ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

ANALYSIS OF MORPHOMETRIC PARAMETERS OF A PAVANA RIVER BASIN, INDIA USING ASTER (DEM) DATA AND GIS

P.P. Choudhari
Assistant Professor, University Department of Geography, University of Mumbai, Mumbai 400098, India
Dr. A.S. Jadhav
Professor & Head,
University Department of Geography, University of Mumbai, Mumbai 400098, India

ABSTRACT

In this present paper, an attempt has been made to study the detail morphometric characteristics of Pavna River watershed, which is a part of the Bhīma River basin in Pune district, Maharashtra. For detailed study used ASTER data (acquired from USGS website) for preparing digital elevation model (DEM), and geographical information system (GIS) was used in evaluation of linear, areal and relief aspects of morphometric parameters. Quantitative Morphometric analysis has been carried for all aspects of Pavna watershed. Watershed boundary, flow accumulation, flow direction, flow length, stream ordering, slope Map, Elevation Map have been prepared using Surface and Arc Hydro Tool in ArcGIS 9.3 software. In this paper there are more than 40 morphometric parameter computed for all aspects. The drainage density of the watershed is 1.93 km/km^2 which indicate very low presence of permeable subsurface formation, dense vegetation and low relief. It is 5th order drainage basin and drainage pattern is dentric type. This studies would help the local people to utilize the resources for sustainable development of the basin area also it would useful for planning for rainwater harvesting and watershed management.

Keywords: ASTER (GDEM), Pavna Watershed, Remote sensing, GIS, Deccan plateau

1. INTRODUCTION

Population pressure is increasing day by day in India on water resources. Drainage basin or watersheds are fundamental units for administrative purposes to conserve or preserve natural resources. Soil and water conservation are the key issues in watershed management while demarcating watersheds. Water resources development plays an important role in the economic and social development of any Nation. Watershed is the area covering all the land that contributes runoff water to a common point. It is a natural physiographic or ecological unit composed of interrelated parts and functions. Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms (Agarwal, 1998; Obi Reddy et al., 2002). A major emphasis in geomorphology over the past several decades has been on the development of quantitative physiographic methods to describe the evolution and behavior of surface drainage networks (Horton, 1945; Leopold & Maddock, 1953; Abrahams, 1984). The morphometric characteristics at the watershed scale may contain important information regarding its formation and development because all hydrologic and geomorphic processes occur within the watershed (Singh, 1992). Morphometric analysis of a watershed provides a quantitative description of the drainage system, which is an important aspect of the characterization of watersheds (Strahler, 1964). In recent years, remote sensing and GIS technique has been emerged as an important tool for river morphometric analysis. Geographical information system is a powerful tool in the assessment of terrain and morphometric parameters of the watershed.

Assessing various terrain and morphometric parameters of the drainage basins and

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

watersheds, as they provide a flexible environment and a powerful tool for the manipulation and analysis of spatial information. The Present study is an attempt to evaluate different morphometric parameters like linear, areal and relief aspects etc. The linear aspects include stream order, stream length, mean stream length, stream length ratio, bifurcation ratio etc. and areal aspects include drainage density, stream frequency, infiltration number, texture ratio/, form factor, basin shape, circulatory ratio, length of overland flow, fitness ratio and drainage pattern. The relief aspects like relief ratio, ruggedness number and slope.

Basin based natural resources system management in mountain region are gaining attention day by day it is accepted by government and community organization. Watershed management is a typical Morphometry and Geomorphologic activity that utilizes DEM (subyani et al., 2010). Drainage basin analysis based on morphometric parameters is very important for watershed planning since it gives an idea about the basin characteristics in terms of slope, topography, soil condition and runoff characteristics, Surface water Potential etc. (H Chandrashekar, M. Sameena). There are some conventional techniques of surveying but they are time consuming and possibility of error because of manual operation. Nowadays GIS technique is used to determine various parameters of drainage basins using spatial analyst tool this will be done in flexible environment. In this present study GIS technology used to calculate parameters of morphometric characteristics of the Pavana river watershed.

2. STUDY AREA

The study area is a Pavana river watershed sub catchment of Bhīma river basin. It is located in the Pune district of Maharashtra state. The study area is shown in fig 1. Pavana River originates at Lonavala and meets to Mula River at Sangavi in pune city. The area is bounded between E longitude - 73^0 24' 00'' to $73^0$52'10'' and 18^0 35' 15'' to 18^0 44' 15''N Latitude covered of pune district on Aster DEM. The study area falls more than 200 cm rainfall region of western part of Maharashtra. The river flows from less urbanized areas to dense urbanized areas. The land use of the catchment area is agricultural, urban and industrial area. In this catchment most of the area is commercial agriculture and intensive chemical fertilizers has resulted ground water and salt contamination.

