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Watershed Characteristics analysis of Bommanur Sub-Watershed,Pulampatti Watershed, Dharmapuri District

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Abstract: *In the present day numerous scarcity of water in and around of the world, have been facing due to the lack of pollution activities via man-made and natural hazards. The quantities analysis of morphological characters of any watershed will be adopted various analyses. In addition to this also the land utilization of any lands with system have adopted in the any kind of approaches or classes. Geospatial techniques were given the solution for sustainable development of the Land and water sectors. In addition also the planning scenario too also.The present paper is deal to morphometric and Bommanur sub-watershed of Pulampatti Watershed, Salem district.The study includes filed and Lab analysis for manual traching methods through SOI and also verified through filed also too.*

Keywords:*Morphological study, Watershed Characteristics analysis,*

Introduction

The application principals of the mathematical statistic to quantities geomorphology is essential is meaningful conclusion are to be achieved. In practice.A particular geometric by measuring from maps or aerial photographs or by different field surveys. When a sample of say 50 or 100 measurement is thus obtained, the standard methods of frequently distribution analysis are used. The individual measurements, termed verities are grouped into classes, and the nature of the distribution examined. The many geometric properties of drainage basins particularly those having the dimension of length area, volume are characteristically, log normal in distribution, where as others properties, particularly dimensionless rations and angular values

Melton collected an extensive body of morph metric data on drainage basin and discusses the sample size-requirement for use in statistical test.

Study area

Pulampatti stream origin from north portion of thumpalappatti with flowing towards south eastern side by are Gendigenhalli, sangenampptti, total area of watershed is 158.3with in a revenue villages. From the boundary of the watershed is flowing from Dharmapuri district major Taluk of the karimanagalam. The watershed is study one of the area total 78˚0′East to 78˚ 15′ East longitude and 12˚ 13′ north to 12˚ 30′ north of longitude the major physical feature has controlled to the structural paddy and fluvial process in the study area

In general physical any area may be mountain plants and plain from the present study area major to relief order like upland and plain. The chooses study area located in the ported of karimangaiam (tk) and there adjutants place (fig) they pulampattiodai agricultural trended from thumpallapatti dam flow village name thumpalapatti river flowing an NN and SE with length at 55km.

In general the study flow from the Boomanur revenue villages located between Sudappatti and Bikkanhalli of the sub-watershed. The physical features of the watershed are plateau and plain zone in nature. The mostly the sub-watershed adopted micro level tanks with perennial one. The sub-watershed extend Latitudes 78º 0′ 12´-780º 5′ E, Longitudes12º 15′-12º0 28′N fall in the zone. The most of the watershed fall in plain with without scrub area. Soil of the watershed is found in the red color in nature of the area. The favorable soil condition is supported to the potential agricultural activities. The Land use and Land cover of the sub-watershed is found the one more check dam around the area with perennial one. The pattern of the land use some of the Plantation crops with plantation in nature because of the nearer the sugar industries.The drainage of the sub-watershed is found around the area many small tanks. The surrounded other villages like, Panchapatti, Vadakampatti,Konampatti etc.The drainage of the bommanur is river, canal and tank system fall under the linear patterns of the drainage. From the sub-watershed also many tank system, the all objects nearer the panchapalli dam.

Objectives

The present study concentrated the d Watershed characteristics studies of Bommanur Sub-Watershed environment or follows

1.To collect the base information of study area around the watersheds population with their habitués.

2.To delineated and Mapping of study area in manual tracing and interpretation, In addition to this Map prepares land use /land cover, Drainage with these characteristic conditions.

3.To concluded/ derived the status of the watershed / sub-watersheds condition and recent population states of the study area.

Research Methodology

1. The following Research Methods based on the objectives on follows
2. To collect base line information of study area includes the population in all, watershed condition, Temperature, rainfall and other essential
3. To collect all other hydrological data s concern area.
4. To delineated and mapping base map with scale of 1:50000 on the linear scale, based on the base map, to feature draw and Interpretation other thematic Maps.
5. To visit and check the wherever doubt from the bases work of the study, remodify and correct based nature study
6. To collect the reference with based the present study compare and added the additional information
7. Final and summarized all the works

Result and Discussion

Bommanur- Morphometric Analysis

Introduction

The Bommanur sub-watershed is one of the Pulampatti watershed for study the morphological characters of the study. It is located in the north eastern side of the main watershed. According to the C.B.Jagadeesh given the work of morphometric analysis of a vrishavathi sub-watershed upstream side of gali anjaneya temple using GIS. The region is fully occupy for fertile resources of water and as well as the soil. The land utilization and Land use is fine setup one. The morphological study would adopt in various approaches. The area of the sub-watershed is15.75 sq.km and stream length of the watershed is 16.25sq.km.

