MATERIALS AND METHODS

The lake Chhatri selected for the present investigation is situated on the East of the Amravati city. It is situated at above 450 meters above the sea level. It is at 77° 46' E longitude and 20° 53.8' N latitude. During rainy season, it is filled to its maximum capacity.

It was constructed during draught of 1880. The morphometric features of the lake Chhatri are as below.

1. Average water spread area
   a) at full supply level : 2.9600 sq.miles
   b) at high flood level : 3.2685 sq. miles
2. Gross storage capacity : 3.25 lac gallons
3. Maximum depth of water at high flood level: 15 feet
4. Mean depth at high flood level: 13.2 feet
5. Catchment area: 3.6659 sq.miles

The location of the Chhatri lake is shown in the fig.3.1 and the actual photographs at three different periods of the year are given as fig.3.2, 3.3 and 3.4. Five sampling spots were selected at the lake based on different characteristics such as, human activity depth, industrial discharges, undisturbed location and ample periphyton. The reservoir is surrounded by open hills towards East which drain water during monsoons. The area of the lake is surrounded by weeds and grassy hilly area from North East and East sides on which the domestic animal graze adding the excreta in the area which gets decomposed and during rainy season it comes under water-spread area.

Monthly samples were collected from the five stations for a period of 14 months from June 1997 to July 1998. The water samples (at a depth of one metre) were collected with the help of Ruttner’s sample in the morning hours. Water samples were brought in one litre cane to the laboratory for analysis. Parameters like temperature, transparency, pH, dissolved oxygen, free CO₂, conductivity, total dissolved solids and alkalinity were analysed at the study sites itself, whereas parameters viz. chloride, total hardness and calcium hardness sulphates, phosphates, nitrates and silicates were analysed in the laboratory.
Fig. 3.1, LOCATION OF CHHATRI LAKE
Fig. 3.2, Lake Chhatri showing 5 sampling spots (during summer season)
Fig. 3.3, Lake Chhatri during rainy session, 1997
Fig. 3.4 Lake Chhatri during winter season, 1997
Fig. 3.5, Lake Chhatri showing Chhatri
The methods used for the analysis of various physico-chemical parameters are as given in standard methods for the examination of water, sewage and industrial wastes (APHA, 1985). Golterman et al., 1978 and National Environmental Engineering Research Institute (NEERI, 1986).

**Physico-Chemical Analysis:**

**Temperature**

The surface water temperature was recorded with a centigrade thermometer having $0.1^\circ C$ division and a range of 0.00 to 50 $^\circ C$.

**Transparency**

Transparency of water was measured by a Secchi disc of 20 cm diameter painted black and white in four alternate quadrates on the upper surface tied with a marked nylon rope for measurement. The Secchi disc was lowered down with the help of a graduated rope till it disappeared from the view and then lifted till it reappeared. The average reading of these two depths (in cm) was considered the limit of visibility and was taken as Secchi disc transparency.

\[
\text{Transparency (cm)} = \frac{X+Y}{2}
\]

where,

\[
X = \text{Depth of disappearance (cm)}
\]
\[
Y = \text{Depth of reappearance (cm)}
\]
Conductivity

The specific conductivity was determined with the help of conductivity meter (Systronics). The result was expressed as $\mu$mhos/cm.

**Total Dissolved Solids (TDS)**

The total dissolved solids were determined with the help of TDS meter (Systronics). The result was expressed as mg/l.

**Hydrogen Ion Concentration (pH)**

The hydrogen ion concentration (pH) was recorded at the collection sites with the help of Grip pH meter (Systronics).

**Free Carbon dioxide (Free CO$_2$)**

Free CO$_2$ was analysed at the sites by using phenolphthalein indicator and sodium hydroxide titrant. 50 ml of sample was taken in a conical flask and five drops of phenolphthalein indicator added. If the colour turned pink, free CO2 was taken as absent, when it remained colourless, it was titrated with 0.02 N Sodium hydroxide until a pink colour appeared.

$$\text{Free CO}_2 \text{ (mg/l)} = \frac{X \times N \times 50 \times 1000}{Y}$$

where,

$X = \text{ml of titrant}$

$Y = \text{ml of sample}$

$N = \text{Normality of titrant}$
Phenolphthalein Alkalinity

50 ml of sample was taken and five drops of phenolphthalein indicator added. If it remained colourless that showed phenolphthalein indicator added. If it remained colourless that showed phenolphthalein alkalinity absent. If it was turned pink, it was titrated with 0.02 N sulphuric acid to a colour less end point.

\[
\text{Phenolphthalein alkalinity (mg/l)} = \frac{X \times N \times 50 \times 1000}{Y}
\]

where,

- \( X = \text{ml of titrant} \)
- \( Y = \text{ml of sample} \)
- \( N = \text{Normality of titrant} \)

Total Alkalinity

Two drops of methyl orange indicator were added to the solution in which phenolphthalein alkalinity was already determined. This was titrated with 0.02N sulphuric acid to the end point, when the colour changed from yellow to faint orange.

\[
\text{Total alkalinity (mg/l)} = \frac{X \times N \times 50 \times 1000}{Y}
\]

