

# Comprehensive Status Report On Drinking Water Quality In Nagercoil, Kanyakumari District, Tamilnadu

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**Abstract** - The main focus of the paper is to prepare a comprehensive status report on drinking water quality of Nagercoil municipal Area. For this purpose, a total of 58 samples were collected from the locality, which comprises of 16 pond water samples, 18 bore water samples and 24 treated water samples. These samples were tested for 16 parameters such as pH, Hardness, Alkalinity, Chloride, TDS, Turbidity, Electrical Conductivity, BOD, COD, Fluoride, Phosphate, Nitrite, Nitrate, Residual Chlorine, Ammonia And Coliforms. Out of these 16 parameters, 11 parameters were used to find out the water quality index. Correlations between the parameters were established using the values obtained by testing. The water quality index of the study area is used for preparing the spatial variation map. From the obtained water quality index it is found that 24.13% of the water samples were excellent, 41.37% of the water were good, 13.79% water is poor, 13.79% water is very poor and 6.89% of water sample is unsuitable for drinking. the water samples were contaminated by pollutants in the order of  $ec > nitrite > phosphate > bod > cod > coliforms > turbidity > ammonia > tds > hardness > alkalinity > ph > chloride > nitrate > fluoride > Rc$ . A certain degree of treatment should given to the water before drinking

**Key Words:** water quality index, spatial variation map, correlation, pond water, bore water, municipal supply water

## 1.INTRODUCTION

Water is the elixir of life and livelihood. Though water is renewable, it is a finite resource. Owing to high population explosion, industrial use, agricultural and house hold usage, water has become the world's most exploitable natural resource. The United Nations in 2010 recognized access to safe affordable water and sanitation as a human right. Yet the practicality and reality remains stark<sup>[1]</sup>. Access to safe water has become a dream nowadays. Poor water quality has become a menace and threat to good health. Out of the total water resources available on the earth, only 2.5% to 3% remains as fresh water, but all the fresh water available cannot be put into use because some are trapped in glaciers, ice caps and permanent snow. Only a little more than 1.2% of all fresh water is surface water which serves most of life's need. It is very important to address the issues of over population, climate change, anthropogenic activities, which consequently lead to deterioration of available fresh water quality and hence distort the global hydrological cycle. Most

polluted fresh water ends up in oceans, damaging coastal ecosystem and fisheries. Thus water quality has become a global issue. In order to focus on effective solution to this global problem, it is mandatory to analyze the water and know the present level of contamination. This paper mainly targets on testing the water quality of fresh water available in Nagercoil area and presenting a comprehensive status report on the characteristics of the same.

## 2. STUDY AREA

Nagercoil is a lush green town located at the southern tip of Tamil Nadu. The town is enclosed by Tirunelveli on its north and east, Kerala to its west and northwest, and the rest by coasts. It is the administrative capital of the district Kanyakumari. The total area of this special grade municipality is 49.371sq.km with elevation of 40m. The total wards in the municipality numbers to 52. The town looks as though it is cradled by hands of the Western Ghats with mesmerizing green cover all around. The enchanting scenic beauty of the place could be attributed to its natural geographical location. The town receives rainfall from both south west monsoon as well as the retreating monsoon. On an average of 79 days in a year, it receives rainfall with varying intensity. According to census 2011, Nagercoil has a population of 224,849 with a sex-ratio of 1,050 females for every 1,000 males, which is much above the national average of 929. The population density of the town is 9,813 per sq.km.

The main supply of water for Nagercoil municipality is taken from the Mukkadal dam, which is located at a distance of 10 km from the main town. Raw water from the reservoir is drawn by gravity and conveyed through pipe lines to the water treatment plant. Due to the increase in population and increase in demand for water of town, water has been taken from two more dams namely Pechiparai dam and Perunchani dam, which is the main source for irrigation. There are three water treatment plants located in Nagercoil with the capacity of 6 MLD, 7MLD and 17MLd. The study area map is shown in the Fig -1

