MAKERERE UNIVERSITY

COLLEGE OF ENGINEERING, DESIGN, ART AND TECHNOLOGY

DEPARTMENT OF CONSTRUCTION ECONOMICS AND MANAGEMENT

COURSE: POST GRADUATE DIPLOMA IN CONSTRUCTION AND PROJECT MANAGEMENT

CMG 7301 –POST GRADUATE DIPLOMA PROJECT REPORT.

STUDENT DETAIL:

SN	Name	Student No.	Reg. No
1	OWEKNIMUNGU BENEDICTO	2000717512	2020/HD08/17512U

PROJECT: CONSTRUCTION OF BORO SOLAR POWERED GRAVITY FLOW PIPED WATER SUPPLY SYSTEM IN PAKWACH DISTRICT.

Supervisor: Dr. DANS NATURINDA

Completed power house & pump attendant house

The completed reservoir

A project report submitted in partial fulfilment of the requirements for the award of Post Graduate Diploma in Construction Project Management of the College of Engineering, Design, Art & Technology of Makerere University.

December 2021.

PROJECT REPORT

BY:

OWEKNIMUNGU BENEDICTO

(AS AT DEC, 2021)

CONSTRUCTION OF BORO SOLAR POWERED GRAVITY FLOW PIPED WATER SUPPLY SYSTEM IN PAKWACH DISTRICT.

Project at ground breaking

Power house at construction

Completed power house and ecosan toilet

DECLARATION

I **OWEKNIMUNGU BENEDICTO** do declare that, this report is my original work. All the information contained in this report is accurate and it has never been submitted to any other university or institution of higher learning for a similar or any other academic award.

Signature.....

Date: 29th | Dec | 2021.

APPROVAL

This work has been carried under my supervision and is now ready for submission to the department of construction economics and management, college of engineering, design, art and technology, Makerere University Kampala with my approval.

Signature:.....

Date:.....13/01/2022.....

DR. DANS NATURINDA

ACADEMIC SUPERVISOR.

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LIST OF ACRONYMS

i)	MWE	Ministry of Water and Environment
ii)	DWSSCG	District Water Supply and Sanitation Conditional Grant
iii)	BoQs	Bill of Quantities
iv)	IFMIS	Integrated Financial Management Information System
v)	PPEs	Personal Protective Equipment
vi)	DWO	District Water Office
vii)	DNRO	District Natural Resource Office
viii)	DCDO	District Community Development Office
ix)	DLG	District Local Government
x)	SAS	Senior Assistant Secretary
xi)	PMU	Project Management Unit
xii)	AASHTO	American Association of State Highway & Transportation of Official

ABSTRACT:

The construction of Boro solar powered gravity flow piped water supply system is aimed at supplying clean, safe portable water to Boro community. Some expected outcomes of the water supply project are reduced prevalence of water borne diseases, improved health standard and increased productivity and hence improved general standard of living.

The reporter explored the project details which included but not limited to: Project name, purpose, stakeholders involved, objective of the project, project cost and initial project duration:

Furthermore, identification and discussion of key management issues such as project delays, Variations, insufficient design information, delay in payments and safety amongst others (both resolved and outstanding) were held, major management decisions taken and the rationale for the decision are discussed. Key challenges were explored, furthermore, lessons learned from the key issues, management decisions and challenges are listed. Finally, the reporter was able to draw conclusions and appropriate recommendations from the project challenges and management issues. Additionally, relevant project documents such as Bill of Quantities, As-built drawings, photographic documentation and site layout were considered.

CHAPTER ONE: INTRODUCTION

Pakwach district was curved out from Nebbi District in the year 2017. The design of the project was hence done in 2017 with a service life of 15 years. According to the test pumping result, the borehole yields 14.3m^3/hr and is estimated to serve over 5,000 people of Boro parish in Panyimur subcounty. The project is aimed at providing safe, clean portable source of water to the population.

The funding for the project is from central government i.e Ministry of Water and Environment (MWE) under District Water Supply and Sanitation Conditional Grant (DWSSCG). Upon completion, the project is expected to improve the general health condition of the population by reduction in the prevalence of water borne diseases and increase productivity.

1.1 Project Details

Table 1: **Project Details**

Project Name:	Construction of Boro Solar Powered Gravity Flow Piped Water Supply System in Pakwach District.
Contract No.	PKCH/618/WRKS/20-21/00039
Source of fund:	Ministry of Water and Environment- District Water Supply and Sanitation Conditional Grant (DWSSCG).
Client:	Pakwach District Local Government
Project Manager:	District Water Officer, Pakwach District Local Government.
Contractor:	Blair Foundation Limited
Site Handover Date:	13th August, 2021
Project Duration:	4 months
Commencement Date	20th August, 2021

Intended Completion Date	20th December 2021
Defects Liability Period	6 months
Initial Works Contract Sum	715,982,315 Ugx

1.2 Project Stakeholders

The major stakeholders involved in this project were as detailed below:

Table 2: Project Stakeholders

Client	Pakwach District Local Government P.O. Box 64, Pakwach.
Funding Agencies	Government of Uganda (Ministry of Water and Environment) – through District Water Supply & Sanitation conditional Grant.
Consultant	Terracon Technical Works (U) Limited. P.O. Box 35289 Kampala.
Contractor	Blair Foundation limited P.O Box 59, Gulu.
Others	• Boro Community • Panyimur sub county

1.3 Purpose

The construction of Boro solar powered gravity flow piped water supply system is aimed at supplying clean, safe portable water to Boro community. This will reduce on the prevalence of water borne diseases in the community, improve health standard and increase community productivity and hence improved general standard of living in line with the requirements of Ministry of water and environment.

1.4 Objective

1.4.1 Main Objective of the Project

-To increase access to safe & clean water and improve the general health in rural area.

1.4.2 Specific Objectives of the Project

(i) Construction of power house and guard/pump attendant house.

(ii) Installation of reservoir tank.

(iii) Laying of transmission, distribution and service pipes.

(iv) Installation of pump.

1.5 Project site Location

The project is located in Boro central village, Boro Parish, Panyimur Sub- County, Pakwach District as observed on the google map below.

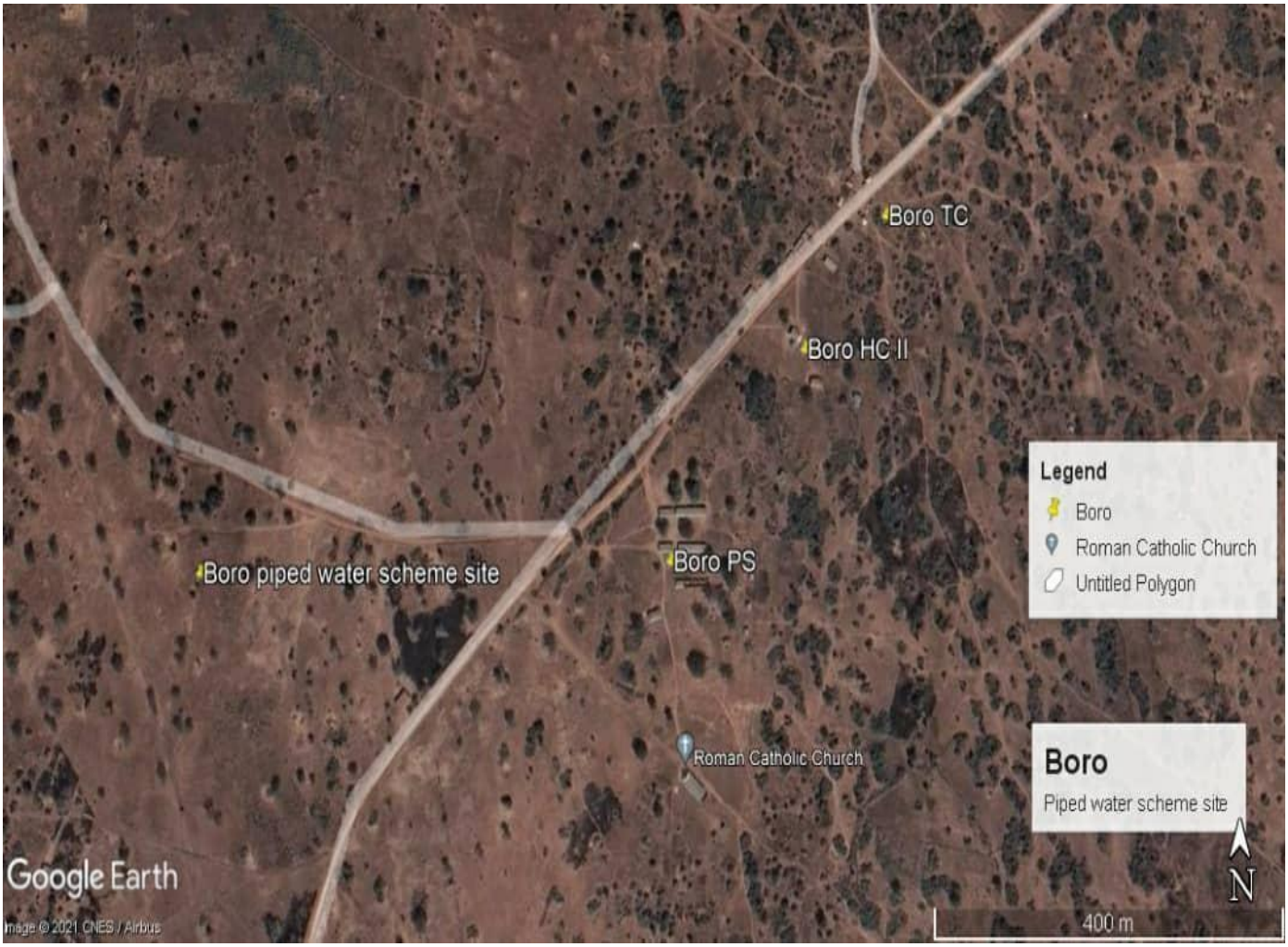


Figure 1: Project Site Location

1.6 Mobilization

1.6.1 Consultant's Mobilization

1.6.1.1 Consultant's Office

The Consultant had no site office, but used to operate from Pakwach town since they only did design work.

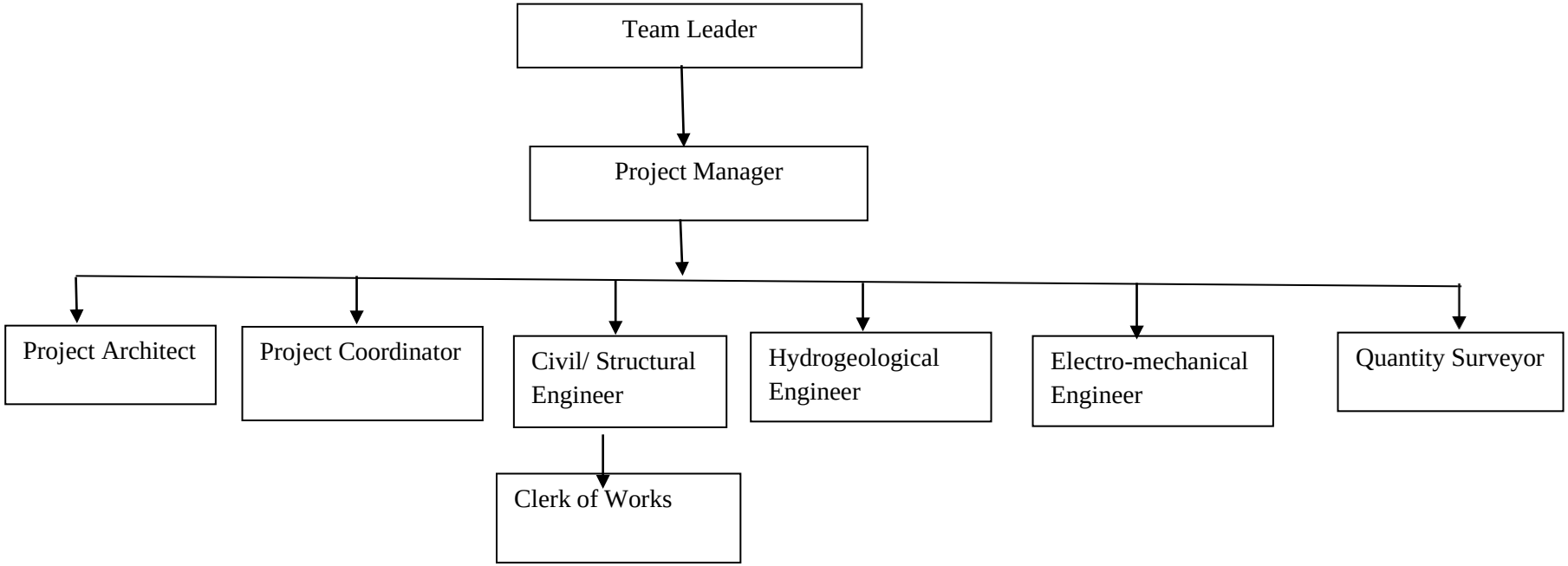
1.6.1.2 Consultant's Personnel

The consultant was fully mobilized for the design works with expatriate experts providing support to the local expertise to ensure quality works is achieved.

The consultant's team comprised of:

1. Team Leader (01 No.)
2. Project Architect (01 No.)
3. Project Coordinator (01 No.)
4. Project Manager/Authorized Representative (01 No.)
5. Civil/Structural Engineers (01 No.)
6. Hydrogeological Engineer (01)
7. Electrical Engineers (01 No.)
8. Quantity Surveyor (01 No.)
9. Clerk of Works (01 No.)

Figure 2: Organization Chart for the project Management Team



1.6.2 Contractor's Mobilization

By 20th August 2021 the contractor had mobilized and established their site office mean.

1.6.2.1 Contractor's Key Personnel

The contractor's team comprised of;

1. Contract Managers (01 No.)
2. Site Engineer (01 No.)
3. Hydrogeological Engineer (01No.)
4. Quantity Surveyor (01 No.)
5. Electrical -Mechanical Engineers (01 No.)
6. Foremen (02 No.)
7. Health and Safety (01 No.)
8. Reservoir installation Technician (01 No.)

1.6.2.2 Contractor's Plant and Machinery

The Contractor mobilized the following equipment on site

Plant Off-Site (On Site as Required)

1. Batching Plant
2. Mixer Trucks
3. Concrete Pump
4. Reinforcement Cutting & Bending Machines
5. Tipper Trucks
6. Dumper truck

Plant On-Site

1. Concrete Mixer
2. Small Tipper Truck
3. Concrete Vibrators

Equipment / Small Tools On-Site

1. Concrete Testing Equipment
2. Automatic Level, Tripod & Staff
3. Total Station, Tripod & Prism

4. Angle Grinder
5. Circular Saws
6. Welding Machine
7. Miscellaneous Hand Tools

1.7 Summary of Project Cost

Table 3: Project Bill of Quantity Summary

BILL No	DESCRIPTION	Corrected BOQ Amount (UGX)
1	PRELIMINARIES AND GENERAL ITEMS	7,600,000
2	BOREHOLE PUMP HOUSE	83,418,531
3	RESERVOIR TANK AND SITE WORKS	148,751,950
4	GUARD / PUMP ATTENDANT HOUSE	19,980,875
5	2 STANCE ECOSAN TOILET	10,340,450
6	ELECTRO MECHANICAL WORKS	113,800,000
7	BOREHOLE PUMPING MAIN	74,537,580
8	CHEMICAL HOUSE	19,331,712
9	DISTRIBUTION NETORKS	100,110,020
	SUB-TOTAL 1	**577,871,118**
	ADD: CONTINGENCIES 5%	28,893,555.9
	SUB-TOTAL 2	**606,764,673.9**
	ADD: VALUE ADDED TAX 18%	109,217,641.3
	GRAND TOTAL	**715,982,315**

The initial project cost was UGX 715,678,162.4**.** However, variation was encountered when the project team realized that the power house and the guard house foundation would rest on clay soil. This required cushioning and more reinforcement to the foundation.

CHAPTER TWO: KEY MANAGEMENT ISSUES

2.1 Key Issues

2.1.1 Project delays

By 20th October 2021, the progress had fallen short by about 5% indicating that the project was 2 weeks behind schedule; this in turn affected the envisaged completion date. Time management was therefore a key management challenge. This delay was a result of:

i) Break-down of equipment on site. The Tipper truck that the contractor was using to ferry materials broke down and work had to stall.

However, the issue was solved as below:

- Notice of delays was issued to the Contractor and requesting him to revise his work program accordingly and mobilize adequate resources to complete on time.
- Extension of time validated by evidence of cause of delays by the designer.

2.1.2 Variations

Variations due to change in design, unforeseen circumstances are some of the issues that required the attention of management. Change of contract in terms of scope and cost presented a challenge. Variations were experienced in;

i) Cushioning and additional reinforcement to the foundation of pump and guard house resulting into extra cost.

ii) Additional excavation works on the reservoir base due to weak soil nature.

iii) Additional works on electrical installation in power house and pump attendant house.

The Contractor followed up such issues with letters to the Client highlighting issues of variations for a decision to be made. The client through the advice from the project manager accepted the variations and payments for the variations amounting to five million shillings (**5,000,000 Ugx)** was made to the contractor. This is an indicator that cost and time overrun is likely to occur.

2.1.3 Insufficient Design Information

At the start of the project, not all requisite information was provided. The designer took long to re-design the foundation of Pump and Guard house on realizing that these structures will rest on

clay soil. The Consultant therefore had to prepare and provide the necessary information to the Contractor in a timely manner.

2.1.4 Delays in Payment

There were delays in payment due to IFMIS system failure, for example as at 20th October 2021, Ugx 20,000,000 was outstanding and to be paid to the Contractor. Such delays hamper the Contractor's cash flow thereby presenting a challenge to the Contractor in proceeding with works.

2.1.5 Safety

Construction work is inherently dangerous. Safety on Construction sites is paramount but not strictly adhered to on many sites. On this site, the contractor provided PPEs to only workers who were working at height (on roof and during installation of reservoir). While ignoring the labours working on ground and below ground level (in foundation).

CHAPTER THREE: THE MAJOR MANAGEMENT DECISIONS TAKEN

Major management decisions were reached during meetings and through correspondence with the various stakeholders.

The following meetings were held since the Contract signing on 20th September 2021 (Minutes of meetings attached in the annex 5).

1. First Site Meeting
2. Second Meeting
3. Third Site Meetings

Various correspondence raising issues requiring management decisions were also forwarded to the relevant stakeholders. Actions/ Management decisions were communicated through letters.

3.1 Issues that required Management Decisions

1. Contractor's relaxation in handling environmental issues.
2. Employment of the indigenous population. The community forwarded for the attention of the management the way contractor ignored the issue of employment of the indigenous population.
3. Extension and connection of the power house to electricity line for alternative power source.
4. The issues of connection of individual yard taps. Community members requesting for individual connections, needed management decision since the plan of management was to first install Public Stand Posts.
5. Re-design of reservoir tower material. The material initially designed for the tower was not available on the market.

3.2 Management Decisions taken on the above issues.

1. Contractor's relaxation in handling environmental and social safe guard issues. Management asked contractor to share environmental and social safe guard management plan. Management decided that all payment certificates should have space for District Natural Resource Officer and District Community Development Officer to sign after checking that environmental and social safe guard issues have been followed before any payment can be made to the contractor.

2. Employment of the indigenous population. The community forwarded to the attention of the management the way contractor ignored the issue of employment of the indigenous population. Management decided that 60% of the work force employed by the contractor should come from the local population as stipulated in the contract.
3. Extension and connection of the power house to electricity line for alternative power source. Community requested to be connected to electricity line. However, management said this will be implemented at the time of operation of the scheme since currently the funding is limited and can only support solar system installation.
4. The issues of connection to individual yard taps. Management communicated to community members requesting for individual connections, that yard tap connections will be done for only homestead within 100m from the distribution line at construction time in addition to Public Stand Posts. Homesteads beyond 100m from distribution line shall be connected during operation.
5. Re-design of reservoir tower material. The material initially designed for the tower was not available on the market. Management had to agree for re-design to include materials available in the market.
6. Safety issues: The contractor was directed to provide PPEs to all workers on site lest, risk not being paid the sum of money for environmental management and social safe guards.

CHAPTER FOUR: KEY CHALLENGES (BOTH RESOLVED AND OUT-STANDING)

4.1 Challenges

The challenges faced by the project include;

- ✓ Frequent heavy rainfall from September to November affected the progress dramatically especially with excavation works.
- ✓ Variation costs as a result of changes made to the designs.
- ✓ Acquisition of land for the project. Community wanted land to be bought which wasn't part of the budget.
- ✓ The unwillingness of the contractor to employ locals caused wrangles between the contractor and the community.
- ✓ Political interference where politicians would like to make technical decisions which they are not qualified to do.
- ✓ Budget management (time and cost over-run): Hidden costs emerged which led to increase in contract sum and completion time.
- ✓ Management of community's existing materials on site: The production borehole was previously fenced using chain link to safe guard it against destruction by animals. The contractor destroyed this fence in the due course of construction yet the community needed the material for future use. This led to wrangles between community and contractor.

4.2 Mitigation of the Challenges

- The Challenge of frequent heavy rainfall was solved by employing extra working hours on dry days and making use of dry weekends. Ensuring that activities done on a dry day are protected against rain damage.
- All changes that resulted in delays and additional costs to the contractor were forwarded to the Client for his decision.
- Every change requested by users/departments, and its cost implication, will have to go through the Client's formal permission before any attention of the contractor will be paid to it.
- Land owners who resisted free offer of land were compensated for their land.
- Contractor was urged to observe and reconsider employment of the locals to curb down wrangles with community.

CHAPTER FIVE: LESSONS LEARNED

- The Challenge of frequent heavy rain can be solved by employing extra working hours on dry days and making use of dry weekends. Ensuring that activities done on a dry day are protected against rain damage. The lesson drawn from the challenge was that works can be balanced and free period of non-working days can be used to bridge or compensate for the lost days in order to beat the contract duration.
- All changes that result in delays and additional costs to the project will be put forward to the Client's attention. The lesson learnt is that the beaucratic systems of management works quite well in management of this challenge because it gives room for the discussion of the issues. However, it delays the project.
- Every change requested by users/departments, and its cost implication, will have to go through the Client's formal permission before any attention of the contractor will be paid to it. The lesson learnt from this challenge was that top-down decision-making help to clear doubts and distrust the client would have developed and hence adequate solution to issues raised.
- Technical instructions should only be issued by authorized technical personnel not politicians.
- Designs should be exhaustive and contingency amount of money provided to such big projects should be adequate to avoid cost escalation.
- Use of the Project Management Unit is a suitable management method which eases communication and decision making in the course of implementation of the project.
- In any project, the community is the first beneficiary, they should be given the due consideration to avoid wrangles between community and the contractor in the implementation of the project.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

- The methodology of breaking the project into sub projects such as Pump house, Reservoir tank, Guard/pump house, 2 stance Ecosan toilet, Electromechanical works, pumping main, chemical house and Distribution networks made construction works manageable and successful.

- Establishment of the Community Project Management Unit (PMU)eased communication and decision making in course of implementation of the project.

- The Project stakeholders had good coordination function of management, the client, consultants, contractors and the public had good coordination hence success of the project.
- Though there were challenges especially during the implementation stage, for example rain affecting daily works, variation arising from the unforeseen circumstances, they were addressed adequately.

6.2 RECOMMENDATION:

The following recommendations should be considered;

- That future projects of this kind should have a component for continuous capacity building and guidance to the workers during construction works so that they are able to deliver adequately and conform to the standard and specification of the design.
- Thorough planning and budgeting should be considered key to minimize variation and the subsequent time and cost over-run.
- Projects should be timed such that all substructure works are executed in dry season so that rainfall does not impact a lot in terms of project delay.
- Political influence should be reduced to a minimal to allow smooth running of project

APPENDICES/ANNEXES:

Annex 1: Works Schedule

Project schedule for the construction of Boro solar powered gravity flow piped water supply system in Pakwach district.

ACTIVITIES	FIRST MONTH				SECOND MONTH				THIRD MONTH				FOURTH MONTH			
	wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk1 3	Wk 14	Wk 16	Wk 17
MOBILIZATION AND OTHER PRELIMINARIES																
PUMP HOUSE																
-Site clearance and excavation.																
-Substructure (Including earthwork, foundation excavation, concreting and ancillaries).																
-Superstructure (Including masonry, concreting and others).																
-Pipe fitting and valves, support and protection.																
-Finishes.																
PUMP ATTENDANT & GUARD HOUSE																
-Site clearance and excavation.																
-Substructure (Including earthwork, foundation excavation, concreting and ancillaries).																
-Superstructure (Including masonry, concreting and others).																
-Finishes.																

2-STANCE ECOSAN TOILET																
-Substructure (Including earthwork, foundation excavation, concreting and ancillaries).																
-Superstructure (Including masonry, concreting and others).																
-Finishes.																
RESERVOIR TANK AND SITE WORKS																
-Site Clearance																
-Substructure (Including earthwork, foundation excavation, concreting and ancillaries).																
-Tower and tank (reservoir) installation																
-Pipe fitting and valves, support and protection																
TREATMENT / CHEMICAL HOUSE																
-Substructure (Including earthwork, foundation excavation, concreting and ancillaries).																
-Superstructure (Including masonry, concreting and others).																
-Finishes.																
PUMPING MAINS																
-Site clearance and excavation.																
-Pipe works involving laying pipes, fitting and valves.																

