iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3077

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Water Supply Scheme for Kakkalampara, Marady Panchayath in Ernakulam District, Kerala

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Abstract: ***Water is the most essential requirement of our life. Apart from using the water for domestic needs, water resource has been the most widely exploited natural system since man occupied this earth. The use of water is increasing rapidly with the growth of population and there is an acute shortage of both surface and underground water due to many manmade activities. Therefore proper management of water usage has a great importance. This paper focuses on study of population, source of water supply, water demand, design of pump set and pump main .This provide information regarding demand and availability of water.***

Keywords: ***Surface water; water quality; water supply; water treatment scheme***

I. INTRODUCTION

In order to fulfill the water demand of the continuously growing population, we need to provide the sufficient and uniform quantity of water through the designed network of pipes known as water supply system. Requirements for public, commercial, and industrial activities should be met by the water supply system. Both quality and quantity requirements must be fulfilled by water in all the cases. Water demand comes from the agricultural, industrial, and domestic sectors. Agriculture accounts for the greatest use and consumption of water worldwide. Population forecasting can be done by various methods including Arithmetical increase method, Geometrical increase method, Incremental increase method, Simple graph method, Decrease rate of growth method etc. Among this the geometric increase method is a simple realistic population model based on past information. The continuous and cumulative nature of population growth can be described by this method.

II. LITERATURE REVIEW

To design water supply system it is important to determine present population of the area to be served. Normally, a design period of 20 to 40 years is selected. So population after 20 to 40 years has to be forecasted. A study on population forecasting method was conducted by Dinesh W. Gawatre1 ,Mahesh H. Kandgule, Shankar D. Kharat. Geometric increase method is a simple realistic population model based on past information. In this method it is assumed that the percentage increase in population from decade to decade is constant. From the population data of previous three or four decades, the percentage increase in population is found and its average is found, the population Pn after n decade is given by ,

$Pn = P [1+ (Ig / 100)]^n$

Ig = average increase for decade

P = present population

n = number of decades

Dr. Jayeshkumar Pitroda (2014) carried out analysis of circular and rectangular overhead water tank . Elevated tanks have many advantages. Elevated tanks do not require the continuous operation of pumps. Short term pump shutdown does not affect water pressure in the distribution system since the pressure is maintained by gravity. And strategic location of the tank can equalize water pressures in the distribution system. However, precise water pressure can be difficult to manage in some elevated tanks .

In design of circular water tank using staad pro by S R Madhuri and B Sri Harsha structural analysis of columns and braces in the supporting frame work overhead tanks for gravity, wind and earthquake loads in compact form to minimize the calculation and also to visualize the effect on various parameters like number of columns, number of braces etc.

III. METHODOLOGY

A. Data Collection for Population Estimation

Water demand can be estimated by studying two factors in detail that is ,rate of demand and population. The demand of water can be divided into five categories including domestic purpose, public purpose, industrial purpose, business purpose, loss and waste. To

estimate rate of demand each category is worked out. The term population indicates total number of people residing in an area. The present population is obtained by referring to the statistics of census record prepared by local body. Geometrical increase method is suitable for normal condition and is a realistic population model which accurately describes the nature of population growth. The decennial increase in population is 7%.

TABLE I
CALCULATION OF FORECASTED POPULATION

Population as per 2011census	Forecasted population in 2037
650	744

B. Water Demand Calculation

TABLE II
CALCULATION OF DESIGN WATER DEMAND

Water Demand in 2017	Design water demand
0.07 mld	0.10 mld

C. Provision

Inorder to meet the requirement of the area ,three overhead tanks are to be provided with 40,000 litres capacity each.

D. Study Area

Marady is a village in Ernakulam district near Muvattupuzha. The total geographical area of village is 1793 hectares. Marady has a total population of 17,176 peoples. There are about 4,255 houses in Marady village. Kakkalampara is in Marady panchayat belonging to Ward No.IX.Kakkalampara is an elevated area and so people living at height often finds difficult to get required amount of water for their day to day activities.At the same time the land is having hard rock so no possibility of digging new well.The only option is to make use of existing water source.For the water supply project in Kakkalmpara a pond of 8cent is suitable to serve as source of water.Since distribution lines are already laid for public supply no extra lines are to be designed. Pumbing main and pump set are to be designed.There is no industrial unit present in the area and so pollution of water by industrial waste doesnot exist.However quality test and analysis of the source water has to be done .Most of the people in the area are agricultural labours.

