

STUDY ON THE TREND ANALYSIS AND WATER QUALITY STATUS DURING 2001-2011 DECADES ON THE NARMADA BASIN

Rajni Kant Sharma

Dr. Rajnikant Sharma, Assistant Research Officer, Narmada Division, Central Water Commission, Bhopal 462011 (MP). Phone 0755-2573630, Fax 0755-2550253, Mob. 9770133044, e-mail rksharma_1976@rediffmail.com. (Paper presenting author)

P Rajan

P. Rajan, Senior Research Assistant, Narmada Division, Central Water Commission, Bhopal 462011 (MP).

Central Water Commission, Bhopal 462011 India

ABSTRACT

Increasingly complex water management decisions require water quality monitoring programs that provide data for various purposes, including trend analyses, to determine the status of water quality. Study on surface water quality trends helps water resource managers in identifying emerging water quality concerns, planning and remediation efforts, and evaluating the effectiveness due to the remediation. The river Narmada is the fifth largest river in the Indian subcontinent and is considered to be the lifeline of the state. Basic water quality parameters like EC, pH, Calcium, Chloride, Carbonate, Fluoride, Nitrate and Phosphate were selected for the purpose of the study. Most of the parameters are in rising trend at all the water quality stations of Narmada and its tributaries while uniform trend of Carbonate, Nitrate and EC indicate lesser contamination of the river. Two parameters viz. pH and Ca show falling trends in the river Narmada. The concentration of many water quality parameters in the Narmada are within the prescribed limits although the trend for these parameters so observed is rising. The average concentrations of the parameters have increased like Phosphate from 0.048 to 0.131 mg/L, Fluoride from 0.18 to 0.51 mg/L, Chloride from 6.95 to 11.21 mg/L and Nitrate from 0.35 to 1.1 mg/L during the period under study. This study on the historical data of Narmada Basin helps to understand the extent of contamination and its impact on ecology of the river. Water quality status of the river Narmada vis-à-vis the classification of water for various designated uses by Bureau of Indian Standards (IS 2296-1982) is also reported in the paper.

1 INTRODUCTION

A watershed is valuable resource for any country. Adequate knowledge of these watersheds is necessary for a rational formulation of water management policies. Central Water Commission initiated a series of integrated river basin studies and measurement of physico-chemical parameters of surface water to understand the water quality of large watersheds like the Narmada river basin as part of the same series.

River Narmada is the seventh largest river among the fourteen major river basins of the country. It is an interstate river having total length of 1312 km, of which 1079 km flows in Madhya Pradesh, 35 km flows along the common border of Madhya Pradesh and Maharashtra, 39 km flows along the border of Maharashtra, and Gujarat and 159 km flows in Gujarat. The total basin area is approximately 98796 sq km, out of which 85859 sq km lies in Madhya Pradesh, 1,538 sq km in Maharashtra and 11,399 sq km. lies in Gujarat. In its 1,312 km long stretch, tributaries of various sizes contribute water and their pollution load to the Narmada River. Some research work in the studied area have been done on the river Narmada like Evaluation of Water Quality of Narmada

River with reference to Physico-chemical Parameters at Hoshangabad city, MP¹ and Temporal and spatial variations in water flow and sediment load in the Narmada River have been done².

2 METHODOLOGY

2.1 SAMPLING STATIONS

There are 18 baseline water quality monitoring stations under the Narmada Basin Organisation, Bhopal where on monthly basis water quality analysis work are carried out. Water quality data for the period 2001-2011 of six water quality stations are used for trend analysis. Locations of the sampling stations taken for the present study are shown in Figure-1 and tabulated below in Table-1.

Table 1 WQ Stations of Narmada Basin Organisation selected for the Study.

WQ Stations at River Narmada	WQ Stations at Tributaries of River Narmada
1. River Narmada at Diddori	1. River Burhner at Mohgaon
2. River Narmada at Hoshangabad	2. River Hiran at Patan
3. River Narmada at Mandaleshwar	3. River Banjar at Bamni

2.2 SAMPLING

Following the standard norms as set by the Water Quality Assessment Authority³, the water samples are collected every month during 08.00 AM to 11.00 AM on the first working day of the month. These water samples were collected at 0.6 times the depth from surface without disturbing the bottom sediments, from the point across the river section having maximum depth or maximum flow along the cross section of the river, so that sample must be representative of the source (i.e. water stream) that is to be evaluated. The samples were collected in clean and pre-rinsed polythene bottles of one litre capacity, filled up to their full capacity without air bubbles. Within 24 hours of collection, the collected water samples are transported to Narmada Divisional Laboratory, CWC, Bhopal for chemical analysis.

