Assessment of Potential Wetland Status in Mudigere Taluk, Chikkamagaluru District, Karnataka, India

Kiran B M[#], Mohan Kumar K N[#], Srikantaswamy S[*], Sanjith J[#],

[#] *Department of Civil Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru.*
[*] *DOS in Environmental Studies, Manasagangotri, University of Mysore, Mysuru.*

*Abstract:-***'Wetland' denotes a large body of water surrounded by land, whether natural or artificial, permanent or temporary with water that is lentic or lotic. Wetlands perform some useful functions in the maintenance of overall balance of nature. Due to economic growth, urbanization, population increase and industrialization, more and more waste materials are discharged making it unfit for any uses. Hence to maintain the ecological balance, it is imperative to preserve these wetlands to make it fit for various purposes. A study is done in Mudigere taluk of Chikkamagaluru District, to identify and assess the status of potential wetlands. The study involves a detailed investigation of physical and chemical water quality parameters of 5 lakes, carried out for a period of three months from March to May-2015, the result reveals that the turbidity of the water have exceeded the permissible limit due to storm water runoff and 2 lakes have attended the Eutrophic condition due to agriculture run-off, sewage pollution and anthropogenic activities.**

Keywords: Wetlands, physical and chemical parameters, Chikkamagalur.

I. INTRODUCTION

A. General

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land or where the land is covered by water. Once treated as transitional habitats or serial stages in succession from open water to land, the wetlands are now considered to be distinct ecosystems with specific ecological characteristics, functions and values. Wetlands, natural and manmade, freshwater or brackish, provide numerous ecological services. The density of birds in particular is an accurate indication of the ecological health of a particular wetland. However, unsustainable use of wetlands without reckoning of their assimilative capacity constitutes major threat to the conservation and management of these vital biodiversity rich areas.

Wetlands consist of 3 - 6% of the earth's land surface, while they make available supplies and services such as: water quality maintenance, agricultural production, fisheries and recreation. Furthermore other services are flood water retention, provision of wildlife habitat, and control of soil erosion. The area of wetland definitely depends on the preservation of agricultural and oasis ecosystems in arid and semi-arid areas. The wetland areas are greatly decreased during the past 50 years due to wetland reclamation, population pressure, water diversion, dam construction, pollution, biological incursion, desertification, climate change, and misguiding policies. Because of this, many wetlands around the world are protected and monitored by various agencies.

There are many different types of wetland. These include areas of marsh, fen, peat land and shallow water bodies. Most are natural but some are human-made and they can be permanent or seasonal. The water in wetlands can be flowing or static and can be fresh, brackish or saline. Marine water that does not exceed 6 meters depth at low tide is also classed as a wetland and many river estuaries are globally significant wetlands.

Despite this definition, modified from the Ramsar Convention on Wetlands (1971), there are different interpretations of what constitutes a wetland around the world. Measurement and mapping techniques also vary between countries and regions. This makes it difficult to accurately measure the number and extent of wetlands globally. According to two estimates, wetlands cover between 125 and 131 million hectares (Mha) in Africa and between 204 and 286 Mha in Asia. Overall, scientists estimate that wetlands cover at least 6% of the world's land area. In South America, the best estimate is approximately 179 Mha.

B. Threats to Wetlands

Wetlands are dynamic ecosystems, changing naturally over time as a consequence of processes such as erosion, sedimentation and coastal flooding. However, human activities, either within the wetland or in the catchment, in which they are situated, can alter these natural processes or accelerate the rate of change, threatening the wetland's continued existence.

While threats vary between regions and even within wetlands, agriculture is considered to be the most significant. This is partly due to the scale of wetland agriculture, which has increased dramatically in recent years and damaged wetlands across the world. But it is also due to its nature: many wetlands have been extensively and irreversibly modified as humans try to increase agricultural productivity.