Where,

- \( X = \text{ml of titrant} \)
- \( Y = \text{ml of sample} \)
- \( N = \text{Normality of titrant} \)
Dissolved Oxygen

Dissolved oxygen was determined by modified Winkler’s method (Golterman et al., 1978). The water sample collected in 125 ml glass stoppered oxygen bottle. One ml of manganous sulphate and one ml of alkaline acid solution was added to the bottom of the bottle to fix the dissolved oxygen. It was thoroughly mixed and then brown precipitate was allowed to settle. 2 ml of concentrated sulphuric acid was added through the side of the bottle and was shaken well to dissolved the precipitate. 50 ml of the above solution was taken in a conical flask and titrated with 0.025 N thiosulphate solution using starch as an indicator to a colourless end point.

\[
\frac{X \times N \times 8 \times 1000}{Y} = \text{Dissolved Oxygen (mg/l)}
\]

where,
- \(X\) = Volume of sodium thiosulphate used (ml)
- \(Y\) = Volume of sample (ml)
- \(N\) = Normality of sodium thiosulphate

Chloride

Chloride was determined by Mohr’s argentometry method. 2 ml of potassium chromate indicator was added to 50 ml of sample and titrated with 0.014 N silver nitrate solution till the sample turned brick red.
Chloride (mg/l) = \( \frac{X \times N \times 35.45 \times 1000}{Y} \)

Where,  
\( X \) = ml of titrant used  
\( Y \) = ml of sample  
\( N \) = Normality of titrant

**Total Hardness**

Total hardness was determined titrimetrically using (Ethylene diamine tetra acetic acid disodium salt) EDTA method. 50 ml of sample taken in a conical flask. One ml of ammonia buffer and a pinch of erichrome black T indicator was added and titrated against 0.01 M EDTA titrant till colour changed from purple to blue.

\[ \text{Total Hardness (mg/l)} = \frac{X \times 1000 \times Z}{Y} \]

where,  
\( X \) = ml of titrant used  
\( Y \) = ml of sample  
\( Z \) = mg CaCO\(_3\) equivalent to 1.0 ml EDTA titrant

**Calcium Hardness**

Calcium hardness was determined by adding one ml of 8% sodium hydroxide solution and 0.2 gm murexide indicator to 50 ml of sample and titrated against 0.01 M EDTA titrant till pink colour changed to purple.
Calcium hardness (mg/l) = \( \frac{X \times 1000 \times Z}{Y} \)

where, 
\( X = \) ml of titrant used 
\( Y = \) ml of sample 
\( Z = \) mg CaCO₃ equivalent to 1.0 ml EDTA titrant.

**Magnesium Hardness**

Magnesium was calculated by deducting values of calcium hardness from total hardness and multiplying by 0.243.

\[ \text{Magnesium hardness} = \text{Total hardness} - \text{Calcium hardness} \times 0.243 \text{ (mg/l)}. \]

**Silicates**

To 50 ml water sample added with rapid succession 1 ml 1 + 1 HCl and 2 ml ammonium molybdate reagent. Mixed by inverting at least six times and allowed to stand for 5 to 10 min. Added 2 ml oxalic acid solution and mixed thoroughly. The intensity of yellow colour was measured at 650 nm and 815 nm after 2 minutes but before 15 minutes and compared with a standard curve.

**Total Phosphates**

25 ml water sample from the water collected from the lake Chhatri was evaporated and the residue was dissolved in 1 ml 70% perchloric acid. Then the perchloric acid was fommed off but not to
dryness and then added followed by a drop of phenolphalein indicator and titrated with sodium hydroxide to slight pink end point and making up the contents to 25 ml, 1 ml ammonium molybdate and 3 drops of freshly prepared stannous chloride were added to it. Blue colour gradually appeared in about 10 minutes.

Absorbance was read spectrophotometrically at a wavelength of 690 nm and the values are noted from the calibration curve.

**Nitrates**

25 ml of water sample was evaporated to dryness on hot water bath and 1 ml phenoldisulphonic acid was added after rubbing the residue thoroughly. 10 ml distilled water and 3 ml ammonia water was added one after the other. An yellow colour was developed. Absorbance was read at 410 nm against a bank and compared with a standard curve.

**Sulphates**

Water sample from Chhatri lake was filtered through whatmann filter paper No.1. 50 ml of filtered water sample was taken into conical flask containing not more than 10 mg/l sulphate. Added 0.15 gm of barium chloride and mixed for 30 minutes using a magnetic stirrer. Measured the absorbance against a distilled water blank at 420 nm and compared with the standard curve.
Plankton Analysis

The five litres composite water samples was filtered through the net number 40 bolting silk and divided into two parts. One was filled with Lugol’s solution and the other part with 4 % formalin. Each replicate of phyto and zooplankton sample was identified and quantified under research microscope using suitable keys and by drop count method.

Fish Studies

Fishes were collected with the help of local fisherman and identified after Day (1889).

Aquatic weeds and Insects

Aquatic weeds and insects were collected and identified (Tonapi, 1980).

Productivity

Primary productivity was determined by light and dark bottle method.

Statistical Analysis

Coefficient of correlations and analysis of variance were carried out on computer.