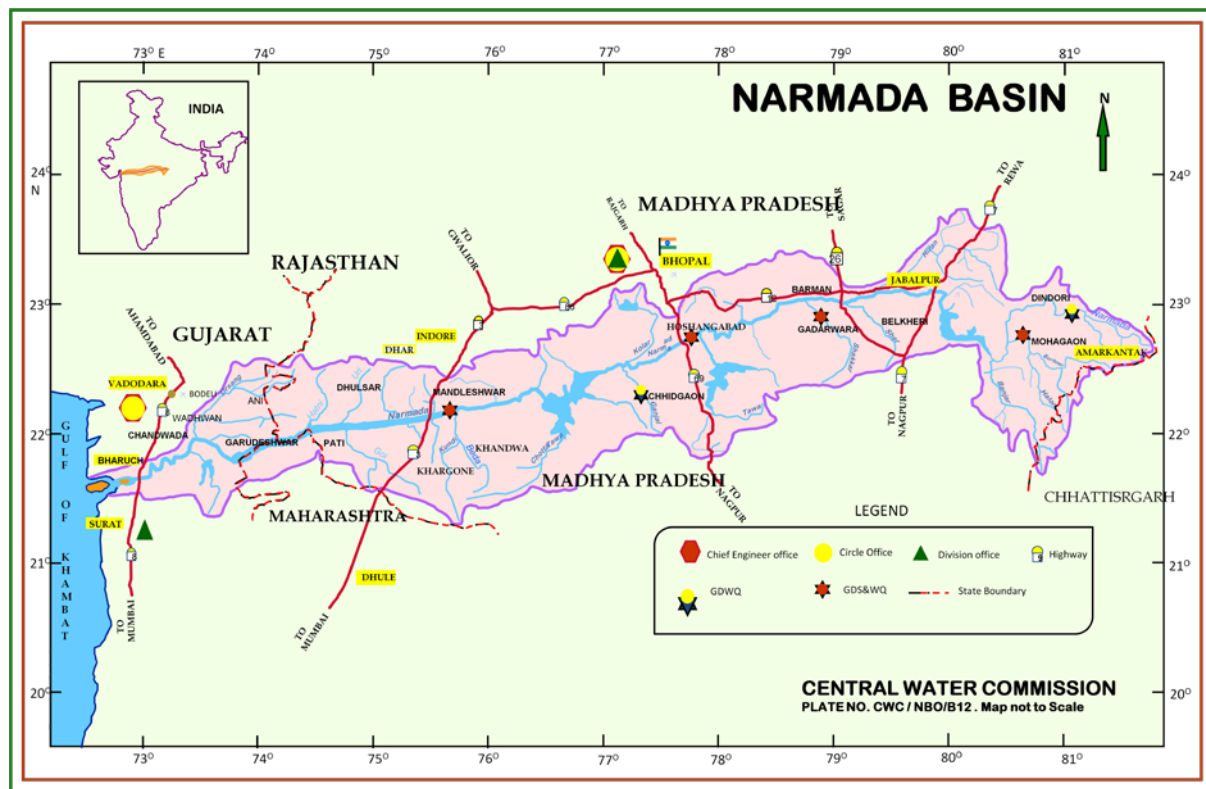


Figure 1 Sampling Stations on Narmada and its tributaries selected for the study.

2.3 ANALYSIS METHODS

The water sample preserved in laboratory were analysed for 24 water quality parameters using standard analytical and/or instrumental methods⁴. The quantitative estimation for the parameters is determined by titrimetric methods, electrical methods, optical methods etc.

2.4 TREND ANALYSIS AND ITS APPLICATIONS

Trend Analysis is the practice of collecting information and attempting to spot a pattern, or trend, in the information. Trend analysis is one of the most often used methods in forecasting. It aims to observe and register the past performance of a certain factor and project it into the future. It involves analysis of two groups of trends: quantitative, mainly based on statistical data, and qualitative, these are at large concerned with social, institutional, organizational, environmental and political patterns.

2.5 PARAMETERS TAKEN FOR TREND ANALYSIS

Basic and very important water quality parameters like Electrical Conductivity (EC), pH, Calcium (Ca^{++}), Chloride (Cl^-), Carbonate (CO_3^{--}), Fluoride (F^-), Nitrate (NO_3^-) and Phosphate (PO_4^{--}) were selected for assessing the trend of water quality. Homogeneity test was applied to the data and obtained graph have shown the trend of the concerned parameters.

3 RESULTS AND DISCUSSION

3.1 TREND ANALYSIS SUMMARY FOR MAIN STREAM NARMADA

It is noticeable here that average pH of the river water of Narmada and its tributaries have decreased. Other parameters have shown more or less increasing or decreasing trend at all the sites of Narmada and its tributaries as well. The trends of all the parameters at all the sites of the river Narmada and its tributaries are summarized below in Table -2.

