

# Determination and workout of morphological characteristics of Makhamalabad mini watershed in Nashik district of Maharashtra

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Received : 03.12.2016; Revised : 17.03.2017; Accepted : 24.03.2017

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■ **ABSTRACT** : The study was carried out on the preparation of contour map for Makhamalabad site and to determine the morphological characteristics of Makhamalabad mini watershed. Topographic surveying and planning was done for Makhamalabad farm. The watershed selected for the study is located off Peth road at Makhamalabad village of Nashik district. The area of watershed undertaken to study is 4.2 ha. Survey was carried out with grid spacing of 20 m. Contour interval was taken of 1 m. From the study of watershed characteristics it was seen that the watershed has fan shape with small catchment area of 4.2 ha, with stream order 1. The drainage density was 0.051 km per sq km. which was relatively very less. So, runoff from catchment was also less. Time of concentration was 3.44 min. It is seen that the watershed has stream order 1. There were more streams per unit area. The drainage density was 0.051 km/km<sup>2</sup>. Thus, the average length of overland flow was more. The area of watershed was less so also the slope and length of stream. This has resulted in higher time of concentration, which was 3.44 min. The length-width ratio was also higher.

■ **KEY WORDS** : Watershed, Drainage density, Catchment, Time of concentration, Contour interval

■ **HOW TO CITE THIS PAPER** : Tiwane, Ashwini P., Kadam, Mahesh M. and Shinde, P.T. (2017). Determination and workout of morphological characteristics of Makhamalabad mini watershed in Nashik district of Maharashtra. *Internat. J. Agric. Engg.*, **10**(1) : 130-132, DOI: 10.15740/HAS/IJAE/10.1/130-132.

Water is an elixir of life; its demand has increased over the years, which warrants the assessment of quality and quantity of water for its optimal utilization. The water and land management on watershed basis has scientific proven base, which helps in increasing the productivity, along with sustainable utilization of resources. Watershed is natural hydrological entity where water flows in a definite path. Geomorphologic conditions are essential pre-requisite in understanding water bearing characteristics of hard rocks. The morphometric parameters of a watershed govern its hydrological response to substantial extent. Non cultivated land is concerned, the pasture land are

taken in to consideration for determining the soil conservation strategies. The pasture lands are covered by dense grass cover and normally not have the soil erosion problem. Erosion problem in this land mainly arises, when the vegetative cover is removed either through grazing or excavated by drought and excessive burning. For such land, the control of erosion is mainly achieved by the use of agronomic measures and soil management techniques.

The present project was, therefore, undertaken with the following objectives :

- Preparation of contour map for Makhamalabad site.

– To determine the morphological characteristics of Makhmalabad mini watershed.

## ■ METHODOLOGY

The watershed selected for study is located at Makhmalabad village of Nashik district. Total area undertaken for study was 10 ha. An actual area of watershed which was delineate from study area 4.2 ha. Grid survey system to be establishing for over field and set takes at grid point usually grid spacing was 30 m in each direction. Watershed characteristics of the catchments under study will be determined from the contour map of watershed. These characteristics are defined as follows:

### Stream order:

When overland flow forms a stream that stream is given order one. When two streams of the same order meet together they form stream of next order.

### Stream length ratio(RL):

It is the ratio between mean length of stream of particular order and mean stream length of next higher order.

### Bifurcation ratio (Rb) : $Rb = Nu/Nu+1$ :

It is ratio of number of streams of particular order and number of streams of next higher order

where,

$Nu$  = Number of stream segment of given order

$Nu+1$  = Number of stream segment of next higher order.

### Average slope of watershed (Sa) : $Sa = H.Lca/10.a$

It is determined using the relationship

where,

$Sa$  = Average slope of watershed in per cent

$H$  = Maximum watershed relief, m

$A$  = Area of watershed, sq. km

$Lca$  = Average length of contour, km

$Lca$  can be computed as follows :

$$Lca = dLci/n$$

where,

$Lci$  = Length of contour, km

$N$  = Number of clearly identifiable

### Form factor (ff):

It is ratio of area to square of the length of watershed.

$$Ff = \text{Area of watershed} / (\text{Length of watershed})^2$$

## ■ RESULTS AND DISCUSSION

The watershed was delineated with the help of contour map. The morphological characteristics of the watershed were determined from the contour map. This chapter gives a brief account of data collected from the site by grid survey, contour map prepared from there data and morphological characteristics of watershed determined from contour map.