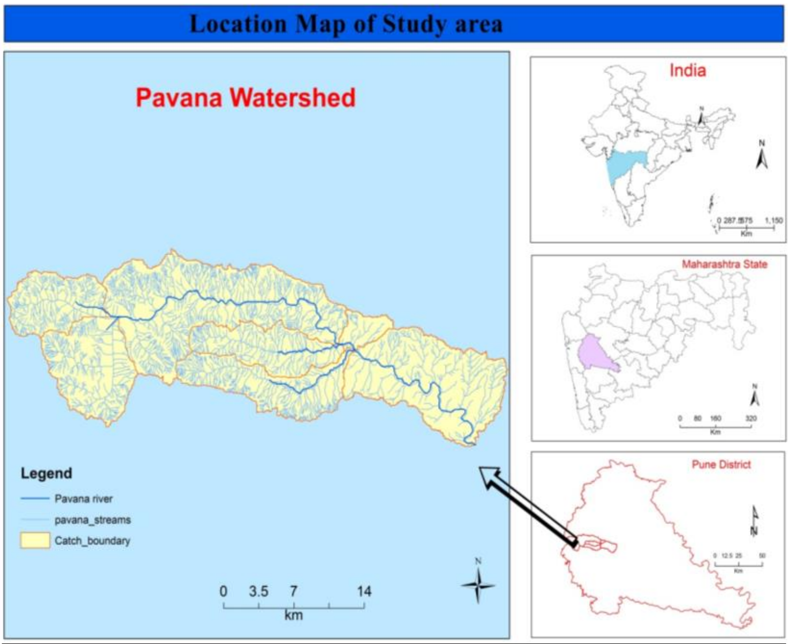

Fig 1: Location Map of Pavana Watershed

3. DATA BASE AND METHODOLOGY

The drainage map fig.no 2 of the Pavana study area has been prepared using Aster DEM. The morphometric parameters of drainage basin like Linear, Areal and Relief were calculated using ASTER (DEM) with 30m spatial resolution data using Arc GIS software.

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

Digital Elevation Model was downloaded from https://asterweb.jpl.nasa.gov/data.asp of the study area has been used in the present study. After that ordering of the stream were done using Strahler stream ordering technique.

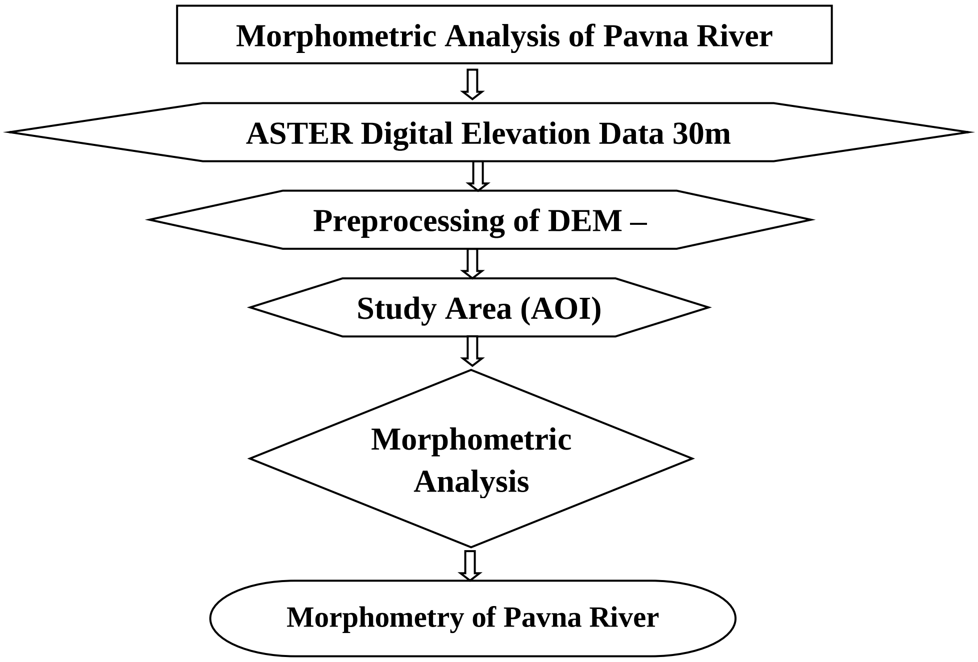

Fig 2: Flow chart of Methodology

The quantitative analysis of morphometric parameters and results is given in Table 1. The Slope, Aster DEM, Drainage Network and Elevation Map of Study area has been shown sequentially in fig no 3 and 4 and these maps were prepared by using study area shape file. Using this shape Study area was clipped from ASTER DEM in the GIS environment.

