Terms of Reference

Drilling of Boreholes in Bugesera, Gatsibo, Kamonyi, Nyagatare and Rutsiro Districts
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Type of Contract (tick the appropriate box)	√ **Institutional Contractor**	Individual Consultant	Technical Assistance to IP (individual)
Title	Drilling of boreholes in Bugesera, Gatsibo, Kamonyi, Nyagatare and Rutsiro Districts		
Purpose	To provide specialized services for drilling and casing of boreholes.		
Type of consultancy:	Delivery based		
Location	Bugesera, Gatsibo, Kamonyi, Nyagatare and Rutsiro Districts		
Duration	1.5 months		
Start Date	August 2025		
Reporting to	Chief WASH		

1. Background

UNICEF plans to support Rwanda Water and Sanitation Corporation (WASAC) Group Ltd and Rwanda Water Resources Board (RWB) in drilling and casing of ten (10) boreholes in five districts, as per below details:

S.No	Lot No.	District	Sector	Village	GPS Coordinates	
1	1	Bugesera	Musenyi	Kabuye	166770	9763205
2		Bugesera	Shyara	Nyabaguma	166579	9753811
3		Kamonyi	Nyamiyaga	Rwankeke	828695	9768677
4		Kamonyi	Mugina	Gishari	830860	9769808
5	2	Nyagatare	To be confirmed (TBC)	TBC	TBC	TBC
6		Nyagatare	TBC	TBC	TBC	TBC
7		Gatsibo	TBC	TBC	TBC	TBC
8		Gatsibo	TBC	TBC	TBC	TBC
9	3	Rutsiro	Boneza	Bugarura Island	TBC	TBC
10		Rutsiro	Boneza	Bugarura Island	TBC	TBC

*Please note that geophysical surveys for all the sites have already been conducted.

The specialised nature of the works planned under this assignment requires the use of experienced drilling contractors with adequate understanding of the local hydrogeological conditions. It is, therefore, planned to engage services of a qualified drilling contractors who have the experience, knowledge and skills for carrying out these works.

It may be noted that the number of boreholes to be drilled is tentative and subject to change, pending the planned site assessments and availability of funds.
The works under this assignment have been divided into three (3) lots (as shown in the above table). The Contractor may bid for one or more lots.

For Lot-3, the contractor should consider transportation of the rig across the lake or propose an alternative modality for drilling of the boreholes.

2. Objectives

The objective of this assignment is to drill and equip boreholes, including drilling and installation of casing, in line with the scope of the works and specifications stated in these ToRs.

3. Description of the assignment / scope of works

The scope of work to be carried out at specified locations under this assignment includes the following:

(i) Drill and install boreholes at the approved sites. This will entail provision of all labour, transport, plant, tools, equipment, materials and appurtenances necessary for drilling of boreholes, including lowering of borehole assembly with PVC casing and screen and end cap; provision of gravel pack at appropriate intervals and back filling; closing near surface water table aquifer, cleaning and development; pump testing; water quality testing both for chemical and biological parameters; chlorination of borehole, in line with the Bill of Quantities (BoQ) given in Annex-1 and technical specifications given in Annex-2.

4. Expected Deliverables

The key deliverables of this assignment are as follows:

- 10 boreholes drilled and casing installed as per the specifications as per the specifications given in Annex-2 (Technical Specifications for borehole drilling).

