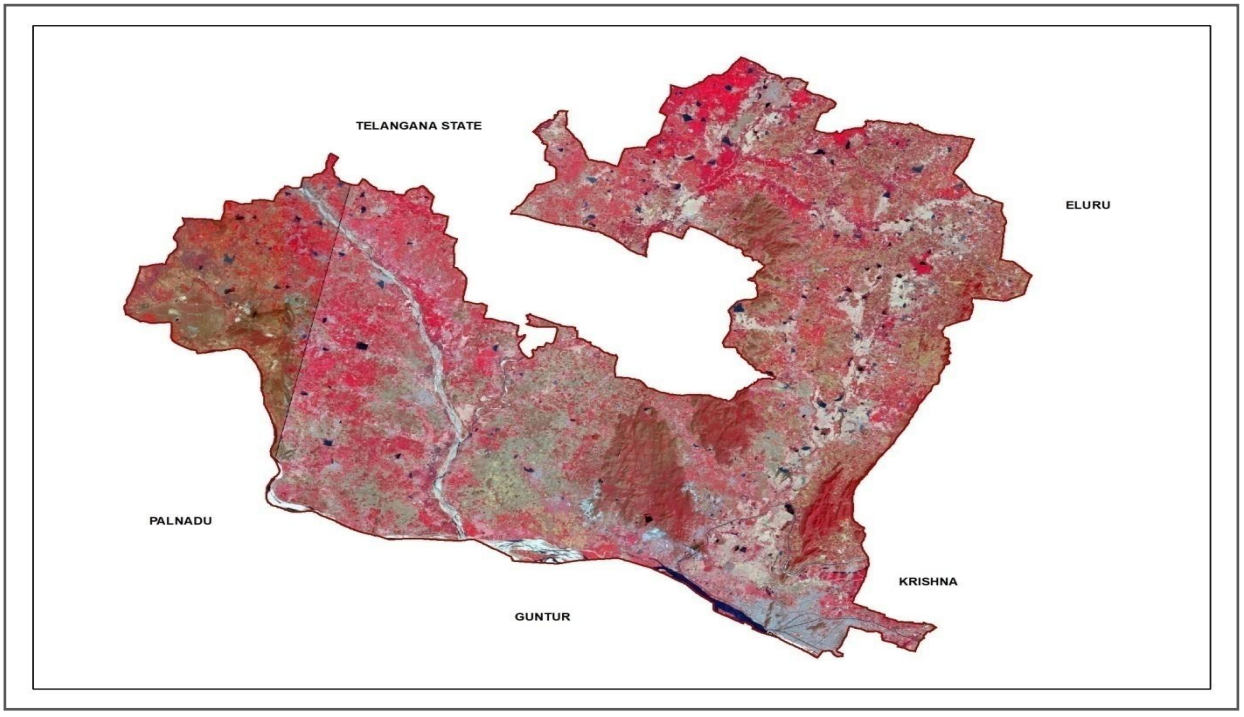
DISTRICT SURVEY REPORT
FOR
SAND AND OTHER MINOR MINERALS
NTR DISTRICT, ANDHRA PRADESH

(FOR THE DEPARTMENT OF MINES AND GEOLOGY, GOVT. OF AP)

As per Notification No. S.O. 141 (E), 15.01.2016, S.O. 3611(E), 25.07.2018, and Enforcement and Monitoring Guidelines for Sand Mining 2020 of MOEF and CC, GoI



Prepared by

ANDHRA PRADESH SPACE APPLICATIONS CENTRE (APSAC)
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Submitted to

DEPARTMENT OF MINES AND GEOLOGY
Government of Andhra Pradesh

November 2023

Andhra Pradesh Space Applications Centre
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Report Scrutiny Mechanism

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PREFACE

The Natural resource inventory is the assessment of the status of a given natural resource of an area at a given point in time. Population pressure results in over- exploitation of resources. The baseline information on the resources would help the administration for better planning and decision making. The main purpose of the report is to disseminate data on the natural resource up to the lowest administrative functionary to facilitate micro level planning and development. The efforts have been made to assess and document the information on land use/land cover, crop, surface water resource, soils, slope, groundwater prospects, groundwater quality, geological information, and minerals resources in NTR district, Andhra Pradesh, based on the satellite remote sensing data and socioeconomic information.

The Department of Mines and Geology (DMG), Government of Andhra Pradesh (AP) requested the Andhra Pradesh Space Applications Center (APSAC) to update the district survey reports with availability of sand mineral information, major and minor mineral details, and river morphology for all the districts in the State. The District Survey report emphasizes and updated the major and minor minerals in the districts of AP. The District Survey reports are updated following the "Sustainable Sand Mining guidelines" issued in 2016 and 2020 and SO 741of 2016 of the Ministry of Environment, Forests and Climate Change provided by the DMG. The comments received from the public, if found fit, shall be incorporated in the report. A list of leases in the district will be provided by the concerned Assistant Directors of Mines and Geology.

The report is an outcome of the efforts of the Scientists and Project Associates at APSAC. I heartily congratulate the team for compiling the report.

(Dr.Sundar Balakrishna, IFS)
Vice-Chairman
APSAC

ACKNOWLEDGEMENTS

Our sincere gratitude to **Sri Gopal Krishna Dwivedi, IAS**, **Principal Secretary,** Department of Mines and Geology, Govt. of Andhra Pradesh for whole-hearted support.

Our sincere gratitude to **Sri Kona Sasidhar, IAS**, **Secretary to Government,** Information Technology, Electronics and Communications (ITE and C), Govt. of Andhra Pradesh and the **Chairman,** APSAC Governing Body, for his constant encouragement.

We would like to express our sincere gratitudeto **Dr. Sundar Balakrishna, IFS**, **Special Secretary to Government,** Information Technology, Electronics and Communications (ITE and C), Govt. of Andhra Pradesh and the **Vice-Chairman, APSAC** Govt. of Andhra Pradesh, for his meticulous guidance and supervision.

We are grateful to the **Sri. V.G. Venkata Reddy**, **Director**, Department of Mines and Geology, Govt. of Andhra Pradesh for entrusting the work for the preparation of District Survey Reports of Andhra Pradesh.

We owe a great deal to **Sri. P Raja Babu, Joint Director,** Department of Mines and Geology for his overall support and guidance during the execution of this work.

We are very much thankful to **Dr.M.J.Ratnakanth Babu, Royalty Inspector (Head Office**), **Smt. P.Damayanthi, Technical Assistant (Head Office)** Mines and Geology for his support to complete the work successfully.

We are also thankful to the **District Mines and Geology Officer,** NTR District for their support in providing information

Our sincere thanks are due to the scientific staff of APSAC who has generated all the thematic maps for District Survey Reports.

APSAC

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LIST OF CONTESTS AS PER THE GAZETTE NO: 2827,Dt:25.07.2018

List of Abbreviations

APSAC	: Andhra Pradesh Space Applications Centre
APMMC	: Andhra Pradesh Minor Mineral Concession
AMSL	: Above Mean Sea Level
AWiFS	: Advanced Wide Field Sensor
APWALTA	: Andhra Pradesh State Water, Land and Trees Authority
APMDC	: Andhra Pradesh Mineral Development Corporation
Bgl	: Below ground level
BT Road	: Bituminous Road
Cl	: Chlorine
CC Road	: Cement concrete
CRZ	: Coastal Regulatory Zone
CPSU	: Central Public Sector Undertaking
CGWB	: Central Ground Water Board
cu.m/day	: Cubic meter per day
DSR	: District Survey Report
DMG	: Directorate of Mines and Geology
DM and GO	: District Mines and Geology Officer
DES	: Directorate of Economics and Statistics
DEM	: Digital Elevation Model
dS/m	: Decisiemens per meter
EIA/EMP	: Environmental Impact Assessment
F	: Fluorine
FAC	: Full Additional Charge
FASAL	: Forecasting Agricultural output using Space, Agrometeorology and Land-based observations
Fe	: Iron
Ft	: feet
GD	: Geosciences Division
GIS	: Geographical Information System
GSI	: Geological Survey of India
Ha	: Hactar
Km	: Kilometer
IRS	: Indian Remote Sensing Satellite
ITE and C	: Information Technology Electronics and Communications
LISS	: Linear Imaging Self Scanning
LULC	: Land Use / Land Cover
Lps	: Litres per second

M	: meter
Mi	: mile
mm	: millimetre
MT	: Million Tonne
MoEF	: Ministry of Environment and Forests
MSL	: Mean Sea Level
NIRD	: National Institute of Rural Development
NH	: Natinal Highway
$NaNO_3$	: Sodium nitrate
NRSA	: National Remote Sensing Agency
NRSC	: National Remote Sensing Centre
PESA	: Panchayats Extension to Scheduled Areas
pH	: Power of hydrogen
PSD	: Performance Security Deposit
PSU	: Public sector Undertakings
R2	: ResourceSat-2
RGNDWM	: Rajiv Gandhi National Drinking Water Mission
RWS and S	: Rural Water Supply and Sanitation
SAR	: Synthetic Aperture Radar
SEB	: Special Enforcement Bureau
SO_4	: Sulfate
Sq.Km	: Square Kilometre
Sq.m	: Square metre
TA	: Tantalum
TIN	:Triangular Irregular Network
TGA	: Total Geographical Area
TIS	: Tank Information System
TTD	: Tirumala Tirupati Devasthanams
WBM	: Water Bound Macadam

Chapter I – Introduction and General Profile

1.1 Administrative Setup

NTR district is one of the coastal districts of Andhra Region in the Indian state of Andhra Pradesh. The NTR district established on 4th April 2022. The district headquarters is located at Vijayawada. Geographically, NTR district is bounded north by Khammam district of Telangana state, south by Palnadu and Guntur districts, on the west by Suryapet district of Telangana state and on the east by NTR and Eluru districts. The total geographical area of the district is 3,316 Sq.km. It is covered with 3 Revenue divisions namely Nandigama, Tiruvuru and Vijayawada; 20 Revenue mandals and 313 Revenue villages. G.Konduru mandal is having maximum number of villages (27) and Vissannapet mandal is having minimum number of villages (10). Out of 20 mandals of the district, the maximum area (273.16 Sq.km) is occupied by Jaggayyapeta mandal and minimum area in Vijayawada East mandal (8.9 Sq.km).

The mandals covered in each Revenue division are shown in Table-1 and its spatial distribution is shown in the Figure-1. The Satellite imagery of the district is shown in Figure-2.

Table 1 List of Mandals Covered in each Revenue division

Nandigama Division	**Tiruvuru Division**	**Vijayawada Division**
Chandarlapadu	A.Konduru	G.Konduru
Jaggayyapeta	Gampalagudem	Ibrahimpatnam
Kanchikacherla	Reddigudem	Mylavaram
Nandigama	Tiruvuru	Vijayawada (Rural)
Penuganchiprolu	Vissannapet	Vijayawada Central
Vatsavai		Vijayawada East
Veerullapadu		Vijayawada North
		Vijayawada West

Data Source: APSAC, Vijayawada.

1.2 Physiography

Physiographically, NTR District may divide into three parts. Mostly the entire district consists of Fluvial and Coastal Landforms, one of the major river of Andhra Pradesh flows through Krishna District. The prominent landforms is a delta and its flood plain, alluvial plain and partly valley fills.

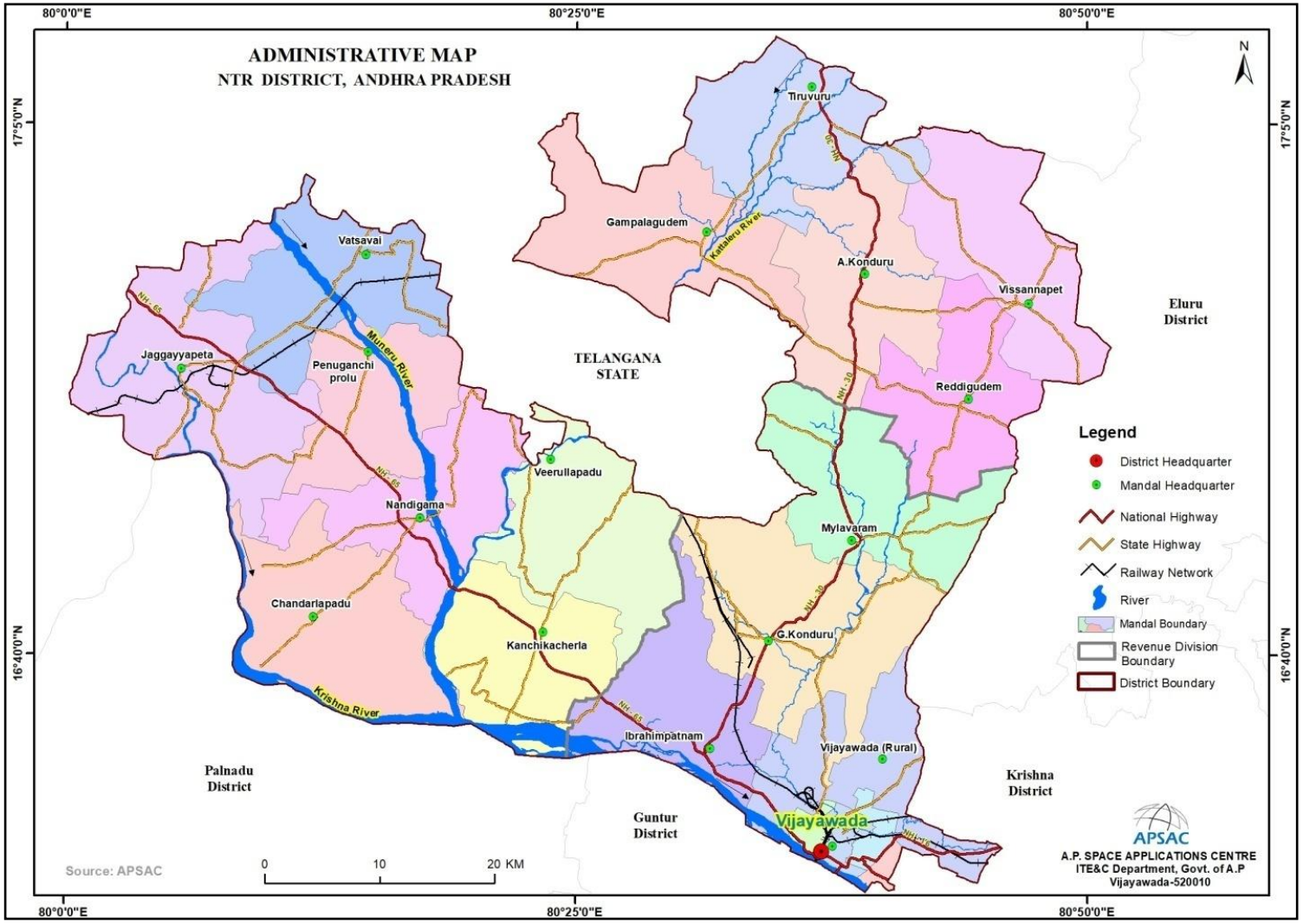

Figure-1: Administrative Map of NTR District, Andhra Pradesh

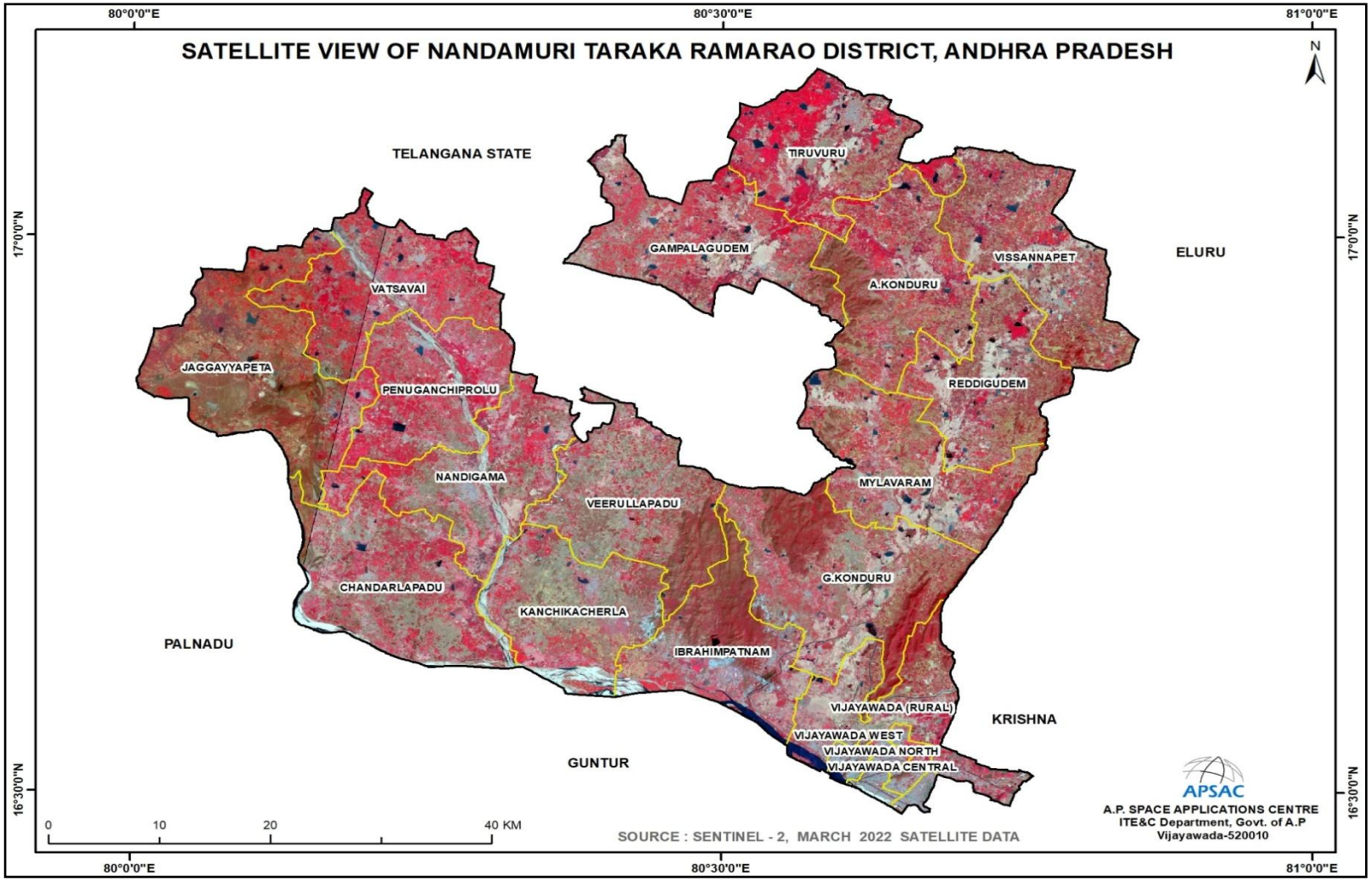

Figure-2: Satellite View of NTR District

Central part of the district is composed of hilly terrains of Eastern Ghar mobile belt associated with structural landforms. The delta of Krishna consists of five major strandlines and about 7 Major distributaries lobes. The shape and sedimentary pattern of Krishna Delta is termed as Bird-foot delta.

1.2.1 Relief

As per the guidelines of All India Soil and Land Use Planning (AIS and LUP) soil survey manual, the slope distribution clearly shows that the district terrain is deltaic plains (Figure-3). The slope map shows that the majority of the district land is nearly level, followed by very gently sloping areas. They account for 71.13% and 26.05% of the district's total area, respectively. These sloping areas are found along the coastal and delta area of the district. The gently sloping areas (3-5%) are found along the streams and the western parts of the district, which accounts 1.58% of the district geographical area. The remaining slope categories account for 1.24% of the district's total area and are found along the scrub and forest areas. These are prevalent in the western parts of the district.

1.2.2 Climate and Rainfall

1.2.2.1. Climate:

Tropical climate conditions with extremely hot summer and cold winter prevail in this district. During the months of April to June is the hottest period with the high temperature in May. The climate of the district is moderate and characterized by a tropical rainy climate with aggressive summer. The period from December to the middle of February month is generally the season of fine weather. The area experiences dry, sub-humid, mega thermal climate with oppressive summer and good seasonal rainfall. The south west monsoon sets in the second week of June and lasts till September end. October and November receives rainfall from north eastmonsoon. The winter starts from December and lasts till mid February followed by summer season up to early June. The mean minimum and maximum temperatures recorded in the district are 18°C in the months of January and 40°C in May respectively. The average rainfall for the last 25 years data used for the analysis. The locations of Automatic Weather Stations (AWS) in NTR District shown in Figure-4.

1.2.2.2. Rainfall:

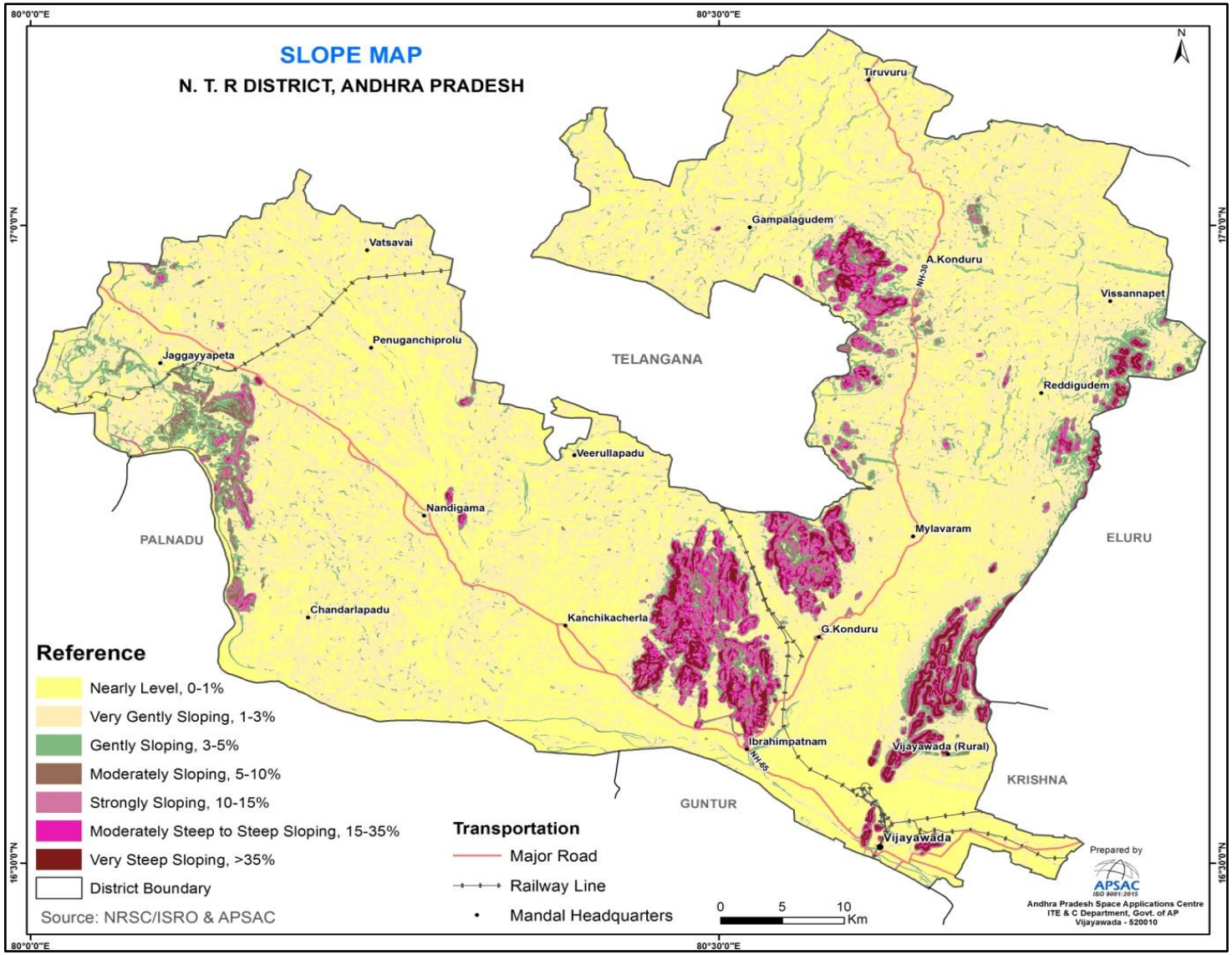

Figure-3: Slope Map of NTR District

The average annual rainfall of the district is 1035.93 mm, of which 736.67 mm falls as South-West (June-September) and 176.78 mm as North-East (October-December) monsoon. The mean minimum and maximum temperatures recorded in the district are 18°C in January and 40°C in May, respectively. The average rainfall for the last 25 years is used for the analysis. The average annual rainfall is shown in Figure-5 and details is given in Table-2.

Table 2 Average Annual Rainfall (mm) in the district, during the year 1997-2021

S.No	Month	Average Annual Rainfall (mm)
1	January	8.23
2	February	8.73
3	March	10.09
4	April	14.08
5	May	54.35
6	June	134.99
7	July	217.89
8	August	234.77
9	September	176.03
10	October	127.34
11	November	39.14
12	December	10.29
	Total	**1,035.93**

1.2.2.3. Drainage

The principal rivers flowing in the district are the NTR, Budameru, Munneru, Paleru and Kattaleru rivers. The NTR river originates in the Western Ghats, Mahabaleswar hills, Sattar District in Maharashtra State and enters into the district near Muktheswarapuram in Jaggayyapeta mandal. The river flows towards south east direction and leaves the district near Prakasam Barrage in Vijayawada. The NTR river flows towards south direction and Joining to Bay of Bengal near Lankavanidibba in NTR district.The Budameru river rises in the Chimalapadu RF, A.Konduru mandal in NTR dsitrict and flows towards south east direction and joining to Kolleru Lake near Immanivanigudem in NTR district. The Munneru river rises in the Narsampet RF, Kothagudem mandal in Telangana State. The river flows towards south direction and joining to NTR river near Eturu in NTR district.

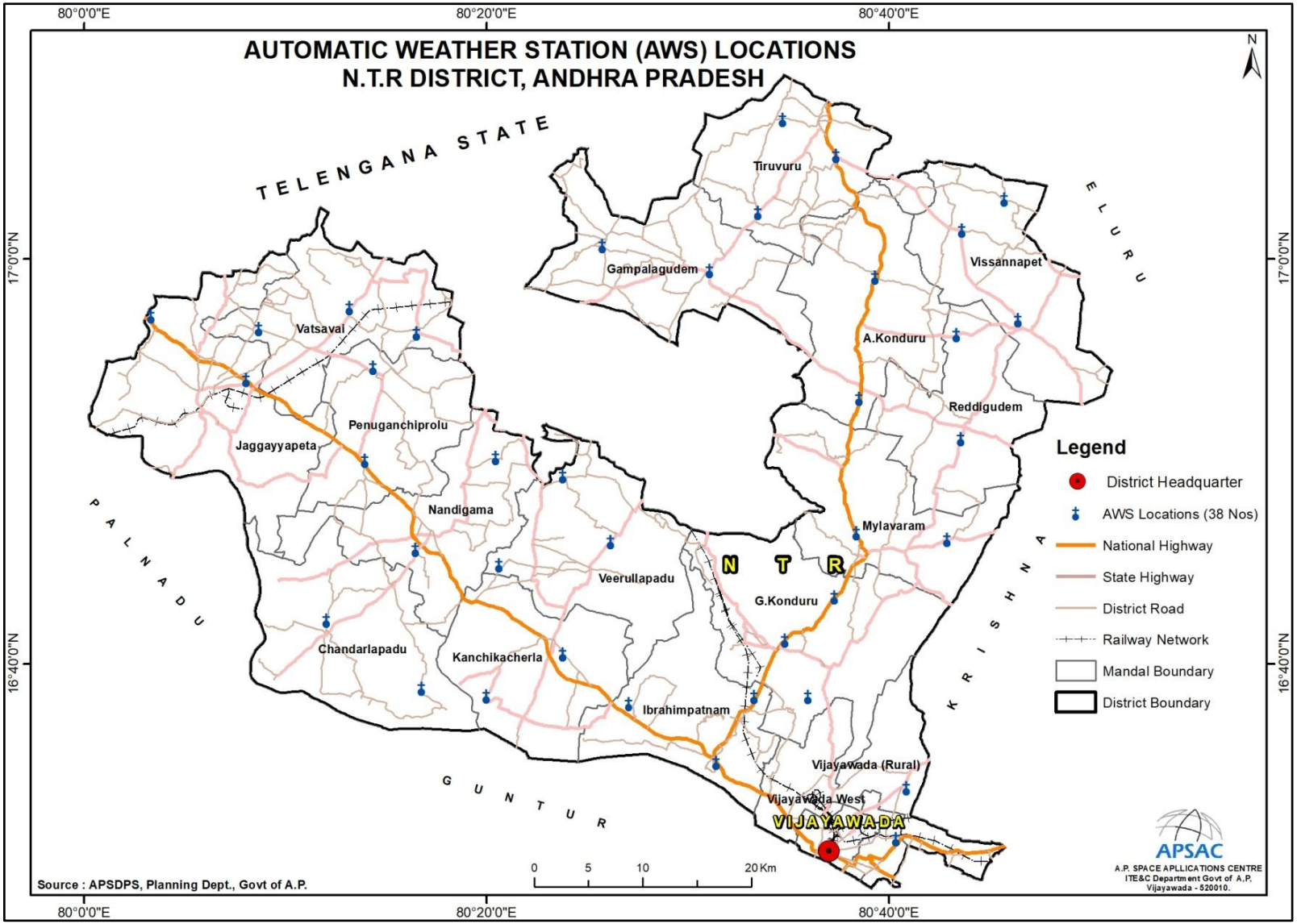

Figure-4: Locations of Automatic Weather Stations (AWS) in NTR District

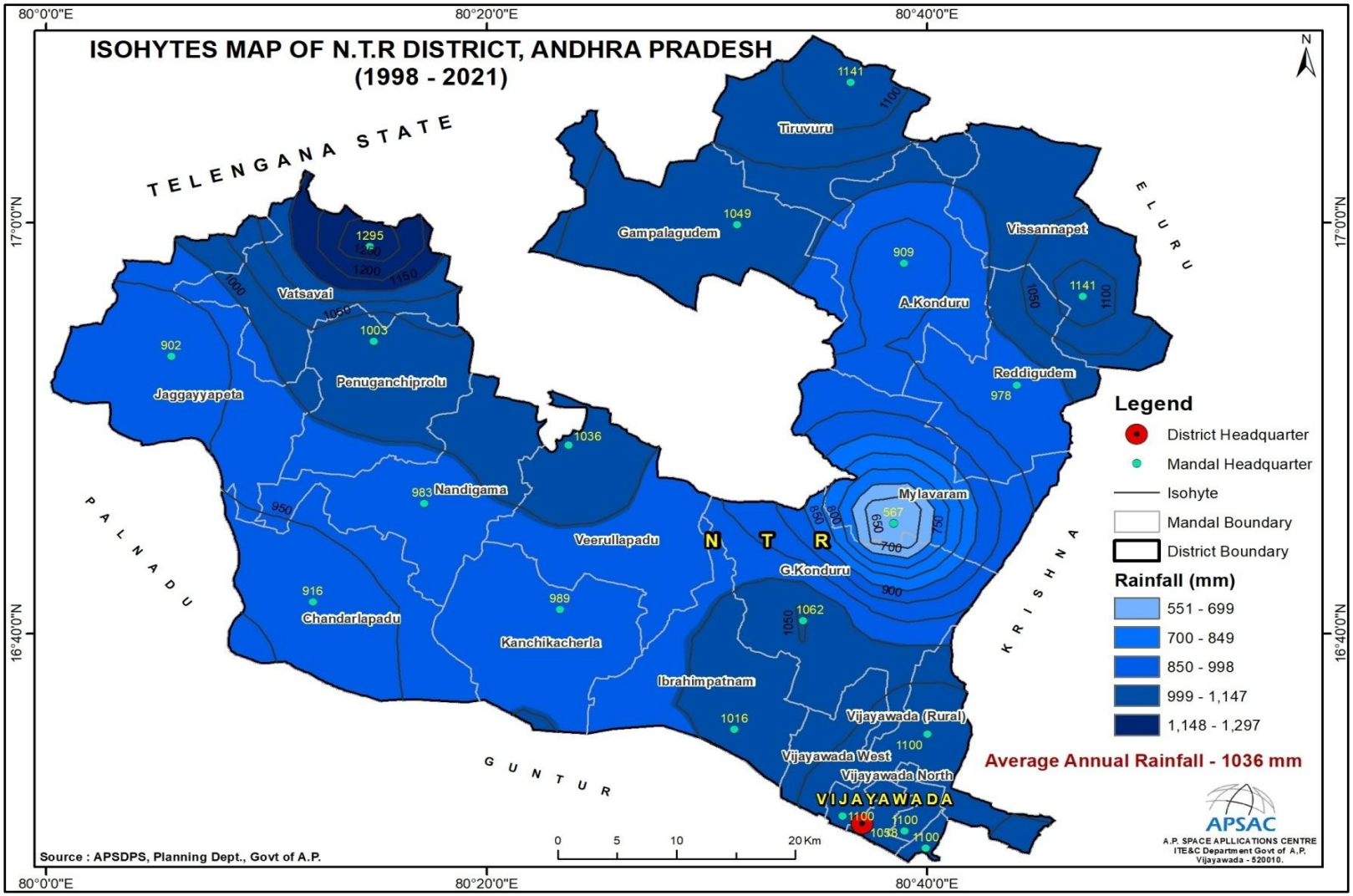

Figure-5: Rainfall distribution in NTR District

The Kolleru Lake is one of the largest freshwater lakes in the country and located between the NTR and Godavari deltas. The Budameru, Tammileru, Ramileru and Gunderu rivers are rises in NTR and Eluru districts, these rivers are flows towards south direction and joining to Kolleru lake. Figure-3 Illustrates the drainage system and the surface water bodies.

1.3 Population and Literacy

1.3.1. Population:

The total population of the district is 22,18,591; of which male and female are 11,14,462 and 11,04,129 respectively as per the 2011 census of India. Among the all mandals, Vijayawada Urban Mandal is having maximum population of 10,21,806; whereas Reddigudem Mandal is having minimum population of 46,226.

The total schedule caste(SC) population in the district is 4,06,350; of which male and female are 2,03,544 and 2,02,806 respectively. The schedule tribe (ST) population is 82,101; of which male and female are 41,431 and 40,670 respectively. The mandal wise population is shown in the Table-3.The mandal wise spatial distribution of total population is depicted in theFigure-6.

1.3.2. Literacy:

The total literacy in the district is 14,74,968; of which male and female are 7,91,785 and 6,83,183 respectively. The total illiterates are 7,43,623; of which male and female are 3,22,677 and 4,20,946 respectively, as per the 2011 census of India.The mandal wise Literacy is shown in the Table-4.

1.3.3. Details of the Occupational Health issues in the District (Last five-year data of number of patients of Silicosis): No cases were reported during last 5 years due to mining activity.

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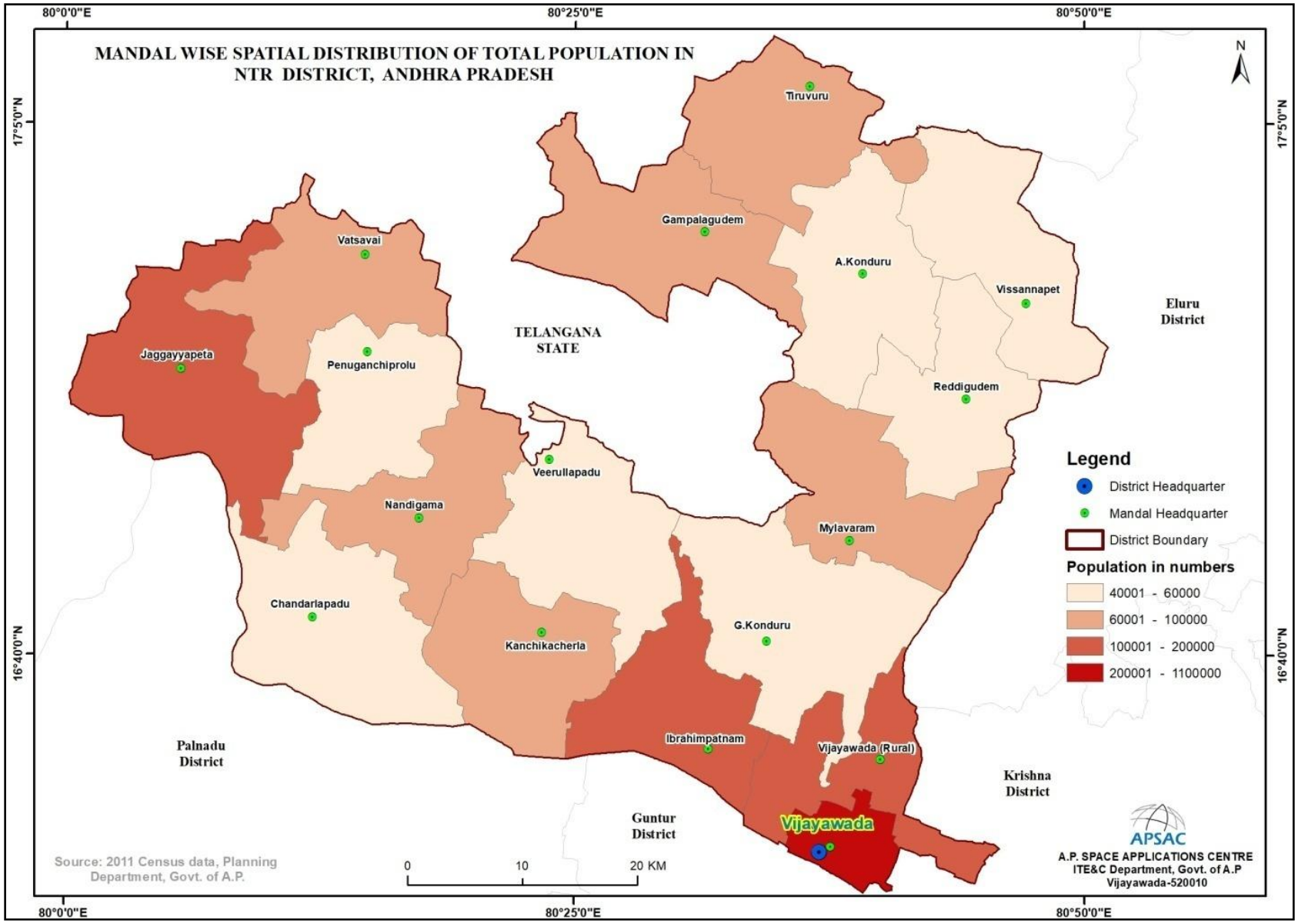


Figure-6: Mandal wise Spatial Distribution of Population in NTR district, Andhra Pradesh

Table 3 Population Statistics Summary of 2011 Census

S.No	Mandal Name	Total House Holds	Total Population	Total Male Population	Total Female Population	Total SC Population	Male SC Population	Female SC Population	Total ST Population	Male ST Population	Female ST Population
1	A.Konduru	12697	48463	24675	23788	12039	6345	5694	12604	6301	6303
2	Chandarlapadu	16489	59943	30277	29666	16892	8629	8263	1816	905	911
3	G.Konduru	15666	57693	29073	28620	18620	9369	9251	2845	1437	1408
4	Gampalagudem	20085	71544	36215	35329	22337	11393	10944	1233	624	609
5	Ibrahimpatnam	27827	103559	50895	52664	24579	12197	12382	5205	2483	2722
6	Jaggayyapeta	32711	126275	62713	63562	22802	11223	11579	10593	5425	5168
7	Kanchikacherla	19897	71075	35430	35645	17763	8959	8804	2039	1015	1024
8	Mylavaram	17939	66947	33684	33263	14510	7215	7295	5007	2523	2484
9	Nandigama	24662	92291	46218	46073	25659	12828	12831	4303	2150	2153
10	Penuganchiprolu	14262	51811	25782	26029	16097	8119	7978	2060	1031	1029
11	Reddigudem	12271	46226	23522	22704	13280	6622	6658	2298	1147	1151
12	Tiruvuru	20605	76731	38679	38052	23572	12043	11529	2181	1089	1092
13	Vatsavai	17149	61749	30670	31079	19050	9456	9594	3731	1843	1888
14	Veerullapadu	14115	49089	24420	24669	18328	9104	9224	1700	841	859
15	Vijayawada (Rural)	38138	153591	79926	73665	25447	13048	12399	4136	2175	1961
16	Vijayawada Central	276081	1021806	512417	509389	98643	48767	49876	15960	8124	7836
17	Vijayawada East										
18	Vijayawada North										
19	Vijayawada West										
20	Vissannapet	15714	59798	29866	29932	16732	8227	8505	4390	2318	2072
Grand Total		**596308**	**2218591**	**1114462**	**1104129**	**406350**	**203544**	**202806**	**82101**	**41431**	**40670**

Data Source: 2011 Census data, Planning Department and DES.

