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ICAR - NBSS & LUP

ICAR-NBSS&LUP Sujala SWS-LRI Atlas No. 69

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

Sujala – III

Karnataka Watershed Development Project- II
Funded by World Bank



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

About ICAR - NBSS&LUP

The ICAR-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 optimising 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 Mattimadu Sub-watershed for Watershed Planning and Development Chitapur Taluk, Kalaburagi District, Karnataka (AESR 6.2)

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How to read and use the Atlas

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

This atlas contains the basic information on kinds of soils, their geographic distribution, characteristics and classification. The soil map and soil based thematic maps derived from soils data on soil depth, soil gravelliness, slope, land suitability for various crops and land use 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 watershed.

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.

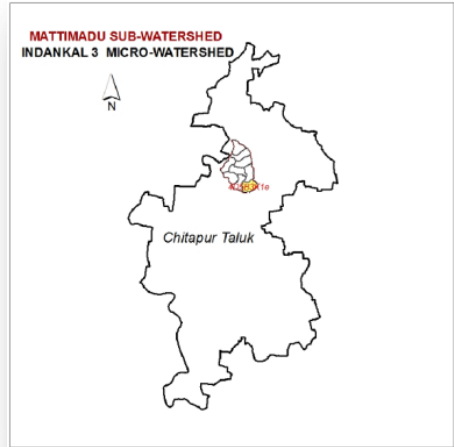
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

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.

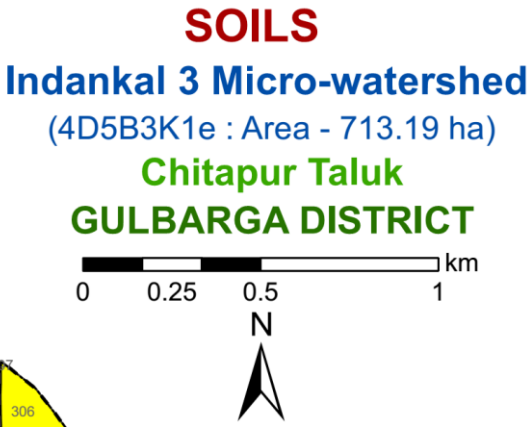
Inset map

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

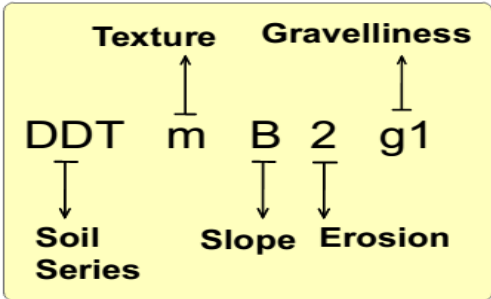
References	
	Streams/Drainage
	Road/Cart track
	Habitation
	Waterbody
	Land parcel with No's
	Village boundary
	Micro-watershed boundary

Soil Phases	Area in ha (%)
1, DDTmB1	185 (25.99)
2, DDTmB2	201 (28.23)
3, DDTmB2g1	11 (1.58)
4, DDTmC3	9 (1.21)
5, DRGmB1	72 (10.07)
6, DRGmB2	70 (9.8)
7, MTMmB1	24 (3.42)
8, MTMmB1g1	65 (9.14)
9, MTMmB2	14 (1.9)
10, MTMmC2g1	18 (2.55)
11, MTMmC3	15 (2.04)
12, TNHmC3	14 (2.01)
13, Railway	4 (0.51)
14, Others*	11 (1.54)

* - Waterbody

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 (LMU)

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

Legend	Area in ha (%)
	LMU-1 14 (2.01)
	LMU-2 136 (19.06)
	LMU-3 548 (76.88)
	Railway 4 (0.51)
	Others* 11 (1.54)

* - Waterbody

Map key

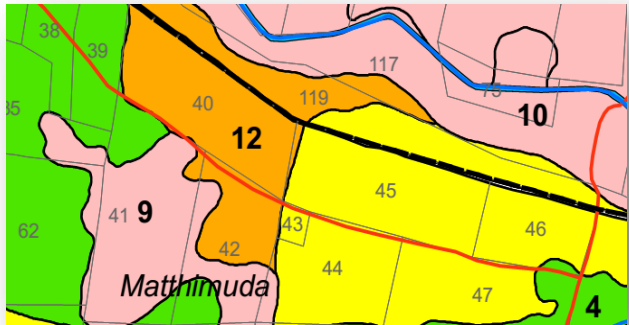
There are many thematic types to be differentiated on the map solely based on colour. Therefore soils and suitability types and their limitations are distinguished by colours with a combination of alpha-numeric characters.

KEY	
TEXTURE	
m	Clay
SLOPE	
B	Very gently sloping (1-3%)
C	Gently sloping (3-5%)
EROSION	
1	Slight
2	Moderate
3	Severe
GRAVELLINESS	
g1	Gravelly (15-35 %)
DEPTH	
TNH	Moderately shallow (50-75 cm)
MTM	Moderately deep (75-100 cm)
DRG	Deep (100-150 cm)
DDT	Very deep (>150 cm)

Key	
S1	Highly Suitable
S2	Moderately Suitable
N	Not Suitable
Limitations	
I	topography
r	rooting condition

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.



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.

Gulbarga popularly known as Kalaburgi is located in the Northern part of the state and lies between 17° 35' and 17° 45' North latitude and between 76° 10' and 77° 45' east longitude. The district is biggest district in the state covering 8.49 % of the area. It has Bijapur district and Sholapur district of Maharashtra on the West, Bidar district and Osmanabad district of Maharashtra on the North, Raichur district on the South. The district has total geographical area of 16174 sq. kms. Major food crops grown in the district are pigeon pea, sorghum, bajra, and paddy. Commercial crops are sugarcane and cotton. Oilseed crops are groundnut and sunflower. The district economy is dominantly agricultural and nearly 75 per cent of population living in the rural areas are dependent on agriculture. Major geology in the district comprise of Deccan trap (basalt), followed by limestone. Laterite and shale were also noticed in patches.

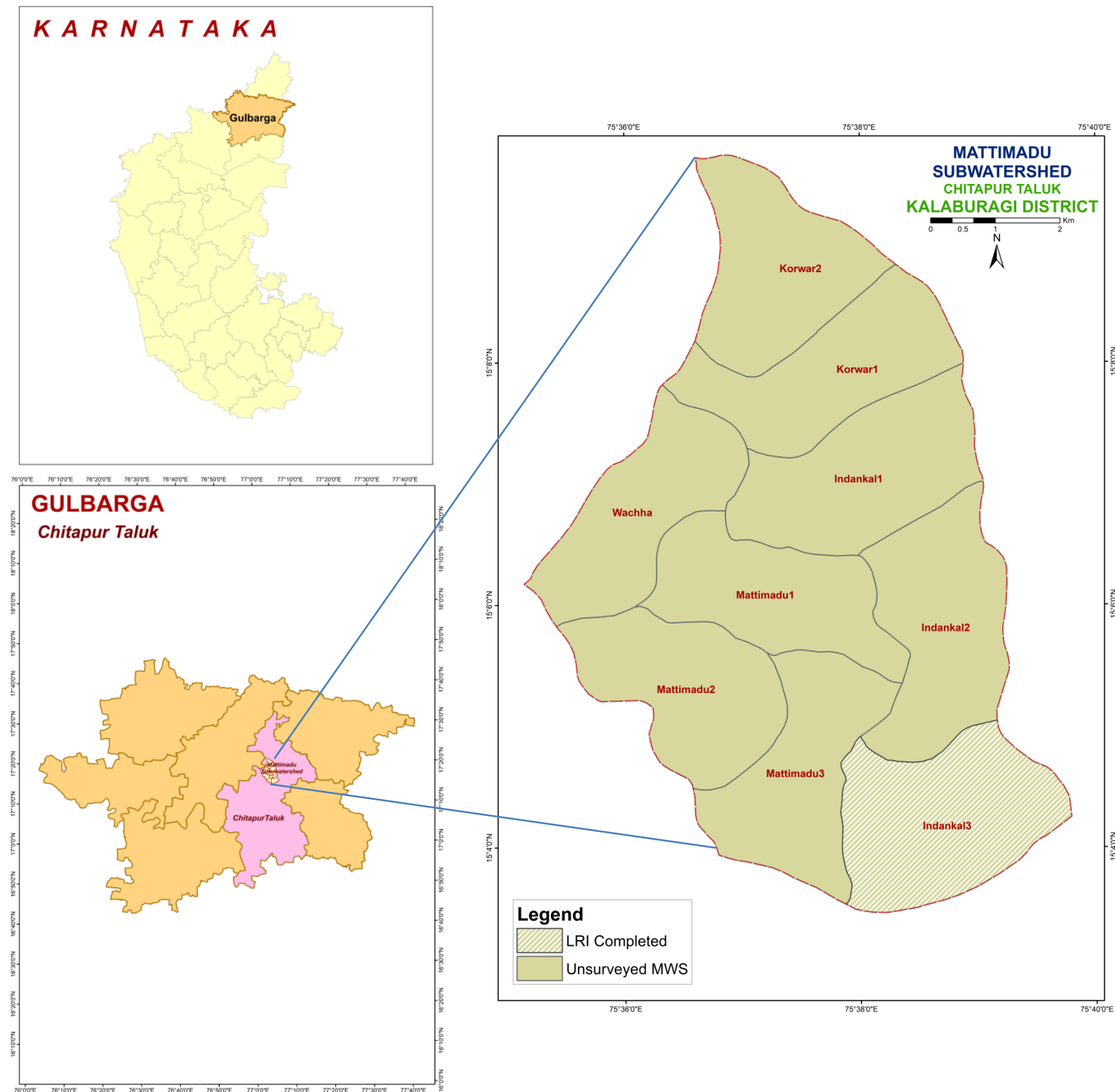
As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of LRI for the Indankal-3 micro-watershed. Mattimadu sub-watershed in Chitapur Taluk, Gulbarga District was selected for data base generation under batch V of Sujala III project. This sub-watershed encompasses of 9 MWs namely, Indankal-1 (4D5B3K1c), Indankal-2 (4D5B3K1d), Indankal-3 (4D5B3K1e), Korwar-1 (4D5B3K1b), Korwar-2 (4D5B3K1a), Mattimadu-1 (4D5B3K2b), Mattimadu-2 (4D5B3K2c), Mattimadu-3 (4D5B3K2d) and Wachha (4D5B3K2a) micro watersheds. Land Resource Inventory (LRI) was generated for one micro watershed (Indankal3 - 4D5B3K1e) among the nine micro-watersheds.

The major landforms identified in the micro-watershed (Indankal3 - 4D5B3K1e) of Mattimadu 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 Indankal3 (4D5B3K1e) micro-watershed in the Mattimadu sub-watershed during February-March 2015 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.

LOCATION AND EXTENT

LOCATION MAP OF MATTIMADU SUB-WATERSHED



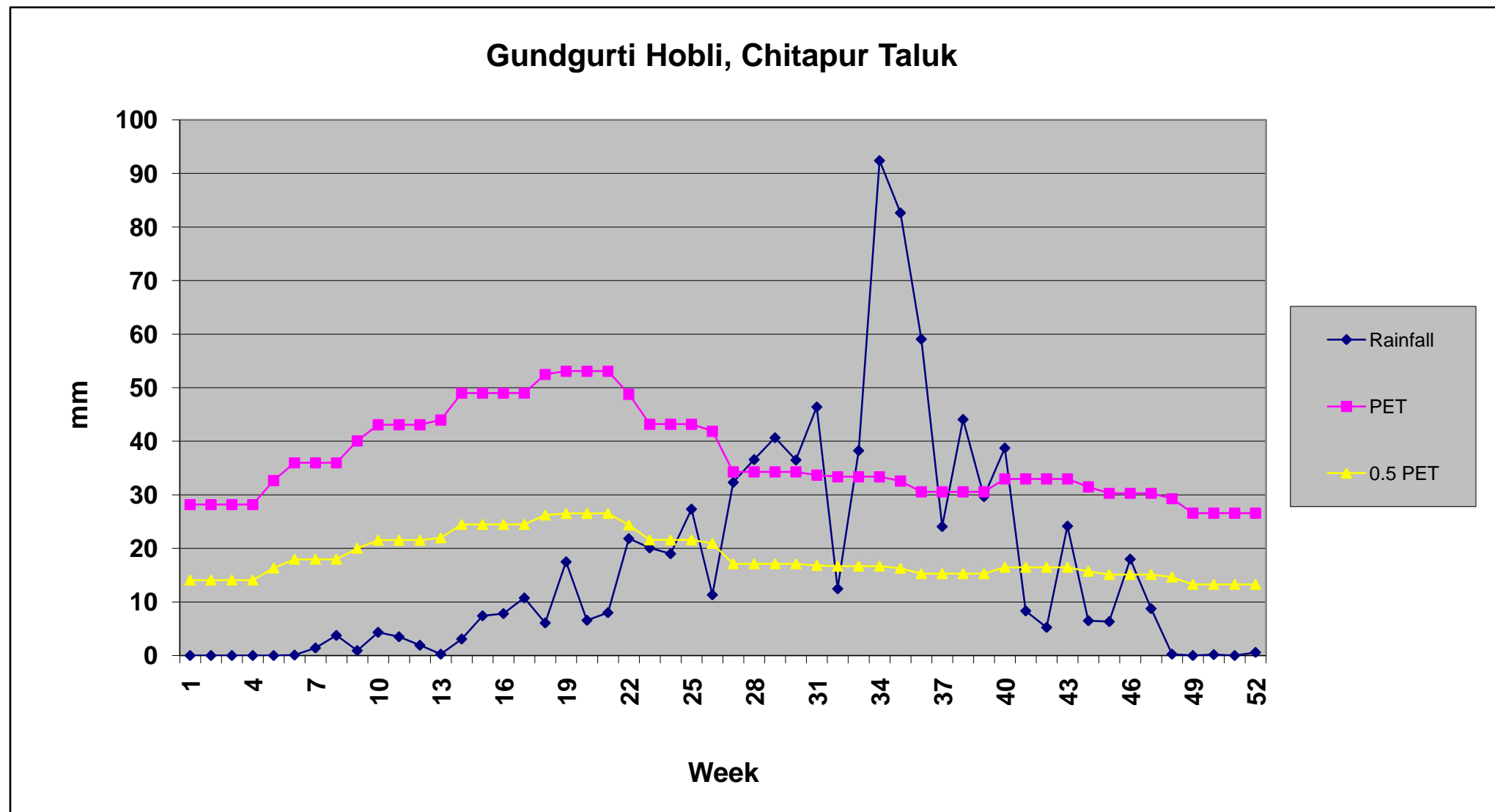
Mattimadu sub-watershed (Chitapur taluk, Kalaburagi district) is located between 17°14'35"–17°20'32" North latitudes and 77°1'50"–77°6'12" East longitudes, covering an area of about 5588 ha.

Indankal-3 micro-watershed (Mattimadu sub-watershed, Chitapur taluk, Gulbarga district) is located in between 17°14'35"–17°20'32" North latitudes and 77°1'50"–77°6'12" East longitudes, covering an area of about 713 ha, bounded by Mopti, Muchkhed, Totanhalli and Invi villages.

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

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

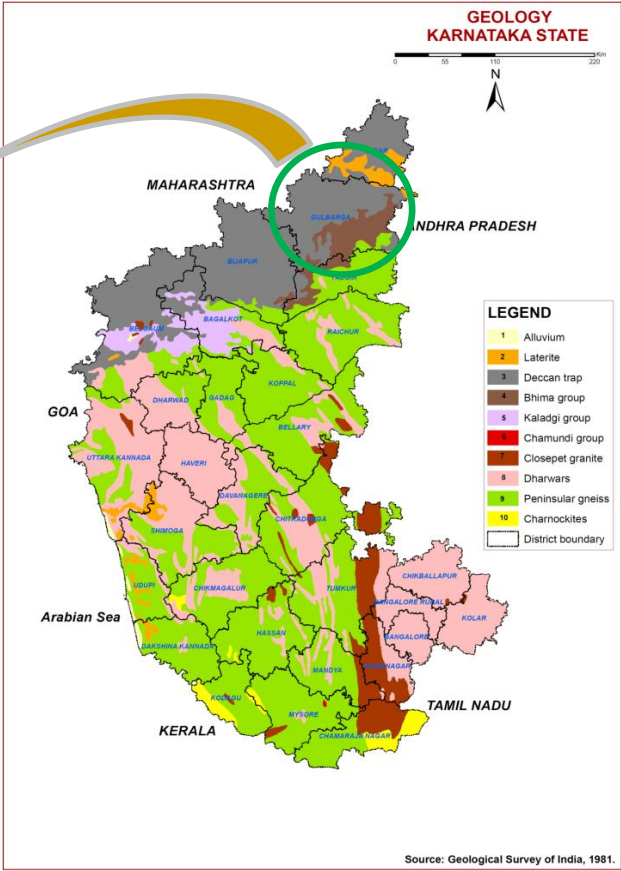
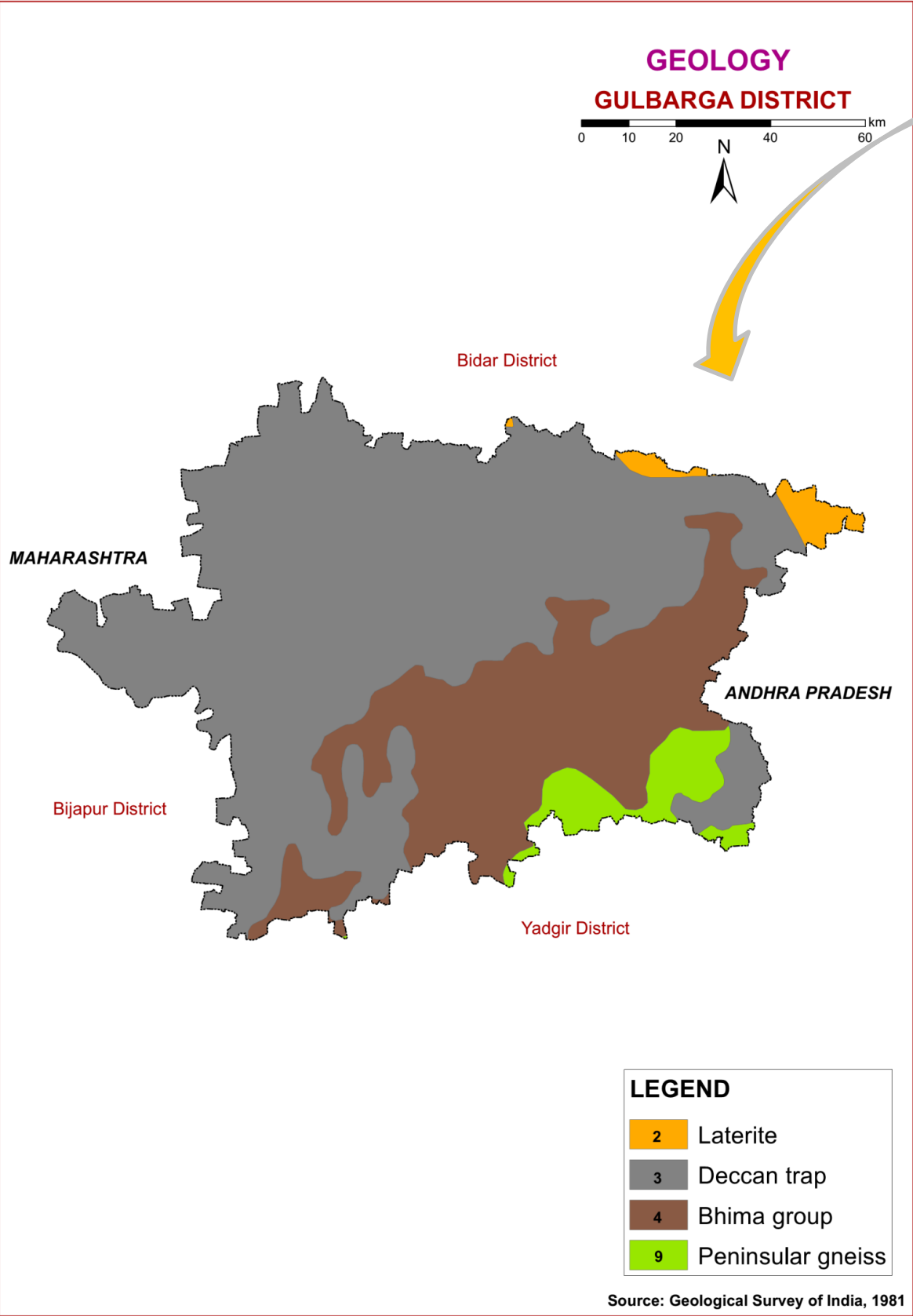
NOTE: In this Sub-Watershed, Land Resource Inventory (LRI) was generated for one micro-watershed (Indankal3 - 4D5B3K1e) among the nine micro-watersheds.



Length of Growing Period (LGP) is varying from June 2nd week to 3rd week of October about 120-150 days and surplus occurs during November which may go either as run off or recharge of ground water

Annual Rainfall : 875 mm. in the Gundgurti hobli, Chitapur taluk

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, Icteo-Cretaceous 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 - GULBARGA DISTRICT

Cainozoic Group

The Palaeocene and Recent formations of Karnataka are the laterites and alluvium of marine and riverine origin.

Laterite: Laterite is a porous, pitted, clay-like rock with yellow, red, brown, grey and mottled colours, and is composed mainly of hydrated oxides of iron and aluminium.

Mesozoic Group

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

Deccan Trap: The Deccan Trap covers the whole of Bidar district, and parts of Gulbarga, Bijapur and Belgaum districts, occupying an area of 25,000 sq. km.

Upper Proterozoic Group

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

Bhima series: This series, equivalent to the Kurnool formations, is named after the Bhima river and occurs in Bijapur and Gulbarga districts.

Archaean Group

The important formations of this group are Peninsular Gneiss, Dharwar schists, and Charnockites.

Peninsular Gneiss: Exposed over a large area of Karnataka in all the districts except Bidar is the Peninsular Gneiss which includes granites of all shades with varying composition.

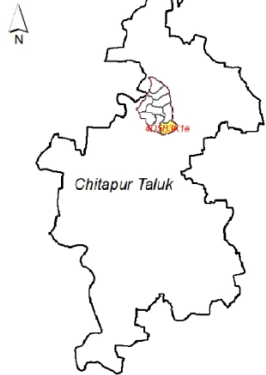
SURVEY METHODOLOGY

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 (250m 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.

MATTIMADU SUB-WATERSHED
INDANKAL 3 MICRO-WATERSHED



Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk
GULBARGA DISTRICT

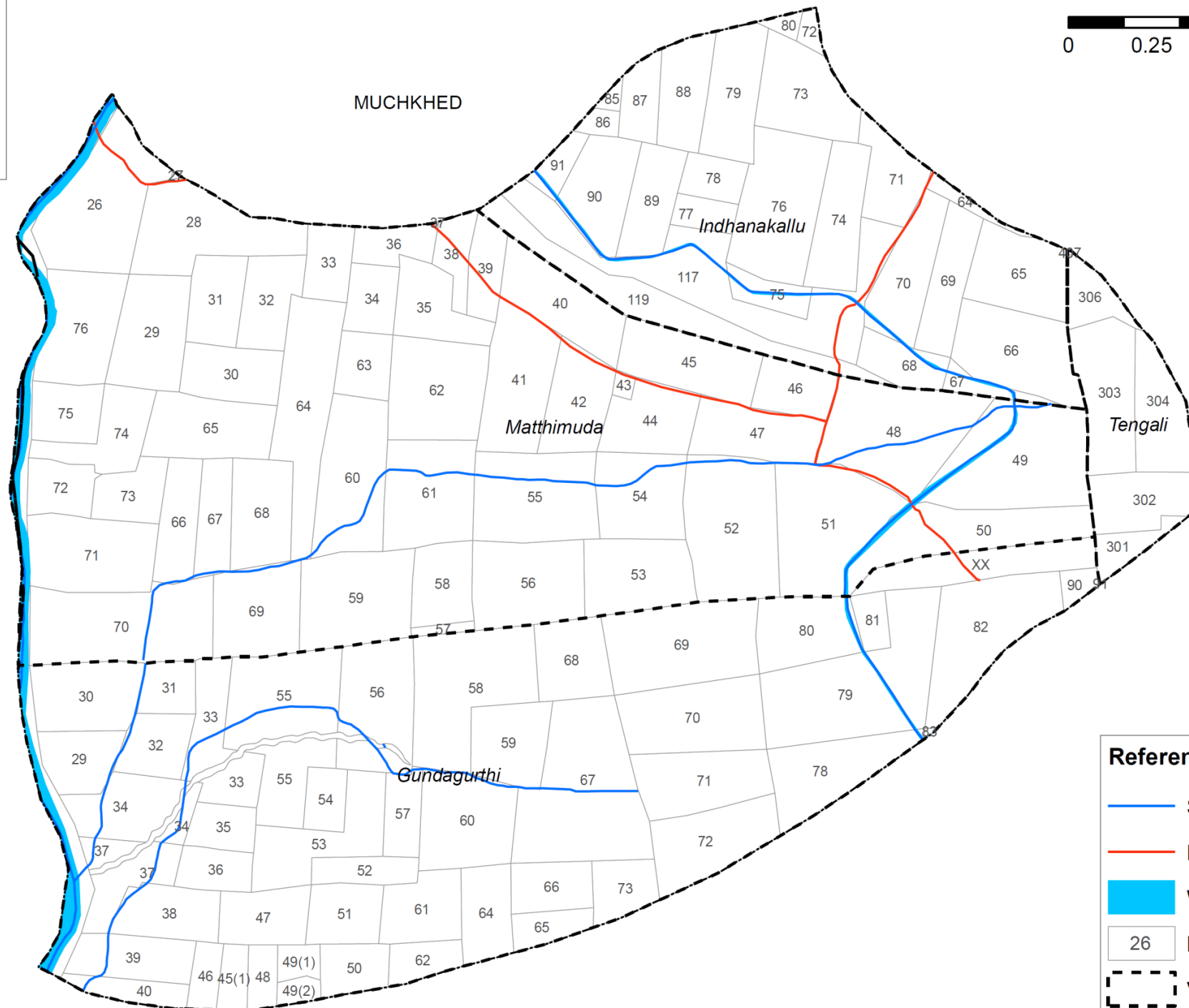
0 0.25 0.5 1 km



MOPTI

MUCHKHED

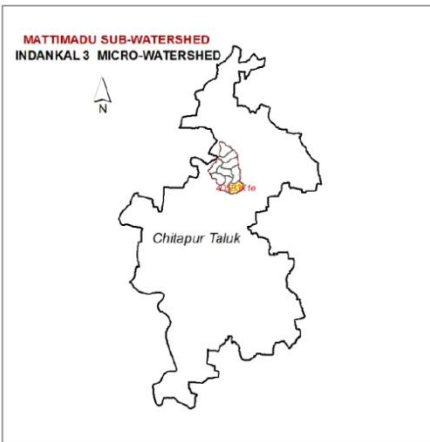
TOTANHALLI



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru



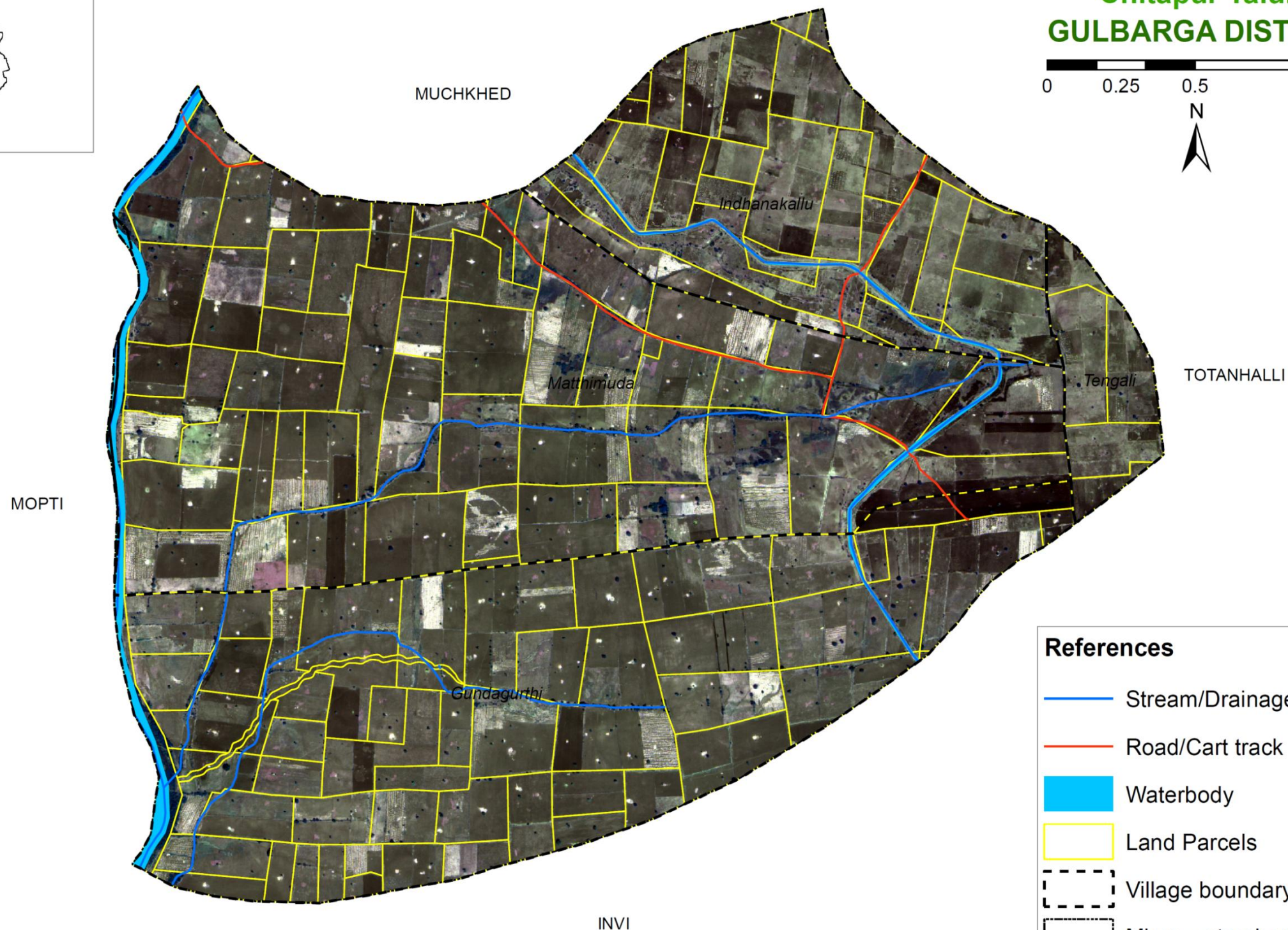
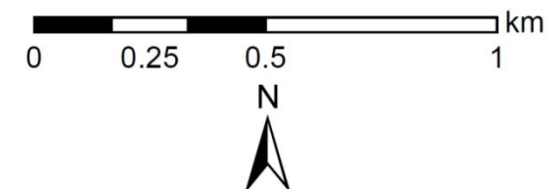
SATELLITE IMAGE

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

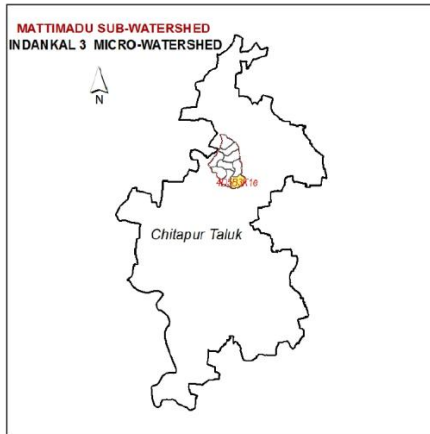
GULBARGA DISTRICT



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land Parcels
- Village boundary
- Micro-watershed boundary

Source: Cartostat 1 Imagery, 2011

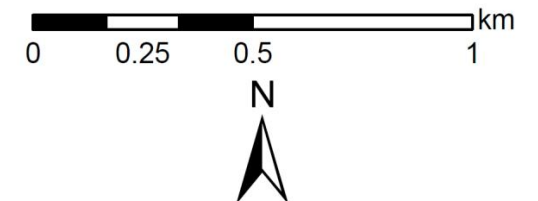


CURRENT LANDUSE (2014)

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chittapur Taluk
GULBARGA DISTRICT