-Manholes and pipework ancillaries																
-Support and Protection																
DISTRIBUTION NETWORKS																
-Site clearance and excavation.																
-Pipe works involving laying pipes, fitting and valves.																
-Manholes and pipework ancillaries																
-Support and Protection																
-Installation of water draw off points.																
ELECTRO-MECHANICAL INSTALLATIONS																
-Installation of solar mounting frame and solar panels																
-Installation of electrical works including cabling, circuit breaker & change over switches																
-System grounding, earthing and lightening protection.																
-Installation of alarm system and auxiliary lightening system.																
-Installation of water pump																
-Practical handover																

Annex 2: Progress as at 20th November 2021

PROGRESS AS AT 20th NOVEMBER 2021.					
Bill No.	Description of work	Scope of works as per contract provision	Progress achieved to date on Activity	% Progress	Remarks
01	Preliminaries				
		As per contract	• Site clearance	100	
			• Contractor's office and yard erected	100	
			•Site hoarding completed	100	
			• Project sign board erected	100	
			OVERALL PROGRESS	**100**	
02	PUMP/POWER HOUSE AND GUARD HOUSE				
	Construction of power house consisting of control room and generator room (for alternative power source).	Substructure, Superstructure, Roof, Plastering, Electrical First Fix, Ceiling, Doors & windows, Painting preparation flooring and chain link fencing	• Substructure	100	Painting delayed by installation of electromechanical components in the power house.
			• Superstructure	100	
			• Roof	100	
			• Plastering	100	
			• Electrical First Fix	100	
			• Frames, doors and windows	100	
			• Flooring	100	
			• Painting	90	
			• Fencing	100	
			OVERALL PROGRESS	**99**	
Bill No-4	RESERVOIR TANK				
	Installation of 60m^3 reservoir on a 15m high	Foundation, support column, ground beam, erection of tower	Foundation	100	Completion achieved.
			Support column	100	

	tower and chain link fencing.	and installation of reservoir tank.	Ground beam	100	
			Erection of tower	100	
			Ground beam	100	
			Installation of reservoir	100	
			Fencing	100	
			OVERALL PROGRESS	**100%**	
Bill No.	Description of work	Scope of works as per contract provision	Progress achieved to date on Activity	% Progress	Remarks
03	CHEMICAL/TREATMENT HOUSE				
	Construction of chemical house for the treatment of water.	Substructure, Superstructure, Roof, Plastering, Electrical First Fix, Ceiling, Doors & windows, Painting preparation flooring	•Substructure,	100%	Electrical works ongoing.
			• Superstructure	100%	
			• Roof	100%	
			• Electrical First Fix	100%	
			• Plastering	100%	
			• Ceiling	100%	
			• Doors and Windows	100%	
			•Painting	100%	
			• Ground floors & Stairs	100%	
				100%	
			OVERALL PROGRESS	**100%**	
04	2-STANCE ECOSAN TOILET				
	Construction of 2-stance ecosan toilet (sanitation facility)	Substructure, Superstructure, Roof, Plastering, Doors, flooring & Painting	Substructure	100	Smooth progress
			Superstructure	100	
			Roof,	100	
			Plastering	100	
			Doors,	100	

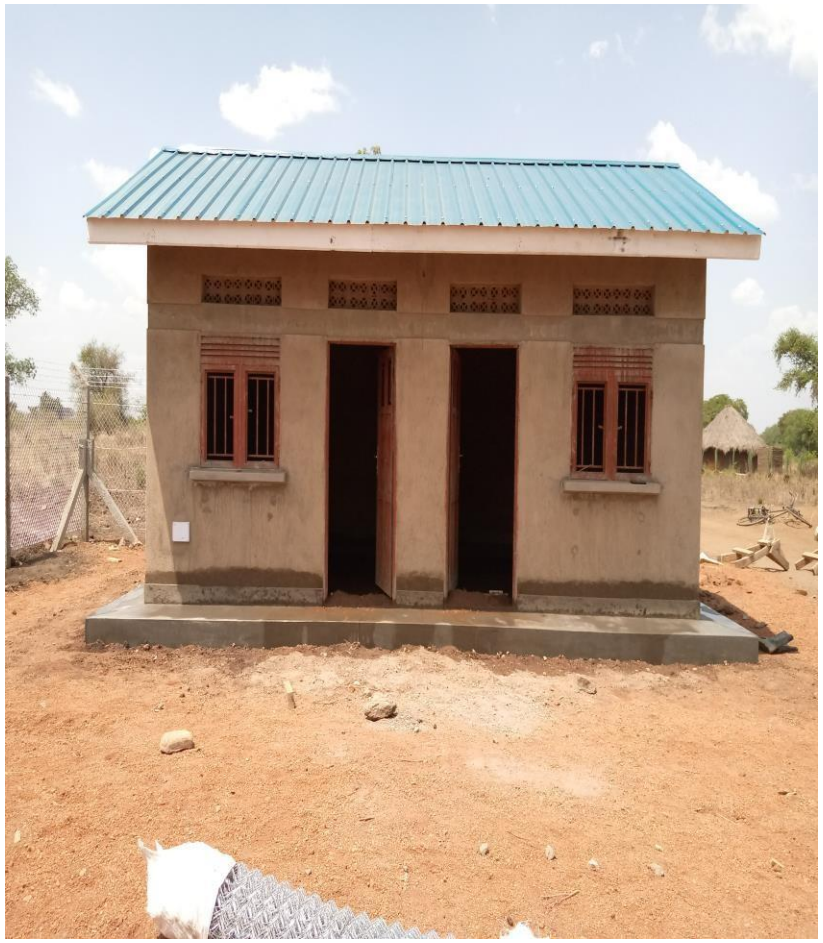
			flooring	100	
			Painting	100	
			OVERALL PROGRESS	**100%**	
05	PUMPING MAIN				
	Laying of HDPE pumping main pressure pipes 1.4km from powerhouse to the reservoir tank and its auxiliary.	Site clearance, Pipework-pipes, Pipework-fittings and valves, Pipework-manholes and pipework ancillaries, Pipework-supports and protection, ancillaries to laying and excavation.	•Site clearance	100%	Laying of pumping main Successfully finished.
			• Pipework-pipes	100%	
			• Pipework-fittings and valves	100%	
			• Pipework-manholes and pipework ancillaries	100%	
			• Pipework-supports and protection, ancillaries to laying and excavation	100%	
			OVERALL PROGRESS	**100%**	
Bill No.	Description of work	Scope of works as per contract provision	Progress achieved to date on Activity	% Progress	Remarks
06	DISTRIBUTION NETWORKS				
	Laying of HDPE distribution networks, pressure pipes 20km from the reservoir tank to the draw off points (community) and its auxiliary.	Site clearance, Plastic Pipes, pipework-fittings and valves, Pipework-manholes ancillaries and Pipework-supports and protection, ancillaries to laying and excavation.	Site clearance	100	Laying of pipes moving on successfully.
			Pipe work- Plastic Pipes	100	
			pipework-fittings and valves	100	
			Pipework-manholes ancillaries	95	
			Pipework-supports and protection	95	
			Ancillaries to laying and excavation.	95	
			Installation of public stand posts	0	
			OVERALL PROGRESS	**84%**	
07	ELECTRO-MECHANICAL WORKS				
	Supply, Delivery and items	Solar mounting frame, Solar	• Solar mounting frame	0%	Materials on transit to

	installation at destination points.	panels, Pump Controller, Water Pump, Miniature Circuit Breaker, Changeover Switch, Cabling, System Grounding, Earthing and Lightning Protection, Alarm System, Auxiliary Lighting System.	• Solar panels	0%	site for installation.
			• Pump Controller	0%	
			• Water Pump	0%	
			• Miniature Circuit Breaker	0%	
			• Changeover Switch	0%	
			• Cabling	0%	
			• System Grounding	0%	
			• Earthing and Lightning Protection	0%	
			• Alarm System	0	
			• Auxiliary Lighting System,		
			OVERALL PROGRESS	**0%**	
Overall Progress is 83% and Time used is 75%					
Financial payment made to contractor **70%.**					

Annex 3: Photo documentation

Project ground breaking with political leaders

Joint technical supervision of reservoir foundation



The guard/pump attendant house under construction

Joint monitoring at power house during construction

Annex 4: Bill of Quantity documentation

PAKWACH DISTRICT LOCAL GOVERNMENT			
CONSTRUCTION OF BORO WATER SUPPLY AND SANITATION SYSTEM			
BILL OF QUANTITIES.			
Grand Summary			
Bill No	**Description**	**Investment Costs**	
		(UGX)	
	GENERAL		
BOR G-1	General Items	7,600,000	
BOR G-2	Dayworks	0	
BOR G-3	Method Related Charges	0	
	WATER SUPPLY AND EQUIPMENT		
BOR W-1	Borehole Pump Station	83,418,531	
BOR W-2	Borehole Pumping Mains	74,537,580	
BOR W-3	Chemical House	19,331,712	
BOR W-4	Reservoir Tanks and Site works	148,751,950	
BOR W-5	Distribution Network	100,110,020	
BOR W-6	Guard and Pump Attendant House	19,980,875	
BOR W-8	Electro - Mechanical Works	113,800,000	
	SANITATION		

BOR S-1	2 stance Ecosan Toilet		
		10,340,450	
	Sub-Total 1	**577,871,118**	
	Allow for 5% contingency	28,893,555.9	
	Sub-Total 2	**606,764,673.9**	
	Allow for 18% VAT	109,217,641.3	
	GRAND TOTAL	**715,982,315**	

BILL No. BOR G-1					
DESCRIPTION: GENERAL ITEMS					
ITEM NO.	**ITEM DESCRIPTION**	**UNIT**	**QUANTITY**	**RATE**	**AMOUNT**
				UShs	**UShs**
	Contractual Requirements				
A110.1	Performance security clause	sum	1		-
A110.2	Advance payment guarantee	sum	1		-
A120	Insurance of works covering all installations during and up to 28 days after the end of the defects liability period	sum	0		-
A130	Third party insurance	sum	0		-
A140	Insurance of Contractors Equipment	sum	0		-
	Specified Requirements				
	Site Offices and Housing				
A211.1	Establishment and removal of offices for the Engineer's staff	sum	1	1,000,000	1,000,000
A211.2	Provision of rented office accommodation for the Engineer's staff before establishment of site offices	month	1	50,000	50,000
A211.3	Provision of rented accommodation for the Engineer's staff (1No unit)	month	3	100,000	300,000

A211.4	Maintenance of offices for the Engineer's staff including provision and payment of utility services	month	3	100,000	300,000
	Services for the Engineer's staff				
	Communication				
A222.1	Establish communication system and dedicated email (mobile, wireless or leased line) system for the Engineer's office	sum	0		-
A222.2	Maintenance of communication system and dedicated email (mobile, wireless or leased line) system for the Engineer's office	month	0		-
	Equipment for use by the Engineer's staff				
A231.1	Provision of office furniture & equipment for the Engineer	sum	1	500,000	500,000
A231.2	Maintenance of office furniture & equipment for the Engineer	month	3	100,000	300,000
A233	Provision of surveying equipment for use by the Engineer	month	1	500,000	500,000
A234	Provision of office stationery & office consumables for use in the Engineer's office	month	3	100,000	300,000
	Attendance upon the Engineer's staff				
A244.1	Technician/Draftsman/Surveyor	month	0		-

	Testing works				
	Testing of Materials				
A250	Concrete works test cubes	nr	5	100,000	500,000
			Carried to Collection		**3,750,000**
	Testing works				
A260.1	Pressure testing of and sterilization of water mains as per specifications: nominal bore not exceeding 500mm; maximum test pressure not exceeding twice the pipe's pressure rating.	km	1	200,000	200,000
A260.2	Water tightness tests for all water retaining structures and reservoirs	sum	1	300,000	300,000

A260.3	Commissioning of water supply system, inclusive of full operations of the water supply system for 30 consecutive days, preparation of daily reports on the operations that comprise of the amount of water pumped, quantity of chemicals utilized, hours of pumping, energy consumed, at least 6No off site detailed water quality tests etc. as directed by the Engineer. These shall form part of the operation and maintenance manual and As-Built drawings that shall be submitted to the Employer. Training Private Operator's staff in basic operation and maintenance procedures of all plant and equipment supplied as per the technical specifications and to the Engineer's approval shall form part of this activity	sum	1	1,000,000	1,000,000
	Temporary Works				
A279.1	Establishment & removal of site sign-boards	nr	2	150,000	300,000
A279.2	Maintenance of site sign-boards until the issue of the Taking-over Certificate	month	3	50,000	150,000
	Provisional Sums				
	Location and/or alteration of existing services				
A420.1		sum	1	500,000	200,000
A420.2	Emergency compensation payments to land or property owners made on behalf of the employer	sum	1	500,000	500,000

A420.3	Provisional sum for Client's administration and supervision expenses	sum	1	1,000,000	1,000,000
	MISCELLANEOUS				
BOR G-1.1	Supply and installation of permanent labels made of engraved granite on the various installations as directed by the Engineer	nr	2	100,000	200,000
BOR G-1.2	Prepare operation and maintenance manuals as per specifications and to the Engineer's approval	sum	0		-
BOR G-1.3	Prepare "as-built" or record drawings as per specifications and to Engineer's approval	sum	0		-
				Carried to Collection	**3,850,000**
	COLLECTION				
	Collection, Page BOR G-1/1				3,750,000
	Collection, Page BOR G-1/2				3,850,000
				Carried to Summary	**7,600,000**

BILL No. BOR W-1

DESCRIPTION: BOREHOLE PUMP STATION AND GENERATOR HOUSE

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	UShs
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/1.0.0 series (including references made there-in to other drawings)				
	DEMOLITION AND SITE CLEARANCE				
	General Site Clearance				
D110	General site clearance including clearance of access road to the site	m^2	328.00	2,000	656,000
	Trees				
	Cut and dispose of trees of the following girth; include removal of stump and backfilling the hole left with top soil				
D210	Girth 500 mm-1 m	nr	2	500,000	1,000,000
	Stumps				

	Remove and dispose of stumps of the following diameter; include for grabbing up the roots and backfilling the hole left with top soil				
D310	Diameter 150-500 mm	nr	3	50,000	150,000
	EARTHWORKS				
	Excavation for foundations				
	Topsoil				
E310	Strip site of top soil average depth 150mm and deposit in heaps at an appropriate place 300m away from site	m^3	8.0	3,000	24,000
	All Materials other than top soil				
	Excavation for foundations in all materials including rock or artificial hard material, commencing surface is the stripped ground level				
E323	Depth for Buildings 0-1.5m	m^3	23.0	5,000	115,000
	Excavation Ancillaries				
E596	Allow for all excavation ancillaries including trimming, preparation, and compaction of excavated surfaces, disposal of excavated material, and timber supports to all excavated surfaces	Sum	1	500,000	500,000
	Anti-termite Treatment				

E597	Apply approved anti-termite treatment to surfaces of hardcore blinding, sides and bottoms of foundation excavations to the manufacturer's instructions	LM	96	2,500	240,000
	Filling				
	Filling to structures by methods specified and to depths as shown in the drawings with the following materials				
E615	Selected imported granular material other than topsoil, rock or artificial hard material to pump house area and compacted to 98% MOD AASHTO	m^3	10.00	6,000	60,000
				Carried to Collection	**2,745,000**
E645	50mm thick bed of approved imported sand blinding on top of hardcore fill well spread, levelled, rammed and consolidated to the Engineer's satisfaction	m^3	1.50	150,000	225,000
E647	300mm thick bed of approved imported hardcore well spread, levelled, rammed and consolidated on stabilized ground to the Engineer's satisfaction	m^3	10.92	18,000	196,560
	Landscaping				
E810	Turfing for lawns inside fenced off compound; include filling with excavated topsoil, levelling and the preparation of the surfaces. Include the planting of water friendly trees as recommended by the Engineer	m^2	400	6,000	2,400,000

	IN SITU CONCRETE				
	Provision of Concrete				
	Ordinary Designed Mix Concrete				
	Grade C20				
	Designed mix, grade C20 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F141	10mm aggregate	m³	5.40	500,000	2,700,000
	Grade C25				
	Designed mix, grade C25 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F151	10mm aggregate	m³	17.80	500,000	8,900,000
	Placing Mass Concrete				
	Bases, Footings and Ground Slabs				
	Placing mass concrete, for strip foundations, grade C20, of the following thickness				
F522	Thickness 150-300mm	m³	5.40	500,000	2,700,000
	Placing Reinforced Concrete				
	Bases, Footings and Ground Slabs				

	Placing reinforced concrete grade C25, for floor slab and generator plinth of the following thickness				
F622	Thickness 150-300mm	m^3	8.40	500,000	4,200,000
	Suspended Slabs				
	Placing reinforced concrete, grade C25, for false slab (ceiling) of the following thickness				
F631	Thickness not exceeding 150mm	m^3	7.50	500,000	3,750,000
	Beams				
	Placing reinforced concrete, grade C25, for ring beam of the following cross-sectional area				
F662	Cross-sectional area 0.03 - 0.1 m^2	m^3	2.00	500,000	1,000,000
				Carried to Collection	**26,071,560**
	CONCRETE ANCILLARIES				
	Formwork-Fair Finish				
	Fair Finish Plane Horizontal				
	Plane fair finish horizontal formwork to floor and pump houses of the following width				
G214	Width: 0.4-1.22m; to false slab soffits	m^2	27.0	12,000	324,000
	Fair Finish Plane Vertical				

	Plane fair finish vertical formwork of the following width				
G244.1	Width: 0.4-1.22m; to floor and generator plinth	LM	24.0	7,000	168,000
G244.2	Width: 0.4-1.22m; to sides of the ring beam and false slab	LM	32.0	7,000	224,000
	Reinforcement				
	Deformed High Yield Steel Bars				
	High yield square twisted or ribbed bars to BS4449 and of the following sizes				
G525	Nominal size, 6 - 16mm	kg	500.0	5,000	2,500,000
	Steel Fabric				
	High tensile steel fabric reinforcement to BS 4483, fabric reference A252, cast in concrete slab with minimum 200mm end side laps, and of the following mass				
G564	Nominal mass 4-5 kg/m²	m^2	45.0	18,000	810,000
	Concrete Accessories				
	Finishing of Top Surfaces				
	Finishing of top surfaces by the following methods				
G811	Class U2 wood float finish to top of floor of Pump Stations	m^2	45.0	12,000	540,000

	PIPEWORK - FITTINGS AND VALVES				
	Pipework and Fittings for Boro Boreholes of yields DWD 52342 with yields 12m^3/hr respectively				
	Iron or Steel pipe fittings to BS 534; all Epoxy coated Steel pipe; PN 16 flanges to BS 4504; not in trenches including casting in as required				
	All pipe specials are annotated and specified on the pump station drawing. The code indicated refers to the code on the drawing.				
	Bends				
J311.1	BH11 - DN 80mm x 45deg flanged small radius bend	No	2	190,200	380,400
J311.2	BH23 - DN80mm x 90deg flanged small radius bend	No	2	190,200	380,400
	Junctions and Branches				
J312.1	BH6 - DN 80mm flanged tee with 25mm female threaded branch	No	2	165,000	330,000
				Carried to Collection	**5,656,800**
	Adaptors				
J351.1	BH21 - OD90 mm X 3" HDPE Compression Flange Adaptor	No	1	175,000	175,000
J351.2	BH8 - DN 15mm diam. Hexagon nipple	No	2	5,660	11,321
J351.3	BH16 - DN 25mm diam. Hexagon nipple	No	2	9,100	18,200

J351.4	BH2 - DN 80 mm Viking Johnson / Maxi Flanged Adaptor	No	2	134,400	268,800
	Glands				
J361.1	BH4 - DN 80mm Double-flexible rubber pipe flanged coupling	No	1	320,000	320,000
	Straight specials - DN 80mm pipe with fittings				
J381.1	BH1 - plain threaded both ends, nominally 3000mm long, cut to suit on site	No	1	234,000	234,000
J383.2	BH3 - Galvanised steel riser pipes 21/2" Class C with BSPT joints from submersible pump to pumphouse; complete to match pump outlet size and pumphouse pipe work	m	85	71,500	6,077,500
J381.3	BH12 - flanged both ends, 800mm f/f	No	1	250,000	250,000
J383.4	BH14 - flanged both ends, 400mm f/f	No	1	250,000	250,000
J383.5	BH19 - flanged both end, nominally 1500mm, cut-to-suit on site	No	1	350,000	350,000
	Gate Valves				
	<u>All flanged gate valve installation to BS 5153, flanges to BS 4505, all to PN 16 complete inclusive of hand wheel and all fittings, as shown in the drawing for the following sizes</u>				
J811.1	DN 80mm	No	2	850,000	1,700,000
	Air Valves				

	BH 18- Flanged VENT-O-MAT CI small orifice anti-shock double air relief valve as specified, flanges to ISO 2441, complete with isolating flanged gate valve to BS 5150 all to PN 16 for the following pipe sizes				
J861.2	DN 80mm	No	1	728,850	728,850
	Pressure Gauge				
J891.1	BH10 - WIKA pressure gauge, DN 50mm case, glycerine filled with 15mm male thread	No	1	215,000	215,000
	Non-Return Valves				
	BH 15 - All flanged non-return valve installation to BS 5153, flanges to BS 4505, all to PN 16 complete inclusive of all fittings, as shown in the drawing for the following sizes				
J891.3	DN 80mm	No	1	650,000	650,000
	Bulk Flow Meter				
J991.1	BH13 - flanged DN 80mm MEINECKE Cosmos WP bulk water meter	No	1	970,000	970,000
				Carried to Collection	**12,218,671**
	PIPEWORK-SUPPORTS AND PROTECTION, ANCILLARIES TO LAYING AND EXCAVATION				
	Isolated pipe supports				

L811	Pipe support 1 - mass concrete 200mm x 200mm x 600mm high, Class 20/20, complete with shuttering, to pipes	nr	1	35,000	35,000
L812	Pipe support 2 - mass concrete 200mm x 200mm x nominal 500mm high, Class 20/20, complete with shuttering, to valve (BH15) and tee (BH6)	nr	2	35,000	70,000
L813	Pipe support 3 - mass concrete 500mm x300mm x nominal 500mm high, Class 20/20, complete with shuttering, to bend	nr	1	35,000	35,000
	ROADS AND PAVINGS				
	Road Base and wearing course				
	Provide, transport up to site, spread, shape, and compact to atleast 95% MDD AASHTO gravel material for flexible road base, of the following thickness				
R117	Depth 150-300 mm applied to access road and parking area	m^3	440.0	27,000	11,880,000
	Kerbs				
	Construct Kerbs of pre-cast concrete to BS 7263 of cross section area 0.05-0.1 m² to the following alignment				
R711	Straight or curved to a radius exceeding 12 m	m	20.0	16,000	320,000
R712	To a radius not exceeding 12 m	m	20.0	16,000	320,000
	PAVINGS				

	Walkways				
R911	Concrete (C20) paved walkway in 600 x 600 x 50mm thick sections; include sand bedding, earthworks, jointing and concrete edge protection	m^2	25.0	25,500	637,500
	BRICKWORK & MASONRY				
	Dense concrete blockwork to BS 7263, jointed with ordinary 1:5 cement mortar, hoop irons every three courses, including 1:4 cement plaster to both faces complete with concrete louvres, as detailed in the drawings, for walls of the following thickness				
U521	225 mm thick	m^2	85.0	35,000	2,975,000
	Permanent Vents				
	Construct dense concrete pre-cast louvered blockwork vents to BS 7263, jointed with ordinary 1:4 cement mortar, hoop irons every three courses, as detailed in the drawings of the following sizes				
U590	1200mm x 2000mm (W x H)	nr	3	216,000	648,000
				Carried to Collection	**16,920,500**
	PAINTING				
	High Gloss				
	Timber Surfaces				

	External quality weather guard paint, two coats, to the following timber surfaces; include surface preparation and undercoat				
V321	Upper surfaces of fascia board inclined at an angle not exceeding 30 degrees to the horizontal	m^2	7.5	12,000	90,000
	Masonry				
	External quality weather guard paint, two coats, to external Wall surfaces; include surface preparation and under coat as specified				
V363	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m^2	40.0	12,000	480,000
	Emulsion Paint				
	Masonry				
	Internal quality vinyl silk paint, two coats, to internal wall; include surface preparation as specified				
V563	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m^2	74.0	8,000	592,000
	WATER PROOFING				
	Protective Layers				
	Flexible Sheeting				

	Flexible polyethylene sheeting, gauge 1000, or similar approved, laid with 300mm overlaps at joints, to the surface of sand blinded hardcore fill				
W421.1	Surfaces of blinding hardcore inclined at an angle not exceeding 30 degrees to the horizontal	m^2	27.0	10,000	270,000
	Damp proof course of Hessian based bitumen impregnated fabric to BS 6398 bedded on 1:4 cement and sand mortar with 150mm overlaps at joints; for the following wall				
W421.2	230 mm thick	m	26.0	12,000	312,000
	Sand and Cement Screed				
	Sand and cement screed of 1:3 cement sand mortar, applied to concrete floors, 25 mm thick, prepared and applied as specified, and finished with a steel float				
W441	Surfaces of floors inclined at an angle not exceeding 30 degrees to the horizontal	m^2	21.0	12,000	252,000
	Rendering- Rough Cast				
W511	Apply rough cast to external wall surfaces inclined at an angle exceeding 60 degrees to the horizontal in 1:3 ordinary cement mortar to the Engineer's satisfaction	m^2	30.0	12,000	360,000
				Carried to Collection	**2,356,000**
	MISCELLANEOUS WORKS				

	Roofing				
BOR W-1.1	Construct roofing, complete as in the drawings and as specified; include tie beams, purlins, rafters, struts, wall plate, facia board and all roofing timber, eave closing, gauge 26 prepainted GCI resin sheeting and ridges	m²	40.0	125,000	5,000,000
	Doors				
	Supply and fix the following mild steel doors to the Engineers' details constructed from 75 x 50 x 2mm hollow steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, 3-lever Yale locking arrangements, and accessories, including aluminium mosquito proof wire gauze welded to mild steel frames in 300mm high permanent vents				
BOR W-1.2	Single leaf steel door, size 900 x 2400mm with 700mm high 4mm thick glass panes and burglar proofing; complete	nr	1	350,000	350,000
BOR W-1.3	Double leaf door overall size 1800 x 2400mm high filled in with 20 x 2mm thick mild steel square hollow section grating welded to door, complete	nr	1	800,000	800,000
	Building Finishes				
BOR W-1.4	Building finishes including, constructing 20x100mm high 1:3 cement-sand skirting, C20 concrete window cills, 700mm wide C20 concrete splash apron, complete to the specifications and as directed by the Engineer	sum	1	500,000	500,000

	Fences				
X135	100x100mm Concrete post of C25 concrete and wire galvanised wire chain link fence of gauge 10 to BS 1722, with triple row of barbed wire on top, anchored into blockwork dwarf wall as per drawings, height 2-2.5 m	m	120.0	65,000	7,800,000
	Gates				
	Supply and complete installation of painted metal field gate to BS 3470 include C25 reinforced concrete pad foundations and columns; and of the following widths				
X236	Width 3.5 m, double leaf complete	nr	1	3,000,000	3,000,000
				Carried to Collection	**17,450,000**
	COLLECTION				
	Collection, Page BOR W-1/1				2,745,000
	Collection, Page BOR W-1/2				26,071,560
	Collection, Page BOR W-1/3				5,656,800
	Collection, Page BOR W-1/4				12,218,671
	Collection, Page BOR W-1/5				16,920,500
	Collection, Page BOR W-1/6				2,356,000
	Collection, Page BOR W-1/7				17,450,000
				Carried to Summary	**83,418,531**

BILL No. BOR W-2

DESCRIPTION: BOREHOLE PUMPING MAINS

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	UShs
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/2.0.0 series (including references made there-in to other drawings)				
	DEMOLITION AND SITE CLEARANCE				
	General Site Clearance				
D110	General site clearance for pipe trench	ha	0.56	2,000,000	1,123,200
	Trees				
	Cut and dispose of trees of the following girth; include removal of stump and backfilling the hole left with top soil				
D210	Girth 500 mm-1 m	nr	10	56,000	560,000
	PIPEWORK-PIPES				
	Plastic Pipes				

