery to the irrigation association of each river basin

Note: The time period required for JICA's consent on procurement differs depending on the type (consultant or contractor) and the amount.

Below are the implementation processes of the Mejerda River Flood Control Project under the above-described conditions. The EIA that will be conducted by the Tunisian side has to be started and obtain approval of the National Agency of Environment Protection at an early date. Land acquisition has to be completed before the initiation of the Project.

Table 4: Implementation Processes of the Mejerda River Flood Control Project



	Item	Month
1	Feasibility Study (JICA)	7
2	EIA	16
3	Loan Appraisal	3
1)	Pledge	
2)	Exchange Note (E/N)	
3)	Loan Agreement (L/A)	
4	Selection of Consultant	24
1)	RFP, S/L, JICA's agreement(12)	
2)	Invitation, submission of proposal(2)	
3)	Proposal evaluation, JICA's agreement(5)	
4)	Contract negotiation(1)	
5)	Contract preparation, signing(1)	
6)	JICA's agree, commencement order	24
5	Project Management Unit	81
6	Consulting Services	81
6.1	Detailed Design	
1)	Survey(4)	18
2)	River structure detailed design(10)	18
3)	Non structure detailed design	18
4)	Cost calculation(4)	18
6.2	Tender Preparation, Assistance	22
6.3	Supervision	48
7	Selection of Contractor, Contract	22
1)	Quality pre-check, documentation, JICA's agree	
2)	Bidding(3)	
3)	Bidding evaluation(4)	
4)	JICA's agreement(2)	
5)	Contract preparation, signing(2)	
6)	JICA's agree, opening L/C, issuing L/com	
8	Land Acquisition and compensation	39
9	Constructure and non-structure implemenetation	48
1)	River Improvement Section-I	48
2)	River Improvement Section-II	48
3)	River Improvement Section-III	48
4)	Non structure measure(48)	48
10	Completion	-

Source: JICA Survey Team

Below is the summary of major processes and implementing schedule based on the above.

Table 5: Implementing Schedule of Major Processes of the Mejerda River Flood Control Project

Major Procedure	Required Period (Months)	Envisioned Implementation Period (From – To)
1.EIA Survey	16	2013.5 - 2014.4
2.Loan Procedure	4	2013.3 - 2013.7
3.Selection of Consultant	24	2013.8 - 2015.7
4.Consulting Service	81	2015.8 - 2022.4
4.1 Detailed Design	(18)	2015.8 - 2017.2
4.2 Tender Documents	(22)	2016.7 - 2018.5
4.3 Supervision works	(48)	2018.5 - 2022.4
5.Selection of Contractor	22	2016.7 - 2018.4
6.Construction	48	2018.5 - 2022.4
7.Completion of the Project	-	2022.5

2.2.2 EIA Implementing Schedule

The general schedule from the start of the EIA to approval was confirmed during conferences with the ANPE and is as shown in the table below.

Implementation of the EIA is based on JICA's EIA Report (draft) for this survey. A quick start will be necessary after the TOR for the order of consultants for the EIA has been created. Additionally, close consultation with the ANPE during this stage will be important.

Table 6: General schedule from the start of the EIA to approval

Step Duration:15 Months	Duration (Month)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Prearation of TOR of EIA Study	2	■														
Public tender offer and submission of bids by applicants	3		■													
Analysis of tenders and preparation of tender analysis report, submission to the Securities Commission				■	■											
Opinion by the Securities Commission and market preparation	1					■										
Carriying out of EIA Study by a contracted consautant company/ Submission of EIA Report to ANPE	6						■	■	■	■	■	■				
Stake Holde Meeting	2								■			■				
Duration of Evaluation and Approval of EIA Report by ANPE	3												■	■	■	

Chapter 3. Current Status of Social Environment of Project Regions

3.1 Current Status of Social Conditions

3.1.1 Outline of Social Condition Survey

The socio-economic study subcontracted to and performed by local consultants is outlined below.

1) Purpose

To collect and analyze socio-economic data to gain a clear understanding of the social conditions of the regions in the project plan. The three main details covered by this survey are as given below:

① To confirm and grasp the socio-economic condition of communities along the Mejerda River and the El Mabtouh Wetlands coast

② To access damage sustained by local residents due to recent floods in 2003 and 2009

③ To determine ownership of the houses, agricultural facilities and other sites along the Mejerda River, especially areas in public water districts and retreat areas (construction lines and easements).

This survey was conducted using the following methods:

① We collected data at the area/sector level where possible in order to compare the data of survey areas/sectors (Imadas: smallest administrative unit). Sector is the unit used to analyze results of the survey.

② A questionnaire given to households along the Mejerda River and the El Mabtouh Wetland coast as well as production facilities that suffered damages from increased water levels of the Mejerda River in the past.

2) Survey Regions and Residents

The target districts and sectors of this survey are shown in the table below. Survey regions were selected based on the following criteria:

① Sectors on the administrative boundary line that at least border the Mejerda River or part of the El Mabtouh Wetlands

② Sectors that suffered damages from floods in 2003 and/or 2009

Sector Chiefs coordinated with the leaders of agricultural extension cells (CTV) and irrigation regions to select survey households. The social condition study was conducted on residents of the Mejerda River and the El Mabtouh Wetland, with a survey sample of 294 households. Residents surveyed belonged to 18 of 47 sectors in seven districts. The districts and sectors in this study are shown in the following table.

Table 7: Study Area and Division List by Reference/Sector

Governorate	District	Sector	Mej.	Mab.	03	09
Bizerte	Utique	Utique (Zana)	●	●	●	
		Utique Nouvelle			●	
		Besbassia		●		
		El Houidh				
		El Mabtouh		●	●	●
		Ain Gehlal		●		
		Sidi Othmène		●	●	
		Bach Hamba	●	●	●	●
	Ghar El Melh	Ghar El Melh				
		Bajou				
		Ousja			●	
		Zouaouine			●	
Ariana	Sidi Thabet	Sidi Thabet	●			
		Bejaoua	●		●	●
		Mongi Slim	●			
		Cebalet Ben Ammar				
		Chorfech	●		●	●
	Kalâat el-Andalous	Kalaat En Andalous Est	●			
		Kalaat Andalous Ouest	●			
		Pont de Bizerte	●		●	
		Bou Hanach				
		El Hessiane				
		Ennahli				
Manouba	Oued Ellil	Oued Ellil				
		Essaida	●		●	●
		Er Riadh				
		Cité El Ouerd				
		Ennajet				
		San Haja				
		El Kobbaa				
	Jedeida	Jedeida	●		●	●
		Jedeida Rached	●		●	●
		Chaouat	●		●	●
		El Mansoura				
		Es Zahra				
		El Habibia				
	Tebourba	Tebourba	●		●	
		El Ansarine				
		Edkhila				
		El Mellaha				
		Banlieue Tebourba				
		Er Raja				
		EchChouigui				
	El Bataan	El Battan	●		●	
		Borj Ettoumi				
		Mehriine				
		El Aroussia				

Note) Mej. - Sectors that border the Mejerda River
Mab. - Sectors that border the El Mabtouh Wetland
03 – Sectors affected by the 2003 floods
09 – Sectors affected by the 2009 floods

Table 8: Geographical distribution of surveyed households by sector and representative percentage

Area	Sector	Surveyed Households	Percentage of surveyed households from total in 2010 estimate census (%)
Utique	Ain Ghlal	4	0.7
	Bach Hamba	20	3.7
	El Mabtouh	23	6.9
	Sidi Othmene	13	7.1
	Utique	6	1.0
Sidi Thabet	Bejaoua	20	3.2
	Chorfesh	22	3.5
	Monji Slim	8	0.8
Kalaât Andalous	Kalaât Andalous Est	8	0.6
	Kalaât Andalous Ouest	28	1.3
	Pont de Bizerte	12	2.1
Oued Ellil	Essaida	4	0.3
Jedeida	Chaouet	15	1.7
	Jedeida	23	2.2
	Jedeida-Hached	23	1.4
Tebourba	Banlieue de Tebourba	19	0.6
	Medina, Tebourba	12	1.2
El Bataan	El Bataan	34	1.7
Total		294	1.5

Source: 2004 General census of the population and habitat (RGPH 2004), National Institute of Statistics (INS)

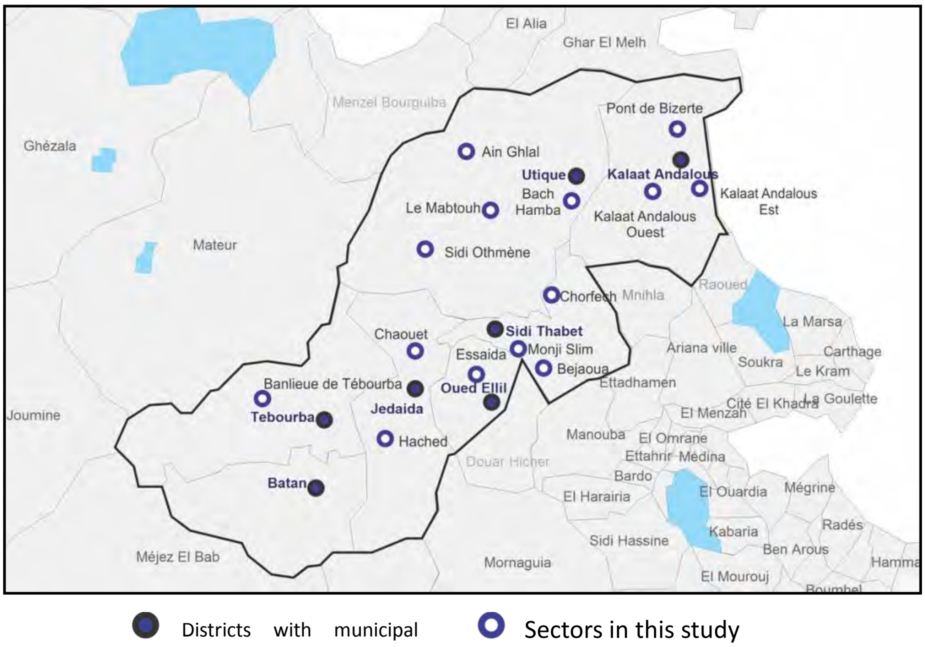


Figure 3: Location Map of Target Districts/Sectors for Socio-Economic Survey

3) Survey Items

Items in the socio-economic survey are shown in the table below.

Table 9: Social Condition Survey Items

Item	Sub-Item	Item Description
(1) Evaluate Socio-Economic Conditions	1) Population/Gender	
	2) Income/Livelihood	
	3) Standard of Living	
	4) Livestock	
	5) Agriculture	
	6) Available services	
	7) Usage of local resources	
(2) Site occupation, site usage	1) Site possession	
	2) Residence	
	3) Agricultural land	
	4) Site occupation	a) Residential areas
		b) Grazing path areas
		c) State owned grazing paths in El Mabtouh Wetland
(3) Flood situation/damage	Flood damage	

3.1.2 Social Condition Survey Results

The survey results have been tallied by district and sector for replies from survey participants and households. The results of the socio-economic survey are as shown below.

(1) Current Socio-Economic Conditions

1) Population & Gender

a) Population

The survey covered the coast of the Mejerda River, home to 18,980 households and 88,118 people in 18 sectors. 55,776 people (12,170 households) from the total live in urban sectors according to the 2004 census.

Based on the fact that the population increased an average of 1% per year between 2004−2010, we estimate the population of surveyed regions to exceed 100,000 people. The figure below shows the average household size (number of members per household) in each district based on the survey.

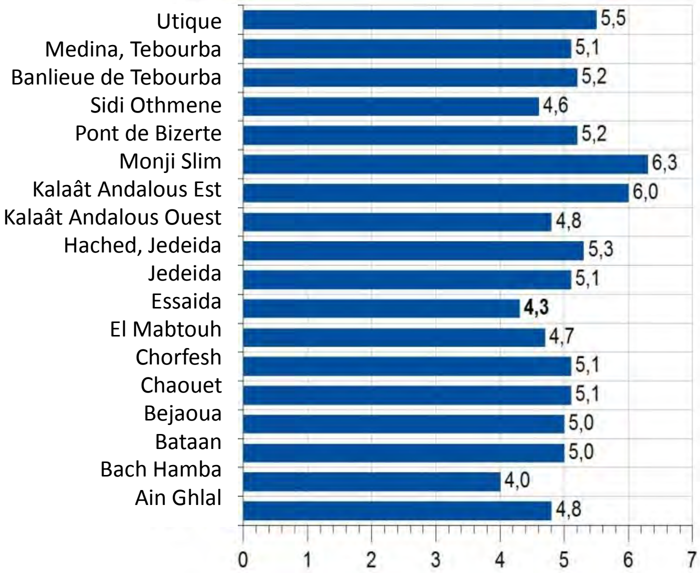


Figure 4: Average Household Size (No. of Members) by Sector

b) Gender

The figure below utilizes 2004 data from the INS and shows the industries the working population belonged to split by gender for surveyed regions.

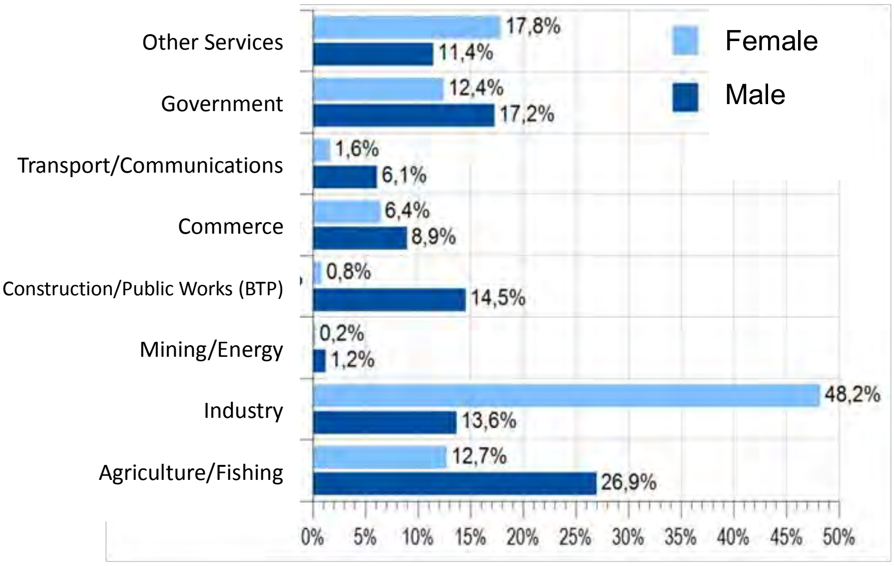


Figure 5: Classification of Working Population in Surveyed Districts by Gender and Industry in 2004

Source: 2004 General Census (RGPH), National Institute of Statistics (INS)

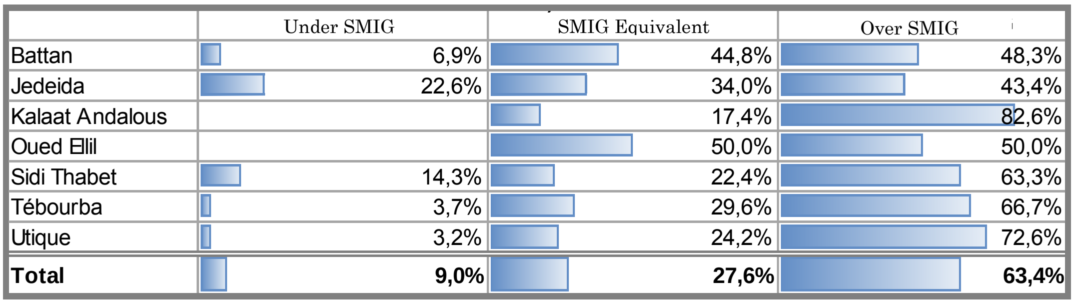
2) Income/Livelihood

The table below shows major sources of income by sector and the percentage (%) of working people in households. Agriculture has a high percentage as the major source of income.

The figure below compares the average income of households to the guaranteed minimum wage (SMIG, 250 TND/month) and splits up those averages into three categories per district. Approximately 37% of these districts have a monthly income equal to or under the SMIG. More than 50% of those in the Jedeida, Oued Ellil and El Bataan Districts earn the equivalent of SMIG or less.

Table 10: Source of Household Income by District (percentage (%) of the working population with income)

District	Salary	Pension	Social Aid	Family Aid	Agriculture	Day Work	Other
Utique	18.7	-	1.4	-	73.2	4.0	2.7
Sidi Thabet	11.5	1.9	1.9	-	80.8	3.9	-
Kalaât Andalous	8.1	-	-	2.1	87.7	-	2.1
Oued Ellil	50.0	-	-	-	50.0	-	-
Jedeida	37.3	1.2	1.2	1.2	43.3	15.7	-
Tebourba	16.7	-	3.3	3.3	66.7	3.3	6.7
El Bataan	37.3	2.3	-	-	53.4	4.7	2.3



	Under SMIG	SMIG Equivalent	Over SMIG
Battan	6,9%	44,8%	48,3%
Jedeida	22,6%	34,0%	43,4%
Kalaat Andalous		17,4%	82,6%
Oued Ellil		50,0%	50,0%
Sidi Thabet	14,3%	22,4%	63,3%
Tébourba	3,7%	29,6%	66,7%
Utique	3,2%	24,2%	72,6%
Total	**9,0%**	**27,6%**	**63,4%**

Figure 6: Classification of Average Household Income by District (Surveyed Household %)

3) Livestock

Approximately half of the households that were surveyed said they raised livestock. Results are shown in the table below. The average number of livestock owned by households in each sector is 35 sheep and 8.4 cows. There are many farmers in Utique that own a high number of livestock. Other districts generally had a lower average amount.

Ain Ghlal, El Mabtouh, Kalaât Andalous, Utique and other districts located on the left bank between El Mabtouh and the river mouth raise many sheep. Sectors that have over 50 sheep are concentrated in sectors with vast wetlands such as El Mabtouh and Kalaât Andalous.

Sectors with an extremely large amount of cows include Bach Hamba and Utique. Essaida, Chorfesh, and Kalaât Andalous Ouest also have a large amount of cows, and many of these household also own many sheep.

Some households (9%) pay a fee for grazing rights, which costs 910 TND annually for an average 153 days of grazing.

Table 11: Number of Livestock of Households in Each Sector

Area	Sector	Sheep			Cows		
		Min	Max	Avg	Min	Max	Avg
Utique	Ain Ghlal	250	250	250	1	10	5.5
	Bach Hamba	4	100	18.1	1	235	21.3
	El Mabtouh	2	400	104.3	1	10	4.1
	Sidi Othmene	3	50	15.7	1	12	5.3
	Utique	3	200	57.0	10	40	21.3
Sidi Thabet	Bejaoua	3	3	3.0	1	12	4.8
	Chorfesh	10	100	41.7	5	20	10.9
	Monji Slim	2	2	2.0	2	8	5.8
Kalaât Andalous	Kalaât Andalous Est	6	70	45.3	1	10	4.8
	Kalaât Andalous Ouest	1	120	29.4	2	70	10.3
	Pont de Bizerte	2	60	14.4	3	12	6.7
Oued Ellil	Essaida	2	2	2.0	11	11	11.0
Jedeida	Chaouet	3	40	16.3	2	6	3.8
	Jedeida	1	15	8.7	1	6	4.0
	Jedeida-Hached	4	15	7.0	1	1	1.0
Tebourba	Banlieue de Tebourba	6	8	7.0	1	6	3.2
	Medina, Tebourba	7	7	7.0	-	-	-
El Bataan	El Bataan	4	20	7.4	1	10	3.3
Average		1	400	35	1	235	8.4

4) Agriculture

Of surveyed households that said they farmed, 70% grow vegetables and use private irrigation. Some agricultural districts, such as El Mabtouh and Sidi Othmene, cultivate produce without irrigation like trees (El Mabtouh) and grains (El Mabtouh, Sidi Othmene). Irrigation farming in this project concentrates the most on the Bach Hamba and Kalaât Andalous Ouest regions.

(2) Land Ownership/ Land Use

1) Ownership of Land

We confirmed the following options with regard to the ownership of land on the coast of the Mejerda River.

① Ownership of land with a certificate of rights
② Ownership of land without a certificate of rights
③ Occupation
④ Renting
⑤ Other

Of the 209 households that answered our question, 37.8% owned land with a certificate of rights while 14.8% owned land without a certificate of rights.

The table below shows the number of households in each district and the manner of land ownership as classified from (1) to (5). Jedeida and Bejaoua have a particularly high number of land owners who do not have a certificate of rights. An extremely high number of households in each sector in Kalaât Andalous Est and Ouest, El Mabtouh, Bach Hamba, and El Bataan held occupational rights.

In addition, compensation is owed to land owners who have a certificate of rights as well as owners that possess land without a certificate based on Tunisian land ownership law.

Table 12: Land Ownership of Agricultural Land in Sectors along the Mejerda River (Survey Participant Households)

Area	Sector	(1) Propr. aTF	(2) Propr. sTF	(3) Occ.	(4) Loc.	(5) Other	Total
Utique	Ain Ghlal	2	1	1	0	0	4
	Bach Hamba	9	0	10	2	0	21
	El Mabtouh	2	1	8	0	0	11
	Sidi Othmene	7	1	0	0	1	9
	Utique	4		1		1	6
Sidi Thabet	Bejaoua	3	7	1	2	0	13
	Chorfesh	13	2	2	5	0	22
	Monji Slim	2	1	2	0	0	5
Kalaât Andalous	Kalaât Andalous Est	1	0	7	0	0	8
	Kalaât Andalous Ouest	3	0	15	8	0	26
	Pont de Bizerte	9		0	2	0	11
Oued Ellil	Essaida	2	0	0	0	0	2
Jedeida	Chaouet	9	2	1	0	0	12
	Jedeida	1	5	2	1	0	9
	Jedeida-Hached	2	0	2	2	0	6
Tebourba	Banlieue de Tebourba	5	5	7	1	0	18
	Medina, Tebourba	3	1	1	0	0	5
El Bataan	El Bataan	2	5	10	4	0	21
Total		79	31	70	27	2	209

① Propr. aTF : Land owners with a certificate of rights
② Propr. sTF : Land owners without a certificate of rights
③ Occ. : Occupiers/Land possessors
④ Loc. : Renters

2) Residence

81% of households own homes, and the disparity between the average of sectors is big (see figure below). The rate of home ownership is low in El Mabtouh (52%) and Kalaât Andalous Ouest (50%).

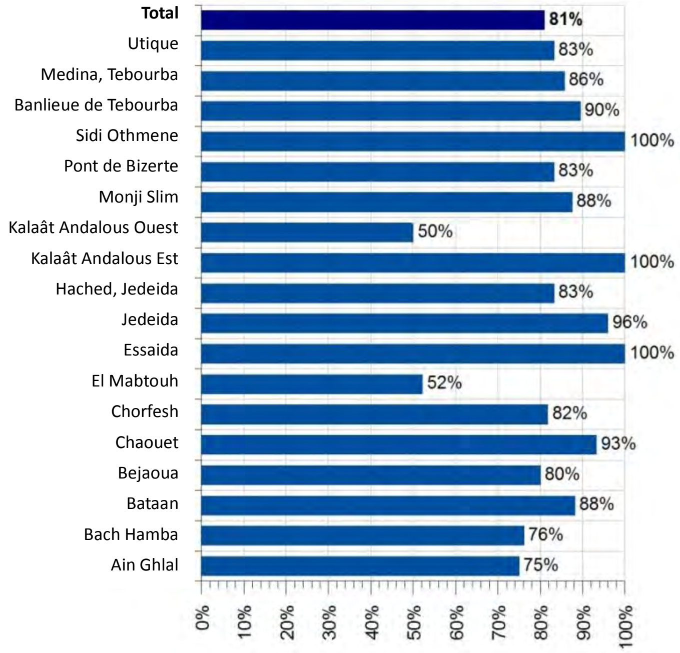


Figure 7: Rate of Home Owning Households (% by Sector)

3) Agricultural Land

The table below shows respondent households by sector who said they farmed in flood plains and near the Mejerda River. These numbers indicate that some parts of Utique, Kalaât Andalous, Jedeida, and other sectors particularly have agricultural land in the flood plains of the Mejerda River.

Table 13: Households that farm in the flood plains of the Mejerda River or nearby areas

District	Sector	Respondent Households	Agriculture near the Mejerda River	Agriculture in Flood Plain
Utique	Ain Ghlal	4	0	0
	Bach Hamba	19	19	10
	El Mabtouh	12	1	1
	Sidi Othmene	12	0	0
	Utique	6	4	1
Sidi Thabet	Bejaoua	12	12	4
	Chorfesh	22	21	9
	Monji Slim	4	4	1
Kalaât Andalous	Kalaât Andalous Est	8	8	2
	Kalaât Andalous Ouest	27	27	16
	Pont de Bizerte	11	11	2
Oued Ellil	Essaida	2	2	0
Jedeida	Chaouet	12	12	0
	Jedeida	9	4	5
	Jedeida-Hached	5	5	0
Tebourba	Banlieue de Tebourba	18	17	3
	Medina, Tebourba	5	5	0
El Bataan	El Bataan	21	21	2
Total				

4) Site Possession

a) Residential Area

The distance between the river and residences is at least 10 to 20 meters for most sectors, but it was two meters in the Jedeida sector. Of a total 25 households, 14 had homes within 60 meters of the river bed in the Jedeida sector. The figures were 10 out of 23 households in the Jedeida-Hached sector, and 6 out of 15 households in Chaouet. Other sectors had a lower percentage than the aforementioned numbers. The table below shows the distribution of residences located within 150 meters of the river bed.

Table 14: Distribution of Residences (No. of Households) Located within 150 meters of the River Bed

District	Sector	Households with Residences within 150m of River Bed (Classified by distance)				Total Households who replied
		< 10	10-19	20-59	60-149	
Utique	Ain Ghlal	-	-	-	-	3
	Bach Hamba	-	1	2	1	21
	El Mabtouh	-	-	-	-	18
	Sidi Othmene	-	-	-	-	12
	Utique	-	-	-	-	5
Sidi Thabet	Bejaoua	-	-	1	4	20
	Chorfesh	-	3	-	4	22
	Monji Slim	-	-	1	3	8
Kalaât Andalous	Kalaât Andalous Est	-	-	2	-	8
	Kalaât Andalous Ouest	-	1	4	4	27
	Pont de Bizerte	-	-	1	2	11
Oued Ellil	Essaida	-	-	-	-	4
Jedeida	Chaouet	-	-	6	6	15
	Jedeida	2	1	11	5	25
	Jedeida-Hached	-	-	8	9	23
Tebourba	Banlieue de Tebourba	-	-	1	2	18
	Medina, Tebourba	-	-	1	-	14
El Bataan	El Bataan	-	-	4	6	33
Total		2	6	42	46	287

(-): No applicable households

b) Grazing Regions

Approximately 75% of households that answered questions about stock farming said they use grazing regions near the Mejerda River while the remaining 25% replied they used the El Mabtouh Wetland or other places.

The Mejerda River is the major grazing region for all sectors besides El Mabtouh, Sidi Othmene, and Ain Ghlal. The El Mabtouh Wetland is the major grazing region for surveyed households in both the El Mabtouh and Sidi Othmene sectors and is used as a secondary grazing region for households in Ain Ghlal and Utique.

c) State Owned El Mabtouh Wetland Grazing Region

The state-owned El Mabtouh Wetland grazing region has an area of 3,365 hectares. Management of grazing regions was officially transferred from the Department of Livestock to the Directorate General of Forests (DGF) due to the change in administration on March 4, 2004. However, the DGF did not actually start managing grazing regions until 2008. The DGF enforced the grazing region management project from 2009 to 2010, but did not enforce it from 2010 to 2011 because of the unstable state of affairs in Tunisia due to the Jasmine Revolution. The Office of Livestock and Pastures (OEP) currently manages them.

The figure below shows the official map of the state owned El Mabtouh Wetland grazing region. They are currently addressing the issue of unlawful occupation in the southern and northeastern regions and are in the final stages of deciding the grazing region.

From 2009 to 2010, 54 nomadic pastoralist shepherds moved a flock of sheep and used this grazing region. The grazing region is also used by 152 shepherds who are permanently settled nearby (see picture below). The number of corresponding sheep for nomadic pastoralists was 15,880 sheep, and the permanent settlers had a flock of approximately 10,000 sheep. The grazing season is from February to April. Other government land besides grazing regions fall under forest precincts[1] managed by the Department of Forestry. Most of the nomadic pastoralists in the forest precincts of El Mabtouh are originally from the Sidi Bouzid and Kairouan Governorates. Grazing fees for forest precincts cost 0.2 TND per livestock per month. However, grazing fees for forest precincts have never been paid by the people who used the grazing region.

Mobile pastoralism has always been conducted in the El Mabtouh Wetland. In the 1980s, it was conducted in wetlands without feed production and grazing issues, and the El Mabtouh Wetland became an important grazing region for nomadic pastoralists in Tunisia. The stagnation of water from floods in either January or February never lasted more than one month a year because the sewerage system was well managed at the time.

However, feed production has been decreasing every year mainly because the operations of the agricultural cooperative have gotten worse, causing perpetual overgrazing, and leading to the decrease of sheep's fescue, a plant used as feed. According to the Office of Livestock and Pastures (OEP), another reason for the deterioration of grazing is due to the construction of the Tunis−Bizerte motorway. Embankment in the motorway construction blocked flood water from draining, causing water to stagnate in wetlands over a long period of time during the rainy season. Saline buildup on the road also negatively influences the growth of feed.

According to the Office of Livestock and Pastures (OEP), the condition of the grazing land in El Mabtouh Wetland is extremely bad and cannot even be considered a grazing region. The forest precincts are in a similar situation, and the outlook for feed production at the current stage is not good.

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[1] Forest management structure for each CRDA

Figure8: Area Map/Official Map of State Owned El Mabtouh Wetland Grazing Region as proposed by the DGF to the Ministry of State Properties (Final Draft)

Source: Bizerte Forest Precinct

Figure 9: Grazing Conditions of State-Owned El Mabtouh Wetland (November 2010)

(3) Flood Damage

Of the 292 households that answered questions about the location of residences relative to the Mejerda River, 206 households, or approximately 70%, said they lived in areas where flooding may occur. Approximately 66% of respondents experienced the 1973 flood, and 98% said they experienced the floods in 2003, 2004, and 2009.

The majority of respondents (approx. 86%) said that the 2003 flood caused the most damage. When residents talk about floods, they always compare damage to the 2003 flood. Responses regarding the 2003 flood are as follows:

1) Submerged houses due to the 2003 flood
   The percentage of submerged houses in each district: Jedeida (89%), El Bataan (88%), Tebourba (76%), Oued Ellil (75%).
2) Submerged depth and time due to the 2003 flood
   The submerged depth was the highest in each sector of Banlieue de Tebourba, Utique, Jedeida, El Bataan, Chaouet at the peak of the flood, and the average flood time was longest in the Utique, Jedeida, Chaouet Sectors.

Table 15: Submersion and Duration of 2003 Flood

Sector Name	Peak Submersion Depth of Flood	Flood Duration	Submerged Houses
Medina, Tebourba			76%
Banlieue de Tebourba	142cm		76%
Utique	130 cm	48hr	
Jedeida	105 cm	43 hr	89%
El Bataan	97 cm		88%
Chaouet	92 cm	34 hr	
Oued Ellil			75%

According to the table below, the Bach Hamba, El Mabtouh, Bejaoua, Chorfesh, Kalaât Andalous Ouest, Jedeida, Jedeida-Hached, Tebourba, and El Bataan Sectors had many flooded regions.

The average amount in damages of surveyed households exceeded 10,000 TND/household. The average in damages for the seven districts of Bach Hamba, El Bataan, Chaouet, Chorfesh, El Mabtouh, Kalaât Andalous Ouest, and Utique is even higher. Of surveyed households, 96 households, or over one third, received reparation from this department. 79% of reparations came in the form of financial aid while 31% was distributed through goods and items.

