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Land Resource and Hydrological Inventory of Belagunda Sub-watershed for Watershed Planning and Development Yadgir Taluk, Yadgir District, Karnataka (AESR 6.2)

Sujala – III
Karnataka Watershed Development Project- II
Funded by World Bank

ICAR - NBSS & LUP

ICAR - National Bureau of Soil Survey and Land Use Planning, Bangalore
Watershed Development Department, Govt. of Karnataka, Bangalore

About ICAR - NBSS&LUP

The National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up during 1976 with the objective to prepare soil resource maps at national, state and district levels and to provide research inputs in soil resource mapping and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimizing land use on different kinds of soils in the country.

The Bureau has been engaged in carrying out soil resource survey, agro-ecological and soil degradation mapping at the country, state and district levels for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and the various applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Bureau has the mandate to correlate and classify soils of the country and maintain a National Register of all the established soil series. The Institute is also imparting in-service training to staff of the soil survey agencies in the area of soil survey, land evaluation and soil survey interpretations for land use planning. The Bureau in collaboration with Panjabrao Krishi Vidyapeeth, Akola is running post-graduate teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

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TO OBTAIN COPIES,

Please write to:

Director, ICAR - NBSS & LUP,
Amaravati Road, Nagpur,
Maharashtra - 440 033, India
Phone : +91-712-2500386, 2500545 (O)
Telefax : +91-712-2500534
E-Mail : director.nbsslup@icar.gov.in
Website URL : https://www.nbsslup.in

Or

Head, Regional Centre, ICAR - NBSS & LUP,
Hebbal, Bangalore,
Karnataka - 560 024, India
Phone : +91-80-23412242, 23410993 (O)
Telefax : +91-80-23510350
E-Mail : hd_rcb.nbsslup@icar.gov.in
nbssrcb@gmail.com

PART - A

Land Resource Inventory of Belagunda Sub-watershed for Watershed Planning and Development Yadgir Taluk, Yadgir District, Karnataka (AESR 6.2)

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Contributors

Dr. Rajendra Hegde Principal Scientist, Head & Project Leader, Sujala-III Project ICAR-NBSS&LUP, Regional Centre, Bangalore - 24	**Dr. P. Chandran** Director, ICAR-NBSS&LUP Coordinator, Sujala-III Project Nagpur - 33	
Field Work, Mapping & Report Preparation		
Dr. B.A. Dhanorkar	Sh. R.S.Reddy	Sh. Somasekhar, T.N.
Dr. K.V. Niranjana	Dr. Mahendra Kumar, M.B.	Smt. Chaitra, S.P.
	Dr. Gopali Bardhan	Ms. Arpitha, G.M.
Field Work		
Sh. C.Bache Gowda	Sh. Ashok, S. Sindagi	Sh. Manohar, Y. Hosamane
Sh. Somashekar	Sh. Veerabhadrappa	Sh. Pramod, Navale
Sh. M. Jayaramaiah	Sh. Kailash.	Sh. Ramesh Hangargi
	Sh. Yogesh, H.N.	Sh. Rakesh, Achalkar
	Sh. Kamalesh, Avate.	
	Sh. Sharan Kumar Uppar	
	Sh. Kalaveerachari, Kammar	
	Sh. Arun, N. Kambar	
GIS Work		
Dr. S.Srinivas	Sh. A.G.Devendra Prasad	
Dr. M.Ramesh	Sh. Prakashanaik, M.K.	
Sh. D.H.Venkatesh	Smt. K.Karunya Lakshmi	
Smt. K.V.Archana	Ms. Seema, K.V.	
Sh. N. Maddileti	Ms. Karuna Kulkarani	
	Sh. Madappaswamy	
	Sh. Rajendra, D.	
	Smt. Prathibha, D.G.	
	Ms. Sowmya, K.B.	
	Ms. Vidya, P.C.	

Laboratory Analysis	
Dr. M. Lalitha	Ms. Vindhya, N.G.
Smt. Arti Koyal	Ms. P. Pavanakumari, P.
Smt. Parvathy, S.	Ms. Rashmi, N.
	Ms. Leelavathy, K.U.
	Smt. Usha Kiran, G.
	Ms. Chaithra, H.K.
	Ms. Gayathri Chalageri
Soil & Water Conservation	
Sh. Sunil P. Maske	
Watershed Development Department, GoK, Bangalore	
Sh. Prabhash Chandra Ray, IFS Project Director & Commissioner, WDD	Dr. A. Natarajan NRM Consultant, Sujala-III Project
Sh. Padmaya Naik, A. Executive Director, WDD	

How to read and use the Atlas

The Land Resource Inventory of Belagunda Sub-watershed (Yadgir Taluk, Yadgir District) for Watershed Planning (AESR 6.2) was undertaken to provide comprehensive site- specific cadastral level information useful for farm level planning and integrated development of the area under Sujala – III, Karnataka Watershed Development Project- II.

This atlas contains the basic information on kinds of soils, their geographic distribution, characteristics and classification. The soil map and soil based thematic maps derived from soils data on soil depth, soil gravelliness, slope, land suitability for various crops and land use management maps are presented on 1:12,500 scale. The maps of fertility status (soil reaction, organic carbon, available phosphorus, available potassium, available sulphur, available calcium, available copper, available manganese, available zinc, available iron, available boron and salinity (EC) on 1:12,500 scale were derived from grid point sampling of the surface soils from the watersheds.

The atlas illustrates maps and tables that depict the soil resources of the watershed and the need for their sustainable management.

The user, depending on his/her requirement, can refer this atlas first by identifying his/her field and survey number on the village soil map and by referring the soil legend which is provided in tabular form after the soil map for details pertaining to his/her area of interest.

The atlas explains in simple terms the different kinds of soils present in the watershed, their potentials and problems through a series of thematic maps that help to develop site-specific plans as well as the need to conserve and manage this increasingly threatened natural resource through sustainable land use management. The Land Resource Atlas contains database collected at land parcel/ survey number level on soils, climate, water, vegetation, crops and cropping patterns, socio-economic conditions, marketing facilities *etc.* helps in identifying soil and water conservation measures required, suitability for crops and other uses and finally for preparing a viable and sustainable land use options for each and every land parcel.

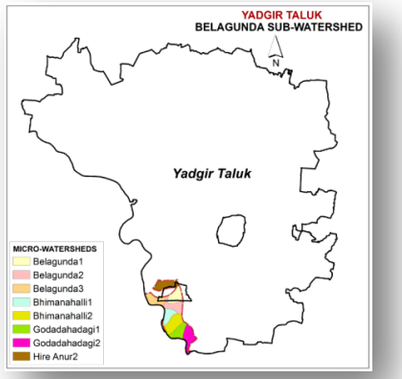
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

Physical, Cultural and Scientific symbols used in the Atlas

Each map in the atlas sheet is complemented with the physical, cultural and scientific symbols to facilitate easy map reading.

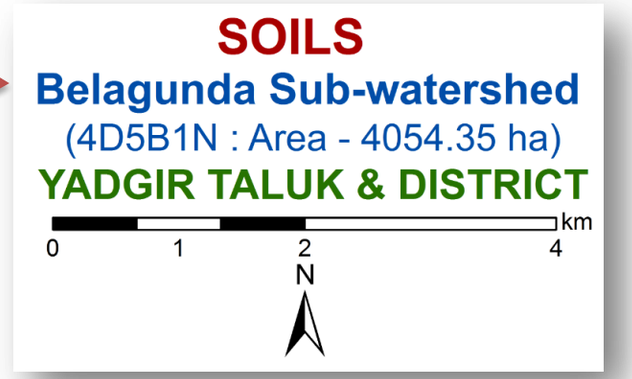
Inset map

Inset provided in each map conveys its strategic location i.e. Taluk, Sub-watershed and Sub-watershed.



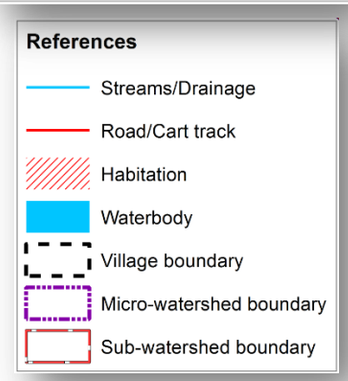
Map title

Map title conveys the relevance of thematic information presented along with a graphical scale, geographical location and watershed details in text form.



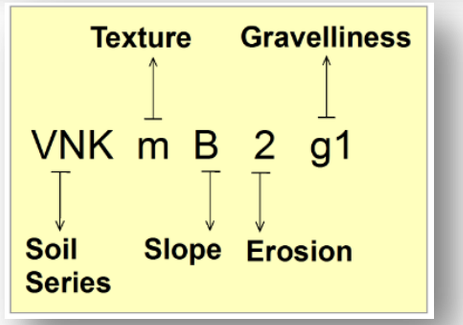
Legends and symbols

*Two legends accompany each map, a **map reference**, which depicts geographic features and a **thematic legend** which portrays spatial information. Picking up the symbol and colour of a particular enables one to go to the legends to obtain the required information.*



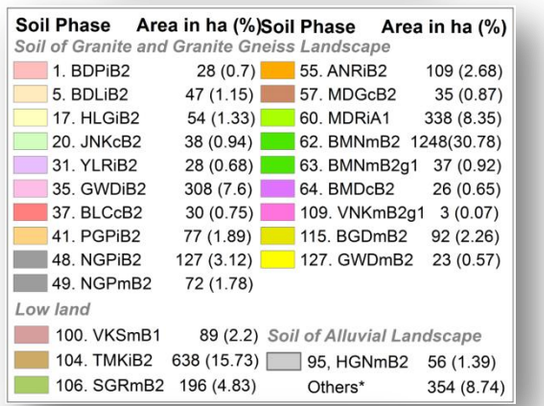
Soil Units

The soil map may be read at different levels. The most detailed level is that of the soil phase. Soil phases are distinguished within soil series mainly based on differences in surface of soil texture, slope, gravelliness, erosion , etc.



Map colours

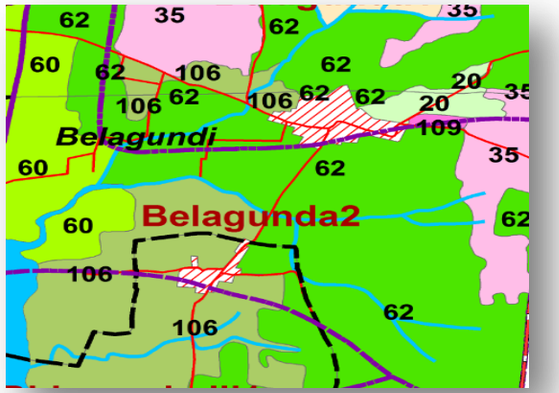
Different shades of colours are used as an aid to distinguish the different classes of soils, crop suitability and other maps.



Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
1. BDPiB2	28 (0.7)	55. ANRiB2	109 (2.68)
5. BDLiB2	47 (1.15)	57. MDGcB2	35 (0.87)
17. HLGiB2	54 (1.33)	60. MDRiA1	338 (8.35)
20. JNKcB2	38 (0.94)	62. BMNmB2	1248(30.78)
31. YLRiB2	28 (0.68)	63. BMNmB2g1	37 (0.92)
35. GWDiB2	308 (7.6)	64. BMDcB2	26 (0.65)
37. BLCcB2	30 (0.75)	109. VNKmB2g1	3 (0.07)
41. PGPiB2	77 (1.89)	115. BGDmB2	92 (2.26)
48. NGPiB2	127 (3.12)	127. GWDmB2	23 (0.57)
49. NGPmB2	72 (1.78)		
Low land			
100. VKSmB1	89 (2.2)	*Soil of Alluvial Landscape*	
104. TMKiB2	638 (15.73)	95, HGNmB2	56 (1.39)
106. SGRmB2	196 (4.83)	Others*	354 (8.74)

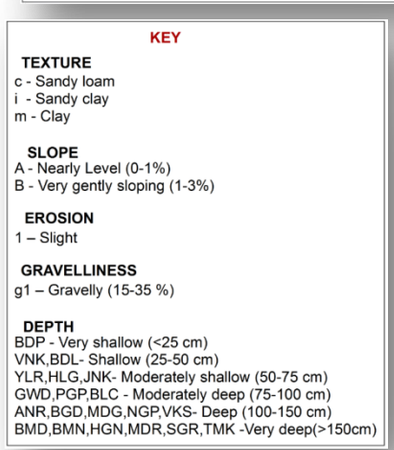
Soil and plot boundaries

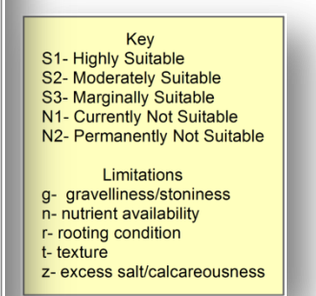
Soil units shown on the map are represented by both the color and a numeral. The soil boundaries are superimposed on land parcel with revenue survey number boundaries to visualize its spatial extent.



Map key

There are many thematic types to be differentiated on the map solely based on colour. Therefore soils and suitability types and their limitations are distinguished by colours with a combination of alpha-numeric characters.





1. Introduction

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to anyone involved in the management of land resources at the grassroots level. In India the area available for agriculture is about 51 per cent of the total area and more than 60 per cent of the people are still relying on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest for farming among the farmers in many areas, large tracts of cultivable lands are turning into fallows and this trend is continuing at an alarming rate.

The watershed management programs are aimed at designing suitable soil and water conservation measures, productivity enhancement of existing crops, crop diversification with horticultural species, greening the wastelands with forestry species of multiple uses and improving the livelihood opportunities for landless people.

The objectives can be met to a great extent when an appropriate Natural Resources Management (NRM) plan is prepared and implemented. It is essential to have site specific Land Resources Inventory (LRI) indicating the potentials and constraints for developing such a site specific plan. LRI can be obtained by carrying out detailed characterization and mapping of all the existing land resources like soils, climate, water, minerals and rocks, vegetation, crops, land use pattern, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed to the farmer and other land users of the area.

The major landforms identified in the Sub-watershed are uplands and low lands. The database was generated by using cadastral map of the village as a base along with high resolution satellite imagery (IRS LISS IV and Cartosat-1). The objectives of the land resource survey, carried out in the Belagunda Sub-watershed covering an area of 4054.35 ha are indicated below.

- Detailed characterization of all the land resources like soil, water, land use, cropping pattern and other resources available at parcel level in the village.
- Delineation of homogenous areas based on soil-site characteristics into management units.
- Collection and interpretation of climatic and agronomical data for crop planning.
- Identification of problems and potentials of the area and strategies for their management.
- Assessment of the suitability of land resources for various crops and other uses.
- Establishment of village level digital land resources database in a GIS framework.
- Enable the watershed and other line departments to prepare an action plan for the integrated development of the watershed.

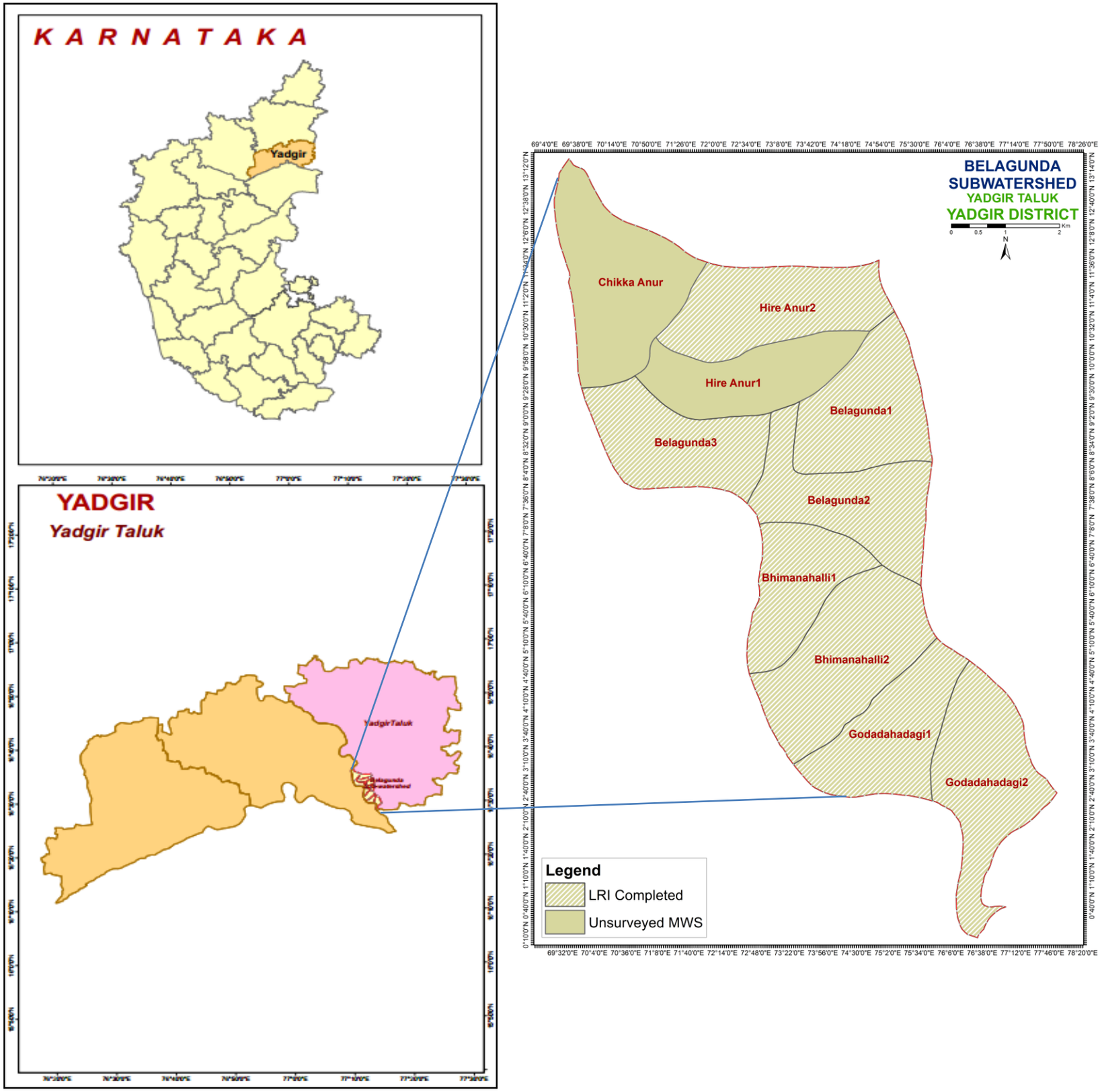
2. General Description of Sub-watershed

The Yadgir, popularly called as “Yadavagiri” by the local people, district came to existence on 30th Dec 2009 by carving out of erst-while Kalaburagi district of Karnataka with a geographical area of 5234.4 square kilometers, located in the northern part of the state. It lies between north latitudes’ $16^0$57’ – $16^0$59’ and east longitudes 77^0 12’ – 77^0 13’. The climate of the district is very hot and dry. The district has an average annual rainfall of 636 mm. Soils are well drained red sandy loam to medium deep black soils. This may be the weathering product of gneissic and granite terrain. Agriculture in Yadgir district is dependent upon rainfall, irrigation tanks, wells, streams etc. The major agricultural crops grown are Jowar, Groundnut, Cotton, Red gram, Bengal gram etc.

As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of Sub-watershed (SWs) - LRI for the Belagunda SWs (code– 4D5B1N) in Yadgir taluk, Yadgir district covering an area of 5091ha. It was selected for data base generation under Sujala III project. This sub-watershed encompasses of 10 MWs namely Belagunda-1 (4D5B1N1e), Belagunda-2 (4D5B1N1f), Belagunda-3 (4D5B1N1d), Bhimanahalli-1 (4D5B1N2a), Bhimanahalli-2 (4D5B1N2b), Chikka Anur (4D5B1N1a), Godadahadagi-1 (4D5B1N2c), Godadahadagi-2 (4D5B1N2d), Hire Anur-1 (4D5B1N1c) and Hire Anur-2 (4D5B1N1b). Land Resource Inventory (LRI) was generated for eight among ten micro-watersheds.

2.1. Location and Extent

LOCATION MAP OF BELAGUNDA SUB-WATERSHED



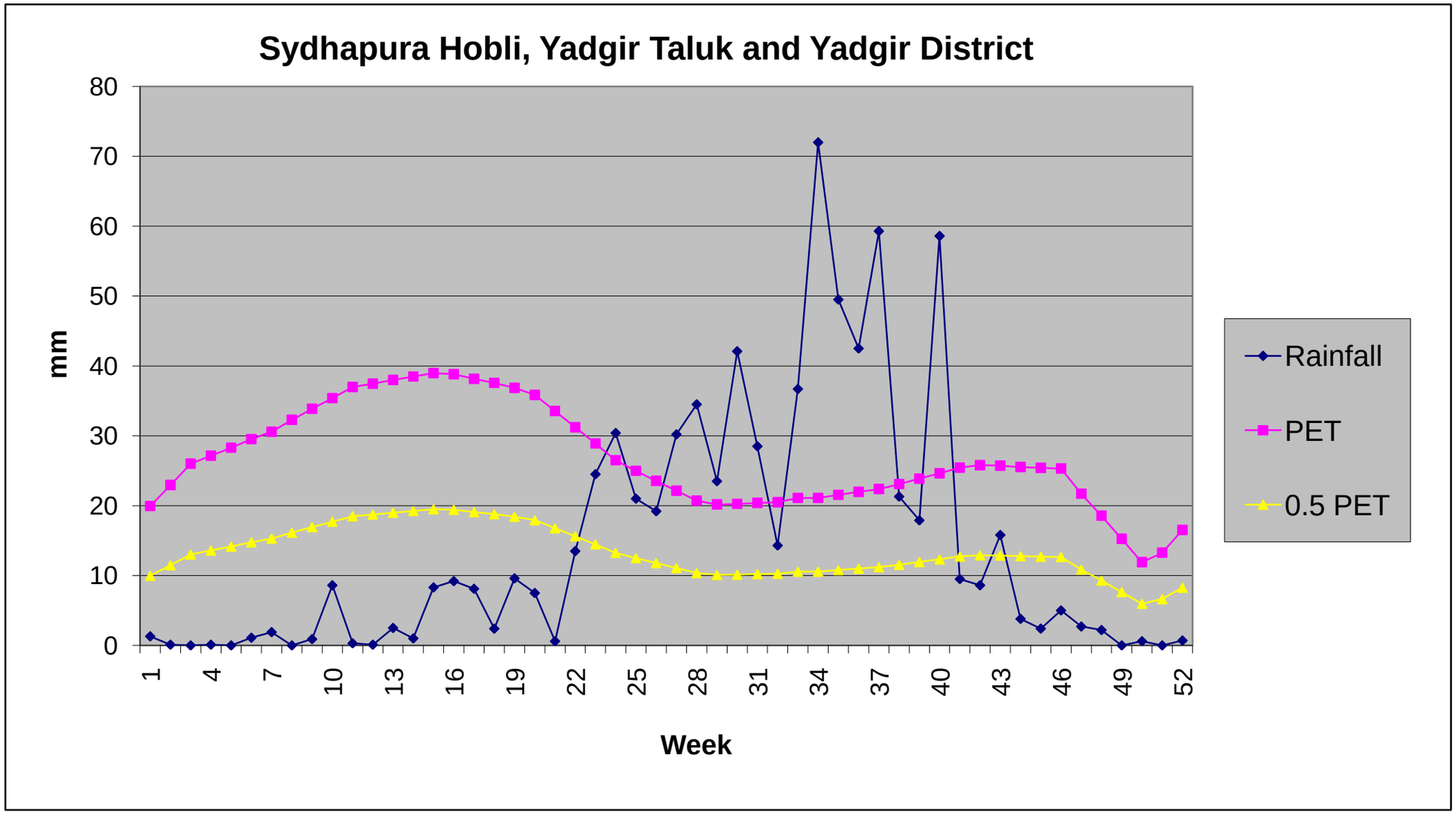
Belagunda sub-watershed (Yadgir Taluk, Yadgir District) is located between $16^0$28'22"–$16^0$36' 8" North latitudes and 77^0 9'47"- 77^0 15'11" East longitudes, covering an area of about 5091ha, bounded by Belagundi, Goodura, Bheenmanahalli villages.

Agro Ecological Sub Region (AESR) 6.2: Central and Western Maharashtra Plateau and North Karnataka Plateau and North Western Telangana Plateau, hot moist semi-arid ESR with shallow and medium loamy to clayey Black soils (medium and deep clayey Black soils as inclusion), medium to high AWC and LGP 120-150 days.

Agro-climatic Zone 2: North-eastern Dry Zone: The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane.

NOTE: Land Resource Inventory (LRI) was generated for eight among ten micro-watersheds

Climate

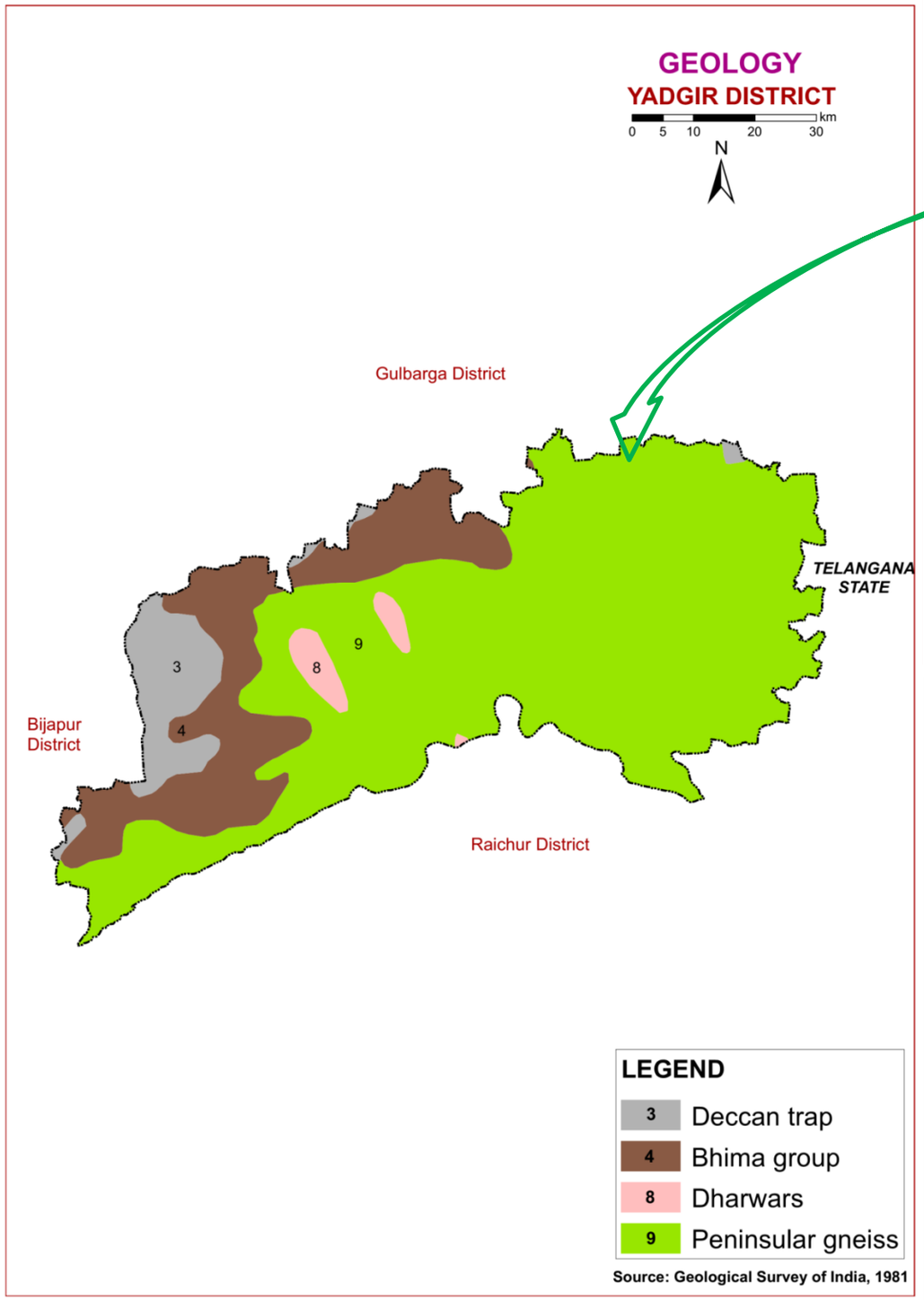


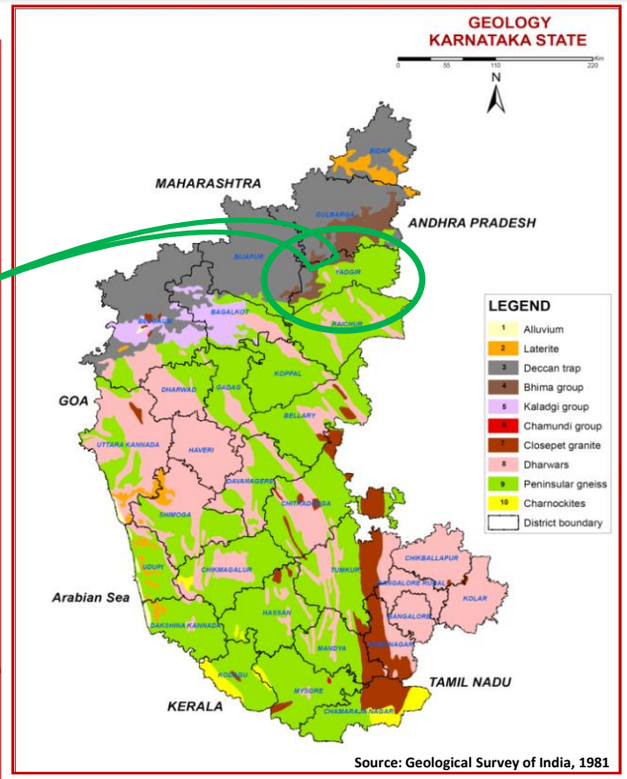
Length of Growing Period (LGP) is varying from June 1st week to 4th week of October (120 - 150 days)

Annual Rainfall : 754 mm. in the Sydhapura Hobli, Yadgir Taluk & District

Source: KSNDMC (1980-2011)

2.3. Geology





GEOLOGY - KARNATAKA STATE

Karnataka forms part of the Peninsular Shield, which is an ancient stable block of the earth's crust. The shield is composed of geologically ancient rocks of diverse origin. These rocks have undergone various degrees of metamorphism and crushing. Overlying these ancient rocks are Proterozoic, lete Creteceous to Palaeocene, Palaeocene to Recent, and Recent sediments.