Table 4 Literacy statistics summary of 2011 Census

S.No	Mandal Name	Total Literacy	Male Literacy	Female Literacy	Total Illiterates	Male Illiterates	Female Illiterates
1	A.Konduru	24067	13982	10085	24396	10693	13703
2	Chandarlapadu	30654	17590	13064	29289	12687	16602
3	G.Konduru	34591	18748	15843	23102	10325	12777
4	Gampalagudem	38847	22169	16678	32697	14046	18651
5	Ibrahimpatnam	71926	37455	34471	31633	13440	18193
6	Jaggayyapeta	78912	43134	35778	47363	19579	27784
7	Kanchikacherla	41291	22971	18320	29784	12459	17325
8	Mylavaram	39144	21602	17542	27803	12082	15721
9	Nandigama	56615	31076	25539	35676	15142	20534
10	Penuganchiprolu	28815	16440	12375	22996	9342	13654
11	Reddigudem	24992	13944	11048	21234	9578	11656
12	Tiruvuru	46072	25452	20620	30659	13227	17432
13	Vatsavai	35119	19692	15427	26630	10978	15652
14	Veerullapadu	26969	15353	11616	22120	9067	13053
15	Vijayawada (Rural)	111181	60666	50515	42410	19260	23150
16	Vijayawada Central	749635	391966	357669	272171	120451	151720
17	Vijayawada East						
18	Vijayawada North						
19	Vijayawada West						
20	Vissannapet	36138	19545	16593	23660	10321	13339
Grand Total		**1474968**	**791785**	**683183**	**743623**	**322677**	**420946**

Data Source: 2011 Census data, Planning Department and DES

1.4 Land Utilization Pattern

1.4.1 Land Use / Land Cover

The Land Use / Land Cover (LULC) pattern of any region is an outcome of various physical and cultural factors and their utilization by man in time and space. Land use refers to the type of utilization to which man has put the land. It also refers to the evaluation of the land with respect to various natural characteristics. But land cover describes the vegetal attributes of the land. Land use/land cover data is essential for planners, decision-makers and those concerned with land resource management. For the proper understanding of the influence of the various human-induced land-use practices with regard to environmental change, it is essential to help simulate the land-use changes. Remote sensing technology is considered the most effective as it provides timely and authentic information about the spatial distribution of land use/land cover, while Geographical Information System (GIS) provides a flexible digital environment for collecting, storing, visualizing and analyzing the spatial data. Remote sensing is an important tool for rapid assessment and monitoring of natural resources. When combined with GIS, it makes it possible to map land use/ land cover phenomena in detail for further planning, development, and decision-making, which is essential for meeting the increasing demands and welfare of the ever-growing population.

1.4.2 Spatial Distribution of Land Use / Land Cover

Using on-screen interpretation techniques, the major common LULC categories, such as built-up (222.43 sq km), agriculture (2429.52 sq km), forest (360.98 sq km), wastelands (80.99 sq km), and water bodies (222.08 sq km), were delineated. At the level III classification, the study area has been mapped into 32 LULC classes (NRSA, 2006). Agriculture land is the most prevalent, followed by built-up land. Agriculture is practiced on about 73% of the district's total area. Figure-7 depicts the spatial distribution of land use / land cover, and Table-5 provides area statistics of the NTR district.

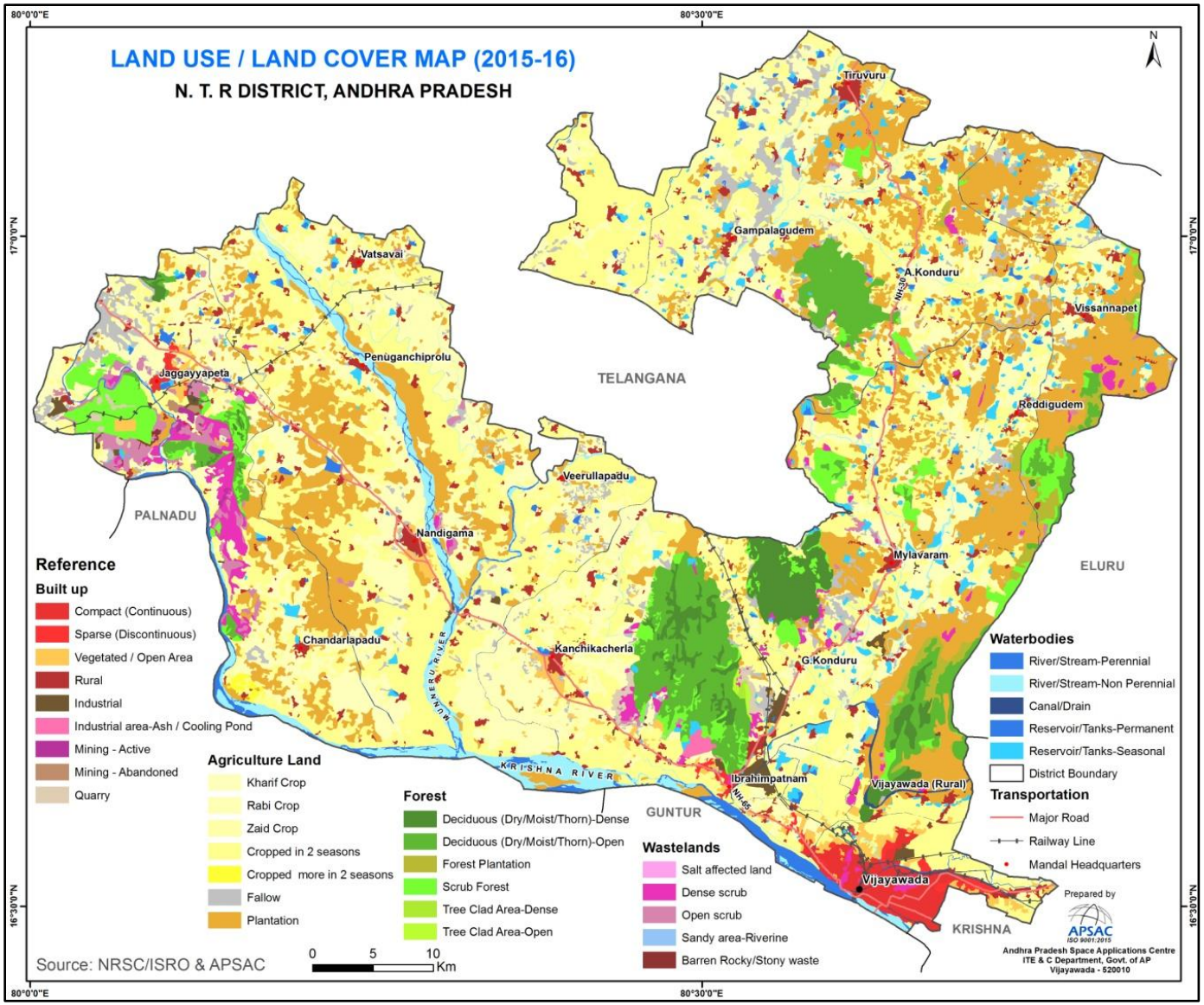


Figure-7: Land use / land cover map of NTR District 2015-16

Table 5 Category-wise distributions of Land Use/Land Cover during 2015-16

S. No	LULC categories	Area in sq. km	% to total
Built-up		**222.43**	**6.71**
1	Compact (Continuous)	41.52	1.25
2	Sparse (Discontinuous)	10.95	0.33
3	Vegetated / Open Area	37.47	1.13
4	Rural	96.63	2.91
5	Industrial	19.05	0.57
6	Industrial area-Ash / Cooling Pond	3.46	0.10
7	Mining - Active	2.20	0.07
8	Mining - Abandoned	1.27	0.04
9	Quarry	9.87	0.30
Agricultural Land		**2429.52**	**73.27**
10	Kharif Crop	669.46	20.19
11	Rabi Crop	79.24	2.39
12	Zaid Crop	84.23	2.54
13	Cropped in 2 seasons	877.51	26.46
14	Cropped more in 2 seasons	2.71	0.08
15	Fallow	113.03	3.41
16	Plantation	603.32	18.19
Forest		**360.98**	**10.89**
17	Deciduous (Dry/Moist/Thorn)-Dense/Closed	66.25	2.00
18	Deciduous (Dry/Moist/Thorn)-Open/Closed	170.63	5.15
19	Forest Plantation	25.20	0.76
20	Scrub Forest	96.50	2.91
21	Tree Clad Area-Dense	0.80	0.02
22	Tree Clad Area-Open	1.60	0.05
Wastelands		**80.99**	**2.44**
23	Salt affected land	0.26	0.01
24	Dense scrub	45.70	1.38
25	Open scrub	33.30	1.00
26	Riverine	0.08	0.00
27	Barren Rocky/Stony waste	1.64	0.05
Water bodies		**222.08**	**6.70**
28	River/Stream-Perennial	37.38	1.13
29	River/Stream-Non Perennial	83.17	2.51
30	Canal/Drain	15.57	0.47
31	Reservoir/Tanks-Permanent	19.35	0.58

32	Reservoir/Tanks-Seasonal	66.61	2.01
Total		**3316.00**	**100.00**

Data source: NR Census 3rd cycle mapping, NRSC/ISRO and APSAC, GoAP

1.4.2.1. Built-up

These are the areas where people live, and they are supported by infrastructure such as buildings, roads, and other modes of transportation, as well as utilities linked to water, vegetation, and open spaces. It consists of built-up (Compact and Sparse), Vegetated / Open Area, Rural, Industrial, and Mining/Quarry. It occupies an area of 222.43 sq. km, which is about 6.71% of the total geographical area of the district. The built-up category includes district headquarters, some mandal headquarters, industrial areas, and rural settlement areas based on size and population. Many vacant lands with layouts and fencing are being developed for real estate development on the outskirts of the Vijayawada, Jaggayyapeta, Nandigama, and Tiruvuru towns.

1.4.2.2. Built-up - Compact (Continuous)

Most of the land is covered by buildings, roads, and artificially surfaced area and cover almost all the ground. The built-up-compact class is assigned where the impermeable surfaces such as the transportation network and urban structures take up more than 80% of the surface area. This category occupied 41.52 sq. km, which are found in Vijayawada, Jaggayyapeta, Nandigama, and Tiruvuru towns.

1.4.2.3. Built-up - Sparse (Discontinuous)

The majority of the land is covered by structures such as buildings, roads, and artificially surfaced areas that are associated with vegetated areas and bare soil, occupying discontinuous but significant surfaces. Between 30 to 80 % of the total surface should be impermeable. This category delineates scattered blocks of residential flats, hamlets, and small villages. It covers an area of 10.95 sq. km and is located in fringe areas of Vijayawada, Jaggayyapeta, Nandigama, and Tiruvuru.

1.4.2.4. Vegetated / Open Area

These are vegetated areas within an urban agglomeration (areas located within or adjacent to urban areas). The vegetation cover of trees, shrubs, and herbs has been delineated and covers the surface area. Open areas used as parks, sport and leisure facilities, camping grounds, sports grounds,

leisure parks, golf courses, race courses, including formal parks etc are considered in this category. This category covers an area of 37.47 sq. km and is found in and around the towns of Vijayawada, Jaggayyapeta, Nandigama, and Tiruvuru.

1.4.2.5. Built-up – Rural

These are lands used for human settlement of a size comparable to urban settlements, in which more than 80% of the people are engaged in primary agricultural activity and are associated with non-commercial and allied classes, and are classified as built-up (rural). The rural built-up area is the most prevalent of the built-up categories and is spread throughout the district. It contributed an area of 96.63 sq. km (2.91%) of the district total geographical area.

1.4.2.6. Industrial

Non-linear impervious surfaces are included in this class, which is related to trade, manufacturing, distribution, and commerce. These are areas where human activity is observed in the form of manufacturing along with other supporting establishments for maintenance. The industrial area occupies an area of 19.05 sq. km, which is observed in and around the towns.

1.4.2.7. Industrial area-Ash / Cooling Pond

These are the portions of the industry which are used for temporary storage of ash, contaminated soil, rubble, cooling of hot water, or tailing pond associated with the industry. The areas where industrial waste is permanently kept are categorized as other waste which is delineated under this category. A stockpile of a storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from the earth's surface is considered under this category. It is observed that this category is found around the industrial areas with an area of 3.46 sq. km.

1.4.2.8. Mining – Active

Mining areas encompass area under surface operations. It is easy to spot these activities' effects on the landscape because they have left behind enormous giant pit mines. Currently, there are extensive surface operations being conducted in the active mining areas to remove economically significant ores. A total of 2.20 sq. km. is contributed by the active mining area.

1.4.2.9. Mining – Abandoned

These are the locations where extensive surface operations to remove economically significant ores were once conducted but are currently being left unfinished for a variety of reasons, including economic, operational, viability, disturbances, etc. Only about 1.27 sq. km. has been contributed under this category.

1.4.2.10. Quarry

These are manifestations of surface mining operations, which involve small-scale land surface excavation for quarries of quartzite, granite, sand, and other materials. They are primarily distinguished by their proximity to cities. It covers 9.87 sq. km and accounts for 0.30% of the district's total area.

1.4.2.11. Agricultural Land

Agriculture land is primarily used for the production of food, fiber, and other commercial and horticultural crops. It includes land under crops, namely cropland, fallow land, agricultural plantations, and aquaculture. The district's economy is primarily based on agriculture, which was found to account for 2429.52 sq. km (73.27%) of its total area during the period. It is also found that the double-cropped area accounts for about 26.46% of the district total. Major food crops grown are Paddy, Jowar, Bajra, Black gram, Bengalgram, Redgram, Sugarcane, Cotton, Tobacco, Chillies, Turmeric, Lemon, Banana, Sapota, and Vegetables.

1.4.2.12. Kharif Crop

The agricultural area cultivated between June/July to September/October coinciding with the South-West monsoon season is considered as Kharif crop. It is associated with rain-fed crops under dry land farming with limited or no irrigation and areas of rain-fed paddy and other dry crops. Kharif cropland is the second-largest agricultural category, covering 669.46 sq. km (20.19%). During the Kharif season, a variety of crops including Paddy, Sugarcane, Jowar, Maize, Redgram, Cotton, and others are widely grown in the district.

1.4.2.13. Rabi Crop

These areas are cultivated between November/December to February/March. It is associated with areas under assured irrigation irrespective of the source of irrigation. However, rain-fed areas with residual soil moisture, particularly in areas with black soil and high rainfall during the Kharif season, also have

areas that are planted with Rabi crops. During the Rabi season, primarily irrigated crops like rice, sugarcane, chillies and vegetables are grown using canals, tanks, and groundwater resources. In the years 2015–16, Rabi cropland covered 79.24 sq. km (2.39%) of the total area.

1.4.2.14. Zaid Crop

These are the cropped areas that are mostly associated with irrigated areas with fertile soils and are confined to plains and delta areas during the summer (April-May). Summer crops grown from April to June were mapped under Zaid cropland occupied an area of 84.23 sq. km.

1.4.2.15. Cropped in two seasons

These are the cropping areas that are commonly associated with irrigated areas during the two cropping seasons. Three combinations are possible in this category viz., - Kharif + Rabi, Kharif + Zaid, and Rabi + Zaid. Cropped areas in any two seasons are mapped under cropped in the two seasons category, occupying an area of 877.51 sq. km (26.46%). These can be found throughout the district, with reliable irrigation provided by canals, tanks, and groundwater.

1.4.2.16. Cropped in more than two seasons

These are the areas that are cropped in more than two cropping seasons. It includes triple-cropped areas (Kharif, Rabi, and Zaid) under multiple cropping. Long-duration crops like sugarcane, cotton, banana, and tobacco are considered under this category.This category accounts for 2.71 sq. km (0.08%) of the district's total geographical area.

1.4.2.17. Fallow land

Fallow land is agricultural land that is used for cultivation but is temporarily allowed to rest or un-cropped for one or more seasons, but not less than a year and not more than five years. The fallow land covers an area of 113.32 sq. km and is devoid of crops during both cropping seasons for various reasons.

1.4.2.18. Agricultural Plantation

These are the areas where agricultural tree crops have been planted using agricultural management techniques. These also include the areas of land use systems and practices wherein the cultivation of herbs, shrubs, and vegetable crops are deliberately integrated with crops mostly in irrigated conditions for ecological and economic reasons. These areas can be

distinguished from cropland, especially using data collected during the Rabi/Zaid season. Plantations appear in varying sizes with regular and sharp edges, indicating the presence of a fence around them. Plantations such as banana, cashew, eucalyptus, teak, and others are grown throughout the district. The plantations category accounts for 603.32 sq. km (18.19%) of the district's total geographical area.

1.4.2.19. Forest

The term forest is used to refer to land with a tree canopy cover of more than 30 percent and an area of more than 0.5 ha. Forest is determined both by the presence of trees and the absence of other predominant land uses within the notified forest boundaries. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. The forest area occupied an area of 360.98 sq. km (10.89%) and found along the coast and western parts of the district where several forest species grow. The important species are teak, nalla maddi, rosewood, devadari, etc.

1.4.2.20. Deciduous (Dry/Moist/Thorn)-Dense

This category is predominantly composed of species, which shed their leaves once in a year, especially during summer. These are mostly broad-leaved tropical forests with a tendency to shed their leaves annually. This category includes all the areas where the canopy cover/density is more than 40 % and contributed 66.25 sq. km in the district.

1.4.2.21. Deciduous (Dry/Moist/Thorn)-Open

This category is predominantly composed of species, which shed their leaves once a year, especially during summer. These are mostly broad-leaved tropical forests with a tendency to shed their leaves annually. This category includes all the forest areas where the canopy cover/density ranges between 10% - 40%. In addition to timber, these forests also contain a large variety of fauna like tigers, leopards, wolves, bears etc.An area of 170.63 sq. km (5.15%) is attributed to this category.

1.4.2.22. Forest Plantation

These are the locations where important tree species for forestry are grown and managed, particularly in notified forest areas. The majority of these are found in uplands and coastal regions. Many of these can be identified based on the sharp boundary exhibited by them. Forest plantations, mainly teak,

bamboo, casuarinas, etc have been delineated with an area of 25.20 sq. km during the period.

1.4.2.23. Scrub Forest

These are the forest areas that are generally seen on the fringes of dense/open forest cover and settlements, where there is biotic and abiotic interference. Most times they are located closer to habitations. Forest blanks which are the openings amidst forest areas, devoid of tree cover, observed as openings of assorted size and shapes as manifested on the imagery are also included in this category. The scrub forests accounted for 96.50 sq. km (2.91%), which are generally prone to the conversion of forest plantations and other development activities within the notified forest.

1.4.2.24. Tree Clad Area-Dense

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-defined crown and being at least 3m tall. Plants essentially herbaceous but with a woody appearance (e.g. Bamboos and ferns) are also classified as trees if the height is more than 5m and as shrubs, if the height is less than 5 m. This category includes all the areas, where the canopy cover/density is more than 40%. The dense tree-clad area contributes an area of 0.80 sq. km, which is found along with forest areas in the district.

1.4.2.25. Tree Clad Area-Open

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-defined crown andbeing at least 3m tall. Plants essentially herbaceous but with a woody appearance (e.g. Bamboos and ferns) are also classified as trees if the height is more than 5 m and as shrubs, if the height is less than 5m. This category includes all the forest areas where the canopy cover/density ranges between10% – 40%. The tree-clad open category has been mapped with an area of 1.60 sq. km.

1.4.2.26. Wastelands

Wasteland is described as degraded land which can be brought under vegetative cover with reasonable effort and which is currently underutilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. Wastelands can result from inherent/imposed disabilities such as location, environment, chemical and

physical properties of the soil, or financial or management constraints. During the study, the area under the wasteland category was mapped at 80.99 sq. km (2.44%), which includes the subcategories of salt affected land, dense scrub, open scrub, coastal sand, and barren rocky / stony waste.

1.4.2.27. Salt affected land

Salinization can be caused by inadequate canal irrigation water management, which causes the water table to rise and, as a result, salts to build up in the root zone in arid, semi-arid, and sub-humid (dry) conditions, as well as by seawater intrusion in coastal regions and/or the use of groundwater with high salt content. They also turn salty when groundwater is salty or soils have grown on salty parent materials. The salt-affected lands are accounted only 0.26 sq. km of the district total area.

1.4.2.28. Dense scrub

The scrub is usually confined to topographically elevated areas, on the hill slopes generally surrounded by agricultural lands. These areas possess shallow and skeletal soils, at times chemically degraded, extremes of slopes, severely eroded and lands subjected to excessive aridity with scrubs dominating the landscape. It is found with varying sizes of small to large areas having a contiguous or dispersed pattern. The dense scrub areas can be found western parts of the district with moderate sloping areas. The area was mapped over a 45.70 sq. km.

1.4.2.29. Open scrub

This category has a similar description as mentioned in the dense scrub except that they possess sparse vegetation or are devoid of scrub and have a thin soil cover. The open scrub areas are found at the foothills and moderate to gentle slopping areas surrounded by agricultural lands. The area mapped under this category is about 33.30 sq. km in the district.

1.4.2.30. Barren Rocky/Stony waste

The barren rock exposures are especially confined to hilly terrain with down slopes with rock outcrops, stony waste, and fragments. Barren rocky areas have been observed as rocky outcrops in the forest and scrubland. It is found that most of the barren rocky areas are being quarried for various construction activities in the district. The area under this category is 1.64 sq. km and it occupies 0.05% of the district.

1.4.2.31. Water Bodies

This category comprises areas with surface water, either impounded in the form of ponds, lakes, and reservoirs or flowing as streams, rivers, canals, etc are delineated. These can be seen clearly in the satellite image in blue to dark blue or cyan depending on the depth of the water. This category includes rivers, streams, canals, lakes, ponds, reservoirs, and tanks. The total area of water bodies, including all sub-categories, is about 222.08 sq. km (6.70%).

1.4.2.32. River/Stream-Perennial

Rivers/streams are the natural course of water flowing on the land surface along a definite channel/slope regularly or intermittently towards a sea in most cases or a lake or an inland basin in desert areas or a marsh or another river. The rivers/streams that flow continuously throughout the year are considered as perennial. It contributes an area of 37.38 sq. km. The important river and rivulets in the district are the NTR. The River NTR flows through the district in a northwest-southeast direction. The Munneru River flows northwest-southwest through the district before joining the NTR.

1.4.2.33. River/Stream-Non Perennial

When the water covers the surface for less than nine months each year, it is considered non-perennial. This also includes the dry part of the river generally characterized by the presence of sand or exposed rocks. It contributes an area of 83.17 sq. km under this category.

1.4.2.34. Canal/Drain

Canals and drains are artificial watercourses constructed for irrigation, navigation or to drain out excess water from agricultural lands. It is found mostly in the coastal plains with an area of 15.57 sq. km.

1.4.2.35. Reservoir/Tanks-Permanent

The reservoir is an artificial lake created by the construction of a dam across the river specifically for hydel power generation, irrigation, and water supply for domestic/ industrial needs, flood control, either singly or in combination. Tanks are small lakes of impounded waterways constructed on land surfaces for irrigation. They are associated with croplands, lowlands, and reservoirs surrounded by hills without vegetation. This includes all reservoirs/tanks with water spread seen at least during one season in a year is considered under the permanent category. The reservoir/tanks-permanent category was

delineated with an area of 19.35 sq. km. These are the one of the sources of the irrigation and spread over the district.

1.4.2.36. Reservoir/Tanks-Seasonal

Dry reservoirs/tanks are those which do not have water spread throughout the year and such are considered seasonal. During the mapping period, where the water spread not found in the three seasons, those areas are mapped in this category. Many of the tanks are found to be seasonal, with a total area of 66.61 sq. km.

1.4.3 Forest Cover Distribution

The forest cover maps were created by interpreting multiple sources of topographical maps and satellite data. Land with a tree canopy cover of more than 10% and a size of more than 0.5 ha is referred to as a forest. Forest is defined by the presence of trees and the absence of other dominant land uses within the notified forest boundaries. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. The spatial distribution of forest cover and its statistics are presented in Figure-8 and Table-6. As per the Forest Department, Government of Andhra Pradesh the Forest boundary map is presented in Figure-9.

Table 6 Forest cover distribution in NTR District

S. No	Type of Forest	Area in sq. km	% to district total
1	Deciduous (Dry/Moist/Thorn)-Dense/Closed	66.25	2.00
2	Deciduous (Dry/Moist/Thorn)-Open/Closed	170.63	5.15
3	Forest Plantation	25.20	0.76
4	Scrub Forest	96.50	2.91
5	Tree Clad Area-Dense	0.80	0.02
6	Tree Clad Area-Open	1.60	0.05
	Total	**360.98**	**10.89**

Data source: NR Census 3rd cycle mapping, NRSC/ISRO and APSAC, GoAP

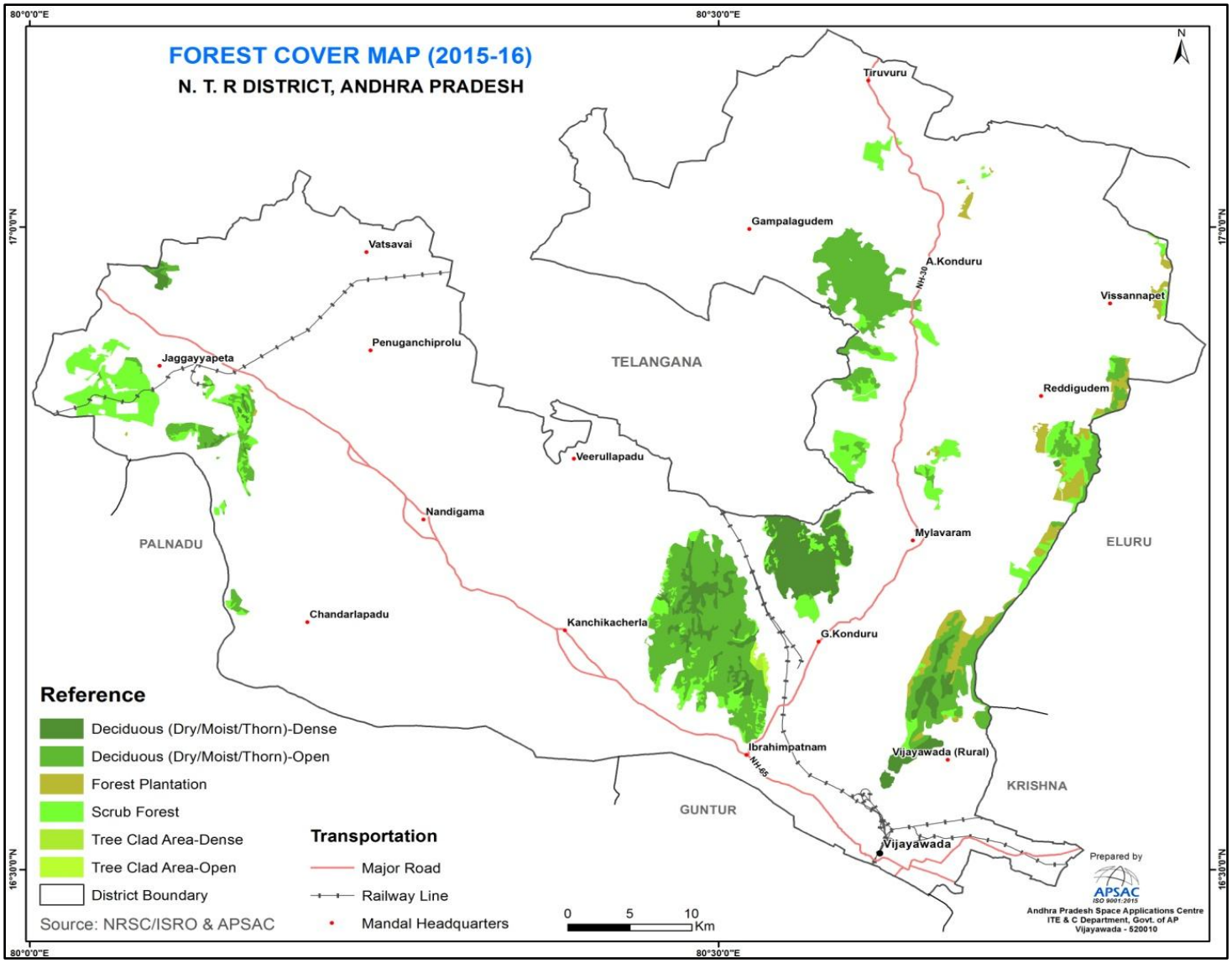


Figure-8: Forest cover map of NTR District

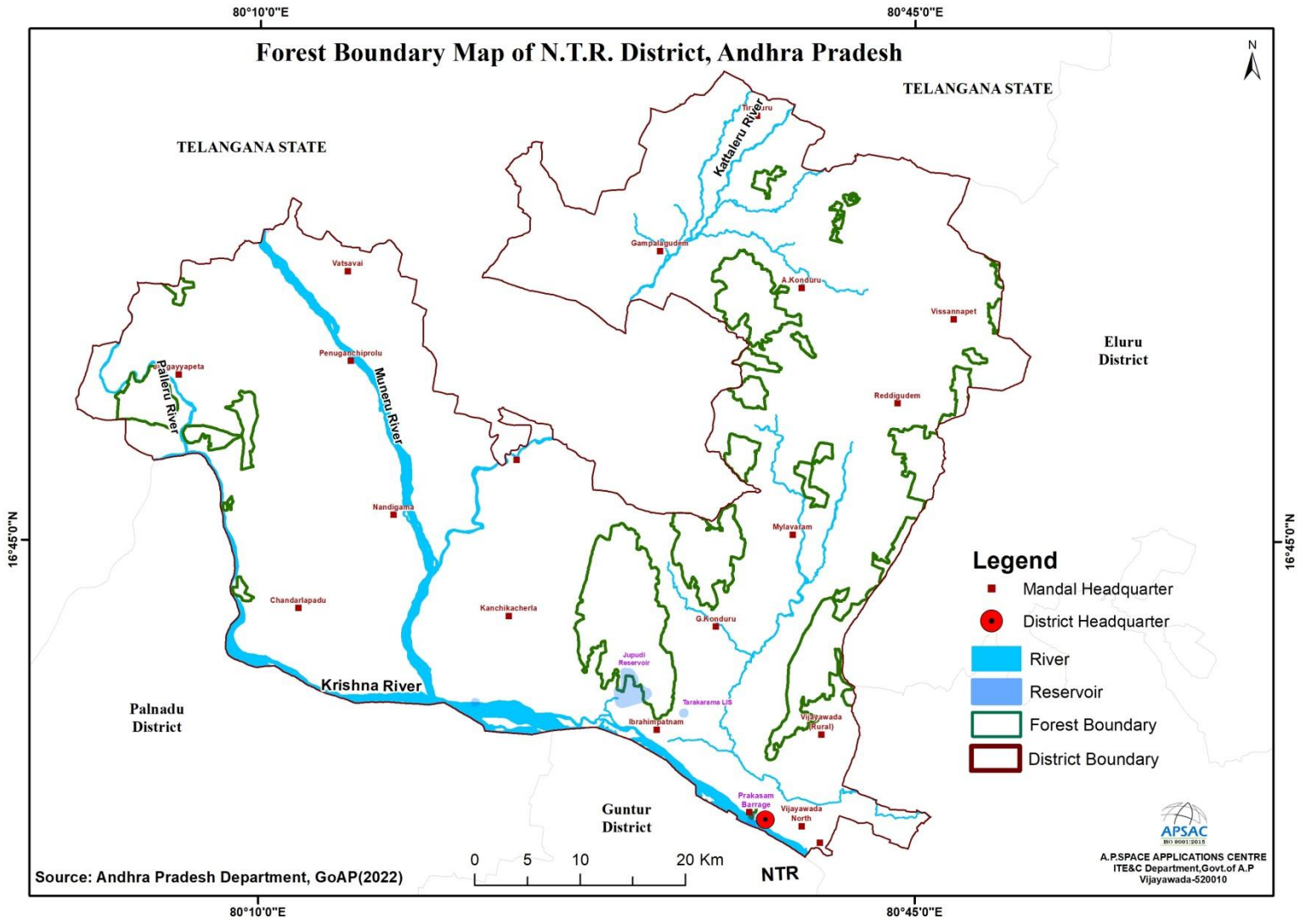


Figure-9: Forest Boundary map of NTR District

The forest cover of the district is concentrated in the east, central, and a few isolated locations in the west. The predominant category is deciduous open forest, which contributes 170.63 sq. km. The deciduous dense and scrub forests contribute 66.25 and 96.50 sq. km, respectively. The forest plantations like Teak, Casuarina, etc have been mapped within the notified forest areas. The forest plantations category covers an area of 96.50 sq. km of the district. The dense and open tree-clad areas have been mapped at 0.80 sq. km and 1.60 sq. km respectively.

1.4.4 Agricultural Resources in NTR District

Remote sensing technology has been successfully used by APSAC during the last two decades in the areas of agriculture both in the spatial and temporal domain under various projects. The vegetation conditions and ranges are shown in the Table-7.

Table 7 Vegetation condition and range in percentage

VCI range (%)	Vegetation Condition	Description
60-100	Normal	Crop condition is Normal
40-60	Moderate	Crop condition is Moderate
0-40	Severe	Crop condition is Severe

1.4.5 Soil Resources of the NTR District

The different types of soils are encountered in the N.T.R district of Andhra Pradesh. The predominant soil types in the district are clayey to gravelly clayey moderately deep dark brown soils 1223.21 sq.km followed by loamy to clayey skeletal deep reddish brown soils 1055.02 sq.km, shallow gravelly red soils 323.25 sq.km, moderately deep calcareous black soils 283.23 sq.km, loamy to gravelly clay deep dark reddish brown soils 252.26 sq. km, deep black clayey soils 29.15 sq.km and gravelly clayey moderately deep red soils 8.3 sq.km. The soil resource map of the district is shown in Figure-10and the soil category with area given in Table-8.

Table 8 Soil classes in NTR district

S.No	Classification	Area in Sq.km
1	Clayey to gravelly clayey moderately deep dark brown soils	1223.21
2	Deep black clayey soils	29.15
3	Gravelly clayey moderately deep red soils	8.3
4	Loamy to clayey skeletal deep reddish brown soils	1055.02
5	Loamy to gravelly clay deep dark reddish brown soils	252.26
6	Moderately deep calcareous black soils	283.23
7	Shallow gravelly red soils	323.25
	Total	3174.42#

#*Exluding the Urban and Waterbodies area*

Data Source: APSAC, Vijayawada

1.4.6 Salt-affected land:

The term 'salt-affected soil/land' refers to soils in which salts interfere with normal plant growth. Salt-affected soils can be divided into saline, saline-sodic and sodic, depending on salt amounts, type of salts, the amount of sodium present, and soil alkalinity.(Reference FAO Soils Portal)

These landscontain an excessive concentration of salts (soluble salts or exchangeable saline or both). Salinization can result from improper management of canal irrigation water, resulting in the rise of the water table and consequent accumulation of salts in the root zone in arid, semi-arid, and sub-humid (dry) conditions and ingress of seawater in coastal regions and/or use of high-salt containing groundwater. They also become saline when soils have developed salt-containing parent materials or have saline groundwater. Coastal saline soils may be with or without ingress or inundation by seawater. The salt-affected soil/ land area in the N.T.R district is 10,296 hectares.Figure-11 illustrates the spatial distribution of salt affected soil in NTR district.

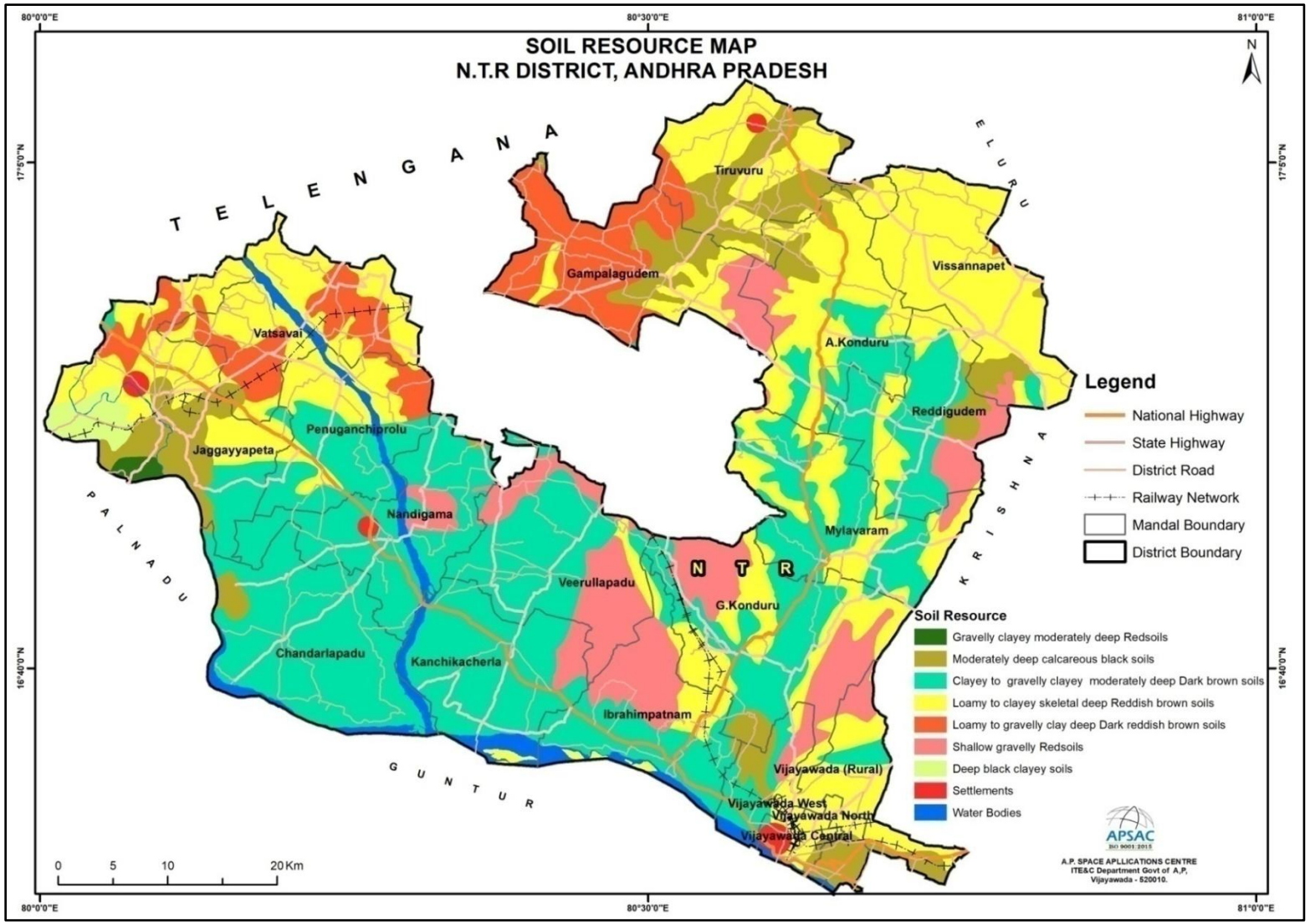


Figure-10: Soil resource map of NTR District

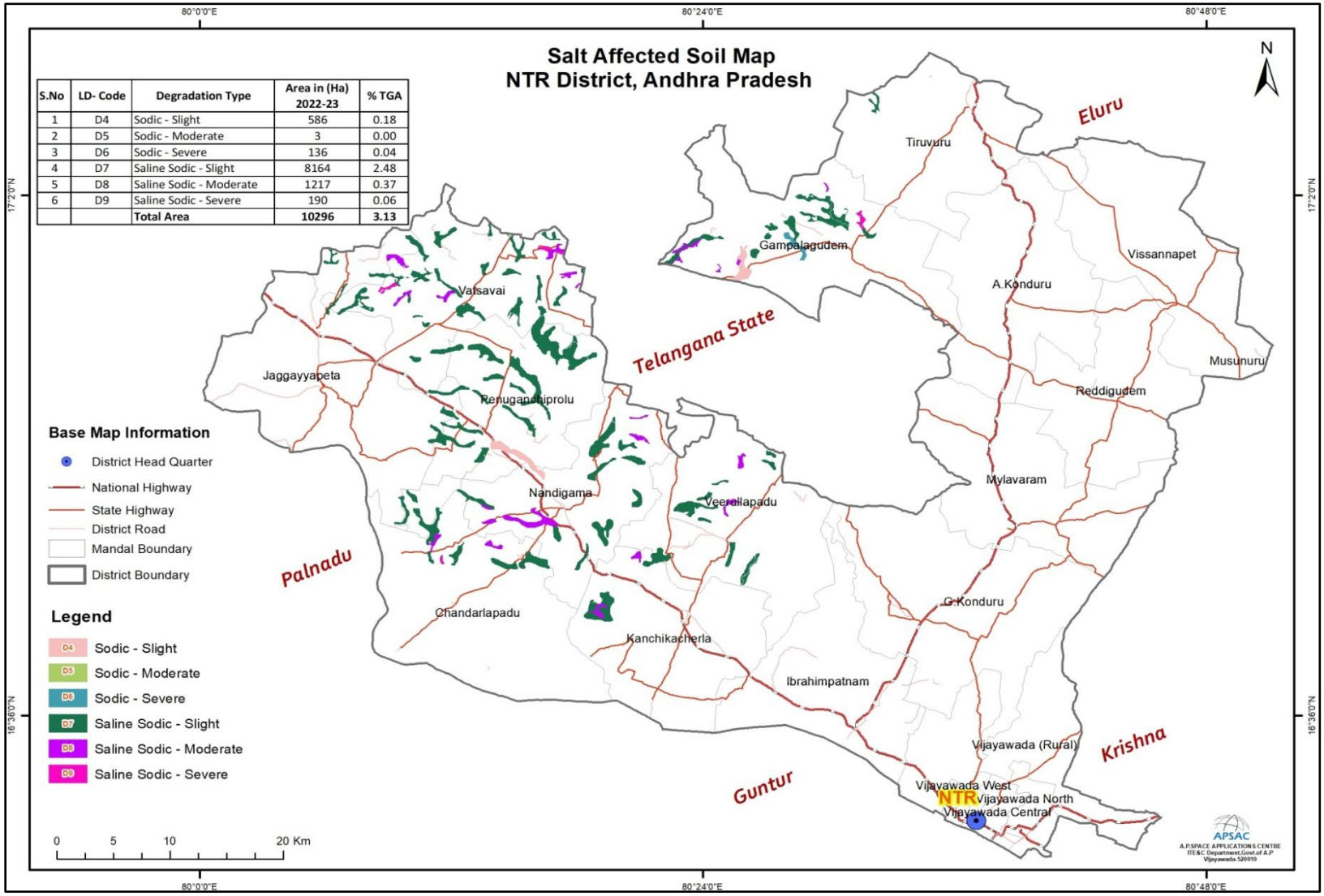


Figure-11: Illustrates the spatial distribution of salt affected soil in NTR district.