Table 16: Distribution of Residences (Households) in Flooded & Serviced Regions by Sector

District	Sector	Flooded Regions	Serviced Region		Total No. of Households
			Public Water Area	Backland	
Utique	Ain Ghlal	0	0	0	4
	Bach Hamba	16	0	0	21
	El Mabtouh	19	0	4	23
	Sidi Othmene	0	0	0	13
	Utique	5	0	0	6
Sidi Thabet	Bejaoua	16	1	1	20
	Chorfesh	22	0	0	22
	Monji Slim	4	1	1	8
Kalaât Andalous	Kalaât Andalous Est	8	0	0	8
	Kalaât Andalous Ouest	24	2	0	26
	Pont de Bizerte	2	1	0	11
Oued Ellil	Essaida	4	0	0	4
Jedeida	Chaouet	5	0	9	14
	Jedeida	12	1	11	24
	Jedeida-Hached	16	0	7	23
Tebourba	Banlieue de Tebourba	17	0	0	19
	Medina, Tebourba	13	0	1	14
El Bataan	El Bataan	23	1	2	32
Total		206	7	36	292

Table 17: Estimate in Damages and No. of Households that Received Aid from 2003 Flood

District	Sector	Damage Estimate (TND/Household)			Households that Received Aid
		Min	Max	Avg	
Utique	Ain Ghlal	500	1,500	1,000	0
	Bach Hamba	400	150,000	25,386	2
	El Mabtouh	800	210,000	17,000	11
	Sidi Othmene	1,200	12,500	3746	0
	Utique	2,000	60,000	14,500	3
Sidi Thabet	Bejaoua	1,000	80,000	8,700	1
	Chorfesh	500	80,000	11,068	0
	Monji Slim	500	500	83	0
Kalaât Andalous	Kalaât Andalous Est	4,000	10,000	7,214	1
	Kalaât Andalous Ouest	1,000	60,000	10,844	1
	Pont de Bizerte	2,000	20,000	4,250	0
Oued Ellil	Essaida	1,000	10,000	3,667	1
Jedeida	Chaouet	200	100,000	13,938	7
	Jedeida	2, 000	40,000	7, 563	13
	Jedeida-Hached	1,500	22,000	5,652	19
Tebourba	Banlieue de Tebourba	800	20,000	8,000	14
	Medina, Tebourba	1,000	35,000	4,536	6
El Bataan	El Bataan	1,000	150,000	12,015	17
Minimum Damage Estimate		200			Households that received aid: 96 total
Maximum Damage Estimate			210,000		
Average Damage Estimate				10,014	

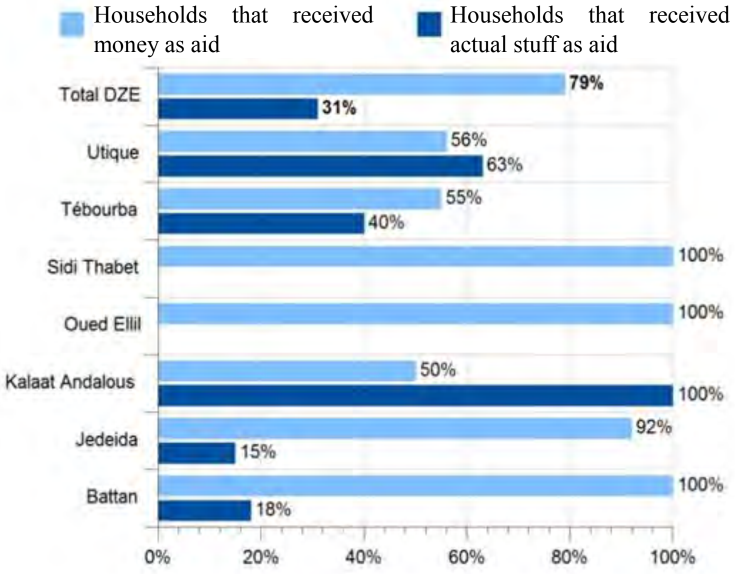


Figure 10: Distribution of Aid for Households that Suffered Damages in 2003 Flood

3.2 Environment Conditions

3.2.1 Preservation restrict etc.

(1) Overview

As Preservation restricts, Tunisia has a subscribed convention and lists of preservation restricts or the similar level of zone as follows,

- Ramsar Convention
- List of the Environmentally Sensitive Areas in the Management Plan of Environmentally Sensitive Areas in Tunisia (Ministry of Environment)
- Wildlife protection area
- List of 46 Important Bird Areas (ZICO)

Though Mejerda river’s downstream has been registered as a humid zone in the Ramsar Convention, the river has not been targeted as a preservation restrict or environmental restriction area.

(2) Humid Zone

1) Overview

According to the Preparatory Study of Tunisia's Wetlands (conducted in 1996 by the University of London for the DGF), there are 5wetland in the Mejerda River periphery as shown in the table below.

① Oued El Hmada (current course of the Mejerda)

② Oued Mejerda (former outflow of the Jedeida into the sea)

③ Garaet Bou Ammar (between the Oued Mejerda and the Garaet El Andalous)

④ Garaet Kalaat El Andalous (coastal zone south of the former course of the Mejerda)

⑤ Garaet El Mabtouh

These wetlands are difficult to differentiate. They form 2 large groups, the Garaet El Mabtouh, and the Ghar El Melh lagoon-Mejerda delta, which the Garaet Kalaat El Andalous forms part of. The El Mabtouh village locates in the center of the El Mabtouh wetland.

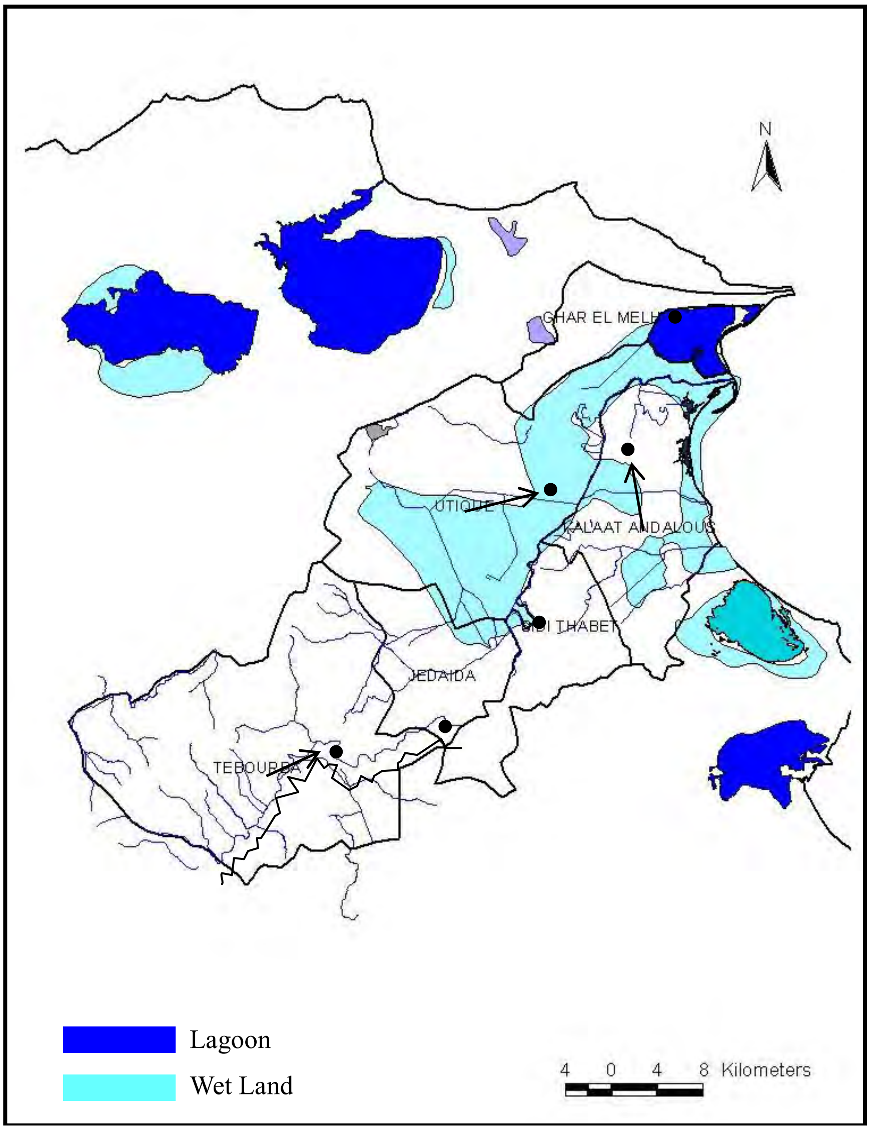


Figure 11: Location of Wetlands near the Mejerda River

Source: APAL (Coastal Protection and Planning Agency)—Coastal Observatory

2)Ghar El Melh Lagoon and the Mejerda River Delta

The Ghar El Melh Lagoon and Mejerda River Delta have the following characteristics:

① One section of the same region is registered under the wetland list of the Ramsar Convention.

② The same region is listed as an Environmentally Sensitive Areas in the Management Plan of Environmentally Sensitive Areas in Tunisia (Ministry of Environment).

③ Kalaât Andalous Wetland (Ariana Governorate) and the river basin between Ghar El Melh Lake - El Mabtouh Wetland was registered as a wildlife protection area in 2010-2011.

The registered areas of the Ghar El Melh Lagoon and Mejerda River delta under the Ramsar Convention are shown in the figure below. The registered area of the lower basin of the Mejerda River is 3.2 kilometers towards the ocean from the delta bridge furthest to the east from the target area in this project.

The Ghar El Melh Lagoon and the Mejerda River delta district has an area of 10,373 hectares, with 7,057 hectares in the Bizerte Governorate and 3,316 hectares in the Ariana Governorate. The following factors are the standards for designating a wetland under the Ramsar Convention:

① The body is a typical delta of the southern Mediterranean Sea and wetland. (Standard 1)

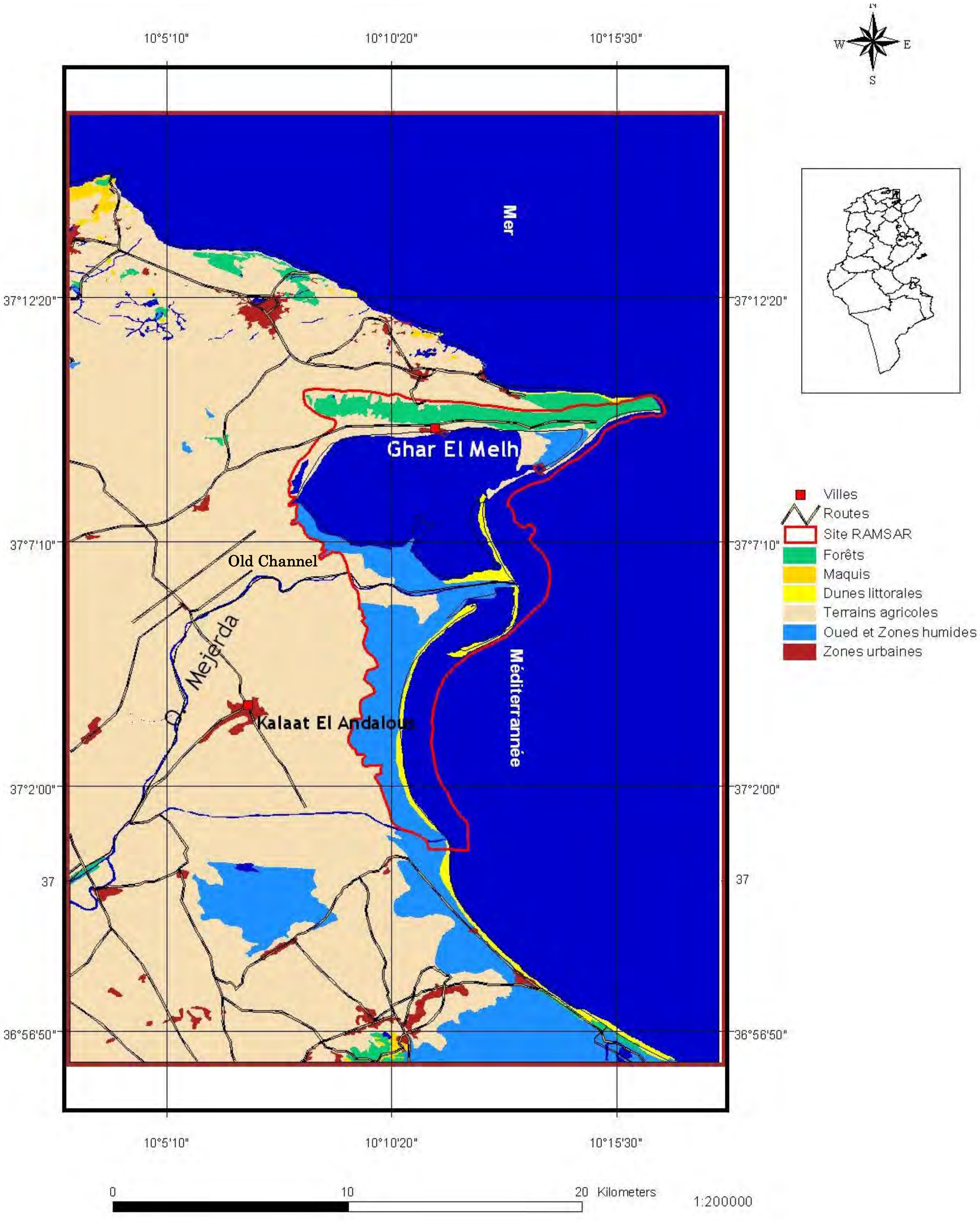
② There is great number of fishes in the final stage of the life cycle (13 of 45 inhabitant species permanently settled in the lagoon), and is a habitat for wildfowls (Standard 4)

③ In the nest building season, the population of collared pratincole crosses the 1% mark. (Standard 6)

④ During the winter season, it becomes a source of food for migratory fish. (Standard 8)

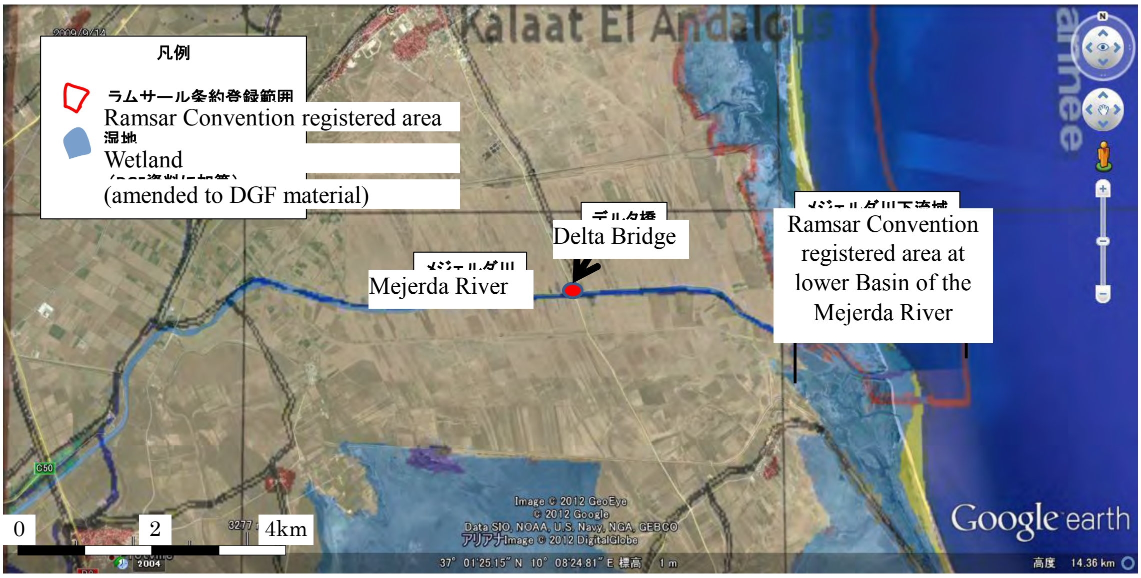
The southern part of the wetland registered under the Ramsar Convention is made of up flood plains and a saline lake, and plant life include halophilous plants such as plant species glasswort and Parish's glasswort (Arthrocnemum). The same region becomes a wetland in the winter. The fields of halophilous plants become the nesting grounds for collared pratincoles. However, this region is not included as an Important Bird Area (ZICO).

This region is designated under the Ramsar Convention and as an Environmental Sensitive Area in the Management Plan of Environmental Sensitive Areas in Tunisia.



Source: DGF

Figure 12: Registered Area of the Ghar El Melh Lagoon & Mejerda River Delta under the Ramsar Convention



(Source: Partially revised from DGF data)

Figure 13: Lower Basin of the Mejerda River registered in the Ramsar Convention

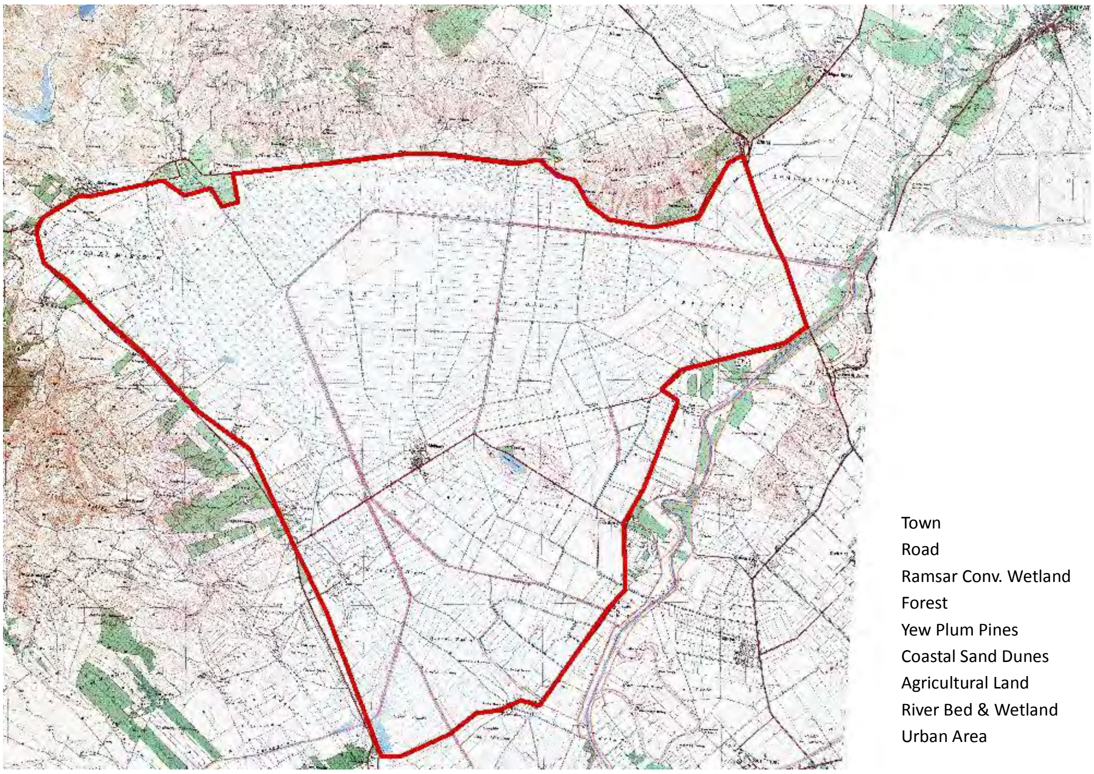
Figure 14: Project Implementation Area

Registered Areas in the Ramsar Convention: El Mabtouh Wetland & Lower Basin of Mejerda River

3) El Mabtouh Wetland

El Mabtouh Wetland is included in Tunisia's list of 46 Important Bird Areas (ZICO) (Code No. TN005). This wetland is where frail wildfowl species like the collared pratincole (Glareola pratincola) and shoveler (Anas clypeata) gather together periodically, and this designated colony corresponds to an Important Bird Area under the A4i standard. The A4i standard says that if the waterfowl population form a colony of at least 1% in the same season or if 5% of the population inhabits a region for an entire season, it is an IBA.

Other wildfowls hibernate in the El Mabtouh Wetland during rainy winters. We can see that the wildfowl population in this wetland resembles the population at Ichkeul Lake located north. The El Mabtouh Wetland also became a wildlife protection area in the 2010-2011 season due to a government ordinance regarding hunting.



Source: Bizerte Forest Precinct

Figure 15: Boundary Map of El Mabtouh Wetland

Figure 16: Scenery of the North Side of the El Mabtouh Wetland (left: May 2011, right: November 2010)

3.2.2 Animals

1) Wildfowls

The table below organizes the biological significance of the wetlands in the target region, especially wildfowls in the Mejerda River delta and the El Mabtouh Wetland based on the Washington Convention, IBA, IUCN Red List, ordinances about hunting, and ordinances that list endangered and rare species. 11 of the 18 species shown in the table are AAO ("Friends of Birds", NGO), and the remaining seven species are designated by the Bizerte Forest Precinct.

Table 18: Wildfowls that Inhabit Assessed Regions and Biological Significance

Scientific Name	Common Name	(1)CITES (Washington Convention)	(2) IBA (Important Bird Area)	(3) IUCN	Tunisia	
					(4) Hunting Ordinances	(5) Endangered Wildlife Ordinance
Glareola pratincola	Collared Pratincole	○	●	○	●	●
Himantopus himantopus	Black-winged Stilt	○	○	○	●	○
Pluvialis apricaria	European Golden Plover	○	○	○	●	○
Vanellus vanellus	Northern Lapwing	○	○	○	○	○
Anas clypeata	Shoveler	○	●	○	○	○
Anas Penelope	Eurasian Wigeon	○	○	○	○	○
Anas crecca	Eurasian Teal	○	○	○	○	○
Ardea cinerea	Grey Heron	○	○	○	●	○
Grus grus	Eurasian Crane	●	○	○	●	●
Circus aeruginosus	Western Marsh-harrier	○	○	○	●	○
Fulica atra	Eurasian Coot	○	○	○	○	○
Pluvialis squatarola	Grey Plover	○	○	○	●	○
Ciconia ciconia	White Stork	○	○	○	●	●
Bubulcus ibis	Cattle Egret	○	○	○	●	○
Ardea alba	Great Egret	○	○	○	●	○
Egretta garzetta	Little Egret	○	○	○	●	●
Burhinus oedicnemus	Stone Curlew	○	○	○	●	○
Calidris alpina	Dunlin	○	○	○	●	●

●Applies to the wildfowl species/○Does not apply to wildfowl species

(1) CITES (Washington Convention) Annex II

(2) According to the A4i standard for IBA (Important Bird Area), pp. 953-973 "Important Bird Areas in Africa and Associated Islands: Priority sites for conservation", L.D.C. Fishpool and M.I.Evans eds., written by Murad AmariHichem Azafzaf, Tunisia 2001. Newbury & Cambridge, UK: Pisces Publications & BirdLife International—BirdLife Conservation Series No. 11

(3) IUCN Red List, Endangered Species standard

(4) August 14, 2010 Regulation regarding hunting in the 2010-2011 season

(5) Ordinance List that designates endangered and rare fauna and flora (TBA)

2) Fish Species

The table below shows the native species that have biological significance based on the Washington Convention, Barcelona Convention, IUCN, and ordinance that designates endangered and rare fauna and flora.

Fairly old biological data for fish species in the lower basin of the delta is the only data that exists for fish species in the Mejerda River. Principal information came from interviews with the INAT (National

Institute of Agronomy of Tunisia), INSTM (National Institute of Sciences and Technologies of the Sea), and DGPA (Directorate General for Agricultural Production).

The most endangered fish species in the Mejerda River is the European eel (*Anguilla anguilla*). The Mejerda River is an important habitat for the life cycle of the European eel. This eel is also covered by Annex II of the Washington Convention as an endangered fish species. It is also classified as a critically endangered species in the IUCN classification system (Category CR). The DGPA set a goal in 2010 to promote the export of eels to Europe, and established and internal document labeled the Tunisian Eel Management Plan in November 2010. The European Commission has not approved of import from Tunisia since 2011. The seasonal migration of Japanese eel from the sea to the river upstream generally occurs between October to January.

The *Aphanius fasciatus (*Mediterranean killifish) has no value as a commercial product, but its habitat is a protected area in the Mediterranean in the Barcelona Convention and a protected area in the protocol (Annex II) regarding biological diversity. It is an important fish species for the biodiversity of the Mejerda River.

Pseudophoxinus fish of the Cyprinidae family and barbels are endemic species to the northeastern part of Maglev region and northern African region. *Pseudophoxinus callensis* is thought to be an endemic species that inhabits the small tributary upstream in the Mejerda River.

Other fish species introduced to the Mejerda River because of their commercial value are carp, roach, minnow, yellowfish, percidae, and catfish. These fish species can mostly be found in the reservoir located upstream. The mosquitofish (*Gambusia affinis holbrookii*) was introduced to exterminate wigglers, and has acclimated to Tunisian rivers.

In addition, the digging and expansion of the Mejerda River in this project will only be done to flood plains and will not be implemented for low water channels (riverbed). As such, the impact on the European eel and other fish species is considered low.

Table 19: Introduced Fish Species in the Mejerda River and Biological Significance

Scientific Name	Common Name	(1) Washington Convention	(2) Barcelona Convention	(3) IUCN	(4) Endangered Wildlife Ordinance
Anguilla anguilla	European eel	●	○	●	○
Aphanius fasciatus	Mediterranean killifish	○	●	○	○
Barbus barbus callensis	Barbel	○	○	○	○
Pseudophoxinus callensis	Phoxinelle De la Calle	○	○	○	○
Pseudophoxinus chaignoni	Phoxinelle de Chaignon	○	○	○	○

●Applies to fish species/○Does not apply to fish species
(1) CITES (Washington Convention) Annex II
(2) Barcelona Convention/Protocol
(3) IUCN Red List, Threatened Species Standard
(4) Ordinance List of Endangered and Rare Fauna & Flora

3) Mammals

The only confirmed mammal is the wild boar, but it does not fall under any protection measures. The

Mejerda River is not considered a good hunting spot by hunters, but boars are hunted on some occasions by the authorities to prevent damage to crops.

The scientific observation of otters in the lower basin of the Mejerda River goes back to 1983 (survey site of McDonald and Masson). According to the DGF (Directorate General of Forests), these animal species do not inhabit the region. According to the Preparatory Study of Tunisia's Wetlands (conducted in 1996 by the University of London for the DGF), plants that grow at the waterfront of the Mejerda River are provide refuge for the otters (*Lutra lutra linnaeus*). At the time, plants that grew at the waterfront composed mainly of nerium (*Nerium oleander*), willow (*Salix sp.*), cattail (*Thypha sp.*) and reed (*Phragmites communis*).

4) Other Animal Species

Amphibians, mollusks, and invertebrates were not covered in the study. However, mussels must be covered in the EIA according to the INSTM.

5) Plant Species

In the flood plain of the Mejerda River, there is a dense population of tamarisk, also known as farash (*Tamarix articulata*; see figure below), which is a natural species to central Tunisia, thought to be introduced as a result of tree-planting to affix the riverbank. The tamarisk is a shrub to medium-tall tree with a height of two to 10 meters. Along the Mejerda River, they branch magnificently to become medium-height trees. The tamarisk germinates from its seeds, roots, and branches, allowing it to multiply quickly.

According to Article 3 in the Forest Act, a forest is defined as naturally or artificially grown plants constituted of one or more tree or shrub species or a uniform/mixed woodland. The trees along the Mejerda River are legally a forest according to this definition. This forest is not a national forest, but is a public water territory. However, the rights to the lumbering of tamarisks and the transport or use of any produce from cultivating new land belong to the DGF as they fall under forest products according to the Forest Act.

Figure 17: Tamarisks (Farash) in the flood plains of the Mejerda River

3.2.3 Environmental pollution

1) Sand Production

ONAS (national sanitation utility of Tunisia) and ANGED (National Waste Management Agency) do not have any information about pollution from hazardous materials like industrial waste deposited in the lower Mejerda River and therefore do not recognize a specified pollutant source along the river. Excavated sand and soil is used on agricultural land, orchards, and grazing lands along the river or other places with similar characteristics. Therefore, we believe that the potential of pollution from toxic substances is low.

The INSTM is engaged in research on ocean sediment pollution from old metal ore deposits with a focus on researching suspended solids in the Mejerda River and the existence of heavy metals carried to the riverbank by the Mejerda River. Pollutants covered in the study include lead, zinc, arsenic, and cadmium. According to the results of this study, the coastal zones near the delta show a higher concentration of lead and zinc than other parts of the Mediterranean. This project will not involve or repair any bridges further downstream than Kalaât Andalous, so the possibility of working in dense metal zones is low.

2) Illegal Solid Waste Grounds

The state of illegal solid waste is as follows.

a) Illegal dumping of industrial solid waste and municipal solid waste into the river or waterways

ANGED says there has never been a problem with illegal dumping along the Mejerda River in the past nor the present. However, the possibility of the illegal dumping of industrial solid waste and municipal solid waste exists for the river and waterways in the region of this Project. Therefore, appropriate measures need to be taken if illegal solid waste dumping is discovered while the project constructs a cross-section of the river channel and works on embankment.

b) Disposal of animal skins in the El Mabtouh Wetland

Animal skins are being illegally disposed in the El Mabtouh Wetland. According to an interview with the AGED, that solid waste is brought in from the industrial area of Utique. This solid waste must be properly disposed of as hazardous waste in the construction process according to Category 0602 in the list of hazardous waste in Decree No. 2000-2339 enacted on October 10, 2000. The location of illegal dumping as captured in 2011 is shown in the figure below.

After confirming waste disposal before construction, hazardous waste will be brought to disposal sites as necessary when discovered on constructions grounds.

Figure 18: Illegal Industrial Waste Dumping Grounds in the El Mabtouh Wetland within the Project Site

c) Other

Unauthorized dumping of other waste such as personal waste is also a problem along the roads, river, and water channels. However, the amount of waste disposed is small.

Chapter 4. Legislative system and related organizations surrounding environmental social considerations in Tunisia

4.1 Legislative system and international treaties surrounding environmental social considerations in Tunisia

4.1.1 Legislative system

(1) Legislative system

Laws and regulations related to the environment in Tunisia are as follows:

1) Environmental Impact Assessment (EIA) Decree: Decree No. 2005-1991 (July 11, 2005, see table below) establishes the targets for EIAs and specification documents
2) Forest Act and enforcement law
3) National Land Maintenance/City Planning Law and enforcement law

Of these, the categories of facilities and projects that must be assessed for environmental impact or have specifications submitted will be stipulated by the EIA Decree. Guidelines for conducting the EIA will also be created by the National Environmental Protection Agency (ANPE). The EIA survey will be conducted based on these guidelines while consulting with the ANPE.

The EIA procedure in Tunisia will ultimately depend on ANPE approval of projects. The ANPE may approve the EIA report assuming the relevant project is implemented by the implementing agency (DGBGTH for the Project).

After consulting with ANPE regarding project implementation, we have confirmed that an EIA must be performed and a report written based on Tunisia environmental law due to the reasons stated below.

Approval for project implementation will be based on the EIA report.

1) New construction or repair of bridges that accompany the widening of rivers and drainage waterways is a relevant project that falls under Category B according to the 2005 government ordinance.
2) A section near the mouth of the Mejerda River is registered under the Ramsar Convention, and environmental consideration is required although it does not fall under the scope of project implementation.

(2) Details of EIA Decree

The details of EIA Decree No. 2005-1991 are shown in the table below. The Terms of Reference (TOR) by Sector created by the ANPE stated in Article 6 was drafted before the 2005 government ordinance was promulgated, and does not include the environmental management plan. Therefore, the ANPE is currently drafting a TOR that includes the environmental management plan.

Table 20: EIA Decree No. 2005-1991

Categories in the EIA regulated by Decree No. 2005-1991 established on July 11, 2005 for facilities and projects that must undergo assessment or submit specification documents

Article 1: The following terms used in this decree will be defined as follows:

1. **Facilities and Projects**: Refers to various facilities and industrial, agricultural, commercial, or other businesses whose activities pollute or degrade the environment.
2. **Environmental Impact Assessment (EIA)**: A survey to examine, evaluate, and measure the effects that **facilities and projects** have on the environment in a direct or indirect manner over a short, medium or long term. **Facilities and projects** must submit a report to the ANPE and attain a decision by the ANPE before acquiring various licenses to operate.
3. **Terms of Reference (TOR) by Sector**: General **TORs (TOR for EIA?)** affected by the sectors in Annex 1 of this decree will be created by the ANPE in the preparation phase of an EIA to consider the client or demandant.

Article 2: An EIA must be performed for **facilities and projects** listed in Annex 1 of this decree. EIA must be performed by a consultant or field specialist.

Article 3: Facilities and projects listed in Annex 2 of this decree must submit **specification documents** to acquire approval from the ministry (ministerial ordinance) that governs the environment. Ministries (ministerial ordinances) establish environmental measures that clients and demandants must comply to.

Article 4: Facilities and projects that are subject to an EIA or submit specification documents must conform to the aptitude and improvement project of settlement areas or environmental protection standards.

Article 5: A license to operate will not be issued to the concerned authorities until a legally authorized specification document has been received for **facilities and projects** that must undergo an EIA. This document must confirm that the ANPE has no objections to implementation or must be signed by the minister of the ministry that governs the environment.

