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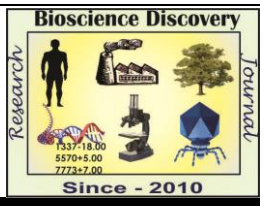


# Spatial Distribution of Municipal Water from Pangri, (MS) India

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**Abstract**

Water is considered as most important natural resource than other natural resources. Before supplying water to public the examination is done to reduce the bacterial contamination. The water supply in Pangri village is by Municipal. Samples were collected to study the bacterial contamination. The most probable test technique was used for identification of quantity of *Escherichia coli*. Total Five tap water samples were collected during August, 2015 to July, 2016. The water samples were collected in well cleaned sterile bottles. There should be no any other contamination so that precaution was taken during sample gathering. These samples were brought immediately to the laboratories for further analysis. The coliform concentration varies from 11 to above 430 MPN/100 ml. All water samples are above permissible limit prescribed by WHO standards. To show the spatial distribution of municipal water Arc GIS software was used.

## INTRODUCTION

In India nowadays there is increase in contamination of water because of pollution. The pipe line connections done underground by municipal are getting damaged so that linkages are causing contamination to well treated drinking water. Due to pathogenic microorganisms like *E. coli* there is cause of diseases so it is more important to identify the bacterial contamination from water. For human population pure water is required for drinking purpose which should be free from bacterial contamination (Talat *et al.*, 2015).

To maintain human health water plays an important role also having right of consuming fresh water. There are many modern techniques which are used for disinfection of water (Shahaby *et al.*, 2015).

The total availability of fresh water on earth is 0.3 to 0.5 percent. Groundwater, surface water atmospheric water and springs are the source of available water for peoples. The quality of fresh water depends upon the environmental factors in specific location (Shukla *et al*., 2017).

Assessment of pure water for drinking purpose is fundamental right of humans. Throughout globe about 1.1 billion people are inaccessible to safe drinking water. Rapid growing population and their demands in developing countries are the reasons for water pollution. Government cannot provide necessary infrastructure for waste water management and supply (Tekpor *et al*., 2017).

Water exists life of all living organisms present on earth for healthy life. Due to bacterial contamination there are major deaths in developing countries. Surface water and groundwater are source of drinking water the fecal contamination causes due to the transfer of contaminated water in fresh water bodies (Kanth *et al*., 2018).

## MATERIALS AND METHODS

The water samples were collected from the free water dispensers from higher education institutions. To define bacterial contamination from selected samples multiple tube fermentation method was used. During research found that there was major contamination of coliform bacteria in Mahidol University, Salaya Campus, Thailand (Pratum and Khananthai, 2017).

For analysis of bacterial contamination total 20 water samples were collected then the most regular method multiple tube fermentation method was used to determine the coliform contamination. They found that 17 samples were unsatisfactory and 3 samples were satisfactory (Malathy *et al*., 2017).

The area of Pangri village is about 547 hectares comes under Nanded tehsil Maharashtra. It is more near to Swami Ramanand Teerth University Nanded and Vishnupuri. In Pangri village there are 226 houses having population about 1261. People use tap water as source for drinking purpose.

Total five Municipal water samples were collected from Pangri village on monthly basis for one year. Samples were immediately brought in laboratory for analysis. The MPN test is carried out for investigation of coliform contamination. Presumptive, Confirmative and Completed test was carried out. The water samples were collected for investigation of coliform concentration. Experimental procedure was carried carefully and precaution was taken to avoid other contamination. MacConkey broth with water dilution 10:10, 5:1 and 5:0.1 is distributed in test tubes and kept for incubation. In confirmative test EMB broth is used for *coliform* growth. At last in Completed test BGLB is used to confirm obtained positive test tubes. Analysis method is used from environmental practical methods given by Trivedi and Goel (Trivedi and Goel, 1998).

## RESULT AND DISCUSSION

In Pangri tap water is used as source of drinking water. Drainage and septic tanks are near to tap water connections and having linkages are the reason for *coliform* contamination. Small children do latrine near to drainage and tap water connections. Municipal water is supplied to public to consume as drinking water. According to standard limit prescribed by WHO there should be 6 to10 MPN/100 ml in potable water. After investigating by MPN test *coliform* were found above permissible limit. The positive obtained test tubes resulted on the basis of Standard Methods for the Examination of Water and Wastewater, 20$^{th}$ edition American Public Health Association, New York (Standard Methods, 1998). The MPN/100 ml ranges from 11 to 430. Minimum MPN/100 ml is 11, maximum is 430 and average ranges from 49.416 to 87.083 (Table 1) and tap water samples are distributed in three different classes (Table 2). Graphical representation shows the monthly variations of *E. Coli* (figure 1–5). The average, minimum and maximum variation is shown in (figure 6).