1.4.7 Horticulture

Horticulture is a science, as well as, an art of production, utilization and improvement of horticultural crops, such as fruits and vegetables, spices, ornamental, plantation, medicinal and aromatic plants. It also includes plant conservation, landscape restoration, landscape, garden design, construction, maintenance,arboriculture, ornamental treesand lawns.

In the N.T.R district, Oil Palm is the major horticulture crop, cultivated in an area of 343.49ha. followed by Mangoes (206.27 ha.), Acid Lime (22.92 ha.), and Coconut (19.49 ha.). The total area under horticulture crops is 608.29 ha. The horticulture crop-wise detail is shown in the Table-9.

Table 9 Area of horticultural crops in NTR district

S.No	Crop	Area in ha
1	Anjura	1.62
2	Dragon Fruit	4.95
3	Banana	2.01
4	Ber	1.22
5	Mangoes	206.27
6	Guava	6.32
7	Acid Lime	22.92
8	Oil Palm	343.49
9	Coconut	19.49
	Total Area	**608.29**

Source: Government of Andhra Pradesh Rashtriya Krishi Vikas Yojana-2022-23.

1.5 Ground Water Prospects in the District:

Groundwater occurs in all most all geological formations and its potential depends upon the nature of geological formations, geographical setup, the incidence of rainfall, recharge, and other hydrogeological characters of the aquifer. In consolidated formations, groundwater occurs under unconfined to semi-confined conditions. Groundwater is developed in these formations by dug wells, dug cum bore wells, and bore wells tapping weathered and fractured zones. The yields are in the range of 20 to 70 m^3/day. The occurrence of fractures in the crystalline formations is limited to 30 to 40m bgl and occasionally extends down to 70-100m bgl. The bore wells constructed in the crystalline formations generally tap the weathered and fractured zones. The yields of the bore wells generally range between 80 to 400 m^3/day. The higher yields are limited to the available thickness of fractured and jointed zones. In the meta sediments,

the yields are very limited and are in the range of 10 to 80 m^3/day. Higher yields occur in limestone formations. Groundwater in semi-consolidated formations occurs under unconfined to confined conditions. Ground water is developed in these formations by dug cum tube wells and tube wells. These formations are potential aquifers. The yields of the dug cum tube wells are in the range of 30 to 45 m^3/day. The granularity of the sandstone bed is the deciding factor of the yield potential as the higher yields are recorded in the Rajahmundry sandstones tapping coarse sandstone beds. The yields of the tube wells in Gollapalli sandstones and Rajahmundry sandstones are in the range of 60 to 200 m^3/day and 600 to 1500 m^3/day respectively.

The deltaic area is underlain by alluvium of recent age consisting of varying proportions of clay, silt, sand, and gravel. The thickness of alluvium ranges from a few meters to about 600m followed by tertiary formations. In deltaic areas, ground water occurrence is controlled by landforms. In the deltaic area, a lot of heterogeneity in hydrogeological conditions exists both spatially and vertically. Freshwater is generally limited to shallow to moderate depths only. Whereas, in the southern part of the delta, it occurs as pockets and lenses. Deep aquifers are generally saline. Palaeo-channels are favourable locations for fresh water aquifers. Ground water occurs under phreatic to confined conditions and is developed through shallow dug wells, filter point wells, and shallow tube wells. The depth of dug wells ranges from about 2 to 7m, while the depth of filter point wells varies from 5 to 13m and the depth of tube wells varies from 40 to 80m. The yields generally range in this aquifer between 250 to 400 m^3/day. Occasionally high yields of up to 15 lps exist in the palaeo-channels. The transmissivity value of the aquifer in the semi and unconsolidated formations varies from 2.5 to 5560 m^3/day. Water level scenario the depth of water levels during pre-monsoon season (May 2012) in the district ranges between 2 and 10 m bgl.

1.6 Infrastructure

1.6.1 Transport Network

NTR district has a well-connected by various modes of transportation such as road and rail. The connectivity of each category is also depicted in Figure-12 The details of each transport network distribution in the district is given below.

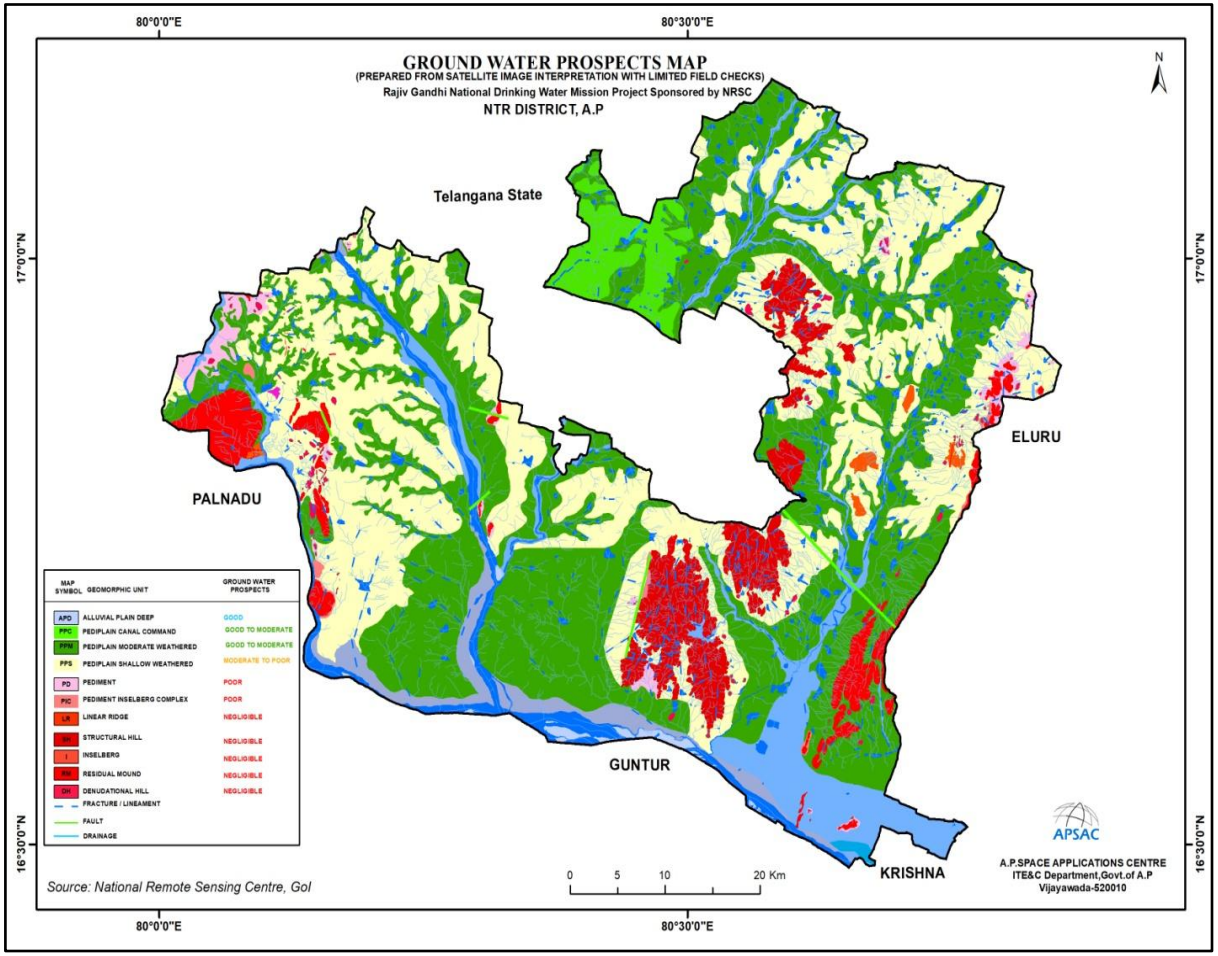


Figure-12: Ground Water prospects in NTR District, Andhra Pradesh

1.6.1.1. Road Transport: The road network of the district has been delineated by using high resolution satellite data under Space Based Information Support for Decentralized Planning (SIS-DP) project and arrived the lengths of the each type of road network. It can be observed that NTR district has a well-developed road network that facilitates connectivity to all towns within the district, and to other major cities and towns of nearby districts. The major road network includes National Highways (NH), State Highways (SH), and District Roads (DR). The rural areas of the district also good connectivity by Panchayat Raj roads / village roads.

The total length of the road network in the district is about 6464.74 km of which, the length of the National Highways is about 176.07 km, State Highways is having a length of about 457.12 km connecting all major towns and cities in the district. The district roads are connecting all towns and mandals having a length of 944.94 km. The length of each road category covered in the district are shown in Table-10.

Table 10 Road Category wise Lengths.

S.No	Road Type	Length in Km
1	National Highway	176.07
2	State Highway	457.12
3	District Road	944.94
4	Village Road	2827.05
5	Cart Track	1237.99
6	Foot Path	551.19
7	City Road	270.38
	Total Length	**6464.74**

Data Source: R and B Department and APSAC, Vijayawada.

NTR district is traversed by Four National Highways. The traverse and description of each highway is as given below:

1.6.1.1.1. National Highway 65(NH65): National Highway 65, is a national highway in India. It runs along the states of Maharashtra, Karnataka, Telangana and Andhra Pradesh. It starts at Pune and ends at Machilipatnam. Major cities on this route are Pune, Solapur, Hyderabad, Suryapet, Vijayawada and Machilipatnam. It starts at Jaggayyapeta in NTR district, and passes through the mandals Nandigama, Kanchikacherla, Ibrahimpatnam, Vijayawada and ends at Machilipatnam in NTR District.

1.6.1.1.2. National Highway 16 (NH16): The NH16 is a major National Highway in India that runs along east coast of West Bengal, Odisha, Andhra Pradesh and Tamil Nadu states. It is a part of the Golden Quadrilateral project to connect India's major cities. The NH starts at Odisha border which passes through the coastal districts in Andhra Pradesh having a length of about 17 km via Srikakulam, Vizianagaram, Visakhapatnam, Anakapalli, Kakinada, East Godavari, Eluru, NTR, NTR, Guntur, Palnadu, Bapatla, Prakasam, S.P.S. Nellore and Tirupati districts. It traverse through Vijayawada in NTR district, which connects to Tamil Nadu Border at Tada in Tirupati district.

1.6.1.1.3. National Highway 30(NH30): National Highway 30 is a primary national highway in India. NH 30 connects Sitarganj in Uttarakhand with Ibrahimpatnam, Vijayawada in Andhra Pradesh. It starts at the junction of NH 9 at Sitarganj and ends at the junction of NH 65 at Ibrahimpatnam, Vijayawada. It traverse through NTR District, and passes through the mandals Tiruvuru, A.Konduru, Mylavaram, G.Konduru and terminates at Ibrahimpatnam.

Some important State Highway segments are covered in the district are given below:

Vijayawada – Vissannapeta road (SH032)

Chevitikallu - Vatsavai road (SH030)

Nuzvid – Gampalagudem road (SH198)

Tiruvuru - Rajavaram road (SH178)

Machilipatnam – Nuzvid – Kalluru Road (SH028)

Vissannapeta – Lakhsmipuram road (SH180)

1.6.1.2. Railways : The Indian Railway line traversing from various stations to cater the transportation needs of the people. The length of Rail network in the district is about 130.28 km covering 9 railway stations. Among these Vijayawada junction is the main Railway station; the important Railway stations are Kondapalli and Rayanapadu; and the Train stations are Cheruvu Madhavaram, Gangineni, Gunadala, Madhura Nagar, Nidamanuru and Ramavarappadu.

NTR district is traversed by a significant railway line that connects various parts of the district and provides connectivity to neighbouring regions. Howrah-Chennai Main Line which is a major trunk route that connects Howrah (Kolkata) in West Bengal to Chennai in Tamil Nadu and also facilitating passenger and freight transportation across the region. It

passes through NTR district, serving main railway station Vijayawada Junction.

The Kazipet-Vijayawada section is a railway line connecting Kazipet and Vijayawada. This track is part of the New Delhi-Chennai main line. The section is under the jurisdiction of South Central Railway. It passes through NTR district, serving important railway stations such as Kondapalli and Rayanapadu. The Motumarri–Vishnupuram section is a railway section of the Indian Railways. The section falls under the administered of both Guntur and Secunderabad railway divisions of South Central Railway zone.

In addition to the main line, there are various branch lines and spur lines namely Vijayawada junction-Gudivada branch line, Cheruvu Madhavaram branch line, Madhura nagar branch line that extend from the main line to connect specific towns with in NTR district. These lines provide local connectivity and transportation services to different parts of the district.

1.6.2 Irrigation

1.6.2.1. Major and Medium Irrigation Projects in NTR district:

Irrigation has assumed an increasing significance in agriculture in the context of new technology, where high yielding varieties and multiple cropping are being practiced. The main reasons for low yields are inadequate rainfall, uneven and uncertain rains during the period of crop growth. It is generally found that the introduction of irrigation is associated with changes in the cropping pattern. The shift from a traditional cropping pattern to the most advantageous cropping pattern is possible only in the presence of irrigation facilities. The new agricultural technology is highly based on sufficient moisture conditions. Thus, the development of irrigation is crucial for increasing agricultural production. The irrigation projects are classified as major, medium and minor irrigation details are shown in Table-11 and Figure-13.

1.6.2.1.1. Major Irrigation Projects:

In NTR district there are four major irrigation projects i.e., NTR Delta System (KDS-Eastern Delta), Nagarjunasagar Left Bank Canal Project (NSLC), Polavaram Right Main Canal and Tarakarama lift Irrigation scheme. The ayacut details of Nagarjunasagar Left Bank Canal (NSLC) an extent of 94,985 Ac ayacut, Tarakarama lift Irrigation scheme an extent of 56,000 Ac ayacut, Polavaram Right Main Canal is diversion of 80 TMC of Godavari waters into the NTR river and Irrigation facilities to an extent

of 62,000 Ac (Combined district) and stabilize ayacut of 13.08 lakh acres in NTR Delta Syatem.

1.6.2.1.2. Medium Irrigation Projects:

The Muniyeru Anicut medium irrigation project (completed) is covered in the district, an extent of 16,427 Ac ayacut. The Minor Lift Irrigation Schemes under *Andhra Pradesh State Irrigation Development Corporation Limited (APSIDC)* (109Nos-Ongoing) covered in the district, an extent of 89,781 Ac ayacut andAnicuts(6Nos) an extent of 982 Ac ayacut, Open Head Channel(1No) an extent of 1,024 Ac ayacut, Supply Channels(5Nos) an extent of 11,520 Ac ayacut are covered in the district an total extent of 13,526 Ac ayacut.

The Water Resources Department 138Nos of minor irrigation tanks (above 100 Ac ayacut) covered in the district an extent of 41,114 Ac ayacut. And also 301Nos of minor irrigation tanks (bellow 100 Ac ayacut) covered in the district an extent of 11,872 Ac ayacut.

Table 11 Major and Medium Irrigation Projects in NTR District

S.No	Project Type	Name of the Project	Status	Ayacut in Ac
1	Major	NTR Eastern Delta System *(Prakasam Barrage-KDS)*	Completed	-
2		Nagarjunasagar Left Bank Canal Project (NSLC)		94,985
3		Polavaram RMC *(80 TMC of water diversion to NTR River and Stabilize ayacut of 13.08 lakh acres NTR Delta* ***(Combined District)***	Ongoing	62,000
4		Tarakarama lift Irrigation scheme		56,000
5	Medium	Muniyeru Anicut	Completed	16,427
6	Minor	Anicuts (6Nos)		982
7		Open Head Channel (1No)		1,024
8		Supply Channels (5Nos)		11,520
9		Lift Irrigation Schemes under APSIDC (109Nos)	Ongoing	89,781
10		Minor Irrigation Tanks 138Nos (Ayacut above 100 Acres)	Completed	41,114
11		Minor Irrigation Tanks 301Nos (Ayacut bellow 100 Acres)		11,872
			Total	**3,85,705**

Data source: WRD, APWRIMS, Govt. of A.P.

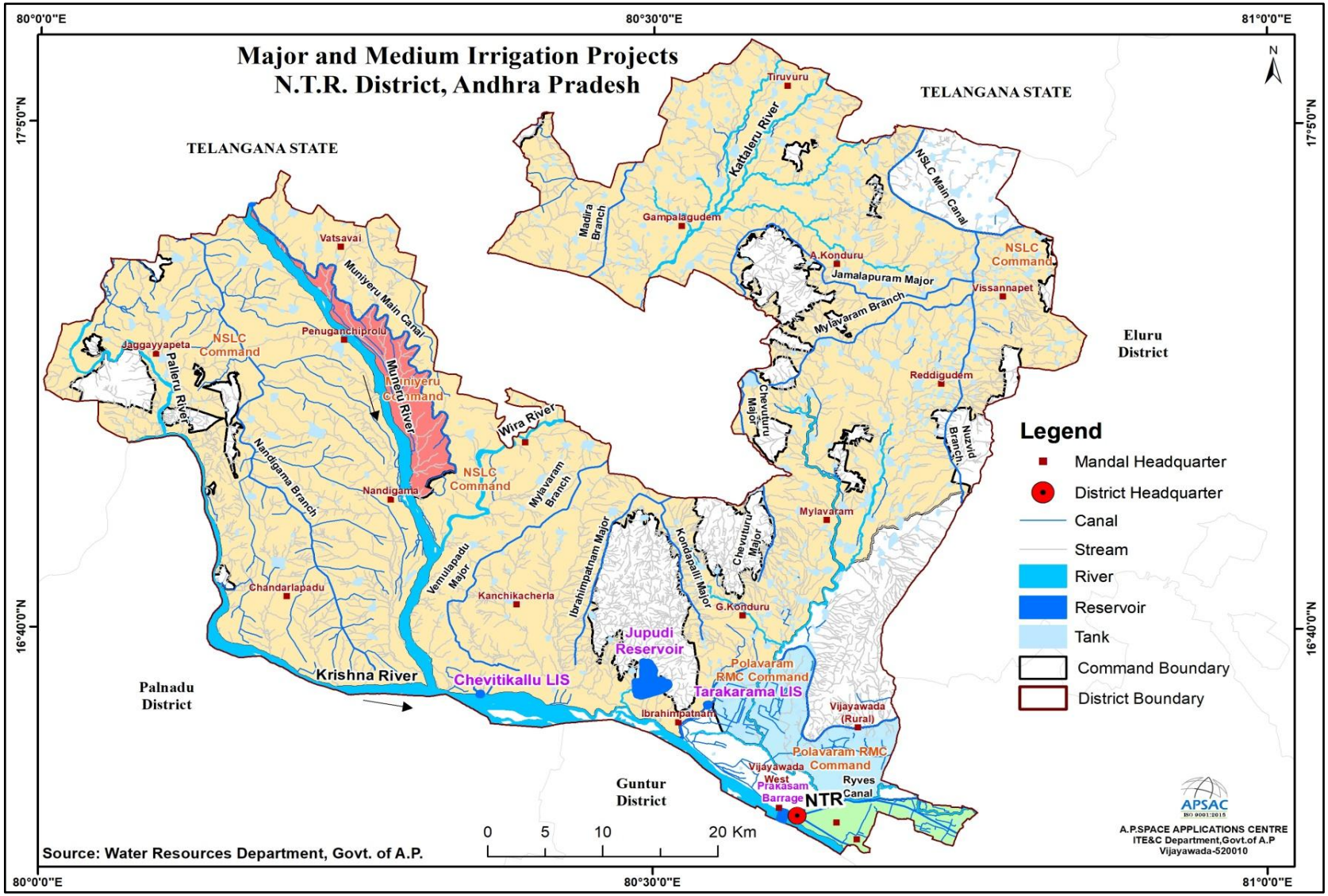


Figure-13: Major and Medium Irrigation Projects of NTR District

1.6.2.2. Tank Information System

As per the information of Water Resources Departmental portal, Andhra Pradesh Water Resources Information and Management System (APWRIMS) and the URL:https://apwrims.ap.gov.in/ in NTR district has 442 minor irrigation tanks. The Designed Storage Capacity of minor irrigation tanks in NTR district 10,436.87 mcft and Current Storage Capacity is 8,654.64 mcft. The mandal wise minor irrigation tanks details of NTR district are shown in Table-12.

Table 12 Mandal wise Minor Irrigation Tanks details of NTR district

S.No	Mandal	No.of MI Tanks	Designed Storage Capacity (mcft)	Current Storage Capacity (mcft)
1	A KONDURU	32	510.34	461
2	CHANDARLAPADU	5	72.34	44.77
3	G KONDURU	40	461.79	190.25
4	GAMPALAGUDEM	47	286.25	264.55
5	IBRAHIMPATNAM	8	359.72	223.59
6	JAGGAYYAPETA	8	1,002.39	1,002.39
7	KANCHIKA CHERLA	4	86.37	81.5
8	MYLAVARAM	33	622.25	373.65
9	NANDIGAMA	5	65.43	26.21
10	PENUGANCHIPROLU	2	97.54	97.54
11	REDDIGUDEM	63	3,359.00	3,258.62
12	TIRUVURU	56	864.64	735.61
13	VATSAVAI	17	190.73	190.73
14	VEERULLAPADU	14	171.54	85.84
15	VIJAYAWADA RURAL	21	226.03	124.55
16	VIJAYAWADA URBAN	8	184.08	127.7
17	VISSANNAPET	79	1,876.43	1,366.14
	TOTAL	**442**	**10,436.87**	**8,654.64**

Data source: WRD, APWRIMS, Govt. of A.P.

1.6.3 Eco-sensitive and Important places

NTR district is blessed with several tourist attractions that offer a mix of historical, cultural, and natural wonders. The important popular tourist, religious and cultural places to visit in the NTR district are shown in the Table-13 and the geographical location of each place is depicted in Figure-14.

Table 13 Important places of Tourism in NTR district.

S.No	Name	Village	Mandal
1	Akkanna Madanna Caves	Vijayawada (M)	Vijayawada (Urban)
2	Bapu Museum	Vijayawada (M)	Vijayawada (Urban)
3	Boating Point	Vijayawada (M)	Vijayawada (Urban)
4	Gandhi Hill	Vijayawada (M)	Vijayawada (Urban)
5	Haritha Berm Park	Vijayawada (M)	Vijayawada (Urban)
6	Kondapalli Bommala Colony	Kondapalle	Ibrahimpatnam
7	Kondapalli Fort	Forest	Ibrahimpatnam
8	Lakshmi Narasimha Swamy Temple	Vedadri	Jaggayyapeta
9	Lakshmi Tirupatamma temple	Penuganchiprolu	Penuganchiprolu
10	Moghalrajpuram Caves	Vijayawada (M)	Vijayawada (Urban)
11	Sri Kanakadurgamma Temple	Vijayawada (M)	Vijayawada (Urban)
12	Sri Venkateswara Swamy Temple	Vijayawada (M)	Vijayawada (Urban)
13	St. Mary's church, Gunadala	Vijayawada (M)	Vijayawada (Urban)

Data Source: Tourism Department, Government of Andhra Pradesh.

A brief description of certain tourist places are given below:

1.6.3.1. Kondapalli Bommala Colony: Kondapalli Bommala Colony is located at a distance of about 23 km from the district headquarter Vijayawada. Kondapalli is well known for its wooden toys named after it. The ancient fort of Kondapalli is a place of historical importance and tourist interest. Kondapalli toys are famous for their lightweight, vibrant colours and age-old production techniques. Themed around mythology, rural life and animals, these toys exhibit joyous and realistic expressions.

1.6.3.2. Mogalrajapuram Caves: Mogalrajapuram Caves is located at a distance of about 170 metres from the district headquarter Vijayawada. The temple has an 'Ardhanarisvara' statue which is thought to be the earliest in South India and one of its kind. One of the caves has an overhanging cornice with artificial windows. The idols of Lord Nataraja and Vinayaka in one cave are still in good condition compared to the other worn out images of deities. It is also a place of archaeological importance.

1.6.3.3. Bhavani Island: Bhavani Island is located at a distance of about 9 km from the district headquarter Vijayawada. The Island with a total area of 130 acres is situated in the middle of river NTR. Journey to the

island by boat is a very pleasant experience. An ideal place for picnics and other special occasions. This island is under the control of APTDC. Bhavani Island is a unique aquatic joint blessed by the placid waters and rows of shady bowers. Fringed by mangroves and manicured gardens, the woodlands, sparkling water bodies and undulating meadows, Bhavani Island is just the right destination for fun, frolic and amusement.

1.6.3.4. Kondapalli Fort: Kondapalli Fort is located at a distance of about 37 km from the district headquarter Vijayawada. The Fort has been constructed as a rock tower rising up to 3 storeys. The fort has 3 entrances and the main entrance is called Dargah Darwazah, built with a single block of granite. Another entrance gate called as Golconda Darwazah is located on the other end of the hill. Located on a crest between two hills is the Tanish Mahal or Palace, the major attraction of Kondapalli fort. There is a deep reservoir near the palace where the water is very cold. Also, one can see several ruined structures in the fort. The surrounding Kondapalli village is famous for the toys made of light wood available on the hill, famously known as Kondapalli toys.

1.6.3.5. Gandhi Hills: Gandhi Hills is located at a distance of about 5 km from the district headquarter Vijayawada. The first Gandhi memorial in India on a hillock, is a major tourist spot in Vijayawada. This Gandhi memorial with seven stupas was constructed to pay tribute to the Father of the Nation. The 52 ft tall Gandhi stupa is the major attraction here. Gandhi Memorial Library, with good collection of books; a Sound and Light show, depicting the life of Mahatma Gandhi; and a planetarium are other attractions here. The panoramic view of the Vijayawada city as seen from the Gandhi Hill is an added attraction here.

1.6.3.6. Bapu Museum : Bapu Museum is located at a distance of about 2.7 km from the district headquarter Vijayawada. The Bapu Museum (formerly: Victoria Jubilee Museum) is an archaeological museum, located at M.G. Road of Vijayawada. The museum is maintained by the Archaeological department and has large collection of sculptures, paintings and artefacts of Buddhist and Hindu relics. The structure of building is an Indo-European style of architectural and is more than a hundred years old structure.

1.6.3.7. Haritha Berm Park: Haritha Berm Park is located at a distance of about 9 km from the district headquarter Vijayawada. It is set in a stunning locale on the banks of the river NTR, by A.P. Tourism, is a picturesque property.

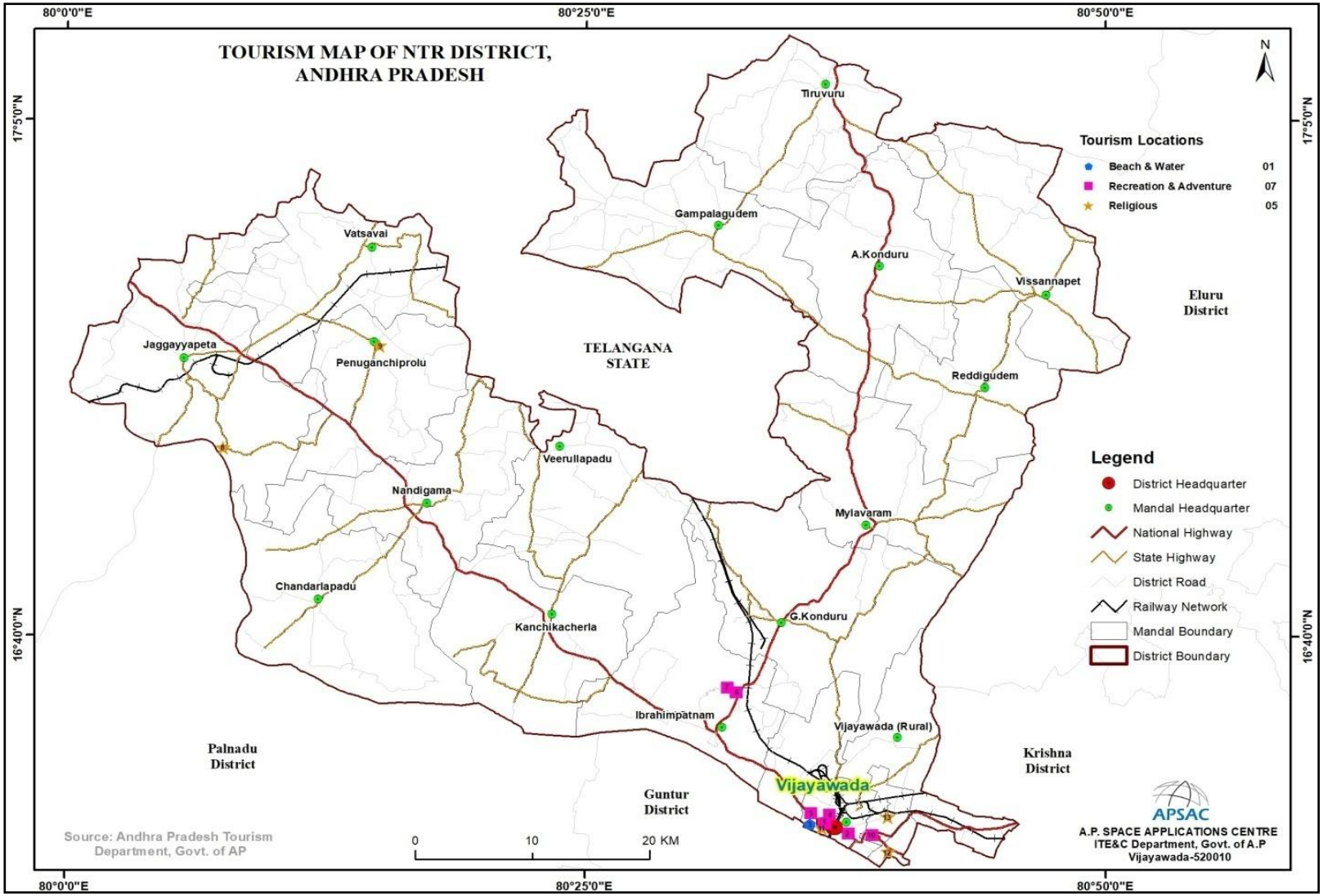


Figure-14 Tourist Map of NTR District, Andhra Pradesh

1.6.3.8. Akkanna Madanna Caves: Akkanna Madanna Caves is located at a distance of about 6 km from the district headquarter Vijayawada. The caves are a group of rock-cut Hindu cave temples in Vijayawada, Andhra Pradesh, India. The twin Akkana and Madanna caves are located in Vijayawada, at the foot of the Indrakeeladri hill.

1.6.4 Places of Religious and Cultural importance

1.6.4.1. Kanaka Durga Temple: Kanaka Durga Temple is located at a distance of about 6 km from the district headquarter Vijayawada. It is situated on the banks of river NTR, Indrakeeladri, Vijayawada. Sri Kanakadurgamma is swayambu(self-manifested). It is one of the largest temples in India and 2nd largest temple in Andhra Pradesh. The temple is built in the Dravidian style of architecture. Temple commonly called as Vijayawada Kanaka Durgamma Temple. In the Krithayuga, Goddess Durga killed Mahishasura who was a disaster for World. Then goddess Durga shined on the Keela mountain with eight arms in the form of MAHISHASURA MARDINI as she had given boon to keela.

1.6.4.2. Lakshmi Narasimha Swamy temple: Lakshmi Narasimha Swamy temple is located at a distance of about 86 km from the district headquarter Vijayawada. Yoga Nanda Lakshmi Narasimha Swamy temple and Siva temples are the key highlights here. It is one of the Pancha Narasimhar Kshetrams in Andhra Pradesh. Among the several shrines of Lord Lakshmi Narasimha Swamy that flourished on the holy banks of river NTR, Vedadri is an important one. The temple structure is conventional, being brightly colored and ornamented with a variety of images. There is a beautiful image of Narasimha Swami in yoga posture outside the temple premises. The Utsava Idols are extraordinarily high and impressive. The temple has beautiful Raja Gopuram with images of gods and goddesses carved on it.

1.6.4.3. St.Mary's Church: St.Mary's Church is located at a distance of about 4 km from the district headquarter Vijayawada. Gunadala Mary Matha Church is one of the most popular churches and is a pilgrimage for Christians in Andhra Pradesh. The shrine is situated in Gunadala, a hilly region at Vijayawada. The holy church is situated on a rocky hill on the Eastern side of Vijayawada City. The church has the rare distinction of having an iron cross set up on the hill top. It houses a museum that has a collection of ancient holy relics and precious gifts from followers.

1.6.4.4. Lakshmi Tirupatamma temple: Lakshmi Tirupatamma templeis located at a distance of about 79 km from the district headquarter Vijayawada. It is one of the most famous temples sitauted at

Penuganchiprolu, NTR district of Andhra Pradesh. There are more than 101 temples are there. One of the Great Pilgrim Sites in Andhra Pradesh is Penuganchiprolu.

1.6.4.5. Sri Venkateswara Swamy Temple: Sri Venkateswara Swamy Temple is located at a distance of about 2 km from the district headquarter Vijayawada. It is also known as Sri Venkateswara Swamy Temple, is a Hindu temple located in the Labbipet area of Vijayawada, Andhra Pradesh, India. The temple is dedicated to Lord Venkateswara, who is a form of Lord Vishnu, one of the principal deities in Hinduism. It is known for its serene atmosphere and the spiritual vibes it offers to devotees. Figure-15 is showing the Transport Network of NTR district, Andhra Pradesh.

1.7 Drainage Pattern

1.7.1 Drainage

The principal rivers flowing in the district are the NTR, Budameru, Munneru, Paleru and Kattaleru rivers. The NTR river originates in the Western Ghats, Mahabaleswar hills, Sattar District in Maharashtra State and enters into the district near Muktheswarapuram in Jaggayyapeta mandal. The river flows towards south east direction and leaves the district near Prakasam Barrage in Vijayawada. The NTR river flows towards south direction and Joining to Bay of Bengal near Lankavanidibba in NTR district.

The Budameru river rises in the Chimalapadu RF, A.Konduru mandal in NTR dsitrict and flows towards south east direction and joining to Kolleru Lake near Immanivanigudem in NTR district. The Munneru river rises in the Narsampet RF, Kothagudem mandal in Telangana State. The river flows towards south direction and joining to NTR river near Eturu in NTR district.

The Kolleru Lake is one of the largest freshwater lakes in the country and located between the NTR and Godavari deltas. The Budameru, Tammileru, Ramileru and Gunderu rivers are rises in NTR and Eluru districts, these rivers are flows towards south direction and joining to Kolleru lake. Figure-16 illustrates the drainage system and the surface water bodies.

1.7.2 Geomorphology of the District:

Using IRS satellite data and GIS detailed geomorphological and structural map of the NTR District was generated as per Rajiv Gandhi National Drinking Water Mission (RGNDWM) guidelines on a 1:50,000 scale. The

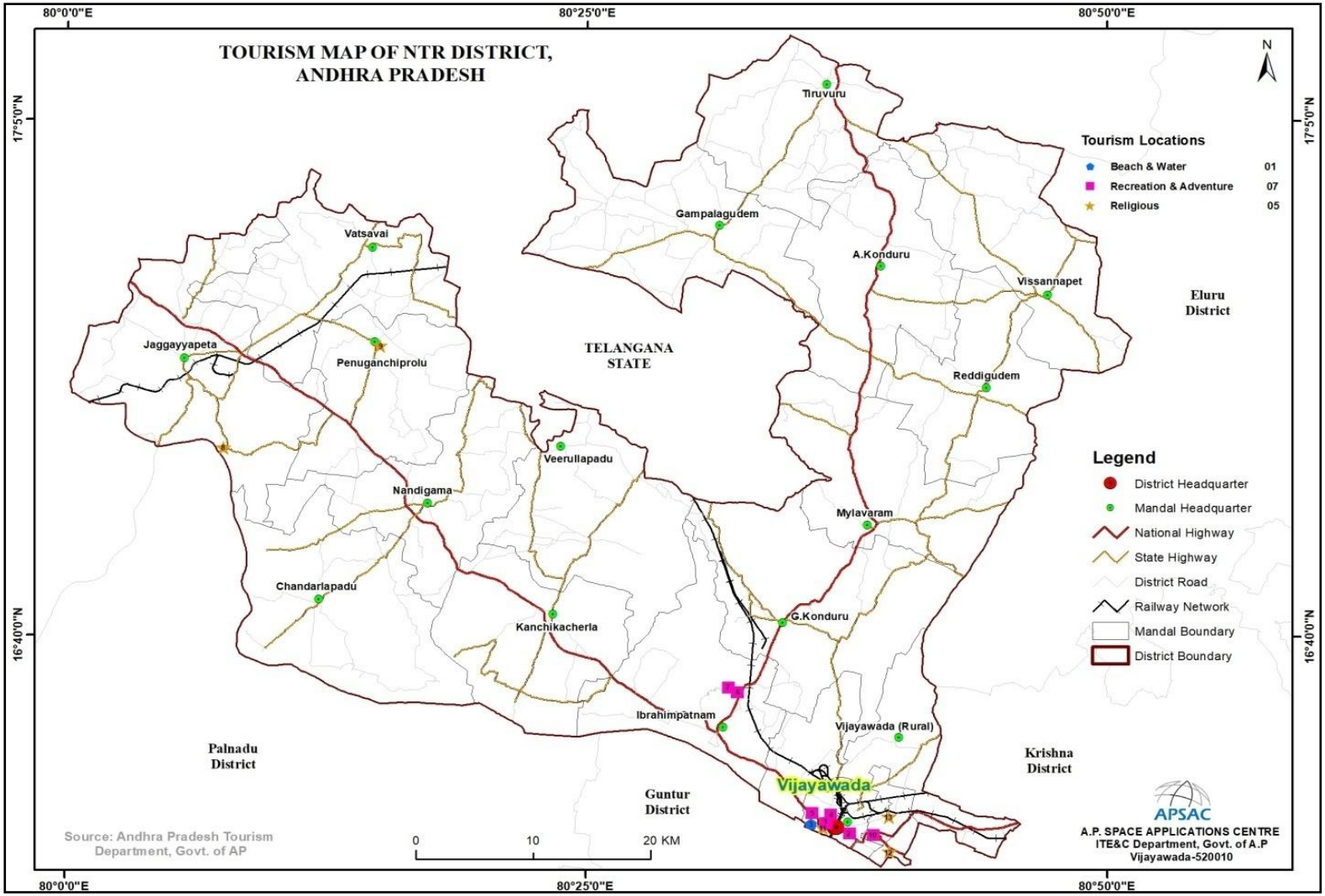


Figure-15: Transport Network of NTR district, Andhra Pradesh

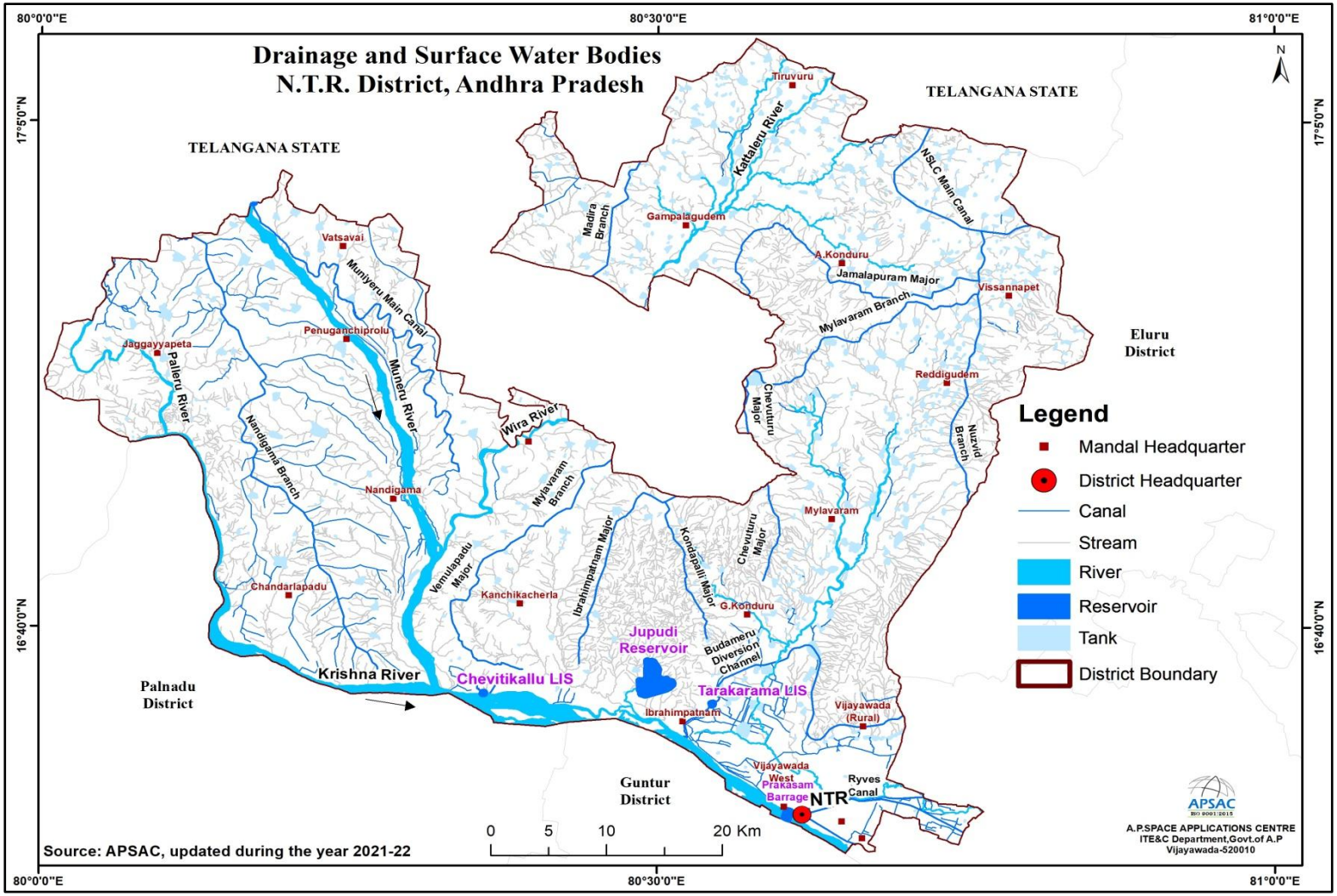


Figure - 16: Drainage Network and Surface Water Bodies of the NTR District

objective of this mapping is to map lithology, geomorphologyand structural characteristics of an area on a 1:50,000 scale and to integrate the same to locate potential ground water prospect zones and to recommend suitable structures for ground water recharge.Various hydrogeomorphic units are delineated and suitable recharge structures are proposed at drinking water-affected villages under this project. The geomorphology map of the NTR district is shown in Figure-17.

