हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

Land Resource and Hydrological Inventory of Chukkanakallu Sub-watershed for Watershed Planning and Development Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

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

ICAR - NBSS & LUP

THE WORLD BANK

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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PART-A

Land Resource Inventory of Chukkanakallu Sub-watershed for Watershed Planning and Development Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

CONTENTS

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How to read and use the Atlas

The Land Resource Inventory of Chukkanakallu Sub-watershed (Koppal Taluk, Koppal District) for Watershed Planning (AESR 3.0) 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.

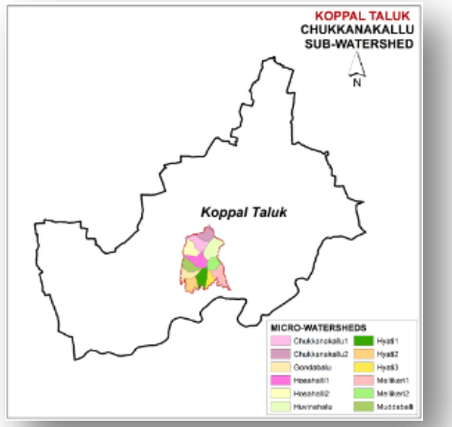
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

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.

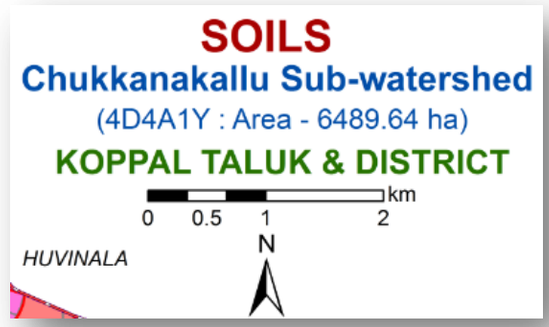
Inset map

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



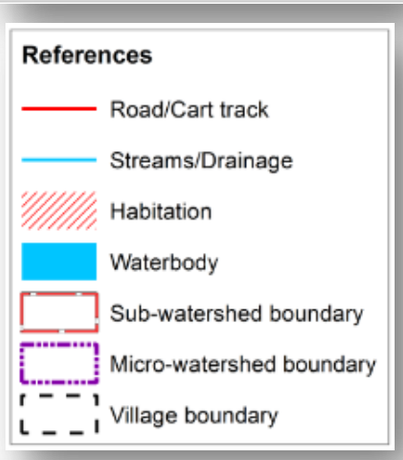
Map title

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



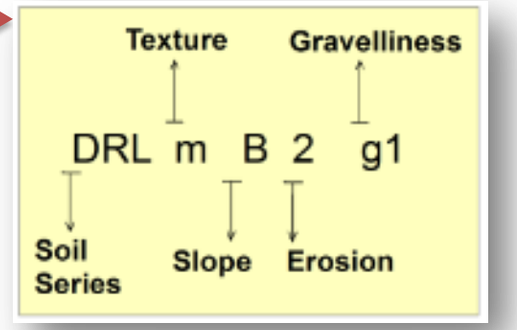
Legends and symbols

*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.*



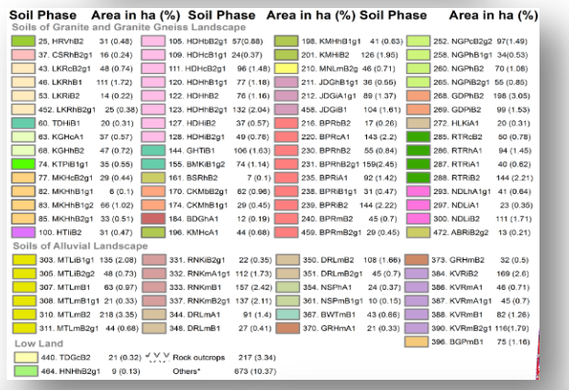
Soil Units

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.



Land Management Units (LMUs)

Grouping of similar soil areas based on their soil-site characteristics into land management units that respond similarly for a given level of management are designated as land management units.

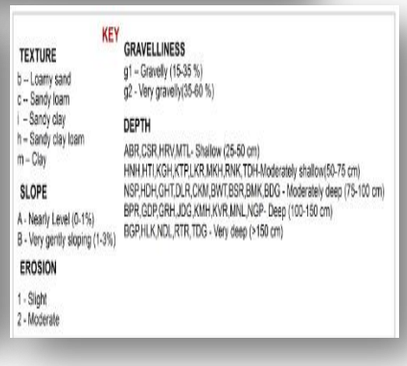
LMU	Area in ha (%)
LMU-1	21 (0.32)
LMU-2	591 (9.11)
LMU-3	771 (11.88)
LMU-4	764 (11.77)
LMU-5	1829 (28.18)
LMU-6	176 (2.71)
LMU-7	348 (5.37)
LMU-8	170 (2.62)
LMU-9	333 (5.13)
LMU-10	9 (0.13)
LMU-11	529 (8.15)
LMU-12	61 (0.93)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

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.

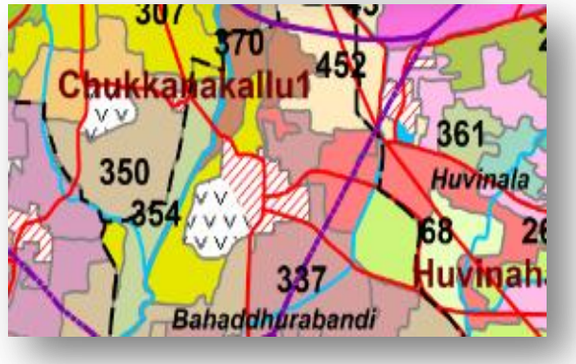
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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



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.



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 Chukkanakallu Sub-watershed covering an area of 6489.64 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.

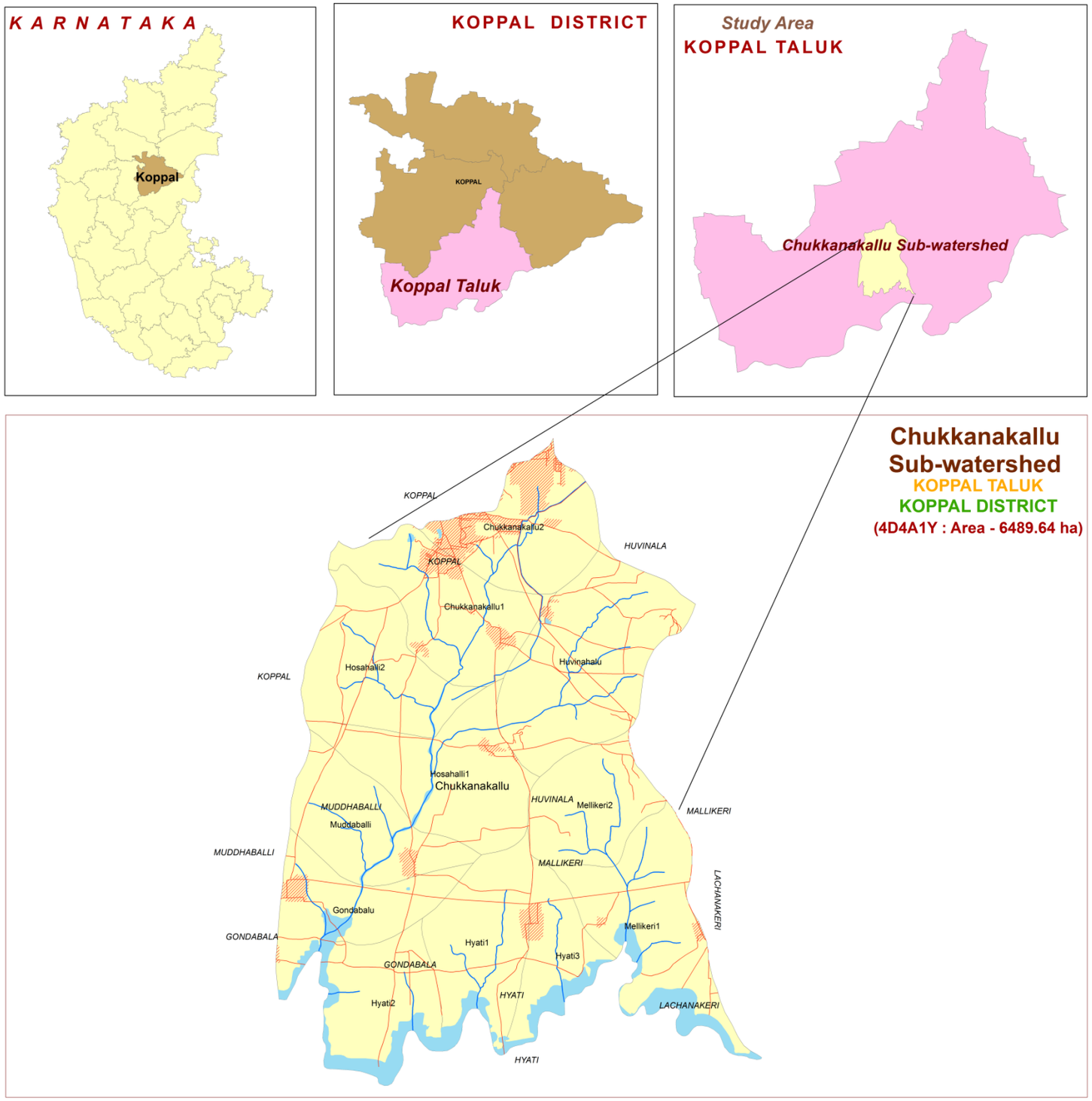
2. General Description of Sub-watershed

The Koppal district came to existence on 1st April 1998 by carving out of erst-while Raichur district of Karnataka with a geographical area of 552495 ha out of which forest area is 29451 ha, located in the northern part of the state. It lies between north latitudes 15˚09′ and 16˚ 01′ and east longitudes 75˚ 46′ and 76˚ 48′. The area falls in the Tungabhadra sub-basin of the Krishna basin. Tungabhadra river flows in the southern boundary of the district in north – easterly direction. The climate of the district is very hot and dry. The district has an average annual rainfall of 572 mm. Soils are well drained red sandy loam to medium deep black soils. This may be the weathering product of schistose, gneissic and granite terrain. Agriculture in Koppal district is dependent upon rainfall, irrigation tanks, wells, streams etc. The major agricultural crops grown are Jawar, Bajra, Wheat, Maize, Paddy, Horsegram, Greengram, Cowpea, Groundnut, Cotton, Niger seeds, Castor, Sunflower, Sugarcane etc. The major fruit crops include Pomegranates, Mango, Sapota, Citrus, Guava, Papaya. The major vegetable crops are leafy vegetables, Tomato, Onion, Brinjal *etc*.

As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of LRI for the Chukkanakallu Sub-watershed in Koppal taluk, Koppal district. It was selected for data base generation under Sujala III project. Chukkanakallu Sub-watershed (code - (4D4A1Y) is covering an area of 6489.64 ha and spread across Muddhaballi, Lachanakeri, Mallikeri, Hyati, Gondabala, Huvinala, and Koppal villages.

LOCATION AND EXTENT

LOCATION MAP OF CHUKKANAKALLU SUB-WATERSHED



The Chukkanakallu Sub-watershed (Koppal taluk, Koppal district) is located in between 15^0 14' – 15^0 20' North latitudes and 75^0 12' – 75^0 7' East longitudes, covering an area of about 6489.64 ha. bounded by across Muddhaballi, Lachanakeri, Mallikeri, Hyati, Gondabala, Huvinala, and Koppal villages

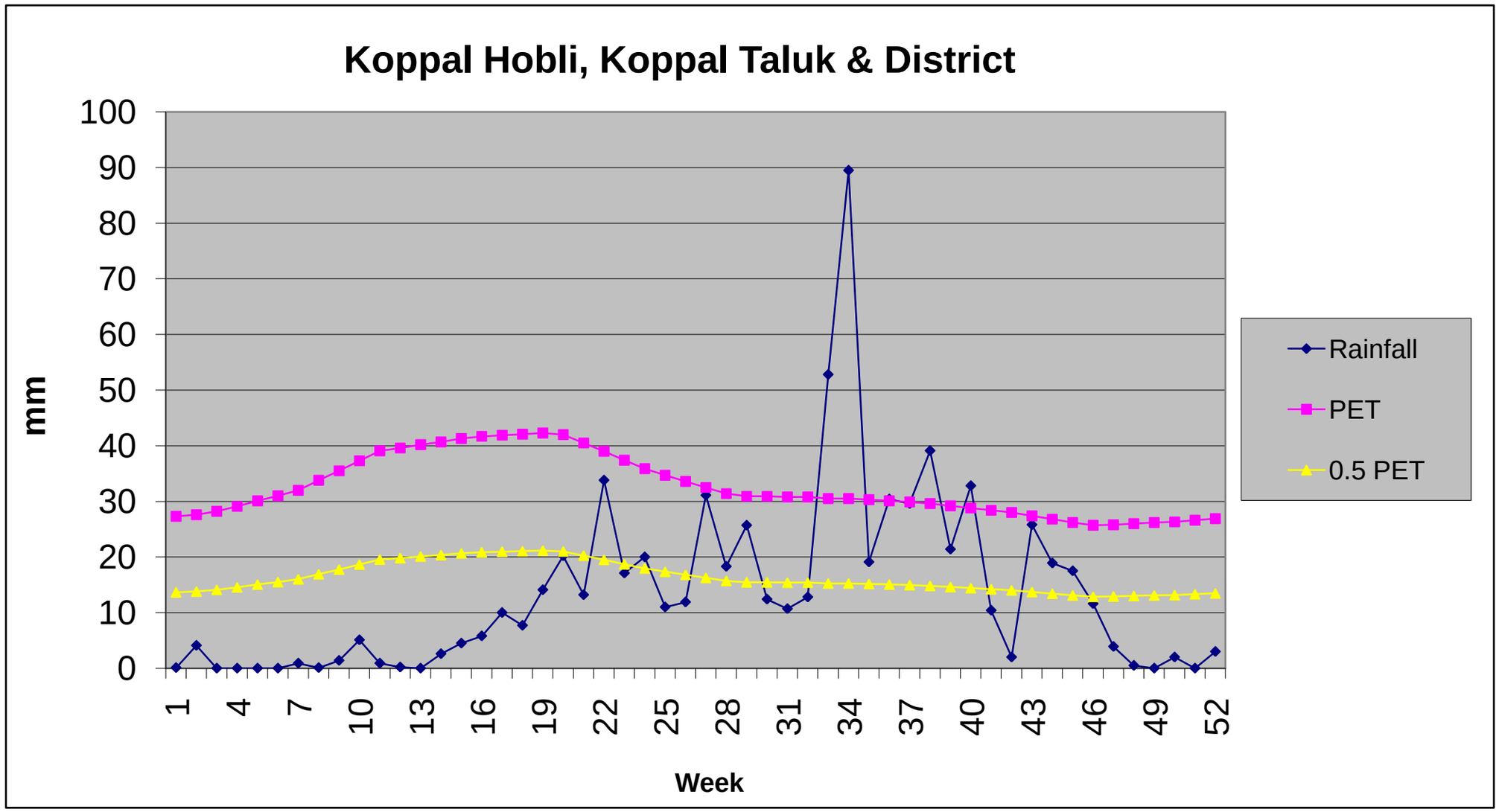
Agro Ecological Region (AER) – 3: (Deccan plateau, hot arid ecosubregion)

Karnataka Plateau (Rayalseema as inclusion), hot arid ESR with deep loamy and clayey mixed Red and Black soils, low to medium AWC and LGP 60-90 days

Agro-climatic Zone 3: Northern Dry Zone:

This zone is the largest in the state with a geographical area of 5.04 M ha, of which about 3.55 M ha is under cultivation. Irrigation is available to about 0.49 M ha. The zone encompasses the entire districts of Bijapur and Bellary, 6 taluks of Koppal, 5 taluks of Dharwad and 5 taluks of Belgaum. Of the 35 taluks in the zone, 9 taluks have a mean elevation of 800-900 m MSL while the rest have an elevation of 450-800 m. The rainfall is similar to that of the northeastern dry zone, ranging between 465 and 785 mm. Black soils are predominant in the zone with depth ranging from shallow to deep. General cropping season is *kharif* in shallow black soils and *rabi* in medium and deep black soils. Important crops of the zone are jowar, maize, bajra, groundnut, pulses, sunflower, cotton and sugarcane.

Climate

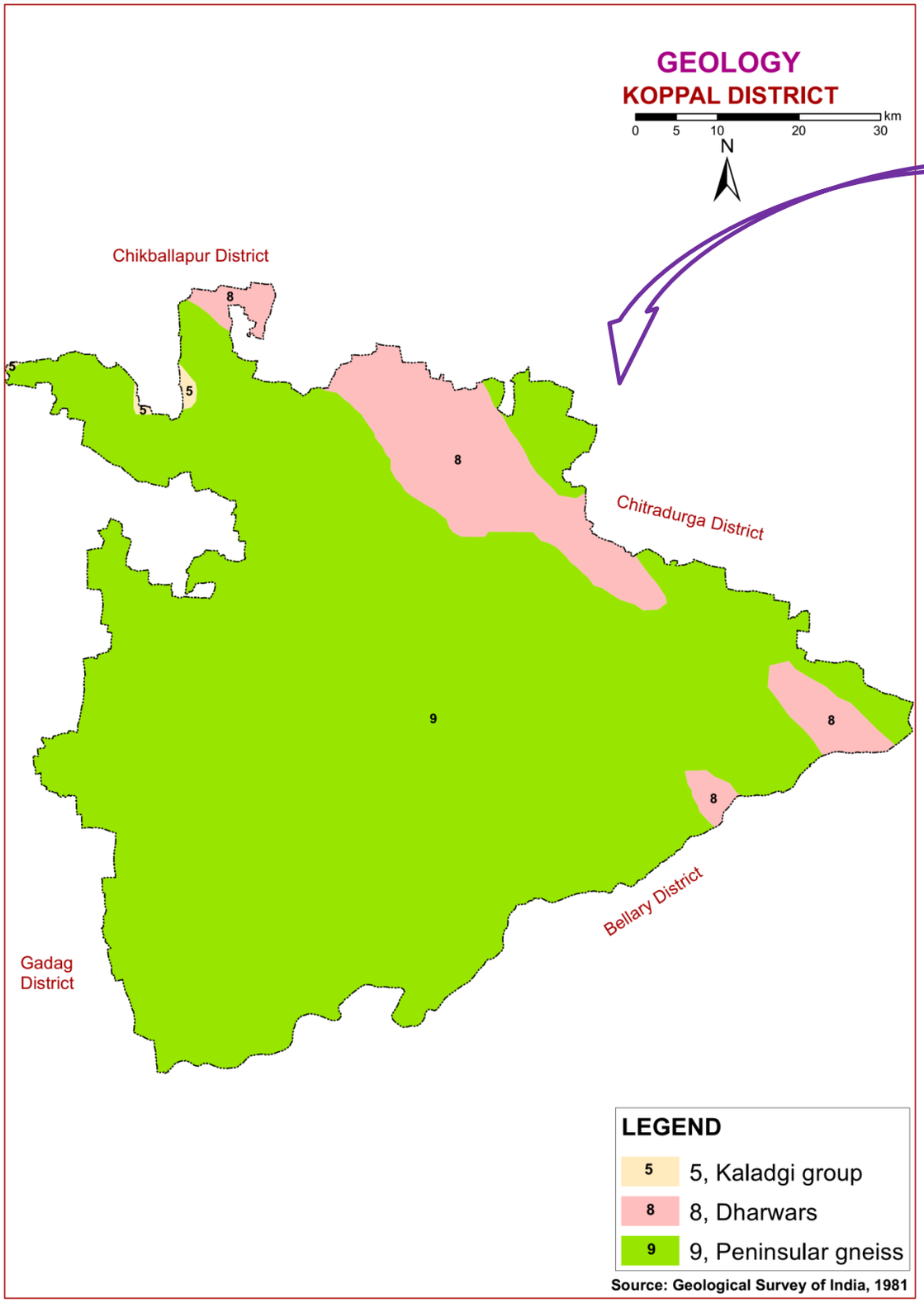


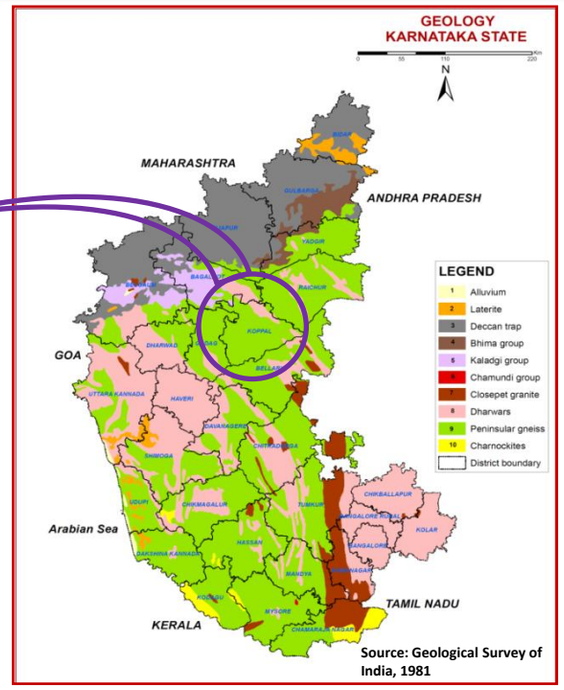
Length of Growing Period (LGP) is varying from July 2nd week to last week of September (< 90 days)

Annual Rainfall : 706 mm. in the Koppal Hobli, Koppal Taluk & District

Source: KSNMDC (1980-2011)

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 - KOPPAL DISTRICT

Kaladgi group

It consists of nearly horizontal sedimentary rocks 3000 to 5000m thick overlying the Archaeans. The component rocks are sandstones, shales, limestone, dolomite and schists.

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 (comprises banded ferruginous quartzites, pyroxenite, gabbro, serpentinite, acid volcanic, phyllites, metabasalt, and quartz-chlorite schist) and Chitradurga groups (includes quartzite, limestone, dolomite, chlorite-schist, and manganese and iron ores with phyllite, metabasalt and conglomerates).

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.

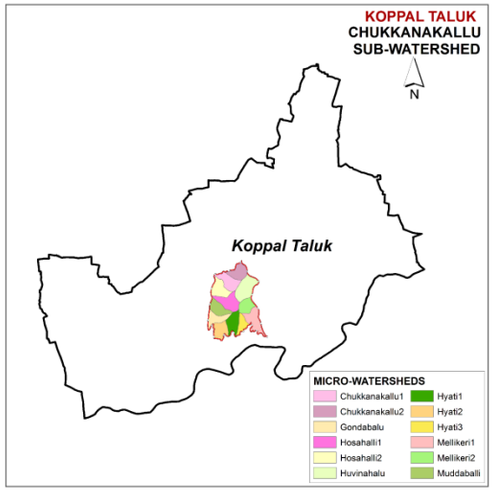
3. SURVEY METHODOLOGY

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

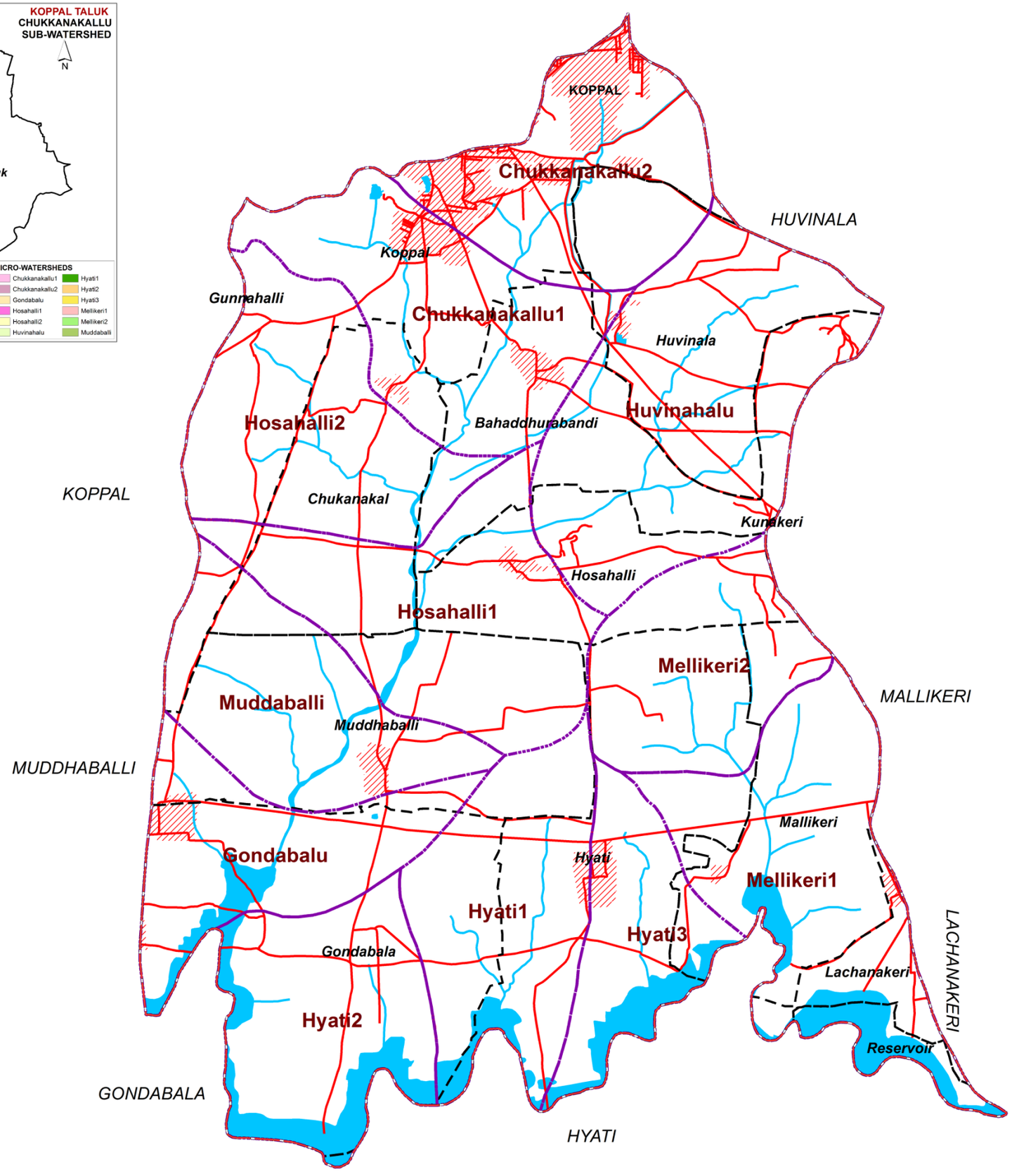


Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N

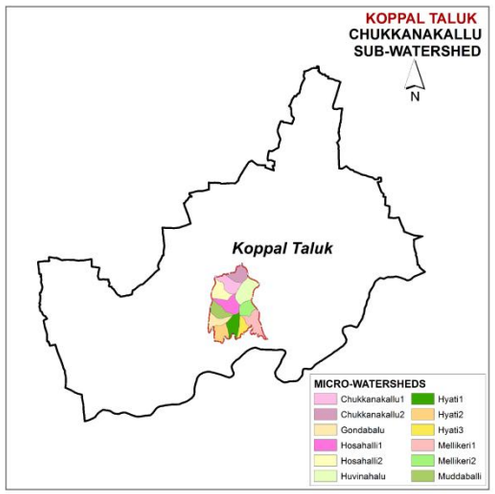


References

- 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

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N

KOPPAL
HUVINALA
KOPPAL
MUDDHABALLI
MALLIKERI
GONDABALA
HYATI
LACHANAKERI

Chukkanakallu2
Chukkanakallu1
Hosahalli2
Hosahalli1
Muddaballi
Gondabalu
Huvinahalu
Mellikeri2
Mellikeri1
Hyati1
Hyati2
Hyati3

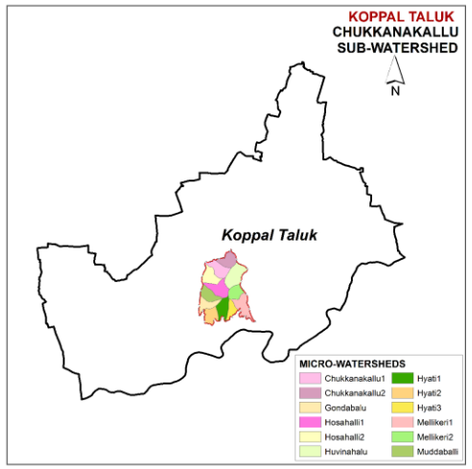
Koppal
Gunnahalli
Huvinala
Bahaddhurabandi
Chukanakal
Kunakeri
Hosahalli
Muddhaballi
Mallikeri
Hyati
Gondabala
Lachanakeri
Reservoir

References

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

Source: Cartosat 1 Imagery, 2011

3.3. Current LandUse



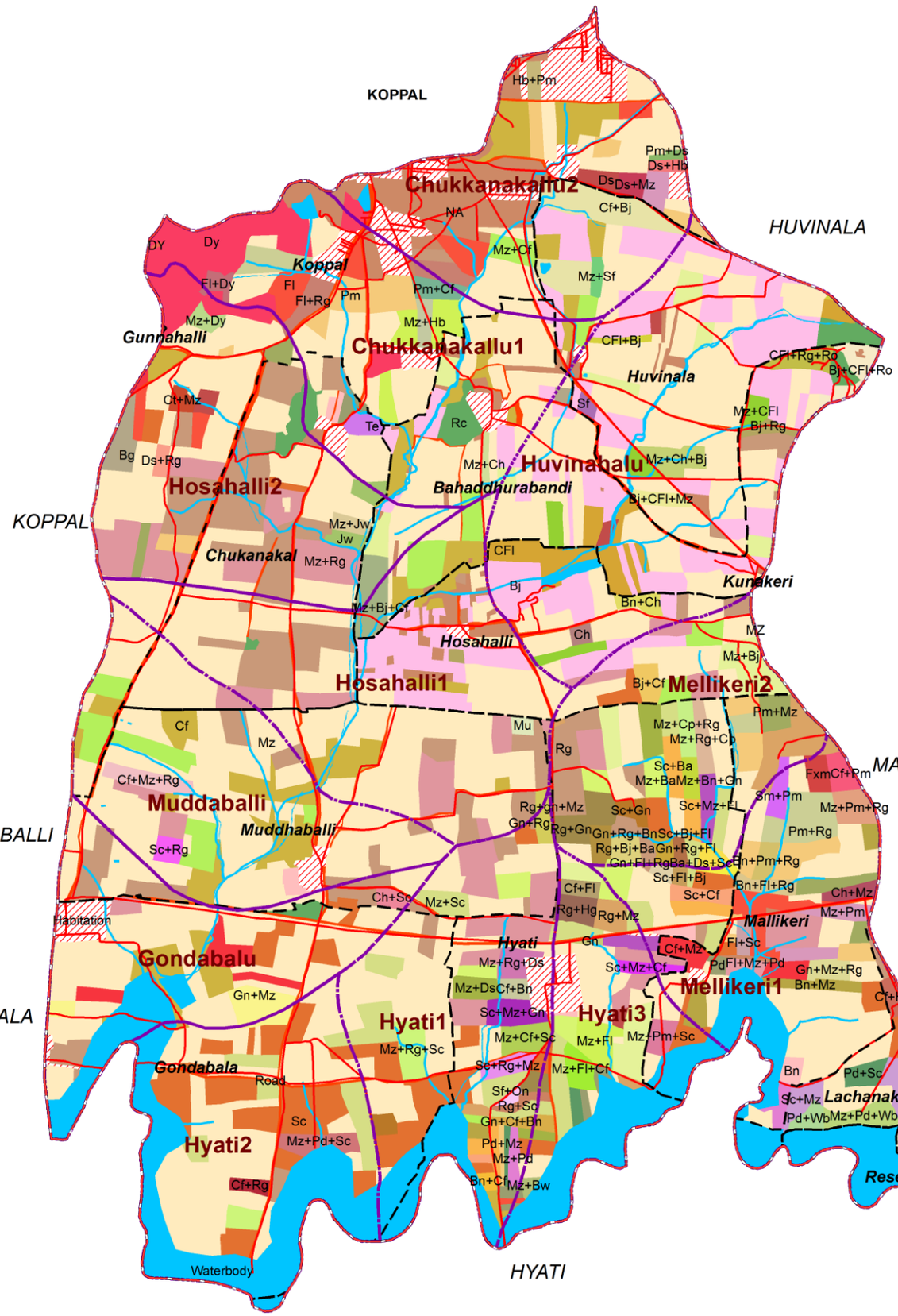
CURRENT LANDUSE (2018)

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N



References

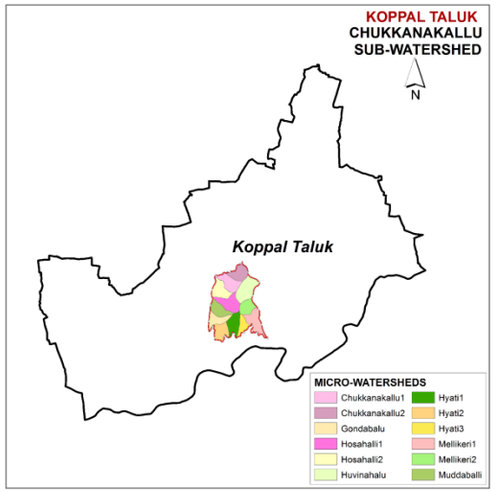
- Streams/Drainage
- Road/Cart track
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Current LandUse

Ba+Ds+Sc	Fl+Sc	Mz+Rg+Ds
Bg	Fxm	Mz+Rg+Sc
Bj	Gn	Mz+Sc
Bj+CFl+Mz	Gn+Cf+Bn	Mz+Sf
Bj+CFl+Ro	Gn+Fl+Rg	Pd
Bj+Cf	Gn+Mz	Pd+Mz
Bj+Rg	Gn+Mz+Rg	Pd+Sc
Bn	Gn+Rg	Pd+Wb
Bn+Cf	Gn+Rg+Bn	Pm
Bn+Ch	Gn+Rg+Fl	Pm+Cf
Bn+Fl+Rg	Hb+Pm	Pm+Ds
Bn+Mz	Jw	Pm+Mz
Bn+Pm+Rg	MZ	Pm+Rg
Bn+Sc+Ds	Mu	Rc
CFl	Mz	Rg
CFl+Bj	Mz+Ba	Rg+Bj+Ba
CFl+Rg+Ro	Mz+Bj	Rg+Gn
Cf	Mz+Bj+Cf	Rg+Hg
Cf+Bj	Mz+Bn+Gn	Rg+Mz
Cf+Bn	Mz+Bw	Rg+Sc
Cf+Fl	Mz+CFl	Rg+gn+Mz
Cf+Hb	Mz+Cf	Sc
Cf+Mz	Mz+Cf+Sc	Sc+Ba
Cf+Mz+Rg	Mz+Ch	Sc+Bj+Fl
Cf+Pm	Mz+Ch+Bj	Sc+Cf
Cf+Rg	Mz+Cp+Rg	Sc+Fl+Bj
Ch	Mz+Ds	Sc+Gn
Ch+Mz	Mz+Dy	Sc+Mz
Ch+Sc	Mz+Fl	Sc+Mz+Cf
Ct+Mz	Mz+Fl+Cf	Sc+Mz+Fl
DY	Mz+Hb	Sc+Mz+Gn
Ds	Mz+Jw	Sc+Rg
Ds+Hb	Mz+Pd	Sc+Rg+Mz
Ds+Mz	Mz+Pd+Sc	Sf
Ds+Rg	Mz+Pd+Wb	Sf+On
Dy	Mz+Pm	Sm+Pm
Fl	Mz+Pm+Rg	Te
Fl+Dy	Mz+Pm+Sc	Habitation
Fl+Mz+Pd	Mz+Rg	NA
Fl+Rg	Mz+Rg+Cp	Road
		Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

3.4. Location of Wells



LOCATION OF WELLS

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N

KOPPAL
HUVINALA
MUDDHABALLI
MALLIKERI
KOPPAL
GONDABALA
HYATI
LACHANAKERI
Gunnahalli
Koppal
Chukkanakallu2
Chukkanakallu1
Huvinala
Huvinahalu
Hosahalli2
Bahaddhurabandi
Chukanakal
Kunakeri
Hosahalli
Hosahalli1
Mellikeri2
Muddaballi
Muddhaballi
Mallikeri
Gondabalu
Hyati
Mellikeri1
Hyati1
Hyati3
Gondabala
Lachanakeri
Hyati2
Reservoir

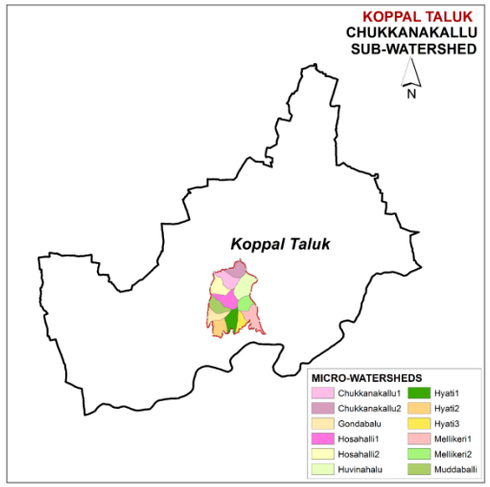
References

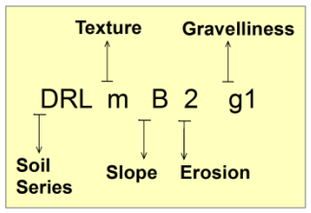
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Legend	No's
Borewell	160
Farm pond	5
Openwell	1