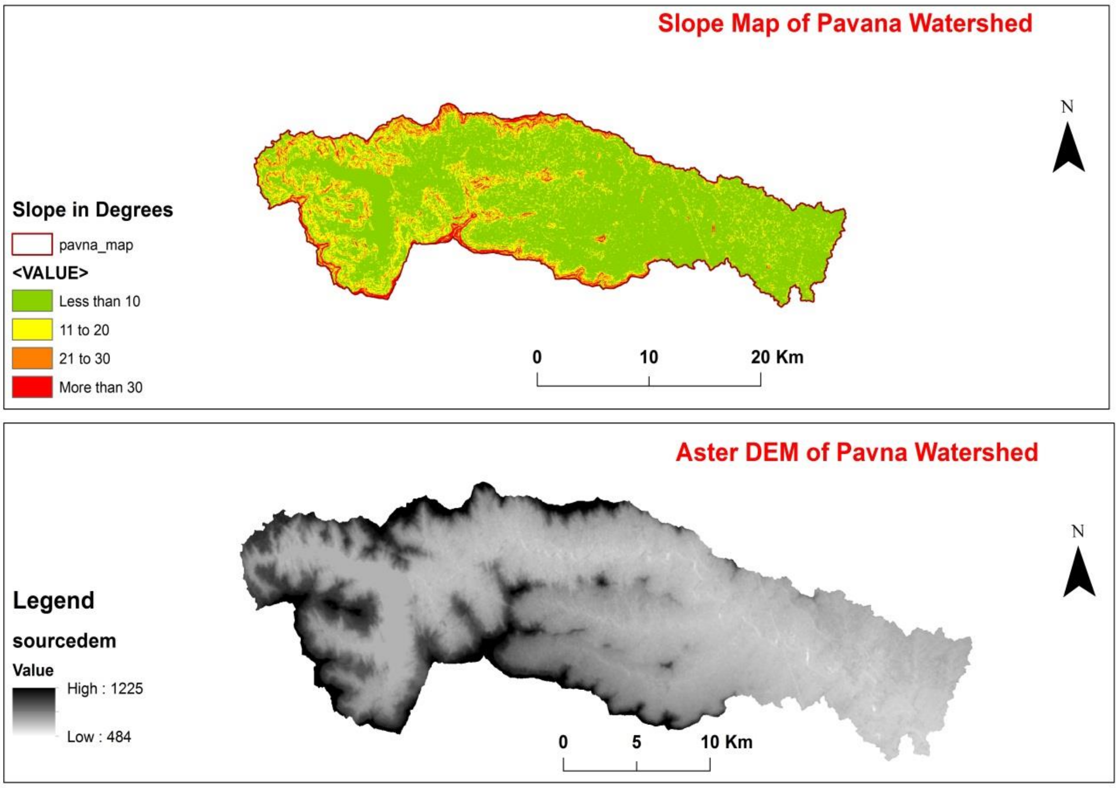

Fig 3: Slope and Aster DEM of Study Area.