5. Reporting requirements

(i) The contractor shall provide to WASAC, RWB and UNICEF, a weekly and per borehole report detailing the progress of the works and the layout of the boreholes. The format for report shall be mutually agreed upon by within one week of signing of the contract;

(ii) The contractor shall maintain records and receipts for the purchase of all materials and remuneration of labour used in the works and shall make such records and receipts available for inspection, upon request;

(iii) The contractor shall keep accurate and systematic records in respect of the works, in accordance with the specifications contained in Annexes. The contractor shall furnish WASAC with one copy each of all such forms/reports up on completion of all boreholes under this assignment;

(iv) The contractor must ensure that all supervision forms are signed by both the drilling supervisor from the Project Consultant and a representative of the contractor. It is emphasised that no payments will be made unless signed forms are presented where interim payment certificates (IPCs) are submitted, the supervision forms for each drilling and construction phase will be supplied by the Project Consultant;

(v) The contractor shall allow Project Consultants, WASAC, RWB and UNICEF access to inspect all forms during progress of the works. Moreover, the contractor shall get the boreholes registered with RWB in line with relevant statutory instrument (s); and

(vi) The contractor shall submit to WASAC, RWB and UNICEF a final report of the works, with detailed accounts of material utilised, technical data such as lithological logs, drill time logs, well completion details, pump test data and results and on installation of hand pumps, in line with RWB's Borehole Completion Report (BCR) requirements.

6. Project Management

The contractor will be contracted by, and report to, UNICEF. The works undertaken by the contractor will be supervised by WASAC, RWB and a Project Consultant to be appointed in this regard.

7. Duration

The works indicated in this TOR are planned to be executed by the Contractor within 6 weeks (1.5 months) from the commencement date. The contractors are required to propose a realistic work programme based on actual resources and availability capacity in the bidding response to ensure that the planning and execution of works can be relied upon, keeping in view the rainy season and accessibility.

8. Payments and securities

(i) Payment will be based on actual works done and following approval by the supervising engineer, and an inspection and certification process. A 10% retention will apply which will be paid at the end of the one year defect liability period or submission of bank guarantee in this regard.

(ii) As soon as, in the opinion of the contractor, the works on at least 2 sites are completed, the Project Consultant should be notified in writing. A taking over certificate in respect of the works will be issued by the Project Consultant after inspection/certification. If any uncompleted works are observed, the contractor will complete the outstanding works in a period less than two weeks and inform the Project Consultants/WASAC/RWB/UNICEF for the issuance of the taking over certificate;

(iii) The contractor shall rectify any works deemed to be defective, or requiring repair, and, if deemed necessary. If the contractor is unable to complete the works in a four-week period from the date of notification, the cost of the works will be deducted from the retention. Alternately, the contractor shall return to WASAC the amount of money paid for the said works; and

(iv) Within one week of the receipt of notification of award from UNICEF, the contractor shall furnish the performance security in accordance with the UNICEF General Conditions of Contract using a form, and from a bank/agency, approved by UNICEF.

9. Qualification and equipment/material requirements

(i) Legally registered to conduct business and drill boreholes in Rwanda;

(ii) Minimum of five (5) years' experience in drilling and installation of handpumps in Rwanda;

(iii) Proven capacity to deliver. The contractor should possess requisite equipment and adequate human resources capacity, as outlined below:

- (a) Adequate equipment for drilling of boreholes including drilling rigs, compressors, mud pump unit and accessories, pump test unit, support trucks and vehicles, GPS unit, water quality testing kit etc
- (b) Adequate staff for drilling works e.g. Contract Manager, Geophysicist, Drilling Engineer in-charge, Foreman for the Drilling Crew(s) and other key staff; and

(iv) Sound financial capacity to undertake the works.

10. Application submission – evaluation process and methods

Qualified contractors are invited to submit sealed separate technical and financial bids for this assignment as presented below:

(a) Technical Proposal

The Technical Proposal that should include, but not limited to:

(i) Description of the firm - legal status, and organizational structure
(ii) Total number of years of experience in the similar works;
(iii) Copy of registration certificate;
(iv) History of litigation/non-performing contracts or declaration of "no pending law suits", where applicable;
(v) Copy of insurance policy;
(vi) Description of similar works carried out during the last five years as per below details (for each project): Project/activity name, award date, completion date, role in the contract (contractor, sub-contractor), total contract amount (RWF or USD) , if partner in a JV or subcontractor, specify participation of total contract amount (RWF or USD), client name, and client contact person's name, telephone number and email.
(vii) Details of equipment/vehicles/materials owned as per below details:
    (i) For drilling rigs, supporting trucks, geophysical investigation equipment, pumping test equipment and generators, the minimum information to be provided include: Number of equipment available to the project, brand, model, capacity/size, year of manufacturing/age, ownership status, i.e., owner, rent/lease, subcontract, other – describe;
    (ii) For Pumps and Casings, the minimum information to be provided include: brand, model, capacity/size, material type (casings), stock in country, delivery lead time in case of importation.
    (iii) For Potable Water Quality Test Kits: brand, model, the range of testing parameters, stock in country, delivery lead time in case of importation.

11. Profiles/CVs of the key professional staff (name, date of birth, years with the firm, total years of experience, nature of experience in this firm and others, education/other trainings and knowledge of English and local languages);
12. Copy of the audited financial statements for last two years (balance sheet and income statement);
13. Proposed approach and methodology in response to the scope of works for the assignments. This should include, among others, details on how the contractor will organize the works, key personnel to be assigned for this assignment (and their positions), and the proposed time to mobilise to the site after signing of the contract; and
14. Proposed approach/methodology for compliance with labour and Environmental, Social, Health and Safety (ESHS) requirements; and
15. Proposed work plan for the assignment.

The submission should be clearly labelled/written "*Request for Bids* – Drilling of Drilling of Boreholes in Bugesera, Gatsibo, Kamonyi, Nyagatare and Rutsiro Districts – Technical Proposal".

(b) Financial Proposal

The Financial Proposal must include full costs for delivering all the works to be carried out under this assignment, including costs for insurances and compliance with labour, environmental, social, health and safety regulations. The currency of the Financial Proposal must be in RWF.

The contractor must provide the financial proposal by completing the BoQs for each lot applied for and also providing a summary as below:

Lot No	**Total amount (RWF)**	**Comments**
1		Reference BoQ for Lot-1
2		Reference BoQ for Lot-2

3		Reference BoQ for Lot-3
Grand Total		

The submission should be clearly labelled/written "*Request for Bids* – Drilling of Drilling of Boreholes in Bugesera, Gatsibo, Kamonyi, Nyagatare and Rutsiro Districts Districts - Financial Proposal".

(c) Assessment Processes of Submitted Proposals

After the opening, each proposal will be assessed first on its technical merits and subsequently on its price. Responses deemed not to meet all of the mandatory requirements will be considered non-compliant and rejected at this stage without further consideration. Failure to comply with any of the terms and conditions contained in this ToR, including provision of all required information, may result in a response or proposal being disqualified from further consideration. Final decision on the evaluation/proposal assessment will rest with WASAC.

(d) Technical Evaluation

The proposals will be evaluated as per the below evaluation criteria:

Technical Proposal		
No.	Criteria	Max. Points
1.0	**Overall response**	**10**
	(i) Demonstrated understanding of and responsiveness to the RFP's requirements	5
	(ii) Overall clarity and completeness of the proposal.	5
2.0	**Proposed Approach, Methodology and Workplan (***How feasible is the proposed approach and methodology?)*	**25**
	(i) Adequacy of the proposed implementation approach/ methodology/workplan	10
	(ii) Structure of the team (s) to be deployed for drilling	10
	(iii) Availability to start works immediately	5
3.0	**Organizational Capacity**	**35**
	(i) Organizational expertise and experience in works of similar nature and complexity completed over a minimum of five (5) years	10
	(ii) Capacity – personnel resources	5
	(iii) Capacity – equipment resources	5
	(iv) Financial capacity (annual turnover, ability to finance the works upfront)	10
	(v) Litigation/arbitration history or history of non-performing contracts	5
Total		**70**

It is recommended that the bidders undertake site visits to the selected refugee settlements/host communities, at their own cost, to acquaint themselves with the locations and conditions on the ground. These visits, however, will not be given points while evaluating technical proposals.