Source: ICAR-NBSS&LUP, Bengaluru

4. The Soils





SOILS

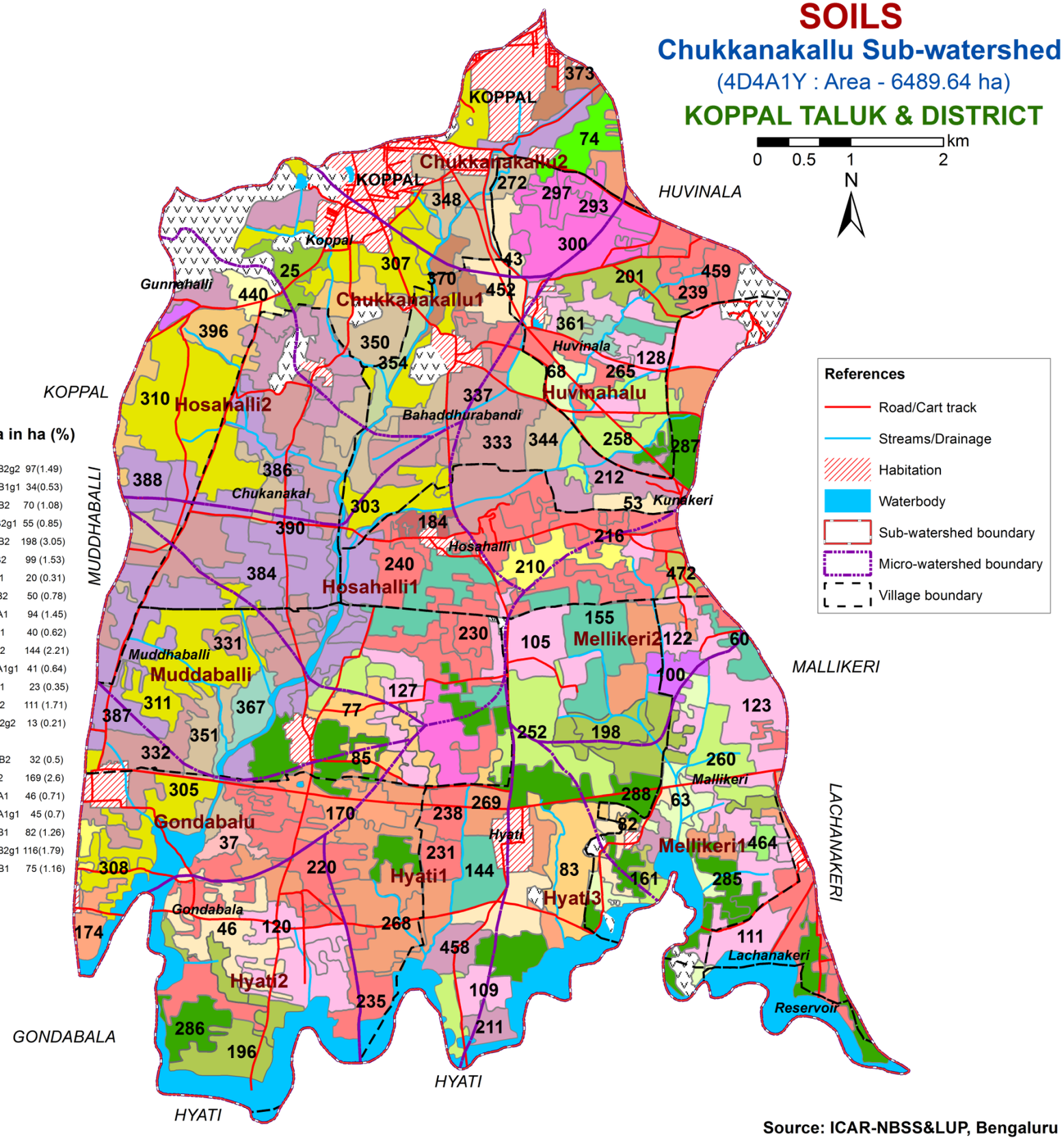
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km 0 0.5 1 2

N



References

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

Soils of Granite and Granite Gneiss Landscape

Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)
25, HRVhB2	31 (0.48)	105. HDHbB2g1	57(0.88)	198. KMHhB1g1	41 (0.63)
37. CSRhB2g1	16 (0.24)	109. HDHcB1g1	24(0.37)	201. KMHiB2	126 (1.95)
43. LKRcB2g1	48 (0.74)	111. HDHcB2g1	96 (1.48)	210. MNLmB2g	46 (0.71)
46. LKRhB1	111 (1.72)	120. HDHhB1g1	77 (1.18)	211. JDGhB1g1	36 (0.55)
53. LKRiB2	14 (0.22)	122. HDHhB2	76 (1.16)	212. JDGiA1g1	89 (1.37)
452. LKRhB2g1	25 (0.38)	123. HDHhB2g1	132 (2.04)	458. JDGiB1	104 (1.61)
60. TDHiB1	20 (0.31)	127. HDHiB2	37 (0.57)	216. BPRbB2	17 (0.26)
63. KGHcA1	37 (0.57)	128. HDHiB2g1	49 (0.76)	220. BPRcA1	143 (2.2)
68. KGHhB2	47 (0.72)	144. GHTiB1	106 (1.63)	230. BPRhB2	55 (0.84)
74. KTPiB1g1	35 (0.55)	155. BMKiB1g2	74 (1.14)	231. BPRhB2g1	159(2.45)
77. MKHcB2g1	29 (0.44)	161. BSRhB2	7 (0.1)	235. BPRiA1	92 (1.42)
82. MKHhB1g1	6 (0.1)	170. CKMbB2g1	62 (0.96)	238. BPRiB1g1	31 (0.47)
83. MKHhB1g2	66 (1.02)	174. CKMhB1g1	29 (0.45)	239. BPRiB2	144 (2.22)
85. MKHhB2g1	33 (0.51)	184. BDGhA1	12 (0.19)	240. BPRmB2	45 (0.7)
100. HTIiB2	31 (0.47)	196. KMHcA1	44 (0.68)	459. BPRmB2g1	29 (0.45)

Soils of Alluvial Landscape

303. MTLiB1g1	135 (2.08)	331. RNKiB2g1	22 (0.35)	350. DRLmB2	108 (1.66)	373. GRHmB2	32 (0.5)
305. MTLiB2g2	48 (0.73)	332. RNKmA1g1	112 (1.73)	351. DRLmB2g1	45 (0.7)	384. KVRiB2	169 (2.6)
307. MTLmB1	63 (0.97)	333. RNKmB1	157 (2.42)	354. NSPhA1	24 (0.37)	386. KVRmA1	46 (0.71)
308. MTLmB1g1	21 (0.33)	337. RNKmB2g1	137 (2.11)	361. NSPmB1g1	10 (0.15)	387. KVRmA1g1	45 (0.7)
310. MTLmB2	218 (3.35)	344. DRLmA1	91 (1.4)	367. BWTmB1	43 (0.66)	388. KVRmB1	82 (1.26)
311. MTLmB2g1	44 (0.68)	348. DRLmB1	27 (0.41)	370. GRHmA1	21 (0.33)	390. KVRmB2g1	116(1.79)
						396. BGPmB1	75 (1.16)

Low Land

440. TDGcB2	21 (0.32)	Rock outcrops	217 (3.34)
464. HNHhB2g1	9 (0.13)	Others*	673 (10.37)

* - Habitation & Waterbody

KEY

TEXTURE
b -- Loamy sand
c -- Sandy loam
i – Sandy clay
h – Sandy clay loam
m – Clay

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

EROSION
1 - Slight
2 - Moderate

GRAVELLINESS
g1 – Gravelly (15-35 %)
g2 - Very gravelly(35-60 %)

DEPTH
ABR,CSR,HRV,MTL- Shallow (25-50 cm)
HNH,HTI,KGH,KTP,LKR,MKH,RNK,TDH-Moderately shallow(50-75 cm)
NSP,HDH,GHT,DLR,CKM,BWT,BSR,BMK,BDG - Moderately deep (75-100 cm)
BPR,GDP,GRH,JDG,KMH,KVR,MNL,NGP- Deep (100-150 cm)
BGP,HLK,NDL,RTR,TDG - Very deep (>150 cm)

Source: ICAR-NBSS&LUP, Bengaluru

4.1 Mapping unit description of Chukkanakallu (4D4A1Y) Sub-watershed in Koppal taluk, Koppal district

Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape				
	ABR	Abbigere soils are shallow (25-50 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation.		**13 (0.21)**
472		ABRiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	13 (0.21)
	CSR	Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown, sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**16 (0.24)**
37		CSRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	16 (0.24)
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark red dish brown, red gravelly sandy clay loam soils occurring on nearly level to gently sloping uplands under cultivation		**31 (0.48)**
25		HRVhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	31 (0.48)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**198(3.06)**
452		LKRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	25 (0.38)
43		LKRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	48 (0.74)
46		LKRhB1	Sandy clay loam surface, slope 1-3%, slight erosion	111(1.72)
53		LKRiB2	Sandy clay surface, slope 1-3%, moderate erosion	14 (0.22)
	HNH	Honnenahalli soils are moderately shallow (50-75 cm), moderately well drained, have brown to dark brown sandy clay soils occurring on nearly level to very gently sloping lowlands under cultivation		**9 (0.13)**
464		HNHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	9 (0.13)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy clay soils occurring on gently very gently to gently sloping uplands under cultivation		**134(2.07)**
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	29 (0.44)
82		MKHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	6 (0.1)
83		MKHhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravelly (35-60%)	66 (1.02)
85		MKHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	33 (0.51)
	HTI	Hatti soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**31 (0.47)**
100		HTIiB2	Sandy clay surface, slope 1-3%, moderate erosion	31 (0.47)
	KGH	Kutegoudanahundi soils are moderately shallow (50-75 cm), well drained, have brown to dark brown gravelly red sandy clay loam soils occurring on nearly level to very gently to gently sloping uplands under cultivation		**84(1.29)**
63		KGHcA1	Sandy loam surface, slope 0-1%, slight erosion	37 (0.57)
68		KGHhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	47 (0.72)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**35 (0.55)**
74		KTPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	35 (0.55)
	TDH	Thammadahalli soils are moderately shallow (50-75cm), well drained, have brown to very dark brown and dark reddish brown sandy clay to clay soils occurring on nearly level to gently sloping uplands		**20 (0.31)**
60		TDHiB1	Sandy clay surface, slope 1-3%, slight erosion	20 (0.31)
	BMK	Bhimanakunte soils are moderately deep (75-100 cm), well drained, have very dark reddish brown to yellowish red gravelly, calcareous sandy clay to clay soils occurring on nearly level to very gently sloping uplands under cultivation		**74 (1.14)**
155		BMKiB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	74 (1.14)

To be continued...

Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape				
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**7 (0.1)**
161		BSRhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	7 (0.1)
	CKM	Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**91 (1.41)**
170		CKMbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	62 (0.96)
174		CKMhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	29 (0.45)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on nearly level very gently sloping uplands under cultivation		**106 (1.63)**
144		GHTiB1	Sandy clay surface, slope 1-3%, slight erosion	106(1.63)
	HDH		Hooradhahalli soils are moderately deep (75-100 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation	548(8.44)
105		HDHbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	57 (0.88)
109		HDHcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	24 (0.37)
111		HDHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	96 (1.48)
120		HDHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	77 (1.18)
122		HDHhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	76 (1.16)
123		HDHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	132(2.04)
127		HDHiB2	Sandy clay surface, slope 1-3%, moderate erosion	37 (0.57)
128		HDHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	49 (0.76)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly red clay soils occurring on nearly level to gently sloping uplands under cultivation		**12 (0.19)**
184		BDGhA1	Sandy clay loam surface, slope 0-1%, slight erosion	12 (0.19)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**715 (11.01)**
216		BPRbB2	Loamy sand surface, slope 1-3%, moderate erosion	17 (0.26)
220		BPRcA1	Sandy loam surface, slope 0-1%, slight erosion	143 (2.2)
230		BPRhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	55 (0.84)
231		BPRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion	159(2.45)
235		BPRiA1	Sandy clay surface, slope 0-1%, slight erosion	92 (1.42)
238		BPRiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	31 (0.47)
239		BPRiB2	Sandy clay surface, slope 1-3%, moderate erosion	144(2.22)
240		BPRmB2	Clay surface, slope 1-3%, moderate erosion	45 (0.7)
459		BPRmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	29 (0.45)

To be continued...

Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape				
	KMH	Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**211(3.26)**
196		KMHcA1	Sandy loam surface, slope 0-1%, slight erosion	44 (0.68)
198		KMHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	41 (0.63)
201		KMHiB2	Sandy clay surface, slope 1-3%, moderate erosion	126(1.95)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay soils occurring on nearly level to gently sloping uplands under cultivation		**297(3.95)**
252		NGPcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	97 (1.49)
258		NGPhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	34 (0.53)
260		NGPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	70 (1.08)
265		NGPiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	55 (0.85)
	GDP	Giddadapalya soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on very gently sloping uplands under cultivation		**297(4.58)**
268		GDPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	198(3.05)
269		GDPiB2	Sandy clay surface, slope 1-3%, moderate erosion	99 (1.53)
	MNL	Mornal soils are deep (100-150 cm), well drained, have dark reddish brown to red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**46 (0.71)**
210		MNLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	46 (0.71)
	JDG	Jedigere soils are deep (100-150 cm), well drained, have dark brown to dark reddish brown red sandy clay to clay soils occurring on nearly level to very gently sloping uplands under cultivation		**229(3.53)**
211		JDGhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	36 (0.55)
212		JDGiA1g1	Sandy clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	89 (1.37)
458		JDGiB1	Sandy clay surface, slope 1-3%, slight erosion	104(1.61)
	NDL	Niduvalalu soils are very deep (>150 cm), well drained, have red to dark reddish brown red gravelly sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**175(2.7)**
293		NDLhA1g1	Sandy clay loam surface, slope 0-1%, slight erosion, gravelly (15-35%)	41 (0.64)
297		NDLiA1	Sandy clay surface, slope 0-1%, slight erosion	23 (0.35)
300		NDLiB2	Sandy clay surface, slope 1-3%, moderate erosion	111(1.71)
	HLK	Hallikere soils are very deep (>150 cm), well drained, have dark brown to dark reddish brown clayey soils occurring on nearly level to very gently sloping uplands under cultivation		**20 (0.31)**
272		HLKiA1	Sandy clay surface, slope 0-1%, slight erosion	20 (0.31)
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on nearly level to very gently sloping uplands under cultivation		**328(5.06)**
285		RTRcB2	Sandy loam surface, slope 1-3%, moderate erosion	50 (0.78)
286		RTRhA1	Sandy clay loam surface, slope 0-1%, slight erosion	94 (1.45)
287		RTRiA1	Sandy clay surface, slope 0-1%, slight erosion	40 (0.62)
288		RTRiB2	Sandy clay surface, slope 1-3%, moderate erosion	144(2.21)
	TDG	Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown, sandy clay loam soils occurring on nearly level to very gently sloping lowlands under cultivation		**21 (0.32)**
440		TDGcB2	Sandy loam surface, slope 1-3%, moderate erosion	21 (0.32)

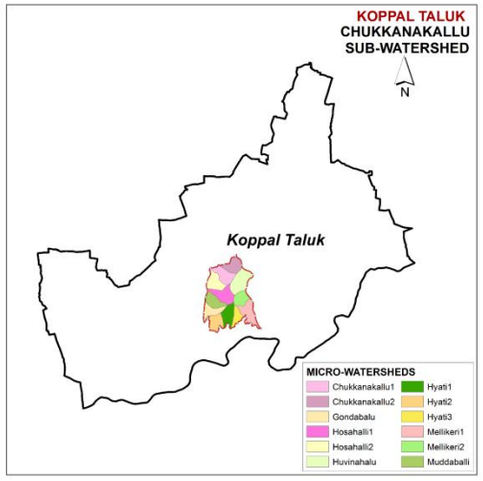
To be continued...

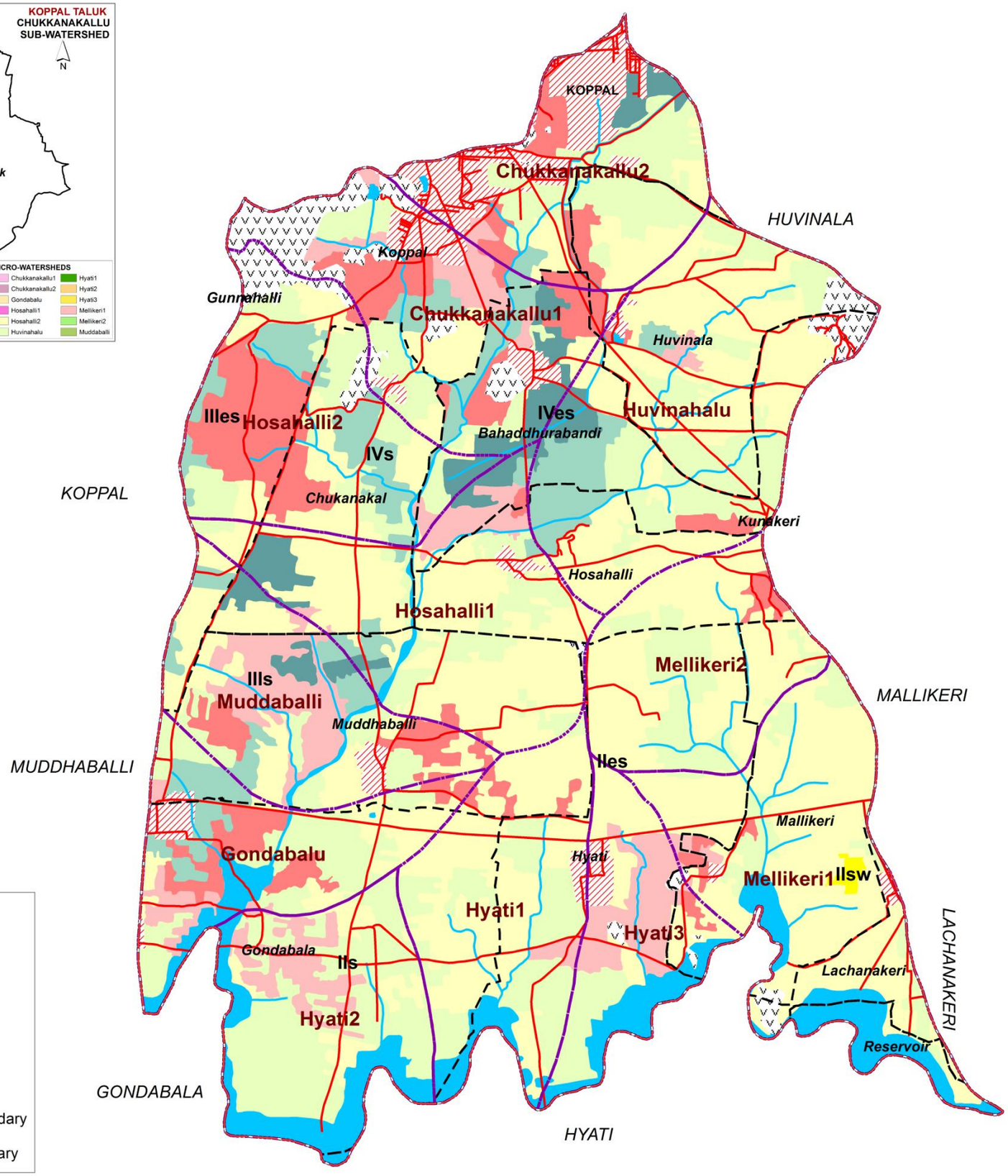
Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Alluvial Landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black gravelly clay soils occurring on nearly level to gently sloping plains under cultivation		**529(8.14)**
303		MTLiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	135(2.08)
305		MTLiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	48 (0.73)
307		MTLmB1	Clay surface, slope 1-3%, slight erosion	63 (0.97)
308		MTLmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	21 (0.33)
310		MTLmB2	Clay surface, slope 1-3%, moderate erosion	218 3.35)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	44 (0.68)
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, sodic black clay soils occurring on nearly level to very gently sloping plains under cultivation		**428(6.61)**
331		RNKiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	22 (0.35)
332		RNKmA1g1	Clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	112(1.73)
333		RNKmB1	Clay surface, slope 1-3%, slight erosion	157(2.42)
337		RNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	137(2.11)
	NSP	Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, sodic black calcareous clay soils occurring on nearly level to very gently sloping plains under cultivation		**34(0.52)**
354		NSPhA1	Sandy clay loam surface, slope 0-1%, slight erosion	24 (0.37)
361		NSPmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	10 (0.15)
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**271(4.17)**
344		DRLmA1	Clay surface, slope 0-1%, slight erosion	91 (1.4)
348		DRLmB1	Clay surface, slope 1-3%, slight erosion	27 (0.41)
350		DRLmB2	Clay surface, slope 1-3%, moderate erosion	108(1.66)
351		DRLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	45 (0.7)
	GRH	Gatareddihal soils are deep (100-150 cm), moderately well drained, have light olive brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**53(0.83)**
370		GRHmA1	Clay surface, slope 0-1%, slight erosion	21 (0.33)
373		GRHmB2	Clay surface, slope 1-3%, moderate erosion	32 (0.5)
	BWT	Bedwatti soils are moderately deep (75-100 cm), moderately well drained, dark brown to dark gray and very dark gray, black calcareous gravelly sandy clay to clay soils occurring on very gently sloping plains under cultivation		**43 (0.66)**
367		BWTmB1	Clay surface, slope 1-3%, slight erosion	43 (0.66)
	KVR	Kavalur soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to very dark grayish brown, calcareous cracking black clay soils occurring on nearly level to very gently sloping plains under cultivation		**458(7.03)**
384		KVRiB2	Sandy clay surface, slope 1-3%, moderate erosion	169 (2.6)
386		KVRmA1	Clay surface, slope 0-1%, slight erosion	46 (0.71)
387		KVRmA1g1	Clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	45 (0.7)
388		KVRmB1	Clay surface, slope 1-3%, slight erosion	82 (1.26)
390		KVRmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	116(1.79)
	BGP	Budagumpa soils are very deep (>150 cm), moderately well drained, have dark yellowish brown to dark brown and dark gray , calcareous sodic black clay soils occurring on nearly level to very gently sloping plains under cultivation		**75 (1.16)**
396		BGPmB1	Clay surface, slope 1-3%, slight erosion	75 (1.16)
999	Rock outcrops	Rock lands, both massive and boulderey with little or no soil		**217 (3.34)**
1000	Others	Habitation and water body		**673 (10.37)**

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

5. Soil Survey Interpretations

5.1. Land Capability Classification





LAND CAPABILITY

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 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.

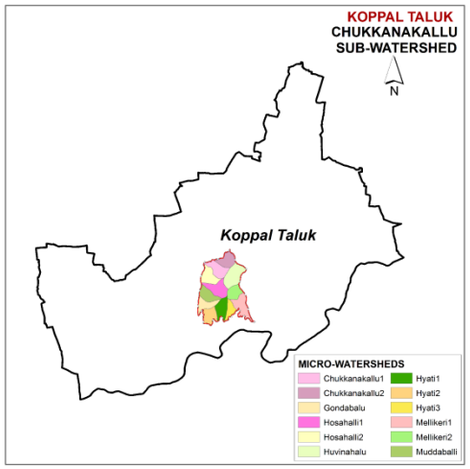
Capability subclass	Area in ha (%)
IIs	1566 (24.14)
IIes	2469 (38.05)
IIsw	9 (0.13)
IIIs	446 (6.87)
IIIes	519 (8.0)
IVs	399 (6.15)
IVes	192 (2.96)
Rock outcrops	217 (3.34)
Others	673 (10.37)

* - 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

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

References

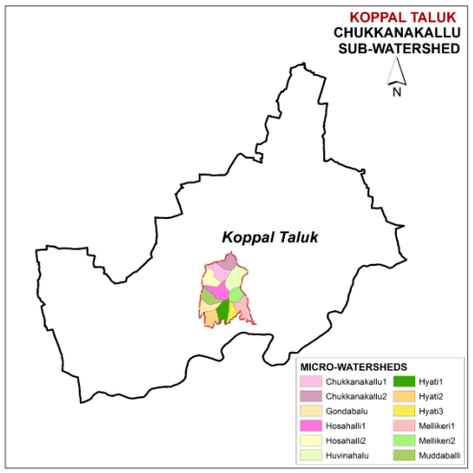
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Depth Class	Area in ha (%)
Shallow (25-50 cm)	589 (9.08)
Moderately shallow (50-75 cm)	940 (14.48)
Moderately deep (75-100 cm)	1185 (18.26)
Deep (100-150 cm)	2266 (34.92)
Very deep (>150 cm)	620 (9.55)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.3. Surface Soil Texture



SURFACE SOIL TEXTURE

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N

References

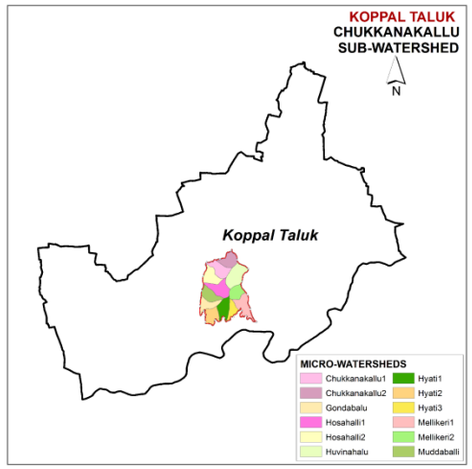
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Texture Class	Area in ha(%)
Loamy sand	136 (2.1)
Sandy loam	588 (9.07)
Sandy clay loam	1429 (22.02)
Sandy clay	1834 (28.25)
Clay	1613 (24.86)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.4. Surface Soil Gravelliness

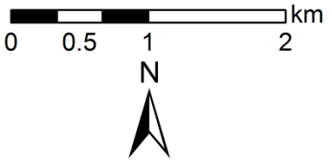


SOIL GRAVELLINESS

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT



References

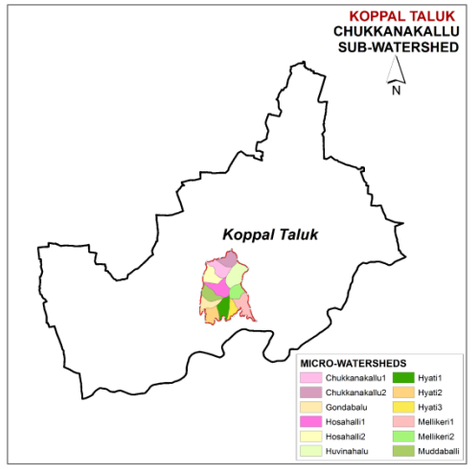
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Gravelly Class	Area in ha (%)
Non gravelly (<15%)	3325 (51.24)
Gravelly (15-35%)	1977 (30.47)
Very gravelly (35-60%)	298 (4.59)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.5. Available Water Capacity



AVAILABLE WATER CAPACITY

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

References

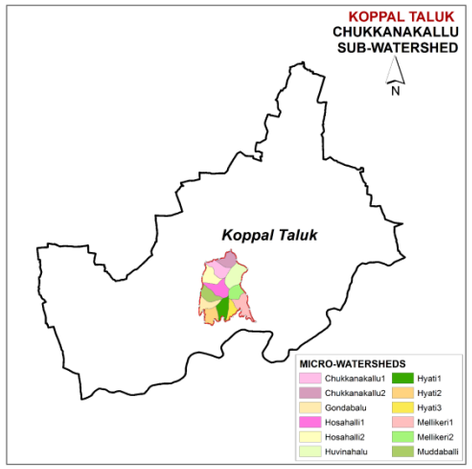
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Available Water Capacity	Area in ha (%)
Very Low (<50 mm/m)	394 (6.06)
Low (51-100 mm/m)	2932 (45.18)
Medium (101-150 mm/m)	1319 (20.33)
High (151-200 mm/m)	348 (5.37)
Very high (>200 mm/m)	607 (9.35)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.6.Slope



SLOPE

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

References

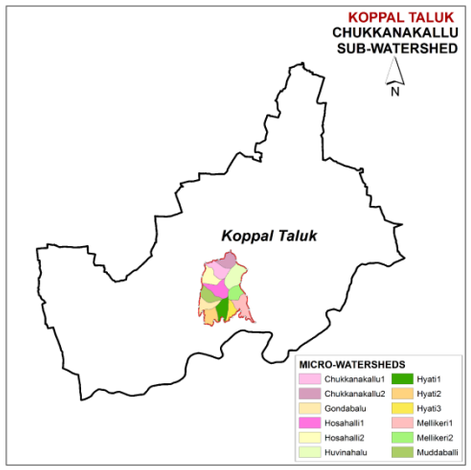
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Slope Class	Area in ha (%)
Nearly level (0-1%)	975 (15.03)
Very gently sloping (1-3%)	4625 (71.27)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.7.Soil Erosion



SOIL EROSION

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N

References

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

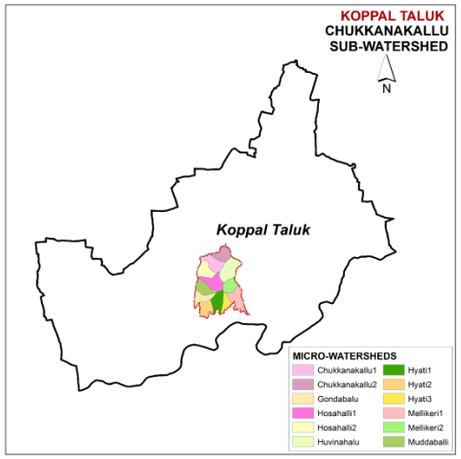
Erosion Class	Area in ha(%)
Slight	2382 (36.71)
Moderate	3218 (49.59)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

6. Soil Fertility Status

6.1. Soil Reaction (pH)



SOIL REACTION (pH) (2018)

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

References

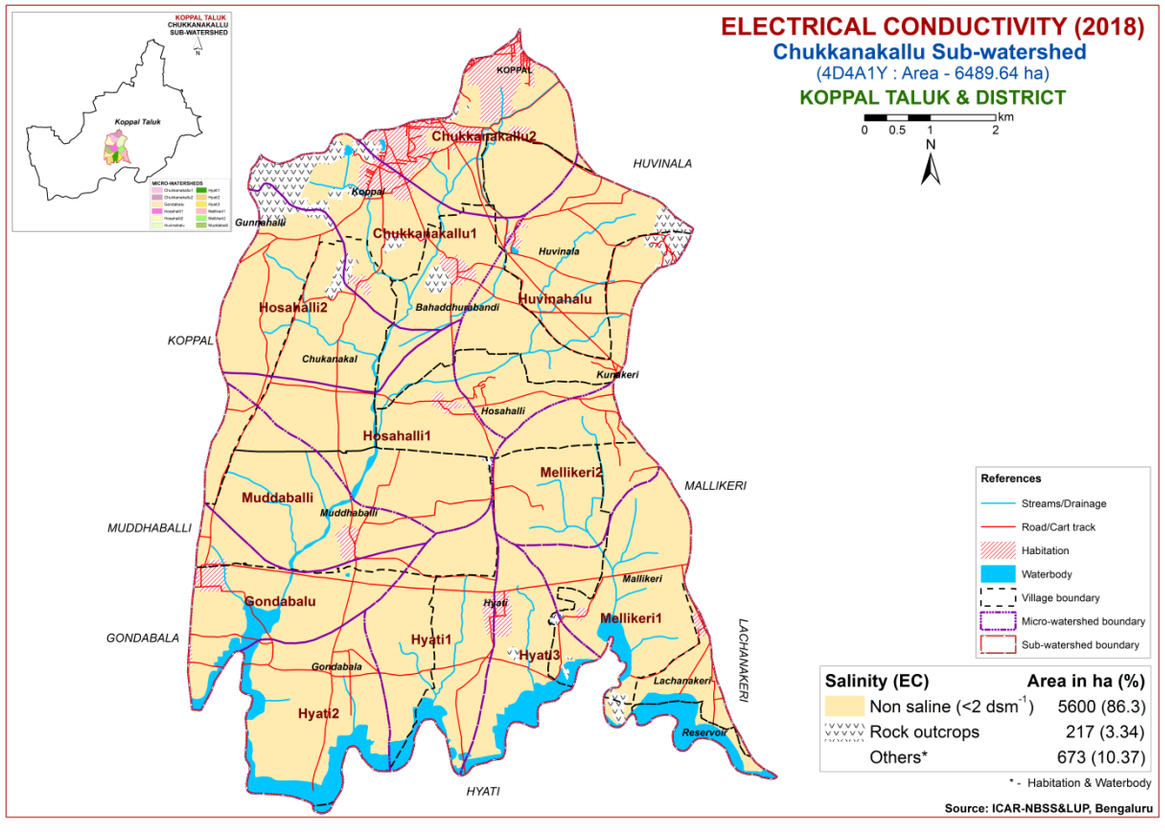
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Reaction Class	Area in ha (%)
Moderately acid (pH 5.5 – 6.0)	70 (1.08)
Slightly acid (pH 6.0 – 6.5)	278 (4.28)
Neutral (pH 6.5 – 7.3)	1495 (23.04)
Slightly alkaline (pH 7.3 – 7.8)	991 (15.27)
Moderately alkaline (pH 7.8 – 8.4)	648 (9.98)
Strongly alkaline (pH 8.4 – 9.0)	1407 (21.68)
Very strongly alkaline (pH > 9.0)	711 (10.96)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

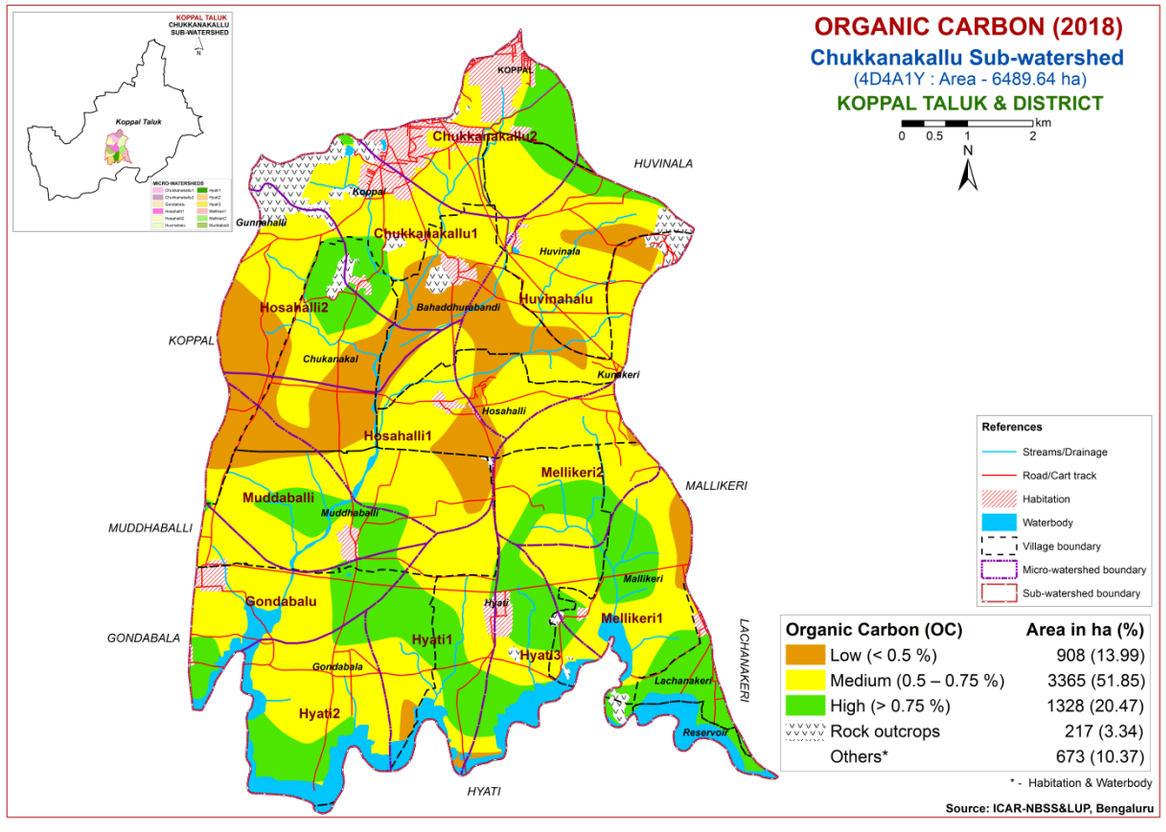
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

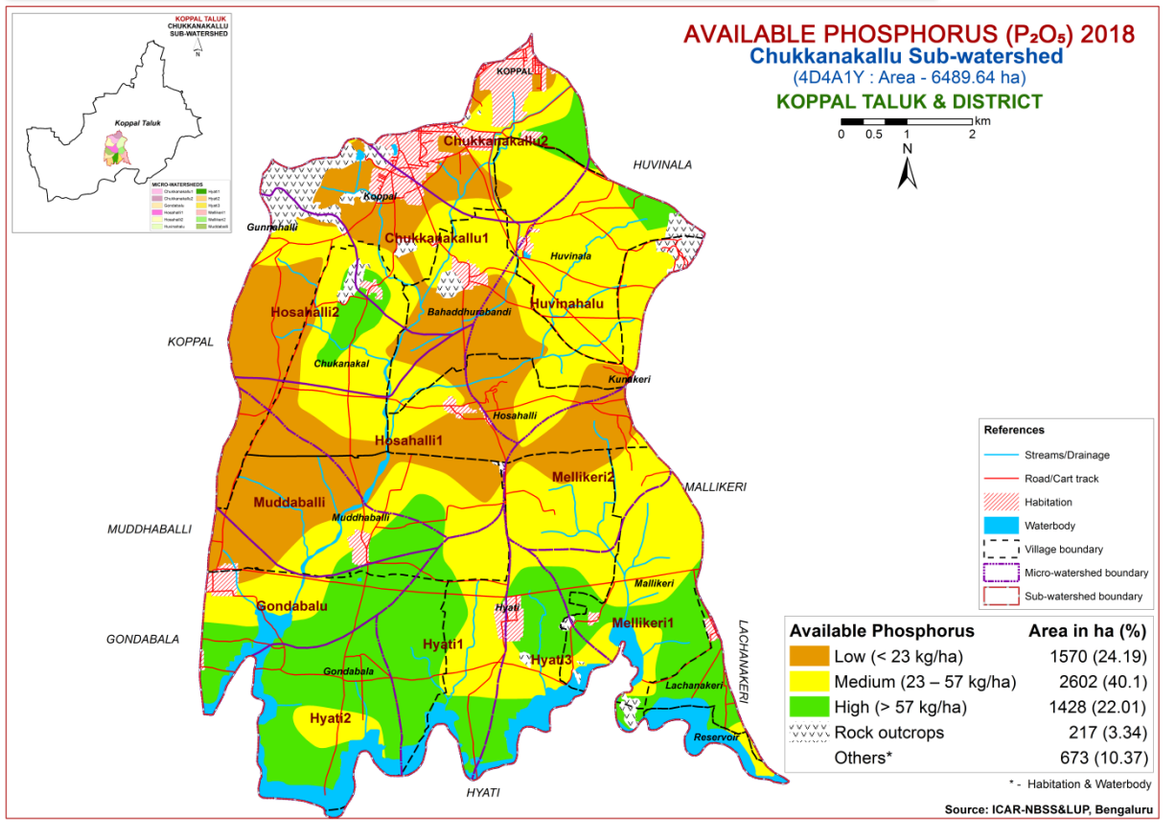
6.2. Electrical Conductivity (EC)



