

ANNEX

- Z-1 Record of Meeting with Relevant Organization***
- Z-2 Exchange Letters with MACO for Priority Projects***
- Z-3 List of Collected Data and Documents***

Z-1 Record of meeting with relevant organization (Zambia)

Date	13th of July, 2010 AM9:00~10:30
Meeting Place	Ministry of Agriculture and Cooperative(MACO) ; Technical Support Branch (TSB)
Visitor	Mr.Abert Chalabesa(Acting Director Department of Agriculture(DoA)/TSB) Mr. Henry Sichembe (Deputy Director DoA/TSB)
Study team	Mr. Kobayashi (JICA study team leader)、 Mr. Sugimoto (JICA expert), Mr. Patrick Chibbamulilo (JICA)
Purpose	Irrigation candidate site
Submitted documentation	Inception report and schedule of survey
Obtained date	
Meeting	
	JICA study team submitted inception report and explained an objective of the survey. The study team will conduct survey in several areas that MACO considered as priority sites with the higher potential for development, and these areas could be irrigation candidate sites for F/S implemented by Japanese Government. ✧ TSB takes charge of three areas: Irrigation, Farm Mechanization, and GIS. ✧ For irrigation projects in operation, a local consultant has already started F/S at three sites in Group-1 of WB. There are small-scale irrigation projects which have been implemented by AfDB and Finland. For reference to other irrigation projects in the future, it might be recommended to inspect the Muvuma Hill site in the area of Mazabuka near Kafue River side. ✧ There are three sites which were documented by Appraisal Report. There is a possibility of joint financing by Japan and WB. Those sites are 1) Rumana in the North Western Province, 2) Kasama near Chambesi River in the Northern Province and 3) Mansa in Luapula Province. ✧ Survey for investigating those sites would be recommended, and rescheduling the survey plan was requested. After the survey would be done in those sites, staffs in charge of the office of each site can follow up the survey. ✧ It was requested that a result of the survey would be reported to TSB. For two sites selected as priority projects, a consensus should be built with MACO and TSB. The date of agreement might be 11th of August indicated in the schedule. JICA side responded that they would report the result of survey to TSB and get an agreement with TSB to conduct survey for project sites which were recommended by them. The modified schedule of survey was sent by e-mail to TSB at later date.

Date	12 th of July, 2010 AM10:30~12:30																																								
Meeting Place	Small Irrigation Project (SIP) Project Office at PACO Lusaka																																								
Visitor	Mr. Goerge Phiri(SIP Project Coordinator) Mr.Shadreck Phiri (SIP Project Engineer)																																								
Study team	Mr. Kobayashi (JICA study team leader)、 Mr. Sugimoto (JICA expert), Mr. Patrick Chibbamulilo (JICA)																																								
Purpose	Progress of SIP, Loan Project of AfDB																																								
Submitted documentation	Inception report and schedule of survey																																								
Obtained data																																									
Meeting																																									
	JICA study team explained an objective of the survey and gave a brief explanation of inception report. The study team will conduct survey in several areas which have the higher potential for development, and finally two sites will be selected as priority sites. JICA also take into consideration of joint financing with other donors as AfDB. ✧ SIP started in 2004 and will finish in 2010. But it took longer time to make survey and they finish it only in two sites. As shown a below table, the target area is totally 1890 ha in 6 sites. No. 7 is Kanankatapa dam and No. 1 is water source facility in Kanankatapa in the table. All 6 projects are planning to install pump up system. They were loan projects of AfDB and the budget was 8 million US\$ in Phase-I. However, the projects had a lack of budget due to delaying survey, and 10 million € was added by grant of Finland for two and half years in Phase-II. Detail of SIP <table><tr><td></td><td>Project name</td><td>Province</td><td>County</td><td>Bene it area (ha)</td></tr><tr><td>1.</td><td>Kanakantapa</td><td>Lusaka</td><td>Chongwe</td><td>620</td></tr><tr><td>2.</td><td>Nega-Nega</td><td>Southern</td><td>Mazabuka</td><td>595</td></tr><tr><td>3.</td><td>Buleya Malima</td><td>Southern</td><td>Sinazongwe</td><td>275</td></tr><tr><td>4.</td><td>Simumpa de Village</td><td>Southern</td><td>Sinazongwe</td><td>150</td></tr><tr><td>.</td><td>Nzenga Fishin Camp</td><td>Southern</td><td>Sinazongwe</td><td>98</td></tr><tr><td>6.</td><td>Chief Sinazongwa Village.</td><td>Southern</td><td>Sinazongwe</td><td>100</td></tr><tr><td>7.</td><td>Kanakanpata dam</td><td>Lusaka</td><td>Chongwe</td><td>---</td></tr></table> ✧ 595 ha in Nega-Nega and 275 ha in Buleya Malima will be completed until 2010. ✧ Small Scale was defined as below, 1) Amount of investment value 2) Technical level in project 3) Type of crops 4) Project cost is less than 300 million Kwacha Selection criteria for small scale irrigation which were decided in “Irrigated Urban Agricultural Assistance Project” by JICA could be useful for SIP, including development of hydropower, infrastructures for conveyance and		Project name	Province	County	Bene it area (ha)	1.	Kanakantapa	Lusaka	Chongwe	620	2.	Nega-Nega	Southern	Mazabuka	595	3.	Buleya Malima	Southern	Sinazongwe	275	4.	Simumpa de Village	Southern	Sinazongwe	150	.	Nzenga Fishin Camp	Southern	Sinazongwe	98	6.	Chief Sinazongwa Village.	Southern	Sinazongwe	100	7.	Kanakanpata dam	Lusaka	Chongwe	---
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7.	Kanakanpata dam	Lusaka	Chongwe	---																																					

	diversion, and management. After the projects finish, all system would be handed over to private sector. ✧ In 6 project sites, Kanankatapa has a possibility of cooperation with Japan is. This site is planned to construct a reservoir with 50,000 ton capacity for storage of water and it is targeted to 620 ha area by SIP. In this site, the potential irrigated area is 2000 ha, and it suggests that 1380 ha will be able to extend for irrigation. Firstly WB had an interest in the intervention in a whole area of Kanankatapa, but now they don't like to develop a part of site for extension of the area. The construction of reservoir with 50,000 ton capacity requires disposing a huge amount of excavation soil due to effluent outlet. However the capacity of reservoir can be expanded to 2.5 million ton using excavation soil for embankment and levelling. There is a possibility to extend the irrigation area of 1380 ha using the expanded reservoir as a water source. But SIP has not enough budget and it only covered 620 ha of a total area. If JICA would conduct F/S in this extension area, SIP would like to work together and cooperate with JICA. Japanese Government implemented project of 30 ha irrigation with pump station and constructed the irrigation centre in Kanankatapa in 1995. However, now the centre is not function and the pump station doesn't work due to breakdown of machines. Including rehabilitation of those facilities, F/S of extension area of 1380 ha should be taken into consideration based on field survey. MACO and Department of the Treasury mentioned that they would not target loan project in agricultural sector. How will they expand irrigation projects using AfDB loan? ✧ Department of the Treasury would continue loan project for irrigation development, and 10 donors would support 300million US\$. They could not stop the loan which account for large portion of national budget. Tax for agriculture is reduced by 15 %, besides import of agricultural machines take the exemption of any duties. As considering the policy for supporting agriculture sector, they will continue loan for irrigation project.
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Date	12 th of July, 2010 AM10:30~12:30
Meeting Place	African Development Bank (AfDB)
Visitor	Mr. Lewis M. Bangwe(Agriculture Specialist) Ms, Kati Manner (Counselor Economic and Development Policy, Agriculture; Finland Embassy)
Study team	Mr. Kobayashi (JICA study team leader)、 Mr. Sugimoto (JICA expert), Mr. Patrick Chibbamulilo (JICA)
Purpose	Loan Project of AfDB, Assistance of Finland
Submitted documentation	Inception report and schedule of survey
Obtained data	
Meeting	
	JICA study team explained an objective of the survey and gave a brief explanation of inception report. The study team will conduct survey in

	several areas which have the higher potential for development, and finally two sites will be selected as priority sites. JICA also take into consideration of joint financing with other donors as AfDB and WB. ✧ Now AfDB is supporting for 4 sectors; 1) Agriculture Sector, 2) Energy Sector, 3) Health Sector, 4) Transport Sector. ✧ In agriculture sector, irrigation is the major component for AfDB, especially infrastructure development is the main project, for such as developing irrigation facilities, farm structures, marketing, private sector, capacity building, Governance of budget, regional integration. ✧ SIP started in 2004, however, it took longer time for a couple years to make F/S, and it leads to lack of budget due to increase of cost for survey. Additionally Sinazongwe, Simumpande Village (150ha) in Southern Province was exempt from the target area of SIP in economic aspect. ✧ On the other hand, Finland made decision to support for irrigation project in December of 2008. They will support 10 million € for SIP as Finland Trust Fund. It is possible that Japan will join these projects collaborating with Finland. In Kanankatapa, Finland thought that the site has higher potential for rice cultivation and will develop rice policy by building Rice Value Chain. For Finland, agriculture is the main sector for assistance and they will keep on joint financing with AfDB. ✧ Finland will fund 11.3 million € to Luapula Province for 4 years since December in 2010. They will conduct survey at Pre-F/S stage for aquaculture, agri-business, service provider and value-chain on rice. ✧ There are almost 2000 reservoirs in Zambia, and it suggests that there might be the higher potential for extending irrigation area. For except this, there are 2000 ha of potential irrigation area in Nega Nega, and the project in this site is implementing in 600 ha. In Muvuma Hill, Pre-F/S has already finished and it targets 3000 ha of coffee plantation, while sugarcane plantation in Nakambala, Chama in Solwegi has a possibility for developing paddy field. ✧ A whole county of Zambia got loan assistance of 600million US\$ and priority sectors are Road and Energy. Now budget of assistance from 2007 to 2010 still remains 120 million US\$. Following assistance will be given in 2011 to 2014, but the amount of budget is not fixed yet and will be decided in December of 2010. From 2011 to 2012, assistance for livestock would be the main component, and from 2013 to 2014, irrigation project will be implemented as pipeline project.
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Date	15 th of July, 2010 AM10:00 – PM11:50
Meeting place	World Bank (WB)
Visitor	Ms. Indira Janaki Ekanayake (Senior Agriculturist) Mr. Alex Mwanakasale (Agricultural Specialist)
Study team	Mr. Kobayashi (JICA study team leader), Dr. Sugimoto (JICA expert), Mr. Chibbamulilo (JICA)
Purpose	Progress of loan projects by WB
Submitted documentation	Inception report, study schedule
Obtained date	- List of sites (Group 1 to3) to be considered based on priority and financing availability (see Table-1) - Zambia Managing Water for Sustainable Growth and Poverty Reduction)
Meeting	
	Explanation of study purpose: Study team explained the inception report, and informed two candidate projects are selected according to the project evaluation of several potential projects. Japanese side may co-financing with WB. ✧ Head office of WB in Washington D.C. instructed the WB office in Zambia to assist the study by the JICA study team. WB expressed that the cooperation with the Japanese Government is so effective that WB positively deal with further projects. ✧ On-going and proposed irrigation projects are enumerated in Table -1. The list was prepared according to the MACO's information, thus WB has not yet decided project selection. WB undertakes 3 projects in Group-1 from a feasibility study to project implementation as a full development with project cost of US\$ 100 million in the concessional credit. Four sites were selected as a Group-2 to conduct one feasibility study and three preliminary feasibility studies with financial assistance of US\$1.57 million in total. Project selection amongst these four projects was not yet proposed. WB may proposed the Japanese Government to implement the projects categorized in the Group-2. The projects in the Group-3 were selected from the political point, including a request from the President and Minister. Potential projects of 18 sites are listed out of initial candidate project of 33 sites. ✧ The JICA study team explained WM a criteria of economic evaluation, say, production of 4 ton/has was feasible but 2 to 2.5 ton/ha was not feasible for maize, and 7 to 7.5 ton/ha became feasible for wheat cultivated in winter. Criteria for rice were not yet examined. WB requested the JICA could transfer technical method to calculate profit of rice.

Table 1: List of site (Group 1 to 3) to be considered based on priority and financing availability

Project Site	Location	Description	River Basin	Intervention Type	Expected Acreage	Indicative Seasonal Vol. Consumption	Existing Crops
Group 1							
Lusitu site	Siavonga – Southern Province	Currently under technical and environmental and socio-economic feasibility study. Mainly smallholder farmers, Phase 1.	Zambezi River	Direct abstraction from Zambezi River	250 to 750 ha	2.5 million m ³	Banana and horticulture
Mwomboshi site	Chhibombo – Central Province	Currently under technical and environmental and socio-economic feasibility study. Both large commercial and small-scale farmers, Phase 1	Luangwa River	Dam on perennial tributary stream/river	4,000 to 5,000 ha	45 million m ³	Mixed crops, but mainly wheat, tobacco, horticulture
Musakashi site	Mufulira – Copperbelt Province	Currently under technical and environmental and socio-economic feasibility study. Medium commercial and small-scale farmers Phase 1	Kafue River	Direct abstraction from Kafue River	500 to 2,000 ha	45 million m ³	Mixed crops, but mainly horticulture, maize and wheat.
Group 2							
Lumwana site	Solwezi – North western Province	Earmarked for study under Phase 2.	Zambezi River	Dam on perennial tributary stream/river	>1,000ha	>10 million m ³	Mixed crops, but mainly horticulture.
Nansanga Farm block	Serenje – Central Province	Earmarked for study under Phase 2. Large scale commercial enterprise driven.	Chambeshi River	Dam on perennial tributary stream/river	>1,000ha	>10 million m ³	Wheat, soya beans, maize and horticulture
Msandile site	Chipata – Eastern Province	Earmarked for study under Phase 2.	Luangwa River	Dam on perennial tributary stream/river	>500ha	>5 million m ³	Tobacco, maize. Groundnuts, sunflower
Nyamphande	Petauke – Eastern Province	Earmarked for study under Phase 2. Large scale commercial enterprise driven.	Luangwa River	Dam on perennial tributary stream/river	>5,000ha	>45 million m ³	Wheat, soya beans, maize and tobacco

Project Site	Location	Description	River Basin	Intervention Type	Expected Acreage	Indicative Seasonal Vol. Consumption	Existing Crops
Group 3							
Mkushi Farm block	Mkushi District – Central Province	See aide memoire October 2009	–	–	–	–	–
Luapula Farm block	Luapula Province	See aide memoire October 2009	–	–	–	–	–
Lundazi dam	Kundazi District – Eastern Province	Potential irrigated area not clear	–	Dam + pumping	–	–	–
Lufubu dam	Mansa District – Luapula Province	Potential irrigated area not clear	–	Dam + gravity	–	–	–
Kufubu dam	Luanshya District – Copperbelt Province	Potential irrigated area not clear	–	Dam + pumping	–	–	–
Lukulu North	Kasama District – Northern Province	Potential irrigated area not clear	–	Gravity	–	–	–
Chiansi (Phase 2)	Kafue District – Lusaka Province	Substantial information available from Infracore, no request for financial support	–	Pumping + center pivot	Perhaps 400 ha	–	–
Kanakanatapa (Phase 2)	Chongwe District – Lusaka Province	Potential irrigated area under Phase 2 not clear	–	Dam + pumping + gravity	–	–	–
Meheba/ Mutanda (near Lumwana)	Solwezi District – North Western Province	Controversial issues (resettlement, refugees, environment, land titling)	–	Options to be explored (dam/ pump/ gravity)	–	–	Pineapples
Ikelenge	Mwinilunga District – North western Province	Main problem is not irrigation but market access (need for conning factory)	–	Weir/ gravity irrigation	400 ha	–	–
Lubu	Chinsali District – Norther Province	Too small. Problematic market access	–	Gravity irrigation	Less than 450 ha	–	–
Mukonchi Scheme	Kapiri Mposhi District – Central Province	ADSP project preparation files ; rejected under ADSP because of high costs. Need to review scheme design and potential crops	–	Dam rehabilitation + pumping	Potential area 500 ha	–	–
Kaleya Sugar	Southern Province	Expansion phase	–	Options to be explored	Potential area of 200 ha including additional supplementary irrigation	–	–
Kalumgwishi Sugar	Kasama District – Northern Province	Land issue remain unclear	–	–	80 ha	–	Sugar Out-grower

Date	15 th of July, 2010 AM11:50 – PM12:30
Meeting place	FAO, IFAD
Visitor	Ms. Suzyo Mulenga (Programme Assistant FAO Zambia) Mr. Dick Siame (Country Officer, IFAD)
Study team	Mr. Kobayashi (JICA study team leader), Dr. Sugimoto (JICA expert), Mr. Chibbamulilo (JICA)
Purpose	Progress of AgWA, Assistance of FAO and IFAD
Submitted documentation	Inception report, study schedule
Obtained date	
Meeting	
	Explanation of study purpose: Study team explained the inception report, and informed two candidate projects are selected according to the project evaluation of several potential projects. Japanese side may make co-financing with AfDB. ✧ FAO has been conducting study of “Water for Agriculture & Energy” by two experts for respective sector. Dr. Salman and consultants is in Zambia at present and will back to FAO head office tomorrow, thus meeting with them is held today, tentatively 16:00 PM at FAO local office. ✧ SIWUP (Smallholder Irrigation and Water Users Programme) commenced in 2000 has completed by IFAD finance at present. The project included 6 irrigation projects in the Southern Province. Water for irrigation of all 6 projects is supplied from dam reservoir. Cost for dams and irrigation facilities were financed by WB and IFAD, respectively. ✧ President of IFAD will visit Zambia from July 21 to 24, and investigate Nabuyani dam/ Irrigation Scheme. The project site is located at 5km from the Livingstone road. The irrigation is composed of 10 ha irrigable area of 50 to 80 ha. Cultivated crops are vegetable, cabbage, green maize, etc.

Date	15 th of July, 2010 PM16:00 – PM17:30
Meeting place	FAO
Visitor	Dr. Maher Salman (Technical Officer, Land and Water Division FAO) Ms. Claudia Casarotto (PhD Researcher Swiss Federal Institute of Technology) Ms. Suzyu Mulenga (Programme Asistant FAO, Zambia)
Study team	Mr. Kobayashi (JICA study team leader), Dr. Sugimoto (JICA expert), Mr. Chibbamulilo (JICA)
Purpose	Progress of AgWA, Assistance of FAO
Submitted documentation	Inception report, study schedule
Obtained date	
面談内容	
	Explanation of study purpose: Study team explained the ption report, and informed two candidate projects are selected according to the project evaluation of several potential projects. Japanese side may make co-financing with AfDB. ✧ FAO is at present conducting “Water for Agriculture & Energy” sectors in 53 countries in Africa. FAO Zambia office is now in charge of three countries, i.e., Egypt, Kenya and Zambia in relation to CAADP. FAO prepared study report in Kenya, composed of project list of 142 candidates and detailed project evaluation including cost estimates of 60 projects. The study report is sent to the JICA study team for his reference to prepare assistance program of the irrigation development projects in Africa by the Japanese Government. ✧ FAO conducted three phased study. As a hydropower, irrigation and soft-component project, pipeline project is now studying. The project report includes economic evaluation and cropping pattern study and its draft report was submitted to the MACO in July 20 as a portfolio. The final report is prepared by August 5. In addition, 33 candidate projects list is being prepared at present. ✧ The draft report mentioned above is sent to the JICA study team. (Collected information: Cropping map of 8 crops, copies of Zambia Water for Agriculture and Energy report and information of Kenya)

Z-2 Exchange Letters with MACO for Priority Projects

Z-2-1 Request letter to MACO for Priority Projects

Date: August 12 2010

Mr. A. K. Banda,
The Permanent Secretary,
Ministry of Agriculture and Cooperatives,
Lusaka, Zambia

RE: Study for the Formulation for Irrigation Projects in Africa

Dear Sir:

In 2008, under the “Tokyo International Conference on African Development” (TICAD) IV, the Japanese Government targeted to contribute towards the development of about 100,000ha of irrigation in Sub-Sahara Africa. During the same convention it was also pledged to double rice production in SSA, from 14 million metric tons to 28 million metric tons by 2018, under an initiative called the “Coalition for African Rice Development” (CARD) which would coordinate effort of major partners in rice development. Zambia is in Group-2 of the CARD supported countries.

As part and parcel of the two initiatives, JICA dispatched a team of consultants to identify areas of high potential, in terms of technical and economic viability for development assistance as one of the four countries that have been included in this phase of study; the others are Uganda, Ghana and Mali.

The consultant, Mr. T. Kobayashi, irrigation & drainage and dam engineer with over 40 years of experiences, arrived in Lusaka on July 11 2010 to conduct the study (from July 12 to August 18 2010). He was accompanied by Dr. A. Sugimoto (MACO advisor), Mr. Matsusita (JICA Assistant Resident Representative) and Mr. Patrick Chibbamulilo (JICA Senior Program Officer) during site/field investigations as well as consultations with the major stakeholders in irrigation development.

Following several consultations between MACO and the study team, and also various stakeholders such as the World Bank, the African Development Bank, Finnish Embassy and the Food and Agricultural Organization among others, and observations based on the results of field/site investigations, the study team has proposed three irrigation development sites, identified earlier by MACO, for possible technical collaboration between Japan (JICA) and the Government of Zambia (MACO), mainly for carrying out the feasibility studies for the respective sites. Specifically, the sites are namely in the order of priority (1) Mwomboshi site in Chisamba (WB IDSP, Group-1), (2) Kanakantapa site in Chongwe (AfDB SIP, focusing on expanding irrigable area) and (3) Kalungu site in Chambeshi river basin (new site identified by the study team).

In a meeting held on August 10 2010 between MACO and JICA consultants Mr.

sites. Specifically, the sites are namely in the order of priority (1) Mwomboshi site in Chisamba (WB IDSP, Group-1), (2) Kanakantapa site in Chongwe (AfDB SIP, focusing on expanding irrigable area) and (3) Kalungu site in Chambeshi river basin (new site identified by the study team).

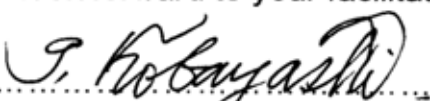
Consensus meeting has been held on August 10 2010 between MACO and JICA Team Leader Mr. T.Kobayashi and results of meeting is shown in the attached meeting minutes herewith.

Technically, the recommendations and proposals for the collaboration presented by the consultant were well received and a consensus has been reached among the pertinent partners mentioned above to continue to pursue in further detail. However, the proposal made is that of the consultant and does not represent the final decision of JICA.

To enable the consultant to finalize the proposals made for this study and to show the way forward, the study team is requesting MACO to facilitate a letter to JICA Headquarters, mentioning that MACO sees the advantages in Japan's technical cooperation in conducting the feasibility studies for the three sites. The technical cooperation will enhance the implementation of the respective projects and contribute to increased agricultural productivity and production.

The letter from MACO will serve to initiate further discussions among the major partners, and upon which decisions shall be made.

We look forward to your facilitation.



Toshimasa KOBAYASHI

Team Leader

Study for the Formulation for Irrigation Projects in Africa

CC:

Ms. M. Chipiri, Director, Department of Agriculture, MACO
Mr. H. Sichembe, Deputy Director, Department of Agriculture, MACO
Ms. Indira J. Ekanayake, the World Bank Zambia Country Office
Mr. Lewis M. Bangwe, the African Development Bank Zambia Country Office
Ms. Kati Manner, Embassy of Finland, Lusaka, Zambia
Mr. S. Nabeya, Resident Representative, JICA Zambia Office, Lusaka
Mr. Hirofumi Hoshi, Director of Eastern and Southern Africa Division,

MEETING MINUTES BETWEEN MACO AND MR. KOBAYASHI ON FINDINGS AND RECCOMENDATIONS

1. Introduction

A meeting was held on Aug 10 2010 (Tuesday) at MACO between MACO (Department of Agriculture, TSB) and the JICA consultant - Mr. Kobayashi. The purpose was to **obtain MACO's opinions** on the findings and recommendations made during the study "STUDY FOR THE FORMULATION FOR IRRIGATION PROJECTS IN AFRICA: VISIT TO ZAMBIA FROM 11th JULY TO 18TH AUGUST 2010."

Those present were: Mr. Henry Sichembe (Deputy Director), Mr. George Sikuleka (Chief Irrigation Engineer), Mr. Toshimasa Kobayashi, Dr. Akira Sugimoto (MACO advisor) and Mr. Patrick Chibbamulilo (JICA)

2. The findings

Mr. Kobayashi reported that the purpose of the mission was to identify potential areas through which JICA can contribute to the expansion of irrigated area in Africa as promised during TICAD IV in 2008. About 100,000 ha were promised together with doubling rice production in SSA by 2018 under CARD initiative.

During the study the consultant, accompanied by Dr. Sugimoto, Mr. Matsushita and Mr. Chibbamulilo, visited 6 sites of which lists and location are shown in the attached sheet and the observations on each are presented as follows:

- (1) Muvuma Hills site: The site has potential for development into a good project. However, the priority from JICA may be low because it is not clear how the small scale farmers would benefit. The major concern was that large scale farmers, who are not the target for JICA's technical cooperation, may have more influence over water use. However, it is MACO's plan to include this project in the SNDP for development.
- (2) Kaleya Smallholder Scheme: The scheme is an example of a successful model of the Public Private Partnership, whereby a company and smallholders are collaborating to produce sugar. Through the visit the consultant had gained insights of the good practices and there is evidence that it is a good model for replication and up-scaling.
- (3) Kanakantapa site: It was revealed that AfDB and Finland are collaborating to develop this scheme, with AfDB providing a loan and Finland a grant. The dam with a capacity of 25 million m³ can irrigate between 2,000 and 3,000 ha but only 620 ha are planned for development as the first phase. In order to improve the economic viability of the dam, JICA could undertake a feasibility study to bring another 2,000 ha or so under irrigation by carrying out a water balance study for the whole scheme. This was welcomed by MACO, commenting that MACO would prefer a grant for further development after the study. AfDB or Finland, depending on the performance of the first phase, may consider funding implementation of the expansion.
- (4) Mwomboshi: It was observed that time was of essence: WB will appraise the project in November 2010 and hold a meeting for Board Approval in March 2011. Given this timeframe frame, JICA, if collaborating in carrying the feasibility study, will need to commence arrangements (which will be for 2 years) starting this fiscal year. The urgency and design for PPP make this project of high priority. However, MACO indicated that the loan arrangement is yet to be negotiated and hence need to wait until March 2011- this is a critical issues and urgent confirmation with WB is required.

- (5) Lumwana Mine site: There were concerns that the dam could be polluted, being near the mine. It was also felt accessibility by smallholders could be limited. The environmental concerns and restricted accessibility, among other things, make it difficult for JICA to cooperate with a scheme of this nature.
- (6) Kalungu site: a tributary of Chambeshi river, is a good potential site for dam construction with micro-hydro generation, apart from the potential for paddy rice production using dikes. MACO indicated that the site will also be in the investment plan to be included in the SNDP

In view of the foregoing, 3 sites were considered in the order of priority as (1) Mwomboshi, (2) Kanakantapa expansion area, and (3) Kalungu site. The prioritization is agreeable for MACO. However it was flagged that the priorities could change when necessary and that justification for prioritizing should be clear.

3. The way forward

It was sounded that JICA or the consultant could draft a letter annexed with this meeting minutes to highlight the observations and recommendations. Following this, MACO will response by indicating JICA's technical support for the prioritized sites will contribute to the implementation of irrigation of these sites. The type of support by JICA could include feasibility studies and Technical Assistance for capacity building in areas of comparative advantage such as paddy rice growing.

List of Potential Large Scale Irrigation Project Sites

No.	Proposed Project Site	Province District	Present Land Use	Estimated Acreage (ha)	Proposed Water Resources	Present Status
①	Muvuma Hills	Southern Province Mazabuka District	Wheat Coffee Small & Large Scale Farmers	4,600	Water from Kafue River through Pump and Pipeline	Under Pre-F/S
②	Kaleya Small Holder	Southern Province Mazabuka District	Sugar Cane PPP-Small Farmers Company	2,207	Water from Zambia Sugar Main Pipeline through Pipeline	Completed
③	Kanakantapa	Lusaka Province Chongwe District	Small Scale Farmers	620 Potential (2,000)	20m Dam Storage 25 million m3	AfDB/Finland SIP Phse-2 Pre-F/S
④	Mwomboshi	Central Province Chibombo District	Small & Large Scale Farmers	5,000	20m Dam Storage 45million m3	WB IDSP Group-1 Pre-F/S
⑤	Lumuwana Mining	North-western Province Solwezi District	Copper and Uranium Mining	1,000	40m Dam Storage 20 million m3	WB IDSP Group-2 Pre-F/S
⑥	Chambeshi River Flood Plane (Kalungu River)	Northern Province Kasama District	Rice	2,000	20m Dam with Mini-hydro Power 1.5 MW Storage 20 million m3	Newly Proposed by JICA Study Team

Note: Numbers shown in each site correspond to the location map as shown below

Location Map of the Potential Large Scale Irrigation Project Sites



Z-2-2 Reply letter from MACO for approval of priority projects

All correspondence should be addressed to:
The Director of Agriculture
Telephone: Lusaka 252029/253346
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MACO/101/21/2

In reply please quote

No.



REPUBLIC OF ZAMBIA

MINISTRY OF AGRICULTURE AND COOPERATIVES

DEPARTMENT OF AGRICULTURE
MULUNGUSHI HOUSE,
INDEPENDENCE AVENUE
P.O. BOX 50291
LUSAKA

27th September 2010

Mr. S. Nabeya
Resident Representative
Japan International Cooperation Agency (JICA)
LUSAKA



Dear Mr. Nabeya,

RESPONSE TO JICA-CONSULTANT'S PROPOSAL FOR TECHNICAL COLLABORATION ON IDSP PROJECT'S SITES: MWOMBOSHI & KANAKANTAPA SITES

Reference is hereby made to the above subject matter.

I wish to acknowledge, with gratitude, receipt of the letter dated 12th August 2010 in which Japan International Cooperation Agency JICA through its consultant Mr. Toshimasa Kobayashi is requesting for my Ministry's no-objection to technical collaboration between Japan (JICA) and the Government of the Republic of Zambia with respect to the proposed carrying out of irrigation feasibility studies in three specific sites, namely; Mwomboshi, Kanakantapa and Kalungu sites.

As the Mwomboshi and Kanakantapa sites move progressively towards technically advanced stages, the proposed technical collaboration on these two sites would not be ideal as that might be duplicative and disruptive to the current efforts and initiatives by other cooperating partners who are already heavily involved and committed in these two respective sites.

I therefore wish to advise that my Ministry would have no-objection to any possible technical collaboration on the Phase II of the Kanakantapa irrigation scheme development on the remaining 1320 Ha and Kalungu sites including any other sites in group two of the sites already identified under the Irrigation Development and Support Project (IDSP).

Looking forward to your continued support and collaboration in our national development endeavors.