1.7.3 Landforms of Fluvial origin

The wordfluvialis used in Earth science to refer to processes and landforms produced by running water. As with other surficial processes, running water can either erode material from the earth's landscape or deposit layers of sediment. The resulting landforms can thus be classified as either erosional landformsor depositional landforms. The incredible power of running water in carving various erosional and depositional landforms is well known. Although the quantity of water in a stream is small at one time during the year, very large volumes of water move through the channel and they form an important component in the hydrological cycle. The fluvial dissection of the landscape consists of valleys and their included channelways organized into a system of connection known as a drainage network. Drainage networks display many types of quantitative regularity that are useful in analyzing both the fluvial systems and the terrains that they dissect (NRSA, 2007).

1.7.3.1. Alluvial plain: A level or gently sloping tract or a slightly undulating land surface produced by extensive deposition of alluvium, usually adjacent to a river that periodically overflows its banks; it may be situated on a flood plain, a delta, or alluvial fan. This landform is predominantly seen in the southern part of the district.

1.7.3.2. Flood plain: The surface or strip of relatively smooth land adjacent to a river channel constructed (or in the process of being constructed) by the present river in its existing regimen and covered with water when the river overflows its banks at times of high water. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current.

1.7.3.3. Valley fill: The unconsolidated sediment deposited by any agent to fill or partly fill a valley.

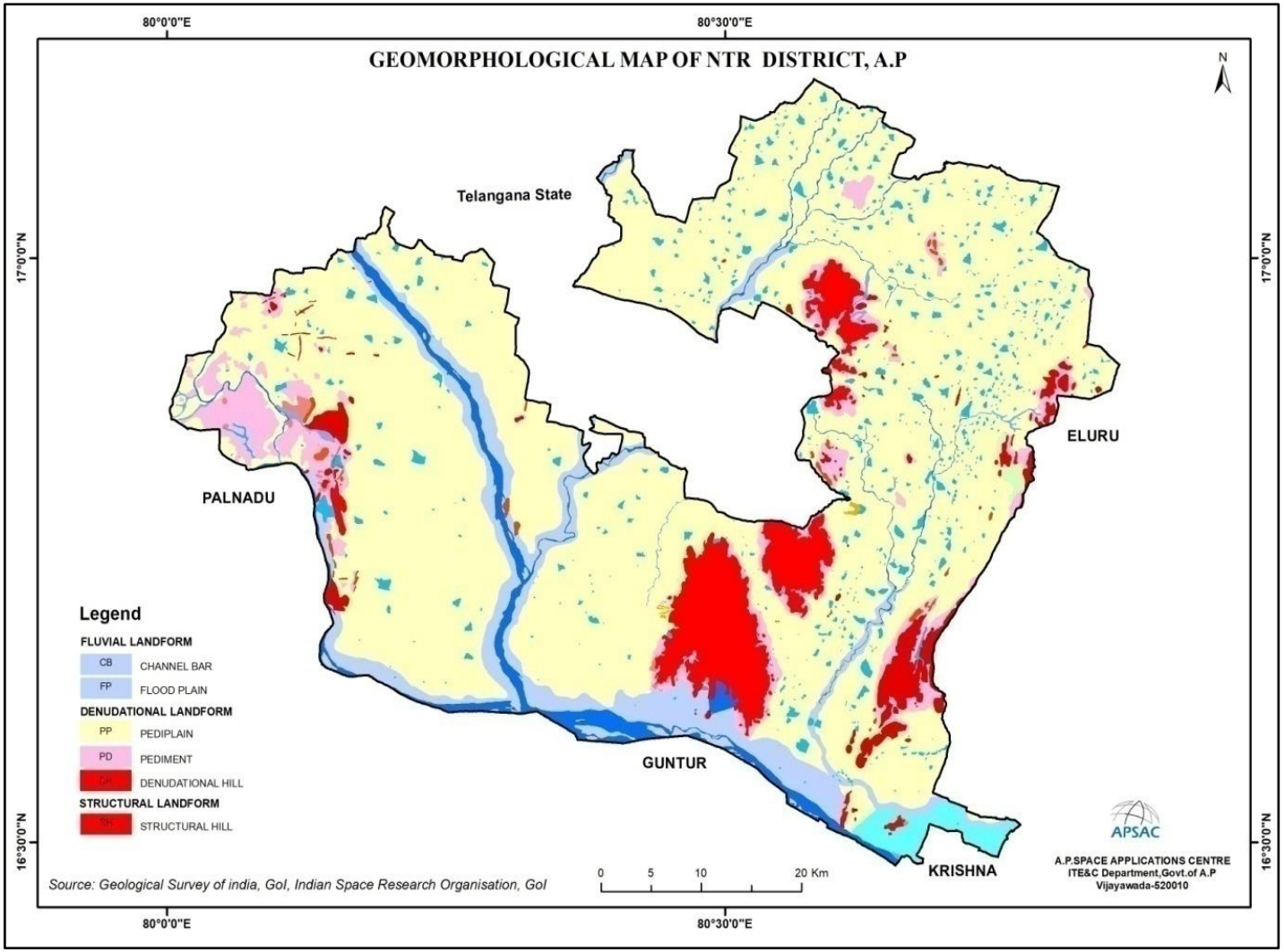


Figure 17: Geomorphology of NTR District, Andhra Pradesh

1.7.4 Landforms of Coastal origins

Coasts are the loci of a unique assemblage of erosional and depositional processes. Various landforms of coastal areas are almost exclusively the result of the action of ocean waves. Wave action creates some of the world's most spectacular erosional landforms. Where wave energy is reduced, depositional landforms like beaches are created. The source of energy for coastal erosion and sediment transport is wave action. A wave possesses potential energy as a result of its position above the wave trough, and kinetic energy caused by the motion of the water within the wave. This wave energy is generated by the frictional effect of winds moving over the ocean surface. Higher the wind speed and longer the fetch or distance of open water across which the wind blows and waves travel, the larger the waves and the more energy they therefore possess. Long open ocean waves or swells travel faster than short, locally generated sea waves. They also have longer wave periods and this is how they are distinguished from the short sea waves on reaching the coast. Long swells, which have travelled hundreds of kilometres, may have wave periods of up to 20 seconds. Smaller sea waves have wave periods of 5 to 8 seconds. Where ocean depths are greater than the length of the waves, the wave motion does not extend to the ocean floor and, therefore, remains unaffected by the floor. As the ocean depth falls below half the wavelength, the bottom increasingly affects the wave motion. As the depth of water decreases, the wave height increases rapidly and the wavelength decreases rapidly. Thus, the wave becomes more and more peaked as it approaches the shore, finally curling over as a breaker and breaking on the shore. As the wave breaks, its potential energy is converted into kinetic energy, providing a large amount of energy for the wave to do the work along the shoreline. Transportation by waves and currents is necessary to move rock particles eroded from one part of a coastline to a place of deposition elsewhere. One of the most important transport mechanisms results from wave refraction. Since waves rarely break onto a shore at right angles, the upward movement of water onto the beach (swash) occurs at an oblique angle. However, the return of water (backwash) is at right angles to the beach, resulting in the net movement of beach material laterally. This movement is known as beach drift. The endless cycle of swash and backwash and resulting beach drift can be observed on all beaches. Frequently, backwash and rip currents cannot remove water from the shore zone as fast as it is piled up there by waves. As a result, there is a build up of water that results in the lateral movement of water and sediment just offshore in a direction with the waves. The currents produced by the lateral movement of water are

known as long shore currents. The movement of sediment is known as long shore drift, which is distinct from the beach drift described earlier, which operates on land at the beach. The combined movement of sediment via long shore drift and beach drift is known as littoral drift. Tidal currents along coasts can also be effective in moving eroded material. While incoming and outgoing tides produce currents in opposite directions daily, the current in one direction is usually stronger than in the other resulting in a net one-way transport of sediment. Long shore drift, long shore currents, and tidal currents in combination determine the net direction of sediment transport and areas of deposition. Using multi-temporal satellite data can bring out the dynamics of the coast (NRSA, 2007).

1.7.4.1. Beach: A gently sloping zone, typically with a concave profile, of unconsolidated material that extends landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation (usually of the effective limit of the highest storm waves).

1.7.4.2. Beach ridge: A low, essentially continuous mound of beach or beach and dune material (sand, gravel, shingle) heaped up by the action of waves and currents on the backshore of a beach beyond the present limit of storm waves or the reach of ordinary tides and occurring singly or as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive positions of an advancing shoreline.

1.7.4.3. Tidal flat: An extensive, nearly horizontal, marshy or barren tract of land that is alternately covered and uncovered by the rise and fall of the tide, and consisting of unconsolidated sediment (mostly mud and sand). It may form the top surface of a deltaic deposit.

1.7.5 Landforms of Structural Origin

The landform of structural origin is related to the structural aspect of the area. Most of the landforms under this class have genesis related to the underlying structure. Structure plays an important role in reducing the resistance of rock which manifests itself in different geomorphic forms. Some of the variations are minor and some are in mega-scale. The mega-scale forms have a dramatic effect on the genesis of landforms and hence mapping of such forms indirectly indicates the structural setup of the area. The mega-scale structural features like fault and fold depending on their type play an important role in the genesis of structural landforms. The influence of geologic structures on the development and appearance

of landscapes is prominent. The influence of geologic structures ranges from large features, which exert a dominant influence on the form of an entire landscape, to small features, which affect an individual landform and the geomorphic processes operating on it. The structural control could be active structures whose form is directly impressed on the modern landscape or ancient structural features whose influence on a modern landscape is due primarily to differential erosion (NRSA, 2007).

1.7.5.1. Structural Hills: Hills and valleys, which are originated due to the tectonic process and are highly dissected by the drainage lines. This can be further classified as high, moderate, and low dissection depending on the density of joints and drainage. Mostly this will be interpreted from planimetric satellite data and the classification is highly subjective.

1.7.6 Landforms of denudational origins

The landform of denudational origin is formed where the denudation process dominates over the other process. Most of the landform resulting from this process is the combined effect of mechanical and chemical weathering. Denudation is the process of removal of material by erosion and weathering. This has a direct influence on the relief of the area especially in the reduction of relief to the base level. The agents are mostly water, ice, and wind. The major factors affecting denudation are geology, climate, tectonics, and anthropogenic effects. All rocks and minerals at or near the surface are attacked by the physical and chemical processes. The effect of this process is not the same everywhere because of rocks varying resistance to change. As a result weathering and erosion yield some landforms, which have typical shapes and forms. Weathering is an essential part of the rock cycle. The parent material or rock weathered material is disaggregated to form smaller fragments and some of the minerals are dissolved and removed by the agent of water. This removal of material is erosion and is accomplished by running water, wind, glacier, etc. The weathering provides the raw material for the sedimentary rock and soil (NRSA, 2007).

1.7.6.1. Denudational Hill: It is a highly dissected hill that has obliterated the structures.

1.7.6.2. Inselberg: A prominent, isolated, steep-sided, usually smoothed and rounded, residual knob, hill, or small mountain of circumdenudation rising abruptly form and surrounded by an extensive and nearly level, lowland erosion surface in a hot, dry region (as in the deserts of southern Africa or Arabia), generally bare and rocky although partly buried by the debris derived from and overlapping its slopes; it is

characteristic of an arid or semiarid landscape in a late stage of the erosion cycle.

1.7.6.3. Pediment: A broad, flat, or gently sloping, rock floored erosion surface or plain of low relief, typically developed by sub-aerial agents (including running water) in an arid or semiarid region at the base of an abrupt and receding mountain front or plateau escarpment, and underlain by bedrock (occasionally by older alluvial deposits) that may be bare but more often partly mantled with a and discontinuous veneer of alluvium derived from the upland masses and in transit across the surface.

1.7.6.4. Pediment-Inselberg Complex: The pediments are dotted by numerous inselbergs of small sizes, which makes it difficult to distinguish them from the pediments. Hence it is called a complex of pediment and inselberg.

1.7.6.5. Pediplain: An extensive, multi-concave, rock-cut erosion surface formed by the coalescence of two or more adjacent pediments and occasional desert domes, representing the result (the "peneplain") of the mature stage of the erosion cycle. Based on the thickness of weathering they are further classified as shallow, moderate, and deep pediplains.

1.7.6.6. Residual Hill: A small remnant hill, which has witnessed all forms of denudation.

1.7.7 Structural Features of NTR District

NTR District has consolidated formations which include crystallines (Khondalites, Charnockites, and granitic gneisses) and metasediments (Dolomites, shales, phyllites, and quartzites) of Archaean and Pre-cambrian periods respectively. The Khondalite Group of rocks are seen as prominent hill ranges (strike ridges) south of Vijayawada, extending towards north and northeast.

The rocks of Khondalite, Charnockite groups, and the layered complex show foliation trending dominantly N-S with local swerves to northeast (NE) - southwest (SW) and northwest (NW) - southeast (SE) (GSI, 2000). The semi-consolidated formations are represented by Tertiary formations (Rajahmundry and Gollapalli sandstones) and unconsolidated formations comprise deltaic alluvial deposits of the Quaternary period (CGWB, 2013). Consolidated formations occur in the northern part of the district. Among consolidated formations occurrence of metasediments is restricted to the northwest part of the district i.e., in parts of Jaggayyapeta, Penuganchiprolu, Nandigama, and Chandralapadu mandals. Semi-consolidated formations occur in the northeastern part of the district and

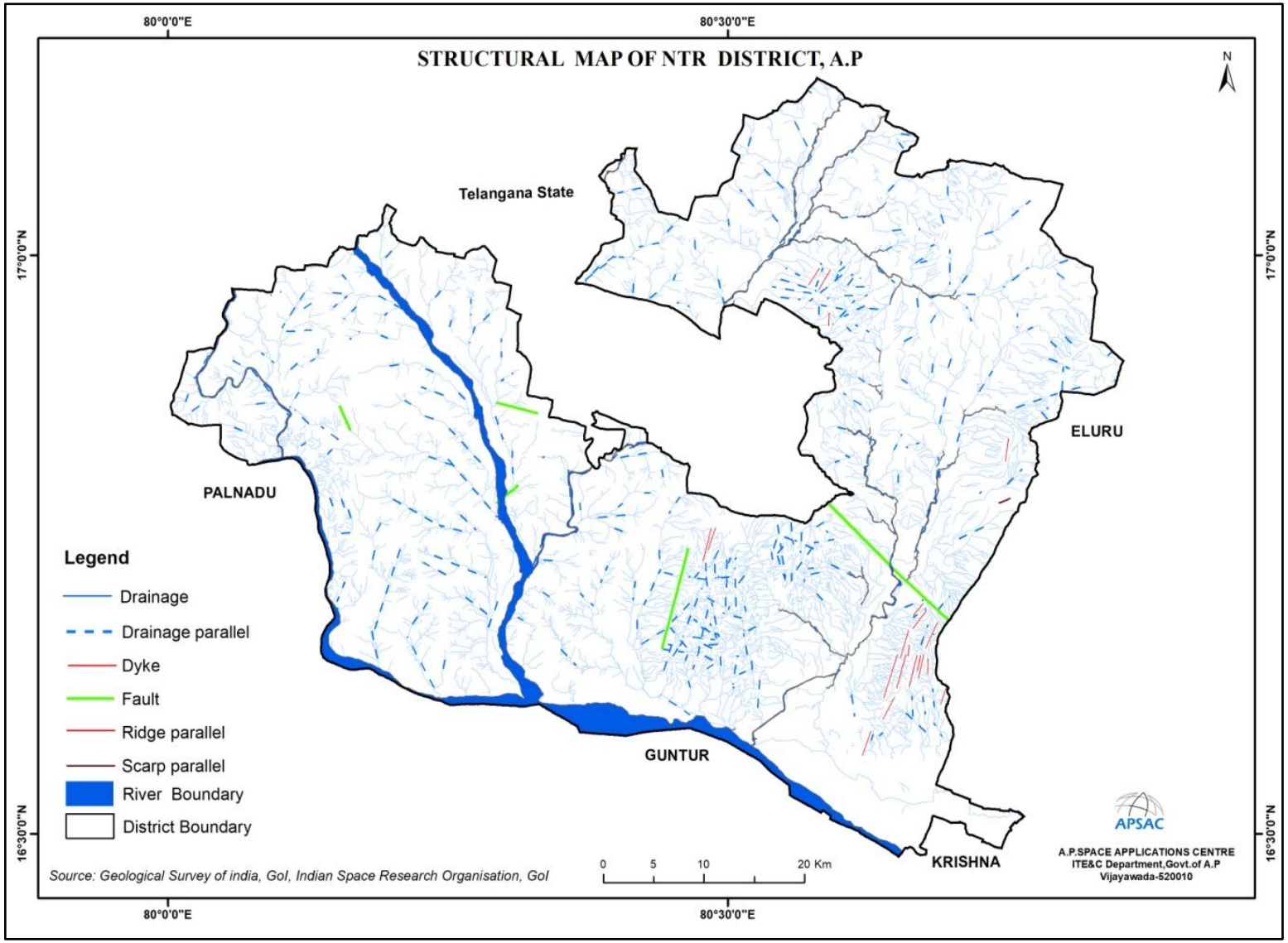


Figure-18: Structural Map of NTR District, Andhra Pradesh

its extension is limited to a small area i.e., in parts of Musunuru, and Nuzividu mandals. These consolidated which are part of the eastern ghat mobile belt are highly disturbed.The semi-consolidated rocks are also disturbed by tectonic activity. Unconsolidated formations occur in the southern part of the district i.e., in the delta area and lineaments cannot be deciphered due to alluvial cover. Prominent lineaments are trending in the northeast (NE) - southwest (SW), northwest (NW) - southeast (SE), and north-northeast (NNE) - south-southwest (SSW) direction in the district (CGWB, 2013). The structural Map of the NTR District is shown in Figure-18.

1.7.8 Ground Water Quality in the NTR District

Groundwater quality laboratory analyzed for physicochemical parameters like Total Dissolved solids, Total Hardness, Chlorides, Nitrate, pH, Fluoride, Iron, Alkalinity, and Sulphate using standard techniques, ground water quality samples were collected for two seasons i.e., post monsoon and pre monsoon in December 2017 to June 2019 from Rural Water Supply and Sanitation Department (RWS and S) and compared with the Bureau of Indian Standards, 2015 Groundwater Quality, in terms of desirable, permissible and non potable classes. Blue, yellow, and red colours indicate the pre monsoon quality, and +,-, symbols indicate the post monsoon quality for desirable, permissible, and non-potable classes respectively. The Ground water quality map of the NTR district is shown in Figure-19.

From the analysis, it has been observed that the ground water is polluted in pre monsoon and post monsoon about 30% of the area is under the nonpotable category due to high concentrations of Total Dissolved solids, Fluoride, and Total Hardness (APSAC, 2017b). Further, about 50% of the area is potable category remaining 20% of the area is covered with hills and water bodies of entire the District The occurrence and movement of groundwater in an area are governed by several factors such as topography, lithology, geological structure, depth of weathering, the extent of factures, drainage pattern, climate conditions and inter relationship between these factors (APSAC, 2017b).

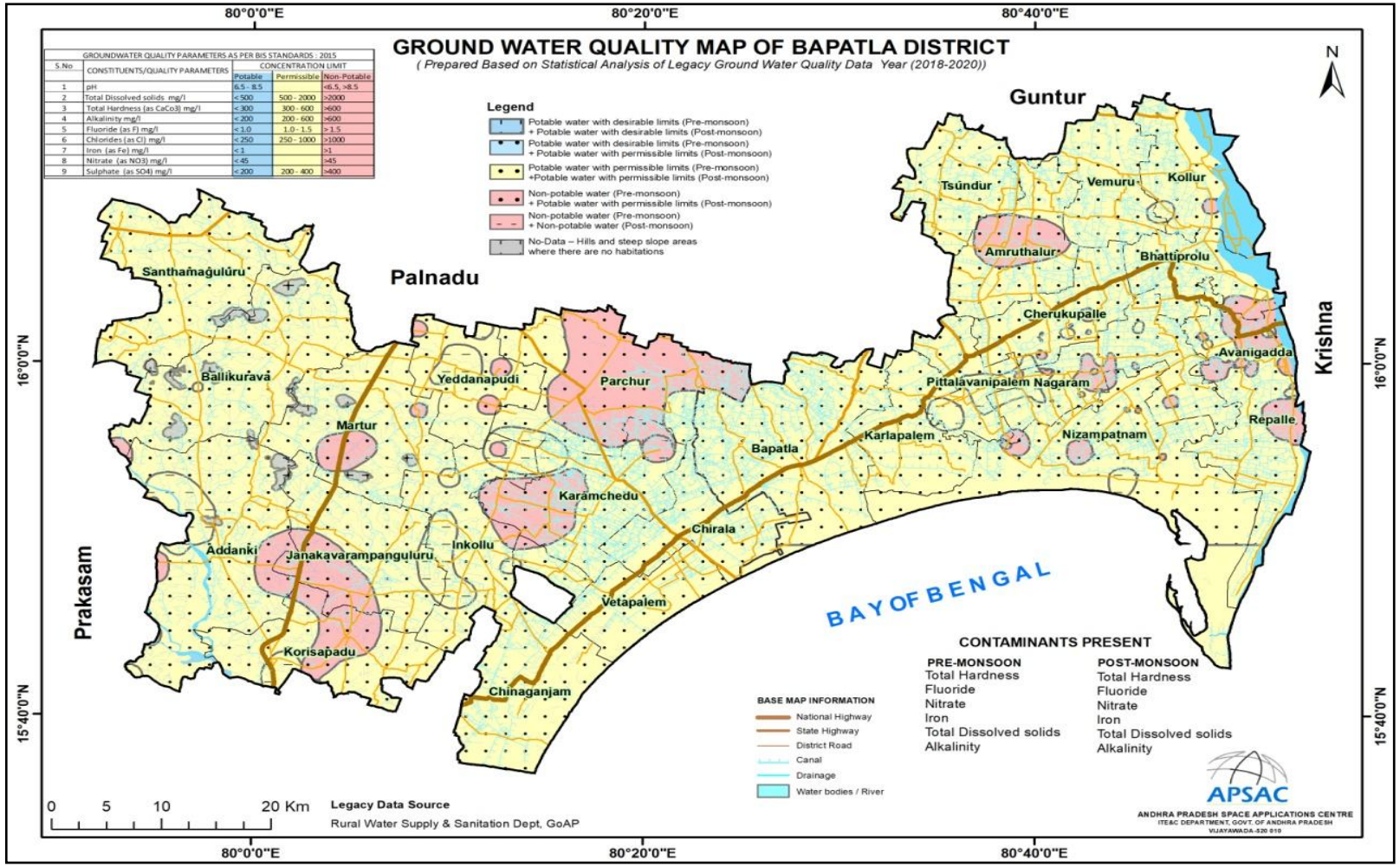


Figure-19: Ground Water Quality Map of NTR District

Chapter – II Minor Minerals

2.1 Overview of Mining Activity

The following leases exist in this NTR office jurisdiction. Mineral Regulatory, the important functioning of this office in these aspects are:-

i. Achievement of Targets of Mineral Revenue collections being fixed to this office annually
ii. Receiving and processing of the Mineral Concession Applications duly conducting the Technical inspection, Survey and demarcation of the Mineral bearing applied areas
iii. Execution and Regulation of the operations of the Mining / Quarry leases in accordance with the Acts and Rules
iv. Issuing of dispatch permits duly collecting the Advance Royalty / Seig.fee from the lease holders on the minerals produced and intend to dispatch from their leased areas through online permit system
v. Controlling the illegal Mining / Quarrying and transportation by conducting the periodical inspections of the Mines and Quarries and also conducting the surprise vehicular checking and imposing the penalties
vi. Finalisation of Demand, Collection and Balance statements of the leases on annual basis

NTR District is one of the chief minor minerals producing districts in the state and endowed with rich and varied minor mineral resources such as black granite, Quartz, Road metal, etc. Other minor minerals like gravel, ordinary earth and feldspar are found and mined in the district.

There are 221 mineral leases in force in NTR district. It is estimated that during the year 2022-23, 1,380 CuM of Black Granite are produced. A total of 71,557CuM of gravel, 13,95,950 Cum of Road metal,67,266 CuM of Ordinary Earth etc are produced in NTR in 2022-23

2.2 Geology of the District

Genaralized Litho-stratigraphic Succession of Andhra Pradesh

Geological Time (a)	Supergroup (b)	Group (c)	Formation (d)
Holocene	-	-	Alluvium, river terraces, beach sands and soils
Pleistocene	-	-	Laterite and Gravel
Mio-Pilocene	-	-	Rajahmundry Fm.
Late Cretaceous	-	-	Deccan Trap with infra-and inter-

Eocene			trappeans	
Lower Cretaceous to Upper Carboniferous	Gondwana	Upper Gondwana	Godavari Valley (Fluviatile) Chikiala Fm. Gangapur Fm.	Coastal Area (Fluvio-marine) Tirupati Fm. (Vejendla Fm) Raghavapuram Fm. (Vemavaram), Kandukuru, Sriperambadur Fms)
		Lower Gondwana	Kota Fm. Maleri Fm.	Gollapalle Fm. (Satyavedu Fm.) Kamthi Fm. Barren Measures, Barakar Fm. Talchir Fm.
			Cuddapah Basin	**Pakhal Basin**
				Sullavai Sandstone
Middle to Upper Proterzoic (980-500 m.y)	Kurnool		Nandyala Shale Koilakuntla Limestone Panyam Quarzite Owk Shale Narji Limestone Banaganapalli Quartzite	Putnur Limestone Penganga Group Takalapalle Arkose

			Srisailam Quartzite	**Alabaka Sandstone**
		Nallamalai	Cumbum Fm.	Lankavaram Shale Pattipalle Quartzite
			Mulug Group	Polavaram Fm. Jakaram Arkose
Middle Proterozoic (1600-1300 m.y.)	Cuddapah	Chitravathi	Bairankonda Quartzite Gandikota Quartzite	Pandikunta Shale
			Tadipatri Fm.	Gunjeda Dolomite
			Pulivendula Quartzite Mallampalli Group	
		Papaghni	Vempalle Fm. Gulcheru Quartzite	Bayyaram Quartzite Bolapalle Fm.
EPARCHAEAN INTERVAL				
Middle Proterozoic to Late Archean (2600-970 m.y)	Eastern Ghats		Charnockite	Charnockite with megacrystic k-feldspar charnockite
			Khondalites	Two pyrozene granulite / amphibolite Calc-silicate / granulite, Garnet-sillimanite-quartz-graphite gneiss (biotite-k-feldspar (Khondalite) Quartzite (gernet, sillimanite)
Late Archaean (2700 m.y)	Dharwar	Ramagiri-Penakacherla, Kolar, Kadiri, Gadwal-Narayanpet, Jonnagiri, Veligallu Peddavuru Schist Belts and W.Part of		Pyroclastic Rocks, local conglomerate / event conglomerate Metabasalt (Pillowed), Acid volcanics, minor andesite, dacite, rhyodacite, amphibolites, metaultramafics, minor quartzite, calcsilicates, phyllites, intrusives of basic

		Nellore Belt.	rocks and granites, rare lamprophyres.
Middle Archaean (3100-2900 y.m)	Older Supracrustals (Sargur)	Eastern and Southern parts of Nellore.	High Grade schists include include garnet, staurolite, kyanite, sillimanite, cordierite (rarely sapphirine-kornuropine as in Karimnagar) Mica schists, calcilicate rocks, crystalline limestone (minor). BIF, fuchsite quartzite, hornblende granulite, amphibolite, migmatite streaky biotite gneiss.
Gneissic Complex			Banded Tonalite-Trondhjemite Gneiss.

Geologically, the State of Andhra Pradesh forms a part of peninsular India and is one of the most ancient land masses. The geological formations of Andhra Pradesh range from the oldest to the recent.

Sargur Supracrustals is the oldest rock in Southern India. They are mostly present as enclaves. They occur as enclaves within the migmatitic gneiss. These supracrustals are exposed in the eastern and southern part of the Nellore schist best. The lithology of Sargur mostly comprises of garnet, staurolite, kayanite schists, BIFs, quartzites, granulites, amphibolites. The gneissic complex comprises of banded tonalite trondhjhemite gneiss which is the basement rock of the study area alongwith migmatitic gneiss and biotite granite gneiss. TTGs are sodic, quartz-bearing granitic (plutonic) rocks with plagioclase as the most common feldspar, and K-feldspar ranging from subordinate to nearly absent. The Dharwarian rocks in Andhra Pradesh are exposed in the western part of the Nellore belt and in many other areas like Ananatapur, Ramagiri-Penakacherla, Kolar, Kadiri, Gadwal-Narayanpet, Jonnagiri, Veligallu Peddavuru Schist Belts and western part of Nellore Belt. The lithology mostly comprises of Metabasalt (Pillowed), Acid volcanics, minor andesite, dacite, rhyodacite, amphibolites, metaultramafics, minor quartzite, calcsilicates, phyllites, intrusives of basic rocks and granites,rare lamprophyres also some Pyroclastic Rocks and local conglomerate / event conglomerate defining hiatus in stratigraphy is observed in the study area. Rocks of middle Proterozoic to late Archaen are exposed in the eastern ghat mobile belt,

they are extremely high grade and fall under granulite metamorphic facies. They mostly include khondalites and charnockites. The metamorphic facies of rocks of eastern ghats goes upto granulite facies. Charnockite with megacrystic k-feldspar, Two pyrozene granulite / amphibolite, Calc-silicate / granulite, Garnet-sillimanite-quartz-graphite gneiss(Biotite-k-feldspar, Quartzite (gernet, sillimanite) and were exposed in most of the state. Cuddapah basin is a part of Dharwar craton and is the second largest purana basin of Peninsular India. It marks the profound unconformity Eparchaen unconformity in early literature. The Cuddapah basin formation exposes rocks of late Proterozoic to upper Proterozoic. The Cuddapah basin is divided into four groups, Nallamalai, Chitravathi, Papaghni and Kurnool. Papaghni comprises of dolomite and limestones, Chitravathi comprises of shale, dolomite and quartzites, Nallamalai comprises of shale, quartzites and arkosic sandstones, Kurnool comprises of shales, quartzites and limestones. The Cuddapah basin is characterised by rhythmic pattern of quartize-shale-carbonates cycle. Uraniferous limestone is also reported from Cuddapah basin. The major exposures of purana rock formations were in Prakasam, Kurnool, Cuddapah, Chittoor, Nellore. The Deccan traps are found in East and West Godavari districts,exposures are near Rajahmundry. Outcrops Tertiary formations are found in East and West Godavari and Visakhapatnam districts and the Quaternary sediments occurring as thick blankets of alluvium are found in the river valleys, deltas and along the East coast.

NTR district is underlain by a variety of geological formations comprising from the oldest Archaeans to Recent Alluvium. Hydrogeologically, these formations are classified as consolidated (Hard), semi-consolidated (Soft), and unconsolidated (Soft) formations. The consolidated formations include crystallines (Khondalites, Charnockites,and Granitic Gneisses) and metasediments (Dolomites, shales, phyllites, and quartzites) of Archaean and Pre-cambrian periods respectively. The semi-consolidated formations are represented by Tertiary formations (Rajahmundry and Gollapalli sandstones) and unconsolidated formations comprise deltaic alluvial deposits of the Quaternary period (CGWB, 2013).

Consolidated formations occur in the northern part of the District. Among consolidated formations occurrence of meta sediments is restricted to the northwest (NW) part of the District i.e., in parts of Jaggayyapeta, Penuganchiprolu, Nandigama, and Chandralapadu Mandals. Semi-consolidated formations occur in the north-eastern part of the District and its extension is limited to a small area i.e., in parts of Musunuru and

Nuzividumandals. Unconsolidated formations occur in the southern part of the District i.e., in the delta area.

The Geological Survey of India (GSI, 2000) gave a detailed account of the geology/lithology of the District with a map on a 1:250,000 scale shown in Figure-19 and an elaborate legend with stratigraphic sequence description is given by GSI as follows. The Eastern Ghats Super Group comprising Khondalite and Chamockite Groups is exposed in the central part of the upland area. They consist of quartz, K-feldspar, garnet, sillimanite, and graphite, with or without corundum. In the north eastern part, many calc granulite and quartzite bands are present, within Khondalite. Acid and intermediate varieties of Charnockite with patches of pyroxene granulite Metagabbro (north of NTR River in the Kondapalli hill ranges) and minor magnetite-hypersthene-quartz granulite extend SW of Kondavidu hill ranges. Layered igneous rocks comprising anorthosite, gabbroic noritic Anorthisite, Leuco gabbro noritic gabbro, and pyroxenite, associated with chromite ore occur as feeble bands within chamockites (GSI, 2000).

The rocks of the Peninsular Gneissic Complex are mostly in the form of migmatized gneisses with enclaves of older metamorphic rocks, such as amphibolite, pyroxene granulite, and actinolite schist. The grey granite gneiss, which is mostly confined to the western part is always well banded, the bands being alternately light and dark in colour. The gneissic rocks are intruded by dykes of dolerite, pegmatite and aplite. The rocks of the Archaean age are overlain by Proterozoic cover sequences of the Cuddapah Super Group and Kumool Group. The contact between the older crystallines and the younger sediments is marked by a pronouncedunconformity known as the Eparchaean Unconformity. The Cuddapah Super Group is represented in the area by the Cumbum Formation (Shale, Phyllite, Dolomite, Limestone,and Quartzite). The Kurnool Group comprises Banganapalle Conglomerate Quartzite and Narji Limestone. Micaceous quartzite of Mulug Group of Pakhal Super Group occurs as discontinuous outcrops east of Nandigama. The Pakhal Super Group is considered to be the timeequivalent of the Cuddapah Super Group.

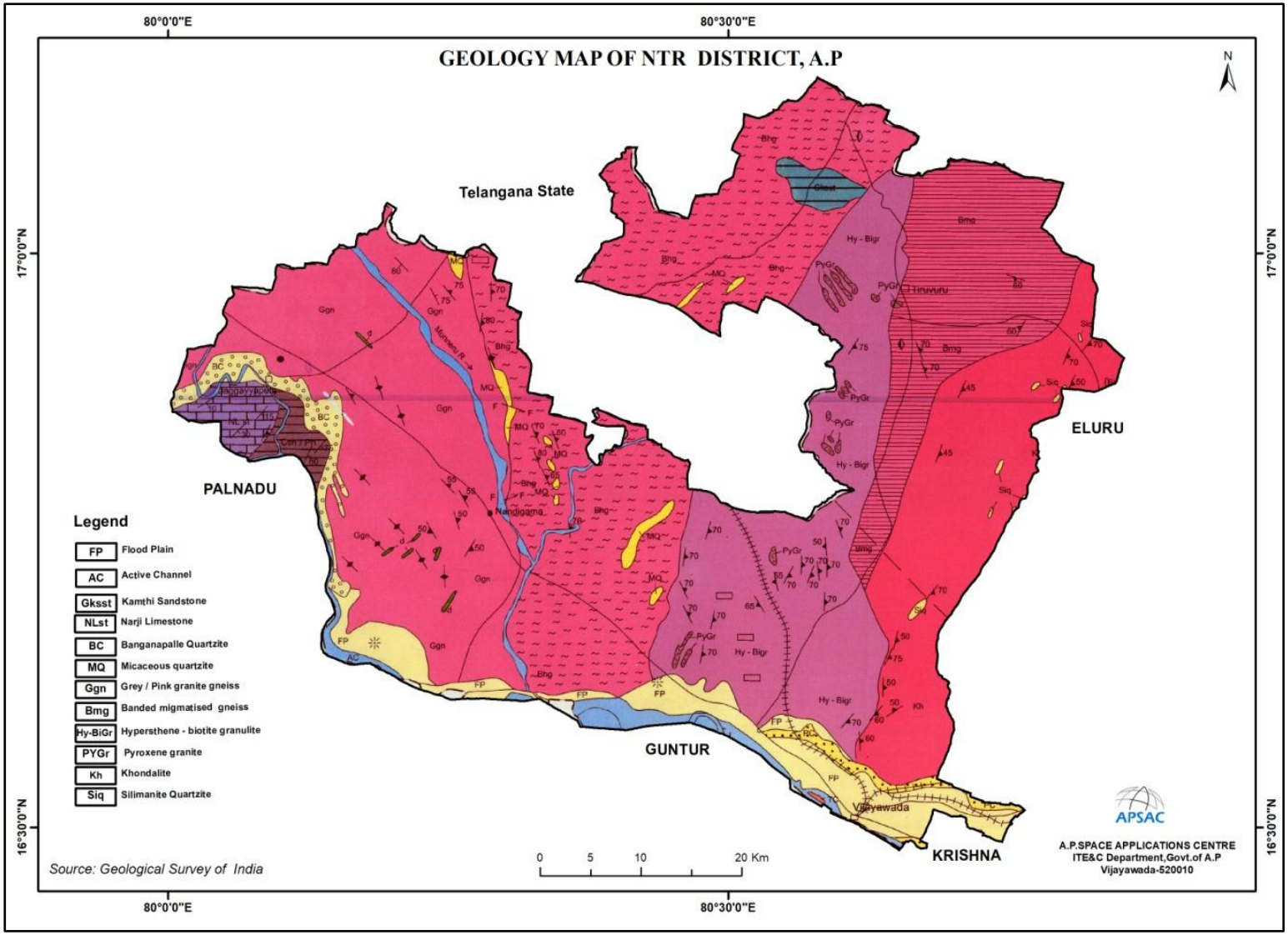
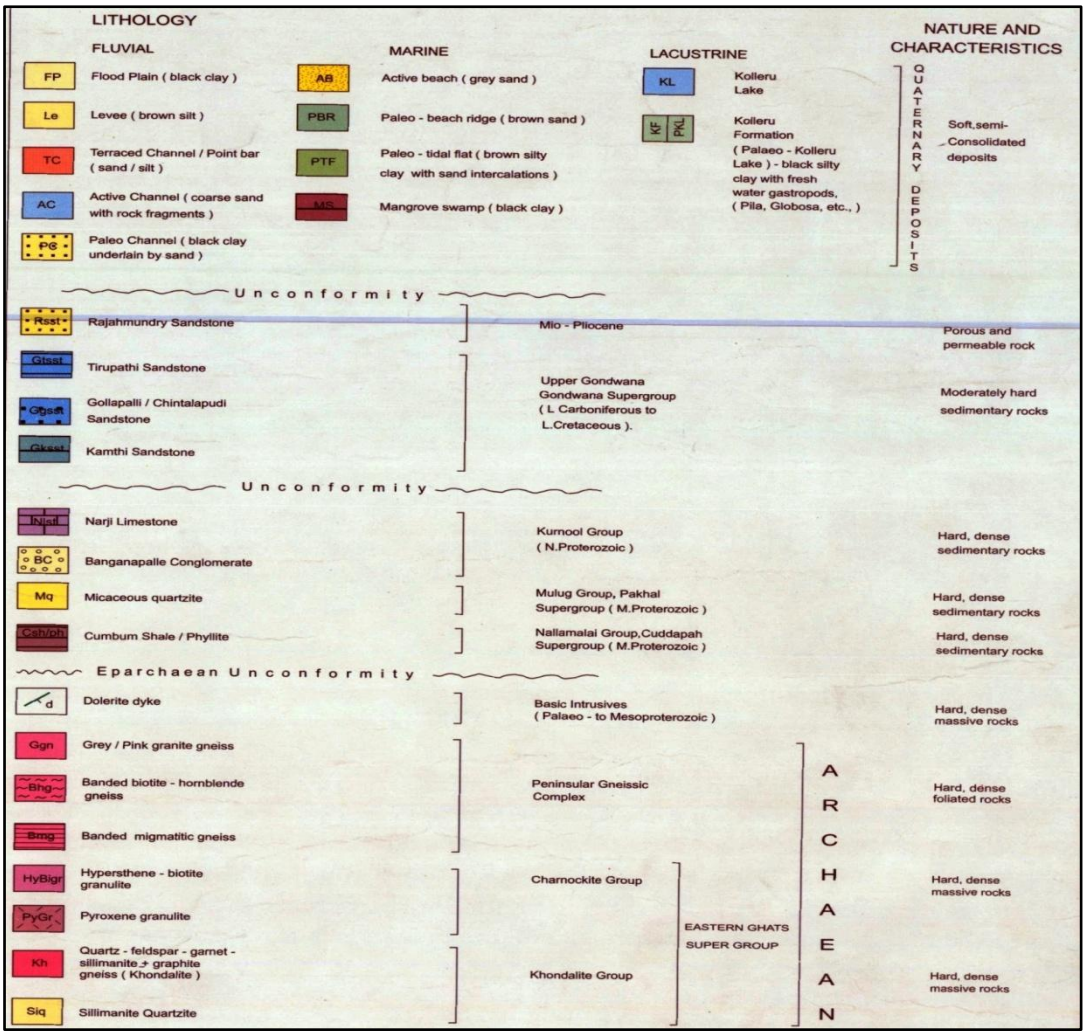


Figure 20: Geology of NTR District, Andhra Pradesh (Source: GSI, 2000)



Detailed Legend with Stratigraphic Sequence of NTR District

2.3 Minor Mineral Resources of NTR District:

As per literature (GSI, 2000) the following minerals are available in the NTR District. *(Data Source: Assistant Director of Mines and Geology, NTR District, Andhra Pradesh)*

2.3.1. Black Granite: Black Graniteisused on facades, floors, and bathrooms and all kinds of funerary art are available in Anumanchipalle, Ramachandrunipeta, Thakkellapadu village in Jaggayyapeta Mandal.

