Drilling and Commissioning of Two (2) x solar powered boreholes in the Limpopo

TECHNICAL SPECIFICATIONS

Phase 1: Water Survey

Specifications Item	**Specifications Details**
Site establishment	Initial preparation of a construction site for borehole drilling
Borehole sitting and geophysical surveys by Geohydrologists ((Use Advanced Electronics Survey Machines)	The survey report must be a detailed analysis of the groundwater potential, and the following must be reflected in the survey report: • **location** of the site to be drilled through the use of Geohydrologist expertise, geological and hydrogeological maps, and advanced geophysical instrumentation • **The correct drilling method/rig** • **Drilling depth/target** The hydro-geological report must be signed off by a professional Certified Natural Scientist that is registered with **SACNASP** Note: **Survey report** to be handed to ARC Personnel. The survey report must include the instruments and methods used. No drilling work will be conducted without a professional survey report. **If the geohydrologists reports no ground water availability in the farm, then no borehole water drilling work will continue. The service provider will be paid for only survey work.**

Phase 2: Borehole Drilling, Casing and Capping

Borehole drilling	150m borehole (165mm diameter) Drilling work to be conducted according to SANS 10299-: 2003 – Development, Maintenance and Management of Groundwater Resources

Casing	**<u>12m steel casing: Casing 177mm x 3mm,</u> Steel casings must be welded together one by one while lowering them down the borehole**
Concrete collar around a borehole	The Drilling Contractor will construct a **shallow circular concrete collar** around a successfully completed borehole. This collar shall have the dimensions set out in the attached Drawing, yielding a volume approaching 0.08 m^3. **The concrete mixture shall consist of water, Portland cement, stone aggregate (10 mm),** and river sand. Quantities of these materials sufficient to make 0.1 m^3 of concrete with the required strength of 30 MPa after 28 days are: (1) 20 litre of water, (2) 42 kg (0.8 bag) of Portland cement, (3) 0.07 m^3 of stone aggregate and (4) 0.07 m^3 of river sand
Cap	The drilling contractor must put a **borehole cap** to prevent any foreign material from entering the borehole
Drilling Machine Requirements	The equipment must be of a suitable size and capacity to deal, on occasion, with: • Deep boreholes (up to 200 m) • Larger than average borehole diameters (up to 254 mm) • Large quantities of groundwater and • Potentially onerous drilling conditions
Borehole drilling report	A driller's log gives details of the construction of the borehole. As a minimum the report must include **Borehole depths and diameters, Casing depths and diameters, Water level, and so on.** A full borehole drilling report must be handed to ARC personnel.
Unsuccessful Borehole	A borehole will be declared unsuccessful at the discretion of the Hydrogeological Consultant who is supervising the borehole drilling. At any time during the course of the work, The Hydrogeological Consultant can order the abandonment of a borehole in progress. When such an unfortunate incidence occurs, ARC will cover only the costs of work done as determined in the bill of quantities (Total costs will be recalculated according to costs per item, e.g. costs per meter of casing/drilling).

If soil formation needs less Steel casing, costs must be adjusted accordingly. If soil formation requires more Steel casing, costs can be adjusted to use the contingency amount.

Similarly, cost adjustments must apply if sufficient water is found at less than 150 m or at more than 150 m.

Screening (Steel type can be put under contingency amount should a need arise).
Phase 3: Borehole Yield and Water Tests

24-Hour Borehole Yield Tests-Sustainable yield	Step draw-down and constant discharge tests, and water level recovery tests Determine correct **sustainable yield** according to the South African National Standard for Water Borehole Test Pumping (SANS 10299-4:2003) The borehole yield test serves as a certificate of compliance and as proof that the borehole installation meets the SANS 10299-4:2003 specifications, **thus a <u>Borehole Yield Tests Certificate must be issued</u>**
Water tests-Chemical and microbial analysis	Tests must be according to the SANS 241-1: 2015 standards. Test report must be supplied with the conclusion **1. Drinking Water Tests** SANS241 Chemistry + Microbiology Testing (Tests to be conducted at SANAS Accredited Laboratory). EC, pH, SAR, Langelier, Ryznar, Turbidity, Colour, Odour, TDS, TSS, Free CI, F, CI, SO_4, NH4-N, NO3-N, NO2-N, Acidity, Alkalinity, Ca, Mg, Na, K, Mn, Fe, Al, HPC Heterotrophic Plate Count, Total coliforms, Faecal Coliforms **2. Irrigation Water Tests** Chemistry & Microbiology Testing (SANS241 Accredited Laboratory) EC, pH, COD, SAR, Langelier, Ryznar, TSS, F, CI, SO4, NH4-N, NO3-N, NO2-N, Alkalinity, CO3, HCO3, Ca, Mg, Na, K, B, Mn, Fe, P, Faecal coliforms, TDS

