CHAPTER 2

GEOGRAPHICAL AND GEOLOGICAL SETTINGS

2.1 INTRODUCTION

The Gadilam river basin is located in the northern part of Tamil Nadu. The basin lies between the Ponnaiyar basin in the north and the Vellar basin in the south. It is an important basin from times of immemorial and had been the centre of activity where many historical events have occurred from the early Pallava Kings (10th Century A.D.) to till the later British period. Ulundurpet, Thiruvennainallur and Rishivandhiyam are the towns developed in a contiguous manner within the study area. The total population of the area is around 270 thousand according to 1991 census. By virtue of its very central location, the study has become the meeting place of communication lines from N-S and E-W traverses in the state. The study area is generally rural in nature, except for a few towns mentioned above. This is located in a semiarid zone and faces acute water shortages.

2.2 LOCATION

The area spreads over an area of 850 sq. kms. and is located between 11° 44' 35" to 11° 56' N latitudes and 78° 58' to 79° 25' E longitudes. Falling mostly within the Survey of India topographic sheets of 58 1/13, M/1,2,5,6 on 1:50,000 scale covering Tirukkoilur, Sankarapuram and Ulundurpet taluks of Vizhupuram district (Fig.2.1).

2.3 TRANSPORT AND COMMUNICATION

Most of the area covers fairly dense shrub and boulders. Owing to the non availability of metalled roads, the communication is somewhat difficult in the catchment area of the basin. Metal roads and non-metal roads from SH.1 to nearby areas cut across the Gadilam river at various places. Ulundurpet is the major town situated at the southeastern part of the study area (Fig. 2.1). The national highway No.45 (Chennai - Tiruchirappalli - Dindigul) passes through Ulundurpet and runs more or less perpendicular to the Gadilam river (Fig. 2.1) crossing near Thirunavallur. A few other state highways connects Ulundurpet with other adjacent towns like Panruti, Vridhachalam, Tirukkoilur and Salem. The good condition of these roads is partly due to availability of the metal road and partly due to the fairly dry climate that prevails within the region. Ulundurpet is
FIG. 2.2 LONG PROFILE OF THE GADILAM RIVER
linked by broad gauge railway line, running between Chennai-Tiruchirappalli. Nearest railway junction is situated at Virudhachalam, 22 km away from Ulundurpet. The airport near Ulundurpet railway station, commissioned during the British rule, serves as a helipad for occasional visiting of dignitaries.

2.4 PHYSIOGRAPHY

The catchment area of the Gadilam river basin consists of extensional hills of the gently dipping Eastern Ghats hill ranges, having an elevation of 100 m. above MSL in the West. The study area has a gentle seaward slope and the physiography of the study area is very much subdued due to prolonged subtropical weathering. The mean elevation here is around 90 m. above mean sea level (MSL). The northern, western, southern and the central parts of the basin are dotted with some prominent inselbergs namely Swamimalai (154 m.), Pasar hill (152 m.), Alwarmalai reserve forest (119 m.), Kunnathur (136 m.) and Killiyur hills (104 m.). The maximum elevation in the plain is 140 m and the minimum elevation is 40 m respectively.

The long profile of the Gadilam river is shown in Fig 2.2 and the study area has a gentle slope (1:9.6) right from its catchment up to the hard rock-sedimentary contact.

The entire stretch of the riverbed is covered with recent river alluvium. Though, the study area has numerous small to medium sized tanks, these are noticed to be mostly dry. Hence, the farmers mainly depend on groundwater for their cultivation.

2.5 CLIMATE

In general, the climate of the area is mostly hot and dry, except during the winter season. As per the Indian Meteorological Department (IMD) records, the temperature ranges from 20° C to 42° C. Though, the basin is not subjected to extreme climate in the summer months, it is quite hot. The difference between the maximum and minimum temperature is only moderate.