(e) Evaluation of financial proposals

Only proposals which receive a minimum of 49 points under the technical evaluation will be considered technically compliant and be eligible for the second phase (financial review).

The total amount of points allocated for the price component is thirty [30]. The maximum number of points will be allotted to the lowest price proposal that is opened and compared among those invited

firms/institutions which obtain the threshold points in the evaluation of the technical component. All other price proposals will receive points in inverse proportion to the lowest price e.g.:

$$\text{Score for price proposal } X = \frac{\text{Max. Score for price proposal} * \text{Price of lowest priced proposal}}{\text{Price of proposal } X}$$

Note: Minimum qualifying mark for technical proposals is 49. In normal circumstances, only those offers that score minimum and above points on technical proposals will be considered for commercial evaluation. However, WASAC reserves the right to evaluate all commercial offers and/or shortlist selected suppliers from among those who score minimum and above technical scores.

(f) Final computing of proposal score

Total proposal scores will be consolidated as follows:

Evaluation of proposal	Maximum points
Technical evaluation of proposals	70
Cost / Financial proposal	30
Total	**100**

The proposal with the best overall scoring, composed of technical responsiveness, merit and price, will be recommended for approval. UNICEF will notify the selected firm/institution by email when the evaluation and award process is completed.

Annex-1 : BoQs

Please refer to the attached excel sheet titled BoQ for Lot-1, Lot-2 and Lot-3

A description of the key items of the BoQ is as follows:

Bill Item 2. Mobilisation, Siting and Demobilisation

This cost also covers the cost of the mobilisation from the place of origin of the contractor to the drilling area and demobilisation back to the same.

The cost of mobilization between the sites will be based on actual mileage.

Bill Item 3 Borehole Drilling

The drilling diameter refers to the end of the borehole, not the upper section. The drilling is cost should be priced based on Linear Meter (LM) for the drilled boreholes, the invoiced quantity will be based on the installation depth of the casing and screen and will NOT account for collapsed metres. An additional 2 metres per borehole will be drilled at each borehole to allow for collapse during installation, these metres can be added to the drilled meters. The contractor is advised to estimate the cost of installation, removal and possible lost temporary casing in the drilling cost.

Bill Item No. 3.1.1 and 3.1.2 Drilling 10"

The main drilling completion diameter for boreholes will be 10” for overburden formations and 8 ” for hard formations; this may require a combination of DTH and Mud rotary techniques. It is expected that the contractor will be able to use both drilling techniques.

The estimated drilling depth ranges from 100 to 120 metres. The drilling meters for 10” are based on the linear meters of drilling for an average of 15m drilling depth, the BoQ item cost is based on the estimated quantities of boreholes to be drilled. The drilling linear meter estimate in the BoQ item should be based on drilling to 120 meters at each site.

Bill Item 3.2 Borehole Lining and Installation

The PVC casing and screens installed shall be new and unused. The casing and screens shall comply with the given specifications. Manufacturer’s certificates of compliance to the given standard and norms shall be submitted to the Supervising consultant prior to supply of materials to site. No materials are permitted to be used for the works without the prior inspection and written approval of the Supervising consultant. The contractor can only invoice for casing and screen installed where the water quality and/or quantity is sufficient.

Bill Item No. 3.2.1 Supply and install 5 inch or 127/140 mm casing

The price covers supply and installation per meter of 127/140 mm PVC casing with flush threaded joints in compliance with and certified by the manufacturer as per DIN 4925. It is estimated that 80% of the installation meters will be plain casing. The BoQ estimate should be based on an installation depth of 120 meters.

Bill Item No. 3.2.2 Supply and install 127/140 mm PVC screens. Slot 1 mm

The price covers supply and installation per meter of 5”, 127/140 mm screens, slots 1 mm with flush threaded joints in compliance with and certified by the manufacturer as per DIN 4925. It is estimated that 20% of the installation meters will be screen casing. The exact number of casing with each slot width will vary per borehole.