Abedanigo K. Banda, PMP
Permanent Secretary

MINISTRY OF AGRICULTURE AND CO-OPERATIVES

- cc. Indira J. Ekanayake (Mrs.)
Task Team Leader – IDSP
- cc. Mr. Lewis M. Bangwe
African Development Bank (AfDB)
- cc. Kati Manner (Ms)
Embassy of Finland

Z - 3 List of Data/Information Collected in Zambia

No.	Title of Document	Source	File Type	Size	Pages	Remarks
IMPLEMENTATION ORGANIZATION						
PROPOSED KANAKANTAPA IRRIGATION SCHEME-PHASE II						
FARMERS TRAINING(KANAKANTAPA)						
001	Brief Report on Nutrition Levels in Kanakantapa 11th July 08		Word File	A4	1	
002	“Entrepreneurship Development” Module	Ministry of Agriculture and Cooperative (MoAC)	Word File	A4	26	
003	Final Evaluations		Excel File			
KANAKANTAPA DAM-RESSETTLEMENT OF HOUSEHOLDS						
004	ZAMBIA: SMALL SCALE IRRIGATION PROJECT (SIP) IMPACT ON HUMAN SETTLEMENTS OF THE PROPOSED	MoAC	Word File	A4	11	
005	ZAMBIA: SMALL SCALE IRRIGATION PROJECT (SIP) LOCATION OF HOUSEHOLDS WITHIN INNUNDATION ZONE OF PROPOSED	MoAC	Word File	A4	8	
006	ZAMBIA: SMALL SCALE IRRIGATION PROJECT (SIP)LOCATION OF HOUSEHOLDS IN THE FLOOD AREA OF THE PROPOSED	MoAC	Word File	A4	12	
007	ZAMBIA: SMALL SCALE IRRIGATION PROJECT (SIP)FIELD REPORT VERIFICATIN OF SETTLEMENTS WITHIN RESEVOIR BASIN – KANAKATAMPA DAM	MoAC	Word File	A4	5	
KK EIA Meeting with Farmers						
Statistics						
008	20100821 Time Finish support in SIP		PDF File		2	
009	ADB SMALL –SCALE IRRIGATION PROJECT Farmer Training (Partial) Report "Entrepreneurship Development” Module	MoAC	Word File	A4	20	
010	ENVIRONMENTAL IMPACT ASSESSMENT KANAKANTAPA IRRIGATION SCHEME SUBMITTED TO THE SMALL-SCALE IRRIGATION PROJECT(SIP)(F/ZMB/IRG/'01/131)MA/SI/AD/05/02	MoAC	Word File	A4	180	
011	Strategic Environmental Assessment Report for Irrigation Schemes in Zambia	JICA	Word File	A4	162	
012	Kanakantapa Small Scale Irrigation Scheme (map 1:1000)	MoAC	PDF File		1	
013	Proposed dam site in Kanakantapa(map 1:20000)	MoAC	PDF File		1	
014	Report on Land Surveying and Mapping of the Small Scale Irrigation Project (SIP) for Ministry of Agriculture and Cooperatives	University of Zambia School of Engineering Department of Geomatic Engineering	Word File	A4	13	

Z - 3 List of Data/Information Collected in Zambia

No.	Title of Document	Source	File Type	Size	Pages	Remarks
015	APPRAISAL REPORT SMALL – SCALE IRRIGATION PROJECT (SIP) REPUBLIC OF ZAMBIA		Word File	A4	53	
016	Annex 1 Technical Proposal (Terms of Reference) for Grant Support to the Small Scale Irrigation Project (SIP)	AfDB/ Finnish Trust Fund	Word File	A4	8	
017	Zambia: ADB-Small Scale Irrigation Project (SIP)/ZMB/IRG/'01/31Farmers' Training Plan	MoAC	Word File	A4	25	
IRRIGATION PLAN						
AfDB Irrigation Subsector Study						
018	ZMBIA • IRRIGATION • SUB-SECTOR • STUDY 8 July2010-Chapter1-4	ADB	Word File	A4	23	
019	ZMBIA • IRRIGATION • SUB-SECTOR • STUDY 8 July2010-Chapter5-7(2)	ADB	Word File	A4	29	
020	ZMBIA•IRRIGATION•SUB-SECTOR•STUDY-Annexes(12 June 2010)	ADB	Word File	A4	26	
Lmuwana Mining						
021	Zambia – Irrigation Development Project Pre-Preparation Mission November 22 – December 12, 2008	Draft Aide Memoire	Word File			
022	Irrigation Development Support Project Concept Note in Brief		Word File			
023	FAO-GRZ-WORLD BANK Irrigation Development Support Project(IDSP)	LUMWANA MINING COMPANY	Power Point File			
024	Lumuwana Business Sustainability Study, October 2007	LUMWANA MINING COMPANY	Word File			
IRRIGATION WATER RESOURCES and ENERGY DEVELOPMENT						
FAO Agriculture Water						
025	WATER FOR AGRICULTURE AND ENERGY DEVELOPMENT	FAO	Word File	A4	93	
026	map Major Crops_A	FAO	PDF File		1	
027	map Major Crops_B		PDF File		1	
028	Water for Agriculture and Energy in Africa:the Challenges of Climate Change National Investment Profile	FAO	PDF File			
PROJECT PLANS						
029	DRAFT AGRICULTURE CHAPTER SIXTH NATIONAL DEVELOPMENT PLAN (SNDP)	MoAC & MoLFD	Word File	A4	28	
030	Chiansi Irrigation Project:Discussion Paper for the National Consultative Stakeholder Workshop On Joint Ventures And Out-grower Schemes in Zambia		PDF File	A4	13	

Z - 3 List of Data/Information Collected in Zambia

No.	Title of Document	Source	File Type	Size	Pages	Remarks
NATIONAL POLICY						
031	National Agriculture Policy (2004 – 2015)	MACO	PDF File	A4	54	
PPP POLICY						
PPP for Irrigation						
032	Irrigation Development and Support Project(IDSP)		PDF File	A4	2	
033	20100806 PPP in Mwomboshi Irrigation Development IDSP		PDF File	A4	4	
034	Public-Private Partnership Act,2009	Ministry of Finance and National Planning (MoFNP)	PDF File	A4	44	
035	Public-Private Partnership policy(summary)	MoFNP	PDF File	A4	18	
036	PPP options in Irrigation Infrastructure Development and Management	MACO	PDF File	A4	130	
ENVIRONMENT						
Environmental Council						
037	Administration Environmenal Council of Zmbia		MHTML Document			
038	Council Environmental Council of Zambia		MHTML Document			
039	EIA Environmental Council of Zambia		MHTML Document			
040	Enveronmental Protection and Pollution Control(Amendment)Act 1999		MHTML Document			
041	Inspector Environmental Council of Zambia		MHTML Document			
042	List Environmental Council of Zambia		MHTML Document			
043	Preliminary Environmental Council of Zambia		MHTML Document			
044	Water Environmental Council of Zambia		MHTML Document			
045	Water Pollution Environmental Council of Zambia		MHTML Document			
STATISTICS						
Metho-DATA from WEW						
046	KASAMA_Max Temp01001		Excel File			
047	KASAMA_Min Temp01001		Excel File			
048	KASAMA_Rel Humidity01001		Excel File			
049	KASAMA_Rianfall 001		Excel File			
050	KASAMA_Sunshine01001		Excel File			
051	KASAMA_Wind speed01001		Excel File			

Z - 3 List of Data/Information Collected in Zambia

No.	Title of Document	Source	File Type	Size	Pages	Remarks
052	LUSAKA02 (1)001		Excel File			
053	LUSAKA02 (2)001		Excel File			
054	LUSAKA02 (3)001		Excel File			
055	LUSAKA02 (4)001		Excel File			
056	LUSAKA02 (5)001		Excel File			
057	LUSAKA02 (6)001		Excel File			
058	LUSAKA02001		Excel File			
059	MANSA001(Rainfall)		Excel File			
060	MANSA max temp		Excel File			
061	MANSA Min Temp		Excel File			
OTHERS						
062	Zambia Map					

PART – IV
Republic of Mali

Office de Développement Rural de Selingué (ODRS)

1. Projet d'Aménagement et de Réhabilitation de Périmètres Irrigués dans la zone de Selingué

Office de la Haute Vallée du Niger (OHVN)

2. Réhabilitation du Périmètre Irrigué de FANABANA

Office du Périmètre Irrigué de Baguinéda (OPIB)

3. Projet d'Aménagement d'Irrigation du Périmètre de Baguinéda

SEDIZON - Office Riz Ségou

4. Projet d'Appui au Développement Rural de Senankou (PADER-S)

SEDIZON - Office du Niger

5. M'bewani PAPAM

Office Riz Mopti

6. Mopti-Nord
7. Périmètre Irrigué Villageois de NEIMA
8. SOFARA
9. BOUGOULA

Moyen Bani

10. Programme de Développement de l'Irrigation dans le Bassin du Bani et à Selingué site de Bla/San (PDI-BS)

Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI

11. Périmètre Irrigué de Block «B»
12. Bas-Fonds
13. Périmètre Irrigué de Block «G-H»
14. PIV Bakoye



Location Map of the Targeted Study Area

PART-IV MALI

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Part - IV Mali

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GLOSSARY OF ACRONYMS

Acronyms	Orthography
AFD	Agence Française Développement
BAD	Banque Africaine de Développement
BADEA	Banque Arabe pour le Développement Économique en Afrique
BCEAO	Banque Centrale des Etats de l’Afrique de l’Ouest
BID	Banque Islamique de Développement
CAADP	The Comprehensive Africa Agriculture Development Programme
CEDEAO	Communauté Économique des Etats de l’Afrique de l’Ouest
DNGR (DRGR)	Direction Nationale(régionale) du Génie Rural
DNSI	Direction Nationale de la Statistique et de l’Informatique
ECOWAP	La Politique agricole commune de la Cedeao
EIE	Étude d’Impact Environnemental
FED	Fonds Européen de Développement
GIE	Groupement d’Intérêt Économique des Hommes
GIEF	Groupement d’Intérêt Économique des Femmes
kfw	kreditanstalt für wiederaufbau
ODRS	Office de Développement Rural de Sélingué
OERT	Organization des Exploitant pour l’Entretien du Réseau Tertiaire
OHVN	Office de la Haute Vallée du Niger
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal
ON	Office du Niger
OPIB	Office du Périmètre Irrigué de Baguinéda
ORM	Office Riz Mopti
ORS	Office Riz Ségou
PDDAA	Programme Détaillé pour le Développement de l’Agriculture Africaine
PNIA	Programme National d'Investissement Agricole
PNIASA	Programme National d’Invesstissement Agricole et de Sécurité Alimentair
SEDIZON	Secrétaiat d’Etat auprès du Premier Ministre Chargé du Développement intégré de la Zone Office du Niger

Chapter 1 Profile of Irrigated Agriculture in Mali

1.1 Profile of Irrigated Agriculture

1.1.1 Overview

Agricultural sector plays a major role in the national economy employing 75% of the working population and occupying 40% of GDP.

The traditional cereal crops are millet, sorghum and maize, however, consumption of rice recently increases rapidly especially in urban areas. In proportion to the high demand, the production also increased to 760,000 tons as of 2008.

In spite of the incremental production in these years, the production has not yet fulfilled the requirement of 860,000 ton. The shortage of approximately 100,000 ton has been covered up by import from Asian countries.

Total cultivable area is estimated at 2,200,000 ha of which only 500,000 ha or 20% has been developed. The unit yield of paddy can be expected to from 4.0 to 6.0 tons/ha under gravity irrigation condition. However, the unit yields in the paddy fields under rainfed condition or submersion control system, which occupy 80 % of developed fields, are limited in the range from 1.0 to 2.0 ton/ha.

In order to fulfill the self-sufficiency of rice, the Mali government is aiming at the increase of unit yield of paddy through development of gravity irrigation system along the Niger river basin, construction of low-land irrigation system in southern areas, and promotion of the NERICA variety in the rainfed areas.

In addition, increasing of farmland size by new irrigated farmland development is becoming crucial to reduce poverty problem caused by decreasing farmland size with population growth.

1.1.2 Irrigated Agriculture in Mali

Irrigation system is a key factor to make agricultural production stable in a country with scarce precipitation like Mali. Irrigation methods introducing in Mali are as follows.

Table 1-1 Irrigation Method and Area

Irrigation Method	Characteristics of the Method and Area
Natural Submersion (La submersion naturelle)	Extensive agriculture is practicing utilizing natural high water level at flood period without water control structures. Many varieties of paddy are sowed in response to water level in the field. Average unit yield is less than 1.0 ton/ha in general.
Controlled Submersion (La submersion contrôlée)	In the rainy season, normally in September when the river water becomes high, this system takes in irrigation water through control gates. Main and a few secondary irrigation canals are constructed to fill the farm plots with water by flooding. Average unit yield is around 2.0 tons/ha. This irrigation system are widely practicing in the areas of Riz Mopti, Riz Ségou, and along the Bani River.

Fully Controlled Gravity Irrigation (L'irrigation gravitaire en maîtrise totale de l'eau)	This is a full water management system by gravity through controlling structures such as weir, intakes and canals to supply irrigation water to farmlands on schedule and in place. In general, main, secondary and tertiary irrigation and drainage canal networks are organized. The target unit yield of paddy can be 5.0 – 6.0 ton/ha. This system can be found in the following areas. - Niger Office management areas, - Just downstream left bank area of Manantali dam. - Baguinéda Irrigation Project - Just downstream right bank area of Sélingué dam. - Tombouctou Region
Fully Controlled Pump Irrigation (L'irrigation en maîtrise totale de l'eau par pompage)	The pump irrigation system can be found along a river with relatively stable flow. Irrigation and drainage canal networks are normally well organized. The target unit yield of paddy can be expected approximately 6.0 ton/ha. This system exists in the river valley of Niger, Sélingué, and Senegal rivers.
Low Land Irrigation (L'irrigation en aménagement de bas-fonds)	This system is common in west Africa with an average rainfall of more than 1200mm per year. In this method, low height weir will be constructed to dam up the small stream for irrigation to gently sloped area along it. In the irrigation area, many seed varieties suitable for inundated water depth are selected by farmers. Expected unit yield can reach to approximately 3.0 ton/ha. This system will be applicable for the regions of Sikkaso and upstream area of the Manantali Dam.

Source : STRATEGIE NATIONALE DE DEVELOPPEMENT DE L'IRRIGATION (SNDI)

1.1.3 Donors' activities and their future plans

Donors' activities and their future plans revealed through site inspections and interviews are summarized as follows.

(1) World Bank (WB)

World Bank decided to finance the irrigation development in M'Bewani-Papam area in June, 2010. Feasibility study with the study period of two months was scheduled to start soon after the decision making. In addition, WB has been financing various irrigation projects in the Bani river basin of African Development Bank intervention, and the downstream area of the Manantali dam.

(2) African Development Bank (AfDB)

AfDB has been financing the “programme de Développement de L'irrigation dans le Bassin de Bani et à Sélingué” which is in preparation stage of Phase II. In Phase II, new projects will be selected in the upper Niger river basin and downstream area of the Sélingué dam.

Moreover, AfDB supported development of small and medium size pump irrigation schemes in Mopti area through PADER program. In the area of the Niger Office, new large scale sugar-cane project will be launched.

At present AfDB takes a leading role in development from the middle reach of the Bani river to Mopti area.

(3) France (AFD)

AFD has been supporting the Niger Office. However, according to AFD, continuation of the support is not guaranteed in future because of poor management of the Niger Office.

(4) Netherlands

The Netherlands chairs the coordination meeting among donors, the “Secrétariat d’Etat auprès du premier Ministre chargé de Développement Intégré de la Zon Office du Niger”, and the Niger Office for smooth operation and development.

In order to bring common consensus from the viewpoints of environment conservation on development of Niger Interior Delta, which is located at downstream area of the Niger Office, the Netherlands published the study report in 2010. In this manner, the Netherlands takes rather aggressive actions for sustainable development.

(5) Germany

For these 20 years, Germany gave supports to the Niger Office for development of 10,000 ha. In addition, many Bas-Fonds projects have been built up in Dogon for 20 years and Tombouctou for 16 years. Germany has a plan to expand the Bas-Fonds development to Sikkasso region. The government of Mali, DNGR, is expecting the expansion of the projects to Sikkasso and Kurikoro.

(6) Other Countries

Millennium Challenge Corporation initiated large scale irrigation development of 14,000 ha in Kouroumari area of the Niger Office. According to the office for the “Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI”, Spain has been supporting irrigation development in Yelimané area where illegal immigrants to Europe come from.

Islamic development bank, with oil-producing countries such as Kuwait and Saudi Arabia in many cases, have been supporting the projects along the Sénégal river basin and the Bani river basin projects.

1.2 Progress of CARD

As a responsible bureau, “Initiative Riz” was created in the Ministry of Agriculture. The National Rice Development Strategy (NRDS), whose template was agreed on in the first general meeting of the CARD, was formulated in February, 2010.

1.3 Progress of CAADP

On Oct.13, 2009, the contract named “ECOWAP/PDDAA DU MALI” was signed among four parties, namely, Mali government , a Donor group, CEDEAO and AU.

The contract included:

- i) Establishment of coordination committee for a regional development among interested parties

- ii) Implementation of PDDAA through a center approach manner
- ii) Monitoring of progress of the development PDDAA
- iii) Implementation of Agricultural Development Plan formulated based on the LOA announced in 2006
- iv) Implementation of a project by participating with not only government and donors but also farmers' group and other persons related to agricultural business

1.4 National Strategy and Plan Related to Irrigation

The “STRATÉGIE NATIONALE DE DÉVELOPPEMENT DE L’IRRIGATION, 2008 (National Irrigation Development Strategy ”sets the basic objectives as follows:

- Guarantee of food security against the climate change
- Improvement of nutrition conditions especially for the young and women
- Reduction of food import, and Development of crops for export
- Improvement of farmers’ income
- Decreasing the numbers of domestic immigrants from dry area

The NRDS gives the first priority to the development of gravity irrigation projects which would be lowest cost. In this context, the strategy pointed out the low development ratio of 10% in the Niger Office area which can be developed up to 900,000 ha under gravity irrigation system.

Chapter 2 Summary of Discussions with Related Agencies

2.1 Schedules of the Field Study

The project formulation team visited the republic of Mali for 37 days from June 1st to July 7th .

The following table shows the summary of the schedule.

Table 2-1 Schedule of the Field Study

Date	Major Activities
June 2 -3	Meeting : Embassy of Japan, MoA, WB Mali, SECIZON, MoF
June 4 -5	Meeting : Niger Office Site visit to M'Bewani-Papam
June 7- 8	Meeting : MoA, EU Mali, Embassy of Netherlands, AfDB, AFD, kfw
June 9 -26	Site Visit : Irrigation projects
June 28 – July 5	Data/information Collection
July 6	Meeting : MoA, WB Mali, kfw, Embassy of Japan
July 7	Data collection at PNPBBF, Move to Dakar

2.2 Records of Discussion with Governmental Agencies

Ministries and governmental organizations visited during the survey period were as follows.

Table 2-2 Malian Governmental Organization/Agency Contacted

Category	Ministry/Organization
Central Government related to Agriculture	Ministry of Agriculture (MoA) DNGR (Direction Nationale du Génie Rural) SEDIZON
Site Office	Office du Niger Office Riz Ségou, Office Riz Mopti Programme Moyen Bani (PDI-BS), Office de Developpment Rural de Selingué (ODRS), Office du Périmètre Irrigué de Baguinéda (OPIB), Office de la Haute Vallée du Niger (OHVN) Projet de Développement Rural Intégré en Aval du Barrage de Manantali PNPBBF
Other governmental Organizations	Ministre de l'Economie et des Finances Ministre de l'Environnement et de l'Assainissement Direction Nationale de l'Assainissement du Contrôle de Pollution et des Nuisances (DNACPN) Institute National de la Statistique Centre National de la Météorologie du Mali

2.3 Records of Interview with International Organizations

International organizations visited during the survey period were as follows.

Table 2-3 International Agencies Contacted

Agencies	Subject
World Bank Mali	Present status and schedule of the M'Bewani- Pamam Irrigation Development Project Possibility of cooperation between JICA and WB
EU Mali	Present status of the M'Bewani Block D development project, Designed Canal Capacity of TIONGONI
Embassy of Netherlands	Coordination committee for the Niger Office Activities of the Netherlands and possibility of cooperation
African Development Bank	Possibility of co-financing
AFD	Activities of France and possibility of cooperation
kfw	Activities of Germany and possibility of cooperation

Chapter 3 Results of the Site Investigation

3.1 Regional Conditions of Paddy Cropping

The “Stratégie Nationale de Développement de la Riziculture” shows the rice cultivation area by irrigation type.

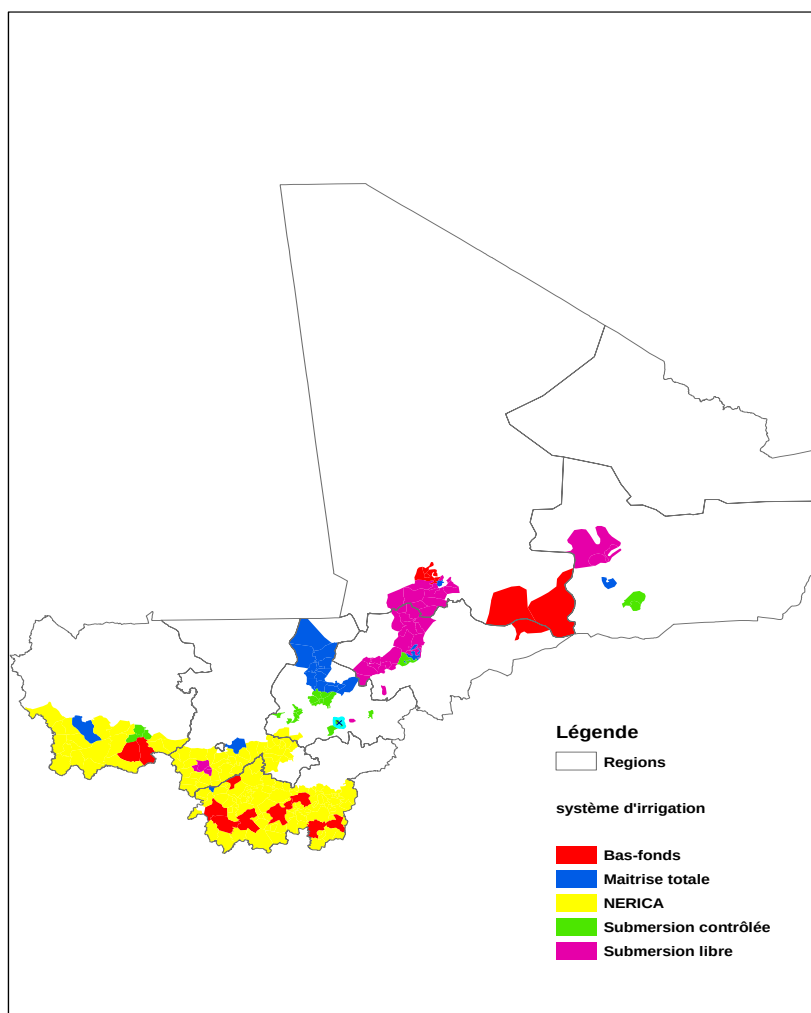
Rice cultivation by fully controlled gravity irrigation (Maîtrise totale) is practicing in blue colored areas on the rice cultivation map. A total area under cultivation of this type is estimated at 125,048 ha with average yield of 6.47 ton/ha as of 2008.

In the green colored areas, the controlled submersion irrigation (Submersion contrôlée) can be observed during flood season. A total area under irrigation by this method is estimated at 74,365 ha with average yield of 2.0 ton/ha as of 2008.

Lowland (Bas-Fonds) irrigation method is dominant in the red colored areas. A total area is estimated at 14,200 ha with average yield of 2.0 ton/ha as of 2008.

The purple colored areas show the natural flooding (Submersion Libre) irrigation zones. A total area is estimated at 251,310 ha with average yield of 0.85 ton/ha as of 2008.

NERICA varieties are introduced in the yellow colored area where rice is grown under rainfed condition. It was reported that unit yield of NERICA was 3.0 ton/ha in 2008 crop season.



Source: Ministère d'Agriculture Secrétaire Général, fév 2009, *STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE*

Table 3-1 Rice Cultivation in Mali

Irrigation Type	Area (ha)	Unit yield 8t/ha)	Production (ton)
Fully Controlled Gravity	125,048	6.47	809,596
Controlled Submersion	74,365	2.00	148,730
Low-Land	14,200	2.00	28,400
Natural Flooding	251,310	0.85	217,447
NERICA	138,050	3.00	414,150
Total	602,297		1,618,323

Source: Ministère d'Agriculture Secrétaire Général, fév 2009, *STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE* , Tableau A 2

3.2 Existing Irrigation Projects

The Ministry of Agriculture set up management offices for the large scale irrigation projects and irrigation projects in some river basins under DNGR. As for the Office du Niger and the Riz Segué, SEDIZON was newly established for integrated management in April, 2010.

(1) Office de la Haute Vallée du NIGER (OHVN)

OHVN is an office located at Bamako to manage 38 irrigation projects with an area of 14,500 ha in the upper Niger river valley from the Guinean border to Bamako.

Until 2002, USAID mainly supported small scale irrigation projects and soft component of rural development. At present, no donor agency intervenes in the valley.

Fully controlled irrigation system by pump is commonly applied. Many of these pump system were constructed in 1980s, and rehabilitation of pump units is urgently required because of serious deterioration.

(2) Office de Développement Rural de Sélingué (ODRS)

ODRS manages the Sankarani and Ouassoulou Balé river basins. Head office is located at Sélingué.

Just downstream area of the Sélingué dam right bank, Sélingué irrigation project was constructed as a compensation for dam construction. The project directly takes in irrigation water from the reservoir through a pipe buried in the dam body. The office has a right to take water of 3 m³/sec, and water volume control is under its management. In addition to the right bank, there are two intake pipes for left bank area. However, these pipes for the left bank have never been utilized.

Within the management area of the office, pump irrigation system introduced dominantly except for the Sélingué irrigation rehabilitation project irrigation rehabilitation project.

(3) Office du Périmètre irrigué de Baguinéda (OPIB)

OPIB was established at Baguinéda village to manage Baguinéda irrigation area of 3,000 ha. From 1987 to 1990, rehabilitation of main canal sections with serious leakage of water and construction of secondary canals were executed by Japanese grant aid.

The Malian government continues rehabilitation of remaining work of the project by utilizing the national budget and support from AfDB.

(4) OFFICE DU NIGER (ON)

ON manages 900,000 ha of potential gravity irrigation area of which 90,000 ha has already developed. Headquarter is located at Ségou and six (6) zone branch offices are set up in each zone.

In order to irrigate left bank of the Niger river, the Markala headworks was built across the Niger river to dam up water level by 5 meter. Irrigation water is conveyed to diversion point named "Poin A" by the head race for distribution among three main canals namely, Sahel, Macina and Costes-Ongoïba.

Historically, many donors have been involved in development and management of ON. For the coordination among these donors and ON, regular meeting is held with the chairmanship of the Netherlands.

(5) OFFICE RIZ SEGOU (ORS)

ORS has jurisdiction over the areas mainly of the Niger river right bank from vicinity of Ségou city to downstream river basin. Head office is located at Ségou in the neighborhood of the ON headquarters, and site office is set up at Dioro village.

In the office area, controlled submersion irrigation method is commonly applied using the Dioro main canal whose intake is located at the upstream right bank of the Markala headworks.

Judging from the location of the intake, dam-up effect of Markala weir can be expected. In this connection, construction works of the improvement project from submersion irrigation to fully controlled gravity irrigation are about to initiate with support from the Islamic development bank.

(6) OFFICE RIZ MOPTI (ORM)

Jurisdictional area of ORM mainly spreads in the vicinity of junction of the Niger river and the Bani river. Head office is located at Sévaré on the national road NO.6.

In the office area, the submersion irrigation is traditionally practiced. However, recently executed rehabilitation projects financed by AfDB such as PADER applied pump irrigation method.

(7) Programme de Mise en Valeur des Plaines du Moyen Bani (PMB)

The site office visited is located at Bla, which was set up by DNGR in response to AfDB's request in order to coordinate the project titled "Programme de Développement de l'Irrigation dans le Bassin du Bani et à Sélingué" led by AfDB. A total of 11 international banks and agencies is concerning with the project.

The office manages the Taro headworks and related irrigation projects. Another site office is scheduled to be built at Djenne for the construction works of Djenne headworks and irrigation projects.

The project stage is Phase I. In this phase, it was scheduled to construct 2 headworks namely Taro and Djenne. Construction work of the Taro headworks was completed. Unfortunately, starting construction work of the Djenne headworks delays for 3 years as a result of local opposition. The work will be commenced within this year.

As for Taro area, intake volume of irrigation water is limited to 6% of total river flow even in flood period to coordinate water rights between downstream water users.

In the Bani river basin, controlled submersion irrigation is dominant.

(8) Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI

The project office located at Bamako manages the Bafing river and the the Sénégal river basins within Mali. The Bafing river originated from the Manantali Dam, and changes its name into the Sénégal l river after joining the Bakoye river.

In addition, the river valley from Yelimane to Kayes is under the office's jurisdiction.

Fully controlled gravity irrigation project is only Manantali B area which is given as a compensation of reservoir construction, and remaining areas are under pump irrigation.

(9) Others

There are various middle and large scale projects in Tonbouctou and Gao areas, which are managed directly by DNGR.

Tonbouctou Area	: Projet D'appui au D'veloppement Rural des Plaines de DAYE, HAMADJA et KORIOUME Projet de Développement Agricole Intégré de la Plaine de SAOUNE
Gao Area	: Projet de Développement Rural du Cercle D'ANSONGO

3.3 Potential Irrigation Area Selected by the Government

During the site investigation trip, irrigation projects requested by the management offices were visited as potential projects.

Tombouctou and Gao areas, where the Niger river flows through, were not visited because of security reason.

(1) Niger River (From upstream to downstream basin)

1. Office de Developpment Rural de Selingué (ODRS)
Projet d'Aménagement et de Réhabilitation de Périmètres Irrigués dans la zone de
Sélingué
2. Office de la Haute Vallée du Niger (OHVN)
Réhabilitation du Péremètre Irrigué de FANABANA
3. Office du Périmètre Irrigué de Baguinéda (OPIB)
Projet d'Aménagement d'Irrigation du Périmètre de Baguinéda
4. SEDIZON - Office Riz Ségou
Projet d'Appui ay Developmnet Rural de Senankou (PADER-S)
5. SEDIZON - Office du Niger
M'bewani PAPAM
6. Office Riz Mopti
Mopti-Nord
Périmètre Irrigué Villageois de NEIMA
SOFARA
BOUGOULA

(2) Bani River Basin

Programme de Développement de l'Irrigation dans le Bassin du Bani et à Sélingué site de Bla/San (PDI-BS)

(3) Sénégal River Basin

Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI

Périmètre Irrigué de Block «G-H» Périmètre Irrigué de Block «B»

Results of site investigation of these potential projects are summarized in project sheets attached in ANNEX1. As for the projects in the Bani river basin, there is no request for additional development.

