

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

Principal Bench, New Delhi

M.A. No. 152/2019

In

Original Application No. 516/2015

In the matter of: -

RELA & Anr.

Applicant(s)

Vs.

State of Andhra Pradesh & Ors.

Respondent(s)

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1.	Evaluation and Validation Report in M.A. No. 152/2019 In Original Application No. 516/2015 in the matter of RELA & Anr. Vs. State of Andhra Pradesh & Ors. in compliance to the Hon'ble NGT order dated 14.02.2020.	
2.	Annexure-I: A copy of Hon'ble NGT order dated 14.02.2020.	
3.	Annexure-II: A copy of report on Environment Impact Assessment of Desiltation of Annaram Barrage Stretch of river Godavari Jayashankar Bhupalpally District.	
4.	Annexure-III: A copy of report on Scientific study on impacts of desiltation at Megadda barrage, Jayashankar Bhupalpally district of Telangana.	
5.	Annexure-IV: A copy of report on District Survey of Jayashankar Bhupalpally, Telangana.	
6.	Annexure-V: A copy of additional report on Study of Environment Impact Assessment on De-siltation of Annaram Barrage & Medigadda Barrage in Jayashankar Bhupalpally, Telangana.	
7.	Annexure-VI: A copy of Environmental Clearance obtained from MoEF& CC by Government of Telangana for Kaleshwaram project.	



(Nazimuddin)
Scientist-E

Central Pollution Control Board,
Parivesh Bhawan, East Arjun Nagar,
Delhi- 110032.

Date: 01.03.2021

Place: Delhi

Evaluation and Validation of Reports submitted by State of Telangana to Hon'ble NGT by committee comprising of expert appraisal committee (non-coal mining) of Ministry of Environment Forest & Climate Change, Central Pollution Control Board (CPCB), Indian School of Mines, Dhanbad and Indian Institute of Technology, Roorkee in the matter of M.A. no. 152/2019 in Original Application No. 516/2015 submitted to Hon'ble National Green Tribunal, Principal Bench, Delhi as per order dated February 14, 2020.

Submitted to

Hon'ble National Green Tribunal

Principal Bench, New Delhi

I Preamble

In the matter of M.A. No. 152/2019 in Original Application No.516/2015, Rela &Anr Vs State of Andhra &Ors, the Hon'ble National Green Tribunal (NGT), Principal Bench vide its order dated May 23, 2019 directed Central Pollution Control Board, Telangana State Pollution Control Board and and SEIAA, Telangana to jointly inspect and submit factual and action taken report. In compliance to Hon'ble NGT order dated 23.05.2019, the committee comprising of CPCB & Telangana SPCB (SEIAA, Telangana was not constituted during this period) submitted the report. Hon'ble NGT directed the State of Telangana to take up further study. In compliance to Hon'ble NGT orders, State of Telangana/ Telangana State Mineral Development Corporation has got studied the De-siltation Impact on the Environment at Medigadda and Annaram Barrages of Jayashankar Bhupalpally District. Government of Telangana also prepared District Survey Report Jayashankar Bhupalpally District, and has submitted that any further sand excavation in the district will be carried out in terms of District Survey Report and Impact Assessment Study on the de-siltation report of Jayashankar Bhupalpally District.

In compliance to Hon'ble NGT order dated 19.12.2019 Telangana State Mineral Development Corporation vide affidavit dated 13.02.2020 has filed following three reports in Hon'ble NGT: ○
District Survey Report, Jayashankar Bhupalpally District, Telangana ○ Environment Impact Assessment Study on de-siltation of Annaram Barrage.
○ Environment Impact Assessment Study on de-siltation of Medigadda Barrage.

II Orders of the Hon'ble Tribunal dated 14.02.2020

“We are of the view that in view of conflicting versions, the report needs to be independently evaluated and validated. For this purpose, we constitute an Expert Committee comprising members of Expert Appraisal Committee on the subject of sand mining from MoEF&CC, nominees of CPCB, IIT Roorkee and Indian School of Mines, Dhanbad. The joint Committee may be assisted by the Telangana State PCB. The CPCB will be the nodal agency for coordination and compliance. The applicants will be free to give their view point/submissions to the CPCB within two weeks. The CPCB will provide all documents to the members of the Committee. The report may be

furnished within two months by email at judicial-ngt@gov.in.” Copy of the NGT order dated 14.02.2020 is enclosed as Annexure-I.

III Composition of the Committee and Scope of Committee

As directed by the Hon’ble Tribunal, the committee comprising of following members was composed:

1. Prof. Kameshwar Rao, Expert Appraisal Member of State Environment Impact Assessment Authority, Andhra Pradesh- Member representing EAC of Ministry of Environment, Forest and Climate Change
2. Prof. V K Sinha, Adjunct Professor, Department of Mining Engineering, Indian school of Mines, Dhanbad
3. Prof. Zulfequar Ahmad, Department of Civil Engineering, IIT Roorkee
4. Smt. Mahima T, Scientist-D, Central Pollution Control Board, Regional Directorate, Chennai

IV Scope of the Committee: In compliance with Hon’ble NGT order, the scope of the committee was to independently evaluate and validate the following three reports submitted by Govt. of Telangana to Hon’ble NGT. CPCB being the nodal agency forwarded copy of the following reports to the committee members and requested the committee to evaluate the reports:

- a. Environment Impact Assessment of Desiltation of Annaram Barrage Stretch of River Godavari Jayashankar Bhupalpally District. (Copy of the report is placed as Annexure-II)
- b. Scientific study report on impacts of desiltation at Medigadda barrage, Jayashankar Bhupalpally district of Telangana. (Copy of the report is placed as Annexure-III)
- c. District Survey Report of Jayashankar Bhupalpally Telangana. (Copy of the report is placed as Annexure-IV)

After the initial assessment of the reports, all the members of the committee have expressed the need for obtaining several clarifications on the said reports, and also felt the need to visit the concerned sites to validate the impacts identified in the reports and to confirm other physical details of the desiltation sites.

V Committee Meeting and Field Visit

The committee convened meeting online with Telangana State Mineral Development Corporation and with agencies involved in carrying out the above study on July 21, 2020. After discussions, the committee members found that three reports submitted by TSMDC are not comprehensive in nature and suggested TSMDC to supplement the reports with following additional information to validate the reports:

- a. whether District Survey Report is prepared in compliance with the MOEFCC guidelines. Impacts on vegetation, flora & fauna from the period of time before the commencement of desiltation and current status;
- b. Design elevation-capacity curve of the reservoir of Medigadda and Annaram barrages.
- c. Dredging/desiltation plan of the reservoirs to achieve desired storage capacity at pond level. Some typical baseline (prior to construction of barrage) cross-sections of the river along with proposed desilted cross sections.
- d. Reports of the Hydrodynamic and sediment transport modelling in the reservoir of the barrages.
- e. Extent of back water in the reservoir and estimation of annual inflow and outflow sediment load.
- f. Estimation of replenishment of sand in the reservoirs.
- g. Any morphological changes in the river due to desilting/mining activities with reference to course of the river prior to construction of the barrages
- h. whether District Survey Report is carried out in compliance with MOEFCC guidelines
- i. Whether due to desiltation & usage of heavy machinery for desiltation, is there any ecological damage i.e Impacts on vegetation, flora & fauna over a period of time before the commencement of desiltation and current status. Type & density of vegetation present in the reaches before commencement of desiltation during 2014 and gradually how it has changed. TSMDC can also compare the results with two or three reference sites in the same region where desiltation activity is not carried out and assess whether any damage has occurred or not. Socio Economic impacts on local people.
- j. Data on ground water level and quantity in the region-(in sand reaches where desiltation activity is carried out) especially w.r.t to Total dissolved solids. Further the results shall

be compared with BIS drinking water standards and inference of the results shall be given.

- k. Data on ground water incision and bed & bank cutting due to desiltation
- l. Measures taken by TSMDC for restoration of damages if any after desiltation
- m. GPS files for the two barrages showing individual stretches of desiltation with their geocoordinates;
- n. A copy of the Kaleswaram project Prior Environmental Clearance along with its EMP, as the areas shown could have been covered under the project and what was the EC conditions;
- o. Approved mining scheme and the methods for the stretches of each barrage.

The committee convened second meeting with officials of Telangana State Mineral Development Corporation, Telangana State Pollution Control Board and with the agencies which have carried out the study namely M /s Sai Manasa Nature Tech Pvt Ltd and M/s PridhviEnvirotech Pvt Ltd on December 22, 2020. Further the committee visited the Annaram barrage, Medigedda barrage and sand reaches and interacted with officials of Irrigation Department, Govt. of Telangana during 22nd to 23rd of December, 2020 for ground truthing of the reports.

Based on the additional information sought by the committee vide meeting dated 27.07.2020 and during field visits, TSMDC submitted additional report vide email on January 5, 2021. Copy of the additional report “Study Report of Environment Impact Assessment on De-siltation of Annaram Barrage &Medigadda Barrage in Jayashankar Bhupalpally District Telangana”is enclosed as Annexure-V.

V Salient details of the reports submitted by TSMDC

Government of Telangana and Telangana State Mineral Development Corporation DC has entrusted the studies on impacts of Desiltation of Annaram Barrage and Medigadda Barrage to two NABET accredited organizations, 1) M/s Pridhvi Enviro Tech Pvt. Limited, Hyderabad (Annaram Barrage) and (2) M/s Sri Sai Manasa Nature Tech Private Limited (SSMNT), Hyderabad (Medigadda Barrage). The study consists of estimation of the siltation loads, Evaluation of Impacts of Desiltation & remedial measures taken, Environmental Management measures undertaken and

proposed by TSMDC and Monitoring Plan. The salient points that are submitted in these reports are as follows:

1. “ Kaleswaram Lift Irrigation Project (KLIP)” is one of the biggest irrigation scheme having three barrages across River Godavari- 1st barrage at Medigadda, 2nd barrage at Annaram barrage and 3rd barrage at Sundilla. The source point for water lifting is near Medigadda village below the confluence of Pranhita and Godavari rivers and 20-KM downstream of Kaleswaram.
2. TSMDC has undertaken de-siltation of the reservoirs with an aim to provide designed water storage capacity for the said reservoirs and make out proper shape of the reservoir bed depending on the depth of sedimentation /silt available.
3. Through sediment flow model and by empirical equations, the studies have estimated that a total deposition of the sediment/silt were, 2,19,64,494.0 m³ in Medigadda Reservoir and 1, 20,56,241.5 m³ in Annaram reservoir, confirmed the need for the de-siltation in order to achieve the designed water storage capacity of these two reservoirs and to maintain the life of reservoirs. Out of this, so far TSMDC has so far desilted 1,93,03,594.94 m³ from Medigadda and 58,49,019.04 m³ from Annaram reservoirs.
4. The length of water spread at full reservoir level is 39-km for Medigadda Barrage and 31-km for Annaram Barrage. The width of Godavari at these barrages ranges between 0.75 km to 1.4 km. Annaram barrage is located at 50-km distance on the upstream of Medigadda barrage. The crest level of the barrage bay is fixed at 1m above the river bed level and hence there will be de-siltation in the upstream of the barrage.
5. The thickness of the sand as estimated from the bore hole data from the region had ranged between 7.5 and 9.5 m. At some places sand dunes have formed. To make proper shape of the reservoir bed, TSMDC has taken sand extraction upto a maximum 3 m from the surface depending on the depth of the sand available from the bed level, so as to maintain the water storage capacity of the reservoir.
6. In case of Medigadda barrage, out of 39 km length of the back water spread area the desiltation was taken upto 28.66 km length of the back water spread area, limiting the operations to the required level - with an average width of 700 m and a maximum depth of

3 m as per the need of the locality to maintain the shape and to restore the storage capacity of the reservoir.

7. Annual sediment load at Manherial station for the year 2014 to 2019 is obtained from the Water Year Book (Vol. II) Suspended Sediment Year Book, Godavari Circle, Hyderabad and given in Table 1, which indicates that the total sediment load at Manherial station in last five year = 18,56,770 m³.

Table: Sediment Load and inflow at Manherial H.O station of CWC

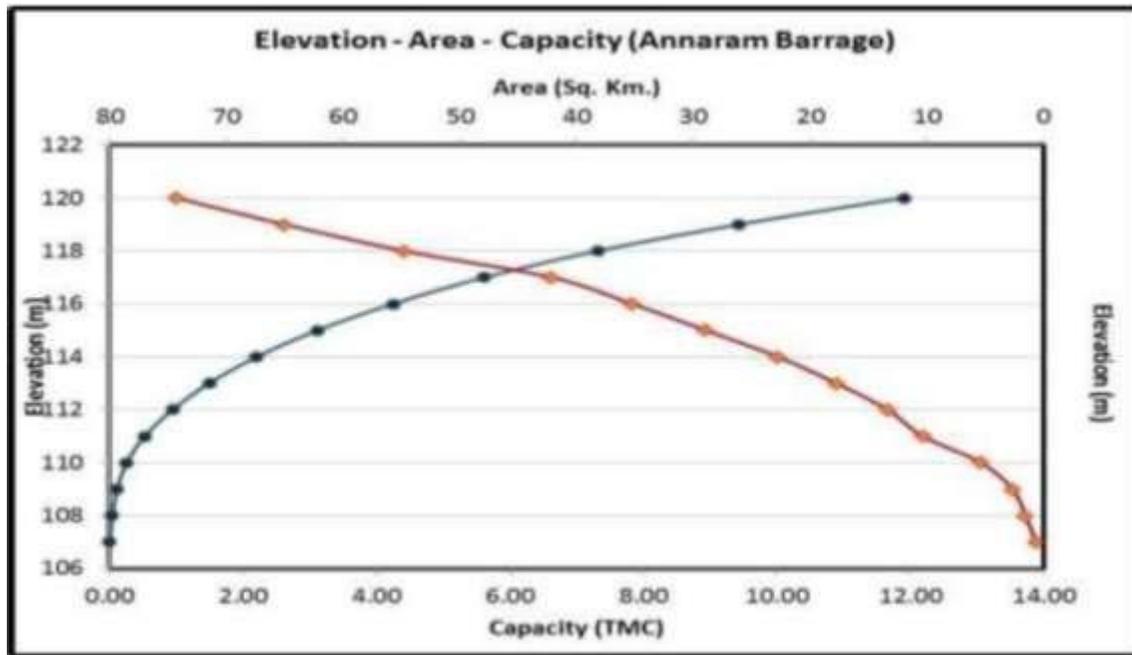
Sl. No	Year	Sediment, MT	Inflow, MCM
1	2014-15	90,676	1,107
2	2015-16	64,964	1,124
3	2016-17	21,31,879	8,081
4	2017-18	10,307	231
5	2018-19	8,02,981	2,071
Total		31,00,807 MT or 1856,770 m ³	12,524
Total per year		3,71,354.1 m ³ / year	2,504.8MCM/ year

8. Protection of river bunds have been done by providing revetment upto 1.5 km upstream of the barrages and flood banks have been constructed from 1.5 km to 8.85 km on right side and 11 km on left side of Annaram Barrage. For Medigadda Barrage flood banks have been constructed from 1.5 km to 6.3 km.



Photo taken during field visit which indicates revetment

9. The Ground water conditions in the Mandals of Mahadevpur, Kataram and Manthani, where the de-silting locations are existing are reported to be under safe extraction conditions as per the Central Ground water Board observations and no major variations or adversaries were reported in the ground water levels and remained normal during the post de-siltation period. The quality of water in both River Godavari and ground water nearer to de-siltation sites were found to be meeting the drinking water standards of IS 10500.
10. Based on the information from the Directorate of Economics and Statistics, the crop yields are observed to be increasing from 2014-15 to 2019-20 which indicates that there are no adverse impacts of either from the stock yards and their transportation routes or due to the desiltation activities on the agriculture or crop yields of the region. Similarly the fishery yields have steadily increased from 2011-12 to 2018-19 in the area. No fish kill incident was reported from both the reservoirs due to de-silting as it has been done only when the river beds were totally dry and without water.
11. TSMDC has plotted elevation area curve for both Medigadda and Annaram barrages which are shown below:



----- Elevation Vs Storage; -----Elevation Vs Area

Figure 1: Designed Elevation – Area – Capacity Curve For Annaram Barrage

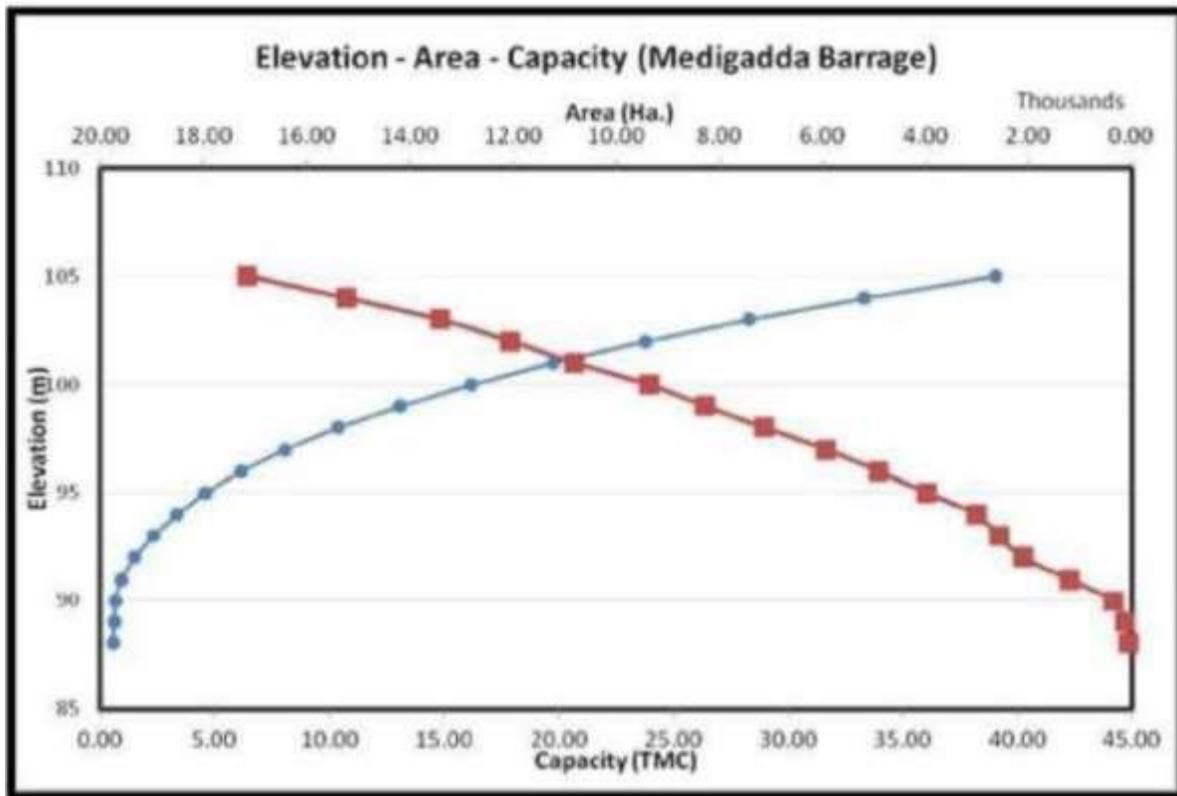


Figure 2: Designed Elevation – Area – Capacity Curve For Medigadda Barrage

12. No adverse impacts were reported on flora and Fauna of the areas near to the de-siltation locations and stockyards. Further TSMDC has taken up development of green belt with 200 saplings at each stock yard periphery and along the road side, as part of Harithaharam Programme of the Government of Telangana.
13. TSMDC has used the existing R&B and Irrigation Roads for transportation of de-silted materials, and as per the studies, the additional traffic volume from the desiltation activity is well within the capacities of the roads as prescribed by IRC guidelines. Further, this additionality is temporary to the periods until the desiltation stocks are cleared, as was observed and noticed by the committee also.
14. The ambient air quality reports are not showing any major negative impacts, and the concentrations of the PM₁₀ and PM_{2.5} were within the standards. TSMDC has taken safety measures like wetting of roads, stabilizing the internal stockyard roads through gravel, covering the lorries through tarpaulin and maintain traffic regulating mechanisms like division of trucks plying in different routes and times, using mostly existing Irrigation roads and maintaining no entry timings
15. TSMDC has carried out ambient air quality monitoring at 12 reaches for parameters PM₁₀, PM_{2.5}, SO₂, NO_x and CO during November & December, 2020. The monitoring results are compared with National Ambient Air Quality Standards (NAAQS) and it is observed that the monitoring results are complying with NAAQS.
16. Ground water quality and ground water levels are monitored. The ground water table data has shown rising trend owing to increase in no. of crops, which necessitated the drawl of ground water due to less than normal rainfall in the years 2015 to 2019. The ground water withdrawal has been supported by increased consumption due to increased crop production since 2014-15 to 2019 – 20. However, all the mandals in Jayashankar Bhupalapally district falls in safe category.
17. The data of flora and faunal species before de-siltation process started along with the construction of barrages of Medigadda and Annaram and after the construction of barrages are comparable and no damage is observed. The de-siltation occurred in the river bed of Godavari, where large sand and silt is exposed and with a varying depths of 8 meters and above. Except few shrubs, no major strata was disturbed. The stock yard areas of desilted

material are nearer to de-siltation reaches and are primarily agricultural lands. Total extent of 168.06 acres and 863.113 acres of patta lands were taken for stock yards in Annaram area and Medigadda area respectively from farmers on lease basis with an agreement to handover the land with improved conditions for cultivation of crops.

18. The tree density estimated in the area is 10 trees per hectare, which is commonly observed in the area. Desilted material is stocked in the stock yard lands without cutting any existing trees. Since already laid roads are being used, no tree was cut for laying the roads. Within the 28 stockyards, no specific road was laid. TSMDC has planted nearly 200 saplings along the periphery of each stock yard.
19. Jayanshankar Bhupalapally District is having 524 Fish rearing tanks with water spread of 16,115 Hectares. There are 103 fishermen co-operative societies and 7711 Fishermen are members of these societies. With construction of Medigadda and Annaram Barrages, the fishery resources improved substantially. Government of Telangana has accorded top priority for development of inland fisheries with implementation of Kaleswaram Project with large impounding of water in Godavari River stretches. The following table was placed in support of the claim, while the information is not conclusive as per the committee's opinion.

Table: Fish & prawn production of Jayashankar Bhupalpally from 2011-2019 in tons

Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Production in Tons	4,410	4,503	6,002	7,699	6,415	7143	7465	7890

20. Rs. 70,45,01,000.00 is the amount earned by locals in surrounding 40 villages during April 2016-Sep 2020 in the process of de-siltation and transportation activities of TSMDC. For Dust Suppression, 10 tractors mounted water sprinklers are engaged by TSMDC. Each of the tractor is being paid Rs. 52,000/- per month. This has helped in improving the socio economic conditions of the people of the region.
21. All the stack yards for storing the desilted material are patta lands taken by TSMDC on lease basis. After desiltation, the stock yard land will be handed over to farmers to use for agricultural purposes. In order to make the stockyard fit for the agriculture, the plan suggested that at least 6-inches sandy soil on the surface be removed before handing it over

to the landowner. Further, before soil reconditioning works need to be carried by TSMDC in consultation with the Agriculture Dept. after conducting necessary soil tests.

VI Present Status of Sand Reaches: Twenty three sand reaches were operated in Medigadda barrage and eight sand reaches in Annaram barrage. Currently during committee inspection it was observed that extraction or production of sand is not taking place in any of the reach. In three sand reaches of Medigadda barrage namely, Bommapur-2, kuntlam-3 and Mahadevpur-I, the sand stored in the stockyard is despatched hence stockyards are in operation. In Annaram barrage, all 8 sand reaches are submerged.