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

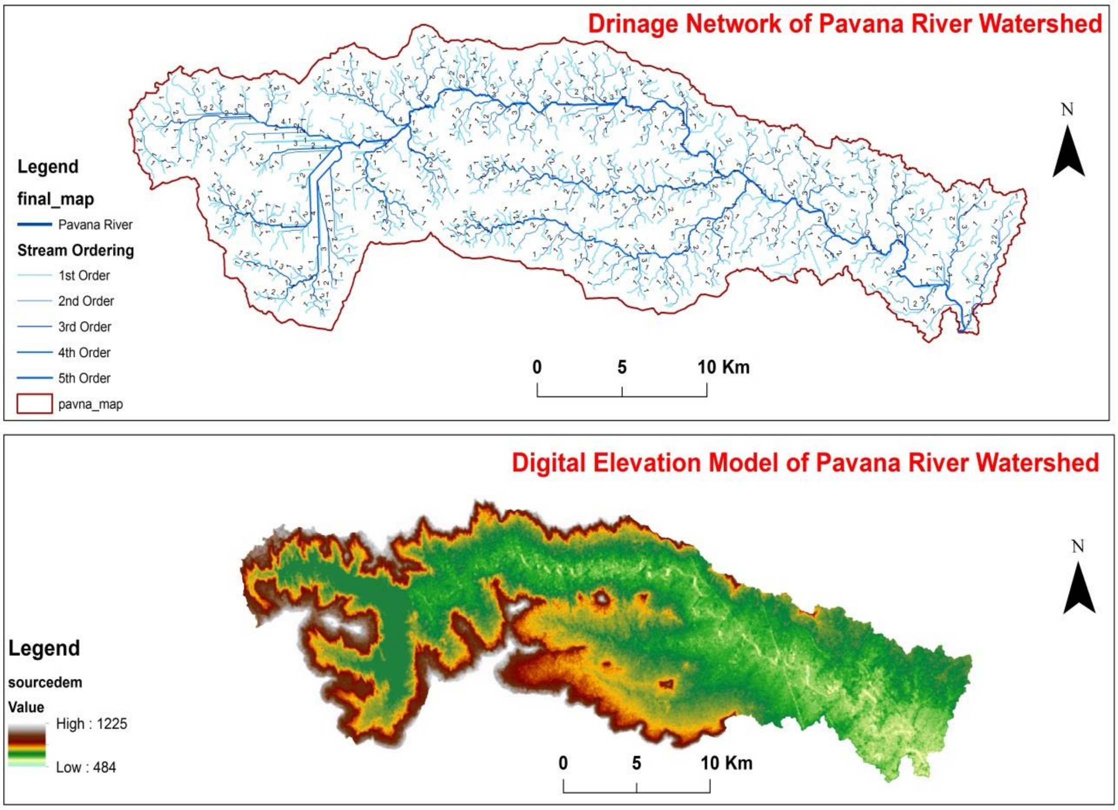

Fig 4: Drainage Network and Elevation Map of Study Area.

4. RESULTS AND DISCUSSION

Morphometric Analysis -

The measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of its landform provides the basis of the investigation of maps for a geomorphological survey (Bates & Jackson, 1980). This approach has recently been termed as Morphometry. The area, altitude, volume, slope, profile and texture of landforms comprise principal parameters of investigation. Dury (1952), Christian, Jenning and Tuidale (1957) applied various methods for landform analysis, which could be classified in different ways and their results presented in the form of graphs, maps or statistical indices.

The morphometric analysis of the Pavana watershed was carried out on the ASTER-DEM with 30 m spatial resolution. The lengths of the streams, areas of the watershed were measured by using ArcGIS-9.3 software, and stream ordering has been generated using Strahler (1953) system, and Hydrology of ArcGIS-9.3 software were used. The linear aspects were methods of Horton (1945), Strahler (1953), Chorley (1957), the areal aspects using those of Schumm (1956), Strahler (1956, 1968), Miller (1953), and Horton (1932), and the relief aspects employing the techniques of Horton (1945), Broscoe (1959), Melton (1957), Schumm (1954), Strahler (1952), and Pareta (2004). The Drainage density and frequency distribution analysis of the watershed area were done using the spatial analyst tool in ArcGIS-9.3 software.

4.1 Drainage Network

4.1.1 Stream Order (Su): In any Quantitative analysis of the watershed Stream ordering is the first step. The stream ordering systems was first advocated by Horton (1945), but Strahler (1952) has proposed this ordering system with some modifications. Here stream ordering was done using Strahler method. It is shown in Table no. 1 (fig no. 4 Map). It has found that the

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

maximum stream order of Pavna River is 5^{th}. It is found that stream frequency is decrease with increasing stream order.

4.1.2 Stream Number (Nu) The total number streams in each stream order is called stream Number. Horton (1945) states that the numbers of stream segments of each order form an inverse geometric sequence with order number.

4.1.3 Stream Length (Lu) Stream length is one of the important hydrological features of the river. Stream which are in shorter length are associated with steep slope and finer textures. Longer length of streams is associated with flatter gradients. Length of the each stream order which is decreasing from 1^{st} order onward. Lengths of all the streams were calculated using GIS software. Horton's law of stream lengths supports the theory that geometrical similarity is preserved generally in watershed of increasing order (Strahler, 1964).

4.1.4 Mean Stream Length (Lum) Mean stream length is calculated summing of all the stream order length divided by total stream order. Mean Stream length is a dimensional property revealing the characteristic size of components of a drainage network and its contributing watershed surfaces (Strahler, 1964).

Table 1:

<table>
<tr><th>Su</th><th>Nu</th><th>Rb</th><th>Lu</th><th>Mean Rb ratio</th><th>Mean stream Length</th><th>Length ratio</th><th>Mean Length ratio</th></tr>
<tr><td>I</td><td>805</td><td></td><td>512.46</td><td rowspan="6">1.78</td><td>0.63</td><td></td><td rowspan="6">1.79</td></tr>
<tr><td>II</td><td>399</td><td>2.01</td><td>243.31</td><td>0.60</td><td>0.47</td></tr>
<tr><td>III</td><td>146</td><td>2.71</td><td>82.91</td><td>0.56</td><td>0.34</td></tr>
<tr><td>IV</td><td>145</td><td>1.00</td><td>67.38</td><td>046</td><td>0.81</td></tr>
<tr><td>V</td><td>101</td><td>1.42</td><td>51.67</td><td>0.51</td><td>0.76</td></tr>
<tr><td>Total</td><td>1596</td><td></td><td></td><td></td><td></td></tr>
</table>