Chapter 4 Potential Development Area

4.1 Criteria for Selection of Targeted Development Areas

The following criteria are adopted for selection of Priority project

- Possibility of Cooperation with World Bank and Donors
- Compatibility with National Policy
- Intention of Malian Government
- Urgency and Necessity
Deterioration of facilities, Request by Farmers
- Stability of Water Source
- Operation and Maintenance Organization, Easiness of Maintenance
- Present Status of Farmers' Organization and Activities
- Accessibility to markets
- Others : Difficulty of land acquisition

4.2 Development Scheme for Targeted Development Areas

A total of 12 candidate projects were identified by the team or requested by the agencies concerned during the site inspection period. The following table 4-1 shows priority ranking of the candidate projects as a result of the study conducted applying the criteria. The study results and process are summarized in the Table 4-2.

Table 4-1 Priority of Candidate Projects

Priority	Project Title	Implementing Agency	Remarks
1	M'Bewani – PAPAM Irrigation Project	ON	Gravity irrigation system High possibility of cooperation with WB
2	Sélingué Irrigation Rehabilitation Project	ODRS	Gravity irrigation system Most deteriorated project among gravity irrigation systems
3	Baguinéda Irrigation Rehabilitation Project	OPIB	Gravity irrigation system Rather good condition of facilities Financing of AfDB is on-going.
4	Manantali B Area Improvement Project	PDRIABM	Gravity irrigation system Rather good condition of facilities Water source is limited.
5	Bas-Fond (Lowland) Irrigation Project	PNPBBF	kfw involvement Effective by small investment
6	Senankou Irrigation Development Project	ORS	Controlled Submersion system High demand by farmers
7	Mopti Nord Irrigation Rehabilitation Pro.	ORM	Controlled Submersion system Good accessibility
8	NEIMA Village Irrigation Rehab. Project	ORM	Small village pump scheme Detailed design had completed
9	FANABAN Irrigation Rehab. Project	OHVN	Pump Irrigation, Located near Bamako High urgency
10	SOFARA Irrigation Extension Pro.	ORM	Controlled Submersion system Difficulty in consistency with existing project
11	BOUGOULA Irrigation Rehab. Project	ORM	Controlled Submersion system Poor accessibility
12	Manantali G – H Area Development Pro.	PDRIABM	Pump Irrigation scheme Poor quality of completed sections

Table 4-2 Study of Candidate Projects (Republic of Mali)

	Candidate Project	Project Site	Budget (million US\$)	Implementing Agency/ Donors	Present Status/ Progress	Objectives and Outcomes			Input	Basic Condition										Advantages	Concerns
						Irrigation Area (ha)	Target Crop	Unit Yield		New /Rehabilitation/ Improvement	Irrigation methods Facilities at water source	Cooperation with WB / Donors	Consistency with National Policy	Urgency	Water Source	Operation and Maintenance	Farmers' Organization	Accessibility			
1	M'bewani - PAPAM Irrigation Project	60 km to the North from Ségou No. 5 on Map	36.9	World Bank ODN	Pre – F/S On-going	4,900	Paddy	5 - 7 t/ha	Construction of irrigation canal network, Main drainage canal, Social Infrastructures	New	Gravity, Fully Controlled	☉	☉ WB	☉	☉	☉	☉	☉	☉	Good conditions of major facilities Investment by WB and WU are on-going. Combined effect of these investment can be expected.	No existence of social infrastructures How to maintain the quality of new immigrants' lives will be a task.
2	Selingué Irrigation Rehabilitation Project	Just Downstream of Dam No. 1 on Map	23	ODRS	Under Operation	Existing 1,500 Expansion 72 New 794	Paddy	-	Lining of Main Canal Extension of 72ha New Development of 794 ha along left bank	Rehabili- -tation	Gravity, Fully Controlled	☉	×	○	☉	☉	○	○	○	Stable water supply is possible by Sélingué Dam	New development area will be much smaller than estimate because of energy losses of water. Deterioration of Drainage pump will damage the production.
3	Baguinéda Irrigation Rehabilitation Project	20 km to the West from Bamako No. 3 on Map	26.4	OPIB / AfDB	Under Operation	3,000	Paddy	-	Lining of Secondary Canals	Improve- -ment	Gravity, Fully Controlled	☉	×	○	○	○	○	○	☉	Vicinity of the Capital Bamako The project was rehabilitated by Japanese Grant aid in 1990s. Main facilities are in good condition.	It is reported that water losses from secondary canals are high. The cause should be examined from various viewpoints including water management.
4	Manantali B Area Improvement Project	Manantali Dam No. 11 on Map	2.9	PDRIABM	Under Operation	682	Vegetable Paddy	-	Lining of Secondary Canals Land Leveling	Improve- -ment	Gravity, Fully Controlled	☉	×	○	○	○	○	○	×	Stable water supply is possible by Manantali Dam	Available water is limited by the capacity of intake pipe. Change of the cropping pattern to paddy should be carefully examined.
5	Bas Fond (Low Land) Irrigation Project	Sikasso Rigion	-	PNPBFF / kfw	Under Operation/ Construction	10 - 100	Paddy Sorghum Millet Vegetable	-	Weir Construction Access Road Const. Farm land Consolidation	New	Gravity Controlled Submersion	○	×	○	○	△	○	○	×	Japan has supported PNPBBF for many years through. Low-land irrigation method is common in West Africa.	Scattered locations of projects Suitable site is limited to the area with rainfall of more than 1,200m. Cooperation with gtz & kfw will be necessary.
6	Senankou (PADER-S) Irrigation Development Project	Near Ségou No. 4 on Map	-	ORS	Concept Stage	1,000	Paddy	2.0 t/ha	F/S	New	Gravity Controlled Submersion	○	×	△	○	○	○	○	△	Strong request of farmers	The system may suffer water shortage from execution of upstream rehabilitation work. Concept should be reconsidered.
7	Mopti Nord Irrigation Rehabilitation Project	Near Mopti No. 6 on Map	-	ORM / AfDB	Construction of 200ha by AfDB	1,500	Paddy	Target 2.0 t/ha, Actual 1.5 t/ha	Rehab. of Main Canal & Intake Const. of Secondary canals & Pump station	Rehabili- -tation	Gravity Controlled Submersion, Pump Station	△	×	△	○	△	△	△	☉	Good location near Mopti Low investment Cost for large area development	High sedimentation rate by flood water Low unit yield
8	NEIMA Village Irrigation Rehabilitation Project	Near Mopti No. 7 On Map	0.45	ORM	Detailed Design Completed	80	Paddy	-	Reconstruction of canals Construction of Dyke	Rehabili- -tation	Pump Irrigation	×	×	△	○	△	△	△	△	-	High possibility of damage by flood
9	FANABANA Irrigation Rehabilitation Project	Near Bamako No.2 on Map	2.26	OHVN	Pre-FS	500	Paddy	-	F/S	Rehabili- -tation	Pump Irrigation	×	×	△	○	○	△	△	○	Installation of small pumps by 2KR in 2000 Good location near Bamako	High possibility of damage by flood due to low installation level of pump control unit
10	SOFARA Irrigation Extension Project	Middle Reach of Bani river No.8 on Map	-	ORM / AfDB	Concept Stage	-	Paddy	2.0 t/ha	F/S	New	Gravity Controlled Submersion	○	×	△	△	△	△	△	○	-	Difficulty of project design because of newly completed SOFARA rehab. project
11	BOUGOULA Irrigation Rehabilitation Project	Middle Reach of Bani river No.9 on Map	-	ORM	Concept Stage	-	Paddy	2.0 t/ha	F/S	Rehabili- -tation	Gravity Controlled Submersion	○	×	△	△	△	△	△	×	-	Poor accessibility
12	Manantali G-H Area Development Project	Downstream Reach of Manatali No. 13 on Map	-	PDRIABM	Interruption of Const. Works	870	-	2.0 t/ha	Construction of Canal Network	Const.	Pump Irrigation, Pump station	×	×	△	○	○	△	△	△	-	Assessment of completed construction works is required. High possibility of quality problems of completed canal and pump works

Chapter 5 Selection of Targeted Area

5.1 Rationale for Selection of Targeted Development Areas

As a priority project, the M'Bewani – Papam Irrigation Development Project is selected because of the following reasons.

- 1) Possibility of cooperation with WB : Possibility is high.
World Bank Mali welcomes JICA cooperation to the development of 4,400 ha due to lack of fund for full area development of 4,900 ha. WB is schedule to conduct F/S for 4,900 ha and execution of construction work of 500 ha.
- 2) Consistency with national Policy : Project is located at highest priority area.
Development of M'Bewani Papam area corresponds to the basic objectives of irrigation development such as guarantee of food security , reduction of food import and improvement of farmer's income.
The "National Rice Development Strategy" gives first priority to irrigation development in the Niger Office area as a sustainable production area.
- 3) Intention of Mali Government :
Mali government has a strong intention to develop the Niger office area expecting huge potential of land and water resources.
- 4) Urgency and Necessity : The project is strongly requested by farmers.
According to farmers in the M'Bewani zone, farm size is small, 0.4 ha/farmer on an average. The number of farmers who can't pay water charge is increasing due to low income caused by small land size. Consequently, farmers have strong will to expand farm land size.
- 5) Stability of Water Source : Water source is stable in rainy season.
Water source is the Niger river. The Costes-Ongiba canal as a main canal has an enough capacity to irrigate the project by gravity.
- 6) O&M Organization : Well organized
M'Bewani zone office was established in 2007. The office conducts O&M activities together with farmers' organization by deciding each assignment of work.
Water charge is collected in reliable manner through farmers' organization.
- 7) Preset Status of Farmers' Organization and Activities : Organization is progressing.
Farmers' organizations exist in the vicinity areas. In the target area, farmers' organization would be established based on the existing one.
- 8) Accessibility : Good accessibility
The project site is located within one hour drive distance. National road No.6 connects Ségeu city with Capital Bamako and Mopti city. The access roads are paved.
- 9) Others : No land acquisition problem because of land ownership under the Niger office

5.2 Present Status of the M'Bewani - Papam Irrigation Development Project Area

5.2.1 Organizational Setup for Operation and Maintenance

(1) Niger Office (Office du Niger) (Office de Riz Segué)

The Niger Office has full responsibilities for operation and management of the project facilities.

The history of the Office goes back to 1932. After independence of Republic of Mali in 1961, the management of the Office area was transferred to the Niger Office under Malian government control. In 1994, the Niger Office was reorganized to improve management capacity introducing a new concept of commercialization.

From April, 2010, the supervising authority was changed from the Ministry of Agriculture to SEDIZON. (Secrétariat d'Etat auprès du Premier Ministre Chargé du Développement intégré de la Zone Office du Niger)

The headquarter is located at Ségou. The management area of the Office is divided into six (6) zones as shown below.

Table 5-1 Niger Office

Zone	Irrigation Area(ha)			Staff*4			
	Management area *1	Out of development area *2	Total *3	Total	Canal management	Gate Operator	Extension Worker
Macina	18,187	2,137	20,324	79	18	3	12
Molodo	8,498	8	8,506	52	8	2	6
Niono	-	-	15,096	72	20	3	6
N'Débougou	11,757	1,205	12,782	64	16	5	6
Kouroumari	14,189	1,027	15,216	71	13	5	7
M'Bewani	9,746	6,908	16,654	69	13	4	10
Headquarter Segué	-	-	-	179	-	4	-
Total			88,578	584	88	26	47

Source: *1, Office du Niger

*2, Calculated deducting value *1 from value *3

*3, Adama SANGARE, mars 2010; *PROJET SUCRIER DE MARKALA, RAPPORT PROVISOIRE «ÉTUDE RELATIVE A L'ETABLISSEMENT D'UN BILAN DES RESSOURCES EN EAU AU DROIT DE LA ZONE DE L'OFFICE DU NIGER»* page 3, BAD

*4, Office du Niger, *Liste du Ppersonnel de l'office du Niger à la date du 31 mai 2010*

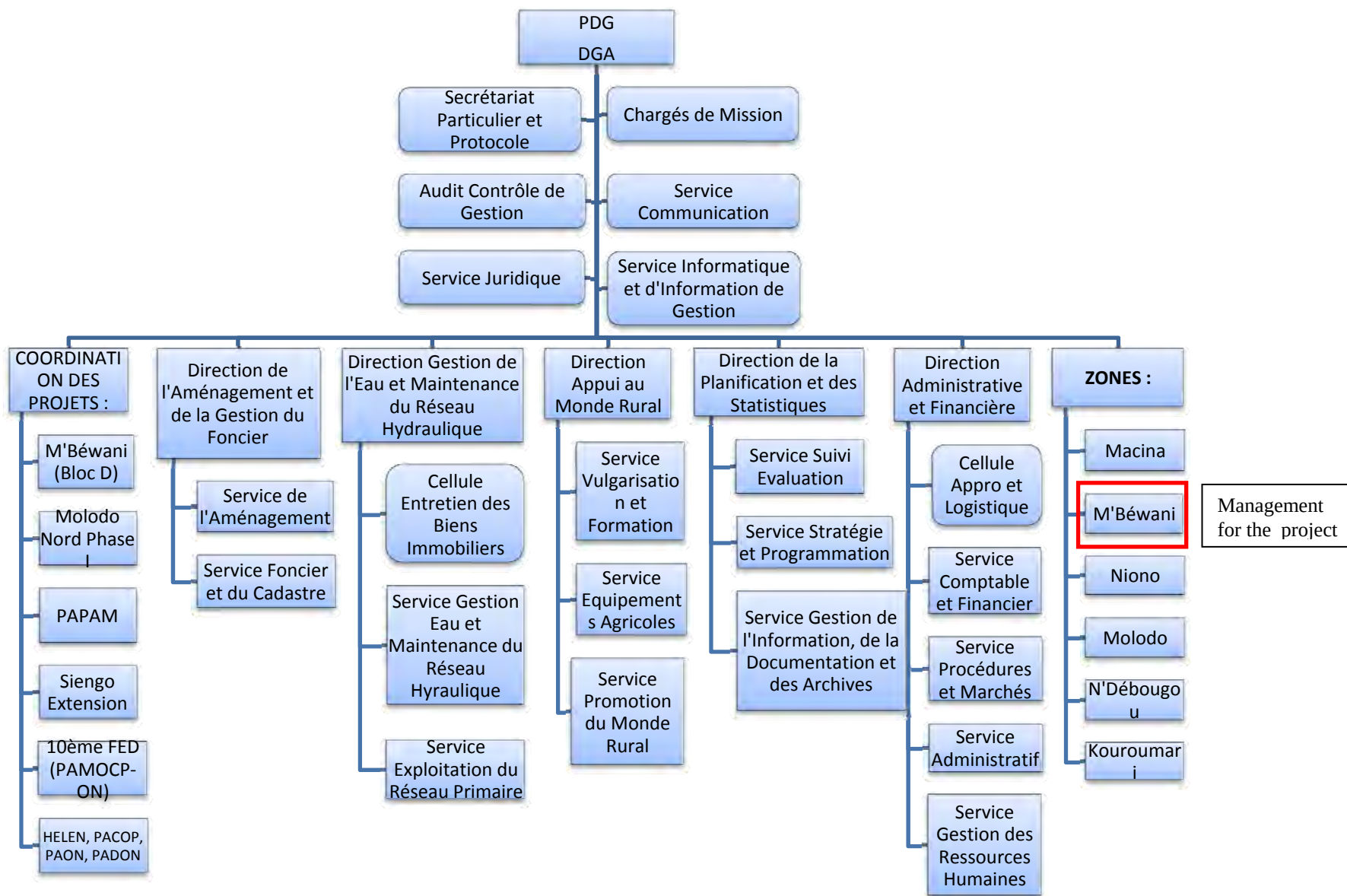
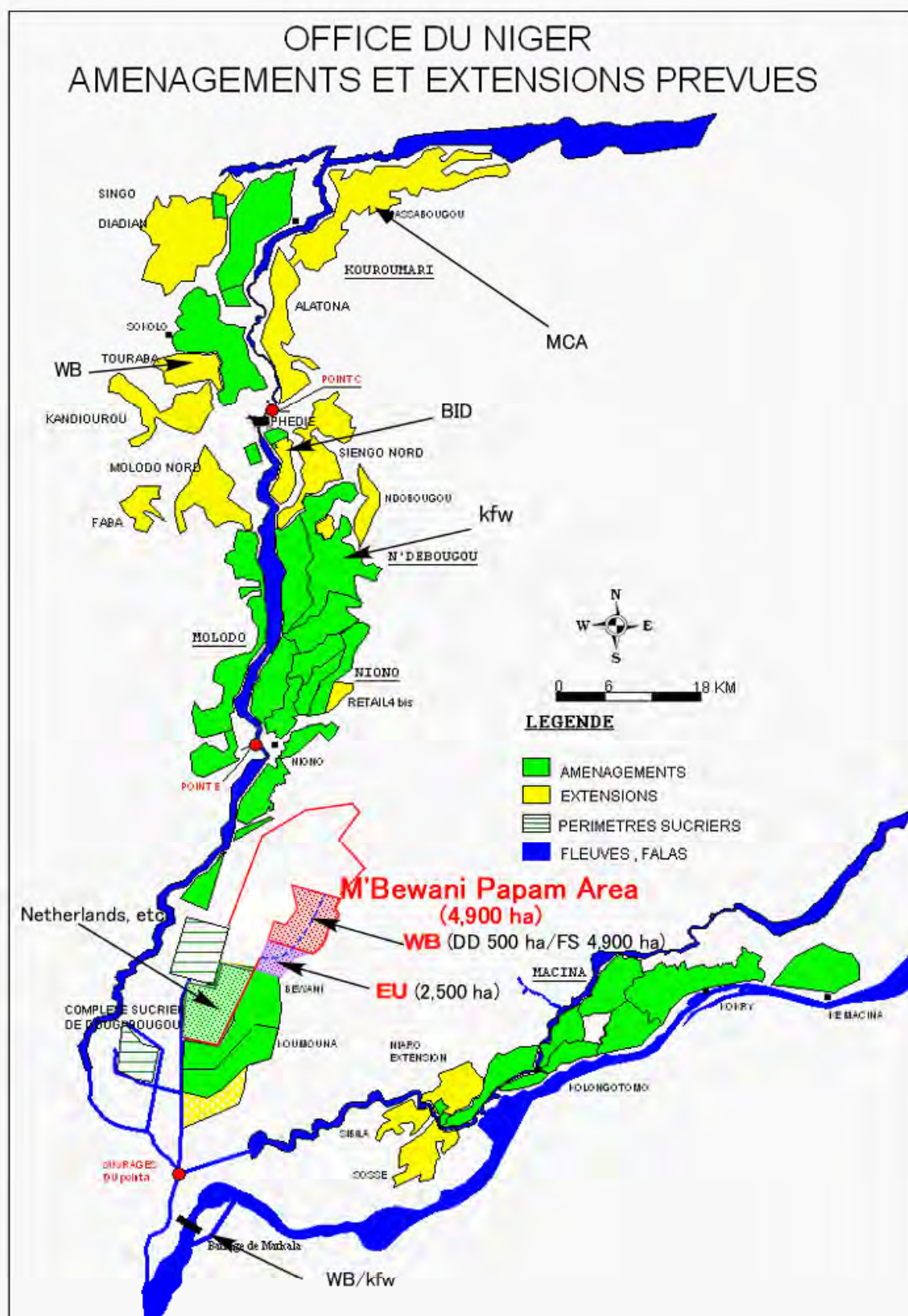


Figure 5-1 Organization Chart of the Niger Office (Office du Niger)

Source : Office du Niger, 2010



Source: "TRANSTEC, Décembre 2008, *Etude d'impact Environnemental du project d'aménagement du casier D de M'Bewani, UE*"
Arranged by the Study Team

Figure 5-2 Location Map of M'Bewani Papam Area

(2) Water Management and Maintenance of Canal Facilities

Development of the M'Bewni zone was initiated by participated approach in 1997. Beneficiaries took part in land reclamation, construction of field ditches and levees, and land leveling. The contribution of beneficiaries accounted for 20 % of the construction cost.

In 2007, new zone office named M'Bewani was set up at Markala to manage the zone and to accelerate development. Water management and maintenance units are created in the Office.

The water management unit prepares the annual O&M program (Programme annuel d'entretien des infrastructures hydrauliques) every year, and collects water fee from farmers for O&M work. As for O&M for secondary canals, CPGFERS, which is a farmers' organization established in response to the new management system created in 1994, takes responsibility. The cost for secondary O&M is provided with the amount of 50 % of the water fee collected. O&M of tertiary system is conducted by farmers with a technical assistance of ON/CPGFERS.

Farmers acquire a right for cultivation from the CPGT, which is also farmers' organization under zone office, by making payment of water fee for last crop season before starting new crop season. With this manner, collection rate reaches to almost 100 %.

However, the payment of water fee is demanded uniformly whether the production is good or not. For this reason, some marginal farmers fail to pay it. These failed farmers can't acquire a right of cultivation in next season, and they become landless. According to the representatives of farmers, the number of these landless farmers reached 25 household in vicinity two villages, and is increasing year by year.

5.2.2 Outline of Extension Services

Agricultural counselors (Conseiller Agricole) assigned to each zone are charged with extension services.

On-site trainings are carried out three to four times a year.

There is a residential area for counselors in the vicinity of the intake structure of M'Bewani distributor. In addition, site offices are stationed in the production area for smooth contact with farmers.



A distant view of Site Office

5.2.3 Farmers' Organization

Several farmers organizations have been established in response to the system changes.

Since 1984, AV (Les Associations villageoises) has been organized. In order to promote organization of farmers, GIE (Groupement d'Intérêt Economique des Hommes) and GIEF (Groupement d'Intérêt Economique des femmes) have been established against degeneration of AV since 1991.

For purposes of maintenance of secondary canal system, above mentioned CPGFERS was set up in the M'Bewani area. The maintenance of new development area would be executed by this existing organization by adding two or three new staff.

OERT (Organization des Exploitant pour l'Entretien du Réseau Tertiaire) would be newly organized for O&M of tertiary canals. This OERT hasn't been well organized in M'Bewani zone because of new establishment of zone office in 2007.

Table 5-2 Farmers' Organization in M'Bewani Zone

Total No. of Village	AV	GIE	GIEF	Cooperative
62	35	39	28	15

Source: ON Zone de M'Bewani, *Physionomie de la Campagne*, 2009 – 2010, mars 2010

5.2.4 Crop Production

At present, rainfed Millet and Sorghum are dominant crops in the proposed development area. However, after constructing irrigation network, the cropping pattern would probably change to a similar pattern to practicing one in vicinity irrigated area.

In the 2009-2010 crop season, rainy season paddy covered 13,102 ha, which comprised the management area of 10,766 ha and the outside area of 2,336 ha. Average unit yield in the management area was 6.12 ton/ha and a total production reached to 78,618 ton.

The following table shows the farmland area and production record of each crop grown in the rainy season.

Table 5-3 Crop Production in 2009 - 2010 Rainy Season in M'Bewani Zone

	Paddy within Zone	Paddy Outside Zone	Minor Cereals (millet, Sorghum)	Corn	Sweet Potato	Okra	Egg Plant
Planted Area (ha)	10,766	2,336	21	4	5	3	2
Unit Yield (ton/ha)	6.12	5.45	1.5	3.5	30	9	10
Production (ton)	65,887	12,731	32	14	150	27	20

Source: ON Zone de M'Bewani, *Physionomie de la Campagne*, 2009 – 2010, mars 2010

According to the production plan, 2,227 ha of paddy and 1,132 ha of vegetable were scheduled to be cultivated in dry season. As actual results at the end of February 2010, paddy area was 207 ha and vegetable was 1,188 ha respectively. A breakdown of cultivated areas in dry season is shown below.

Table 5-4 Crop Production in 2009 - 2010 Dry Season in M'Bewani Zone

Crop	Harvested area (ha)	Crop	Harvested area (ha)
Paddy	207	-	-
Vegetable	1,188		
Eschlot	841	Cabbage	32
Tomato	114	Okra	30
Potato	102	Corn	20
Others	49	-	-

Source: ON Zone de M'Bewani, mars 2010, *Physionomie de la Campagne*, 2009 – 2010

5.2.5 Marketing and Distribution System

The project area is located within one hour drive distance from Ségou, the second largest city in Mali. Ségou city is located at 235 km to the east-southeast from the capital Bamako. The project area has an advantage in distribution of agricultural products because of the national road No.6 which connects Ségou to Bamako and the 3rd largest city of Mopti.

5.2.6 Land Tenure and Land Use

Every crop season, CPGT gives farmers a right to cultivation under the control of M'Bewani zone office. To private companies or persons, the farmlands are rented with the condition that the private cultivator should develop irrigation and drainage facilities within the area by himself.

For a purpose of sugar production, farmlands of 5,500 ha was rented to N-SUKALA that is a joint financing company of Mali and China. In addition, a farmland of 1,000 ha was rented to COVEC of Chinese private company with a 30-years contract.

5.2.7 River Discharge

Study team of SOGREAH/BECEOM/BETICO estimated river discharge of the Niger river at Markala weir site as a result of analysis of discharge data from 1957 to 1997 observed at the Koulikoro gauging station. Judging from this study result, there would be no water source problem during the rainy season because of low use rate of less than 10% in total river flow.

During the dry season from February to June, however, there would be no room for rice cultivation in newly development area in consideration of river maintenance flow of 30 m³/s for downstream use. In the dry season, crop diversification excluding rice would be necessary in order to increase farmer's income.

Table 5-5 Estimated River Discharge at Markala (unit : m³/sec)

Discharge at Koulikoro (1957-1996)	Drought	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	10 years'	131	62	29	16	34	104	468	1923	3210	2303	859	319
	5 years'	147	77	37	24	43	122	537	2055	3518	2465	981	374
	2 years' possibility	230	127	64	44	74	204	792	2525	4373	3299	1475	570
Effect of Sélingué Dam		32	33	64	101	77	102	30	-357	-378	-87	-26	33
Losses between Koulikoro and Markala		-12	-11	-11	-10	-5	-1	-5	0	-5	-11	-18	-24
Evaporation		-27	-30	-37	-38	-38	-31	-24	-20	-19	-23	-26	-25
Average flow at Markala		223	119	80	97	108	274	793	2148	3971	3178	1405	554
Intake Volume		55	55	59	62	79	82	72	85	124	127	98	55
Rate of Intake in %		25	46	74	64	73	30	9	4	3	4	7	10

Source: Tidiani TORAORE - Office du Niger, oct 2005, *Présentation Technique de la Zone Office du Niger*

5.2.8 Unit Water Requirement and Water Source in the Project Area

The Niger Office stipulates the unit water requirements in the norm as shown below.

Table 5-6 Unit Water Requirement

Irrigation Water Requirement		Drainage Water Requirement	
Secondary Canal (Distributeur) :	2.4 l/ha/s	Drainage Area 0 - 50 ha	1.8 l/ha/s
Tertiary Canal (Partiteur) :	2.0 l/ha/s	Drainage Area 51 - 1000 ha	1.4 l/ha/s
Field Ditch (Arroseurs) Rainy Season	1.8 l/ha/s	Drainage Area 1001 - 5000 ha	1.0 l/ha/s
	Dray Season 2.0 l/ha/s	Drainage Area 5001 ha -	0.5 – 0.8 l/ha/s

Source : Office du Niger, *NORMES TECHNIQUES D'AMÉNAGEMENT A L'OFFICE DU NIGER*

The following table calculates maximum irrigable areas of each main canal at peak water demand of 2.4 l/s.

Table 5-7 Canal Capacity of 3 Major Canals

水路	Maximum (m3/s)	Water Losses (m3/s)	Available Discharge (m3/s)	Maximum Irrigable area at Peak water demand of 2.4 l/s
Head Race	240			100,000
Main Canal				
Sahel	110	11.00	99.00	41,250
Macina	75	3.75	71.25	29,688
Costes Ongoïba	48	1.25	46.75	19,479
Total of Main Canal			217.00	90,417

Source : Tidiani TORAORE - Office du Niger, oct 2005, *Presentation Technique de la Zone Office du Niger*

Irrigable Area in the Rainy Season

The M'Bewani zone belongs to Costes Ongoïba Main Canal. The maximum irrigable area of the zone is estimated at 19,479 ha at peak demand time. The peak commonly occurs in dry season. The water demand in the rainy season would be 10% lower than the peak as shown in the Table 5-6. Taking these into consideration, irrigable area in the rainy season would be approximately 21,500 ha.

Irrigation Area at Present

On the other hand, existing cultivated area in the zone is 16,654 ha as shown in Table 5-1. This total area includes the N-SUKALA area of 5,500 ha whose intake structure is constructed on the Sahel canal. Therefore, actual irrigation area covered by the Costes Ongoïba canal would be around 11,000 ha. By the way, the actual cultivation records of 2009-2010 crop season got a summed up figure of 13,000 ha which includes the outside of management area of 2,300 ha.

Additionally Irrigable Area

If we add the new M'Bwani Block-D area of 2,500 ha to this area of 13,000 ha, the irrigation area of the Costes Ongoïba canal would be 15,500 ha. Now, the irrigable area in the rainy season would be 21,500 ha as calculated above. Therefore, additionally irrigable area would be 6,000 ha.

Irrigable area in the rainy season		Irrigation area at present		Additionally Irrigable Area
21,500 ha	-	15,500 ha	=	6,000 ha

The development area is 4,900 ha in the M'Bewani-Papam. The area is smaller than the additionally irrigable area of 6,000 ha. This calculation shows that the proposed project would be able to receive irrigation water without improving the existing Costes Ongoïba canal.

Moreover, the irrigable area is calculated on the condition that cultivation would start at the same time in whole area. Commonly, water demand would decrease after planting. Actually, this situation would not happen because of limitation of manpower and machinery.

In conclusion, the project would have more allowance in water use, and no problem in water source in the rainy season.

5.2.9 Soils

Soil survey was carried out in the Block- D area. The survey results are described in the following reports.

"AHT GROUP AG et BETICO, juin 2009; RAPPORT DÉFINITIF DE L'ÉTUDE D'AVANT-PROJET DÉTAILLÉ DU CASIER DU BLOC "D" DE M'BÉWANI, VOLUME 1: ÉTUDES TECHNIQUES, UE"

As a result, the project area was categorized into three zones, namely paddy zone 75 % of a total area, vegetable zone 15% , and fruit tree zone 10 %, in consideration of salinity and permeability of soil. The soil condition of the proposed project area would be similar to the Block-D. Consequently, there is a possibility of existence of sandy soil. Soil survey should be carefully conducted to find suitable crops.

5.2.10 Basic Infrastructures such as Electricity and Communication

There exists two villages in the project area. Basic social infrastructures such as electricity, water distribution system, health center, school are not developed.

The only public infrastructure is a multipurpose well constructed by farmers.

5.2.11 Management and Maintenance in Vicinity Area

There are no existing irrigation and drainage facilities in the project area. After construction of irrigation and drainage facilities, the same maintenance system as upstream area would be applied. The existing O&M is explained in 5.2.1.

5.2.12 Environmental Considerations

The proposed project is categorized as A in the Malian standard which requires EIES "d'Impact Environmental et Social".

