IJFANS International Journal of Food and Nutritional Sciences
ISSN PRINT 2319-1775 Online 2320-7876, www.ijfans.org
*Research Paper* © 2012 IJFANS. All Rights Reserved, UGC CARE Listed ( Group -I) Journal Volume 11, Iss 3, Mar 2022

# MORPHOMETRIC CHARACTERISTICS OF VEL RIVER BASIN, MAHARASHTRA

**Priyadarshani More**
Dept.of Geography Dr. Babasaheb Ambedkar ASC College, Mahad

**Abstract**

Quantitative analysis of the basin geometry has been attempted for the Vel River Basin, sub-basin of Bhima River basin. The quantitative parameters worked out include the linear, areal and relief aspects. The significance of this study is to understand the drainage network relationship and to suggest the means of better utilization of water resources in the basin.

**Keywords**: Linear aspects, Areal aspects, Relief aspects

**Introduction:**

Drainage basins are the fundamental units of the fluvial landscape. The term morphometry is used in several disciplines to mean the measurement and anaysis of form characteristics. In geomorphology it is applied to numerical examination of landform, which may be more properly termed geomorphometry. This morphometry essential because every drainage basin unit differs in shape, size, area, relief and gradient from other basins. If these features can be measured using some form of mathematial analysis then it is possible to describe accurately the morphology of a region. Systematic description of the geometry of a drainage basin and its stream channel system requires measurement of linear, areal and relief aspects of drainage network.

**Aims and Objectives:**

1) To understand the morphometric characteristics of Vel Riverbesse areal and relief aspects)
2) To understand the morphometry of Vel river which originates in low and at plateau region.

**Study Area:**

The Vel River is a tributary of Bhima River with most of its catcheners in and zone in Upland Westem Maharashtra. The river flows over the platesu reggon y known as Peth Pathar. The Vel River with a length of 64 kms has its source about 15k upstream of Peth, near Matewadi, on the 700 mts denudational surface. This surface forms the divide between the Bhima and Ghod rivers. The Vel River therefore lacks a catchment in the high rainfall Western Ghats zone unlike the Bhima, Mula-Maths and Indrayani, Talegaon Dhamdhere is on the Vel about 8 kms from its confluence with the Bhima. Its most of catchment in the semi arid zone in Upland Western Maharashtra and it form an elongated shaped basin. The total area under basin is about 200 sq.kma

Geographically, the Vel basin extends between 18° 35'N to 18° 45°N 74 5' E to 74° 15' Elngitude. The highest attitude is 1078 mts. The river flows through the total 34 villages and its flow direction is from west to cast direction.

**Database and methodology:**

The Vel River basin was demarcated from the Survey of India (50f) toposheet of 1:50000 scale. The parameters of morphometric characteristics were analysed using the standard techniques followed by several pioneers in the field such Horton (1945) Strahler (1964), Schulz (1976), Miller (1953), Schumm (1956), Stoddart (1965), Melton (1957), Langbein (1947), Morisawa (1985).

**Results and Disscussion:**

**A) Linear Aspects**

1) **Stream Order**: There are different methods of designating the stream order however, the modified method of Strahler (1952) is adopted for the present analysis, and the number of segments of each order are tabulated in table 1. The Vel basin is a fifth order basin with 430, 90, 26, 4 and 1 segments in first, second, third, fourth, and fifth order respectively. It means these stream segments change with increasing order. There are decrease in stream segments with increase in stream orders, which has been clear from fig no.1.

2) **Rb** :It is observed that there are more number of channels of a particular order than the next higher order. This observation leads to the recognition of bifurcation ratio (Rb), which is the ratio between the number of a given order (Nu) to the number of segments of the next higher order (Nu + 1). Mathematically the bifurcation ratio (Rb) is given by the following formula:

Rb-Nu/Nu+1

The Rb for each set of streams has been calculated and presented in table no. 1. The bifurcation ratio of the Vel basin is 4.68 (fig.2), which indicates the mature stage.

*Research Paper* © 2012 IJFANS. All Rights Reserved, 

3) **Length of main channel**: This is the length along the longest water course from the outflow point of designated subbasin to the upper limit to the catchment boundary Various methods used for length measurement from topographic maps. For measuring the length of Vel River, the thread length method is used. The total length of Vel Riveris 64 km.

4) **Stream legths** (Lu): The stream length has an importat relationship with the surface flow discharge, longer the length slower the appearance of flood and larger the surface flow.