Sl.No	Name of the Stockyard	Assessed Quantity in CBM as per DLSC report	Quantity of sand extracted and despatched as on 30.11.2020	Balance to be excavated	Agreement Date/Due Date	Remarks
1	Mahadevpur-6 IRR		11,75,715.77			Direct Loading
2	Mahadevpur-5	17,40,000.00	3,67,191.00	13,72,809.00	21.01.2017 to 20.07.2018 (M/s. MSR Projects Pvt Ltd)	No Sand & No Excavation
3	Mahadevpur-4	17,40,000.00	10,09,097.00	7,30,903.00	22.01.2020 to 21.01.2021 (M/s.Salvo Explosives and Chemicals Private Limited)	No Sand & No Excavation
4	Mahadevpur-3	17,40,000.00	9,74,349.50	7,65,650.50	20.09.2019 to 19.09.2020 (M/s. G. Sathyanarayana Reddy)	No Sand & No Excavation
5	Mahadevpur-2	17,40,000.00	4,84,058.00	12,55,942.00	01.01.2020 to 31.12.2020 (M/s. P. VenkataRamanaiiah and Company)	No Sand & No Excavation

6	Mahadevpur-1	17,40,000.00	5,80,011.50	11,59,988.50	29.02.2020 to 28.02.2021 (M/s.SaiDex Engineering Pvt Ltd)	Stockyard in operation
7	Bhrahmanpally-1	13,50,000.00		13,50,000.00	19.05.2017 to 18.11.2019 (G.Laxmi Narayana)	No Excavation (at the time of sand reach submerged in the water and there is no accessibility)
8	Bhrahmanpally-2	13,50,000.00	8,28,263.00	5,21,737.00	06.02.2020 to 05.02.2021(M/s. Sudhakara Infra Tech Private Limited)	No Sand & No Excavation
9	Bommapur-2	21,60,000.00	10,48,799.50	11,11,200.50	22.01.2020 to 21.01.2021 (M/s.Salvo Explosives and Chemicals Private Limited)	Stockyard in operation
10	Bommapur-1	21,60,000.00	7,66,665.50	13,93,334.50	22.01.2020 to 21.01.2021 (M/s.Salvo Explosives and Chemicals Private Limited)	Stockyard quantity exhausted

11	Elekeshwaram	24,00,000.00	14,29,986.50	9,70,013.50	06.02.2019 to 05.02.2020 (M/s. Sudhakara Infra Tech Private Limited)	AREA submerged in the river hence, Pusukupalli-1 is reallotted for remaining quantity
12	Begalur-1	4,00,000.00	2,36,196.00	1,63,804.00	11.06.2018 to 10.12.2019 (G. Lakshmi Narayana)	stockyard sand exhausted
13	Begalur-2	13,50,000.00	3,52,256.00	9,97,744.00	25.02.2019 to 24.08.2020 (M/s.SaiDex Engineering Pvt Ltd)	stockyard sand exhausted
14	Suraram -2	15,57,000.00	13,50,566.50	2,06,433.50	08.01.2020 to 07.01.2021 (M/s. Tapaswi Infra Projects Pvt Ltd)	Submerged in river
15	Suraram-1	15,57,000.00		15,57,000.00	08.01.2020 to 07.01.2021 (M/s. Tapaswi Infra Projects Pvt Ltd)	No Excavation (at the time of sand reach submerged in the water and there no accessibility)

16	Pusukupalli-1	9,00,000.00	1,01,254.00	7,98,746.00	18.05.2020 to 17.05.2021 (M/s. Sudhakara Infra Tech Private Limited)	Stockyard Quantity Exhausted
17	Pusukupally-2	9,52,762.00	5,83,002.00	3,69,760.00	07.10.2019 to 06.10.2020 (M/s. KrushiInfras India Pvt Ltd)	Stockyard Quantity Exhausted(Agreement period Completed on 16.10.2020)
18	Pusukupally-3	16,74,000.00	13,43,724.00	3,30,276.00	19.11.2019 to 18.11.2020 (M/s. Sai Ram Granites)	Stockyard Quantity Exhausted(Agreement period Completed on 18.11.2020)
19	Kuntlam-1	15,00,000.00	15,00,190.50	-190.50	07.02.2019 to 06.02.2020 (M/s. Kaveri Engineering Projects Private Limited)	Quantity exhausted
20	Kuntlam-2	15,00,000.00	9,80,230.50	5,19,769.50	06.02.2020 to 05.02.2021 (M/s. Kaveri Engineering Projects Private Limited)	No Excavation

21	Kuntlam-3	15,00,000.00	12,40,380.50	2,59,619.50	31.01.2020 to 29.01.2021 (M/s. Kaveri Engineering Projects Private Limited)	Stockyard in operation
22	Palugula-1	15,00,000.00	14,50,827.67	49,173.00	23.10.2019 to 22.10.2020 (G.Shankar)	Agreement expired
23	Palugula-2	15,00,000.00	15,00,830.00	-830.00	12.10.2019 to 11.10.2020 (N.Jagga Reddy & Co)	Quantity exhausted
	Total	3,40,10,762.00	1,93,03,594.94	1,58,82,883.50		
Present Status of sand reaches in Annaram Barrage						
1	Tallagadda -1	15,00,000.00	4,30,712.50	10,69,287.50	13.12.2018 to 12.12.2019 (M/s.SaiDex Engineering Pvt Ltd)	Area submerged in the river in Annaram Barrage, hence, no
2	Tallagadda-2 (Gundrathpally)	15,00,000.00	10,04,366.04	4,95,633.50	18.03.2019 to 17.03.2020 (M/s. Sai Ram Granites)	quarry is in operation
3	Damarakunta-1	15,60,000.00	17,105.00	15,42,895.00	07.04.2017 to 16.10.2018 (R.VidyaSagar Rao)	

4	Damarakunta-2	15,60,000.00	7,93,714.50	7,66,285.50	19.02.2019 to 18.02.2020 (R.VidyaSagar Rao)	
5	Mallaram 1	7,80,000.00	7,79,999.50	0.50	11.06.2018 to 10.12.2019 (M/s Vensa Infra Structure Ltd)	Quantity exhausted
6	Mallaram 2	15,00,000.00	14,59,955.50	40,044.50	23.10.2018 to 22.04.2020	Quantity exhausted
7	Villasagar Block-1	9,00,000.00	5,39,509.50	3,60,490.50	17.10.2019 to 16.10.2020 (M/s Vensa Infra Structure Ltd)	Area submerged in the river in Annaram Barrage hence, no quarry is in operation
8	Villasagar Block-2	15,00,000.00	8,23,656.50	6,,76,343.50	14.02.2019 to 28.02.2021(M/s Vensa Infra Structure Ltd)	
	TOTAL	1,08,00,000.00	58,49,019.04	42,74,637.00		

VII Observations of the committee on the reports submitted by TSMDC and field visit

1. Government of Telangana/ TSMDC undertook sand extraction activity for creation of storage space essentially required to impound water in Medigadda and Annaram barrages. Part of the sand extracted was used for construction of barrages itself (captive consumption). Construction of Medigadda and Annaram barrages are part of the Kaleshwaram project. Government of Telangana has obtained Environmental Clearance from MoEFCC for Kaleshwaram project which envisages the construction of Medigadda and Annaram barrages. Copy of EC is obtained as Annexure-VI.
2. During inspection, it was observed that the barrages are filled with water. The banks of the river are well protected by boulder pitching. Embankment protection of bunds provided to river after stopping the sand extraction.
3. Through model runs the NABET accredited consultants have estimated that the sand extraction was carried out in areas where sand was accumulated to a depth of 8m to 10m. The committee observed that the sand reaches are established on right side of the river and sand accumulation is more on the right side due to curvature in the river.
4. The district level sand committee (DLSC) has inspected the sand reaches during 2015-2017 and ascertained the sand availability in each reach based on which TSMDC carried out sand extraction. Though the present District survey report is prepared post-project (post desiltation activity) submission, it is prepared based on DLSC reports. The DSR indicates both the sand extracted previously and also the sand available in the reaches for future.
5. The impact assessment were conducted by NABET accredited consultants, however, their assessment mostly related to the post project impacts/ damages by comparing the baseline data generated for the Kaleshwaram project. The studies were conducted during December 2019 to February, 2020 while all the reaches were stopped desilting operations during December 2019 to March 2020. The study period was very short and due to monsoon and submergence in the area complete assessment of impacts is not carried out. TSMDC may regularly monitor and assess the impacts post desiltation.

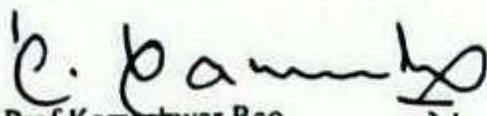
6. The reservoir capacity of Medigedda barrage at FRL of 100m is estimated as 16.17 TMC. The desilted volume of sand in medigedda 1,93,03,594.94 CBM.
7. The reservoir capacity of Annaram barrage at FRL level of 119m is estimated as 10.87 TMC. The desilted volume of sand in Annaram is 58,49,019.04 CBM.
8. The reports submitted by TSMDC does not indicate any major long term impacts or damage to environment in terms of change in water quality, loss of flora etc. The committee during inspection and by satellite images observed that there is minor loss of vegetation near to stockyards. The vegetation is likely to grow if no further activities are taken up. TSMDC has undertaken compensatory afforestation of native species near to the reaches. There are no changes in flow pattern or morphology of the river. There is no shoal formation in u/s however degradation of bed was noticed downstream of the barrage.
9. Based on empirical formulas the total silt load deposited in Annaram and Medigadda barrages in last 5 years is 2,40,20,735.5m³ and quantity desilted (as per empirical calculations) is 2,37,61,239 m³.
10. During inspection, the committee did not observe any crop damage in the villages near to the reaches. The data of flora and faunal species before de-siltation process started along with the construction of barrages of Medigadda and Annaram and after the construction of barrages are comparable and no damage is indicated . The tree density estimated in the area is 10 trees per hectare, which is commonly observed in the area.



VIII Conclusions of the Committee

1. The three reports submitted by Telangana State Mineral Development Corporation namely
1.Environment Impact Assessment of Desiltation of Annaram Barrage Stretch of River Godavari Jayashankar Bhupalpally District, 2.Scientific study report on impacts of desiltation at Medigadda barrage, Jayashankar Bhupalpally district of Telangana and 3.District Survey Report of Jayashankar Bhupalpally Telangana by carrying out the study through NABET accredited consultants M/s Pridhvi Enviro Tech Pvt. Limited,Hyderabad and M/s Sri Sai Manasa Nature Tech Private Limited (SSMNT), Hyderabad read with the supplementary reports submitted (Annexures – II, III, IV, V) are satisfactory, and the project activities were carried out with adequate environmental safeguards.
2. In future whenever the barrages are taken for desiltation, TSMDC shall re-ascertain the quantity of silt deposits. Bathymetric survey of reservoir at intervals of 500m can be carried out biannually, and update elevation capacity curve of reservoir for quantification of siltation. This will help in quantifying desilting of sediments for restoration of design capacity of reservoir.
3. The committee visited the Medigedda sand stockyard which is 100 hectares which as on the date of inspection contained 4 lakh m³(as reported by TSMDC officials) in a private

land taken on lease. The committee recommends that the TSMDC have to submit closure plans for all the stock yards enabling it for agriculture use again once the stocks are cleared. Reclamation of land for agriculture.



Prof. Kamalwar Rao
Member representing EAC of Ministry of
Environment, Forest and Climate Change



Prof. V K Sinha, Adjunct Professor
Department of Mining Engineering
Indian school of Mines, Dhanbad



Prof. Zulfequar Ahmad
Department of Civil Engineering, IIT Roorkee



Mahima T, Scientist-D
Central Pollution Control Board, Regional
Directorate, Chennai

Item No. 04

Court No. 1

**BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI**

M.A. No. 152/2019
IN
Original Application No. 516/2015

RELA &Anr.

Applicant(s)

Versus

State of Andhra &Ors.

Respondent(s)

Date of hearing: 14.02.2020

**CORAM: HON'BLE MR. JUSTICE ADARSH KUMAR GOEL, CHAIRPERSON
HON'BLE MR. JUSTICE S.P WANGDI, JUDICIAL MEMBER
HON'BLE DR. NAGIN NANDA, EXPERT MEMBER
HON'BLE MR. SIDDHANTA DAS, EXPERT MEMBER**

For Applicant(s): Mr.Sravan Kumar, Advocate

For Respondent(s): Mr. A. Sanjeev Kumar, Spl GP
Mr.DhananjayBajjal, Advocate for TSPCB
Mr. Rajkumar, Advocate for CPCB
Mr. Kumar Rajesh Singh, Advocate for MoEF&CC

ORDER

1. This order is being passed in continuation of order dated 23.05.2019. Prayer in this application is against mechanical sand mining, de-siltation, dredging in Godavari and Krishna river beds and its tributaries without obtaining environment clearance from the MoEF&CC and the SEIAA and without conducting statutory EIA.

2. The applicants submitted that a joint inspection report furnished by the CPCB clearly found that in the name of de-siltation, sand mining was being done without mandatory environmental clearance, to provide free sand to the construction companies. Sand mining was said to be taking place at various places, including in District Guntur, Andhra Pradesh, as reported in the Deccan Chronicle newspaper dated 18.02.2017. In the State of Telangana, sand was being mined illegally from Godavari and Krishna Rivers. The same was being booked online at the rate of Rs. 9,000/- per truck. In Hyderabad, it was sold at the rate of Rs. 45,000/- per truck. The State of Telangana was allotting such sand to private contractors for diverting the same to sand mafia. Transportation was resulting in accidents and air pollution.
3. On consideration of the matter, vide order dated 23.05.2019, this Tribunal directed a factual and action taken report to be submitted by a joint Committee comprising of the Central Pollution Control Board (CPCB), Telangana State Pollution Control Board and SEIAA, Telangana.
4. In view of the above, a joint inspection report was filed by the CPCB on 12.07.2019. The report *inter-alia* is as follows:

“Sand mining areas

28 sand reaches of total area 1400 hectares have been identified for de-siltation in Godavari River in a length of around 39 km in Jayashankar Bhupalpally District, comprising 20 sand reaches in the submergence area of Medigadda barrage and 8 sand reaches in the submergence area of Annaram barrage. These barrages are located in the border area of Telangana and Maharashtra. Out of these, 26 reaches are in operation and remaining 02 are not in operation. 7 reaches are reported on patta land.

No sand extraction is being carried River Krishna in Telangana.

Procedure followed

The procedure followed for identification and execution of de siltation projects in Telangana is explained in Section IV of the report. Identification of reaches for de-siltation and initial approval is given by Irrigation Department, further approval is given by District Level Sand Committee, and excavation, storage and sale of sand is done by TSMDC through contractors. The government has notified the stockyard price of sand as Rs. 600 per cubic meter.

Pre-assessment of available sand quantity and sand thickness

The assessment of sand was done by the joint team of DLSC during November/December 2016. As per the report, the sand available in submergence of Medigadda barrage is 4,18,80,000 CBM in ten villages, out of which 15,35,000 CBM is proposed to be used for Medigadda barrage and pump house at Kannepally, and the remaining 4,03,45,000 CBM was recommended to be allocated to TSMDC. The sand availability at submergence of Annaram barrage is estimated as 1,26,00,000 CBM in two villages and the same was recommended for allocation to TSMDC. Government of Telangana handed over the sand bearing areas in the submergence area under Medigadda and Annaram barrages to TSMDC vide proceedings dated 16.12.2016 of District Collector & Magistrate.

TSMDC has fixed the boundary of each sand reach by geo-coordinates but the boundaries are not demarcated on the ground.

TSMDC initiated the excavation of sand before work orders were issued and the quantity of sand sold during that period (13.02.2015 to March, 2017) was 3,82,186.00 CBM. Online sand records are available from 13.02.2015 and the total quantity of sand sold as on 14.06.2019 is 3,35,43,639 CBM.

In the sand assessment report the sand thickness is mentioned as 2 to 3 metre for submergence areas of Medigadda barrage but a depth of 3 metre was taken into consideration to estimate the sand availability in the submergence areas of Medigadda. Similarly, the sand thickness is mentioned as 1.5 to 3 metre for submergence areas of Annaram barrage but a depth of 3 metres has been taken into consideration to estimate the sand availability as well as for excavation.

Godavari River is having a thickness of about 2 to 3 meter. In spite of this, the thickness of sand permitted for extraction is

3m and in few reaches sand extraction up to a depth of 4m is permitted.

There is no scientific mechanism for monitoring the depth and area of sand excavation.

Other observations

In all the sand reaches it was observed that water is accumulated in the pits wherever extraction is taking place.

The historical satellite images reveal that some vegetation cover is lost in certain reaches because of Patta lands coming under submergence due to construction of barrages and sand extraction is extensively taking place in the reaches.

Approximately four thousands of vehicles are plying per day in these sand reaches of JayashankarBhupalpally district for transportation of sand. In certain places, it was observed that the vehicles were plying through the villages and no pucca roads were developed.

Weigh bridges are not existing in all the sand reaches and 16 weigh bridges are empanelled with M's TSMDC and the vehicles are weighed in these weighbridges.

Recommendation in the joint report related to above points

If DSR is properly prepared it could give the total sand reserve available in a district. Further with the help of a scientific replenishment study the data on the amount of sand resource that can be extracted in the district without harming the balance of sand deposition in rivers can be derived.

The project proponent may devise scientific monitoring mechanism to carry out the sand extraction within the permitted boundaries and depth.

TSMDC may establish an Absolute Elevation below which no extraction may occur. The absolute elevation below which no extraction/ mining could occur or "redline" would be surveyed on a site-specific basis in order to avoid impacts to structures such as bridges and to avoid vegetation impacts associated with down-cutting due to excessive removal of sediment.

There is a scope for improvement and recommended to relook into the State Policy and improve as per the MoEF& CC Sustainable Sand Mining Guidelines of 2016.”

5. Since the above report did not give a complete picture, this Tribunal directed further study vide order dated 19.12.2019.
6. In view of above order, the State of Telangana has filed an affidavit on 13.02.2020 stating as follows:

“ xxxxxxxxxx

The Government of Telangana has got studied De-siltation Impact on the Environment at Medigadda and Annaram Barrages of JayashankarBhupalpally District.

Further submitted that the Government of Telangana also prepared District Survey Report in JayashankarBhupalpally District, and any further sand excavation in the district will be carried out in terms of District Survey Report and Impact Assessment Study on the de-siltation report of JayashankarBhupalpally District. And following reports submitting for kind perusal of Hon'ble National Green Tribunal, New Delhi.

1. District Survey Report, JayashankarBhupalpally District
2. Environment Impact Assessment Study on de-siltation of Annaram Barrage.
3. Environment Impact Assessment Study on de-siltation of Medigadda Barrage.

It is further submitted that the State of Telangana any further de-siltation of reservoirs will be taken up after carrying out the Impact Assessment Study on the environment and by following the mitigation measures mentioned in the Impact Assessment Study and District Survey Report. It is further submitted that District Survey Reports in other districts was also taken up and reports will be ready by this month end.”

7. The above reports need to be independently evaluated and validated in view of conflicting versions. For this purpose, we constitute an Expert Committee comprising Members of Expert Appraisal Committee (EAC) on the subject of the MoEF&CC, nominees of the CPCB, IIT Roorkee, and the Indian School of Mines, Dhanbad. The nodal agency will be the CPCB for

coordination and compliance. The Committee will be entitled to seek assistance from any other expert or agency. The State PCB may also render such assistance as may be sought. The applicants will be free to give their view point/submissions to the CPCB within two weeks. The CPCB will provide all documents to the members of the Committee.

8. A copy of this order be sent to MoEF&CC, CPCB, IIT Roorkee, the Indian School of Mines, Dhanbad and the State PCB by e-mail for compliance. The report may be furnished within two months by e-mail at judicial-ngt@gov.in.
9. On submission of the report, this Tribunal will consider the course of action to be adopted in the matter.

List for further consideration of the report on 13.05.2020.

Adarsh Kumar Goel, CP

S.P Wangdi, JM

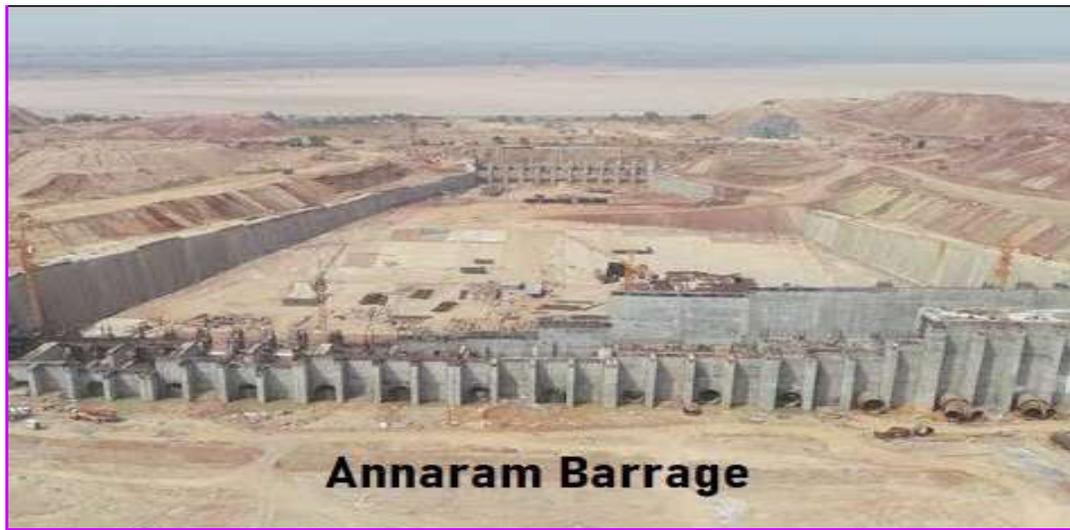
Dr.Nagin Nanda, EM

Siddhanta Das, EM

February 14, 2020
M.A. No. 152/2019
In Original Application No. 516/2015
AK



TELANGANA STATE MINERAL DEVELOPMENT CORPORATION LIMITED
(A State Government Undertaking)



Annaram Barrage

**ENVIRONMENTAL IMPACT ASSESSMENT
OF
DE-SILTATION OF ANNARAM BARRAGE
STRETCH OF RIVER GODAVARI
JAISANKAR BHUPALAPALLI DISTRICT**

PREPARED BY

**TELANGANA STATE MINERAL
DEVELOPMENT CORPORATION LIMITED,
KHAIRTABAD, HYDERBAD.**

TECHNICAL CONSULTANT
PRITHVI ENVIROTECH PRIVATE LIMITED

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EXECUTIVE SUMMARY

Telangana Mineral Development Corporation taken up the environmental impact study of sand de-silting activities in the river stretches before Annaram Barrage, which is part of Kalesharam Project in Telangana. A total of 9 sand reaches considered for study. Out of them 7 are in River Godavari and 2 are from Maneru River before it reaches Godavari. Out of 9 reaches, Two reaches i.e. Tallagadda I and Tallagadda II are within 100 meters and 730 meters from Annaram Barrage and hence it is recommended not to take up de-silting in these reaches.

The Sand estimation from 7 reaches, that can be de-silted is 84,65,300 M³/annum. Detailed environmental Impact assessment is done for de-silting activity. The base line environmental studies indicate, very good environmental conditions in the study area of 10 KM from Annaram Barrage is observed.

The Ground water conditions in the Mandals of Mahadevpur, Kataram and Manthani Mandals, where the de-silting locations are identified are under safe extraction conditions as per the Central Ground water Board observations

Environmental Impacts due to de-silting, stock piling at stockyards and transportation of sand are outlined in the report. Remedial measures for mitigation of impacts are suggested. A budget estimate of Rs. 9,50,00 on capital expenditure on the stock yards and recurring expenditure Rs. 12,50,00 is suggested for remedial measures.

Regular Environmental monitoring of water, air, noise and soil qualities surrounding the reaches and stockyards and ground fluctuation studies and changes in biotic environment is suggested.

Long term data collection on sand replenishment, bed erosion and channel

width is suggested to to assess the long terms impacts and to decide the extend of mining that can be done in sustainable manner.

Sustainable sand mining management guidelines 2016 outlined by Ministry of Environment, Forests & Climate Change, Government of India shall be followed as outlined in the recommendations in the report.

Scope of Studies

Telangana State Mineral Development Corporation assigned the job for preparing Scientific Environmental Impact Assessment report for de-silting of River stretches of Annaram Barrange to Pridhvi Envirotech (P) Limited. The Scope of studies covers the following aspects

- Necessity for De -Silting of Sand reaches in the River Godavari Leading to Annaram Barriage
- Environmental Setting and Collection and analysis of Environmental Base Line data
- Environmental Impacts of De-silting
- Identification of Remedial measures for to mitigate the impacts
- Estimation of costing for remedial measures

Both Primary and Secondary data collection is done and presented in the Report.

Chapter I

GODAVARI RIVER BASIN AND KALESWARAM PROJECT

Telangana State is situated in the central stretch of the Indian Peninsula on the Deccan Plateau. It is the 29th state of India and twelfth-largest state in the country with an extent of 114,840 square kilometres and a population of 35.3 Millions (2011 census). The climate in this region is semi- arid and has skewed distribution of rainfall in space and time necessitating water management. The culturable area in the state is 75.21 lakh ha and net irrigated area is 22.89 lakh ha (30.43% of cultivable area).

The economy of Telangana is mainly driven by agriculture. The economy of the state is predominantly agrarian; agriculture contributes about 50% of the state's income and employs about 70% of the work force. Since agriculture is the main activity and it has close links with the development in other sectors, for overall economic progress of the state. Achieving faster agricultural growth is imperative. Thus there is an urgent need for increasing crop production to meet the demands of increasing population as well as to create employment in rural Telangana.