MOPTI

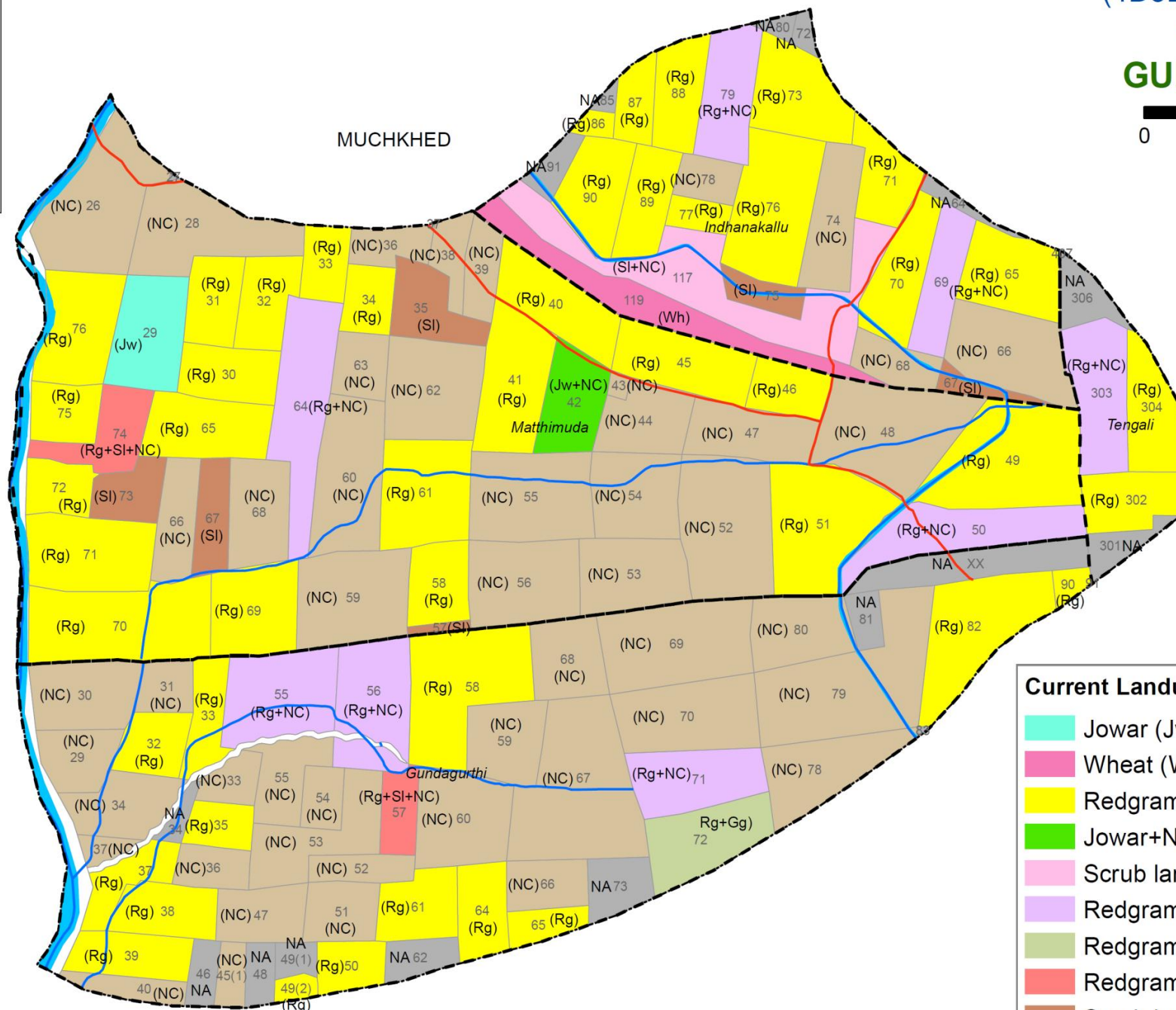
MUCHKHED

TOTANHALLI

INVI

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel With No's
- Village boundary
- Micro-watershed boundry



Current Landuse

- Jowar (Jw)
- Wheat (Wh)
- Redgram (Rg)
- Jowar+No Crop (Jw+NC)
- Scrub land+No Crop (SI+NC)
- Redgram+No Crop (Rg+NC)
- Redgram+Greengram (Rg+Gg)
- Redgram+Scrub land+No Crop (Rg+SI+NC)
- Scrub land (SI)
- No Crop (NC)
- NA
- Others*

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

MATTIMADU SUB-WATERSHED
INDANKAL 3 MICRO-WATERSHED



MOPTI

MUCHKHED

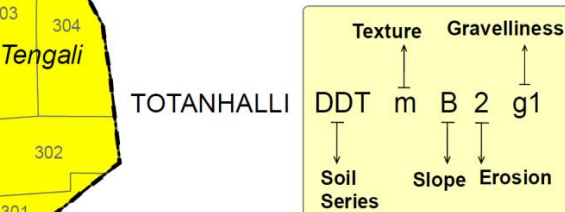
Indhanakallu

Matthimuda

Gundagurthi

INVI

TOTANHALLI



SOILS

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



KEY

TEXTURE
m – Clay

SLOPE
B – Very gently sloping (1-3%)
C – Gently sloping (3-5%)

EROSION
1 – Slight
2 – Moderate
3 -- Severe

GRAVELLINESS
g1 – Gravelly (15-35 %)

DEPTH
TNH - Moderately shallow (50-75 cm)
MTM - Moderately deep (75-100 cm)
DRG - Deep (100-150 cm)
DDT - Very deep (>150 cm)

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Soil Phases	Area in ha (%)
1, DDTmB1	185 (25.99)
2, DDTmB2	201 (28.23)
3, DDTmB2g1	11 (1.58)
4, DDTmC3	9 (1.21)
5, DRGmB1	72 (10.07)
6, DRGmB2	70 (9.8)
7, MTMmB1	24 (3.42)
8, MTMmB1g1	65 (9.14)
9, MTMmB2	14 (1.9)
10, MTMmC2g1	18 (2.55)
11, MTMmC3	15 (2.04)
12, TNHmC3	14 (2.01)
13, Railway	4 (0.51)
14, Others*	11 (1.54)

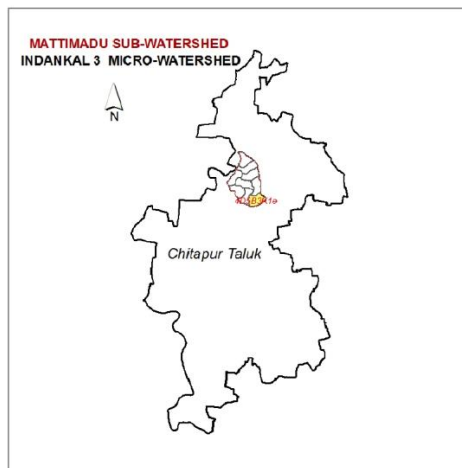
* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

Mapping unit description of Indankal-3 (4D5B3L2c) Micro-watershed in Chitapur Taluk, Gulbarga District

Sl.No	Map unit	Description	Area in ha (%)
1	DDTmB1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3% slope, slightly eroded	185.36 (25.99)
2	DDTmB2	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3 % slope, moderately eroded	201.30 (28.23)
3	DDTmB2g1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3 % slope, moderately eroded, slightly gravelly, 15-35 per cent gravel.	11.24 (1.58)
4	DDTmC3	Very deep, black clayey soils developed from weathered basalt on gently sloping uplands, clay surface on 3-5 % slope, severely eroded	8.66 (1.21)
5	DRGmB1	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3% slope, slightly eroded	71.81 (10.07)
6	DRGmB2	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3% slope, moderately eroded	69.93 (9.80)
7	MTMmB1	Moderately deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3 % slope, slightly eroded.	24.41 (3.42)
8	MTMmB1g1	Moderately deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3 % slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	65.20 (9.14)
9	MTMmB2	Moderately deep, black clayey soils developed from weathered basalt on very gently sloping uplands, clay surface on 1-3 % slope, moderately eroded.	13.58 (1.90)
10	MTMmC2g1	Moderately deep, black clayey soils developed from weathered basalt on gently sloping uplands, clay surface on 3-5 % slope, moderately eroded, slightly gravelly, 15-35 per cent gravel.	18.20 (2.55)
11	MTMmC3	Moderately deep, black clayey soils developed from weathered basalt on gently sloping uplands, clay surface on 3-5 % slope, severely eroded.	14.56 (2.04)
12	TNHmC3	Moderately shallow, black clayey soils developed from weathered basalt on gently sloping uplands, clay surface on 3-5 % slope, severely eroded.	14.34 (2.01)

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



LAND CAPABILITY

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



MOPTI

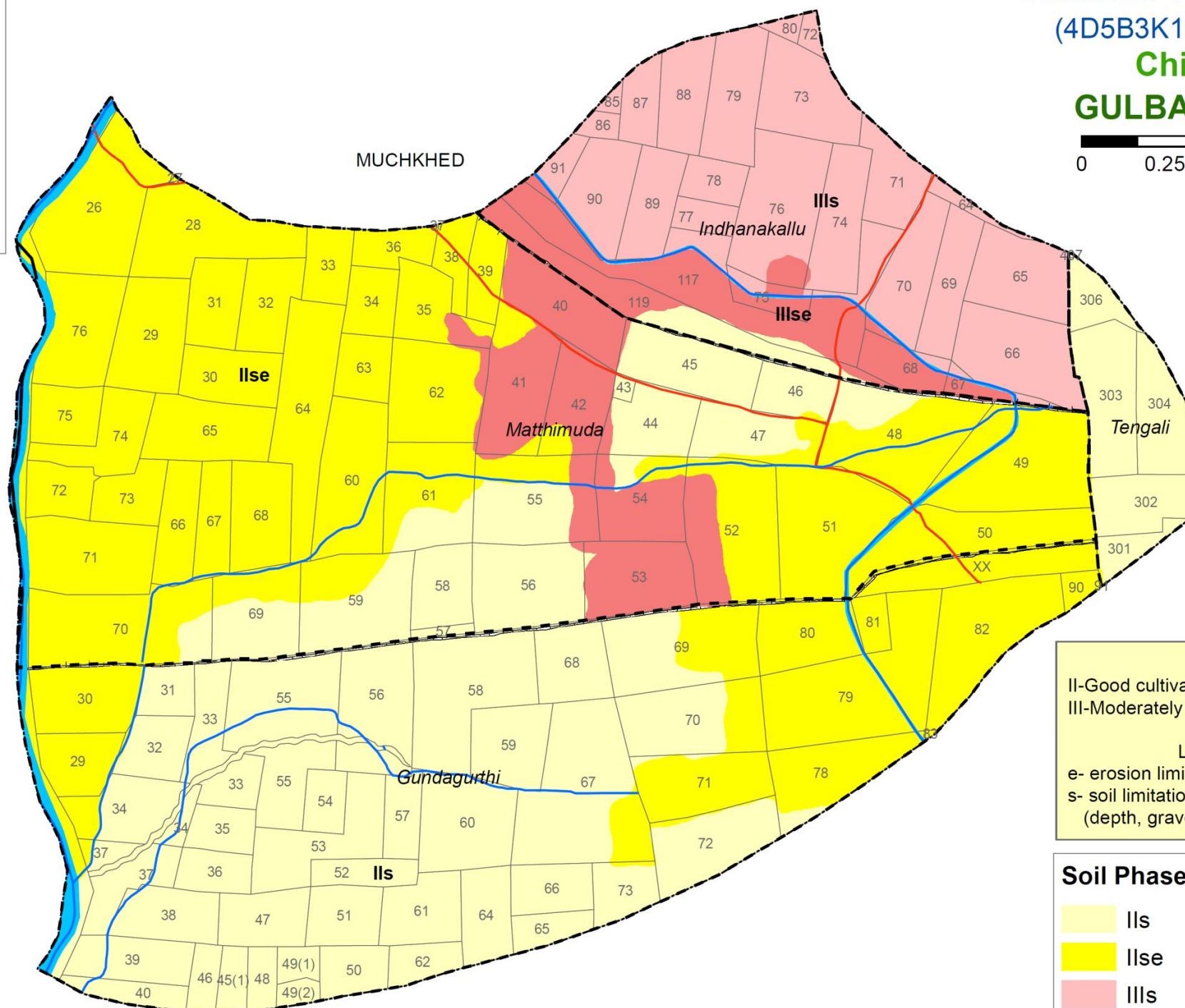
MUCHKHED

TOTANHALLI

INVI

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary



Key

II-Good cultivable land
III-Moderately good cultivable land

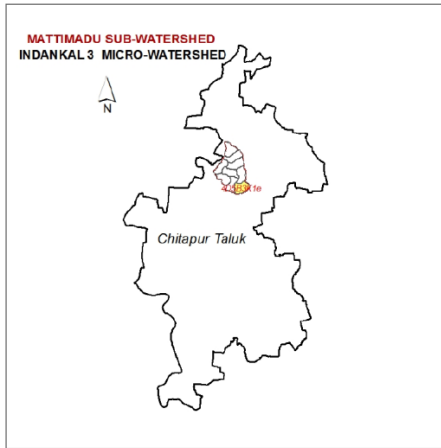
Limitations

e- erosion limitation
s- soil limitation
(depth, gravelliness, texture, salinity/alkalinity)

Soil Phases	Area in ha (%)
IIs	257 (36.06)
IIse	291 (40.82)
IIIs	90 (12.57)
IIIse	61 (8.51)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SOIL DEPTH

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



MOPTI

MUCHKHED

Indhanakallu

Matthimuda

Tengali

TOTANHALLI

Gundagurthi

INVI

References

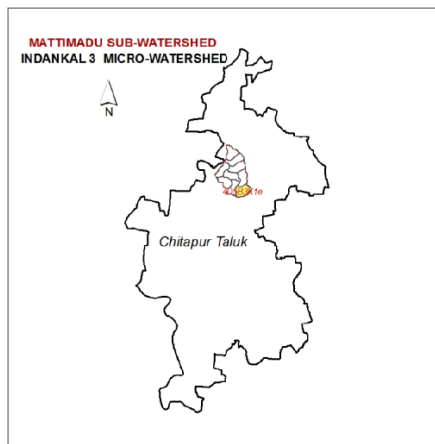
- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Depth Classes

Moderately shallow (50-75 cm)	14 (2.01)
Moderately deep (75-100 cm)	136 (19.06)
Deep (100-150 cm)	142 (19.87)
Very deep (>150 cm)	407 (57.01)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SURFACE SOIL TEXTURE

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



MOPTI

MUCHKHED

Indhanakallu

Matthimuda







Tengali

TOTANHALLI

INVI

Gundagurthi

References

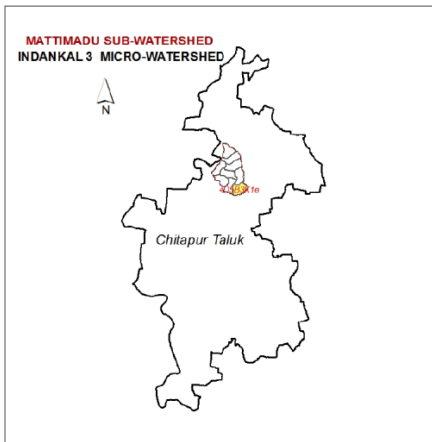
-  Stream/Drainage
-  Road/Cart track
-  Waterbody
-  Land parcel with No's
-  Village boundary
-  Micro-watershed boundary

Texture Class

	Clay	699 (97.95)
	Railway	4 (0.51)
	Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SOIL GRAVELLINESS

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



MOPTI

MUCHKHED

Indhanakallu

Matthimuda







Tengali

TOTANHALLI




INVI

Gundagurthi

References

-  Stream/Drainage
-  Road/Cart track
-  Waterbody
-  Land parcel with No's
-  Village boundary
-  Micro-watershed boundary

Gravelly Class

Gravelly Class	Area in ha (%)
 Non gravelly (<15%)	608 (85.19)
 Gravelly (15-35%)	95 (13.27)
 Railway	608 (85.19)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

MATTIMADU SUB-WATERSHED
INDANKAL 3 MICRO-WATERSHED



Chitapur Taluk

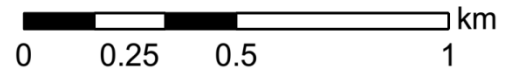
AVAILABLE WATER CAPACITY

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



MOPTI

MUCHKHED

Indhanakallu

Matthimuda

Tengali

TOTANHALLI

INVI

Gundagurthi

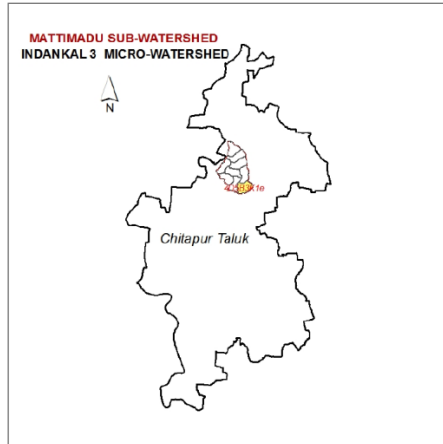
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Available Water Capacity	Area in ha (%)
Low (51-100 mm/m)	29 (4.05)
Medium (101-150 mm/m)	130 (18.23)
Very high (>200 mm/m)	540 (75.67)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SLOPE

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



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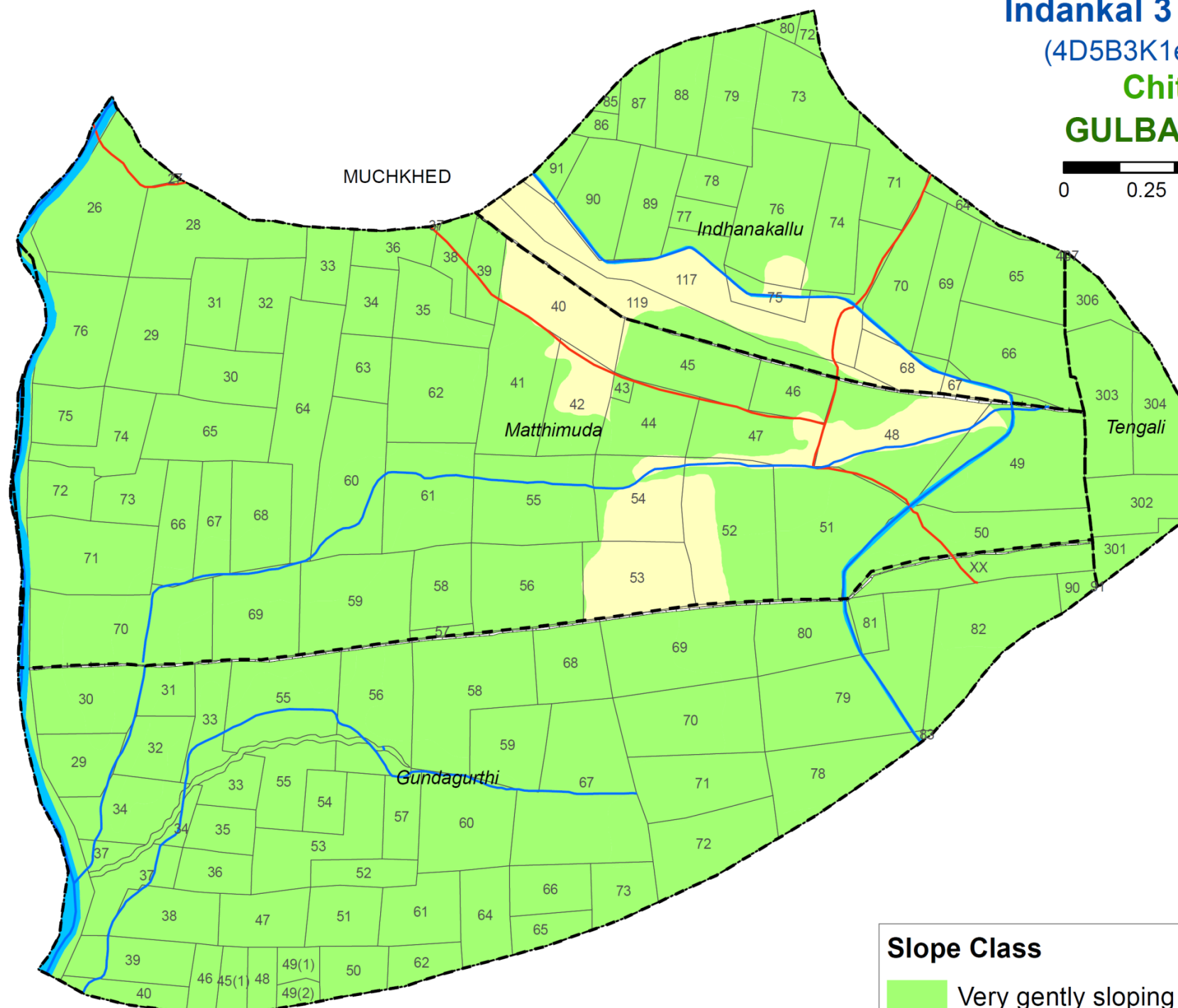
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References

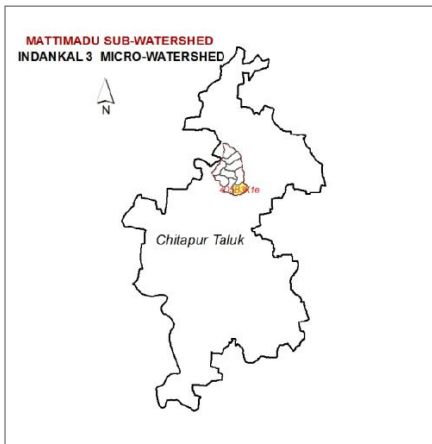
- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary



Slope Class	Area in ha (%)
 Very gently sloping (1-3%)	643 (90.13)
 Gently sloping (3-5%)	56 (7.82)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SOIL EROSION

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



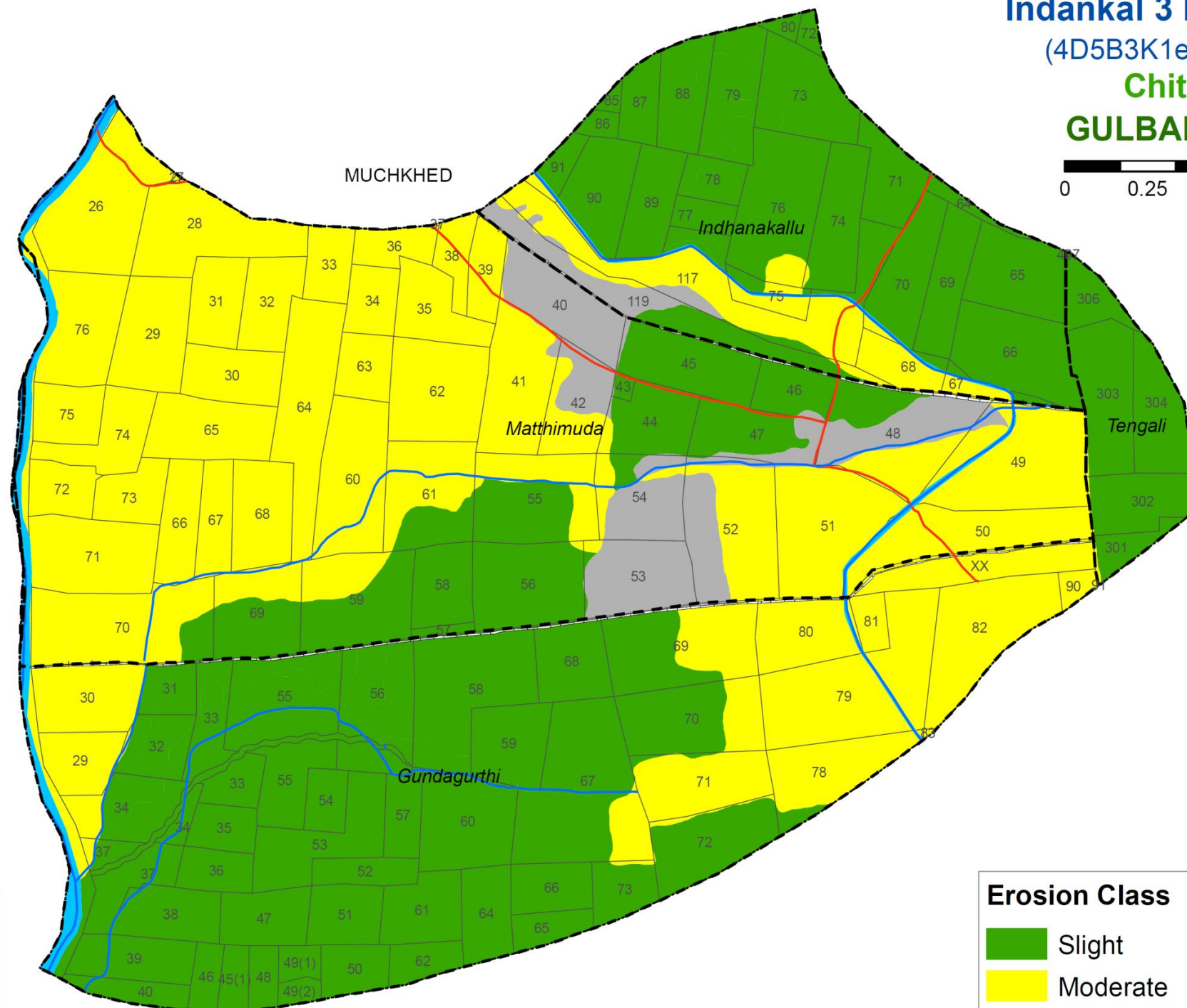
MOPTI

TOTANHALLI

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References

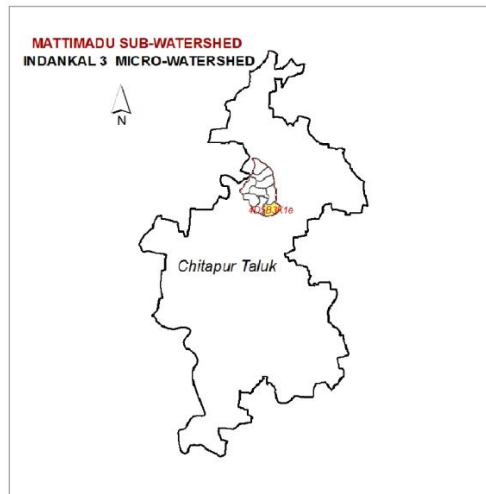
- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary



Erosion Class	Area in ha (%)
Slight	347 (48.62)
Moderate	314 (44.06)
Severe,	38 (5.27)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



SOIL REACTION (pH) (2014)

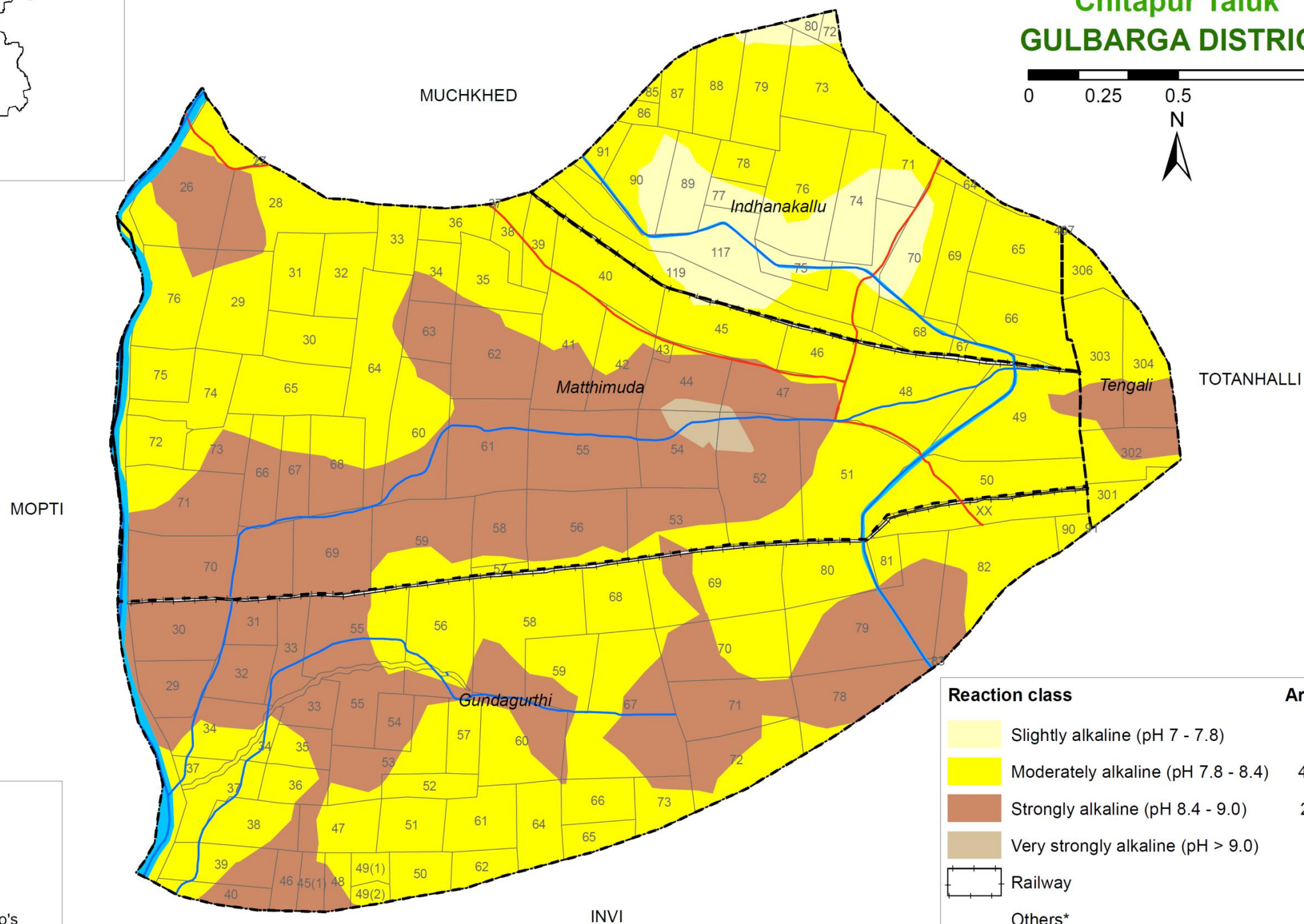
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