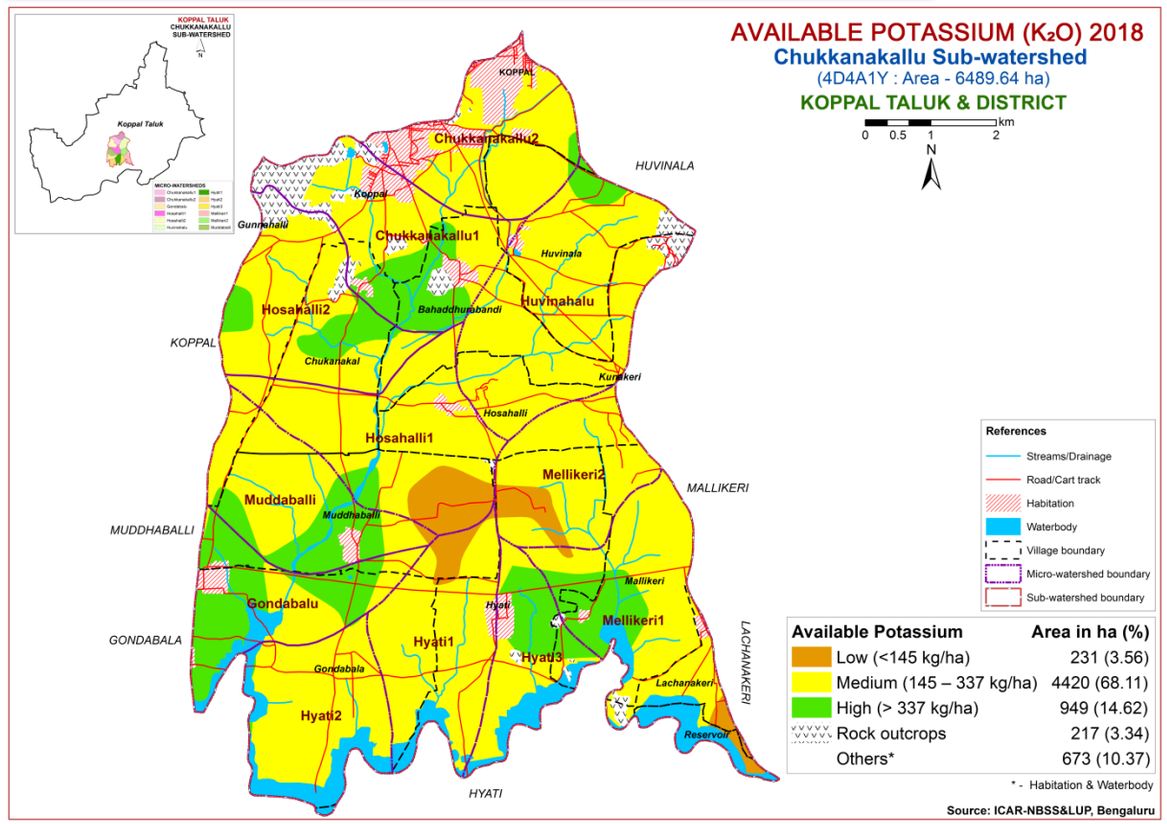
6.3. Organic Carbon



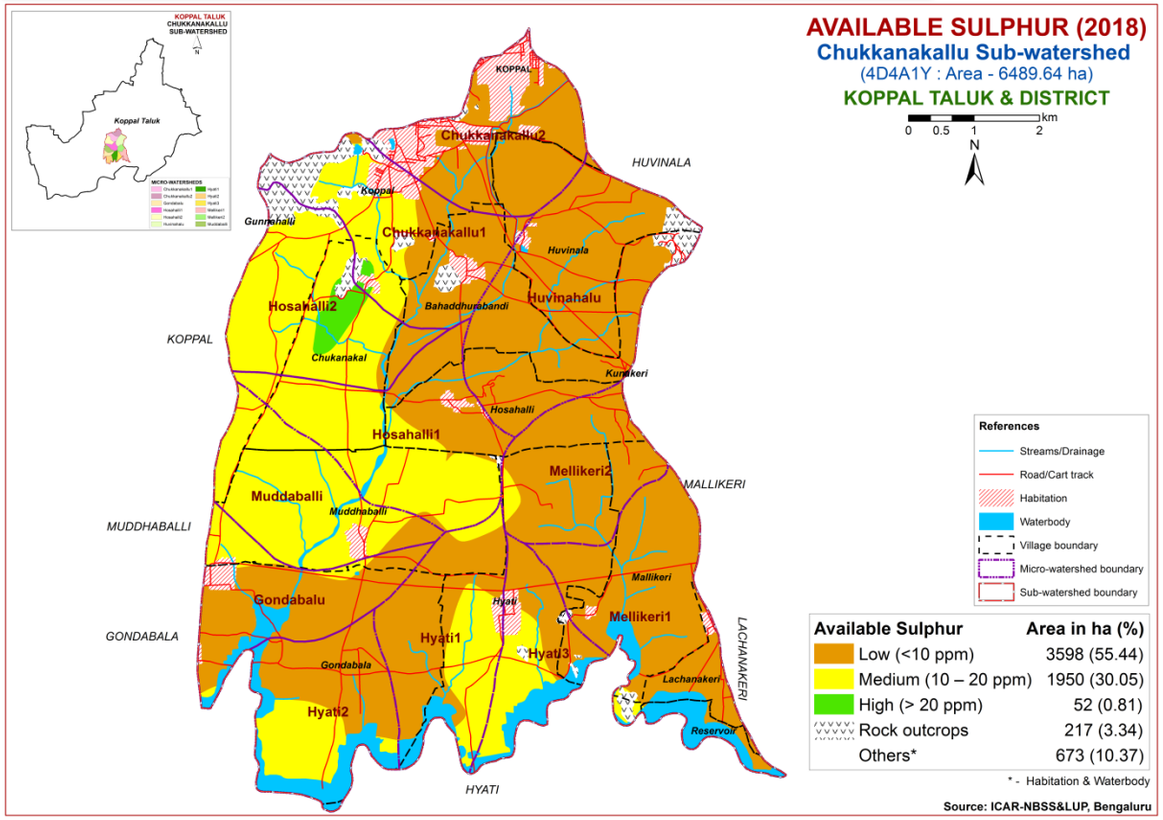
6.4. Available Phosphorus



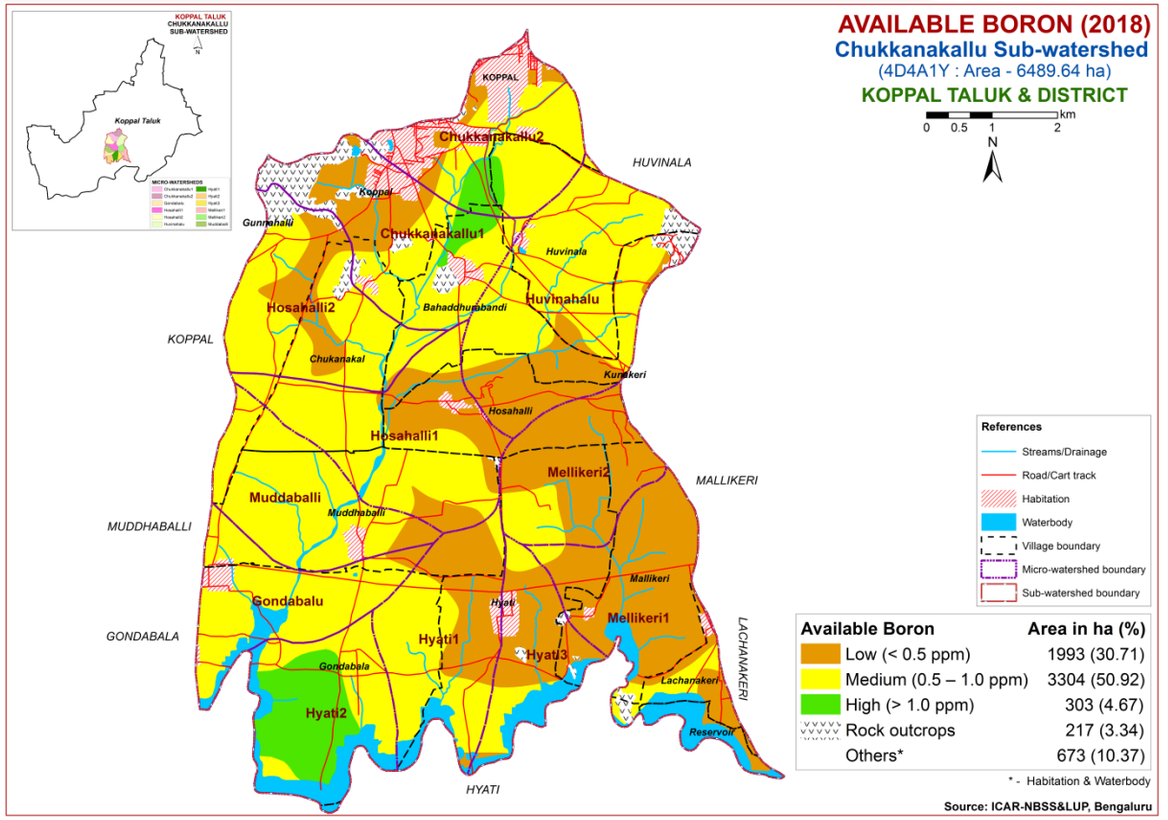
6.5. Available Potassium



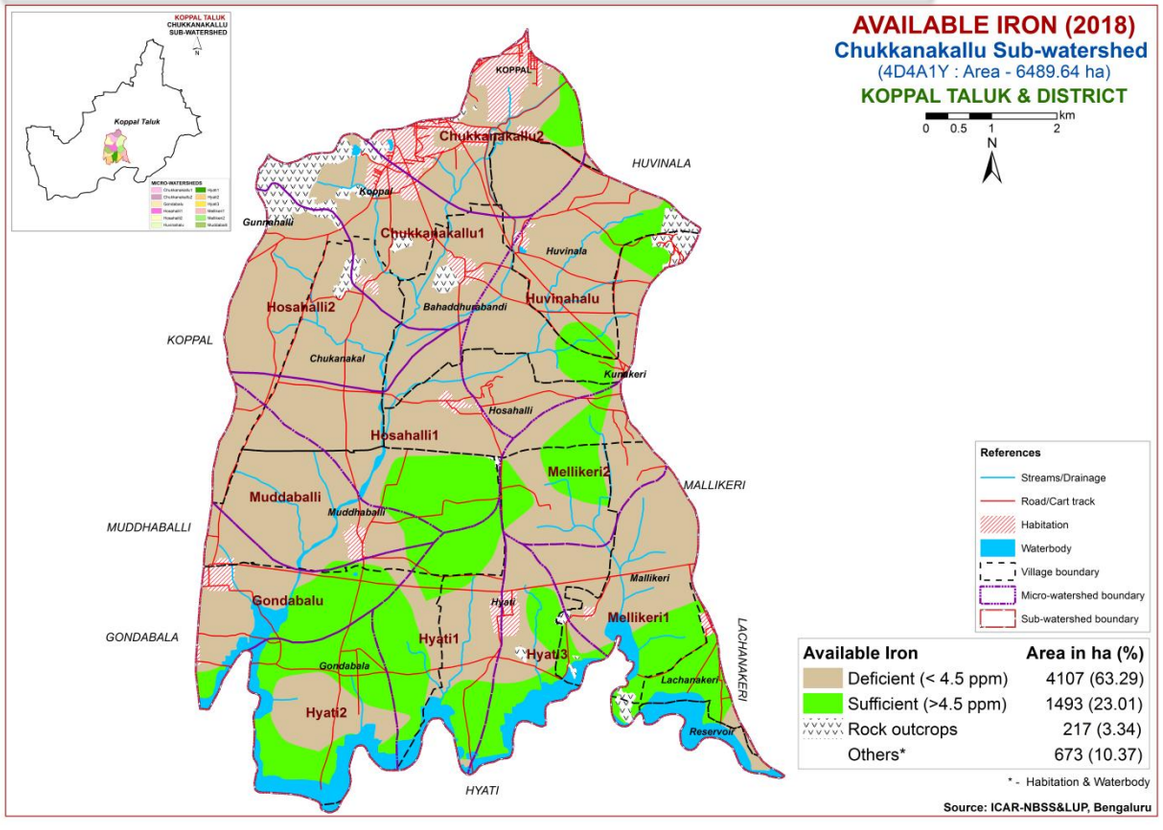
6.6. Available Sulphur



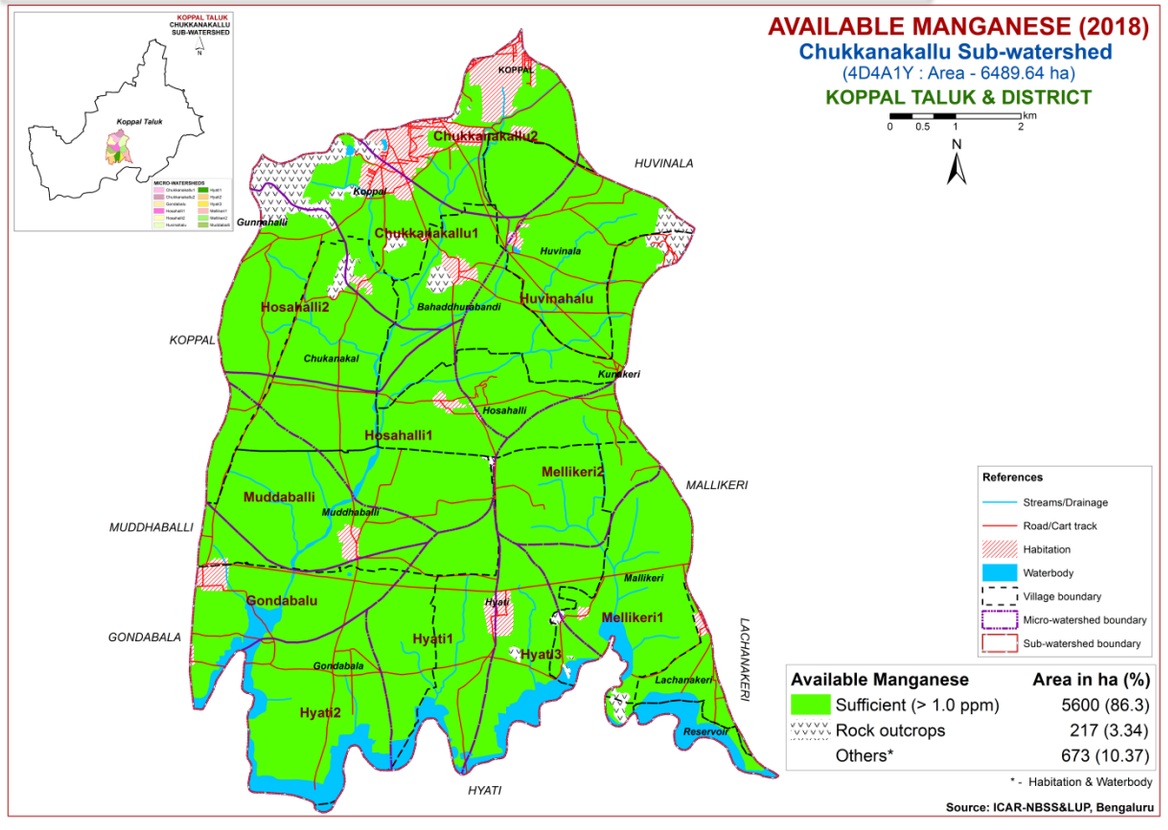
6.7. Available Boron



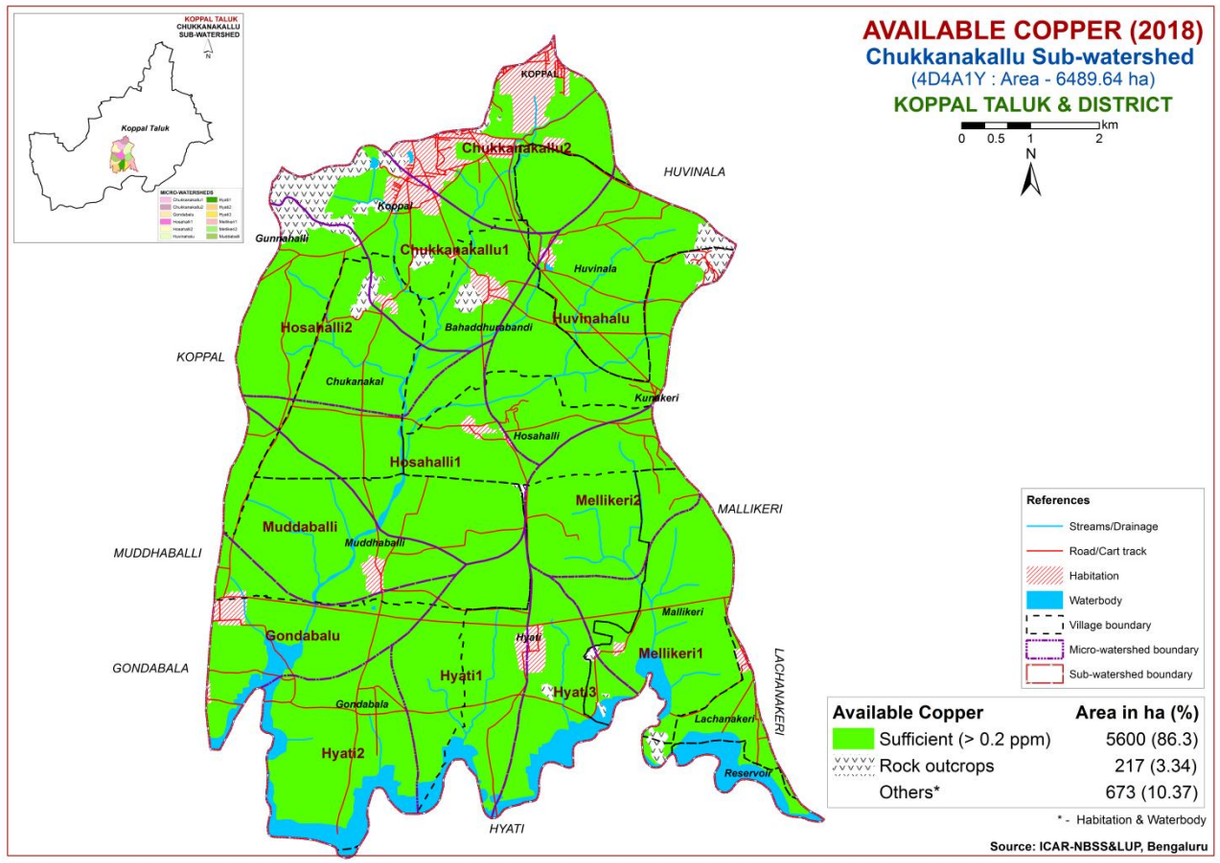
6.8. Available Iron



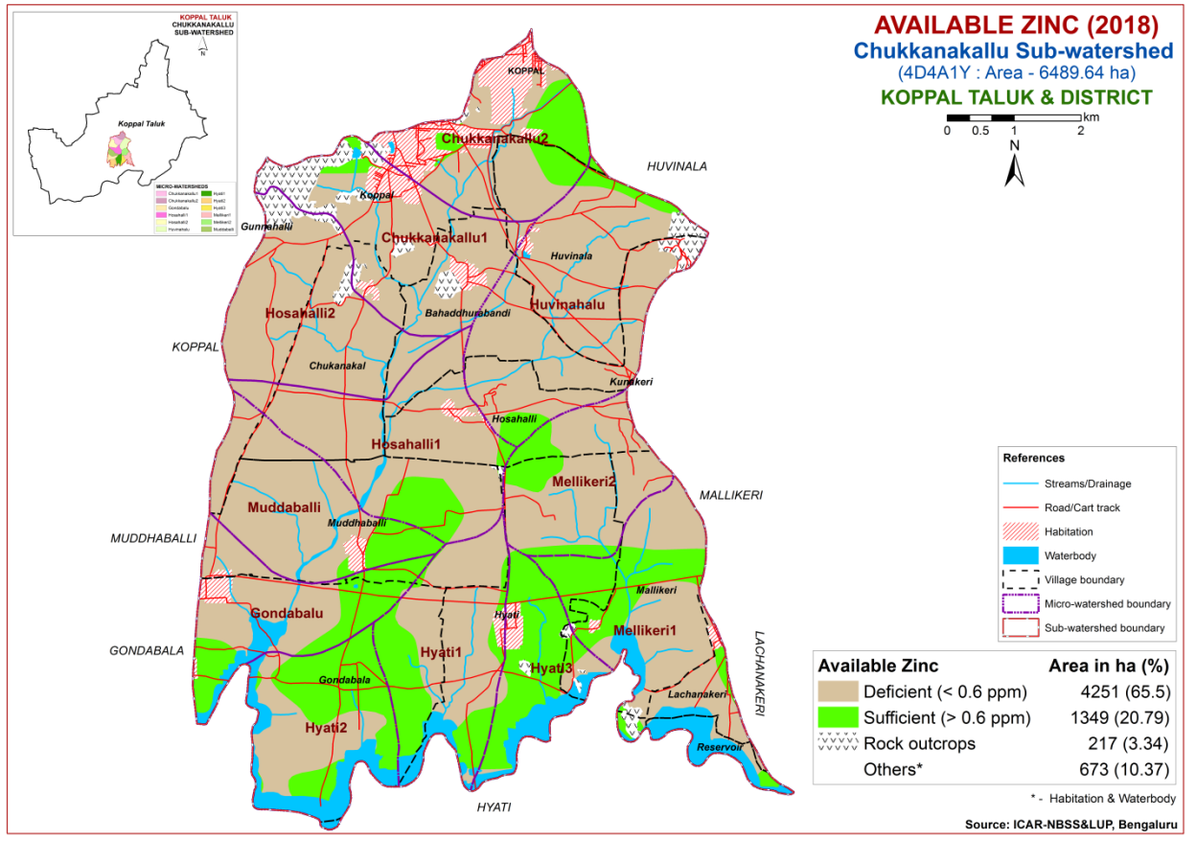
6.9. Available Manganese



6.10. Available Copper



6.11. Available Zinc



6.12. Correcting the Soil Nutrient Deficiencies

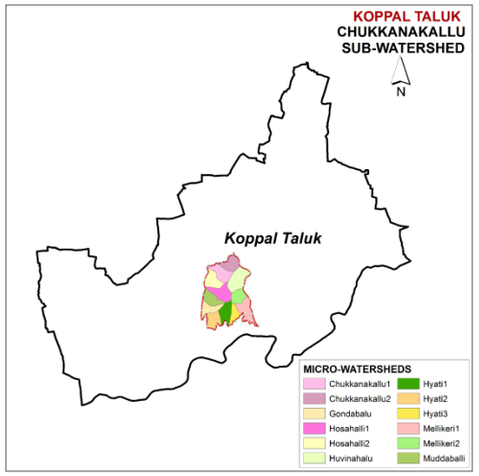
1. Reclamation of Salt affected soils
   a) When the soil is having neutral pH (6.5-7.5), no need of adding amendments (lime or gypsum)
   b) If the soil pH is <6.5, apply burnt lime to soil as per specifically recommended dosage and again after 2 years proper change has to be made based on soil test results.
   c) If the soil pH is 7.5-8.5 due to excess calcium content, drain out the excess calcium form the soil with good quality irrigation water.
   d) If the soil pH is more than 8.5 due to higher sodium content in soil, apply specifically recommended dose of gypsum & drain out the excess salts with good quality irrigation water.

2. In case of low & high content of major nutrients in the soil, follow the modifications as given bellow:
   - N: P: K (N: P_2O_5: K_2O) **For low N content**, add 25 % extra to the Recommended Dose of Fertilisers (RDF).
     For high N content, reduce 25% from the RDF and apply to soil.
     Eg:- if 100kg N, then we have to apply
     100+25% for deficient soil.
     100% for medium available N content soil.
     100-25% for higher N content soil.
   - Follow the same in case of P & K.

3. Use or Incorporation of biofertilizers like Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Bacteria and mycorrhiza enhances normal available nutrients in soil to the plants and also reduce the input cost of cultivation.
4. For calcium deficient soil, apply N-fertilizers like calcium ammonium nitrate; Gypsum can also supply calcium ($CaSO_4$. $2H_2O$)
5. Apply 405kg $MgSO_4$ per ha to the magnesium deficient soil. In case of perennial horticulture crops apply 150-200g/ plant.
6. In sulphur deficient acid soils (Humid region) apply phosphorus (in the form of) through SSP & use sulphur coated urea to the crops.
7. Apply 30-50kg ferrous sulfate ($FeSO_4$) per ha to the iron deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre $FeSo_4$ /plant as foliar spray.
8. Apply 30-40kg/ha – manganese sulfate ($MnSO_4$) as soil application to the manganese deficient soils. In case of perennial Horticulture crops apply 3-5 g/litre $MnSO_4$ /plant as foilar application.
9. Apply Zinc – 10-25 kg/ha –$ZnSO_4$ – soil application to the Zinc deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre – foliar application.
10. Apply Copper – 5-10 kg /ha – copper sulfate ($CuSO_4$) soil application for the copper deficient soils and for Perennial horticultural crops 3-5g/ litre – $CuSO_4$/plant as foliar application.
11. Apply borax 8-10 kg/ha in boron deficient soils and for Perennial horticultural crops as foliar application – 1g / litre.
12. Apply molybdenum – ammonium molybdate 200-250 gm/ha for Molybdenum deficient soils or dissolve 1g / litre ammonium molybdate for Foliar spray.
13. Soil sampling and testing needs to be done at every 2-3 years interval.

7. Land Suitability for Major Crops

7.1. Land Suitability for Sorghum

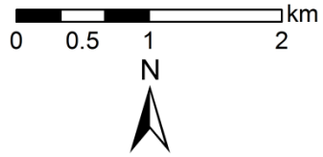


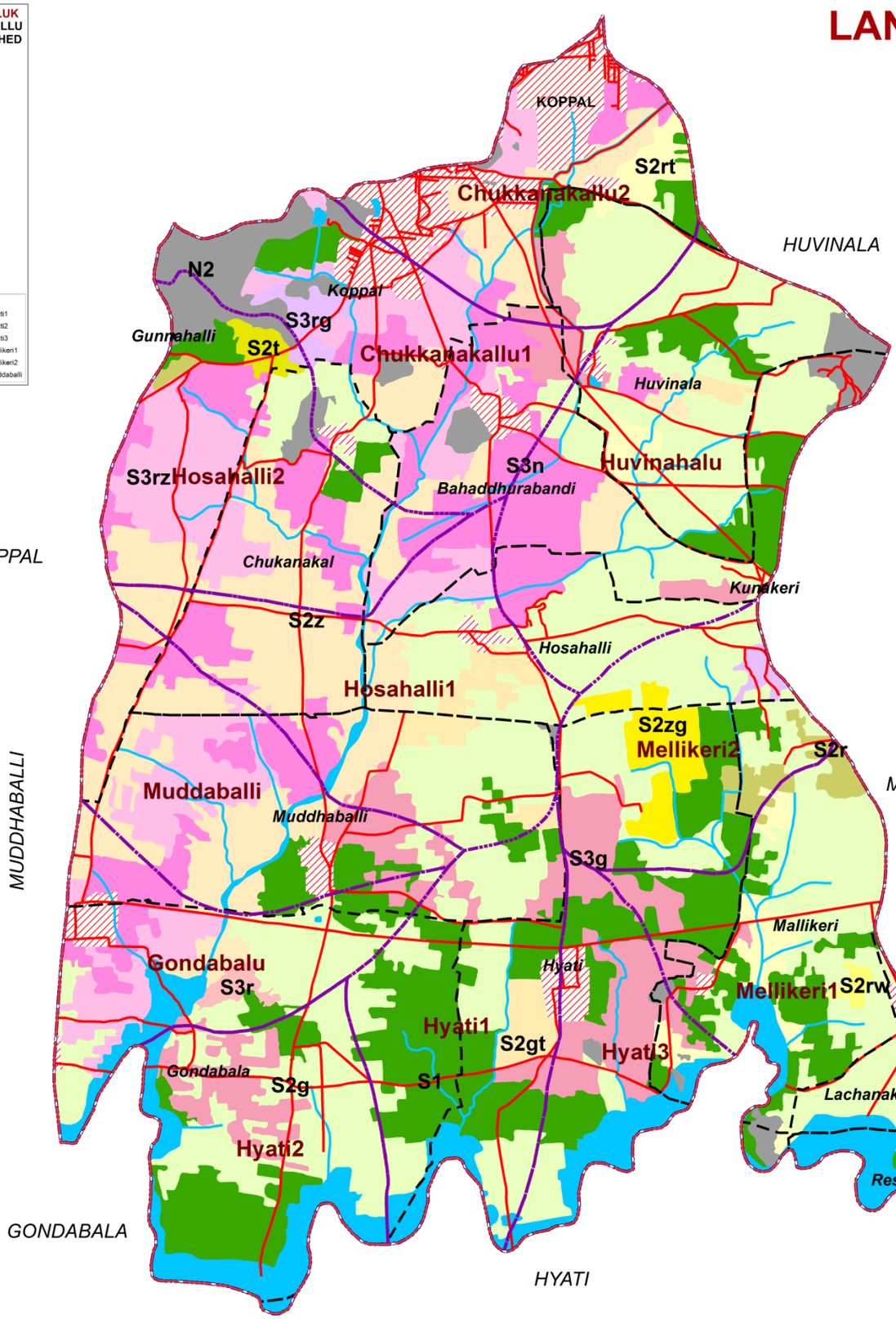
LAND SUITABILITY FOR SORGHUM

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT





Suitability subclass	Area in ha (%)
S1	920 (14.18)
S2g	1920 (29.59)
S2r	51 (0.78)
S2t	21 (0.32)
S2z	771 (11.88)
S2gt	106 (1.63)
S2rt	119 (1.83)
S2rw	9 (0.13)
S2zg	74 (1.14)
S3g	430 (6.62)
S3n	591 (9.11)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N2- Permanently Not Suitable

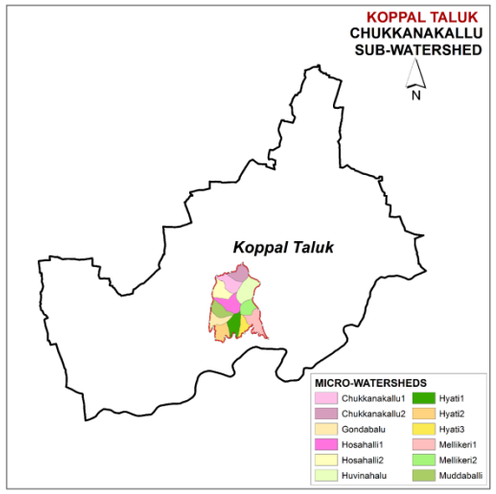
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.2. Land Suitability for Maize



LAND SUITABILITY FOR MAIZE

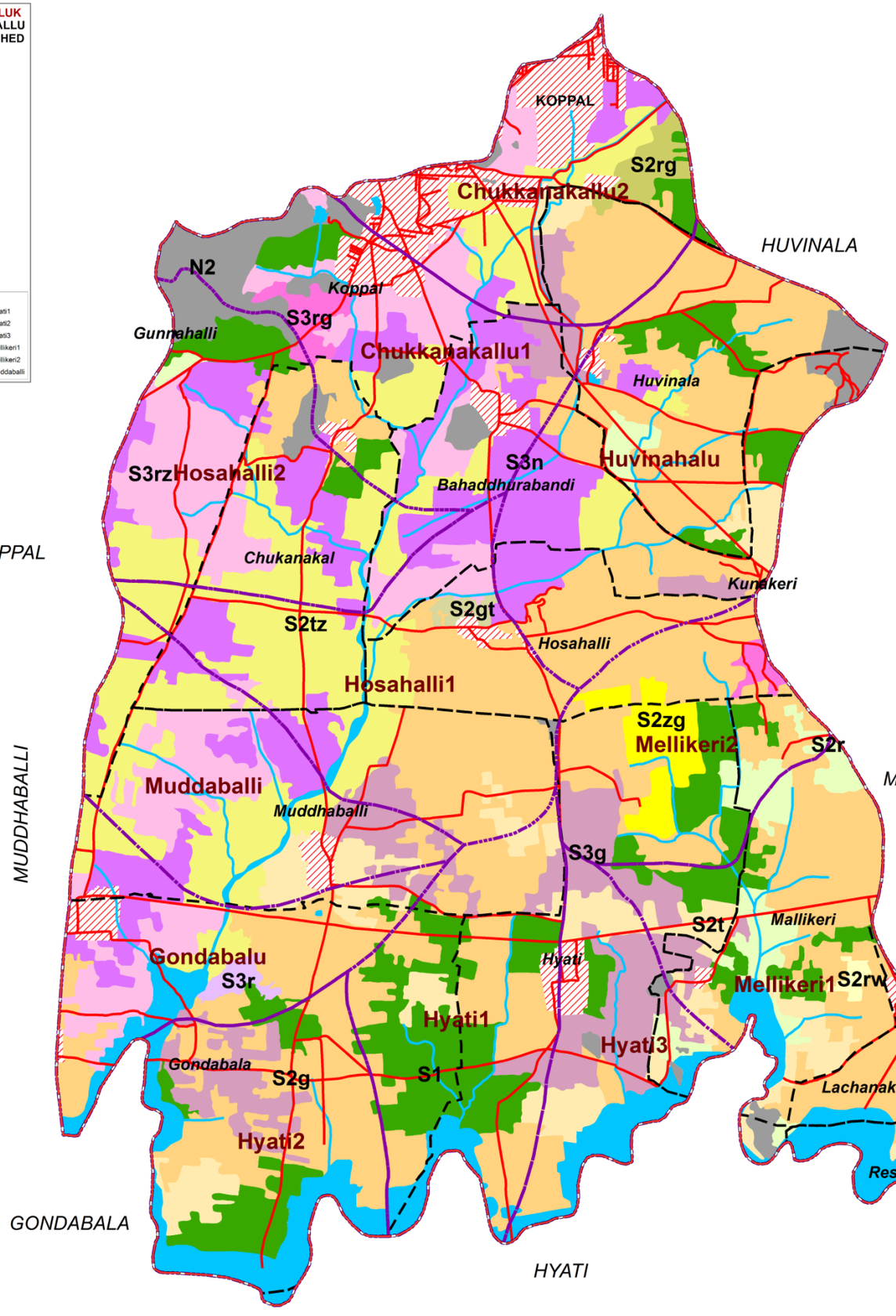
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N2- Permanently Not Suitable

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

References

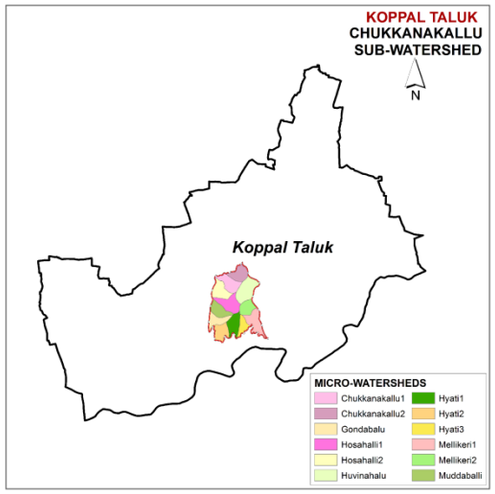
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	593 (9.13)
S2g	2013 (31.03)
S2r	134 (2.07)
S2t	348 (5.37)
S2gt	12 (0.19)
S2rg	35 (0.55)
S2rw	9 (0.13)
S2tz	771 (11.88)
S2zg	74 (1.14)
S3g	430 (6.62)
S3n	591 (9.11)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.3. Land Suitability for Redgram



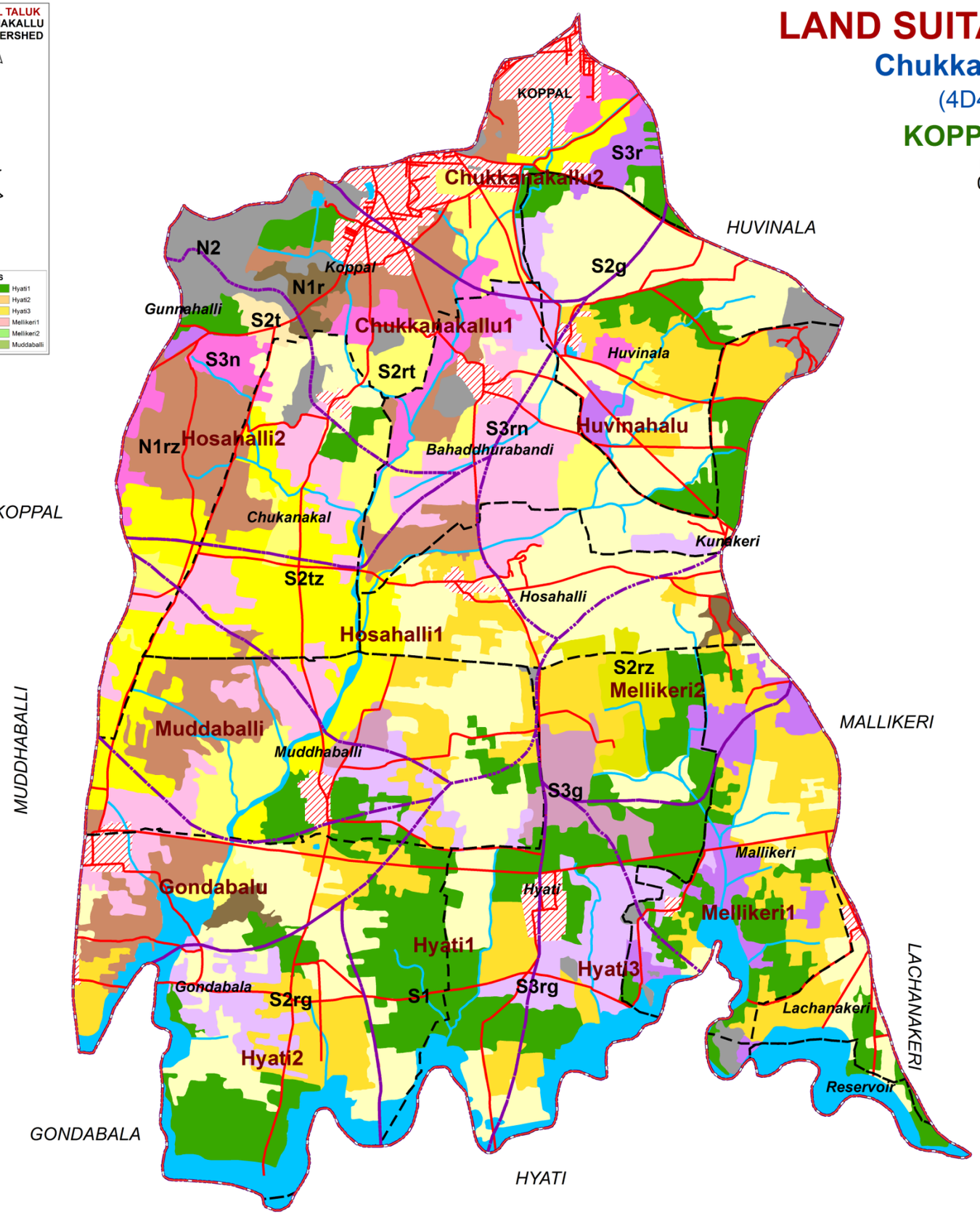
LAND SUITABILITY FOR REDGRAM

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

References

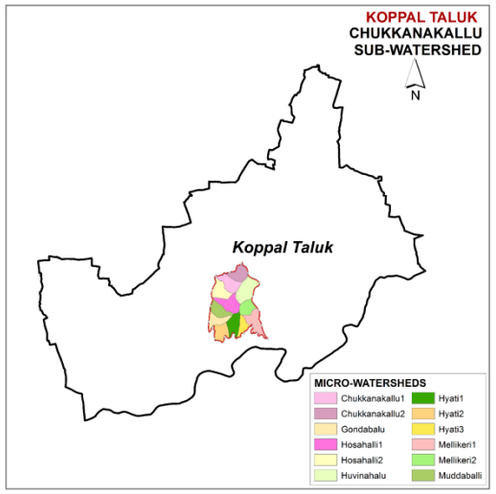
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	920 (14.18)
S2g	1262 (19.45)
S2t	21 (0.32)
S2rg	764 (11.77)
S2rt	313 (4.83)
S2rz	74 (1.14)
S2tz	458 (7.05)
S3g	97 (1.49)
S3n	163 (2.51)
S3r	178 (2.75)
S3rg	333 (5.13)
S3rn	428 (6.6)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.4. Land Suitability for Bajra



