CHAPTER 1
Geological setting of Sarabanga minor basin
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1.1 Introduction:

It is not an exaggeration that in the modern world, the stage of economic and cultural development of a nation or community is measured by its use of available water resources both on the surface of the ground and under the ground.

The rise in the standard of living and consumption of water go hand in hand. E.g. USA per capita consumption = 875 litres a day and India 100 litres a day. Water is the life blood of agriculture. It is a source of power and also provides waterways.

In our present day race for industrial development the role of water is very vital.

1.1.1 India's Water resources:

The annual rainfall in India averages to 45 inches over the entire country representing somewhere of the order of 3000 million acre feet of water. Of this quantity, 1000 million acre feet of water is lost by evaporation; 650 million acre feet goes seeping into the soil and 1350 million acre feet runs-off contributing to 1.
The entire surface flow cannot be utilised due to the flow characteristics, climate, soil condition, topography etc. It is estimated that only 450 million acrefeet of surface running water out of 1350 million acrefeet can be harnessed for irrigation effectively.

Of the 650 million acrefeet of water seeping underground, groundwater resources in India is estimated to be fairly high. The actual sub surface storage up to a depth of 1000 feet is calculated as 30000 million acre feet of water. This storage of water is nearly 10 times of the annual rain fall in our country. In addition every year there is replenishment of groundwater by annual rainfall. Therefore utilizing even a fraction of these huge underground reserve of water helps us to develop semi arid and arid areas where irrigation from river systems is not possible.

India has the largest arable land next to China. In this context the role of groundwater in national economy becomes very important.

Groundwater has certain distinct advantages over surface water. It is usually present almost everywhere to some extent. The quality and quantity and
mode of occurrence may differ from place to place. Its reservoir being underground it is not easily lost to evaporation. Unlike surface water body, it does not waste arable land surface.

Large capital is not needed to withdraw the groundwater to the surface. If there is a failure in the storage method of surface water, there can be heavy disaster, but in the case of a groundwater bore hole failure only a small area is affected.

1:1:2. Study area

The rivers of India is shown in Fig. 1. hydrogeological map of TamilNadu is shown in Fig. 2. TamilNadu is 130.1 lakh square kilo metres in area and has 22 districts. Salem district is shown in Fig. 3.

The south west monsoon of June-September brings rain to the north western part of the state covering Nilgiri, Coimbatore, Salem and parts of Trichi districts. The average rainfall is 842 mm ranging from 200 mm to 1910 mm. Table 1 shows rainfall in the districts of TamilNadu. From the table it is seen that Salem district receives the lowest rainfall of 1029 mm only. Cauvery basin area falls in Nilgiri, Coimbatore, Periyar, Salem, Trichi and Thanjavur districts.
Fig. 1. The rivers of India.
HYDROGEOLOGICAL MAP OF TAMIL NADU

Fig. 2. Hydrogeological map of Tamilnadu.
<table>
<thead>
<tr>
<th>S.NO</th>
<th>DISTRICT</th>
<th>ANNUAL RAINFALL (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MADRAS</td>
<td>1166</td>
</tr>
<tr>
<td>2</td>
<td>CHENGAUPTU</td>
<td>1105</td>
</tr>
<tr>
<td>3</td>
<td>DHARMAPURI</td>
<td>971</td>
</tr>
<tr>
<td>4</td>
<td>NORTH ARCOT</td>
<td>1525</td>
</tr>
<tr>
<td>5</td>
<td>SOUTH ARCOT</td>
<td>1071</td>
</tr>
<tr>
<td>6</td>
<td>NILGIRI</td>
<td>2043</td>
</tr>
<tr>
<td>7</td>
<td>COIMBATORE</td>
<td>2607</td>
</tr>
<tr>
<td>8</td>
<td>PERIYAR</td>
<td>1090</td>
</tr>
<tr>
<td>9</td>
<td>SALEM</td>
<td>1029</td>
</tr>
<tr>
<td>10</td>
<td>TRICHIRAPALLI</td>
<td>1876</td>
</tr>
<tr>
<td>11</td>
<td>TANJAVUR</td>
<td>1133</td>
</tr>
<tr>
<td>12</td>
<td>MADURAI</td>
<td>1706</td>
</tr>
<tr>
<td>13</td>
<td>PUDUKKOTAI</td>
<td>715</td>
</tr>
<tr>
<td>14</td>
<td>RAMANATHAPURAM</td>
<td>848</td>
</tr>
<tr>
<td>15</td>
<td>TIRUNELVELI</td>
<td>1201</td>
</tr>
<tr>
<td>16</td>
<td>KANNIYAKUMARI</td>
<td>1301</td>
</tr>
</tbody>
</table>
River Sarabanga Plate.1. Fig.1. flows in the northwestern part of Salem district and joins Cauvery at Komarapalayam Fig. 4. The figure shows the course of river Sarabanga and also run-off zone, infiltration zone, moderately weathered and fractured zone and highly weathered and fractured zone. Further it includes the water table contour lines. Being moderately weathered and fractured zone, the Sarabanga minor basin is very deficient in groundwater movement. The author has made an attempt to study the Sarabanga minor basin and also present the computer application on hydrogeological data of this basin.

