Study of Pumping test on well for Pre-Manson and Post-Manson for NANNAJ BASIN

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ABSTRACT

Pumping tests are normally carried out to determine the yield of the well and the drawdown. This information provides a basis for determining the water supply available from the well, for selecting the type of the pump and for estimating the cost of pumping. Hydrological studies at different depth horizons for the Nannajodha basin in Solapur, district, Maharashtra, India has been represented by various contourmaps at different electrode spacing. We are correlated with the local Geology of the area to detect the various pre-monsoon and post-monsoon readings of the groundwater.

Keywords: Pumping Test, Pre Mansoon, Post Mansoon, Aquifer, Ground water Level, Hydro geological Investigation, Transmisivity

Introduction:

Water is major natural resource of dry environment in which man occupies the center stage. Ground water represents the largest available source of fresh water in the hydrologic cycle. Ground water is the major source to supplement the surface water for domestic and irrigational use. Since ground water is limited and at all times difficult to locate, great care is needed to be taken for assessment and exploitation of ground water. Rainfall (precipitation), an integral part of the hydrological cycle, is the source of all fresh water in the earth. We tend to misjudge the enormous quantity of water brought down from rainfall in our neighbourhood.

Nannajodha basin, a tributary of Sina River with its catchment area of 120sq. Km. Forms Sub-basin of Sina River. The study area falls on survey of India Toposheets 47 0/13 and 47 0/14 bounded with north latitude 17^0 45' and 17 0 53' 12" and East longitudes 75^0 45' and 75^0 53' 3". The basin comprises of zeolitic and hard massive basalt.

Objectives of pumping test

There are two main objectives of pumping tests:

a) A pumping test may be performed in order to determine the hydraulic characteristic of aquifers or water bearing layers. Such a test is often called an aquifer test because it is the aquifer rather than the pump or well which is tested.

b) A pumping test may provide information about the yield and drawdown of the well. These data can be used for determining the specific capacity or the discharge drawdown ratio of the well, for selecting the type of the pump and for estimating the cost of pumping. The specific capacity gives a measure of the effectiveness or productive capacity of the well. Such a pumping test is sometimes called a 'well-test'.

The Geomorpholocal and electrical resistivity and hydro geological investigations were carried out for Nannajodha basin.

1) Geomorphological studies:
   a. Linear aspects.
   b. Aerial aspects.
   c. Relief (gradient) aspects.

2) Ground water levels flows of 42 observation wells for pre & post monsoon were recorded.
3) Aquifer performance test (pump test) has been carried out to know the transmissivity and storativity of aquifers.
4) Electrical Resistivity:Electrical sounding to know the subsurface formations has been carried out.
5) On the basis of above studies hydro geological set up of the Nannajodha basin has been prepared.

Figure 1: Location map of Nannajodha basin District Solapur, Maharashtra, India

Figure 2: Location map of the area

METHODOLOGY:-

Geomorphology:

Linear Aspects: The linear aspect consists of studies on stream order, bifurcations ratio and stream length ratio. Such studies help to understand the development of the basin erosional characteristics and near surface fault and fracture patterns in the creation of the stream.

Bifurcation Ratio: Bifurcation ratio is the ratio of number of streams of higher order to the number of streams of the lower order using above relationship, bifurcation ration obtained for Nannajodha basin is projected in the above table.

Stream Length Ratio: The length ratio which is defined as the ratio of the mean length of the streams of the order to the length of the streams of the next lower order has been calculated for each pair of successive orders. The means length of the stream increase with the order in direct proportion in fig.
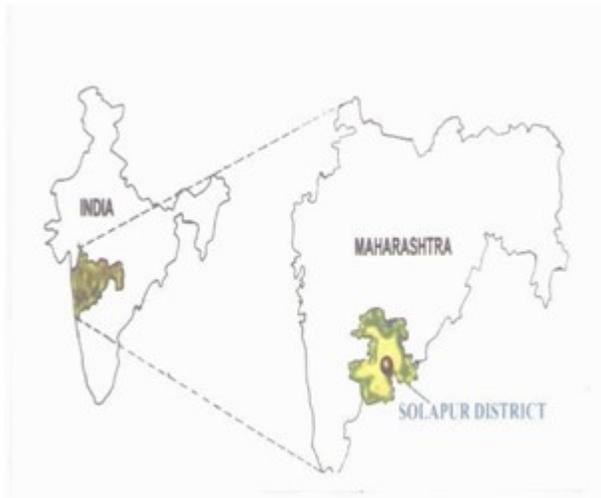
Lineament map:

Figure 3: Drainage of the basin

Aquifer test: Pump tests on 4 large diameter wells consisting of weathered, jointed, fractured and massive rock types were carried out using farmer's pumps. Variation in the abstraction rate was monitored through 900 "v" notch and drawdown in the water levels have been noted at frequent intervals. Time drawdown-recovery graphs were obtained. The pumping has been carried out for a minimum 180 minutes and the recovery has been recorded for a minimum of 200 minutes. Transmissivity and storativity have been calculated. Initially using the procedures suggested by GSDA. This method, modified for large diameter wells, is similar to Cooper-Jacob method of solution in this method time drawdown data are plotted on a semi log graph and the slope of the straight line graph, for log cycle is calculated and used in the formula given below for the computation of T and S values.

$T=2.30 \times Q/4 \times \Delta S$ m^2/day.

Where,

T= Coefficient of transmissivity

Q= Average discharge per day

ΔS= Slope of the graph.

Time since pump started in m8inutes verses drawdown in meter.

$$S=2.25 \times T t_0 x/D^2$$

Where,

S= Storage coefficient

T= Coefficient of transmissivity

T_0= Obtained from graph of time since pump started verse drawdown

D= Effective diameter of the well.

Pump tests and recovery tests for four locations have been carried out and the observation data is presented in table below and the semilogarithimic graphs are given below. The results of aquifer test are given in the table below. It has been observed for the results that transmissivity (T) varies between 45.65m3/ day and 17.33m3/ day and storativity (s) from 4.19×10^{-2} to 6.05×10^{-2}. The values are higher where weathered, highly jointed, fractured, andzeolitc basalts form the earth. This shows heterogeneous character normally represented by hard rocks.

OBSERVATION:-

1) Initial water level (mts): 6.20mts below the ground level
2) Diameter of the well (mts): 9.83mts.
3) H.p. / make of motar: 5 HP.
4) Diameter of Discharge pipe:
   a) Suction pipe: 9cm
   b) Delivery pipe: 9cm

PUMP TEST RECOVERY READINGS:

Observation number	Observation(mts)	Time(min)
1	6.96	2.50
2	6.87	3.00
3	6.85	3.10
4	6.83	3.20
5	6.80	3.30
6	6.79	3.40
7	6.77	3.55
8	6.75	4.10
9	6.73	4.25
10	6.71	4.55
11	6.69	5.10
12	6.66	5.25

DISSCUSSION AND CONCLUSION

The results of project work on hydrological studies of Nannajodha basin Solapur, District, Maharashtra, have been discussed and the conclusion drawn is given in the following paragraphs. Geomorphologicaly the area is classified as the plateau the highest contour is 500m above mean sea level and lowest contour 440m above mean sea level. Geologically the area falls under Ambernali formation and Wai subgroup of Deccan basalt group in the stratigraphic sequence. Red bole mix zeolitic (amygdaloidal) unit of lower lava flow and basal clinker and massive basalt with sheet joining and hard homogeneous park grading into fractured basalt of upper lava flow are exposed in the area.

Hydrologicaly the aquifer are represented by weathered, fractured and vesicular /zeolitic and basal clinker formation.Pre monsoon depth of water table is 15.24mt.below surface and post monsoon minimum depth of water below surface is 0.60mt.

The aquifer parameters like transmissivity range between $45.65m^3$/day to $17.33m^3$ / day and storativity ranges between 4.19×10^{-2} to 6.05×10^{-2} representing a typical hard rock characteristics.

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