Water Distribution System

- Supply, deliver and installation of **1 x 10000L JoJo tanks or equivalent**, **with 1 X 1.5m tank stand,** (Supply all pipe network and accessories to the borehole outlet pipe), construct a robust concrete plinth/foundation to support the 1 x steel stand

(The steel stand must be covered with **two layers of paint, one made with a rust-proof paint and the other made with a thick paint finish or galvanized)**

- The work should include **trenching** for pipes leading to the tank, and all the **couplings** must be fitted and buried together with the pipes
- **Fit a valve to the bottom of the tank**
- **The tank and steel stand are to be installed within 25 m of the borehole and solar PV system**
- **4 x100m rolls, 32mm pipe (Class 16) (Pipe may be 40/50mm, depending on pipe outlet discharge diameter.**

Drawing: Concrete collar around a borehole

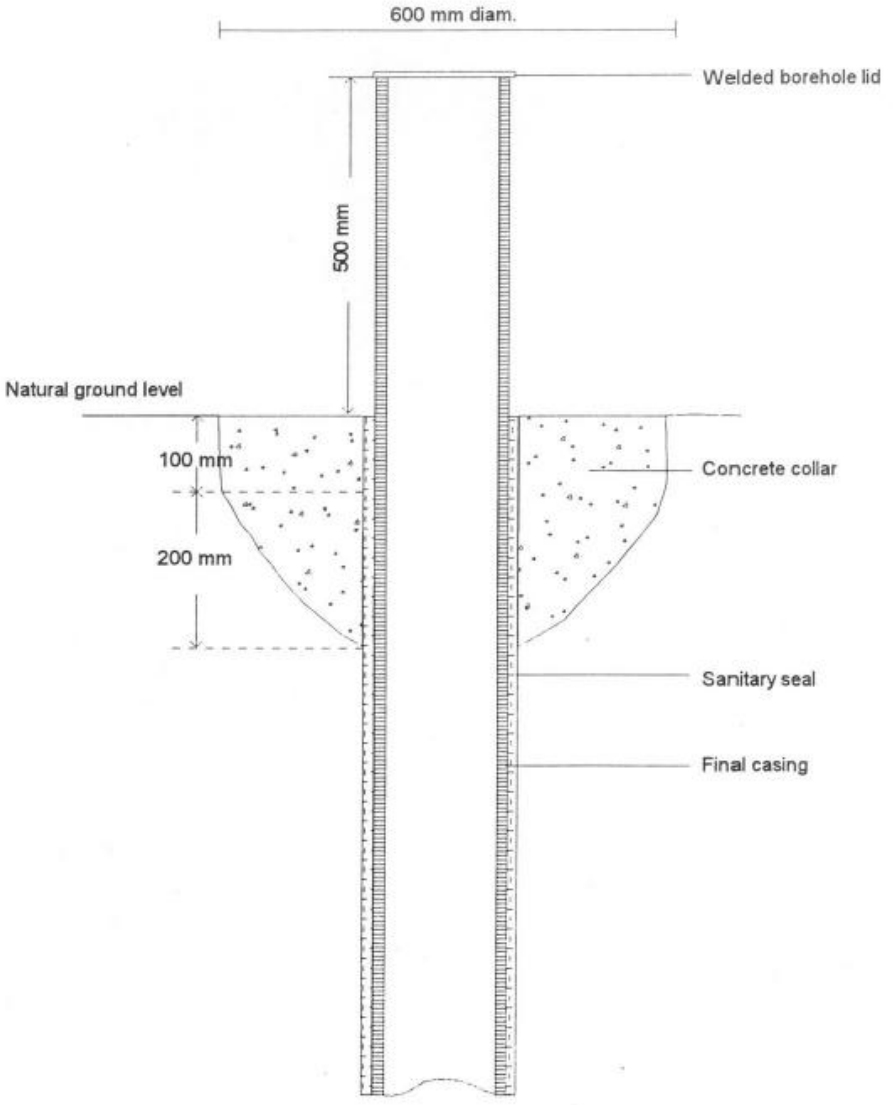

Figure 1 Concrete Collar Dimensions

Phase 4: Renewable Energy-Solar PV installations

Solar System

Specifications Item	Specifications Details
Monocrystalline Solar modules (3.33kW) **(555W x 6 solar modules)**	Monocrystalline solar modules aligned to face True North Employ the services of a Geomatics Professional (GPr) or Geomatics Technologist (GTg) Optimum tilt angle must be from 20 to 35 degrees **Brands:** Solar modules: Jinko Solar, Canadian Solar, JA solar, RenewSys, Trinasolar , SunPro, Risen ,Haitai Solar, Astroenergy or **Equivalent**
2.2 kW Centrifugal Solar borehole pump and a 2.2kW Solar pump controller with a Built-in MPPT (Maximum Power Point Tracking) technology) **Pump pressure head = 243m** **Flow = 4m^3 /hour**	Water pumping at specified depth (Depth as per drilling contractor advice) Use pump data sheets to select the correct pump that fit the required flow and pressure drop
Level sensor for the submersible pump (to be installed in the borehole)	**Dry-run protection**
Float level switches	Installed in the 10000-litre tank for controlling the pump and the level of water in the tank
Protection cabinet	• Protect equipment from overload (use fuses) • Switch off the installation to perform maintenance via a main switch ON / OFF(Isolator switch) • Protect the installation from lightning strikes and surges (surge arresters - SPD) • **Create a central point of grounding**