Stream Number and order(U)

For stream ordering Horton's Law was followed by designating an un-branched streams as first order stream, when two first order streams joint it was designated as second order, two second order join together to form third order and so on. This is the most important parameter for drainage basin analysis, in the study area (PSW1) sub-Watershed total number of streams found is159 out of which 87.1is of first order, 56of second, 11of third order, 5 of fourth . The watershed wise number, order and length are given in Table.1. It reveals that maximum number of streams is found in First order (87 and minimum number found in fouth order (5), it is also noted that first order streams are highest in number in all micro watersheds while highest order has the lowest number. The sub-Watershed covering an area 15.75.

Table No.1 Stream Orders and Numbers— Bommanur

Sream Orders	No of Streams	Bifurcation ratio	Total Length(km)	Mean Length(km)	Length ratio	Mean ratio
1	87	1.55	76.1	0.44	0.88	
2	56	5.09	69.1	0.39	0.28	
3	11	2.2	19.6	0.11	0.27	0.357
4	5	0	6.3	0.03	0	
			171.1			

Stream Length(Lu)

Average length ratio is 0.357 and comparing with first, second, and third order it is observed to be indicating that water flow in the source region is limited which is due to semi- arid environment. Length ratio of 1st order is high which indicates higher surface flow. It can be seen from the table.1 that as the order increases mean length also increases and so ratio increases.

Stream Length Ratio(Rl)

Table No.2 Area Ratio- Bommanur

Stream Orders	Stream Numbers	Area in km2	Mean Area	Area Ratio
1	87	0.71	0.30	1
2	56	0.7	0.30	0.03
3	11	0.2	0.08	0.12
4	5	0.7	0.30	0
Total	159	2.31		

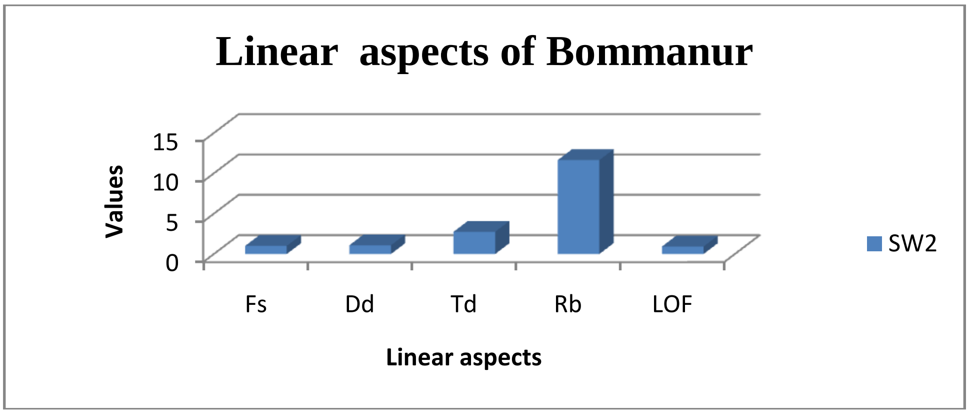
Linear Aspects

Linear parameters include stream frequency, drainage density, drainage texture, bifurcation ratio and length of overland flow

Table No .3 Linear Parameters

LINEAR ASPECTS OF BOMMANUR SUB-WATERSHED					
SW	Fs	Dd	Td	Rb	LOF
SW2	1	1.08	2.75	11.64	0.92

Fig No.1 Linear Parameters



Stream Frequency(Fs)

The Stream frequency is defined as the total number of stream segments of all orders per unit area (Horton, 1932). Generally high stream frequency is related to impermeable sub surface material, sparse vegetation, high relief and low infiltration

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capacity of the region. The stream frequency of all stream order is mentioned in Table 3. The study revealed that the Stream orders 1st Sub -watersheds have high stream frequency because of the fact that it falls in the zone of fluvial channels and the presence of ridges on both sides of the valley which results in highest stream frequency while as watersheds Stream order 3 and 4 has low stream frequency because of low relief . Highest value of stream frequency noted for Stream order 4 (0.79 km/km2) and Stream order 2 (8.11km/km2) produces more runoff in comparison to others(Table .4).

