

Pennaiyar Basin

Introduction

Location and extent

As per the Central Water Commission's Basin Report, Pennaiyar Basin is the second largest interstate East flowing river basin among the 12 basins lying between Pennar and Cauvery basins. It covers a large area in the State of Tamil Nadu besides the areas covered in the states of Karnataka and Andhra Pradesh

The basin is located between the geographical co-ordinates Latitude 11⁰ 38'30" N & 12⁰ 54'00" N and Longitude 77⁰ 39'30" E & 79⁰ 54".15" E. The total area of the basin in Tamil Nadu is 11,375.55sq.km and that of Union Territory of Pondicherry is 90 Sq.km.

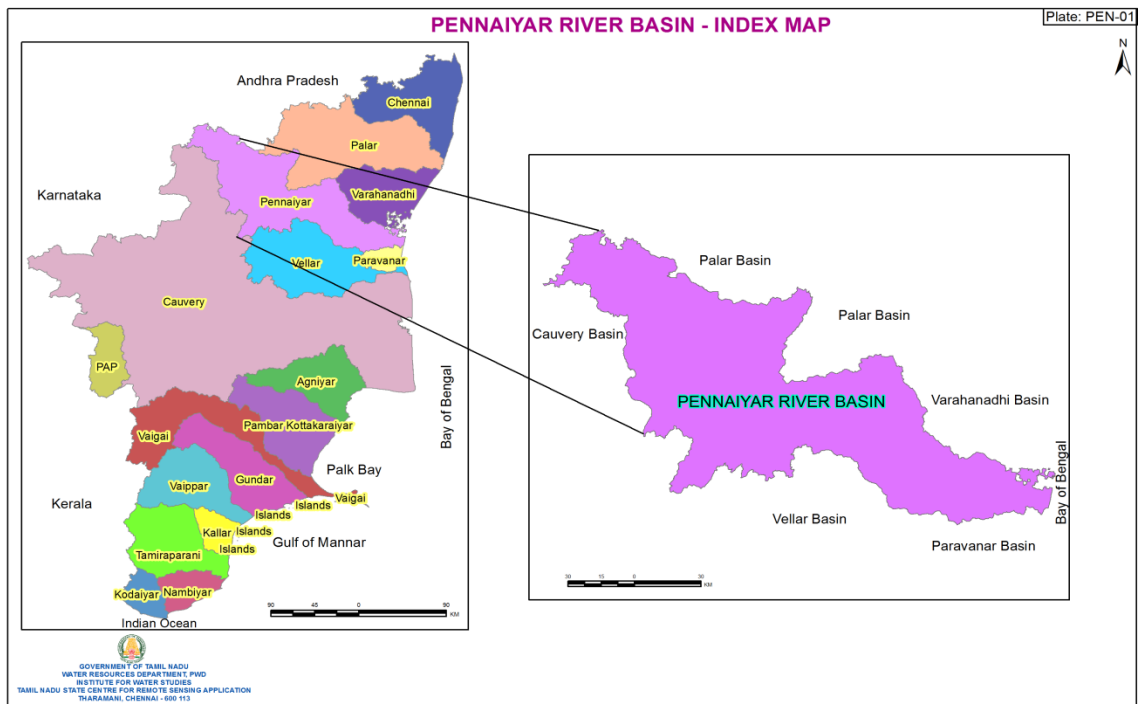


Figure 1 Index Map of Pennaiyar River Basin

Table 1 Sub Basin Wise Administrative Details (According To Flow Pattern)

Sl. No.	Sub Basin Name	Sub Basin Area Sq.Km.	District Name	District Area in Sq.Km.
1	Chinnar - West	125.315	Krishnagiri	125.315
2	Chinnar - East	307.959	Krishnagiri	307.959
3	Markandanadhi	368.210	Krishnagiri	368.210
4	Kambainallur	919.279	Dharmapuri	891.804
			Krishnagiri	27.475
5	Pambar	1757.418	Dharmapuri	4.834
			Krishnagiri	902.857
			Vellore	849.727

6	Vaniyar	998.385	Dharmapuri	817.580
			Krishnagiri	3.131
			Salem	177.674
7	Matturar	58.498	Dharmapuri	0.002
			Krishnagiri	18.441
			Thiruvannamalai	35.547
			Vellore	4.508
8	Kottapattikallar	410.229	Dharmapuri	353.120
			Salem	13.429
			Thiruvannamalai	3.947
			Villupuram	39.733
9	ValayarOdai	85.394	Thiruvannamalai	85.394
10	RamakalOdai	14.415	Thiruvannamalai	14.415
11	Pambaran and Varattar	292.092	Dharmapuri	18.785
			Thiruvannamalai	244.648
			Villupuram	28.659
12	Aliyar	211.070	Thiruvannamalai	211.070
13	Musukundanadhi	179.255	Thiruvannamalai	13.441
			Villupuram	165.814
14	Thurinjalur	853.623	Thiruvannamalai	742.772
			Villupuram	110.851
15	Gadilam	1562.903	Cuddalore	503.475
			Villupuram	1059.428
16	Upto Krishnagiri Reservoir	772.638	Dharmapuri	14.749
			Krishnagiri	757.889
17	Krishnagiri to Pambar	894.518	Dharmapuri	208.888
			Krishnagiri	685.630
18	Pambar to Thirukovilur	1002.393	Dharmapuri	196.521
			Krishnagiri	49.211
			Thiruvannamalai	370.600
			Vellore	48.804
			Villupuram	337.257
19	Lower Pennaiyar	561.963	Cuddalore	162.015
			Villupuram	399.948

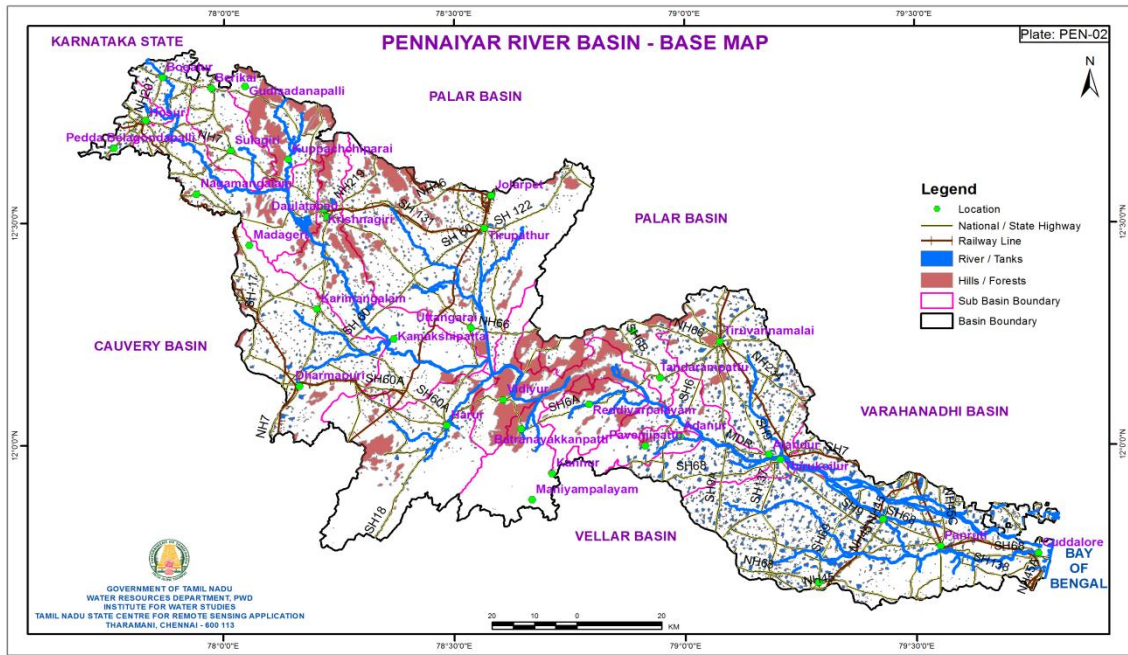


Figure 2 Base Map of Pennaiyar River Basin

This Figure depicts the rivers and reservoirs in the basin, hills and reserved forest and settlements.