Table 2 Trend analysis summary of WQ parameters

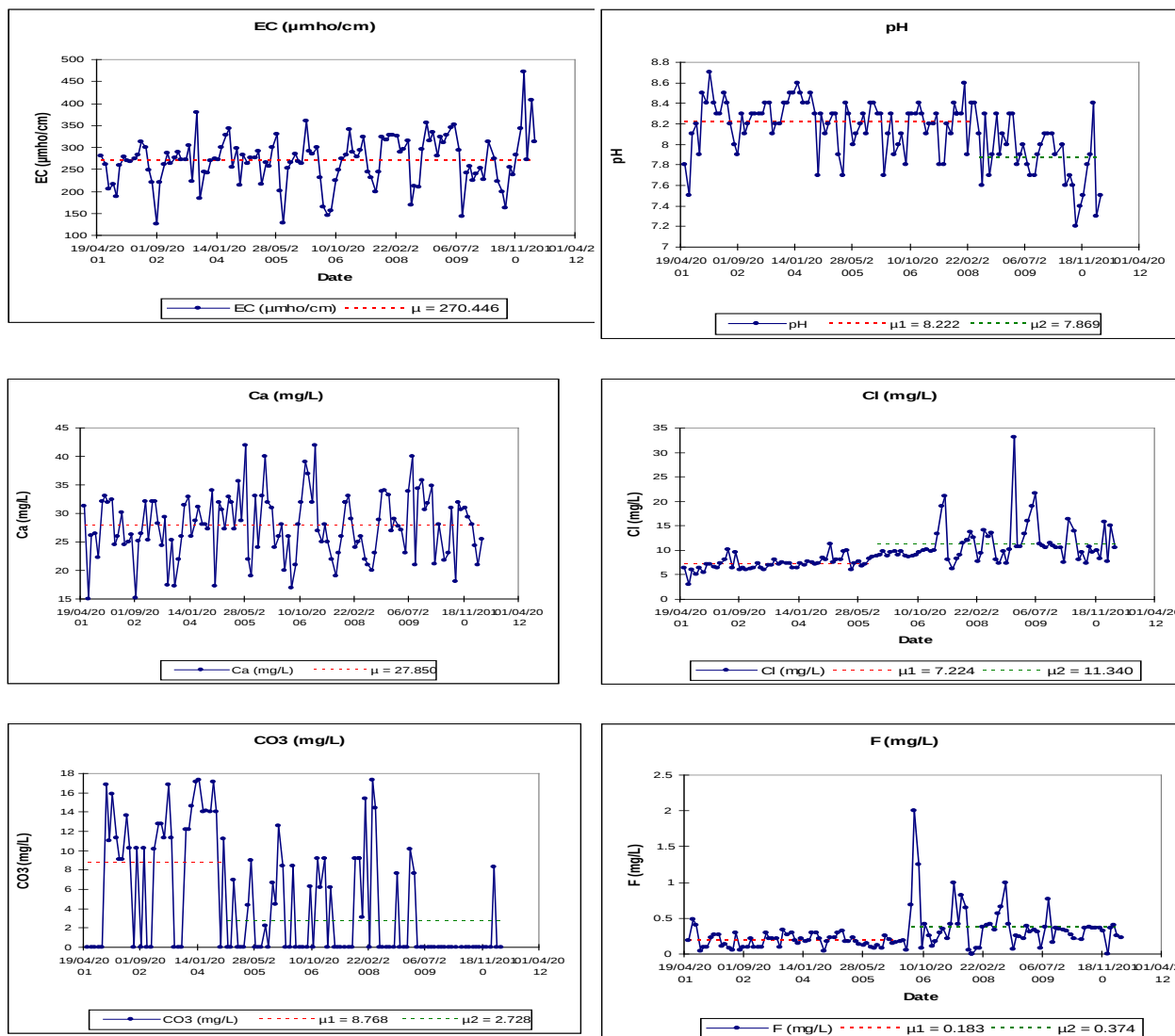
Sites	EC	pH	Ca	Cl	CO3	F	NO3	PO4
WQ stations of the main stream Narmada								
1. Dindori	-	F	-	R	F	R	-	R
2. Hoshangabad	-	-	-	R	-	R	-	R
3. Mandleshwar	-	F	-	R	F	R	R	R
WQ stations on the tributaries of the river Narmada								
1. Mohgaon	-	-	-	R	-	-	-	R
2. Patan	-	-	F	R	-	-	-	R
3. Bamni	-	F	-	R	-	-	-	R

R...Rising Trend, F.....Falling Trend, - ..No Trend

3.2 NARMADA AT DINDORI

Some basic water quality parameters namely EC, pH, NO_3^- and Ca^{++} have shown uniform trend throughout the reporting period 2001-2011.

Increasing trend have been found for other parameters like PO_4^{---} , (μ_1 0.048 increased to μ_2 0.131 mg/L), Cl^- (μ_1 7.224 increased to μ_2 11.34 mg/L) and F^- (μ_1 0.183 increased to μ_2 0.374 mg/L), since then none of the parameters have crossed their tolerance limits as prescribed by BIS standards. Decreasing trend of the water pollutants like pH (μ_1 8.22 decreased to μ_2 7.869) and CO_3^{--} (μ_1 8.768 decreased to μ_2 2.728 mg/L) has also been found. Graph plotted through Homogeneity Test is shown in Figure-2.