### Morphological characteristics of watershed :

Watershed characteristics influencing the runoff are given in Table 1. These characteristics help to know the hydrological behaviour of the watershed. From the table, it is seen that the watershed has stream order. There were more streams per unit area. The drainage density was 0.051 km/km<sup>2</sup>. Thus, the average length of overland flow was more *i.e.* 210 m. The area of watershed was less, hence, the slope and length of stream were less. This has resulted in more time of concentration. The length-width ratio was more than unity.

Topographic surveying and planning was done for Makhmalabad farm. The watershed selected for the study is located off Peth road at Makhmalabad village of Nashik district area of watershed undertaken to study was 4.2 ha. Survey was carried out with grid spacing of 20 m. Contour interval was taken of 1 m. Demarcation

**Table 1 : Watershed characteristics influencing the runoff**

Sr. No.	Morphological characteristics of watershed	No. / value
1.	Area, ha	4.2
2.	Stream order	1
3.	Length width ratio	1.05
4.	Stream length ,m	215
5.	Relative relief	1.678
6.	Average watershed slope %	0.95
7.	Stream frequency no. of stream/ sq. km	$2.38 \times 10^{-5}$
8.	Drainage density, km/sq. km	0.051
9.	Drainage factor	0.091
10.	Max. basin length, m	210
11.	Shape index	1.05
12.	Form factor	0.9523
13.	Time of concentration, min.	3.44

was done according to contour lines. It was seen that the watershed has long shape. Streams were marked on the contour map. Total stream length and stream orders were measured.

By using the map all other morphological characteristics were studied and analyzed. These characteristics were most useful while computing the runoff from catchment area. Most of the design procedures of soil and water conservation measures do need morphological characteristics of watershed. Slope of watershed, shape of watershed, drainage density and time of concentration were relatively most necessary characteristics to select the measure of soil and water conservation. These characteristics help to know the hydrological behaviour of the watershed. Balasubramanian and Sivanappen (1981); Bali (1980); Nag and Chakraborty (2003); NookaRatnam *et al.* (2005) and Reddy *et al.* (2002) also worked on the related topic and the results found were more and less similar to the present investigation.

### Conclusion :

*Watershed characteristics helped to know the hydrological behavior of the watershed :*

Morphological characteristics were studied and analyzed.

From the study of watershed characteristics it was seen that the watershed has fan shape with small catchment area of 4.2 ha, with stream order 1.

The drainage density was 0.051 km per sq km. which was relatively very less. So runoff from catchment was also less. Time of concentration was 3.44 min.

It is seen that the watershed had stream order 1.

There were more streams per unit area. The drainage density was 0.051 km/km<sup>2</sup>. Thus, the average length of overland flow was more. The area of watershed was less so also the slope and length of stream. This has resulted in higher time of concentration, which was 3.44 min. The length-width ratio was also higher.

The watershed had 'Fan shape'. That means the peak rate of runoff was higher in short time duration. The slope of watershed was steep in middle half side opposite to outlet.

So in that side of watershed runoff was maximum.

Therefore, soil and water conservative measures such as terracing, staggered trenches etc. should be done in this segment of watershed. But in middle half side at outlet of watershed has gentle slope, so strip cropping should be done.

The strip crops check the runoff and force them to infiltrate into the soil, thereby facilitate the conservation of rain water.

To divert the runoff from main stream, grassed waterways were adopted. It is essential to make survey and study the morphological characteristics of watershed before planning, designing and executing the works of mechanical control of soil erosion. Therefore, determination of watershed characteristics is a pre-requisite for any watershed development programme.

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