During January-February, the study area has a very pleasant climate with warm days and cool nights, but by the close of February, the climate becomes very sultry, the temperature shoots up to 42° C till May and early June. With the setting of the southwest monsoon in the later part of June, the heat abates and strong winds blow from the
### TABLE 2.1 - AVERAGE MONTHLY AND ANNUAL RAINFALL IN (MM) IN AND AROUND STUDY AREA

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>SW MONSOON</th>
<th>NE MONSOON</th>
<th>ANNUAL</th>
</tr>
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<td>ULUNDURPET</td>
<td>42</td>
<td>10</td>
<td>6</td>
<td>27</td>
<td>64</td>
<td>48</td>
<td>73</td>
<td>122</td>
<td>135</td>
<td>190</td>
<td>204</td>
<td>102</td>
<td>379</td>
<td>497</td>
<td>1030</td>
</tr>
<tr>
<td>TIRUKOILUR ANAICUT</td>
<td>24</td>
<td>6</td>
<td>13</td>
<td>29</td>
<td>94</td>
<td>58</td>
<td>103</td>
<td>160</td>
<td>173</td>
<td>233</td>
<td>186</td>
<td>99</td>
<td>495</td>
<td>519</td>
<td>118</td>
</tr>
<tr>
<td>SANKARAPURAM</td>
<td>18</td>
<td>3</td>
<td>17</td>
<td>22</td>
<td>55</td>
<td>30</td>
<td>75</td>
<td>124</td>
<td>144</td>
<td>182</td>
<td>165</td>
<td>83</td>
<td>375</td>
<td>433</td>
<td>926</td>
</tr>
</tbody>
</table>

**AVERAGE ANNUAL RAINFALL**: 1046.87
southwest bringing sporadic rainfall. September and October are cooler, though sultry, after the onset of north-east monsoon, in the middle of October, cold weather begins with wind velocities of 5 to 15 km / hour from north-east. The actual average annual Potential Evapotranspiration (PET) is found to be 301 cm. Humidity of the study area varies relatively from 55 to 63 percent.

Generally, the distribution of rainfall in Tamil Nadu is scanty with respect to other states. As for the study area concerned, almost 60 percent of the year, remains dry, though it receives rains during both the southwest and north-east monsoons. The basin receives appreciable rainfall during the north-east monsoon season especially, Ariyur and the northern most part of the study area (Fig 2.3), which are brought by the troughs of low pressure established in the southern part of Bay of Bengal during October and December. However, southwest monsoon alone has a precipitation of about one third of the average rainfall, which helps the formers to take the rainfed cultivation.

The mean annual rainfall for the state of Tamil Nadu state is 942 mm., whereas mean annual rainfall in Ulundurpet rain gauge station is 1030 mm, which is higher than the state average. It is to be noted, of the three rainfall stations, only Ulundurpet station lie within the study area and other two stations namely Tirukkoilur and Sankarapuram lie in northern and north-western parts respectively (Fig. 2.3a). The rainfall break-up figures for Ulundurpet with respect to the various seasons are given below.

1. Total rainfall during transitional period, January – May, 153 mm
2. Total rainfall during southwest monsoon 379 mm
3. Total rainfall during north-east monsoon 498 mm

The mean monthly and annual rainfall of the three rain gauge stations both in and around the study area for a period from 1962 to 1997 is presented (Table 2.1). The mean annual rainfall in this area has been computed as 1046.87 mm. The average annual isohyets is shown in the Fig. 2.3. Owing to the uneven distribution of annual rainfall observed in all these three stations, the isohyctal average for this area has been calculated as 1060 mm. From the isohycte map (Fig. 2.3) and the rainfall data it was noticed that the rainfall is higher in the north and north-eastern part of the study area (Tirukkoilur Taluk - 1184
Fig. 1. Garudan Rock – origin point of Gadilam river

Fig. 2. Spring in Garudan Rock – Main water source for the origin of Gadilam River, Location – Mayanur, Rishivandhiyam Block.
A view of Gadilam river near Gadilam village.
Location - Trijunction of Tirukoilur, Ulundurpet and Sankarapuram Taluk.
mm) and lower in western part (Sankarapuram Taluk - 926 mm). Substantial precipitation during October, seems to be a striking feature for the last three decades.