Bill Item No. 3.2.3 Supply and install bottom plug

The price covers supply and installations of bottom plugs of PVC at the bottom of the borehole. Cement plugs poured into plain casing are not to be used.

Bill Item No 3.2.4 Sanitary Seal and Grouting

The sanitary seal and grouting must be installed using a mixture of cement and bentonite to prevent contamination from the surface water

Bill Item No 3.2.5 Installation of gravel pack

The price covers supply and installation of well sorted, well washed gravel with grain size 1-4 mm and 0.5mm to 2mm for Kalahari and fine sedimentary formations. The price is per borehole. The contractor should make estimates based on filling the annulus of the borehole with gravel pack to within 4m of the surface. The gravel pack must be composed of 90% quartz with less that 5% mica and no weather material or laterite.

Bill Item 3.2.7 Cleaning and Development by airlifting

Borehole development shall be limited to jetting and airlifting methods only. Any damage caused by development procedures shall be rectified by the Contractor to the on-site Employer's representative satisfaction.

The minimum development time shall be three hours. Sediments and other materials falling to the bottom of the borehole during the development shall be removed by airlifting or bailing after the completion of the development. Development shall be considered complete when the water is clean and free of sand

Bill Item 3.3 Platform and lockable cover

The borehole shall be finished with a small platform and a lockable cover as per drawing in Annex 3.

Bill Item 4 Test Pumping, water sampling and analysis

Approximately 10 boreholes will be drilled. The actual test to be carried out depends on the yield. The assumed yield and recommended test are given in the Table below:

The test shall be done by a flow rate indicated by the supervisor. The following drill results have been assumed:

No.	Yield	No of holes	Step hours	Constant rate hours	Total pump hours	Recovery hours	Total recovery hours
1	Dry	1	0	0	0	3	3
2	between 1 and 2 m3/hr	2	0	3	6	3	6
3	2 and 5 m3/hr	2	4	24	56	6	12
4	5 and 15 m3/hr	3	4	48	156	6	18

The pump rate shall not fluctuate more than +/- 10% during pumping. In case of a breakdown of the equipment during the pumping test the borehole shall be allowed to recover to its static water level and for at least 6 hours or to the previous SWL.

Laboratory tests

This cost per borehole should cover the cost of key chemical and bacteriological tests to be conducted for boreholes as per Government of Rwanda's relevant guidelines.

Annex-2: Technical Specifications for Borehole Drilling

1. General

The Contract is for the drilling and construction of boreholes including drilling, installation of casings and screen, gravel pack installation, grouting, well development, and pumping tests.

Access to many drilling sites may involve difficult access conditions. It is expected that the drilling contractor make allowances for this as part of the drilling cost. The contractor should carry out a reconnaissance if they are uncertain of access; no consideration will be given to difficult access after the contract is signed.

2. Geophysical Investigation and Siting

The geophysical investigations and siting for the boreholes have already been completed. Hence, the contractor will drill the borehole at the specified sites.

3. Personnel, drilling equipment and safety equipment

The contractor shall provide capable and experienced personnel to perform this work, while putting in place adequate health and safety measures in line with local regulations and taking all reasonable precautions to prevent any death or injury to persons. The Contractor shall ensure that all of its site staff (permanent and causal) are provided with appropriate PPE. The contractor shall ensure that the site is not accessed by any unauthorized persons and a perimeter shall be set up around the site to prevent unauthorized access;

The contractor must get all the requisite insurances. WASAC shall not be liable for any damages or compensation as a result of accident or injury to any workers employed by the contractor, any sub-contractor. The contractor shall ensure the site is left clean and tidy with all pits dug to facilitate drilling back-filled and levelled. Abandoned or dry boreholes must also be back-filled; and

4. Storage and transport of fuel and lubricants

The contractor shall comply with local regulations applicable to the use and storage of diesel, petrol, paraffin fuel and lubricating oil found at the work site or stored at the base camp. He shall ensure that adequate measures are taken to comply with local environmental regulations and precautions are taken against fire and environmental contamination. No fuel or lubricant must be transported with any item to be installed in the borehole, in particular casing, and screen filter pack.