One of the main impacts is disruption to wetland hydrology. Many have been drained so that the land can be used to grow crops, including biofuels – 12 Mha of peat land have been drained in Southeast Asia for palm oil production. Other impacts include diverting water via irrigation canals and the over extraction of water for intensive agriculture. Fertilizers, pesticides and other agrochemicals can pollute the water in a wetland. While the farmers within a wetland are often the focus of attention for those seeking to protect wetlands, agricultural practices upstream also affect the quality and quantity of water flowing into them. For example, upstream irrigation projects and extraction for agriculture can reduce the flow of water to a wetland. Agricultural practices may also increase surface runoff and soil erosion, thereby increasing the amount of sediment entering a wetland. Wetlands should be considered as part of larger landscapes (e.g. a basin) when examining agriculture–wetland interactions.

C. Study Area

Mudigere is a Panchayath town and Taluk of Chikkamagaluru District located in Karnataka State, India. It is located in Western Ghats forest and is 35 km away from the district headquarters. Mudigere is very famous for coffee plantation and is one of the most famous hill stations in Karnataka. The pleasant climatic condition of area makes it an adventurous hub for many water sports and trekking events.

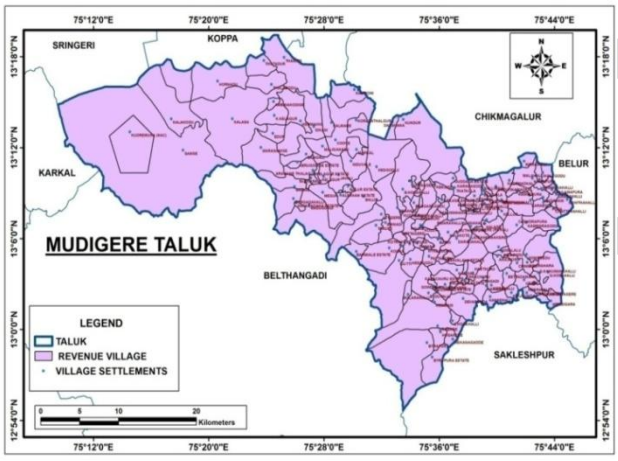

Fig. 1: Study Area

Mudigere is located at 13.13 ^{0}N 75.63 ^{0}E. It has an average elevation of 915 meters (3001 feet).

Table 1: Details of Study Area

Sl No	Item	Details
1	Population	9,677 (2011)
2	Area	115 sq.Km
3	Numbers wards	11
4	Markets/ Towns	1
5	Biomedical establishment	1
6	Temperature	15^{0}c -32 ^{0}c
7	Annual rainfall	3000mm-3500mm

II. MATERIALS AND METHODOLOGY

The study involves the primary data collection from the related government agencies and identifying the potential wetlands in the Mudigere Taluk. A physical and chemical water quality analysis of the wetlands is conducted to check the quality of the water and is conducted for the periods of once in a month from March to May.

A. Sample Location

The sample location was selected to provide the best representation of water quality and pollutants load of the lake. The water samples from the wetlands were collected regularly once a month from predetermined sampling points to represent station1 (inlet), corresponding points station2 (outlet). The geography position of these locations will be determined using geography positioning system (GPS). Each sample was collected from each of the sample locations.

Table 2: G.P.S Location of Wetlands in Mudigere Taluk

Sl no	Wetlands	Latitude(N)	Longitude(E)
1	Bairamman Lake	13.140731	75.688327
2	Dodda lake	13.060559	75.649721
3	Dinne Lake	13.11.08649	75.641139
4	Bydal Lake	13.14071	75.599621
5	Uramundina lake	13.123301	75.61459

B. Sample Collection

Water samples were collected on the surface and before the sampling; care has been taken to ensure that the sampling bottles were treated with 10% HNO_3 or diluted HCL and subsequently washed with distilled water. The samples were analyzed immediately for parameters, which need to be determined instantly and rest of the samples were refrigerated at 4 ^{0}C to be analyzed later. All the analysis method was followed as per the standard procedures mentioned in APHA and AWWA, 2005. Dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Total dissolved solids (TDS), Total suspended solids (TSS), Phosphate and Chloride (Cl_2)

III RESULTS AND DISCUSSIONS

A. Physico-Chemical Analysis

The physico-chemical analysis were conducted for different parameters such as Dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD),Total dissolved solids (TDS), Total suspended solids (TSS), Phosphates (PO_4) and Chloride(Cl_2). Some of the parameters have to be determined at site like DO fixing. The remaining analytical parameters were conducted in laboratory.