Horton observed that mean length of channel segments of a given order is smaller than that of higher order in a particular ratio called "length ratio", which is defined as the ratio of mean channel length of an order (Lu) to that of lower order (Lu+1). Mathematically the length ratio (RL) is given by the following formula:

RL Lu/Lu+1

The length ratio of the Vel basin is 1.77 and the values are presented in table no. 1.

In the case of Vel basin when the order of streams plotted against the cumulative mean length of streams forms a direct geometric sequence by increasing systematically with order and thus confirms Horton's (1945) law of stream length.

**Table No. 1 Morphoetry (Linear Aspects) of Vel River**

| Stream Order | Stream Number | Length Ratio 'RL | Bifurcation Ratio Rb | Total Length (in km) |
|---|---|---|---|---|
| 1 | 430 | 4.77 | 1.29 | 297.31 |
| 2 | 90 | 3.46 | 0.69 | 80.65 |
| 3 | 26 | 2.15 | 0.89 | 49.75 |
| 4 | 4 | 6.5 | 0.91 | 14.4 |
| 5 | 1 | 3.6 | 1.88 | 64 |

1**) Basin Perimeter**: Basin perimeter is an iportant linear aspect of the morphometry It can be defined as the length of the water divide of the catchment area of the basin. It also determinant factor of the size of the drainage basin. The basin perimeter of Vel basin is 129.5 km.

2) **Relative Perimeter**: The value of the relative perimeter has been calculated with the help of following expression. Rative Perimeter P/A The relative perimeter of Vel is 63.04 km.

**B) Areal Aspects :-**

**Drainage Area (A):**Drainage area represents the area enclosed within the boundary of the watershed divide. The drainage area (A) is probably the single most important watershed characteristic for hydrologic design. It reflects the volume of water that can be generated from rainfall. The area of the whole basin is 266 sq.km.

1) **Drainage Density (D)** : Drainage density is defined as the ratio of the total length of channels of all orders in a basin to the area of the basin. It is derived by using the formulai.c. D=Lu/Au

The drainage density of Vel basin is 1.66 which is very low because this basin is mostly in semi-arid zone and due to plateau region there are slope is also gentle. So the development of stream segments in this basin is more or less affected by rainfall, temperature, gradient and vegetation.

2) **Constant of Channel Maintenance:** A measure of reciprocal of drainage density used by Schumm (1956) is termed as constant of channel maintenance. It is defined as the ratio between the area of a drainage basin and the total length of all the channels expressed in square meter per meter. It is equal to the reciprocal of the drainage density and it is an inverse function of drainage density. It is expressed as follow: C="L/A The constant of channel maintenance of the Vel basin is 0.6016. it is found that in the semi-arid climatic environment the constant of channel maintenance is low.

3) **Stream Frequency**: Stream frequency is defined as the number of streams per unit area in a drainage basin. It is also computed by the formula1.e. F="Nu/Au The stream frequency of Vel basin is 2.06, so the texture of the drainage net is medium quaity.

4) **Circularity Ratio**: The circularity ratio and form factor are the measurements to analyse the outline form of the basin. The circularity ratio is the ratio of the basin area of a circle having the same perimeter as the basin. The value of this ratio approaches 1 as the shape of the basin approaches a circle. It is calculated from the following relationship

RC= Area of basin/Area of Circle=4zA/P

The circularity ratio of Vel basin is 0.19 therefore it is not more circular shaped basin then it is more elongated shaped basin because value is less than 1.

*Research Paper* © 2012 IJFANS. All Rights Reserved, 

**C) Relief Aspects:** The parameter converging the relief aspect of the basin and channel network are as follows:

1) **Basin Relief (H):** Relief of a basin is the maximum vertical distance from the stream mouth to the highest point on the divide. The total relief (H) of Vel basin is 538 meter.

2) **Relief Ratio (Rh)** : Relief ratio is the ratio between total basin relief (ie, difference in elevation of basin mouth and summit) and basin length, measured as the longest dimension of the drainage basin. It is calculated by using following formula: Rh =H/Lb The relief ratio of Vel basin is 9.78.

3) **Ruggedness Number (Rn):** Ruggedness number is a product of relief (H) and drainage density (D) where both terms are in the same units. This dimensionless measure combines slope and length characteristics into one expression: Rn HD. So, the ruggedness number of Vel basin is 893.08.

