ANNEX II. TENTATIVE* MASTER PLAN OF THE TECHNICAL COOPERATION FOR "CAPACITY DEVELOPMENT PROJECT FOR FARMERS ORGANIZATIONS IN EASTERN PROVINCE, RWANDA (Tentative*)"

* This Project is not approved by the Government of Japan, yet.

1. Project Name:
   Capacity Development Project for Farmers Organizations in Eastern Province, Rwanda

2. Period of Cooperation for the Project:
   5 years (assumed period; Nov. 2009-Nov.2014)

3. Target Group
3.-1 Members of farmers organizations in Eastern Province, including those in the Japan's Grant Aid Project sites
3.-2 Service Providers who are staff or members of organizations under the contract with public sector

4. Overall Goal
   Contribution for poverty alleviation and food security in Eastern Province

5. Project Purpose
   Capacity of target farmers associations for sustainable agriculture production is enhanced.

6. Outputs
   (1) Human resource development is promoted through various kinds of trainings
   (2) Infrastructures for improving agriculture production are established and managed
   (3) Collaboration among public and private stakeholders is strengthened

7. Project Activities
   (1) Various kinds of trainings for human resource development
   (2) Establishment of infrastructures, such as demonstration fields, dry yards, storages, etc., for improving agriculture production
   (3) Strengthening of collaboration among public and private stakeholders

8. Input
   (1) Japanese Side
      1) Dispatch of Experts
      2) Implementation of Trainings
      3) Provision of Equipment
      4) Construction of Facilities (irrigation fields, dry yards, storages, etc.,)
      5) Activity Budget
   (2) Rwandan Side
      1) Counterparts (Officials, Service Providers)
      2) Local Cost
      3) Office Space

ANNEX III. TENTATIVE* FRAMEWORK OF THE GRANT AID PROJECT FOR THE LAND HUSBANDRY, WATER HARVESTING AND HILLSIDE IRRIGATION (LWH)

* This Project is not approved by the Government of Japan, yet.

1 Objective of the Project

The objective is to construct water reservoirs in candidate areas, making effective contributions to:
- successful implementation of SPAT
- participation of decentralized local governance in expansion of land care, water-harvesting and hillside-irrigation for improved food security and livelihoods
- increased social, economical, environmental and political benefits

2 Candidate water reservoir sites (see Appendix 1)

2-1. Site No.2 in Sub-Watershed 3: Gashora Sector, Bugesera District
2-2. Site No.31 in Sub-Watershed 6: Rugarama Sector, Gatsibo District
2-3. Site No.22 in Sub-Watershed17: Remera Sector, Ngoma District
2-4. Site No.21 in Sub-Watershed18: Remera 2 Sector, Ngoma District

3 Responsible and Implementing Agency

MINAGRI

4 Japan's Grant Aid Scheme

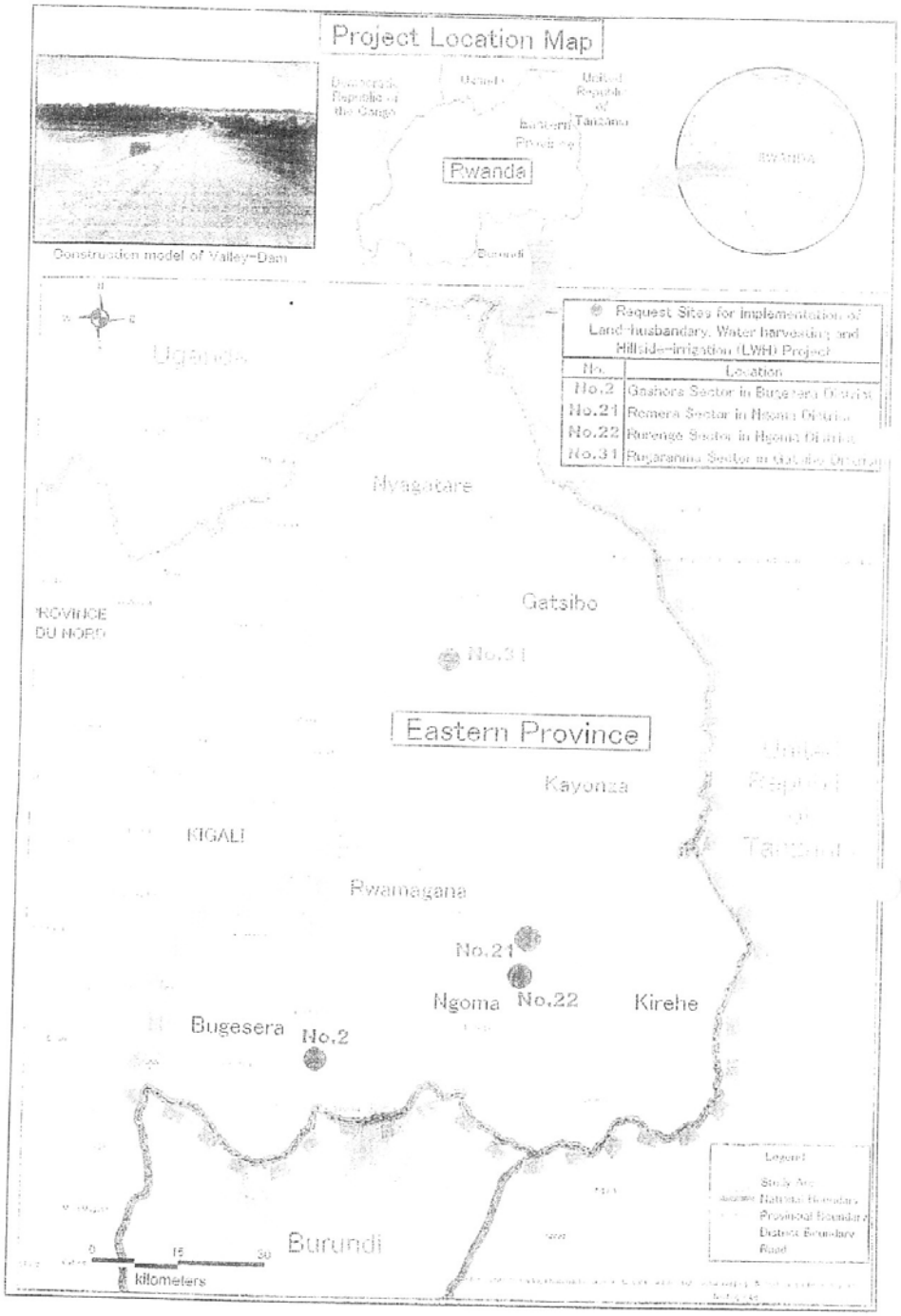
The Rwandan side understood the outline of Japan's Grant Aid Scheme explained by the Team, as described in Appendix 2.

6 Further Study

If all or some of the 4 candidate reservoirs are found to be feasible as a result of the Study, JICA will dispatch the Basic Design Study Team, later.

Appendix 1. Site Map
Appendix 2. Outline of Japan's Grant Aid Scheme

Appendix 1 : Site Map



Government of Japan assigns JICA to conduct a study on the request. If necessary, JICA send a Preliminary Study Team to the recipient country to confirm the contents of the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable

Appendix 2 : JAPAN'S GRANT AID SCHEME

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request. If necessary, JICA send a Preliminary Study Team to the recipient country to confirm the contents of the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic

document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

a) confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
b) evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
c) confirmation of items agreed on by both parties concerning the basic concept of the Project;
d) preparation of a basic design of the Project; and
e) estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a consulting firm selected through its own procedure (competitive proposal). The selected firm participates the Study and prepares a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Project, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to maintain the technical consistency between the Basic Design and Detailed Design as well as to avoid any undue delay caused by the selection of a new consulting firm.

3. Japan's Grant Aid Scheme

1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

5) Undertakings required to the Government of the recipient country

a) to secure a lot of land necessary for the construction of the Project and to clear the site;

b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;

c) to ensure prompt unloading and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid;

d) to exempt Japanese nationals from customs duties, internal taxes and fiscal levies which may be imposed in the recipient country with respect to the supply of the products and

services under the verified contracts;

e) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;

f) to ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Project; and

g) to bear all the expenses, other than those covered by the Grant Aid, necessary for the Project.

6) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

7) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

8) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.

9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commission to the Bank.

Appendix 2-1

UNDERTAKINGS BY THE GOVERNMENT OF THE RECIPIENT COUNTRY

1. To secure a lot of land necessary for the Project;

2. To clear and level the site for the Project prior to the commencement of the construction;

3. To provide a proper access road to the Project site;

4. To provide facilities for distribution of electricity, water supply, telephone trunk line and drainage and other incidental facilities outside the site;

5. To undertake incidental outdoor works, such as gardening, fencing, exterior lighting, and other incidental facilities in and around the Project site, if necessary;

6. To ensure prompt unloading and customs clearance of the products purchased under the Japan's Grant Aid at ports of disembarkation in the Recipient Country;

7. To exempt Japanese nationals from customs duties, internal taxes and fiscal levies which may be imposed in THE RECIPIENT COUNTRY with respect to the supply of the products and services under the verified contracts;

8. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into THE RECIPIENT COUNTRY and stay therein for the performance of their work;

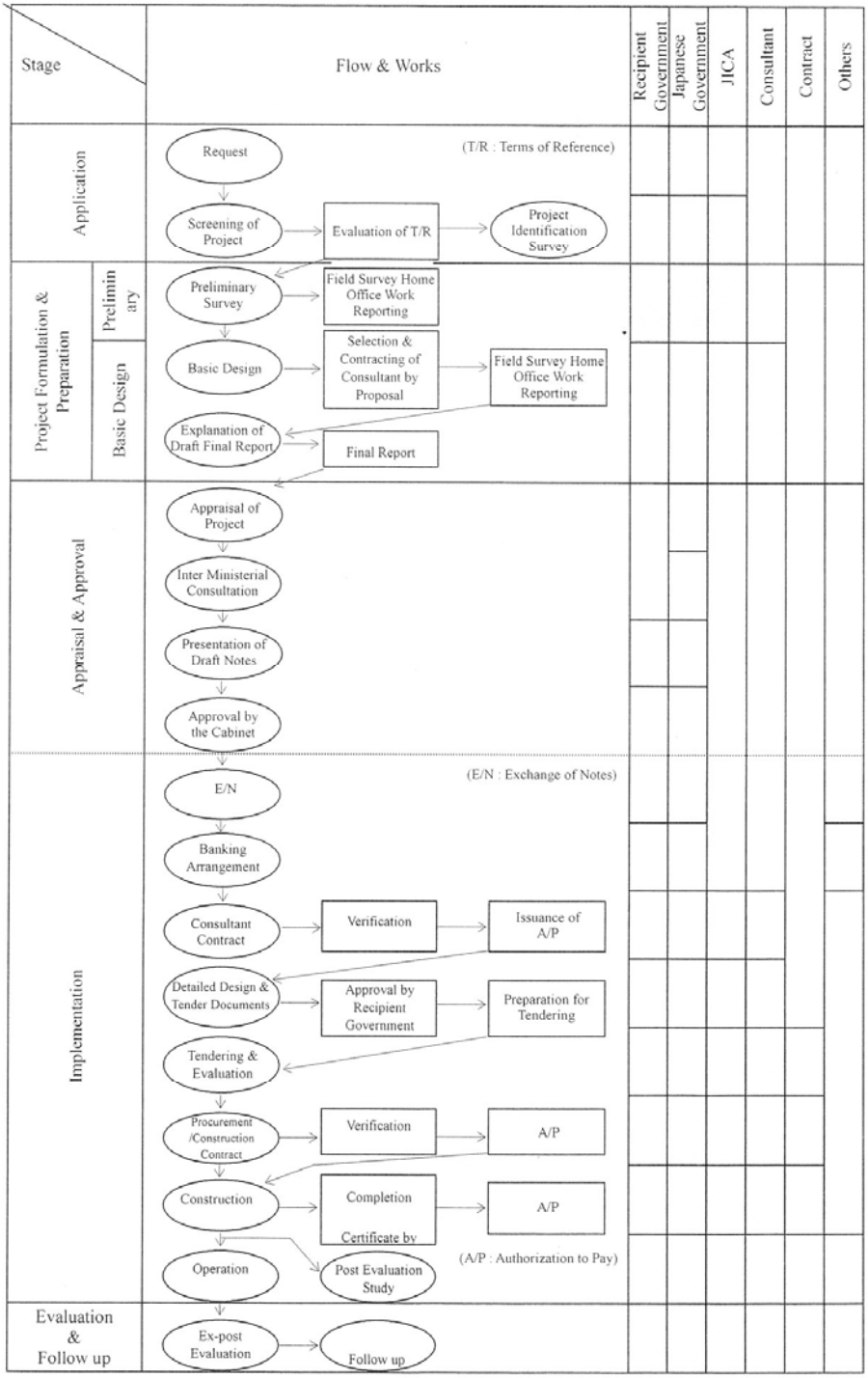
9. To bear commissions, namely advising commissions of an Authorization to Pay (A/P) and payment commissions, to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement (B/A);

10. To provide necessary permissions, licenses, and other authorization for implementing the Project, if necessary;

11. To ensure that the facilities constructed and equipment purchased under the Japan's Grant Aid be maintained and used properly and effectively for the Project; and

12. To bear all the expenses, other than those covered by the Japan's Grant Aid, necessary for the Project.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



２．　Socio-Economic Survey

2:Socio-economic Survey

Introduction

This report is a socio-economic survey of the Preparatory Study for Formulation of the Program for Rural Development in Southern Part of Eastern Province in Rwanda (Irrigated Agriculture). The objective of this survey is to grasp current socio-economic situations and to examine the proper scale and functions of irrigation facilities and its feasibility. The survey covered four communities which are adjoining to four proposed dam sites in the Eastern Province. The proposed dams are located in; Gashora Sector (Bugesera District), Remera and Rurenge Sectors (Ngoma District) and Rugarama Sector (Gatsibo District).

The team of Sanyu Consultant Inc. and Devnet carried out the fieldwork between 24th and 31st March 2009. We should like to thank all the three Districts of Eastern Province and Sectors officials we spoke to for their cooperation, assistance and time.

The report uses the approach adopted in the feasibility study of development projects or programs of participatory for strengthening ownership as the basic organizing principle for the study. The methodology adopted also provides a framework for building on the baseline survey in future work. The questionnaire and the information gathered can be replicated in a number of ways, and possibly integrated into the regular agriculture programs (irrigation) surveys that already take place.

The report contains four sections. The first is concerned with the methods of the survey. The second contains the summary report of 1st day workshop with Sector officials and community leaders. The third contains the summary of 2nd day workshop with the potential farmer beneficiaries of the project and the last part contains the analysis of the individual household questionnaire survey (baseline survey).

1. Methods of Survey

The socio-economic survey was carried out with the set of workshops and interviews with questionnaire to potential farmer beneficiaries. Following table shows the program of the socio-economic survey.

Table 1.1.1 Program of the Socio-economic Survey

Schedule	Target	Items for Survey and Explanation to the Beneficiaries
1st day Key-informant interview	Officers of Sector, Cell and representatives of Imidugudu	Confirm benefited imidugudu, population, issues in the area, agriculture practice, farmer organizations, land, extension services, water, electricity, health, and other social aspects.
2nd day Explanation for potential beneficiaries and workshop	Potential farmer beneficiaries of target imidugudu	Current farming, irrigation practice, explanation on project, necessity of farmer organization for O&M, location of the project, discussion on the project
3rd day to 6th day Individual interview with questionnaire (baseline survey)	Potential farmer beneficiaries of imidugudu (around 40househods per site)	Family structure, land use, cropping pattern, farm inputs, crop production, market, constraints on farming, income, interest in the project and willingness for farmer organization, etc.

The Socio-economic survey started on March 23 and by March 26, the exercises of the first and second programs were completed in all the 4 sites. After that, the baseline survey was carried out and the survey was completed in 3 days in each site. When we conducted the workshop with potential farmer beneficiaries in Rurenge Sector, it was found that part of the potential beneficial area (on the other side of the valley hill) belongs to the neighbor Sector, Remera. There for another workshop with the

concerned farmers in Remera Sector was held for the Rurenge site (Ngoma 21 Rurenge). On the workshops with the farmers, majority of the participants was male, but female participants were relatively high in Gashora and Remera Sectors. Table below summarizes the outline of the execution of the socio-economic survey.

Workshop with farmers in Rurenge Sector

Table 1.1.2 Outline of the Socio-economic Survey Execution

Site	1st Day (Key-informant Interview)	2nd Day (Workshop with Potential Farmer Beneficiaries)	Baseline Survey
Gashora Sector (Bugesera2)	March 23 At Sector office Participants:13 (Sector officer: 7) (Cell officer:6)	March 24 At Kagomashi Cell office Participants: 47 (male 29, female 18) 3 Imidugudu residents participated.	March 25～27 Valid HH 40
Remera Sector (Ngoma 21)	March 25 At Sector office Participants: 11 (Sector / Cell officer:6) Imidugudu rep.:5)	March 26 At Bugera Cell office Participants: 26 (male 17, female 9) 4Imidugudu residents participated.	March 27～29 Valid HH 39
Rurenge Sector (Ngoma 22)	March 25 At Sector office Participants:36 (Sector / Cell officer:10) (Imidugudu rep.: 26)	March 26 At project site (on the day, there was a communal workand people were working on clearing the road to the project site. After the work, the workshop was held.) Participants: 206 (male 195, female 11) 4 Imidugudu residents from RurengeSector participated. April 17 2 Imidugud residents from Remera Sector participated. Participants: 35 (male 22, female 13)	March 27～29 Valid HH 37
Rugarama Sector (Gatsibo 31)	March 23 At Gihuta Cell office (beneficial site) Participants: 10 (Sector / Cell officer: 5) (Imidugudu rep.: 5)	March 24 At the yard of Sector office compound Participants: 96 (male 82, female 14) Potential beneficial Imidugud would 4, but because there was a survey team recently came in to survey nearby another dam construction site funded by Rural Sector Support Program (RSSP), some people were mixed up with that project. Hence another 2 Imidugudu residents, who would be benefited from the other dam construction came to the workshop. The number of participants of 4 Imidugudu, which would be benefited from this project, was 70 (male 59, female 11).	March 25～27 Valid HH 38

2. The First Day Session

2.1 Bugesera 2 Gashora

Workshop with Sector / Cell representatives: No.2 Gashora Sector, Bugesera District
23rd March 2009 from 09:30 to 14:00
At Gashora Sector office Total Participants: 13

2.1.1 The Sector

The sector has a big potential for irrigation and agricultural development since it has plenty of marshland (4 lakes belong to the sector). The sector is promoting maize crops with the support of the private company named "PRODEV Bugesera". In this project, the company provides seeds, fertilizer and agricultural machinery to the farmers and the company is getting 50 % of the crop yields. The cooperative produce maize crops with its area of 300 ha.

There is an irrigation project with its scale of 104 ha which was started with the support by Luxemburg government. 34 ha of its irrigation area belong to Kagomasi cell. As for RSSP project, MINAGRI is supporting the cooperatives with the irrigation area of 9 ha in Kasava.

2.1.2 Income Sources of Residents

Major income sources of the residents in the Sector are: crop farming, livestock, fishery, small trading and labor at construction work.

2.1.3 Agriculture

(1) Crop Production

In the Sector, production of maize and beans is increasing, while sorghum and sweet potato are decreasing. The reasons: the regional agricultural policy is to increase the highly marketable crops for the increasing crops. However, there is not enough storage for the decreasing crops.

For maize, it is increasing to the present production of 4 ton/ha compared to that of 1 -2 ton/ha because the farmers used fertilizers. For cassava, it is increasing because of the policy change of land consolidation and improvement of seeds.

(2) Use of Fertilizers / Pesticides

Organic fertilizer: 70 % of the farmers use organic fertilizer and all the farmers use compost. As for chemical fertilizers, it is estimated that 30 % of the farmers use N.P.K.17.17 and Urea. MINAGRI provides the chemical fertilizers to the farmers and the farmers pay 50 % at harvest ("Voucher" system). Prices are: N.P.K.17.17: 460 Rwf/kg, Urea: 410 Rwf/kg

(3) Procurement of Seeds

Procurement of seeds in the Sector is explained as following table:

Table 2.1.1 Procurement of Seeds in the Sector

Rice	No cultivation now.
Maize	Agriculture cooperative provides the seeds. Quality: Good, Price: 335 Rwf/kg, Supply quantity: Enough
Haricot bean	MINAGRI supplies the seeds. Quality: Good, Price: 400 Rwf/kg, Supply quantity: Not enough at dry season.
Cassava	MINAGRI supplies the seeds. Quality: Good, Price: 400 Rwf/kg, Supply quantity: Not enough, Variety: TM14, TM63
Sorghum	The seeds are provided by the farmers who have seeds. Quality: Not Good, Price: 250 Rwf/kg, Supply quantity: Enough
Sweet potato	The seeds are provided by the farmers who have seeds. Quality: Not Good, Price: 500 Rwf/kg, Supply quantity: Enough
Vegetables	Cooperative provides the seeds from seed shops. Quality: Good1) Cabbage Price: 1,500 Rwf/mg, Not enough quantity at dry season 2) Tomato 3,800 Rwf/500mg 3) Onion 3,000 Rwf/50g 4)

(4) Farm Labor

The following type of farmers is common in the cell:

- farmers who cultivate their own lands
- farmers who work as laborer
- farmers who is doing a collective farming

The farmers who cultivate their lands by themselves is most common. The farmers who provide their labor force follows above farmers, and these farmers are more common than the farmers who is doing a collective farming. The farmers who provide their labor are hired at any season. The labor cost is 1,000 Rwf/man-day.

(5) Milling Facilities, Post-harvest, and Marketing

There are 12 milling facilities in the target area (Cell). They store the crop products at plastic storage cell (50 ton/cell). Farmers sell the crops directly to the market. Selling Prices are: maize: 150 Rwf/kg, haricot bean: 300 Rwf/kg, Cassava (After milling): 240 Rwf/kg, cassava (No process): 70 Rwf/kg, Sorghum: 250 Rwf/kg, Sweat potato: 150 Rwf/kg. For transporting crops, farmers carry the produces on the head or bicycle.

(6) Farmers Organization

There are 12 Cooperatives exist in the Sector and 1 cooperative is situated in Kagomasi Cell. The cooperatives are divided into each groups by their living area. Following table shows the cooperatives in and around the target area.

Table 2.1.2 Cooperatives in and around the Target Area

Name	Indakuki	COAIQR
Established year	2007	2007
Legal status	Registered by MINICO	Registered by MINICO
Objectives of Coop.	• Maize cropping • Growing cassava • Soap production • Dyeing of local cloths	• Growing vegetables
No. of member	2,500	232
Membership fee	16,000 Rwf/entry	10,000 Rwf/entry
Current status (active or not?)	Active	Active

(7) Conflicts

They have some conflicts at the inheritance or succession of their lands. In this case, the Sector leader solves the conflict by making discussion between each parties concerned. They also apply a national law and impose punishment on the persons of crime. They also have local court and the party concerned can appeal to the court. The property mismanagement is common in cooperatives.

(8) Ranking of Issues Concerning Agriculture

The participants were asked to rank the agricultural issues in the area. Following are the issues ranked:

1. No water at dry season
2. The marshlands are not developed for agricultural development.
3. Processing facility of crop products toward increasing their marketability is not enough.

2.1.4 Rural Lives

(1) Energy Source

For cooking, firewood from forests are used. However, the quantity of firewood is in shortage. For lightening, candle or kerosene lamp are commonly used. No electricity is distributed at the villages.

(2) Water Source

For drinking, there are 35 public water taps at the sector. For domestic use (washing clothes, dishes), people use the public tap water or lake water. For animals, they use lake water.

(3) Education

Following are the data on education status in the Sector:

a) No. of nursery schools and enrolment ratio (No. 204 Enrolment ratio: 20 %)

b) No. of Elementary school, Enrolment ratio, and Drop-out ratio (No.: 4 Enrolment ratio (male 44 % female 56 %), Drop-out ratio: (male 0.6 % female 0.9 %)

c) No. of Secondary school, Enrolment ratio, Drop-out ratio (No.: 2 Enrolment ratio: (male 45% female 56 %), Drop-out ratio: (male 0.7 % female 0.3 %)

d) Literacy rate: (male 48% female 52 %)

(4) Health

There is a clinic from 200 m from the sector office. The number of doctor and nurse is 9 and there are 20 beds in the clinic. Popular diseases in the area are malaria, respiratory infections, parasite infection, and physical injuries.

(5) Finance

A rural bank provides an access for finance to the farmers at planting seasons. Only 20 farmers use the finance. Solidarity guarantee is the basic condition. Tontine system by rotating fund is used among the farmers.

(6) Projects Implemented in the Sector

Following table shows the projects recently implemented in the Sector:

Table 2.1.3 Projects Recently Implemented in the Sector

Name of Project	Purpose	Year implemented	Fund source (amount)	Status (successful?)
RWAA22 Project in Bugesera	Irrigation	2006		Nor successful. It took long procedures for procurement. The procurement is delayed.
Electrification project (Nyabagenawa - Gashora)	Electrification	2009	CDF (National Government) 600 Million RWF	Started this year. Good progress.
Health care access extension project	Public health	2008	USAID	Complete July this year. Good progress

2.1.5 Opinions on Irrigation Development

(1) Compensation

Compensation by money is a basis. The compensation is carried out by studying the property value. The compensation is made only for land owners. The compensation for landless farmers is not conducted.

(2) Change of Land Use

The change of land use or change of crop types depends on the type of crops or farming seasons. There is no regulation for the change of crop types.

3) Reallocation of Land

There is no problem if the project contributes the beneficiary of 50 farmers. The average size of farm land is 1 ha/farmer and its maximum size is 2 ha/farmer.

4) Necessity of the project

The project is necessary. They hope the early implementation. The follow-up or training is also necessary.

2.2 Ngoma 21 Remera

Workshop with Sector / Cell representatives: No.21 Remera Sector, Ngoma District
25th March 2009 from 09:00 to 12:30
At Remera Sector office Total Participants: 11

2.2.1 The Sector

The feature of the Sector is characterized with the aspects below:

1) Enough fertile land
2) Flat area will make the farmers active for farming and selling products.
3) The settlement of population is growing due to the government policy of land consolidation for cultivation.
4) There is an irrigation project with its scale of 104 ha which was started with the support by

2.2.2 Income Sources of Residents

Major income sources of the residents in the Sector are: crop farming, livestock, small trading, craft (carpentry), and masonry (production of construction materials).

2.2.3 Agriculture

(1) Crop Production

In the Sector, production of haricot beans (Season A), sorghum (Season B), banana and tomato is increasing since they are marketable. On the other hand, production of sweet potato, taro and cassava is decreasing since they are not marketable. Specifically the unit yield of banana is increasing because the farming technique is improved and farmers could get a new variety of seeds.

(2) Use of Fertilizers / Pesticides

Approximately 85% of the farmers use manure, and 95% of farmers use compost. Farmers using chemical fertilizers are very few (2%). Farmers can get chemicals from 2 local cooperatives by credit and pay them back after harvest.

(3) Procurement of Seeds

Procurement of seeds in the Sector is explained as following table:

Table 2.2.1 Procurement of Seeds in the Sector

Rice	Milling plant provides seeds to the cooperatives. The cooperatives distribute the seeds to the farmers. The farmers pay them later. Variety: (Short grain, ling grain), Quality: Good, Quantity: Not enough, Price: 250 Rwf/kg
Maize	MINAGRI provides the seeds. Variety: Katumani, Quality: Not productive, Price: 200 Rwf/kg, Supply quantity: Not enough
Haricot bean	Farmers keep the seeds for next season. Variety: Short Climbing, Price: 300 Rwf/kg, Supply quantity: Enough
Cassava	Farmers rotate the seeds. Variety: Flour cassava and fresh cassava, Price: 200 Rwf/heap, Supply quantity: Enough
Sorghum	Farmers keep the seeds for next season. Variety: Traditional seeds, Price: 200 Rwf/kg, Supply quantity: Enough
Sweet potato	Farmers keep the seeds for next season. Variety: No name, Price: 1,000 Rwf/basket, Supply quantity: Enough
Vegetables	1) Tomato: Farmers buy seeds at shops. Variety: 2, Price: 34,000 Rwf/kg, Enough 2) Cassava: Farmers buy seeds at shops. Variety: 1, Price: 900 Rwf/500mg, Enough 3) Onion: Farmers buy seeds at shops. Variety: 3, Price: ? , Enough 4) Green pepper: From other farmers, Variety: 2, Price: 1,000 Rwf/kg , Enough

(4) Farm labor

The following type of farmers is common in the cell

- The farmers who cultivate their own lands: Common (No.1)
- The farmers who is doing a collective farming: Follows above (No.2)
- The farmers who work as laborer: No.3

Hiring labors is done for weeding or harvesting. Wage is about 1,000Rwf/man.day. People who can afford to pay hire the labors.

(5) Milling Facilities, Post-harvest, and Marketing

In the Sector, they have drying facility for paddy, milling facility for maize and sorghum. Farmers store the crop products by bags. There are no storage facilities. Loss by mouse for maize and sorghum are observed.

Farmers sell the crops directly to the market. Selling price of the produces are: maize: 200 Rwf/kg, rice: 250 Rwf/kg, Cassava (After milling): 150 Rwf/kg, sorghum: 200 Rwf/kg, Sweet potato: 1,000Rwf/basket, Tomato: 14,000Rwf/basket, and Onion: 350 Rwf/Kg. Farmers transport crops either on the head or by bicycle.

(6) Farmers Organization

There are 4 agricultural cooperatives in the Sector as following table:

Table 2.2.2 Agricultural Cooperatives in the Sector

Name	Abakanqukirakawa	Banana	Maize	Rice
Established year	2006	2008	2008	n.a.
Legal status	Registered by MINICO	Registered by MINICO	Registered by MINICO	n.a.
Objectives of Coop.	Assist farmers in milling coffee.	Promotion of banana crops	Promotion of maize crops	n.a.
No. of member	2800	115	n.a.	n.a.
Membership fee	20,000 RWF/entry	5,000 RWF/entry	n.a.	n.a.
Current status (active or not?)	Active	Active	n.a.	n.a.

(7) Conflicts

There is no conflict at present. In case of small conflict, farmers appeal to Imidugudu leader together with other farmers to settle it. There is no regulation for settling the conflicts.

(8) Ranking of Issues Concerning Agriculture

Following are the ranking of issues concerning agriculture in the area by the participants:

1) Climate change: little water at dry season.
2) Access to input: fertilizer, improvement of seeds
3) Poor farming technology and farming practice.
4) Farmers do not have big and specific market place.

2.2.4 Rural Lives

(1) Energy Source

For cooking, firewood from forests are used. For lightening, kerosene lamp is commonly used. Electricity is distributed very few.

(2) Water Source

For drinking, there are 8 public tap and also there is spring but the quantity is not enough. For domestic use, people use public tap water, well, and rain water. For animals, public tap water, well, and river water are used.

(3) Health

There are 2 clinics, but no hospital and no doctor in the Sector. Popular diseases are malaria and worm diseases. They have a health insurance system named “Mutnelle” (1,000Rwf per year x household) to health care. In case of sickness, patient pays only 15% of the total payment.).

(4) Finance

A rural bank provides an access for finance to the farmers at planting seasons. Present guarantee such as forest, banana plant or coffee plain is the basic condition. Very few use the bank.

(5) Projects Implemented in the Sector

There was a project called Intra-health Project. The project purpose was to improve public health situation. The project was implemented in 2004 under the finance of USAID. The project is working well.

2.2.5 Opinions on Irrigation Development

1) Compensation

There is no house and only farm lands. They follow the compensation regulation. They don7t know the process. They don’t object to the compensation by money. Ministry of Infrastructure will pay the compensation.

2) Change of land use

There is no regulation for changing land use. A good sample or practice in other projects will let the farmers to change their mind for changing their land use.

3) Reallocation of land

The existing land area is very small. Therefore, they think that the reallocation will be very difficult.

4) Necessity of the project

The project is necessary.

2.3 Ngoma 22 Rurenge

Workshop with Sector / Cell representatives: No.22 Rurenge Sector, Ngoma District
25th March 2009 from 10:30 to 13:20
At Rurenge Sector office Total Participants: 36

2.3.1 The Sector

In 2006, the Sector was established merging three sectors: Rurenge, Rumbuwe and Kaberangae Sectors. Total population of Rurenge Sector is 20,183 and the Sector consists of 6 Cells: Rujambara, Musya, Bwikubo, Kagarai, Rugesi, and Muhurire. The proposed dam site is located in Rujambara Cell in Rurenge Sector and Ndekeme Cell in neighboring Remera Sector. The boundary of the two sectors is at the bottom of the target valley.

Rurenge Sector has a natural forest of 6ha with wildlife in there. The Sector wishes to make the forest a national park. There is a big pond for fish breeding in the Sector constructed by Chinese.

Imidugudu to be involved in the beneficiary area and upstream reaches of the proposed dam are

Nyabaganza, Gitobe, Mbonwa and Masyoza. Nyabaganza and Gitobe are rather situated in the upstream reaches of the proposed dam axis. Imidugudu called Akarambaraye could also be in the beneficial area. As for Remera side, Gikomero imidugudu in Ndekeme Cell will be the beneficiary imidugudu.

2.3.2 Land Use

There are sharecroppers in the Sector though they are not many. The landowner shares with renter 50: 50 of inputs and harvest. There are also few absentee landowners but not in paddy fields.

2.3.3 Income Sources of Residents

Major income source of the people in the Sector is agriculture. Major products are rice, beans, tomatoes, coffee and sorghum. Milk and beef cow is also an important income source. There are very few people who are engaged in commerce.

2.3.4 Agriculture

(1) Crop Production

Major crops are rice in valley, tomatoes, banana, beans, pineapples, and sorghum. Coffee is also seen a lot as coffee tress are grown in 26,000ha in the Sector. Season A records better production than season B.

There are three marshlands in which rice is cultivated. They are Mwambo (90ha), Gisaya (50ha), and Rwampunga (15ha). The proposed dam site covers Rwampunga marshland. Unit yield of rice in the marshland is around 4t/ha in season A (Aug/Sep – Jan/Feb) and 2.5t ～ 3.5t/ha in season B (Feb/Mar – July). In Mwambo, there is a weir in the stream for rice irrigation.

Generally the crop production shows increasing tendency due to fertilizer application, introducing new variety seeds, though rice yield remains still low.

(2) Use of Fertilizers / Pesticides

Chemical fertilizers are used for rice and coffee (NPK and Urea). For rice, coffee and tomato, farmers are using chemical fertilizers and pesticides. Price of fertilizers are: NPK: 480Rwf/kg, Urea: 410Rwf/kg and DAP 550Rwf/kg. The Cooperative (union?) of the Eastern Province, COCURIRWA supplies the fertilizers. They used to provide DAP but stopped it now. For rice, 100kg/ha of NPK and 100kg/ha of Urea (50kg x 2 times) are recommended to apply and farmers are practicing it.

Crops (rice, banana, potato) are attacked by “kirabiranya”. It makes crop shrinking and dry-up. When caterpillars (igishorogwa) attacks crop, kirabiranya occurs. Also rice is attacked by flies. Farmers use supermetrine, riceband and benerate. Supermetrine and riceband cost 4,500Rwf/liter each. Benerate costs 9,000Rwf/kg. In Gisaya marchland standard use of pesticides is 20 liters/50ha. Farmers also use chiyoda and ditan for coffee and tomatoes. Farmers go to shop to buy pesticides

(3) Procurement of Seeds

There are many varieties of rice grown in the marshland. They are as local name; union, zogingi (machine), Pekin, which are a group of kigoli (short grain) and wat, namde, facagiro, muturage (tall grain). The cooperative used to bring seeds, but now farmers are multiplying seeds by themselves. Presisent of the cooperative in Gisya marchland heard about Nerica rice.

Though the government has been distributing hybrid maize seeds, maize is not much grown in the area. Seeds of beans, sorghum and sweet potato are recycled by farmers. Farmers buy seeds of vegetables from shop (traders come to sell seeds at the market days). Cassava has been attacked by disease (cassava mosaic).

(4) Farm Labor

They have collective work for transplanting and harvesting of rice and also harvesting of coffee. Collective work is common but hire labor is more common because hiring labor is more quickly arranged. To get people for collective work takes more time. Wage is 600 – 700 Rwf/day (half day). Poor people in the area and sometimes from outside come to work for hired labor.

(5) Milling facilities, Post-harvest, and Marketing

Few farmers have knapsack spryer. Other farmers are renting the sprayer from the owners. Renting fee is 200Rwf/day. There are 2 rice milling machines in the area. Their capacities are around 6t/day. The milling machines are privately owned. If farmers bring small quantity like 25 – 35kg, milling cost is 25Rwf.kg, but if they bring bigger quantity, it will be 20Rwf/kg. According to the rule of the rice cooperative, farmers should sell at least 80% of products to the cooperative. Rice is therefore sold mainly through the cooperative. For other crops like beans, tomatoes, middlemen come to buy them. Coffee is also sold through the coffee cooperative.

(6) Farmers Organization

a) Rice Cooperatives

Each marshland has a rice cooperative. Basic information is as follows:

Table 2.3.1 Rice Cooperatives in the Marshlands of the Sector

Marshland	Mwambu	Gisaya	Rwmpunga
Name of coop	Kiearama rice farmers coop.	COPAGRI	TWLFATANYE
Establishment	Established in 1986 by Chinese. In 2003 COCRIRWA (provincial level coop) took over it and in 2006 transferred to the current coop and registered.	In 2003 established as an association and registered in 2006 to the Ministry of Commerce.	They were branch of COCRIRWA but made their own coop, but it has not been registered yet.
Membership	More than 300	378	180 (Remera saido around 80, Rurenge side around 100)
Fee	5,000Rwf and no more payment	5,000Rwf and no more payment	5,000Rwf as membership and 500Rwf/year.

There is a land tax: 25mx20m of paddy field: 1,000Rwf/year to the District office

b) Other Organizations

They have cow keeping group, pineapple growers group, beekeepers group, coffee cooperative, banana growers, 3 basket weaving groups, motorcycle group, bicycle group and commerce group.

(7) Conflict

Cooperative is in charge of conflict management. If the conflict goes beyond the control of coop, it will be taken to court / police. Cooperative organizes water management (assign one person to distribute water). Sometimes farmers do not give the share of products to the coop.

(8) Ranking of Issues concerning Agriculture

1. Climate change (change abruptly)
2. Marketing (perishable is difficult to store)
3. Machinery (no adoption)
4. Marshlands are not well prepared.
5. They cannot cultivate in season C (dry season).
6. It is not easy to find pesticides (expensive).

2.3.5 Rural Lives

(1) Energy Source

Cooking energy is firewood. Lighting is mainly kerosene lump. Only one village (Kalama) near the Sector office has been electrified, but most of the villagers still do not access to the electricity.

(2) Water Source

For drinking water, they fetch it from stream and boil. There are also 18 springs in the Sector. There are also around 9 wells along Mwambu valley, but out of them 5 wells are working. For other wells, when you pump sands come up. There are 10 roof catchments (water tank). Local NGO called Intra Health assisted the Sector for water tank.

(3) Education

There are 17 nursery schools, 4 primary schools, 1 secondary school and 2 district schools. Due to change of the policy, every child has to go to school and can go to school free (for secondary up to standard 3).

(4) Health

There is one health center in the Sector. There is no doctor but 8 nurses. There is also 27 beds in the health center. Popular diseases are malaria, intestine worms, respiratory breeding (coughing), and typhoid.

(5) Finance

Not many farmers are using finance. Mainly commerce people use the finance facility.

When I saw the Bank of Popularie next to the Sector office, there were photographs of 28 people (24 men and 4 women). They were delinquents. They were warned by this method.

(6) Projects Implemented in the Sector)

There is a project for building houses for returned refugees by Red Cross from 2007 to 2009. In total 150 houses are to build. Remaining is 47.

By CDF (Community Development Fund by the government), the health center was rehabilitated in 2008.

2.3.6 Opinions on Irrigation Development

Everybody needs water and therefore we also need project for other areas, too. Water should not only be for irrigation but also for domestic use.

2.4 Gatsibo 31 Rugarama

Workshop with Sector / Cell / Imdiugudu reperesentatives: No.31 Rugarama
23rd March 2009 from 10:45 to 13:35
At Gihuta cell office Total participants: 10

2.4.1 The Sector

Rugarama Sector with current boundary was established in 2006 when the government implemented the renovation of the local administrations. The participants described Rugarama Sector as agriculture dominated area with mainly rice, banana, sugarcane, a large-scale market in the Sector and they looked proud of the existence of a health center established with the assistance of a NGO (ADRA).

Rugarama Sector consists of 6 Cells: Gihuta, Bugarama, Kanyangese, Motare, Remera and Matunguru. The beneficiariy area and the dam site are located in Gihuta and Kanyangese Cells, of which Gihuta Cell covers both the dam construction site and the first downstream beneficial uplands. As for Kanyangese, the area is located in the tale of the potential beneficial area beyond the tarmac road from the proposed dam site.

Imidugudu to be involved in the beneficial area and dam site are total 4: Gasbenyi I and Agatare in Gihuta and Rwagitima and Amahoro in Knyangese. The land which would be submerged by the dam belong to Gasbenyi I and Agatare.

2.4.2 Income Sources of Residents

Major income sources of the residents in the Sector are agriculture, commerce (selling agriculture products), carpentry, and handcraft (basket weaving).

24.3 Agriculture

(1) Crop Production

Major crops in the Sector are rice, banana, and sugarcane. Vegetables are few but cabbages are major vegetable grown in the Sector. The crop seasons are seasons A and B and there is no irrigated farming during dry season in the Sector.

The participants reported that the cultivated area is decreasing due to soil erosion and also the cultivated area per capita is decreasing due to population increase. They also observe that crop yields are generally decreasing due to climate change, poor agriculture technology, and population increase. Because of population increase, the land use is becoming more intensive so that the soil fertility has been degraded. They also mentioned about unstable water supply depending on rain.

Average unit yield of rice in this area is reported around 3t/ha.

(2) Use of Fertilizers / Pesticides

Majority of farmers use compost / manure for banana and maize. Rice farmers are using chemical fertilizers (Urea, NPK, DAP) and pesticides. Pesticides are also used for cabbage and tomato crop (chiyoda).

Fertilizers are provided by the government to the cooperative with 50% of subsidy. As for pesticides, farmers buy them at shop.

(3) Procurement of Seeds

Varieties of rice are Chigoli (local name), Yumi etc. Cooperative is distributing the seeds to farmers. As for maize seeds, farmers used to recycle them. In 2008 the government has started program of distributing hybrid seeds free through RADA. Also RADA has been providing cassava seed potato, which is disease tolerant (cassava mosaic disease), since 2007. Other seeds of crops such as haricot bean, sorghum, and sweet potato are all recycled by farmers. Farmers buy the seeds of vegetables from shops.

(4) Farm Labor

Customary collective work for farming operation is not so common in this area, but cooperative and associations sometimes organize collective work e.g. road clearing when soil was eroded from the gulley).

Hired labor is common though there are not many hired labor. Wage is 600Rwf/day (6:00 – 12:00) for both men and women. Hire labor is used for all of the farming operation. Most of the hired labor is from the same imidugudu and few come from outside.

(5) Milling facilities, Post-harvest, and Marketing

There are more than 10 mills for maize using diesel in the Sector. They are private millers and milling cost is 30Rwf/kg. There is 1 milling facility in the Sector run by cooperative. The facility has been installed for 4 years with the assistance of NGO (ADRA). The capacity of the rice mill is 3t/day and milling price is 25Rwf/kg.

There is no public store for maize and rice and farmers are storing the harvest at home. Post-harvest loss is not much (but loss of maize by birds was observed) but farmers harvest the produce at the same time and sell them at the same time, os the price of maize becomes very low.

Farmers sell rice to the cooperative and maize directly to market (where middlemen also come). Price is 400Rwf/kg (milled rice) for rice and 200Rwf/kg for maize (some people sell maize after milling and the price is about 250Rwf/kg).

(6) Farmers Organization

a) Rice Cooperative (COPRORIZ Ntende)

The cooperative was established in 2003 and already registered (to the Ministry of Commerce). Total membership is 916. Membership fee, at the beginning was 3,700 Rwf but now increased to 25,660Rwf. Apart from the membership fee, the members are to pay 750Rwf/10a/season. They are considered as No.1 cooperative in the District. The cooperative covers 3 Sectors: Rwimboga, Gitoki and Rugarama. Their office is located in Rugarama Sector.

b) Other Organizations

In the Sector, there are many groups (cooperatives, associations) for various activities. These are: basket making, cow breeding, beekeeping, handcraft, sewing, mechanics, meat sellers, etc.

(7) Conflict

Sometimes conflict occurs between farmers over the border of their farms. Firstly cooperative will mediate the conflict and if the issue goes beyond control, issue is taken to the government (court).

(8) Ranking of Issues concerning Agriculture

Following are the ranking of the issues by the participants:

1. Storages for farm products
2. Irrigation
3. Pests
4. Fertilizers

2.4.4 Rural Lives

(1) Energy Source

Energy for cooking is firewood. Firewood is one of the most difficult issues in the Sector because the trees have been decreasing in the Sector. People are even buying firewood (1,500Rwf/bunch). Both men and women go to fetch firewood.

For lighting, people use kerosin most and candle at second. Some people can access to electricity.

(2) Water Source

There are 10 taps in Gihuta Cell and 2 wells in the lowland. Water quality is ok.

(3) Education

There is no nursery school but churches take a role of taking care of small children.

There are 5 primary schools in the Sector. Due to the law, primary education is compulsory, so that every child goes to school. There is some drop-out from primary school.

There is 1 secondary school in the Sector. The enrolment ratio is not known but due to the change of government policy, school fee has become free up to standard 3 since 2008 so that now every child is going to secondary school.

(4) Health

There is one health center in the Sector. There is no doctor at the center but around 10 nurses and technicians. Popular diseases in the Sector are malaria, TB, intestine worms, typhoid, and HIV. According to the government policy all the residents are to buy health insurance, which cost 1,000Rwf/person.

(5) Finance

Not many people are using finance facility.

(6) Projects Implemented in the Sector)

ADRA (NGO) has implemented 1) reclamation of marshland from 2002 to 2003, 2) construction of schools / houses in 4 sites in 2002, and 3) construction of wells in 2003 and 4) construction of the health center in 2004. RSSP has also been implemented to construct a factory of cassava processing located in Gihuta Cell. The factory has not been operated since they are still waiting for the installation of a machine. Cassava cooperative in the area requested this project to RSSP and it was appraised. The membership of the cooperative is 180 (This RSSP project could be the Second RSSP).

2.4.5 Opinions on Irrigation Development

People in the area are suffering from soil erosion through the gulley, which are in the target dam site.

Due to soil erosion when heavy rain comes, the road is blocked and crops are damaged. People are clearing the road by community work.

Some people showed anxiety of flood incidence, which could damage the houses in the downstream reaches of the proposed dam site.

Lands which will be submerged by dam should be compensated with money.

If dam was constructed, people in the hill side would cultivate rice or vegetables. Some also wish to feed fish in the dam.

3. The Second Day Mission

3.1 Gashora (Bugesera 2)

Workshop with Potential Farmer Beneficiaries: No.2 Gashora Sector, Kagomashi Cell
24th March 2009 from 09:00 to 12:00
At Kagomasi Cell office

1) Potential beneficial imidugudu and participants:

Sector	Cell	Imidugudu	Male	Female
Gashora	Kagomasi	Akagako	4	3
		Kuwuruganda	17	11
		Kagomasi	8	5
		Total	29	19

2) Questions from the participants to the Project

Q: Can the proposed dam reserve the water at dry season? Is there any possibility for dry-up on the proposed dam reservoir? Because, the rain water is very little at the project site.

A: The specialists of the JICA team are studying now based on the meteorological, hydrological geological and engineering viewpoints.

Q: In order to avoid the dry-up of the reservoir, I recommend you to connect the water of the downstream lake with the proposed reservoir. How do you think of my idea?

A: We are still studying the proposed project from technical, economical, social and environmental viewpoints. However, we also have to consider the increase of the project cost.

Q: Can you make higher the dam height more than the proposed height (15m).

A: If we raise the dam height, the reservoir water will reach and overtop the road and military land which are located at the downstream side of the proposed reservoir.

Q: Can the proposed dam shift to the lake in terms of supply of stable water?

A: We are still studying the proposed project from technical, economical, social and environmental viewpoints.

Q: I am worrying about the erosion at the upstream side. How do you think of this issue?

A: We also consider planning the proposed in order to avoid such erosion.

3) Farmers Organization

Q1: Are you a member of any group? Number: male 15 female 6

Group 1 group name INDAKUKI, male female fee 16,000 Rwf

Activity of the group: Maize cropping, growing cassava -

Q2: Do you understand the necessity of Water Users' Association? Number: All

Q3: How do you establish the Water Users' Association?

The participants discussed that the farmers need a meeting to discuss how to create a committee for such organization. 1st meeting is necessary after the construction of dam. After that they conduct election for deciding the committee member. Then, the committee contributes a fund.

Q4: How much per year will you pay for water fee?

0Rwf	None	
500Rwf	None	
1,000Rwf		All
More than 1,000Rwf		None

4) Discussion on land reallocation, if the dam will be constructed.

Q1: Compensation for the farmers whose farmland will be submerged.

Basically, the farmers need the compensation by money. They need at least 700 Rwf/m2 taking the case of consideration of road construction (400 Rwf/m2) into consideration.

Q2: Compensation for the farmers whose farmland will be occupied by irrigation facilities.

Same as above.

Q3: How do you allocate irrigation area? (How about landless farmers?)

The change of the crop types is not a problem for the farmers. The cooperative will manage the land allocation. For the lost land, the cooperative will rent a land from farmers and will distribute it to the farmer who has lost a land. As for the issue of landless farmer, the government should take care for them.

Q4: How can you share the benefit of irrigation fairly?

The surplus of the crop products will be sold at the local market. The benefit will be used for health insurance. The benefit will be contributed by the cooperative.

5) Impacts of the Project

Positive impact: household starvation will be reduced at this area. Housing will be improved by the increase of the chance of earning income. Job will be increased for landless people at the downstream side. The income level of female will be improved.

Negative impact: The dam will cause over-flooding in case of heavy rain.

6) Crops to grow if the dam was constructed

(1) Rice: They don’t have enough quantity of rice. Also, they are marketable.
(2) Vegetables: The soil is suitable for their production. (Tomato, cabbage, green beans)
(3) Maize

7) for Project

All the participants agreed with the project. The reasons are:

(1) The project will prolong the stable water even at dry season.
(2) The farmers can produce crops at 3 seasons.
(3) The jobless people will have a chance for getting their jobs.

3.2 Remera (Ngoma 21)

Workshop with Potential Farmer Beneficiaries: No.21 Remera Sector, Bugera Cell
26th March 2009 from 09:50 to 12:00
At Bugera Cell office

1) Potential beneficial imidugudu and participants:

Sector	Cell	Imidugudu	Male	Female
Remera	Bugera	Munini 1	8	4
		Munini 2	7	1
		Jisunda	2	2
		Gesero	0	2
		Total	17	9

2) Questions from the participants to the Project

Q: Will the irrigation water be supplied only to the marshland? Will it be supplied to upland hill?

A: The JICA study team is studying now on the technical and also economical point of view.

Q: The canal will not be possible because of its location. The canal should be located at more upstream side in terms of providing more beneficiaries.

A: The JICA study team is studying now on the technical and also economical point of view.

Q: Some farmland will be submerged in the upstream by the project. Does the project developer provide an alternative land?

A: We conducted an interview with the sector officer yesterday. At that meeting they answered that the compensation for the submerged farmland will be made by money.

Q: When will the project start?

A: Its construction will start next year.

3) Location of farmland

Whose farmland will be submerged: 4
Whose farmland is located at upstream reaches of proposed dam: 4 (same as above)
Whose farmland is located at the downstream reaches of proposed dam 8

4) Irrigation

Nobody says that they have enough water. Only 1 person irrigates by using container.

5) Farmers Organization

10 males and 4 females among the participants belong to cooperative. There are cooperatives in and around the Cell:

Group 1 group name Coffee Cooperative number 400 (total) fee 10,000 Rwf
Group 2 group name Banana Plant. Coop, number 118 (total) fee 5,000 Rwf
Group 3 group name Rice Farmer Coop., number n.a. fee n.a. Rwf

Activity of the group

Group 1: Milling by a milling equipment
Group 2: Training farmers to take new technology to develop marketable crop production
Group 3: To assist farmers to develop marshlands, to provide seeds to the market

The participants understood the necessity of Water Users' Association or farmers organization for irrigation water management and discussed the organization as follows.

(1) Basically, all beneficiaries of the farm land should be members of WUA.

(2) A committee should be elected from the members. This committee should do the registration of WUA and collect membership fee from the members.

(3) Water fee is basically necessary. However, they cannot decide how much the membership fee should be at this moment.

6) Discussion on land reallocation, if the dam will be constructed

Q1: Compensation for the farmers whose farmland will be submerged.

(1) The farmers think that the compensation should be made by money.

(2) On other hand, they also think that more guarantee for their lives should be considered. On these points, they think that alternatives lands take priority over the compensation by money.

(3) JICA should compensate for the submerged farmlands.

(4) Some farmers think that they cannot decide because the stage is before construction.

(5) First of all, they want to know the exact location to clarify the compensation issue.

Q2: How do you allocate irrigation area? (How about landless farmers?)

(1) Basically, the farmers don't have enough lands. On this point, they don't think that they can be members of WUA.

(2) The marshland is basically government land. If the land is reallocated, all the farmers will have benefit equally.

(3) The people who are not benefited by the project will buy the crops which are produced by the irrigated water.

(4) As for the landless farmers, they will be able to provide their labor forces at construction stage, However, they have no idea for it after construction. The sector officer should have responsibility for land reallocation.

(5) Some part of upland can be exchanged with marshland. On this point, they support the reallocation of land (About 30 participants support this opinion.)

7) Impacts of the Project.

Positive impact: They will get jobs. They will be able to grow vegetables to improve their life of households. Even for the landless people, they will get jobs during construction and get crops after construction.

Negative impact: None

8) Crops to grow if the dam was constructed

(1) Rice: They are marketable.
(2) Vegetables: They are marketable.
(3) Maize

9) for the Project

All the participants agreed with the project. The reasons are: 1) the project will provide jobs and 2) the farmers will get enough water at dry season.

3.3 Rurenge (Ngoma 22)

3.3.1 Rurenge Side

Workshop with Potential Farmer Beneficiaries: No.22 Rurenge Sector, Rujambara Cell
26th March 2009 from 10:40 to 12:10
At the proposed dam site

1) Potential beneficial imidugudu and participants:

Sector	Cell	Imidugudu	Location	Male	Female
Rurenge	Rujambara	Nyabaganza	Upstream	60	2
		Gitobe	Upstream	30	1
		Mbonwa	Downstream	34	0
		Mashyoza	Downstream	34	4
		Akarambaroye	Upstream? (not directly involved)	37	4
Remera	Ndekeme	Gikomero	Both Upstream and downstream	0	0
			Total	195	11

Total 206 people attended. This day, there was a community work to clear the road to the rice irrigation site. The meeting was held after the community work. Women also went to attend animal vaccination, therefore, less women attendance. Since the meeting was organized by Rurenge Sector, people who belong to Remera Sector did not come (not informed).

2) Location of farmland

Among the participants:

Whose farmland will be submerged: 26
Whose farmland is located at upstream reaches of the proposed dam: 18
Whose farmland is located at downstream reaches of the proposed dam: 31

3) Irrigation

Nobody says that they have enough water. 40 participants irrigate their farmland by watering cans and basins. And all the participants showed their wish to have stable water supply.

4) Farmers Organization

65 men and 5 women join in groups or cooperatives. 30 men and 4 women do not join any group. There is a rice cooperative in the target area. Name of the cooperative is TWIFATANYE.

Memebrship is 180 (around 80 from Remera side, around 100 from Rurenge side). Area is around 15ha and annual fee is 500Rwf/year.

There are 3 groups of merry-go-round (each member contribute money and each one takes the money in turn).

Name	male	female	fee
Intorezayesu	90 (both male and female)		100Rwf/week
Tuzamurane	20 (both male and female)		1,200Rwf/month
Twiyubaka	32	38	200Rwf/week

All the participants responded that they understand the necessity of water users association.

On how to establish the water users association:

- Form a cooperative. This coope might be a different one from the existing rice cooperative.
- Form a different cooperative from the existing one but the new cooperative should collaborate with the existing one.
- Existing cooperative covers the existing paddy fields in the bottom of the valley. New cooperative will be formed for the owners of the farmland in the slope.
- These two cooperatives can be combined and select one president.

31 persons showed willingness to pay 500Rwf for water fee.

5) Discussion on land reallocation

- Compensation to the land on upstream of the dam should be money to buy other land.
- How to share benefit: for those who do not have land in the irrigation area, paid labor will be given to them.
- Those who do not have land in the irrigated land should al be a member of cooperative and get share of income through cooperative activities.
- Those who do not have land can be engaged in fish culture in the dam.
- The dam lake could be developed for water park (boat service etc.)

6) Impacts of the Project

- Blocking water upstream may cause water shortage at downstream reaches.
- Construction of dam may affect for domestic and drinking water source in downstream reaches.
- There are Tanzanian refugees who got land from the government in this area.

7) Crops to grow if the dam was constructed

Rice, tomato, cabbage, maize, carrot, eggplant

8) for Project

All the participants agreed with the project.

3.3.2 Remera Side

Workshop with Potential Farmer Beneficiaries: No.22 Remera Sector, Ndekwe Cell
17th April 2009 from 9:50 to 12:00
At Ndekwe Cell office

1) Potential beneficial imidugudu and participants:

Sector	Cell	Imidugudu	Male	Female
Remera	Ndekwe	Gikomero	19	13
		Rugando	3	0
		Total	22	13

2) Questions from the participants to the Project

Q: We are worrying about the compensation which will be caused by the project.

A: MINAGRI has a policy for compensation for the affected farmers and has some experiences on compensation in other projects.

3) Location of farmland

Among the participants:

Whose farmland will be submerged: 5
Whose farmland is located at upstream reaches of the proposed dam: 5
Whose farmland is located at downstream reaches of the proposed dam: 14

4) Irrigation

None of the participants have enough irrigation water and no one practices irrigated agriculture.

5) Farmers Organization

There are following groups in the Imidugudu.

Group 1 group name: Rice Cooperative 8 participants were the members of the cooperative.
Group 2 group name: Association for funeral: 65 – 80 members fee: 200Rwf/month
Group 3 group name: Building / repair a house: 70 members fee: 1,100Rwf/2months

Activity of the group

Group 1: Cooperative activities for rice production
Group 2: Securing people for preparing a funeral for a person's death
Group 3: Collecting money from the members for building and repairing a house

All the participants agreed with the necessity of farmers organization (Water Users' Association) for irrigation water management. They discussed the establishing the organization as follows:

(1) Call the farmers who will receive direct benefits
(2) Hold a meeting and form a association which is based on contract

6) Discussion on land reallocation, if the dam will be constructed.

Q1: Compensation for the farmers whose farmland will be submerged.

The farmers think that the compensation should be made by money because the government will not provide lands

Q2: Compensation for the farmers whose farmland will be occupied by irrigation facilities.

Same as previous question

Q3: How do you allocate irrigation area? (How about landless farmers?)

To have a meeting is first.

Q4: How can you share the benefit of irrigation fairly?

Same as previous question and to have a meeting is very important.

7) Impacts of the project.

Negative impact: they are worrying about the negative impact on the existing springs.

8) Crops to grow if the dam was constructed

They hope to grow the crops which consume a lot of water. Therefore, they hope to grow rice.

9) for the Project

All the participants agreed with the project. The reason is that the project will provide water.

3.4 Rugarama (Gatsibo 31)

Workshop with Potential Farmer Beneficiaries: No.31 Rugarama
24th March 2009 from 10:00 to 12:00
At Gihuta cell office compound

There is another gulley near the proposed dam site and recently somebody visited the gulley and did some work like measurement. Therefore, some people misunderstood the proposed site was that gulley and came to the meeting. Only few members of the rice cooperative were present at the meeting.

(A farmer says) The rice cooperative (COPRORIZ Ntende) started with few members and those original farmers left the coop, but the coop remained. This existing cooperative can help establish new association for water management.

(A farmer says) People are also interested in fish breeding in the dam.

1) Potential beneficial imidugudu and participants:

Sector	Cell	Imidugudu	Location	Male	Female
Rugarama	Gihuta	Gashenyi I	Upstream	18	6
		Agatare	Upstream	24	3
		Ntende	Out of the target area	5	1
		Nyagahawga	Out of the target area	4	0
		Gashenyi II	Out of the target area	17	2
	Kanyangese	Rwagitima	Downstream	10	2
		Amahoro	Downstream	7	0
			Total	82	14

Total 96 people attended.

2) Location of farmland

Among the participants:

Whose farmland will be submerged: 4

Whose farmland is located at upstream reaches of the proposed dam: 2
Whose farmland is located at downstream reaches of the proposed dam:

3) Irrigation

Nobody says that they have enough water and nobody irrigates their field. And all the participants showed their wish to have stable water supply.

4) Farmers Organization

Name	male	female	fee
COPRORIZ (rice farmers coop)			
Tubungabunga ibikorwa rewezo (care of infrastructure (clean road)	1	0	
Dushygikiye umuco (Basket weaving)	0	22	5,000Rwf
COTAMORU	3	0	31,000Rwf

4. Baseline Survey

4.1 Method

Baseline survey was conducted with questionnaire attached hereunder with around 40 households from each site. The questionnaire was developed with discussions between JICA Study Team and Local Consultant Team and enumerators who are recruited from the target 4 sites, so that they are very familiar with the local situation of the sites. After we confirmed the Imidugudu, which are concerned with the project area on the 1st day of the socio-economic survey exercises, the enumerators visited the concerned Imidugudu and randomly selected households and carried out individual interviews.

4.2 Provisional Results of the Survey

This section presents the results of the baseline survey from various aspects. Data is still under revision, so that the results shown in this section are still provisional.

4.2.1 Demographical Feature

(1) Family Size

Average family sizes of the sample households in Gashora, Remera, Rurenge and Gatsibo are 5.1, 4.9, 4.9 and 6.0 respectively. Those who live alone in Gashora and Remera are all adult men. Number of households whose head is widow is 5 in Gashora, 9 in Remera, 10 in Rurenge and 15 in Rugarama.

Table 4.2.1 Family Size of the Sample Households (Provisional)

Family Size	Gashora		Remera		Rurenge		Gatsibo	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
1	1	3%	2	5%	0	0%	0	0%
2	1	3%	1	3%	3	8%	1	3%
3	5	13%	8	21%	10	27%	0	0%
4	10	25%	7	18%	4	11%	6	16%
5	5	13%	8	21%	9	24%	11	29%
6	8	20%	6	15%	3	8%	9	24%
7	6	15%	3	8%	2	5%	4	11%
8	4	10%	0	0%	2	5%	2	5%
9	0	0%	1	3%	4	11%	3	8%
10 -	0	0%	3	8%	0	0%	2	5%
Average	**5.1**	100%	**4.9**	100%	**4.9**	100%	**6.0**	100%
Widow headed	5	13%	9	23%	10	27%	15	39%

(2) Population Structure by Age Group

Following table shows the number of population of the sample households by age group. In all the sites, the younger generation has significant share for both female and male. The share of population under 29 years old is around 70% in all the sites. The share of population of male under 29 years old is slightly higher than female in each site.

Table 4.2.2 Population of the Sample Households by Age Group (Provisional)

Age Group	Gashora				Remera				Rurenge				Rugarama			
	Female		Male		Female		Male		Female		Male		Female		Male	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0 - 9	31	29%	30	31%	17	19%	16	16%	26	30%	28	30%	28	24%	28	25%
10- 19	30	28%	23	23%	30	34%	44	43%	21	24%	32	34%	29	25%	37	33%
20 - 29	17	16%	20	20%	13	15%	17	17%	17	20%	15	16%	14	12%	12	11%
30 -39	8	7%	7	7%	12	13%	6	6%	13	15%	11	12%	8	7%	13	12%
40 -49	9	8%	6	6%	10	11%	8	8%	3	3%	5	5%	16	14%	10	9%
50 - 59	8	7%	9	9%	6	7%	6	6%	3	3%	0	0%	9	8%	6	5%
60 - 69	4	4%	3	3%	1	1%	2	2%	3	3%	1	1%	3	3%	3	3%
70 -79	0	0%	0	0%	0	0%	1	1%	0	0%	1	1%	4	3%	2	2%
80 -	0	0%	0	0%	0	0%	3	3%	0	0%	0	0%	4	3%	0	0%
Total	107	100%	98	100%	89	100%	103	100%	86	100%	93	100%	115	100%	111	100%

(3) Occupation

Almost all the family members of the sample households are engaged in farming apart from students. In Remera, 2 persons are working as shopkeepers and 1 person is engaged in trading. In Rugarama 2 persons are working as teachers and 1 person is engaged in trading and 1 in carpentry.

(4) Education Status

Tables below show the educational status of the population of the sample households by age group. Since the government of Rwanda has introduced free primary education, the enroll ratio of the primary education shows higher in younger generations. Basically it is indicated that the education status of male is higher than female, especially of secondary enrollment. This tendency is clearer for elder generations. There are 3 persons who went to university in Rugarama. One male of the three is still at schools and other two males are working as teachers.

Table 4.2.3 Education Status by Age Group in Gashora (Provisional)

Age Group	Gashora													
	Female							Male						
	No.	Primary		Secondary		Over		No.	Primary		Secondary		Over	
		No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)
6 - 9	13	9	69%	-	-	-	-	15	12	80%	-	-	-	-
10- 19	30	28	93%	1	3%	0	0%	23	19	83%	1	4%	0	0%
20 - 29	17	11	65%	0	0%	0	0%	20	13	65%	2	10%	0	0%
30 -39	8	5	63%	0	0%	0	0%	7	5	71%	0	0%	0	0%
40 -49	9	2	22%	0	0%	0	0%	6	4	67%	0	0%	0	0%
50 - 59	8	3	38%	0	0%	0	0%	9	6	67%	0	0%	0	0%
60 - 69	4	1	25%	0	0%	0	0%	3	2	67%	0	0%	0	0%
70 -79	0	-	-	-	-	-	-	0	-	-	-	-	-	-
80 -	0	-	-	-	-	-	-	0	-	-	-	-	-	-
Total	89	59	**66%**	1	**1%**	0	**0%**	83	61	**73%**	3	**4%**	0	**0%**

Table 4.2.4 Education Status by Age Group in Remera (Provisional)

Age Group	Remera													
	Female							Male						
	No.	Primary		Secondary		Over		No.	Primary		Secondary		Over	
		No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)
6 - 9	12	12	100%	-	-	-	-	10	10	100%	-	-	-	-
10- 19	30	17	57%	11	37%	0	0%	44	28	64%	16	36%	0	0%
20 - 29	13	10	77%	0	0%	0	0%	17	7	41%	10	59%	0	0%
30 -39	12	2	17%	0	0%	0	0%	6	3	50%	1	17%	0	0%
40 -49	10	5	50%	0	0%	0	0%	8	6	75%	0	0%	0	0%
50 - 59	6	0	0%	0	0%	0	0%	6	2	33%	0	0%	0	0%
60 - 69	1	0	0%	0	0%	0	0%	2	1	50%	0	0%	0	0%
70 -79	0	-	-	-	-	-	-	1	0	0%	0	0%	0	0%
80 -	0	-	-	-	-	-	-	3	0	0%	0	0%	0	0%
Total	84	46	**55%**	11	**13%**	0	**0%**	97	57	**59%**	27	**28%**	0	**0%**

Table 4.2.5 Education Status by Age Group in Rurenge (Provisional)

Age Group	Rurenge													
	Female							Male						
	No.	Primary		Secondary		Over		No.	Primary		Secondary		Over	
		No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)
6 - 9	11	11	100%	-	-	-	-	12	12	100%	-	-	-	-
10- 19	21	16	76%	4	19%	0	0%	32	27	84%	3	9%	0	0%
20 - 29	17	16	94%	0	0%	0	0%	15	13	87%	1	7%	0	0%
30 -39	13	9	69%	0	0%	0	0%	11	10	91%	0	0%	0	0%
40 -49	3	2	67%	0	0%	0	0%	5	5	100%	0	0%	0	0%
50 - 59	3	3	100%	0	0%	0	0%	0	-	-	-	-	-	-
60 - 69	3	2	67%	0	0%	0	0%	1	0	0%	0	0%	0	0%
70 -79	0	-	-	-	-	-	-	1	1	100%	0	0%	0	0%
80 -	0	-	-	-	-	-	-	0	-	-	-	-	-	-
Total	71	59	**83%**	4	**6%**	0	**0%**	77	68	**88%**	4	**5%**	0	**0%**

Table 4.2.6 Education Status by Age Group in Rugarama (Provisional)

Age Group	Rugarama													
	Female							Male						
	No.	Primary		Secondary		Over		No.	Primary		Secondary		Over	
		No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)
6 - 9	11	8	73%	-	-	-	-	11	10	91%	-	-	-	-
10- 19	29	27	93%	1	3%	0	0%	37	27	73%	8	22%	0	0%
20 - 29	14	8	57%	5	36%	0	0%	12	8	67%	3	25%	1	8%
30 -39	8	6	75%	0	0%	0	0%	13	7	54%	4	31%	2	15%
40 -49	16	12	75%	0	0%	0	0%	10	8	80%	1	10%	0	0%
50 - 59	9	4	44%	0	0%	0	0%	6	4	67%	2	33%	0	0%
60 - 69	3	3	100%	0	0%	0	0%	3	2	67%	0	0%	0	0%
70 -79	4	2	50%	0	0%	0	0%	2	2	100%	0	0%	0	0%
80 -	4	2	50%	0	0%	0	0%	0	-	-	-	-	-	-
Total	98	72	**73%**	6	**6%**	0	**0%**	94	68	**72%**	18	**19%**	3	**3%**

4.2.2 Crop Farming

(1) Land Tenure

Most of the sample households are small-scale farmers. They own one or few pieces of farmland. Those who rent or rent out the land are few. Because farmers are not really recognizing the exact size of their farmland, it seems the accuracy of the answers on the land size by the households is low.