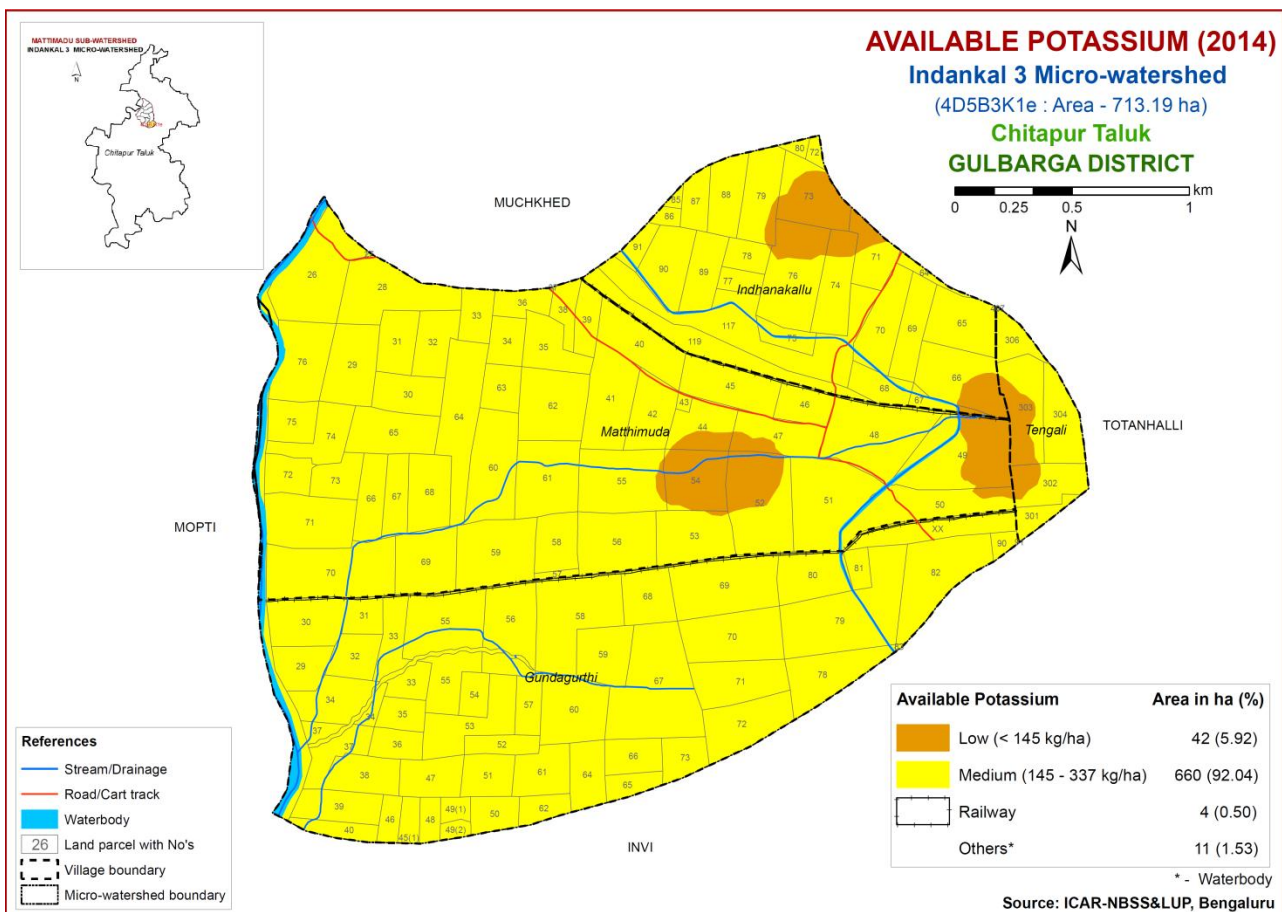
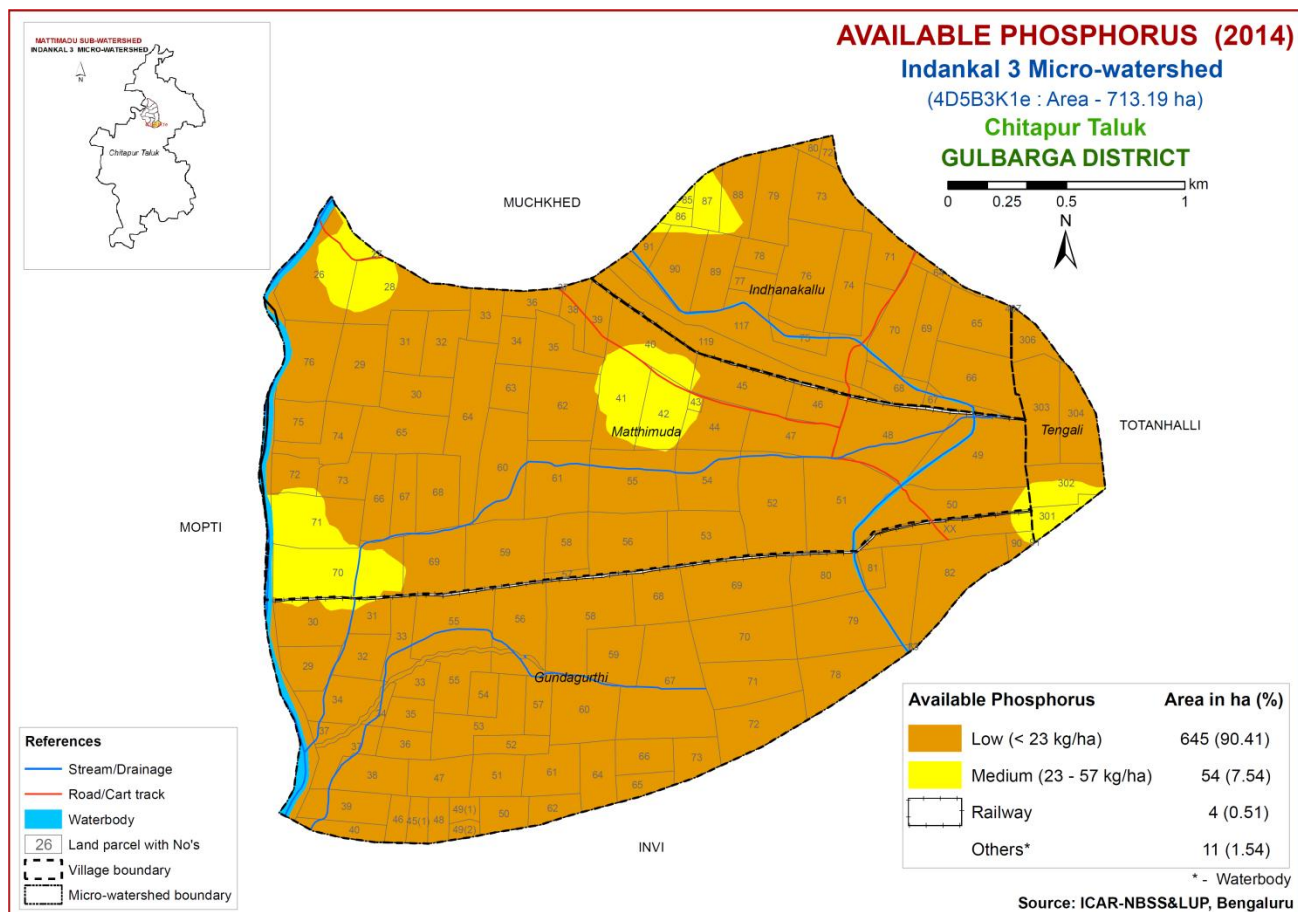
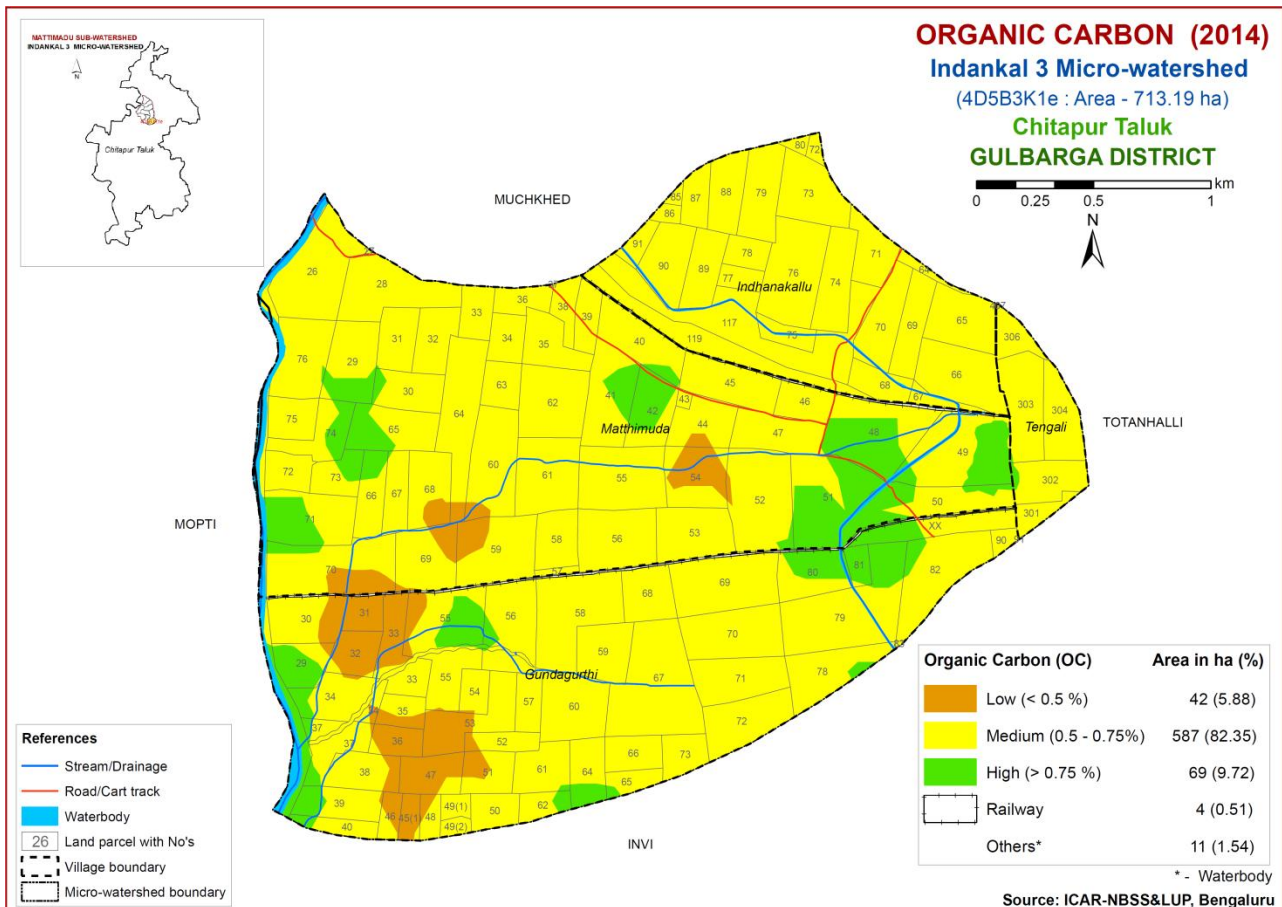
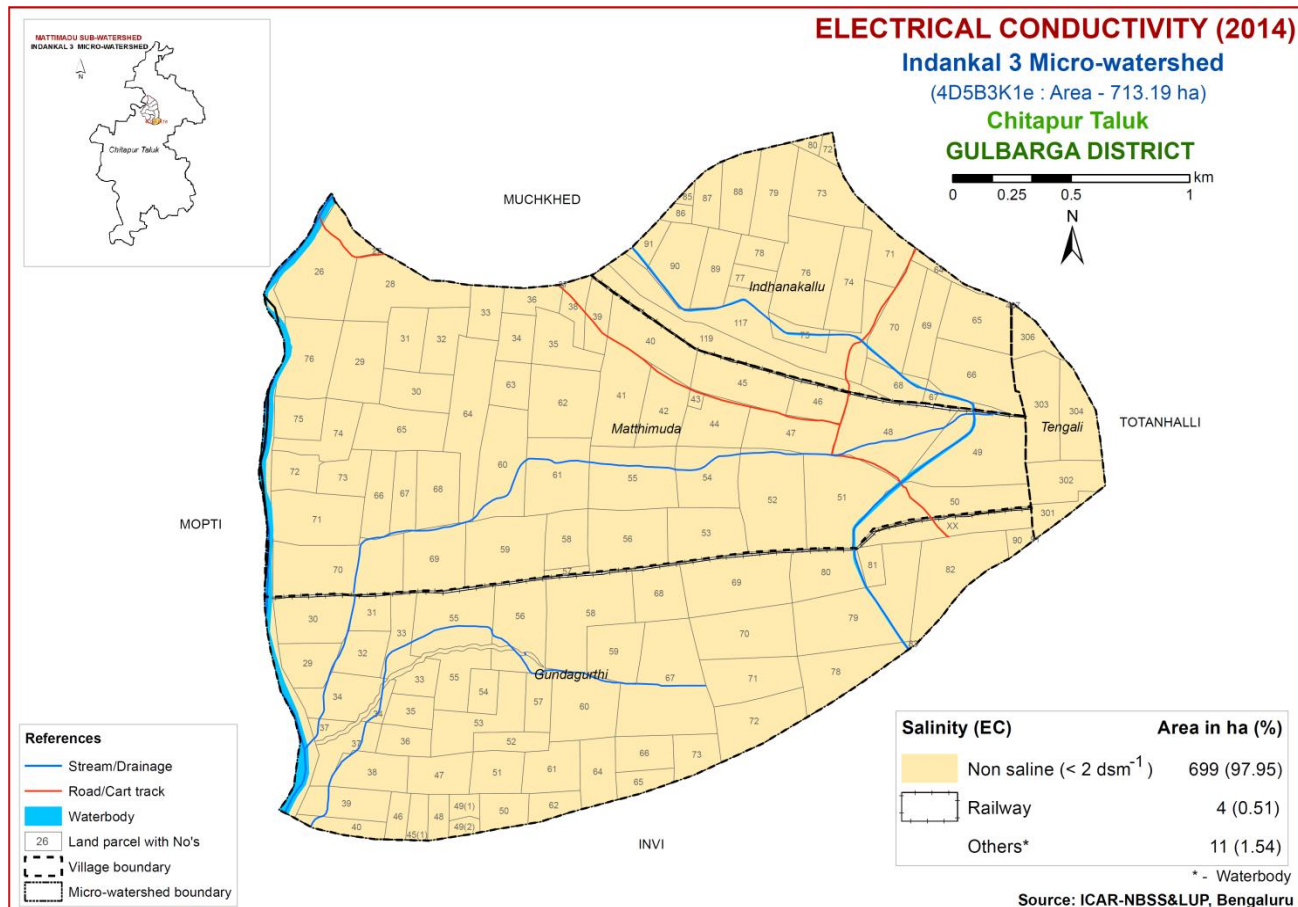
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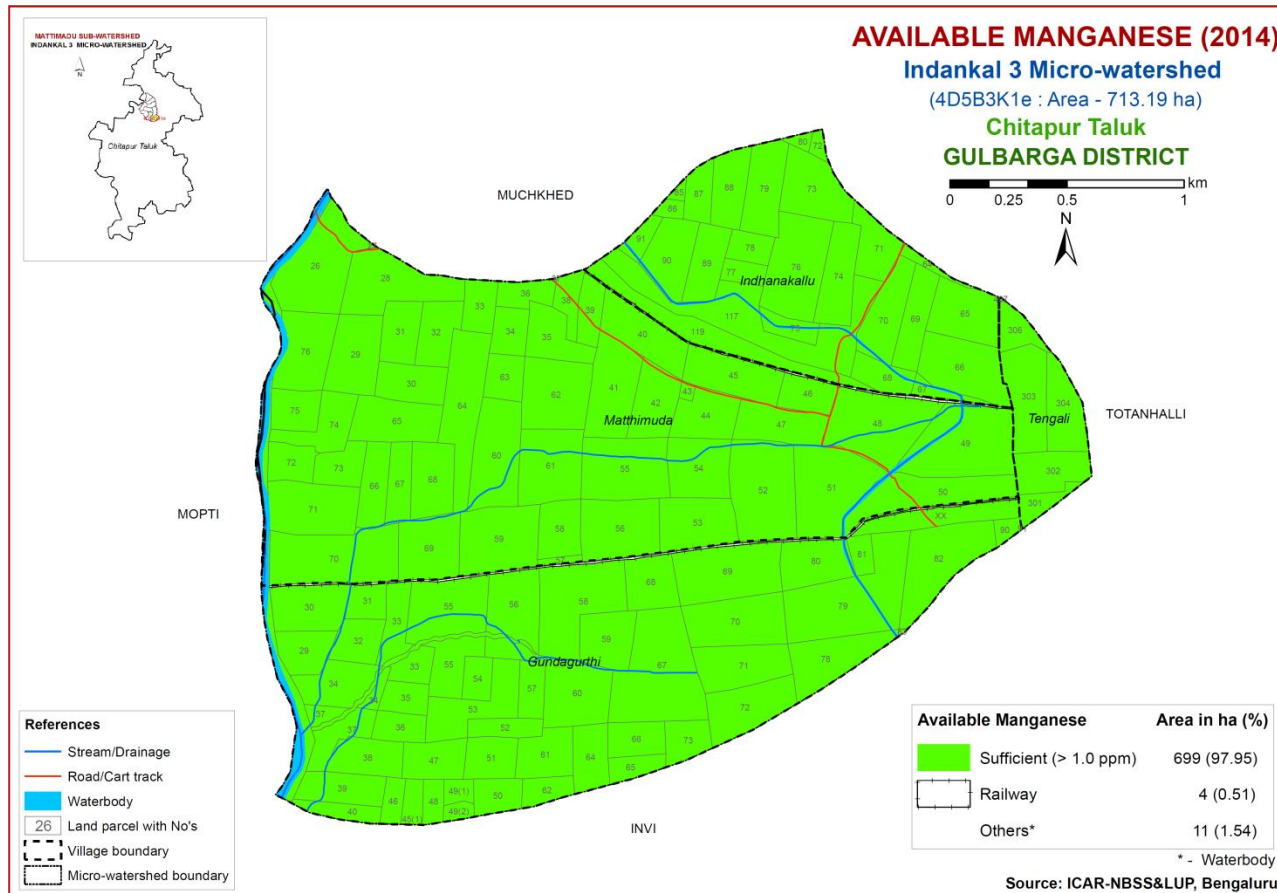
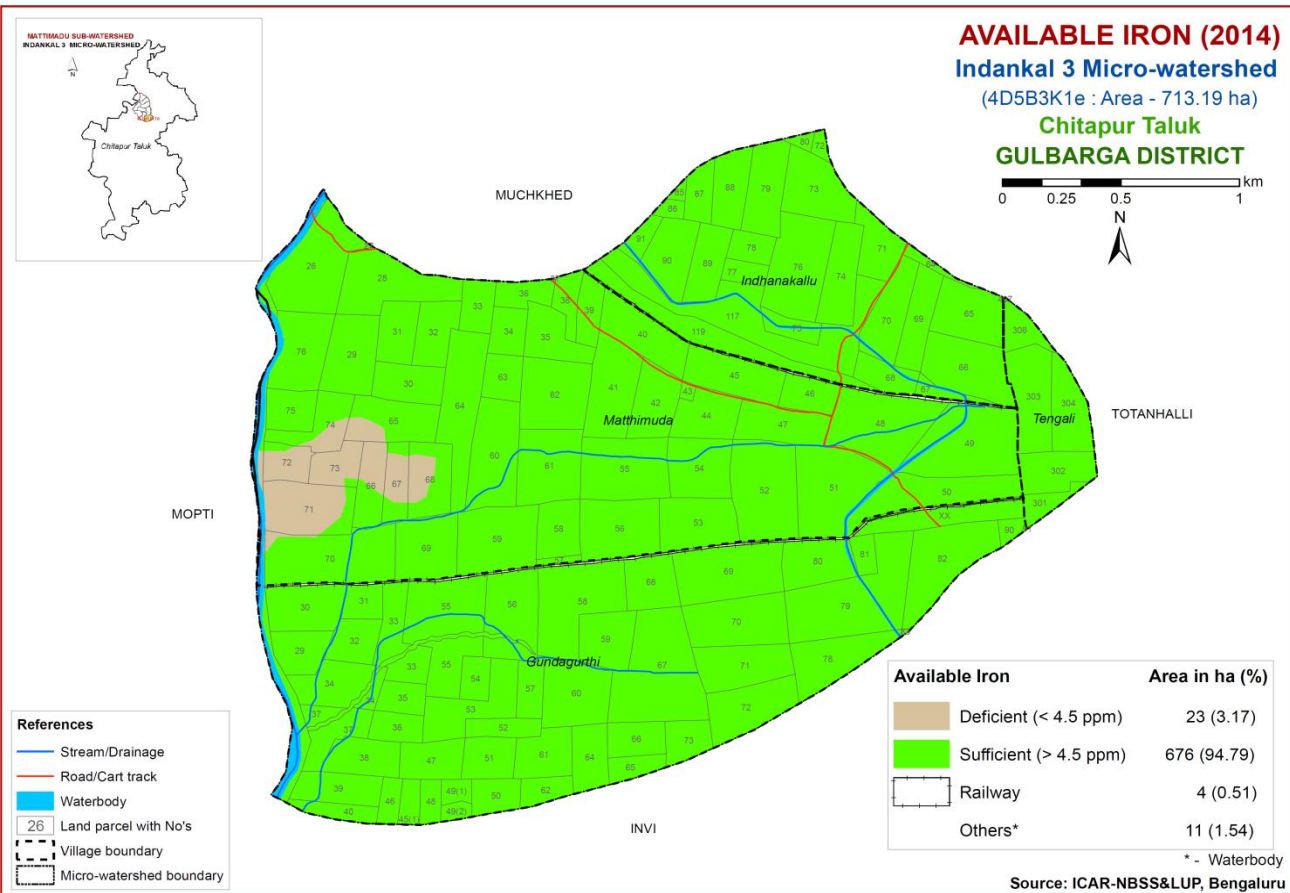
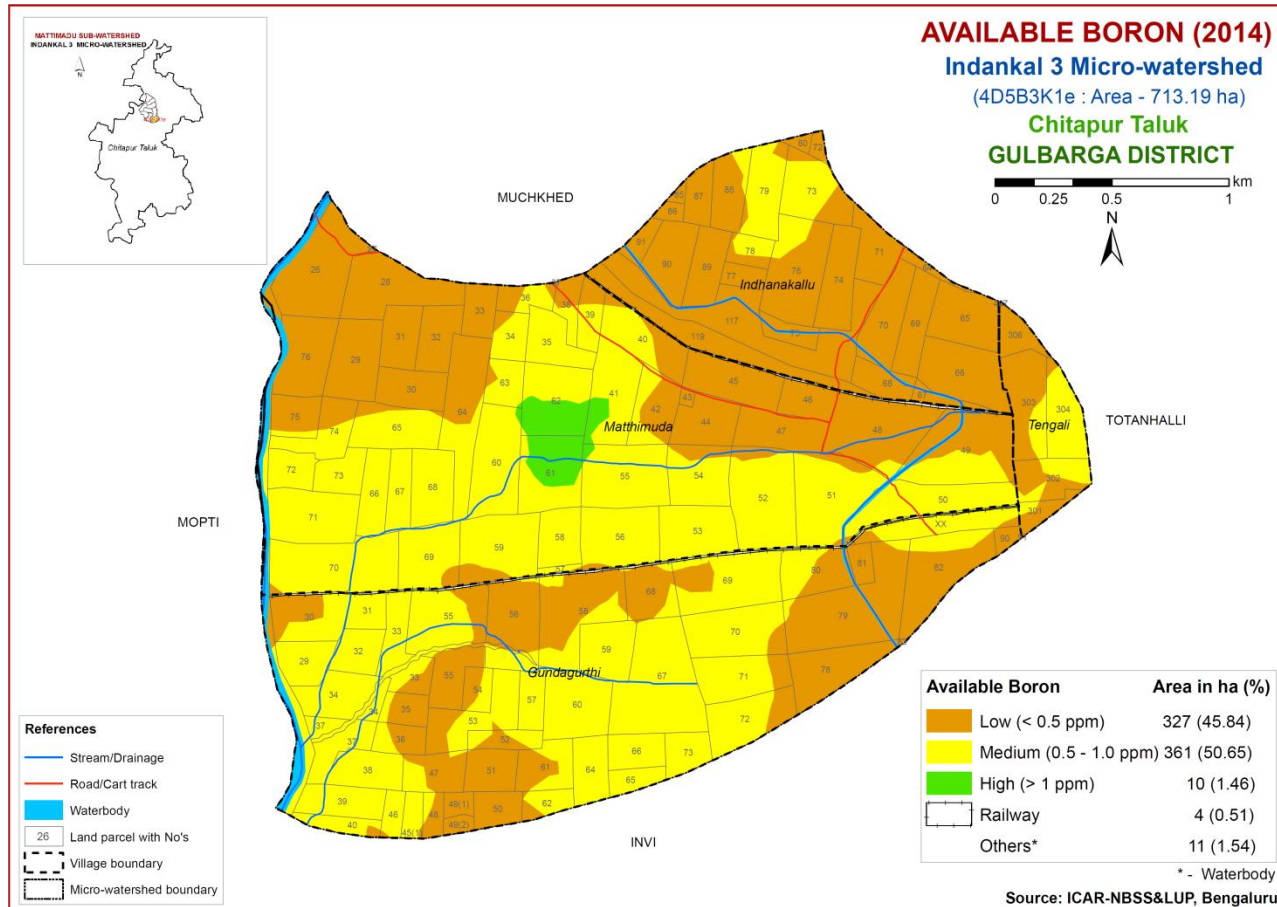
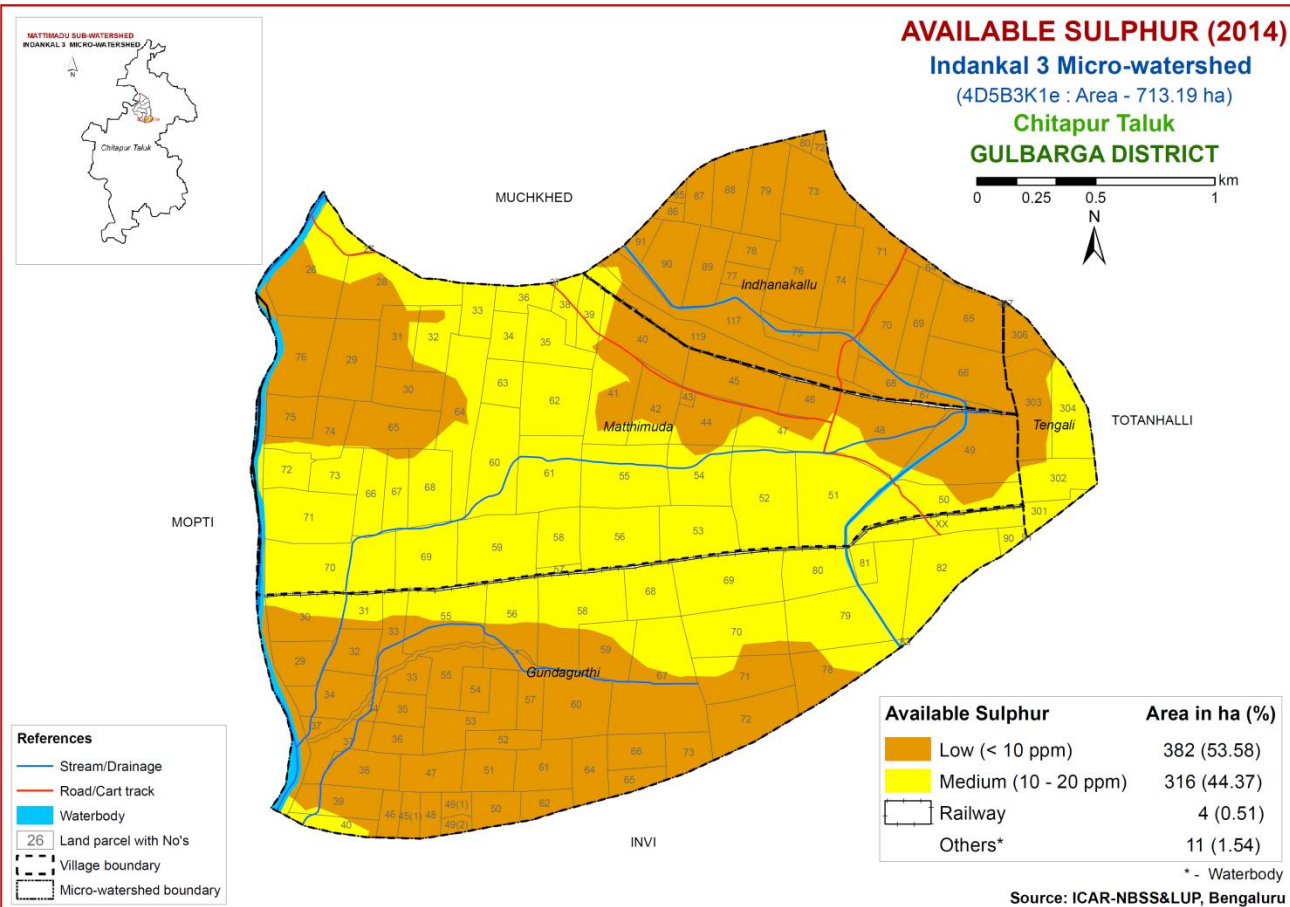
- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

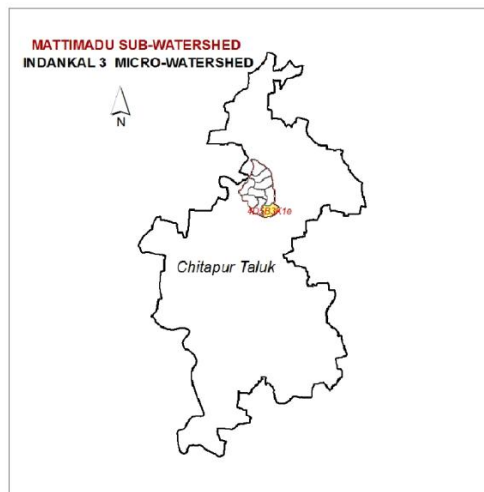
Reaction class	Area in ha (%)
 Slightly alkaline (pH 7 - 7.8)	35 (4.90)
 Moderately alkaline (pH 7.8 - 8.4)	414 (58.07)
 Strongly alkaline (pH 8.4 - 9.0)	246 (34.50)
 Very strongly alkaline (pH > 9.0)	3 (0.48)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru







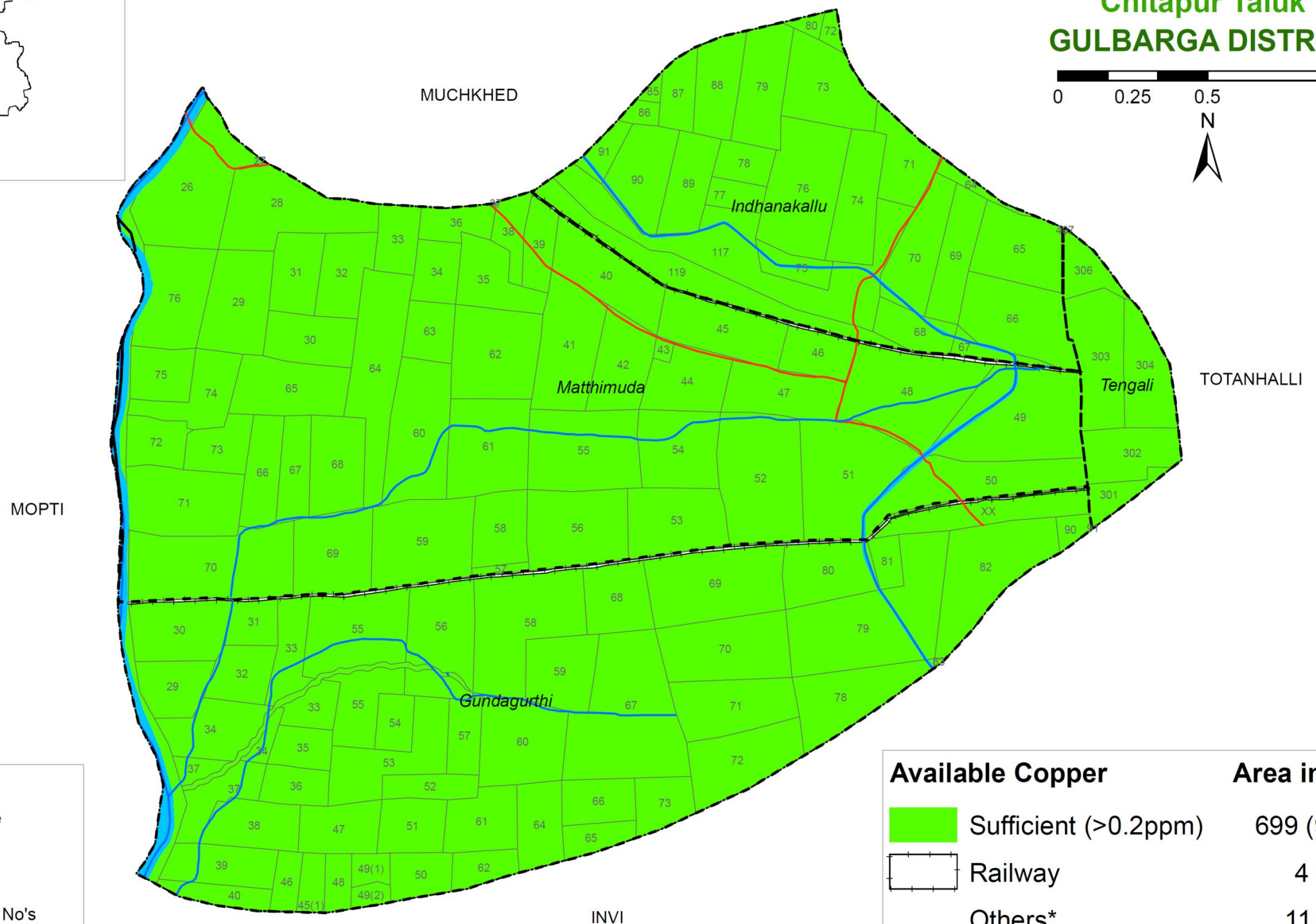
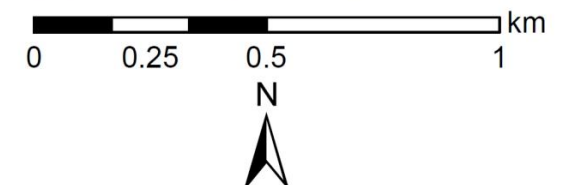
AVAILABLE COPPER (2014)

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

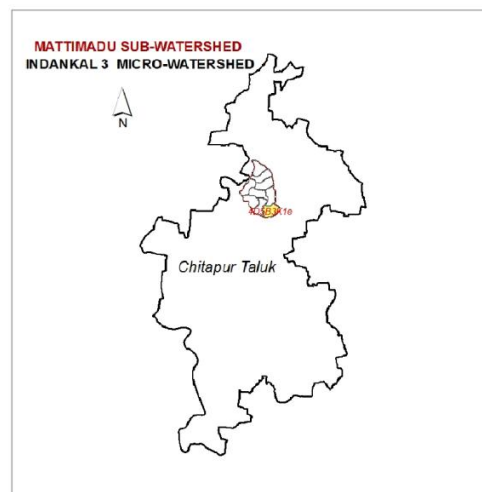
Available Copper

Area in ha (%)

■	Sufficient (>0.2ppm)	699 (97.95)
 	Railway	4 (0.51)
 	Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