4) **Relief**: Relief can be defined as the difference in elevation of any part of the surface. It can be expressed in two ways: Absolute Relief ii) Relative Relief

**Relative Relief:** Relative relief is the difference between highest and lowest height in inch sq.grid. The relative relief of Vel basin is divided into 5 categories. These are as following:

0-150 m, 150-300 m, 300-450 m, 450-600 m and More than 600 According to map the hilly relief (600-1078 m height) is seen in upper reach part and small hills and plateaus like topography having 450 to 600 m height is seen is middle reach pat whereas the flat topography is seen in lower reach part.

5) **Hypsometric Curve:** Hypsometric analysis or the relation of horizontal crones sectional drainage basin area to elevation, was developed in its modern dimensionless form by Langbein and others (1947). The hypsometric (Area-Altitude) analysis is rela with the ground surface and altitude. A hypsometric curve is the graphical representat showing the basin areas on abscissa situated above various altitudes. Langbein (194 first used such study to collect hydrologic data and (Strahler, 1964) popularized the method. This is an ogive or cumulative- frequency curve, which represents the absolute or relative areas of land above or below each contour. The mean height of land and the mean depth of sea occur as two steps on the hypsometric curve of the earth's surface.Hypsometric curve of Vel basin suggests vertical slope at the source region, concavity and the lower part shows convexity.

6) **Channel morphometry**: Channel morphometry includes various parameters like width, depth, velocity, volume of water, river competence, sediment flow of water etc. Generally there are many interrelations among these parameters. The increase in width decreases the velocity so that erosion decreases. The increase in depth and decrease in width increases the velocity of stream. When width increases and depth decreases then there depositional work becomes active. While studying the channel morphology of Vel River, the width and depth of channel are measured. The W/D ratio has been calculated as shown in table no. 3

**Table No. 3 W/D Ratio of Vel River Channel**

| Sr.no. | Sites | Width | Depth W/D ratio |
|---|---|---|---|
| 1 | Karegaon | 11 | 3.66 |
| 2 | Bhaodi | 10 | 2.5 |
| 3 | Kolharwadi | 7 | 2.33 |
| 4 | Kurwandi | 20 | 3.33 |
| 5 | Pargaon | 98 | 29.3 |
| 6 | Wafgaon | 50 | 12.5 |
| 7 | Pimpalwadi | 60 | 12 |
| 8 | Shikrapur | 67 | 13.4 |
| 9 | Vitthalwadi | 69 | 17.25 |

**Compiled by Author**

According to table no. 3 it can be concluded that the channel width of Vel River has been increased to downstream direction (from source to mouth) lo upper reach part of the basin (till Pargaon) the width of channel is narrow and depth is increased so the velocity is more in this region therefore the big boulders are soon in this zone. After this the channel width increased but the change in depth is negligible. So the sediment transport capacity decreased from middle reach zone. As well as the erosion capacity also decreased However there are no gradation even near its confluence because the potholes and flutemarks are also well developed in this bedrock in lower reach at Bhairav temple.

**Conclusion:**

After studying the morphometric characteristics of Vel River it can be concluded that the basin obeys the laws of stream numbers, stream length and the stream areas of Horton. It is a fifth order basin with a drainage density of 1.66 km/sq.km., which is a course textured basin. The Vel is elongated shaped

*Research Paper* © 2012 IJFANS. All Rights Reserved, 

basin. Lineament is straight so there is no existence of geologic changes in the basin. The rate of headward erosion is active in source region therefore it can be concluded that there are some possibilities of river capture in this zone.

**References**:

1. Abrahm's, A.D. (1984): "Channel networks: A geomorphological Perspective", Water resource research, 20, 161-168.
2. Bloom, A.L. (1979): "Geomorphology: A systematic analysis of late Cenozoic landforms", Prentice Hall, New Delhi.
3. Embleton, C. and Thomes, (1980): "Process in Geomorphology", Arnold Heinemann pub, New Delhi.
4. Gregory, K.J: and Walling, D.E. (1973): "Drainage basin form and process, London; Arnold.
5. Horton, R.E. (1932): "Drainage basin characteristics", Trans Am. Geophys Union, Vol. 13, pp.350-360.
6. Leopold, L.B., Wolman, M.G and Miller, J.P. (1964): "Fluvial processes in geomorphology", Freeman and Co., San Francisco, 522pp.
7. Strahler, A.N. (1964): "Quantitative geomorphology of drainage basins and channel networks", In V.T. Chow (ed.), Handbook of Applied Hydrology pp.39-76.