(2) Present Crop Production

Because the accuracy on the size of farmland is in question, here summarizes the number (share) of the sample households who grow certain crops and their amount of production. Tables 4.2.7 to 4.2.10 show the share of the households who grow each crop and the average production in kg. Major crops grown commonly in the 4 sites are sorghum, bean, maize, cassava, sweet potato, and banana. Vegetables are comparably grown more in Remera. Rice is also cultivated in Rurenge and Rugarama. But for Rugarama, rice crop is seen in the downstream marshland, where the project cannot cover due to avoid overlapping with the beneficial area of RSSP.

Although the unit yield per area is difficult to assess while the accuracy of the land size is in question, the yield could be presumed low due to inter-cropping and rain-fed agriculture. Since the inter-cropping is common in all the sites, density of crop stands is lower than that of mono-cropping, that would result in low unit yield if the data of one crop was taken from the inter-cropped farmland. Also under rain-fed cropping, the yield would be unstable. It may required to conduct spot yield survey to obtain accurate unit yield of crops.

Table 4.2.7 No.(%) of Household who grow each crop and Average Production (Gashora)

Crop	Bean	Cassava	Sorghum	Maize	Sweet potato	Banana
No. of HH (%)	93%	83%	80%	80%	50%	35%
Average Harvest (kg)	296	579	300	87	233	130

Table 4.2.8 No.(%) of Household who grow each crop and Average Production (Remera)

Crop	Cassava	Sorghum	S. potato	Bean	Tomato	Maize
No. of HH (%)	62%	56%	51%	41%	23%	15%
Average Harvest (kg)	848	406	382	160	118	59

Table 4.2.9 No.(%) of Household who grow each crop and Average Production (Rurenge)

Crop	Sorghum	Bean	Maize	Rice	Cassava	S. potato	Banana	Cabbage
No. of HH (%)	68%	46%	32%	19%	19%	11%	8%	3%
Average Harvest (kg)	416	273	357	65	101	96	28	157

Table 4.2.10 No.(%) of Household who grow each crop and Average Production (Rugarama)

Crop	Maize	Sorghum	Bean	Banana	Rice	Cassava	S. potato	Cabbage
No. of HH (%)	63%	42%	37%	16%	11%	5%	5%	5%
Average Harvest (kg)	180	248	72	270	53	27	21	13

(3) Present Cropping Pattern

With the result of the baseline survey and also considering the filed visit of the sites, present cropping pattern in the 4 sites are described. At present, inter-cropping of several crops such as sorghum, bean, maize, cassava and sweet potato are common. Crop season is basically season A (Sep. to Jan.) and season B (Feb. to Jun.). There is no report of significant irrigation agriculture during the season C (dry season: Jul. to Sep.) in all the sites. Tables 4.2.11 to 14 show the present cropping pattern in the 4 sites.

Table 4.2.11 Present Cropping Pattern in Bugesera 2 Gashora

Crop	Area	Inter/ Monc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sorghum	22%	Inter crop												
Maize	12%	Inter crop												
Sweet potato	7%	Inter crop												
Haricot bean	30%	Inter crop												
Cassava	24%	Inter crop												
Banana	4%	Mono crop												

Table 4.2.12 Present Cropping Pattern in Ngoma 21 Remera

Crop	Area	Inter/ Monc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sorghum	29%	Inter crop												
Maize	7%	Inter crop												
Sweet potato	17%	Inter crop												
Haricot bean	16%	Inter crop												
Vegetable (1)	4%	Mono crop												
Vegetable (2)	4%	Mono crop												
Cassava	18%	Inter crop												
Banana	5%	Mono crop												

Table 4.2.13 Present Cropping Pattern in Ngoma 22 Rurenge

Crop	Area	Inter/ Monc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	15%	Mono crop												
Sorghum	24%	Inter crop												
Maize	20%	Inter crop												
Sweet potato	5%	Inter crop												
Haricot Bean	24%	Inter crop												
Vegetable (Cabbage)	2%	Mono crop												
Cassava	5%	Inter crop												
Banana	5%	Mono crop												

Table 4.2.14 Present Cropping Pattern in Ngoma 22 Rurenge

Crop	Area	Inter/ Monc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sorghum	24%	Inter crop												
Maize	34%	Inter crop												
Sweet potato	2%	Inter crop												
Haricot bean	15%	Inter crop												
Cassava	4%	Inter crop												
Banana	21%	Monocrop												

(4) Issue of Farming

Problems on farming were asked to the interviewees. Figures below show the answers of the interviewees on the question. Interviewees were to pick the first, second and third serious issue from the list of issues. In all the four sites, most of the interviewees ranked “lack of irrigation water” as the most serious issue. This result would be borne to the fact that the project aims at irrigation development. The answer would have been biased from the intention of the survey. But in Remera some interviewees picked other issues as the most serious one such as “Lack of seeds”, “Lack of storage facilities”, “Lack of fertilizers” etc. “Lack of seeds” were picked as the second serious issue in Remera and Rurenge, while the second serious issue were “Lack of fertilizers” in Rugarama. In Gashora, the number of interviewees who picked Lack of seeds or Lack of fertilizers as second or third was about equal. Incidence of pests and diseases were also found as a significant issue in the four sites.

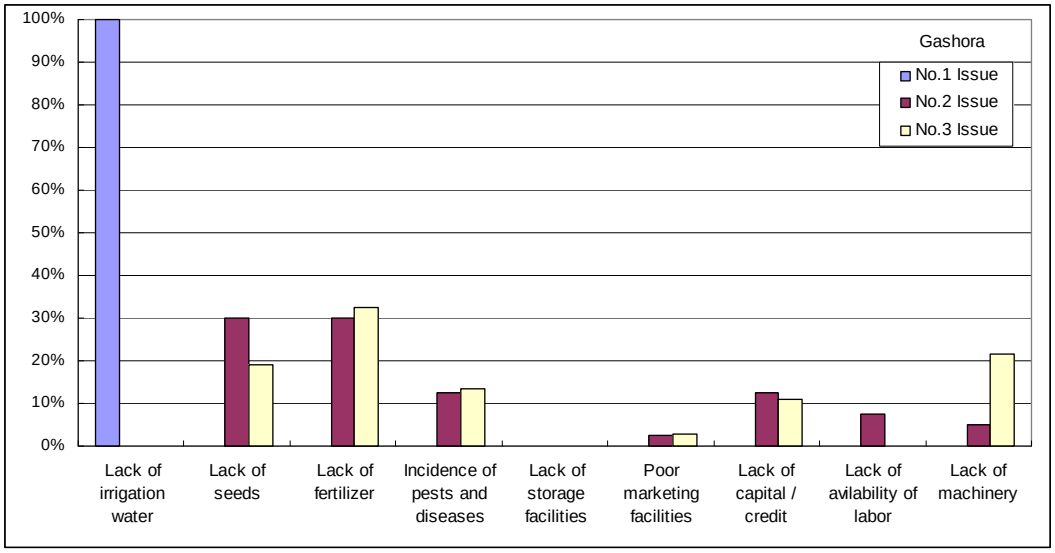


Figure 4.2.1 Issues of Farming (Gashora)

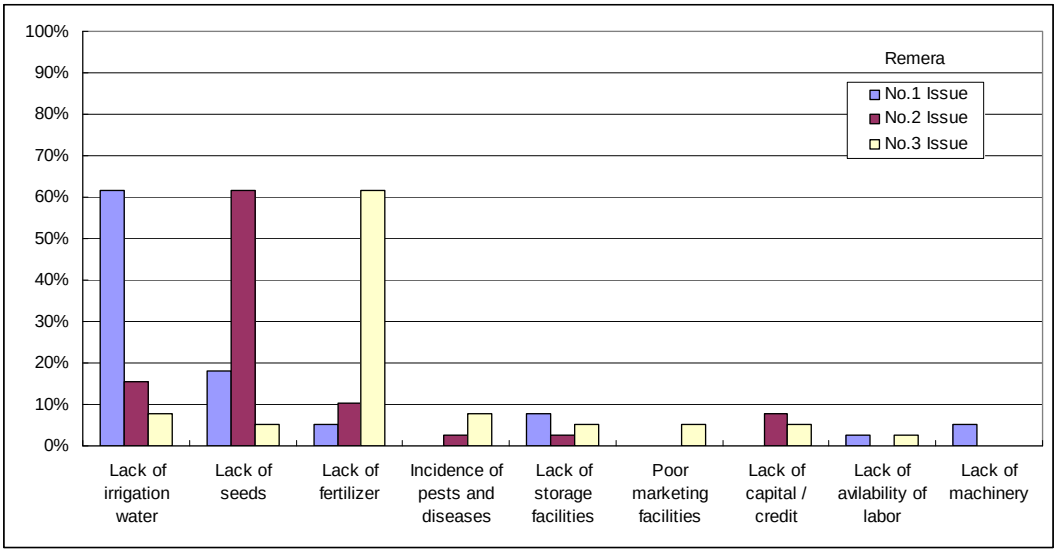


Figure 4.2.2 Issues of Farming (Remera)

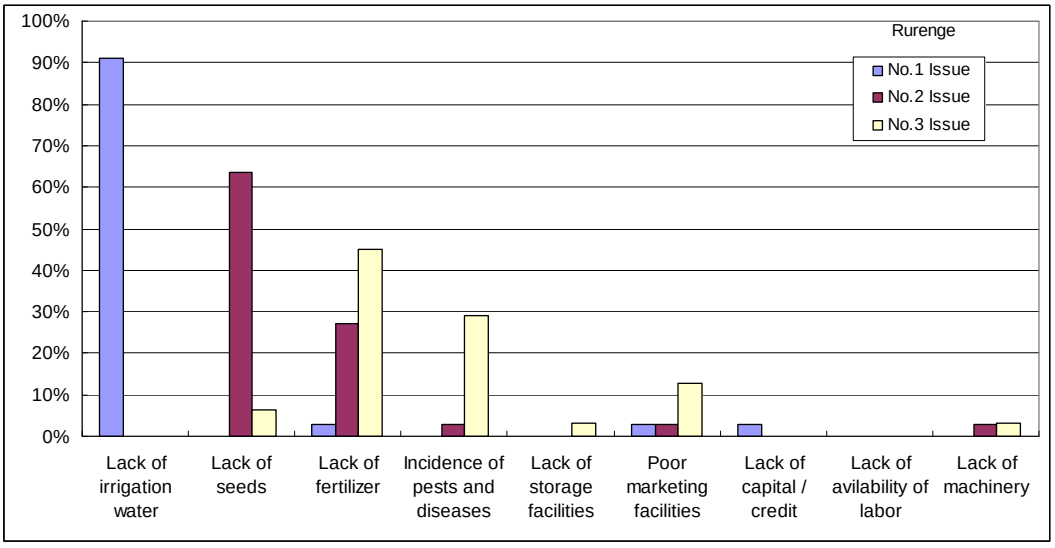


Figure 4.2.3 Issues of Farming (Rurenge)

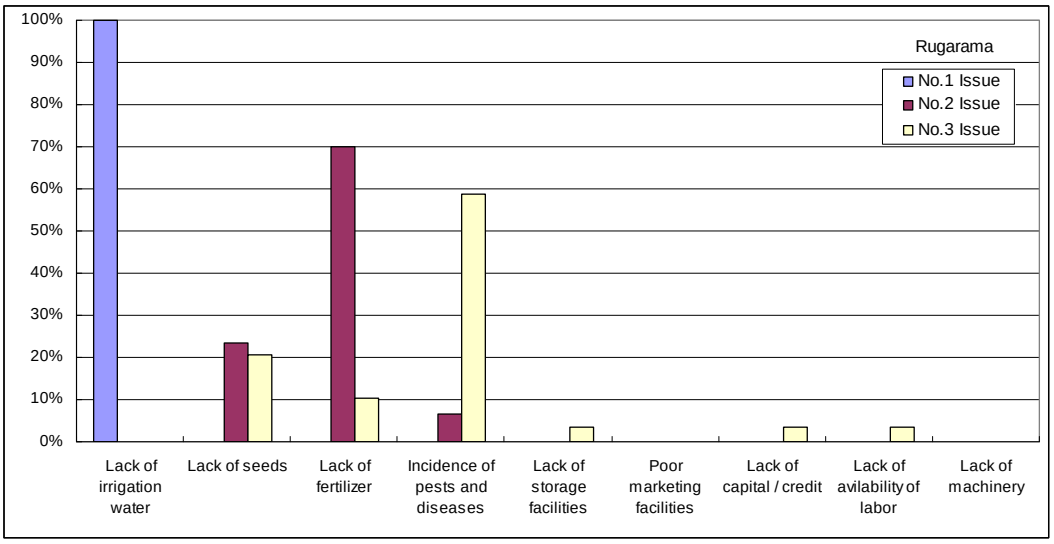


Figure 4.2.4 Issues of Farming (Rugarama)

(5) Aspiration of Farmers on Crop with Irrigation

Interviewees were asked if they would like to grow rice if there were enough irrigation water. All the interviewees in Gashora and Remera and 84% in Rurenge answered that they would like to grow rice. As for Rugarama, only 24% was positive with growing rice.

Table 4.2.15 Farmers Aspiration for Rice Cultivation with Irrigation

Crop	Gashora	Remera	Rurenge	Rugarama
No. of Sample HH	40	39	37	38
Rice	100%	100%	84%	24%

Also the interviewees were asked if they wish to grow other crops if there were enough irrigation water. As the table below shows, they selected maize, cabbage, tomato, carrot and other vegetables with irrigation.

Table 4.2.16 Farmers Aspiration for Selecting Crops with Irrigation

Crop	Gashora	Remera	Rurenge	Rugarama
No. of Sample HH	40	39	37	38
Maize	55%	79%	16%	82%
Cabbage	55%	41%	59%	-
Tomato	30%	28%	41%	3%
Carrot	33%	28%	30%	3%
Other Vegetables	53%	26%	57%	84%

Other Vegetables: onion, eggplant, leek etc.

(6) Willingness to Pay for Irrigation Water Fee

The interviewees were also asked if they were willing to pay for irrigation water fee for O&M of the irrigation facilities, if they were constructed. Most of the interviewees responded positively, but in Rugarama 31% of the interviewees was reluctant to pay the fee. The mode of value that they are willing to pay is 1,000Rwf per year except for Rurenge, in which the mode is 500Rwf.

Table 4.2.17 Willingness to Pay for Irrigation Water Fee

Rwf/year	Gashora		Remera		Rurenge		Rugarama	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	1	3%	0	0%	2	6%	10	31%
0 - 499	4	11%	3	10%	2	6%	1	3%
500 - 999	6	16%	6	20%	21	60%	0	0%
1000 - 1499	26	68%	13	43%	9	26%	20	63%
1500 - 1999	0	0%	0	0%	0	0%	0	0%
2000 -	1	3%	8	27%	1	3%	1	3%
Mode (Rwf)	1,000		1,000		500		1,000	
Max. (Rwf)	2,000		15,000		2,000		2,000	
Average (Rwf)	834		2,233		620		694	

(7) Conflict over Water

There are few conflicts over water in the 4 sites except for Remera, where conflict incidence was given from 46% of the interviewees. Generally few case of conflict over water would be due to absence of irrigation. Because of rain-fed agriculture, though farmers are somehow controlling water by terracing and ditches, it would not cause so much conflict among farmers.

Table 4.2.18 Conflict over Irrigation Water

Site	Answer "Yes"		Conflict Incidence
	No.	(%)	
Gashora	1	3%	It was in dry season and people fed the crops with water but they got bad harvests
Remera	18	46%	Negotiation over shortage of rain water, storage of rainwwater, water sharing
Rurenge	2	5%	Negotiatino over storages of rain water
Rugarama	0	-	

4.2.4 Farm Inputs

(1) Seeds

Tables 4.2.19 to 4.2.22 show how farmers are procuring seeds by crop. It is indicated that self-supply (multiplication) of seeds is the majority for each crop. In Gashora and Rurenge, the case of buying seeds of bean is more than self-supply. When they buy seeds, majority is buying seeds from shops. In Rugarama, the government program to provide free hybrid seeds of maize has been implemented in the area and that effects are reflected to the answer of the interviewees.

Table 4.2.19 Procurement of Seeds (Gashora)

Where to get	Maize		Bean		Cassava		Sorghum		Sweet potato	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Self-supply only	20	65%	16	43%	19	68%	29	76%	10	63%
Self + Buy	10	32%	20	54%	7	25%	9	24%	6	38%
Buy only	1	3%	1	3%	2	7%	0	0%	0	0%
Where to buy										
Other farmer	0	0%	0	0%	1	14%	0	0%	3	50%
Shop	7	64%	11	55%	3	43%	5	63%	1	17%
Middlemen	2	18%	1	5%	2	29%	1	13%	0	0%
Government	0	0%	0	0%	0	0%	0	0%	0	0%
Others	2	18%	8	40%	1	14%	2	25%	2	33%

Table 4.2.20 Procurement of Seeds (Remera)

Where to get	Maize		Bean		Cassava		Sorghum		Sweet potato	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Self-supply only	10	77%	17	94%	28	100%	24	92%	27	90%
Self + Buy	2	15%	0	0%	0	0%	1	4%	1	3%
Buy only	1	8%	1	6%	0	0%	1	4%	2	7%
Where to buy										
Other farmer	2	67%	-	-	-	-	1	100%	1	50%
Shop	1	33%	-	-	-	-	0	0%	1	50%
Middlemen	0	0%	-	-	-	-	0	0%	0	0%
Government	0	0%	-	-	-	-	0	0%	0	0%
Others	0	0%	-	-	-	-	0	0%	0	0%

Table 4.2.21 Procurement of Seeds (Rurenge)

Where to get	Maize		Bean		Cassava		Sorghum		Rice	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Self-supply only	11	50%	6	38%	2	67%	18	78%	5	71%
Self + Buy	9	41%	8	50%	1	33%	1	4%	1	14%
Buy only	2	9%	2	13%	0	0%	4	17%	1	14%
Where to buy										
Other farmer	9	82%	9	90%	1	100%	0	0%	2	100%
Shop	10	91%	9	90%	1	100%	4	80%	1	50%
Middlemen	1	9%	0	0%	0	0%	1	20%	0	0%
Government	0	0%	0	0%	0	0%	1	20%	0	0%
Others	0	0%	0	0%	0	0%	0	0%	0	0%
	N=11		N=10		N=1		N=5		N=2	

Table 4.2.22 Procurement of Seeds (Rugarama)

Where to get	Maize		Bean		Cassava		Sorghum	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Self-supply only	8	19%	12	60%	3	43%	5	45%
Self + Buy	10	23%	0	0%	3	43%	4	36%
Buy only	0	0%	2	10%	1	14%	2	18%
Gv't provision	25	58%	6	30%	0	0%	0	0%
Where to buy								
Other farmer	5	14%	1	13%	4	100%	1	17%
Shop	0	0%	0	0%	0	0%	0	0%
Middlemen	1	3%	0	0%	0	0%	1	17%
Government	25	71%	6	75%	0	0%	0	0%
Others	0	0%	0	0%	0	0%	0	0%
	N=35		N=8		N=4		N=6	

(2) Fertilizers and Pesticides

Only few sample households are using chemical fertilizers and non of the households are using pesticides. It is significant that 68% of the households in Gashora apply compost / manure. Table below shows the use of fertilizers and pesticides.

Table 4.2.23 Use of Fertilizers and Pesticides

Site	Gashora		Remera		Rurenge		Rugarama	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Chemical Fertilizers	1	3%	4	10%	9	24%	1	3%
Compost / Manure	27	68%	2	5%	0	0%	0	0%
Pesticides	0	0%	0	0%	0	0%	0	0%

(3) Farm Labor

Mode of wage for farming work is 700Rwf per day for both male and female in Gashora, 800Rwf for both male and female in Remera, and 600Rwf for both male and female in Rugarama. In Rurenge, the mode of wage for farming work for male is 1,000Rwf per day while the one for female is 800Rwf per day. In Rurenge, wage for male shows high rate and difference from female unlike the other sites. One factor would be the paddy work like plowing and paddling, which is considered more tedious than upland cropping. Normally such paddy work is charged at 1,000Rwf per day.

(4) Tools and Equipment

All the farmers are using simple hand tools only for farming such as hoes, machetes and sacks to put the harvest. All the tools are replaced within 2 years. Majority of sample farmers replace the tools every year.

4.2.5 Marketing

Majority of farm produces are sold directly to the local markets. Also there are cases that farmers are selling their produces to middlemen. Crops also often sold to middlemen are maize, cassava, rice, banana, and sorghum. Transportation from farm to house and from house to market is all by manual labor. Almost all the sample farmers say they carry their produces on their heads from the farms to their houses. As for carrying the produces to market, some people use bicycle (45% in Gashora and 58% in Rugarama).

4.2.6 Extension Services

(1) Extension Service Received

On question of whether they have received any extension services, the households in Gashora was found much less received the services than other sites. Table below summarizes the experience of extension services and their contents. In Remera and Rurenge, both of which are in Ngoma District, the households have received relatively many services. The service providers are not only the government but also NGOs.

Table 4.2.24 Extension Services Received in the Four Sites

	Gashora	Remera	Rurenge	Rugarama
Yes	1 (3%)	17 (44%)	17 (46%)	12 (32%)
Kind	Dissemination of new variety	Dissemination of new variety Fertilization Pest/desease control Agro forestry Soil erosion control Storing / processing	Dissemination of new variety Fertilization Pest/desease control Agro forestry Soil erosion control Storing / processing	Dissemination of new variety Fertilization Soil erosion control
Who	NGO	Agriculture Officer, NGO	Agriculture Officer, NGO	Agriculture Officer, NGO

(2) Extension Services Wished

Interviewees were also asked what kind of extension services they wish to receive. In Gashora, major contents the interviewees specified are fertilization, soil erosion control, pest / disease control, and dissemination of new varieties. In Remera, request for fertilization was significantly high and storing / processing, pest / disease control, dissemination of new varieties and soil erosion control followed. In Rurenge, dissemination of new varieties, soil erosion control, fertilization, and pest disease control are major requests. As particular point, fish breeding and crop husbandry specifically for maize, cabbage

and tomato were requested in Rurenge. In Rugarama, significant number of the interviewees raised requests for soil erosion control particularly acquiring skills for terracing.

Table 4.2.25 Requested Extension Services

Site	Extension Service	No. of Vote
Gashora	Fertilization	16
	Soil erosion control	15
	pest/ disease control	15
	Dissemination of new variety	14
	Agro-forestry	10
	Storing/ processing	10
	Livestock realing	4
	All kinds on training	17
Remera	Fertilization	30
	Storing/processing	19
	Pest/disease control	18
	Dissemination of new variety	15
	Soil erosion control	15
	Agro-forestry	14
	Livestock rearing	1
	All kinds on training	6
Rurenge	Dissemination of new variety	7
	Soil erosion control	7
	Fertilization	6
	Pest/disease control	5
	Fish breeding	2
	Maize crop	2
	Cabbage and tomato crop	1
Rugarama	Terracing (Soil erosion control)	13
	Fertilization	10
	Dissemination of new variety	2
	Pest/disease control	2

4.2.7 Farm Household Income

Average annual farm household income in Gashora, Remera, Rurenge and Rugarama is estimated at 146,000Rwf, 425,000Rwf, 241,000Rwf and 135,000Rwf respectively. Out of them income from crop production occupies 81%, 50%, 91% and 75% in Gashora, Remera, Rurenge and Rugarama respectively. Income level in Remera is the highest among the 4 sites and also income from toher than crop is high in Remera. Table 4.2.26 below shows the average annual income of the 4 sites.

Farmers allocates significant amount of farm produce for their self-consumption. The monetary value of produce for the self-consumption was also estimated. The value of the annual self-consumption in Gashora, Remera, Rurenge and Rugarama is 158,000Rwf, 155,000Rwf, 118,000Rwf and 73,000Rwf respectively. Total annual farm household income and self-consumption value are estimated at 304,000Rwf in Gashora, 580,000Rwf in Remera, 359,000Rwf in Rurenge and 209,000Rwf in Rugarama.

Table 4.2.26 Average Annual Income of the Sample Households in the Four Sites

Item	Gashora		Remera		Rurenge		Rugarama	
	Rwf	(%)	Rwf	(%)	Rwf	(%)	Rwf	(%)
Crop	118,521	81%	211,351	50%	219,297	91%	101,493	75%
Livestock	17,008	12%	44,282	10%	8,703	4%	18,283	13%
Fishery	0	0%	7,692	2%	0	0%	0	0%
Forest	1,625	1%	82,538	19%	0	0%	0	0%
Farm labor	7,710	5%	0	0%	0	0%	1,389	1%
Other	1,550	1%	79,231	19%	13,108	5%	14,278	11%
Total	146,414	100%	425,094	100%	241,108	100%	135,443	100%
Home Cosumption Value	157,813		155,333		118,068		73,181	
Total Value	304,227		580,427		359,176		208,624	
Crop + Home Consumption	276,334	91%	366,684	63%	337,365	94%	174,674	84%

Table 4.2.27 and Figure 4.2.5 below show the share of the sample households by income group. In this table and figure include the cash income and the value of self-consumption. Share of households under the annual income of 500,000Rwf occupy 90% in Gashora, 62% in Remera, 73% in Rurenge and 92% in Rugarama.

Table 4.2.27 Sample Households in the Four Sites by Income Group

Annual Income + Home consumption Value (Rwf)	Gashora			Remera			Rurenge			Rugarama		
	No.	Share	Acc.	No.	Share	Acc.	No.	Share	Acc.	No.	Share	Acc.
< 100,000	8	20%	20%	6	15%	15%	3	8%	8%	13	36%	36%
100,000 < 200,000	7	18%	38%	5	13%	28%	7	19%	27%	12	33%	69%
200,000 < 300,000	8	20%	58%	4	10%	38%	10	27%	54%	5	14%	83%
300,000 < 400,000	6	15%	73%	6	15%	54%	4	11%	65%	1	3%	86%
400,000 < 500,000	7	18%	90%	3	8%	62%	3	8%	73%	2	6%	92%
500,000 < 600,000	0	0%	90%	3	8%	69%	5	14%	86%	1	3%	94%
600,000 < 700,000	2	5%	95%	1	3%	72%	3	8%	95%	1	3%	97%
700,000 < 800,000	0	0%	95%	3	8%	79%	0	0%	95%	0	0%	97%
800,000 < 900,000	0	0%	95%	0	0%	79%	1	3%	97%	0	0%	97%
900,000 < 1,000,000	1	3%	98%	1	3%	82%	0	0%	97%	0	0%	97%
1,000,000 <	1	3%	100%	7	18%	100%	1	3%	100%	1	3%	100%
Total	40	100%		39	100%		37	100%		36	100%	

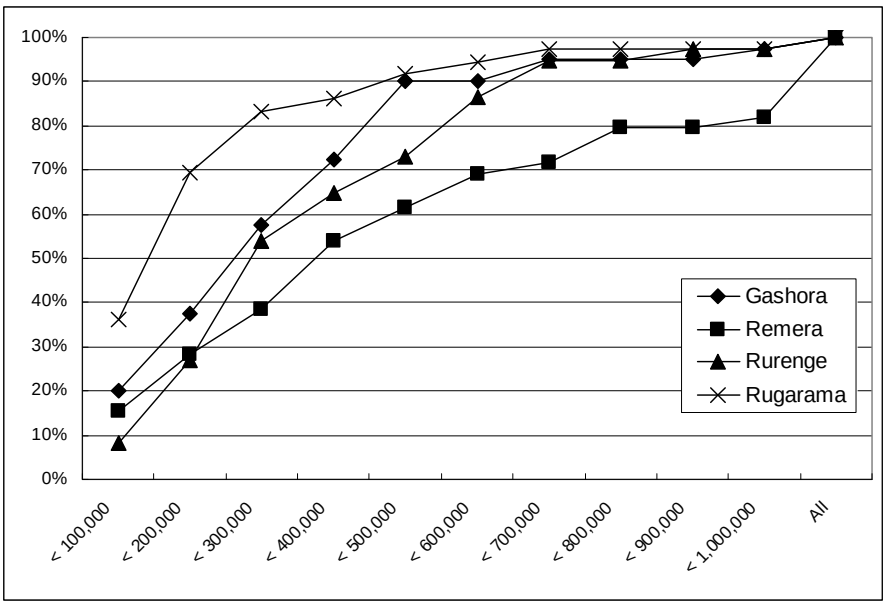


Figure 4.2.5 Sample Households in the Four Sites by Income Group

Questionnaire for the 1st Day:

Questionnaire for Baseline Survey

No. .

Date of Survey: / / , Time: from : to : .
Name of Surveyor: _____

Participants: → List of Participants

1. On the Sector

1.1 When was the Sector established? ( )

1.2 Remarkable Features and Achievements in the Sector

1.3 Current Population

Please provide data (attached Table 1)

1.4 Which imidugudu would be located at upstream / downstream of the proposed dam axis?

Please identify the imidugudu and provide data (attached Tables 2 and 3)

1.5 Number of farm households according to land tenure

Please provide data attached Table 4

2. Land Use

Total area by use, land distribution etc.

Please provide data on land use and land distribution as attached Tables 5 and 6

3. Income Sources of Residents

What kind of income sources the residents have? By rank

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

4. Agriculture

4.1 Major Crop Area and Production by Season

What are the major crops? How are the productions? ( )

Please provide the data as attached Tables 7 and 8

4.2 Are there farmers growing crops with irrigation during dry season?

(Yes No)

Season C (Irrigation in Dry Season June 2008 to August 2008)

Cell / Crop								
	Area (ha)	Production (t)	Area (ha)	Production (t)	Area (ha)	Production (t)	Area (ha)	Production (t)
Rice								
Maize								
Haricot bean								

4.3 Trend of Crop Area

Is the total cropping area increasing or decreasing? Which crops are increasing or decreasing? and the reasons for the trend.

4.4 Trend of crop yield

Are the yields (production per unit) of crops increasing or decreasing? Which crops? Reasons.

4.5 Use of Fertilizers and Pesticides (both organic and chemical)

1) How is the use of chemicals / manure / compost by farmers? (% of total farmers, what kind of chemicals?)

2) Where do they get chemicals? Price?

3) Do you recommend farmers to use chemicals?

4.6 Procurement of seeds

How are the farmers procuring seeds? Major variety? How is the quality? Price? Is seeds supply enough? Do you know Nerica rice? etc.
(answer by crop)

Rice	
Maize	
Haricot bean	
Cassava	
Sorghum	
Sweet potato	
Vegetables	

4.7 Farm labor (hired labor / customary collective work)

1) Are there any customary collective work for farming? Are they very common or not?

2) How common is hired labor on farming? For which farm operation labor is hired? How much is the wage? What kind of people gets the hired labor?

4.8 Agriculture Machinery

1) What kind of farming tools is commonly used? Are there any drying or milling facilities in the villages?

2) In case there is milling machines in their villages

No.	Place	How old?	Capacity	Fee for milling	Who is Owner
1					
2					
3					
4					
5					

4.9 Post- harvesting and Marketing of farm products

1) How are farmers storing harvest? How is the loss?

2) How are farmers selling products? Directly to market, middlemen, etc. How is the price? How do they transport the products?

4.10 Organizations of farmers (cooperatives and others)

1) Are there Agriculture Cooperatives? (name, objective, legal status, membership fee, current status)

Name		
Established year		
Legal status		
Objectives of Coop.		
No. of member		
Membership fee		
Current status (active or not?)		

2) Any other organizations in the villages?

4.11 Any conflict over farming? And how do you solve?

4.12 Ranking of issues concerning agriculture in the area

Please rank the critical issues on agriculture development in your area (irrigation, inputs, pests, marketing etc.)

5. Rural Lives

5.1 Energy source of villages

What are the energy source in the village?

1) For cooking ( )
2) For lightening ( )
3) For warming ( )

Remarks

5.2 Domestic water sources

1) For drinking ( )
2) For domestic use (washing clothes, dishes) ( )
3) For animals ( )

Remarks (Number of water points, distance from villages, water quality)

No.	Location (valley or top of hill?) and type (spring. borehole etc.)	Distance from village (km)	Water quality	Water capacity
1				
2				
3				
4				
5				

5.3 Education (By sector)

1) No. of Nursery schools and enrolment ratio (No. Enrolment ratio %)
2) No. of Elementary school, Enrolment ratio, and Drop-out ratio
No.( ) Enrolment ratio (male % female %) Drop-out ratio (male % female %)
3) No. of Secondary school, Enrolment ratio, Drop-out ratio
No.( ) Enrolment ratio (male % female %) Drop-out ratio (male % female %)
4) Literacy rate (by sector)
(male % female %)

5.4 Health (location of clinic (how far), popular diseases)

1) No. of clinic and hospital (public or private) and location, No. of doctors and No. of beds

2) Popular diseases

3) Are there any insurance system that farmers are applying?

5.5 Finance for farmers

Access of finance for farmers, conditions, how often farmers are using finance facilities,

5.6 Any Project implemented in the Sector (by resident themselves, by support of government or NGO or donors)

Name of Project	Purpose	Year implemented	Fund source (amount)	Status (successful?)

6. Opinions on Irrigation Development

- Compensation of farmland which would be submerged if the dam was constructed
- Change of land use (from upland crop to paddy field)
- Reallocation of land
- It the project necessary? etc.

Thank you very much for your cooperation.

Questionnaire of 2nd Day:

Farmers' Workshop

No. .

Date of Survey: / / , Time: from : to : .
Name of Surveyor: _____
Name of District _____
Name of Sector _____
Name of Cell _____
Name of Imidugudu _____ , _____

Number of Attendants

Name of Imidugudu _____	Male	Female
Name of Imidugudu _____	Male	Female
Name of Imidugudu _____	Male	Female
Name of Imidugudu _____	Male	Female

1. Explanation of the project
1.1 Location of the dam
1.2 Location of the reservoir
1.3 Irrigation area
1.4 Merit of the project
- Irrigation in the dry season. Stable water supply. Increase of production.
- Training on farming. Introducing appropriate technology.

1.5 Demerit of the project
- Some farmland will be submerged
- Maintenance work should be done by the farmers.
- Farm land reallocation

1.6 Question
1.6.1 Location of farmland
- Is your farmland in the area which will be submerged? (count number) _____
- Is your farmland in the upstream area of proposed dam? (count number) _____
- Is your farmland in the downstream area of proposed dam? (count number) _____

1.6.2 Irrigation
Do you have enough water supply now? (count number) _____
Do you irrigate your farmland now? (count number) _____
How do you irrigate? _____
Do you need stable water supply? (count number) _____

2. Necessity of establishment of water users' association (group)
2.1 Role of water users' association
- Operation of irrigation facilities (irrigation plan, rotation irrigation)
- Maintenance of irrigation facilities
- Collection of water fee

2.2 Water fee
- Water fee is used for operation and maintenance of irrigation facilities; wage for gate keeper, wage for maintenance work (cleaning canals, repair work etc.), cost for maintenance material(cement, sand, stones etc.) and so on.
- Water fee is about 800 Rwf/season (example: another irrigation scheme)

2.3 Question
- Are you a member of any group? (count number) male female
- Cooperative (count number) male female membership fee Rwf

Group 1	group name _____	, number	male	female	fee	Rwf
Group 2	group name _____	, number	male	female	fee	Rwf
Group 3	group name _____	, number	male	female	fee	Rwf

- Activity of the group
  Group 1 _____
  Group 2 _____
  Group 3 _____

- Do you understand the necessity of water users' association? (count number) _____
- How do you establish water users' association? (discussion)

_____
_____
_____
_____
_____

- How much per year will you pay for water fee? 0 500Rwf 1000Rwf
More than 1000Rwf Others

2.4 Discussion on land reallocation, if the dam would be constructed..
- Compensation for the farmers whose farmland will be submerged.

_____
_____
_____
_____

- Compensation for the farmers whose farmland will be occupied by irrigation facilities.

_____
_____
_____
_____

- How do you allocate irrigation area? (How about landless farmers?)

_____
_____
_____
_____

- How can you share benefit of irrigation fairly?

_____
_____
_____
_____

3. Discussion with groups on impacts of the project.
(What would happen? eg. To female, male, poor group etc.)

_____
_____
_____

4. Question
Do you need this project? (count number) male female
The reason why yes; _____
_____
_____
The reason why no; _____
_____
_____

Thank you very much

Questionnaire for Baseline Survey:

Questionnaire for Baseline Survey

No. .

Date of Survey: / / , Time: from : to : .
Name of Surveyor: _____

Name of Imidugudu: _____ (How many years do you live in the village?)
Name of Cell: _____
Name of Sector: _____
Location of farm land:
Upstream / Downstream of Proposed dam Axis

1. Personal Data:

1. Name:			2. Marital status: M / S / widow (er)
3. Age:	4. Sex: M / F	5. Education:	6. Occupation

2. Family Structure (Family members are those who share food)

No	Sex (M/F)	Age	Relation with you	Education	Occupation
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

3. Land Ownership

3.1 Land holding

a-1. Owned: (Total ha)	a-2. How many pieces of farmland do you own? ( )	
b. Leased from somebody (paying a fee)	Season A: (ha)	Season B: (ha)
c. Rent to somebody (receiving a fee)	Season A: (ha)	Season B: (ha)
d. How long are you leasing the farmland? (1. only one crop season, 2. one year, 3. more than 2 years)		

(*):Season A = around September – Jan Season B = around Feb- Jun,

3.2 In terms of contract

3.2.1 Lease from somebody

1. Product: kg of per (season / year / others) to be given to landowner
2. Cash: Rwf per (season / year / others) to be given to landowner
3. Others:

3.2.2 Rent out to somebody

1. Product: kg of per (season / year / others) to be received
2. Cash: Rwf per (season / year / others) to be received
3. Others:

4. Agriculture

4.1 When do you plant and harvest by crop? And how much is planted/harvested area, yield, etc.

Crops \ Month	Mono-crop Or Inter-crop	1	2	3	4	5	6	7	8	9	10	11	12	Cropped area (ha)	Yield (kg)
(Example)				←	—	—	—	→							
Rice in season A	(M I)														
Rice in season B	(M I)														
Haricot beans	(M I)														
Sorghum	(M I)														
Maize in season A	(M I)														
Maize in season B	(M I)														
Cassava	(M I)														
Sweet Potato	(M I)														
Banana	(M I)														
Crops \ Month	Mono-crop Or Inter-crop	1	2	3	4	5	6	7	8	9	10	11	12	Cropped area (ha)	Yield (kg)
Vegetables ( )	(M I)														
( )	(M I)														
( )	(M I)														

( )	(M I)														
( )	(M I)														
( )	(M I)														

M= mono-crop, I= inter-crop

4.2 What are the most serious problems on farming operation?

a. Lack of irrigation water, b. Lack of seeds, c. Lack of fertilizer, d. Incidence of pests and diseases, e. Lack of storage facilities, f. Poor marketing facilities, g. Lack of capital /credit, h. Lack of availability of labor, i. Lack of machinery j. Others ( )
Problem Ranking (Choose the number what to be circled above) : 1._____ ,2._____ 3._____

4.3 Where and how do you dry rice or maize after harvested?

Where (_____)

How ( )

4.4 Where and how do you mill rice or maize?

(1) Rice:

Where (_____)

How ( )

(2) Maize:

Where (_____)

How ( )

5. Irrigation

5.1.1 Would you want to grow rice in dry season if dam and irrigation facilities were constructed?

(Yes / No)

5.1.2 Would you want to grow other crops in dry season with irrigation if dam and irrigation facilities were constructed?

(Yes / No), if yes which crops? ( )

5.2 Would it be possible for you to contribute water users' fee in cash or kind if dam and irrigation facilities were constructed? (Yes / No)

5.2.1 If the answer of 5.2 is "Yes", what is the maximum water fee you are willing to pay?

Product: _____kg per (season / year / others_____)

Or cash: _____Rwf per (season / year / others_____)

5.3 Do you have some experiences of conflict concerning the irrigation water?

(Yes / No)

5.3.1 If the answer of 5.3 is "Yes", How was the situation, what were the reasons and how did you solve the conflict?

(_____)

6 Agriculture Inputs

6.1 Seeds:

Item / Crops	Self supply (kg) (1)	External supply (kg) (2)	Total Supply (kg) (3) = (1) + (2)	Where to get seeds (select from below)	Price for external supply (Rwf)
Rice in season A Variety ( )				a b c d e	
Rice in season B Variety ( )				a b c d e	
Maize in season A Variety ( )				a b c d e	
Maize in season B Variety ( )				a b c d e	
Haricot beans				a b c d e	
Cassava				a b c d e	
Sorghum				a b c d e	
Sweet Potato				a b c d e	
Vegetables( )				a b c d e	
( )				a b c d e	
( )				a b c d e	
( )				a b c d e	
( )				a b c d e	

Where to get seeds: a=from other farmer, b=from shop in nearby town, c=middlemen, d=government, e=others

6.2 Chemical Fertilizer and Pesticides

Items / Crop	Price (Rwf)	Total (kg) or (liter)	Rice (kg) or (liter)	Maize (kg) or (liter)	Cassava (kg) or (liter)	Sorghum (kg) or (liter)	Vegetables (_____) (kg) or (liter	(_____) (kg) or (liter)
Urea								
(Others)								
Manure / compost								

6.3 Labor Distribution

Crop	Operation	Family labor (man・day)		Hired labor (man・day)	
		Male	Female	Male	Female
Rice	Land preparation				
	Planting				
	Weeding				
	Harvesting/transporting				
	Other work ( )				
Maize	Land preparation				
	Planting				
	Weeding				
	Harvesting/transporting				
	Other work ( )				
Cassava	Land preparation				
	Planting				
	Harvesting/transporting				
	Other work ( )				
Sorghum	Land preparation				
	Planting				
	Weeding				
	Harvesting/transporting				
	Other work ( )				

Crop	Operation	Family labor (man・day)		Hired labor (man・day)	
		Male	Female	Male	Female
Sweet potato	Land preparation				
	Planting				
	Weeding				
	Harvesting / transporting				
	Other work ( )				
Irish potato	Land preparation				
	Planting				
	Weeding				
	Harvesting / transporting				
	Other work ( )				
Vegetables ( )	Land preparation				
	Planting				
	Weeding				
	Harvesting / transporting				
	Other work ( )				
Vegetables ( )	Land preparation				
	Planting				
	Weeding				
	Harvesting / transporting				
	Other work ( )				
Vegetables ( )	Land preparation				
	Planting				
	Weeding				
	Harvesting / transporting				
	Other work ( )				

6.4 Average wage rate for hired labor:

Male: ( ) Rwf/day, Female: ( ) Rwf/day

6.5 Tools: What kind of tools are you using

Tools	Number you have	Price (Ref/piece)	How often do you replace?

7 Marketing

7.1 Marketing condition

Item / Crops	Home Consump-tion (1)	Sold to Whom			Total Sold (kg) (5) = (2) + (3) + (4)	Total Cash Income (Rwf) (6)	Farm-gate Price Average (Rwf/kg) (7) = (6) / (5)
		directly selling to Market (2)	Middleman (3)	Others ( ) (4)			
Rice	kg	kg	kg	kg	kg		
Maize	kg	kg	kg	kg	kg		
Banana	kg	kg	kg	kg	kg		
Sorghum	kg	kg	kg	kg	kg		
Cassava	kg	kg	kg	kg	kg		
Sweet Potato	kg	kg	kg	kg	kg		
Irish Potato	kg	kg	kg	kg	kg		
Vegetable ( )	kg	kg	kg	kg	kg		
( )	kg	kg	kg	kg	kg		
( )	kg	kg	kg	kg	kg		
( )	kg	kg	kg	kg	kg		
( )	kg	kg	kg	kg	kg		

7.2 How do you transport the crops from farm to house and from house to market?

a. From farm to house ( )

b. From house to market ( )

8. Extension Services

8.1 Have you received any agriculture extension services? (Yes / No)

8.1.1 If the above answer is "Yes", from whom and what kinds of assistance have you received?

Kind of technical assistance you received	From whom a. Agricultural Officer, b. NGOs ( ), c. Others ( )
a. Dissemination of new variety	
b. Fertilization	
c. Pest / disease control	
d. Storing / Processing	
e. Soil erosion control	
f. Agro forestry	
g. Livestock rearing	
h. Fish breeding	
i. Others	

8.2 Are there any technical assistance, which you want to receive?

Kind of technical assistance you want to receive	Components
a. Dissemination of new variety	
b. Fertilization	
c. Pest / disease control	
d. Storing / Processing	
e. Soil erosion control	
f. Agro forestry	
g. Livestock rearing	
h. Fish breeding	
i. Others	

9. Incomes and Expenditure

9.1 Information on Income (excluding self consumption)

Source of Income apart from crop farming	Annual Income (Rwf)
a. Livestock (by species / products) ◆ Sales of animals (Specie) (Heads)	
◆ Sales of poultry	
◆ Sales of eggs (pieces/day x price (RWf/piece)	
◆ Sales of milk (liters/day x price (RWf/liter)	
b. Selling fish	
c. Forestry products (wood, firewood, etc.)	
d. Farm labor	
e. Other paid work: ( )	
f. Business ( )	
g. Migrant work (to where?:) (for how long? Months)	
h. Loan	
i. Others	
Total	

9.2 Information on Expenditure (excluding self consumption)

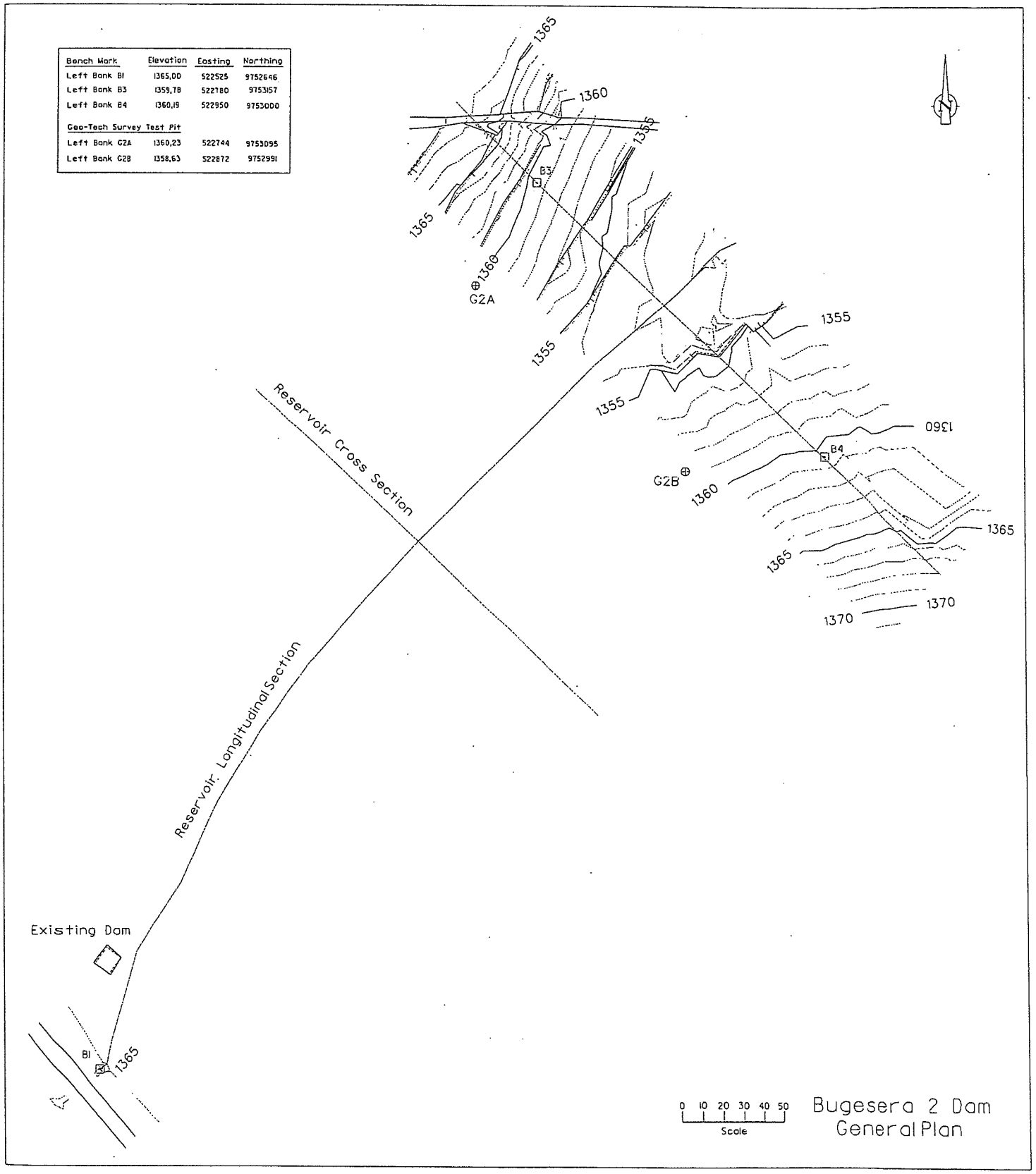
Expenses apart from crop farming	Annual Expenditure (Rwf)
a. Livestock ◆ Care (Pasture, Feeding, Transportation, etc.)	
b. Education	
c. Food	
d. Medication	
e. Tax etc.	
f. Energy	
g. Repayment for credit	
h. Social Activities (Religious event, marriage, etc.)	
i. Cloths, general goods for living life, etc.	
j. Water fee	
k. Saving	
l. Others	
Total	

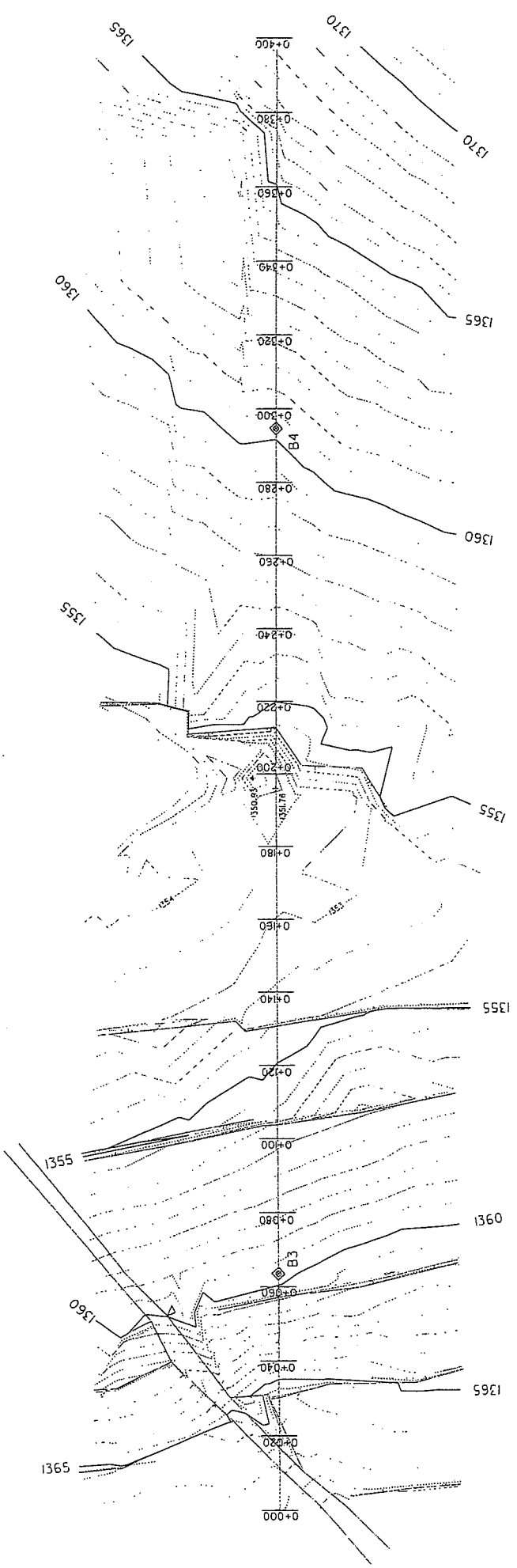
10. What kind of improvement concerning agriculture do you want?

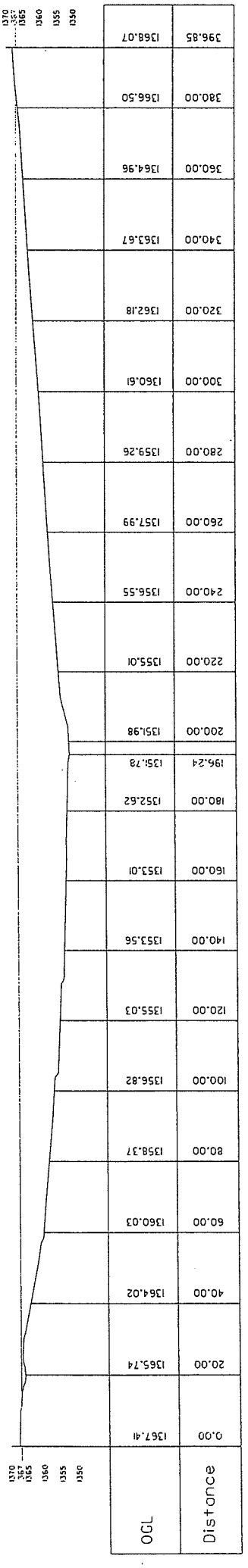
1. Irrigation water sufficiently, 2. Agricultural extension services, 3. Strengthening the farmer's organization,
4. Diversification of crops, 5.Others ( )

Thank you very much for your cooperation.

３．　Topographic Survey


Bench Mark | Elevation | Easting | Northing
Left Bank B1 | 1365,00 | 522525 | 9752646
Left Bank B3 | 1359,78 | 522180 | 9753157
Left Bank B4 | 1360,19 | 522950 | 9753000
Geo-Tech Survey Test Pit
Left Bank G2A | 1360,23 | 522744 | 9753095
Left Bank G2B | 1358,63 | 522872 | 9752991
1365
1360
1355
B3
G2A
B4
G2B
1370
Reservoir Cross Section
Reservoir. Longitudinal Section
Existing Dam
B1
0 10 20 30 40 50
Scale
Bugesera 2 Dam
General Plan



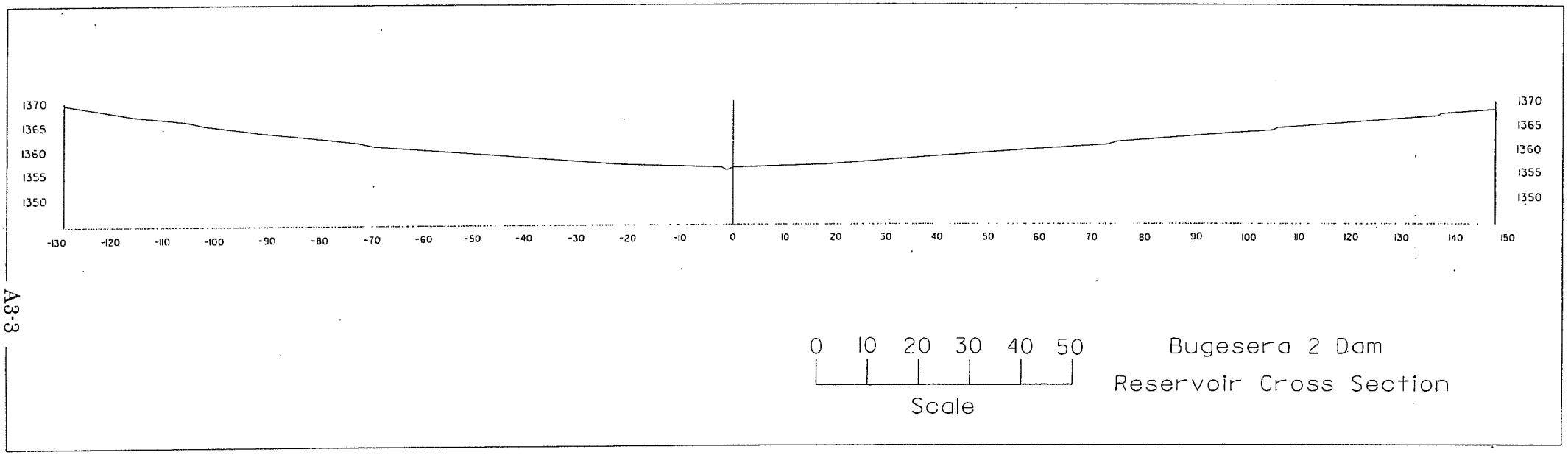


Distance	OGL
0.00	1367.41
20.00	1365.74
40.00	1364.02
60.00	1360.03
80.00	1358.37
100.00	1356.82
120.00	1355.03
140.00	1353.56
160.00	1353.01
180.00	1352.62
196.24	1351.73
200.00	1351.98
220.00	1355.01
240.00	1356.55
260.00	1357.99
280.00	1359.26
300.00	1360.61
320.00	1362.18
340.00	1363.67
360.00	1364.96
380.00	1366.50
396.85	1368.07

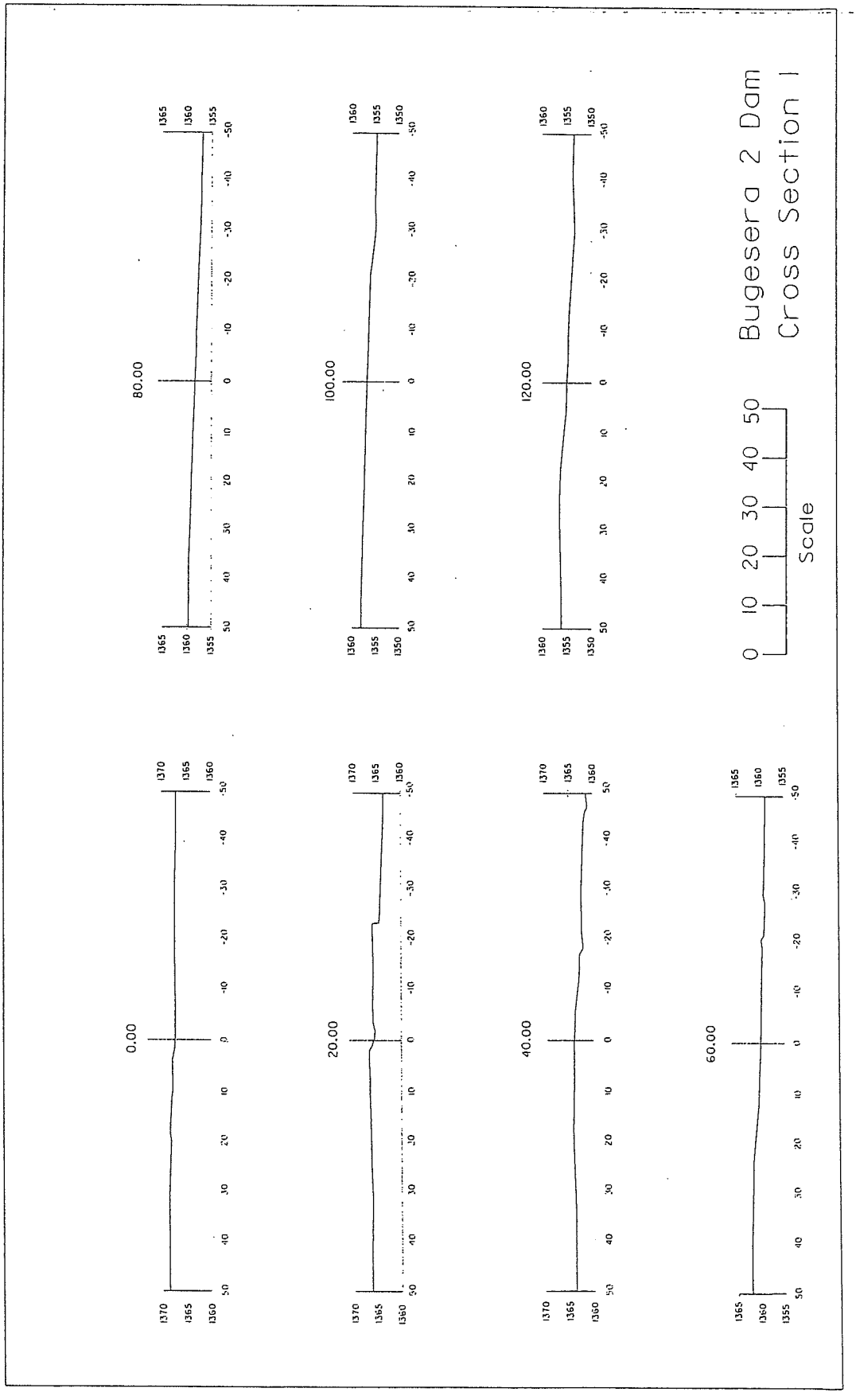
Dam Axis

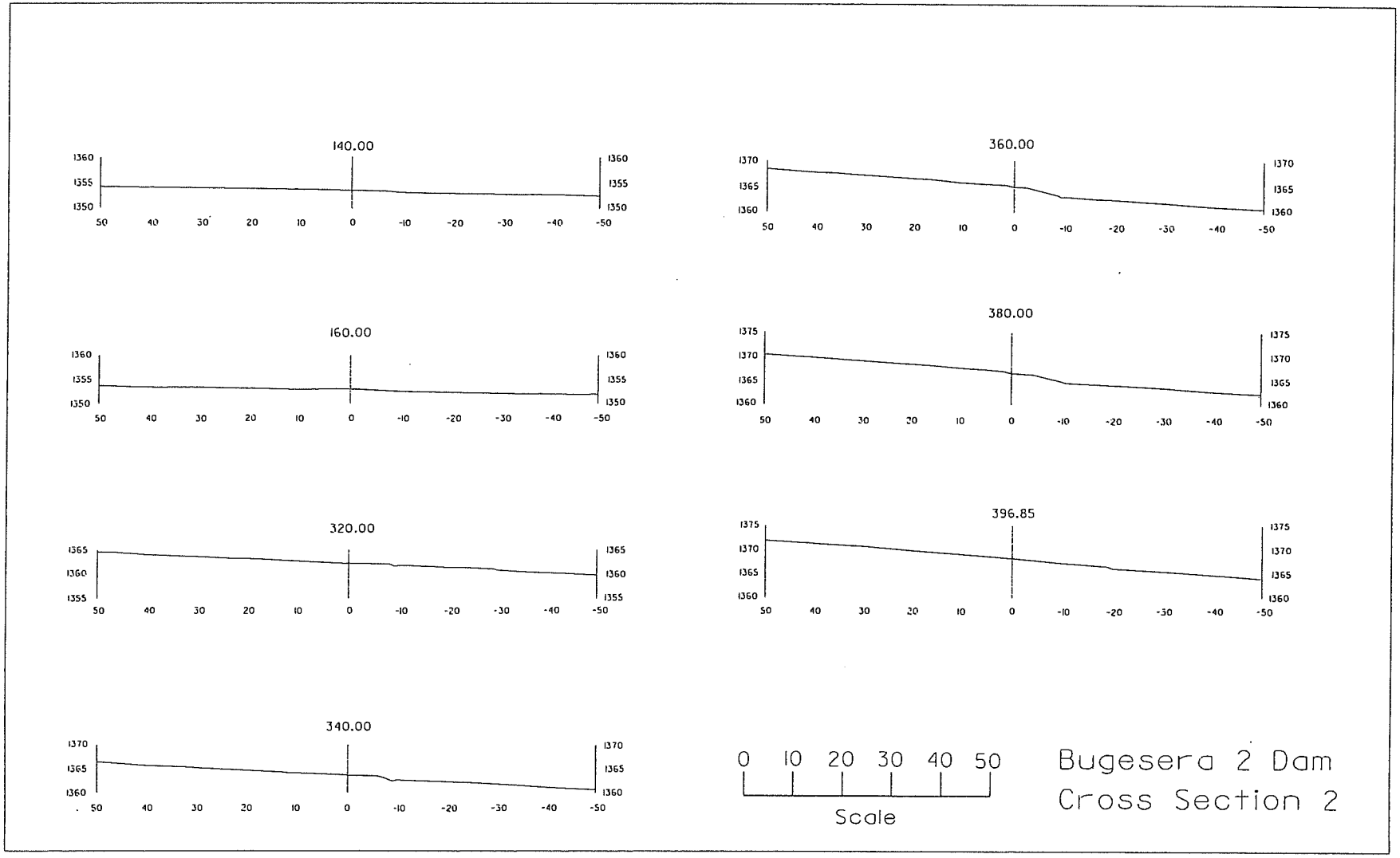
0 10 20 30 40 50
Scale

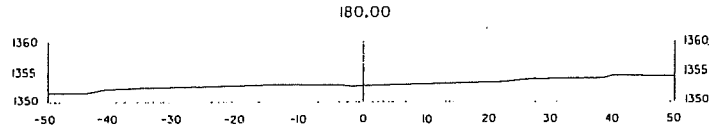
Bugesera 2 Dam Plan
Longitudinal Section

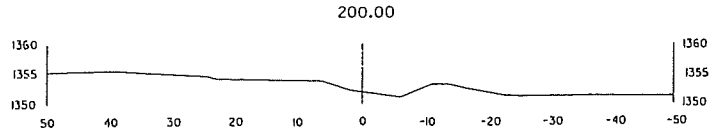

1370
1365
1360
1355
1350
-130 -120 -110 -100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
0 10 20 30 40 50
Scale
Bugesera 2 Dam
Reservoir Cross Section

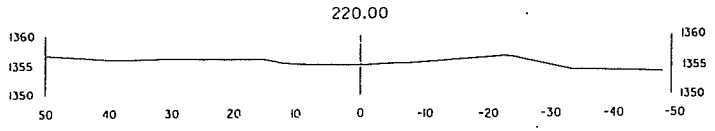
Distance	TGL
0.00	1365.00
20.00	1363.94
40.00	1362.22
60.00	1362.49
80.00	1361.90
100.00	1361.48
120.00	1361.05
140.00	1360.53
160.00	1360.02
180.00	1359.59
200.00	1359.26
220.00	1358.92
240.00	1358.60
260.00	1358.28
280.00	1357.87
300.00	1357.43
320.00	1357.04
340.00	1356.73
360.00	1356.42
380.00	1355.94
400.00	1355.45
420.00	1355.07
440.00	1354.76
460.00	1354.45
480.00	1354.17
500.00	1353.89
520.00	1353.31
540.00	1352.95
560.00	1352.85
560.76	1352.38
580.00	1352.05
600.00	1351.69
616.40	1351.59