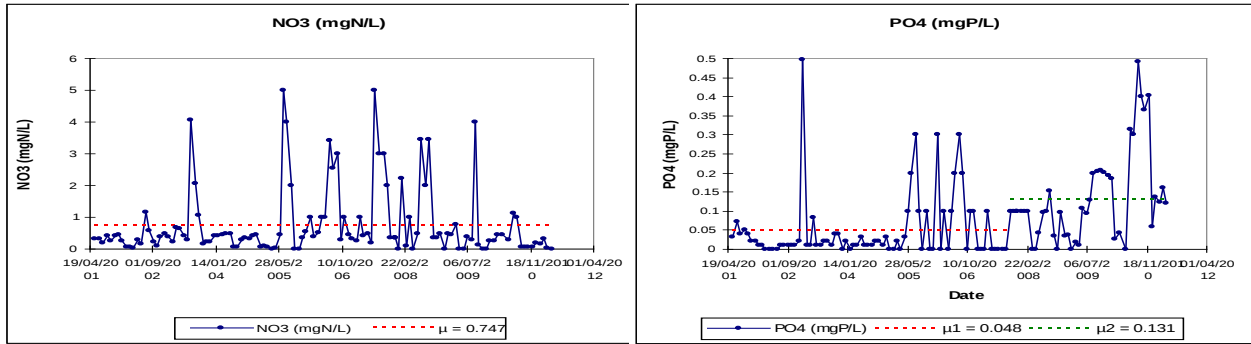
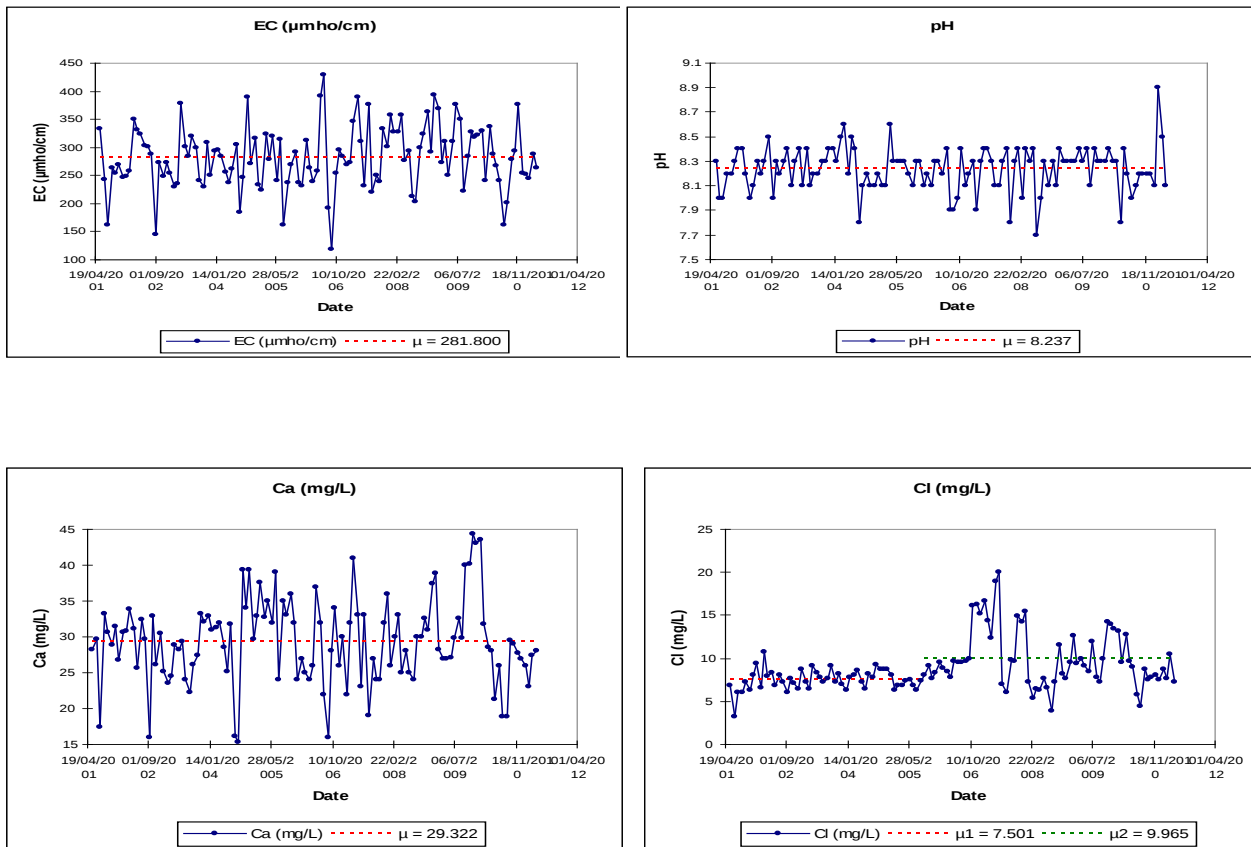


Figure 2 Trend Analysis showing the trend of pollutants for the site Dindori during 2001-2011.

3.3 NARMADA AT HOSHANGABAD

Out of water quality parameters taken for trend analysis in this site some parameters viz. EC, pH, NO₃, CO₃, Ca and F are in uniform trend. Pollutants whose trend found to be increasing are PO₄ (μ_1 0.035 increased to μ_2 0.177 mg/L) and Cl (μ_1 7.501 increased to μ_2 9.965 mg/L).