1.1 About the Irrigation Potential of Telanana

Two major river systems are there in the State of Telangana ie., Godavari and Krishna Rivers and their tributaries. Out of total cultivable area, 30-35% is only the net irrigated area. Though there is large tract of cultivable and fertile land in the command area, lack of irrigation facility has been depriving farmers of better yield. After the bifurcation of the state, Government of Telangana gave major thrust for improving irrigation infrastructure of the state.

Also Telangana is fast developing as seed bowl of the country. Seed is the basic and vital input that could increase crop yields substantially, provided

good management practices are followed with other inputs. Availability of diverse agro-climatic regions with cool and dry weather conditions around the year made Telangana a congenial place for cultivating crops for the production of quality seed.

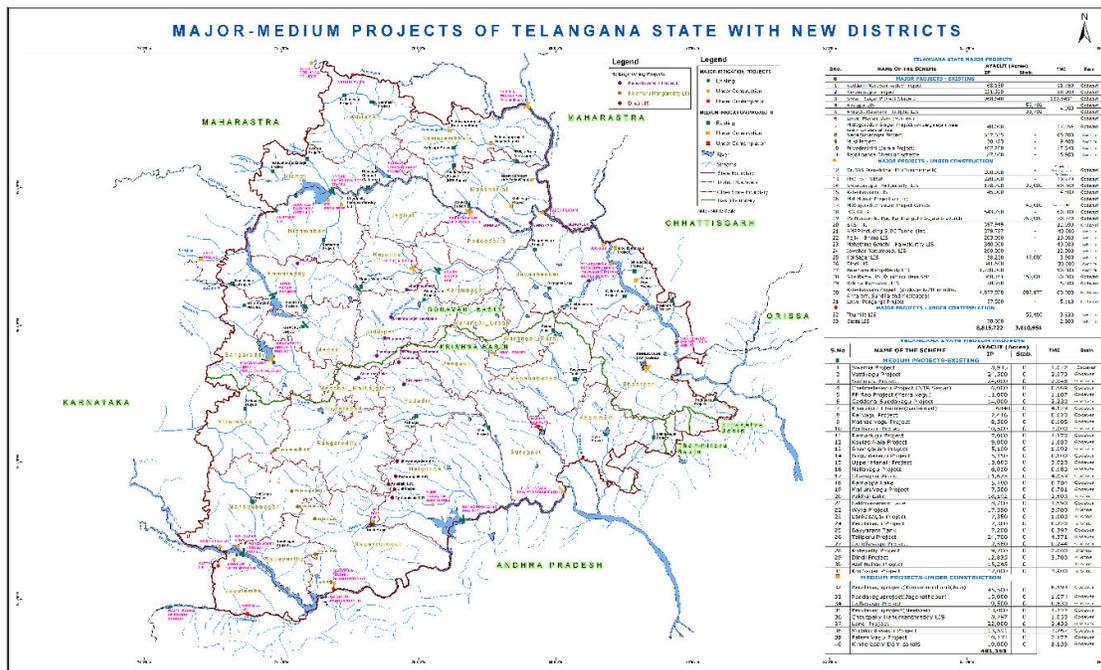
Since Hyderabad has excellent logistic services facilities and strategically located in the middle of the country connecting East-West and North-South, there is a high potential for the State to become a 'Seed Bowl of the Country'.

The State produces around 37.42 lakh quintals of seeds of various crops every year, consisting paddy, hybrid paddy, maize, cotton and Bengal gram etc. At present, about 90-95% of hybrid rice seed production is being taken up by different seed companies in Warangal and Karimnagar districts. Nizamabad supplies 100 percent seed requirements of hybrid jowar and bajra for the country.

1.2 Major and Medium Irrigation projects in Telangana

Below map provides overall drain system in Telangana.

Figure 1.1 Major and Medium Irrigation projects in Telangana



Below table provides the details of Ayacut (Irrigation Potential & Stabilization of Ayacut) under each project

Table 1.1

Irrigation Potential and storage capacities of Major and Medium Irrigation projects

TELANGANA STATE MAJOR PROJECTS					
SNo.	NAME OF THE SCHEME	AYACUT (Acres)		TMC	Basin
		IP	Stab.		
● MAJOR PROJECTS - EXISTING					
1	Kaddam Narayan Reddy Project	68,150	-	11.750	Godavari
2	Nizam Sagar Project	231,339	-	58.000	Godavari
3	Sriram Sagar Project Stage-I	968,640	-	130.548*	Godavari
4	Alisagar LIS	-	53,792	4.900	Godavari
5	Arugula Rajaram - Gutpha LIS	-	38,792		Godavari
6	Lower Manair Dam (24.07 TMC)				Godavari
7	M.Bagareddy Singur Project (Including Manjera Water supply, Excluding Ghnapur)	40,000		17.054	Godavari
8	Nagarjunasagar Project	657,655	-	105.700	Krishna
9	Musi Project	30,183	-	9.400	Krishna
10	Priyadarshini (Jurala Project)	102,200	-	17.840	Krishna
11	Rajoli banda Diversion scheme	87,500	-	15.900	Krishna
● MAJOR PROJECTS - UNDER CONSTRUCTION					
12	Dr.BRA Pranahitha LIS (Tummidihetti)	200,000	-	Shown in Kaleshwaram Project 19.979	Godavari
13	FFC from SRSP	220,000	-	19.979	Godavari
14	Sripadasagar Yellampally LIS	178,700	30,000	60.360	Godavari
15	Kaleshwaram LIS	45,000	-	4.500	Godavari
16	Mid Manair Project (20 TMC)				Godavari
17	M.Bagareddy Singur Project Canals		40,000	Stabilization	Godavari
18	JCR GLIS	543,750	-	60.000	Godavari
19	PV.Narasimha Rao Kanthanpally Sujala Sravanthi	-	750,000	70.370	Godavari
20	SRSP -II	397,949	-	22.999	Godavari
21	AMRP including SLBC Tunnel (Inc	379,787	-	40.000	Krishna
22	Rajiv - Bhima LIS	203,000	-	20.000	Krishna
23	Mahathma Gandhi - Kalwakurthy LIS	340,000	-	40.000	Krishna
24	Jawahar Nettempadu LIS	200,000	-	22.000	Krishna
25	KoilSagar LIS	38,250	12,000	3.900	Krishna
26	Dindi LIS	341,500		30.000	Krishna
27	Palamuru RangaReddy LIS	1,230,000		90.000	Krishna
28	Sita Rama LIS Dummugudem Anicut	360,161	150,000	50.000	Godavari
29	Baktha Ramadasu LIS	58,958		5.500	Godavari
30	Kaleshwaram Project (package 6-28 including Annaram, Sundilla and Mediqadda)	1,827,500	1,882,970	160.000	Godavari
31	Lower Penganga Project	37,500	-	5.119	Godavari
● MAJOR PROJECTS - UNDER CONTEPLATION					
32	Thumilla LIS		53,400	3.630	Krishna
33	Gattu LIS	28,000		2.800	Krishna
		8,815,722	3,010,954		

EIA Report on De-siltation of Sand-Annaram Barriage

TELANGANA STATE MEDIUM PROJECTS					
S.No	NAME OF THE SCHEME	AYACUT (Acres)		TMC	Basin
		IP	Stab.		
■ MEDIUM PROJECTS-EXISTING					
1	Swarna Project	8,945	0	1.012	Godavari
2	Vattivagu Project	24,500	0	2.970	Godavari
3	Sathnala Project	24,000	0	2.048	Godavari
4	Chelmelavagu Project (NTR Sagar)	6,000	0	0.569	Godavari
5	PP Rao Project (Yerra vagu)	11,000	0	1.107	Godavari
6	Gaddena-Suddavagu Project	14,000	0	2.230	Godavari
7	Khanapur Channel(Sadarmat)	6848	0	4.129	Godavari
8	Ralivagu Project	2,416	0	0.620	Godavari
9	Mathadivagu Project	8,500	0	0.905	Godavari
10	Pocharam Project	10,500	0	3.000	Godavari
11	Ramadugu Project	7,000	0	1.170	Godavari
12	Koulas Nala Project	9,000	0	1.680	Godavari
13	Shanigaram Project	5,100	0	1.092	Godavari
14	Boggulavagu Project	5,150	0	0.600	Godavari
15	Upper Manair Project	13,085	0	3.020	Godavari
16	Nallavagu Project	6,030	0	0.980	Godavari
17	Ghanapur Anicut	21,625	0	4.059	Godavari
18	Ramappa Lake	5,180	0	0.784	Godavari
19	MalluruVagu Project	7,500	0	0.781	Godavari
20	Pakhal Lake	18,192	0	2.600	Krishna
21	Lakhnaram Lake	8,700	0	1.590	Godavari
22	Wyra Project	17,390	0	3.700	Krishna
23	Lankasagar Project	7,350	0	1.000	Krishna
24	Peddavagu Project	2,360	0	0.220	Krishna
25	Bayyaram Tank	7,200	0	0.397	Godavari
26	Taliperu Project	24,700	0	4.371	Godavari
27	Gundlavagu Project	2,580	0	0.244	Godavari
28	Kotepally Project	9,200	0	2.000	Krishna
29	Dindi Project	12,835	0	3.700	Krishna
30	Asif Nahar Project	15,245	0		Krishna
31	KoilSagar Project	12,000	0	3.900	Krishna
■ MEDIUM PROJECTS-UNDER CONSTRUCTION					
32	Peddavaguproject(Komarambhim)(Ada)	45,500	0	8.599	Godavari
33	Peddavaguproject(Jaganathapur)	15,000	0	1.074	Godavari
34	Gollavagu Project	9,500	0	0.830	Godavari
35	Peddavaguproject(Neelwai)	13,000	0	1.727	Godavari
36	Choutpally Hanumanthreddy LIS	8,297	0	1.050	Godavari
37	Lendi Project	22,000	0	2.430	Godavari
38	Modikuntavagu Project	13,591	0	3.267	Godavari
39	Palem Vagu Project	10,132	0	2.177	Godavari
40	Kinnerasani Dam canals	10,000	0	8.139	Godavari
		481,151			

1.3 River Godavari and its Basin

The Godavari is India's second longest river after the Ganga. Its source is in Triambakeshwar, Maharashtra. It flows east for 1,465 kilometres (910 mi), draining the states of Maharashtra (48.6%), Telangana (18.8%), Andhra Pradesh (4.5%), Chhattisgarh (10.9%), Odisha (5.7%), ultimately emptying into the Bay of Bengal through its extensive network of

tributaries. Measuring up to 312,812 km². It forms one of the largest river basins in the Indian subcontinent, with only the Ganga and Indus rivers having a larger drainage basin.

In terms of length, catchment area and discharge, the Godavari is the largest in peninsular India, and had been dubbed as the Vridha Ganga.

The river has been revered in Hindu scriptures for many millennia and continues to harbour and nourish a rich cultural heritage. In the past few decades, the river has been barricaded by a number of barrages and dams, keeping a head of water (depth) which lowers evaporation. Its broad river delta houses 729 persons/km² – nearly twice the Indian average population density.

Godavari enters into Telangana in Nizamabad district at Kandakurthy where Manjira, Haridra rivers joins The river flows along the border between Nirmal and Mancherial districts in the north and Nizamabad, Jagityal, Peddapalli districts to its south. About 12 km after entering Telangana , it merges with the back waters of the Sriram Sagar Dam. The river after emerging through the dam gates enjoys a wide riverbed, often splitting to encase sandy islands. The river receives a minor but significant tributary Kadam river. It then emerges at its eastern side to act as state border with Maharashtra and later enter into Bhadradi Kothagudem district. In this district the river flows through an important Hindu pilgrimage town – Bhadrachalam.

The river further swells after receiving tributary Kinnerasani River and exits into Andhra Pradesh.

The major tributaries of the river can be classified as the left bank tributaries which include the Purna, Pranhita, Indravati and Sabari River covering nearly 59.7% of the total catchment area of the basin and the right bank tributaries Pravara, Manjira, Manair together contributing 16.1% of

the basin.

Pranhita is the largest tributary covering about 34% of its drainage basin. Though the river proper flows only for 113 km (70 mi), by virtue of its extensive tributaries Wardha, Wainganga, Penganga, the sub-basin drains all of Vidharba region as well as the southern slopes of the Satpura Ranges. Indravati is the 2nd largest tributary, known as the "lifeline" of the Kalahandi, Nabarangapur of Odisha & Bastar district of Chhattisgarh. Due to their enormous sub-basins both Indravati and Pranhita are considered rivers in their own right. Manjira is the longest tributary and holds the Nizam Sagar reservoir. Purna is a prime river in the water scarce Marathwada region of Maharashtra.

1.3.1 Drainage Basin of River Godavari

With 312,812 km² of basin area covering 5 states, Godavari is one of the largest river basins in the Indian subcontinent, with only the Ganga and Indus rivers having a larger drainage basin. Following table gives sub basin areas in Percentage. The basin map of the River Godavari is given at **Figure 1.2**

Figure 1.2 Basin Map of River Godavari

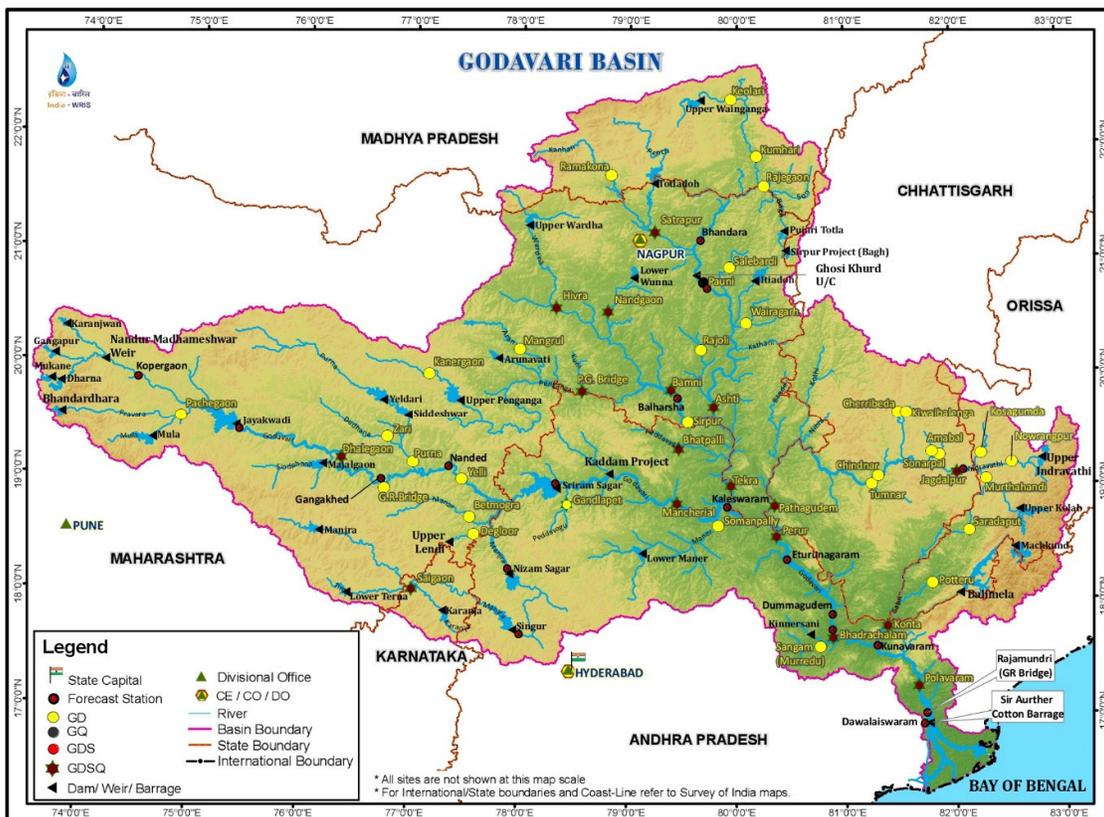


Table1.2 Major Tributaries & Basins of Godavari River

Tributary	Bank	Confluence Location	Confluence Elevation (Mts)	Length (Kms)	Sub-basin area (km ²)	% of Sub basin area
Pravara	Right	Pravara Sangam, <u>Nevasa, Ahmednagar, Maharashtra</u>	463	208	6,537	2.08%
Purna	Left	Jambulbet, <u>Parbhani, Marathwada, Maharashtra</u>	358	373	15,579	4.98%
Manjira	Right	Kandakurthi, Renjal, <u>Nizamabad, Telangana</u>	332	724	30,844	9.86%
Manair	Right	Arenda, <u>Manthani, Karimnagar, Telangana</u>	115	225	13,106	4.18%
Pranhita	Left	Kaleshwaram, <u>Mahadevpur, Karimnagar, Telangana</u>	99	113	1,09,078	34.87%
Indravati	Left	Somnoor Sangam, <u>Sironcha, Gadchiroli, Maharashtra</u>	82	535	41,655	12.98%
Sabari	Left	Kunawaram, <u>East Godavari, Andhra Pradesh</u>	25	418	20,427	6.53%
Upper , Middele and Lower basin of Godavari						24.2%

1.4 Brief description of Kaleshwaram Project

Keeping in view of huge potential of Godavari River, The Government of Telangana started Kaleswaram Project, which is now considered as irrigation wonder in the World.

- It is one of the largest irrigation and drinking water project taken up by Telangana. Along with new ayacut creation, it would also stabilize existing ayacut in the state.
- Total Potential for irrigation is 45 lakh acers per cropping season.
- The water stored by the construction of barrages at Medigadda, Annaram and Sundilla barrage and reservoirs is conveyed through a canal network to 13 district of the state.
- Apart from supplying water for irrigation, the project also caters
 - 30TMC of drinking water to Hyderabad and Secunderabad cities.
 - 10 TMC of water to en route villages and,
 - 16 TMC of water for industrial use.
- The project has been divided into 7 links and further 28 packages, each link conveying water from a source to a storage system and in turn to distributing system to irrigate agricultural fields.

The proposed Kaleshwaram Project envisages construction of three barrages between Yellampally & Medigadda viz.

- Medigadda Barrage on Godavari near Medigadda (Kaleshwaram),
- Annaram Barrage on Godavari downstream of confluence of Manair River with Godavari river near Annaram
- Sundilla Barrage on Godavari downstream of Yellampally barrage near Sundilla.

To utilize Godavari water by diverting about 180 TMC for Irrigation purpose (134.5TMC), stabilisation of existing command area (34.5 TMC), drinking water to Hyderabad (30 TMC), drinking water to en route villages (10 TMC) & for industrial uses (16 TMC).

The Total Cost of the project is estimated at Rs. 86000 Crores

The Location of proposed Kaleshwaram project starts near Kaleshwaram,

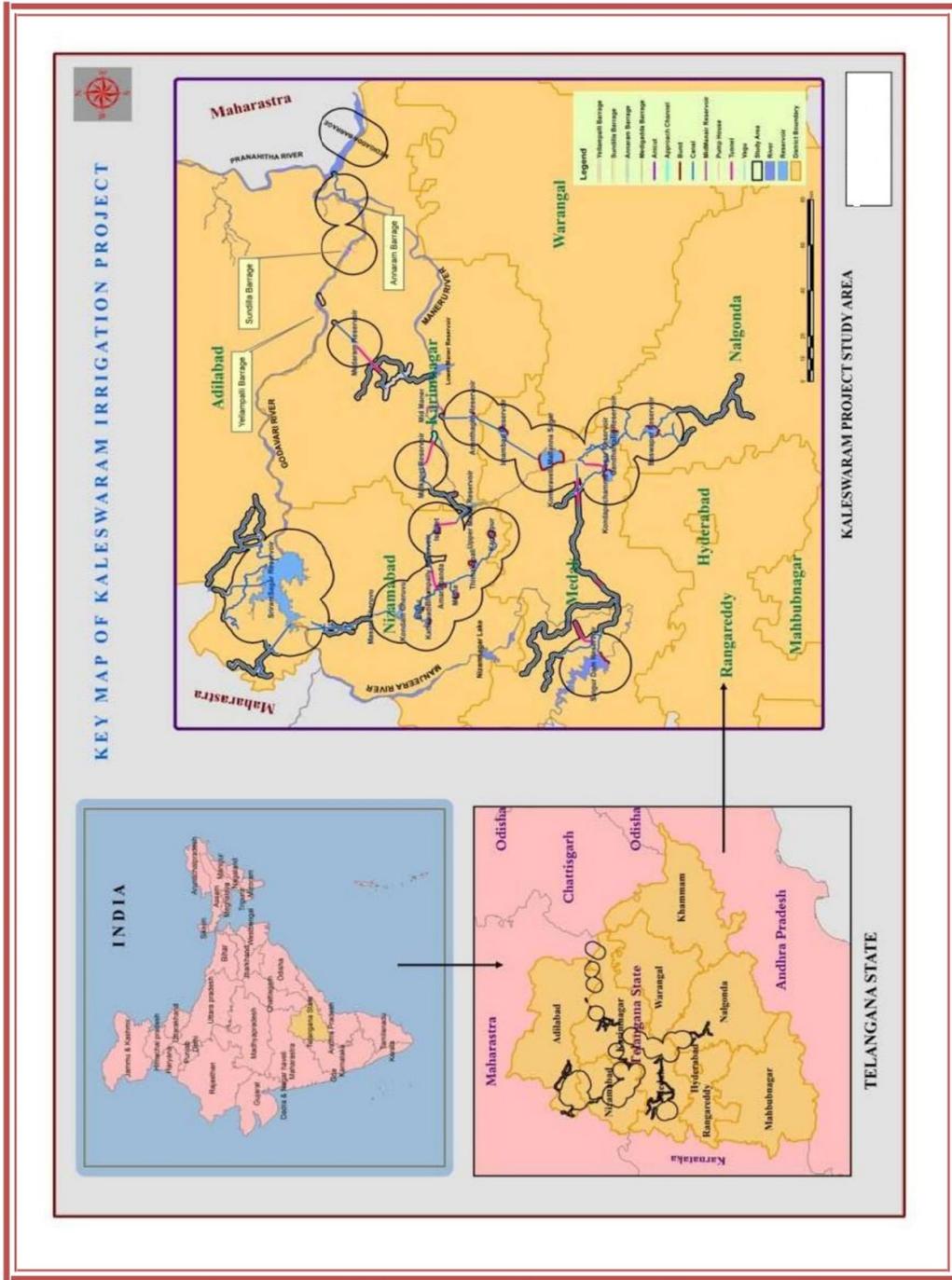
Medigadda village, Karimnagar District, Telangana State.

The Co-ordinates for three barrages are:

- Medigadda Barrage: 80°04'37" E Longitude and 18° 42' 48" N Latitude
- Annaram Barrage: 79°49'02" E Longitude and 18° 45' 37" N Latitude
- Sundilla Barrage: 79°36'43" E Longitude and 18° 47' 13" N Latitude

The location map is shown in **Figure 1.3**

Figure1.3: Key map of the Kalewaram Irrigation Project



1.5 About Annaram Barrage

As a part of Kaleshwaram Project, Annaram Barrage is built across River Godvari at Annaram (V), Mahadevpur (M) in Jaishankar Bhupalapally District at Geo Co-ordinates of 79049'02" E Longitude and 180 45' 37" N Latitude. The Capacity of Barrage is 11.9 tmcft. The total spillway gates are 68 numbers. The bed level of barrage is 107.0 Meters and the Pond level is 120 Meters.

The Barrage is completed in 2019 and pumping of Godavari water started. The photographs of the Barrage is give in **Figure 1.4**

Figure 1.4 Annaram Barrage View







CHAPTER 2

SILT LOADS AND NECESSITY OF DE-SILTING

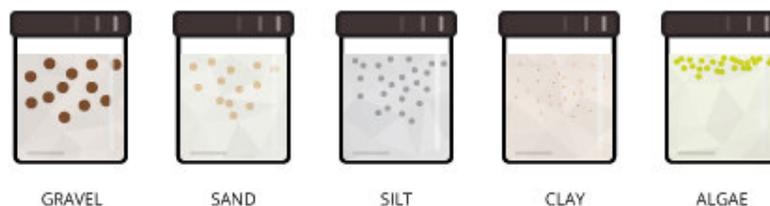
Erosion, movement and deposit of sediments is a natural process in rivers and Streams. However, factors such as heavy Rainfall, creation of irrigation structures, de-forestation of catchment areas and other man made interventions will increase the siltation of rivers.

Siltation will reduce the carrying capacity of the rivers and reduce the storage of reservoirs thus by result in reducing life of reservoirs as well as reduce the intended aims of their reservoirs for supply of water for various uses.