Table No .4 Stream Frequency

Stream Order	Stream Number	Area in km2	Stream Frequency
1	87	7.61	0.20
2	56	6.9	8.11
3	11	1.96	0.11
4	5	6.3	0.79
Total	159		

Drainage Density(Dd)

The drainage density is the stream length per unit area in a region (Horton, 1945 and Strahler, 1952). It is an essential element of drainage morphometry to study the landscape dissection, runoff potential, infiltration capacity of the land, climatic condition and vegetation cover of the basin. Drainage density (1.08) of the watershed is given in Table .3 . It has been observed that low drainage density is found to be associated with regions having highly permeable subsoil material under dense vegetative cover, and where relief is low while as high values of drainage density are noted for the regions of weak or impermeable subsurface materials, sparse vegetation and mountainous relief (Nag 1998). Hence in this study high drainage density was found in Stream order 4 and Stream order 3 because of impermeable sub surface material and mountainous relief . Low Dd value for Stream order 1,2 and 4 indicates that it has highly permeable sub surface material and low relief.

Drainage Texture(Dt)

The Drainage texture is defined as the total number of stream segments of all orders per perimeter of the area (Horton, 1945). The drainage texture depends upon a number of natural factors such as climate, rainfall, vegetation, rock and soil type, infiltration capacity, relief and stage of development (Smith, 1950) and classified drainage into five classes i.e., very coarse (<2), coarse (2-4), moderate (4-6), fine (6-8) and very fine (>8). The drainage texture found to be very coarse, value is 2.75 in the Bommanur sub-watershed catchment of Pulampatti Watershed .

Bifurcation ratio(Rb)

Bifurcation ratio related to the branching pattern of the drainage network is defined as a ratio of the number of streams of a given order to the number of streams of the next higher order. Bifurcation ratio (11.64)is supposed to be controlled by drainage density, stream entrance angles, lithological characteristics, basin shape, basin area etc. (Singh 1998) Bifurcation values are ranging from 1.2 to 3.6. The higher values of 2 and 5 order streams indicate well developed stream network. The bifurcation values in the $2^{nd}$and 4th order are low compared to the overall bifurcation ratio of the basin. Bifurcation values ranging from 17 to 20 suggest that it is a natural river system where uniformity is seen with respect to climate, rock type and stage of development. The purpose of stream ordering is not only to index size and scale but also to afford an approximate index of the amount of stream flow which can be produced by particular network.

Length of overflow Land(Lo)

It is one the most important independent variables affecting hydrological and physiographical development of a drainage basin. It is the length of water over the ground before it gets concentrated into definite stream channels and is equal to half of drainage density (Horton, 1945). Length of overland flow relates inversely to the average channel slope. The shorter length of over land flow for sub-watershed point out the quicker runoff process, than other Sub-Watersheds. The Length of the over land flow of sub-watershed is 0.92.

Shape Parameters

Shape parameters include form factor, shape factor, elongation ratio, compactness ratio and circulatory ratio.

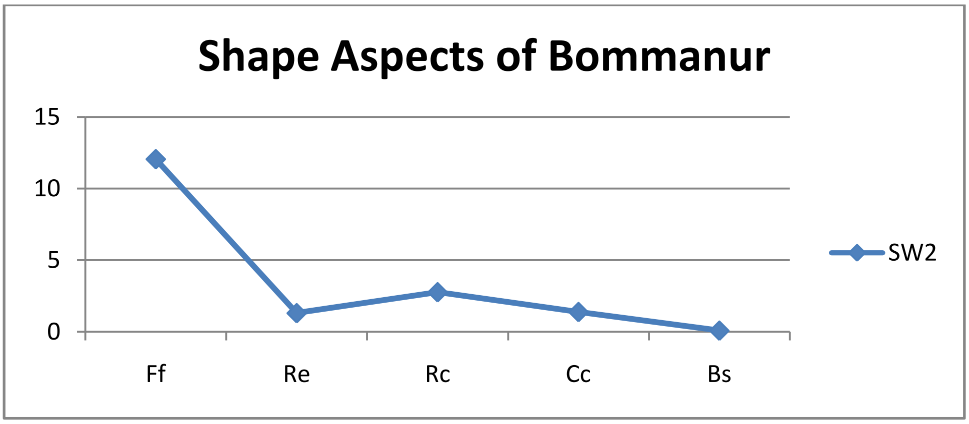
Form Factor(Ff)

Form factor is defined as the ratio of basin area to the square of the basin length (Horton, 1932). The values of form factor would always be less than 0.7854 (perfectly for a circular basin). High value of form factor stating the circular shape of the basin and Smaller the value of form factor more elongated will be the basin. Form factor value (Table.6). The observation shows that the PSW2(12.04) watersheds are highly elongated while as the watersheds PSW1, PSW3 and PSW4 are less elongated. The values of form factor for Pulampatti catchment indicates that the whole catchment is elongated. The elongated watershed with low value of form factor indicates that the basin will have a flatter peak flow for longer duration. Flood flows of such elongated basins are easier to manage than from the circular basin.