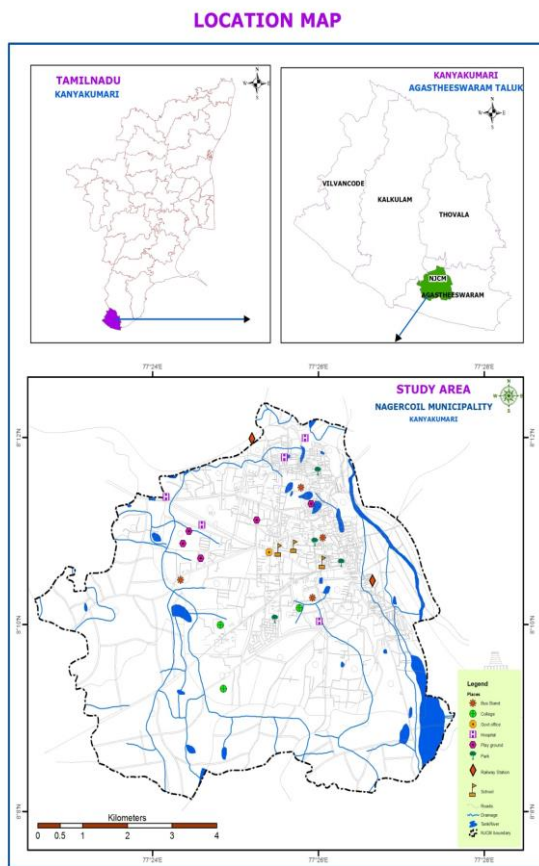


Fig -1: Study Area Map

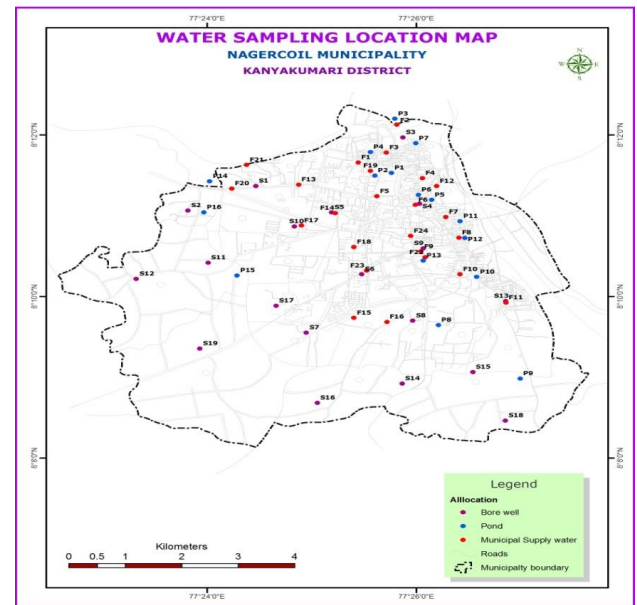


Fig -2: Sampling Locations

### 3. METHODOLOGY

A total of 18 ground water samples , 25 treated water samples and 16 pond water samples were collected from the Nagercoil municipal area. These samples were tested for 16 parameters such as pH, hardness, alkalinity, chloride, TDS, E.C, BOD, COD, fluoride, phosphate, nitrate, nitrite, residual chlorine, turbidity, ammonia and fecal coliform count. The sampling is done as per the Indian standard (IS:3025 method of sampling and testing), and the collected samples were tested within 24 hours. The bacterial test is done as per the Indian Standard, IS:1622-1981.

The results obtained during the analysis are used for establishing a correlation between the parameters, finding the water quality index and for the preparation of spatial variation map for clear understanding.

#### 3.1 SAMPLING LOCATION

The location of all the sampling points is plotted in the map and is shown in the Fig -2

### 4. WATER QUALITY INDEX (WQI)

The water quality index is a statistical method to find out the quality of water by using the tested parameters such as pH, Hardness, alkalinity, chloride, TDS, fluoride, nitrate, residual chlorine, ammonia. Based on the water quality index value, the water is classified into five types as shown in the table-1

Table -1 Standards For Water Quality Index

Water quality index value	Water quality
<50	Excellent
50-100	Good water
100-200	Poor water
200-300	Very poor water
>300	Water unsuitable for drinking