De-silting is removal of sand, silt and other sediments from rivers beds in order to restore its natural capacity. De-siltation is having potential to improve the hydualic performance of the rivers as well as water reservoirs created for their intended use. However, indiscriminate de-silting can cause adverse impacts on rivers ecology and flow

2.1 Sediments in River systems

Sediment refers to the conglomerate of materials, organic and inorganic, that can be carried away by water, wind or ice. While the term is often used to indicate soil-based, mineral matter (e.g. clay, silt and sand), decomposing organic substances and inorganic biogenic material are also considered sediment. Most mineral sediment comes from erosion and weathering, while organic sediment is typically detritus and decomposing material such as algae



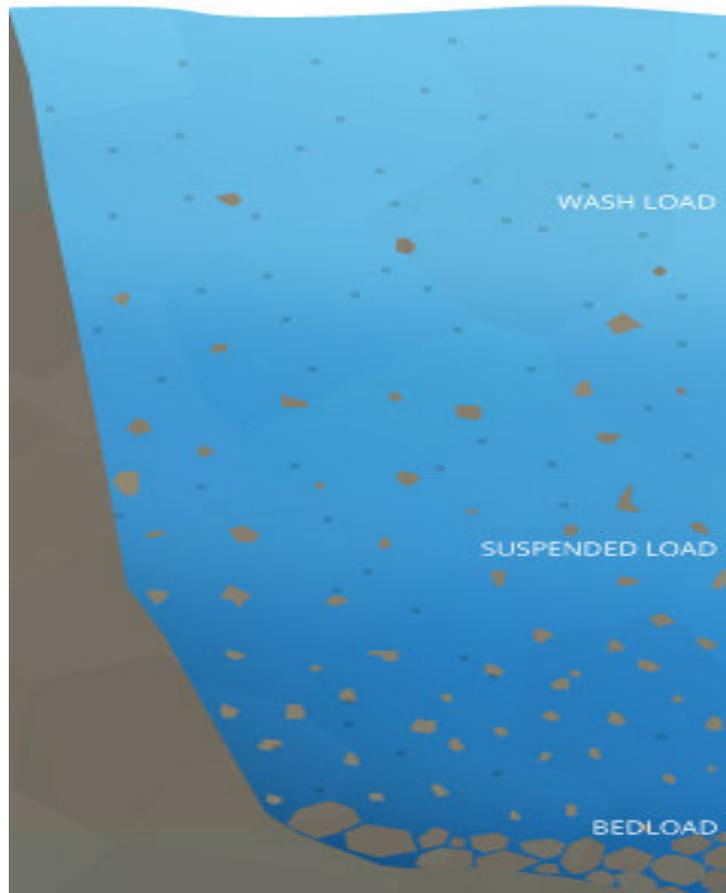
These particulates are typically small, with clay defined as particles less

than 0.00195 mm in diameter, and coarse sand reaching up only to 1.5 mm in diameter. However, during a flood or other high flow event, even large rocks can be classified as sediment as they are carried downstream. Sediment is a naturally occurring element in many bodies of water, though it can be influenced by anthropogenic factors.

Suspended or Bedded?

In an aquatic environment, sediment can either be suspended (floating in the water column) or bedded (settled on the bottom of a body of water). When both floating and settled particles are monitored, they are referred to as SABS: Suspended and Bedded Sediments

Figure 2.1 Suspended Sediment vs Suspended Solids



Fine sediment can be found in nearly any body of water, carried along by the water flow. When the sediment is floating within the water column it is considered suspended. In this application, the terms “suspended sediment” and “suspended solids” are nearly interchangeable. The main difference between the two is in the method of measurement

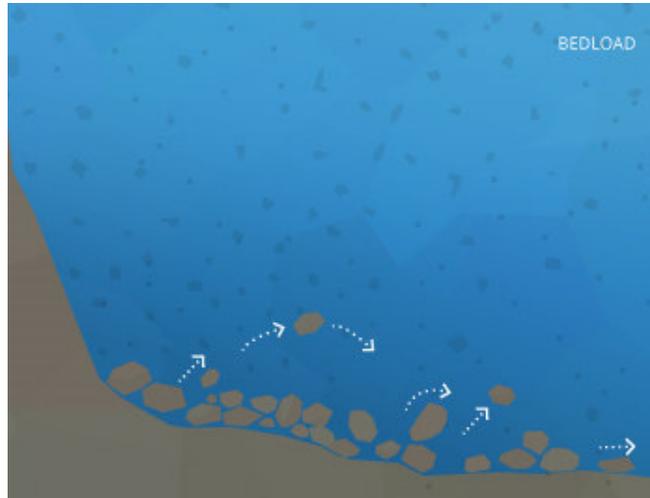
What is Sediment Transport?

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.

Figure2.2: Movement of Silt loads in Rivers



Figure 2.3: Bedload

Bedload particles travel with water flow by sliding or bouncing along the bottom.

Bedload is the portion of sediment transport that rolls, slides or bounces along the bottom of a waterway. This sediment is not truly suspended, as it sustains intermittent contact with the streambed, and the movement is neither uniform nor continuous. Bedload occurs when the force of the water flow is strong enough to overcome the weight and cohesion of the sediment. While the particles are pushed along, they typically do not move as fast as the water around them, as the flow rate is not great enough to fully suspend them. Bedload transport can occur during low flows (smaller particles) or at high flows (for larger particles). Approximately 5-20% of total sediment transport is bed load. In situations where the flow rate is strong enough, some of the smaller bedload particles can be pushed up into the water column and become suspended.

2.2 Sediments load of River Godavari

The average annual run-off and sediment load of River Godavari and other major rivers in India is given in the table below (table 2.1). On the global

scale, River Godavari ranks ninth in terms of sediment transport. 50% of total sediment load of all tropical Indian Rivers in the peninsula is contributed by River Godavari.

Table 2.1

Sediment Transport Load of Major Indian and World Rivers

Mean discharge and sediment transport of tropical Indian rivers and major world rivers						
River	Drainage Area Km ²		Annual runoff 10 ⁶ m ³		Sediment Transport Total	
Tropical Indian Rivers						
Godavari	313	147	92	245	170	000
Krishna	251	360	32	397	4	110
Cauvery	66	243	11	510	1	500
Mahanadi	88	320	54	510	30	700
Narmada	87	892	46	673	69	700
Tapti	49	136	9	713	24	700
Pennar	48	660	5	203	6	900
Brahmani	28	200	16	340	20	400
Mahi	25	501	10	817	9	700
Major World Rivers						
Ganges	750	000	493	000	329	000
Brahamaputra	580	000	510	000	597	000
Huangyeo	745	000	48	000	1080	000
Amazon	6300	000	5500	000	900	000
Yangtze	1950	000	1063	000	487	000
Irrawady	430	000	422	000	285	000
Magdalena	240	000	236	000	220	000
Mississippi	3267	000	580	000	210	000
Orinoco	950	000	946	000	210	000
Mekong	795	000	666	000	160	000

(Source: Paper on Erosion, Transport and deposition of Sediments by the tropical rivers of India by Shri P. Viswanathan, AL Ramanathan & V. Surbramanian)

2.3 Basin Geology and sediment contribution

The Rock formations in the drainage basin plays key role in controlling the sediment transport by a river. The typical rock formations in the peninsula are Granites and hard rocks, Deccan traps and sedimentary rocks. The Districition of rock types in the Godavari basin and their relative contribution to annual sediment loads is given in the table. Sedientry rocks in the Godavari basin contributes relatively large sediment loads because of their high degree of erodibility. The Deccan traps occupies nearly half of the basin area and contributes to same proportion of sediment. Below table

provides contribution of sediment loads by different rock types in Godavari Basin

Table 2.2

Contribution of Sediment loads by Individual Rock Types

Contribution to the total suspended sediment load by individual rock types in the Godavari basin			
Rock type	% of basin area	Annual sediment load (TS) (Tx10⁶)	% of T_s
Granite and hard rocks	39	27	16
Deccan traps	48	87	51
Sedimentary rocks	13	13	33
TOTAL	100	170	100

Source: Biksham & Subramanian

2.4 Grain size Distribution of Sediments in Peninsular Rivers

Below table presents grain size distribution sediments of River Godavari and other major Peninsular rivers.

Table 2.3

Grain size Distribution of Sediments loads of Peninsular Rivers

The contribution of individual size fraction to the total sediment load						
River	Coarse size fraction (>200 μm)		Medium size fraction (200-75 μm)		Fine size fraction (<75 μm)	
	Range	Mean	Range	Mean	Range	Mean
Godavari	2-60 (2-23)	23 (14)	3-70 (5-30)	33 (19)	39-191 (49-87)	114 (67)
Krishna	0.005-2.2 (2-14)	0.80 (10)	2-3.7 (9-23)	1.7 (22)	1.9-10.4 (63-89)	5.2 (68)
Cauvery	0.002-0.7 (9-37)	0.4 (21)	0.0001-0.5 (4-20)	0.2 (12)	0.2-2.7 (43-87)	1.1 (67)

Figures in Parenthesis indicates percentages
(Source: Paper on Erosion, Transport and deposition of Sediments by the tropical rivers of India by Shri P. Viswanathan, AL Ramanathan & V. Surbramanian)

CHAPTER 3

DESCRIPTION OF SAND STRETCHES

Based on the observations over the past 5 years and considering the accessibility, nine reaches are identified in the riverbed. The details of reaches identified in the Annaram Barrage are given below in the table. 3.1

Table 3.1 List of Sand Reaches in Annaram Barrage

S.No	Reach Name	Long Lats of Reach	Village	Mandal	District
1	Tallagadda 1	18 ⁰ 45' 43.25" 79 ⁰ 49' 26.1"	Annaram	Mahadevpur	Bhupalpally
2	Tallagadda 2	18 ⁰ 45' 16.26" 79 ⁰ 49' 26.29"	Tallagadda	Mahadevpur	Bhupalpally
3	Damerakunta 1	18 ⁰ 42' 22.62" 79 48' 51.12"	Damerakunta	Kataram	Bhupalpally
4	Damerakunta 2	18 ⁰ 41' 30.45" 79 ⁰ 49' 19.88"	Damerakunta	Kataram	Bhupalpally
5	Laxmipur	18 ⁰ 41' 33.77" 79 ⁰ 49' 18.5"	Laxmipur	Kataram	Bhupalpally
6	Vilasagar Block 1	18 ⁰ 40' 8.41" 79 ⁰ 50' 3.18"	Vilasagar	Kataram	Bhupalpally
7	Vilasagar Block 2	18 ⁰ 41' 4.69" 79 ⁰ 49' 40.01"	Vilasagar	Kataram	Bhupalpally
8	Mallaram 1	18 ⁰ 40' 56.76" 79 ⁰ 49' 14.55"	Mallaram	Manthani	Peddapally
9	Mallaram 2	18 ⁰ 40' 56.76" 79 ⁰ 49' 14.55"	Mallaram	Manthani	Peddapally

Following are details of stockyard proposed for sand near reaches.

Table 3.2: Details of Stock Yards

S.No	Sand Reach	Survey No's	Extent of Land	Village and Mandal	Type of Land
1	Thallagadda-I	3,13,19/A & 48/A, 18/15, 18, 18/6, 15/D,15/E,16/E, 16/F & 3/B, 18/5/2, 17, 18/4 & 19/4, 18/9	27.06	Thallagadda village, Mahadevapur Mandal	Patta Land
2	Thallagadda-II	25, 19/36, 24/2/1, 24/1, 22/2, 25, 25/3, 26, 27/1, 28/2	27.00	Thallagadda village, Mahadevapur Mandal	Patta Land
3	Laxmipur	537/C1, 537/C/2, 537/b, 537/D, 460, 501/A & 501/B, 533 & 534, 473 & 473/A, 490, 502 & 505, 471, 376, 476, 472, 382,	31.03	Laxmipur village Kataram Mandal	Patta Land
4	Vilasagar Block-I	908, 867, 935/A, 907, 1/15, 142/A, 271/A, 908, 1/39	30.25	Vilasagar village Kataram Mandal	Patta Land
5	Vilasagar Block-II	1/102, 1/1, 1/123, 1/151, 854/B, 1/125, 1/94, 907, 1/32, 1, 1/75, 1/92, 934	28.01	Vilasagar village Kataram Mandal	Patta Land
6	Mallaram-I	87/A1, 69/A, 87/A, 162A, 162/A, 165	16.04	Mallaram Village Manthani Mandal	Patta Land
7	Mallaram-II	88/A,77/B,79	8.29	Mallaram Village Manthani Mandal	Patta Land
8	Damerakunta	632 and 629	25.0	Damerakunta village Kataram Mandal	Govt Land

Figure3.1: The google map of the reaches identified



3.1 Key Features of the surroundings of reaches

Out of the 9 reaches identified, 2 reaches are falling in the village of Mallaram village, Manthani Mandal in Peddapalli District and 2 reaches in the village of Annaram and Thallagadda, Mahadevapur Mandal. Remaining 5 reaches are falling under Villages of Dhamerakunta, Laxmipur, Vilasagar of Kataram Mandal in Jaisankar Bhupalapalli District. 10 KM radius of the Annaram and barrage covering sand reaches is given in the topo sheet presented below at

Figure.3.2

Base maps of the study area are presented at **figure 3.3**

Digital elevation map of the District is presented at **figure 3.4**

Figure 3.2 Topo map of the Sand reaches

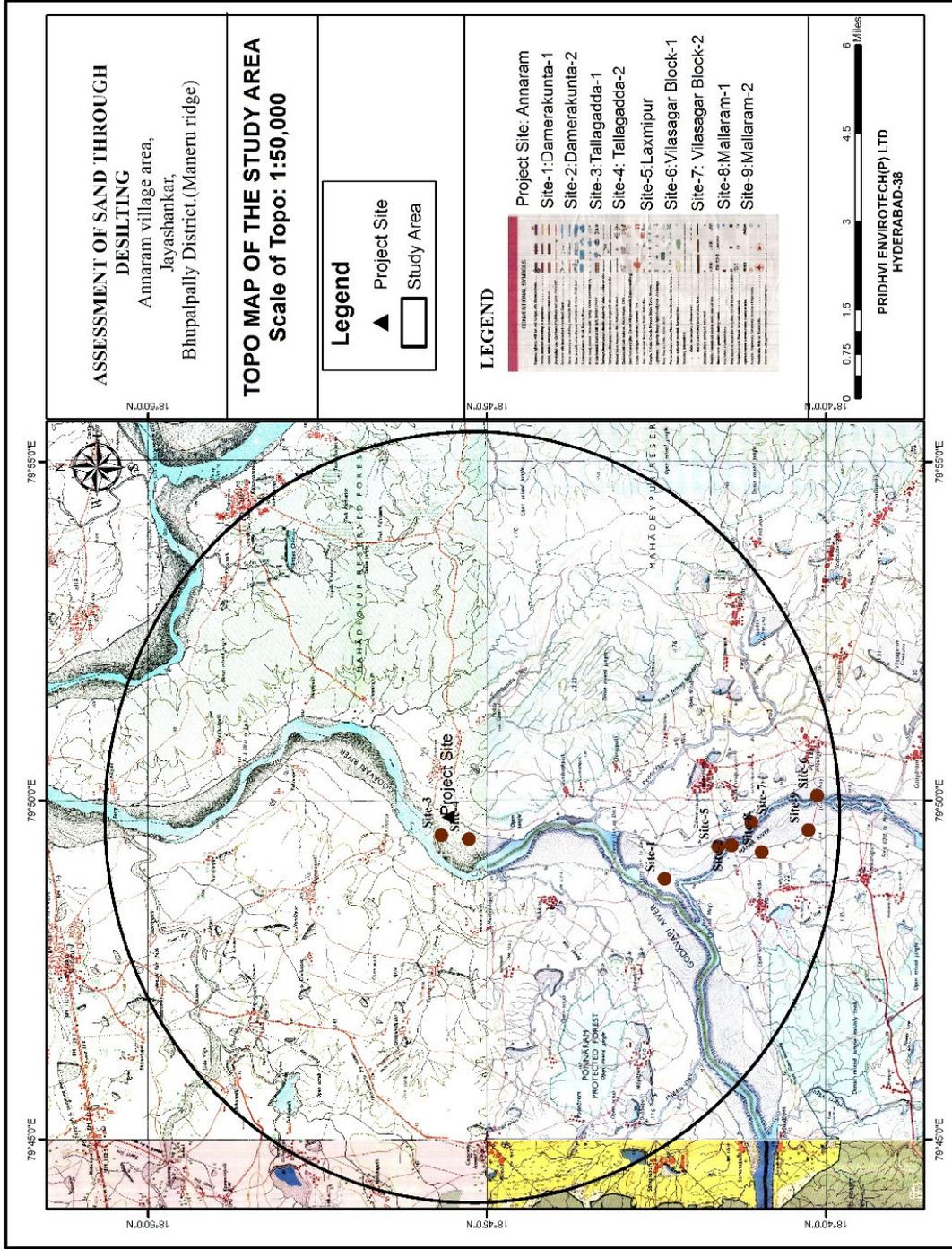


Figure 3.3 Base Map of the Sand reaches

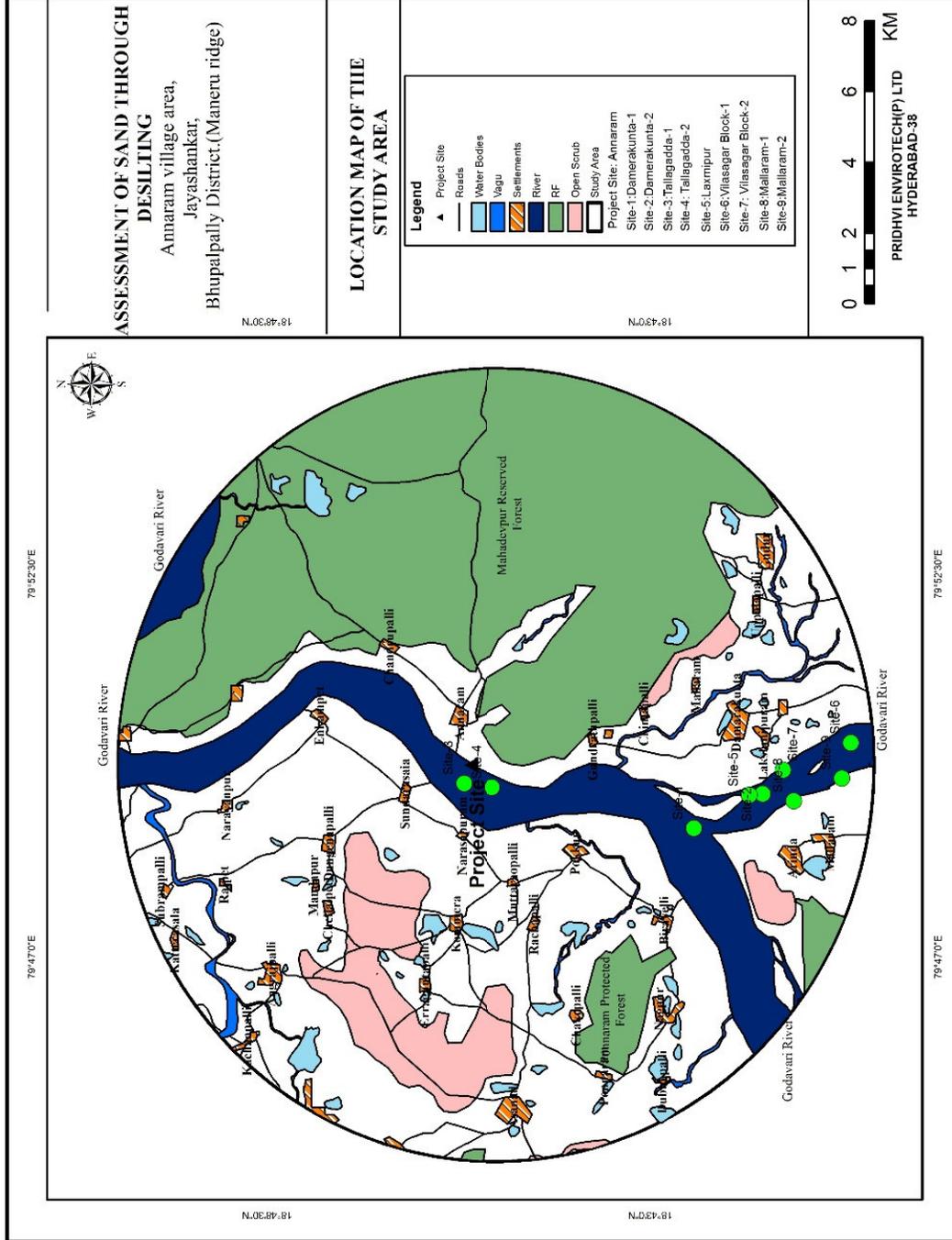
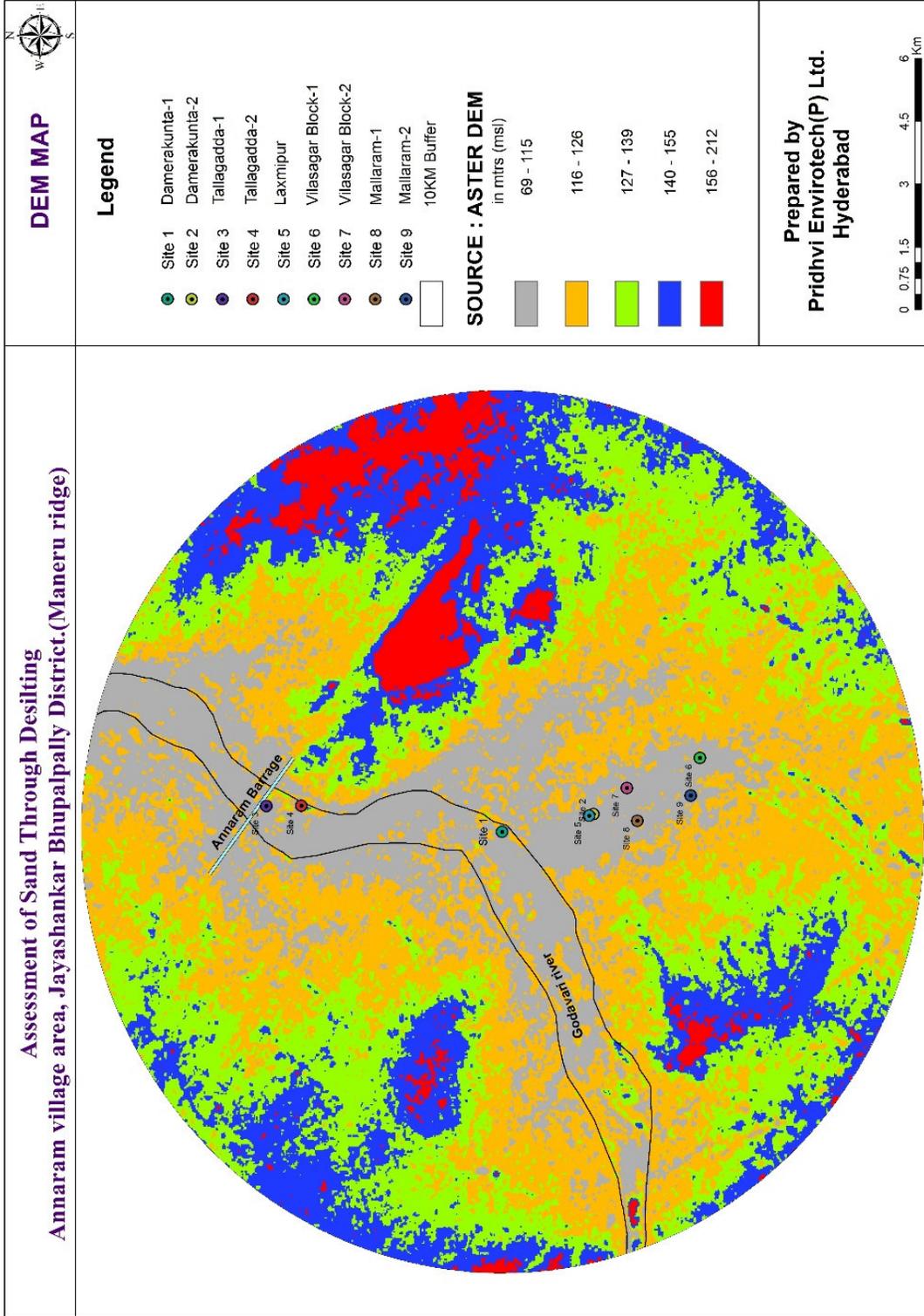


Figure: 3.4 Digital Elevation map



3.2 Environmental Setting of Annaram Barrage & Surroundings

The 10 KM radius of Barrage and surroundings fall under two Districts of Telangana ie. Peddapalli District and Jaisankar Bhupalapalli. They are covered under Manthani Mandal of Peddpalli District and Mahadevpur, Kataram Mandals of Jaisankar Bhupalapalli District. There are 16 villages in these mandals falling under 10 Km radius with total population 24,676.

