CHAPTER 4

STUDY AREA

4.1 GENERAL

The earth is known as the “Blue Planet” or “Water planet”. The presence of water makes it unique and is the sole basis for the sustenance of life on the earth. About 70.7% of the earth is covered by water and the remaining is land. However, out of this vast coverage of water only 1% is available for human consumption. The remaining 97% of water is in the ocean and 2% in the Polar Regions in the form of glaciers. The 1% consumable quality of water is available on the surface of the earth as well as underground. In Tamil Nadu nearly 98% of the surface water resources and 73% of ground water resources have been exhausted. Unless it is better planned to harness, to conserve, manage and utilize the water resources, it is going to be a severe crisis for water. There are 34 river basins in Tamil Nadu, India. For the purpose of taking up micro-level hydrological studies and water resources planning activities, the 34 river basins are grouped into 17 major river basins by the Public Works Department, of the Tamil Nadu State Government. Nambiyar river basin is one among them. The Nambiyar basin falls in Tirunelveli and Thoothukudi districts. There are three rivers in this basin. The Karamaniyar is in the northern part of the basin and Hanumanadhi River is in the southern part of the basin and the Nambiyar River is in between these two rivers. Tamiraparani basin on north and Kodaiyar basin on south and the Gulf of Mannar on the east surround this basin. The Nambiyar river basin falls in part of the Survey of India toposheets 58H and 58L and it
lies between the following co-ordinates: North- Latitudes 08° 08’00” - 08° 33’ 00” and East - Longitude 77° 28’00” - 78° 15’ 00”. This basin is sandwiched between Tamiraparani basin on the north and Kodayar basin on the west. The total area of the basin is 2084 sq.km and it covers part of Tirunelveli and Thoothukudi districts.

4.2 PHYSIOGRAPHY

Physiographically, Nambiyar basin is divided into western hilly region and eastern plain undulating topography. Western hilly region extends from Agsthayarmalai in the north and Kanyakumari town in the south and it acts as the western boundary of the basin. All the rivers flow from the eastern slope of the Western Ghats at various altitudes.

A stream from the east of Kalakkadu village joins the Manimuthar main canal and surplus from Vijayanarayanam tank forms the Karamaniyar River. Numerous streams in the downstream join the river Karamaniyar. Its width is increasing from Sathankulam till its end.

The river Nambiyar originates in the eastern slopes of the Western Ghats near Nalikkal Mottai about 9.6 km west of Thirukkarangudi village at an altitude of about 1646 m above MSL. Kalankal odai is a tributary of Nambiyar River which originates near Kannanallur area, after traversing 6.5 km and finally it joins Nambiyar at 37th km near Kovankulam.

Hanumanadhi originates in the eastern slopes of the Western Ghats at an altitude of 1100 m above MSL in the Mahendragiri hill region. Uppar River originates in the eastern slopes of the Western Ghats near Takkumalai east forest at an altitude of about 808 m above MSL.
The elevation of the Western Ghats, ranging from +300 m to +1200 m above MSL, is in this basin area. There are several peaks which are raised above +1000m. MSL. They are Kaniyini mottai 1663 m, Mahendragiri hills 1657 m, Kottankaitatti mottai 1530 m and Thiruvannamalai hills 1402 m.

The eastern plain is an undulating topography with its elevation varying from +100 m to +15 m. All the rivers starting in the Western Ghats regions flow in the plains towards east, southeast and south directions. There are two reservoirs in the Nambiyar basin, the first one is Namibiyar and the other, Kodumudiayar. There is one big tank located at Vijayanarayananam village called Vijayanarayananam Lake.

In the eastern part of the basin, two patches of sand dunes are noticed and they are deposited by wind action. These sands are reddish white in colour and they are locally called “Teri sands”. One patch of Teri sand dunes occurs north of Tisaiyanvilai called Ittamalai Teri, and another one which occurs at the northeast of Sattankulam, called Kudiramoli Teri, with considerable thickness ranging from 20 to 30 m above ground level. Ittamalai Teri rises above 60 m from MSL.

