**Annex A**

**TOR for Drilling and Construction of Borehole at Owa River Side - Ura Settlement**

1. General

During the emergency WASH response for Ura settlement site; Owa river has been used as an immediate source of water supply from which; raw water is made to be lifted using raw water pump and passed through physical and chemical treatment processes before it gets to distribution by gravity. However, the extraction of river water combined with its treatment and distribution is an expensive operation and as such the operation must devise a durable intervention that can possibly step up the level of service from where it is now to a stage where the people of concern and its hosting community can get an improved access to services. As a result, it is required to carry out a rapid ground water resource mapping; RGWRM followed by a hydrogeological survey to indicate a potential well point in the water shed of the Ura settlement.

To facilitate the drilling of deep wells’ operation; the hydro geological survey and investigation for potential ground water mapping is currently under progress by a local consultant using the state-of-the-art technologies for ground water exploration. However, in tandem with the hydrogeological survey, it necessitates to float the tender for the drilling of deep wells so that the earmarked funding obtained for the operation can be used efficiently.

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| Geographical Coordinates, UTM | |
| Northing | 1147144 |
| Easting | 676703 |
| Elevation | 1280 m asl. |

Therefore, this term of reference is outlined to invite all legitimate drilling contractors with relevant experience to take part in the tender for procurement of borehole drillings at Ura settlement site specifically at the Owa river valley corridor, as per the scope of works outlined below.

1. Purpose.

This term of reference serves as an implementation tool prepared to call a potential drilling contractor who has been delivering the drilling of water wells in the project area so that the responsive drilling company will be tasked to implement the drilling of water well in the designated site as per the below stated scope of works.

1. Scope of works / deliverables by the contractor

Referencing the existing hydrological and geophysical survey investigation which will soon be completed, the contractor will bench mark the identified drilling site. The selected drilling contractor is expected to mobilize his skilled manpower and drilling rig machinery to accomplish the following essential tasks:

* 1. The areas within the Sites of the Works on which the Contractor shall be permitted to do his work, to assemble his equipment and tolls, to erect his stores as well as the rights-of-way for access to the said areas mentioned herein will be provided by the Employer.
  2. The Drilling rig shall be capable of drilling to the specified depths and diameters as per the BoQ and technical specification detailed and carrying out all subsequent operations required in this specification to bring the well to its completion stage.
  3. Unless specified differently the drilling Contractor shall be at liberty to drill the deep wells in the indicated location by any of the following drilling methods:

i) Down the hole (DTH) drilling

ii) Air Rotary/Mud rotary

iii) Combination of any of the above

* 1. The drilling contractor should submit his program of work in a very simplified format. The Contractor shall select the initial diameter of drilling in accordance with the equipment at his disposition and approved by the hydrogeologist / Engineer. Whenever the nature of the geological formation is such that it is necessary to ensure the stability of the Deep well and/or that deposits are likely to fall in and/or be washed into the shallow well then, the Contractor shall line the Deep well to the satisfaction of the engineer with suitable temporary casing. The Contractor shall notify the Engineer in advance of each decrease in diameter of drilling. The following shall apply to drilling with conventional drilling rigs:
     1. The equipment shall be of the proper type and shall be in good condition so that the work can be done without any interruption. Drill collars of sufficient size and length shall be installed to maintain verticality.
     2. Foaming additives and Bentonites can be used in DTH/Mud Rotary drilling method.
     3. The selection, supply and use of drilling additives shall be the sole responsibility of the Contractor. Toxic or dangerous substances that may adversely affect the quality of the water shall not be added to the drilling fluid.
     4. The Contractor shall be responsible for maintaining the quality of the drilling fluid to assure:
* Protection of water bearing formation, and potential aquifer formations exposed in the well,
* Good representative samples of the formation material.
  1. The Contractor shall collect samples at each ***2-meters*** drilling depth intervals and shall measure electrical conductivity (EC) and temperature for the interval specified on the discharged water during drilling.
  2. Casing to be used for the conductor pipe shall be of the specified diameter. The casing pipe may be of the longitudinal screw type. However, different types of casing may be used subject to the Engineer’s approval. Casing to be used for the permanent inner casing and as permanent part of the Deep well shall have the specified diameter. The type and grade of tube shall be in accordance with API Standards. Surface casing may require for about 30m for alleviation of collapse and Boulders/ deposits along drill sites. The casing will be some permanent or some Temporary.
  3. Temporary casings under this specification are defined as temporary units or outer casings, which may be withdrawn when the permanent casing and screen are placed. The temporary outer casings intended for construction purpose only, shall be of such weight and design as necessary to prevent entrance of fine material, to be reasonably watertight, and to permit its installation without distortion or rupture to the specified depth and dimension. Surface casing may require for about 30m for alleviation of collapse and Boulders/ deposits along drill sites. The casing will be some permanent or some Temporary.
  4. Well screens of 8 inches nominal diameter shall be provided for the production well as directed by the Engineer. The length of active screen shall be determined in relation to the thickness of water-bearing strata and according to the driller’s log and electrical log. The screen shall be designed to produce a minimum loss of head or draw down between the water bearing strata, and the well and shall be of a standard manufactured type. The type of screen to be used shall be slotted type. Screen opening as approved by the Engineer shall preferably be V shaped, widening inward to permit fine particles to pass through without clogging during development of the borehole. The total open area of the screens shall be at least 30% of the total pipe area. Engineer’s Approval for the Construction and Completion of Deep well. The Contractor shall present for the Engineer’s approval his proposed material and construction methods for the completion of the well regarding the following subjects:
* Completion of the Deep well by natural development
* Details of the screen including type and technical specification