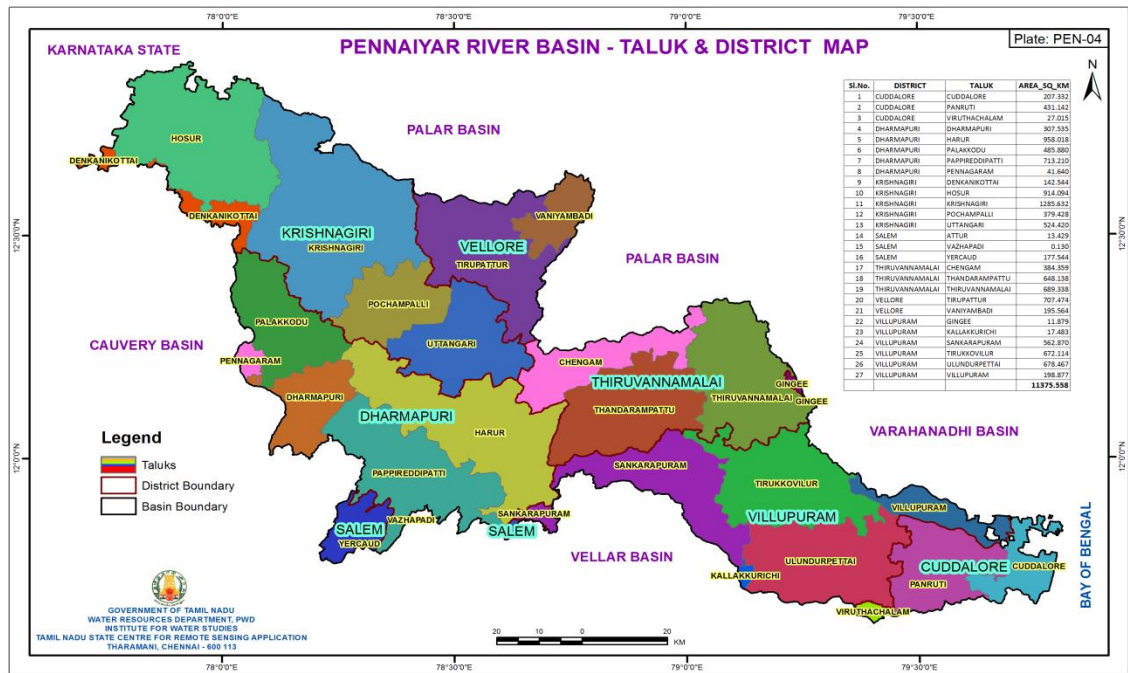


Figure 3 District Map of Pennaiyar River Basin

The number of districts covered by the basin is illustrated. The area of the districts covered, the taluks and blocks covered are given in Table 1

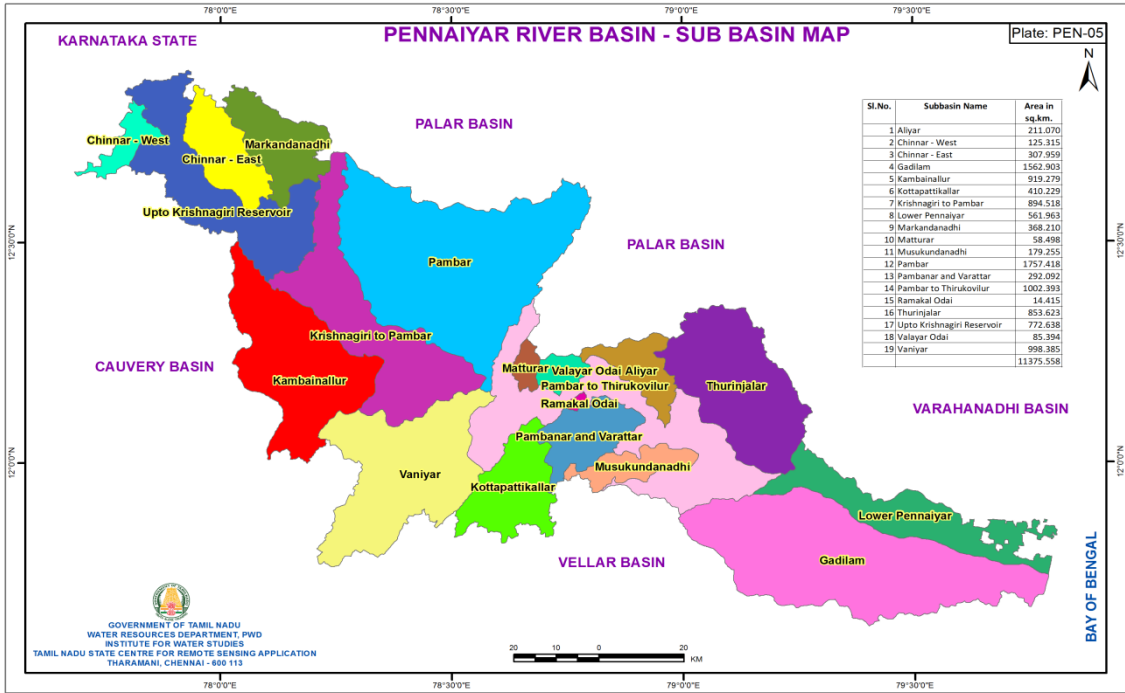


Figure 4 Sub Basin Map of Pennaiyar River Basin

There are 19 sub-basins in the Pennaiyar river basin. The area of the sub basins are given in the figure 4.