5.2.13 Cooperation with Donors

The project was approved by the Board meeting of WB in June, 2010. Continuously, a feasibility study for the area of 4,900 ha in two months period and then the detailed design for the area of 500 ha in 5 months period were scheduled to be conducted.

Since the two months period seems to be rather short to conduct a feasibility study for an area of 4,900 ha, the result of F/S would need to be examined about the following points.

- Preparation of topographic map: Covering area, scale
- Soil survey result
- Plan of social infrastructure
- Selected irrigation area for Detailed Design

5.2.14 Other Concerns

Labor force in two existing villages is not sufficient to cultivate the whole project. Consequently, it would be necessary to receive immigrants from outside, and to construct social infrastructures for them in order to guarantee a quality of life.

The farmers requested the following infrastructures at the meeting in the M'Bewani area.

- Health Center
- School
- Trunk Road
- Drinking water supply
- Playground for youth
- Household vegetable garden

5.3 Project Plan of the M'Bewani - Papam Irrigation Development Project

5.3.1 Project Component

Location of the project area of 4,900 ha is indicated with red color on the map on the right.

The Tiogoni branch canal that is branched off from the M'Bewani distributer canal would supply irrigation water to majority of the area. This canal is also supply irrigation water to the Block D area of 2,500 ha, indicated with blue color on the map.

The Block-D is scheduled to commence construction in 2010 by EU financing.

In the project area, one main canal and two main drainage canals are scheduled to be constructed.

They are Tigon branch irrigation canal with blue color, Tango main drain with orange color, and Kalankorola main drain with orange color, respectively.

Tertiary network construction and land consolidation works should be conducted.

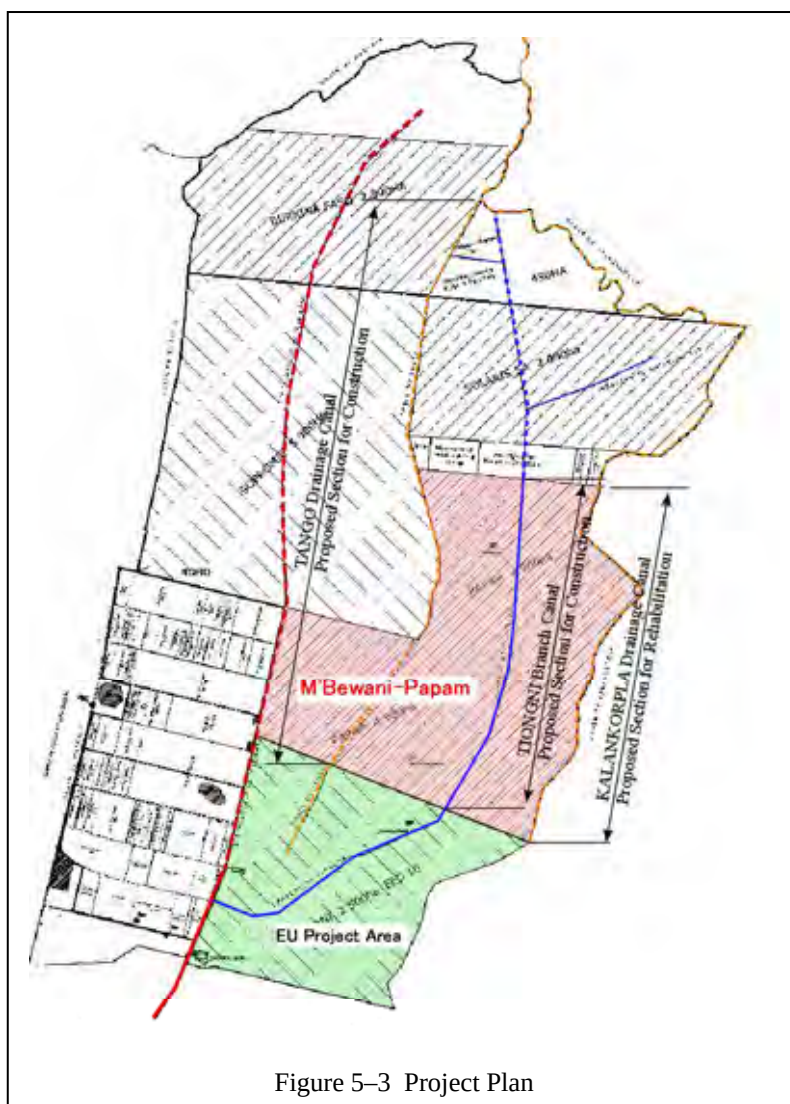


Figure 5-3 Project Plan

Estimate work volume of these construction works are itemized as follows.

Main Irrigation Canal (Tiongoni Branch)	: 8.1 km (9.5 m ³ /s)
Main Drainage Canal (Tango)	: 17.0 km
Main Drainage Canal (Kalankorola)	: 10.0 km
Tertiary canal network	: 4,400 ha
Land Consolidation, Field canal network	: 4,400 ha
Social Infrastructures	: 800 families
(School, Health Center, Trunk Road, Well, Playground)	

5.3.2 Estimated Project Cost

The exchange rate used in this estimate is as follows.

US\$ 1 = Yen 85, Euro 1.0 = 655.957 FCFA= Yen 115

(1) Estimate of Irrigation Development Cost

Direct construction cost of irrigation related facilities is estimated based on the cost estimate of the Block D in 2009 in consideration of similarities in topographic conditions and project components. Development area would be 4,400 ha excluding WB area of 500 ha.

Table 5-8 Cost Estimate of Canal Relate Work

(unit: FCFA)

Cost Component	Unit	EU estimate	Unit Rate	Q'ty	Amount	Remarks
Preparatory Work	ha	723,500,000	313,339	4,400	1,378,692,074	
M'Bewani Distributer	m	537,295,197	93,280	-	-	
Related inspection road	m	150,652,800	26,155	-	-	
Tiongoni Branch	m	546,812,289	87,308	8,100	707,197,755	
Related inspection road	m	163,808,765	26,155	8,100	211,855,500	
Kalankorla Drainage Canal	m	184,492,500	36,175	10,000	361,750,000	
Tango Drainage Canal	m	182,379,973	60,793	17,000	1,033,486,514	
Tertiary Canal Work	ha	1,422,727,333	616,166	4,400	2,711,130,474	
Field Ditch Work	ha	993,452,280	430,252	4,400	1,893,109,585	
Land Leveling	ha	962,488,000	416,842	4,400	1,834,104,461	
Related Structure Work	ha	1,276,388,800	552,789	4,400	2,432,269,693	
Other work	L.S.	76,545,000	3,151	4,400	145,863,144	
Farmers' Contribution	ha	400,333,500	173,380	4,400	762,870,247	
Total of Direct Cost		7,620,876,437			13,472,329,447	
Physical Contingency	L.S.	381,043,822			1,347,23,944	10% of direct cost
Construction Supervision	L.S.	402,600,000	174,361	4,400	767,189,259	
Total		8,404,520,259			15,586,751,651	

Source : AHT GROUP AG et BETICO, juin 2009; RAPORT DÉFINITIF DE L'ÉTUDE D'AVANT-PROJET DÉTAILLÉ DU CASIER DU BLOC "D" DE M'BÉWANI, VOLUME 1: ÉTUDES TECHNIQUES, UE

(2) Estimate of Project Cost

Cost of social infrastructure for new immigrants is included in the estimate with the amount of 10 % of the direct irrigation development cost. Engineering services would be 5 % of direct construction cost.

As a result, the project cost is estimated at 17,883 million FCFA or 27.3 million euro, or 3,137 million Yen. In this estimate, price contingency is not counted.

Table 5-9 Estimated Project Cost

Work Item	Amount (FCFA)	Remarks
Irrigation Facilities	13,472,300,000	US\$ 6,300/ha
Physical Contingency	1,347,200,000	10 % of Irrigation Cost
Basic Social Infrastructure	1,347,200,000	
Sub-Total (Direct Construction Cost)	16,301,500,000	
Construction supervision	767,200,000	
Sub-total	17,068,700,000	
Engineering Services (D/D)	815,076,000	5% of the Direct construction cost
VAT (18%)	-	
Total	17,883,780,000	Euro 27,279,000 Yen 3,137,000,000

Source : JICA team

(3) Estimated Maintenance Cost

Maintenance cost is estimated by multiplying unit rate of the M'Bewani Block-D by the new project area.

Table 5-10 Maintenance Cost

(Unit: FCFA)

EU estimate	Unit Cost (ha)	Area to be Maintained	Annual Amount
Annual Cost	12,470	4,400	54,868,000

Source : AHT GROUP AG et BETICO, juin 2009; RAPPORT DÉFINITIF DE L'ÉTUDE D'AVANT-PROJET DÉTAILLÉ DU CASIER DU BLOC "D" DE M'BÉWANI, VOLUME 3: MISE A JOUR DE L'ÉTUDE AGRO-SOCIO-ÉCONOMIQUE, UE

(4) Estimated Benefit

Benefit is estimated based on the M'Bewani Block-D estimate with the following assumptions.

- Incremental agricultural production would bear benefit.
- Net irrigation area would be 3,740 ha , which is equivalent to 85% of the gross area of 4,400 ha.
- In the rainy season, 75% of the farmland would be covered by paddy, 15% by vegetable, and 10% by fruit trees.
- Crop intensity would be 130 % in the same manner as the Block-D. In the rainy season would be 100% and 30 % in the dry season.
- Rice production would be limited to the rainy season in consideration of limited water source.
- Estimated construction period is 3years. The project would start to make a benefit from the 4th year, and it would reach to its full scale in 7th year.
- International market price of rice is estimated at 450 US\$/ton = 218 FCFA/kg.

Based on the assumption mentioned above, the economic benefit can be calculated as shown in the following table.

Table 5-11 Calculation of Economic Benefit

(unit : 1,000 FCFA)

Crop	Area(ha)	1 st year	2 nd Year	3 rd year	4 th year	5 th year	6 th year	7 th year
Rainy season Paddy	2,805				315,877	409,708	486,529	576,153
Vegetable	561				581,050	664,057	747,064	830,071
Dry season Paddy	0				0	0	0	0
Vegetable	1,009				1,045,207	1,194,522	1,343,837	1,493,152
Existing Forest	440	-55,090	-55,090	-55,090	-55,090	-55,090	-55,090	-55,090
Total		-55,090	-55,090	-55,090	1,892,044	2,218,197	2,527,340	2,849,287

Source : Basic data is based on the study result of “M’Bewani Block D” area.

5.3.3 Internal Rate of Return

Economic Internal Rate of Return (EIRR) on a preliminary basis is calculated as follows.

$$\text{EIRR} = 14.6 \%$$

In this calculation, the financial cost of irrigation works are converted into the economic cost by applying the construction conversion factor of 0.85.

ANNEX

M-1 Project Investigation Sheet

M-2 List of Collected Data and Documents

M-1 Project Investigation Sheets

Project Investigation Sheet (1)

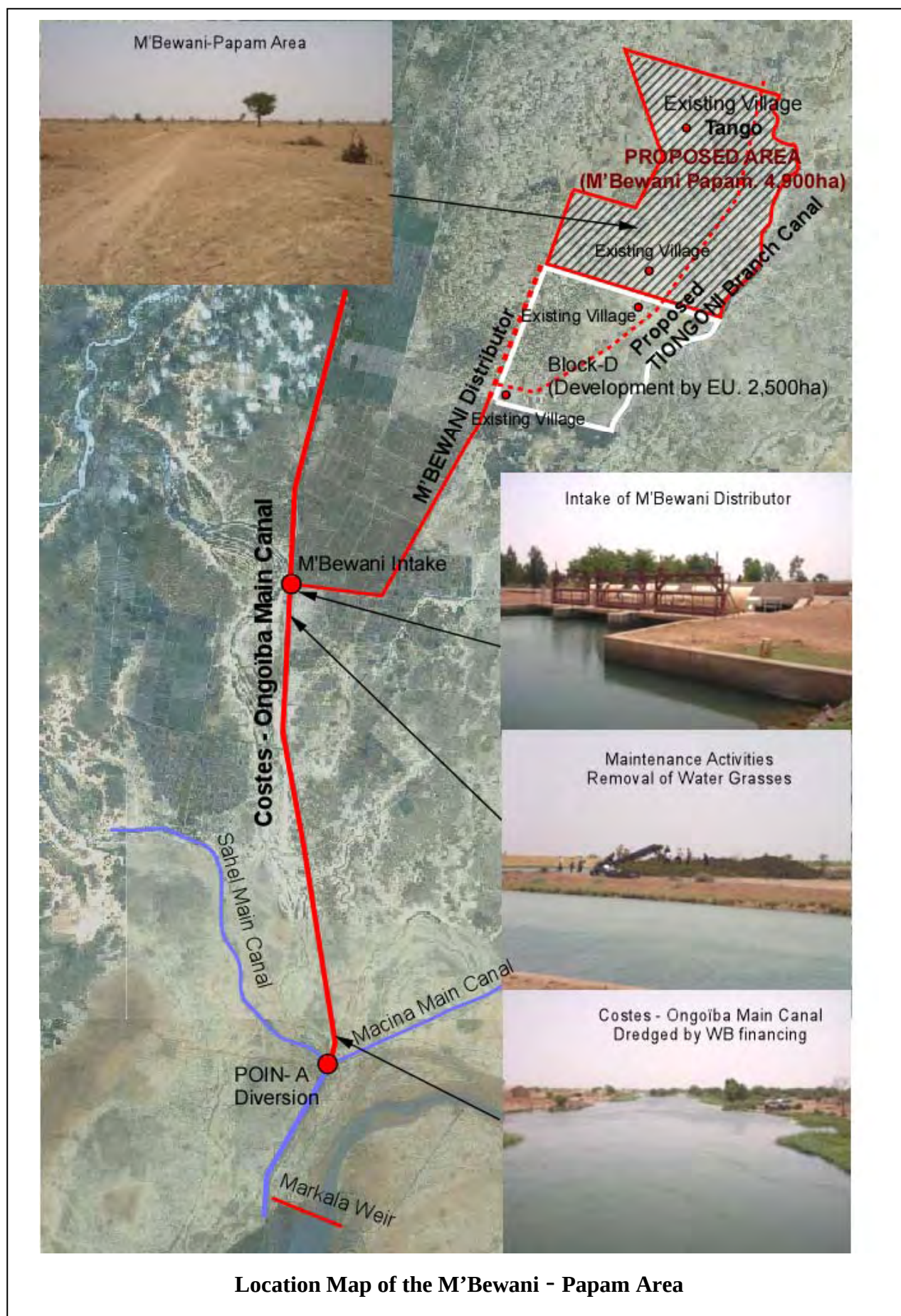
Project Title	M'BEWANI-Papam Area Irrigation Development Project
Date of Investigation	June 4 th , 2010
Investigator	Mme A. TAKAGI (JICA Senegal office), M. Manabu Masaki
Guide	Rakui Kone (Office du Niger)
Investigation Results	
Irrigation System	▪ Markala Weir controls the water level for Irrigation. (The weir was rehabilitated in 1994 with financial support of WB and kfw) ▪ Intake structure is located on the left bank, and head race conveys water to diversion point "Poin A". The head race will be rehabilitated by MCA. ▪ At "Poin A", irrigation water is diverted into three canals namely, Sahel, Costes-Ongoïba, and Macina. Intake structures are under rehabilitation , or were rehabilitated. ▪ the Costes-Ongoïba main canal supplies Irrigation water to the M'Bewani zone. ▪ The canal section with the length of 19km from intake of the Costes-Ongoïba main canal was rehabilitated from 2002 to 2004 by WB financing. ▪ Canal maintenance work such as removal of water grasses seems to be conducted for main and secondary canals. (See attached photo) ▪ M'bewani ditributer which branches off from the Coste-Ongoïba main canal supplies water to the project area. ▪ M'bewani ditributer was rehabilitated in 1997, and automatic water level control intake structure was manufactured in 2003. These faicilities are in good condition. ▪ Tongoni baranch canal, which branches off from M'bewani ditributer, is scheduled to supply irrigation water to the project area.
Accessibility	▪ The project area is located at 40km to the North-Northeast from the Niger Office headquarters. ▪ The asphalt paved road connects Ségou and the intake site of M'bewani ditributer within one hour. ▪ The inspection road along the M'Bewani ditributer is paved with laterite. The road condition is good. ▪ In the project site, there is no road except traces of tires. ▪ In general, accessibility is good.
Present Status of Agriculture	▪ Along the existing M'Bewani area, dry season paddy was harvested at the time of investigation. ▪ In the project area, farmers grow millet and sorghum only in the rainy season. ▪ According to the villagers in the existing Tango village, 35 households cultivate an area of 20 ha. The average area per household can be calculated at 0.57 ha. The farm size is merginal. ▪ In addition to the rainy season cultivation, farmers breed cattle.
Soils, etc.	▪ Bushes and small trees scatter widely in the project area. ▪ Soil conditions would be almost the same as that of Block-D. ▪ The top layer of soil may be silty type.

	▪ Natural depression and salty soils were not observed. ▪
Social Infrastructures	▪ Water for daily life relies on an open well. According to villagers in Tango village, depth of the water level in the well rose recently to 35 m from that of 44 m 20 years before after construction of the M'Bwani canal. ▪ There is no other infrastructures in the project area.
Findings	In conclusion, the project would not have particular difficulty in development. For further stage, the followings should be studied. ▪ Designed canal capacity of the Tiogoni canal in Block-D ▪ Necessary components of social infrastructures

M'BEWANI Area (1/3)	
	
Markala weir across the Niger River	
	
Diversion Point (Poin A) Intake Structure of Costes Ongoïba Main Canal	Costes Ongoïba Main Canal dredged by WB financing

M'BEWANI Area (2/3)	
	
Intake Structure of M'BEWANI Distributor	Automatic Water Level Control Gate of Intake Structure
	
Maintenance Work (Removal of water grass from main canal)	Upstream Reach of M'Bewani Distributor
	
Inspection Road for the M'Bewani Distributer (Upstream section, Paved with Laterite)	End point of the M'Bewani Distributer (There is an Extension Plan.)

M'BEWANI Area (3/3)	
	
Project Site : Project Area near Existing Village (A well is seen in the Center.)	
	
Project Site : Existing Village in the Project Area	Project Site : Proposed Project Area

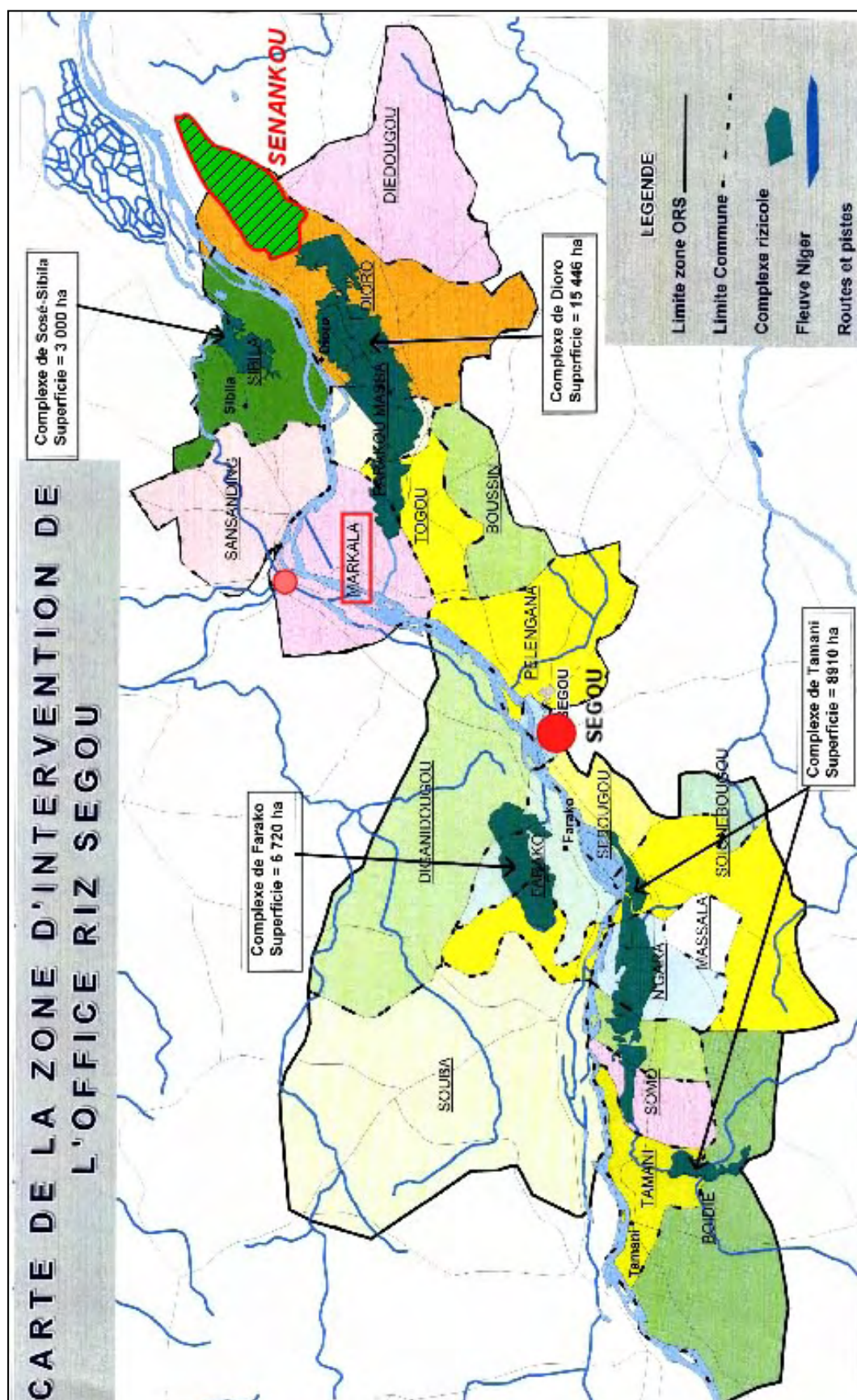


Project Investigation Sheet (2)

Project Title	SENANKOU Rural Development Support Project Projet d'Appui au Développement Rural de SENANKOU(PADER-S)
Date of Investigation	June 5 th , 2010
Implementation Agency	Office Riz Ségeu
Request by Agency	The project area is located at 60 km to the North-East from Ségeu. The Senankou project area is 6,000 ha in total. Request is the detailed design of controlled Submersion Irrigation System for 1,000 ha.
Estimated project Cost	250 million FCFA (equivalent to 44 million Yen)
Number of Beneficiaries	56,573 persons including villages in the vicinity
Project Area	1,000ha (Total area of 6,000ha)
Investigation Results Irrigation System	In the upstream area, an existing paddy area of 15,500 ha of the Dioro complex (Complex Dioro) spreads. These paddy areas are irrigated through Dioro main canal applying controlled submersion irrigation method. Intake of the Dioro canal is dug on the right bank in the upstream reach of the Markala weir. The controlled submersion irrigation method requires following facilities: - main and secondary irrigation canals - flood protection-cum- water storage dyke system - water level control structure equipped with gates Proposed Senankou project would apply the method of controlled submersion irrigation.
Present Status of Agriculture	• In the project area, farmers grow millet and sorghum only in the rainy season. • The target unit yield is 2.0 ton/ha of an average yield of the controlled submersion irrigation method after constructing new system.
Social Infrastructures	• There is a branch office of the "PROJETD'APPUIALAFILIERE SEMENCIERE" . • There is no other infrastructures in the project area.
Accessibility	• In the rainy season, the access road would have a problem between Ségeu and Dioro because of deterioration of road surface. • From Dioro, a laterite paved road on a dyke along the Niger river and a dirt road along the drainage connect the project site. • The dirt road section from dyke to project site will not be accessible in the rainy season.
Findings	Merits and demerits found in Controlled submersion irrigation method are as follows: • Required facilities for Controlled Submersion Irrigation Method are: - Protection-cum-Storage Dyke system - Main and secondary canals (Canal density is low.) • Expecting unit yield is low of 2.0 t/ha • Canal maintenance work requires huge cost and labor force because of sedimentation by flood water. • The project is largely affected by upstream project of Dioro. • The Dioro project is scheduled to improve the irrigation system from

	controlled submersion to full gravity. This system change may bring about water shortage to the project. It is necessary to pay attention to the system design of Dioro project.	
Data/information Collected	Présentation Project Aménagement de Plaines en Zone ORS Fiche de projet de SENANKOU Carte de la zone d'intervention de l'office Riz Ségou Complexe de Dioro Zone D'intervention de l'ORS dans le Delta 2	
List of Attendance	Directeur Général Adjoint Chargé de planification Chef Section, Vulgarisation Chef Division, Aménagement-Infrastructure rural Chargé de mission, Ingénieur Génie Civil Volet crédit Agricole Chef Section DAF Chef Section DGA	Babougou TRAORE Bakary Thiero Zan Traore Daoude Thiero Dramane Diarra Daouda Tangora Mamadou Salif Diakité Bolouyou Traoré

Office Riz Ségou, Senankou Area	
Intake Structure on the Dioro Main Cana;	Dioro Main Canal (Upstream Section)
Existing Control Gate Structure No.1	Existing Control Gate Structure No.2
Requested Project Area (Main Canal runs in the center of this Photo.)	Adjacent Area to Requested Project Area



Source : Office Riz Ségou

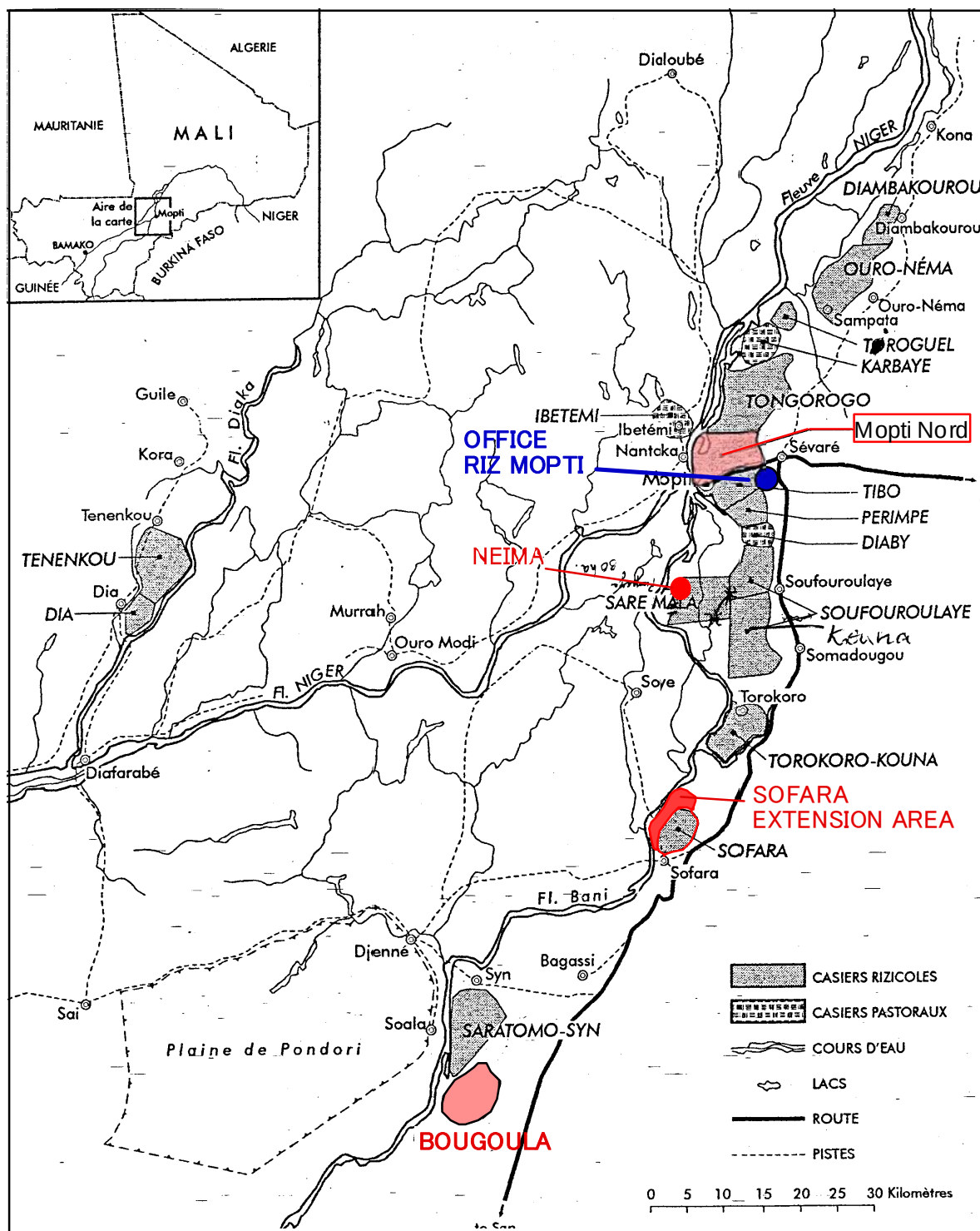
Location Map of the SENANKOU Irrigation Project

Project Investigation Sheet (3)

Project Title	Mopti North Irrigation Rehabilitation Project
Date of Investigation	June 14 th , 2010
Implementation Agency	Office Riz Mopti
Request by Agency	Rehabilitation of controlled submersion irrigation area of 1,500 ha. Project component : Main canal, Secondary Canals, Water Level Control Structure , Pump Station
Estimated project Cost	Unidentified
Number of Beneficiaries	Unidentified
Project Area	1,500 ha
Investigation Results Irrigation System Present Status of Agriculture Social Infrastructures Accessibility	Existing system was constructed in 1976. The project area is located at adjacent area to the North from Mopti city. The project adopts the controlled submersion irrigation system. The intake structure, which is located at 5km downstream from Mopti on the right bank, starts controls of water level in the fields in September to keep water level of 60 to 130 cm from the paddy fields. Dyke runs in the middle of the project area dividing it in two. At the crossing of the main canal, a gated structure is installed to control water levels of two areas. In the project area, one main canal and only one secondary canal were observed during the site visit. Canal density seems to be low. Rainy season paddy is cultivated in the area of 1,000ha. Unit yield of paddy is in the range of 1.2 - 1.9t/ha. In the West edge near Mopti, a small pump irrigation scheme with the area of 200 ha is under construction under PADER (AfDB program). Access road on the dyke is paved with laterite, and is in good condition.
Findings	- The system requires rehabilitation. The canal capacity of the main canal reduced seriously, secondary canals are not provided sufficiently. Low canal density may affect productivity. - Accessibility is excellent. - Study on the project rehabilitation plan was carried out in 1981. Considering changes of circumstances in the past 30 years, the plan should be reviewed. Feasibility study would be necessary. - AfDB has intervened in the ORM area for many years. For realization of the project, coordination between AfDB would be necessary.
Data/ Information Collected	Office Riz Mopti, mai 2004, juin 2009; Note de Présentation Office Riz Mopti; Localisation des Casier Rizivole et Pastoraux DNGR, août 1982; Région de Mopti, Cercle de Mopti, AMENAGEMENT DE MOPTI-NORD «ETUDE HYDRA ULIQ UE, MODIFIEE» DNGR, décembre 1981; Région de Mopti, Cercle de Djenné, AMENAGEMENT DE BOUGOULA «ETUDE HYDRA ULIQ UE, DEVIS ESTIMATIFS» DNGR, août 1982; Région de Mopti, Cercle de Mopti, AMENAGEMENT DE SARE-MALA DIVISION EN DEUX CASIERS «NOUVELLE ETUDE HYDRAULIQUE -DEVIS ESTIMATIF» DNGR, novembre 1981; Région de Mopti, Cercle de Djenné, AMENAGEMENT DE SOFARA, AMELIORATION ET EXTEN «ETUDE HYDRAULIQUE»
Persons Contacted	Directeur Général Adama BERTHE

	Chef Section Génie Rural, Aménagiste DGA Chef Division Vulgarisation Agricole	Béni Traoré Hamadoun Maïga Oumar BERTHE
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Office Riz Mopti, Mopti – Nord Area	
	
Irrigation Area (Controlled Submersion Irrigation)	Irrigation Area (Controlled Submersion Irrigation)
	
Existing Main Canal (Canal Section becomes narrow.)	Control Gate Structure in the Project Area
	
Irrigation Area (Backward view of the intake Gates)	Existing Intake Gates



Source: Office Riz Mopti

Project Location Map of the Office Riz Mopti

Project Investigation Sheet (4)

Project Title	PÉRIMÈTRE IRRIGUÉ VILLAGEOIS DE NEIMA
Date of Investigation	June 14 th , 2010
Implementation Agency	Office Riz Mopti
Request by Agency	Rehabilitation of village irrigation project which was constructed in 1980s with financial assistance of the Netherlands. Project Component: - Conveyance Canal 100 m - Irrigation Canal Network 6.0 km - Drainage Canal Network 7.0 km - Canal Related Structures L.S. - Dyke System 2.6km
Estimated project Cost	225 million FCFA (estimated in June, 2009)
Number of Beneficiaries	1746 persons (3 villages : Neima,Mankamou, and Saré-Mabo)
Project Area	80 ha
Investigation Results	This system irrigates 80 ha by pumped up irrigation water from the Bani River.
Irrigation System	
Present Condition of Agriculture	This system is out of service.
Social Infrastructures	This project is located at west edge of the SARE-MALA submersion irrigation project area. In order to prevent inundation caused by flood water levels coming from the SARE-MALA area, a dyke system would be necessary.
Accessibility	Dyke system as a link road is paved with laterite. Accessibility in the season is good.
Findings	▪ The conveyance canal constructed in 1980s is completely buried by sand and covered with bushes. ▪ The cause of the deterioration was not identified, but there is a possibility that the area has been inundated by floods from the Bani River. ▪ Pumps require frequent fuel supply. The area, however, is far from the trunk road network. The project have a difficulty in fuel supply.
Data/Information Collected	- S.A.E.D. SARL, juin 2009; Étude Technique D'avant Projet Detaille (APD) du Périmètre Irrigué Villageois de Neima Dans la Région de Mopti, Rapport de Synthese Volume 1 version corrigée - dito - , Rapport d'Études Pédologiques Volume 2 version corrigée - dtio - , Rapport d'Études des Impacts Environnementaux Volume 3 version corrigée, - dtio - , Rapport d'Études Socio Économiques Volume 4 version corrigée - dito - , Plan D'Aménagement du Périmètre
Persons Contacted	Chef Section Génie Rural, Aménagiste Béni Traoré

PÉRIMÈTRE IRRIGUÉ VILLAGEOIS DE NEIMA Area	
	
The Bani River as Water Source	Old Conveyance Canal (Canal Section was buried by sand and covered with bushes.)
	