The study on bacterial analysis of drinking water by MPN method in tertiary care hospital and adjoining area western UP, India was done. The samples were collected from municipal tap water, government hand pumps and water cooler. *Coliform* concentration had shown its 50 percent presence in municipal water samples (Kumar *et al.*, 2013).

The samples were collected for investigating bacterial contamination of drinking water supplies in a modern rural Neighborhood and found that water used in households is contaminated by *coliform* (Lamka *et al.*, 1980). The study reveals that Microbial analysis of sachet and tap water in Enugus state on Nigeria was found that coliform is 500 MPN/100 ml (Ohanu *et al.*, 2012).

After evaluation of *coliform* it is found that all results are above permissible limit prescribed by WHO. The Municipal water samples 1, 3 and 4 has shown there higher concentration of coliform. By using Arc GIS software the spatial distribution of municipal water is shown in (figure 7 – 18). Through spatial distribution method you can analyze easily high and low concentration of E. Coil from selected sampling locations from Pangri area. To avoid such microbial contamination easy method is to boil water at $100^0$C or follow the chlorination process.

**Table 1: Showing the MPN/100 ml during August, 2015 to July, 2016**

| Month | TW-1 | TW-2 | TW-3 | TW-4 | TW-5 |
|---|---|---|---|---|---|
| **Aug** | 81 | 69 | 69 | 81 | 36 |
| **Sep** | 72 | 69 | 81 | 64 | 32 |
| **Oct** | 69 | 69 | 81 | 72 | 40 |
| **Nov** | 350 | 81 | 70 | 45 | 430 |
| **Dec** | 95 | 70 | 46 | 110 | 250 |
| **Jan** | 12 | 25 | 17 | 14 | 32 |
| **Feb** | 11 | 12 | 24 | 13 | 17 |
| **Mar** | 32 | 28 | 23 | 32 | 45 |
| **Apr** | 32 | 22 | 22 | 24 | 17 |
| **May** | 25 | 25 | 28 | 16 | 17 |
| **Jun** | 28 | 35 | 45 | 41 | 48 |
| **Jul** | 180 | 180 | 430 | 81 | 81 |
| **Min** | **11** | **12** | **17** | **13** | **17** |
| **Max** | **350** | **180** | **430** | **110** | **430** |
| **Ave** | **82.25** | **57.08333** | **78** | **49.41667** | **87.08333** |

Note: TW = Tap Water provided by municipal

**Table 2: Tap water quality classification**

| Water Class | Permissible Limit (WHO) MPN/100 | No. of Samples |
|---|---|---|
| **Potable** | 0-5 | - |
| **Moderate** | 6-10 | - |
| **Non-Potable** | 10 Above | 5 |