5. Mobilization and demobilization

The item for mobilisation to the drilling area shall include moving the drilling unit and all other equipment, materials and stores from the point of origin to the base camp(s) and setting up the base camp(s); and movements between drilling sites within the project area. The contractor shall clean up the drill site before demobilization and ensure that any damage to roads or fields made during access to the drill site is restored. It should be noted that the initial mobilisation from return demobilisation to the project area(s) should be included in the individual mobilisation between sites.

6. Borehole Drilling

The drilling is based on a Linear Metre (LM). The drilling meterage will be based on the installed depth and will not account for metres of drilling lost due to collapse. During drilling an additional 2 metres will however be drilled to allow for potential collapse during installation of casing and screen; these extra metres can be included in the depth drilled.

The contractor must only start drilling with explicit approval of the project consultant and drilling should only be conducted in the presence of representative of the supervision consultant, it should be noted that drilling and construction works carried out with an authorised representative will not be countersigned on the supervision forms.

In all formations the diameter of the hole in the screened zone and down to the bottom of the borehole should be a minimum 8" or 200 mm. The tenderer must be able to drill using mud rotary and air percussion drilling in the same borehole, hereinafter referred to as "combination drilling".

As the boreholes are planned to be mechanised in the long run, they shall be cased with high impact-resistant uPVC plastic casings and screens specifically manufactured for boreholes according to the internationally accepted guidelines. The casings for the boreholes must have an inner diameter of 127 mm (5 inch) and a PVC pipe wall thickness of at least 6mm.

It is essential that the borehole is straight and vertical to allow the installation of the pump without difficulty. If required by the project consultant the contractor shall demonstrate the verticality and alignment using a 3m dummy, if the dummy fails to move freely the contractor will be obliged to correct the verticality or drill a replacement borehole at their own expense.

The casing and screen must also be approved once delivered to the project area. The required characteristics of UPVC casing and screen are as follows:

Reference	Characteristics	Standard
Material	uPVC of quality without lead stabilizer, mass additives maximum 3 %, elasticity module 3,000 N/mm2, tensile strength 45-55 N/mm2.	DIN 8061
Inner/outer diameter	100/114mm and 127/139mm	DIN 8062 DIN4925
Wall thickness	6 mm (minimum)	DIN 8062
Screen	Screw flush joints, traction resistance 2,000 kg	DIN 4925
Screen slots	0.3, 0.5 and 1 mm openings, open area minimum 9%	DIN 4925
Compressive strength	Minimum 17 bars	DIN 19532

The casing and screen must be approved by the supervising consultant prior to mobilisation and when delivered to the project base camp.

Temporary casing made of steel shall be installed in unstable overburden and sediments before drilling the basement. Temporary steel casing should have screwed flush joints however welded section will be allowed. The Contractor shall ensure that it is of sufficient diameter to enable drilling

of the complete borehole at the required diameter, together with installation of permanent borehole casing, screen, and for placing the gravel pack.

For successful boreholes, the temporary casings in the soft formations shall be removed from the hole, as soon as the borehole has been completed, unless the on-site Employer's representative instructs the Contractor to do otherwise, based on the nature of the geological formation.

Temporary casing installation and removal must be priced into the drilling cost. No separate item will be invoiceable. This also includes any temporary casing that cannot be removed from the borehole.

7. Joints, Centralizers and Bottom Plugs

All casings and screens shall have screwed flush joints with sturdy threads, either curved or angular with no eccentricity to allow for easy handling.