Su: Stream order, Nu: Number of streams, Rb: Bifurcation ratios, Rbm: Mean bifurcation ratio, Lu: Stream Length, Lum: Mean Stream Length, Lurm: Stream Length ratio

4.1.5 Stream Length Ratio (Lurm) The length ratio of various streams of different order shows variations. The stream length ratio of Pavna river basin varies between 0.47 to 0.76. Horton (1945, p.291) states that the length ratio is the ratio of the mean (Lu) of segments of order (So) to mean length of segments of the next lower order (Lu-1), which tends to be constant throughout the successive orders of a basin

4.1.6 Bifurcation Ratio (Rb) and Mean Bifurcation Ratio (Rbm) Bifurcation ratio means number of stream of any given order to the number of streams in next order. It is observed from the Rb is not same from one order to its next order these irregularities are dependent upon the geological and lithological development of the drainage basin (Strahler 1964). In the present study, the bifurcation ratio is 1.42 to 2.01. Mean bifurcation ratio is 1.78. The low bifurcation values are indicative of relatively less structural complexity which in turn has not distorted the drainage pattern of the basin (Strahler, 1964). Also, these values may show little difference in the environmental conditions of the basins.

4.1.7 Main Channel Length (Cl) Stream length is defined as the length of main channel from source to mouth. Total length of the main channel is calculated using tool of Arc GIS software 9.3. Total length of the Pavana River is 68.87 km

4.1.8 Rho Coefficient (ρ) The Rho coefficient is an important parameter relating drainage density to physiographic development of a watershed which facilitate evaluation of storage

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

capacity of drainage network and hence, a determinant of ultimate degree of drainage development in a given watershed (Horton 1945). Changes in in parameter of Rho depend on climatic, geologic, biologic and geomorphologic. Rho coefficient for the Pavana river basin is 0.32 it indicates that highest hydrologic storage at the time of flood.

4.2 Basin Geometry

4.2.1 Length of the Basin (Lb) It indicates the travel time of surface water from furthest point to mouth of the river. Basin length of the Pavana basin is 50 km. (1956) defined the basin length as the longest dimension of the basin parallel to the principal drainage line. Gregory and Walling (1973) defined the basin length as the longest in the basin in which are end being the mouth. Gardiner (1975) defined the basin length as the length of the line from a basin mouth to a point on the perimeter equidistant from the basin mouth in either direction

4.2.2 Basin Area (A) The area of the study sub basin is 494 km^2. The area of the total basin area is calculated using GIS Software. Schumm (1956) established an interesting relation between the total watershed areas and the total stream lengths, which are supported by the contributing areas.

4.2.3 Mean Basin Width (Wb) - The mean basin width of the Pavana basin is 9.88km. However it is different from source to mouth. If the basin width is small it indicate elongated shape which led to groundwater recharge potentially more than the large values.

4.2.4 Basin Perimeter (P) Basin perimeter is defined as the outer boundary of the watershed. Total outer boundary length is considered is basin perimeter. Total basin perimeter of Pavana basin is 150.612 km. total basin perimeter was calculated using GIS Software.

4.2.5 Length Area Relation (Lar) Hack (1957) found that for a large number of basins, the stream length and basin area are related by a simple power function as follows: Lar = 1.4 * A0.6

4.2.6 Lemniscate's (k) Chorely (1957), express the lemniscate's value to determine the slope of the basin. In the formula k = Lb2 / 4 * A. Where, Lb is the basin length (Km) and A is the area of the basin (km2). The lemniscate's (k) value for the Pavana watershed is 1.26, which shows that the watershed occupies the maximum area in its regions of inception with large number of streams of higher order.

4.2.7 Form Factor (Ff) Horton (1932) has proposed this parameter to predict the flow intensity of a basin of a defined area. Value of form factor for perfectly circular basin will greater than 0.78 and lower value the basin is elongated. It means less intense rainfall have lower peak runoff of longer duration over entire basin. The Ff of the whole basin is 0.19 which indicate lower value of form factor and thus indicate elongated in shape. Elongated basin with low form factor indicates the basin will have flatter peak of flow for longer duration. Flood flow management is easy to manage in elongated basin as compare to circulatory basin.

4.2.8 Elongation Ratio (Re) According to Schumm (1965, p. 612), 'elongation ratio is defined as the ratio of diameter of a circle of the same area as the basin to the maximum basin length. Strahler states that this ratio runs between 0.6 and 1.0 over a wide variety of climatic and geologic types. The varying slopes of watershed can be classified with the help of the index of elongation ratio, i.e. circular (0.9-0.10), oval (0.8-0.9), less elongated (0.7-0.8), elongated (0.5-0.7), and more elongated (< 0.5). The elongation ratio for Pavana river basin is 0.50 indicates the low relief of the terrain and elongated in shape.