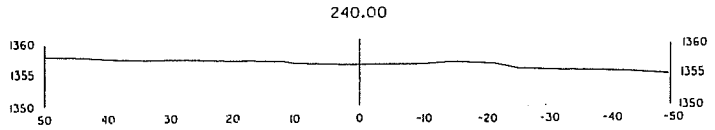

Bugesera 2 Dam
Cross Section 1
Scale
0 10 20 30 40 50
0.00
20.00
40.00
60.00
80.00
100.00
120.00

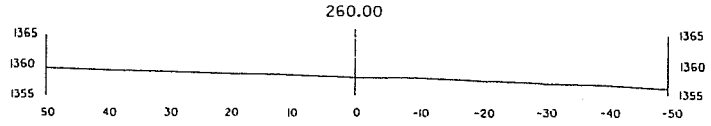

140.00
1360
1355
1350
50 40 30 20 10 0 -10 -20 -30 -40 -50
160.00
320.00
340.00
360.00
1370
1365
1360
380.00
1375
1370
1365
1360
396.85
0 10 20 30 40 50
Scale
Bugesera 2 Dam
Cross Section 2

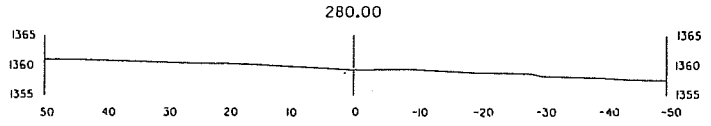


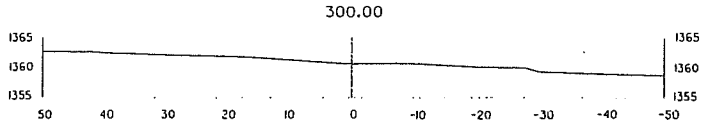


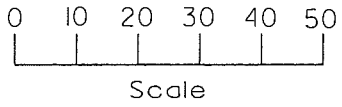




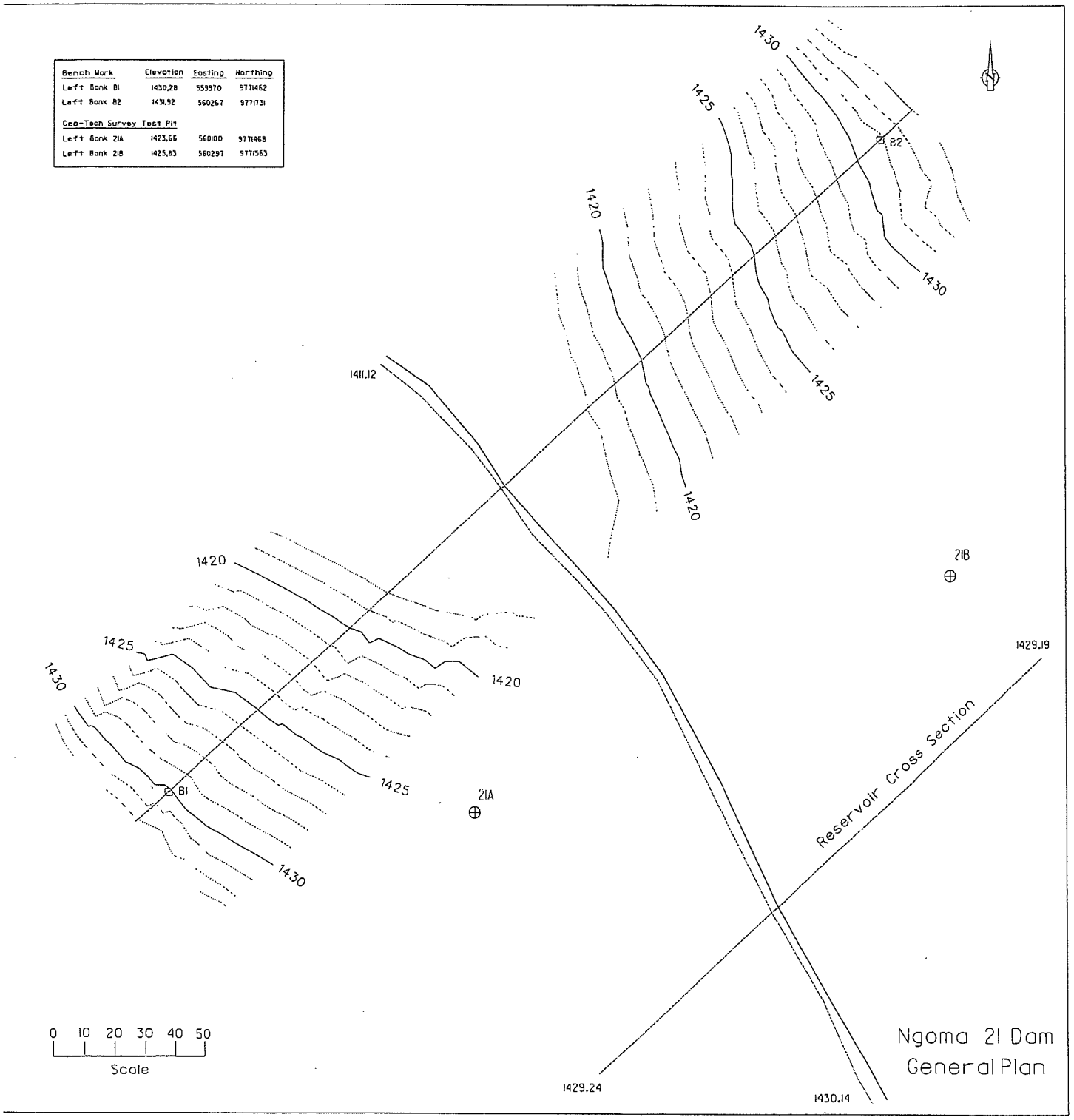








Bugesera 2 Dam
Cross Section 3


Bench Mark | Elevation | Easting | Northing
Left Bank B1 | 1430.28 | 555970 | 9771462
Left Bank B2 | 1431.92 | 560267 | 9771731
Geo-Tech Survey Test Pit
Left Bank 21A | 1423.65 | 560100 | 9771468
Left Bank 21B | 1425.83 | 560297 | 9771563
1430
1425
1420
B2
1411.12
1420
1425
1430
B1
21A
21B
1429.19
Reservoir Cross Section
1429.24
1430.14
0 10 20 30 40 50
Scale
Ngoma 21 Dam
General Plan

Ngoma 21 Dam Plan
Longitudinal Section
Scale
0 10 20 30 40 50
Dam Axis
Distance
OGL
0.00 1432.13
20.00 1429.83
40.00 1427.76
60.00 1425.73
80.00 1423.63
100.00 1421.54
120.00 1419.62
140.00 1417.70
160.00 1416.08
180.00 1414.47
200.00 1414.99
220.00 1416.31
240.00 1417.42
260.00 1418.80
280.00 1420.19
300.00 1421.74
320.00 1423.30
340.00 1424.99
360.00 1426.68
380.00 1428.48
400.00 1430.28
420.00 1432.24
427.29 1433.08
B1
B2
1430
1425
1420
1415
1410
1435
0+000
0+020
0+040
0+060
0+080
0+100
0+120
0+140
0+160
0+180
0+200
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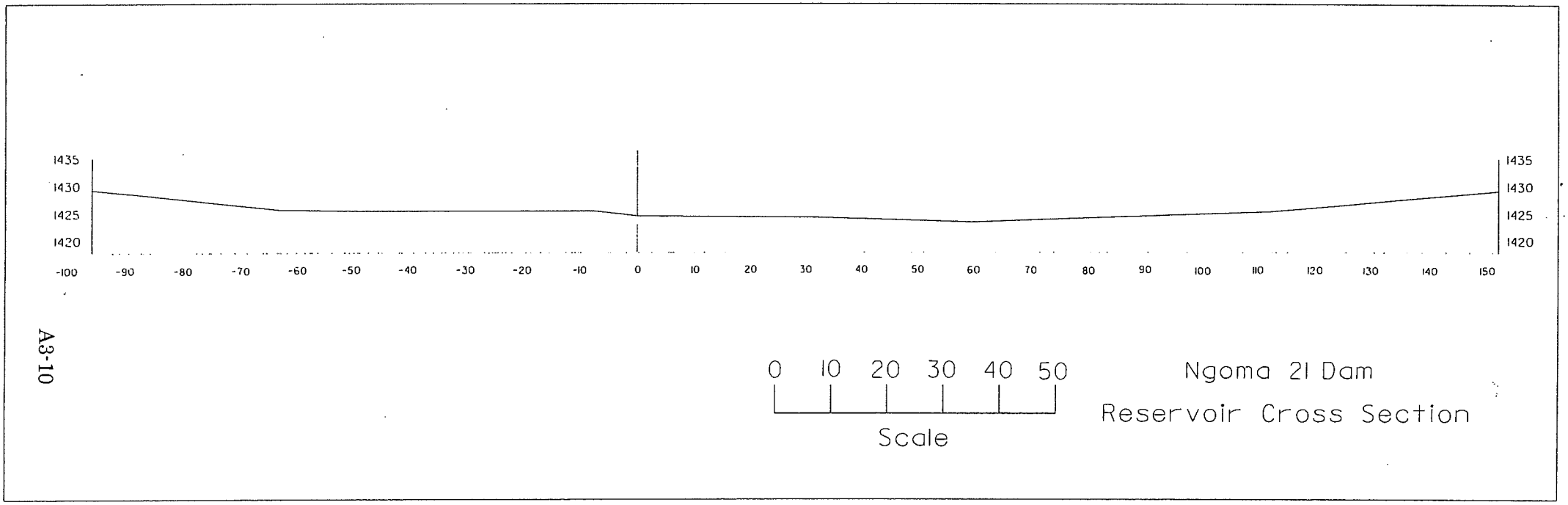
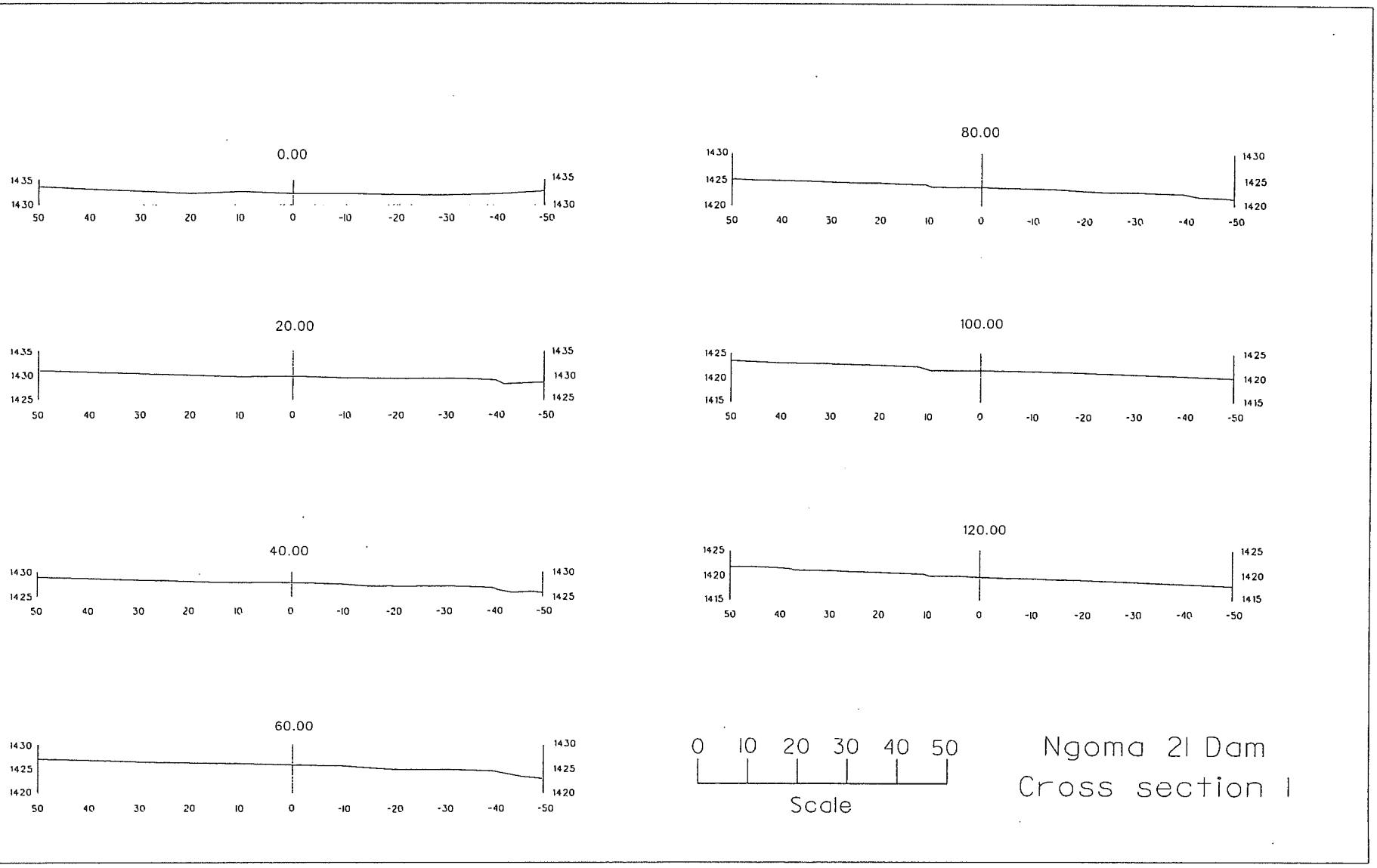
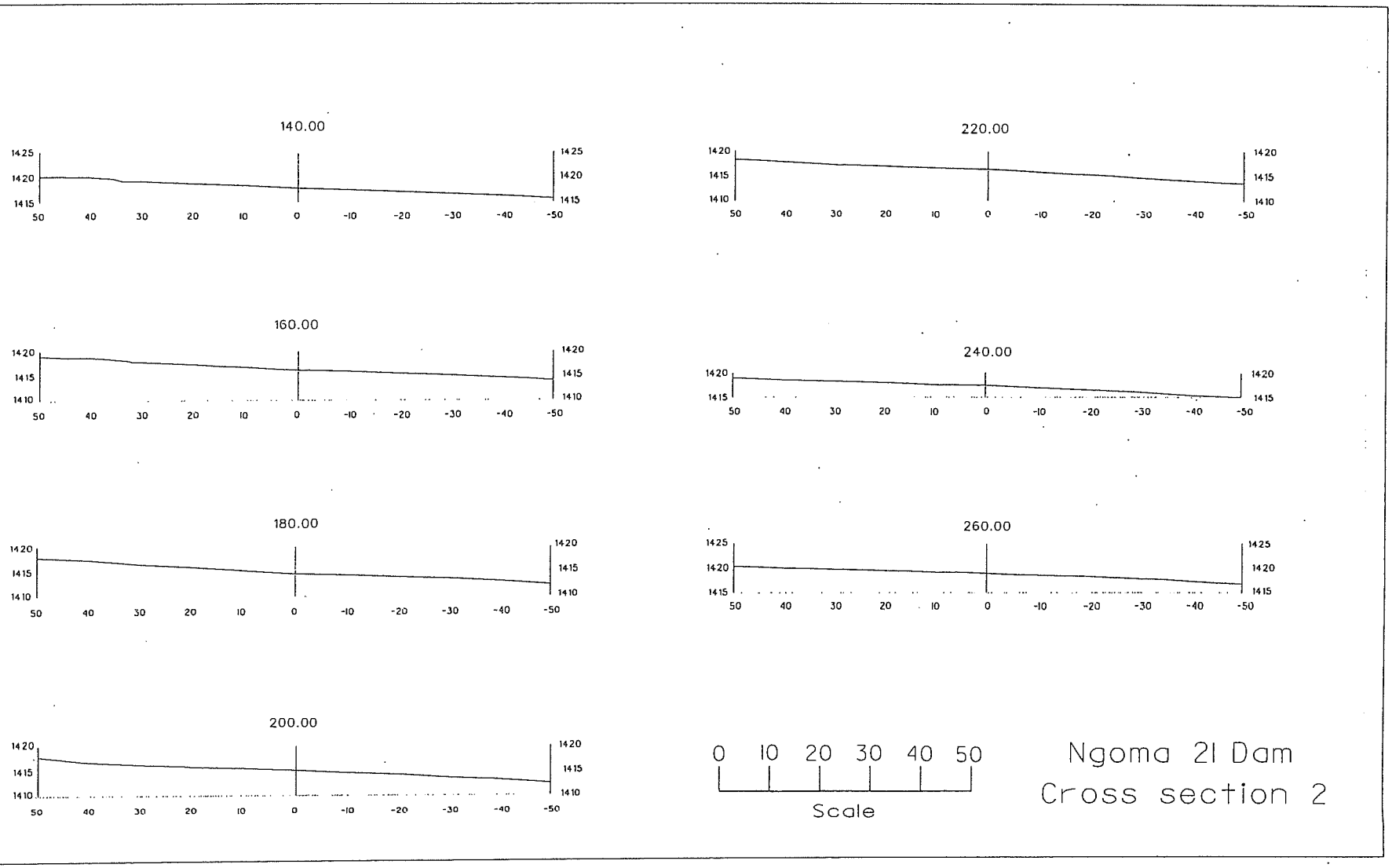
0+400
0+420
0+427.29

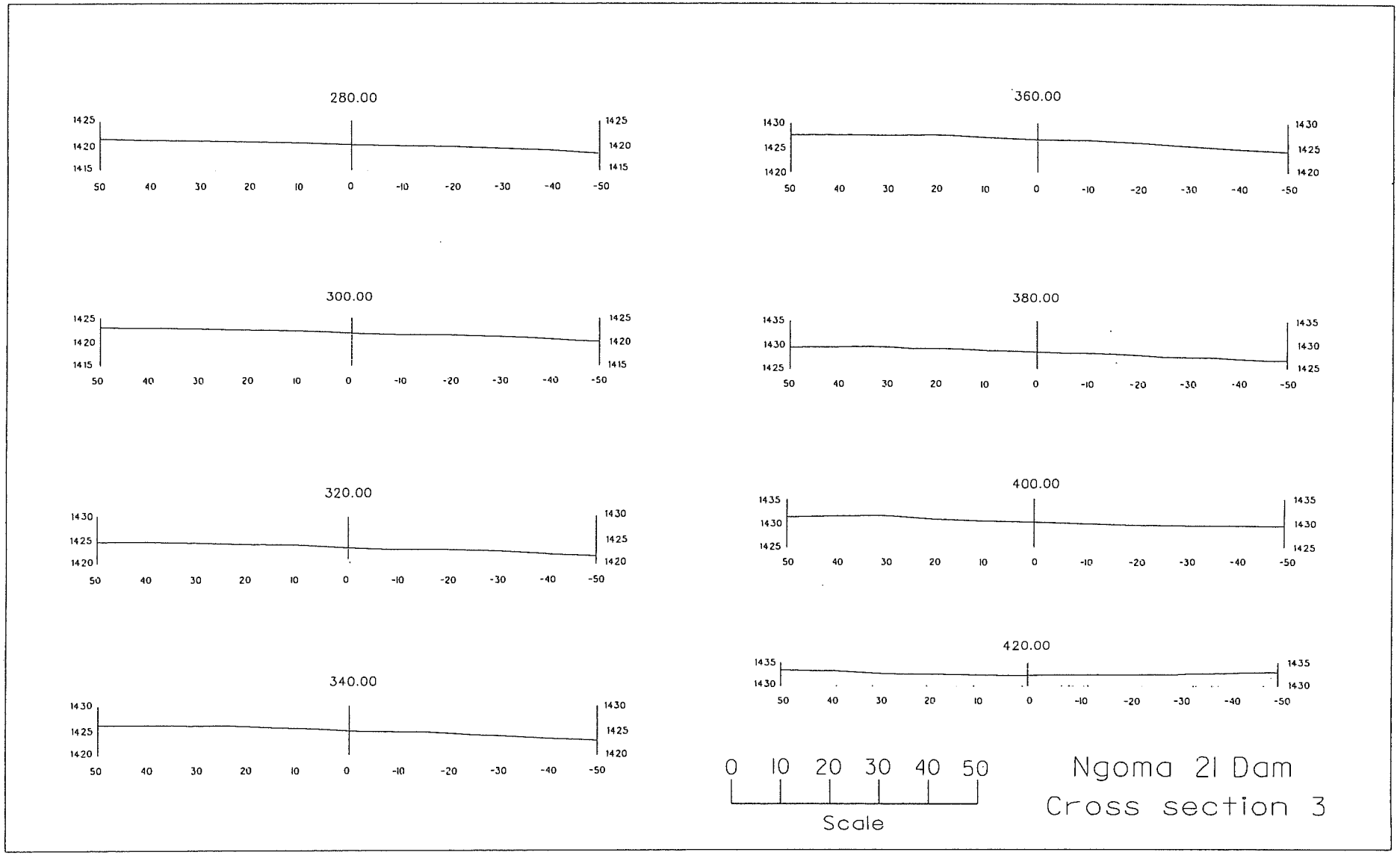

1435
1430
1425
1420
-100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
0 10 20 30 40 50
Scale
Ngoma 21 Dam
Reservoir Cross Section

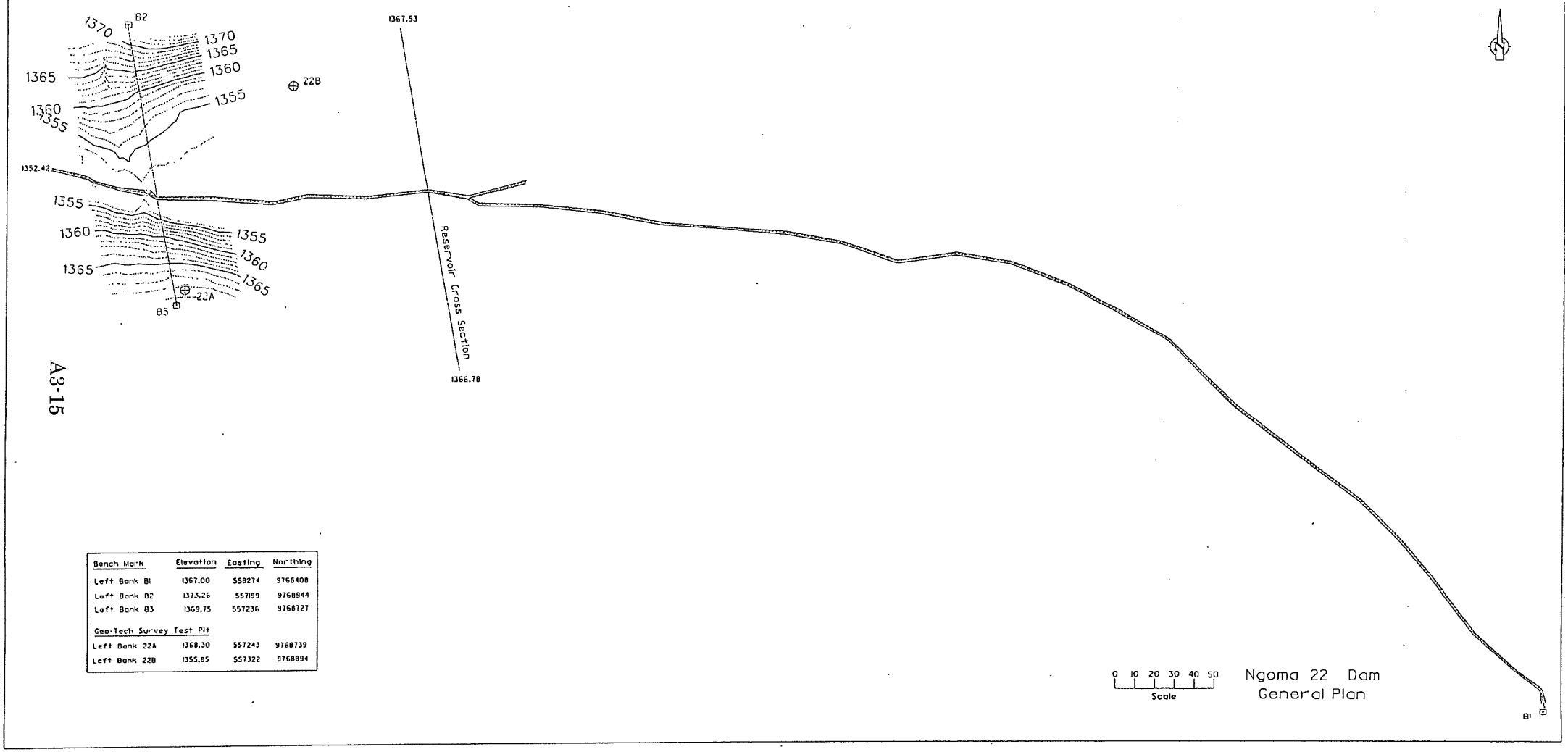
A3-10

Distance	OGL
0.00	1430.14
20.00	1428.73
40.00	1427.38
60.00	1426.14
80.00	1424.95
100.00	1423.96
120.00	1423.05
140.00	1422.14
160.00	1421.23
180.00	1420.31
200.00	1419.49
220.00	1418.76
240.00	1417.65
260.00	1416.34
280.00	1415.37
289.99	1415.00
300.00	1414.57
320.00	1413.57
340.00	1412.43
360.00	1411.15
360.54	1411.12

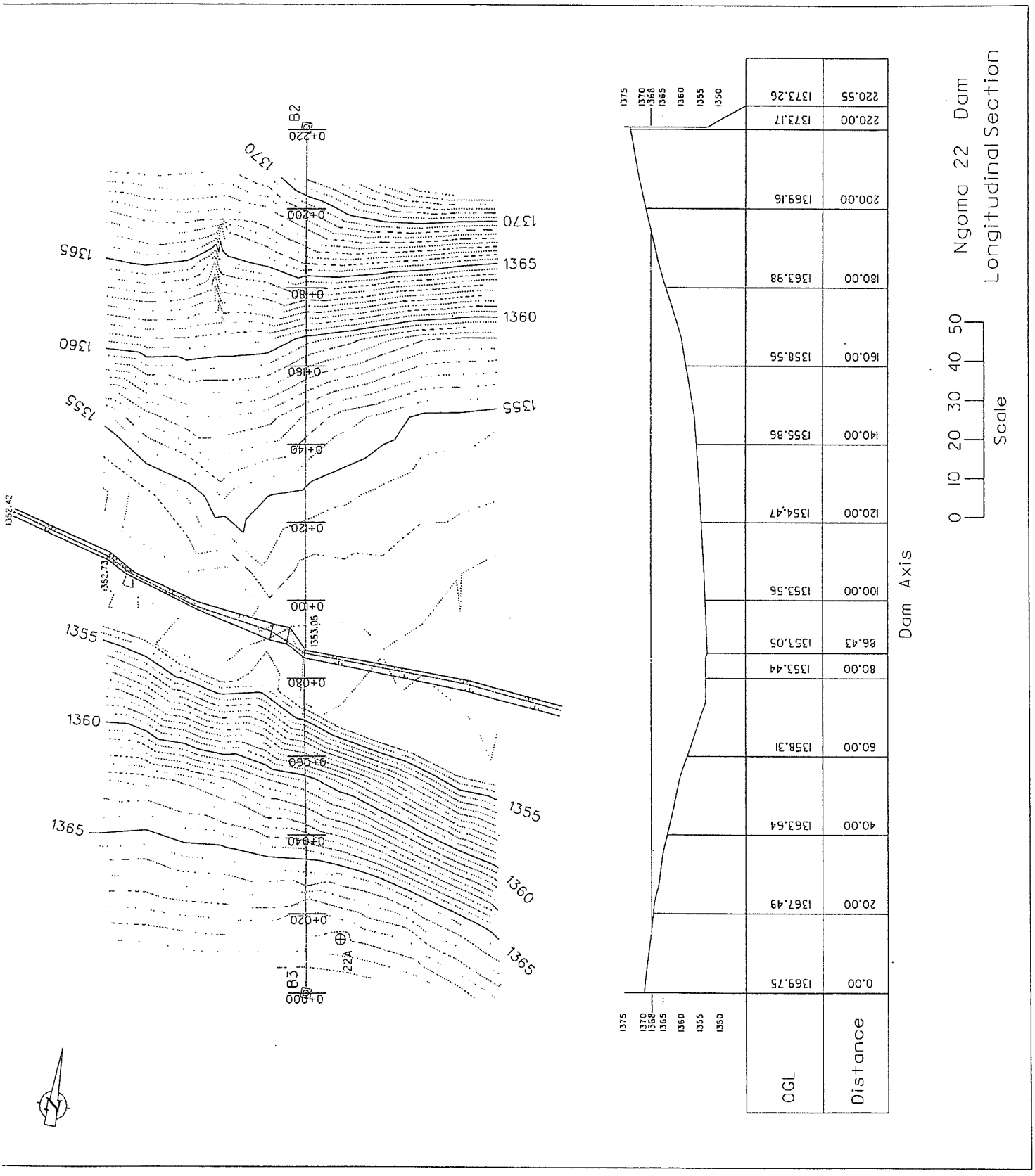

0.00
1435
1430
50 40 30 20 10 0 -10 -20 -30 -40 -50
20.00
1435
1430
1425
40.00
1430
1425
60.00
1430
1425
1420
80.00
1430
1425
1420
100.00
1425
1420
1415
120.00
0 10 20 30 40 50
Scale
Ngoma 21 Dam
Cross section 1

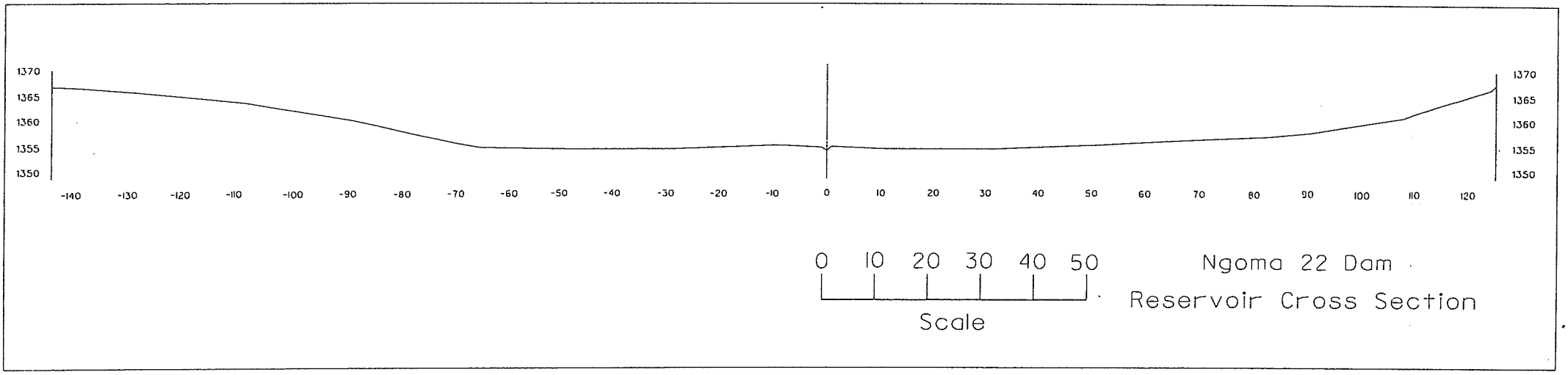

140.00
1425
1420
1415
50 40 30 20 10 0 -10 -20 -30 -40 -50
160.00
1420
1415
1410
180.00
200.00
220.00
240.00
260.00
0 10 20 30 40 50
Scale
Ngoma 21 Dam
Cross section 2


280.00
1425
1420
1415
50 40 30 20 10 0 -10 -20 -30 -40 -50
300.00
320.00
340.00
360.00
1430
1425
1420
380.00
1435
1430
1425
400.00
420.00
0 10 20 30 40 50
Scale
Ngoma 21 Dam
Cross section 3

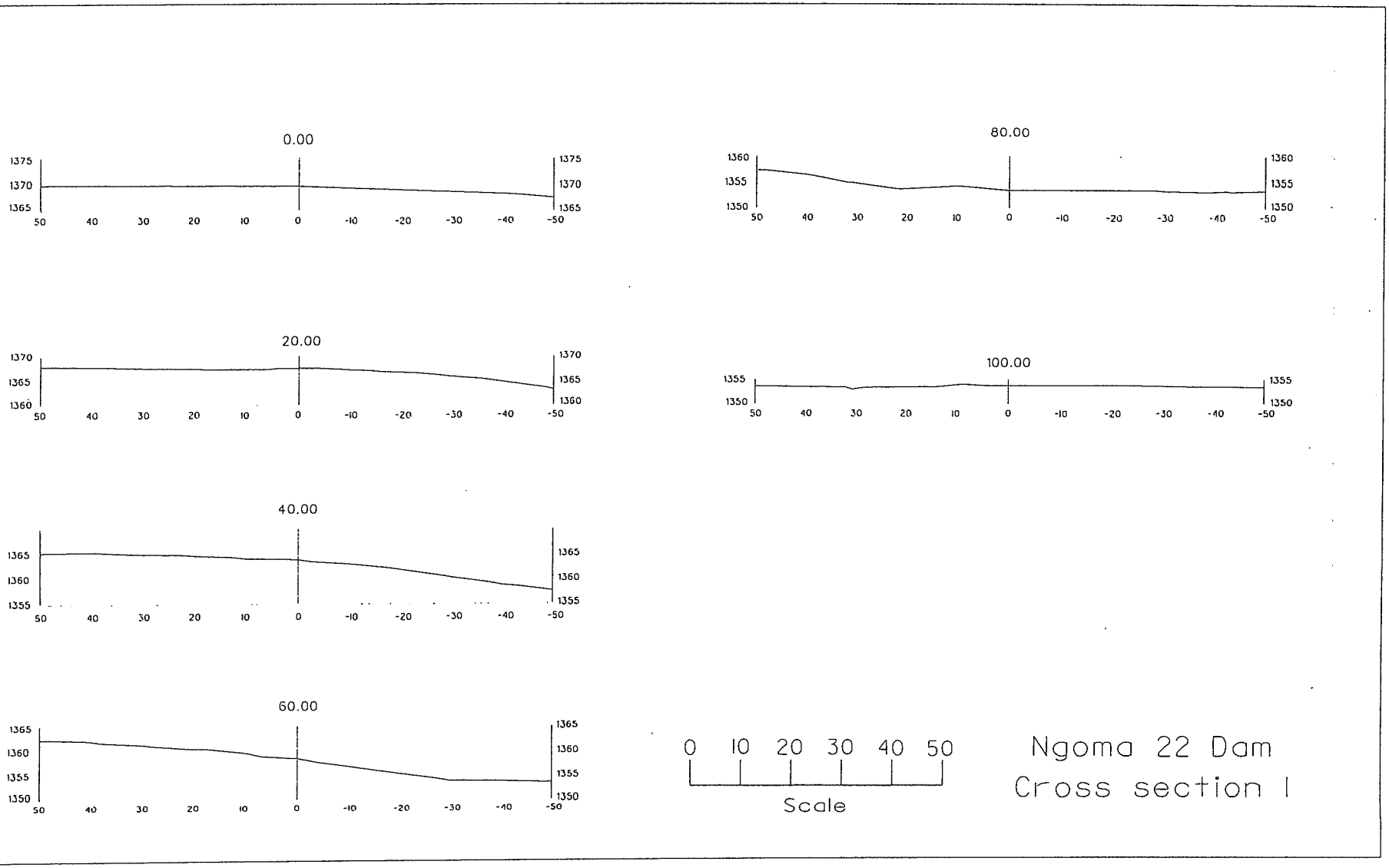


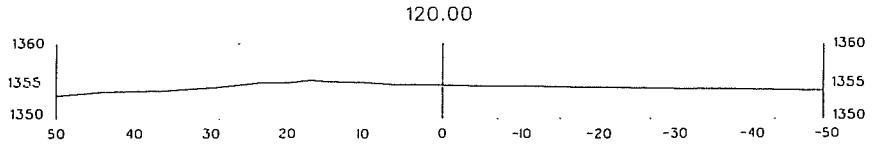
Bench Mark	Elevation	Easting	Northing
Left Bank B1	1367.00	558274	9768408
Left Bank B2	1373.26	557199	9768944
Left Bank B3	1369.75	557236	9768727
Geo-Tech Survey Test Pit			
Left Bank 22A	1368.30	557243	9768739
Left Bank 22B	1355.85	557322	9768894

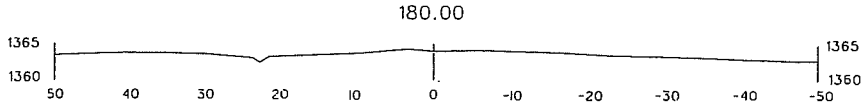

Ngoma 22 Dam
Longitudinal Section
Scale
0 10 20 30 40 50
Dam Axis
Distance
OGL
0.00 1369.75
20.00 1367.49
40.00 1363.64
60.00 1358.31
80.00 1353.44
86.43 1357.05
100.00 1353.56
120.00 1354.47
140.00 1355.86
160.00 1358.56
180.00 1363.98
200.00 1369.16
220.00 1373.17
220.55 1373.26
B2
B3
0+220
0+200
0+180
0+160
0+140
0+120
0+100
0+080
0+060
0+040
0+020
0+000
1370
1365
1360
1355
1352.42
1352.72
1353.05
22A

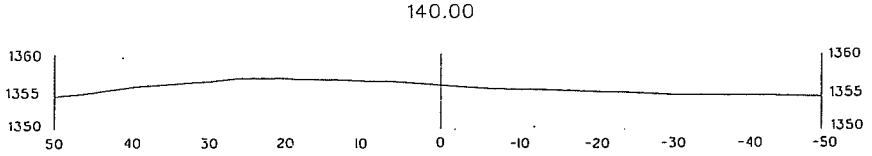

1370
1365
1360
1355
1350
-140 -130 -120 -110 -100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
0 10 20 30 40 50
Scale
Ngoma 22 Dam
Reservoir Cross Section

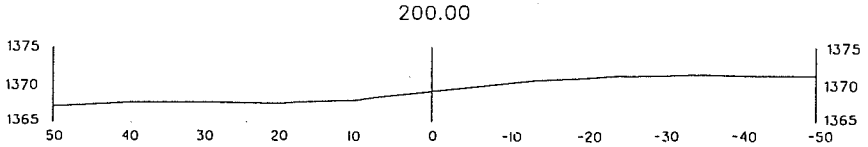
Distance
Elevation
Reservoir Longitudinal Section

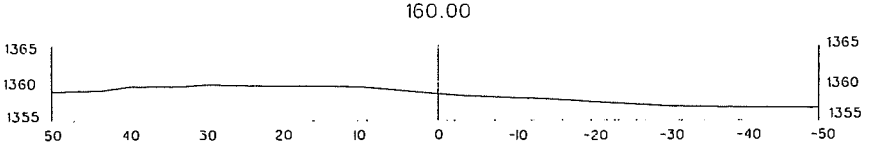

0.00
1375
1370
1365
50 40 30 20 10 0 -10 -20 -30 -40 -50
20.00
1370
1365
1360
40.00
1365
1360
1355
60.00
1365
1360
1355
1350
80.00
1360
1355
1350
100.00
1355
1350
0 10 20 30 40 50
Scale
Ngoma 22 Dam
Cross section I

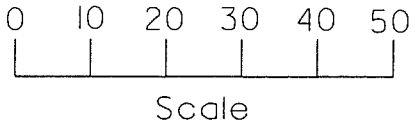






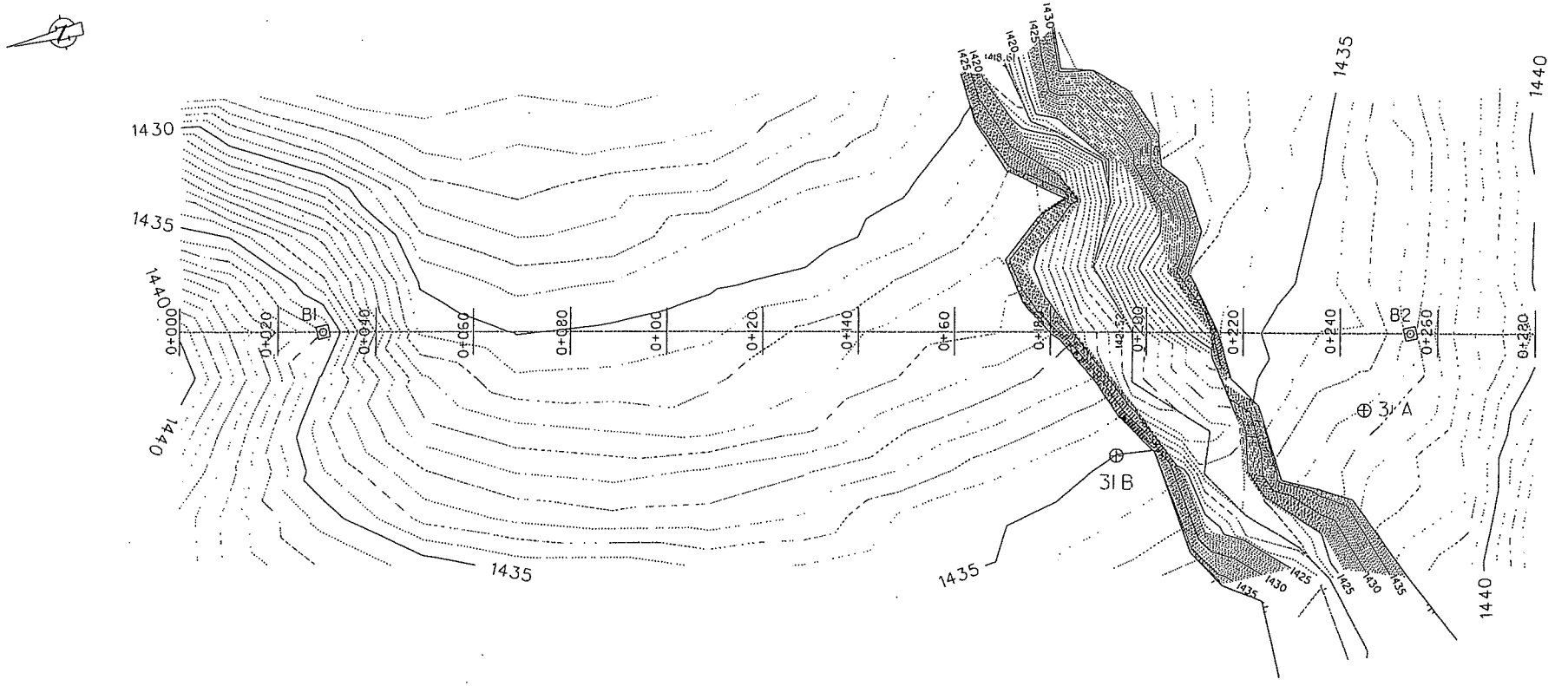






Ngoma 22 Dam
Cross section 2

A3-20



OGL	1439.87	1436.95	1432.94	1430.17	1430.04	1430.25	1430.79	1431.46	1431.87	1432.43	1421.52	1422.42	1434.85	1435.52	1437.58	1439.60
Distance	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	197.05	200.00	220.00	240.00	260.00	279.96

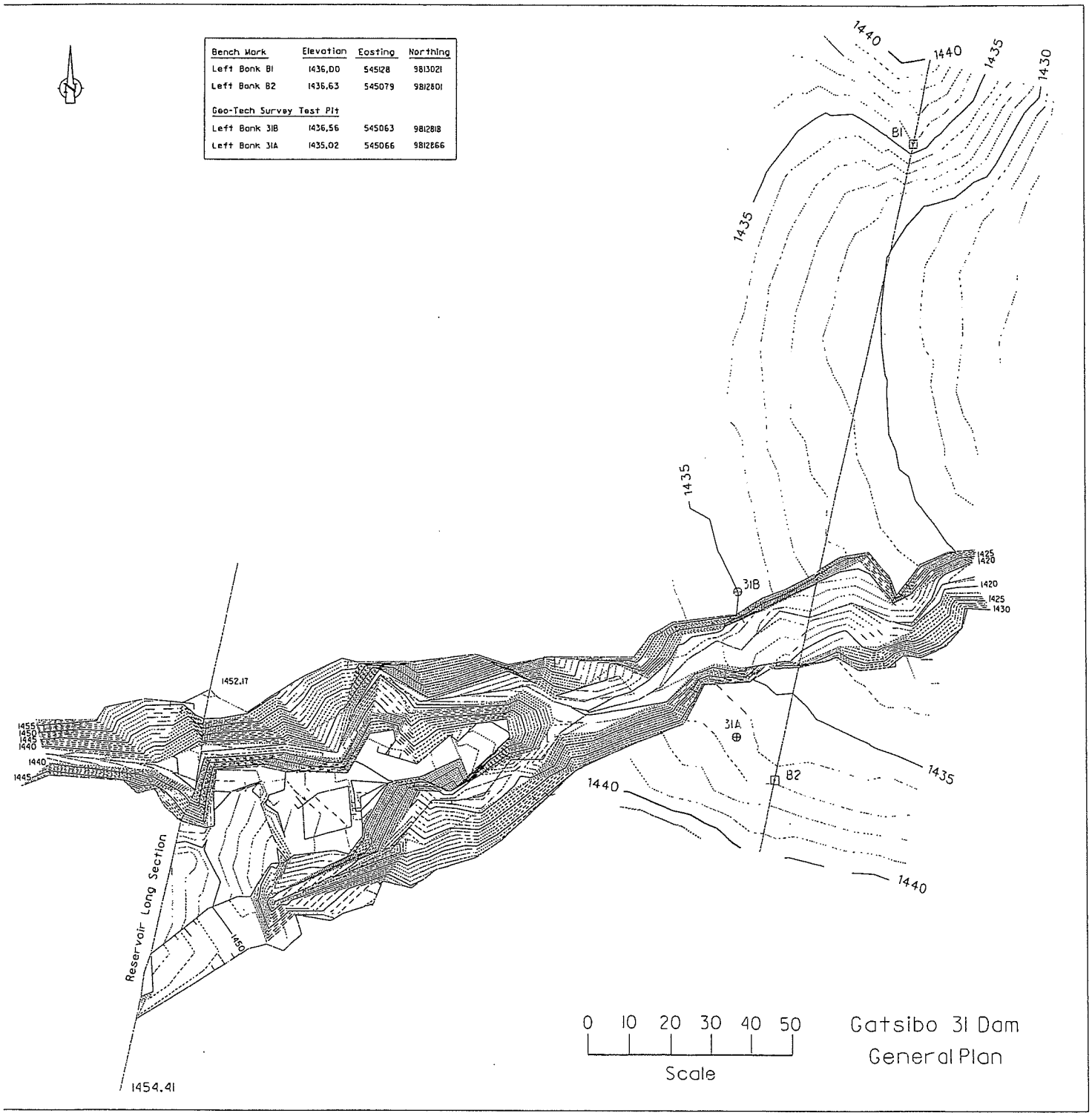
Dam Axis

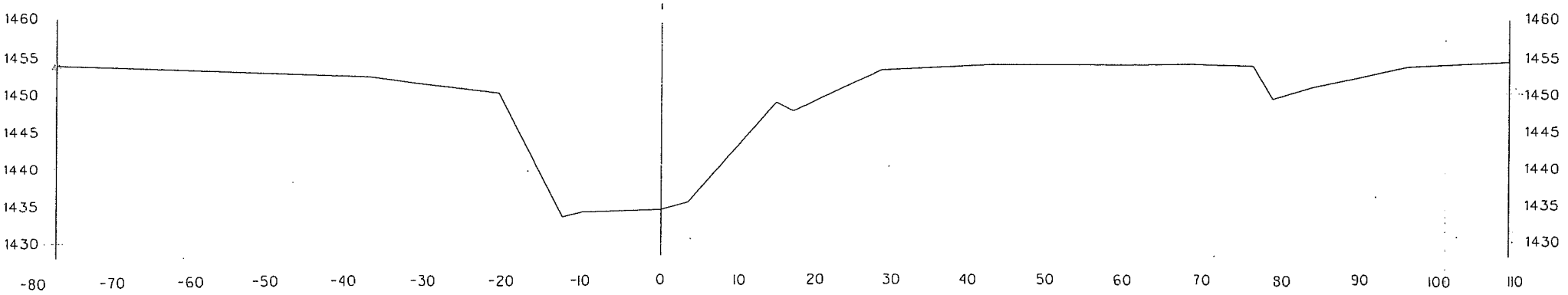
0 10 20 30 40 50

Scale

Gatsibo 31 Dam
Longitudinal Section

A3-21


Bench Mark | Elevation | Easting | Northing
Left Bank B1 | 1436,00 | 545128 | 9813021
Left Bank B2 | 1436,63 | 545079 | 9812801
Geo-Tech Survey Test Pit
Left Bank 31B | 1436,56 | 545063 | 9812818
Left Bank 31A | 1435,02 | 545066 | 9812866
1440
1440
1435
1430
B1
1435
1435
31B
1425
1420
1420
1425
1430
1452.17
31A
B2
1435
1440
1440
1455
1450
1445
1440
1445
Reservoir Long Section
1450
1454.41
0 10 20 30 40 50
Scale
Gatsibo 31 Dam
General Plan



A3-23

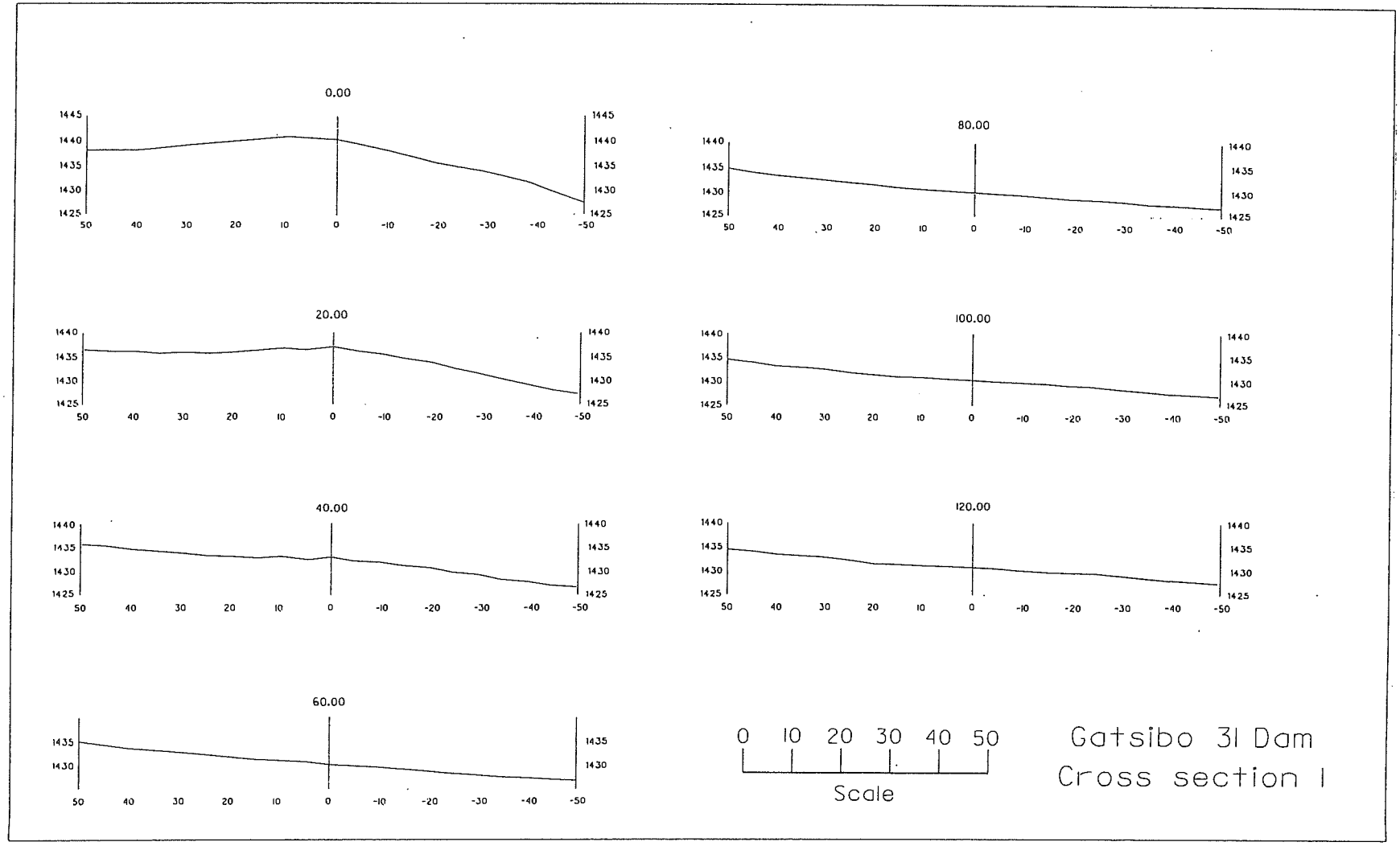
0 10 20 30 40 50

Scale

Gatsibo 31 Dam

Reservoir Cross Section

Catsibo 31 Dam
Reservoir Longitudinal Section
0 10 20 30 40 50
Scale
Distance
OGL
0.00 1438.31
20.00 1436.85
40.00 1435.33
60.00 1433.92
80.00 1432.78
100.00 1432.12
120.00 1430.81
140.00 1430.00
160.00 1427.94
180.00 1426.60
200.00 1425.41
220.00 1424.79
240.00 1424.14
260.00 1423.52
280.00 1422.41
300.00 1421.65
311.51 1421.52 Dam Axis
320.00 1421.18
340.00 1420.21
360.00 1419.43
380.00 1418.62
380.19 1418.61
1445
1440
1435
1430
1425
1420
1415


0.00
1445
1440
1435
1430
1425
50 40 30 20 10 0 -10 -20 -30 -40 -50
80.00
1440
1435
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1425
50 40 30 20 10 0 -10 -20 -30 -40 -50
20.00
1440
1435
1430
1425
50 40 30 20 10 0 -10 -20 -30 -40 -50
100.00
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1435
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40.00
1440
1435
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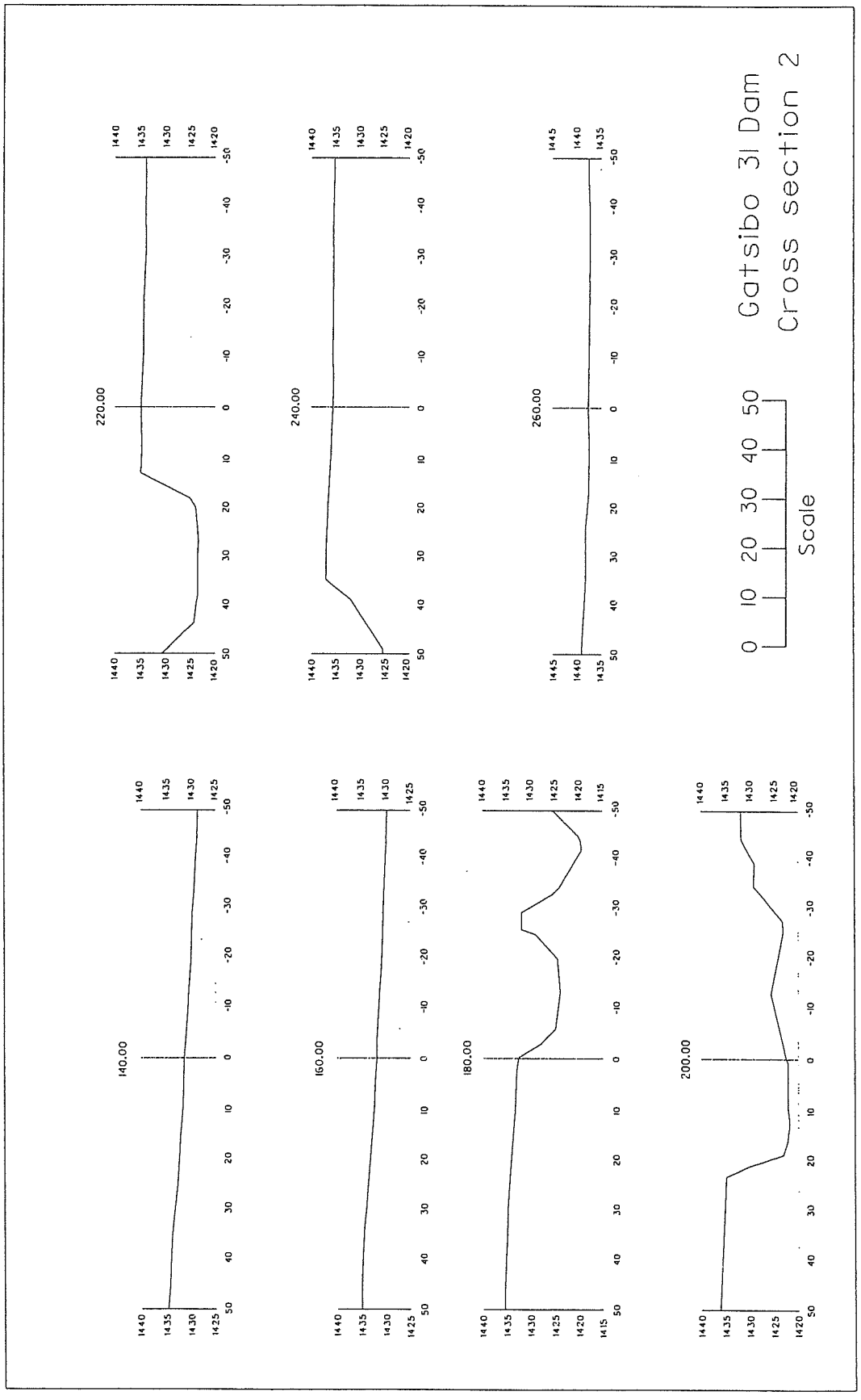
1425
50 40 30 20 10 0 -10 -20 -30 -40 -50
120.00
1440
1435
1430
1425
50 40 30 20 10 0 -10 -20 -30 -40 -50
60.00
1435
1430
50 40 30 20 10 0 -10 -20 -30 -40 -50
0 10 20 30 40 50
Scale
Gatsibo 31 Dam
Cross section 1


Gatsibo 31 Dam
Cross section 2
0 10 20 30 40 50
Scale
140.00
160.00
180.00
200.00
220.00
240.00
260.00

4. Geotechnical Survey

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

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FACULTY OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING AND ENVIRONMENTAL TECHNOLOGY
SOIL MECHANICS & GEOTECHNICAL ENGINEERING LABORATORY

LABORATORY SOIL TEST RESULTS ON IRRIGATED AGRICULTURE IN EASTERN PROVINCE PROJECT

GASHORA SITE

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

INSTITUT DES SCIENCES ET TECHNOLOGIE DE KIGALI

BP 3900, Avenue de L'Armee, Kigali, Rwanda.website:www.kist.ac.rw

SOIL MECHANICS LABORATORY
LABORATORY TEST REPORT

Job No :SC0004/ 2009 **Date**:28/04/2009

Client: SANYU CONSULTANTS INC

Project: IRRIGATED AGRICULTURE IN EASTERN PROVINCE

1.Introduction.

At the request of the client, Soil samples taken from the GASHORA SITE for testing, in KIST Soil Mechanics Laboratory .Test Method used ASTM D4318, D422, D2216, D854-00
The tests performed and results are shown in the table of the results below:

2.Table of the results:

S/N	Test performed	Test results		
1	Depth (m)	Gashora A 0.20 -2.0m	Gashora A 2.0-4.0m	Gashora A 4.0-5.0m
2	Natural Moisture Content %	9.8	11.5	6.8
3	Atterberg i) Liquid Limit %	35.2	32.6	25.9
	ii) Plastic Limit %	18.9	15.7	14.6
	iii) Plasticity Index %	16.3	16.9	11.3
4	Specific Gravity		2.68	2.70
5	Partical sizes (sieve size mm)	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	100	99.2
	2.36mm	100	97.2	94.2
	1.18mm	89.6	87.6	76.0
	600 µm	85.0	82.4	68.6
	425 µm	82.6	78.8	64.6
	300 µm	79.6	75.8	59.8
	150 µm	71.2	65.0	48.4
	75 µm	62.4	55.2	39.0

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armee B.P.3900 Kigali

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

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BP 3900, Avenue de L'Armee, Kigali, Rwanda.website:www.kist.ac.rw

SOIL MECHANICS LABORATORY
LABORATORY TEST REPORT

Job No :SC0004 / 2009 **Date**:28/04/2009

Client: SANYU CONSULTANTS INC.