Casings shall be installed under "extension" meaning that once they reach the bottom of the hole the casing and screen string is raised by 300mm above the bottom and held in suspension whilst gravel is inserted.

A bottom plug shall be fitted on the lower end of the screen or casing per NRWSSP guidelines. The use of a concrete plug with uPVC casing is not allowed, the bottom plug should be a dedicated unit glued to the bottom of the first casing.

8. Borehole Sampling and Data Collection

During drilling, samples of unwashed drill cuttings shall be collected at 1 m interval and laid out in rows of ten from left to right. A representative sample of every distinct horizon or change of rock type as directed by the Project Consultants shall be packed and stored in solid polythene bags and accurately labelled with the name of the community, borehole number, date and depth of sampling.

9. Rate of Drilling

Accurate records of penetration rate per metre shall be maintained. The drilling contractor must nominate a member of staff to record the data and provide a good quality stopwatch to record the penetration rates. A different form is to be used for DTH and Mud rotary drilling, this form should also include mud viscosity based on March funnel readings and when water/drilling polymer is added to the mud reservoir. If Mud rotary drilling is used followed by DTH, the Mud rotary form should be continued. All form format will be provided by the project consultant's representative, it is the responsibility of the contractor to copy the forms and have them available at each site.

10. Interim Yield Tests

Where DTH drilling is carried out the yield should be measured using a 20 liter bucket. Interim yield tests shall be carried out at the end of each drilling rod after the first water strike. The borehole should be blown for 5 minutes to accurately measure the yield on the V notch weir.

11. Final Drilling Depth

The representative from the project consultants has the responsibility for determining the final drilling depth according to indications provided by the hydrogeological and geophysical survey and analysis of drill cuttings on site.

The installed depth shall be the depth invoiced plus 1.0 metres to allow for the casing string to be pulled upwards so that it is hanging and also to allow for the cost of the casing above ground. The on-site representative has the right to ask for the casing and screen to be removed if any collapse offsets the depth of the screens in relation to man water strikes.

12. Identification of the Drilled Boreholes

The Contractor shall mark the borehole code given by the on-site Employer's representative on the borehole casing, using a permanent water-proof marker; this should be clearly visible to avoid confusion during subsequent construction activities.

13. Filter pack

Boreholes shall be filter packed with clean, well-rounded quartz gravel, ranging in size from 1mm to 4mm for both the alluvial areas and the harder rocks.

Where temporary casing has been used, the filter pack must be inserted into the annulus between the temporary casing and the borehole casing. The installation of the pack should be done at 3m intervals, then the temporary casing pulled out, this will prevent the collapse of the formation directly onto the borehole casing and screen.

The location and transport of the gravel pack is the responsibility of the contractor, it is highly recommended that during the site visits that the location and the cost of sieving/transport is factored into the unit cost for gravel pack installation.

14. Sanitary Seal

The sanitary seal shall be made of cement-bentonite grout. Quick-hardening cement is NOT allowed for sanitary seal of the uPVC casing since the heat production is increased and may cause damage on uPVC.

Bentonite shall comprise 4% by weight of the cement. First, bentonite shall be mixed with water, then cement shall be added and the grout mixed thoroughly until it forms thick slurry free of lumps. The grout shall be placed outside the casing, using a grout pump and pipe, in one continuous operation, from the bottom and upwards.

The grout seal shall be installed to a depth of 6 – 8 metres below ground level. It is essential that when the filter pack is installed that the level is measured during installation so that when the filter pack reaches 8 metres below ground level the annular space can be grouted.

15. Backfilling and Borehole Capping

All permanent borehole linings should be completed 600 mm above ground level, capped and protected with a borehole chamber with a lockable metal lid. It must be underlined that it is the

contractors' responsibility to protect the borehole from vandalism until it is handed over. Any permanent damage resulting from the borehole not being safely secured will result in the contractor having to replace the borehole at their expense.