The formula for calculating the water quality index

$$WQI = \sum_{i=1}^n S_i \quad \dots\dots\dots(1)$$

S<sub>i</sub>- sub index of each parameter and it is calculated as follows

$$S_i = Q_i \cdot W_i \quad \dots\dots\dots(2).$$

Q<sub>i</sub> - quality index of each parameter

W<sub>i</sub>- relative weightage of each parameter

Quality index is found out using the following formula

$$Q_i = T_v / S_v \quad \dots\dots\dots(3)$$

T<sub>v</sub> - tested value of each parameter

S<sub>v</sub> - standard value of each parameter as per IS: 10500

The relative weightage is calculated by using the assumed weight for each parameter based on the importance. Higher weightage is assigned for the parameters nitrate and ammonia, lower weightage is assigned for hardness,

alkalinity and residual chlorine and the relative weightage is calculated using the formula

$$W_i = w_i / \sum w_i \dots\dots\dots(4)$$

The relative weightage of the parameters are shown in the Table-2

**Table -2** Relative Weightage Calculation

S.No	Parameter	Indian Standards	Weight (wi)	Relative Weightage
1	pH	6.5-8.5	4	0.10526
2	Hardness	200	2	0.05263
3	Alkalinity	200	2	0.05263
4	Chloride	250	3	0.07894
5	TDS	500	4	0.10526
6	Turbidity	1	3	0.07894
7	Fluoride	1	4	0.10526
8	Nitrate	45	5	0.13157
9	Iron	0.3	4	0.10526
10	Ammonia	0.5	5	0.13157
11	Residual chlorine	0.2	2	0.05263
			$\sum w_i = 38$	

## 5. RESULTS AND DISCUSSION

Samples of ground water, treated supply water, pond water were collected, tested for contaminants and compared with Indian standards to find its compliance percentage. The compliance percentage of ground water, treated water, pond water and the overall percentage compliance are tabulated as shown in the Table -3

**Table -3** Percentage Compliance With Indian Standards

Parameter	Indian standard (IS:10500)	Percentage compliance in bore water	Percentage compliance in treated supply water	Percentage compliance in pond water	Overall compliance
pH	6.5 - 8.5	66.7	100	100	89.84
Hardness	200	72.3	100	81.25	86.45
Alkalinity	200	100	100	56.25	88.14
Chloride	250	72.3	100	100	91.53
TDS	500	61.2	100	56.25	76.28
Turbidity	1	100	45.84	0	49.16
E.C	-	0	0	0	0
BOD	-	22.3	27.8	0	25.5
COD	-	33.4	62.5	0	35.6
Fluoride	1	88.9	100	100	96.62

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Phosphate	-	16.7	37.5	0	22.1
Nitrite	-	0	37.5	0	18.7
Nitrate	45	88.9	100	81.25	91.53
R.C	0.2	100	95.84	100	98.31
Ammonia	0.5	83.4	100	25	74.58
Coliform	0	22.3	100	0	47.46

### 5.1 WATER QUALITY INDEX (PERCENTAGE)

On comparing the water quality index value and the index classification the percentage of various water qualities has been calculated for all the three sources and has been represented in the tabular in the table - 4 and the overall quality has been represented in chart -1

### 5.2 SPATIAL VARIATION MAPS

With the obtained water quality index values with respect to the area of sampling. The spatial variation of the water quality has been represented in the form of a map. Mapping has been done by using ARCGIS software. Three maps (Fig -3, Fig -4, Fig -5) have been plotted for water quality index of three sources (bore water, municipal supply water, pond water) and the overall water quality of the study area is shown in the Fig -6

**Table - 4** percentage of various water quality in different sources with respect to the index value classification

WATER QUALITY INDEX	BORE WATER (%)	POND WATER (%)	TREATED WATER (%)	OVERALL WATER (%)
<50 <b>EXCELLENT WATER</b>	16.66	0	45.83	24.137
50-100 <b>GOOD WATER</b>	66.66	0	50	41.379
100-200 <b>POOR WATER</b>	11.11	31.25	4.16	13.793
200-300 <b>VERY POOR WATER</b>	5.55	43.75	0	13.793
>300 <b>WATER UNSUITABLE FOR DRINKING</b>	0	25	0	6.896