4.3 DRAINAGE

Nambiyar river basin is constituted by rivers like Nambiyar, Karamaniyar, and Hanumanadhi. Nambiyar and Hanumanadhi originate in the eastern slopes of the Western Ghats at an altitude of about 1000 m MSL. Karamaniyar River originates from the surplus water from Vijayanarayanan tank of about 100 m. The watershed area comprises the hilly region of Mavadirottai, Kakamunikal mottai, Thiruvannamalai and Mahendragiri hills.
4.4 SUB-BASINS DESCRIPTION

4.4.1 Karamaniyar River

It has a number of small seasonal streams and gets its flows mainly from the surpluses of Vijayanarayanan tank and from monsoon rainfall. Manimuthar main canal joins the river near Pillaikulam village. After traversing a total distance of 56.5 km, the Karamaniyar River flows into the Gulf of Mannar near Manapadu village in Tirunelveli District. The Karamaniyar River feeds about 75 tanks and has a registered ayacut of 2976 hectares. The total extent of this sub-basin is 903.93 sq.km, Covering blocks of Alwarthirunagari, Tiruchendur, Sathankulam, Udankudi, Kalakkadu, Nanguneri and Radhapuram either in part or full.

4.4.2 Nambiyar River

Nambiyar River originates in the eastern slopes of the Western Ghats near Nalikkal Mottai about 9.6 km west of Thirukkarangudi village at an altitude of about 1060 m. This river is constituted by three branches of seasonal streams, like Tamaraiar, Kombaiar and Kodumudiar. Kombaiyar and Kodumudiyar originate at the eastern slope of the Western Ghats at an altitude of about 1600 m. near Mahendragiri hills. Nambiyar then takes an easterly course up to the Tirunelveli-Nagercoil trunk road crossing and flows in a south-easterly direction. Parattaiyar originates in the eastern slopes of the Western Ghats at an altitude of about 1200 m. near Kakamunjikai Mottai and joins another arm of Nambiyar at the foot of the hills. After feeding a number of small tanks, this finally joins with Nambiyar again near Ervadi at 18.5 km.

Kalankal odai is another tributary which originates near Kannallur area in Nanguneri taluk of Tirunelveli District. It gets flows from the
surpluses of a few tanks dependent on other streams. After traversing a distance of 6.5 km, it finally joins with the Nambiyar near Kovankulam.

Another tributary which originates near Vadakku Valliyur area in Nanguneri taluk of Tirunelveli district at an altitude about 90 m gets flows from the surpluses of small tanks dependent on other streams. After traversing a distance of 10.5 km finally the tributary joins Nambiyar near Sankarapuram village. Finally the Nambiyar River flows into the Gulf of Mannar after traversing a total distance of 59 km from the origin.


4.4.3 Hanumanadhi River

Hanumanadhi originates in the eastern slopes of the Western Ghats at an altitude of 1100 m in the Mahendragiri hill region on the North West of Panakkudi village in Nanguneri Taluk of Tirunelveli District. It has a number of jungle streams. After feeding a few tanks, they join Hanumanadhi River at various points. It flows in the hill ranges for about 5.6 km and reaches 6.4 km west of Panakkudi village in Nanguneri taluk. It traverses entirely in Nanguneri taluk for a distance of about 32 km and flows into the Gulf of Mannar. There are 11 small anicut across this river viz. 1. Sivanpilli anicut, 2.Senthilkathayan anicut, 3.Thandayarkulam anicut, 4. Sanjetti anicut, 5. Perungudi anicut, 6. Vadakkankulam anicut, 7. Adankarkulam anicut, 8. Sakkilianparai anicut, 9. Kanjaneri anicut, 10. Alaganerai anicut, and 11.Koliankulum anicut. The total area of the sub-basin is 510.179 sq.km.
covering blocks of Kalakkadu, Valliyur, Radhapuram in Tirunelveli District and Thoothukudi District either in part or full.

4.5 RELIEF

The highest elevation of different ranges, 1657 m, 1585 m and 1530 m are found in Kalakkadu reserved forest, Mahendragiri Reserved forest and the minimum elevation is 500 m at the foot hills at the western part of this basin. Adjacent to this hill ranges, the 100 m contour runs across this basin from north to south.

The remaining part of the basin is generally a plain terrain with gentle slope towards south and east. There is a sand dune namely ‘Teri sand’ in the south of Sattankulam having an elevation of 67 m. There is also a similar type of structure in and around the villages Kuttam and Uvari in the south of Thisaiyanvilai.

The river Karamaniyar flows in the basin at the eastern part of the basin from northwest to southeast, passing through Sattankulam and confluences with Gulf of Mannar at Kulasekaranpattinam.

Nambiyar River originates at an elevation of 1479 m in Nalikkal Mottai with Kallakadu reserved forest. It traverses through Pudukulam, Pettaikulam and confluences in Gulf of Mannar at Thiruvambalampula.