Unsuccessful boreholes due to non-compliance with the Technical Specifications, loss of tools, accidents or any other cause shall be backfilled and the site restored to its previous state. This is the responsibility of the Contractor and will be carried out at their own expense.

16. Borehole Development

Borehole development shall be carried out using the airlift method.

The minimum development time shall be three hours. Sediments and other materials falling to the bottom of the borehole during the development shall be removed by airlifting or bailing after the completion of the development. Development shall only be considered complete when the water is clear and free of sand. **NOTE** – There is no maximum development time, the end of development with be based on water clarity and no visible sand or silt. It should be noted that installation of unwashed gravel pack will result in increased development time especially where the screen slot width is 0.5mm and 0.3mm.

17. Onsite data reporting data collection

After completion of each construction activity the Contractor must ensure that the supervision forms are signed correctly. A record summarizing the data from the drilling of each borehole, including the GPS coordinates, and subsequent activities must be made.

18. Head of the Borehole

(i) The successful borehole must be completed with a wellhead constructed around the casing. The pit for a concrete wellhead will be 75cmx75cmx50cm deep concrete constructed according to the specification provided by the Consultant. The concrete used in this headworks shall be B25 mixed in the proportion 3-wheel barrow stone, 2 wheel barrow river sand and 1 wheelbarrow cement (2 x 50kg).
(ii) In case of hand pump installation, concrete for the wellhead will also be used for the mounting of the pump pedestal.
(iii) The protruding casing shall be sealed with suitable cap to prevent any an unauthorized opening and entrance of foreign materials that can render the borehole useless. This cap will have a hinge and a rim extending downward over the casing. A lock will be placed (VIRO brand security level 4) and the keys will be presented and signed by the representative of WASAC.
(iv) The borehole well head shall be completed as per illustrations in Annex-3.

Annex- 3: Well head design



Production well



Monitoring well



Monitoring well



Monitoring well

Annex- 4: Borehole Development and Pump Testing Forms

No.	Description
Attachment No. 1	Borehole Development Form
Attachment No. 2.	Pump Testing Form

Attachment No. 1 Borehole Development

District: Borehole Number:

Community:

Depth at start of Development: m Static Water Level: m

Depth at end of Development: m Date:

Screen One: GPS Location (Decimal Degrees/WGS84)

Screen Two: E:

Casing Stick Up: S:

AIRS-JETTING

Cycle	Start time	End time	Cycle time (min)	BH depth (m)	Observations
1					
2					
3					
4					
5					
6					
Total cycle time (min)					

OVER PUMPING

Cycle	Start time	End time	Cycle time (min)	Observations
1				
2				
3				
4				
5				
Total cycle time (min)				

…… ……..

Contractor Representative District Representative

Attachment No. 2 Borehole Pump Test Form

BOREHOLE PUMP TEST FORM **Attachment No. 3**

Name of Site: _____ *Ward:* _____
Constituency: _____ Province: _____
Chief: _____
Borehole No.: _____
Drilled by : _____ Date: _____
Pump Tested by: _____ Total Depth: _____ Meters
Grid Ref.: _____ S.W.L _____ Meters

Clock Time (hrs)	Elapsed time (mins)	Yield (pumping rate) litres/sec	Depth from surface to water (m)	Quality of water		Recovery level after Pumping		
				Clear	Turbid	Clock Time (hrs)	Elapsed time when pump stops (mins)	Water level (m)
	0						0	
	1						1	
	2						2	
	3						3	
	4						4	
	5						5	
	10						6	
	15						7	
	20						8	
	25						9	
	30						10	
	35						12	
	40						14	
	45						16	
	50						18	
	60						20	
	70						25	
	80						30	
	90						35	
	100						40	
	110						45	
	120						50	
	150						55	
	180						60	
	210						70	
	240						80	
	270						90	
	300						105	
	330						120	
	360							
	400					**Remarks:**		