In the stratigraphic succession of rocks in Karnataka the Archaean group is the oldest, followed by Proterozoic, Mesozoic and Cainozoic formations.

GEOLOGY - YADGIR DISTRICT

Mesozoic Group

Towards the end of the Cretaceous Period there was tremendous volcanic activity in the Peninsular part of India with eruption of a series of lava flows which came out through fissures and cracks. This formation is Known as the Deccan Trap.

Deccan Trap: The Deccan Trap covers an area of 25,000 sq. km. Eight lava flows have been identified in Karnataka, horizontally overlying the older formations. The thickness of the individual flows averages about five metres. The Deccan Trap is relatively uniform in petrographic character. The most common type is augite basalt. Dominant colour is greyish green; texture ranges from cryptocrystalline to glassy. The rock is often visicular and scoriaceous.

Upper Proterozoic Group

Formations of the Upper Proterozoic in Karnataka are closepet granites, Chamundi granites, Kaladgi series and Bhima series.

Bhima series

This series, equivalent to the Kurnool formations, is named after the Bhima river and occurs in Bijapur and Gulbarga districts. It covers an area of about 4200 sq. km and is overlain by the Deccan trap. The group consists of horizontal, unfossiliferous, unmetamorphosed sedimentary rocks such as sandstones, green, purple and black shales, and cream and bluish limestones. The thickness is about 477 metres.

Dharwar schists

The Dharwar schists consist of a complex series of crystalline schists associated with ultrabasic rocks such as amphibolite, peridotites and dunites. These schists are found in long, narrow bands of various dimensions running NW-SE through the Peninsular Gneiss. The Dharwars are divided into Upper and Lower.

Upper Dharwars are equivalent to the Archaean to Lower Proterozoic, and are divided into Bababudan.

Lower Dharwars occur in Mysore district and include amphibolite schist, quartzite, ironstone and marble.

Peninsular Gneiss

Exposed over a large area of Karnataka in all the districts except Bidar is the Peninsular Gneiss which is a heterogeneous mixture of several types of granitic rocks such as banded gneisses, granitic gneisses, granites and gneissic granites, granodiorites and diorites. The banded gneisses consist of white bands of quartz-feldspar alternating with dark bands of biotite, hornblende, and minor accessories. The granite group includes granites of all shades with varying composition. Peninsular gneiss seems to have formed by the granitization of the older rocks.

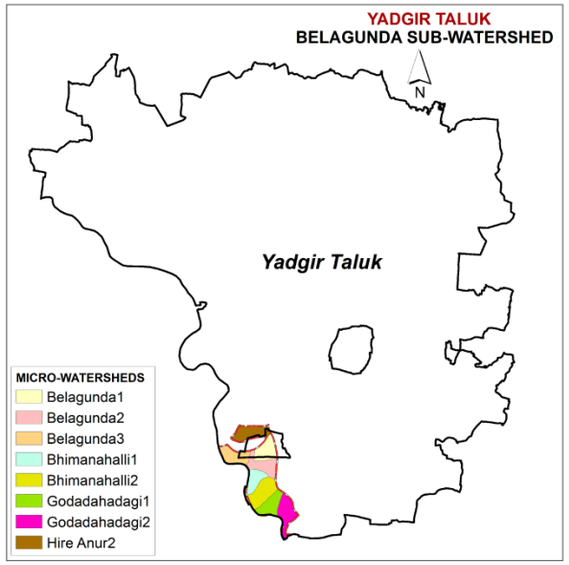
3. Survey Methodology

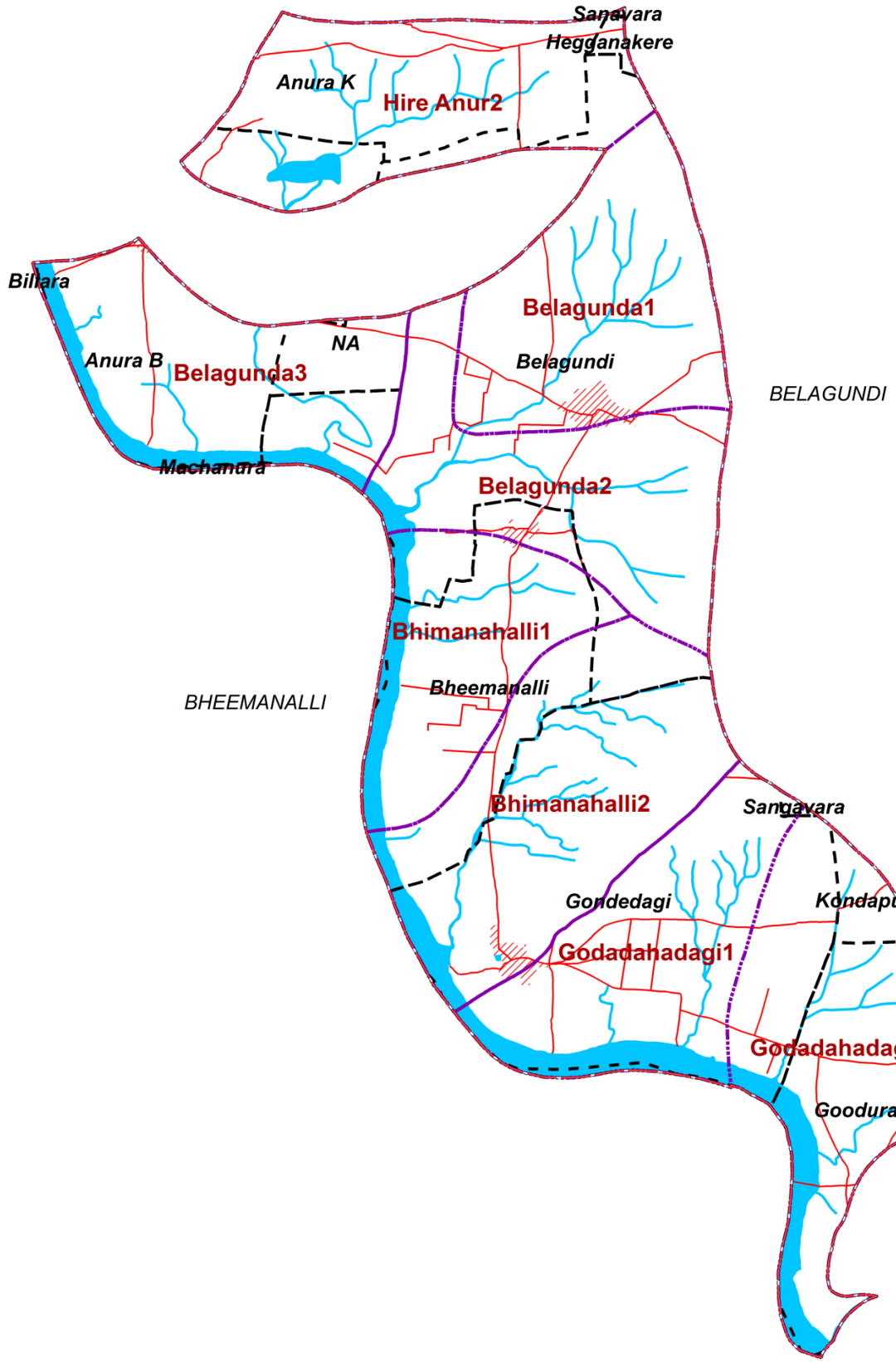
Sequence of activities in generation of LRI

- Traversing the watershed using cadastral maps and imagery as base
- Identifying landforms, geology, land use and other features
- Selecting fields representing land units
- Opening profiles to 2 m depth
- Studying soil and site characteristics
- Grouping similar areas based on their soil-site characteristics into land management units
- Preparation of crop, soil and water conservation plan
- Socio-economic evaluation

The required site and soil characteristics are described and recorded on a standard proforma by following the protocols and guidelines given in the soil survey manual and field guide. Collection of soil samples from representative pedons for laboratory characterization and collection of surface soil samples from selected fields covering most of the management units for macro and micro-nutrient analysis is being carried out (320m grid intervals). Further processing of data at chemical lab and GIS lab are carried out to generate various thematic maps for each of the study area.

3.1. Database Used - Cadastral map





Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

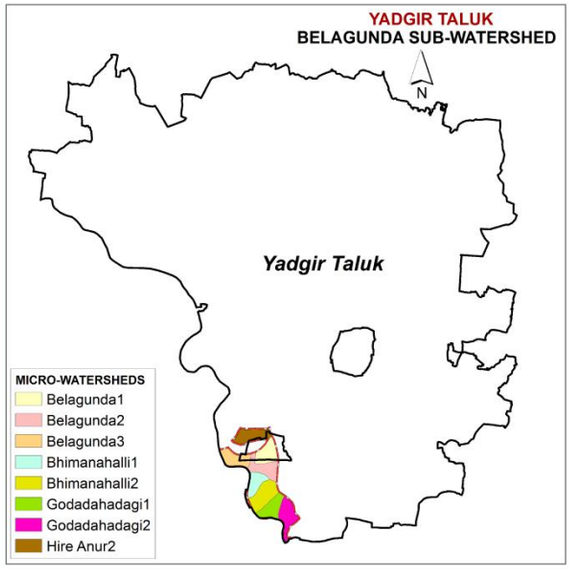
N

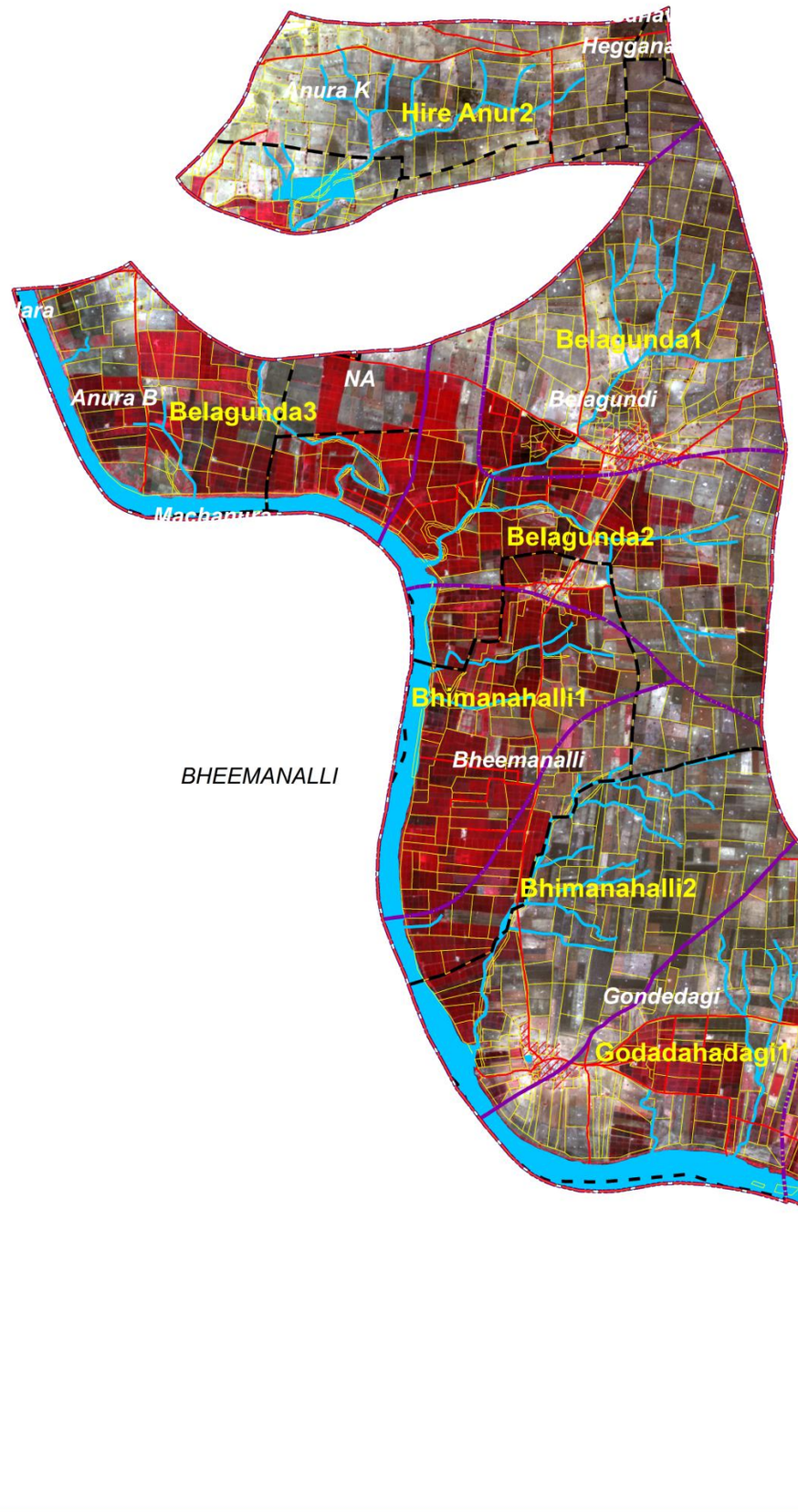
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

3.2. Database Used - Satellite Image





SATELLITE IMAGE
Belagunda Sub-watershed
(4D5B1N : Area - 4054.35 ha)
YADGIR TALUK & DISTRICT

0 1 2 4 km

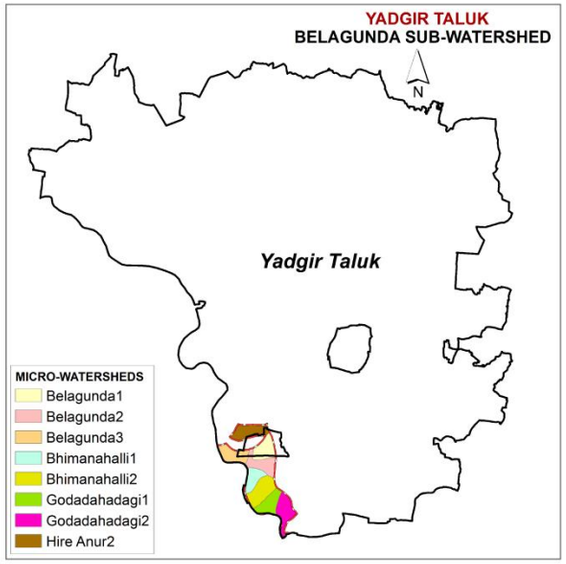
N

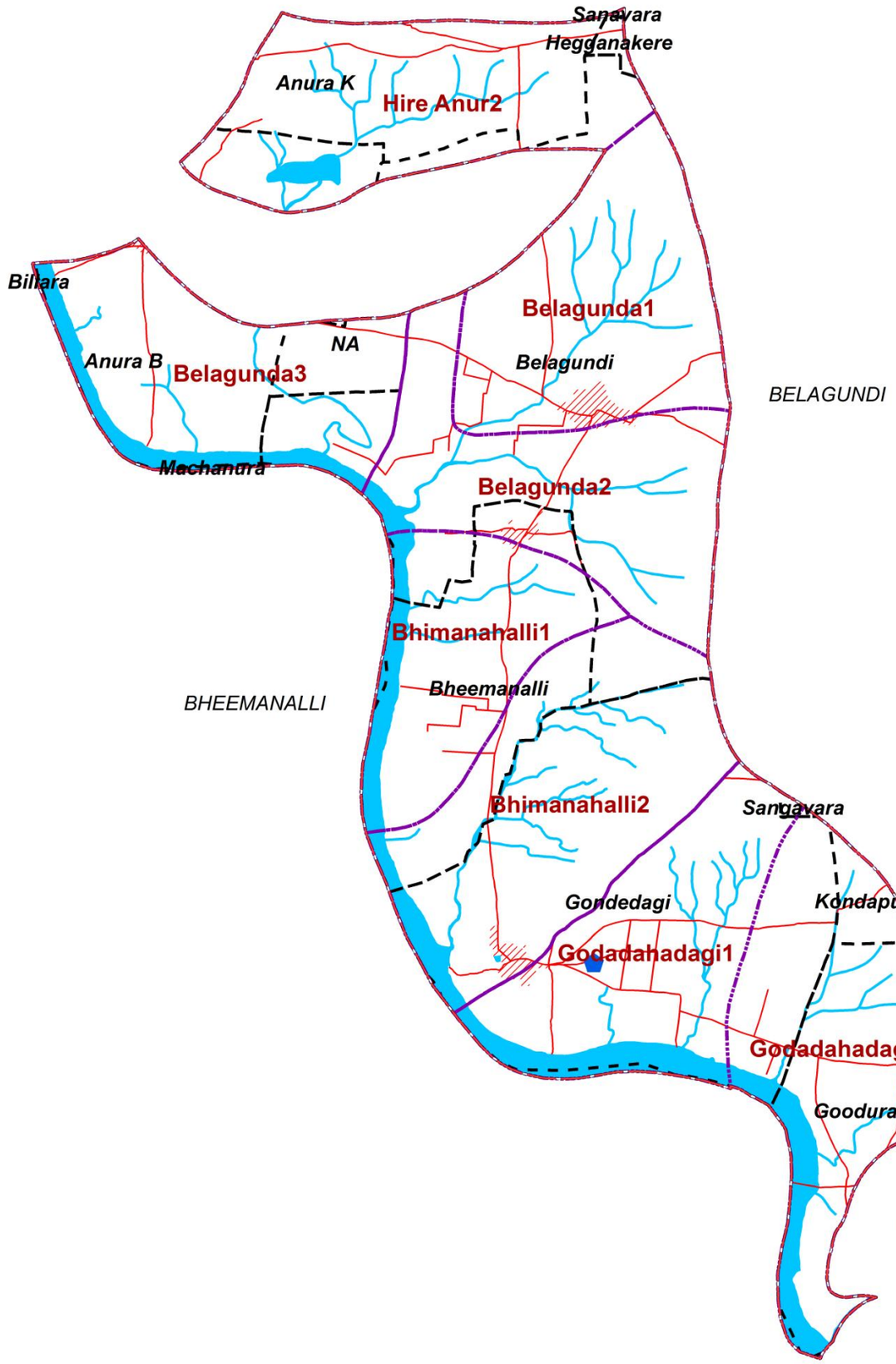
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Land parcels
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: Cartosat-1 Imagery, 2011

3.3. Location of Wells





LOCATION OF WELLS

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

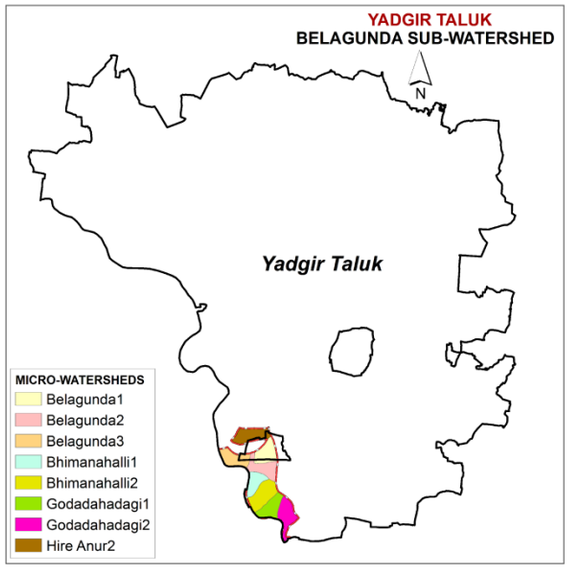
References

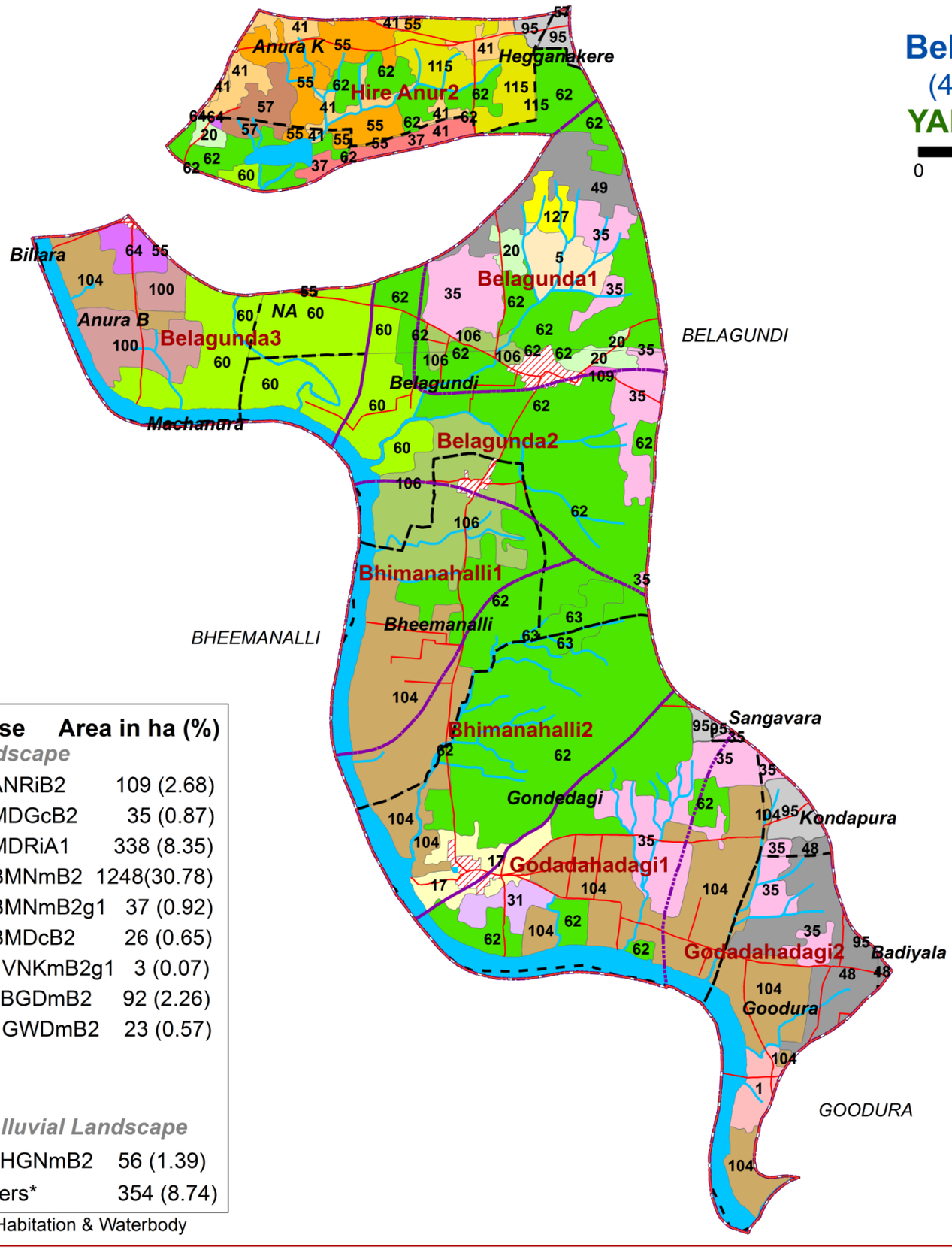
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Legend	No's
Open well	1

Source: ICAR-NBSS&LUP, Bengaluru

4. The Soils





SOILS
Belagunda Sub-watershed
(4D5B1N : Area - 4054.35 ha)
YADGIR TALUK & DISTRICT

km 0 1 2 4
N

Texture **Gravelliness**

VNK m B 2 g1

Soil Series | Slope | Erosion

Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
1. BDPiB2	28 (0.7)	55. ANRiB2	109 (2.68)
5. BDLiB2	47 (1.15)	57. MDGcB2	35 (0.87)
17. HLGiB2	54 (1.33)	60. MDRiA1	338 (8.35)
20. JNKcB2	38 (0.94)	62. BMNmB2	1248(30.78)
31. YLRiB2	28 (0.68)	63. BMNmB2g1	37 (0.92)
35. GWDiB2	308 (7.6)	64. BMDcB2	26 (0.65)
37. BLCcB2	30 (0.75)	109. VNKmB2g1	3 (0.07)
41. PGPiB2	77 (1.89)	115. BGDmB2	92 (2.26)
48. NGPiB2	127 (3.12)	127. GWDmB2	23 (0.57)
49. NGPmB2	72 (1.78)		
Low land			
100. VKSmB1	89 (2.2)	*Soil of Alluvial Landscape*	
104. TMKiB2	638 (15.73)	95, HGNmB2	56 (1.39)
106. SGRmB2	196 (4.83)	Others*	354 (8.74)

* - Habitation & Waterbody

KEY

TEXTURE
c - Sandy loam
i - Sandy clay
m - Clay

SLOPE
A - Nearly Level (0-1%)
B - Very gently sloping (1-3%)

EROSION
1 – Slight

GRAVELLINESS
g1 – Gravelly (15-35 %)

DEPTH
BDP - Very shallow (<25 cm)
VNK,BDL- Shallow (25-50 cm)
YLR,HLG,JNK- Moderately shallow (50-75 cm)
GWD,PGP,BLC - Moderately deep (75-100 cm)
ANR,BGD,MDG,NGP,VKS- Deep (100-150 cm)
BMD,BMN,HGN,MDR,SGR,TMK -Very deep(>150cm)

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

4.1 Mapping unit description of Belagunda (4D5B1N) Sub-watershed in Yadgir Taluk, Yadgir district

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss Landscape				
	BDP	Baddeppalli soils are very shallow (<25 cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**28 (0.7)**
1		BDPiB2	Sandy clay surface, slope 1-3%, moderate erosion	28 (0.7)
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, slightly calcareous sandy loam soils occurring on very gently to gently sloping uplands under cultivation		**47 (1.15)**
5		BDLiB2	Sandy clay surface, slope 1-3%, moderate erosion	47 (1.15)
	VNK	Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown, sandy clay red soils occurring on very gently to moderately sloping uplands under cultivation		**3 (0.07)**
109		VNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.07)
	HLG	Halagera soils are moderately shallow (50-75 cm), well drained, have very dark grayish brown to dark yellowish brown, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation.		**54 (1.33)**
17		HLGiB2	Sandy clay surface, slope 1-3%, moderate erosion	54 (1.33)
	JNK	Jinkera soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, slightly calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**38 (0.94)**
20		JNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	38 (0.94)
	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, clay red soils occurring on very gently to gently sloping uplands under cultivation		**28 (0.68)**
31		YLRiB2	Sandy clay surface, slope 1-3%, moderate erosion	28 (0.68)
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, calcareous sodic sandy clay loam soils occurring on very gently sloping uplands under cultivation		**331 (8.17)**
35		GWDiB2	Sandy clay surface, slope 1-3%, moderate erosion	308 (7.6)
127		GWDmB2	Clay surface, slope 1-3%, moderate erosion	23 (0.57)
	BLC	Balichakra soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown, sandy clay loam red soils occurring on very gently sloping uplands under cultivation		**30 (0.75)**
37		BLCcB2	Sandy loam surface, slope 1-3%, moderate erosion	30 (0.75)
	PGP	Poglapur soils are moderately deep (75-100 cm), well drained, have dark brown, dark reddish brown to yellowish red sandy clay soils occurring on very gently sloping uplands under cultivation		**77 (1.89)**
41		PGPiB2	Sandy clay surface, slope 1-3%, moderate erosion	77 (1.89)

To be continued….