1) Bairamman Lake

Table 3: Water Quality Analysis of Bairamman Lake

Parameters	March		April		May	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	6.8	7.1	6.4	6.8	5.8	5.9
DO(mg/L)	7.1	2.5	6.9	2.1	5.2	5.8
BOD(mg/L)	12.4	44.2	12	55.2	12.8	15.2
COD(mg/L)	31	112.5	28.7	133.7	28.5	33.8
TSS(mg/L)	70.3	65.9	70.9	65.2	90.2	80.8
Turbidity(NTU)	4.1	2.2	4.5	2.8	7.6	7.2
Sulphates (mg/L)	2.4	9.4	2.8	9.1	6.7	9.8
Nitrates(mg/L)	1.7	2.2	1.6	2.4	5	4.5
Hardness, (mg/L)	71	92	65	72	100	120
Acidity, (mg/L)	1.9	5.1	2.3	5.8	2.8	6.2

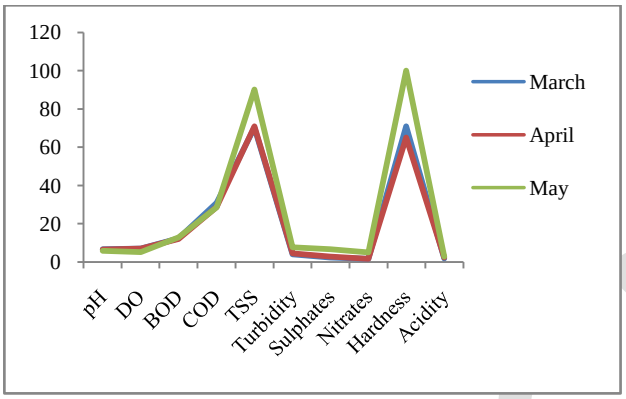

Figure 2: water quality analysis of Bairamman Lake in the inlet

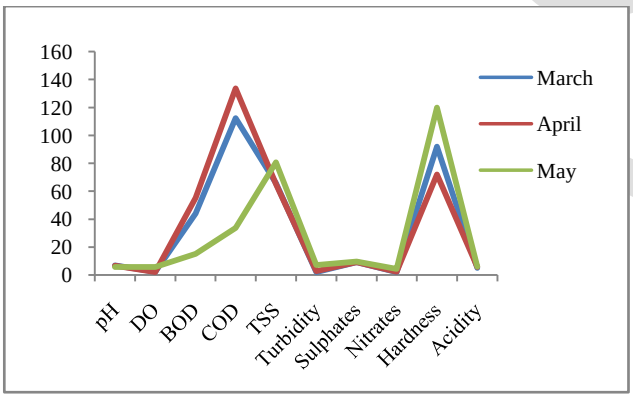

Figure 3: water quality analysis of Bairamman Lake in the outlet

Table 3 shows the physico chemical analysis values of Bairamman lake for the month of March, April and May, pH of 6.8 was maximum in the month of March at the inlet and minimum of 5.8 in the month of May at the inlet, DO of 7.1 mg/L was maximum at the inlet and minimum of 2.4 mg/L at the outlet in the month of March, BOD of 55.2mg/L was maximum in the month of April at the outlet and minimum of 11.3 mg/L in the month of May at the inlet, COD of 133.7 mg/L maximum in the month of April at the outlet and minimum of 25.1 mg/L in the month of May at the inlet, Hardness of 120 mg/L was maximum in the month of May at the outlet and minimum of 65 mg/L in the month of April at inlet, acidity of 6.2 mg/L was maximum in the month of May at the outlet and minimum of 1.9 mg/L in the month of March at the inlet , sulphates of 9.8 mg/L was maximum in the month of May at the outlet and minimum of 2.4 mg/L in the month of March at the inlet , nitrates of 5 mg/L was maximum in the month of May at the inlet and minimum of 1.7 mg/L in the month of March at the inlet Total suspended solids concentration of 90.2 mg/L was maximum in the month of May at the inlet minimum of 65.2 mg/L in the month of April at the outlet, turbidity of 7.6 NTU was maximum in the month of May at the inlet minimum of 2.2NTU in the month of March at the outlet.