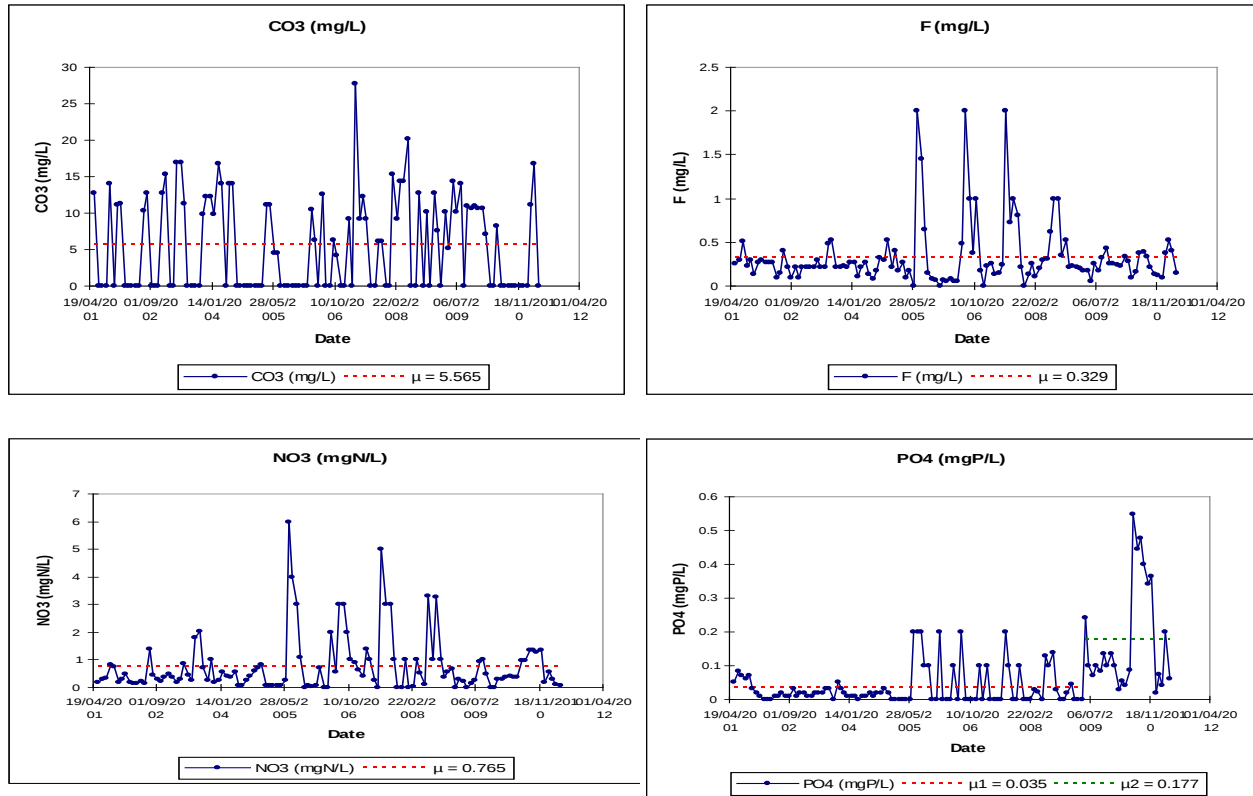
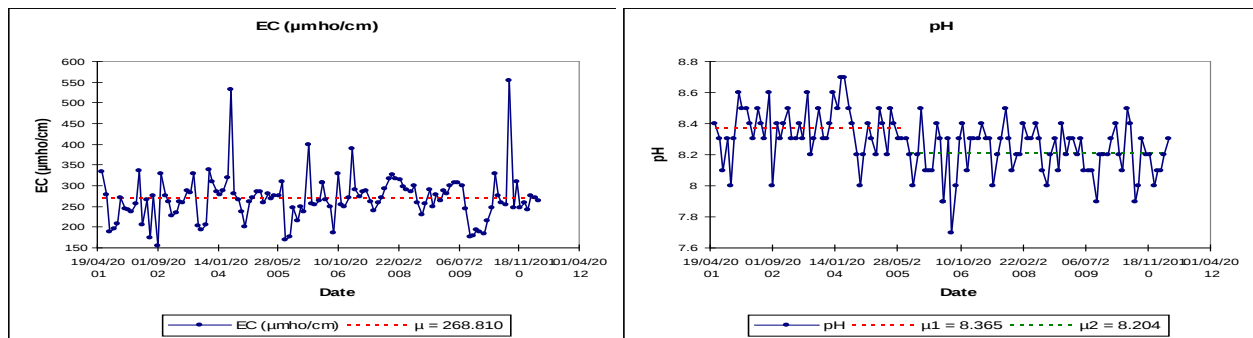


Figure 3 Trend Analysis showing the trend of pollutants for the site Hoshangabad during 2001-2011

3.4 Narmada at Mandaleshwar

EC and Ca are in uniform trend. Some parameters which have shown positive trend are NO₃ (μ_1 0.455 increased to μ_2 1.159 mg/L), PO₄ (μ_1 0.039 increased to μ_2 0.209 mg/L), Cl (μ_1 7.678 increased to μ_2 10.058 mg/L) and F (μ_1 0.265 increased to μ_2 0.383 mg/L).

Other parameters like pH (μ_1 8.365 decreased to μ_2 8.204) and CO₃ (μ_1 12.93 decreased to μ_2 3.386 mg/L) have shown negative trend at the site. Figure-4 shows the trend of various parameters at the site.