Neima Irrigation Area	Neima Irrigation Area
	
Intake of the Sare-Mala Irrigation Project adjacent to the Neima Scheme	Sare-Mala Irrigation Project (Irrigation Area: Controlled Submersion Irrigation System)

Project Investigation Sheet (5)

Project Title	SOFARA Extension and BOUGOULA Rehabilitation Projects
Date of Investigation	June 15 th , 2010
Implementation Agency	Office Riz Mopti
Request by Agency	SOFARA extension project is aiming at development of the area laying between the Bani River and the SOFARA irrigation project rehabilitated by AfDB financing. Bougoula rehabilitation project component consists of rehabilitation of dyke and canals of the controlled submersion irrigation system.
Estimated project Cost	Unidentified
Number of Beneficiaries	Unidentified
Project Area	Unidentified
Investigation Results Irrigation System Agriculture	There are two alternative ideas for the SOFARA extension projects. Plan A is to irrigate by pump, and Plan B is to use the existing submersion method. ORM has not yet studied these ideas. Bougoula rehabilitation project would not change the irrigation method. Proposed crop is Paddy.
Findings	• The SOFARA extension project is formulated to compensate reduced irrigable area caused by the irrigation system change in the existing SOFARA irrigation project. • System design of the SOFARA extension project needs to pay attention to the systems of the SOFARA rehabilitation project. • In the Bougoula rehabilitation project area, cattle breeding and inland fishing are prosperous. • Deterioration of the system facilities are serious. • The area is far from the trunk road network, and road network in the project isn't exist. Accessibility is poor.
Data/Information Collected	• DNGR, décembre 1981; Région de Mopti, Cercle de Djenné, AMENAGEMENT DE BOUGOULA «ETUDE HYDRAULIQUE, DEVIS ESTIMATIFS» • DNGR, novembre 1981; Région de Mopti, Cercle de Djenné, AMENAGEMENT DE SOFARA, AMELIORATOPN ET EXTEN «ETUDE HYDRAULIQUE»
Persons Contacted	Chef Section Génie Rural, Aménagiste Béni Traoré

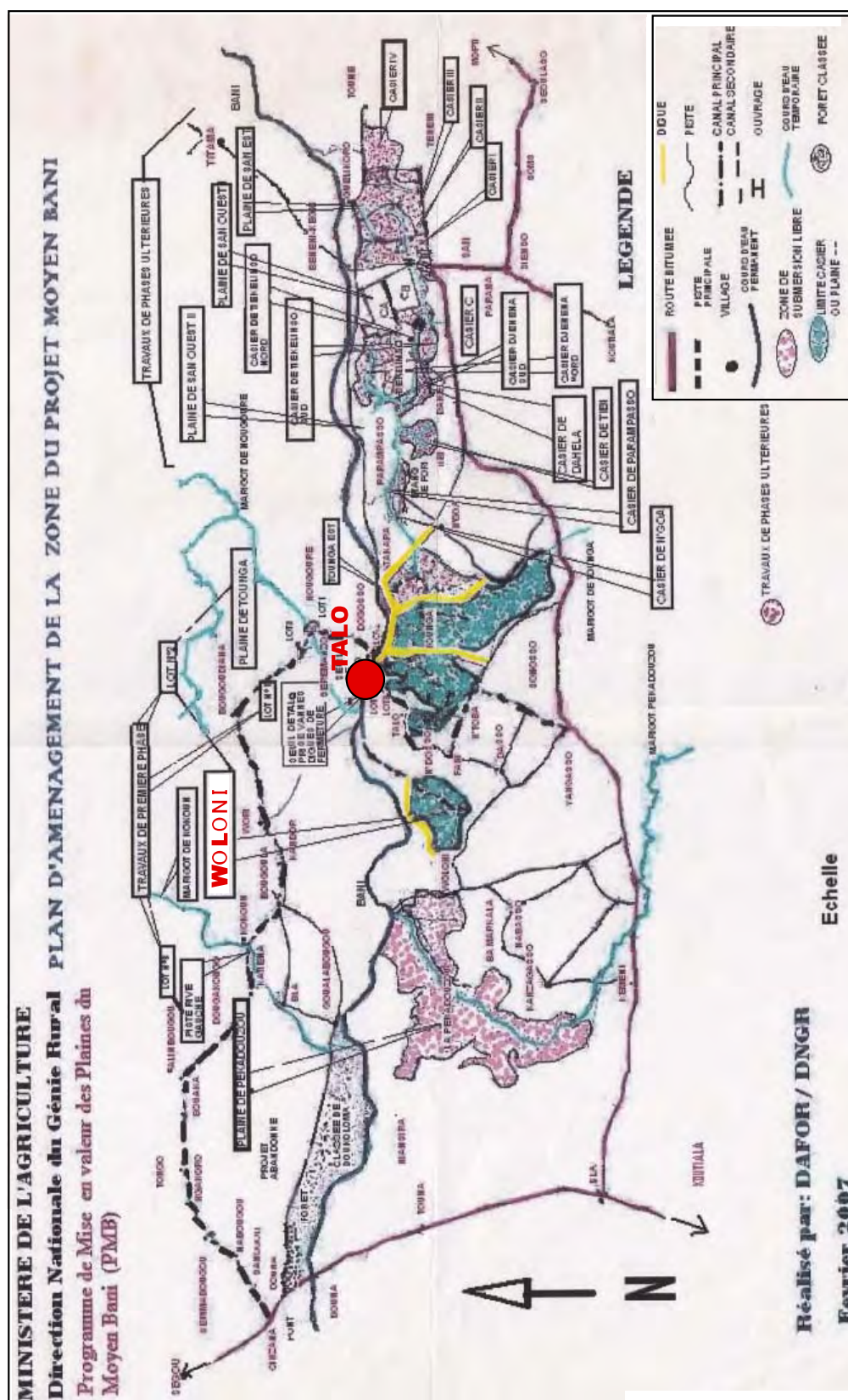
SOFARA Area	
	
Existing Rehabilitated SOFARA Project (Financing by AfDB, Irrigation System is Changed From the Controlled Submersion Irrigation to the Pump Irrigation)	Existing Rehabilitated SOFARA Project (Newly Constructed Pump Station)
	
Existing Rehabilitated SOFARA Project (Newly Constructed Main Canal)	Extension Area Requested (Area between Existing SOFARA Area and the Bani River)
	
Extension Area Requested (Both Bank Area of the Head Race from the Bani River)	

BOUGOULA Area	
	
Head Race from the Bani River	Existing Water Level Control Gate
	
Existing Main Canal	Existing Dyke
	
Irrigation Area	Irrigation Area

Project Investigation Sheet (6)

Project Title	Programme de Mise en Valeur des Plaines du Moyen Bani (PMB)
Date of Investigation	June 21 st , 2010
Implementation Agency	Programme de Mise en Valeur des Plaines du Moyen Bani (PMB)
Request by Agency	- (Financial arrangement has already completed.)
Estimated project Cost	Unidentified
Number of Beneficiaries	216,992 persons
Project Area	-
Investigation Results Irrigation System	This is a project executed under the “Programme de Développement de l'Irrigation dans le Bassin du Bani et à Sélingué site de Bla/San (PDI-BS), Phase I” financed by AfDB and other 11 donors. Stable water supply by Taro headworks is expected. Intake water volume, however, is limited to 6% of the flood discharge. This proportion of 6% is decided to correspond to the ratio of catchment area. The project planned to construct another headworks at Djenné. Construction of another one has been postponed because of opposition of residents in downstream area.
Findings	▪ The system constructed large scale weir system for stable water supply only in the rainy season. However, improvement of productivity can't be expected by this method. Unit yield of this system is limited to 2.0 ton/ha. In addition, the system would not intake water in the dry season. In this context, I have a doubt about feasibility of the project. ▪ The main canal is almost disappearing after 4 years operation. Controlled submersion irrigation method, which uses flood water, have a difficulty in maintenance of canal system.
Data/Information Collected	- Programme de Développement de l'Irrigation dans le Bassin du Bani et à Sélingué site de Bla/San (PDI-BS), juin 2010; NOTE TECHNIQUE SUR LE PROGRAMME - PDI-BS, février 2007; PLAN D'AMENAGEMENT DE LA ZONE DU PROJECT MOYEN BANI
Persons Contacted	Programme de Développement de l'Irrigation dans le Bassin du Bani et à Sélingué, Coordonnateur du site de Bla/San, Ingénieur d'Etat en Génie Rural, Direction National du Génie Rural Adama DIARRA

TARO Area	
	
TARO Weir	
	
Intake Structure (Right Bank of the Taro Headworks)	Right Bank Head Race (at Taro headworks)
	
Intake Gate Structure and Main Canal in the WOLONI project area	WOLONI Main Canal (The main canal is almost disappearing after 4 years operation.)



Source : Programme de Mise en Valeur des Plaines du Moyen Bani

Rehabilitation Plan for the Middle Reach of the Bani River

Project Investigation Sheet (7)

Project Title	Baguineda Area Irrigation Improvement Project (Projet d'Aménagement d'Irrigation du Périmètre de Baguinéda)
Date of Investigation	June 14 th , 2010
Implementation Agency	Baguineda Irrigation Office (Office du Périmètre Irrigué de Baguinéda, OPIB)
Request by Agency	Request of Japanese grant aid 1.Improvement of Irrigation Facilities (main works) • Concrete lining for Secondary Canals • Link Road Construction among Villages • Construction of Irrigation and Drainage Pump Station 2.Heavy Machinery for Maintenance Works
Estimated project Cost	13.183 milliard FCFA (equivalent to 263million Yen) 1. Improvement of Irrigation Facilities 11,983,000,000 FCFA • Concrete lining for Secondary Canals 5,400,000,000 FCFA • Link Road Construction among Villages 1,000,000,000 FCFA • Construction of Irrigation and Drainage Pump Station 1,200,000,000 FCFA • Others 4,383,000,000 FCFA 2. Heavy Machinery for Maintenance Works 1,200,000,000 FCFA
Number of Beneficiaries	2,893 farmers
Project Area	3,000 ha
Investigation Results	The project uses the Sotoba intake together with a power generation plant. In the dry season, competitive use of intake water occurs between the plant and the project. As a solution of this conflict, OPIB constructed new intake to increase intake water with the financial support of AfDB. The main canal has been continuously improved by the national budget, JICA grant aid, and AfDB financing. As a future plan, construction of new pump station was proposed to prevent draw down of intake water level in the dry season.
Findings	• Concrete lining canal sections of main canal were well functioning. • OPIB reported that water shortage problems happened regularly at end sections of the secondary canals because of excessive water losses from canals. • Long canal, whose length is longer than 1.5 km, may create the water loss problem. There are 16 long canals out of 42 secondary canals in the project. • In order to judge necessity of canal lining for all the long canals, a monitoring survey about water loss and water management manners would be necessary. • Urbanizing following the expansion of Bamako city area is progressing in and around the upper reach of the Baguineda project. • Baguineda village itself has developed drastically since the early1990's when the Japanese grant aid project had been executed. • Since the link road network is not developed well around the project area, inspection road of the main canal is utilized as a trunk road for

	daily life. • Traffic volume of the inspection road is increasing day by day. To reduce the traffic volume, new link road network was proposed. • Arrangement of road network should be carefully examined not to accelerate the urbanization. • Negative impact to the canal system by urbanization such as sewage and unexpected flood flow should be carefully considered.	
Data/Information Collected	- OPIB, juin 2010; FORMULAIRE DE REQUETE POUR LA COOPERATION FINANCIERE NON-REMBOURSABLE DU JAPON (DONS POUR LES PROJETS GENERA UX) - BETICO-Mali, avril 2008; PLAND'ENSEMBLE, OPIB - OPIB, juillet 2010; Caractéristiques des Canaux Secondaires de Baguinéda	
Persons Contacted	Directeur Général Chef Section Suivi/Evaluation Chef Division Plan-Suivi/Evaluation Chef Division Travaux Spécialiste en Acquisition Respons. Suivi/Evaluation	Seydou Bassié Touré Zan Bouaré Julien Coulibaly Boua Samake Mourlaye Sangare Cisse Sadio

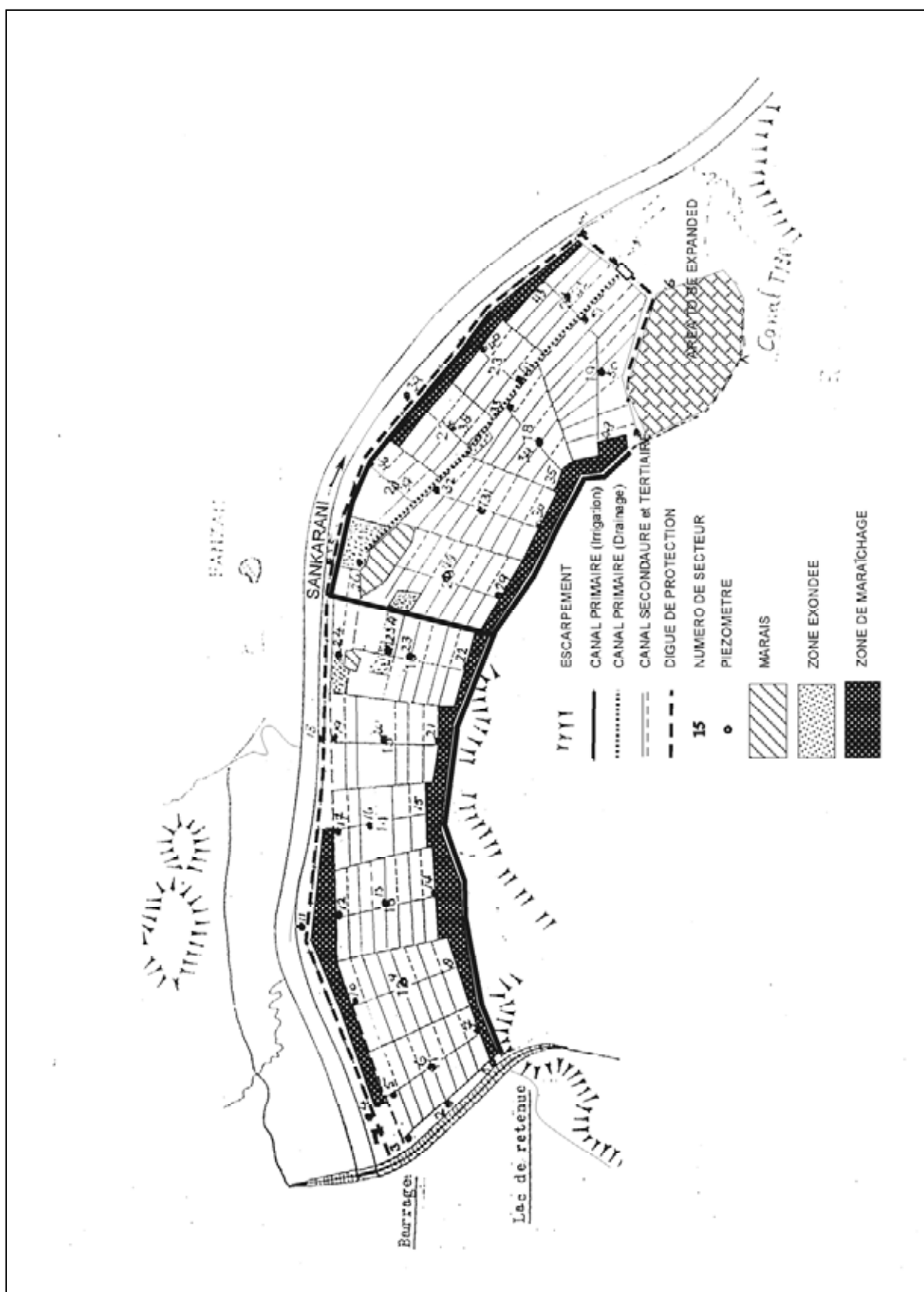
Baguinéda Area	
	
Existing Intake Structure (Shared Facility with Sotoba Generation Plant)	Additional Intake Structure Constructed by AfDB Financing
	
Upstream Section of Main Canal	Secondary Canal Requested for Rehabilitation with lining

Project Investigation Sheet (8)

Project Title	Projet d'Aménagement et de Réhabilitation de Périmètres Irrigués dans la zone de Sélingué
Date of Investigation	June 22 nd , 2010
Implementation Agency	Selengue Rural Development Officec (ODRS : Office de Développement Rural de Sélingué)
Request by Agency	ODRS makes a request of Japanese grant aid to conduct the following works. • Main Canal Rehabilitation of Canal Lining : 10,727 m • Extension of Farmland Downstream area of Existing Project : 72 ha • New development on the left bank Fanzan-Faraba Sémbè Area : 794 ha
Estimated project Cost	10.9 milliard FCFA (equivalent to 2,000 million Yen) - Rehabilitation of Main Canal 1.5 milliard FCFA - Extension : Périmètre aval 0.3 milliard FCFA - New Development : Fanzan-Faraba Sémbè 9.1 milliard FCFA
Number of Beneficiaries	Unidentified
Project Area	Developed Area : 1,500 ha Expansion Area : 72 ha New Development : 794 ha
Investigation Results	Existing project area is located at just downstream area of the Sélingué dam on the tight bank of the Sankarani river.
Irrigation System	There are two main canals. Main canal No.1 (6,522 m) takes in water directly from the Sélingué dam. Main canal No.2 (4,205m) branches off from the Main canal No.1.
Present Condition of Agriculture	The extreme flood in 2001 breached the protection dyke and damaged the canal system. As a restoration works, secondary canals were covered with concrete. Lining works for Main canals, however, were not executed because of shortage of Budget. A main drainage canal runs through the project area in the middle, and a drainage pump house is stationed at the crossing point of the drain and the dyke. The project can receive 3m ³ /s of irrigation water for both rainy and cry seasons based on the agreement signed among Ministry of rural development (today, MoA), Ministry of economics and finance, and Ministry of energy and water. Basically, the project is double-rice-cropping area. But rice cultivation in the dry season is given up in some areas because of water shortage caused by excessive water losses from secondary canals. The abandoned area in the dry season is increasing year by year.
Findings	• The earth canal section of main canal No.1 remains long, and some concrete-lining sections are seriously deteriorated. • Concrete lining canals of secondary are in good condition. • Two outlets of pipes can be observed on the left bank of dam body. Diameters of these pipes may be approximately 50 cm each. These pipes would be used for new development.

	• If we assume that these pipes would connect to an open channel at 100m downstream and the difference of water level between reservoir surface and the pipe center is 10m, these pipes would be able to take in 2.0 m³/sec of water from the dam. • Taking conveyance losses in the 12 km section of open channel into consideration, it can be judged that approximately 400~500ha of rice cultivation would be possible. • In case of the pipeline system, energy losses would increase and irrigable area would decrease. • In order to irrigate the whole new development area, cropping pattern should be carefully examined. • Flood protection dyke system would be necessary for expansion area of 72 ha. Judging from the project plan map, this area needs additional drainage pump station. The cost is not included in the request . • The request didn't mentioned about rehabilitation of drainage pump station. One pump unit out of three was out of order and removed because of lack of spare parts. If the other pump would be out of order and it would not be possible to repair, rice production in rainy season would be damaged due to poor drainage. • In the project plan, rehabilitation or reconstruction of drainage pump station should be considered.	
Data/ Information Collected	- ODRS, juin 2010; Project d'Aménagement et de Réhabilitation de Périmètres Irrigués dans la zone de Sélingué, REQUETE DE FINANCEMENT - ODRS; Plan2 Postes d'observation niveau piézométrique - Ministère des Mines de L'Energie et de L'Eau, Ministère de L'Economie et des Finances, Ministère du Développement Rural, juin 2002; ARRETE INTERMINISTERIEL No 02/ MMEE-MEF-MDR, "FIXANT LES ATTRIBUTION, LA COMPOSITION ET LES MODALITES DE FONCTIONNEMENT DE LA COMMISSION <<GESTION DES EA UX> > DE LA RETENUE DE SELINGUE - ODRS; AMENAGEMENTS HYDRO AGRICOLES ET ROUTES EXISTANTS ET PLANIFIES DANS LA ZONE D'INTERVENTION - ODRS; ORGANIGRAMME GENERAL DE L'ODRS - ODRS, jan 2009; Décision N° 0001/DG-ODRS "FIXANT L'ORGANISATION INTERNE ET LES REGALES PARTICULIERS DE FONCTIONNEMENT ET D'ADMINISTRATION DE L'OFFICE DE DEVELOPPEMENT RURALDE SELINGUE (ODRS)"	
Persons Contacted	Directeur Général Adjoint Chef Département, Aménagements, Infrastructures et Equipments Ruraux Chef Section, Infrastructures et Equipments Ruraux Chef Section, Gestion Eau et Réseau Hydrolique	Dramane Sanogo Siraman Bagayoko Abdoul Kadry Kantako Hamet Keïta

SélinguéArea	
	
Intake Structure	Secondary Irrigation Canal (Paved with concrete in 2001)
	
Main Canal No.1	Main Canal No.1
	
Drainage Pump Station (One Pump Unit has broken down)	Main Canal No.2 (It is said that frequent maintenance work is necessary.)



Source : Office de Développement Rural de Sélingué

Locatio Map of Sélingué Irrigation Rehabilitation Project

Project Investigation Sheet (9)

Project Title	Réhabilitation du Périmètre Irrigué de FANABANA
Date of Investigation	23 rd , 2010
Implementation Agency	Office de la Vallée du Niger (OHVN)
Request by Agency	• Survey, Detailed Design • Rehabilitation of Canal system • Reconstruction of Pump Station
Estimated Project Cost	1,129,500,000 FCFA in 2002 (equivalent to 226 million Yen)
Number of Beneficiaries	320 Farmers, Population 2,935 persons (as of 1996)
Project Area	500 ha
Investigation Results	The project area is located at 25 km upstream reach of the Niger River to the South-West from capital Bamako. The system started operation in 1980/81 crop season, and the system stopped operation in 1985/86 season because of breakdown of pump units. After reviewing the project from 1997 to 2000 by local budget, small pump units were provided to the project. In 2002, a rehabilitation plan was submitted showing two alternative plans. Plan A : Rehabilitation of canal system + Rehabilitation of existing pump station Plan B : Rehabilitation of canal system + Construction of new pump station The estimated project cost shown above is based on Plan B. Present status of cultivation using small pump units is as follows: Rice 243ha, Maize 26ha, Sorghum 14ha, Others 40ha
Findings	• Accessibility and location is good • Recondition of pump station is a pre-condition of this project. • Power transmission line reaches to 2 km point from the pump site. Extension of power line needs to be taken into account. • The project area is surrounded by flood protection dyke. Drainage system should be reviewed in future design.
Data/Information Collected	OHVN, mai 2006; REQUET DE FINANCEMENT POUR LA REHABILITATION DU PERIMETRE IRRIGUE DE FARABANA
Persons Contacted	Directeur Général Issa DJIRE Chef de l'unité de Gestion Bakary Marega Irrigué de FARABANA

9. FANABANA Area	
	
Abandoned Pump Station	Pump Station needs to be Totally Rehabilitated
	
Niger River as Water Source	Portable Pump Unit (After Breakdown of Pump Station, portable unit is used to irrigate a part of irrigation area.)
	