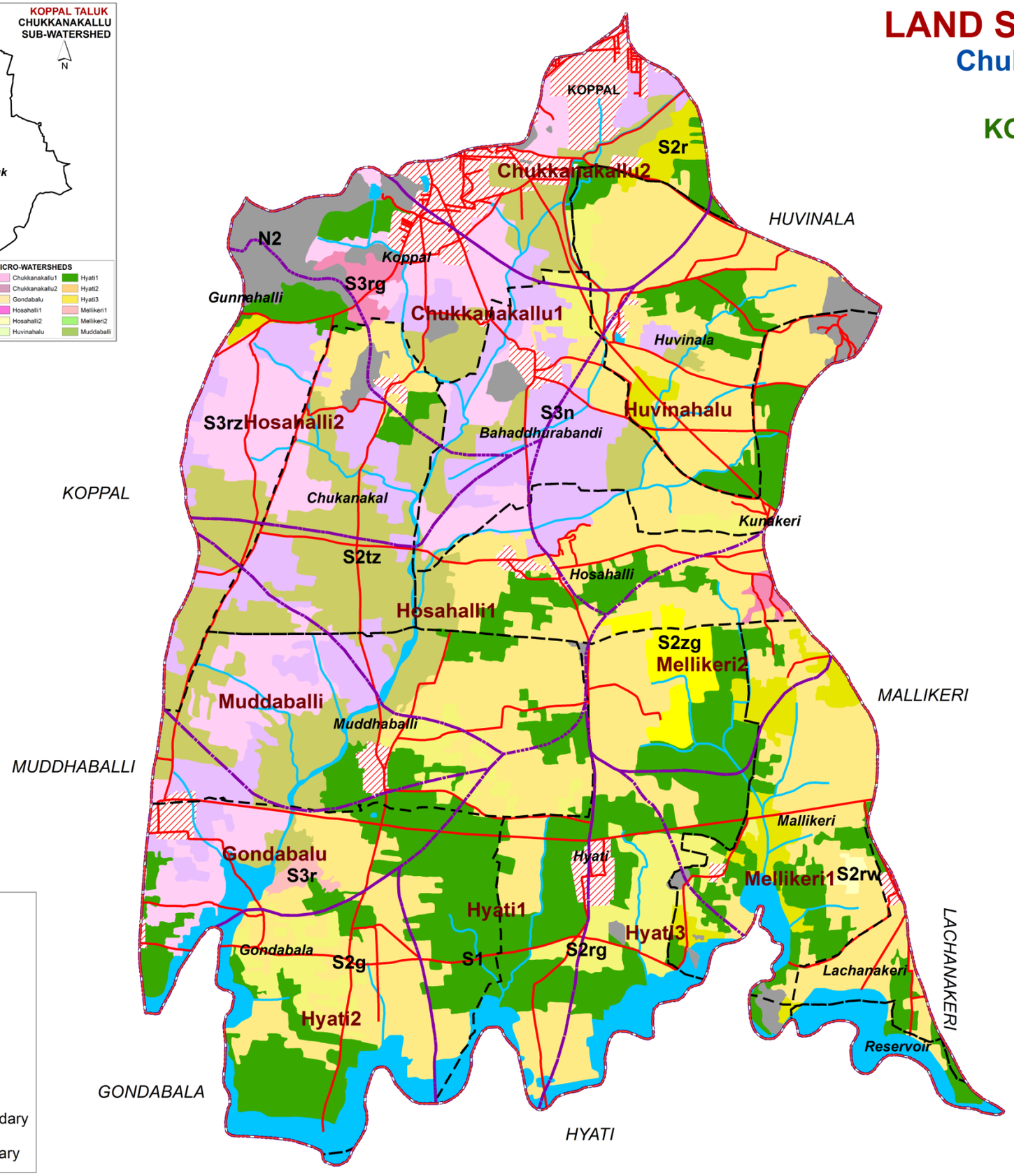
LAND SUITABILITY FOR BAJRA

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N2- Permanently Not Suitable

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

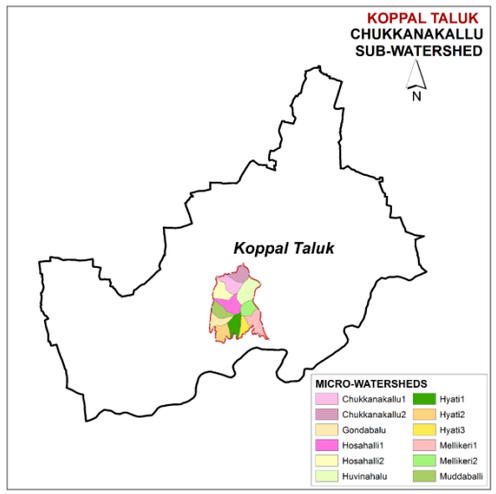
Suitability subclass	Area in ha (%)
S1	1225 (18.88)
S2g	1839 (28.33)
S2r	170 (2.62)
S2rg	333 (5.13)
S2rw	9 (0.13)
S2tz	771 (11.88)
S2zg	74 (1.14)
S3n	591 (9.11)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.5. Land Suitability for Drumstick



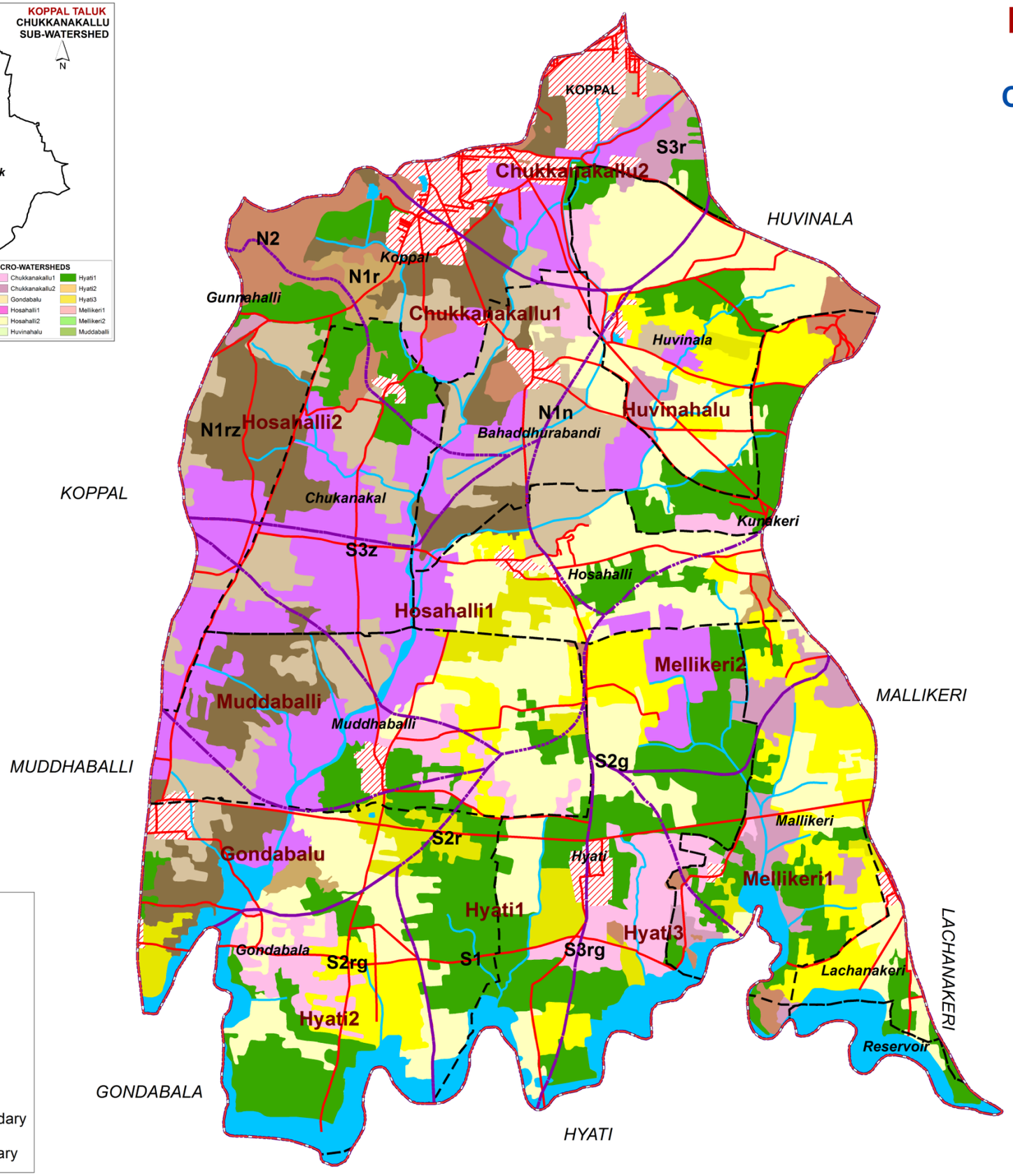
LAND SUITABILITY FOR DRUMSTICK

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N



References

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

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

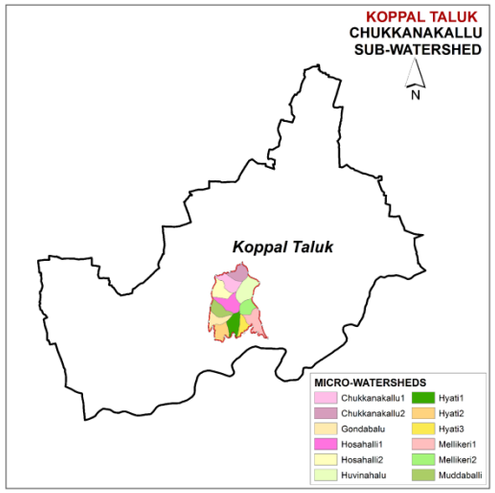
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S3r	178 (2.75)
S3z	845 (13.02)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.6. Land Suitability for Sunflower



LAND SUITABILITY FOR SUNFLOWER

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

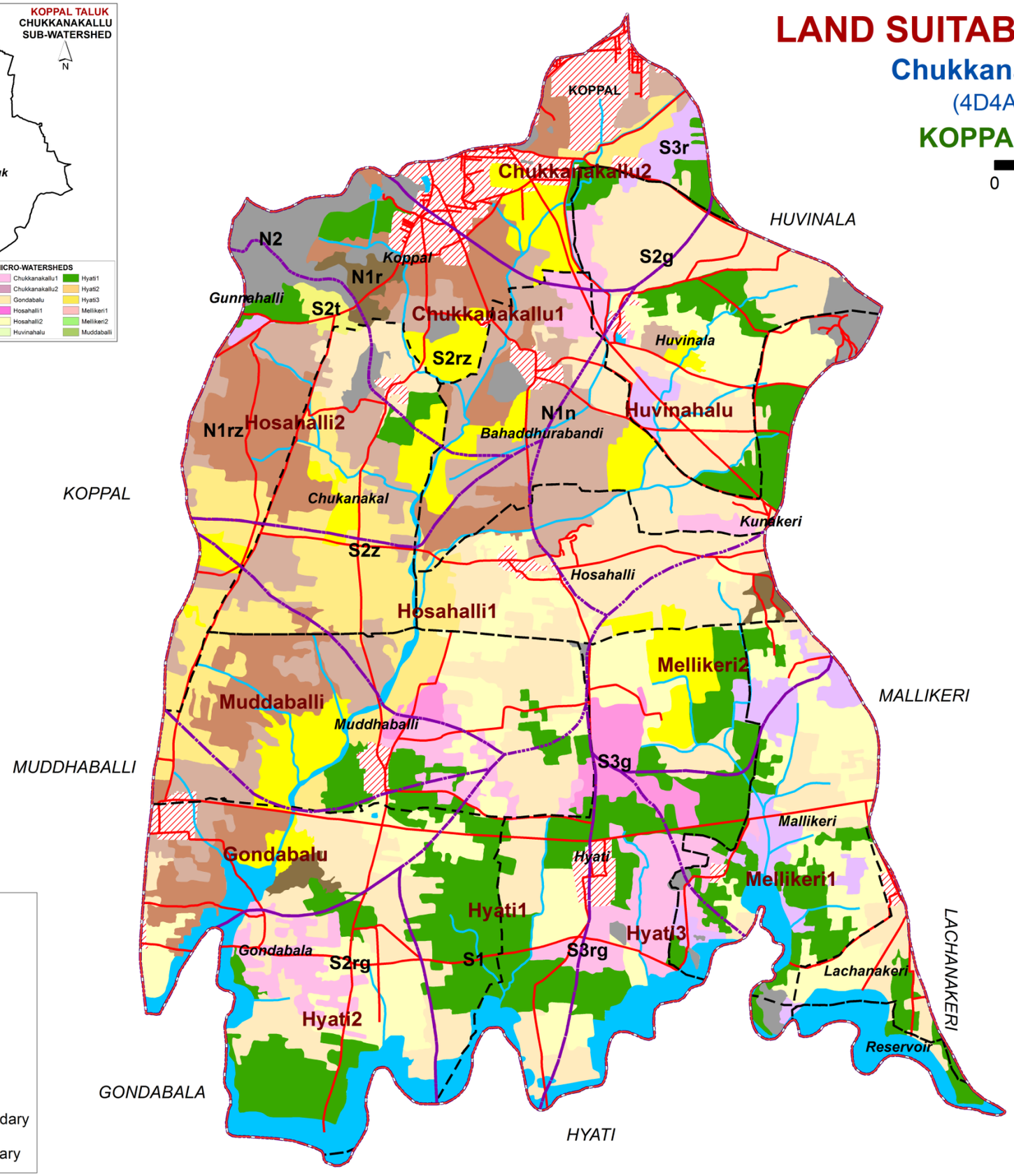
KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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



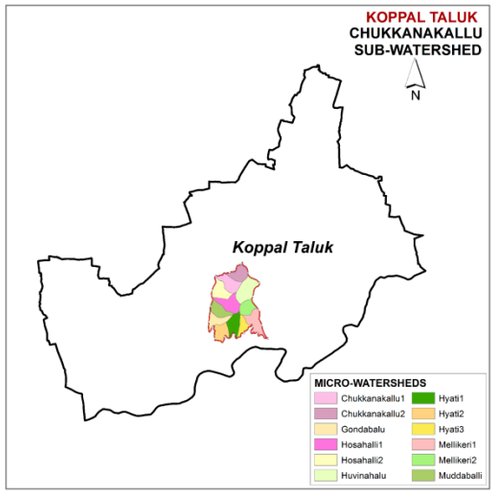
Suitability subclass	Area in ha (%)
S1	920 (14.18)
S2g	1262 (19.45)
S2t	21 (0.32)
S2z	458 (7.05)
S2rg	764 (11.77)
S2rz	387 (5.97)
S3g	97 (1.49)
S3r	178 (2.75)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.7. Land Suitability for Cotton

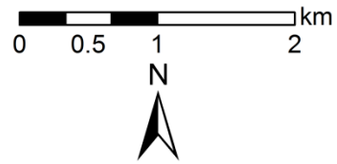


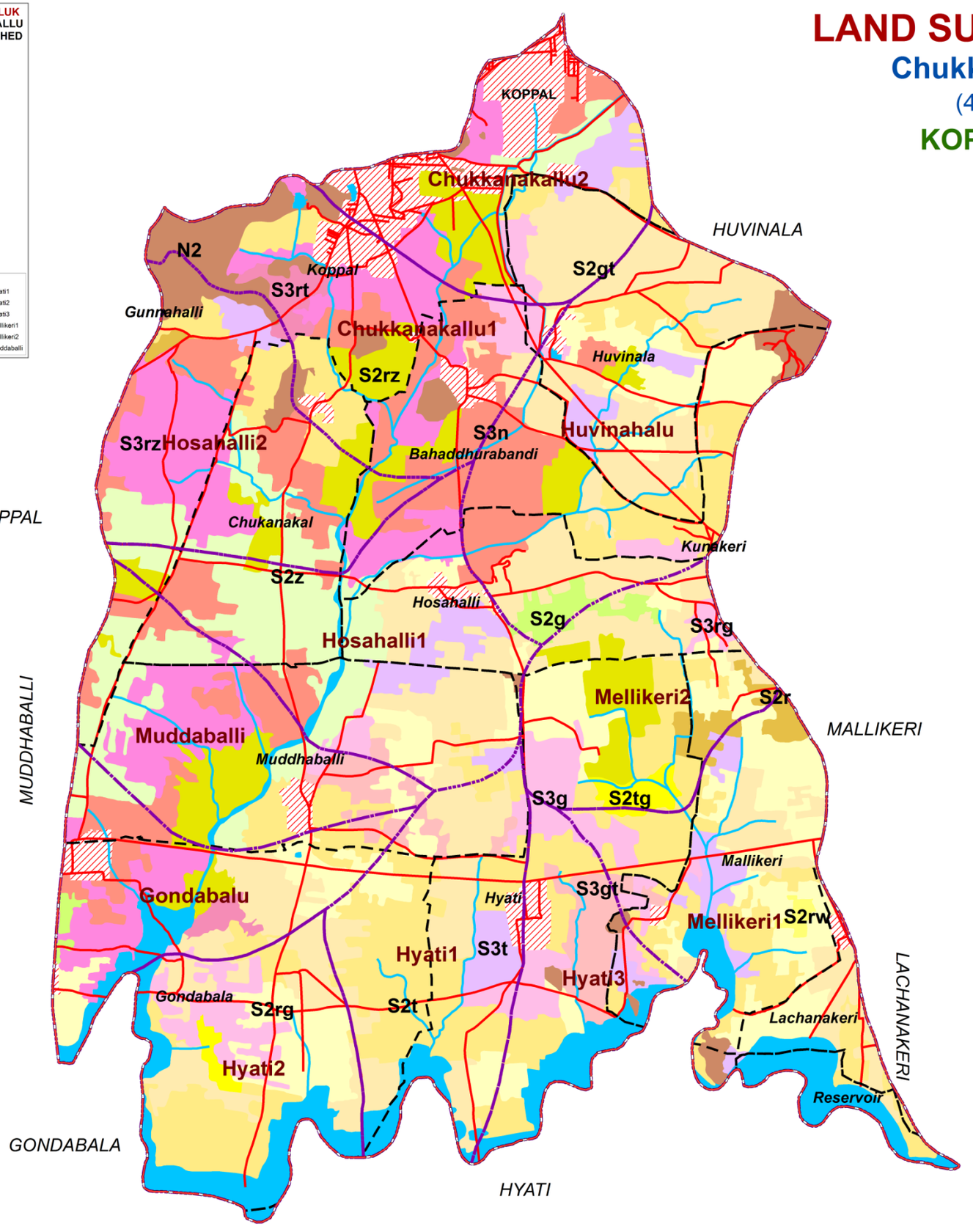
LAND SUITABILITY FOR COTTON

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT





Key
S2- Moderately Suitable
S3- Marginally Suitable
N2- Permanently Not Suitable

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

References

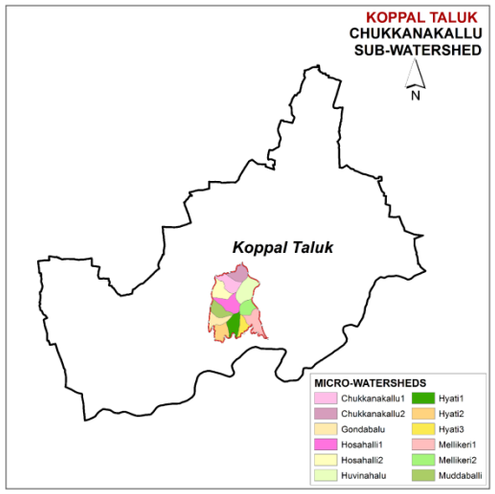
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S2g	46 (0.71)
S2r	51 (0.78)
S2t	1045 (16.1)
S2z	458 (7.05)
S2gt	1050 (16.18)
S2rg	658 (10.14)
S2rw	9 (0.13)
S2rz	387 (5.97)
S2tg	41 (0.63)
S3g	296 (4.56)
S3n	591 (9.11)
S3t	245 (3.78)
S3gt	134 (2.07)
S3rg	13 (0.21)
S3rt	47 (0.73)
S3rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.8. Land Suitability for Bengalgram



LAND SUITABILITY FOR BENGALGRAM

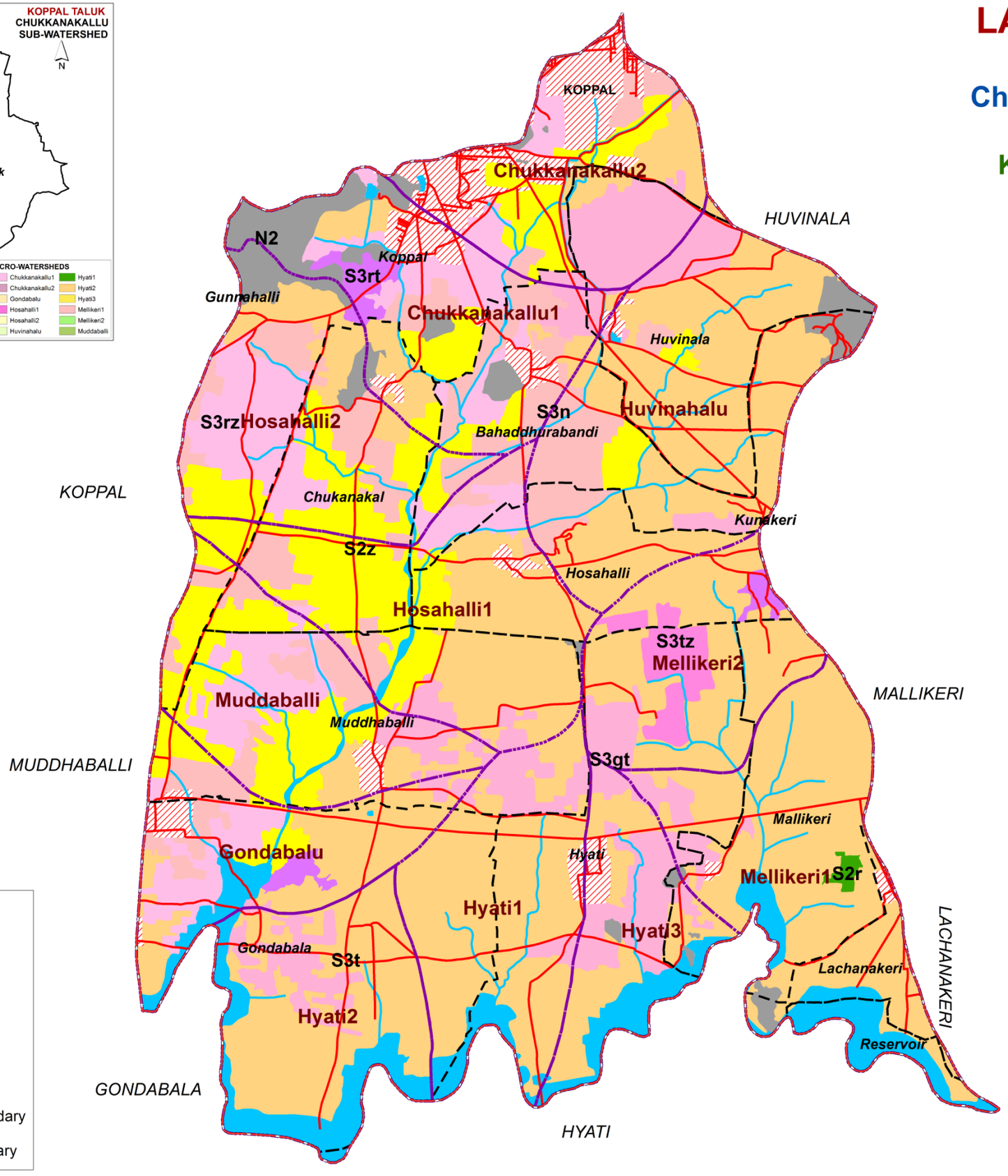
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key
S2- Moderately Suitable
S3- Marginally Suitable
N2- Permanently Not Suitable

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

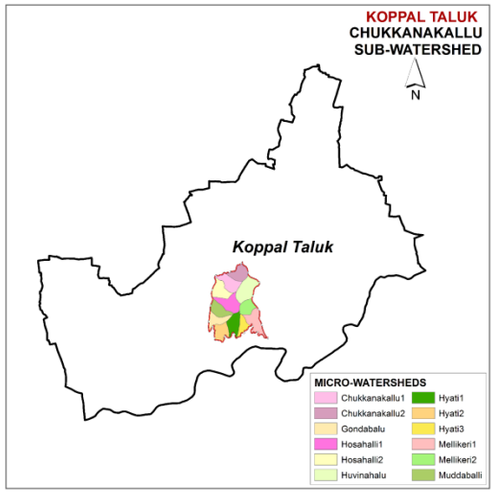
Suitability subclass	Area in ha (%)
S2r	9 (0.13)
S2z	771 (11.88)
S3n	591 (9.11)
S3t	2961 (45.63)
S3gt	605 (9.33)
S3rt	61 (0.93)
S3rz	529 (8.15)
S3tz	74 (1.14)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.9. Land Suitability for Groundnut



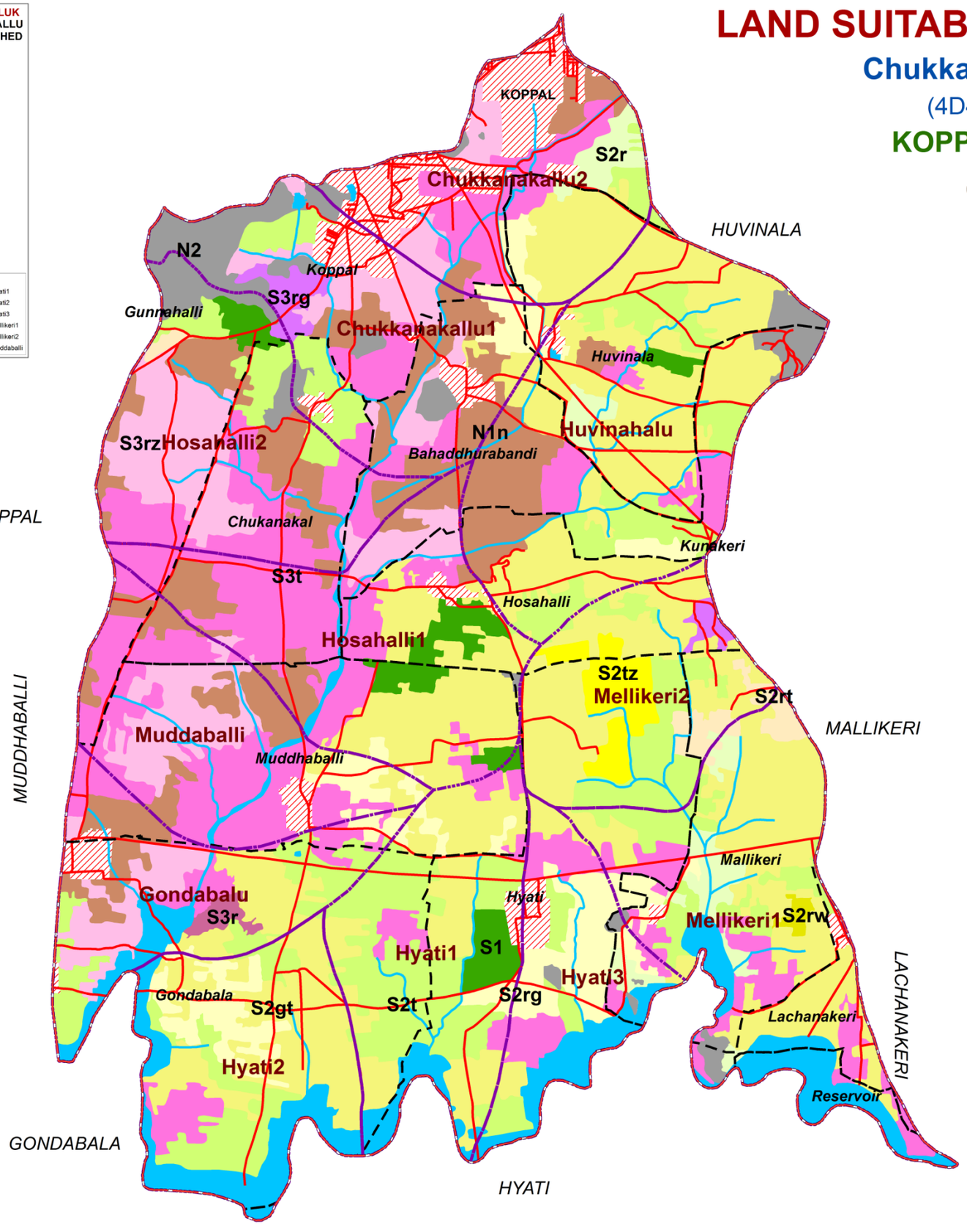
LAND SUITABILITY FOR GROUNDNUT

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

km
0 0.5 1 2
N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

References

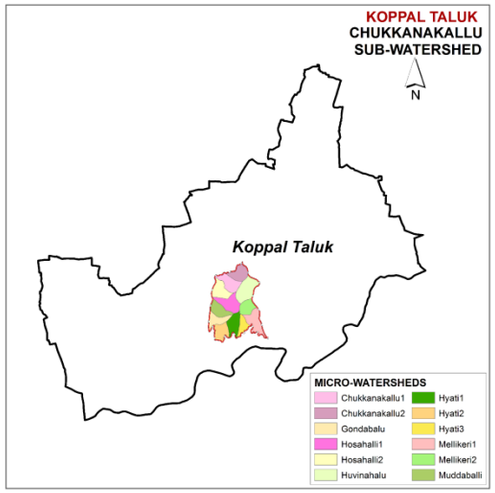
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	126 (1.95)
S2r	119 (1.83)
S2t	882 (13.59)
S2gt	1695 (26.12)
S2rg	333 (5.13)
S2rt	51 (0.78)
S2rw	9 (0.13)
S2tz	74 (1.14)
S3r	16 (0.24)
S3t	1132 (17.44)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.10. Land Suitability for Chilli



LAND SUITABILITY FOR CHILLI

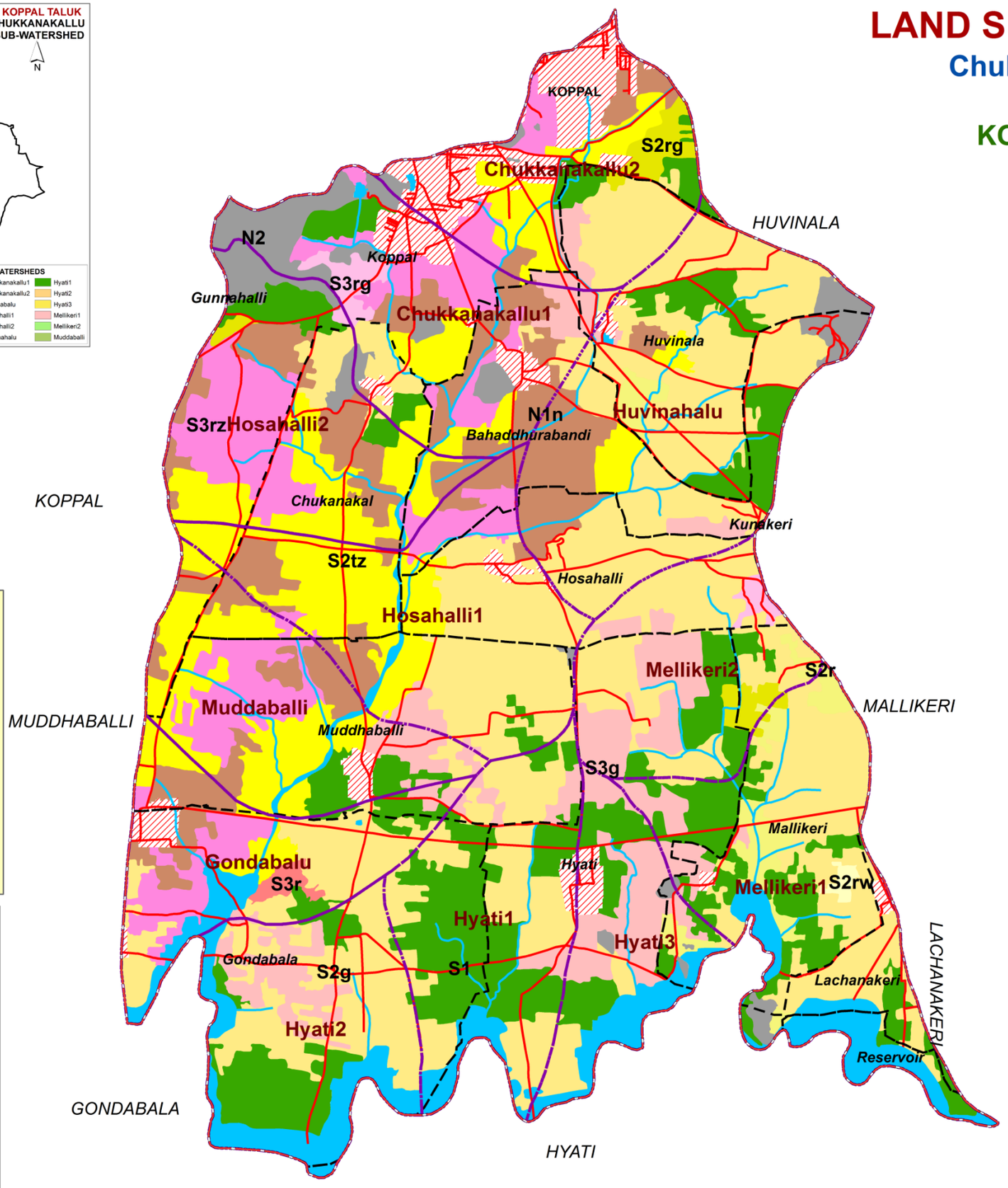
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

References

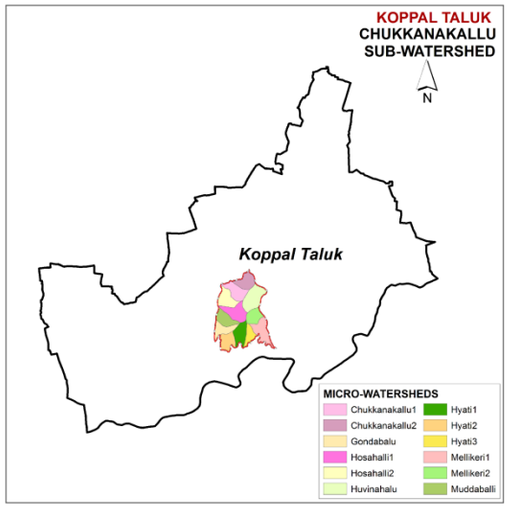
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S2tz	771 (11.88)
S3g	504 (7.76)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.11. Land Suitability for Pomegranate



LAND SUITABILITY FOR POMEGRANATE

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

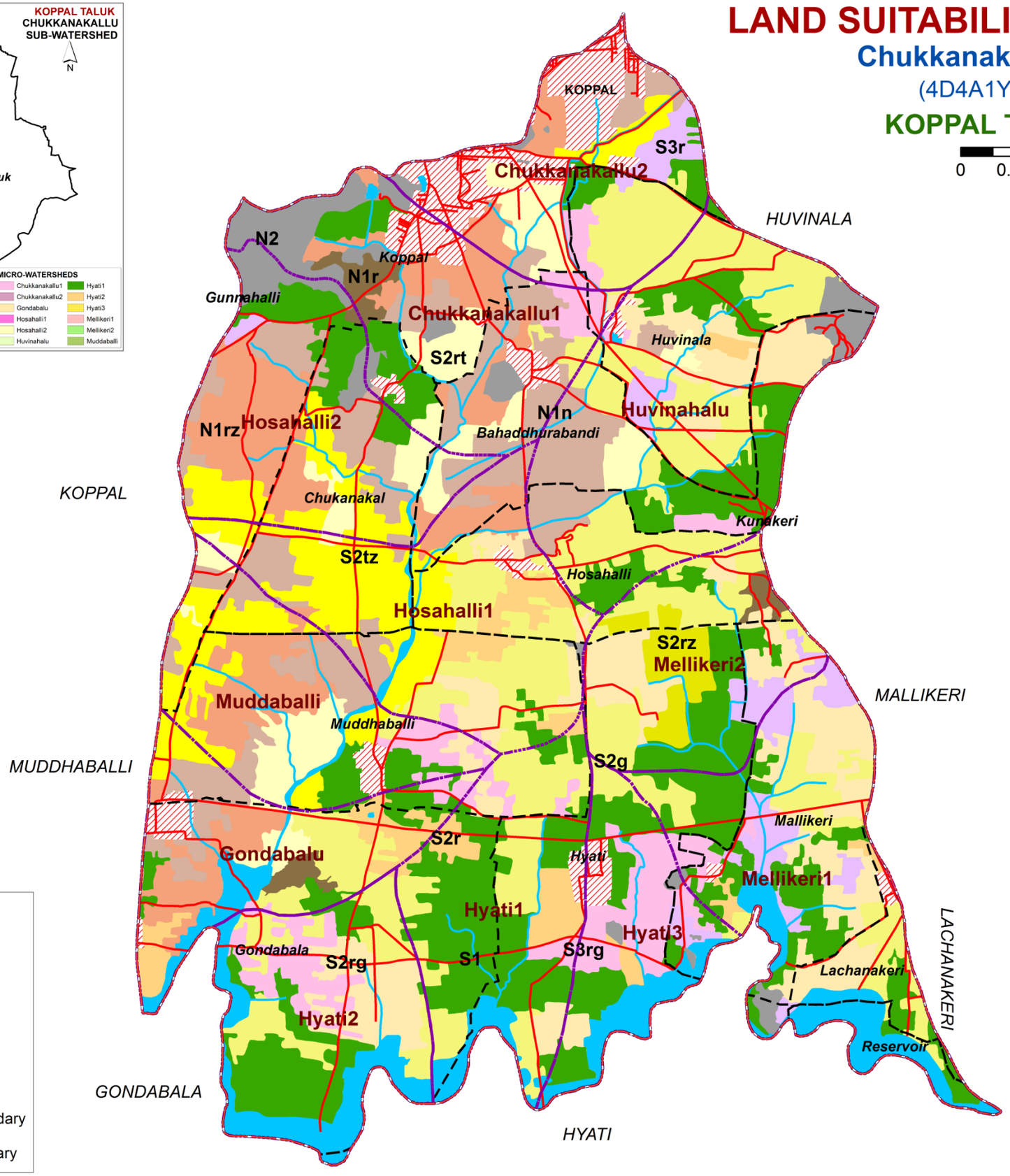
KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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



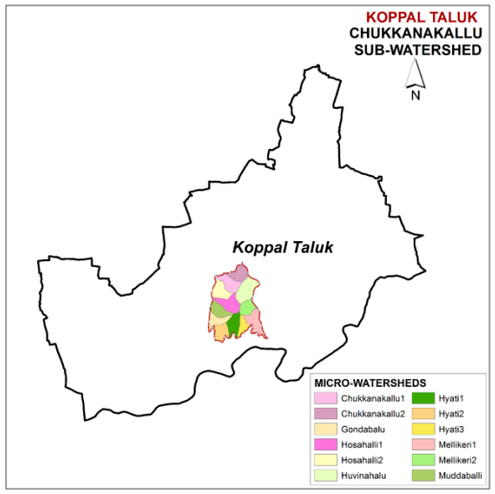
Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S2rt	313 (4.83)
S2rz	74 (1.14)
S2tz	458 (7.05)
S3r	178 (2.75)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.12. Land Suitability for Tomato