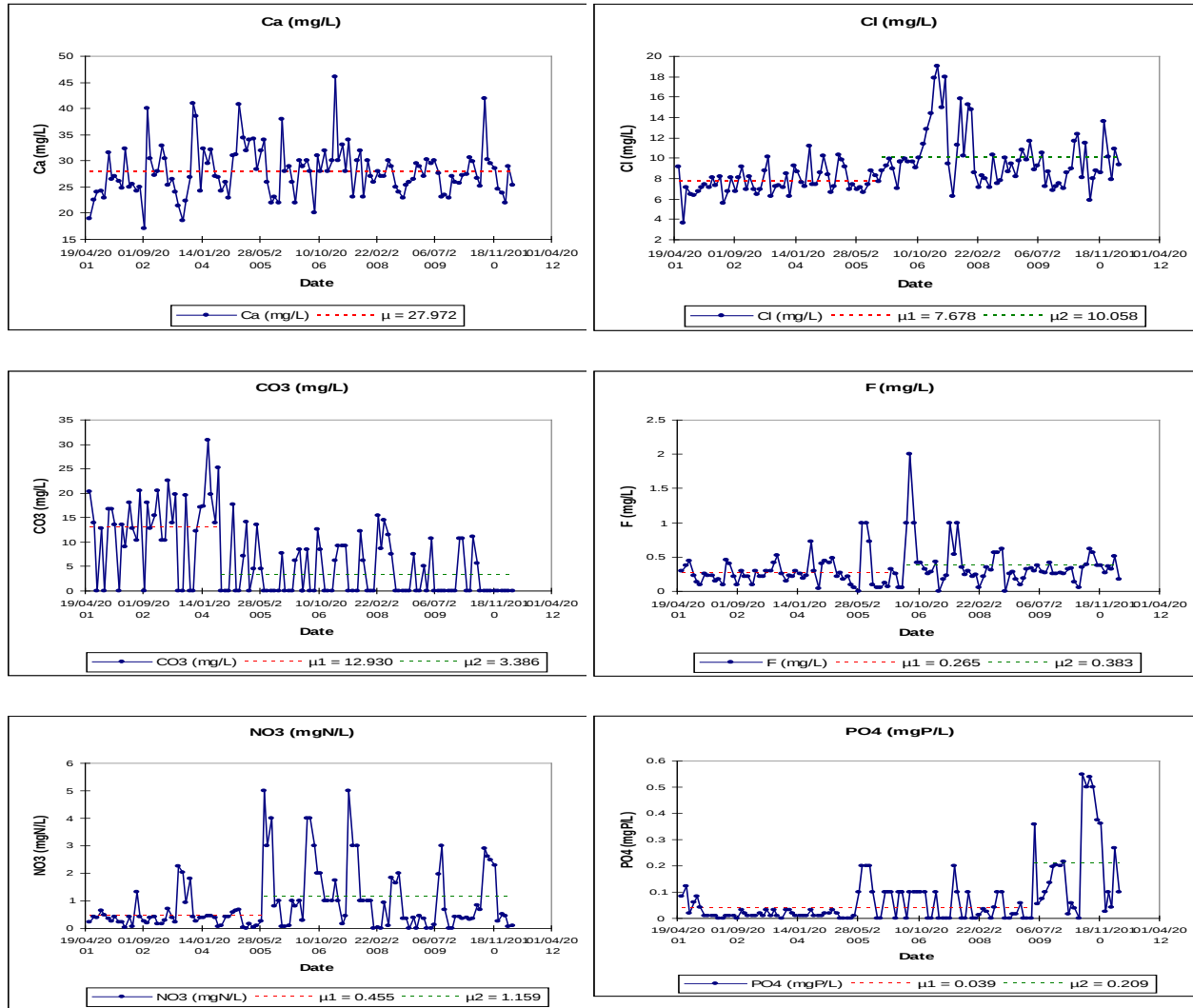


Figure 4 Trend Analysis showing the trend of pollutants for the site Mandleshwar during 2001-2011

4 Trend Analysis Summary for the tributaries of river Narmada

4.1.1 BURNER AT MOHGAON

The data on the site for the last 10 years indicate that many water quality parameters have no trend viz. pH, EC, NO₃, CO₃ and Ca. None of the parameters have seen to show negative trend at the site.

Parameters namely PO₄ (μ₁ 0.031 increased to μ₂ 0.176 mg/L), Cl (μ₁ 6.861 increased to μ₂ 9.97 mg/L) and F (μ₁ 0.256 increased to μ₂ 0.356 mg/L), have significant increasing trend in the river Burhner at Mohgaon. Phosphate and Nitrate are the two parameters which have normally seen to cross their respective tolerance limits in the reporting period 2001.2011. Figure 5 indicated the trend of various pollutants of the river.

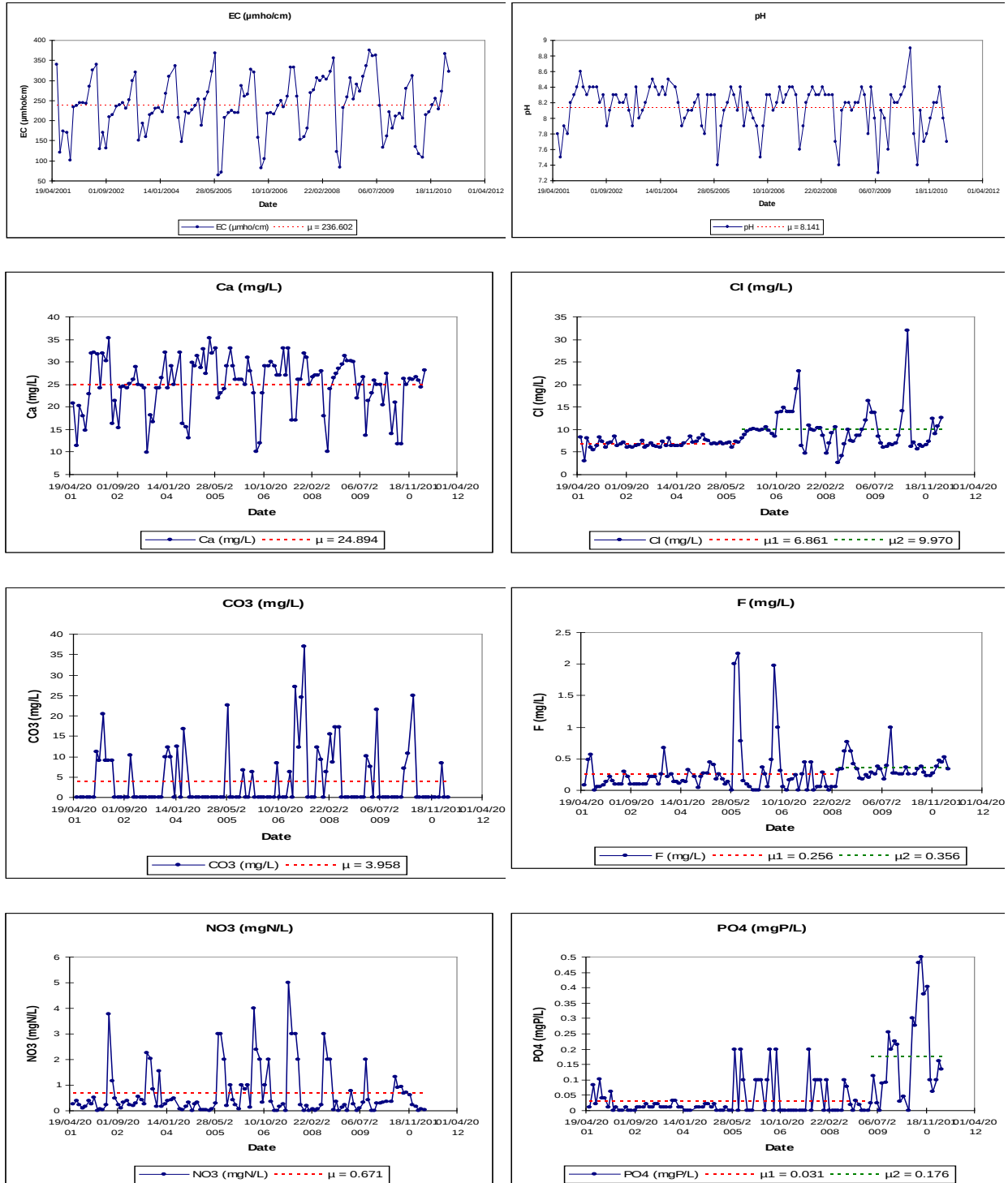


Figure 5 Trend Analysis showing the trend of pollutants for the site Mohgaon during 2001-2011.