Grounding	Equipment and System Grounding **Equipment Grounding:** Connect the solar module frame, solar array mounting structure (Steel support structure), enclosures, metal frames and conduits of the system to a grounding electrode (metal rod or plate buried in the soil).

	System Grounding: Connects the current-carrying conductors/electrical components of the system, to negative/ the neutral, to the grounding electrode. Please refer to **Table below** for sizes of grounding wires
Enclosures	All enclosure must have suitable protection against outdoor conditions such as rain.
Mounting Structure	Solar modules will be mounted on poles (use steel structure, painted, minimum of 4 poles), The steel structure stand for solar modules must be covered with **two layers of paint,** one made with a rust-proof paint and the other made with a thick paint finish or galvanized. **Mount structure height=3.5m** **The structure must be structurally strong to withstand winds**
Supply all cables	Red and black solar cables, pump power supply cable-submersible wire **(10mm^2, 4 core),** grounding wires and other related cables
Sundries	All accessories: Supply all sundries items such as earth spike, clamps, MC4 connectors and so on.

Equipment to be grounded	**Size and type of wire to connect To the ground rod**
Solar modules	Same size as solar panels cables
Solar modules support / stand and metallic frames	16 mm² / Insulated
Lightning arrestor inside the protection cabinet	16 mm² / Insulated
Metal frame of pump controller	16 mm² / Insulated
Pump controller	Same size as power supply cables
Submersible pump	Same size as power supply cables

Lightning Protection and Earthing for Solar PV

Apply measures to prevent catastrophic damage and failure of the installed PV system due to lightning. South Africa is in a highly lightning-dense region when compared to the rest of the world. Therefore, lightning strikes can still pose a risk to any electrical system, including solar panels, so **installing lightning protection specific to the installed solar PV system.** Proper grounding, surge protection, and adherence to safety guidelines are crucial to minimizing the potential damage caused by lightning strikes. Grounding involves connecting solar panels and other electrical components to the Earth's surface, creating a path for electrical currents to safely dissipate into the ground. **Use earthing, electrical configurations, and protection products based on standard compliance and protection**.