LAND SUITABILITY FOR TOMATO

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

KOPPAL
HUVINALA
MUDDHABALLI
MALLIKERI
GONDABALA
HYATI
LACHANAKERI

Chukkanakallu2
S2rg
N2
Koppal
S3rg
Gunnahalli
Chukkanakallu1
Huvinala
S3rzHosahalli2
N1n
Bahaddhurabandi
Huvinahalu
Chukanakal
Kunakeri
S3t
Hosahalli
Hosahalli1
Mellikeri2
S2r
Muddaballi
Muddhaballi
S3g
Mallikeri
Gondabalu
S3r
Hyati
Mellikeri1
S2rw
Hyati1
Hyati3
Gondabala
S2g
S1
Lachanakeri
Hyati2
Reservoir

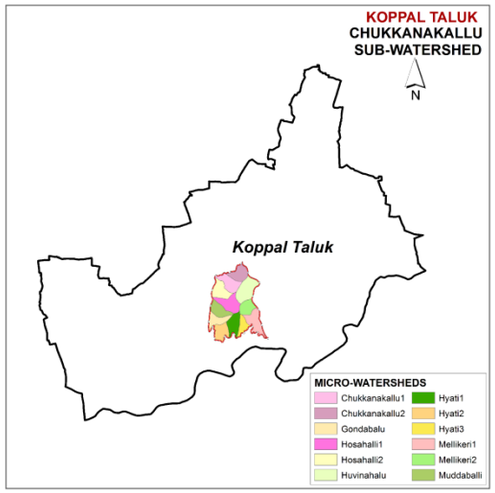
Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S3g	504 (7.76)
S3r	16 (0.24)
S3t	771 (11.88)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.13. Land Suitability for Mulberry



LAND SUITABILITY FOR MULBERRY

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

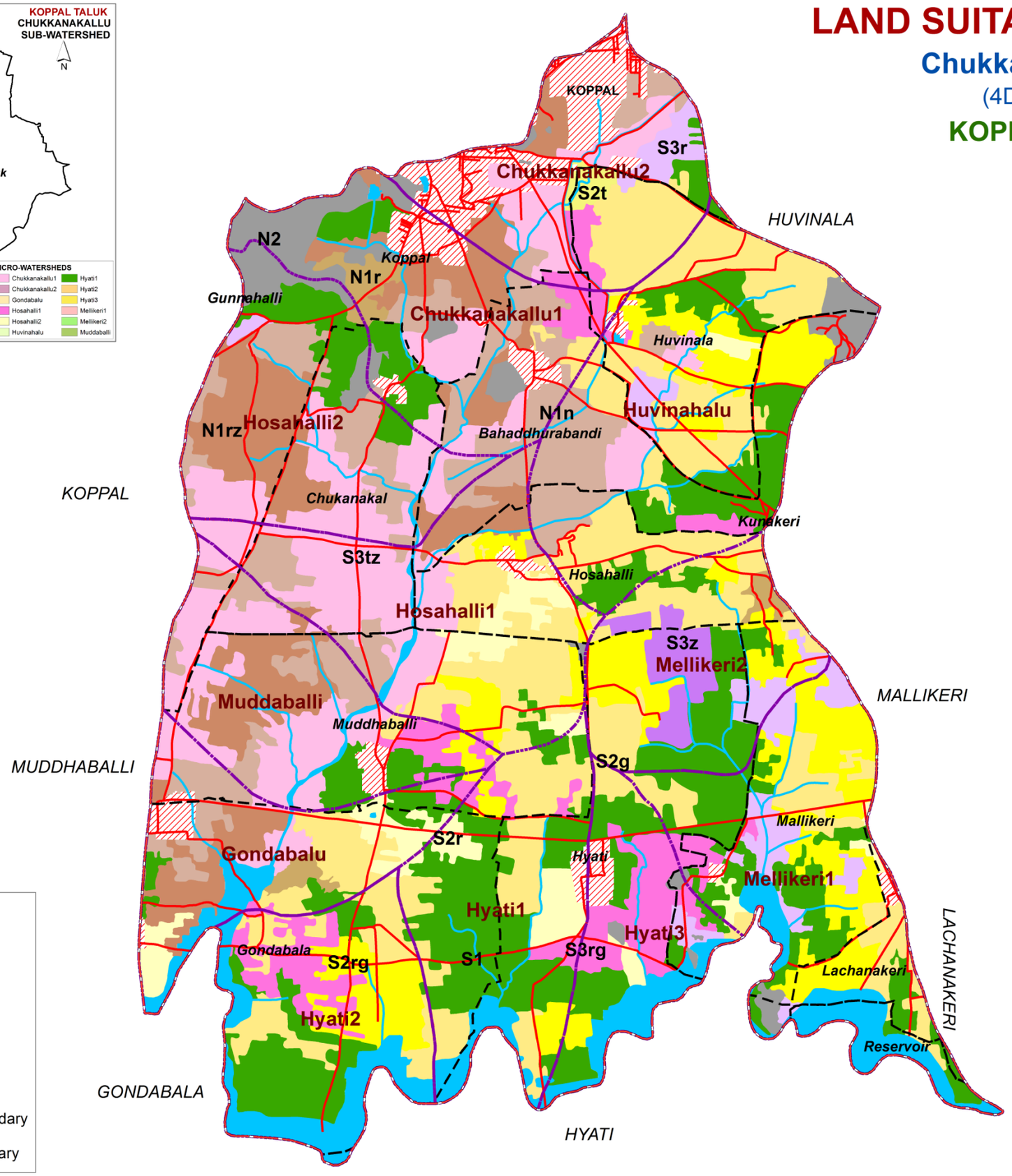
KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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



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

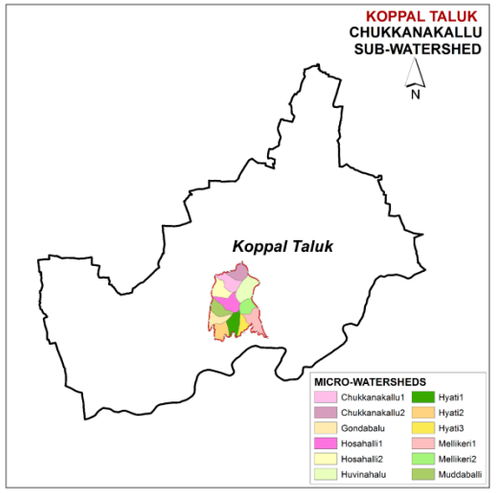
Suitability subclass	Area in ha (%)
S1	1133 (17.45)
S2g	1147 (17.68)
S2r	204 (3.14)
S2t	20 (0.31)
S2rg	560 (8.63)
S3r	178 (2.75)
S3z	74 (1.14)
S3rg	333 (5.13)
S3tz	771 (11.88)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: Mulberry suitability evaluation only for mulberry leaf, not for silkworm rearing

7.14. Land Suitability for Bhendi



LAND SUITABILITY FOR BHENDI

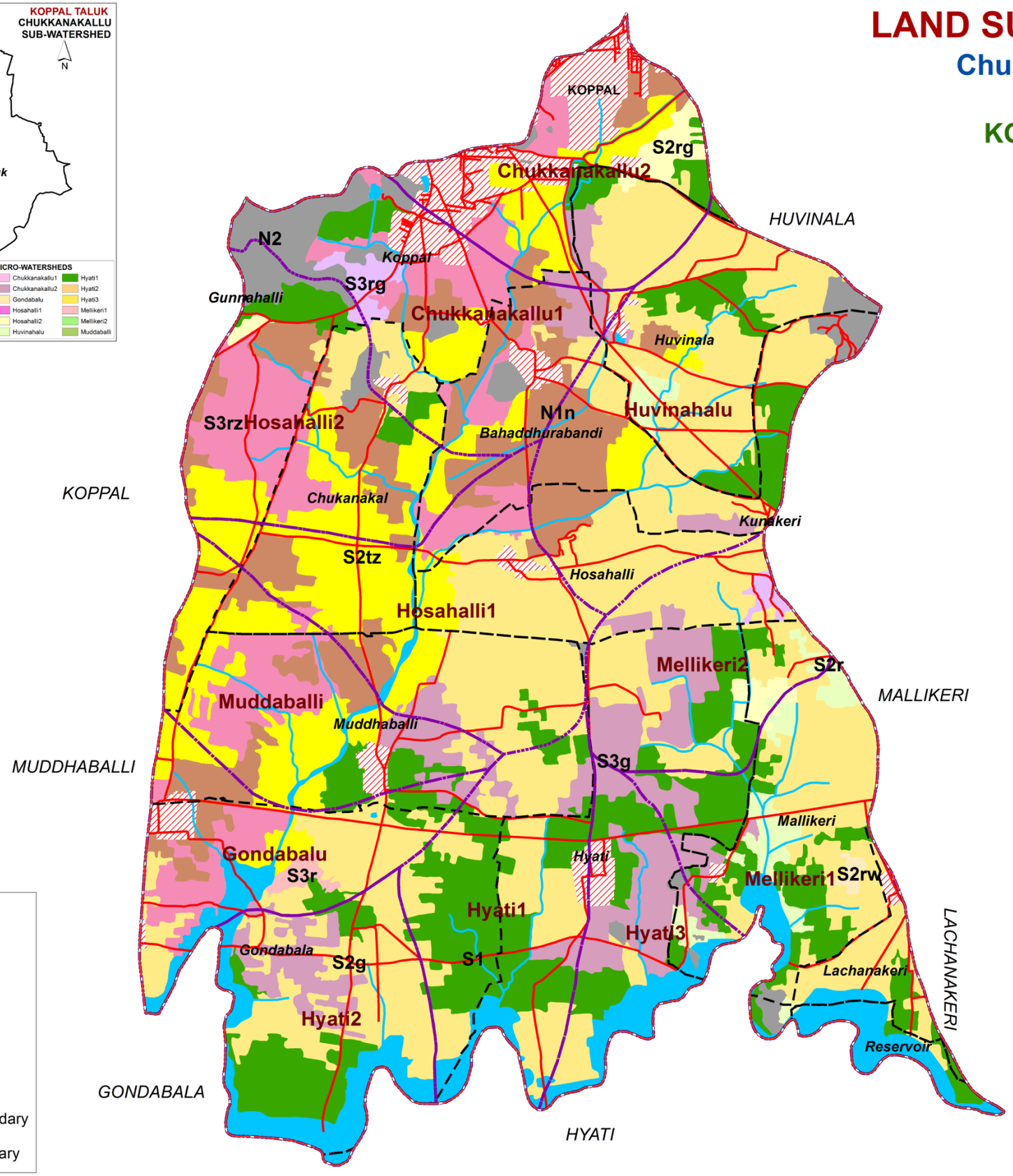
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

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

Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S2tz	771 (11.88)
S3g	504 (7.76)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

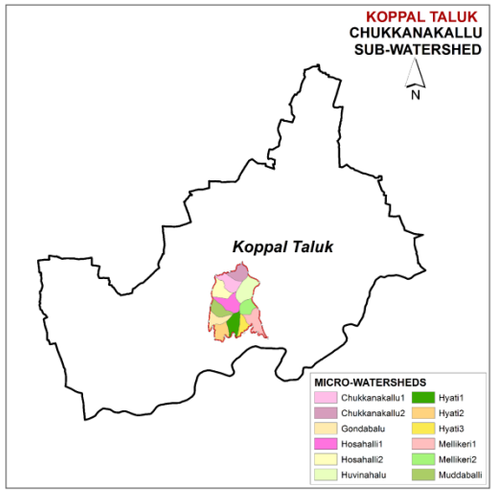
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.15. Land Suitability for Guava



LAND SUITABILITY FOR GUAVA

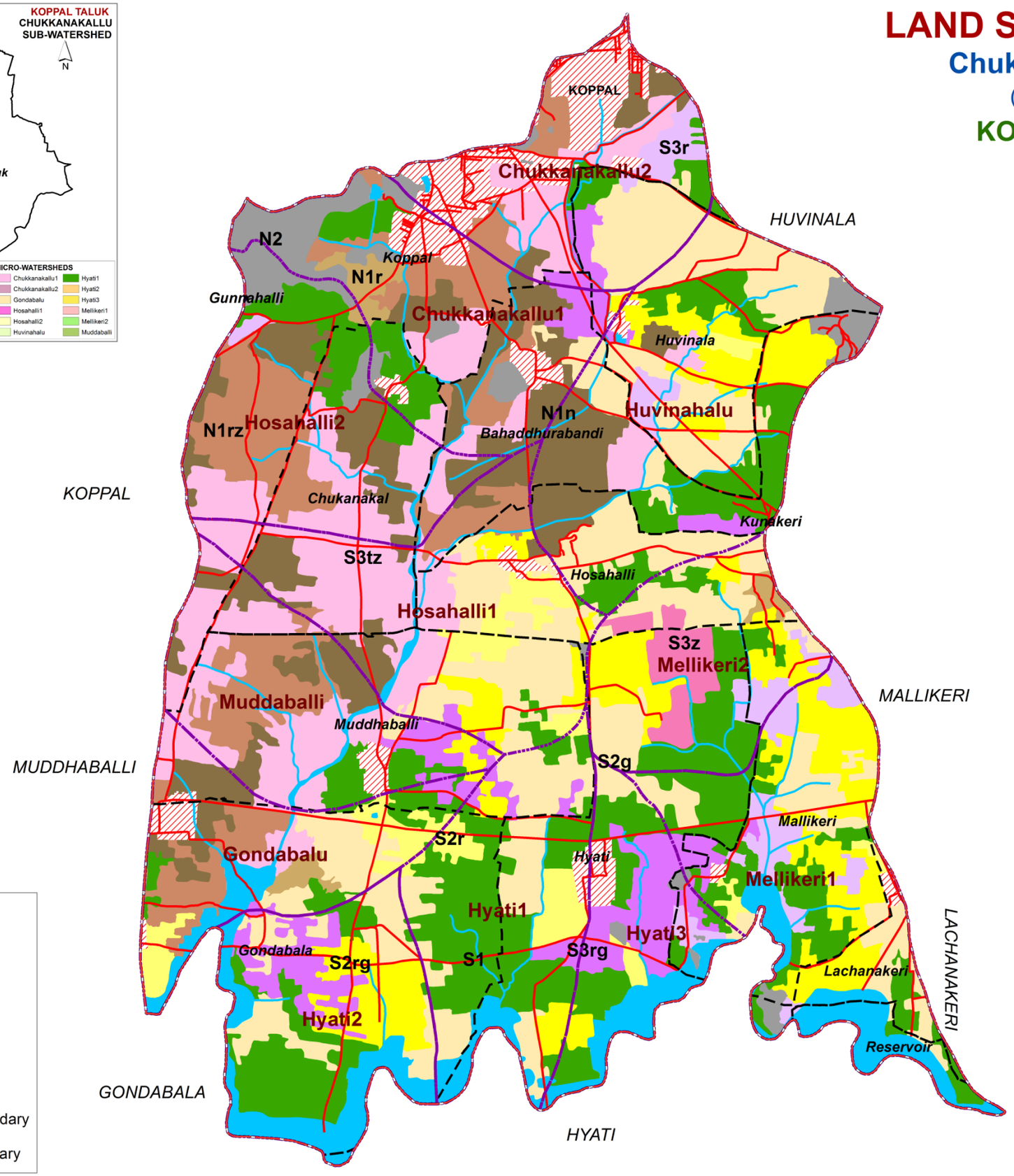
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



References

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

Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

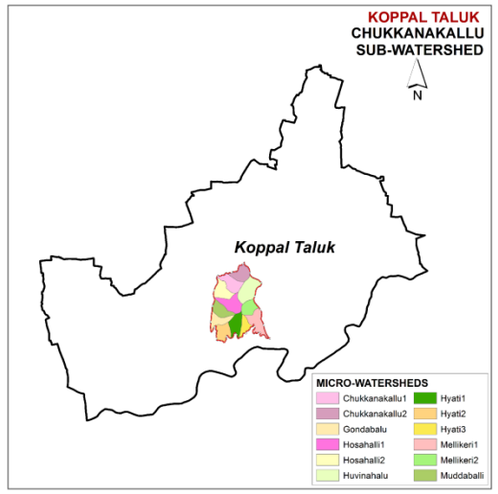
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S3r	178 (2.75)
S3z	74 (1.14)
S3rg	333 (5.13)
S3tz	771 (11.88)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.16. Land Suitability for Mango



LAND SUITABILITY FOR MANGO

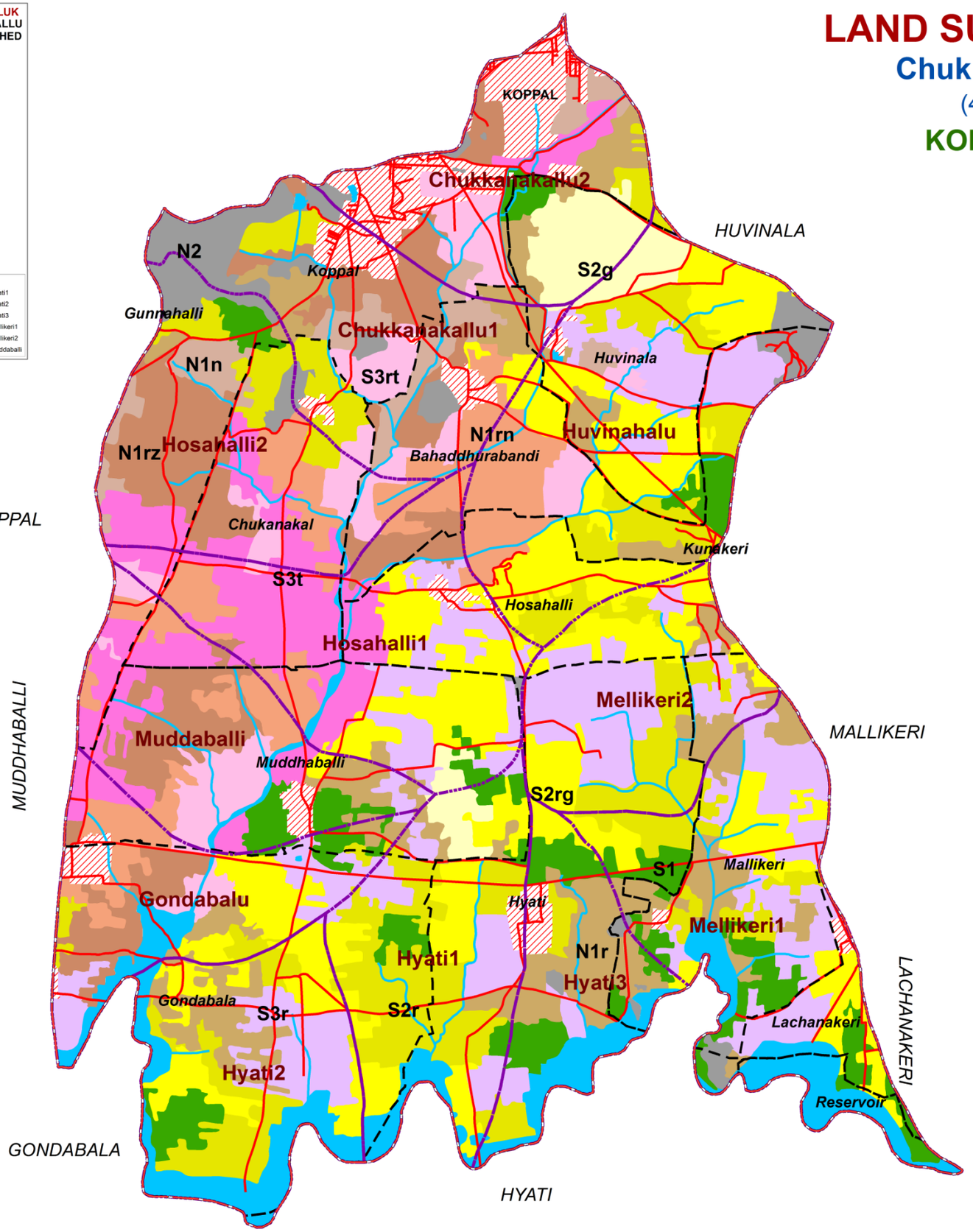
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

References

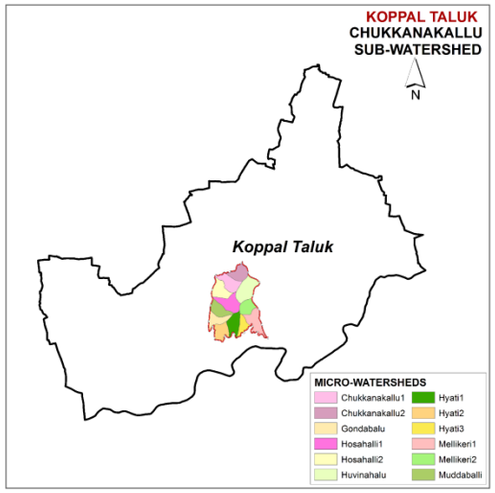
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	369 (5.69)
S2g	176 (2.71)
S2r	784 (12.07)
S2rg	972 (14.97)
S3r	838 (12.91)
S3t	458 (7.05)
S3rt	313 (4.83)
N1n	163 (2.51)
N1r	572 (8.81)
N1rn	428 (6.6)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.17. Land Suitability for Sapota



LAND SUITABILITY FOR SAPOTA

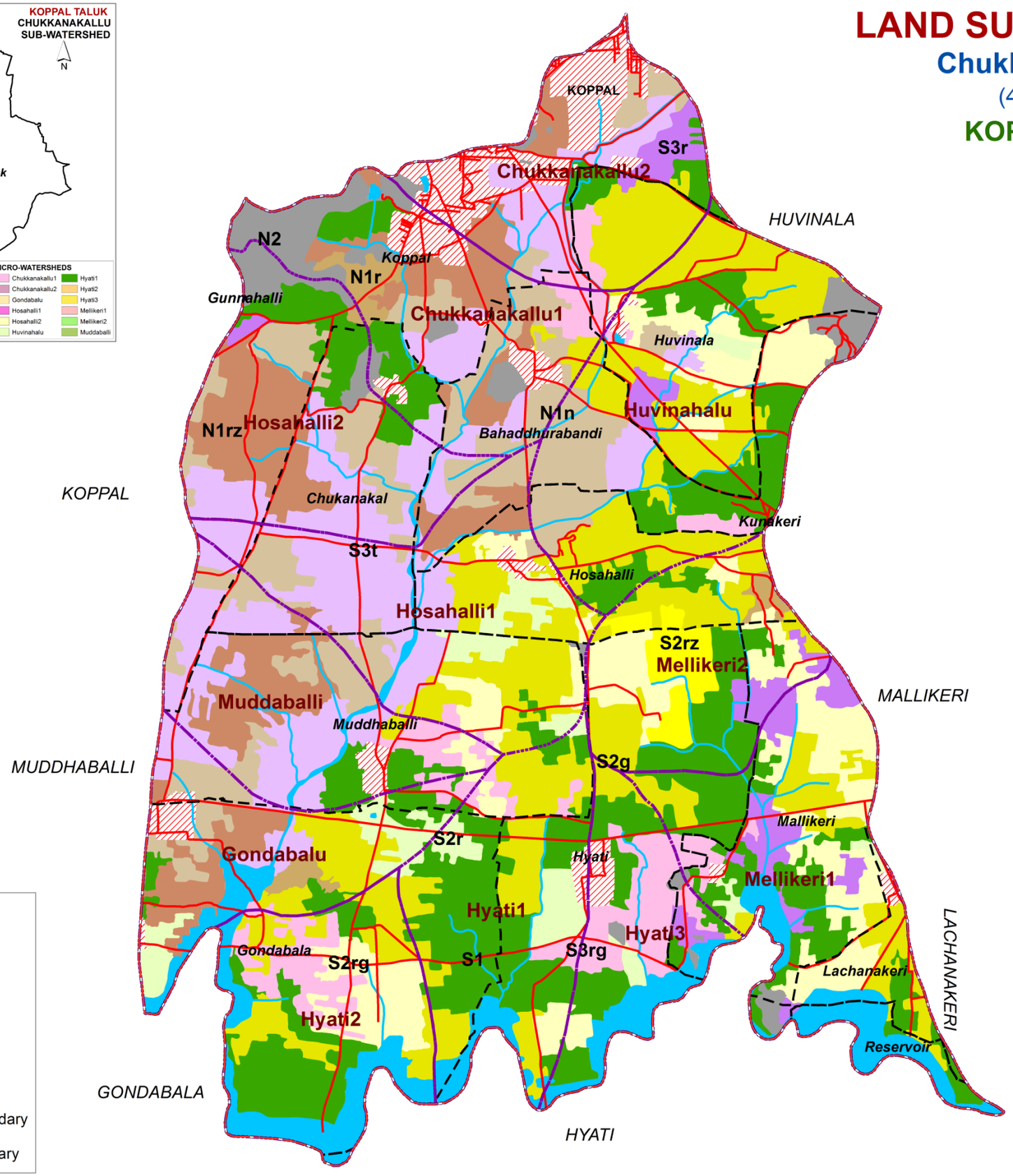
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S2rz	74 (1.14)
S3r	178 (2.75)
S3t	771 (11.88)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

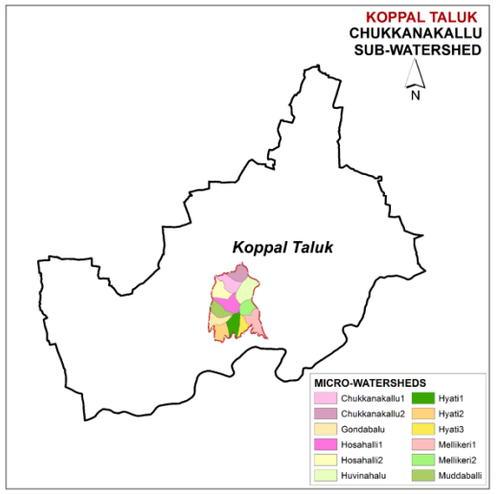
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.18. Land Suitability for Jackfruit



LAND SUITABILITY FOR JACKFRUIT

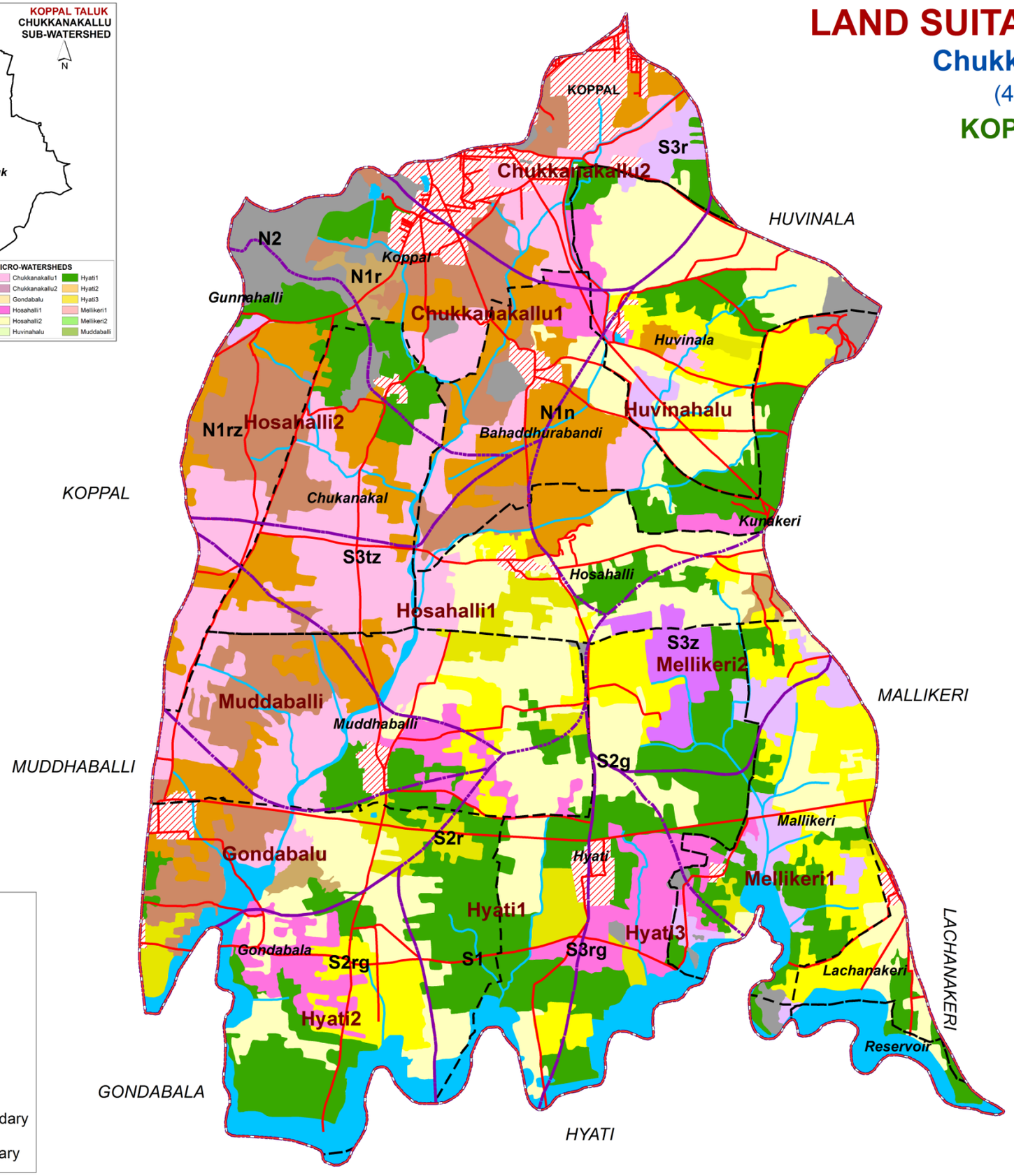
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S3r	178 (2.75)
S3z	74 (1.14)
S3rg	333 (5.13)
S3tz	771 (11.88)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

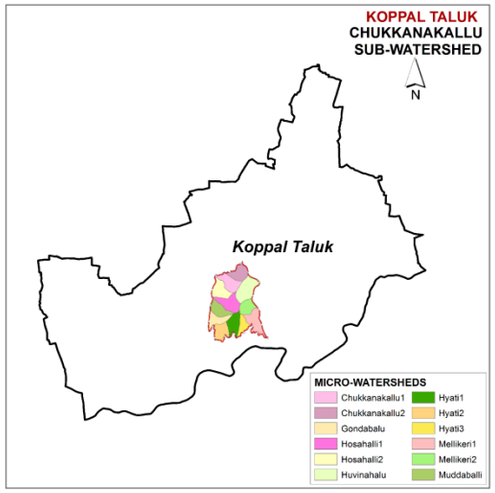
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.19. Land Suitability for Jamun



LAND SUITABILITY FOR JAMUN

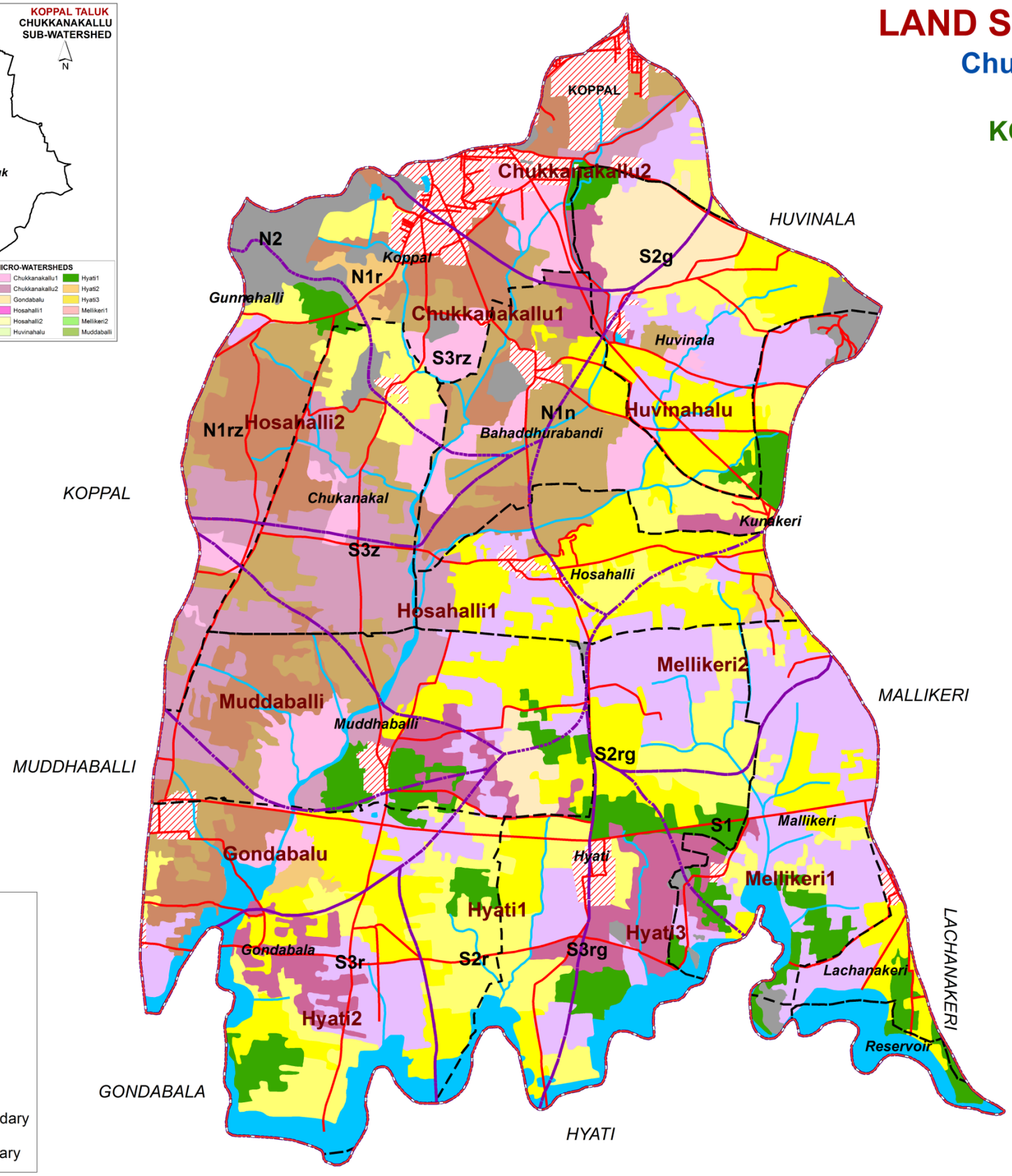
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	369 (5.69)
S2g	176 (2.71)
S2r	784 (12.07)
S2rg	972 (14.97)
S3r	1016 (15.66)
S3z	458 (7.05)
S3rg	333 (5.13)
S3rz	313 (4.83)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

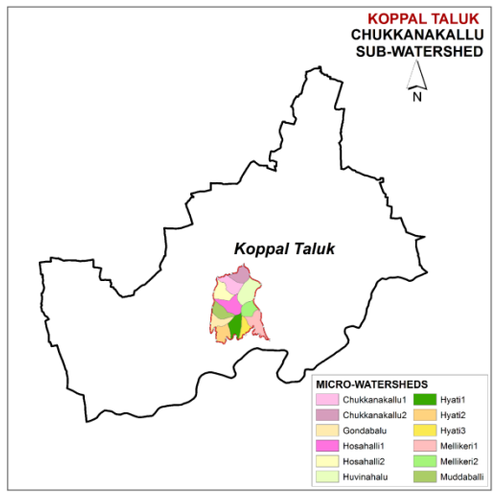
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.20. Land Suitability for Musambi



LAND SUITABILITY FOR MUSAMBI

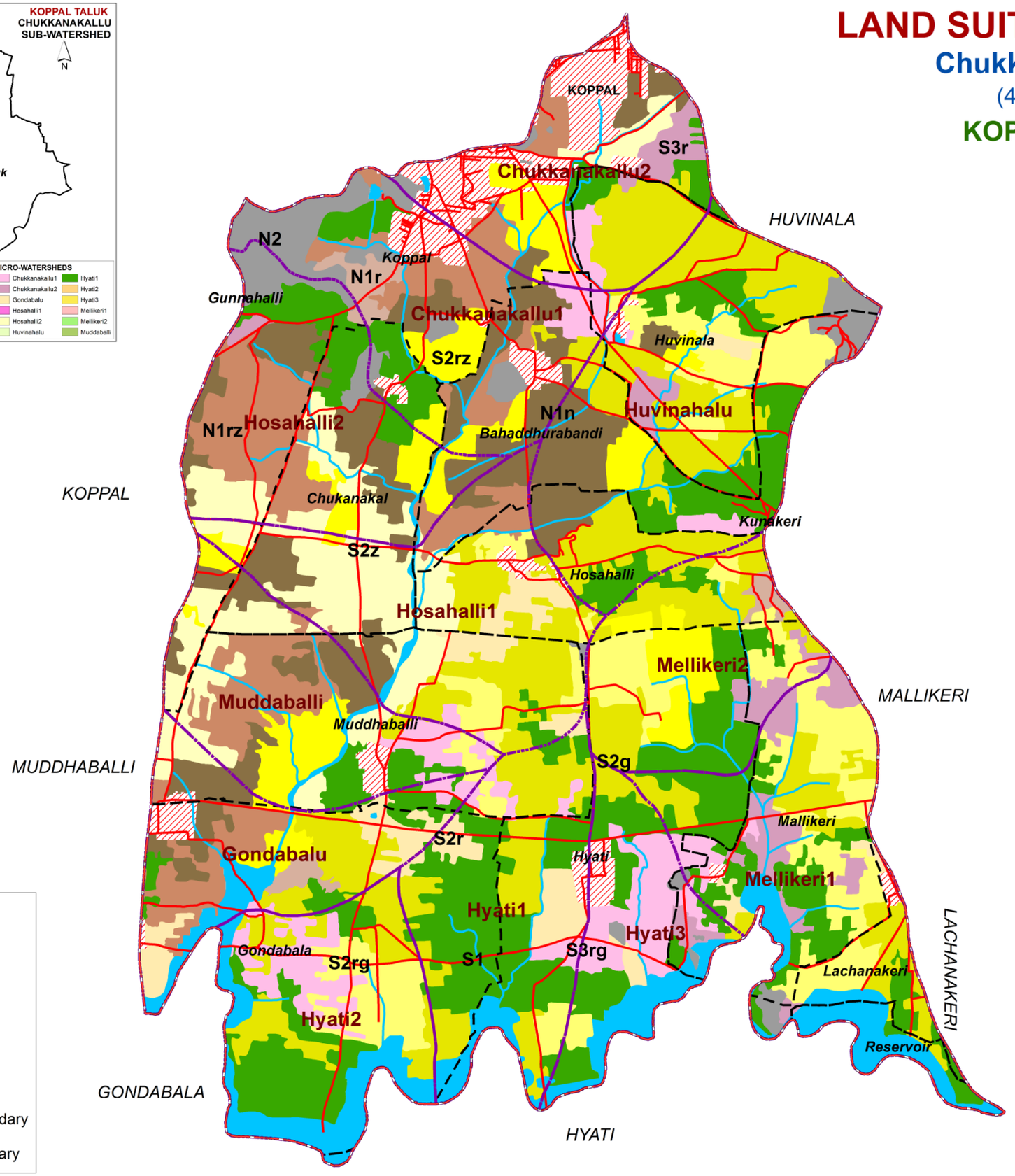
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2z	458 (7.05)
S2rg	560 (8.63)
S2rz	387 (5.97)
S3r	178 (2.75)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

