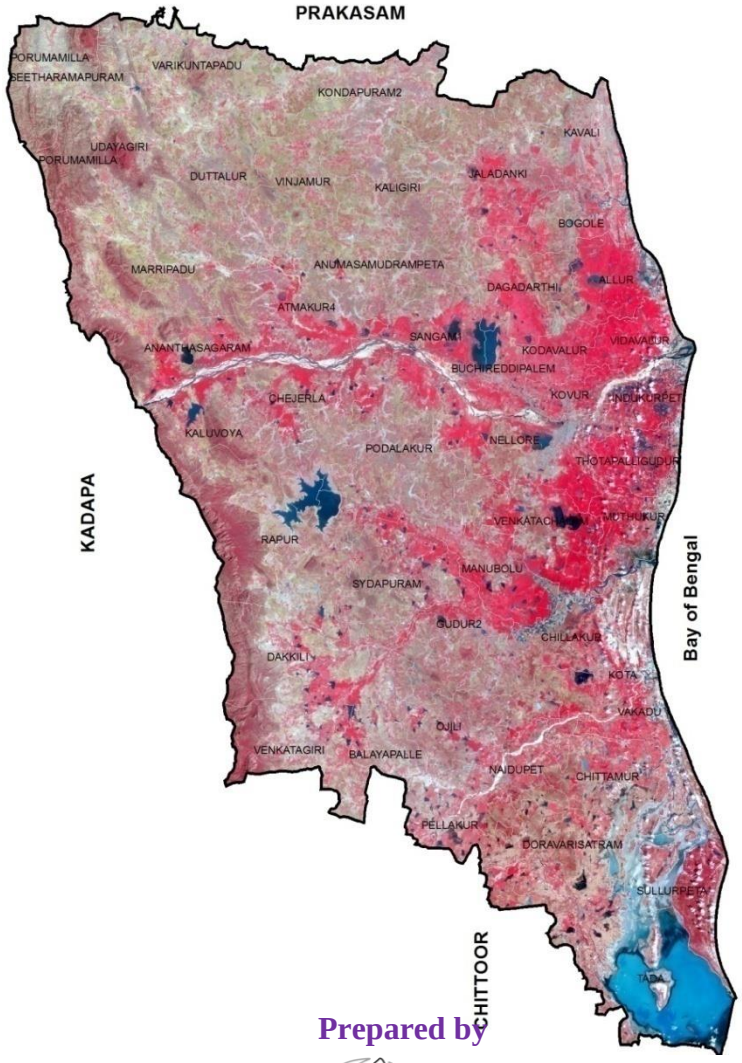
DEPARTMENT OF MINES AND GEOLOGY
Government of Andhra Pradesh

DISTRICT SURVEY REPORT SPS NELLORE DISTRICT



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VICE CHAIRMAN
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1. Salient Features of Nellore District

Nellore District is in the South Eastern bit of the State with a costal length of 163Km by Bay of Bengal on the East. The locale was known as Vikrama Simhapuri until the point when thirteenth Century and later it came to be alluded to as Nellore. Generally the region was under the run of Mouryas, Sathavahanas, Pallavas, Cholas, Telugcholas, Kakatias, Pandyans and so on. A famous Telugu poet Tikkana Somayaji interpreted/translated 15 Parvas of Sanskrit Mahabharata into Telugu in Nellore. It is assumed that Nellore was arranged in Dandakaranya woods into which the Aryas first infiltrated as gutsy sages with the ascent of the Mouryan Empire. Nellore additionally appears to have under its impact and was a piece of the Ashoka Empire in the third century B.C. It was next incorporated into the Pallava Dominion between the fourth and 6th century A.D. Nellore locale shaped a piece of the composite Madras State till first October, 1953. On first November 1956, when the States were rearranged on a Linguistic premise, this area went under the Andhra Pradesh State. The name of Nellore region has been changed as Sri Potti Sriramulu Nellore District on 4 th June, 2008. SPSR Nellore District is one of the nine Coastal districts of Andhra Pradesh and it is the southernmost one. It lies between 13^0 25' and 15^o 55' N of the Northern Latitude and 79^0 9' and 80^0 14' of the Eastern Longitude. It spreads over a territory of 13,076 Sq.Km and these records for 4.75% of aggregate region of the State.

1.1 Administrative Setup

The District is bounded by the following places and features on all the four sides on the East Bay of Bengal, West Kadappa District, North Prakasam District and South Chittoor District and Tamilnadu. There are 05 Revenue Divisions with headquarters at Kavali, Nellore, Gudur, Atmakur and Naidupet and 46 Revenue Mandals with equal number of Mandal Parishads also exist in the District. A total of 940 Gram Panchayats are in position comprising all notified Gram Panchayats. There is one Municipal Corporation at Nellore, 05 Municipalities at Kavali, Gudur, Venkatagiri, Atmakur and Sullurpet and One Nagar Panchayat at Naidupet.

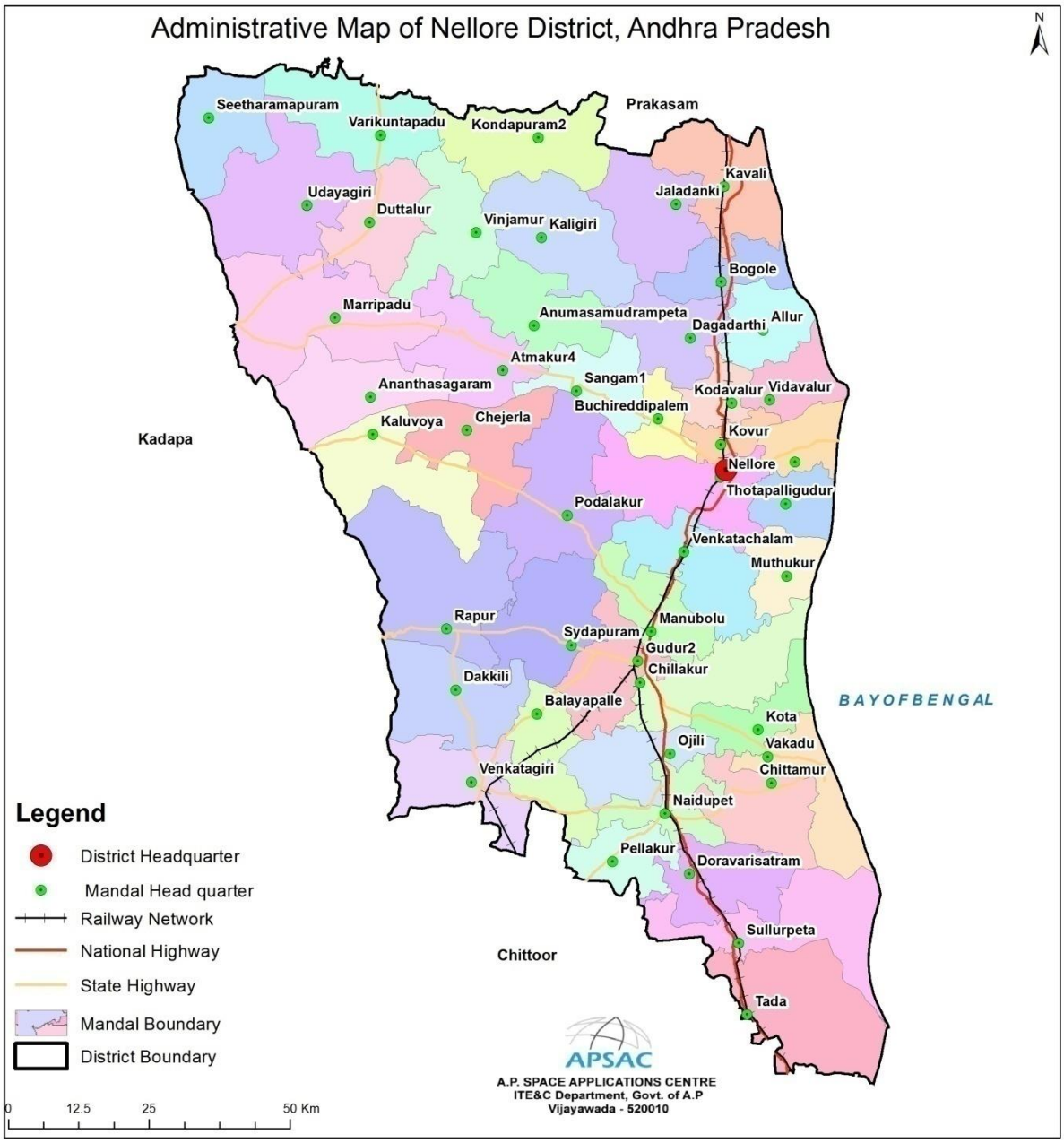


Fig.1 Administrative Boundaries of Nellore District, Andhra Pradesh

1.2 Drainage

The central streams which replete the area of Penner and Swarnamukhi. Different Streams periodic and exuberant in character are Kandaleru and Boggeru. Each of these waterways and rivulets got dry of the year and convey substantial surges amid stormy season. The Penner River is the most essential stream which is of help to Kovur, Kodavalur, Vidavalur, Indukurpet, Nellore, Buchireddipalem, Muthukur and Thotapallegudur Mandals. It streams for around 112 km in the region through Atmakur, amongst Kovur and Nellore and falls into the Bay of Bengal. It has two anicuts, one at Sangam and the other at Nellore. The various minor streams and their beds lie so low underneath the bordering lands that their water is only occasionally accessible for water system purposes appeared in Fig: 2

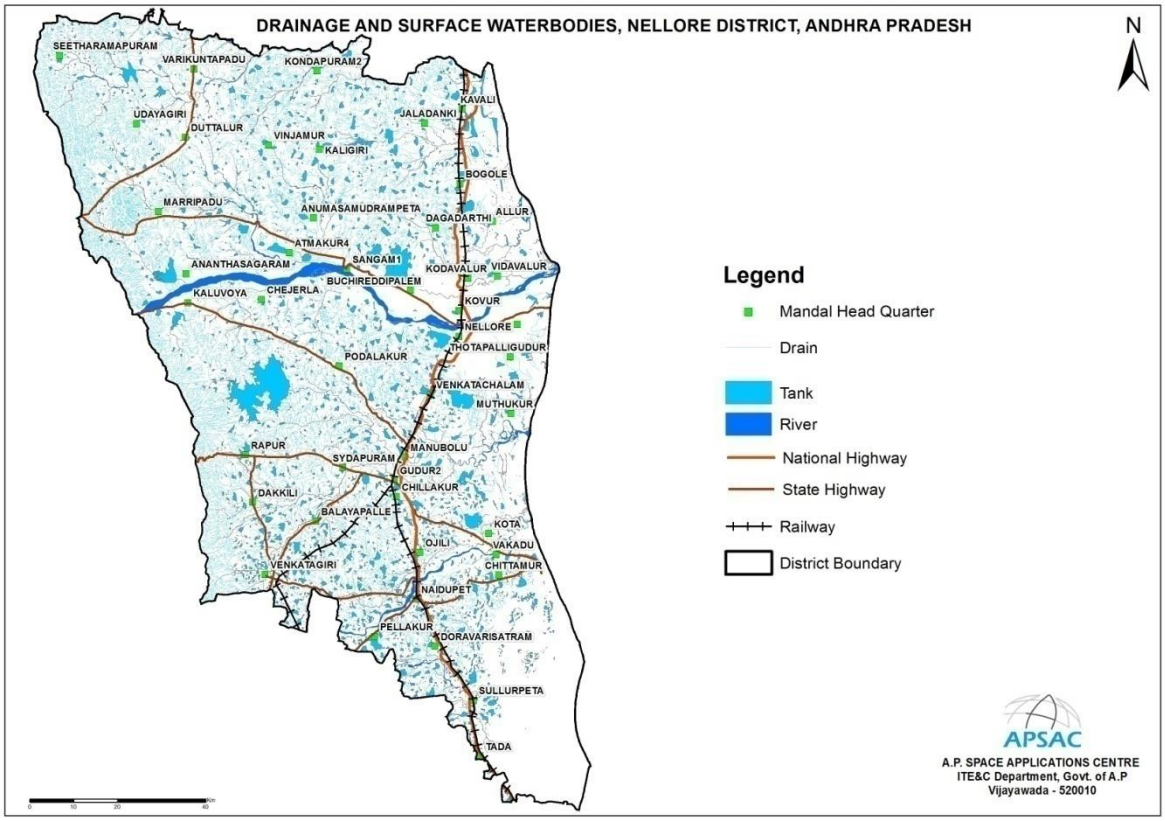


Fig.2 Drainage Network and Surface Water bodies of the District

1.2. a Eco Sensitive Zone:

A marine protected area (MPA) is essentially a space in the ocean where human activities are more strictly regulated than the surrounding water -similar on land. These places are given special protection for natural or historic marine resource by local, state, territorial, native, regional or national authorities. In Nellore District, Pulicat Lake has marine protected places. The area of Pulicat Lake is 500 Sq.km.

1.2b Wildlife Sanctuary:

Any area other than the area comprised with any reserve forest or the territorial water can be notified by State government to constitute a sanctuary, if such area is of adequate ecological, funna, floral, geomorphological, nature or zoological significance for the purpose of protecting, propagating or developing wildlife or its environment. Some restricted activities are allowed inside the Sanctuary area. There are 543 existing wildlife sanctuaries in India covering an area of 118,918 Sq.km, which is 3.62% of the geographical area of the country. In Andhra Pradesh, the total area under wildlife sanctuaries (WLS) is 5,942 Sq.km and 13 wildlife sanctuaries are covered. In Nellore District, there are 2 wildlife sanctuaries, namely Nellapattu WLS and Pulicat Lake WLS. The Nellapattu wildlife sanctuary is spread in 4.59 Sq.km and Pulicat Lake 500 Sq.km area covered.

1.3 Climate and Rainfall

In Nellore region, during the time of November the atmosphere is portrayed by stickiness. In spite of the fact that the midyear is severe, the regular precipitation is very great. The south-west storm that takes after the midyear season keeps going up to the second seven day stretch of October. The withdrawing North-east rainstorm begins from mid October to the finish of November. The period from December to mid February appreciates for the most part a fine climate. The mean most extreme temperatures are typically high in the sweltering climate time frame i.e. from April to June (35.70 C to 37.5 C).

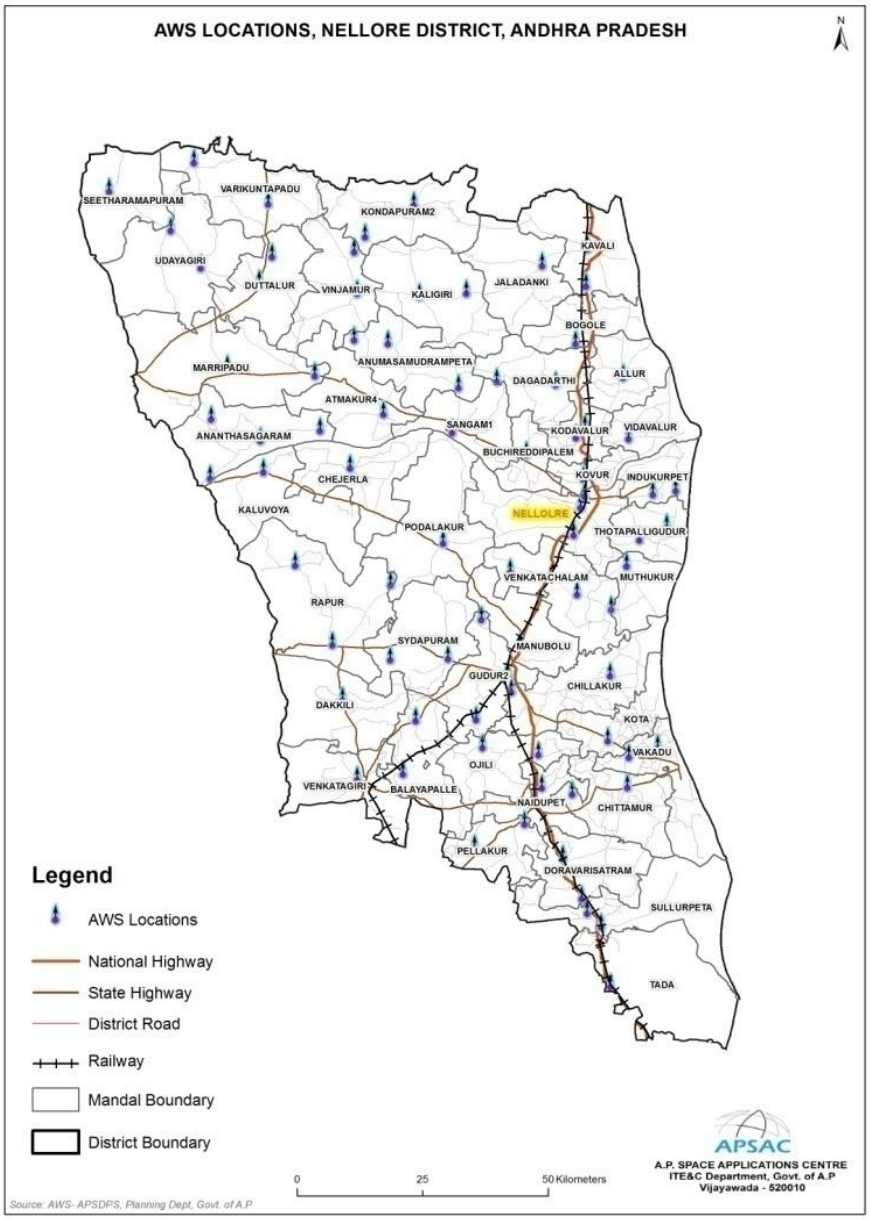
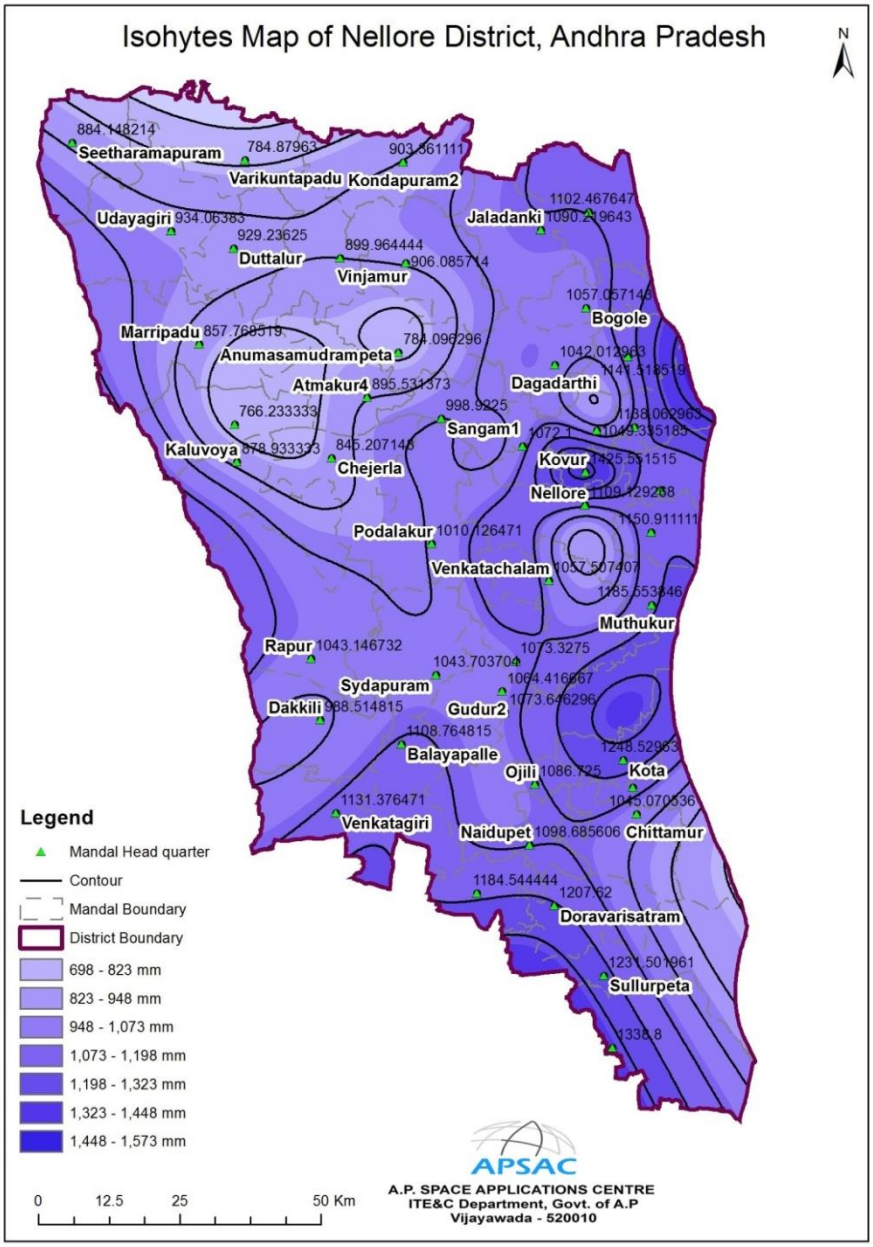


Fig. 3 Automatic Weather Stations in Nellore District

The mean greatest temperature is generally low in the long periods of December (15.1^{0}C) and January (12.4^{0}C). From July to November, the mean most extreme temperature for the most part fluctuates from 39.5^0 C to 29.5^0 C. When all is said and done, low daylight wins in the long stretch of October which matches with the blooming time of rice trim developed in the locale. The low daylight with shady climate as a rule exhausts rice grain yields. The stormy season begins with beginning of the South-west rainstorm in the last piece of June. Precipitation in the area, when all is said and done, increases from the East towards the West. The typical precipitation of the locale is 1,080 mm. The most noteworthy measure of precipitation of 1,404 mm is gotten amid the year 2005– 2006, while minimal measure of precipitation of 809 mm is recorded amid the year 2002–2003. The aggregate rainfall got amid the decade is 10,594.3 mm as against the typical precipitation of 10,800 mm, with a precipitation deviation of - 1.9%. Amid the South-

west storm season for the decade, the region got 3,026.2 mm as against the typical precipitation of 3,310 mm of precipitation, with a precipitation deviation of - 8.57%, while North-east rainstorm was exceptionally frail (Fig. 4).