4.1.2 HIRAN AT PATAN

In this site over the last 10 years most of the WQ parameters like EC and pH have shown the uniform trend at this station, whereas only Calcium (μ_1 44.7 decreased to μ_2 38.87 mg/L) have decreasing trend in the river Hiran at Patan.

Increasing trend for the parameters like NO₃ (μ_1 0.567 increased to μ_2 1.368 mg/L), PO₄ (μ_1 0.034 increased to μ_2 0.181 mg/L) and Cl (μ_1 9.608 increased to μ_2 19.331 mg/L) have been seen, although the parameters have

shown increasing trend at the station but most of the time they are in their respective tolerance limits of BIS, except 2-3 cases in the reporting period. Figure-6 shows the trend of different pollutants.

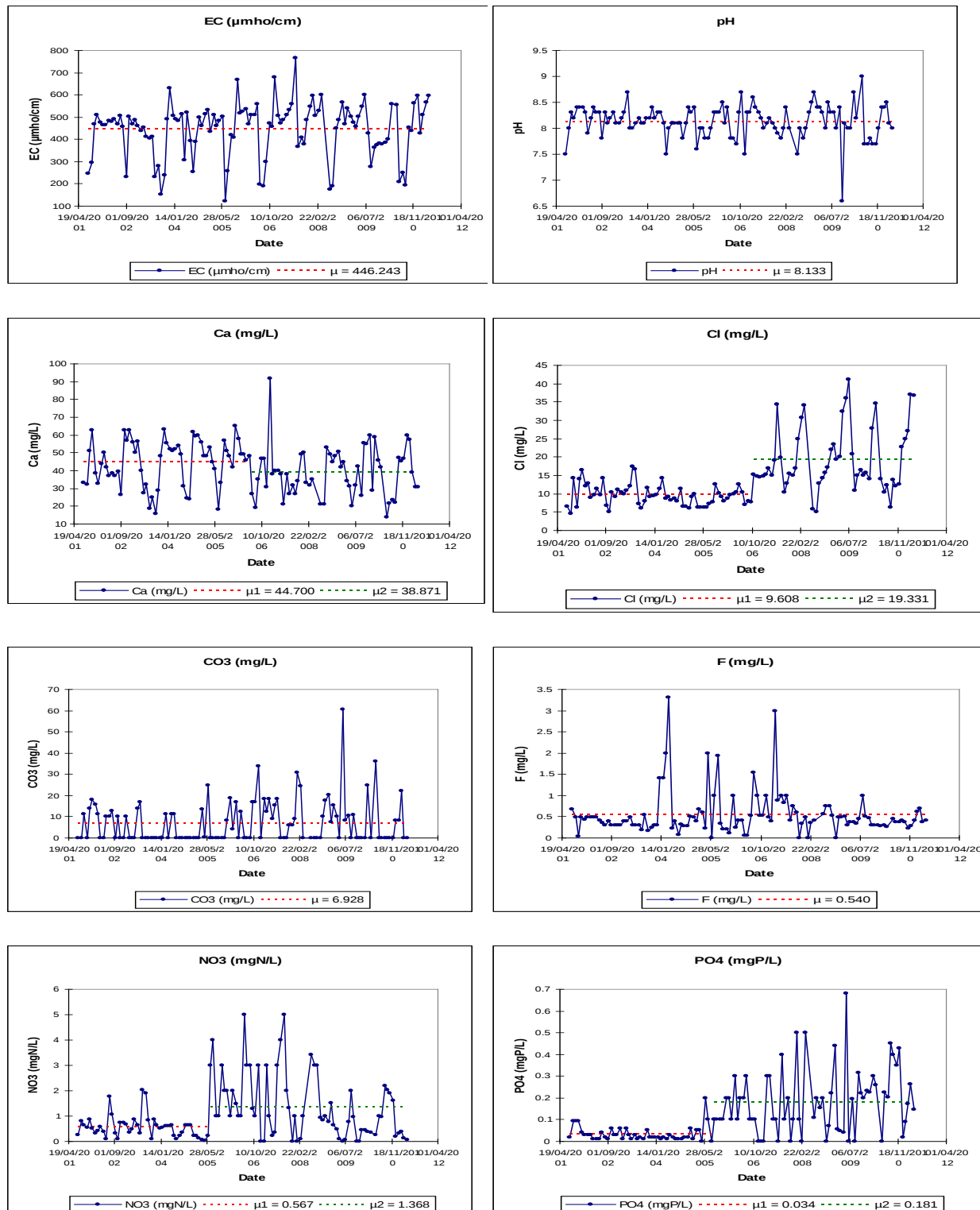


Figure 6 Trend Analysis showing the trend of pollutants for the site Patan during 2001-2011.

4.1.3 BANJAR AT BAMNI

At Bamni water quality station parameters like EC, CO₃ and Ca are showing uniform trend. Parameters like NO₃ and PO₄ show positive trend whereas only pH showed negative trend on the data of the last 10 years.