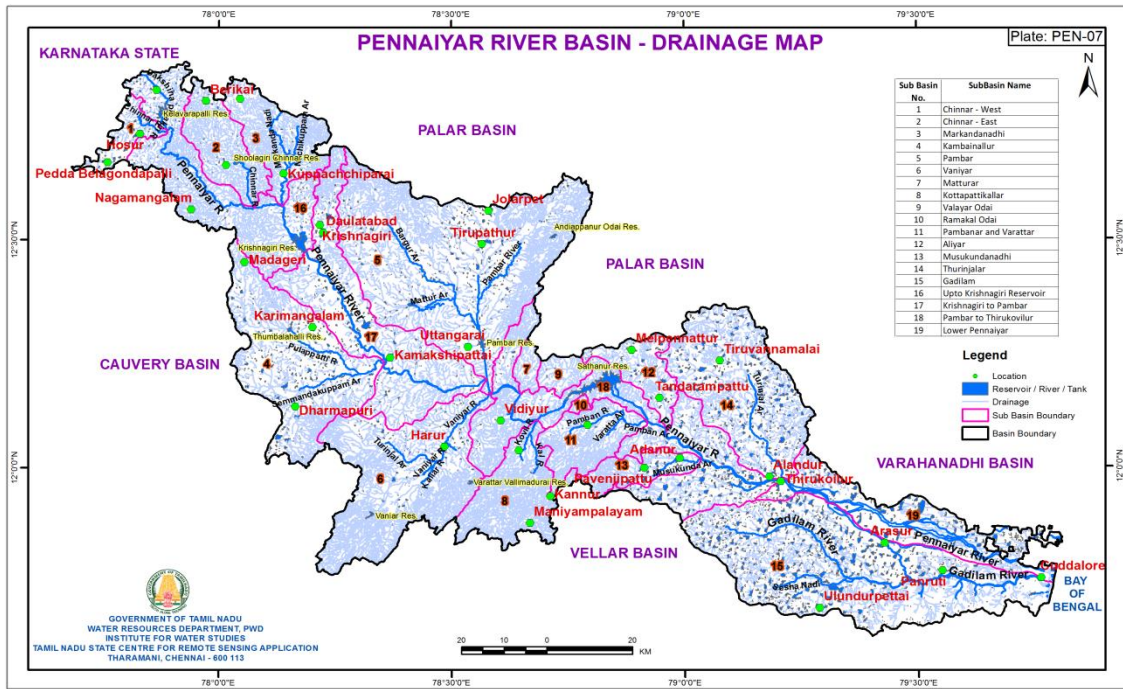


Figure 5 Drainage Map of Pennaiyar River Basin

Table2 Description of Land Forms and Groundwater Occurrence

Geomorphic Units	Characteristics	Hydrogeology	Groundwater Potential
Estuary	It is usually defined as that part of lower river coast	It is affected by the mixing of fresh water and salt water.	Saline
Beach ridges	It is adjacent to the coastal area. Parallel to sub parallel ridges developed. Parallel to the coastline. Running several kilometers length.	Comprised of wind blown sand and shell directly rain fed. Good recharge. High infiltration	Moderate
Swales	Forms in the coastal zone in between ridges and sand dunes. It is forming a low-lying depression.	Infiltration moderate recharge is good. Shallow water table.	Good
Alluvial Plain (Flood plain & Interfluvials plain)	Comprised of flat surface of the flood plains and the fluvials carried in between the streams are forming an unconsolidated sediment like, sand silt, gravels sand particles dominates.	In filtration good recharge in very good from flood water discharge by two or three stream comprehending of several old river course show the of river.	Good to Very good
River island	Comprised of coarse to fine alluvium. It remain as island in the river course. Having a thick vegetation cover.	Infiltration and recharge is good	Good
Sand dune (Active)	Active sand dunes change the forms constantly migrating under influence of prevailing wind such dunes are common and area devoid of vegetative cover. Observed in between rivers.	Infiltration is high. Recharge is mostly from the rainfall and run of water.	Poor to moderate
Old river course	Comprised of sand grains of various sizes with clay forming a narrow uniformly widened course. And in between the rivers.	Infiltration is higher in this unit. Recharge is goods and mainly from the rivers.	Very good
Bazada	Coalescence of alluvial cones and fans formed at the break of composite slopes at the foothills boundary	More infiltration. Recharge zone is comprised of colluviofluvial materials	Good
Geomorphic Units	Characteristics	Hydrogeology	Groundwater Potential
Valley fill	Comprised of cobbles, pebbles and detridal materials of	Infiltration is good recharge is from stream	Good

	varying grains, sizes, lithology like sarel, silt, kankar and friable clay. Formed in linear depression along the stream /drainage	and rivers	
Duricrust	Poor drainage facility. Induced evaporation and percolation cause thin salt incrustation. Very fine silty clay	Less Infiltration	Very Poor
Upland (Teritary)	Occupying elevated land plain terrain-medium to coarse textured less drainage density. Infiltration and permeability is good. Prone to erosion and deterioration.	Direct recharge from rainfall. Infiltration	Good Deeper aquifers
Gullies and Ravines	Formation of perceptible unconsolidated materials removed in gullies. Comprises fine grained alluvium semi consolidated. Dissection of land network developed in gullies. Drainage flowing from upland developed along the river course	Run off zone filled with alluvials at the bottom of gullies and ravines.	Poor
Pediment	Rock cut surface with thin veneer of soil cover. Under going deterioration and erosional processes.	Run off zone	Poor
Pediment (Out crop Complex)	Forming more outcrops area with the without soil cover.	Run off zone	Poor
Pediment covered by out crop (Reserve Forest)	Outcrops area covered by the reserve forest.	Direct recharge from rainfall	Run off zone
Buried pediment Shallow	Intermediate zone Between pediment and buried pediment moderate weathering thickness is less.	Moderate infiltration recharge by influenced by hydrogeolgical feature	Less to Moderate
Geomorphic Units	Characteristics	Hydrogeology	Groundwater Potential
Buried pediment Shallow (moderate)	Intermediate zone Between buried pediment shallow and shallow buried pediment deep. Weathering thickness is moderate.	Poor infiltration recharge by influenced by hydrological feature	Moderate
Buried pediment Shallow (Deep)	Intermediate zone between buried pediment moderate and	Moderate infiltration recharge, influenced by	Moderate

	deep buried pediment. Weathering thickness is appreciably more.	hydrogeological features	
Buried Pediment Deep	Occupying low-lying topography. Weathered thickness more connected by good drainage network and hydrological bodies. Less drainage density. Infiltration and permeability is good.	Infiltration is high. Recharge from tanks and streams. Moderate infiltration recharge by influenced by hydrological feature	Good
Hill top valleys (Erosional Surface)	Developed in the vegetation in the low lying topograph on the hills. Comprised of colluvium and fluvium with less to moderate thickness of weathered rock	Soil moisture high. Good recharge from rain water infiltration good	Good to Moderate
Structural Hill	Composed of composite ridges and hill top valleys traversed by structural features	Run off zone Little Infiltration moderate on the hill top valleys and super imposed secondary fractures	Moderate and poor

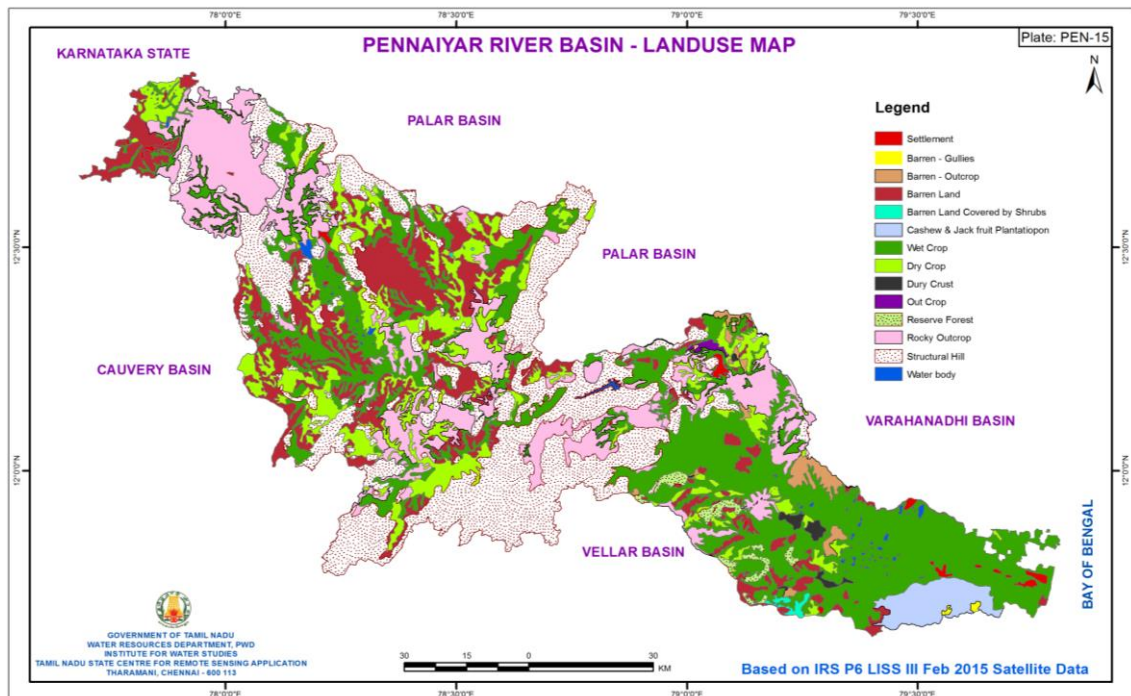


Figure 6 Landuse Map of Pennaiyar Sub Basin

Table 3 Land use Classification – Pennaiyar River Basin

Landuse Category		2015	
I st Level	II nd Level	Area in sq.km.	Percentage %
Crop Land	Paddy and Sugarcane	3213.94	28.25
	Groundnut, Cholam, Etc.	1264.28	11.11
	Cashew and Jack fruit plantation	199.33	1.75
		4677.55	41.12
Waste Land	Land affected by Alkalinity/ Salinity	45.58	0.40
	Barren Land	1360.45	11.95
	Barren Land- Out Crop	126.93	1.12
	Barren Land –Gullies	7.41	0.07
	Barren Land Covered by Shrub	22.78	0.20
	Out Crop	14.47	0.13
	Rocky Out Crop	1601.54	14.08
		3179.16	27.95
Forest Land	Reserve Forest	125.56	1.10
	Structural Hill/Medium Dense Forest	2882.64	25.34
		3008.20	26.44
Water Bodies	Tank/ Reservoir River	408.32	3.59
Settlement		102.32	0.90
TOTAL		11,375.55	100