1:2 Location of the study area

The exact location of the study area under investigation lies between the North latitudes of 11° 29' 09" and 11° 45' 20" and East longitudes of 77° 48' 40" and 78° 03' 00" comprised in the toposheet No 58 E/13, 58 E/14, 58 E/15, 58 I/1 published by Survey of India. The Sarabanga minor basin is coloured in the river basin map of TamilNadu Fig. 5. The Sarabanga minor basin sketch is shown in Fig. 6. (The Sarabanga minor basin consists of the following 4 Sub-basins.)
Fig. 4. Sarabanga river map...
Fig. 5. River basin map of Tamilnadu.
Fig. 6. Sarabanga minor basin sketch.
1. Kadayampatti Sub basin.
2. Mecheri Sub basin.
3. Jalagandapuram Sub basin.
4. Edappadi Sub basin.

On the western side of Sarabanga minor basin Mettur sub basin of Cauvery minor basin is situated. On the eastern side of Sarabanga minor basin, Ponniar minor basin is located. Towards south, Thirumanimuthar sub basin is present. Mettur Stanley reservoir is located on the north eastern border of Salem district. The Sarabanga minor basin has an area of 1,28,779.70 acres. Out of these acres, 1,02,077.43 acres comes under nonayacut category and 4,114.90 ayacut category. Nearly 894 Wells are located in the above minor basin. It covers parts of Omalur, Mettur, Sankari taluks. A broad gauge railway line of Southern Railway running almost NW-SE connects Mettur in the NW and Salem in SE direction.

National highway No. NH7 passess through the study area connecting Salem and Omalur. Almost all villages are well connected by state maintained roads.
1.3 General Statement—hydrogeological parameters:

The amount of water available in the study area depends on the values of hydrogeological parameters defining the water budget of the area. This is expressed in an equation as follows.

\[ P \downarrow = E \uparrow + R \rightarrow + I \downarrow + \Delta S \]

Where

- \( P \) = Precipitation
- \( E \) = Evapotranspiration
- \( R \) = Surface run off
- \( I \) = Infiltration
- \( \Delta S \) = Change in storage

and the arrows denote the direction of movement.

In the study area precipitation is equivalent to rainfall. Evapotranspiration consists of two parts: 1. Actual evaporation of water from land vegetation or open water surfaces and transpiration of water through vegetation. 2. Surface runoff constitutes the maximum amount of water that can be saved. By infiltration through the land surface water may form soil water in the upper soil layers or percolate further to form groundwater in fully saturated deeper level. The change in the storage covers the amount of water for various reasons is added to or subtracted from storage in the area.
Fig. 7. The hydrogeological cycle.

Fig. 7a. Simple schematic diagram for the hydrologic cycle.
A separate budget equation can be written for the groundwater recharge which is balanced by the groundwater runoff, groundwater evapotranspiration, subsurface underflow and change in the groundwater storage for a given period of time. The budget equation offers a means of estimating the groundwater recharge when the other quantities are estimated.

1:4 Geological setting of Sarabanga minor basin:

The following rock types have been met with during the field survey and each rock type comprises many varieties depending on addition or omission of certain minerals sillimanite gneiss, magnetite-quartzite, biotite gneiss, hornblende gneiss, granitic gneiss, amphibolite, charnockite, pink granites with pegmatites and basic dolerite dykes.

During the well inventory studies the contacts between different litho-units were studied and are marked on the map by observing carefully their disposition on the surface and different dug wells. The contacts between the rock types in other places are inferential as the critical areas are under soil cover.
Fig. 8. shows the geological map of the study area. Approximately the study area can be divided into three divisions on the basis of geomorphology.

1. **Northern division:** It is comprised of pre-cambrian metasediments, peninsular gneisses, charnockite and pink granites with pegmatites. It is a hilly terrain with undulating topography. The Sarabanga river flows almost parallel to NNE-SSW direction.

2. **Central division:** It is comprised of pre-cambrian metasediments, peninsular gneisses, charnockite and pink granites with pegmatites and intrusive carbonatite complexes. It is dissected by NE-SW fault described by Graddy (1971). It is mostly an undulating terrain with small mounds. The Sarabanga river takes a deviation to almost E-W direction.

3. **Southern division:** It is mostly soil covered and cultivated. Plate I. Fig. 2. The Sarabanga river again changes its course to NE-SW direction.

**1.5 Methods of study:**

The advent of the micro computer during the mid 1970's led to the down loading of many computer application to personal computers. Initially these
EXPLANATION OF PLATE I

Figure:

1. View of Sarabanga river near Edappadi Town

2. The Western side views of chittar in Sarabanga river
Fig. 8
Geological map of Sarabanga minor basin.
scale 1" = 4 miles

- Peninsular gneiss
- Granite
- Charnockite
- Pegmatite
- Carbonatite
application consisted of text processing, spreadsheet and small database management programmes. Attempt to implement mapping application software on these machines were impeded by the constraints of 8 bit architecture. It was not until 16 bit microprocessor were introduced, the implementation of the software for mapping became possible. These 16 bit microprocessors are faster and their computational speed can be accelerated with the addition of the arithmetic co-processor and they are able to address 1024 K. b (Kilobytes) of memory.

Since the acceptance of computers, both statistical application and data based activities have grown enormously. The recent availability of low cost microcomputer and mini computer systems has helped geological investigative studies to a very great extent. In this study of hydrogeological investigation of Sarabanga minor basin computer has been used for both data base management and statistical applications. The hydrogeochemical data have been analysed and the data are presented in various formats like Bar chart, pie diagram trilinear diagram and classification diagrams.