Project: IRRIGATED AGRICULTURE IN EASTERN PROVINCE

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2.Table of the results:

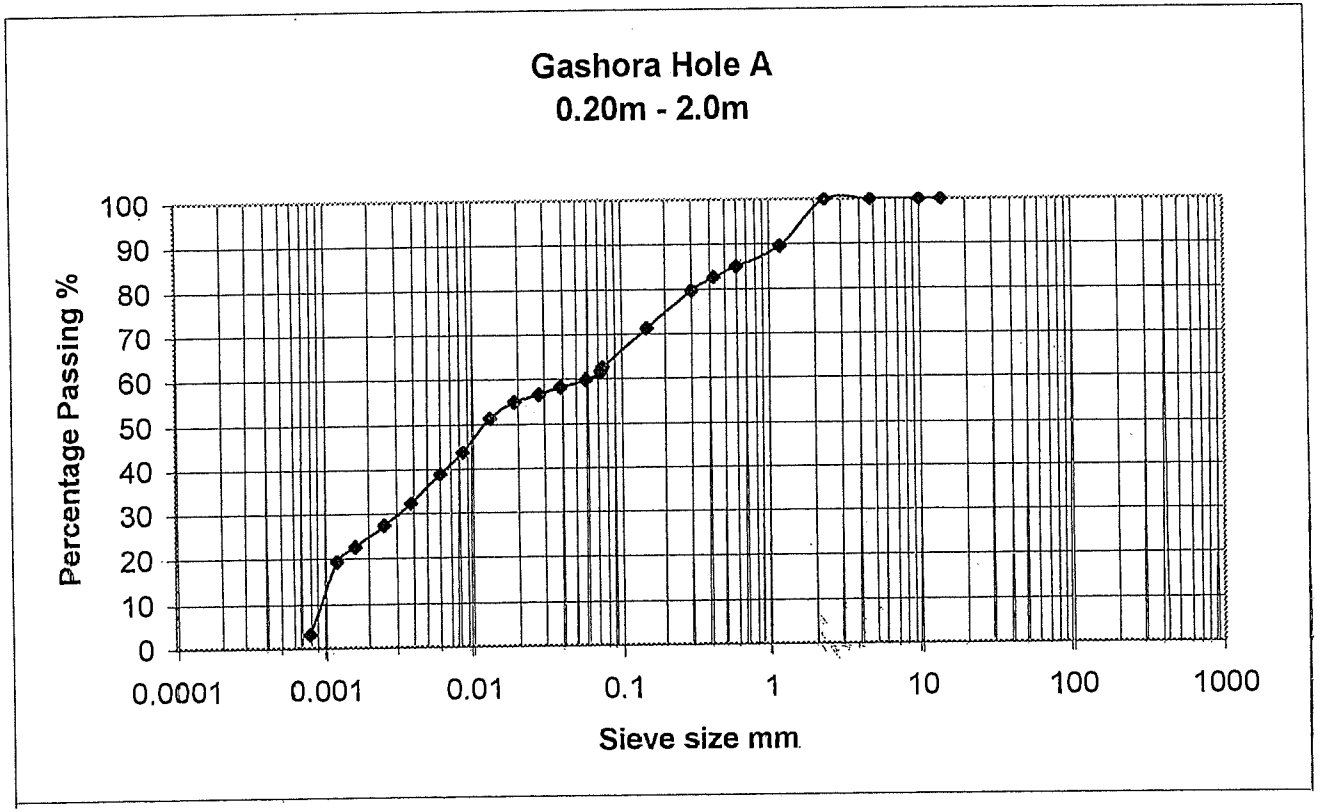
S/N	Test performed	Test results		
1	Depth (m)	Gashora B 0.30 - 1.0m	Gashora B 1.0 -3.0m	Gashora B 3.0m – 5.0m
2	Natural Moisture Content %	10.5	11.8	4.6
3	Atterberg i) Liquid Limit %	30.4	33.1	26.3
	ii) Plastic Limit %	15.6	17.6	15.9
	iii) Plasticity Index %	14.8	15.5	10.4
4	Specific Gravity	2.68	2.67	2.70
5	Partical sizes (sieve size mm)	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	100	93.8
	2.36mm	100	98.0	82.4
	1.18mm	94.4	87.2	63.8
	600 µm	87.4	82.4	59.2
	425 µm	83.2	79.4	57.0
	300 µm	77.0	76.0	54.6
	150 µm	60.6	66.4	47.2
	75 µm	52.3	57.2	39.6

Notes:Finer Particals than 75µm see graph attached

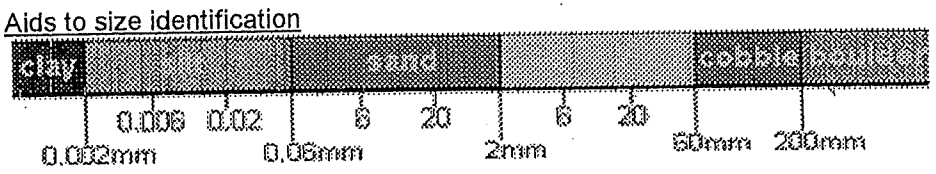
Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armée B.P.3900 Kigali

Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	89.6
0.6	85
0.425	82.6
0.3	79.6
0.15	71.2
0.075	62.4
0.073	61.4
0.058	59.8
0.039	58.2
0.028	56.6
0.019	55
0.013	51.4
0.0085	43.7
0.006	38.8
0.0038	32.3
0.0025	27.5
0.0016	22.6
0.0012	19.4
0.00079	3.2



Size range of grains



Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	97.2
1.18	87.6
0.6	82.4
0.425	78.8
0.3	75.8
0.15	65
0.075	55.2
0.07	52.1
0.048	46.7
0.034	41.6
0.022	38.6
0.014	33.8
0.009	25.7
0.0066	22.5
0.0035	17.7
0.0028	11.3
0.002	6.4
0.0012	3.2
0.001	3.2
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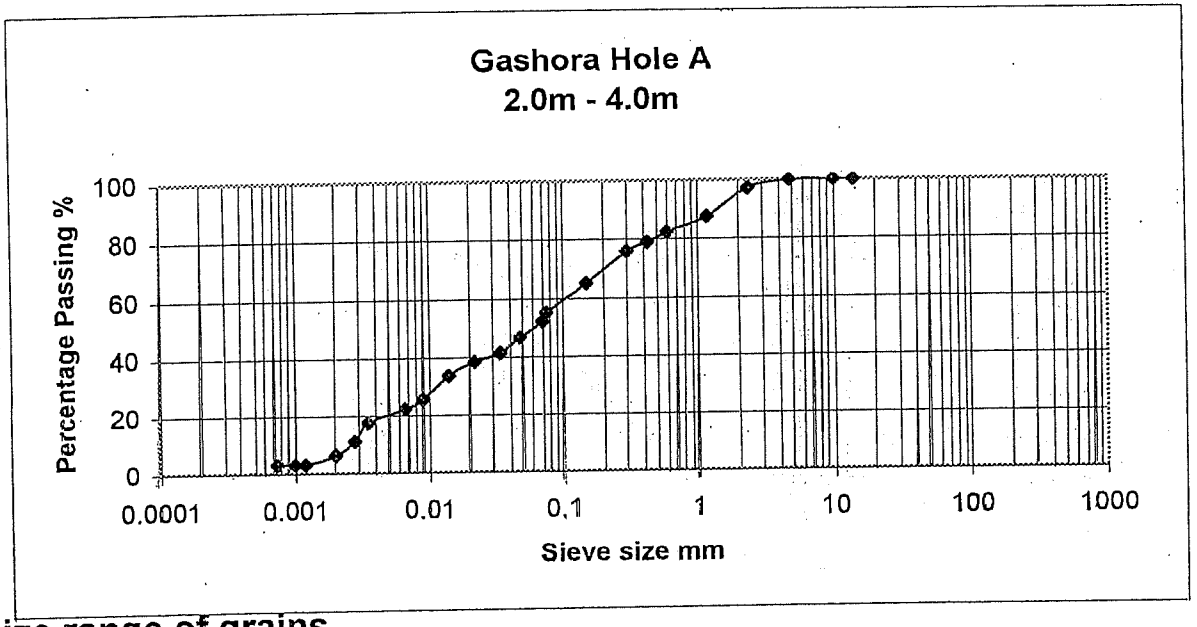
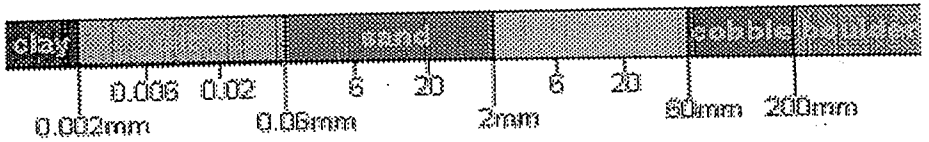
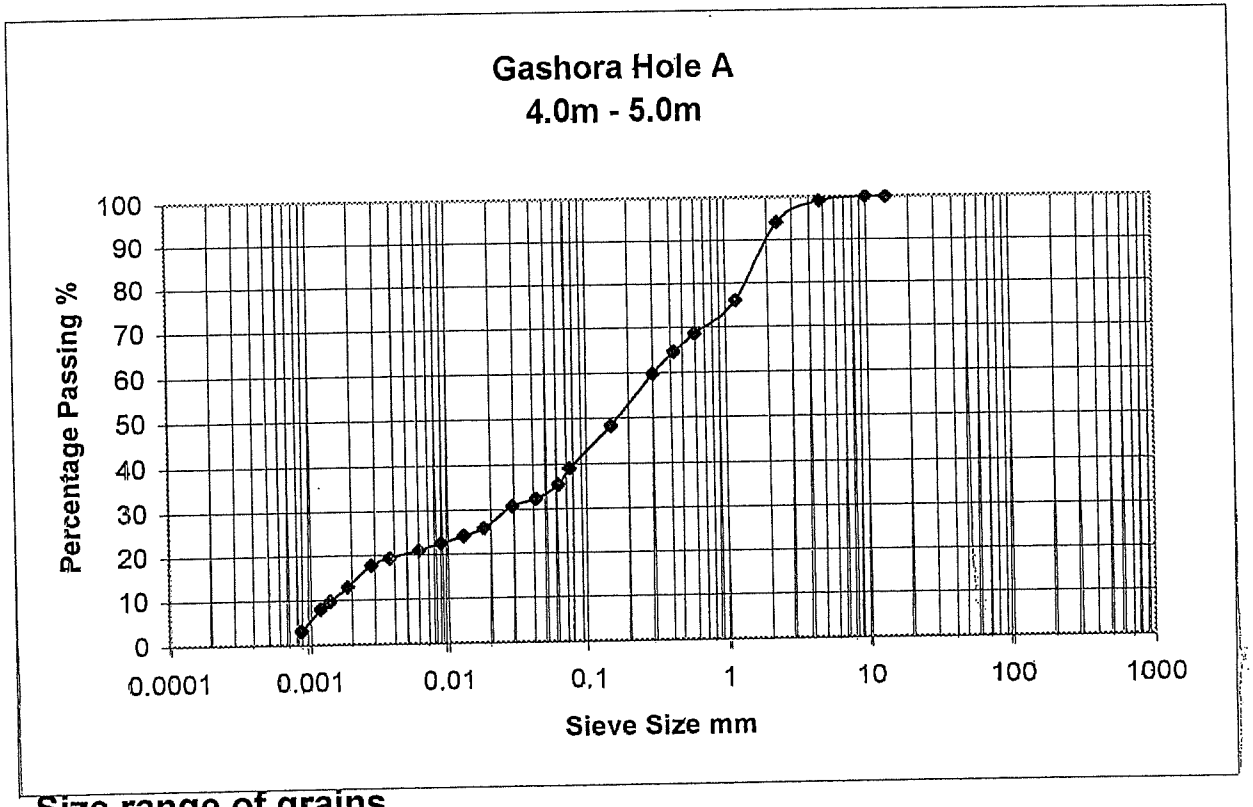


Size range of grains

Aids to size identification

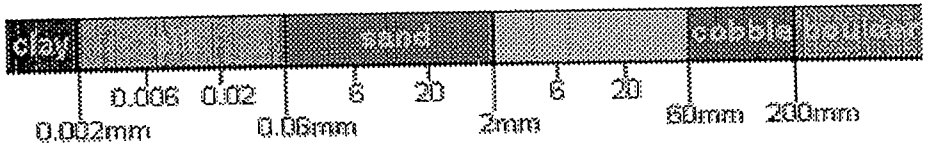


Sieve size mm	%Passing
14	100
10	100
4.75	99.2
2.36	94.2
1.18	76
0.6	68.6
0.425	64.6
0.3	59.8
0.15	48.4
0.075	39
0.062	35.4
0.043	32.2
0.029	30.6
0.018	25.8
0.013	24.1
0.0089	22.5
0.0062	20.9
0.0038	19.3
0.0028	17.7
0.0019	12.9
0.0014	9.7
0.0012	8
0.00087	3.2

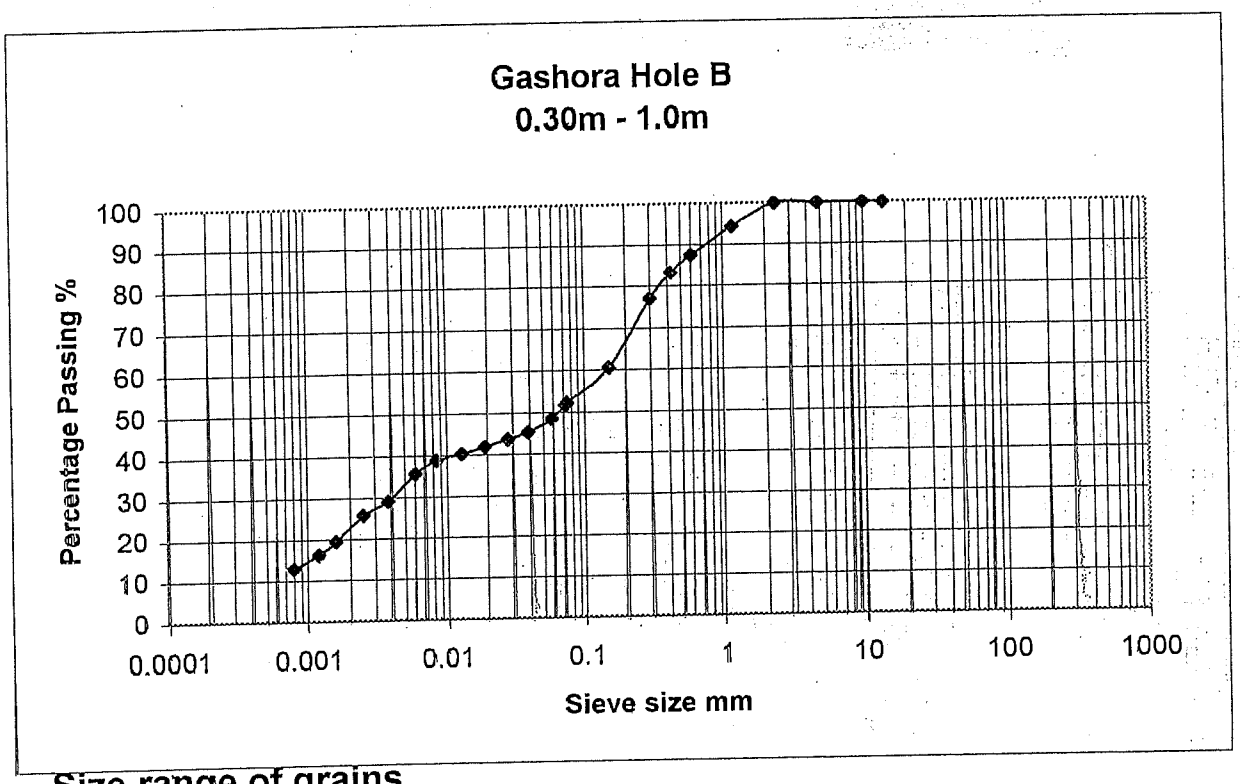


Size range of grains

Aids to size identification

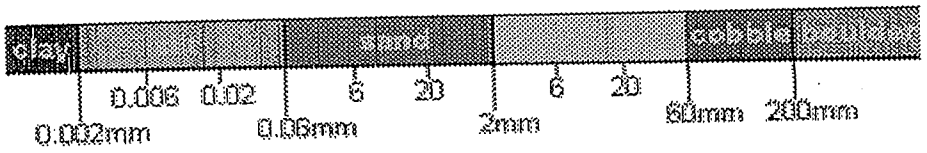


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	94.4
0.6	87.4
0.425	83.2
0.3	77
0.15	60.6
0.075	52.3
0.073	51.8
0.058	48.5
0.039	45.3
0.028	43.7
0.019	42
0.013	40.4
0.0085	38.8
0.006	35.6
0.0038	29.1
0.0025	25.9
0.0016	19.4
0.0012	16.2
0.00079	12.9

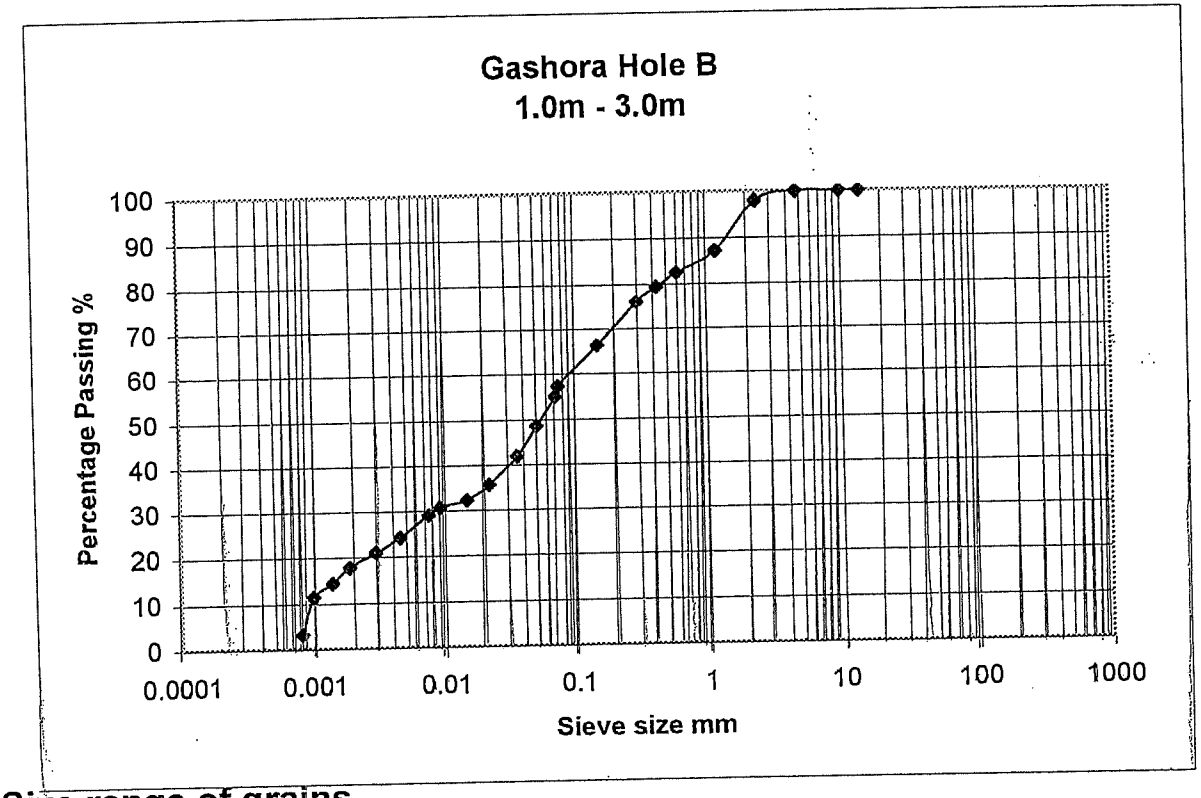


Size range of grains

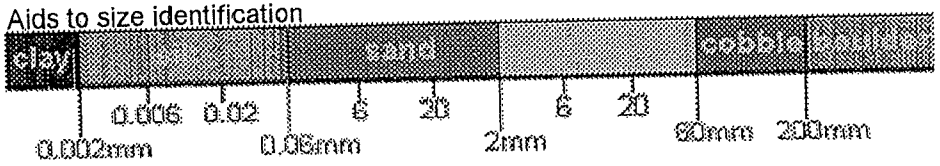
Aids to size identification



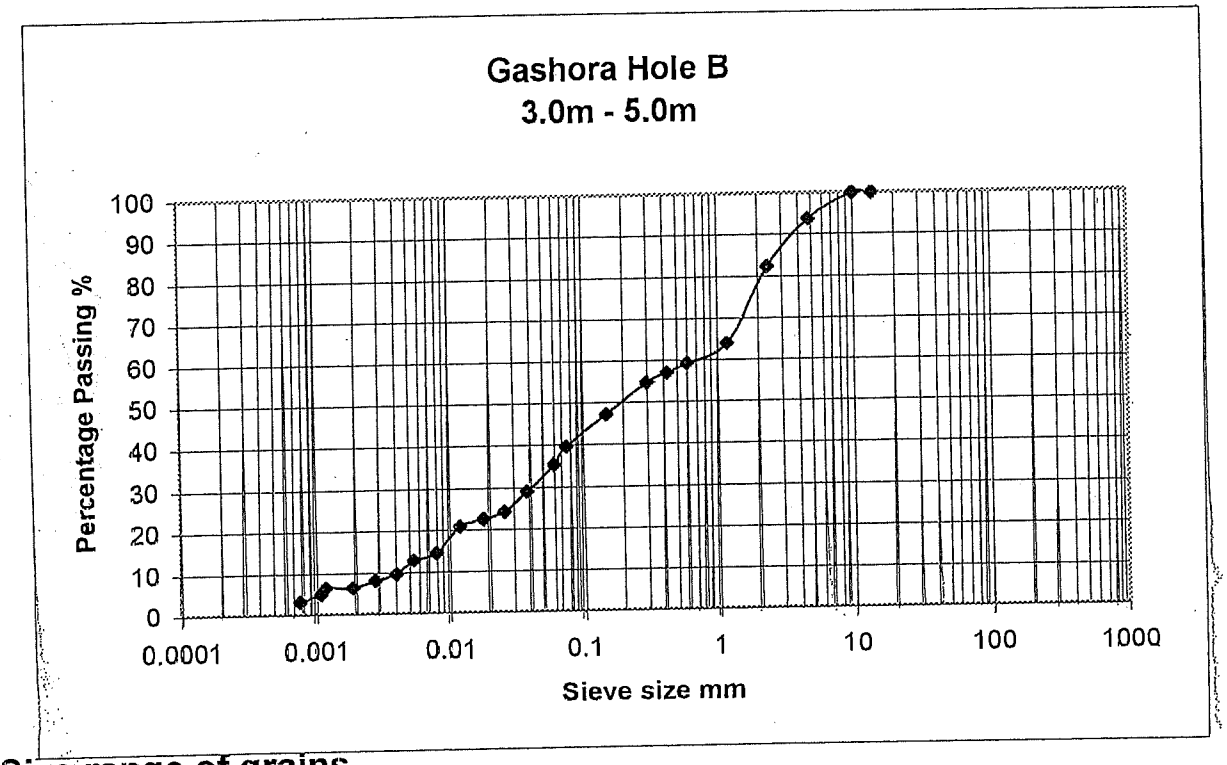
Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	98
1.18	87.2
0.6	82.4
0.425	79.4
0.3	76
0.15	66.4
0.075	57.2
0.071	55
0.051	48.5
0.036	42
0.022	35.6
0.015	32.3
0.0093	30.7
0.0076	29.1
0.0046	24.3
0.003	21
0.0019	17.8
0.0014	14.5
0.001	11.3
0.00082	3.2



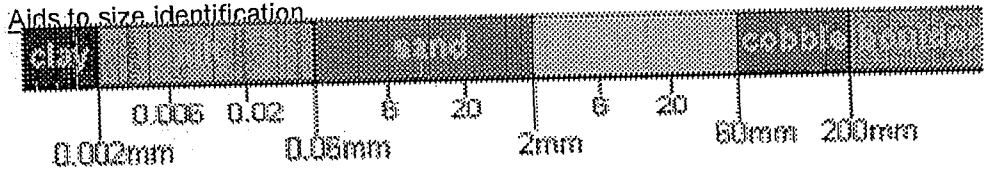
Size range of grains



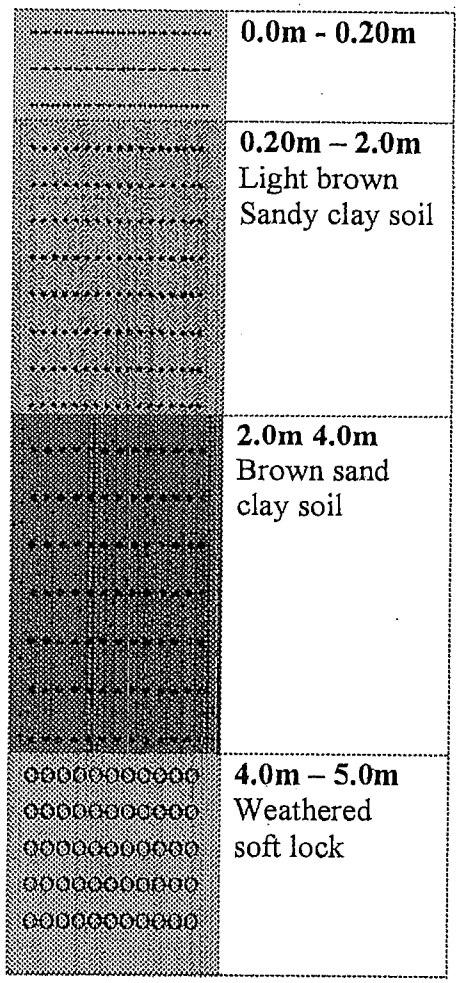
Sieve size mm	%Passing
14	100
10	100
4.75	93.8
2.36	82.4
1.18	63.8
0.6	59.2
0.425	57
0.3	54.6
0.15	47.2
0.075	39.6
0.061	35.4
0.038	29.1
0.026	24.3
0.018	22.6
0.012	21
0.008	14.6
0.0054	12.9
0.004	9.7
0.0028	8.1
0.0019	6.5
0.0012	6.5
0.0011	4.9
0.00076	3.2



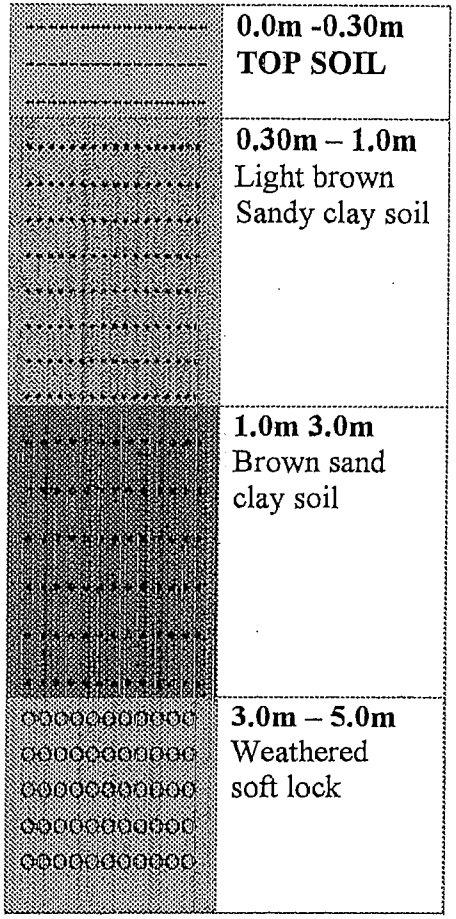
Size range of grains



GASHORA HOLE A



GASHORA HOLE B



REMERA SITE

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

INSTITUT DES SCIENCES ET TECHNOLOGIE DE KIGALI

BP 3900, Avenue de L'Armee, Kigali, Rwanda website:www.kist.ac.rw

SOIL MECHANICS LABORATORY

LABORATORY TEST REPORT

Job No :SC0004 / 2009 **Date**:28/04/2009

Client: SANYU CONSULTANTS INC

Project: IRRIGATED AGRICULTURE IN EASTERN PROVINCE

1.Introduction.

At the request of the client, Soil samples taken from the REMERA SITE for testing, in KIST Soil Mechanics Laboratory . Test Method used ASTM D4318, D422, D2216, D854-00 The tests performed and results are shown in the table of the results below:

2.Table of the results:

S/N	Test performed	Test results		
1	Depth (m)	Remera A 0.30m -1.0m	Remera A 1.0m – 3.0m	Remera A 3.0m – 5.0m
2	**Natural Moisture Content %**	12.5	10.8	13.6
3	**Atterberg i) Liquid Limit %**	48.9	56.6	54.9
	ii) Plastic Limit %	25.4	28.8	27.9
	iii) Plasticity Index %	23.5	27.8	27.0
4	**Specific Gravity**	2.65	2.66	2.65
5	**Partical sizes (sieve size mm)**	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	97.8	100
	2.36mm	99.6	95.4	99.0
	1.18mm	99.0	93.8	98.0
	600 µm	97.4	92.2	96.8
	425 µm	95.8	91.6	96.0
	300 µm	93.8	90.8	95.0
	150 µm	88.4	89.0	93.2
	75 µm	81.2	85.4	87.8

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

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KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

INSTITUT DES SCIENCES ET TECHNOLOGIE DE KIGALI

BP 3900, Avenue de L'Armee, Kigali, Rwanda.website:www.kist.ac.rw

SOIL MECHANICS LABORATORY
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2.Table of the results:

S/N	Test performed	Test results		
1	Depth (m)	Remera B 0.30m -1.0m	Remera B 1.0m -3.0m	Remera B 3.0m - 5.0m
2	Natural Moisture Content %	12.5	14.6	16.5
3	Atterberg i) Liquid Limit %	34.2	57.7	57.6
	ii) Plastic Limit %	19.7	29.3	28.9
	iii) Plasticity Index %	14.5	28.4	28.7
4	Specific Gravity	2.67	2.64	2.64
5	Partical sizes (sieve size mm)	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	100	100
	2.36mm	99.2	99.4	97.0
	1.18mm	98.2	98.0	95.0
	600 µm	96.4	96.8	93.2
	425 µm	95.2	95.2	92.4
	300 µm	93.8	94.2	91.8
	150 µm	90.6	90.6	90.2
	75 µm	86.2	83.0	86.8

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armee B.P.3900 Kigali

Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	100
0.6	99
0.425	98.6
0.3	97.8
0.15	93.4
0.075	70.6
0.067	68.2
0.058	64.4
0.049	61.5
0.035	55.4
0.022	50.3
0.018	45
0.012	40.4
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0.0058	25.9
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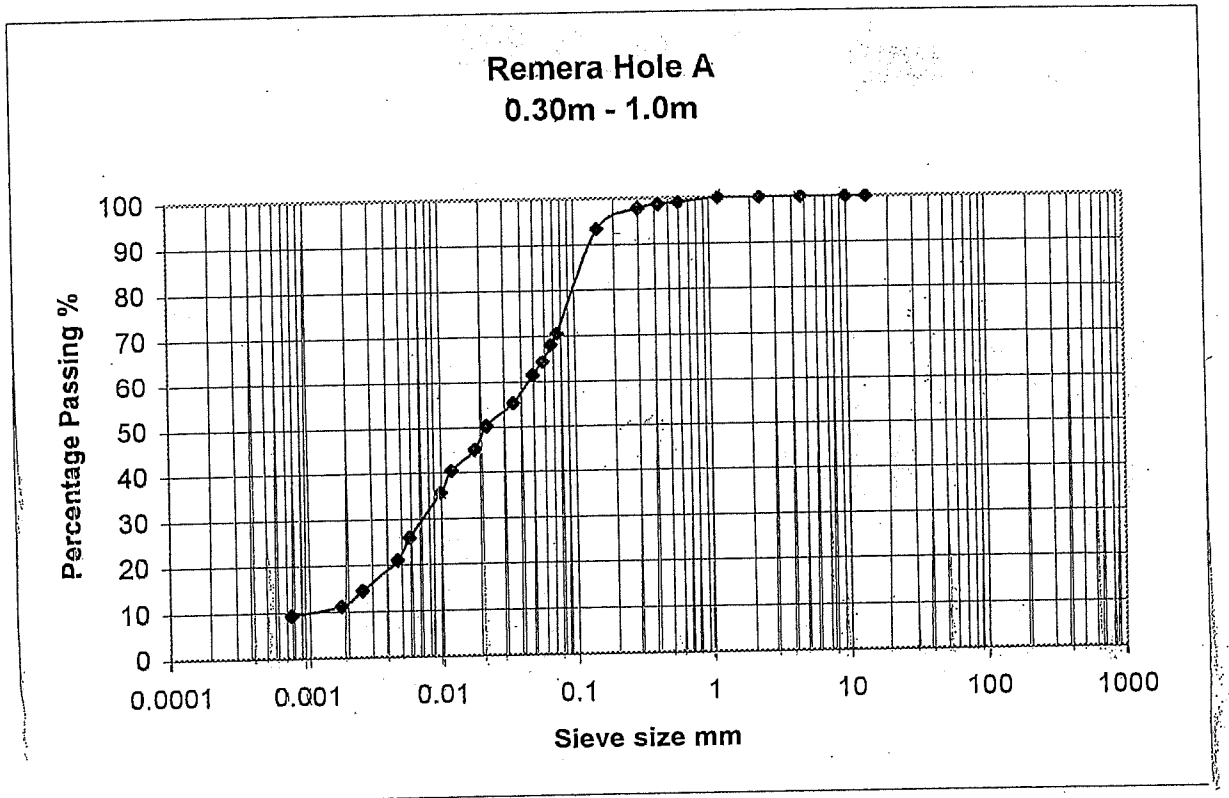
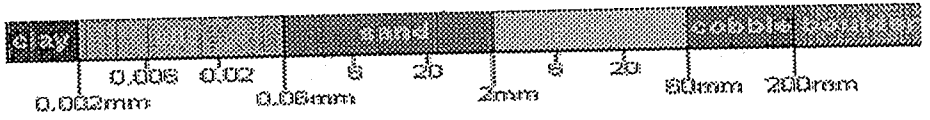
0.0026	14.6
0.0018	11.3
0.00077	9.4

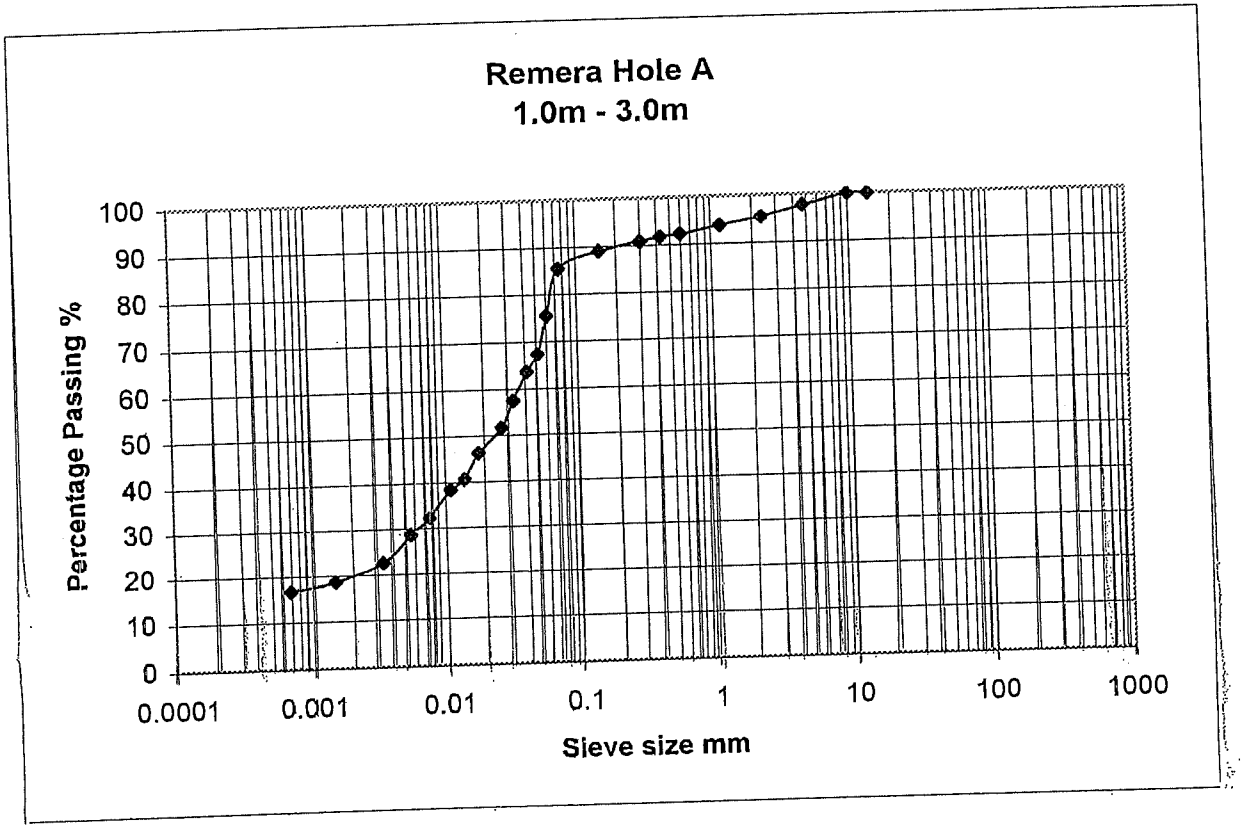


Size range of grains

Aids to size identification

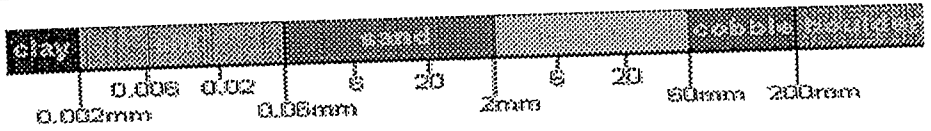


Sieve size mm	%Passing
14	100
10	100
4.75	97.8
2.36	95.4
1.18	93.8
0.6	92.2
0.425	91.6
0.3	90.8
0.15	89
0.075	85.4
0.06	75.4
0.051	67.5
0.042	63.8
0.033	57.6
0.027	51.7
0.018	46.3
0.014	40.6
0.011	38.5
0.0076	32.3
0.0055	28.7
0.0034	22.6
0.0015	18.7
0.0007	16.7

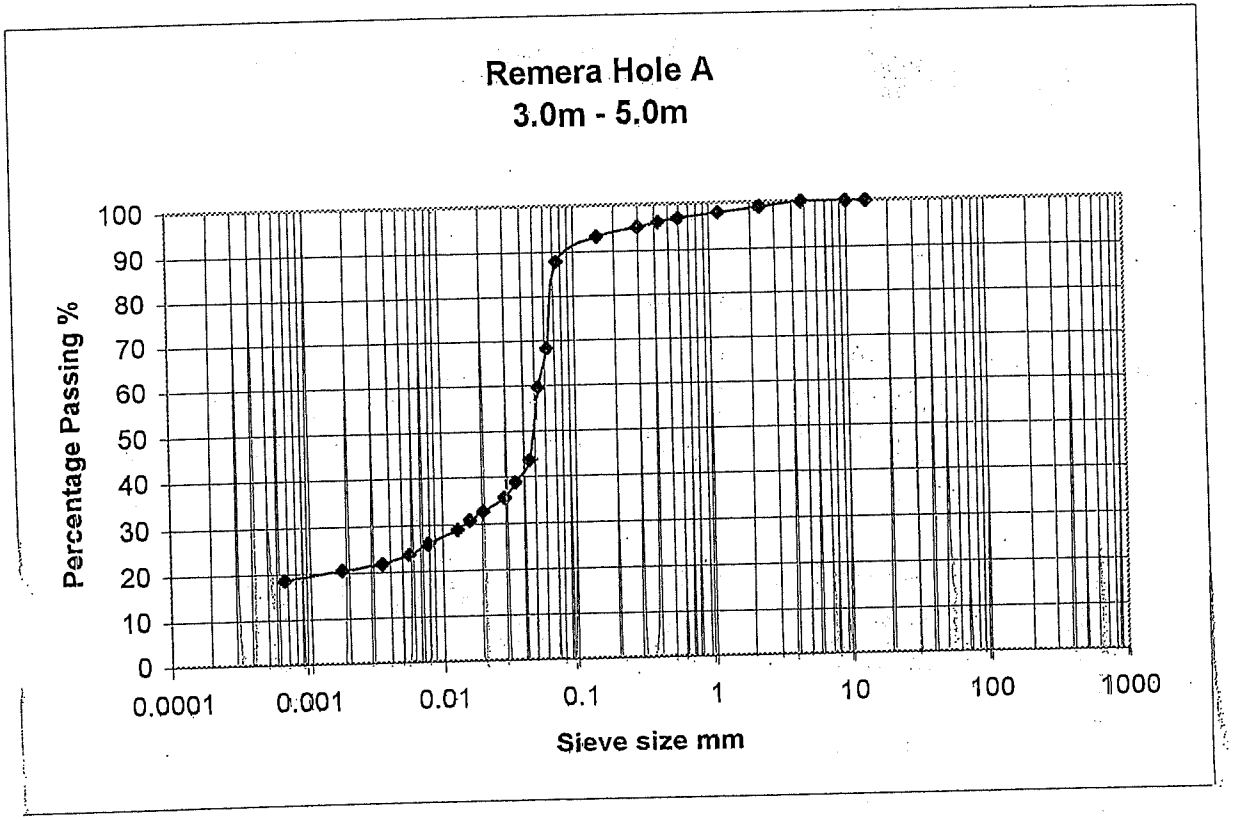


Size range of grains

Aids to size identification

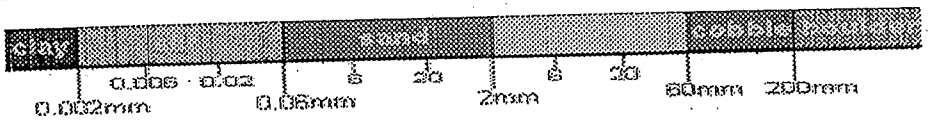


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	99
1.18	98
0.6	96.8
0.425	96
0.3	95
0.15	93.2
0.075	87.8
0.062	68.3
0.053	59.6
0.045	43.5
0.035	38.7
0.029	35.4
0.02	32.6
0.016	30.8
0.013	28.9
0.0079	25.9
0.0057	23.8
0.0036	21.8
0.0018	20.6
0.00068	18.7

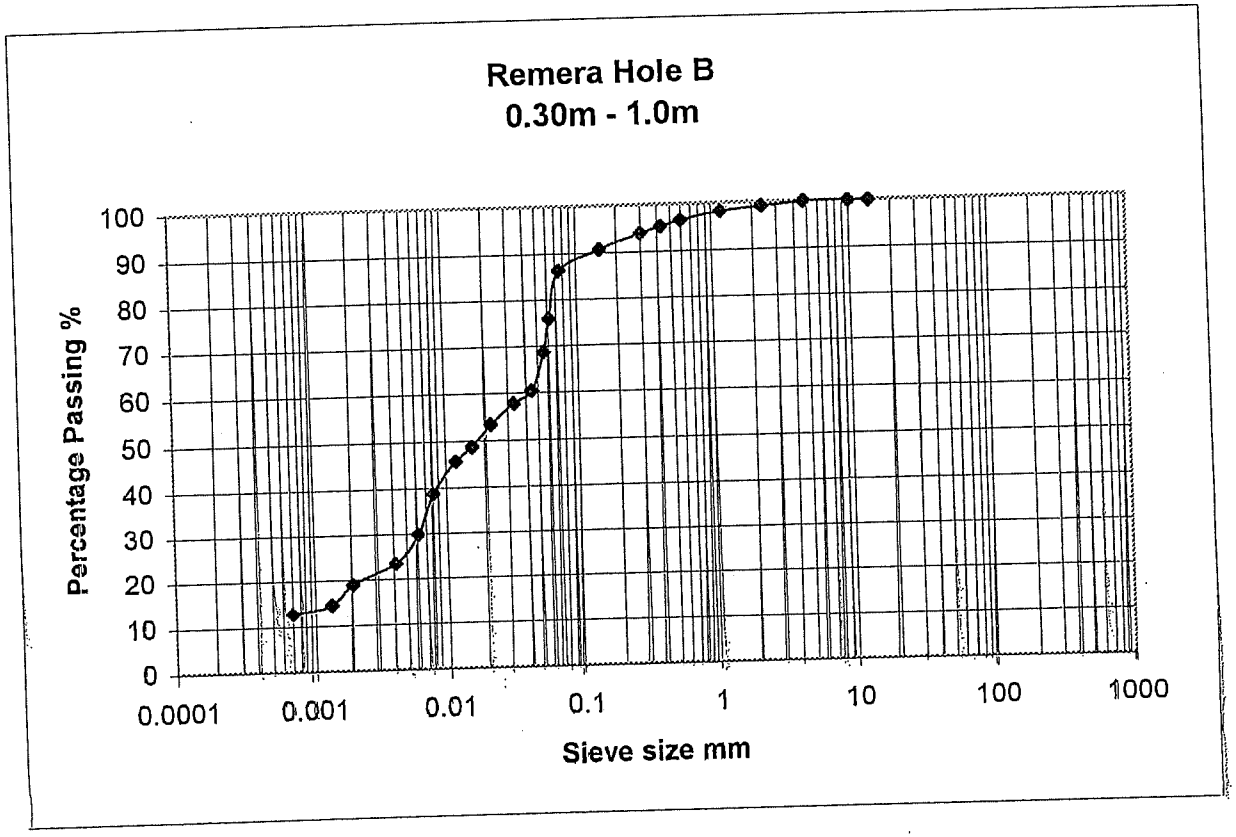


Size range of grains

Aids to size identification

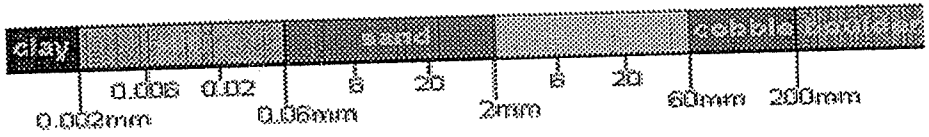


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	99.2
1.18	98.2
0.6	96.4
0.425	95.2
0.3	93.8
0.15	90.6
0.075	86.2
0.062	75.8
0.056	68.7
0.045	60.5
0.033	57.8
0.022	53.4
0.016	48.7
0.012	45.8
0.0081	38.7
0.0062	29.8
0.0042	23.5
0.002	18.9
0.0014	14.6
0.00072	12.8

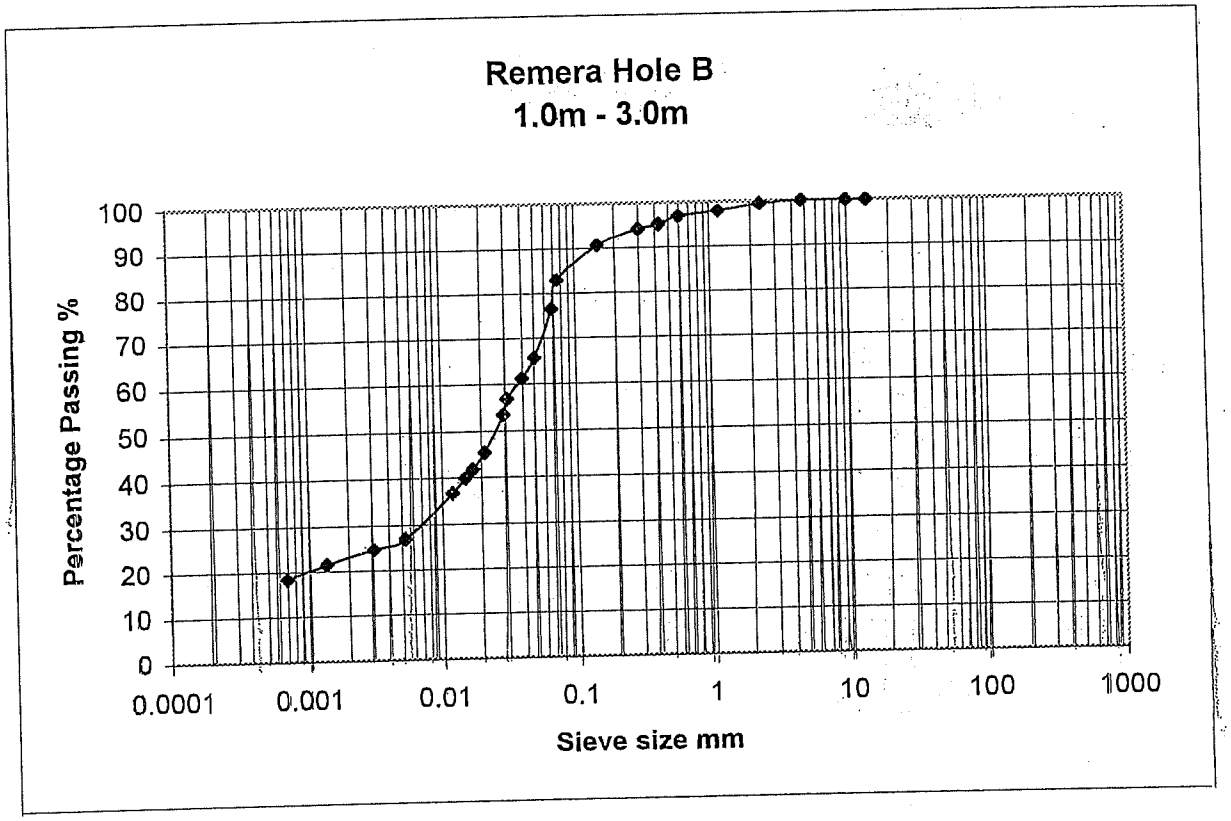


Size range of grains

Aids to size identification

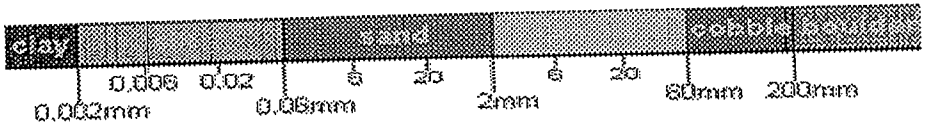


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	99.4
1.18	98
0.6	96.8
0.425	95.2
0.3	94.2
0.15	90.6
0.075	83
0.068	76.5
0.05	65.8
0.04	61.2
0.031	56.9
0.029	53.4
0.021	45.3
0.017	41.8
0.015	39.8
0.012	36.7
0.0053	26.9
0.0031	24.7
0.0014	21.5
0.00071	18.4

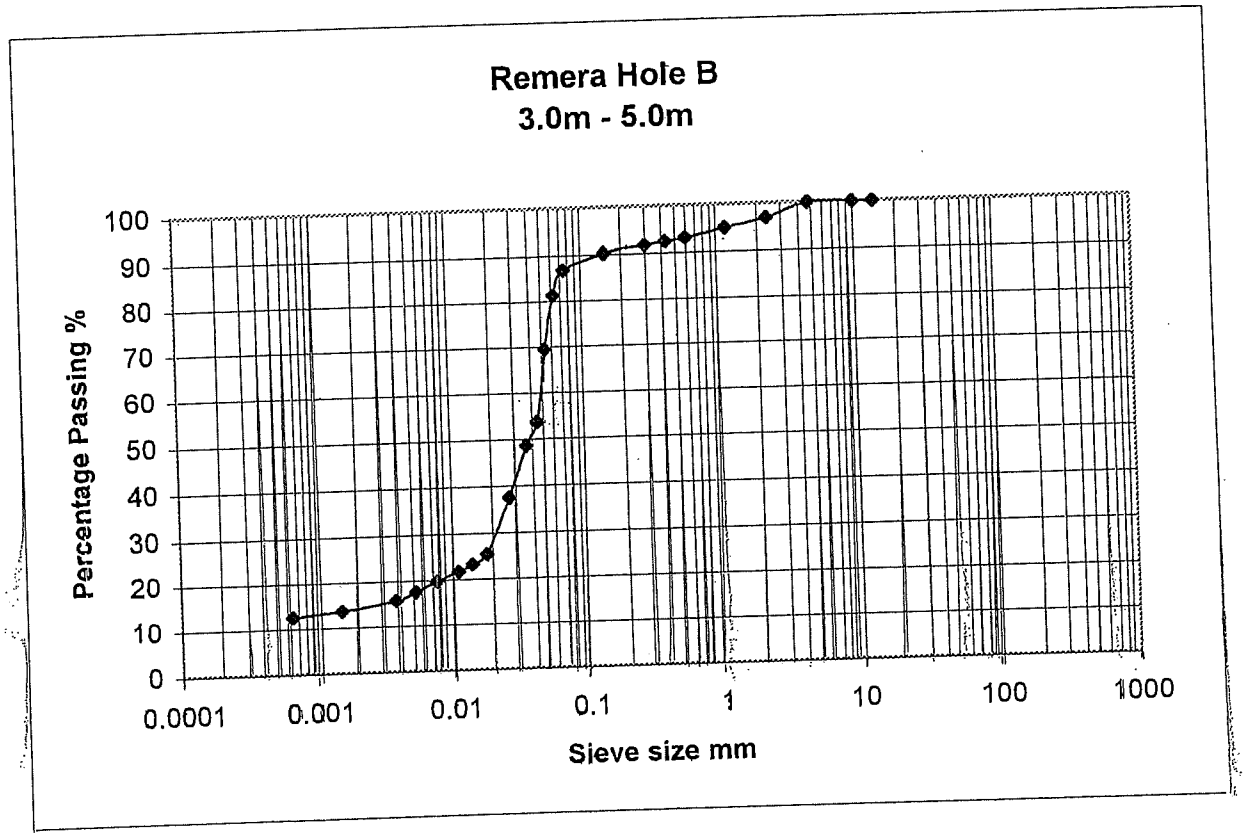


Size range of grains

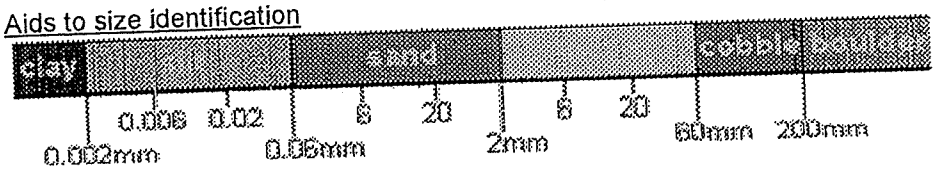
Aids to size identification



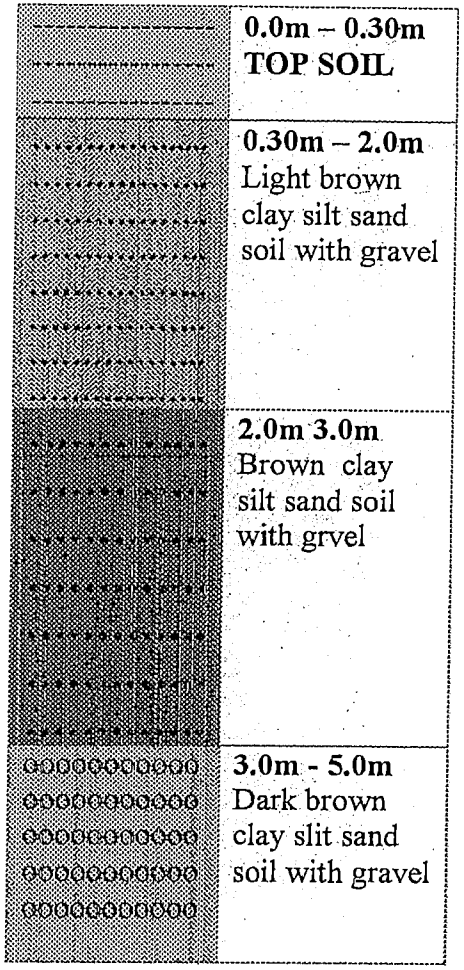
Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	97
1.18	95
0.6	93.2
0.425	92.4
0.3	91.8
0.15	90.2
0.075	86.8
0.062	81.3
0.053	69.5
0.045	53.7
0.037	48.6
0.027	37.5
0.018	25.6
0.014	23.4
0.011	21.8
0.0076	19.8
0.0053	17.6
0.0038	15.8
0.0015	13.7
0.00065	12.7



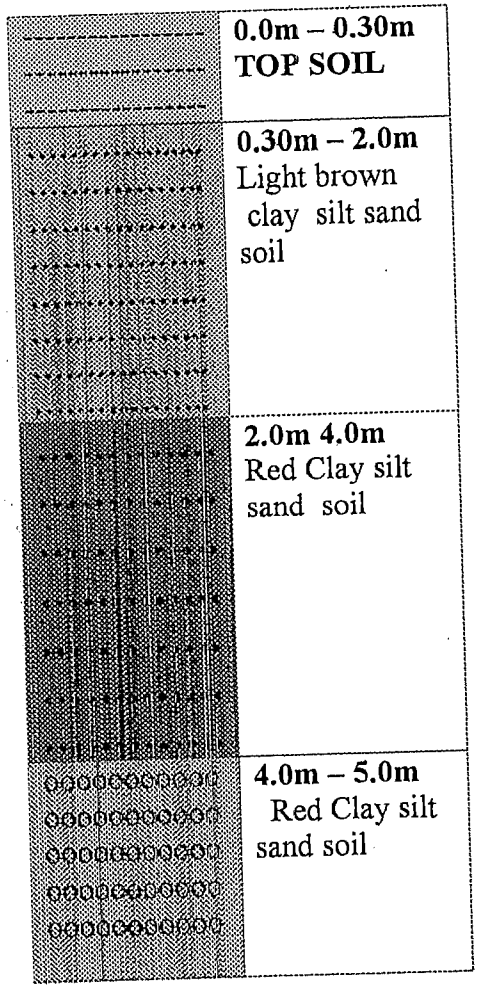
Size range of grains



REMERA HOLE A



REMERA HOLE B



RULENGE SITE

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

INSTITUT DES SCIENCES ET TECHNOLOGIE DE KIGALI

BP 3900, Avenue de L'Armee, Kigali, Rwanda website:www.kist.ac.rw

SOIL MECHANICS LABORATORY
LABORATORY TEST REPORT

Job No :SC0004 / 2009 **Date**:28/04/2009

1.Introduction.

At the request of the client, Soil samples taken from the RULENGE SITE for testing, in KIST Soil Mechanics Laboratory Test Method used ASTM D4318, D422, D2216, D854-00 The tests performed and results are shown in the table of the results below:

2.Table of the results:

S/N	Test performed	Test results		
1	Depth (m)	Rulenge A 0.20m-1.5m	Rulenge A 1.5m -3.5m	Rulenge A 3.5m-5.0m
2	Natural Moisture Content %	9.6	10.4	11.6
3	Atterberg i) Liquid Limit %	40.9	58.6	55.6
	ii) Plastic Limit %	19.2	28.7	27.9
	iii) Plasticity Index %	21.7	29.9	27.7
4	Specific Gravity	2.65	2.66	2.70
5	Partical sizes (sieve size mm)	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	100	100
	2.36mm	98.8	100	98.6
	1.18mm	97.2	98.2	97.2
	600 µm	95.2	96.4	95.6
	425 µm	93.4	95.6	94.8
	300 µm	91.4	94.6	93.6
	150 µm	85.4	91.4	90.2
	75 µm	78.0	86.4	84.2

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armee B.P.3900 Kigali

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

INSTITUT DES SCIENCES ET TECHNOLOGIE DE KIGALI

BP 3900, Avenue de L'Armee, Kigali, Rwanda.website:www.kist.ac.rw

SOIL MECHANICS LABORATORY
LABORATORY TEST REPORT

Job No :SC0004/ 2009 **Date**:28/04/2009

Client: SANYU CONSULTANTS INC

Project: IRRIGATED AGRICULTURE IN EASTERN PROVINCE

1.Introduction.

At the request of the client, Soil samples taken from the RULENGE SITE for testing, in KIST Soil Mechanics Laboratory Test Method used ASTM D4318, D422, D2216, D854-00 The tests performed and results are shown in the table of the results below:

2.Table of the results:

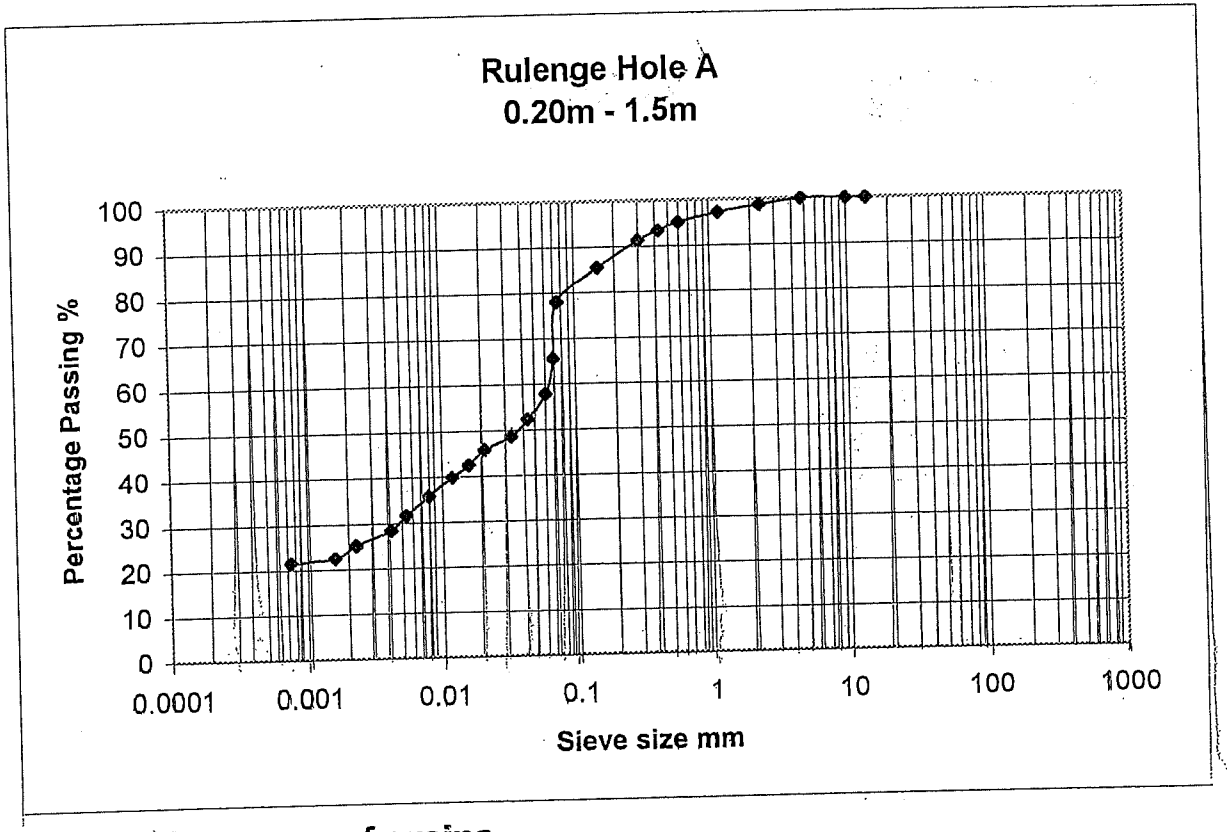
S/N	Test performed	Test results		
1	Depth (m)	Rulenge B 0.20m – 1.0m	Rulenge B 1.0m -3.5m	Rulenge B 3.5m -5.0m
2	**Natural Moisture Content %**	7.6	9.6	6.8
3	**Atterberg i) Liquid Limit %**	57.9	44.7	38.4
	ii) Plastic Limit %	27.5	22.8	17.6
	iii) Plasticity Index %	30.4	21.9	20.8
4	**Specific Gravity**	2.65	2.63	2.70
5	**Partical sizes (sieve size mm)**	Percentage Passing %		
	14mm	100	100	100
	10mm	100	89.8	100
	4.75mm	100	71.0	93.6
	2.36mm	100	60.0	87.0
	1.18mm	100	55.0	83.6
	600 µm	98.2	52.6	80.8
	425 µm	97.2	51.4	79.6
	300 µm	96.0	50.2	78.4
	150 µm	92.6	47.4	75.0
	75 µm	88.4	44.6	70.4

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

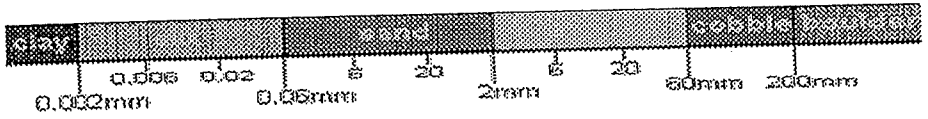
KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armée B.P.3900 Kigali

Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	98.8
1.18	97.2
0.6	95.2
0.425	93.4
0.3	91.4
0.15	85.4
0.075	78
0.069	65.7
0.06	57.8
0.044	52.4
0.033	48.6
0.021	45.7
0.016	42.5
0.012	39.8
0.008	35.7
0.0054	31.6
0.0042	28.4
0.0023	25.3
0.0016	22.5
0.00076	21.5

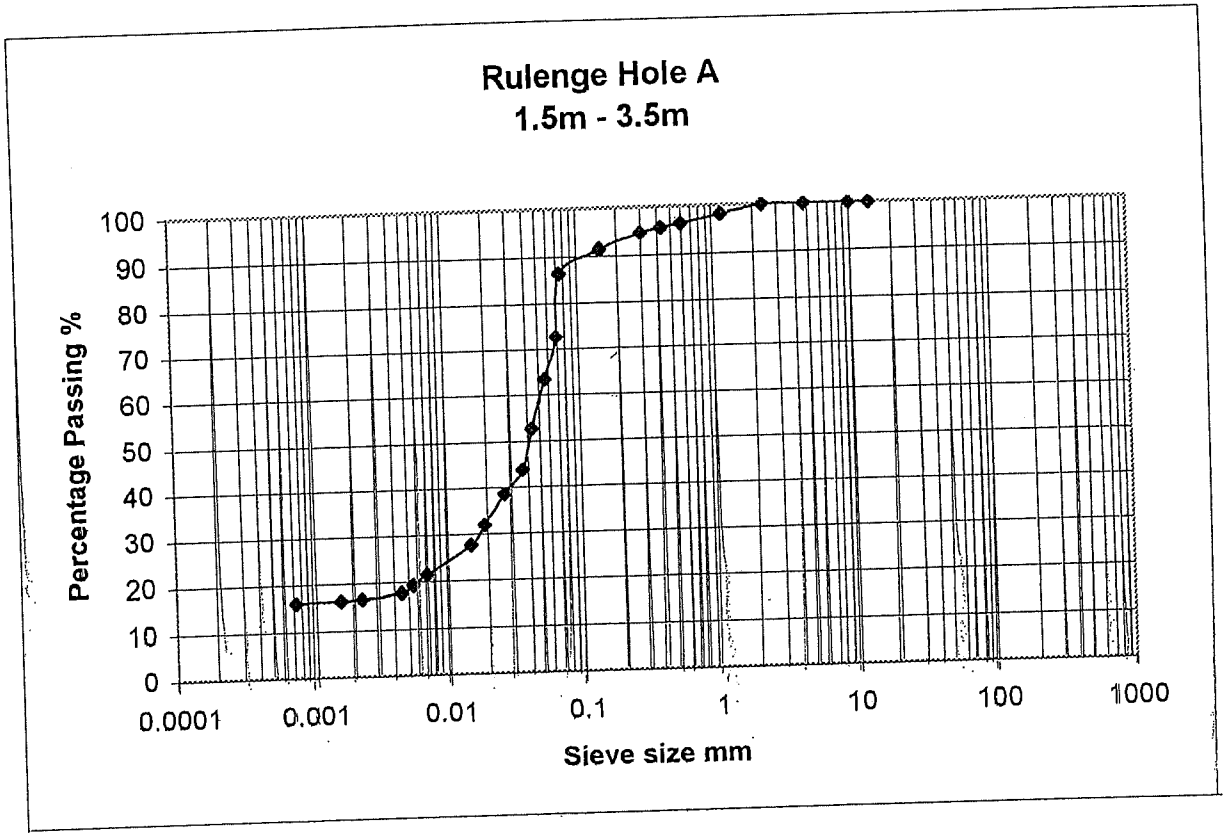


Size range of grains

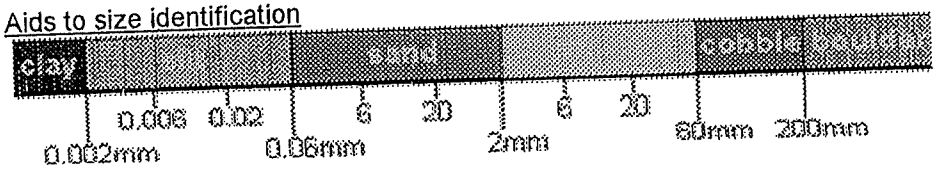
Aids to size identification



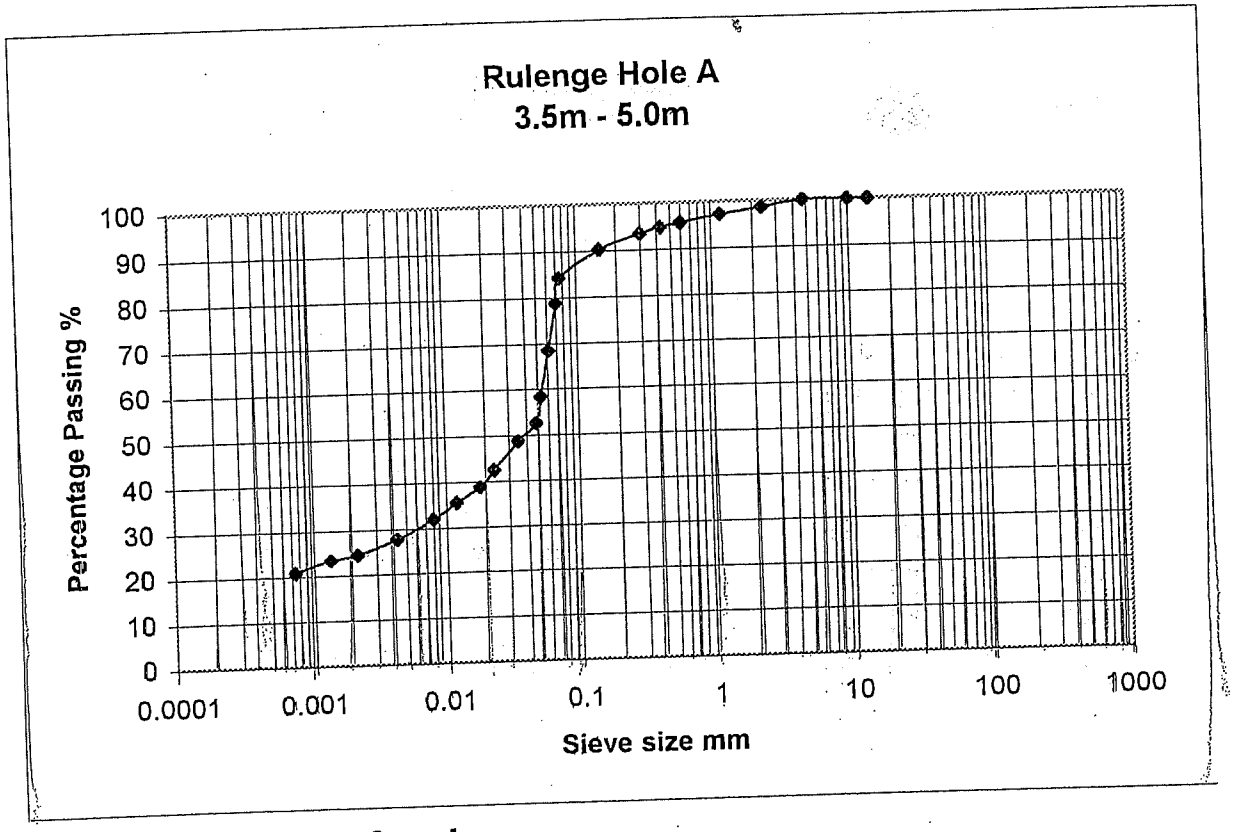
Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	98.2
0.6	96.4
0.425	95.6
0.3	94.6
0.15	91.4
0.075	86.4
0.069	72.6
0.056	63.4
0.044	52.7
0.037	43.8
0.027	38.5
0.019	31.9
0.015	27.6
0.007	21.5
0.0055	19.3
0.0045	17.9
0.0023	16.8
0.0016	16.5
0.00075	16.2



Size range of grains

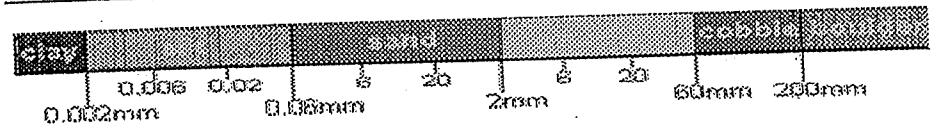


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	98.6
1.18	97.2
0.6	95.6
0.425	94.8
0.3	93.6
0.15	90.2
0.075	84.2
0.07	78.7
0.061	68.5
0.052	58.4
0.048	52.6
0.035	48.7
0.023	42.5
0.018	38.7
0.012	35.4
0.008	31.9
0.0043	27.8
0.0022	24.6
0.0014	23.5
0.00076	20.9