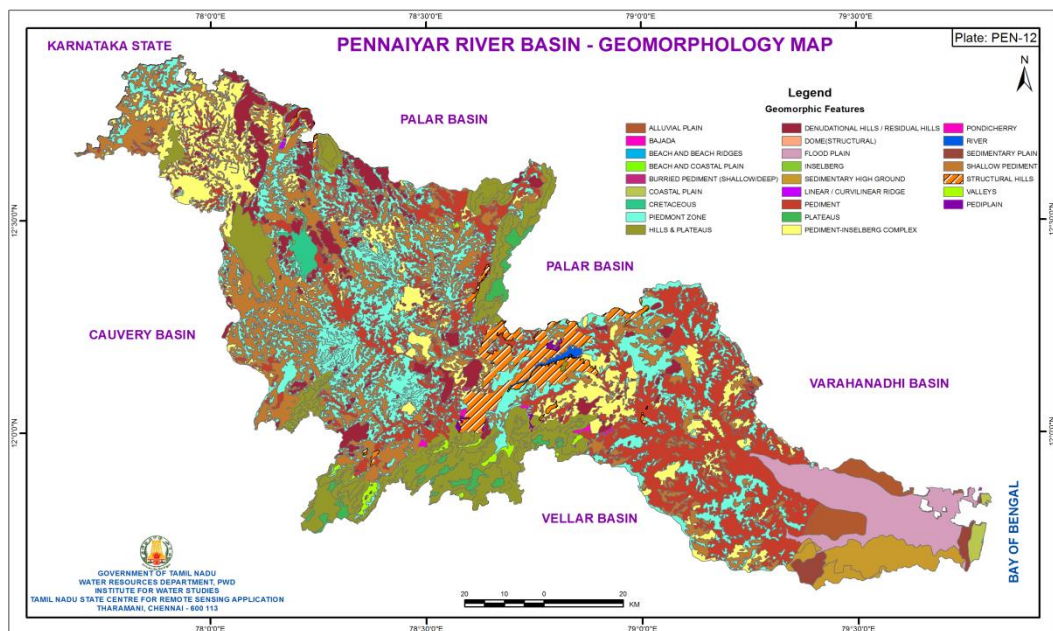


Figure 7 Geomorphology Map of Pennaiyar River Basin

Table 4 Geomorphology

Sl. No.	Geomorphic Unit	Area in Sq. Km	Percentage %
1.	Estuary	5.90	0.05
2.	Alluvial plain (Flood plain & interfluvials plain)	487.04	4.26
3.	River Island	13.54	0.12
4.	Sand dune	12.69	0.11
5.	Old river course	67.05	0.58
6.	Bazada	34.19	0.30
7.	Valley fill	214.63	1.88
8.	Duri crust	47.67	0.42
9.	Upland (Tertiary)	295.45	2.58
10.	Gullied and Ravines	62.93	0.55
11.	Pediment	654.53	5.72
12.	Pediment covered by outcrop	3082.53	26.94
13.	Pediment covered by outcrop/RF	43.98	0.38
14.	Shallow buried pediment	684.90	5.99
15.	Shallow buried pediment moderate	1272.53	11.12
16.	Shallow buried pediment deep	637.66	5.57
17.	Deep buried pediment	429.15	3.75
18.	Hill top valleys	181.78	1.59
19.	Low structure hill	249.18	2.18
20.	Structure hill/ RF	16.86	0.15
21.	Structural hill	2473.11	21.62
22.	Settlement	71.83	0.63
23.	Tank/River/Reservoir	426.43	3.73
Total		11465.558	100.00

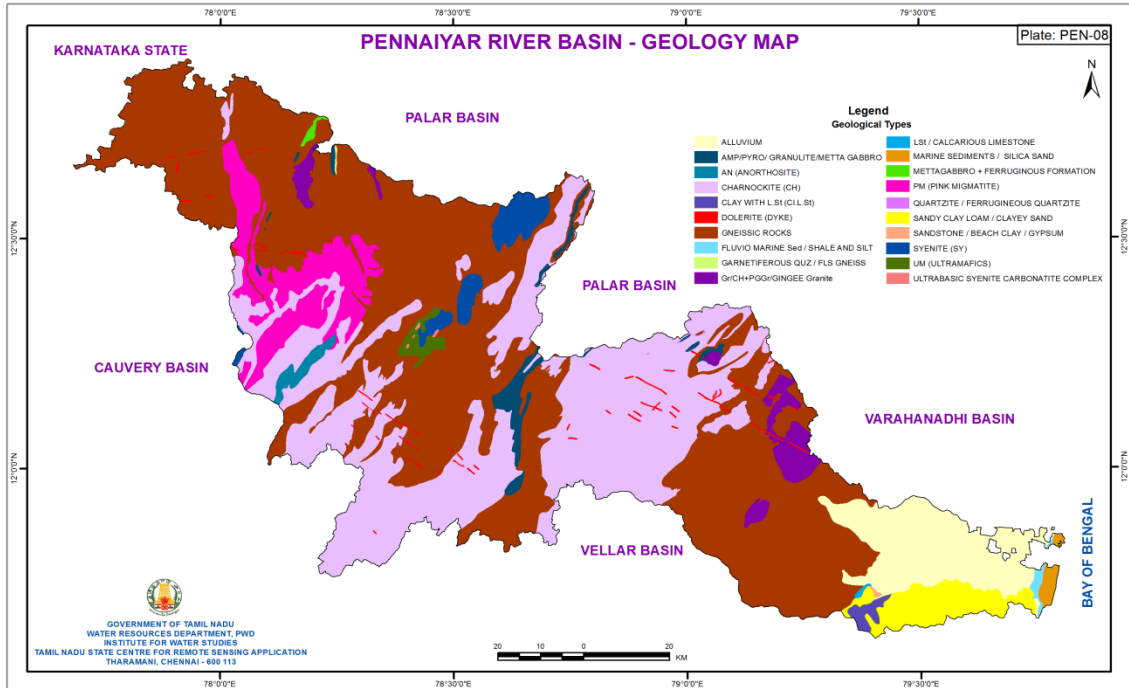


Figure 8 Geology Map of Pennaiyar Sub Basin

Western part of Tiruvannamalai district in the basin is a hilly terrain (structural hills & denudation hills & plateaus) with an undulating rugged topography. Rocks of the hornblende-biotite gneiss and epidote-hornblende gneiss occur as concordant bands within the charnockite country. These bands are involved in sympathetic folding within the charnockite rocks. Landslide prone areas are demarcated near Polur of Tiruvannamalai district.

A greater part of the Villupuram district in the basin is covered by rocks belonging to Archaean age comprising the charnockite group and the migmatite complex. The terrain displays much-structural complexity due to the multiple deformations it has suffered. A number of prominent shear zones have been recognized viz., N-S shear zone, east of Gingee town and NNW-SSW near the eastern foot of the Kalayan hill SW of Kallakkurichchi and is the most striking. The rock of Mio-Pliocene age i.e. Cuddalore sandstone and laterite were from low plateaus in the northeastern part of the district. The south-central part is marked by depositional regime of Pennaiyar and Gadilam rivers. These are manifested in the form of flood plains occurring at the lowest elevation in the areas. The coastal plain represents Cretaceous- Eocene formation. Some of the Palaeo shorelines are recognizable inland suggesting periods of marine transgression and regression. The Quaternary sediments are of the two types that are deposited under fluvial environment and Marine environment. They comprise flood plain / back swamp deposit (lagoon) tidal flat, mudflat deposits (black clays and muds.) The ongoing geodynamic process is generally progradation along the coast which is modified at several places by erosion and deposition by aeolian and fluvial sediments.