Clients or demandants cannot use a license that does not conform to these regulations.

The operation license for each **facility and project** that must undergo an EIA and submit specifications must include all compliance and implementation measures shown on the EIA and specification document.

Article 6: Details of the EIA must reflect foreseeable incidents of **facilities and projects** toward the environment, and include the following items at the bare minimum:

1. A detailed description of **facilities and projects.**
2. An analysis of the initial condition of the site or an environmental analysis of site especially for **facilities and projects** that may impact sites during implementation and sites with natural resources.
3. An analysis of the foreseeable direct and indirect impact of **facilities and projects** on districts whose environments are protected by law, especially areas protected for their natural resources, fauna, flora, forests, nature, history, landscape, vulnerable regions, protected species, national parks, and urban parks.
4. Measures and an estimate of required costs that clients or demandants are considering for **facilities and**

projects to remove or reduce damage to the environment, as well as compensation if possible.

5. A detailed **Environmental Management Plan** of **facilities and projects.**

The necessary components will be stipulated in the **TOR by Sector drafted by the ANPE**.

Article 7: The client or demandant must draft an EIA report of their **facility and project** based on the **TOR by Sector mentioned in the last section in Article 6** of this decree. Costs for carrying out the EIA will be borne by the client or demandant.

Article 8: The client or demandant must submit three signed copies of the EIA report, one copy of the legally authorized specification document to the ANPE, and one copy of the report and specification document to the relevant ministries to obtain a license.

Article 9: The ANPE will decide on a petition of objection regarding the implementation of **facilities and projects** within 21 working days of receiving the EIA report of **facilities and projects** listed under Category A in Annex 1 of this decree, and three working months after receiving the EIA report of **facilities and projects** listed under Category B in Annex 1 of this decree. If a petition of objection is not made by the ANPE within these periods, it will be considered as an implicit approval of implementation.

If **facilities and projects** under Category A in Annex 1 of this decree may impact districts whose environments are protected by law, especially forests, natural, historical, landscape, or vulnerable regions, protected species, national parks, or urban parks, the 21 working day period will be extended to three working months.

Article 10: If **facilities and projects** may impact districts whose environments are protected by law, especially forests, natural, historical, landscape, or vulnerable regions, protected species, national parks, urban parks, fauna, or flora, they must request the opinion about the implementation of **facilities and projects** from the ANPE for relevant districts or the supervisor for protected species.

The opinion from districts or supervisors of these species must be reported to the ANPE within 15 days of receiving such notification.

If a statement is not received from the supervisor within this period (15 days), it will be considered as an implicit approval of implementation.

Article 11: Concerned authorities or government offices will revoke licenses if the measures stated on the EIA report and specification document are not followed.

Article 12: The articles and items in this decree apply to new facilities, industrial, agricultural, and commercial projects, expansions, modifications to facilities, or changes to production methods for existing facilities, industrial, agricultural, and commercial projects listed in Annex 1 and 2 of this decree.

Article 13: The articles and items of EIA Decree No. 91-362 from March 13, 1991 are void.

Article 14: The Minister of Environment and Sustainable Development**,** Minister of National Defense, Minister of Trade and Handicrafts, Minister of Regional and Local Development, Minister of Agriculture and Hydraulic Resources, Minister of State Property and Land Affairs, Ministry of Social Affairs, Solidarity and Tunisians Abroad, Ministry of Culture and Safeguard of Patrimony, Minister of Tourism, Minister of Health, and Minister of Industry, Energy, and Small Enterprises are responsible for enforcing this decree for their respective fields as published in the Official Journal of the Tunisian Republic (JORT).

Established: July 11, 2005, Tunis

Annex 1: Facilities and projects that must undergo an EIA

Category A: The ANPE will decide on a petition of objection regarding the implementation of facilities and projects within 21 working days of receiving an EIA report of **facilities and projects**. If a petition of objection is not made by the ANPE within this period, it will be considered as an implicit approval of implementation.

01) **Facilities and projects** involved in the management of household solid waste or food waste at a capacity of 20 tons/day or less
02) **Facilities and projects** involved in the treatment and manufacture of construction material, porcelain, and glass
03) **Facilities and projects** involved in the manufacture of pharmaceutical products
04) **Facilities and projects** involved in the manufacture of nonferrous metals
05) **Facilities and projects** involved in metalworking and surface treatment
06) **Facilities and projects** involved in the mining of oil and natural gas
07) Industrial quarries of aggregates or sand, clay pits, and marble quarries with a production output of 300,000 tons/year or less
08) **Facilities and projects** involved in the manufacture of sugar or baking powder
09) **Facilities and projects** involved in the coloring of fabrics, threads, and clothes as well as the production and fading of jeans

10) Renovation projects of agricultural districts with an area of five hectares or less
11) Urban housing plans with an area between five and 20 hectares
12) Renovation projects of tourist districts with an area between 10-30 hectares
13) **Facilities and projects** involved in the manufacture of mineral fiber
14) **Facilities and projects** involved in the production, processing, packaging, and preservation of food products
15) Slaughterhouses
16) **Facilities and projects** involved in the production or assembly of automobiles, trucks, or motorbikes
17) Shipyard projects
18) **Facilities and projects** involved in the production, operation and maintenance of aircrafts
19) **Facilities and projects** involved in the aquaculture of shellfish for consumption
20) **Facilities and projects** involved in the desalination of industrial or tourist facilities
21) **Facilities and projects** involved in thalassotherapy and the use of mineral springs
22) **Facilities and projects** involved in lodgings with 300 beds or more
23) **Facilities and projects** involved in the production of paper and cardboard
24) **Facilities and projects** involved in manufacture of elastomer (synthetic rubber) or peroxide

Category B: The ANPE will decide on a petition of objection regarding the implementation of facilities and projects within three working months of receiving an EIA report of **facilities and projects**. If a petition of objection is not made by the ANPE within this period, it will be considered as an implicit approval of implementation.

01) **Facilities or projects** involved in oil refining and facilities that liquefy or gasify at least 500 tons/day of carbon or oil shale
02) **Facilities and projects** that generate electricity of at least 300 MW/day
03) **Facilities and projects** involved in the management of household solid waste or food waste at a capacity of at least 20 tons/day
04) **Facilities and projects** involved in the management of dangerous solid waste
05) **Facilities and projects** involved in the production of cement, lime, or plaster
06) **Facilities and projects** involved in the manufacture of chemicals, pesticides, paint, wax, and bleaching agents classified under Category 2 in the dangerous, unsanitary or hazardous building list
07) **Facilities and projects** involved in the iron industry
08) Industrial aggregate and sand quarries as well as mining projects of mineral resources that produce over 300,000 tons/year
09) **Facilities and projects** involved in the manufacture of paper pulp and cellulose
10) Construction projects of railways, motorways, expressways, bridges, and interchanges
11) Construction projects of airport runways that exceed 2,100 meters
12) Construction projects of commercial ports, fishing harbors, or leisure ports
13) Construction projects of industrial districts that exceed an area of five hectares
14) Urban housing plans that exceed an area of 20 hectares
15) Renovation projects of tourist districts that exceeds an area of 30 hectares
16) Transport facilities of crude oil or gas
17) **Facilities and projects** involved in urban sewage treatment
18) Industrial water treatment **facilities and projects**
19) **Facilities and projects** involved in the leather or white leather industry
20) Irrigation and cultivated land projects that use recycled wastewater for agriculture
21) Large dam projects
22) Aquaculture projects that are not included in Category A in Annex 1
23) **Facilities and projects** involved in desalination for supplying drinking water to urban areas
24) Resort projects that exceed 1,000 beds
25) **Facilities and projects** involved in the mining, treatment, and cleaning of minerals and non-minerals
26) **Facilities and projects** involved in the manufacture of phosphate ore and secondary products

Annex 2: Facilities and projects that must submit specification documentation

01) Urban housing plans that do not exceed an area of five hectares and renovation projects of tourist districts that do not exceed an area of 10 hectares
02) Renovation projects of educational institutions
03) Aqueduct construction projects
04) Nature districts and vulnerable regions (areas protected by law) not included in Annex 1 that are not

supplied with electricity
05) Renovation projects of coasts that are not included in Annex 1
06) **Facilities and projects** involved in olive pulverization (oil extraction plants)
07) **Facilities and projects** involved in the extraction of plant or animal oils
08) **Facilities and projects** classified as animal production operations
09) **Facilities and projects** involved in textile industry not included in Annex 1
10) **Facilities and projects** involved in the pressing and cutting of large metal pieces
11) **Facilities and projects** involved in the storage and logistics of hydrocarbons as well as gasoline stands that wash automobiles and perform oil changes
12) **Facilities and projects** involved in the manufacture of starch
13) Conventional quarries
14) **Facilities and projects** involved in the storage of gas and chemicals
15) Manufacturing of metal containers, construction of water storage facilities, and manufacturing of steel sheets
16) Washing areas that use water to wash clothes and blankets
17) Hill dams
18) **Facilities and projects** involved in the manufacture of medical support products

4.1.2 Approaches on Environmental Considerations Surrounding the Forest Act and National Land Maintenance/City Planning Law

An overview of the approach for environmental considerations surrounding the Forest Act and National Land Maintenance/City Planning Law is shown in the table below:

Table 21: Overview of approach for environmental considerations surrounding the Forest Act and National Land Maintenance/City Planning Law

Law	Environmental Consideration Conditions
1. Forest Act Division III Chapter 1: Nature Conservation/Article 208	If a project may potentially impact the environment due to its scale or the effect it has on nature, the project is subject to a preliminary EIA.
2. Forest Act Division III Chapter 2: Conservation of Wild Fauna and Flora /Article 209	Activities that may potentially harm wild fauna and flora that are endangered and rare are prohibited. A list of wild fauna and flora that are endangered and rare is established by a ministerial ordinance.
3. Forest Act Division III Chapter 4: Wetland Conservation/Article 225	Protects wild fauna and flora in wetlands.
4. National Land Maintenance/City Planning Law Article 11	If equipment, facilities, or established structures may potentially harm the environment due to their scale and impact, the plan or project is subject to a preliminary EIA.
5. February 22, 1989 Mines and Quarries Regulation Act No. 89-20	Small scale quarries (less than 70,000 tons/year or for clay, less than 5,000 tons/year) must provide an environmental impact summary. Industrial quarries (whose quarrying exceed small scale quarries) are subject to an EIA.

4.2 Environmental Social Consideration Procedure and Flow

The procedure and flow from the start of the EIA process to the approval of this project, which has been confirmed by the ANPE, is shown as follows.

① The project implementing agency (DGBGTH, Ministry of Agriculture) will determine if an EIA is necessary for the construction of facilities and implementing of projects that fall under Lists A and B in Annex 1 of EIA Decree No. 2005-1991. The implementing agency must also submit project specification documents to the ANPE for the construction of facilities and implementing of projects that fall under Annex 2.

After consulting the ANPE regarding this study, this project includes the new construction or repair of bridges, and the implementing agency has confirmed that an EIA is required as it fall under List B in Annex 1 of the 2005 ordinance.

② A preliminary study will be conducted before the EIA is performed. The purpose of the preliminary study is to scope basic information in order to draft the TOR for the EIA after the ANPE and implementing agency consult regarding (3) and impact to the natural and social environment. The EIA draft report will be created based on this study.

③ The implementing agency will consult the ANPE to draft a TOR for the EIA based on (2) in order to select and hire consultants to perform the EIA.

④ Once the TOR has been prepared, the implementing agency will announce the TOR and then select, contract, and hire consultants or specialists to perform the EIA.

⑤ Consultants or specialists hired for the EIA will perform the EIA based on the TOR drafted in (2).

⑥ The implementing agency will submit the EIA report to the ANPE.

⑦ The ANPE will evaluate the relevance of the EIA report.

⑧ If the ANPE has no objections, the EIA report will be approved within 21 days for List A and within three months for List B.

⑨ The implementing agency can begin implementing the facilities and projects covered by the EIA after the EIA report has been approved.

Against the backdrop described above, the Ministry of Agriculture (DGBGTH) needs to perform EIA in accordance with the 2005 government ordinance for EIAs in Tunisia to have the Project approval. The Ministry of Agriculture (DGBGTH) also needs to create a TOR for placing an order for EIA survey with consultants through consultation with ANPE. The EIA draft created based on the survey is regarded as a TOR summary based on the results of survey that has been conducted.

An EIA has already been performed by the Tunisian-side implementing agency (National Water Distribution Utility: SONEDE) for the existing JICA project Desalination of Southern Ben Gardane in the Medenine Governorate. SONEDE has been recognized for performing the EIA efficiently and in a relatively short period. SONEDE has been recognized because: 1) They performed a scoping because of the preliminary study performed in order to draft a TOR for the EIA, and 2) when they performed the EIA, SONEDE consulted closely with the ANPE and the consultants of the EIA.

The EIA Draft Report created during this Study includes scoping, impact assessments, easing measures, an environmental management plan, and monitoring based on the results of this Study, and we believe Tunisia can use this study and final considerations effectively to draft a TOR.

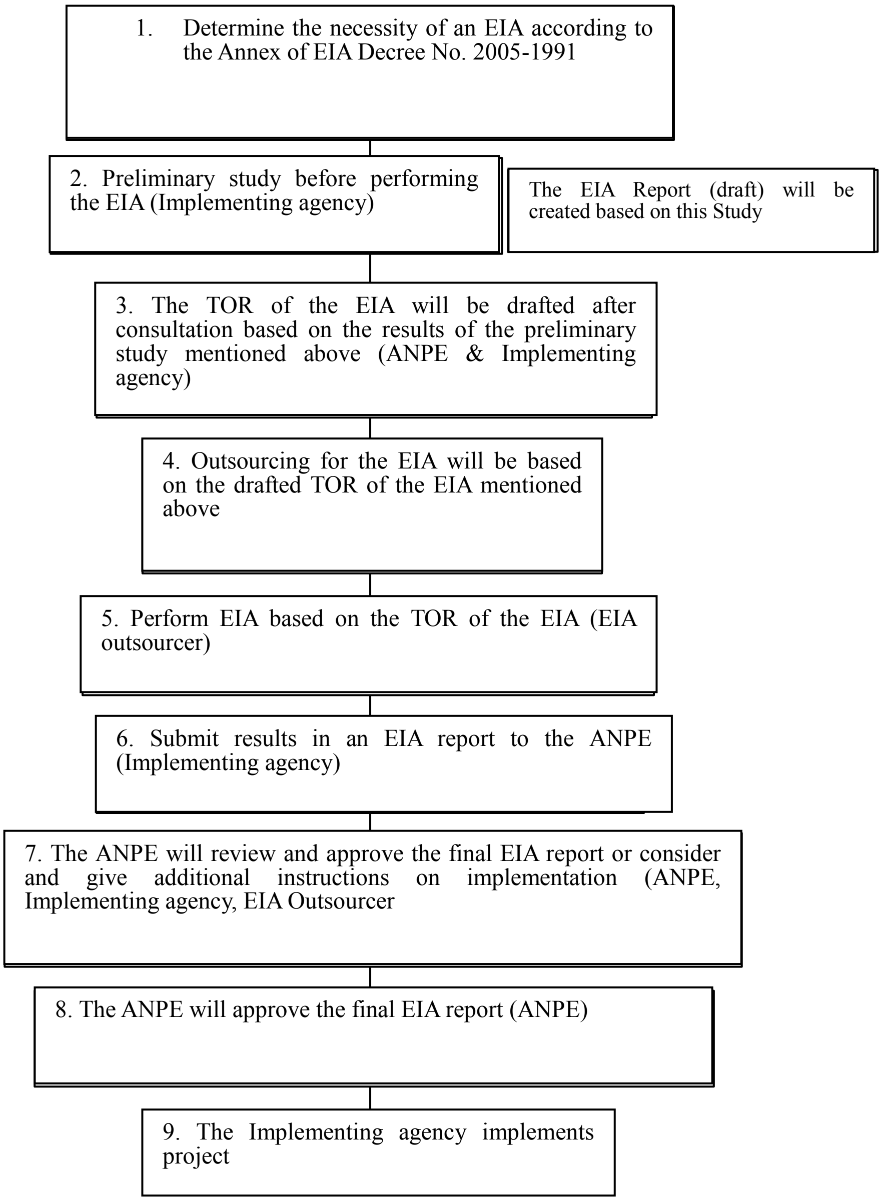


Figure 19: Flow from start of the EIA procedure to the implementation of the project

According to the ANPE, scoping the environment in Step 2 is insufficient, and there have been cases where the ANPE did not approve of projects over several years even though an EIA was performed in Step 5.

4.3 Comparison of resident resettlement regulations in Tunisia and JICA guidelines

A table comparing resident resettlement regulations in Tunisia and JICA guidelines is shown below.

Table 22: Comparison between Tunisian law on compensation/resettlement with JICA guidelines

	JICA guidelines	Resident resettlement regulations in Tunisia	Gaps between Tunisian law and JICA guidelines	Resettlement policy for the Project
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	-	This principle has not been expressly stipulated in Tunisian law. However, since all relevant government agencies have adopted policies to avoid the unfair loss of rights of citizens after the Jasmine Revolution, it is clear that this principle is honored.	A process of land acquisition and compensation following the Land Ownership Law will be applied.
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	Land Ownership Law (Decree No. 26 of 14 April 2003)	Common to both Tunisian land ownership law and JICA guidelines.	A process of land acquisition and compensation following the Land Ownership Law will be applied.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Land Ownership Law (Decree No. 26 of 14 April 2003)	Same as above	A process of land acquisition and compensation following the Land Ownership Law will be applied.
4	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Land Ownership Law (Decree No. 26 of 14 April 2003)	Same as above	A process of land acquisition and compensation following the Land Ownership Law will be applied.
5	Compensation and other kinds of assistance must be provided prior to	Land Ownership Law (Decree No. 26 of 14	Following the Land Ownership Law, compensation is conducted prior to	A process of land acquisition and compensation following the Land Ownership

	displacement. (JICA GL)	April 2003)	resettlement	Law will be applied.
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	-	Preparatory policy for resettlement plans for large-scale dam projects is applied by the Division of Planning and Construction. Consultations with residents are not held with residents regarding the plan.	For the current Project draft, there will be no large-scale involuntary resettlement. (Current no. of households to be resettled: 1 HH) However, the resettlement plan drafted as a part of the Impact Assessment by the DGBGTH will be made available to the public.
7	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	-	For compensation procedures following the Land Ownership Law, negotiations cannot be conducted with affected residents in advance.	For the current Project draft, there will be no large-scale involuntary resettlement. However, in the unlikely event of an occurrence of such, the DGBGTH should consult with residents regarding the resettlement process while concealing specific compensation amounts prior to the responsible ministry's decision.
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	-	Since the language used by affected residents is Arabic, there are no problems.	For the current Project draft, there will be no large-scale involuntary resettlement.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	-	There are is no participation system for affected residents within involuntary resettlement procedures in Tunisia.	More consultations should be held with residents as a part of the Impact Assessment. Through this, affected residents can participate in planning.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their	-	There is no particular system for processing grievances apart from filing a lawsuit.	A system for processing grievances as a part of the land acquisition and compensation process will be proposed.

	communities. (JICA GL)			
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	-	Social, land, and initial construction surveys are stipulated as land acquisition procedures, but there are no regulations regarding cut-off dates for obtaining eligibility for loss compensation.	Following JICA guidelines, the DGBGTH will announce via the governorate offices of Ariana, Bizerte, and Manouba that the cut-off date for obtaining eligibility for loss compensation will be start date of the population census.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Land Ownership Law (Decree No. 26 of 14 April 2003)	Unless there are claims by other land owners, rules related to the cut-off date for obtaining eligibility for loss compensation for residents without legal rights to land will also be set to match Tunisian law.	A process of land acquisition and compensation following the Land Ownership Law will be applied.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	-	DGBGTH policy states that preference will be given to exchanging land with that having the same or larger surface area than the owned land within a 20km radius.	The DGBGTH already has experience with this type of compensation in rural districts. This method will be preferentially applied for this Project as well.

14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	-	Although this principle is not clearly stated in law, the DGBGTH applies it for resident resettlement due to large projects.	Although the number of residents to be resettled is small, it is possible to adapt this principle.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	-	If the amount of compensation is insufficient for the need, this principle can be adapted in the form of subsidies from the governorates.	This will be handled in the same manner through a support system as the governorate or Regional Commissions of Expropriation level.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	-	The population targeted for resettlement in this project is less than 200. Therefore, DGBGTH will make a plan based on the simplified resettlement plan (draft) prepared by the study team.	-

Source: JICA guidelines

Chapter 5. Environmental Impact of the Project

5.1 Verification of the Contingency Plan

(1) Zero Option

The contingency plan for this project in the case that this project does not proceed (zero option) will be discussed here. If this project does not take place, the region will be subject to damage caused by floods as is the case now. Floods will continue to damage resident properties, including buildings and farmland, and along with floods, domestic waste water will remain in the region and unsanitary conditions will occur. Furthermore, as urbanization grows in the lower basin of the Mejerda River, injuries to residents and damage to property caused by 10th-year floods.

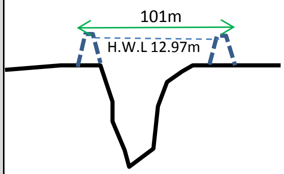
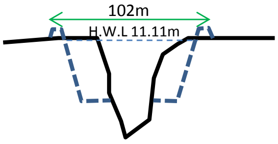
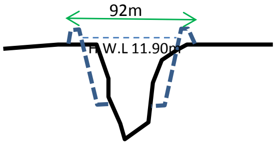
The negative impacts caused by this project discussed in the previous section can be mitigated mainly by environmental management planning during construction. Therefore, the positive effects of this project will outweigh the negative impacts.

(2) Verification of Alternative Plans

Three plans of the crosssecion of river channels shown in the table below were examined for selecting the river channel plan of the Project.

Although all plans have minimum impacts on natural environment, they require resettlement of residents and land acquisition. In consideration of impacts on historical structures, plan ② (excavation + expansion) was chosen as most appropriate.

Table 23: Verification of Alternative Plans

		Comparison of River Channels		
Types of Alternative Plans		② **Embankment Plan**	③ **Excavation Plan (excavation + expansion)**	④ **Excavation + Embankment Plan**
Diagram				
Summary of Alternative Plan		In consideration of 1.0 meter allowance height of current crosssection + embankment, the embankment has gradient of 1:2 and levee crown width of 4.0m. No excavation is conducted in principle.	The river channel is excavated to the deepest possible with 1.0 meter of allowance height, 1:2 of embankment gradient, and the lower excavation limit of 2.0 to 5.0m from the riverbed. (not reaching the low-flow channel)	Based on the excavation plan, embankment is built with allowance height (1.0m) to reduce the amount of excavation.
Embankment Height and H.W.L		②Compared with the excavation plan, H.W.L is 2.4 meters higher on average, and the embankment height becomes higher accordingly.	H.W.L is around the surrounding ground level and embankment of allowance height becomes necessary.	Embankment height and H.W.L can be lower than ① thanks to the effect of excavation of river channel.
Land Use		Residential land and farmland	Residential land and , farmland	Residential land and farmland
Environmental Social Considerations	**Impact on natural environment**	It may have minimum impact.	It may have minimum impact. The excavation and expansion is carried out in flood channels.	It may have minimum impact. The excavation and expansion is carried out in flood channels.
	Scope of necessary land (scope of land acquisition)	Large	Large	Small
	Impact on historical structures	Removal or relocation of the ancient bridge of Jedeida is necessary.	No impact	Removal or relocation of the ancient bridge of Jedeida is necessary.
	Resettlement of residents and land acquisition	Impact: significant Construction of embankment along the river in the city requires resettlement of residents.	Impact: significant Excavation and expansion requires resettlement of residents and land acquisition along the river.	Impact: minor Although the embankment can be lower than ① thank to excavation, excavation and embankment requires land acquisition and resettlement of residents.
	Other social impacts	No significant impact	Same as left	Same as left
Recommended Most Appropriate Plan and Reasons		This plan is not recommended. There is major impact of resettlement of residents and land acquisition and it also affects historical structures.	This is most recommended. There is no impact on historical structures.	This plan is not recommended. Although the impact of resettlement of residents and land acquisition is minor, it has major impact on historical structures.

5.2 Estimation of Scoping and potential effects

Clarify environmental and social issues to be considered through scoping as well as items that should be taken into account and survey methods for the EIA.

The chart below shows the scoping results for the environment and social impacts. Scoping was conducted as per JICA guidelines.

Table 24: Scoping Results for Environmental and Social Considerations

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
Physical Environment and Pollution			
Air Pollution/Dust	B-	D	Before and During Construction: Chapter 8: There is a possibility that trucks and heavy machinery may produce air pollution and dust during construction. However, this can be prevented by performing such actions as selecting suitable traffic routes, regular maintenance of heavy machinery, and watering while excavating. After Construction: There is no possibility of negative impacts to the surrounding atmosphere.
Water Pollution	B-	D	Before and During Construction: Chapter 9: Although there is the possibility of water pollution from engine oil leaked from heavy machinery, this impact is extremely small. As excavation work will only be conducted in flood channels and will not be done in water, there should be no turbidity degradation. After Construction: There is no possibility of negative impacts to water quality.
Ground Pollution	B-	D	Before and During Construction: Chapter 10: Although there is the possibility of ground pollution from engine oil leaked from heavy machinery and dump trucks, impact should be minor. This risk can be reduced by enforcing inspections of construction machinery. When excavating in flood channels, contaminated sediment may also be accidentally excavated. If this occurs, the contaminated sediment will be dealt with in the appropriate manner. The excavation and expansion of the Mejerda River is planned to be carried out for sand and soil used as farmland and residential land accumulated along the river and thus there is little possibility of containing harmful substances. Thus, there is very little possibility of ground pollution in the target area. It can be used for embankment as it does not contain harmful substances. After Construction: There is no possibility of negative impacts to the soil.
Solid Waste	B-	D	Before and During Construction: This project will generate a large amount of solid waste from excavated earth, and removed

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
			and cleared tamarisk forests. This waste needs to be taken care of appropriately from an environmental impact standpoint. Furthermore, solid waste from non-approved animal skin disposal sites near the El Mabtouh wetlands impacts the Mejerda River. It is necessary to clarify the scope of disposal sites (scope of solid waste which can be disposed of) and take dangerous materials/waste to appropriate disposal sites when within the excavation scope in order to avoid impacting the retarding basin and Mejerda River. As described in "Ground Pollution," there is very little possibility of the soil to be excavated along the riverbed containing harmful substances; excavated soil can be used for embankment. This enables generation of less waste of soil. After Construction: There is no possibility that solid waste will be created.
Noise	B-	D	Before and During Construction: River Excavation River excavation and river structure construction will generate noise. It is possible to minimize noise impact by using low-noise heavy machinery and restricting work hours. After Construction: There is no possibility that noise will be generated.
Odors	B	D	Before and During Construction: Section expansion along the Mejerda River targets the flood channel and we do not expect that substances that produce foul odors are buried. Furthermore, we have not confirmed that there are places where massive amounts of solid waste have accumulated at the river section. However, if solid waste that produces a foul odor is found as construction proceeds, it is necessary to carefully remove the waste and take it to the appropriate disposal site. After Construction: There is no impact from this project.
Ground Subsidence	D	D	Before and During Construction: There is no cause for ground subsidence. After Construction: There is no cause for ground subsidence.

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
Risks to the Environment			
Nature Reserves	B-	D	Before and During Construction: The downstream and gulf area of the Mejerda River is listed under the Ramsar Convention. However, construction will not take place within the area registered with the Ramsar Convention. El Mabtouh wetlands are a nature reserve under ZICO but the construction that will be conducted in the wetlands is only along the channel so any impact to birdlife from construction will be limited. After Construction: The flood analysis results in Chapter 4 shows no significant change in the scope of flood in the downstream and gulf area of the Mejerda River listed under the Ramsar Convention. Thus, the impact after construction is likely to be minimum. There is likely to be no impact on the El Mabtouh wetlands after the completion of construction.
Natural Habitats	B-	D	Before and During Construction: The downstream and gulf area of the Mejerda River is listed under the Ramsar Convention. However, construction will not take place within the area registered with the Ramsar Convention. The low flow channel will not be excavated, and only the flood channel will be excavated and expanded. As a certain amount of trees are planned to be left, it is possible to minimize the impact on birds and fish. El Mabtouh wetlands are a nature reserve under ZICO, but the construction area is limited and the frequency of flooding will not change so we expect that there will not be a large impact on natural habitat. Therefore, there will be almost no direct impact to natural habitat from this project. After Construction: As explained above, there will be no impact on the Mejerda River and the El Mabtouh wetlands. The Project is not likely to cause any significant change in the scope of flood in the wetland listed under the Ramsar Convention and will have little impact after construction.
Biodiversity	B-	D	Before and During Construction: As only the flood channel at the Mejerda River will be excavated and expanded in this project, the current situation of the low flow channel (river bed) where fish live will remain as it is and therefore there will be no major impact on fish and birds. Furthermore, it is possible to leave a certain number of trees on the riverside to secure the birds' habitat. Therefore, it is possible to

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
			minimize the impact on birds and fish, and the impact on biodiversity will be limited. After Construction: The Project is not likely to cause any significant change in the scope of flood in the wetland listed under the Ramsar Convention and it will have little impact. There will be almost no impact to natural habitat from this project.
Ground Stability and Erosion Risk	B-	D	Before and During Construction: Construction in the river may destabilize the river bank. After Construction: Slope gradient is planned for stability, which also reduces the risk of erosion.
Topography and Geology	B-	D	Before and During Construction: Excavation of the flood channel may destabilize the river bank and change the terrain of the river channel. By sufficiently easing the slope gradient during excavation, it is possible to avoid any impact caused by topographic change. After Construction: There is no possibility of any negative impact.
Hydrological Phenomena	D	A+	Before and During Construction: This project is mainly for the excavation and expansion of the flood channel of the Mejerda River and no construction will be conducted at the low flow channel of the river bank. Therefore, the impact will be negligible. After Construction: The Project is expected to have positive impacts on residents along the river as the floods in the rainy season decrease. There will be no bank protection in the zone of excavation and expansion. Thus, erosion, transfer and accumulation of sand and soil in the river channel will be as same as before the Project, causing no impact on its transfer. Although the frequency of soil transfer and accumulation on surrounding farmland to be caused by floods decreases, soil supply to the farmland will continue as flood exceeding the project scale will occur.
Flood Risk	D	A+	Before and During Construction: There is no effect on the risk of floods. After Construction: flood control structures are designed for 10th-year rains. These structures protect residences, buildings, infrastructure, and cultivated lands in regions that flood easily. By improving

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
			bridges, it becomes possible to secure access during flood season.
Social Environment			
Involuntary Relocation of Residents	B-	D	Before and During Construction: Currently there is one house that needs to be relocated due to the Mejerda River expansion. Residential relocation will be confirmed based on the final schedule, but there will be no major relocation. After Construction: There is no negative impact.
Accidental Loss or Destruction of Structures other than Residences	B-	D	Before and During Construction: As stated previously, the number and kinds of structures other than residential buildings for this project will be researched later. However, no major loss or destruction will occur. The stated compensation by the Ministry of State Properties and Real Estate Affairs will be paid for land, fixed structures, planting, and all structures used to maintain lives of owners and occupants. If the value of original residence was low and the compensation amount was also low, the governorate will offer compensation to relocate to an alternative site. However, the relocating resident will be responsible for construction in the suggested alternative site. For residents who live on land, land-based compensation will have priority over compensation by cash. The compensation amount will be based on the land possession regulations and JICA environmental society guidelines (announced in April, 2010). The loss of livelihood of the recipient may also be considered for the compensation amount. After Construction: There is no impact.
Loss of farm land, unharvested crops, and shrub land	B-	D	Before and During Construction: Area within three meters of the river bank will be public land. In urban areas, easement designated land will be within 25 meters from the river bank on the left and right sides, and in rural areas, it will be within 100 meters on the left and right sides. The river channel width will be planned within this range so basically construction will be conducted within state-owned land or easement designated land. However, farm land will be lost. After Construction: There is no impact.