2.3.2. Gravel: The gravelis used for the formation of kacha roads and filling Low-level areas. This mineral is available in Chegireddipadu, Cheruvu Madhavaram, Konduru, Loya villages in G.Konduru Mandal, Vinagadapa village in Gampalagudem Mandal, Jupudi, Kachavaram, Kondapalle villages in Ibrahimpatnam Mandal. Also, the gravel is available in Chillakallu, Ramachandrunipeta, Tirumalagiri villages in Jaggayyapeta Mandal,Vedurubeedem village in Mylavaram Mandal,Bhimavaram village in Vatsavai Mandal,Pathapadu village in Vijayawada Rural Mandal.

2.3.3. Ordinary Earth: Utilized for construction purposes and is available in Loya village in G Konduru Mandal, Chillakallu village in Jaggayyapeta Mandal, and Paritala village in Kanchikacherla Mandal.

2.3.4. Road Metal: The road metal is utilized for construction purposes, also as railway ballast, and is available in Cheruvu Madhavaram, Konduru, Loya villages in G Konduru Mandal. Road metal is also available in Vinagadapa village of Gampalagudem Mandal, Jupudi, Kachavaram, Kondapalle villages in Ibrahimpatnam Mandal, Chillakallu village in Jaggayyapeta Mandal, Paritala village in Kanchikacherla Mandal.

2.3.5. Feldspar: Used in the process of glassmaking, ceramics, and to an extent as a filler and as an extender in the paint, plastics, and rubber industries is available in Anumollanka, Arlapadu, Kanumuru villages in Gampalagudem Mandal, Laxmipuram village inTiruvuru Mandal.

2.3.6. Quartz: The quartz available in the NTR district is used in Paint, Ceramic tiles, and Glass Industries and is available in Anumollanka, Arlapadu, Kanumuru villages in Gampalagudem Mandal, Kudapa village in Reddigudem Mandal, Laxmipuram village in Tiruvuru Mandal.

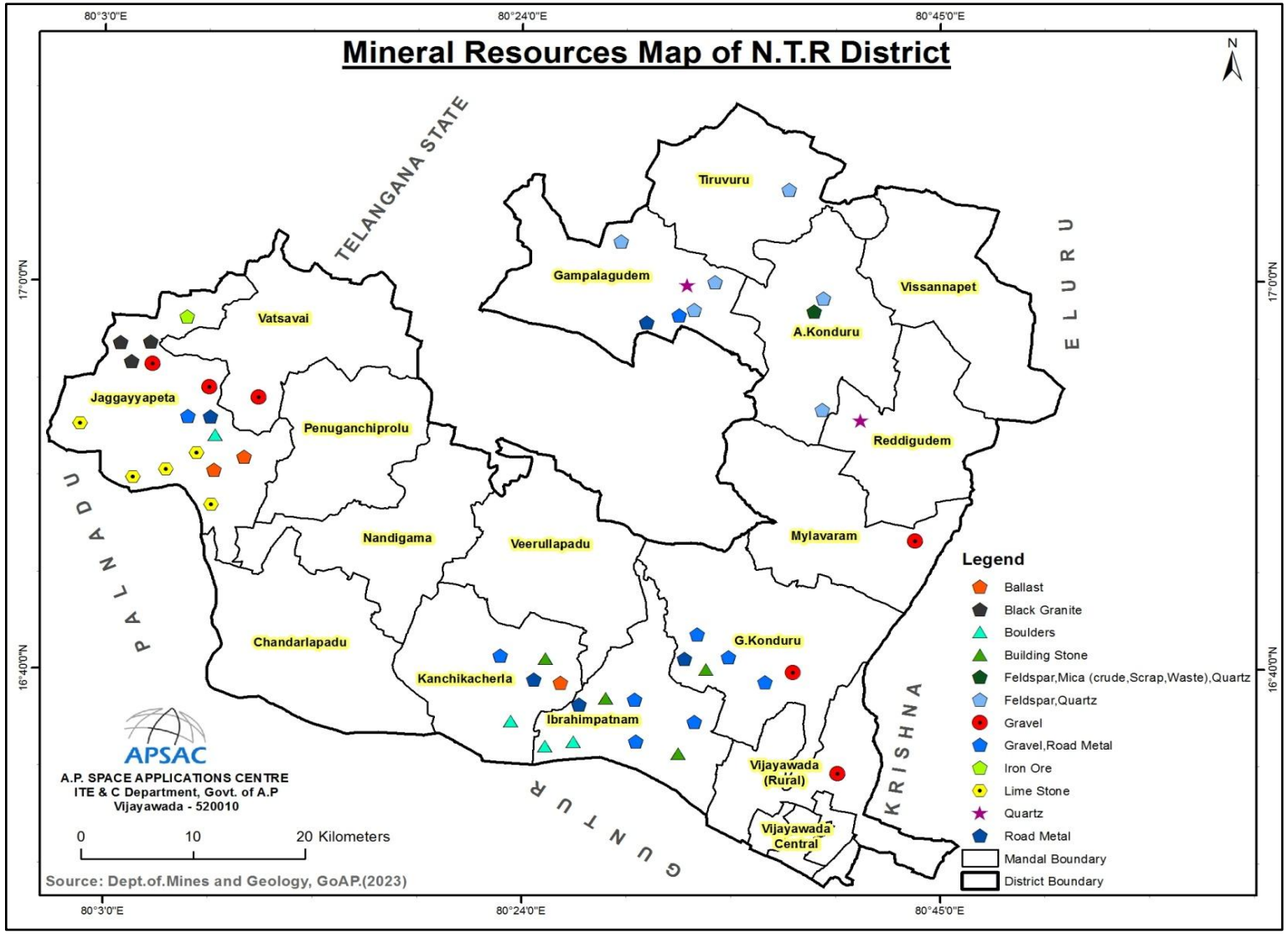


Figure-21: Mineral Resource Map of NTR District

The Detailed List of statement showing the Leases wise for Minor Minerals during the period described in Table-14:

Table 14 Statement showing the List of details Leases wise for Minor Minerals during the Period (Present Status)

S. No	Lessee Name	Mineral	lease Type	Extent	Survey No	Execution Date	Expiry Date	LEASE STATUS	Geo Cordinates1	Geo Cordinates
	M/s. Aparna Enterprises Limited	Feldspar,Quartz	Other Quarry Lease	2.76	161	19/06/2007	18/06/2027	ACTIVE	16-59-28.72641 16-59-30.30003 16-59-31.29115 16-59-31.44828	80-38-17.93264 80-38-20.35063 80-38-18.40866 80-38-14.26320
	Ramisetty Kiran Kumar	Feldspar,Mica,Quartz	Other Quarry Lease	1.725	84/14 and 15	3/3/2022	2/3/2042	ACTIVE	16-57-34.10249 16-57-41.73211 16-57-42.14676 16-57-42.49131	80-38-52.36695 80-37-01.27922 80-36-58.34534 80-36-55.96158
	M/s Lorven Minerals	Feldspar,Quartz	Other Quarry Lease	0.696	13/p	4/2/2022	3/2/2032	ACTIVE	16-55-32.43921 16-55-32.85388 16-55-33.72537 16-55-34.34478	80-37-57.89514 80-37-58.09117 80-37-56.66373 80-37-56.87131
4	Smt V. Lakshmi Tirupathamma	Gravel,Road Metal	Other Quarry Lease	1.347	5	22/03/2018	31/03/2024	ACTIVE	16-42-39.15665	80-33-16.87818
									16-42-40.20261	80-33-14.33994
									16-42-40.78046	80-33-12.12916
									16-42-41.32001	80-33-14.98001
5	Smt Vemulakonda Samrajyam	Gravel,Road Metal	Other Quarry Lease	2.24	7	22/03/2018	21/03/2028	ACTIVE	16-42-30.94938	80-33-20.75795
									16-42-31.11481	80-33-17.24043
									16-42-36.38402	80-33-21.94259
									16-42-37.34640	80-33-17.00571
6	Smt Vemulakonda Samrajyam	Gravel,Road Metal,Rough Stone	Other Quarry Lease	0.457	13	22/03/2018	21/03/2028	ACTIVE	16-42-31.10159	80-33-00.65368
									16-42-32.59054	80-33-02.91342
									16-42-32.69594	80-33-04.05019
									16-42-32.82798	80-33-03.28802

8	Vemulakonda Lakshmi Tirupatamma	Gravel,Road Metal	Other Quarry Lease	2.428	4	16/06/2022	15/06/2032	ACTIVE	16-42-46.03674	80-34-36.06095
									16-42-47.12115	80-34-28.22292
									16-42-49.27820	80-34-27.88888
									16-42-49.87459	80-34-28.06410
9	M/s Sri VENKATA SAI STONE CRUSHER	Gravel,Road Metal	Other Quarry Lease	1.255	55	24/08/2007	31/03/2024	ACTIVE	16-41-26.62550	80-34-14.73675
									16-41-28.61854	80-34-11.80723
									16-41-29.49723	80-34-17.48264
									16-41-31.49015	80-34-14.55311
10	M/s Sri Venkata Sai Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.295	55	15/04/2008	31/03/2024	ACTIVE	16-41-29.46600	80-34-19.61300
									16-41-30.95600	80-34-17.42300
									16-41-31.72100	80-34-20.96300
									16-41-32.46900	80-34-15.19900
11	M/s The Standard Granite Crusher	Building Stone,Gravel,Road Metal	Other Quarry Lease	1	26/2	7/1/2011	6/1/2026	INACTIVE	16-40-22.18617	80-31-53.35812
									16-40-23.75791	80-31-54.70264
									16-40-24.51971	80-31-48.77967
									16-40-26.22024	80-31-49.94333
12	M/s Sri Aditya Crushers Private Limited	Gravel,Road Metal	Other Quarry Lease	3.032	41	10/6/2014	31/03/2024	ACTIVE	16-40-32.80856	80-32-03.25177
									16-40-34.21842	80-31-29.61528
									16-40-37.98584	80-31-58.93343
									16-40-38.33345	80-31-58.30419
13	M/s Bellatrix Infrastructre Pvt Ltd	Road Metal	Other Quarry Lease	0.809	41	24/06/2016	23/06/2026	ACTIVE		
14	M/s Kanaka Durga Metal Works	Road Metal	Other Quarry Lease	1	26/2	18/11/2000	16/11/2030	INACTIVE	16-39-59.47001	80-31-37.18001

									16-40-00.24337	80-31-39.84482
									16-40-00.69001	80-31-43.83001
									16-40-01.39001	80-31-36.97001
15	Sri A.Suresh Babu	Road Metal	Other Quarry Lease	1.012	41	28/02/2006	8/2/2026	ACTIVE	16-40-34.74209	80-32-09.48649
									16-40-35.44305	80-32-07.86009
									16-40-37.13685	80-32-10.92374
									16-40-38.25188	80-32-09.11945
16	M/s Bellatrix Infrastructre Pvt Ltd	Building Stone,Gravel,Road Metal,Rough Stone	Other Quarry Lease	0.202		15/05/2009	14/05/2024	ACTIVE		
17	M/s A.S.N.Granites	Building Stone,Gravel,Road Metal	Other Quarry Lease	3.746	41	28/02/2009	31/03/2024	ACTIVE	16-40-39.62 16-40-40.48 16-40-38.05 16-40-35.59	80-32-09.72 80-32-07.80 80-32-08.77 80-32-07.88
18	M/s Bhagya Rekha Stone Crusher	Road Metal	Other Quarry Lease	5	U.S.B	5/12/2015	17/12/2028	INACTIVE	16-39-10.88288 16-39-11.74892 16-39-24.96251 16-39-25.82373	80-32-10.33152 80-32-06.66090 80-32-14.44142 80-32-08.69164
19	M/s Sri T.Venkateswara Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.214	U.S.B	4/6/2016	3/6/2031	INACTIVE	16-39-58.25321	80-31-57.97472
									16-39-58.46739	80-31-59.25533
									16-40-00.96001	80-32-04.35001
									16-40-01.38548	80-31-59.01071
20	M/s Srinivasa Edifice Pvt Ltd.,	Gravel,Road Metal	Other Quarry Lease	16.814	USB	1/4/2010	27/01/2025	INACTIVE	16-39-48.58528	80-32-09.90665
20									16-39-48.76658	80-31-57.80847
20									16-39-50.52810	80-32-09.70453
20									16-39-55.06396	80-32-09.26123

21	Veerapaneni Prabhakar	Gravel	Other Quarry Lease	0.83	522/(F)P, 522/G,523/B	14/11/2022	13/11/2027	ACTIVE	16-38-40.48951	80-38-09.81351
21									16-38-40.70835	80-38-09.90439
21									16-38-41.03311	80-38-09.26841
21									16-38-41.59852	80-38-09.16111
22	Kolupoti Pramukh	Gravel	Other Quarry Lease	3.2	113/2 and 114/3,4,5,6	16/06/2022	15/06/2027	ACTIVE	16-39-15.06513	80-38-33.15102
22									16-39-15.57500	80-38-27.92130
22									16-39-19.37020	80-38-35.68341
22									16-39-19.39511	80-38-35.47060
23	Brij Gopal P Shah	Feldspar,Quartz	Other Quarry Lease	1.417	265/2P	9/3/2022	8/3/2042	ACTIVE	17-01-29.27880	80-29-34.77402
23									17-01-31.00837	80-29-31.22287
23									17-01-33.33566	80-29-36.28965
23									17-01-33.35579	80-29-36.22530
24	M/s Gayatri Granite Industries	Color Granite	Granite Quarry Lease	2.51	294	1/1/2005	31/12/2024	INACTIVE		
25	M/s G.S.R.Granites	Color Granite	Granite Quarry Lease	2	291	8/9/2006	7/9/2026	INACTIVE		
26	K.Nagul Meera	Quartz	Other Quarry Lease	1.424	53/1	15/04/2008	14/04/2028	INACTIVE		
27	M/s Lorven Minerals	Feldspar,Quartz	Other Quarry Lease	1.178	223/2 and 3(P)	4/2/2022	3/2/2032	ACTIVE	16-58-59.25922	81-33-56.89632
27									16-58-59.37048	81-33-56.50867
27									16-58-59.38853	81-33-57.27776
27									16-58-59.51031	81-33-57.14463
28	V Lakshmi Tirupatamma	Feldspar,Quartz	Other Quarry Lease	4.185	267/1 to 4 and 268/1 to 3	16/06/2022	15/06/2042	ACTIVE	16-57-53.48357	80-35-13.26662

28									16-57-54.04743	80-35-08.19552
28									16-57-54.48261	80-35-11.91813
28									16-57-55.05304	80-35-06.04930
29	M/s Balaji Acqua and Agro Products (P) Ltd	Quartz	Other Quarry Lease	7.46	0	17/08/2015	29/07/2035	ACTIVE		
30	Sree Lakshmi Constructions	Gravel,Road Metal	Other Quarry Lease	4.2	296	18/03/2019	17/03/2034	ACTIVE	16-57-09.28891	80-33-31.46165
30									16-57-09.86573	80-33-31.86165
30									16-57-11.18999	80-33-24.88001
30									16-57-12.13340	80-33-25.44699
31	Sree Lakshmi Constructions	Gravel,Road Metal	Other Quarry Lease	4.45	296	18/03/2019	17/03/2034	ACTIVE	16-57-18.19185	80-33-25.44645
31									16-57-19.83451	80-33-31.31505
31									16-57-20.33199	80-33-22.89935
31									16-57-20.36999	80-33-31.88999
32	M/s Sri Lakshmi Constructions	Gravel,Road Metal	Other Quarry Lease	3	296	10/6/2009	13/10/2033	ACTIVE	16-57-19.29001	80-33-32.59999
32									16-57-20.36999	80-33-31.88999
32									16-57-23.44001	80-33-29.95999
32									16-57-28.01834	80-33-34.83023
33	Sri T Kesava Rao	Road Metal	Other Quarry Lease	1.214	296	8/2/2017	7/2/2027	ACTIVE	16-57-12.13340	80-33-25.44700
33									16-57-13.09000	80-33-21.67000
33									16-57-14.81927	80-33-27.43065
33									16-57-15.72000	80-33-23.68000
34	Sri Bala Krishna Tulasidas	Road Metal	Other Quarry Lease	1	84	10/7/2012	31/03/2024	ACTIVE		
35	M/s Sri Sarath Stone Crusher	Road Metal	Other Quarry Lease	1.416	1	10/7/2013	19/03/2027	ACTIVE	16-38-22.88	80-26-58.19
35									16-38-25.13	80-26-50.08
35									16-38-23.34	80-26-49.95
35									16-38-21.02	80-26-58.09
36	M/s N.V.Subba Rao and Co.,	Road Metal	Other Quarry Lease	1	1/C	15/06/2011	11/7/2026	INACTIVE	16-38-07.4800	80-26-19.11

36									16-38-09.08	80-26-21.09
36									16-38-06.58	80-26-23.67
36									16-38-05.59	80-26-20.19
37	M/s Om Sitarama Stone Crusher	Road Metal	Other Quarry Lease	1	1	14/02/2011	3/9/2029	ACTIVE	16-38-40.37	80-27-03.01
37									16-38-37.94	80-27-03.75
37									16-38-36.40	80-27-00.47
37									16-38-36.74	80-26-57.98
38	M/s Sri Venkateswara Engg and Co.,	Road Metal	Other Quarry Lease	2.354	1	7/12/2012	21/03/2027	INACTIVE		
39	CH.NAGA RAJU	Road Metal	Other Quarry Lease	1.619	1	16/02/2008	15/02/2028	ACTIVE	16-38-36.74	80-26-57.98
39									16-38-36.07	80-27-01.83
39									16-38-31.51	80-27-01.37
39									16-38-32.18	80-26-56.55
40	M/s Musunuru Mallikarjuna Rao and Co.,	Building Stone,Gravel,Road Metal	Other Quarry Lease	1.238	1/D	11/12/2009	28/12/2024	ACTIVE	16-38-09.08	80-26-21.09
40									16-38-06.58	80-26-23.67
40									16-38-11.25	80-26-24.15
40									16-38-08.32	80-26-25.79
41	M/s Nagendra Swamy Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.012	1/B2	26/05/2009	31/03/2024	ACTIVE	16-38-	-
42	M/s Sri Venkateswara Engg and Co.,	Building Stone,Gravel,Road Metal,Rough Stone	Other Quarry Lease	0.421	1	30/01/2009	29/01/2024	INACTIVE	-	-
43	M/s R.P.R. Engineering and Co.,	Building Stone,Gravel,Road Metal	Other Quarry Lease	4.763	1	29/03/2010	31/03/2024	ACTIVE	-	-
44	M/s Musunuru Mallikarjuna Rao and Co.,	Building Stone,Gravel,Road Metal,Rough Stone	Other Quarry Lease	2.728	1	27/01/2010	1/4/2024	ACTIVE	-	-
45	M/s Sri Venkateswara Engg and Co.,	Building Stone,Gravel,Road Metal	Other Quarry Lease	2.068	1	29/03/2010	28/12/2024	INACTIVE	-	-
46	M/s Nimmagadda	Building	Other Quarry	2.428	1	22/05/2010	21/05/2025	ACTIVE	-	-

	Brahmeswara Rao and Co.,	Stone,Gravel,Road Metal,Rough Stone	Lease							
47	M/s Sri Nagendra Swamy Stone Crusher	Road Metal	Other Quarry Lease	0.939	1/C	26/10/2010	15/08/2025	ACTIVE		
48	M/s Jagadamba Granite Metal Works	Road Metal	Other Quarry Lease	2.023	1	9/11/2006	31/03/2024	ACTIVE	16-38-27.97	80-26-51.62
48									16-38-26.13	80-26-58.08
48									16-38-22.88	80-26-58.19
48									16-38-24.68	80-26-51.73
49	Smt T.Lakshmamma	Road Metal	Other Quarry Lease	2.529	1	22/09/2004	31/03/2024	ACTIVE		
50	CH NAGA SANKARA RAO	Road Metal	Other Quarry Lease	0.81	0	2/5/2007	31/03/2024	ACTIVE	16-38-32.09	80-26-58.23
50									16-38-31.67	80-27-00.49
50									16-38-28.73	80-26-57.36
50									16-38-29.35	80-26-55.20
51	Sri Balakrishna Tulasidasan	Boulders,Gravel,Road Metal	Other Quarry Lease	1.618	1	10/12/2018	31/03/2024	ACTIVE	16-38-15.22	80-26-46.94
51									16-38-14.78	80-26-50.31
51									16-38-09.60	80-26-51.40
51									16-38-10.19	80-26-47.96
52	M/s Sri Balaji Stone Crusher	Boulders,Road Metal	Other Quarry Lease	4.679	1	28/02/2020	27/02/2035	ACTIVE	16-38-	
53	M/s Srinivasa Enterprises	Gravel,Road Metal	Other Quarry Lease	3	38/2	14/03/2008	31/03/2024	ACTIVE	16-36-28.93898	80-29-02.08370
53									16-36-29.33852	80-28-57.17945
53									16-36-35.39802	80-29-05.28650
53									16-36-37.10838	80-29-00.65312
54	M/s Srinivasa Stone Crusher and Co.,	Building Stone,Gravel,Road Metal,Rough Stone	Other Quarry Lease	2.226	38/2	26/08/2009	25/08/2024	INACTIVE	16-36-29.28605	80-28-54.47282
54									16-36-29.33852	80-28-57.17945
54									16-36-37.10838	80-29-00.65312
54									16-36-38.03918	80-28-58.13154
55	Sri B.Sai Babu	Gravel,Road Metal	Other Quarry Lease	0.74	38/2	10/6/2014	27/04/2027	ACTIVE	16-36-36.39865	80-29-02.57581

55								16-36-37.10838	80-29-00.65312
55								16-36-39.37943	80-29-05.19231
55								16-36-40.08917	80-29-03.26961
56	M/s Srinivasa Stone Crusher	Gravel,Road Metal	Other Quarry Lease	4	28C	14/05/2009	19/04/2029	ACTIVE	
57	M/s Rasi Granites	Black Granite	Granite Quarry Lease	3.43	73/8	24/09/2005	23/09/2025	ACTIVE	16-57-35.00	80-04-08.04
57									16-57-37.02	80-04-06.50
57									16-57-35.80	80-04-02.90
57									16-57-29.10	80-04-02.60
58	M/s. Raasi Granites	Black Granite	Granite Quarry Lease	2	73/8	22/09/2005	21/09/2025	ACTIVE	16-57-25.54045	80-04-07.77017
58									16-57-26.93265	80-04-08.79861
58									16-57-28.26516	80-04-05.26866
58									16-57-28.89519	80-04-05.30722
59	Sri Nanjala Veeraiah	Black Granite	Granite Quarry Lease	1.8	90/7	21/05/2007	20/05/2027	INACTIVE	-	-
60	M/s. Viraj Granites	Black Granite	Granite Quarry Lease	1.8	90/7	16/08/2007	20/05/2027	INACTIVE	-	-
61	M/s Sri Sai Shankar Granites	Black Granite	Granite Quarry Lease	2.2	41/2	22/08/2012	21/08/2032	ACTIVE	16-57-08.34118	80-05-23.40612
61									16-57-05.85359	80-05-22.38123
61									16-57-04.07883	80-05-18.76932
61									16-57-03.94169	80-05-19.08200
62	M/s Renuka Granites	Black Granite	Granite Quarry Lease	1.934	41	11/2/2014	4/8/2030	ACTIVE	16-57-03.60250	80-05-27.60623
62									16-57-05.20370	80-05-22.31888
62									16-57-06.64825	80-05-28.79465
62									16-57-08.58010	80-05-23.77952
63	Mandi Pratap	Gravel	Other Quarry Lease	1	41/2	21/06/2022	20/06/2027	ACTIVE	16-57-13.30645	80-05-05.42998
63									16-57-14.79039	80-05-02.50729
63									16-57-15.22004	80-05-13.52317
63									16-57-15.36315	80-05-06.59566
64	M/s Sri Sai Shankar	Black Granite	Granite Quarry	1.66	41	1/6/2006	31/05/2026	ACTIVE	16-57-08.34118	80-05-23.40612

	Granites		Lease							
64									16-57-05.85359	80-05-22.38123
64									16-57-04.07883	80-05-1876932
64									16-57-03.94169	80-05-19.08200
65	M/s. Katti-Ma Exports Limited	Black Granite	Granite Quarry Lease	1.5	41	9/2/2004	31/03/2024	ACTIVE	16-57-11.29132	80-05-14.48528
65									16-57-12.38627	80-05-09.66390
65									16-57-14.44486	80-05-15.57877
65									16-57-15.39864	80-05-10.73306
66	M/s. Madhucon Granites Limited	Black Granite	Granite Quarry Lease	3	41	28/05/2004	27/05/2024	ACTIVE	16-57-15.22004	82-05-13.52317
66									16-57-15.39864	82-05-10.73306
66									16-57-15.71882	82-05-14.90487
66									16-57-16.03511	82-05-16.21668
67	M/s Katti-Ma-Exports Pvt Ltd	Black Granite	Granite Quarry Lease	1	41	7/4/2005	6/4/2025	ACTIVE	16-57-10.02978	80-05-13.77416
67									16-57-10.48615	80-05-11.30723
67									16-57-10.99501	80-05-15.91271
67									16-57-11.29132	80-05-14.48528
68	M/s Sri Laxmi Enterprises	Iron Ore	Mining Lease	9.269	214	26/06/2008	25/06/2028	ACTIVE	16-57-25.16334	80-06-01.54723
68									16-57-27.57439	80-05-56.95207
68									16-57-27.98994	80-06-06.66485
68									16-57-30.70358	80-05-57.97831
69	M/s Sesha Sai Ispat Ltd	Iron Ore	Mining Lease	4.86	91,92,93,94 and 101	21/11/2008	20/11/2028	INACTIVE	-	-
70	M/s. Anand Metallics and Power (P) Ltd	Iron Ore	Mining Lease	4.25	37/2, 37/3A	22/11/2007	21/11/2027	INACTIVE	-	-
71	Sri Veda RAja Gopalam	Iron Ore	Mining Lease	4.563	4/P, 334	22/02/2007	28/03/2025	INACTIVE	-	-
72	Sri Godada Rama Mohan	Black Granite	Granite Quarry Lease	0.967	159/2	29/09/2008	28/09/2028	INACTIVE	-	-
73	Sri Malledi Venu Madhav	Black Granite	Granite Quarry Lease	1	68/P	5/9/2008	4/9/2028	INACTIVE	-	-
74	Sri More Vinod	Gravel	Other Quarry	0.849	84/1	8/3/2021	7/3/2026	ACTIVE	16-55-40.01403	80-07-11.39881

	Kumar		Lease							
74									16-55-40.19745	80-07-12.67628
74									16-55-41.00191	80-07-09.72640
74									16-55-43.47791	80-07-10.75134
75	Sri Ponguluri Venkata Ravi	Black Granite	Granite Quarry Lease	1.624	31/3C, 32/1A and 32/2A1	9/10/2019	8/10/2039	ACTIVE	16-56-06.69758	80-04-16.55788
75									16-56-06.75351	80-04-14.83635
75									16-56-07.62763	80-04-15.37231
75									16-56-09.14334	80-04-17.42192
76	Ch.Venkateswara Rao	Black Granite	Granite Quarry Lease	1.95	69/2	9/4/2015	8/4/2035	ACTIVE	16-55-52.33401	80-04-45.80717
76									16-55-52.58154	80-04-45.39984
76									16-55-56.18844	80-04-45.24313
76									16-55-56.20188	80-04-47.30575
77	M/s. Ultratech Cement Limited	Lime Stone	Mining Lease	629.22	376	6/3/2012	5/3/2042	ACTIVE	16-50-37.34754	80-05-20.89735
77									16-50-38.08228	80-05-19.53579
77									16-50-38.49338	80-05-18.77396
77									16-50-38.89943	80-05-18.02149
78	The Ramco Cements Limited	Lime Stone	Mining Lease	160	376P	17/03/2009	16/03/2029	ACTIVE	16-51-17.02937	80-03-47.78550
78									16-51-17.03328	80-03-49.47046
78									16-51-17.10367	80-03-51.15389
78									16-51-17.14228	80-03-52.80094
79	M/s. Rashtriya Inspat Nigam Ltd	Lime Stone	Mining Lease	1295	376etc..	9/8/2000	7/8/2030	ACTIVE	16-50-22.98366	80-05-17.17780
79									16-50-26.06899	80-05-11.71397
79									16-50-27.43379	80-05-19.64077
79									16-50-34.76678	80-05-23.60274

80	M/s Kakatiya Cement Sugar and Industries Ltd	Lime Stone	Mining Lease	121.46	236	20/05/1982	19/05/2032	ACTIVE	16-50-53.43727	80-04-06.19156
80									16-50-53.52893	80-04-07.75567
80									16-50-53.65525	80-04-09.43744
80									16-50-53.78579	80-04-11.18000
81	M/s. Sri Bhavani Stone Crushers	Ballast,Building Stone,Gravel,Road Metal	Other Quarry Lease	3.925	268	22/07/2016	22/02/2026	ACTIVE	16-52-56.64031	80-09-16.16102
81									16-52-55.85741	80-09-16.87471
81									16-52-55.88242	80-09-20.01062
81									16-52-52.22982	80-09-20.8654
82	M/s Sri Bhavani Stone Crusher	Ballast,Boulders,Road Metal	Other Quarry Lease	8.093	132	22/02/2016	21/02/2026	ACTIVE	16-52-47.29812	80-09-18.93377
82									16-52-45.67091	80-09-19.28512
82									16-52-45.63093	80-09-21.70456
82									16-52-47.58309	80-09-21.89326
83	M/s Sri Bhavani Stone Crusher	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	2	132/3	11/9/2015	10/9/2030	ACTIVE	16-52-47.72841	80-09-21.940121
83									16-52-46.93921	80-09-28.83631
83									16-52-40.80152	80-09-25.13102
83									16-52-43.21331	80-09-23.48741
84	M/s Bhavani Stone Crusher	Road Metal	Other Quarry Lease	1	268	2/2/2007	20/11/2025	ACTIVE	16-52-59.18991	80-09-11.17501
84									16-52-59.53632	80-09-12.83191
84									16-52-59.36581	80-09-13.65801
84									16-52-59.66941	80-09-14.25591
85	M/s Sri Bhavani Stone Crusher	Road Metal	Other Quarry Lease	0.76	132/3	31/03/2008	31/03/2024	ACTIVE	16-52-48.39661	80-09-28.99341
85									16-52-48.53952	80-09-30.48321
85									16-52-47.22932	80-09-32.33462
85									16-52-42.72991	80-09-32.42321
86	M/s Sri Bhavani	Road Metal	Other Quarry	0.586	132/8 132	31/03/2008	31/03/2024	ACTIVE	16-52-46.06701	80-09-12.31192

	Stone Crusher		Lease							
86									16-52-45.43351	80-09-12.93631
86									16-52-44.03421	80-09-14.64501
86									16-52-42.96041	80-09-14.88801
87	M/s Sri Bhavani Stone Crusher	Road Metal	Other Quarry Lease	0.607	132/10	31/03/2008	31/03/2024	ACTIVE	16-52-48.09971	80-09-12.25912
87									16-52-46.12621	80-09-15.61261
87									16-52-45.79961	80-09-15.37402
87									16-52-44.03422	80-09-14.64501
88	M/s Sri Bhavani Stone Crusher	Road Metal	Other Quarry Lease	0.234	132/22	1/4/2008	31/03/2024	ACTIVE	16-52-37.49671	80-09-30.60492
88									16-52-35.30371	80-09-30.99141
88									16-52-36.10181	80-09-28.42631
89	M/s Sri Bhavani Stone Crusher	Gravel,Road Metal	Other Quarry Lease	6.952	132/3,	31/03/2008	31/03/2024	ACTIVE	16-52-39.08843	80-09-17.42872
89									16-52-37.51601	80-09-16.96603
89									16-52-39.4944380-09-18.91499	
89									16-52-40.72897	80-09-22.57436
90	The Ramco Cements Limited	Lime Stone	Mining Lease	88.35	65P	21/04/2005	18/12/2024	ACTIVE	16-51-00.78571	80-06-17.68178
90									16-51-01.29170	80-06-19.05712
90									16-51-01.87235	80-06-20.63538
90									16-51-02.40998	80-06-17.77887
91	The Ramco Cements Limited	Lime Stone	Mining Lease	256.54	1/1,1/2,2/1,3/1,19,21,22,26,76	10/12/2006	9/12/2026	ACTIVE	16-51-26.80878	80-07-30.35386
91									16-51-26.89840	80-07-27.52420
91									16-51-27.70103	80-07-26.93255
91									16-51-28.42184	80-07-26.79372
92	M/s Rex Global Ventures Private Limited	Gravel	Other Quarry Lease	4.9	176 and 177	2/1/2023	1/1/2028	ACTIVE	16-51-19.89828	80-07-43.91620
92									16-51-24.81320	80-07-51.45559

92									16-51-28.54569	80-07-45.65780
92									16-51-29.46643	80-07-45.96968
93	THE KCP LIMITED	Lime Stone	Mining Lease	368.35	68/P,69/P, 70,71	21/02/2002	20/02/2032	ACTIVE	16-49-37.55346	80-04-25.08138
93									16-49-38.51344	80-04-20.28784
93									16-49-39.06590	80-04-17.23565
93									16-49-39.61718	80-04-14.28807
94	The Ramco Cements Limited	Lime Stone	Mining Lease	60.72	124P	27/06/2001	26/06/2031	ACTIVE	16-50-11.47590	80-08-39.69661
94									16-50-11.59823	80-07-21.30631
94									16-50-11.73940	80-07-21.79566
94									16-50-11.79015	80-08-38.03902
95	M/s.The Ramco Cements Limited	Lime Stone	Mining Lease	124.33	20,38,39,41 to 46,48 to 51,53/	1/10/1997	30/09/2047	ACTIVE	16-49-30.77626	80-06-53.16381
95									16-49-31.92593	80-06-50.32610
95									16-49-32.31928	80-06-45.54012
95									16-49-32.38931	80-06-46.82966
96	M/s Hemadri Cements Limited	Lime Stone,Ochre	Mining Lease	38.69	221	30/10/2008	31/03/2030	ACTIVE	16-47-55.02550	80-08-18.61240
96									16-47-55.46245	80-08-18.50551
96									16-47-57.04591	80-08-18.11906
96									16-47-57.54522	80-08-16.98867
97	M/s. Hemadri Cements Limited	Lime Stone	Mining Lease	38.445	221	18/01/2010	31/03/2030	ACTIVE	16-48-18.96076	80-08-19.35081
97									16-48-19.72847	80-08-21.30129
97									16-48-20.34390	80-08-22.86492
97									16-48-20.58596	80-08-19.43001
98	M/s. Hemadri Cements Ltd	Lime Stone	Mining Lease	26.71	191	18/01/2010	10/9/2025	ACTIVE	16-49-56.06623	80-08-49.13348
98									16-49-56.71273	80-08-55.99995
98									16-49-53.71199	80-08-45.13734
98									16-49-55.39400	80-08-47.51823

99	M/s. Sri Sai Baba Mining Works	Black Granite	Granite Quarry Lease	1.068	181/3, 181/4,182/1	14/03/2005	13/03/2025	INACTIVE		
100	M/s.Sarada Stone crusher	Road Metal	Other Quarry Lease	1.61	801	29/12/2006	31/03/2024	ACTIVE	16-39-28.59276	80-26-36.92374
100									16-39-30.71088	80-26-36.76539
100									16-39-30.81323	80-26-44.30540
100									16-39-33.08262	80-26-44.10076
101	Sri Ch. Ajad Kumar	Road Metal	Other Quarry Lease	4	801	24/10/2006	31/03/2024	ACTIVE	16-40-15.61001	80-26-49.62031
101									16-40-16.66471	80-26-47.94600
101									16-40-17.81753	80-26-46.11594
101									16-40-22.17567	80-26-54.09120
102	M/s Veeranjaneya Stone Crusher	Road Metal	Other Quarry Lease	2.02	801	25/02/2006	31/03/2024	ACTIVE	16-39-44.54142	80-26-41.66165
102									16-39-44.56096	80-26-49.08889
102									16-39-46.68949	80-26-49.17709
102									16-39-46.71256	80-26-44.42731
103	Sri Pavan Granites	Ballast,Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	1.07	801	2/12/2006	9/8/2036	ACTIVE	16-38-57.16064	80-26-19.73240
103									16-38-57.83215	80-26-21.64331
103									16-39-03.12399	80-26-21.16671
103									16-39-03.30090	80-26-18.97964
104	Sri Ch. Ajad Kumar	Road Metal	Other Quarry Lease	12	801	3/5/2007	31/03/2024	ACTIVE	16-40-02.71800	80-26-46.36800
104									16-40-04.01500	80-26-45.05100
104									16-40-09.81800	80-26-57.22000
10									16-40-11.24100	80-26-50.00000

4										
105	Ch. Ajad Kumar	Road Metal	Other Quarry Lease	1.25	801	20/04/2007	31/03/2024	ACTIVE	16-40-11.35190	80-26-42.55081
105									16-40-12.07083	80-26-38.89631
105									16-40-12.18274	80-26-40.57846
105									16-40-14.26055	80-26-41.03684
106	M/s PVR Chalapathi Metal Industries	Building Stone,Gravel,Road Metal	Other Quarry Lease	1	801	20/12/2007	12/7/2027	INACTIVE	16-40-08.04261	80-26-45.07040
106									16-40-09.07180	80-26-47.58866
106									16-40-11.60985	80-26-43.11545
106									16-40-12.74652	80-26-45.60115
107	M/s Narayana Swamy Stone Crusher	Road Metal	Other Quarry Lease	3	801	12/12/2007	16/11/2031	ACTIVE	16-39-39.24986	80-26-54.76402
107									16-39-44.18373	80-26-49.05161
107									16-39-44.58646	80-26-54.70564
107									16-39-46.68949	80-26-49.17709
108	Murakonda Venkata Prasad	Road Metal	Other Quarry Lease	1.5	801	5/11/2007	4/11/2027	ACTIVE	16-39-32.62789	80-27-05.60459
108									16-39-33.38143	80-27-01.87076
108									16-39-37.18123	80-27-06.14126
108									16-39-37.79515	80-27-02.32147
109	M/s Sri Lakshmi Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	0.809	801	1/11/2007	18/06/2027	INACTIVE	16-39-34.30343	80-26-44.51185
109									16-39-33.29649	80-26-47.57376
109									16-39-30.67192	80-26-47.66324
109									16-39-31.59917	80-26-44.70137

110	M/s Srinivasa Granite Metal Industries	Ballast,Boulders,Building Stone,Road Metal	Other Quarry Lease	2.428	801	23/02/2005	19/08/2034	ACTIVE	16-39-42.36615	80-26-36.02047
110									16-39-44.51324	80-26-33.63961
110									16-39-44.54142	80-26-41.66165
110									16-39-44.55399	80-26-38.24181
111	M/s Veeravalli Concrete (P) Ltd	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	1.5	801	17/11/2008	31/03/2024	ACTIVE	16-39-36.49927	80-26-47.56609
111									16-39-36.88649	80-26-44.89540
111									16-39-40.62036	80-26-52.48384
111									16-39-41.08556	80-26-49.33398
112	M/s Sri Sai GAnesh Stone Crusher	Building Stone,Gravel,Road Metal	Other Quarry Lease	1.668	801	28/03/2008	15/06/2027	ACTIVE	16-39-59.77506	80-26-47.86476
112									16-40-00.99512	80-26-46.67902
112									16-40-06.69810	80-26-53.47763
112									16-40-08.05824	80-26-51.51172
113	M/s.Sri. Anjaneya Swamy stone crusher	Gravel,Road Metal	Other Quarry Lease	1.667	801	28/03/2008	15/06/2027	ACTIVE	16-39-58.77600	80-26-49.20390
113									16-39-59.77506	80-26-47.86476
113									16-40-00.74161	80-26-50.98870
113									16-40-03.49835	80-26-53.85807
114	Smt B. Vimala Reddy	Road Metal	Other Quarry Lease	15	801	18/07/2008	16/07/2028	ACTIVE	16-38-52.72376	80-26-51.99829
114									16-39-27.79154	80-26-36.98363
114									16-39-27.93223	80-26-31.59897
114									16-39-32.66022	80-26-36.61965
115	Sri. B. Trivikramu	Gravel,Road Metal	Other Quarry Lease	2.428	801	14/03/2008	27/12/2026	ACTIVE	16-39-27.79154	80-26-36.98363

115									16-39-27.93223	80-26-31.59897
115									16-39-32.66022	80-26-36.61965
115									16-39-32.84420	80-26-31.30371
116	Sri V. Krishna Brahmam	Building Stone,Gravel,Road Metal	Other Quarry Lease	1	801	23/01/2008	7/1/2028	ACTIVE	16-39-34.67332	80-26-50.94037
116									16-39-34.87217	80-26-47.57077
116									16-39-36.49927	80-26-47.56609
116									16-39-39.91385	80-26-51.64074
117	Sri B. Srinivasa Rao	Road Metal	Other Quarry Lease	2.024	801	13/11/2013	31/03/2024	ACTIVE	16-38-08.04676	80-26-21.40424
117									16-38-09.83551	80-26-18.62647
117									16-38-12.88920	80-26-25.44516
117									16-38-14.92674	80-26-21.92474
118	Sri Kanumuri Siddi Vinayak	Road Metal	Other Quarry Lease	2.428	801	24/12/2013	31/03/2024	ACTIVE	16-38-46.15300	80-26-25.76700
118									16-38-46.32200	80-26-32.16700
118									16-38-46.55500	80-26-30.17000
118									16-38-46.66300	80-26-22.15200
119	Sri Kanakadurga Stone Crusher	Building Stone,Gravel,Road Metal	Other Quarry Lease	1.214	801	19/12/2013	9/3/2028	ACTIVE	16-39-21.09900	80-26-19.19400
119									16-39-22.06900	80-26-13.88800
119									16-39-23.26700	80-26-19.54000
119									16-39-24.63600	80-26-14.33100
120	Sri N.Rama Rao	Road Metal	Other Quarry Lease	1.619	801	4/3/2013	31/03/2024	ACTIVE	16-39-46.68949	80-26-49.17709
120									16-39-46.71256	80-26-44.42731