	HDPE pressure pipes to BS 3505, include unions / sockets, all to PN 10, OD 90mm, laid in trench to the following depths				
I712.1	Depth not exceeding 1.5m	m	1,700	23,430	39,831,000
	PIPEWORK-FITTINGS AND VALVES				
	Cast / Spun Iron or Steel Pipe Fittings external epoxy coated to AWWA C213				
	Bends				
	Ductile Iron all flanged 45 degrees bends to ISO 2531, flanges to ISO 2441, all to PN16, cement mortar lines and of the following sizes				
J312.1	80 mm ND	nr	1	732,500	732,500
	Junctions				
	All flanged tee to BS 4346, flanges to BS 4504, all to PN16, cement mortar lined, and of the following sizes				
J321.1	80/80 mm ND	nr	1	1,375,200	1,375,200
	Tapers				
	All flanged taper to BS 4772, flanges to BS 4504 all to PN16, and of the following sizes				
J331.1	150/80 mm ND	nr	1	600,600	600,600

	Adaptors				
	Flange adaptor of large tolerance, maxi type to fit all pipe spigots to BS 3505, flanges to BS 4505, all to PN16, and of the following sizes				
J352.2	80 mm ND	nr	1	460,920	460,920
				Carried to Collection	**44,683,420**
	Plastic Pipe Fittings				
	Bends				
	Compression Bends to fit HDPE pipe spigots, to DIN 8076 - BS 5114, all to PN16, and of the following spigot sizes				
J611	OD 90 mm X 90^0 bends	nr	2	69,000	138,000
	Adaptors				
	Compression Flange adaptor to fit HDPE pipe spigots, to DIN 8076-BS5114, all to PN16 and of the following spigot sizes				
J651.1	OD 90 mm X 21/2"	nr	2	93,120	186,240

	Valves and Penstocks				
	Air Valves				
	Flanged anti shock, anti surge double air valve, 40mm ND, as specified, flanges to ISO 2441, complete with isolating gate valve to ISO 7259, flange on socket tee, thrust blocks, distance pieces, all to PN16, as specified and all fittings necessary to make the connection complete; for the following pipe sizes				
J862	80 mm ND	nr	2	1,524,960	3,049,920
	Non-Return Valves				
	All flanged non-return valve installation to BS 5153, flanges to BS 4505, all to PN 16 complete inclusive of all fittings, as shown in the drawing for the following sizes				
J891.1	80 mm ND	No	1	650,000	650,000
	Washouts				
	Type 2 Washout as specified in the drawings, complete with CI Tee, adaptors, drainage pipes, CI gate valves, CI flap valve, surface boxes, thrust blocks, uPVC down pipe, and all other fittings necessary to make the complete installation on pipes of the following sizes; all to PN16				
J911	80 mm ND	nr	2	1,200,000	2,400,000

	PIPEWORK-MANHOLES AND PIPEWORK ANCILLARIES				
	Other Chambers				
	In situ Concrete Chambers				
	Concrete washout outfall structure, complete, as specified in drawings, and of the following depths				
K231.1	Depth not exceeding 1.5m	nr	2	1,000,000	2,000,000
	Concrete air valve chamber, complete as specified in the drawings, and of the following depths				
K231.2	Depth not exceeding 1.5m	nr	2	750,000	1,500,000
				Carried to Collection	**9,924,160**
	Concrete chamber for pipe manifold, complete with vented lockable manhole cover, valve surface boxes for DN 40 - DN 80 valves, galvanised step irons, as specified in the drawings, and of the following depths				
K231.3	Depth not exceeding 1.5m	nr	2	600,000	1,200,000
	Crossings				

	Open Channels				
	Lined open channels crossings for pipes of the following sizes				
K681	Not exceeding 300 mm ND	nr	5	28,000	140,000
	Reinstatement				
	Roads				
	Breaking up, temporary and permanent reinstatement of tarmac roads for the following pipe sizes (Inclusive of processing the necessary approvals from the relevant authorities)				
K731.1	Diameter not exceeding 300 mm ND	m	60.0	137,500	8,250,000
	Breaking up, temporary and permanent reinstatement of gravel roads for the following pipe sizes				
K731	Diameter not exceeding 300 mm ND	m	15	60,000	900,000
	Other Pipework Ancillaries				
	Marker Posts				
K820.1	Marker posts for Non Return valves	nr	1	40,000	40,000
K820.2	Marker posts for pipes	nr	9	40,000	340,000
K820.3	Marker posts for air valves	nr	2	40,000	80,000
K820.4	Marker posts for wash outs	nr	2	40,000	80,000

	PIPEWORK-SUPPORTS AND PROTECTION, ANCILLARIES TO LAYING AND EXCAVATION				
	Extras to Excavation and Backfilling				
	In Pipe Trenches				
	Extras to excavation in pipe trenches in the following materials				
L111	In rock	m^3	10.0	120,000	1,200,000
	Surrounds				
	Pipe surrounds of selected excavated granular material for the following pipe sizes				
L521	Diameter not exceeding 200 mm ND	m	1,400	3,000	4,200,000
	Pipe surrounds of imported granular material for the following pipe sizes				
L531	Diameter not exceeding 200 mm ND	m	250	6,000	1,500,000
	Pipe surrounds of mass concrete for the following pipe sizes				
L541	Diameter not exceeding 200 mm ND	m	50	15,000	750,000
				Carried to Collection	**18,680,000**
	Concrete Stools and Thrust Blocks				

	Thrust Blocks				
	Mass concrete grade C15 thrust blocks for pipes and fittings, volume 0.2-0.5 m^3 ,for the following pipe sizes				
L731	Diameter not exceeding 200 mm ND	nr	5	250,000	1,250,000
				Carried to Collection	**1,250,000**
	COLLECTION				
	Collection, Page ZIG W-2/1				44,683,420
	Collection, Page ZIG W-2/2				9,924,160
	Collection, Page ZIG W-2/3				18,680,000
	Collection, Page ZIG W-2/4				1,250,000
				Carried to Summary	**74,537,580**

BILL No. BOR W-3

DESCRIPTION: CHEMICAL HOUSE

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	**UShs**
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/3.0.0 series (including references made there-in to other drawings)				
	EARTHWORKS				
	Excavation for foundations				
	Ordinary Soil				
	Excavation for foundations in material other than topsoil, rock or artificial hard material, commencing surface is the formation level				
E323	Depth 0.5 - 1.0 m	m^3	10.0	10,000	100,000
	Rock				
	Excavation for foundations in rock, commencing surface is the exposed surface of the rock				

E333	Depth 0.5 - 1.0 m	m^3	4.4	25,000	108,883
	Excavation Ancillaries				
	Preparation				
	Preparation of excavated surfaces for whole structure in the following materials				
E522	Material other than topsoil, rock, or artificial hard material inclined at an angle not exceeding 45 degrees to the horizontal	m^2	10.0	4,375	43,750
E523	Rock surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m^2	1.5	5,000	7,500
	Disposal of Excavated Material				
	Disposal of excavated material to fill sites as specified and as directed by the Engineer				
E532	Material other than topsoil, rock, or artificial hard material	m^3	6.00	10,938	65,625
E533	Rock	m^3	0.50	10,938	5,469
	Anti-termite Treatment				
E597	Apply approved anti-termite treatment to surfaces of hardcore blinding, sides and bottoms of foundation excavations to the manufacturer's instructions	sum	1	150,000	150,000
	Filling Ancillaries				
	Filling				

	Filling to Structures by methods specified and to depths as shown in the drawings with the following materials				
E614	Selected excavated granular material other than topsoil, rock or artificial hard material compacted to 98% MOD AASHTO	m^3	8.00	10,795	86,360
E645	50mm thick bed of approved imported sand blinding on top of hardcore fill well spread, levelled, rammed and consolidated to the Engineer's satisfaction	m^3	1.10	17,500	19,250
				Carried to Collection	**586,837**
E647	300mm thick bed of approved imported hardcore well spread, levelled, rammed and consolidated on stabilized ground to the Engineer's satisfaction	m^3	6.30	72,000	453,600
	Trimming				
	Trimming of surfaces filled with material other than topsoil, rock or artificial hard material, for the following types of work surfaces				
E712	Surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m^2	40.10	4,690	188,069
	Trimming of surfaces filled with rock, for the following types of work surfaces				

E713	Surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m^2	3.80	6,250	23,750
	IN-SITU CONCRETE				
	Provision of Concrete				
	Ordinary Designed Mix Concrete				
	Grade C20				
	Designed mix, grade C20 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F141	10mm aggregate	m^3	0.00		
	Grade C25				
	Designed mix, grade C25 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F151	10mm aggregate	m^3	0.00		
	Placing Mass Concrete				
	Bases, Footings and Ground Slabs				
	Placing mass concrete, for strip foundations, grade C20, of the following thickness				
F522	Thickness 150-300mm	m^3	3.00	300,000	900,000

	Placing Reinforced Concrete				
	Bases, Footings and Ground Slabs				
	Placing reinforced concrete C25, for floor slab, stairs and tank base of the following thickness				
F622	Thickness 150-300mm	m^3	1.00	450,000	450,000
	Beams				
	Placing reinforced concrete grade C25, for ring beam of the following cross-sectional area				
F562	Cross-sectional area 0.03 - 0.1 m^2	m^3	1.05	450,000	472,500
				Carried to Collection	**2,487,919**
	CONCRETE ANCILLARIES				
	Formwork-Fair Finish				
	Fair Finish Plane Horizontal				
	Plane fair finish horizontal formwork of the following width				
G212	Width: 0.1-0.2m	m^2	1.75	18,500	32,375
	Fair Finish Plane Vertical				

	Plane fair finish vertical formwork of the following width				
G243	Width: 0.2-0.4m	m²	17.2	18,500	318,200
	Reinforcement				
	Deformed High Yield Steel Bars				
	High yield square twisted or ribbed bars to BS 4449 and of the following sizes				
G525	Nominal size, 6 - 16mm	kg	87.0	5,500	478,500
	Steel Fabric				
	High tensile steel fabric reinforcement to BS 4483, fabric reference A252, cast in concrete slab with minimum 200mm end side laps, and of the following mass				
G564	Nominal mass 4-5 kg/m²	m²	22.50	15,850	356,625
	Concrete Accessories				
	Finishing of top surfaces				
	Finishing of top surfaces by the following methods				
G811	Class U2 wood float finish to top of floor	m²	22.50	12,600	283,500
	BRICKWORK AND MASONRY				
	Burnt clay brickwork				

	Burnt clay brickwork to BS 7263, jointed with ordinary 1:5 cement mortar, hoop irons every three courses, including 1:4 cement plaster to both faces complete, as detailed in the drawings, for walls of the following thickness				
U523	200 mm thick	m²	90.00	35,000	3,150,000
	Permanent Vents				
	Construct dense concrete pre-cast louvered blockwork vents to BS 7263, jointed with ordinary 1:4 cement mortar, hoop irons every three courses, as detailed in the drawings of the following sizes				
U590	1500mm x 1200mm (W x H)	nr	2	300,000	600,000
				Carried to Collection	**5,219,200**
	PAINTING				
	High Gloss				
	Timber Surfaces				
	External quality weather guard paint, two coats, to the following timber surfaces; include surface preparation and undercoat				
V321	Upper surfaces of fascia board inclined at an angle not exceeding 30 degrees to the horizontal	m²	5.50	8,500	46,750

	Masonry				
	External quality weather guard paint, two coats, to the following smooth concrete surfaces; include surface preparation and under coat as specified				
V333	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m²	55.00	8,500	467,500
	Emulsion Paint				
	Masonry				
	Internal quality emulsion paint, two coats, to the following smooth masonry surfaces, include surface preparation and undercoat as specified				
V553	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m²	71.00	8,500	603,500
	WATER PROOFING				
	Protective Layers				
	Flexible Sheeting				
	Flexible polyethylene sheeting, gauge 1000, or similar approved, laid with 300mm overlaps at joints, to the surface of sand blinded hardcore fill				

W421.1	Surfaces of blinding hardcore inclined at an angle not exceeding 30 degrees to the horizontal	m^2	22.50	2,500	56,250
	Damp proof course of Hessian based bitumen impregnated fabric to BS 6398 bedded on 1:4 cement and sand mortar with 150mm overlaps at joints; for the following wall				
W421.2	230 mm thick	m	22.2	4,500	99,900
	Sand and Cement Screed				
	Sand and cement screed of 1:3 cement sand mortar, applied to concrete floors, 25 mm thick, prepared and applied as specified, and finished with a steel float				
W441	Surfaces of floors inclined at an angle not exceeding 30 degrees to the horizontal	m^2	20.70	15,104	312,656
	Rendering- Rough Cast				
W511	Apply rough cast to external wall surfaces inclined at an angle exceeding 60 degrees to the horizontal in 1:3 ordinary cement mortar to the Engineer's satisfaction	m^2	44.00	8,000	352,000
				Carried to Collection	**1,938,556**
	MISCELLANEOUS WORKS				
	Windows				

	Supply and fix the following mild steel casement windows to the Engineers' details constructed from standard steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, plugging and fixing to head jamb and cill; 300mm permanent louvered vent with 75x2mm steel louvers and single shutter complete with 4mm thick clear glass panes, and burglar proofing				
BOR W-3.1	Mild steel window overall size 1200 x 1500mm high	nr	0		
BOR W-3.2	Mild steel window overall size 1500 x 1500mm high	nr	0		
	Doors				
	Supply and fix approved solid hardwood with three coats of polyurethane varnish on general surfaces of door as described; 50mm two panel framed door comprising 50 x 100mm stiles, top, middle and bottom rails all grooved and with both panels filled with 30 x 100mm vertical tongued and grooved battens with rubber door stops, all iron mongery and locking arrangements of the following sizes				
BOR W-3.3	900mm x 2400mm (W x H including 300mm wood pvo)	nr	2	500,000	1,000,000
	Roofing				

BOR W-3.4	Construct roofing, complete as in the drawings and as specified; include tie beams, purlins, rafters, struts, wall plate, fascia board and all roofing timber, gauge 26 prepainted GCI resin sheeting and ridges; the GCI sheet should be resin bonded or with other protection against corrosion by Chlorine	m²	30.00	75,000	2,250,000
BOR W-3.5	Supply and install expanded metal and plastered ceiling nailed to brandering made from sawn treated Cyprus or other similar grade and approved timber in roof structure; complete including 3 coats of matt emulsion paint and 600 x 600mm hardwood access trap door	m²	22.00	45,000	990,000
	Plumbing and Drainage				
BOR W-3.6	Supply, lay and fix inlet pipes, valves and fittings; including ball valves and flowmeter; from the outlet pipe of the nearby reservoir tank to the water tank of size OD32mm, all pipe and fittings in HDPE/uPVC/PPR to PN 10 as approved by the Engineer	Sum	1	600,000	600,000
BOR W-3.7	Supply, lay and fix drain pipes, valves and fittings from the tanks to the nearest manhole, as in the drawings, of size OD63mm, all pipe and fittings in HDPE/uPVC/PPR to PN10 as approved by the Engineer; include manhole connection and making good joint	Sum	1	600,000	600,000
	Mixing Tanks				
BOR W-3.8	Supply and install chlorine generation and dosing PVC tanks of 1000 litres capacity as specified and as approved by the Engineer; include complete connection to Electrolytic Disinfecting Machine, Dosing equipment, and	nr	2	579,600	1,159,200

	incoming DN200mm uPVC pumping Main				
	Building Finishes				
BOR W-3.9	Chemical house finishes including, constructing 20x100mm high 1:3 cement-sand skirting, C20 concrete window cills, 600mm wide C20 concrete splash apron, 2 no. drainage manholes of internal dimension 700x700mm with OD 110 PVC drainage pipework to soak pit included, 300mm x 1380mm x 100mm thick reinforced concrete doser plinth cover slabs over inlet pipe channel, etc complete to the specifications and as directed by the Engineer	Sum	1	2,500,000	2,500,000
				Carried to Collection	**9,099,200**
	COLLECTION				
	Collection, Page BOR W-3/1				586,837
	Collection, Page BOR W-3/2				2,487,919
	Collection, Page BOR W-3/3				5,219,200
	Collection, Page BOR W-3/4				1,938,556
	Collection, Page BOR W-3/5				9,099,200
				Carried to Summary	**19,331,712**

DESCRIPTION: ECOSAN TOILET

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	UShs
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/1.0.0 series (including references made there-in to other drawings)				
	EARTHWORKS				
	Excavation for foundations				
	Topsoil				
E310	Strip site of top soil average depth 150mm and deposit in heaps at an appropriate place 300m away from site	m^3	6.0	3,000	18,000
	All Materials other than top soil				
	Excavation for foundations in all materials including rock or artificial hard material, commencing surface is the stripped ground level including apron.				
E323	Depth for Buildings 0-1.5m	m^3	6.0	5,000	30,000
	Excavation Ancillaries				

E596	Allow for all excavation ancillaries including trimming, preparation, and compaction of excavated surfaces, disposal of excavated material, and timber supports to all excavated surfaces	Sum	1	20,000	20,000
	Anti-termite Treatment				
E597	Apply approved anti-termite treatment to surfaces of hardcore blinding, sides and bottoms of foundation excavations to the manufacturer's instructions	sum	1	100,000	100,000
	Filling				
	Filling to structures by methods specified and to depths as shown in the drawings with the following materials				
E615	Selected imported granular material other than topsoil, rock or artificial hard material to building area and compacted to 98% MOD AASHTO	m^3	5.00	6,000	30,000
E645	50mm thick bed of approved imported sand blinding on top of hardcore fill well spread, levelled, rammed and consolidated to the Engineer's satisfaction	m^3	0.60	150,000	90,000
E647	300mm thick bed of approved imported hardcore well spread, levelled, rammed and consolidated on stabilized ground to the Engineer's satisfaction including apron	m^3	3.00	18,000	54,000
				Carried to Collection	**342,000**
	IN-SITU CONCRETE				
	Provision of Concrete				

	Ordinary Designed Mix Concrete				
	Grade C20				
	Designed mix, grade C20 concrete, to BS 5328, with ordinary portland cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F141	10mm aggregate	m^3	0.00		
	Grade C25				
	Designed mix, grade C25 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F151	10mm aggregate	m^3	0.00		
	Placing Mass Concrete				
	Footings and Ground or oversite Slabs				
	Placing mass concrete of the following grade in Foundation, Oversite slab & Apron				
F522	Thickness 200mm grade C20 in foundation	m^3	1.50	500,000	750,000
	Thickness 150mm in Ground / Oversite slab & apron grade C15	m^3	2.80	300,000	840,000
	Placing Reinforced Concrete				
	Bases, Footings and Ground Slabs				
	Placing reinforced concrete grade C25, of the following thickness				

F622	Thickness 150-300mm for suspended floor slab	m^3	1.10	500,000	550,000
	Column base & stud	m^3	0.80	500,000	400,000
	Beams(lintel)				
	Placing reinforced concrete, grade C25, for ring beam (lintel) of the following cross-sectional area				
F662	Cross-sectional area 0.03 - 0.1 m^2	m^3	0.15	500,000	75,000
	CONCRETE ANCILLARIES				
	Formwork-Fair Finish				
	Fair Finish Plane Horizontal				
	Plane fair finish horizontal formwork of the following width				
G214	Width: 0.4-1.22m; to soffit of suspended slab	m^2	7.0	12,000	84,000
	Fair Finish Plane Vertical				
	Plane fair finish vertical formwork of the following width				
G244.1	Width: 0.4-1.22m; to floor and steps	m^2	7.8	12,000	93,600
G244.2	Width: 0.4-1.22m; to sides of the ring beam & column	m^2	3.8	12,000	45,600
				Carried to	

				Collection	**2,838,200**
	Reinforcement				
	Deformed High Yield Steel Bars				
	High yield square twisted or ribbed bars to BS4449 and of the following sizes				
G525	Nominal size, 6 - 12mm (in column base, stud & solid suspended slab)	kg	125.0	5,000	625,000
	Steel Fabric				
	High tensile steel fabric reinforcement to BS 4483, fabric reference A252, cast in concrete slab with minimum 200mm end side laps, and of the following mass				
G564	Nominal mass 4-5 kg/m²	m^2	0.0		
	Concrete Accessories				
	Finishing of Top Surfaces				
	Finishing of top surfaces by the following methods				
G811	Class U2 wood float finish to top of floor	m^2	10.0	12,000	120,000
	BRICKWORK, BLOCKWORK, AND MASONRY				
	Burnt clay brickwork				

	Burnt clay brickwork to BS 7263, jointed with ordinary 1:5 cement mortar, hoop irons every three courses, including 1:4 cement plaster to both faces complete, as detailed in the drawings, for walls of the following thickness				
U521.1	150 mm thick	m^2	40.0	30,000	1,200,000
U521.2	230 mm thick	m^2	20.0	35,000	700,000
	Permanent Vents				
	Dense brickwork vents to BS 7263, jointed with ordinary 1:5 cement mortar above door and window openings, including mosquito mesh, for walls of the following thickness				
U589	150 - 230 mm thick	m^2	1.0	45,000	45,000
	PAINTING				
	High Gloss				
	Timber Surfaces				
	External quality weather guard paint, two coats, to the following timber surfaces; include surface preparation and undercoat				
V321	Upper surfaces of fascia board inclined at an angle not exceeding 30 degrees to the horizontal	m^2	2.0	12,000	24,000
	Emulsion Paint				
	Masonry				
	External quality weather guard paint two coats, to the following wall surfaces; include surface preparation as specified				

V363	Surfaces of external walls inclined at an angle exceeding 60 degrees to the horizontal	m²	18.0	12,000	216,000
				Carried to Collection	**2,930,000**
	Internal quality vinyl silk paint, two coats, to internal wall surfaces; include surface preparation as specified				
V563	Surfaces of internal walls inclined at an angle exceeding 60 degrees to the horizontal	m²	25.0	8,000	200,000
	WATER PROOFING				
	Damp Proofing				
	Rendering- Rough Cast				
W511	Apply rough cast to external wall surfaces inclined at an angle exceeding 60 degrees to the horizontal in 1:3 ordinary cement mortar to the Engineer's satisfaction	m²	10.0	12,000	120,000
	Flexible Sheeting				
	Flexible polyethylene sheeting, gauge 1000, or similar approved, laid with 300mm overlaps at joints, to the surface of sand blinded hardcore fill				
W421.1	Surfaces of blinding hardcore inclined at an angle not exceeding 30 degrees to the horizontal	m²	0.0		

	Damp proof course of Hessian based bitumen impregnated fabric to BS 6398 bedded on 1:4 cement and sand mortar with 150mm overlaps at joints; for the following wall				
W421.2	150 - 230 mm thick	m	15.0	12,000	180,000
	Protective Layers				
	Sand and cement screed of 1:3 cement sand mortar, applied to concrete floors, 25 mm thick, prepared and applied as specified, and finished with a steel float including apron				
W441	Surfaces of floors inclined at an angle not exceeding 30 degrees to the horizontal	m^2	22.0	12,000	264,000
	MISCELLANEOUS WORKS				
	Roofing				
BOR W-6.1	Construct roofing, complete as in the drawings and as specified; include tie beams, purlins, rafters, struts, wall plate, fascia board and all roofing timber, gauge 26 pre painted GCI sheeting and ridges, and 112mm uPVC rain water guttering and DN 80 drainage pipes to the Engineer's satisfaction.	m^2	12.0	125,000	1,500,000
BOR W-6.2	Supply and install expanded metal and plastered ceiling nailed to brandering made from sawn treated Cyprus or other similar grade and approved timber in roof structure; complete including 3 coats of matt emulsion paint and 600x600mm hardwood access trap door	m^2	0.0		
				Carried to Collection	**2,264,000**

	Windows				
	Supply and fix the following mild steel casement windows to the Engineers' details constructed from standard steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, plugging and fixing to head jamb and cill.				
BOR W-6.3	Mild steel window overall size 1000 x 1100mm high complete with 4mm thick clear glass panes, and burglar proofing	nr	0		
	Doors				
	Supply and fix the following mild steel doors to the Engineers' details constructed from 75 x 50 x 2mm hollow steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, 3-lever Yale locking arrangements, and accessories				
BOR W-6.4	Single leaf solid steel door, size 900 x 2100mm; complete	nr	0		
	Supply and fix approved solid hardwood door with three coats of polyurethane varnish on general surfaces of door as described; 50mm two panel framed door comprising 50 x 100mm stiles, top, middle and bottom rails all grooved and with both panels filled with 30 x 100mm vertical tongued and grooved battens with rubber door stops, all iron mongery and locking arrangements of the following sizes				
BOR W-6.5	900mm x 2100mm (W x H)	nr	2	250,000	500,000
	Building Finishes				

BOR W-6.6	Building finishes including, constructing 20x100mm high 1:3 cement-sand skirting, C20 concrete window cills, complete to the specifications and as directed by the Engineer	sum	1	200,000	200,000
	Plumbing and Drainage				
BOR W-6.7	Supply and install a 1500 litre ($1.5m^3$) Polyethylene tank as Poly tank, elevated up to 1.0m above ground level on a rendered brickwork platform, complete with a DN 15mm Brass outlet tap, inlet DN 80 uPVC pipe work from overhead rain water gutters, DN 80 uPVC overflow and drainage pipework to soak pit (inclusive) as per drawings	Sum	0		
BOR W-6.8	Provide and fix urine diverting squat pans as directed by Engineer	nr	1	70,000	70,000
	Supply and Install urine diversion sanitation system consisting of: (Seal joints with PVC cement)				
BOR W-6.9	1 - 1/4" PVC Pipes	m	2.5	7,500	18,750
BOR W-6.10	1 - 1/4" PVC Bends	nr	1	7,500	7,500
BOR W-6.11	1 - 1/4" PVC Tees	nr	2	7,500	15,000
BOR W-6.12	1 - 1/4" Plugs	nr	2	7,500	15,000
BOR W-6.13	Supply and Install DN 100mm PVC vent pipes 3m long, complete with rain stoppers and galvanised fly trap	nr	2	50,000	100,000

				Carried to Collection	**926,250**
	Urine Collection Tank				
BOR W-6.14	Supply and install a urine collecting tank of capacity 220 litres complete with an outlet tap and an overflow connected to the soak pit	nr	1	150,000	150,000
BOR W-6.15	Supply and install an ash container/bucket as approved by the Engineer	nr	2	25,000	50,000
BOR W-6.16	Supply and install 1no. toilet paper holder.	nr	1	40,000	40,000
BOR W-6.17	Supply and Install Ecosan vault solar heaters [Galvanised Iron sheets of gauge 16, 800x800 mm and painted black] complete with galvanised frame, hinges, handles, and locks to make it air tight	nr	2	400,000	800,000
				Carried to Collection	**1,040,000**
	COLLECTION				
	Collection, Page BOR W-6/1				342,000
	Collection, Page BOR W-6/2				2,838,200
	Collection, Page BOR W-6/3				2,930,000
	Collection, Page BOR W-6/4				2,264,000
	Collection, Page BOR W-6/5				926,250
	Collection, Page BOR W-6/6				