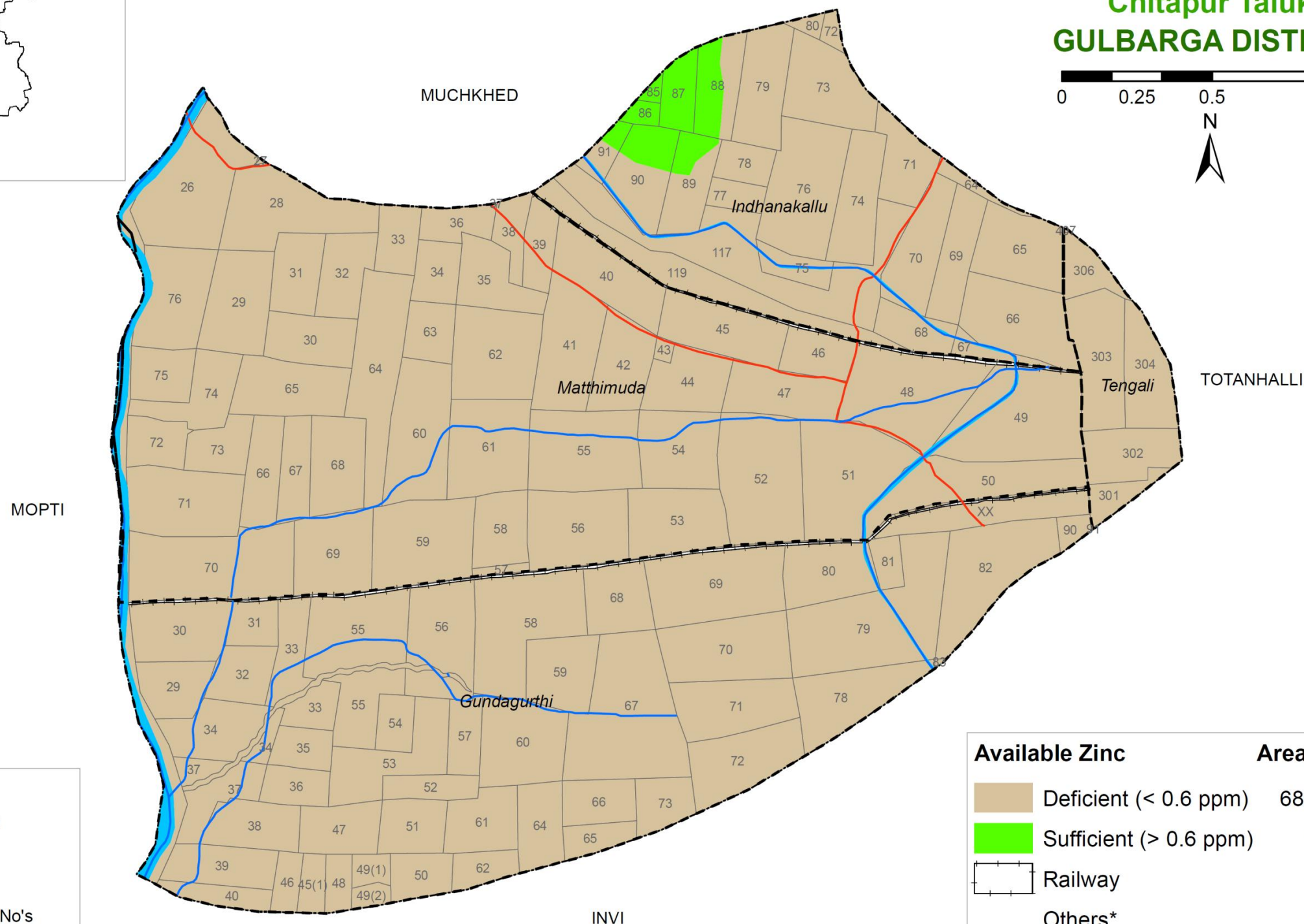
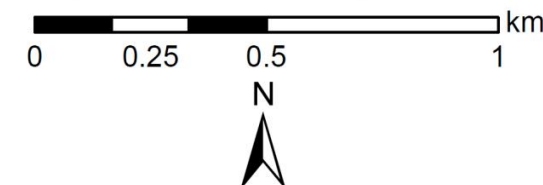


AVAILABLE ZINC (2014)

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk
GULBARGA DISTRICT



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Available Zinc		Area in ha (%)
	Deficient (< 0.6 ppm)	688 (96.44)
	Sufficient (> 0.6 ppm)	11 (1.52)
	Railway	4 (0.51)
	Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

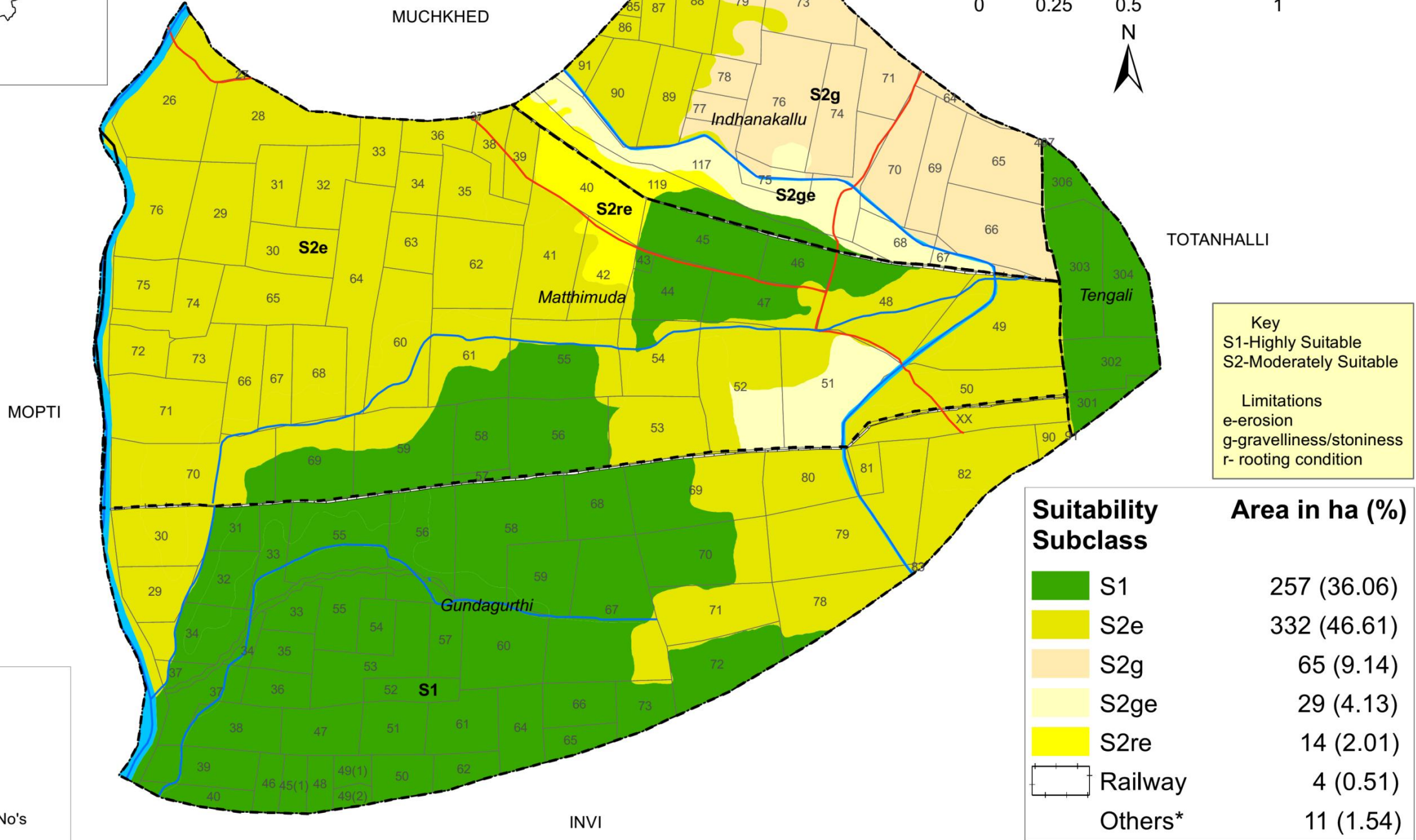
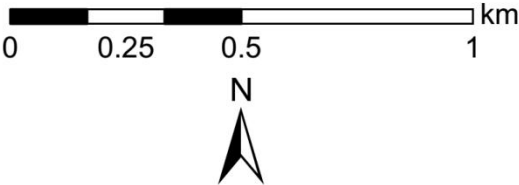
LAND SUITABILITY FOR SORGHUM

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key
S1-Highly Suitable
S2-Moderately Suitable

Limitations
e-erosion
g-gravelliness/stoniness
r- rooting condition

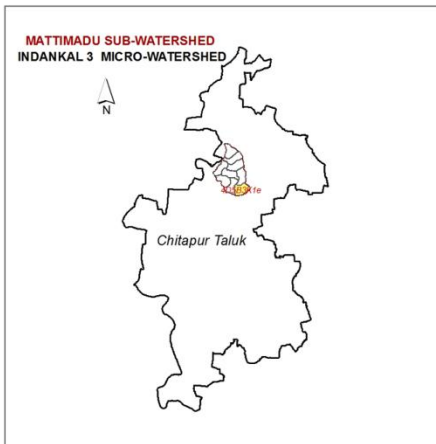
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S1	257 (36.06)
S2e	332 (46.61)
S2g	65 (9.14)
S2ge	29 (4.13)
S2re	14 (2.01)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR MAIZE

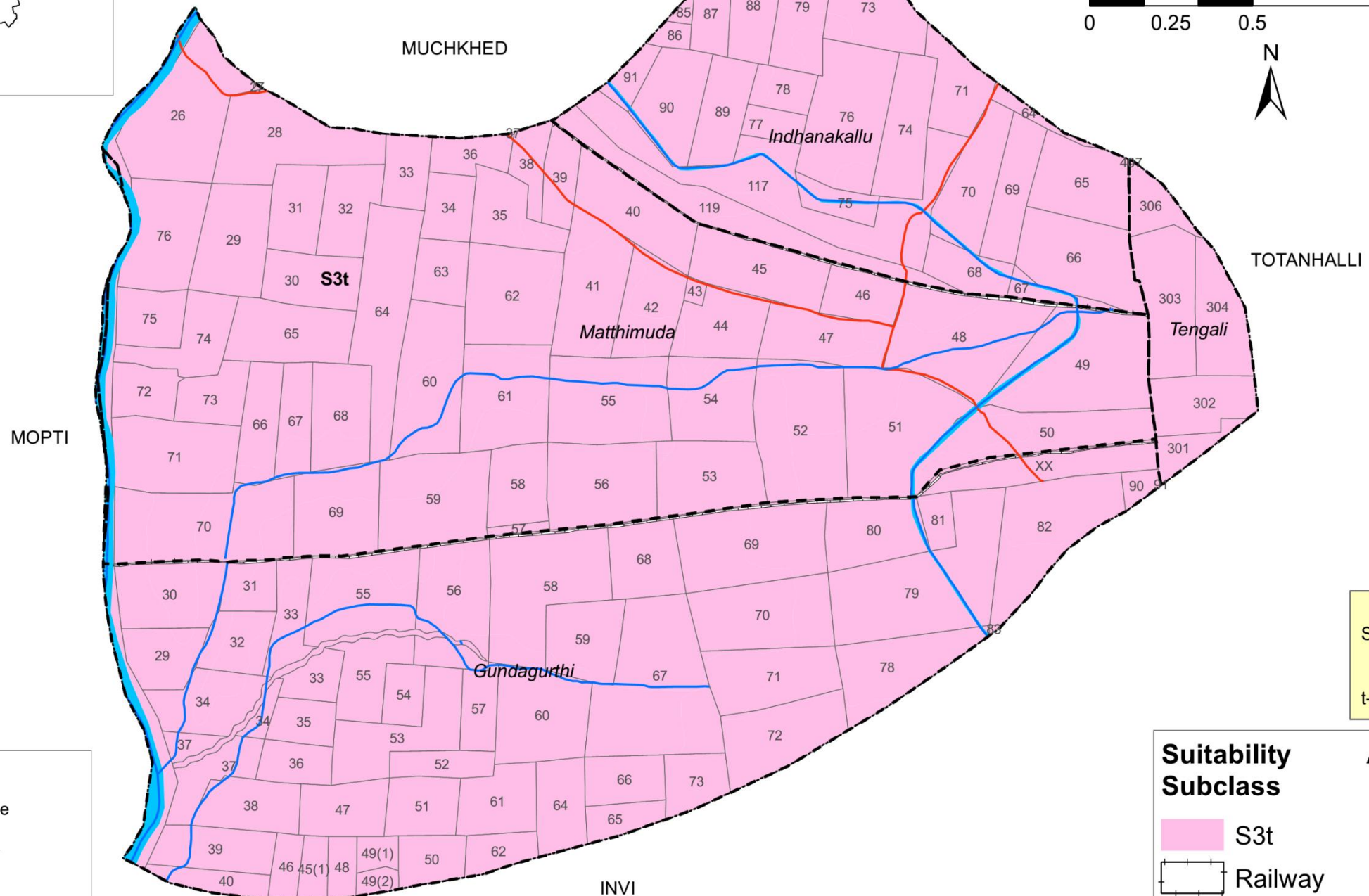
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



Key
S3-Marginally Suitable
Limitations
t-texture

References

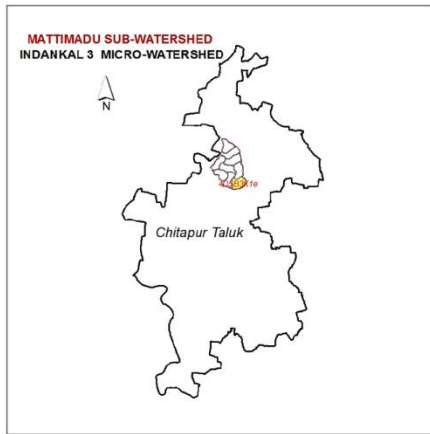
- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass

 S3t	699 (97.95)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

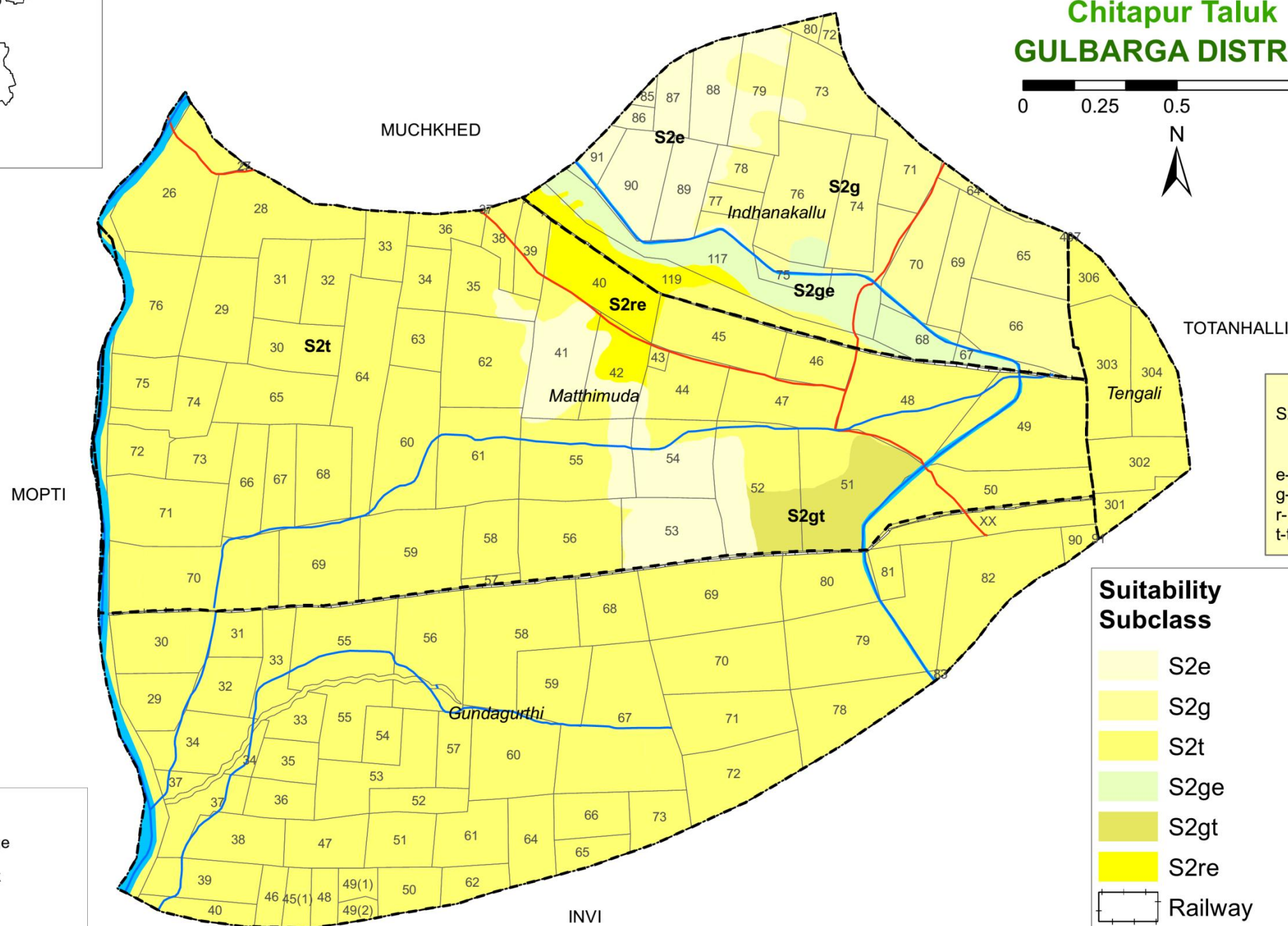
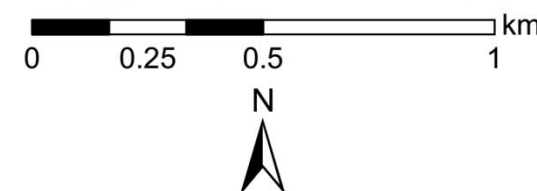


LAND SUITABILITY FOR PIGEONPEA

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk
GULBARGA DISTRICT



Key
S2-Moderately Suitable

Limitations
e-erosion
g-gravelliness/stoniness
r- rooting condition
t-texture

- References**
- Stream/Drainage
 - Road/Cart track
 - Waterbody
 - Land parcel with No's
 - Village boundary
 - Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S2e	53 (7.37)
S2g	65 (9.14)
S2t	537 (75.3)
S2ge	18 (2.55)
S2gt	11 (1.58)
S2re	14 (2.01)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

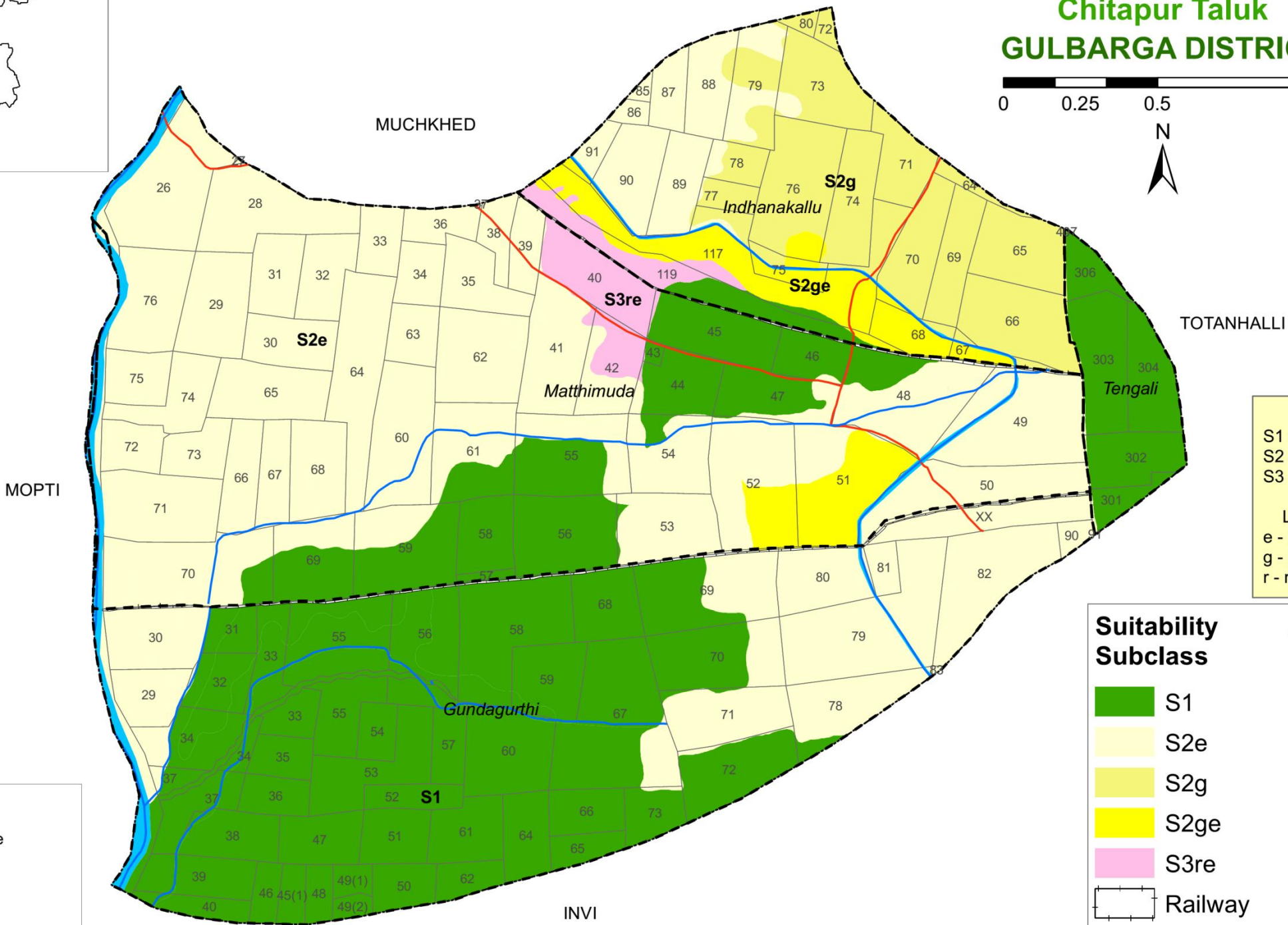
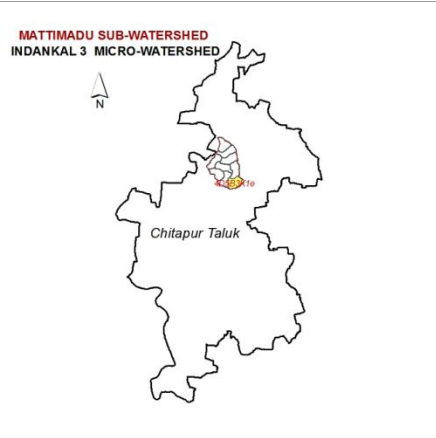
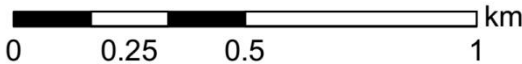
LAND SUITABILITY FOR SUNFLOWER

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key
S1 - Highly Suitable
S2 - Moderately Suitable
S3 - Marginally Suitable

Limitations
e - erosion
g - gravelliness/stoniness
r - rooting condition

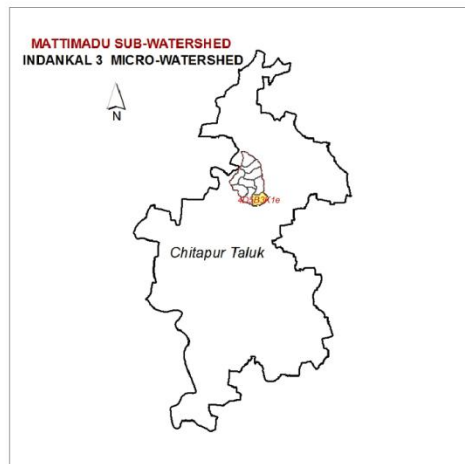
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S1	257 (36.06)
S2e	332 (46.61)
S2g	65 (9.14)
S2ge	29 (4.13)
S3re	14 (2.01)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



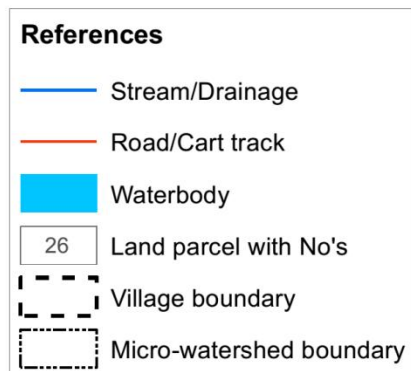
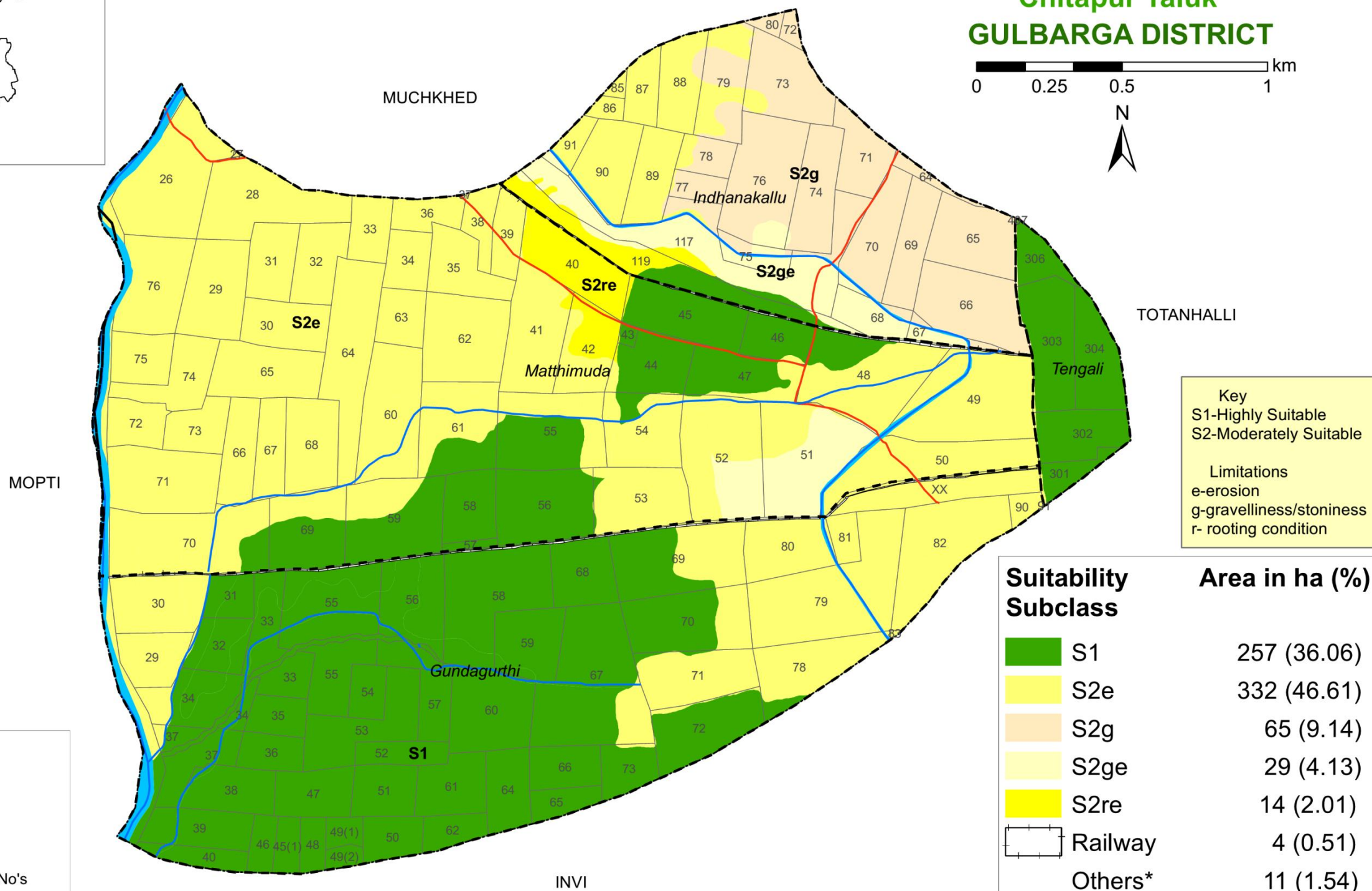
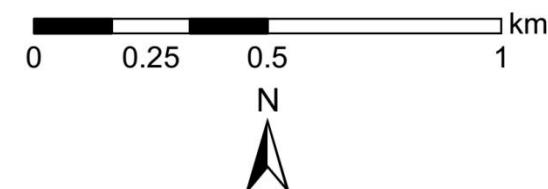
LAND SUITABILITY FOR COTTON

Indankal 3 Micro-watershed

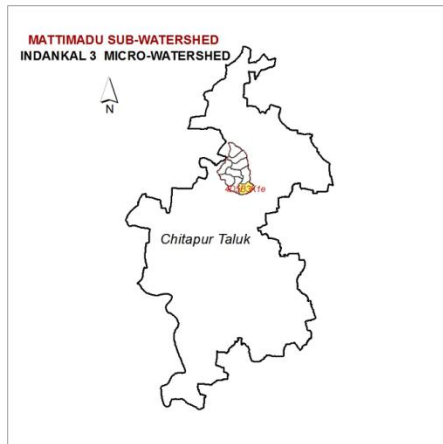
(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Source: ICAR-NBSS&LUP, Bengaluru



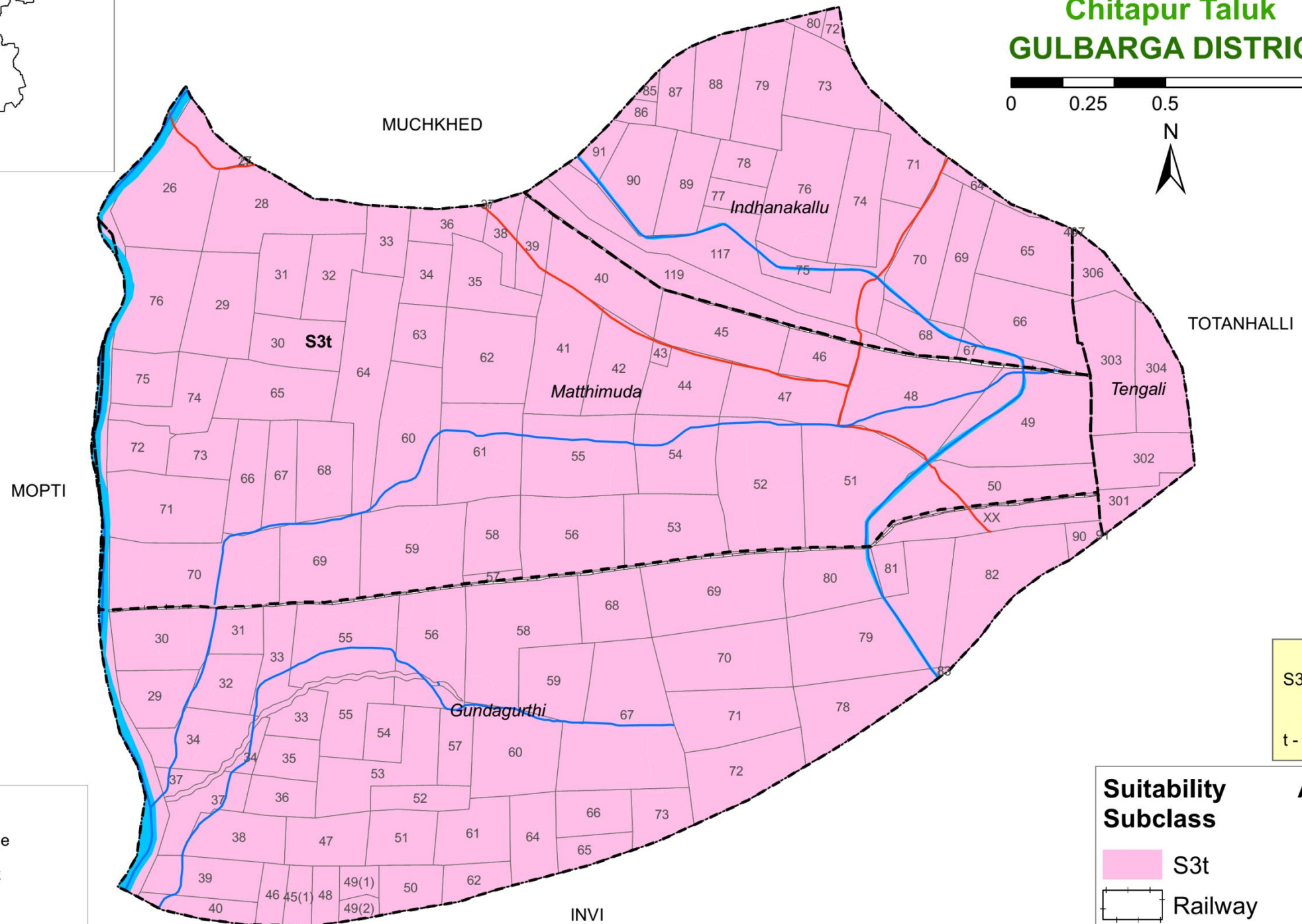
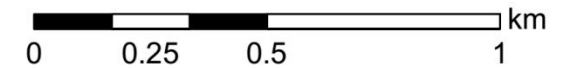
LAND SUITABILITY FOR SUGARCANE

