

**AN INTEGRATED HYDROGEOLOGICAL STUDY OF THE
MUVATTUPUZHA RIVER BASIN, KERALA, INDIA**

**Synopsis of the Ph.D. Thesis
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By

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INTRODUCTION

In India, nearly 90% of rural and 30% of urban population depend on groundwater for meeting their drinking and domestic requirements. In addition, it accounts for nearly 60% of the irrigation potential of the country. The spatio-temporal variation in rainfall and regional/ local differences in geology and geomorphology has led to an uneven distribution of groundwater in different regions of the country. So an attempt has been made to develop a scientific database on the groundwater of the Muvattupuzha river basin, Kerala, based on hydrogeological, geophysical, hydrogeochemical and remote sensing techniques. The study area spreads over an area of 1475 sq. km and lying between longitude $76^{\circ} 20'$ and $77^{\circ} 00'$ E and latitude of $9^{\circ} 40'$ and $10^{\circ} 10'$ N.

The present study deals with the different characteristics of the shallow aquifer, which is encountered with laterite and underlain by hard rock. Groundwater yield from wells of hard rock area is generally limited and is due to the small pore size, low degree of interconnectivity and low permeability. The groundwater yield of an area also depends on the fracture patterns and nature and extent of weathering of the country rocks. The groundwater storage is mostly controlled by the thickness and hydrological properties of the weathered zone and the aquifer geometry. The over exploitation of aquifer, beyond the 'safe yield' limit, causes undesirable effects like continuous declination in groundwater levels, reduction in river flow, reduction in wetland surface, degradation of groundwater quality and many other environmental problems like drought famine.

Scientific management of groundwater resources requires a detailed study on hydrogeology, hydrometeorology, hydrochemistry, geophysics and remote sensing. The geophysical study helps to delineate aquifer thickness and layer parameters while the geochemical analysis gives the quality of groundwater. Further management policies for water resources, before the introduction of remote sensing techniques, have crippled by the limitations of conventional methods used in resource survey and monitoring. The effective management of groundwater resource can be done only when there is an adequate knowledge

about its spatial and temporal distribution. Thus remote sensing techniques give a new dimensions to the effective management by satisfying the primary need and helps in real time analysis such scarce and valuable resources. This can be substantiated by studies like resources evaluation of remote sensing. Time bound conventional data and real time remotely sensed data are compared and correlated to produce the most exciting results for master minding the conservation, optimum utilization and management of such precious resources. Hence in the present study, an integrated approach has been made to study the groundwater potential of the basin of the Muvattupuzha river through conventional survey (hydrological characteristics, geophysical and groundwater chemistry) and remote sensing techniques. Geographic Information System (GIS), being one of the best tool for generating scientific database on groundwater, has been used.

Research work related to the groundwater quality, its potential and rainfall study are rather limited. Since 1976 the Government of Kerala has been constructing new irrigation canals to solve the groundwater problem of this basin under the Muvattupuzha Valley Irrigation Project (MVIP) programme. Most of the irrigation canals are on the northern part of the river. However some of the area of the basin experiences sever shortage of water during pre monsoon.

OBJECTIVES:

Scientific database on groundwater will facilitate identification of potential / prospective zone and helps for systematic selection of appropriate site for drilling wells and for sustainable groundwater development. The present investigation is taken up in this backdrop with the following objectives:

- To evaluate the aquifer parameters and yield characteristics through dug well pumping test.
- Determination of the seasonal variations (Pre-monsoon and Post-monsoon) of groundwater quality thereby to evaluate its suitability for various uses.

- To demarcate the groundwater potential zones by the integration of remotely sensed data, geophysical data and other terrain parameters like drainage density and lineament density using Geographic Information System.
- To generate scientific database on the groundwater of the Muvattupuzha river basin using Geographic Information System.

METHODOLOGY

- 1) Twenty six National Hydrographic Stations maintained by Central Ground water Department have been utilized for analysing the trend of ground water level for 10 years (1992 to 2001). Hydrometeorological data have been collected from Kerala state Electricity Board and Indian Meteorological Department in order to prepare well hydrographs.
- 2) Pumping test data have been collected to determine transmissivity, permeability and specific capacity of the aquifer.
- 3) Resistivity data have been obtained from the study area using Vertical Electrical Sounding (VES) to identify different layer parameters and thickness
- 4) Hydrogeochemical parameters have been measured to determine the quality of groundwater by collecting data from 55 dug wells for pre monsoon and post monsoon
- 5) Remotely sensed data have been used for the preparation of various thematic maps include geomorphology, drainage, landuse and lineament
- 6) Demarcation of groundwater potential zones in the study area has been done by integrating various thematic maps and also terrain parameters using

Geographic Information System. Geographic Information System (GIS) is also used in generating scientific database on groundwater.

SUMMARY OF CHAPTERS

The thesis has been addressed in 7 chapters. The first chapter is introductory, stating the necessity of integrated study and drawing it from a careful review of literature relevant to the present study. It also provides a description about the study area, geology, drainage, physiography, and landuse pattern. The objectives of the investigation are also given at the end of the chapter.

Chapter 2 deals with the methodology adopted for the work. The collection of groundwater samples, processing techniques, various laboratory analysis of groundwater samples, pumping test and analysis, resistivity survey and analysis, satellite data collection, image processing techniques and Geographic Information System are discussed in detail.

Chapter 3 deals with hydrogeology of the basin. It covers the systematic description of water level and pumping tests etc. Pumping test gives transmissivity, different specific capacity indices, time for full recovery and optimum yield etc. of shallow aquifer of this basin

The hydrogeophysical characteristics from resistivity analysis, layer parameters and its corresponding thickness are provided in chapter 4. This data has been utilised to bring out basement configuration to find out favourable zones for groundwater development.

Chapter 5 examines the groundwater quality and suitability for varied uses. The physical parameters analysed are pH and electrical conductivity. Chemical parameters such as major cations and anions, total iron, fluoride, total dissolved solids, hardness and biological parameter e.coli, are determined. The

occurrence and spatial distribution of various major and minor constituents have been discussed and expressed diagrammatically.

In chapter 6, integration of remotely sensed data and other terrain parameters with help of Geographic Information System is presented. Groundwater potential zones of the basin are demarcated. A database of this basin has been developed using hydrogeological, geophysical, hydrogeochemical data and other terrain parameters in GIS.

The summary of the work and the major conclusions drawn there from are given in Chapter 7. The bibliography is given at the end.