Fig.4



Distribution of Rainfall in Nellore District, Andhra Pradesh

Table: 1 Mandal Wise Average Annual Rainfall (mm)

Mandal Wise Average Annual Rainfall (mm)														
S No	Mandal Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1	ALLUR	25.70	16.08	5.70	9.52	51.46	49.34	84.49	96.80	91.89	313.60	300.21	96.73	1141.52
2	BOGOLE	22.47	13.01	7.28	7.20	48.86	49.01	69.79	87.63	89.47	281.94	292.76	87.64	1057.06
3	KAVALI	20.23	13.62	7.68	10.74	50.75	46.70	78.95	100.10	113.65	284.07	283.08	92.90	1102.47
4	ANANTHASAGARAM	7.84	8.10	6.97	17.48	32.02	39.33	58.19	75.17	64.83	181.83	222.42	52.06	766.23
5	DAGADARTHI	12.78	13.74	4.61	7.57	41.50	38.64	73.03	81.98	89.53	285.69	312.61	80.33	1042.01
6	GUDUR	9.68	11.93	7.10	10.35	38.46	44.09	84.35	100.68	97.52	254.80	295.37	110.09	1064.42
7	JALADANKI	18.08	18.76	5.06	9.87	55.65	45.93	78.63	96.93	117.61	274.19	301.47	68.05	1090.22
8	ANUMASAMUDRAMPETA	9.48	10.30	4.86	15.32	40.38	45.17	64.61	77.86	69.99	205.18	196.79	44.14	784.10
9	ATMAKUR	6.75	7.52	5.77	11.23	45.10	39.27	68.71	72.74	102.23	216.10	244.65	75.47	895.53
10	BALAYAPALLE	13.51	6.54	7.25	15.53	48.43	57.87	93.27	94.35	90.69	244.49	317.68	119.16	1108.76
11	BUCCHIREDDIPALEM	13.27	19.77	4.41	5.79	38.18	40.32	85.13	99.53	96.78	283.23	293.03	92.67	1072.10
12	CHEJERLA	4.92	11.82	5.53	10.19	38.53	39.26	57.86	72.87	90.31	206.88	240.58	66.45	845.21
13	CHILLAKUR	13.32	10.13	6.95	11.26	45.27	39.82	89.12	104.69	90.99	247.43	301.92	112.74	1073.65
14	CHITTAMUR	20.86	10.49	4.54	11.66	39.01	53.63	79.69	82.65	90.29	237.19	302.77	112.30	1045.07
15	DAKKILI	7.35	9.46	7.13	23.36	39.97	51.20	71.05	76.75	74.92	228.01	291.37	107.95	988.51
16	DORAVARISATRAM	24.00	18.02	5.36	14.51	36.33	69.67	105.15	118.78	114.75	264.51	304.59	131.98	1207.62
17	DUTTALUR	8.43	13.82	10.60	34.84	46.93	57.20	68.41	107.37	96.62	234.87	195.95	54.22	929.24
18	INDUKURPET	16.35	14.91	4.58	12.56	53.22	51.12	83.08	100.17	88.89	297.96	312.27	95.79	1130.90

19	KALIGIRI	10.56	10.07	9.53	15.31	46.85	47.02	77.39	81.29	82.51	222.56	246.97	56.02	906.09
20	KALUVOYA	4.47	15.51	10.89	16.10	37.86	40.01	68.96	92.33	84.04	204.30	240.92	63.55	878.93
21	KODAVALUR	14.13	14.89	5.81	6.43	43.95	47.29	66.96	89.25	88.34	277.81	294.33	100.16	1049.34
22	KONDAPURAM	9.68	11.27	13.18	13.01	47.42	40.94	72.26	88.26	99.39	228.31	234.95	44.69	903.36
23	KOTA	28.18	15.39	6.38	15.67	49.34	61.24	94.38	96.82	95.86	303.56	349.49	132.22	1248.53
24	KOVUR	14.16	15.99	3.46	11.74	55.32	62.29	111.19	123.93	117.96	371.87	415.58	122.08	1425.55
25	MANUBOLU	17.77	15.82	2.73	12.52	33.70	27.27	72.45	104.32	100.64	269.19	297.59	119.38	1073.33
26	MARRIPADU	4.92	12.39	11.77	15.64	34.15	54.00	65.45	84.54	78.44	217.07	223.47	55.93	857.77
27	MUTHUKUR	21.27	25.37	7.44	8.60	53.80	61.24	80.59	103.63	102.82	312.04	306.42	102.33	1185.55
28	NAIDUPETA	24.84	18.86	6.32	10.20	33.48	54.15	88.93	106.52	104.16	230.10	299.40	121.73	1098.69
29	NELLORE	13.10	10.34	2.42	9.05	40.16	43.12	84.41	99.97	91.42	281.12	337.23	96.78	1109.13
30	OJILI	21.77	8.29	7.51	14.64	45.26	51.84	81.44	89.27	102.03	250.43	299.39	114.86	1086.73
31	PELLAKUR	21.71	14.61	7.56	16.79	45.63	78.21	97.03	105.36	101.79	256.99	312.24	126.64	1184.54
32	PODLAKUR	9.90	22.49	9.56	10.31	38.10	50.13	77.45	88.27	93.31	239.93	276.04	94.65	1010.13
33	RAPUR	12.21	14.01	8.74	26.28	35.60	46.42	80.99	88.69	96.69	229.77	288.23	115.52	1043.15
34	SANGAM	14.70	7.80	5.27	13.06	36.05	42.31	64.07	100.16	112.49	257.88	252.04	93.12	998.92
35	SEETHARAMAPURAM	2.82	10.94	8.68	22.32	48.81	71.26	114.03	105.73	107.01	208.14	155.08	29.32	884.15
36	SULLURPETA	19.93	16.33	4.43	13.86	37.10	57.97	108.65	111.20	126.38	254.48	340.48	140.70	1231.50
37	SYDAPURAM	5.76	6.79	9.61	15.29	47.70	48.84	89.30	89.53	98.48	225.96	297.86	108.58	1043.70
38	TADA	22.76	16.87	12.08	15.66	47.36	71.03	115.33	131.49	110.56	276.53	361.14	157.99	1338.80
39	THOTAPALLIGUDUR	15.70	13.56	4.22	11.64	52.03	56.33	82.17	99.31	93.37	302.18	310.73	109.68	1150.91

40	UDAYAGIRI	8.52	11.02	12.97	19.90	56.19	47.15	78.35	89.81	107.68	221.94	223.03	57.49	934.06
41	VAKADU	17.73	12.65	3.80	17.54	39.02	55.70	88.32	97.62	99.48	264.37	324.11	114.08	1134.43
42	VARIKUNTAPADU	8.96	6.70	12.11	13.72	41.50	41.72	59.37	87.37	81.33	205.96	198.26	27.87	784.88
43	VENKATACHALAM	15.89	20.42	3.50	4.77	44.63	41.71	78.56	93.23	83.19	278.19	285.07	108.37	1057.51
44	VENKATAGIRI	12.91	16.07	5.31	17.34	40.83	57.50	90.49	96.17	104.11	249.53	317.46	123.66	1131.38
45	VIDAVALUR	17.95	16.43	7.45	17.13	45.45	45.28	73.49	95.51	91.83	302.39	322.37	102.80	1138.06
46	VINJAMUR	9.48	15.07	10.25	19.49	57.40	54.31	72.19	84.49	96.73	205.01	222.15	53.39	899.96
Total		14.28	13.56	7.05	13.98	44.02	50.30	81.04	95.02	96.15	254.12	283.51	93.35	1046.38

1.4 Transport and Communications

The transportation road network is essential to the monetary advancement, exchange and social mix of the nation. It encourages smooth movement of the two individuals and products. The National highways network system of India is a system of through ways that is overseen and kept up by organizations of the Government of India. These roadways are estimated to be more than 96,260 km (59,810 mi) including more than 1,000 km (620 mi) of constrained access turnpikes (motorways). Out of 96,260 Km of national parkways, 46,260 or more km is no less than 4 different ways and the rest of 50,000 Km two way lined. Indian government has set itself an objective to develop and update 30 Km of interstate and for each day (11,000 Km for each year) and all new development. In this way, the PWD road network and the Panchayat road assume an essential part in the improvement of the town at first, trailed by Mandal, area and State in general. Krishnapatnam Port is the first green field Port in Nellore District and it was privatized in 1997. Press mineral payload is accessible from Hospet Bellary locale for sending out through Krishnapatnam Port. 12 Berths are accessible alongside other related offices and foundation offices. The business tasks started from July 2008. This region has a road length of 8284 Km, out of which road with a length of 361 Kms are shaped with Cement concrete though road with a separation of 4498 Kms and 642 Kms are blacktop and metalled leaving an outstanding length of 2783 Kms as un-metalled. The National Highway i.e., Chennai to Kolkata goes through the locale pretty much parallel to the expansive gauge Railway line from Chennai to Howrah appeared in Fig: 5

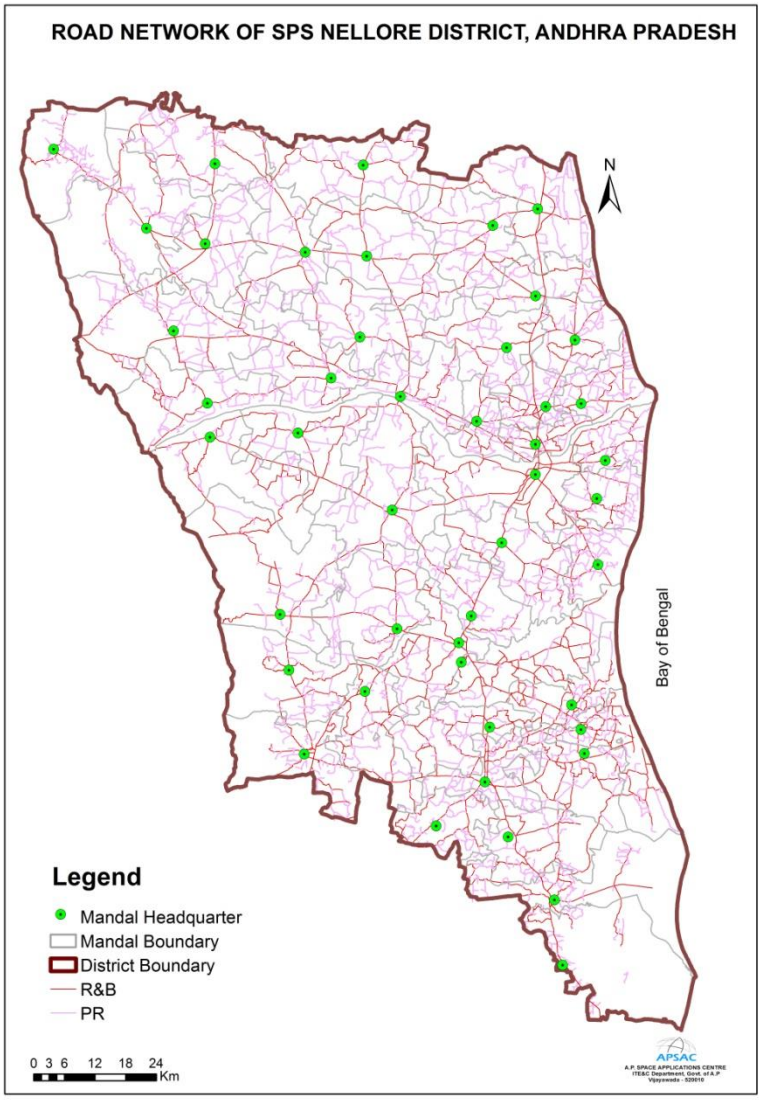
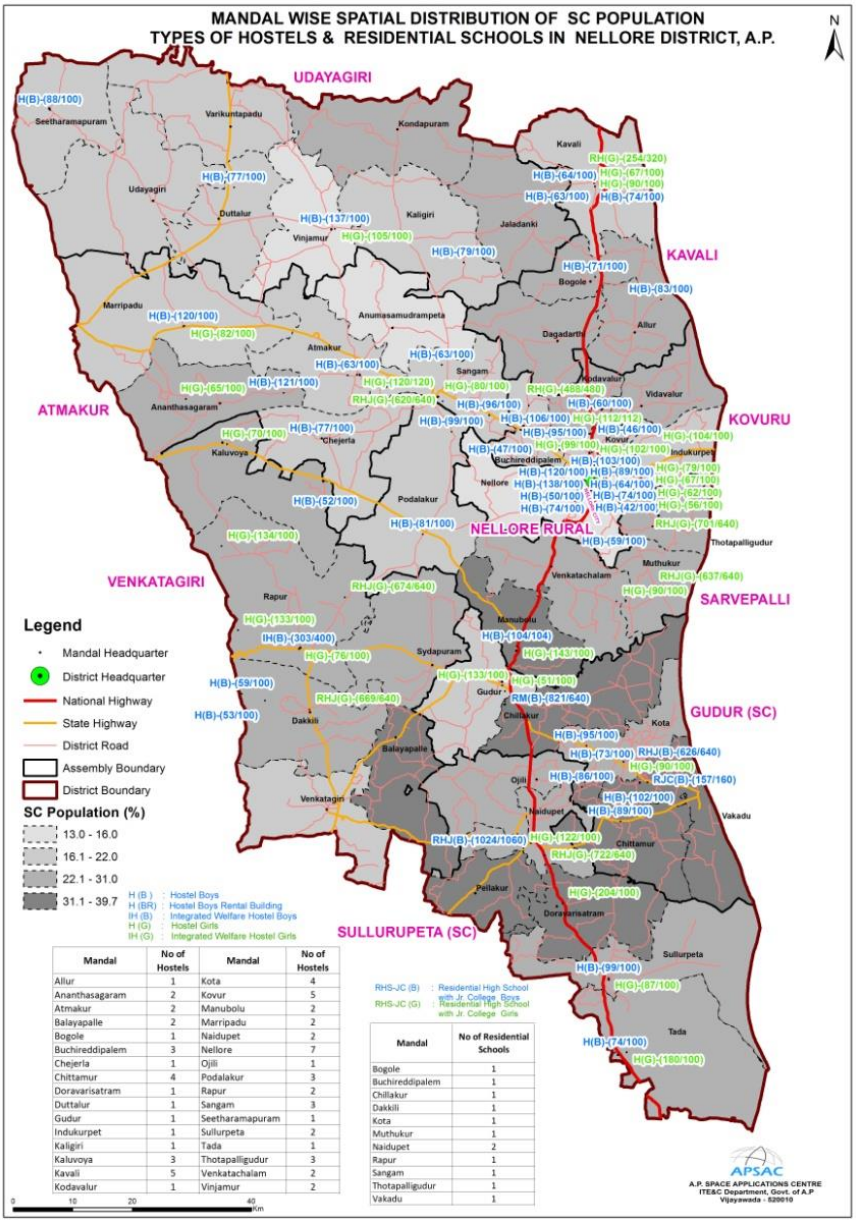


Fig.5 Transport Network of Nellore District, Andhra Pradesh

1.5 Population and Literacy

The total area of the District is 13,076 Sq.Kms. The total population of the District as per 2011 population census is 29.64 lakhs. Out of this, the rural and urban populations are 21.06 lakhs and 8.58 lakhs, respectively forming 71.06 % and 28.94% of total population. The density of population is 227 per Sq.km shown in Fig: 6. The population of females per 1000 males is 985. The population covered under Scheduled Castes and Scheduled Tribe communities is 6.66 Lakhs and 2.86 Lakhs, respectively. The decennial growth rate is registered at 11.05% whereas the density of population per Sq.Km has been increased from 204 to 227 in the period 2001-2011. As regards the working population of the District, there are as many as 10.76 lakh main workers out of the total population of 29.64 Lakhs, the balance being the non-workers to an extent of 18.87 lakhs. The main workers and marginal workers stand at 81.9% and 18.1%, respectively out of the total work force. There are as many as 2974 primary schools existing in the District. Out of them, bulks of primary schools are being managed by Mandal Parishads. A total of 646 Upper Primary

schools are functioning in the District under all the managements. There are 749 High Schools, 07 High Schools attached to Junior Colleges and 208 junior colleges in the District in the reference year under all managements.



Mandal	No of Hostels	Mandal	No of Hostels
Allur	1	Kota	4
Ananthasagaram	2	Kovur	5
Atmakur	2	Manubolu	2
Balayapalle	2	Marripadu	2
Bogole	1	Naidupet	2
Buchireddipalem	3	Nellore	7
Chejerla	1	Ojili	1
Chittamur	4	Podalakur	3
Doravarisatram	1	Rapur	2
Duttalur	1	Sangam	3
Gudur	1	Seetharamapuram	1
Indukurpet	1	Sullurpeta	2
Kaligiri	1	Tada	1
Kaluvoya	3	Thotapalligudur	3
Kavali	5	Venkatachalam	2
Kodavalur	1	Vinjamur	2

Mandal	No of Residential Schools
Bogole	1
Buchireddipalem	1
Chillakur	1
Dakkili	1
Kota	1
Muthukur	1
Naidupet	2
Rapur	1
Sangam	1
Thotapalligudur	1
Vakadu	1

Fig: 6 Distribution of Scheduled Caste in Nellore District, Andhra Pradesh

1.6 Important Places

1.6a Places of Tourist Interest

There are several places of tourist interest in the locale for which visitors and explorers are being captivated to visit either every year or on special events where merriments generally occur. The centrality and verifiable significance of these spots are quickly described here under.

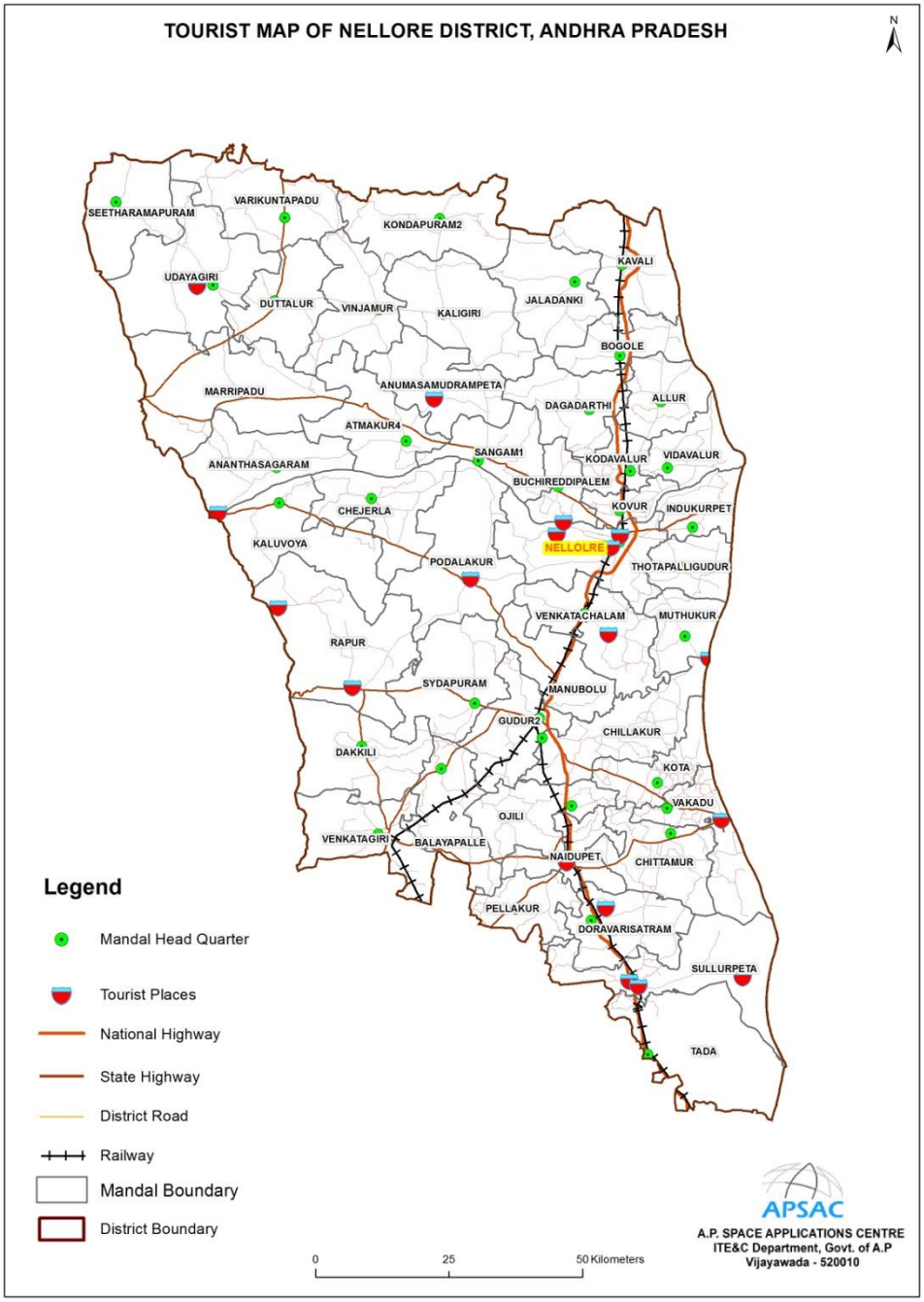


Fig: 7 Important Tourist places map in Nellore District

1.6b Places of Religious and Cultural importance

Ranganadha Swamy temple is known as Ranganayukulu, is arranged on the southern bank of the River Penner at Nellore. It has an incredible Galigopuram with 29Mts. stature with seven gold kalasams. Addala Mandapam Mirrors are there to reflect many pictures of Lord Krishna and this introduces an all encompassing perspective. Penchalakona temple is around 8 Kms from Gonupalli town of Rapur mandal. There is a well known temple of Penusila Narasimha Swamy where yearly celebration is occurring amid April-May. Narasimhakonda: It is 8 Kms from Nellore town. Vedagiri Narasimha Swamy is harping on the slope. Brahmotsavam is being commended with conventional gaiety in the period of May. Jonnawada temple knows

as a Kamakshi Amma temple near Jonnawada Village. Lady devotees visit the sanctuary day by day. Ayyappa Swamy Temple is arranged at Vedayapalem in Nellore town. Every day, numerous lovers and voyagers visit the temple. Kasumuru Darga known as Mastanvali Darga in this town where "Urusu" is being celebrated magnificently by neighborhood Muslims and foreigners. An old Mosque is there at A.S.Pet at a distince of 11 Kms from Atmakur. Yearly "Urusu" is being praised superbly for the sake of Khajarahamuthulla Nayab Rasool with the general population hailing from the nation over.

1.6c Places of Economic and Commercial importance

Mypadu is a popular summer resort arranged at a separation of 22kms from Nellore. Somasila will be Somasila Anicut on Penner River between Veligonda slopes. A celebrated Sivalayam temple is also there. Pulicat Lake was secured between the towns of Koridi and Pantrangam along 12 Kms. Diverse assortments of feathered creatures originate from inaccessible places in the long stretch of November. Nelapattu is in Doravarisatram mandal. The feathered creature asylum there is being conducted as "Flemingo" celebration for 3 days in the long stretch of February. Transient winged creatures of various species accumulate at the Lake from October to March. SHAR, Sriharikota Rocket propelling station is universally well known.

2. Land Utilization, Forest and Slope in the District

The Land Use / Land Cover (LULC) pattern of any region is an outcome of various physical and cultural factors and their utilization by man in time and space. Land use refers to the type of utilization to which man has put the land. It also refers to the evaluation of the land with respect to various natural characteristics. But land cover describes the vegetal attributes of land. Land use/land cover data is essential for planners, decision makers and those concerned with land resources management. For the proper understanding of the influence of the various human-induced land use practices with regard to the environmental change, it is essential to help simulate the land use changes. Remote sensing technology is considered most effective as it provides timely and authentic information about the spatial distribution of land use/land cover, while Geographical Information System (GIS) provides a flexible digital environment for collecting, storing, visualizing and analyzing the spatial data. Remote sensing as a vital tool helps for rapid assessment and monitoring of a natural resource. When combined with GIS, it makes it possible to map land use/cover phenomena in detail for further planning, development, and decision-making, which is essential for meeting the increasing demands and welfare of the ever-growing population.

2.1 Land Use / Land Cover Classification

Various land use/land cover categories have been delineated by using 3 seasons (Kharif, Rabi & Zaid) satellite data under level-3 classification. For on-screen digitization, visual image interpretation techniques (size, shape, colour, tone, texture, association and pattern) have been used for classifying the land use/land cover map (NRSA, 2006). This information is used for general planning purposes at District/mandal level. The broad categories are built-up, agricultural, forest, wastelands, wetlands and water bodies. The spatial distribution of land use/land cover of the Nellore District is shown in Fig. 8 and area statistics presented in Table-2.