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
	NGP	Nagalapur soils are deep (100-150 cm), moderately well drained, have very dark gray to very dark grayish brown, black calcareous cracking clay soils occurring on very gently sloping uplands under cultivation		**199 (4.9)**
48		NGPiB2	Sandy clay surface, slope 1-3%, moderate erosion	127 (3.12)
49		NGPmB2	Clay surface, slope 1-3%, moderate erosion	72 (1.78)
	ANR	Anur soils are deep (100-150 cm), moderately well drained, have dark gray to dark brown, calcareous sodic clay soils occurring on very gently to gently sloping uplands under cultivation		**109 (2.68)**
55		ANRiB2	Sandy clay surface, slope 1-3%, moderate erosion	109 (2.68)
	MDG	Mundargi soils are deep (100-150 cm), well drained, have brown to dark yellowish brown, sandy clay loam soils occurring on very gently sloping uplands under cultivation		**35 (0.87)**
57		MDGcB2	Sandy loam surface, slope 1-3%, moderate erosion	35 (0.87)
	BGD	Belagundi soils are deep (100-150 cm) well drained, have brown to dark yellowish brown, slightly calcareous clayey soils occurring on nearly level to very gently sloping uplands under cultivation		**92 (2.26)**
115		BGDmB2	Clay surface, slope 1-3%, moderate erosion	92 (2.26)
	MDR	Madhwara soils are very deep (>150 cm), well drained, have very dark gray to very dark brown, slightly calcareous sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**338 (8.35)**
60		MDRiA1	Sandy clay surface, slope 0-1%, slight erosion	338 (8.35)
	BMN	Bhimanahalli soils are very deep (>150 cm), moderately well drained, have very dark gray, calcareous cracking clay black soils occurring on very gently sloping uplands under cultivation		**1285 (31.7)**
62		BMNmB2	Clay surface, slope 1-3%, moderate erosion	1248 (30.78)
63		BMNmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	37 (0.92)
	BMD	Bomraldoddi soils are very deep (>150 cm), well drained, have dark reddish brown to dark grey, reddish brown, dark brown and yellowish red, slightly calcareous sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**26 (0.65)**
64		BMDcB2	Sandy loam surface, slope 1-3%, moderate erosion	26 (0.65)
	VKS	Vankasambar soils are deep (100-150 cm), well drained, very dark brown to brown, sodic calcareous sandy clay loam soils occurring on very gently to gently sloping lowlands under cultivation		**89 (2.2)**
100		VKSmB1	Clay surface, slope 1-3%, slight erosion	89 (2.2)
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have very dark gray to dark brown, slightly calcareous sodic clay soils occurring on nearly level to very gently sloping low lands under cultivation		**638 (15.73)**
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	638 (15.73)

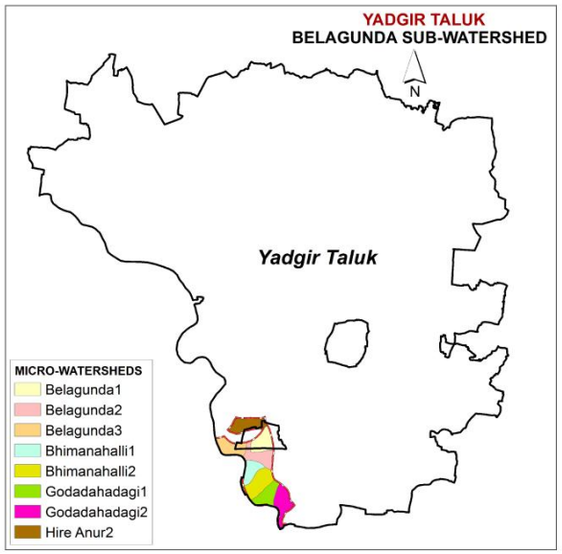
To be continued….

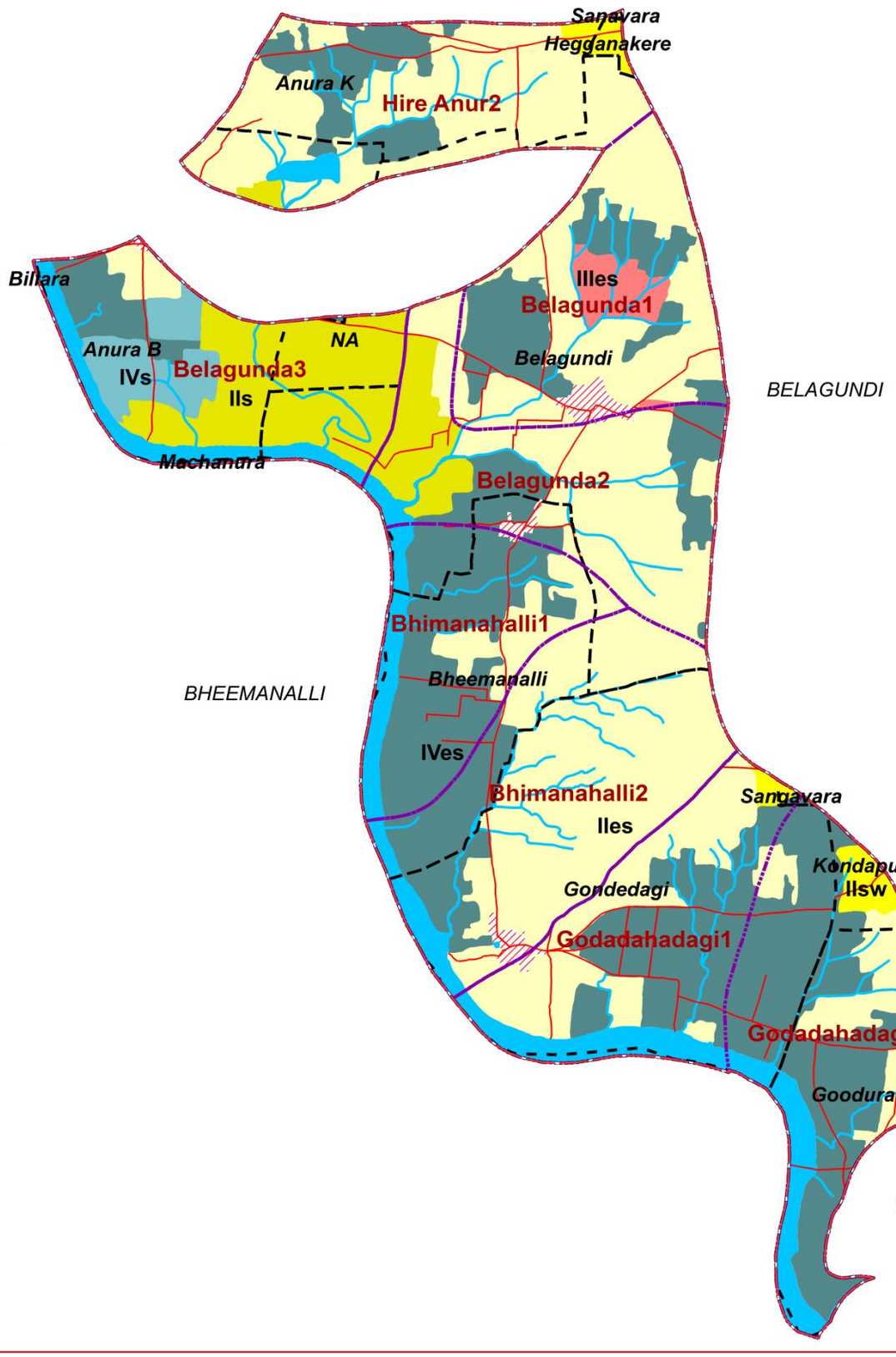
Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
	SGR	Sangwar soils are very deep (>150 cm), moderately well drained, have dark gray to very dark gray, calcareous sodic cracking clay soils occurring on nearly level to very gently sloping lowlands under cultivation		**196 (4.83)**
106		SGRmB2	Clay surface, slope 1-3%, moderate erosion	196 (4.83)
Soils of Alluvial Landscape				
	HGN	Hegganakera soils are very deep (>150 cm), moderately well drained, have very dark gray to dark grayish brown, slightly calcareous cracking clay soils occurring on very gently sloping plains under cultivation		**56 (1.39)**
95		HGNmB2	Clay surface, slope 1-3%, moderate erosion	56 (1.39)
1000		Others	Habitation & Waterbody	**354 (8.74)**

* Soil map unit numbers are continuous for the taluk, not for the sub-watershed

5. Soil Survey Interpretations

5.1. Land Capability Classification





LAND CAPABILITY
Belagunda Sub-watershed
(4D5B1N : Area - 4054.35 ha)
YADGIR TALUK & DISTRICT

0 1 2 4 km
N

Key
II - Good cultivable land
III - Moderately good cultivable lands
IV - Fairly good cultivable lands

Limitations
e - erosion limitation
s - soil limitation
(depth, gravelliness, texture, salinity/alkalinity)
w - Excess of water
(wetness high water table, drainage) limitation.

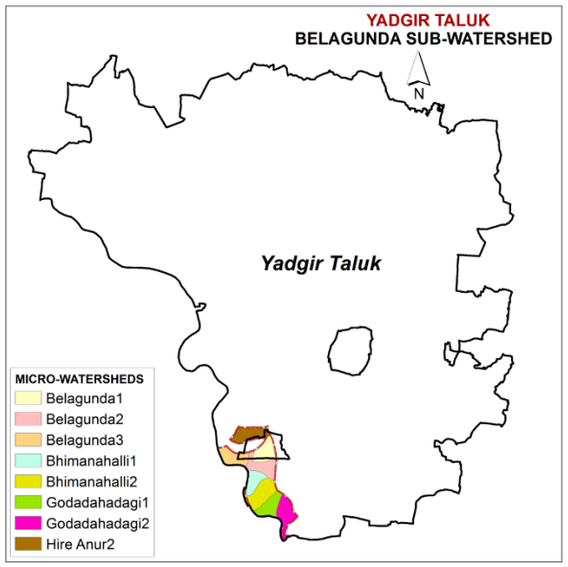
Capability subclass	Area in ha (%)
IIs	338 (8.35)
IIes	1865 (45.99)
IIsw	56 (1.39)
IIIes	49 (1.22)
IVs	89 (2.2)
IVes	1302 (32.12)
Others*	354 (8.74)

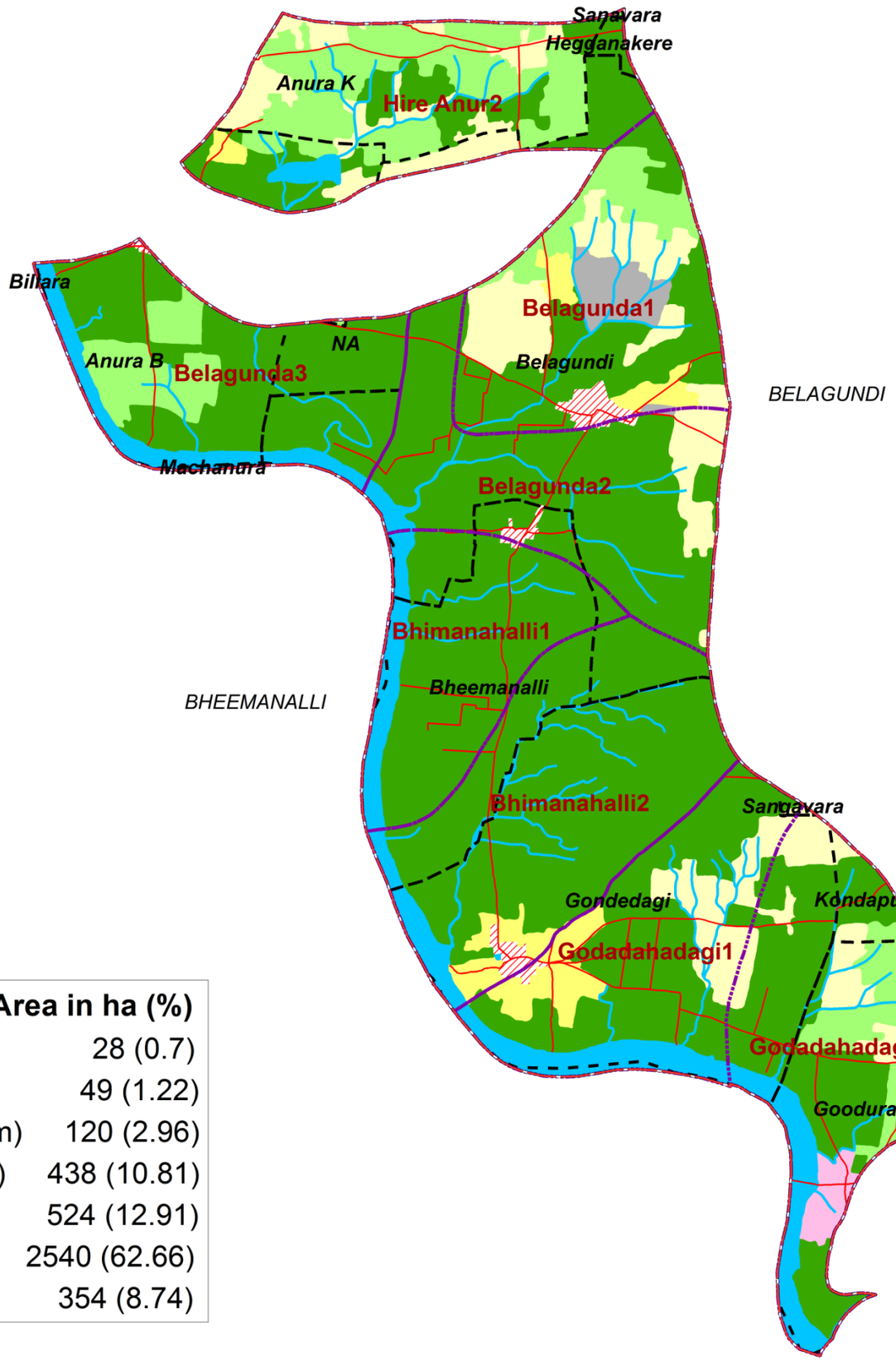
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.2. Soil Depth





SOIL DEPTH

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Depth Class	Area in ha (%)
Very shallow (<25 cm)	28 (0.7)
Shallow (25-50 cm)	49 (1.22)
Moderately shallow (50-75 cm)	120 (2.96)
Moderately deep (75-100 cm)	438 (10.81)
Deep (100-150 cm)	524 (12.91)
Very deep (>150 cm)	2540 (62.66)
Others*	354 (8.74)

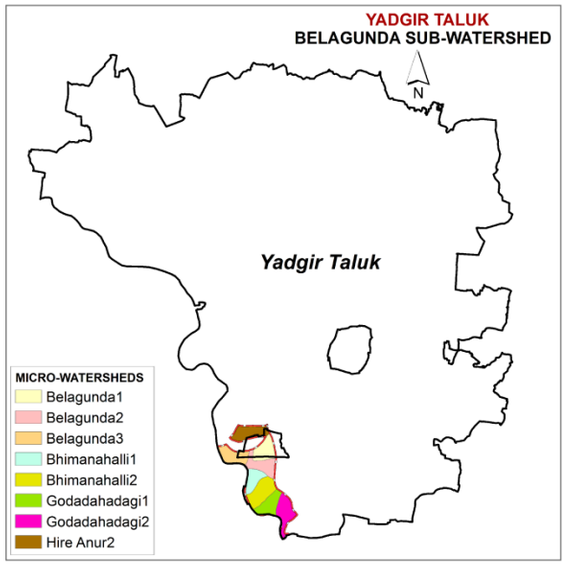
* - Habitation & Waterbody

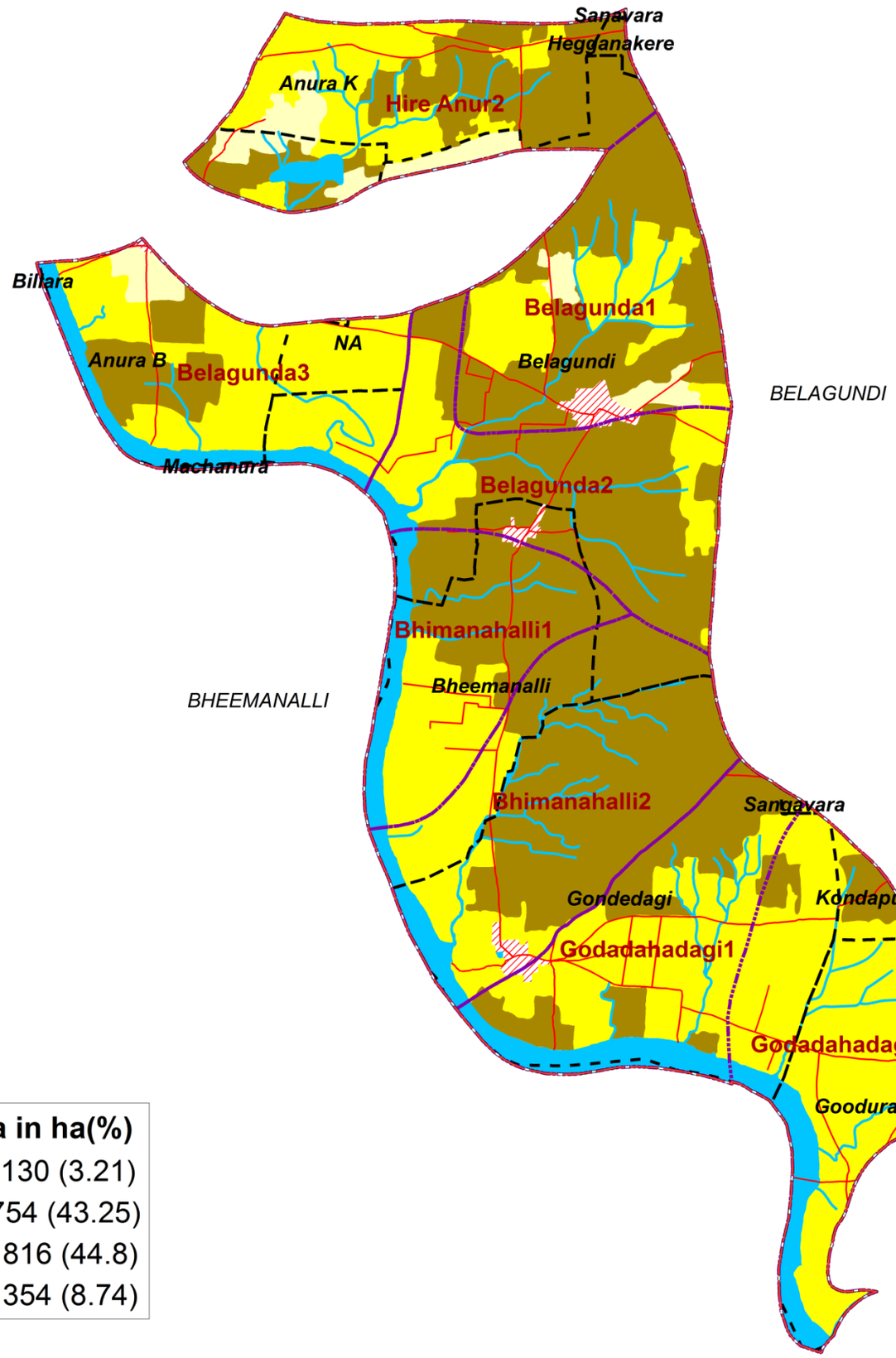
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.3. Surface Soil Texture





SURFACE SOIL TEXTURE

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Texture Class	Area in ha(%)
Sandy loam	130 (3.21)
Sandy clay	1754 (43.25)
Clay	1816 (44.8)
Others*	354 (8.74)

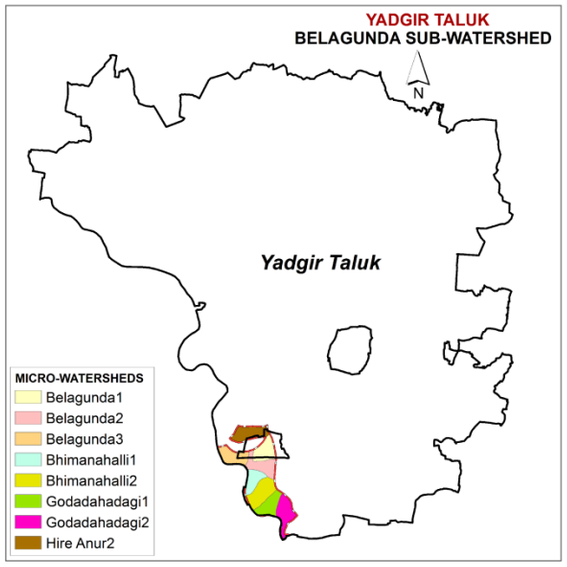
* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.4. Surface Soil Gravelliness



SOIL GRAVELLINESS

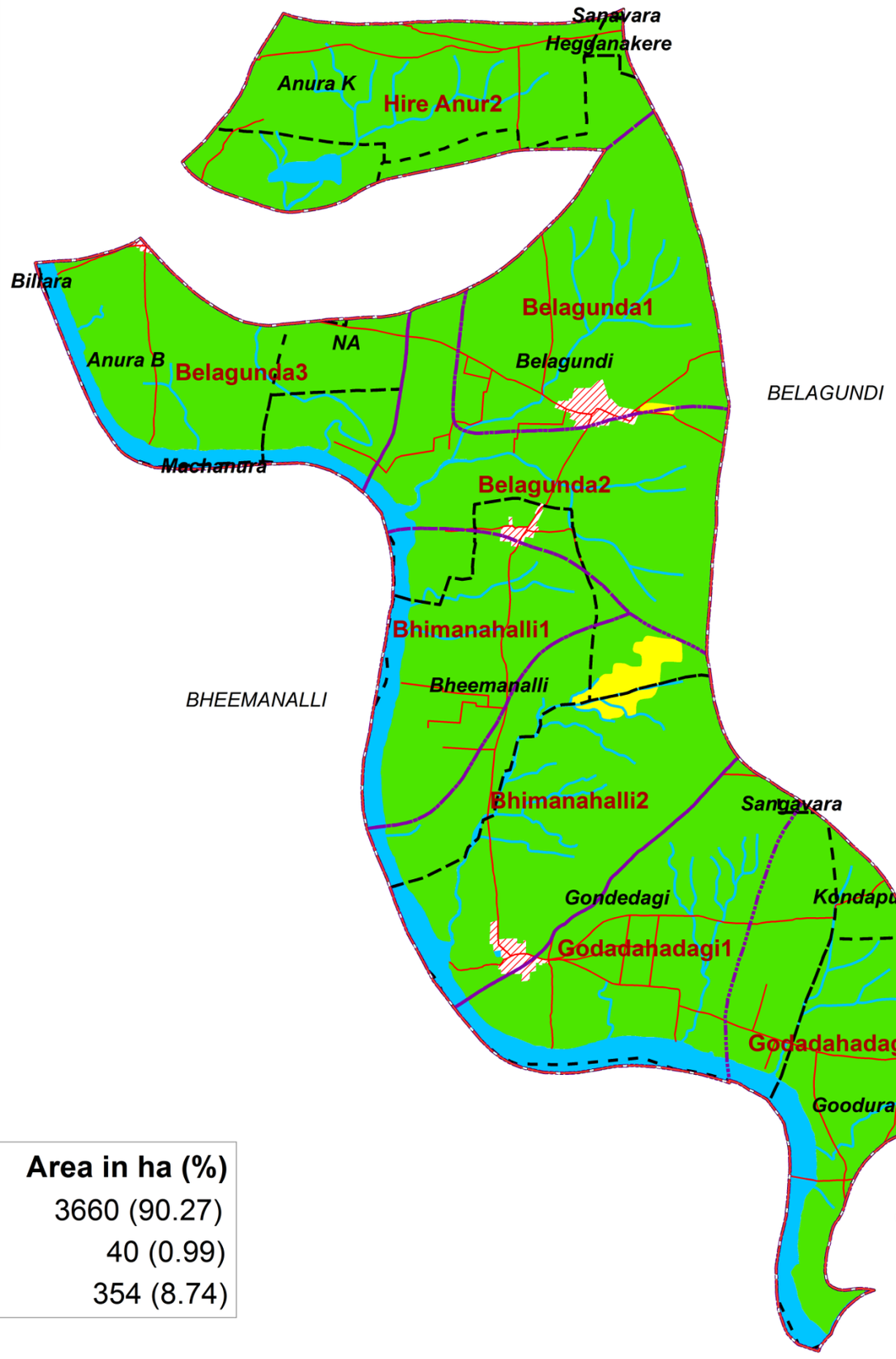
Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N



Gravelly Class	Area in ha (%)
Non gravelly (<15%)	3660 (90.27)
Gravelly (15-35%)	40 (0.99)
Others*	354 (8.74)

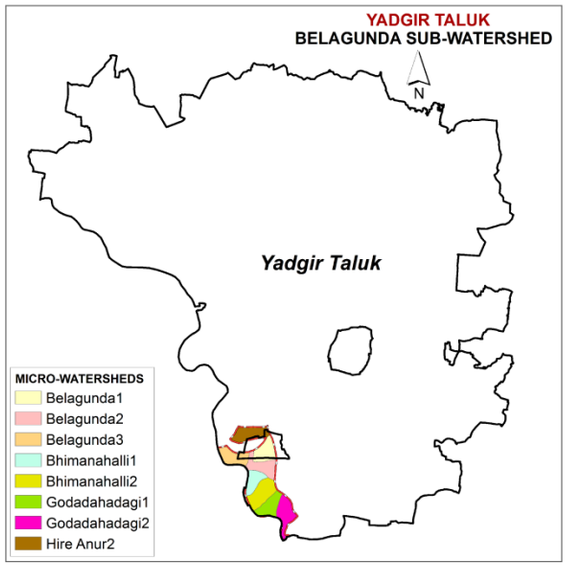
* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.5. Available Water Capacity



AVAILABLE WATER CAPACITY

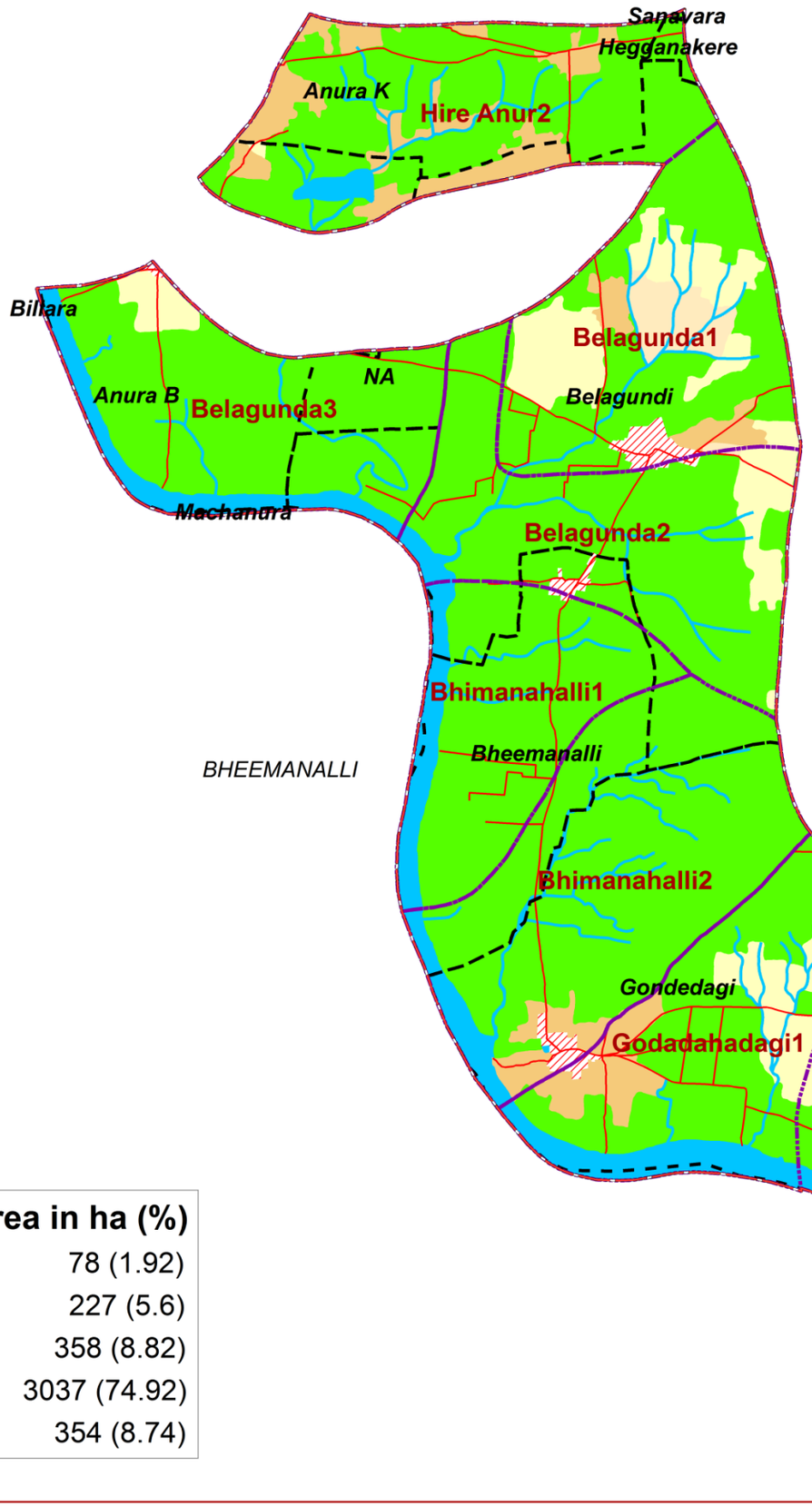
Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N



Available Water Capacity	Area in ha (%)
Very low (<50 mm/m)	78 (1.92)
Low (51-100 mm/m)	227 (5.6)
Medium (101-150 mm/m)	358 (8.82)
Very high (>200 mm/m)	3037 (74.92)
Others*	354 (8.74)