The river Hanumanadhi originates at an elevation of 1100 m in Mahendragiri reserved forest. It traverses through Panakkudi, Vadakankulam and finally confluences with the Gulf of Mannar at the south of Erukkamkulam.
4.6 GEOLOGY

The various rock types exposed and the structural details of Nambiyar river basin were collected from the Geological Survey of India. The basin area comprises of rocks of Khondalite and Charnockite groups of Archaean age in major part of the area. Migmatite gneiss of Archaean age also occurs in the plains. The coastal plains host rocks of Misocene, of quaternary and recent age.

The Khondalite group consists of Garnet-biotite sillimanite gneiss with or without graphite. It consists of sheets of sillimanite needles, biotite, occasional lenses of graphite with red and pink garnet. These rocks exhibit fine foliation and perfect parallel banding. Influx of granitic material has resulted in the formation of quartzo-feldspathic gneiss in many places.

Charnockite occurs mostly as concordant bands and lenses of varied dimensions in association with Khondalite with diffused contacts. It grades into gneiss and vice versa both along and across the strike. Generally, it is garnetiferous near the contact with gneiss and non-garnetiferous in the middle portion. The rocks show granblastic texture and are mostly intermediate to acidic.

The Migmatite complex consists of granite gneiss. The rocks of the Migmatite group are widely distributed and interlayed with Charnockite in the central and southern part of the area. Garnet-biotite gneiss occurs as bands and lenses and stands out as raised ridges. It is characterised by the presence of biotite foliae and concentration of garnet in layers. At places, the garnet, biotite gneiss also carries segregations of graphite flacks.

In the eastern part of the basin, a few outcrops of hard marine sand stone and shell limestone with intercalations of pebble beds of miocene age,
unconformably overlie the rocks of the Archaean age. The pebble bed consists of angular to sub-angular and coarse fragments of quartz, in a matrix of ferruginous clay. The formation comprising of hard sandstone and calcareous shelly limestones are encountered north of Sattankulam. Tisaiyanvilai called as Panambarai sandstone are equivalent of Cuddalore sandstone formation. The sandstone is seen as patches extending from southwest to northeast direction parallel to the coast. The shell limestone is compact and consists of corals and shells of gastropods and are embedded in a fine grained calcareous matrix.

Quaternary grit, sandstone and shell limestone overlie the Miocene rocks with a distinct unconformity marked by a bed of conglomerates in the southeastern corner of Nanguneri taluk.

Kankar and tuffaceous limestone of recent age occur along the nallahs of the Karamaniyar, Nambiyar and its tributaries over a width of 200m to 300m and extends over a length of 6 km and more. It is generally hard, massive and shows a modular structure.

In the southeastern part of the basin, beyond Sattankulam and Tisayanvilai, recent to sub-recent quaternary alluvial plains extend with isolated friable sandstone and shell limestone. Teri sands occur north of Tisaiyanvilai (Ittamali Teri) and Northeast of Sattankulam (Kudiramoli Teri) with considerable thickness ranging from 20 to 35 m. These are reddish in colour and medium to coarse grained.

### 4.7 Hydro-Geology

In hard rocks, weathered zone exists up to 25 mbgl underlain by fractures up to 30 mbgl as per lithology of boreholes. In Nanguneri, Vadaku Valliyur and Vijaynarayananapuram areas the yield of the bore wells range from
54 to 295 lpm. Transmissivity of the aquifer is 10-20 m²/day. Weathered zones exist up to 20 mbgl. followed by fractures up to 40 mbgl. Yield of the bore wells in this area range from 25 to 100 lpm. Transmissivity of the formation vary from 5-10 m²/day. In the western part of the basin (Panagudi and Radhapuram areas) weathered mantle persist from 30-45 mbgl and fractures continue up to 50 mbgl. The yield of the boreholes ranges from 15 to 80 lpm. Transmissivity of the aquifer is from 2 to 40 m²/day. In the southern part of the basin, south of Radhapuram and Kudankulam, the weathered zone exists 15-25 mbgl and fractures continue up to 30 mbgl. Transmissivity of the aquifer in this region is 2 to 30 m²/day. In the southern part of the basin near Kudangulam, sandstone occurs up to 15 mbgl underlain by gneisses. In coastal alluvium, south and southeast of Tisaiyanvilai, sandstone is encountered up to 33 mbgl near Nadaruvari and it goes up to 90 mbgl near Pailanthuruvai underlain by gneisses. In Kundal area sandstone content is up to 120 mbgl with intervening limestone and clay. Water level is at 26 mbgl. and the yield is 583 lpm. The transmissivity of the aquifer is 43 m²/day. Specific conductance of groundwater is 655 microsiemens. In general yield of bore wells in Teri sands in sedimentary formations range from 200 to 1950 lpm and in Tertiary sandstones in coastal alluvium area ranges from 75 to 1045 lpm. In hard rocks, the yield of the boreholes range from 45 to 295 lpm.