					1,040,000
				Carried to Summary	**10,340,450**

BILL No. BOR W-6

DESCRIPTION: GUARD AND PUMP ATTENDANT HOUSE

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	**UShs**
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/1.0.0 series (including references made there-in to other drawings)				
	EARTHWORKS				
	Excavation for foundations				
	Topsoil				
E310	Strip site of top soil average depth 150mm and deposit in heaps at an appropriate place 300m away from site	m^3	10.0	10,000	100,000
	All Materials other than top soil				
	Excavation for foundations in all materials including rock or artificial hard material, commencing surface is the stripped ground level				
E323	Depth for Buildings 0-1.5m	m^3	14.7	12,500	183,750
	Excavation Ancillaries				

E596	Allow for all excavation ancillaries including trimming, preparation, and compaction of excavated surfaces, disposal of excavated material, and timber supports to all excavated surfaces	Sum	1	300,000	300,000
	Anti-termite Treatment				
E597	Apply approved anti-termite treatment to surfaces of hardcore blinding, sides and bottoms of foundation excavations to the manufacturer's instructions	sum	1	100,000	100,000
	Filling				
	Filling to structures by methods specified and to depths as shown in the drawings with the following materials				
E615	Selected imported granular material other than topsoil, rock or artificial hard material to building area and compacted to 98% MOD AASHTO	m^3	5.45	15,000	81,750
E645	50mm thick bed of approved imported sand blinding on top of hardcore fill well spread, levelled, rammed and consolidated to the Engineer's satisfaction	m^3	0.79	17,500	13,825
E647	300mm thick bed of approved imported hardcore well spread, levelled, rammed and consolidated on stabilized ground to the Engineer's satisfaction	m^3	4.75	72,000	342,000
				Carried to Collection	**1,121,325**
	IN-SITU CONCRETE				
	Provision of Concrete				
	Ordinary Designed Mix Concrete				

	Grade C20				
	Designed mix, grade C20 concrete, to BS 5328, with ordinary portland cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F141	10mm aggregate	m³	2.25	480,000	1,080,000
	Grade C25				
	Designed mix, grade C25 concrete, to BS 5328, with ordinary port land cement to BS 12, aggregate to BS882, for the following aggregate sizes				
F151	10mm aggregate	m³	3.36	525,000	1,764,000
	Placing Mass Concrete				
	Bases, Footings and Ground Slabs				
	Placing mass concrete, for strip foundations, grade C20, of the following thickness				
F522	Thickness 150-300mm	m³	2.25	75,000	168,750
	Placing Reinforced Concrete				
	Bases, Footings and Ground Slabs				
	Placing reinforced concrete grade C25, for floor slab and steps of the following thickness				
F622	Thickness 150-300mm	m³	2.85	75,000	213,750

	Beams				
	Placing reinforced concrete, grade C25, for ring beam of the following cross-sectional area				
F662	Cross-sectional area 0.03 - 0.1 m^2	m^3	0.51	75,000	38,250
	CONCRETE ANCILLARIES				
	Formwork-Fair Finish				
	Fair Finish Plane Horizontal				
	Plane fair finish horizontal formwork of the following width				
G214	Width: 0.4-1.22m	m^2	1.0	12,000	12,000
	Fair Finish Plane Vertical				
	Plane fair finish vertical formwork of the following width				
G244.1	Width: 0.4-1.22m; to floor and steps	m^2	7.8	12,000	93,600
G244.2	Width: 0.4-1.22m; to sides of the ring beam	m^2	3.8	12,000	45,600
				Carried to Collection	**3,415,950**
	Reinforcement				
	Deformed High Yield Steel Bars				

	High yield square twisted or ribbed bars to BS4449 and of the following sizes				
G525	Nominal size, 6 - 16mm	kg	64.0	5,500	352,000
	Steel Fabric				
	High tensile steel fabric reinforcement to BS 4483, fabric reference A252, cast in concrete slab with minimum 200mm end side laps, and of the following mass				
G564	Nominal mass 4-5 kg/m²	m²	16.0	15,850	253,600
	Concrete Accessories				
	Finishing of Top Surfaces				
	Finishing of top surfaces by the following methods				
G811	Class U2 wood float finish to top of floor	m²	16.0	12,600	201,600
	BRICKWORK, BLOCKWORK, AND MASONRY				
	Dense Concrete Blockwork				
	Dense concrete blockwork to BS 7263, jointed with ordinary 1:5 cement mortar, hoop irons every three courses, including 1:4 cement plaster to both faces complete, as detailed in the drawings, for walls of the following thickness				
U521.1	150 mm thick	m²	51.2	30,000	1,536,000
U521.2	230 mm thick	m²	43.9	35,000	1,536,500
	Permanent Vents				

	Dense brickwork vents to BS 7263, jointed with ordinary 1:5 cement mortar above door and window openings, including mosquito mesh, for walls of the following thickness				
U589	150 - 230 mm thick	m^2	1.0	50,000	50,000
	PAINTING				
	High Gloss				
	Timber Surfaces				
	External quality weather guard paint, two coats, to the following timber surfaces; include surface preparation and undercoat				
V321	Upper surfaces of fascia board inclined at an angle not exceeding 30 degrees to the horizontal	m^2	5.4	8,500	45,900
	Masonry				
	External quality weather guard paint two coats, to the following smooth concrete surfaces; include surface preparation as specified				
V363	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m^2	4.5	8,500	38,250
				Carried to Collection	**4,013,850**
	Emulsion Paint				
	Masonry				

	Internal quality vinyl silk paint, two coats, to the following smooth concrete surfaces; include surface preparation as specified				
V563	Surfaces of walls inclined at an angle exceeding 60 degrees to the horizontal	m²	46.0	8,500	391,000
	WATER PROOFING				
	Damp Proofing				
	Rendering- Rough Cast				
W511	Apply rough cast to external wall surfaces inclined at an angle exceeding 60 degrees to the horizontal in 1:3 ordinary cement mortar to the Engineer's satisfaction	m²	68.0	16,000	1,088,000
	Flexible Sheeting				
	Flexible polyethylene sheeting, gauge 1000, or similar approved, laid with 300mm overlaps at joints, to the surface of sand blinded hardcore fill				
W421.1	Surfaces of blinding hardcore inclined at an angle not exceeding 30 degrees to the horizontal	m²	16.0	2,500	40,000
	Damp proof course of Hessian based bitumen impregnated fabric to BS 6398 bedded on 1:4 cement and sand mortar with 150mm overlaps at joints; for the following wall				
W421.2	150 - 230 mm thick	m	21.0	4,500	94,500
	Protective Layers				

	Sand and cement screed of 1:3 cement sand mortar, applied to concrete floors, 25 mm thick, prepared and applied as specified, and finished with a steel float				
W441	Surfaces of floors inclined at an angle not exceeding 30 degrees to the horizontal	m^2	16.0	12,500	200,000
	MISCELLANEOUS WORKS				
	Roofing				
BOR W-6.1	Construct roofing, complete as in the drawings and as specified; include tie beams, purlins, rafters, struts, wall plate, fascia board and all roofing timber, gauge 26 pre painted GCI sheeting and ridges, and 112mm uPVC rain water guttering and DN 80 drainage pipes to the Engineer's satisfaction.	m^2	27.0	80,000	2,160,000
BOR W-6.2	Supply and install expanded metal and plastered ceiling nailed to brandering made from sawn treated Cyprus or other similar grade and approved timber in roof structure; complete including 3 coats of matt emulsion paint and 600x600mm hardwood access trap door	m^2	14.0	80,000	1,120,000
				Carried to Collection	**5,093,500**
	Windows				
	Supply and fix the following mild steel casement windows to the Engineers' details constructed from standard steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, plugging and fixing to head jamb and cill				
BOR W-6.3	Mild steel window overall size 1000 x 1100mm high complete with 4mm thick clear glass panes, and burglar proofing	nr	1	700,000	700,000

	Doors				
	Supply and fix the following mild steel doors to the Engineers' details constructed from 75 x 50 x 2mm hollow steel sections primed with red oxide paint, painted with three coats of high gloss paint; complete with all necessary iron mongery, 3-lever Yale locking arrangements, and accessories				
BOR W-6.4	Single leaf solid steel door, size 900 x 2100mm; complete	nr	1	850,000	850,000
	Supply and fix approved solid hardwood with three coats of polyurethane varnish on general surfaces of door as described; 50mm two panel framed door comprising 50 x 100mm stiles, top, middle and bottom rails all grooved and with both panels filled with 30 x 100mm vertical tongued and grooved battens with rubber door stops, all iron mongery and locking arrangements of the following sizes				
BOR W-6.5	800mm x 2100mm (W x H)	nr	2	600,000	1,200,000
	Building Finishes				
BOR W-6.6	Building finishes including, constructing 20x100mm high 1:3 cement-sand skirting, C20 concrete window cills, 700mm wide C20 concrete splash apron, complete to the specifications and as directed by the Engineer	sum	1	750,000	750,000
	Plumbing and Drainage				

BOR W-6.7	Supply and install a 1500 litre (1.5m^3) Polyethylene tank as Poly tank, elevated up to 1.0m above ground level on a rendered brickwork platform, complete with a DN 15mm Brass outlet tap, inlet DN 80 uPVC pipe work from overhead rain water gutters, DN 80 uPVC overflow and drainage pipework to soak pit (inclusive) as per drawings	Sum	1	1,500,000	1,500,000
BOR W-6.8	Provide and fix urine diverting squat pans as directed by Engineer	nr	2	70,000	140,000
	Supply and Install urine diversion sanitation system consisting of: (Seal joints with PVC cement)				
BOR W-6.9	1 - 1/4" PVC Pipes	m	2.5	7,500	18,750
BOR W-6.10	1 - 1/4" PVC Bends	nr	1	7,500	7,500
BOR W-6.11	1 - 1/4" PVC Tees	nr	2	7,500	15,000
BOR W-6.12	1 - 1/4" Plugs	nr	2	7,500	15,000
BOR W-6.13	Supply and Install DN 100mm PVC vent pipes 3m long, complete with rain stoppers and galvanised fly trap	nr	2	50,000	100,000
				Carried to Collection	**5,296,250**
	Urine Collection Tank				
BOR W-6.14	Supply and install a urine collecting tank of capacity 220 litres complete with an outlet tap and an overflow connected to the soak pit	nr	1	150,000	150,000

BOR W-6.15	Supply and install an ash container/bucket as approved by the Engineer	nr	2	25,000	50,000
BOR W-6.16	Supply and install 1no. toilet paper holder.	nr	1	40,000	40,000
BOR W-6.17	Supply and Install Ecosan vault solar heaters [Galvanised Iron sheets of gauge 16, 800x800 mm and painted black] complete with galvanised frame, hinges, handles, and locks to make it air tight	nr	2	400,000	800,000
				Carried to Collection	**1,040,000**
	COLLECTION				
	Collection, Page BOR W-6/1				1,121,325
	Collection, Page BOR W-6/2				3,415,950
	Collection, Page BOR W-6/3				4,013,850
	Collection, Page BOR W-6/4				5,093,500
	Collection, Page BOR W-6/5				5,296,250
	Collection, Page BOR W-6/6				1,040,000
				Carried to Summary	**19,980,875**

BILL No. BOR W-4

DESCRIPTION: STORAGE RESERVOIR AND SITE WORKS

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	**UShs**
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/4.0.0 series (including references made there-in to other drawings)				
	DEMOLITION AND SITE CLEARANCE				
	General Site Clearance				
D110	General site clearance for works	m^2	575	2,000	1,150,000
	EARTHWORKS				
	General Excavation				
	Topsoil				
E410	Strip site of top soil average depth 150mm and deposit in heaps at an appropriate place 300m away from site	m^3	15.0	3,000	45,000
	Excavation for foundations				

	Ordinary Soil				
	Excavation for foundations (stub columns), in material other than topsoil, rock or artificial hard material, commencing surface is the stripped ground level				
E323	Depth 0.5-1m	m^3	39.00	5,000	195,000
E324	Depth 1-2m	m^3	13.00	8,000	104,000
	Rock				
	Excavation for foundations, in rock, commencing surface is the stripped ground level				
E335	Depth 0.5 - 1.0 m	m^3	1.20	10,000	12,000
	Excavation Ancillaries				
	Preparation				
	Preparation of excavated surfaces in the following materials				
E522	Material other than topsoil, rock or artificial hard material inclined at an angle not exceeding 45 degrees to the horizontal	m^2	34.56	1,500	51,840
E523	Rock surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m^2	6.90	2,000	13,800
	Disposal of Excavated Material				

	Disposal of excavated material to sites as shown in the site layout and as specified and as directed by the Engineer				
E531	Soil	m³	8.5	2,500	21,250
E533	Rock	m³	1.3	2,500	3,250
				Carried to Collection	**1,596,140**
	Filling				
	Structures				
	Filling by methods specified and to depths as shown in the drawings with the following materials				
E614	Selected excavated material other than topsoil, rock or artificial hard material	m³	3.60	3,000	10,800
E615	Selected imported granular material other than topsoil, rock or artificial hard material to pump house area and compacted to 98% MOD AASHTO	m³	0.90	10,000	9,000
	Filling Ancillaries				
	Trimming of Filled Surfaces				
	Trimming of surfaces filled with material other than topsoil, rock or artificial hard material, for the following types of work surfaces				

E712	Surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m²	35.00	2,000	70,000
	Trimming of surfaces filled with rock, for the following types of work surfaces				
E713	Surfaces inclined at an angle not exceeding 45 degrees to the horizontal	m²	6.90	2,000	13,800
	Landscaping				
E810	Turfing for lawns inside fenced off compound; include filling with excavated topsoil, levelling and the preparation of the surfaces. Include the planting of water friendly trees as recommended by the Engineer	m²	393	6,000	2,358,000
	Provision of Hardcore				
E810	Provision and placement of 300mm thick hardcore base for the tank footings	m²	49	12,000	588,000
	IN-SITU CONCRETE				
	Provision of Concrete				
	Ordinary Designed Mix Concrete				
	Grade C15				

	Designed mix, grade C15 concrete, to BS 5328, with ordinary Portland cement to BS 12, aggregate to BS 882, for the following aggregate sizes				
F131	10 mm aggregate	m³	4.20	300,000	1,260,000
				Carried to Collection	**4,309,600**
	Grade C25				
	Designed mix, grade C25 concrete, to BS 5328, with ordinary Portland cement to BS 12, aggregate to BS 882, for the following aggregate sizes				
F151	10 mm aggregate	m³	28.00	500,000	14,000,000
	Placing Mass Concrete				
	Blinding				
	Placing blinding concrete, grade C15, of the following thickness				
F512	Thickness 150-300mm	m³	6.00	300,000	1,800,000
	Placing Reinforced Concrete				
	Bases, Footings and Ground Slabs				
	Placing reinforced concrete, grade C25, for column base footings of the following thickness				

F522	Thickness 300-500 mm	m³	7.00	500,000	3,500,000
	Columns				
	Placing reinforced concrete, grade C25, for columns of the following thickness				
F522	Thickness 300-500 mm	m³	3.00	500,000	1,500,000
	CONCRETE ANCILLARIES				
	Formwork-Fair Finish				
	Fair Finish Plane Vertical				
	Plane fair finish vertical formwork of the following width				
G245	Width exceeding 1.22m	m²	24.00	12,000	288,000
	Reinforcement				
	High Yield Steel				
	High yield square twisted or ribbed bars to BS4449 and of the following sizes				
G525	Nominal size, 16mm	kg	129.0	5,000	645,000
	Nominal size, 12mm	kg	190.0	5,000	950,000
	Nominal size, 8mm	kg	105.0	4,000	420,000
	Concrete Accessories				
	Finishing of Top Surfaces				

	Finishing of top surfaces by the following methods				
G812	With steel float finish	m²	2.30	12,000	27,600
				Carried to Collection	**23,130,600**
	PIPEWORK - PIPES				
	Plastic Drain Pipes				
	uPVC drain pipes, to BS 5481, with flexible joints to BS 4346 or BS 6209, 110 mm OD PN 6, laid in trench to the following depths				
I512	Depth not exceeding 1.5m	m	30	25,000	750,000
	PIPEWORK - FITTINGS AND VALVES				
	Cast or Spun Iron Pipe Fittings				
	external epoxy coated to AWWA C213				
	Bends				
	Ductile iron all flanged 90 degree bend, to BS 4772, flanges to BS 4504, all to PN 10, cement mortar lined, and of the following sizes				
J311.1	50 mm ND	nr	1	281,250	281,250
J311.3	80 mm ND	nr	1	562,500	562,500
J311.4	100 mm ND	nr	2	843,750	1,687,500

	Ductile iron all flanged 90degree duck foot bend, to BS 4772, flanges to BS 4504, all to PN 10, cement mortar lined, and of the following sizes				
J311.7	80 mm ND	nr	1	800,000	800,000
J311.8	100 mm ND	nr	2	1,200,000	2,400,000
	Junctions and Branches				
	All flanged tee to BS 4346, flanges to BS 4504, all to PN 10, and of the following sizes				
J321.1	100/50 mm ND	nr	1	850,000	850,000
	Double Collars				
	Viking Johnson or similar, wide range coupling to fit all pipe spigots to PN 10, and of the following sizes				
J341.1	80 mm ND	nr	1	650,000	650,000
J341.2	100 mm ND	nr	2	975,000	1,950,000
	Adaptors				
	Flange adaptor, Maxi Type or similar wide range adaptor to fit pipe spigots, flanges to BS 4505, all to PN 10 and of the following sizes				
J351.1	80 mm ND	nr	2	230,520	461,040
J351.2	100 mm ND	nr	2	460,920	921,840
	Bell mouths				

	Flanged bell mouth to ISO 2531, flanges to ISO 2441, of the following sizes all to PN 10				
J372.1	100 mm ND	nr	1	1,250,000	1,250,000
				Carried to Collection	**12,564,130**
	Straight Specials				
	Ductile iron double flanged pipe, to BS 4772, flanges to BS 4504, cement mortar lined, all to PN 10 and of the following sizes				
J381.1	50 mm ND not exceeding 1.0m	nr	4	65,000	260,000
J381.5	80 mm ND not exceeding 1.0m	nr	3	150,000	450,000
J381.6	80 mm ND not exceeding 3.0m	nr	2	470,000	940,000
J381.9	100 mm ND not exceeding 1.0m	nr	2	180,000	360,000
J381.10	100 mm ND not exceeding 3.0m	nr	2	420,000	840,000
	Strainer				
	Flanged outlet pipe strainer, to BS 4772, flanges to BS 4504, all to PN 10, cement mortar lined, and of the following sizes				
J491.1	100 mm ND	nr	1	916,500	916,500
	Gate Valves: Hand Operated				

	All flanged CI gate valves to BS 5150, flanges to BS 4505, all to PN 10 for operation by tee key, with extension spindle not exceeding 1.5 metres long, and of the following sizes				
J811.1	50 mm ND	nr	2	720,960	1,441,920
J811.2	80 mm ND	nr	2	1,083,360	2,166,720
J811.3	100 mm ND	nr	2	1,800,960	3,601,920
	Ball Float Valves				
	Flanged Balanced ball float valve, flanges to BS 4505, all to PN 10				
J891.2	100 mm ND	nr	1	1,800,960	1,800,960
	Bulk Flow Meter				
	"Woltman" Helix Type Bulk Flow Meter inclusive of all couplings, adaptors, steel pipe distance pieces, CI valves, thrust blocks, etc and all other fittings to make the installation complete, as specified, all fittings to PN 10, including lockable vented blockwork chamber with cast in valve surface boxes, and on the following main pipe sizes				
J991.1	100 mm ND	nr	1	1,800,960	1,800,960
	PIPEWORK - MANHOLES AND PIPEWORK ANCILLARIES				
	Manholes				
	Blockwork Manhole				

	Blockwork chamber complete with C20 concrete base, vented lockable manhole cover, valve surface boxes, galvanised step irons, as specified in the drawings, and of the following depths				
K171	Depth not exceeding 1.5m	nr	4	500,000	2,000,000
				Carried to Collection	**16,578,980**
	Other Chambers				
	In situ Concrete Chambers				
	Washout out fall structure, complete including flap valve, all fittings and pipework necessary to complete installation, as specified in drawings, and of the following depths; all fittings and pipework to PN 10				
K231	Depth not exceeding 1.5m	nr	1	500,000	500,000
	Supply and construct grouted stone pitching using mortar mix 1:4, include 50mm thick coping using 1:2:4 concrete mix on top of the stone pitching of same width as the wall thickness for drains of cross section				
K 491	Cross section area 0.5-1.0m^2	m	20.0	62,500	1,250,000

	PIPEWORK-SUPPORTS AND PROTECTION, ANCILLARIES TO LAYING AND EXCAVATION				
	In Pipe Trenches				
	Extras to excavation in pipe trenches in the following materials				
L111	In rock	m^3	2.0	100,000	200,000
	Valve Surface Boxes				
	Valve surface box for DN 50 - DN 100 valves, with lockable cover securely attached to main body of surface box by chain or bolt, include down pipe, complete as specified and to the following depths				
K251.2	Depth not exceeding 1.5m	nr	4	500,000	2,000,000
	Other Pipework Ancillaries				
	Marker Posts				
K820.1	Marker posts for gate valves	nr	2	40,000	80,000
K820.2	Marker posts for bulk meters	nr	1	40,000	40,000
	Surrounds				
	Pipe surrounds, of selected excavated granular material, for the following pipe sizes				

L521	Diameter not exceeding 300 mm ND	m	20.0	1,875	37,500
				Carried to Collection	**4,107,500**
	MISCELLANEOUS WORKS				
	Supply and Install cold pressed galvanised steel sectional tank with external flanges and pitched cover with 1No. 1m wide access man way, water level indicator (scale in cubic metres) and plates with inlet, outlet, washout and overflow connection complete with access points, ventilators (4 nr), walkway, handrailing, and internal and external access ladders with safety hoops, inclusive of painting, finishes and all necessary accessories to installation complete as specified and detailed in the drawings; to the Engineer's satisfaction. All tank accessories shall be of hot dipped galvanised steel.				
BOR W-4.1	Reservoir: 60m^3 nominal capacity erected on a 12m high tower	nr	1	65,000,000	65,000,000
BOR W-4.2	12m High Steel tower	nr	1	15,000,000	15,000,000
				Carried to Collection	**86,465,000**
	COLLECTION				
	Collection, Page BOR W-4/1				1,596,140
	Collection, Page BOR W-4/2				4,309,600
	Collection, Page BOR W-4/3				23,130,600
	Collection, Page BOR W-4/4				12,564,130
	Collection, Page BOR W-4/5				16,578,980
	Collection, Page BOR W-4/6				4,107,500
	Collection, Page BOR W-4/7				86,465,000
				Carried to Summary	**148,751,950**

BILL No. BOR W-5

DESCRIPTION: DISTRIBUTION NETWORK

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	**UShs**
	Preamble:				
	The works under this bill are covered under Part 2 of the Particular Specifications. The relevant drawings are the DRAWING MWE/WSDF-C/SRVCS/13-14/4.0.0 series (including references made there-in to other drawings)				
	DEMOLITION AND SITE CLEARANCE				
	General Site Clearance				
D110	General site clearance for pipe trench	m^2	3,600.00	2,000	7,200,000
	Trees				
	Cut and dispose of trees of the following girth; include removal of stump and backfilling the hole left with top soil				
D210	Girth 500 mm-1 m	nr	5	56,000	280,000
	Stumps				
	Remove and dispose of stumps of the following diameter; include for grabbing up the roots and backfilling the hole left with top soil				

D310	Diameter 150-500 mm	nr	1	85,000	85,000
D320	Diameter 500 mm -1 m	nr	1	85,000	85,000
	Plastic Pipes				
	Plastic Pressure Pipes				
	uPVC pressure pipes to BS3505, with flexible joints to BS4346 all to PN10, OD110mm, laid in trench to the following depths				
I512.3	Depth not exceeding 1.5m	m	570	28,925	16,487,250
	HDPE pressure pipes to BS 3505, include unions / sockets, all to PN 10, OD 90mm, laid in trench to the following depths				
I712.1	Depth not exceeding 1.5m	m	150	27,560	4,134,000
	HDPE pressure pipes to BS 3505, include unions / sockets, all to PN 10, OD 63mm, laid in trench to the following depths				
I712.3	Depth not exceeding 1.5m	m	450	13,650	6,142,500
	HDPE pressure pipes to BS 3505, include unions / sockets, all to PN 10, OD 50mm, laid in trench to the following depths				
I712.5	Depth not exceeding 1.5m	m	750	8,580	6,435,000
	HDPE pressure pipes to BS 3505, include unions / sockets, all to PN 10, OD 40mm, laid in trench to the following depths				
I712.5	Depth not exceeding 1.5m	m	990	5,590	5,534,100
				Carried to Collection	**46,382,850**

	PIPEWORK-FITTINGS AND VALVES				
	Cast / Spun Iron or Steel Pipe Fittings external epoxy coated to AWWA C213				
	Junctions and Branches				
	All flanged tee to BS 4346, flanges to BS 4504, all to PN10 and of the following sizes				
J321.1	40/40 mm ND	nr	1	166,530	166,530
J321.2	50/40 mm ND	nr	1	179,340	179,340
J321.3	80/80 mm ND	nr	1	230,580	230,580
J321.4	100/100 mm ND	nr	1	528,413	528,413
	Tapers				
	All flanged concentric taper to BS 4772, flanges to BS 4504 all to PN 10, cement mortar lined, and of the following sizes				
J331.1	80/50 mm ND	nr	1	334,631	334,631
J331.2	80/40 mm ND	nr	1	433,781	433,781
J331.3	50/40 mm ND	nr	2	458,910	917,820
	Adaptors				
	Flanged adaptor to fit uPVC pipe spigots to BS 3505, flanges to BS 4505, all to PN10, and of the following sizes				
J351.1	100 mm ND	nr	1	230,520	230,520
	Plastic Pipe Fittings				
	Bends				

	Compression 90^0 Bends to fit HDPE pipe spigots, to DIN 8076 - BS 5114, all to PN 10, and of the following spigot sizes				
J611.1	OD 75 X 75 mm	nr	0		
J611.2	OD 63 X 63 mm	nr	0		
	Adaptors				
	Compression Flange adaptor to fit HDPE pipe spigots, to DIN 8076 - BS 5114, all to PN 10, and of the following spigot sizes				
J651.1	OD 90 mm X 3"	nr	1	93,120	93,120
J651.2	OD 63 mm X 2"	nr	1	66,240	66,240
J651.3	OD 50 mm X 11/2"	nr	1	44,160	44,160
J651.4	OD 40 mm X 11/4"	nr	2	44,160	88,320
	End caps				
	Compression HDPE end caps to fit HDPE spigots, to ISO 161 and to PN 10 of the following spigot sizes				
J691.1	OD 50 mm	nr	3	13,440	40,320
J691.2	OD40 mm	nr	3	11,200	33,600
				Carried to Collection	**3,387,375**
	Valves and Penstocks				
	Gate Valves: Hand Operated				