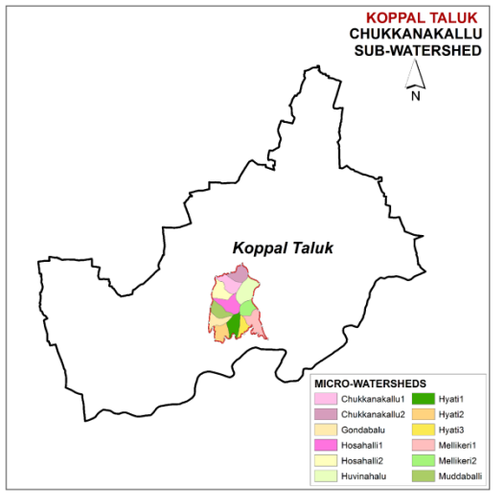
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.21. Land Suitability for Lime



LAND SUITABILITY FOR LIME

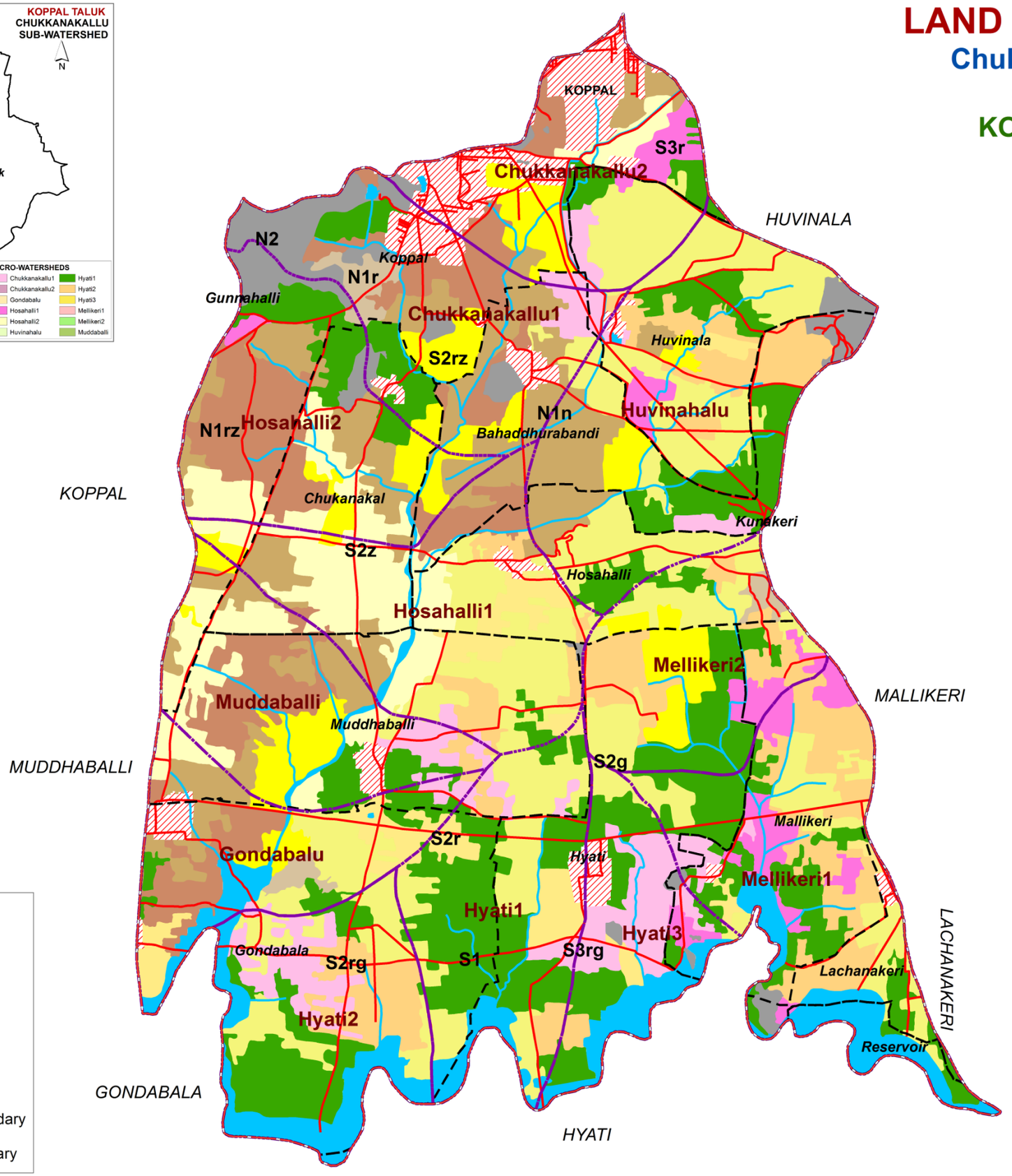
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1153 (17.76)
S2g	1147 (17.68)
S2r	204 (3.14)
S2z	458 (7.05)
S2rg	560 (8.63)
S2rz	387 (5.97)
S3r	178 (2.75)
S3rg	333 (5.13)
N1n	591 (9.11)
N1r	61 (0.93)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

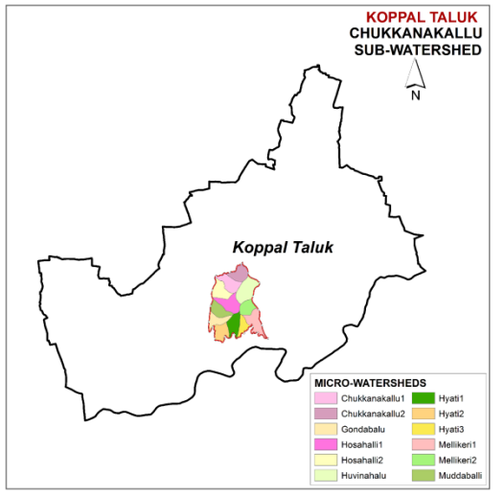
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.22. Land Suitability for Cashew



LAND SUITABILITY FOR CASHEW

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

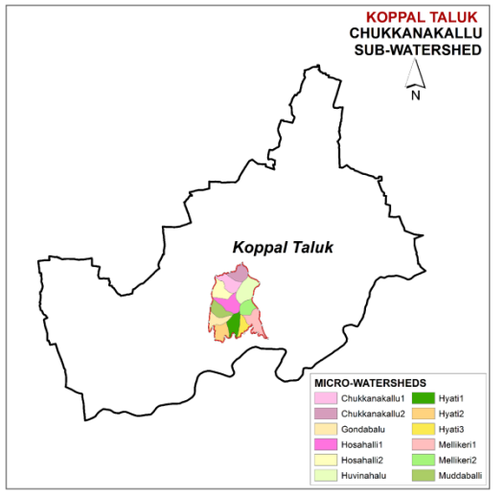
Suitability subclass	Area in ha (%)
S1	1132 (17.44)
S2g	1147 (17.68)
S2r	204 (3.14)
S2rg	560 (8.63)
S3r	170 (2.62)
S3w	21 (0.32)
S3rg	333 (5.13)
S3rw	9 (0.13)
N1r	61 (0.93)
N1rt	529 (8.15)
N1tn	591 (9.11)
N1tz	845 (13.02)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.23. Land Suitability for Custard Apple



LAND SUITABILITY FOR CUSTARD APPLE

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

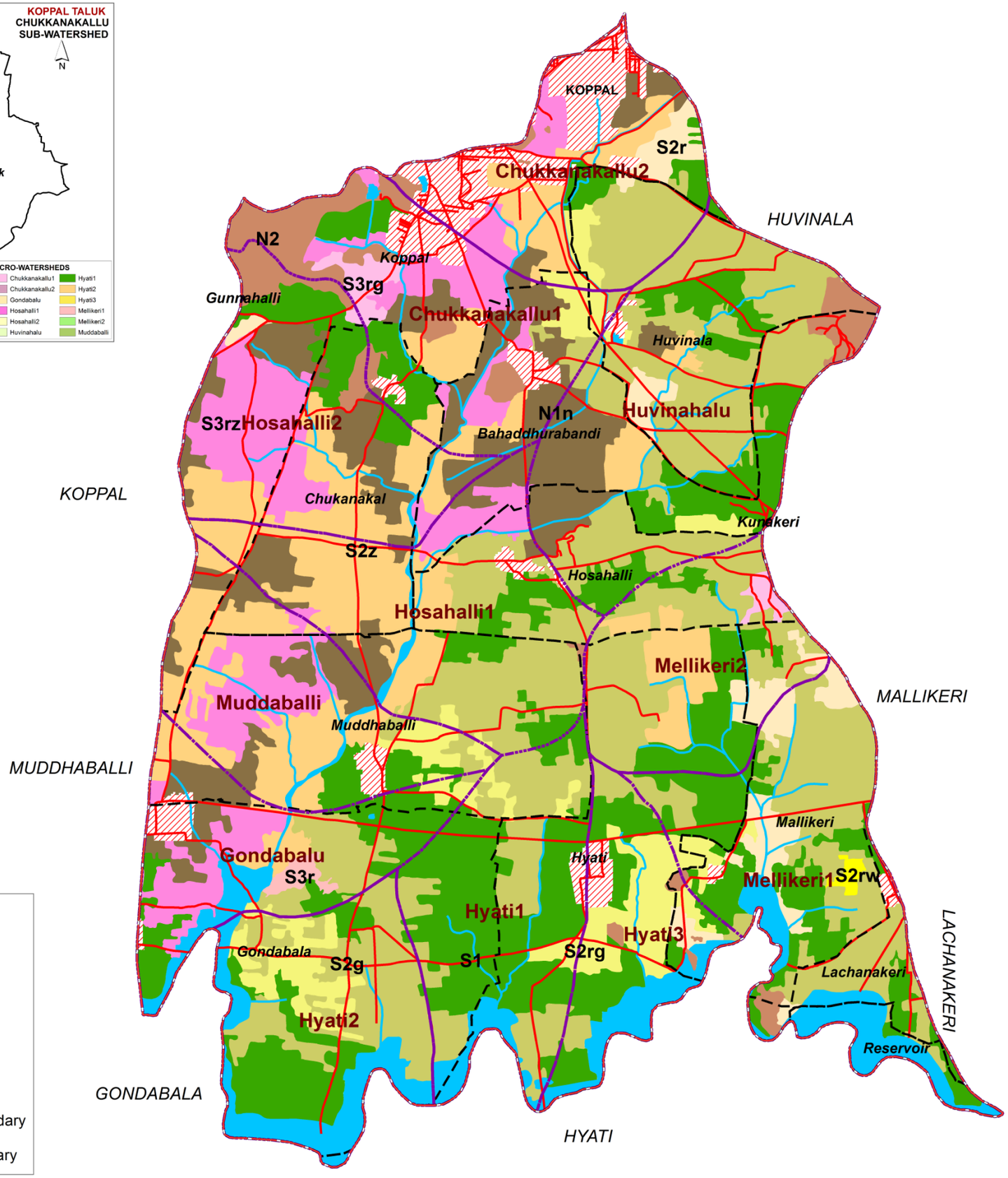
KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
w- drainage
z- excess salt/calcareousness



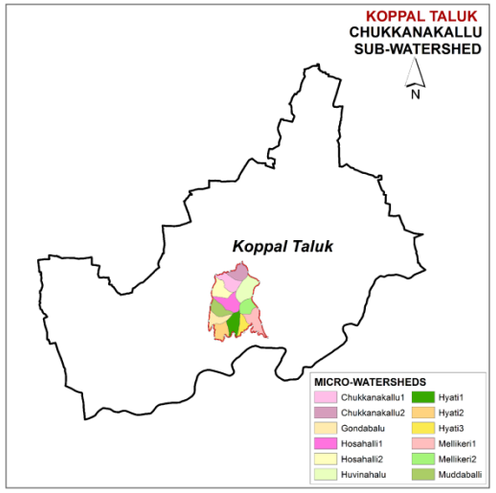
Suitability subclass	Area in ha (%)
S1	1357 (20.9)
S2g	1707 (26.31)
S2r	170 (2.62)
S2z	845 (13.02)
S2rg	333 (5.13)
S2rw	9 (0.13)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.24. Land Suitability for Amla



LAND SUITABILITY FOR AMLA

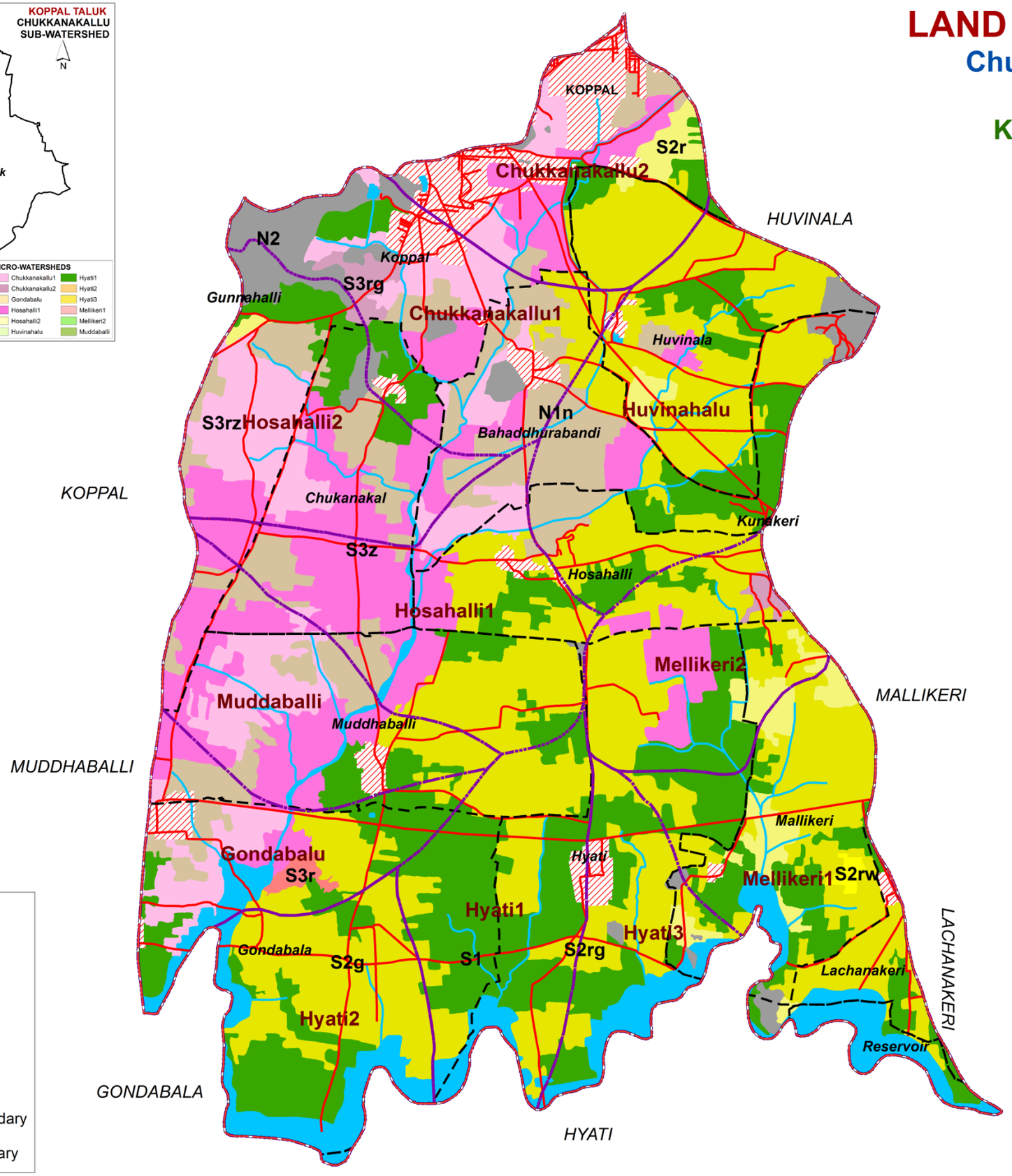
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2-Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
w- drainage
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	1357 (20.9)
S2g	1707 (26.31)
S2r	170 (2.62)
S2rg	333 (5.13)
S2rw	9 (0.13)
S3r	16 (0.24)
S3z	845 (13.02)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

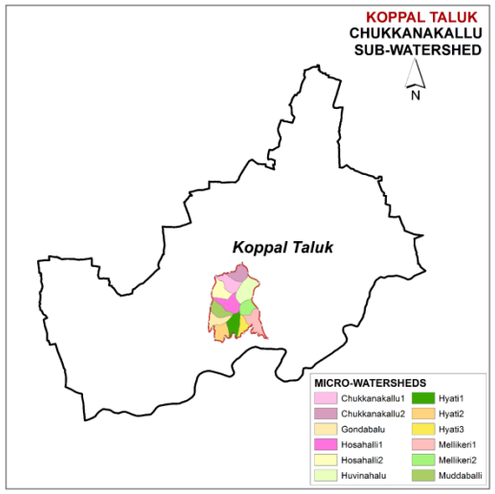
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.25. Land Suitability for Tamarind



LAND SUITABILITY FOR TAMARIND

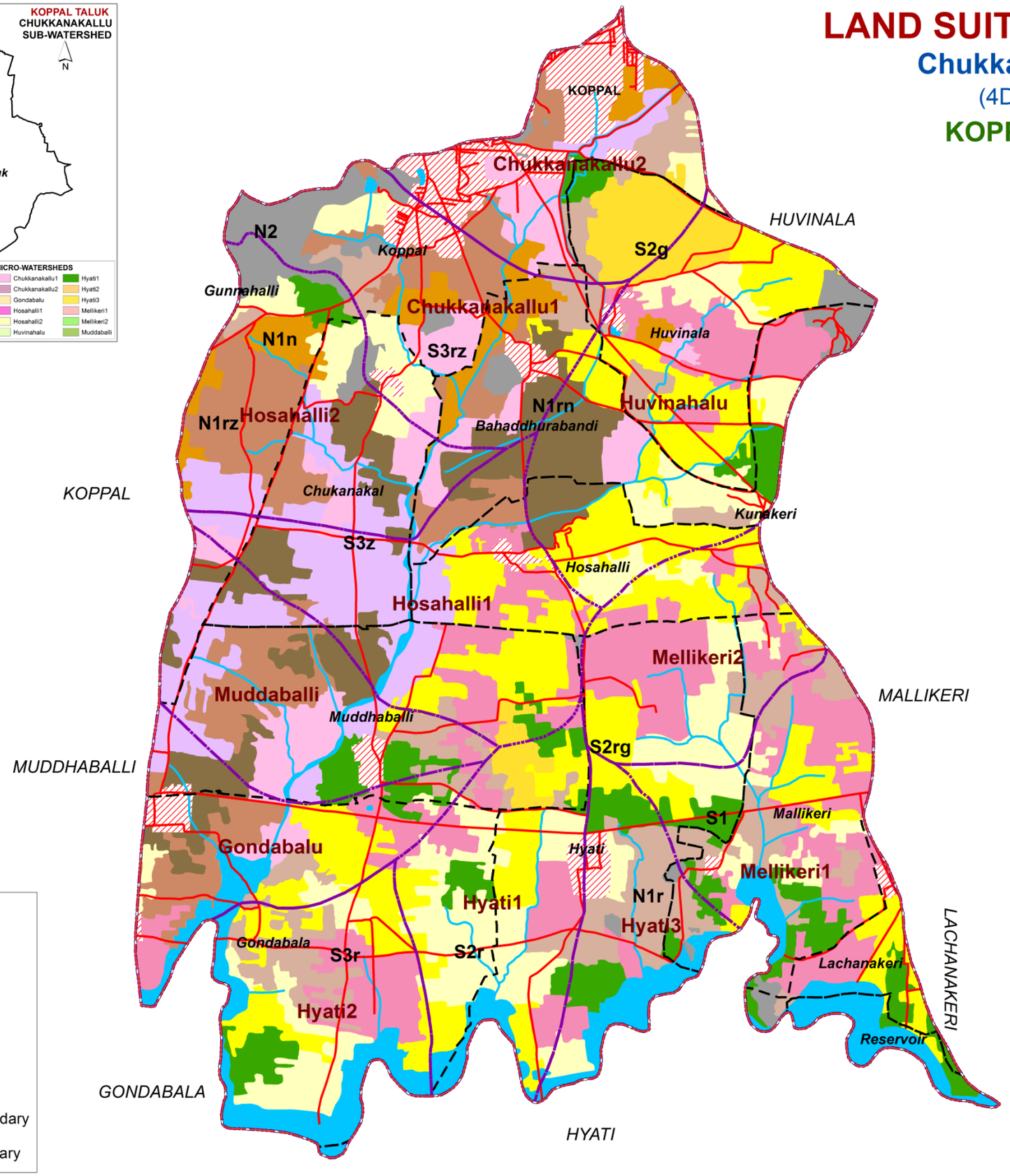
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	369 (5.69)
S2g	176 (2.71)
S2r	784 (12.07)
S2rg	972 (14.97)
S3r	838 (12.91)
S3z	458 (7.05)
S3rz	313 (4.83)
N1n	163 (2.51)
N1r	572 (8.81)
N1rn	428 (6.6)
N1rz	529 (8.15)
N2	217 (3.34)
Others*	673 (10.37)

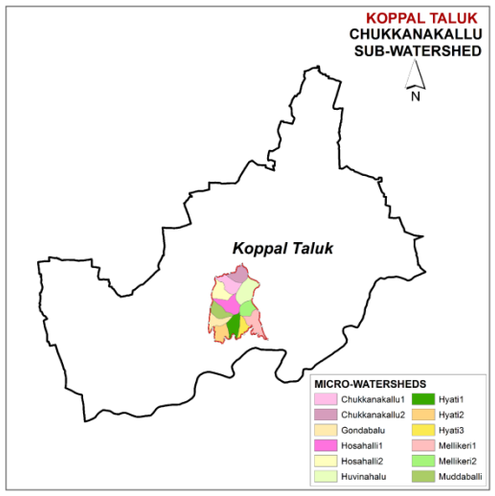
* - Habitation & Waterbody

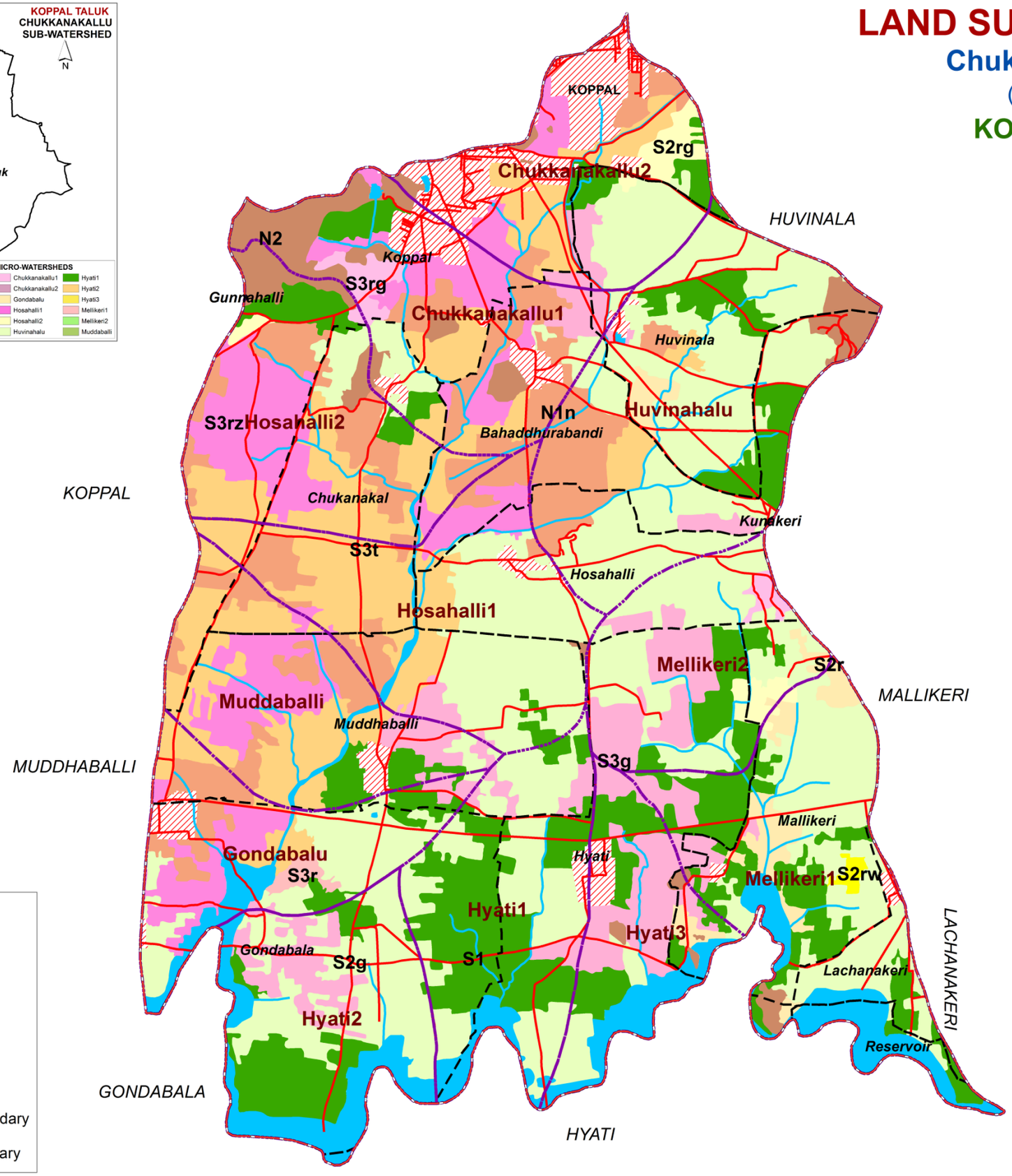
References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.26. Land Suitability for Brinjal





LAND SUITABILITY FOR BRINJAL

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

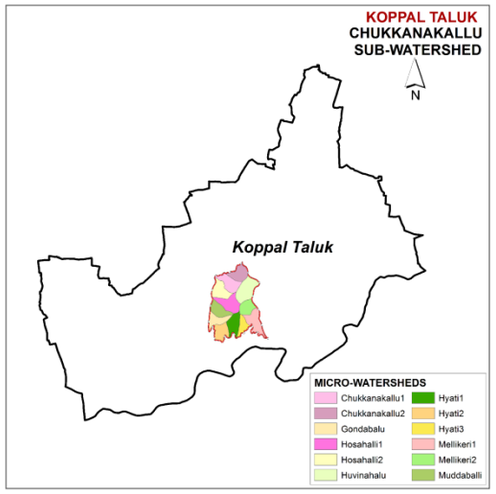
Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S3g	504 (7.76)
S3r	16 (0.24)
S3t	771 (11.88)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

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

Source: ICAR-NBSS&LUP, Bengaluru

7.27. Land Suitability for Onion



LAND SUITABILITY FOR ONION

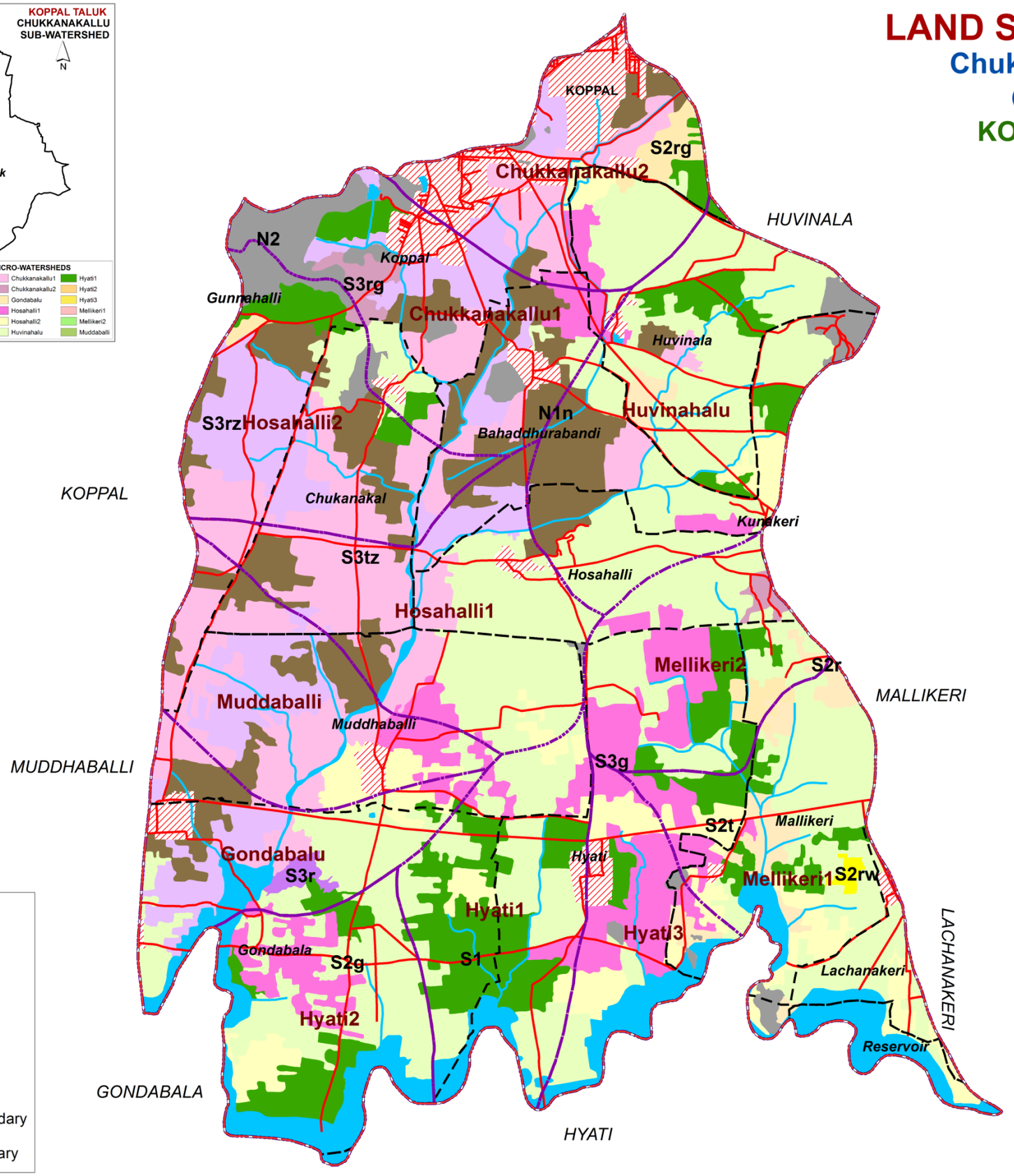
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

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

Limitations

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

Suitability subclass	Area in ha (%)
S1	593 (9.13)
S2g	2026 (31.22)
S2r	104 (1.6)
S2t	348 (5.37)
S2rg	66 (1.02)
S2rw	9 (0.13)
S3g	504 (7.76)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
S3tz	771 (11.88)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

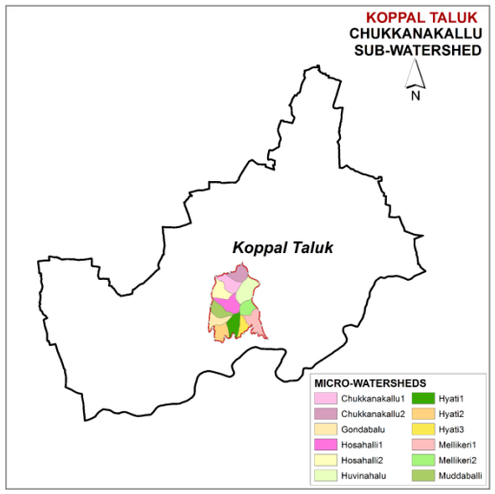
* - Habitation & Waterbody

References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.28. Land Suitability for Jasmine



LAND SUITABILITY FOR JASMINE

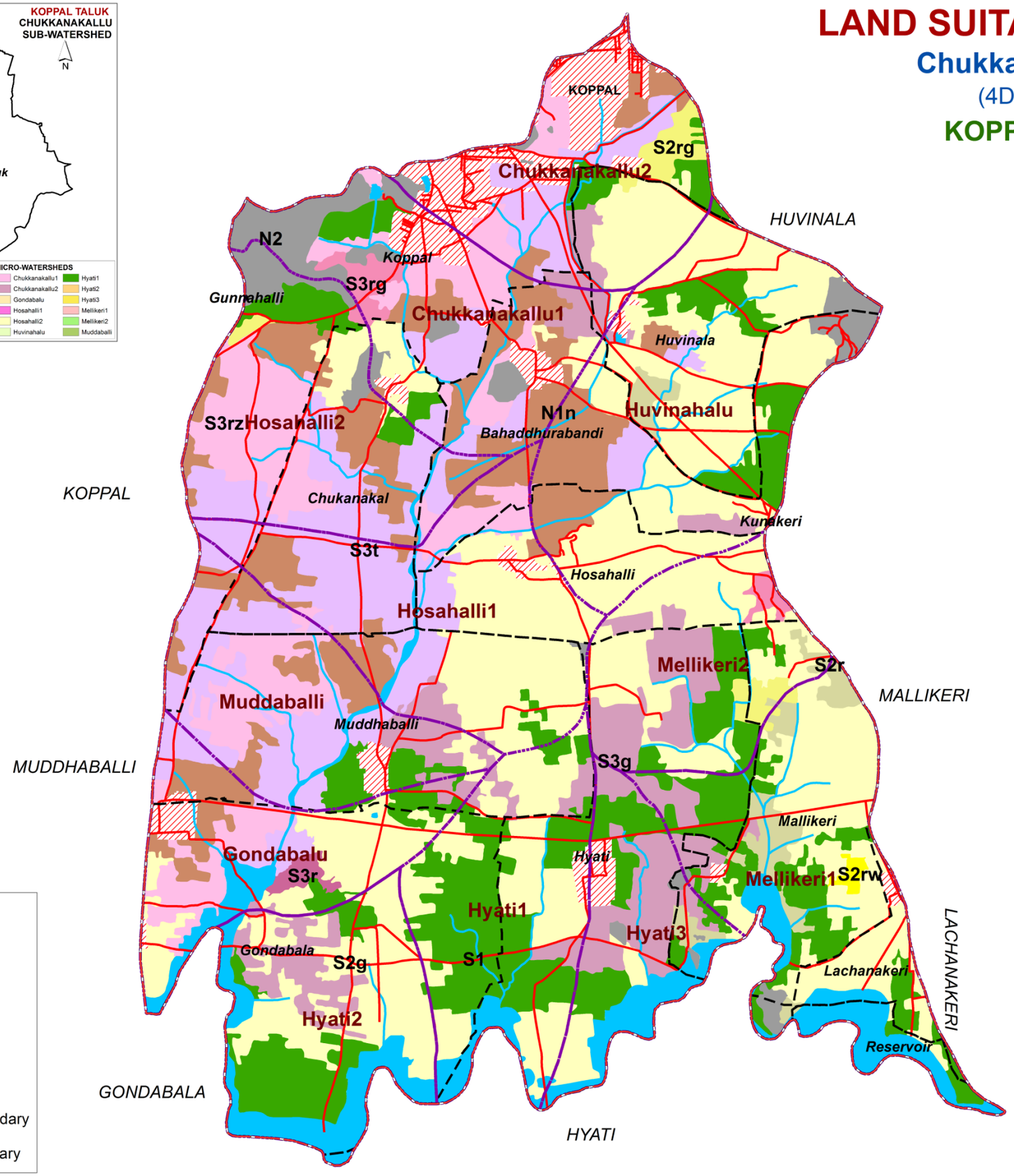
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

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

Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S3g	504 (7.76)
S3r	16 (0.24)
S3t	771 (11.88)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

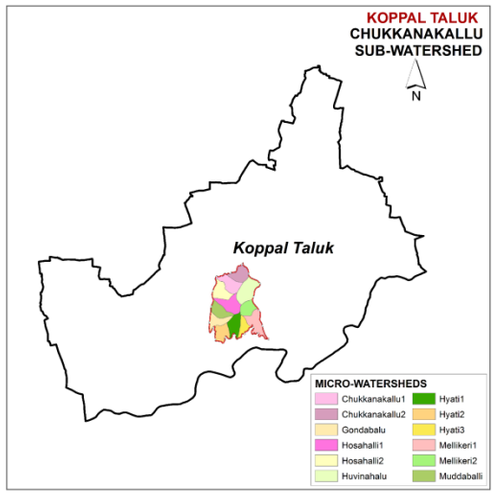
* - Habitation & Waterbody

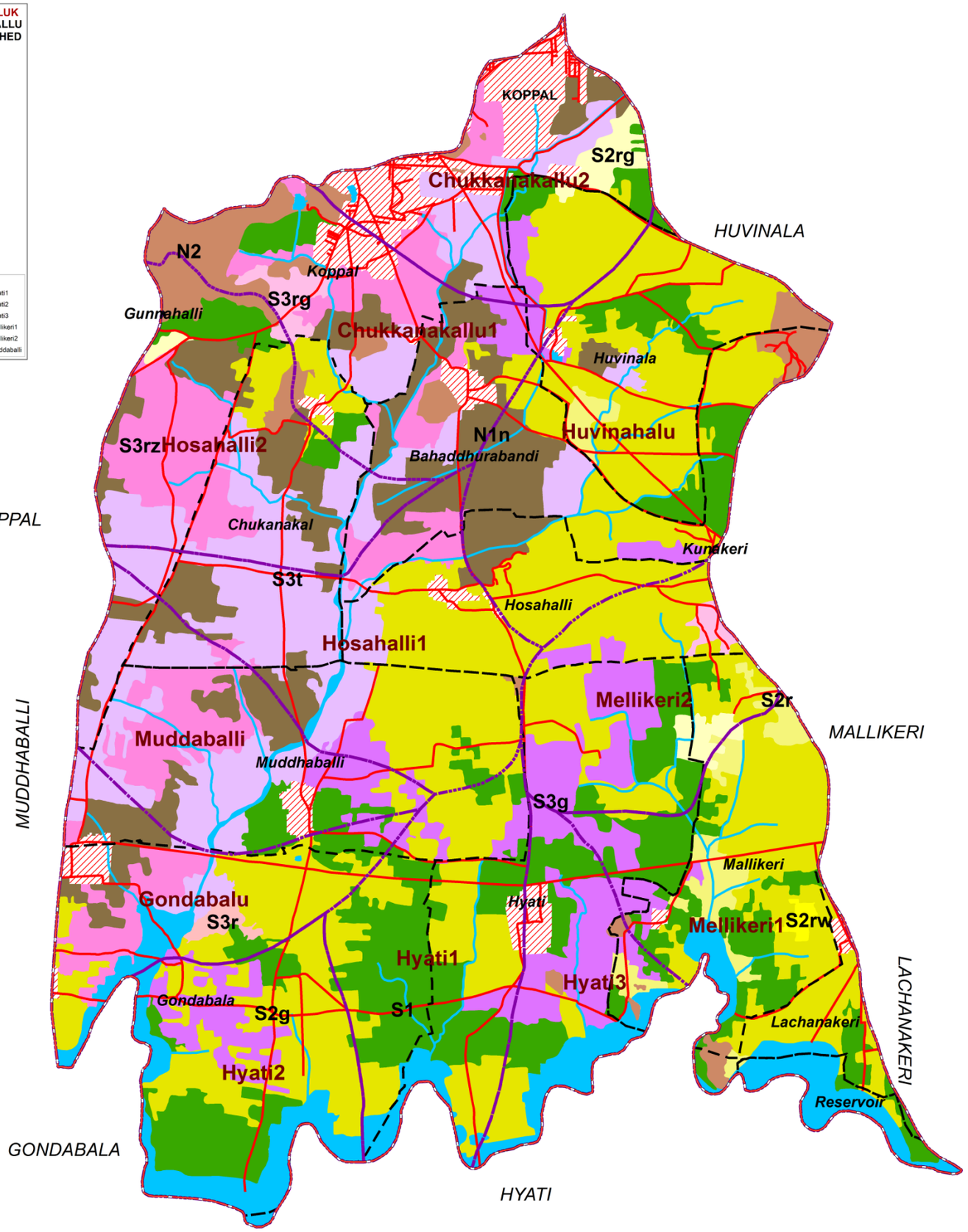
References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.29. Land Suitability for Crossandra