Increasing trend for the parameters like NO₃ (μ_1 0.43 increased to μ_2 1.105 mg/L), PO₄ (μ_1 0.05 increased to μ_2 0.154 mg/L), Cl (μ_1 7.155 increased to μ_2 9.626 mg/L) and F (μ_1 0.219 increased to μ_2 0.499 mg/L). Negative or decreasing trend have been found for three parameters viz. pH (μ_1 8.184 decreased to μ_2 7.849) only. Figure – 7 shows the trend of pollutants during the decade.

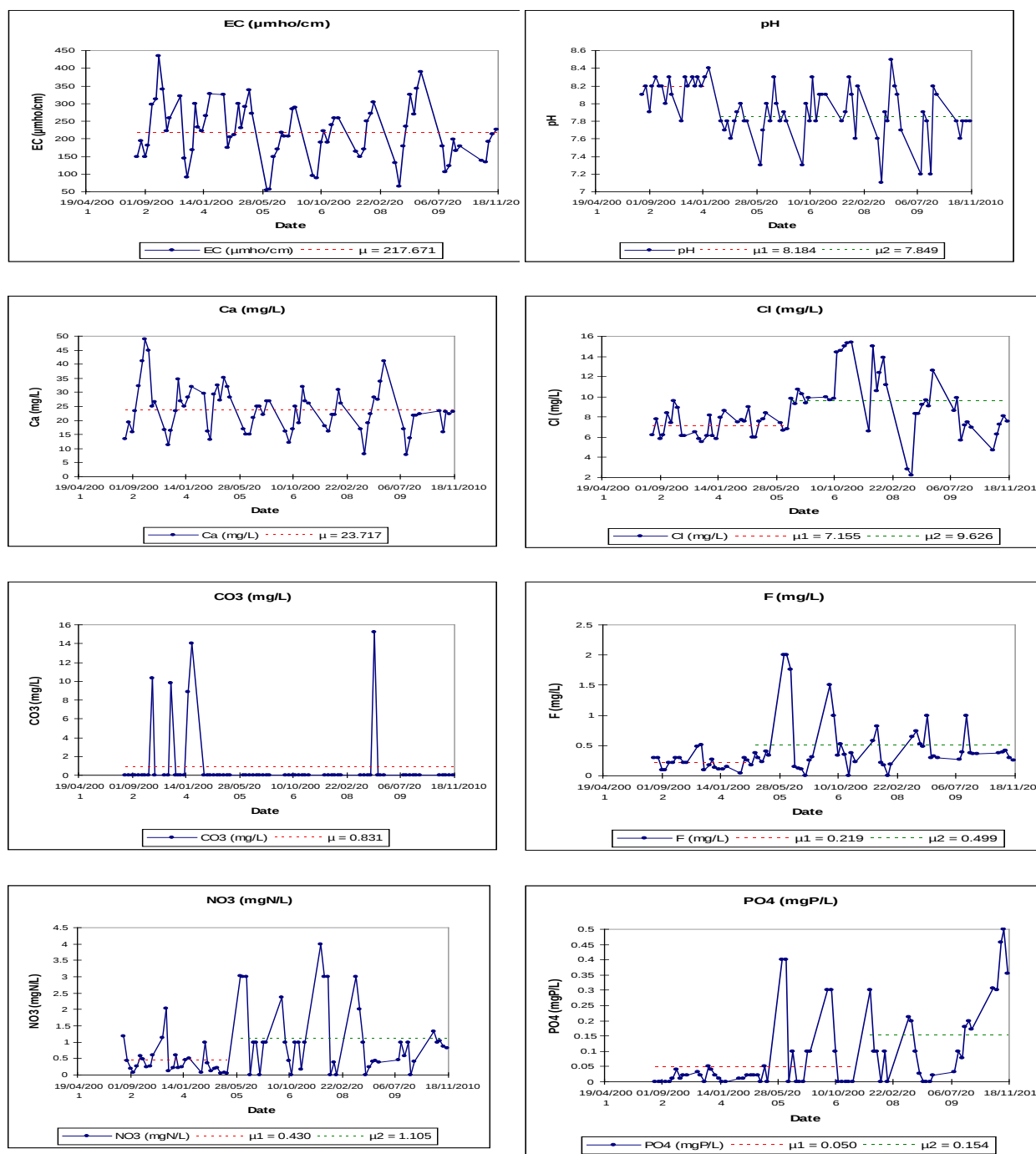


Figure 7 Trend Analysis showing the trend of pollutants for the site Bamni during 2001-2011.

5 ACKNOWLEDGEMENT

The authors are thankful to Chief Engineer, Narmada Basin Organisation, Bhopal, Superintending Engineer, NBO, Bhopal and Executive Engineer, Narmada Division, Bhopal for their encouragements for the study conducted on Trend Analysis.

REFERENCES

1. Sharma Shraddha, Vishwakarma Rakesh, Dixit Savita and Jain Praveen, **Evaluation of Water Quality of Narmada River with reference to Physco-chemical Parameters at Hoshangabad city, MP, India**, Research Journal of Chemical Sciences, Vol. 1(3) June 2011.
2. Harish Gupta and G. J. Chakrapani, **Temporal and spatial variations in water flow and sediment load in the Narmada River**, Current Science, VOL. 92, No. 5, 10th March 2007.
3. Water Quality Assessment Authority's Gazette Protocol dated 17th June 2005 of the Ministry of Environment and Forests, New Delhi.
4. APHA, **Standard method for the examination of water and waste water**, American Public Health Association, AWWA, WPEC, 19th edition, New York, 1998.