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key
S3 - Marginally Suitable
Limitations
t - texture

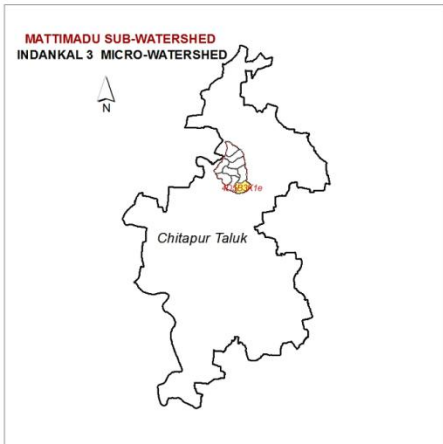
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S3t	699 (97.95)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



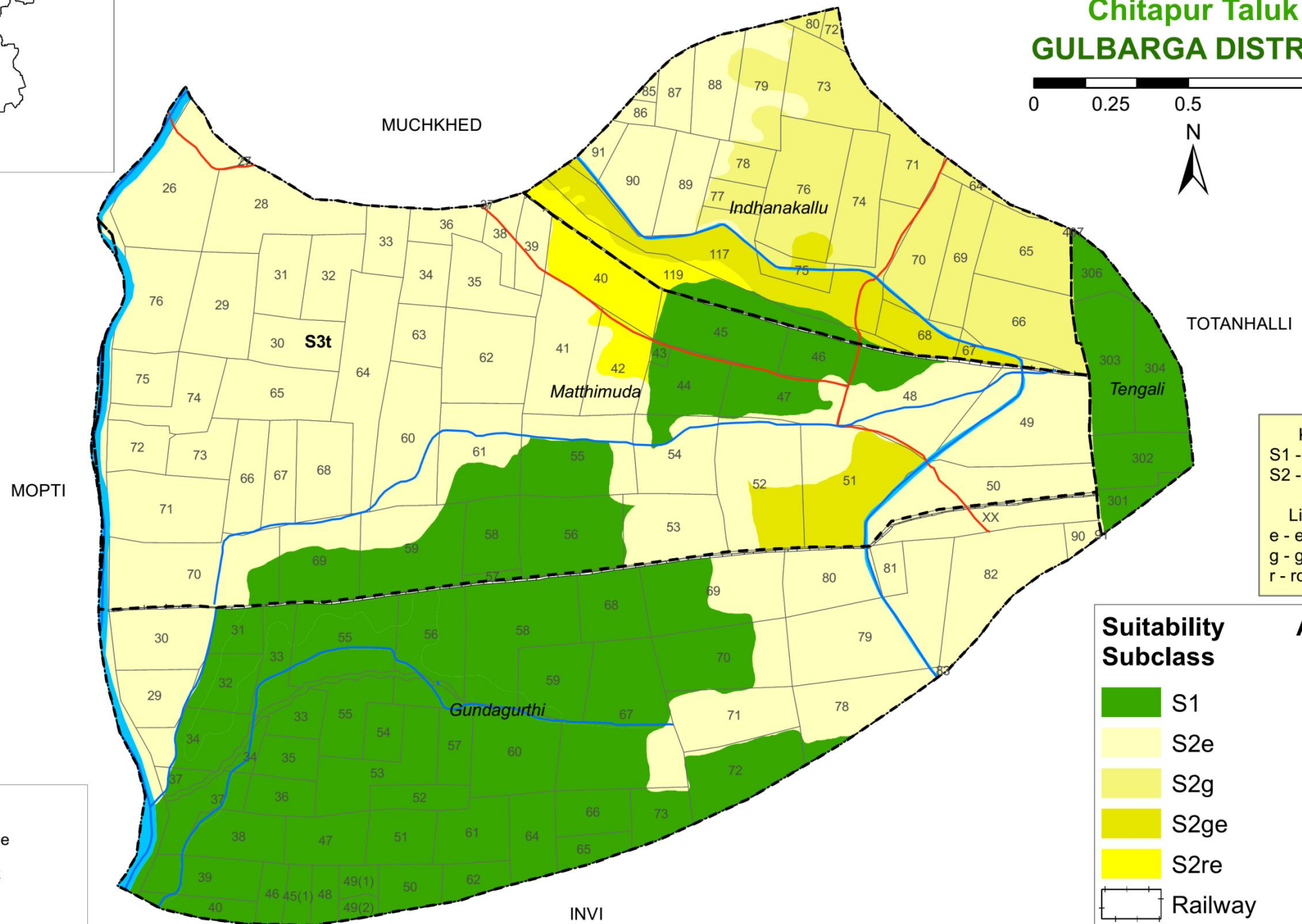
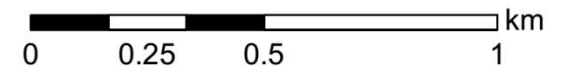
LAND SUITABILITY FOR SOYBEAN

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key
S1 - Highly Suitable
S2 - Moderately Suitable

Limitations
e - erosion
g - gravelliness/stoniness
r - rooting condition

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S1	257 (36.06)
S2e	332 (46.61)
S2g	65 (9.14)
S2ge	29 (4.13)
S2re	14 (2.01)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

LAND SUITABILITY FOR BENGALGRAM

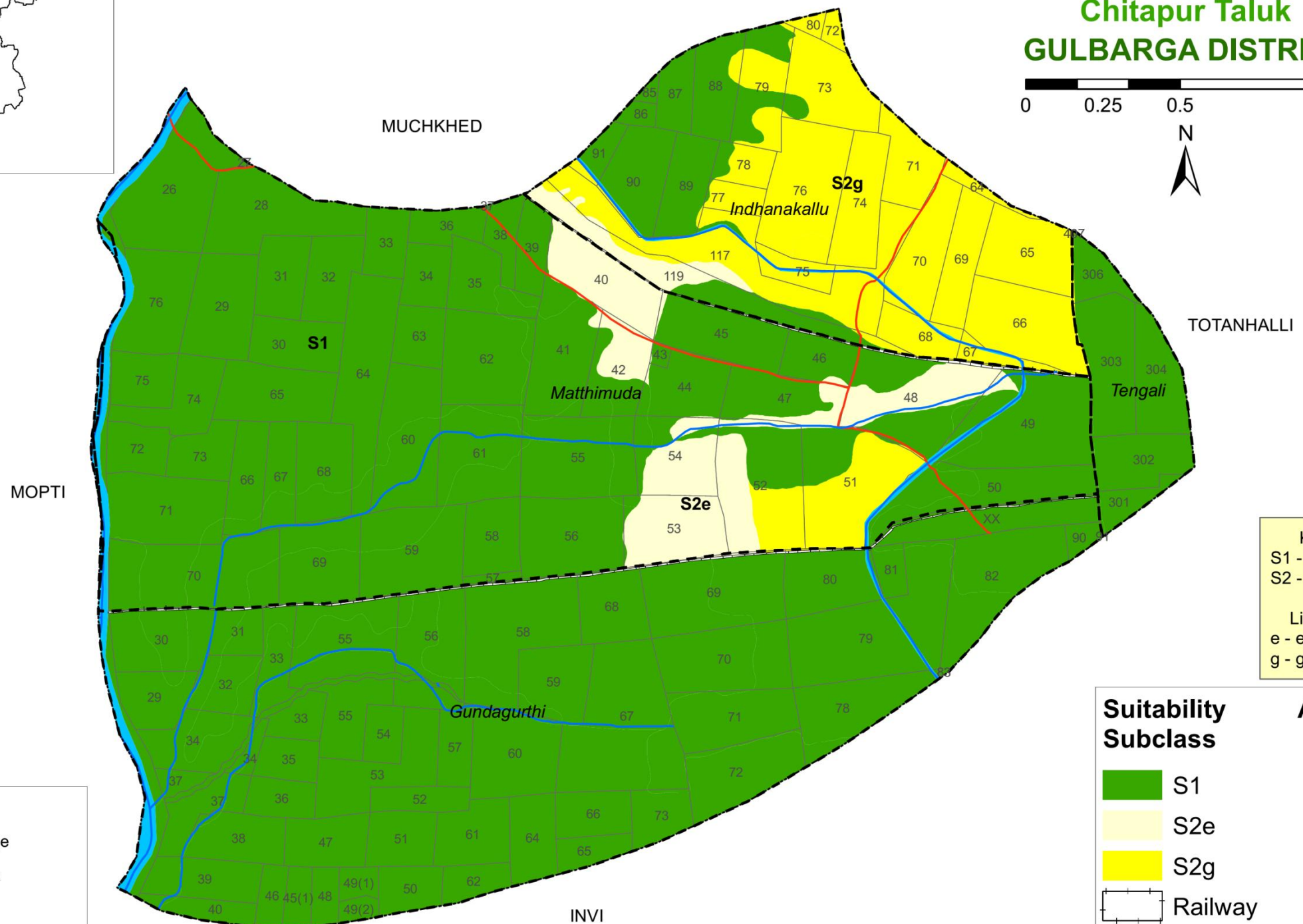
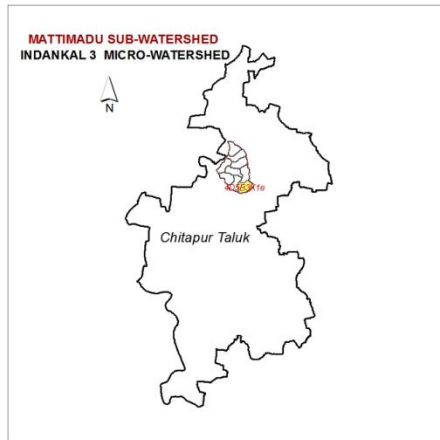
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



Key
S1 - Highly Suitable
S2 - Moderately Suitable

Limitations
e - erosion
g - gravelliness/stoniness

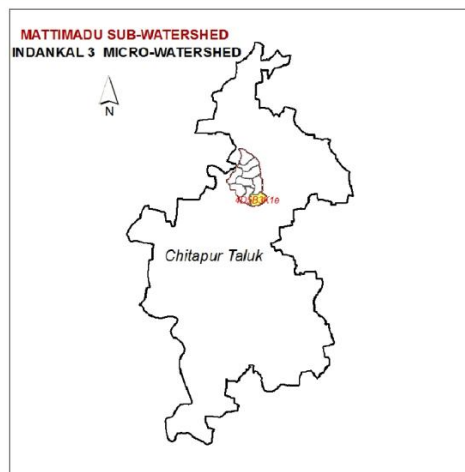
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
 S1	566 (79.42)
 S2e	38 (5.27)
 S2g	95 (13.27)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR GUAVA

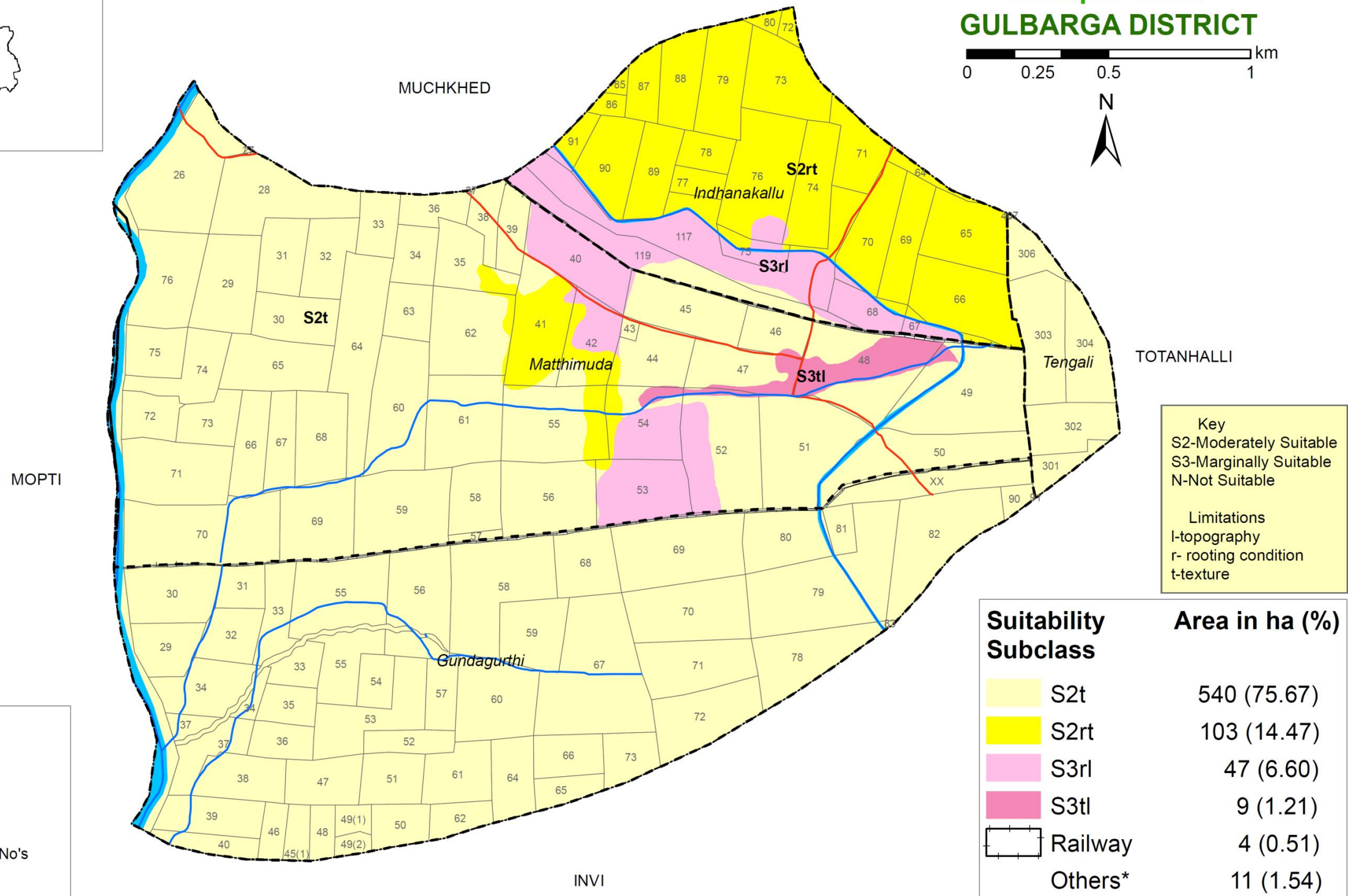
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



Key
S2-Moderately Suitable
S3-Marginally Suitable
N-Not Suitable

Limitations
l-topography
r- rooting condition
t-texture

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
 S2t	540 (75.67)
 S2rt	103 (14.47)
 S3rl	47 (6.60)
 S3tl	9 (1.21)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

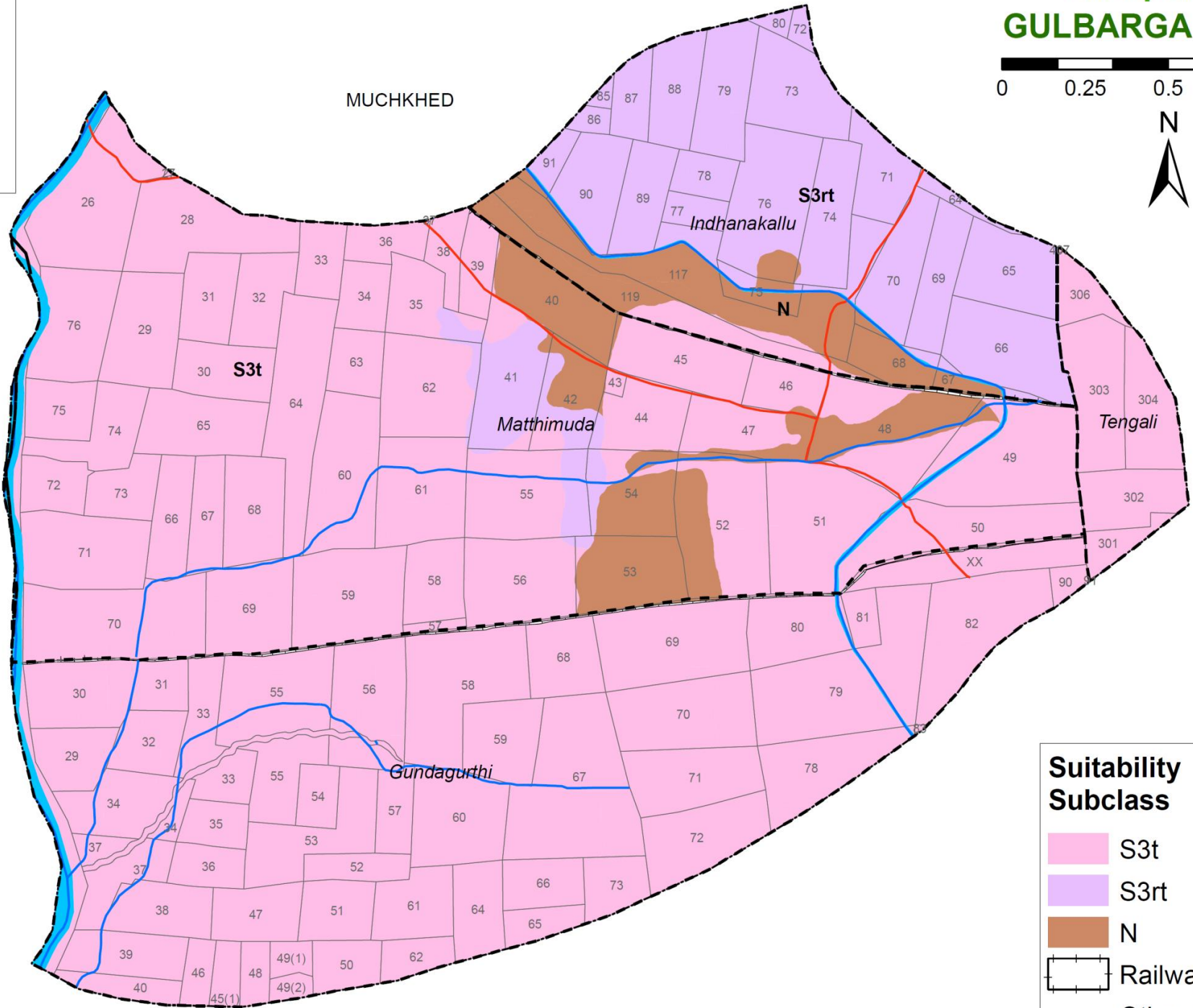
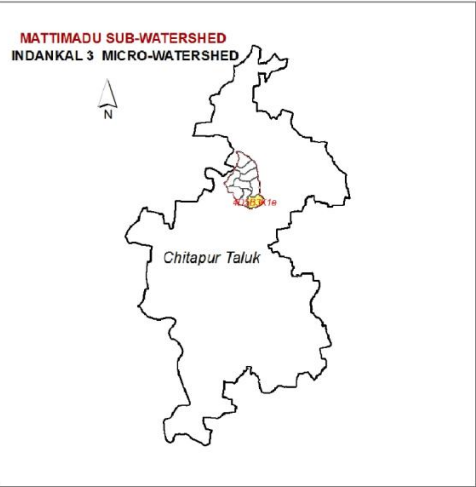
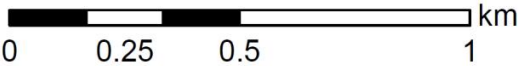
LAND SUITABILITY FOR MANGO

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



TOTANHALLI

MOPTI

INV I

MUCHKHED

S3rt

Indhanakallu

N

Matthimuda

Tengali

Gundagurthi

Key

S3-Marginally Suitable

N-Not Suitable

Limitations

r- rooting condition

t-texture

References

Stream/Drainage

Road/Cart track

Waterbody

Land parcel with No's

Village boundary

Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S3t	540 (75.67)
S3rt	103 (14.47)
N	56 (7.82)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

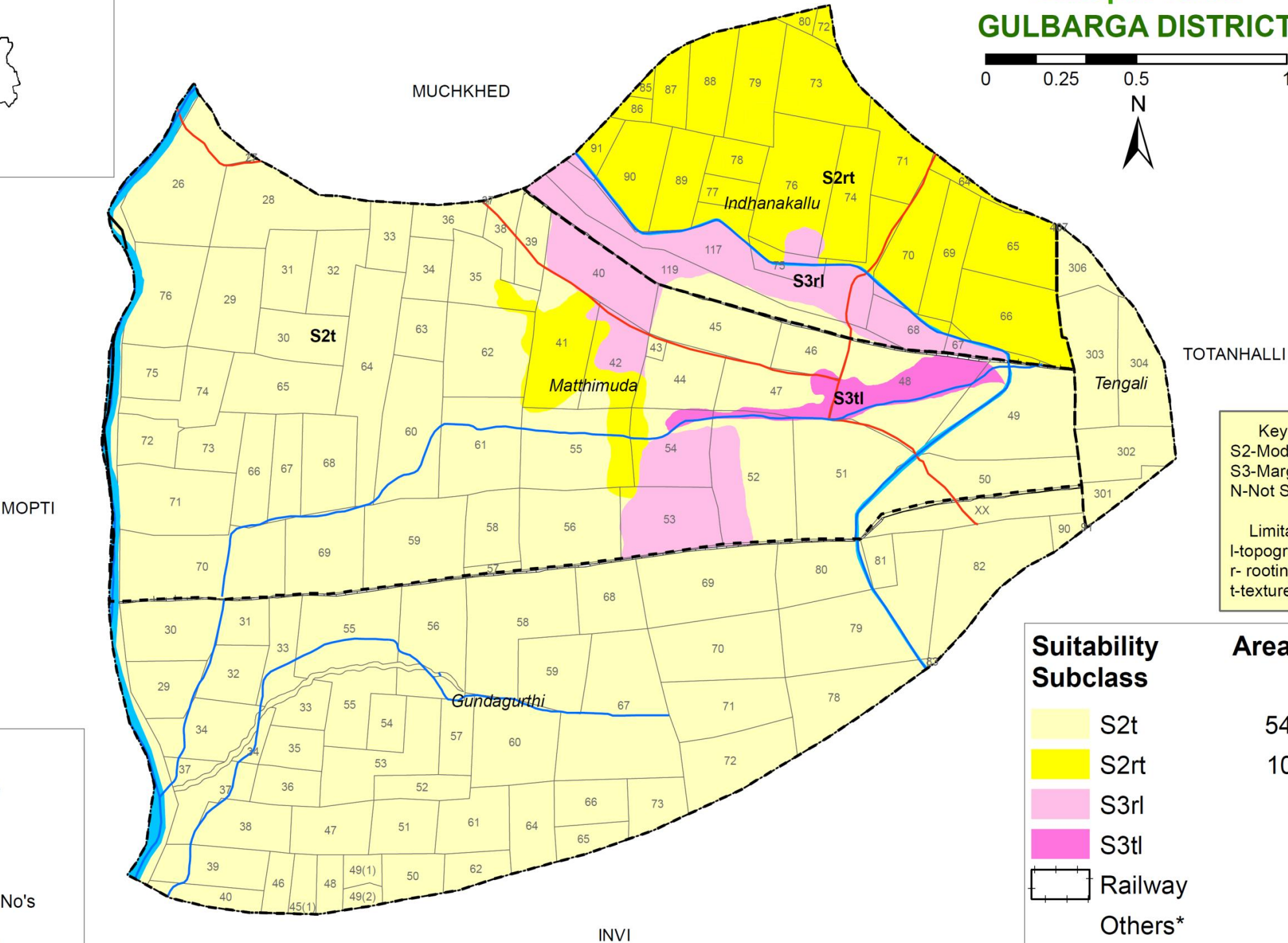
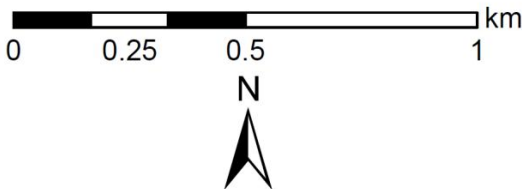
LAND SUITABILITY FOR SAPOTA

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key

S2-Moderately Suitable
S3-Marginally Suitable
N-Not Suitable

Limitations

l-topography
r- rooting condition
t-texture

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S2t	540 (75.67)
S2rt	103 (14.47)
S3rl	47 (6.60)
S3tl	9 (1.21)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

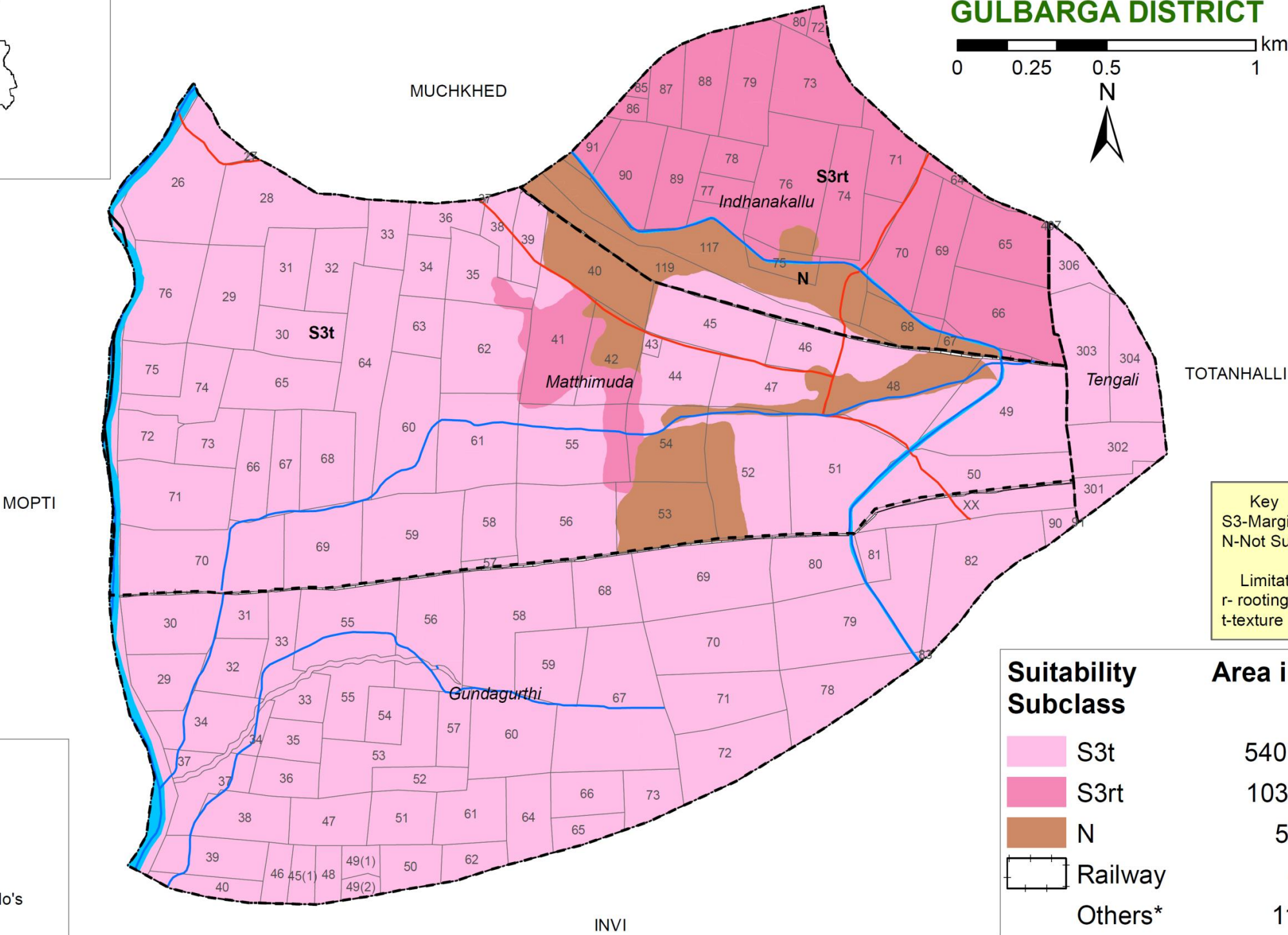
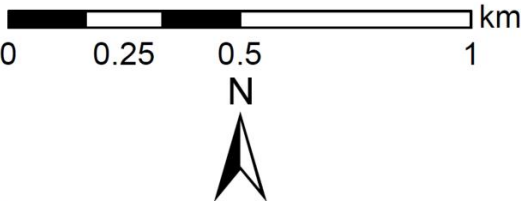
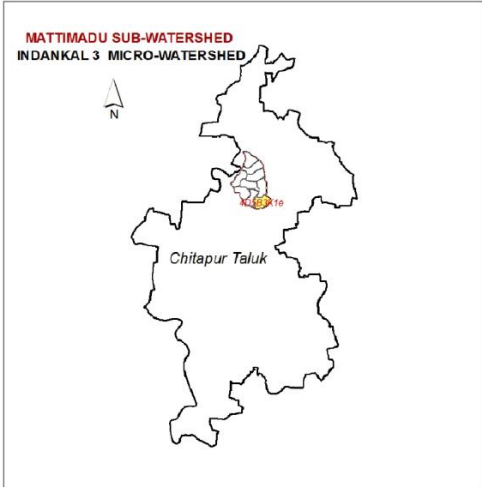
LAND SUITABILITY FOR JACKFRUIT

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

<p>Key</p> <p>S3-Marginally Suitable</p> <p>N-Not Suitable</p> <p>Limitations</p> <p>r- rooting condition</p> <p>t-texture</p>	
Suitability Subclass	Area in ha (%)
S3t	540 (75.67)
S3rt	103 (14.47)
N	56 (7.82)
Railway	4 (0.51)
Others*	11 (1.54)
* - Waterbody	

Source: ICAR-NBSS&LUP, Bengaluru

LAND SUITABILITY FOR JAMUN

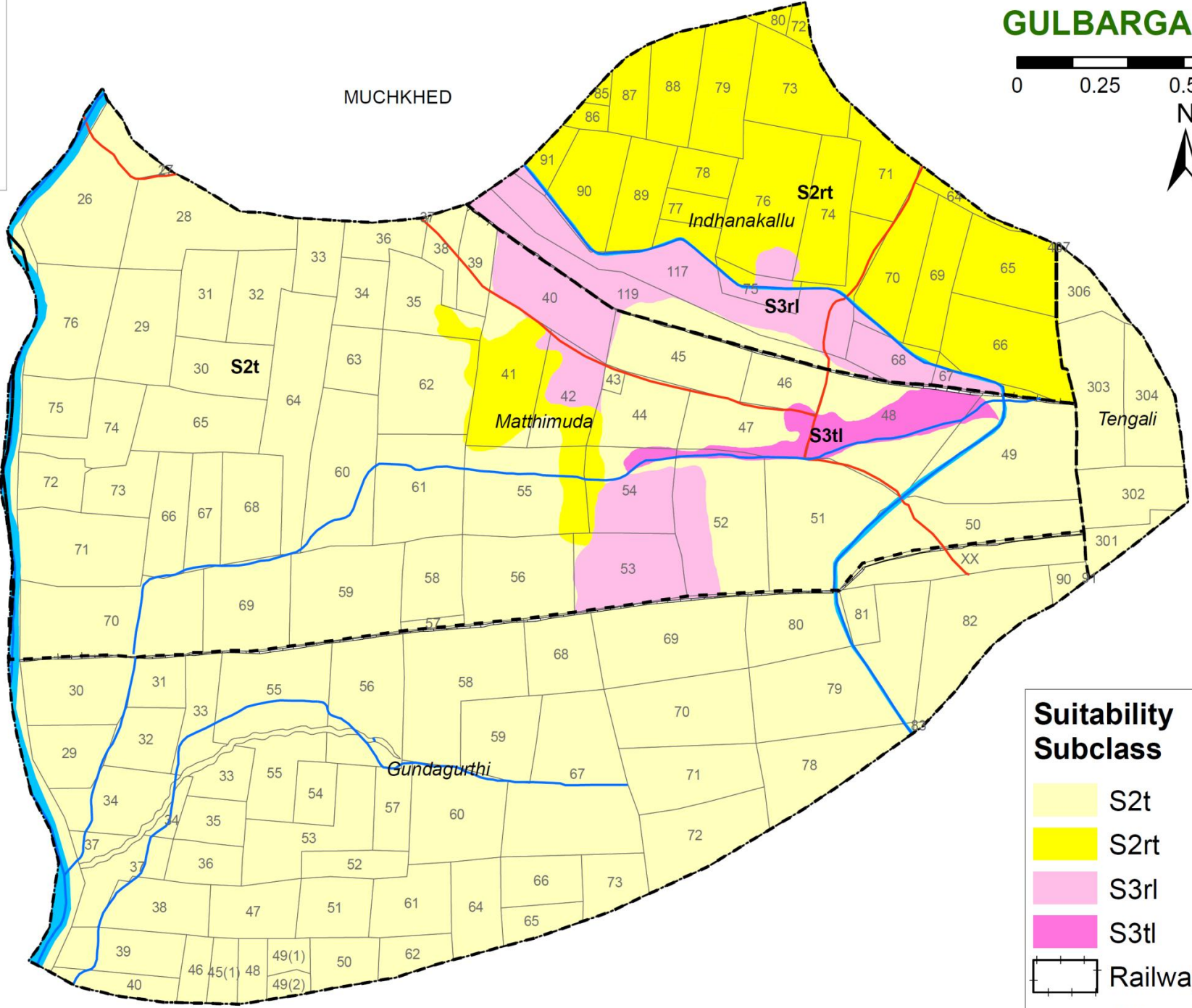
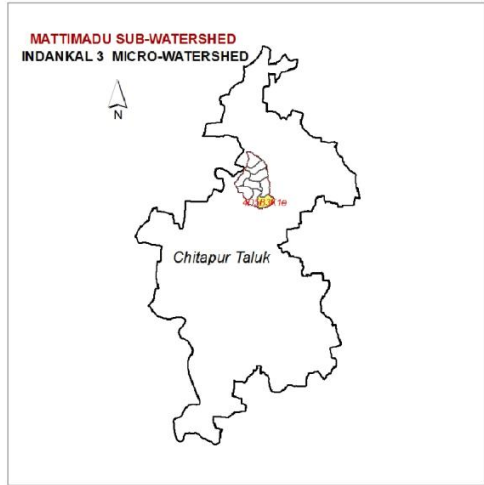
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