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
Means of Living, Poverty, and Vulnerableness	D	A+	Before and During Construction: The loss of farm land and unharvested crops can be one factor of the impoverishment of a family. The scale of impoverishment depends upon the living environment of the family and the living environment data will be locally researched and collected. With the already obtained data, it is not possible to fully analyze the vulnerability of the local community against this project and possible factors that could cause poverty. After Construction: The burden of the weakest family against the damage risk from flood will be reduced. Naturally, the impact of this project on the poorest families will be positive.
Minorities	D	D	Before and During Construction: It is necessary to clarify the existence of minority races in the area this project will be conducted in order to define the impact caused by this project on minority races. The El Mabtouh wetlands are government-owned pastures and it is possible that the minority races are nomadic. In this case, the flood period is limited and the impact on minority races will be small. After Construction: Dependent on the existence of minorities in the El Mabtouh wetlands and their characteristics.
Local Economy/Employment	B+	B+	Before and During Construction: By conducting this project, day laborer employment opportunities can be offered to those who are unemployed. After Construction: The removal of deposited sand at the river and diversion channel and on-going maintenance, such as trimming tamarisk trees, will be employment opportunities for the local residents.
Land and Regional Resource Usage	B-	D	Before and During Construction: Regional resources are limited to water resources of the Mejerda River. The impact on water resources is described in the section below, Water Resources. As for land use, the earthfill of the access road becomes higher in accordance with the bridge height increase and the land for it is needed. It is in small amount and thus the impact is likely to be minimum. After Construction: Because there are few floods in the El Mabtouh retarding basin in the scale that operates and

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
			they are submerged less than for 20 days, it has little impact on land use in the wetlands.
Water Resources	B-	D	Before and During Construction: The Mejerda River is an important water resource for irrigation for local residents. These facilities pump water from the Mejerda River by using small pumps. The construction work might impact irrigation pumping, but it is possible to minimize the impact on facilities by conducting appropriate support (temporary relocation of pumps and water supply pipes) during construction. After Construction: There is no impact on water resources.
Public Infrastructure and Social Projects	B-	D	Before and During Construction: Construction work may greatly affect traffic in the surrounding area without adequate controls. Soil disposal after excavation and transporting it to disposal sites might cause traffic congestion and become a factor in traffic accidents. There is also a possibility that bridge construction may cause traffic jams, but adequate planning can minimize this impact. After Construction: There is no negative impact.
Local Community Organizations	B+	B+	Before and During Construction: To implement new O&M activity for the river and channels during and after this project is complete, it will be necessary to adjust existing systems and organizations. This may also be an opportunity for new local communities to become active. After Construction: For river and channel operation and maintenance, the alignment of local level systems and organizations may be necessary.
Distribution of Profits and Social Equality	C	A+	Before and During Construction: Local employment and commercial activities can be anticipated during construction. After Construction: The benefits from flood control measures will be equally distributed and there will be no negative impact on the project.
Localized Conflicts	C	D	Before and During Construction: There is a possibility that localized conflicts may occur due to employment for construction or road construction and an increase in traffic.

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
			After Construction: The benefits of relief from flood damage will be equally distributed.
Historical and Cultural Heritage	D	D	Before and During Construction: The known heritage listed sites in the project construction region are the El Bataan Weir Bridge and Old Jedeida Bridge. These sites were designated for protection as cultural heritage sites on January 15, 2012. Because the river channel plan (H.W.L and crosssection of river channel are set not to cause impact) and construction plan are formulated with consideration given to the cultural heritage, it does not have impact on it. After Construction: Because the river channel plan (H.W.L and crosssection of river channel are set not to cause impact) and construction plan are formulated with consideration given to the cultural heritage, it does not have impact on it.
Scenery	C	D	Before and During Construction: As the shape of the river bank changes and the plant coverage on the flood channel will be completely removed, the flood channel excavation on the Mejerda River and river structure construction will directly impact the scenery. However, the value of the Mejerda River scenery to local communities and the government is not yet clear. This project may cause the scenery to change. By analyzing the awareness of the local people of this project, it would be possible to evaluate the impact of the plan. After Construction: There is no possibility that there will be any impact on scenery after construction is completed.
Gender and Children's Rights	C	B+	Before and During Construction: It is necessary to clarify the impact this project may have on gender equality and respect for children's rights through consultation with stakeholders. After Construction: As flood damage will decrease, safety for women and children, who are vulnerable, will increase.

Impacts	Impact Assessment		Expected Impact / Assessment
	Before and During Construction	After Construction	
AIDS, Sexually Transmitted Diseases, and Sanitation	D	D	Before and During Construction: There is no chance the construction environment of this project will become a factor in the worsening of AIDS and spreading of sexually transmitted diseases. This project also will not impact the sanitation or health of the residents. After construction: There is no possibility that there will be any impact.
Occupational Health And Sanitation/ Workplace Safety	D	D	Before and During Construction: The current law concerning the work environment and on-site safety management will be applied, but this project will not pose any particular risks to worker health or safety management. After construction: There is no possibility that there will be any impact.

Source: JICA Study Team

Impact Rating

A+/- : It is possible that the project might largely give positive/negative effects. B+/- : It is possible that the project might slightly give positive/negative effects. C+/- : It is unclear whether the project will give a positive or negative impact (supplemental research is necessary and a more adequate evaluation of the effect of the project can be performed as the research continues).

D : The project will have no positive or negative impact on the environment.

5.3 TOR for Study of Environmental Considerations (Study Items)

The chart below shows the study items for the environmental consideration study based on JICA guidelines.

Table 25: Study Items for Environmental Society Considerations (TOR)

Environment	Study Purposes and Targets	Study Method
Physical Environment and Pollution		
Air Pollution/Dust	・Appropriate method to dispose of plant waste to avoid incineration. ・Method to prevent circulation of dust	・Consultation with related organizations such as ANGED, INRGREF, DGF, and CRDAs ・Evaluation of similar cases
Water Pollution	・Measures to prevent suspended matter in the river ・Measures to prevent accidental engine oil leaks	・Technical methods for river expansion and excavation
Ground Pollution	・Measures to prevent accidental engine oil leaks ・Identifying previous waste disposal sites that are dangerous along the Mejerda River ・Appropriate disposal of solid waste that was accidentally excavated	・Consultation with related organizations such as ANGED and ONAS ・Evaluation of similar cases ・Confirmation of scheduled construction and planned technical methods ・On-site inspections ・Analysis of Google Earth images
Solid Waste	・Specifying disposal methods of plant waste, excavated soil, and construction waste	Consultation with ANGED, INRGREF, DGF, the CRDAs, the Department of Quarries and Explosives, Ministry of State Properties and Real Estate Affairs, Real Estate Housing Agency (AFH), Industrial Land Agency (AFI), Tunisian Electricity and Gas Company (STEG), Society for the Study and Promotion of South Tunis (SEPTS), and other organizations
Noise	・Applying current legal standards ・Prevention of noise pollution in areas that noise impacts	・Check regulations
Risks to the Environment		
Nature Reserves	・Deciding geographical boundaries of existing wetlands listed under the Ramsar Convention, which are Ghar El Melh Lagoon and the Mejerda River delta ・A report concerning the progress status of feasibility analysis documents for listing the El Mabtouh basin under the above convention	・Consultation with related organizations such as DGF, World Wide Fund for Nature (WWF), and Coastal Protection and Planning Agency (APAL) ・Collect maps and documents related to the area listed under the Ramsar Convention
Natural Habitat	・Identify natural habitat and swamps in the project area ・Methods for protecting natural habitat that is sensitive to	・Collect data related to the Mejerda River and swamps in the project area ・Consultation with related organizations such as DGF, the CRDAs, WWF, and APAL

Environment	Study Purposes and Targets	Study Method
	environmental changes	・On-site inspections
Biodiversity	・Identify species living in the study area ・Analyze the importance of the identified species and the sensitivity to any impact from this project ・Measures to protect endangered species	・Collect data related to wildlife living in the project area ・Establish standard for biological importance of wildlife ・Consultation with and collect information from related organizations such as DGF, DGPA, INSTM, INAT, WWF, AAO, and a local hunting group in Manouba
Ground Stability and Erosion Risk	・Measures for preventing river bank erosion	・Consultation with related organizations such as DGF, Economic and Social Council (CES), and the CRDAs ・Confirmation of scheduled construction and planned technical methods
Topography and Geology	・Confirm design for river expansion/excavation and bridge construction and rebuilding	・Confirmation from the implementing agency
Hydrological Phenomena	・Same as above and confirm construction methods	・Confirmation from the implementing agency
Social Conditions		
Involuntary Relocation of Residents	・Confirm design for river expansion/excavation and bridge construction and rebuilding ・Clarification of the number of families impacted by this project ・Confirmation of procedure for land acquisition and compensation ・Associated measures for relocation of land and properties ・Simultaneously consider Tunisian customs and obligations as well as JICA guidelines to make a framework for relocation to alternative sites and compensation in advance (create a basic relocation plan)	・Confirmation from the implementing agency ・Clarify land and ownership status to be affected by the river extension and excavation, and building and construction work for new bridges operated by related agencies, such as DGBGTH for land acquisition, expropriation and compensation, Office of Topography and Cadastre (OTC), Detailed Survey of Water Resources Agency (BIRH), and DGRE ・Conduct supplemental study for the social survey performed by JICA ・On-site inspections ・Possibly compare Tunisian procedures for relocation to alternative sites and compensation with JICA procedural guidelines in order to clarify any existing differences
Accidental Loss or Destruction of Structures other than Residences	Same as above	Same as above
Loss of farm land, unharvested crops, and shrub land	・Confirm design for river expansion/excavation and bridge construction and rebuilding ・Clarification of the borders of government-owned land in the El Mabtouh wetlands	・Confirmation from the implementing agency ・Discussion with related agencies, such as DGF, forest district (especially Bizerte district in regard to El Mabtouh), OTC, BIRH, and DGRE ・Collect maps and documents related to land sections and boundaries

Environment	Study Purposes and Targets	Study Method
Means of Living, Poverty, and Vulnerableness	・Evaluation of the socioeconomic attributes of the surrounding households ・Measures to prevent any impact on vulnerable residents	Conduct supplemental study for the social survey performed by JICA
Minorities	・Characterization of the nomadic people in the El Mabtouh basin (the number, where they are from, the importance of migration to maintain household income) ・Impact risk evaluation ・Measures to alleviate impact	Conduct supplemental study for the social survey performed by JICA Discuss with related agencies, such as the Office and Livestock and Pasture (OEP), DGF, the related forest districts (Bizerte and Ras Jebel), CTV permeation organizations and the CRDAs
Local Economy/Employment	・Confirm labor requirements for construction	・Confirmation and review from the implementing agency
Land and Regional Resource Usage	・Evaluate the impact risks from the usage of regional resources and this project	Conduct supplemental study for the social survey performed by JICA
Water Resources	・Evaluate the impact risks from surrounding residents' water usage and this project ・Mitigation measures	・Confirm with farmers who get their irrigation water from the Mejerda River
Public Infrastructure and Social Projects	・Identify community organizations that are sensitive to any impact caused by this project ・Evaluate status of access to various organizations ・Guarantee continuity of access and take measures to mitigate any impact on traffic congestion	・Supplement the social survey conducted by JICA ・On-site observation of study
Distribution of Profits and Social Equality	・Evaluation of the socioeconomic attributes of the surrounding households ・Measures to prevent uneven distribution of benefits created by this project	・Supplement the social survey conducted by JICA
Localized Conflicts	・Evaluation of the socioeconomic attributes of the surrounding households ・Measures to prevent uneven distribution of benefits created by this project	・Supplement the social survey conducted by JICA
Historical and Cultural Heritage	・Indentify places of national and regional historical/cultural heritage in the project areas ・Confirm conservation status for historical buildings and procedure to follow if an archaeological discovery occurs during construction ・Measures to prevent damage to heritage sites	・Consultation with related organizations such as The National Institute of Heritage (INP), Heritage Development/Agency for Cultural Affairs, National Development Bureau, engineers, and mayors ・Collect data related to important heritage sites in the project area ・Confirmation of contents of river channel plan examination

Environment	Study Purposes and Targets	Study Method
Scenery	・Evaluate the importance of the Mejerda River scenery for surrounding residents and authorities ・Protection of the Mejerda River scenery	・Consultation with related organizations such as INP, Heritage Development/Agency for Cultural Affairs, National Development Bureau, the engineers, mayors, and APAL ・Collect data related to important scenic areas
Gender and Children's Rights	・Evaluate the risks of any impact to the lifestyle of women and children from this project and preventive measures for any gender gap created as the result of this project ・Consider the opinion of women about this project	・Supplement the social survey conducted by JICA ・Conduct hearings with residents through stakeholder consultations

5.4 Impact Assessment Result

5.4.1 Impact Assessment Result

(1) Impact Assessment Result

The chart below shows the results of the survey on environmental social considerations. The impact on physical, natural, and social environments is divided into before and during construction. Possible mitigation methods are also described. Details are listed for items that are considered to have a comparatively large impact. See the diagram at the beginning of this chapter for the geographical composition of this project.

Table 26: Results of Impact Assessment on the Environment and Society

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Physical Environment and Pollution						
Air Pollution/Dust	**During Construction** When construction is close to a residential area, the air may be polluted by truck and machinery exhaust, and dust kicked up by trucks driving through the area may have a negative impact to the surrounding houses. Construction crews need to manage this during construction.	B-	B-	D	B-	B-
Water Pollution	**During Construction** While it normally it does not happen, there is a possibility that oil may accidentally leak from the engines of heavy machinery and other construction machinery and pollute the water. It is therefore necessary to adequately maintain machinery. It will also be necessary to manage construction so turbidity does not worsen due to excavation and expansion of the flood channel.	B-	B-	B-	D	D
Ground Pollution	**During Construction** The excavation and expansion of the Mejerda River is planned to be carried out for sand and soil used as farmland and residential land accumulated along the river and thus there is little possibility of containing harmful substances. While the project itself will not pollute the ground, there is a possibility of ground pollution if polluted soil is accidentally excavated and transported to a different location. It is impossible to eliminate the possibility of excavating buried waste or old, small-scale dangerous waste disposal sites along the Mejerda River. If polluted soil is found during excavation and expansion operations, it will be taken to a disposal site and disposed of in an appropriate manner. Furthermore, polluted soil will not be used in construction materials.	B-	B-	D	B-	B-
Solid Waste	**During Construction** A large amount of soil waste will be excavated. As described in Ground Pollution above, there is little possibility of excavated soil along the river bed containing harmful substances. Thus, it can be used for embankment. Surplus soil, if any, shall be transported to the disposal site and disposed of surely. Due to the trimming and removal of tamarisk trees, there will be a large amount of plant waste that will be difficult to use effectively. This waste will be handled appropriately and its reuse will be investigated. With regards to the illegal animal skin disposal site near the proposed embankment construction site in the El Mabtouh wetlands, if the site is related to the tanning industry, it will be necessary to dispose of it as designated dangerous waste (stipulated as Class 0602, Edict 2000-2339, October 10, 2010 in the Dangerous Waste List). The scope of construction and waste disposal will be confirmed before the start of construction, and if waste is found in the scope of construction, it will be transported to a disposal site and handled accordingly. This procedure can minimize the impact on the environment.	B-	B-	D	B-	B-

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Noise	**During Construction** When construction is close to a residential area, the noise from trucks and machinery may affect the surrounding houses. It is necessary to confirm that the environmental standard is satisfied by regularly monitoring the noise level at construction sites and considering the transport routes of trucks.	B-	B-	D	B-	B-
Topography and Geology	**During Construction** River topography will change, in particular by river expansion and excavation. It is necessary to consider slope gradient and scenery in the design.	B-	B-	D	B-	B-
Hydrological Phenomena	**During Construction** This project is mainly for the excavation and expansion of the flood channel of the Mejerda River and no construction will be conducted at the low flow channel of the river bank. Therefore, we believe the impact will be negligible.	B-	B-	D	B-	B-
	After construction The Project is expected to have positive impacts on residents along the river as the floods in the rainy season decrease. Although the frequency of soil transfer and accumulation on surrounding farmland to be caused by floods decreases, soil supply to the area will continue as the flood exceeding the project scale will occur. There will be no bank protection in the zone of excavation and expansion. Thus, erosion, transfer and accumulation of sand and soil in the river channel will be as same as before the Project, causing no impact on its transfer.					
Soil Stability and Erosion Risk	**During Construction** During the construction period, the risk of the erosion to the gradient soil may increase temporarily. It is necessary to consider an appropriate slope gradient to avoid surface erosion. It is also necessary to reduce soil erosion through silt traps during construction. Construction crews need to manage this.	B-	B-	D	B-	B-
	After construction It is necessary to consider an appropriate slope gradient and vegetation at the design phase to avoid surface erosion. Periodical monitoring and maintenance are necessary.	B-	B-	D	B-	B-

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Risks to the Environment						
Biologically Important Areas for Natural Habitat	**During Construction** The main purpose for this project is flood channel excavation and expansion. As no construction will be conducted at the low flow channel and a certain number of trees will remain, no major impact is expected to water and bird life habitat. There is likely to be no direct impact on the wetlands listed under the Ramsar Convention because of no improvement work of river channel from the Delta bridge to the lower stream to the mouth of the Mejerda River. The flood analysis results in the wetland area before and after the Project also show no significant change in the scope of flood. Because excavation and expansion work in the upper stream does not include excavation in waters, no turbid water is caused. Thus, there will be very little impact on the wetlands. The construction area in the El Mabtouh wetlands is limited and the frequency of flooding will not change so we expect that there will not be a large impact on natural habitat. Based on the above, impacts on biologically important areas for natural habitats are believed to be minimum.	B-	B-	B-	D	D
Biodiversity of Protected Species	**During Construction** There are 2 kinds of endangered species living in the Mejerda River: the European eel and the Mediterranean killfish (*Aphanius fasciatus*). As the project construction is excavation and expanding only at the flood channel and not at the low flow channel (riverbed) where the European eel and the Mediterranean killfish live, the impact on these important species will be small. The impact on feeding ground of birds in the low-flow channel will be also minimum. The impact on birds living in tree shades will be also minimum by securing a certain volume of trees along the river where they live.	B-	D	D	D	D
	After construction It is possible to contribute to the development of biodiversity of native habitat, in particular birds, along the Mejerda River by permanently maintaining riverbed vegetation after construction is complete. Continuing maintenance after construction is crucial for maintenance of the environment. The flood analysis results in the wetlands listed under the Ramsar Convention show little change in the scope of flood between before and after the Project and there will be no impact on biodiversity there.	B+	D	D	D	D
Possible Flooding	**Before Construction** Structural design for flood controls is based on the risk of 10th-year floods caused by rainfall amounts that occur once a decade. These structures protect houses, buildings, infrastructure, and crops in expected areas of flooding. The benefits brought by this project will be especially important to each sector of Tebourba, El Bataan, Jedeida, and Oued Ellil, as well as Kalaat Andalous, El Bataana, and Utica where most of houses lost their livelihoods to flooding. Improving bridges will allow residents to pass through flooded areas.	A+	A+	D	A+	A+

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
	After construction It is essential to maintain the riverbed to keep the benefits of the river improvement project in the long term and avoid the increase of woody plants and silt. For river vegetation, tracking and maintenance methods of vegetation need to be defined. It is necessary to select and plant the trees that are suitable for maintenance.	B+	D	D	D	D
Social Conditions						
Involuntary Relocation of Residents	**Before Construction** Currently there is one house that needs to be relocated due to the Mejerda River expansion. Residential relocation will be confirmed based on the final schedule, but there will be no major relocation. The stated compensation by the Ministry of State Properties and Real Estate Affairs will be paid for land, fixed structures, planting and all structures used to maintain lives of owners and occupants. If the value of original residence was low and the compensation amount was also low, the government will offer compensation to relocate to an alternative site. However, the resident relocating will be responsible for construction on the suggested alternative site. The compensation amount will be based on the land possession regulations and JICA environmental society guidelines (announced in April, 2010). The loss of livelihood of the recipient may also be considered for in the compensation amount.	B-	D	D	D	D
Loss or Involuntary Relocation of Structures Other than Residences	**Before Construction** There are several civilian facilities in the area this project takes place. They are storage rooms for tools, barns, abandoned houses, storage facilities for river water pumps, facilities for protecting electronic devices for pumps, and so on. As stated previously, the number and kinds of structures besides residences for this project will be researched later. However, no major loss or destruction will occur. The stated compensation by the Ministry of State Properties and Real Estate Affairs will be paid for land, fixed structures, planting, and all structures used to maintain lives of owners and occupants. If the compensation amount was low, the government will offer compensation to relocate to an alternative site. However, the resident relocating will be responsible for construction on the suggested alternative site. For residents who live on land, land-based compensation will have priority over compensation by cash. The compensation amount will be based on the land possession regulations and JICA environmental society guidelines (announced in April, 2010). The loss of livelihood of the recipient may also be considered for the compensation amount.	B-	D	D	D	D

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Crops and Trees being Cultivated	**Before Construction** Crops and fruit currently being cultivated as well as trees will be lost under land acquisition for this project. However, considering the number of related households and the expected loss of income, the impact is not enormous. However, the impact on livelihoods in Jedeida and El Bataan from the loss of cash income is greater than rural areas. The owners and occupants will receive compensation through the compensation procedure for land acquisition and property.	B-	B-	D	B-	B-
Land Use	**Before Construction** There is no particular impact.	D	D	D	D	D
	During Construction As bridges already exist, bridge improvements will have no impact on land usage. However, when jacking bridges, the embankment of the attached roads will be also be raised and therefore the width of the road will need to be increased. Thus, it will be necessary to acquire new land and change land usage. However, as the dimensions of the banked area are about **m2 for each point of the bridge, there will be no major impact on land usage. For any change in land usage, the stated compensation by the Ministry of State Properties and Real Estate Affairs will be paid for land, fixed structures, planting, and all structures used to maintain lives of owners and occupants. For residents who live on land, land-based compensation will have priority over compensation by cash. The compensation amount will be based on the land possession regulations and JICA environmental society guidelines (announced in April, 2010). The loss of livelihood of the recipient may also be considered for the compensation amount.	B-	B-	D	D	B-
	After construction Because there are few floods in the El Mabtouh retarding basin in the scale that operates and they are submerged less than for 20 days, it has little impact on land use in the retarding basin.	B-	B-	B-	B-	B-
Water Resources	**During Construction** The Mejerda River is the main water resource for individual irrigation in Kalaat Andalous, Sidi Thabet, Tebourba, and El Bataan areas. Local Resources below shows the impact on and evaluation for individual irrigation. As residents in the Mejerda River construction area are supplied with drinking water either publicly or privately, there will be no impact on water resources in the construction area. As no underwater excavation or damming will be conducted during construction, the water quality should not change and there will be no impact on irrigation and drinking water.	B-	D	D	D	D
	After construction Drinking water will be supplied either publicly or privately to the residents around the Mejerda River. Therefore, this project will not impact the water supply.	D	D	D	D	D

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Local Resources/ Regional Resources	**During Construction** The residents in communities along the Mejerda River rarely trim trees, fish, or hunt. The only natural/regional resource that has any value in the region is the water from the Mejerda River. The water can only be gathered by placing a small pump directly into the Mejerda River or by using a small pump in a pump storage room. If such equipment exists in the construction area, it is necessary to consult with the equipment owners to temporarily relocate the pumps and hoses so there will be no problems associated with intake of water for irrigation. Furthermore, construction will not use structures that stop water and excavation work will only be done in the flood channel along the river. Therefore, there will be no change in the low flow channel (river bed) and hence there will be no major impact on local resource usage.	B-	D	D	D	D
	After construction Because there are few floods in the El Mabtouh retarding basin in the scale that operates and they are submerged less than for 20 days, it has little impact on land use in the retarding basin.	D	D	D	D	D
Local Economy, Employment, and Livelihood	**During Construction** Through this project, daily employment opportunities can be offered to the local residents during construction. Priority should be given to employment for local labor.	B+	B+	D	B+	B+
	After construction Employment opportunities will be created for local residents to maintain the river by trimming vegetation.	B+	B+	D	B+	B+
Poverty and Vulnerability	**After construction** According to a study about income standard, the ratio for poor or vulnerable residents is high in Jedeida, Sidi Thabet, and El Bataan. These households are greatly affected by any impact on real estate or agricultural livelihood. It is possible to minimize any impact through compensation. On the other hand, this project reduces the damage caused by floods to households that are easily affected. More than half of the houses and properties of households in Jedeida and El Bataan were severely damaged by floods, and they will benefit greatly from this project. Overall, this project is positive for the poorest households.	B+	D	D	D	D
Localized Conflicts	**Before Construction** Localized conflicts appear to be complaints about land. According to the land plan, about half of the surveyed households are either owners that do not possess land title certificates or occupants. Therefore, it appears that conflicts among people will be about differences in the amount of compensation during the land acquisition procedure.	B-	B-	D	B-	C
Profit Distribution and Equality	**Before Construction** There will be no negative impact on the principle of socioeconomic equality. With an equal land acquisition compensation system for this project, unequal and negative impacts will be reduced.	D	D	D	D	D

Impacts	Reasons for Assessment	Geographical composition of this project				
		Me	El	DL	Ch	Pt
Minorities	**Before Construction** Regarding the conditions for free travel rights in El Mabtouh for semi-nomadic people, it is necessary to consider their characteristics (number of domestic animals for seasonal migration, their origins, travel frequency, and the importance of maintaining household income by migration) in the EIA.	D	D	D	D	D
Gender and Children's Rights	**During Construction/After construction** It is mainly men who get water for irrigation or do farm work. This project does not negatively affect gender equality or children's rights.	D	D	D	D	D
Access for Schools, Medical Services, and other Social Welfare Services	**Before Construction** **During Construction** There is a possibility that traffic could be affected during construction by river expansion, excavation work, and bridge improvement.	B-	D	D	D	D
Traffic Jams and Accidents	**During Construction** There is a possibility that traffic could be affected during construction by river expansion, excavation work, and bridge improvement. For this reason, school access, health organizations, and other social organizations will be affected. Traffic congestion is expected due to the transportation of excavated soil. If it is transported on arterial highways or in residential areas, the impact may be great. These possibilities will be clarified by impact assessments.	B-	B-	D	B-	B-
Historical and Cultural Heritage	**Before Construction/During Construction** There will be no impact on the historical and cultural heritage of El Battan weir bridge and the ancient bridge of Jedeida as the river channel is planned not to affect them.	B-	D	D	D	D
Scenery	**During Construction** Greenery will be lost from trimming the tamarisk trees on the river bank and therefore the scenery along the Mejerda River will change. However, it is possible to reduce this impact by planting greenery along the managed roads.	B-	D	D	D	D

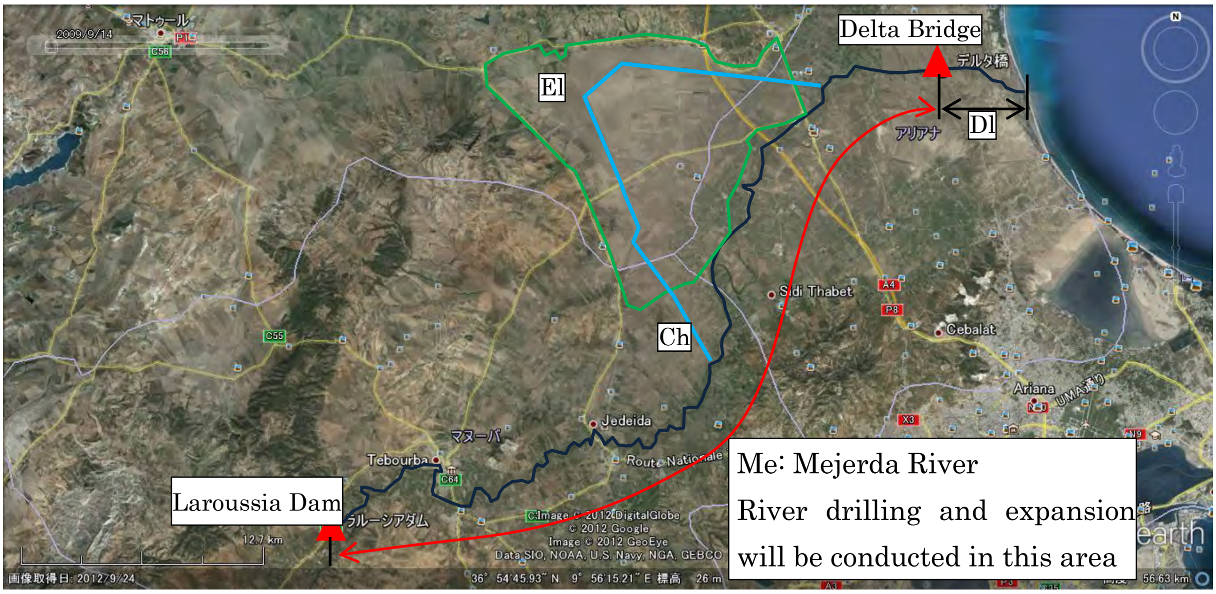
Source: JICA Study Team 2011

Project Components

Me : Mejerda River (The range of the excavation and expansion work conducted by this project is shown between the Laroussia Dam and Delta Bridge. See image below)
El : El Mabtouh wetlands
DL: Delta Bridge – Delta Region of Mejerda River
Ch : Channel/diversion channel
Pt: Bridge

Impact Classification

A+/- : Significantly positive or negative impact
B+/- : Insignificant positive or negative impact
C+/- : Areas of unconfirmed impact (supplemental studies required)
D : No impact



(2) Items that are Considered to have a Comparatively Large Impact

1) Impact to Aquatic Habitat of the Mejerda River

Because the natural landscape is likely to change due to construction to secure the cross-sectional flow of the river bed and embankment construction, it will cause adverse effect on the aquatic habitat environment at the low-flow channel. Taking the following measures, it will be possible to minimize the impact on the European eels and other aquatic habitats and birds with the feeding ground in the low-flow channel:

- Excavation and expansion only in the flood channel.
- No excavation that causes turbid water in the river channel (low-flow channel)

2) Impact on Wetlands

The use of the El Mabtouh wetlands as a retarding basin is not considered a factor in the degradation of the physical and biological environment that birds need. As the flooding period of the El Mabtouh wetland is short, we anticipate that the impact is the same as usual as a result.

On the other hand, there is no direct impact as no excavation or expansion work is conducted along the Mejerda River in the lower stream of the wetlands listed under the Ramsar Convention. Flood analysis results of the wetlands are shown in Charts 4-32 to 4-36 for the current river channel and Charts 4-37 to 4-41 for planned river channel each in terms of 1/5, 1/10, 1/20, 1/50, and 1/100. Comparison of the scope of floods of the current and planned river channels in terms of probable annual flood occurrence shows no significant difference. There is no difference in the frequency of flood between before and after the Project implementation. Because the excavation and expansion work is carried out in water in the upper stream in the scope of registered wetlands of the Mejerda River, no turbid water is caused and thus it will have no impact on the wetlands. Therefore, the Project will have almost no impact on the wetlands listed under the convention and their biota.

3) Impact on Forest Cover at the Flood Channel and Embankment

Dense tamarisk trees will disappear and the natural scenery of the river will change because of the river expansion and embankment construction. Meanwhile, the Ministry of Agriculture and residents living near the river have a negative opinion of the forest cover at the flood channel. The former thinks that the forest cover prevents water flow during floods and the latter thinks that tamarisk trees are useless as a forestry product. Furthermore, farmers complain that wild pigs hide in the tamarisk trees and damage crops along the river, and therefore trimming the tamarisk trees can be an effective method in reducing damage from wild pigs.

4) Impact on Land Animals

The impact from tree trimming on wild pigs that use tamarisk trees to hide is great, but we do not anticipate that it will directly impact wild pig groups greatly. Furthermore, wild pigs are not protected species.

Although birds live in trees along the river, the impact on them can be minimized by securing a certain amount of trees. The impact on the feeding ground along the low-flow channel will be also minimum as there is no construction work to be carried out there.

5) Impact Caused by Excavated Soil Waste

A large amount of excavated soil waste will be generated by this project from excavation and expansion work at the flood channel along the Mejerda River. When the excavated soil can be reused as material for banking, it will be given priority and used effectively, and when soil waste needs to be disposed of, it will be taken to a soil disposal site.

Approximate amount of soil to be excavated from the flood channel along the river during construction is 15,500,000 m3, of which only 1,000,000 m3 is used in the construction of levees along Medjerda River. However, as excavated surface soil of 30 to 50 cm is not utilized for embankment material, it will be soil waste[2]. Final disposal of soil waste of 14,500,000 and environmental management will become an important issue.

The excavation and expansion of the Mejerda River is planned to be carried out for sand and soil used as farmland and residential land accumulated along the river and thus there is little possibility of containing harmful substances. Thus, there is very little possibility of ground pollution in the target area. It can be used for embankment as it does not contain harmful substances.

Traffic congestion can be anticipated when transporting soil for reuse or to a disposal site. If it is transported on arterial highways or in residential areas, the impact may be great. Considering the negative impact to surrounding residents from transporting excavated waste soil, it is necessary to take specific action, such as selecting routes for environmental management.