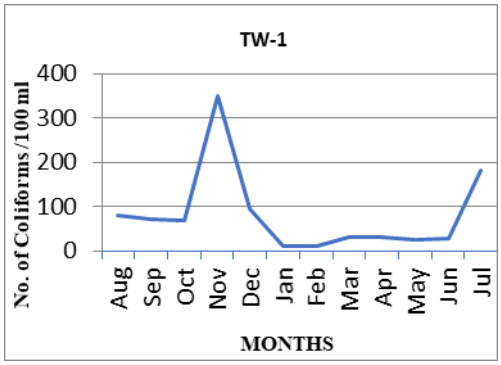



**Figure 1:** Graphical representation of MPN/100ml of TW-1**.**

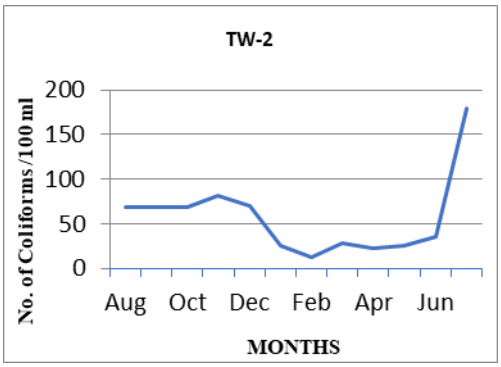



**Figure 2:** Graphical representation of MPN/ 100 ml of TW-2

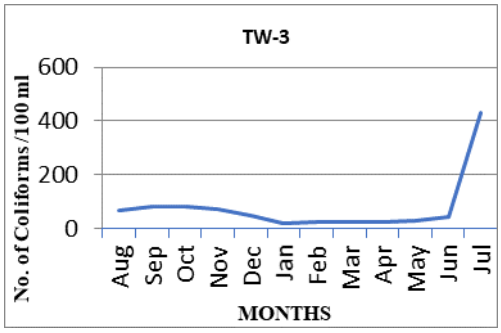



**Figure 3:** Graphical representation of MPN/100ml of TW-3**.**

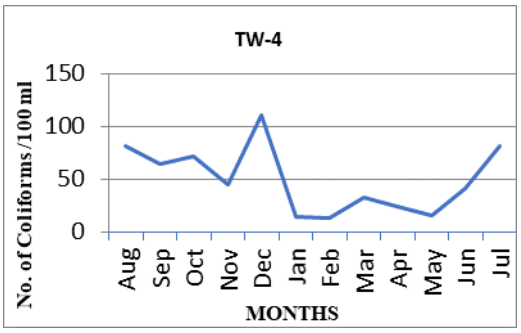



**Figure 4:** Graphical representation of MPN/ 100 ml of TW-4

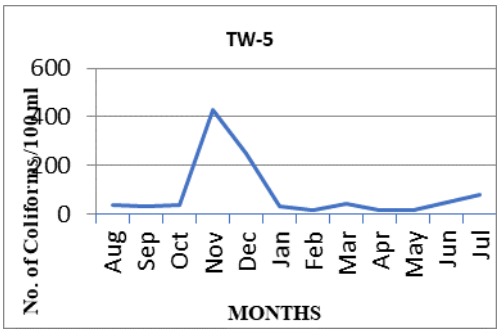