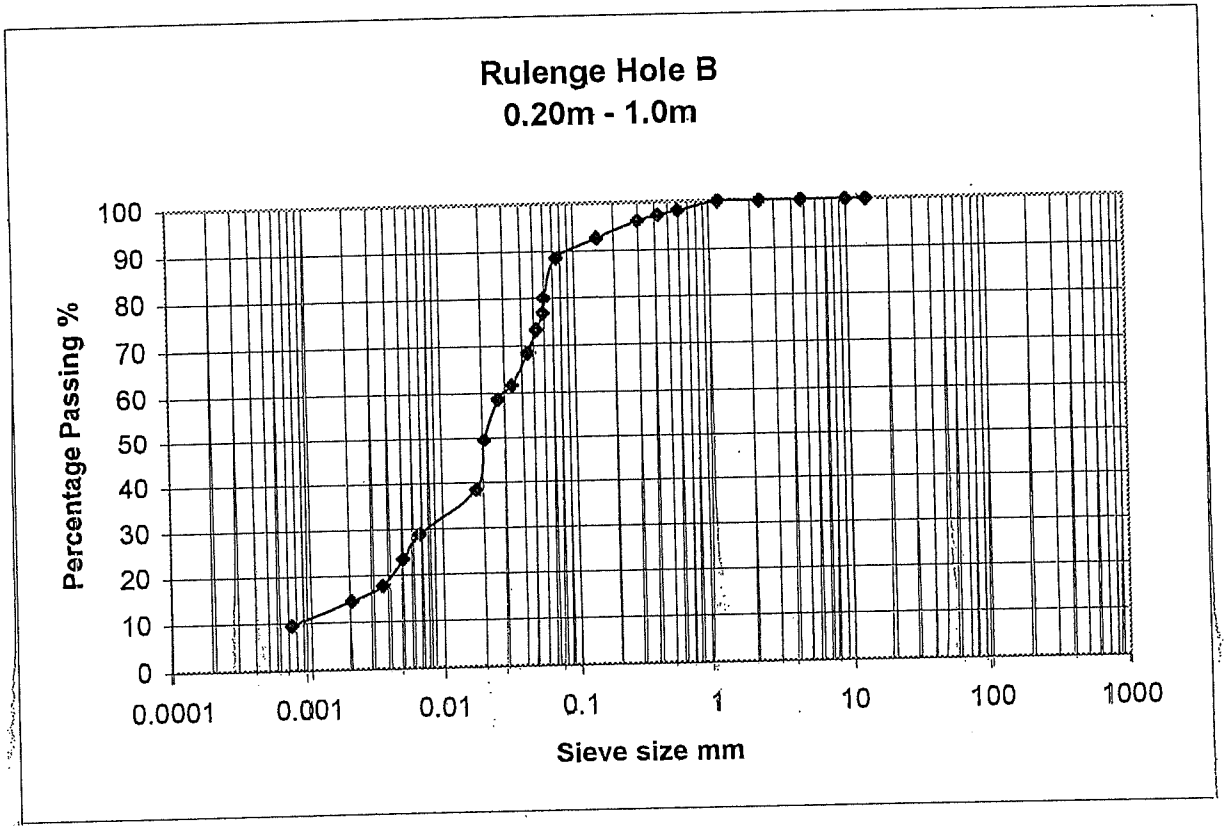


Size range of grains

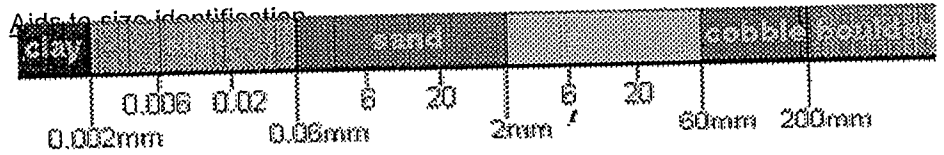
Aids to size identification



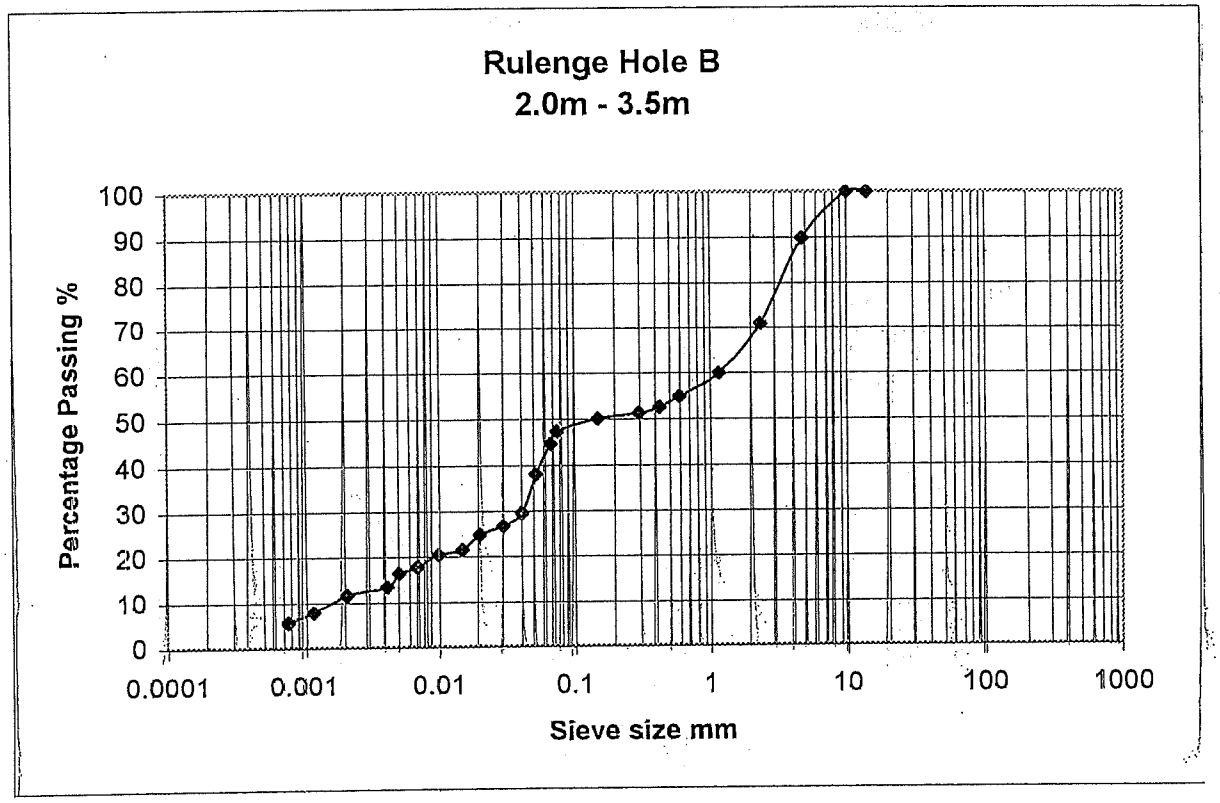
Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	100
0.6	98.2
0.425	97.2
0.3	96
0.15	92.6
0.075	88.4
0.06	79.9
0.059	76.8
0.052	73.4
0.045	68.6
0.034	61.8
0.027	58.7
0.021	49.5
0.018	38.3
0.0068	28.9
0.0051	23.5
0.0036	17.7
0.0021	14.6
0.00076	9.5



Size range of grains

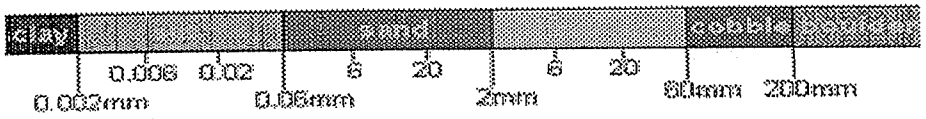


Sieve size mm	%Passing
14	100
10	100
4.75	89.8
2.36	71
1.18	60
0.6	55
0.425	52.6
0.3	51.4
0.15	50.2
0.075	47.4
0.067	44.6
0.052	38
0.041	29.5
0.03	26.7
0.02	24.7
0.015	21.6
0.01	20.4
0.007	17.8
0.0051	16.5
0.0042	13.5
0.0021	11.7
0.0012	7.8
0.00077	5.7

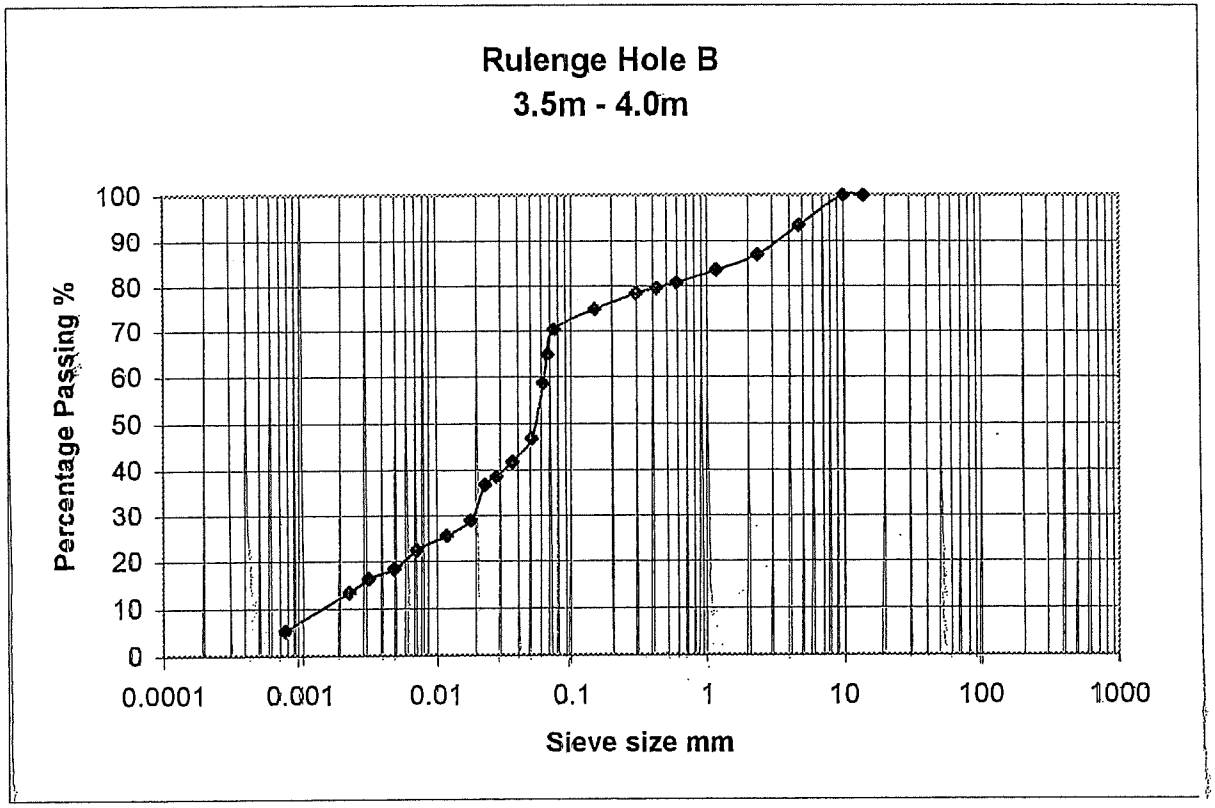


Size range of grains

Aids to size identification

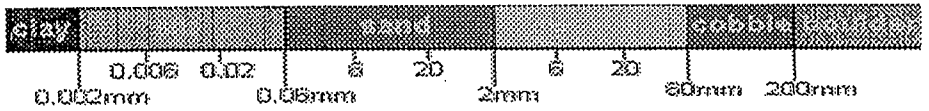


e size	%Passing
14	100
10	100
4.75	93.6
2.36	87
1.18	83.6
0.6	80.8
0.425	79.6
0.3	78.4
0.15	75
0.075	70.4
0.067	64.8
0.062	58.7
0.051	46.9
0.037	41.7
0.028	38.4
0.023	36.7
0.018	28.9
0.012	25.6
0.0072	22.4
0.0049	18.4
0.0032	16.4
0.0023	13.4
0.00078	5.4

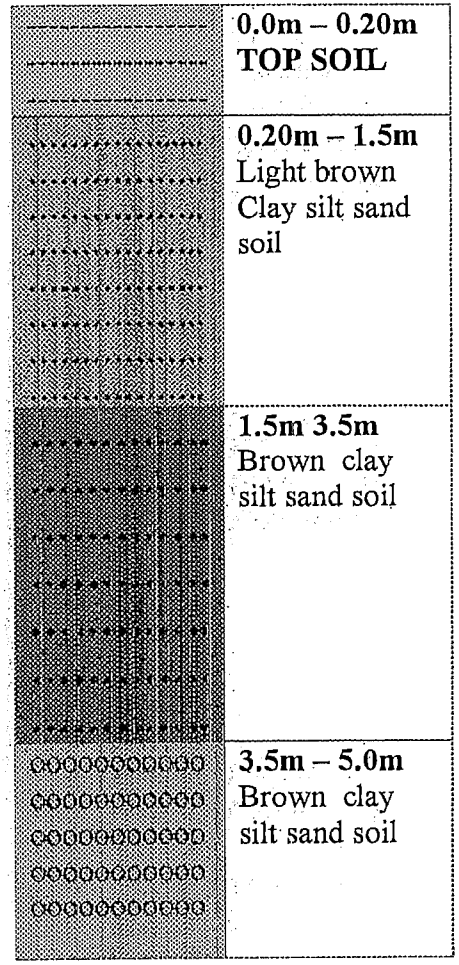


Size range of grains

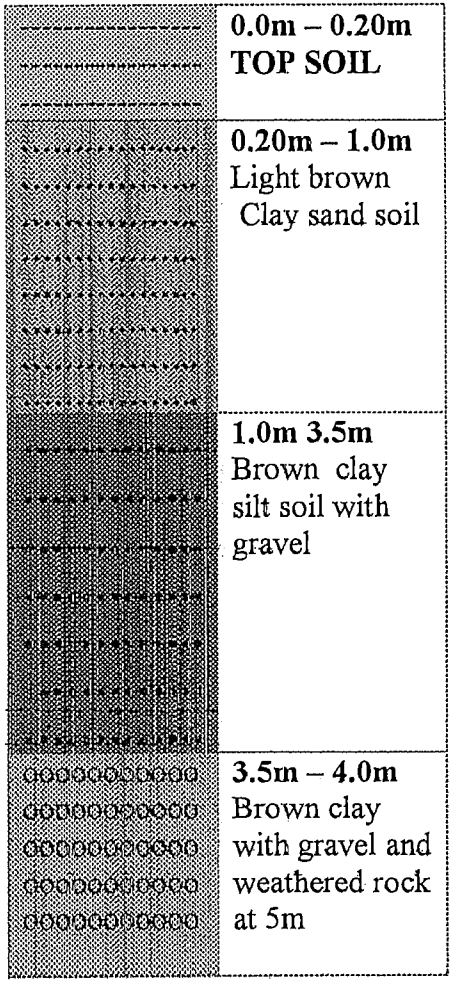
Aids to size identification



RULENGE HOLE A



RULENGE HOLE B



GATSIBO SITE

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY

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BP 3900, Avenue de L'Armee, Kigali, Rwanda.website:www.kist.ac.rw

SOIL MECHANICS LABORATORY

LABORATORY TEST REPORT

Job No :SC0004 / 2009 **Date**:28/04/2009

Client: SANYU CONSULTANTS INC

Project: IRRIGATED AGRICULTURE IN EASTERN PROVINCE

1.Introduction.

At the request of the client, Soil samples taken from the GATSIBO SITE for testing, in KIST Soil Mechanics Laboratory . Test Method used ASTM D4318, D422, D2216, D854-00 The tests performed and results are shown in the table of the results below:

2.Table of the results:

S/N	Test performed	Test results		
1	Depth (m)	Gatsibo A 0.20m-3.0m	Gatsibo A 3.0m -4.0m	Gatsibo A 4.0m-5.0m
2	**Natural Moisture Content %**	8.6	10.4	7.5
3	**Atterberg i) Liquid Limit %**	38.8	39.5	47.9
	ii) Plastic Limit %	17.5	18.5	23.9
	iii) Plasticity Index %	21.3	21.0	24.0
4	**Specific Gravity**	2.70	2.68	2.64
5	**Partical sizes (sieve size mm)**	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	97.6	99.0
	2.36mm	100	94.6	98.6
	1.18mm	100	93.6	97.4
	600 µm	99.0	92.6	96.6
	425 µm	98.6	91.8	96.0
	300 µm	97.8	90.6	95.2
	150 µm	93.4	85.5	91.0
	75 µm	70.6	73.4	81.0

Notes:Finer Particals than 75µm see graph attached

Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

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2.Table of the results:

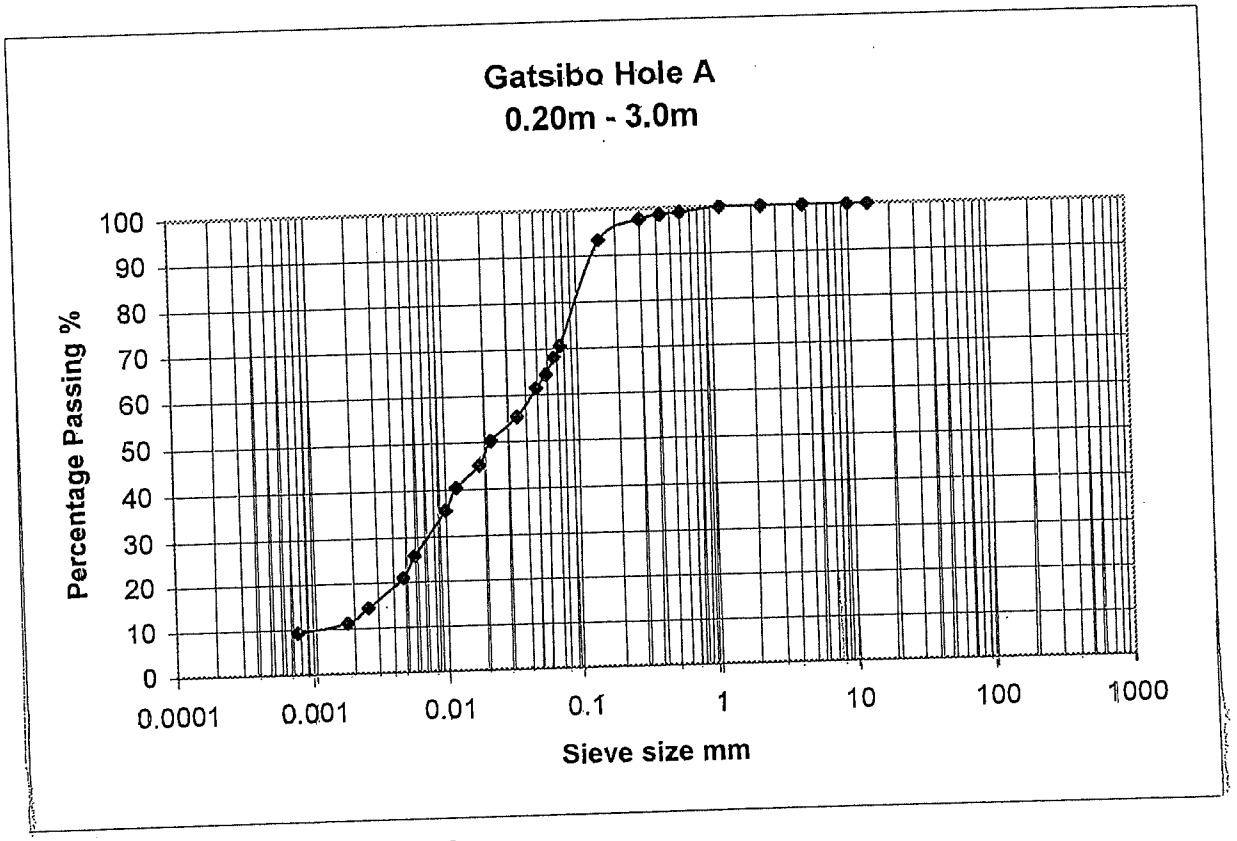
S/N	Test performed	Test results		
1	Depth (m)	Gatsibo B 0.20 -1.0m	Gatsibo B 1.0m – 3.0m	Gatsibo B 3.0m – 5.0m
2	Natural Moisture Content %	10.4	11.9	6.2
3	Atterberg i) Liquid Limit %	48.6	40.2	37.2
	ii) Plastic Limit %	24.8	17.6	16.7
	iii) Plasticity Index %	23.8	22.6	20.5
4	Specific Gravity	10.4	11.9	6.2
5	Partical sizes (sieve size mm)	Percentage Passing %		
	14mm	100	100	100
	10mm	100	100	100
	4.75mm	100	100	100
	2.36mm	100	99.8	96.6
	1.18mm	99.0	98.8	94.2
	600 µm	98.0	97.4	92.4
	425 µm	97.0	96.4	91.2
	300 µm	95.8	95.0	89.8
	150 µm	91.0	88.2	83.0
	75 µm	81.4	73.0	68.8

Notes:Finer Particals than 75µm see graph attached

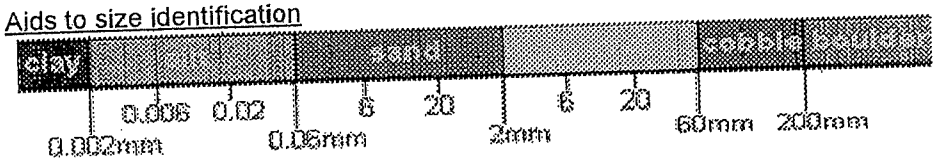
Tested by: KABAYIZA Bertin
Geotechnical Senior Laboratory Technician

KIGALI INSTITUTE OF SCIENCE AND TECHNOLOGY KIST Avenue de l'Armee B.P.3900 Kigali

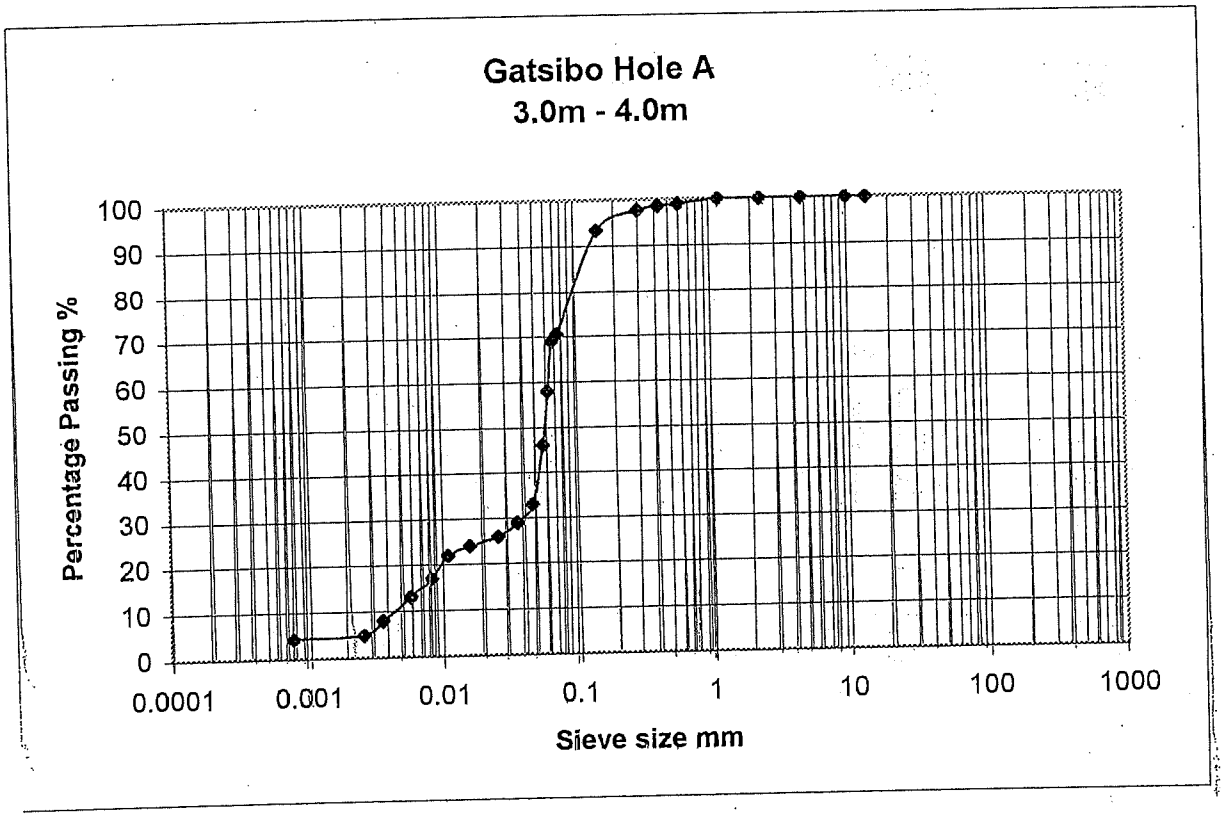
Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	100
0.6	99
0.425	98.6
0.3	97.8
0.15	93.4
0.075	70.6
0.067	68.2
0.058	64.4
0.049	61.5
0.035	55.4
0.022	50.3
0.018	45
0.012	40.4
0.01	35.6
0.0058	25.9
0.0047	21
0.0026	14.6
0.0018	11.3
0.00077	9.4



Size range of grains

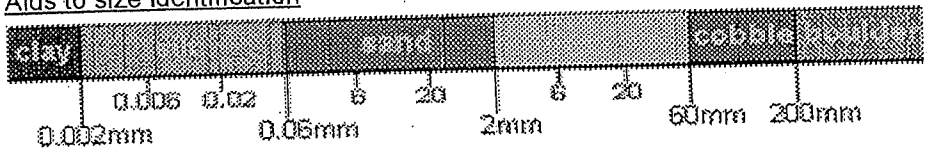


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	100
0.6	99
0.425	98.6
0.3	97.8
0.15	93.4
0.075	70.6
0.068	69
0.063	58
0.057	46
0.047	33
0.036	29
0.026	26
0.016	24
0.011	22
0.0083	17
0.0058	13
0.0036	8
0.0026	5
0.00078	4.2

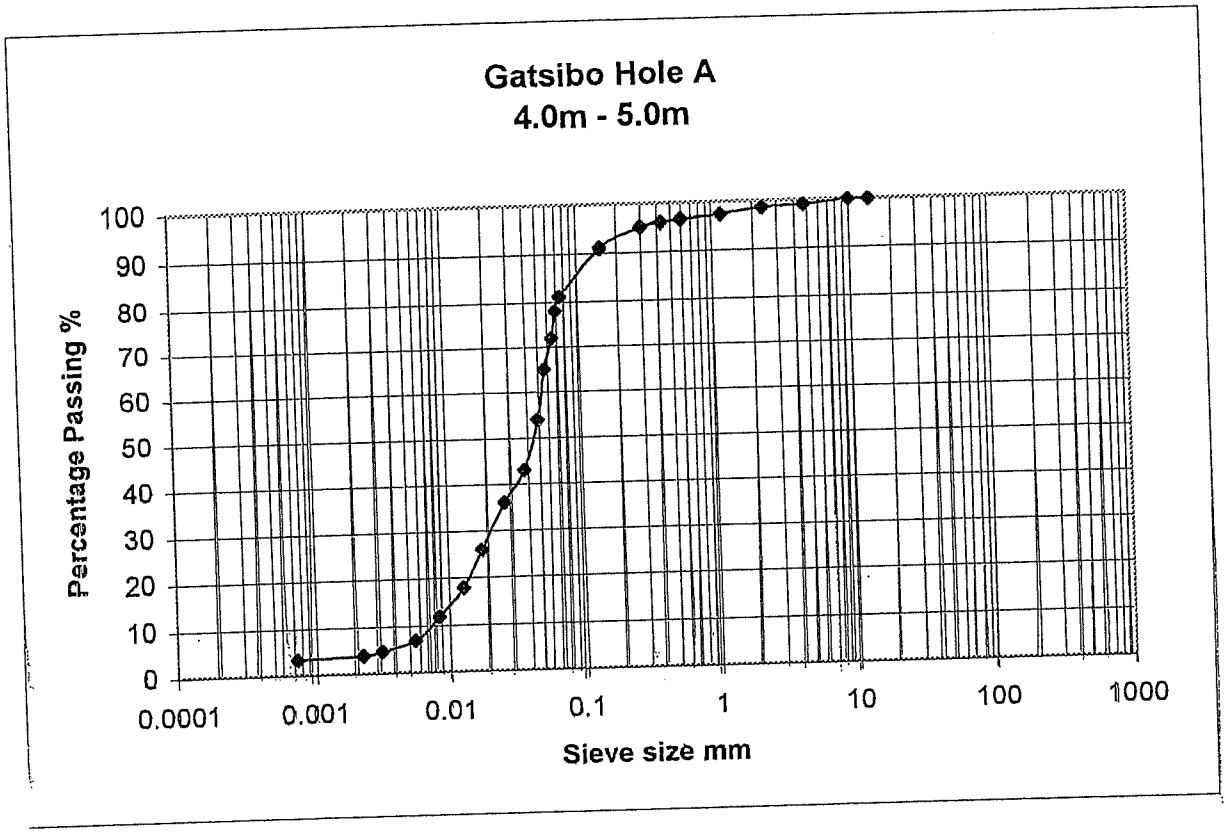


Size range of grains

Aids to size identification

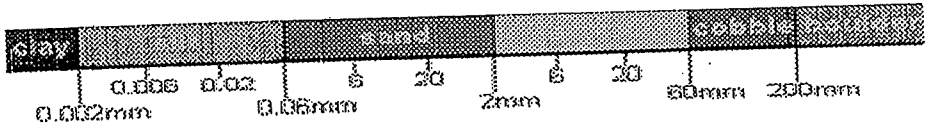


Sieve size mm	%Passing
14	100
10	100
4.75	99
2.36	98.6
1.18	97.4
0.6	96.6
0.425	96
0.3	95.2
0.15	91
0.075	81
0.069	78
0.064	72
0.056	65
0.049	54
0.038	43
0.027	36
0.018	26
0.013	18
0.0085	12
0.0056	7
0.0032	4.8
0.0023	4
0.00076	3.5

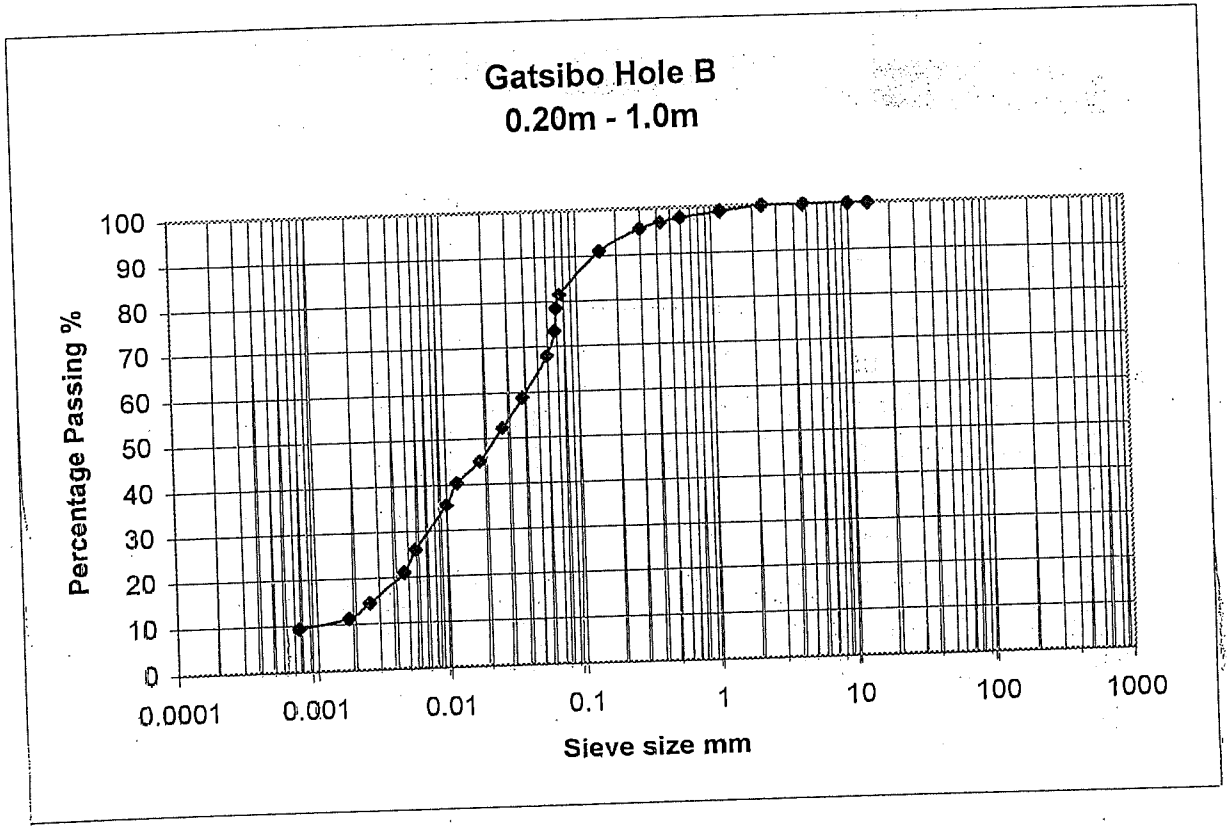


Size range of grains

Aids to size identification

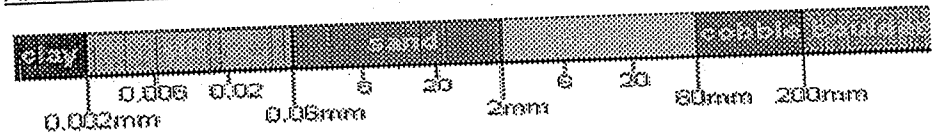


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	100
1.18	99
0.6	98
0.425	97
0.3	95.8
0.15	91
0.075	81.4
0.07	78.5
0.068	73.4
0.059	67.8
0.038	58.9
0.027	52.3
0.018	45
0.012	40.4
0.01	35.6
0.0058	25.9
0.0047	21
0.0026	14.6
0.0018	11.3
0.00077	9.4

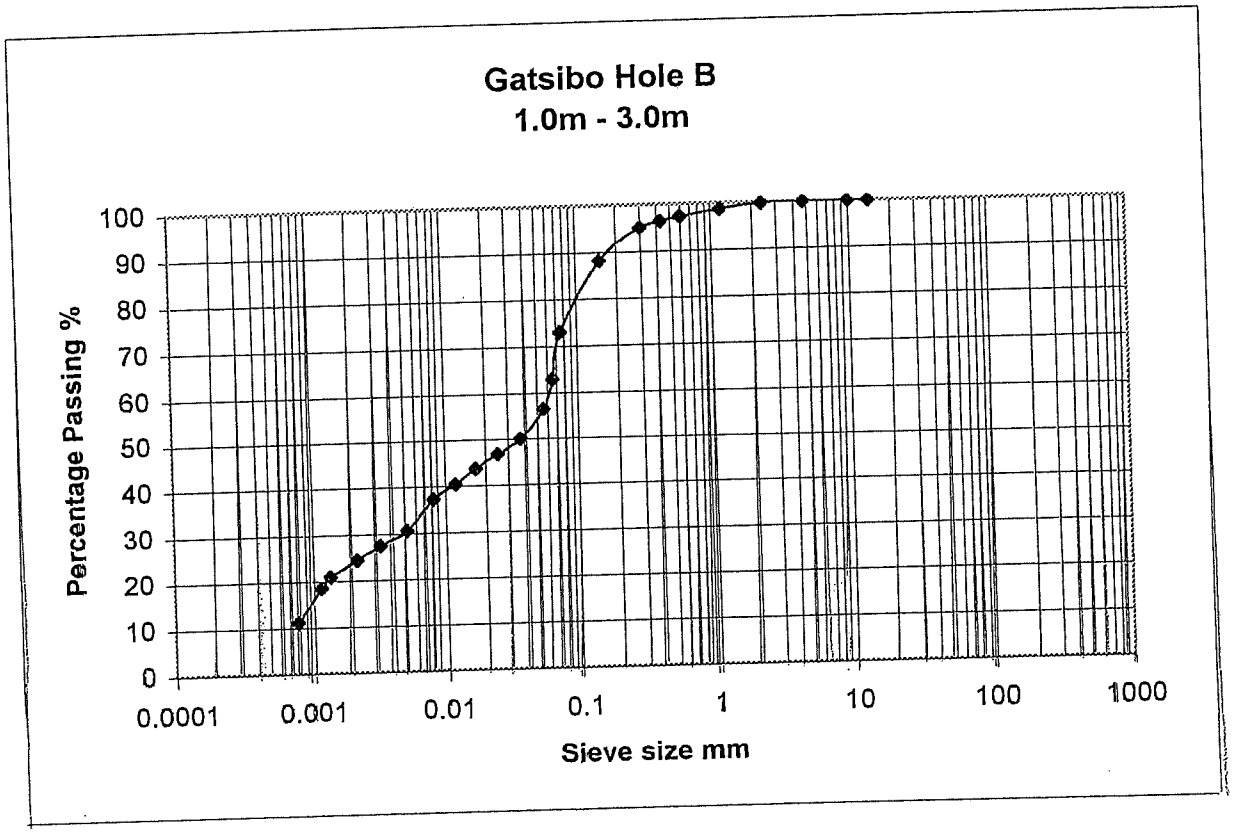


Size range of grains

Aids to size identification

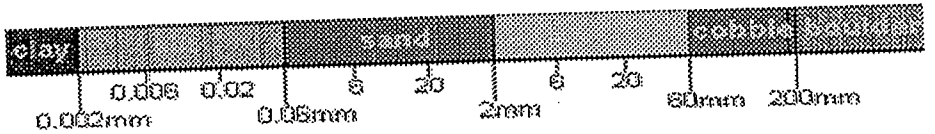


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	99.8
1.18	98.8
0.6	97.4
0.425	96.4
0.3	95
0.15	88.2
0.075	73
0.065	63.1
0.055	56.6
0.037	50.1
0.025	46.9
0.017	43.7
0.012	40.4
0.0082	37.2
0.0052	30.7
0.0033	27.5
0.0022	24.5
0.0014	21
0.0012	18.5
0.0008	11.3

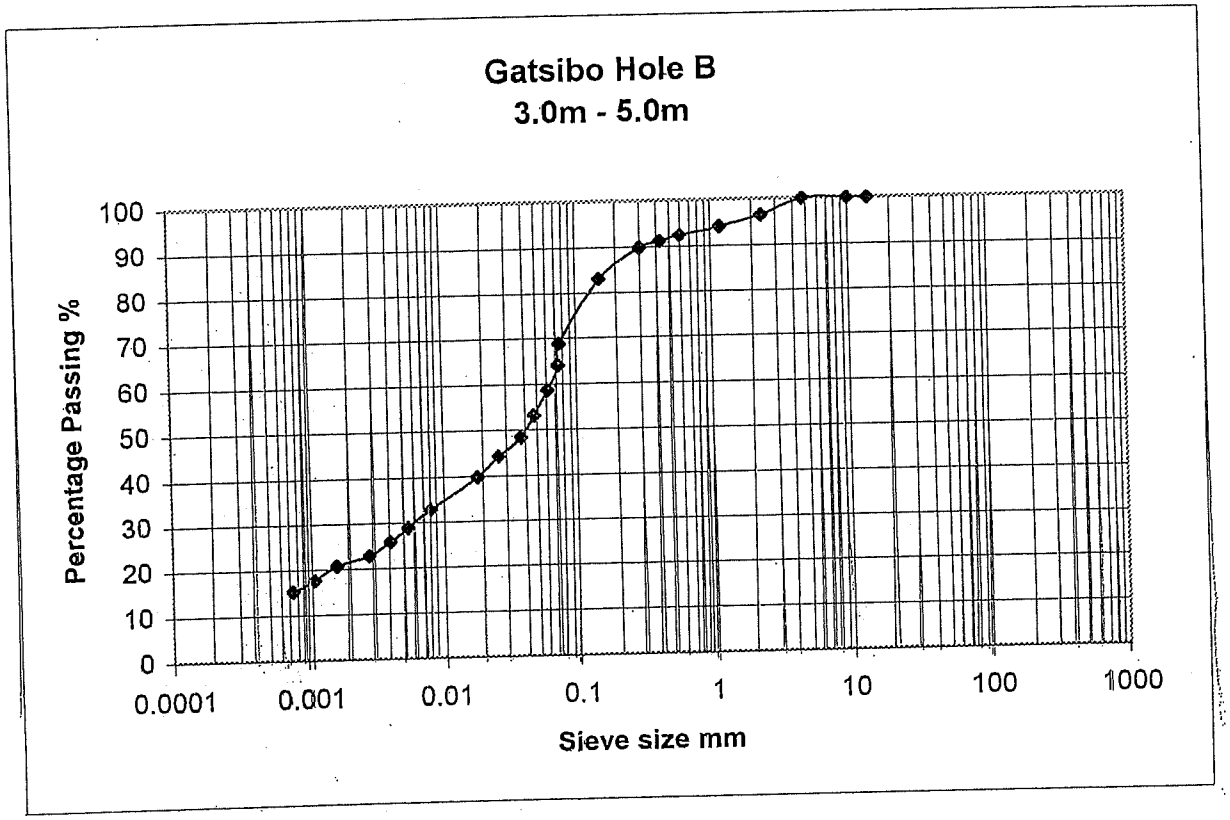


Size range of grains

Aids to size identification

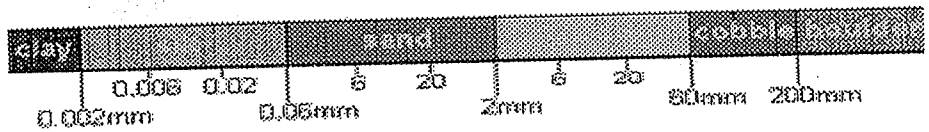


Sieve size mm	%Passing
14	100
10	100
4.75	100
2.36	96.6
1.18	94.2
0.6	92.4
0.425	91.2
0.3	89.8
0.15	83
0.075	68.8
0.073	64.1
0.061	58.6
0.048	53.1
0.038	48.3
0.026	44.4
0.018	39.8
0.008	32.8
0.0054	28.9
0.004	25.8
0.0028	22.8
0.0016	20.7
0.0011	17.6
0.00076	15.3

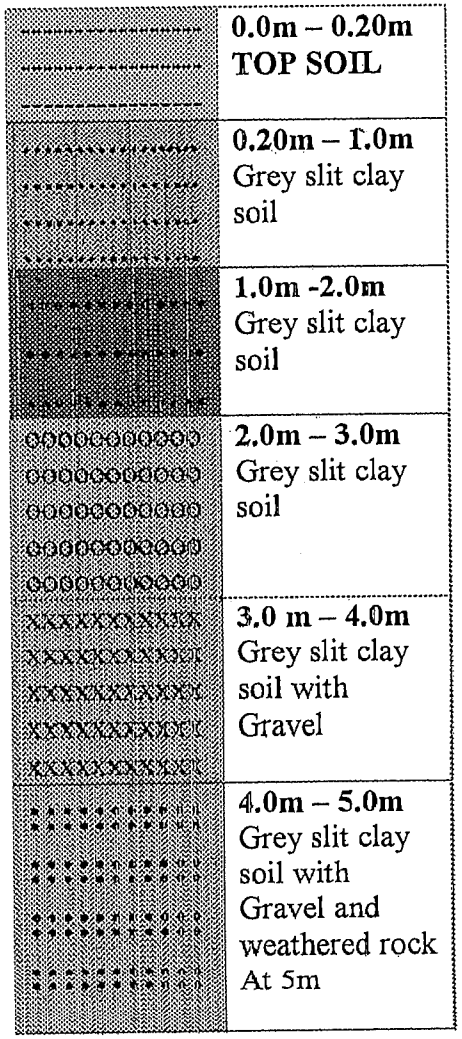


Size range of grains

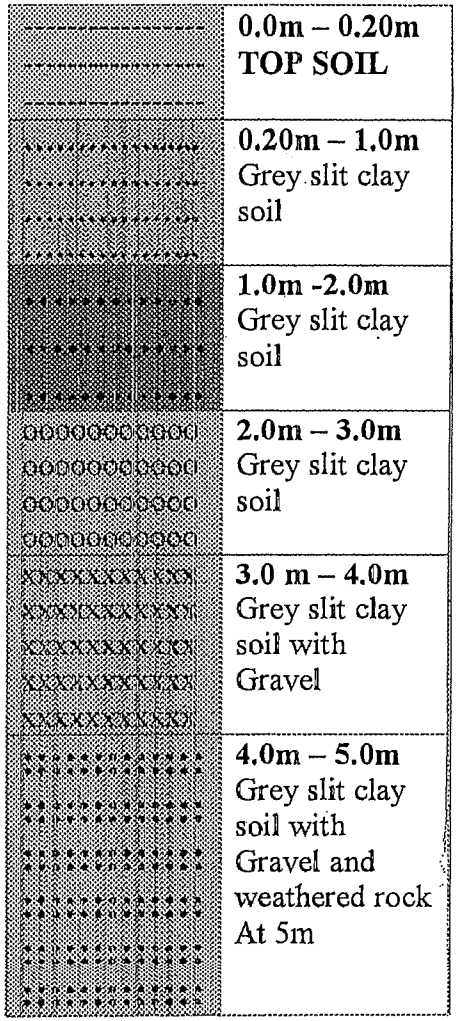
Aids to size identification



GATSIBO HOLE A



GATSIBO HOLE B



5. Water Quality Test

National University of Rwanda
Université Nationale du Rwanda

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Website: www.nur.ac.rw

WATER QUALITY TESTING REPORT

SANYU CONSULTANTS INC.

	Unit	N° 2: Gashora	N° 21: Remera	N° 22: Rurenge	N° 31: Rugarama
pH		7.65	7.09	7.08	7.49
E. Conductivity	µS/cm	21.0	210	151.8	423
Dissolved Oxygen	mg/l	5.3	2.0	6.2	4.5
Suspended Solids	mg/l	3330	7	189	61
Total Nitrogen	mg/l	1.2	0.7	7.5	3.25
Arsenic	mg/l	0.0	0.0	0.0	0.0
Copper	mg/l	0.00	0.06	0.00	0.00
Zinc	mg/l	0.00	0.00	0.00	0.04
COD	mg/l	2	0	0	6

BIRORI Mardochée

Chef de laboratoire

21/04/2009

Excellence in Education and Service to the People

6. Geological Survey

Co-ordinate	STUDY FOR IRRIGATED		Sheet 1 of 1
E 30 12.190	AGRICULTURE EASTERN RWANDA		
N 2 14.396	**BUGESERA 2**		Date 31st, May 2009
G.L. 1356.37	**SITE DRILLING LOG**		Drillhole No. : BH 1

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows) N VALUE	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST Bar	LUGION	PIZOMETER	DESCRIPTION OF STRATA
		0.0													MOIST REDDISH BROWN CLAY WITH SAND GRAVEL
1.5M		0.0	1.5	6 8 14 31 33 92		1.5		B1							
		1.5	3.0	blows=REFUSAL	x x x x x x x x x x			D2 B3	⬇						MOIST YELLOWISH STFF CLAY WITH SAND
4		3.0	4.0		x x x x			D4	⬇	1.00	0.50				WEATHERED SANDSTONE
5		4.0	5.0		x x x x x x x					1.00	0.60				
6.5	1.10	5.0	6.5		x x x x					1.50	0.45				WEATHERED SANDSTONE-GRANITE
8		6.5	8.0		x x x x					1.50	0.50	1.00 2.00 3.00 1.00	1.06 1,06 1.13 1.46		WEATHERED SANDSTONE-GRANITE
9.5		8.0	9.5		x x x					1.50	0.50				WEATHERED SANDSTONE-GRANITE
11	1.00	9.5	11.0							1.50	1.50	3.00 4.00 5.00	0.68 0.92 0.77		HIGHLY WEATHERED SANDSTONE-GRANITE
END OF BORE HOLE 1												6.00 3.00 4.00 5.00 6.00	0.95 0.64 0.76 0.83 0.93	PZ	HIGHLY WEATHERED GRANITE

N SPT : Blows coun
PZ : Pizo meter
D: SPT Shoe sample
: SPT TEST r

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 10 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate E 30 12.190 Scale 2 14.396 G.L. 1351.38	STUDY FOR IRRIGATED AGRICULTURE EASTERN RWANDA DAM SITE BUGESERA 2 SITE DRILLING LOG		Sheet 1 of 1 Date May 2009
Centre position			Drillhole No. : BH 2

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows) N VALUE					Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST Bar	LUGION	PIZOMETER	DESCRIPTION OF STRATA
		0.0							x x x x x x										GREY MOIST CLAY WITH SILTY SAND
1.5M		0.0	1.5	5	3	3	3	3	12 x x x	1.5		B1							
									x x x x x x			D2							MOIST YELLOWISH GREY CLY WITH FINE SAND
3.0M		1.5	3.0	4	7	4	4	5	20 x x			B3							
									x x			D4							MOIST YELLOW CLAY WITH SAND GRAVEL
4.5		3.0	4.5	6	3	4	4	4	15 x			B5							
									x x x x x			D6							MOIST GRAVEL SAND, YELLOW
5		4.5	5.0						x			B7							
									x x x							2.00	3.20		MOIST STIFF YELLOW SILT SAND
6		5.0	6.0	9	6	9	11	12	38 x			B8				3.00	2.20		
									x x x			D9							YELLOWISH GREY CLAY SAND GRAVEL
7		6.0	7.5						x			B10							
				50blows=REFUSA					x x x			D11							
9		7.5	9.0							7.5				1.50	1.30				HIGHLY WEATHERED SAND-GRANITE
10		9.0	10.0											1.00	0.50				
																2.00	1.06		HIGHLY WEATHERED SAND-GRANITE
11		10.0	10.5											0.50	0.40	4.00	0.76		
12		10.5	12.0											1.50	0.60				HIGHLY WEATHERED SANDSTONE-GRANITE
	10.50																		HIGHLY WEATHERED GRANITE
13		12.0	13.5											1.50	0.90				
																6.00	0.78		HIGHLY WEATHERED GRANITE
15		13.5	15.1											1.55	1.20	8.00	0.81		
END OF BORE HOLE 2																			

N SPT : Blows coun
PZ : Pizo meter
D: SPT Shoe sample
: SPT TEST r

Notes : Collapse of formation after packer test

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 15 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate	STUDY FOR IRRIGATED		Sheet 1 of 1
E 30 12.190	AGRICULTURE EASTERN RWANDA		
S 2 14.396	DAM SITE BUGESERA 2		Date May 2009
G.L. 1357.00	SITE DRILLING LOC		
Centre position			Drillhole No. : BH 3

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA: Depth (m) From	To	N (Blows) N VALUE	Legend	Change of strata: Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST: Bar	LUGION	PIZOMETER	DESCRIPTION OF STRATA
		0.0													
															MOIST REDDISH BROWN SOFT CLAY
1.5M		0.0	1.5	6 4 3 4 6 17		1.5		B1							
					x x			D2	⬇						MOIST YELLOWISH BROWN STIFF CLAY WITH SAND GRAVEL=MURRAM
3.0M		1.5	3.0	18 13 8 11 8 40	x x			B3							
					x			D4	⬇						MOIST YELLOWISH BROWN STIFF CLAY WITH SAND GRAVEL
4.5		3.0	4.5	50 BLOWS=REFUSAL	x										
					x x			D6	⬇			3.00	1.17		WEATHERED SANDSTONE-GRANITE
5		4.5	5.0		x			B7							
6.5		5.0	6.5							1.50	0.65				WEATHERED SANDSTONE-GRANITE
8		6.5	8.0							1.50	0.70				WEATHERED SANDSTONE-GRANITE
9.5		8.0	9.5												WEATHERED SANDSTONE-GRANITE
										1.50	1.00				
												5.00	1.44		WEATHERED SANDSTONE-GRANITE
10		9.5	10.1							0.50	0.35				
END OF BORE HOLE 3														PZ	

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 15 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

BPC&ENGINEERING SERVICES LTD		PROJECT	AGRICULTURE EASTERN RWANDA	Sheet 1 of 1
CLIENT	SANYU CONSULTANT-JICA			
N		LOCATION	BUGESERA 2	Date june 2009
G.L.	**DAILY REPORT**			Drillhole No. : BH 1

BH1

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT				parker data							
					Depth m	Preesue=kgf		Lugion	Water leve	Core Run	re Recove	Sample N0
31-May-09	0700-0800	**Start of Days shift**-Travel to site										
	0800-1300	Moving Rig to BH1										
01-Jun-09	0800-1800	Stansby Mechanical breakdown										
02-Jun-09	0800-1800	Stansby Mechanical breakdown										
	1800	End of Days Shift										
03-Jun-09	0700-0800	**Start of Days shift**-Travel to site										
	0800-0830	Set up Rig on BoreHole BH 2										
	0830-1540	Move Rig and Equipent to BH 1										
	1540-1600	Set up Rig on BoreHole BH 1										
	1600-1620	Connect Auger										
	1620-1700	Augering	Reddish Brown sandy Gravelly clay			0.00-1.50m						B1
	1700-1720	SPT				1.50-1.95M	6/6,3/8,3/14,3/31,3/33=N92					D2
	1720-1800	Augering	Dry Yellowish Grey sandy silty Clay			1.50-3.0M						B3
	1800-1820	SPT				3.00-3.20M	6/50,=REFUSAL					D4
	1820	END OF SHIFT			3.00m				Dry			
04-Jun-09	0700-0810	Start of Days shift-Travel to site										
	0810-0830	Fuel and Service			3.00m				Drt			
	0830-0900	Clean the core barrel										
	0900-0940	Drill				3.00-4.00m				1.00m	0.50m	
	0940-1000	Raise and Lower core barrel										
	1000-1100	Drill				4.00-5.00				1.00m	0.60m	
	1100-1120	Raise and Lower core barrel							1.10m			
	1120-1140	Insert casing										
	1140-1200	Lower parker Equipment										
	1200-1300	parker test			5	0.00-5.00m	10	1.06				
							20	1.06				
							30	1.13				
							10	1.46				
	1300-1400	Withdraw casing										
	1400-1440	Lower core barrel										
	1440-1510	Drill barrel could not hold the sample hence Augering used				5.00-6.50				1.5	0.45	
	1510-1530	Raise and Lower core barrel										
	1530-1600	Drill Sample collected by Auger due to segregstion				6.50-8.0				1.5	0.5	
	1600-1620	Raise and Lower core barrel										
	1620-1700	Drill Sample collected by Auger due to segregstion				8.00-9.5M				1.5	0,5	
	1700-1720	Raise and lower core barrel										
	1720-1800	Drill				9.5-11.0				1.5	1.5	
	1800-1830	Raise core barrel							1.00m			
	1830	END OF DAYS SHIFT										
05-Jun-09	0700-0730	**Start of Days shift**-Travel to site										
	0700-8000	Fuel the truck and move to site										
	8000-9000	Fuel rig and service							1.4m			
	0900--0930	Insert casing										
	0930-1000	Lower parker Equipment			10.0m	5.0-10.0m						
	1000--1200	parker test					3bar	0.68				
							4bar	0.916				
							5bar	0.773				
							6bar	0.955				
							3bar	0.644				
							4bar	0.766				
							5bar	0.826				
							6bar	0.933				
	1200-1230	Withdraw casing										
	1230-1330	Inser perforated PVC										
	DISMATLE RIG=END OF BORE 1				11m							

BPC&ENGINEERING SERVICES LTD														Sheet 1 of 1			
CLIENT		SANYU CONSULTANT-JICA					PROJECT	AGRICULTURE EASTERN RWANDA									
N																	
E						LOCATION	BUGESERA 2							Date 7th June 2009			
G.L.		**DAILY REPORT**												Drillhole No. 2			
BH2																	
Centre position																	
Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT							parker data								
								Depth	Depth Range	eesue=B	Lugion	SPT	Water Lev	Core Run	ore Recover	Sample No	
26-May-09	0700-0800	**Start of Days shift**-Travel to site															
	0800-1300	Mechanical problem															
	1330-1400	Dismatling the Rig															
	1400-1800	Moving the Rig to the Bore Hole 2															
	1800	End of Days Shift															
27-May-09	0700-0800	**Start of Days shift**-Travel to site															
	0800-0950	Set up Rig on BoreHole BH 2															
	0950-1000	Preparating for Augering															
	1000-1100	Augering		Moist Grey brown Silty sandy CLAY				0	0.00-1.50M								B1
	1100-1130	SPT							1.50-1.95M	6/5,3/3,3/3,3/3,3/3=N12							D2
	1130-1230	Augering							1.50-3.0M								B3
	1230-1300	SPT							3.0-3.45M	6/4,3/7,4/4,3/4,3/5=N20							D4
	1300-1345	Augering		Moist Yellowish Grey sandy silty Gravel					3.00-4.50								B5
	1345-1410	SPT							4.50-4.95M	6/6,3/3,3/4,3/4,3/4=N15							D6
	1410-1500	Augering		Moist sandy Gravelly Clay					4.50-5.00M								B7
	1500-1530	Insert casing															
	1530-1550	Lower parker Equipment															
	1550-1650	parker test						5m	0.00-5.00m	2bar	3.2Ltrs/min						
										3bar	2.2Ltra/min						
	1650-1700	Raise parker Equipment															
	1700-1730	Withdraw casing						5.0m					Nil				
	1730	End of Days Shift															
28-May-09	0700-0730	**Start of Days shift**-Travel to site															
	0730-0830	Fuel & Service Rig						5.0m					Nil				
	0830--0900	Augering		Moist soft Yellowish Grey silty sandy clay					5.00-6.00M								B8
	0900-0945	SPT							6.00-6.45M	6/9,3/6,3/9,3/11,3/12=N38							D9
	0945-1030	Augering		Moist Yellowish Grey clayey silty sandy G					6.00-7.50M								B10
	1030-1115	SPT							7.5-7.95M	6/25,3/50,=**REFUSAL**							D11
	1115-1125	Lower core barrel															
	1125-1300	Drill							7.50-9.00					1.5	1.3		
	1300-1330	Raise and Lower core barrel															
	1330-1400	Drill							9.0-10.00M					1	0.5		
	1400-1425	Raise core barrel															
	1425-1500	Insert casing															
	1500-1530	Lower parker Equipment															
	1530-1700	parker test						10	5.00-10.00	2bar	1.06						
	1700-1745	Raise parker Equipment								4bar	0.76						
	1745-1800	Lower core barrel															
	1800-1830	Drill							10.00-10.50					0.5	0.5		
	1830-1900	Raise core barrel						10.5					**0.90m**				
	1900	END OF SHIFT															
29-May-09	0700-0800	**Start of Days shift**-Travel to site															
	0800-0830	Fuel & Service Rig						10.5					1.9				
	0830-0900	Lower core barrel															
	0900-1000	Drill							10.50-12.00					1.5	0.6		
	1000-1030	Raise and Lower core barrel															
	1030-1230	Drill							12.00-13.50					1.5	0.9		
	1230-1300	Raise and Lower core barrel															
	1300-1430	Drill							13.5-15.05					1.5	1.2		
	1430-1500	Raise core barrel															
	1500-1600	Insert casing															
	1600-1615	parker test						15	10.00-15.00	6 bar	0.78						
	1615-1700	Parker test								8 bar	0.81						
	1700-17300	Raise parker Equipment															
	1730-1800	Withdraw casing															
	1800-1830	Insert Paforated PVC pipe-Collapse of the hole after packer test						15.5m									
		End of Bore hole 2															
	1830-1900	**Dismatling the Rig**															

BPC&ENGINEERING SERVICES LTD CLIENT SANYU CONSULTANT-JICA	PROJECT	AGRICULTURE EASTERN RWANDA	Sheet 1 of 1
N	LOCATION	BUGESERA 2	Date 5TH JUNE 2009
G.L.	**DAILY REPORT**		Drillhole No. : BH 3

BH3

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT					parker data						
						Depth m	Preesue=Bar		Lugion	Water level	Core Run	Core Recovere	Sample N0
30-May-09	0700-0750	**Start of Days shift**-Travel to site											
	0730-1100	Moving and setting Rig BH3											
	1100-1130	Preparation for Augering											
	1130-1200	Augering Reddish Brown loose Clay with silt sand					0.00-1.50						B1
	1200-1230	SPT					1.5-1.95	6/6,3/4,3/3,3/4,3/6=N17					D2
	1230-1300	Augering Yellow stiff clay with Gravel=murram					1.50-3.0						B3
	1300-1330	SPT					3.00-3.45	6/18,3/13,3/8,3/11,3/8=N50					D4
	1330-1400	Augering Yellow stiff clay with sand Gravel					3.00-4.5						B5
	1400-1430	SPT					4.5-4.6	>50Blows=REFUSAL					D6
	1430-1500	Proof by Augering STIFF YELLOW CALY WITH SAND GRAVEL					4.5-5.0						B7
	1500-1520	Insertng Casing											
	1520-1530	Lower packer test equipment											
	1530-1600	Packer test				5	0.00-5.00	3	1.17				
	1600-1610	Withdraw packer and casing											
	1610-1630	Lower core barrel											
	1630-1730	Drill					5-6.5				1.5	0.65	
	1730-1800	Raise core barrel											
	1800	End of shift											
31-May-09	0700-0750	**Start of Days shift**-Travel to site											
	0730-0800	Fuel and Service											
	0800-1830	Lower core barrel											
	1830-1000	Drill					6.5-8.0				1.5	0.7	
	1000-1030	Raise and Lower core barrel											
	1030-1230	Drill					8.5-9.5				1.5	1	
	1230-1300	Raise and Lower core barrel											
	1300-1445	Drill					9.5-10.0				1.5	0.35	
	1445-1500	Raise core barrel											
	1500=1530	Insert casing											
	1530-1600	Lower parker Equipment											
	1600-1630	parker test				10	5-10	5	1.44				
	1630-1640	Withdrawpacker											
	1640-1700	Install Perforated Pvc .Pipe could not go to the end due to collapse of the wall after packer test											
	1820	END OF SHIFT											
	DISMATLE RIG=END OF BOR3					11m							

Co-ordinate	STUDY FOR IRRIGATED		Sheet 1 of 1
E 30 32.193	AGRICULTURE EASTERN RWANDA		Date 11-Jun-09
S 2 03.930	DAM SITE NGOMA 21		
G.L. 1423.30	SITE DRILLING LOG		Drillhole No. : BH1

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows)					N VALU	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST LUGION	PIZOMETER	DESCRIPTION OF STRATA
		0.0								x x x x x x x x									MOIST DARK BROWN SILTY CLAY
1.5M		0.0	1.5	2	1	2	1	1	5		1.5		B1						
		1.5	3.0							x x x x x x x x			D2						MOIST REDDISH BROWN SILTY CLAY
3.0M		1.5	3.0	3	3	3	3	3	12		3.0		B3						
		3.0	4.5							x x			D4						MOIST REDDISH BROWN SILTY CLAY
4.5		3.0	4.5	2	1	1	3	3	8		4.5		B5						
		4.5	5.0							x x x x x x			D6			1.00 2.00	0.60 0.33		MOIST REDDISH BROWN SILTY CLAY
5		4.5	5.0								5.0		B7						
		5.0	6.0							x x									MOIST REDDISH BROWN STIFF SILTY CLAY
6		5.0	6.0	4	3	3	3	3	12		6.0		B8						
		6.0	7.5							x x			D9						MOIST REDDISH BROWN STIFF SILTY CLAY
7		6.0	7.5	12	6	8	4	3	21		7.5		B10						
		7.5	9.0							x x			D11						MOIST REDDISH BROWN YELLOWISH GREY STIFF SILTY CLAY WITH GRAVEL
9		7.5	9.0	14	13	14	14	13	54		9.0		B12						
		9.0	10.0							x x x			D13			3.00 4.00	0.60 0.58		MOIST REDDISH YELLOW STIFF SILTY CLAY WITH GRAVEL
10		9.0	10.0								10.0		B14						
END OF BORE HOLE 2										x									

N SPT : Blows coun
PZ : Pizo meter
D: SPT Shoe sample
: SPT TEST r

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 15 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate	STUDY FOR IRRIGATED		Sheet 1 of 1
E 30 32.193	AGRICULTURE EASTERN RWANDA		Date 9-Jun-09
S 2 03.930	DAM SITE NGOMA 21		
G.L. 1414.47	SITE DRILLING LOG		Drillhole No. : BH 2

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows) N VALUE	Legend	Change of Depth (m)	Change of Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER bar	PACKER Lugion	PIZOMETER	DESCRIPTION OF STRATA
		0.0													MOIST DARK BROWN SILTY CLAY
1.5M		0.0	1.5	2 1 1 1 2 5		1.5		B1							
								D2							MOIST REDDISH BROWN SILTY CLAY
3.0M		1.5	3.0	3 3 3 3 3 12				B3							
								D4							MOIST REDDISH BROWN SILTY CLAY
4.5		3.0	4.5	2 3 3 5 4 15				B5							
								D6				1.00 2.00 3.00	0.46 0.33 0.31		MOIST REDDISH BROWN SILTY CLAY
5		4.5	5.0					B7							
															MOIST REDDISH BROWN SILTY CLAY
6		5.0	6.0					B8							
															MOIST REDDISH BROWN SILTY CLAY
7		6.0	7.5	7 5 5 5 5 20				B9							
								D10							
9		7.5	9.0	>50blows=REFUSAL		9.0									REDDISH BROWN SEGREGATED TUFF
10		9.0	10.5							1.50	0.70	0.00	27.33		
															REDDISH BROWN TUFF
12		10.5	12.0							1.50	0.70				
															REDDISH BROWN TUFF
13		12.0	13.5							1.50	1.10				
	10.5														REDDISH BROWN TUFF WITH BOULDER
15		13.5	15.0							1.50	1.15	0.00	40.00		
END OF BORE HOLE 2															

N SPT : Blows coun
PZ : Pizo meter
D: SPT Shoe sample
: SPT TEST r

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 15 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate	STUDY FOR IRRIGATED	Sheet 1 of 1
E 30 32.193	AGRICULTURE EASTERN RWANDA	
S 2 03.930	REMERA DAM - NGOMA 21	Date June 2009
G.L. 143.62	SITE DRILLING LOG	
Centre position		Drillhole No. : BH 3

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows)	N VALU	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER Bar	TEST Lugion	PIZOMETER	DESCRIPTION OF STRATA
		0.0														MOIST REDDISH BROWN STIFF CLAY
1.5M		0.0	1.5	4 3 4 3	13		1.5		B1							
						x x x x x x x x			D2	↓						MOIST REDDISH BROWN STIFF CLAY
3.0M		1.5	3.0	5 4 5 4	17	x x			B3							
						x x			D4	↓						MOIST REDDISH BROWN STIFF CLAY
4.5		3.0	4.5	7 5 7 7	26	x			B5							
						x x x x x x			D6	↓			1bar 2bar 3bar	1.46Lrs/min 1.0Ltr/min 0.68Ltrs/min		MOIST REDDISH BROWN STIFF CLAY
5		4.5	5.0			x			B7				2bar	0.83Lts/min		
						x x							1bar 3bar	0.93Ltr/min 0.57Ltrs/min		MOIST REDDISH BROWN STIFF CLAY
6		5.0	6.0	18 12 8 8	36	x			B8							
						x x x			D9	↓						MOIST REDDISH BROWN STIFF CLAY WITH GRAVEL=MURAM
7		6.0	7.5	10 8 9 9	35	x			B10							
						x x x			D11	↓						MOIST REDDISH BROWN STIFF CLAY WITH GRAVEL=MURAM
8		7.0	8.5						B12							MOIST REDDISH BROWN STIFF CLAY WITH GRAVEL=MURAM
9		8.5	10.0	11 9 8 8	33				B13							
									D14	↓			3bar 4bar	0.35Ltrs/Min* 0.23Ltrs/min*		
10		9.5	10.1								0.50	0.40				
END OF BORE HOLE 3															PZ	

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APEC ENGINEER SERVICES LTD

Borehole depth : 10 m
Logged by :F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

BPC&ENGINEERING SERVICES LTD				Sheet 1 of 1
CLIENT	SANYU CONSULTANT-JICA	PROJECT	AGRICULTURE EASTERN RWANDA	
S 2 03.930				
E 30 32.193		LOCATION	NGOMA 21-REMERA	Date 11th June 2009
G.L. 1423.3	**DAILY REPORT**			Drillhole No. 1

BH1

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT	Depth	Depth Range	parker data Preesue=Bar	parker data Permeability	SPT	Water Level	Core Run	Core Recovered	Sample No
	0600-0630	Start of shift and travel to site									
	0630-0645	Fueling and servicing the rig									
	0645-0745	Moving and setting on BH1									
	0745-0800	Preparation of Auger									
	0800-0820	Augering Moist Dark Brown Silty Clay		0.00-1.5							B1
	0820-0840	SPT		1.5-1.95	6/2,3/1,3/2,3/1,3/1=5						D2
	0840-0900	Augering Moist Reddish Brown silty Clay		1.5-3.0							B3
	0900-0920	SPT		3.0-3.45	6/3,3/3,3/3,3/3,3/3=12						D4
	0920-0940	Augering Moist Reddish Brown silty Clay		3.0-4.5							B5
	0940-1000	SPT		4.5-4.95	6/2,3/1,3/1,3/3,3/3=8						D6
	1000-1020	Augering Moist Reddish Brown silty Clay		4.5-5.0							B7
	1020-1040	Insering casing									
	1040-1100	Lower parker Equipment									
11-Jun-09	1100-1130	parker test		0.0-5.0	1	0.6					
	1130-1200	Withdraw packer and casing			2	0.33					
	1200-1230	Augering Moist Reddish Brown stiff silty Clay		5.0-6.0							B8
	1230-1250	SPT		6.0-6.45	6/4,3/3,3/3,3/3,3/3=N12						D9
	1250-1320	Augering Moist Reddish Brown stiff silty Clay		6.0-7.5							B10
	1320-1340	SPT		7.5-7.95	6/12,3/6,3/8,3/4,3/3=N21						D11
	1340-1400	Augering Moist Reddish Brown Yellowish Grey silty Clay with Gravel		7.5-9.0							B12
	1400-1420	SPT		9.0-9.45	6/14,3/13,3/14,3/14,3/13=N54						D13
	1420-1440	Augering Moist Yellowish,Reddish silty Clay with Gravel		9.0-10.0	3	0.6					B14
	1440-1500	Insering casing			4	0.58					
	1500-1520	Lower parker Equipment									
	1520-1600	parker test									
	1600-1620	Withdraw packer									
	1620-1640	Install the perfprated PVC									
	1640-1700	Withdraw casing									
	1700-1720	Dismatling the Rig									
	1720-1830	Moving the Rig to Loading Zone/Start to mobilize to Ngoma 22									
		End of Bore hole 1									

BPC&ENGINEERING SERVICES LTD			Sheet 1 of 1
CLIENT	SANYU CONSULTANT-	PROJECT AGRICULTURE EASTERN RWANDA	
S 2 03.930			
E 30 32.193	LOCATION NGOMA 21-REMERA		Date 9th June 2009
G.L. 1414.47	**DAILY REPORT**		Drillhole No. 2

BH2

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT	Depth	epth Ran	parker data Bar	Lugion	SPT	Water L	Core Run	e Recov	Sample No
09-Jun-09	1320-1500	Moving and set Rig on Bore Hole 2									
	1500-1520	Preparating for Augering									
	1520-1540	Augering Moist Dark Brown Clay		0.00-1.5							B1
	1540-1600	SPT		1.5-1.95	6/2,3/1,3/1,3/1,3/2=5						D2
	1600-1620	Augering Moist Reddish Brown silty Clay		1.5-3.0							B3
	1620-1640	SPT		3.0-3.45	6/3,3/3,3/3,3/3,3/3=12						D4
	1640-1700	Augering Moist Reddish Brown silty Clay		3.0-4.5							B5
	1700-1720	SPT		4.5-4.95	6/2,3/3,3/5,3/4=13						D6
	1720-1740	Augering Moist Reddish Brown Stiff silty Clay		4.5-6.0							B7
	1740-1800	parker test		0-5	1	0.46					
					2	0.33					
	1800-1820	Augering		6.0-7.5	3	0.31					B8
	1820-1840	SPT		7.5-7.95	6/7,3/5,3/5,3/5,3/5=N20						D9
		END OF SHIFT									
10-Jun-09	0700-0730	Start of shift and travel to site									
	0730-0800	Fueling and servicing the rig									
	0800-0830	Augering Moist Reddish Brown Stiff silty Clay with G		9.50-9.00M							B10
	0830-0840	SPT		9.0-9.2	>50=REFUSAL						D11
	0840-0900	Lower Core barrel									
	0900-0940	Drill		9.0-10.5					1.5	0.7	
	0940-1010	parker test			0	27.33					
	1010-1040	Lower barrel									
	1040-1200	Drill		10.5-12.0					1.5	0.7	
	1200-1230	Raise and Lower									
	1230-1315	**Drill**		12.0-15.5					1.5	1.1	
	1315-1345	Raise and Lower core barr									
	1345-1420	Drill		13.5-15.0					1.5	1.15	
	1420-1440	Raise core barrel									
	1440-1500	Insering casing		6.00-7.50M							
	1500-1520	Lower parker Equipment									
	1520-1550	parker test	15	10.0-15.0	0	40					
	1550-1620	Withdrawpacker									
	1620-1640	Install the perfprated PVC									
	1640-1700	Withdraw casing									
		End of Bore hole 2									
		Dismatling the Rig									

BPC&ENGINEERING SERVICES LTD		PROJECT	AGRICULTURE EASTERN RWANDA	Sheet 1 of 1
CLIENT	SANYU CONSULTANT-JICA			
N		LOCATION	**NGOMA 21**	Date 9TH JUNE 2009
G.L.		**DAILY REPORT**		Drillhole No. : BH 3

BH3

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT	Depth m	parker data					
					Preesue =Bar	Permeability	Water level	Core Run	Core Recovere	Sample N0
07-Jun-09		Mobilise to Ngoma 21 site								
	0700-0740	**Start of Days shift**-Travel to site								
	0730-0800	Fuel and service Rig								
	0800-1300	Move and set on BH 3								
	1300-1320	Preparation for Augering								
	1320-1340	Augering Reddidh Dark Brown Silt Clay		0.00-1.5						B1
	1340-1400	SPT		1.5-1.95	6/4,3/3,3/4,3/4,3/4=N13					D2
	1400-1420	Augering Moist Reddidh Brown stiff Silt Clay		1.50-3.0						B3
	1420-1440	SPT		3.00-3.45	6/5,3/4,3/5,3/4,3/4=N17					D4
	1440-1500	Augering Moist Reddidh Brown stiff Silt Clay		3.00-4.5						B5
	1500-1520	SPT		4.5-4.95	6/7,3/5,3/7,3/7,3/7=N26					D6
	1520-1540	Augering Moist Reddidh Brown stiff Silt Clay		4.5-5.0						B7
08-Jun-09	1540-1550	Insertng Casing								
	1550-1600	Lower packer test equipment								
	1600-1830	Packer test	5	0.00-5.00	1bar	1.46Lrs/min				
					2bar	1.0Ltr/min				
					3bar	0.68Ltrs/min				
					2bar	0.83Lts/min				
					1bar	0.93Ltr/min				
	1830-1900	Withdraw packer and casing			3bar	o.57Ltrs/min				
	1900	End of shift								
	1630-1730	Drill		5-6.5				1.5	0.65	
	1730-1800	Raise core barrel								
	1800	End of shift								
	0700-0730	**Start of Days shift**-Travel to site								
	0730-0800	Fuel and Service								
	0800-0900	Augering Moist Reddidh Brown stiff Silt Clay		5.0-6.0						B8
	0900-0920	SPT		6.0-6.45	6/18,3/12,3/8,3/8,3/8=36					D9
	0920-1000	Augering Moist Reddidh Brown stiff Silt Clay with M		6.0-7.0						B10
	1000-1020	SPT		7.5-7.95	6/10,3/8,3/9,3/9,3/9=33					D11
09-Jun-09	1020-1030	Augering Moist Reddidh Brown stiff Silt Clay with M		7.0-8.5						B12
	1030-1100	Augering Moist Reddidh Brown stiff Silt Clay with M		8.5-10.0						B13
	1100-1120	SPT		8.5-8.95	6/11,3/9,3/8,3/8,3/8 N=33					D14
	1120-1205	parker test	10	5.0-10.0	3bar	0.35Ltrs/Min*				
					4bar	0.23Ltrs/min*				
	1205-1230	Install Perforated Pvc .								
	1720	END BH 3 AND SHIFT TO BH 2								

*=Take was to low could not go to high pressures

Co-ordinate	STUDY FOR IRRIGATED	Sheet 1 of 1
E 30 20.900	AGRICULTURE EASTERN RWANDA	Date 13-Jun-09
S 2 05.618	REMERA DAM - NGOMA 22	
G.L. 1359.31	SITE DRILLING LOG	
Centre position		Drillhole No. : BH 1

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows) N VALU	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST LUGION Bar	Lugion	PIZOMETER	DESCRIPTION OF STRATA
		0.0													
															MOIST REDDISH DARK BROWN SOFT SILTY CLAY
1.5M		0.0	1.5	2 1 2 2 2 7		1.5		B1							
		1.5						D2							MOIST REDDISH BROWN STIFF CLAY
3.0M		1.5	3.0	3 2 2 2 2 8				B3							
		3.0						D4							MOIST REDDISH BROWN STIFF CLAY
4.5		3.0	4.5	4 3 3 3 3 12				B5							
		4.5						D6				1.00	2.93		MOIST REDDISH BROWN STIFF CLAY
												2.00	1.90		
5		4.5	5.0					B7				3.00	1.70		
		5.0													MOIST REDDISH BROWN STIFF CLAY
6		5.0	6.0	8 3 3 3 3 12				B8							
		6.0						D9							MOIST REDDISH BROWN STIFF SILTY CLAY WITH GRACEL
7.5		6.0	7.5	6 6 5 4 6 21				B10							
		7.5						D11							MOIST YELLOWISH BROWN STIFF CLAY WITH GRAVEL
8		7.5	9.0	16 14 14 13 13 54				B12							
		9.0						D13				3.00	1.40		MOIST GREYISH BROWN STIFF CLAY WITH GRAVEL
10		9.0	10.0					B14				4.00	1.51		
												5.00	1.36		
END OF BORE HOLE 1														PZ	

SANYU CONSULTANTS INC.