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[2] Article 7 of Act No. 96-41 states that inert wastes mean "those which consist of soil and natural rock dug in a pit or generated from the demolition, construction or renovation, with the nature of ore mainly, and those which are not contaminated by dangerous substances and other elements potentially harmful,"
Therefore, soil which is taken from the bed and embankment of Medjerda River shall be treated as an inert waste in principle.

6) Impact Caused by Large Amounts of Plant Waste

During river bed construction, a large amount of plant waste will be generated from trimming tamarisk plants on the flood channel. The law regarding solid waste, Article 7 of Act No. 96-41 dated June 10th, 1996, states that it is prohibited to burn waste outside, except for plant waste, or use waste as fuel. Burning plant waste is the most common method to dispose of it, but this generates pollution and greenhouse gases. As this project takes place in rural areas, the impact from pollution is not significant, but reuse of materials should be prioritized to enable control of greenhouse gas emissions.

7) Impact on Cultural Heritage

Consideration is given to the historical structures of El Battan weir bridge and the ancient bridge of Jedeida in the formulation of the river channel plan not to cause any impact on them. The construction plan is also formulated not to cause any impact during the construction. Thus, there is no impact on such structures.

5.4.2 Comprehensive impact assessment

A summary of the results of surveys conducted up until now and the EIA of project implementation is summarized in the table below.

Table 27: Summary of project environmental impact assessment

Impact item		Impact assessment during at time of scoping		Impact assessment based on the results of the current survey	
		Pre-construction/during construction	Post-construction	Pre-construction/during construction	Post-construction
Physical environment and pollution					
1	Air pollution/dust	B-	D	B-	D
2	Water pollution	B-	D	B-	D
3	Ground pollution	B-	D	B-	D
4	Waste	B-	D	B-	D
5	Noise	B-	D	B-	D
6	Topography and geology	B-	D	B-	D
7	Hydrosphere	D	A+	B-	D
8	Soil stability and erosion risk	B-	D	B-	B-
Environment and risk					
9	Natural habitats, biologically important areas	B-	D	D	D
10	Protected species and biodiversity	B-	D	B-	B+
11	Flood risk	D	A+	A+	B+
Social conditions					
12	Involuntary resettlement of residents	B-	D	B-	D
13	Damage to non-residential	B-	D	B-	D

Impact item		Impact assessment during at time of scoping		Impact assessment based on the results of the current survey	
		Pre-construction/during construction	Post-construction	Pre-construction/during construction	Post-construction
	structures and involuntary resettlement of residents				
14	Loss of vegetation and cultivated produce	B-	D	B-	D
15	Use of on-site and regional resources	B-	D	B-	D
16	Water resources	B-	D	B-	D
17	On-site resources	B-	D	B-	D
18	Regional economy/employment/livelihood	B+	B+	B+	B+
19	Poverty and vulnerability	C	A+	D	B+
20	Regional interest and opposition	C	D	B-	D
21	Profit sharing, fairness	C	A+	D	D
22	Minority peoples	D	D	D	D
23	Gender/children's rights	C	B+	D	D
24	Public infrastructure and social services	B-	D	B-	D
25	Traffic congestion, traffic accidents	B-	C	B-	D
26	History/cultural heritage	D	D	D	D
27	Scenery	C	D	B-	D

Source: JICA Study Team

An explanation of impact can be found in Table 20.

Impact classification:

A+/- : Significantly positive or negative impact

B+/- : Insignificant positive or negative impact

C+/- : Unconfirmed impact (additional study required)

D : No impact

Chapter 6. Mitigation Measures

(1) Overview of Mitigation Measures

The table below shows the results of the study of the environmental management plan to mitigate the impact based on the scoping and impact assessment results shown earlier. The environmental management plan (impact mitigation measures) on main points is summarized.

1) Measures to Protect Aquatic Organism and Birds

The measures described below are advised in order to protect aquatic organisms living in the Mejerda River.

① Plant trees to assure an area with shade. For example, on one side of the river, areas three to five meters wide and 100 meters long per kilometer, which is about 5% of the total length, can be preserved. This would enable the physical environment to protect creatures with shade at several areas of the river.

② As excavation and expansion work will be limited to the flood channel, the impact to aquatic organisms, such as eels, is expected to be small.

③ The DGBGTH will coordinate so that organizations such as INSTM, INAT, DGPA, WWF[3], and AAO[4] can contribute to the impact assessment as necessary.

2) Impact Mitigation Measures for Tamarisk Tree Trimming

To mitigate the impact of trimming tamarisk trees, alternative trees will be used to cover the flood channel and embankment in order to control erosion. Therefore, it is necessary to select the appropriate types of trees to plant. Furthermore, a certain number of trees will be left on the riverside to secure bird habitat.

3) Procedure for Removal and Effective Reuse of Excavated Soil Waste

The following conditions must be fulfilled for excavated soil waste removal and reuse.

① Soil waste is inert waste that is free of pollution.

② If there is a special disposal site for inert waste, this site should be used, but if there is no disposal site for inert waste, soil waste needs to be reused. According to Article 29 of Act No. 96-41 dated June 10, 1996, reuse has to be considered when disposing of solid waste.

It is necessary to select the excavated soil waste disposal and reuse methods from the following options.

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[3] World Wildlife Fund
The world's largest international NGO for the environment. Their policy is to maintain biodiversity and reduce the ecological footprint for life on earth.

[4] Association 'Les Amis Des Oiseaux'
Tunisian environmental NGO for the protection of birds. AAO is one of the NGOs in partnership with Bird Life International (above note 5) with 18 African countries. The activity consists mainly of donations from supporters and commissions from studies for international organizations and international NGOs.

Options below are shown in order of priority.

① Embankment material
② Disposal at former quarries
③ Use as covering materials for Jebel Shakeel waste control
④ Reuse in other construction projects
⑤ Disseminate to farm land

The excavation and expansion work is planned to be conducted in the zone currently used as farmland and residential land along the Mejerda River. It is formed as a result of erosion and accumulation of soil on the river bank. Thus, it is unlikely that the excavated soil will contain harmful substances.

4) Effective Use of Plant Waste

The following list shows the possibilities for effective use of plant waste generated from trimming tamarisk trees.

① Composting branches
② Carbonization of tree trunks to produce charcoal
③ Crush wood to produce wood particles
④ Other uses

Good quality of compost cannot be obtained from tamarisk trees and the charcoal is also poor quality. INRGREF proposed the possibility of molded charcoal products with higher calorific power, but this has not yet been achieved. Other effective uses have not been proposed yet. Trunks can be used as charcoal if they are offered free of charge to agencies that want them.

On the other hand, using trunks and branches in protective dikes and consolidated foundations is an effective use of materials as proposed in the master plan. The following are challenges for using trees as materials for protective dikes and consolidated foundation:

① It is preferable that trunks do not have knots, are well dried, and are more than 10 centimeters in diameter (recommendations from the DGF). Trunk length of about one meter is also necessary so that it can be secured to the ground. In reality, it is difficult to obtain trunks with this length without knots due to the branch conditions of tamarisk plants on the Mejerda River.

② As there is no evidence that this method has been done before in Tunisia, empirical research is necessary.

5) Excavated Waste Control at Unmanaged Waste Disposal Sites

It is necessary to remove waste expected to be generated from unmanaged waste disposal sites during river bed construction to authorized managed waste disposal sites. The closest site is the Jebel Shakeel managed waste disposal site (general waste). Industrial waste that is categorized as hazardous (such as animal skins near El Mabtouh wetlands) has to follow transport and removal regulations. If a new waste disposal site is established or an old disposal site is discovered during construction, the obligations of construction contractors have to be clearly stated in the tender documents and contract conditions.

(2) Required Costs for Mitigation Measures

As it is possible to handle mitigation measures as normal construction and administrative activity, there is no need to plan a special budget. Cost of individual environmental monitoring to be conducted as a mitigation measure is shown in Table 7-25 in 7.4.

Chapter 7. Environment Management and Monitoring Plan

7.1 Environment Management Plan

7.1.1 Issues to be Considered in the Environment Management Plan

The environment management plan, which includes the environment monitoring plan, needs to be discussed in the Environmental Impact Assessment (EIA) that Tunisia creates to approve the project.

The following issues need to be discussed in the EIA.

1) Management plan for excavated soil at the Mejerda River bed
2) Protection plan for habitat environment in the Mejerda River
3) Planting plan at the Mejerda River bed
4) Plans for resident relocation to alternative sites and compensation
5) Environment monitoring plan

1) Issues to be Considered on the Management Plan for Excavated Soil at the Mejerda River Bed

a) Management Plan for Excavated Soil

In the Management Plan for Excavated Soil at the Mejerda River Bed, the fact that this project will reduce the impact on the physical, natural and human environments in the project area as well the purposes, methods, activities, and responsibilities to be developed will be clarified so that this project can be accepted. The targets are described below.

1. Reuse the excavated soil as much as possible.
2. Inert waste that cannot be reused will be disposed at a specialty created soil disposal site.
3. In order to reduce traffic congestion and the risks of traffic accidents, transportation of excavated soil to reuse sites or soil disposal sites will be managed.

When reusing excavated soil, ANGED and ANPE will match the material and methods of use. When landfill is being performed during construction work, the standard will be established with the project officer and the project needs to be confirmed to comply with the standard. If the materials are not compatible with reuse or categorized as inorganic waste, the appropriate disposal method needs to be defined with ANGED, and the category for the waste and the transporting and waste disposal methods need to be established by contractors approved by the Ministry of Environment.

b) Reusing Land

In the Management Plan for Excavated Soil, reuse and disposal procedures will be proposed. The possibility for reuse became clear after consulting concerned parties who could possibly accept excavated soil in the area of the project or close to the project site. The chart below shows the consultation summary. As the most of this construction will finish in 2013, they are not the subject to disposal of excavated soil generated by this project. Therefore, it is necessary to discuss soil reuse with the related agencies again after the project starts.

c) Soil Disposal Sites

Old quarries will be considered for the disposing of soil (soil disposal sites). Old quarries that were closed before Act No. 89-20, which controls quarry development, dated February 22, 1989, and have not been redeveloped since, are up for consideration.

As a result of interview with DGBGTH, three former government-owned quarries below are suggested as possible soil disposal sites.

1) Ariana Nali
2) Maiana (Manouba Governorate)
3) Jebel Turki (Ariana Governorate)

DGBGTH has not created the site selection list at this stage. The inert waste disposal plan at quarries will be created as a technical proposal for the redevelopment of quarries together with the quarry agency. In this technical proposal, the initial conditions, the scheduled redevelopment construction, and the estimated amount of waste will be described. The main points of the redevelopment are security to prevent accidents, stability of slope and face, and the recovery of scenery. The recovery of scenery refers to topography recovery and there is no obligation to plant vegetation.

A fact to be noted when burying excavated soil in old quarries is that the excavation site may have been an illegal waste disposal site and the waste may cause pollution during construction. In order to assure environmental approval, it is important to take measures when planning construction for proper handling and management in case such waste is generated.

d) Disposal Affiliated with the Ministry of Environment Redevelopment Plan

In the Study on Environment for Utilization and Redevelopment of Quarries: First Stage – Analysis and Evaluation of Quarry Impact on the Environmental Plan, the Ministry of Environment planned the study based on the redevelopment of 100 quarries in Tunisia. This study targets 12 governorates, including Manouba, Ariana, the great Tunis bloc and Bizerte. In this project area, several quarries in the Manouba governorate, especially quarries in Maiana and Kelidia, can be prioritized.

Table 28: Review of Civil Engineering Plans with Possible Reuse of Excavated Soil

Planning Agencies	Consultation Date	Title of Agency Representative	Plan Name and Location	Area (ha)	Required Amount of Soil	Scheduled Construction Period	Possibility of Reuse
AFH/Ground and Residence Agency	2011/5/12	Director of Research and Planning Office	Between Zana (Utica Governorate) and highway	400	-	-	Not clear
AFH Ariana Local Agency	2011/6/9	Local Office Director	Tunis garden in Aguba (Manouba Governorate)	300	0	Summer 2012	No
STEG/Tunisia Power Gas Public Corporation	2011/6/9	Director of Adjustment/Production, Director of Technology Office	Kalaat El Andaluis	88	1,320,00 0	At the end of 2012	No
AFI/Industrial Ground Office	2011/6/13	Director of Ground Issue Office, Deputy Director of Research	Utica Industrial Area	50	-	June 2011	No
			Utica/Ejidida	-	-	2012 - 2016	Not clear
			Chafrou Raoued	53	53,000	June 2012	No
SEPTS/Tunis Sud Assessment and Development Company	2011/6/16	General Director, Director of Technology Office	Tunis/ Sud lake	127 (practically 50)	750,000	2013	Yes
Tunis Gulf Development Company	2011/6/20	Assistant for General Director	Financial support between Kalaat Andalous and Raoued	520	-	-	Yes

2) Issues to be Considered for the Protection and Recovery Plans for Aquatic Habitat Environment in Mejerda River

It is necessary that the aquatic habitat protection and recovery plan for the Mejerda River minimizes any impact to the environment of the Mejerda River caused by this project.

1) As the excavation and expansion work along the Mejerda River will only be conducted at the flood channel and not at the low flow channel (river bed), the impact to European eels and other fish that live in or migrate to the river will be minimized.

2) For birds living in trees along the river, a certain number of trees will be kept as described in 3), and by limiting the loss of forest at the Mejerda River flood channel, the impact will be minimized.

3) Issues to be considered for the Mejerda River Bed Planting Plan

In the Mejerda River bed planting plan, the targets, methods, and activities for the following issues will be clarified in order to reduce the impact on the Mejerda River's environment from this project.

1) The loss of forest at the Mejerda River flood channel will be limited by assuring that a certain number of trees are kept along the river. This conservation activity considers both the natural scenery and biology (a potential biological corridor and evacuation site).
2) Create alternative vegetation at the highest part of the river bed to compose a linear natural habitat.
3) Reinforce the ground by planting appropriate trees to curb the erosion risk at the river bed.
4) Precisely plan the planting period and work, and planting requests with the DGF or the Forestry Department.
5) Clearly define the responsibility and methods to maintain planting at the river bed in the long run.

The existing study, through discussions with the DGF and the Forestry Department, show the most appropriate kinds of trees for planting. The following trees were proposed to be planted on the other side of the dike and the upper side of repaired slope.

- Acacia, especially *Acacia cyclops*, *Acacia aurida*
- Oleander
- Caper
- *Robinia pseudoacacia*

The following is a reference of plants to be planted at the lower part of river bed.

- *Sesuvium portulacastrum*
- Atriples

4) Plans for Compensation and Resident Relocation to Alternative Sites

The status of involuntary resident relocation and land acquisition will be described in Chapter 8 (Land Acquisition and Residents Relocation). The resident relocation and compensation plan also needs to be created as The Resident Relocation Plan, which also includes the monitoring plan, by Tunisia. Furthermore, relocation, compensation, and monitoring must be conducted based on the created plan.

In Chapter 8 of this report, The Simple Relocation Plan for Residents (Projection) is introduced as reference material for The Resident Relocation Plan that Tunisia composed for smooth land acquisition and resident relocation.

7.1.2 Environmental Management Plan

Environmental Management Plan is as shown below.

Table 29: Environmental Management Plan

Class	Impacts		Assessment	Proposed Mitigation Measures and Environment Management Plans	Related Agencies	Project Stage	**Overview**
Pollution Countermeasures	1	Air Pollution/Dust	B-	Prioritize leveling of excavated soil to reduce the amount to be transported Cover the soil and waste when transporting to soil disposal sites or reusing sites Regular, suitable inspections and maintenance for heavy machinery and trucks.	Construction companies to conduct ANPE to manage CRDAs and DHER to monitor	**During Construction**	Consultant is responsible for preparing a monitoring study report
	2	Water Pollution	B-	Regular, suitable inspections and maintenance for heavy machinery and trucks. Collect and dispose of engine oil or prevent oil leaks by installing an oil fence Prevent flow of excess soil with a silt trap and an excavation slope to protect from erosion. Pretreatment of contaminated water through natural filtering when preparing concrete made structures Review construction methods to reduce water pollution	Construction companies to conduct ANPE to manage CRDAs and DHER to monitor	**During Construction**	Consultant is responsible for preparing a monitoring study report
	3	Ground Pollution	B-	Regular, suitable inspections and maintenance for heavy machinery and trucks. Collect and dispose of engine oil	Construction companies to conduct ANGED to coordinate and	**During Construction**	Consultant is responsible for preparing a monitoring study report

				Advance analysis of excavated soil to decide how to handle the soil Appropriate disposal and management of existing solid waste that was accidentally excavated during construction	decide ANPE to manage CRDAs and DHER to monitor		
	4	Solid Waste	B-	Appropriate disposal and management of inert waste generated by plant waste and excavation Confirm the extent of disposal at illegal animal skin disposal sites and handle appropriately as necessary	Construction companies to conduct ANGED to coordinate and decide ANPE to manage CRDAs and DHER to monitor	**During Construction**	Consultant is responsible for preparing a monitoring study report
	5	Noise	B-	Prevention of noise pollution in areas that noise impacts. Set and adhere to the management standard and time limit	Construction companies to conduct ANPE to manage CRDAs/DHER to monitor	**During Construction**	Consultant is responsible for preparing a monitoring study report
Environment	6	Natural Habitat	B-	Excavate at the river flood channel where it is higher than the drought water level in the dry season Protection plan for trees planted at the low flow channel along the river bank line (leave the original shady area on one side of the river for at least 100 meters per kilometer, which is about 5% of the total by straight line) Plant trees or plants at the lower dammed area of the river bank crest and the flood channel slope Look after plants on the river bed	Construction companies to conduct ANPE to coordinate and decide CRDAs/DHER and DGF to monitor	During and after construction	Consultant is responsible for preparing a monitoring study report

	7	Biodiversity	B-	River flood channel excavation	Construction companies to conduct applicable excavation at the river flood channel ANPE to manage CRDAs/DHER in cooperation with INAT and INSTM to monitor	Before, during and after construction	Confirm eel migration routes and habitat based on EIA research Seek help from INAT and INSTM for monitoring research of species that are sensitive to environmental changes (before and after construction) Consultant is responsible for preparing a monitoring study report
	8	Ground Stability and Erosion Risk	B-	Plant trees or plants at the low dammed area of the river bank crest and the flood channel slope to protect the slope Manage plants on the river bed	Construction companies to conduct ANPE to manage CRDA/DHER and CRDA/CES to monitor	During and after construction	Consultant is responsible for preparing a monitoring study report
Social Conditions	9	Involuntary Relocation of Residents	B-	Follow JICA guidelines and plan compensation and relocation for land acquisition and compensation within the framework of legal procedures	Land Acquisition Section of DGBGTH, which is the responsible agency for monitoring research, expropriating organizations, and local committees for evaluation and operation Ministry of State Properties and Real Estate Affairs to decide CRDAs/DHER to monitor relocation support	Before and During Construction	Create a relocation plan for local residents and conduct land acquisition, compensation, and relocation based on the plan The fundamental documents are the monitoring study cards sited in the chapter describing land acquisition Land Acquisition Section of DGBGTH and expropriating organizations can manage the monitoring

					Public hearing for preparation of pre-procedure under the DGBGTH (public hearing within the stakeholder discussion and impact assessment framework) The representativeness of Omdas at the stakeholder is currently being re-evaluated. It is preferable that a public hearing is held directly for the local residents.		study together with assistance from consultants
	10	Accidental Loss or Destruction of Structures other than Residences	C	Same status as item 9	Same status as item 9	Before and During Construction	Same status as item 9
	11	Loss of farm land, unharvested crops, and shrub land	B-	Same status as item 9	Same status as item 9	Before and During Construction	Same status as item 9
	12	Means of Living, Poverty, and Vulnerableness	C	Same status as item 9 because the land acquisition conditions possibly affects livelihood	Same status as item 9	Before and During Construction	Same status as item 9
	13	Minorities	D	Consider requests from nomads at the final technical design for the flood control basin functions Public hearing to take opinions from nomadic people into consideration to design the flood control basin (public hearing within the impact assessment framework)	DBGGTH within the impact assessment framework CRDA/DHER and DGF to coordinate and monitor ANPE to manage	Before and During Construction	Public hearing within the impact assessment framework will be held when nomads are in El Mabtouh

	14	Water Resources	B-	Prior confirmation on the irrigation pump facility when any impact is anticipated When a countermeasure is required during construction, relocate pumps and hoses. Also consider providing alternative irrigation water when necessary	Construction companies to conduct CRDA/DHER and DGRE to decide and monitor CRDA/DGRE to manage	**During Construction**	Identify the number of pump facilities that are authorized based on the EIA
	15	Public Infrastructure and Social Projects	B-	Public hearing to listen to the opinions of the surrounding residents (public hearing within the stakeholder discussion and impact assessment framework) Traffic management during the period of construction	Construction companies to conduct DGBGTH and CRDA/DHER to coordinate surrounding residents and police Ministry of Works and Department of Interior to decide and manage CRDA/DHER to monitor measures	Before and During Construction	Consultant is responsible for preparing a monitoring study report
	16	Localized Conflicts	C	Same condition as item 9 because the land acquisition conditions possibly causes localized conflicts	Same status as item 9	Before and During Construction	Same status as item 9
	17	Distribution of Profits and Social Equality	C				
	18	Historical and Cultural Heritage	C	Consider during design stage Provide thorough safety management during construction in areas where injury can be anticipated	Construction companies to conduct applicable construction Cooperation with cultural heritage organizations to	**During Construction**	Consultant is responsible for preparing a monitoring study report

					conduct appropriate construction close to the El Bataan historical buildings		
	19	Scenery	C	Implement considerations made at design stage	Construction companies to conduct DGF to coordinate and decide	**Before Construction**	

7.2 Environmental Monitoring Plan

(1) Items that should be taken into consideration in the environmental monitoring plan

The environmental monitoring survey plan needs to be structured to include the pre-construction design stage (the stage during which the monitoring plan is established) and monitoring activities that are to occur both during and after construction is complete.

1) Pre-construction (monitoring)

The environmental management of this project is to be based on an appropriate management plan. Upon the formulation of an excavated soil management plan, cooperation will be required from the Department of Quarries and Explosives, the Ministry of State Properties and Real Estate Affairs, and individuals involved in the planning of civil engineering works related to the disposal of excavated soil. Cooperation with the Ministry of the Environment will be required in terms of quarry redevelopment plans and the disposal of soil waste. Because the selection of disposal sites is to be included, a pre-construction monitoring survey will also be necessary.

2) During construction (management and monitoring)

Contracts with general contractors and the environmental management incorporated into the environmental management plan of this project are the responsibility of DGBTH, which will report the results of management activities to ANPE.

1) Disposal of hazardous substances, on-site waste, and excavated waste of waste collection sites that conforms to laws regulations

2) Repair or construction of bridges across the Mejerda that will allow for an unobstructed flow of traffic while construction is taking place

3) Provision of support and alternative water supplies to farmers authorized to take water from the Mejerda for irrigation

4) Implementation of the following items, which are directed toward management activities and place particular focus on site environmental management.

① Status of the transport, effective use, and disposal of excavated soil
② Status of steps taken to preserve or restore underwater habitats
③ Status of cultivation plans for riverside vegetation

5) Periodic inspection and maintenance of dump trucks and other vehicles used to transport the heavy machinery, raw materials, and soil to be used in construction

6) Observation of the water quality (particularly turbidity) at the Ramsar site located at the lowest reaches of the Mejerda during construction

3) Monitoring activities at the project implementation stage (monitoring)

Monitoring of the environmental status of the project site during project implementation will be conducted based on a combination of visual inspection and samples collected for comparative analyses between present state and initial state values. The following points have been mentioned as preferential items in terms of the implementation of monitoring in this project.

1) Living creatures (fish, amphibians, mollusks, and birds)

2) Status of flood channel and riverside plant coverage

3) Visual observation of accumulation phenomena and riverside erosion

4) Visual observation of the flood channel and riverside occupation of human activities (cultivated lands, buildings)

In the event that problems are confirmed via comparisons against the initial state in the monitoring of project implementation, the DGBGTH will take corrective measures to solve them. Because ANPE confirmation is to be received with regard to measures proposed at the EIA and the implementation of environmental management plans, monitoring reports are to be submitted to ANPE.

The environmental monitoring plan is shown below. Table 7-25 shows the environmental and water quality monitoring form and standard values. Referential standard values are shown when available and the implementation costs are the referential price in existing reports.

Table 30: Environmental Monitoring Plan

Classification	Environmental Items		Parameters	Monitoring Methods and Frequency	Monitored Sites	Implementing Agencies
Pollution measures	1	Air pollution/dust	PM-10	Method: Air pollution survey: dust inspection and analysis Frequency: 1/month	Around plant sites Around public facilities	Inspection and analysis performed by consultant DGBGTH compiles the results and reports it to ANPE.
	2	Water pollution	Water quality analysis: Suspended matters Turbidity Biological oxygen demand (BOD) Chemical oxygen demand (COD) Visual observation: Installation check of silt trap, etc. Engine oil management on site (storage, collection, incidental leakage) Maintenance records: Inspection and maintenance of heavy machines and dump trucks and their records	Method: Water quality analysis Visual monitoring Confirmation of maintenance records Frequency: 1/month	One location in the lower stream of construction zone and one location on the contrast site in the upper stream for water quality	inspection and analysis performed by consultant Maintenance records and installation check performed by implementing agency and reported regularly to DGBGTH DGBGTH compiles the results and reports it to ANPE.
	3	Ground pollution	Visual observation: Visual monitoring of incidental engine oil leakage, etc., on site Confirmation of maintenance records: Confirmation of inspection and maintenance records of heavy machines and dump trucks in routine inspection Confirmation of transportation records: Transportation records to disposal site if there is any polluted soil	Method: Visual monitoring Confirmation of maintenance records Confirmation of transportation records Frequency: Routine monitoring	Vehicle management at vehicle base Engine oil management on site Transportation records created on site	Visual observation and recording performed by construction company and reported to DGBGTH regularly. DGBGTH visits the construction site as necessary for confirmation. DGBGTH compiles the results and reports it to ANPE.
	4	Waste	Confirmation of waste list: Generation volume measurement records, and	Method: Confirmation of waste list	Excavation site and land for structure	Visual observation and recording performed by

Classification	Environmental Items		Parameters	Monitoring Methods and Frequency	Monitored Sites	Implementing Agencies
			list confirmation of inactive waste (excavated soil), construction waste, plant waste, and waste left on the site before project implementation (types of waste: municipal waste, industrial waste and hazardous waste based on the list provided under law) Confirmation of transportation records: Confirmation of list of transportation of waste above to disposal site Visual monitoring: Confirmation and monitoring of reuse of excavated soil Confirmation and monitoring of disposal of surplus soil	Confirmation of transportation records Visual monitoring Frequency: Routine monitoring	construction	construction company and reported to DGBGTH regularly. DGBGTH visits the construction site as necessary for confirmation. DGBGTH compiles the results and reports it to ANPE.
	5	Noise	Noise measurement with noise meter: Noise Compliance with noise standard by measuring noise when construction is carried out near residences and school and other public facilities Setup working hours and compliance with them Compliance with noise standards when nighttime work is needed Proper handling of complaints	Method: Noise measurement with noise meter Frequency: Conducted through working hours once a week Each time when nighttime work is needed	Near residences and school and other public facilities	Noise measurement performed by consultant DGBGTH compiles the results and reports it to ANPE. When the construction company receives a complaint, it reports it to DGBGTH and the two parties discuss measures to be taken.
Environment	6.	Natural habitats	Visual monitoring: Monitoring of no impact of flood channel work on low-flow channel (riverbed area) Confirmation that certain volume of trees in certain zone in flood channel is secured	Method: Visual monitoring Frequency: Routine monitoring	Points in the Mejerda where the project is implemented	Visual monitoring performed by construction company and reported to DGBGTH regularly. DGBGTH visits the construction site as necessary for confirmation. DGBGTH compiles the

Classification	Environmental Items		Parameters	Monitoring Methods and Frequency	Monitored Sites	Implementing Agencies
						results and reports it to ANPE.
	7	Biodiversity	Visual monitoring: same as 6 Inhabitation survey: Regularly observe fish living in several chosen points along the Mejerda River Inhabitation survey: Regularly observe fish living in several chosen points along the Mejerda River	Method: Visual monitoring Inhabitation survey Frequency: Same as 6 for visual monitoring Once in dry season (mid dry season) and twice in rainy season (early and mid rainy season) for inhabitation survey	Along the Mejerda River	Performed by INAT or INSTM
Social conditions	8	Loss or destruction contrary to the intention of non-residential structures	Field survey: Confirmation of situation of structures that are likely to be affected by the Project implementation Hearing survey: Hearing with residents that have impact of land acquisition and compensation for loss of structure	Method: Field survey Hearing survey Frequency: Field survey before construction Hearing survey once at compensation for loss	Site of structures that are likely to be affected by the Project implementation	Field survey and hearing survey conducted by consultant Consultant submits record cards to DGBGTH and its expropriation and compensation section confirms them.
	9	Living means, poverty and vulnerability	Field survey: Confirmation of situation of residents on which land acquisition for the Project implementation is likely to have impact on their means of living Hearing survey: Hearing with residents who are affected by land acquisition and compensation for it Confirmation of gap between residents' relocation plan and compensation plan	Method: Field survey Hearing survey Frequency: Field survey before construction Hearing survey once at compensation for loss	Area where land acquisition for the Project is likely to have impact on the means of living	Field survey and hearing survey performed by consultant Consultant submits record cards to DGBGTH and its expropriation and compensation section confirms them.
	10	Water resources	Field survey: Confirmation of use of water resources of the Mejerda River (irrigation use of river water)	Method: Field survey Visual monitoring	Along the Mejerda River Points where pumps	Visual monitoring performed by construction company and reported to DGBGTH

Classification	Environmental Items		Parameters	Monitoring Methods and Frequency	Monitored Sites	Implementing Agencies
			Confirmation of number of holders of water pumping permits for the Mejerda and the current circumstances in terms of water pumping via pumps and hoses Visual monitoring: Confirmation of points where pump relocation is needed: Confirmation of relocation of pumps during construction and return of them after construction	Frequency: Field survey once before construction Visual monitoring conducted when pumps and hoses for pumping are needed	and hoses for water pumping needs to be relocated during construction	regularly. DGBGTH visits the construction site as necessary for confirmation.
	11	Public infrastructure and social services	Visual monitoring: Confirmation of traffic congestion Residents' hearing: Complaints about traffic congestion, etc.	Method: Visual monitoring Residents' hearing Frequency: Once every half year for residences and infrastructure that are likely to be affected during construction Once during construction period for residences and infrastructure that are likely to be affected only during construction of the zone	Around individual construction site or residential area and infrastructure where traffic is affected by the Project	Performed by construction company and reported to DGBGTH regularly DGBGTH visits the construction site as necessary for confirmation.

Note: Table 7-25 has referential standard values are shown when available and the implementation costs are the referential price in existing reports.

(2) Environmental monitoring standards

1) Environment and water standards in Tunisia

According to the ANPE, Tunisian environmental management standards are in compliance with WHO guidelines and European standards. Under Pollution Indices described in JICA's environmental guidelines, the results confirmed by ANPE in terms of Tunisia's chosen management standards are shown in the diagram below. In Tunisia, there are standards for air (NT 106-04), standards for wastewater (NT 106-02), and standards for waste (NT-41-96). Water quality standards (surface water/groundwater) are currently being prepared at ANPE. In the event that impact is observed due to complaints from residents over water turbidity, measures have been taken to reduce turbidity as much as possible.

Table 31: Comparison of environmental management items included among JICA guidelines and the current indices in place in Tunisia

Classification	Item	Tunisian management indices
1. Pollution index	Air standards	○ (NT-106-04)
	Water quality standards	Surface water/groundwater standards currently under development
	Wastewater	○ (NT-106-02)
	Waste	○ (NT-41-96)
	Ground pollution	×
	Noise/vibration	×
	Land subsidence	×
	Odor	×
	Sediment	×

2) International standards that should be considered

The table below shows Tunisia's environmental standards (provisional values) and international standards. On the other hand, discussions with ANPE have revealed that baseline surveys on water quality, noise, and vibrations are fundamentally performed at the time of the EIA that precedes a project. Water quality and other monitoring indices that will come into play during project implementation are established based on the results of the assessment. In terms of items without national management indices, baseline surveys for water quality, noise, and vibrations will be performed during the EIA. Appropriate management values will need to be established following a review of both the assessment results and international standards.