There are no National Parks, Wild life sanctuaries and other eco sensitive zones in the area. The Following Reserve Forest areas are there within 10 KM radius of the study area.

Table 3.3 Reserve forests in the study area

S.No	Reserve Forest Name	Distance from the sand reach (Nearest)	Direction from the sand reach	Type of Forest
1	Manthini RF	4.2 km	SW	Dense Mixed Forest
2	Ponnaram Protected forest	3.85	West	Open mixed Forest
3	Mahadev pur	5.55	East	Open Mixed Forest

CHAPTER 4.0

ENVIRONMENTAL SETTING

4.1 DISTRICT PROFILE

4.1.1 Brief Description of District

Jayashankar Bhupalpally is one of 33 Districts in Telangana State. It is located in north latitudes 18°43'14" and east longitudes 79°86'05". The total area of the district is 5,524.0 sq.km. The district is surrounded by Peddapalle, Mahabubabad, Warangal Rural, Warangal Urban, Kothagudem districts and the states of Chhattisgarh and Maharashtra.

Jayashankar Bhupalpally (Acharya Jayashankar) District is carved out of erstwhile Warangal District with the annexation of some parts of Karimnagar and Khammam. The district is named after Telangana ideologue, Prof. K. Jayashankar.

The district is divided as 11 Mandals viz., Bhupalpally, Ghanpur (Mulug), Regonda, Mogullapally, Chityala, Tekumatla, Malharrao, Kataram, Mahadevpur, Palimela, and Mahamutharam. It has a total population of 10,99,560 as per 2011 census. The district has 5 towns and 279 villages in 323 gram panchayats.

Agriculture is the main occupation in rural parts of the district, with paddy, chilli, cotton and turmeric being the chief crops grown in the area. Devadula lift Irrigation and tanks constructed by Kakatiya rulers are the primary sources of irrigation. Industries like Singareni Collieries, Kakatiya Thermal power plant, and some small agriculture-based industries exists in the District. Jayashankar Bhupalpally is also well connected by road – NH 163 passes through the district.

Figure 4.1
Location Map of Jayashankar Bhupalpally

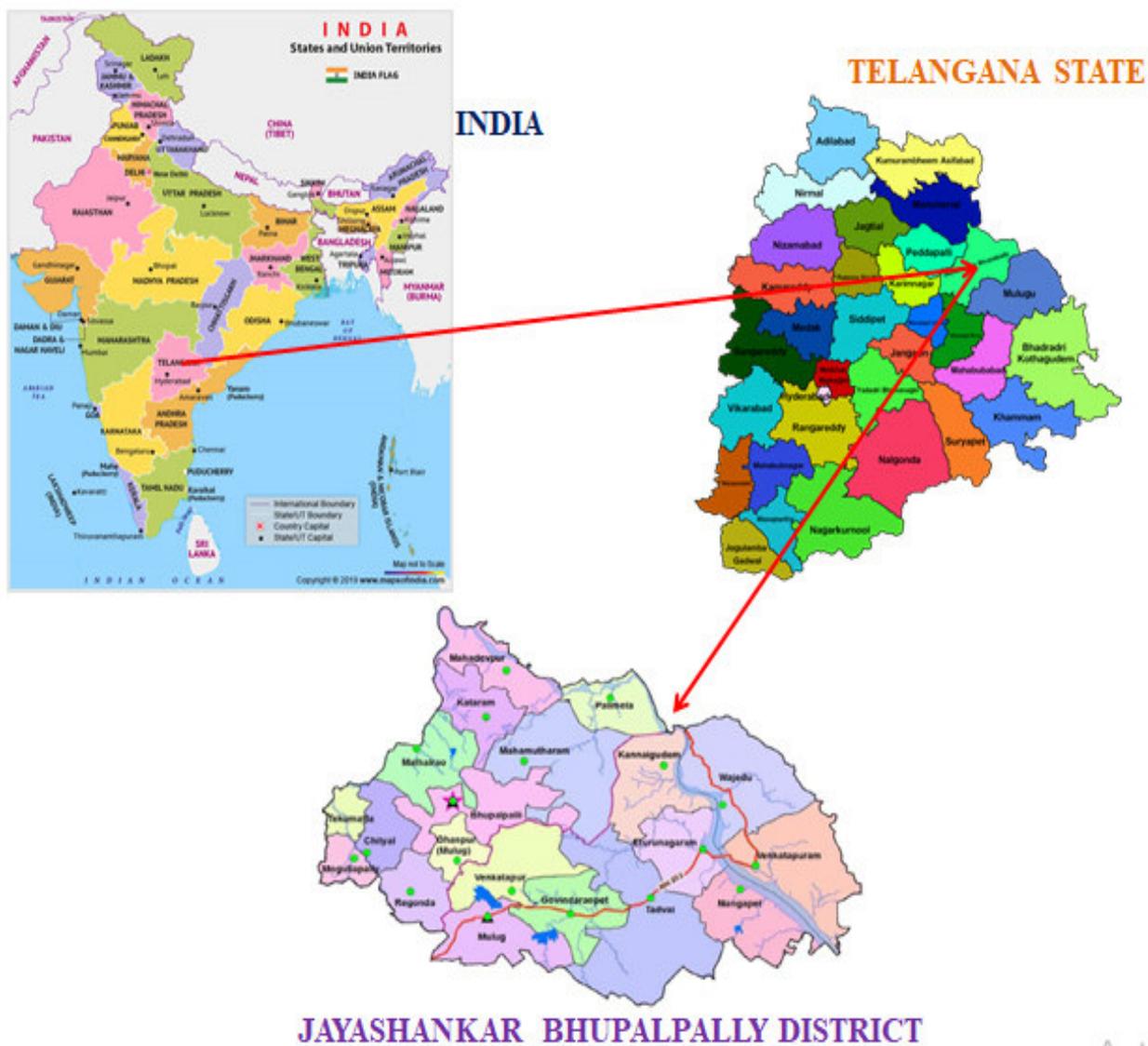
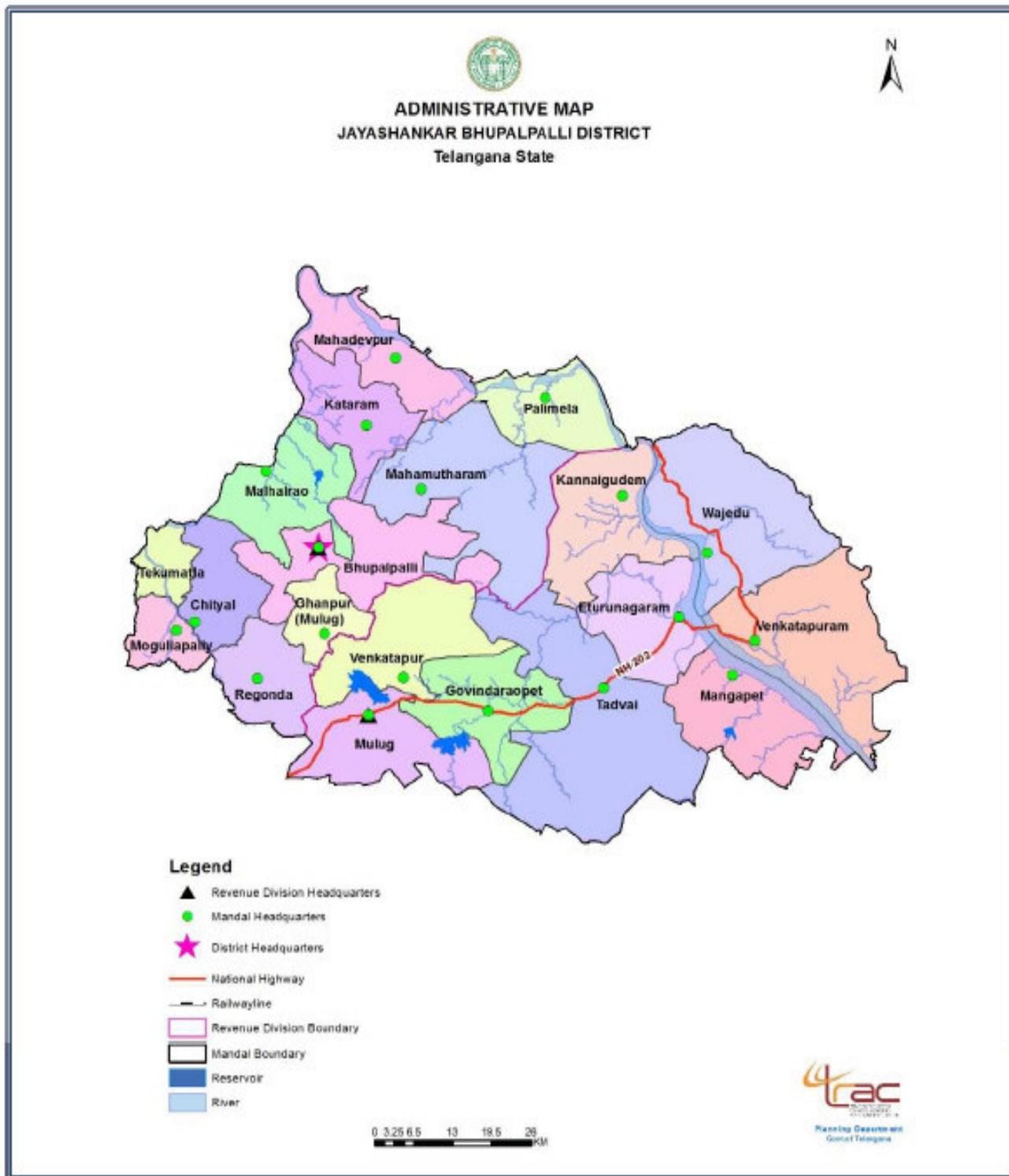


Figure 4.2 Jayashankar Bhupalpally District Map



4.1.2 Administrative setup

The district comprises 20 Mandals and 2 revenue divisions namely Bhupalpally and Mulugu and 550 villages.

Table 4.1 Jayashankar Bhupalpally Administration Setup

Geographical Area	5524 sq.km
Revenue villages	559 No's
Revenue Mandals	20 No's
Revenue Divisions	2 No's
Gram Panchayats	274 No's
Mandal Prja Parishads	17 No's
Municipalities	1 No's
Number of Assembly Constituencies	2 No's

4.1.3 Rail and Road Network

There is no railway network in this district. The road network of the entire district is 577 Km. State Highways is 33 Kms., Major District roads is 229 Kms. and Rural roads is 316 Kms of total road network of the district. **Road network map of Jayashankar Bhupalpally is given in Figure**

NH163 – Hyderabad – Bhopalapatnam (Chhattisgarh) – Connecting two states

NH63 – Nizamabad – Jagdalpur (Chhattisgarh) – Connecting two states

4.1.4 Tourism and Recreation

Many pilgrim centers and historical places adorn the district like the Kaleshwaram temple, Kaleshwara Mukteswara Swamy temple located at Mahadevpur Mandal. Hemachala Lakshmi Narsimha Swamy temple is located in Malluru ghat of Mangapet mandal.

Ramappa Temple located in Palampet of Venkatapuram mandal, is a marvellous example of the creative genius of the Kakatiyas.

Bhupalpally district is also known for its beautiful waterfalls and other scenic spots. Bogatha falls is one of the tourist attractions, surrounded by dense forest, hills, streams and tribal hamlets. It is located in Koyaveerapuram village in Wajedu mandal. Bogatha Waterfalls is also known as Telangana's Niagara, and is considered to be the second largest waterfall in the State. Gaddalasari waterfall is also a nearby tourist attraction.

Further, the district also have famous lakes that are big tourist attractions- the Ramappa Lake and the Laknavaram Lake. Ramappa Lake, constructed in 13th Century A.D. during Ganapathi Deva's time substantiates the intricate irrigation work of the Kakatiyas. And the Laknavaram Lake, surrounded by deciduous forest, is a very popular tourist spot.

4.2 Forest Resources and Eco sensitive zones in the District

Frests occupy 2,72,224 Ha. (49.28%) of total Geographical area of the District

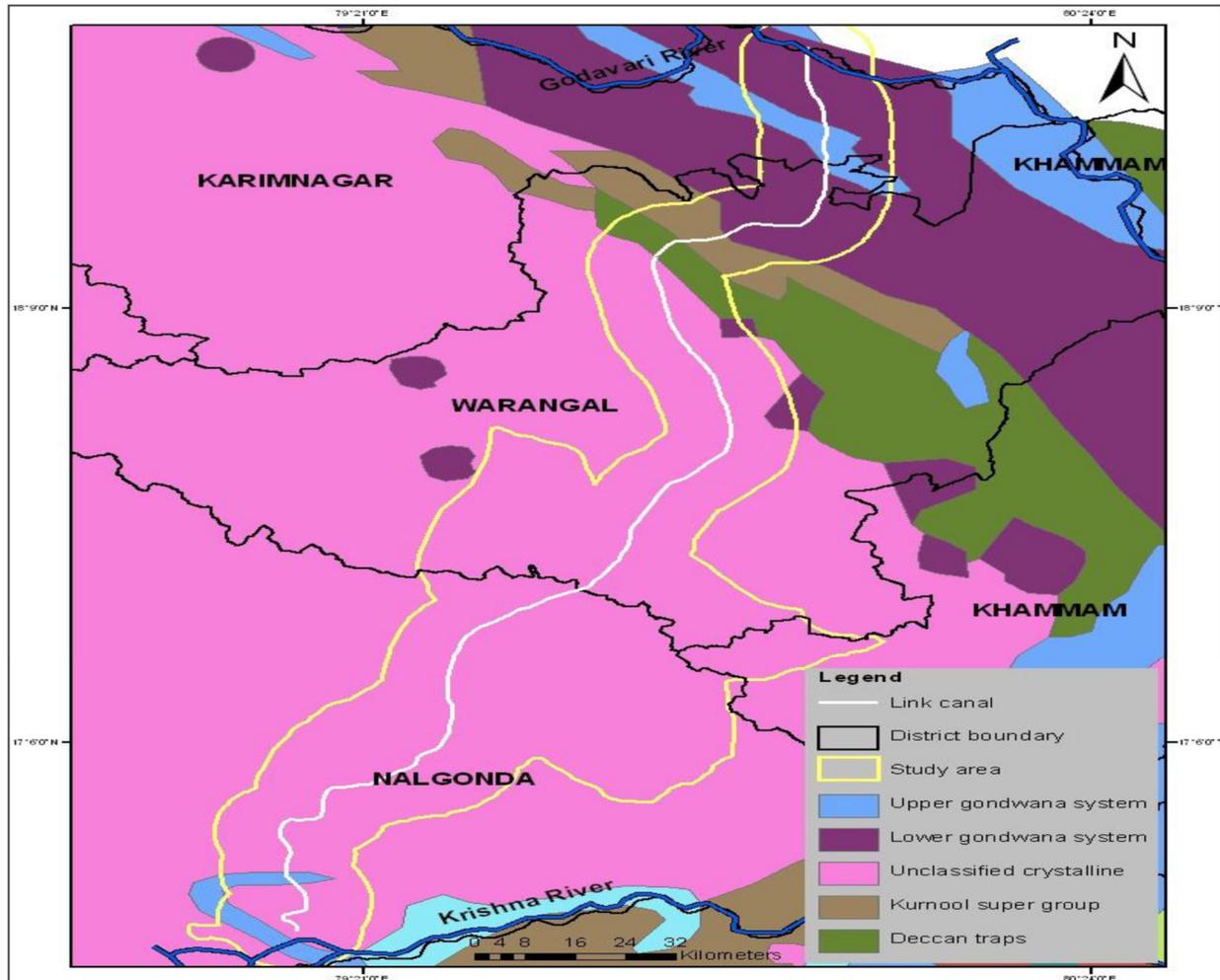
There are no National Parks, Wild life sanctuaries and other eco sensitive zones in this area.

4.3 Geology of the District

The oldest formations are represented by Archaean rocks, which include a) Older Metamorphics comprising banded magnetite quartzite, hornblende schist, chlorite schist and amphibolites and b) Peninsular Gneissic Complex comprising granite-biotite gneiss, grey granodiorite, porphyritic granite and intruded by dolerite, dolerite porphyry and aplite veins. These are seen up to Pakhal and Mulug from where the sediments of the Pakhal Supergroup, viz. Conglomerate, dolomite, arkose, quartzites and shales occur and are followed by Gondwana Supergroup of rocks, which form the easternmost portion of the district.

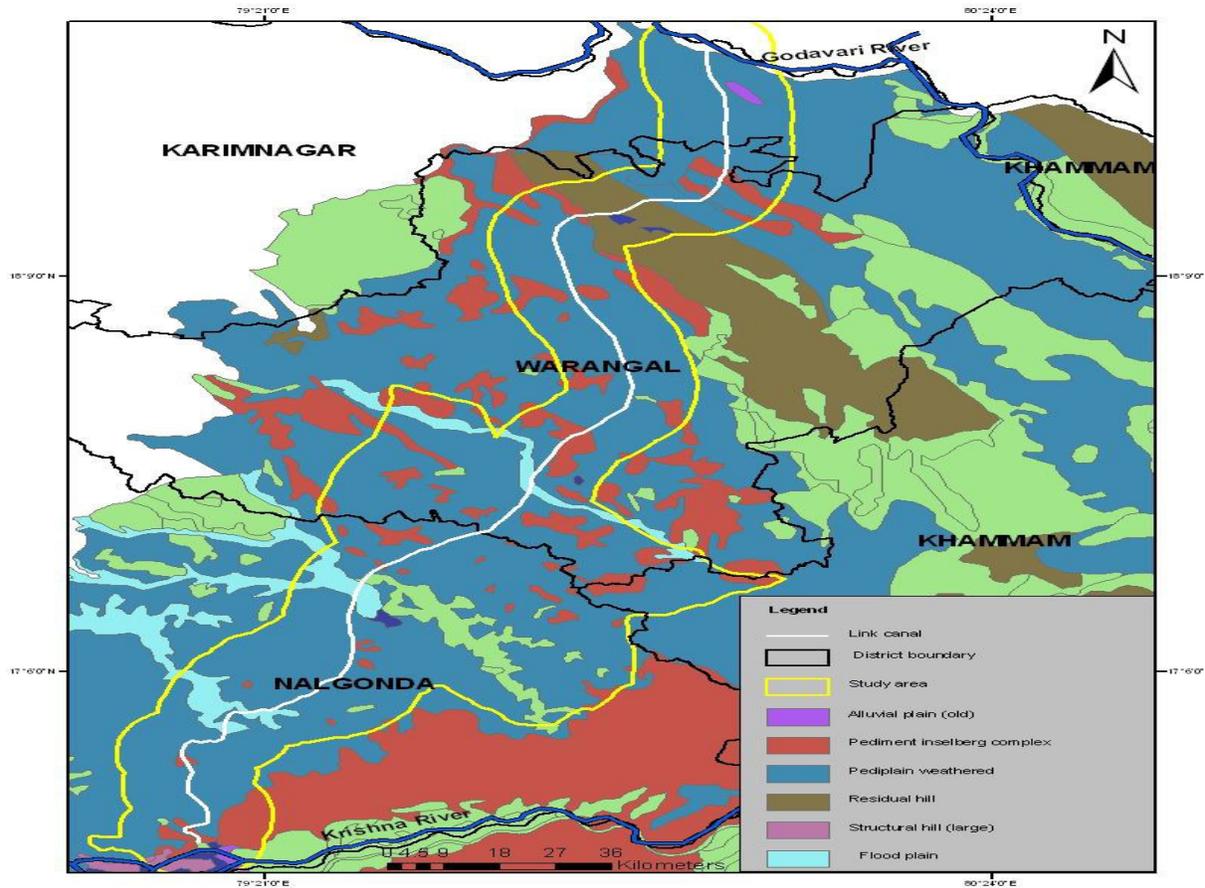
The Sullavai Sandstone lies between the Pakhal and the Gondwanas. The middle to upper Proterozoic period is marked by the deposition of Pakhal Supergroup and Penganga Group of rocks. The former includes a) Mallampalle Group comprising Bollapalli Conglomerates and Gunjeda Dolomite and b) Mulug Group comprising Jakaram Arkose, Pattipalli Quartzite and Lakhavaram Shale while the latter includes Sullavai Sandstone. The Gondwana Supergroup of rocks of this area include a) Talchir Formation with boulder comprising sandstone with coal seams c) Barren Measure Formation with ferruginous sandstone e) Maleri Formation with red clays and calcareous sandstone and f) Kota Formation with sandstone and fossiliferous limestone.

The important minerals occurring in this district are coal, iron ore and stowing sand, in addition to other minerals like dolomite, laterite, and commercial grades of granite, road metal, gravel, morum, ordinary earth, and sand.

Figure 4.4 Regional Geology Map of the Godavari Basin in Telangana

4.3.1 GEOMORPHOLOGY

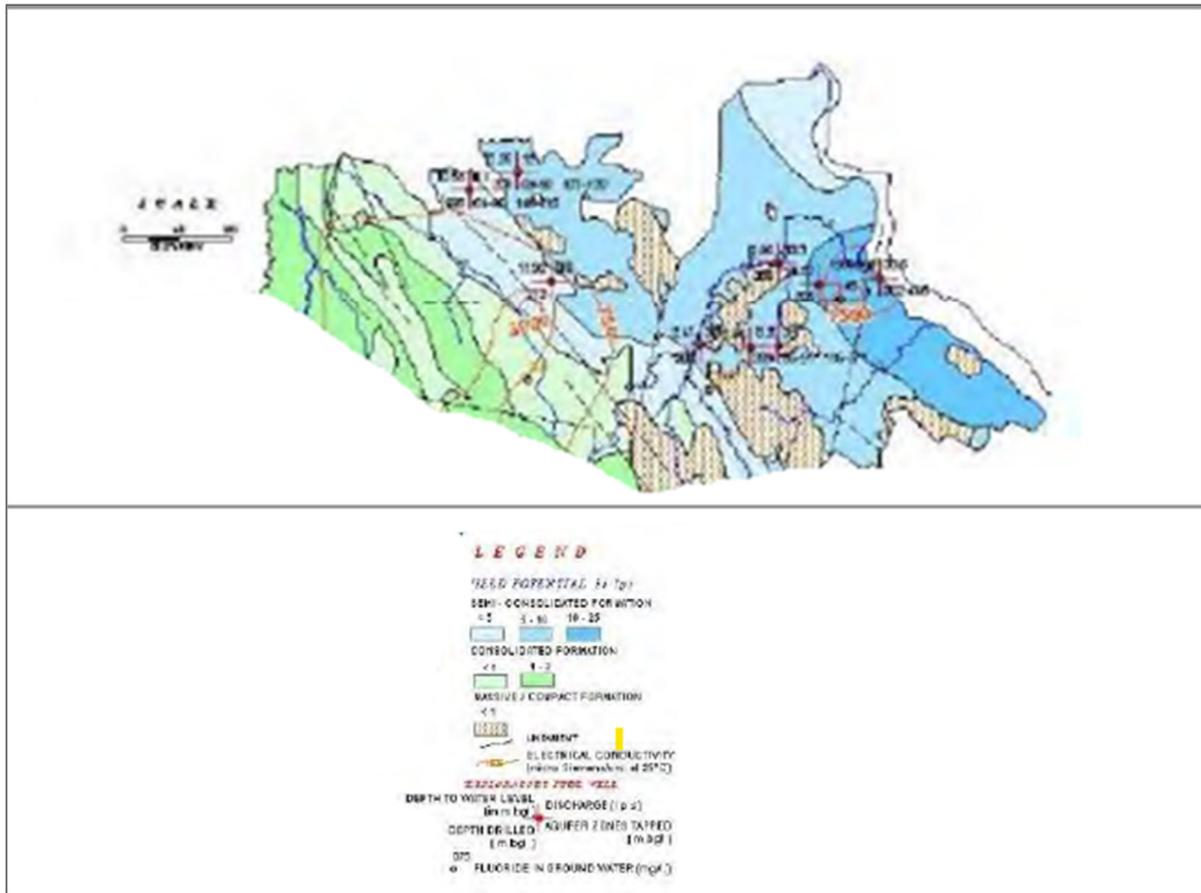
The district is distinguished by the pediment-inselberg complex with gently undulating plain abounding with a number of small hills, mounds, tors, dykes, etc, and with the fluvial alluvial deposits along the Godavari River and its stream courses (Figure). The area in generally constitute matured, dissected, undulating and rolling topography with erosional landscape covered by a layer of brown loamy soil of varied thickness. The in the district with its relief areas and river courses range from 90 - 350 m above mean sea level (amsl).