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

4.2.9 Circularity Ratio (RC) If the RC value approaching 1 it indicates the basin shape is circular it means uniform infiltration and water will take long time to reach at outlet. (1953) has described the basin of the circularity ratios range 0.4 to 0.5, which indicates strongly elongated and highly permeable homogenous geologic materials. The RC of the whole Pavana basin is 0.26 which indicating basin is elongated in shape and low discharge of runoff.

4.2.10 Drainage Texture (Dt) Drainage texture is one of the important concepts in morphometric analysis of the basin. Drainage texture means spacing of drainage line Dt is calculated total number of stream segments of all orders per perimeter of that area (Horton, 1945). (Smith, 1950) has classified drainage texture into five different textures i.e., very coarse (<2), coarse (2 to 4), moderate (4 to 6), fine (6 to 8) and very fine (>8). For Pavana river basin the drainage texture is 10.59. It itself indicates watershed comes under very fine category.

4.2.11 Compactness Coefficient (Cc) Horton (1945) has expressed Cc is the relationship of a hydrologic basin with that of a circular basin having same area as the hydrologic basin. Actually circular basin is most hazardous because of whatever rainfall fall in that basin it will suddenly come at an outlet and this situation will create flood. For the Pavana watershed Cc value is 1.92.

4.2.12 Fitness Ratio (Rf)

As per Melton (1957), the ratio of main channel length to the length of the watershed perimeter is fitness ratio, which is a measure of topographic fitness. Fitness ratio means channel length to the length of basin perimeter which is measure of topographic fitness. The fitness ratio of the Pavana watershed is 0.45 which means basin is elongated and has a good chance for groundwater recharge.

4.3 Drainage Texture Analysis

4.3.1 Stream Frequency (Fs) The stream frequency depends on rock structure of the basin it also reflects in the form of texture of drainage network. Stream frequency of the Pavana river basin is 3.23 km/km^2. It suggests that basalt rock is dominant in basin area.

4.3.2 Drainage Density (Dd) Drainage density is the stream length per unit area in region of watershed (Horton, 1945, p.243 and 1932, p. 357; Strahler, 1952, and 1958; Melton 1958) is another element of drainage analysis. A high value of any drainage basin indicates large amount of precipitation and low drainage density reflects hard rocks in that sub basin and infiltration is more. Drainage density of the Pavana basin is 1.93 km/km^2.

4.3.3 Constant of Channel Maintenance (1/D) Schumm (1956) used the inverse of drainage density or the constant of channel maintenance as a property of landforms. The constant of channel maintenance indicates the relative size of landform units in a drainage basin and has a specific genetic connotation (Strahler, 1957). Channel maintenance constant of the Pavana watershed is 0.51 Kms^2/Km.

4.3.4 Drainage Intensity (Di) Faniran (1968) defines the drainage intensity, as the ratio of the stream frequency to the drainage density. Drainage intensity for the Pavana basin is 1.67. Low values of Drainage intensity, drainage density and stream frequency will not remove water from the watershed and it will responsible for flooding, gully erosion and landslides.

4.3.5 Infiltration Number (If) Infiltration Number gives an idea about infiltration characteristics of the basin. If the infiltration number is higher lower will be infiltration and higher runoff. Infiltration is product of drainage density and stream frequency. The

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

infiltration Number of Pavana basin is 6.23.

4.3.6 Drainage Pattern (Dp) In the Pavana River watershed there is homogeneous rock without underlying geologic structure hence the dendritic drainage pattern is found.

4.3.7 Length of Overland Flow (Lg) Horton (1945) used this term to refer to the length of the run of the rainwater on the ground surface before it is localized into definite channels. Since this length of overland flow, at an average, is about half the distance between the stream channels, Horton, for the sake of convenience, had taken it to be roughly equal to half the reciprocal of the drainage density. Length of Overland flow for Pavana river watershed is 0.26 kms which shows low surface runoff.

4.4 Relief Characteristics

4.4.1 Height maximum of the basin (km) – The highest point of the basin is 1.22 km which gives highest elevation of the watershed.

4.4.2 Height minimum of the basin (km) – The lowest point of the basin is 0.53 km which gives lowest elevation of the watershed.

4.4.3 Relief Ratio (Rhl) Relief ratio means difference between highest and lowest point of elevation of the watershed. The relief ratio may be defined as the ratio between the total relief of a basin and the longest dimension of the basin parallel to the main drainage line (Schumm, 1956). The Relief ratio of the Pavana basin is 0.01. This indicates that relief is moderate to steep.

4.4.4 Relief Basin relief plays an important role in the development of landform, drainage, subsurface water flow etc. The Relief of the basin is 492 m. Sub basin wise it may different.