Table No .6 Shape Aspects of Bommanur

SW	Ff	Re	Rc	Cc	Bs
SW2	12.04	1.3	2.76	1.38	0.08

Fig No .2 Shape Aspects of Bommanur



Elongation ratio(Re)

The elongation ratio is defined as the ratio between the diameter of the circle of the same area as the drainage basin and the maximum length of the basin (Schumn, 1956). Analysis of elongation ratio indicates that the areas with higher elongation ratio values have high infiltration capacity and low runoff. A circular basin is more efficient in the discharge of runoff than an elongated basin (Singh et. al., 1997). The values of elongation ratio generally vary from 0.6 to 1.0 over a wide variety of climate and geologic types. Values close to 1.0 are typical of regions of very low relief, whereas values in the range 0.6 to 0.11 are usually associated with high relief and steep ground slope (Strahler, 1964). Shape of the sub-watershed found to be elongated have low elongation ratio and less elongated have high elongation ratio. In the watershed, these values are less than 1.3 and hence all the Sub-watersheds are generally elongated in shape.

Circularity Ratio(Rc)

Circularity ratio is defined as the ratio of the area of the basin to the area of a circle having the same circumference as the perimeter of the basin (Miller 1953. High value of circulatory ratio indicates the maturity stage of topography. The value 2.76 for PSW2 indicates very less circular in shape than the other sub-watersheds .

Compactness Coefficient (Cc)

It is defined as the basin perimeter divided by the circumference of a circle to the same area of the basin. Compactness coefficient is directly proportional to the erosion risk assessment i.e. lower values signifies less vulnerability for risk factors, while higher values indicates great vulnerability and represents the need of implementation of conservation measures. So the study reveals that sub-watershed(1.38) is moderate prone to erosion risk in the whole catchment.

Shape Factors(Bs)

It is the ratio of the square of the basin length (Lb) to area (A) of the basin (Horton, 1945) and is in inverse proportion with form factor (Rf). The shape factor of the sub-watershed is 0.08.

Relief aspects of the Watershed

The relief aspects of sub-watershed are also important in water resources studies, direction of stream flow analysis and denudation conditions of the watershed. Relief aspects like basin relief (H), relative relief (Rp), relief ratio (Rh) and ground slope or ruggedness number (Rn) were measured .

Basin Relief (H)

Basin relief is described as the elevation difference between the reference points i.e. maximum vertical distance between highest (divide) and the lowest (outlet) located in the drainage basin . Schumm (1956) measured it along the longest dimension of the basin parallel to the principle drainage line. The relief for sub-watershed varies from400 to 700 meters . The watershed has been divided into high, medium and low relief regions in which sub-watershed are having Lowest basin relief. The lower relief of these sub-watersheds indicates high gravity of water flow as well as infiltration and low runoff conditions as well as sediment down the slope.

Table No.7 Areal Aspects of Bommanur

SW	Basin Relief	Relief Ratio	Relative Relief	Ruggedness Number
SW2	700	4.09	12.28	648.14

Relief Ratio

Relief Ratio is the ratio of basin relief to the horizontal distance on which relief was measured (Schumm, 1956). According to Schumm (1956), there is a direct relationship between the relief and gradient of the channel. It measures overall steepness of the watershed and is also considered as an indicator for the intensity of erosion process occurring in the watershed. High value of relief ratio is the characteristics of the hilly region. The relief ratio for watershed 4.09 . It was noticed that the lower values of relief ratio for sub-watershed indicated less slope and low relief.

Relative Relief (Rr)

Relative Relief (Rr) is the ratio of relief (H) to the perimeter of basin. It is an important morphometric variable used for the general estimation of morphological characteristics of terrain. The relative relief for watershed 12.28. The sub-watershed having higher relative relief has higher runoff potential than others.