**Figure 5:** Graphical representation of MPN/100ml of TW-5**.**

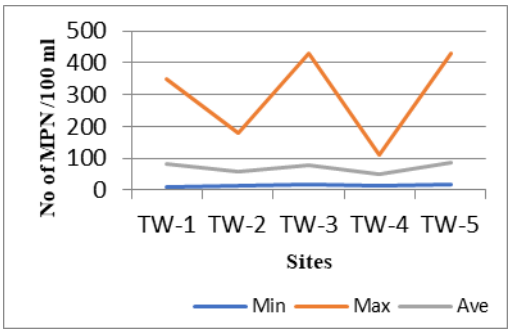



**Figure 6:** Graphical representation of MPN/100ml showing Minimum, Maximum and Average values.

**Spatial Distribution of MPN/100 ml from August, 2015 to July, 2016**

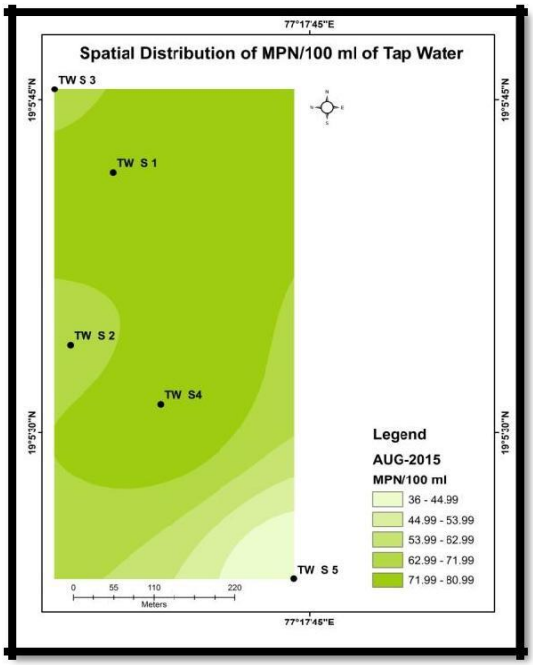



Figure 7

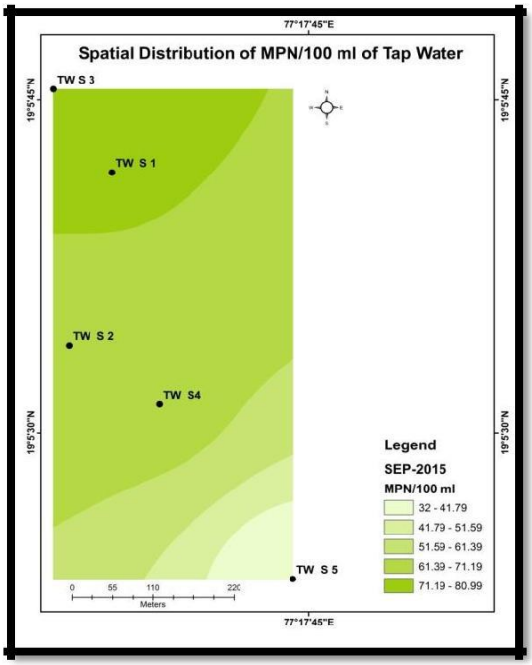



**Figure 8**

**Figure 7 & 8: S**howing the spatial distribution of MPN/100 ml of August, 2015 and September, 2015

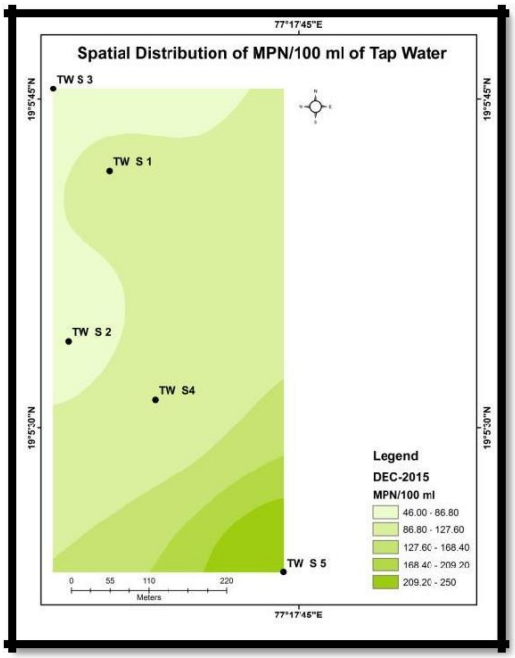