TOTANHALLI

MOPTI

INVI

Key
S2-Moderately Suitable
S3-Marginally Suitable
N-Not Suitable

Limitations
l-topography
r- rooting condition
t-texture

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass

Area in ha (%)

S2t	540 (75.67)
S2rt	103 (14.47)
S3rl	47 (6.60)
S3tl	9 (1.21)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

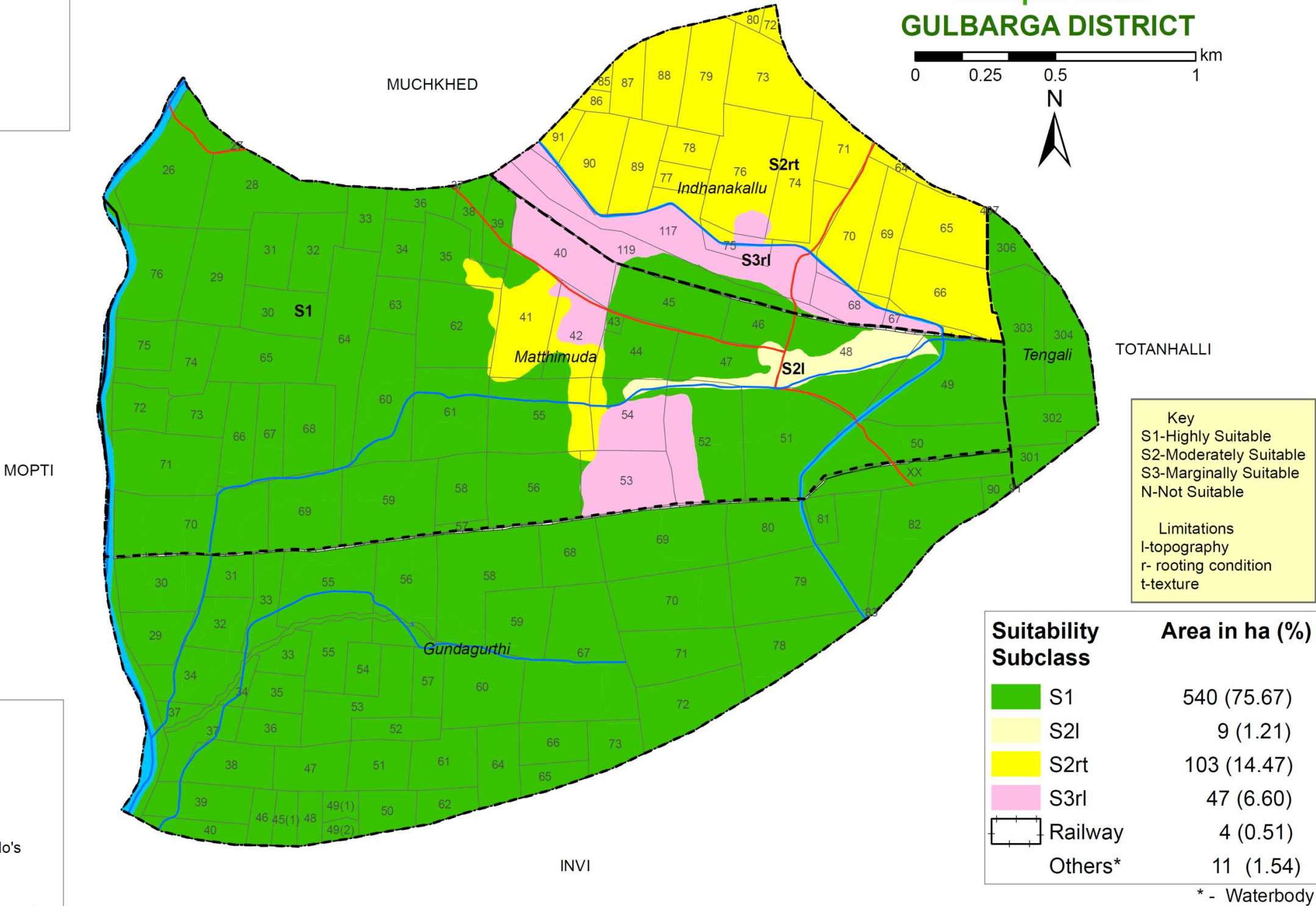
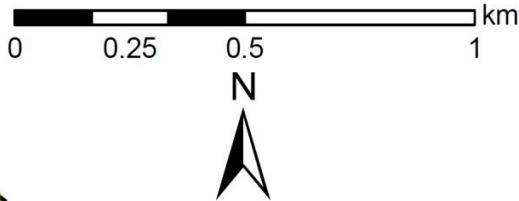
Source: ICAR-NBSS&LUP, Bengaluru

LAND SUITABILITY FOR MUSAMBI

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk
GULBARGA DISTRICT



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Key

- S1-Highly Suitable
- S2-Moderately Suitable
- S3-Marginally Suitable
- N-Not Suitable

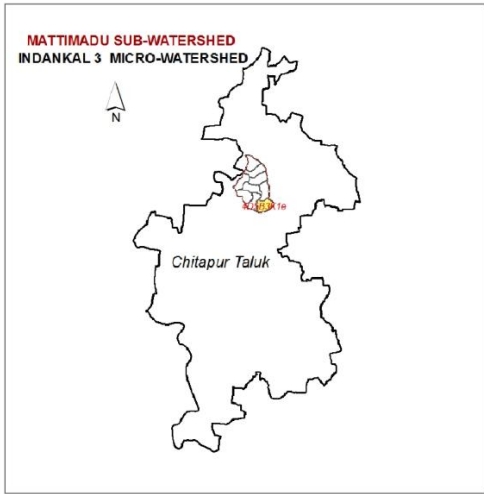
Limitations

- l-topography
- r- rooting condition
- t-texture

Suitability Subclass	Area in ha (%)
S1	540 (75.67)
S2I	9 (1.21)
S2rt	103 (14.47)
S3rl	47 (6.60)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

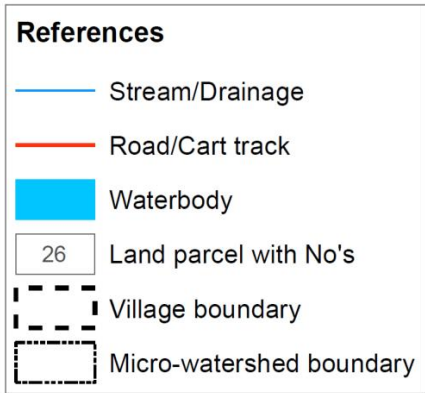
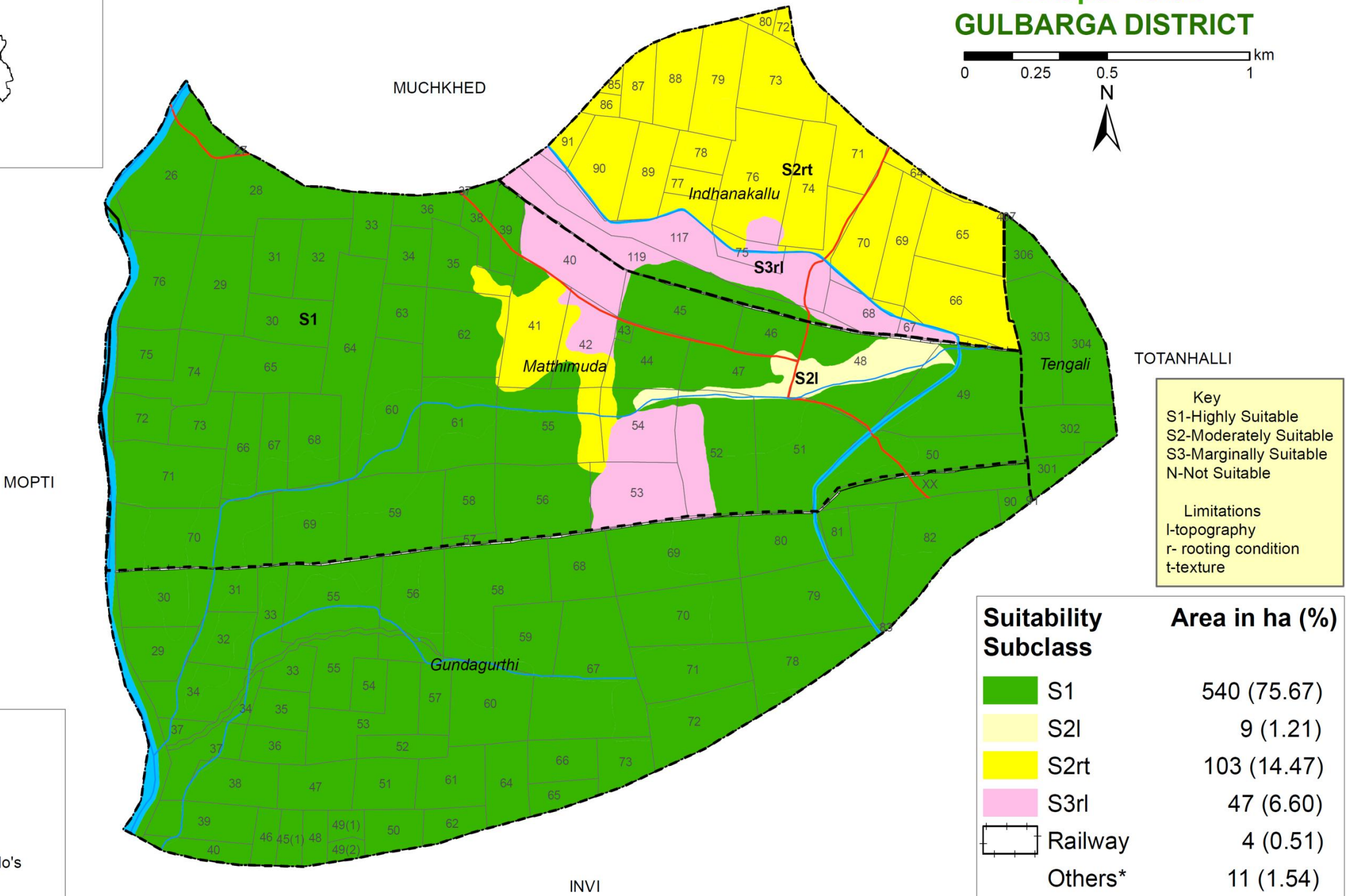
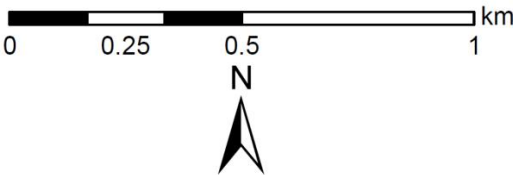


LAND SUITABILITY FOR LIME

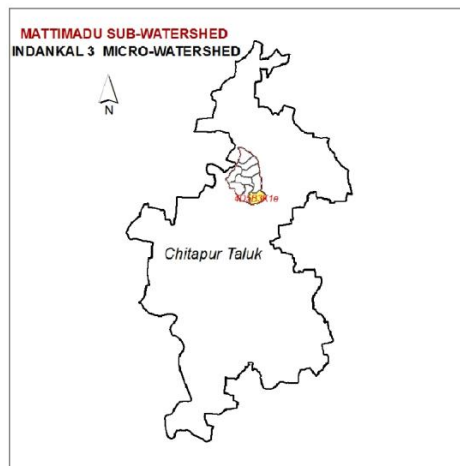
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk
GULBARGA DISTRICT



Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR CASHEW

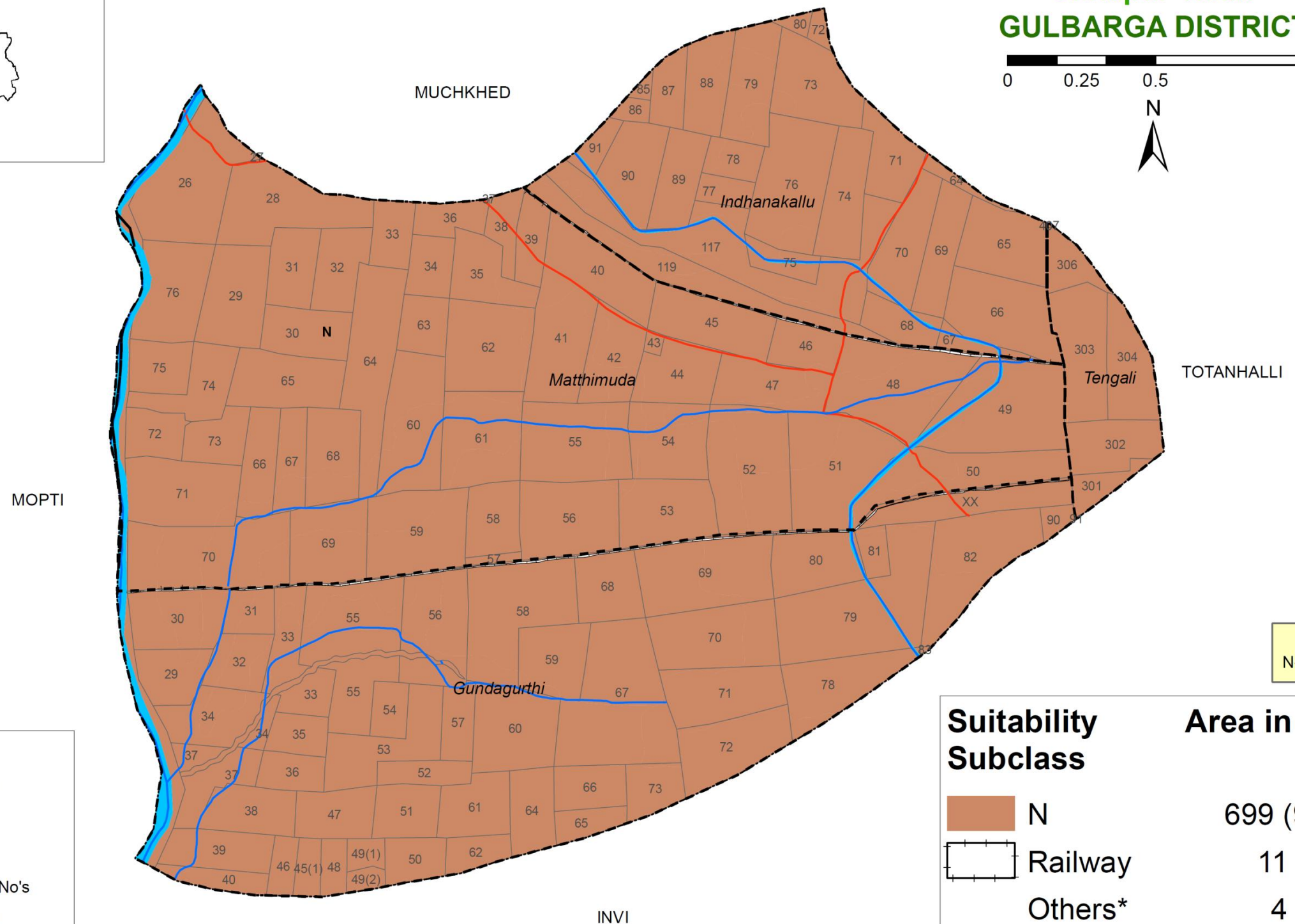
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



Key
N-Not Suitable

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

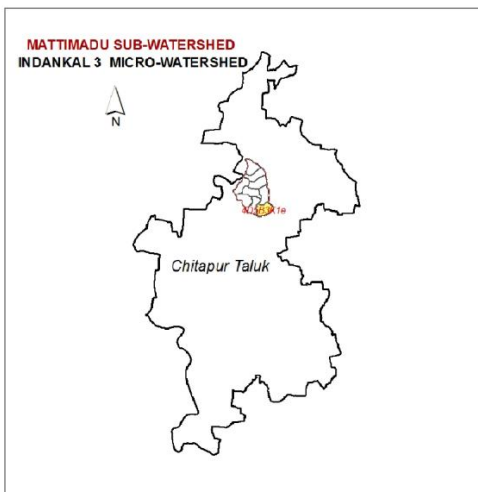
Suitability Subclass

Area in ha (%)

N	699 (97.95)
Railway	11 (1.54)
Others*	4 (0.51)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



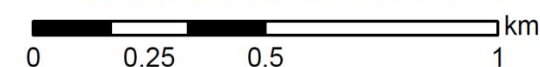
LAND SUITABILITY FOR CUSTARD APPPLE

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

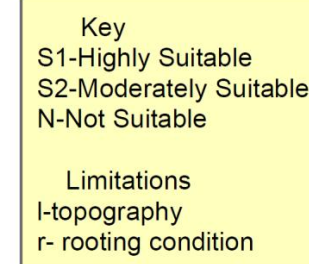
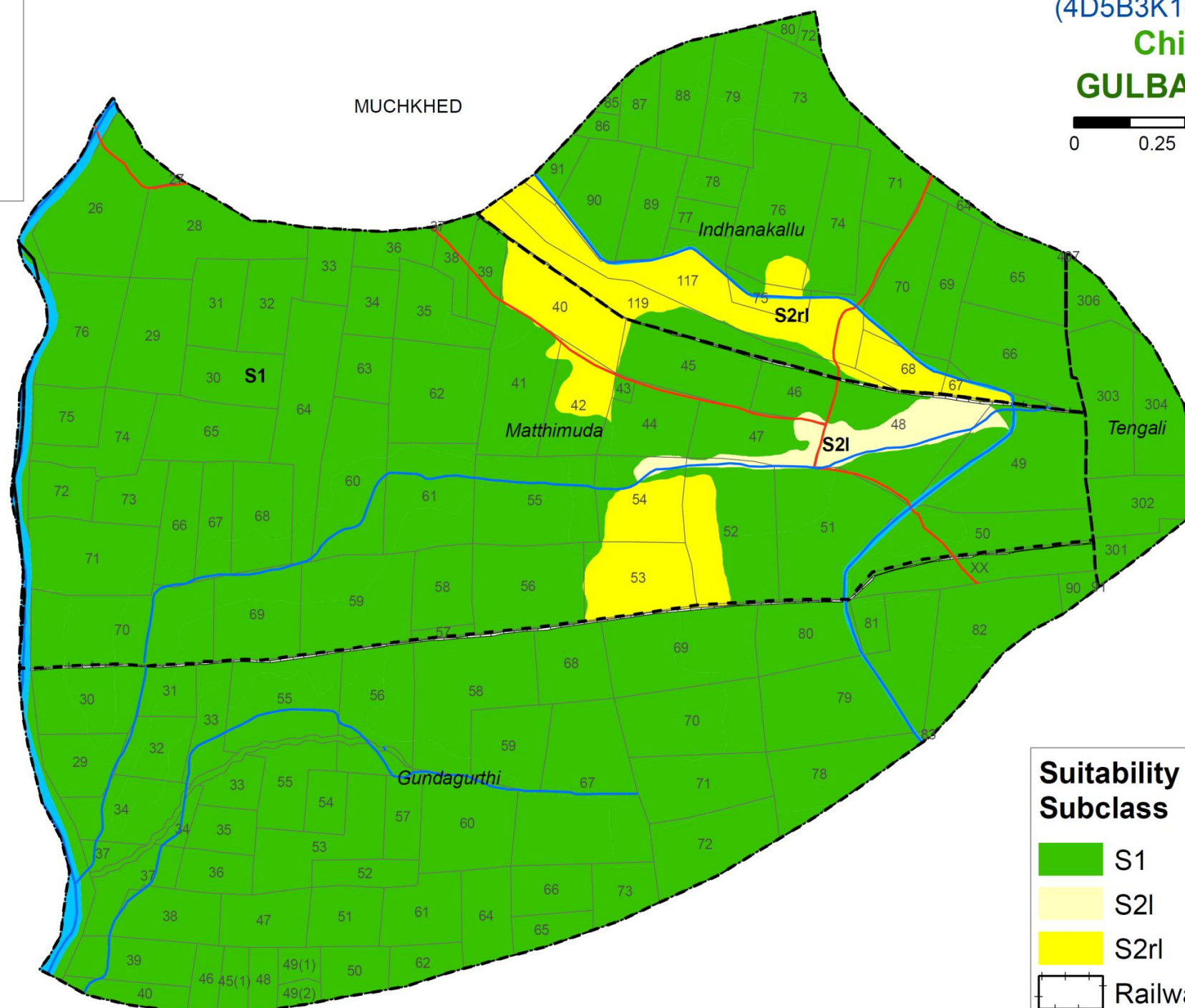
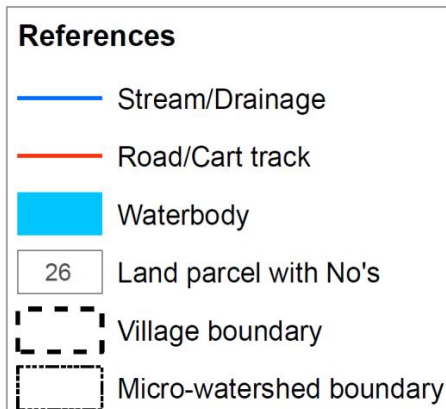


MOPTI

MUCHKHED

TOTANHALLI

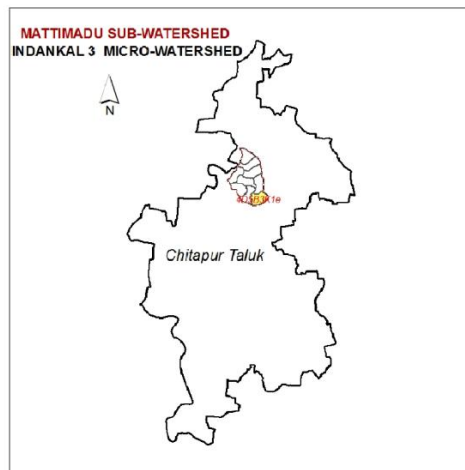
INVI



Suitability Subclass	Area in ha (%)
S1	643 (90.13)
S2l	9 (1.21)
S2rl	47 (6.60)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR AMLA

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



MOPTI

MUCHKHED

TOTANHALLI

INVI

References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

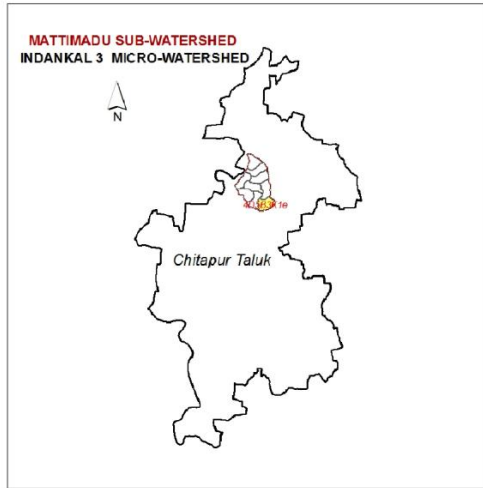
Key
S1-Highly Suitable
S2-Moderately Suitable
N- Not Suitable

Limitations
l-topography
r- rooting condition

Suitability Subclass	Area in ha (%)
■ S1	643 (90.13)
■ S2l	9 (1.21)
■ S2rl	47 (6.60)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



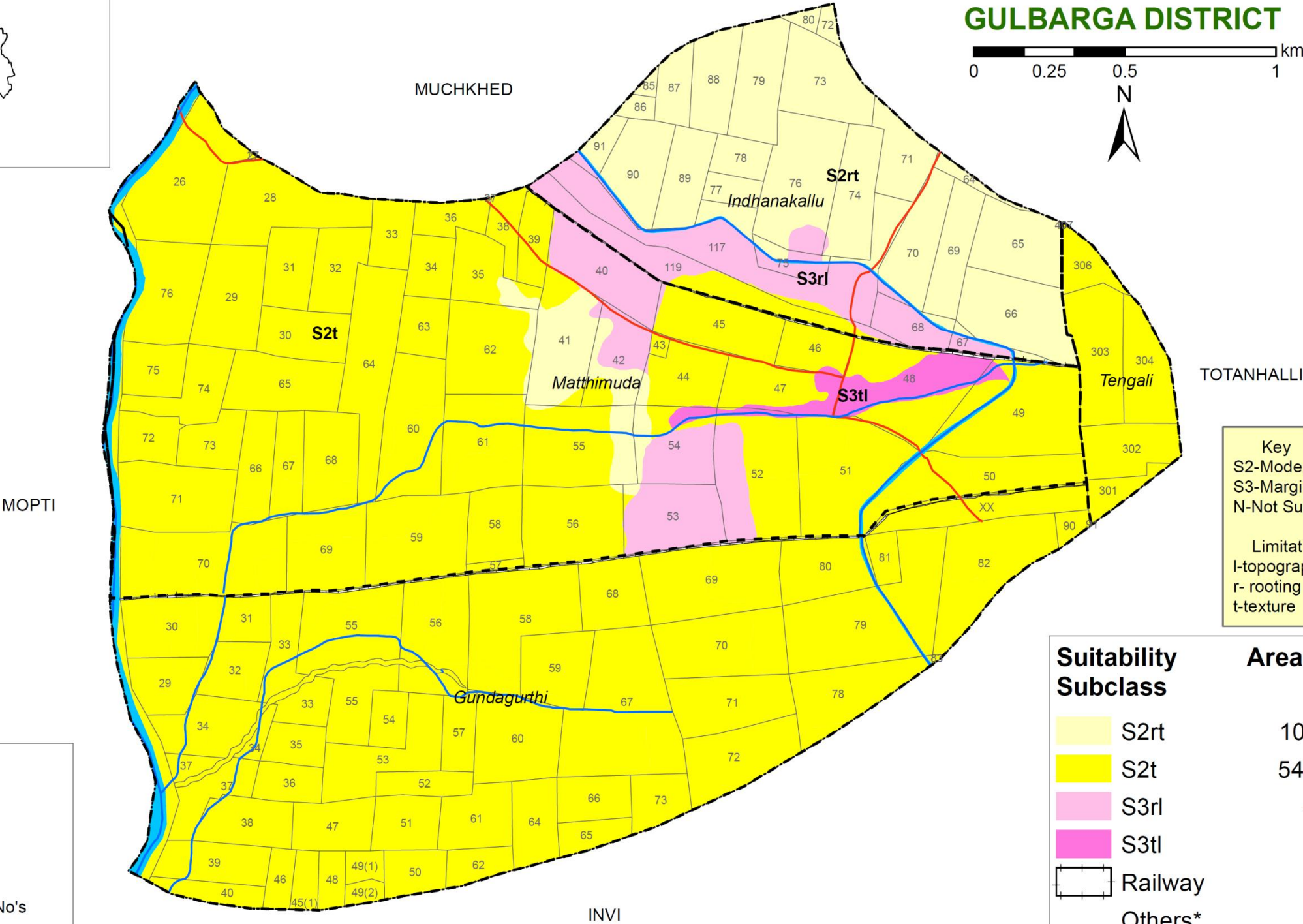
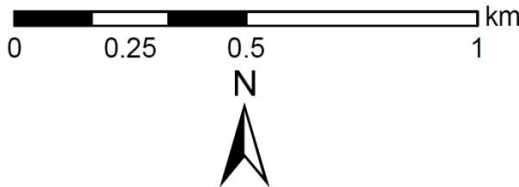
LAND SUITABILITY FOR TAMARIND

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT



Key
 S2-Moderately Suitable
 S3-Marginally Suitable
 N-Not Suitable

Limitations
 l-topography
 r- rooting condition
 t-texture

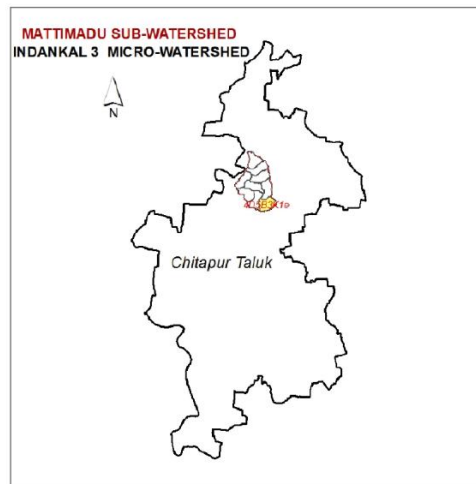
References

- Stream/Drainage
- Road/Cart track
- Waterbody
- Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability Subclass	Area in ha (%)
S2rt	103 (14.47)
S2t	540 (75.67)
S3rl	47 (6.60)
S3tl	9 (1.21)
Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



LAND MANAGEMENT UNITS

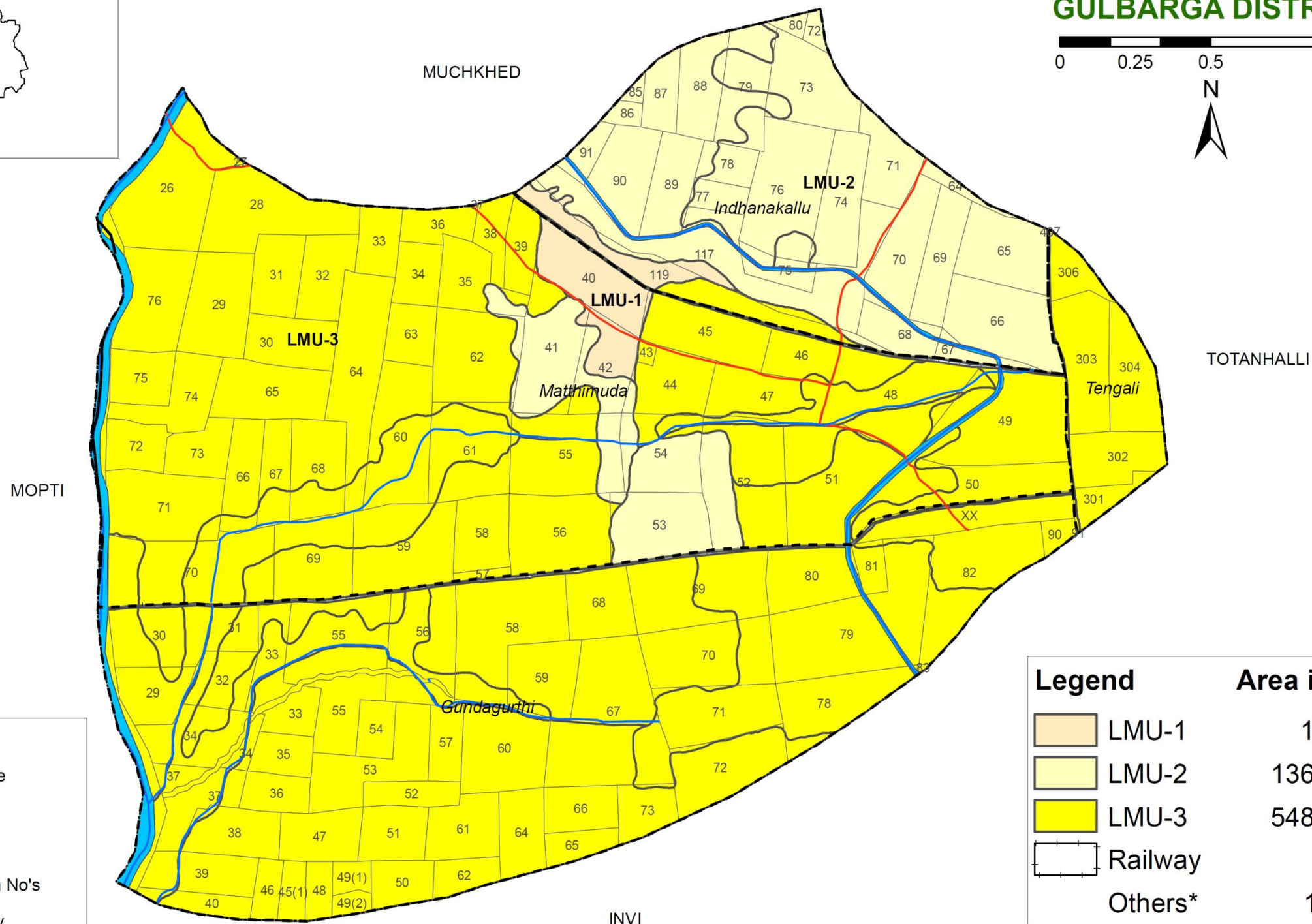
Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Legend