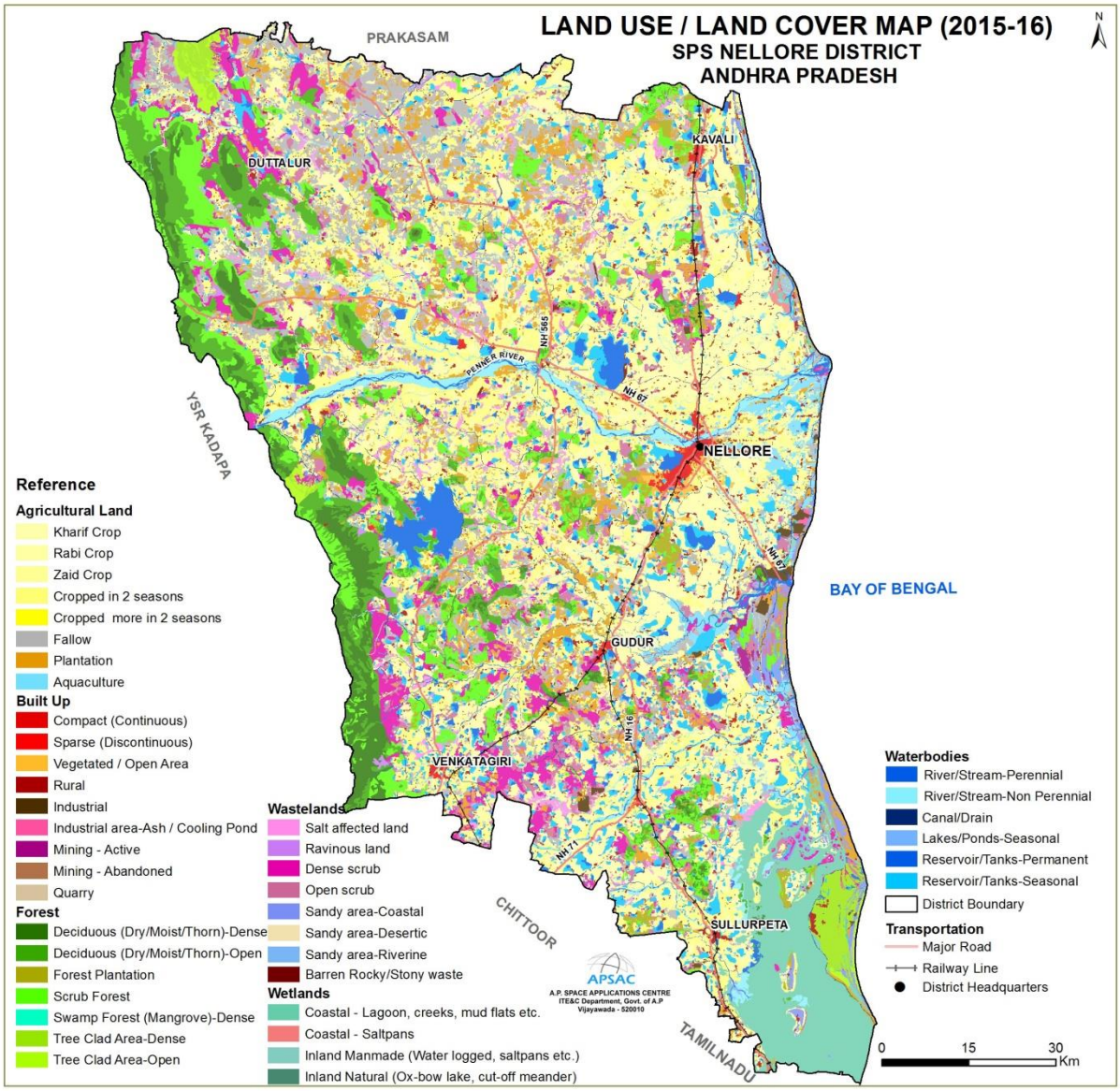


Fig.8 Land Use / Land Cover Map of Nellore District during 2015-16

Table- 2 Category-wise Distributions of Land use/Land Cover during 2015-16

S.No	Land Use Categories	Year 2015-16	
		Area in Sq.km	%
1	Compact (Continuous)	43.01	0.33
2	Sparse (Discontinuous)	18.78	0.14
3	Vegetated / Open Area	42.52	0.33
4	Rural	258.52	1.98
5	Industrial	43.29	0.33
6	Industrial area-Ash / Cooling Pond	3.29	0.03
7	Mining - Active	13.21	0.10
8	Mining - Abandoned	0.34	0.00
9	Quarry	20.87	0.16
	Built Up	**443.83**	**3.39**
10	Kharif Crop	268.34	2.05
11	Rabi Crop	2398.55	18.34
12	Zaid Crop	25.27	0.19
13	Cropped in 2 seasons	2131.17	16.30
14	Cropped more in 2 seasons	0.27	0.00
15	Fallow	1273.42	9.74
16	Plantation	716.72	5.48
17	Aquaculture	202.19	1.55
	Agricultural Land	**7015.92**	**53.65**
18	Deciduous (Dry/Moist/Thorn)-Dense	371.06	2.84
19	Deciduous (Dry/Moist/Thorn)-Open	676.6712	5.17
20	Forest Plantation	178.77	1.37
21	Scrub Forest	755.72	5.78
22	Littoral/Swamp Forest (Mangrove)-Dense	2.55	0.02
23	Tree Clad Area-Dense	129.05	0.99
24	Tree Clad Area-Open	56.08	0.43
	Forest	**2169.90**	**16.59**
25	Salt affected land	266.02	2.03
26	Ravinous land	14.32	0.11
27	Dense scrub	565.51	4.32
28	Open scrub	405.38	3.10
29	Sandy area-Desertic	0.39	0.00
30	Coastal	130.54	1.00
31	Riverine	13.16	0.10
32	Barren Rocky/Stony waste	7.83	0.06
	Wastelands	**1403.16**	**10.73**
33	Inland Natural (Ox-bow lake, waterlogged	0.20	0.00

	etc.)		
34	Inland Manmade (Water logged, saltpans etc.)	3.53	0.03
35	Coastal - Lagoon, creeks, mud flats etc.	586.85	4.49
36	Coastal - Saltpans	11.26	0.09
	Wetland	**601.83**	**4.60**
37	River/Stream-Perennial	121.69	0.93
38	River/Stream-Non Perennial	254.58	1.95
39	Canal/Drain	56.95	0.44
40	Lakes/Ponds-Seasonal	0.01	0.00
41	Reservoir/Tanks-Permanent	310.22	2.37
42	Reservoir/Tanks-Seasonal	698.24	5.34
	Water bodies	**1441.70**	**11.03**
	Grand Total	**13076.34**	**100.00**

Built-Up

These are the regions of human habitation that have a front of structures, transport and communication, utilities in relationship with water, vegetation and vacant lands. It comprises built-up (Compact and Sparse), Vegetated/Open Area, Rural, Industrial and Mining/Quarry. It involves a region of 443.83 Sq. km, which is around 3.39% of the total geographical area of the region. Of which, rural area contributes 1.98% which is over half of the developed classification.

Built up - Compact (Continuous)

Most of the land is covered by buildings, roads, and artificially surfaced area and cover almost all the ground. The built-up - compact class is assigned when the urban structures and transport network (i.e. impermeable surfaces) occupy more than 60 % of the surface area. This category occupied 43.01 Sq. km, which are found in urban areas.

Built up - Sparse (Discontinuous)

Most of the land is covered by the structures like buildings, roads and artificially surfaced areas associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. Between 20 to 60 % of the total surface should be impermeable. Scattered blocks of residential flats, hamlets and small villages are delineated under this category. It contributes an area of 18.78 Sq. km, which are found in peri-urban areas.

Vegetated / Open Area

These are vegetated areas within urban agglomeration (situated within or in contact with urban areas). Vegetation cover of trees, shrubs, and herbs covers at least 0.33% of the total surface area, which has been delineated. Parks, sport and leisure facilities, camping grounds, sports grounds, leisure parks, golf courses, race courses, including formal parks etc are considered in this category. This category occupies an area of 42.52 Sq. km.

Built-Up – Rural

These are the lands used for the human settlement of size comparatively less than the urban settlements of which more than 60% of the people are involved in the primary activity of agriculture and associated with non-commercial and with allied classes are identified as built up (rural) category. The rural area contributed is about 258.53 Sq. km.

Industrial

Non-linear impervious surfaces are included in this class which is related to trade, manufacturing, distribution, and commerce. These are areas where the human activity is observed in the form of manufacturing along with other supporting establishments for maintenance. The industrial area occupies an area of 43.29 Sq. km, which is observed in and around towns.

Industrial area-Ash / Cooling Pond

These are the portions of industry which are used for temporary storage of ash, contaminated soil, rubble, cooling of hot water or tailing pond associated with the industry. The areas where industrial waste is permanently kept, categorized as other waste which is delineated under this category. A stockpile of storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from earth's surface is considered under this category. It is observed that this category is found around the industrial areas with an area of 3.92 Sq. km.

Mining – Active

Mining areas encompass area under surface operations. The recognizable impacts of these activities on the landscape are unmistakable giant pit mines covering vast areas. The active mining areas are presently large-scale surface operations of removal of economically important ores and presently going on. The active mining area contributes an area of 13.21 Sq. km.

Mining – Abandoned

These are the areas where large-scale surface operations of removal of economically important ores are carried out in the past, but presently kept abandoned due to various reasons like economical, operational, viability, disturbances etc. Only 0.34 Sq. km has been contributed under this category.

Quarry

These are manifestations of surface mining operations wherein small-scale excavation of land surface for sand, gravel, clay-phosphate mines, limestone quarries etc. are taking place. They are mostly characterized by their nearness to urban areas. It contributes an area of about 20.87 Sq.km.

Agricultural Land

The land use category primarily used for the production of food, fiber, and other commercial and horticultural crops. It includes land under crops namely cropland, fallow land, agricultural plantation and aquaculture. The agricultural category is found as the major category covering 7015.92 Sq. km (53.65%) during 2015-16. It is also found that double-cropped area is about 16% of the District total. **Kharif Crop**

Agricultural area cultivated between June/July to September/ October coinciding with SW monsoon season is considered as Kharif crop. It is associated with rain-fed crops under dryland farming with limited or no irrigation and areas of rain-fed paddy and other dry crops. Kharif is found to be the second major agricultural category with an extension of 268.34 Sq. km (2.05%).

Rabi Crop

These areas are cultivated between November/December to February/March. It is associated with areas under assured irrigation irrespective of the source of irrigation. However, rabi cropped areas also occur in rain-fed regions, under residual soil moisture conditions especially in black soil areas with high rainfall during Kharif season. The extent of rabi cropped area is about 2398.55 Sq. km (18.34%).

Zaid Crop

These are the areas that are cropped during summer (April – May) which are mostly associated with irrigated areas with fertile soils, confined to plains/delta areas. The areas are found in 25.27 Sq. km during 2015-16.

Cropped in two seasons

These are the areas that are cropped during two cropping seasons that are often seen associated with irrigated areas. Three combinations are possible in this category viz., - Kharif + Rabi, Kharif + Zaid and Rabi + Zaid. It is found that this is the major agricultural category with an extent of 2131.17 Sq. km (16.30%).

Cropped in more than two seasons

These are the areas which are cropped in more than two cropping seasons. It includes triple cropped areas (Kharif, Rabi and Zaid), areas under multiple cropping. Long duration crops like sugarcane, cotton, banana, pineapple etc., are considered under this category. It contributes an area of 0.27 Sq. Km.

Fallow land

The agricultural land which is being used for cultivation but is temporarily allowed to rest or un-cropped for one or more seasons, but not less than a year and for not more than five years is referred to as fallow land. The fallow land occupies an area of 1273 Sq. km. (16.30%).

Agricultural Plantation

These are the areas under agricultural tree crops planted adopting agricultural management techniques. These also include the areas of land use systems and practices wherein cultivation of herbs, shrubs, and vegetable crops are deliberately integrated with agricultural crops mostly in irrigated conditions for ecological and economic reasons. These areas are separable from cropland, especially with the data acquired during rabi/zaid season. Plantations appear in dark-red to red tone of different sizes with regular and sharp edges indicating the presence of a fence around it. It is found that 5.48% of the land is under plantation crops during 2015-16.

Aquaculture

These are the areas where fish and shrimps are bred and reared for commercial purposes. Aquaculture ponds are located mostly along the coast or in lakes, river and estuaries. This category is mostly found along the coast with an area of 202.19 Sq. km (8.48%).

Forest

The term forest is used to refer to land with a tree canopy cover of more than 15 percent and area of more than 0.5 ha. Forest is determined both by the presence of trees and the absence of other predominant land uses within the notified forest boundaries. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. The forest cover is occupied about 2169.90 Sq. km (16.59%).

Deciduous (Dry/Moist/Thorn)-Dense

This category is predominantly composed of species, which shed their leaves once a year, especially during summer. These are mostly broad-leaved tropical forests with a tendency to shed their leaves annually. This category includes all the areas where the canopy cover/density is more than 75 % and contributed 371.06 Sq. km.

Deciduous (Dry/Moist/Thorn)-Open

This category is predominantly composed of species, which shed their leaves once a year, especially during summer. These are mostly broad-leaved tropical forests with a tendency to shed their leaves annually. This category includes all the forest areas where the canopy cover/density ranges between 20 - 60 percent. An area of 676.67 Sq. km is attributed to this category.

Forest Plantation

These are the areas of tree species of forestry importance, raised and managed especially in the notified forest areas. Most of these are located in uplands, coastal areas the within notified areas. Many of these can be identified based on the sharp boundary exhibited by them. The distribution of forest plantation is 178.77 Sq. km.

Scrub Forest

These are the forest areas which are generally seen at the fringes of dense forest cover and settlements, where there is biotic and abiotic interference. Most times, they are located closer to habitations. Forest blanks which are the openings amidst forest areas, devoid of tree cover, observed as openings of assorted size and shapes as manifested on the imagery are also included in this category. It is attributed to an area of 755.72 Sq. km (5.78%).

Swamp Forest (Mangrove)-Dense

These are the areas with the plants evergreen in nature, halophytic, dense or woody in nature, occurring along tidal waters/creeks, estuaries and along the delta in coastal areas. They are densely colonized in coastal on tidal flats, estuaries salt marshes etc. This category includes all the areas where the canopy cover/density is less than 2%. This category is found along the coastal areas with an account of 2.55 Sq. km.

Tree Clad Area-Dense

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-defined crown and being at least 3 m tall. Plants essentially herbaceous but with a woody appearance (e.g. bamboos and ferns) are also classified as trees if the height is more than 5 m and as shrubs, if the height is less than 5 m. This category includes all the areas

where the canopy cover/density is more than 80%. It occupied an area of 129.05 Sq. km.

Tree Clad Area-Open

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-defined crown and being at least 3 m tall. Plants essentially herbaceous but with a woody appearance (e.g. bamboos and ferns) are also classified as trees if the height is more than 5 m and as shrubs, if the height is less than 5 m. This category includes all the forest areas where the canopy cover/density ranges between 20 - 60 per cent. It is attributed to an area of 56.08 Sq. km.

Wastelands

Wasteland is described as degraded land which can be brought under vegetative cover with reasonable effort and which is currently underutilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. Wastelands can result from inherent/imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints. The area under this category is 1403.16 Sq. km (10.73%).

Salt-affected land

These lands are containing an excessive concentration of salts (soluble salts or exchangeable saline or both). Salinization can result from improper management of canal irrigation water resulting in the rise of the water table and consequent accumulation of salts in the root zone in arid, semi-arid and sub-humid (dry) conditions and ingress of sea water in coastal regions and/or use of high-salt containing ground water. They also become saline when soils have developed on salt containing parent materials or have saline ground water. Coastal saline soils may be with or without ingress or inundation by sea water. These lands are accounted for 2.03 Sq. km only.

Dense scrub

The scrub is usually confined to topographically elevated areas, on the hill slopes generally surrounded by agricultural lands. These areas possess shallow and skeletal soils, at times chemically degraded, extremes of slopes, severely eroded and lands subjected to excessive aridity with scrubs dominating the landscape. It is found with varying sizes of small to large areas having a contiguous or dispersed pattern. The dense scrub is mostly identified on the hills and occupied an area of 565.51 Sq. km.

Open scrub

This category has a similar description as mentioned in the dense scrub excepting that they possess sparse vegetation or devoid of scrub and have a thin soil cover. The open scrub is found at foothills surrounded by agricultural lands with an account of 405.38 Sq. km.

Coastal Sand

Coastal sands are the sands that are accumulated as a strip along the sea-coast. Very high reflectance exhibited by this category especially in the NIR region of the

spectrum enables their separation with the salt-affected land. It is found in along the coast and occupied an area of 130.54 Sq. km (1.00%).

Riverine sand

Riverine sands are those that are seen as accumulations in the flood plain as sheets which are the resultant phenomena of river flooding. The sandy areas occurring within or in continuity to river course are to be excluded from this category. These are found along the Penner Nellore River and attributed only 13.16 Sq. km.

Barren Rocky/Stony waste

The barren rock exposures are especially confined to hilly terrain with down slope with rock outcrops, stony waste and fragments. The area under this category is 7.83 Sq. km.

Wetlands

All submerged or water-saturated lands, natural or man-made, inland or coastal, permanent or temporary, static or dynamic which necessarily have a land-water interface, are defined as wetlands. The wetlands category is found having 601.83 Sq. Km (4.60%) with four sub categories.

Wetland - Inland - Natural

These are the areas that include ox-bow lakes, cut-off meanders, playas, swamp, marsh, peat bogs etc (with vegetation). This category contributed 0.20 Sq. km of the District total.

Wetland - Inland- Manmade

Waterlogged areas (seasonal and perennial) created due to the negative effect of human management practices and are present with vegetation. This is attributed to an area of 3.53 Sq, km.

Wetland – Coastal

These include estuaries, lagoons, creek, backwater, bay tidal flat/mud flat, mangrove, salt marsh/marsh with vegetation and other hydrophytic vegetation. It contributed an area of 586.85 Sq. km (4.49%)

Coastal - Saltpans

Saltpans are flat expanses of areas covered with salt usually white under the Sum. Saltpans are manmade saline ecosystem from which crude salt is extracted during summer. These are un-drained, usually small and shallow, natural depression or hollow in which brackish water accumulates and evaporates leaving behind salt deposits. This category found nearer to Machilipatnam area and attributed 11.26 Sq, km

Water Bodies

This category comprises areas with surface water, either impounded in the form of ponds, lakes and reservoirs or flowing as streams, rivers, canals etc. These are seen clearly on the satellite image in blue to dark blue or cyan colour depending on the depth of water. Waterbody category occupies an area about 1441.70 Sq. km with 11.03% of the District.

River/Stream-Perennial

Rivers/streams are the natural course of water flowing on the land surface along a definite channel/slope regularly or intermittently towards a sea in most cases or a

lake or an inland basin in desert areas or a marsh or another river. The rivers/streams that flow continuously throughout the year are considered perennial. It contributes an area of 121.69 Sq. km.

River/Stream-Non Perennial

When the water covers the surface for less than nine months in each year considered non perennial. This also includes the dry part of river generally characterized by the presence of sand or exposed rocks. It is found that most of the streams fall under non perennial category which contributes an area of 254.58 Sq. Km (1.95%).

Canal/Drain

Canals and drains are artificial watercourse constructed for irrigation, navigation or to drain out excess water from agricultural lands. It is found mostly in coastal plains with an area of 56.95 Sq. km.

Reservoir/Tanks-Permanent

The reservoir is an artificial lake created by the construction of a dam across the river specifically for hydel power generation, irrigation, and water supply for domestic/ industrial needs, flood control, either singly or in combination. Tanks are small lakes of impounded waterways constructed on land surface for irrigation. They are associated with croplands, low lands and reservoirs surrounded by hills without vegetation. This includes all reservoirs/tanks with water spread seen at least during one season in a year is considered under the permanent category. This category occupies an area of 310.22 Sq. km.

Reservoir/Tanks-Seasonal

Dry reservoirs/tanks are those which do not have water spread throughout the year are considered seasonal. It is found that many of the tanks are under seasonal category with an area of 698.24 Sq. km.

2.2 Slope Map of the District

The concept of measuring slope from a topographic map is a familiar one for most professionals in the natural resources and landscape planning / management and surveying professions. Slope is a measurement of how steep the ground surface is. Steeper the ground surface is, greater the slope. Slope is measured by calculating the tangent of the surface. The tangent is calculated by dividing the vertical change in elevation by the horizontal distance. Slope is normally expressed in planning as a percent slope which is the tangent (slope) multiplied by 100. Percent Slope = Height / Base * 100

Reliable estimation of the stability of slopes and foundations is very demanding because it is important for terrain analysis to understand the natural process in the disciplines of topography, geology, soils, hydro-geology, infrastructure planning, hazard management both at surface and subsurface. In view of this, slope will play an important role while doing decentralized planning at grass root level. Traditionally contours information from 1:50,000 or 1:25,000 topographic maps are used for preparation of slope by manual procedures based contour value difference for unit horizontal distance. The emergence of remote sensing & GIS systems and the

availability of topographic data in DEM or TIN formats, slope maps can be generated using image processing and GIS methods. Representation of slope in percentage is understandable rationale for the resource mapping and planning. Slope information is one of the GIS layers that play an important role in natural resources and District planning process. It is proposed to generate the necessary slope layer from the available digital topographic data such as Carto DEM and open source Digital Elevation Model data (NRSC, 2009).

From Fig. 9, it is observed that majority of the mandals are covered with level to nearly level slope of 0 to 1%. Very gently sloping areas are observed in many places of Nellore District. Gently sloping areas are observed in parts of Sydapuram, Balayapalle, Venkatagiri, Chejerla, Sangam1, Bogole. Steep sloping and very steep sloping categories are found in Eastern part of the Nellore District.

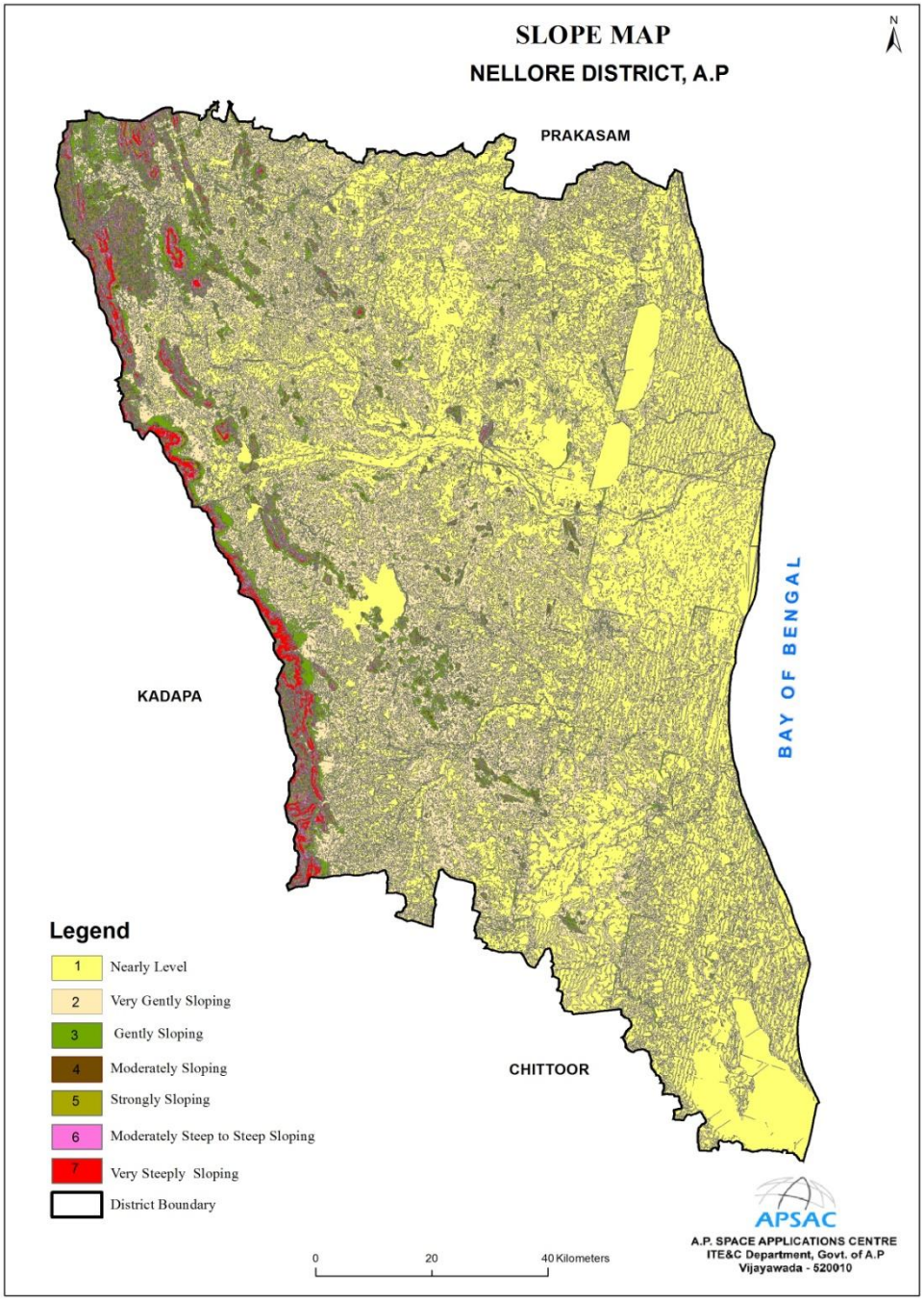


Fig. 9 General Slope of Nellore District, Andhra Pradesh

Slope data generated from DEM using GIS techniques produces triangular nature slope polygon. To generate meaningful slope layer it is suggested to aggregate slope polygons by using manual procedures. However, the slope generated from GIS analysis can be used directly for any decision-making planning purpose. The accuracy of the slope is dependent on accuracy of the DEM used for slope generation. The DEM should a bare earth and should not have spikes or dips which are common in automatic DEM generation. Therefore, to use Carto DEM, conversion to bare earth DEM has to be carried out before slope layer generation.

2.3 Forest Cover Distribution

The forest cover in the District based on the interpretation of IRS R2 LISS III data (2015-16) is 2169.9 Sq. km which is 16.6% of the total geographical area (TGA) of the District. As per the land use manual (NRSC 2016), the forests of the District can be classified into 7 forest classes and class-wise areas are presented in Table-3. The spatial distribution of forest cover in the District is shown in Fig-10.