Ruggedness number (Rn)

Ruggedness number (Rn) is the product of drainage density (Dd) and basin relief (H) (Strahler, 1957; Melton, 1958) in the same unit. The highest value of ruggedness was observed in sub-watershed (648.14),in which both total basin relief and drainage density values are high, i.e., in these sub-watersheds slope is very steep linked with its slope length . The sub-watersheds having low relief but high drainage density are ruggedly textured as areas of higher relief having less dissection. The higher ground slopes in case of above sub-watersheds lying in upper reach of the basin specify lower time of concentration of overland flow and the possibilities of soil erosion will be higher in these sub-watersheds . In relief aspect calculation, some of the linear (length, perimeter, etc.) and shape (drainage density) parameters are applied. Thus, the morphometric description has shown substantial role in differentiating the hydro-topographical behavior of the watershed through the analysis of linear, areal and relief aspects of the sub-watersheds.

Conclusion

The present study concentrated sub-watershed wise morphometric study of Bommanur, Pulampatti watershed, Dharmapuri district using manual tracing methods, measured . The analysis followed by the morphological tools with linear, areal and relief parameters included.

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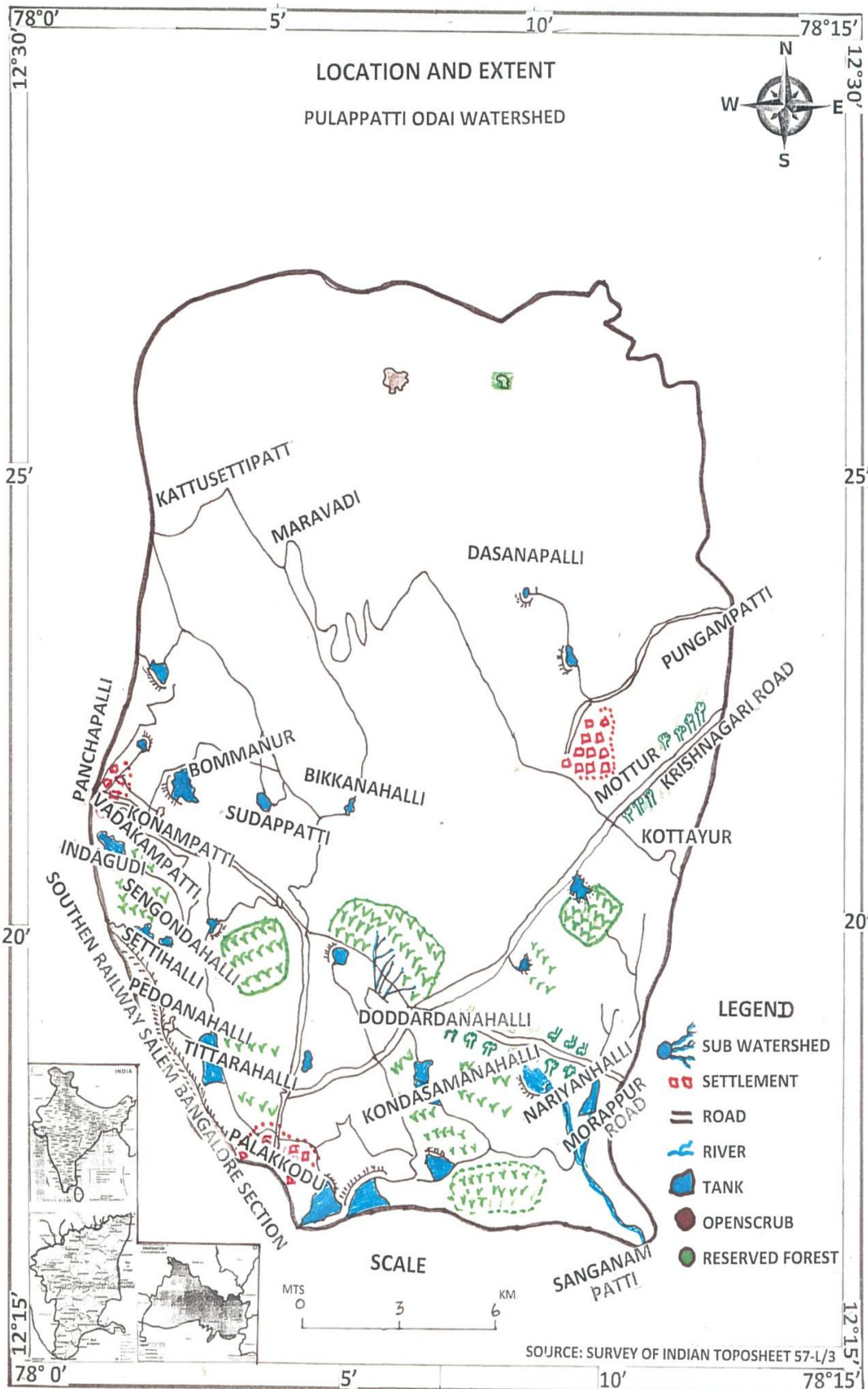