**Figure 9**

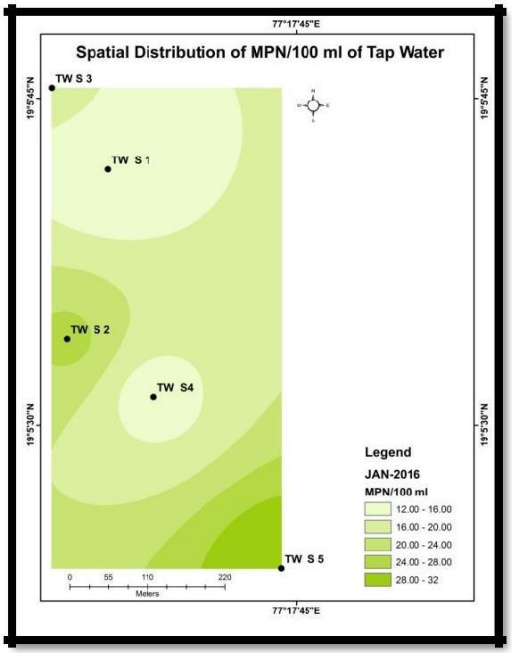



**Figure 10**

**Figure 9 & 10:** Showing the spatial distribution of MPN/100 ml of October, 2015 and November, 2015

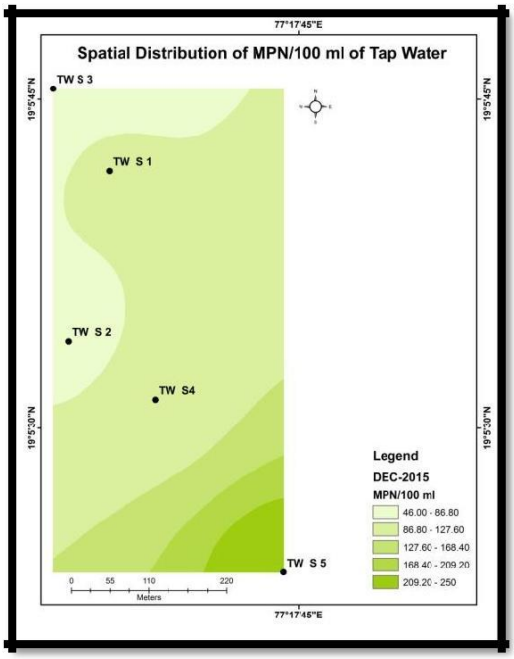



**Figure 11**

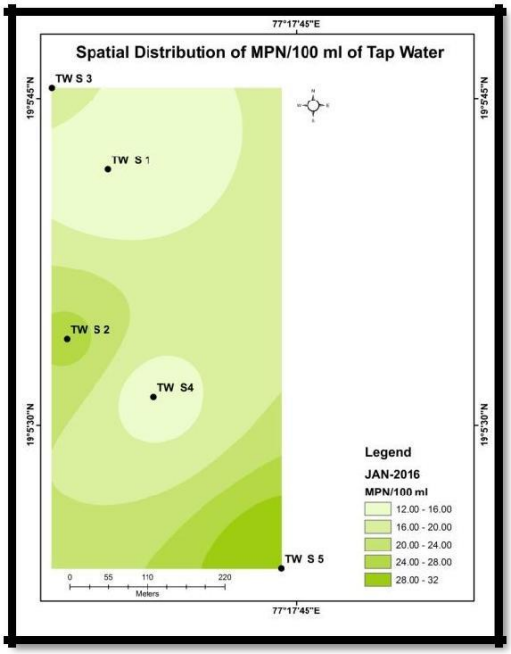
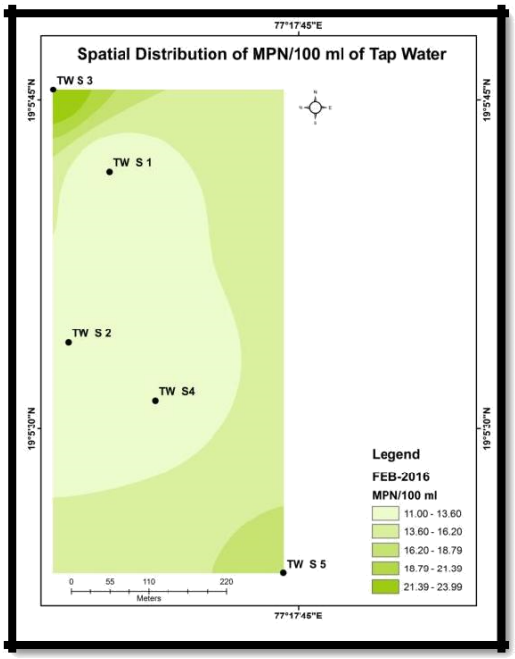



**Figure 12**

**Figure 11 &12**: Showing the spatial distribution of MPN/100 ml of December, 2015 and January, 201



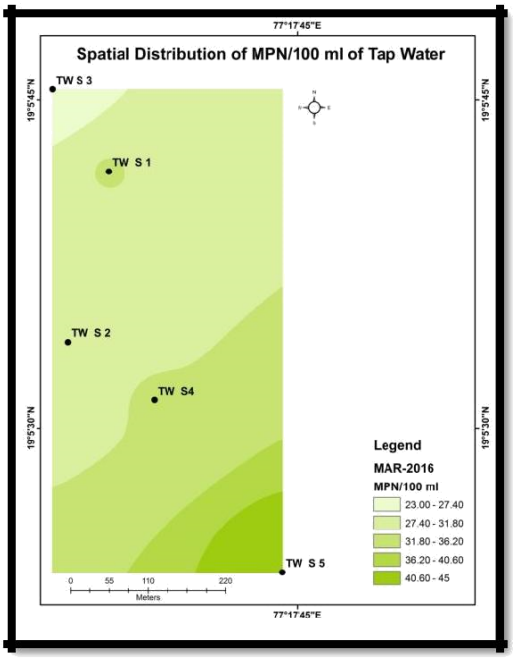
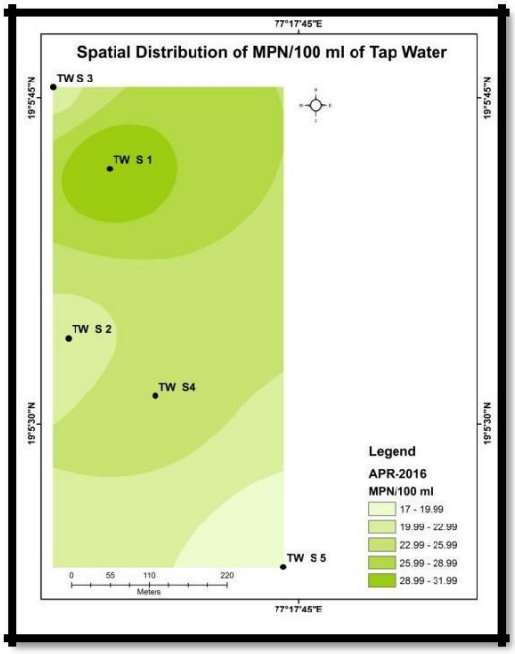