120									16-39-50.40543	80-26-49.12309
120									16-39-50.43590	80-26-44.39683
121	N. Umameswara Rao	Gravel,Road Metal	Other Quarry Lease	5	801	4/4/2013	31/03/2024	ACTIVE	16-38-21.39340	80-26-37.50117
121									16-38-22.90641	80-26-34.51314
121									16-38-32.18984	80-26-41.81084
121									16-38-33.68253	80-26-35.33078
122	Sri B. Venkata Bhaskara Maruthi Prasad	Road Metal	Other Quarry Lease	1.618	801	19/11/2013	7/12/2023	INACTIVE	16-39-17.05023	80-26-20.14891
122									16-39-17.81536	80-26-15.34264
122									16-39-20.57807	80-26-18.27274
122									16-39-20.93527	80-26-20.55839
123	M/s Sri Vijaya Lakshmi Stone Crusher	Road Metal	Other Quarry Lease	2.809	801	20/05/2013	31/03/2024	ACTIVE	16-38-57.83215	80-26-21.64331
123									16-38-58.05088	80-26-22.27093
123									16-38-59.02804	80-26-23.49012
123									16-39-03.12399	80-26-21.16671
124	Kuchipudi Srinivasa Rao	Building Stone,Gravel,Road Metal	Other Quarry Lease	5	801	4/4/2013	31/03/2024	ACTIVE	16-38-34.28980	80-26-30.20301
124									16-38-34.78192	80-26-30.55829
124									16-38-52.86696	80-26-25.04745
124									16-38-53.51977	80-26-23.81255
125	M/s. Pavan Granite Metal Works	Building Stone,Gravel,Road Metal	Other Quarry Lease	1.214	801	30/10/2013	31/03/2024	ACTIVE	16-38-52.86696	80-26-25.04745
125									16-38-53.51977	80-26-23.81255

125									16-38-55.05389	80-26-25.06545
125									16-38-55.78186	80-26-27.35918
126	Sri A. Satyanarayana	Road Metal	Other Quarry Lease	0.308	801	14/12/2009	13/09/2029	ACTIVE	16-38-32.93046	80-26-19.09197
126									16-38-33.06036	80-26-19.18309
126									16-38-33.71154	80-26-13.14915
126									16-38-33.81807	80-26-13.83962
127	Sri M.Srinivas	Road Metal	Other Quarry Lease	1.214	801	14/05/2009	4/4/2029	ACTIVE	16-38-35.82852	80-26-15.27504
127									16-39-24.24700	80-26-16.38900
127									16-39-25.11300	80-26-17.16200
127									16-39-25.72900	80-26-14.85300
128	M/s Madhavi Metal Crushers	Road Metal	Other Quarry Lease	1.417	801	5/7/2009	4/7/2024	ACTIVE	16-39-24.24700	80-26-16.38900
128									16-39-25.11300	80-26-17.16200
128									16-39-25.72900	80-26-14.85300
128									16-39-26.63800	80-26-15.46800
129	M/s.Robo Silicon	Road Metal	Other Quarry Lease	9.5		12/5/2009	5/11/2027	ACTIVE	16-39-21.46619	80-26-59.39814
129									16-39-22.69624	80-26-48.39373
129									16-39-30.67192	80-26-47.66324
129									16-39-30.83645	80-26-51.95715
130	M/s. Robo Silicon (P) Ltd	Road Metal	Other Quarry Lease	5.382	801	25/07/2009	24/07/2024	ACTIVE	16-39-18.19653	80-27-03.44662
130									16-39-19.86232	80-26-47.05468
130									16-39-21.46619	80-26-59.39814
130									16-39-21.75178	80-27-03.87922

131	Sri B. Srinadh	Road Metal	Other Quarry Lease	8	801	26/02/2009	24/02/2029	ACTIVE	16-38-43.86911	80-27-07.34610
131									16-38-46.50738	80-27-11.37008
131									16-38-58.17883	80-26-56.19414
131									16-39-00.80456	80-27-00.27513
132	M/s Modern Stone Crusher	Road Metal	Other Quarry Lease	2	801	17/06/2009	15/06/2034	ACTIVE	16-39-30.75632	80-27-05.47983
132									16-39-31.28717	80-27-02.14916
132									16-39-31.03485	80-27-15.88254
132									16-39-31.47861	80-27-12.26575
133	Sri. P. Ravi Kumar	Road Metal	Other Quarry Lease	2.08	801	24/11/2009	23/08/2029	ACTIVE	16-39-35.47273	80-27-12.72849
133									16-39-35.88848	80-27-10.05950
133									16-39-41.58091	80-27-10.70514
133									16-39-41.95556	80-27-11.25724
134	M/s. Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	3	801	24/11/2009	2/9/2034	ACTIVE	16-39-30.22528	80-27-08.81047
134									16-39-29.69423	80-27-12.14110
134									16-39-20.06552	80-27-12.73083
134									16-39-20.60958	80-27-09.40021
135	M/s N.V.Subba Rao and co	Road Metal	Other Quarry Lease	2.226	801	17/06/2009	8/7/2024	ACTIVE	16-39-06.52169	80-26-19.74001
135									16-39-07.36116	80-26-16.54885
135									16-39-13.58166	80-26-21.48395
135									16-39-14.16129	80-26-18.20167
136	B. Hema Latha	Gravel,Road Metal	Other Quarry Lease	5	801	26/03/2009	24/03/2029	ACTIVE	16-38-48.62734	80-27-11.23786
136									16-38-49.45467	80-27-12.09826

136									16-38-53.23044	80-27-13.13198
136									16-38-58.74828	80-27-03.35042
137	Sri S.Seetha Ramanjaneyulu	Road Metal	Other Quarry Lease	2	801	25/02/2009	24/02/2029	ACTIVE	16-38-46.50738	80-27-11.37008
137									16-38-47.15301	80-27-12.38680
137									16-39-00.80456	80-27-00.27513
137									16-39-01.46281	80-27-01.23489
138	Sri N. Veeraiah	Building Stone,Gravel,Road Metal	Other Quarry Lease	2.428	801	11/12/2009	9/12/2029	ACTIVE	16-38-18.72000	80-26-34.30000
138									16-38-21.39300	80-26-37.50100
138									16-38-21.91500	80-26-26.38100
138									16-38-22.23000	80-26-30.79000
139	M/s Vengamamba Eng.Co.	Road Metal	Other Quarry Lease	4.354	801	5/3/2009	31/03/2024	ACTIVE	16-38-35.82852	80-26-15.27504
139									16-38-36.92571	80-26-24.40962
139									16-38-39.12404	80-26-27.36926
139									16-38-40.06198	80-26-22.03711
140	Sri K. Srinivasa Rao	Road Metal	Other Quarry Lease	3.023	801	23/03/2010	22/03/2025	ACTIVE	16-38-13.27158	80-26-24.93937
140									16-38-15.00000	80-26-21.50000
140									16-38-16.50000	80-26-18.50000
140									16-38-17.20000	80-26-27.10000
141	M/s.Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	1	801	18/05/2010	1/12/2034	ACTIVE	16-39-36.00650	80-27-09.39552
141									16-39-32.08182	80-27-09.41424
141									16-39-32.48386	80-27-06.11966
14									16-39-41.62105	80-27-10.06849

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142	M/s. Narayana Swamy stone crusher	Gravel,Road Metal	Other Quarry Lease	3	801	5/5/2010	4/5/2025	ACTIVE	16-39-32.08182	80-27-09.41424
142									16-39-32.48386	80-27-06.11966
142									16-39-41.62105	80-27-10.06849
142									16-39-42.21787	80-27-06.70745
143	M/s Sree Associates	Road Metal	Other Quarry Lease	1	801	5/1/2010	1/10/2029	ACTIVE	16-39-54.71509	80-26-56.59237
143									16-39-55.21396	80-26-59.47668
143									16-39-57.96910	80-26-56.55565
143									16-39-58.72808	80-26-59.42031
144	Sri Ch. Ajad Kumar	Gravel,Road Metal	Other Quarry Lease	8	801	14/05/2010	13/05/2025	ACTIVE	16-40-01.06700	80-27-04.68485
144									16-40-07.24735	80-26-54.88404
144									16-40-09.70919	80-26-57.39782
144									16-40-10.56412	80-26-52.13219
145	M/s Sri Pavan Granite Metal Works	Ballast,Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	3.09	801	12/5/2010	11/5/2025	ACTIVE	16-38-54.49485	80-26-17.66542
145									16-38-54.76576	80-26-15.75141
145									16-38-57.16064	80-26-19.73240
145									16-39-03.30090	80-26-18.97964
146	M/s Anjaneya Swami Stone Crusher	Ballast,Boulders,Gravel,Road Metal	Other Quarry Lease	0.202	801	30/03/2010	29/03/2025	ACTIVE	16-40-06.69810	80-26-53.47763
146									16-40-07.70726	80-26-54.33059
146									16-40-08.05824	80-26-51.51172
146									16-40-09.40826	80-26-52.09917
14	Sri Sai Ganesh Stone	Ballast,Boulders,Build	Other Quarry	0.647	801	25/02/2010	24/02/2025	ACTIVE	16-40-01.73172	80-26-47.18301

7	Crusher	ing Stone,Gravel,Road Metal	Lease							
147									16-40-01.89977	80-26-46.97673
147									16-40-06.69810	80-26-53.47763
147									16-40-07.70726	80-26-54.33059
148	Sri V. Sri Hari	Road Metal	Other Quarry Lease	6	801	27/07/2010	6/12/2029	ACTIVE	16-39-13.31717	80-26-59.32563
148									16-39-14.57947	80-26-46.90398
148									16-39-18.59004	80-26-59.57462
148									16-39-19.85234	80-26-47.15288
149	M/s. Raja Laxmi Stone Crusher	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	3.095	801	5/5/2010	4/5/2025	ACTIVE	16-39-21.46619	80-26-59.39814
149									16-39-21.67146	80-27-02.73824
149									16-39-31.28717	80-27-02.14916
149									16-39-31.85867	80-26-58.80008
150	Robo Silicon Pvt Ltd	Road Metal	Other Quarry Lease	0.809	801	13/04/2010	24/11/2027	ACTIVE	16-39-30.83645	80-26-51.95715
150									16-39-31.38730	80-26-47.59772
150									16-39-32.85952	80-26-51.97049
150									16-39-33.29649	80-26-47.57376
151	M/s Sri Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	1.619	801	16/03/2012	19/12/2026	ACTIVE	16-38-28.48533	80-26-23.68699
151									16-38-28.89888	80-26-27.81674
151									16-38-32.58275	80-26-22.63414
151									16-38-33.00554	80-26-26.76290
152	M/s Sri Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	1.619	801	16/03/2012	19/12/2026	ACTIVE	16-38-24.38985	80-26-24.75669

152									16-38-24.79620	80-26-28.88718
152									16-38-28.48533	80-26-23.68699
152									16-38-28.89888	80-26-27.81674
153	M/s Nandini Stone Crushers	Road Metal	Other Quarry Lease	1.618	801	19/05/2012	18/05/2027	ACTIVE	16-38-51.47830	80-26-22.14981
153									16-38-54.03751	80-26-24.23491
153									16-38-54.49485	80-26-17.66542
153									16-38-57.16064	80-26-19.73240
154	M/s Mahewari Stone Crusher	Road Metal	Other Quarry Lease	1.619	801	4/8/2012	24/07/2034	ACTIVE	16-38-38.85309	80-26-28.94176
154									16-38-39.13032	80-26-27.36076
154									16-38-40.06760	80-26-22.03815
154									16-38-41.08819	80-26-30.31910
155	M/s Mahewari Stone Crusher	Road Metal	Other Quarry Lease	2	801	25/01/2012	8/9/2024	ACTIVE	16-38-41.32034	80-26-28.78275
155									16-38-42.09636	80-26-23.64697
155									16-38-42.72529	80-26-20.33335
155									16-38-43.64669	80-26-29.99496
156	M/s.Mahewari Stone Crusher	Road Metal	Other Quarry Lease	0.809	801	22/10/2014	21/10/2024	INACTIVE	16-38-40.06800	80-26-22.03800
156									16-38-40.64600	80-26-18.71500
156									16-38-42.09600	80-26-23.64700
156									16-38-42.72500	80-26-20.33300
157	M/s.Venkata swarna Granites.	Gravel,Road Metal	Other Quarry Lease	3	801	7/6/2012	6/6/2027	ACTIVE	16-40-25.18301	80-26-40.51047
157									16-40-26.19868	80-26-38.24520
157									16-40-30.38790	80-26-40.36711

157									16-40-31.38236	80-26-37.73732
158	M/s Machilipatanam Port Ltd	Gravel,Road Metal	Other Quarry Lease	10	801	2/3/2012	17/07/2028	ACTIVE	16-38-39.94878	80-27-01.95703
158									16-38-43.86911	80-27-07.34610
158									16-38-52.72376	80-26-51.99829
158									16-38-56.72704	80-26-57.32558
159	M/s. Narayana Swamy stone crusher	Road Metal	Other Quarry Lease	3.848	801	10/5/2012	24/06/2025	ACTIVE	16-39-25.99145	80-26-21.86974
159									16-39-27.68370	80-26-30.56453
159									16-39-28.96513	80-26-20.49857
159									16-39-29.93537	80-26-20.60629
160	M/s.Shirdi Sai Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.877	801	7/7/2012	31/03/2024	ACTIVE	16-38-37.49733	80-26-31.92920
160									16-38-38.60887	80-26-28.78934
160									16-38-41.08819	80-26-30.31910
160									16-38-41.32034	80-26-28.78275
161	M/s V. N. Associates	Building Stone,Gravel,Road Metal	Other Quarry Lease	4	801	10/12/2012	31/03/2024	ACTIVE	16-38-50.29762	80-26-29.70241
161									16-38-50.49059	80-26-28.05532
161									16-38-53.23570	80-26-29.55831
161									16-38-54.08285	80-26-32.20963
162	M/s Sri Sarada Stone Crusher	Building Stone,Road Metal	Other Quarry Lease	5	801	27/12/2012	26/12/2027	ACTIVE	16-39-22.94269	80-26-43.43522
162									16-39-24.59251	80-26-47.33548
162									16-39-27.06664	80-26-38.25239
162									16-39-28.44531	80-26-47.57659
16	M/s Padmaja Stone	Road Metal	Other Quarry	1.214	801	7/9/2012	18/05/2027	ACTIVE	16-38-19.96569	80-26-21.34390

3	Crusher		Lease							
163									16-38-21.19029	80-26-19.02505
163									16-38-23.35388	80-26-23.31975
163									16-38-24.90000	80-26-20.60000
164	M/s Narayana Swamy Stone Crusher	Ballast,Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	1	801	4/8/2012	10/10/2027	ACTIVE	16-39-49.64985	80-26-49.82918
164									16-39-50.09105	80-26-53.17398
164									16-39-52.20568	80-26-49.31193
164									16-39-52.64635	80-26-52.65749
165	M/s Sri Sai Srinivasa Stone Crusher	Road Metal	Other Quarry Lease	1.619	801r	11/7/2012	10/7/2027	ACTIVE	16-	
166	M/s Maruthi constructions	Road Metal	Other Quarry Lease	2.426	801	22/12/2003	30/06/2033	ACTIVE	16-38-46.43630	80-26-31.18655
166									16-38-47.22674	80-26-24.48519
166									16-38-49.90595	80-26-33.04535
166									16-38-50.69116	80-26-26.34329
167	M/s Nandini Stone Crushers	Road Metal	Other Quarry Lease	0.708	801	10/10/2003	8/10/2033	ACTIVE	16-38-54.03751	80-26-24.23491
167									16-38-55.05389	80-26-25.06545
167									16-38-57.16064	80-26-19.73240
167									16-38-58.05088	80-26-22.27093
168	M/s Sree Padmaja Stone Crushers	Road Metal	Other Quarry Lease	1.821	801	20/09/2004	18/09/2029	ACTIVE	16-38-17.63921	80-26-26.22661
168									16-38-19.96569	80-26-21.34390
168									16-38-20.68972	80-26-28.29759
168									16-38-23.35388	80-26-23.31975
16	M/s Maruthi	Boulders,Gravel,Road	Other Quarry	1.214	801	3/3/2004	1/2/2026	ACTIVE	16-39-16.49787	80-26-23.60607

9	constructions	Metal	Lease							
169									16-39-17.05023	80-26-20.14891
169									16-39-20.38771	80-26-23.96318
169									16-39-20.93527	80-26-20.55839
170	M/s Nandini Stone Crushers	Road Metal	Other Quarry Lease	1	801	27/11/2004	24/07/2034	ACTIVE	16-39-39.43976	80-26-43.92461
170									16-39-40.58683	80-26-41.62447
170									16-39-42.62574	80-26-47.78458
170									16-39-43.73959	80-26-45.26511
171	M/s N.V.Subba Rao and co	Road Metal	Other Quarry Lease	1.934	801	16/10/2004	14/10/2034	ACTIVE	16-39-06.23793	80-26-21.99064
171									16-39-06.52169	80-26-19.74001
171									16-39-10.74948	80-26-26.25479
171									16-39-11.30633	80-26-23.22739
172	M/s Virtue Industries	Gravel,Road Metal	Other Quarry Lease	0.934	801	16/03/2023	15/03/2038	ACTIVE	16-40-01.89977	80-26-46.97673
172									16-40-02.53351	80-26-46.49251
172									16-40-06.22746	80-26-56.39390
172									16-40-07.36273	80-26-55.78369
173	M/s Nandini Stone Crushers	Road Metal	Other Quarry Lease	0.809	801	21/09/1999	20/09/2024	ACTIVE	16-38-54.03751	80-26-24.23491
173									16-38-55.05389	80-26-25.06545
173									16-38-57.16064	80-26-19.73240
173									16-38-58.05088	80-26-22.27093
174	M/s PVR Chalapathi Metal Industries	Road Metal	Other Quarry Lease	1.619	801	14/05/2015	2/5/2027	ACTIVE	16-40-24.13743	80-26-47.18872
174									16-40-25.13998	80-26-45.45046
17									16-40-31.56371	80-26-51.84956

4										
174									16-40-32.59585	80-26-50.07903
175	M/s PVR Chalapathi Metal Industries	Building Stone,Gravel,Road Metal	Other Quarry Lease	1.214	801	14/05/2015	10/10/2028	ACTIVE	16-40-05.68342	80-26-42.16608
175									16-40-08.77340	80-26-44.64670
175									16-40-08.77340	80-26-44.64670
175									16-40-09.59942	80-26-41.40847
176	M/s P.V.R. Chalapathi Metal Industries	Gravel,Road Metal	Other Quarry Lease	0.979	801	5/10/2015	27/04/2025	INACTIVE	16-40-10.00686	80-26-47.08292
176									16-40-11.24072	80-26-49.99984
176									16-40-12.74652	80-26-45.60115
176									16-40-12.94193	80-26-45.49944
177	M/s. Pavan Granite Metal Works	Road Metal	Other Quarry Lease	2	801	4/12/2015	3/12/2027	ACTIVE	16-39-36.88649	80-26-44.89540
177									16-39-37.38925	80-26-42.18733
177									16-39-39.43976	80-26-43.92461
177									16-39-41.08556	80-26-49.33398
178	M/s Sri Gopal Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.91	810	25/02/2020	24/02/2030	ACTIVE	16-39-02.96900	80-26-59.84300
178									16-39-03.05100	80-27-02.86900
178									16-39-10.49300	80-27-03.27700
178									16-39-11.44100	80-27-00.98800
179	M/s Sri Gopal Stone Crusher	Gravel,Road Metal	Other Quarry Lease	1.8	801	25/02/2020	24/02/2030	ACTIVE	16-39-02.83700	80-26-57.59200
179									16-39-02.96900	80-26-59.84300
17									16-39-11.14400	80-27-00.98800

9										
179									16-39-11.78900	80-26-58.72100
180	M/s Modern Crushers	Gravel,Road Metal	Other Quarry Lease	0.81	801	17/03/2022	16/03/2037	ACTIVE	16-39-02.78394	80-26-24.09174
180									16-39-03.12399	80-26-21.16671
180									16-39-05.92514	80-26-24.59491
180									16-39-06.23793	80-26-21.99064
181	M/s Sri Gopal Rocks and Minerals	Gravel,Road Metal	Other Quarry Lease	3	801	13/04/2022	14/04/2032	ACTIVE	16-38-52.59425	80-27-13.62782
181									16-38-56.68641	80-27-14.74063
181									16-39-03.06181	80-27-05.74585
181									16-39-04.80312	80-27-06.70624
182	Katragadda Srinivasa Chakravarthy	Gravel,Road Metal	Other Quarry Lease	8.36	801	11/5/2022	10/5/2032	ACTIVE	16-38-49.97801	80-26-32.43033
182									16-38-50.29762	80-26-29.70241
182									16-38-54.08285	80-26-32.20963
182									16-38-55.57728	80-26-36.04215
183	M/s SRK Stone Crusher	Gravel,Road Metal	Other Quarry Lease	3.8	801	13/04/2022	12/4/2037	ACTIVE	16-40-26.36862	80-26-40.47331
183									16-40-26.80634	80-26-45.87262
183									16-40-32.81813	80-26-49.55362
183									16-40-35.55821	80-26-45.21740
184	M/s Sree Associates	Gravel,Road Metal	Other Quarry Lease	0.969	801	18/08/2022	17/08/2037	ACTIVE	16-39-54.14723	80-26-53.30932
184									16-39-54.71509	80-26-56.59237
184									16-39-57.40143	80-26-53.29999
184									16-39-57.96910	80-26-56.55565
18	M/s Sri Gopal Stone	Boulders,Gravel,Road	Other Quarry	1.13	801	3/8/2022	2/8/2032	ACTIVE	16-39-02.98222	80-27-02.90490

5	Crushers	Metal	Lease							
185									16-39-03.17050	80-27-05.71646
185									16-39-04.71408	80-27-06.62836
185									16-39-05.58136	80-27-04.51208
186	Sri Vallabhaneni Venkateswara Rao	Boulders,Gravel,Road Metal	Other Quarry Lease	9	801	30/11/2022	29/11/2032	ACTIVE	16-38-49.34000	80-26-36.32300
186									16-38-49.97800	80-26-32.43000
186									16-38-55.57700	80-26-36.04200
186									16-38-56.27800	80-26-40.01600
187	Sri Murakonda Venkata Prasad	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	2.96	801	10/2/2023	9/2/2033	ACTIVE	16-39-37.18123	80-27-06.14126
187									16-39-37.79515	80-27-02.32147
187									16-39-45.70901	80-27-07.11005
187									16-39-46.02764	80-27-03.26212
188	Sri Kanaka Durga Stone Crusher	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	3	801	10/4/2015	2/3/2030	ACTIVE	16-39-39.43976	80-26-43.92461
188									16-39-40.58683	80-26-41.62447
188									16-39-42.62574	80-26-47.78458
188									16-39-43.73959	80-26-45.26511
189	M/s P.V.R.Chalapathi Metal Industries	Gravel,Road Metal	Other Quarry Lease	0.505	801	25/04/2015	24/04/2025	INACTIVE	16-40-04.93630	80-26-45.47326
189									16-40-08.04261	80-26-45.07040
189									16-40-09.07180	80-26-47.58866
189									16-40-09.32408	80-26-48.68717
190	M/s Vaishnavi Metal and Rocks Sand Enterprises	Boulders,Building Stone,Gravel,Road Metal	Other Quarry Lease	2.5	801	6/11/2007	5/11/2027	ACTIVE	16-39-57.04647	80-26-51.65594

190									16-39-58.34855	80-26-54.74995
190									16-39-58.77599	80-26-49.20389
190									16-40-00.74161	80-26-50.98870
191	M/s V. N. Associates	Road Metal	Other Quarry Lease	8.498	801	24/03/2014	19/01/2024	INACTIVE	16-38-49.97801	80-26-32.43033
191									16-38-50.29762	80-26-29.70241
191									16-38-54.08285	80-26-32.20963
191									16-38-55.57728	80-26-36.04215
192	Smt K.Radha Rani	Road Metal	Other Quarry Lease	1.214	801	23/01/2014	31/03/2024	ACTIVE	16-39-22.61364N	80-26-21.94259E
192									16-39-24.12265N	80-26-16.28541E
192									16-39-25.11313N	80-26-17.16174E
192									16-39-27.05885N	80-26-21.37756E
193	M/s Veeravali Concrete Pvt Ltd	Gravel,Road Metal	Other Quarry Lease	1.214	801	19/06/2014	18/06/2029	ACTIVE	16-39-32.93418	80-26-50.39.754
193									16-39-38.29.015	80-26-51.30576
194	M/s Pavan Granite Metal works	Gravel,Road Metal	Other Quarry Lease	6	801	14/07/2014	4/1/2025	ACTIVE	16-39-44.98041	80-26-54.20695
194									16-39-45.88354	80-27-02.11234
194									16-39-50.09105	80-26-53.17398
194									16-39-50.69235	80-26-56.48637
195	S.R.K. Stone Crusher	Road Metal	Other Quarry Lease	0.809	801	24/04/2014	13/05/2027	ACTIVE	16-40-24.50702	80-26-40.73719
195									16-40-24.87852	80-26-44.80408
195									16-40-26.39924	80-26-41.86114
195									16-40-26.78789	80-26-45.88529
196	M/s Modern Crusher	Boulders,Building Stone,Gravel,Road	Other Quarry Lease	1.44	801	19/11/2014	11/5/2025	ACTIVE	16-39-03.30090	80-26-18.97964

		Metal								
196									16-39-03.83580	80-26-15.09933
196									16-39-06.52169	80-26-19.74001
196									16-39-07.74084	80-26-15.10550
197	M/s Veeravali Concrete (P) Ltd	Gravel,Road Metal	Other Quarry Lease	1.214	801	19/06/2014	18/06/2029	ACTIVE	16-39-34.59453	80-26-55.66731
197									16-39-35.13725	80-26-51.00237
197									16-39-37.48853	80-26-55.97462
197									16-39-38.11835	80-26-51.40078
198	M/s Pavan Granite Metal Works	Gravel,Road Metal	Other Quarry Lease	0.809	801	14/07/2014	3/10/2026	ACTIVE	16-39-50.09105	80-26-53.17398
198									16-39-50.69235	80-26-56.48637
198									16-39-52.64635	80-26-52.65749
198									16-39-53.24754	80-26-55.97516
199	M/s Venkateswara Stone Crusher	Road Metal	Other Quarry Lease	2.023	801	27/10/2014	4/2/2035	ACTIVE	16-39-58.34855	80-26-54.74994
199									16-39-58.78888	80-26-55.72809
199									16-40-00.71155	80-26-58.02378
199									16-40-00.74161	80-26-50.98871
200	M/s. Venkateswara Stone Crusher	Road Metal	Other Quarry Lease	1	801	27/10/2014	16/07/2028	ACTIVE	16-39-57.04647	80-26-51.65594
200									16-39-58.34855	80-26-54.74995
200									16-39-58.77599	80-26-49.20389
200									16-40-00.74161	80-26-50.98870
201	B. Trivikram	Road Metal	Other Quarry Lease	2.361	801	23/03/2010	27/03/2025	ACTIVE	16-39-25.69675	80-26-31.72990
201									16-39-32.20606	80-26-27.91207
20									16-39-32.80950	80-26-32.30636

1										
201									16-39-32.84420	80-26-31.30371
202	Sri Yepuri Venkata Subba Rao	Gravel	Other Quarry Lease	0.813	113/8 and 113/9	18/02/2022	17/02/2027	ACTIVE	16-46-46.39173	81-44-14.95227
202									16-46-46.83372	81-44-08.98514
202									16-46-47.57832	81-44-12.28678
202									16-46-47.57832	81-44-12.28679
203	M/s Universal Minerals	Quartz	Other Quarry Lease	1.012	47/1B, 48/8,9	9/6/2004	8/6/2024	ACTIVE	16-54-15.53	80-40-25.86
203									16-54-15.61	80-40-23.51
203									16-54-16.78	80-40-23.68
203									16-54-20.15	80-40-21.87
204	M/s Amethyst Mines	Feldspar,Mica,Quartz	Other Quarry Lease	2.205	########	10/2/2023	9/2/2043	ACTIVE	16-52-20.85587	80-39-53.15579
204									16-52-21.02964	80-39-52.31825
204									16-52-21.50831	80-39-51.96458
204									16-52-21.89738	80-39-47.56291
205	A.Sudhakar Reddy	Quartz	Other Quarry Lease	4.01	587,588	29/03/2005	28/03/2025	INACTIVE	-	-
206	T.Ravi Kumar	Quartz	Other Quarry Lease	0.441	447	4/11/2003	3/11/2023	INACTIVE	-	-
207	Akshaya Constructions	Feldspar,Quartz	Other Quarry Lease	2.818	88/1A(p)	31/12/2019	30/12/2039	ACTIVE	-	-
208	Ms Balaji Acqua Agro Products Pvt Ltd	Feldspar,Quartz	Other Quarry Lease	1.275	89/2A, 2B(P), 2C, 2D and 3	25/11/2017	24/11/2037	ACTIVE	17-05-04.39	80-39-10.04
208									17-05-03.35	80-39-11.83
208									17-05-03.27	80-39-11.83
208									17-05-01.83	80-39-11.56

209	M/s R.S.P. Granites	Black Granite	Granite Quarry Lease	2	104	8/2/2013	1/7/2028	INACTIVE		
210	Sri Mrella Sura Reddy	Gravel	Other Quarry Lease	3.824	2771	18/01/2021	17/01/2026	ACTIVE	16-52-42.18240	80-09-41.78880
210									16-52-44.01721	80-09-44.98262
210									16-52-44.52240	80-09-39.49200
210									16-52-45.94598	80-09-42.68902
211	Smt P. Kavitha	Color Granite	Granite Quarry Lease	1	71/2	21/05/2004	20/05/2024	INACTIVE	-	-
212	Smt B. Sri Lakshmi	Black Granite	Granite Quarry Lease	9	164	26/09/2007	25/09/2027	INACTIVE	-	-
213	MEIL Vijayawada Bypass Roadways	Ordinary Earth	For Temporary Permit	0.59	210	15/09/2023	13/11/2023	ACTIVE	-	-
214	Devagiri Omkar Reddy	Gravel	Other Quarry Lease	1.519	38/2C, 2D and 2E	25/04/2023	24/04/2028	ACTIVE	16-36-43.87187	80-39-26.34609
214									16-36-43.94134	80-39-26.08108
214									16-36-46.32523	80-39-26.42381
214									16-36-48.76022	80-39-26.66771
215	Gopu Seshu Vani	Gravel	Other Quarry Lease	0.405	211/3A(P)	6/1/2020	5/1/2025	ACTIVE	16-35-16.039	80-38-41.77414
215									16-35-15.46944	80-38-44.29385
215									16-35-14-74990	80-38-44.33930
215									16-35-15.03351	80-38-42.76610
216	Devagiri Sankar Reddy	Gravel	Other Quarry Lease	1.08	38/2F, 38/3	22/10/2020	21/10/2025	ACTIVE	16-36-42.81071	80-39-25.93872
216									16-36-43.27639	80-39-29.01163
216									16-36-43.32755	80-39-27.41260
216									16-36-43.45640	80-39-27.85881
217	Sri Savaram Koteswara Rao	Gravel	Other Quarry Lease	0.517	1-Feb	30/05/2022	29/05/2027	ACTIVE	16-36-47.05773	80-39-01.86373
217									16-36-47.56329	80-38-59.52490

217									16-36-49.70468	80-39-02.29718
217									16-36-50.24762	80-39-00.70601
218	V.Nageswara Rao	Quartz	Other Quarry Lease	3.99	517, 518	12/6/2008	11/6/2028	INACTIVE	-	-
219	B.Pedda Venkata Rao	Quartz	Other Quarry Lease	2.225	514/1	9/4/2008	8/4/2028	INACTIVE	-	-

Data Source: District of Mines and Geology, NTR District, Andhra Pradesh

The Details of statement showing the letter of intent (LoI) in the district is showing in Table-15:

Table 15: The list of the letter of intent (LoI) in the District

Geo Coordinates of the LOI issued areas pertains to O/o DMGO, Vijayawada, NTR District								
Sl.No	Name of the Lesee	Mineral	Sy. No	Village	Mandal	Extent in Hects	Latitude	Longitude
1	M/s V. N. Associates	Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	4	16-38-50.29762 16-38-50.49059 16-38-53.23570 16-38-54.08285	80-26-29.70241 80-26-28.05532 80-26-29.55831 80-26-32.20963
2	M/s Nandini Stone Crushers	Road Metal	801	Paritala	Kanchikacherla	1	16-39-39.43976 16-39-40.58683 16-39-42.62574 16-39-43.73959	80-26-43.92461 80-26-41.62447 80-26-47.78458 80-26-45.26511
3	M/s Nandini Stone Crushers	Road Metal	801	Paritala	Kanchikacherla	0.708	16-38-54.03751 16-38-55.05389 16-38-57.16064 16-38-58.05088	80-26-24.23491 80-26-25.06545 80-26-19.73240 80-26-22.27093
4	Kuchipudi Srinivasa Rao	Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	5	16-38-34.28980 16-38-34.78192 16-38-52.86696 16-38-53.51977	80-26-30.20301 80-26-30.55829 80-26-25.04745 80-26-23.81255
5	M/s Sri Vijaya Lakshmi Stone Crusher	Road Metal	801	Paritala	Kanchikacherla	2.809	16-38-57.83215 16-38-58.05088 16-38-59.02804 16-39-03.12399	80-26-21.64331 80-26-22.27093 80-26-23.49012 80-26-21.16671
6	M/s.Sarada Stone crusher	Road Metal	801	Paritala	Kanchikacherla	1.61	16-39-28.59276 16-39-30.71088 16-39-30.81323 16-39-33.08262	80-26-36.92374 80-26-36.76539 80-26-44.30540 80-26-44.10076
7	M/s. Pavan Granite Metal Works	Road Metal	801	Paritala	Kanchikacherla	2	16-39-36.88649 16-39-37.38925 16-39-39.43976	80-26-44.89540 80-26-42.18733 80-26-43.92461

							16-39-41.08556	80-26-49.33398
8	M/s Venkateswara Stone Crusher	Road Metal	801	Paritala	Kanchikacherla	2.023	16-39-58.34855 16-39-58.78888 16-40-00.71155 16-40-00.74161	80-26-54.74994 80-26-55.72809 80-26-58.02378 80-26-50.98871
9	Sri Pavan Granites	Ballast,Boulders,Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	1.07	16-38-57.16064 16-38-57.83215 16-39-03.12399 16-39-03.30090	80-26-19.73240 80-26-21.64331 80-26-21.16671 80-26-18.97964
10	Modern Crushers	Road Metal, Boulders, Building Stone and Gravel	801	Paritala	Kanchikacherla	1.93	16-39-31.28717 16-39-30.75632 16-39-24.32419 16-39-24.85504	80-27-02.14916 80-27-05.47983 80-27-05.87385 80-27-02.54321
11	Sri. P. Ravi Kumar	Road Metal	801	Paritala	Kanchikacherla	2.08	16-39-35.47273 16-39-35.88848 16-39-41.58091 16-39-41.95556	80-27-12.72849 80-27-10.05950 80-27-10.70514 80-27-11.25724
12	M/s.Robo Silicon	Road Metal		Paritala	Kanchikacherla	9.5	16-39-21.46619 16-39-22.69624 16-39-30.67192 16-39-30.83645	80-26-59.39814 80-26-48.39373 80-26-47.66324 80-26-51.95715
13	Ch. Ajad Kumar	Road Metal	801	Paritala	Kanchikacherla	1.25	16-40-11.35190 16-40-12.07083 16-40-12.18274 16-40-14.26055	80-26-42.55081 80-26-38.89631 80-26-40.57846 80-26-41.03684
14	Sri Ch. Ajad Kumar	Road Metal	801	Paritala	Kanchikacherla	12	16-40-02.71800 16-40-04.01500 16-40-09.81800 16-40-11.24100	80-26-46.36800 80-26-45.05100 80-26-57.22000 80-26-50.00000
15	Sri V. Krishna Brahmam	Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	1	16-39-34.67332 16-39-34.87217 16-39-36.49927 16-39-39.91385	80-26-50.94037 80-26-47.57077 80-26-47.56609 80-26-51.64074
16	M/s Veeravalli Concrete (P) Ltd	Boulders,Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	1.5	16-39-36.49927 16-39-36.88649 16-39-40.62036	80-26-47.56609 80-26-44.89540 80-26-52.48384

							16-39-41.08556	80-26-49.33398
17	N. Umameswara Rao	Gravel,Road Metal	801	Paritala	Kanchikacherla	5	16-38-21.39340 16-38-22.90641 16-38-32.18984 16-38-33.68253	80-26-37.50117 80-26-34.51314 80-26-41.81084 80-26-35.33078
18	Sri. B. Trivikramu	Gravel,Road Metal	801	Paritala	Kanchikacherla	2.428	16-39-27.79154 16-39-27.93223 16-39-32.66022 16-39-32.84420	80-26-36.98363 80-26-31.59897 80-26-36.61965 80-26-31.30371
19	Sri V. Sri Hari	Road Metal	801	Paritala	Kanchikacherla	6	16-39-13.31717 16-39-14.57947 16-39-18.59004 16-39-19.85234	80-26-59.32563 80-26-46.90398 80-26-59.57462 80-26-47.15288
20	M/s PVR Chalapathi Metal Industries	Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	1	16-40-08.04261 16-40-09.07180 16-40-11.60985 16-40-12.74652	80-26-45.07040 80-26-47.58866 80-26-43.11545 80-26-45.60115
21	M/s PVR Chalapathi Metal Industries	Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	1.214	16-40-05.68342 16-40-08.77340 16-40-08.77340 16-40-09.59942	80-26-42.16608 80-26-44.64670 80-26-44.64670 80-26-41.40847
22	M/s PVR Chalapathi Metal Industries	Road Metal	801	Paritala	Kanchikacherla	1.619	16-40-24.13743 16-40-25.13998 16-40-31.56371 16-40-32.59585	80-26-47.18872 80-26-45.45046 80-26-51.84956 80-26-50.07903
23	M/s.Sri. Anjaneya Swamy stone crusher	Gravel,Road Metal	801	Paritala	Kanchikacherla	1.667	16-39-58.77600 16-39-59.77506 16-40-00.74161 16-40-03.49835	80-26-49.20390 80-26-47.86476 80-26-50.98870 80-26-53.85807
24	M/s Maruthi constructions	Road Metal	801	Paritala	Kanchikacherla	2.426	16-38-46.43630 16-38-47.22674 16-38-49.90595 16-38-50.69116	80-26-31.18655 80-26-24.48519 80-26-33.04535 80-26-26.34329
25	Sri Kanumuri Siddi Vinayak	Road Metal	801	Paritala	Kanchikacherla	2.428	16-38-46.15300 16-38-46.32200 16-38-46.55500	80-26-25.76700 80-26-32.16700 80-26-30.17000

							16-38-46.66300	80-26-22.15200
26	Sri Ch. Ajad Kumar	Road Metal	801	Paritala	Kanchikacherla	4	16-40-15.61001 16-40-16.66471 16-40-17.81753 16-40-22.17567	80-26-49.62031 80-26-47.94600 80-26-46.11594 80-26-54.09120
27	Sri Kanaka Durga Stone Crusher	Boulders,Building Stone,Gravel,Road Metal	801	Paritala	Kanchikacherla	3	16-39-39.43976 16-39-40.58683 16-39-42.62574 16-39-43.73959	80-26-43.92461 80-26-41.62447 80-26-47.78458 80-26-45.26511
28	M/s Sree Associates	Road Metal	801	Paritala	Kanchikacherla	1	16-39-54.71509 16-39-55.21396 16-39-57.96910 16-39-58.72808	80-26-56.59237 80-26-59.47668 80-26-56.55565 80-26-59.42031
29	M/s. Venkateswara Stone Crusher	Road Metal	801	Paritala	Kanchikacherla	1	16-39-57.04647 16-39-58.34855 16-39-58.77599 16-40-00.74161	80-26-51.65594 80-26-54.74995 80-26-49.20389 80-26-50.98870
30	M/s N.V.Subba Rao and co	Road Metal	801	Paritala	Kanchikacherla	1.934	16-39-06.23793 16-39-06.52169 16-39-10.74948 16-39-11.30633	80-26-21.99064 80-26-19.74001 80-26-26.25479 80-26-23.22739
31	Smt B. Vimala Reddy	Road Metal	801	Paritala	Kanchikacherla	15	16-38-52.72376 16-39-27.79154 16-39-27.93223 16-39-32.66022	80-26-51.99829 80-26-36.98363 80-26-31.59897 80-26-36.61965
32	M/s Srinivasa Granite Metal Industries	Ballast,Boulders,Building Stone,Road Metal	801	Paritala	Kanchikacherla	2.428	16-39-42.36615 16-39-44.51324 16-39-44.54142 16-39-44.55399	80-26-36.02047 80-26-33.63961 80-26-41.66165 80-26-38.24181
33	Sri N.Rama Rao	Road Metal	801	Paritala	Kanchikacherla	1.619	16-39-46.68949 16-39-46.71256 16-39-50.40543 16-39-50.43590	80-26-49.17709 80-26-44.42731 80-26-49.12309 80-26-44.39683
34	M/s Mahewari Stone Crusher	Road Metal	801	Paritala	Kanchikacherla	1.619	16-38-38.85309 16-38-39.13032 16-38-40.06760	80-26-28.94176 80-26-27.36076 80-26-22.03815

							16-38-41.08819	80-26-30.31910
35	CH.NAGA RAJU	Road Metal	1	Kachavaram	Ibrahimpatnam	1.619	16-38-36.74 16-38-36.07 16-38-31.51 16-38-32.18	80-26-57.98 80-27-01.83 80-27-01.37 80-26-56.55
36	CH NAGA SANKARA RAO	Road Metal	1	Kachavaram	Ibrahimpatnam	0.81	16-38-32.09 16-38-31.67 16-38-28.73 16-38-29.35	80-26-58.23 80-27-00.49 80-26-57.36 80-26-55.20
37	Sri Patan John Khan	Road Metal	1/2B	Kachavaram	Ibrahimpatnam	1.036	16-38-11.36 16-38-12.85 16-38-15.67 16-38-14.19	80-26-58.06 80-26-58.01 80-26-51.32 80°26'51.44
38	Sri Patan John Khan	Road Metal	1	Kachavaram	Ibrahimpatnam	0.607	16°38'15.67 16°38'14.19 16°38'17.36 16°38'15.90	80°26'51.32 80°26'51.44 80°26'47.45 80°26'47.53
39	Sri Balakrishna Tulasidas	Boulders,Gravel,Road Metal	1	Kachavaram	Ibrahimpatnam	1.618	16-38-15.22 16-38-14.78 16-38-09.60 16-38-10.19	80-26-46.94 80-26-50.31 80-26-51.40 80-26-47.96
40	M/s Sri Nagendra Swamy Stone Crusher	Road Metal	1	Kachavaram	Ibrahimpatnam	2.428	16°38'21.62 16°38'20.04 16°38'17.87 16°38'15.35	80°26'49.82 80°26'56.13 80°26'50.06 80°26'56.12
41	M/s R.P.R. Engineering and Co.,	Building Stone,Gravel,Road Metal	1	Kachavaram	Ibrahimpatnam	4.763	16°38'37.60 16°38'37.32 16°38'33.52 16°38'30.05	80°27'3.82 80°27'11.21 80°27'3.04 80°27'3.46
42	M/s. Jagadamba Granite Metal Works Smt B.Durga Bhavani	Road Metal	1	Kachavaram	Ibrahimpatnam	2.023	16-38-27.97 16-38-26.13 16-38-22.88 16-38-24.68	80-26-51.62 80-26-58.08 80-26-58.19 80-26-51.73

Data Source: District Mines and Geology Officer, NTR District

2.4 Details of Royalty in last 3 years

The list of royalty in last 3 years in NTR district is shown in Table-16.

