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# REPORT ON BOREHOLE TEST PUMPING

**CLIENT: SIKAWA SECONDARY SCHOOL**
**BOREHOLE NAME & LOCATION: KILGORIS**

**Testing Contractor: BETTERLINE WATER LIMITED**

Compiled by

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**Dated: 11TH OCTOBER, 2024**

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## GLOSSARY OF TERMS

**Aquifer**: A geological formation or structure, which stores and transmits water and which is able to supply water to wells, boreholes or springs to satisfy a particular water demand.

**Aquifer characteristics:** Ability of the aquifer to store and transmit ground water

**Confined aquifer:** Are those aquifers in which the piezometric level is higher than the elevation at which the aquifer was encountered. Static water levels are higher than the top of the formations.

**Drawdown:** The distance between the static water level and the pumped water level.

**Hydro geological:** Those factors that deal with subsurface water and related geological aspects of surface water

**Pumping Water Level**: The level at which water stands in a well when pumping is in progress, this is also called the dynamic water level when measured as measured in the well.

**Recharge:** General term applied to the passage of water from surface or subsurface sources (e.g. rivers, rainfall, and lateral ground water flow) to the aquifer zones.

**Recovery:** Return to static water level following abstraction of groundwater.

**Residual Drawdown:** During water level recovery, the distance between pumped water level and the static water level.

**Semi-confined aquifer:** An aquifer partially confined by soil layers of low permeability through which recharge and discharge can still occur.

**Specific Capacity:** RatioS of pumping rate and drawdown ($m^3/hr/m$), a measure of the well performance.

**Static Water Level:** The level of water in a well that is not affected by abstraction of ground water.

**Test Pumping:** A test that is conducted to determine aquifer or well characteristics.

**Transmissivity:** A measure of the aquifer characteristics to conduct water through its saturated thickness ($m^2/day$)

**Well Yield:** Is the volume of water per unit of time discharged as litres or cubic metres from a well either by pumping or free flow.

**Yield:** Volume of water discharge from a well, usually in $m^3/hr$

## INTRODUCTION

Getting an adequate supply of safe clean water has a great deal of advantages from ensuring availability of enough quantities by the client for various domestic processes, reducing health risks associated with insufficient water in the upcoming projects, to provision of reliable water.

Taking these into account, the client needing to know the quantity of production from his borehole contracted Test Pumping Unit to carry out a Test Pumping procedure, this is the report.

## OBJECTIVES

1. To establish the borehole's potential by estimating the sustainable yield and hydraulic performance for water supply.
2. To collect a water sample for submission to a reputable laboratory for quality analysis.

## CONCEPT

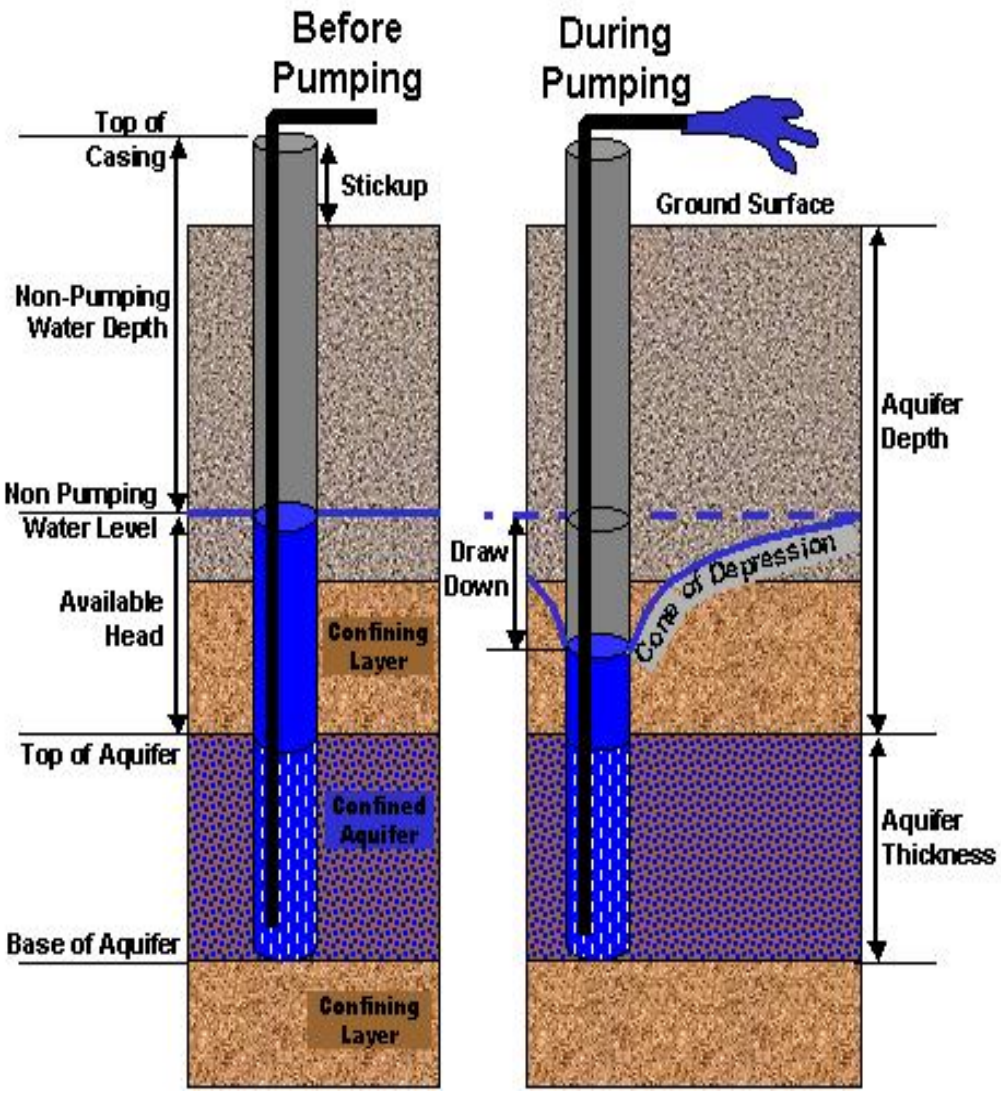
The test pumping consists of pumping the borehole at variable rates and recording the water level (and therefore the drawdown) in the pumping well, the Recovery rate is thereafter recorded with the pump now switched off.