Table-3 Forest Cover Distribution of Nellore District

S. No	Forest Category (2015 - 16)	Area in Sq. km.	% TGA
1	Deciduous (Dry/Moist/Thorn)-Dense	371.1	2.8
2	Deciduous (Dry/Moist/Thorn)-Open	676.7	5.2
3	Forest Plantation	178.8	1.4
4	Scrub Forest	755.7	5.8
5	Littoral/Swamp Forest (Mangrove)-Dense	2.5	0.0
6	Tree Clad Area-Dense	129.0	1.0
7	Tree Clad Area-Open	56.1	0.4
Total Forest		2169.9	16.6

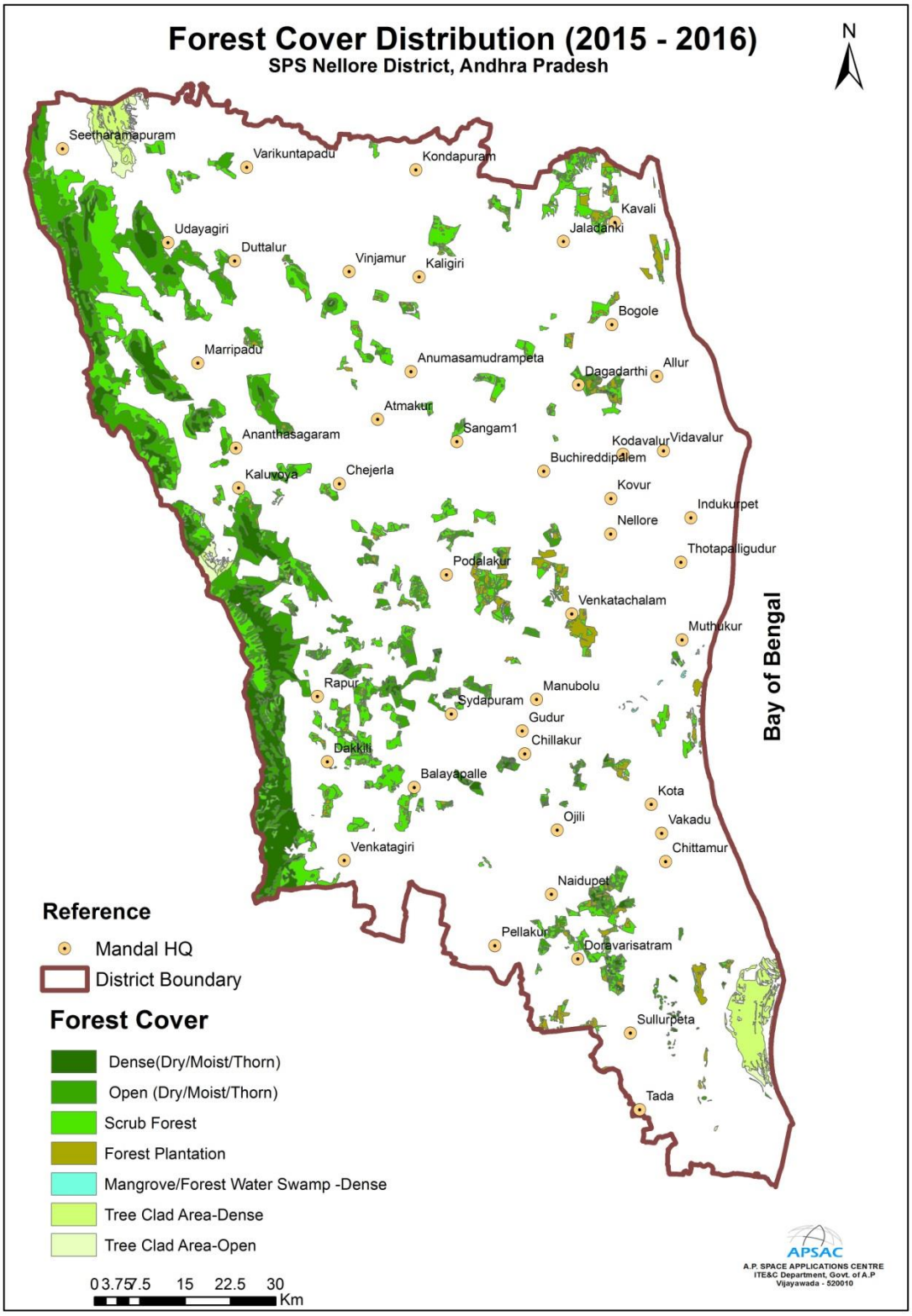


Fig. 10 Forest covers map of Nellore District during 2015-16

3. Agricultural Resources in the Nellore District

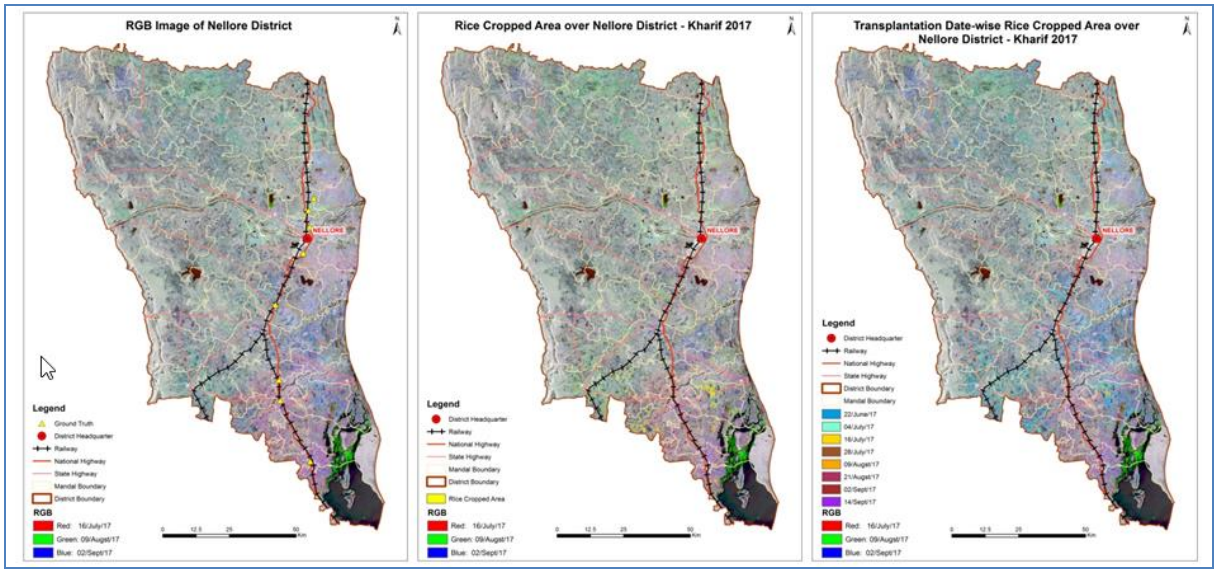
Remote sensing technology has been successfully used by APSAC during the last two decades in the areas of agriculture both in spatial and temporal domain under various projects. APSAC carried out in-season forecasting of acreage for major crops i.e. Kharif rice, Rabi rice, cotton, groundnut etc, at State/ District level for the last two decades in Andhra Pradesh to enable the administrators and planners to take strategic decisions on import-export policy matters and trade negotiations. Rice and Cotton are the most dominant crops in Andhra Pradesh in both Kharif seasons. In this connection, Department of Agriculture and Directorate of Economics & Statistics are generating data on conventional methods for estimation of crop area and production. In this regard, satellite remote sensing plays a pivotal role with limited field visits for timely for estimation and monitoring the crops.

3.1 Kharif Rice Estimation using SAR data

Andhra Pradesh Space Applications Centre (APSAC) has carried out Kharif rice crop acreage estimation over Nellore District using Microwave Remote Sensing (Sentinel-1A) data under FASAL project. Sentinel-1A Synthetic Aperture Radar (SAR) VV polarization data (Spatial Resolution 20m) is used for the analysis. The rice acreage using sentinel-1 microwave remote sensing data for Nellore District was estimated at 29,901 ha.

3.2 Kharif and Rabi crop acreage Estimation

Remote sensing technology has been successfully used by APSAC during the last two decades in the areas of agriculture both in spatial and temporal domain under various projects. APSAC carried out in-season forecasting of acreage for major crops i.e. Kharif rice, Rabi rice, cotton, groundnut etc, at State/District level for the last two decades in Andhra Pradesh to enable the administrators and planners to take strategic decisions on import-export policy matters and trade negotiations. Rice is the most dominant crop in Andhra Pradesh in both Kharif (July- October /November) and Rabi (November- April) seasons which grows in irrigated and rain-fed areas and other major crops are Groundnut, Cotton, Maize, Pulses, Sugarcane, Jowar, Chillies, etc. In connection, Department of Agriculture and Directorate of Economics and Statistics are generating data on conventional methods for estimation of crop area and production. In this regard, satellite remote sensing plays a pivotal role with limited field visits for timely for estimation and monitoring the crops shown in Fig. 12



(a) (b) (c)

Fig. 11 (a) Ground truth data overlaid on multi-temporal RGB image, (b) Rice cropped area and (c) Transplantation date-wise rice cropped area over Nellore District.

Table.4 Rice crop acreage estimation Rabi 2016-17

SNo.	District	Rice crop acreage using optical RS data (Ha.)
1	Nellore	**147395**

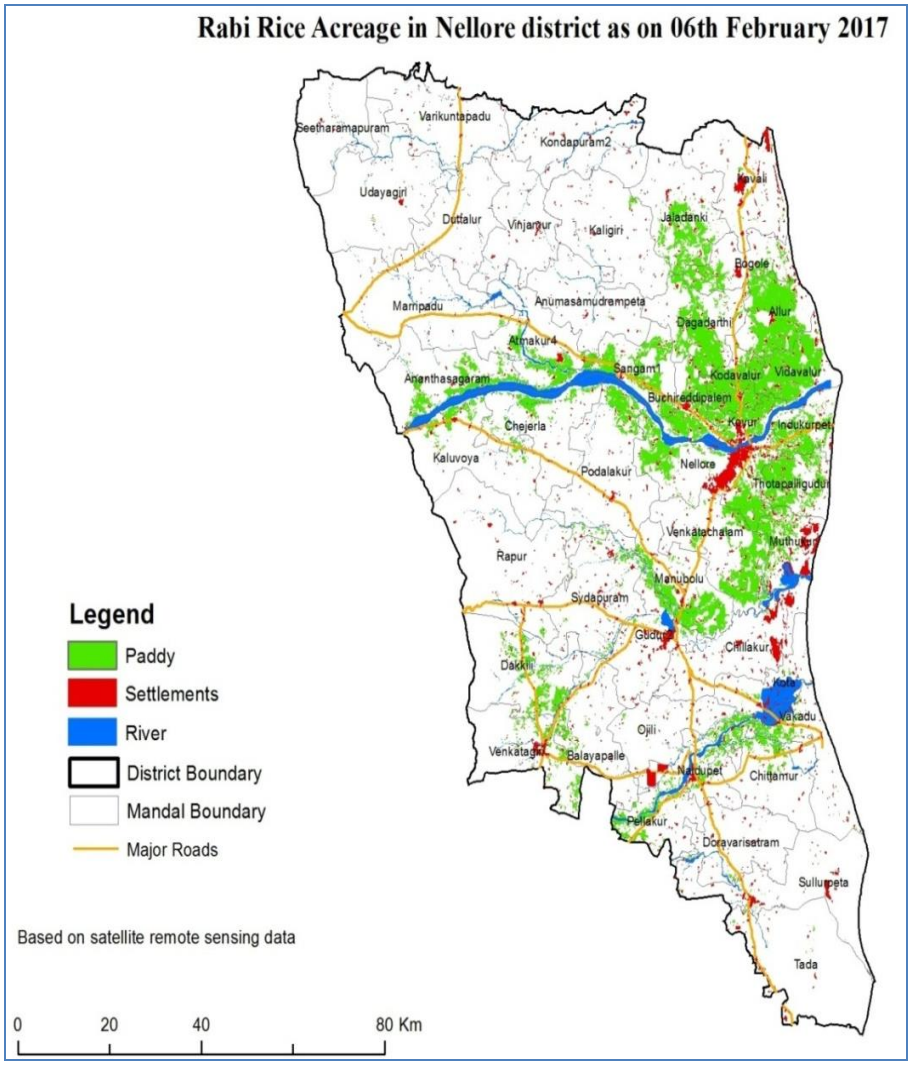


Fig. 12 Rice crop acreage estimation Rabi 2016-17

3.3 Horticulture of Nellore District

Andhra Pradesh is the second largest producer of horticulture crop. The State is giving special thrust to the sector under various schemes. The annual Growth rate has been estimated for different sub-sectors like fruits, vegetables plantation, spices, and flowers. The following tables have clearly shown the area and production for each horticulture crop in Nellore District.

Table :5 Aerial Extent (Ha) of Fresh Fruits with Production (MT) in Nellore District (2017-18)

Aerial Extent (Ha) of Fresh Fruits with Production (MT) in Nellore District(2017-18)			
Sl.No	**Name of The Fresh Fruit**	**Statistics**	
1	Amla	*Area*	80
		Production	480
2	**Banana**	*Area*	1640
		Production	41000
3	Ber	*Area*	27
		Production	
3	Lemon (Lime & Other Citrus Fruits)	*Area*	17876
		Production	286016
4	Orange & Batavia	*Area*	2130
		Production	42600
5	Guava	*Area*	350
		Production	4200
6	Mango	*Area*	9665
		Production	135308
7	Papaya	*Area*	1000
		Production	100000
8	Pomegranate	*Area*	9
		Production	72
9	Sapota	*Area*	391
		Production	3910
10	Muskmelon	Area	600
		Production	12000
11	Watermelon	Area	895
		Production	17900
12	Other Fruits	Area	2356
		Production	23560
	Total Fresh Fruits	Area	37019
		Production	667046

Table: 6 Aerial Extent (Ha) of Vegetables with Production (MT) in Nellore District (2017-18)

Aerial Extent (Ha) of Vegetables with Production (MT) in Nellore District(2017-18)

Sl.No	Name of The Vegetables	Statistics	
1	Beans	Area	170
		Production	1700
2	Bitter Guard	Area	275
		Production	2673
3	Bottle Gourd	Area	140
		Production	1120
4	Brinjal	Area	520
		Production	9360
5	Cabbage & Knol-Khol	Area	5
		Production	50
6	Capsicum	Area	1
		Production	90
9	Cucumber	Area	250
		Production	3750
10	Chillies Green	Area	1200
		Production	16800
11	Bhendi	Area	550
		Production	4950
12	Onion	Area	140
		Production	2520
13	Pumpkin	Area	20
		Production	400
14	Sweet Potato	Area	60
		Production	600
15	Tapioca	Area	53
		Production	424
16	Tomato	Area	37
		Production	666
17	Other Vegetables	Area	800
		Production	9600
	Total Vegetables	Area	4221
		Production	54703

Table:7 Aerial Extent (Ha) of Plantation with Production (MT) in Nellore District (2017-18)

Aerial Extent (Ha) of Plantation with Production (MT) in Nellore District (2017-18)			
Sl.No	**Name of The Plantation**	**Statistics**	
1	Cashew	*Area*	200
		Production	2000

2	Cocoa	*Area*	40
		Production	32
3	Coconut	*Area*	471
		Production	57
4	Oilpalm	*Area*	4169
		Production	62535
	Total Plantations	Area	4880
		Production	64567

Table: 8 Aerial Extent (Ha) of Spices with Production (MT) in Nellore District (2017-18)

Aerial Extent (Ha) of Spices with Production (MT) in Nellore District (2017-18)			
Sl.No	**Name of The Spices**	**Statistics**	
1	Betelvine	Area	272
		Production	2720
2	Chillies (Dried)	Area	2128
		Production	6384
3	Tamarind	Area	25
		Production	375
4	Turmeric	*Area*	180
		Production	1080
5	Others Spices	*Area*	200
		Production	2000
	Total (Spices)	Area	2805
		Production	9839

Table: 9 Aerial Extent (Ha) of Flowers with Production (MT) in Nellore District (2017-18)

Aerial Extent (Ha) of Flowers with Production (MT) in Nellore District (2017-18)			
Sl.No	**Name of The Flowers**	**Statistics**	
1	Chrysanthemum	*Area*	75
		Production	375
2	Jasmine	*Area*	180
		Production	900
3	Marigold	*Area*	220
		Production	1100
5	Tuberose	*Area*	200
		Production	1000
6	Crossandra	*Area*	80
		Production	400
7	Other Flowers	*Area*	50
		Production	250
8	Total Flowers	Area	805
		Production	4025

3.4 Soils Resource of Nellore District

Horticulture is the backbone of the general population in the locale. The aggregate edited region of the locale is 4.63 Lakh hectares amid the year 2015-16 which shapes 35% of the aggregate zone of the area. The main harvests being developed are Paddy, Bajra, Sugarcane, Groundnut, Fruits and Vegetables, Chillies, Cotton and Tobacco. Sunflower Crop is step by step picking up energy and is favoured by the vast majority of the ranchers to different products. According to the Census of operational possessions directed with reference year 2010-11, an aggregate of 4,57,015 operational property are existing for every single social gathering which incorporate institutional, joint and individual possessions with 4,78,548 hectares of zone worked. Among them, upwards of 88,661 and 24,706 operational properties have a place with SC and ST people group and the zone worked by them is 53,236 and 14,307 hectares individually. The soils of the District are classified as black, red and sandy shown in Fig: 13. The red soil is prevalent with 40% of the territory in the locale while a belt of sand keeps running along the ocean drift. The dark cotton soil and sandy top soils possess 23% and 34% of the zone separately.

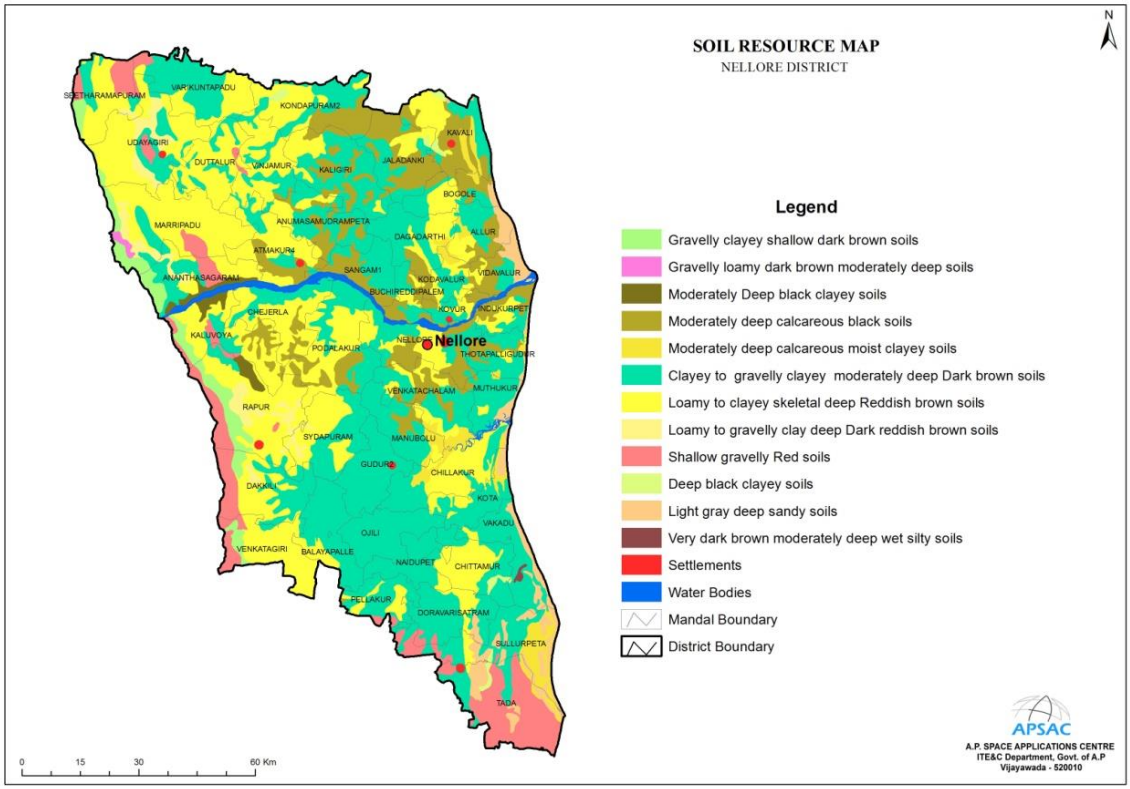
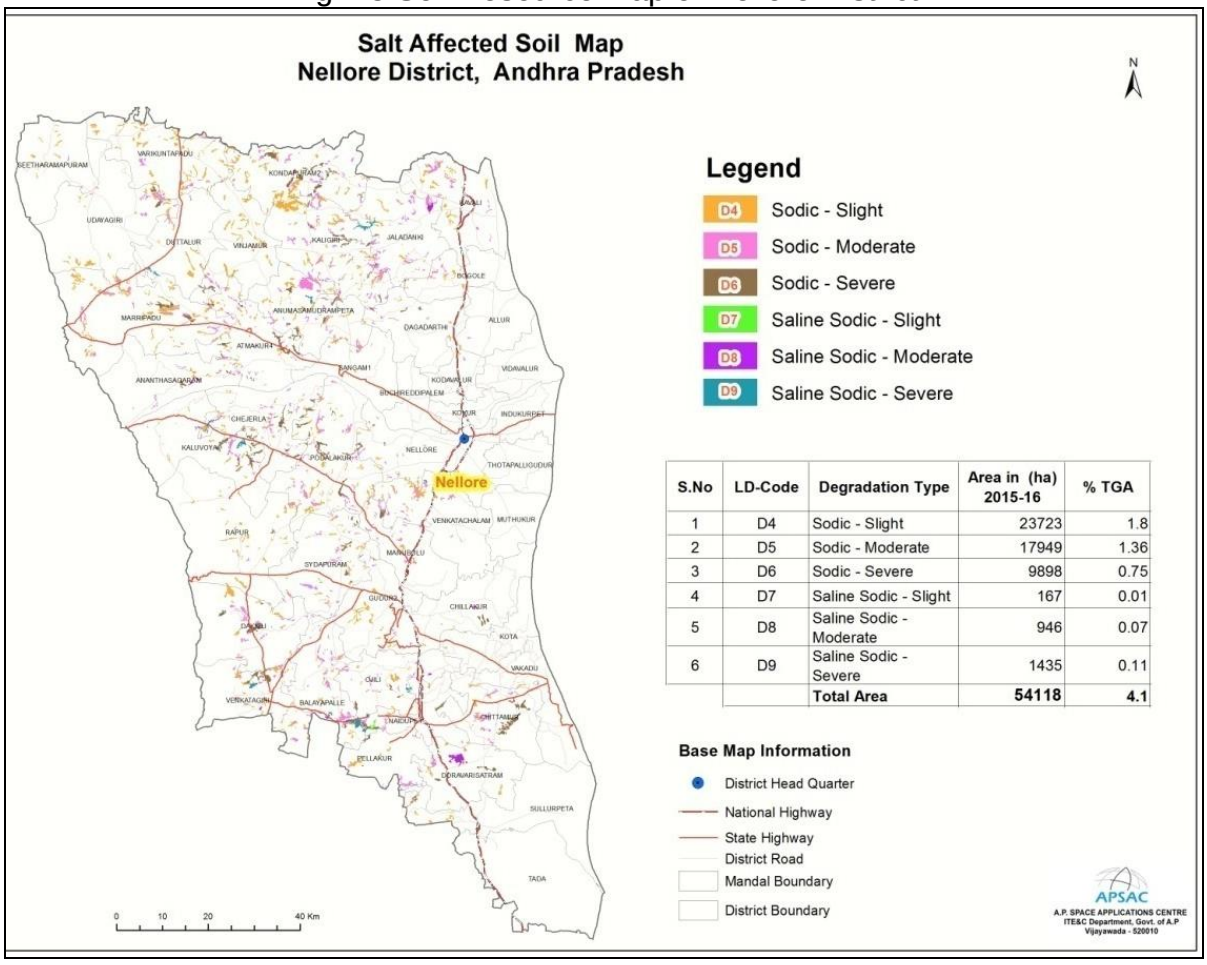


Fig: 13 Soil Resource Map of Nellore District



S.No	LD-Code	Degradation Type	Area in (ha) 2015-16	% TGA
1	D4	Sodic - Slight	23723	1.8
2	D5	Sodic - Moderate	17949	1.36
3	D6	Sodic - Severe	9898	0.75
4	D7	Saline Sodic - Slight	167	0.01
5	D8	Saline Sodic - Moderate	946	0.07
6	D9	Saline Sodic - Severe	1435	0.11
		Total Area	**54118**	**4.1**