	All flanged CI gate valves to BS 5150, flanges to BS 4505, all to PN 10 for operation by tee key, with cap and extension spindle not exceeding 1.5 metres long, and of the following sizes				
J811.1	40 mm ND	nr	2	375,500	751,000
J811.2	50 mm ND	nr	1	450,600	450,600
J811.3	80 mm ND	nr	1	590,850	590,850
J811.4	100 mm ND	nr	1	733,525	733,525
	Air Valves				
	Flanged anti shock, anti-surge double air valve, 40 mm ND, as specified, flanges to ISO 2441, complete with isolating gate valve to ISO 7259, flange on socket tee, thrust blocks, distance pieces, all to PN 10, as specified and all fittings necessary to make the connection complete; for the following pipe sizes				
J862.1	40 mm ND	nr	2	583,080	1,166,160
J862.2	50 mm ND	nr	1	680,260	680,260
J862.3	80 mm ND	nr	1	777,440	777,440
J862.4	100 mm ND	nr	1	1,524,960	1,524,960
	Washouts				
	Type 2 Washout as specified in the drawings, complete with CI Tee, adaptors, drainage pipes, CI gate valve, CI flap valve, surface boxes, thrust blocks, uPVC down pipe, and all other fittings necessary to make the complete installation on pipes of the following sizes; all to PN10				
J911.1	40 mm ND	nr	0		
J911.2	50 mm ND	nr	0		
J911.3	80 mm ND	nr	1	2,209,000	2,209,000

J911.4	100 mm ND	nr	1	2,858,000	2,858,000
	PIPEWORK-MANHOLES AND PIPEWORK ANCILLARIES				
	Other Chambers				
	In-situ Concrete Chambers				
	Concrete washout outfall structure, complete, as specified in drawings, and of the following depths				
K231	Depth not exceeding 1.5m	nr	3	1,000,000	3,000,000
	Pre-cast Concrete Chambers				
	Concrete air valve chamber, complete as specified in the drawings, and of the following depths				
K251.1	Depth not exceeding 1.5m	nr	3	750,000	2,250,000
	Valve Surface Boxes				
	Valve surface box for DN 50 - 100 valves, with lockable cover securely attached to main body of surface box by chain or bolt, include down pipe, complete as specified and to the following depths				
K251.2	Depth not exceeding 1.5m	nr	3	500,000	1,500,000
				Carried to Collection	**18,491,795**
	Crossings				

	Open Channels				
	Stone pitched or concrete lined open channel crossings for pipes of the following sizes				
K681	Not exceeding 300 mm ND	nr	2	45,000	90,000
	Unlined open channel crossings for pipes of the following sizes				
K682	Not exceeding 300 mm ND	nr	2	28,000	56,000
	Reinstatement				
	Roads				
	Breaking up, temporary and permanent reinstatement of tarmac roads for the following pipe sizes (Inclusive of processing the necessary approvals from the relevant authorities)				
K731.1	Diameter not exceeding 300 mm ND	m	0.0		
	Breaking up, temporary and permanent reinstatement of gravel roads for the following pipe sizes (Inclusive of processing the necessary approvals from the relevant authorities)				
K731.2	Diameter not exceeding 300 mm ND	m	60	30,000	1,800,000
	Other Pipework Ancillaries				
	Marker Posts				
K820.1	Marker posts for gate valves	nr	3	40,000	120,000
K820.2	Marker posts for air valves	nr	3	40,000	120,000
K820.3	Marker posts for wash outs	nr	3	40,000	120,000

K820.4	Marker posts for pipes	nr	2	40,000	80,000
	PIPEWORK-SUPPORTS AND PROTECTION, ANCILLARIES TO LAYING AND EXCAVATION				
	Extras to Excavation and Backfilling				
	In Pipe Trenches				
	Extras to excavation in pipe trenches in the following materials				
L111	In rock	m^3	6.0	120,000	720,000
	Concrete Stools and Thrust Blocks				
	Thrust Blocks				
	Mass concrete grade C15 thrust blocks for pipes and fittings, volume 0.2-0.5 m^3, for the following pipe sizes				
L731	Diameter not exceeding 300 mm ND	nr	9	240,000	2,160,000
				Carried to Collection	**5,266,000**
	Surrounds				
	Pipe surrounds of selected excavated granular material, for the following pipe sizes				
L521	Diameter not exceeding 200 mm ND	m	5,250	3,000	15,750,000
	Pipe surrounds of imported granular material, for the following pipe sizes				
L531	Diameter not exceeding 200 mm ND	m	450	6,000	2,700,000
	Pipe surrounds of mass concrete, and for the following pipe sizes				

L541	Diameter not exceeding 200 mm ND	m	300	15,000	4,500,000
	Public Stand Posts				
	Construct a double faucet Stand Post complete as in drawing including all earthwork, building work, concrete works, plumbing, drains and soak pit, all relevant fitings; galvanized iron pipe and fittings, brass stop cock, lockable steel meter protection box, taps and domestic water meter, raising meter above ground, GI/HDPE connection, all to PN 10 (service line measured separately under items I712)				
L999.1	ND 20 mm (3/4")	nr	4	908,000	3,632,000
				Carried to Collection	**26,582,000**
	COLLECTION				
	Collection, Page BOR W-5/1				46,382,850
	Collection, Page BOR W-5/2				3,387,375
	Collection, Page BOR W-5/3				18,491,795
	Collection, Page BOR W-5/4				5,266,000
	Collection, Page BOR W-5/5				26,582,000
				Carried to Summary	**100,110,020**

DESCRIPTION: ELECTROMECHANICAL EQUIPMENT

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				UShs	UShs
	Supply and Deliver items to installation destination				
	Solar Mounting Frame				

1.1	Solar Array mounting frame made from galvanised-rust free/ resistant steel metal supported by galvanized steel pipes/ angle sections onto reinforced concrete base supplied and constructed to specifications. Special bolts and nuts with Allen-keys shall be supplied for fastening modules, enhanced for theft-proof or spot welded as required by specifications and to the satisfaction of the Engineer	sum	1	15,000,000	15,000,000
					-
	Solar Modules				-
1.2	Solar Modules-260Wp, 30.9Vmpp, 8.09Ampp module configured using 650VDC system voltage, Mono/polycrystalline, 25 years warranty, with serial number and MWE-label embedded within encapsulation, with anodized aluminum frame; supplied and installed to specifications	no	63	750,000	47,250,000
					-
	Pump Controller				-
1.3	11kW Pump controller (with induction motors) with pure sinewave output at 98% efficiency at full-load, PWM-UPFC, 3-phase, 0.95pf , 500-7000VDC, output voltage 380-400-415VAC-variable speed drive with MPPT technology, 50Hz (Variable speed, +5hz selectable speed increase), with surge protection, overload, underload, IP65 casing, pump dry-run and full-tank shutoff protection supplied and installed to specifictions	no	1	10,000,000	10,000,000
					-
	Water Pump				-

1.4	7.5kW water pump (yield=12m3/hr, head=125m), water pump, multistage centrifugal submersible, 3-phase Induction motor, 380-400-415V, 50Hz variable speed motor, 0.77pf at rated current, with capacity to deliver 12m3/hr at 125m total pumping head (thread/flange connection type) stainless steel casing, supplied and installed with all accessories inclusive of dry-run protection accessories to specifications	no	1	18,000,000	18,000,000
					-
	Minature Circuit Breaker				-
1.5	PV-Disconnect Switch/ Miniature Circuit breaker with total capacity of 10A, 700VDC, to be installed at the terminating junction box of each panel, supplied and installed to specifications for Dohwe Central site.	no	3	2,500,000	7,500,000
					-
	Changeover Switch				-
1.6	Change-over switch rated 10kW 3-phase (TPN) 415V, manually operated and to be used for hybrid switching operation of Solar-PV system with Diesel generator system supplied to specifications	no	1	1,000,000	1,000,000
					-
	Cabling				-
1.7	Assortment set of electrical cables, interconnects and accessories for complete system wiring, including where necessary, underground cables, wired in full-conduit technique; supplied and installed to specifications in chemical house.	no	1	500,000	500,000
					-
	System Grounding				-

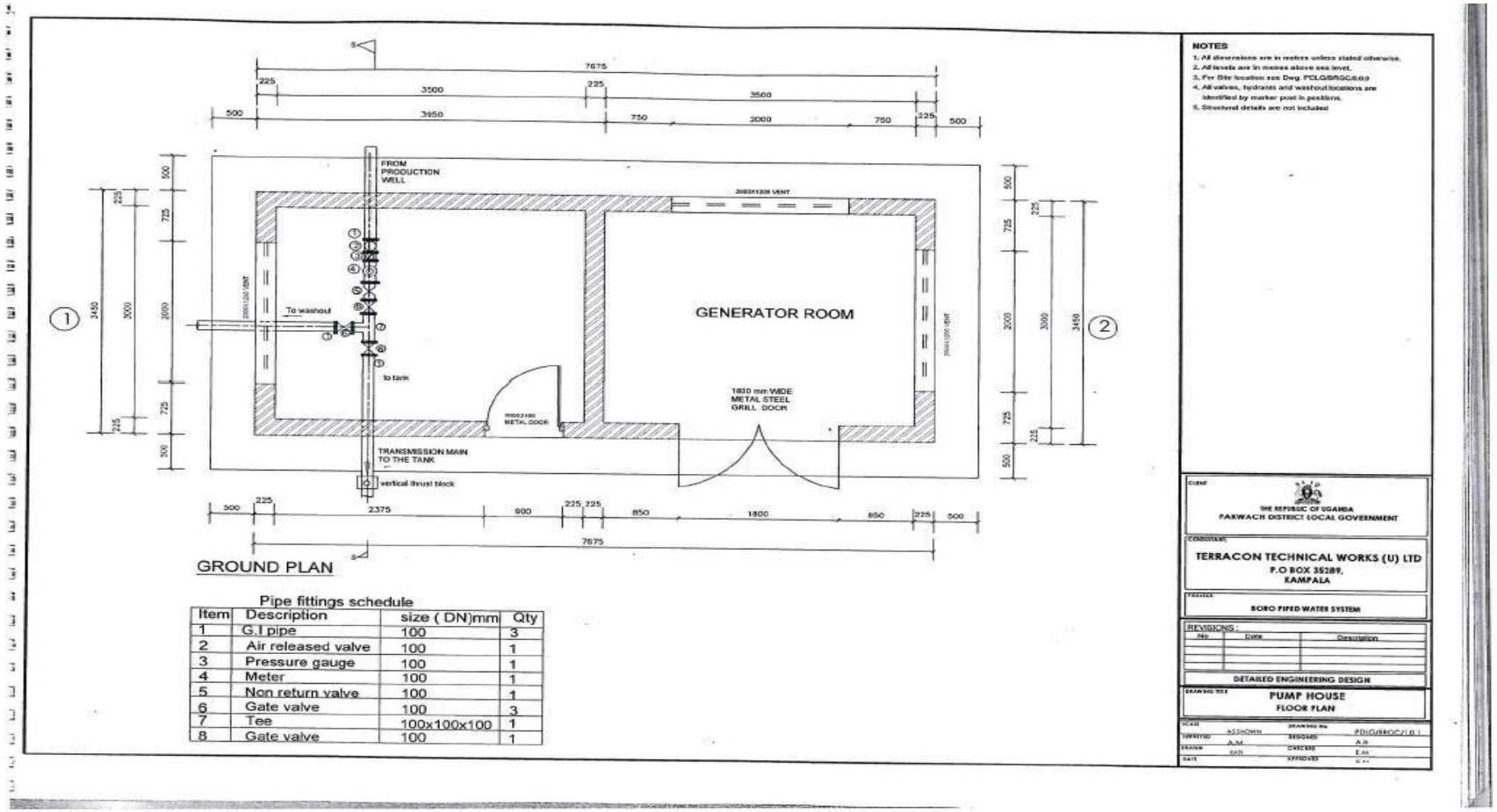
1.8	System grounding with equi-potential bonding to earth impedence lower than 5ohms; for all conducting parts within the installation including the inverter, array mounting frame, metal cabinets, and metal pipes supplied and installed to specifications	no	1	3,000,000	3,000,000
					-
1.9	**Earthing and Lightning Protection**				-
					-
1.91	Copper tape of hard drawn high conductivity copper 3mm x 25mm cross section for horizontal and down conductors complete with fixing clips and all accessories as by FURSE or equal.	M	30		-
					-
1.9.2	Air terminals 20x3500mm complete with tape adapters, spikes and all accessories by FURSE or equal.	No.	2		-
					-
1.9.3	Test clamp complete as by FURSE or equal.	No.	2		-
					-
1.9.4	Earth Electrodes 20x3000mm made from hard drawn copper or copper weld complete with cap, earth clamp, manhole and all accessories as made by FURSE or equal.	No.	2		-
					-
1.9.5	General Earthing by 50mm^2 stranded bare copper cable complete with all accessories.	M	40		-

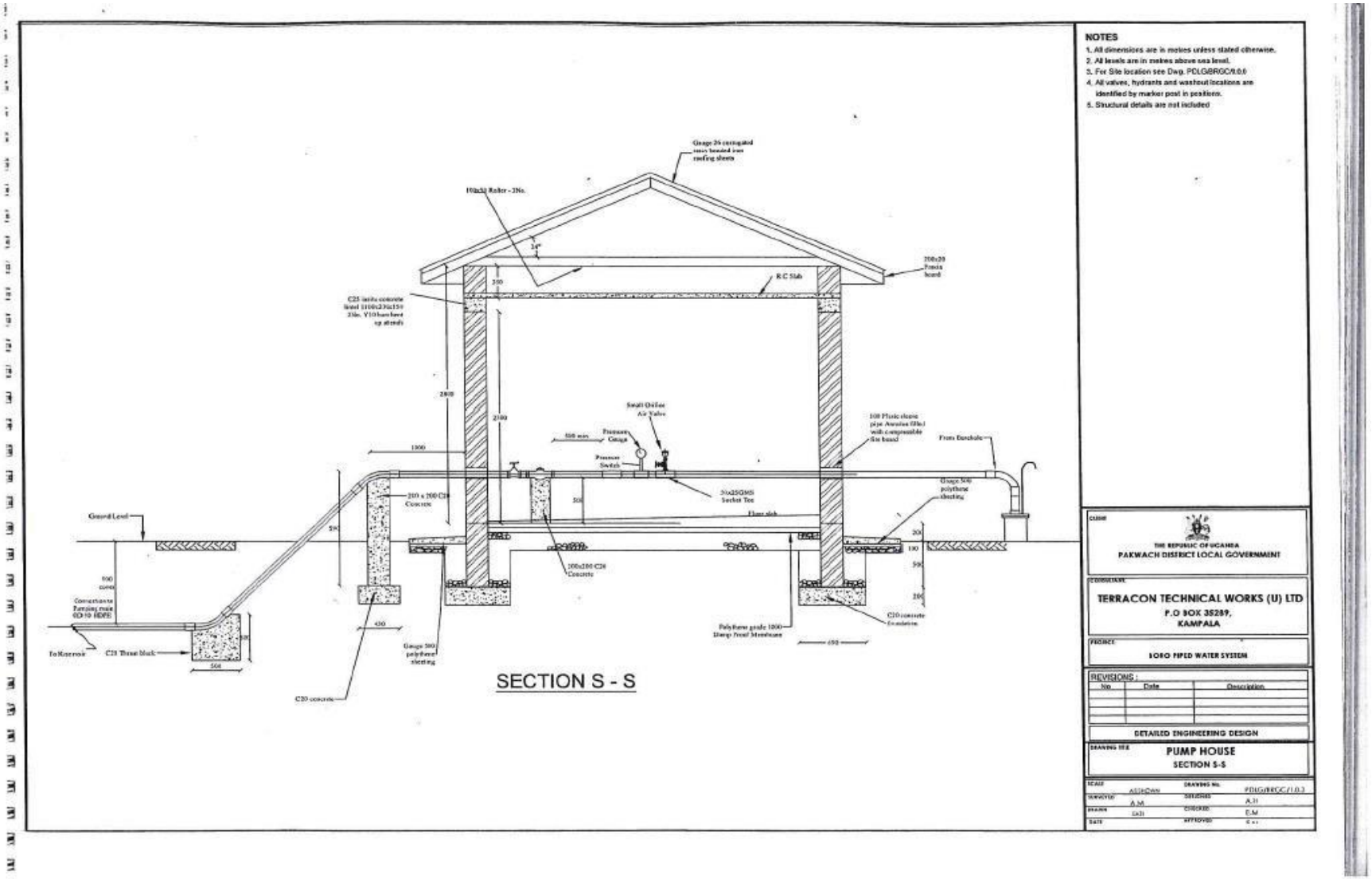
					-
	Alarm System				-
1.10	Alarm system set with siren for intrusion and safety protection of solar modules, where intrusion detection is based on mechanical vibrations/ tampering of the solar array structure, wired and integrated within the installation; complete with all accessories;	LS	0	-	-
					-
1.11	Spare parts for repairs and replacement parts (Circuit breakers, CFL lamps, fuses, blocking diodes for modules) including 4pcs of spare modules	LS	1	1,200,000	1,200,000
					-
	Auxilliary Lighting System				-
1.12	Auxillary solar-PV lighting system set featuring a 2x275Wp solar module, 1250Watt inverter, module mounting, 30A Regulator, 2x200Ah Battery, 7-11W/240VAC CFL Lamps, with switches, sockets, and lamp holders complete supplied and installed to specifications 3.6 in powerhouse, guard /attendant house and chemical house and other areas necessary within the scheme.	LS	1	7,000,000	7,000,000
					-
1.13	construction of pump house and guard house	sum	0	-	-
					-

1.14	production of O&M manuals, operator's hand book shall be printed in full colour and well bound booklet and maintenance charts, record keeping books, and facility data- plate well laminated framed and hang on the wall inside the pump house	site	2	1,200,000	2,400,000
					-
1.15	Equipment &Tool set to be used by scheme operator (Digital multimeter -rating 1000V, set of screw drivers, cable cutter, pliers, Hummer, set of Allen keys, insulating tape- 5pcs etc.)	LS	1	950,000	950,000
					-
				Carried to Collection	**113,800,000**

Annex 5: As Built Drawings

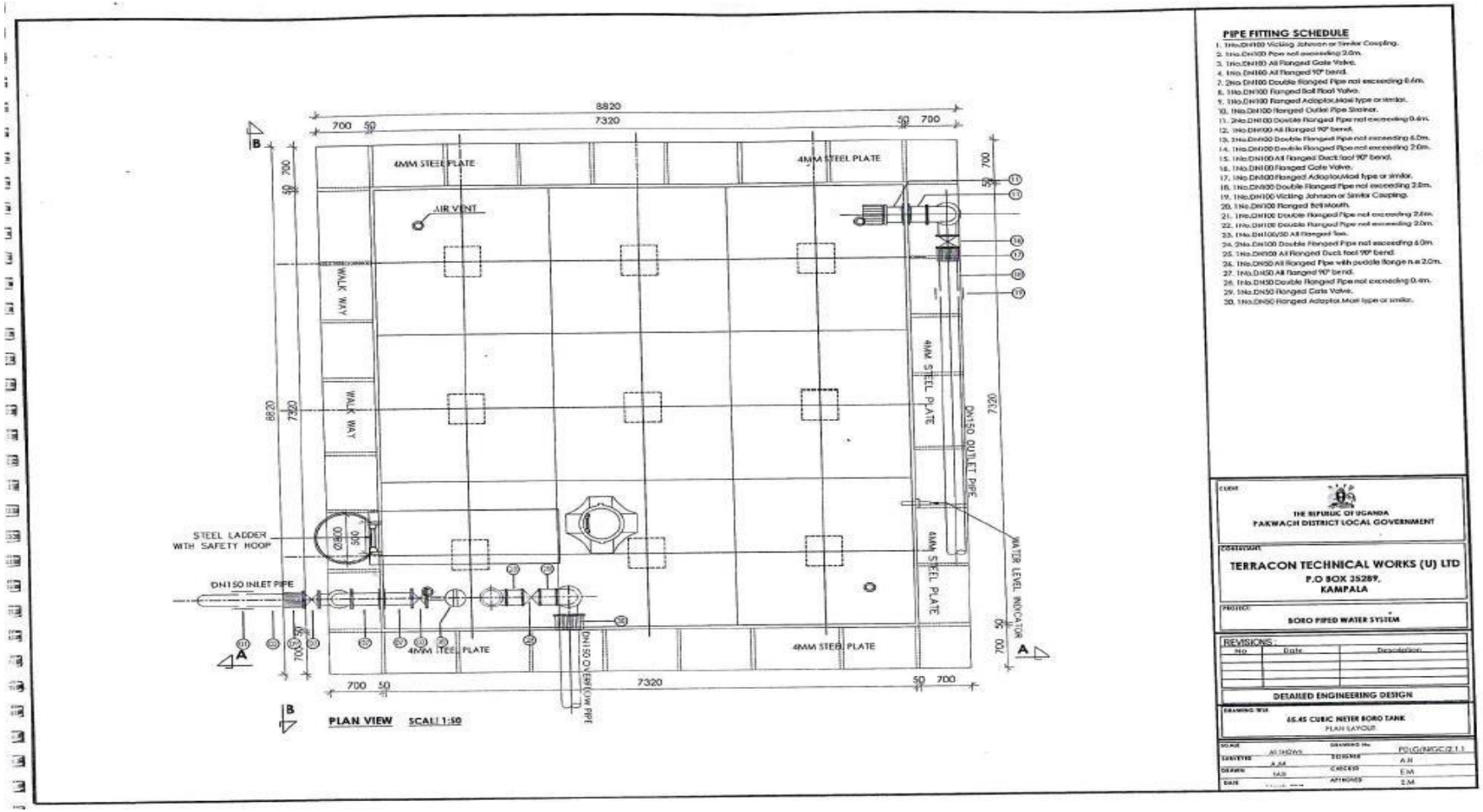
THE PUMP / POWER HOUSE

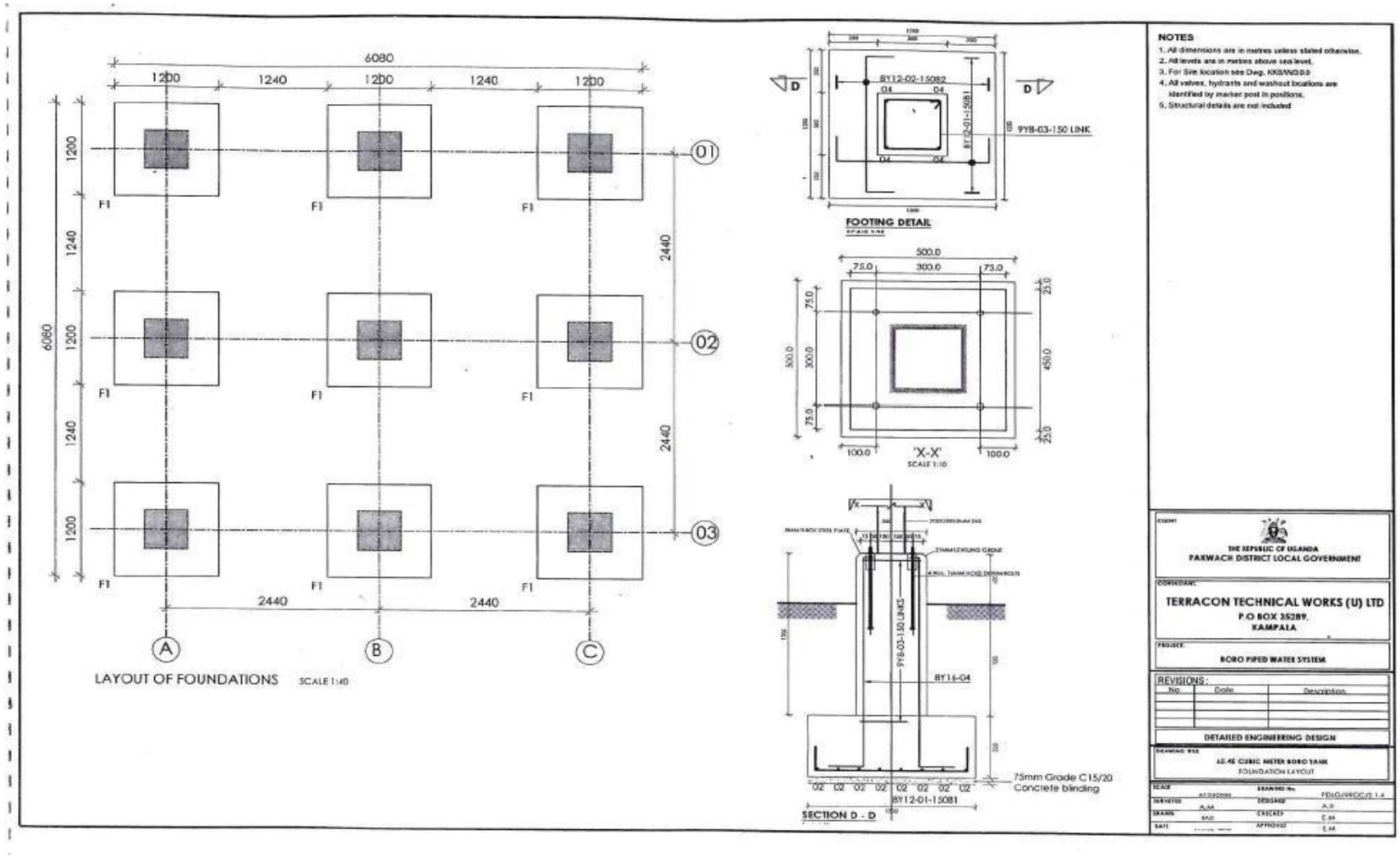


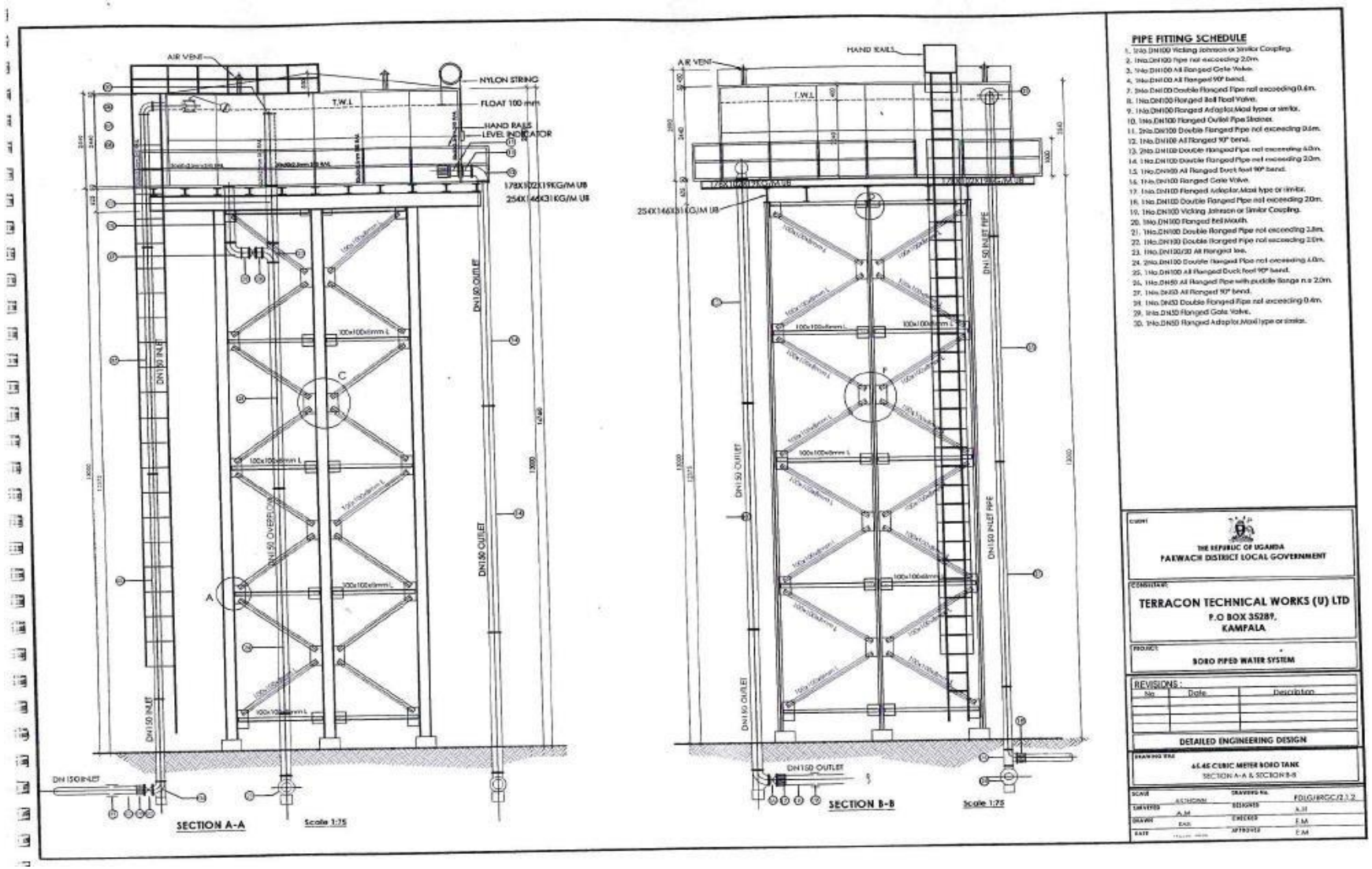

NOTES
1. All dimensions are in metres unless stated otherwise.
2. All levels are in metres above sea level.
3. For Site location see Dwg. PDLG/BRGC/0.0.0
4. All valves, hydrants and washout locations are identified by marker post in positions.
5. Structural details are not included
Gauge 26 corrugated roofing sheets
R.C Slab
Ground Level
Flow slab
C20 concrete
SECTION S - S
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
DETAILED ENGINEERING DESIGN
PUMP HOUSE
SECTION S-S
PDLG/BRGC/1.0.3