FIG – 1

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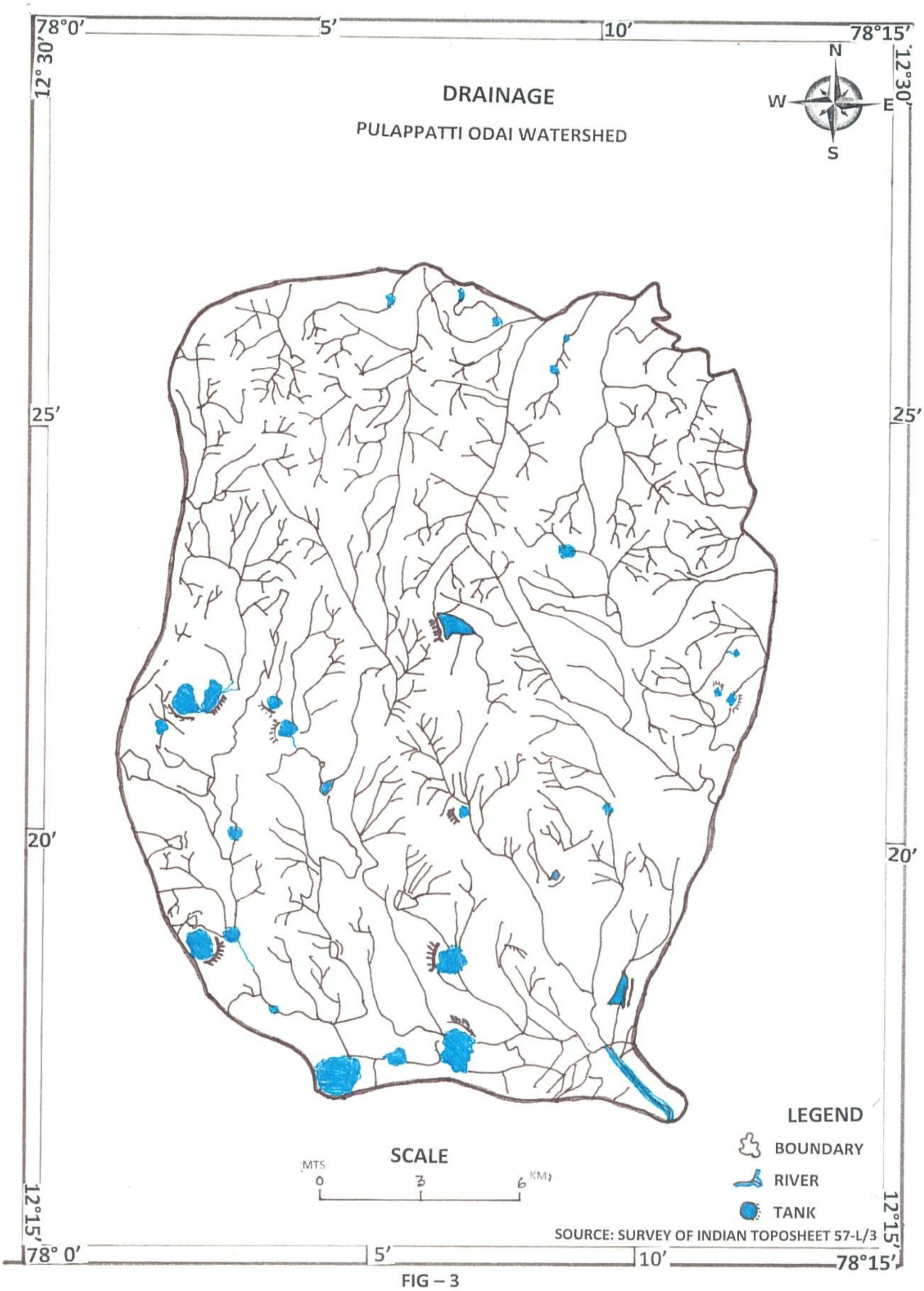

FIG – 3