Figure 4.5 Regional Geomorphology of the Area

4.3.2 HYDROGEOLOGY

The depth to water levels range from 2.71 meters bgl to 20 m.bgl. The shallow water level of <5 m is observed as isolated patches in the district. The deeper water levels of more than 20 m bgl are observed in north-western part of the district. In rest of the area it varies from 5 to 20 m bgl. Majority of the area shows water level range of 5 to 10 m bgl. The nature of occurrence and behaviour of ground water in different water bearing formations are as follows.

**Figure 4.6 Hydrogeology Map of Jayashankar Bhupalpally District
(Forming part of erstwhile Warangal District)**



4.4 Rivers and Streams and Drainage of the District

The major Godavari River Basin, as well its tributary Manneru River coursing along the northern boundary of the district, and joining the Godavari River near Nagapuram. The area is locally characterized by dendritic drainage, with a gentle slope towards Major River and stream courses, and water bodies. Drainage map and Watershed map is given in **Figure 4.7**

Figure 4.7 Drainage Map

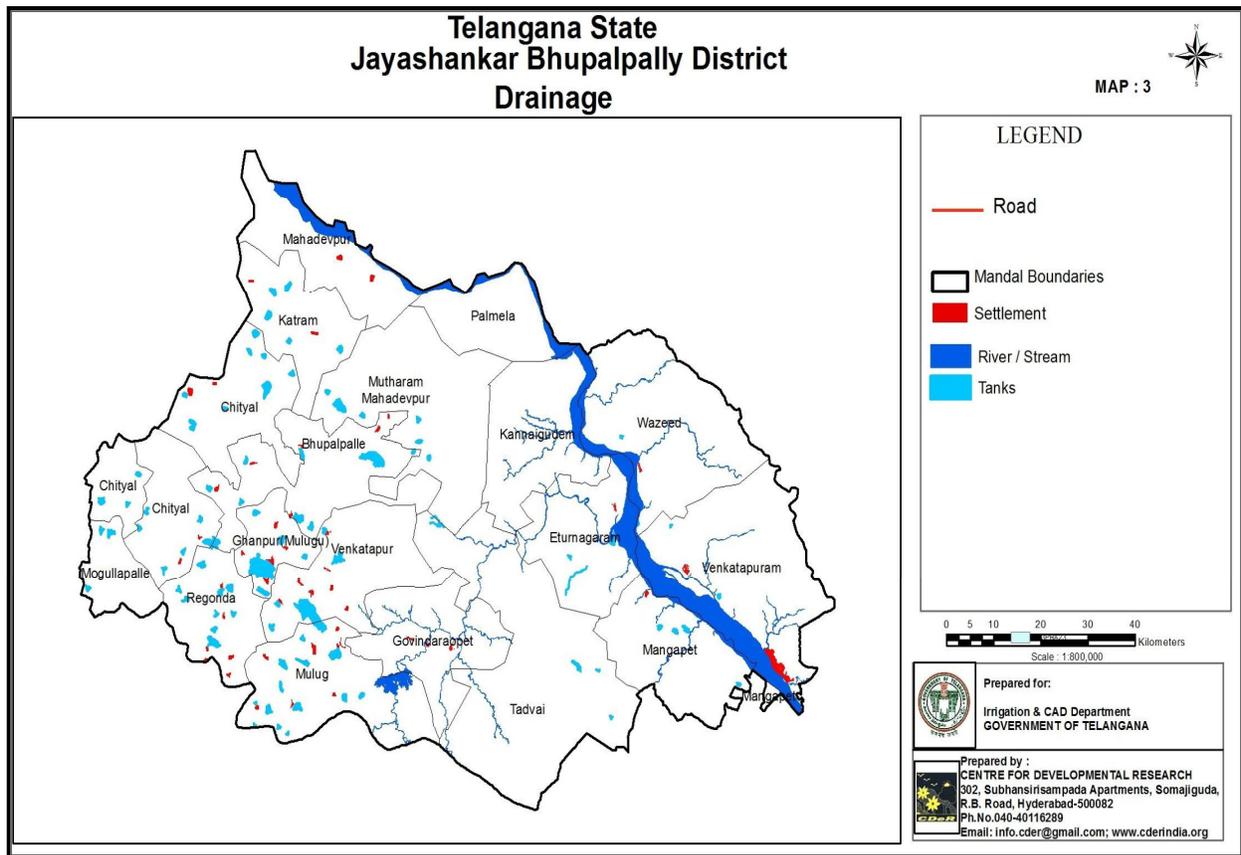
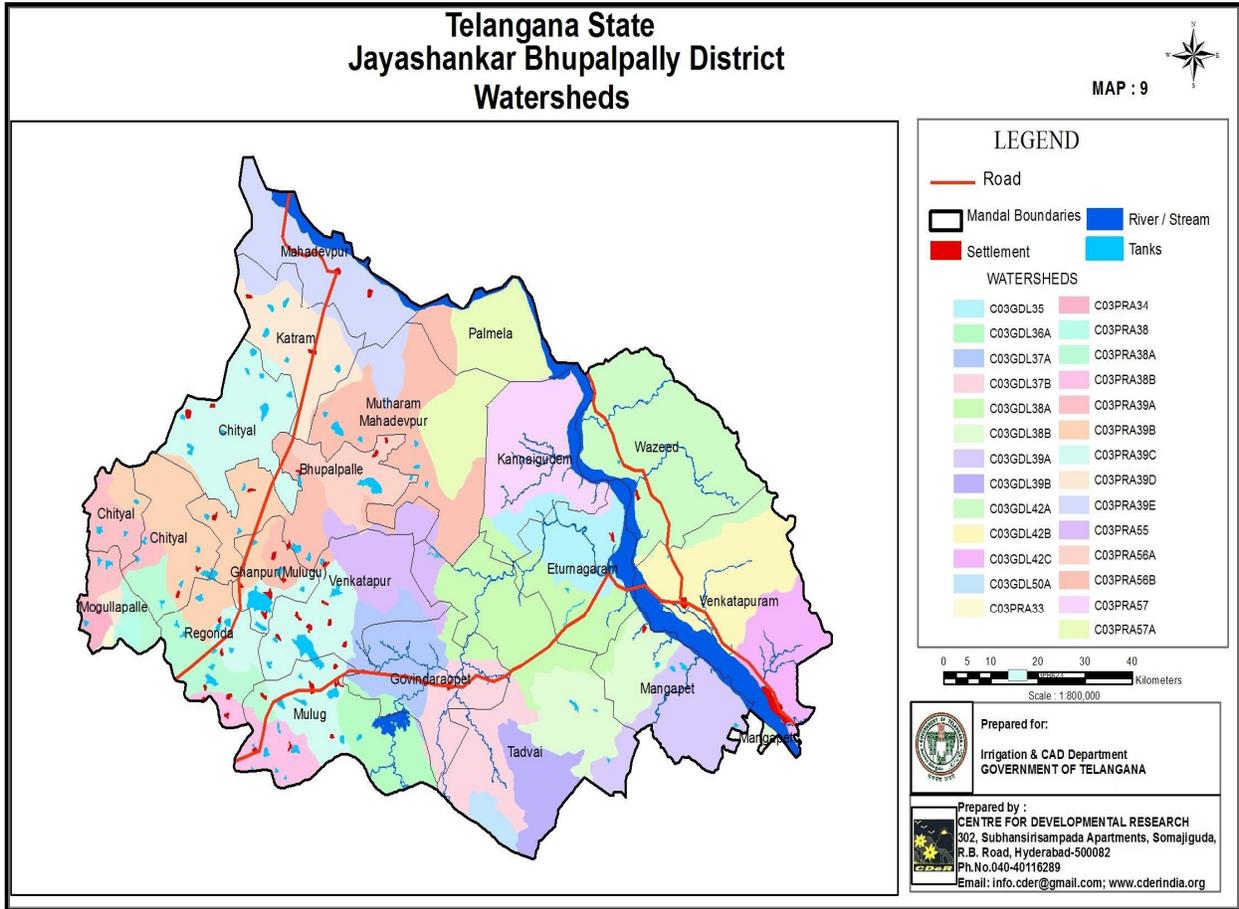


Figure 4.8 Watershed Map



4.5 Water Resources of the District

The total water Demand estimate of the District is 2491 Million Cubic Meters. Below table 4.2 gives overall water demand from various sectors in 2020

Table 4.2 Total water Demand of the district

S.No	Sector	Total Water Demand in Million Cubic Meters
1	Crop Water	30.5
2	Domestic	2267.61
3	Live Stock	9.60
4	Industries	78.51
5	Power	105.95
Total water demand		2491.71

The total water demand is proposed to be met from existing major, Medium and Minor irrigation sources and ground water potential of the District

4.5.1 Surface water resources

Godavari River which is tributary of Munneru is major River that flows in Jayashankar Bhupalpally District.

Major Irrigation Projects

Distict is irrigated with Sri Ram Sagar Project canal with an ayacut of 33,500 Hectares and Annaram Barrage.

There are five medium irrigation projects in the district, which are Laknavaram Lake, Ramappa Lake, Malluruvagu, Boguula Vagu, Gundla Vagu Projects with

an ayacut of 10,103 Hectares.

Minor Irrigation Projects

There are 2075 Minor Irrigation Projects with an ayacut of 52,377 Hectares and 12 Lift Irrigation schemes with an ayacut of 2241 Hectares.

Table showing area cultivated under different irrigation facilities in the District is given below.

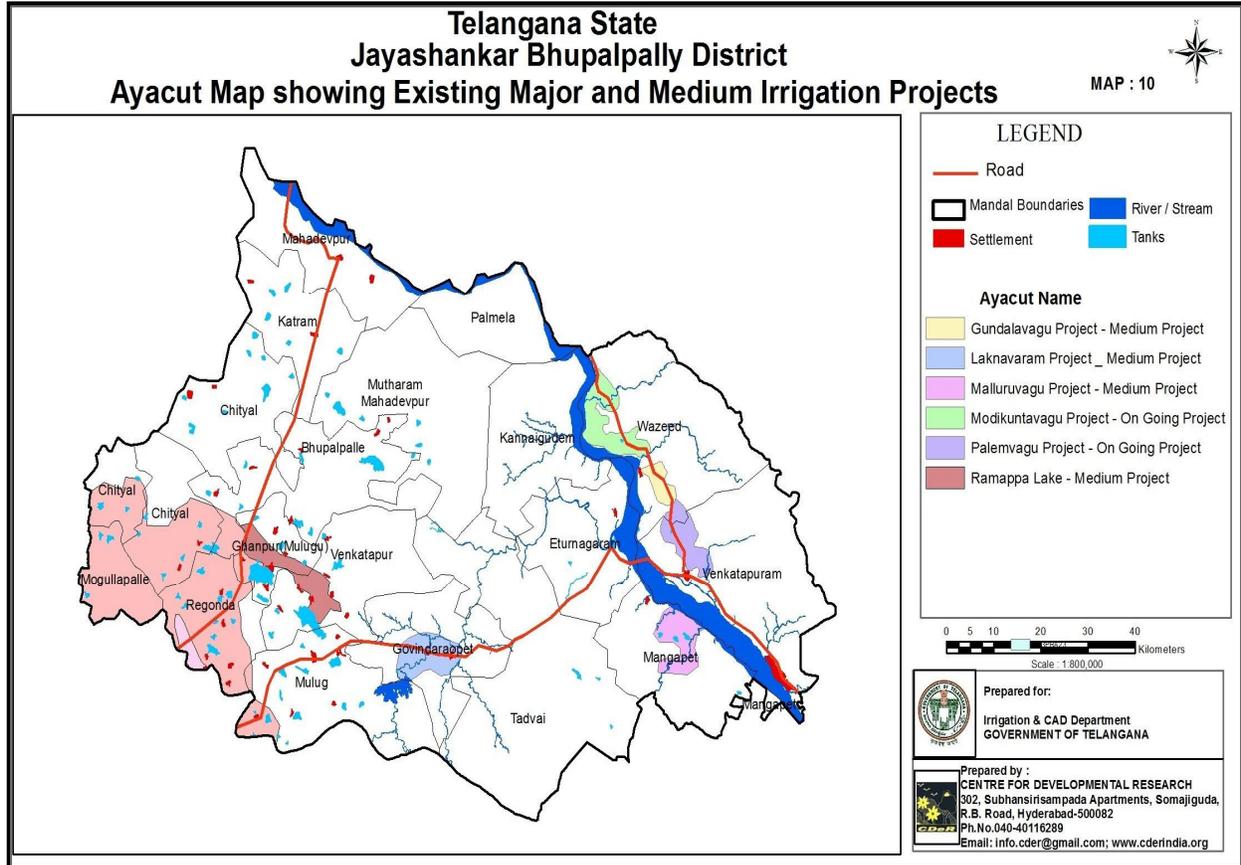
Table 4.3 Surface Water Availability in Bhupalpally District

S.no	Projects/Schemes	Nos	Ayacut in Ha.			Storage in MCM		
			IPC	IPU	Gap Ayacut	Created	Present Existing	Storage Gap
I	Major Irrigation Projects							
1	SRSP Stage I	1	33500	33500	0	449.56	449.56	-
2	Kaleshwaram Project	1	18211	18211	0	337.0	337.0	
II	Medium Irrigation Projects							
1	Laknavaram Lake	1	3522	3522		47.26	47.26	-
2	Ramappa Lake	1	2085	2085		27.98	27.98	-
	Malluruvagu	1	3036	3036		40.74	40.74	-
3	Gundlavagu Project	1	1045	-	1045	14.02	-	14.02
4	Boggula Vagu	1	2085	1460	625	27.98	27.98	19.59
III	Minor Irrigation Schemes	2075	52377	29926	22451	702.88	393.81	309.07
IV	TSIDC LI Schemes	12	2241	1074	1167	30.07	16.68	4.21
	Total		118102	92814	25288	1677.49	1332.62	344.87

Below map shows the major and minor irrigation projects in the District

Figure 4.9 Map Showing Major and Minor Irrigation Projects in Jayashankar Bhupalpally District

Figure 4.9 Ayacut map of Jayashankar Bhupalapally District



4.5.2 Ground Water Resources

The newly formed Jayashankar Bhupalpally district was formed taking parts of the erstwhile districts of Warangal, Khammam and Karimnagar districts. Central Ground Water Board (CGWB) in coordination with the Telangana State Ground Water Department (TSGWD) carried out ground water assessment for the year 2016-17, mainly based on the norms proposed by the Ground Water Estimation Committee (GEC-97). Based on the stage of ground water development and water level trends, the ground water assessment units (mandals) are categorized as described below. Overall, the newly formed district falls under safe category, with few exceptions. The assessment results indicate Kataram mandal as overexploited with the stage of ground water development 110%. Bhupalpally, Ghanapur (Mulug), Mogullapally, Regonda and Venkatapuram mandals form semi-critical areas with the stage of ground water extraction in the range of 71 to 82 %. The ground water resource details are given in **Table 4.4**

Table 4.4 Assessment of Mandal-wise Dynamic Ground Water Resources, Jayashankar Bhupalpally District, Telangana, Year of Study 2016-17. (Ground water Resources in Ha.m.)

Sl. No	Assessment Unit / Mandal Name	Current Annual Ground Water			Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use (18=12-13-14-17)	Stage of Ground Water Extraction (%) (19=(16/12)*	Categorization (OE / Critical/ Semicritical /Safe)
		Irrigation Use	Industrial Use	Domestic & Industrial Use				
Sl. No		13	14	15	17	18	19	20
1	Bhupalpally	2264		66	263	743	71	Semi-Critical
2	Chityal	1789		155	160	1119	63	Safe
3	Eturnagaram	2015		38	111	3049	40	Safe
4	Ghanapur Mulug	603		52	75	125	82	Semi-Critical
5	Govindaraopet	940		90	135	2098	32	Safe
6	Kannaigudem*	709		62	62	3400	18	Safe
7	Kataram	2422		75	134	0	110	Over Exploited
8	Mahadevpur	1481		94	122	1158	57	Safe
9	Malharao Tadicherla	1496		138	138	1454	53	Safe
10	Mangapet	2358		86	204	1265	64	Safe
11	Mogullapally	2150		66	188	683	73	Semi-Critical
12	Mulug	2049		284	284	2588	47	Safe
13	Mutaram mahadevpur	885		148	148	2916	26	Safe
14	Palimela	543		68	68	348	64	Safe
15	Regonda	1562		155	208	466	77	Semi-Critical
16	Tadvai	1541		110	110	3258	34	Safe
17	Takumatla	1436		50	122	854	62	Safe
18	Venkatapur	305		72	77	323	53	Safe
19	Venkatapuram	1313		99	110	510	73	Semi-Critical
20	Wazeed	1217		106	106	1060	56	Safe

4.6 Soil and Crops of the District

4.6.1. Soil

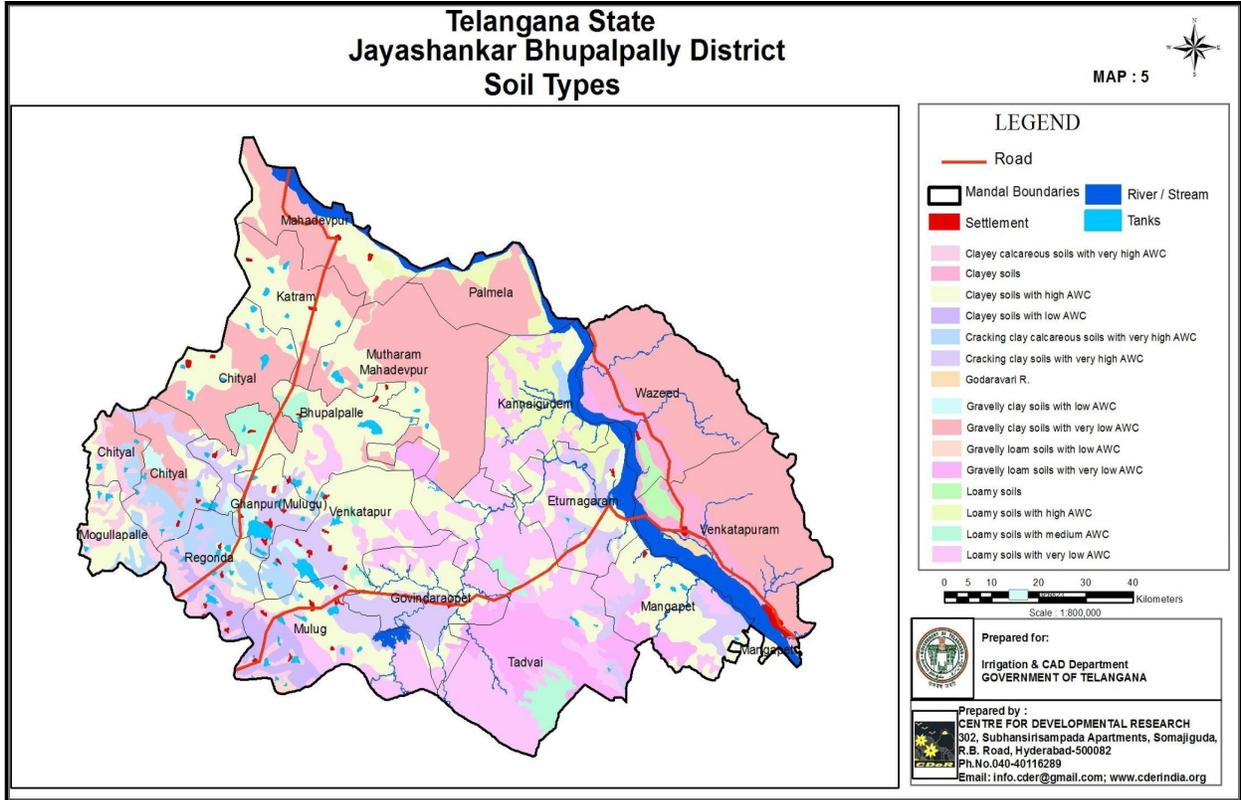
Soil Profile

The soils of the district mainly comprise of sandy loams with patches of shallow black cotton soils and at places even medium black cotton soils. The soils are moderately shallow with depth varying from 55 cms to 125 cms. The soil profile varies from sandy clay loams to clay loams in surface horizon and sandy clay loams to clay loams to clay in sub-surface horizon.

Soil Classification

The soils in the district can be divided into red soils, black soils, loams and sandy loams, Red soils occupy about 55% of the district; black soils about 22% and loams about 14%. The soils are rich in Potash and deficient in nitrogen and phosphorus. In terms of micronutrient status, the soils are deficient in zinc.

Figure 4.10 Map Showing Types of soils in Jayashankar Bhupalpally District



4.6.2. Crops

The main crop in the district is Paddy in kharif and Rabi season. The other cereal crops grown are jowar, maize, and other minor millets are grown

Table 4.4 Season –wise Cropping Pattern (Year: 2013-14)

S No.	Crop	Kharif (Ha)	Rabi (Ha)
1	Cereals	62937	17840
2	Coarse Cereals	2890	4621
3	Pulses	1417	3180
4	Oilseed	207	1688
5	Fiber	60981	175
6	Others	17113	5062
Total		145545	32566

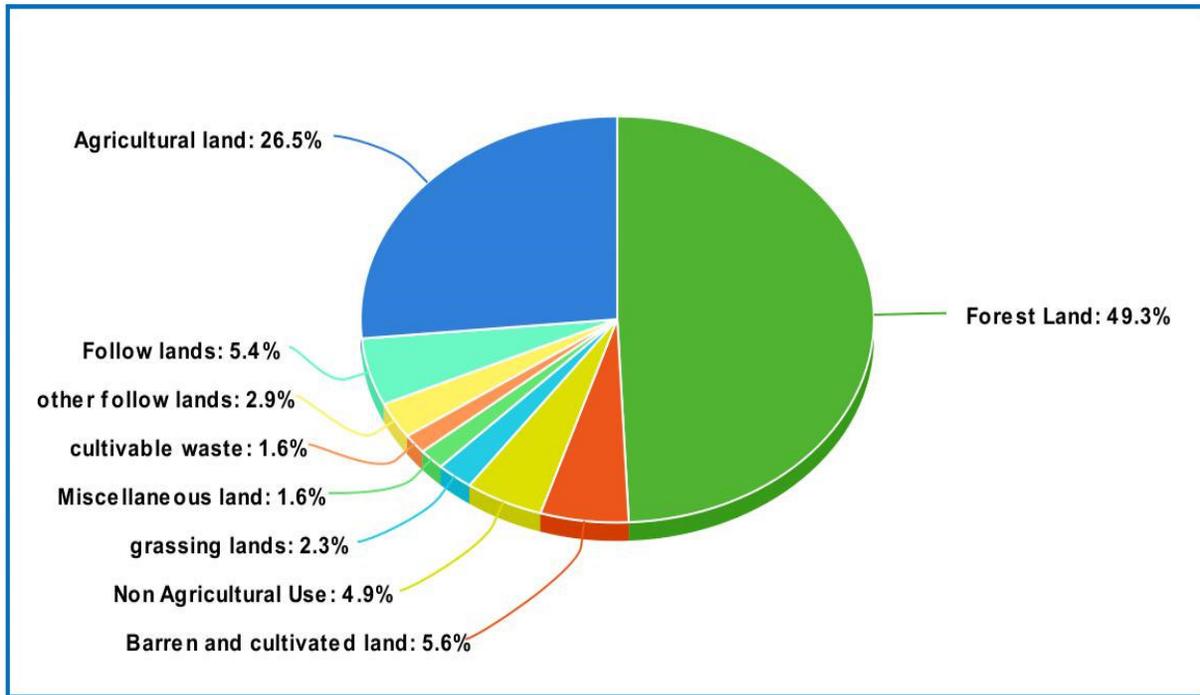
CHAPTER 5.0**Environmental Base Line****5.1 Land Use and Land cover**

The district has a total geographical area of 5,52,388 Ha. (5,524 sq.km.) of which forests occupy 2,72,224 Ha. (49.28%) total land other than cultivation is 3,30,182 Ha. and the total land available for cultivation 2,22,207 Ha. i.e., the area under ultimate irrigation potential/cultivable area in the district. Out of this ultimate irrigation potential / cultivable area, the area under assured irrigation is 99,891 ha and the area under rain fed cultivation is 1,22,316 Ha. Land Use and land cover pattern of the district is given in **Table -5.1**

