

TECHNICAL SPECIFICATION FOR DRILLING OF DEEP TUBEWELL IN LAHAN MUNICIPALITY

1. General

1.1. Requirement, Specifications, Standards and Brand Names

The contractor shall fulfil all requirements and obligations under all Clauses of the specifications applicable to the construction work involved in the contract. Neither the following clauses of this specification, the detailed description therein, nor the quantities shall limit the obligations of the contractor under the accompanying conditions of contract.

Where items are not included in Bill of Quantities for any such requirements or obligations, the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bill of Quantities.

All the standards mentioned herein shall be deemed to form a part of this specification. All references to such standards shall be to the latest edition or revision thereof unless otherwise stated. Where a specific standard is referred to in this specification, another standard will be acceptable provided that it ensures an equal or higher quality of materials and workmanship than the standards referred to. If the contractor intends to use such alternative standards, S/he shall notify the Project thereof, submitting with the notice two copies of the proposed standard, and shall not alter any material or perform any work unless and until S/he has obtained the Project's approval of such standard.

Brands name where used in the specification is only intended to define a standard of quality and performance and the contractor may use other equivalent products approved by the Project.

2. Tubewell Construction

2.1. General

- The contractor must be equipped with his own drilling rig, air compressor, pump and their accessories. The contractor must produce letter of experience for tubewell construction and ownership of the said equipment.

- The method of drilling should be Direct Rotary or Reverse Rotary. It is up to the contractor to choose the suitable drilling method based on the type of equipment available with them and drilling condition. However, the choice of drilling method should commensurate with the time of completion of the work as per the contract.
- The Annexes (Annexes A, B, C and D) Should be filled up by the contractors hydrogeologist or representatives prepared by implementing agencies.
- After consulting and negotiating with the concerning agency, the Water Aid Nepal/ NWSC Lahan Branch shall make available the required land for construction of the tubewell.
- The contractor shall make his/her own camping arrangement and find necessary access to the construction site. After completion of work the area shall be cleaned by the contractor of all unnecessary materials used during construction period.
- The contractor shall necessarily mobilise required number of suitable drilling rigs and accessories and equipment along with concerned man power to ensure timely completion of the said work.
- The 24-inch diameter Guide pipe should be installed upto the depth of 6 m below ground level (bgl) before the drilling of pilot hole start.
- The contractor shall necessarily maintain the record of the strata encountered during the course of drilling (The format will be provided). The lithological samples each of 0.5 kg at an interval of 1.0 m. or at the change of strata are collected in plastic bags. These samples should be submitted to the NWSC Lahan's representative at the earliest possible along with lithological log records.

Different strata are defined as follows:

<i>Soft Strata:</i>	<i>Strata made of loose clay, silt, sand and fine gravel</i>
<i>Medium Strata:</i>	<i>Strata made of medium-coarse gravel, siltstone & sticky clay</i>
<i>Hard Strata:</i>	<i>Strata made of pebble, cobble and boulder; and bed rock</i>

On the basis of the maximum thickness of strata found in the area (in existing Tube well) the cost estimate has been prepared. It has also considered the thin strata which will be encountered during drilling. The design of the tubewell will be prepared by the contractor's hydrogeologist after the discussion with concerning agencies. The final design will be provided to the contractor for the lowering of assembly.

- After completion of drilling of pilot hole, the contractor shall carry out electrical resistivity/self potential logging through his/her Geologist/Geophysicist both down and up in the borehole in the presence of the Hydro Geologist/Engineer of the consulting firm using an appropriate electric logging machine. The Contractor will prepare a report of the geological and electrical logging duly signed by the contractor's Hydro geologist/Engineer.
- Based on the driller's log and borehole logging results the contractor shall submit his/her detailed proposed design of the tube well assembly. S/he and considers most suitable design to be installed. The Hydro geologist /Engineer of the consulting firm will review the contractor's proposal and will provide the contractor a written approval for the well assembly.
- The pilot hole and the electric logging report will be the basis for the final depth of drilling. The Hydro geologist/Engineer will instruct the contractor on the final depth of reaming the pilot hole to larger diameter as mentioned in the BOQ.
- The tube well assembly shall be installed in the borehole using centralizers (with the instruction of Hydro geologist/Engineer)
- Verticality of the bore hole must be checked after the drilling of pilot hole and then while lowering the approved well design using centralizers at a maximum of 12 m. spacing (or instructed by site in-charge), however no centralizers would be used in the screen portion. The number of centralizers in each set should be three. In no case, the axis of the well assembly should not deviate more than 10mm. in 40m from an imaginary plumb line.