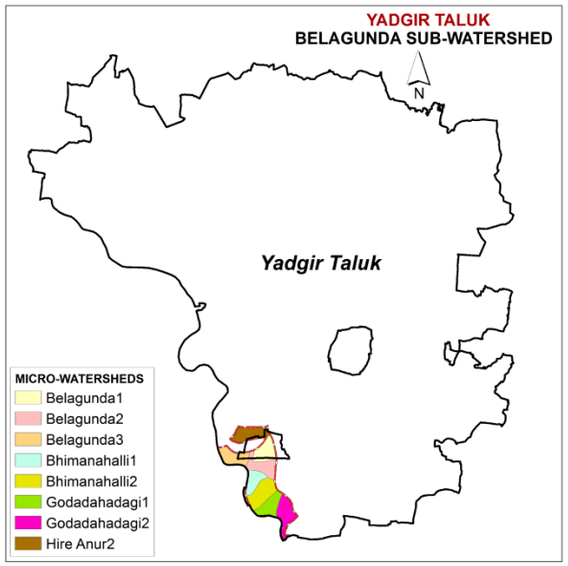
* - Habitation & Waterbody

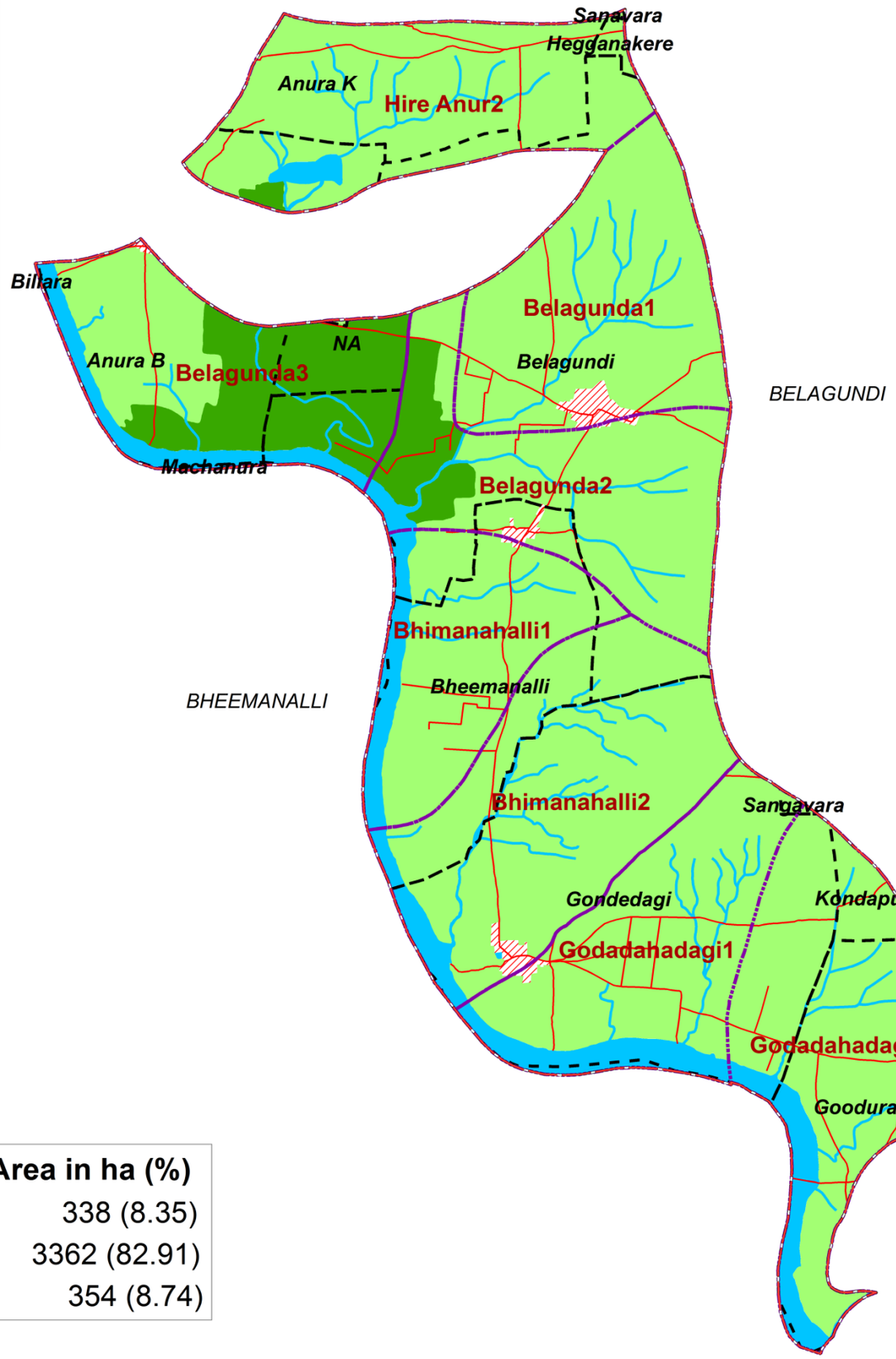
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.6.Slope





SLOPE

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Slope Class	Area in ha (%)
Nearly level (0-1%)	338 (8.35)
Very gently sloping (1-3%)	3362 (82.91)
Others*	354 (8.74)

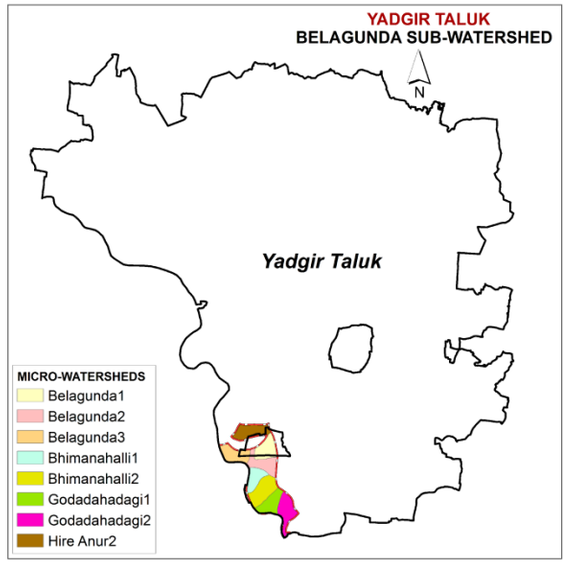
* - Habitation & Waterbody

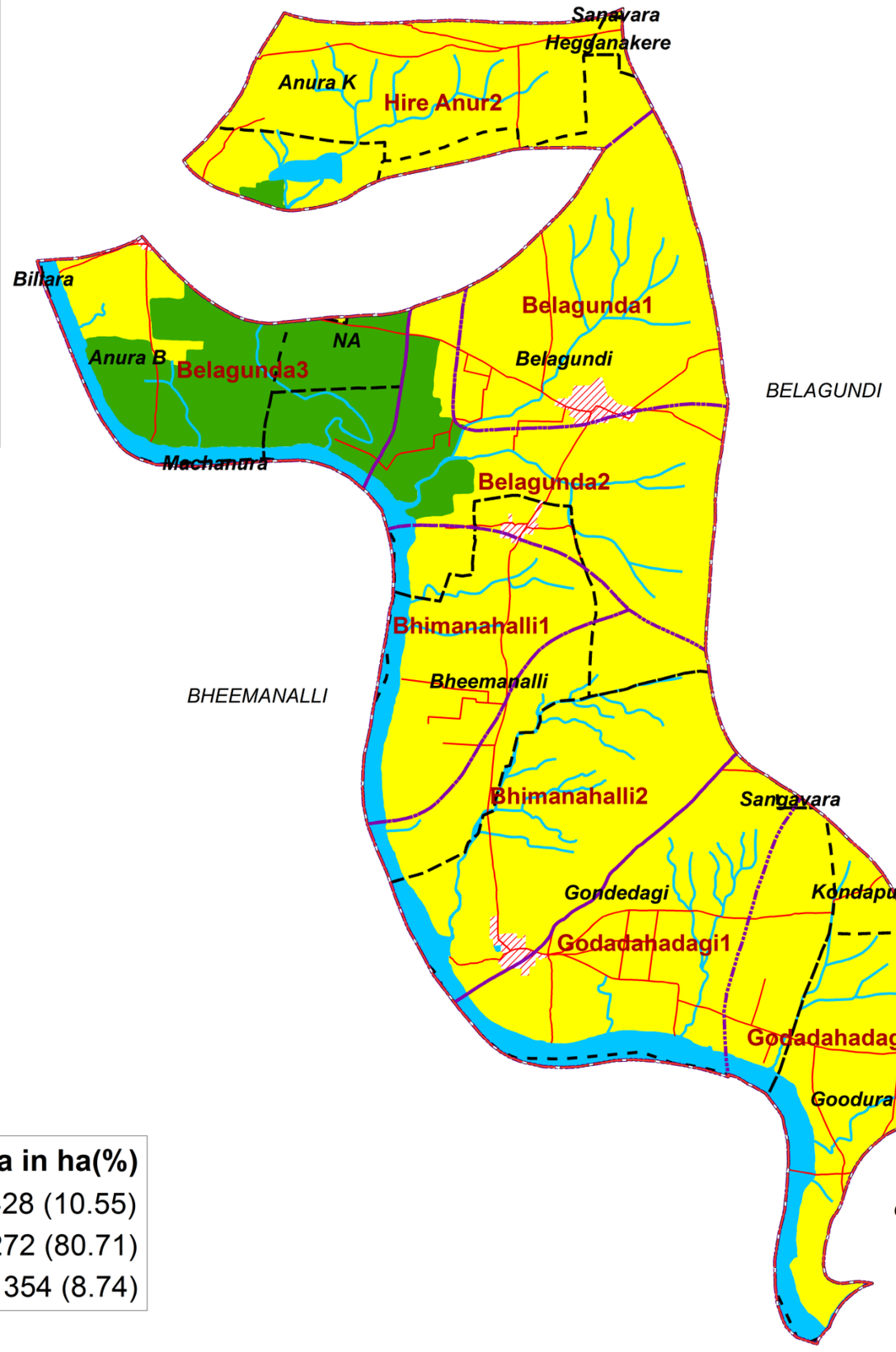
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.7.Soil Erosion





SOIL EROSION

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Erosion Class	Area in ha(%)
Slight	428 (10.55)
Moderate	3272 (80.71)
Others*	354 (8.74)

* - Habitation & Waterbody

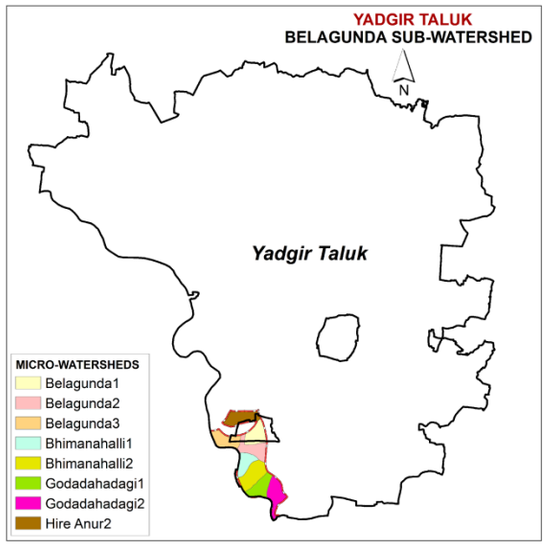
References

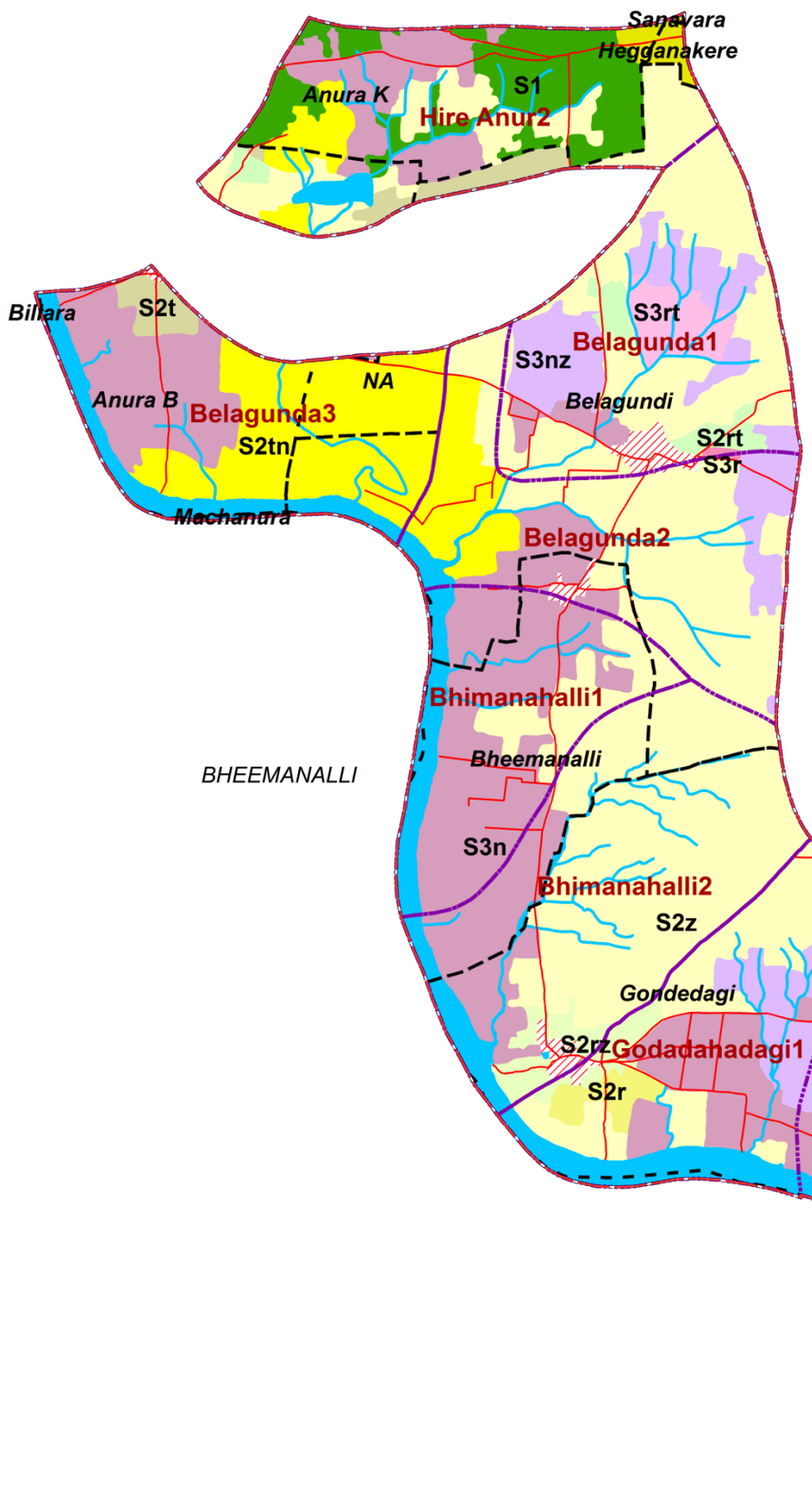
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6. Land Suitability for Major Crops

6.1. Land Suitability for Sorghum





LAND SUITABILITY FOR SORGHUM

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

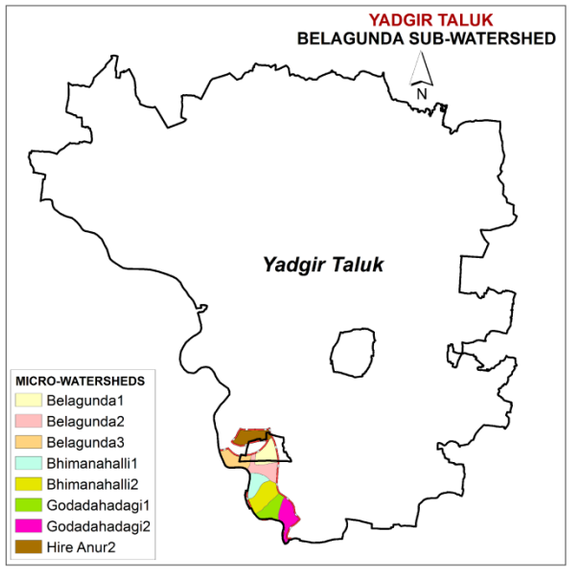
Suitability subclass	Area in ha (%)
S1	168 (4.15)
S2r	28 (0.68)
S2t	57 (1.4)
S2z	1484 (36.61)
S2nw	56 (1.39)
S2rt	38 (0.94)
S2rz	54 (1.33)
S2tn	374 (9.21)
S3n	1032 (25.44)
S3r	3 (0.07)
S3nz	331 (8.17)
S3rt	47 (1.15)
N1r	28 (0.7)
Others*	354 (8.74)

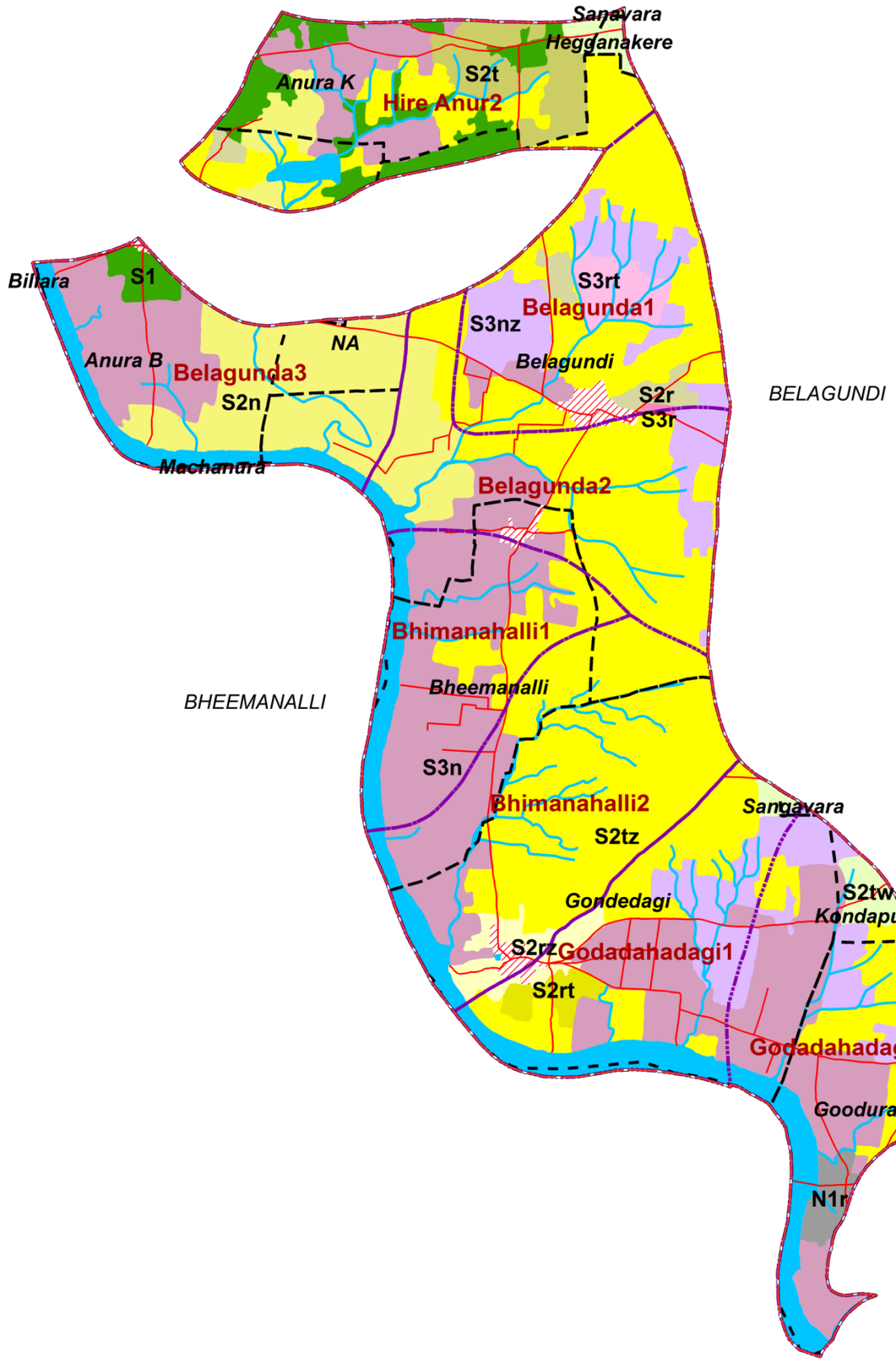
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.2. Land Suitability for Maize





LAND SUITABILITY FOR MAIZE

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

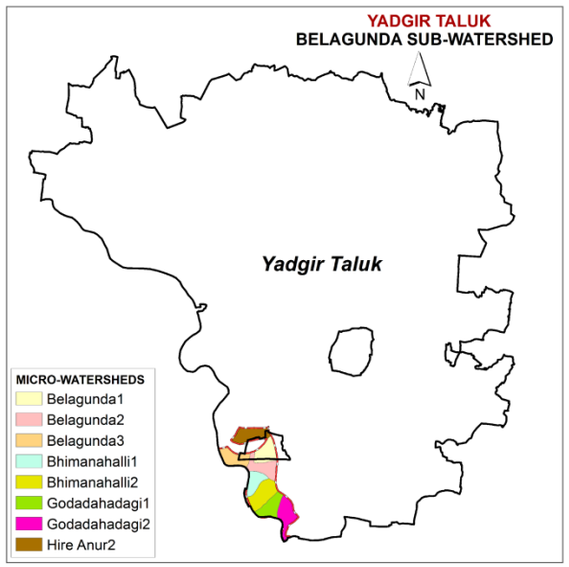
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2n	374 (9.21)
S2r	38 (0.94)
S2t	92 (2.26)
S2rt	28 (0.68)
S2rz	54 (1.33)
S2tw	56 (1.39)
S2tz	1484 (36.61)
S3n	1032 (25.44)
S3r	3 (0.07)
S3nz	331 (8.17)
S3rt	47 (1.15)
N1r	28 (0.7)
Others*	354 (8.74)

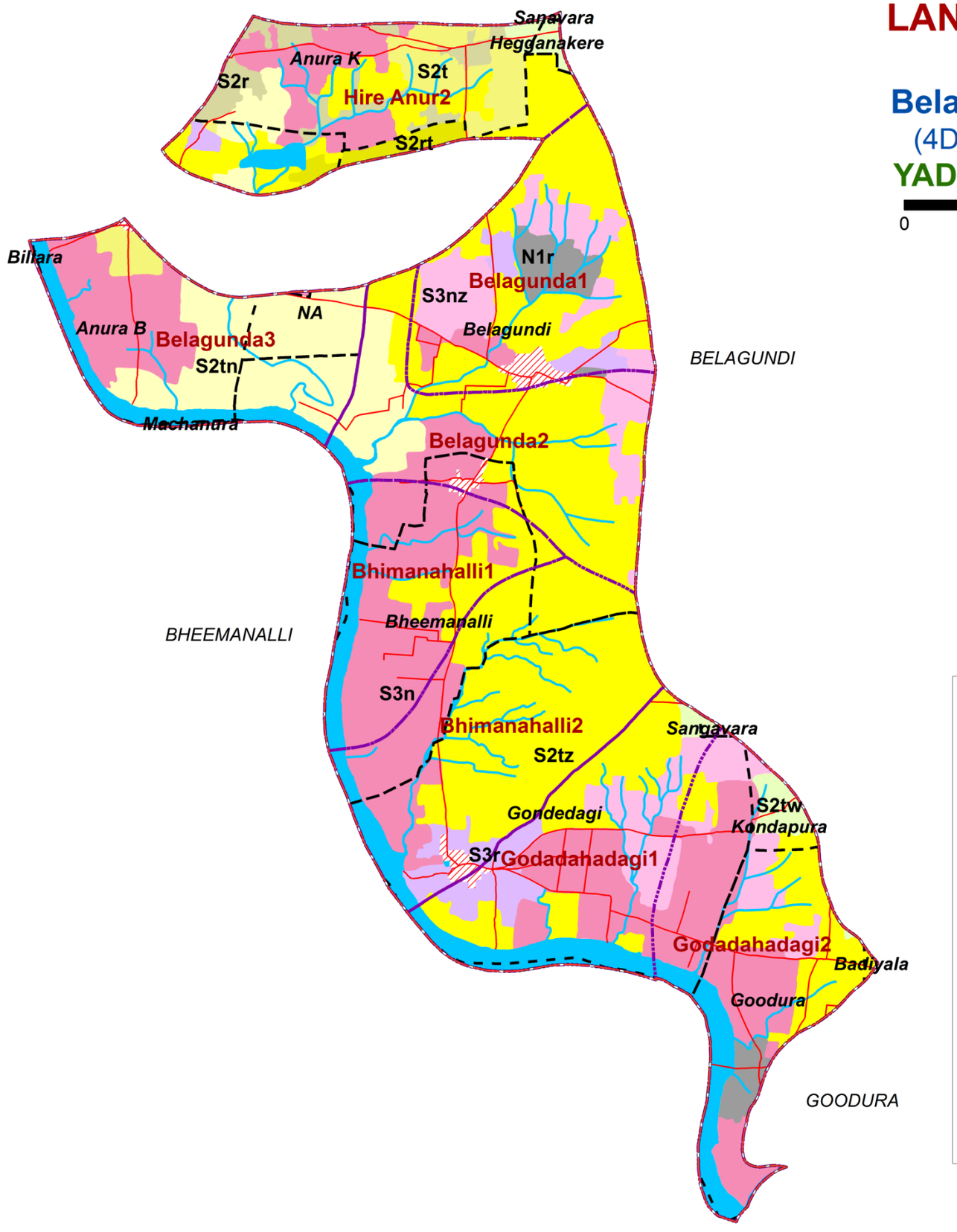
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.3. Land Suitability for Redgram





LAND SUITABILITY FOR REDGRAM

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

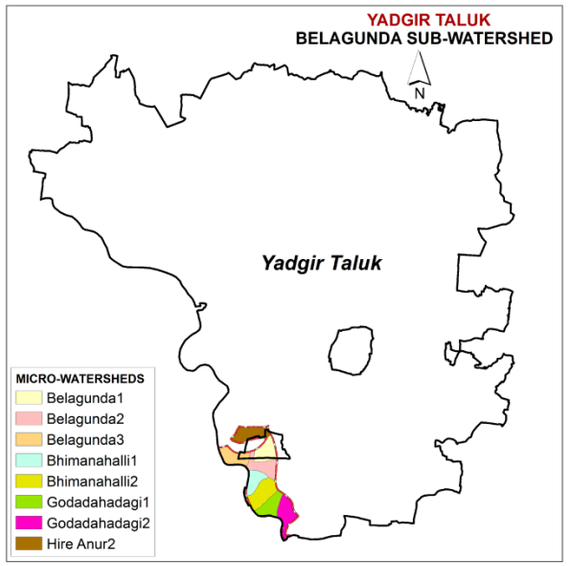
Suitability subclass	Area in ha (%)
S2r	77 (1.89)
S2t	118 (2.92)
S2rt	30 (0.75)
S2tn	374 (9.21)
S2tw	56 (1.39)
S2tz	1484 (36.61)
S3n	1032 (25.44)
S3r	120 (2.96)
S3nz	331 (8.17)
N1r	78 (1.92)
Others*	354 (8.74)

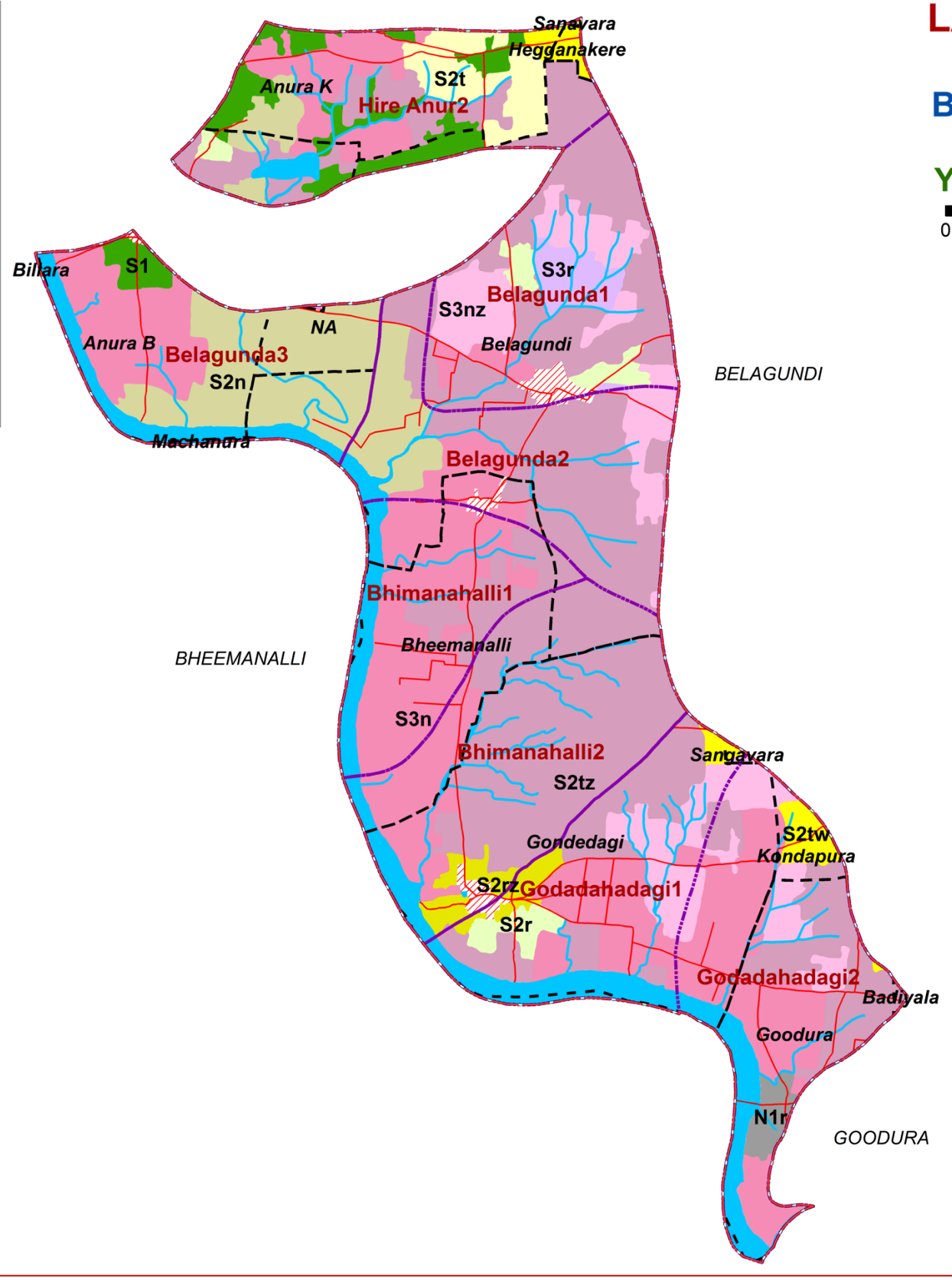
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.4. Land Suitability for Bajra