	Area in ha (%)
 LMU-1	14 (2.01)
 LMU-2	136 (19.06)
 LMU-3	548 (76.88)
 Railway	4 (0.51)
Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

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

**Table. Proposed Crop Plan for Indankal-3 Micro-watershed, Mattimadu Sub-watershed
Chitapur Taluk, Gulbarga District based on soil-site–crop suitability Assessment**

LMU	Mapping unit	Survey No	Characters	Crops proposed				Suitable Intervention
				Field crops	Forestry Crop/Grasses	Horticulture crops (Rainfed Condition)	Horticulture crops with suitable intervention	
LMU-1	TNHmC3	Indhankallu: 119 Mattimuda: 40,42	Moderately shallow black soil (50-75 cm) 3-5 % slope severely eroded.	Sorghum, Black gram, Green gram, Soybean, Sesame, Safflower Rabi: Sorghum, Chickpea	Subabhul, Neem, Teak	Custard apple, Charoli, Ber, Amla Vegetable: Ladies finger, Brinjal, Cowpea, Flower: Marigold, Chrysanthemum	Custard apple, Charoli, Ber, Amla, Papaya, Lime, Citrus Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds
LMU-2	7 MTMmB1 8 MTMmB1g1 9 MTMmB2 10 MTMmC2g1 11 MTMmC3	Indhankallu: 64,65,66,67,68, 69,70,71,72,73, 74,75,76,77,78, 79,80,85,86,87, 88,89,90,91,117 Mattimuda: 41,52,53,54	Moderately deep black soil (75-100 cm), 1-3 % slope, slightly to moderately eroded.	Sorghum, Cotton, Red Gram, Black gram, Green gram, Soybean, Sesame, Sunflower, Safflower Rabi: Sorghum, Chickpea	Subabhul, Neem, Teak	Custard apple, Charoli, Ber, Amla Vegetable: Ladies finger, Brinjal, Cowpea, Flower: Marigold, Chrysanthemum	Custard apple, Charoli, Ber, Amla, Papaya, Banana, Lime, Citrus Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds

LMU	Mapping unit	Survey No	Characters	Crops proposed				Suitable Intervention
				Field crops	Forestry Crop/Grasses	Horticulture crops (Rainfed Condition)	Horticulture crops with suitable intervention	
LMU-3	1 DDTmB1 2 DDTmB2 3 DDTmB2g1 4 DDTmC3 5 DRGmB1 6 DRGmB2	Gundagurthi: 29,30,31,32,33,34,35,36 ,37,38,39,40,45(1),46,4 7,48,49(1),49(2),50,51,5 2, 53,54,55,56,57,58,59,60 ,61,62,64,65,66,67,68,6 9,70,71,72,73,78,79,80, 81,82,83,90,91 Mattimuda: 26,27,28,29,30,31,32,33 ,34,35,36,37,38,39,43,4 4,45,46,47,48,49,50,51, 55,56,57,58,59,60,61,62 ,63,64,65,66,67,68,69,7 0,71,72,73,74,75,76 Tengali: 301,302,303,304,306, 407	Deep to very deep Black soil (100-150 & >150 cm), 1-3 % slope, slight to moderate erosion	Sorghum, Cotton, Red Gram,Black gram, Green gram, Soybean, Sunflower, Safflower, Sesame, Rabi: Sorghum, wheat, Chickpea Mixed cropping: Red gram-cotton Pulses+sorghum	-	Vegetable: Ladies finger, Brinjal, Cowpea, coriander Field crops: Sorghum, Cotton, Red Gram, Sunflower, Safflower, Perennial component: Guava, Tamarind, Sapota, Lime, Mosambi Flower: Marigold, Chrysanthemum	Banana, Papaya, Lime. Mosambi, Guava, Tamrind Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds

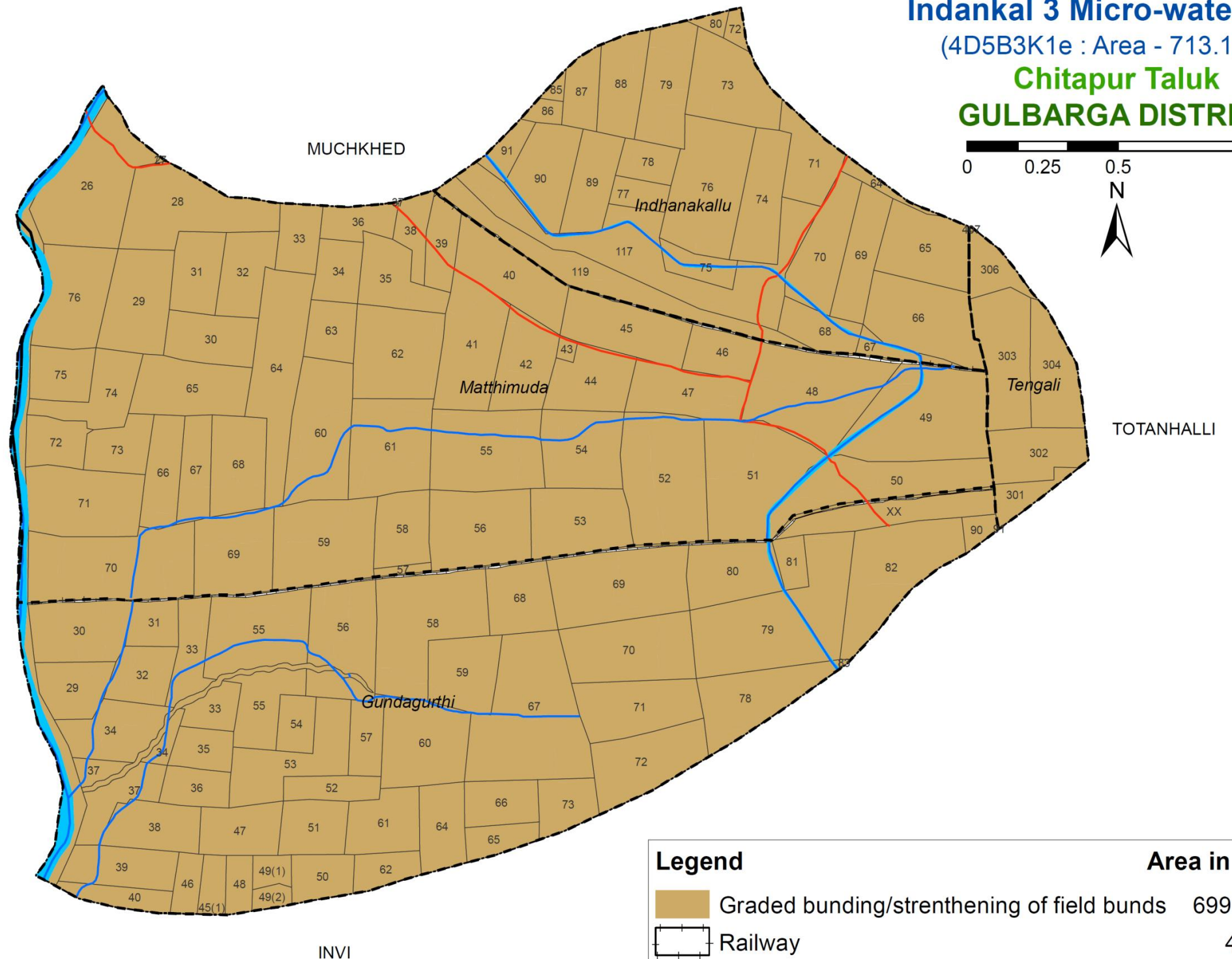
SOIL & WATER CONSERVATION PLAN

Indankal 3 Micro-watershed

(4D5B3K1e : Area - 713.19 ha)

Chitapur Taluk GULBARGA DISTRICT

0 0.25 0.5 1 km



References

- Stream/Drainage
- Road/Cart track
- Waterbody
- 26 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Legend

	Graded bunding/strenthening of field bunds	699 (97.95)
	Railway	4 (0.51)
	Others*	11 (1.54)

* - Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

WATER BUDGETING

Indakal 3 Micro-watershed, Chitapur Taluk				(4D5B3K1e : Area - 713.19 ha)			
EXAMPLE:							
Catchment Details:	Area:	713.2	ha.	Average annual Rainfall		723 mm	
	slope:	1 to 5	%	NO. of Runoff Producing Rains		8	
				Total Depth of Rain on runoff producing rainy days		99 mm	
				(Run off producing Rainy day : A day with > 2o mm depth Rain)			
A. QUANTITY OF RUNOFF WATER:							
=	Catchment area (ha.)	x	Depth of rain water of runoff producing rains(mm)		x	10000	
			3/4 x			1000	
=	713.19 x		99 x			10000	
=			7 1/4 x			1000	
=	368853.777 m³						
B. QUANTITY OF WATER STORED BEHIND GRADED BUNDS (0.3M Crest height in Waste weirs):.							
=	Bund Length	x	Cross sectional area of storage (m²)				
=	139638 x		2.16		S / F	Where:	
=	301618.08 m³					s = landslope:	2.08 %
						F = Fall between bunds	0.6 m
TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.							
	GRADED BUND						TOTAL
	301618.08						301618.08
C. BALANCE OF RUNOFF WATER:							
=	QUANTITY OF RUNOFF WATER -		-	TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.			
=	368853.78	-	301618.08				
=	67235.70 m³						
NOTE: QUANTITY OF RUNOFF TO BE SET APART FOR THE COMMITMENTS LIKE EXISTING WATER BODIES HAS TO BE TAKEN CARE OF BEFORE FINALISING THE NUMBER AND CAPACITY OF STORAGE/ RECHARGE STRUCTURES							

D. ADDITIONAL STORAGE STRUCTURES:

= BALANCE OF RUNOFF WATER/ STORAGE CAPACITY OF PROPOSED STRUCTURE

			STORAGE CAPACITY (m3)		
DIMENSION OF POND(m)			EXCAVATION BY SEGMENTAL METHOD		EXCAVATION BY MECHANICAL MEANS
L x W x D			QUANTITY (m³)	NOS.	QUANTITY (m³) NOS.
67235.70	/	319.7	12 X 12 X 3	319.7	210 258 261
OR					
67235.70	/	530.3	15 X 15 X 3	530.3	127 447 150
OR					
67235.70	/	794.9	18 X 18 X 3	794.9	85 690 97
OR					
67235.70	/	1113.5	21 X 21 X3	1113.5	60 987 68

OR CHECK DAMS/NALA BUNDS ON DECIDING THE IDEAL SPOTS FOR RECHARGE

PART - B

Hydrological Inventory of Mattimadu Sub-watershed, Chitapur Taluk, Kalaburagi District, Karnataka for Watershed Planning and Development



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



**Hydrological Inventory of Mattimadu Sub-watershed, Chitapur
Taluk, Kalaburagi District, Karnataka for Watershed Planning
and Development**



ICAR - NBSS & LUP

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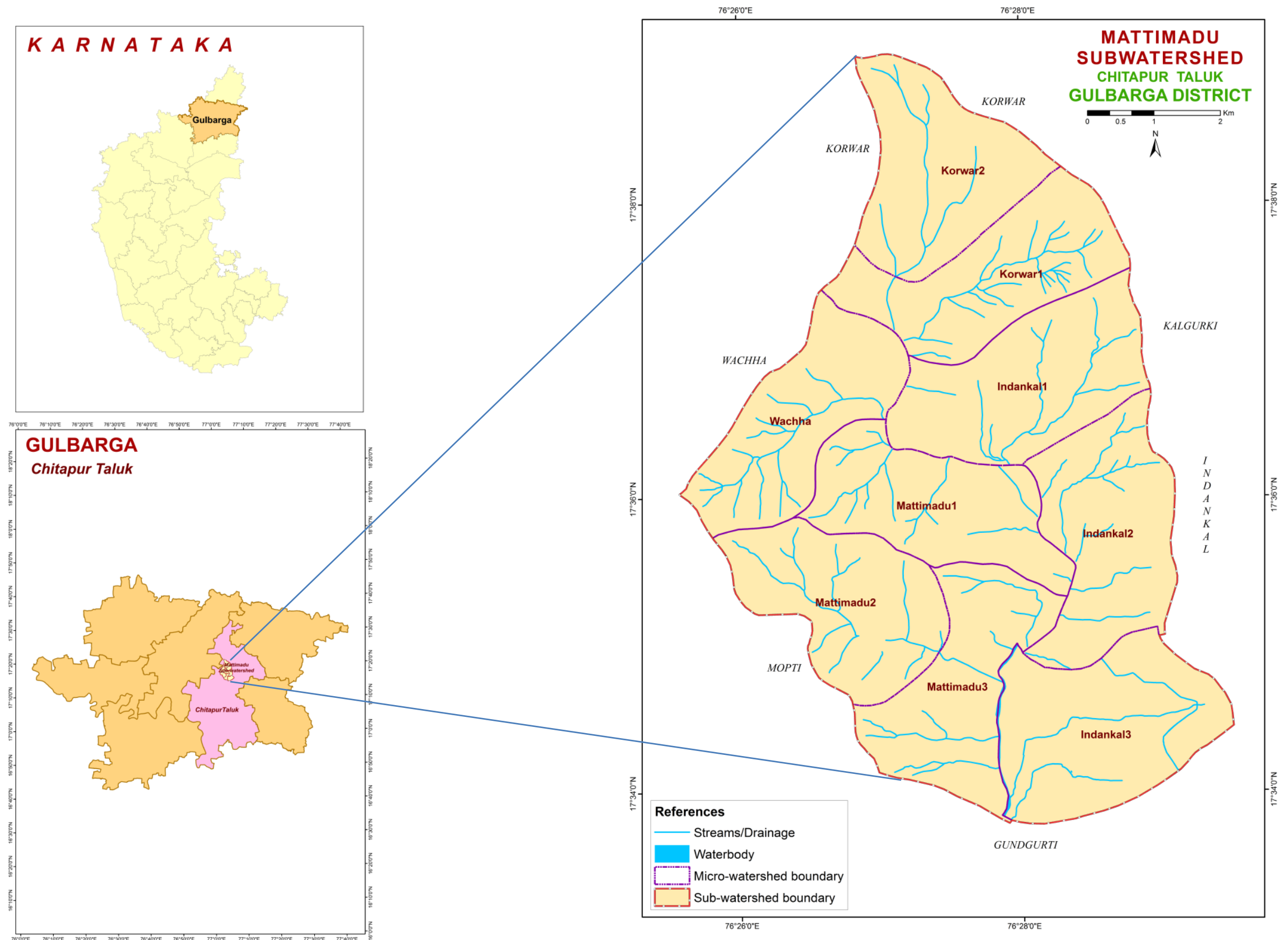
Details of Hydrology Team of LRI Partner Responsible for Preparation of Atlas

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

INTRODUCTION

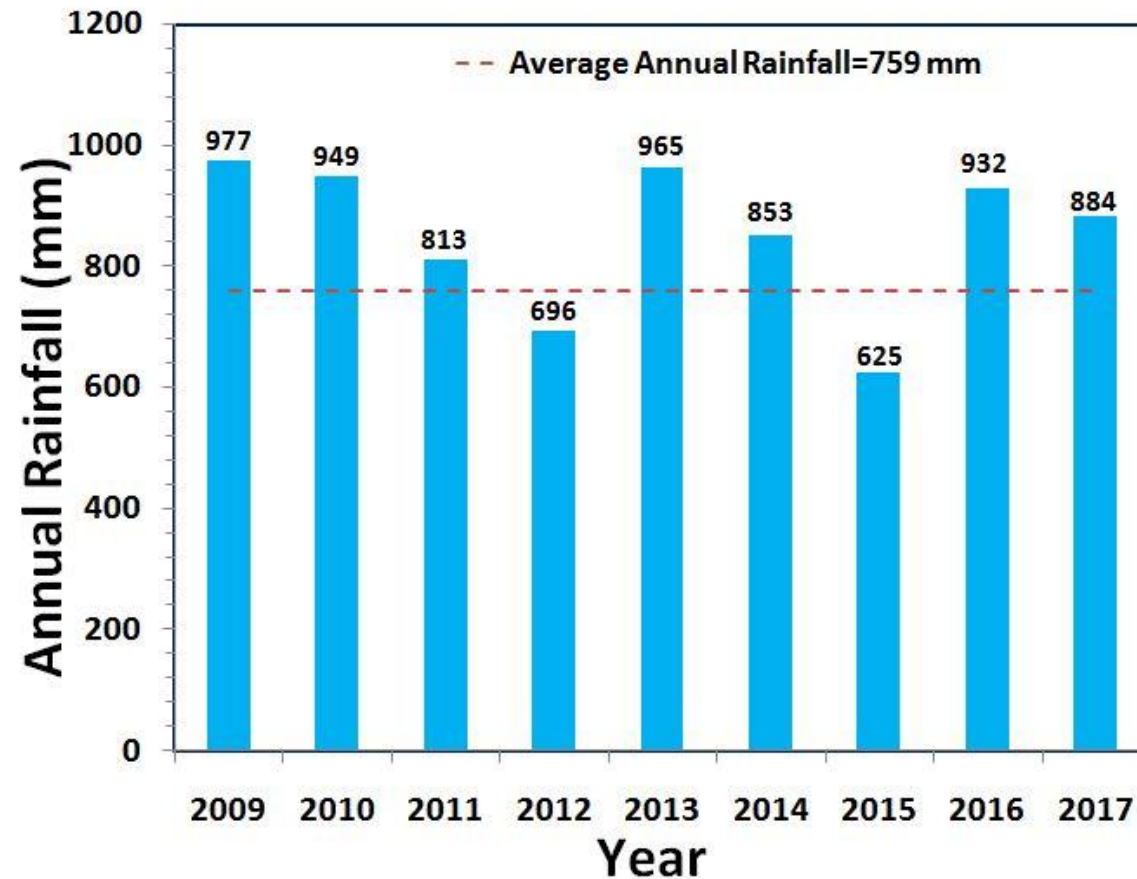
- The inventory and documentation of spatial and temporal changes in hydrological components of Mattimadu sub-watershed (4D5B3K) in Chitapur taluk, Kalaburagi district, has been undertaken for integrated planning, development and management at the level of soil mapping units.
- Mattimadu sub-watershed (Chitapur taluk, Kalaburagi district) is located between $17^{\circ}14'35''$ – $17^{\circ}20'32''$ North latitudes and $77^{\circ}1'50''$ – $77^{\circ}6'12''$ East longitudes, covering an area of about 5588 ha.
- This sub-watershed encompasses of 9 MWs namely, Indankal-1 (4D5B3K1c), Indankal-2 (4D5B3K1d), Indankal-3 (4D5B3K1e), Korwar-1 (4D5B3K1b), Korwar-2 (4D5B3K1a), Mattimadu-1 (4D5B3K2b), Mattimadu-2 (4D5B3K2c), Mattimadu-3 (4D5B3K2d) and Wachha (4D5B3K2a) micro watersheds. Land Resource Inventory (LRI) was generated for one among the nine micro-watersheds.
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 759 mm.
- In this sub-watershed major *kharif* crops grown are Maize, Soyabean, Redgram, Sugarcane, Sunflower, Cotton and major *rabi* crops are Sorghum and Bengal gram.
- 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 MATTIMADU SUB-WATERSHED



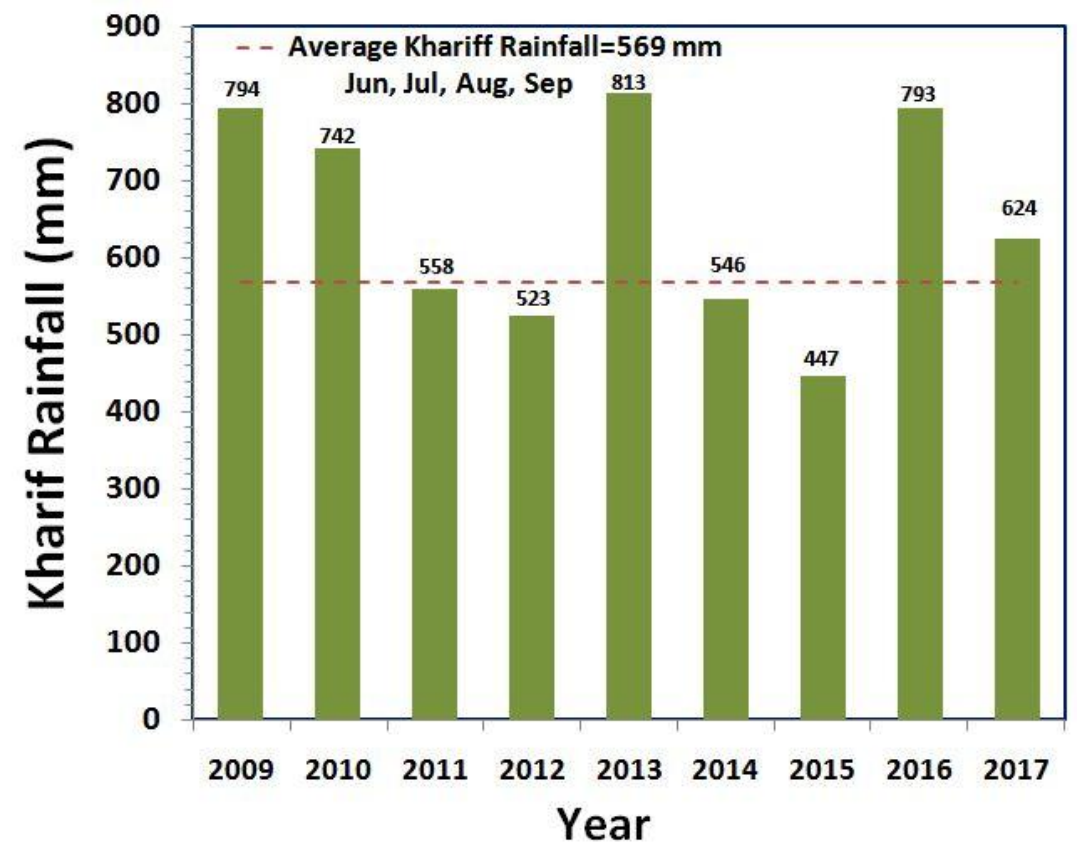
Soil & Water Conservation Structures in Mattimadu Sub-watershed, Chitapur taluk, Kalaburagi district

RAINFALL INDEX

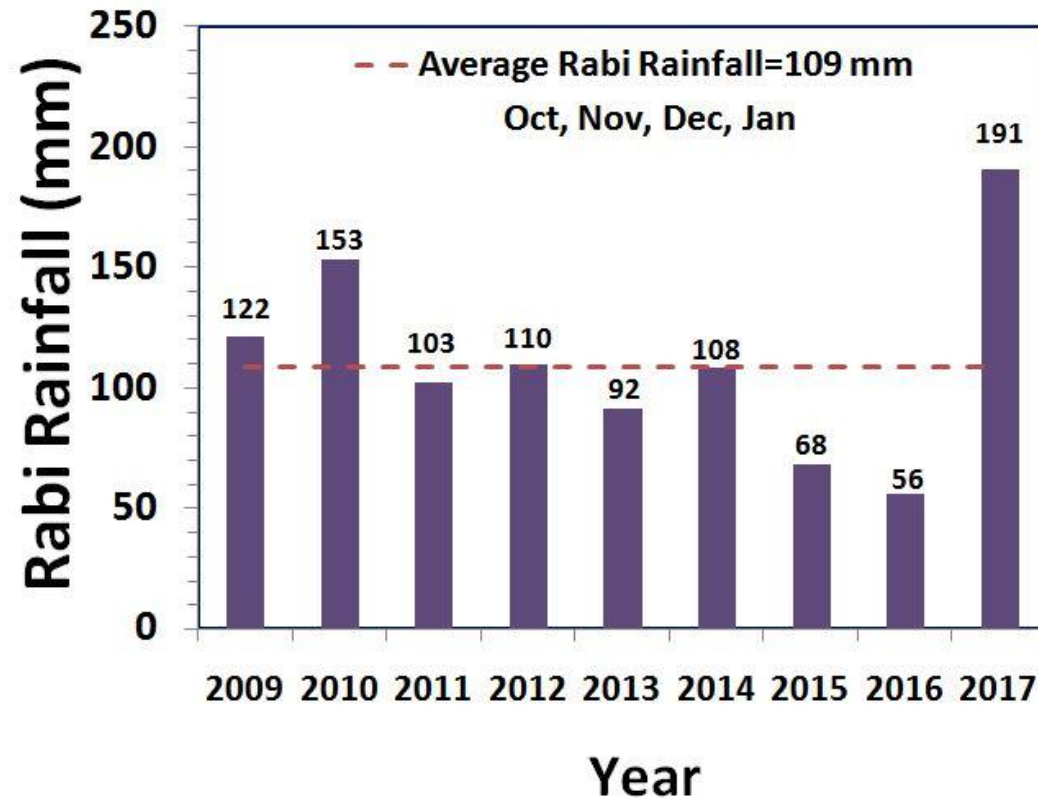


The *kharif* rainfall (Jun–Sep) is an average about 75% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2011, 2012, 2014 and 2015 the *kharif* rainfall was deficient by 2%, 8%, 4% and 21% respectively.

The average annual rainfall (1960-2014) recorded at the Chitapur station in Chitapur taluk of Kalaburagi district is 759 mm. The annual rainfall at Gundgurthi station (Hobli H.Q.) is presented. During the years 2012 and 2015 the annual rainfall was deficient by 8% and 18% respectively.