LAND SUITABILITY FOR CROSSANDRA

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

References

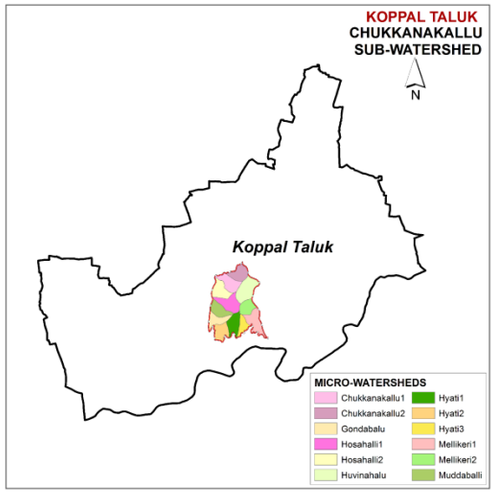
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S3g	504 (7.76)
S3r	16 (0.24)
S3t	771 (11.88)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.30. Land Suitability for Marigold



LAND SUITABILITY FOR MARIGOLD

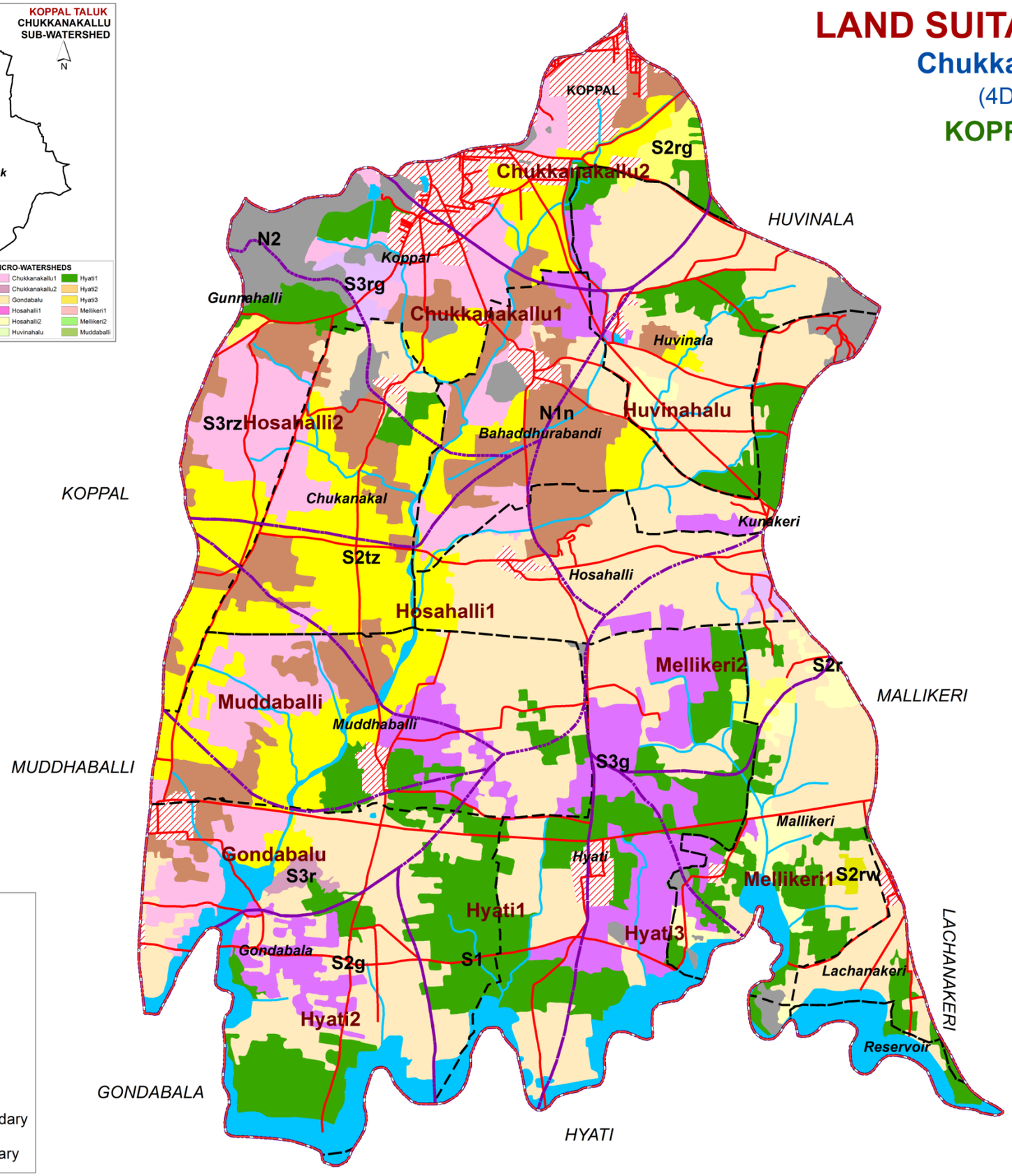
Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N



Key

S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations

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

Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S2tz	771 (11.88)
S3g	504 (7.76)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

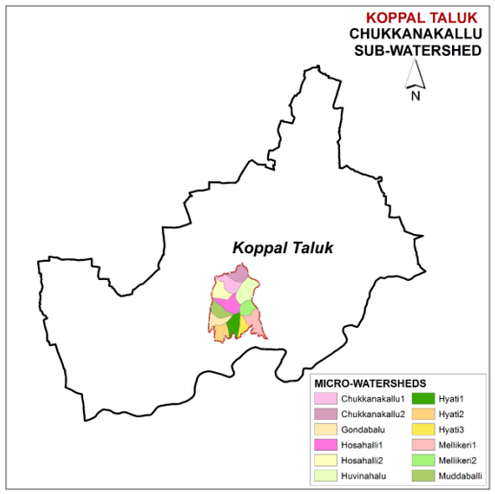
* - Habitation & Waterbody

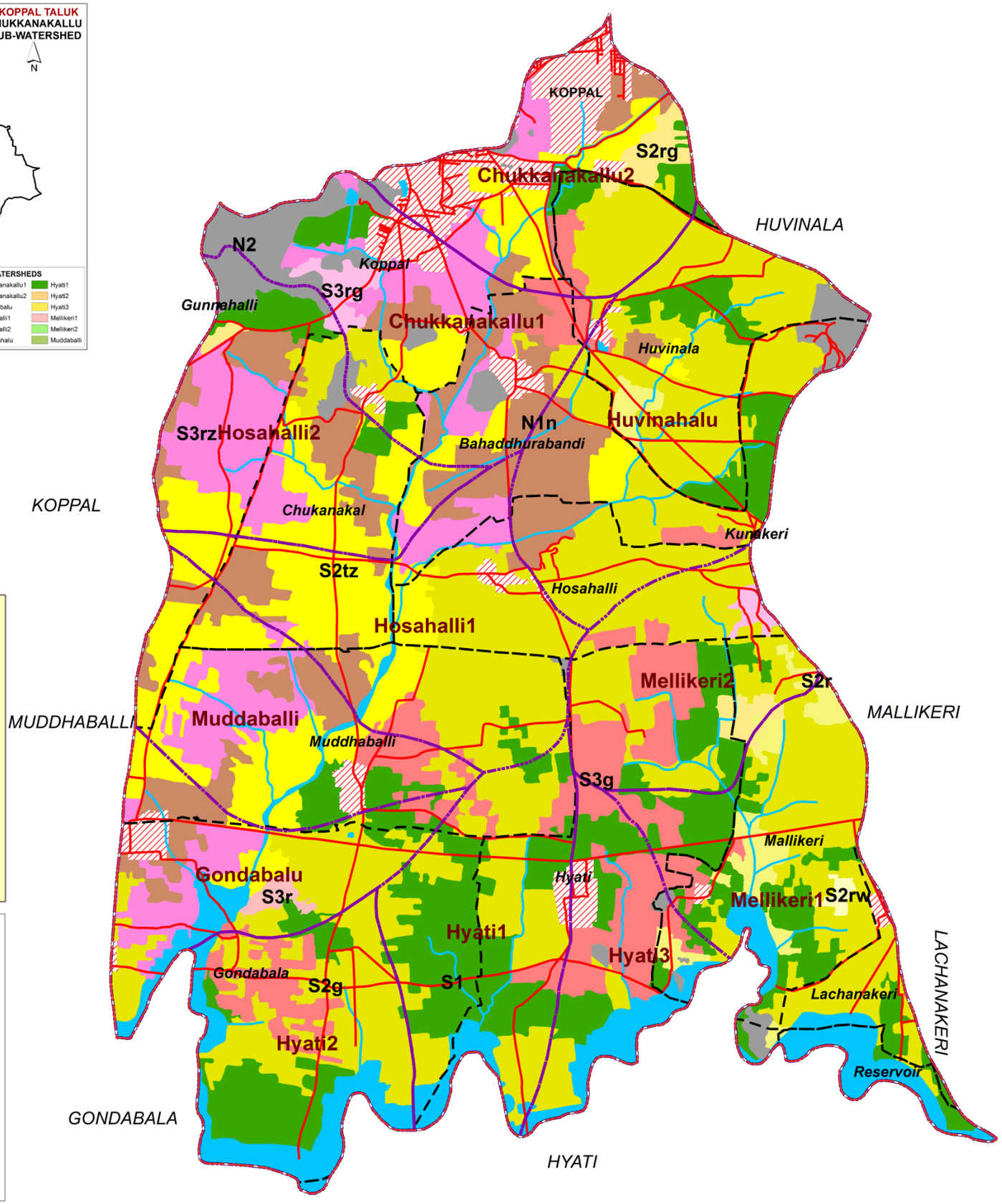
References

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

Source: ICAR-NBSS&LUP, Bengaluru

7.31. Land Suitability for Chrysanthemum





Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

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

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

LAND SUITABILITY FOR CHRYSANTHEMUM

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

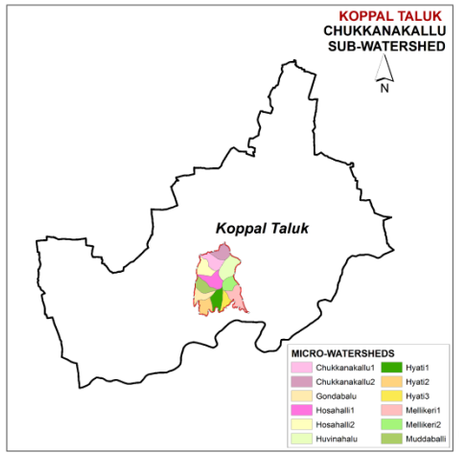
Suitability subclass	Area in ha (%)
S1	941 (14.5)
S2g	2026 (31.22)
S2r	104 (1.6)
S2rg	66 (1.02)
S2rw	9 (0.13)
S2tz	771 (11.88)
S3g	504 (7.76)
S3r	16 (0.24)
S3rg	45 (0.69)
S3rz	529 (8.15)
N1n	591 (9.11)
N2	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

8. Soil and Water Conservation Measures

8.1. Soil & Water Conservation Plan

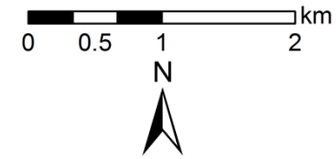


SOIL & WATER CONSERVATION PLAN

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT



References

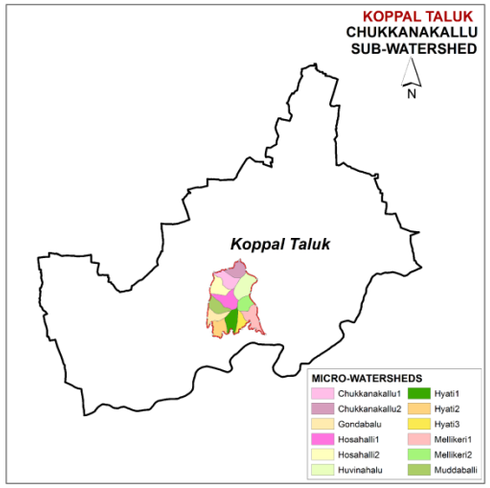
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

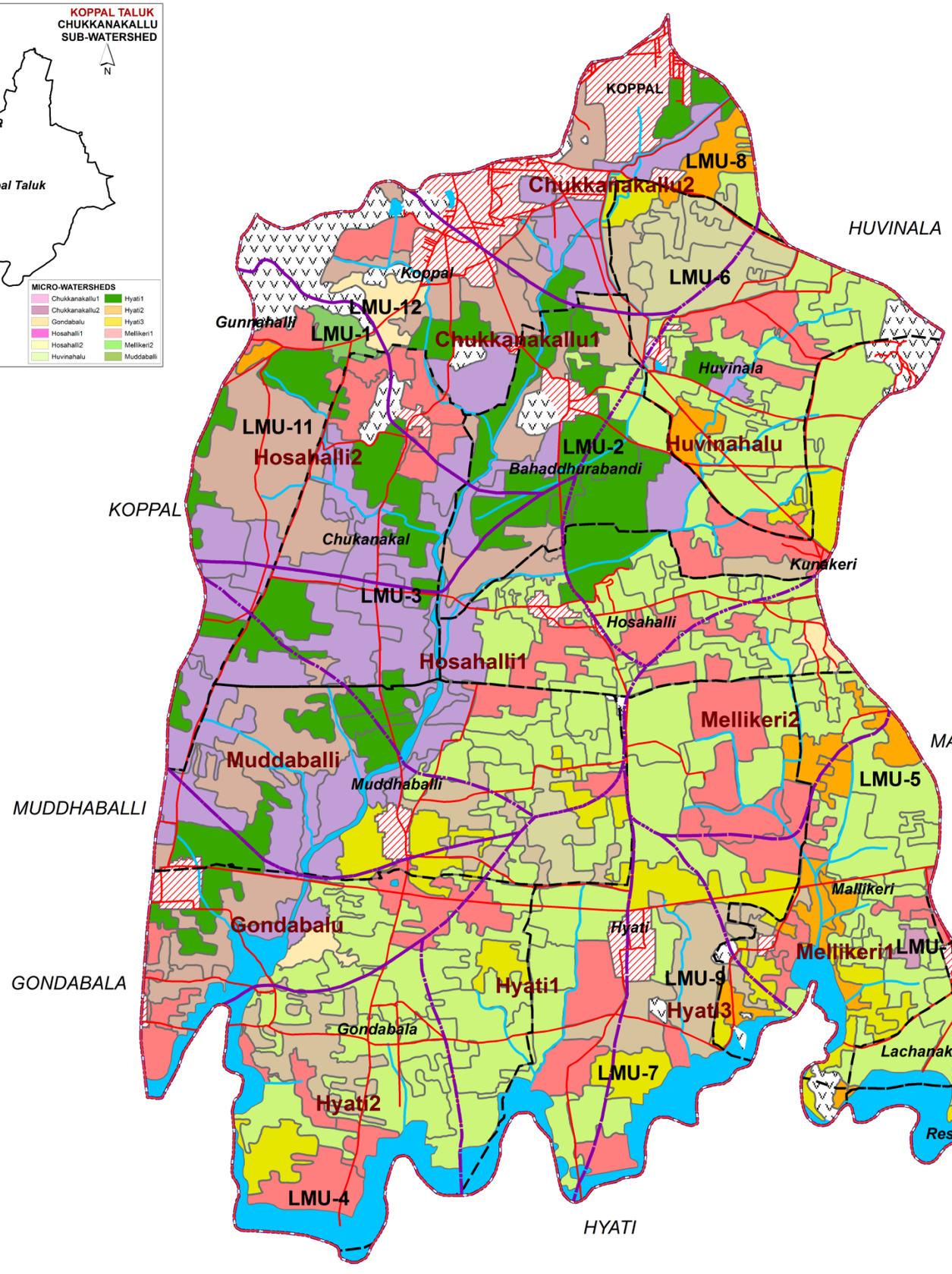
Legend	Area in ha (%)
Trench cum bunding	3045 (46.91)
Graded bunding	1693 (26.08)
Strengthening of existing bunds/bunding	863 (13.3)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

9. Land Management Units





LAND MANAGEMENT UNITS

Chukkanakallu Sub-watershed

(4D4A1Y : Area - 6489.64 ha)

KOPPAL TALUK & DISTRICT

0 0.5 1 2 km

N

References

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

LMU	Area in ha (%)
LMU-1	21 (0.32)
LMU-2	591 (9.11)
LMU-3	771 (11.88)
LMU-4	764 (11.77)
LMU-5	1829 (28.18)
LMU-6	176 (2.71)
LMU-7	348 (5.37)
LMU-8	170 (2.62)
LMU-9	333 (5.13)
LMU-10	9 (0.13)
LMU-11	529 (8.15)
LMU-12	61 (0.93)
Rock outcrops	217 (3.34)
Others*	673 (10.37)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: *Proposed Crop Plan for LMU's are given in Table*

10.Table. Proposed Crop Plan for Chukkanakallu Sub-watershed, Alavandi hobli, Koppal taluk, Koppal district based on soil-site–crop suitability assessment

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	440.TDGcB2 (Very deep, lowland sandy clay loam soils)	Maize, Sorghum, Groundnut, Sunflower, Bajra, Red gram, Mulberry	**Fruit crops**: : Amla, Tamarind **Vegetables:** Tomato, Chillies, Drumstick, Onion, Bhendi, Brinjal **Flowers:**Marigold, Chrysanthemum**,** Jasmine, Crossandra	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practises
2	331.RNKiB2g1 332.RNKmA1g1 333.RNKmB1 337.RNKmB2g1 354.NSPhA1 361.NSPmB1g1 370.GRHmA1 373.GRHmB2 396.BGPmB1 (Moderately shallow to deep, sodic clay 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
3	344.DRLmA1 348.DRLmB1 350.DRLmB2 351.DRLmB2g1 384.KVRiB2 386.KVRmA1 387.KVRmA1g1 388.KVRmB1 390.KVRmB2g1 367.BWTmB1 (Moderately deep to deep, black calcareous clay soils)	Maize, Sorghum, Sunflower, Bajra, Cotton, Red gram, Bengal gram, Soybean, Safflower, Linseed	**Fruit crops**: Pomegranate, Lime, Musambi, Custard apple **Vegetables:** Drumstick, Chillies, Bhendi, Coriander **Flowers:**Marigold, Chrysanthemum,	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practises

To be continued…

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
4	144.GHTiB1 155.BMKiB1g2 161.BSRhB2 170.CKMbB2g1 174.CKMhB1g1 196.KMHcA1 198.KMHhB1g1 201.KMHiB2 210.MNLmB2g1 211.JDGhB1g1 212.JDGiA1g1 458.JDGiB1 (Moderately deep to deep, red sandy clay to clay soils)	Maize, Sorghum, Groundnut, Sunflower, Bajra, Mulberry, Cotton, Red gram	**Fruit crops**: Mango, Sapota, Pomegranate, Amla, Cashew, Custard apple, Guava, Jackfruit, Jamun, Lime, Musambi, Tamarind **Vegetables:** Tomato, Chillies, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:** Marigold, Chrysanthemum**,** Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
5	105.HDHbB2g1 109.HDHcB1g1 111.HDHcB2g1 120.HDHhB1g1 122.HDHhB2 123.HDHhB2g1 127.HDHiB2 128.HDHiB2g1 216.BPRbB2 220.BPRcA1 230.BPRhB2 231.BPRhB2g1 235.BPRiA1 238.BPRiB1g1 239.BPRiB2 240.BPRmB2 252.NGPcB2g2 258.NGPhB1g1 260.NGPhB2 265.NGPiB2g1 268.GDPhB2 269.GDPiB2 459.BPRmB2g1 184.BDGhA1 (Moderately deep to deep, red gravelly sandy clay to clay soils)	Maize, Sorghum, Sunflower, Groundnut, Bajra, Cotton, Red gram	**Fruit crops** : Sapota, Pomegranate, Amla, Cashew, Guava, Custard apple, Jack fruit, Jamun, Lime, Musambi **Vegetables:** Tomato, Chilli, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)

To be continued…

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
6	293.NDLhA1g1 297.NDLiA1 300.NDLiB2 (Very deep, red gravelly sandy clay soils)	Maize, Sorghum, Sunflower, Groundnut, Bajra, Cotton, Red gram	**Fruit crops** : Mango, Tamarind, Sapota, Pomegranate, Amla, Cashew, Guava, Custard apple, Jack fruit, Jamun, Lime, Musambi **Vegetables:** Tomato, Chilli, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
7	272.HLKiA1 285.RTRcB2 286.RTRhA1 287.RTRiA1 288.RTRiB2 (Very deep, red clay soils)	Maize, Sorghum, Sunflower, Bajra, Mulberry, Cotton, Red gram, Horse gram, Field bean	**Fruit crops** :Mango, Sapota, Guava, Tamarind, Pomegranate, Lime, Musambi Cashew, Jackfruit, Jamun Custard apple, Amla **Vegetables:** Tomato, Chillies, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:**Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
8	60.TDHiB1 63.KGHcA1 68.KGHhB2 74.KTPiB1g1 100. HTIiB2 (Moderately shallow, red sandy clay to sandy clay loam soils)	Maize, Sorghum, Groundnut, Bajra, Cotton, Horse gram, Castor	**Fruit crops** : Amla, Custard apple **Vegetables:** Tomato, Chilli, Onion, Bhendi, Brinjal ,Curry leaves **Flowers:**Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)

To be continued…

LMU. No	Soil Map Units	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
9	43.LKRcB2g1 46.LKRhB1 53.LKRiB2 77.MKHcB2g1 82.MKHhB1g1 83.MKHhB1g2 85.MKHhB2g1 452.LKRhB2g1 (Moderately shallow, red gravelly sandy clay soils)	Bajra, Groundnut, Horse gram, Castor	**Fruit crops** : Amla, Custard apple **Vegetables:** Curry leaves **Flowers:** Marigold, Chrysanthemum	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
10	464.HNHhB2g1 (Moderately shallow, lowland sandy clay soils)	Maize, Sorghum, Groundnut, Bajra, Cotton, Bengal gram	**Fruit crops** : Amla, Custard apple **Vegetables:** Curry leaves, Tomato, Chilli, Onion, Bhendi, Brinjal **Flowers:**Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
11	303.MTLiB1g1 305.MTLiB2g2 307.MTLmB1 308.MTLmB1g1 310.MTLmB2 311.MTLmB2g1 (Shallow, black calcareous clay soils)	-	Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope
12	25.HRVhB2 37.CSRhB2g1 472.ABRiB2g2 (Shallow, red gravelly sandy clay to sandy clay loams soils)	-	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 Chukkanakallu Sub-Watershed of Koppal Taluk, Koppal 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 Chukkanakallu Sub-Watershed of Koppal Taluk, Koppal 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

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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
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INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Chukkanakallu sub-watershed (4D4A1Y) in Koppal taluk, Koppal district, has been undertaken for integrated planning, development and management at the level of soil mapping units.

- Chukkanakallu sub-watershed is located between $15^0$21'12''–$15^0$14'31'' North latitudes and $76^0$12'18''–$76^0$7'7'' East longitudes, covering an area of about 6457 ha.

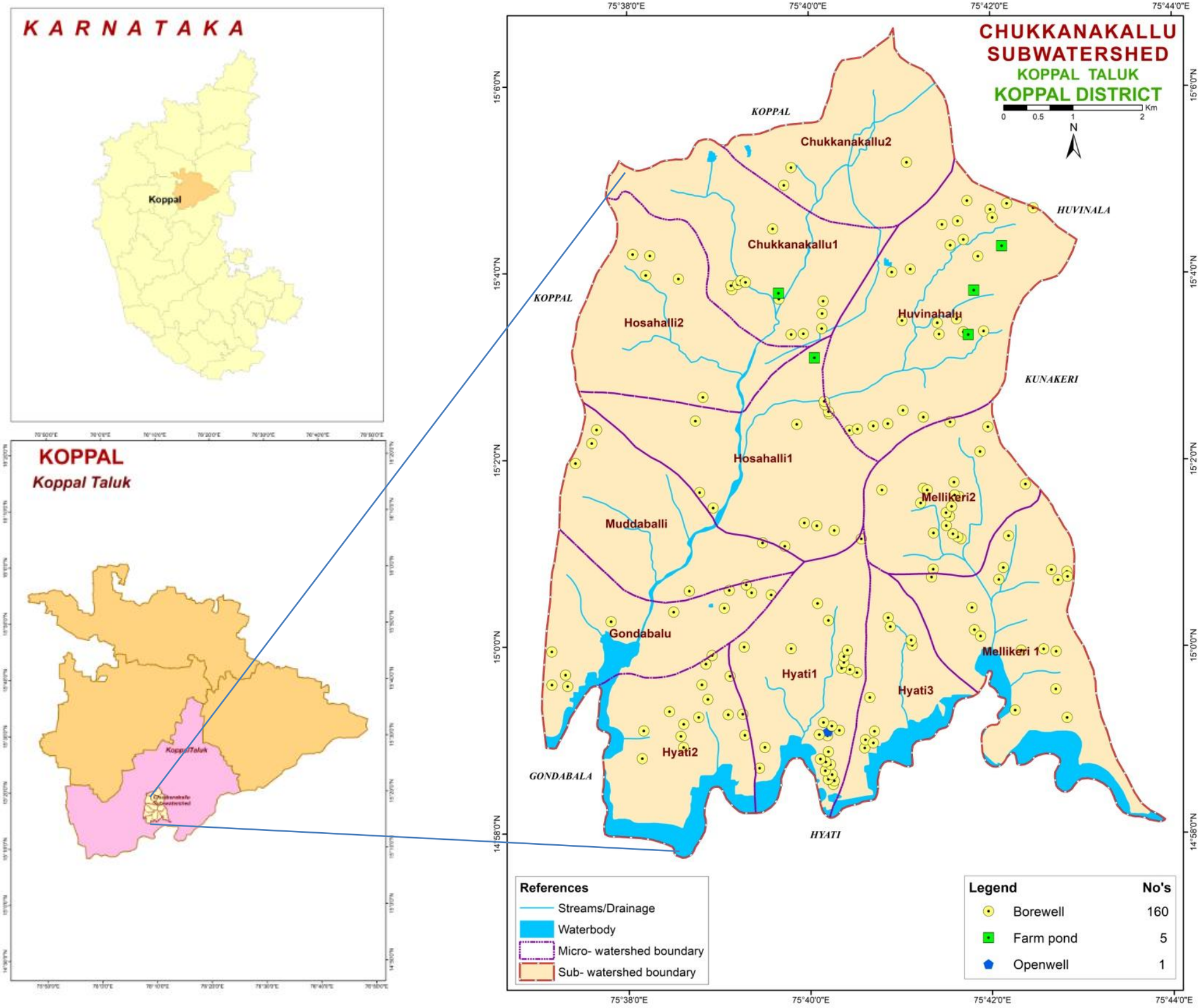
- This sub-watershed encompasses 12 MWS namely, Chukkanakallu-1 (4D4A1Y1b), Chukkanakallu-2 (4D4A1Y1a), Gondabalu (4D4A1Y1g), Hosahalli-1 (4D4A1Y1e), Hosahalli-2 (4D4A1Y1c), Huvinahalu (4D4A1Y1d), Hyati-1 (4D4A1Y2b), Hyati-2 (4D4A1Y2a), Hyati-3 (4D4A1Y2c), Mellikeri-1 (4D4A1Y2e), Mellikeri-2 (4D4A1Y2d) and Muddaballi (4D4A1Y1f) micro watersheds. Land Resource Inventory (LRI) was generated for all the twelve micro-watersheds.

- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 631 mm.

- In this sub-watershed major *kharif* crops grown are Maize, Cotton, Sunflower, Bajra, Groundnut, Redgram and major *rabi* crops are Sorghum, Bengal gram and Safflower.

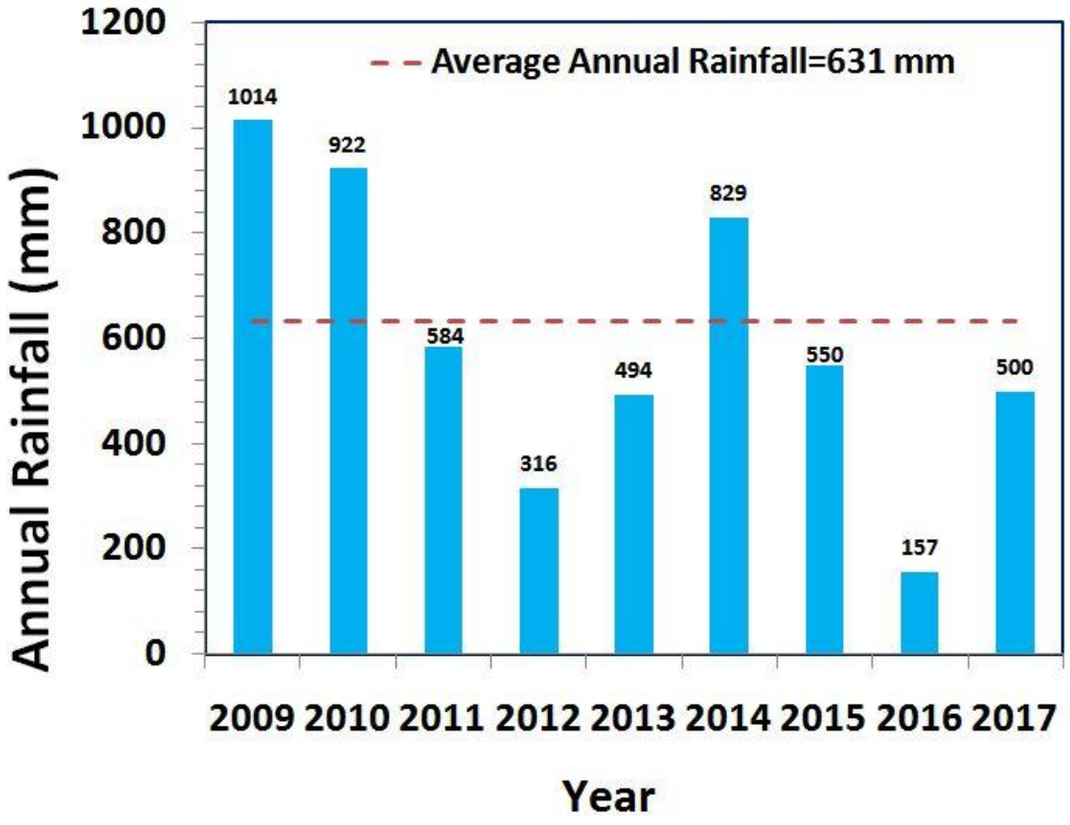
- Hydrological components namely rainfall (annual, *kharif*, *rabi* and summer*)*, PET, AET, runoff, surface soil moisture, ground water status and water balance are presented.

LOCATION MAP OF CHUKKANAKALLU SUB-WATERSHED



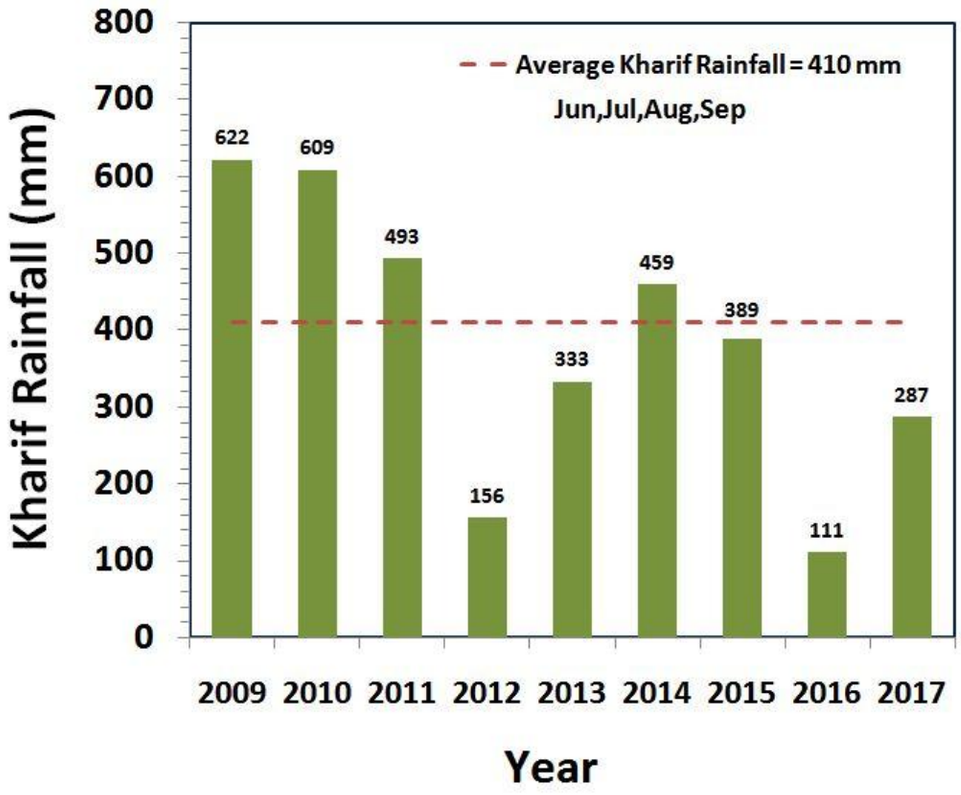
Soil & Water Conservation Structures in Chukkanakallu Sub-watershed, Koppal taluk, Koppal district

RAINFALL INDEX

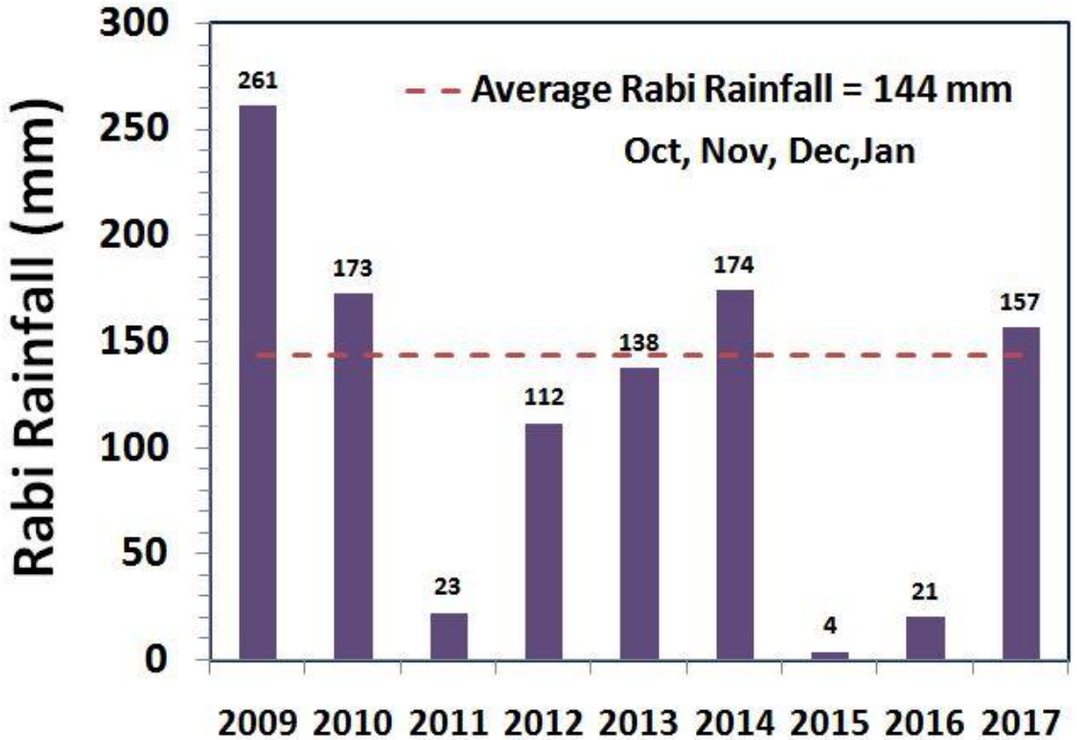


The average annual rainfall (1960-2014) recorded at the Koppal station in Koppal taluk of Koppal district is 631 mm. The annual rainfall at Koppal station (Hobli H.Q.) is presented. During the years 2011, 2012, 2013, 2015 and 2016 the annual rainfall was deficient by 7%, 50%, 22%, 13%, 75% and 21% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 65% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2012, 2013, 2015, 2016 and 2017 the *kharif* rainfall was deficient by 62%, 19%, 5%, 73 and 30% respectively.