LAND SUITABILITY FOR BAJRA

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

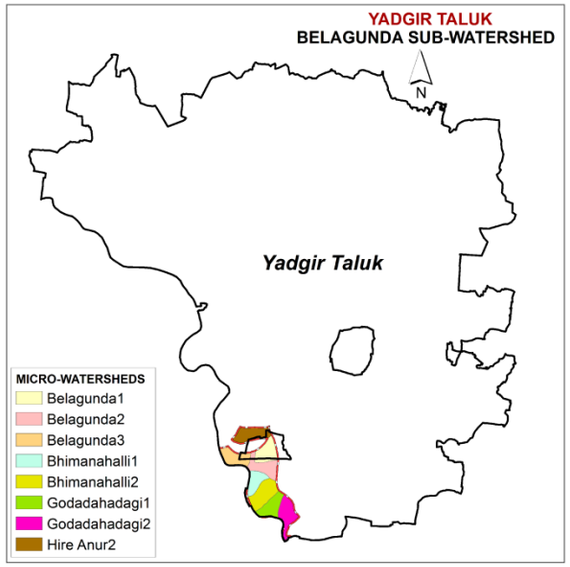
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2n	374 (9.21)
S2r	66 (1.62)
S2t	92 (2.26)
S2rz	54 (1.33)
S2tw	56 (1.39)
S2tz	1484 (36.61)
S3n	1032 (25.44)
S3r	49 (1.22)
S3nz	331 (8.17)
N1r	28 (0.7)
Others*	354 (8.74)

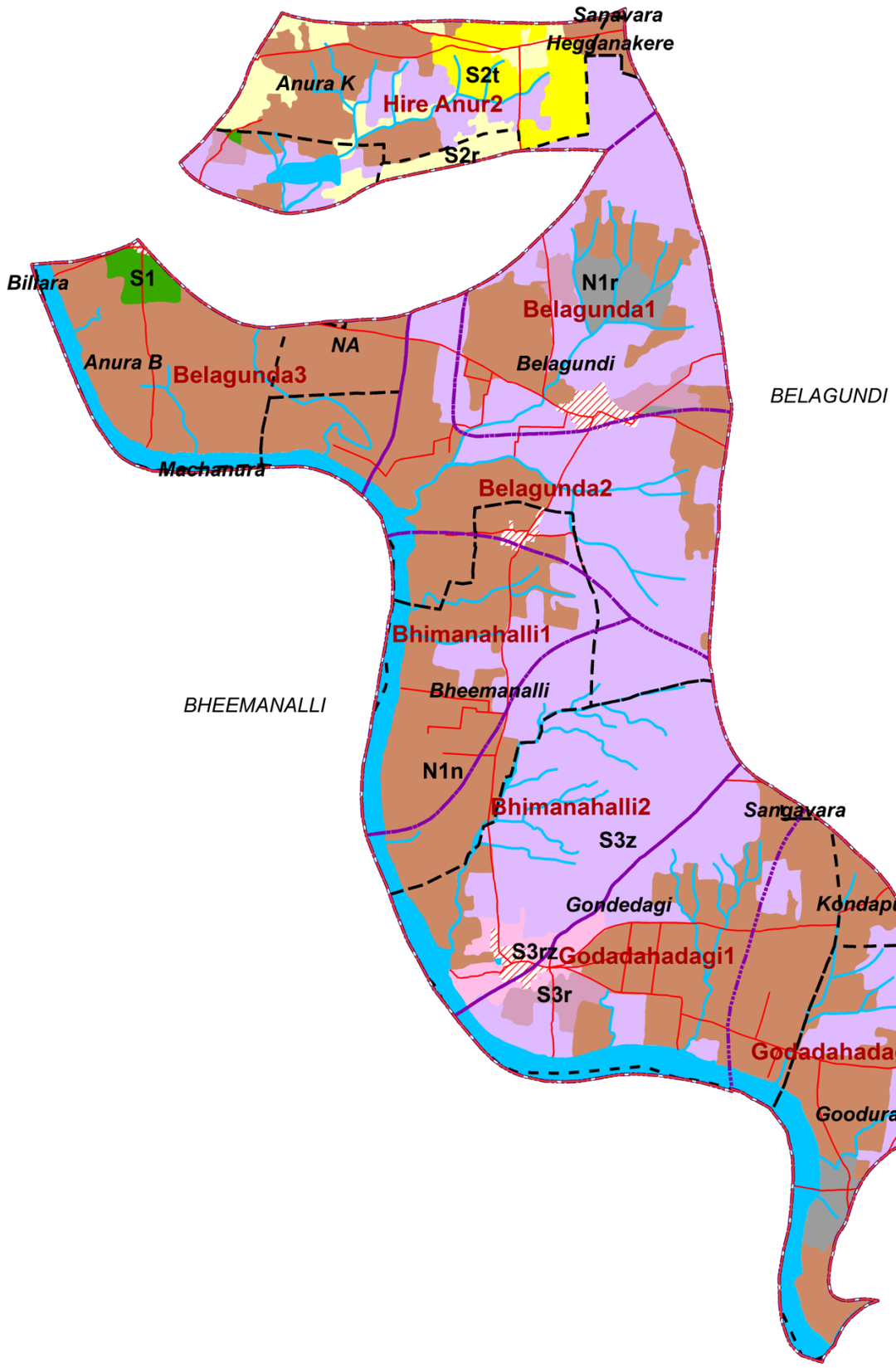
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.5. Land Suitability for Drumstick





LAND SUITABILITY FOR DRUMSTICK

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

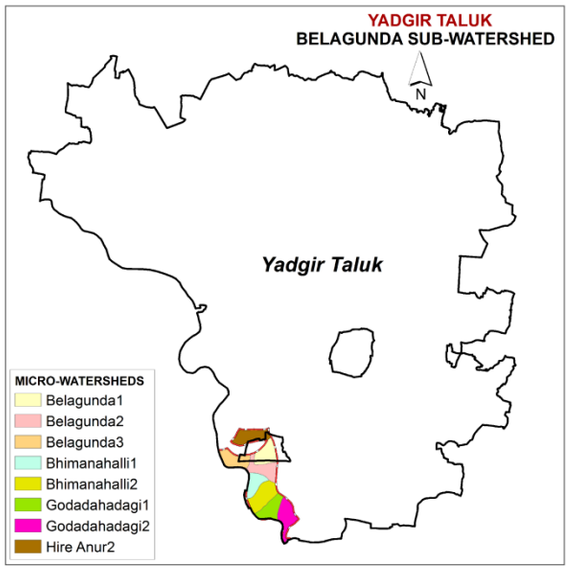
Suitability subclass	Area in ha (%)
S1	26 (0.65)
S2r	107 (2.64)
S2t	92 (2.26)
S3r	66 (1.62)
S3z	1484 (36.61)
S3rz	54 (1.33)
N1n	1793 (44.22)
N1r	78 (1.92)
Others*	354 (8.74)

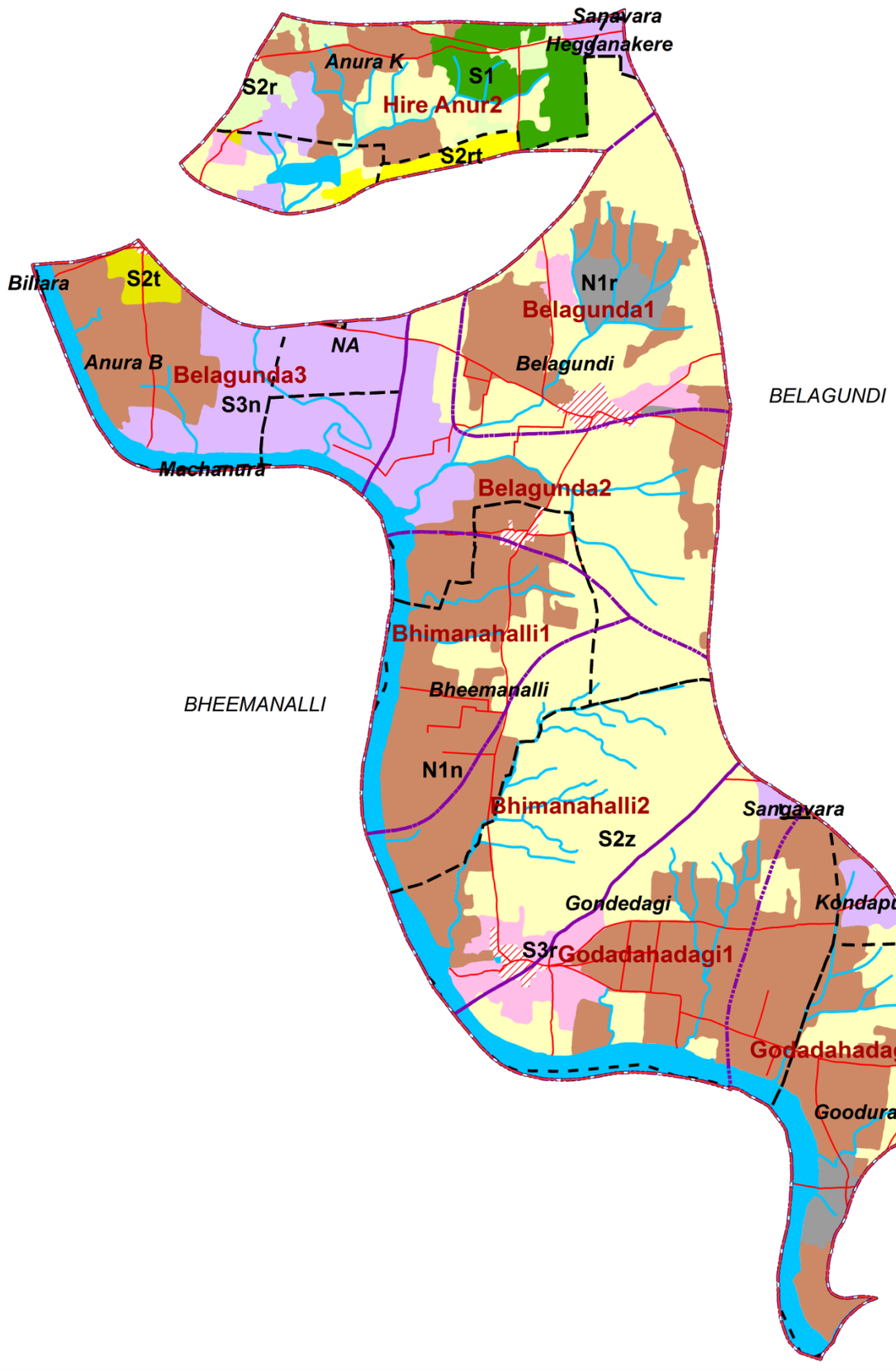
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.6. Land Suitability for Sunflower





LAND SUITABILITY FOR SUNFLOWER

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

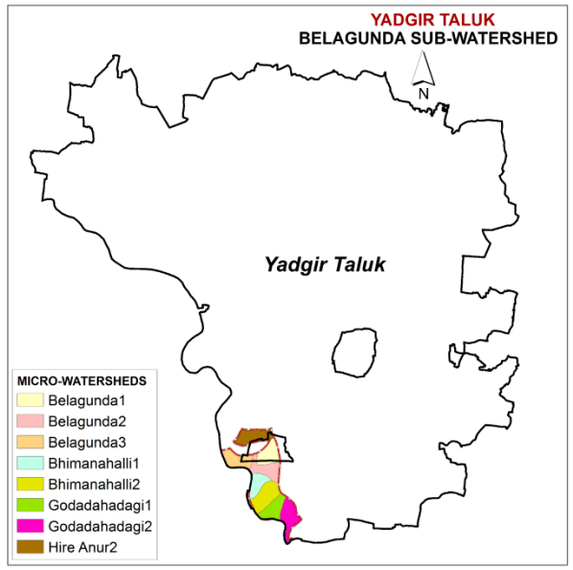
Suitability subclass	Area in ha (%)
S1	92 (2.26)
S2r	77 (1.89)
S2t	26 (0.65)
S2z	1484 (36.61)
S2rt	30 (0.75)
S3n	430 (10.6)
S3r	120 (2.96)
N1n	1363 (33.61)
N1r	78 (1.92)
Others*	354 (8.74)

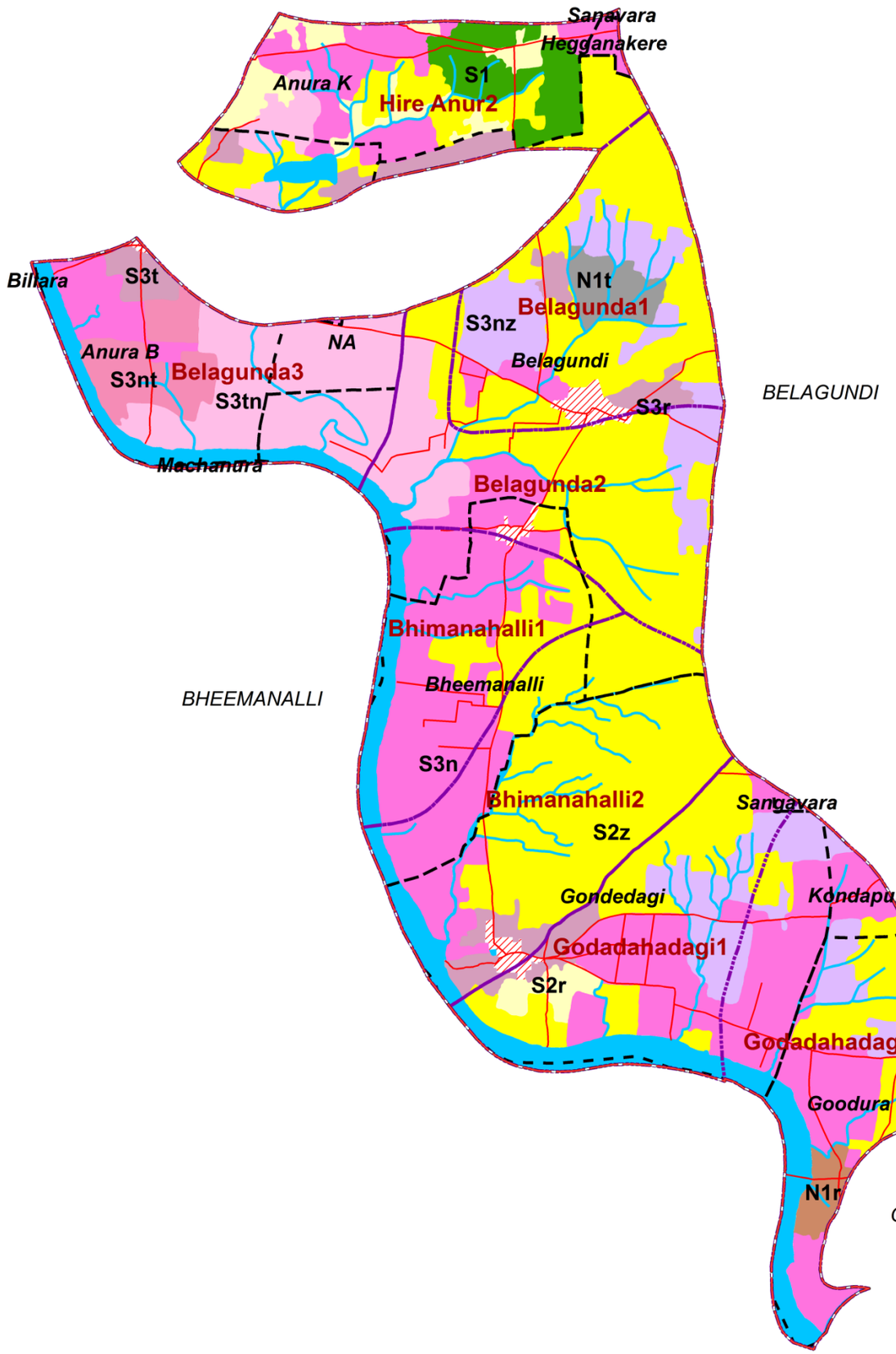
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.7. Land Suitability for Cotton





LAND SUITABILITY FOR COTTON

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

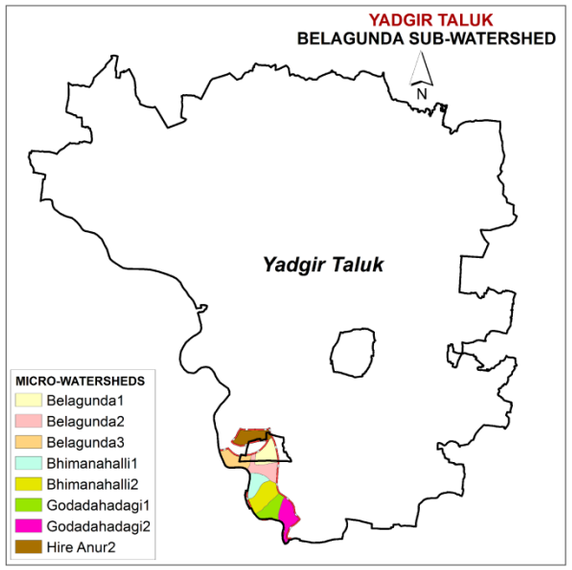
Suitability subclass	Area in ha (%)
S1	92 (2.26)
S2r	104 (2.57)
S2z	1484 (36.61)
S3n	999 (24.63)
S3r	3 (0.07)
S3t	149 (3.68)
S3nt	89 (2.2)
S3nz	331 (8.17)
S3tn	374 (9.21)
N1r	28 (0.7)
N1t	47 (1.15)
Others*	354 (8.74)

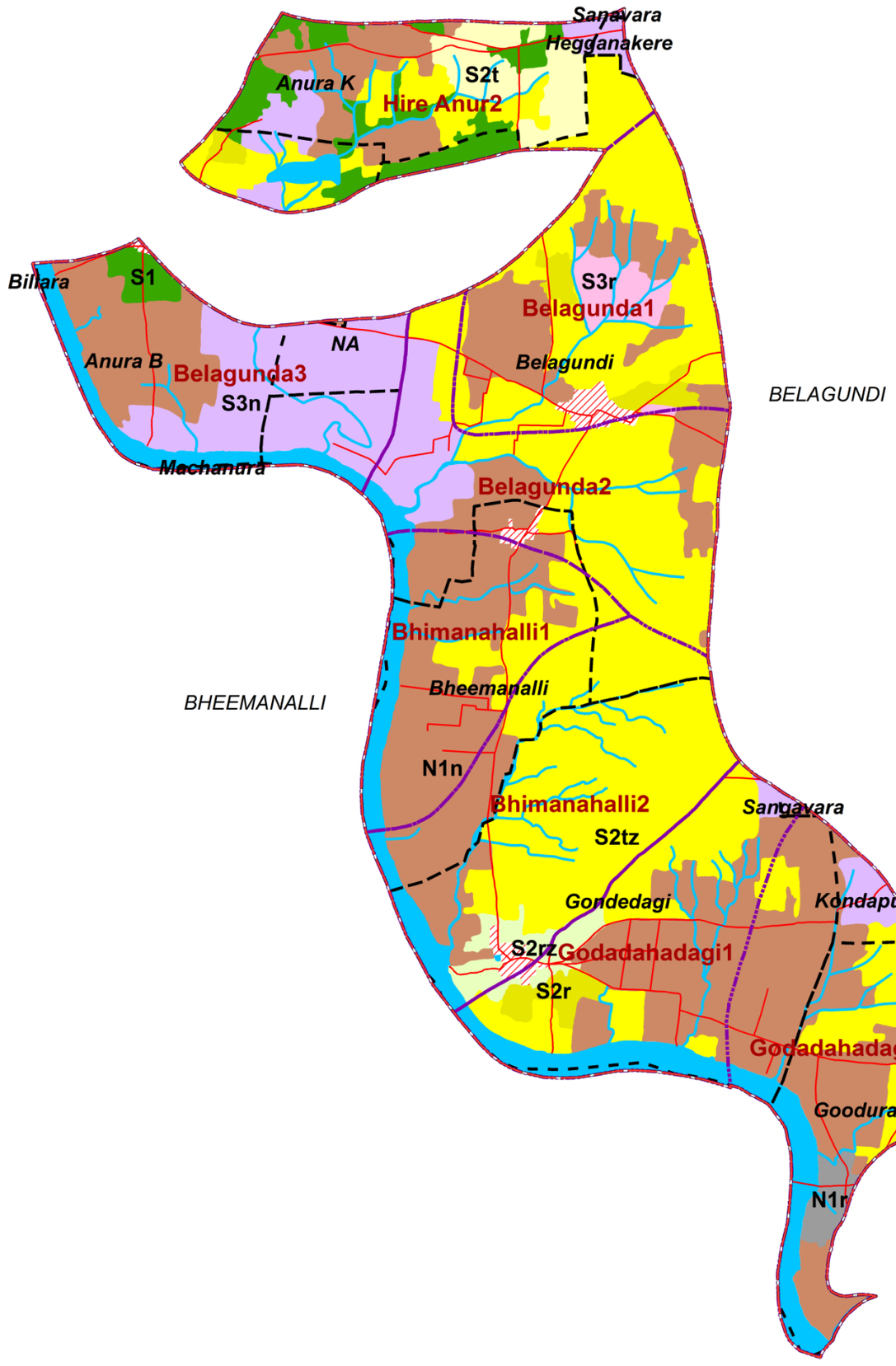
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.8. Land Suitability for Chilli





LAND SUITABILITY FOR CHILLI

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

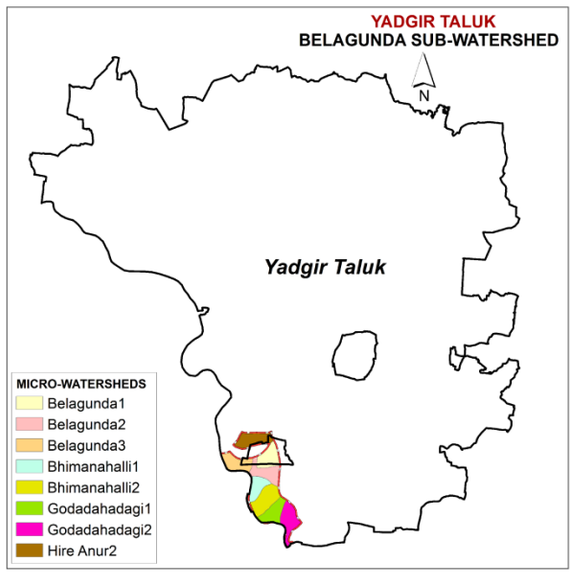
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2t	92 (2.26)
S2rz	54 (1.33)
S2tz	1484 (36.61)
S3n	430 (10.6)
S3r	49 (1.22)
N1n	1363 (33.61)
N1r	28 (0.7)
Others*	354 (8.74)

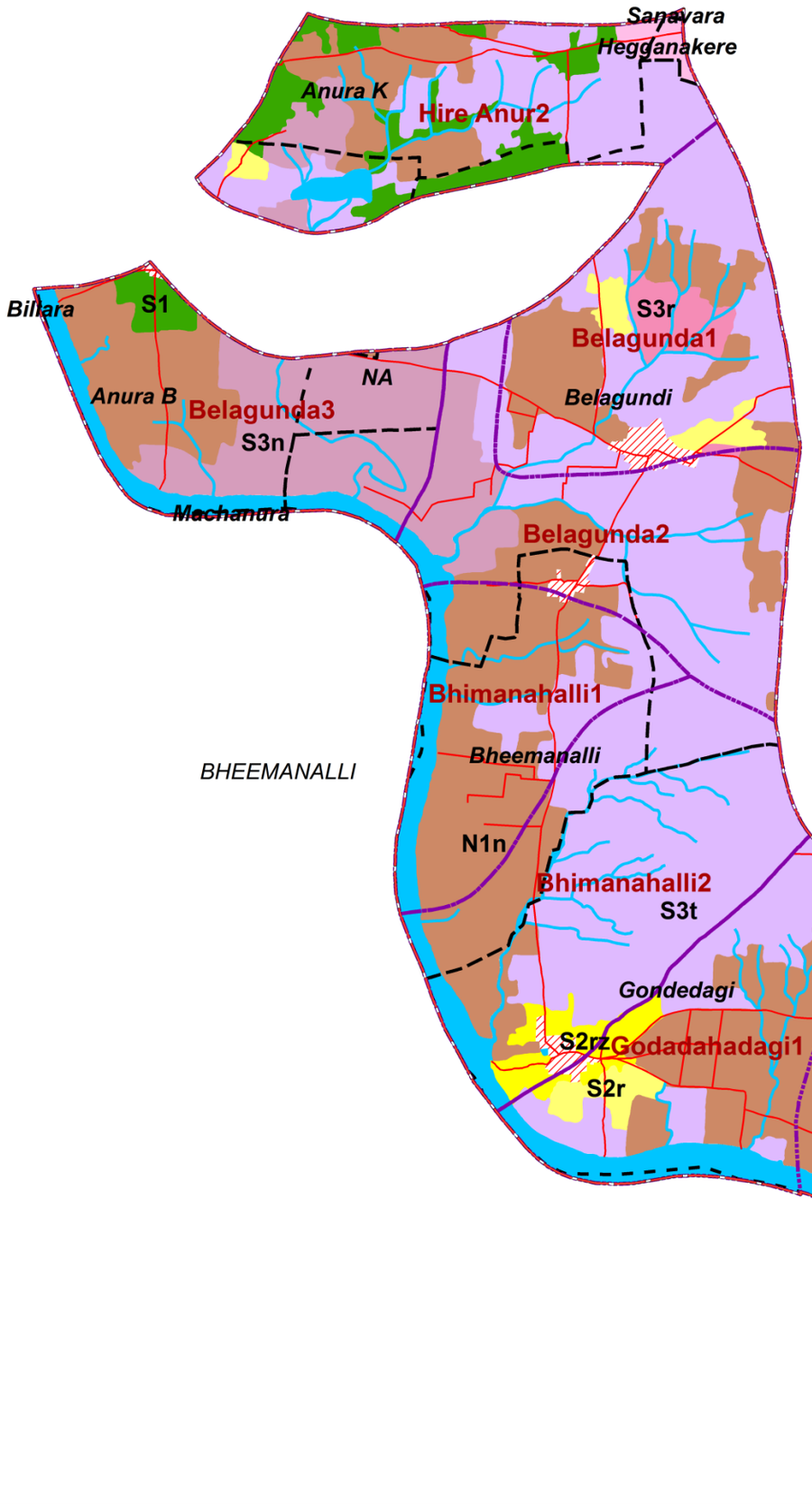
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.9. Land Suitability for Tomato





LAND SUITABILITY FOR TOMATO

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2rz	54 (1.33)
S3n	374 (9.21)
S3r	49 (1.22)
S3t	1576 (38.87)
S3tn	56 (1.39)
N1n	1363 (33.61)
N1r	28 (0.7)
Others*	354 (8.74)

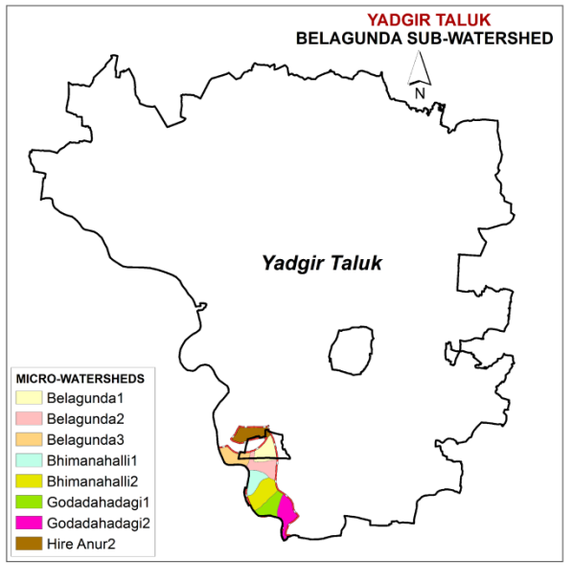
* - Habitation & Waterbody

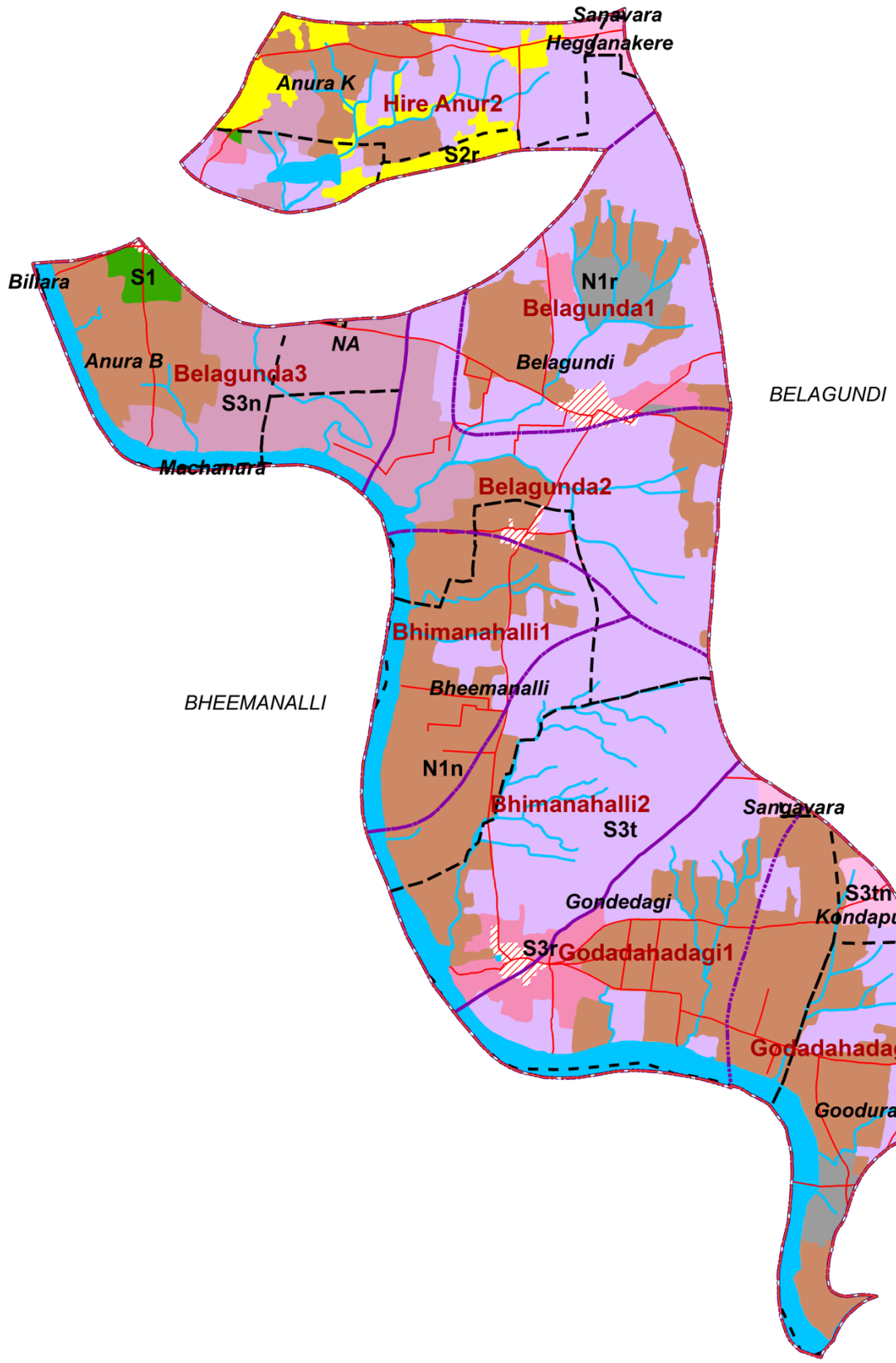
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.10. Land Suitability for Sapota