4.8 INDUSTRIES

4.8.1 Power Generation

There is no power project (Thermal or Hydro Power) situated in this basin. Power is being distributed through southern grid. There is no scope for further development.
4.8.2 Major Industries

Palmyra industry exists in many places. The cottage industries include be-keeping, artificial flowers making, cane furniture making, wood turning industry, tailoring etc., and safety matches are made in many places. Handloom weaving, beedi rolling and net weaving are predominant in some places. Cotton, yarn and textiles are the main items produced by the large-scale industries. Seyed Cotton Mills is a medium scale industry with 224 workers. Sundaram Textile Limited is a spinning factory manufacturing cotton yarn. The factory provides employment to 400 persons.

4.8.3 Mineral-Based Industry

Limestone, Kankar, Garnet and Limonite are available in large quantities. There are number of stone crushers which use the stones for making jellies. There are also bricks and tiles industries, which use earth for making bricks and tiles. Granites which are used for polishing are found in many places. Beedi manufacturing is an important industry. Every village has small factories where beedies are made.

4.8.4 Garnet Industry

A group of complex silicate minerals by name Garnet have physical properties of isometric crystal formula and general chemical formula. The beech area of Radhapuram taluk contains a variety of garnets, which is used in industries as almandite, the occurrence of which here, is commercially attractive. The garnet is collected under mining leases. V.V. Minerals is one of the important garnet industries in the basin. Nanguneri taluk under the basin has been selected for intensive development of rural industries. The Government of Tamil Nadu is conducting many schemes to improve the status of the people.
4.9 NON-CONVENTIONAL ENERGY RESOURCES

A highly favourable wind for six months during South West monsoon is a good source of power. Similarly there is moderate wind during North East monsoon. Prior to 1990, the industries in India, and in particular Tamil Nadu, registered deceleration and there was a setback in the industrial growth all over India.

4.10 IMPACT OF INDUSTRIES IN THE BASIN

Most of the industries in the basin are medium or small scale industries. The raw materials used in various industries are cotton, coconut waste, seeds for oil, latex, lime stone, wood, sand, milk flour and polythene etc., The source of water for most of the industries is only groundwater through bore wells. The industrial water supply requirement for the basin area was calculated by Public Works Department, Government of Tamil Nadu, as 1.8314 MCM in 1994. The demand projection has been calculated by TNPWD and the data is given below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Water demand in MCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>5.4990</td>
</tr>
<tr>
<td>2044</td>
<td>9.1500</td>
</tr>
</tbody>
</table>

Due to over extraction of ground water, the water table is considerably lowered. Large number of mining industries causes geomorphologic changes which also may be a reason for runoff. There are no direct entry points of pollution from the industries to the rivers, channels and tanks. It has been observed that no hazardous chemicals or effluents are discharged in rivers or channels or tanks. Most of the industries do not have proper effluent treatment facilities. The only possible pollution is the dust
pollution due to many crusher mills, lime stone and blue metal industries. This leads to bronchial diseases. Women and children are involved in beedi industries which pose the major problem of health of the people.

4.11 DISEASE / HEALTH HAZARDS

The predominant places for kidney disorders are Uvari, Tissayanvilai, Radhapuram, Chettikulam, Therkukallikulam, Moolakaraipatti, Ittamoli and Munanjipatti. There is no report of epidemic in the basin area. Seasonal fever and diarrhea are reported in many villages. The reason for kidney disorder is due to the salinity of ground water in this area. This is also because of lack of rainfall, scarcity of water and sea water intrusion. Skin related diseases are often reported because of the poor quality of water, water logging, poor drainage and sanitary facilities. Thyroid disease due to iodine deficiency has also been reported in many villages such as Sattankulam, Udankudi etc., Because of the above mentioned reasons and lesser chances for agricultural labour, people started migrating to major cities like Mumbai, Chennai etc., and the rate of migration is very high in this area.