(3) Tunisia's existing water quality monitoring observation sites/data utilization

Water quality monitoring for the Mejerda river basin is conducted at the observation stations shown in the figure below. Once a year, these observation stations observe water temperature, pH, electrical conductivity, salinity, BOD, COD, and turbidity. It may be possible to use the data and observation facilities of these observation stations to help establish standard monitoring values during project implementation and to monitor water quality throughout construction.

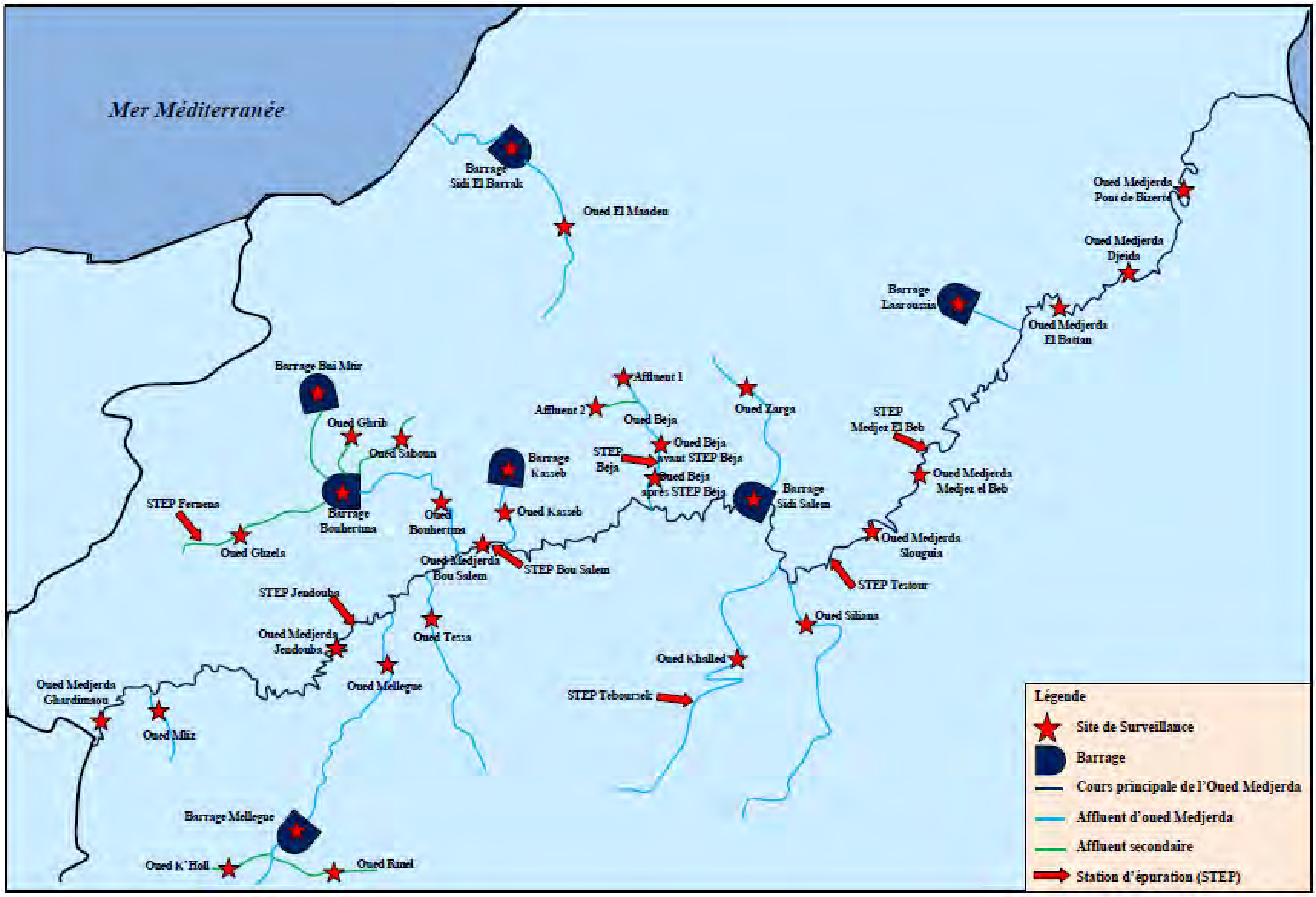


Figure 20: Location of water quality monitoring stations in the Mejerda river basin

7.3 Budget, funding, and organizations responsible for environmental management and monitoring

(1) Responsible organizations

Organizations responsible for the environmental monitoring of this project include the companies commissioned for construction (during construction) and the DGBGTH/MOA after the improvements are in use (construction is complete).

(2) Budget and funding for environmental management and monitoring

The General Direction of Dams and Large Hydraulic Works of the Ministry of Agriculture (DGBGTH, / MA), the ordering party, needs to secure the budget for the environmental management and monitoring. The implementation budget for each monitoring item also needs to be clarified. The costs are to be confirmed based on interview with C/P in DFR explanation, although the table below show the referential price in existing reports of the implementation costs.

Table 32: Environmental/water quality monitoring form, standard values and monitoring cost

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Average measurement</th><th rowspan="2">Maximum measurement</th><th rowspan="2">Tunisian standards (1)</th><th colspan="2">International standards (reference)</th><th rowspan="2">Observation point, frequency, and method</th><th rowspan="2">Implementation costs (TD/year)</th></tr>
<tr><th>International standard name: standard</th><th>Japan</th></tr>
<tr><td>Noise</td><td></td><td></td><td>Noise</td><td>WHO Guideline:
Residential, Institutional, Educational:
Daytime (07 :00-22 :00) 55dBA
Nighttime (22 :00-07 :00) 45dBA
Industrial, commercial
Daytime (07 :00-22 :00) 70dBA
Nighttime (22 :00-07 :00) 70dBA</td><td><table>
<tr><th rowspan="2">Type of area</th><th colspan="2">Standard values</th></tr>
<tr><th>Daytime</th><th>Nighttime</th></tr>
<tr><td>AA</td><td>Under 50dB</td><td>Under 40dB</td></tr>
<tr><td>A and B</td><td>Under 55dB</td><td>Under 45dB</td></tr>
<tr><td>C</td><td>Under 60dB</td><td>Under 50dB</td></tr>
</table>
otes) 1 In terms of time of day, daytime refers to the period from 6AM until 10PM, while nighttime refers to the period between 10PM and 6AM.
Areas with a grade of AA usually have a number of social welfare facilities like medical treatment centers that require an especially tranquil setting.
reas with a grade of A are almost exclusively residential.
Areas with grade of B are mainly residential.
reas with a grade of C are a</td><td>Public facilities and residences near the construction site
Once a week during working hours
Acoustic measurements via sound level meter</td><td>Reference
500 TD
(JICA EIA report from Desalination of Southern Ben Gardane in the Medenine Governorate)</td></tr>
</table>

					mix of residential, commercial, and industrial.		
Air quality			Guide value PM-10 Average : 40-60µg/m^3 24 hours：120µg/m^3	WHO Guideline: PM$_{2.5}$: 10µg/m^3 annual mean 25µg/m^3 24-hour mean PM$_{10}$: 20µg/m^3 annual mean 50µg/m^3 24-hour mean	SPM (Lower than PM10)： One day per-hour average：0.10mg/ m3 One hour value：0.20mg/ m3 PM2.5： Annual average value：15µg/m3 Daily average value：35µg/m3	The vicinity of the construction site Every month Inspection/analysis of dust（PM10）	Reference 500 TD (JICA EIA report from Desalination of Southern Ben Gardane in the Medenine Governorate)
Water quality MSE (SS)			50mg/l	EHS Guideline for treated sanitary sewage discharges (IFC) 50mg/l	25mg/l or less（rivers）		
Water quality DBO5 (BOD5)			6mg/l O$_2$	EHS Guideline for treated sanitary sewage discharges (IFC) 30mg/l (BOD)	11mg/l or less（rivers）		
Water quality DCO (COD)			30mg/l O$_2$	EHS Guideline for treated sanitary sewage discharges (IFC) 125mg/l	1mg/l or less（lakes/marshes）		
Water quality Dissolved oxygen (DO)			6mg/l O$_2$	WHO：no standard USEPA：no standard EU：no standard	7.5mg/l or less（rivers）		
Water quality pH			6-9	WHO：No standard USEPA：6.5-8.5	6.5 or more 8.5 or less （rivers）		

				EU：6.5-9.5			
Water quality Temperature			24-25.5℃	WHO：No standard USEPA：No standard EU：No standard	None		
Waste	—	—	NT-41-96	—	—	Construction site Every week Project waste	Reference 500T D (JICA EIA report from Desalination of Southern Ben Gardane in the Medenine Governorate)

Notes (1): MSE, DBO5, DCO, DO, pH, and temperature are provisional figures are based on water quality standards (surface water/groundwater) that are currently being developed by ANPE

Chapter 8. Stakeholder conference

8.1 Current implementation status and conference overview

Current environmental impact assessment procedures in Tunisia do not include legally mandated stakeholder consultation procedures. Nevertheless, DGBGTH has already held three stakeholder conferences regarding the implementation of this project.

(1) First conference

1) Schedule

DGBGTH, with the assistance of each CRDA and the DHER Director, held a conference with authorities under the following schedule.

Table 33: Schedule of the first conferences

Target governorate	Date and time	Notes
Bizerte	Nov. 18, 2010	At the time of the JICA Study Team's first dispatch
Ariana	Nov. 25, 2010	Same as above
Manouba	Nov. 27, 2010	Same as above

2) Attendees

The limited number of participants was from the following concerned organizations.

① Representation (various areas = delegation = mutanadiyat = a government division between governorate and sector)

② Engineers of local authorities

③ Omdas (clan leaders) (sector/Imadas)

④ Several organizations, including DHER, CTV (Cellule de Territoriale de Vulgalisation), CES, and the CRDA which has jurisdiction over forests.

A list of conference participants is shown in the table below. ANPE representatives participated in a conference in Manouba governorate. Local residents are represented by Omdas. The selection of the authorities that participated is thought to have represented the various concerned parties. There exists room for debate over Omdas representation and is being re-examined in the wake of the Jasmine Revolution. Due to a variety of organizational reasons, the state of progress of this project was not at a point that would allow for an expanded conference. For that reason, the number of authorities at the first conference was limited.

However, as show in the table below, the representation of each of the organizations at the conference was not necessarily thought to be sufficient. In Ariana for example, a lack of communication at the local level led to only two of the expected six Omdas participating, despite DGBGTH preparations. Those with jurisdiction over forests are top-level authorities concerned with the sections of the project related to the environment. However, they had no representatives in attendance at the conferences in Bizerte and Ariana.

Table 34: First conference participants

Participant		Bizerte	Ariana	Manouba
Omdas（clan leaders）		6	2	6
Local authorities		x	1	1
CRDA	DHER	–	–	1
	DVPPA	–	–	1
	CTV	1	3	5
	Forest authority	1	–	1
	CES	–	2	2
	Other	1	4	1
Other	ANPE	–	–	1
	DGBGTH	1	1	1
	JICA	2	2	3
	Total	12	15	23

3）Objectives

The main purpose of conferences with authorities is to get them to participate in discussions about the project. The purpose of conferences with authorities is to gain a shared understanding of this project's objective and its components, confirm what form that this project will take in terms of how it will affect the local community, and to discuss the environmental problems that could possibly occur as a result of the project.

Additionally, the re-commissioning performed by local consultants when carrying out social surveys was explained, providing a valuable chance to receive assistance from authorities in terms of its implementation. In actuality, Omdas and CRDA support is necessary when it comes to identifying households and interviewing them for the social survey. A secondary goal of the conferences is to collect data on the social conditions (particularly land use/occupation) of the each Imadas based on materials prepared by JICA Study Team.

4) Results

Coordinating between Omdas and the various participating organizations when the conference was held was accompanied by difficulties. DHER's strong participation allowed the conference to progress.

As a result, this conference led to successful debate among authorities over the advantages of this project (flood damage reduction) and the disadvantages (land seizure).

The first conference allowed participants to understand the project from various angles as well as to understand the necessity of plan. Additionally, this first conference was thought to have helped ease the organization of the second conference, which was scheduled for September 2011.

(2) Second conference

The Jasmine Revolution occurred right before the conference.

1) Schedule

Conferences with the steering committee held at the MARHP in September 28, 2011 had already been held.

2) Attendees

Authorities from ANPE and CRDA were in attendance.

3) Objectives

Environmental and social considerations were explained and discussed based on the progress of the survey.

4) Results

The contents of the progress report were explained. Additionally, the land occupation of the project, the necessity of resettlement (2 households), and the impact on the environment was also explained.

(3) Third conference

1) Schedule

The conference was held on January 31, 2012. Participation was expanded to include NGOs. Following the Jasmine revolution, participation of the Omdas who are no longer viewed as representatives of the citizens was substituted by the participation of local residents from the Mejerda river area.

2) Attendees

Individuals and organizations that participated in the third stakeholders' conference are shown in the table below. DGBGTH invited UTAP (Union of Agriculture and Fisheries), representatives from local environmental protection agencies, WWF representatives, and INAT, but none of them decided to attend. In actuality, Omdas sufficiently represented local residents from around the Mejerda river, and as a result, DGBGTH decided that it was not necessary to place the burden of participation on the residents themselves.

Table 35: Third conference participants

Participant		No. of people
Omdas		4
Citizen representatives		2
CRDA	DHER	1
	Ressources Eau	1
	CTV	3
	Forest authority	1
	CES	1
DGF		1
AAO		1
DGBGTH		3
Total		18

3) Objectives

The object of the conference was to explain the progress of the survey, seek participation from a wide variety of residents from around the Mejerda and organized involved in the management of environmental protection, and obtain the opinions of beneficiaries.

4) Results

DGBGTH presented an overview of the project (work contents, objectives) and explained that the participation of beneficiaries was important for the success of the project in the long-term. Additionally, the need for local residents and farmers to participate in the project's development was emphasized. To that end, participants were encouraged to participate in the steering committee held in March 2012 so that they would be able to contact DGBGTH and receive a copy of the master plan and feasibility report via CD or email.

Environmental conditions of this project discussed at the conference included the desired method of reuse for the timber waste of tamarisk trees and agricultural reuse of the soil generated by flood channel excavations. DGBGTH explained project follow-up surveys and long-term facility maintenance and management methods. Additionally, the NGO Association of the Friends of Birds (AAO) mentioned that they would like to be involved in the project's impact assessment. DGBGTH explained their interest in working on the impact assessment with benefitting organizations, relevant organizations, and CRDAs.

In terms of land seizure, DGBGTH, after confirming that residents preferred receiving alternative land to compensation, placed the land to be expropriated at a radius of 20 kilometers and proposed offering a greater expanse of land as compensation. Participants also recognized the necessity of minimizing the impact of agricultural land expropriation in the basin.

Additional topics of discussion included existing bridges in need of alterations and flood risk.

8.2 Overview and schedules of new stakeholder conferences

1) Holding period

- After the EIA and during the resettlement planning stage

2) Most desired participants

- Residents and local authorities that are expected to be impacted

3) Contents of the meeting

- Explanation and overview (components, objectives, land targeted for acquisition, etc.) of the project.
- Explanation of the results of the first through third stakeholder conferences.
- Explanation of the procedures involved from land acquisition to resettlement as well as the compensation to residences and local authorities that are impacted.
- Confirmation of the demands of the residents/local authorities to be impacted.

4) Other

- In preparing a simple resettlement plan, sufficient information must be prepared in advance and followed by a conference with residents and local authorities.
- The explanation at the conference should be meaningful for the residents/local authorities to be impacted.
- It is hoped that the resettlement plan will conform to attachment A's World Bank safeguard policy OP 4.12.

6 Related Documents of Chapter 9 (Land Acquisition and Resident Relocation)

6.1 Abbreviated Resettlement Action Plan (Draft)

Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River: Development of Flood Prevention Measures

Abbreviated Resident Resettlement Plan (Draft)

March 2013

Japan International Cooperation Agency

Yachiyo Engineering Co., Ltd.

Table of Contents

1. Background

The Mejerda River is an international river through Algeria and Tunisia with a total channel length of 460 km and a basin area of 23,700 sq. km. With 312 km of the channel length (68%) and 15,830 sq. km. (67%) of the basin area within Tunisian territory, it is the largest basin area in the country. In the northern part of Tunisia where the river runs through, the rainy season is from September to March. Frequent flooding during this period has obstructed land use in the flood plain of the lower basin.

The Sidi Salem Dam was constructed in 1981 as part of the flood control measures in the lower basin. In the 22 years since its construction, there has been no flooding downstream from the dam. With a relative abundance of rainfall and fertile lands in Tunisia over this period, agricultural development boomed and grew into a driving force for the economy of the lower basin. In 2003, however, discharged water from the dam caused a seriously damaging flood. It caused severe damage with submerging duration of more than a month, 6 deaths, 27,000 evacuees, damaging field crops and houses and blocking area access. Further floods caused by discharges from Sidi Salem Dam in 2004, 2005, 2009 and 2012 have resulted in similar socioeconomic damage and increased poverty. These factors are impeding the continuous development that Tunisia has achieved. The area is in urgent need of comprehensive flood measures as existing flood safeguards are low standard.

Upon request from the Tunisia government to improve these conditions, JICA conducted the Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River: Development of Flood Prevention Measures (hereinafter referred to as the “Development Survey”) over 26 months from 2006 to 2008. As a result of the Development Survey, they devised a master plan for integrated basin management focused on preventing flooding of the Mejerda River. The master plan comprised levees, flood control basins and other structural measures, as well as non-structural measures, including flood forecasting warning system, flood fighting and evacuation system, organization skill building, and land use restriction management in the flood plain. In 2009, the Tunisia government then requested a feasibility survey (FS) for the project proposed in the Development Survey. JICA responded by conducting the Preparatory Survey on Integrated Basin Management and Flood Control Project for Mejerda River (hereinafter the “Preparatory Survey”) from September 2010 to May 2012. To collect basic information and review basic countermeasures, the Preparatory Survey focused on the lowest basin, Zone D2. This area was regarded in the master plan as that with the biggest economic effect.

2. Project Overview

2.1 Project Overview

2.1.1 Overview of the Overall Project Plan

The Mejerda River Flood Control Project is to carry out river improvement works to prevent inundation damage in Jedeida and Tebourba in the downstream and farmland on both sides of the river. The river improvement works will be carried out in a 60.4-kilometer section from the Kalaat el Andalous Bridge to the Larousia Weir in the upstream. At the time of flooding, water will be diverted at a speed of 200 m^3 /s (part of the design flood discharge at a speed of 800m^3/s) and temporarily stored in the El Mabtouh Retarding Basin. As measures against flood exceeding the designed level and flood caused by global warming, a flood forecasting warning system, a dam management system and a flood fighting and evacuation system shall be established at the same time as structural measures of the river improvement works.

2.1.2 Contents of Construction Works

(1) River Improvement and Retarding Basin Works (Structural Measures)

For the Mejerda river projects, sufficient cross section has been secured for the design flow of 600~800m^3/s with a design scale based on the return period of 10 years. The structural measures of the Mejerda River Flood Control Project are river improvements (levee construction and river-bed excavation) necessary for the design flow, construction of a retarding basin for diversion and storage of design flood discharge, construction of discharge channels to the retarding basin and drainage channels from the basin to the Mejerda River, and construction of appurtenant structures of the discharge and drainage channels.

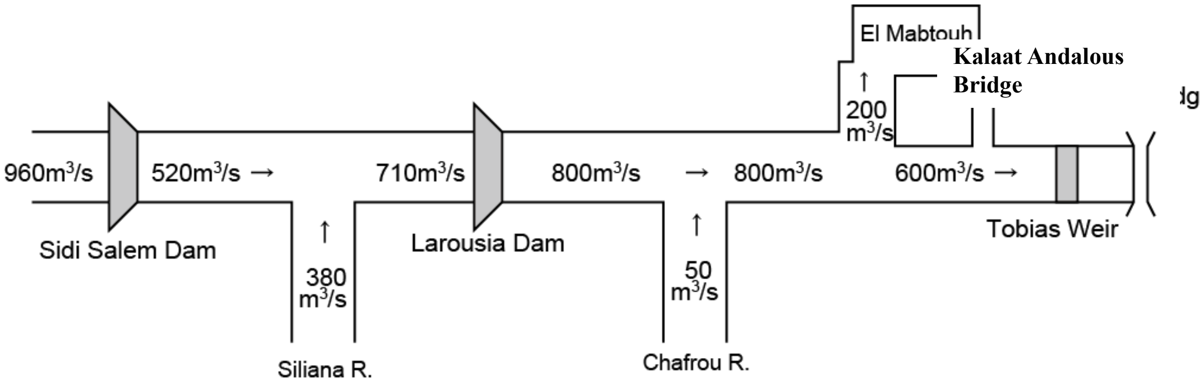


Figure 1: Assignment of Design Flood Discharge (D2 Zone: Larousia Dam – Kalaat Andalous Bridge)

14 bridges over the Mejerda River, 3 bridges over the Chaffrou River, a tributary of the Mejerda River, (in total 17 bridges in Construction Zones I and II) and 15 bridges over discharge channels from the El Mabtouh Retarding Basin will be reconstructed or newly constructed. The following table shows the overview of the target facilities, number of bridges, major river structures etc.

Table 1: Overview of River Improvement and Retarding Basin Works of the Mejerda River Flood Control Project

Classification	Works	Unit	River Improvement I	River Improvement II	River Improvement III	Total
Length		Km	34.1	31.2	26.1	91.4
River Improvement						
	Excavation	1000m3	5,659	2,361	2,048	10,068
	Embankment	1000m3	508	525	73	1,106
	Removal	1000m3	5,151	1,815	1,975	8,941
River Facilities						
El Mabtouh						
	Inflow Weir	Unit	-	1	-	1
	Discharge Control	Unit	-	1	-	1
	Outflow Gate	Unit	-	1	-	1
	Overflow Weir	Unit	-	1	-	1
Mejerda River						
	Sluiceway	Unit	5	0	4	9
Bridges			9	15	8	32
	Reconstruction	Bridge	2	6	2	10
	Construction	Bridge	0	3	0	3
	Raising	Bridge	1	0	1	2
	Demolish	Bridge	2	0	1	3
	No Measures	Bridge	4	6	4	14

The following map shows the target areas of river improvement and retarding basin works and the locations of reconstruction and construction of bridges.

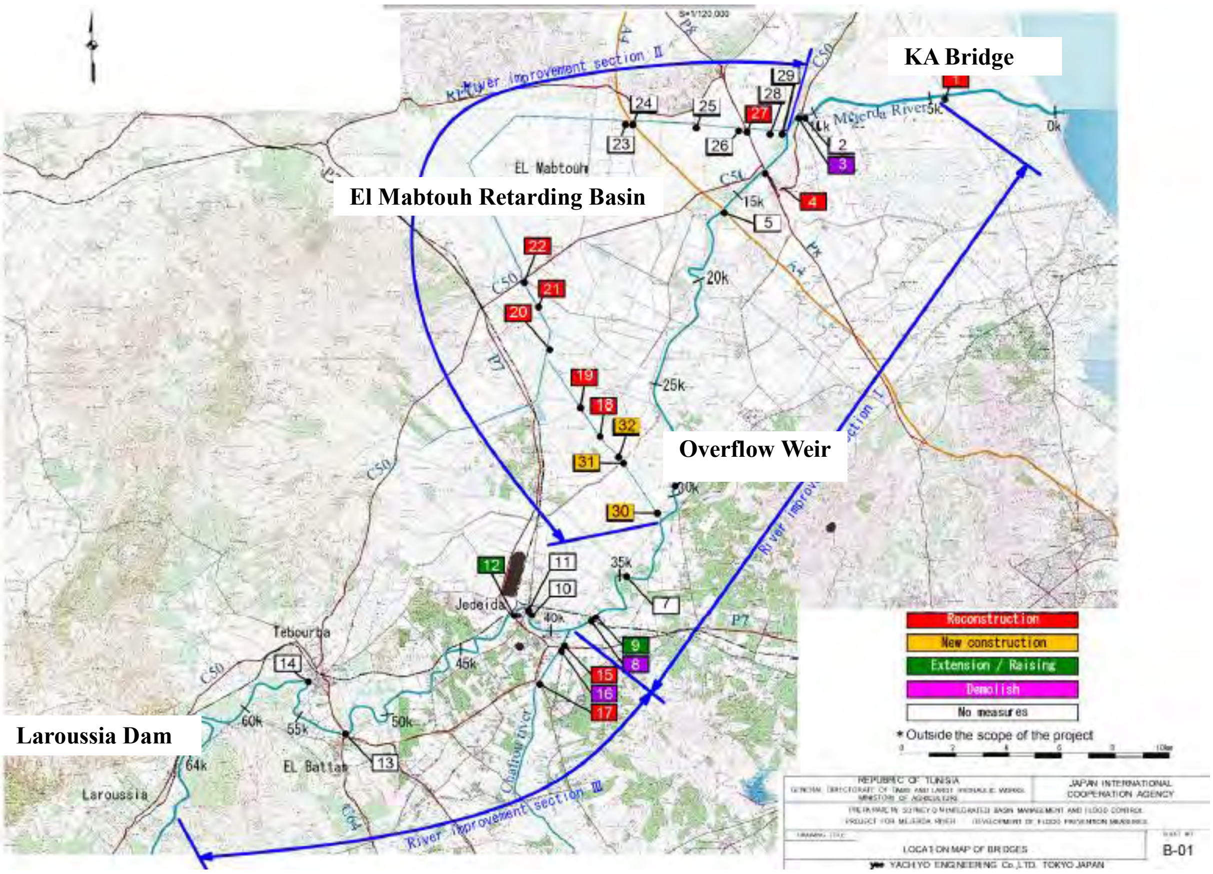


Figure 2: Target Areas of River Improvement and Retarding Basin Works
(Construction Zones and Locations of Bridges)

(2) Nonstructural Measures

Nonstructural measures play complementary roles as measures against flood exceeding the design flood level and also as adaptation measures against climate changes with such characteristics as smaller investment cost than structural measures and usefulness as short-term responses and measures. Listed below are the nonstructural measures to be carried out in the Mejerda River Flood Control Project.

Table 2: Contents of the Nonstructural Measures to Be Carried Out in the Mejerda River Flood Control Project

No.	Envisioned Non-structural Measures	Relative Agencies/Bodies	Project Area
1	Dam Flood Management System	DGBGTH	Sidi Salem Dam
2	Warning Information System and Flood Fighting Activities Plan	MA ONPC CRDA	Mejerda River (D2 Zone)
3	Strengthening of Organization and Capacity Development for Flood Management System	MA (DGRE, DGBGTH) MEq	Mejerda River

Source: JICA Survey Team

2.2 Schedules of Project Implementing and Environmental Impact Assessment

2.2.1 Schedules of Project Implementing

We set the project implementing schedule after considering the major processes listed below. The following table shows processes and time periods required for processes concerning the project implementation such as major loan procedures, planning survey, environment impact assessment (EIA), detailed design, estimate of accumulation, bidding and construction management. We assume the pledge will be made in June 2013 and 24 months will be required for the selection of the consultant.

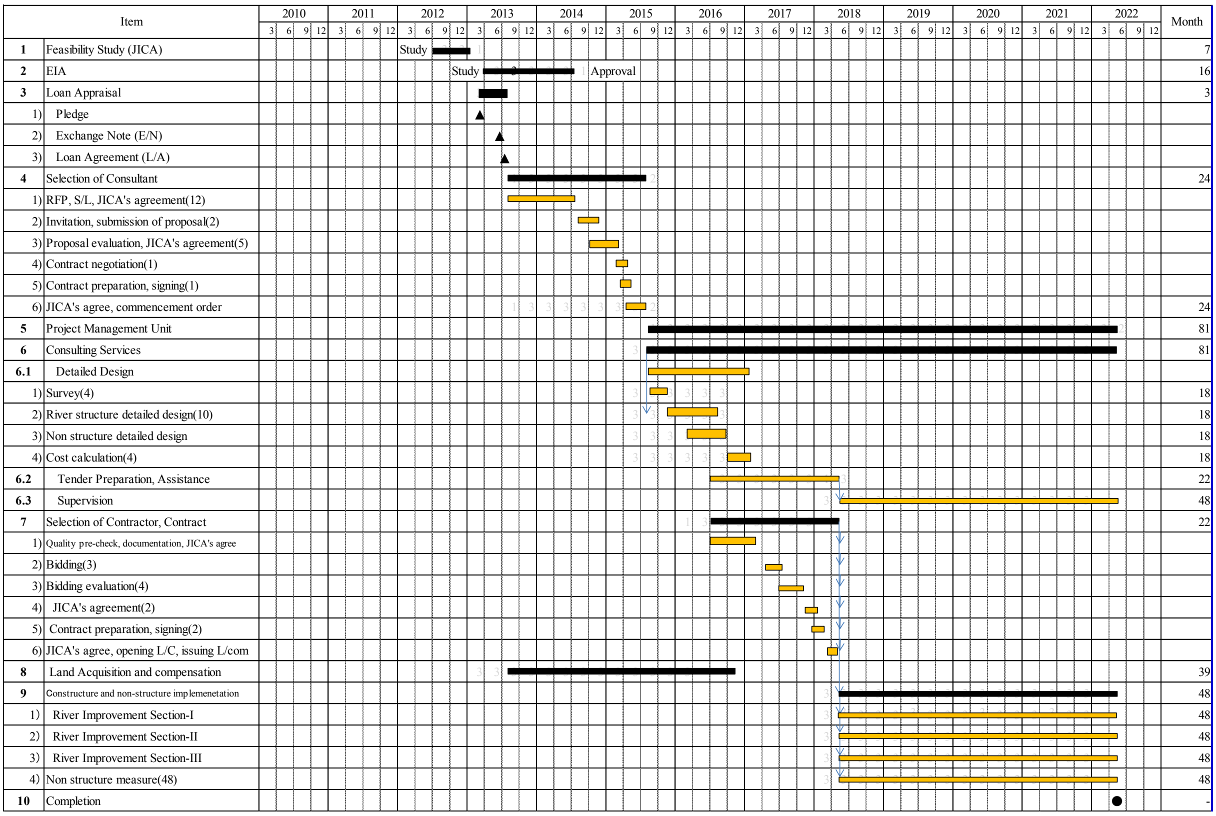
Table 3: Time Periods Required for Major Processes and their Contents

No.	Process	Required time period	Contents
1	Yen loan procedures	4 months	Jun 2013 Pledge Sept 2013 Conclusion of E/N Oct 2013 Conclusion of L/A
2	Environment Impact Assessment (EIA)	(16 months)	Selection of consultant: 5 months Local survey: 4 months Report to and examination by the National Environment Protection Agency (ANPE): 6 months Approval from ANPE: 1 month
3	Land acquisition	22 months	After the completion of EIA and detailed design and before the start of construction
4	Selection of consultants	24 months	Creation of RFP and short list and consent of JICA: 12 months Invitation and submittal of proposal: 2 months Evaluation of the proposal and consent of JICA: 5 months Contract negotiation: 2 months Preparation and conclusion of contract: 1 month Consent of JICA on contract and notice to commence: 2 months
5	Detailed design	18 months	Location survey and research: 4 months Detailed design related to river improvement, bridges and river structures: 10 months (including 8 months for design of nonstructural objects) Volume calculation and estimation of accumulation: 4 months Preparation of bidding documents: 3 months
6	Selection of contractors	22 months	Prequalification of bidders, creation of bidding documents and consent of JICA: 8 months Bidding: 3 months Bidding evaluation: 4 months Consent of JICA: 2 months Negotiation and conclusion of contract: 2 months JICA's consent to contract, opening of L/C and issue of L/Com: 2 months
7	Implementation of main construction works and nonstructural measures	48 months	River improvement of River-I, II, III, construction of bridges and a retarding basin River-I (48), River-II (48), River-III (48) Implementation of programs related to nonstructural measures
8	Completion of construction and delivery	-	Completion of facilities and delivery to the irrigation association of each river basin

Note: The time period required for JICA's consent on procurement differs depending on the type (consultant or contractor) and the amount.

Below are the implementation processes of the Mejerda River Flood Control Project under the above-described conditions. The EIA that will be conducted by the Tunisian side has to be started and obtain approval of the National Agency of Environment Protection at an early date. Land acquisition has to be completed before the initiation of the Project.