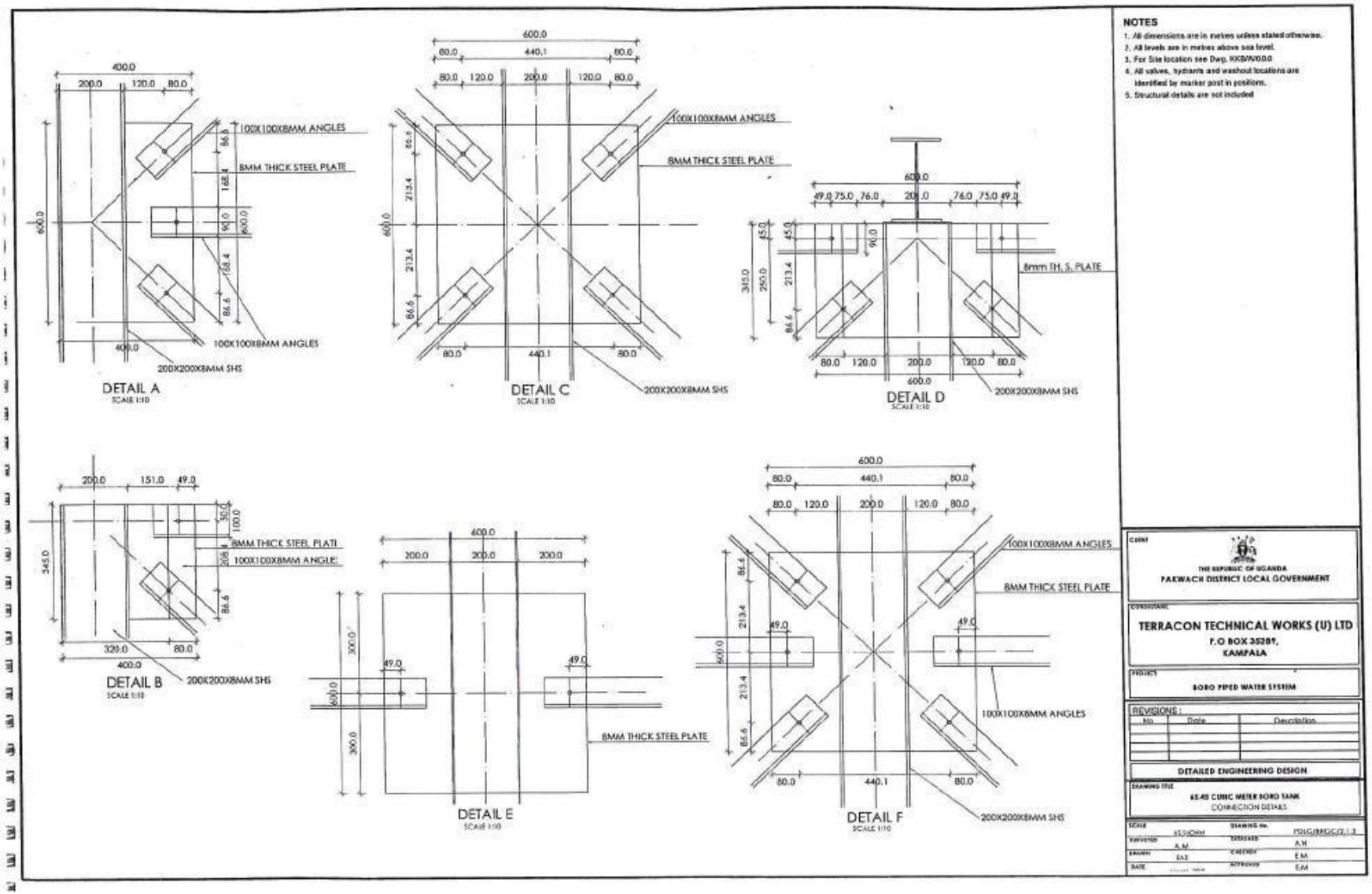

REAR ELEVATION
SIDE ELEVATION 1
FRONT ELEVATION
SIDE ELEVATION 2
NOTES
1. All dimensions are in metres unless stated otherwise.
2. All levels are in metres above sea level.
3. For Site location see Dwg. PDLG/BRGC/0.0.0
4. All valves, hydrants and washout locations are identified by marker post in positions.
5. Structural details are not included
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35287,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
PUMP HOUSE
ELEVATIONS
PDLG/BRGC/1.0.2
A.M
E.A.I
E.M

THE RESERVOIR

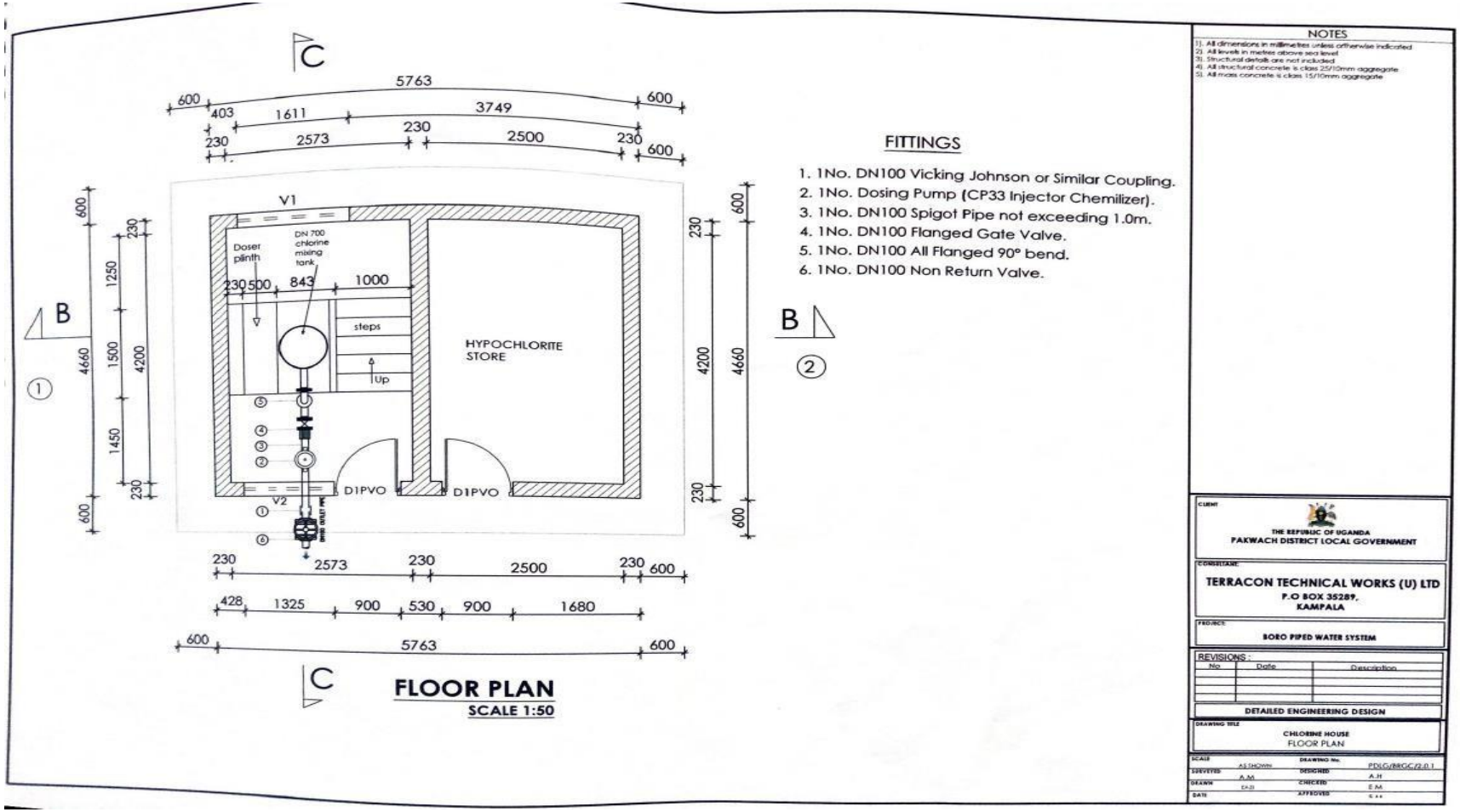


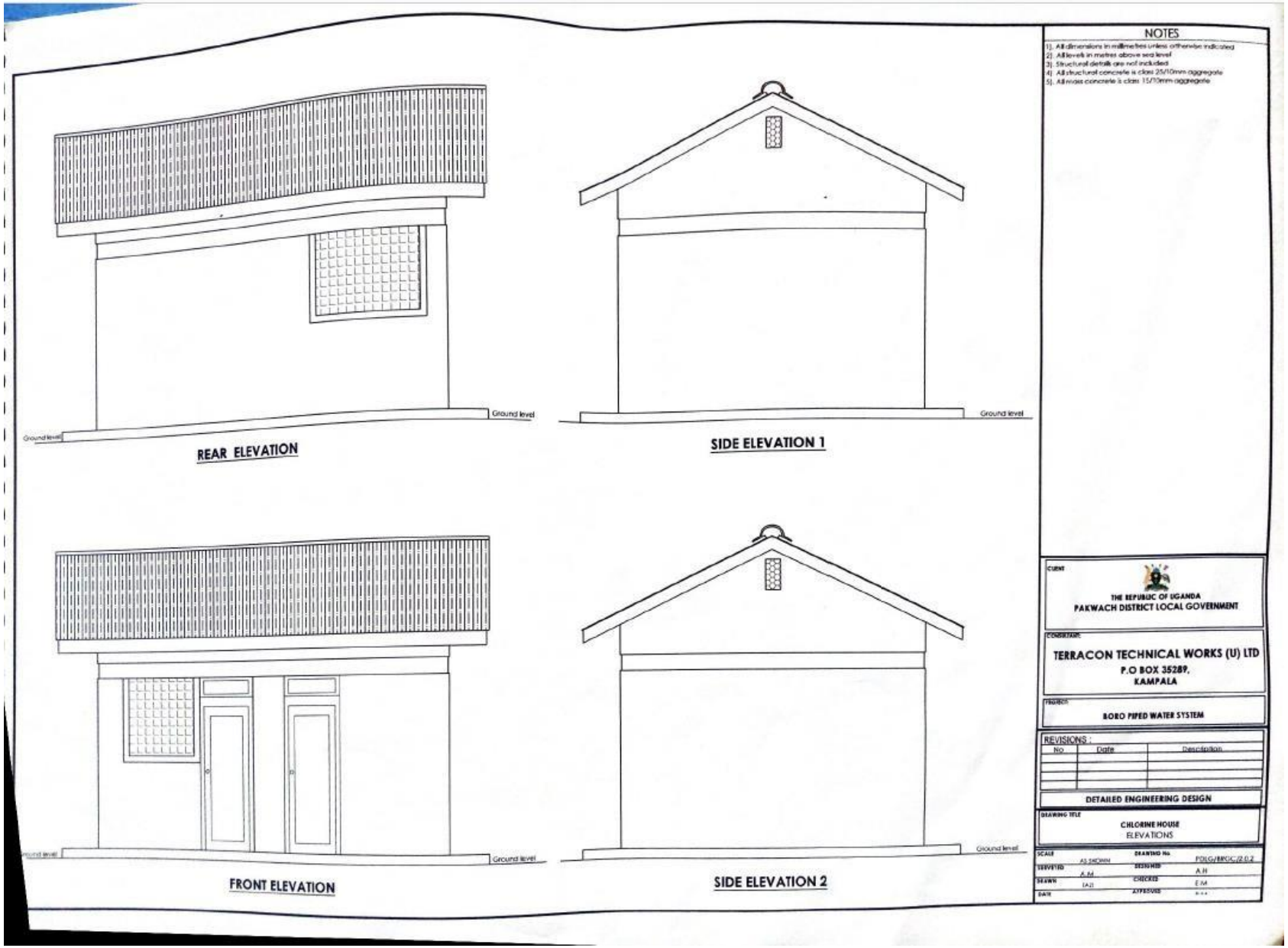

6080
1200
1240
1200
1240
1200
2440
2440
2440
01
02
03
A
B
C
F1
LAYOUT OF FOUNDATIONS
SCALE 1:40
FOOTING DETAIL
9Y8-03-150 LINK
500.0
75.0
300.0
75.0
'X-X'
SCALE 1:10
SECTION D - D
75mm Grade C15/20
Concrete blinding
NOTES
1. All dimensions are in metres unless stated otherwise.
2. All levels are in metres above sea level.
3. For Site location see Dwg. KKB/WD/0.0
4. All valves, hydrants and washout locations are identified by marker post in positions.
5. Structural details are not included
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS:
DETAILED ENGINEERING DESIGN
45.45 CUBIC METER BORO TANK
FOUNDATION LAYOUT

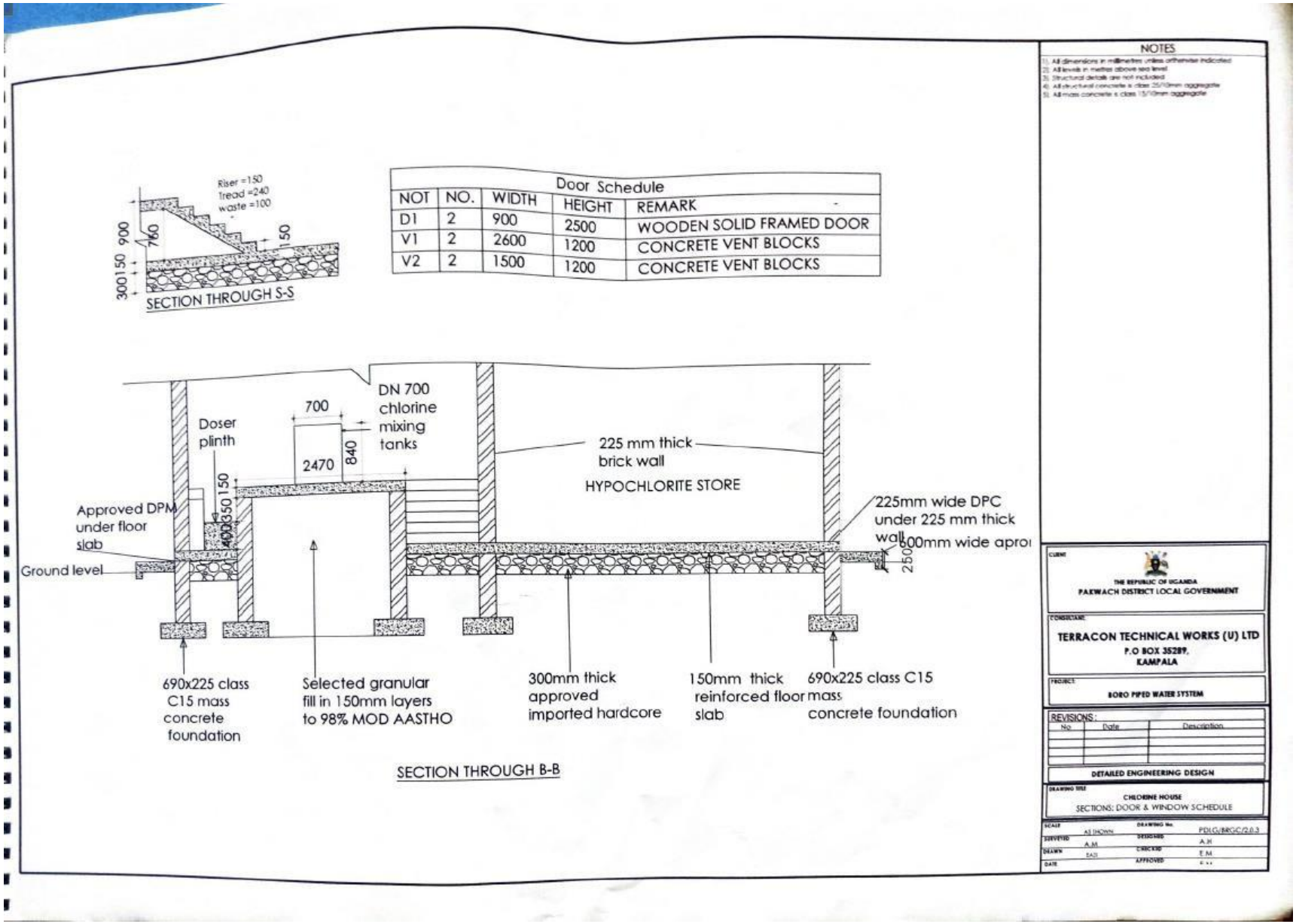

AIR VENT
NYLON STRING
FLOAT 100 mm
T.W.L
HAND RAILS
LEVEL INDICATOR
178X102X19KG/M UB
254X146X31KG/M UB
DN150 OUTLET
DN150 INLET
DN150 OVERFLOW
DN150 INLET
SECTION A-A
Scale 1:75
HAND RAILS
AIR VENT
T.W.L
DN150 INLET PIPE
DN150 OUTLET
DN150 OUTLET
SECTION B-B
Scale 1:75
PIPE FITTING SCHEDULE
1. 1No.DN100 Viclaing Johnson or Similar Coupling.
2. 1No.DN100 Pipe not exceeding 2.0m.
3. 1No.DN100 All Flanged Gate Valve.
4. 1No.DN100 All Flanged 90° bend.
7. 2No.DN100 Double Flanged Pipe not exceeding 0.6m.
8. 1No.DN100 Flanged Ball Float Valve.
9. 1No.DN100 Flanged Adaptor,Mosi type or similar.
10. 1No.DN100 Flanged Outlet Pipe Strainer.
11. 2No.DN100 Double Flanged Pipe not exceeding 0.6m.
12. 1No.DN100 All Flanged 90° bend.
13. 2No.DN100 Double Flanged Pipe not exceeding 4.0m.
14. 1No.DN100 Double Flanged Pipe not exceeding 2.0m.
15. 1No.DN100 All Flanged Duck foot 90° bend.
16. 1No.DN100 Flanged Gate Valve.
17. 1No.DN100 Flanged Adaptor,Mosi type or similar.
18. 1No.DN100 Double Flanged Pipe not exceeding 20m.
19. 1No.DN100 Viclaing Johnson or Similar Coupling.
20. 1No.DN100 Flanged Bell Mouth.
21. 1No.DN100 Double Flanged Pipe not exceeding 3.8m.
22. 1No.DN100 Double Flanged Pipe not exceeding 2.0m.
23. 1No.DN100/50 All Flanged tee.
24. 2No.DN100 Double Flanged Pipe not exceeding 4.0m.
25. 1No.DN100 All Flanged Duck foot 90° bend.
26. 1No.DN50 All Flanged Pipe with puddle flange n.o 2.0m.
27. 1No.DN50 All Flanged 90° bend.
28. 1No.DN50 Double Flanged Pipe not exceeding 0.6m.
29. 1No.DN50 Flanged Gate Valve.
30. 1No.DN50 Flanged Adaptor,Mosi type or similar.
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
45.45 CUBIC METER BORO TANK
SECTION A-A & SECTION B-B
SCALE
DRAWING No.
FDLG/BRGC/2.1.2
DESIGNED
A.H
DRAWN
CHECKED
F.M
DATE
APPROVED
F.M

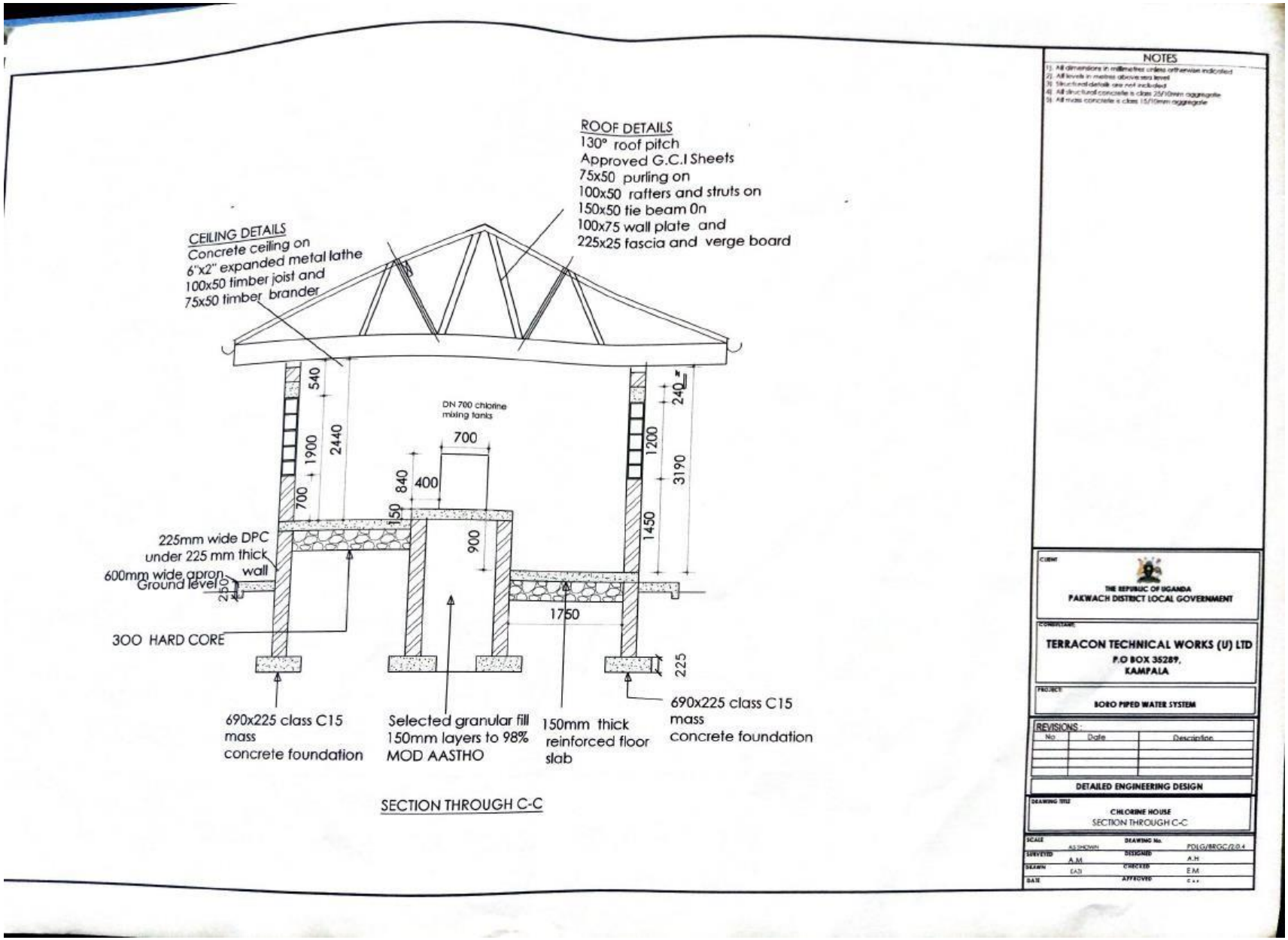

NOTES
1. All dimensions are in metres unless stated otherwise.
2. All levels are in metres above sea level.
3. For Site location see Dwg. KKB/W/00.0
4. All valves, hydrants and washout locations are identified by marker post in positions.
5. Structural details are not included
DETAIL A
SCALE 1:10
100X100X8MM ANGLES
8MM THICK STEEL PLATE
200X200X8MM SHS
DETAIL C
SCALE 1:10
DETAIL D
SCALE 1:10
8mm TH. S. PLATE
DETAIL B
SCALE 1:10
DETAIL E
SCALE 1:10
DETAIL F
SCALE 1:10
CLIENT
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
CONSULTANT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35281,
KAMPALA
PROJECT
BORO PIPED WATER SYSTEM
REVISIONS :
No.
Date
Description
DETAILED ENGINEERING DESIGN
DRAWING TITLE
65.45 CUBIC METER BORO TANK
CONNECTION DETAILS
SCALE
AS SHOWN
DRAWING No.
PSHG/BPGCC/2/13
SURVEYED
A.N
DESIGNED
A.H
DRAWN
EAE
CHECKED
E.M
DATE
APPROVED
E.M