& ENGINEER SERVICES LTD

Borehole depth : 10 m
Logged by :F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate	STUDY FOR IRRIGATED	Sheet 1 of 1
E 30 20.900	AGRICULTURE EASTERN RWANDA	
Scale 2 05.618	DAM SITE NGOMA 22	Date 15-17th June 2009
G.L. 135356.00	SITE DRILLING LOG	
Centre position		Drillhole No. : BH 2

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows) N VALU	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST LUGION Bar	Lu.	PIZOMETER	DESCRIPTION OF STRATA
		0.0			x x										
					x x										DARK GREY/WHITISH WET CLAY WITH SAND CLAY
					x x										
1.5M		0.0	1.5	2 1 1 1 1 4	x x			B1							
					x x			D2	⬇						
2	Water				x x										DARK GREY/WHITISH WET STIFF SILTY CLAY WITH
					x x										
3.0M		1.5	3.0	>50blows=REFUSAL	x x			B3							
					x x	3.1			⬇						COARSE GRAINED FRAGMENTED QUARTZITIC =BOULDERS
4		3.0	4.0							1.00	0.20				
												1.00	6.40		COARSE GRAINED FRAGMENTED QUARTZITIC BOULDERS WITH
												2.00	4.16		
5.5		4.0	5.5							1.50	0.40	3.00	3.26		
															COARSE GRAINED FRAGMENTED QUARZITIC WITH CLAY
7		5.5	7.0							1.50	0.50				
															COARSE GRAINED FRAGMENTED QUARTZITIC MIXED WITH CLAY
8.5		7.0	8.5							1.50	0.35				
															COARSE GRAINED FRAGMENTED QUARTZITIC BOULDERS WITH CLAY
10		8.5	10.0							1.50	0.40				
												3.00	3.48		COARSE GRAINED FRAGMENTED QUARTZITIC BOULDERS WITH
												4.00	3.46		
11.5		10.0	11.5			10.0				1.00	0.20	5.00	3.73		
															COARSE GRAINED QUARTZITIC WITH CLAY
13		11.5	13.0							1.50	0.40				
															COARSE GRAINED QUARTZITIC WITH CLAY
14.5		13.0	14.5							1.50	0.50				
												5.00	3.65		REDDISH HIGHLY WEATHERD QUARTZITIC BOULDERS WITH
												6.00	3.31		
15		14.5	15.1							1.50	0.30	7.00	3.26		
END OF BORE HOLE 2															

N SPT : Blows coun
PZ : Pizo meter
D: SPT Shoe sample
: SPT TEST r

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Borehole depth : 15 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

Co-ordinate	STUDY FOR IRRIGATED		Sheet 1 of 1
E 30 20.900	AGRICULTURE EASTERN RWANDA		
S 2 05.618	NGOMA 22 RURENGE VALLEY DAM		DATE 19/JUN/2009
G.L. 1358.50	SITE DRILLING LOG		
Centre position			Drillhole No. : BH 3

Depth Scale	Depth to Water (m)	SAMPLING AND INSITU DATA Depth (m) From	To	N (Blows)					N VALU	Legend	Change of strata Depth (m)	Level (m)	Sample	SPT	CORE RUN	CORE RECOV	PACKER TEST Bar	Lugion	PIZOMETER	DESCRIPTION OF STRATA
		0.0																		
																				DARK BROWN MOISTURED CLAY
1.5M		0.0	1.5	2	2	2	2	2	8		1.5		B1							
													D2	⬇						MOIST YELLOWISH BROWN STIFF CLAY
3.0M		1.5	3.0	2	1	2	3	3	9				B3							
	STRACK WATER AT 3.M												D4	⬇						MOIST YELLOWISH BROWN WET CLAY
4.5		3.0	4.5	7	3	2	2	2	9				B5							
													D6	⬇			1.00	1.20		GREYISH BROWN SILTY WET CLAY WITH SAND
5		4.5	5.0										B7				2.00	1,3		
																	3.00	0.88		
6		5.0	6.0	8	9	9	7	8	33				B8							GREYISH BROWN WET SILTY CLAY
													D9	⬇						GREYISH BROWN WET SILTY CLAY
8		6.0	7.5	9	9	7	15	17	48				B10							
													D11	⬇						REDDISH BROWN STIFF WET SILTY CLAY WITH BOULDERS
9		7.5	9.0	15	17	17	19	17	70				B12							
													D13	⬇			3.00	0.93		REDDISH BROWN STIFF CLAY
10		9.0-10.0		50 BLOWS REFUSAL									B14				4.00	0.80		
																	5.00	0.76		
END OF BORE HOLE 3																				

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Borehole depth : 10 m
Logged by : F. O
Checked by : H. G.
Approved by :G.K

Fig. (1)

BPC&ENGINEERING SERVICES					PROJECT	AGRICULTURE EASTERN RWANDA							Sheet 1 of 1	
CLIENT	SANYU CONSULTANT-JICA													
N					LOCATION	**NGOMA 22**							Date 13-14/June/2009	
G.L.					**DAILY REPORT**								Drillhole No. : BH 1	
					BH1									
Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT						parker data						
						Depth m		Preesue= Bar	Permeability	Water level	Core Run	Core Recovered	Sample	
13/6/2009	0700-0730	**Start of Days shift**-Travel to site												
	0730-0800	Fuel and service Rig												
	0800-1100	Waiting for crop evaluation												
	1100-1200	Move the rig to the new location Ngoma 22												
	1200-1210	Preparation for Augering												
	1210-1230	Augering	Reddidh Dark Brown Silt Clay				0.00-1.5						B1	
	1230-1250	SPT					1.5-1.95	6/2,3/1,3/2,3/2,3/2=N7					D2	
	1250-1310	Augering	Moist Reddidh Brown stiff Silt Clay				1.50-3.0						B3	
	1310-1330	SPT					3.00-3.45	6/3,3/2,3/2,3/2,3/2=N8					D4	
	13330-1350	Augering	Moist Reddidh Brown stiff Silt Clay				3.00-4.5						B5	
	1350-1410	SPT					4.5-4.95	6/4,3/3,3/3,3/3,3/3=N12					D6	
	1410-1500	Augering	Moist Reddidh Brown stiff Silt Clay				4.5-5.0						B7	
	1500-1530	Insertng Casing												
	1530-1610	Lower packer test equipment												
	1610-1655	Packer test				5	0.00-5.00	1bar	2.93Lrs/min					
								2bar	1.9Ltr/min					
								3bar	1.7Ltrs/min					
	1655-1710	Withdraw packer and casing												
	1710-1730	Augering	Moist Reddidh Brown stiff Silt Clay				5.0-6.0						B8	
	1730-1750	SPT					6.0-6.95	6/8,3/3,3/3,3/3,3/3=N12					D9	
	1750-1820	Augering	Moist Reddidh Brown stiff Silt Clay with Gravel				6.0-7.5						B10	
	1820-1840	SPT					7.7-7.95	6/6,3/6,3/5,3/4,3/6=N21					D11	
	1840-1900	Augering	MoistYellowish Brown stiff Silt Clay with Gravel				7.5-9.0						B12	
	1900	END SHIFT												
14/6/2009	0700-0730	**Start of Days shift**-Travel to s												
	0730-0840	Fuel and Service												
	0800-0900	SPT					9.0-9.45	6/16,3/14,3/14,3/13,3/13=54					D13	
	0900-0930	Augering	Moist Greyish Brown stiff Silt Clay				9.0-10.0						B14	
	0930-0940	Insertng Casing												
	0940-1000	Lower packer test equipment												
	1000-1100	parker test				10	5.0-10.0	3bar	1.4Ltrs/Min*					
								4bar	1.51Ltrs/min*					
								5bar	1.35Lts/Min					
	1100-1140	Install Perforated Pvc .												
		END BH 1 AND SHIFT TO BH 2												

BPC&ENGINEERING SERVICES LTD		PROJECT	AGRICULTURE EASTERN RWANDA	Sheet 1 and 3 of BH 2
CLIENT	SANYU CONSULTANT-JICA			
N		LOCATION	NGOMA SITE 22	Date 14-16TH JUNE 2009
G.L.	**DAILY REPORT**			Drillhole No. : BH 2

BH 2

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT						parker data					
						Depth m		bar	Lugion	Water level	Core Run	Core Recovere	Sample N0
	0700-0800	Start of days shift and travel to site											
	0800-0830	Fuel and service of rig											
14-Jun-09	0830-0930	DISMENTAL RIG											
	0930-1800	Move rig and equipments toward B/HOLE 2											
		END OF DAY SHIFT											
	0700-0730	Start of days shift and travel to site											
	0730-0750	Fuel and service of rig											
	0750-1300	Move rig and equipments toward B/HOLE 2											
	1300-1330	Preparation for Augering											
	1330-1400	Augering		Moist Dark Grey Black Silty sandy CLAY		0	0.00-1.50M						B1
15-Jun-09	1400-1420	SPT					1.50-1.95M	6/2,3/1,3/1,3/1,3/1=N4					D2
	1420-1440	Augering		Moist Grey Stiff Silty CLAY			1.50-3.0M			2.m water			B3
	1440-1500	SPT					3.0-3.45M	Rock at 3.1m=N value refusal					D4
	1500-1800	Mechanical breakdown											
		END OF DAY SHIFT											
	0700-0730	Start of days shift and travel to site								0.3			
	0730-1450	waiting time rig under repair											
	1450-1500	Lower core barrel											
	1500-1530	Drill				3.0-4.0					1	0.2	
	1530-1600	Raise and Lower barrel											
16-Jun-09	1600-1640	Drill				4.0-5.5					1.5	0.4	
	1640-1700	Raise core barrel				5.5				0.4			
	1700-1720	Insert casing				0.0-5.0		1	6.4				
	1720-1730	Lower packer equipment						2	4.16				
	1730-1830	Packer test						3	3.26				
	1830-1900	Withdraw packer and casing											
		END OF DAYS SHIFT								0.3			
	00600-0630	Start of days shift and travel to site											
	0630-0700	Fueling and service the Rig				5.5				0.3			
	0700-0810	Lower core barrel											
	0810-1030	Drill				5.5-7.0					1.5	0.5	
	1030-1100	Raise and Lower barrel											
	1130-1200	Drill				7.0-8.5					1.5	0.35	
	1200-1230	Raise and Lower barrel											
	1230-1400	Drill				8.5-10					1.5	0.4	
	1400-1430	Raise and Lower barrel								0.3			
	1430-1440	Insert casing						3	3.48				
	1440-1500	Lower packer equipment						4	3.46				
	1500-1520	Packer test				10		5	3.73				
	1520-1540	Withdraw parker and casing											
17-Jun-09	1540-1550	lower core barrel											
	1550-1600	Drill				10.0-11.5					1.5	0.2	
	1600-1630	Raise and Lower barrel											
	1630-1700	Drill				11.50-13.00					1.5	0.4	
	1700-1720	Raise and Lower core barrel											
	1720-1740	Drill				13.0-14.5					1.5	0.5	
	1740-1810	Raise and lower core barrel											
	1810-1840	Drill				14.5-15.1					0.6	0.3	
	1840-1900	Raise and lower core barrel						5	3.653				
	1900-1920	Inser casing						6	3.311				
	1920-1930	Lower packer equipment						7	3.26				
	1930-2030	Packer test											
	2130-2040	Withdraw parker and casing											
	2040-2100	Instal PVC pipes to 13m due to collapse of the hole											
		END OF BH2											

BPC&ENGINEERING SERVICES LTD CLIENT SANYU CONSULTANT-JICA		PROJECT	AGRICULTURE EASTERN RWANDA	Sheet 1 of 1
N		LOCATION	NGOMA SITE 22	Date 18-Jun-09
G.L.	**DAILY REPORT**			Drillhole No. : BH 3

BH3

Date/Day	TIME HRS &Mins	DESCRIPTION OF WORKS CARRIED OUT	Depth m	PACKER TEST Bar	Lugion	Water lev	Core Run	re Recove	Sample N0
18-Jun-09	0700-0730	**Start of Days shift**-Travel to site							
	0730-0800	Fuel and service rig							
	0800-1800	Move rig to BH 3							
		END OF SHIFT							
19-Jun-09	0700-0730	Start of Days shift and Travel to site							
	0730-0800	Fuel the rig							
	0800-0900	Move and Set rig on BH3							
	0900-0920	Preparation for Augrering							
	0920-0950	Auger Dark brown moistured clay	0.0-1.5						B1
	0950-1010	S.P.T	1.5-1.95	6/2 3/2 3/2 3/2 3/2 N=8					D2
	1010-1030	Auger Yellowish brown moistured clay	1.5-3.0						B3
	1030-1050	S.P.T	3.0-3.45	6/2 3/1 3/2 3/3 3/3 N=9					D4
	1050-1120	Auger Yellowish brown moistured clay	3.0-4.5						B5
	1120-1140	S.P.T	4.5-4.95	6/7 3/3 3/2 3/2 3/2 N=9					D6
	1140-1200	Auger Greyish brown clay with sand	4.5-5.0						B7
	1200-1210	Insert casing							
	1210-1220	Lower packer test equipments							
	1220-1320	Packer test	0.0-5.0	1	1.2				
	1320-1330	Withdraw packer and Casing		2	1.3				
	1330-1400	Auger Greyish brown wet clay	5.0-6.0	3	0.88				B8
	1400-1430	S.P.T	6.0-6.45	6/8 3/9 3/9 3/7 3/8 N=33					D9
	1430-1450	Auger Greyish brown wet clay	6.0-7.5						B10
	1450-1520	S.P.T	7.5-7.95	6/9 3/9 3/7 3/15 3/17 N=48					D11
	1520-1530	Auger Reddish brown stiff clay boulders	7.5-9.0						B12
	1530-1540	S.P.T	9.0-9.45	6/15 3/17 3/17 3/19 3/17 N=70					D13
	1540-1610	Auger Reddish brown stiff clay	9.0-10.0						B14
	1610-1640	S.P.T		6/50 BLOWS REFUSAL					
	1640-1700	Insert casing							
	1700-1730	Lower packer test equipments		3	0.93				
	1730-1830	Packer test		4	0.8				
	1830-1840	Withdrawpacker		5	0.76				
	1840-1850	Instal piezometer pipes							
		Withdraw casing							
	1840-1900	**END OF B/H 3**							

7 . Preliminary Scoping on Study Area

7. Preliminary Scoping on Study Area

1 Preliminary Scoping

The possible environmental and social impacts in each project site are shown in Table 1.

Social Environment

No houses will be submerged and its resettlement will not be anticipated. However, the impacts on existing farmlands are estimated due to the impounding reservoir by the project. Some labor farmers were identified as vulnerable people by this study and their livelihood may be lost in case of the submergence of the farmlands in the upstream side of the project site. At the same time, their opportunities to have jobs during the construction stage and due to the increase of crop products at dry seasons are expected by the project. Therefore, the overall impacts on these people are currently not clear. As for land use, the change of land use is anticipated due to the reallocation of farmlands at the operation stage. Since no irrigation systems are currently developed at present at he project sites, and the new irrigation facilities may require an establishment of a new organization for operation and maintenance and it may cause some conflicts among the farmers over the distribution of irrigation water and the unbalanced beneficiaries. As for disasters, some impacts on workers or surrounding farmers may be caused by the construction works. Especially at the site of Gashora No.2, some impacts on the operation of LWH project adjacent to the proposed project may be caused. And also in Rugarama No.31, some impacts of slope collapse at gulley may be caused by the impounding of the reservoir.

Natural Environment

In Rugarama No.31, some impacts of slope collapse at gulley or soil erosion may be caused by the impounding of the reservoir. In Remera No.21 and No.22, some impacts on existing springs may be caused at the operation stage.

Pollution

Not large amount of use of chemical fertilizer or pesticide is identified at each project site. However, the increase of these chemicals at farming or cropping works may be caused by the increase of farmers' income. Especially in Gashora No.2, some impacts on eutrophication at the downstream lake are anticipated due to the increase of such chemicals. At construction stage, the solid waste disposal, inappropriate treatment / disposal of construction wastes and noise / vibration are estimated at each project site. The access roads at each project site to be planned on steep slopes of hillsides may cause the dwelling houses facing along the roads.

Table 1 Preliminary Scoping (4 Project Sites)

	No.	Possible Adverse Impacts	Overall Rating	Planning Stage		Construction Stage					Operation Stage				
				Land Expropriation	Change of Land Use	Construction of Access Road	Excavation Works at Dam Axis	Extraction of Soils and Rocks at Borrow Pit and Quarry Site	Dam Embankment Works	Construction Works of Canals, Intake and Spillways	Establishment of New Water Users Association	Impoundment of Reservoir	Allocation of Irrigated Water	Reallocation of Farming Lands	Cropping Works or Cultivating Works
Social Environment	1	Resettlement													
	2	Local Life / Livelihood	C	C		C	C	C	C	C		C			C
	3	Land Use	B		B									B	
	4	Separation of Communities, Existing Organization	B								B				
	5	Traffic, Local Infrastructures	B			B	B		B	B					
	6	Vulnerable People such as poor, indigenous and minorities	C			C	C		C	C					C
	7	Unbalanced Beneficiaries	B		B						B		B	B	
	8	Archeological Sites and Cultural Assets													
	9	Conflicts in Communities	B	B							B		B	B	
	10	Water right and rights of common													
	11	Public health													
	12	Disaster or infectious diseases	B			B	B	B	B	B		B*1			
Natural Environment	13	Topography / Geology													
	14	Groundwater (Spring)											B*3		
	15	Soil Erosion	B*2									B*2			
	16	Lake / Rivers													
	17	Coastal Areas													
	18	Flora and Fauna													
	19	Meteorology													
	20	Landscape													
	21	Global Warming													
Pollution	22	Air Pollution													
	23	Water Pollution	B												B
	24	Soil Contamination													
	25	Solid Waste Management	B			B	B	B	B	B					
	26	Noise / Vibration	B			B	B	B	B	B					
	27	Ground Subsidence													
	28	Odor													
	29	Bottom sediments													
	30	Traffic Accidents, etc.	B			B	B	B	B	B					

Notes)

*1 : Impacts are anticipated in No.2 Gashora and No.31 Rugarama site.

*2 : Impact is anticipated in No.31 Rugarama site.

*3 : Impacts are anticipated in No.21Remera and No.22 Rurenge sites

Rating Criteria A: Significant impacts, B : Some impacts, C : Not clear (To be studied further), Blanks : Almost no impacts

2 Summary of Possible Impacts, Study mathods and Recommended Mitigation Measures

Table 2 shows the summary of possible impacts, the study methods for the impact levels and recommended mitigation measures towards negative impacts. There no exact information on the land ownership of the agricultural lands at each project site at present, and the accurate data on the land

ownership and the land size need to be acquired at the initiation of the proposed project. As for the impacts on the landless farmers, the possibilities of the increase of employment and allocation of the irrigated lands to them needs to be discussed among the parties concerned. The monitoring will be necessary at construction stage. The monitoring for the discharge and water quality of springs at Remera 21 and Rurenge 22 will be necessary after construction since these water is currently used by the residents.

Table 2 Possible Impacts, Study Methods and Recommended Mitigation measures

Possible Impacts		Rating	Study Method	Recommended Mitigation Measures
Social Environment	Local Life / Livelihood	C	There no exact information on the land ownership of the agricultural lands at each project site at present, and the accurate data on the land ownership and the land size need to be acquired at the initiation of the proposed project.	Preparation of appropriate compensation plan by the project developer, their notice to affected farmers, council meetings toward mutual agreements. Monitoring after compensations.
	Land Use	B	Existing land use and future land use plan should be clarified from the relevant authorities and a project developer.	Preparation of land use plan by the project developer especially on farmlands reallocation plan
	Separation of Communities, Existing Organization	B	Public awareness survey on the willing to participate in the new organization of water use and pay the water use from the parties concerned (Officers, farmers) at the approval of the proposed project	Council meetings among the parties concerned (project developer, sector / cell officers, and beneficiaries). Monitoring at operation stage. Training on operation and maintenance.
	Traffic, Local Infrastructures	B	Household survey along the access roads (e.g. Number of houses, number of households, population, family structure). Review of the construction plans of the constructing companies.	Allotment of traffic guides at construction stage. Monitoring at construction stage.
	Vulnerable People such as poor, indigenous and minorities	C	Socio-economy survey for the landless farmers (population, labor cost, life style and livelihood, etc.) Awareness survey for the proposed project. Interview survey on employment plans to the government.	Preparation of appropriate employment plan including reallocation of lands to landless farmers by the government. Monitoring at operation.
	Unbalanced Beneficiaries	B	Awareness survey on water distribution and beneficiaries to the parties concerned (Officers, farmers)	Council meetings among the parties concerned (project developer, sector / cell officers, and beneficiaries). Monitoring at operation.
	Conflicts in communities	B	Awareness survey on unbalanced beneficiaries to the parties concerned (Officers, farmers)	Council meetings among the parties concerned (project developer, sector / cell officers, beneficiaries). Monitoring at operation.
	Disaster or infectious diseases	B	Topographic and geological survey at basic design or detail design	Council meetings among the parties concerned (MINAGRI, etc.) especially on No.2 Gashora. Adoption of design to reduce disaster
Natural Environment	Soil Erosion	B	Topographic and geological survey at basic design or detail design	Adoption of design to reduce disaster. Review on adoption of the project of No.31 Rugarama.
	Groundwater (Spring)	B	Design method to avoid the adverse impacts on existing springs. Topographic and geological survey at basic design or detail design.	Monitoring of discharge and water quality of springs（No.21 and No.22 sites）.
Pollution	Water Pollution	B	Gashora No.2: Water quality survey for eutrophication at downstream lake. No.21 Remera and No.22 Rurenge: Survey of discharge and water quality of springs	Monitoring at the drainage from the proposed irrigation sites before, during and at construction. Monitoring of discharge and water quality of springs（No.21 and No.22 sites）.
	Solid Waste Management	B	Review of the construction plan including solid waste management of the constructing companies	Appropriate treatment / disposal of solid wastes during construction. Monitoring during construction.
	Noise / Vibration	B	Review of the construction plan of the constructing companies. Monitoring of noise and vibration at construction stage.	Adoption of low noise / vibration equipment or low noise construction methods. Monitoring of noise and vibration at construction stage.
	Traffic Accidents, etc.	B	Review of the construction plan including safety measures of the constructing companies.	Allotment of traffic guides at construction stage. Monitoring at construction stage.

Notes) Rating Criteria A: Significant impacts, B：Some impacts, C：Not clear (To be studied further), Blanks：Almost no impacts

８．　Economic Analysis

ANNEX: Economic Analysis

1. Water Requirement and Irrigable Area at Each Site

Table 1 Total Irrigable Area by Site and Case

Site case	Cropping Pattern	Irrigfation Water Requirement	Irrigation Efficiency	Water Requirement	Total Water Requirement	Effective Reservoir Capacity	Total Irrigable area
		mm	%	m^3/ha	m^3/ha	1000m^3	ha
Bugesera 2 (1)	Banana20%, Pineapple80%	240.10	65	3,694	3,694	375.0	102
Bugesera 2 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	375.0	67
Bugesera 2 (3-1)	Maize45%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	283.76	65	4,366	7,418	375.0	51
Bugesera 2 (3-2)	Paddy 20%	152.63	50	3,053			
Bugesera 3 (1)	Banana10%, Pineapple90%	182.85	65	2,813	2,813	419.6	149
Bugesera 3 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	419.6	75
Bugesera 3 (3-1)	Maize45%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	283.76	65	4,366	7,418	419.6	57
Bugesera 3 (3-2)	Paddy 20%	152.63	50	3,053			
Bugesera 4 (1)	Banana20%, Mangoes20%	734.40	65	11,298	11,298	812.5	72
Bugesera 4 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	812.5	146
Bugesera 4 (3-1)	Maize45%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	283.76	65	4,366	7,418	812.5	110
Bugesera 4 (3-2)	Paddy 20%	152.63	50	3,053			
Ngoma 21(1)	Banana20%, Avocado80%	509.32	65	7,836	7,836	376.3	48
Ngoma 21(2)	Maize75%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	400.46	65	6,161	6,161	376.3	61
Ngoma 21(3-1)	Maize55%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	309.99	65	4,769	7,722	376.3	49
Ngoma 21(3-2)	Paddy 20%	147.64	50	2,953			
Ngoma 22 (1-1)	Pineapple80%	42.74	65	658	3,610	1,132.9	314
Ngoma 22 (1-2)	Paddy 20%	147.64	50	2,953			
Ngoma 22 (2-1)	Maize15%, Vegetables(1) 30%, Vegetables(2)30%, Banana5%	255.29	65	3,928	6,880	1,132.9	165
Ngoma 22 (2-2)	Paddy 20%	147.64	50	2,953			
Gatsibo 31 (1)	Banana10%, Coffee90%	743.71	65	11,442	11,442	14.6	1
Gatsibo 31 (2)	Maize70%, Vegetables(1) 5%, Vegetables(2)5%, Banana20%	486.65	65	7,487	7,487	14.6	2

2. Project Cost: Case 1

Table 2 Cost estimation (Unit: Rwf): Financial Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	21,660,000	10,830,000	10,830,000	1	15,603,000	7,801,500	7,801,500
Coffer Dam	m^3	5,700	1,500	8,550,000	7,011,000	1,539,000	1,300	5,982,000	4,905,240	1,076,760
Cut-off Trench	m^3	4,560	20,000	91,200,000	74,784,000	16,416,000	6,893	48,246,000	39,561,720	8,684,280
Dam	m^3	5,700	111,000	632,700,000	518,814,000	113,886,000	114,612	487,532,000	399,776,240	87,755,760
Spillway	m	319,200	160	51,072,000	43,411,200	7,660,800	210	51,894,000	44,109,900	7,784,100
Outlet Works	LS	34,200,000	1	34,200,000	29,070,000	5,130,000	1	133,573,000	113,537,050	20,035,950
Others	LS	17,100,000	1	17,100,000	8,550,000	8,550,000	1	14,585,000	7,292,500	7,292,500
Pipeline	m	171,000	4,110	702,810,000	618,472,800	84,337,200	3,833	582,709,200	512,784,096	69,925,104
TOTAL				1,559,292,000	1,310,943,000	248,349,000	1	1,340,124,200	1,129,768,246	210,355,954
/ha				15,287,176				8,994,122		

Table 3 Cost estimation (Unit: Rwf): Economic Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	20,793,600	9,963,600	10,830,000	1	14,978,880	7,177,380	7,801,500
Coffer Dam	m^3		1,500	7,989,120	6,450,120	1,539,000	1,300	5,589,581	4,512,821	1,076,760
Cut-off Trench	m^3		20,000	85,217,280	68,801,280	16,416,000	6,893	45,081,062	36,396,782	8,684,280
Dam	m^3		111,000	591,194,880	477,308,880	113,886,000	114,612	455,549,901	367,794,141	87,755,760
Spillway	m		160	47,599,104	39,938,304	7,660,800	210	48,365,208	40,581,108	7,784,100
Outlet Works	LS		1	31,874,400	26,744,400	5,130,000	1	124,490,036	104,454,086	20,035,950
Others	LS		1	16,416,000	7,866,000	8,550,000	1	14,001,600	6,709,100	7,292,500
Pipeline	m		4,110	653,332,176	568,994,976	84,337,200	3,833	541,686,472	471,761,368	69,925,104
TOTAL				1,454,416,560	1,206,067,560	248,349,000	1	1,249,742,740	1,039,386,786	210,355,954
/ha				21,707,710				16,663,237		

Table 4 Cost estimation (Unit: Rwf): Financial Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	16,801,000	8,400,500	8,400,500	1	21,660,000	10,830,000	10,830,000
Coffer Dam	m^3	5,700	1	0	0	0	1,500	8,550,000	7,011,000	1,539,000
Cut-off Trench	m^3	4,560	16,800	151,200,000	123,984,000	27,216,000	24,000	109,440,000	89,740,800	19,699,200
Dam	m^3	5,700	224,905	1,010,900,000	828,938,000	181,962,000	140,000	798,000,000	654,360,000	143,640,000
Spillway	m	319,200	180	15,806,000	13,435,100	2,370,900	250	79,800,000	67,830,000	11,970,000
Outlet Works	LS	34,200,000	1	17,459,000	14,840,150	2,618,850	1	34,200,000	29,070,000	5,130,000
Others	LS	17,100,000	1	15,783,000	7,891,500	7,891,500	1	17,100,000	8,550,000	8,550,000
Pipeline	m	171,000	2,026	186,691,531	164,288,547	22,402,984	2,754	470,934,000	414,421,920	56,512,080
TOTAL				1,414,640,531	1,161,777,797	252,862,734		1,539,684,000	1,281,813,720	257,870,280
/ha				19,647,785				32,076,750		

Table 5 Cost estimation (Unit: Rwf): Economic Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	16,128,960	7,728,460	8,400,500	1	20,793,600	9,963,600	10,830,000
Coffer Dam	m^3		1	0	0	0	1,500	7,989,120	6,450,120	1,539,000
Cut-off Trench	m^3		16,800	141,281,280	114,065,280	27,216,000	24,000	102,260,736	82,561,536	19,699,200
Dam	m^3		224,905	944,584,960	762,622,960	181,962,000	140,000	745,651,200	602,011,200	143,640,000
Spillway	m		180	14,731,192	12,360,292	2,370,900	250	74,373,600	62,403,600	11,970,000
Outlet Works	LS		1	16,271,788	13,652,938	2,618,850	1	31,874,400	26,744,400	5,130,000
Others	LS		1	15,151,680	7,260,180	7,891,500	1	16,416,000	7,866,000	8,550,000
Pipeline	m		2,026	173,548,447	151,145,463	22,402,984	2,754	437,780,246	381,268,166	56,512,080
TOTAL				1,321,698,307	1,068,835,573	252,862,734		1,437,138,902	1,179,268,622	257,870,280
/ha				9,052,728				23,559,654		

Table 6 Cost estimation (Unit: Rwf): Financial Price

			Ngoma22				Gatsibo31			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	21,660,000	10,830,000	10,830,000	1	21,660,000	10,830,000	10,830,000
Coffer Dam	m^3	5,700	1,500	8,550,000	7,011,000	1,539,000	1,500	8,550,000	7,011,000	1,539,000
Cut-off Trench	m^3	4,560	12,000	54,720,000	44,870,400	9,849,600	13,200	60,192,000	49,357,440	10,834,560
Dam	m^3	5,700	65,000	370,500,000	303,810,000	66,690,000	35,000	199,500,000	163,590,000	35,910,000
Spillway	m	319,200	160	51,072,000	43,411,200	7,660,800	100	31,920,000	27,132,000	4,788,000
Outlet Works	LS	34,200,000	1	34,200,000	29,070,000	5,130,000	1	34,200,000	29,070,000	5,130,000
Others	LS	17,100,000	1	17,100,000	8,550,000	8,550,000	1	17,100,000	8,550,000	8,550,000
Pipeline	m	171,000	15,224	2,603,304,000	2,290,907,520	312,396,480	1,500	256,500,000	225,720,000	30,780,000
TOTAL				3,161,106,000	2,738,460,120	422,645,880		629,622,000	521,260,440	108,361,560
/ha				19,158,218						

Table 7 Cost estimation (Unit: Rwf): Economic Price

			Ngoma22				Gatsibo31			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	20,793,600	9,963,600	10,830,000	1	20,793,600	9,963,600	10,830,000
Coffer Dam	m^3		1,500	7,989,120	6,450,120	1,539,000	1,500	7,989,120	6,450,120	1,539,000
Cut-off Trench	m^3		12,000	51,130,368	41,280,768	9,849,600	13,200	56,243,405	45,408,845	10,834,560
Dam	m^3		65,000	346,195,200	279,505,200	66,690,000	35,000	186,412,800	150,502,800	35,910,000
Spillway	m		160	47,599,104	39,938,304	7,660,800	100	29,749,440	24,961,440	4,788,000
Outlet Works	LS		1	31,874,400	26,744,400	5,130,000	1	31,874,400	26,744,400	5,130,000
Others	LS		1	16,416,000	7,866,000	8,550,000	1	16,416,000	7,866,000	8,550,000
Pipeline	m		15,224	2,420,031,398	2,107,634,918	312,396,480	1,500	238,442,400	207,662,400	30,780,000
TOTAL				2,942,029,190	2,519,383,310	422,645,880		587,921,165	479,559,605	108,361,560
/ha				17,830,480						

3. Project Cost: Case 2

Table 8 Cost estimation (Unit: Rwf): Financial Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	21,660,000	10,830,000	10,830,000	1	15,603,000	7,801,500	7,801,500
Coffer Dam	m^3	5,700	1,500	8,550,000	7,011,000	1,539,000	1,300	5,982,000	4,905,240	1,076,760
Cut-off Trench	m^3	4,560	20,000	91,200,000	74,784,000	16,416,000	6,893	48,246,000	39,561,720	8,684,280
Dam	m^3	5,700	111,000	632,700,000	518,814,000	113,886,000	114,612	487,532,000	399,776,240	87,755,760
Spillway	m	319,200	160	51,072,000	43,411,200	7,660,800	210	51,894,000	44,109,900	7,784,100
Outlet Works	LS	34,200,000	1	34,200,000	29,070,000	5,130,000	1	133,573,000	113,537,050	20,035,950
Others	LS	17,100,000	1	17,100,000	8,550,000	8,550,000	1	14,585,000	7,292,500	7,292,500
Pipeline	m	171,000	2,700	461,700,000	406,296,000	55,404,000	1,930	329,952,273	290,358,000	39,594,273
TOTAL				1,318,182,000	1,098,766,200	219,415,800	1	1,087,367,273	907,342,150	180,025,123
/ha				19,674,358				14,498,230		

Table 9 Cost estimation (Unit: Rwf): Economic Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	20,793,600	9,963,600	10,830,000	1	14,978,880	7,177,380	7,801,500
Coffer Dam	m^3		1,500	7,989,120	6,450,120	1,539,000	1,300	5,589,581	4,512,821	1,076,760
Cut-off Trench	m^3		20,000	85,217,280	68,801,280	16,416,000	6,893	45,081,062	36,396,782	8,684,280
Dam	m^3		111,000	591,194,880	477,308,880	113,886,000	114,612	455,549,901	367,794,141	87,755,760
Spillway	m		160	47,599,104	39,938,304	7,660,800	210	48,365,208	40,581,108	7,784,100
Outlet Works	LS		1	31,874,400	26,744,400	5,130,000	1	124,490,036	104,454,086	20,035,950
Others	LS		1	16,416,000	7,866,000	8,550,000	1	14,001,600	6,709,100	7,292,500
Pipeline	m		2,700	429,196,320	373,792,320	55,404,000	1,930	306,723,633	267,129,360	39,594,273
TOTAL				1,230,280,704	1,010,864,904	219,415,800	1	1,014,779,901	834,754,778	180,025,123
/ha				18,362,399				13,530,399		

Table 10 Cost estimation (Unit: Rwf): Financial Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	16,801,000	8,400,500	8,400,500	1	21,660,000	10,830,000	10,830,000
Coffer Dam	m^3	5,700	1	0	0	0	1,500	8,550,000	7,011,000	1,539,000
Cut-off Trench	m^3	4,560	16,800	151,200,000	123,984,000	27,216,000	24,000	109,440,000	89,740,800	19,699,200
Dam	m^3	5,700	224,905	1,010,900,000	828,938,000	181,962,000	140,000	798,000,000	654,360,000	143,640,000
Spillway	m	319,200	180	15,806,000	13,435,100	2,370,900	250	79,800,000	67,830,000	11,970,000
Outlet Works	LS	34,200,000	1	17,459,000	14,840,150	2,618,850	1	34,200,000	29,070,000	5,130,000
Others	LS	17,100,000	1	15,783,000	7,891,500	7,891,500	1	17,100,000	8,550,000	8,550,000
Pipeline	m	171,000	4,108	702,491,586	618,192,596	84,298,990	3,500	598,500,000	526,680,000	71,820,000
TOTAL				1,930,440,586	1,615,681,846	314,758,740		1,667,250,000	1,394,071,800	273,178,200
/ha				13,222,196				27,331,967		

Table 11 Cost estimation (Unit: Rwf): Economic Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	16,128,960	7,728,460	8,400,500	1	20,793,600	9,963,600	10,830,000
Coffer Dam	m^3		1	0	0	0	1,500	7,989,120	6,450,120	1,539,000
Cut-off Trench	m^3		16,800	141,281,280	114,065,280	27,216,000	24,000	102,260,736	82,561,536	19,699,200
Dam	m^3		224,905	944,584,960	762,622,960	181,962,000	140,000	745,651,200	602,011,200	143,640,000
Spillway	m		180	14,731,192	12,360,292	2,370,900	250	74,373,600	62,403,600	11,970,000
Outlet Works	LS		1	16,271,788	13,652,938	2,618,850	1	31,874,400	26,744,400	5,130,000
Others	LS		1	15,151,680	7,260,180	7,891,500	1	16,416,000	7,866,000	8,550,000
Pipeline	m		4,108	653,036,178	568,737,188	84,298,990	3,500	556,365,600	484,545,600	71,820,000
TOTAL				1,801,186,038	1,486,427,298	314,758,740		1,555,724,256	1,282,546,056	273,178,200
/ha				12,336,891				25,503,676		

Table 12 Cost estimation (Unit: Rwf): Financial Price

			Ngoma22				Gatsibo31			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	21,660,000	10,830,000	10,830,000	1	21,660,000	10,830,000	10,830,000
Coffer Dam	m^3	5,700	1,500	8,550,000	7,011,000	1,539,000	1,500	8,550,000	7,011,000	1,539,000
Cut-off Trench	m^3	4,560	12,000	54,720,000	44,870,400	9,849,600	13,200	60,192,000	49,357,440	10,834,560
Dam	m^3	5,700	65,000	370,500,000	303,810,000	66,690,000	35,000	199,500,000	163,590,000	35,910,000
Spillway	m	319,200	160	51,072,000	43,411,200	7,660,800	100	31,920,000	27,132,000	4,788,000
Outlet Works	LS	34,200,000	1	34,200,000	29,070,000	5,130,000	1	34,200,000	29,070,000	5,130,000
Others	LS	17,100,000	1	17,100,000	8,550,000	8,550,000	1	17,100,000	8,550,000	8,550,000
Pipeline	m	171,000	8,000	1,368,000,000	1,203,840,000	164,160,000	1,500	256,500,000	225,720,000	30,780,000
TOTAL				1,925,802,000	1,651,392,600	274,409,400		629,622,000	521,260,440	108,361,560
/ha				11,671,527						

Table 13 Cost estimation (Unit: Rwf): Economic Price

			Ngoma22				Gatsibo31			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	20,793,600	9,963,600	10,830,000	1	20,793,600	9,963,600	10,830,000
Coffer Dam	m^3		1,500	7,989,120	6,450,120	1,539,000	1,500	7,989,120	6,450,120	1,539,000
Cut-off Trench	m^3		12,000	51,130,368	41,280,768	9,849,600	13,200	56,243,405	45,408,845	10,834,560
Dam	m^3		65,000	346,195,200	279,505,200	66,690,000	35,000	186,412,800	150,502,800	35,910,000
Spillway	m		160	47,599,104	39,938,304	7,660,800	100	29,749,440	24,961,440	4,788,000
Outlet Works	LS		1	31,874,400	26,744,400	5,130,000	1	31,874,400	26,744,400	5,130,000
Others	LS		1	16,416,000	7,866,000	8,550,000	1	16,416,000	7,866,000	8,550,000
Pipeline	m		8,000	1,271,692,800	1,107,532,800	164,160,000	1,500	238,442,400	207,662,400	30,780,000
TOTAL				1,793,690,592	1,519,281,192	274,409,400		587,921,165	479,559,605	108,361,560
/ha				10,870,852						

4. Project Cost: Case 3

Table 14 Cost estimation (Unit: Rwf): Financial Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	21,660,000	10,830,000	10,830,000	1	15,603,000	7,801,500	7,801,500
Coffer Dam	m^3	5,700	1,500	8,550,000	7,011,000	1,539,000	1,300	5,982,000	4,905,240	1,076,760
Cut-off Trench	m^3	4,560	20,000	91,200,000	74,784,000	16,416,000	6,893	48,246,000	39,561,720	8,684,280
Dam	m^3	5,700	111,000	632,700,000	518,814,000	113,886,000	114,612	487,532,000	399,776,240	87,755,760
Spillway	m	319,200	160	51,072,000	43,411,200	7,660,800	210	51,894,000	44,109,900	7,784,100
Outlet Works	LS	34,200,000	1	34,200,000	29,070,000	5,130,000	1	133,573,000	113,537,050	20,035,950
Others	LS	17,100,000	1	17,100,000	8,550,000	8,550,000	1	14,585,000	7,292,500	7,292,500
Pipeline	m	171,000	1,644	281,124,000	247,389,120	33,734,880	1,173	200,610,982	176,537,664	24,073,318
TOTAL				1,137,606,000	939,859,320	197,746,680	1	958,025,982	793,521,814	164,504,168
/ha				22,306,000				16,807,473		

Table 15 Cost estimation (Unit: Rwf): Economic Price

			Bugesra2				Bugesra3			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	20,793,600	9,963,600	10,830,000	1	14,978,880	7,177,380	7,801,500
Coffer Dam	m^3		1,500	7,989,120	6,450,120	1,539,000	1,300	5,589,581	4,512,821	1,076,760
Cut-off Trench	m^3		20,000	85,217,280	68,801,280	16,416,000	6,893	45,081,062	36,396,782	8,684,280
Dam	m^3		111,000	591,194,880	477,308,880	113,886,000	114,612	455,549,901	367,794,141	87,755,760
Spillway	m		160	47,599,104	39,938,304	7,660,800	210	48,365,208	40,581,108	7,784,100
Outlet Works	LS		1	31,874,400	26,744,400	5,130,000	1	124,490,036	104,454,086	20,035,950
Others	LS		1	16,416,000	7,866,000	8,550,000	1	14,001,600	6,709,100	7,292,500
Pipeline	m		2,700	261,332,870	227,597,990	33,734,880	1,415	186,487,969	162,414,651	24,073,318
TOTAL				1,062,417,254	864,670,574	197,746,680	1	894,544,237	730,040,069	164,504,168
/ha				15,856,974				11,927,256		

Table 16 Cost estimation (Unit: Rwf): Financial Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS	21,660,000	1	16,801,000	8,400,500	8,400,500	1	21,660,000	10,830,000	10,830,000
Coffer Dam	m^3	5,700	1	0	0	0	1,500	8,550,000	7,011,000	1,539,000
Cut-off Trench	m^3	4,560	16,800	151,200,000	123,984,000	27,216,000	24,000	109,440,000	89,740,800	19,699,200
Dam	m^3	5,700	224,905	1,010,900,000	828,938,000	181,962,000	140,000	798,000,000	654,360,000	143,640,000
Spillway	m	319,200	180	15,806,000	13,435,100	2,370,900	250	79,800,000	67,830,000	11,970,000
Outlet Works	LS	34,200,000	1	17,459,000	14,840,150	2,618,850	1	34,200,000	29,070,000	5,130,000
Others	LS	17,100,000	1	15,783,000	7,891,500	7,891,500	1	17,100,000	8,550,000	8,550,000
Pipeline	m	171,000	2,476	423,419,586	372,609,236	50,810,350	2,249	384,579,000	338,429,520	46,149,480
TOTAL				1,651,368,586	1,370,098,486	281,270,100		1,453,329,000	1,205,821,320	247,507,680
/ha				11,310,744				23,825,066		

Table 17 Cost estimation (Unit: Rwf): Economic Price

			Bugesra4				Ngoma21			
	Unit	Unit Price USD	Q	Cost	F/C	L/C	Q	Cost	F/C	L/C
Preparation, Mobilization	LS		1	16,128,960	7,728,460	8,400,500	1	20,793,600	9,963,600	10,830,000
Coffer Dam	m^3		1	0	0	0	1,500	7,989,120	6,450,120	1,539,000
Cut-off Trench	m^3		16,800	141,281,280	114,065,280	27,216,000	24,000	102,260,736	82,561,536	19,699,200
Dam	m^3		224,905	944,584,960	762,622,960	181,962,000	140,000	745,651,200	602,011,200	143,640,000
Spillway	m		180	14,731,192	12,360,292	2,370,900	250	74,373,600	62,403,600	11,970,000
Outlet Works	LS		1	16,271,788	13,652,938	2,618,850	1	31,874,400	26,744,400	5,130,000
Others	LS		1	15,151,680	7,260,180	7,891,500	1	16,416,000	7,866,000	8,550,000
Pipeline	m		4,080	393,610,847	342,800,497	50,810,350	3,500	357,504,638	311,355,158	46,149,480
TOTAL				1,541,760,707	1,260,490,607	281,270,100		1,356,863,294	1,109,355,614	247,507,680
/ha				10,560,005				22,243,661		

Table 18 O&M Cost (Unit: Rwf): Financial Price

Item	Q'ty	Amount (Rwf per year)		
		Total	F/C	L/C
Dam operator	1M x 12M	24,000	-	24,000
Gate operator	4M x 12M	96,000	-	96,000
Dam cleaning	50 MD	25,000	-	25,000
Road maintenance	50 MD	25,000	-	25,000
Spillway cleaning	50 MD	25,000	-	25,000
Materials for maintenance	LS	15,000	12,000	3,000
Pipeline spare	LS	250,000	225,000	25,000
Total		460,000	237,000	223,000

Table 19 O&M Cost (Unit: Rwf): Economic Price

Item	Q'ty	Amount (Rwf per year)		
		Total	F/C	L/C
Dam operator	1M x 12M	12,000	-	12,000
Gate operator	4M x 12M	48,000	-	48,000
Dam cleaning	50 MD	12,500	-	12,500
Road maintenance	50 MD	12,500	-	12,500
Spillway cleaning	50 MD	12,500	-	12,500
Materials for maintenance	LS	14,040	11,040	3,000
Pipeline spare	LS	232,000	207,000	25,000
Total		343,540	218,040	125,500

5. Unit Price for Financial and Economic Analyses

Table 20 Unit Price

Item	Unit	Financial Price	Economic Price	Remark
Products				
Sorghum	kg	300	276	SCF
Sweet potato	kg	55	51	SCF
Cassava	kg	50	46	SCF
Rice	kg	280	258	SCF
Maize	kg	250	230	SCF
Haricot bean	kg	300	276	SCF
Banana	kg	50	46	SCF
Cabbage	kg	100	92	SCF
Tomato	kg	200	184	SCF
Pineapple	kg	150	138	SCF
Avocado	pcs	50	46	SCF
Mango	kg	400	368	SCF
Coffee (cherry)	kg	600	552	SCF
Seeds/Seedlings				
Sorghum	kg	180	166	SCF
Sweet potato	vine	150	150	non-tradable
Cassava	nos	10	9	SCF
Rice	kg	500	460	SCF
Maize	kg	300	276	SCF
Haricot bean	kg	300	276	SCF
Banana	kg	300	276	SCF
Cabbage	kg	800	736	SCF
Tomato	kg	21,667	19,934	SCF
Pineapple	nos	44	40	SCF
Avocado	seedling	2,000	1,840	SCF
Mango	seedling	1,000	920	SCF
Coffee (cherry)	seedling	25	23	SCF
Fertilizers				
NPK	kg	480	480	no tariff
DAP	kg	480	480	no tariff
Urea	kg	410	410	no tariff
DSP	kg	500	500	no tariff
CAN	kg	400	400	no tariff
Manure	kg	5	5	non-tradable
Pesticides				
Thiodan	liter	11,000	10,120	SCF
Ridomil	kg	10,000	9,200	SCF
Dithane	kg	1,600	1,472	SCF
Dimethoate	liter	6,000	5,520	SCF
Kitazine	liter	8,500	7,820	SCF
Materials				
Multing grass	kg	500	500	non-tradable
Farm Labor	man-day	800	320	Labor conversion factor

Note: Tools such as hoes, saw, shovels re coneerted by SCF to economic price.
Economic price of local materials is equivalent to market price

Table 21 Standard Conversion Factor (Unit: million US$)

Item	2006	2007	2008	Average
(1) Import	548.06	737.19	589.31	624.85
(2) Export	147.30	176.70	145.30	156.43
(3) Import Tax	64.96	66.25	64.99	65.40
(4) Export Tax	0.00	0.00	0.00	0.00
(5) Subsidy for Export	0.00	0.00	0.00	0.00
(6)＝(1)＋(2)	695.36	913.89	734.61	781.29
(7)＝(1)＋(2)＋(3)－(4)＋(5)	760.32	980.14	799.60	846.69
(8)SCF＝(6)÷(7)	0.91	0.93	0.92	0.92

Data: BNR, Statistical year book, MINEFIN
Data on Import and Export: BNR
Data on Import Tax: MINFIN Revenue data
Exchange Rate: Rwanda Statistics and Figures in Year 2008

6. Cost and Benefit of Crops per Ha/Season: Crops only for Presdent Situation

Table 22 Without Project Situation (Financial Price)

Activities	Unit	Sorghum			Sweet Potato			Cassava		
		Unit Price	Quantity	Total Price	Unit Price	Quantity	Total Price	Unit Price	Quantity	Total Price
(A) INCOME										
Main Product	Kg	300	1,200	360,000	55	12,000	660,000	50	10,000	500,000
By-product	Kg									
Total Gross Income				**360,000**			**660,000**			**500,000**
(B) Procution Cost										
Labor										
Clearing land	MD	800	10	8,000	800	10	8,000	800	10	8,000
Plowing	MD	800	66	52,800	800	66	52,800	800	66	52,800
Lotary Plow?	MD	800	50	40,000	800	50	40,000	800	50	40,000
Leveling	MD	800	10	8,000	800	10	8,000	800	10	8,000
Transport and manure application(10t)	MD	800	50	40,000	800	50	40,000	800	50	40,000
Chemical fertilizer application	MD	800	0	0	800	0	0	800	0	0
Planting	MD	800	50	40,000	800	50	40,000	800	50	40,000
Weeding	MD	800	90	72,000	800	90	72,000	800	90	72,000
Pesticide application	MD	800	0	0	800	0	0	800	0	0
Bird chasing (Guarding)	MD	800	45	36,000	800	60	48,000	800	60	48,000
Defanage	MD	800		0	800	10	8,000	800		0
Harvesting	MD	800	10	8,000	800	18	14,400	800	43	34,400
Threshing	MD	800	7	5,600	800		0	800		0
Winnowing	MD	800	6	4,800	800		0	800		0
Drying	MD	800	5	4,000	800		0	800		0
Storing	MD	800	3	2,000	800	20	16,000	800		0
Sub-total			**402**	**321,200**		**434**	**347,200**		**429**	**343,200**
Inputs										
Seeds (Suckers)	Kg	180	30	5,400	150	2,000	300,000	10	10,000	100,000
Manure	Kg	5	10,000	50,000	5	10,000	50,000	5	10,000	50,000
NPK	Kg	480	0	0	480	0	0	480	0	0
Urea	Kg	410	0	0			0			0
Pestcides (Thiodan)	Liter	11,000	0	0			0			0
Pestcides (Ridomil)	Kg			0	10,000	0	0	10,000	0	0
Pestcides (Dithane)	Kg			0	1,600	0	0			0
Pestcides (Dimethoate)	Liter			0	6,000	0	0			0
Sub-total				**55,400**			**350,000**			**150,000**
Grand Total				**376,600**			**697,200**			**493,200**
(C) Net Return				**-16,600**			**-37,200**			**6,800**
(D) Family Labor	% of labor		80	256,960		80	277,760		80	274,560
(E) Production Cost exclude family labor				119,640			419,440			218,640
(F) Net Income				**240,360**			**240,560**			**281,360**

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 23 Without Project Situation (Economic Price)

Activities	Unit	Sorghum			Sweet Potato			Cassava		
		Unit Price	Quantity	Total Price	Unit Price	Quantity	Total Price	Unit Price	Quantity	Total Price
(A) INCOME										
Main Product	Kg	276	1,200	331,200	51	12,000	612,000	46	10,000	460,000
By-product	Kg									
Total Gross Income				**331,200**			**612,000**			**460,000**
(B) Procution Cost										
Labor										
Clearing land	MD	400	10	4,000	400	10	4,000	400	10	4,000
Plowing	MD	400	66	26,400	400	66	26,400	400	66	26,400
Lotary Plow?	MD	400	50	20,000	400	50	20,000	400	50	20,000
Leveling	MD	400	10	4,000	400	10	4,000	400	10	4,000
Transport and manure application(10t)	MD	400	50	20,000	400	50	20,000	400	50	20,000
Chemical fertilizer application	MD	400	0	0	400	0	0	400	0	0
Planting	MD	400	50	20,000	400	50	20,000	400	50	20,000
Weeding	MD	400	90	36,000	400	90	36,000	400	90	36,000
Pesticide application	MD	400	0	0	400	0	0	400	0	0
Bird chasing (Guarding)	MD	400	45	18,000	400	60	24,000	400	60	24,000
Defanage	MD	400		0	400	10	4,000	400		0
Harvesting	MD	400	10	4,000	400	18	7,200	400	43	17,200
Threshing	MD	400	7	2,800	400		0	400		0
Winnowing	MD	400	6	2,400	400		0	400		0
Drying	MD	400	5	2,000	400		0	400		0
Storing	MD	400	3	1,000	400	20	8,000	400		0
Sub-total			**402**	**160,600**		**434**	**173,600**		**429**	**171,600**
Inputs										
Seeds (Suckers)	Kg	166	30	4,980	150	2,000	300,000	9	10,000	90,000
Manure	Kg	5	10,000	50,000	5	10,000	50,000	5	10,000	50,000
NPK	Kg	480	0	0	480	0	0	480	0	0
Urea	Kg	410	0	0			0			0
Pestcides (Thiodan)	Liter	10,120	0	0			0			0
Pestcides (Ridomil)	Kg			0	9,200	0	0	9,200	0	0
Pestcides (Dithane)	Kg			0	1,472	0	0			0
Pestcides (Dimethoate)	Liter			0	5,520	0	0			0
Sub-total				**54,980**			**350,000**			**140,000**
Grand Total				**215,580**			**523,600**			**311,600**
(C) Net Return				**115,620**			**88,400**			**148,400**
(D) Family Labor	% of labor		80	128,480		80	138,880		80	137,280
(E) Production Cost exclude family labor				87,100			384,720			174,320
(F) Net Income				**244,100**			**227,280**			**285,680**

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops per Ha/Season

Table 24 Crop: Rice (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	280	3,000	840,000	5,000	1,400,000	6,200	1,736,000	6,800	1,904,000	7,000	1,960,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**840,000**		**1,400,000**		**1,736,000**		**1,904,000**		**1,960,000**
(B) Procution Cost												
1. Nursery												
Nursery preparation	MD	800	45	36,000	45	36,000	45	36,000	45	36,000	45	36,000
Seeds	Kg	500	10	5,000	10	5,000	10	5,000	10	5,000	10	5,000
Sub-total				**41,000**		**41,000**		**41,000**		**41,000**		**41,000**
2. Production (Labor)												
Land clearing	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Plowing	MD	800	66	52,800	66	52,800	66	52,800	66	52,800	66	52,800
Puddling	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Paddying	MD	800	65	52,000	65	52,000	65	52,000	65	52,000	65	52,000
Mixing	MD	800	40	32,000	40	32,000	40	32,000	40	32,000	40	32,000
Leveling	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Chemical Fertilizing	MD	800	0	-	5	4,000	8	6,400	9	7,200	10	8,000
Transplanting	MD	800	60	48,000	60	48,000	60	48,000	60	48,000	60	48,000
Weeding	MD	800	95	76,000	95	76,000	95	76,000	95	76,000	95	76,000
Watering	MD	800	20	16,000	20	16,000	20	16,000	20	16,000	20	16,000
Pestcides application	MD	800	20	16,000	20	16,000	20	16,000	20	16,000	20	16,000
Guarding / bird chasing	MD	800	75	60,000	75	60,000	75	60,000	75	60,000	75	60,000
Harvesting	MD	800	9	7,200	14	11,200	18	14,400	19	15,200	20	16,000
Threshing	MD	800	26	20,800	43	34,400	53	42,400	58	46,400	60	48,000
Drying	MD	800	9	7,200	14	11,200	18	14,400	19	15,200	20	16,000
Winnowing	MD	800	9	7,200	14	11,200	18	14,400	19	15,200	20	16,000
Storing and Weighing	MD	800	4	3,200	7	5,600	9	7,200	10	8,000	10	8,000
Sub-total			568	**454,400**	608	**486,400**	635	**508,000**	645	**516,000**	651	**520,800**
3. Production (Inputs)												
Fertilizer: DAP	Kg	480	0	-	50	24,000	80	38,400	90	43,200	100	48,000
Fertilizer: Urea	Kg	410	0	-	50	20,500	80	32,800	90	36,900	100	41,000
Pesticdes: Kitazine	Liter	8,500	3	25,500	3	25,500	3	25,500	3	25,500	3	25,500
Pesticdes: Dimethoate	Liter	6,000	3	18,000	3	18,000	3	18,000	3	18,000	3	18,000
Sub-total				**43,500**		**88,000**		**114,700**		**123,600**		**132,500**
4. Other												
Land tax	1ha	10,000	1	10,000	1	10,000	1	10,000	1	10,000	1	10,000
Contribution	1ha	20,000	1	20,000	1	20,000	1	20,000	1	20,000	1	20,000
Sub-total				**30,000**		**30,000**		**30,000**		**30,000**		**30,000**
Grand Total				**568,900**		**645,400**		**693,700**		**710,600**		**724,300**
(C) Net Return				**271,100**		**754,600**		**1,042,300**		**1,193,400**		**1,235,700**
(D) Family Labor	% of labor		80	392,320	80	417,920	80	435,200	80	441,600	80	445,440
(E) Production Cost exclude family labor				(121,220)		336,680		607,100		751,800		790,260
(F) Net Income				**961,220**		**1,063,320**		**1,128,900**		**1,152,200**		**1,169,740**
Incremental Achievement					50%		80%		95%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 25 Crop: Rice (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	258	3,000	774,000	5,000	1,290,000	6,200	1,599,600	6,800	1,754,400	7,000	1,806,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**774,000**		**1,290,000**		**1,599,600**		**1,754,400**		**1,806,000**
(B) Procution Cost												
1. Nursery												
Nursery preparation	MD	400	45	18,000	45	18,000	45	18,000	45	18,000	45	18,000
Seeds	Kg	460	10	4,600	10	4,600	10	4,600	10	4,600	10	4,600
Sub-total				**22,600**		**22,600**		**22,600**		**22,600**		**22,600**
2. Production (Labor)												
Land clearing	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Plowing	MD	400	66	26,400	66	26,400	66	26,400	66	26,400	66	26,400
Puddling	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Paddying	MD	400	65	26,000	65	26,000	65	26,000	65	26,000	65	26,000
Mixing	MD	400	40	16,000	40	16,000	40	16,000	40	16,000	40	16,000
Leveling	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Chemical Fertilizing	MD	400	0	-	5	2,000	8	3,200	9	3,600	10	4,000
Transplanting	MD	400	60	24,000	60	24,000	60	24,000	60	24,000	60	24,000
Weeding	MD	400	95	38,000	95	38,000	95	38,000	95	38,000	95	38,000
Watering	MD	400	20	8,000	20	8,000	20	8,000	20	8,000	20	8,000
Pestcides application	MD	400	20	8,000	20	8,000	20	8,000	20	8,000	20	8,000
Guarding / bird chasing	MD	400	75	30,000	75	30,000	75	30,000	75	30,000	75	30,000
Harvesting	MD	400	9	3,600	14	5,600	18	7,200	19	7,600	20	8,000
Threshing	MD	400	26	10,400	43	17,200	53	21,200	58	23,200	60	24,000
Drying	MD	400	9	3,600	14	5,600	18	7,200	19	7,600	20	8,000
Winnowing	MD	400	9	3,600	14	5,600	18	7,200	19	7,600	20	8,000
Storing and Weighing	MD	400	4	1,600	7	2,800	9	3,600	10	4,000	10	4,000
Sub-total			568	**227,200**	608	**243,200**	635	**254,000**	645	**258,000**	651	**260,400**
3. Production (Inputs)												
Fertilizer: DAP	Kg	480	0	-	50	24,000	80	38,400	90	43,200	100	48,000
Fertilizer: Urea	Kg	410	0	-	50	20,500	80	32,800	90	36,900	100	41,000
Pesticdes: Kitazine	Liter	7,820	3	23,460	3	23,460	3	23,460	3	23,460	3	23,460
Pesticdes: Dimethoate	Liter	5,520	3	16,560	3	16,560	3	16,560	3	16,560	3	16,560
Sub-total				**40,020**		**84,520**		**111,220**		**120,120**		**129,020**
4. Other												
Land tax	1ha	-	1	-	1	-	1	-	1	-	1	-
Contribution	1ha	20,000	1	20,000	1	20,000	1	20,000	1	20,000	1	20,000
Sub-total				**20,000**		**20,000**		**20,000**		**20,000**		**20,000**
Grand Total				**309,820**		**370,320**		**407,820**		**420,720**		**432,020**
(C) Net Return				**464,180**		**919,680**		**1,191,780**		**1,333,680**		**1,373,980**
(D) Family Labor	% of labor		80	196,160	80	208,960	80	217,600	80	220,800	80	222,720
(E) Production Cost exclude family labor				268,020		710,720		974,180		1,112,880		1,151,260
(F) Net Income				**505,980**		**579,280**		**625,420**		**641,520**		**654,740**
Incremental Achievement					50%		80%		95%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops per Ha/Season