LAND SUITABILITY FOR SAPOTA

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture

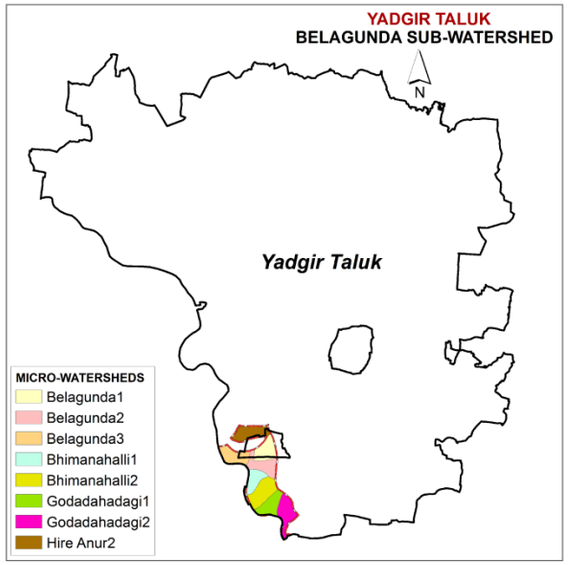
Suitability subclass	Area in ha (%)
S1	26 (0.65)
S2r	107 (2.64)
S3n	374 (9.21)
S3r	120 (2.96)
S3t	1576 (38.87)
S3tn	56 (1.39)
N1n	1363 (33.61)
N1r	78 (1.92)
Others*	354 (8.74)

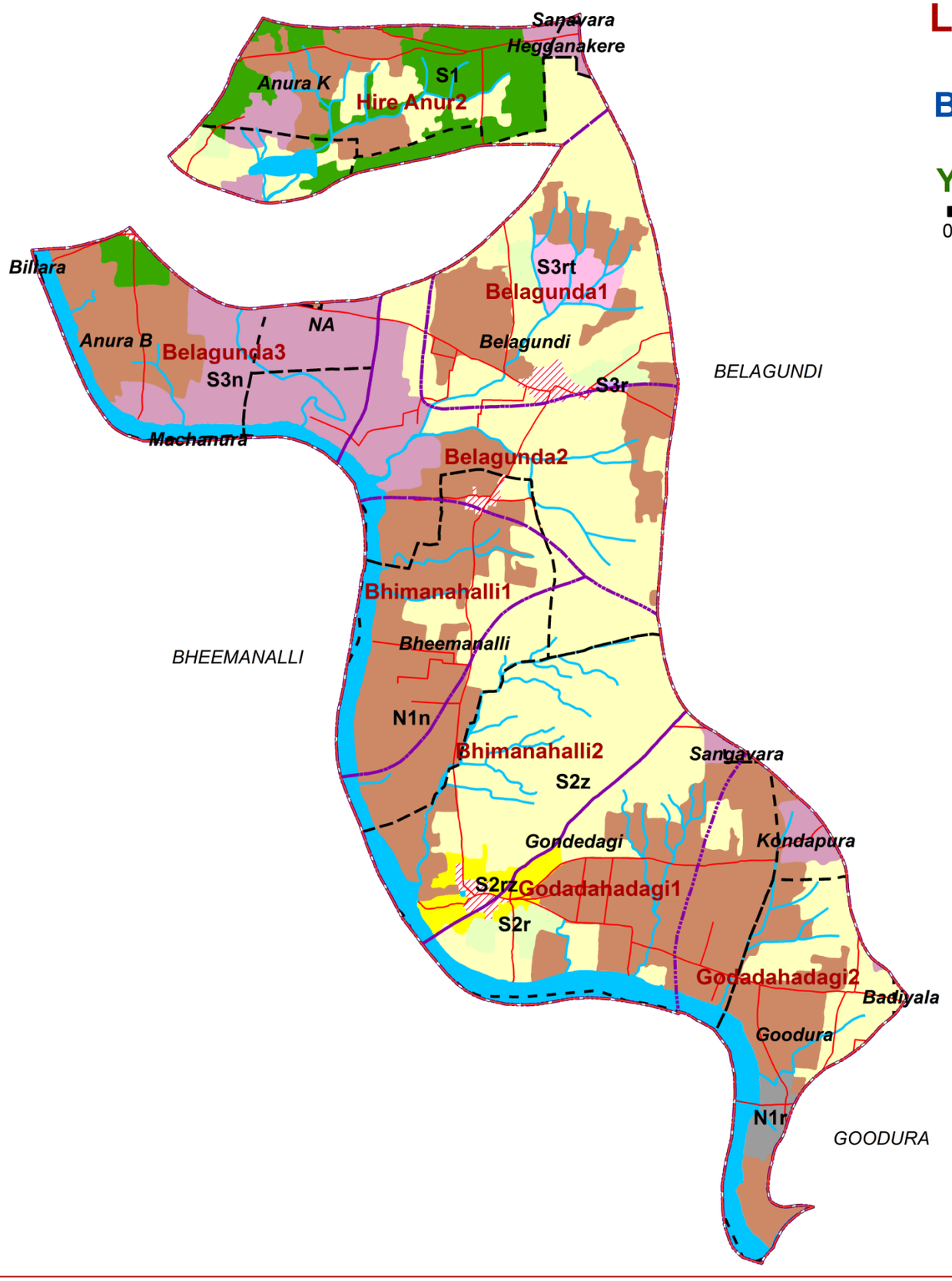
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.11. Land Suitability for Custard Apple





LAND SUITABILITY FOR CUSTARD APPLE

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

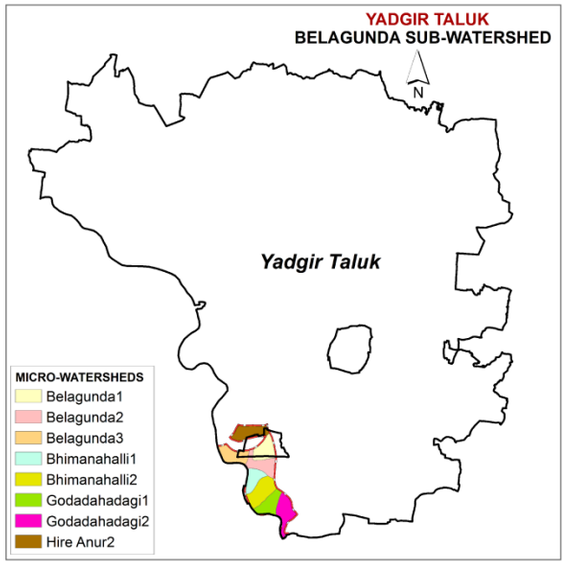
Suitability subclass	Area in ha (%)
S1	225 (5.56)
S2r	66 (1.62)
S2z	1484 (36.61)
S2rz	54 (1.33)
S3n	430 (10.6)
S3r	3 (0.07)
S3rt	47 (1.15)
N1n	1363 (33.61)
N1r	28 (0.7)
Others*	354 (8.74)

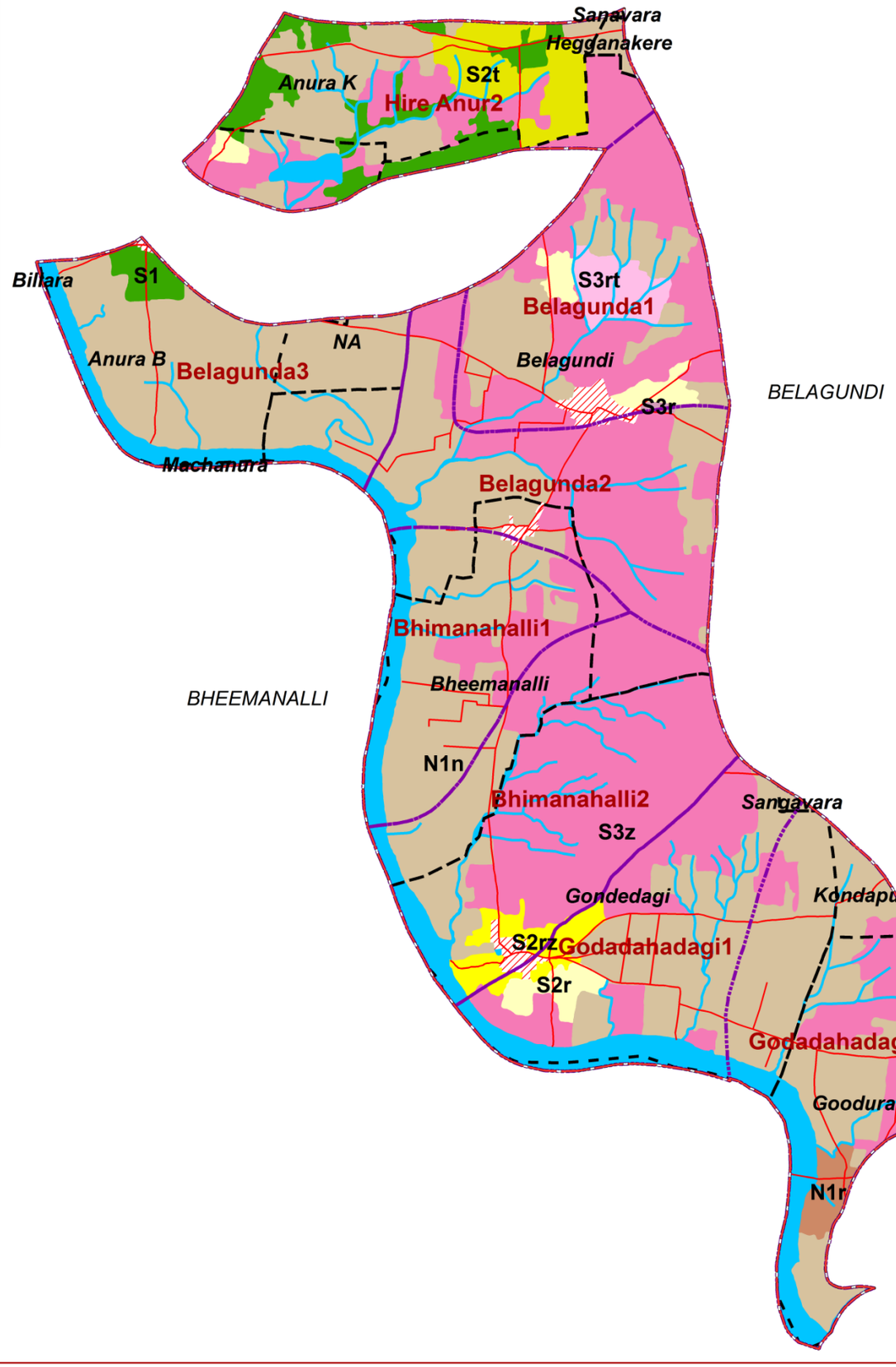
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.12. Land Suitability for Amla





LAND SUITABILITY FOR AMLA

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

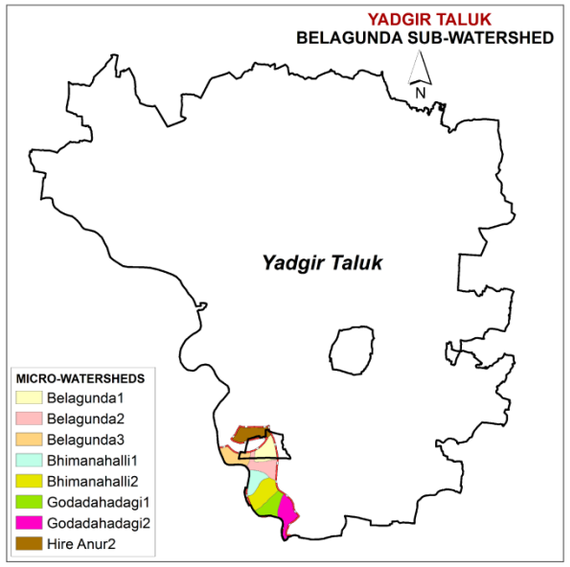
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2t	92 (2.26)
S2rz	54 (1.33)
S3r	3 (0.07)
S3z	1484 (36.61)
S3rt	47 (1.15)
N1n	1793 (44.22)
N1r	28 (0.7)
Others*	354 (8.74)

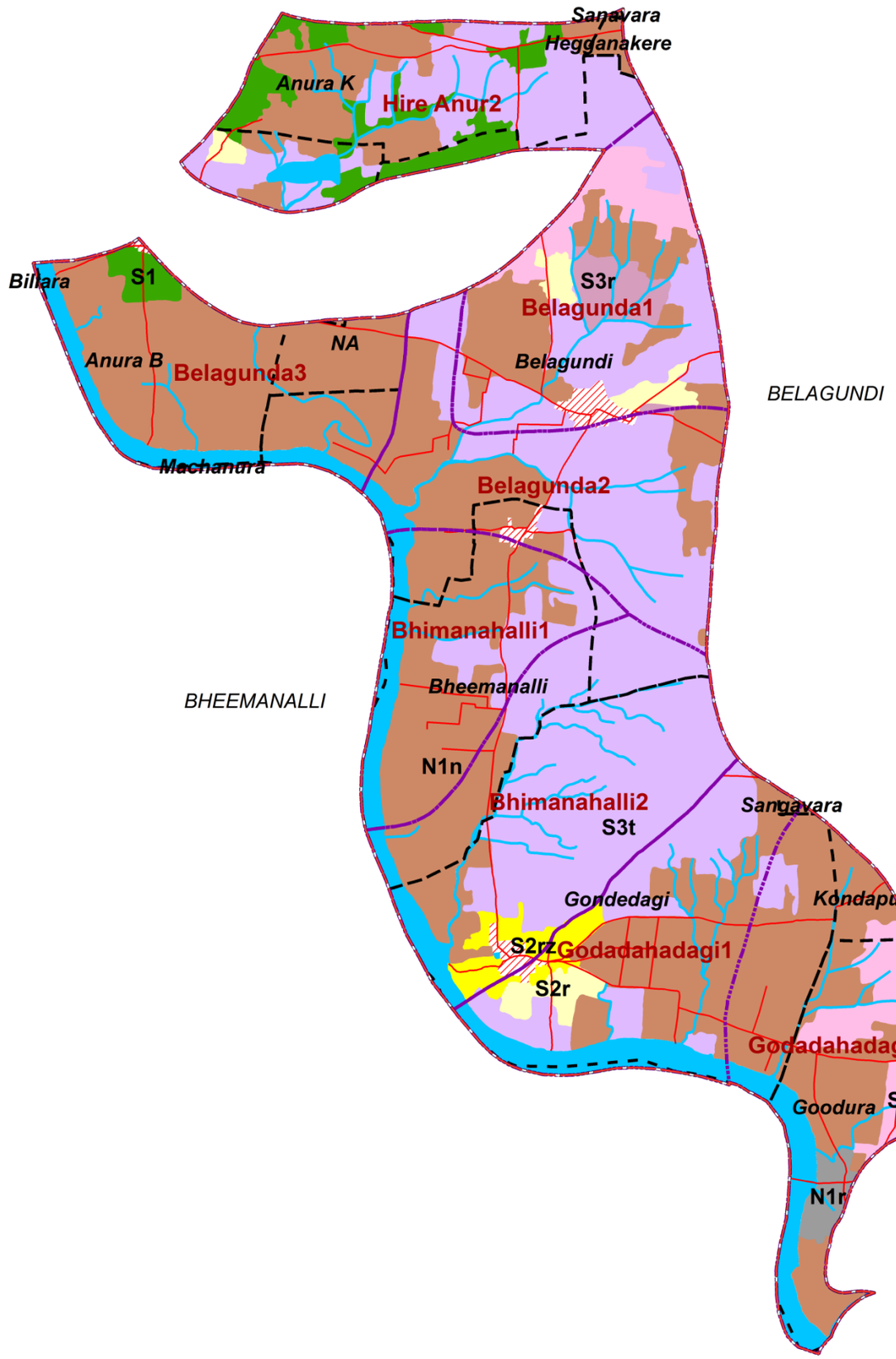
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.13. Land Suitability for Onion





LAND SUITABILITY FOR ONION

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

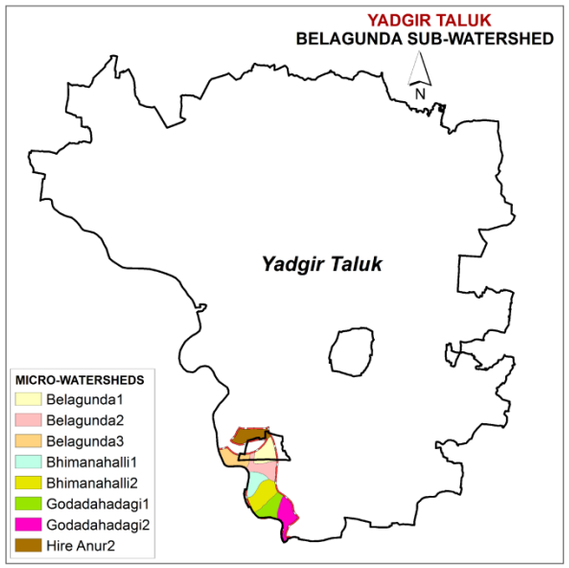
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2rz	54 (1.33)
S3r	49 (1.22)
S3t	1377 (33.97)
S3tz	199 (4.9)
N1n	1793 (44.22)
N1r	28 (0.7)
Others*	354 (8.74)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.14. Land Suitability for Marigold



LAND SUITABILITY FOR MARIGOLD

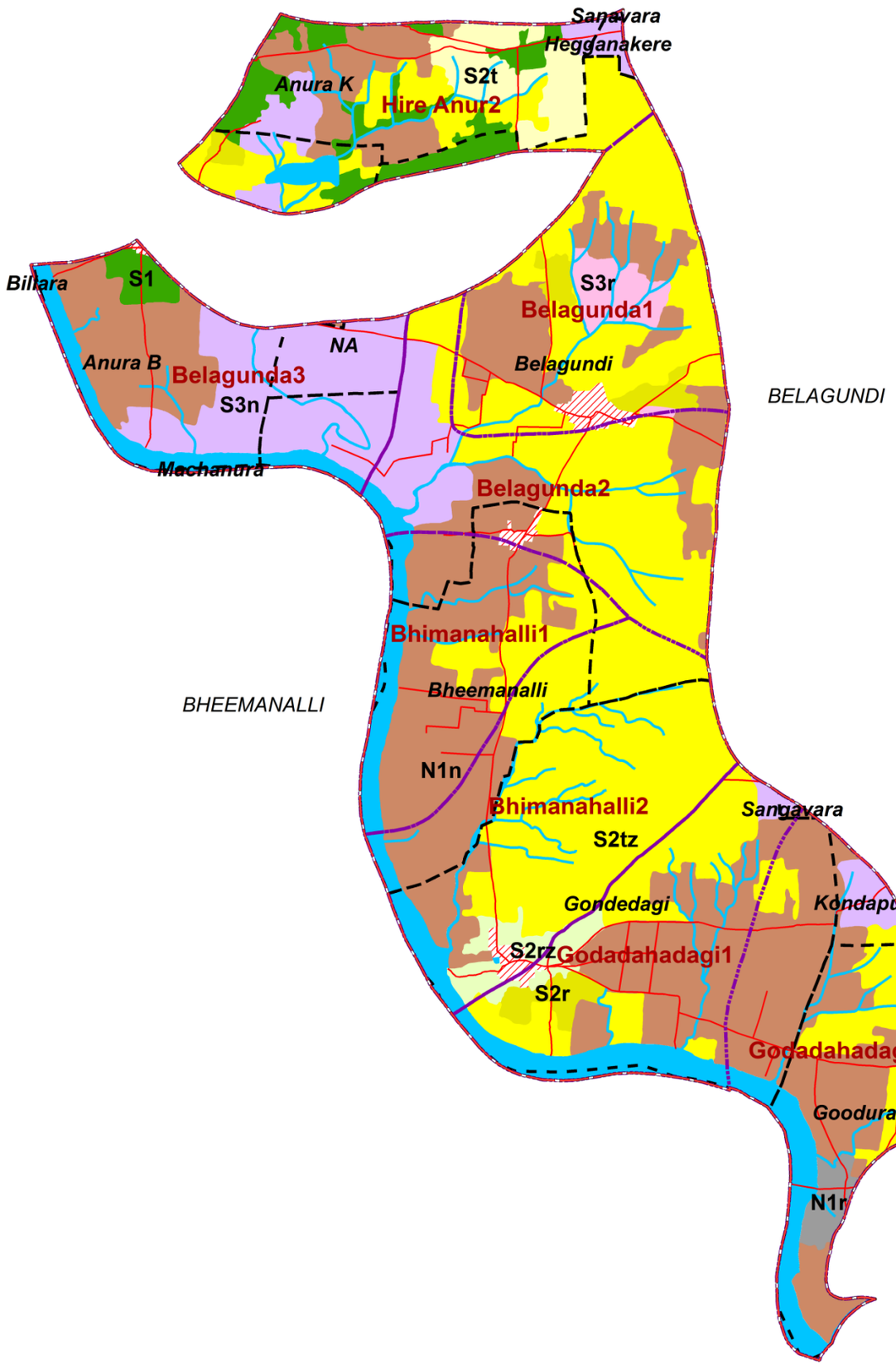
Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

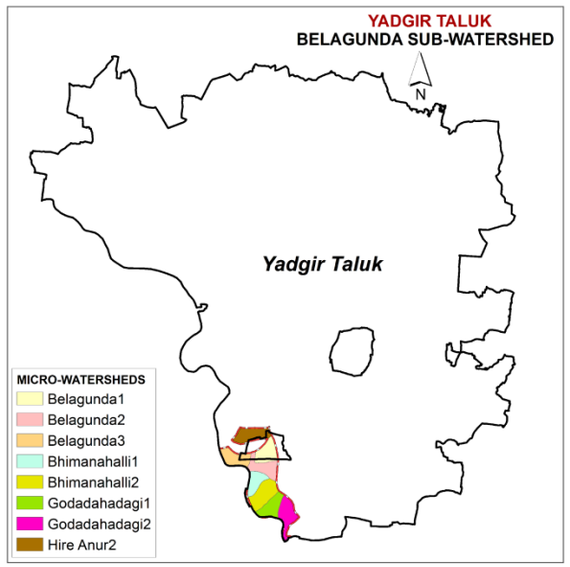
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2t	92 (2.26)
S2rz	54 (1.33)
S2tz	1484 (36.61)
S3n	430 (10.6)
S3r	49 (1.22)
N1n	1363 (33.61)
N1r	28 (0.7)
Others*	354 (8.74)

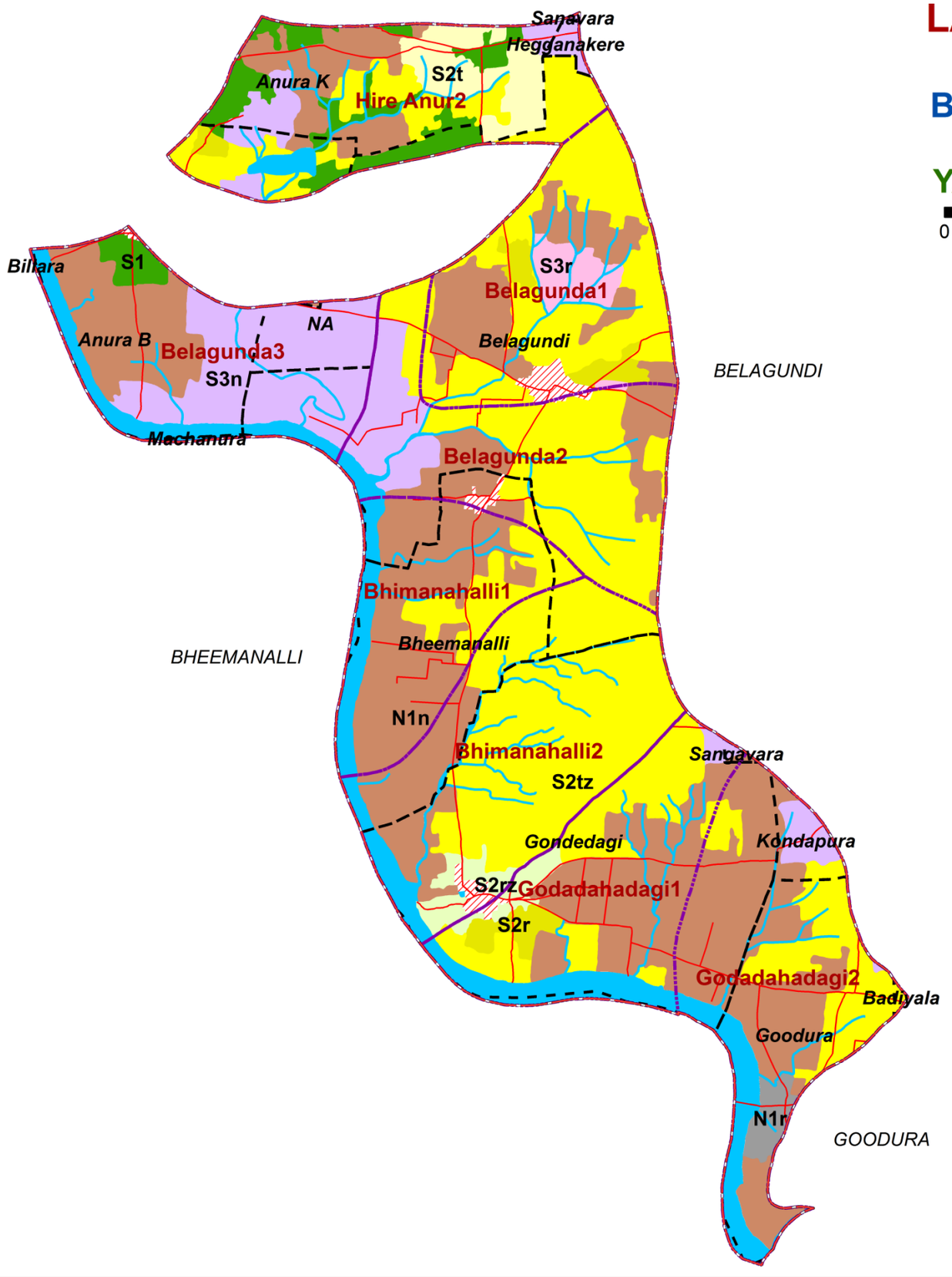
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6.15. Land Suitability for Chrysanthemum





LAND SUITABILITY FOR CHRYSANTHEMUM

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

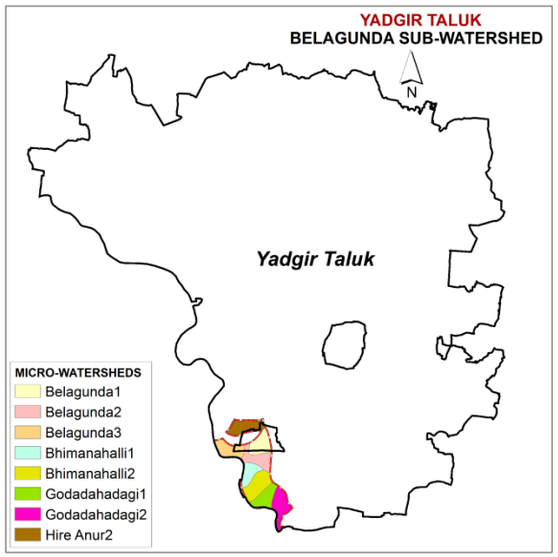
Suitability subclass	Area in ha (%)
S1	134 (3.3)
S2r	66 (1.62)
S2t	92 (2.26)
S2rz	54 (1.33)
S2tz	1484 (36.61)
S3n	430 (10.6)
S3r	49 (1.22)
N1n	1363 (33.61)
N1r	28 (0.7)
Others*	354 (8.74)