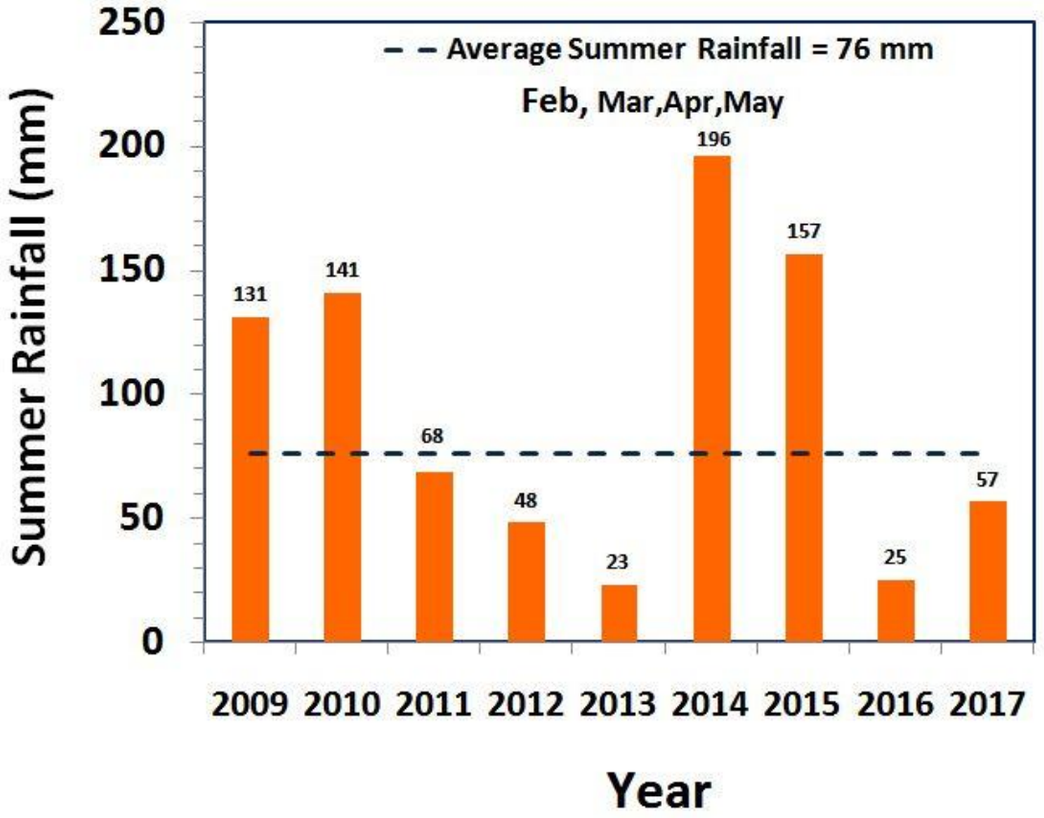


RAINFALL INDEX

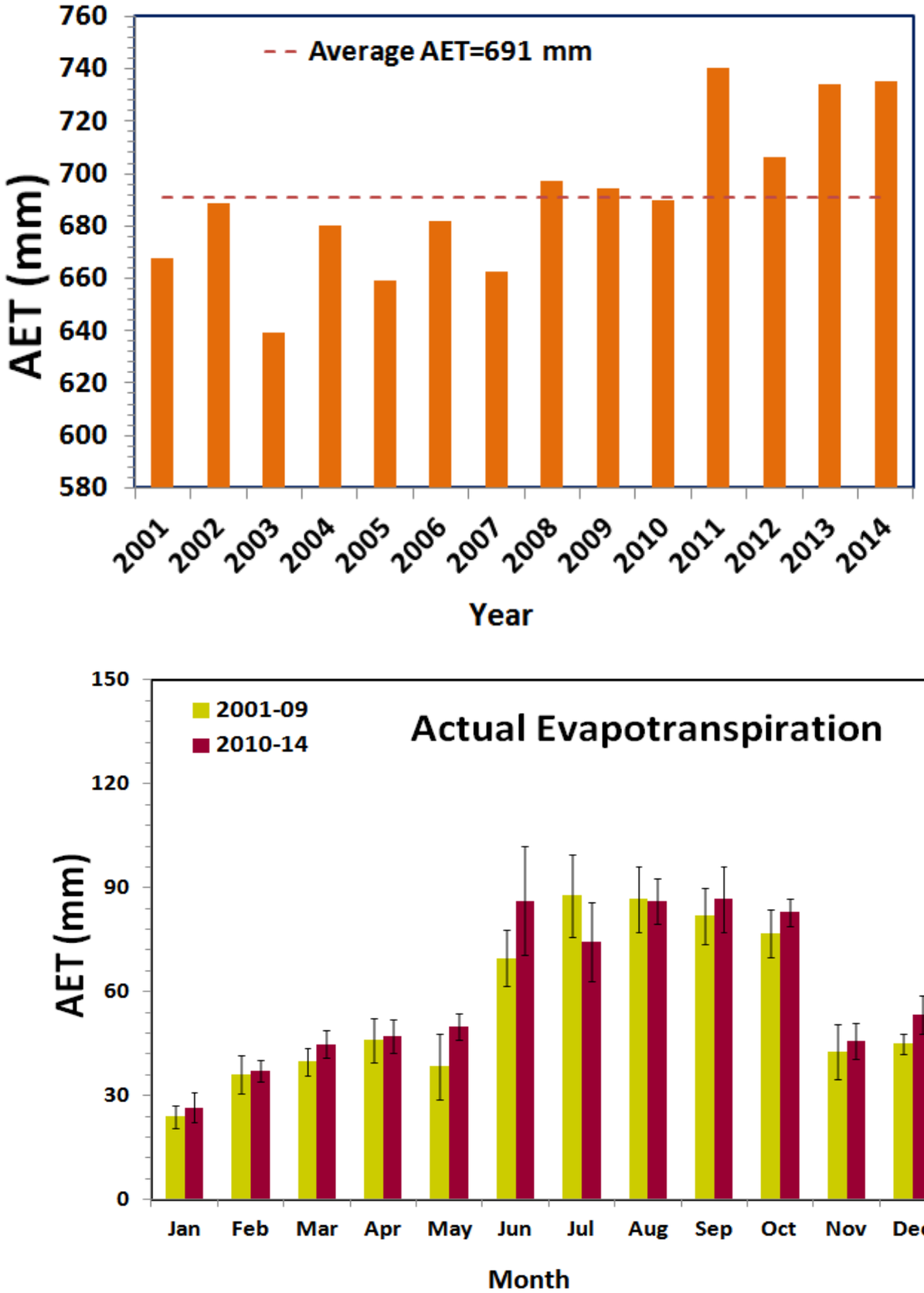


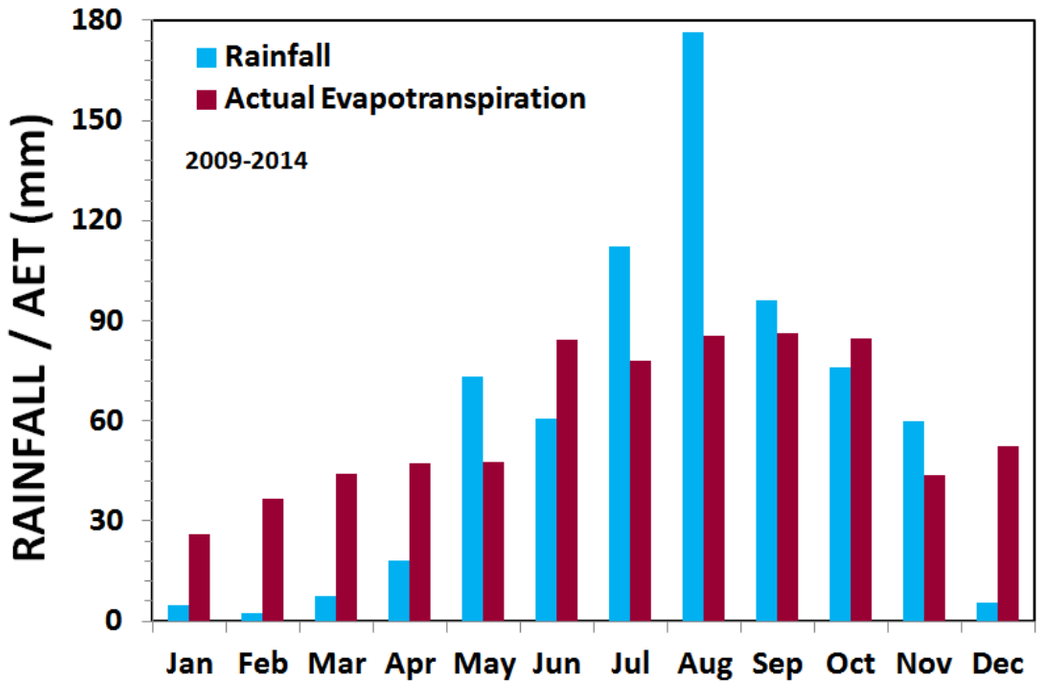
The average *rabi* rainfall (Oct-Jan) is about 20% of the average annual rainfall. During the years 2011, 2012, 2013, 2015 and 2016 the *rabi* rainfall was deficient by 84%, 22%, 4%, 97 and 85% respectively.

The average summer rainfall (Feb-May) is about 15% of the average annual rainfall.



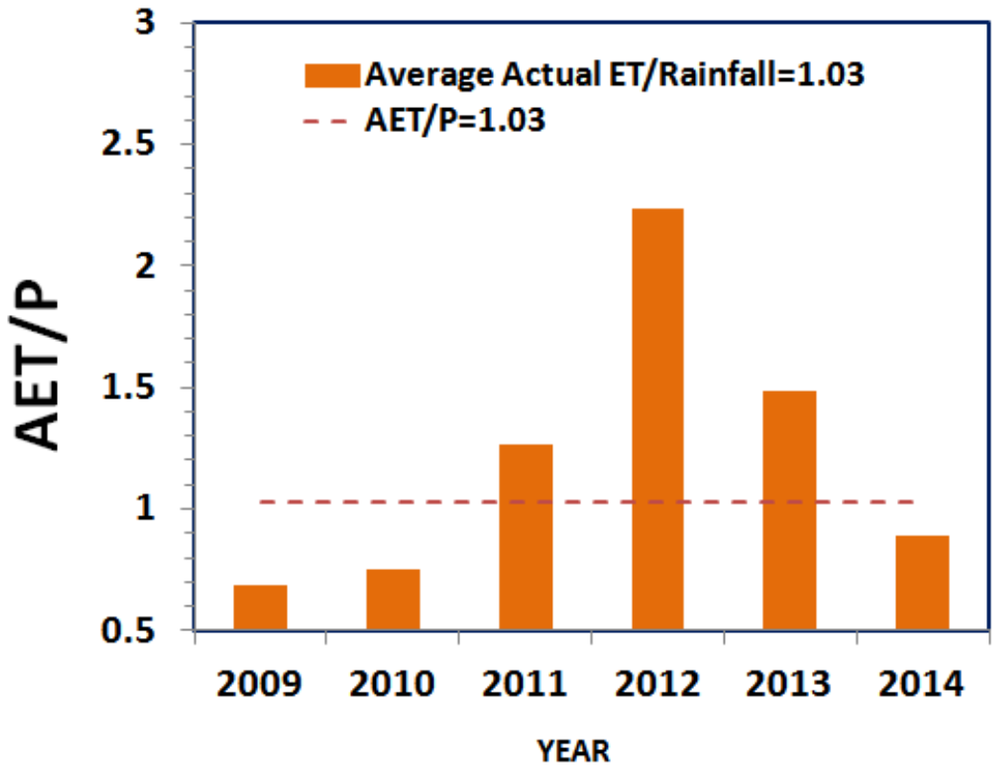
EVAPOTRANSPIRATION



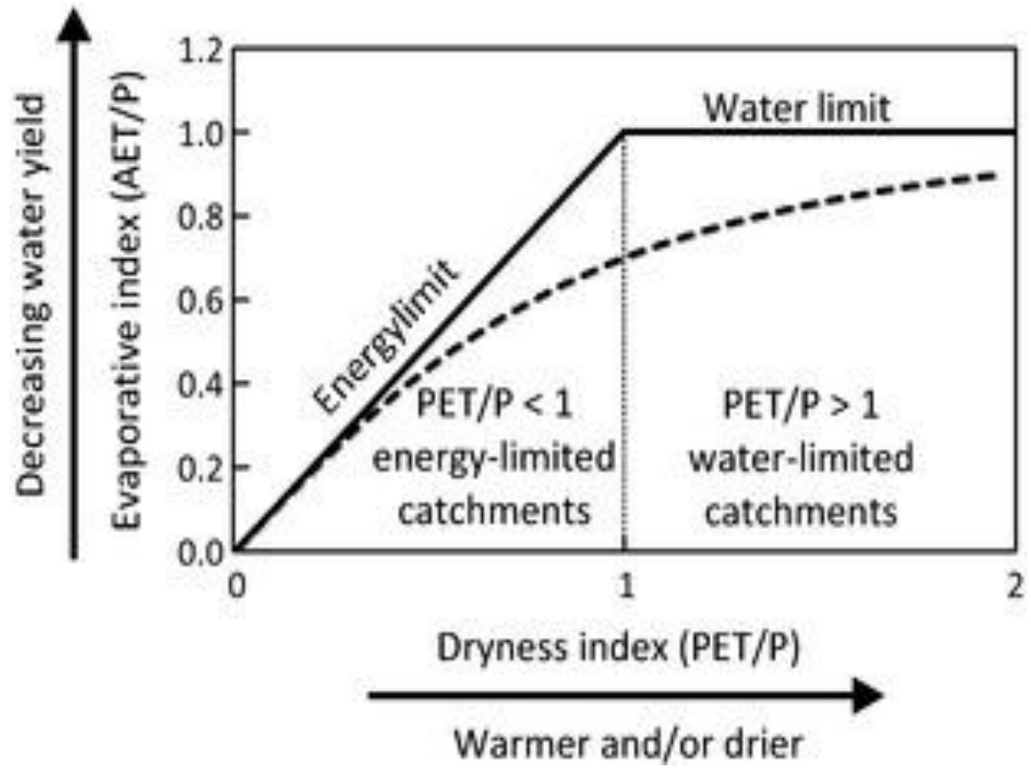


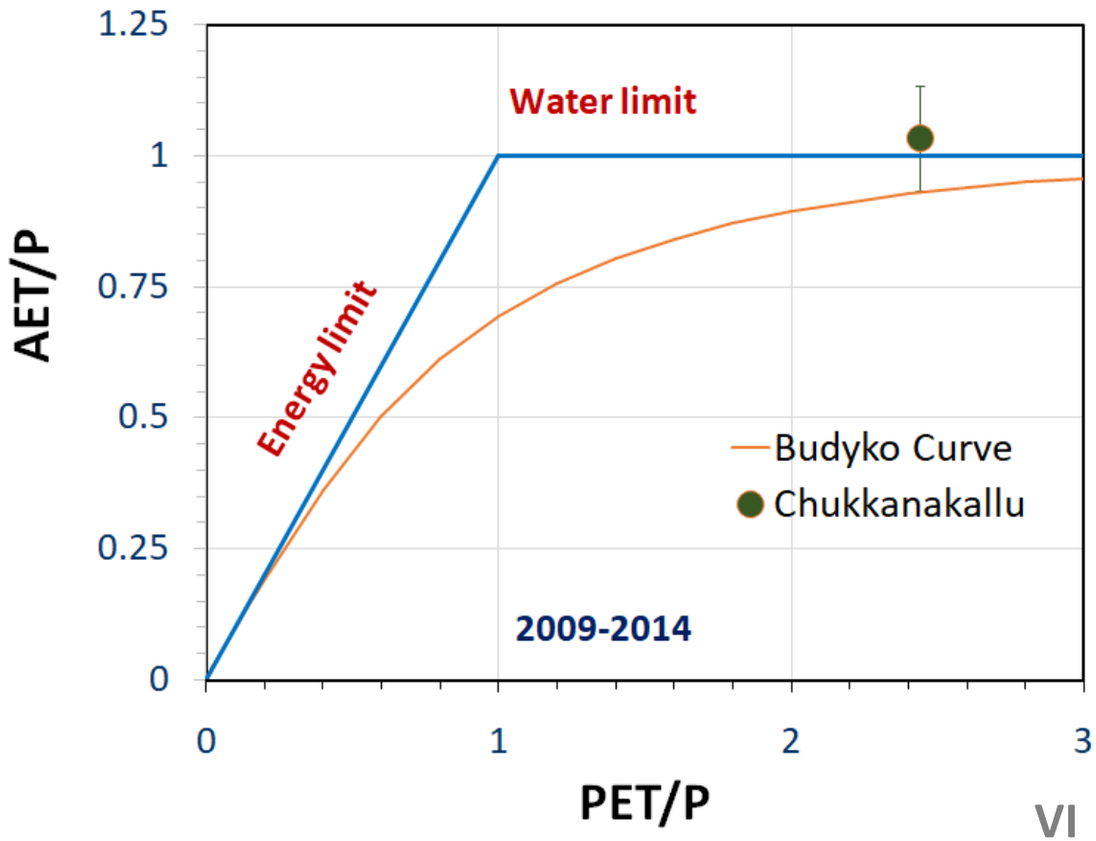
The average annual actual ET is higher than the average rainfall. During *kharif* average rainfall and ET was found to be 410 mm and 334 mm respectively, whereas in *rabi* it was about 144 mm and 207 mm. In comparison to the 2001-2009, the annual ET increased by 6 % during 2010-2014 compared to 2001-2009.

EVAPOTRANSPIRATION INDEX

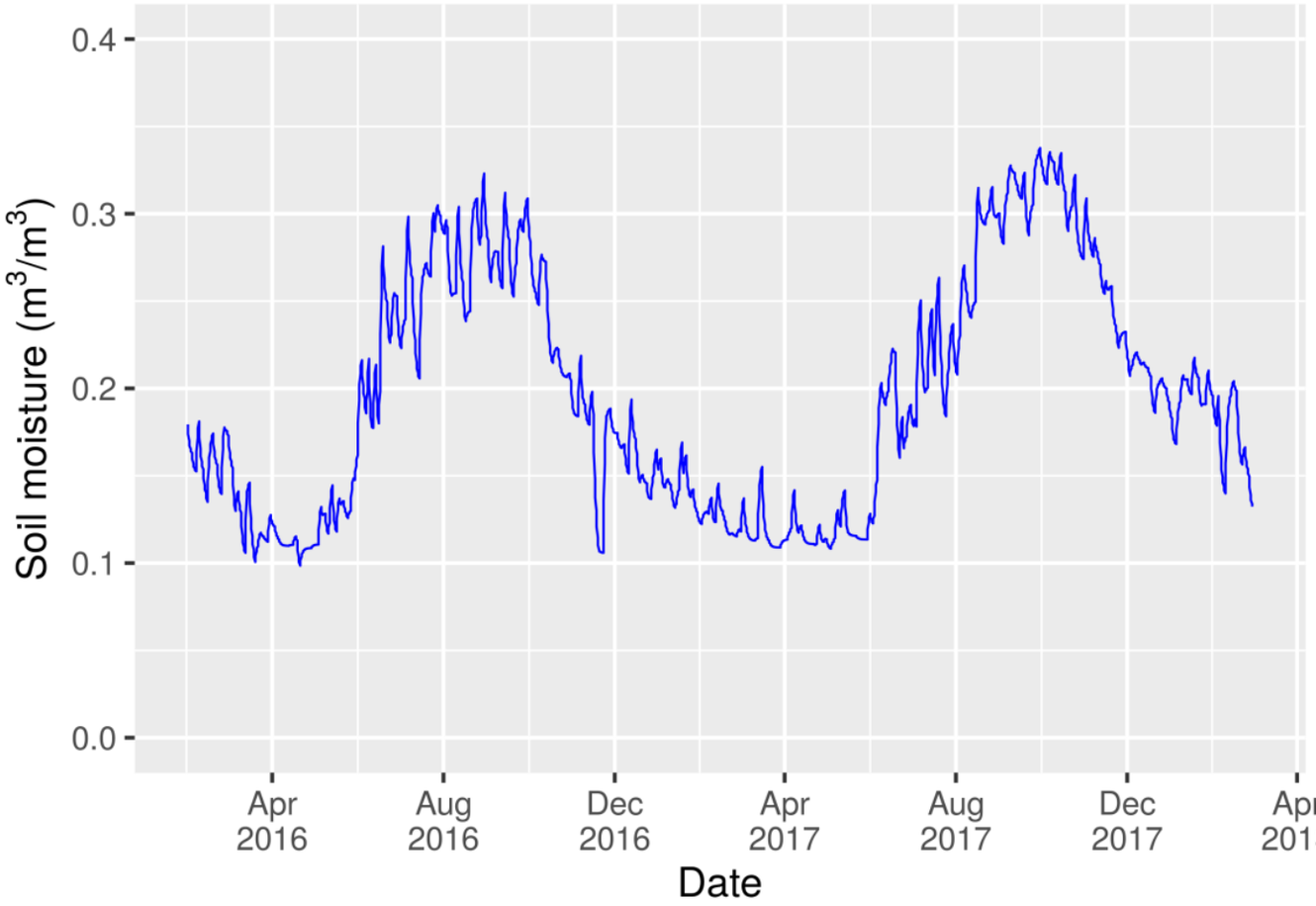


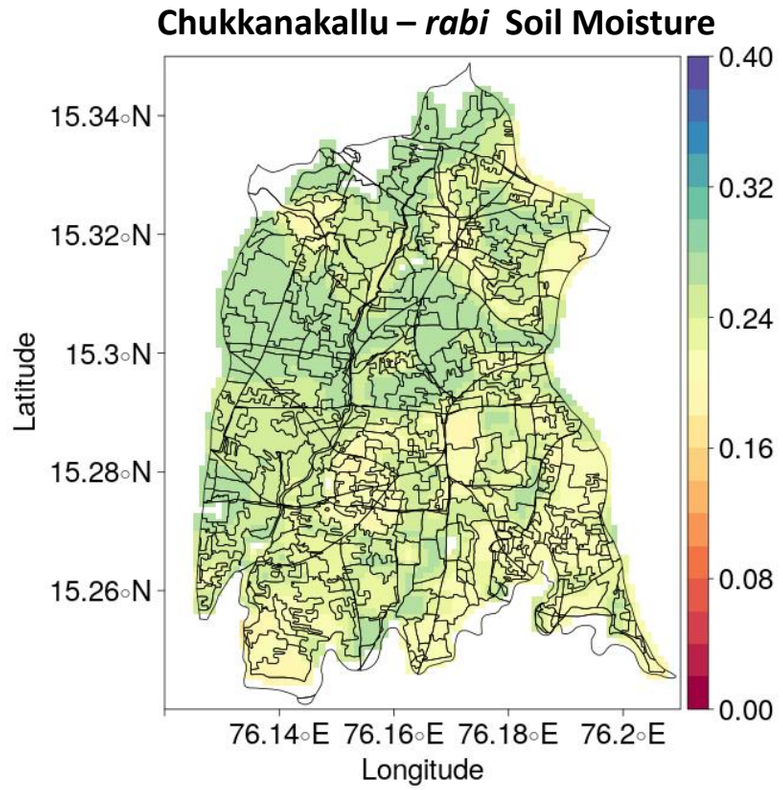
The average AET/P ratio was about 103%, which is higher than the sustainable limit of about 80%. Even during extremely lower rainfall year of 2012, AET was 690 mm. This suggests the presence of water storage and utilization from other sources such as groundwater, which buffered the lower rainfall.



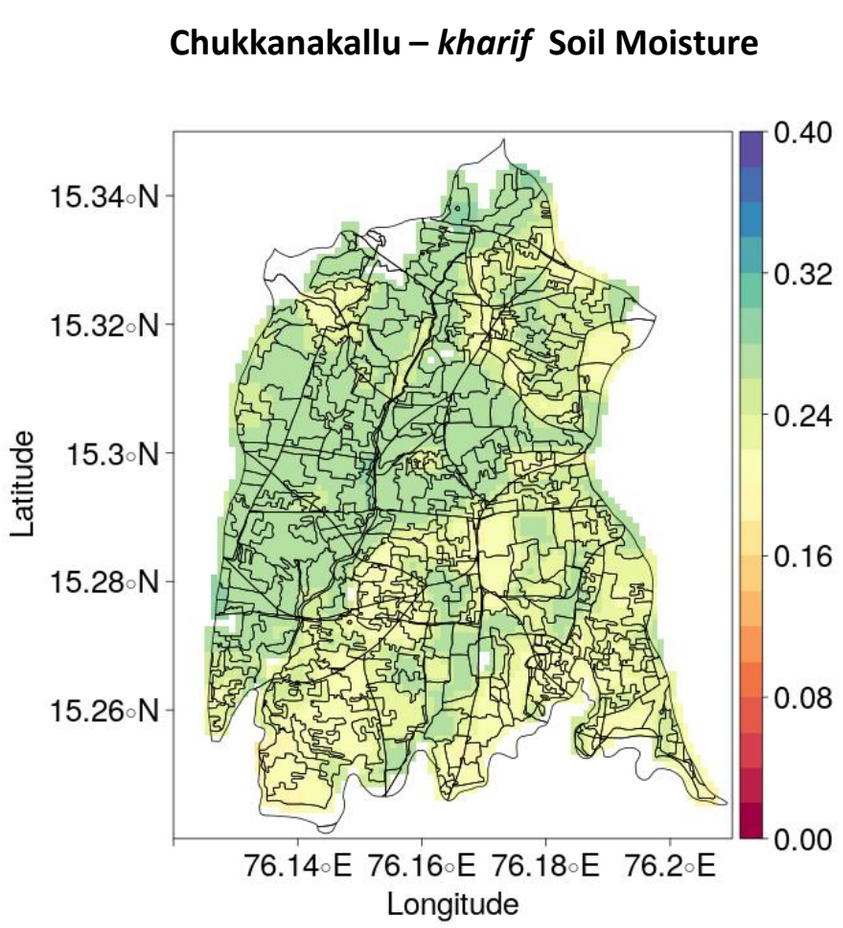


SATELLITE RETRIEVED SOIL MOISTURE





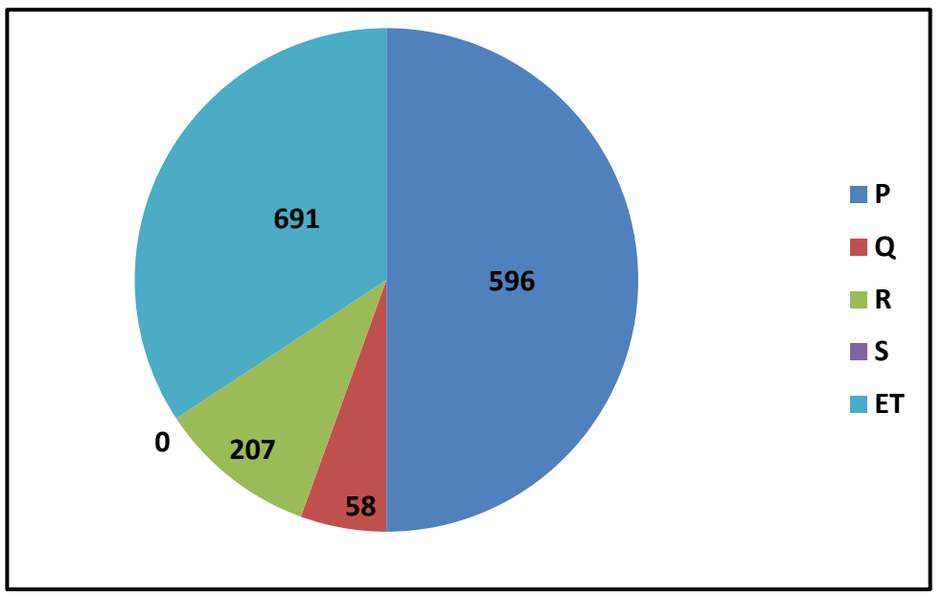
The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 28-32% in *kharif* and 17-32% in *rabi* seasons of 2016 and 13-32% in *kharif* and 17-34% in *rabi* seasons of 2017.



Water Balance

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

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- S = Storage change in the watershed

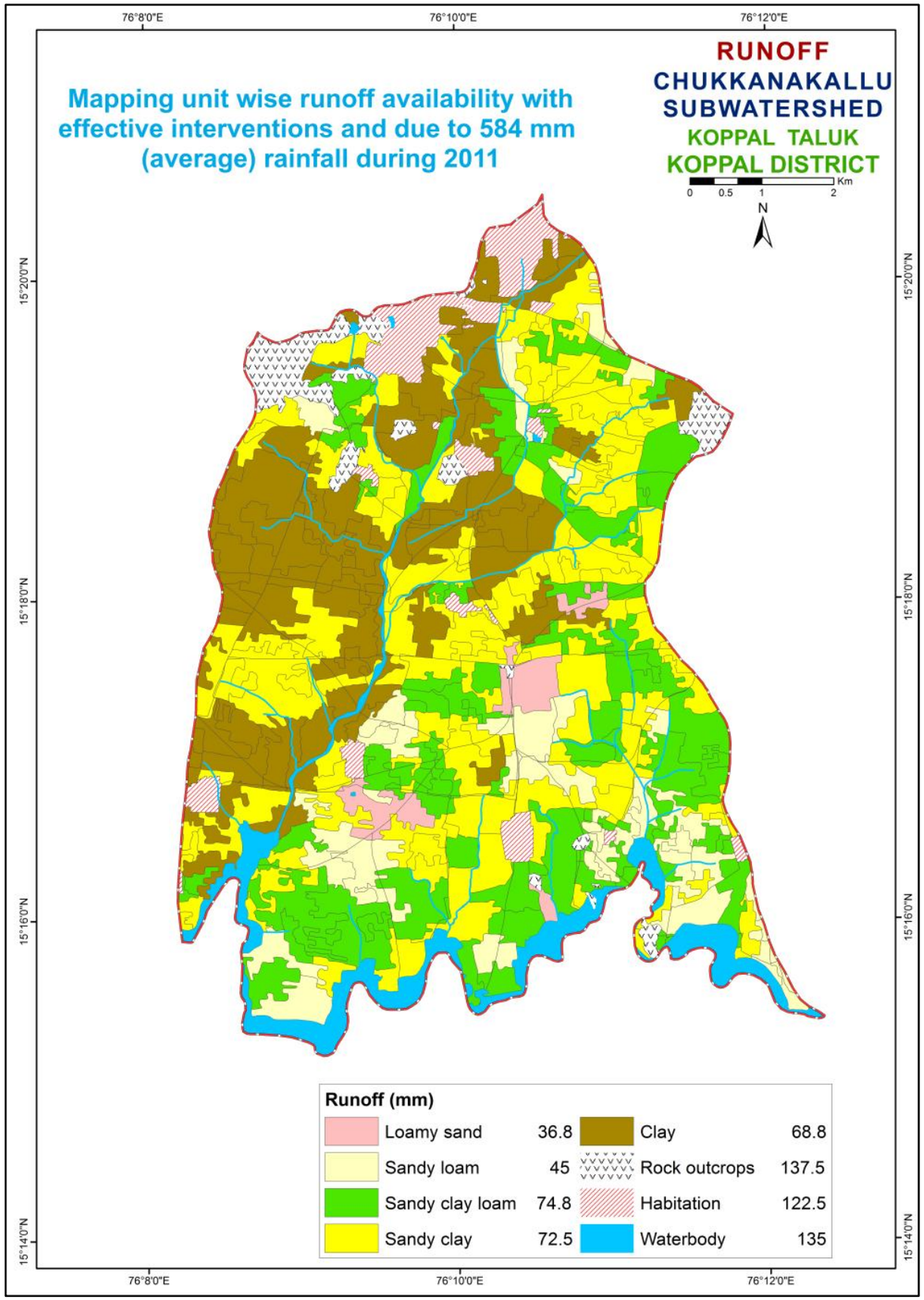


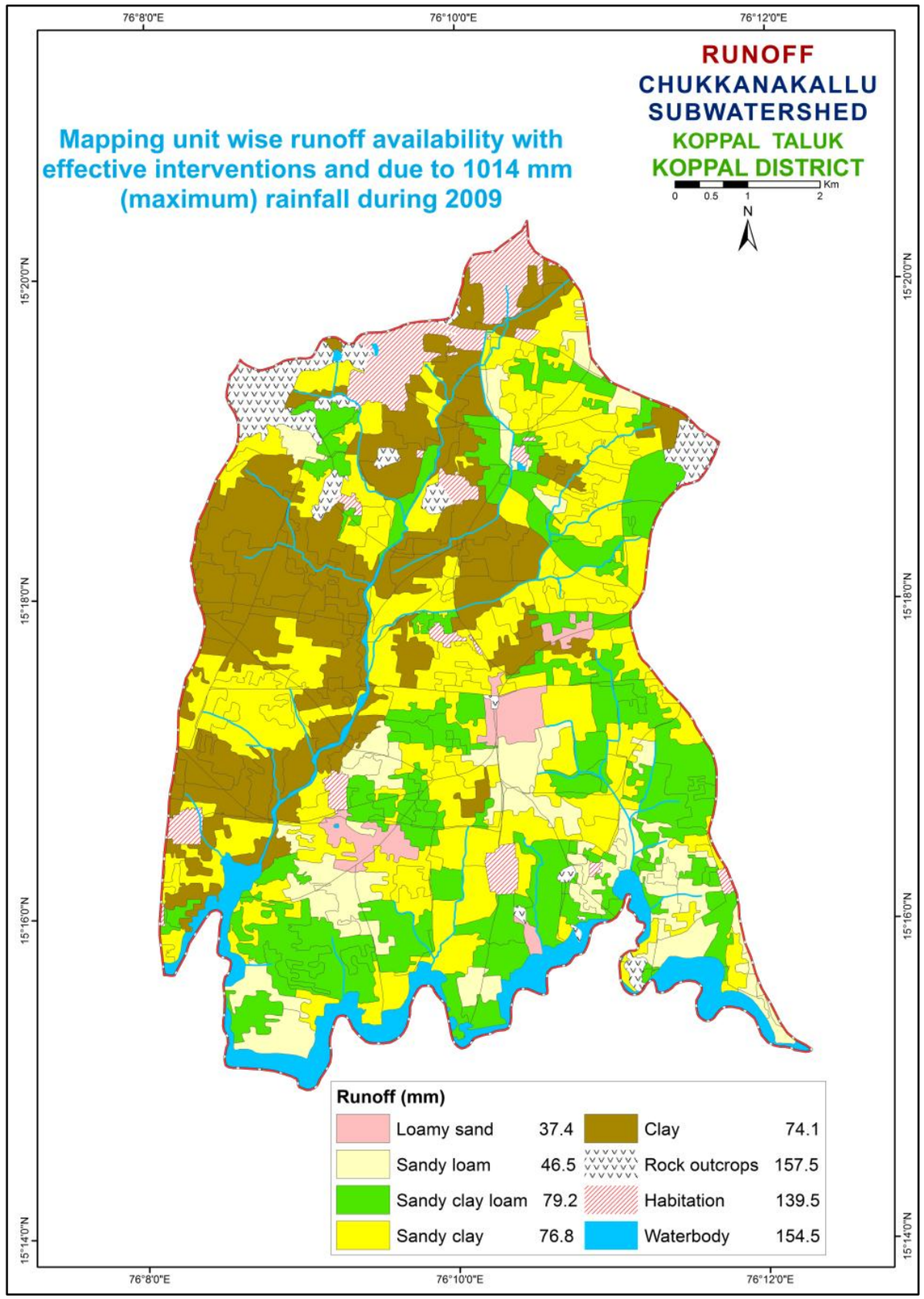
During July-September months, Precipitation is higher than Evapotranspiration, hence Runoff can occur in the watershed.

P = 596 mm (average of 2009-2017) ET = 691 mm R = 207 mm S = 0 mm Q = 58 mm

Sl. No.	Parameters	Average_ 2011 (mm)	Maximum_ 2009 (mm)
1.	Rainfall	584	1014
2.	Runoff availability with existing conditions	102.45	112
3.	Runoff availability with effective interventions	76.62	83.00
4.	Runoff allowed as environmental flow at the outlet	22.99	25.00
5.	Runoff excess for harvesting by construction of structures	53.64	57.97

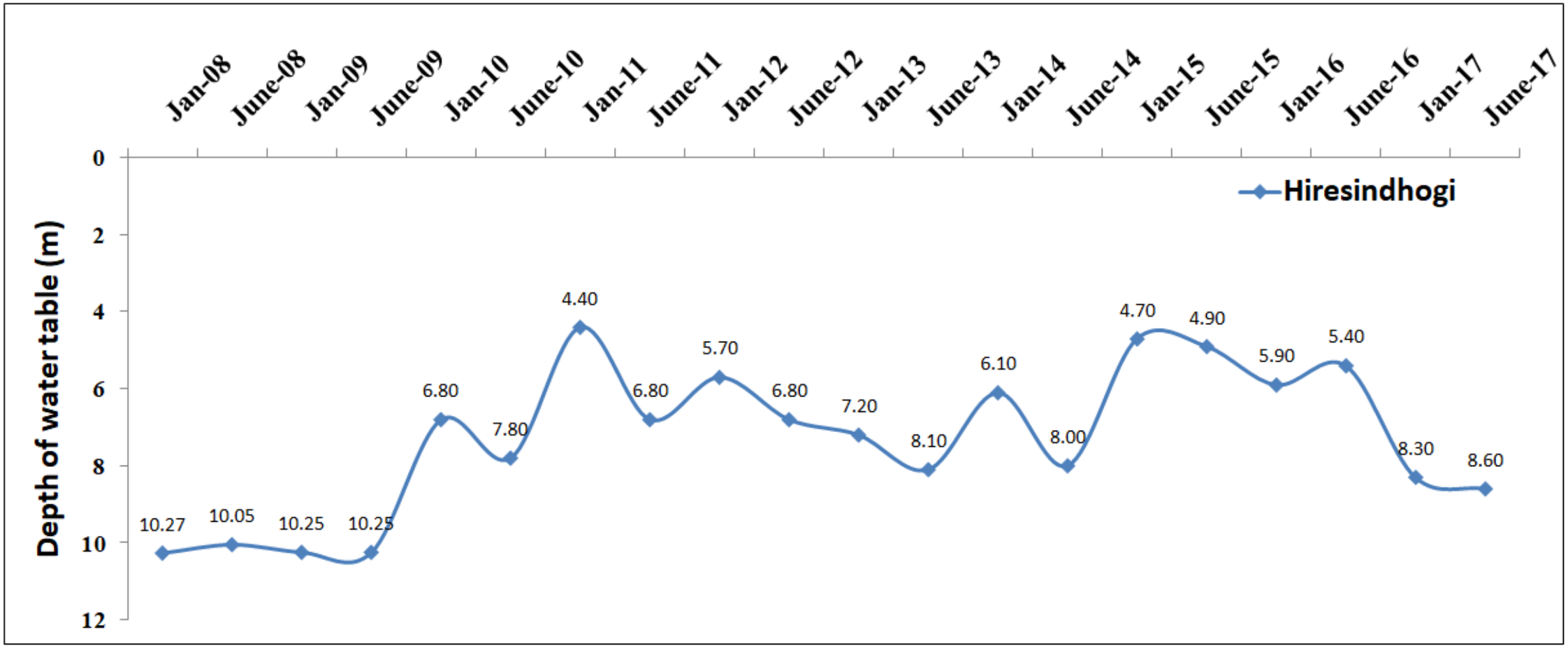
RUNOFF


RUNOFF
CHUKKANAKALLU
SUBWATERSHED
KOPPAL TALUK
KOPPAL DISTRICT
Mapping unit wise runoff availability with effective interventions and due to 584 mm (average) rainfall during 2011
0 0.5 1 2 Km
N
76°8'0"E
76°10'0"E
76°12'0"E
15°20'0"N
15°18'0"N
15°16'0"N
15°14'0"N
Runoff (mm)
Loamy sand 36.8
Sandy loam 45
Sandy clay loam 74.8
Sandy clay 72.5
Clay 68.8
Rock outcrops 137.5
Habitation 122.5
Waterbody 135


RUNOFF
CHUKKANAKALLU
SUBWATERSHED
KOPPAL TALUK
KOPPAL DISTRICT
Mapping unit wise runoff availability with effective interventions and due to 1014 mm (maximum) rainfall during 2009
0 0.5 1 2 Km
N
76°8'0"E
76°10'0"E
76°12'0"E
15°20'0"N
15°18'0"N
15°16'0"N
15°14'0"N
Runoff (mm)
Loamy sand 37.4
Sandy loam 46.5
Sandy clay loam 79.2
Sandy clay 76.8
Clay 74.1
Rock outcrops 157.5
Habitation 139.5
Waterbody 154.5

GROUND WATER STATUS

HIRESHINDHOGI STATION



The total number of wells present in Chukkanakallu Sub-watershed as per LRI data is 161. The above graph depicts the groundwater levels during the years 2008-2009 was declined whereas groundwater levels in 2010-2016 was increased and gradually decreased in 2017.

X

SUMMARY

- The average annual rainfall of 631 mm in the Chukkanakallu sub-watershed as recorded from the Koppal station data by KSNDMC.
- 65 percent, 20 percent and 15 percent of the annual rainfall occurs during *kharif, rabi* and Summer seasons respectively and exhibited a higher temporal variability.
- The evapotranspiration estimation tool developed indicated that the watershed water balance is about to cross sustainable limit as average ET almost approached the average annual rainfall.
- The estimated runoff available to use is 58 mm for an average annual rainfall of 596 mm (2009-2017). The utilizable groundwater is 145 mm (70% of 207 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (0 mm) and utilizable runoff plus recharge is 203 (=145+58+0)
- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 541 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 676 mm (i.e. 125% of AET). This demand for the two seasons is higher by 473 mm, i.e. (676-203). The AET in June-Sept months is 70% of rainfall. Hence, there is slightly less opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.
- The total number of wells present in Chukkanakallu Sub-watershed as per LRI data is 161. The above graph depicts the groundwater levels during the years 2008-2009 was declined whereas groundwater levels in 2010-2016 was increased and gradually decreased in 2017.