Fig: 14 Salt Affected Soil Map of Nellore District

4. Coastal Recourses and Aquaculture of Nellore District

4.1 Shoreline Change Status of Nellore District

The length of Nellore coastline is 167km. The Forests cover is 23% of the area. Nellore is a city and Municipal Corporation in the South Indian State of Andhra Pradesh. It is located on the banks of the Penner River and is well known for its aquaculture and agricultural produce. Nellore is located at 14.43°N to 79.97°E. Rainfall in Nellore occurs between the months of October and December due to the north-east monsoon. This period gives about 60% of the city's annual rainfall. Cyclones are common in the city during this period, causing floods. In order to identify the critically eroded areas along the Nellore coast and to suggest appropriate remedial measures, summary statistics for the rate of change is given in Table.10. The analysis discovered that about 42.29% of the coastlines were under stable or accretion, whereas remaining 20.01% region was experiencing varying erosion. While the Southern side of Upputuru River is noticed with high accretion shown in Fig.15

Table: 10 Shoreline Status of Nellore District

Classification of Coast	Extent (Km)	Percentage of Coast (%)	Cumulative (%)
High Erosion	2.63	1.57	20.01
Medium Erosion	7.09	4.24	
Low Erosion	23.76	14.20	
High Accretion	2.28	1.36	42.29
Medium Accretion	24.53	14.66	
Low Accretion	43.95	26.27	
Stable Coast	63.09	37.70	37.70
Length of coastline	167.33		

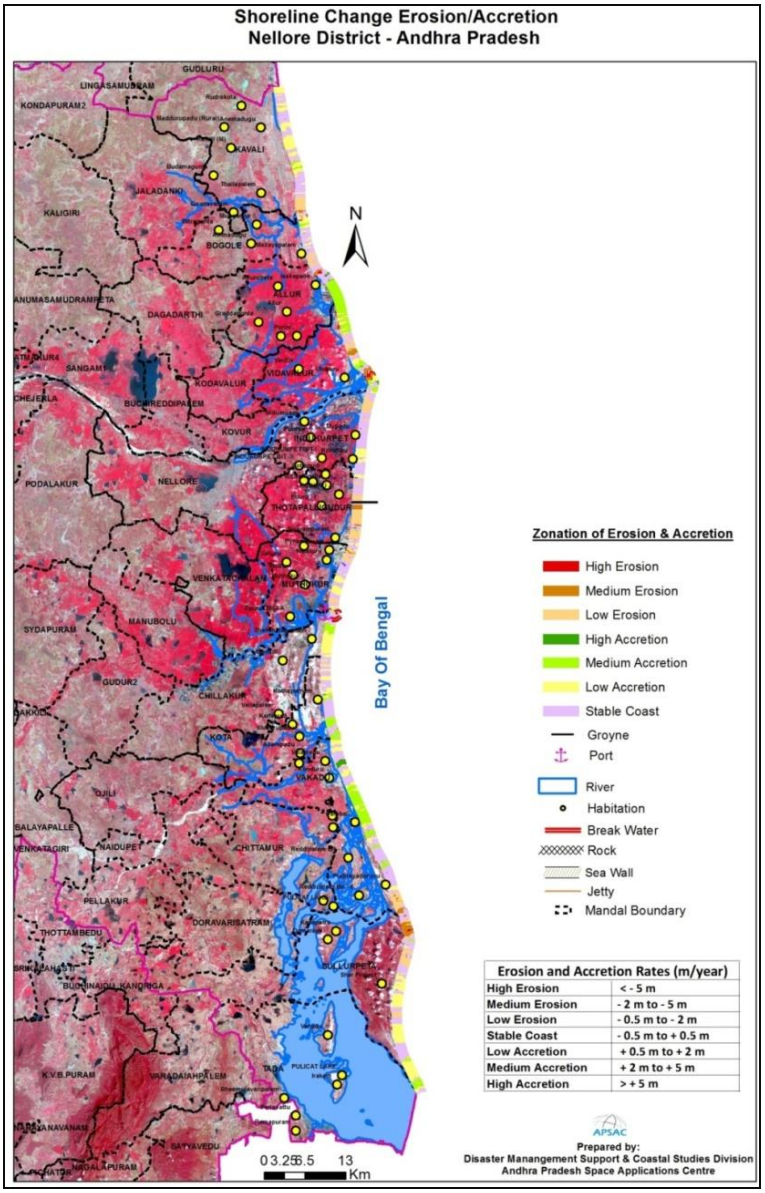
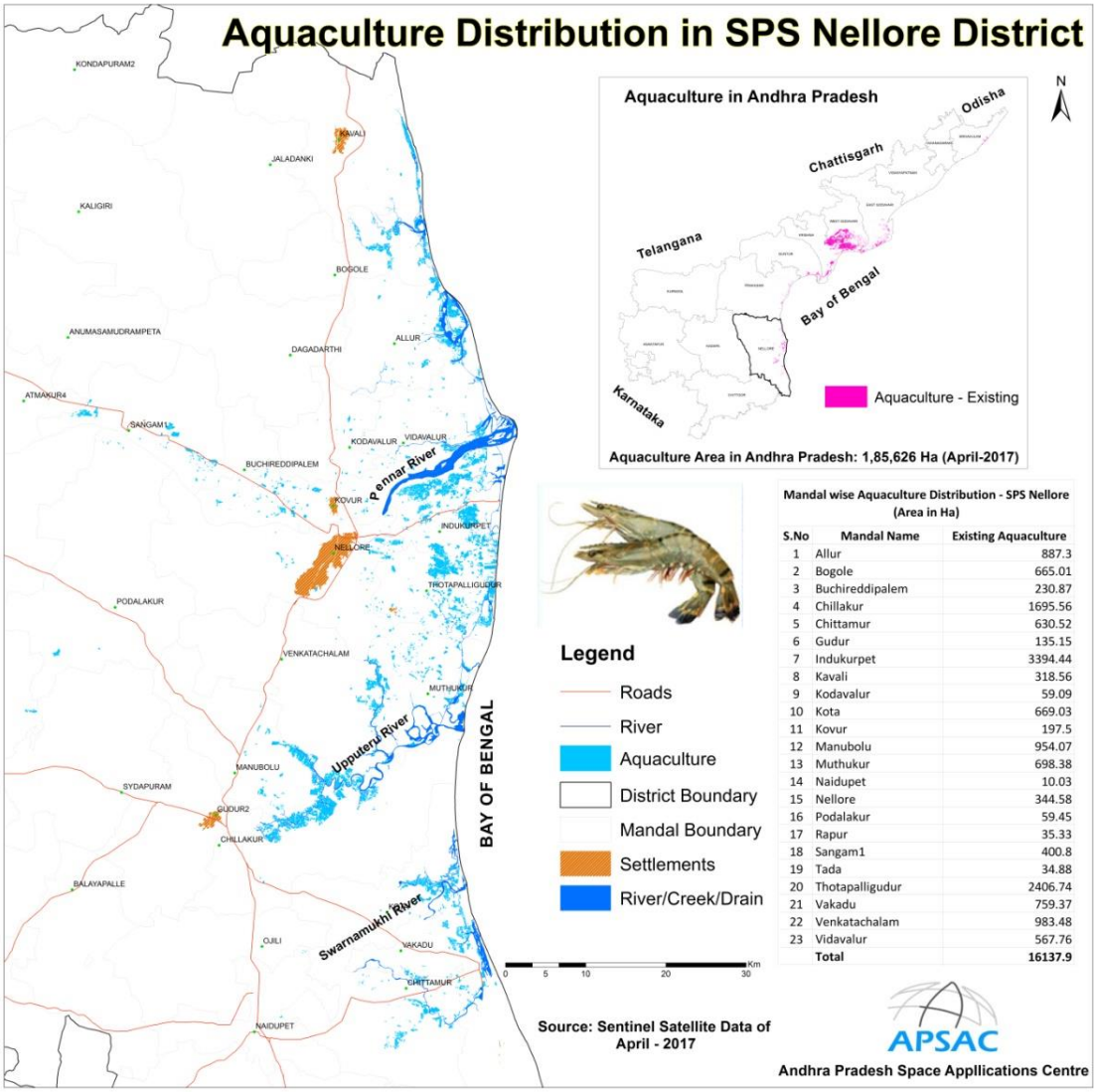


Fig: 15 Status of shoreline change in Nellore District

4.2 Aquaculture in Nellore District

Using high resolution satellite data coupled with ground survey existing aquaculture sites, potential areas for aquaculture development and abandoned aquaculture regions are mapped in all coastal Districts of Andhra Pradesh and mandal-wise/ village-wise area statistics are calculated. Nellore is one of the Coastal Districts in Andhra Pradesh which has Aquaculture area distributed along the Upputeru River, Buckingham canal and other Creeks and River bank areas. In Andhra Pradesh, 9 percent of aqua area has been distributed in Nellore district along Penner River, Upputeru, Swarnamukhi back water Buckingham Canal, Kandaleru Creek, Chippaleru Buckingham Canal, Nakkala kaluva and other small rivers, streams, drains and Canals. In Nellore District 14,107 ha Aquaculture, 14,301ha Abandoned/dry/Potential, and 421 ha salt pans and 28,829 ha total aqua area is distributed. In Nellore District, the highest aquaculture area distributed is in Indukurpet Mandal i.e 3,687 ha aquaculture, 2,299 ha abandon/dry/potential and

total is 5,986 ha area distributed and lowest is Gudluru 3.17 ha, Kovur 32 ha of aquaculture and Abandoned/dry/Potential area has been distributed depicted in Fig: 16



Mandal wise Aquaculture Distribution - SPS Nellore (Area in Ha)

S.No	Mandal Name	Existing Aquaculture
1	Allur	887.3
2	Bogole	665.01
3	Buchireddipalem	230.87
4	Chillakur	1695.56
5	Chittamur	630.52
6	Gudur	135.15
7	Indukurpet	3394.44
8	Kavali	318.56
9	Kodavalur	59.09
10	Kota	669.03
11	Kovur	197.5
12	Manubolu	954.07
13	Muthukur	698.38
14	Naidupet	10.03
15	Nellore	344.58
16	Podalakur	59.45
17	Rapur	35.33
18	Sangam1	400.8
19	Tada	34.88
20	Thotapalligudur	2406.74
21	Vakadu	759.37
22	Venkatachalam	983.48
23	Vidavalur	567.76
	Total	16137.9

Fig. 16 Area of Aquaculture Distribution in Nellore District

5. Water and Irrigation Resources of the Nellore District

5.1 Surface water Resource of Nellore District in Nellore District

5.1.1 River basin in Nellore District

The Penner River is one of the significant East Flowing Rivers in southern India. It ascends in the Chenna Kasavahill of the Nandidurg extend in Karnataka, streams the North Westerly way through Kolar and Tumkur regions of Karnataka and enters Andhra Pradesh in the Hindupur taluk of Anantapur area runs eastwards before depleting into the Bay of Bengal close Nellore. The Somasila is significant venture in the catchment zone of the stream bowl. Situated in peninsular India, the Penner bowl stretches out finished conditions of Andhra Pradesh and Karnataka having a territory of 55,213 Sq.km with most extreme length and width of 433 km and 266 km. The fan molded basin is limited by the Erramala extend on the North, by the Nallamala and Velikonda scopes of the Eastern Ghats on the East, by the Nandidurg slopes on the South and by the tight edge isolating it from the Vedavati valley of the Krishna Basin on the West. The other slope runs in the basin toward the South of the stream are the Seshachalam and Paliconda ranges. The Penner (otherwise called Uttara Pinakini) is one of the significant waterways of the promontory. The Pennerr rises in the Chenna Kasava slope of the Nandidurg run, in Chikkaballapura region of Karnataka and streams towards East in the long run depleting into the Bay of Bengal. The aggregate length of the waterway from origin to its outfall in the Bay of Bengal is 597 km. The essential tributaries of the waterway joining from left are the Jayamangali, the Kunderu and the Sagileru while the Chitravathi, the Papagni and the Cheyyeru go along with it from right shown in fig.17

The Basin of the Penner and its tributaries covers parts of the Southern Deccan Plateau, including the vast majority of the Rayalaseema region of Andhra Pradesh and parts of Karnataka. The Kolar Plateau frames the separation between the Penner watershed and those of the Kaveri, Ponnaiyar, and Palar streams toward the South. The Penner channels the Northern segment of the level, which incorporates parts of Kolar and Tumkur areas in Karnataka. The Krishna River and its tributaries deplete the Deccan plateau toward the West and North of the Penner's watershed, and the low Erramala slopes frames the Northern gap of the Penner region. The upper watershed of the Penner incorporates Cuddapah District, central and Eastern Anantapur District, the Southern piece of Kurnool District, North Western Chittoor District. The Penner at that point streams East through a gap in the Eastern Ghats ranges onto the plain of Coastal Andhra, flowing through Nellore city before it empties into the Bay of Bengal at a place called Uttukuru, 15 km East of Nellore. Swarnamukhi is an east streaming waterway having an aggregate length of 130 km. This is an independent river which raises at a height of 300 m in the Eastern Ghats and goes close Pakala town in Chittoor area of Andhra Pradesh, India.

The Swarnamukhi is an east flowing river Basin having a little catchment area of 3225 km^2. It grows at an altitude of 300 m in the eastern Ghat ranges near Pakala village in the Chittoor District of Andhra Pradesh. It runs generally in the north-eastern direction passing through the famous Tirupati Hills before joining into the Bay of Bengal. Its total length is 130 km. This is an independent river and receives no major tributaries and, therefore, its flow depends only on rainfall in its upper catchment. The mean annual rainfall in the Swarnamukhi Basin decreases from 1270 mm at the eastern extremity of the basin to 762 mm at the western extremity. The north-east monsoon sets in the month of October and draws back before November. The average maximum air temperature in the catchment fluctuates from 30C to 32 C and the least between 22.5 C and 25 C. Nevertheless, the streams are also struck by the tidal cycles, by the action of waves, the shore line geography and by the presence of different water masses, assuming predominantly a SW-NE direction

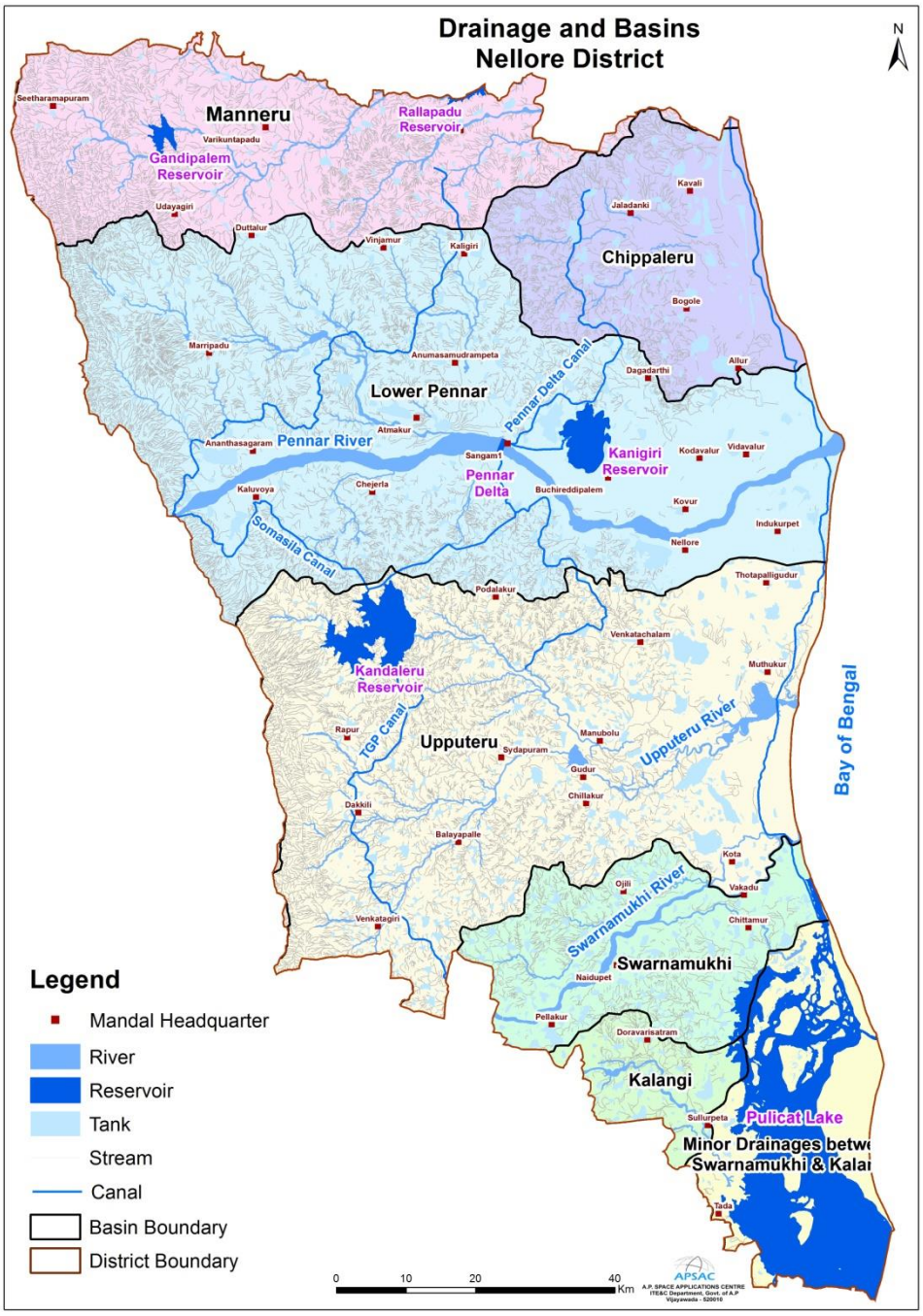


Fig. 17 Drainage and Basins Nellore District

Table:11 Drainage System with Description of main rivers

S.No	Name of the River	Area Drained (Sq.KM)	% of Area Drained in the District
1	Upputeru	3678	27.8
2	Swarnamukhi	1002.7	7.59
3	Penner	4305.39	32.5
4	Manneru	1737	13.1

5	Kandaleru/ Chippaleru	1155	8.7
6	Kalangi	1334	10

Table: 12 Salient Features of Important Rivers and Streams

S.No	Name of the River or Stream	Total Length in the District (in Kms)	Place of Origin	Altitude at Origin
1	Upputeru	116.46	Rapur, Andhra Pradesh	450 m
2	Swarnamukhi	63.55	Chandragiri, Andhra Pradesh	300 m
3	Penner	110.58	Nandi Hills, Chikbullapur, Karnataka	1478 m
4	Manneru	11.63	Velikonda Reserved Forest, Andhra Pradesh	100 m
5	Kandaleru / Chippaleru	42.63	Manubolupadu Reserved Forest, Andhra Pradesh	83 m
6	Kalangi	39.10	Adavaram Village, KVB Puram Mandal, Chittoor	800 m

5.1.2 Major and Medium Irrigation Projects in Nellore District

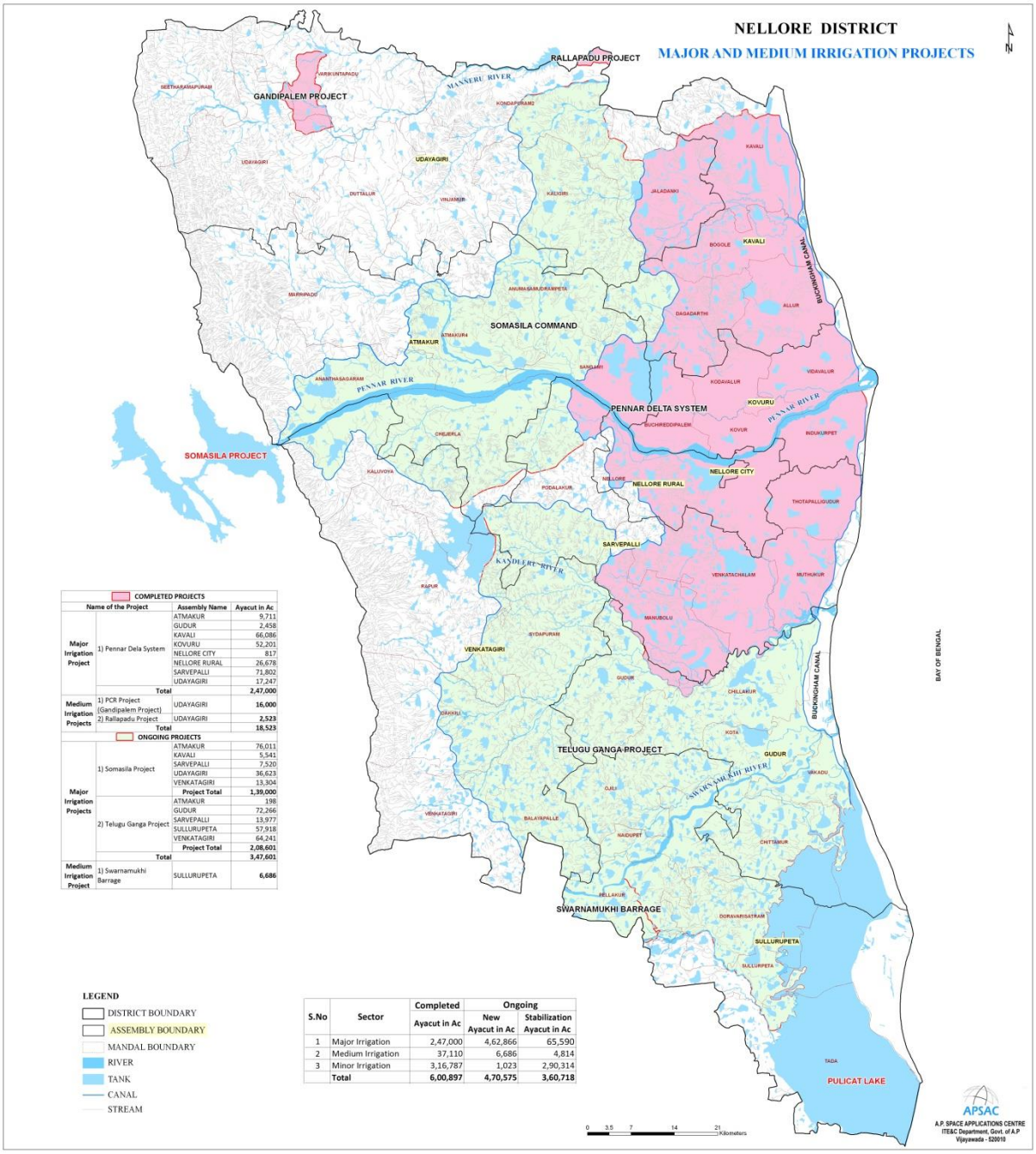
Irrigation has assumed an increasing significance in agriculture in the context of new technology, where high yielding varieties and multiple cropping is being practiced. The main reasons for low yields are inadequate rainfall, uneven and uncertain rains during the period of crop growth. It is generally found that the introduction of irrigation is associated with changes in the cropping pattern. The shift from traditional cropping pattern to the most advantageous cropping pattern is possible only in the presence of irrigation facilities. The new agricultural technology is highly based on sufficient moisture conditions. Thus, the development of irrigation is crucial for increasing agricultural production. The irrigation projects are classified as major, medium and minor irrigation projects shown in fig. 18

5.1.3 Major Irrigation Project

The major irrigation projects covering Nellore District are Penner delta system, somasila project and Telugu Ganga Project. In Penner delta system, an extent of 247,000 acres, Somasila project 139,000 acres and Telugu Ganga Project is 208,601 acres are covred and they fall under eighteen assembly constituencies. The mandals covered are Atmakur, Gudur, Kavali, Kovuru, and Nellore city, Nellore Rural, Sarvepalli, Udayagiri and Venkatagiri. The overall coverage under major irrigation project is 594,601 acres. The major ongoing projects are somasila project and Telugu Ganga Project.

5.1.4 Medium Irrigation Project

he Medium irrigation project are PCR Project (Gandipalem Project) and Rallapadu Project. These medium irrigation projects fall under three assembly segments with an ayacut of 18,523 acres. The assembly segments covered are Udayagiri and Sullurupeta. The ongoing medium irrigation project is Swarnamukhi Barrage project. The ongoing medium irrigation project falls under Sullrurupeta mandal covering 6686 acres.