2) Dodda Lake

Table 4: Water Quality Analysis of Dodda Lake

Parameters	March		April		May	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	7.1	7.2	6.8	6.9	6.8	6.9
DO(mg/L)	5.7	4.7	5.4	4.4	5.4	4.4
BOD(mg/L)	6.8	23.2	7.2	28.8	7.2	28.8
COD(mg/L)	17.6	54.2	16.8	63.4	16.8	63.4
TSS(mg/L)	76.5	72.4	72.1	70.4	72.1	70.4
Turbidity(NTU)	7	9	6.4	85	6.4	85
Sulphates (mg/L)	3	9	2.1	6.4	2.1	6.4
Nitrates(mg/L)	2.5	4.2	2.1	4	2.1	4
Hardness, (mg/L)	60	51	54	46	180	150
Acidity, (mg/L)	2	5.1	2.2	4.6	2.6	5

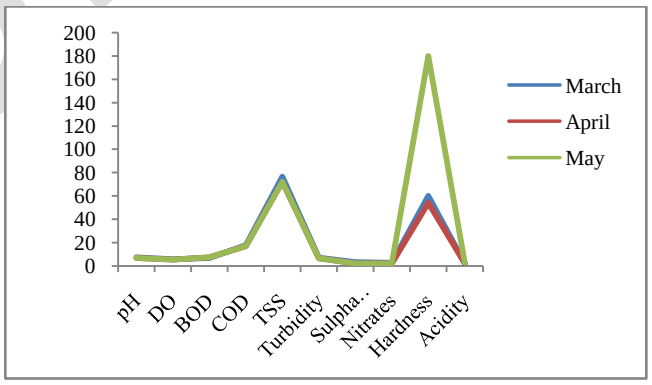

Figure 4: Water quality analysis of Dodda Lake in the inlet

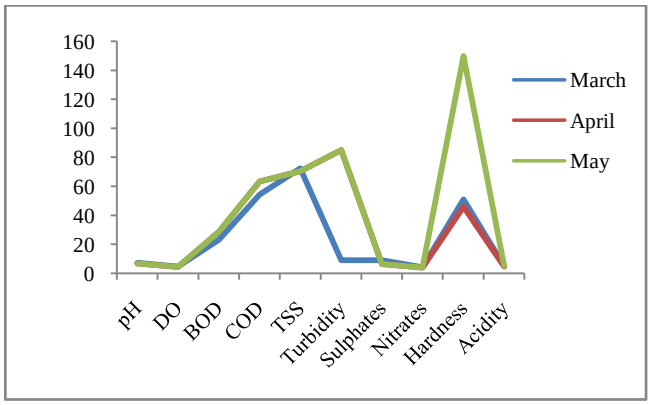

Figure 5: Water quality analysis of Dodda Lake in the outlet

Table 4 shows the physico chemical analysis values of Dodda lake for the month of March, April and May pH was maximum in the month of March that is 7.1mg/L at the inlet and minimum in the month of May that is 6mg/L at the outlet and DO was maximum in the month of May that is 4.1mg/L at the outlet and minimum in the month of May that is 4.1mg/L at the outlet and BOD was maximum in the month of April that is 29.4 mg/L at the outlet and minimum in the month of March that is 6.8 mg/L at the inlet and COD was maximum in the month of April that is 68.7 mg/L at the outlet and minimum in the month of April that is 16.8mg/L at the inlet and Hardness was maximum in the month of May that is 180mg/L at the inlet and minimum in the month of April that is 46mg/L at the outlet, and acidity was maximum in the month of May that is 5mg/L at the outlet and minimum in the month of March that is 2mg/L at the inlet and the sulphate was maximum in the month of March that is 9mg/L at the outlet and minimum in the month of April that is 2.1mg/L at the inlet, and nitrates was maximum in the month of May that is 6.6mg/L at the outlet and minimum in the month of April that is 2.1mg/L at the inlet, and Total suspended solids are more in the month of May that is 109.4mg/L at the inlet and minimum in the month of March that is 67.5mg/L at the outlet, and turbidity was maximum in the month of April that is 85 NTU at the outlet and minimum in the month of April that is 6.4NTU at the inlet.