E. Tests for Water Quality Analysis

1) Determination of Alkalinity: Phenolphthalein alkalinity = 0 mg/L Methyl orange alkalinity = 300 mg/L

As per IS 10500-1991 the desired limit of alkalinity is 200 mg/l under permissible limit is 600 mg/l since the obtained value of alkalinity is within the specified limits, the sample can be used for drinking purpose with respect to alkalinity criteria.

2) Determination of Acidity : Mineral acidity = 80 mg/L

Total acidity = 0 mg/L

Since mineral acidity is present, treatment should be provided for the water sample.

3) Determination of Dissolved Oxygen : The amount of dissolved oxygen present in the water sample is found to be 8.5 mg/L.The amount of atmospheric oxygen in fresh water should in between 14.6 mg/L (0°C) – 7 mg/L (35°C).Since the obtained valve is within the range, the sample can be used for drinking purpose.

4) Determination of MPN of Faecal Coliform : Water containing faecal coliforms will produce gas in 24 hours when inoculated in A broth and incubated at certain temperature. The water sample was found to be free from faecal coliforms.

5) Determination of Residual Chlorine: Residual chlorine content in the sample is 0mg/L.As per IS 10500-1991,the desirable limit of residual chlorine is 0.2 mg/L. Since the obtained value is less than the limit specified limit,the water sample is safe for drinking purpose with respect to residual chlorine content.

6) Determination of Chloride: Chloride content in the given sample is 0.506 mg/L .As per IS 10500-1991, desirable limit of chloride content in drinking water is 250 mg/L .Since the obtained value is less than the specified limit, the water is safe for drinking purpose.

7) Determination of Hardness: Hardness of the given sample is 7.5 mg/L.As per IS 10500-1991, the desirable limit of hardness is 300 mg/L. Since the obtained value is less than the specified limit, it is safe for drinking purpose.

8) Determination of Turbidity: Turbidity of the given sample is 30 NTU.As per IS 10500-1991 , the permissible limit of turbidity is 5 NTU. Since the value of turbidity is above the specified limit ,treatment is required for the sample.

10) Determination of Sulphates: Amount of sulphate present in water sample is 21.55 mg/L.As per IS 10500-1991 the desirable and permissible limit of suphete is 200 mg/L and 400 mg/L respectively. Since the obtained value is within the specified limits , the water is suitable for drinking purpose.

11) Determination of Ph: The pH value obtained for the sample is 7.The desirable limit of pH for drinking water is 6.5 – 8.5.Since the obtained value of pH is 7 ,the water sample is safe for drinking purpose.

F. Design of Pumping Main

Pumping main is the length of pipe from source to overhead tank. The design of pumping main is as follows:

The velocity of flow is assumed as 1 m/s.

Length of pumping main = 564 m
Water demand = 0.10 mld
Average hours of pumping = 5 hrs
Effective discharge = (0.10 x 24) / 5 = 0.48 mld
Rate of pumping = (0.48 x 1000000) / (24 x 60 x 60) = 5.56 lps

G. Design of Pump Set

With the consideration of availability of space, economy, ease of maintenance centrifugal pump is found to be suitable.

Static head including 2m residual head=39m
Loss of head = 6.76 m
Minor loss = 0.67 m
Total loss = 47 m
Rate of pumping = 5.56 lps
HP of pump set = (5.56 x 47x 100) / (75 x 70) = 4.97 HP

Thus 10 HP centrifugal pump set is provided.

IV.CONCLUSIONS

The study on population and water demand have provided the water requirement of the area. Detailed study about the study area helped to provide adequate solution for the problems faced by the people in the area. Quality of the source could be determined by conducting proper quality analysis and the water is found to be of good quality. A properly dimensioned pump set and pumping main were designed for the area.