COMPLETED PROJECTS			
Name of the Project		Assembly Name	Ayacut in Ac
Major Irrigation Project	1) Pennar Dela System	ATMAKUR	9,711
		GUDUR	2,458
		KAVALI	66,086
		KOVURU	52,201
		NELLORE CITY	817
		NELLORE RURAL	26,678
		SARVEPALLI	71,802
		UDAYAGIRI	17,247
	Total		2,47,000
Medium Irrigation Projects	1) PCR Project (Gandipalem Project)	UDAYAGIRI	16,000
	2) Rallapadu Project	UDAYAGIRI	2,523
	Total		18,523
ONGOING PROJECTS			
Major Irrigation Projects	1) Somasila Project	ATMAKUR	76,011
		KAVALI	5,541
		SARVEPALLI	7,520
		UDAYAGIRI	36,623
		VENKATAGIRI	13,304
		Project Total	1,39,000
	2) Telugu Ganga Project	ATMAKUR	198
		GUDUR	72,266
		SARVEPALLI	13,977
		SULLURUPETA	57,918
		VENKATAGIRI	64,241
		Project Total	2,08,601
	Total		3,47,601
Medium Irrigation Project	1) Swarnamukhi Barrage	SULLURUPETA	6,686

S.No	Sector	Completed	Ongoing	
		Ayacut in Ac	New Ayacut in Ac	Stabilization Ayacut in Ac
1	Major Irrigation	2,47,000	4,62,866	65,590
2	Medium Irrigation	37,110	6,686	4,814
3	Minor Irrigation	3,16,787	1,023	2,90,314
	Total	6,00,897	4,70,575	3,60,718

Fig. 18 Major and Medium Irrigation Projects of Nellore District

5.1.5 Tank Information System

Andhra Pradesh Space Application centre developed a Web Portal GIS for Tank Information System (TIS) in Andhra Pradesh. In the said web portal, minor irrigation tanks are classified as more than 40 ha, 10 to 40 ha and less than 10 ha command. Information related to nearly 15,000 tanks in Andhra Pradesh has been published in APSAC website and the information regarding 304 tanks in Nellore District has so far been published in the website (http://apsac.ap.gov.in:8090/tis). In that information, all are of 10 to 40 ha category. The tank-wise information regarding location details, hydrological details and other standard information related to the tank are presented.

5.2 Ground Water Scenario and Quality of the District

5.2.1 Geomorphology of the District

Geomorphologically, the District can be broadly divided into 3 distinct units, viz., western hills, central pediplains and eastern deltaic & coastal plains. The higher relief is represented by hill ranges of Eastern Ghats, in the western border of the District. These hills are locally known as Veligonda hills, run in a north-westerly direction with the highest elevation of 1,105 m amsl at Penchalakonda. The pediplain area i.e., in the central part of the district extends in a north - south direction. The general altitude of this physiographic unit varies from 36 to 170 m amsl with isolated hillocks. The master slope of the area is from west to east towards the Bay of Bengal. The deltaic and coastal plain extends from north to south along the eastern margin of the District all along the coast. Penner and Swarnamukhi rivers are the major contributors to the formation of the deltaic plains. The sandy coastal plain Using IRS satellite data and GIS detailed geomorphological and structural map of Nellore District was generated as per Rajiv Gandhi National Drinking Water Mission (RGNDWM) guidelines on 1:50,000 scale. The objective of this is to map lithology, geomorphology and structural characteristics of an area on 1:50,000 scale and to integrate the same to locate potential ground water prospect zones and to recommend suitable structures for ground water recharge. Various hydro-geomorphic units are delineated and suitable recharge structures are proposed at drinking water affected villages under this project. The description of geomorphic units of different origins mapped in Nellore District are shown in fig. 19 and presented below.

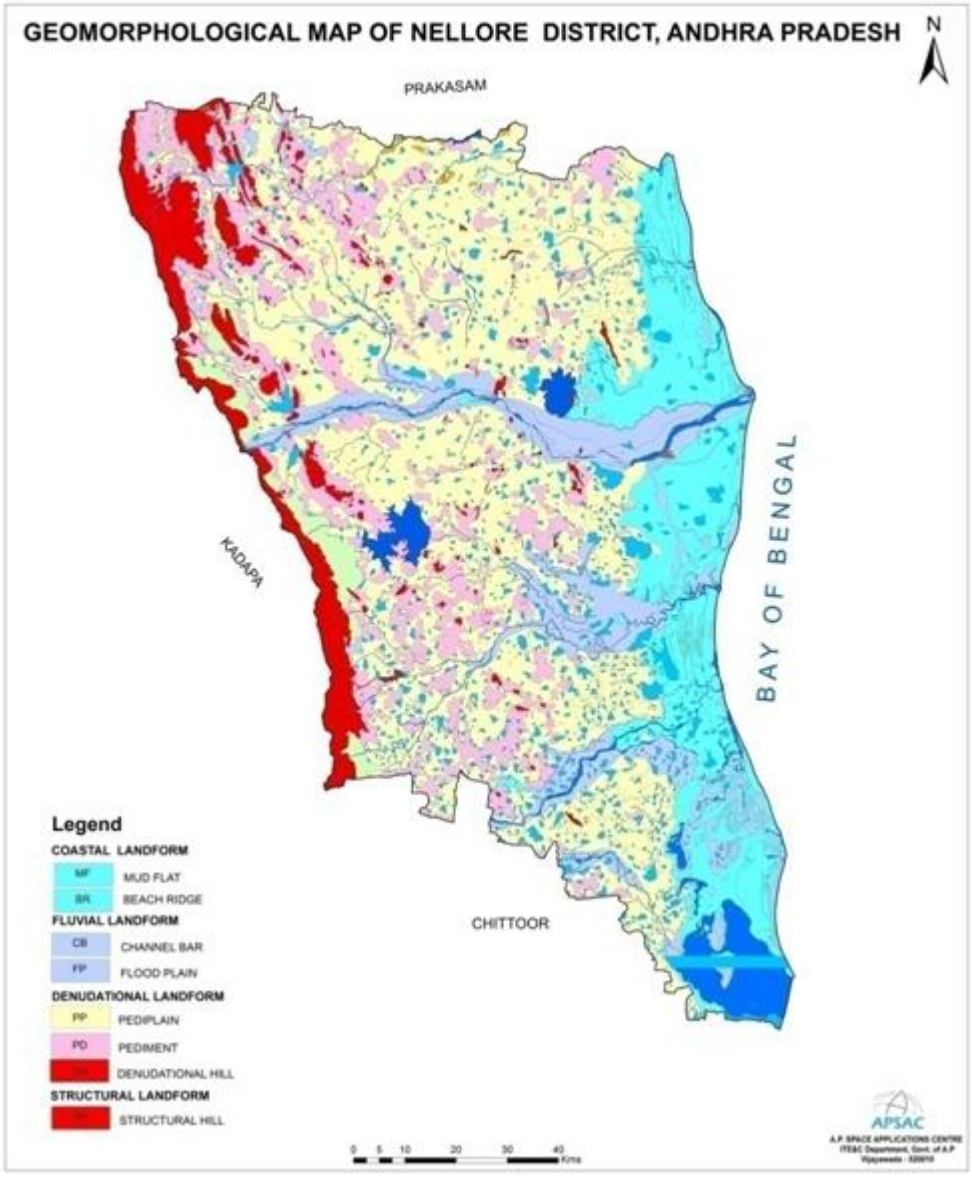


Fig.19 Geomorphology of Nellore District, Andhra Pradesh

5.2.2 Landforms of fluvial origin

The word fluvial is used in Earth science to refer to processes and landforms produced by running water. As with other surgical processes, running water can either erode material from the earth's landscape, or deposit layers of sediment. The resulting landforms can thus be classified as either erosional landforms or depositional landforms. The incredible power of running water in carving various erosional and depositional landforms is well known. Although the quantity of water in stream is small at one time during the course of the year, very large volumes of water move through the channel and they form an important component in the hydrological cycle. The fluvial dissection of the landscape consists of valleys and their included channel ways organized into a system of connection known as a drainage network. Drainage networks display many types of quantitative regularity

that are useful in analyzing both the fluvial systems and the terrains that they dissect (NRSA, 2007).

Alluvial plain: A level or gently sloping tract or a slightly undulating land surface produced by an extensive deposition of alluvium, usually adjacent to a river that periodically overflows its banks; it may be situated on a flood plain, a delta, or alluvial fan. This landform is predominantly seen on the southern part of the District.

Palaeochannel: Deep valleys cut in the bedrock terrain and today filled largely with alluvium, glacial outwash gravels and sands or with tills. These are a good source for underground water.

Flood plain: The surface or strip of relatively smooth land adjacent to a river channel constructed (or in the process of being constructed) by the present river in its existing regimen and covered with water when the river overflows its banks at times of high water. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current.

Delta: The low, nearly flat, alluvial tract of land deposited at or near the mouth of a river, commonly forming a triangular or fan shaped plain of considerable area enclosed and crossed by many distributaries of the main river, perhaps extending beyond the general trend of the coast, and resulting from the accumulation in a wider body of water (usually a sea) of sediment supplied by a river in such quantities that it is not removed by tides, waves and currents.

Valley fill: The unconsolidated sediment deposited by any agent so as to fill or partly fill a valley.

5.2.3 Landforms of coastal origin

Coasts are also the loci of a unique assemblage of erosional and depositional processes. Various landforms of coastal areas are almost exclusively the result of the action of ocean waves. Wave action creates some of the world's most spectacular erosional landforms. Where wave energy is reduced, depositional landforms like beaches are created. The source of energy for coastal erosion and sediment transport is wave action. A wave possesses potential energy as a result of its position above the wave trough, and kinetic energy caused by the motion of the water within the wave. This wave energy is generated by the frictional effect of winds moving over the ocean surface. Higher the wind speed and longer the fetch or distance of open water across which the wind blows and waves travel, the larger the waves and the more energy they therefore possess. Long open ocean waves or swells travel faster than short, locally generated sea waves. They also have longer wave periods and this is how they are distinguished from the short sea waves on reaching the coast. Long swells, which have travelled hundreds of kilometers, may have wave periods of up to 20 seconds. Smaller sea waves have wave periods of 5 to 8 seconds. Where ocean depths are greater than the length of the waves, the wave motion does not extend to the ocean floor and therefore remains unaffected by the floor. As the ocean depth falls below half the wavelength, the bottom increasingly

affects the wave motion. As the depth of water decreases, the wave height increases rapidly and the wavelength decreases rapidly. Thus, the wave becomes more and more peaked as it approaches the shore, finally curling over as a breaker and breaking on the shore. As the wave breaks, its potential energy is converted into kinetic energy, providing a large amount of energy for the wave to do work along the shoreline. Transportation by waves and currents is necessary in order to move rock particles eroded from one part of a coastline to a place of deposition elsewhere. One of the most important transport mechanisms results from wave refraction. Since waves rarely break onto a shore at right angles, the upward movement of water onto the beach (swash) occurs at an oblique angle. However, the return of water (backwash) is at right angles to the beach, resulting in the net movement of beach material laterally. This movement is known as beach drift. The endless cycle of swash and backwash and resulting beach drift can be observed on all beaches. Frequently, backwash and rip currents cannot remove water from the shore zone as fast as it is piled up there by waves. As a result, there is a build up of water that results in the lateral movement of water and sediment just offshore in a direction with the waves. The currents produced by the lateral movement of water are known as long shore currents. The movement of sediment is known as long shore drift, which is distinct from the beach drift described earlier, which operates on land at the beach. The combined movement of sediment via long shore drift and beach drift is known as littoral drift. Tidal currents along coasts can also be effective in moving eroded material. While incoming and outgoing tides produce currents in opposite directions on a daily basis, the current in one direction is usually stronger than in the other resulting in a net one-way transport of sediment. Long shore drift, long shore currents, and tidal currents in combination determine the net direction of sediment transport and areas of deposition. Using multi-temporal satellite data can bring out the dynamics of the coast (NRSA, 2007).

Beach: A gently sloping zone, typically with a concave profile, of unconsolidated material that extends landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation (usually of the effective limit of the highest storm waves).

Beach ridge: A low, essentially continuous mound of beach or beach and dune material (sand, gravel, shingle) heaped up by the action of waves and currents on the backshore of a beach beyond the present limit of storm waves or the reach of ordinary tides, and occurring singly or as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive positions of an advancing shoreline.

Coastal plain: A low, generally broad but sometimes narrow plain that has its margin on the shore of a large body of water (esp. the ocean) and its strata either horizontal or very gently sloping toward the water, and that generally represents a strip of recently emerged sea floor or continental shelf.

Dune and Swale complex: It is a large complex of parallel wetland swales and upland beach ridges (dunes) found in coastal embayment and on large sand spits along the shorelines of the Great Lakes. The upland dune ridges are typically forested, while the low swales support a variety of herbaceous or forested wetland types, with open wetlands more common near the shoreline and forested wetlands more prevalent further from the lake.

Tidal flat: An extensive, nearly horizontal, marshy or barren tract of land that is alternately covered and uncovered by the rise and fall of the tide, and consisting of unconsolidated sediment (mostly mud and sand). It may form the top surface of a deltaic deposit.

5.2.4 Landforms of Structural Origin

Landform of structural origin is related to structural aspect of the area. Most of the landforms under this class have genesis related to underlying structure. Structure plays an important role in reducing the resistance of rock which manifests itself in different geomorphic forms. Some of the variation is minor and some are in mega scale. The mega scale forms have a dramatic effect on the genesis of landforms and hence mapping of such forms indirectly indicates the structural set up of the area. The mega scale structural features like fault and fold depending on its type plays an important role in genesis of structural landform. The influence of geologic structures on the development and appearance of landscapes is prominent. The influence of geologic structures ranges from large features, which exert a dominant influence on the form of an entire landscape, to small features, which affect an individual landform and the geomorphic processes operating on it. The structural control could be active structures whose form is directly impressed on the modern landscape or ancient structural features whose influence on a modern landscape is due primarily to differential erosion (NRSA, 2007).

Dome: A general term for any dome shaped landform or rock mass, such as a smoothly rounded rock-capped mountain summit, roughly resembling the dome of a building.

Structural Hills: Hills and valleys, which are originated due to tectonic process and are highly dissected by the drainage lines. This can be further classified as highly, moderately and low dissection depending on the density of joints and drainage. Mostly this will be interpreted from a planimetric satellite data and the classification is highly subjective.

Dyke Ridge: Intrusive features that are emplaced within the pre-existing fractures or where the fluid pressure is great enough for them to form their own fracture during emplacements. They are discordant bodies.

Cuesta: A hill or ridge with a gentle slope on one side and a steep slope on the other; specifically an asymmetric ridge with one face (dip slope) long and gentle and conforming with the dip of the resistant bed or beds that form it, and the opposite face (scarp slope) steep or even cliff-like and formed by the out crop of the resistant rocks, the formation of the ridge being controlled by the differential erosion of the gently inclined strata.

5.2.5 Landforms of Denudational origin

Landform of denudational origin is formed where the denudation process dominates over the other process. Most of the landform resulting due to this process is the combined effect of mechanical and chemical weathering. Denudation is the process of removal of material by erosion and weathering. This has direct influence on the relief of the area especially in the reduction of relief to the base level. The agents are mostly water, ice and wind. The major factors affecting denudation are geology, climate, tectonics and anthropogenic effects. All rocks and minerals at or near surface are attacked by physical and chemical process. The effect of this process is not the same everywhere because of rocks varying resistance to change. As a result, weathering and erosion yield number of landforms, which have typical shape and forms. Weathering is an essential part of the rock cycle. The parent material, or rock weathered material is disaggregated to form smaller fragments and some of the minerals are dissolved and removed by the agent of water. This removal of material is erosion and is accomplished by running water, wind, glacier etc. The weathering provides a raw material for the sedimentary rock and soil (NRSA, 2007).

Denudational Hill: It is a highly dissected hill which has obliterated the structures.

Inselberg: A prominent, isolated, steep sided, usually smoothed and rounded, residual knob, hill or small mountain of circumdenudation rising abruptly form and surrounded by an extensive and nearly level, lowland erosion surface in a hot, dry region (as in the deserts of southern Africa or Arabia), generally bare and rocky although partly buried by the debris derived from and overlapping its slopes; it is characteristic of an arid or semiarid landscape in a late stage of the erosion cycle.

Pediment: A broad, flat or gently sloping, rock floored erosion surface or plain of low relief, typically developed by sub aerial agents (including running water) in an arid or semiarid region at the base of an abrupt and receding mountain front or plateau escarpment, and underlain by bedrock (occasionally by older alluvial deposits) that may be bare but more often partly mantled with a and discontinuous_veneer of alluvium derived from the upland masses and in transit across the surface.

Pediment-Inselberg Complex: The pediments dotted by numerous inselberg of small sizes, which make it difficult to distinguish from the pediments. Hence it is called a complex of pediment and inselberg.

Pediplain: An extensive, multi-concave, rock cut erosion surface formed by the coalescence of two or more adjacent pediments and occasional desert domes, and representing the end result (the “peneplain”) of the mature stage of the erosion cycle. Based on the thickness of weathering they are further classified as shallow, moderate and deep pediplains. **Residual Hill:** A small remnant hill, which has witnessed all forms of denudation.

5.3 Structural Features of Nellore District

The rock of Dharwar supers lap form a prominent NE-SE trending belt from north of udayagiri to south of Gudur attaining a width of 25km in a broad synformed structure. Carbonate occurs as a narrow NW-SE trending band within the Dharwar Meta volcanic having a width of 50 to 60km over a strike length of 8km close to the margin of Dharwar. Prominent lineaments in this District are treading in NE-SW and NW-SE directions shown in fig. 20.

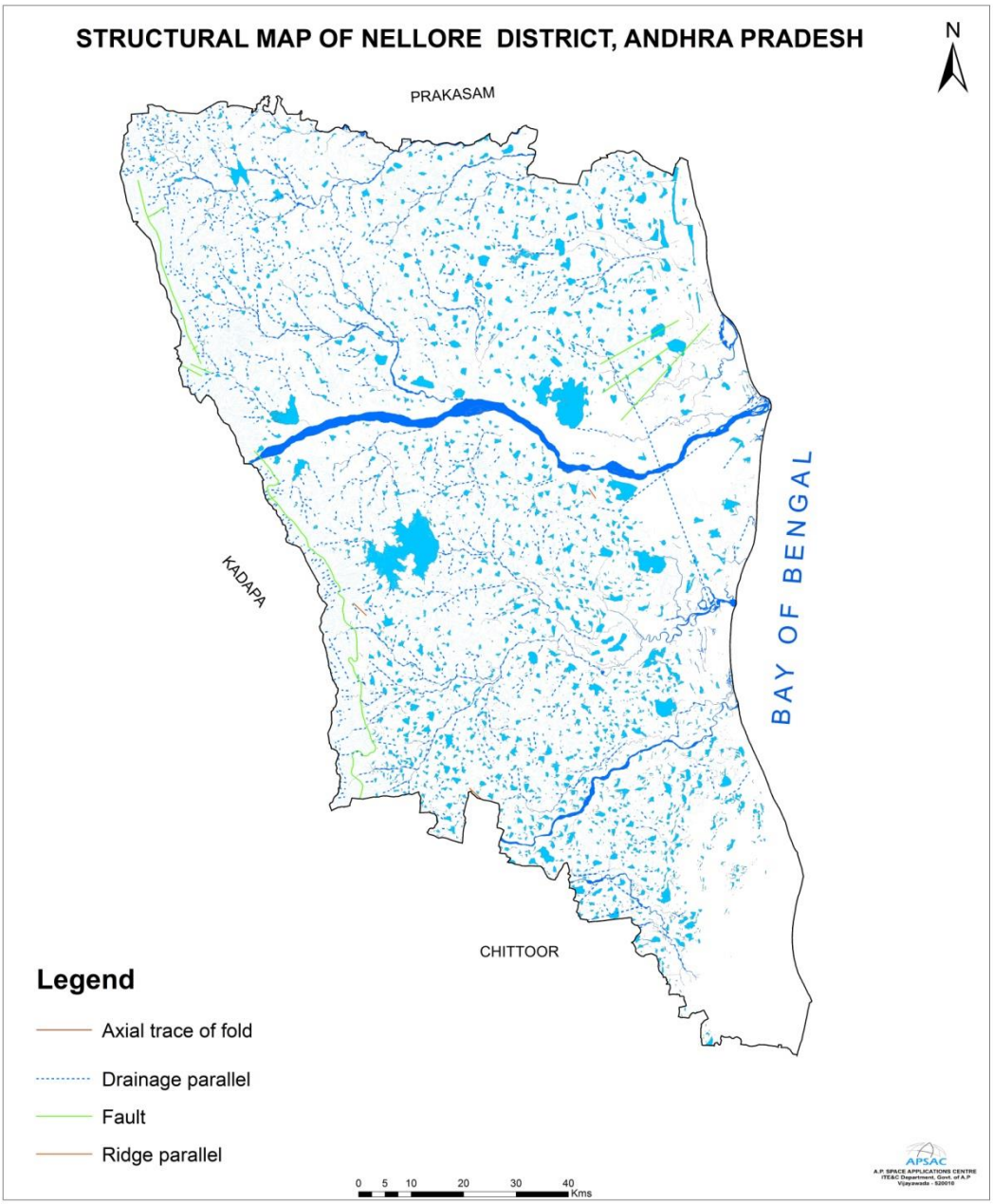


Fig.20 Structural Map of Nellore District, Andhra Pradesh

5.4 Ground Water Prospects in the Nellore District

Ground water occurs in almost all geological formations and its potential depends upon the nature of geological formations, geographical set up, incidence of rainfall, recharge and other hydrogeological characters of the aquifer. Among the consolidated formations gneisses are relatively good aquifers. Schistose formations also form potential aquifers when the wells tapping contact zones with intrusive. Quartzites and shales of Cuddapah group are of little significance from the ground water point of view as they are restricted to the hilly terrain in the western margin of the District. In the consolidated formations ground water occurs under unconfined to semi confined conditions. Ground water is developed in these formations by dug wells, dug cum bore wells and bore wells tapping weathered and fractured zones.

The yield of the dug wells is in the range of 15 to 35 m3/day and reduce considerably during peak summer periods. The occurrence of fractures in these formations is limited to 40 to 60 m bgl and occasionally extends down to 70 to 80 m bgl. The bore wells in these formations generally tap the weathered and fractured zones. The yields of the bore wells generally range between 80 and 350m^3/day. The higher yields are limited to the available thickness of fractured zones.

Among the semi-consolidated formations, laterites only form potential aquifers when their thickness is more than 8 m and without any overburden, whereas sandstones do not form potential aquifers, as these are very thin. In laterites ground water occurs under unconfined conditions. Ground water is developed in these formations by dug wells. The yield of these wells varies from < 1 to 2 m^3 / hr. Among the un-consolidated formations river alluvium i.e., in deltaic area form potential aquifers. In deltaic area ground water occurrence is controlled by landforms and also in this area a lot of heterogeneity in hydro geological conditions exist both spatially and vertically. In the lower Penner delta area fresh water is generally limited to a depth of 40 m, whereas in Swarnamukhi delta it is limited to 15 m. Most of the coastal alluvium aquifers are saline. Palaeo-channels are favourable locations for fresh water aquifers shown in fig. 21.