The Contractor shall construct the well as aforesaid on data and analysis of samples taken from the drilled well and other information obtained during drilling operations and to the Engineer’s satisfaction. In no case should the Contractor undertake the completion of a Deep well prior to obtaining the Hydrogeologist’s approval.

* 1. The annular space between the surface casing and the wall of the drilled hole shall be filled with cement grout. Temporary casings shall be gradually and carefully extracted to expose the screen completely in the water bearing formation. The Contractor may leave the temporary casing in the Deep well above the screen, but no payment will be made for such temporary casing left in the drilled well.
* Verticality and alignment shall be tested by lowering into the housing line below ground surface a section of pipe 13m long or a cylindrical dummy of the same length.
* The outer diameter of the pipe used for this test (the plumb) shall be 12mm smaller than the diameter of that part of the casing or hole being tested, If a dummy is used, it shall consist of a 10 or 13m long galvanized rolled sheet metal.
* If the Contractor fails to correct such faulty alignment or verticality the Hydrogeologist / Engineer may refuse to accept the payment of the drilled well. The engineer may waive the requirements of this paragraph for verticality if, in his judgment.
* The Contractor shall, after completion of the test, prepare and submit to the Hydrogeologist/Engineer a graph showing the verticality and alignment, or deviations there from, for every 3m from ground level up to the bottom of the housing line.
* Sanitary seal. The contractor should provide an effective seal against the entry of contaminants, the upper 3 meters of the annular space between the casing and the borehole wall shall be grouted using cement slurry of 1.85- 2.15 kg cement/liter. Grout shall be injected into the annulus in a single operation so that a complete and continuous seal is achieved, by a method approved by the Supervisor.
* Gravel pack: Suitable gravel pack shall be supplied by the Contractor. Gravel pack should consist of washed, well; rounded particles of a uniform grading of between 2.5 and 4.0 mm, shall comprise 90% siliceous material and must contain no clay, shale, silt, fines, excessive amounts of calcareous material or crushed rock. In terms of grain size, 90% of the gravel pack material shall conform to the grading specified by the Supervisor prior to the commencement of the Works. Prior to delivery, the Contractor shall subject samples of the gravel to a grain size analysis at the Contractors expense and the results submitted together with a sample of the gravel to the Supervisor for approval. The Supervisor shall approve the gravel before its installation. Sufficient gravel pack shall be installed to cover completely the uppermost screen, including an additional 2m length {to allow for settling). Emplacement should be by means of a conductor pipe, and a good supply of water should be introduced with the gravel to prevent "bridging". The tremie {conductor) pipe should be raised gradually as the level of the gravel builds up. The gravel pack should be capped with a clay seal to prevent contamination. The annular space above this seal can be backfilled with inert drill cuttings up to 3 meters below the ground level.
  1. Regarding well development, the Contractor shall furnish all necessary pumps, compressors, and other needed equipment as well as equipment of approved size and type for measuring the water discharge and shall develop the well by such approved methods as shall be necessary to give the maximum yield of water per meter of drawdown and extract from the water-bearing formation the maximum practical yield. After conducting provisional **pumping tes**t, developing process shall start immediately and will be considered as completed when the borehole produces entirely **clear water** to the satisfaction of the Hydrogeologist. The water shall be considered sand free when no samples taken during the pumping test contain more than 5 parts per million of sand size particles by weight. The Engineer may require additional development work aimed to further improve the specific capacity of the well. Testing should not commence until complete development is achieved. Development process shall be carried out in the presence of the Hydrogeologist /Engineer who will issue detailed instructions as the work proceeds. The Contractor shall advise the Hydrogeologist in sufficient time before staring the development of the borehole.
  2. Development by air compressor shall start immediately after well construction is completed and no elapsed time is permitted. The airlift is to proceed systematically, from top to bottom until the discharge will be composed of load free clear water. Changing to further development methods such as the usage of surge plunger, jetty tool and pump development is subject to the Hydrogeologist approval.
  3. After the well has been constructed and developed the Contractor shall notify the Hydrogeologist to that effect and shall make the necessary arrangements for conducting the final pumping tests. Besides these final tests the Hydrogeologist may order the Contractor to carry out such additional tests during and after construction as he may deem necessary. All tests shall be run with similar equipment and in a manner like that hereinafter described. The Contractor shall furnish all labor, materials, equipment, and supplies required and shall operate the pumping unit at such rates of discharge and for such periods of time as required for the execution of the tests.
  4. The following requirements shall apply to step drawdown and step recovery tests:
* Before the test commences, a deep meter, a stopwatch, and graph paper pad and pencil shall be on hand. The deep meter shall be checked by lowering into the casing and a trial measurement shall be performed.
* Once the equipment has been checked, at least three readings of the water level shall be taken during the half hour immediately preceding the test at ten-minute intervals to obtain the trend of the water level. If two of these are identical, it is possible to proceed with the test. If variations occur, the readings must continue for some time until a definite pattern is obtained.
* The test shall cover at least four or five steps:

* During successive steps, the discharge shall be increased when the draw down starts to stabilize. Discharges shall preferably, but not necessarily, be increased in steps of 0.2x Q-max. The Q-max will be known approximately from the pumping development stage and preliminary pumping test. The test shall commence with the lowest envisaged discharge rate.
* Water levels shall be recorded during this time at intervals as follows for each of the steps:



* During this time the discharge rate shall be kept constant and recorded periodically.
* The duration of each step shall be in no case less than 90 minutes, and if necessary, longer, until a stable dynamic water level has been achieved.
* At successive steps, the procedure for recording water levels and rates of discharge shall be repeated. The discharge rates of each subsequent step shall be increased by at least 50% of the preceding step until the maximum discharge is attained.
* A similar procedure shall be followed when a reverse step test is carried out.
* At the start of a reverse step test pumping from the borehole shall be at the maximum discharge and the dynamic water level shall be stable. Discharge and water levels shall be recorded. In the first step, the discharge shall be decreased. The following steps will be in the same pattern as the conventional step drawdown test. The consistency of the arrayed discharge/drawdown readings, i.e. the anticipated rectilinear regression line, is to be checked in the field. Should further development of the well be decided upon, another step-drawdown test shall be carried out at the well after the additional development.
* The following shall apply to drawdown and recovery tests:
* Drawdown and recovery tests shall be carried out in wells after development and the step drawdown tests have been completed. Tests shall commence after a stable water level trend has been ascertained.
* During the drawdown test, the discharge to be determined by the Hydrogeologist (most probably Q-max) will be always constant. The time of its start will be noted by use of a stopwatch. Water levels will be recorded immediately preceding the start, and then at the following intervals of time in minutes after pumping has started.
* The test shall be continued for 48- hours or shall be terminated earlier in case the dynamic water level has stabilized for more than 6 hours.
* At the end of a drawdown test, a recovery test will be carried out. This test is a mirror image of a drawdown test. The time at which recovery commences, is when pumping stops. This time is recorded, and water levels are recorded at the same time interval arrangement as previously noted.
* The Contractor shall furnish and install the necessary pumping equipment consisting of a sufficient number; capable of pumping 4l/s with a head of 100m other approved devices shall be provided so that the discharge may be controlled as required.
* The pump shall be a vertical turbine pump, oil or water lubricated or any other submersible pump type of pump approved by the engineer and shall be in good running condition. The pumping unit shall be complete with prime mover of ample power, controls and appurtenances and shall be capable of being operated for long periods without interruption.
* The pump base shall have a suitable opening for inserting a water level measuring device. The Contractor shall make available at the site during pumping test program, at least two such pumps.
* The Contractor shall also furnish, install, and maintain equipment of approved size and type for measuring the flow of water, such as a weir tank, orifice, or water meter. A regulation valve shall be inserted into the discharge pipe just outside the pump head.
* Submersible pump with all its accessories which can give 1-4 Lit/second with 170m head, but also equipped with stand by pump:
* For Medium Discharge Borehole 2-6 Lit/second with 120m Head.
* For Small Discharge Borehole 0.75-2Lit/second with 120m Head.
* Water quality test will be conducted for physical and bacteriological test during Constant pump test step and physicochemical at laboratory by collecting samples properly for all parameters.
* The results of all tests shall be recorded in the form prescribed by the Engineer and full test reports shall be transmitted to the Hydrogeologist /Engineer’s office within ten days after the completion of the tests.
* The following water analysis shall be carried out both at field & central level:
* Temperature
* PH
* Electrical Conductivity (EC)
* Chemical water quality test at central water laboratory.
  1. All reports pertaining to drilling operation should be reported, such as:
* Daily drilling report,
* Working record and samples
* Identification and lithology formations
* Records of water level
* Records of casing and screen pipes.
* Records of verticality and alignment
* Records of pumping tests.
* Records of water physical and chemical analysis
* Well capping & proper well head construction.
* Well completion reports and cleaning the surrounding. On completion of the borehole, the site must be left clean and free from all debris, hydrocarbons and waste, and all pits filled to the satisfaction of the Supervisor.
* Sealing of abandoned well.