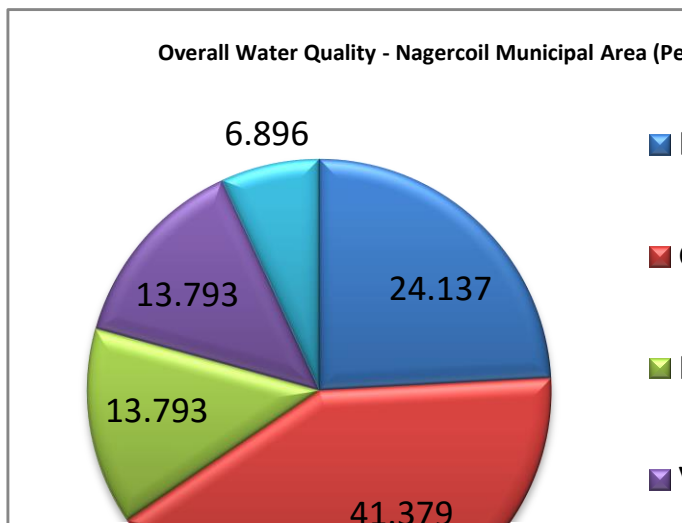


Chart - 1 Overall Water Quality Index

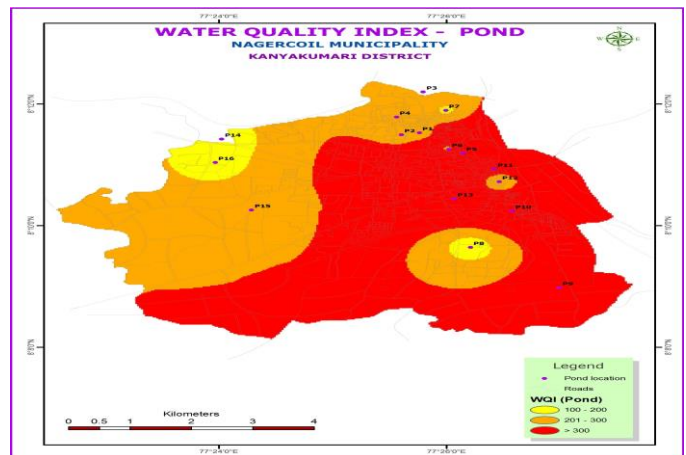


Fig -5: Spatial Variation map-pond Water Nagercoil Municipality

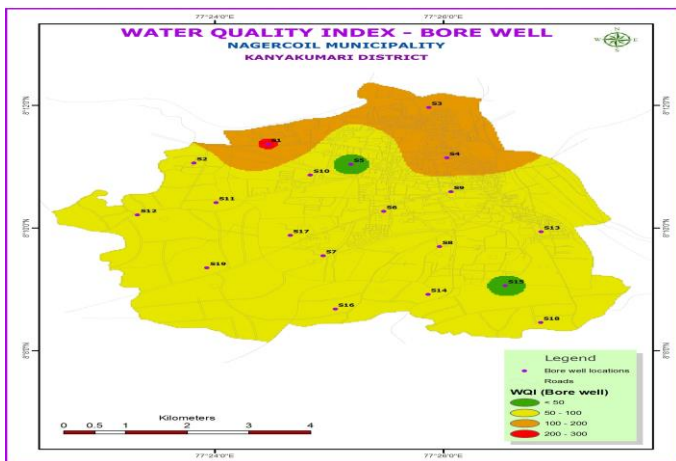


Fig -3: Spatial Variation map-Bore Water Nagercoil Municipality

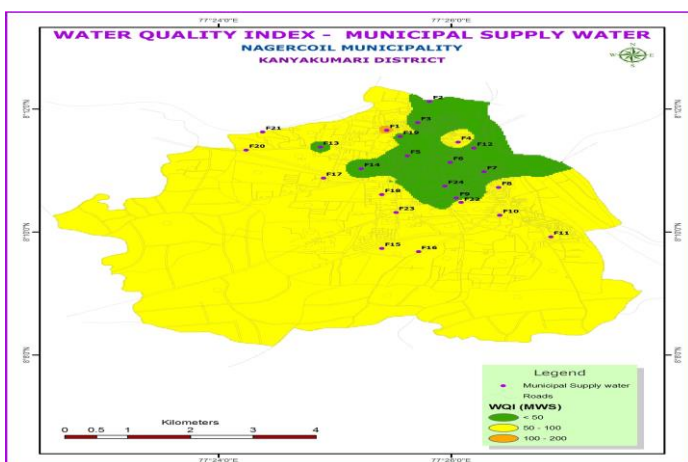


Fig -4: Spatial Variation map-municipal supply water, Nagercoil Municipality

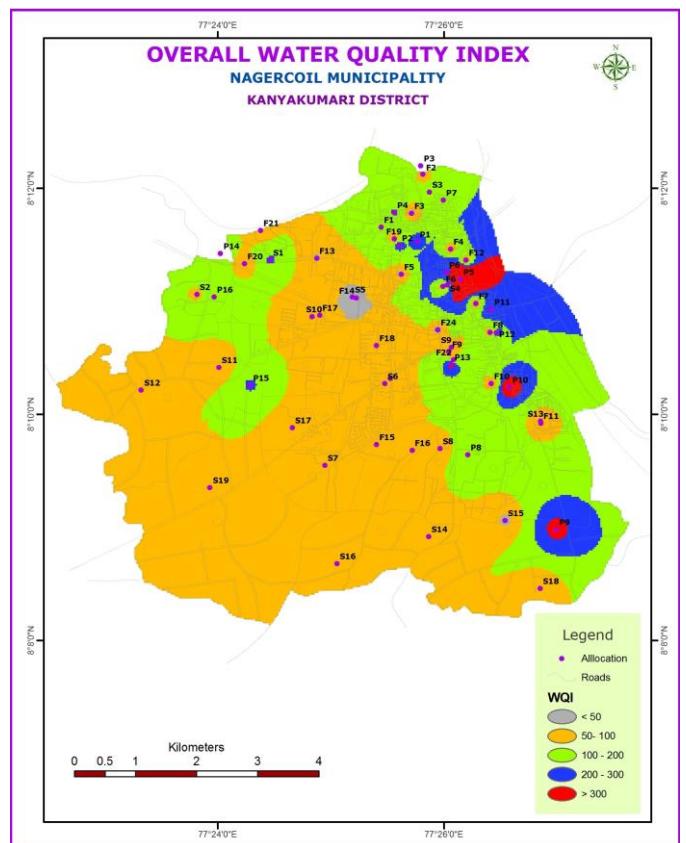


Fig -6: Spatial Variation map-overall Water quality Nagercoil Municipality

### 5.3 CORRELATION

The correlation matrix has been plotted for all the parameter using ms-excel, correlation draws a relation between the datas of the parameter. the correlation between each parameter is shown in the Fig -7



	Ph	Hardness	Alkalinity	Chloride	Tds	Turbidity	E.C	BOD	COD	Fluoride	phosphate	nitrite	nitrate	R.C	Ammonia	bacteria
Ph	1															
Hardness	-0.19574	1														
Alkalinity	0.393262	0.416374	1													
Chloride	-0.28353	0.903231	0.255932	1												
Tds	-0.07626	0.84801	0.572965	0.872894	1											
Turbidity	0.26883	0.135368	0.624594	0.051101	0.259526	1										
E.C	-0.06253	0.839158	0.601455	0.858108	0.997305	0.280266	1									
BOD	0.415234	0.262902	0.778688	0.094762	0.337612	0.567025	0.353075	1								
COD	0.395486	0.264964	0.77086	0.097762	0.337577	0.563704	0.354442	0.996248	1							