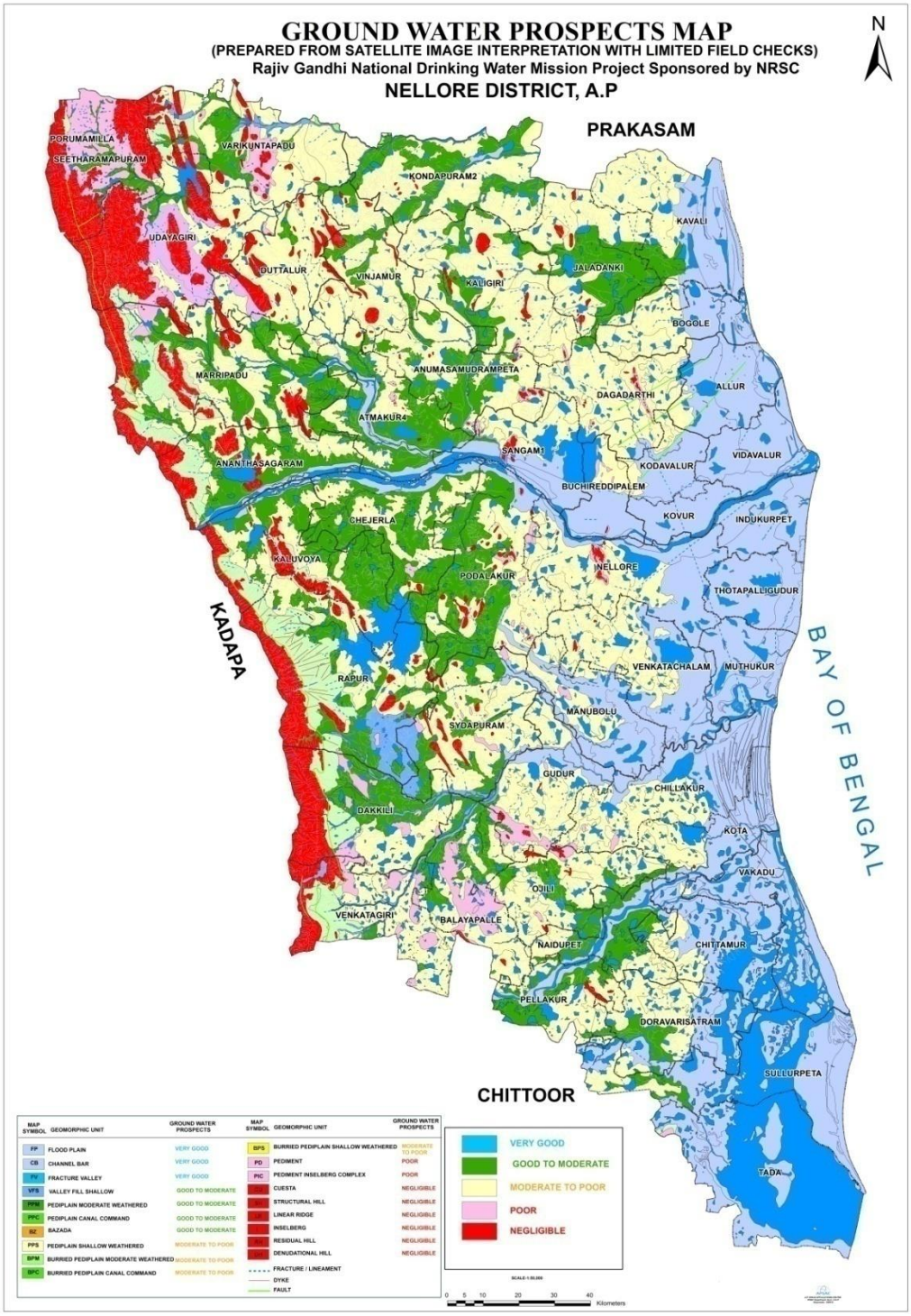


Fig.21 Ground Water Scenario in Nellore District, Andhra Pradesh

Wind-blown sand/ sand dunes are fresh water aquifers. Ground water occurs under phreatic to confined conditions and is developed through shallow dug wells, filter point wells and tube wells. The depth of dug wells ranges from 5 to 12 m, while the depth of filter point wells generally varies from 6 to 11 m. The yields generally range in this aquifer between 500 and 1000 m^3/day. Occasionally high yields also occur in the palaeochannels. The transmissivity value of the aquifers in the consolidated formations, semi-consolidated formations and unconsolidated formations generally vary from 15 to 75 m^2/day, 20 to 60 m2/day and 200 to 500 m2/day respectively,

whereas specific capacity ranges from 10 to 290 lpm/mdd, 140 to 270 lpm/mdd and 35 to 1000 m^3/day/mdd respectively.

5.5 Ground Water Level Scenario

The depth to water level during pre-monsoon season (May, 2012) in the District generally ranges between 2 and 5 m bgl. Water levels more Fig 22. Depth to Water Level Pre-Monsoon (MAY, 2012) has 5m bgl occurs in the north western and a small area in south eastern parts of the District i.e., in the parts of Sitarampuram,

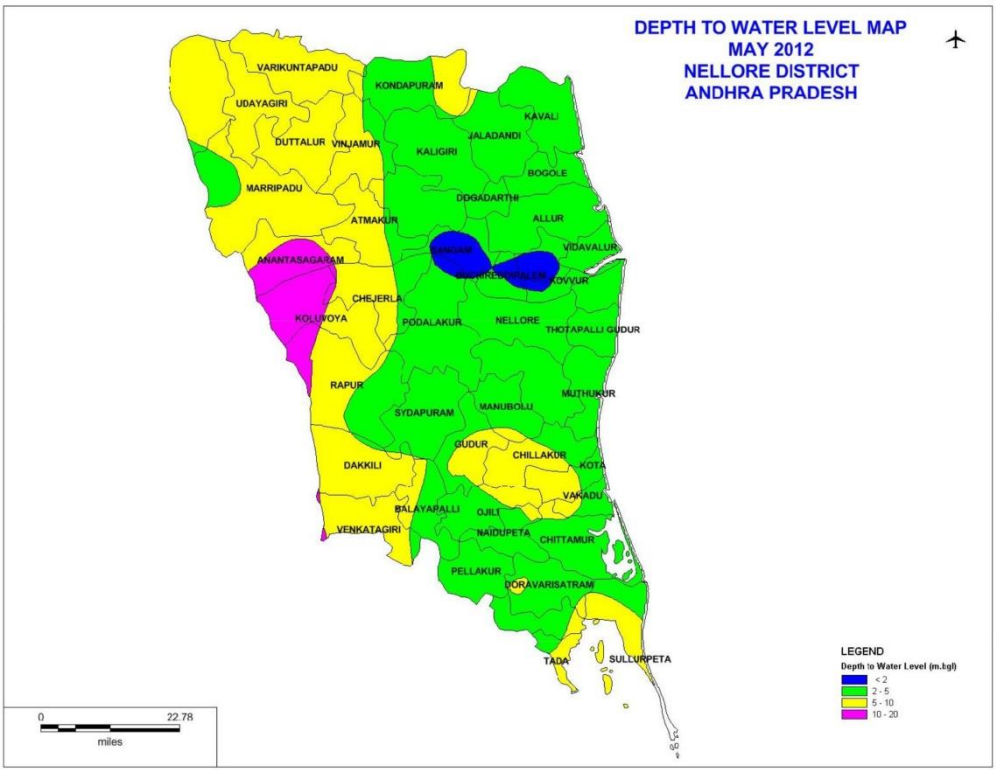


Fig. 22 Depth to Water Level Pre-Monsoon (May, 2012)

Varikuntapadu, Udayagiri, Duttalur, Marripadu, Ananthasagaram, Chillakur and Kota mandals. The shallow water levels i.e., < 2 m bgl occur in parts of Sangam, Buchireddipalem and Kovvur mandals. The depth to water level ranges between 5 and 10 m bgl in the north western area and a limited area in the west central part of the District during post monsoon season (Nov, 2012). The shallow water levels i.e., < 2 m bgl occur in the North eastern part of the area. In the rest of the District, the water levels range between 2 to 5 m bgl (Fig. 23).

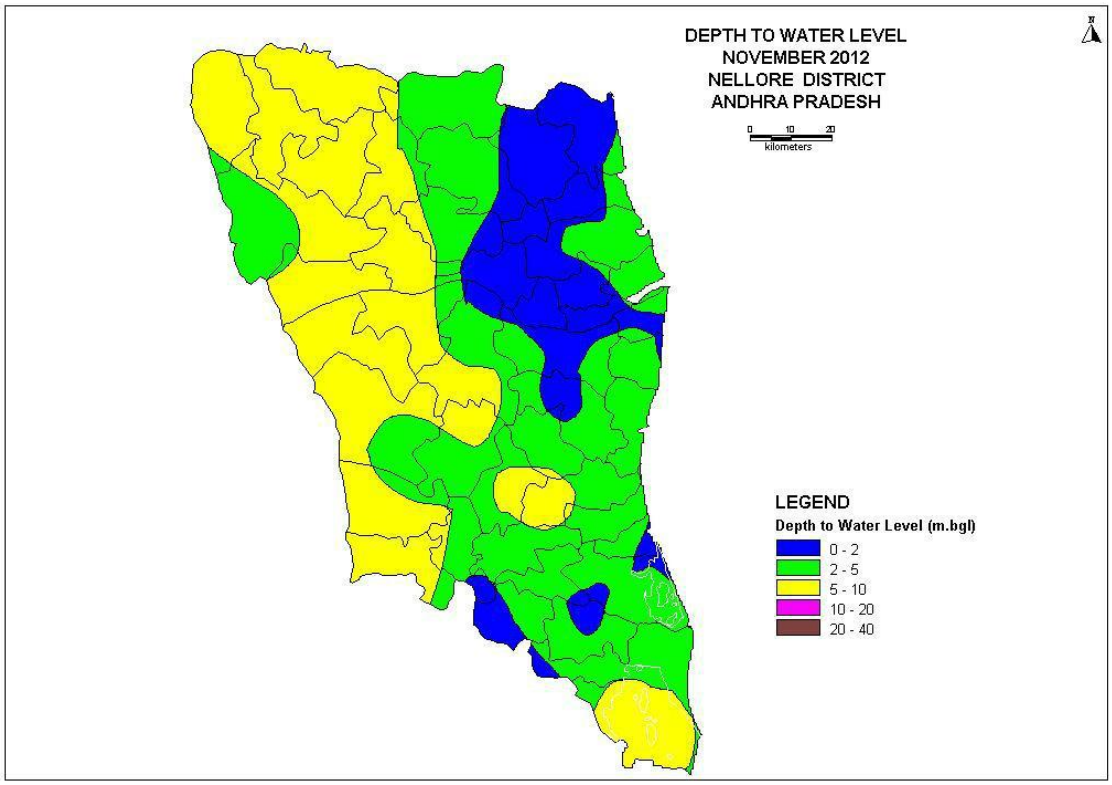


Fig 23 Depth to Water Level Post- Monsoon (Nov, 2012)

Ground water levels fluctuate considerably in response to the recharge and draft conditions of ground water reservoir. Overall rise in water levels from pre-monsoon to post-monsoon in the range of 0.03 to 3.52 m exist in the District, where as fall is in the range of 0.05 to 3.00 exist mainly in the western margin of the District i.e., in the parts of Udayagiri, Atmakuru, Dattaluru, Gudur, Manubolu, Rapur, Podalakur and Venkatagiri mandals. Long-term trend of water level (1997 to 2011) indicates that during pre-monsoon a raise in the range of 0.0123 to 0.1700 m/yr in Kondapuram, Dagadarthi, Podalakuru, Venkatachalam, Mathukuru and DV Satram areas, whereas in the majority of the District a fall in the range of 0.0062 to 0.3638 m/yr is observed. During post monsoon period both raise and fall are observed in the range of 0.0103 to 0.2940 m/yr and 0.0064 to 0.6192 m/yr, respectively. The water table elevation ranges between <10 m amsl in coastal areas and 166 m amsl in the northwestern part of the District (Udayagiri mandal). The water table contours are almost parallel to the topographic contours and the general ground water flow direction is towards east i.e., towards the sea.

5.6 Ground Water Resources

The ground water recharge worthy area in the District is 1253284 ha which is subdivided in to 377133 ha of command, 836503 ha of non-command area and the remaining 39647ha is Poor Ground Water Quality area. The ground water recharge due to rainfall in the command area is 312.19 MCM whereas the recharge due to other sources is 995.10 MCM with a total annual ground water resource of 1307.38 MCM. In the non-command area the recharge due to rainfall is 815.77 MCM and recharge due to other sources is 246.01 MCM with a total annual resource of

1061.78 MCM. Net annual ground water availability is 1183.48 MCM in the command and 972.16 MCM in non-command area with a total of 2155.64 MCM in the entire District.

The gross ground water draft for all uses in the command area is in the order of 301.63 MCM whereas it is 490.01MCM in non-command area and the total gross ground water draft for all uses in the District is 791.64 MCM. Out of this resource 61.96 MCM in Command area and 47.04 MCM in non-command area with the total of 109.00 MCM in the entire District are allocated to cater to the domestic and industrial needs of the population in the District as on 2025. Net ground water availability for future irrigation use is 846.22 MCM in the command, 463.25 MCM in non-command area and 1309.47 MCM in the entire District.

Table: 13 Ground water resource of future development

(in MCM)

	Command Area	Non - command Area	Total
Recharge from Rainfall	312.19	815.77	1128
Recharge from other sources	885.1	246.01	1241.2
Total Recharge	1307.38	1061.78	2369.2
Gross draft for all uses	301.63	490.01	791.64
Stage of Ground water Development	25%	50%	37%
Category	Safe	Safe	Safe
Allocation for future domestic & Industrial uses	61.96	47.04	109
Net ground water available for future irrigation uses	846,22	463.25	1309.5

Ground water resources for each mandal are presented in Table - 10 for the consideration of future development. The net availability of ground water in the District varies from 10.11 MCM in S.R.Puram mandal to 136.52 MCM in Vidavalur mandal. Whereas gross ground water draft for all uses varies from 4.93 MCM in Kodavalur Mandal to 45.65 MCM in Nellore Rural mandal. The stage of ground water development is as low as 9% in Alluru and Bogole mandals and as high as 72% in Pellakur Mandal. All 46 mandals in the District are categorized as ‘safe’.

5.7 Ground Water Quality of the District

The quality of ground water is as important as quantity. Ground water from shallow as well as deeper aquifers of consolidated formations of the District is generally good. In general ground water is suitable for domestic, industrial and irrigation purposes, except in Kondapuram and Kaluvoya areas, where EC values are more than permissible limit exist. In the alluvial formations, the quality of ground water is found to deteriorate from west to east i.e., towards coast. All along the coast, both shallow and deeper aquifers are saline. However, along the coast limited potable

ground water zones do exist at shallow levels but they may not sustain for heavy withdrawals. Away from the coast, fresh water in the aquifers is limited to shallow to moderate depths. Deeper aquifers are invariably saline. Quality of water in the palaeochannels is comparatively good. Overall the ground water from shallow aquifers is suitable for domestic and irrigation purposes, except in Kondapuram, DV Satram and Koluvoya areas in North, South and western part of the District, respectively where values of EC are more than permissible limit exist. Arsenic and Fluoride contents in the ground water of the District are within the permissible limits. Nitrate enrichment (more than permissible limit) is high at isolated places in the coastal and in Venkatagiri, Rapur, and Atmakur areas due to localised pollution. Ground water from these areas can be used for other than drinking purposes.

Ground water samples were collected from 2083 habitations out of 2825 habitations representing for two seasons i.e., post monsoon and pre monsoon in December 2012 and June 2014 for the entire District. The water samples were collected from Rural Water Supply and Sanitation Department (***RWS & S***) and analyzed for physical-chemical parameters like TDS, TH, Cl, NO3, pH, F, Fe, TA and SO4 using standard techniques in the laboratory and compared with the BIS (10500-2015) standards in terms of desirable, permissible and non potable classes shown in fig.24. Blue, yellow and red colours indicate pre monsoon quality and +, - , symbols indicate post monsoon quality for desirable, permissible and non-potable classes, respectively.

From the analysis, it has been observed that the ground water is polluted in pre monsoon and post monsoon. About 10% of the area is under non potable category due to high concentration of Nitrate and Total Hardness. About 80% of the area is in potable category and the remaining 10% of the area is covered in hills and water bodies of the entire District. The occurrence and movement of groundwater in an area are governed by several factors such as topography, lithology, and geological structure, depth of weathering, extent of factures, drainage pattern, and climate conditions and interrelationship between these factors.

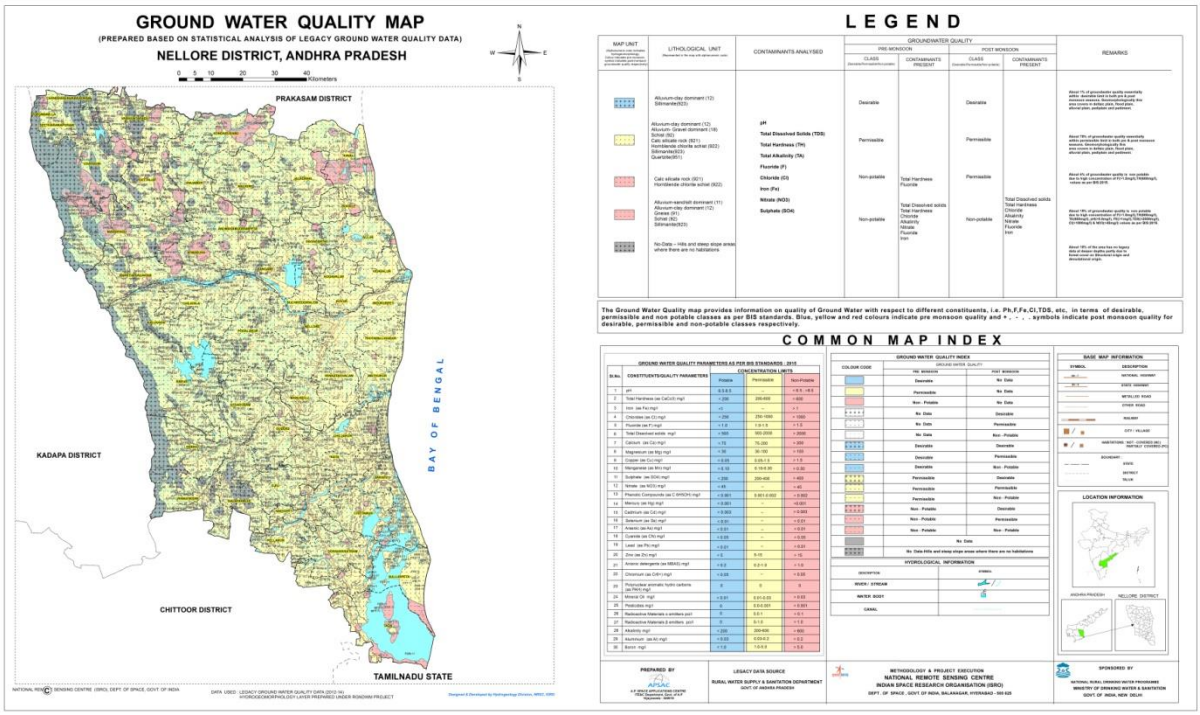


Fig. 24 Ground Water Quality Map of Nellore District

5.8 Status of Ground Water Development

The assessment of ground water resources in the District has brought to light the wide scope for utilising the ground water resources to boost the irrigation. Ground water is one of the most important and essential commodities for agricultural development, thus the judicious and scientific management of the resource is essential. It is, therefore, imperative that wells have to be designed and spaced properly for meeting the irrigation water requirements of the District. In the consolidated formations at present dug wells of 7 x 7 m to 10 x 10 m size with depths of 7 to 10 m exists. In these formations, ground water is also developed through dug cum bore wells as the dug wells are not getting sufficient yields. The depth of the in-wells in these structures ranges from 20 to 30 m. The depth of dug wells in laterites varies from 4 to 18 m and generally they are of rectangular shape whereas in the unconsolidated formations the dug wells with 6 to 8 m diameter are in the depth range of 6 to 9 m.

Ground water in the District is also developed through bore wells of 250 to 380 mm diameter, which are drilled down to 40 to 70 m depth in consolidated formations. Similarly filter point wells/tube wells in unconsolidated formations with 380 mm diameter are drilled down to depths of about 6 to 20 m. And, also filter point wells are driven down to a depth ranging between 5 and 8 m in the coastal alluvium wherever the potential zones are available.

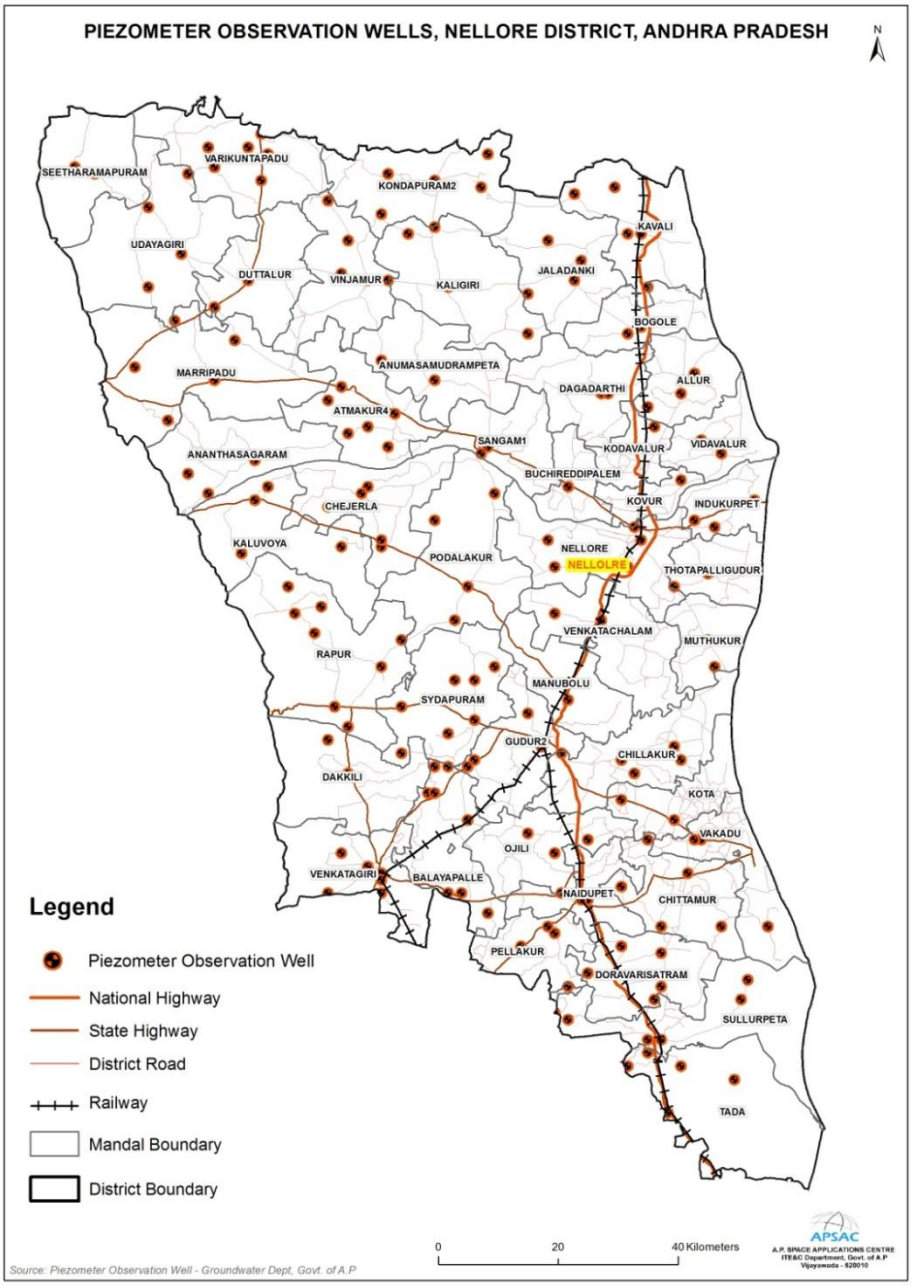


Fig: 25 Piezometer Observation wells in Nellore District

Ground water irrigation in the District is not extensive and it accounts only for 29% of the gross irrigation of the District. A total number of 35,239 dug wells and 30,416 bore/tube wells are functioning in the District. A total area of 938 Sq.km is irrigated through ground water, of which 127 Sq.kms with dug well sources and 811 Sq.km by bore/ tube wells.