Table 16: List of royalty in last 3 years

Royalty for 2022-23					
S. No.	**Mineral**	**Royalty (in Rs. Lakhs)**	**Consideration Amt. (in Rs. Lakhs)**	**DMF (In Rs. Lakhs)**	**MERIT (in Rs. Lakhs)**
1	Black Granite	40	20	5	0.802
2	Feldspar	36.04	36	11	0.721
3	Gravel	33	34	10	0.657
4	Ordinary Earth	30	30	9	0.605
5	Quartz	16	16	5	0.326
6	Road Metal	1008	1154	302	20
Total		**1164**	**1290**	**342**	**23**

Royalty for 2021-22					
S. No.	**Mineral**	**Royalty (in Rs. Lakhs)**	**Consideration Amt. (in Rs. Lakhs)**	**DMF (In Rs. Lakhs)**	**MERIT (in Rs. Lakhs)**
1	Black Granite	71	18	9	1
2	Building Stone	3	2	1	0
3	Feldspar	33	17	10	1
4	Gravel	60	30	18	1
5	Murram	6	3	2	0
6	Ordinary Earth	23	12	7	0
7	Quartz	10	5	3	0
8	Road Metal	782	411	235	16

Total	988	496	284	20

Royalty for 2020-21				
S. No.	**Mineral**	**Royalty (in Rs. Lakhs)**	**DMF (In Rs. Lakhs)**	**MERIT (in Rs. Lakhs)**
1	Black Granite	47	6	1
2	Feldspar	24	7	0
3	Gravel	46	14	1
4	Murram	5	1	0
5	Ordinary Earth	42	13	1
6	Quartz	13	4	0
7	Road Metal	886	266	18
Total		**1062**	**310**	**21**

Data Source: District Mines and Geology Officer, NTR District

2.5 Details of Production in last 3 years

The details of production in last 3 years in NTR district is shown in Table-17.

Table 17: List of production details in last 3 years

Production for 2022-23			
S. No.	**Mineral**	**Unit**	**Production (in MT)**
1	Black Granite	Cubic Meter	1,380
2	Feldspar	MT	36,040
3	Gravel	Cubic Meter	71,557
4	Ordinary Earth	Cubic Meter	67,266
5	Quartz	MT	18,137

6	Road Metal	Cubic Meter	13,95,950

Production for 2021-22

S. No.	Mineral	Unit	Production (in MT)
1	Black Granite	Cubic Meter	2395
2	Building Stone	Cubic Meter	3435
3	Feldspar	MT	33360
4	Gravel	Cubic Meter	132298
5	Murram	Cubic Meter	13990
6	Ordinary Earth	Cubic Meter	51593
7	Quartz	MT	11350
8	Road Metal	Cubic Meter	942541

Production for 2020-21

S. No.	Mineral	Unit	Production (in MT)
1	Black Granite	Cubic Meter	1627.228
2	Feldspar	MT	23600
3	Gravel	Cubic Meter	101135
4	Murram	Cubic Meter	10000
5	Ordinary Earth	Cubic Meter	94022
6	Quartz	MT	14075
7	Road Metal	Cubic Meter	1011293

2.6 Impact on environment

The extraction and utilization of minor minerals have become integral to our modern way of life, fueling infrastructure development, construction, and various industries. However, the impact of these activities on the environment cannot be

underestimated. Minor minerals, which include granite, road metal, gravel, clay, and more, play a significant role in shaping the natural landscape and ecosystems. The various environmental consequences associated with the extraction and use of minor minerals are:

2.6.1. Habitat Destruction: The mining of minor minerals often entails the removal of topsoil and vegetation, leading to habitat destruction. This can disrupt ecosystems, displace wildlife, and threaten the survival of numerous species. Loss of biodiversity is a significant concern in regions with extensive mining operations.

2.6.2. Land Degradation: Mining activities can lead to land degradation, including soil erosion and compaction. This not only reduces the land's fertility but also affects its ability to support agriculture and vegetation growth. Moreover, land degradation can contribute to increased vulnerability to natural disasters like floods.

2.6.3. Water Pollution: Mining operations can contaminate nearby water bodies through the discharge of sediments, chemicals, and heavy metals. This pollution can have detrimental effects on aquatic life, disrupt local hydrology, and compromise the quality of water available for human consumption.

2.6.4. Air Quality: Dust emissions from mining sites can deteriorate air quality in surrounding areas. The fine particles and pollutants released during excavation and transportation of minor minerals can pose health risks to both workers and nearby communities.

2.6.5. Regulatory Challenges: Enforcing regulations and monitoring mining activities in remote or unregulated areas can be challenging, allowing illegal and unsustainable practices to persist.

The extraction and utilization of minor minerals are essential for economic development, but they come at a cost to the environment. Recognizing the environmental impacts of these activities is crucial for sustainable resource management.

2.7 Remedial Measures

The provisions of Rule 12 (1) and Rule 12 (5) and of Andhra Pradesh Minor Mineral Concession Rules, 1966 allows the State Government to issue the Letters of Intent with the stipulated conditions to submit

Approved Mining Plan (AMP), Environment Clearance (EC) and Consent for Establishment (CFE) for grant of lease.

Mine Plan stipulate the maximum permissible annual production of the mineal from the designated lease area and also includes estimated quantum of solid waste generation and its method of disposal, etc. Based on the Approved Mine Plan projections, Environment Management Plan shall be prepared and SEIAA makes the decision to grant the EC based on the EMP.

Leaseholders commit to all the remedial measures in the Mining Plan and the State Environment Impact Assessment Authority (SEIAA) ensures the remedial measures are being adhered to during the tenure of the Environmental Clearance.

Leaseholders in the district have adopted various remedial measures to mitigate the impact of mining on the environment. These measures aim to reduce the environmental footprint of mining operations and address the associated challenges. Some common practices include:

i. **Environmental Impact Assessments (EIAs):** Leaseholders conduct comprehensive EIAs to evaluate the potential environmental consequences of mining projects. They shall use this information to develop mitigation strategies.

ii. **Reclamation and Rehabilitation:** Leaseholders work to restore mined areas by recontouring landscapes, replanting native vegetation, and stabilizing soils to promote ecosystem recovery.

iii. **Water Management:** Proper management of water resources is crucial. Leaseholders use techniques like sedimentation ponds, water recycling, and water treatment facilities to minimize water pollution and ensure responsible water use.

The following preventive measures are being followed for minimizing adverse effects on water regime:

a) Small Gully checks, gully check dams, silt settling tanks, silt traps, etc. shall be constructed.

b) Along all discharge points leaving the mining lease, into the surrounding area, suitable number of filter walls of sufficient lengths shall be erected across the flow, at intervals, all along the length to prevent suspended solids entering the surrounding streams/ drains/ water courses, to confine the discharge water quality to the permissible limits.
c) Regular monitoring may be carried out and further remedial steps as may be necessary may be taken.

iv. **Waste Management:** Effective management of mining waste, such as tailings and slag, involves containment in secure facilities to prevent soil and water contamination. Advances in waste disposal technologies are also being explored.

Steps being followed for effective waste management:

a) Implementation of practices to minimize waste generation at the source. This involves optimizing extraction techniques, reducing overburden removal, and improving resource utilization.
b) Encouraging recycling and reuse of waste materials wherever possible within the mining operation.
c) Selection of an appropriate disposal methods based on waste characteristics and environmental considerations. Common methods include landfilling, controlled dumping, and backfilling.
d) Treatment of contaminated water and effluents using appropriate technologies before discharge.

v. **Afforestation:** Leaseholders carry out a year-wise afforestation plan for the initial years with detailed costing of each plant, its maintenance per piece, etc.

While these measures represent positive steps toward mitigating environmental impact, it's important to note that the effectiveness of these practices can vary widely depending on factors such as the location, scale, and specific mineral being mined. Continuous improvement and adaptation are essential in the mining industry's ongoing efforts

2.8 Reclamation Measures

As per Rule 7A (ii) of Andhra Pradesh Minor Mineral Concession Rules, 1966, Mine Closure Plan shall be submitted by the leaseholder before 6 months of expiry of the lease in the proforma as prescribed by the Director. The Deputy Director concerned shall approve the mine closure plan and ensure compliance of conditions of the approved mine closure plan before expiry of the lease period.

Financial assurance of Rs.50,000/-(Rupees Fifty Thousand) for the quarry lease granted below five(5) hectares and Rs.10,000/- (Rupees Ten Thousand) per Hectare or part thereof for the quarry lease granted five (5) hectares and above, shall be submitted in the form of deposit. If the leaseholder does not reclamate the area as mentioned in the Mine Closure Plan, the deposit shall be forfeited and the Department of Mines and Geology ensure the proper implementation of the Mine Closure Plan.

2.9 Risk Assessment and Disaster Management Plan

Leaseholders conduct comprehensive risk assessment, prepare a model disaster management plan and submit in the Mining Plan.

The leaseholders maintain and arrange following resources at the mine site:

a) Firefighting equipment

b) Ambulance services with location

c) List of volunteer organizations

d) List of Civil, Police and other authorities to be informed in case of an accident

e) Last of mobile crane operators (Government, Public Sector, and Private Sector).

f) List of mines, contacts, facility available nearby

g) List of first aiders and contacts.

h) List of Officers of DGMS to be informed in case of serious accidents Concerned DGMS officers concerned is displayed at the mine head.

The leaseholders shall monitorthe total execution of the disaster management plan. The resources of all departments including men and material are being promptly made available. They are also conducting regular mock rehearsals with their staff to update the risk register and accordingly, disaster management plan

2.9.1. Mineral Regulatory:

The important functioning of District Mines and geology Officer, NTR are:-

1. Achievement of Targets of Mineral Revenue collections being fixed to this office annually

2. Receiving and processing of the Mineral Concession Applications duly conducting the Technical inspection, Survey and demarcation of the Mineral bearing applied areas

3. Execution and Regulation of the operations of the Mining / Quarry leases in accordance with the Acts and Rules

4. Issuing of dispatch permits duly collecting the Advance Royalty / Seig.fee from the lease holders on the minerals produced and intend to dispatch from their leased areas through online permit system

5. Controlling the illegal Mining / Quarrying and transportation by conducting the periodical inspections of the Mines and Quarries and also conducting the surprise vehicular checking and imposing the penalties

6. Finalisation of Demand, Collection and Balance statements of the leases on annual basis

2.10 Plantation and Green Belt Development

Leaseholders are complying with the plantation and green belt development programmes as committed in their Mining Plans.

CHAPTER III: SAND

3.1 Sand Mineral Resources of the NTR District

3.1.1 General Sand Mineral Details NTR District

(Prepared as per Sustainable Sand Mining Management Guidelines 2016 and 2020)

In the NTR District, the NTR, Budameru, Thammileru and Munneru Rivers cover a total of 194 km, 22.72 km, 50.74 km, and 46.87 km respectively. These rivers are the major contributors to sand deposits. The said rivers are seasonal mostly flowing in the rainy season. There is one Prakasam Barrage across the NTR River mentioned above. A list of details of the Production of Sand in the last three years given in Table-18 and the NTR district has newly formed as per bifurcation, so that were sand production is not available in the district.

Table 18 Details of Production of Sand in the last three years in the District

Si. No.	Year	Production of Sand in MTs	Revenue Generated (in Rs)
1	2020-21	--	--
2	2021-22	13,22,790	11,64,05,520
3	2022-23	11,55,021	10,16,41,848

Data Source: District Mines and Geology Officer, NTR District

3.1.2 River Basins in NTR District

The NTR major river basin is covered with 80% area of the district and Budameru, partially covered with Ramileru, Tammileru river basins.The NTR river major tributaries are Munneru and Paleru rivers. The NTR Basin extends over Andhra Pradesh, Maharashtra and Karnataka having a total area of 2,58,948 Sq.km which is nearly 8% of the total geographical area of the country. The NTR river enters into the district near Muktheswarapuram in Jaggayyapeta and leaves the district near Prakasam Barrage in Vijayawada.

The catchment area of each river basin is delineated by using master plan records and updated with survey of India toposheets (1:50K). The NTR riverbasin and Budameruriver basins catchment areas are 2,296 Sq.km and 968.3 Sq.km in the district. The district having total number of tanks

including ponds and minor irrigation tanks 829. The Hydrological units of NTR district is shown in Table-19, Drainage system with description of main rivers is shown in Table-20,Salient features and altitudes origin of rivers is shown in Table-21 and rivers lengths of NTR district is shown in Table-22.

Table 19 Hydrological units of NTR District

S. No	Major Basin	Minor Basin	Catchment Area (Sq.km)	No of. Tanks
1	Krishna	Branches of River NTR Joining Sea	361.22	35
2		Munneru	1,714.55	427
3		Paleru	220.26	29
4	Minor Drainages in NTR Delta Joining Sea in NTR District	Minor Drainages in NTR Delta Joining Sea in NTR District	28.27	2
5	Budameru	Budameru	968.3	336
Total			**3,293**	**829**

Data source: APSAC, Vijayawada

Table 20 Drainage System with Description of main Rivers

S.No	Name of the River	Area Drained (Sq.Km)	% of Area Drained in the District
1	Branches of River NTR Joining Sea	361.22	10.97
2	Paleru	220.26	6.69
3	Munneru	1706.77	51.84
4	Budameru	949.82	28.85
5	Ramileru	18.48	0.56
6	Minor Drainages in Krishna Delta Joining Sea in NTR District	28.27	0.86
7	Tammileru	7.77	0.24

Data source: APSAC, Vijayawada

Table 21 Salient Features of Important Rivers in NTR District

S.No	Name of the River	Place of Origin	Altitude at Origin (m)
1	NTR	Western Ghats, Mahabaleswar hills, Sattar District, Maharashtra State	1,400

2	Budameru	Chimalapadu RF, A.Konduru mandal in NTR dsitrict	415
3	Ramileru	Annaravupeta RF, Vissannapet mandal in NTR dsitrict	428
4	Tammileru	Tirumal Kunta RF, Lankalapalli in Telangana State	423
5	Munneru	Narsampet RF, Kothagudem mandal in Telangana State	489
6	Paleru	Station Ghanpur mandal in Telangana State	389

Data source: APSAC, Vijayawada

Table 22 Rivers Lengths in NTR District

S. No	Name of the Major Basin	Name of the Minor Basin	Name of the River	River Length in Km
1	Budameru	Budameru	Budameru River	7.83
2			Konda Vagu	2.65
3			Kotula Vagu	16.10
4			Puli vagu	14.92
5	Krishna	Branches of River Krishna Joining Sea	Krishna River	17.81
6		Munneru	Ippala Vagu	25.20
7			Kattaleru River	48.90
8			Krishna River	7.05
9			Muneru River	58.71
10			Padamata Vagu	19.30
11			Wira River	15.90
12			Yedulla Vagu	16.55
13		Paleru	Palleru River	26.55
Total				**277.48**

Data Source : APSAC, Vijayawada

The Krishna River: After the Ganga, Godavari, and Brahmaputra, the Krishna River is the fourth-largest river in terms of watercourses and river basin in India. The river, also called Krishnaveni, is around 1,288 kilometers (800 miles) long. In India's Maharashtra, Karnataka, Telangana, and Andhra Pradesh, it is a significant source of irrigation.Krishna river enters into north east part of the district near Chilumuru village, Kolluru mandal and joining to Bay of Bengal near Gangadipalem village, Nizampatnam mandal in Bapatla district.

The Krishna Delta is sub-arcuate and lobate type occupying an area of 4600 km2 extending from Baptla District in the west to Kaikalur in the

east and the apex centred near Vijayawada. A slope of 0.0002 is estimated for the delta and it has 125 km long coastline. The geological formations in the Krishna River basin are mainly Deccan Trap, in the upper reaches, and Archaean Kadapa and Krnool, Upper Gondwana and Tertiary formations in the lower reaches.

3.1.3 Process of Deposition of Sediments in the Rivers of the District

Sediment transport is a natural process, and many have argued that the point of rivers is to move sediment downstream. However, with land use changes, e.g., deforestation and construction; agricultural practices; and development activities, accelerated erosion rates is ubiquitous. Sediment in the water column reduces transparency and can be deposited downstream and exacerbate flooding. Three principal sources of sediment are the following:

Sediment transport is the movement of organic and inorganic particles by water. In general, the greater the flow, the more sediment that will be conveyed. Water flow can be strong enough to suspend particles in the water column as they move downstream, or simply push them along the bottom of a waterway. Transported sediment may include mineral matter, chemicals and pollutants, and organic material. Another name for sediment transport is sediment load. The total load includes all particles moving as bedload, suspended load, and wash load.

3.1.3.1. Bedload

As the name suggests, this element of sediment movement consists of loose, granular particles at the sediment-water interface (such as a stream bed or tidal flat). Air or water that moves across the bed will being to move grains if the flow velocity is great enough to overcome the force of gravity and any resistance at grain contacts. This is the **threshold velocity** and shows in Figure-22.

The bedload contains two main components:

- the **traction load**, or traction carpet, and
- the **saltation loads**.

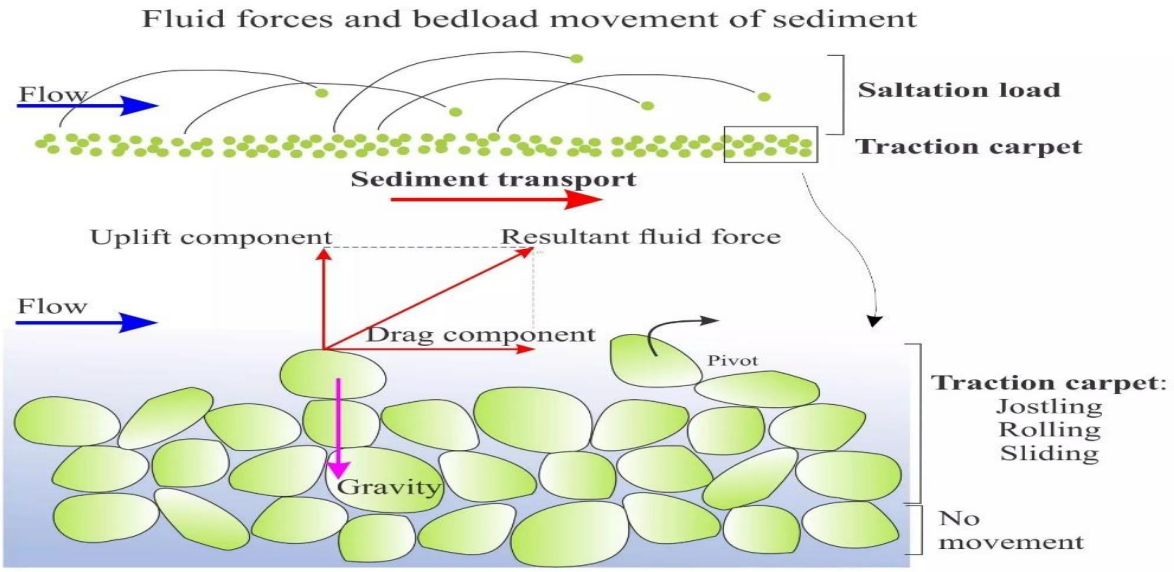

Figure-22: Bedload Movement of Sediment

The various components of force involved in initiation of grain movement are shown above. Here, fluid flowing over a sediment bed produces shear stresses that can be resolved into a component of drag (parallel to the bed) and a lift component normal to the bed. At the threshold velocity when the resultant fluid force on grains is greater than gravity, grains begin to roll, slide and jostle along the bed like a moving carpet – the **traction carpet**.

3.1.3.2. Suspended Load Most natural flows in rivers, shallow marine settings and air are turbulent. Even at low-flow velocities, the speed and trajectories of flow can vary considerably – witness the eddies and boils in seemingly tranquil streams. Very fine particulate sediment (particularly clays) can be kept in suspension for long periods by turbulence; the stresses generated by turbulent flow balance or overcome the gravitational force acting on the particles.

If turbulence decreases significantly, for example when a river empties into a lake, then most particles will gradually settle to the sediment bed. The rate at which a particle settles out of suspension is called the **settling velocity**, where the force of gravity (downwards) exceeds the combined effects of upward-directed **buoyancy forces** acting on a grain and the drag on a particle caused by **fluid (viscous) resistance**. Thus, the rate of settling depends on the size, shape and density of particles, and the viscosity of the fluid. In general, settling through air is much more rapid than through water (Figure-23).

Both bedload and suspension load are important processes in the generation of sedimentary structures. In particular, bedload transport of loose sand is the critical process for growth of bedforms and their internal cross-stratification (crossbedding). The description of **bedforms** (crossbeds) and the flow conditions (**flow regime**) under which they form have been described in other posts.

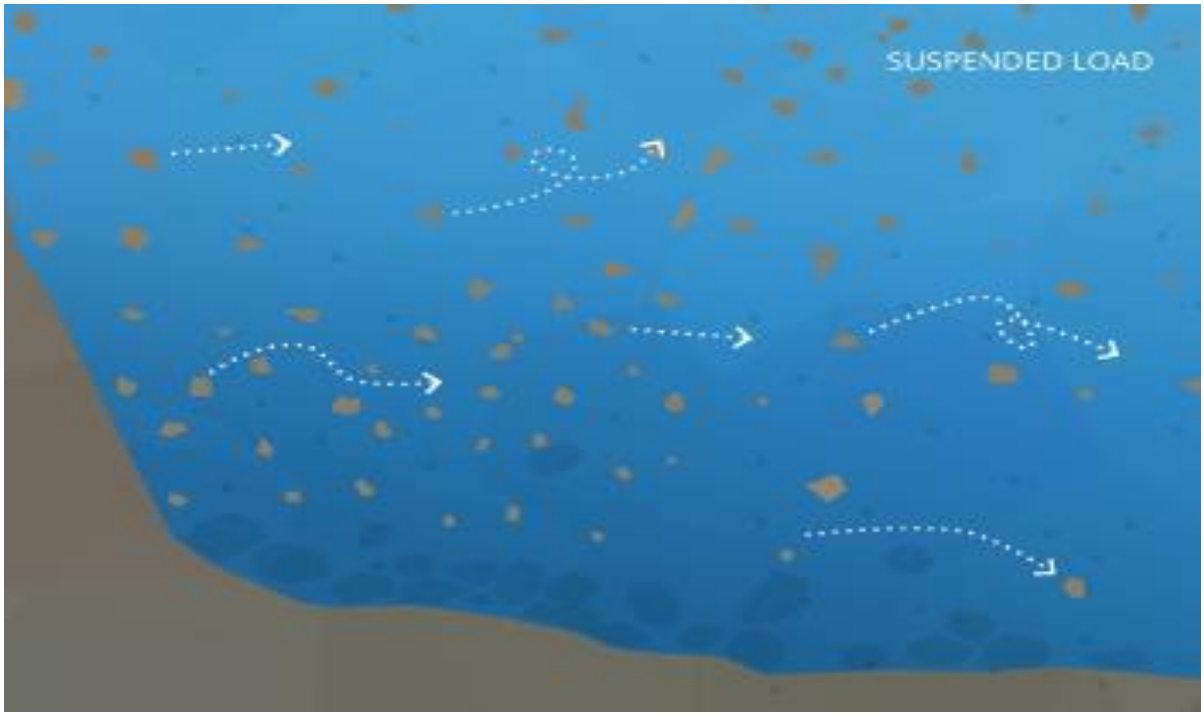

Figure-23: Sediment Load

3.1.3.3. Wash Load

The wash load is the portion of sediment that will remain suspended even when there is no water flow. The wash load is a subset of the suspended load. This load is comprised of the finest suspended sediment (typically less than 0.00195 mm in diameter). The wash load is differentiated from the suspended load because it will not settle to the bottom of a waterway during a low or no flow period. Instead, these particles remain in permanent suspension as they are small enough to bounce off water molecules and stay afloat. However, during flow periods, the wash load and suspended load are indistinguishable. Turbidity in lakes and slow-moving rivers is typically due the wash load 8. When the flow rate increases (increasing the suspended load and overall sediment transport), turbidity also increases. While turbidity cannot be used to estimate sediment transport, it can approximate suspended sediment concentrations at a specific location (Figure-24).

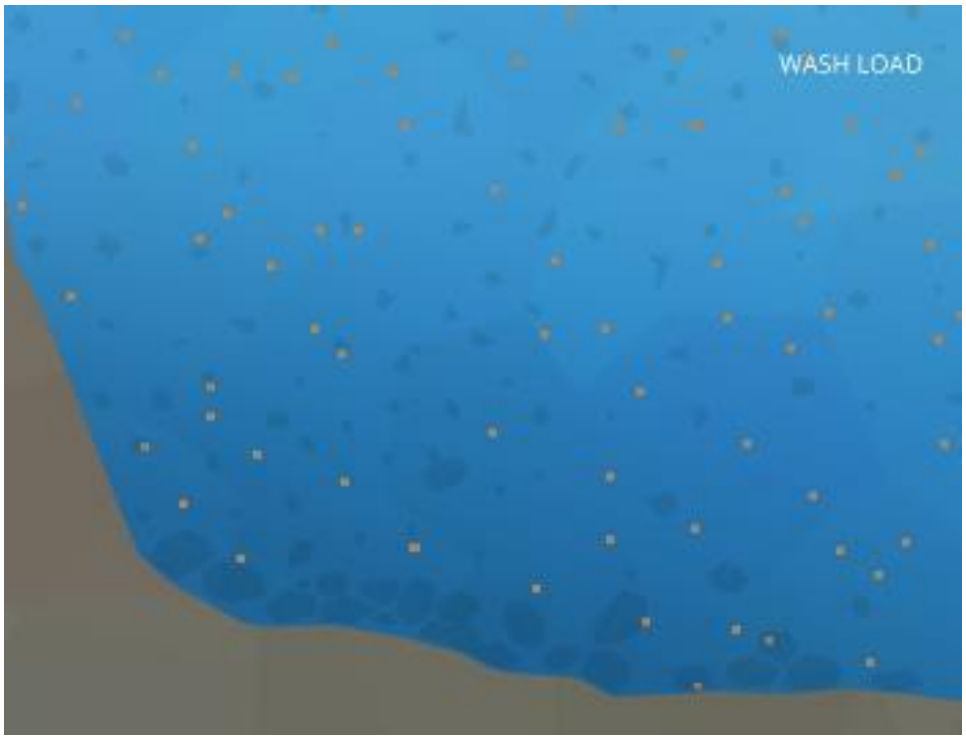

Figure-24: Wash Load

3.1.3.4. Settleable Solids

The suspended particles that fall to the bottom of a water body are called settleable solids. As they are found in riverbeds and streambeds, these settled solids are also known as bedded sediment. The size of settleable solids will vary by water system – in high flow areas, larger, gravel-sized sediment will settle out first. Finer particles, including silt and clay, can be carried all the way out to an estuary or delta (Figure-25).

Figure-25: Settleable Solids

3.1.3.5. Sediment Deposition

Sediment is necessary to the development of aquatic ecosystems through nutrient replenishment and the creation of benthic habitat and spawning areas. These benefits occur due to sediment deposition – when suspended particles settle down to the bottom of a body of water. This settling often occurs when water flow slows down or stops and heavy particles can no longer be supported by the bed turbulence. Sediment deposition can be found anywhere in a water system, from high mountain streams, to rivers, lakes, deltas and floodplains. However, it should be noted that while sediment is important for aquatic habitat growth, it can cause environmental issues if the deposition rates are too high, or too low. Sediment transportation and Deposition depends upon various factors like Slope of the Area, Annual Rainfall, Lithology, flow intensity of River, Geomorphology, Soil, Geology and Land use.

In sediment transport a distinction is generally made between fine and coarse sediment, because the transport mechanisms differ. Coarse sediment (grain size >63 μm) tends to be characterised by particles that remain separate and are chemically inert; fine sediments (<63 μm) on the other hand tend to come together as flocculated populations (flocs) and have the tendency to attract organic material and contaminants to their surface. A great deal has been researched and written about the break up and flocculation of these primary particles under turbulence and subsequent settling (e.g., Uncles et al., 2010). These differences imply important variations in the rate of transport and settling characteristics for the same flow conditions for different sediments. The nature of the physical environment also has an important bearing on this, in that fine sediment tend to be found in sheltered environments (shallow, enclosed estuarine systems), while beaches on open coasts are characterised by coarser materials. This reflects the energy of the water in which the particles become suspended and their subsequent fate (Figure-26).

Rates of transport of material are generally expressed in terms of a flux, as kg/s for example, where this figure is generally obtained by considering the product of the flow rate (in m^3/s) and the concentration of material in suspension (kg/m^3). This does not necessarily imply a requirement for the material to be suspended; it is equally possible to express a bed load using the same units, for example, but it does imply that to obtain an estimate of the sediment flux it is necessary to know both the concentration and the flow rate over a given cross section. Both

these quantities can be measured and there are a variety of techniques available to do this, using insitu collection or sampling, in situ optical or acoustic methods, or remote sensing from aircraft or satellites (Uncles and Mitchell, 2017)

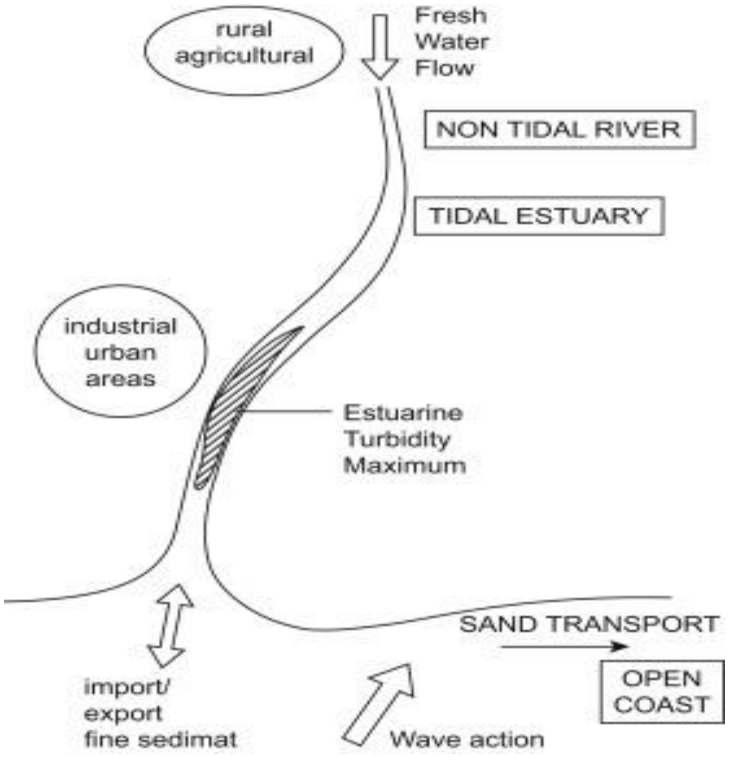

Figure-26: Sediment Deposition Process

Process of Deposition of Sediments in the Rivers of the District Sand is deposited because of the following reasons: (a) Floods: The surface or strip of relatively smooth land adjacent to a river channel constructed (or in the process of being constructed) by the present river in its existing regimen and covered with water when the river overflows its banks at times of high water. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current (b) Valley fill: The unconsolidated sediment deposited by any agent so as to fill or partly fill a valley.

3.1.4 Replenishment Study

A replenishment study for riverbed sand is required in order to nullify the adverseimpacts arising due to excessive sand extraction. Mining within ornear the riverbed has adirect impact on the stream's physicalcharacteristics, such as channel geometry, bedelevation, substratum composition and stability, in-stream roughness of the bed, flowvelocity, discharge capacity, sediment transport capacity etc.For

sustainable river sand mining, it is necessary that the mine pits formed as a resultof sand excavation are refilled with sand by the natural process of replenishment in areasonable period so that the area is again available for mining. The rate of grosserosion is dependent upon many physical factors like climatic conditions, the nature of thesoil, the slope of the area, topography and land use. Theeffect of any of these variables may vary greatly from one geographic location to another, andthe relative importance of controlling factors often varies within a givenland resource area(Dendy, 1976).

There is no denial of the fact that bed load changes from hour to hour, day to day, andyear to year; estimating annual bed load rates is a dynamic process involving carefulexamination. Therefore, proper care has been taken before applying the empirical model tocalculate the sediment yield from the watershed.

The estimation of sand replenishment is based on empirical and analytical approaches.There are many sediment transport equations as well as models which are suitable for use inthe prediction of the replenishment rate of rivers/watersheds. The sedimentation modelsinclude SWAT, HEC-HMS etc. These models are developed based on the fundamentalhydrological and sedimentological processes. They may provide detailed temporal and spatialsimulation but usually require extensive data input. Hourly/daily input values ofmeteorological and radiation variables are required for continuous simulations. Some of theempirical equations for estimating sediment transport are as follows.

Annual Replenishment Rate for sand for Major Sand Resource Area is determined using emperial mathematical expression Dendy Bolton Equation and reproduced below:

- Einstein (1950)
- Laursen (1958)
- Bagnold (1966)
- Engelund-Hansen equation (1967)
- Yang equations (1973)
- Dendy- Bolton equation (1976)
- Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)
- Van Rijn (1984)
- Zanke (1987)

To estimate the transport capacity or the sediment load being conveyedby a waterstream, one of the many transport equations that are available in

the literature is frequentlyused. Einstein (1950) introduced statistical methods to represent the turbulent behaviour ofthe flow. Bagnold (1966) introduced an energy concept and related the sediment transportrate to work done by the fluid. Engelund and Hansen (1967) presented a simpleand reliableformula for the total load transport in rivers. The Yang equation makes use of the total bedhydraulic radius, and studies show that it is good for estimating the sediment transport in thechannel for the condition of dunes on the bed. MUSLE includes only one type of sediment yield (sheet and rill Erosion). Van Rijn (1984) solved the equations ofmotions of anindividual bed-load particle and computed the saltation characteristics and the particlevelocity as a function of the flow conditions and the particle diameter for plane bedconditions. The equations of Zanke and Van Rijn seem to be only moderately satisfactory inestimating the sediment transport in the channel for the condition of dunes on the bed.However, it appears that no single equation could provide reliable estimates of a total load ofsediment transport for all ofthe bed forms that could occur sequentially or randomly inalluvial channels or natural water courses. The comparison of the equations for estimatingsediment rate is given below Table 23.

Table 23: Different types of Sediment transport equation

Sl.No.	**Sediment Transport Equation**	**Remarks**
1	Einstein (1950)	Bed load function was determined for many but not all types of stream channels
2	Laursen (1958)	Laursen equation outperforms other transport equations in the silt range
3	Bagnold (1966)	Bagnold related the sediment transport rate to work done by the fluid
4	Engelund-Hansen equation (1967)	The original Engelund-Hansen relation (OEH) is based on a single characteristic grain size, which limits its applicability in sand-bed rivers with a wide GSD
5	Yang equations (1973)	It makes use of a total bed hydraulic radius

Sl.No.	Sediment Transport Equation	Remarks
6	Dendy- Bolton equation (1976)	It uses both drainage area and means annual runoff for estimation of sediment yield. It calculates all types of sediment yield like sheet and rill erosion, gully erosion, channel bed and bank erosion and mass movement
7	Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)	MUSLE includes only one type of sediment yield (sheet and rill Erosion)
8	Van Rijn (1984)	Calculated equations of motions of an individual bed-load particle for plane bed conditions
9	Zanke (1987)	Zanke was found to be moderately satisfactory for the condition of the dunes on the bed.

Data Source: District Mines and GeologyOfficer, NTR District, Andhra Pradesh

In this study, the rate of gross silt production in the watershed and the ability of thestream system to transport the eroded material in a river have been carried out by the Dendy-Bolton equation. Dendy-Bolton formula is often used to calculate the sedimentation yield asit uses both drainage area and mean annual runoff as key parameters to give a yield value.Also, Dendy-Bolton equation calculates all types of sediment yield like sheet and rillerosion, gully erosion, channel bed and bank erosion and mass movement.

The drainage area of Krishna River in NTR district is situated upstream of the Prakasam Barrage. The Water Resource Department of Andhra Pradesh records the total realization of waterat the Prakasam Barrage, which is considered as the upstream part of the river Krishna with respect to Prakasam Barrage. For calculation of sediment yield, the total realization of water at the Prakasam Barrage for water year 2022-23 (June 2022 to May 2023) of 1525 TMC is taken as run-off.

From Munneru River, the total realization of water for the water year 2022-23 (June 2022 to May 2023) is 120 TMC.

Annual Replenishment Rate for sand for Major Sand Resource Area is determined using emperial mathematical expression Dendy Bolton Equation and the data obtained from Water Resources Dept., GoAP was used and reproduced below:

For Average Annual Run-off less than 2"

$S = 1280 \times Q0.46 [1.43 - 0.26 \log (A)]$ Formula.....(A)

For Average Annual Run-off move than 2"

$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log (A)]$ Formula.....(B)

Q = Mean Annual Run-off in mm

A = Net drainage Area in Sq. km

S = Sediment yield (tons/Sq. km/yr)

As the runoff is less tha 2 inches in the NTR District, the sedimentation yield for Munneru and Krishna River in NTR District is arrived based on the above Dendy Bolton Equation or Formula (A). The sedimentation yield in NTR District is showin Table -23.

Table 24 Sedimentation yield in NTR District

Name of the River	Area Drained (sq. km)	Mean Annual Run-off (in mm)	Rate of Annual Deposition in the River (tons / sq. km /year)	Annual Deposition (tonne)
Munneru	1706.77	5.45	154	2,62,878*
Krishna	3,293	35.93	327.69	10,79,078**

Data Source: District Mines and GeologyOfficer, NTR District, Andhra Pradesh

***Note**: The sedimentation yield was calculated manually by APSAC and the value is **2,89,361 Tones/ year.** The details are provided as an Annexure-II at page number 144-145.

****Note**: The sedimentation yield was calculated manually by APSAC and the value is **11,87,841 Tones/ year.** The details are provided as an Annexure-II at page number 146-147.

In this report, the sediment yield was calculated using the standard records of Department of Water Resources. To ensure systematic and scientific studies, Department of Mines and Geology is in the process of selection of NABET Accredited agency for conducting detailed and regular replenishment studies for potential sand bearing areas.

3.1.5 Details of Sand Mining Leases:

The river Krishna is the main source of sand in the district flowing in the following mandals:

Name of the river	List of Mandals
Munneru	Nandigama and Jaggaiahpeta
Krishna	Vatsavai, Jaggaiahpeta, Penuganchiprolu, Nandigama, Veerllapau, Chandarlapadu and Kanchikacherla

Data Source: District Mines and GeologyOfficer, NTR District, Andhra Pradesh

Proposed potential Sand Mining Leasesin NTR district shown in Table-24.