**Figure 13** **Figure 14**

**Figure 13 & 14:** Showing the spatial distribution of MPN/100 ml of February, 2016 and March, 2016



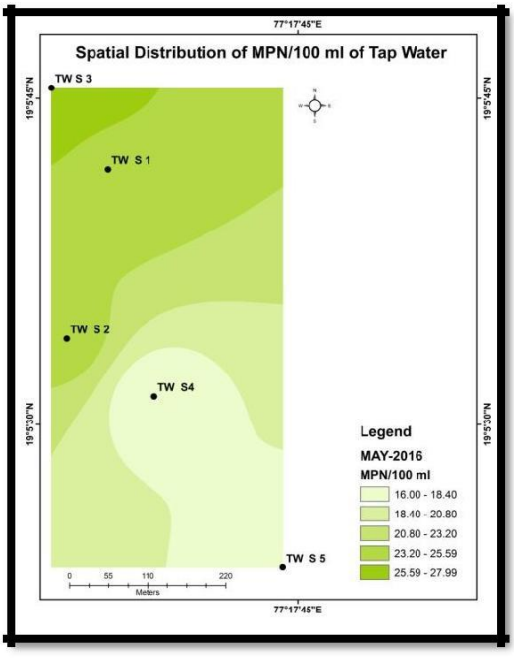




**Figure 15** **Figure 16**

**Figure 15 & 16:** Showing the spatial distribution of MPN/100 ml of April, 2016 and May, 2016

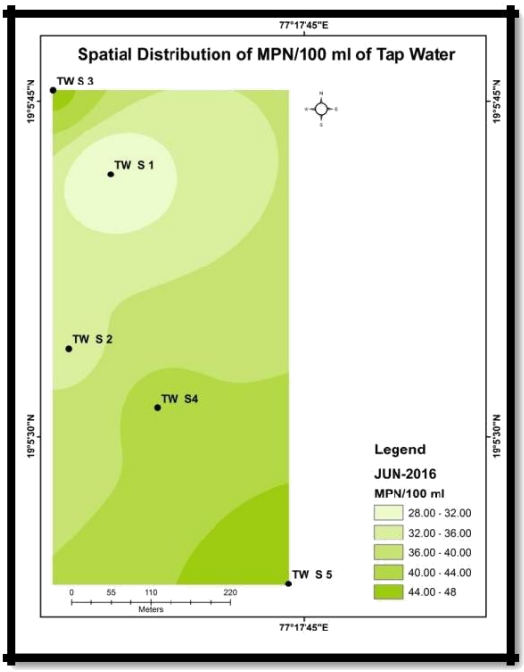



**Figure 17**

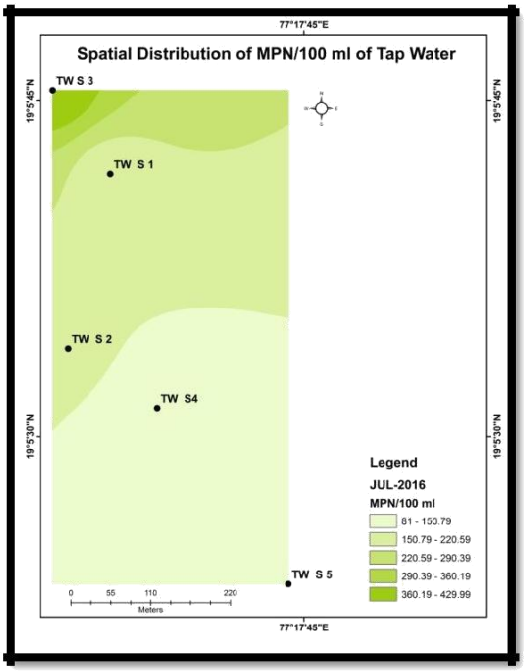



**Figure 18**

**Figure 17 & 18:** Showing the spatial distribution of MPN/100 ml of June, 2016 and July, 2016

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