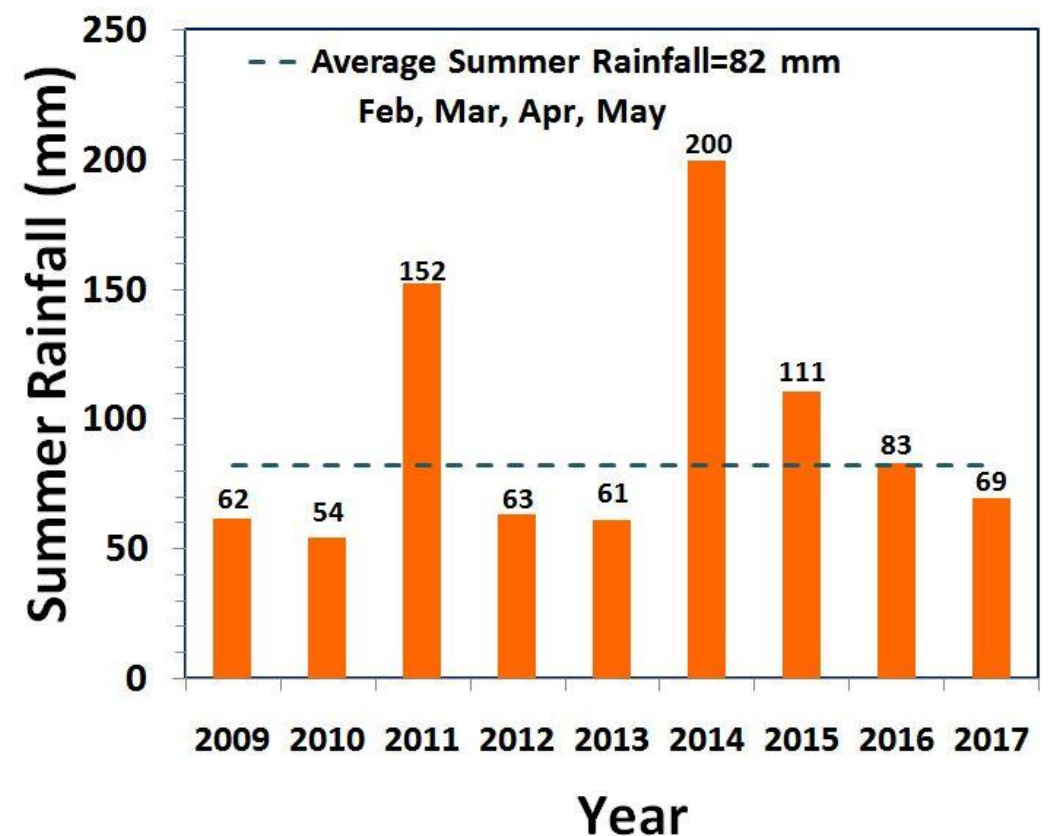


RAINFALL INDEX

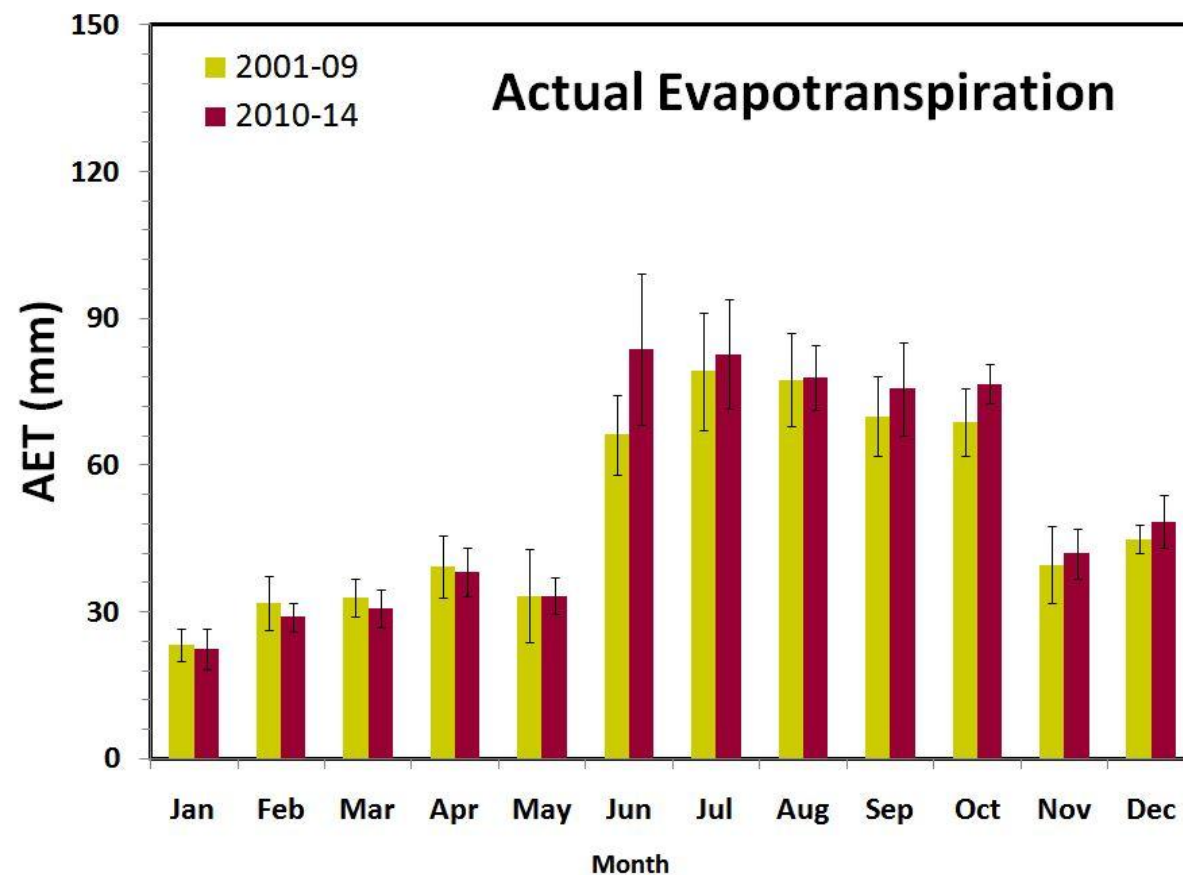
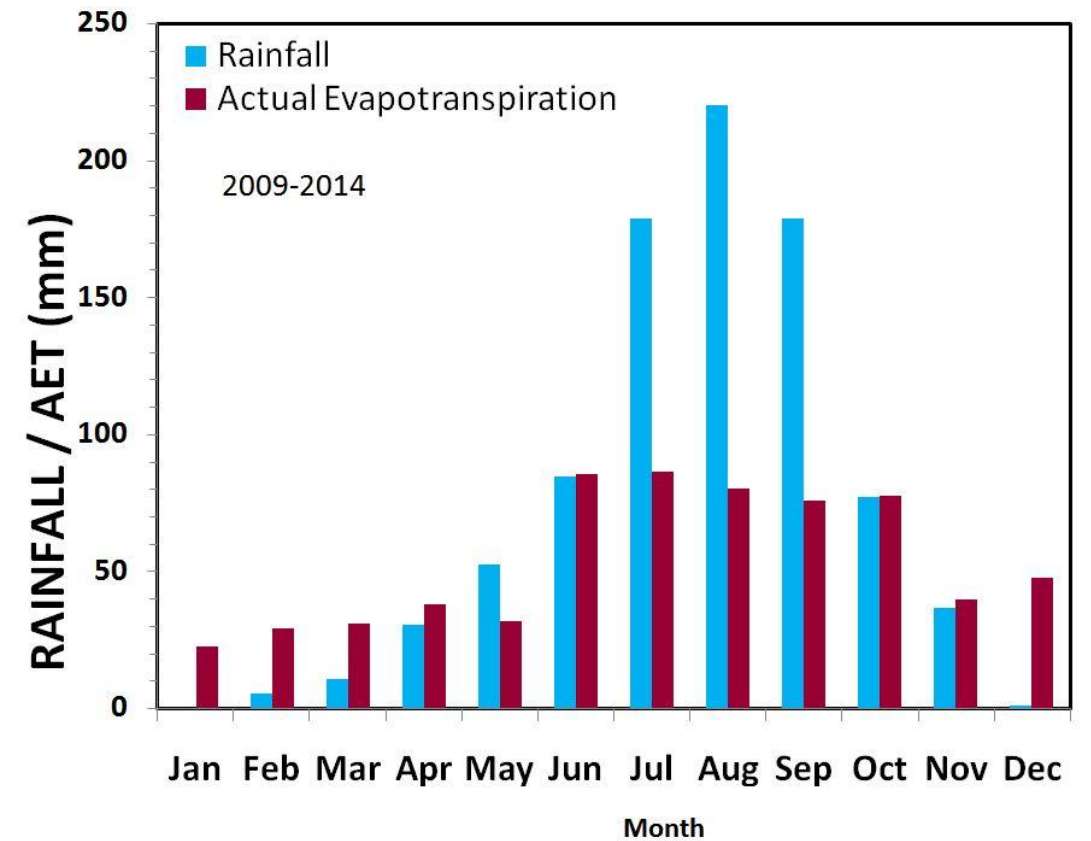
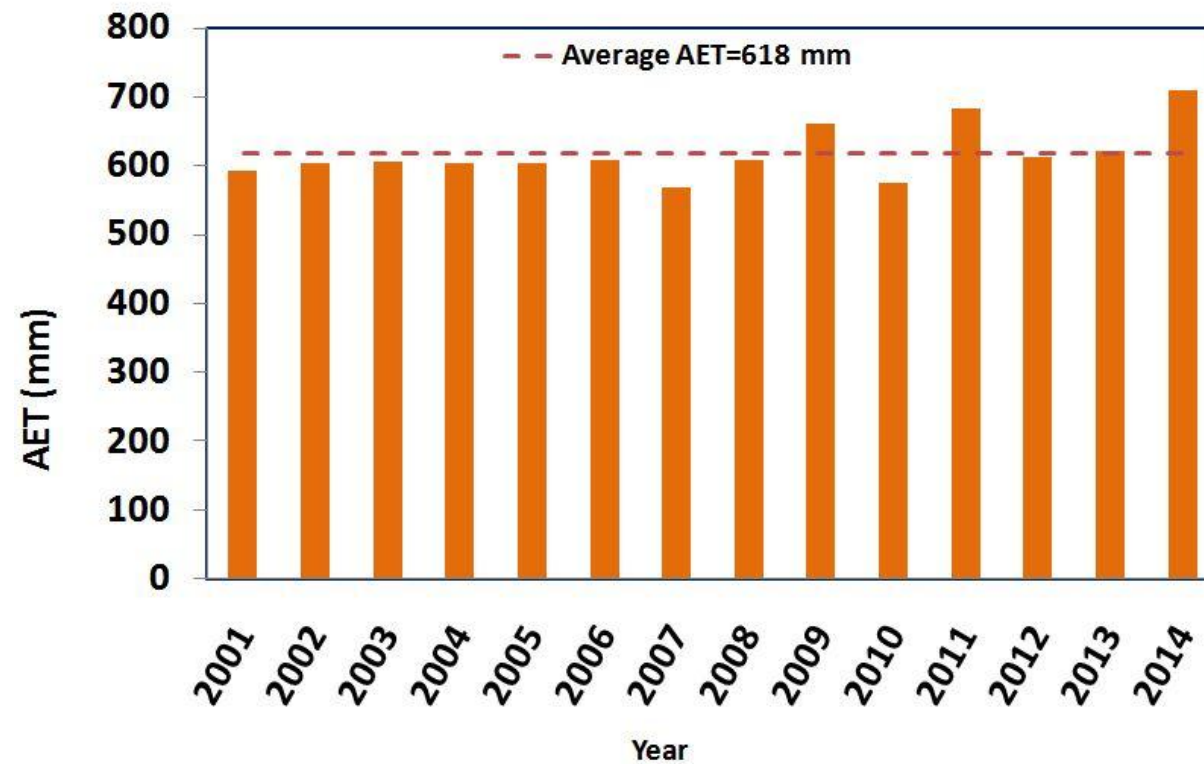


The average summer rainfall (Feb-May) is about 12% of the average annual rainfall.

The average *rabi* rainfall (Oct-Jan) is about 13% of the average annual rainfall. During the years 2011, 2013, 2015 and 2016 the *rabi* rainfall was deficient by 6%, 16%, 38% and 49% respectively.

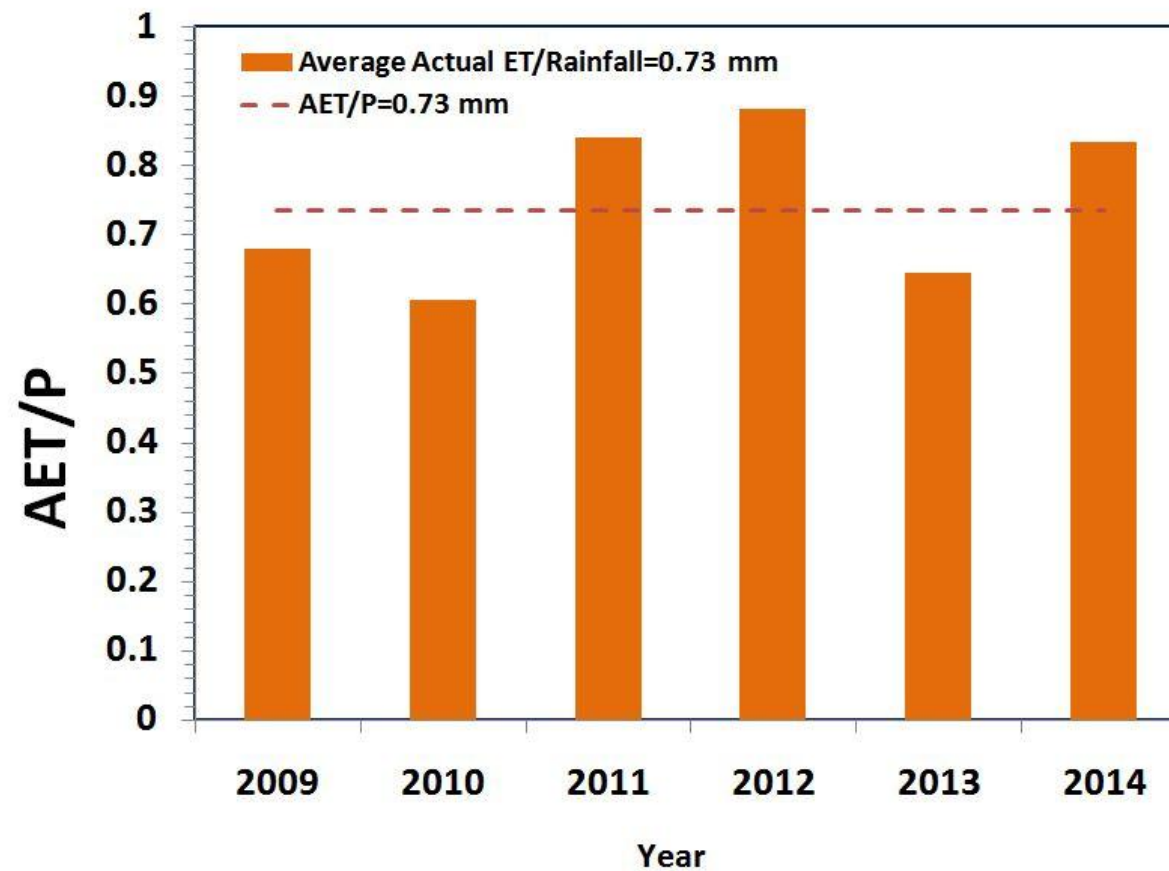


EVAPOTRANSPIRATION

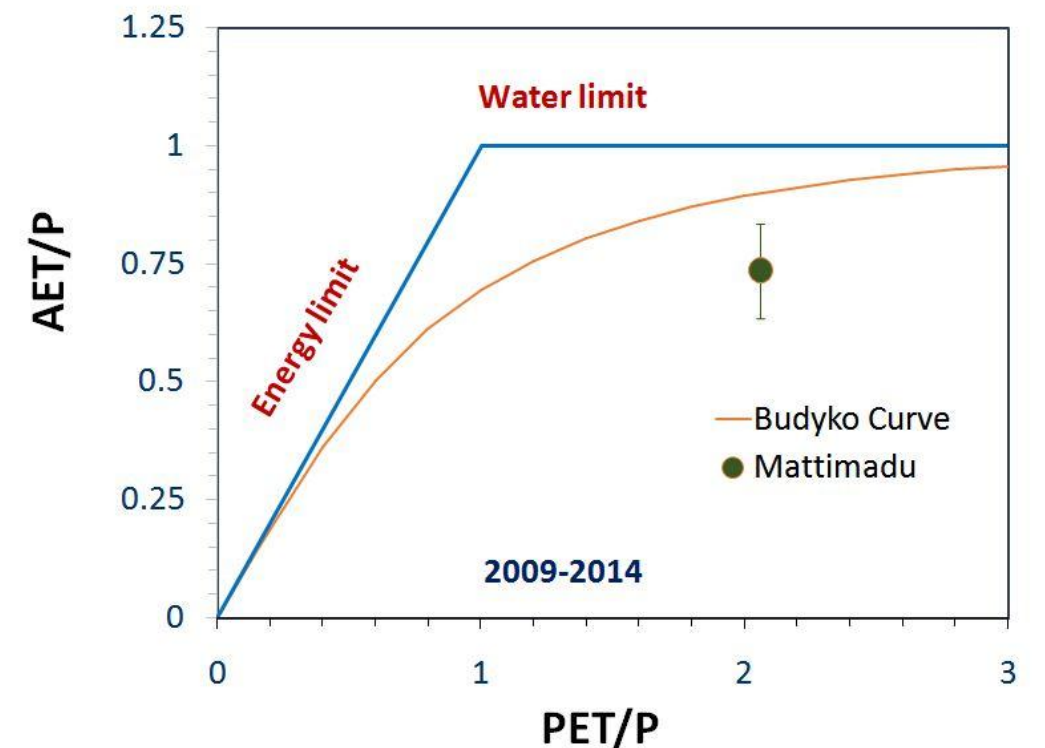
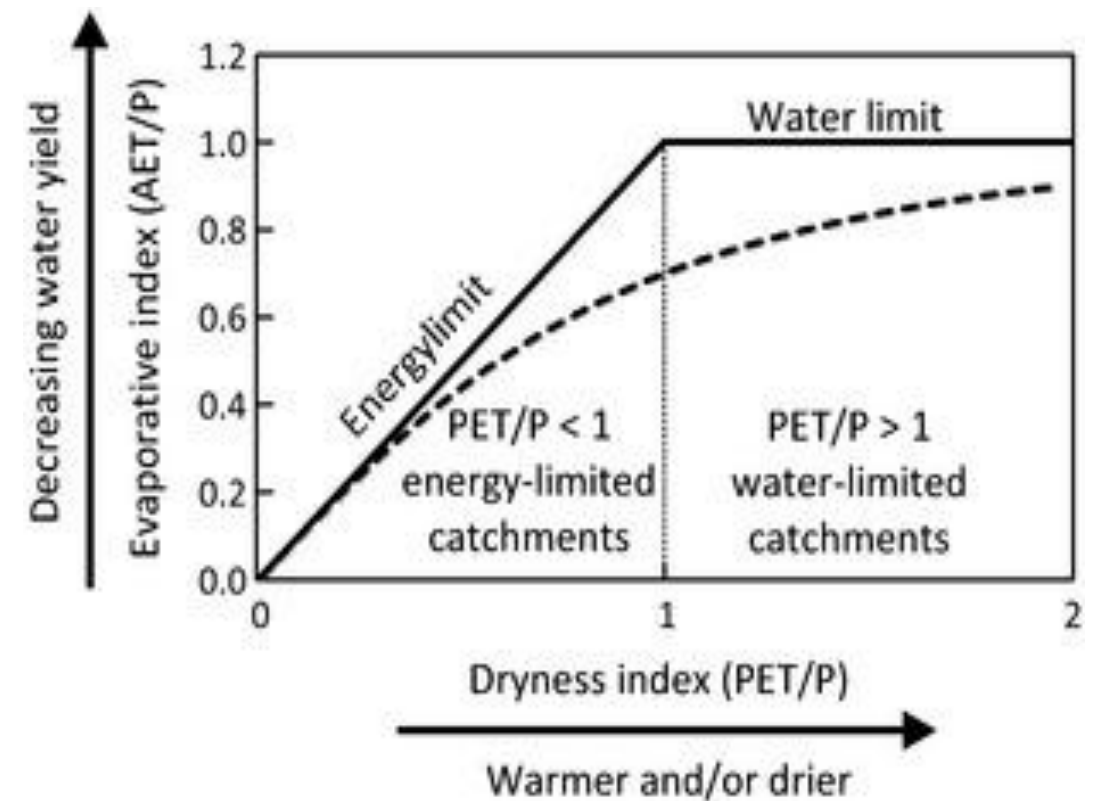


The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and ET was found to be 649 mm and 327 mm respectively, whereas in *rabi* it was about 111 mm and 187 mm. In comparison to the 2001-2009, the annual ET increased by 5% during 2010-2014.

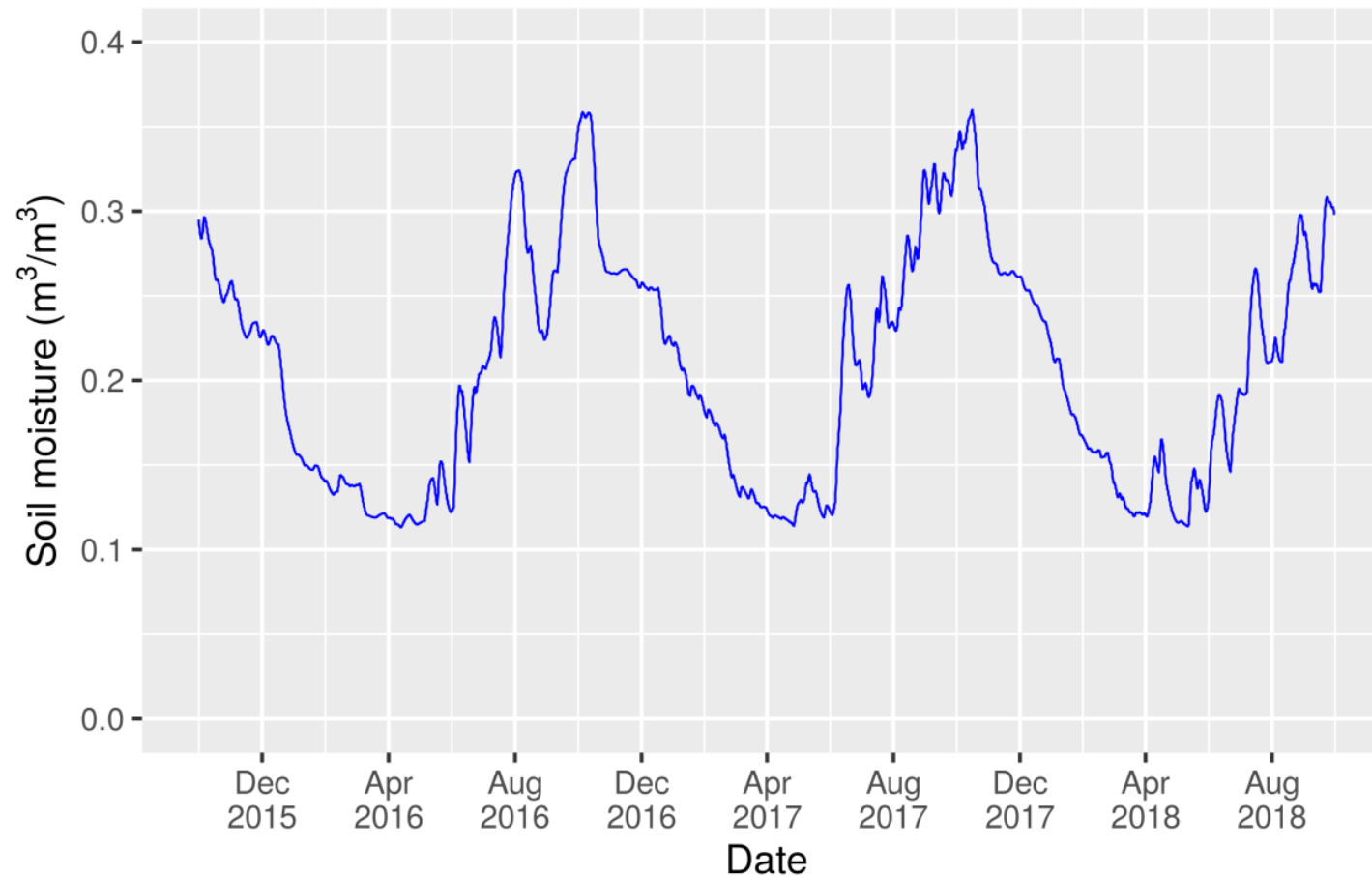
EVAPOTRANSPIRATION INDEX



The average AET/P ratio was about 73%, which is lower than the sustainable limit of about 80%. This suggests the sub-watershed is in sustainable limit due to good rainfall during *kharif* season.

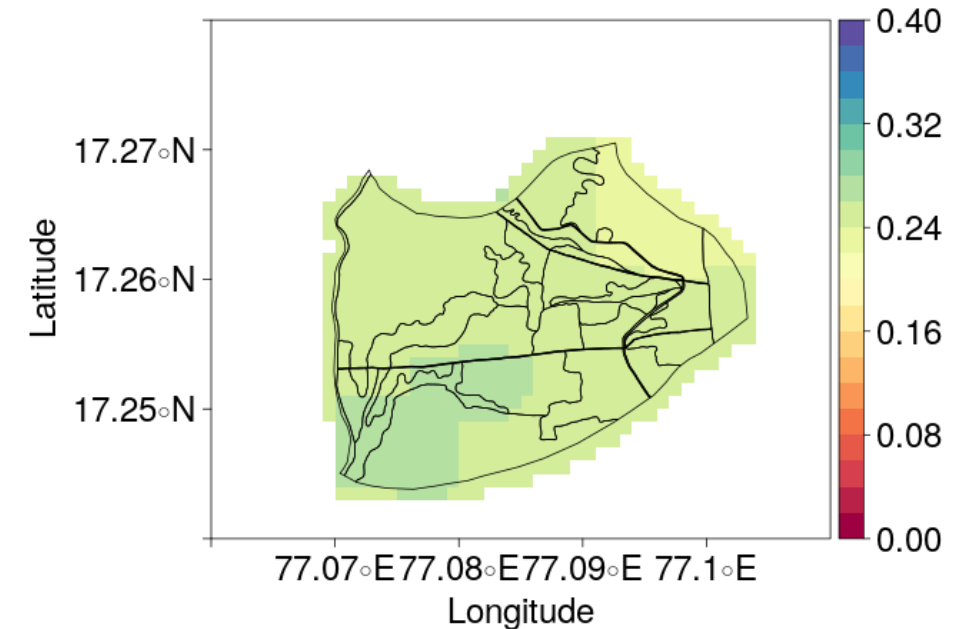


SATELLITE RETRIEVED SOIL MOISTURE

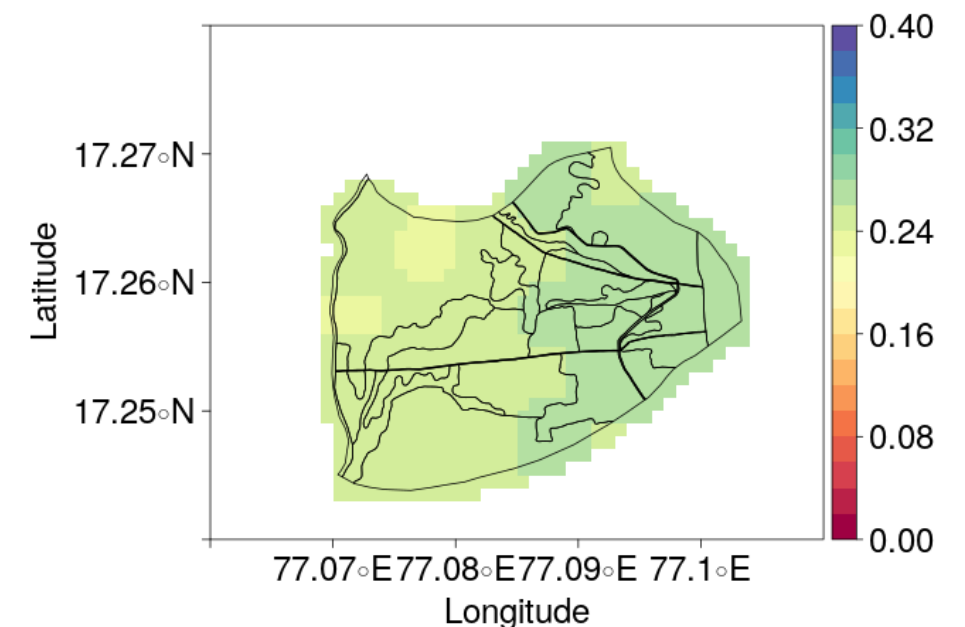


The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 13-23% in *kharif* and 24-36% in *rabi* seasons of 2016 and 13-33% in *kharif* and 23-35% in *rabi* seasons of 2017.

Mattimadu– Rabi Soil Moisture



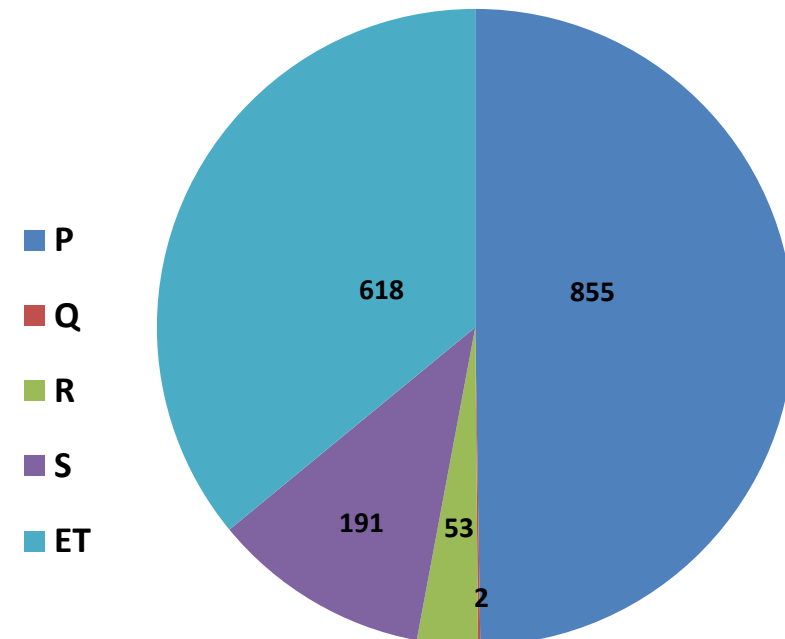
Mattimadu– Kharif Soil Moisture



WATER BALANCE

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

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

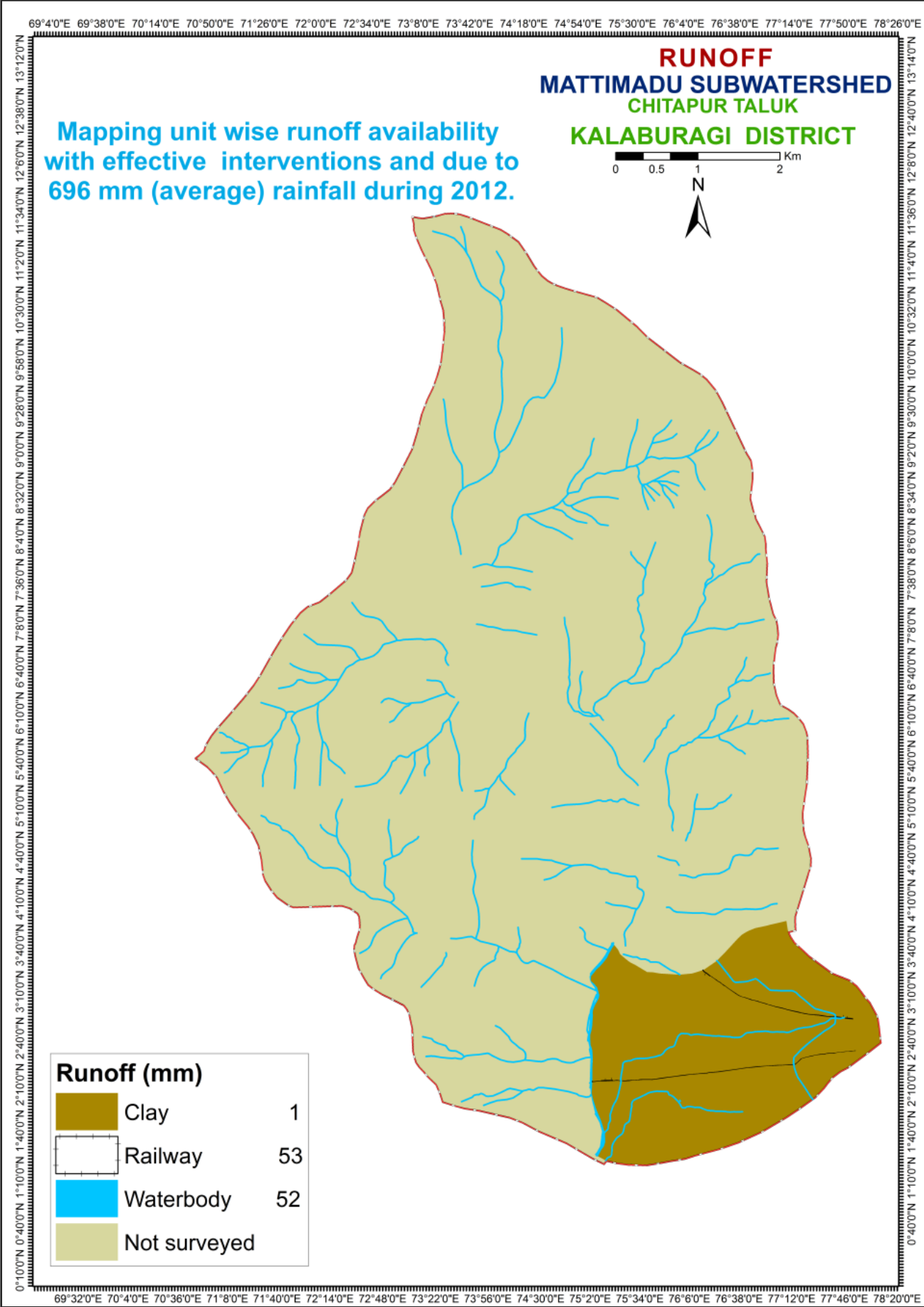


During July-September months, Precipitation is slightly higher than Evapotranspiration, hence slight Runoff can occur in the watershed.

P = 855 mm (average of 2009-2017) ET = 618 mm R = 53 mm S = 191 mm Q = 2 mm

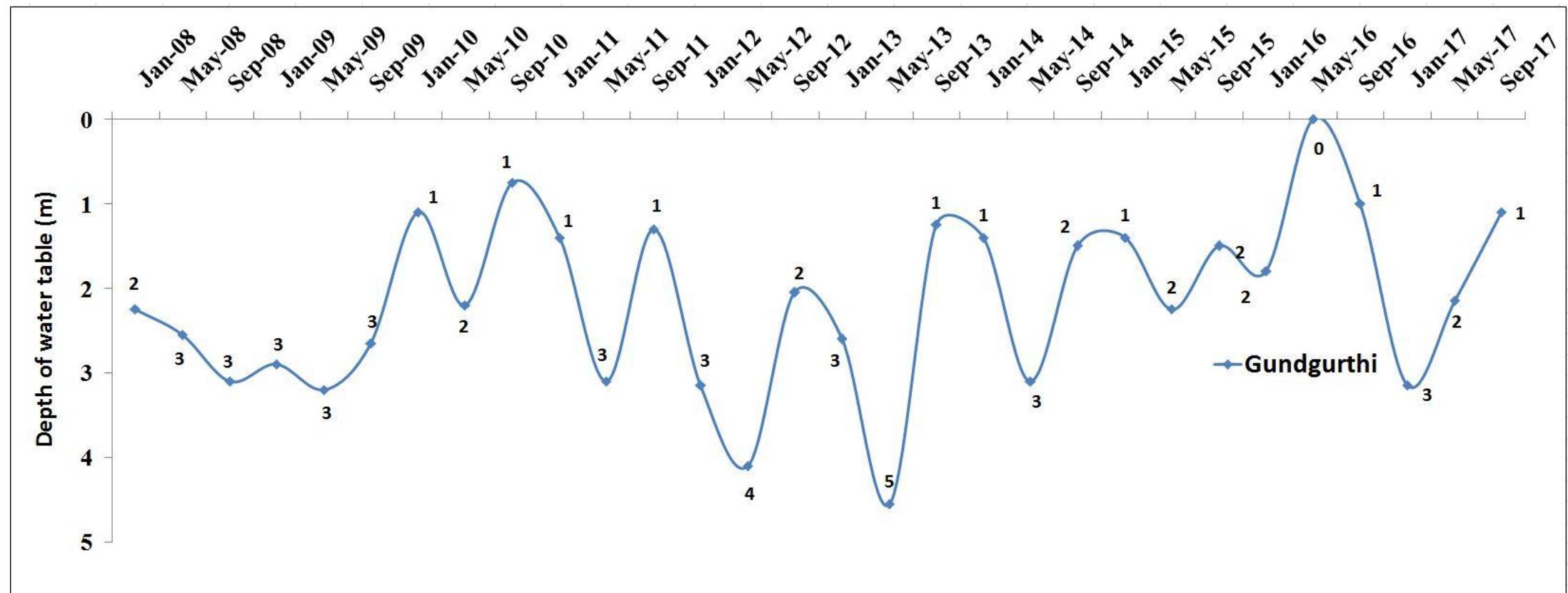
Sl. No.	Parameters	Average_2012 (mm)
1.	Rainfall	696
2.	Runoff availability with existing conditions	34
3.	Runoff availability with effective interventions	2
4.	Runoff allowed as environmental flow at the outlet	0.43
5.	Runoff excess for harvesting by construction of structures	2

RUNOFF



GROUND WATER STATUS

GUNDGURTHI STATION



The groundwater level was found from the data obtained from KSNDMC for the nearest station Gundgurthi. The above graph depicts the groundwater levels during the years 2008-2017 was slightly varying except May 2016.

SUMMARY

- The average annual rainfall of 759 mm in the Mattimadu sub-watershed as recorded from the Gundgurthi station data by KSNDMC.
- 75%, 13% and 12% of the annual rainfall occurs during *kharif*, *rabi* and summer seasons respectively and exhibited a higher temporal variability.
- The evapotranspiration estimation tool developed indicates that the watershed water balance is in sustainable limit.
- The estimated runoff available to use is 2 mm for an average annual rainfall of 855 mm (2009-2017). The utilizable groundwater is 37 mm (70% of 53 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (191 mm) and utilizable runoff plus recharge is 230 ($=191+37+2$)
- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 514 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 642 mm (i.e 125% of AET). This demand for the two seasons is higher by 412 mm, i.e. (642-230). The AET in June-Sept months is 49% of rainfall. Hence, there is a good opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.
- The groundwater level was found from the data obtained from KSNDMC for the nearest station Gundgurthi. The groundwater levels during the years 2008-2017 was slightly varying except May 2016.