Table 4: Implementation Processes of the Mejerda River Flood Control Project



Item		Month
1	Feasibility Study (JICA)	7
2	EIA	16
3	Loan Appraisal	3
1)	Pledge	
2)	Exchange Note (E/N)	
3)	Loan Agreement (L/A)	
4	Selection of Consultant	24
1)	RFP, S/L, JICA's agreement(12)	
2)	Invitation, submission of proposal(2)	
3)	Proposal evaluation, JICA's agreement(5)	
4)	Contract negotiation(1)	
5)	Contract preparation, signing(1)	
6)	JICA's agree, commencement order	24
5	Project Management Unit	81
6	Consulting Services	81
6.1	Detailed Design	
1)	Survey(4)	18
2)	River structure detailed design(10)	18
3)	Non structure detailed design	18
4)	Cost calculation(4)	18
6.2	Tender Preparation, Assistance	22
6.3	Supervision	48
7	Selection of Contractor, Contract	22
1)	Quality pre-check, documentation, JICA's agree	
2)	Bidding(3)	
3)	Bidding evaluation(4)	
4)	JICA's agreement(2)	
5)	Contract preparation, signing(2)	
6)	JICA's agree, opening L/C, issuing L/com	
8	Land Acquisition and compensation	39
9	Constructure and non-structure implemenetation	48
1)	River Improvement Section-I	48
2)	River Improvement Section-II	48
3)	River Improvement Section-III	48
4)	Non structure measure(48)	48
10	Completion	-

Source: JICA Survey Team

3. Object of Abbreviated Resident Resettlement Plan (Draft)

Abbreviated Resident Resettlement Plan (Draft) specifies the locus of the policy, counter measure, activities, responsibility in order to implement the compensation and reinstallation for the habitants directly affected by this Project. Based on the plan, DGBGTH will finalize Abbreviated Resident Resettlement Plan. The proposal of the Draft Plan aims these procedures will be conducted smoothly taking into account of not only the related domestic laws but also JICA’s Guidelines.

4. Necessity and scale of land acquisition and resident resettlement for the Project

Although impacting homes has been avoided to the greatest extent possible in this Project, it is necessary to conduct land acquisition and land/property compensation procedures for the privately-owned portion of land in the Project's target area. Due to the implementation of this Project, the following will be affected in the target area: agricultural land (405,520m^2 (including 3,630 m^2 for road widening for bridge construction) in Job Division I, 1,254,766m^2 in Job Division II, and 304,912m^2 (including 1,110 m^2 for road widening for bridge construction) in Job Division III), unharvested crops/fruit trees/forests, structures such as storehouses or pump sheds, and two households (approx. 15 people). However, based on the household land area and estimated loss of income, the impact is not considered serious.

The details of impacts on immovable property due to land acquisition for the Project are those identified in the Preliminary Social and Land Survey included in the land acquisition procedures. They include the number affected lots and their land area, and ownership details of land, diversion channels, and discharge channels along the Mejerda River and the El Mabtouh retarding basin. In all target regions, the major impact on immovable property is the loss of agricultural land.

For example, since all areas of the El Mabtouh retarding basin (Job Division II) are state-owned land, land acquisition procedures are completed with just the change of land use procedures for the grazing district. However, it is expected that this will generate a loss of agricultural land and grazing land for area residents on the west and north sides of the retarding basin.

Results of field surveys conducted by the Survey Team show that the residential districts that will be impacted the most by acquisition of agricultural land are Jedeida and Jedeida Rachid, which have a high dependency rate on farming income. Residents of the El Battan district are also highly dependent on farming income, but since grazing livestock is more important than crops in this district, it is thought that the loss of land will have a negligible impact on their livelihoods.

In addition, since approximately half of the households along the Mejerda River are owners without land registry certificates or are occupants/tenants, it was discovered that there is a risk for conflict between owners/occupants regarding ownership of lots. Therefore, during land acquisition procedures, the DGBGTH, the Regional Commissions of Assessment and Adjustments, and other related agencies should conduct procedures as amicably as possible, placing importance on prompt land acquisition.

Around the time of the cut-off date for expropriation procedures for land with no proprietary rights, the start date for the population census to be implemented by the DGBGTH in 2014 will be set based on the JICA Category B Project report guidelines for environmental and social considerations.

To prevent an influx of new residents on to the Project land after the cut-off date, the DGBGTH will disseminate information to citizens via the governorate offices of Ariana, Bizerte, and Manouba regarding the areas that were demarcated for the Project. The Survey Team coordinated and consulted with the DGBGTH during the period of this survey so that this dissemination of information may be conducted in an effective manner. In addition, the approval of the DGBGTH was obtained to systematically and continuously publicize this to prevent a further population influx after boundary demarcation.

5. Results of Population census and Survey on property and land

5.1 Population census

A population census was conducted for all land occupants affected by the Project. The number of affected persons is organized by category and shown in the table below.

Population census data will be updated at the time of formulating the detailed plan.[1]

Table 5: Number of Project Affected Units (PAUs) and Affected Persons (APs)

Type of loss	No of PAUs			No of APs		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for displacement	2	0	2	15	0	15
1 HH [2] (Structure owner on Gov. land)	2	0	2	15	0	15
2 HH (Structure on Private land)	0	0	0	0	0	0
3 HH (Tenants)	0	0	0	0	0	0
4 CBEs [3] (Structure owner Gov. land)	0	0	0	0	0	0
5 CBEs (Structure owner on Private land)	0	0	0	0	0	0
6 CBEs (Tenants)	0	0	0	0	0	0
7 Community owned structures including physical cultural resources	0	0	0	0	0	0
Not required for displacement	0	0	0	0	0	0
8 Land owners	0	0	0	0	0	0
9 Wage earners	0	0	0	0	0	0
Grand Total (1-9)	2	0	2	15	0	15

Source: JICA Survey Team

5.2 Survey on property and land

Through a survey on property and land conducted on land targeted for the Project, all assets that are physically and economically affected (land, residences, shops, public facilities, trees, etc.)[4] and their quantities are shown in the tables below.

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[1] World Bank OP4.12 states that in general, if land acquisition is not conducted within 2 years of a census, data shall be updated.

[2] HH: House Hold

[3] CBEs: Commercial and Business Enterprises

[4] It is generally not necessary to consider movable assets such as livestock as eligible for compensation. However, if it become evident that the affected residents' employment or other means of livelihood will change due to resettlement, it will be necessary to make these assets eligible for compensation.

i) Land

Table 6: Affected land

No.	Area	Land Type	Affected (m^2)	Affected (m^2)	Total (m^2)
			Broaden Channel	Road attached to bridge	
1	Job Division-I	Farm Land (Private land)	619,600	3,630	623,230
2	Job Division-II	Farm Land (Gov. land) Farm Land (Private land)	693,900 1,254,800	180 1,910	694,080 1,256,710
3	Job Division-III	Farm Land (Private land)	443,800	1,110	444,910
Farm Land (Gov. land) Farm Land (Private land) Total			693,900 2,318,200 3,012,100	180 6,650 6,830	694,080 2,324.850 3,018,930

Source: JICA Survey Team

ii) Buildings

Table 7: Affected buildings

No.	Area	Type of Building	Sub-Total	Total
Residential Building				
1	Job Division-I	single story, brick	2	2

Source: JICA Survey Team

6. Result of the Domestic economy and household survey

The socio-economic study subcontracted to and performed by local consultants is outlined below.

6.1 Purpose

To collect and analyze socio-economic data to gain a clear understanding of the social conditions of the regions in the project plan. The three main details covered by this survey are as given below:

(i) To confirm and grasp the socio-economic condition of communities along the Mejerda River and the El Mabtouh Wetlands coast
(ii) To access damage sustained by local residents due to recent floods in 2003 and 2009
(iii) To determine ownership of the houses, agricultural facilities and other sites along the Mejerda River, especially areas in public water districts and retreat areas (construction lines and easements).

This survey was conducted using the following methods:

(i) We collected data at the area/sector level where possible in order to compare the data of survey areas/sectors (Imadas: smallest administrative unit). Sector is the unit used to analyze results of the survey.
(ii) A questionnaire given to households along the Mejerda River and the El Mabtouh Wetland coast as well as production facilities that suffered damages from increased water levels of the Mejerda River in the past.

6.2 Survey Regions and Residents

The target districts and sectors of this survey are shown in the table below. Survey regions were selected based on the following criteria:

(i) Sectors on the administrative boundary line that at least border the Mejerda River or part of the El Mabtouh Wetlands
(ii) Sectors that suffered damages from floods in 2003 and/or 2009

Sector Chiefs coordinated with the leaders of agricultural extension cells (CTV) and irrigation regions to select survey households. The social condition study was conducted on residents of the Mejerda River and the El Mabtouh Wetland, with a survey sample of 294 households. Residents surveyed belonged to 18 of 47 sectors in seven districts. The districts and sectors in this study are shown in the following table.

Table 8: Study Area and Division List by Reference/Sector

Governorate	District	Sector	Mej.	Mab.	03	09
Bizerte	Utique	Utique (Zana)	●	●	●	
		Utique Nouvelle			●	
		Besbassia		●		
		El Houidh				
		El Mabtouh		●	●	●
		Ain Gehlal		●		
		Sidi Othmène		●	●	
		Bach Hamba	●	●	●	●
	Ghar El Melh	Ghar El Melh				
		Bajou				
		Ousja			●	
		Zouaouine			●	
Ariana	Sidi Thabet	Sidi Thabet	●			
		Bejaoua	●		●	●
		Mongi Slim	●			
		Cebalet Ben Ammar				
		Chorfech	●		●	●
	Kalâat el-Andalous	Kalaat En Andalous Est	●			
		Kalaat Andalous Ouest	●			
		Pont de Bizerte	●		●	
		Bou Hanach				
		El Hessiane				
		Ennahli				
Manouba	Oued Ellil	Oued Ellil				
		Essaida	●		●	●
		Er Riadh				
		Cité El Ouerd				
		Ennajet				
		San Haja				
		El Kobbaa				
	Jedeida	Jedeida	●		●	●
		Jedeida Rached	●		●	●
		Chaouat	●		●	●
		El Mansoura				
		Es Zahra				
		El Habibia				
	Tebourba	Tebourba	●		●	
		El Ansarine				
		Edkhila				
		El Mellaha				
		Banlieue Tebourba				
		Er Raja				
		EchChouigui				
	El Bataan	El Battan	●		●	
		Borj Ettoumi				
		Mehriine				
		El Aroussia				

Note) Mej. - Sectors that border the Mejerda River
Mab. - Sectors that border the El Mabtouh Wetland
03 – Sectors affected by the 2003 floods
09 – Sectors affected by the 2009 floods

Table 9: Geographical distribution of surveyed households by sector and representative percentage

Area	Sector	Surveyed Households	Percentage of surveyed households from total in 2010 estimate census (%)
Utique	Ain Ghlal	4	0.7
	Bach Hamba	20	3.7
	El Mabtouh	23	6.9
	Sidi Othmene	13	7.1
	Utique	6	1.0
Sidi Thabet	Bejaoua	20	3.2
	Chorfesh	22	3.5
	Monji Slim	8	0.8
Kalaât Andalous	Kalaât Andalous Est	8	0.6
	Kalaât Andalous Ouest	28	1.3
	Pont de Bizerte	12	2.1
Oued Ellil	Essaida	4	0.3
Jedeida	Chaouet	15	1.7
	Jedeida	23	2.2
	Jedeida-Hached	23	1.4
Tebourba	Banlieue de Tebourba	19	0.6
	Medina, Tebourba	12	1.2
El Bataan	El Bataan	34	1.7
Total		294	1.5

Source: 2004 General census of the population and habitat (RGPH 2004), National Institute of Statistics (INS)

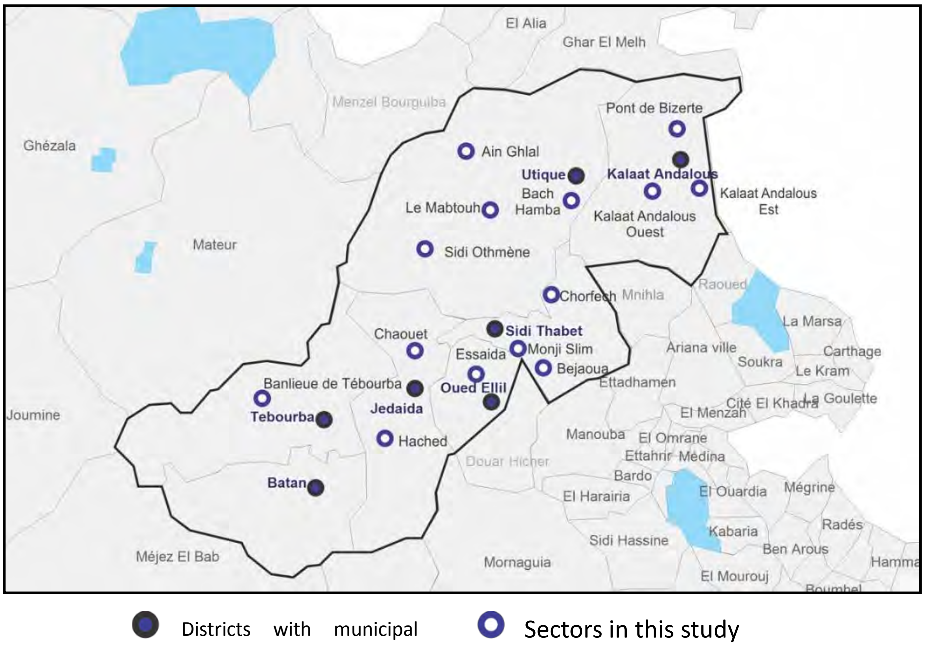


Figure 3: Location Map of Target Districts/Sectors for Socio-Economic Survey

6.3 Survey Items

Items in the socio-economic survey are shown in the table below.

Table 10: Social Condition Survey Items

Item	Sub-Item	Item Description
(1) Evaluate Socio-Economic Conditions	1) Population/Gender	
	2) Income/Livelihood	
	3) Standard of Living	
	4) Livestock	
	5) Agriculture	
	6) Available services	
	7) Usage of local resources	
(2) Site occupation, site usage	1) Site possession	
	2) Residence	
	3) Agricultural land	
	4) Site occupation	a) Residential areas
		b) Grazing path areas
		c) State owned grazing paths in El Mabtouh Wetland
(3) Flood situation/damage	Flood damage	

6.4 Field Survey Period

The field survey was conducted from December 10, 2010 to January 10, 2011. Before the survey, the DGBGTH held a stakeholders meeting in November 2010, where directives of the survey were given for the districts, sectors, and CRDAs.

6.5 Social Condition Survey Results

The survey results have been tallied by district and sector for replies from survey participants and households. The results of the socio-economic survey are as shown below.

6.5.1 Current Socio-Economic Conditions

1) Population & Gender

a) Population

The survey covered the coast of the Mejerda River, home to 18,980 households and 88,118 people in 18 sectors. 55,776 people (12,170 households) from the total live in urban sectors according to the 2004 census.

Based on the fact that the population increased an average of 1% per year between 2004−2010, we estimate the population of surveyed regions to exceed 100,000 people. The figure below shows the average household size (number of members per household) in each district based on the survey.

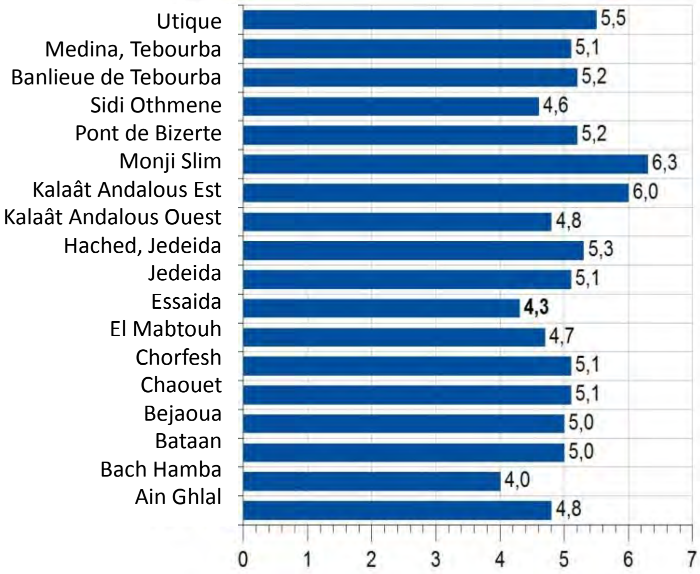


Figure 4: Average Household Size (No. of Members) by Sector

b) Gender

The figure below utilizes 2004 data from the INS and shows the industries the working population belonged to split by gender for surveyed regions.

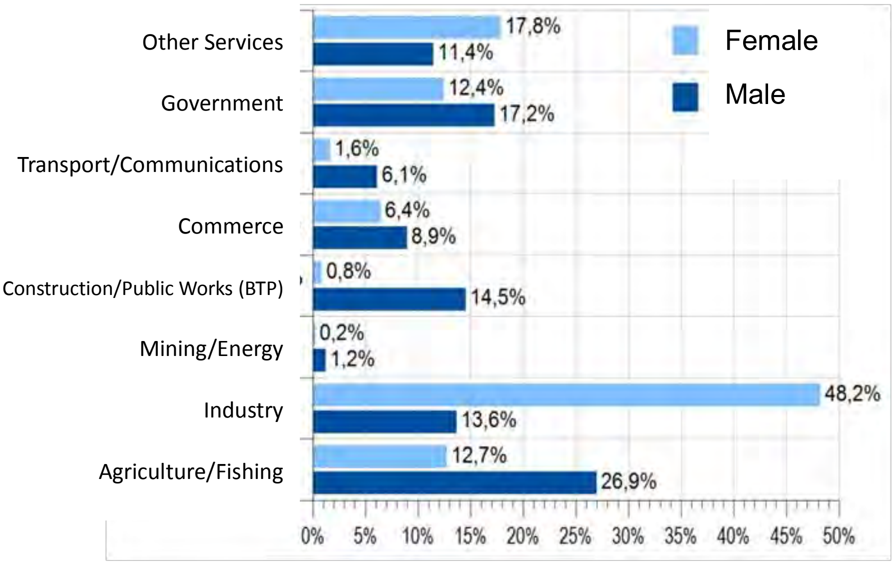


Figure 5: Classification of Working Population in Surveyed Districts by Gender and Industry in 2004

Source: 2004 General Census (RGPH), National Institute of Statistics (INS)

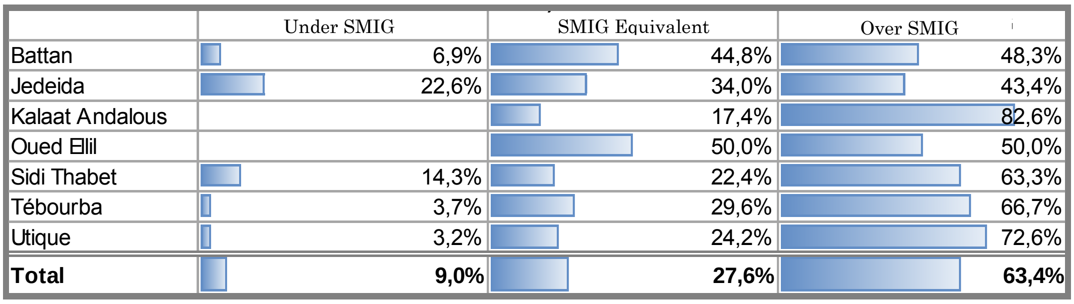
2) Income/Livelihood

The table below shows major sources of income by sector and the percentage (%) of working people in households. Agriculture has a high percentage as the major source of income.

The figure below compares the average income of households to the guaranteed minimum wage (SMIG, 250 TND/month) and splits up those averages into three categories per district. Approximately 37% of these districts have a monthly income equal to or under the SMIG. More than 50% of those in the Jedeida, Oued Ellil and El Bataan Districts earn the equivalent of SMIG or less.

Table 11: Source of Household Income by District (percentage (%) of the working population with income)

District	Salary	Pension	Social Aid	Family Aid	Agriculture	Day Work	Other
Utique	18.7	-	1.4	-	73.2	4.0	2.7
Sidi Thabet	11.5	1.9	1.9	-	80.8	3.9	-
Kalaât Andalous	8.1	-	-	2.1	87.7	-	2.1
Oued Ellil	50.0	-	-	-	50.0	-	-
Jedeida	37.3	1.2	1.2	1.2	43.3	15.7	-
Tebourba	16.7	-	3.3	3.3	66.7	3.3	6.7
El Bataan	37.3	2.3	-	-	53.4	4.7	2.3



	Under SMIG	SMIG Equivalent	Over SMIG
Battan	6,9%	44,8%	48,3%
Jedeida	22,6%	34,0%	43,4%
Kalaat Andalous		17,4%	82,6%
Oued Ellil		50,0%	50,0%
Sidi Thabet	14,3%	22,4%	63,3%
Tébourba	3,7%	29,6%	66,7%
Utique	3,2%	24,2%	72,6%
Total	**9,0%**	**27,6%**	**63,4%**

Figure 6: Classification of Average Household Income by District (Surveyed Household %)

3) Livestock

Approximately half of the households that were surveyed said they raised livestock. Results are shown in the table below. The average number of livestock owned by households in each sector is 35 sheep and 8.4 cows. There are many farmers in Utique that own a high number of livestock. Other districts generally had a lower average amount.

Ain Ghlal, El Mabtouh, Kalaât Andalous, Utique and other districts located on the left bank between El Mabtouh and the river mouth raise many sheep. Sectors that have over 50 sheep are concentrated in sectors with vast wetlands such as El Mabtouh and Kalaât Andalous.

Sectors with an extremely large amount of cows include Bach Hamba and Utique. Essaida, Chorfesh, and Kalaât Andalous Ouest also have a large amount of cows, and many of these household also own many sheep.

Some households (9%) pay a fee for grazing rights, which costs 910 TND annually for an average 153 days of grazing.

Table 12: Number of Livestock of Households in Each Sector

Area	Sector	Sheep			Cows		
		Min	Max	Avg	Min	Max	Avg
Utique	Ain Ghlal	250	250	250	1	10	5.5
	Bach Hamba	4	100	18.1	1	235	21.3
	El Mabtouh	2	400	104.3	1	10	4.1
	Sidi Othmene	3	50	15.7	1	12	5.3
	Utique	3	200	57.0	10	40	21.3
Sidi Thabet	Bejaoua	3	3	3.0	1	12	4.8
	Chorfesh	10	100	41.7	5	20	10.9
	Monji Slim	2	2	2.0	2	8	5.8
Kalaât Andalous	Kalaât Andalous Est	6	70	45.3	1	10	4.8
	Kalaât Andalous Ouest	1	120	29.4	2	70	10.3
	Pont de Bizerte	2	60	14.4	3	12	6.7
Oued Ellil	Essaida	2	2	2.0	11	11	11.0
Jedeida	Chaouet	3	40	16.3	2	6	3.8
	Jedeida	1	15	8.7	1	6	4.0
	Jedeida-Hached	4	15	7.0	1	1	1.0
Tebourba	Banlieue de Tebourba	6	8	7.0	1	6	3.2
	Medina, Tebourba	7	7	7.0	-	-	-
El Bataan	El Bataan	4	20	7.4	1	10	3.3
Average		1	400	35	1	235	8.4

4) Agriculture

Of surveyed households that said they farmed, 70% grow vegetables and use private irrigation. Some agricultural districts, such as El Mabtouh and Sidi Othmene, cultivate produce without irrigation like trees (El Mabtouh) and grains (El Mabtouh, Sidi Othmene). Irrigation farming in this project concentrates the most on the Bach Hamba and Kalaât Andalous Ouest regions.

5) Standard of Living

Indicators for the standard of living include household fittings (telephone, PC, washing machine, etc.), the supply of water, gas, and electricity, and household conveniences such as a sewerage system for urban areas and garbage collection. These indicators were used by the INS in the 2004 General Census conducted for all districts. The figure below compares 11 items in household fittings between the national average and surveyed districts in this study.

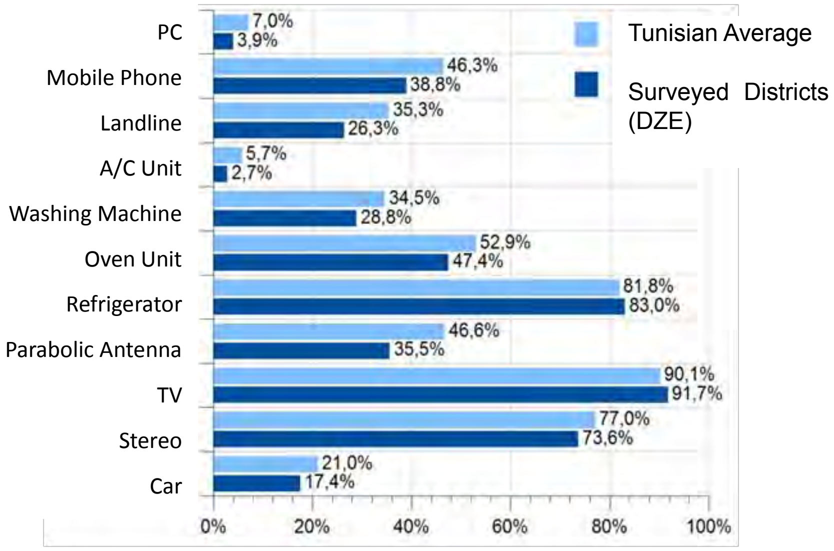


Figure 7: Comparison of household fittings for surveyed districts (DZE) and the national average in 2004

Source: 2004 General Census(RGPH), National Institute of Statistics (INS)

According to the 2004 General Census, we saw that the surveyed districts in this study have a higher rate of water and electricity supply as well as sewerage systems than the national average. The table below shows how each sector is supplied with drinking water and the availability of electricity. Areas with the least supply of electricity are Jedeida-Hached and the districts of Utique. Approximately 50% of drinking water is supplied by SONEDE while the remaining half gets their water mainly from local water management associations who are also in charge of the water supply from irrigation channels.

Table 13: Supply Methods of Drinking Water and Availability of Electricity (%) in Each District and Sector

District	Sector	Supply Method of Drinking Water			Avail. of Electricity (%)
		SONEDE	Well	Other Water Resource	
Utique	Ain Ghlal	25	0	75	50.0
	Bach Hamba	81	0	19	90.5
	El Mabtouh	50	0	50	60.9
	Sidi Othmene	0	0	100	84.6
	Utique	0	0	100	16.7
Sidi Thabet	Bejaoua	95	0	5	95.0
	Chorfesh	36	5	59	50.0
	Monji Slim	13	0	87	37.5
Kalaât Andalous	Kalaât Andalous Est	0	0	100	-
	Kalaât Andalous Ouest	0	0	100	-
	Pont de Bizerte	83	0	17	66.7
Oued Ellil	Essaida	-	-	-	-
Jedeida	Chaouet	-	-	-	-
	Jedeida	92	0	8	48.0
	Jedeida-Hached	80	0	20	16.7
Tebourba	Banlieue de Tebourba	21	11	68	78.9
	Medina, Tebourba	-	-	-	-
El Bataan	El Bataan	92	0	8	73.5
Average		49.1	1.4	49.5	48

6) Availability of Transportation Services

The major findings from this study are as follows.

- Most survey participants in Sidi Thabet and Kalaât Andalous feel they have a difficult time accessing the main road and utilizing schools and medical services. Many survey participants in Jedeida also responded they had trouble utilizing either schools (73.4%) or medical services (76.6%).
- Participants in the three districts mentioned above mentioned problems commuting to work.
- Sectors where it is critically difficult to commute to work are Monji Slim, Kalaât Andalous Est and Ouest, Chaouet, as well as Bejaoua and Chorfesh.
- Very few use cars, so walking is the main method of transportation for commuting to work and receiving services.
- The majority (98% of participants) said it was not necessary to cross the Mejerda River to commute to work and receive services.

7) Use of Local Resources

The largest natural resource the local community utilizes is river water from the Mejerda River. Many people privately pump the water to use for irrigation. In particular, the Kalaât Andalous, Sidi Thabet, Tebourba, and El Bataan Districts use the Mejerda River as their main water source for private irrigation water. Irrigation water can be privately pumped from the Mejerda River by placing a small pump directly into the river terrace or setting up a small pump shack and installing a small pump inside. Either option only requires the installation of a simple pump and does not require a large scale facility. In addition, most residents along the Mejerda River do not collect wood, fish, nor hunt.

6.5.2 Land Ownership/Residence/Land Use

1) Ownership of Land

We confirmed the following options with regard to the ownership of land on the coast of the Mejerda River.

① Ownership of land with a certificate of rights
② Ownership of land without a certificate of rights
③ Occupation
④ Renting
⑤ Other

Of the 209 households that answered our question, 37.8% owned land with a certificate of rights while 14.8% owned land without a certificate of rights.

The table below shows the number of households in each district and the manner of land ownership as classified from (1) to (5). Jedeida and Bejaoua have a particularly high number of land owners who do not have a certificate of rights. An extremely high number of households in each sector in Kalaât Andalous Est and Ouest, El Mabtouh, Bach Hamba, and El Bataan held occupational rights.

In addition, compensation is owed to land owners who have a certificate of rights as well as owners that possess land without a certificate based on Tunisian land ownership law.

Table 14: Land Ownership of Agricultural Land in Sectors along the Mejerda River (Survey Participant Households)

Area	Sector	(1) Propr. aTF	(2) Propr. sTF	(3) Occ.	(4) Loc.	(5) Other	Total
Utique	Ain Ghlal	2	1	1	0	0	4
	Bach Hamba	9	0	10	2	0	21
	El Mabtouh	2	1	8	0	0	11
	Sidi Othmene	7	1	0	0	1	9
	Utique	4		1		1	6
Sidi Thabet	Bejaoua	3	7	1	2	0	13
	Chorfesh	13	2	2	5	0	22
	Monji Slim	2	1	2	0	0	5
Kalaât Andalous	Kalaât Andalous Est	1	0	7	0	0	8
	Kalaât Andalous Ouest	3	0	15	8	0	26
	Pont de Bizerte	9		0	2	0	11
Oued Ellil	Essaida	2	0	0	0	0	2
Jedeida	Chaouet	9	2	1	0	0	12
	Jedeida	1	5	2	1	0	9
	Jedeida-Hached	2	0	2	2	0	6
Tebourba	Banlieue de Tebourba	5	5	7	1	0	18
	Medina, Tebourba	3	1	1	0	0	5
El Bataan	El Bataan	2	5	10	4	0	21
Total		79	31	70	27	2	209

① Propr. aTF : Land owners with a certificate of rights
② Propr. sTF : Land owners without a certificate of rights
③ Occ. : Occupiers/Land possessors
④ Loc. : Renters

2) Residence

81% of households own homes, and the disparity between the average of sectors is big (see figure below). The rate of home ownership is low in El Mabtouh (52%) and Kalaât Andalous Ouest (50%).

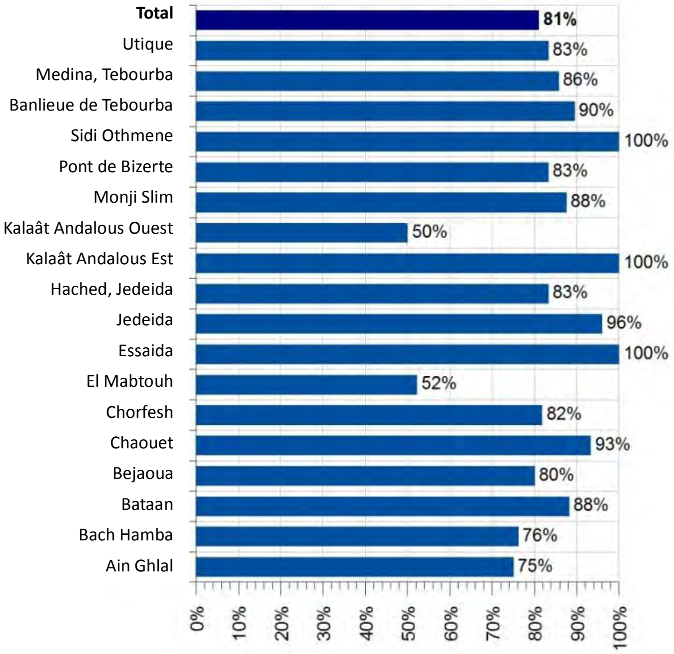


Figure 8: Rate of Home Owning Households (% by Sector)

3) Agricultural Land

The table below shows respondent households by sector who said they farmed in flood plains and near the Mejerda River. These numbers indicate that some parts of Utique, Kalaât Andalous, Jedeida, and other sectors particularly have agricultural land in the flood plains of the Mejerda River.