1. Tender application & selection process

The bid is open to all drilling contractors of category WC. Class six and above with renewed license valid for the 2016 E.C Year; registration card issued from the Ministry of Water and Energy, VAT registration certificate and Tax Identification Number (TIN).

For the award of this project, UNHCR has established evaluation criteria which govern the selection of offers received. Evaluation is made on a technical and financial basis. The percentage assigned to each component is determined in advance as follows. The Technical offer will be evaluated using inter alia the following criteria and percentage distribution: [70] % from the total score. A pass mark of 50/70 points and above will be required to pass the technical evaluation.

1. Team composition

The Contractor will maintain a full crew. The drilling crew/ rig operators should be composed of 7 to 8 experienced operators led by a chief driller and a senior hydrogeologist to oversee the drilling and testing to be carried out under this Contract. All safety precautions should be adhered while operating the rig machine and incase of any damage caused on working crew, the contractor will be fully responsible for any medical support and insurance related issue.

1. Time Frame

The time frame given for site handover, early mobilization of equipment , personnel and drilling accessories and time for drilling and well completion report is 35 days.

1. Reporting

All required reports should be done by the contractor.

***Detailed Technical Evaluation Matrix***

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| **Sr.No** | **REQUIREMENT** | **DESCRIPTION** | **SCORE** |
| 1 | Statutory Documents | • Certificate of incorporation – **5 Points** (1 = 5points, 0 = 0points)  • TIN certificate – **5 Points:**  (1 = 5points, 0 = 0points)  • VAT Certificate– **5 Points:**  (1 = 5points, 0 = 0points)  • Grade 5 and above General contractor.  Company registration by Ministry of water works - **5 Points.**  (1 = 5points, 0 = 0points) | 20 |
| 2 | Delivery Capacity/ Past performance | * Drilling company’s experience in water well drilling in Ethiopia, particularly in Assosa area. Provide previous project samples. – **10 Points** (5 projects or more **=** 10 points, 2 – 4 projects = 5, 1project = 2.5, 0 projects = 0) * Timeliness of delivery, provide project completion certificates for past projects – **5 Points** – (2 or more certificates = 5, 1 = 2.5, 0 = 0) * Working experience with UNHCR or international organizations - **5 Points** (2 or more organizations = 5points, 1 = 2.5, 0 = 0) | 20 |
| 3 | Technical qualification | * Compliance to the terms of reference/specification of the proposed services. Ability to complete the project within the specified time. **10 Points** (Yes = **10**, No = **0**) * Qualification of technical personnel/ drilling crew (CV) - **10 Points** (7 or more = 10, 5 = 5, less than 5 operators =1) * Proof of ownership of drilling rig machine; compressor mounted on or trailed by a truck; test pumps; driving genset and any other ancillaries related to the work. – **10 Points** (3 or more equipment = 10, 2 = 5, 1 = 1, 0 = 0) | 30 |
| **Total Score** | | | **70** |

**Minimum Technical score required to proceed to Financial evaluation: 50/70.**