Main Canal	Irrigation Area

Project Investigation Sheet (10)

Project Title	Péremètre Irrigué de B																			
Date of Investigation	June 24 th , 2010																			
Implementation Agency	Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI																			
Request by Agency	Concrete Lining for Secondary Canals, 13 km																			
Estimated project Cost	Unidentified																			
Number of Beneficiaries	Unidentified																			
Project Area	Gross Area 1,024 ha Developed Area 870 ha Irrigation Area 818 ha (Paddy : 212 ha, Vegetable : 695 ha)																			
Investigation Results	The irrigation system spreads around just downstream area of Manantali Dam along left bank of the Bafing river. The project started as a compensation of the Manantali dam construction with financial support with financial support of Islamic Development Bank, Kuwait and Saudi Arabian Funds. The 6.5 km section from dam site to the No.1 regulating reservoir, ductile iron pipe with diameter of 1,200mm is laying . For diversion of irrigation water, stand type division works are provided on the pipeline. A list of project facilities is shown below. <table> <tr> <td>Main Canal</td> <td>:</td> <td>16 km (including Pipeline 7.4 km)</td> </tr> <tr> <td>Secondary Canal</td> <td>:</td> <td>11 canals, 13 km</td> </tr> <tr> <td>Tertiary Canal</td> <td>:</td> <td>67 canals, 33 km</td> </tr> <tr> <td>Field Ditch</td> <td>:</td> <td>75 km</td> </tr> <tr> <td>Main Drain</td> <td>:</td> <td>41 km</td> </tr> <tr> <td>Secondary Drain</td> <td>:</td> <td>16 km</td> </tr> </table>		Main Canal	:	16 km (including Pipeline 7.4 km)	Secondary Canal	:	11 canals, 13 km	Tertiary Canal	:	67 canals, 33 km	Field Ditch	:	75 km	Main Drain	:	41 km	Secondary Drain	:	16 km
Main Canal	:	16 km (including Pipeline 7.4 km)																		
Secondary Canal	:	11 canals, 13 km																		
Tertiary Canal	:	67 canals, 33 km																		
Field Ditch	:	75 km																		
Main Drain	:	41 km																		
Secondary Drain	:	16 km																		
Present Condition of Agriculture	In the project plan, scheduled crop intensity of rice was 25 %. However, farmers prefer to plant rice instead of cash crops. Actual crop intensity of rice may be far beyond 25 %.																			
Findings	• Main system, which consists of pipeline and concrete paved open channel, is in good condition. • The management office reported that water losses from the secondary canals down to tertiary canals are huge because of no pavement. • In the course of site visit, some secondary canals were covered with grasses and bushes, though planting season is coming. • It may be necessary to review the water management rules and actual manners in the field.																			
Data/Information Collected	Note d'information technique sur le Projet (résumé de l'APD)																			
Persons Contacted	Directeur Chef Division Infrastructure et Equipment Chargé de Vulgarisation	Aliou Bamba Bouba Diarra Boubacar S. DAOU																		

10. Manantali B Area	
	
Distant View of Manantali Dam	Intake Pipe
	
Stand Type Division Works	Irrigation Area
	
Main Canal with Concrete Lining	Secondary Canal to be Rehabilitated with Lining

Project Investigation Sheet (11)

Project Title	Péremètre Irrigué de G-H									
Date of Investigation	June 25 th , 2010									
Implementation Agency	Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI									
Request by Agency	Construction of Canal Network									
Estimated project Cost	Un identified (Original Budget was 50 milliard FCFA)									
Number of Beneficiaries	1200 persons									
Project Area	870ha (Gross Area = 1024ha)									
Investigation Results	The project commenced with grant aid support of Islamic Development Bank, Kuwait and Saudi Arabian Funds. In the course of construction, the project used up the budget, and then some construction works such as pump shed and canal network remain uncompleted because of withdrawal of Libyan contractor. As for pump shed, Malian contractor is schedule d to continue with additional support. Regarding the canal network construction, however, there is no hope of arranging budget. Reasons for withdrawal were mainly caused by insufficient survey of the site conditions. - Availability of railway as main transportation means Transportation cost rose because of unreliability of railway. - Availability of coarse aggregate for concrete Sufficient volume was not acquired in adjacent area.									
Irrigation System	Irrigation water, 3.08litter/sec, pumped up on the right bank of the Bafing river is once stored in a distribution tank (300m³), and then two irrigation canal networks distribute it. Work volume of canal network is follows. <table><tr><td>Main Canal</td><td>10.8 km</td></tr><tr><td>Secondary Canal</td><td>17.9 km</td></tr><tr><td>Tertiary Canal and Field ditch</td><td>116 km</td></tr><tr><td>Drainage Canals</td><td>54 km</td></tr></table>		Main Canal	10.8 km	Secondary Canal	17.9 km	Tertiary Canal and Field ditch	116 km	Drainage Canals	54 km
Main Canal	10.8 km									
Secondary Canal	17.9 km									
Tertiary Canal and Field ditch	116 km									
Drainage Canals	54 km									
Findings	• No tags or sticker to show the manufacture and the type was found on pump unit stored near the abandoned pump station. • Maintenance of pump would be difficult in acquisition of spare parts. • Main canal was constructed with the length of 1 km. The embankment may have a quality problem. • The project would have a problem in quality of constructed works by Libyan contractor.									
Data/Information Collected	-									
Persons Contacted	Directeur Chef Division Infrastructure et Equipment Chargé de Vularisation	Aliou Bamba Bouba Diarra Boubacar S. DAOU								

11. Manantali G-H Area	
	
Pump Station under Construction	Un-installed Pump Units (6 units)
	
Inside View of Switch Board Shed	Connection part of Main Canal and Distribution Tank
	
Inside of Distribution Tank Outlet of Pipeline	Residence for O&M staff

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
OFFICE DU NIGER (ON)						
Organization/Budget/Plan of Operation						
001	Office du Niger, MAI 2010; <i>ORGANIGRAMME GLOBAL DE L'OFFICE DU NIGER</i>	Office du Niger	Word file	A4	1	Latest Organization Chart
002	Office du Niger; <i>LISTE DU PERSONNEL DE L'OFFICE DU NIGER A LA DATE DU 31 MAI 2010</i>	Office du Niger	Excel file	A4	1	List of staff
003	Office du Niger, mar 2008; <i>Budget Exercice 2008</i>	Office du Niger	Ring Binding	A4	30	Budget 2008
004	Office du Niger, mar 2009; <i>Budget Exercice 2009</i>	Office du Niger	Ring Binding	A4	30	Budget 2009
005	Office du Niger, mar 2010; <i>Budget Exercice 2010</i>	Office du Niger	Ring Binding	A4	25	Budget 2010, 4-10 pages missing
006	Office du Niger, avril 2008; <i>Contrat Plan Etat-Office du Niger- Exploitants Agricoles Période 2008-2012, version finale</i>	Office du Niger	Ring Binding, Word file	A4	103	Plan of Operation
006B	Office du Niger Direction General, 2010 ; <i>ATELIER SUR REORGANISATION ET L'ORIENTATION DES ACTIVITES DE L'OFFICE DU NIGER, SYNTHESE DES TRAVAUX</i>	Office du Niger	Word file	A4	25	Plan of Operation
Operation and Maintenance						
007	ON, mars 2009 ; <i>PROGRAMME ANNUEL D'ENTRETIENS INFRASTRUCTURES HYDRAULIQUES DE L'OFFICE DU NIGER - EXERCICE 2009, VERSION DEFINITIVE</i>	Office du Niger	Word file	A4	10	O&M Plan for 2009
008	ON, mars 2009 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	52	O&M Plan for 2009, Annex
009	ON, novembre 2007 ; <i>PROGRAMME ANNUEL D'ENTRETIENS INFRASTRUCTURES HYDRAULIQUES DE L'OFFICE DU NIGER - EXERCICE 2008, VERSION PROVISoire</i>	Office du Niger	Word file	A4	13	O&M Plan for 2008
010	ON, novembre 2007 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	52	O&M Plan for 2008, Annex
011	ON,décembre 2006 ; <i>PROGRAMME ANNUEL D'ENTRETIENS INFRASTRUCTURES HYDRAULIQUES DE L'OFFICE DU NIGER - EXERCICE 2007, VERSION PROVISoire</i>	Office du Niger	Word file	A4	43	O&M Plan for 2007
012	ON,décembre 2006 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	64	O&M Plan for 2007, Annex
013	ON, juillet 2007 ; <i>BILAN DES TRAVAUX D'ENTRETIEN DU RESEAU HYDRAULIQUE AU 30 JUIN 2007 - EXERCICE 2007</i>	Office du Niger	Word file	A4	9	Results of O&M 2007
014	ON, juite 2007 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	103	Results of O&M 2007, Annex
015	ON, avril 2007 ; <i>BILAN D'EXECUTION DES TRAVAUX D'ENTRETIEN DU RESEAU HYDRAULIQUE DE L'OFFICE DU NIGER AU 31 DECEMBRE 2006</i>	Office du Niger	Word file	A4	10	Results of O&M 2006
016	ON, avril 2007 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	63	Results of O&M 2006, Annex

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
017	ON, décembre 2006 ; <i>BILAN D'EXECUTION DES TRAVAUX D'ENTRETIEN DU RESEAU HYDRAULIQUE DE L'OFFICE DU NIGER AU 31 DECEMBRE 2005</i>	Office du Niger	Word file	A4	10	Results of O&M 2005
018	ON, décembre 2006 ; - dito - : ANNEXE	Office du Niger	Excel file	A4	101	Results of O&M 2005, Annex
Development Plan in the Area						
019	ON/DT/SAHB, février 2010; <i>PROGRAMME GOUVERNEMENTAL D'AMENAGEMENT HYDROAGRICOLE DE 60,000 HA A L'OFFICE DU NIGER POUR LA PERIOD 2008 A 2012 «POINT D'EXECUTION AU 31 DECEMBRE 2009»</i> , Office du Niger	Office du Niger	Word file	A4	10	Development Plan for 2008-2012
020	CDP, décembre 2004; <i>Étude du Schéma Directeur de Développement pour la Zone de l'Office du Niger (Etape Finale) «DOCUMENT 1a , PAPPOT SUR LES ORIENTATIONS STRATEGIQUE»</i> , AGETIER MALI	Office du Niger	PDF file	A4	57	Development Plan by Dutch Consultants
021	CDP, décembre 2004; - dito - , <i>«DOCUMENT 1b , RAPPORT SUR LE DIAGNOSTIC INSTITUTIONNEL»</i> , AGETIER MALI	Office du Niger	PDF file	A4	25	- ditto - volume 1b
022	CDP, décembre 2004; - dito - , <i>«DOCUMENT 2a , PLAN D'ACTION»</i> , AGETIER MALI	Office du Niger	PDF file	A4	88	- ditto - volume 2a
023	CDP, décembre 2004; - dito - , <i>«DOCUMENT 2b , GUIDE OPERATIONNEL»</i> , AGETIER MALI	Office du Niger	PDF file	A4	26	- ditto - volume 2b]
024	CDP, décembre 2004; <i>Étude du Schéma Directeur de Développement Phase Finale , «Contrat Plan 2005-2007»</i>	Office du Niger	wmf file	A4	1	- ditto - : Plan 2005-2007
025	CDP, décembre 2004; <i>Étude du Schéma Directeur de Développement Phase Finale , «Phase 1 2008 - 2013»</i>	Office du Niger	wmf file	A4	1	- ditto - : Plan 2008-2013
026	CDP, décembre 2004; <i>Étude du Schéma Directeur de Développement Phase Finale , «Phase 2 2014 - 2020»</i>	Office du Niger	wmf file	A4	1	- ditto - : Plan 2014-2020
027	CDP, décembre 2004; <i>Étude du Schéma Directeur de Développement Phase Finale , «Cart de Base»</i>	Office du Niger	wmf file	A4	1	- ditto - : Plan
Organization Chart						
028	Office du Niger; <i>PLAN DE ZONAGE DES AMENAGEMENTS ET PROJECTION, avril 2009</i>	kfw	Printed Material	B1	1	
029	SOGREAH, 1981; <i>PROJET DE REHABILITATION DE L'INFRASTRUCTURE HYDRAULIQUE DE L'OFFICE DU NIGER « PLAN D'ENSEMBLE - FLEUVE NIGER A PARTIR DE MARKALA Echelle: 1/200,000»</i> , ON	Office du Niger	JPG file	A0	1	
Farmers' Organization						
030	Présidence de la République ; <i>LOI N° 01-076/DU 18 JUIL 2001 «REGISSANT LES SOCIETES COOPERATIVES EN REPUBLIQUE DU MALI»</i>	Office du Niger	Word file	A4	16	Law related to cooperatives

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
031	Présidence de la République ; LOI N° 04-038/DU 05 AOUT 2004 «RELATIVE AUX ASSOCIATIONS»	Office du Niger	Word file	A4	9	- ditto -
Design Standard, etc.						
032	ON ; NORMES TECHNIQUES D'AMÉNAGEMENT A L'OFFICE DU NIGER	Office du Niger	Word file	A4	2	Unit water requirement
Water Balance Study						
033	Adama SANGARE, mars 2010; PROJET SUCRIER DE MARKALA, RAPPORT PROVISOIRE «ÉTUDE RELATIVE A L'ETABLISSEMENT D'UN BILAN DES RESSOURCES EN EAU AU DROIT DE LA ZONE DE L'OFFICE DU NIGER», BAD	Office du Niger	PDF file	A4	76	Study by AfDB financing
034	MCA, septembre 2007; Projet d'Irrigation d'Alatona «Rapport Technique d'Irrigation IR1 - Le potentiel de l'agriculture irriguée dans les zones de l'Office du Niger en relation avec le développement du périmètre d'Alatona, Version Définitive	Office du Niger	PDF file	A4	45	
035	Dr. Rolf Schüttrumpf et Toon Bökkers en collaboration avec Adama SANGARE, janvier 2008; ANALYSE DU POTENTIEL D'IRRIGATION LORS DE LA SAISON SECHE DANS LA ZONE DE L'OFFICE DU NIGER, Office du Niger	Office du Niger	Word file	A4	Main Text 51	33 files
036	DHI & BRL; Etablissement du Modèle de Gestion du Bassin du Niger	Office du Niger	PP file	A4	29	
037	Expertise Collegiale, IER, IRD, juin 2005; AVENIR DU FLEUVE NIGER AU MALI - SYNTHÈSE, Rapport provisoire	Office du Niger	PDF file	A4	94	
038	Systeme De Modelisation	Office du Niger	PP file	A4	36	
039	Tidiani TRAORE, octobre 2005; PRRESENTATION TECHNIQUE DE LA ZONE OFFICE DU NIGER, Direction Générale	Office du Niger	Word file	A4	18	
Information about M'Béwani Zone						
040	Office du Niger, nov 2009; SCHEMA D'AMENAGEMENT DU CASIER DE M'BEWANI (PROVISOIRE, Echelle 1/50,000)	Office du Niger	Photo copy	A3	1	Location Map of M'BEWANI
041	AHT GROUP AG et BETICO, juin 2009; RAPORT DÉFINITIF DE L'ÉTUDE D'AVANT-PROJET DÉTAILLÉ DU CASIER DU BLOC "D" DE M'BÉWANI, VOLUME 1: ÉTUDES TECHNIQUES , UE	Office du Niger	PDF file	A4	134	Study report on M'BEWANI Area Vol. 1
042	AHT GROUP AG et BETICO, juin 2009; -ditto-, VOLUME 2: DOSSIER DE CARTES ET PLANS , UE	Office du Niger	PDF, DWG	A4	69	Study report on M'BEWANI Area Vol.2 , Drawing
043	AHT GROUP AG et BETICO, juin 2009; - ditto -, VOLUME 3: MISE A JOUR DE L'ÉTUDE AGRO-SOCIO-ÉCONOMIQUE , UE	Office du Niger	PDF file	A4	117	Study report on M'BEWANI Area Vol 3

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
044	AHT GROUP AG et BETICO, juin 2009; - dito -, <i>l'ÉTUDE D'IMPACT ENVIRONNEMENTAL</i> , UE	Office du Niger	PDF file	A4	150	EIA of M'BEWANI
045	Commission Européenne, juin 2009; <i>DOSSIER D'APPEL D'OFFRE OUVERT INTERNATIONAL</i>	Office du Niger	Word file	A4	234	Tender Document
046	Ministère des Affaires Étrangères et de la Coopération International; <i>DOSSIER D'APPEL D'OFFRE RELATIF AU CONTROLE & LA SURVEILLANCE DES TRAVAUX</i>	Office du Niger	Word file	A4	61	Tender Document
047	TRANSTEC, décembre 2008; <i>Rapport Provisoire " Étude d'Impact Environnemental du projet d'aménagement du casier «D» de M'Béwani</i> , UE	Office du Niger	PDF file	A4	217	EIA of M'BEWANI
048	Italtrend, décembre 2008; <i>Rapport de Faisabilité Provisoire «PROJET DE REALISATION DE 40 KM DE DRAIN COLLECTEUR DANS LE KALA SUPERIEUR ETUDES DE FAISABILITE, D'APD ET DAO</i> , UE	Office du Niger	Word file	A4	46	
049	Office du Niger Zone de M'Béwani, mars 2010; <i>PHYSIONOMIE DE LA CAMPAGNE 2009-2010</i>	Office du Niger, Direction de la	Photo copy, Word file	A4	20	
OFFICE RIZ SEGOU						
050	Office Riz Seou ; <i>Fiche de projet de SENANKOU</i>	Office Riz Ségou	Photo copy	A4	2	
051	Office Riz Seou ; Feuille d'Information de Projet Prioritaire	Office Riz Ségou	Photo copy	A4	1	
052	Office Riz Seou ; <i>Fiche de projet des Plaines, Mares et Périmètres Irrigués Villageois du DELTA 2</i>	Office Riz Ségou	Photo copy	A4	7	
053	Office Riz Seou ; Liste des Projets d'aménagement hydro-agricole	Office Riz Ségou	Photo copy	A4	1	
054	Office Riz Seou, juin 2010 ; <i>Carte de la zone d'intervention de l'office Riz Ségou</i>	Office Riz Ségou	Photo copy	A4	1	
055	Office Riz Ségou, juin 2010 ; <i>Complexe de Dioro</i>	Office Riz Ségou	Photo copy, AutoCAD	A4	1	
056	Office Riz Ségou ; <i>Zone D'intervention de l'ORS dans le Delta 2</i>	Office Riz Ségou	Photo copy	A4	1	
057	Office Riz Ségou; <i>Présentation Project Aménagement de Plaines en Zone Office Riz Ségou</i>	Office Riz Ségou	PowerPoint	A4	12	
OFFICE RIZ MOPTI						
058	Office Riz Mopti, mai 2004; <i>Note de Présentation</i>	Office Riz Mopti	PDF file	A4	18	
059	Office Riz Mopti, juin 2009; <i>Note de Présentation</i>	Office Riz Mopti	PDF file	A4	15	
060	Office Riz Mopti; <i>Localisation des Casier Rizivole et Pastoraux</i>	Office Riz Mopti	Photo copy	A4	1	
061	S.A.E.D. SARL, juin 2009; <i>Étude Technique D'avant Projet Detaille (APD) du Périmètre Irrigué Villafeois de Neima Dans la Rigion de Mopti, Rapport de Synthese Volume 1 version corrigée</i> , Office Riz Mopti	Office Riz Mopti	Photo copy	A4 A3	45 8	

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
062	S.A.E.D. SARL, juin 2009; - dito - , <i>Rapport d'Études Pédologiques Volume 2 version corrigée</i> , Office Riz Mopti	Office Riz Mopti	Photo copy	A4	48	
063	S.A.E.D. SARL, juin 2009; - dtio - , <i>Rapport d'Études des Impacts Environnementaux Volume 3 version corrigée</i> , Office Riz Mopti	Office Riz Mopti	Photo copy	A4	63	
064	S.A.E.D. SARL, juin 2009; - dtio - , <i>Rapport d'Études Socio Économiques Volume 4 version corrigée</i> , Office Riz Mopti	Office Riz Mopti	Photo copy	A4	23	
065	S.A.E.D. SARL, juin 2009; - dito - , <i>Plan D'Aménagement du Périmètre</i> , Office Riz Mopti	Office Riz Mopti	Printed Material	A1	1	
066	DNGR, décembre 1981; <i>Région de Mopti, Cercle de Djenné, AMENAGEMENT DE BOUGOULA «ETUDE HYDRAULIQUE, DEVIS ESTIMATIFS»</i>	Office Riz Mopti	PDF file	A4	37	
067	DNGR, août 1982; <i>Région de Mopti, Cercle de Mopti, AMENAGEMENT DE MOPTI-NORD «ETUDE HYDRAULIQUE, MODIFIEE»</i>	Office Riz Mopti	PDF file	A4	31	
068	DNGR, août 1982; <i>Région de Mopti, Cercle de Mopti, AMENAGEMENT DE SARE - MALA DIVISION EN DEUX CASIERS «NOUVELLE ETUDE HYDRAULIQUE - DEVIS ESTIMATIF»</i>	Office Riz Mopti	PDF file	A4	46	
069	DNGR, novembre 1981; <i>Région de Mopti, Cercle de Djenné, AMENAGEMENT DE SOFARA, AMELIORATOPN ET EXTEN «ETUDE HYDRAULIQUE»</i>	Office Riz Mopti	PDF file	A4	24	
Programme de Mise en Valeur des Plaines du Moyen Bani (PMB)						
070	Programme de Développement de l'Irrigation dans le Bassin bu Bani et à Sélingué site de Bla/San (PDI-BS), juin 2010; <i>NOTE TECHNIQUE SUR LE PROGRAMME</i>	PDI-BS	Photo copy	A4	7	
071	PDI-BS, février 2007; <i>PLAN D'AMENAGEMENT DE LA ZONE DU PROJECT MOYEN BANI</i>	PDI-BS	Printed Material	A3	1	
Office de Développement Rural de Selingué (ODRS)						
072	ODRS, juin 2010; <i>Project d'Aménagement et de Réhabilitation de Périmètres Irrigués dans la zone de Sélingué, REQUETE DE FINANCEMENT</i>	ODRS	Photo copy	A4	5	
073	ODRS; <i>Plan2 Postes d'observation niveau piézométrique</i>	ODRS	Photo copy	A4	1	
074	Ministère des Mines de L'Enegie et de L'Eau, Ministère de L'Economie et des Finances, Ministère du Développement Rural, juin 2002; <i>ARRETE INTERMINISTERIEL No 02/ MMEE-MEF-MDR, "FIXANT LES ATTRIBUTION, LA COMPOSITION ET LES MODALITES DE FONCTIONNEMENT DE LA COMMISION <<GESTION DES EAUX>> DE LA RETENUE DE SELINGUE</i>	ODRS	Photo copy	A4	1	
075	ODRS; <i>AMENAGEMENTS HYDRO AGRICOLES ET ROUTES EXISTANTS ET PLANIFIES DANS LA ZONE D'INTERVENTION</i>	ODRS	Printed Material	A0	1	
076	ODRS; <i>ORGANIGRAMME GENERAL DE L'ODRS</i>	ODRS	Photo copy	A4	1	

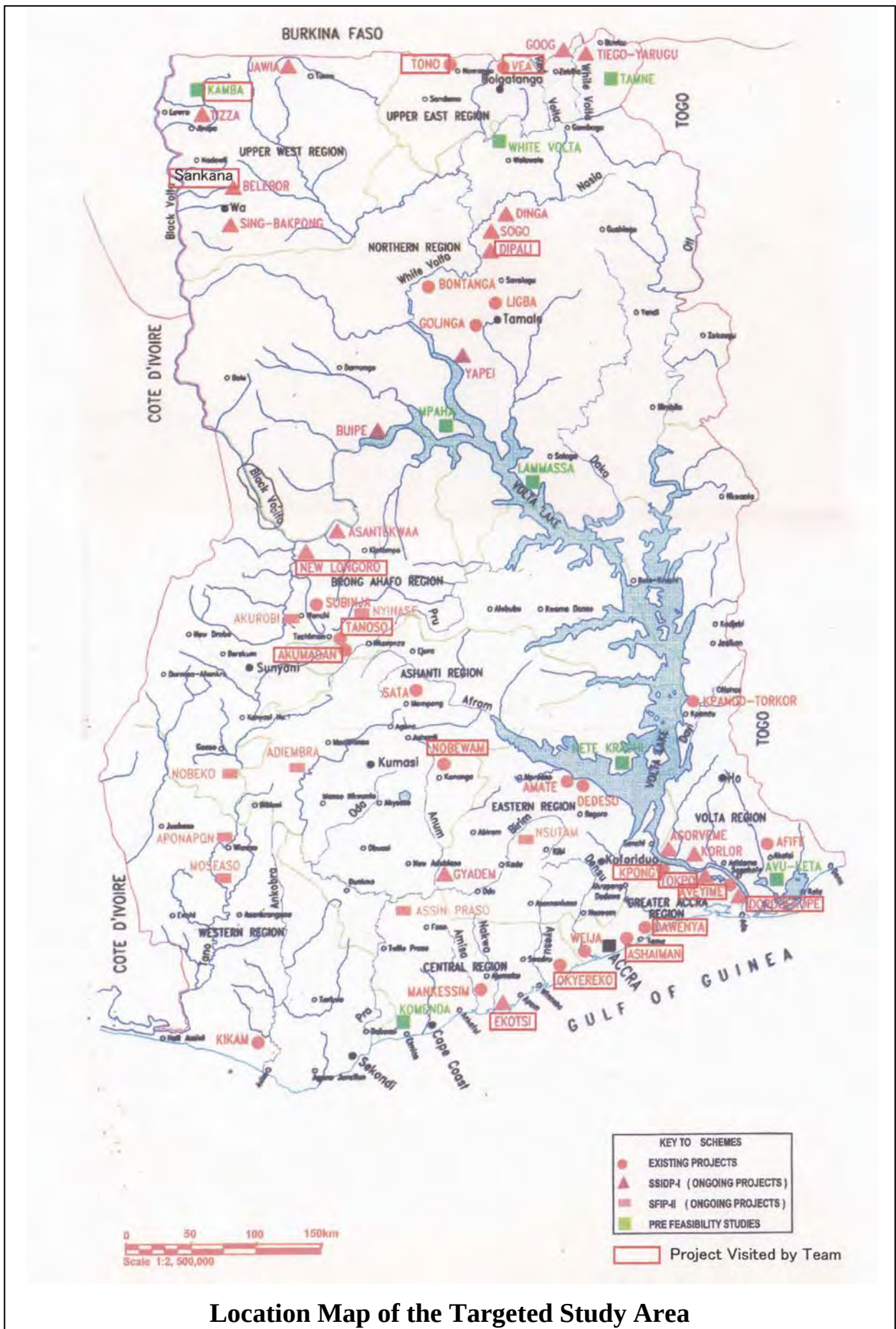
M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
077	ODRS, jan 2009; <i>Décision N° 0001/DG-ODRS "FIXANT L'ORGANISATION INTERNE ET LES REGALES PARTICULIERS DE FONCTIONNEMENT ET D'ADMINISTRATION DE L'OFFICE DE DEVELOPPEMENT RURAL DE SELINGUE (ODRS)"</i>	ODRS	Photo copy	A4	1	
Office du Périmètre irrigué de Baguinéda (OPIB)						
078	OPIB, juin 2010; <i>FORMULAIRE DE REQUETE POUR LA COOPERATION FINACIERE NON-REMBOURSABLE DU JAPON (DONS POUR LES PROJETS GENERAUX)</i>	OPIB	Photo copy	A4	10	
079	BETICO-Mali, avril 2008; <i>PLAN D'ENSEMBLE, OPIB</i>	OPIB	Drawing	A0	1	
080	OPIB, juillet 2010; Caractéristiques des Canaux Secondaires de Baguinéda	OPIB	Photo copy	A4	2	
Office de la Haute Vallée du NIGER (OHVN)						
081	OHVN, mai 2006; <i>REQUET DE FINANCEMENT POUR LA REHABILITATION DU PERIMETRE IRRIGUE DE FARABANA</i>	OHVN	Photo copy	A4	14	
082	OHVN ; <i>INVENTAIRE DES PLAINES</i>	OHVN	Excel file	A4	1	
National Plan/Strategy						
083	Assemblée Nationale - 3eme Législature, 2006 ; <i>LOI N° 06-40/AN-RM «PORTANT LOI D'ORIENTATION AGRICOLE»</i>	Office du Niger	Word file	A4	29	
084	MINISTÈRE DU DÉVELOPPEMENT RURAL ET DE L'EAU SECRÉTARIAT GÉNÉRAL, 1999; <i>STRATÉGIE NATIONALE DE DÉVELOPPEMENT DE L'IRRIGATION</i>	DNGR	Word file	A4	77	
085	H.N'D ingénieurs conseils sarl Société Hamady N'DJIM, mai 2008; <i>STRATÉGIE NATIONALE DE DÉVELOPPEMENT DE L'IRRIGATION Rapport final</i> , Direction Nationale du Génie Rural, Programme National d'Infrastructures Rurales (PNIR)	DNGR	Word file	A4	68	
086	Secrétariat Général du Gouvernement, Publié avec le concours du PNUD et de la Coopération Française ; <i>LOI No02-006/ DU 31 JAN.2002 «PORTANT CODE DE L'EAU»</i>	DNGR	PDF file	A4	15	
087	Cellule Nationale CEDEAO, août 2010; <i>Plan National D'Investissement Prioritaire dans Le Secteur Agricole au Mali 2011-2015</i>	CEDEAO	PDF file	A4	81	
088	M. Abdrahmane BERTHE et M. Sadio KEITA, août 2009; Investissements Agricoles et Croissance Économique en vue de la Réduction de la Pauvreté, PDDAA	PDDAA	PDF file	A4	61	
Environment						
089	SECRÉTARIAT GENERAL DU GOUVERNEMENT; <i>DECRET N° 08-346/PRM DU 26 JUIN 2008 "RELATIF A L'ETUDE D'IMPACT ENVIRONMENTAL ET SOCIAL</i>	Direction National de l'Assainissement	Photo copy	A4	10	

M - 2 List of Data and Documents Collected in Mali

No.	Title of Document	Source	File Type	Size	Pages	Remarks
090	Royal Haskoning, A&W, GID, 2010; <i>Etat des lieux du Delta Intérieur -ver une vision commune de développement</i> , Le Ministère de l'Environnement et de l'Assainissement	Embassy of the Netherlands	Bookbinding	A4	182	
Statistics						
091	Institute National de la Statistique; <i>PRIX MOYENS DE VENTE DES MATERIAUX ET PRODUIT DE CONSTRUCTION A BAMAKO MOIS DE MARS 2010</i>	Institute National de la Statistique	Photo copy	A4	5	
092	Institute National de la Statistique; <i>INDICE DES MATERIAUX ET PRODUITS DE CONSTRUCTION A BAMAKO (BASE 100 EN 2000)</i>	Institute National de la Statistique	Excel file	-	427kB	
093	Institute National de la Statistique; <i>PRIX MOYENS DE VENTE DES MATERIAUX ET PRODUIT DE CONSTRUCTION A BAMAKO</i>	Institute National de la Statistique	Excel file	-	551K B	
Others						
094	AfDB; Mali: <i>PROGRAMME DE DEVELOPPEMENT IRRIGATION PHASE II</i>	AfDB	Photo copy	A4	1	
095	Cellule de Planification et de Statistique du Secteur de Développement Rural, 2009; <i>Répertoire 2009 des projets et Programmes du Secteur du Développement Rural</i>	Programme National des Petit Barrages et Bas-	Bookbinding	A4	216	
096	Ministère de l'Agriculture, Cellule de Planification et de Statistique, décembre 2008; <i>Rapport de Monitoring Externe National Orienté vers les Résultats : MENOR 10/08</i>	PNPBBF	PDF file	A4	5	
097	Direction Nqtionqle de Génie Rural, PNPBBF, Avril 2010 ; <i>CONTRIBUTION DU PNPBBF A LA REDUCTION DE LA PAUVRETE EN MILIEU RURAL AU MALI, FINANCEMENT FONDS JAPONAIS KRII.</i>	PNPBBF	Word file	A4	19	
098	Kara-Consult & Cabinet d'Etudes et de Conseils; <i>EVALUATION DES IMPACTS SOCIO-ECONOMIQUES DES REALISTAIONS DU PROGRAMME NATIONAL DE PETITS BARRAGES ET BAS-FONDS</i> , Direction Nqtionqle de Génie Rural, PNPBBF	PNPBBF	Word file	A4	20	
099	Direction Nqtionqle de Génie Rural, PNPBBF ; <i>BARRAGE</i>	PNPBBF	Word file	A4	94	
100	Direction Nqtionqle de Génie Rural, PNPBBF ; <i>LISTE DES DEMANDES DE FINANCEMENT DE PETITS BARRAGES ET BAS-FONDS</i>	PNPBBF	Word file	A4	12	
101	Direction Nqtionqle de Génie Rural, PNPBBF ; <i>REQUETE JAPON PAR REGION 2009</i>	PNPBBF	Word file	A4	7 Files	
Projet de Développement Rural Intégré en Aval du Barrage de MANANTALI						
102	Projet de Développement Rural Intégré en Aval du Barrage de Manantali : <i>Note d'information technique sur Projet (résumé de l'APD)</i>	PDIAM	Word file	A4	7	
103	Projet de Développement Rural Intégré en Aval du Barrage de Manantali, juin 2010 : <i>Rapport diagnostic du périmètre "B"</i>	PDIAM	Word file	A4	4	

PART – V
Republic of Ghana



Location Map of the Targeted Study Area

PART-V GHANA

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Part - V Ghana

Location Map of the Targeted Project Area

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Glossary of Acronyms

Acronyms	Orthography
AfDB	African Development Bank
AgSSIP	Agriculture Sector Services Improvement Project
CAADP	The Comprehensive Africa Agriculture Development Programme
CARD	Coalition for African Rice Development
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
FAPIM	Farmers' Participation in Irrigation Management
GDP	Gross Domestic Product
GIDA	Ghana Irrigation Development Authority
GOG	Government of Ghana
GPRS	Ghana/Growth Poverty Reduction Strategy
GWCL	Ghana Water Company Limited
ICOUR	Irrigation Company of Upper Region
IFAD	International Fund for Agricultural Development
JICA	Japan International Co-operation Agency
MiDA	Millennium Development Authority
MOFA	Ministry of Food and Agriculture
NEPAD	New Partnership for African Development
NWP	National Water Policy
OM&R	Operation Maintenance and Repair
SFIP	Small Farms Irrigation Project
SSIDP	Small Scale Irrigation Development Project
VRA	Volta River Authority

Chapter 1 Profile of Irrigated Agriculture in Ghana

1.1 Profile of Irrigated Agriculture

Rice is second staple food after maize , and the per capita consumption is recorded at 22 kg.

Production of paddy is estimated at 250,000 ton/year, which covers 30 % of national demand. To make up this deficiency of rice, Ghana depends on import from Asian countries such as Vietnam.

A main producing center of rice is Central and Southern area where sufficient rainfall can be expected.

A ratio of irrigated paddy field is only 25 %, and paddy production is practicing mainly under rainfed condition.

Ghana Irrigation Development Authority (GIDA) has a responsibility for irrigated agriculture in Ghana.

GIDA manages 54 irrigation project coring a total area of 11,700 ha. Majority of these projects are small scale pumping irrigation schemes, and large scale projects, which have a commanding area of more than 500ha, are limited to 4 such as Kpong, Tono, Afife, Veia projects.