3) Dinne Lake

Table 5: Water Quality Analysis of Dinne Lake

Parameters	March		April		May	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	7.3	7.3	7.1	7.2	5.7	6.1
DO(mg/L)	5.4	5.1	5.5	6.4	5.1	4.9
BOD(mg/L)	7.6	11.6	14.4	4.9	12.8	11.6
COD(mg/L)	16.4	30.7	32.8	11.2	26.8	25.6
TSS(mg/L)	68.3	70.4	64.9	67.1	130.4	100.2
Turbidity(NTU)	7	16	6.8	17.2	16.8	11
Sulphates(mg/L)	7	9	7.2	8.4	8	7.6
Nitrates(mg/L)	2	4.1	2.5	4.4	5.6	4.1
Hardness, (mg/L)	37	40	34	37	200	160
Acidity, (mg/L)	1.7	4	1.4	3.4	2.2	3.9

Table 5 shows the physico chemical analysis values of Dinne lake for the month of March, April and May the pH was maximum in the month of March that is 7.3mg/L at the outlet and minimum in the month of May that is 5.7 mg/L at the inlet and DO was maximum in the month of April that is 6.4mg/L at the outlet and minimum in the month of May that is 4.3mg/L at the outlet and BOD was maximum in the month of May that is 16.8mg/L at the inlet and minimum in the month of April that is 4.9mg/L at the outlet and COD was maximum in the month of May that is 29.2mg/L at the outlet and minimum in the month of April that is 11.2mg/L at the outlet and Hardness was maximum in the month of May that is 200mg/L at the inlet and minimum in the month of April that is 34mg/L at the inlet, and acidity was maximum in the month of March that is 4mg/L at the outlet and minimum in the month of April that is 1.4mg/L at the inlet, and sulphates was maximum in the month of March that is 9mg/L at the outlet and minimum in the month of March that is 7mg/L at the inlet, and nitrates was maximum in the month of May that is 5.6mg/L at the inlet and minimum in the month of March that is 2mg/L at the inlet, and Total suspended solids are more in the month of May that is 139.6mg/L at the inlet and minimum in the month of April that is 61.4mg/L at the inlet , and turbidity was maximum in the month of April that is 17.2 NTU at the outlet and minimum in the month of April that is 6.8NTU at the inlet.