Table 15: Households that farm in the flood plains of the Mejerda River or nearby areas

District	Sector	Respondent Households	Agriculture near the Mejerda River	Agriculture in Flood Plain
Utique	Ain Ghlal	4	0	0
	Bach Hamba	19	19	10
	El Mabtouh	12	1	1
	Sidi Othmene	12	0	0
	Utique	6	4	1
Sidi Thabet	Bejaoua	12	12	4
	Chorfesh	22	21	9
	Monji Slim	4	4	1
Kalaât Andalous	Kalaât Andalous Est	8	8	2
	Kalaât Andalous Ouest	27	27	16
	Pont de Bizerte	11	11	2
Oued Ellil	Essaida	2	2	0
Jedeida	Chaouet	12	12	0
	Jedeida	9	4	5
	Jedeida-Hached	5	5	0
Tebourba	Banlieue de Tebourba	18	17	3
	Medina, Tebourba	5	5	0
El Bataan	El Bataan	21	21	2
Total				

4) Site Possession

a) Residential Area

The distance between the river and residences is at least 10 to 20 meters for most sectors, but it was two meters in the Jedeida sector. Of a total 25 households, 14 had homes within 60 meters of the river bed in the Jedeida sector. The figures were 10 out of 23 households in the Jedeida-Hached sector, and 6 out of 15 households in Chaouet. Other sectors had a lower percentage than the aforementioned numbers. The table below shows the distribution of residences located within 150 meters of the river bed.

Table 16: Distribution of Residences (No. of Households) Located within 150 meters of the River Bed

District	Sector	Households with Residences within 150m of River Bed (Classified by distance)				Total Households who replied
		< 10	10-19	20-59	60-149	
Utique	Ain Ghlal	-	-	-	-	3
	Bach Hamba	-	1	2	1	21
	El Mabtouh	-	-	-	-	18
	Sidi Othmene	-	-	-	-	12
	Utique	-	-	-	-	5
Sidi Thabet	Bejaoua	-	-	1	4	20
	Chorfesh	-	3	-	4	22
	Monji Slim	-	-	1	3	8
Kalaât Andalous	Kalaât Andalous Est	-	-	2	-	8
	Kalaât Andalous Ouest	-	1	4	4	27
	Pont de Bizerte	-	-	1	2	11
Oued Ellil	Essaida	-	-	-	-	4
Jedeida	Chaouet	-	-	6	6	15
	Jedeida	2	1	11	5	25
	Jedeida-Hached	-	-	8	9	23
Tebourba	Banlieue de Tebourba	-	-	1	2	18
	Medina, Tebourba	-	-	1	-	14
El Bataan	El Bataan	-	-	4	6	33
Total		2	6	42	46	287

(-): No applicable households

b) Grazing Regions

Approximately 75% of households that answered questions about stock farming said they use grazing regions near the Mejerda River while the remaining 25% replied they used the El Mabtouh Wetland or other places.

The Mejerda River is the major grazing region for all sectors besides El Mabtouh, Sidi Othmene, and Ain Ghlal. The El Mabtouh Wetland is the major grazing region for surveyed households in both the El Mabtouh and Sidi Othmene sectors and is used as a secondary grazing region for households in Ain Ghlal and Utique.

c) State Owned El Mabtouh Wetland Grazing Region

The state-owned El Mabtouh Wetland grazing region has an area of 3,365 hectares. Management of grazing regions was officially transferred from the Department of Livestock to the Directorate General of Forests

(DGF) due to the change in administration on March 4, 2004. However, the DGF did not actually start managing grazing regions until 2008. The DGF enforced the grazing region management project from 2009 to 2010, but did not enforce it from 2010 to 2011 because of the unstable state of affairs in Tunisia due to the Jasmine Revolution. The Office of Livestock and Pastures (OEP) currently manages them.

The figure below shows the official map of the state owned El Mabtouh Wetland grazing region. They are currently addressing the issue of unlawful occupation in the southern and northeastern regions and are in the final stages of deciding the grazing region.

From 2009 to 2010, 54 nomadic pastoralist shepherds moved a flock of sheep and used this grazing region. The grazing region is also used by 152 shepherds who are permanently settled nearby (see picture below). The number of corresponding sheep for nomadic pastoralists was 15,880 sheep, and the permanent settlers had a flock of approximately 10,000 sheep. The grazing season is from February to April. Other government land besides grazing regions fall under forest precincts[5] managed by the Department of Forestry. Most of the nomadic pastoralists in the forest precincts of El Mabtouh are originally from the Sidi Bouzid and Kairouan Governorates. Grazing fees for forest precincts cost 0.2 TND per livestock per month. However, grazing fees for forest precincts have never been paid by the people who used the grazing region.

Mobile pastoralism has always been conducted in the El Mabtouh Wetland. In the 1980s, it was conducted in wetlands without feed production and grazing issues, and the El Mabtouh Wetland became an important grazing region for nomadic pastoralists in Tunisia. The stagnation of water from floods in either January or February never lasted more than one month a year because the sewerage system was well managed at the time.

However, feed production has been decreasing every year mainly because the operations of the agricultural cooperative have gotten worse, causing perpetual overgrazing, and leading to the decrease of sheep's fescue, a plant used as feed. According to the Office of Livestock and Pastures (OEP), another reason for the deterioration of grazing is due to the construction of the Tunis−Bizerte motorway. Embankment in the motorway construction blocked flood water from draining, causing water to stagnate in wetlands over a long period of time during the rainy season. Saline buildup on the road also negatively influences the growth of feed.

According to the Office of Livestock and Pastures (OEP), the condition of the grazing land in El Mabtouh Wetland is extremely bad and cannot even be considered a grazing region. The forest precincts are in a similar situation, and the outlook for feed production at the current stage is not good.

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[5] Forest management structure for each CRDA

Figure 9: Area Map/Official Map of State Owned El Mabtouh Wetland Grazing Region as proposed by the DGF to the Ministry of State Properties (Final Draft)

Source: Bizerte Forest Precinct

Figure 10: Grazing Conditions of State-Owned El Mabtouh Wetland (November 2010)

6.5.3 Flood Damage

Of the 292 households that answered questions about the location of residences relative to the Mejerda River, 206 households, or approximately 70%, said they lived in areas where flooding may occur. Approximately 66% of respondents experienced the 1973 flood, and 98% said they experienced the floods in 2003, 2004, and 2009.

The majority of respondents (approx. 86%) said that the 2003 flood caused the most damage. When residents talk about floods, they always compare damage to the 2003 flood. Responses regarding the 2003 flood are as follows:

1) Submerged houses due to the 2003 flood
   The percentage of submerged houses in each district: Jedeida (89%), El Bataan (88%), Tebourba (76%), Oued Ellil (75%).
2) Submerged depth and time due to the 2003 flood
   The submerged depth was the highest in each sector of Banlieue de Tebourba, Utique, Jedeida, El Bataan, Chaouet at the peak of the flood, and the average flood time was longest in the Utique, Jedeida, Chaouet Sectors.

Table 17: Submersion and Duration of 2003 Flood

Sector Name	Peak Submersion Depth of Flood	Flood Duration	Submerged Houses
Medina, Tebourba			76%
Banlieue de Tebourba	142cm		76%
Utique	130 cm	48hr	
Jedeida	105 cm	43 hr	89%
El Bataan	97 cm		88%
Chaouet	92 cm	34 hr	
Oued Ellil			75%

According to the table below, the Bach Hamba, El Mabtouh, Bejaoua, Chorfesh, Kalaât Andalous Ouest, Jedeida, Jedeida-Hached, Tebourba, and El Bataan Sectors had many flooded regions.

The average amount in damages of surveyed households exceeded 10,000 TND/household. The average in damages for the seven districts of Bach Hamba, El Bataan, Chaouet, Chorfesh, El Mabtouh, Kalaât Andalous Ouest, and Utique is even higher. Of surveyed households, 96 households, or over one third, received reparation from this department. 79% of reparations came in the form of financial aid while 31% was distributed through goods and items.

Table 18: Distribution of Residences (Households) in Flooded & Serviced Regions by Sector

District	Sector	Flooded Regions	Serviced Region		Total No. of Households
			Public Water Area	Backland	
Utique	Ain Ghlal	0	0	0	4
	Bach Hamba	16	0	0	21
	El Mabtouh	19	0	4	23
	Sidi Othmene	0	0	0	13
	Utique	5	0	0	6
Sidi Thabet	Bejaoua	16	1	1	20
	Chorfesh	22	0	0	22
	Monji Slim	4	1	1	8
Kalaât Andalous	Kalaât Andalous Est	8	0	0	8
	Kalaât Andalous Ouest	24	2	0	26
	Pont de Bizerte	2	1	0	11
Oued Ellil	Essaida	4	0	0	4
Jedeida	Chaouet	5	0	9	14
	Jedeida	12	1	11	24
	Jedeida-Hached	16	0	7	23
Tebourba	Banlieue de Tebourba	17	0	0	19
	Medina, Tebourba	13	0	1	14
El Bataan	El Bataan	23	1	2	32
Total		206	7	36	292

Table 19: Estimate in Damages and No. of Households that Received Aid from 2003 Flood

District	Sector	Damage Estimate (TND/Household)			Households that Received Aid
		Min	Max	Avg	
Utique	Ain Ghlal	500	1,500	1,000	0
	Bach Hamba	400	150,000	25,386	2
	El Mabtouh	800	210,000	17,000	11
	Sidi Othmene	1,200	12,500	3746	0
	Utique	2,000	60,000	14,500	3
Sidi Thabet	Bejaoua	1,000	80,000	8,700	1
	Chorfesh	500	80,000	11,068	0
	Monji Slim	500	500	83	0
Kalaât Andalous	Kalaât Andalous Est	4,000	10,000	7,214	1
	Kalaât Andalous Ouest	1,000	60,000	10,844	1
	Pont de Bizerte	2,000	20,000	4,250	0
Oued Ellil	Essaida	1,000	10,000	3,667	1
Jedeida	Chaouet	200	100,000	13,938	7
	Jedeida	2, 000	40,000	7, 563	13
	Jedeida-Hached	1,500	22,000	5,652	19
Tebourba	Banlieue de Tebourba	800	20,000	8,000	14
	Medina, Tebourba	1,000	35,000	4,536	6
El Bataan	El Bataan	1,000	150,000	12,015	17
Minimum Damage Estimate		200			Households that received aid: 96 total
Maximum Damage Estimate			210,000		
Average Damage Estimate				10,014	

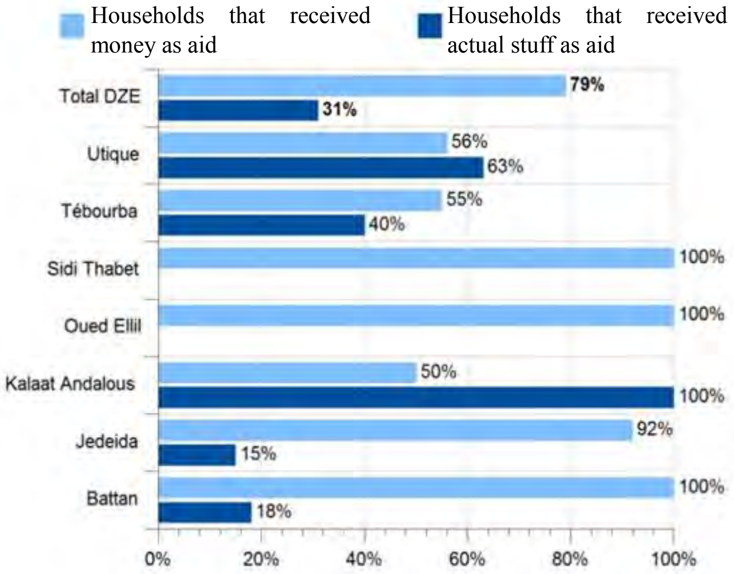

Figure 11: Distribution of Aid for Households that Suffered Damages in 2003 Flood

7. Type of loss, compensation and assistance beneficiaries, compensation package

Land ownership transfer conditions such as type of loss, compensation and assistance beneficiaries, compensation package, and responsible organizations as based on JICA guidelines are shown in the table below.

Table 20: Entitlement matrix (JICA Guidelines)

Type of loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation issues/Guidelines	Organization Responsible
Loss of agricultural land, orchards, gardens Loss of residential or commercial land	·Legal owner of land, ·Occupant with legal rights, ·Occupant without legal rights but recognized after 6-month public announcement	Replacement value of land (cash compensation or land based compensation according to the wish and to cover the market value of land as determined by Ministry of State Domain	i) Assessment of quantity and quality of land by DGBGTH and OTC with support of Regional Commissions of Expropriation	DGBGTH, OTC, Regional Commissions of Expropriation
			ii) Assessment of Market Value by Land Market Survey	Regional Commissions of Expropriation
			iii) Assessment of Cash Compensation under Law	Ministry of State Domain
			iv) Updating of title of the affected persons	DGBGTH, Regional Commissions of Expropriation
			v) Payment of Cash Compensation under Law	DGBGTH, Governorates
Loss of trees and standing crops Loss of built structures including house	·Legal owner of land, ·Occupant with legal rights, ·Occupant without legal rights but recognized after 6-month public announcement	Replacement value of assets (cash compensation) to cover the market value of assets as determined by Ministry of State Domain	i) Assessment of quantity and quality of assets by DGBGTH and OTC with support of Regional Commissions of Expropriation and CRDA	DGBGTH, OTC, Regional Commissions of Expropriation, CRDA
			ii) Assessment of Market Value by Land Market Survey	Regional Commissions of Expropriation
			iii) Assessment of Cash Compensation under Law	Ministry of State Domain
			iv) Payment of Cash Compensation under Law	DGBGTH, Governorates

Source: JICA Survey Team

8. Compensation for loss

For land acquisition and compensation procedures for the Project, just and fair compensation will be provided for owners/occupants of the target land based on the Tunisian Land Ownership Law, regardless of the legality/illegality of land ownership. As recommended in the JICA guidelines, consultations will be conducted with the relevant parties, and forcible land expropriation procedures will be kept to a minimum, in accordance with existing Tunisian law regarding land acquisition and compensation. Mutual agreement reached through discussions between the acquirer and persons whose land is expropriated will be used as the fundamental principle. In order to ensure conformance with JICA guidelines, this Project will propose to the DGBGTH that matters not clearly defined by Tunisian law such as public hearings, public assistance for resettling socially vulnerable persons, and monitoring for land acquisition, compensation, and resident resettlement procedures be treated as important items.

Preparations for consultation will be conducted as a duty of the Regional Commissions of Assessment and Adjustment. Other related parties may not conduct discussions in the place of the Regional Commission of Assessment and Adjustment. Therefore, the land acquisition schedule may be greatly affected based on whether mutual consultations with this Commission are sufficiently and smoothly conducted.

When the land boundaries are set and the decree for public utility declaration has been promulgated, the DGBGTH will begin preparing the plan for acquisition, compensation, and resettlement. Compensation for all eligible structures pertaining to sustaining the livelihoods of the owners/occupants such as land, immovable facilities, planted land, etc. will be paid the compensatory amount stipulated by the Ministry of State Domains. If the amount of compensation is low due to the value of the original residence being low, the governorate may provide supplementary funds to assist with relocation to alternative land. However, the relocated person will be responsible for construction of the housing, etc. on the provided alternative land himself. For residents whose livelihoods are based on the land, compensation in the form of a land base will be preferentially provided instead of just financial compensation. The compensatory amounts will conform to JICA guidelines, with some cases taking into consideration the loss of livelihoods means of the eligible person.

The cut-off date for the Project will serve as the notification date, as based on the Land Ownership Law. For acquisition procedures for land with no proprietary rights, the start date for the population census to be implemented by the DGBGTH in 2014 will be set based on the JICA Category B Project report guidelines for environmental and social considerations.

9. Reconstruction of livelihoods

As a measure for the reconstruction of livelihood for resettled residents, it is required that the full cost in the form of subsidies be provided for resettlement and restoration of livelihoods and standards of living. This amount will be based on existing Tunisian regulations, appraisal reports prepared by the Regional Commissions of Expropriation, and the results of appraisal report evaluation by experts at the Ministry of State Domains.

10. Grievance mechanism

In Tunisian law related to land acquisition and compensation, objections to the awarded compensatory amount can only be filed through a lawsuit in court at the time of land expropriation. A grievance processing system to support responding to the requests of residents subject to land expropriation has not been established.

For this project, a Project Team within the CRDA of each governorate will accept grievances from residents subject to land acquisition procedures as a method of support for agricultural promotion organizations. This will be spearheaded by the DGBGTH as a means of assisting residents by listening to their grievances and thinking of problem resolutions. The grievances heard will be reported to the governorate or the special Resident Resettlement Coordination Committees established within the governorate. The DGBGTH will cooperate with Service of Water Use and Agricultural Facilities of the CRDA of each governorate to conduct overall monitoring for the Project while taking into account the grievance processing system. Furthermore, in order to provide definite support to socially vulnerable residents, the governor of each governorate will notify the Regional Commissions for Assessment and Adjustment that they are to include a representative from social welfare agencies as a member of the commission.

11. Considerations for socially vulnerable people

Using results of a survey on livelihoods and lifestyles conducted on 300 household in the Project area, the effects on socially vulnerable people (the poor, women, children, ethnic minorities) were also analyzed.

From these survey results, it was determined that the ratio of poor residents with household incomes under the minimum wage, as well as residents in vulnerable positions is particularly high in the Jedeida, Sidi Thabet, and El Battan Districts. It is expected that the loss of cropland and unharvested crops due to land acquisition for the Project will have a serious impact on the agricultural livelihoods of these households. These impacts can be relieved through land and property compensation procedures. In addition, most of these households have received very serious damage to their houses and property from flooding. Therefore, the losses suffered from flood damage can be mitigated through this project.

In regard to gender rights and children’s rights, since farm work and drawing water for irrigation is mainly conducted by men, field surveys showed that women’s viewpoints were not largely reflected. However, it was determined that there are no adverse affect on gender equality or the rights/living environment of children caused by this Project. Furthermore, since flood damage will be mitigated due to the Project, an increased level of safety for people vulnerable to disaster (women and children) can be expected.

In regard to ethnic minorities, there is a group of ethnic minority people who engage in grazing activities within the Project region under the free passage rights of state-owned grazing land in El Mabtouh in particular. Although it is necessary to consider their land of origin, number of livestock migrating seasonally, and their cycle of passage, this Project is not considered to affect a specific ethnic minority group.

Although public assistance for socially vulnerable owners/occupants is not specifically written in land acquisition and compensation procedures, for land acquisition procedures for the Project, it is important to make thorough considerations of the vulnerabilities of owners/occupants based on the statement of demands written by the owner/occupants for the Regional Commissions of Assessment and Adjustment.

The DGBGTH will confirm the a representative from social welfare agencies are present during meetings of the Regional Commission of Assessment and Adjustment, and will also designate the CRDA as the responsible party for monitoring social assistance for the most vulnerable residents to facilitate backup in the establishment of a support system for socially vulnerable people.

12. Relevant organizations for Expropriation and Compensation

The legal land expropriators are the Division of Expropriation of Dams and Services of Expropriation and Compensations within the Directorate of Large Dams of the DGBGTH. From this position, they are responsible for land acquisition procedures in cooperation with the following relevant organizations.

- The Directorate General of Acquisition and Boundary Demarcation and the Directorate General for Appraisals within the Ministry of State Domains and Land Affairs (hereinafter called "Ministry of State Domains")
- Governorate branches of the Ministry of State Domains
- Office of Rural Land Conservation (a public companies set up within the Ministry of State Domains to handle registration management)
- CRDA
- Governorates and relevant districts
- Regional Commissions of Expropriation
  With the Governor acting as chairperson, this commission consists of representatives from the DGBGTH, MEq, Ministry of State Domains, CRDA, and relevant districts.
- Regional Commissions of Assessment and Adjustment
  With a government official acting as chairperson, this commission generally consists of about 12 people as standing and temporary members. They include the land expropriator, local representatives of the MEq, experts from the Ministry of State Domains, representatives of regional social welfare agencies, district court representatives, and CRDA representatives.
- Court of justice (involved if there are land expropriation procedures)
- Central Committee on Land Use Planning and Development
  This committee consists of the major relevant directorates, the Ministry of State Domains, and the governors of governorates in Project areas. It is only involved for special cases, such as disputes between owners during land acquisition or the discovery of cultural or archeological artifacts during construction work.
- Central Steering Committee
  Study on the establishment of this committee by the Ministry of State Domains, the MEq, and the ME began following the revolution in order to facilitate land acquisition procedures through government involvement. The timing of establishment and primary activities of the committee are yet undetermined.

13. Implementation schedule

The implementation schedule (draft) for land acquisition and involuntary resident resettlement is shown in the following table. The timing for beginning procedures is indicated in the table with an arrow. For this Project, it is expected that actual resettlement will begin after compensation for lost assets has been paid.

Table 12: Schedule for land and property acquisition (draft)

Implementation schedule Period: 22 months	**Period (months**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	Notes
(1) Confirmation of public benefit of the project and assessment of required land (2) Appraisal by the Regional Commissions of Expropriation (3) Confirmation of land owners and land registration certificates (4) Examination of land owners and compensation amounts by the Ministry of State Domains	6	■	■	■	■	■	■																	Land acquisition through consultations is set as a precondition, but this may be carried over to court trials depending on the situation.
Based on the Abbreviated Resident Resettlement Plan prepared by the Survey Team, DGBGTH make its own version.	2						■	■																
Consultations pertaining to land acquisition by the Regional Commissions of Assessment and Adjustment, land owners, and the implementing agency of the Project	3							■	■	■														
From the completion of discussions with the Regional Commissions of Assessment and Adjustment to the finish of resident resettlement	6										■	■	■	■	■	■								
If there are court procedures	13										Court preparations	1st trial (approx. 6 months)						2nd/3rd trial (approx. 3 months)						If carried over to court trials, this will take more than one year.
Monitoring	10							■	■	■	■	■	■	■	■	■	▒						▒	If carried over to court trials, an interview survey on the compensation for loss will be conducted in the 16th or 22nd month.

Source: JICA Survey Team

14. Costs and financial resources

Relocation and compensation costs related to resident resettlement and land acquisition are planned to be calculated based on property and land survey results that can be found within EIA survey items. The DGBGTH will be the implementing body. In addition, it is necessary for these relocation and compensation costs, as well as costs associated with monitoring resident resettlement to be shown clearly in a resident relocation plan to be drafted by the DGBGTH.

Table 21: Item of the compensation

No.	Item	Qty	Unit price (TND)	Acquisition price (TND)
1	Compensation fee（Fee for reinstallation of Structure, public infrastructure etc.）	2	－	350,000
2	Compensation fee (Crop compensation)	2,324,850	－	23,030,545
3	Compensation fee for the private land（for the legal residents）	2,324,850（Need of confirmation of legal or illegal）	3.5	9,000,000
4	Relocation fee（transportation fee for the luggage and the residents to the new address, tax/administration fee, Construction fee for the temporary residential house etc.）	2	－	10,000
5	Administration fee（staff cost, Monitoring management fee etc.）	－	－	－
6	Fee for the reconstruction of the livelihood（If the loss of the gained capital exceeds more than 10% because of the expropriation, the fee for the preparation of alternative income creation, vocational training, introducing another job should be supported.）	－	－	－
	Total	－	－	－

15. Land acquisition and resident resettlement monitoring

Monitoring associated with resident resettlement procedures are not sufficiently covered by laws related to land acquisition and compensation procedures in Tunisia. Therefore, it will be supplemented by JICA guidelines. Monitoring will be conducted with the purpose of checking plan execution along with the progress of land acquisition and compensation procedures, confirming that the Project land is vacated under appropriate conditions, and ascertaining the status of resettled residents during implementation of the resident resettlement plan.

The DGBGTH Division of Expropriation of Dams or the Service of Expropriation and Compensation will be the implementing agency for monitoring and will organize a monitoring committee for the land acquisition, compensation, and resettlement plan.

The land acquisition and resettlement monitoring plan is shown in the table below. The DGBGTH will make an overall evaluation by conducting monitoring using a monitoring form while receiving advice and support from the Consultant or related agencies, and then proceed with land acquisition. Monitoring forms will be managed by the implementing agency for monitoring. The form will be created by appropriately referring to the sample monitoring form for land acquisition and involuntary resident resettlement as shown in the following table. It is recommended that the monitoring form be used for each target sector identified by results of the land registration survey conducted at the time of the Detailed Design Survey of the Project.

Table 22: Land acquisition and resident resettlement monitoring plan

Purpose	Item	Implementation point	Frequency	Responsible agency
【Before construction】				
Confirm consensus building related to business activities and compensation methods.	Follow stakeholder meetings.	Stakeholder meeting venue or resettlement residence	When stakeholder meetings are held	**Evaluation and implementation :** DGBGTH (Directorate General for Dams and Major Hydraulic Works) Land Acquisition Division **Decision :** Ministry of State Domains and Land Affairs **Relocation assistance means monitoring :** CRDA／DHER
Confirm the progress of land acquisition.	Record the number of land acquisitions.	Resettlement residence	Done once before construction	
Confirm the progress of resettlement.	Record the number of moved people and households.	Resettlement residence	Done once before construction	
Confirm the progress of compensation payment.	Record the number of residents paid compensation.	Resettlement residence	Done once before construction	
【During construction】				
Confirm the living conditions of resettled residents.	Record the number of incidence of complaints and their solutions.	Resettlement destination	Done once before construction	

Table 23: Example of land acquisition and resident resettlement monitoring form

Monitoring form for Preparation of Resettlement Sites **No.**

Explanation of the land (e.g. Location, size of the area, no. of resettlement HH, etc.)	**Status (Completed (date) / not completed)**	**Details (e.g. Site selection, identification of candidate sites, discussion with PAP, Classification of the land (State-owned land / Private land (Cropland / Tree plantation / Plantation planting / Pasture / Residence and adjunct / Other)))**	**Expected Date of Completion**

Public Consultation

No.	Date	Place	Contents of the consultation / main comments and answers
1.			
2.			

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter		
Preparation of RAP									
Employment of Consultants		Man-month							
Implementation of Census Survey (including Socioeconomic Survey)									
Approval of RAP			Date of Approval:						
Finalization of PAPs List		No. of PAPs							
Progress of filling the request card (if any)		No. of PAPs							
No. of PAPs who need Resettlement support		No. of PAPs							
No. of PAPs who have received Resettlement support		No. of PAPs							
Progress of signing the administrative sales contract based on discussion		No. of HHs							
Progress of Compensation Payment		No. of HHs							
Amount of Compensation for the land in the project site		TND							
Amount of Compensation for the properties in the project site		TND							
Transferred Compensation payment for the land to the Finance Bureau		TND	Date of Approval:						
Transferred Compensation payment for the properties to the Finance Bureau		TND	Date of Approval:						
Progress of Land Acquisition (All Lots)		ha							
Lot 1		ha							
Lot 2		ha							
Lot 3		ha							
Lot 4		ha							
Progress of Asset Replacement (All Lots)		No. of HHs							
Lot 1		No. of HHs							
Lot 2		No. of HHs							
Lot 3		No. of HHs							
Lot 4		No. of HHs							
Progress of Relocation of People (All Lots)		No. of HHs							
Lot 1		No. of HHs							
Lot 2		No. of HHs							
Lot 3		No. of HHs							
Lot 4		No. of HHs							

Source: JICA Survey Team

16. Consultations with residents

As was described in the previous chapter on environmental and social considerations, three stakeholders meetings were held for this Project. Participants were representatives from each relevant agency and Omdas (tribal leaders). Affected residents did not participate. This was because the DGBGTH decided that there was no need to place a burden on residents by requiring them to attend the meetings since the residents around the Mejerda River were sufficiently represented by the Omdas. However, after the Jasmine Revolution, the Omdas tend not to be seen as a representative of residents. Therefore, for resident consultations conducted in the future, residents including land owners/occupants should also be summoned.

In particular, at the third stakeholders meeting, there was an explanation by participants that it was necessary to minimize the impact created by expropriation of agricultural land in the area surrounding the El Mabtouh wetlands. In addition, the DGBGTH confirmed that is was better for land owners engaging in farming activities to be compensated with alternative land than through compensation in trust. Therefore, they proposed that compensation be made with alternative land located within a 20km radius that has the same or larger land area of the original land.

Although consultations with residents is not stipulated in land acquisition procedures, it was determined that it is necessary to publicize information on the impacts and effects of the Project and hold multiple stakeholders meetings during the implementation of the Environmental and Social Considerations Survey in order to facilitate the understanding of residents regarding the Project. However, the selection of participants will respect the practices and customs of the residents and the communities.

6.2 Results of Land Acquisition and Resident Relocation conducted by the Ministry of Agriculture in recent years

The table below shows results of Land Acquisition and Resident Relocation conducted by the Ministry of Agriculture in recent years.

Year	Name of project	EIA	Land Acquisition and Resident Relocation
1998	Sidi El Barrak Construction Project （Beja Governorate）	Completed	4,000ha, 1,500 residents Relocation was completed, land registration is under way
2002	El Kebir Dam Construction Project （Jendouba Governorate）	Completed	250ha, 700 residents Relocation is under way
2004	El Moula Dam Construction Project （Jendouba Governorate）	Completed	200ha, 100 residents Relocation is under way
2007	Ettine Dam Construction Project （Bizerte Governorate）	Completed	1,000ha, 30 residents Relocation is under way
2007	Herka Dam Construction Project （Bizerte Governorate）	Completed	300ha, 40r residents Relocation is under way

As Sidi El Barrak Construction Project in 1998 was a very large project, Relocation destinations were 13 cities. Costs incurred on land acquisition and resident relocation in this project are as follows:

Costs for installation of vegetation and structures in the destination city: 13,000,000TND
Costs for preparation of destination: 500,000TND
Administrative expenses: 1,000,000TND
Cost of land: 11,000,000TND

In addition, the following documents are available:

- Land acquisition progress report (1995)
- Land acquisition progress report (1995 - 1996)
- Land acquisition progress report (1998)
- Land acquisition progress report (2001)

7 Related Documents of Chapter 10 (Project Implementing Plan)

7.1 Partial translation of the Presidential Decrees related to the establishment of PMU for recent projects implemented by the Ministry of Agriculture

(1) Project of Interconnection of the Two Dams El Houareb and Sidi Saad for the Development of Irrigation in the Governorate of Kairouan

Partial Translation

Decree n° 2012-1258 since 1st of August 2012, on the establishment of a unit of management by objectives for the realization of the project of interconnection of the two dams El Houareb and Sidi Saad for the development of irrigation in the governorate of Kairouan and setting out its organization and operation's procedures.

Inacts as follows:

Article 1- it is created at the ministry of agriculture a management unit by objectives for the realization of the project of interconnection of the two dams El Houareb and Sidi Saad for the development of irrigation in the governorate of Kairouan. It is placed under the authority of director general of dams and large hydraulic works.

Art 2- Missions of the unit management by objectives for the realization of the project of interconnection of the two dams El Houareb and Sidi Saad for the development of irrigation in the governorate of Kairouan are as follows :

- Ensure the execution of different operations within the scope of the project.
- Coordinate effective realization phases of the project to ensure alignment with the objective set.
- Take appropriate and timely decisions to readjust the running of the project

And in general manner way , the realization of all other duties within the scope of the project and referred to it by the supervisory authority.

Art 3 ……

Art 5- The unit management by objectives for the realization of the project of interconnection of the two dams El Houareb and Sidi Saad for the development of irrigation in the governorate of Kairouan includes the following functional jobs :

1- The director of unit with function and benefits of central administration director.
2- A deputy director in charge of programming and monitoring with the evaluation function and benefits as director of central administration.
3- A department head in charge of monitoring and assessment with function and benefits of chief of central administration.
4- A department head responsible for administrative and financial affairs function and benefits of chief of central administration.

(2) Project of Triple Channel Sejnane – Joumine – Mejerda

Decree n° 2003-1081 since 5th of Mai 2003, on the establishment of a unit of management by objectives for the realization of the project of triple channel Sejnane - Joumine - Medjerda , its organization and operation’s procedures.

Partial Translation

In acts as follows:

Article 1- it is created at the ministry of agriculture, environment and water resources a management unit by objectives for the realization of the project of triple channel Sejnane - Joumine – Medjerda. It is placed under the authority of the ministry of agriculture, environment and water resources.

Art 2- Missions of the unit management objectives for the realization of the project of triple channel Sejnane - Joumine – Medjerda, are as follows :

- Ensure the execution of different operations within the scope of the project.
- Coordinate effective realization phases of the project to ensure alignment with the objective set
- Take appropriate and timely decisions to readjust the running of the project and their harmonization with geological and geotechnical eventual changes.
- Ensure follow- up missions of office control and exploit them for the success of the project.

And a general manner way , the realization of all other duties within the scope of the project and referred to it by the supervisory authority.

Art 3- The duration of the project to triple channel Sejnane - Joumine – Medjerda is fixed at seven years starting from the date of entry into force of this decree.

The time of realization of the project phases are fixed as follows: ……..