Excluding SSIDP and SFIP from 54 GIDA projects, the remaining 22 projects are so-called "Public Irrigation Schemes". These Public Irrigation Schemes are directly managed by GIDA through site offices. Moreover , JICA program of "Farmers Participatory Irrigation Management, FAPIM" targets these projects .

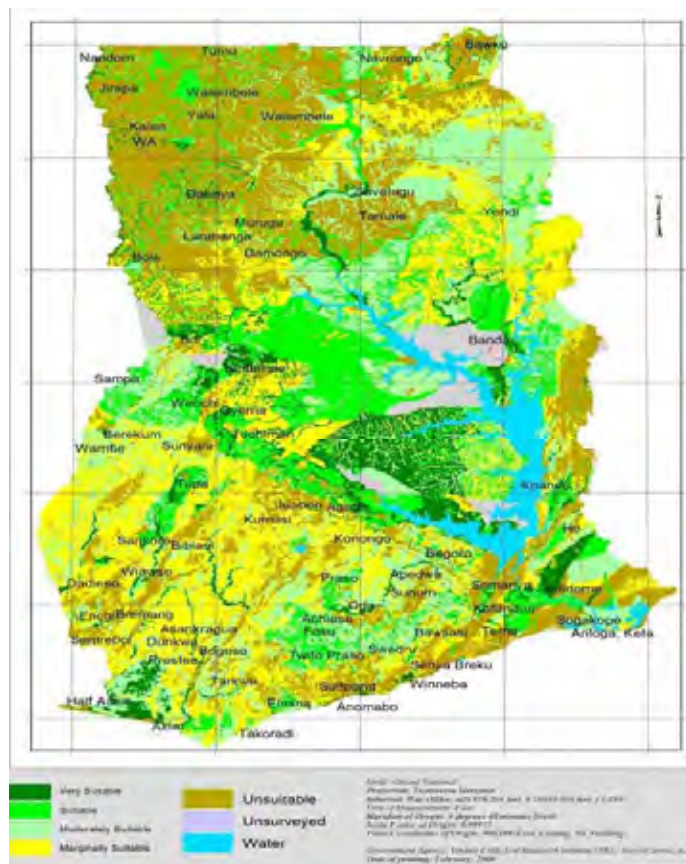


Figure 1-1 Rice Production Capability Map

Source : MOFA, Feb. 2009 : National Rice Development Strategy (Draft) page20

Table 1-1 Rice Production and Consumption

	1998	1999	2000	2001	2002	2003	2004
Area harvested (1,000ha)	130.4	105.3	115.2	136.0	122.8	117.0	119.4
Unit Yield (ton/ha)	1.5	2.0	2.2	2.0	2.3	2.0	2.0
Production as paddy (1,000 t)	193.6	209.8	248.7	274.6	280.0	238.8	241.8
Import (1,000 t, milled rice equiv.)	78.0	69.1	167.0	368.1	314.3	755.0	448.0
Food aid in rice (milled)	2.3	9.8	10.8	11.8	15.5	7.4	-

Source: CARD Home Page

Table 1-2 Rice Production in each Zone

	Upland			Rainfed lowland			Irrigated lowland			Total		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.
2008	7	1.5	11	92	2.5	230	19	4.0	76	118	2.7	316
2013	30	2.2	66	150	3.0	450	25	5.0	125	205	3.1	641
2018	45	2.5	113	300	3.5	1,050	30	6.0	180	375	3.6	1,343

Source: CARD Home Page

1.2 Progress of CARD

A committee for CARD is created in the Ministry of Food and Agriculture. As for the "NATIONALE RICE DEVELOPMENT STRATEGY ", the document was published in February, 2009.

1.3 Progress of CAADP

The CAADP Compact was signed in Oct. 28,2009 under leadership of the WB. The Ghana government aims to execute mid-term investment plan in agricultural sector based on the FASDEF-II with ECOWA within the frame work of CAADP.

In 2007, the Ministry of Food and Agriculture formulated FASDEP II targeting at:

- i) Capacity building of MFA staff and strengthening of MFA organization,
- ii) Promotion of agricultural credit,
- iii) Developing, spreading, and utilizing of suitable agricultural techniques,
- iv) Improvement of social infrastructures,
- v) Promotion of selected crops, and
- vi) Improvement of access to markets

Following the termination of GPRSII in 2009, the Ghana government is preparing a national development plan setting a goal at the year of 2015. The outline of the strategic framework of the plan was announced in June, 2009. They are:

- i) Industrialization of agriculture by modernization of agricultural technologies
- ii) Investment to human resources development in order to increase productivity
- iii) Reduction of gaps among regions in terms of income
- iv) Institutional reform for heading to improvement of management skills for efficient agricultural development

At the same time, a mid-range national development plan for four years from 2010 to 2013 was settled on. The draft plan as of Aug. 2009 aimed at:

- i) Sustainable economic growth,
- ii) Reduction of poverty,
- iii) Achievement of millennium goals by 20015, and
- iv) Joining in medium class income counties.

In order to realize above mentioned aims, the following measures were considered.

- i) Stabilization of macro economy
- ii) Modernization of agriculture ,
- iii) Development agro-industry,
- iv) Cooperation between government and private sector, and
- v) Improvement of governance.

1.4 National Strategy and Plan Related to Irrigation

To achieve the Irrigation Policy Goals: *”To achieve sustainable growth and enhanced performance of irrigation contributing fully to the goals of the Ghanaian agriculture sector”*⁽ⁱ⁾, as outlined in the Growth and Poverty Reduction Strategy, the Irrigation Policy proposes the following thrusts/Objectives .

- i. Performance and Growth.
- ii. Socio-Economic Inclusion.
- iii. Responsible Production.
- iv. Enhanced Services

To realize the objective of “Performance and Growth”, the policy set specific sub-objectives corresponding to the policy implementation strategy.

- (a) To raise productivity of agricultural water for irrigation, livestock watering and aquaculture.
- (b) To enhance production potential of ongoing irrigation activities
- (c) To develop new irrigation areas according to demand and feasibility
- (d) To establish appropriate funding mechanisms for public irrigation
- (e) To increase private sector investment in irrigation

In order to implement these sub-objectives, the responsibility is given to GIDA as a central agency.

At present, necessary budget to manage the “Public (Formal) Irrigation Project” is not allocated sufficiently. In item (b) of the sub-objectives, increase of direct budgetary allocation to GIDA is stipulated as a strategic action.

In addition, chapter 6 of the policy mentions organizational reform of GIDA. In this regard, it is highly expected that GIDA will be strengthened financially and organizationally.

¹ National Irrigation Policy , Strategies and Regulatory Measures, May 2010, Page 18

Chapter 2 Summary of Discussions with Related Agencies

2.1 Schedules of the Field Study

The project formulation team visited the republic of Ghana for 52 days from July 10th to Aug. 30th. The following table shows the summary of the schedule.

Table 2-1 Schedule of the Field Study

Date	Major Activities
July 10	Team member, Mr. Masaki, entered the Republic of Ghana
July 12 ~ 15	Meeting : JICA , Ministry of Food and Agriculture, GIDA., AfDB
July 19 ~Aug. 5	Site Visit : Site investigation of 17 projects
Aug. 9 ~Aug. 17	Reporting : Site Investigation Report Meeting : JICA, FAO, World Bank
Aug. 18	Team leader Mr. Kobayashi entered the Republic of Ghana
Aug. 19	Meeting : Reporting about results of site investigations and discussion on project priority
Aug. 20 ~Aug. 26	Site Visit and Data Collection
Aug. 27	Meeting with JICA
Aug.30	Meeting with WB, and Leaving for Tokyo

2.2 Records of Discussion with Governmental Agencies

Ministries and governmental organizations visited during the survey period were as follows.

Table 2-2 Ghanaian Governmental Organization/Agency Contacted

Category	Ministry/Organization
Central Office	Ministry of Food and Agriculture (MoFA) Ghana Irrigation Development Authority (GIDA)
Fiel Offices	Project Office : Okyereko, Ahaiman, Kpong, Nobewam, Akumadan Regional Office : Techiman (Ahanti1, Brong- Ahafo) Northern Region (Tamale) Upper West (Wa) Upper East (Bolgatanga) NRGP Office (Tamale)

2.3 Record of Interview with International Organizations

International organizations visited during the survey period were as follows.

Table 2-3 International Agencies Contacted

Agencies	Subject
World Bank	Schedule and findings of WB Mission Possibility of cooperation on the Accra Plains Irrigation Project
African Development Bank	Possibility of cooperation with JICA (SSID,NRGP, etc.)
FAO	Possibility of cooperation in future

Chapter 3 Results of the Site Investigation

3.1 Regional Conditions of Paddy Cropping

Prior to site investigation, the team studied potential areas for irrigation development from viewpoints of water resources and land resources. As a result, potential areas for large scale irrigation development are the Bui (or Black Volta) river basin, the White Volta river basin, Accra Plains, and Left bank of Lower Volta river (Kpong left).

3.1.1 Bui River Basin (Black Volta)

On the Rice Production Capability Map of NRDS, this area is categorized as suitable for rice cropping. The area, however, has not developed for irrigated agriculture.

The Ghanaian government exchanged signature between China about irrigation development of 3,000 ha in the Bui basin including hydropower generation development. In July, 2010, it was said that tendering for procurement of engineering services was called.

3.1.2 White Volta River Basin

The White Volta river basin is one of the potential area for rice cultivation in terms of flat topographic conditions. Because the river basin is flood prone area, river structures such as weir have not constructed. Therefore, pumping irrigation projects of small and medium scale spread out along the river.

Introduction of gravity irrigation by construction of river structure would worsen the flood problem and require huge investment. Pumping irrigation would be an immediate measure for irrigation development.

3.1.3 Accra Plains

Accra plans Irrigation Project is a huge project spreading on right bank of the Volta river covering development area of 156,000 ha (200,000 ha officially). The government has kept an intense desire to develop the area for a long time.

The project has a vast undulating Plains. Therefore, there is a difficulty in developing the entire area by open channels.

In June, 2010, feasibility study reports on development of the entire area of 200,000 ha and the selected priority area were submitted by consultants with a financial support of Kuwait funds.

According to the study report on priority area, areas with a sloping of under 5 % are selected, the priority area of 5,000 ha would be irrigated by pumping irrigation.

The project was taken up by the world bank mission for project formulation. In this context, study team review the priority project to find a possibility of co-financing with the world bank. As a result, the team found a possibility of gravity irrigation taking irrigation water from the Kpong reservoir. Sub-clause 5-2-2 of Chapter 5 in this report explains the review result.

3.1.4 Kpong Left Bank

The Kpong left bank irrigation project covering potential area of 5,000 ha is irrigated by gravity canal system whose source is the Kpong reservoir.

MiDA submitted a final feasibility study report targeting 2,000 ha in April, 2010. By the way, it is said the MCA support is scheduled to terminate by the end of 2011. The progress of the scheme is noticeable for limitation of implementation period.

3.2 Existing Irrigation Projects

GIDA manages 56 irrigation projects, which consist of 22 public schemes, 26 SSID projects, and 8 SFI projects, as listed below. In addition to these projects, there are hundreds of community managed schemes mainly in the Northern Regions. Moreover, various sizes of private farms scatter over the country.

The list of 56 projects is attached as Annex 2 in this report.

Table 3-1 Existing Irrigation Project

Project	Category	Potential Area (ha)	Developed Area (ha)	Remarks
Ashaiman	22 Public Schemes	155	155	Supported by JICA grant aid
Dawhenya	22 Public Schemes	450	200	
Kpong	22 Public Schemes	3,028	2,786	Rehabilitated by AfDB
Weija	22 Public Schemes	1,500	220	
Afife	22 Public Schemes	950	880	Rehabilitated by WB
Aveyime	22 Public Schemes	120	60	Rehabilitated by WB
Kpanndo-Torkor	22 Public Schemes	356	40	
Mankessim	22 Public Schemes	260	17	
Okyereko	22 Public Schemes	111	81	Supported by JICA grant aid
Subinja	22 Public Schemes	121	60	
Tanoso	22 Public Schemes	115	64	
Sata	22 Public Schemes	56	34	
Akumadan	22 Public Schemes /	1,000	65	Rehabilitated by WB
Anum Valley	22 Public Schemes	140	80	The same project as Nobewam
Amate	22 Public Schemes	203	101	Rehabilitated by WB
Dedeso	22 Public Schemes	400	20	Rehabilitated by WB
Kikam	22 Public Schemes	27	27	
Bontanga	22 Public Schemes	570	450	
Golinga	22 Public Schemes	100	40	
Libga	22 Public Schemes	20	16	
	Sub-Total	9,682	5,396	
Tono	22 Public Schemes	3,840	2,490	ICOUR management project
Vea	22 Public Schemes	1,197	850	ICOUR management project
	Sub-Total	5,057	3,340	
SSIDP	26 Schemes		2,349	
SFIP	8 Schemes		460	

3.3 Potential Irrigation Area Selected by the Government

3.3.1 Potential Irrigation Area

GIDA requested rehabilitation of 10 public irrigation projects out of 22 and development of three new projects as potential areas.

Through discussion with AfDB, SSDIP projects and newly commenced NRGPs were included in candidate projects for site investigation. Through discussion with AfDB, SSDIP projects and newly commenced NRGPs were included in candidate projects for site investigation.

3.3.2 Site Investigation of the Potential Irrigation Areas

The study team visited potential areas to clarify present status of the projects. Some projects were not visited due to time constraints and security reasons.

The following table shows the candidate projects and visited projects. Results of site visits are summarized in the Project Sheet attached as Annex-1.

Table 3-2 Potential Project and Site Investigation

Project	Category	Irrigation Area*	Date of Site visit	Remarks
Tono	GIDA requested project	3840 (2490)	Aug. 2	
Vea	GIDA requested project	1197 (850)	Aug.3	
Dawhenya	GIDA requested project	450 (200)	July 21	
Ashaiman	GIDA requested project	155 (155)	July 21	Supported by JICA grant aid
Okyereko	GIDA requested project	111 (81)	July 19	Supported by JICA grant aid
Aveyime	GIDA requested project	120 (60)	July 22	
Kpong	GIDA requested project	3028 (2786)	July 23	AfDB extended
Afife	GIDA requested project	950 (880)	-	WB rehabilitated
Akumadan	GIDA requested project	1000 (65)	July 27	WB rehabilitated
Nobewam	GIDA requested project	140 (140)	July 26	
Kamba	New Development	-	July 30	F/S conducted
Tamne	New Development	-	-	F/S conducted
Sori and Puri	New Development	-	-	Details are not known
Ekotsi	AfDB (SSID)	25 (4)	July 19	
Dordoekope 2	AfDB (SSID)	103 (20)	July 20	
Agorveme	AfDB (SSID)	109 (109)	July 20	
Tokpo	AfDB (SSID)	91 (68)	July 22	
New Longoro	AfDB (SSID)	448 (344)	July 28	Priority by Regional office1
Dipali	AfDB (SSID, NRGPs candidate)	240 (171)	July 28	Priority by Regional office1
Sankana	Community Management	140 (20)	July 30	Priority by Regional office1

Note; Irrigation Area shows the potential area in ha, and figures in parentheses mean developed area.

Source : GIDA and GIDA site offices

Chapter 4 Potential Development Area

4.1 Criteria for Selection of Targeted Development Areas

The following criteria are adopted for selection of Priority project

- Possibility of Cooperation with World Bank and Donors
- Compatibility with National Policy
- Intention of Ghanaian Government
- Urgency and Necessity
- Deterioration of facilities, Request by Farmers
- Stability of Water Source
- Operation and Maintenance Organization, Easiness of Maintenance
- Present Status of Farmers' Organization and Activities
- Accessibility to markets
- Others : Difficulty of land acquisition

4.2 Development Scheme for Targeted Development Areas

A total of 8 candidate projects were identified by the team or requested by the agencies concerned during the site inspection period. The following table 4-1 shows priority ranking of the candidate projects as a result of the study conducted applying the criteria. The study results and the process are summarized in the table 4-2.

Table 4-1 Priority of Candidate Projects

Priority	Project Title	Implementing Agency	Remarks
1	Tono -Vea Irrigation Projects	ICOUR	Tono is given higher priority than Vea by ICOUR and Ghanaian government.
2	Accra Plains Irrigation Project	GIDA	There is a possibility of gravity irrigation by using the Kpong Reservoir as water source. Realization of the project is a dream of the government.
3	Kpong Right Bank Irrigation Improvement Project	GIDA	Comprehensive improvement project of the Kpong and the proposed Accra-Plains whose main canal would run through the Kpong irrigation area.
4	Rehabilitation of Public Irrigation Schemes	GIDA	Rehabilitation of projects managed by GIDA such as Ashaiman and Okyereko
5	Improvement of SSIDP	GIDA	-
6	Northern Rural Growth Programme	IFAD, MOFA, AfDB	Commenced in 2010
7	Kpong Left Bank Irrigation Project	MiDA	Project supported by MCA
8	New Irrigation Development Project	GIDA	Three new projects of Kamba, Tamne, Sori and Puri

Table 4-2 Study of Candidate Projects (Republic of Ghana)

	Candidate Project	Project Site	Budget (million US\$)	Expected Donor	Implementing Agency, Donors	Present Status/ Progress	Objectives and Outcomes			Input	Basic Condition									Advantages	Concerns	
							Irrigation Area (ha)	Target Crop	Unit Yield		New /Rehabilitation/ Improvement	Irrigation methods Facilities at water source	Cooperation with WB / Donors	Consistency with National Policy	Urgency	Water Source	Operation and Maintenance	Farmers' Organization	Accessibility			
1	Tono - Vea Irrigation Project	Upper West Region	Tono: 25.2 Vea : 43.5	-	ICOUR	Tono: Under Rehabilitation Vea : Waiting for F/S	Tono: 2,490 Vea : 850	Paddy	5 - 7 t/ha	Tono : Grant Aid Lining of Secondary canals, Dredging of Main Drainage canal Vea : Grant Aid Lining of Main and Secondary canals, Dredging of Main Drainage canal Rehabilitation of Dam body Dredging of reservoir	Fully Controlled Gravity with reservoirs Capacity of reservoirs Tono:	Rehab.	△	◎	◎	◎	◎	◎	◎	◎	The project would be the co-financing one with IFAD and AfDB. ICOUR has a responsibility of O&M of Tono and Vea projects. In Tono , ICOUR has obtained a certain result. Priority of Government is high.	Main canal system of Tono was paved by concrete in 2007, and is in good condition. Secondary systems of both projects are deteriorated seriously, and require rehabilitation. Reservoir of the Vea project is jointly used for drinking water supply of Bolgatanga. Coordination between waterworks would be necessary for rehabilitation works of dam body and reservoir.
2	Accra Plains Irrigation Project (Comprehensive development with Kpong)	Lower Volta	85	WB (High possibility of co-financing)	GIDA	Detailed F/S Completed	F/S: 5,000 Newly Proposed 2,000	Paddy, etc.	7.0 t/ha	F/S for Comprehensive Development	Fully Controlled Gravity using existing Kpong reservoir	New	◎	○	◎	◎	◎	◎	◎	◎	The project plans of the F/S by Kuwait Funds adopts pump irrigation system for priority area of 5,000 ha. However, there is a possibility of gravity irrigation in consideration of the project location where the Kpong reservoir and existing scheme are located at upstream area.	Cost estimate of the F/S is expensive. (18,000 us\$/ha) Additional study about the cropping plan, the target yield, and the possibility of gravity irrigation should be executed urgently.
		Greater Accra	23.0	WB (Comprehensive project with Accra-Plains)	GIDA (AfDB)	New development was Completed in 2003	3,000	Paddy, Banana plantation	-	Dredging of Main Drainage Canal	Gravity , Pump only for Plantation	Imprv.	◎	◎	×	△	◎	◎	◎	◎	Gravity Irrigation by Kpong reservoir	GIDA management matter, pointed out by JICA mission in 2006, has not yet improved.
3	Rehabilitation of Public Irrigation Schemes	Nation-wide	See project sheet	-	GIDA	Waiting for F/S	-	Paddy	-	Grant Aid	Pump /Gravity	Imprv.	△	×	◎	◎	◎	◎	◎	-	Farmers demand the completion of the projects strongly.	Quality of construction works is poor.
4	Improvement of Small Scale Irrigation Project	Nation-wide	See project sheet	-	GIDA	Expiration of Project Loan in 2006	-	Paddy	-	Grant Aid	Pump /Gravity	Imprv. New	△	×	◎	◎	◎	◎	◎	-	The project would be the co-financing one with IFAD and AfDB. The project just started, and there is a room for intervention.	Priority project for infrastructure component would be improvement of SSIDPs.
5	Northern Rural Growth Programme (NRGP)	Northern Region, Upper East, Upper West	58	IFAD, AfDB	MOFA, IFAD, AfDB	Commenced in 2010	Under Identifying	Paddy	-	Cooperation with NRGp Grant aid of a part of the project	Pump /Gravity	Improv. New	△	×	◎	◎	◎	◎	◎	-	The project will start implementation in short time.	MCA Fund's is scheduled to expire in 2011. Project implementation will have a difficulty.
6	Kpong Left bank Irrigation Project		16	USA	MiDA	F/S completed	2,000	Paddy	-	Grant Aid	Fully Controlled Gravity	New	◎	×	◎	◎	◎	◎	◎	-	One of three projects is lack of data.	
7	New Irrigation Development Project	Northern Region	-	-	GIDA	F/S review	-	Paddy, etc.	-	Review of F/S	Pump /Gravity	New	◎	×	◎	◎	◎	◎	◎	-	Unidentified	

Note: ICOUR : Irrigation Company of Upper Region, GIDA : Ghana Irrigation Development Authority, MOFA : Ministry of Food and Agriculture, MIDA : Millennium Development Authority

Chapter 5 Selection of Targeted Area

5.1 Rationale for Selection of Targeted Areas

5.1.1 Tono-Vea Irrigation Projects

As a result of evaluation of candidate projects, the study team selected the TONO-VEA irrigation projects as a target area for development. Although Tono and Vea are two separate project, they are practically treated as one project because of their unified O&M organization of ICOUR (Irrigation Company of Upper Region). This report follows the practice.

Reasons for selection of the Tono-Vea irrigation projects are as follows.

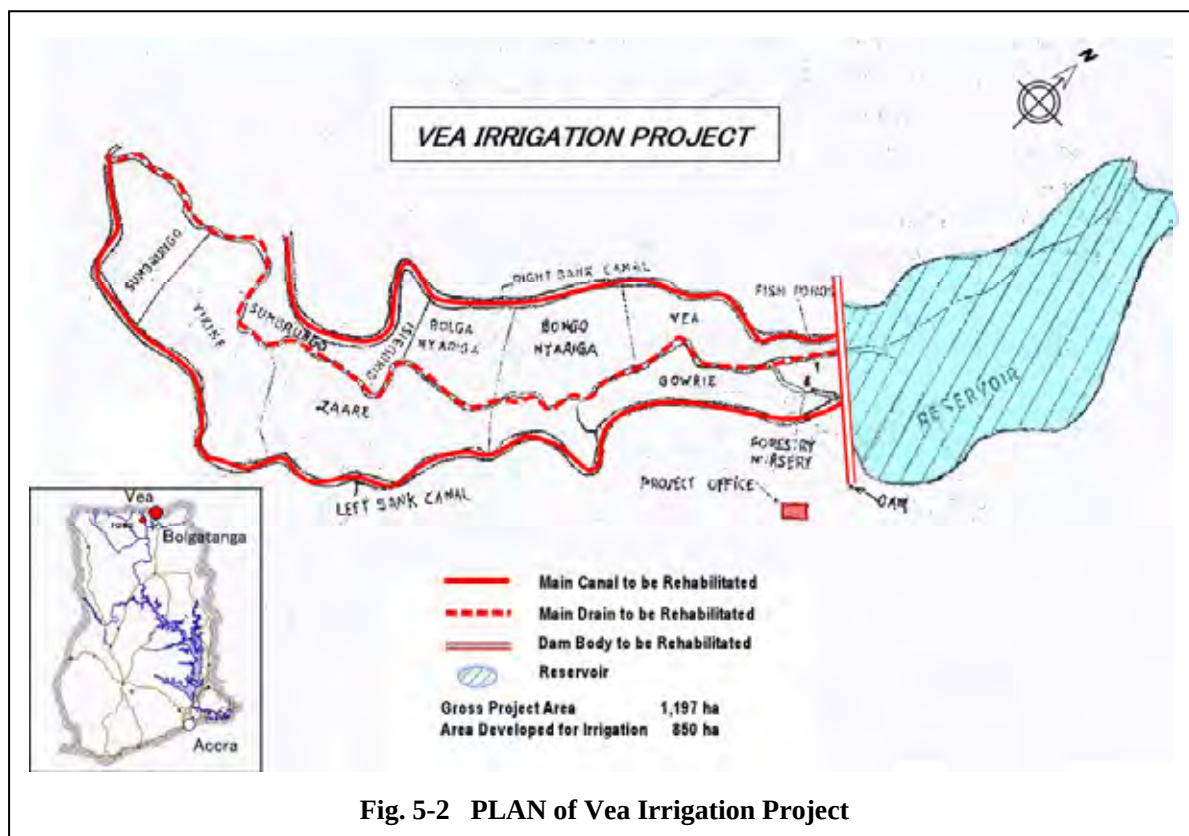
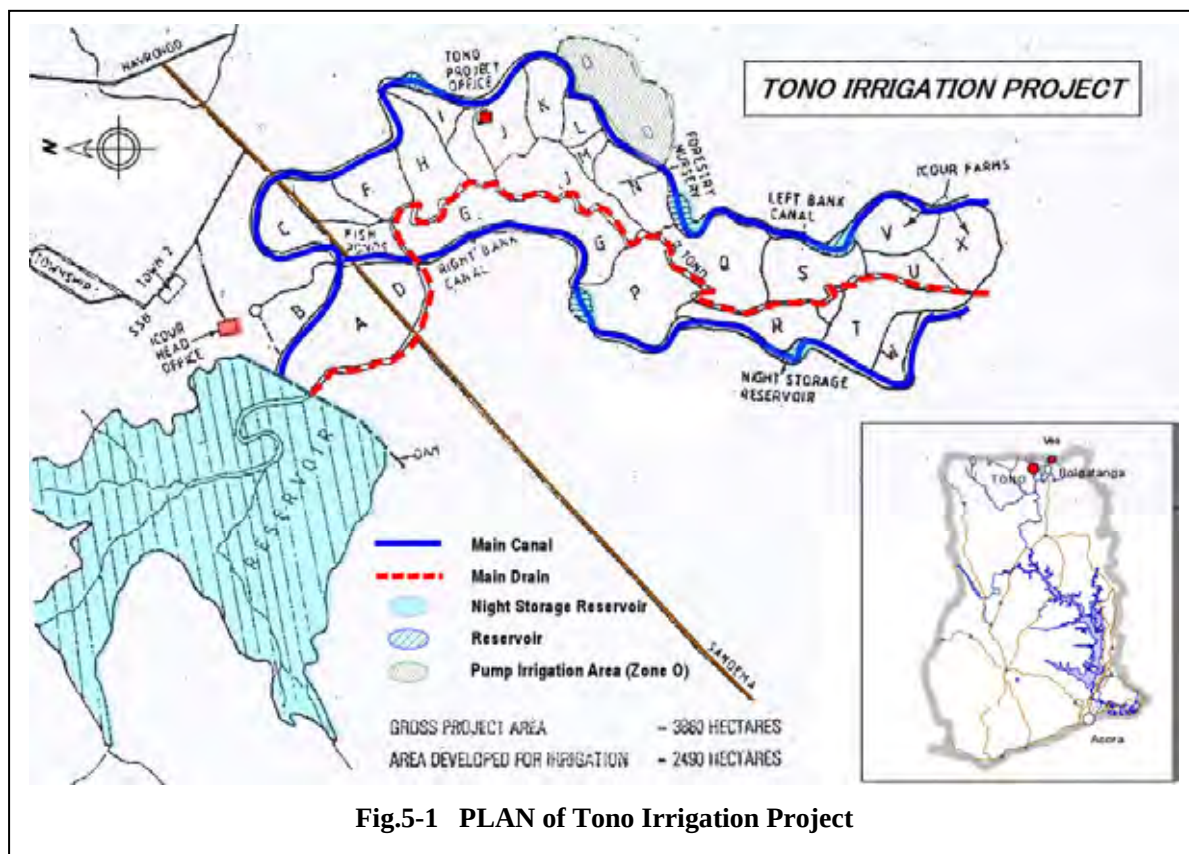
- 1) Consistency with National Policy : In the national Irrigation Policy, “enhancement of production potential of on-going irrigation activities” is one of the objectives. Rehabilitation of these projects is in consistency with this policy.
- 2) Intention of the Government : These two projects are large scale projects constructed by national budget in 1960s.

MoFA has continued direct investment to Tono irrigation project among others.

GIDA gave third priority to these projects because the management of the projects was beyond control of GIDA. In spite of 3rd place in the GIDA priority, the project has high priority in MoFA.
- 3) Urgency and Necessity : Farmers have strong intention of rehabilitation of irrigation and drainage facilities.
- 4) Stability of Water Source : Both Tono and Vea projects are able to supply stable irrigation water by gravity from their reservoirs.
- 5) O&M organization : ICOUR can ensure their O&M budget independently from the National budget.
- 6) Present Status of Farmer’s Organization : The organizations have being re-formed from the traditional community based one to new WUA with farmers participatory concept.
- 7) Accessibility : A paved trunk road runs through the Tono project area. The Vea project is adjacent to Bolgatanga city. Accessibility of two projects are good.
- 8) Others : Northern regions are most depressed zone in the nation economy, and agriculture is main sector in northern economy. In this connection, enhancement of irrigated agriculture is crucial in this zone.

These projects play a role of rice-basket in the region.

There is no land tenure problem in these two projects.



5.1.2 Kpong-Accra Plains Irrigation Project

Kpong-Accra Plains Irrigation Project has a possibility of cooperation with World Bank. Moreover, the Project has a vast potential area of 150,000- 20,000 ha for new irrigation development in spite of unique conditions of location near capital Accra. Land, human, water resources are abundant.

In the case that the Kpong reservoir would be available for irrigation water supply to the proposed area, the Accra Plains project would have a possibility of gravity irrigation.

In the future stage, adjustment with Volta River Authority, who manages the Kpong reservoir, would be necessary for mutual agreement of water use of the reservoir.

Realization of the project expected for a long time would correspond to the government intention.

Sub-clause 5.2.2 discusses possibility of gravity irrigation and proposed project plan of the Kpong-Accra Plains irrigation project.

5.2 Plan of Project of the Final Candidate Sites

5.2.1 Project for Rehabilitation of Irrigation and Drainage in Tono-Vea

(1) Present conditions of Tono-Vea

1) Operation and Maintenance Organizations

ICOUR (Irrigation Company of Upper Region) has responsibility for operation and maintenance activities. ICOUR was established to manage both the Tono and the Vea projects in 1995. At initial stage, engineers were sent from GIDA. At present, ICOUR hires her own personnel by herself. There is no personnel exchange between ICOUR and GIDA.