Urban water supply to Nellore town is from both Penner River and ground water. The requirement for Kavali and Gudur towns is being met mostly by ground water. The rural water supply in the District is through both surface and ground water. A total number of 240 open wells, 16698 bore/tube wells and 2425 protected water schemes are meeting the drinking water requirements of the rural population shown in Fig. 25

5.9 Ground Water Development

The scope for further development of ground water in the district varies widely from place to place and from mandal to mandal. Hence, scientific and judicious development and management of available water resource will contribute to the overall planned development and is important of the economy of the District. There is a huge scope for further development of ground water resources which will bring more areas under irrigation in the District. Present irrigation is confined to 72% of the net sown area. Hence the rest of 28% area is devoid of irrigation facilities. Though surface water is abundant, its availability during summer season is very scarce due to swift nature of streams and rivers. The District is underlained by hard (consolidated) and soft (semi-consolidated & unconsolidated) formations, therefore DTH rigs and DR rigs respectively are most suitable for deployment. In the deltaic areas the ground water is supplementary source for irrigation requirements in few mandals. The ground water development in the coastal area is to be carried out judiciously by installing low capacity pumps as the fresh water zones are limited and also to minimise salinity problems. In order to monitor the advancement of fresh water/saline water interface towards inland in due course of time with rapid ground water development, it is necessary for construction of piezometers perpendicular to the coast line for monitoring the water level and chemical quality of the water. Based on the yield potential the aquifers of the hard (consolidated) formations of the District are classified as low (<3 lps), Low to Moderate (1 to 5 lps) and High (1 to 10 lps), and the soft (semi & Un consolidated) formations as Low (<3 lps), Moderate (2 to 10 lps) & High (5 to 15 lps) yield potential areas shown in Fig: 26

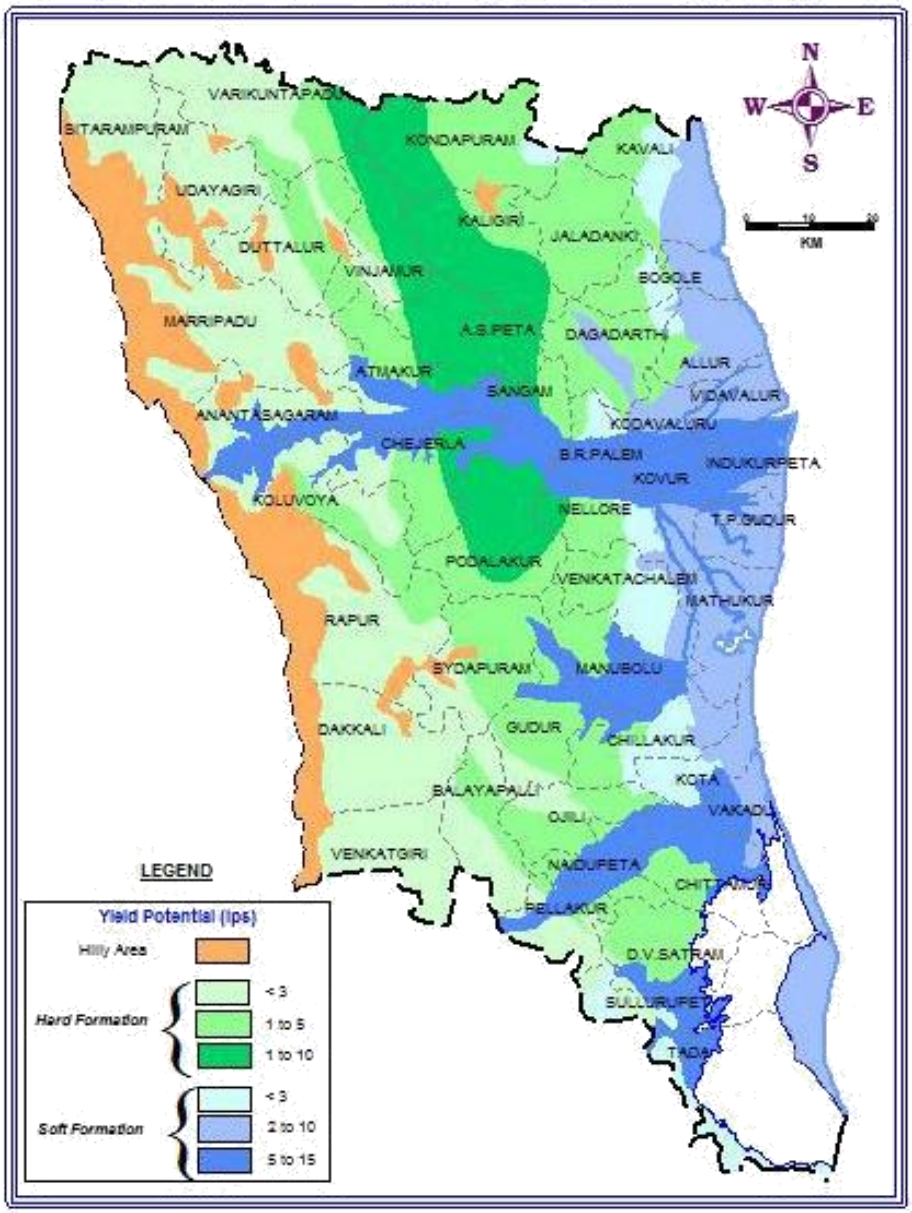


Fig: 26 Ground Water Yield Potential Map, Nellore District

6. Geology and Mineral Resources of Nellore District

6.1 Geology of Nellore District

The District is underlain by variety of geological formations comprising from the oldest Archaeans to Recent Alluvium. Hydrogeologically these formations are classified as consolidated (Hard), semi-consolidated (Soft) and unconsolidated (Soft) formations. The Consolidated formations include mainly migmatised high grade metamorphic (essentially garnetiferous amphibolitespelitic schist), low grade metamorphic (essentially amphibolites & pelitic schists) of Nellore schist belt, granitic gneiss and Cuddapahs (Quartzite & Shale) of Pre-Cambrian period. The schist and gneisses are intruded by granites, pegmatites and basic dykes. One of the high grade mica in the world is being mined around Gudur occurs in the pegmatites. Among these consolidated formations, schists (amphibolites and pelitic schists) and gneisses occupied the major area of the District, where as the quartzites and shales of Cuddapah group are restricted to the western margin of the District. The semi consolidated formations occur as discrete patches and are represented by Gondwana sandstones, Cuddalore sandstones and laterites of Triassic, Tertiary and Quaternary periods respectively. Gondwana sandstones occur as a small patch in the northern part of the District. Cuddalore sandstones and Laterites occur as isolated patches in the eastern margin of the District shown in fig: 27 and Fig. 28. The unconsolidated formations comprise of river alluvium, coastal alluvium and wind-blown sand deposits of Quaternary period. The river alluvium occurs all along the banks of major rivers and the deltaic areas formed by Penner and Swarnamukhi rivers. The Penner and Swarnamukhi deltas cover an area of 1470 Sq.km and 415 Sq.km, respectively. The thickness of alluvium increases from west to east, it ranges from few meters to 150 m and 60 m in Penner and Swarnamukhi delta areas respectively and is followed by sand stones. The coastal alluvium covers an area of 900 Sq.km lie along the coast. The wind-blown sand deposits occur as narrow dunes in the coastal areas and the thickness varies from 5m to 7m. These deposits extensively occur over Sriharikota Island. Prominent lineaments in the District are trending in NE-SW and NW-SE directions.

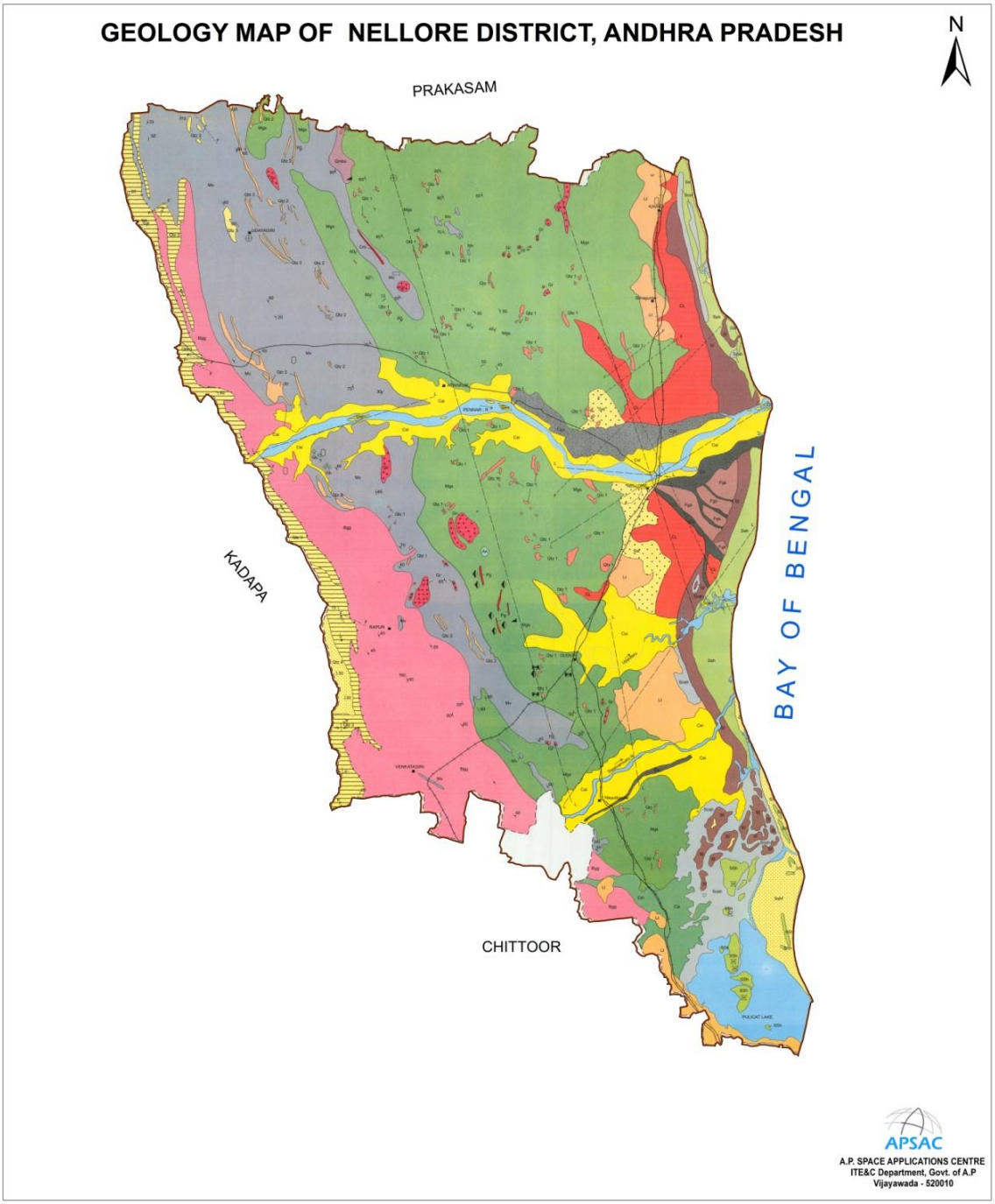


Fig.27 Geology of Nellore District, Andhra Pradesh

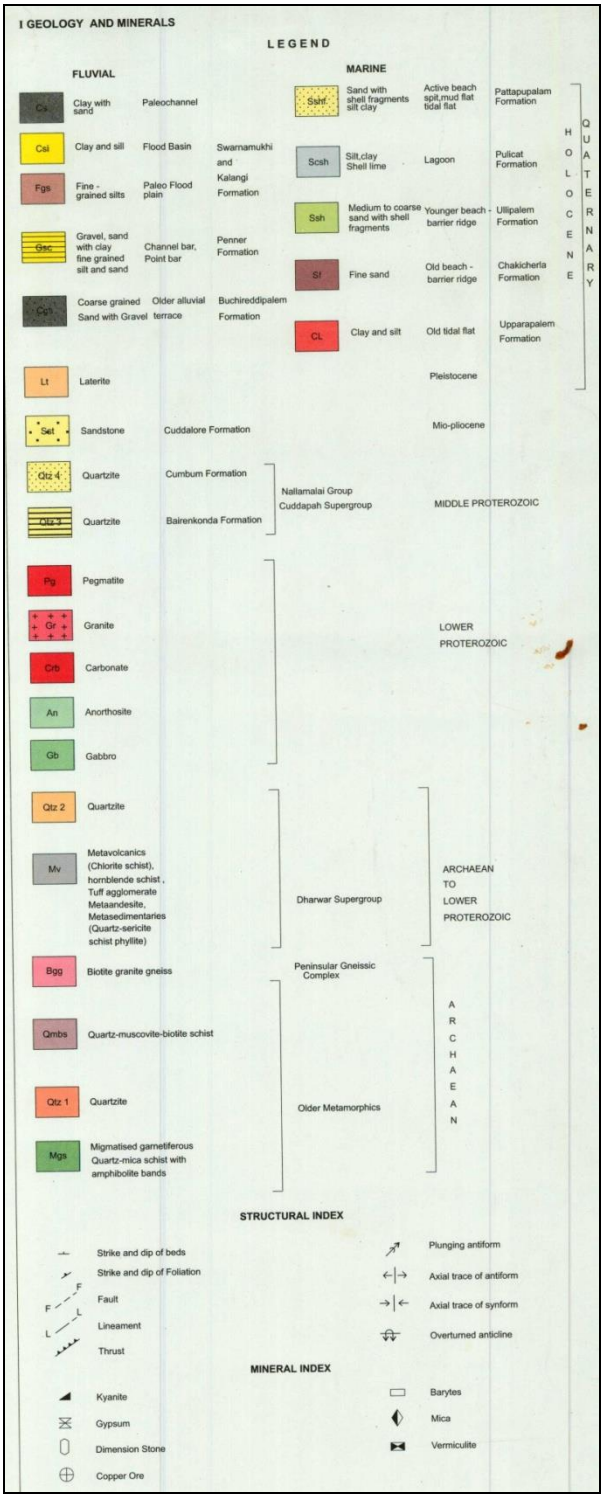


Fig.28 Detailed Legend with Stratigraphic Sequence of Nellore District

6.2 Mineral Resources of Nellore District

Silica sand: The silica sand is available in Kota mandal and Chilakur. The use of silica sand is that mineral silica sand is used in the foundries glass making refractory industries

Quartz: The quartz mineral is available in Sydapuram, Gudur, Podalakur, Atmakur, Duttalur, Chillakur, Marripadu, Chejrla, Seetharamapuram, Udayagiri, Varikuntapadu, Kaligiri, Kondapuram. The quartz containing 98% of Sio_2 is used in

glass making and Ferro alloys industries and also used for manufacture of integrated chips used in Electronics circuits.

Feldspar: The potassium and sodium feldspar available in these following mandals and is widely utilized in manufacturing of ceramic industries and sanitary wares. The feldspar mandals are Sydapuram, Gudur,Podalakur, Chillakur, Varikuntapadu,Kaligiri mandals.Used for Glassmaking, Ceramic and to some extent as a filler and Extenderin Paints< Plastic and Rubber.

Mica: Mica is available in following mandals, Sydapuram, Gudur and podalakur. The mica used in electrical industry and electronics industries. The die electric strength is 10,000 volts per one mm thick mica sheet. It can withstand high temperature and used in space vehicle. Most of the mica produced in India is exported

Vermiculite: The physical property of the mineral of expanding on heating and insulation against heat is used in the thermal stations. The vermiculite is available in Sydauram and Gudur mandal.

Iron ore: The mineral iron ore in this District is somewhat low grade and contains 45% of fe_20_3 is supplied to the steel and iron industries for manufacturing the steel. The iron ore is available in Pellakur mandal. It is Used for Automobiles, Locomotives, Ships, Building furniture, Paper Clips, Tools and Reinforcing rods for Concrete.

Laterite: The laterite mineral available in Kavali and Bogole mandals, these minerals is largely supplied to cement industries utilized as clastic material. Used for monument building.

Road Metal: The various rock formation available in the District i.e., Granite Gneiss, Schists, Dolerite, Gabbro, Quartzites, are used as road and building materials and is widely used in civil construction of building etc, the road metals are available in Jaladanki, Papur, Gudur, Dagadarthi, Sangam,Ananthasagaram, Vinjamoor, Duttalutru, Marripadu and Udayagiri mandals.

Gravel: The Gravel is available in Venkatachalam, Nellore Rural, Kota, Chillakur, manubolu and Bogole mandals. This mineral is used for laying road and for filling purpose.

Granite: The Granite is used as flooring, Electrical Industry and Decorative purpose and available in Vinjamoor mandal only.

Barytes: The barites are available in the District is of low grade and in terms of chemical composition $Baso_4$ and Specific gravity is embedded with impurities and with high content of silica and Iron. The barite is available in Vinjamoor mandal. The Barytes is used as Oil Industry, Paints, Petroleum well drilling mud and Pigments.

7. Details of Major and Minor Minerals Their Production

7.1 Mineral Resource of Nellore District

The main economic province of minerals is confined to the Nellore schist belt which is having the Dharwar schistose rocks that intrude by pegmatites / Quartz veins. NSB extends over 200 kms of length encompassing parts of Nellore District and Prakasam District. It has the general trend of NS extended Naidupet on the south to annaluru (Kaligiri mandal) in the north. It has the pegmatities veins having Mica, Quartz & feldspar mainly concentarion in Gudur, Sydapuram and Podalakur Mandals. At some places in this Schist belt use mineral vermiculite is also available.
The coastal Quaternary era beach sands are extended in the coastal mandal of kota and chillakur having width of about 15 kms and length of about 30 kms and mainly grated the lease of silica sand in this area. At some places, the barites deposits of qauaternary era are intruded as veins in Vinjamuru Manda.
Beside the above, The District possesses a considerable number of areas having the intruded rock formation of Granite Gneiss, Delerite dyke. These rock formations, which are used for road and building purpose, are spread at Gattupalli, Annavaram of Jaladanki MAndal, Puligilapadu of Rapur mandal , Kandra and Vendodu of Gudur Mandal.

The main economic province of minerals is confined to the Nellore Schist Belt (NSB) which is having the Dharwar Schistose rocks intruded by Pegmatites / Quartz veins. NSB extends over 200 Kms of length encompassing parts of SPSR Nellore District and Prakasam District. It has the general trend of NS extended Naidupet in South to Annaluru (Kaligiri Mandal) in the North. It has the Pegmatite veins having Mica, Quartz & Feldspar mainly concentrating in Gudur, Sydapuram and Podalakur Mandals. At some places in this Schist Belt, the mineral Vermiculite is also available.

The coastal Quaternary era beach sands are extended in the coastal Mandals of Kota Chillakur and Vakadu having the width of about 15 Kms and length of about 30 Kms and mainly the leases of Silica Sand are granted in this area.

Besides the above, the District has a considerable number of areas having the intruded rock formations of Granite Gneiss, Dolerite dykes. These rock formations, which are used for road and building purposes, are spread at Gattupalli, Annavaram of Jaladanki Mandal, Puligilapadu of Rapur Mandal, Kandra and Vendodu of Gudur Mandal. The important minerals occurring in the District and their details are as follows:

Silica Sand

The mineral Silica sand is prevalently occurring all along the coastal villages of Kota and Chillakur mandals of SPSR Nellore District. It is stretching to the length

of 35 Kms and at a width of 12 Kms covering in an extent of about 42000 Hectares. Most of the Silica sand bearing area was covered with Agriculture lands, habitations and Forest land. The vacant tract of barren land bearing with Sand dunes, which is undulated and is not suitable for agricultural purpose, has been allotted for Silica Sand Mines. At present, 80 leases are in force out of which 16 leases are nonworking. The leases are covering an extent of 1263.955 Hectares. Out of this, 1130.562 Hectares are Government land and the remaining 133.393 is Patta Land.

The occurrence of Silica Sand in this region is unique which was deposited by marine transgression during Eocene period in coastal villages of Chillakur and Kota mandals of SPSR Nellore District. The mineral Silica Sand is catering to industrial needs of the country as it is unique in its quality and grain size. Most of the Silica Sand is being dispatched to Kerala, TamilNadu, Karnataka and Maharashtra and within the State also. As such, the Silica Sand is a major constituent in the manufacture of glass industry and utilized in bulk quantities by M/s Saint Gobain, M/s Mangalore minerals and M/s Hindustan National Glass Industry. Silica sand is being utilized in foundries as mouldings and for castings etc.

Further as far as the Mineral Revenue and dispatch for this financial year is concerned, about 3084994 MTs of Silica Sand gets dispatched. As such, Silica Sand is one of the major contributors in terms of Revenue to the District.

Mica

Mica is a rare mineral available in Gudur region alone comprising Gudur, Sydapuram and Podalakur Mandals in the SPSR Nellore District. It is a well known fact that Andhra Pradesh, Rajasthan, Bihar and Jharkhand are the only Mica producing States in the country. Prior to the Second World War, India was far the largest supplier of high grade sheet Mica. As far as AP is concerned, Gudur area in the SPSR Nellore District (comprising Gudur, Sydapuram and Podalakur Mandals) is only the producer of this mineral, thus the Gudur area falls within the Mica bearing pegmatite zone with its associated minerals i.e., Quartz and Feldspar. The Mica mining industry in the District has more than a Century old history and the local workers have become so proficient in trimming, grading and packing Mica that the Indian Mica is considered the best prepared in the world.

Geologically, the Mica occurring belt in the District is named as Nellore Schist Belt in which the earlier rocks are Schists of Kandra Volanics into which Granites and Pegmatites have intruded resulting in formation of Mica books with varying sizes and two main varieties such as green and ruby mica are prominent, muscovite variety is also occurring in the District. Further as per the IBM study report, 0.22 MTs of total resources are said to be in the Nellore District alone.

Mica is having a peculiar property as it can be easily and accurately split into very thin sheets or films of any specified thickness due to perfect basal cleavage. It has the unique combination of elasticity, toughness, flexibility and transparency and possesses resistance to heat and sudden change in temperature and high dielectric

strength. Mica is chemically inert and stable and does not absorb water. Owing to its high insulating property, it finds multiple industrial applications in Electrical and other industries. Sheet Mica is mainly used in electrical and micanite industries while scrap mica is used in the manufacture of mica paper and ground mica, which, in turn, is used in asphaltic roofing, welding electrodes, paints, rubber, cosmetics, insulation bricks etc.,

Further, as far as the Mineral Revenue and dispatch for the financial year 2017-18 is concerned, about 17532 MTs of Mica got dispatched.

Quartz

The Quartz mineral is mainly available in Sydapuram, Gudur, Podalakur, Atmakur, Duttalur, Chillakur, Marripadu, Chejarla, Seetharampuram, Udayagiri, Varikuntapadu, Kaligiri, Kondapuram mandals of SPSR Nellore District. The Quartz is an associated mineral of Mica. Both Quartz and Feldspar are the by-products of Mica mining. Prior to 1980, Quartz and Feldspar were considered very low value minerals and hence were not given much importance by the Mica Entrepreneurs then, and therefore thrown as waste in Mica mining. However with the rapid industrialization, the market for Quartz and Feldspar also picked up due to their usage in various fields. The composition of Quartz is Silicon Dioxide (SiO_2) with varied percentage. Depending on the percentage of SiO_2, it is classified into 3 categories i.e., A-Grade, B-Grade and C-Grade.

The lustre of this mineral is transparent, glassy, semi glassy, granular, semi granular. The mineral comprising maximum silicate up to 99.80% is of glassy and granular variety, and multiple applications are found in the industry. Electronics and electrical industries are the major consumers of this mineral because of its specific characteristic properties and can act as insulator also. The quartz is the principal raw material for various industrial units such as ceramics, glass and ferroalloy industry and a powerful deoxidizing agent. Its major applications are in electrical steel used for transformers and dynamos, alloy steel for tools and automobile valves in iron casting and mineral dressing. Electro-conductivity is one of other important properties of the Quartz mineral. The low EC value Quartz is having high demand in the market which is widely used in manufacturing semi-conductors. Few quantities of this type of quartz were produced last year from Sydapuram area by M/s Chettinad Morimura Company of Japan who is a giant manufacturer of semi-conductors.

Further as far as the Mineral Revenue and dispatch for this financial year 2017-18 is concerned, about 114250 MTs of Quartz got dispatched.

Feldspar

The Feldspar mineral is mainly available in Sydapuram, Gudur, Podalakur, Chillakur, Varikuntapadu, Kaligiri & Kondapuram of SPSR Nellore District. Feldspar is also an associated mineral of Mica. It can be extracted like other by-products of Mica mining. It is used in ceramic tiles and in the manufacture of fire bricks for heat resistance in thermal power plants, furnaces, foundries etc., Further due to rapid

depletion of Granite and Marble in the country, many of the entrepreneurs planned to utilize the ceramic tiles as both ornamental and flooring purposes in beautiful colours and comfortable sizes where the Feldspar mineral is playing a prominent role in manufacturing of vitrified ceramic tiles and constitutes 70% mass in the production of tiles. Hence, there is a shoot up in the production of the mineral Feldspar in the recent times. There are mainly two types of Feldspar mineral occurring in the District as Potassium Feldspar and Sodium Feldspar. As far as the Mineral Revenue and dispatch for the financial year 2017-18 is concerned, about 221095 MTs of Feldspar got dispatched.

Laterite

The Laterite mineral is mainly available in Kavali, Bogole mandal and parts of Kota mandal of SPSR Nellore District. The Laterite occurs as thin capping over ferruginous sand stone. The Laterite occurred in these mandals is formed from gneisses and it has a chemical composition from Aluminium and silicate. The Laterite is soil and rock type in which iron and Aluminium are commonly considered to have formed in hot and wet tropical areas. Nearly all the Laterites of rusty-red coloration occur because of high iron oxide content.

The mineralogical and chemical compositions of Laterites are depending on their parent rock. Its main applications are used in Cement industries. There are four (4) working Leases for Laterite in the District.

Further as far as the Mineral Revenue and dispatch for this financial year 2017-18 is concerned, about 1050 MTs of Laterite got dispatched.

Vermiculite

The Vermiculite mineral is mainly available in Gudur, Sydapuram & Podalakur Mandals of SPSR Nellore District. It occurs in the form of lenses and veins of about 10 to 20 cms width in gneisses. The Vermiculite is the mineral having Magnesium, Iron, and Aluminium Silicate with water (H_2O) component. Vermiculite naturally occurs and contains stone, earth material and plant traces of roots & shoots. The mineral Vermiculite occurring in the District is black to brown and yellow in colours and is consisting of exfoliation property. Hence, it is useful as insulator for heat and widely utilized as moisture retaining material in nurseries and also used in thermal power stations and break plates in order to reduce the heat and lining in Kilns and light weight tiles.

There are seven Mining Leases are in jurisdiction of this District and as far as the Mineral Revenue and dispatch for this financial year 2017-18 is concerned, about 6645 MTs of Vermiculite got dispatched.

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