Table 25 The detail of Potential Sand Mining Leases

Reach Name	Quantity (in MTs)	Geo-Coordinates	Remarks
Indugupalli 1	73950	N16°58'59.01'' E80°11'13.31'' N16°59'01.66'' E80°11'18.63'' N16°58'54.06'' E80°11'23.95'' N16°58'51.46'' E80°11'18.87''	Proposed
Allurupadu-1	74700	N16°56'20.73'' E80°13'34.58'' N16°56'24.17'' E80°13'40.23'' N16°56'22.33'' E80°13'44.67'' N16°56'14.60'' E80°13'40.39''	Proposed
Pendyala-1	74100	N16°41'20.07'' E80°018'05.46'' N16°41'15.37'' E80°18'13.30'' N16°41'10.61'' E80°18'08.83'' N16°41'12.43'' E80°18'02.93''	Proposed

Pendyala-2	73350	N16°41'44.55'' E80°18'18.05'' N16°41'42.30'' E80°18'23.06'' N16°41'34.50'' E80°18'19.32'' N16°41'35.75'' E80°18'13.25''	Proposed
Vemulapalli-1	74550	N16°39'45.42'' E80°17'48.17'' N16°39'47.65'' E80°17'55.26'' N16°39'40.97'' E80°17'57.69'' N16°39'37.62'' E80°17'52.09''	Proposed
Vemulapalli-2	74250	N16°40'24.78'' E80°17'51.35'' N16°40'25.85'' E80°17'57.25'' N16°40'16.53'' E80°17'58.53'' N16°40'16.14'' E80°17'52.61''	Proposed
Ganiathkuru-1	72150	N16°36'19.62'' E80°23'43.30'' N16°36'14.87'' E80°23'52.75'' N16°36'10.98'' E80°23'49.49'' N16°36'15.18'' E80°23'40.38''	Proposed
Ganiathkuru-2	69450	N16°36'32.52'' E80°23'15.30'' N16°36'31.03'' E80°23'22.89'' N16°36'24.51'' E80°23'20.88'' N16°36'26.00'' E80°23'13.73''	Proposed
Pokkunuru-1	73200	N16°38'55.48'' E80°09'13.20'' N16°39'01.44'' E80°09'14.80'' N16°38'56.68'' E80°09'23.43'' N16°38'51.85'' E80°09'21.83''	Proposed
Pokkunuru-2	74250	N16°38'48.96'' E80°09'42.30'' N16°38'55.84''	Proposed

		E80°09’44.09’ N16°38’52.13’’ E80°09’51.67’’ N16°38’46.33’’ E80°09’50.06’’	
Pokkunuru-3	74700	N16°38’36.45’’ E80°10’17.52’’ N16°38’41.21’’ E80°10’08.37’’ N16°38’46.27’’ E80°10’09.78’’ N16°38’41.52’’ E80°10’19.19’’	Proposed
Ustepalli-1	74700	N16°41’44.98’’ E80°08’48.69’’ N16°41’45.77’’ E80°0855.29’’ N16°41’38.35’’ E80°08’57.46’’ N16°41’37.43’’ E80°08’49.90’’	Proposed
Kasarabada-2	74700	N16°41’17.73’’ E80°08’55.59’’ N16°41’16.88’’ E80°09’04.16’’ N16°41’11.41’’ E80°09’03.37’’ N16°41’11.96’’ E80°08’53.18’’	Proposed
Eturu-1	73950	N16°36’46.68’’ E80°19’37.26’’ N16°36’47.18’’ E80°19’43.15’’ N16°36’37.93’’ E80°19’44.10’’ N16°36’37.41’’ E80°19’38.49’’	Proposed
Venganayukunipalem-1	67800	N16°50’17.40’’ E80°17’05.51’’ N16°50’19.74’’ E80°17’09.39’’ N16°50’09.04’’ E80°17’13.34’’ N16°50’07.21’’ E80°17’09.29’’	Proposed
Senagapadu-1	73650	N16°49’01.14’’ E80°17’38.82’’ N16°49’02.96’’ E80°17’46.18’’ N16°48’55.69’’ E80°17’48.30’’	Proposed

		N16°48’54.64” E80°17’41.03”	
Penuganchiprolu-2	74550	N16°53’33.49” E80°16’01.48” N16°53’36.80” E80°16’05.20” N16°53’28.91” E80°16’12.61” N16°53’25.26” E80°16’09.48”	Proposed
Penuganchiprolu-1	74250	N16°52’05.94” E80°16’28.28” N16°52’05.30” E80°16’34.42” N16°51’56.64” E80°16’34.64” N16°51’56.35” E80°16’28.96”	Proposed
Senagapadu-2	73800	N16049’27.10” E80017’36.73” N16049’29.29” E80017’44.09” N16049’21.97” E80017’46.47” N16049’20.38” E80017’40.11”	Existing
Kunikinapadu-1	72750	N16036’15.21” E80021’10.71” N16036’10.32” E80021’17.30” N16036’05.80” E80021’12.20” N16036’09.96” E80021’06.13”	Existing
Kasarabada-1	73800	N16041’17.73” E80008’55.59” N16041’16.88” E80009’04.16” N16041’11.41” E80009’03.37” N16041’11.96” E80008’53.18”	Existing
Kanniveedu-1	74850	N16058’02.55” E80011’53.15” N16058’05.53” E80011’56.69” N16057’57.11” E80012’04.85” N16057’53.97” E80012’01.49”	Existing

Ganiathkuru-3	73050	N16035'35.66'' E80021'59.29'' N16035'29.49'' E80022'10.88'' N16035'26.47'' E80022'08.11'' N16035'32.34'' E80021'56.62''	Existing
Chevitikallu-1	72750	N16035'56.12'' E80021'28.63'' N16035'56.58'' E80021'34.57'' N16035'47.49'' E80021'34.74'' N16035'47.01'' E80021'29.09''	Existing

Data Source: District Mines and GeologyOfficer, NTR District, Andhra Pradesh

Probable Sand bearing areas in the district shown in Table-25. Name of the sand bearing index are given from North to South direction. The Probable Sand bearing areas were identified through field survey with the help of hand held GPS (Global Positional System) and the help of existing literature.

Table 26 : Probable Sand Mining reaches in the NTR District

S.No	Name of the River	Sand Bearing Area	Central Coordinates		Area in Ha
			latitude	longitude	
1	Muneru River	A	17° 0' 14.472" N	80° 10' 3.229" E	15.841713
2	Muneru River	B	16° 59' 3.885" N	80° 11' 7.212" E	11.378343
3	Muneru River	C	16° 58' 32.350" N	80° 11' 22.472" E	6.661838
4	Muneru River	D	16° 57' 58.513" N	80° 11' 57.222" E	19.577324
5	Muneru River	E	16° 57' 20.447" N	80° 12' 31.666" E	6.85008
6	Muneru River	F	16° 56' 57.121" N	80° 12' 49.981" E	4.540145
7	Muneru River	G	16° 56' 21.080" N	80° 13' 43.108" E	25.799111
8	Muneru River	H	16° 54' 34.404" N	80° 14' 59.117" E	69.060641
9	Muneru River	I	16° 53' 29.488" N	80° 16' 8.218" E	9.09531
10	Muneru River	J	16° 53' 8.984" N	80° 16' 3.980" E	27.822906
11	Muneru River	K	16° 52' 24.473" N	80° 16' 35.039" E	35.977481
12	Muneru River	L	16° 51' 53.547" N	80° 16' 33.841" E	49.220559
13	Muneru River	M	16° 50' 0.434" N	80° 17' 19.000" E	30.921497
14	Muneru River	N	16° 48' 21.094" N	80° 18' 1.393" E	10.950689
15	Muneru River	O	16° 48' 1.560" N	80° 17' 53.649" E	12.702712
16	Muneru River	P	16° 47' 15.100" N	80° 17' 51.902" E	18.46143
17	Muneru River	Q	16° 45' 9.230" N	80° 18' 45.026" E	25.131242

18	Muneru River	R	16° 43' 46.561" N	80° 18' 55.336" E	19.489286
19	Muneru River	S	16° 43' 23.031" N	80° 19' 11.425" E	5.345203
20	Muneru River	T	16° 42' 38.207" N	80° 18' 47.375" E	37.143575
21	Muneru River	U	16° 41' 26.733" N	80° 18' 11.607" E	79.776653
22	Muneru River	V	16° 40' 26.312" N	80° 17' 55.689" E	74.16062
23	Muneru River	W	16° 39' 44.396" N	80° 17' 50.100" E	53.281829
24	Muneru River	X	16° 38' 34.411" N	80° 18' 39.893" E	55.040098
25	Muneru River	Y	16° 37' 50.048" N	80° 19' 0.289" E	34.186118
26	Muneru River	Z	16° 36' 47.954" N	80° 19' 26.347" E	8.615633
27	Muneru River	AA	16° 41' 15.062" N	80° 8' 57.446" E	105.672043
28	Muneru River	AB	16° 39' 3.935" N	80° 9' 12.103" E	276.647641
29	Muneru River	AC	16° 36' 47.589" N	80° 19' 46.471" E	29.696775
30	Muneru River	AD	16° 36' 12.939" N	80° 21' 12.465" E	66.242572
31	Muneru River	AE	16° 35' 55.103" N	80° 21' 37.211" E	41.014307
32	Muneru River	AF	16° 35' 31.190" N	80° 22' 7.110" E	39.913911
33	Muneru River	AG	16° 36' 36.498" N	80° 23' 26.406" E	76.450033
34	Muneru River	AH	16° 36' 6.715" N	80° 24' 25.106" E	30.854711
35	Muneru River	AI	16° 35' 46.125" N	80° 25' 24.818" E	115.520487

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh

3.1.6 Details of De-Siltation Location: (Lakes/Ponds/Dams etc.)

The detail of potential of de-siltation location in NTR Distict shown in Table-26.

Table 27 List of Potential De-Siltation Location: (Lakes/Ponds/Dams etc.) (Existing and proposed)

Name of the Reservoir/Dams	Maintain/ Controlled by State Govt./PSU etc.	Location	District	Tehsil	Size (Ha)	Quantity MT/Year	Existing/ Proposed
NIL							

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh

3.1.7 Details of Patta Lands in the District:

The detail list of Patta Lands in the NTR distict shown in Table-27.

Table 28 Details of Patta Lands.

Owner	Sy. No.	Area (Ha)	District	Tehsil	Village	Total Reserve (MT)	Total Mineral to be mined	Existing/ Proposed

							(MT)	
Nil								

Data Source: District Mines and GeologyOfficer,NTR District, Andhra Pradesh

3.1.8 Details of M-Sand Plants in the District:

The details list of Manufacturing Sand in NTR district shaon in Table-28.

Table 29 Shown Details of Details of M-Sand Plants

Plant Name	Owner	District	Tehsil	Village	Geo-location	Quantity Tonnes/Annum
NIL There are no existing M - Sand units under this NTR office jurisdiction						

Data Source: District Mines and GeologyOfficer, NTR District, Andhra Pradesh

3.1.9 Details of Cluster of Sand Mining Leases

The area of Cluster of Mining Leases in NTR jurisdictionshown in Table-29.

Table 30 Details Cluster of Mining Leases in NTR District

Sl.No	Name of the Cluster	Location (Latitude and Logitude)	Extent (in Ha)	Total No. of Mining Leases in the Cluster	No.of Leases working	Extent of the working leases (in Ha)
NIL						

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh

3.1.10 Details of Contiguous Clusters

The area of Contiguous Cluster of Sand Reaches in NTR jurisdictionshown in Table-30.

Table 31 Details of Contiguous Cluster of Sand Reaches in NTR District

Sl.No	Name of the Cluster	Location (Latitude and Logitude)	Extent (in Ha)	Total No. of Mining Leases in the Cluster	No.of Leases working	Extent of the working leases (in Ha)
NIL						

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh

3.1.11 Sand Reaches Details in NTR District

The Department of mines and geology has already idendified sand reachpoints in NTR. The sand reaches points locations details (Figure-27 and Figure-28. Apart from the existing, new sand reaches identified and shown in Figure-29. , Pre and Post Monsoon Sand Reach Point showin in Figure-30, Figure-31 and Figure-32 respectively) are given by District Mines and Geology Officer, NTR. The Probable Sand bearing areas in the District is showing in Figure-33.

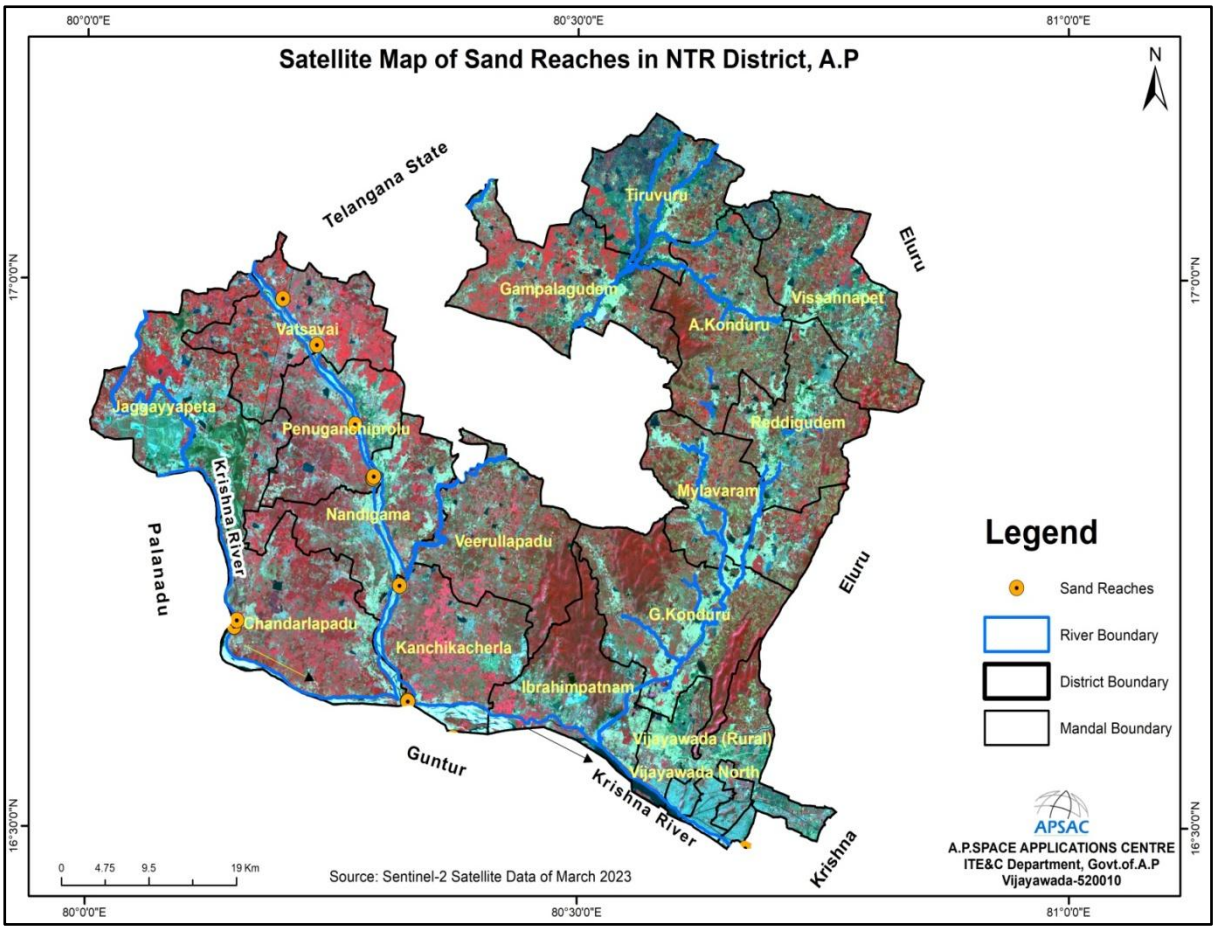

Figure-27: Satellite View of Krishna River map in NTR District.

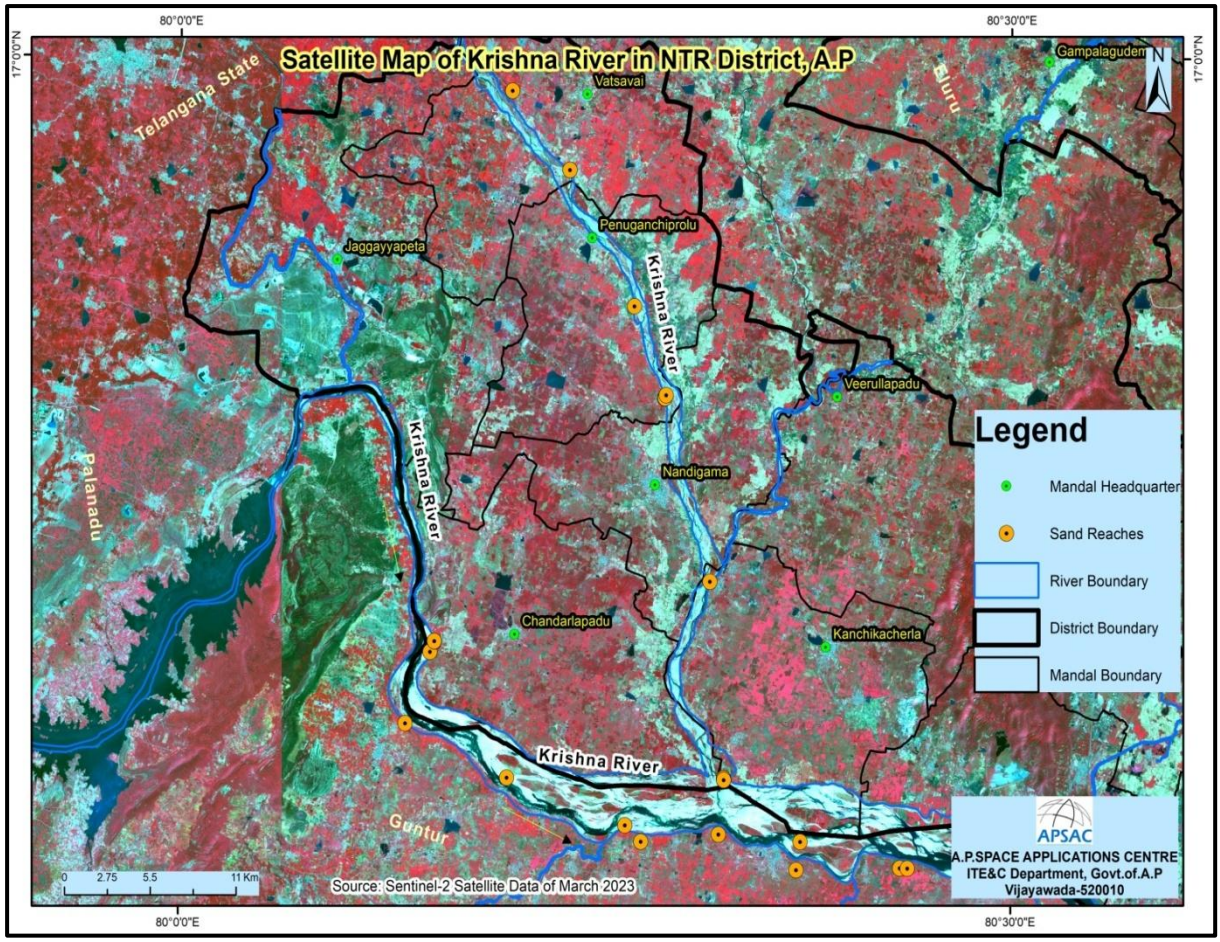

Figure-28: Satellite View of Krishna River map in NTR District.

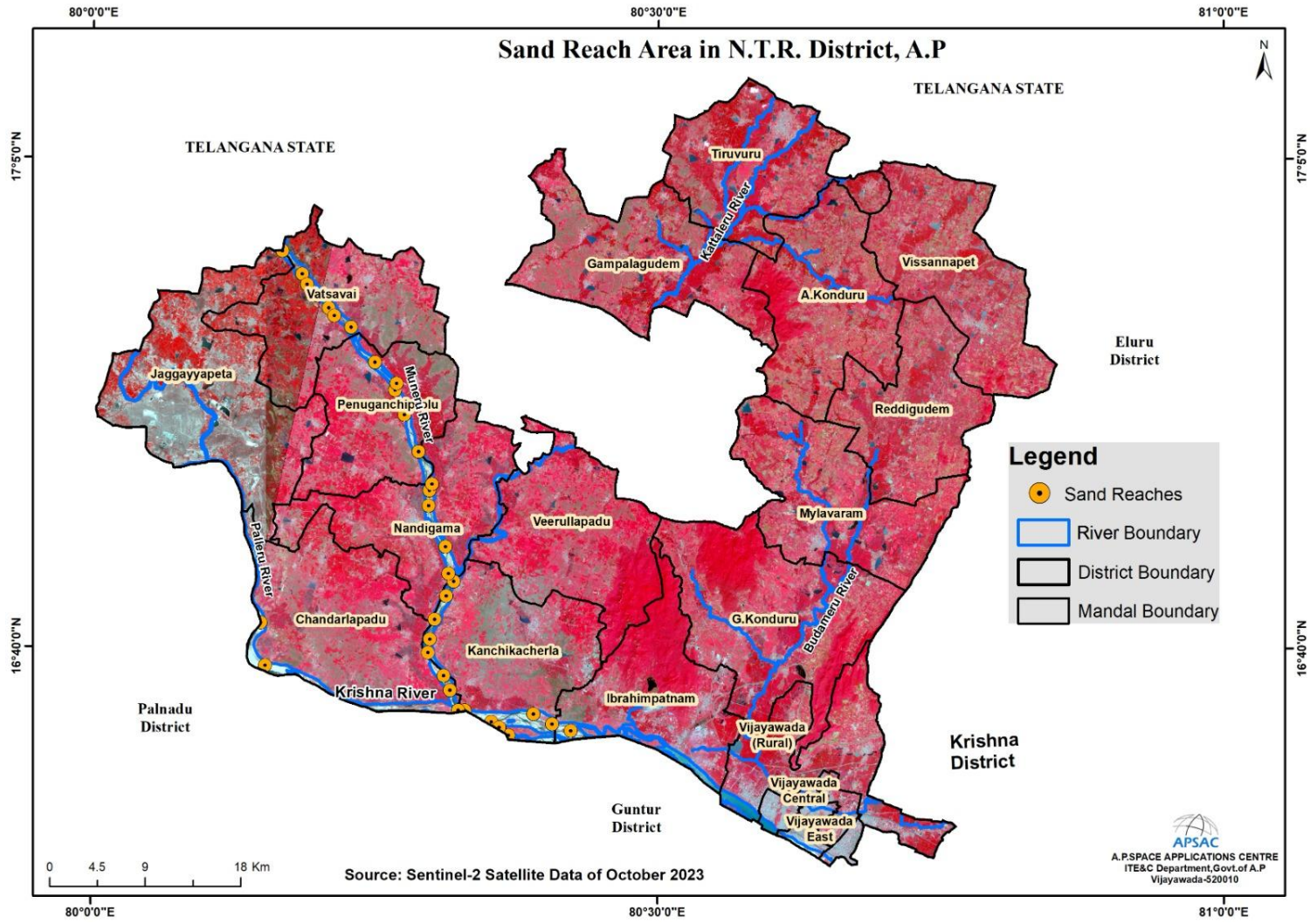

Figure-29: Satellite View of Krishna River map in NTR District

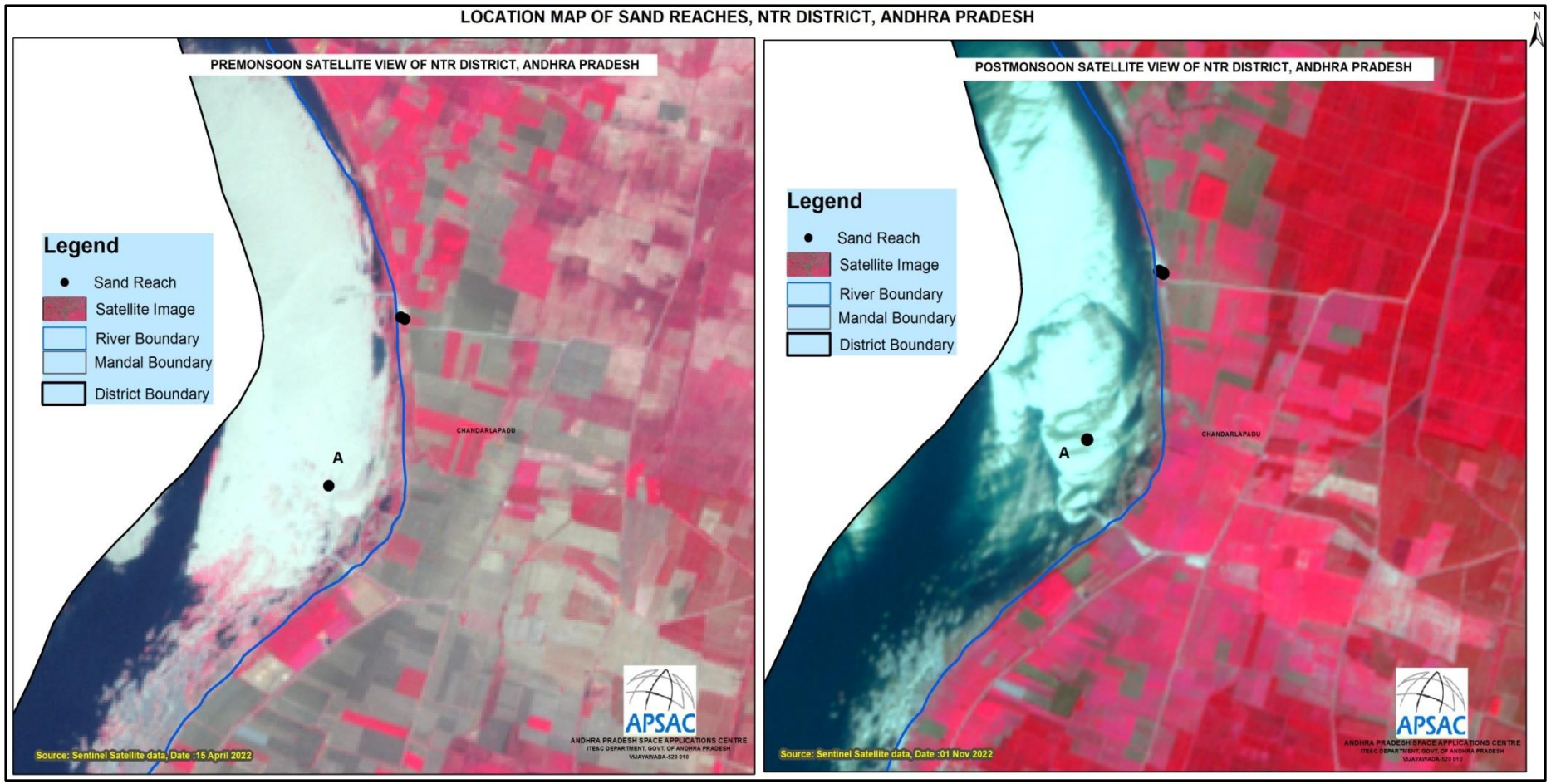

Figure-30: Pre and Post Monsoon Sand Reach Point - A

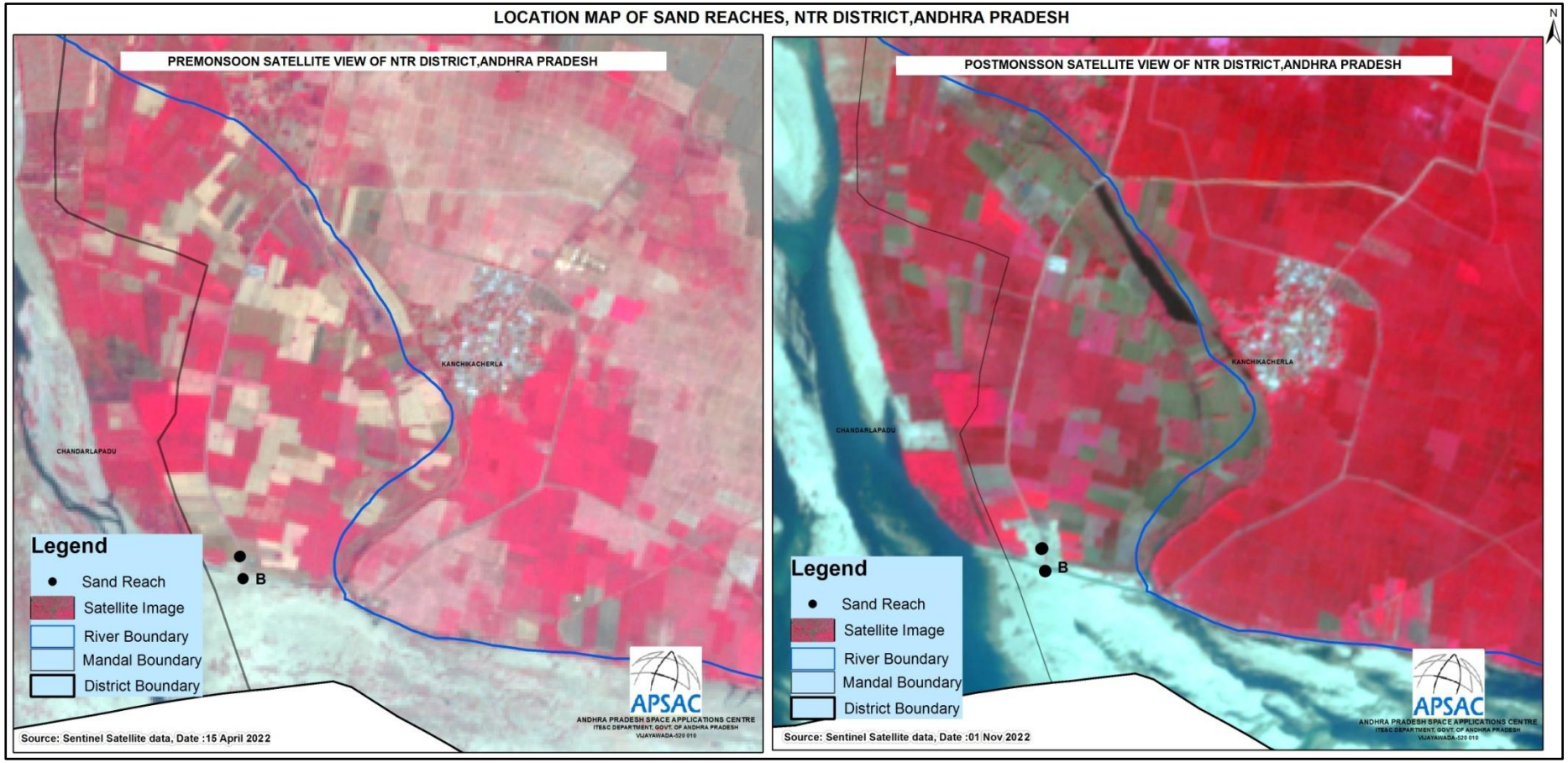

Figure-31: Pre and Post Monsoon Sand Reach Point –B

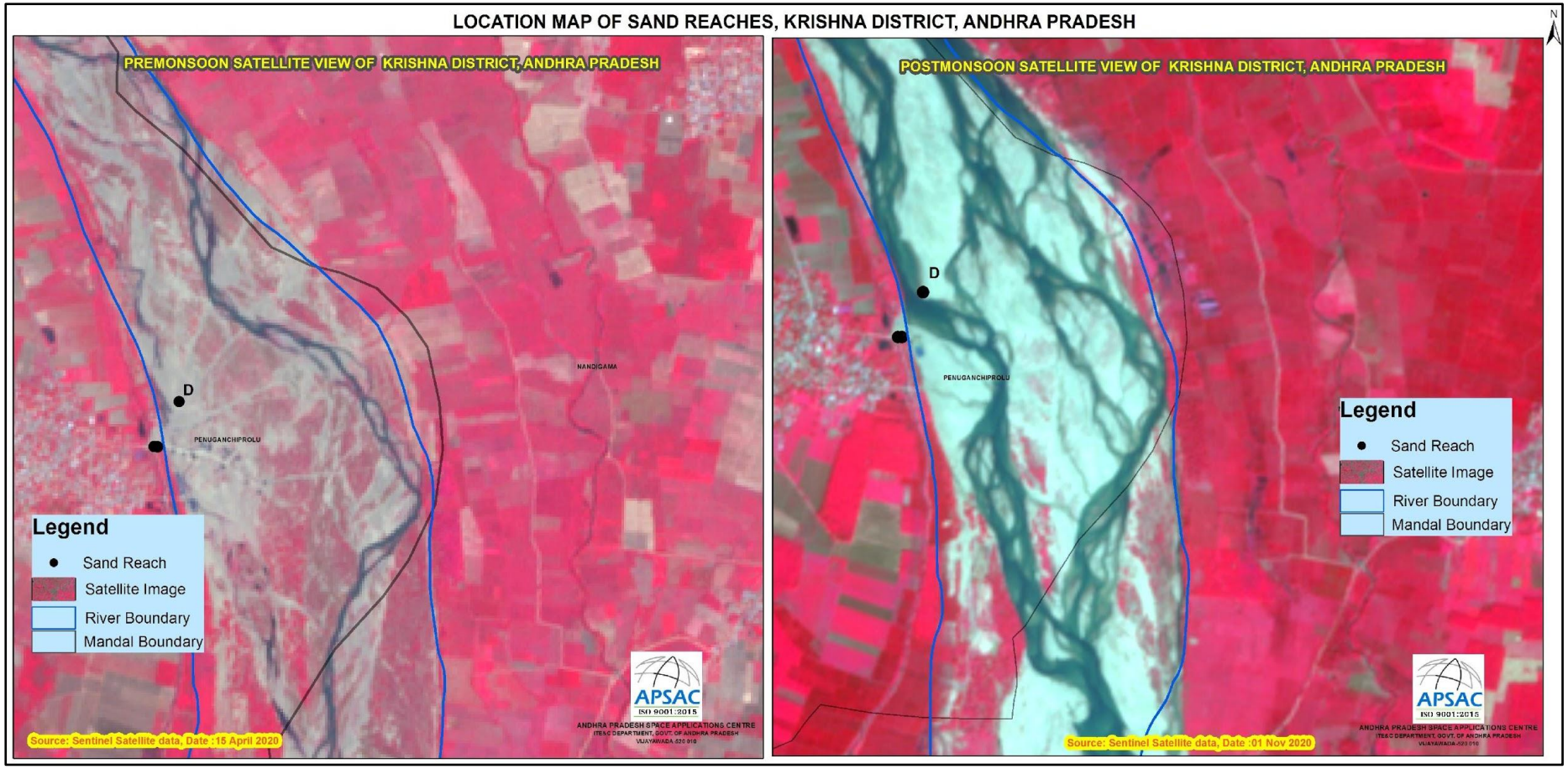

Figure-32: Pre and Post Monsoon Sand Reach Point –D

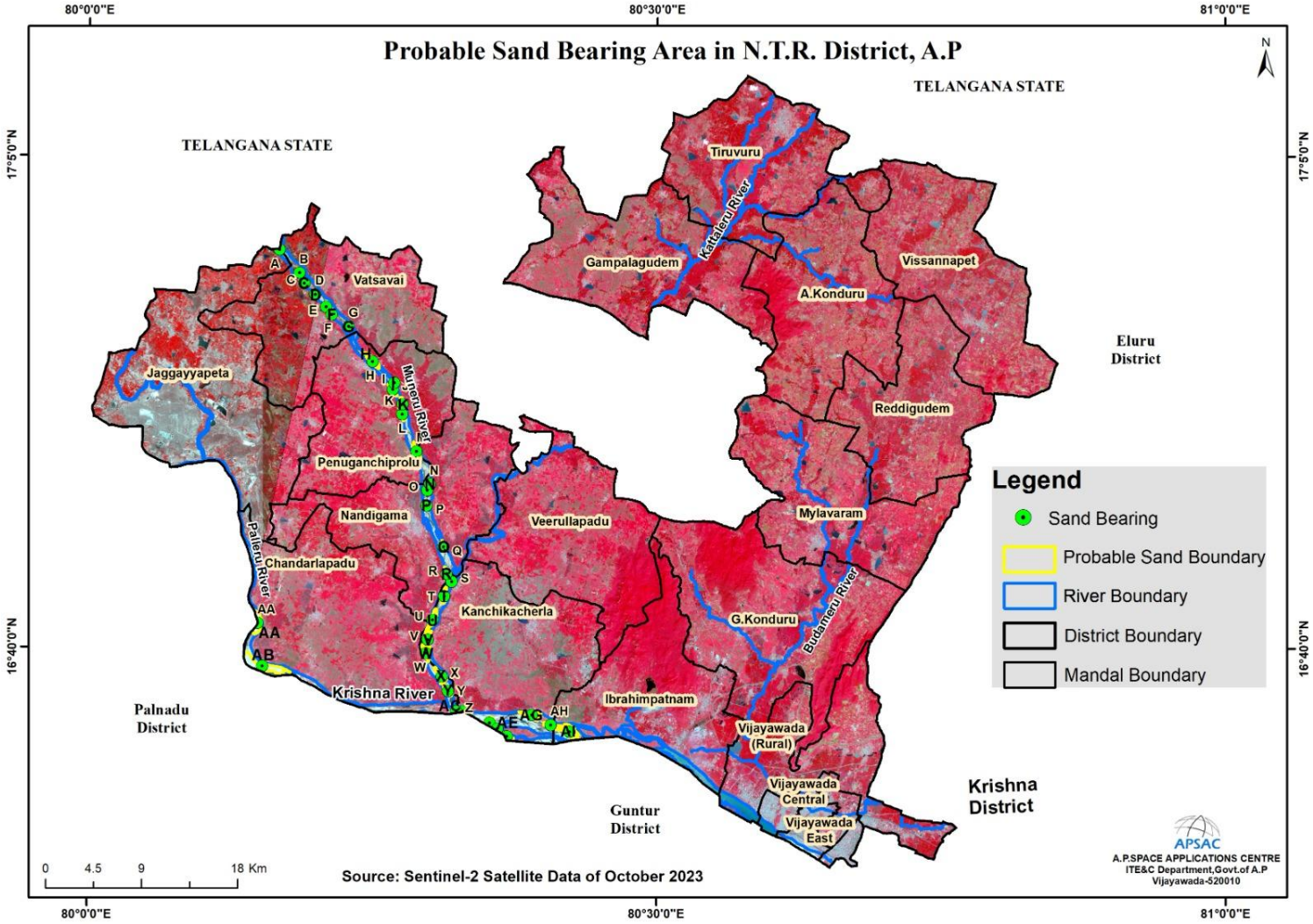

Figure-33: Probable Sand Mining reaches in the NTR District

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ANNEXURE - I

As the average annual run-off is less than 2" in the NTR District, the sedimentation yield for Munneru River in NTR District, arrived manually by APSAC based on the Dendy Bolton Equation or Formula and is given below.

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$

Q = Mean Annual Run-off in mm
A = Net drainage Area in Sq. km
S = Sediment yield (tons/Sq. km/yr)

Sedimentation yield for the Munneru River in NTR District

Name of the River	Area Drained (sq. km)	Mean Annual Run-off (in mm)
Munneru	1706.77	5.45

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh and APSAC, Vijayawada

The given drained area value converted from Sq.Km to Sq.mile and the mean annual run-off converted from mm to inches for the calculations.

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$ **Tones/sq.mile/year**

Drainage Area (A) = 1706.77 sq. Km (1 Sq.km = 0.386 Sq.mile)
= 1706.77 x 0.386
A = 658.813 Sq.mile ----------(1)

Mean Annual Run-off (Q) = 5.45 mm (1 mm = 0.0393 inches)
= 5.45 x 0.0393
Q = 0.214185 inches ----------(2)

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$ **Tones/sq.mile/year**

$S = 1280 \times (0.21418^{0.46}) [1.43 - 0.26 \log (658.813)]$

Log 65 of 8 = 0.8182
0.8 = 6
As per base, the value = 2.0000
_____(+)
Log 309.213=2.8188 ----------(3)

$= 1280 \times (0.21418^{0.46}) [1.43 - 0.26 \times 2.8188]$

$= 1280 \times (0.21418^{0.46}) [1.43 - 0.73287]$

$= 1280 \times (0.21418^{0.46}) [0.697122]$

$= 1280 \times 0.49222 \times 0.697122$

$= 439.2158$

S = 439.2158 **Tones/sq.mile/year** ----------(4)

For total district Sedimentation Yield =

Per Sq.mile Sedimentation Yield (4) x Total Drainage Area (1)

439.2195 x 658.813 = 2,89,361

As the Sedimentation yield calculated manually,

The sedimentation in the total River in the NTR District = **2,89,361 Tones/ year**

ANNEXURE-II

As the average annual run-off is less than 2" in the NTR District, the sedimentation yield for Krishna River in NTR District, arrived manually by APSAC based on the Dendy Bolton Equation or Formula and is given below.

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$

Q = Mean Annual Run-off in mm
A = Net drainage Area in Sq. km
S = Sediment yield (tons/Sq. km/yr)

Sedimentation yield for the Munneru River in NTR District

Name of the River	Area Drained (sq. km)	Mean Annual Run-off (in mm)
Krishna	3,293	35.93

Data Source: District Mines and Geology Officer, NTR District, Andhra Pradesh and APSAC, Vijayawada

The given drained area value converted from Sq.Km to Sq.mile and the mean annual run-off converted from mm to inches for the calculations.

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$ **Tones/sq.mile/year**

Drainage Area (A) = 3293 sq. Km (1 Sq.km = 0.386 Sq.mile)
= 3293 x 0.386
A = 1271.098 Sq.mile ----------(1)

Mean Annual Run-off (Q) = 35.93 mm (1 mm = 0.0393 inches)
= 35.93x 0.0393
Q = 1.412049 inches ----------(2)

$$S = 1280 \times Q^{0.46} [1.43 - 0.26 \log (A)]$$ **Tones/sq.mile/year**

$S = 1280 \times (1.412049^{0.46}) [1.43 - 0.26 \log (1271.098)]$

Log 12 of 7 = 0.1038
1 = 3
As per base, the value = 3.0000
_____(+)
Log 1271 = 3.1041 ----------(3)

= 1280 x ($1.412049^{0.46}$) [1.43 – 0.26 x 3.1041]

= 1280 x ($1.412049^{0.46}$) [1.43 – 0.80706]

= 1280 x ($1.412049^{0.46}$) [0.622934]

= 1280 x 1.17200 x 0. 622934

= 934.5006

S = 934.5006 **Tones/sq.mile/year** ----------(4)

For total district Sedimentation Yield =

Per Sq.mile Sedimentation Yield (4) x Total Drainage Area (1)

934.5006 x 1271.098 = 11,87,841

As the Sedimentation yield calculated manually,

The sedimentation in the total River in the NTR District = **11,87,841 Tones/ year**

****END****