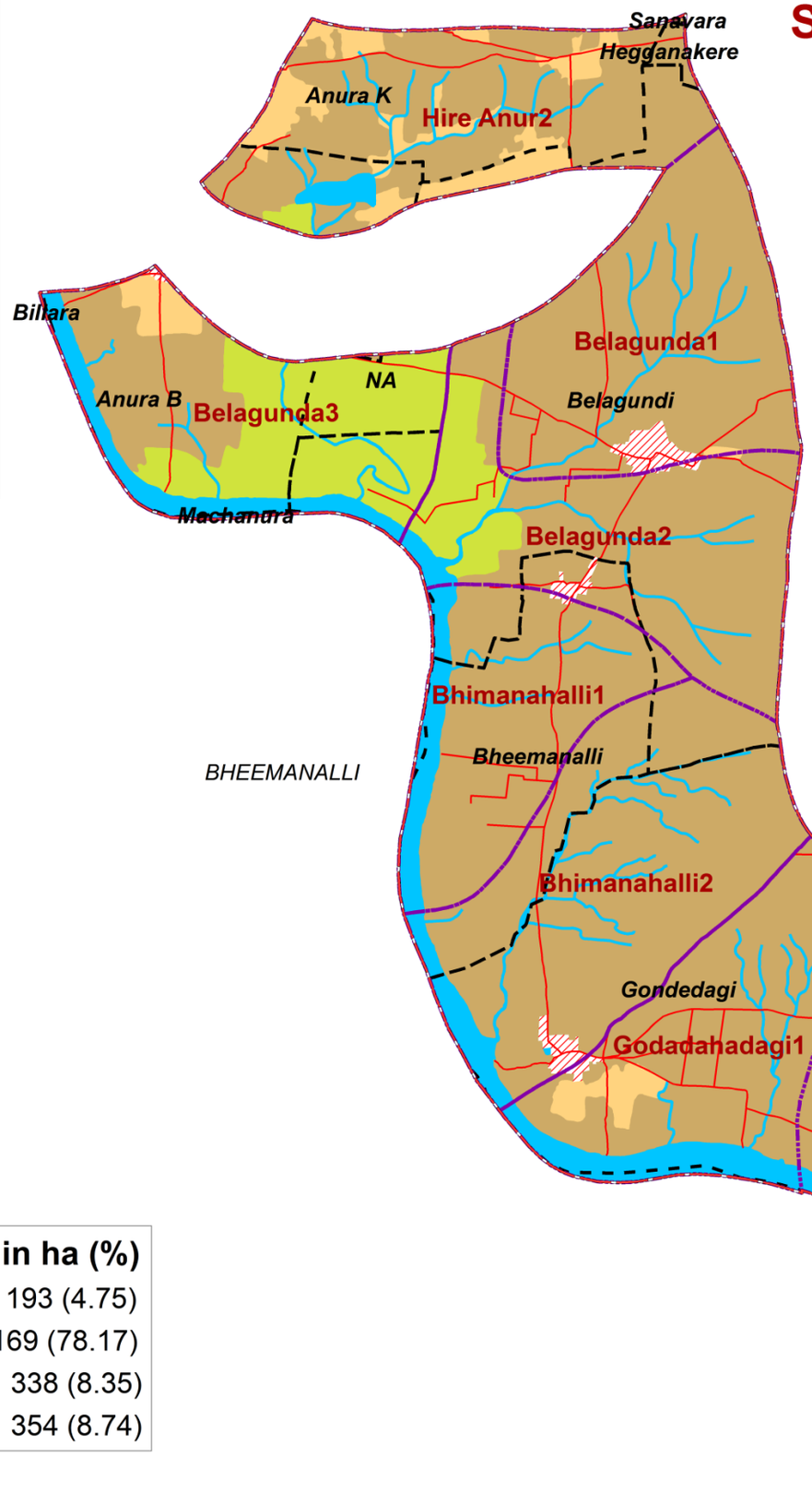
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.1. Soil & Water Conservation Plan





SOIL & WATER CONSERVATION PLAN

Belagunda Sub-watershed

(4D5B1N : Area - 4054.35 ha)

YADGIR TALUK & DISTRICT

0 1 2 4 km

N

Legend	Area in ha (%)
Trench cum bunding	193 (4.75)
Graded bunding	3169 (78.17)
Strengthening of existing bunds	338 (8.35)
Others*	354 (8.74)

* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

8. Table. Proposed Crop Plan for Belagunda Sub-watershed, Sydhapura Hobli, Yadgir Taluk, Yadgir District based on soil-site–crop suitability Assessment

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	55.ANRiB2 35.GWDiB2 127.GWDmB2 106.SGRmB2 104.TMKiB2 100.VKSmB1 (Sodic soils)	-	**Agri-Silvi-Pasture** Ber, Aonla, Acacia sp. Dhaincha, Rhodes grass, Para grass ,Bermuda grass	Application of gypsum, iron pyrites and elemental sulphur. Addition of farm yard manures, green manures and providing subsurface drainage
2	115.BGDmB2 62.BMNmB2 63.BMNmB2g1 48.NGPiB2 49.NGPmB2 (Deep to very deep, black clay soils)	Maize, sorghum, Sunflower, Cotton, Red gram, Bengalgram, Bajra	**Fruit crops:** Lime, Musambi, Custard apple, Pomegranate **Vegetables:** Chilli, Bhendi **Flowers:** Marigold,Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
3	37.BLCcB2 64.BMDcB2 41.PGPiB2 (Moderately deep to very deep, red sandy clay loam soils)	Sunflower, Sorghum, Maize, Groundnut, Red gram, Bajra	**Fruit crops:** Mango, Musambi, Sapota, Tamarind, Pomegranate, Amla, Custard apple, Guava, Jackfruit, Jamun, Lime **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal, Drumstick, Coriander **Flowers:**Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
4	95.HGNmB2 57.MDGcB2 60.MDRiA1 (Deep to very deep, strongly alkaline soils)	Sorghum, Maize, Bajra	**Agri-Silvi-Pasture** Ber, Aonla, Acacia sp. Dhaincha, Rhodes grass, Para grass ,Bermuda grass	Application of gypsum, iron pyrites and elemental sulphur. Addition of farm yard manures, green manures and providing subsurface drainage

To be continued….

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
5	31.YLRiB2 (Moderately shallow, red clay soils)	Maize, sorghum Groundnut, Bajra, Cotton	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli, Brinjal, Bhendi, Onion **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
6	17.HLGiB2 20.JNKcB2 (Moderately shallow, sandy clay loam soils)	Maize, sorghum, Groundnut, Cotton, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli, Onion, Bhendi **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
7	5.BDLiB2 1.BDPiB2 109.VNKmB2g1 (Shallow to very shallow soils)	-	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

PART - B

Hydrological Inventory of Belagunda Sub-watershed, Yadgir Taluk, Yadgir District, Karnataka for Watershed Planning and Development

Sujala - III
Karnataka Watershed Development Project-II
Watershed Development Department
Government of Karnataka

THE WORLD BANK

Hydrological Inventory of Belagunda Sub-watershed, Yadgir Taluk, Yadgir District, Karnataka for Watershed Planning and Development

Prepared by
ICAR-National Bureau of Soil Survey and Land Use Planning
Regional Centre, Hebbal, Bangalore - 560 024

ICAR - NBSS & LUP

Phone:080-23412242 **E-mail:nbssrcb@gmail.com**

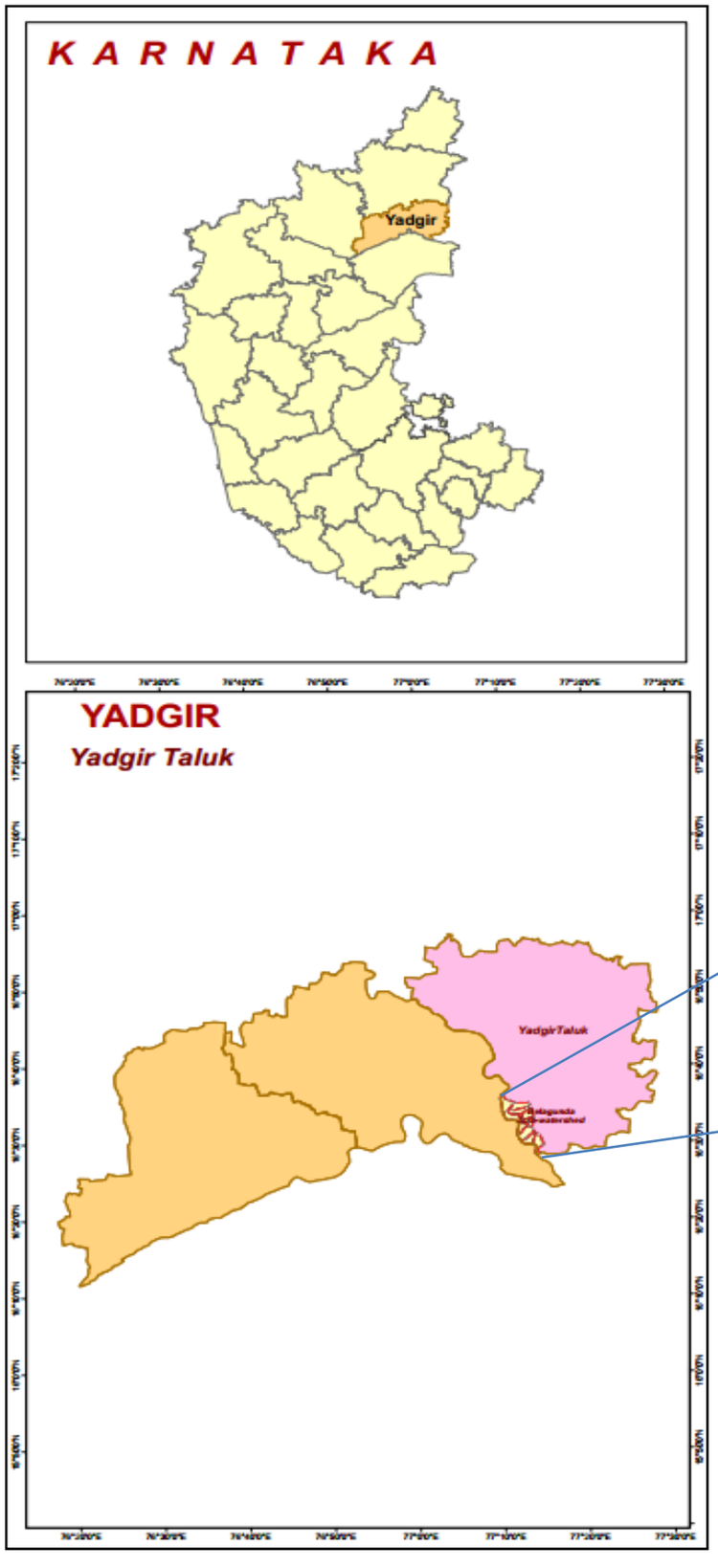
Details of Hydrology Team of LRI Partner Responsible for Preparation of Atlas

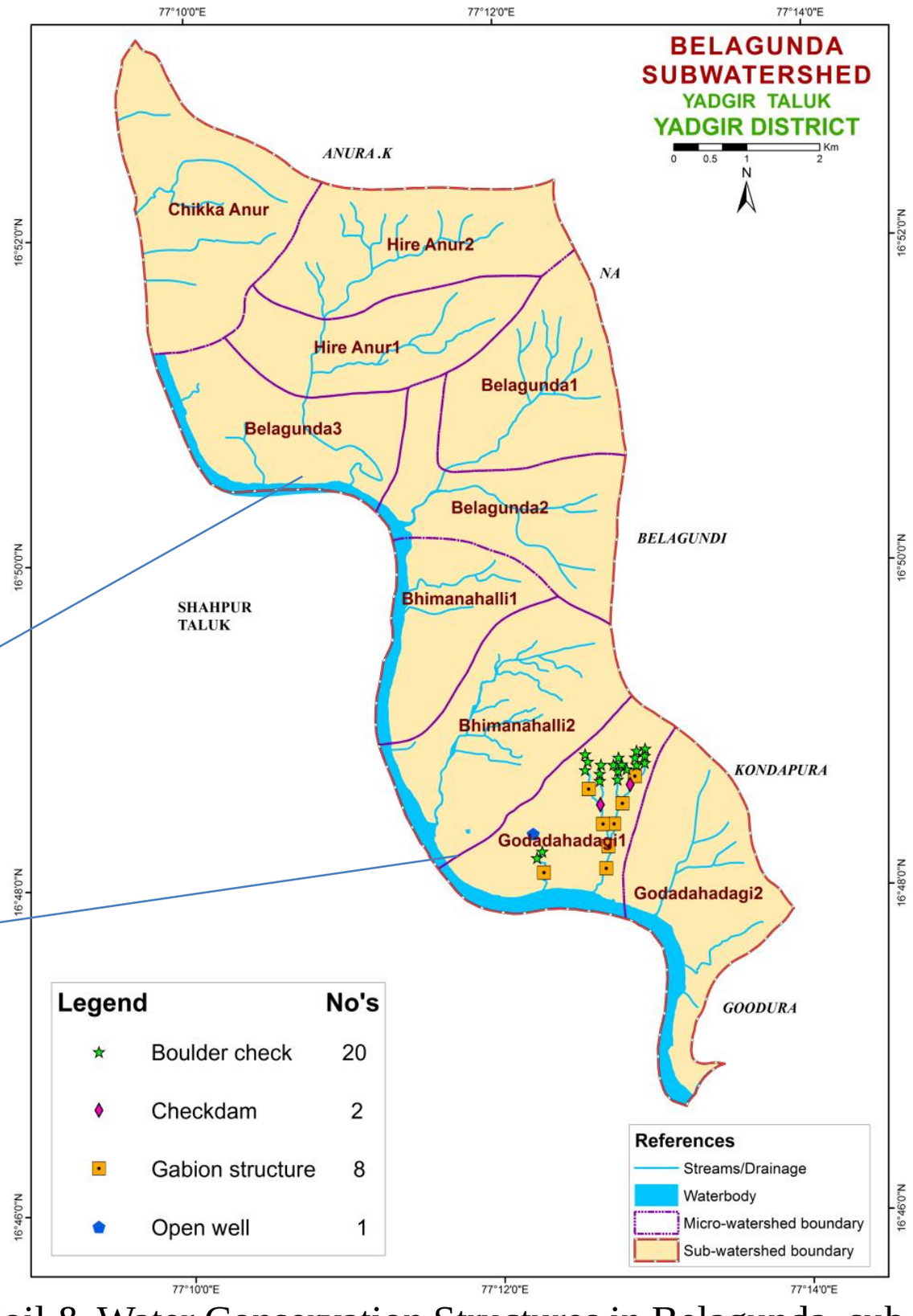
Name	Designation
Dr. Rajendra Hegde	Principal Scientist & Head Coordinator
Dr. S. Srinivas	Principal Scientist
Dr. K .V. Niranjana	Chief Technical Officer
Sh. R.S.Reddy	Consultant
Sh. A.G.Devendra Prasad	Consultant
Smt. K.Karunya Lakshmi	Research Associate
Ms. Seema, K.V.	Senior Research Fellow
Dr. Sekhar Muddu (Reviewed and approved)	Professor & Lead Scientist, Dept. of Civil Engineering & ICWaR, IISc, Bangalore
	Email: hd_rcb.nbsslup@icar.gov.in nbssrcb@gmail.com **Phone: Office:** 080-23412242,23410993 **Fax:** 080-23510350

INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Belagunda sub-watershed (4D5B1N) in Yadgir Taluk, Yadgir District, has been undertaken for integrated planning, development and management.
- Belagunda sub-watershed (Yadgir Taluk, Yadgir District) is located between $16^0$28'22''–$16^0$36' 8'' North latitudes and 77^0 9'47''- 77^0 15'11'' East longitudes, covering an area of about 5091 ha.
- This sub-watershed encompasses of 10 MWs namely Belagunda-1 (4D5B1N1e), Belagunda-2 (4D5B1N1f), Belagunda-3 (4D5B1N1d), Bhimanahalli-1 (4D5B1N2a), Bhimanahalli-2 (4D5B1N2b), Chikka Anur (4D5B1N1a), Godadahadagi-1 (4D5B1N2c), Godadahadagi-2 (4D5B1N2d), Hire Anur-1 (4D5B1N1c) and Hire Anur-2 (4D5B1N1b). Land Resource Inventory (LRI) was generated for eight among ten micro-watersheds.
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 887 mm.
- In this sub-watershed major *kharif* crops grown are Maize, Cotton, Sunflower, Groundnut, Red gram, Chilly, Soybean , Paddy and major *rabi* crops are Sorghum, Bengalgram, Bajra.
- Hydrological components namely rainfall (annual, *kharif*, *rabi* and summer), PET, AET, runoff, surface soil moisture, ground water status and water balance are presented.

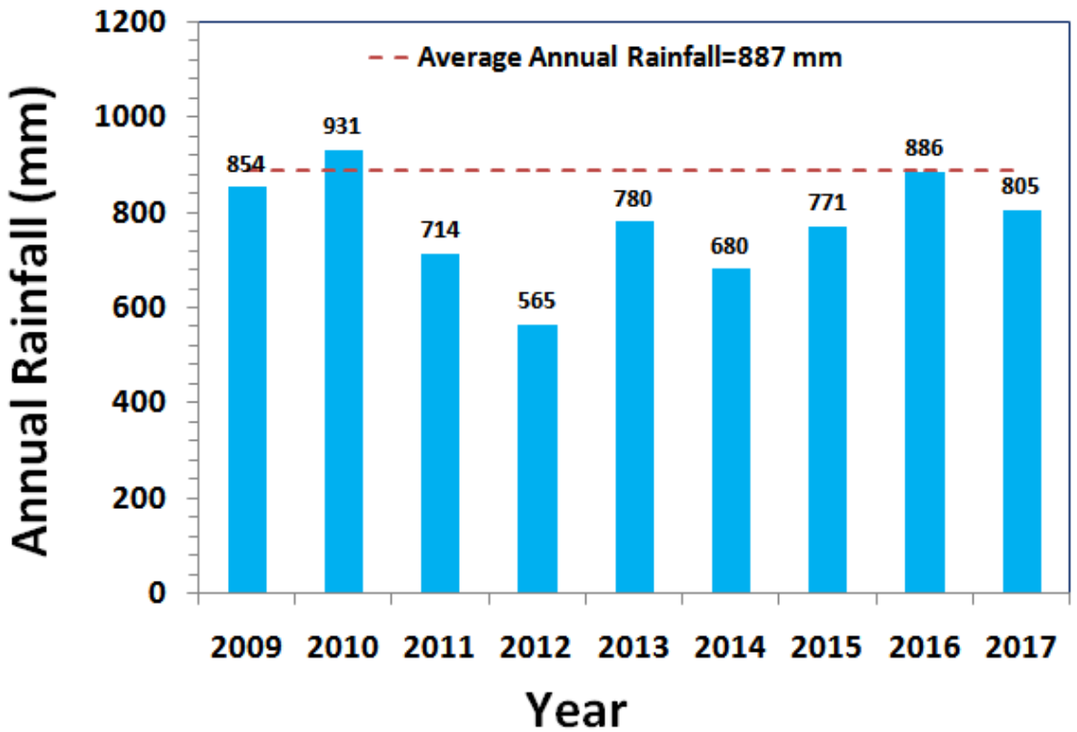
LOCATION MAP OF BELAGUNDA SUB-WATERSHED





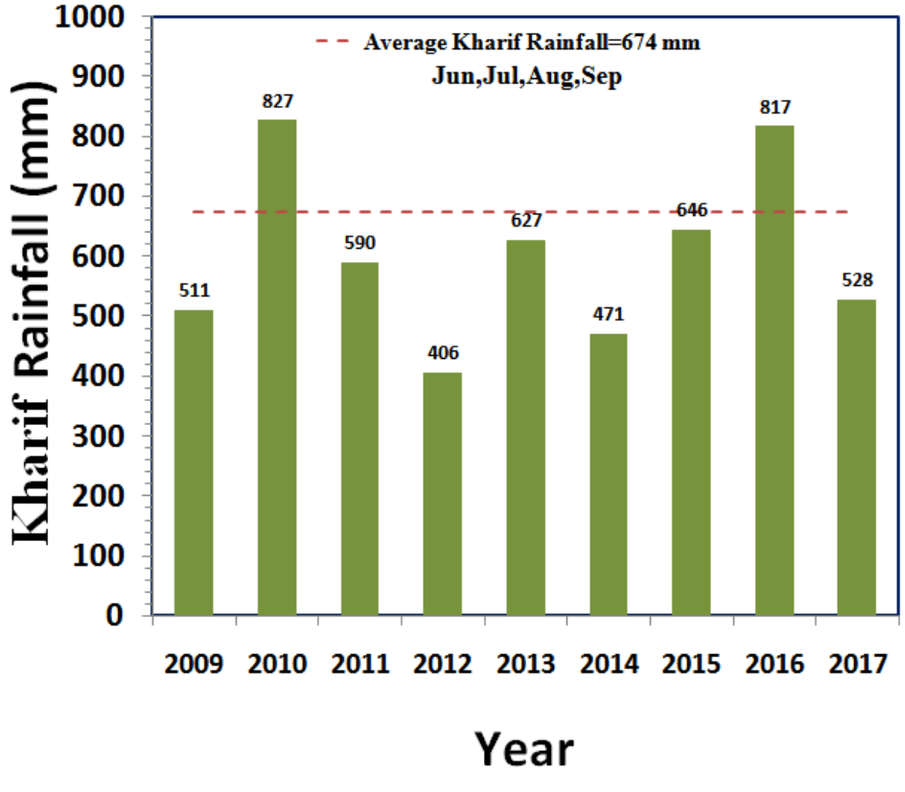
Soil & Water Conservation Structures in Belagunda sub-watershed, Yadgir taluk, Yadgir district

RAINFALL INDEX

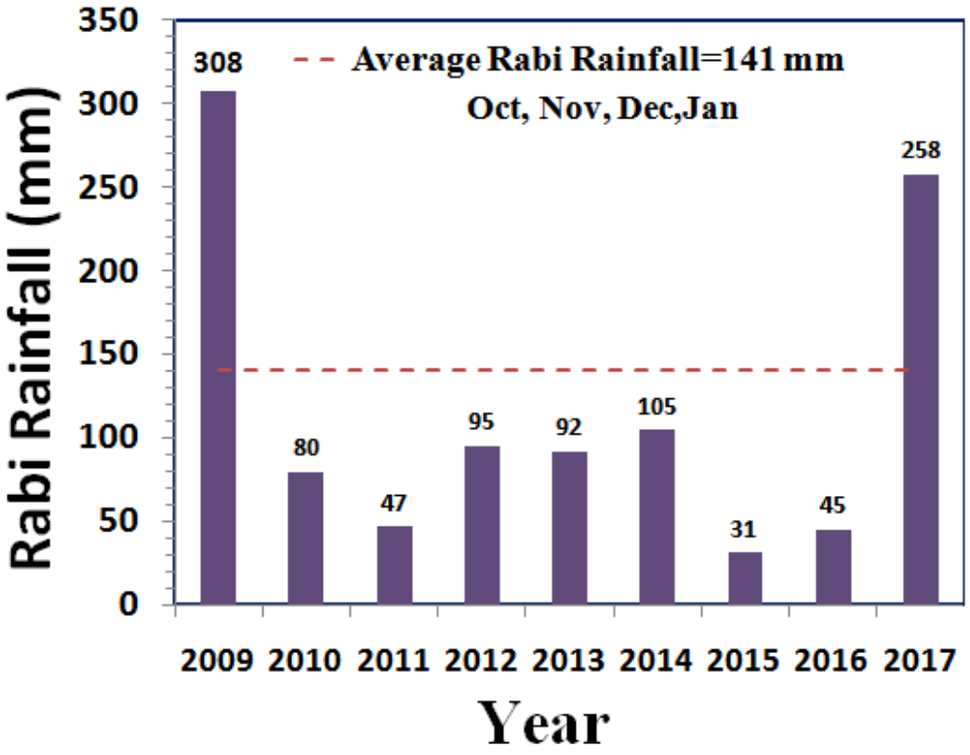


The average annual rainfall (1960-2014) recorded at the Yadgir station in Yadgir taluk of Yadgir district is 887 mm. The annual rainfall at Saidapur station (Hobli H.Q.) is presented. During the years 2009, 2011, 2012, 2013, 2014, 2015 and 2017 the annual rainfall was deficient by 5%, 27%, 51%, 17%, 33%, 18% and 13% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 77% of the annual rainfall and it typically follows the annual rainfall patterns.

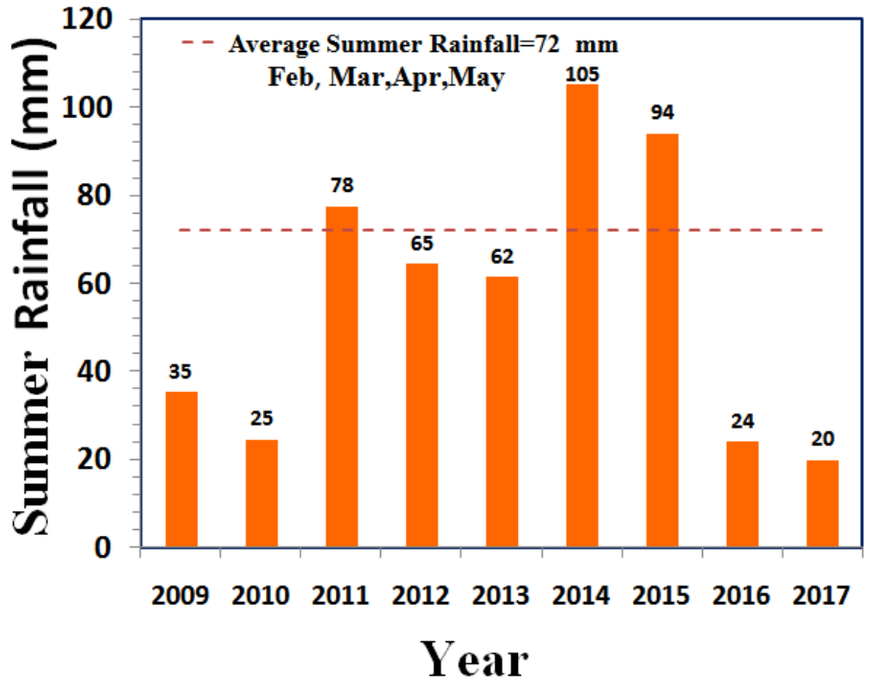


RAINFALL INDEX

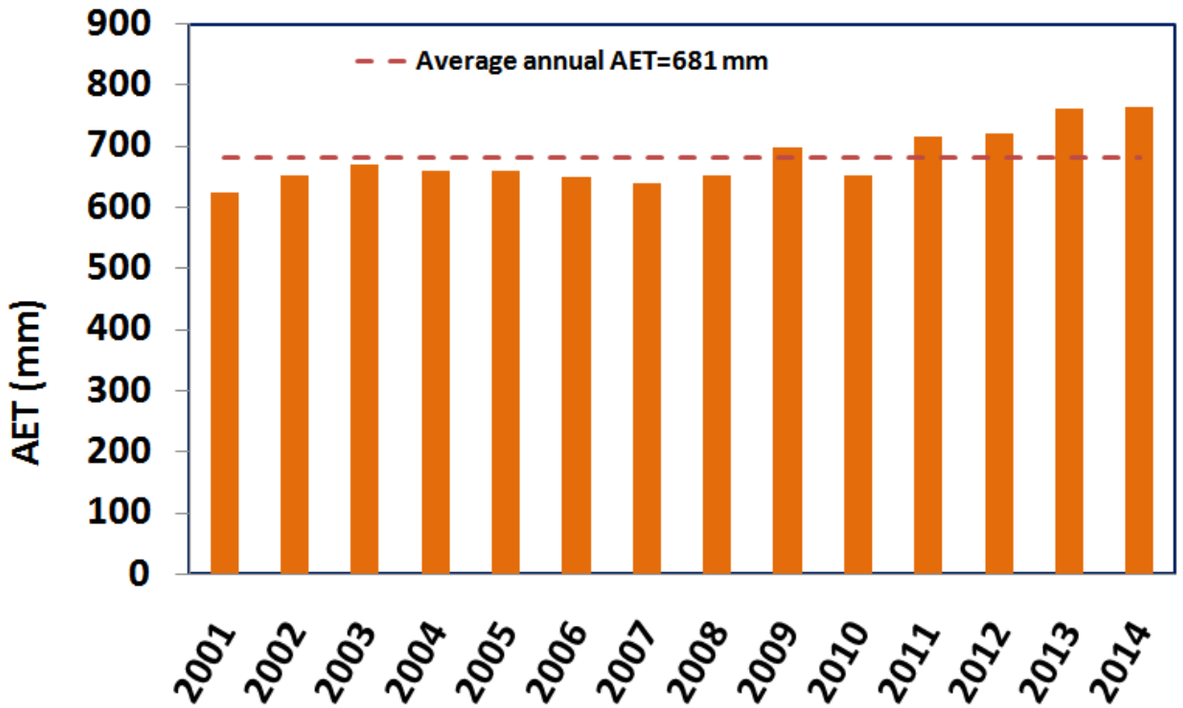


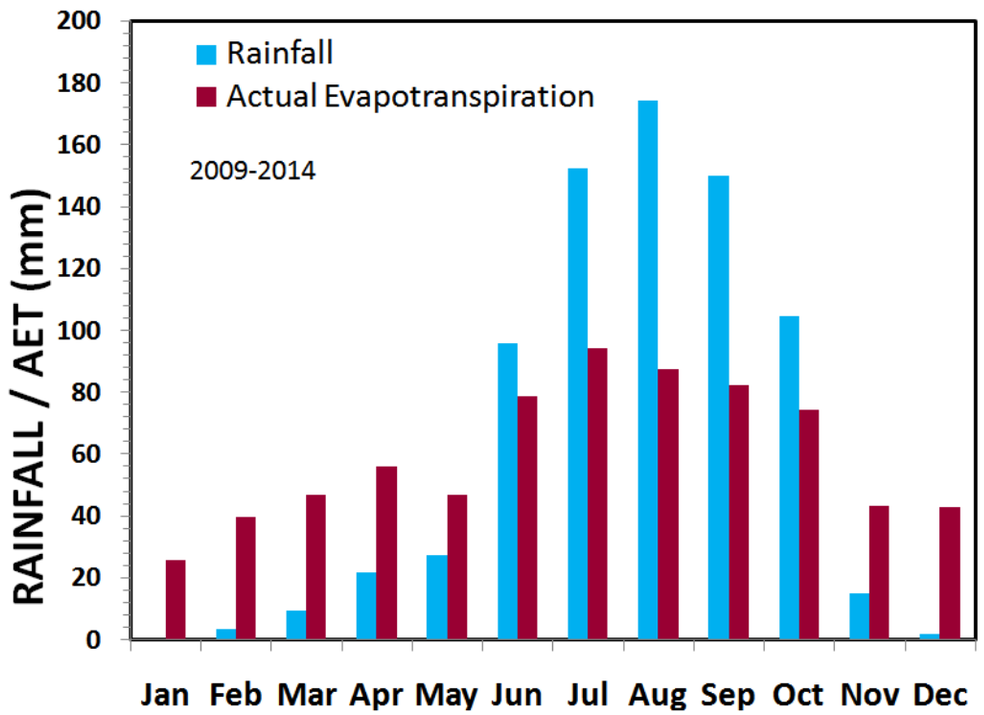
The average *rabi* rainfall (Oct-Jan) is about 15% of the Average annual rainfall. During the years 2009 and 2017 high *rabi* rainfall was received, where as other years showed deficient rainfall.

