Groundwater Potentials Assessment of Langtang Area Plateau State, North Central Nigeria.

By

Habila Alfred Zingchang

NATIONAL WATER RESOURCES INSTITUTE
Water – Rock interaction is among the leading mechanisms responsible for groundwater chemistry (better known as hydro-geochemistry).

The subsurface geology and materials making up the aquifer are important parameters in determining the characteristics of an aquifer and the value of an aquifer as a spring of water depends largely on two inherent potentials: the capacity to retain (Storativity) and transmit water (Transmissibility).
INTRODUCTION cont’d
Statistics from inventory of water points in Langtang area shows that most wells and boreholes dry up completely or provide little water for domestic uses during the peak of dry season.

Ground water development in basement complex terrain therefore needs proper knowledge and understanding of the aquifer characteristics to enable the Hydrogeologists with the right tools.

There is visible evidence of dental fluorosis in the inhabitants of the study area, hence the need to carry out water quality assessment to define the sources of contamination of the groundwater.
MATERIALS AND METHODS

• Mapping
  • GPS Device
  • Topographic base map
  • Lineament map of the study area

• Sampling Kits
  • Water sample bottles
  • Sample bags
  • pipet
  • conc. HCl

• Record
  • Field notebooks,
  • Water-proof marker pens

• Tools & Instruments
  • Geological Hammer
  • pH meter
  • Electrical conductivity and TDS meter,
  • Thermometer, measuring tape
Pumping Test data for 25 boreholes was collated and analysed for hydraulic properties such as; Yield (Q), Transmissivity (T), Hydraulic Conductivity (K), Storativity (S), Specific capacity ($S_c$), and Static Water Levels (SWL).

The Cooper-Jacob’s non-uniform straight line equation was adopted

\[
T = \left[\frac{(2.30Q)}{(4\pi\Delta S)}\right] \times \log_{10}\left(\frac{t_2}{t_1}\right)
\]

\[
S = 2.25 \frac{Tt_0}{r^2}
\]

\[
K = \frac{T}{B}
\]

**T= Transmissivity; B= Aquifer thickness**
### RESULTS AND DISCUSSIONS

<table>
<thead>
<tr>
<th>Aquifer Hydraulic Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (m$^3$/d)</td>
<td>50 – 555</td>
</tr>
<tr>
<td>Transmissivity (m$^2$/d)</td>
<td>0.89 – 14.5</td>
</tr>
<tr>
<td>Storagivity, S</td>
<td>0.02 – 4.94</td>
</tr>
<tr>
<td>Specific Capacity, $S_c$ (m$^2$/d)</td>
<td>4.86 – 57.14</td>
</tr>
<tr>
<td>Hydraulic Conductivity, K (m/d)</td>
<td>0.3 – 2.43</td>
</tr>
<tr>
<td>Static Water Level, SWL (m)</td>
<td>2 – 15.42</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSIONS cont’d

60% Ca-Mg-HCO₃

37% Na-HCO₃

Ground water

3% Ca-Mg-SO₄

Piper Diagram
CONCLUSION

- The determined hydraulic characteristics are useful tools for groundwater prospecting in the study area.
- The groundwater potential is classified into five zones: very low, low, moderate, high and very high potential zones, while the yield of the aquifers falls within low to moderate class.
- The water quality results show high levels of fluoride above the WHO limits of (0.5-1.5 mg/L).
Fluoride concentrations of 3.47 mg/l in some parts of the study area is a source of public health concern as the value is above the WHO upper limits of 1.5 mg/l. Hence it is necessary to treat both surface and groundwater to reduce the Fluoride concentrations to the acceptable limits (0.5 – 1.5) before use.

Detailed hydrogeological methods should be applied in ground water prospecting to identify the few moderate yield aquifers for abstraction of water for sustainable rural supply.
Thank You