Table 5.1 Land use land cover details of Jayashankar Bhupalpally District

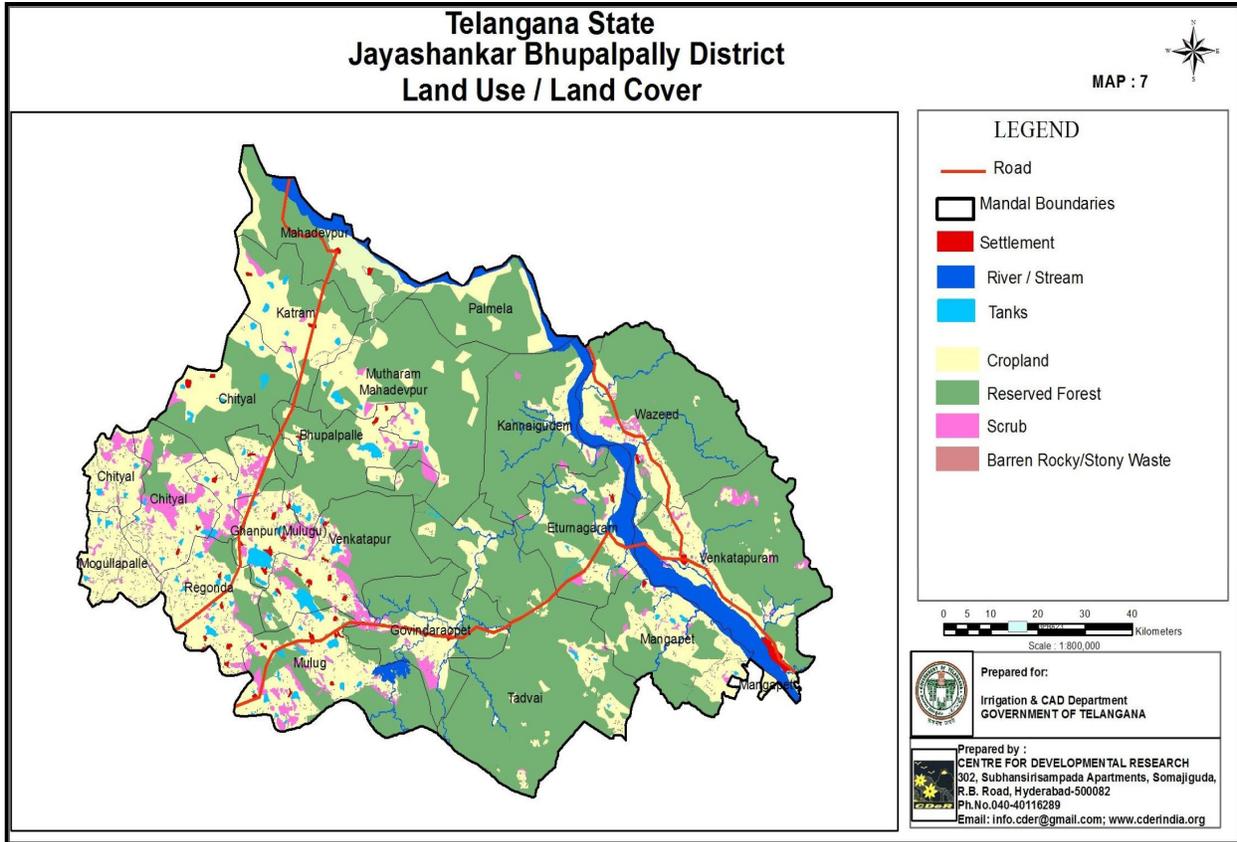
Land cover	Area (In Ha)	Area In %
Forest land	272224	49.28
Barren and Cultivable Land	30703	5.56
Land put to Non Agricultural use	27255	4.94
Permanent Pastures & Other Grassing land	12692	2.30
Miscellaneous land	9181	1.64
Cultivable Waste	8617	1.55
Other Follow lands	15821	2.87
Follow lands	29558	5.36
Agricultural Land	146338	26.50

Figure 5.1 Pie Diagram of the Land Use/Land Cover



- Forest Land
- Barren and cultivated land
- Non Agricultural Use
- grassing lands
- Miscellaneous land
- cultivable waste
- other follow lands
- Follow lands
- Agricultural land

Figure 5.2 Land Use/Land Cover Map of Jayashankar Bhupalpally District



5.2 Water Quality

5.2.1. Ground Water quality of study area

Geomorphic features, Climate and Rainfall, Topography and Land Slope, Drainage pattern, Soils and Agricultural activities and ultimately the nature, thickness, distribution and structure of different geological formations, independently or collectively or in association with each other play a distinct role in the occurrence, movement, quality and availability of Ground Water.

Geographical set-up and Geomorphic features control, in a large measure the amount of precipitation that contributes to run off and ground water recharge.

Dry conditions in arid and semi-arid climatic conditions results in large-scale evaporation losses, promotes oxidation processes and results in the deep ground water level.

High rainfall contributes higher amounts of infiltration and deep percolation to recharge ground water. Development of landforms mainly depends upon the nature of the rocks, their resistance to erosion and the geologic structure, climatic conditions and vegetative cover.

5.2.2. Ground Water Quality

Quality of ground water can be expressed in terms of Specific Electrical Conductance (E.C.), which is a measure of dissolved salt content. The permissible limits of E. C. for drinking and irrigation purposes respectively are 1500 and 2000 μ /cm at 25 °C.

The samples were collected from 4 Bore Wells at Sand reaches i.e., Mallaram, Thallagadda, Damerakunta, Vilasagar and got them analyzed for associated parameters. Summarized Results of Chemical Analysis of Ground Water Samples is shown in the **Table 5.2**

Table 5.2 Analysis of Ground Water of the study area

S.No.	PARAMETER	Method APHA 23rd Edition	Mallaram Village (Near School) Ground Water - 1	Tallagadda Village	Vilasagar Village	Damerakunta Village	Requirement Acceptable limit	Permissible limit in the absence of alternative source
1	pH	4500 H+B	7.23	7.1	7.42	7.36	6.50 - 8.50	NS
2	Dissolved Oxygen	4500-O C	6.30	6.4	6.4	6.2	1.0	9.0
3	Color (Hazen units)	2120 B	<1.0	<1.0	<1.0	<1.0	1	100
6	Odour	2150 B	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
7	Taste	2160	Agreeable Taste	Agreeable Taste	Agreeable Taste	Agreeable Taste	Agreeable Taste	Agreeable Taste
8	Total dissolved solids	2540 C	752	774	742	766	500 max	2000 max
9	Total hardness as CaCO ₃	2340 C	317.52	318.50	314.62	321.40	200 max	600 max
10	Calcium hardness as CaCO ₃	3500 Ca B	225.4	227.36	221.80	223.82	75 max	200 max
11	Magnesium as Mg	3500-Mg B	92.12	91.14	86.40	89.62	30 max	100 max
12	Copper as Cu	3111 B	<0.05	<0.05	<0.05	<0.05	0.05 max	1.5 max
13	Iron as Fe	3500 Fe B	0.26	0.31	0.25	0.29	0.3 max	No relaxation
14	Manganese as Mn	3111 B	<0.05	<0.05	<0.05	<0.05	0.1 max	0.3 max
15	Chlorides as Cl	4500 Cl-C	129.64	130.12	130.12	131.62	250 max	1000 max
16	Sulphates as SO ₄	4500 SO ₄ D	36.52	38.43	36.82	39.28	200 max	400 max

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17	Nitrates as NO ₃	4500 NO ₃ B	4.86	5.12	4.92	4.89	45 max	No relaxation
18	Flourides as F	4500 F-D	0.7	0.64	0.59	0.61	1.0 max	1.5 max
19	Mercury as Hg	3112B	<0.001	<0.001	<0.001	<0.001	0.001	No relaxation
20	Cadmium as Cd	3111 B	<0.01	<0.01	<0.01	<0.01	0.003	No relaxation
21	Selenium as Se	3500 Se C	<0.01	<0.01	<0.01	<0.01	0.01	No relaxation
22	Arsenic as AS	IS 3025 (Part-37)	<0.01	<0.01	<0.01	<0.01		No relaxation
23	Cyanide as CN	4500 CN- C, E	<0.05	<0.05	<0.05	<0.05	0.05	No relaxation
24	Lead as Pb	3111 B	<0.01	<0.01	<0.01	<0.01	0.01 max	No relaxation
25	Zinc as Zn	3111 B	0.72	0.75	0.71	0.76	5.0 max	15 max
26	Total Chromium as Cr	3111 B	<0.05	<0.05	<0.05	<0.05	0.05 max	No relaxation

The results indicate that ground water is of average natural type with pH ranging from 7.1 to 7.72. Against desirable limit of 250 mg/l and permissible limit of 1000 m/l of Chloride, ground water samples had a minimum of 129.64 mg/l and maximum of 131.62 mg/l indicating that ground water is within the limits of good taste, its palatability is not affected. Total Hardness of ground water ranged between 314.62 mg/l and 321.4 mg/l and is well within the limits of 200 – 600 mg/l (permissible and acceptable levels). Total Dissolved Solids ranged from 742 mg/l to 766 mg/l. showing low salt content at all places well within the permissible ranges of 500 and 2000 mg/l respectively. The low values are attributable to the dilution through good recharge from upper terrain storm water flow. Ground water is found less mineralized with no harmful substances and all the chemical constituents well within the suitable limits for drinking and all other purposes.

5.2.3. Surface Water quality

Surface water samples were collected from 4 sand reaches i.e., Mallaram, Damerakunta, Thallagadda, Vilasagar.

Summarized results of chemical analysis of surface water samples are shown in the **Table 5.3**

Table 5.3 Analysis of Surface Water of the study area

S.No	PARAMETER	Method APHA 23rd Edition	Dhamarakunta Surface Water	Thalagada Surface Water	Mallaram Sand Reach Surface Water	Vilasagar Surface Water	Limits
1	pH	4500 H+B	7.83	8.22	7.96	7.92	6.5 to 8.5
2	Dissolved Oxygen	4500-O C	6.3	6.40	6.4	6.3	6.0
3	Biochemical Oxygen Demand	IS 3025(Part-44) 2009	2	--	--	--	2.0
4	Total Coliform	IS 1622	50	--	--	--	50
5	Color (Hazen units)	2120 B	<1.0	<1.0	<1.0	<1.0	10
6	Odour	2150 B	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
7	Taste	2160	Agreeable Taste	Agreeable Taste	Agreeable Taste	Agreeable Taste	Agreeable Taste
8	Total dissolved solids	2540 C	229	218	210	214	500
9	Total hardness as CaCo ₃	2340 C	133.28	112.70	147.00	142.00	300
10	Calcium hardness as CaCo ₃	3500 Ca B	71.54	56.84	83.30	82.10	200
11	Magnesium as Mg	3500-Mg B	61.74	55.86	63.70	62.60	100
12	Copper as Cu	3111 B	<0.05	<0.05	<0.05	<0.05	1.5
13	Iron as Fe	3500 Fe B	<0.10	<0.10	<0.10	<0.10	0.3
14	Manganese as Mn	3111 B	<0.10	<0.10	<0.10	<0.10	0.5
15	Chlorides as Cl	4500 Cl-C	36.2	40.6	22.50	21.60	250

EIA Report on De-Siltation of Sand-Annaram Barrage

16	Sulphates as SO ₄	4500 SO ₄ D	14.58	14.82	23.26	20.9	400
17	Nitrates as NO ₃	4500 NO ₃ B	<1.0	<1.0	<1.0	<1.0	20
18	Flourides as F	4500 F-D	0.59	0.72	0.53	0.64	1.5
19	Mercury as Hg	3112B	<0.001	<0.001	<0.001	<0.001	0.001
20	Cadmium as Cd	3111 B	<0.01	<0.01	<0.01	<0.01	0.01
21	Selenium as Se	3500 Se C	<0.01	<0.01	<0.01	<0.01	0.01
22	Arsenic as AS	IS 3025 (Part-37)	<0.01	<0.01	<0.01	<0.01	0.05
23	Cyanide as CN	4500 CN-C, E	<0.05	<0.05	<0.05	<0.05	0.05
24	Lead as Pb	3111 B	<0.01	<0.01	<0.01	<0.01	0.1
25	Zinc as Zn	3111 B	0.82	0.86	0.63	0.68	15
26	Total Chromium as Cr	3111 B	<0.01	<0.01	<0.01	<0.01	0.05

Surface water is found to be of good quality. The results indicate the water with pH ranging from 7.83 to 8.22 and fall in the average natural type pH range of 6.5 to 8.5. Chlorides of the samples ranges between 21.60 mg/l and 40.6 mg/l. Total Hardness of ground water ranged between 112.70 mg/l and 147.0 mg/l and is well within the limits of 300 – 600 mg/l and Total Dissolved Solids ranged from 210 mg/l to 229 mg/l. The dissolved oxygen is varying between 6.3 to 6.4 mg/lit.

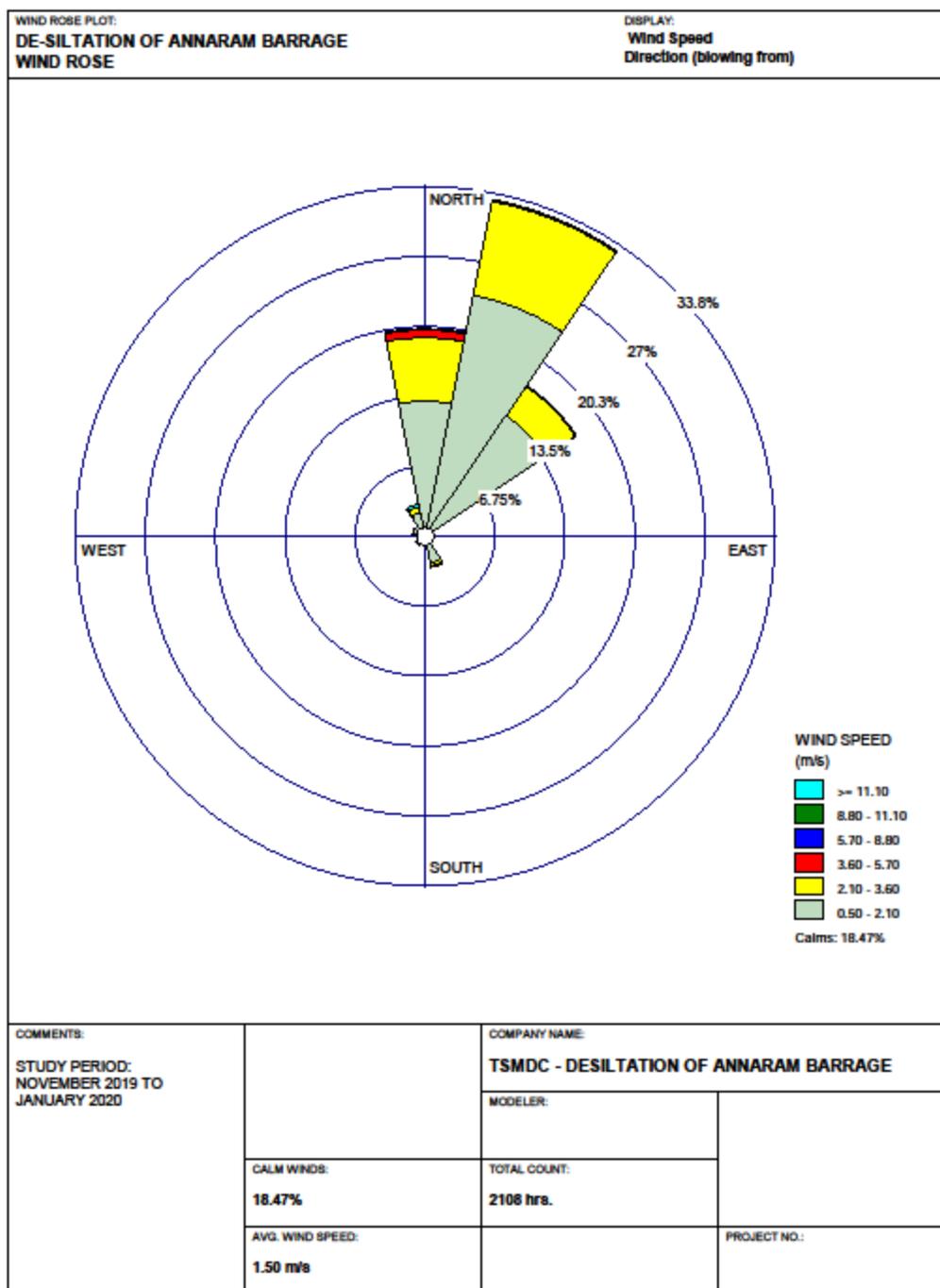
Overall, the surface water quality in the region comes in the category B and C of IS 2296: 1982.

5.3 Air Quality

Air pollution means the presence in the outdoor atmosphere of one or more contaminants or combinations thereof in such quantities and of such duration as are may tend to be injurious to human, plant or animal life or property. Air pollutants include smoke, vapours, soot, fumes, gases, mist, odours, particulate matter, radioactive material or noxious chemicals. With various anthropogenic activities like industries, agriculture, mining and infrastructure, a range of different pollutants are released into the atmosphere that are dispersed and have a significant impact on neighbourhood air environment. Thus collection of base line data of air environment occupies a predominant role in the impact assessment statement. The ambient air quality status across the study zone forms basis for prediction of the impacts due to the proposed project.

The data required to assess air quality impacts in and around neighbourhood is achieved by designing such a network, which encompasses micro meteorological conditions, quantity and quality of emissions from, locations, duration, resources/monitoring technology and operational criteria. The optimal scheme for air quality monitoring should consider all the above factors.

Figure 5.3: Wind Rose Diagram



Source: IMD Data

5.3.1. Scope of Field Study

The scope of baseline status of the ambient air quality can be accessed through a well-designed ambient air quality stations network. An intensive ambient air quality monitoring of the study area consisting of 10 km radius with the proposed housing project site as the centre point was carried out during the study period. The ambient air quality was monitored at eight locations spread over entire study area. At each sampling station monitoring was carried out for 24 hours in a day for 2 days a week, for two months. The major air pollutants monitored on 24 hourly bases PM₁₀, PM_{2.5}, Sulphur dioxide, Oxides of Nitrogen and carbon monoxide. Sampling and analysis of the above variables is according to the guidelines of Central Pollution Control Board.

5.3.2. Description of Sampling Locations

The location of ambient air quality stations is contingent on the meteorological status of the area. Table 5.4 presents the ambient air quality locations, distances, and directions from the Project site.

Table 5.4 Details of Ambient Air Quality Monitoring Locations

S. No	Location Name	Distance (Km)	Direction
1	Annaram	1.12	ENE
2	Gundrathpally	2.33	SSE
3	Damerakunta	1.35	E
4	Mallaram	1.26	WSW
5	Vilasagar	0.69	ENE
6	Arenda	1.25	SW
7	Venktapur	1.63	WSW
8	Lakshmapur	1.10	ENE

5.3.3. Pre-project Ambient Air Quality Status

The existing baseline levels with respect to PM₁₀, PM_{2.5}, Sulphur dioxide, Oxides of Nitrogen and Carbon monoxide are presented in **Table 5.5**

Table 5.5 Air Quality status

Sampling Time: 24 Hrs

Pollutant	Maximum	Minimum	Mean	98 Percentile
1) Location: Annaram				
PM ₁₀ (µg/m ³)	58.2	51.8	54.62	57.92
PM _{2.5} (µg/m ³)	25.74	19.80	23.25	25.73
SO ₂ (µg/m ³)	16.3	13.7	15.26	16.25
NO _x (µg/m ³)	22.1	18.7	20.05	21.69
CO (mg/m ³)	0.3	0.1	0.23	0.3
2) Location: Gundrathpally				
PM ₁₀ (µg/m ³)	57.8	51.3	54.57	57.71
PM _{2.5} (µg/m ³)	26.4	20.10	23.46	26.26
SO ₂ (µg/m ³)	16.90	13.5	15.34	16.85
NO _x (µg/m ³)	21.70	18.1	20.06	21.61
CO (mg/m ³)	0.4	0.1	0.26	0.4
3) Location: Damerakunta				
PM ₁₀ (µg/m ³)	55.2	48.7	52.88	55.06
PM _{2.5} (µg/m ³)	24.7	20.7	22.76	24.65
SO ₂ (µg/m ³)	17.8	14.4	15.69	17.57
NO _x (µg/m ³)	23.5	19.1	20.23	22.44
CO (mg/m ³)	0.3	0.1	0.18	0.3
4) Location: Mallaram				

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PM ₁₀ (µg/m ³)	56.1	47.6	52.31	55.41
PM _{2.5} (µg/m ³)	25.1	21.3	22.79	24.5
SO ₂ (µg/m ³)	17.8	15.2	16.12	17.66
NO _x (µg/m ³)	24.1	19.2	20.28	22.77
CO (mg/m ³)	0.3	0.1	0.21	0.3
5) Location: Vilasagar				
PM ₁₀ (µg/m ³)	54.9	46.2	52.11	54.62
PM _{2.5} (µg/m ³)	26.1	22.3	23.51	25.64
SO ₂ (µg/m ³)	17.9	14.8	16.34	17.85
NO _x (µg/m ³)	24.5	19.2	20.7	24.32
CO (mg/m ³)	0.4	0.1	0.24	0.4
6) Location: Arenda				
PM ₁₀ (µg/m ³)	57.6	50.4	53.15	56.5
PM _{2.5} (µg/m ³)	25.3	20.4	23.32	25.21
SO ₂ (µg/m ³)	18.4	15.3	16.39	18.17
NO _x (µg/m ³)	24.5	19.3	20.86	24.32
CO (mg/m ³)	0.4	0.1	0.25	0.4
7) Location: Venkatapur				
PM ₁₀ (µg/m ³)	58.2	51.3	54.39	57.92
PM _{2.5} (µg/m ³)	24.9	19.6	23.24	24.85
SO ₂ (µg/m ³)	17.9	15.4	16.41	17.85
NO _x (µg/m ³)	24.5	19.4	21.29	24.18
CO (mg/m ³)	0.4	0.2	0.25	0.4
8) Location: Lashmipur				
PM ₁₀ (µg/m ³)	57.1	50.3	54.18	57.01

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PM _{2.5} (µg/m ³)	25.4	20.3	23.33	25.26
SO ₂ (µg/m ³)	17.4	14.5	16.3	17.3
NO _x (µg/m ³)	23.6	20.1	21.35	23.23
CO (mg/m ³)	0.4	0.2	0.25	0.35

All parameters reported are well within the specified National Ambient air quality standards. National Ambient Air Quality standards as notified in 2009 are given in the table below

Table5.6: National Ambient Air quality Standards

S.no	Pollutant	Time Weighted average	Industrial, Residential, Rural and other area µg/m ³	Ecologically sensitive area µg/m ³
1	Particulate Matter (size less than 10 µm) or PM ₁₀ µg/m ³	Annual	60	60
		24 hours	100	100
2	Particulate Matter (size less than 2.5 microns) or PM _{2.5} µg/m ³	Annual	40	40
		24 hours	60	60
3	Sulphur Dioxide (SO ₂),	Annual	50	20
		24 hours	80	80
4	Nitrogen Dioxide (NO ₂),	Annual	40	30
		24 hours	80	80
5	Carbon Monoxide (CO) mg/m ³	8 Hours	2	2
		1 hour	4	4

5.4 Noise quality

Noise is an unwanted sound without musical quality. Artificial noise and its impact on environment, grown apace with advancing human civilization. Noise pollution is equally hazardous to environment as air, water and other forms of pollution. Various noise measurement units have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common scale is, weighted decibel dB (A), and measured as the relative intensity level of one sound with respect to another sound (reference sound).

The impact of noise depends on its characteristics (instantaneous, intermittent or continuous in nature), time of day (day or night) and location of noise source. The environmental impact of noise can have several effects varying from noise induced hearing loss to annoying depending on noise levels.

5.4.1. Selection of Sampling Locations

Locations for noise monitoring in the project impact area are identified based on the proposed dredging and stocking areas proposed. In all, 8 locations were selected for monitoring of noise levels to cover all types of sensitive receptors and all types of traffic anticipated along the residential areas.

5.4.2. National Noise Standards

The Central Pollution Control Board has specified ambient noise levels for different land uses for day and night times. Importance was given to the timing of exposure and areas designated as sensitive. **Table** gives the noise standards set.

Table 5.7 National ambient noise level standards

Area Code	Category	Limits in Decibels (dB A)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zones	50	40

Note: (1) **Daytime:** 6 AM to 10 P.M., **Night-time** 10 PM to 6 AM; (2) Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts. Source: Central Pollution Control Board, New Delhi.

5.4.3. Results & Analysis of Noise Monitoring

Table: gives the values observed at various locations along the project routes.