2.2. Tube well Assembly

Immediately after drilling, reaming and reconditioning the borehole to the specified diameter and depth, the contractor shall make necessary arrangement for lowering the well assembly in accordance with the design approved. The typical well design of well is shown in Annex.

All the construction materials with pipes and strainers (screen) required during the process of construction of tubewell should be provided by the NWSC Lahan.

The housing pipe shall project a distance of 300 - 500 mm above the ground level during installation depending on the site condition. The top of the housing pipe shall have a flange welded on to which a blank flange shall bolt on at all time when the well is not attended by the Contractor. The casing pipes shall be joined by means of airtight welding of rings and iron plates

The casing pipes and strainers (screen) shall be joined by means of airtight welding. After installation a verticality test must be carried out and the limit shall be 10mm. in 40m.

2.3. Gravel Packing

Immediate after lowering the well assembly into final position, the contractor shall fill the annular space between the well assembly and the wall of the bore hole with pea gravel (2-4 mm) in presence of the technical representative of the consulting agencies. To prevent bridging and reduce the possibility of damage to the tubewell assembly by sudden collapse of bridged gravel pack washing should be carried out during the gravel packing.

The gravel packing process should be continuous until the entire annular space 6m below (Guide pipe level) ground level is filled with the gravel, and then clean water should be pumped in through the casing to remove drilling mud.

Tube well sounding must be carried out to ensure well clearance as well as its verticality.

2.4. Well Development

After the lowering of tubewell assembly and gravel packing, the well shall be developed by the contractor using the combination of the following four methods. The Tubewell shall be developed by Back washing, Jetting, Surging and Air lifts pumping (By Compressor) or bailing for 48 hours continuously and developed by the Pumping (over pumping) for 48 hours continuously.

1. Back washing
2. Jetting and Surging
3. Air lifts pumping (By compressor)/ Bailing
4. Well Development by Pumping (Over pumping)

Airlifting should be done by lowering small diameter conductor pipe up to required depth as per consultants' instruction. *The Completion of the well development shall be certified by the consultant only when the water becomes clear and contains less than 50 (Fifty) PPM of silt or sand particles.*

2.5. Pumping Test

Following the satisfactory completion of well development, the contractor shall carry out step and continuous draw down test and recovery tests for 48 hour (24 hour for Continuous and 24 for step drawdown pumping test) continuously pumping by using a suitable pump. The whole pumping method including development and test should be carried out as directed by the

consultant and concern agencies representative. The whole pumping test should necessarily be conducted in presence and close co-ordination with concerned representative.

The steps of the pumping will be decided after the development of tubewell by pump. The number of steps will be decided by the consultant in step draw down test.

The pumping test shall be carried out in the presence of an authorized representative(s). The contractor shall carefully and accurately record simultaneous reading of water level, time since commencement of pumping and flow intervals of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 80 and 100 minutes and continue at 30-minute interval till the level stabilizes itself. The discharge of the well should be measured in every 60 minutes of pumping during continuous pumping test using flow meter or V-notch or both.

On completion of test, the contractor shall stop pumping and immediately start the recording the simultaneous readings of water levels in the well and the time since cessation of pumping, at the same time intervals of the pumping test, until the static water level recovered its original position.

The step drawdown test and the constant pump test will be carried out as instructed by the consultants' Hydro geologist and discharges shall be measured and recorded by the contractor using standard discharge measuring equipment (Flow Meter) approved by the consultant and implementing agencies.

All test results shall be handed over to the NWSC and WAN.

2.6. Sealing of Bore Hole

After gravel packing the space between the borehole and the housing pipe up to 6 m. 3 m with clay packing and upper 3m shall be sealed with approved concrete mix made with fine aggregate of maximum size 10 mm. or with cement slurry.

The Contractor shall submit his/her proposals for sealing the well for approval by the Hydro Geologist/Engineer of **implementing agencies**. Well sealing shall be carried out in the presence of the Hydro Geologist/Engineer.

2.7. Report

After completion of tube well drilling, development and pumping test works, the contractor shall prepare comprehensive report and submit to the client. The report shall contain but not limited to progress of drilling, lithologs, electrical logging records, well design, well development history and pumping test data and its interpretation with photographs together with water quality.