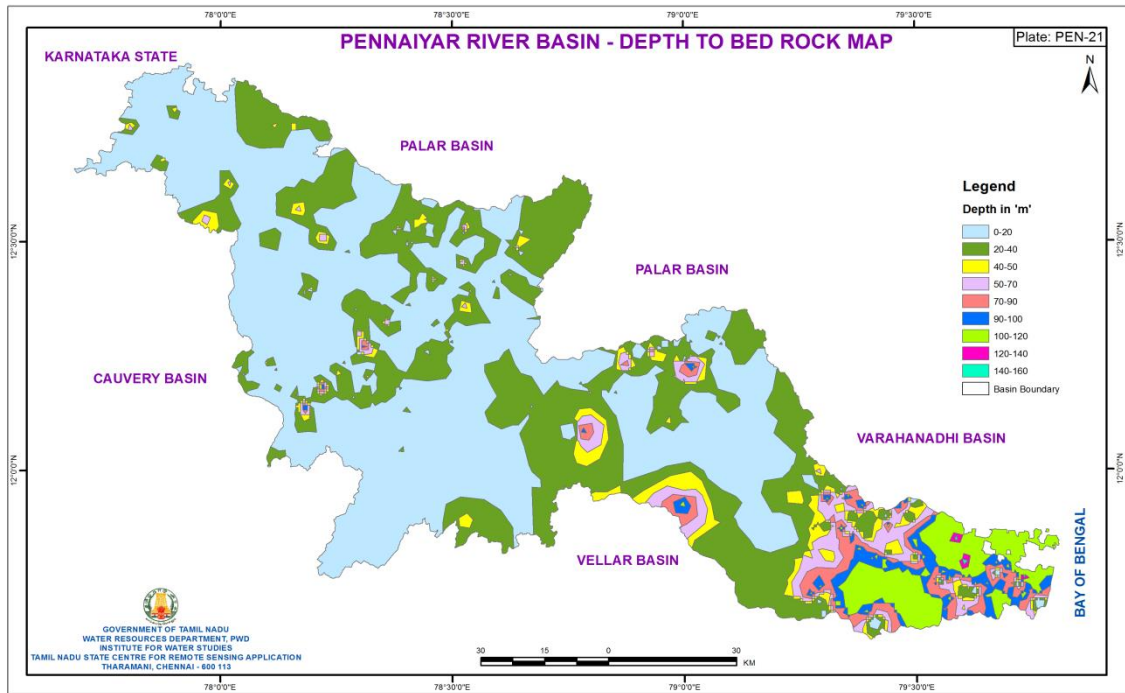


Figure 9 Depth to Bedrock Map of Pennaiyar Sub Basin

Based on Vertical Electrical Soundings (VES), the following maps are generated with interpolation techniques.

- 1) Depth of Unconsolidation Map
- 2) Depth to Weathered rock and
- 3) Depth to bed rock representing the depth to bottom of aquifer in metre below ground level has been drawn.

Depth of unconsolidation map is used to analyse the foundation structures in construction industry. Depth of weathered rock map is showing the actual dynamic ground water column and water level below this indicates the over extraction status of the area. Hence in general the depth to bedrock map is used in assessing groundwater quantum.

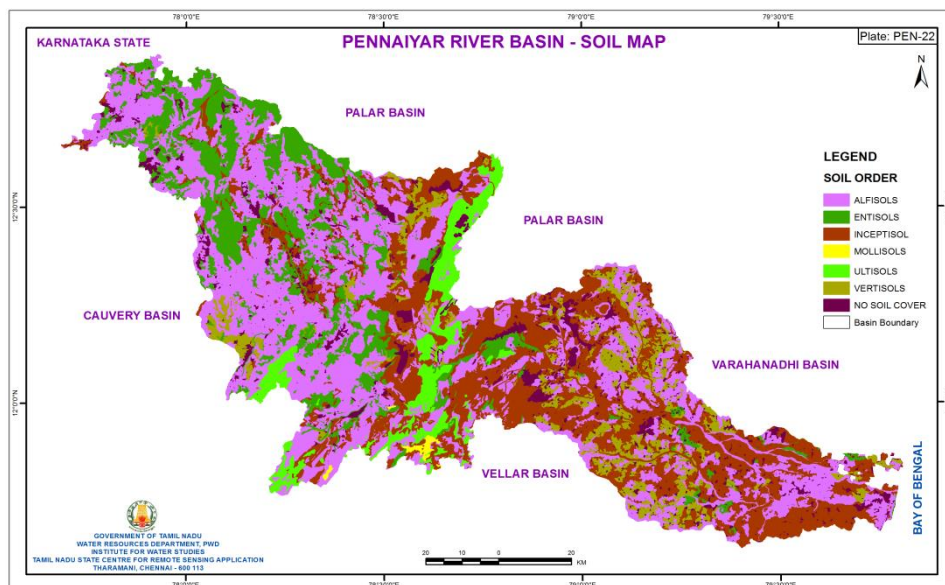


Figure 10 Soil Map of Pennaiyar Sub Basin

The soils of the Pennaiyar Basin have been shown in Figure 10. The predominant soil types found in this river basin is Inceptisols, Alfisols, Entisols and Vertisols. Due to different stages of weathering of parent material, the above soil types are met within combination.

Larger part of the Dharmapuri and Krishnagiri district is covered by Entisols and a little extent is occurring in Villupuram and Vellore districts.

Demographic and social characteristics:

The projected population in Pennaiyar River Basin for 2014 is given below in **Table 5**.

Table 5 Projected population in Pennaiyar River Basin for 2015

S. No	Name of Sub basin	Area in Sq.km	Total Urban Population in million		Total Rural Population in million	
			2011	2015	2011	2015
1	Chinnar West	125.32	0.000	0.000	0.089	0.094
2	Chinnar East	307.96	0.219	0.237	0.049	0.052
3.	Markandanathi	368.21	0.000	0.000	0.101	0.106
4.	Kambainallur	919.28	0.086	0.093	0.366	0.385
5.	Pambar	1757.42	0.132	0.143	0.611	0.643
6.	Vaniyar	998.39	0.046	0.050	0.247	0.260
7.	Maturar	58.50	0.000	0.000	0.016	0.017
8	Kottapattikallar	410.23	0.000	0.000	0.039	0.041
9	ValayarOdai	85.39	0.000	0.000	0.021	0.022
10	RamakkalOdai	14.41	0.000	0.000	0.000	0.000
11	Pambanar and Varattar	292.09	0.000	0.000	0.069	0.073
12	Aliyar	211.07	0.000	0.000	0.063	0.066
13	Muskundanadhi	179.26	0.000	0.000	0.058	0.061
14	Thurinjalar	853.62	0.181	0.196	0.347	0.365
15	Gadilam	1562.90	0.334	0.362	0.768	0.809
16	UptoKrishnagiri Reservoir	772.64	0.021	0.023	0.233	0.245

17	Krishnagiri to Pambar	894.52	0.164	0.178	0.301	0.317
18	Pambar to Thirukovilur	1002.39	0.013	0.014	0.300	0.316
19	Lower Pennaiyar	561.96	0.06	0.065	0.343	0.361
	Total	11375.56	1.256	1.361	4.021	4.233
Average Annual growth rate			1.3%		2%	

Population Density

The Sub Basin wise population density of Pennaiyar River Basin is given in **Table 6**. The population density is higher in Chinnar West sub Basin (2149 persons per sq.km) and lower in Kottapattikallar sub Basin (95 Persons per sq.km).

Table 6 Sub Basin wise population density in the Pennaiyar River Basin

Sl. No	Name of the sub Basin	Area (Sq.km)	Total population 2015	Density (Person/Sq.km)
1.	Chinnar West	125.32	269291	2149
2.	Chinnar East	307.96	89169	290
3.	Markandanathi	368.21	100511	273
4.	Kambainallur	919.28	451616	491
5.	Pambar	1757.42	742856	423
6.	Vaniyar	998.39	293049	294
7.	Maturar	58.50	16388	280
8	Kottapattikallar	410.23	38846	95
9	ValayarOdai	85.39	20777	243
10	RamakkalOdai	14.41	0	0
11	Pambanar and Varattar	292.09	69445	238
12	Aliyar	211.07	62955	298
13	Muskundanadhi	179.26	57854	323
14	Thurinjalar	853.62	527497	618
15	Gadilam	1562.90	1101439	705
16	UptoKrishnagiriReservoir	772.64	254107	329

17	Krishnagiri to Pambar	894.52	465348	520
18	Pamabar to Thirukovilur	1002.39	313719	313
19	Lower Pennaiyar	561.96	403571	718
Total		11375.56	5278438	
Average population Density				453

Hydro meteorological characteristics

Monsoon and Non-monsoon periods

Pennaiyar river basin lies within the tropical monsoon zone. Based on the hydro-meteorological features of the basin, year is divided into two periods (i.e) 1) Monsoon period spanning from June to December and 2) Non-monsoon period spanning from January to May. The monsoon period is further sub-divided into Southwest monsoon period spanning from June to September (4 months) and Northeast monsoon period spanning from October to December (3 months). Similarly, the non-monsoon period is further sub-divided into winter period spanning from January & February (2 months) and summer period spanning from March to May (3 months). The monsoon period is hydrological significant for water resources analysis.