Note: Only electrical contractor will be allowed to work on electrical installation, thus a registered qualified electrician, either **Installation Electrician (IE)** or a **Master Installation Electrician (MIE)** will be required to submit his/her registration certificate from the Department of Labour to ARC before electrical work commences. IE or NIE must issue a **COC** when electrical work is completed. The **IE or NIE who will be signing off the electrical CoC must be in control on site. He must carry out or supervises the work effectively.**

Further note that a **licenced Single-Phase Tester (SPT)** cannot work with DC and will therefore not sign off on DC installations, which would include PV and any three-phase installations. Therefore, a person with SPT qualification cannot issue a Certificate of Compliance for solar installations.

Fencing-Supply and Installation of Security Fencing around the Borehole and Solar System for one of the 2 sites: Fencing perimeter per site=24m.

Fencing Materials	• 3000mm x 1800mm steel palisade panels • Palisade Fencing Pale 30mm x 30mm x 2mm/40mm x 40mm x 3mm • Steel posts (square tubing):76mm x 76mm x 2 mm with 2.4m height (Includes concrete mix), Dig 600mm deep for erecting steel posts(Hole Dimensions: 600mm X 300mm X 300mm) • 1800mm x 1000m mm Steel pedestrian gate, hinges and locks • Two layers of paints
Installation	Installation of posts, fencing and paint work

Product Compliance

Solar PV modules must have a Certificate of Compliance with the SANS/ IEC standards. Therefore, the solar modules must conform with the following:

- IEC61215(2016), IEC61730(2016)
- ISO9001:2015: Quality Management System
- ISO14001:2015: Environment Management System
- ISO45001:2018
- Occupational health and safety management systems

The above IEC standards must be reflected in the solar modules data sheets.

All other solar powered system components must comply with IEC/SABS standards, and proof/certificates of compliance will be required for quality assurance.

System Commissioning

Commissioning which includes documentation, inspection, and testing should be carried out in accordance with applicable codes of practice and regulations. **Commissioning documentation should include single line diagram, individual component documentation, an O&M manual, and equipment warranty information**. **Warranties against defective components or poor workmanship must be submitted. Under the defects period, any items that fail, and are not installed to standard, or are damaged, must be corrected on site at cost to the contractor/supplier/installer.**

Electrical Installation must be done by a qualified electrical wireman with a valid registration with the Department of Labour. A valid electrical certificate of compliance must be issued once installed, specific to the installation of the solar system. The installation must comply with all warranty claim processes specific to each brand of equipment.

The service provider must submit warranty certificates as guided by the following table:
Warranties Periods:

Component	Warranty Period
Solar modules	12 Year product warranty 25 Years linear power performance Warranty
Pump/motor	Minimum of 1 years
MPPT solar pump controller	Minimum of 1 years
Remaining components	Minimum of 1 year
Workmanship warranty/guarantee for all installations	1 Year
Structural: Solar module structural support	5 years

Contingency Provision
A **contingency amount equal to 10%** of the quoted price must be included. This reserve will be held by the Agricultural Research Council (ARC) to address any unforeseen circumstances. The use of this amount will be subject to prior written agreement between ARC and the appointed Contractor/Service Provider.

Compulsory Requirements

CIDB Grading
Bidders must be registered with the Construction Industry Development Board (CIDB) and hold a minimum grading of **2CE or higher**.

Relevant Experience
Service providers must demonstrate proven experience in similar work**. A minimum of three reference letters** must be submitted, each confirming completion of projects of similar size and scope. These letters must include traceable contact details. The projects should specifically relate to borehole drilling and commissioning or bulk water infrastructure **installation.**

A letter which covers both Warranty and workmanship guarantees must be submitted together with all the bidding documents. The letter must be written in Company's letterhead.

Data sheets for (1) solar modules, (2) solar pump controller and (3) submersible pump must be submitted together with all the bidding documents. Solar modules must comply with SANS/IEC standards.

Compulsory Site Briefings
Attendance of a site briefings is **mandatory** for all prospective bidders.

Site Briefing:
Location: Mokopane, Limpopo

Coordinates: 24°00'23.8"S 28°57'42.6"E

The drilling locations (sites)

Province	**Site Locations**	**No. of boreholes**
Limpopo	Total area: 4,309.50 m² ha of land, Ramokone Vency Magongwa Farm 24°00'23.8"S 28°57'42.6"E 17.5ha of land, Maijane Rachuene Agriculture 24°20'13.7"S 29°39'54.2"E	**2**