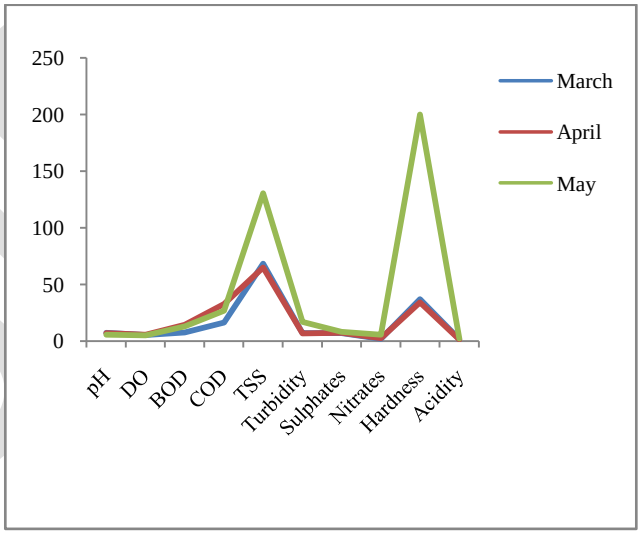

Figure 6: Water quality analysis of Dinne Lake in the inlet

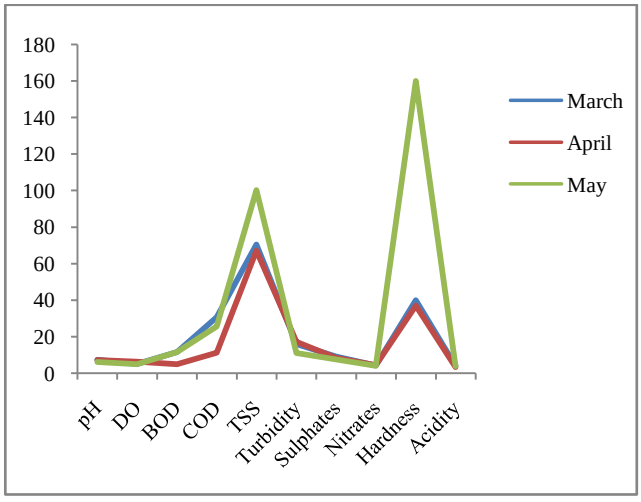

Figure 7: Water quality analysis of Dinne Lake in the outlet

4) Bydal Lake

Table 6: Water Quality Analysis of Bydal Lake

Parameters	March		April		May	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	6.8	6.6	6.8	6.7	6.4	6.2
DO(mg/L)	2.7	2.2	1.2	1.3	5.9	5.4
BOD(mg/L)	16.4	25.6	11.6	28.8	13.6	12.4
COD(mg/L)	51.8	67.7	27.9	62.7	30.2	25.6
TSS(mg/L)	61.5	56.7	59.2	53.1	145.5	120.6
Turbidity(NTU)	17	23	15	21	18.2	14.5
Sulphates (mg/L)	7	13	6.4	11	7	10.3
Nitrates(mg/L)	3	4.9	3.2	4.5	6.8	5
Hardness, (mg/L)	81	119	89	110	300	250
Acidity(mg/L)	3.6	11.9	3.3	11.1	3.9	13.8