Table 26 Crop: Maize (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	250	1,500	375,000	3,250	812,500	4,125	1,031,250	4,475	1,118,750	5,000	1,250,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**375,000**		**812,500**		**1,031,250**		**1,118,750**		**1,250,000**
(B) Procution Cost												
Labor												
Clearing land	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Plowing	MD	800	66	52,800	66	52,800	66	52,800	66	52,800	66	52,800
2nd Plowing	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Leveling	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Transport and manure application(10t)	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Chemical fertilizer application	MD	800	0	0	5	4,000	7	5,600	9	7,200	10	8,000
Planting	MD	800	12	9,600	12	9,600	12	9,600	12	9,600	12	9,600
Weeding	MD	800	70	56,000	70	56,000	70	56,000	70	56,000	70	56,000
Watering	MD	800	20	16,000	20	16,000	20	16,000	20	16,000	20	16,000
Pesticide application	MD	800	0	0	4	3,200	6	4,800	7	5,600	8	6,400
Bird chasing (Guarding)	MD	800	30	24,000	30	24,000	30	24,000	30	24,000	30	24,000
Harvesting	MD	800	8	6,400	16	12,800	21	16,800	22	17,600	25	20,000
Removing seeds	MD	800	6	4,800	13	10,400	17	13,600	18	14,400	20	16,000
Winnowing	MD	800	1	800	3	2,400	3	2,400	4	3,200	4	3,200
Drying	MD	800	3	2,400	3	2,400	3	2,400	3	2,400	3	2,400
Grading	MD	800	1	800	1	800	1	800	1	800	1	800
Storing	MD	800	1	800	1	800	1	800	1	800	1	800
Sub-total			**338**	**270,400**	**364**	**291,200**	**377**	**301,600**	**383**	**306,400**	**390**	**312,000**
Inputs												
Seeds	Kg	300	30	9,000	30	9,000	30	9,000	30	9,000	30	9,000
Manure	Kg	5	10,000	50,000	10,000	50,000	10,000	50,000	10,000	50,000	10,000	50,000
DAP	Kg	480	0	0	50	24,000	70	33,600	90	43,200	100	48,000
Urea	Kg	410	0	0	25	10,250	35	14,350	45	18,450	50	20,500
Pestcides (Thiodan)	Liter	11,000	0	0	1.5	16,500	2	22,000	2.5	27,500	3	33,000
Sub-total				**59,000**		**109,750**		**128,950**		**148,150**		**160,500**
Grand Total				**329,400**		**400,950**		**430,550**		**454,550**		**472,500**
(C) Net Return				**45,600**		**411,550**		**600,700**		**664,200**		**777,500**
(D) Family Labor	% of labor		80	216,320	80	232,960	80	241,280	80	245,120	80	249,600
(E) Production Cost exclude family labor				113,080		167,990		189,270		209,430		222,900
(F) Net Income				**261,920**		**644,510**		**841,980**		**909,320**		**1,027,100**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 27 Crop: Maize (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	230	1,500	345,000	3,250	747,500	4,125	948,750	4,475	1,029,250	5,000	1,150,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**345,000**		**747,500**		**948,750**		**1,029,250**		**1,150,000**
(B) Procution Cost												
Labor												
Clearing land	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Plowing	MD	400	66	26,400	66	26,400	66	26,400	66	26,400	66	26,400
2nd Plowing	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Leveling	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Transport and manure application(10t)	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Chemical fertilizer application	MD	400	0	0	5	2,000	7	2,800	9	3,600	10	4,000
Planting	MD	400	12	4,800	12	4,800	12	4,800	12	4,800	12	4,800
Weeding	MD	400	70	28,000	70	28,000	70	28,000	70	28,000	70	28,000
Watering	MD	400	20	8,000	20	8,000	20	8,000	20	8,000	20	8,000
Pesticide application	MD	400	0	0	4	1,600	6	2,400	7	2,800	8	3,200
Bird chasing (Guarding)	MD	400	30	12,000	30	12,000	30	12,000	30	12,000	30	12,000
Harvesting	MD	400	8	3,200	16	6,400	21	8,400	22	8,800	25	10,000
Removing seeds	MD	400	6	2,400	13	5,200	17	6,800	18	7,200	20	8,000
Winnowing	MD	400	1	400	3	1,200	3	1,200	4	1,600	4	1,600
Drying	MD	400	3	1,200	3	1,200	3	1,200	3	1,200	3	1,200
Grading	MD	400	1	400	1	400	1	400	1	400	1	400
Storing	MD	400	1	400	1	400	1	400	1	400	1	400
Sub-total			**338**	**135,200**	**364**	**145,600**	**377**	**150,800**	**383**	**153,200**	**390**	**156,000**
Inputs												
Seeds	Kg	276	30	8,280	30	8,280	30	8,280	30	8,280	30	8,280
Manure	Kg	5	10,000	50,000	10,000	50,000	10,000	50,000	10,000	50,000	10,000	50,000
DAP	Kg	480	0	0	50	24,000	70	33,600	90	43,200	100	48,000
Urea	Kg	410	0	0	25	10,250	35	14,350	45	18,450	50	20,500
Pestcides (Thiodan)	Liter	10,120	0	0	1.5	15,180	2	20,240	2.5	25,300	3	30,360
Sub-total				**58,280**		**107,710**		**126,470**		**145,230**		**157,140**
Grand Total				**193,480**		**253,310**		**277,270**		**298,430**		**313,140**
(C) Net Return				**151,520**		**494,190**		**671,480**		**730,820**		**836,860**
(D) Family Labor	% of labor		80	108,160	80	116,480	80	120,640	80	122,560	80	124,800
(E) Production Cost exclude family labor				85,320		136,830		156,630		175,870		188,340
(F) Net Income				**259,680**		**610,670**		**792,120**		**853,380**		**961,660**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops per Ha/Season

Table 28 Crop: Haricot Bean (Long) (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	300	900	270,000	1,350	405,000	1,575	472,500	1,665	499,500	1,800	540,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**270,000**		**405,000**		**472,500**		**499,500**		**540,000**
(B) Procution Cost												
Labor												
Clearing land	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Plowing	MD	800	66	52,800	66	52,800	66	52,800	66	52,800	66	52,800
2nd Plowing	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Leveling	MD	800	10	8,000	10	8,000	10	8,000	10	8,000	10	8,000
Transport and manure application(10t)	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Chemical fertilizer application	MD	800	0	0	5	4,000	7	5,600	9	7,200	10	8,000
Planting	MD	800	20	16,000	20	16,000	20	16,000	20	16,000	20	16,000
Weeding	MD	800	66	52,800	66	52,800	66	52,800	66	52,800	66	52,800
Pesticide application	MD	800	0	0	8	6,400	11	8,800	14	11,200	16	12,800
Bird chasing (Guarding)	MD	800	15	12,000	15	12,000	15	12,000	15	12,000	15	12,000
Harvesting	MD	800	10	8,000	15	12,000	18	14,400	19	15,200	20	16,000
Threshing	MD	800	10	8,000	15	12,000	18	14,400	19	15,200	20	16,000
Winnowing	MD	800	3	2,400	4	3,200	4	3,200	5	4,000	5	4,000
Drying	MD	800	3	2,400	3	2,400	3	2,400	3	2,400	3	2,400
Grading	MD	800	1	800	1.5	1,200	1.5	1,200	1.5	1,200	1.5	1,200
Storing	MD	800	1	800	1.5	1,200	1.5	1,200	1.5	1,200	1.5	1,200
Sub-total			315	**252,000**	**340**	**272,000**	**351**	**280,800**	**359**	**287,200**	**364**	**291,200**
Inputs												
Seeds (Suckers)	Kg	300	70	21,000	70	21,000	70	21,000	70	21,000	70	21,000
Manure	Kg	5	10,000	50,000	10000	50,000	10000	50,000	10000	50,000	10000	50,000
DAP	Kg	480	0	0	50	24,000	70	33,600	90	43,200	100	48,000
Pestcides (Dimethoate)	Liter	6,000	0	0	1.5	9,000	2	12,000	2.5	15,000	3	18,000
Sub-total				**71,000**		**104,000**		**116,600**		**129,200**		**137,000**
Grand Total				**323,000**		**376,000**		**397,400**		**416,400**		**428,200**
(C) Net Return				**-53,000**		**29,000**		**75,100**		**83,100**		**111,800**
(D) Family Labor	% of labor		90	226,800	90	244,800	90	252,720	90	258,480	90	262,080
(E) Production Cost exclude family labor				96,200		131,200		144,680		157,920		166,120
(F) Net Income				**173,800**		**273,800**		**327,820**		**341,580**		**373,880**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 29 Crop: Haricot Bean (Long) (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	276	900	248,400	1,350	372,600	1,575	434,700	1,665	459,540	1,800	496,800
By-product	Kg			0		0		0		0		0
Total Gross Income				**248,400**		**372,600**		**434,700**		**459,540**		**496,800**
(B) Procution Cost												
Labor												
Clearing land	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Plowing	MD	400	66	26,400	66	26,400	66	26,400	66	26,400	66	26,400
2nd Plowing	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Leveling	MD	400	10	4,000	10	4,000	10	4,000	10	4,000	10	4,000
Transport and manure application(10t)	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Chemical fertilizer application	MD	400	0	0	5	2,000	7	2,800	9	3,600	10	4,000
Planting	MD	400	20	8,000	20	8,000	20	8,000	20	8,000	20	8,000
Weeding	MD	400	66	26,400	66	26,400	66	26,400	66	26,400	66	26,400
Pesticide application	MD	400	0	0	8	3,200	11	4,400	14	5,600	16	6,400
Bird chasing (Guarding)	MD	400	15	6,000	15	6,000	15	6,000	15	6,000	15	6,000
Harvesting	MD	400	10	4,000	15	6,000	18	7,200	19	7,600	20	8,000
Threshing	MD	400	10	4,000	15	6,000	18	7,200	19	7,600	20	8,000
Winnowing	MD	400	3	1,200	4	1,600	4	1,600	5	2,000	5	2,000
Drying	MD	400	3	1,200	3	1,200	3	1,200	3	1,200	3	1,200
Grading	MD	400	1	400	1.5	600	1.5	600	1.5	600	1.5	600
Storing	MD	400	1	400	1.5	600	1.5	600	1.5	600	1.5	600
Sub-total			315	**126,000**	**340**	**136,000**	**351**	**140,400**	**359**	**143,600**	**364**	**145,600**
Inputs												
Seeds (Suckers)	Kg	276	70	19,320	70	19,320	70	19,320	70	19,320	70	19,320
Manure	Kg	5	10,000	50,000	10000	50,000	10000	50,000	10000	50,000	10000	50,000
DAP	Kg	480	0	0	50	24,000	70	33,600	90	43,200	100	48,000
Pestcides (Dimethoate)	Liter	5,520	0	0	1.5	8,280	2	11,040	2.5	13,800	3	16,560
Sub-total				**69,320**		**101,600**		**113,960**		**126,320**		**133,880**
Grand Total				**195,320**		**237,600**		**254,360**		**269,920**		**279,480**
(C) Net Return				**53,080**		**135,000**		**180,340**		**189,620**		**217,320**
(D) Family Labor	% of labor		90	113,400	90	122,400	90	126,360	90	129,240	90	131,040
(E) Production Cost exclude family labor				81,920		115,200		128,000		140,680		148,440
(F) Net Income				**166,480**		**257,400**		**306,700**		**318,860**		**348,360**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops per Ha/Season

Table 30 Crop: Banana (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project			
			Qu'ty	Total Value	1st Crop		2nd Crop	
					Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME								
Main Product	Kg	50	12,000	600,000	20,198	1,009,920	22,248	1,112,400
By-product (suckers)	Kg	300	2,213	663,754	3,724	1,117,231	4,102	1,230,600
Total Gross Income				1,263,754		2,127,151		2,343,000
(B) Procution Cost								
Labor								
Clearing land	MD	800	77	61,600	77	61,600	77	61,600
Plowing	MD	800	93	74,400	93	74,400	93	74,400
Lotary Plow?	MD	800	21	16,800	21	16,800	21	16,800
Digging for banana	MD	800	21	16,800	21	16,800	21	16,800
Transport and manure application(10t)	MD	800	15	12,000	15	12,000	15	12,000
Planting banana sucker	MD	800	9	7,200	9	7,200	9	7,200
Weeding	MD	800	354	283,200	354	283,200	354	283,200
Multing (banana)	MD	800	8	6,400	8	6,400	8	6,400
Harvesting	MD	800		0		0		0
Sub-total			**598**	**478,400**	**598**	**478,400**	**598**	**478,400**
Inputs								
Seeds (Suckers)	Kg	300	1,100	330,000	1,100	330,000	1,100	330,000
Manure	Kg	5	55,000	275,000	55,000	275,000	55,000	275,000
Sub-total				**605,000**		**605,000**		**605,000**
Grand Total				**1,083,400**		**1,083,400**		**1,083,400**
(C) Net Return				**180,354**		**1,043,751**		**1,259,600**
(D) Family Labor	% of labor		90	430,560	90	430,560	90	430,560
(E) Production Cost exclude family labor				652,840		652,840		652,840
(F) Net Income				**610,914**		**1,474,311**		**1,690,160**
Incremental Achievement					80%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 31 Crop: Banana (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project			
			Qu'ty	Total Value	1st Crop		2nd Crop	
					Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME								
Main Product	Kg	46	12,000	552,000	20,198	929,126	22,248	1,023,408
By-product (suckers)	Kg	276	2,213	610,654	3,724	1,027,852	4,102	1,132,152
Total Gross Income				1,162,654		1,956,979		2,155,560
(B) Procution Cost								
Labor								
Clearing land	MD	400	77	30,800	77	30,800	77	30,800
Plowing	MD	400	93	37,200	93	37,200	93	37,200
Lotary Plow?	MD	400	21	8,400	21	8,400	21	8,400
Digging for banana	MD	400	21	8,400	21	8,400	21	8,400
Transport and manure application(10t)	MD	400	15	6,000	15	6,000	15	6,000
Planting banana sucker	MD	400	9	3,600	9	3,600	9	3,600
Weeding	MD	400	354	141,600	354	141,600	354	141,600
Multing (banana)	MD	400	8	3,200	8	3,200	8	3,200
Harvesting	MD	400		0		0		0
Sub-total			**598**	**239,200**	**598**	**239,200**	**598**	**239,200**
Inputs								
Seeds (Suckers)	Kg	276	1,100	303,600	1,100	303,600	1,100	303,600
Manure	Kg	5	55,000	275,000	55,000	275,000	55,000	275,000
Sub-total				**578,600**		**578,600**		**578,600**
Grand Total				**817,800**		**817,800**		**817,800**
(C) Net Return				**344,854**		**1,139,179**		**1,337,760**
(D) Family Labor	% of labor		90	215,280	90	215,280	90	215,280
(E) Production Cost exclude family labor				602,520		602,520		602,520
(F) Net Income				**560,134**		**1,354,459**		**1,553,040**
Incremental Achievement					80%		100%	

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops

Table 32 Crop: Cabbage (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	100	10,000	1,000,000	16,500	1,650,000	19,750	1,975,000	21,050	2,105,000	23,000	2,300,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**1,000,000**		**1,650,000**		**1,975,000**		**2,105,000**		**2,300,000**
(B) Procution Cost												
Seed Bed Making												
Preparing seed beds	MD	800	4	3,200	4	3,200	4	3,200	4	3,200	4	3,200
Watering	MD	800	24	19,200	24	19,200	24	19,200	24	19,200	24	19,200
Sub-total				**22,400**		**22,400**		**22,400**		**22,400**		**22,400**
Inputs for Bed Making												
Grass		5,000	1	5,000	1	5,000	1	5,000	1	5,000	1	5,000
Compost manure		1,500	10	15,000	10	15,000	10	15,000	10	15,000	10	15,000
Seeds	kg	800	0.4	320	0.4	320	0.4	320	0.4	320	0.4	320
Fungicides /Pesticides	Liter	1,600	1	1,600	1	1,600	1	1,600	1	1,600	1	1,600
Watering tools		2,500	2	5,000	2	5,000	2	5,000	2	5,000	2	5,000
Sub-total				**26,920**		**26,920**		**26,920**		**26,920**		**26,920**
Labor												
Clearing	MD	800	8	6,400	8	6,400	8	6,400	8	6,400	8	6,400
Plowing	MD	800	45	36,000	45	36,000	45	36,000	45	36,000	45	36,000
Ridging	MD	800	60	48,000	60	48,000	60	48,000	60	48,000	60	48,000
Leveling	MD	800	40	32,000	40	32,000	40	32,000	40	32,000	40	32,000
Compost manure transport	MD	800	40	32,000	40	32,000	40	32,000	40	32,000	40	32,000
Chemical fertilizing	MD	800	0	0	20	16,000	30	24,000	34	27,200	40	32,000
Planting	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Watering	MD	800	30	24,000	30	24,000	30	24,000	30	24,000	30	24,000
Spraying Pesticides	MD	800	60	48,000	60	48,000	60	48,000	60	48,000	60	48,000
Weeding	MD	800	70	56,000	70	56,000	70	56,000	70	56,000	70	56,000
Harvesting	MD	800	35	28,000	57	45,600	69	55,200	73	58,400	80	64,000
Sub-total				**350,400**		**384,000**		**401,600**		**408,000**		**418,400**
Inputs												
Fertilizer (DSP)	kg	500	0	0	125	62,500	188	94,000	213	106,500	250	125,000
Fertilizer (CAN)	kg	400	0	0	25	10,000	38	15,200	43	17,200	50	20,000
Pesticdes (Dimethoate)	Liter	6,000	3.3	19,800	3.3	19,800	3.3	19,800	3.3	19,800	3.3	19,800
Pesticdes (Dithane)	kg	1,600	20	32,000	20	32,000	20	32,000	20	32,000	20	32,000
Sub-total				**51,800**		**124,300**		**161,000**		**175,500**		**196,800**
Grand Total				**451,520**		**557,620**		**611,920**		**632,820**		**664,520**
(C) Net Return				**548,480**		**1,092,380**		**1,363,080**		**1,472,180**		**1,635,480**
(D) Family Labor	% of labor		90	335,520	90	365,760	90	381,600	90	387,360	90	396,720
(E) Production Cost exclude family labor				116,000		191,860		230,320		245,460		267,800
(F) Net Income				**884,000**		**1,458,140**		**1,744,680**		**1,859,540**		**2,032,200**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RODHA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 33 Crop: Cabbage (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	92	10,000	920,000	16,500	1,518,000	19,750	1,817,000	21,050	1,936,600	23,000	2,116,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**920,000**		**1,518,000**		**1,817,000**		**1,936,600**		**2,116,000**
(B) Procution Cost												
Seed Bed Making												
Preparing seed beds	MD	400	4	1,600	4	1,600	4	1,600	4	1,600	4	1,600
Watering	MD	400	24	9,600	24	9,600	24	9,600	24	9,600	24	9,600
Sub-total				**11,200**		**11,200**		**11,200**		**11,200**		**11,200**
Inputs for Bed Making												
Grass		5,000	1	5,000	1	5,000	1	5,000	1	5,000	1	5,000
Compost manure		1,500	10	15,000	10	15,000	10	15,000	10	15,000	10	15,000
Seeds	kg	736	0.4	294	0.4	294	0.4	294	0.4	294	0.4	294
Fungicides /Pesticides	Liter	1,472	1	1,472	1	1,472	1	1,472	1	1,472	1	1,472
Watering tools		2,300	2	4,600	2	4,600	2	4,600	2	4,600	2	4,600
Sub-total				**26,366**		**26,366**		**26,366**		**26,366**		**26,366**
Labor												
Clearing	MD	400	8	3,200	8	3,200	8	3,200	8	3,200	8	3,200
Plowing	MD	400	45	18,000	45	18,000	45	18,000	45	18,000	45	18,000
Ridging	MD	400	60	24,000	60	24,000	60	24,000	60	24,000	60	24,000
Leveling	MD	400	40	16,000	40	16,000	40	16,000	40	16,000	40	16,000
Compost manure transport	MD	400	40	16,000	40	16,000	40	16,000	40	16,000	40	16,000
Chemical fertilizing	MD	400	0	0	20	8,000	30	12,000	34	13,600	40	16,000
Planting	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Watering	MD	400	30	12,000	30	12,000	30	12,000	30	12,000	30	12,000
Spraying Pesticides	MD	400	60	24,000	60	24,000	60	24,000	60	24,000	60	24,000
Weeding	MD	400	70	28,000	70	28,000	70	28,000	70	28,000	70	28,000
Harvesting	MD	400	35	14,000	57	22,800	69	27,600	73	29,200	80	32,000
Sub-total				**175,200**		**192,000**		**200,800**		**204,000**		**209,200**
Inputs												
Fertilizer (DSP)	kg	500	0	0	125	62,500	188	94,000	213	106,500	250	125,000
Fertilizer (CAN)	kg	400	0	0	25	10,000	38	15,200	43	17,200	50	20,000
Pesticdes (Dimethoate)	Liter	5,520	3.3	18,216	3.3	18,216	3.3	18,216	3.3	18,216	3.3	18,216
Pesticdes (Dithane)	kg	1,472	20	29,440	20	29,440	20	29,440	20	29,440	20	29,440
Sub-total				**47,656**		**120,156**		**156,856**		**171,356**		**192,656**
Grand Total				**260,422**		**349,722**		**395,222**		**412,922**		**439,422**
(C) Net Return				**659,578**		**1,168,278**		**1,421,778**		**1,523,678**		**1,676,578**
(D) Family Labor	% of labor		90	167,760	90	182,880	90	190,800	90	193,680	90	198,360
(E) Production Cost exclude family labor				92,662		166,842		204,422		219,242		241,062
(F) Net Income				**827,338**		**1,351,158**		**1,612,578**		**1,717,358**		**1,874,938**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RODHA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops

Table 34 Crop: Tomato (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	200	7,000	1,400,000	12,500	2,500,000	15,250	3,050,000	16,350	3,270,000	18,000	3,600,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**1,400,000**		**2,500,000**		**3,050,000**		**3,270,000**		**3,600,000**
(B) Procution Cost												
Seed Bed Making												
Preparing seed beds	MD	800	4	3,200	4	3,200	4	3,200	4	3,200	4	3,200
Watering	MD	800	24	19,200	24	19,200	24	19,200	24	19,200	24	19,200
Sub-total				**22,400**		**22,400**		**22,400**		**22,400**		**22,400**
Materials for Bed Making												
Trees		2,000	12	24,000	12	24,000	12	24,000	12	24,000	12	24,000
Grass		5,000	1	5,000	1	5,000	1	5,000	1	5,000	1	5,000
Compost manure		1,500	10	15,000	10	15,000	10	15,000	10	15,000	10	15,000
Seeds	kg	21,667	0.3	6,500	0.3	6,500	0.3	6,500	0.3	6,500	0.3	6,500
Fungicides /Pesticides	Liter	1,600	1	1,600	1	1,600	1	1,600	1	1,600	1	1,600
Watering tools		2,500	2	5,000	2	5,000	2	5,000	2	5,000	2	5,000
Sub-total				**57,100**		**57,100**		**57,100**		**57,100**		**57,100**
Labor												
Clearing	MD	800	8	6,400	8	6,400	8	6,400	8	6,400	8	6,400
Plowing	MD	800	45	36,000	45	36,000	45	36,000	45	36,000	45	36,000
Ridging	MD	800	60	48,000	60	48,000	60	48,000	60	48,000	60	48,000
Leveling	MD	800	40	32,000	40	32,000	40	32,000	40	32,000	40	32,000
Compost manure transport	MD	800	40	32,000	40	32,000	40	32,000	40	32,000	40	32,000
Chemical fertilizing	MD	800	0	0	20	16,000	30	24,000	34	27,200	40	32,000
Planting	MD	800	50	40,000	50	40,000	50	40,000	50	40,000	50	40,000
Watering	MD	800	30	24,000	30	24,000	30	24,000	30	24,000	30	24,000
Spraying Pesticides	MD	800	60	48,000	60	48,000	60	48,000	60	48,000	60	48,000
Weeding	MD	800	70	56,000	70	56,000	70	56,000	70	56,000	70	56,000
Harvesting	MD	800	31	24,800	56	44,800	68	54,400	73	58,400	80	64,000
Sub-total				**347,200**		**383,200**		**400,800**		**408,000**		**418,400**
Inputs												
Materials required		15,000	25	375,000	25	375,000	25	375,000	25	375,000	25	375,000
Chemical fertilizers (DSP)	DSP	500	0	0	125	62,500	188	94,000	213	106,500	250	125,000
Chemical fertilizers (CAN)	CAN	400	0	0	25	10,000	38	15,200	43	17,200	50	20,000
Pesticdes (Dimethoate)	liter	6,000	3.3	19,800	3.3	19,800	3.3	19,800	3.3	19,800	3.3	19,800
Pesticdes (Dithane)	kg	1,600	20	32,000	20	32,000	20	32,000	20	32,000	20	32,000
Storing materials		300	1,000	300,000	1,000	300,000	1,000	300,000	1,000	300,000	1,000	300,000
Sub-total				**726,800**		**799,300**		**836,000**		**850,500**		**871,800**
Grand Total				**1,153,500**		**1,262,000**		**1,316,300**		**1,338,000**		**1,369,700**
(C) Net Return				**246,500**		**1,238,000**		**1,733,700**		**1,932,000**		**2,230,300**
(D) Family Labor	% of labor		90	332,640	90	365,040	90	380,880	90	387,360	90	396,720
(E) Production Cost exclude family labor				820,860		896,960		935,420		950,640		972,980
(F) Net Income				**579,140**		**1,603,040**		**2,114,580**		**2,319,360**		**2,627,020**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RODHA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

Table 35 Crop: Tomato (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st Crop		2nd Crop		3rd Crop		4th Crop	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	184	7,000	1,288,000	12,500	2,300,000	15,250	2,806,000	16,350	3,008,400	18,000	3,312,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**1,288,000**		**2,300,000**		**2,806,000**		**3,008,400**		**3,312,000**
(B) Procution Cost												
Seed Bed Making												
Preparing seed beds	MD	400	4	1,600	4	1,600	4	1,600	4	1,600	4	1,600
Watering	MD	400	24	9,600	24	9,600	24	9,600	24	9,600	24	9,600
Sub-total				**11,200**		**11,200**		**11,200**		**11,200**		**11,200**
Materials for Bed Making												
Trees		2,000	12	24,000	12	24,000	12	24,000	12	24,000	12	24,000
Grass		5,000	1	5,000	1	5,000	1	5,000	1	5,000	1	5,000
Compost manure		1,500	10	15,000	10	15,000	10	15,000	10	15,000	10	15,000
Seeds	kg	19,934	0.3	5,980	0.3	5,980	0.3	5,980	0.3	5,980	0.3	5,980
Fungicides /Pesticides	Liter	1,472	1	1,472	1	1,472	1	1,472	1	1,472	1	1,472
Watering tools		2,300	2	4,600	2	4,600	2	4,600	2	4,600	2	4,600
Sub-total				**56,052**		**56,052**		**56,052**		**56,052**		**56,052**
Labor												
Clearing	MD	400	8	3,200	8	3,200	8	3,200	8	3,200	8	3,200
Plowing	MD	400	45	18,000	45	18,000	45	18,000	45	18,000	45	18,000
Ridging	MD	400	60	24,000	60	24,000	60	24,000	60	24,000	60	24,000
Leveling	MD	400	40	16,000	40	16,000	40	16,000	40	16,000	40	16,000
Compost manure transport	MD	400	40	16,000	40	16,000	40	16,000	40	16,000	40	16,000
Chemical fertilizing	MD	400	0	0	20	8,000	30	12,000	34	13,600	40	16,000
Planting	MD	400	50	20,000	50	20,000	50	20,000	50	20,000	50	20,000
Watering	MD	400	30	12,000	30	12,000	30	12,000	30	12,000	30	12,000
Spraying Pesticides	MD	400	60	24,000	60	24,000	60	24,000	60	24,000	60	24,000
Weeding	MD	400	70	28,000	70	28,000	70	28,000	70	28,000	70	28,000
Harvesting	MD	400	31	12,400	56	22,400	68	27,200	73	29,200	80	32,000
Sub-total				**173,600**		**191,600**		**200,400**		**204,000**		**209,200**
Inputs												
Materials required		15,000	25	375,000	25	375,000	25	375,000	25	375,000	25	375,000
Chemical fertilizers (DSP)	DSP	500	0	0	125	62,500	188	94,000	213	106,500	250	125,000
Chemical fertilizers (CAN)	CAN	400	0	0	25	10,000	38	15,200	43	17,200	50	20,000
Pesticdes (Dimethoate)	liter	5,520	3.3	18,216	3.3	18,216	3.3	18,216	3.3	18,216	3.3	18,216
Pesticdes (Dithane)	kg	1,472	20	29,440	20	29,440	20	29,440	20	29,440	20	29,440
Storing materials		300	1,000	300,000	1,000	300,000	1,000	300,000	1,000	300,000	1,000	300,000
Sub-total				**722,656**		**795,156**		**831,856**		**846,356**		**867,656**
Grand Total				**963,508**		**1,054,008**		**1,099,508**		**1,117,608**		**1,144,108**
(C) Net Return				**324,492**		**1,245,992**		**1,706,492**		**1,890,792**		**2,167,892**
(D) Family Labor	% of labor		90	166,320	90	182,520	90	190,440	90	193,680	90	198,360
(E) Production Cost exclude family labor				797,188		871,488		909,068		923,928		945,748
(F) Net Income				**490,812**		**1,428,512**		**1,896,932**		**2,084,472**		**2,366,252**
Incremental Achievement					50%		75%		85%		100%	

Note: Analysis is based on the data collected from RODHA, socio-economic survey of the JICA Study Team and data collected in the local markets and villages.

7. Cost and Benefit of Crops

Table 36 Crop: Pineapple (Financial Price)

Activities	Unit	Unit Price	With Project (3Years)		With Project					
			Qu'ty	Total Value	1st Year		2nd Year		3rd Year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME										
Main Product	Kg	150	50,000	7,500,000	0	0	25,000	3,750,000	25,000	3,750,000
By-product	Kg			0		0		0		0
Total Gross Income				**7,500,000**		**0**		**3,750,000**		**3,750,000**
(B) Procution Cost										
Labor										
Clearing	MD	800	10	8,000	10	8,000	0	0	0	0
First plowing	MD	800	50	40,000	50	40,000	0	0	0	0
Second plowing	MD	800	66	52,800	66	52,800	0	0	0	0
Leveling	MD	800	10	8,000	10	8,000	0	0	0	0
Planting suckers	MD	800	350	280,000	350	280,000	0	0	0	0
Mulching	MD	800	100	80,000	40	32,000	30	24,000	30	24,000
Organic manure	MD	800	70	56,000	50	40,000	10	8,000	10	8,000
Weeding and harvesting	MD	800	2,160	1,728,000	720	576,000	720	576,000	720	576,000
Sub-total				**2,252,800**		**1,036,800**		**608,000**		**608,000**
Inputs										
Buying suckers	Nos	44	45,000	1,980,000	45,000	1,980,000	0	0	0	0
Buying mulching grass		500	500	250,000	200	100,000	150	75,000	150	75,000
Buying manure	ton	5	20,000	100,000	14,000	70,000	3,000	15,000	3,000	15,000
Sub-total				**2,330,000**		**2,150,000**		**90,000**		**90,000**
Grand Total				**4,582,800**		**3,186,800**		**698,000**		**698,000**
(C) Net Return				**2,917,200**		**-3,186,800**		**3,052,000**		**3,052,000**
(D) Family Labor	% of labor		90	2,027,520	90	933,120	90	547,200	90	547,200
(E) Production Cost exclude family labor				2,555,280		2,253,680		150,800		150,800
(F) Net Income				**4,944,720**		**-2,253,680**		**3,599,200**		**3,599,200**
3 year-cycle										

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets

Table 37 Crop: Pineapple (Economic Price)

Activities	Unit	Unit Price	With Project (3Years)		With Project					
			Qu'ty	Total Value	1st Year		2nd Year		3rd Year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME										
Main Product	Kg	138	50,000	6,900,000	0	0	25,000	3,450,000	25,000	3,450,000
By-product	Kg			0		0		0		0
Total Gross Income				**6,900,000**		**0**		**3,450,000**		**3,450,000**
(B) Procution Cost										
Labor										
Clearing	MD	400	10	4,000	10	4,000	0	0	0	0
First plowing	MD	400	50	20,000	50	20,000	0	0	0	0
Second plowing	MD	400	66	26,400	66	26,400	0	0	0	0
Leveling	MD	400	10	4,000	10	4,000	0	0	0	0
Planting suckers	MD	400	350	140,000	350	140,000	0	0	0	0
Mulching	MD	400	100	40,000	40	16,000	30	12,000	30	12,000
Organic manure	MD	400	70	28,000	50	20,000	10	4,000	10	4,000
Weeding and harvesting	MD	400	2,160	864,000	720	288,000	720	288,000	720	288,000
Sub-total				**1,126,400**		**518,400**		**304,000**		**304,000**
Inputs										
Buying suckers	Nos	40	45,000	1,800,000	45,000	1,800,000	0	0	0	0
Buying mulching grass		500	500	250,000	200	100,000	150	75,000	150	75,000
Buying manure	ton	5	20,000	100,000	14,000	70,000	3,000	15,000	3,000	15,000
Sub-total				**2,150,000**		**1,970,000**		**90,000**		**90,000**
Grand Total				**3,276,400**		**2,488,400**		**394,000**		**394,000**
(C) Net Return				**3,623,600**		**-2,488,400**		**3,056,000**		**3,056,000**
(D) Family Labor	% of labor		90	1,013,760	90	466,560	90	273,600	90	273,600
(E) Production Cost exclude family labor				2,262,640		2,021,840		120,400		120,400
(F) Net Income				**4,637,360**		**-2,021,840**		**3,329,600**		**3,329,600**
3 year-cycle										

Note: Analysis is based on the data collected from RADA, socio-economic survey of the JICA Study Team and data collected in the local markets

7. Cost and Benefit of Crops per Ha/Season

Table 38 Crop: Avocado (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st year		2nd year		3rd year		4th year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	pcs	50	61,200	3,060,000							61,200	3,060,000
By-product	pcs			0		0		0		0		0
Total Gross Income				**3,060,000**		**0**		**0**		**0**		**3,060,000**
(B) Procution Cost												
Labor												
Clearing	MD	800	10	8,000	10	8,000		0		0		0
1st Plowing	MD	800	40	32,000	40	32,000		0		0		0
2nd Plowing	MD	800	50	40,000	50	40,000		0		0		0
Organic manure application	MD	800	30	24,000	30	24,000		0		0		0
Chemical fertilizers	MD	800	20	16,000	20	16,000		0		0		0
Leveling	MD	800	15	12,000	15	12,000		0		0		0
Preparing seeds	MD	800	10	8,000	10	8,000		0		0		0
Planting	MD	800	40	32,000	40	32,000		0		0		0
Weeding (3)	MD	800	210	168,000	70	56,000	70	56,000	70	56,000		0
Watering	MD	800	15	12,000	5	4,000	5	4,000	5	4,000		0
Harvesting	MD	800	90	72,000		0		0		0	90	72,000
Grading	MD	800	5	4,000		0		0		0	5	4,000
Sub-total				**428,000**		**232,000**		**60,000**		**60,000**		**76,000**
Inputs												
Buying seedlings		2,000	204	408,000	204	408,000		0		0		0
Buying manure kg		5	10,200	51,000	10,200	51,000		0		0		0
Buying chamical fertilizers		500	50	25,000	50	25,000		0		0		0
Buying pestcides		100,000	1	100,000	1	100,000		0		0		0
Sub-total				**584,000**		**584,000**		**0**		**0**		**0**
Grand Total				**1,012,000**		**816,000**		**60,000**		**60,000**		**76,000**
(C) Net Return				**2,048,000**		**-816,000**		**-60,000**		**-60,000**		**2,984,000**
(D) Family Labor	% of labor		90	385,200	90	208,800	90	54,000	90	54,000	90	68,400
(E) Production Cost exclude family labor				626,800		607,200		6,000		6,000		7,600
(F) Net Income				**2,433,200**		**-607,200**		**-6,000**		**-6,000**		**3,052,400**

Note: Analysis is based on the data collected from R ODHA and data collected in the local market s

Table 39 Crop: Avocado (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st year		2nd year		3rd year		4th year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	pcs	46	61,200	2,815,200							61,200	2,815,200
By-product	pcs			0		0		0		0		0
Total Gross Income				**2,815,200**		**0**		**0**		**0**		**2,815,200**
(B) Procution Cost												
Labor												
Clearing	MD	400	10	4,000	10	4,000		0		0		0
1st Plowing	MD	400	40	16,000	40	16,000		0		0		0
2nd Plowing	MD	400	50	20,000	50	20,000		0		0		0
Organic manure application	MD	400	30	12,000	30	12,000		0		0		0
Chemical fertilizers	MD	400	20	8,000	20	8,000		0		0		0
Leveling	MD	400	15	6,000	15	6,000		0		0		0
Preparing seeds	MD	400	10	4,000	10	4,000		0		0		0
Planting	MD	400	40	16,000	40	16,000		0		0		0
Weeding (3)	MD	400	210	84,000	70	28,000	70	28,000	70	28,000		0
Watering	MD	400	15	6,000	5	2,000	5	2,000	5	2,000		0
Harvesting	MD	400	90	36,000		0		0		0	90	36,000
Grading	MD	400	5	2,000		0		0		0	5	2,000
Sub-total				**214,000**		**116,000**		**30,000**		**30,000**		**38,000**
Inputs												
Buying seedlings		1,840	204	375,360	204	375,360		0		0		0
Buying manure kg		5	10,200	51,000	10,200	51,000		0		0		0
Buying chamical fertilizers		500	50	25,000	50	25,000		0		0		0
Buying pestcides		92,000	1	92,000	1	92,000		0		0		0
Sub-total				**543,360**		**543,360**		**0**		**0**		**0**
Grand Total				**757,360**		**659,360**		**30,000**		**30,000**		**38,000**
(C) Net Return				**2,057,840**		**-659,360**		**-30,000**		**-30,000**		**2,777,200**
(D) Family Labor	% of labor		90	192,600	90	104,400	90	27,000	90	27,000	90	34,200
(E) Production Cost exclude family labor				564,760		554,960		3,000		3,000		3,800
(F) Net Income				**2,250,440**		**-554,960**		**-3,000**		**-3,000**		**2,811,400**

Note: Analysis is based on the data collected from R ODHA and data collected in the local market s

7. Cost and Benefit of Crops per Ha/Season

Table 40 Crop: Mango (Financial Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st year		2nd year		3rd year		4th year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	400	15,000	6,000,000							15,000	6,000,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**6,000,000**		**0**		**0**		**0**		**6,000,000**
(B) Procution Cost												
Labor												
Clearing	MD	800	10	8,000	10	8,000		0		0		0
1st Plowing	MD	800	40	32,000	40	32,000		0		0		0
2nd Plowing	MD	800	50	40,000	50	40,000		0		0		0
Organic manure application	MD	800	30	24,000	30	24,000		0		0		0
Chemical fertilizers	MD	800	20	16,000	20	16,000		0		0		0
Leveling	MD	800	15	12,000	15	12,000		0		0		0
Preparing seeds	MD	800	10	8,000	10	8,000		0		0		0
Planting	MD	800	40	32,000	40	32,000		0		0		0
Weeding (3)	MD	800	210	168,000	70	56,000	70	56,000	70	56,000		0
Watering	MD	800	15	12,000	5	4,000	5	4,000	5	4,000		0
Harvesting	MD	800	90	72,000		0		0		0	90	72,000
Grading	MD	800	5	4,000		0		0		0	5	4,000
Sub-total				**428,000**		**232,000**		**60,000**		**60,000**		**76,000**
Inputs												
Buying seeddlings		1,000	256	256,000	204	204,000		0		0		0
Buying manure kg		5	10,200	51,000	10,200	51,000		0		0		0
Buying chamical fertilizers		500	50	25,000	50	25,000		0		0		0
Buying pestcides		100,000	1	100,000	1	100,000		0		0		0
Sub-total				**432,000**		**380,000**		**0**		**0**		**0**
Grand Total				**860,000**		**612,000**		**60,000**		**60,000**		**76,000**
(C) Net Return				**5,140,000**		**-612,000**		**-60,000**		**-60,000**		**5,924,000**
(D) Family Labor	% of labor		90	385,200	90	208,800	90	54,000	90	54,000	90	68,400
(E) Production Cost exclude family labor				474,800		403,200		6,000		6,000		7,600
(F) Net Income				**5,525,200**		**-403,200**		**-6,000**		**-6,000**		**5,992,400**

Note: Analysis is based on the data collected from RODHA and RADA, and data collected in the local markets

Table 41 Crop: Mango (Economic Price)

Activities	Unit	Unit Price	Without Project		With Project							
			Qu'ty	Total Value	1st year		2nd year		3rd year		4th year	
					Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	368	15,000	5,520,000							15,000	5,520,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**5,520,000**		**0**		**0**		**0**		**5,520,000**
(B) Procution Cost												
Labor												
Clearing	MD	400	10	4,000	10	4,000		0		0		0
1st Plowing	MD	400	40	16,000	40	16,000		0		0		0
2nd Plowing	MD	400	50	20,000	50	20,000		0		0		0
Organic manure application	MD	400	30	12,000	30	12,000		0		0		0
Chemical fertilizers	MD	400	20	8,000	20	8,000		0		0		0
Leveling	MD	400	15	6,000	15	6,000		0		0		0
Preparing seeds	MD	400	10	4,000	10	4,000		0		0		0
Planting	MD	400	40	16,000	40	16,000		0		0		0
Weeding (3)	MD	400	210	84,000	70	28,000	70	28,000	70	28,000		0
Watering	MD	400	15	6,000	5	2,000	5	2,000	5	2,000		0
Harvesting	MD	400	90	36,000		0		0		0	90	36,000
Grading	MD	400	5	2,000		0		0		0	5	2,000
Sub-total				**214,000**		**116,000**		**30,000**		**30,000**		**38,000**
Inputs												
Buying seeddlings		920	256	235,520	204	187,680		0		0		0
Buying manure kg		5	10,200	51,000	10,200	51,000		0		0		0
Buying chamical fertilizers		500	50	25,000	50	25,000		0		0		0
Buying pestcides		92,000	1	92,000	1	92,000		0		0		0
Sub-total				**403,520**		**355,680**		**0**		**0**		**0**
Grand Total				**617,520**		**471,680**		**30,000**		**30,000**		**38,000**
(C) Net Return				**4,902,480**		**-471,680**		**-30,000**		**-30,000**		**5,482,000**
(D) Family Labor	% of labor		90	192,600	90	104,400	90	27,000	90	27,000	90	34,200
(E) Production Cost exclude family labor				424,920		367,280		3,000		3,000		3,800
(F) Net Income				**5,095,080**		**-367,280**		**-3,000**		**-3,000**		**5,516,200**

Note: Analysis is based on the data collected from RODHA and RADA, and data collected in the local markets

7. Cost and Benefit of Crops

Table 42 Crop: Coffee (Cherry) (Financial Price)

Activities	Unit	Unit Price	With Project (3Years)		With Project							
					1st Year		2nd Year		3rd Year		4th Year	
			Qu'ty	Total Value	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	600	3,750	2,250,000	0	0	0	0	3,750	2,250,000	3,750	2,250,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**2,250,000**		**0**		**0**		**2,250,000**		**2,250,000**
(B) Procution Cost												
1) Land preparation												
Digging holes 40 holes/day	MD	800	63	50,400	63	50,400		0		0		0
1st plowing	MD	800	100	80,000	100	80,000		0		0		0
2nd plowing	MD	800	150	120,000	150	120,000		0		0		0
Erosion control	MD	800	15	12,000	15	12,000		0		0		0
Sub-total				**262,400**		**262,400**		**0**		**0**		**0**
2) Planting								0		0		0
Buying 2500 seeddlings , 25 Rwf/ seeddling	plant	25	2,500	62,500	2,500	62,500		0		0		0
Transport of seedlings: 200 seeddlings/day	MD	800	13	10,400	13	10,400		0		0		0
Planting: 150 seeddlings/day	MD	800	17	13,600	17	13,600		0		0		0
Shed (200 seedlings/day)	MD	800	13	10,400	13	10,400		0		0		0
Manure (15 kg/hole) + transport	Kg	30	37,500	1,125,000	37,500	1,125,000		0		0		0
Sub-total				**1,221,900**		**1,221,900**		**0**		**0**		**0**
3) Upkeeping								0		0		0
1st mulching	MD	800	250	200,000	250	200,000		0		0		0
2nd mulching	MD	800	125	100,000		0	125	100,000		0		0
3rd mulching	MD	800	125	100,000		0		0	125	100,000		
Upkeeping for the first three years	MD	800	150	120,000	50	40,000	50	40,000	50	40,000		
Agobiada hole: 200 seedlings / day	MD	800	13	10,400	13	10,400		0		0		
pruning 400 trees/day	MD	800	6	4,800		0	3	2,400	3	2,400		
1 saw/3years/1500 rwf	saw	1,500	10	15,000		0	5	7,500	5	7,500		
1 prinning shears /3years/3500rwf	pruning	3,500	10	35,000		0	5	17,500	5	17,500		
1 hou/3years/1500 Rwf	hou	1,500	10	15,000		0	5	7,500	5	7,500		
1 pitch fork/3years/2550 Rwf	pitich	2,500	10	25,000		0	5	12,500	5	12,500		
1 shovel/3years 1500rwf	shovel	1,500	10	15,000		0	5	7,500	5	7,500		
3 Baskets	basket	1,000	10	10,000		0	5	5,000	5	5,000		
Sub-total				**650,200**		**250,400**		**199,900**		**199,900**		**0**
4) Planting mulching grass												
1 ha of themeda grass 300000 rwf		300,000	1	300,000	1	300,000						
5) Land acquisition												
2 ha (1 ha for caffee, 1 ha for themeda grass)		1,000,000	2	2,000,000	2	2,000,000						
6) Production cost				**4,434,500**		**4,034,700**		**199,900**		**199,900**		**0**
7) Benefit 10% (443350 rwf x 3 years)				1,330,350		443,450		443,450		443,450		
8) Total investment				**5,764,850**		**4,478,150**		**643,350**		**643,350**		**0**
9) Depreciation for 30 years				192,162								
2. Expenses												
Upkeeping X4/year, 100 trees/day	MD	800	100	80,000					100	80,000	100	80,000
Mulching 25feet/day (cutting and transport)	MD	800	100	80,000					100	80,000	100	80,000
Plant care chemicals: 1.25L/ha at 4500 rwf/1	Liter	4,500	1	4,500					1	4,500	1	4,500
Spraying 25 MD X 2	MD	800	50	40,000					50	40,000	50	40,000
pruning 200 feet/day X 1/term	MD	800	50	40,000					50	40,000	50	40,000
Organic manure: 1t/ha at 480 000rwf/ha	Ton	480,000	1	480,000					1	480,000	1	480,000
Fertilizer application: 100 trees/day X 2	MD	800	50	40,000					50	40,000	50	40,000
Harvesting 30kg/day for 18750kg of cherry	MD	800	625	500,000					625	500,000	625	500,000
Taking off red skins and washing	MD	800	156	124,800					156	124,800	156	124,800
drying	FF	5,000	1	5,000					1	5,000	1	5,000
Buying sprayer : 5000 rwf/year	pcs	5,000	1	5,000					1	5,000	1	5,000
Buying 200 racks 2500 rwf/year	pcs	833	20	16,660					20	16,660	20	16,660
Buying 10 saws	pcs	500	10	5,000					10	5,000	10	5,000
Buying 10 pruning shears	pcs	1,667	10	16,670					10	16,670	10	16,670
Buying 20 empty sacks	pcs	67	20	1,340					20	1,340	20	1,340
Transport and sale	MD	800	94	75,200					94	75,200	94	75,200
Total annual expenses				**1,514,170**		**0**		**0**		**1,514,170**		**1,514,170**
2. Annual depreciation				192,162								
3. Total annual charges				**1,706,332**		**4,478,150**		**643,350**		**2,157,520**		**1,514,170**
Production of annual charges 1500gr/ tree x 2500= 3750kg				455								
Cost price of 1 kg of parched coffee				80								
(C) Net Return				**543,668**		**-4,478,150**		**-643,350**		**92,480**		**735,830**
(D) Family Labor	% of labor		80	1,289,600	80	277,760	80	113,920	80	897,920	80	784,000
(E) Production Cost exclude family labor				416,732		4,200,390		529,430		1,259,600		730,170
(F) Net Income				**1,833,268**		**-4,200,390**		**-529,430**		**990,400**		**1,519,830**

Note: Analysis is based on the data collected from Rwanda Coffee Development Authority.

Table 43 Crop: Coffee (Cherry) (Economic Price)

Activities	Unit	Unit Price	With Project (3Years)		With Project							
					1st Year		2nd Year		3rd Year		4th Year	
			Qu'ty	Total Value	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price	Qu'ty	Total Price
(A) INCOME												
Main Product	Kg	552	3,750	2,070,000	0	0	0	0	3,750	2,070,000	3,750	2,070,000
By-product	Kg			0		0		0		0		0
Total Gross Income				**2,070,000**		**0**		**0**		**2,070,000**		**2,070,000**
(B) Procution Cost												
1) Land preparation												
Digging holes 40 holes/day	MD	400	63	25,200	63	25,200		0		0		0
1st plowing	MD	400	100	40,000	100	40,000		0		0		0
2nd plowing	MD	400	150	60,000	150	60,000		0		0		0
Erosion control	MD	400	15	6,000	15	6,000		0		0		0
Sub-total				**131,200**		**131,200**		**0**		**0**		**0**
2) Planting								0		0		0
Buying 2500 seeddlings , 25 Rwf/ seeddling	plant	23	2,500	57,500	2,500	57,500		0		0		0
Transport of seedlings: 200 seeddlings/day	MD	400	13	5,200	13	5,200		0		0		0
Planting: 150 seeddlings/day	MD	400	17	6,800	17	6,800		0		0		0
Shed (200 seedlings/day)	MD	400	13	5,200	13	5,200		0		0		0
Manure (15 kg/hole) + transport	Kg	30	37,500	1,125,000	37,500	1,125,000		0		0		0
Sub-total				**1,199,700**		**1,199,700**		**0**		**0**		**0**
3) Upkeeping								0		0		0
1st mulching	MD	400	250	100,000	250	100,000		0		0		0
2nd mulching	MD	400	125	50,000		0	125	50,000		0		0
3rd mulching	MD	400	125	50,000		0		0	125	50,000		
Upkeeping for the first three years	MD	400	150	60,000	50	20,000	50	20,000	50	20,000		
Agobiada hole: 200 seedlings / day	MD	400	13	5,200	13	5,200		0		0		
pruning 400 trees/day	MD	400	6	2,400		0	3	1,200	3	1,200		
1 saw/3years/1500 rwf	saw	1,380	10	13,800		0	5	6,900	5	6,900		
1 prinning shears /3years/3500rwf	pruning	3,220	10	32,200		0	5	16,100	5	16,100		
1 hou/3years/1500 Rwf	hou	1,380	10	13,800		0	5	6,900	5	6,900		
1 pitch fork/3years/2550 Rwf	pitich	2,300	10	23,000		0	5	11,500	5	11,500		
1 shovel/3years 1500rwf	shovel	1,380	10	13,800		0	5	6,900	5	6,900		
3 Baskets	basket	920	10	9,200		0	5	4,600	5	4,600		
Sub-total				**373,400**		**125,200**		**124,100**		**124,100**		**0**
4) Planting mulching grass												
1 ha of themeda grass 300000 rwf		300,000	1	300,000	1	300,000						
5) Land acquisition												
2 ha (1 ha for caffee, 1 ha for themeda grass)		1,000,000	2	2,000,000	2	2,000,000						
6) Production cost				**4,004,300**		**3,756,100**		**124,100**		**124,100**		**0**
7) Benefit 10% (443350 rwf x 3 years)				1,201,290		400,430		400,430		400,430		
8) Total investment				**5,205,590**		**4,156,530**		**524,530**		**524,530**		**0**
9) Depreciation for 30 years				173,520								
2. Expenses												
Upkeeping X4/year, 100 trees/day	MD	400	100	40,000					100	40,000	100	40,000
Mulching 25feet/day (cutting and transport)	MD	400	100	40,000					100	40,000	100	40,000
Plant care chemicals: 1.25L/ha at 4500 rwf/1	Liter	4,140	1	4,140					1	4,140	1	4,140
Spraying 25 MD X 2	MD	400	50	20,000					50	20,000	50	20,000
pruning 200 feet/day X 1/term	MD	400	50	20,000					50	20,000	50	20,000
Organic manure: 1t/ha at 480 000rwf/ha	Ton	480,000	1	480,000					1	480,000	1	480,000
Fertilizer application: 100 trees/day X 2	MD	400	50	20,000					50	20,000	50	20,000
Harvesting 30kg/day for 18750kg of cherry	MD	400	625	250,000					625	250,000	625	250,000
Taking off red skins and washing	MD	400	156	62,400					156	62,400	156	62,400
drying	FF	4,600	1	4,600					1	4,600	1	4,600
Buying sprayer : 5000 rwf/year	pcs	4,600	1	4,600					1	4,600	1	4,600
Buying 200 racks 2500 rwf/year	pcs	766	20	15,320					20	15,320	20	15,320
Buying 10 saws	pcs	460	10	4,600					10	4,600	10	4,600
Buying 10 pruning shears	pcs	1,534	10	15,340					10	15,340	10	15,340
Buying 20 empty sacks	pcs	62	20	1,240					20	1,240	20	1,240
Transport and sale	MD	400	94	37,600					94	37,600	94	37,600
Total annual expenses				**1,019,840**		**0**		**0**		**1,019,840**		**1,019,840**
2. Annual depreciation				173,520								
3. Total annual charges				**1,193,360**		**4,156,530**		**524,530**		**1,544,370**		**1,019,840**
Production of annual charges 1500gr/ tree x 2500= 3750kg				318								
Cost price of 1 kg of parched coffee				80								
(C) Net Return				**876,640**		**-4,156,530**		**-524,530**		**525,630**		**1,050,160**
(D) Family Labor	% of labor		80	644,800	80	138,880	80	56,960	80	448,960	80	392,000
(E) Production Cost exclude family labor				548,560		4,017,650		467,570		1,095,410		627,840
(F) Net Income				**1,521,440**		**-4,017,650**		**-467,570**		**974,590**		**1,442,160**

Note: Analysis is based on the data collected from Rwanda Coffee Development Authority.

8. Financial Benefit (Financial Price)

Table 44 Bugesera 2 Gashora Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	22.4	-	14.7	-	10.8	-	240	-	240	-	240	-	5,376	-	3,528	-	2,592
Maize	12%	-	12.2	-	8	-	5.9	-	262	-	262	-	262	-	3,196	-	2,096	-	1,546
Sweet potato	7%	7.1	7.1	4.7	4.7	3.4	3.4	241	241	241	241	241	241	1,711	1,711	1,133	1,133	819	819
Beans	30%	30.6	30.6	20.1	20.1	14.7	14.7	174	174	174	174	174	174	5,324	5,324	3,497	3,497	2,558	2,558
Cassava	24%	24.5	24.5	16.1	16.1	11.8	11.8	281		281		281		6,885	-	4,524	-	3,316	-
Banana	5%	5.1	5.1	3.4	3.4	2.5	2.5	611		611		611		3,116	-	2,077	-	1,528	-
Total	100%	67.3	101.9	44.3	67.0	32.4	49.1								32,643		21,485		15,736

Table 45 Bugesera 3 Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	32.8	-	16.5	-	12.1	-	240	-	240	-	240	-	7,872	-	3,960	-	2,904
Maize	12%	-	17.9	-	9	-	6.6	-	262	-	262	-	262	-	4,690	-	2,358	-	1,729
Sweet potato	7%	10.4	10.4	5.3	5.3	3.9	3.9	241	241	241	241	241	241	2,506	2,506	1,277	1,277	940	940
Beans	30%	44.7	44.7	22.5	22.5	16.5	16.5	174	174	174	174	174	174	7,778	7,778	3,915	3,915	2,871	2,871
Cassava	24%	35.8	35.8	18	18	13.2	13.2	281		281		281		10,060	-	5,058	-	3,709	-
Banana	5%	7.5	7.5	3.8	3.8	2.8	2.8	611		611		611		4,583	-	2,322	-	1,711	-
Total	100%	98.4	149.1	49.6	75.1	36.4	55.1								47,773		24,082		17,675

Table 46 Bugesera 4 Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	15.8	-	32.1	-	23.3	-	240	-	240	-	240	-	3,792	-	7,704	-	5,592
Maize	12%	-	8.6	-	17.5	-	12.7	-	262	-	262	-	262	-	2,253	-	4,585	-	3,327
Sweet potato	7%	5	5	10.2	10.2	7.4	7.4	241	241	241	241	241	241	1,205	1,205	2,458	2,458	1,783	1,783
Beans	30%	21.6	21.6	43.8	43.8	31.8	31.8	174	174	174	174	174	174	3,758	3,758	7,621	7,621	5,533	5,533
Cassava	24%	17.3	17.3	35	35	25.4	25.4	281		281		281		4,861	-	9,835	-	7,137	-
Banana	5%	3.6	3.6	7.3	7.3	5.3	5.3	611		611		611		2,200	-	4,460	-	3,238	-
Total	100%	47.5	71.9	96.3	145.9	69.9	105.9								23,032		46,742		33,926

Table 47 Ngoma 21 Remera Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	29%	13.9	13.9	17.7	17.7	13.6	13.6	240	240	240	240	240	240	3,336	3,336	4,248	4,248	3,264	3,264
Maize	7%	3.4	3.4	4.3	4.3	3.3	3.3	262	262	262	262	262	262	891	891	1,127	1,127	865	865
Sweet potato	17%	8.2	8.2	10.4	10.4	8	8	241	241	241	241	241	241	1,976	1,976	2,506	2,506	1,928	1,928
Beans	16%	7.7	7.7	9.8	9.8	7.5	7.5	174	174	174	174	174	174	1,340	1,340	1,705	1,705	1,305	1,305
Vegetable (Cabbage)	4%	-	1.9	-	2.4	-	1.9	-	884	-	884	-	884	-	1,680	-	2,122	-	1,680
Vegetable (Tomato)	4%	1.9	-	2.4	-	1.9	-	579	-	579	-	579	-	1,100	-	1,390	-	1,100	-
Cassava	18%	8.6	8.6	11	11	8.5	8.5	281		281		281		2,417	-	3,091	-	2,389	-
Banana	5%	2.4	2.4	3.1	3.1	2.4	2.4	611		611		611		1,466	-	1,894	-	1,466	-
Total	100%	46.1	46.1	58.7	58.7	45.2	45.2								21,749		27,669		21,359

Table 48 Ngoma 22 Rurenge Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2				Case 1		Case 2				Case 1		Case 2			
		SA	SB	SA	SB			SA	SB	SA	SB			SA	SB	SA	SB		
Rice	15%	47.1	47.1	24.8	24.8			961	961	961	961			45,263	45,263	23,833	23,833		
Sorghum	24%	-	75.4	-	39.6			-	240	-	240			-	18,096	-	9,504		
Maize	20%	62.8	62.8	33	33			262	262	262	262			16,454	16,454	8,646	8,646		
Sweet potato	5%	15.7	15.7	8.3	8.3			241	241	241	241			3,784	3,784	2,000	2,000		
Beans	24%	75.4	75.4	39.6	39.6			174	174	174	174			13,120	13,120	6,890	6,890		
Vegetable (Cabbage)	2%	-	6.3	-	3.3			-	884	-	884			-	5,569	-	2,917		
Cassava	5%	15.7	15.7	8.3	8.3			281		281				4,412	-	2,332	-		
Banana	5%	15.7	15.7	8.3	8.3			611		611				9,593	-	5,071	-		
Total	100%	232.4	314.1	122.3	165.2										194,912		102,562		

Table 49 Gatsibo 31 Rugarama Net Return Without Project (Financial Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2				Case 1		Case 2				Case 1		Case 2			
		SA	SB	SA	SB			SA	SB	SA	SB			SA	SB	SA	SB		
Sorghum	24%	-	0.2	-	0.5			-	240	-	240			-	48	-	120		
Maize	34%	0.3	0.3	0.7	0.7			262	262	262	262			79	79	183	183		
Sweet potato	2%	0	0	0.0	0.0			241	241	241	241			-	-	-	-		
Beans	15%	0.2	0.2	0.3	0.3			174	174	174	174			35	35	52	52		
Cassava	4%	0	0	0.1	0.1			281		281				-	-	28	-		
Banana	21%	0.2	0.2	0.4	0.4			611		611				122	-	244	-		
Total	100%	0.7	0.9	1.5	2.0										398		862		

Table 50 Bugesera 2 Gashora Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	20.4	-	1,474	1,690	1,690	1,690	-	30,070	34,476	34,476	34,476
Pineapple	80%	81.6	-2,254	3,599	3,599	3,599	3,599	-183,926	293,678	293,678	293,678	293,678
Total	100%	102						-183,926	323,748	328,154	328,154	328,154

Table 51 Bugesera 3 Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	29.8	-	1,474	1,690	1,690	1,690	-	43,925	50,362	50,362	50,362
Pineapple	80%	119.2	-2,254	3,599	3,599	3,599	3,599	-268,677	429,001	429,001	429,001	429,001
Total	100%	149						-268,677	472,926	479,363	479,363	479,363

Table 52 Bugesera 4 Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	14.4	-	1,474	1,690	1,690	1,690	-	21,226	24,336	24,336	24,336
Pineapple	80%	57.6	-2,254	3,599	3,599	3,599	3,599	-129,830	207,302	207,302	207,302	207,302
Total	100%	72						-129,830	228,528	231,638	231,638	231,638

Table 53 Ngoma 21 Remera Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	9.6	-	1,474	1,690	1,690	1,690	-	14,150	16,224	16,224	16,224
Avocado	80%	38.4	-607	-6	-6	3,052	3,052	-23,309	-230	-230	117,197	117,197
Total	100%	48						-23,309	13,920	15,994	133,421	133,421

Table 54 Ngoma 22 Rurenge Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Rice	20%	62.8	2,192	2,322	2,322	2,322	2,322	137,658	145,822	145,822	145,822	145,822
Pineapple	80%	251.2	-2,254	3,599	3,599	3,599	3,599	-566,205	904,069	904,069	904,069	904,069
Total	100%	314.0						-428,547	1,049,891	1,049,891	1,049,891	1,049,891

Table 55 Gatsibo 31 Rugarama Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	10%	0.1	-	1,474	1,690	1,690	1,690	-	147	169	169	169
Coffee	90%	0.9	-4,200	-529	990	1,520	1,520	-3,780	-476	891	1,368	1,368
Total	100%	1.0						-3,780	-329	1,060	1,537	1,537

8. Financial Benefit (Financial Price)

Table 56 Bugesera 2 Gashora Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Maize	65%	43.6	645	842	909	1,027	1,027	1,027	1,027	1,027	28,122	36,711	39,632	44,777	44,777	44,777	44,777	44,777
Vegetable (Cabbage)	15%	10.1	-	1,458	-	1,745	-	1,860	-	2,032	-	14,726	-	17,625	-	18,786	-	20,523
Vegetable (Tomato)	15%	10.1	1,603	-	2,115	-	2,319	-	2,627	-	16,190	-	21,362	-	23,422	-	26,533	-
Beans	15%	10.1	274	328	342	374	374	374	374	374	2,767	3,313	3,454	3,777	3,777	3,777	3,777	3,777
Banana	5%	3.4	-		1,474		1,690		1,690		-	-	5,012	-	5,746	-	5,746	-
Total		77.3										101,829		135,639		145,062		149,910

Table 57 Bugesera 3 Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Maize	65%	48.8	645	842	909	1,027	1,027	1,027	1,027	1,027	31,476	41,090	44,359	50,118	50,118	50,118	50,118	50,118
Vegetable (Cabbage)	15%	11.3	-	1,458	-	1,745	-	1,860	-	2,032	-	16,475	-	19,719	-	21,018	-	22,962
Vegetable (Tomato)	15%	11.3	1,603	-	2,115	-	2,319	-	2,627	-	18,114	-	23,900	-	26,205	-	29,685	-
Beans	15%	11.3	274	328	342	374	374	374	374	374	3,096	3,706	3,865	4,226	4,226	4,226	4,226	4,226
Banana	5%	3.8	-		1,474		1,690		1,690		-	-	5,601	-	6,422	-	6,422	-
Total		86.5										113,957		151,788		162,333		167,757

Table 58 Bugesera 4 Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Maize	65%	94.9	645	842	909	1,027	1,027	1,027	1,027	1,027	61,211	79,906	86,264	97,462	97,462	97,462	97,462	97,462
Vegetable (Cabbage)	15%	21.9	-	1,458	-	1,745	-	1,860	-	2,032	-	31,930	-	38,216	-	40,734	-	44,501
Vegetable (Tomato)	15%	21.9	1,603	-	2,115	-	2,319	-	2,627	-	35,106	-	46,319	-	50,786	-	57,531	-
Beans	15%	21.9	645	842	909	1,027	1,027	1,027	1,027	1,027	14,126	18,440	19,907	22,491	22,491	22,491	22,491	22,491
Banana	5%	7.3	-		1,474		1,690		1,690		-	-	10,760	-	12,337	-	12,337	-
Total		167.9										240,719		321,419		343,763		354,275

Table 59 Ngoma 21 Remera Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Maize	75%	45.8	645	842	909	1,027	1,027	1,027	1,027	1,027	29,541	38,564	41,632	47,037	47,037	47,037	47,037	47,037
Vegetable (Cabbage)	10%	6.1	-	1,458	-	1,745	-	1,860	-	2,032	-	8,894	-	10,645	-	11,346	-	12,395
Vegetable (Tomato)	10%	6.1	1,603	-	2,115	-	2,319	-	2,627	-	9,778	-	12,902	-	14,146	-	16,025	-
Beans	10%	6.1	274	328	342	374	374	374	374	374	1,671	2,001	2,086	2,281	2,281	2,281	2,281	2,281
Banana	5%	3.1	-		1,474		1,690		1,690		-	-	4,569	-	5,239	-	5,239	-
Total		67.2										90,449		121,152		129,367		132,295