Table 7 Sub basin wise Dependable Rainfall in mm

Name of the sub basin	Dependability			
	25%	50%	75%	90%
Chinnar - West	24.72	18.21	13.53	9.45
Chinnar - East	52.97	44.63	30.41	21.55
Markandanadhi	71.52	60.64	42.67	28.95
Kambainallur	223.43	160.50	140.44	114.26
Pambar	276.66	219.59	135.22	97.03
Vaniyar	203.15	173.65	124.77	98.38
Mottur	11.13	8.93	6.78	3.18
Kovilar	94.43	78.54	63.98	50.10
Valayar Odai	17.85	15.29	10.50	6.44
Ramakal Odai	3.19	2.37	1.34	0.85
Pambanar and Varattar	66.45	51.61	41.91	30.40

Aliyar	74.08	57.14	43.92	27.77
Musukundanadhi	39.67	31.91	22.01	16.18
Thurinjalar	193.23	155.18	121.08	74.14
Gadilam	430.49	312.10	247.15	96.38
Upto Krishnagiri Reservoir	158.58	123.58	88.42	66.91
Krishnagiri to Pambar	174.66	138.78	112.76	101.50
Pambar to Thirukovilur	123.47	91.08	48.63	24.56
Lower Pennaiyar	215.88	177.93	145.09	101.46

Table 8 Aridity Index (I_a) For Climatic Classification						
S.No.	Name of Stations	Annual Ave. Precipitation P mm	PET mm	Total deficit P-PET mm	I_a Aridity Index	Classification
1	Cuddalore	1171.72	1479.90	308.18	-20.82	Dry humid
2	Panruti	1081.91	1479.90	397.99	-26.89	Dry humid
3	Barur	846.98	1479.90	632.92	-42.77	Semi Arid
4	Dharmapuri	961.76	1479.90	518.14	-35.01	Semi Arid
5	Harur	902.39	1479.90	577.51	-39.02	Semi Arid
6	Nedungal	878.32	1479.90	601.58	-40.65	Semi Arid
7	Palacode	900.08	1479.90	579.82	-39.18	Semi Arid
8	Thalli	884.63	1479.90	595.27	-40.22	Semi Arid
9	Hosur	695.53	1479.90	784.37	-53.00	Semi Arid
10	Krishnagiri	1005.58	1479.90	474.32	-32.05	Dry humid
11	Melumalai	820.37	1479.90	659.53	-44.57	Semi Arid
12	Penkondapuram	627.56	1479.90	852.34	-57.59	Semi Arid
13	Royakotta	575.41	1479.90	904.49	-61.12	Semi Arid
14	Uthangarai	736.36	1479.90	743.54	-50.24	Semi Arid

15	Chengam	920.90	1479.90	559.00	-37.77	Semi Arid
16	Kilnatchipattu	917.36	1479.90	562.54	-38.01	Semi Arid
17	Sathanur Dam	790.14	1479.90	689.76	-46.61	Semi Arid
18	Sathanur Pickup Anicut	936.81	1479.90	543.09	-36.70	Semi Arid
19	Thiruvannamalai	924.51	1479.90	555.39	-37.53	Semi Arid
20	Vanapuram	984.26	1479.90	495.64	-33.49	Semi Arid
21	Thirupathur	853.59	1479.90	626.31	-42.32	Semi Arid
22	Vaniyambadi	809.65	1479.90	670.25	-45.29	Semi Arid
23	Thirukoilur	988.00	1479.90	491.90	-33.24	Dry humid
24	Thirukoilur Anicut	1025.37	1479.90	454.53	-30.71	Dry humid
25	Ulundhurpet	1002.69	1479.90	477.21	-32.25	Dry humid
26	Vanur	926.26	1479.90	553.64	-37.41	Semi Arid
27	Villupuram	1000.66	1479.90	479.24	-32.38	Dry humid
28	Pondicherry	1291.64	1479.90	188.26	-12.72	Dry humid

Table 9 Weather Stations

SI.No	Name of the weather station	Sub-basin	Maintained by
1	Kilinachipattu	Thurinjaralar	PWD
2	Melumalai	Chinnar east	PWD
3	Palur	Gadilam	PWD
4	Thirukoilur FCS	Lower Pennaiyar	PWD
5	Vaniyar reservoir	Vaniyar	PWD
6	Krishnagiri Reservoir	Krishnagiri to Pambar	PWD

Table 10 Climatological Parameters

SI. No	Climatological Parameter (Annual Average)	Kilinachipattu	Melumalai	Palur	Thirukoilur FCS	Vaniyar reservoir	Krishnagiri Reservoir
1	Average monthly temperature Maximum in ⁰ Celsius	32.30	31.37	33.31	30.81	28.94	27.76
2	Average monthly temperature Minimum in ⁰ Celsius	24.99	18.72	24.29	19.84	24.32	22.79
3	Average mean temperature in ⁰ Celsius	28.65	25.05	28.80	25.33	26.63	25.28
4	Average relative humidity in %	64.73	70.41	73.94	84.50	78.21	76.77
5	Average wind velocity in km/hour	5.44	2.55	5.17	6.16	4.80	8.45
6	Average Sunshine hours / day	5.22	6.61	6.39	5.80	5.22	5.91
7	Average Pan Evaporation in mm/month	172.63	256.91	162.67	159.16	192.14	204.88

Table 11 Abstract of Drought Assessment (From 2001-02 to 2014-15)

Sl.No.	STATION CODE	M0	M1	M2	M3
1	Anaimaduvu Reservoir	7	6	2	0
2	Barur	7	4	4	0
3	Chengam	7	7	1	0
4	Cuddalore	9	4	2	0
5	Dharmapuri	7	6	1	1
6	Gomukhi Reservoir	9	5	1	0
7	Harur	2	5	4	4
8	Hosur	9	2	4	0
9	Jolarpettai	6	6	3	0
10	Kilnachipattu	7	6	2	0
11	Krishnagiri	8	3	3	1
12	Manimuthar Reservoir	11	4	0	0
13	Marandahalli	8	5	2	0
14	Melumalai	7	5	2	1
15	Nedungal	7	2	6	0
16	Palacode	7	5	3	0

17	Panruti	8	3	0	0
18	Pappireddypatty	4	7	4	0
19	Perugondapuram	7	6	2	0
20	PickupAnicut - Sathanur	7	7	1	0
21	Rayakotta	10	3	1	1
22	Sathanur Dam	10	1	4	0
23	Thalli	10	3	2	0
24	Thanipadi	8	7	0	0
25	Thirukovilur	8	5	2	0
26	Thirupathur	10	2	1	2
27	Thiruvannamalai	12	2	1	0
28	Thoppaiyar Dam	10	4	0	1
29	Ulundurpet	4	9	2	0
30	Uthangarai	8	5	1	1
31	Vanapuram	12	1	2	0
32	Vaniambadi	9	3	3	0
33	Villupuram	8	5	2	0

Table 12 Drought Assessment

Sl. No	Range of Di	Classification of drought	Category
1.	> 0	M0	No drought
2.	0 to - 25	M1	Mild drought
3.	-25 to -50	M2	Moderate drought
4.	< - 50	M3	Severe drought

Eto values (mm/month) of FCS for Pennaiyar basin													
Name of the basin & FCS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
Pennaiyar basin - Vaniyar reservoir FCS	108.8	118.4	155.9	153.0	154.7	139.8	125.6	129.9	114.9	107.9	85.8	85.3	123.3

Table 13 Influencing Raingauge Stations of each sub-basin

Sl. No.	Name of sub basins	Subbasin area (Sq.Km.)	Raingauge stations
1.	Chinnar West	125.315	Thali, Hosur
2.	Chinnar East	307.959	Melumalai
3.	Markandanadhi	368.210	Melumalai, Vanapuram
4.	Kambainallur	919.279	Dharmapuri
5.	Pambar	1757.418	Thirupathur, Perugondapuram
6.	Vaniyar	998.385	Harur
7.	Mottur	58.498	Uthangarai
8.	Kovilar	410.229	Harur, Pickup Anicut
9.	Valayar Odai	85.394	Uthangarai, Sathanur Dam
10.	Ramakkal Odai	14.415	Sathanur Dam
11.	Pambanar and Varattar	292.092	Sathanur Pickup Anicut
12.	Aliyar	211.070	Chengam
13.	Musukandanadhi	179.255	Vanapuram, Sathanur Pickup Anicut
14.	Thurinjalar	853.623	Thiruvannamalai, Kilnachipattu
15.	Gadilam	1562.903	Ulundurpet, Panruti
16.	Upto Krishnagiri Reservoir	772.638	Krishnagiri

17.	Krishnagiri to Pambar	894.518	Barur
18.	Pambar to Thirukoilur	1002.393	Royakotta
19.	Lower Pennaiyar	561.963	Villupuram, Thirukoilur, Cuddalore, Vanur, Thirukoilur Anicut, Pondicherry
	TOTAL	11375.558	

Irrigation and Agriculture Classification and Properties of Soil

Sub-basin wise Soils found in this basin are as follows. Chinnar west, Chinnar east, Kambainallur, Krishnagiri to Pambar, Markandanadhi, Up to krishnagiri reservoir and vaniyar sub basin has Non Calcareous red & brown and calcareous black soil. Aliyar, Gadilam, Kottapattikallar, Lower Pennaiyar, Matturar, Muskundanadhi, Pambar, Pambanar&Varattar, Pambar to Thirukovilur, Ramakkalodai, Thurinjar, Valayarodai has Red sandy loam and clay loam. Some part of Lower Pennaiyar and Gadilam sub basin has got coastal alluvium soil.