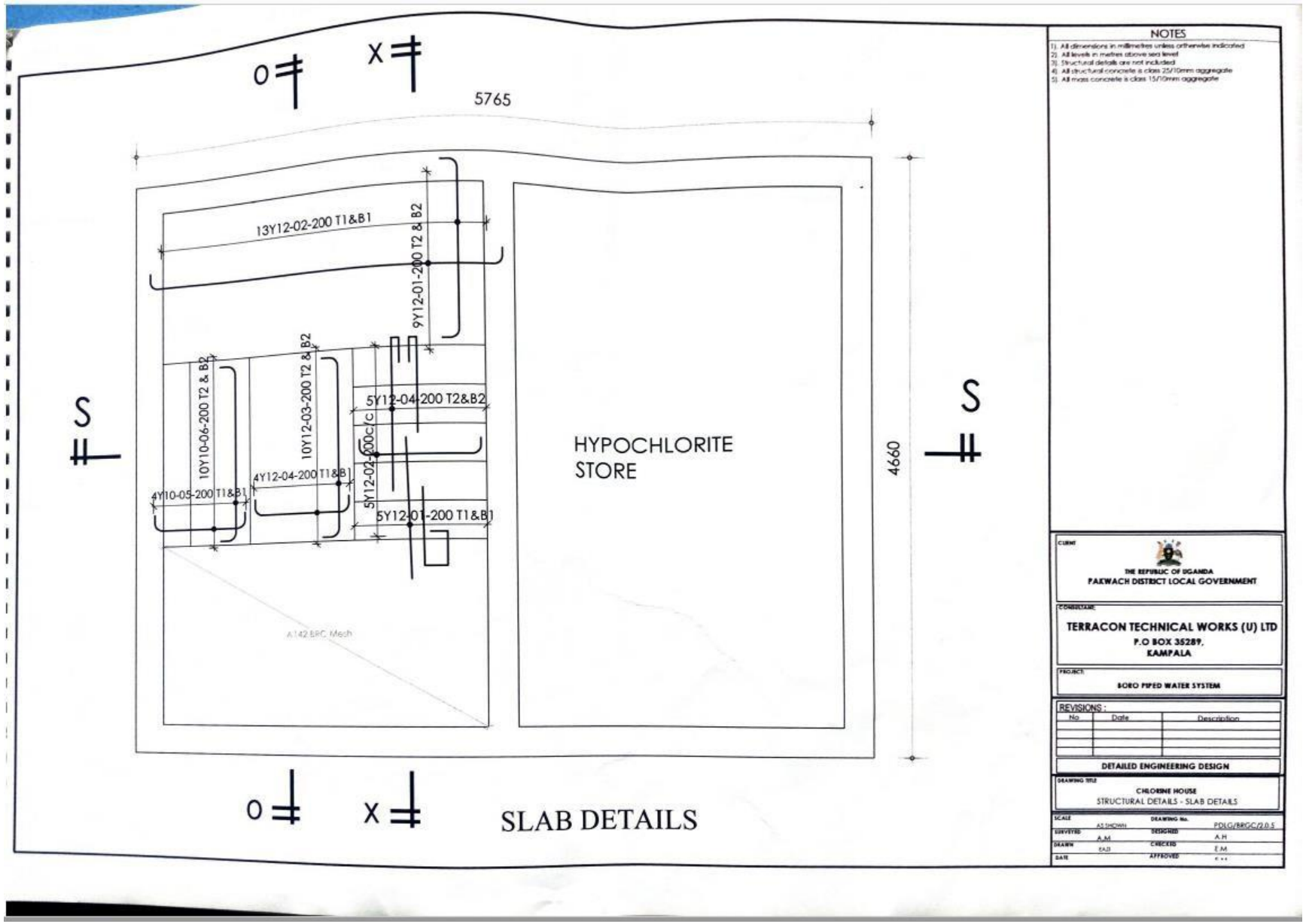
CHEMICAL/TREATMENT HOUSE

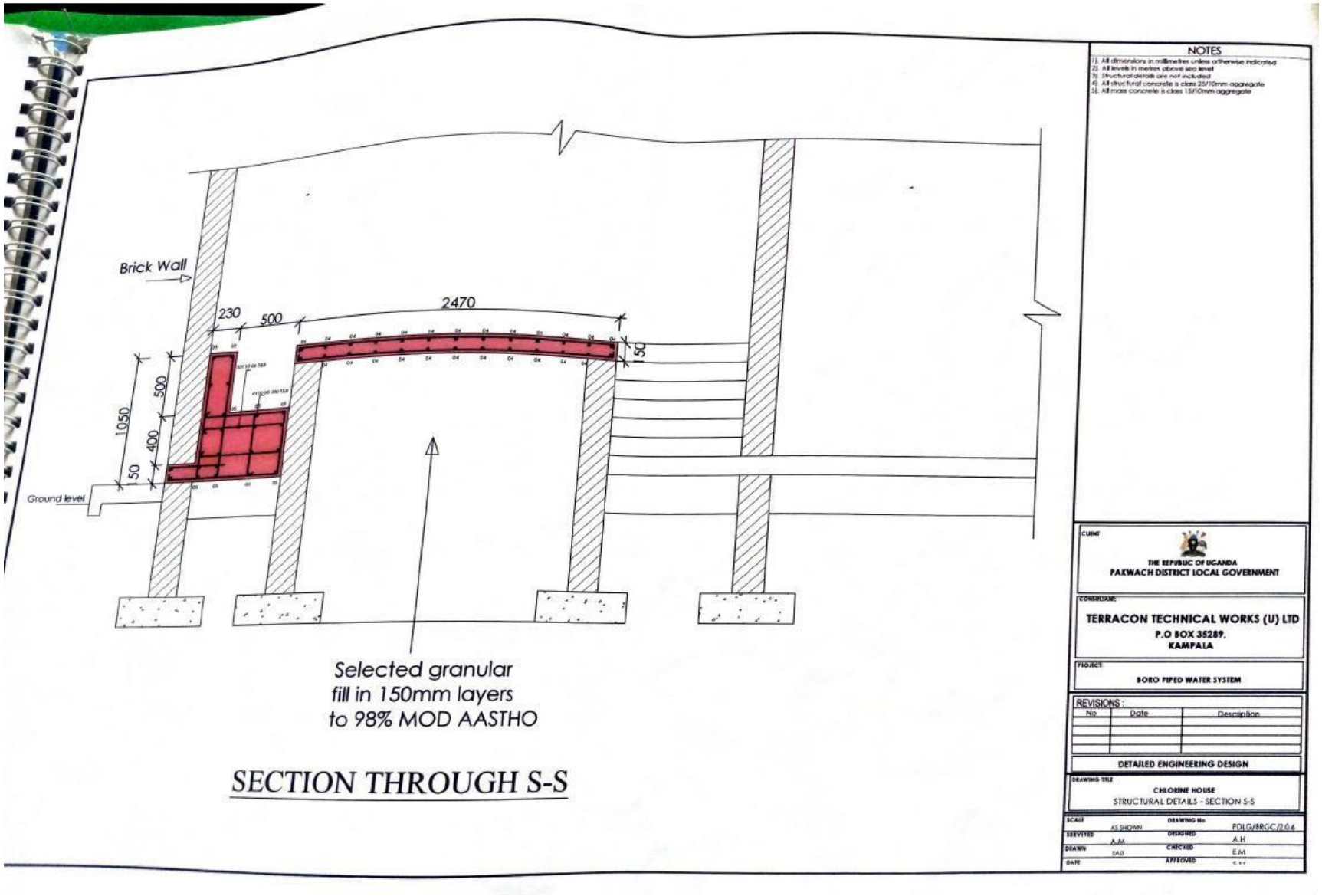


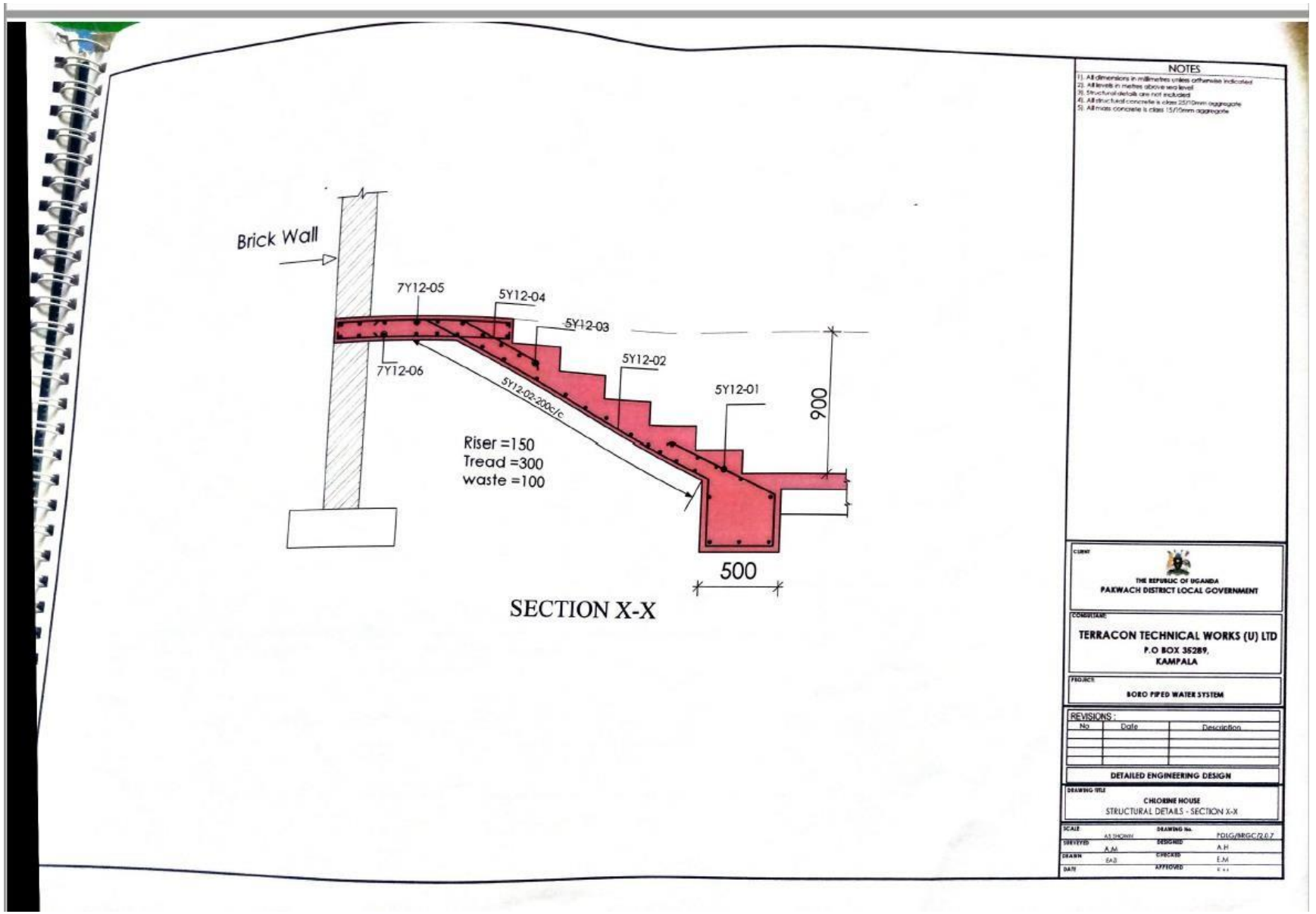

NOTES
1). All dimensions in millimetres unless otherwise indicated
2). All levels in metres above sea level
3). Structural details are not included
4). All structural concrete is class 25/10mm aggregate
5). All mass concrete is class 15/10mm aggregate
REAR ELEVATION
SIDE ELEVATION 1
FRONT ELEVATION
SIDE ELEVATION 2
Ground level
CLIENT
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
CONSULTANT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
PROJECT
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
DRAWING TITLE
CHLORINE HOUSE
ELEVATIONS
SCALE
AS SHOWN
DRAWING No.
PDLG/BWSC/2.0.2
SURVEYED
A.M
DESIGNED
A.H
DRAWN
A.O
CHECKED
E.M
DATE
APPROVED


Riser =150
Tread =240
waste =100
900
760
50
300
150
SECTION THROUGH S-S
Door Schedule
NOT | NO. | WIDTH | HEIGHT | REMARK
D1 | 2 | 900 | 2500 | WOODEN SOLID FRAMED DOOR
V1 | 2 | 2600 | 1200 | CONCRETE VENT BLOCKS
V2 | 2 | 1500 | 1200 | CONCRETE VENT BLOCKS
DN 700 chlorine mixing tanks
700
840
2470
Doser plinth
150
350
400
225 mm thick brick wall
HYPOCHLORITE STORE
Approved DPM under floor slab
Ground level
225mm wide DPC under 225 mm thick wall
250
690x225 class C15 mass concrete foundation
Selected granular fill in 150mm layers to 98% MOD AASTHO
300mm thick approved imported hardcore
150mm thick reinforced floor slab
690x225 class C15 mass concrete foundation
SECTION THROUGH B-B
NOTES
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS:
No | Date | Description
DETAILED ENGINEERING DESIGN
CHLORINE HOUSE
SECTIONS: DOOR & WINDOW SCHEDULE
AS SHOWN
A.M
A.H
E.M
PDLG/BRGC/2.0.3

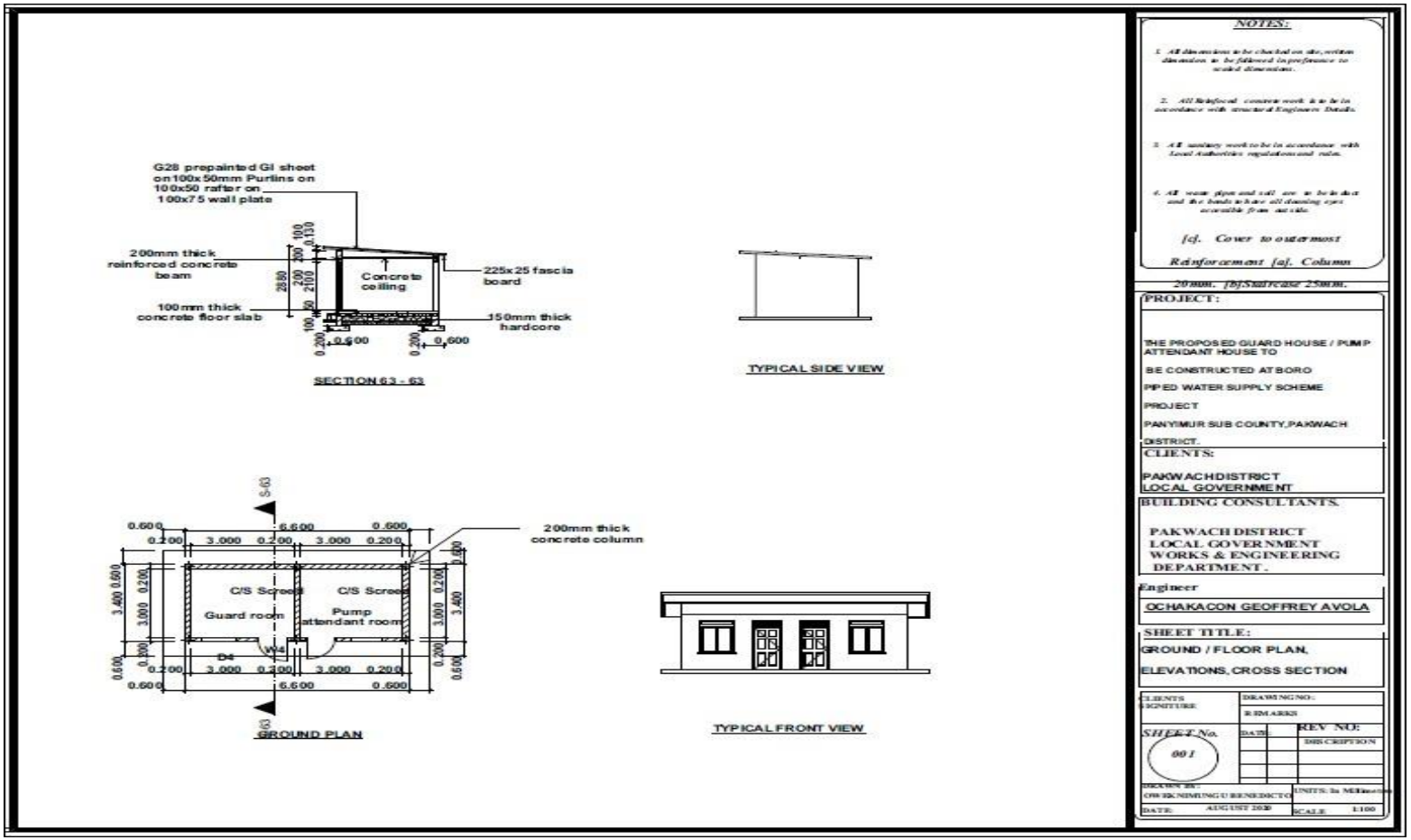

ROOF DETAILS
130° roof pitch
Approved G.C.I Sheets
75x50 purling on
100x50 rafters and struts on
150x50 tie beam On
100x75 wall plate and
225x25 fascia and verge board
CEILING DETAILS
Concrete ceiling on
6"x2" expanded metal lathe
100x50 timber joist and
75x50 timber brander
DN 700 chlorine mixing tanks
700
400
840
150
540
1900
2440
700
240
1200
3190
1450
900
225mm wide DPC
under 225 mm thick wall
600mm wide apron
Ground level
250
300 HARD CORE
1750
225
690x225 class C15 mass concrete foundation
Selected granular fill 150mm layers to 98% MOD AASTHO
150mm thick reinforced floor slab
690x225 class C15 mass concrete foundation
SECTION THROUGH C-C
NOTES
1). All dimensions in millimetres unless otherwise indicated
2). All levels in metres above sea level
3). Structural details are not included
4). All structural concrete is class 25/10mm aggregate
5). All mass concrete is class 15/10mm aggregate
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
CHLORINE HOUSE
SECTION THROUGH C-C
SCALE
AS SHOWN
DRAWING No.
PDLG/BRGC/2.0.4
SURVEYED
A.M.
DESIGNED
A.H
DRAWN
EA3
CHECKED
E.M.
DATE
APPROVED


NOTES
1). All dimensions in millimetres unless otherwise indicated
2). All levels in metres above sea level
3). Structural details are not included
4). All structural concrete is class 25/10mm aggregate
5). All mass concrete is class 15/10mm aggregate
5765
4660
13Y12-02-200 T1&B1
9Y12-01-200 T2 & B2
10Y10-06-200 T2 & B2
10Y12-03-200 T2 & B2
5Y12-04-200 T2&B2
5Y12-02-200c/c
4Y12-04-200 T1&B1
4Y10-05-200 T1&B1
5Y12-01-200 T1&B1
HYPOCHLORITE STORE
A142 BRC Mesh
S
S
0
X
0
X
SLAB DETAILS
CLIENT
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
CONSULTANT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
PROJECT
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
DRAWING TITLE
CHLORINE HOUSE
STRUCTURAL DETAILS - SLAB DETAILS
SCALE
AS SHOWN
DRAWING No.
PDLG/BRGC/2.0.5
SURVEYED
A.M
DESIGNED
A.H
DRAWN
BAD
CHECKED
E.M
DATE
APPROVED

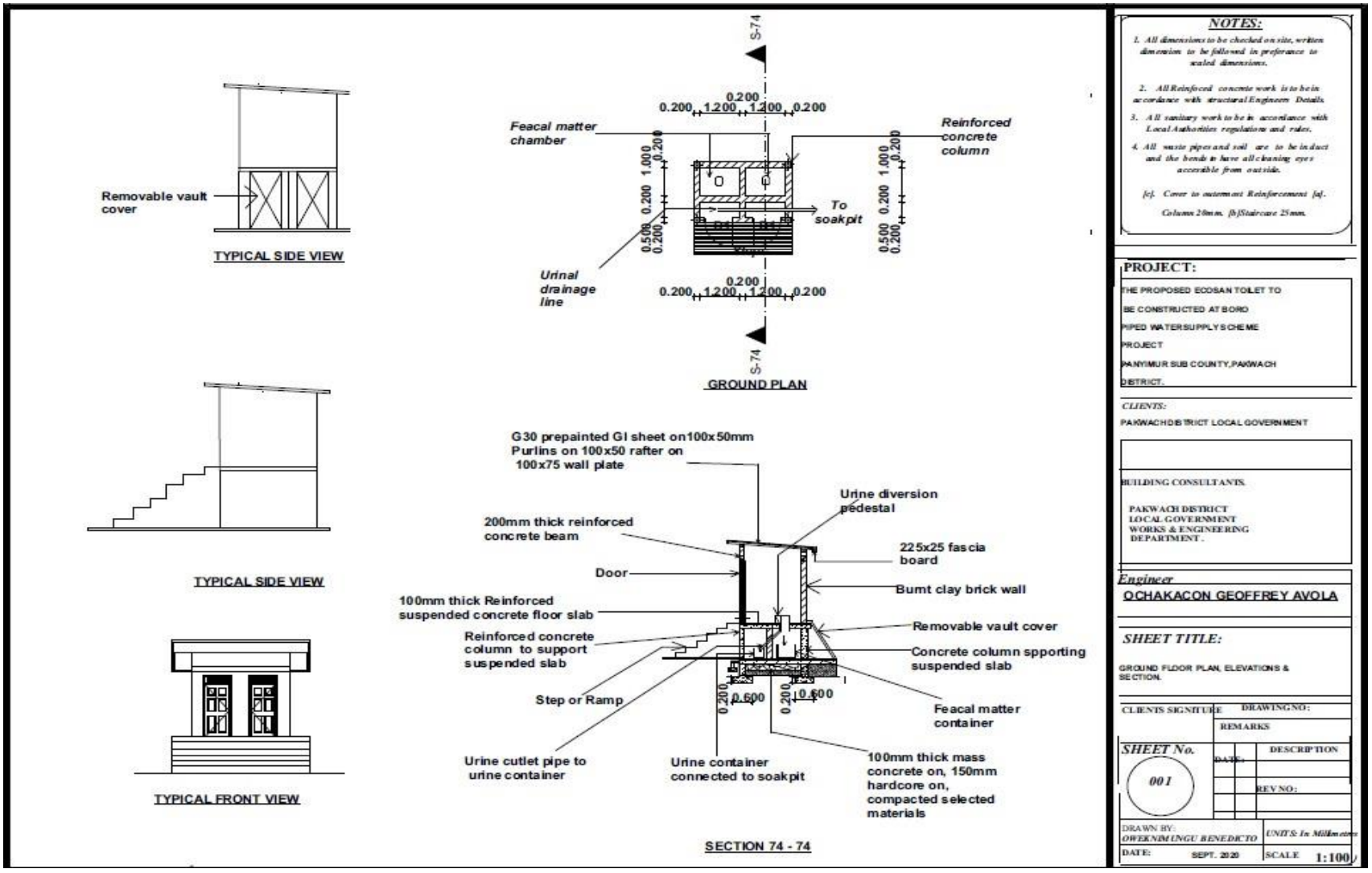

Brick Wall
230
500
2470
150
500
1050
400
150
Ground level
Selected granular
fill in 150mm layers
to 98% MOD AASTHO
SECTION THROUGH S-S
NOTES
1). All dimensions in millimetres unless otherwise indicated
2). All levels in metres above sea level
3). Structural details are not indicated
4). All structural concrete is class 25/10mm aggregate
5). All mass concrete is class 15/10mm aggregate
CLIENT
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
CONSULTANT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
PROJECT
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
DRAWING TITLE
CHLORINE HOUSE
STRUCTURAL DETAILS - SECTION S-S
SCALE
AS SHOWN
DRAWING No.
PDLG/BRGC/2.0.6
SURVEYED
A.M
DESIGNED
A.H
DRAWN
S.A.O
CHECKED
E.M
DATE
APPROVED


Brick Wall
7Y12-05
5Y12-04
5Y12-03
5Y12-02
5Y12-01
7Y12-06
5Y12-02-200c/c
Riser =150
Tread =300
waste =100
900
500
SECTION X-X
NOTES
1). All dimensions in millimetres unless otherwise indicated
2). All levels in metres above sea level
3). Structural details are not included
4). All structural concrete is class 25/10mm aggregate
5). All mass concrete is class 15/10mm aggregate
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
BORO PIPED WATER SYSTEM
REVISIONS :
No
Date
Description
DETAILED ENGINEERING DESIGN
CHLORINE HOUSE
STRUCTURAL DETAILS - SECTION X-X
AS SHOWN
PDLG/MRGC/2.0.7
A.M
A.H
6A2
E.M

THE PUMP ATTENDANT AND GUARD HOUSE



THE ECOSAN TOILET`



Annex 6: Minutes of site meetings.

MINUTE FOR THE FIRST SITE MEETING OF BORO PIPED WATER SUPPLY SYSTEM HELD ON 20th SEPTEMBER 2021 AT BORO CENTRAL VILLAGE.

AGENDA

1. Opening prayer.
2. Self-introduction.
3. Welcome remark from SAS -Panyimur sub county.
4. Project update information by DWO.
5. Site/Progress inspection.
6. Presentation of contractor's progress report.
7. Reaction to presentation of progress report.
8. Ways forward /resolutions.
9. Remark from the office of RDC.
10. Remark from office of LC5 and closure.

MEMBERS PRESENT IN THE MEETING

No	Name	Sex	Title	Contact
1.	Ocaya Milton	M	Site Engineer -Blair	0770904545
2.	Okot Steward	M	Director -Blair foundation ltd	O772523158
3.	Oweknimungu Benedicto	M	District Water Officer	0774871841
4.	Ochakachon Geoffrey Avola	M	District Engineer	0772198914
5.	Kimira Innocent	M	Assistant district Water Officer -Mobilization	0772633388

6.	Adunget Jacob	M	Deputy RDC	0780378361
7.	Otitgiu Babra	F	For: CAO	0777079346
8.	Acen Immaculate	F	For: CDO -Panyimur S/C	0782780789
9.	Muswa Maurice	M	SAS	0783753493
10.	Oweka Jeneffer	F	Environment Officer	0776460597
11.	Onyutha John	M	Senior procurement Officer	0772433749
12.	Manda Christine	F	For: C/person LC5	0775385838
13.	Alirach Wilfred	M	CFO	0772464463
14.	Awor Bernardette	F	DCDO	0777089444
15.	Okello Dickens	M	Site foremen- Blair	0783037468

MEMBERS ABSENT WITH APOLOGY;

1. Abyeto Stella – CAO Pakwach DLG.

MIN. No.	**ITEM**	**RESPONSIBILITY**
MIN.**1:** 1ST **Site Meeting** 20th	**Prayer** The meeting started at 11:15pm with opening prayer led by the the area women district councilor for Panyimur who called on God's spirit to descend & be amidst us so that	Mrs. Mandawun Christine

/September/2021	every discussion here would be for the development the district.	
MIN.2**:** 1ST **Site Meeting** 20th /September/2021	**Introduction** Self- introduction by each of the participants was successfully done.	All members
MIN.3**:** 1ST **Site Meeting** 20th /September/2021	**Project Information Update** The update was given by the District Water Officer -Oweknimungu Benedicto who pointed out the following vital information on the project. ➢ Name of project: Construction of Boro Piped Water Supply System. ➢ Initial Contract Sum: Ugx 715,982,315 ➢ Contract Ref No. ➢ Source of fund: District Water Supply & Sanitation Conditional Grant (DWSSCG) ➢ Client: Pakwach District Local Government ➢ Contractor: Blair Foundation Limited ➢ Supervisor: Pakwach District Local Government, Works Dep't. ➢ Designer: Techno Consult Ltd ➢ Project Manager: District Water Officer - Pakwach DLG ➢ Planned Initial coverage: 6 neighboring villages	-All members to note

	➢ Site hand over date: 13th/ August/2021. ➢ Duration: 4 months ➢ Intended completion date: 20th/September/2021. ➢ Defect Liability Period: 6 months	
MIN.4**:** 1ST **Site Meeting** 20 th /September/2021	**Welcome Remark from SAS / LC3 Panyimur.** ➢ The remark was made by SAS- Panyimur who in his speech, observed protocol, thanked the members present and said he was happy to meet to meet the contractor. ➢ Noted that work was already in good shape though within a short while.	
MIN.5**:** 1ST **Site Meeting** 20th /September/2021	**Site Inspection and findings** ➢ A member expressed concern about the strength of the Econsan toilet since in her view, the toilet looked taller. ➢ Another member expressed concern on the time of finishing the project. He pointed out that, remaining duration is only two and a half months but the quantity of work remaining was much, how will the contractor ensure they finish on time? ➢ Variation Concern: a member noted that variation realized in excavation and other works should be written first, taken to contract committee early enough to be paid in the same year.	➢ All members and contractor to note Contractor & Project manager to note.