V. ACKNOWLEDGMENT

We are thankful to our paper guide and Mr Daniel A V ,Assistant Professor ,Civil Engineering Department, Viswajyothi College of Engineering and Technology for their guidance, motivation and constructive suggestions that are helpful for us in the execution of this paper. We are also thankful to the Marady Panchayath members for providing necessary information regarding population for the study.

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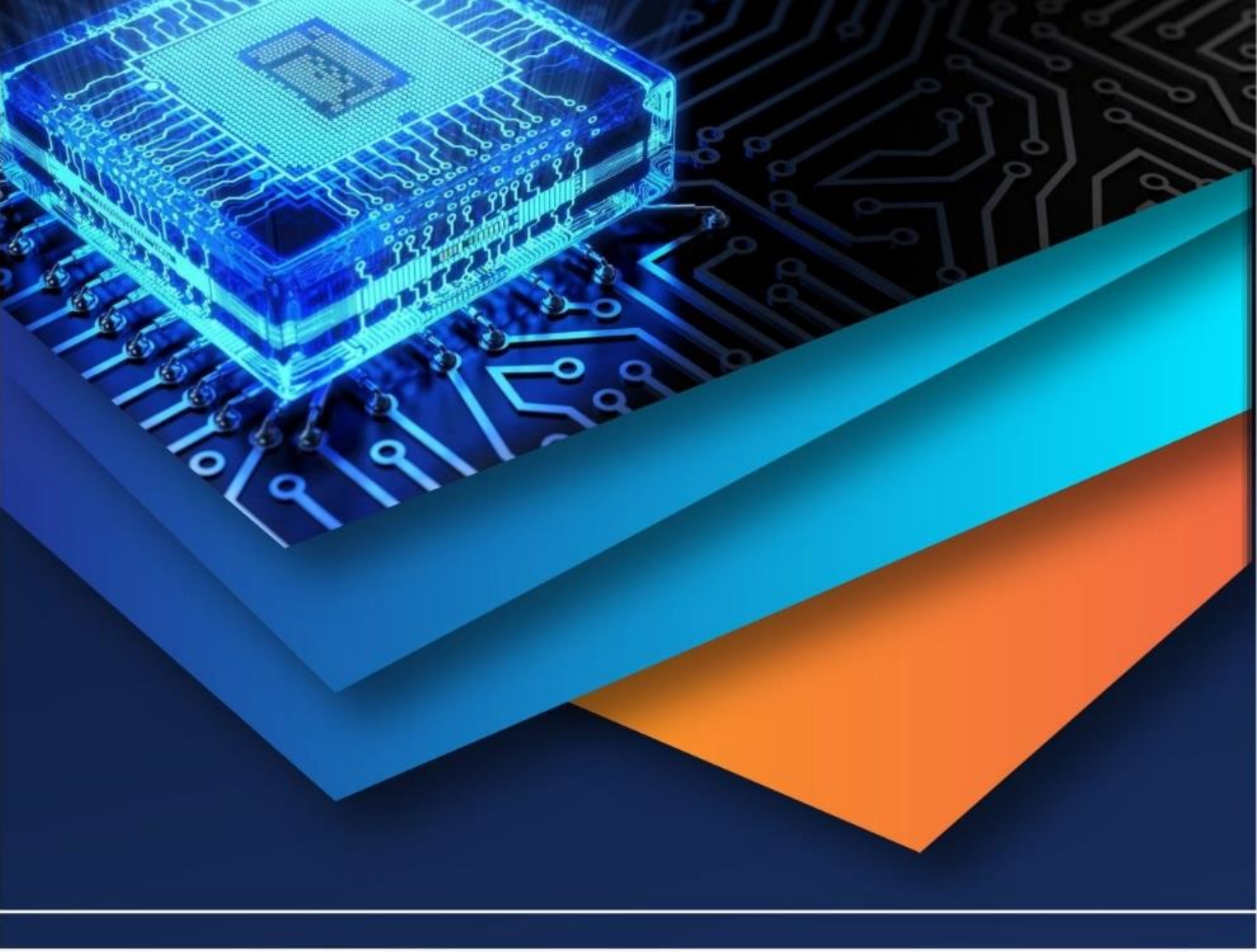

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