Land Holdings

According to the 2010-11 Agricultural census, the state had 81.18 lakh holdings with an operating area of 64.88 lakh ha. Marginal farmers (area less than 1 ha.) constitute 77% who operated 35% of the total area. Small farmers (1 to 2 ha) had a share of 15% and operated 25.3 % of the total area. Semi-medium (2 to 4 ha) and medium farmers (4 to 10 ha.) accounted for 7.5 % and operated 34.0% of the total area. Large farmers (more than 10 ha.) had a share of 0.4% operated 5.4% of total area. Average size of holding in the state was 0.80ha. In Tamil Nadu the per capita availability of land is only 0.19 ha and the per capita net sown area is only 0.10 ha.

PENNAIYAR RIVER SYSTEM:

The Pennaiyar river is having 14 tributaries, namely, 1.Chinnar West, 2.Chinnar East, 3.Markandanadhi, 4.Kambainallur, 5.Pambar, 6.Vaniyar, 7.Kottaipatti, 8.Kallar, 9.Valayar Odai, 10.Ramakkal, 11.Pambanar, 12.Aliyar, 13.Musukundanadhi and 14.Thurinjar.

There are also 7 major Anicuts namely NedungalAnicut, KumarapattiAnicut, IchembadiAnicut, Sathanur pick up Anicut, TirukkoilurAnicut, Ellis ChoultryAnicut and SornavurAnicut.

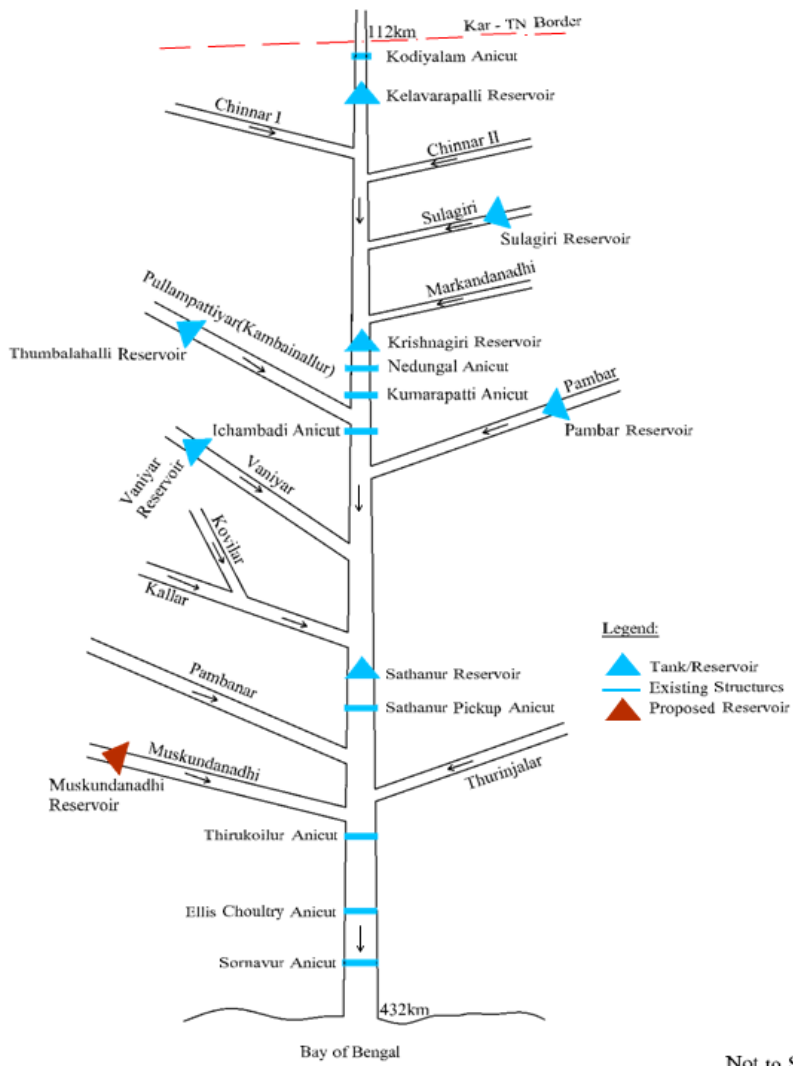
In addition to this, there are 152 Minor Anicuts and about 66 open offtake channels in this river basin. A pick up anicut is located below 7km from the Sathanur reservoir to divert water to canals and river.Tirukovilur, Ellis Choultry, Sornavuranicuts are the major anicuts located below the Sathanur reservoir. There are 19 open off takes to feed the tanks above TirukovilurAnicut and 47 open off takes to feed the tanks below TirukovilurAnicut.

Tributaries of River Pennaiyar

S. No.	River	Source	Sub-Tributaries	Length of Main	Drainage sqkm.
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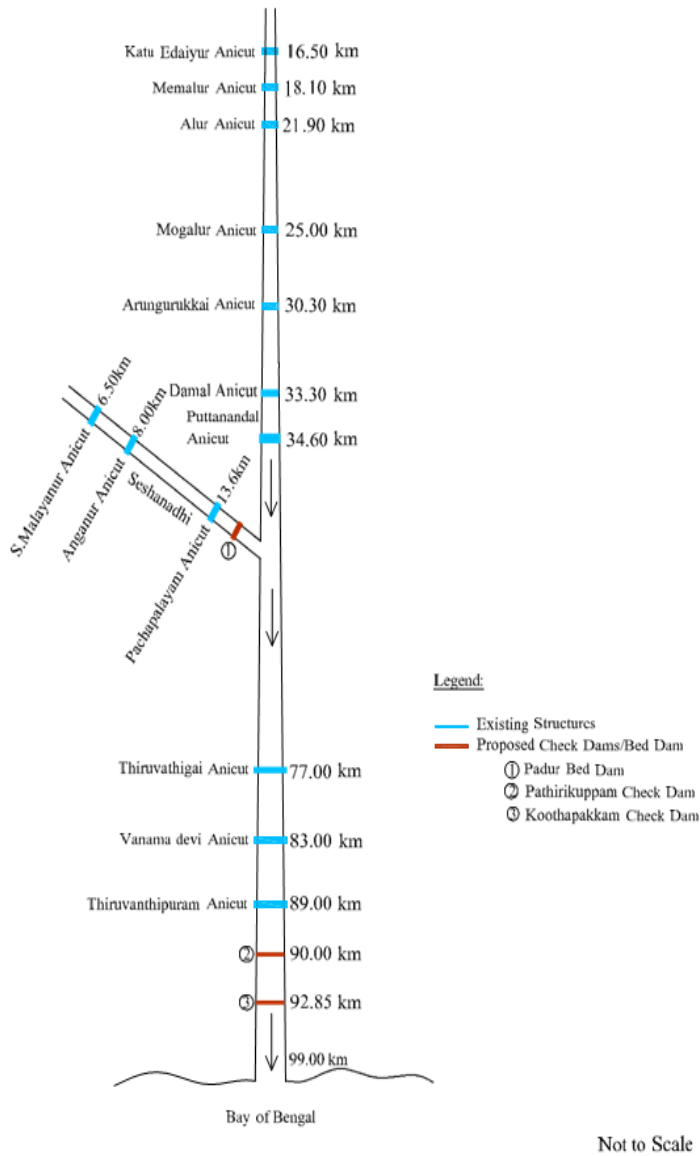
				Tributaries km	
1	Chinnar West	Karnataka		40	120
2	Chinnar East	Berigai		30	300
3	Markandanathi	Karnataka	Natchikuppam, Veppanapatti R	30	450
4	Kambainallur	Thoppur Hills MSL 2950 DharmapuriTaluk	Palapathi Solakuttai	50	900
5	Pambar	Alangayam Hills MSL 3200	Mottur river Bargur river Kunnathur R	70	1900
6	Vaniyar	VaniyambadiTaluk Yercaud Shevoray Hills	Meenar Peeniar Kallar Varattar	55	1100
7	Kottapatti	Kalvarayan Hills	-	40	450
8	Kallar	HarurTaluk			
9	ValayarOdai	ChengamTaluk	KodiOdai Para- yarpalayamodai	15	70
10	Ramakkal	Ponnaiyar R.F. MSL 1500		5	16
11	Pambanar	ValasamalaiVaratta r R.F. 3400 MSL	Varattar Nettapalli Ar.	35	280
12	Aliyar	ChengamTaluk		30	220
13	Musukundanadhi	Alamur MSL 3900		40	200
14	Thurinjar	Kavuthamalai R.F. MSL 1900		55	820