Fluoride	-0.03875	0.029823	-0.10152	0.028237	-0.009665	0.017853	-0.01529	0.030747	0.036797	1						
phosphate	0.16014	0.110351	0.352431	0.190363	0.348457	0.185231	0.35170	0.323574	0.338267	0.07352	1					
nitrite	0.130433	0.26019	0.606655	0.240308	0.488104	0.393567	0.51263	0.425277	0.432178	0.128054	0.508391	1				
nitrate	-0.00278	0.255174	0.390343	0.327759	0.407278	0.354794	0.426204	0.396615	0.412923	-0.07995	0.306912	0.240986	1			
R.C	-0.05109	-0.27385	-0.25238	-0.27919	-0.30492	-0.13354	-0.30982	-0.23033	-0.23661	-0.01515	-0.20453	-0.20489	-0.24457	1		
Ammonia	-0.10293	0.454806	0.346049	0.285262	0.383418	0.300045	0.387923	0.265764	0.26636	0.195138	0.01127	0.258555	0.048887	-0.17097	1	
bacteria	0.300557	0.245466	0.668199	0.157303	0.359413	0.464514	0.383375	0.685038	0.692542	0.078108	0.481421	0.457088	0.273651	0.33724	0.348839	1

Fig -7: correlation between the parameters

## 6. CONCLUSIONS

From the obtained results of the work done to find out the drinking water quality of nagercoil, it is inferred that the best source of drinking water is treated supply water, pond water has the highest contamination among the three sources. Thus suitable treatment should be given to the water from all the three sources before drinking

## ACKNOWLEDGEMENT

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