MIN.6**:** 1ST **Site Meeting** 20th /September/2021	**Contractor's Progress report** The contractor quantified the work progress as follows: ➢ Power house at 80% ➢ Ecosan toilet at 90% ➢ Guard/pump attendant house at 90% ➢ Site fencing at 90% ➢ Compound work at 50% ➢ Reservoir supply and installation works at 40% with; • Steel plate was ready to be transported to site. • Excavation works finished • Steel framework (HS and I-beams) under design **Cause of delay** ➢ The contractor noted that the reservoir base work will have to undergo complete setting / hardening for 21 days. ➢ Reservoir material not readily available ➢ He therefore notified the house that these may call for extension of time. **Challenges**	All members to note

	➢ Lack of readily available reservoir tower material ➢ Loose soil – leading to deep excavation ➢ Material very far away -haulage difficulty and time consumption. **Opportunity** The contractor however noted the following opportunities that has sped up his work. ➢ Nearby water source ➢ Constant & Timely project supervision by the project management team.	

MIN.7**:** 1ST **Site Meeting** 20th /September/2021	**Reaction to Contractor's progress report.** ➢ Member started by acknowledging a good progress of the work and continued as follows.	Contractor to note.

	➢ Pointed that the contractor has not cover any of the environmental issues. ➢ She requested the contractor to share the Environmental and Social management plan for easy monitoring. ➢ Contractor should employ the local workers in a good percentage. ➢ Tasked the contractor to explain how they will manage and finish the project within the remaining time frame. ➢ Contractor to install up signage at the junction to the site to direct people to the site. ➢ Contractor to limit free entry and exit through the main gate. ➢ PPEs to be integrated for all workers and visitors. ➢ Addition of time will only be considered for unforeseen circumstances; this will not take care of delay due to construction constraints. ➢ Contractor to redraw his workplan and share with the project manager in 3-days time to give assurance of finishing work within the remaining timeframe. ➢ Contractor to deduct local service tax and submit to the sub county. ➢ Community members such as CDO, LC1 chairperson, elders and youths to be engaged in this type of meeting for them to own the project. ✓ **<u>Contractor's response</u>** • On local service tax: Contractor agreed to make consultation on local service	ADWO to note during mobilization. All members to note

	tax and pay later if found prudent. • On local content: Contractor noted that all materials except manufactured ones (reservoir materials) are being supplied by the locals. • On local's employment: Locals excavated foundation, did manual work during construction and cooking. • However; the contractor noted that the locals have challenge of abscondment/absenteeism from work without prior notice.	

MIN.8**:** 1ST **Site Meeting** 20th /September/2021	**Communication from LC5 Representative -Speaker** The speaker commented the followings: ➢ Was happy to welcome members once again in her area ➢ Was happy that NRM is fulfilling its manifesto of the SDG-6 (clean water supply) ➢ Noted that she learnt a lot from the meeting. ➢ She emphasized that the limited involvement of the locals is bad and should be dealt with. ➢ Commented that the reservoir area should be condoned off.	All members to note.

	➢ That the contractor should do a lot of work in the dry season so that the rainy season do not disturb them a lot. ➢ Lastly noted that work has taken shape and she was very proud of it.	
MIN.9**:** 1ST **Site Meeting** 20th /September/2021	**Communication from office of RDC – Assistant RDC.** The Assistant RDC commented the followings; ➢ Observed protocol and appreciated members ➢ Thanked the DWO for the guidance he gave through the meeting ➢ Conveyed greeting from the RDC who was on official duty in Maracha district. ➢ Reminded that vision 2030 is that all people in rural area should have clean water. And noted that in this project, value for money should be realized. ➢ Community engagement during work is key to avoid the ill move e.g theft that they may plan. ➢ Sustainability plan should be considered; e.g standby generator during rainy season, are people able to pay for the water? e.t.c ➢ Emphasized that contractor should take seriously the issues concerning environment. ➢ Next meeting scheduled for 20th October, 2021. ➢ The meeting was adjourned at 3:25pm.	

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Secretary Chairperson

MINUTE FOR THE SECOND SITE MEETING OF BORO PIPED WATER SUPPLY SYSTEM HELD ON 20TH OCTOBER 2021 AT SITE (BORO CENTRAL VILLAGE).

AGENDA

1. Opening prayer.
2. Self-introduction.
3. Project information update
4. Welcome remark from SAS -Panyimur sub county.
5. Site inspection report.
6. Presentation of contractor's progress report.
7. Reaction to contractor's report and way forward.
8. Adjournment

MEMBERS PRESENT IN THE MEETING.

No	Name	Sex	Title	Contact
16.	Ocaya Milton	M	Site Engineer -Blair	0770904545
17.	Okot Steward	M	Director -Blair foundation ltd	O772523158
18.	Oweknimungu Benedicto	M	District Water Officer	0774871841
19.	Okello Haruni	M	Borehole technician	0779686223
20.	Kerumbe Julius	M	For; District Engineer	0773892895
21.	Owoda Emmanuel	M	Planner	0774705302

22.	Rupiny Ronald	M	Education officer	0772677006
23.	Olwor Patrick	M	SCDO	0773075332
24.	Jakweyo Emmy	M	For; DIA	0782482434
25.	Oweka Jenifer	F	Environment Officer	0776460597
26.	Okaro Herbert	M	For CAO	0786349797
27.	Olwor Patrick	M	SCDO	0773075332
28.	Manda Christine	F	For: C/person LC5	0775385838
29.	Hon. JB Okumu Odongkara	M	District Councillor	0772383716
30.	Fuathum Judith Kigezi	F	District Health Inspector	0777449197
31.	Ongiertho Anthony	M	For; SAS Panyimur	0776162949
32.	Oryem Richard	M	District Planner	0774248599
33.	Jakisa Kenedy	M	Driver	0782810741

MEMBERS ABSENT WITH APOLOGY;

1. Abyeto Stella – CAO Pakwach DLG.

MIN. No.	ITEM	RESPONSIBILITY
MIN.**1:** 2nd **Site Meeting** 20th /October/2021	**Prayer** The meeting started at 11:30pm with opening prayer led by the the assistant district water officer -mobilization who called on God's guidance through the discussion for the betterment of Pakwach district.	ADWO-mobilization
MIN.2**:** 2nd **Site Meeting** 20th /October/2021	**Introduction** Self- introduction by each of the participants was successfully done.	All members
MIN.3**:** 2nd **Site Meeting** 20th /October/2021	**Project Information Update** The update was given by the District Water Officer -who reminded participant of the following vital information on the project. ➢ **Name of project**: Construction of Boro Piped Water Supply System. ➢ **Initial Contract Sum**: Ugx 715,982,315 ➢ **Contract Ref No**: PKCH/618/WRKS/20-21/00039. ➢ **Source of fund**: District Water Supply & Sanitation Conditional Grant (DWSSCG) ➢ **Client:** Pakwach District Local Government ➢ **Contractor:** Blair Foundation Limited ➢ **Supervisor:** Pakwach District Local Government, Works Dep't.	DWO

	➢ **Designer:** Techno Consult Ltd ➢ **Project Manager**: District Water Officer -Pakwach DLG ➢ **Planned Initial coverage**: 6 neighboring villages ➢ **Site hand over date:** 13th/ August/2021. ➢ **Duration:** 4 months ➢ **Intended completion date:** 20th/August/2021. ➢ **Defect Liability Period:** 6 months	
MIN.4**:** 2nd **Site Meeting** 20th /October/2021	**Welcome Remark from SAS Panyimur.** ➢ Thanked participants for good time management. ➢ Noted that there is good work progress. ➢ Thanked contractor for his cooperation with community	
MIN.5**:** 2nd **Site Meeting** 20th /October/2021	**Site Inspection and findings** ➢ A member noted that the foundation to reservoir to be sited on a firm ground. ➢ Members noted that contractor has to speed up work on the project to catchup with time. ➢ Contractor should cast and cure the reservoir base concrete for at least 21 days before installation of tower.	Contractor, Project manager and all members to note.

	➢ Reservoir material was not on site and is against time.	
MIN.6**:** 2nd **Site Meeting** 20th /October/2021	**Contractor's Progress report** The contractor quantified the work progress as follows: ➢ Power house at 90% ➢ Ecosan toilet at 95% ➢ Guard/pump attendant house at 95% ➢ Site fencing at 95% ➢ Compound work at 70% ➢ Reservoir supply and installation works at 60% with; • Steel plate was ready to be transported to site. • Excavation works finished • Steel framework (HS and I-beams) already designed • Concrete foundation concrete cast up to ground level. ➢ Environmental issues: • Atleast 60% covered with lawn and pavement for parking in place. **Cause of delay**	All members to note

	➢ The contractor noted that the reservoir base work will have to undergo complete setting / hardening for 21 days. ➢ Reservoir material has been redesigned since the first proposal was not on market. **Challenges** ➢ Lack of readily available reservoir tower material ➢ Loose soil – leading to deep excavation ➢ Material very far away -haulage difficulty and time consumption. ➢ Theft of material by community members **Opportunity** The contractor however noted the following opportunities that has sped up his work. ➢ Nearby water source ➢ Constant & Timely project supervision by the project management team.	

MIN.7**:** 2nd **Site Meeting** 20th /October/2021	**Reaction to Contractor's progress report.** ➢ Member noted a good progress in work and commented as follows. ➢ Variation Concern: a member noted the variation experienced should be worked out faster so that it is paid before end of financial year to avoid money being taken back to the treasury. ➢ Contractor should employ the local workers in a good percentage. ➢ Contractor to step up on environmental issues and complete the lawning of the	Contractor to note.

	unpaved areas. ➢ Contractor to plant signage both at site and at junction to the site for easy identification of on-going works. ➢ PPEs to be integrated for all workers and visitors. ➢ Addition of time will only be considered for unforeseen circumstances; this will not take care of delay due to construction constraints. ➢ Contractor to draw a new work plan to help track time management. ➢ Contractor to observe the use of local content. ✓ **Contractor's response** • Contractor noted that he employed local workers however, they are disappointing with high level of absenteeism and this is retarding work progress. • On local content: Contractor noted that apart from manufactured ones, all materials are being locally obtained.	All members to note
MIN.8**:** 2nd **Site Meeting** 20th /September/2021	**Adjournment:** ➢ The next meeting is scheduled for 22nd November, 2021. ➢ The meeting was adjourned at 2:48pm.	Chairperson

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Secretary Chairperson

MINUTE FOR THE THIRD SITE MEETING OF BORO PIPED WATER SUPPLY SYSTEM HELD ON 22ND NOVEMBER 2021 AT SITE (BORO CENTRAL VILLAGE).

AGENDA

2 Opening prayer.
3 Self-introduction.
4 Project information update
5 Welcome remark from SAS -Panyimur sub county.
6 Site inspection report.
7 Presentation of contractor's progress report.
8 Reaction to contractor's report and way forward.
9 Adjournment

MEMBERS PRESENT IN THE MEETING.

No	Name	Sex	Title	Contact
34.	Manda Christine	F	For; C/person LCV	0775385838
35.	Okaro Harbert	M	For; CAO	0786349797
36.	Okot Steward	M	Director -Blair foundation ltd	O772523158
37.	Oweknimungu Benedicto	M	District Water Officer	0774871841
38.	Kerumbe Julius	M	For; District Engineer	0773892895
39.	Okello Haruni	M	Borehole technician	0779686223

40.	Rupiny Ronald	M	Education Officer	0772677006
41.	Jakweyo Emmy	M	For; DIA	0782482434
42.	Awor Bernardette	F	DCDO	0777089444
43.	Ali John Alfred	M	Ag. CDO	0773179104
44.	Oweka Jeneffer	F	Environment Officer	0776460597
45.	Hon. JB Okumu Odongkara	M	District Councillor	O772383716
46.	Hon.Othum David	M	Area Councillor	0777029522
47.	Fuathum JudithKigezi	F	DHI	0777449197
48.	Ocaya Milton	F	Site Engineer -Blair Fdn ltd	0770904545
49.	Jakisa Kenedy	M	Driver	0782510741

MEMBERS ABSENT WITH APOLOGY;

2. Abyeto Stella – CAO Pakwach DLG.

MIN. No.	ITEM	RESPONSIBILITY

MIN.**1:** 3rd **Site Meeting** 22nd /November/2021.	**Prayer** The meeting started at 10:25pm with opening prayer led by Internal Auditor who called upon God's guidance throughout the meeting so that the intended purpose of the meeting can be achieved.	Mr. Jakweyo Emmy
MIN.2**:** 3rd **Site Meeting** 22nd /November/2021	**Introduction** Self- introduction by each of the participants was successfully done.	All members
MIN.3**:** 3rd **Site Meeting** 22nd /November/2021	**Project Information Update** The district water officer informed the meeting about the following must know project information. ➢ **Name of project**: Construction of Boro Piped Water Supply System. ➢ **Initial Contract Sum**: Ugx 715,982,315 ➢ **Contract Ref No**: PKCH/618/WRKS/20-21/00039. ➢ **Source of fund**: District Water Supply & Sanitation Conditional Grant (DWSSCG) ➢ **Client:** Pakwach District Local Government ➢ **Contractor:** Blair Foundation Limited ➢ **Supervisor:** Pakwach District Local Government, Works and technical service department.	-Oweknimungu Benedicto.

	➢ **Designer:** Techno Consult Ltd ➢ **Project Manager**: District Water Officer -Pakwach DLG ➢ **Planned Initial coverage**: 6 neighboring villages ➢ **Site hand over date:** 13th/August/2021. ➢ **Duration:** 4 months ➢ **Intended completion date:** 20th/December/2021. ➢ **Defect Liability Period:** 6 months	
MIN.4**:** 3rd **Site Meeting** 22nd /November/2021	**Welcome Remark from SAS Panyimur .** ➢ Welcomed members for the meeting ➢ Noted good work progress. ➢ Thanked contractor for his update unity with community	
MIN.5**:** 3rd **Site Meeting** 22nd /November/2021	**Site Inspection and findings** ➢ Fencing of the reservoir site to be caried out since the site is isolated, theft and vandalism of some parts can occur. ➢ Members noted that contractor has to speed up work on the project to catchup with time. ➢ Some of the workers were observed without PPEs. ➢ Some element of the Environmental guidelines like barricading of site was not not	Contractor and Project manager to note.

	observed.	
MIN.6**:** 3rd **Site Meeting** 22nd /November/2021	**Contractor's Progress report** The contractor quantified the work progress as follows: ➢ Power house at 98% ➢ Ecosan toilet at 99% ➢ Guard/pump attendant house at 99% ➢ Site fencing at 100% ➢ Compound work at 90% ➢ Reservoir supply and installation works at 95% with; • Steel tower already erected and reservoir plate assembled. • Reservoir site being fenced. ➢ Environmental issues: • At least 80% covered, with pavement for parking in place. **Cause of delay** ➢ Redesign of the steel tower members ➢ The cutting to size and transportation of the steel tower delayed work.	All members to note

	Challenges ➢ Lack of readily available reservoir tower material ➢ Loose soil – leading to deep excavation ➢ Material very far away -haulage difficulty and time consumption. ➢ Theft of material by community members **Opportunity** The contractor however noted the following opportunities that has sped up his work. ➢ Nearby water source ➢ Constant & Timely project supervision by the project management team.	

MIN.7**:** 3rd **Site Meeting** 22nd /November/2021	**Reaction to Contractor's progress report.** ➢ Member noted a good progress in work and commented as follows. ➢ Contractor to expedite the construction of fence at the reservoir site to meet targeted project duration ➢ Reservoir site to be fully planted with crawling grass to reduce on erosion ➢ Contractor to plant signage both at site and at junction to the site for easy identification of on-going works. ➢ PPEs to be integrated for all workers and visitors.	Contractor to note.

	➢ Addition of time will be considered for only delay due to unforeseen circumstances. ➢ Contractor to continuously observe the local content policy. ✓ **Contractor's response** • Contractor noted that he will continuously use local labour and material to help the community benefit from the project. • Contractor agreed to expedite the fence construction to catch up with time. Noting that all the fence material was already on site. • Contractor noted that he constantly provided PPEs since the first site meeting only that some workers ignore their usage. • Contractor agreed to barricade the reservoir site	All members to note
MIN.8**:** 3rd **Site Meeting** 22nd /November/2021	**Adjournment:** ➢ The meeting was adjourned at 2:15pm.	Chairperson

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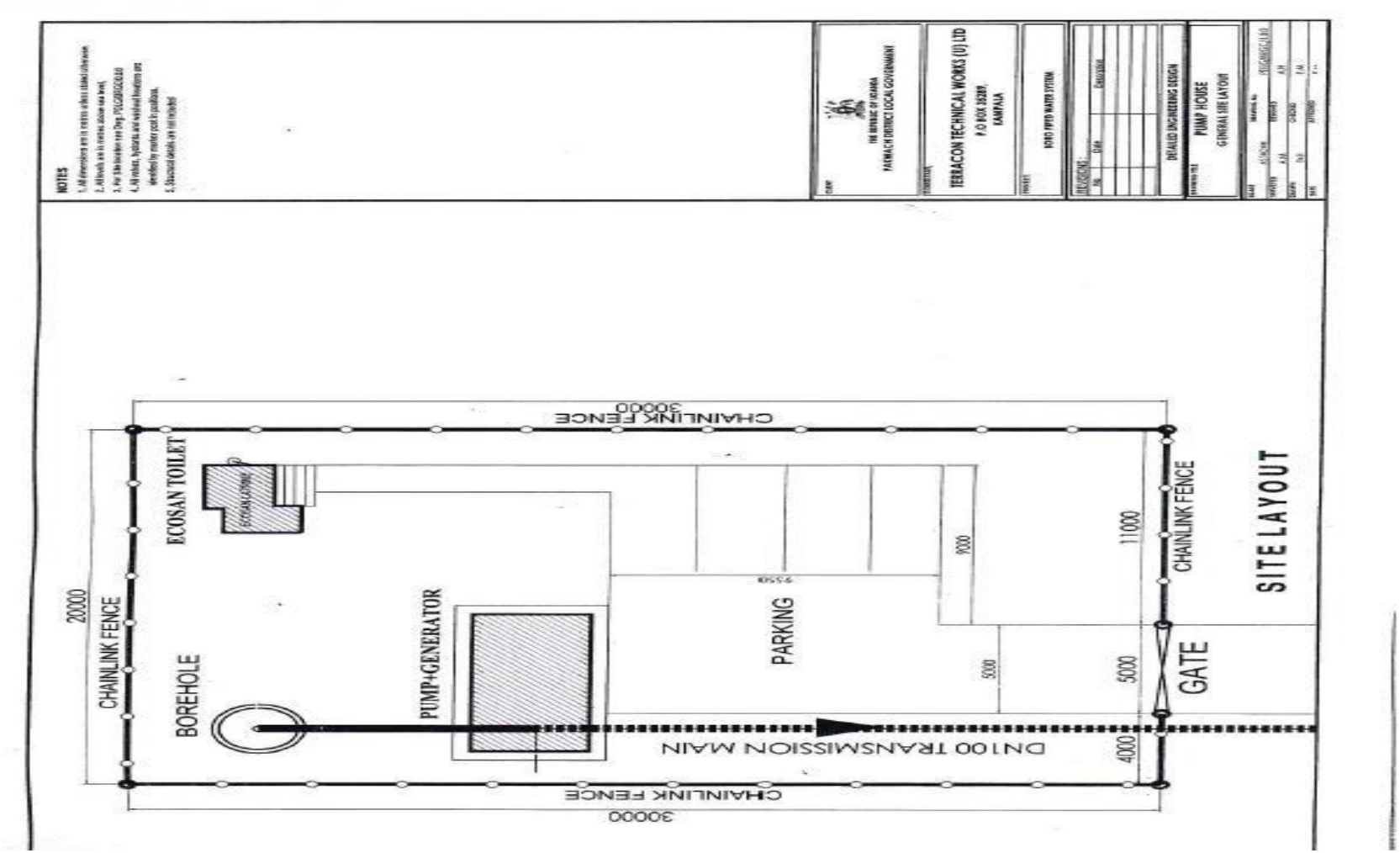
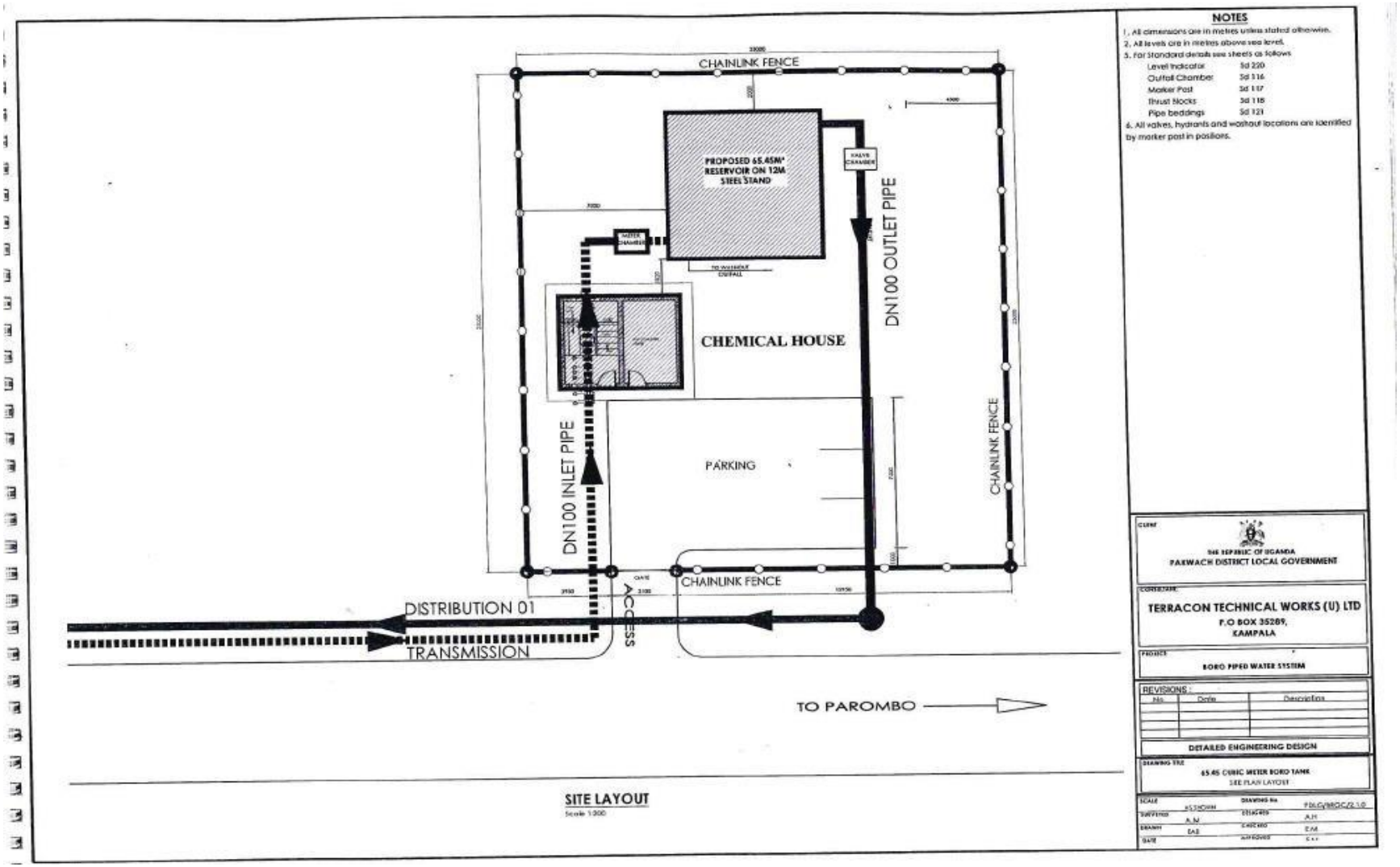
Secretary Chairperson.

Annex 7: Site Layout




CHAINLINK FENCE
PROPOSED 65.45M³ RESERVOIR ON 12M STEEL STAND
VALVE CHAMBER
METER CHAMBER
TO WASHOUT OUTFALL
DN100 OUTLET PIPE
CHEMICAL HOUSE
DN100 INLET PIPE
PARKING
CHAINLINK FENCE
CHAINLINK FENCE
GATE
ACCESS
DISTRIBUTION 01
TRANSMISSION
TO PAROMBO
SITE LAYOUT
Scale 1:200
NOTES
1. All dimensions are in metres unless stated otherwise.
2. All levels are in metres above sea level.
3. For Standard details see sheets as follows
Level Indicator Sd 220
Outfall Chamber Sd 116
Marker Post Sd 117
Thrust Blocks Sd 118
Pipe beddings Sd 121
4. All valves, hydrants and washout locations are identified by marker post in positions.
CLIENT
THE REPUBLIC OF UGANDA
PAKWACH DISTRICT LOCAL GOVERNMENT
CONSULTANT
TERRACON TECHNICAL WORKS (U) LTD
P.O BOX 35289,
KAMPALA
PROJECT
BORO PIPED WATER SYSTEM
REVISIONS :
No. Date Description
DETAILED ENGINEERING DESIGN
DRAWING TITLE
65.45 CUBIC METER BORO TANK
SITE PLAN LAYOUT
SCALE AS SHOWN
DRAWING No PDLG/WSC/2.1.0
SURVEYED A.M
DESIGNED A.H
DRAWN BAB
CHECKED E.M
DATE
APPROVED E.K.I