FIG 5.3 PENNAIYAR RIVER



Not to Scale

FIG 5.4 GADILAM RIVER



EXISTING STORAGE RESERVOIRS

Table 5.2 Details of reservoir in Pennaiyar River Basin

S. No.	Name of the Reservoir	Capacity in Mcum	Water Spread Area in sq.Km	Catchment in sqkm.	Ayacut in ha.
1	Kelavarapalli	13.22	4.332	2442	3240
2	ShoolagiriChinnar	2.3	0.445	144	871
3	Krishnagiri	66.1	12.48	5428	3647
4	AndiappanurOdai	3.177	0.866	5281	2034

5	Thumbalahalli	3.68	1.94	233	1059
6	Pambar	7.02	2.43	1736	1619
7	Vaniyar	11.78	1.093	102	3460
8	VarattarVallimadurai	3.12	0.596	61.46	2067
9	Sathanur	228.91	18.21	10826	18211

Table 5.1 Tank Details of Pennaiyar River Basin

S.NO	Name of Sub basin	No of Tanks		Capacity in Mcum		AyacutBenifitted	
		System	Non-System	System	Non-System	System	Non-System
1	Chinnar West	---	4		2.28		268
2	Chinnar East	---	2		0.72		122.5
3	Markandanadhi	---	4		1.58		292.22
4	Kambainallur	---	36		14.01		115238.4
5	Pambar	9	37	2.11	33.33	416.85	3198.24
6	Vaniyar	5	4	2.39	1.05	6086	3255
7	Matturar	---	---	---	---	---	---
8	Kottaipattikallar	---	1		0.51		708
9	ValayarOdai	---	---	---	---	---	---
10	RamakkaOdai	---	---	---	---	---	---
11	Pambaranar and Varattar	---	1		0.88		82.98
12	Aliyar	3	11	0.27	7.22	58.07	655.79
13	Musukandanadhi	10	8	66.42	194.95	195.99	590.89
14	Thurinjalur	21	47	98.8735	23.66	1067.57	2489.245
15	Gadilam	69	109	460.29	56.59	5610.21	8294.48
16	UptoKrishnagiri Reservoir	---	9		4.56		1007.48
17	Krishnagiri to Pambar	26	21	3.497635	28.03	941.6	2261.35
18	Pambar to Thirukoilur	54	11	477.47	67.08	2294.245	921.09
19	Lower Pennaiyar	9	98	97.8591	530.875	1367.04	10497.145
	TOTAL	206	403	1,209.18	967.320	18,037.58	1,49,882.81

Table Anicut details in Pennaiyar River Basin

Sl.No.	Name of the Anicut	Total Area Irrigated
1.	NedungalAnicut	1760 ha
2.	KumarapattiAnicut	1011 ha
3.	IchembadiAnicut	2529 ha
4.	Sathanur pick up Anicut	18211 ha
5.	TirukovilurAnicut	8910 ha
6.	Ellis ChoultryAnicut	5065 ha
7.	SornavurAnicut	2509 ha

GROUNDWATER POTENTIAL IN THE STUDY AREA

Groundwater potential as on March 2013 is calculated as 766.77 M.cum and is given in table

Table- Ground Water Potential Calculation as Mar 2013

Name of District covered	Area covered in %	Net water available	Ground water potential District wise
Cuddalore	5.54	128495.06	7118.63
Dharmapuri	22.37	36669.66	8203.00
Krishnagiri	28.17	35425.08	9979.25
Salem	1.47	54609.38	802.76
Thiruvannamalai	15.35	111687.47	17144.03
Vellore	7.67	58970.76	4523.06
Villupuram	19.43	148771	28906.21

Total 76676.92143 Ha.m
766.7692143 M.cum

PRESENT AND FUTURE WATER DEMANDS

DOMESTIC WATER DEMAND

Projected population and domestic water demand

Year		Population	Demand	Total	Total
			MLD	MLD	MCM
2011	Municipality	709718	63.8746	255.217	93.1541
	T.Panchayat	288361	20.1853		
	Urban Total	998079	84.0599		
	Rural	4278921	171.157		
2017	Municipality	799258	71.9332	279.614	102.059
	T.Panchayat	324741	22.7319		

	Urban Total	1123999	94.6651		
	Rural	4623714	184.949		
2020	Municipality	848179	76.3361	292.715	106.841
	T.Panchayat	344618	24.1233		
	Urban Total	1192797	100.459		
	Rural	4806393	192.256		
2030	Municipality	1033925	93.0533	341.222	124.546
	T.Panchayat	420088	29.4062		
	Urban Total	1454013	122.459		
	Rural	5469073	218.763		
2040	Municipality	1260349	113.431	398.202	145.344
	T.Panchayat	512084	35.8459		
	Urban Total	1772433	149.277		
	Rural	6223120	248.925		
2050	Municipality	1536358	138.272	465.213	169.803
	T.Panchayat	624228	43.696		
	Urban Total	2160586	181.968		
	Rural	7081131	283.245		

INDUSTRIAL WATER DEMAND

WATER DEMAND CALCULATION FOR SMALL, MEDIUM AND LARGE INDUSTRIES BASED ON INDUSTRY CENSUS AS TAKEN FROM IWS

Sl. No.	Type of industry	Average Rate of Water consumption as given in IWS m ³ /day	2010		2017		2020		2030		2040		2050	
			No. of industry as per IWS	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand
1	Small scale industry	2.5	1738	1.59	2979	2.72	3752	3.42	8101	7.39	17489	15.96	37757	34.45
2	Medium & large scale industry	2500	190	173.38	326	297.48	410	374.13	886	808.48	1912	1744.7	4128	3766.8
Total Demand in M.Cum				174.97		300.2		377.55		815.87		1760.66		3801.25

WATER BALANCE

The water balance statement for the current year 2017 and the projected years are shown in the table

Sl. No	Name of the basin	Area of the basin (in Sq.Km)	No. of Sub basins	Year	Demand of water in various sectors (MCM)						Water availability (MCM)					Surplus / Deficit in Mcum
					Irrigation	Domestics	Industries	Live stock	Others	Total	Surface water potential	Ground water potential	Quantity of recycled water from Sewage	Quantity of water from desilting	Total	
1	Ponnaiyar	11375.00	19	2017	2076.33	102.06	300.20	33.820	0.00	2478.59	1319.58	766.77	4.10	59.23	2149.68	-328.91
				2020	2076.33	106.84	377.55	33.950	0.00	2560.72	1319.58	766.77	4.10		2090.45	-470.27
				2030	2076.33	124.55	815.87	34.790	0.00	3016.75	1319.58	766.77	4.10		2090.45	-926.30
				2040	2076.33	145.34	1760.66	36.260	0.00	3982.33	1319.58	766.77	4.10		2090.45	-1891.88
				2050	2076.33	169.80	3801.25	38.54	0.00	6047.38	1319.58	766.77	4.10		2090.45	-3956.93