### Discharge Measurement and Recovery Measurements

Discharge measurement was done by an approved volumetric method. A calibrated container of 20litres capacity when full was used. When time to fill measurement is made, each discharge measurement is calculated from the average of three-time measurements. Discharge varies by no more than 15% across the constant discharge test. A globe valve was used to control the discharge as the case demanded. **See Discharge Drawdown Test data sheet.**

The recovery test is very useful in qualitatively assessing the pumping effect and possible dewatering of aquifers that may result due to the limited extent of an aquifer. Furthermore, the recovery test will indicate the level to which the aquifer is actually dewatered by measuring the residual drawdown after the borehole is allowed to recover.

## PROCEDURE
## TEST PUMPING CALIBRATION




### Continuous Rate Test (CRT) for 24 Hours
**7TH and 8TH OCTOBER 2024**

The team lowered a **Submersible pump SP 3-60Pump** and **1 1/2''** inches GI pipes down to **156m**. The pump was powered by a generator 40KVA. The Static Water Level was measured at **8.68m** before starting the test.

**18:25:00 hours:** Commenced testing. An average flow of **2.4m³/hr**. was recorded during the test with the gate valve fully opened as was with respect to flow.

## Recovery Test Measurements (RTM) After 24 Hours

**4th OCTOBER 2024**

**18:25:00 hours:** The RTM began immediately after the CRT, when the pump was switched off. A total of **99.63%** recovery coefficient was recorded during the **240mins** recovery test measurement. This resulted into **0.64m** residual drawdown. **See annexed Recovery data sheet**.

The test unit was pulled out thereafter.

## RESULTS AND ANALYSIS

### Specific Yield/Specific Capacity (24 Hours)

A borehole Specific Capacity (an estimate of borehole transmissibility) is calculated as yield per meter of drawdown.

Using (**Driscoll, 1986**) formula

Specific capacity S = Q/s

=discharge per hour ($m^3$/hr)/ maximum drawdown (m)

= (2.4/173.38.)

=**0.013842427$m^3$/hr/m**

*Table 1: Summary of bore hole and test data results*

| **DETAILS/LOCATION** | **TRANSMARA BOREHOLE** |
|---|---|
| Date drilled | Refer to drilling records |
| Measured depth | 200m |
| Water Struck Levels | Refer to drilling records |
| Date of Test | 7th to 8th October, 2024 |
| Static Water Level (SWL) | 8.68m |
| Pump Intake Depth | 156m |
| Pumping Water Level (PWL) | 182m |
| Drawdown | 173.38m |
| Average tested Well Yield | 2.4$m^3$/hr. |
| Duration of Test Pumping | 24 Hours |
| Recovery Time | 240mins |
| Recovery Coefficient | 99.63% |
| Residual Drawdown | 0.64m |
| Specific Capacity | **0.013842427 $m^3$/hr/m** |
| Transmissivity | **0.405306263 $m^2$/day** |
| ***Maximum safe design yield (Considering 70% of the average yield)*** | ***1.68$m^3$/hr.*** |

## Aquifer Transmissivity (T)

It is a measure of the aquifer characteristics to conduct water through its saturated thickness

By using (**Logan, 1964)** formula,

Transmissivity, T= 1.22 Q/s expressed in $m^2$/day: 1.22 is a constant,

Q is discharge per day and S is drawdown

=1.22 X (2.4X 24)/173.38

=**0.405306263 $m^2$/day**

## Analysis of Ground Water Potential

With a Specific Capacity of **0.013842427$m^3$/hr/m**, an aquifer Transmissivity of **0.405306263$m^2$/day** and a recovery coefficient of **99.63%,** it is conclusive that the borehole is of a excellent recharge potential and is fed mainly from unconfined aquifers. The drilled well depth is assumed to have fully explored all the available upper aquifers in this geological set up.

# CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSIONS

1. With a Specific Capacity of **0.013842427$m^3$/hr/m,** and an aquifer Transmissivity of **0.405306263$m^2$/day,** the borehole is of a excellent recharge potential.
2. The drilled depth in this hydro geological setup is assumed to have fully explored all the available upper aquifers in this geological setup.
3. The average tested well yield was **1.68$m^3$/hr.**

## RECOMMENDATIONS

The following recommendations are made

1. The Design Yield considering a **173.38m** drop from the SWL during abstraction should be a maximum of **1.68$m^3$/hr.**
2. Abstraction should not exceed 10 hours a day, since over pumping would lead to the aquifer depletion.
3. The drop pipes used for lowering the pump into position should be of either class B GI or UPVC pipes with sufficient tensile strength to withstand the stresses and vibrations associated with pumping water