4.4.5 Ruggedness Index Ruggedness is the product of maximum basin relief and drainage density, where both parameters are in the same unit. If the value of Ruggedness index is high basin has steep and long slope. Ruggedness index value for Pavana river basin is 1.33 which means that upper part there is steep slope and lower part is less.

4.4.6 Dissection Index (Dis) Dissection index gives the vertical erosion depth. Dissection index of Pavana basin is 0.56 means it is moderate vertical erosion. Dissection index is a parameter implying the degree of dissection or vertical erosion and expounds the stages of terrain or landscape development in any given physiographic region or watershed (Singh and Dubey 1994). On average, the values of Dis vary between‘0’ (complete absence of vertical dissection/erosion and hence dominance of flat surface) and‘1’ (in exceptional cases, vertical cliffs, it may be at vertical escarpment of hill slope or at seashore).

Table 2: Morphometric Analysis of Pavana Watershed

S. No	Morphometric Parameter	Formula	Reference	Result
4.1	**Drainage Network**			
4.1.1	Stream Order (Su)	Hierarchical Rank	Strahler (1952)	1 to 5
	1^{st} Order Stream (Suf)	Suf = N1	Strahler (1952)	805
4.1.2	Stream Number (Nu)	Nu = N1+N2+ …Nn	Horton (1945)	1596
4.1.3	Stream Length (Lu) Kms	Lu = L1+L2..Ln	Strahler (1964)	957.73
4.1.4	Mean Stream Length Ratio (Lurm)	see Table 1	Horton (1945)	1.79
4.1.5	Stream Length Ratio (Lur)	**see Table 1**	Strahler (1964)	
4.1.6	Bifurcation Ratio (Rb)	**see Table 1**	Strahler (1964)	
4.1.6	Mean Bifurcation Ratio (Rbm)	see Table 1	Strahler (1964)	1.78
4.1.7	Main Channel Length (Cl) Kms	GIS Software	-	68.87

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341

4.1.8	Rho Coefficient (ρ)	ρ = Lur / Rb	Horton (1945)	0.32
4.2	**Basin Geometry**			
4.2.1	Basin Length (Lb) Kms	GIS Software Analysis	Schumm (1956)	50
4.2.2	Basin Area (A) Sq Kms	GIS Software	Schumm (1956)	494
4.2.3	Mean Basin Width (Wb)	Wb = A / Lb	Horton (1932)	9.88
4.2.4	Basin Perimeter (P) Kms	GIS Software	Schumm (1956)	150.612
4.2.5	Length Area Relation (Lar)	$Lar = 1.4 * A^{0.6}$	Hack (1957)	57.84
4.2.6	Lemniscate's (k)	$k = Lb^2 / A$	Chorley (1957)	1.26
4.2.7	Form Factor Ratio (Rf)	$Ff = A / Lb^2$	Horton (1932)	0.19
	Relative Perimeter (Pr)	Pr = A / P	Schumm (1956)	3.27
4.2.8	Elongation Ratio (Re)	Re = 2 / Lb * (A /	Schumm(1956	0.50
4.2.9	Circularity Ratio (Rc)	$Rc = 12.57 *(A / P^2)$	Miller (1953)	0.26
4.2.10	Drainage Texture (Dt)	Dt = Nu / P	Horton (1945)	10.59
4.2.11	Compactness Coefficient (Cc)	$Cc = 0.2841 * P / _{A}\ 0.5$	Gravelius (1914)	1.92
4.2.12	Fitness Ratio (Rf)	Rf = Cl / P	Melton (1957)	0.45
4.3	**Drainage Texture Analysis**			
4.3.1	Stream Frequency (Fs)	Fs = Nu / A	Horton (1932)	3.23
4.3.2	Drainage Density (Dd) Km / Kms^2	Dd = Lu / A	Horton (1932)	1.93
4.3.3	Constant of Channel Maintenance (Kms^2 / Km)	C = 1 / Dd	Schumm (1956)	0.51
4.3.4	Drainage Intensity (Di)	Di = Fs / Dd	Faniran (1968)	1.67
4.3.5	Infiltration Number (If)	If = Fs * Dd	Faniran (1968)	6.23
4.3.6	Drainage Pattern (Dp)		Horton (1932)	
4.3.7	Length of Overland Flow (Lg) Kms	Lg = A / 2 * Lu	Horton (1945)	0.26
4.4	**Relief Characterizes**			
4.4.1	Height Maximum of Basin Mouth (Z) m	GIS Analysis / DEM	-	1.22
4.4.2	Minimum Height of the Basin (z) m	GIS Analysis /DEM	-	0.53
4.4.3	Relief Ratio (Rhl)	Rhl = H / Lb	Schumm(1956	0.01
4.4.4	Total Basin Relief (H) m	H = Z - z	Strahler(1952)	0.69
4.4.5	Ruggedness Index (Ir)	Rn = Dd * (H /1000)	Patton & Baker (1976)	1.33
4.4.6	Dissection Index (Dis)	Dis = H / Ra	Singh & Dubey (1994)	0.56