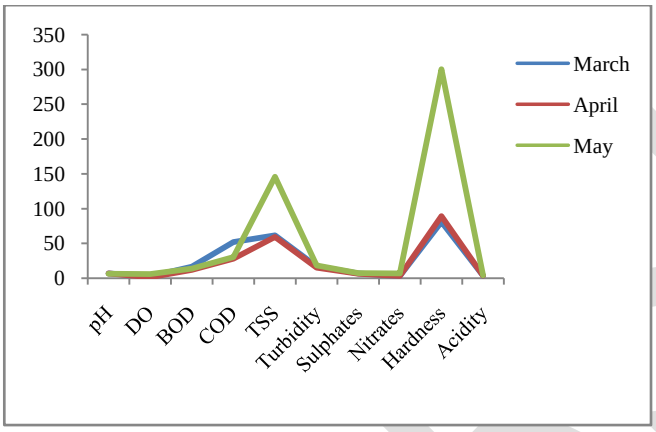

Figure 8: Water quality analysis of Bydal Lake in the inlet

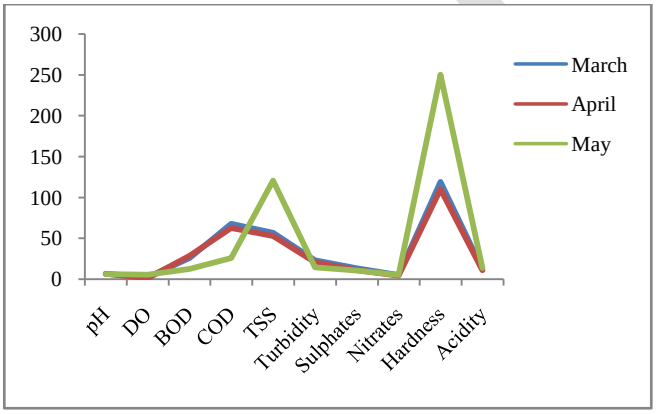

Figure 9: Water quality analysis of Bydal Lake in the outlet

Table 6 shows the physico chemical analysis values of Bydal lake for the month of March, April and May the pH was maximum in the month of March that is 6.8mg/L in the inlet and minimum in the month of May that is 6mg/L at the outlet and DO was maximum in the month of May that is 5.9mg/L at the inlet and minimum in the month of April that is 1.2mg/L at the inlet and BOD was maximum in the month of April that is 28.8 mg/L at the outlet and minimum in the month of April that is 11.6mg/L at the inlet and COD was maximum in the month of March that is 68.4mg/L at the outlet and minimum in the month of May that 25.6mg/L at the outlet is and Hardness was maximum in the month of May that is 300mg/L at the inlet and minimum in the month of March that is 81mg/L at the inlet and acidity was maximum in the month of May that is 13.8mg/L at the outlet and minimum in the month of April that is 3.3mg/L at the inlet and sulphates was maximum in the month of March that is 13mg/L at the outlet and minimum in the month of April that is 6.4mg/L at the inlet and nitrates was maximum in the month of May that is 6.8mg/L at the inlet and minimum in the month of March that is 3mg/L at the inlet and Total suspended solids are more in the month of May that is 159.1mg/L at the inlet and minimum in the month of April that is 51.5mg/L at the outlet, and turbidity was maximum in the month of March that is 23NTU at the outlet and minimum in the month of May that is 14.5 NTU at the outlet.

5) Uramundina Lake

Table 7: Water Quality Analysis of Uramundina Lake

Parameters	March		April		May	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	7.2	7.1	7.1	7.1	4.8	5
DO(mg/L)	6.8	5.8	6.5	5.9	6.2	6
BOD(mg/L)	7.6	7.2	6.4	5.6	10.4	7.6
COD(mg/L)	15.7	16.6	16.6	12.4	24.6	16.4
TSS(mg/L)	56.5	50.7	54.8	45.5	120.4	110.2
Turbidity(NTU)	38	1	34	9	13.5	12
Sulphates (mg/L)	7	6	6.9	5.9	7.2	10.3
Nitrates(mg/L)	2.8	3.9	2.5	3.7	7.2	4.5
Hardness, (mg/L)	82	7	71	9	120	130
Acidity(mg/L)	2.5	7	2.1	6.8	2.6	7.3

Table 7 shows the physico chemical analysis values of Uramundina lake for the month of March, April and May the pH was maximum in the month of March that is 7.2mg/L in the inlet and minimum 4.7 mg/L at the inlet in the month of May and DO was maximum and minimum in the month of March that is 6.8mg/L at the inlet and 5.2mg/L at the outlet and BOD was maximum in the month of May that is 10.9mg/L at the inlet and minimum in the month of April that is 5.6 mg/L at the outlet and COD was maximum in the month of May that is 24.9mg/L at the inlet and minimum in the month of April that is 12.1 mg/L at the outlet and Hardness was maximum in the month of May that is 130mg/Lat the outlet and minimum in the month of March that is 7.0mg/L at the outlet , and acidity was maximum in the month of May that is 7.3mg/L at the outlet and minimum in the month of APRIL that is 2.1mg/L at the inlet , and sulphates was maximum in the month of May that is 10.3mg/L at the outlet and minimum in the month of April that is 5.9 mg/Lat the outlet and nitrates was maximum in the month of May that is 7.2mg/L at the inlet

and minimum in the month of April that is 2.5mg/L at the inlet and Total suspended solids are more in the month of May that is 134.7mg/L at the inlet and minimum in the month of April that is 42.3 mg/L at the outlet , and turbidity was maximum in the month of March that is 38.0 NTU at the inlet and minimum in the month of April that is 9.0NTU at the outlet.