2.6 DRAINAGE

The Gadilam river originates at an altitude of 167 m above MSL from Mayanur hills (Plate 2, Fig.1, 2) in the west and after a long run of 112 km., it empties in the Bay of Bengal, 2 km. east of Cuddalore. Seshanadhi R is the major tributary of this river. The Gadilam is a small ephemeral river when compared to the rivers like Cauvery, Ponnaiyar of Tamil Nadu state (Fig. 2.4). This study area is almost a plain with poking relief hills and is dominated by numerous tanks. The Gadilam river receives the drainage of its own catchment and forms a definite course and flows towards east (Plate 3). The major drainage patterns found in the study area are circular, trellis and dendritic types. The Gadilam river has many supply canals, namely Thamalodai, Nariyanadai, Mallikaodai, Maranodai and Naavalodai. These canals are mainly used for irrigation purposes. They originate from the ponds, numerous gullies and from barren rocky wastes of adjoining regions. The Seshanadhi R (IV order stream) is the main tributary of the Gadilam (IV order stream). After the confluence of Seshanadhi R at Maranodai the Gadilam river becomes a V order river, according to the Strahlet (1958) classification. There are two dams constructed across the Gadilam river, viz., Mogalar dam and Puthanendhal dam. The total area under Gadilam irrigation scheme within the study area is about 15,000 acres of which nearly 9000 acres are irrigated by these two dams. Malattar river sub-basin, a misfit river in the north-eastern part, which occupies a small area within the study area is the inter basinal area between Gadilam and Ponnaiyar basin (Fig 2.4).

2.7 GEOLOGY AND STRUCTURE

Tamil Nadu is predominantly a Precambrian terrain, but for a small linear strip running along the east coast, which contains Mesozoic and Tertiary sediments. The major crystalline rocks of this Precambrian shield area are made of various kinds of gneisses, Khondalites and Charnockites. These rocks are often traversed by ultramafic, basic, granitic and syenitic intrusives. The sedimentaries like pink and white shales and feldspathic sandstones found adjacent to the coastline are considered to be of Upper Gondwana age. These rocks are unconformably followed by the marine fossiliferous Upper Cretaceous formations of Tiruchirappalli and Cuddalore formations of Miocene age. The sediments belonging to Holocene age include the alluvium in river
valleys and deltaic regions and coralline limestones in parts of the Gulf of Mannar (GSI, 1995).

The study area falls a part of the Archaean complex of the South Indian Peninsula. The integration of available geological maps (GSI, 1995), the interpretation of resistivity data, bore hole data and satellite images followed up by field work show that this area mainly comprises of older Peninsular gneisses and to the lesser extent paragneisses and charnockite suites of rocks. Granites, syenites, quartz veins and ultra basic rocks corresponding to the later stage traverse these rocks (Fig. 2.5). Apart from these, younger dolerite dykes and pegmatite intrusives are also indicates widespread igneous activity. As a result of tectonic disturbances and differential weathering phenomena, the study area is having an undulating topography. The regional strike trend of the study area is north-east to southwest, with dip ranging in magnitude from 85° to 15° in southeast. The following stratigraphic succession has been observed.

Recent to: Top Soil - clayey sands, sandy clay and sands.

Subrecent

Archaeans: Younger dolerite dykes
Granites, syenites, quartz & pegmatite intrusives and ultra basic rocks
Paragneisses and Charnockites
Peninsular gneisses.

Gneisses and granites are the dominant rocks exposed in the basin. The gneisses include granitic gneisses which were metamorphosed into hornblende biotite gneisses. Well exposed outcrops of granitic gneisses are seen near Thirunarumkonrai and Kunnathur. These outcrops show well developed folding as an evidence of the faulting, migmatisation and foliation. Gneissic rocks are also found at the ground level as clear rock cut surfaces as seen in Emam and Elrampattu.

The general strike of the foliation of the gneisses in this area varies, generally between NNE - SSW and NE - SW, with southeasterly dip. The gneisses are broadly jointed and sheared. The joint patterns show (i) NE - SW strike of 80° with a dip of 80° towards north, north-west and spacing between the joints varies from 1 to 4 m. (ii) N- S with a dip of about 85° towards west and spacing about 1.5 m. The nature of the boundary between the Archaean and the Cretaceous rocks is not well defined in surface
exposures. However, a strong deep gravity anomaly is reported to the east of Ulundurpet area (GSI, 1995).