Table 60 Ngoma 22 Rurenge Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Rice	20%	33	1,063	1,129	1,152	1,170	1,170	1,170	1,170	1,170	35,079	37,257	38,016	38,610	38,610	38,610	38,610	38,610
Maize	15%	24.8	645	842	909	1,027	1,027	1,027	1,027	1,027	15,996	20,882	22,543	25,470	25,470	25,470	25,470	25,470
Vegetable (Cabbage)	30%	49.5	-	1,458	-	1,745	-	1,860	-	2,032	-	72,171	-	86,378	-	92,070	-	100,584
Vegetable (Tomato)	30%	49.5	1,603	-	2,115	-	2,319	-	2,627	-	79,349	-	104,693	-	114,791	-	130,037	-
Beans	30%	49.5	274	328	342	374	374	374	374	374	13,563	16,236	16,929	18,513	18,513	18,513	18,513	18,513
Banana	5%	8.3	-		1,474		1,690		1,690		-	-	12,234	-	14,027	-	14,027	-
Total		214.6										290,533		363,386		386,074		409,834

Table 61 Gatsibo 31 Rugarama Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Maize	70%	1.4	645	842	909	1,027	1,027	1,027	1,027	1,027	903	1,179	1,273	1,438	1,438	1,438	1,438	1,438
Vegetable (Cabbage)	5%	0.1	-	1,458	-	1,745	-	1,860	-	2,032	-	146	-	175	-	186	-	203
Vegetable (Tomato)	5%	0.1	1,603	-	2,115	-	2,319	-	2,627	-	160	-	212	-	232	-	263	-
Beans	5%	0.1	274	328	342	374	374	374	374	374	27	33	34	37	37	37	37	37
Banana	20%	0.4	-		1,474		1,690		1,690		-	-	590	-	676	-	676	-
Total		2.1										2,448		3,759		4,044		4,092

Table 62 Bugesera 2 Gashora Net Return With Project (Financial Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Rice	20%	9.8	1,063	1,129	1,152	1,170	1,170	1,170	1,170	1,170	10,417	11,064	11,290	11,466	11,466	11,466	11,466	11,466
Maize	45%	22.1	645	842	909	1,027	1,027	1,027	1,027	1,027	14,255	18,608	20,089	22,697	22,697	22,697	22,697	22,697
Vegetable (Cabbage)	15%	7.4	-	1,458	-	1,745	-	1,860	-	2,032	-	10,789	-	12,913	-	13,764	-	15,037
Vegetable (Tomato)	15%	7.4	1,603	-	2,115	-	2,319	-	2,627	-	11,862	-	15,651	-	17,161	-	19,440	-
Beans	10%	4.9	274	328	342	374	374	374	374	374	1,343	1,607	1,676	1,833	1,833	1,833	1,833	1,833
Banana	5%	2.5	-		1,474		1,690		1,690		-	-	3,685	-	4,225	-	4,225	-
Total		54.1										79,946		101,299		107,140		110,692

Table 63 Bugesera 3 Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Rice	20%	11	1,063	1,129	1,152	1,170	1,170	1,170	1,170	1,170	11,693	12,419	12,672	12,870	12,870	12,870	12,870	12,870
Maize	45%	24.8	645	842	909	1,027	1,027	1,027	1,027	1,027	15,996	20,882	22,543	25,470	25,470	25,470	25,470	25,470
Vegetable (Cabbage)	15%	8.3	-	1,458	-	1,745	-	1,860	-	2,032	-	12,101	-	14,484	-	15,438	-	16,866
Vegetable (Tomato)	15%	8.3	1,603	-	2,115	-	2,319	-	2,627	-	13,305	-	17,555	-	19,248	-	21,804	-
Beans	10%	5.5	274	328	342	374	374	374	374	374	1,507	1,804	1,881	2,057	2,057	2,057	2,057	2,057
Banana	5%	2.8	-		1,474		1,690		1,690		-	-	4,127	-	4,732	-	4,732	-
Total		60.7										89,707		113,658		120,211		124,195

Table 64 Bugesera 4 Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Rice	20%	21.2	1,063	1,129	1,152	1,170	1,170	1,170	1,170	1,170	22,536	23,935	24,422	24,804	24,804	24,804	24,804	24,804
Maize	45%	47.7	645	842	909	1,027	1,027	1,027	1,027	1,027	30,767	40,163	43,359	48,988	48,988	48,988	48,988	48,988
Vegetable (Cabbage)	15%	15.9	-	1,458	-	1,745	-	1,860	-	2,032	-	23,182	-	27,746	-	29,574	-	32,309
Vegetable (Tomato)	15%	15.9	1,603	-	2,115	-	2,319	-	2,627	-	25,488	-	33,629	-	36,872	-	41,769	-
Beans	10%	10.6	274	328	342	374	374	374	374	374	2,904	3,477	3,625	3,964	3,964	3,964	3,964	3,964
Banana	5%	5.3	-		1,474		1,690		1,690		-	-	7,812	-	8,957	-	8,957	-
Total		116.6										172,451		218,349		230,916		238,548

Table 65 Ngoma 21 Remera Net Return With Project (Financial Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB	Net Return (000Rwf/ha) 1st Year SA	1st Year SB	2nd year SA	2nd year SB	3rd year SA	3rd year SB	4th year SA	4th year SB
Rice	20%	9.4	1,063	1,129	1,152	1,170	1,170	1,170	1,170	1,170	9,992	10,613	10,829	10,998	10,998	10,998	10,998	10,998
Maize	55%	25.9	645	842	909	1,027	1,027	1,027	1,027	1,027	16,706	21,808	23,543	26,599	26,599	26,599	26,599	26,599
Vegetable (Cabbage)	10%	4.7	-	1,458	-	1,745	-	1,860	-	2,032	-	6,853	-	8,202	-	8,742	-	9,550
Vegetable (Tomato)	10%	4.7	1,603	-	2,115	-	2,319	-	2,627	-	7,534	-	9,941	-	10,899	-	12,347	-
Beans	5%	2.4	274	328	342	374	374	374	374	374	658	787	821	898	898	898	898	898
Banana	5%	2.4	-		1,474		1,690		1,690		-	-	3,538	-	4,056	-	4,056	-
Total		49.5										74,950		95,367		100,687		102,943

9. Economic Benefit (Economic Price)

Table 66 Bugesera 2 Gashora Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	22.4	-	14.7	-	11.2	-	116	-	116	-	116	-	2,598	-	1,705	-	1,299
Maize	12%	-	12.2	-	8	-	6.1	-	152	-	152	-	152	-	1,854	-	1,216	-	927
Sweet potato	7%	7.1	7.1	4.7	4.7	3.6	3.6	88	88	88	88	88	88	625	625	414	414	317	317
Beans	30%	30.6	30.6	20.1	20.1	15.3	15.3	53	53	53	53	53	53	1,622	1,622	1,065	1,065	811	811
Cassava	24%	24.5	24.5	16.1	16.1	12.2	12.2	148		148		148		3,626	-	2,383	-	1,806	-
Banana	5%	5.1	5.1	3.4	3.4	2.6	2.6	345		345		345		1,760	-	1,173	-	897	-
Total	100%	67.3	101.9	44.3	67.0	33.7	51.0								14,332		9,435		7,185

Table 67 Bugesera 3 Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	32.8	-	16.5	-	12.5	-	116	-	116	-	116	-	3,805	-	1,914	-	1,450
Maize	12%	-	17.9	-	9	-	6.8	-	152	-	152	-	152	-	2,721	-	1,368	-	1,034
Sweet potato	7%	10.4	10.4	5.3	5.3	4	4	88	88	88	88	88	88	915	915	466	466	352	352
Beans	30%	44.7	44.7	22.5	22.5	17.1	17.1	53	53	53	53	53	53	2,369	2,369	1,193	1,193	906	906
Cassava	24%	35.8	35.8	18	18	13.7	13.7	148		148		148		5,298	-	2,664	-	2,028	-
Banana	5%	7.5	7.5	3.8	3.8	2.9	2.9	345		345		345		2,588	-	1,311	-	1,001	-
Total	100%	98.4	149.1	49.6	75.1	37.7	57.0								20,980		10,575		8,029

Table 68 Bugesera 4 Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	22%	-	15.8	-	32.1	-	24.2	-	116	-	116	-	116	-	1,833	-	3,724	-	2,807
Maize	12%	-	8.6	-	17.5	-	13.2	-	152	-	152	-	152	-	1,307	-	2,660	-	2,006
Sweet potato	7%	5	5	10.2	10.2	7.7	7.7	88	88	88	88	88	88	440	440	898	898	678	678
Beans	30%	21.6	21.6	43.8	43.8	33	33	53	53	53	53	53	53	1,145	1,145	2,321	2,321	1,749	1,749
Cassava	24%	17.3	17.3	35	35	26.4	26.4	148		148		148		2,560	-	5,180	-	3,907	-
Banana	5%	3.6	3.6	7.3	7.3	5.5	5.5	345		345		345		1,242	-	2,519	-	1,898	-
Total	100%	47.5	71.9	96.3	145.9	72.6	110.0								10,112		20,521		15,472

Table 69 Ngoma 21 Remera Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3		Case 1		Case 2		Case 3	
		SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Sorghum	29%	13.9	13.9	17.7	17.7	14.2	14.2	116	116	116	116	116	116	1,612	1,612	2,053	2,053	1,647	1,647
Maize	7%	3.4	3.4	4.3	4.3	3.4	3.4	152	152	152	152	152	152	517	517	654	654	517	517
Sweet potato	17%	8.2	8.2	10.4	10.4	8.3	8.3	88	88	88	88	88	88	722	722	915	915	730	730
Beans	16%	7.7	7.7	9.8	9.8	7.8	7.8	53	53	53	53	53	53	408	408	519	519	413	413
Vegetable (Cabbage)	4%	-	1.9	-	2.4	-	2	-	660	-	660	-	660	-	1,254	-	1,584	-	1,320
Vegetable (Tomato)	4%	1.9	-	2.4	-	2	-	324	-	324	-	324	-	616	-	778	-	648	-
Cassava	18%	8.6	8.6	11	11	8.8	8.8	148		148		148		1,273	-	1,628	-	1,302	-
Banana	5%	2.4	2.4	3.1	3.1	2.5	2.5	345		345		345		828	-	1,070	-	863	-
Total	100%	46.1	46.1	58.7	58.7	47	47								10,489		13,342		10,747

Table 70 Ngoma 22 Rurenge Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2				Case 1		Case 2				Case 1		Case 2			
		SA	SB	SA	SB			SA	SB	SA	SB			SA	SB	SA	SB		
Rice	15%	47.1	47.1	24.8	24.8			464	464	464	464			21,854	21,854	11,507	11,507		
Sorghum	24%	-	75.4	-	39.6			-	116	-	116			-	8,746	-	4,594		
Maize	20%	62.8	62.8	33	33			152	152	152	152			9,546	9,546	5,016	5,016		
Sweet potato	5%	15.7	15.7	8.3	8.3			88	88	88	88			1,382	1,382	730	730		
Beans	24%	75.4	75.4	39.6	39.6			53	53	53	53			3,996	3,996	2,099	2,099		
Vegetable (Cabbage)	2%	-	6.3	-	3.3			-	660	-	660			-	4,158	-	2,178		
Cassava	5%	15.7	15.7	8.3	8.3			148		148				2,324	-	1,228	-		
Banana	5%	15.7	15.7	8.3	8.3			345		345				5,417	-	2,864	-		
Total	100%	232.4	314.1	122.3	165.2										94,201		49,568		

Table 71 Gatsibo 31 Rugarama Net Return Without Project (Economic Price)

Crop	Share (%)	Irrigable Area (ha)						Net Return W/O Project (000Rwf/ha/year)						Total Net Return W/O Project (000Rwf/year)					
		Case 1		Case 2				Case 1		Case 2				Case 1		Case 2			
		SA	SB	SA	SB			SA	SB	SA	SB			SA	SB	SA	SB		
Sorghum	24%	-	0.2	-	0.5			-	116	-	116			-	23	-	58		
Maize	34%	0.3	0.3	0.7	0.7			152	152	152	152			46	46	106	106		
Sweet potato	2%	0	0	0.0	0.0			88	88	88	88			-	-	-	-		
Beans	15%	0.2	0.2	0.3	0.3			53	53	53	53			11	11	16	16		
Cassava	4%	0	0	0.1	0.1			148		148				-	-	15	-		
Banana	21%	0.2	0.2	0.4	0.4			345		345				69	-	138	-		
Total	100%	0.7	0.9	1.5	2.0										206		455		

Table 72 Bugesera 2 Gashora Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	20.4	-	1,139	1,338	1,338	1,338	-	23,236	27,295	27,295	27,295
Pineapple	80%	81.6	-2,488	3,056	3,056	3,056	3,056	-203,021	249,370	249,370	249,370	249,370
Total	100%	102						-203,021	272,606	276,665	276,665	276,665

Table 73 Bugesera 3 Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	29.8	-	1,139	1,338	1,338	1,338	-	33,942	39,872	39,872	39,872
Pineapple	80%	119.2	-2,488	3,056	3,056	3,056	3,056	-296,570	364,275	364,275	364,275	364,275
Total	100%	149						-296,570	398,217	404,147	404,147	404,147

Table 74 Bugesera 4 Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	14.4	-	1,139	1,338	1,338	1,338	-	16,402	19,267	19,267	19,267
Pineapple	80%	57.6	-2,488	3,056	3,056	3,056	3,056	-143,309	176,026	176,026	176,026	176,026
Total	100%	72						-143,309	192,428	195,293	195,293	195,293

Table 75 Ngoma 21 Remera Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	20%	9.6	-	1,139	1,338	1,338	1,338	-	10,934	12,845	12,845	12,845
Avocado	80%	38.4	-659	-30	-30	2,777	2,777	-25,306	-1,152	-1,152	106,637	106,637
Total	100%	48						-25,306	9,782	11,693	119,482	119,482

Table 76 Ngoma 22 Rurenge Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Rice	20%	62.8	2,112	2,708	2,708	2,708	2,708	132,634	170,062	170,062	170,062	170,062
Pineapple	80%	251.2	-2,488	3,056	3,056	3,056	3,056	-624,986	767,667	767,667	767,667	767,667
Total	100%	314.0						-492,352	937,729	937,729	937,729	937,729

Table 77 Gatsibo 31 Rugarama Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Are (ha)	Net Return W/ Project (000Rwf/ha/year)					Total Net Return W/ Project (000Rwf/ha/year)				
			1st year	2nd year	3rd year	4th year	5th year	1st year	2nd year	3rd year	4th year	5th year
Banana	10%	0.1	-	1,139	1,338	1,338	1,338	-	114	134	134	134
Coffee	90%	0.9	-4,157	-525	526	1,050	1,050	-3,741	-473	473	945	945
Total	100%	1.0						-3,741	-359	607	1,079	1,079

9. Economic Benefit (Economic Price)

Table 78 Bugesera 2 Gashora Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Maize	65%	43.6	494	671	731	837	837	837	837	837	21,538	29,256	31,872	36,493	36,493	36,493	36,493	36,493
Vegetable (Cabbage)	15%	10.1	-	1,168	-	1,422	-	1,524	-	1,677	-	11,797	-	14,362	-	15,392	-	16,938
Vegetable (Tomato)	15%	10.1	1,246	-	1,706	-	1,891	-	2,168	-	12,585	-	17,231	-	19,099	-	21,897	-
Beans	15%	10.1	135	180	190	217	217	217	217	217	1,364	1,818	1,919	2,192	2,192	2,192	2,192	2,192
Banana	5%	3.4	-		1,139		1,338		1,338		-	-	3,873	-	4,549	-	4,549	-
Total		77.3										78,358		107,942		116,410		120,754

Table 79 Bugesera 3 Net Return With Project (Economic Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Maize	65%	48.8	494	671	731	837	837	837	837	837	24,107	32,745	35,673	40,846	40,846	40,846	40,846	40,846
Vegetable (Cabbage)	15%	11.3	-	1,168	-	1,422	-	1,524	-	1,677	-	13,198	-	16,069	-	17,221	-	18,950
Vegetable (Tomato)	15%	11.3	1,246	-	1,706	-	1,891	-	2,168	-	14,080	-	19,278	-	21,368	-	24,498	-
Beans	15%	11.3	135	180	190	217	217	217	217	217	1,526	2,034	2,147	2,452	2,452	2,452	2,452	2,452
Banana	5%	3.8	-		1,139		1,338		1,338		-	-	4,328	-	5,084	-	5,084	-
Total		86.5										87,690		120,793		130,269		135,128

Table 80 Bugesera 4 Net Return With Project (Economic Price): Case 3

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Maize	65%	94.9	494	671	731	837	837	837	837	837	46,881	63,678	69,372	79,431	79,431	79,431	79,431	79,431
Vegetable (Cabbage)	15%	21.9	-	1,168	-	1,422	-	1,524	-	1,677	-	25,579	-	31,142	-	33,376	-	36,726
Vegetable (Tomato)	15%	21.9	1,246	-	1,706	-	1,891	-	2,168	-	27,287	-	37,361	-	41,413	-	47,479	-
Beans	15%	21.9	494	671	731	837	837	837	837	837	10,819	14,695	16,009	18,330	18,330	18,330	18,330	18,330
Banana	5%	7.3	-		1,139		1,338		1,338		-	-	8,315	-	9,767	-	9,767	-
Total		167.9										188,939		259,960		280,078		289,494

Table 81 Ngoma 21 Remera Net Return With Project (Economic Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Maize	75%	45.8	494	671	731	837	837	837	837	837	22,625	30,732	33,480	38,335	38,335	38,335	38,335	38,335
Vegetable (Cabbage)	10%	6.1	-	1,168	-	1,422	-	1,524	-	1,677	-	7,125	-	8,674	-	9,296	-	10,230
Vegetable (Tomato)	10%	6.1	1,246	-	1,706	-	1,891	-	2,168	-	7,601	-	10,407	-	11,535	-	13,225	-
Beans	10%	6.1	135	180	190	217	217	217	217	217	824	1,098	1,159	1,324	1,324	1,324	1,324	1,324
Banana	5%	3.1	-		1,139		1,338		1,338		-	-	3,531	-	4,148	-	4,148	-
Total		67.2										70,005		96,910		104,297		106,921

Table 82 Ngoma 22 Rurenge Net Return With Project (Economic Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Rice	20%	33	920	1,192	1,334	1,374	1,374	1,374	1,374	1,374	30,360	39,336	44,022	45,342	45,342	45,342	45,342	45,342
Maize	15%	24.8	494	671	731	837	837	837	837	837	12,251	16,641	18,129	20,758	20,758	20,758	20,758	20,758
Vegetable (Cabbage)	30%	49.5	-	1,168	-	1,422	-	1,524	-	1,677	-	57,816	-	70,389	-	75,438	-	83,012
Vegetable (Tomato)	30%	49.5	1,246	-	1,706	-	1,891	-	2,168	-	61,677	-	84,447	-	93,605	-	107,316	-
Beans	30%	49.5	135	180	190	217	217	217	217	217	6,683	8,910	9,405	10,742	10,742	10,742	10,742	10,742
Banana	5%	8.3	-		1,139		1,338		1,338		-	-	9,454	-	11,105	-	11,105	-
Total		214.6										233,674		312,688		333,832		355,117

Table 83 Gatsibo 31 Rugarama Net Return With Project (Economic Price): Case 2

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Maize	70%	1.4	494	671	731	837	837	837	837	837	692	939	1,023	1,172	1,172	1,172	1,172	1,172
Vegetable (Cabbage)	5%	0.1	-	1,168	-	1,422	-	1,524	-	1,677	-	117	-	142	-	152	-	168
Vegetable (Tomato)	5%	0.1	1,246	-	1,706	-	1,891	-	2,168	-	125	-	171	-	189	-	217	-
Beans	5%	0.1	135	180	190	217	217	217	217	217	14	18	19	22	22	22	22	22
Banana	20%	0.4	-		1,139		1,338		1,338		-	-	456	-	535	-	535	-
Total		2.1										1,905		3,005		3,264		3,308

Table 84 Bugesera 2 Gashora Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Rice	20%	10.2	920	1,192	1,334	1,374	1,374	1,374	1,374	1,374	9,384	12,158	13,607	14,015	14,015	14,015	14,015	14,015
Maize	45%	23	494	671	731	837	837	837	837	837	11,362	15,433	16,813	19,251	19,251	19,251	19,251	19,251
Vegetable (Cabbage)	15%	7.7	-	1,168	-	1,422	-	1,524	-	1,677	-	8,994	-	10,949	-	11,735	-	12,913
Vegetable (Tomato)	15%	7.7	1,246	-	1,706	-	1,891	-	2,168	-	9,594	-	13,136	-	14,561	-	16,694	-
Beans	10%	5.1	135	180	190	217	217	217	217	217	689	918	969	1,107	1,107	1,107	1,107	1,107
Banana	5%	2.6	-		1,139		1,338		1,338		-	-	2,961	-	3,479	-	3,479	-
Total		56.3										68,532		92,808		98,519		101,830

Table 85 Bugesera 3 Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Rice	20%	11.4	920	1,192	1,334	1,374	1,374	1,374	1,374	1,374	10,488	13,589	15,208	15,664	15,664	15,664	15,664	15,664
Maize	45%	25.7	494	671	731	837	837	837	837	837	12,696	17,245	18,787	21,511	21,511	21,511	21,511	21,511
Vegetable (Cabbage)	15%	8.6	-	1,168	-	1,422	-	1,524	-	1,677	-	10,045	-	12,229	-	13,106	-	14,422
Vegetable (Tomato)	15%	8.6	1,246	-	1,706	-	1,891	-	2,168	-	10,716	-	14,672	-	16,263	-	18,645	-
Beans	10%	5.7	135	180	190	217	217	217	217	217	770	1,026	1,083	1,237	1,237	1,237	1,237	1,237
Banana	5%	2.9	-		1,139		1,338		1,338		-	-	3,303	-	3,880	-	3,880	-
Total		62.9										76,573		103,693		110,072		113,770

Table 86 Bugesera 4 Net Return With Project (Economic Price): Case 1

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Rice	20%	22	920	1,192	1,334	1,374	1,374	1,374	1,374	1,374	20,240	26,224	29,348	30,228	30,228	30,228	30,228	30,228
Maize	45%	49.5	494	671	731	837	837	837	837	837	24,453	33,215	36,185	41,432	41,432	41,432	41,432	41,432
Vegetable (Cabbage)	15%	16.5	-	1,168	-	1,422	-	1,524	-	1,677	-	19,272	-	23,463	-	25,146	-	27,671
Vegetable (Tomato)	15%	16.5	1,246	-	1,706	-	1,891	-	2,168	-	20,559	-	28,149	-	31,202	-	35,772	-
Beans	10%	11	135	180	190	217	217	217	217	217	1,485	1,980	2,090	2,387	2,387	2,387	2,387	2,387
Banana	5%	5.5	-		1,139		1,338		1,338		-	-	6,265	-	7,359	-	7,359	-
Total		121.0										147,428		199,546		211,800		218,895

Table 87 Ngoma 21 Remera Net Return With Project (Economic Price): Case 3

Crop	Share (%)	Crop Area (ha)	Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year		Net Return (000Rwf/ha) 1st Year		2nd year		3rd year		4th year	
			SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB	SA	SB
Rice	20%	9.8	920	1,192	1,334	1,374	1,374	1,374	1,374	1,374	9,016	11,682	13,073	13,465	13,465	13,465	13,465	13,465
Maize	55%	27	494	671	731	837	837	837	837	837	13,338	18,117	19,737	22,599	22,599	22,599	22,599	22,599
Vegetable (Cabbage)	10%	4.9	-	1,168	-	1,422	-	1,524	-	1,677	-	5,723	-	6,968	-	7,468	-	8,217
Vegetable (Tomato)	10%	4.9	1,246	-	1,706	-	1,891	-	2,168	-	6,105	-	8,359	-	9,266	-	10,623	-
Beans	5%	2.5	135	180	190	217	217	217	217	217	338	450	475	543	543	543	543	543
Banana	5%	2.5	-		1,139		1,338		1,338		-	-	2,848	-	3,345	-	3,345	-
Total		51.6										64,769		88,067		93,292		95,399

10. Flow of Benefit (Financial Price)

Table 88 Bugesera 2 Gashora Case 1

Year	W/O P	W/ P	Increment
1	32,643	-183,926	-216,569
2	32,643	323,748	291,105
3	32,643	328,154	295,511
4	32,643	328,154	295,511
5	32,643	328,154	295,511

Table 89 Bugesera 2 Gashora Case 2

Year	W/O P	W/ P	Increment
1	21,485	101,829	80,344
2	21,485	135,639	114,154
3	21,485	145,062	123,577
4	21,485	149,910	128,425
5	21,485	149,910	128,425

Table 90 Bugesera 2 Gashora Case 2

Year	W/O P	W/ P	Increment
1	15,736	79,946	64,210
2	15,736	101,299	85,563
3	15,736	107,140	91,404
4	15,736	110,692	94,956
5	15,736	110,692	94,956

Table 91 Bugesera 3 Case 1

Year	W/O P	W/ P	Increment
1	47,773	-268,677	-316,450
2	47,773	472,926	425,153
3	47,773	479,363	431,590
4	47,773	479,363	431,590
5	47,773	479,363	431,590

Table 92 Bugesera 3 Case 2

Year	W/O P	W/ P	Increment
1	24,082	113,957	89,875
2	24,082	151,788	127,706
3	24,082	162,333	138,251
4	24,082	167,757	143,675
5	24,082	167,757	143,675

Table 93 Bugesera 3 Case 3

Year	W/O P	W/ P	Increment
1	17,675	89,707	72,032
2	17,675	113,658	95,983
3	17,675	120,211	102,536
4	17,675	124,195	106,520
5	17,675	124,195	106,520

Table 94 Bugesera 4 Case 1

Year	W/O P	W/ P	Increment
1	23,032	-129,830	-152,862
2	23,032	228,528	205,496
3	23,032	231,638	208,606
4	23,032	231,638	208,606
5	23,032	231,638	208,606

Table 95 Bugesera 4 Case 2

Year	W/O P	W/ P	Increment
1	46,742	240,719	193,977
2	46,742	321,419	274,677
3	46,742	343,763	297,021
4	46,742	354,275	307,533
5	46,742	354,275	307,533

Table 96 Bugesera 4 Case 2

Year	W/O P	W/ P	Increment
1	33,926	172,451	138,525
2	33,926	218,349	184,423
3	33,926	230,916	196,990
4	33,926	238,548	204,622
5	33,926	238,548	204,622

Table 97 Ngoma 21 Remera Case 1

Year	W/O P	W/ P	Increment
1	21,749	-23,309	-45,058
2	21,749	13,920	-7,829
3	21,749	15,994	-5,755
4	21,749	133,421	111,672
5	21,749	133,421	111,672

Table 98 Ngoma 21 Remera Case 2

Year	W/O P	W/ P	Increment
1	27,669	90,449	62,780
2	27,669	121,152	93,483
3	27,669	129,367	101,698
4	27,669	132,295	104,626
5	27,669	132,295	104,626

Table 99 Ngoma 21 Remera Case 3

Year	W/O P	W/ P	Increment
1	21,359	74,950	53,591
2	21,359	95,367	74,008
3	21,359	100,687	79,328
4	21,359	102,943	81,584
5	21,359	102,943	81,584

Table 100 Ngoma 22 Rurenge Case 1

Year	W/O P	W/ P	Increment
1	194,912	-428,547	-623,459
2	194,912	1,049,891	854,979
3	194,912	1,049,891	854,979
4	194,912	1,049,891	854,979
5	194,912	1,049,891	854,979

Table 101 Ngoma 22 Rurenge Case 2

Year	W/O P	W/ P	Increment
1	102,562	290,533	187,971
2	102,562	363,386	260,824
3	102,562	386,074	283,512
4	102,562	409,834	307,272
5	102,562	409,834	307,272

Table 102 Gatsibo 31 Rugarama Case 1

Year	W/O P	W/ P	Increment
1	398	-3,780	-4,178
2	398	-329	-727
3	398	1,060	662
4	398	1,537	1,139
5	398	1,537	1,139

Table 103 Gatsibo 31 Rugarama Case 2

Year	W/O P	W/ P	Increment
1	862	2,448	1,586
2	862	3,759	2,897
3	862	4,044	3,182
4	862	4,092	3,230
5	862	4,092	3,230

11. Flow of Benefit (Economic Price)

Table 104 Bugesera 2 Gashora Case 1

Year	W/O P	W/ P	Increment
1	14,332	-203,021	-217,353
2	14,332	272,606	258,274
3	14,332	276,665	262,333
4	14,332	276,665	262,333
5	14,332	276,665	262,333

Table 105 Bugesera 2 Gashora Case 2

Year	W/O P	W/ P	Increment
1	9,435	78,358	68,923
2	9,435	107,942	98,507
3	9,435	116,410	106,975
4	9,435	120,754	111,319
5	9,435	120,754	111,319

Table 106 Bugesera 2 Gashora Case 2

Year	W/O P	W/ P	Increment
1	7,185	68,532	61,347
2	7,185	92,808	85,623
3	7,185	98,519	91,334
4	7,185	101,830	94,645
5	7,185	101,830	94,645

Table 107 Bugesera 3 Case 1

Year	W/O P	W/ P	Increment
1	20,980	-296,570	-317,550
2	20,980	398,217	377,237
3	20,980	404,147	383,167
4	20,980	404,147	383,167
5	20,980	404,147	383,167

Table 108 Bugesera 3 Case 2

Year	W/O P	W/ P	Increment
1	10,575	87,690	77,115
2	10,575	120,793	110,218
3	10,575	130,269	119,694
4	10,575	135,128	124,553
5	10,575	135,128	124,553

Table 109 Bugesera 3 Case 3

Year	W/O P	W/ P	Increment
1	8,029	76,573	68,544
2	8,029	103,693	95,664
3	8,029	110,072	102,043
4	8,029	113,770	105,741
5	8,029	113,770	105,741

Table 110 Bugesera 4 Case 1

Year	W/O P	W/ P	Increment
1	10,112	-143,309	-153,421
2	10,112	192,428	182,316
3	10,112	195,293	185,181
4	10,112	195,293	185,181
5	10,112	195,293	185,181

Table 111 Bugesera 4 Case 2

Year	W/O P	W/ P	Increment
1	20,521	188,939	168,418
2	20,521	259,960	239,439
3	20,521	280,078	259,557
4	20,521	289,494	268,973
5	20,521	289,494	268,973

Table 112 Bugesera 4 Case 2

Year	W/O P	W/ P	Increment
1	15,472	147,428	131,956
2	15,472	199,546	184,074
3	15,472	211,800	196,328
4	15,472	218,895	203,423
5	15,472	218,895	203,423

Table 113 Ngoma 21 Remera Case 1

Year	W/O P	W/ P	Increment
1	10,489	-25,306	-35,795
2	10,489	9,782	-707
3	10,489	11,693	1,204
4	10,489	119,482	108,993
5	10,489	119,482	108,993

Table 114 Ngoma 21 Remera Case 2

Year	W/O P	W/ P	Increment
1	13,342	70,005	56,663
2	13,342	96,910	83,568
3	13,342	104,297	90,955
4	13,342	106,921	93,579
5	13,342	106,921	93,579

Table 115 Ngoma 21 Remera Case 3

Year	W/O P	W/ P	Increment
1	10,747	64,769	54,022
2	10,747	88,067	77,320
3	10,747	93,292	82,545
4	10,747	95,399	84,652
5	10,747	95,399	84,652

Table 116 Ngoma 22 Rurenge Case 1

Year	W/O P	W/ P	Increment
1	94,201	-492,352	-586,553
2	94,201	937,729	843,528
3	94,201	937,729	843,528
4	94,201	937,729	843,528
5	94,201	937,729	843,528

Table 117 Ngoma 22 Rurenge Case 2

Year	W/O P	W/ P	Increment
1	49,568	233,674	184,106
2	49,568	312,688	263,120
3	49,568	333,832	284,264
4	49,568	355,117	305,549
5	49,568	355,117	305,549

Table 118 Gatsibo 31 Rugarama Case 1

Year	W/O P	W/ P	Increment
1	206	-3,741	-3,947
2	206	-359	-565
3	206	607	401
4	206	1,079	873
5	206	1,079	873

Table 119 Gatsibo 31 Rugarama Case 2

Year	W/O P	W/ P	Increment
1	455	1,905	1,450
2	455	3,005	2,550
3	455	3,264	2,809
4	455	3,308	2,853
5	455	3,308	2,853

12. Calculation of Finaicial Internal Rate of Return (FIRR)

Table 120 FNPV (000Rwf) (I=10%)

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	524,149	1,603,678	88,774	-797,259	2,741,268	-562,857
Case 2	-203,513	118,544	615,268	-697,459	591,913	-541,206
Case 3	-291,594	-42,666	89,985	-676,374		

Table 122 FIRR (%)

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	16.4%	25.9%	12.9%	4.4%	22.5%	#DIV/0!
Case 2	9.5%	13.8%	17.2%	4.8%	16.9%	#DIV/0!
Case 3	7.7%	11.3%	12.9%	3.8%		

Table 121 F-B/C

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	1.38	2.34	1.07	0.42	1.97	0.005
Case 2	0.83	1.12	1.36	0.53	1.34	0.04
Case 3	0.71	0.95	1.06	0.48		

Table 123 Bugesera 2 Gashora Flow of Cost and Benefit (Financial Price): Case 1

EIRR = 16.4% B/C = 1.38

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	16.4%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,559,292		1,559,292	-216,569	-1,775,861	0.85929	1,339,883	-186,095	0.89286	1,392,225	-193,365
2		460	460	291,105	290,645	0.73838	340	214,946	0.79719	367	232,067
3		460	460	295,511	295,051	0.63448	292	187,496	0.71178	327	210,339
4		460	460	295,511	295,051	0.54520	251	161,114	0.63552	292	187,803
5		460	460	295,511	295,051	0.46849	216	138,443	0.56743	261	167,681
6		460	460	295,511	295,051	0.40257	185	118,963	0.50663	233	149,715
7		460	460	295,511	295,051	0.34592	159	102,223	0.45235	208	133,674
8		460	460	295,511	295,051	0.29725	137	87,840	0.40388	186	119,352
9		460	460	295,511	295,051	0.25542	117	75,480	0.36061	166	106,564
10		460	460	295,511	295,051	0.21948	101	64,859	0.32197	148	95,147
11		460	460	295,511	295,051	0.18860	87	55,733	0.28748	132	84,952
12		460	460	295,511	295,051	0.16206	75	47,890	0.25668	118	75,850
13		460	460	295,511	295,051	0.13926	64	41,152	0.22917	105	67,723
14		460	460	295,511	295,051	0.11966	55	35,361	0.20462	94	60,467
15		460	460	295,511	295,051	0.10282	47	30,386	0.18270	84	53,989
16		460	460	295,511	295,051	0.08836	41	26,110	0.16312	75	48,204
17		460	460	295,511	295,051	0.07592	35	22,436	0.14564	67	43,040
18		460	460	295,511	295,051	0.06524	30	19,279	0.13004	60	38,428
19		460	460	295,511	295,051	0.05606	26	16,566	0.11611	53	34,311
20		460	460	295,511	295,051	0.04817	22	14,235	0.10367	48	30,635
21		460	460	295,511	295,051	0.04139	19	12,232	0.09256	43	27,352
22		460	460	295,511	295,051	0.03557	16	10,511	0.08264	38	24,422
23		460	460	295,511	295,051	0.03056	14	9,032	0.07379	34	21,805
24		460	460	295,511	295,051	0.02626	12	7,761	0.06588	30	19,469
25		460	460	295,511	295,051	0.02257	10	6,669	0.05882	27	17,383
26		460	460	295,511	295,051	0.01939	9	5,731	0.05252	24	15,520
27		460	460	295,511	295,051	0.01666	8	4,924	0.04689	22	13,858
28		460	460	295,511	295,051	0.01432	7	4,231	0.04187	19	12,373
29		460	460	295,511	295,051	0.01230	6	3,636	0.03738	17	11,047
30		460	460	295,511	295,051	0.01057	5	3,124	0.03338	15	9,864
Total	1,559,292	13,340	1,572,632		6,776,212		1,342,268	1,342,268		1,395,520	1,919,669
							NPV =	0		NPV =	524,149

Table 124 Bugesera 2 Gashora Flow of Cost and Benefit (Financial Price): Case 2

EIRR = 9.5% B/C = 0.83

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	9.5%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,318,182		1,318,182	80,344	-1,237,838	0.91362	1,204,319	73,404	0.89286	1,176,948	71,736
2		460	460	114,154	113,694	0.83470	384	95,285	0.79719	367	91,003
3		460	460	123,577	123,117	0.76260	351	94,240	0.71178	327	87,960
4		460	460	128,425	127,965	0.69673	320	89,478	0.63552	292	81,616
5		460	460	128,425	127,965	0.63655	293	81,749	0.56743	261	72,872
6		460	460	128,425	127,965	0.58156	268	74,687	0.50663	233	65,064
7		460	460	128,425	127,965	0.53133	244	68,236	0.45235	208	58,093
8		460	460	128,425	127,965	0.48543	223	62,342	0.40388	186	51,869
9		460	460	128,425	127,965	0.44350	204	56,957	0.36061	166	46,311
10		460	460	128,425	127,965	0.40519	186	52,037	0.32197	148	41,349
11		460	460	128,425	127,965	0.37019	170	47,542	0.28748	132	36,919
12		460	460	128,425	127,965	0.33822	156	43,435	0.25668	118	32,963
13		460	460	128,425	127,965	0.30900	142	39,684	0.22917	105	29,432
14		460	460	128,425	127,965	0.28231	130	36,256	0.20462	94	26,278
15		460	460	128,425	127,965	0.25792	119	33,124	0.18270	84	23,463
16		460	460	128,425	127,965	0.23565	108	30,263	0.16312	75	20,949
17		460	460	128,425	127,965	0.21529	99	27,649	0.14564	67	18,704
18		460	460	128,425	127,965	0.19669	90	25,260	0.13004	60	16,700
19		460	460	128,425	127,965	0.17970	83	23,078	0.11611	53	14,911
20		460	460	128,425	127,965	0.16418	76	21,085	0.10367	48	13,313
21		460	460	128,425	127,965	0.15000	69	19,264	0.09256	43	11,887
22		460	460	128,425	127,965	0.13704	63	17,600	0.08264	38	10,613
23		460	460	128,425	127,965	0.12521	58	16,079	0.07379	34	9,476
24		460	460	128,425	127,965	0.11439	53	14,691	0.06588	30	8,461
25		460	460	128,425	127,965	0.10451	48	13,422	0.05882	27	7,554
26		460	460	128,425	127,965	0.09548	44	12,262	0.05252	24	6,745
27		460	460	128,425	127,965	0.08723	40	11,203	0.04689	22	6,022
28		460	460	128,425	127,965	0.07970	37	10,235	0.04187	19	5,377
29		460	460	128,425	127,965	0.07281	33	9,351	0.03738	17	4,801
30		460	460	128,425	127,965	0.06653	31	8,543	0.03338	15	4,287
Total	1,318,182	13,340	1,331,522		2,454,028		1,208,441	1,208,441		1,180,243	976,730
							NPV =	0		NPV =	-203,513

Table 125 Bugesera 2 Gashora Flow of Cost and Benefit (Financial Price): Case 3

EIRR = 7.7% B/C = 0.71

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	7.7%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,137,606		1,137,606	64,210	-1,073,397	0.92857	1,056,344	59,623	0.89286	1,015,720	57,330
2		460	460	85,563	85,103	0.86224	397	73,775	0.79719	367	68,210
3		460	460	91,404	90,944	0.80065	368	73,182	0.71178	327	65,060
4		460	460	94,956	94,496	0.74345	342	70,595	0.63552	292	60,346
5		460	460	94,956	94,496	0.69035	318	65,553	0.56743	261	53,881
6		460	460	94,956	94,496	0.64103	295	60,870	0.50663	233	48,108
7		460	460	94,956	94,496	0.59524	274	56,522	0.45235	208	42,953
8		460	460	94,956	94,496	0.55272	254	52,484	0.40388	186	38,351
9		460	460	94,956	94,496	0.51324	236	48,735	0.36061	166	34,242
10		460	460	94,956	94,496	0.47658	219	45,254	0.32197	148	30,573
11		460	460	94,956	94,496	0.44253	204	42,021	0.28748	132	27,298
12		460	460	94,956	94,496	0.41092	189	39,020	0.25668	118	24,373
13		460	460	94,956	94,496	0.38157	176	36,232	0.22917	105	21,762
14		460	460	94,956	94,496	0.35431	163	33,644	0.20462	94	19,430
15		460	460	94,956	94,496	0.32900	151	31,241	0.18270	84	17,348
16		460	460	94,956	94,496	0.30550	141	29,009	0.16312	75	15,489
17		460	460	94,956	94,496	0.28368	130	26,937	0.14564	67	13,830
18		460	460	94,956	94,496	0.26342	121	25,013	0.13004	60	12,348
19		460	460	94,956	94,496	0.24460	113	23,226	0.11611	53	11,025
20		460	460	94,956	94,496	0.22713	104	21,567	0.10367	48	9,844
21		460	460	94,956	94,496	0.21090	97	20,026	0.09256	43	8,789
22		460	460	94,956	94,496	0.19584	90	18,596	0.08264	38	7,847
23		460	460	94,956	94,496	0.18185	84	17,268	0.07379	34	7,007
24		460	460	94,956	94,496	0.16886	78	16,034	0.06588	30	6,256
25		460	460	94,956	94,496	0.15680	72	14,889	0.05882	27	5,586
26		460	460	94,956	94,496	0.14560	67	13,825	0.05252	24	4,987
27		460	460	94,956	94,496	0.13520	62	12,838	0.04689	22	4,453
28		460	460	94,956	94,496	0.12554	58	11,921	0.04187	19	3,976
29		460	460	94,956	94,496	0.11657	54	11,069	0.03738	17	3,550
30		460	460	94,956	94,496	0.10824	50	10,278	0.03338	15	3,169
Total	1,137,606	13,340	1,150,946		1,654,048		1,061,249	1,061,249		1,019,014	727,420
							NPV =	0		NPV =	-291,594

13. Calculation of Economic Internal Rate of Return (EIRR)

Table 126 ENPV (000Rwf) (I=10%)

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	380,563	1,337,807	4,509	-701,114	2,888,640	-526,147
Case 2	-255,393	37,538	435,934	-680,516	699,874	-505,937
Case 3	-227,945	6,722	175,285	-566,755		

Table 128 EIRR (%)

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	15.4%	24.3%	12.0%	4.8%	23.8%	#DIV/0!
Case 2	8.6%	12.6%	15.9%	4.4%	18.2%	#DIV/0!
Case 3	8.4%	12.1%	13.8%	4.8%		

Table 127 E-B/C

	Bugesera2	Bugesera3	Bugesera4	Ngoma 21	Ngoma 22	Gatsibo 31
Case 1	1.29	2.20	1.00	0.45	2.10	0.002
Case 2	0.77	1.04	1.27	0.51	1.44	0.04
Case 3	0.76	1.01	1.13	0.53		

Table 129 Bugesera 2 Gashora Flow of Cost and Benefit (Economic Price): Case 1

EIRR = 15.4% B/C = 1.29

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	15.4%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,454,417		1,454,417	-217,353	-1,671,770	0.86661	1,260,410	-188,360	0.89286	1,298,587	-194,065
2		344	344	258,274	257,930	0.75101	258	193,966	0.79719	274	205,894
3		344	344	262,333	261,989	0.65083	224	170,735	0.71178	245	186,723
4		344	344	262,333	261,989	0.56402	194	147,960	0.63552	219	166,717
5		344	344	262,333	261,989	0.48878	168	128,223	0.56743	195	148,855
6		344	344	262,333	261,989	0.42358	146	111,119	0.50663	174	132,906
7		344	344	262,333	261,989	0.36708	126	96,297	0.45235	156	118,666
8		344	344	262,333	261,989	0.31811	109	83,452	0.40388	139	105,952
9		344	344	262,333	261,989	0.27568	95	72,320	0.36061	124	94,600
10		344	344	262,333	261,989	0.23891	82	62,673	0.32197	111	84,464
11		344	344	262,333	261,989	0.20704	71	54,313	0.28748	99	75,414
12		344	344	262,333	261,989	0.17942	62	47,068	0.25668	88	67,334
13		344	344	262,333	261,989	0.15549	53	40,790	0.22917	79	60,120
14		344	344	262,333	261,989	0.13475	46	35,349	0.20462	70	53,679
15		344	344	262,333	261,989	0.11677	40	30,633	0.18270	63	47,927
16		344	344	262,333	261,989	0.10120	35	26,547	0.16312	56	42,792
17		344	344	262,333	261,989	0.08770	30	23,006	0.14564	50	38,207
18		344	344	262,333	261,989	0.07600	26	19,937	0.13004	45	34,114
19		344	344	262,333	261,989	0.06586	23	17,278	0.11611	40	30,459
20		344	344	262,333	261,989	0.05708	20	14,973	0.10367	36	27,195
21		344	344	262,333	261,989	0.04946	17	12,976	0.09256	32	24,281
22		344	344	262,333	261,989	0.04287	15	11,245	0.08264	28	21,680
23		344	344	262,333	261,989	0.03715	13	9,745	0.07379	25	19,357
24		344	344	262,333	261,989	0.03219	11	8,445	0.06588	23	17,283
25		344	344	262,333	261,989	0.02790	10	7,319	0.05882	20	15,431
26		344	344	262,333	261,989	0.02418	8	6,342	0.05252	18	13,778
27		344	344	262,333	261,989	0.02095	7	5,496	0.04689	16	12,302
28		344	344	262,333	261,989	0.01816	6	4,763	0.04187	14	10,984
29		344	344	262,333	261,989	0.01573	5	4,128	0.03738	13	9,807
30		344	344	262,333	261,989	0.01364	5	3,577	0.03338	11	8,756
Total	1,454,417	9,976	1,464,393		5,921,852		1,262,316	1,262,316		1,301,050	1,681,614
							NPV =	0		NPV =	380,563

Table 130 Bugesera 2 Gashora Flow of Cost and Benefit (Economic Price): Case 2

EIRR = 8.6% B/C = 0.77

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	8.6%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,230,281		1,230,281	68,923	-1,161,358	0.92116	1,133,290	63,489	0.89286	1,098,465	61,538
2		344	344	98,507	98,163	0.84854	292	83,587	0.79719	274	78,529
3		344	344	106,975	106,631	0.78165	269	83,617	0.71178	245	76,143
4		344	344	111,319	110,975	0.72002	248	80,152	0.63552	219	70,745
5		344	344	111,319	110,975	0.66326	228	73,833	0.56743	195	63,165
6		344	344	111,319	110,975	0.61097	210	68,013	0.50663	174	56,398
7		344	344	111,319	110,975	0.56280	194	62,651	0.45235	156	50,355
8		344	344	111,319	110,975	0.51843	178	57,712	0.40388	139	44,960
9		344	344	111,319	110,975	0.47756	164	53,162	0.36061	124	40,143
10		344	344	111,319	110,975	0.43991	151	48,971	0.32197	111	35,842
11		344	344	111,319	110,975	0.40523	139	45,110	0.28748	99	32,002
12		344	344	111,319	110,975	0.37329	128	41,554	0.25668	88	28,573
13		344	344	111,319	110,975	0.34386	118	38,278	0.22917	79	25,511
14		344	344	111,319	110,975	0.31675	109	35,260	0.20462	70	22,778
15		344	344	111,319	110,975	0.29178	100	32,480	0.18270	63	20,338
16		344	344	111,319	110,975	0.26877	92	29,920	0.16312	56	18,159
17		344	344	111,319	110,975	0.24759	85	27,561	0.14564	50	16,213
18		344	344	111,319	110,975	0.22807	78	25,388	0.13004	45	14,476
19		344	344	111,319	110,975	0.21009	72	23,387	0.11611	40	12,925
20		344	344	111,319	110,975	0.19352	67	21,543	0.10367	36	11,540
21		344	344	111,319	110,975	0.17827	61	19,845	0.09256	32	10,304
22		344	344	111,319	110,975	0.16421	56	18,280	0.08264	28	9,200
23		344	344	111,319	110,975	0.15127	52	16,839	0.07379	25	8,214
24		344	344	111,319	110,975	0.13934	48	15,511	0.06588	23	7,334
25		344	344	111,319	110,975	0.12836	44	14,289	0.05882	20	6,548
26		344	344	111,319	110,975	0.11824	41	13,162	0.05252	18	5,847
27		344	344	111,319	110,975	0.10892	37	12,124	0.04689	16	5,220
28		344	344	111,319	110,975	0.10033	35	11,169	0.04187	14	4,661
29		344	344	111,319	110,975	0.09242	32	10,288	0.03738	13	4,161
30		344	344	111,319	110,975	0.08513	29	9,477	0.03338	11	3,716
Total	1,230,281	9,976	1,240,257		2,039,761		1,136,650	1,136,650		1,100,929	845,536
							NPV =	0		NPV =	-255,393

Table 131 Bugesera 2 Gashora Flow of Cost and Benefit (Economic Price): Case 3

EIRR = 8.4% B/C = 0.76

Year	Cost (000Rwf)			Benefit (000Rwf)	Benefit -Cost (000Rwf)	Present Value	Present Value		Present Value	Present Value	
							Discout Rate	8.4%		Discout Rate	12.0%
	Investment	O & M	Total	Total			Cost	Benefit		Cost	Benefit
1	1,062,417		1,062,417	61,347	-1,001,070	0.92231	979,874	56,580	0.89286	948,587	54,774
2		344	344	85,623	85,279	0.85065	293	72,835	0.79719	274	68,258
3		344	344	91,334	90,990	0.78456	270	71,657	0.71178	245	65,010
4		344	344	94,645	94,301	0.72360	249	68,486	0.63552	219	60,149
5		344	344	94,645	94,301	0.66738	230	63,165	0.56743	195	53,704
6		344	344	94,645	94,301	0.61553	212	58,257	0.50663	174	47,950
7		344	344	94,645	94,301	0.56771	195	53,731	0.45235	156	42,813
8		344	344	94,645	94,301	0.52360	180	49,556	0.40388	139	38,226
9		344	344	94,645	94,301	0.48292	166	45,706	0.36061	124	34,130
10		344	344	94,645	94,301	0.44540	153	42,155	0.32197	111	30,473
11		344	344	94,645	94,301	0.41080	141	38,880	0.28748	99	27,208
12		344	344	94,645	94,301	0.37888	130	35,859	0.25668	88	24,293
13		344	344	94,645	94,301	0.34944	120	33,073	0.22917	79	21,690
14		344	344	94,645	94,301	0.32229	111	30,504	0.20462	70	19,366
15		344	344	94,645	94,301	0.29725	102	28,134	0.18270	63	17,291
16		344	344	94,645	94,301	0.27416	94	25,948	0.16312	56	15,439
17		344	344	94,645	94,301	0.25286	87	23,932	0.14564	50	13,785
18		344	344	94,645	94,301	0.23321	80	22,073	0.13004	45	12,308
19		344	344	94,645	94,301	0.21509	74	20,358	0.11611	40	10,989
20		344	344	94,645	94,301	0.19838	68	18,776	0.10367	36	9,812
21		344	344	94,645	94,301	0.18297	63	17,317	0.09256	32	8,760
22		344	344	94,645	94,301	0.16875	58	15,972	0.08264	28	7,822
23		344	344	94,645	94,301	0.15564	54	14,731	0.07379	25	6,984
24		344	344	94,645	94,301	0.14355	49	13,586	0.06588	23	6,235
25		344	344	94,645	94,301	0.13240	46	12,531	0.05882	20	5,567
26		344	344	94,645	94,301	0.12211	42	11,557	0.05252	18	4,971
27		344	344	94,645	94,301	0.11262	39	10,659	0.04689	16	4,438
28		344	344	94,645	94,301	0.10387	36	9,831	0.04187	14	3,963
29		344	344	94,645	94,301	0.09580	33	9,067	0.03738	13	3,538
30		344	344	94,645	94,301	0.08836	30	8,363	0.03338	11	3,159
Total	1,062,417	9,976	1,072,393		1,721,334		983,279	983,279		951,050	723,105
							NPV =	0		NPV =	-227,945

９．　Procurement

1. Drilling company

① Foraky Africa Rwanda
Mr. Patrick Carpentier
Director General
250-(0)-78-8301304
This company was only one drilling company in Rwanda until recently. It has experiences of water resources development project by Japanese assistance and investigation of foundation of dams, roads, bridges and buildings.

② Africa Drilling & Exploration Ltd.
Mr. Jyothi Basu
General Manager
Phone: 250-(0)78-8309495
Aderwanda2008@gmail.com
This company was established in 2007 in Rwanda. However, it has experiences in India and Zambia for more than 15 years. It has 18 years experienced engineer and some staffs. Since 20007, it carried out deep well development project and geological survey employed by private companies and NGOs.

③ Planning the Future Company
Mr. J. Bosco NTUNZWENIMANA
General Manager
Phone: +257-29-559520, +257-77740527
jbntunzwe@yahoo.fr
Drilling company in Brundi

④ GEOSCIENCES&CIVIL ENGINEERING
Mr. Didi Didace
Managing Director
Phone: +257-24-7655, +257-79932018
didaced@yahoo.fr
Drilling company in Brundi

⑤ MIDROC FOUNDATION Specialist Pvt Ltd
Mr. Achim Braun,
General Manager,
Mobile Phone: +251-911-200327
Fax: +251-11-4402703
e-mail: midrocfoundation@ethionet.et
Branch office of Ethiopian drilling company. It has experiences of geological survey in Eastern African countries.

⑥ B.P.C. & Engineering Services Ltd
Building, Civil, Geotech & Engineering Services
Mr. G.K.Wambugu
Director
Mobile Phone: +254-734139348
e-mail: bpcontractors@yahoo.com
Kenyan company. It has experiences of geological survey for Japanese assisted projects in Kenya and Sudan.

2. Topographic survey company

① BEEGL s.a.r.l.
Mr. Innocent Ntiruhongerwa

Director of Administration and Finance
P.O.Box 6686. Kigali, Rwanda
Tel: (250) (0) 78-8308875
Fax: (250) 584947
E-mail: beegl@beegl.com
Established in 1997.
It has 9 staffs including engineers who have experiences more than 20 years. Main clients are MINECOFIN, MINAGRI and private companies. It works for topographic survey work for pipelines, roads and housing land.

② GIS-TECH CONSULTANTS SARL
Mr. Rono Kiplangat
Operations Manager
P.O.Box 3521, Kigali, Rwanda
Tel: (250) (0) 78-8548638
E-mail: ronohchep@gmail.com, gistechsarl@gmail.com
Established in 2006. It has 7 staffs including 3 engineers. It works for topographic survey work for private companies, District projects and GIS database.

③ Geoinfo Africa
Mr. Tonui K. Jackson
Director
P.O.Box 1804, Kigali, Rwanda
Tel: (250) 078-830-8853,
E-mail: tonuijk@geoinfo-africa.com
It has 5 engineers. One of them has a experience of working for Japanese assisted projects in Uganda.

3. Geotechnical survey

① Soil Mechanics and Geotechnical Engineering Laboratory, Kigali Institute of Technology and Science
Mr. Berin Kabayiza
Laboratory Technician
Tel: 078-8517636

② National University of Rwanda
P.O.Box 56, Butare Rwanda
Tel: (250) 252530122
E-mail: info@nur.ac.rw

③ Foraky Africa
Drilling company described above. It outsources laboratory test.

④ Africa Drilling & Exploration Ltd.
Drilling company described above. It outsources laboratory test.

4. Water quality test

① Faculty of Science, Laboratory of Water Analysis, National University of Rwanda
Mr. Mardochee Birori
Chief of laboratory
Tel: 078-8599447
E-mail: fs-dean@nur.ac.rw
Branch office of national University of Rwanda

② ELECTROGAZ
P.O.Box 537, Kigali
Mr. J. Pierre Nkeramihigo
Chef d'Usine de traitement d'eau de kimisagara-Kigali
Tel: 078-8306897
E-mail: elgz@rwanda1.com, jpnkeramihigo@electrogaz.co.rw
It is responsible for electric and water supply project in Rwanda. It is experienced in water quality test for water supply project.

5. Building constructor

① Tohomas & Piron
P.O.Box 6589, Kigali, Rwanda
Ms. Coralie Piron
Gerante
Tel: (250) 518501
E-mail: coraliepiron@tpintl.net
Branch office of Belgian main construction company.
It has 350 staffs in Rwanda. It works mainly for building works but it also works for civil work.

② ROKO Constuction
P.O.Box 323, Kigali, Rwanda
Mr. Nigel Done
Operations Manager
Tel: 078-8307005
E-mail: rokomanager@rwanda1.com
Established in 1969in Uganda and in 2001 in Rwanda. It works mainly for building works in Rwanda. It has dam engineers in head office in Uganda. In case of dam construction work, it takes dam engineers from Uganda.

③ STRABAG international GmbH
P.O.Box 4832, Kigali, Rwanda
Mr. Karl-Heinz Schneider
Commercial Manager
Tel: (250) 55102804
E-mail: strabag@rwanda1.com
Branch office of a main construction company in Austria. It works for buildings, roads, bridges and ports in Europe. It works for many roads construction projects in Rwanda.

④ Fair Construction
P.O.Box 3109, Kigali, Rwanda
Mr. Joseph Mugisha
Chairman
Tel: 078-8300080
E-mail: fair@fairconstruction.co.rw

⑤ Enterprize de Construction Mubuligi Paul
P.O.Box 1127, Kigali, Rwanda
Mr. Paul Mubiligi
Director
Tel: 078-8300211
E-mail: paulmub@yahoo.fr
Established in 1984. It works for roads, buildings, water supply systems and dams construction. It has experiences of dam construction for RSSP project and a few dams for other projects.

April 2009 Price List

No.	DESCRIPTION		UNIT	Price	Currency	remark
	[Labor]				RWF	
1	Administrator		day	40,000		Rwandatel
2	Asst. Administrator		day	30,000		Rwandatel
3	Accountant		day	23,300		Thomas &Pirron Rwandatel and BRALIRWA
4	Typist		day	8,300		Thomas &Pirron Rwandatel and BRALIRWA
5	Civil Engineer (senior)		day	28,300		Thomas &Pirron, Rwandatel and BRALIRWA
6	Civil Engineer		day	23,300		Thomas &Pirron, Rwandatel and BRALIRWA
7	Asst. Engineer		day	15,000		Thomas &Pirron, Rwandatel and BRALIRWA
8	Mechanic Engineer (senior)		day	20,000		Thomas &Pirron, Rwandatel and BRALIRWA
9	Mechanic Engineer		day	15,000		Thomas &Pirron, Rwandatel and BRALIRWA
10	Asst. Mechanic		day	6,500		Thomas &Pirron, Rwandatel and BRALIRWA
11	Electric Engineer (senior)		day	20,000		Thomas &Pirron, Rwandatel and BRALIRWA
12	Electric Engineer		day	15,000		Thomas &Pirron, Rwandatel and BRALIRWA
13	Asst. Electric		day	6,500		Thomas &Pirron, Rwandatel and BRALIRWA
14	Technician		day	6,000		Thomas &Pirron, Rwandatel and BRALIRWA
15	Surveyor		day	6,500		Average of payment in Rwanda
16	Store keeper		day	4,000		Average of payment in Rwanda
17	Office boy		day	1,000		Average of payment in Rwanda
18	Chief Security		day	3,000		Average of payment in Rwanda
19	Security		day	1,500		Average of payment in Rwanda
20	Cook		day	2,000		Average of payment in Rwanda
21	Cook helper		day	500		Average of payment in Rwanda
22	Houseboy		day	1,000		Average of payment in Rwanda
23	General Foreman		day	10,000		Average of payment in Rwanda
24	Foreman		day	7,000		Average of payment in Rwanda
25	Carpenter		day	6,500		Average of payment in Rwanda
26	Bar bender		day	6,500		Average of payment in Rwanda
27	Welder (qualified)		day	6,500		Average of payment in Rwanda
28	Welder		day	5,000		Average of payment in Rwanda
29	Welder helper		day	3,000		Average of payment in Rwanda
30	Concrete worker		day	5,000		Average of payment in Rwanda
31	Rigger (slinger)		day	5,000		Average of payment in Rwanda
32	Mason		day	4,000		Average of payment in Rwanda
33	Skilled Labor (senior)		day	6,000		Average of payment in Rwanda
34	Skilled Labor		day	5,000		Average of payment in Rwanda
35	Labor		day	3,000		Average of payment in Rwanda
36	Operator (heavy)		day	12,000		Rwandatel
37	Operator		day	10,000		Rwandatel
38	Driver (heavy)		day	10,000		Rwandatel
39	Driver		day	6,500		Rwandatel
40	Electrician		day	6,500		Rwandatel
41	Mechanic		day	6,500		Rwandatel
	[Rental Equipment]				RWF	
51	Buldozer					
		Weight 21 ton class	day	450,000		Fair construction
		Weight 15 ton class	day	350,000		Fair construction
		Weight 6 ton class	day	150,000		Fair construction
52	Backhoe	Bucket capacity 0.6m3	day	350,000		
		Bucket capacity 1.0m3	day	450,000		
53	Dump Truck	11 ton	day	150,000		Fair construction
		8 ton	day	120,000		Fair construction
		4 ton	day	80,000		Fair construction
54	Truck Crane		day			
		Lifting capacity 20 ton class	day	640,000		Euro corp

No.	DESCRIPTION		UNIT	Price	Currency	remark
		Lifting capacity 10 ton class	day	350,000		Euro corp
55	Trailer w/ tractor	30 ton class	day	500,000		Euro corp
		20 ton class	day	400,000		Euro corp
56	Pick-up Truck	1 ton	day	60,000		Gorilla
57	Motor Grader	Blade width 3.1m	day	360,000		Fair construction
58	Road Roller	Weight 10-12 ton	day	250,000		Rugerinyange Ese
59	Pneumatic Tire Roller	Weight 20 ton	day	450,000		Fair construction
60	Wheel Type Loader	1.5-2.0 m3	day	360,000		Fair construction
61	Concrete Pump	20m3/hour	day	20,000		Fair construction
62	Portable Air Compressor	Discharge air 5.0 m3/min	day	100,000		Fair construction
63	Deisel Engine Generator	Capacity 100 KVA	day	300,000		IPS(Integrated Power systems
		Capacity 50 KVA	day	200,000		IPS(Integrated Power systems
64	Welding Machine	Engine welder, 300A	day	60,000		André Ese
		Electric welder, 300 A	day	30,000		André Ese
65	Tank Lorry	Capacity 4,000 liter	day	150,000		Fair construction
66	Driver (heavy)	2.5 ton class	day	20,000		Rugerinyange Ese
67	Micro Bus	25 passengers	day	70,000		Okapi
68	Wagon	12-15 passengers	day	40,000		Okapi
69	Station Wagon	5-9 passengers	day	40,000		Okapi
70	Pick-up Truck	1 ton	day	60,000		Okapi
	[Material]				RWF	
80	Cement	Ordinary portland	1bag	10,000		Coopérative KORA
81	Aggregate	river gravel, 5-40mm	m3	10,000		Nyabugogo Parking
		river gravel, 5-25mm	m3	10,000		Nyabugogo Parking
		crushed stone, 5-25mm, 5-40mm	m3	65,000		Fair construction
82	Timber and Plank	50 x 50 mm	m3	50,000		Gakinjiro
83	Nail	Common wire nail	kg	1,500		Quincaillerie Orange
84	Steel Plate					
		thk = 10 mm	ton	259,500		SONATUBE
		thk = 6 mm		130,000		SONATUBE
		thk = 4.5mm etc		105,000		SONATUBE
85	Steel Pipe		m or 6m			
		D 100 mm, t = 6 mm		85,000		SONATUBE
		D 150 mm, t = 6 mm		156,000		SONATUBE
		D 200 mm, t = 6 mm		245,000		SONATUBE
86	Welding rod	B - 10	kg	1,500		Quicaillerie orange
		B - 17	kg	1,500		Quicaillerie orange
87	Concrete Block	150 mm thk (700 psi)	pc	600		Coopérative KORA
88	Brick	Adobe block 10" x 10 "	pc	70		Coopérative KORA
89	Gasoline		liter	576		Station Engen
90	Light Oil (Diesel Oil)		liter	576		Station Engen
91	Kerosene		liter	520		Station Engen
92	PVC Pipe (PN10)	tariff or	m or 6m			Sonatube
		PVC, dia 50 mm		9,500		Sonatube
		PVC, dia 100 mm		44,005		Sonatube
		PVC, dia 150 mm		93,000		Sonatube
		PVC, dia 200 mm		145,000		Sonatube
93	Fittings for PVC pipe (PN 10)	tariff				
	Threaded Uinion Tee reducer		pc	2,500		Sonatube
			pc	11,500		Sonatube
			pc	50,000		Sonatube
94	Ready Mixed Concrete	140 kg / cm2, at site	m3			
		180 kg / cm2, at site	m3	140,800		Fair construction
		210 kg / cm2, at site	m3	144,800		Fair construction
		240 kg / cm2, at site	m3	163,800		Fair construction
		350 kg / cm2, at site	m3	176,800		Fair construction
	[Tools/Furniture]				RWF	
100	Pick		Unit	7,300		Coopérative KORA
101	Hand Saw		Unit	4,200		Coopérative KORA
102	Hammer	iron	Unit	4,210		Coopérative KORA
		wood	Unit	4,000		Coopérative KORA
103	Weel barrow		Unit	30,000		Coopérative KORA
104	Wire brush		Unit	500		
105	Grinder		Unit	95,000		Nakumat
106	Welding Mask		sets	10,400		Nakumat
107	Brush	for paint	Unit	4,380		Nakumat
108	Washing machine	auto, 6.7 kg	Unit	344,000		Nakumat
109	Refrigerator	large	Unit	725,000		Nakumat
		small	Unit	361,200		Nakumat
110	Freezer	large	Unit	597,780		Nakumat
111	TV set	27"	Unit	490,000		Nakumat
		19"	Unit	280,000		Nakumat
112	Video deck		Unit	15,000		Nakumat

No.	DESCRIPTION		UNIT	Price	Currency	remark
113	stand fan		Unit	69,700		Nakumat
114	Desk	large	Unit	190,000		Nakumat
115	Chair	large	Unit	95,000		Nakumat
		small	Unit	84,000		Nakumat
116	Sofa set	for living	Unit	600,000		Nakumat
		for office	Unit	1,560,000		Nakumat
117	Kitchen table	for 6 men	Unit	800,000		Nakumat
118	Bed	wooden	Unit	220,000		Nakumat
119	Mattress		Unit	94,000		Nakumat
120	Water pot		Unit	6,760		Nakumat
121	Toaster		Unit	27,900		Nakumat
122	Clock		Unit	8,000		Nakumat
	[Utilities/others]				RWF	
130	Tel	to Tokyo 1st 3 min.	min	525		Rwandatel
		every 1 min.	min	525		Rwandatel
131	Fax	to Tokyo 1st 1 min.	min	525		Rwandatel
132	Telephone	installation	Unit	30,000		Rwandatel
		fixed charge	Unit	30		Rwandatel
133	Taxi	rental fee	hour	40,000		Average in Rwanda
		long period	day	35,000		Average in Rwanda
134	Jeep rental fee	long period	day	70,000		Average in Rwanda
135	Hotel		night	45,000		Average in Rwanda
136	Rental house	2 bedrooms L.D.	mth	200,000		Average in Rwanda
137	Electric power		kwh	132		Electrogaz
138	Water fee		m3	240		Electrogaz
	[General Temporary Works				RWF	
	Temporary Buildings]					
140	Site Office (by Concrete Block)		m2	5,000		Average in Rwanda
141	Site Office (by Wooden)		m2	2,000		Average in Rwanda
142	Site Office (by Local Made Brick)		m2	800		Average in Rwanda
143	Unit House (Rental) 4 x 8 yd		mth	400,000		Average in Rwanda
144	Unit House (Rental) 4 x 6 yd		mth	300,000		Average in Rwanda
145	Unit House (Rental) 4 x 10 yd		mth	600,000		Average in Rwanda
146	Warehouse (Material Stock/by Block)		m2	3,000		Average in Rwanda
147	Warehouse (Material Stock/by Wooden)		m2	1,500		Average in Rwanda
	[Safety Facility]					
150	Safety Rope (16mm /100M)		Rod	55,000		Nakumat
151	Rain Coat		EA	12,600		Nakumat