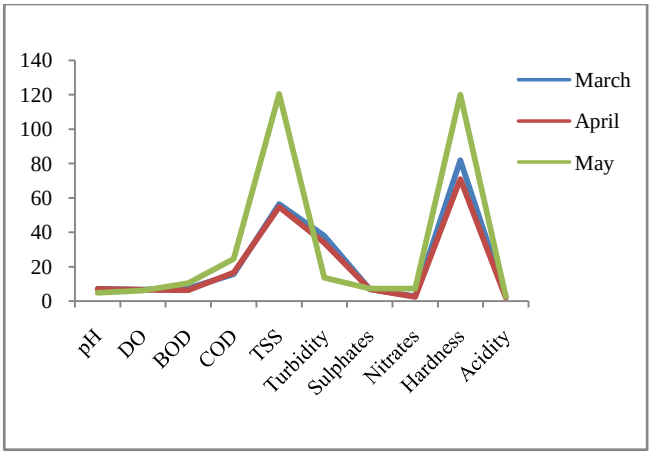

Figure 10: Water quality analysis of Uramundina Lake in the inlet

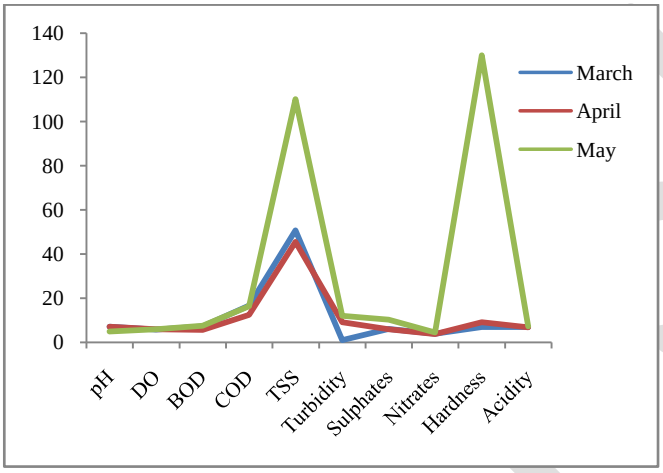

Figure 11: Water quality analysis of Uramundina Lake in the outlet

IV CONCLUSIONS

- The water quality analysis results of Bairamman lake, reveals that pH, COD, Nitrates, TSS, Turbidity, Sulphates, acidity and hardness are all well within the permissible standards prescribed by Indian standard specifications for drinking water. But BOD exceeds the permissible value at the outlet in the month of April as the outlet was closed and lake was polluted by the sewage water.
- In the Dodda lake the water quality analysis results reveals that pH, DO, COD, Nitrates, TSS, Sulphates and hardness are all well within the permissible standards prescribed by Indian standard specifications for drinking water but Turbidity exceeds the permissible limit both at the inlet and outlet in the month of April.
- In the Dinne lake the water quality analysis results reveals that pH, DO, BOD, COD, Nitrates, TSS, Sulphates and hardness are all well within the permissible standards prescribed by Indian standard specifications for drinking water but Maximum value of Turbidity is was found exceeding the permissible limit at the outlet in the month of April.
- In the Bydal lake the water quality analysis results reveals that pH, BOD, COD, Nitrates, TSS, Sulphates and hardness are all well within the permissible standards prescribed by Indian standard specifications for drinking water but Maximum value of Turbidity is was found exceeding the permissible limit both at the inlet and outlet in the month of April. And DO was found below 4 mg/L at inlet as well at outlet.
- In the Uramundina lake the water quality analysis results reveals that pH, DO, BOD, COD, Nitrates, TSS, Sulphates and hardness are all well within the permissible standards prescribed by Indian standard specifications for drinking water but Maximum value of Turbidity is was found exceeding the permissible limit both at the inlet in the month of March and at the outlet in the month of April.

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