Pegmatites are distributed in the study area with intrusives of quartz veins as ridges at several places, especially in Killiyur. Granites in the form of stocks and bosses occur at few places. The exposure of granite show variations in their granularity and colour index. They are generally devoid of joints and rock cleavages. They have also been intruded by the basic dykes with the intercalation of gneissic bands. Granite outcrops are well exposed to the south of Mandagapadi village, Attur and to the north of Gadilam-Rishivandhiyam road. Among the ultrabasic rocks fine grained amphibolite schist near Ariyur are seen as clusters of broken boulders, possessing a NE-SW trend of 21° foliation and dip of 76° due west. It is traversed by many minor quartz veins. These veins lie parallel to the foliation. Medium grained syenites composed mainly of feldspar and of little Pyroxene without any preferential orientation are exposed near Pillaiyarkuppam. Massive outcrops of syenites are also noticed. The clear cut boundary between amphibolite schist and syenite is also noticed.

Charnockites are hard, massive and coarse grained. They are bluish black in colour and due to leaching of iron from hypersthene, red soils are found in Pallavadi and Sendamangalam. Subramaniam (1990) has discussed the charnockite province where rocks of granulitic facies are developed and in some places shows the retrogression of the amphibolite facies. Sughavanam et al., (1990) reported that magnetite quartzites, schists and amphibolites are overlain by emplaced sills and dykes. The rocks exhibit a regional foliation of NNE-SSW. Due to laterally developed and changed conditions the rocks were thrown into isoclinal folds with broad synforms and narrow antiforms. Simultaneously with this process of folding, the area has undergone granulitic facies metamorphism. This has led to the formation of charnockite from older gneisses and schists and also pyroxene granulite from amphibolites.

The exposure of recent alluvium is noticed along the course of the river Gadilam near the Dindigul - Chennai (NH 45) road. The subsurface lithological details collected from a few selected boreholes in the study area are shown in the figure 2.6. The depth of weathering varies from 1.5m to 15m and depth to basement, ranges from 10m to more than 42m is found to be increasing towards the east where the slope is very gentle. The
top soil thickness is rather meagre, weathered and fractured zone thickness is appreciable. It may be added that the weathered Granite with a total thickness of about 16.5 m is noticed at K.Palayam on the granite province without any sign of top soil.

2.8 SOILS

As per Valdiya (1987), the soils in the east coast of Tamil Nadu mainly belong to Oxisols i.e., the residual accumulation of inactive sediments. Laterites are distributed in the upper region and have produced a type of soil known as Latersols i.e., the ultimate residue of clays and sandstones which have undergone chemical weathering. The laterites also produce another type of soil called as Nitosols rich in Fe and Al content. In the uppermost part of the rivers the Archaean hardrock mainly made up of basic types, have produced lime rich soils. From Melpalangur to Pillayarkuppam, the hard Archaean rocks have shown the character of resistance to weathering, by the presence of sharply protruding rocky edges and boulders in the sides of gullies. The soils of Pillayarkuppam, Attur, Ariyur are alkaline in nature. Alluvial and loamy soils are the most common types bordering around the stream courses, which are dark brown to dark greyish brown. This is typically found in areas west of Senjikuppam, Padur and Perumbattu.

2.9 VEGETATION

Based on the nature of vegetation, the study area can be differentiated into three major groups

1. Densely vegetated areas
2. Sparsely vegetated areas and
3. Vegetations due to cultivation

Dense vegetations are present in the reserve forests of Aviriyur, Swamimalai and Melpalangur in the upper part and Nattamur and Pandur in the eastern part of the study area. In general, the trees distributed in these regions are Eucalyptus globulus (Eucalyptus), Equisetofolia (Casuaria), Saccharum arundinaceum, Retz (Karuvela), Azadirachka indica, A Juss (Neem tree), Ficus carica (Fig tree), Bambusa arundinacea, Willd (Bamboo) and Borassus flabellifer, Linn (Palm trees). The sparsely vegetated area comprises bushes, shrubs, grass, thorny bushes, one or two large trees along with sparsely grown smaller trees. In the inhabited area, in the midst of cultivable lands, one can observe trees like Tectona grandis (Teak), Adenanthera pavonina (Sandal), Bombusa
arundinacea, Willd (Bamboo), Equisetifolia (Casuarina) and Mangifera indica (Mango trees). In addition to the paddy cultivation in this region Saccharum officinarum, Linn. (Sugar cane), ficus religiosa (ragi), Capsicum annum (Chillies), Lycopersicon esculentum (Tomato), Lens esculenta (Horse gram), Nigella (Fitches) and Gossypium herbaceum (cotton) are also cultivated. The cash crop like Musacacea (Banana) and coconucifera, Linn. (coconut) are also encouraged for cultivation.