Necessary operation and maintenance cost is born from water fee collected from farmers, land fee, rental charge of farm machinery, and engineering service fee for design works of community based irrigation facilities.

As for salary of staff, MoFA pays.

2) Farmers' Organization

In Tono project, Tono Irrigation Cooperative Farmers' Union is organized. Under the farmers' union, 27 farmers' associations with 500 members are formed. Approximately 3,500 farmers, however, stays in the traditional community based organization.

With registration to the government, the organization is able to receive credit from Agro-development Bank for purchasing of seed, fertilizer, pesticide, etc. The numbers registered associations are limited to 14 out of 27.

A right to cultivate farmland is given by the Village Committee. Nine village committees are set up in Tono and Vea project areas, respectively. Moreover, the Committee concerns about extension services.

(2) Proposed Project Works of the Tono Project

Necessary project components are different between the Tono and the Veia project due to conditions of irrigation facilities. Therefore, project cost estimate and project evaluation are separately studied.

Irrigation and drainage facilities except main canals are seriously deteriorated in the past 25 years after completion of the project. Especially, block lining of secondary canals are broken completely.

Proposed rehabilitation works are listed below.

- Rehabilitation of Secondary : 152 km, (Secondary 42 km, Sub-secondary 110km) and Sub-secondary
- Rehabilitation of Main Farm Road : 42 km
- Dredging of Main Drainage Canal : 40 km
- Replacement of Pump for “O” area : 2 pump units

(3) Estimated Project Cost of the Tono Irrigation Project

Applied exchange rates of currencies are as follows.

$$\text{US\$ } 1 = \text{Yen } 85 = 1.4 \text{ GHC}$$

1) Estimated Project Cost

Construction cost is estimated based on the standard unit cost of the GIDA project and the cost estimate of Accra Plains F/S.

The Project cost is estimated at 18 million US\$ as shown below.

Table 5-1 Estimated Construction Cost : Tono

Cost Component	Amount (US\$)	Remarks
Rehabilitation of Secondary Canals (152 km)	3,042,000	
Rehabilitation of Main Farm Road (42km)	2,565,000	
Replacement of Pump for “O” Area	1,500,000	
Dredging of Main Drainage Canal	4,443,000	
Direct Construction Cost	11,550,000	
Physical Contingency	1,155,000	10% of Direct construction Cost
Sub-Total	12,705,000	
Indirect Cost	5,320,000	
Construction Cost	18,025,000	

Note; Estimate of study team

2) Estimated maintenance cost

Annual operation and maintenance cost would be 3 % of the direct construction cost.

Table 5-2 Estimated Maintenance Cost : Tono (Unit: US\$)

	Direct Construction Cost	Ratio	Total
Annual Cost	11,550,000	3.0 %	346,500

Note ; Estimate by study team

3) Estimated Benefit

New production by replacement of pump units and recovered production by improvement of drainage conditions are counted as benefit.

Assumptions in estimate are as follows.

- Unit yield of paddy is 6.0 ton/ha.
- Percentage of rice grain weight remaining after milling is 65%.
- International market price of rice is 450 US\$/ha as of Aug, 2010.
- Production cost is 20% of the rice price.

Table 5-3 Estimated Benefit : Tono (Unit: US\$)

	Area (ha)	Unit Yield of milled rice (ton/ha)	Production (ton)	Unit price	Benefit
Rainy Season Rice Recovered	1,500	0.65	900	360	351,000
New production	400	3.90	1320		561,600
Dry Season Rice Recovered	1,200	0.65	720		280,800
New production	400	3.90	1320		561,600
Total					1,755,000

Note ; Estimate by study team

4) Estimated Economic Internal Rate of Return (EIRR)

Economic internal rate of return is calculated under the following assumptions.

- Project life is 30 years in consideration of actual conditions of existing projects in Ghana.
- Construction period is 2 years. Construction cost is allotted to two years equally.
- During the construction period for two years, dry season cropping would be suspended. The production value are counted as negative benefit.
- Full project benefit would start to be born from the third year.
- In order to convert financial project cost to economic cost, construction conversion rate of 0.85 is used.

EIRR is calculated as follows.

$$\text{EIRR} = 11.4 \%$$

5) Proposed Project Works of the Veia Irrigation Project

Veia irrigation project was completed in 1980 as the first large scale project constructed by the national budget. In the past 30 years, main and secondary canal system is deteriorated seriously. The irrigable area remarkably reduces from developed area of 850 ha to 468 ha.

Proposed rehabilitation works requested by Veia site office of ICOUR and farmers are as follows.

- Raising of levee height, rehabilitation of dam body
- Replacement of intake gate at the beginning point of the main canal
- Rehabilitation of main canal : total 26.5km (left bank 14.5km, right bank 12.0 km)
- Construction of Night Storage Reservoir
- Lining of secondary canals : 48 km
- Dredging of main canal : 48 km
- Rehabilitation of farm roads : 21 km
- Supply of post harvesting machinery
- Development of social infrastructure : Drinking water supply

(4) Estimated Project Cost of the Veia Project

Applied exchange rates of currencies are as follows.

$$\text{US\$ } 1 = \text{Yen } 85 = 1.4 \text{ GHC}$$

1) Estimated Project Cost

Construction cost is estimated based on the standard unit cost of the GIDA project and the cost estimate of Accra Plains F/S.

The Project cost is estimated at 31 million US\$.

Table 5- 4 Estimated Project Cost : Veia

Cost Component	Amount (US\$)	Remarks
Raising of levee height, rehabilitation of dam body	8,810,000	
Rehabilitaion of main canal	3,559,000	
Lining of secondary canals	1,137,000	
Rehabilitaion of farm roads	1,428,000	
Rehabilitaion of farm roads	5,331,000	
Direct Construction Cost	20,265,000	
Physical Contingency	2,027,000	10% of Direct construction Cost
Sub-Total	22,292,000	
Indirect Cost	8,925,000	
Construction Cost	31,217,000	

Note ; Estimate by study team

2) Estimated Operation and Maintenance Cost

Annual operation and maintenance cost would be 3 % of the direct construction cost.

Table 5-5 Estimated Maintenance Cost : Vea (Unit: US\$)

	Direct Construction Cost	Ratio	Total
Annual Cost	20,265,000	3.0 %	607,950

Note ; Estimate by study team

3) Estimated Benefit

Production by redevelopment of unused farmland of 382 ha and additional production by rehabilitation of secondary canals are counted as benefit.

Assumptions in estimate are as follows.

- Unit yield of paddy is 6.0 ton/ha.
- Percentage of rice grain weight remaining after milling is 65%.
- International market price of rice is 450 US\$/ha as of Aug, 2010.
- Production cost is 20% of the rice price.

Table 5- 6 Estimated Benefit : Vea (Unit: US\$)

	Area (ha)	Unit Yield of milled rice (ton/ha)	Production (ton)	Unit price	Benefit
Rainy season Additional production	200	1.63	325	360	126,000
Redevelopment	382	3.90	1,490		529,452
Dry season Additional production	400	1.63	650		252,800
Redevelopment	382	3.90	1,490		529,452
Total					1,423,656

Note ; Estimate by study team

4) Estimated Economic Internal Rate of Return (EIRR)

Economic internal rate of return is calculated under the following assumptions.

- Project life is 30 years in consideration of actual conditions of existing projects in Ghana.
- Construction period is 2 years. Construction cost is allotted to two years equally.
- During the construction period for two years, dry season cropping would be suspended. The production value are counted as negative benefit.
- Full project benefit would start to be born from the third year.
- In order to convert financial project cost to economic cost, construction conversion rate of 0.85 is used.

EIRR is calculated as follows.

$$\text{EIRR} = 1.6 \%$$

The low EIRR indicates that project component should be reconsidered to realize the rehabilitation project.

5.2.2 Project for Irrigation and Drainage in Kpong-Accra Plains

(1) Background

Accra Plains extends about 156,000ha (approximately 200,000ha) along Right Bank of lower Volta River. In June 2010, the irrigation scheme on the F/S and the irrigation project on the first prioritized area (relatively flat with 5000 ha) were carried out with an absolute assistance from Kuwait Fund (a grand of US\$1.4million). This 200,000ha includes the existing irrigation areas in Kpong Right Bank and Aveyime Pump irrigation area which is now under rehabilitation work by the WB. At downstream, there is a private pump irrigation area for paddy cultivation using water from Volta River. This is owned by Prairie Volta Ltd, USA fund (currently 200 ha) and the company has a plan to expand the area up to 8,000ha.

At the end of August 2010, the mission from the WB formally visited Ghana for the development project on Accra Plains. If the WB is officially planning to enforce an investigation on this area, the project will be co-financed with Japan. This proposed study includes gravitational irrigation development system from Kpong Dam (downstream of Volta River) through the existing Kpong Right Bank area (3,000ha) and up to the Accra Plains 1st (5,000ha) and 2nd (2,000ha) Priority Area.

1) Kpong Right Bank Irrigation Project

(Potential Area: 3,028ha, Developed Area: 2,786ha, Present Irrigated Area: 2,200ha and Paddy Rice Irrigation Area: 1,867ha)

The original irrigation system in 1968 was simply to pump up water from Volta River. Upon the completion of Kpong Dam, the irrigation area was expanded and the gravitational irrigation was introduced in order to directly obtain water from Kpong Dam. The entire construction work was financed by AfDB, BADEA and GOG. The rehabilitation project was completed at the end of 2003. However, any adequate maintenance for main drainage system has not been performed therefore some of the area is faced on poor drainage due to accumulated sedimentation. The major crops in the area are paddy rice and vegetable. In some parts, a private banana plantation (1,400 ha) is also using the pumped water from the main irrigation canal.

2) Accra Plains Irrigation Project (5,000ha)

According to the F/S, the 1st priority area (5,000ha) was originally planned to be irrigated by the pumped water from Volta River. The total cost is estimated at US\$100 million; the construction cost per a unit area is US\$18,000/ha and the costs is around US\$20,000/ha including cost of operation and maintenance. The IRR is estimated at 14.9%. The proposed major crops are paddy rice, cowpea, maize, onion, pepper, tomato, soybean and fodder. The results of F/S will be quite risky plan. The study seems to possess no possibility to introduce

gravitational irrigation and also, because of the high cost and the difficulties in operation and maintenance cost by pumping up operation. Regarding the F/S, the WB also commented on the same matters.

(2) The Study on Possibility for a Direct Intake from Kpong Dam

The water intake from Kpong Dam is largely been dominated by a direct intake from the hydro-power generation located in the centre. Apart from this, there is a water intake structure with a gate (about 7m³/sec) located in Kpong Right Bank. Also, MiDA is currently planned on water intake (about 9.0m³/sec) from Kpong Dam for Kpong Left Bank irrigation scheme.

According to MiDA, the permission of water intake from the dam has been obtained from Volta River Authority (VRA) based on the water level fluctuation study caused by the amount of water intake from the Kpong Dam reservoir. The water fluctuation of Kpong Dam is shown in *Fig.1 "Lake Kpong Average Monthly Reservoir Level (m) 1984-2009"*. From *Fig. 1*, the intake water level for Kpong Left Bank is set at EL. 14.8m. However, the actual fluctuation level varies between EL.14.8m to EL.15.0m. The level dropped abnormally during 1998 and 2007 and the reason for this is yet unknown. One expects on overall maintenance works or even an unusual drought. Either way, it is necessary to confirm the actual cause. The normal full water level of Kpong Dam is EL. 14.75m, and the tail water level at the downstream is EL.3.00m so that the head of power generation is 11.75m.

The water level draw down in Kpong Dam reservoir by this project has been estimated with an assumption that the irrigation intake capacity (10.0m³/sec) is needed for the proposed irrigation scheme for new development area of Accra Plains 1st and 2nd priority area of 5,000ha. According to the WB reports as shown in *Fig. 3*, the water storage capacity of Kpong Dam is approximately 160 million tons with water surface area of 37 km². The water level draw down per day has been calculated assuming that 10.0 m³/sec of water is taken from Kpong Dam every day.

$$10\text{m}^3/\text{sec} \times 86,400 \text{ Sec} = 864,000 \text{ m}^3/\text{day}$$

$$\Delta h = 864,000 / (37\text{km}^2 \times 1000\text{m} \times 1000\text{m}) = 0.0234\text{m} = 2.34 \text{ cm}$$

This value is an estimate without considering an inflow of water from the upstream of Aksoombo Dam. The hydropower generation might be affected by the head of water level however; it is possible to adjust the level by using an operation system. Nevertheless it is a definite necessity to formally negotiate with the VRA and to clarify the affection of the intake capacity on the level of water in the dam.

(3) Possibility of Gravitational Irrigation System

As shown in *Fig. 3*, full water surface level of existing Kpong Dam is EL. 14.8m- 15.0 m.

However, according to a topographic map of Accra Plains 1st Priority Area, area with an elevation lower than EL. 20 m was selected. On the other hand, the area lower than EL. 10m is estimated about 3,700ha (75%) within 5,000ha.

Accordingly, with an assumption that the gravitational irrigation system would cover elevation 3,700 ha of the Accra, the available difference of the elevation between Kpong Dam

and Accra Plains area would become 5m. Total length of main irrigation canal from Kpong Dam to Accra Plains would be approximately. Consequently, the average slope of the main canal would be $5\text{m} / 50\text{km} \times 1000 = 1/10,000$, and the velocity becomes $V=0.654\text{m/sec}$ for $10.0\text{ m}^3/\text{sec}$ of water flow by a trapezoidal section.

As a conclusion, the gravitational irrigation system would be able to irrigate approximately 3,700 ha of the Accra Plains first priority area.

As for the remains of 1,300ha, there are three options. They are:

- i) irrigation by small pump units,
- ii) exclusion of the area below EL.10m, and
- iii) inclusion of the privately owned rice farming area of 1,300 ha.

Irrigation system for the remaining area needs to be studied in an expected next stage.

(4) Additional Narboyita Area

the downstream area of Kpong Right Bank irrigation project, there is a wide low-lying wetland. It would be possible to introduce paddy cultivation to this wetland by improving drainage system of Narboyita River. For drainage improvement, construction of a main drainage canal system together with a flood control dam in the upstream reach of the river would be necessary. According to the F/S report on Accra Plains, this area has been categorized as Priority 2 area and the potentiality of the area for irrigation is quite high.

Therefore, it is recommendable to include in the proposed irrigation area. In this report, the area is named as the Narboyita Area with an area of 2,000 to 3,000 ha.

(5) Proposed Narboyita Dam

There is an excellent site for constructing a dam in the wetland at the upstream of Narboyita River., According to the full water surface area of 9km^2 and EL.15m from a topological map (1/50000), approximately 20 million m^3 of storage capacity can be expected.

Reservoirs have a possibility not only to supply water for irrigation, but also to be used for cut of peak flows of floods for improvement of drainage system and land reclamation of the wetlands area in the downstream. The reservoir can also be applied to flood control.

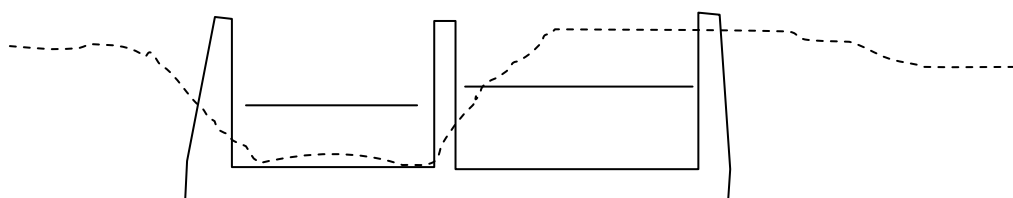
During rain seasons, the peak flows can be stored in the reservoir which reduces the flood affection in the downstream area, while in the dry seasons reservoir water can be used for irrigation.

In addition, since the dam is located in the middle of the main canal, the reservoir can be used as a regulating reservoir to control and adjust reaching time of irrigation water supply to the Accra Plains area. In the case that the canal would be extended for 50km with the velocity of 0.6 m/s , irrigation water would take 21.2 hours to reach from intake site the end. The reservoir would make possible to reduce the time to half a day, and would contribute to better water management.

(6) Integration Plan with Kpong Right Bank and Accra Plains main canals

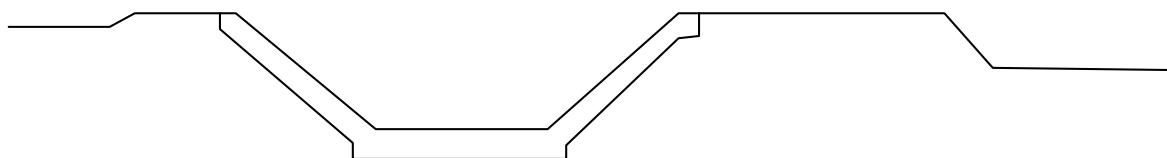
With a possibility to implement gravitational irrigation, the route for the main irrigation canal is studied as shown in the Fig. 2. Intake from Kpong Dam would be necessary to construct one more intake near the existing intake for Kpong Right Bank Irrigation Project. The depth of reservoirs would be around 5-7m, therefore construction of intake structure would be possible to implement in dry works by using sheet piles for temporary works.

For the rout of the main canal, the existing Kpong Right Bank can be utilized. It has a trapezoidal section with stone pitching. In order to reduce canal seepage loss, the canal can be lined by concrete and saved water can be utilized for Accra Plains irrigation water. At the same time, the rout of the Kpong Right Bank main canal passes in the high elevation area and the canal right of way for additional canal is sufficient. In order to introduce an individual operation of water intake, irrigation canal shape can be introduced to separate at the centre of the canal section as shown below.



Proposed Main Canal Section in the Area of Kpong Right Area

If the current slope of the irrigation canal in Kpong is steeper than 1:5,000, it is necessary to study separation of Kpong irrigation canal from a trapezoidal canal in Accra Plains.



Section of an individual irrigation canal

(7) Proposed Kpong –Accra Plains Irrigation Project

The potential integrated irrigation area includes Kpong Right Bank area of 3,000ha, new Narboyita wetland area of 2,000ha, and Accra Plains 1st Priority Area of 5,000ha. Thus the total irrigation area would be 10,000ha. In addition, there is a possibility to expand the area, if the existing private pump irrigation area of 200ha would switch from pump irrigation to gravitational irrigation in order to attain low priced irrigation water.

The total intake amount of irrigation water for 10,000ha is estimated at approximately 15m³/sec. By excluding the current intake amount of 7.0m³/sec from Kpong Right Bank, the amount of additional intake would be 8.0m³/sec. The supply from Narboyita Dam would be

expected around $2.0\text{m}^3/\text{sec}$ or more. Therefore, the required capacity of a new intake would be approximately $6.0\text{m}^3/\text{sec}$.

The water source of the irrigation system would be the Kpong dam, the main canal would flow through the existing Kpong Right Bank Irrigation project area, and then reach the Accra Plains 1st priority area across the wetland of the proposed Narboyita area.

Since the elevation of the Narboyita area is rather low, the main canal needs to make detour to pass through high elevation area. Therefore, total length of the main canal is estimated at 50 km. In addition, construction of the Narboyita dam is expected in the middle reach of the main canal.

Fig.5-4 illustrates proposed layout of the proposed Kpong - Accra Plains Irrigation Project

(8) Future Study

In expected next stage, the following studies would be required.

- i) Potential areas for gravitational through topographic survey
- ii) Alternative irrigation methods for areas excluded from gravitational irrigation system
- iii) Possibility of irrigation water supply by gravity to private rice farm downstream
- iv) Total irrigation area of the project and required total water amount taking water supply from Norboyita Dam into account

After executing the study, the required intake amount for irrigation from Kpong Dam should be discussed with the VRA.

Kpong Reservoir

Hydrometric statistics monitored of the Kpong Hydropower reservoir are shown in the figure below. Generally the water is at above 14.80m +asl. This defines the command level of the resource over the irrigation project area.

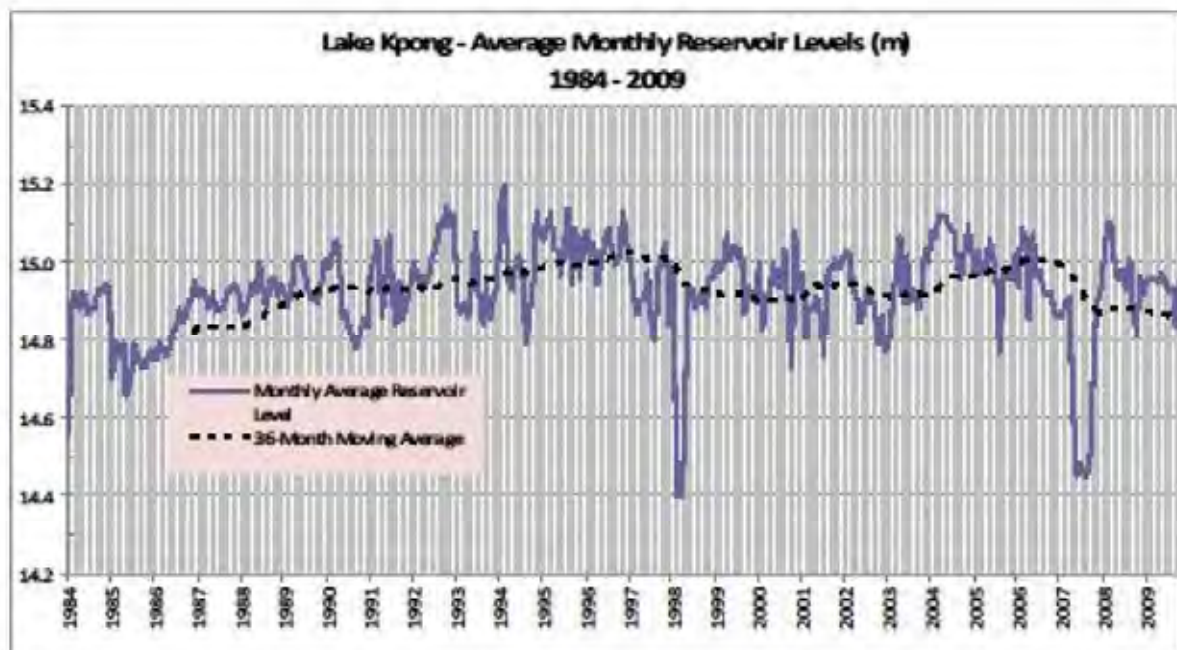


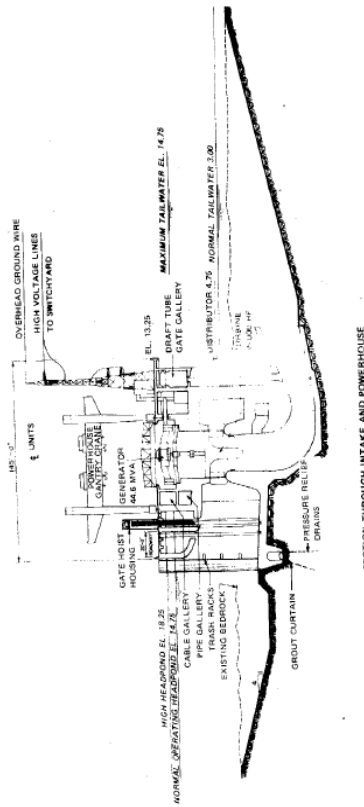
Fig. 5-3 Lake Kpong Average Monthly Reservoir Level (m) 1984-2009



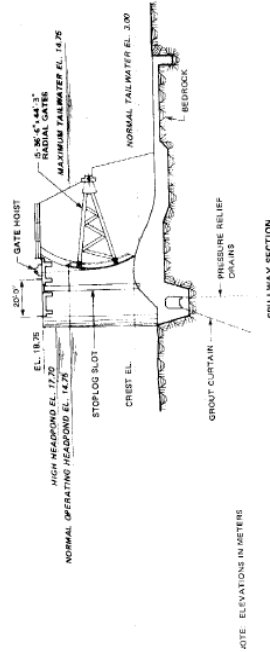
Fig. 5-4 Kpong Right to Accra Plains 1st Priority Area Map

ANEX 13
Drawing 2

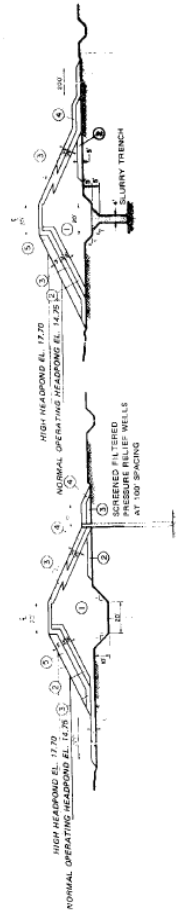
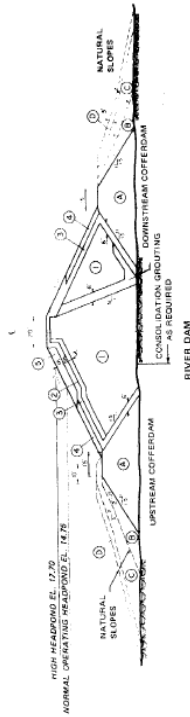
KPONG HYDROELECTRIC PROJECT
GHANA
SECTIONS THROUGH DAM AND DYKES



SECTION THROUGH INTAKE AND POWERHOUSE



SPILLWAY SECTION



TOTAL CUTOFF DIKE

PARTIAL CUTOFF DIKE

ANEX 13
Drawing 1

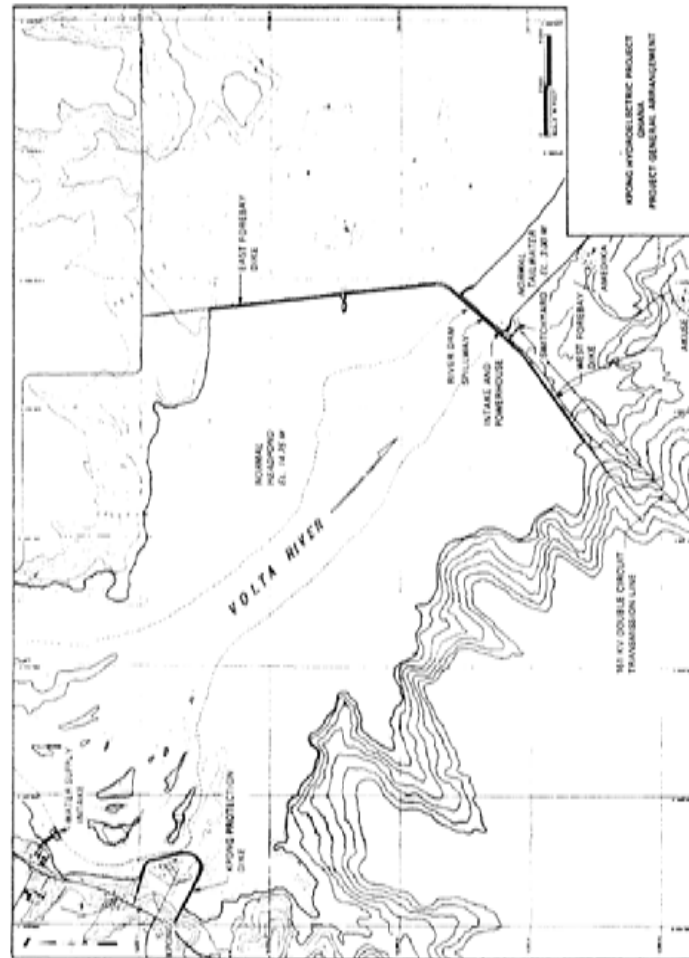


Fig. 5-5 Kpong Hydraulic Power Generation Dam

(9) Estimated Construction Cost and Project Evaluation

Required construction works for the project are as follows.

- Enlargement of Kpong main canal : In order to share the right of way of the Kpong canal, the Kpong canal would be enlarged. The canal is planned as trapezoidal with concrete lining.
- Main canal construction for Accra Plains : Trapezoidal concrete lining canal from the end of the Kpong main canal to the project area
- Construction of secondary system : Development applying the same standard as the Accra Plains project
- Construction of tertiary system : - ditto -
- Construction of Narboyita reservoir : Reservoir with a capacity of 20 MCM
- Construction of Narboyita drain : New main drainage canal in the Narboyita area to improve drainage condition
- Dredging of Kpong main drain : Since the canal for Accra-Plains would pass in the Kpong area, requested dredging works of the Kpong main works is included. The main drainage canal would affect the drainage conditions in the Narboyita area

1) Estimated Project Cost

Construction cost is estimated based on the standard unit cost of the GIDA project and the cost estimate of Accra Plains F/S. The Project cost is estimated at 112 million US\$.

Applied exchange rates of currencies are as follows.

$$\text{US\$ } 1 = \text{Yen } 85 = 1.4 \text{ GHC}$$

Table 5- 7 Estimated Construction Cost : Kpong - Accra Plains Irrigation Project

Cost Component	Amount (US\$)	Remarks
Enlargement of Kpong main canal	7,833,000	
Main canal construction (30 km)	11,702,000	
Construction of secondary system	31,360,000	
Construction of tertiary system	9,100,000	
Construction of Narboyita reservoir	15,600,000	
Construction of Narboyita drain	17,009,000	
Dredging of Kpong main drain	5,376,000	
Direct Construction Cost	97,980,000	
Physical Contingency	9,798,000	10% of Direct construction Cost
Sub-Total	107,778,000	
Engineering Services	4,899,000	10% of Direct construction Cost
Construction Cost	112,677,000	

Note ; Estimate by study team

2) Estimated Operation and Maintenance Cost

Annual operation and maintenance cost would be 3 % of the direct construction cost.

Table 5- 8 Estimated Maintenance Cost (Unit: US\$)

	Direct Construction Cost	Ratio	Cost
Annual Cost	97,980,000	3.0 %	2,939,000

Note ; Estimate by study team

3) Estimated Benefit

New production by double cropping in the Accra-Plains project and additional production in the Kpong project are counted as benefit.

Assumptions in estimate are as follows.

- Unit yield of paddy is 6.0 ton/ha.
- Percentage of rice grain weight remaining after milling is 65%.
- International market price of rice is 450 US\$/ha as of Aug, 2010.
- Production cost is 20% of the rice price.

Table 5- 9 Estimated Benefit (Unit: US\$)

	Area (ha)	Unit Yield of milled rice (ton/ha)	Production (ton)	Unit price	Benefit
Rainy Season Rice	7,000	3.9	23,100	360	9,828,000
Dry Season Rice	7,000	3.9	23,100		9,828,000
Additional production in Kpong area	333	3.9	1,299		4,67,532
Total					20,123,532

Note ; Estimate by study team

(10) Estimated Economic Internal Rate of Return (EIRR)

Economic internal rate of return is calculated under the following assumptions.

- Project life is 30 years in consideration of actual conditions of existing projects in Ghana.
- Construction period is 6 years.
- In order to convert financial project cost to economic cost, construction conversion rate of 0.85 is used.

EIRR is calculated as follows.

$$\text{EIRR} = 16.4 \%$$

ⁱ National Irrigation Policy , Strategies and Regulatory Measures, May 2010, Page 18