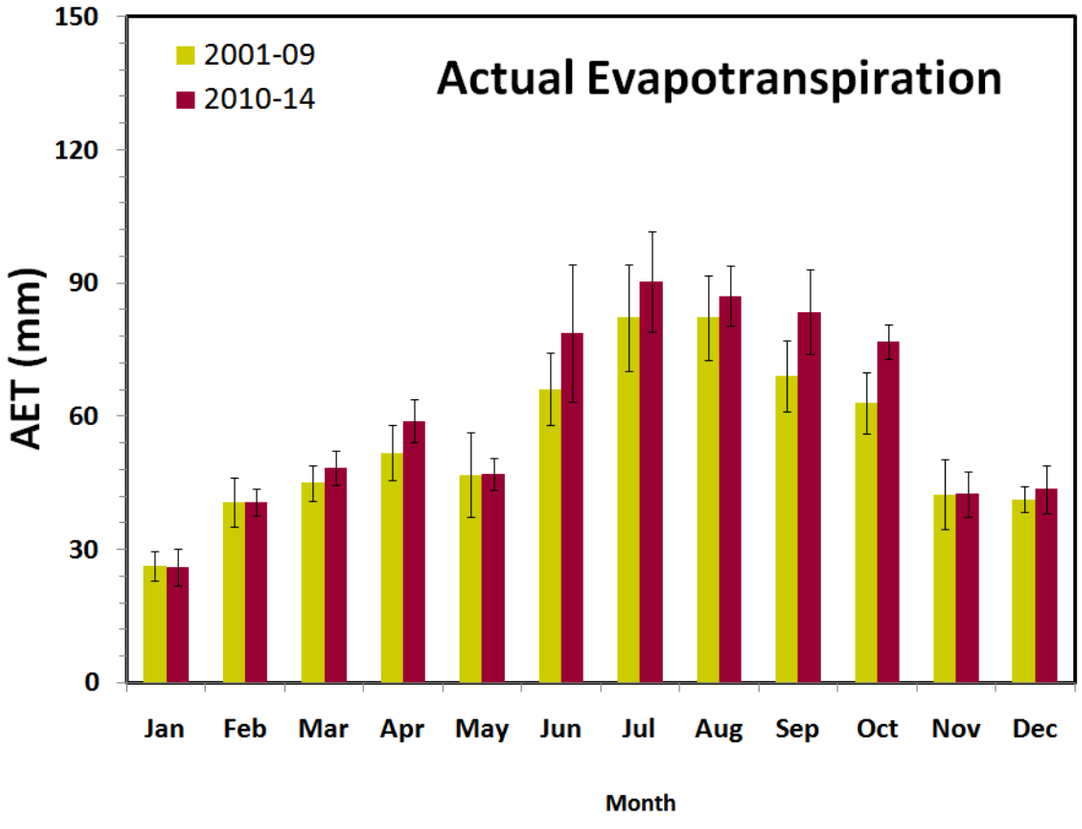
The average summer rainfall (Feb-May) is about 7% of the average annual rainfall.



EVAPOTRANSPIRATION



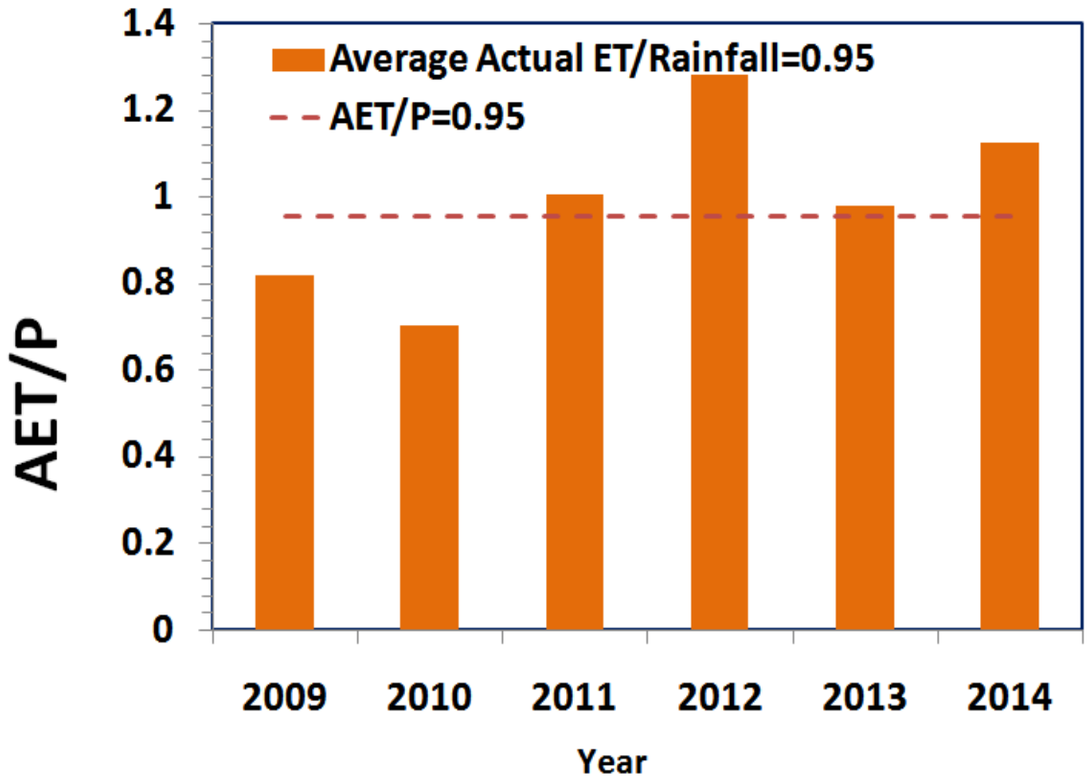


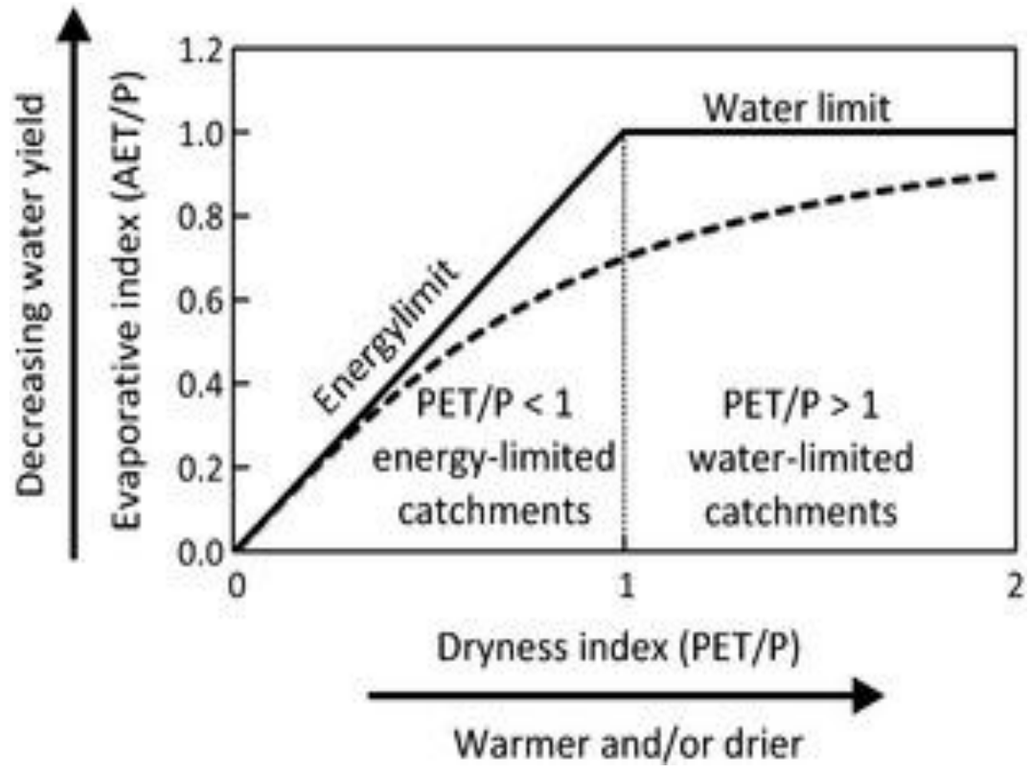


The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and AET was found to be 674 mm and 343 mm respectively, whereas in *rabi* it was about 141 mm and 187 mm. The annual ET increased by 9% during 2010-2014 compared to 2001-2009 .

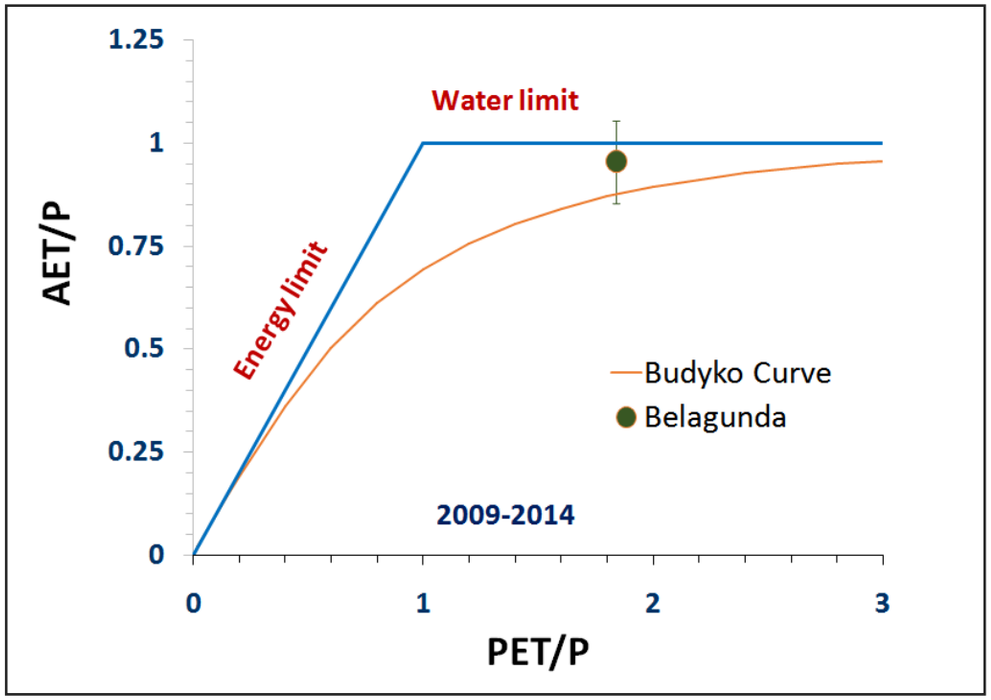
V

EVAPOTRANSPIRATION INDEX

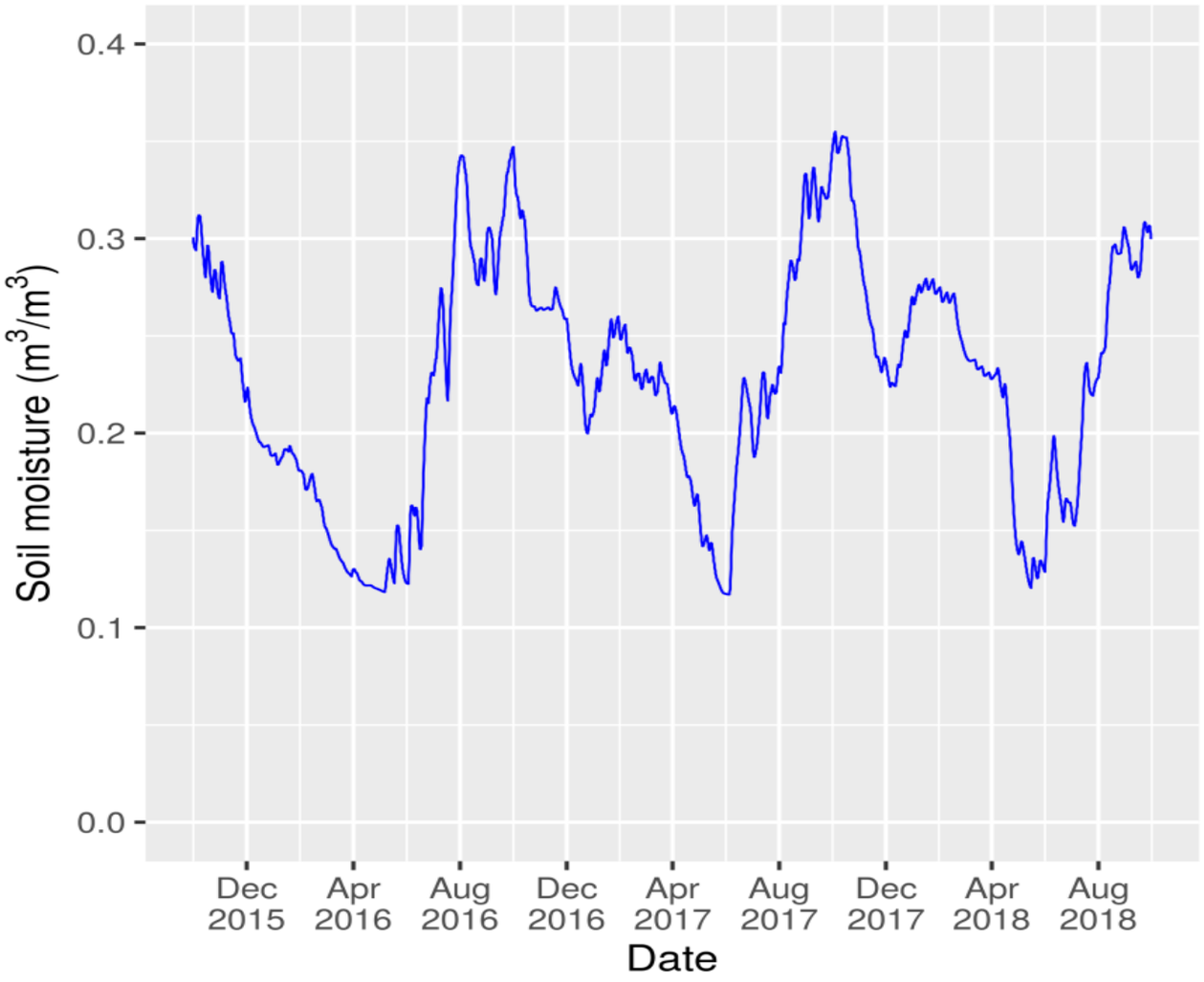




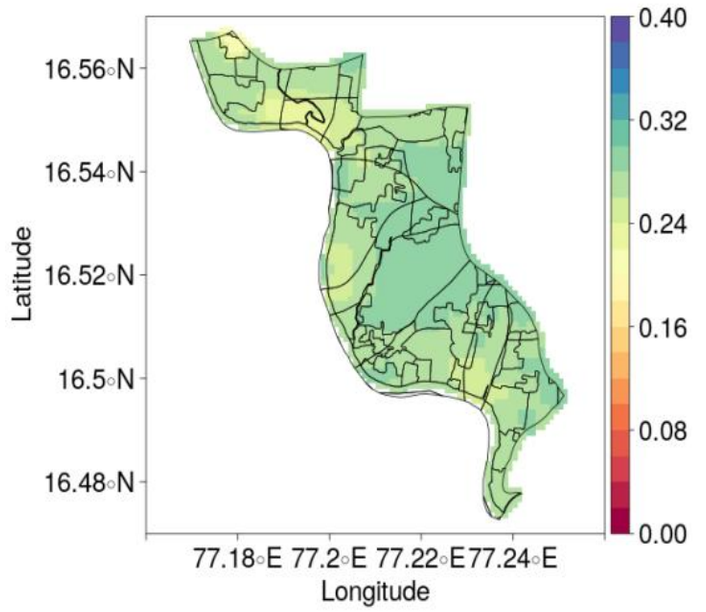
The average AET/P ratio was about 95%, which is higher than the sustainable limit of about 80%. Even during extremely lower rainfall year of 2012, AET was 680 mm. This suggests the presence of water storage and utilization from other sources such as groundwater, which buffered the lower rainfall.



SATELLITE RETRIEVED SOIL MOISTURE

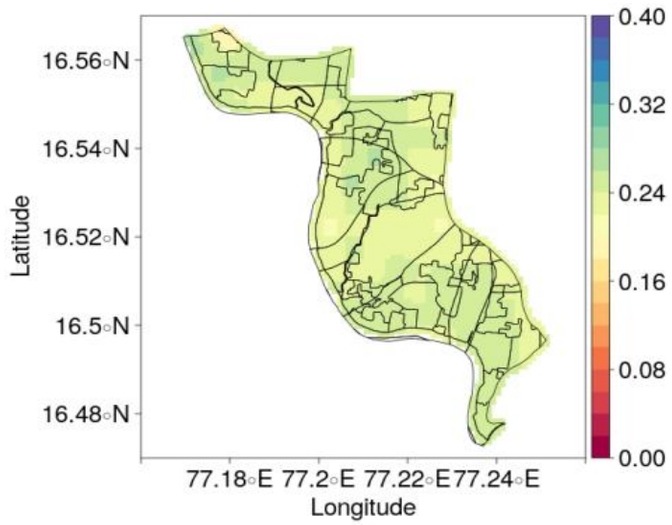


Belagunda– *rabi* Soil Moisture



The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 17-31 % in *kharif* and 18-35% in *rabi* seasons of 2016 and 13-33% in *kharif* and 23-35% in *rabi* seasons of 2017.

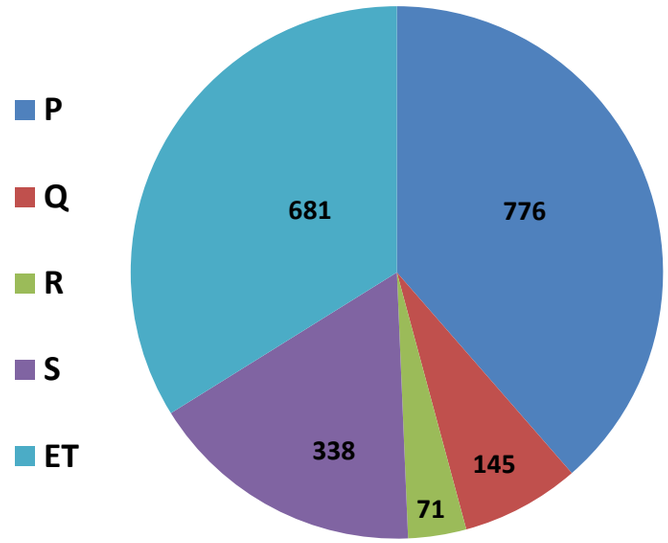
Belagunda– *kharif* Soil Moisture



WATER BALANCE

$$Q = P - E - R - S$$

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- S = Soil moisture storage change

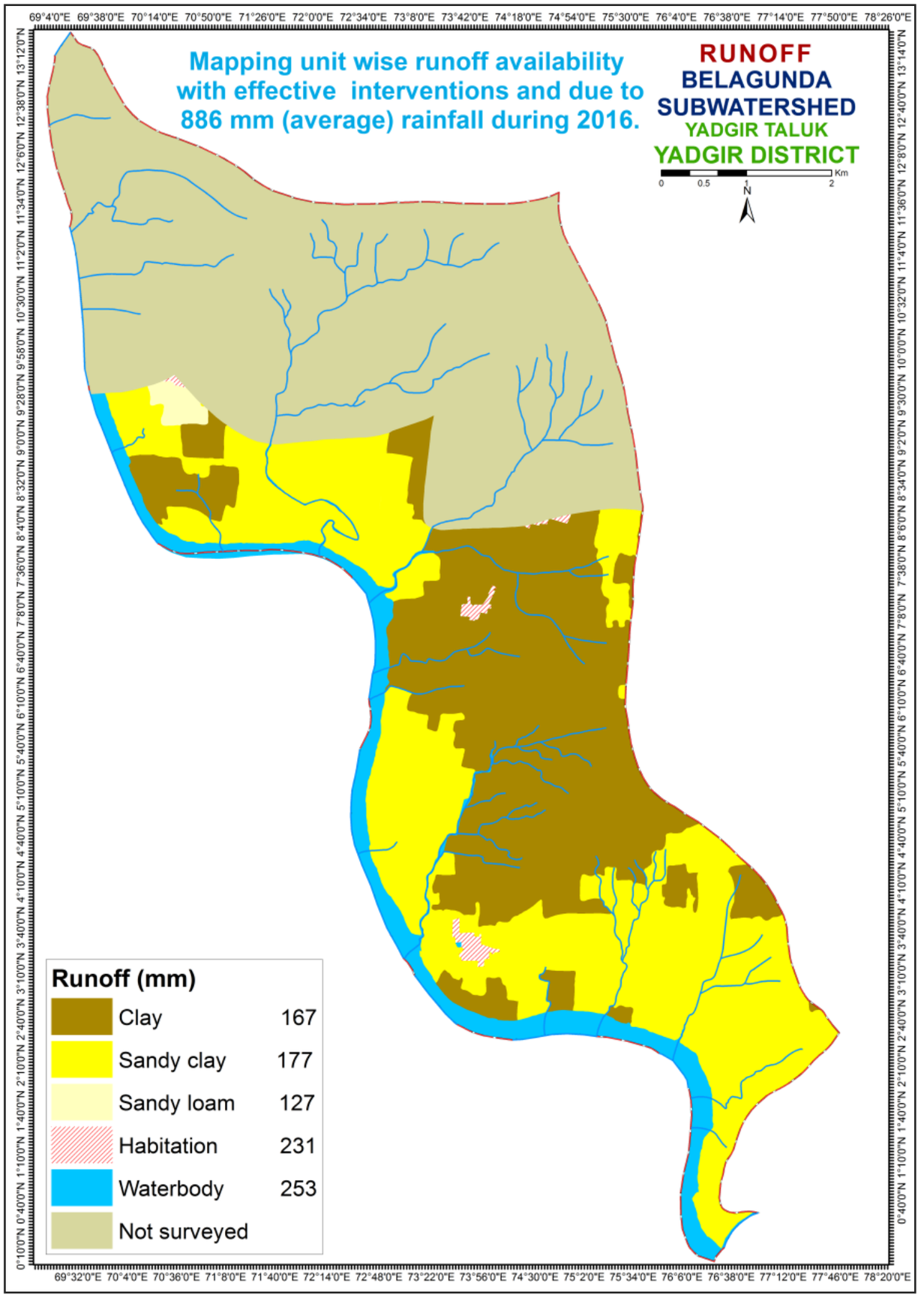


During June-October months, Precipitation is higher than Evapotranspiration, hence Runoff can occur in the watershed.

P = 776 mm (average of 2009-2017) ET = 681 mm R = 71 mm S = 338 mm Q = 145 mm

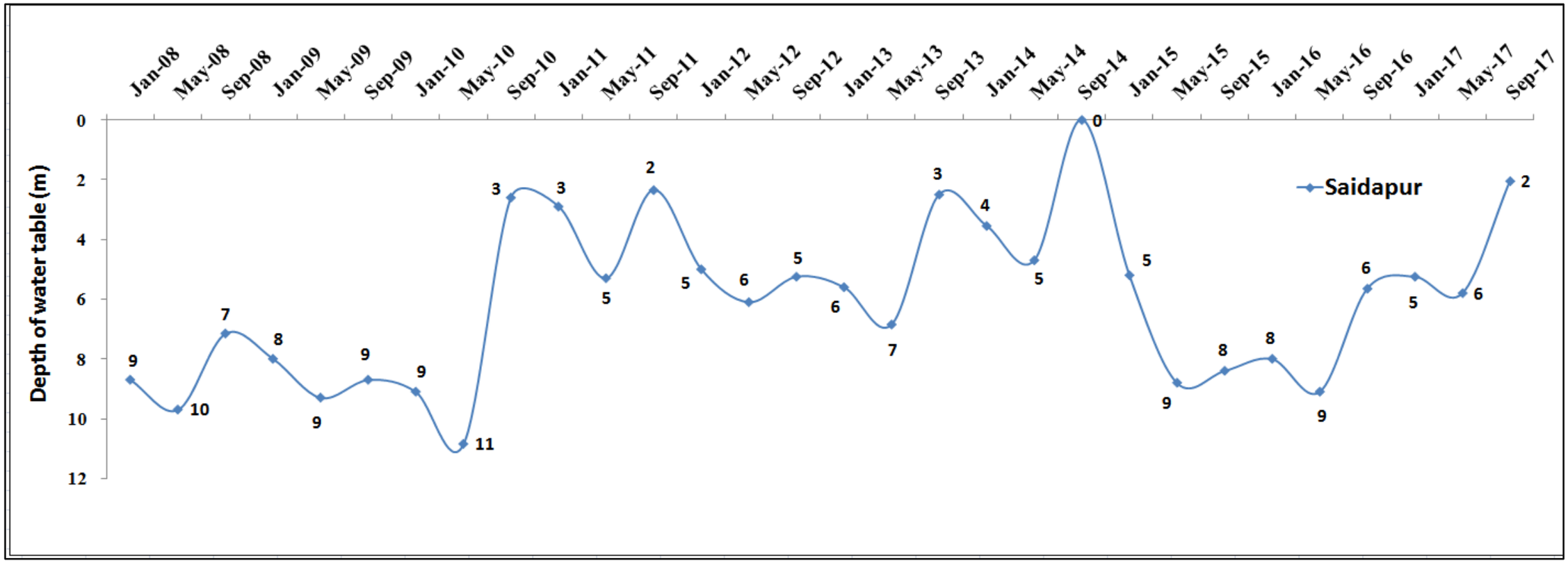
Sl. No.	Parameters	Average_ 2016 (mm)
1.	Rainfall	886
2.	Runoff availability with existing conditions	214
3.	Runoff availability with effective interventions	180
4.	Runoff allowed as environmental flow at the outlet	35
5.	Runoff excess for harvesting by construction of structures	145

RUNOFF


Mapping unit wise runoff availability with effective interventions and due to 886 mm (average) rainfall during 2016.
RUNOFF
BELAGUNDA
SUBWATERSHED
YADGIR TALUK
YADGIR DISTRICT
Km
0
0.5
1
2
N
Runoff (mm)
Clay 167
Sandy clay 177
Sandy loam 127
Habitation 231
Waterbody 253
Not surveyed

GROUND WATER STATUS

SAIDAPUR STATION



The groundwater level shown above is from the data obtained from Dept. of Mines & Geology for the nearest station Saidapur. The graph depicts the groundwater levels during the years 2008-2009 and 2011-2017 were slightly varying. Deepest level was found in 2010 year.

X

SUMMARY

- The average annual rainfall of 887 mm in the Belagunda sub-watershed as recorded from the Saidapur station data.

- 77%, 15% and 7% of the annual rainfall occurs during *kharif*, *rabi* and summer seasons respectively and exhibited a higher temporal variability.

- The evapotranspiration estimation tool developed indicates that the watershed water balance is in deficit. The cropping & irrigation choices are not appropriate and need to be altered to shift the deficit water balance.

- The estimated runoff available to use is 145 mm for an average annual rainfall of 776 mm (2009-2017). The utilizable groundwater is 49.7 mm (70% of 71 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (338 mm) and utilizable runoff plus recharge is 533 (=338+145+50)

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 529 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 661 mm (i.e. 125% of AET). This demand for the two seasons is higher by 128 mm, i.e. (661-533). The AET in June-Sept months is only 60% of rainfall. Hence, there is a good opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.

- The groundwater level data is obtained from Dept. of Mines & Geology for the nearest station Saidapur.