5. Conclusion

The drainage Morphometry gives information about hydro geologic maturity of the river and it helps to understand the relationship between the drainage basin and hydro geologic parameters. Remote Sensing and GIS is a Powerful tool for the preparation of drainage map and understanding of watershed morphometric parameters. This new

ISSN
(Print) 2320 – 6446, (Online) 2320 – 8341
technology is better than traditional technique. GIS techniques characterized by very high accuracy of mapping and measurement prove to be a competent tool in morphometric analysis. The quantitative analysis the river basin has found immense utility in the watershed prioritization and river basin evaluation for natural resources management like soil and water. The morphometric analysis was done for linear, areal and relief aspects of the Pavana watershed with more than 40 morphometric parameters. The shape of the basin is elongated and drainage network is dentric type which shows homogeneity in texture. For the Morphometric analysis Geospatial technology that GIS has helped to understand the various characteristics of the river basin Such as nature of bedrock, runoff, infiltration capacity etc. The conclusion derived in this paper will suggested and recommended to develop water mechanism for better application of the river basin. Finally it is concluded that GIS is an excellent tool for interpreting the quantitative geomorphology the river basin.

6. REFERENCES

1) Baiju C, Kumar A, Gopinath G, Chandram S, Ramkumar T (2015) " GIS Based Morphometric Analysis of the Kochara sub-watershed of Greater Periyar (GPP) of south Western Ghats, India, International Journal of Advanced Remote Sensing and GIS, Volume 4, Issue 1, pp. 895-910.
2) Chandrashekar H, Lokesh K, Sameena M, (2015) " GIS –Based Morphometric Analysis of Two Reservoir Catchments of Arkavati River, Ramanagaram District, Karnataka, Elsevier Journal, conference Proceeding pp. 1345-1353.
3) Ghaffar A, Abdellatif M, Azzam M, Riad M (2015) " Watershed Characteristic and Potentiality of Wadi El-Arish, Sinai, Egypt, International Journal of Advanced Remote Sensing and GIS, Volume 4, Issue 1, pp 1070-1091.
4) Lallianthanga and Hmingthanpuii (2013) " Integrated Land Use Planning of Aizwal District, Mizoram, India Using Geospatial Techniques", International Journal of Advanced Remote Sensing and GIS, Volume 2, Issue 1, pp. 341-350.
5) Mishra S, Nagarajan R (2010)" Morphometric analysis and prioritization of sub-watersheds using GIS and Remote Sensing techniques: A case study of Odisha, India", International Journal of Geomatics and Geosciences, volume 1, No 3, 2010, pp 501-550.
6) Pareta K, Pareta U (2011) "Quantitative Morphometric Analysis of a Watershed of Yamuna Basin, India Using Aster (DEM) Data and GIS", International Journal of Geomatics and Geosciences, Volume 2, No 1, pp. 248-269.
7) Rao N, Latha S, Kumar A, Krishna H, (2010) " Morphometric Analysis of Gostani River Basin in Andhra Pradesh State, India Using Spatial Information Technology, International Journal of Geomatics and Geosciences, Volume 1, No 2, pp 179-187
8) Rao L, Ansari R, Yusuf A (2011) "Morphometric Analysis of Drainage Basin Using Remote Sensing and GIS Techniques: A Case Study of Etmadpur Tehsil, Agra District, U.P", International Journal of Research in Chemistry and Environment, Vol 1, Issue 2, pp 36-45.
9) Rawat P, Tiwar P, Pant C (2011) " Morphometric Analysis of Third order River Basins Using High Resolution Satellite Imagery and GIS Technology: Special Reference to Natural Hazard Vulnerability Assessment, E-International Scientific Research Journal, volume 3, Issue 2, pp. 70-87
10) Somashekar R, Ravikumar P Sowmya S, Dar M (2011) " Runoff Estimation and Morphometric Analysis for Hesaraghatta Watershed Using IRS-1D LISS III FCC Satellite Data, Journal of Indian Soc Remote Sensing pp 95-106
11) Tolessa A, Rao J, Babu V (2013) " Morphometric Analysis of Tandava River Basin, Andhra Pradesh, India, International Journal of Advanced Remote Sensing and GIS, Volume 2, Issue 1, pp. 59-69.
12) Topno A, Singh A, Vaishya R (2015) " SCS CN Runoff Estimation for Vindhyachal Region using Remote Sensing and GIS, International Journal of Advanced Remote Sensing and GIS, International Journal of Advanced Remote Sensing and GIS, Volume 4, Issue 1, pp. 1214-1223.