Table 5.8 Equivalent Noise levels in study area

S No.	Location	Equivalent Noise Levels Leq dB(A)	
		Leq day	Leq Night
1	Annaram	51.3	39.4
2	Gundrathpally	49.3	37.9
3	Damerakunta	47.6	38.5
4	Mallaram	49.6	37.2
5	Vilasagar	51.8	36.8
6	Arenda	48.3	38.7
7	Venkatapur	49.1	37.5
8	Lakshmipur	46.4	36.3

The noise data reveals that the values were well within the standards as CPCB norms. In the study area maximum value 52.8 dB (A) was observed at Vilasagar and minimum value 36.3 dB (A) at Lakshmipur was observed.

5.5 Soil quality

The soils in the district can be divided into red soils, black soils, loams and sandy loams, Red soils occupy about 55% of the district; black soils about 22% and loams about 14%. The soils are moderately shallow with depth varying from 55cm to 125cm. The soils are rich in Potash and deficient in nitrogen and phosphorus. In terms of micronutrient status, the soils are deficient in zinc.

The Soil characteristics include both physical and chemical parameters. M/s. Pridhvi Envirotech (P) Limited field team carried out soil survey to assess the soil characteristics of the study area.

Table 5.9 Analysis of Soil samples of the Study area

S.No.	Parameters	Unit	Annaram	Gundrathpall	Damerakunt	Mallar	Vilasaga	Arend	Venkatapu	Lakshmipu
1	pH (1:5 Soil water extract)		8.11	7.12	9.01	9.05	6.23	7.89	6.45	7.92
2	E.C (1:5 Soil water extract)	µmhos/cm	51.1	60.1	154.2	51.1	169.3	187.7	51.1	136.8
3	Bulk Density	g/cc	1.26	1.24	1.27	1.22	1.12	1.35	1.23	1.28
4	Moisture	%	5.90	4.39	4.44	5.23	4.98	4.51	5.86	5.78
5	Nitrates as N	kg/ha								
6	Phosphorous as P	kg/ha	76.63	925.32	434.25	1026.92	746.35	656.28	223.35	988.38
7	Potassium as K+	kg/ha	52.6	6.7	22.6	27.93	65.84	34.8	42.9	45.2
8	Sodium as Na	kg/ha	31.27	33.99	25.37	17.4	27.2	14.38	19.5	31.7
9	Calcium as Ca	mg/kg	5.7	17	6.3	47.3	33.2	8.3	6.8	7.89
10	Magnesium as Mg ²⁺	mg/kg	0.7	1.27	1.6	5.1	0.7	5.8	5.37	4.12
11	Sulphates as So ₄	mg/kg	62.4	42.0	23.4	54.2	32.2	36.6	29.9	36.6
12	Organic Carbon	%	0.01	0.04	0.41	0.24	0.54	0.32	0.27	0.39
13	Texture									
	a) Sand %	%	58	52	64	50	66	54	58	66
	b) Silt %	%	10.0	10.0	8.0	10.0	13.0	11.0	14.0	13.0
	c) Clay %	%	32	38	28	42	24	33	31	25
	Type of Soil		Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay
14	Zinc as Zn	mg/kg	91.6	89.4	98.4	60.2	94.5	98.2	76.8	84.2
15	Cation Exchange Capacity (CEC)	meq/kg	4.9	7.26	8.38	3.99	15.97	11.98	4.12	12.72
16	Total Nitrogen as N	%	74.29	100.27	120.37	325.21	465.69	401.72	212.76	202.64

The pH of soil ranges from slightly Acid to very strongly alkaline. The cation exchange capacity of the soils is very low to moderate. The level of extractable potassium is low. The Ca/Mg ratio varies from balanced to low. The total Nitrogen as N is low in the area. The base saturation of the samples is predominantly very strongly leached. Bulk density of soil of impact varies from 1.24- 1.26 g/cc. Soil texture is predominantly Clayee and silty Loan.

Table 5.10 Soil Parameters - Reference Tables

General interpretation of pH measured		
pH	Range	Classification
	<4.5	Extremely Acidic
	4.51 -5.0	Very Strong Acidic
	5.1-5.5	Strong Acid
	5.6- 6.0	Moderately Acid
	6.1-6.5	Slightly acid
	6.6-7.3	Neutral
	7.4-7.8	Mildily Alkaline
	7.9 -8.4	Moderately Alkaline
	8.5-9.0	Strongly Alkaline
	>9.0	Very Strongly Alkaline

Source: Bruce and Rayment (1982).

Ca/ mg Ratio	
	Description
<1	Ca Deficient
1-4	Ca (Low)
4-6	Balanced
6-10	Mg (Low)
>10	Mg deficient

Source: Eckert (1987)

Rating of Total Nitrogen	
Rating (% by W)	Description
<0.05	Very low
0.05-0.15	Low
0.15-0.25	Medium
0.25-0.50	High
>0.5	Very High

Source: Bruce and Rayment (1982)

Rating for Cation exchange Capacity	
	CEC (Cmol+)/kg
Very low	<6 *
Low	6-12
Moderate	12-25
High	25-40
Very High	>40

Source: Metson (1961)

* Soils with CEC less than three are often low in fertility and susceptible to soil acidification.

Base Saturation as a criterion of leaching	
Range (%BS)	Rating
70-100	Very Weakly Leached
50-70	Weakly Leached
30-50	Moderately Leached
15-30	Strongly Leached
0-15	Very Strongly Leached

Source: Metson (1961)

Extractable Potassium (K)	
	K
low	<150 ppm* (< 0.4 meq/100 g soil)
medium	150-250 ppm (0.4-0.6 meq/100 g soil)
high	250-800 ppm (0.6-2.0 meq/100 g soil)
excessive	>800 ppm (>2.0 meq/100 g soil)

Source: Abbott (1989)

5.6 Flora and Fauna

5.6.1 Flora of Area

The proposed Dreging sites are near Annaram project surrounded by open land with very less vegetation cover. Most of the region is dry and mesophytic conditions. Vegetation is limited to river side, pond side and roadside apart from reserved forests.

Core zone: The project site is near Godavari River, aquatic ecosystem with few common shrubs and herbs. Entire area is with Sand reaches without any forest or agriculture land. There are no REET species present in the core zone. No migratory corridors or breeding grounds for faunal species present here.

The most commonly seen shrubs are *Calotropis procera* and *Zizyphus jujube* and herbs are common grass species grown naturally. Apart from that few weeds are commonly seen at few places are *Euphorbia hirta*, *Aerva lanata*, *Croton bonplandianum* and *Parthenium hysterophorus*. The faunal composition generally with aves and fish fauna. In aves, Mynas, Sparrows, Bar headed Goose, Swifts are seen. A detailed list of shrubs, herbs and ornamental plants present in the Core zone is mentioned in Annexure

Buffer zone is mostly with human habitations and one reserve forest. The list of flora and fauna covered under these are not elaborately given in the list. The common species found at roadside and village wood land are given. Buffer area is mainly village woodland. Some part of the buffer area is under reserve forest. This area is having good number of tree species having mesophytic adaptation. Most of the region is plain with red soil. Hence vegetative survey mainly conducted on Trees. The floral quantification has been done in the reserve forest areas where quadrat method has been adopted. There are no endangered and endemic plants present in the buffer and core zones. There are few medicinal, timber / fuel wood, fodder and other socio-economic purposes. The faunal composition was also estimated

based on the direct and indirect evidences. *Lannea coromandelica*, *Soymida febrifuga*, *Xylia xylocarpa*, *Syzygium cumini*, *Phoenix sylvestris*, *Dalbergia sissoo*, *Prosopis juliflora*, *Tectona grandis*, *Mangifera indica*, *Terminalia alata*, *Lantana camara*, *Saraca asoca*, *Strychnos nux vomica*, *Gmelina asiatica*, *Hardwickia binata*, *Azadirachta indica*, *Leucaena leucocephala*, *Morinda tinctoria* and *Holarrhena antidysenterica* are commonly seen in the reserve forested area. *Albizia procera*, *Albizia lebbek*, *Delonix regia*, *Azadirachta indica*, *Peltoforum sp.*, *Terminalia catapa*, *Psidium guava*, *Dalbergia sissoo* and *Tamarindus indica* are predominant near villages. A detailed list of plantations, floral and faunal species present in the buffer zone. Aquatic ecosystem, the study area comprises of few small and medium sized tanks. These ponds provide the suitable habitat for fresh water aquatic and semi aquatic plants. *Hydrilla*, *Ipomoea aquatic*, *Lemna minor*, *Limnophila heterophylla*, *Marsilea quadrifolia*, *Neptunia oleracea* *Operculina turpethum*, *Neptunia oleracea*, *Typha angustata* are most common in the study area. The fresh water fishes are given in the list collected from secondary sources. There were no REET category species of aquatic and semi aquatic plants in the study area.

5.6.1.1 Quantitative analysis

The study area is mainly focused through secondary data validation from primary observations. Checklist is prepared and marked the species noticed during rapid assessment. 20 sampling points are through Area-Species graph and the quantitative analysis done based on the methodology adopted for various species.

The habit wise and ecosystem wise status of various floral species observed are given here graphically.

Fig 5.4 Flora Species Distribution

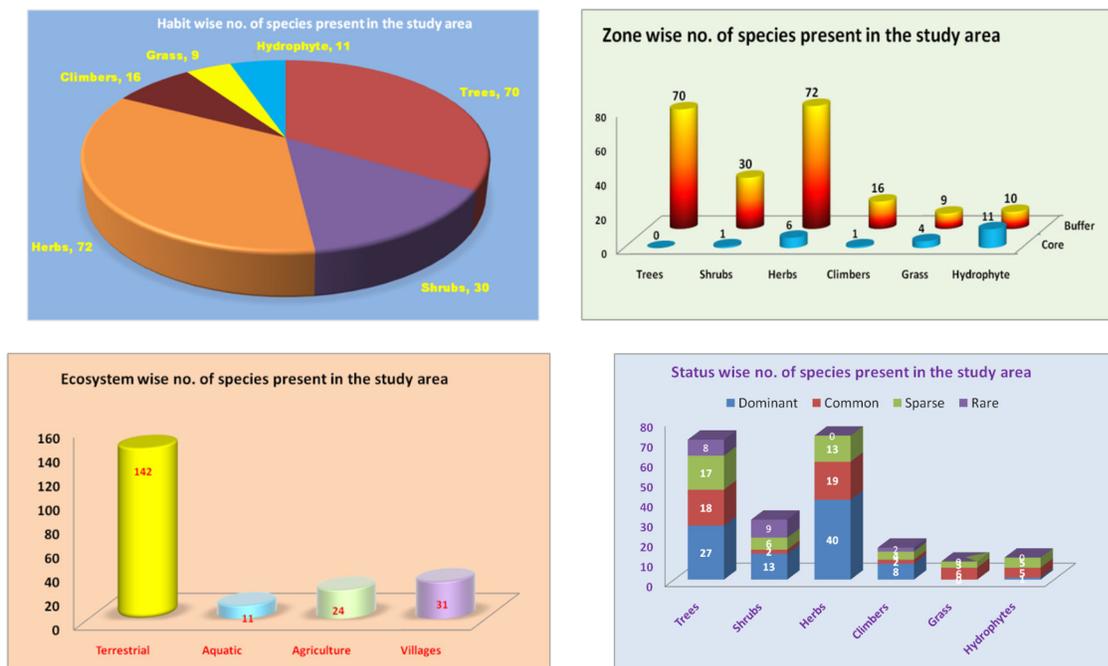


Table 5.11 Phytosociological data of study area

S.No	Scientific Name	Density	Rel Density	Frequency	Rel Frequency	Abundance	Rel Abundance	IVI
1	<i>Azadirachta indica</i>	0.85	3.70	55.00	5.45	1.55	3.42	12.56
2	<i>Dalbergia sissoo</i>	1.35	5.87	40.00	3.96	3.38	7.46	17.29
3	<i>Gmelina asiatica</i>	0.90	3.91	60.00	5.94	1.50	3.32	13.17
4	<i>Hardwickia binata</i>	0.85	3.70	60.00	5.94	1.42	3.13	12.77
5	<i>Holarrhena</i>	0.60	2.61	40.00	3.96	1.50	3.32	9.88
6	<i>Tectona grandis</i>	1.30	5.65	60.00	5.94	2.17	4.79	16.38
7	<i>Lannea coromandelica</i>	2.70	11.74	50.00	4.95	5.40	11.94	28.63
8	<i>Lantana camara</i>	1.10	4.78	60.00	5.94	1.83	4.05	14.78
9	<i>Leucaena</i>	0.80	3.48	50.00	4.95	1.60	3.54	11.97
10	<i>Mangifera indica</i>	1.25	5.43	40.00	3.96	3.13	6.91	16.30
11	<i>Morinda tinctoria</i>	0.55	2.39	55.00	5.45	1.00	2.21	10.05
12	<i>Phoenix sylvestris</i>	1.30	5.65	30.00	2.97	4.33	9.58	18.20
13	<i>Xylia xylocarpa</i>	1.60	6.96	70.00	6.93	2.29	5.05	18.94
14	<i>Prosopis juliflora</i>	1.35	5.87	70.00	6.93	1.93	4.26	17.06
15	<i>Terminalia alata</i>	1.15	5.00	65.00	6.44	1.77	3.91	15.35
16	<i>Saraca asoca</i>	1.05	4.57	50.00	4.95	2.10	4.64	14.16
17	<i>Soyimida febrifuga</i>	1.75	7.61	55.00	5.45	3.18	7.03	20.09
18	<i>Strychnos nux vomica</i>	0.95	4.13	35.00	3.47	2.71	6.00	13.60
19	<i>Syzygium cumini</i>	1.60	6.96	65.00	6.44	2.46	5.44	18.83
			100		100		100	300.0

Figure 5.5 Graph showing Important Value Index of dominant tree species within area

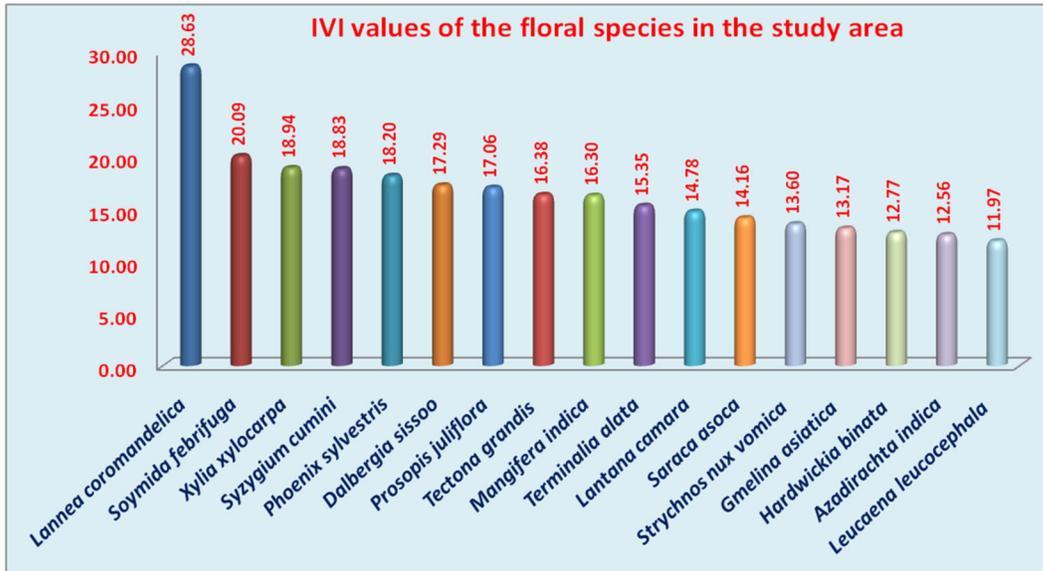


Figure 5.6 Photographs of the study area

	
<i>Senna occidentalis (L.) Link</i>	<i>Typha angustata</i>
	
<i>Solanum surattense Burm. f.</i>	<i>Hyptis suaveolens (L.) Poit.</i>
	
<i>Alternanthera sessilis (L.) R.Br. ex DC.</i>	<i>Aerva lanata (L.) Juss</i>



Table 5.12 Biodiversity indices values of the sampling sites in buffer zone:

Dominance D	0.056
Shannon H	2.912
Simpson 1-D	0.944
Evenness $e^{H/S}$	0.976
A/F value	0.045

5.6.1.2 Distribution pattern (A/F ratio): The ratio between abundance and frequency was used to interpret the distribution pattern of species (Whitford, 1949). Distribution pattern of species in the study area is identified as **random distribution** as the value of A/F ratio is **0.045**. This

random distribution of species is mainly due to various ecosystems present in the buffer zone. The Shannon indices value of study area is **2.912** indicates **Good diversity** (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). Population size and Dominance of the species is **6%** and Evenness is around **98%** (Indicates the species are evenly distributed in core and buffer zones). This might be due to contiguous patches of Eucalyptus and Subabul species and natural species such *Azadirachta indica*, *Phoenix*, *Prosopis juliflora* (near the villages), *Peltophorum pterocarpum* and *Delonix regia* (near roadside). The present study indicates A<B<C>D>E in frequency classification and as per the Raunkiaer's law of frequency, classification indicates that species diversity is distributed maximum for 40 to 60%. This result indicates that all most all plants frequency is more or less equal due to some of the plant species such as *Xylia xylocarpa*, *Syzygium cumini*, *Phoenix sylvestris*, *Dalbergia sissoo*, *Prosopis juliflora*, *Tectona grandis*, *Mangifera indica*, *Terminalia alata* and *Lantana camara* are **frequently found** floral species throughout the region.

5.6.2 Fauna within the Core and buffer zones:

Throughout the study area, there no direct evidence of wild animal species observed. From the secondary source (local people near villages) it is also revealed that presence of common snakes exists here. Common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaverbirds, Mynas, Black drangos, Crows, Sparrows are sighted here.

5.6.2.1 Endemic, Threatened and Endangered Species

From the present survey it appears that none of the terrestrial species are under endangered and threatened species, and not listed in the Schedule I of the Indian Wildlife (Protection) Act, 1972 as amended in 1991.

5.6.2.2 Terrestrial fauna of the Core area and the Buffer zone

As the animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible. However, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are three reserved forest blocks in the buffer zone, they are in the form of small and isolated patches. As these forest blocks are surrounded by villages on all sides, they are subject to biotic pressures of grazing and cutting. As such, there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area. There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere Reserve or Elephant Corridor or other protected areas within 10 km radius from core area. It is evident from the available records, reports and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows. The list of Mammalian species directly sighted or recorded during field survey and also from literature review is given in Annexure. The list of bird species recorded during field survey and literature from the study area are given in Annexure.

The list of reptilian species recorded during field survey and literature from the study area are given in Annexure. The list of Amphibian species recorded during field survey and literature from the study area are given in Annexure. The list of Fish species recorded during field survey and literature from the study area are given in Annexure. The list of Butterfly species recorded during field survey and literature from the study area are given in Annexure. It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act. Similarly,

none of them comes under the REET category. Some of the birds listed were rare locally but they do not fall under any of the REET categories.

5.6.2.3 Effect on Migratory corridors, Nesting and Breeding sites

There are no migratory corridors, nesting and breeding sites within the proposed site or in the core area. No need to take any mitigation measures in this connection.

5.6.2.4 Effect on REET species

From the list, no Rare or Endangered or Endemic or Threatened (REET) species or any species listed in Schedule I of the Wildlife (Protection) Act. Hence, species specific and habitat specific mitigation measures are not needed in this connection. The project site does not overlap with any of the recognized Ramsar sites. The construction phase does not envisaged excavation or alteration in water bodies hence shall not entail changes in aquatic biodiversity. The construction does not involve diversion or change in the major rivers, canals. Considering these predicted impacts, a comprehensive green belt development plan and Wildlife management plan are proposed which shall improve the existing status of ecosystems and associated biodiversity in the nearby area.

5.7 Socio Economic status of the District

Jayashankar Bhupalpally District is a new district carved out of the existing 10 districts in the State and is named after Kothapalli Jayashankar popularly known as Professor Jayashankar (6August 1934 – 21 June 2011), an Indian academic and Social Activist committed for achieving a separate Telangana state leading the mass movement fought. He often stated that unequal distribution of river water was the root cause of separate Telangana movement.

Jayashankar Bhoopalpally District, with population of about 6.2 lakh is Telangana 9th least populous district. There are 12 sub districts in the district, among them Ghanpur station is the most populous sub district with population of about 92 thousand and Tadavi is the least populous sub district with population of about 23 thousand.

The district is home to about 6.2 lakh people, among them about 3.1 lakh (50%) are male and about 3.1 lakh (50%) are female. 67% of the whole population are from general caste, 19% are from schedule caste and 14% are schedule tribes. Child (aged under 6 years) population of Jayashankar Bhoopalpally district is 9%, among them 52% are boys and 48% are girls. There are about 1.6 lakh households in the district and an average 4 persons live in every family. Majority of the population, nearly 88% (about 5.5 lakh) live in rural areas and 12% (about 73 thousand) population live in the urban areas of the district.

Hindus contribute 96% of the total population and are the largest religious community in the district followed by Muslims which contribute 3% of the total population. Female Sex ratio per 1000 male in Hindus are 1003 in Muslims are 995.

As of 2011 census there are 1003 females per 1000 male in the district. Sex ratio in general caste is 1003, in schedule caste is 980 and in schedule tribe is 1,031. There are 932 girls under 6 years of age per 1,000 boys of the same age in the district.

Total about 3.5 lakh people in the district are literate, among them about 2 lakh are male and about 1.5 lakh are female. Literacy rate (children under 6 are excluded) of Jayashankar Bhoopalpally is 62%. 71% of male and 52%

of female population is literate here.

Jayashankar Bhoopalpally has 53% (about 3.3 lakh) population engaged in either main or marginal works. 56% male and 49% female population are working population. 51% of total male population is main (full time) workers and 6% are marginal (part time) workers. For women 39% of total female population is Main and 10% are marginal workers.

Table 5.13
BHUPALAPALLY (JAYASHANKAR) DISTRICT: DEMOGRAPHY DETAILS (2011 CENSUS)
(in Nos)

Sl.no	Mandal	TRU	Total Population	Male	Female	Children below 6 yrs	SC	ST
1	2	3	4	5	6	7	8	9
1	Bhupalpalle	Rural	50142	24971	25171	4880	9629	6603
	Bhupalpalle	Urban	42387	21810	20577	3568	8104	3347
	Bhupalpalle	Total	92529	46781	45748	8448	17733	9950
2	Chityal	Rural	37314	18307	19007	3259	7635	2302
3	Eturunagaram	Rural	30293	14991	15302	3165	6688	8251
4	Ghanapur_Mulug	Rural	35952	17837	18115	3750	6980	2222
5	Govindaraopet	Rural	30738	15320	15418	2781	4458	7947
6	Kannaigudem	Rural	10860	5321	5539	1409	3320	3525
7	Kataram	Rural	37336	18617	18719	3615	12640	3845
8	Mahadevpur	Rural	30714	15110	15604	3086	6729	3137
9	Malharrao	Rural	25343	12685	12658	2308	5734	2220
10	Mangapet	Rural	36927	18525	18402	3687	5529	10826
	Mangapet	Urban	11493	5776	5717	957	952	734
	Mangapet	Total	48420	24301	24119	4644	6481	11560
11	Mogullapalle	Rural	35901	17902	17999	2947	7745	170
12	Mulug	Rural	61741	31197	30544	6011	8231	14221
13	Mutharam_Mahadevpur	Rural	26312	13187	13125	2663	7380	9072
14	Palmela	Rural	7775	3876	3899	903	2283	2576
15	Regonda	Rural	59602	29773	29829	5246	10828	1495
16	Tadvai	Rural	22879	10893	11986	2149	2293	11876
17	Tekumatla	Rural	27985	13923	14062	2482	6330	203
18	Venkatapur	Rural	33159	16550	16609	3195	6138	4207
19	Venkatapuram	Rural	31765	15384	16381	3357	5050	12452
20	Wazeed	Rural	24816	12248	12568	2433	3814	12313
	Total	Rural	657554	326617	330937	63326	129434	119463
	Total	Urban	53880	27586	26294	4525	9056	4081
	Total	Total	711434	354203	357231	67851	138490	123544

5.7.1 Literacy Status

Telangana literacy rate is 67.22 percent as per 2011 census, out of which male literacy is 75.6 percent and female literacy is 58.8 percent. Gender difference in literacy is substantially high requiring attention. The literacy rates among SC and ST are 58.8 percent and 49.5 percent respectively. Improving the literacy status among women, SC and ST is a major challenge before the state Government. At the District level, total literacy 62 percent with 71 percent male and 52 percent female literates.

5.7.2 Education Status

Educational facilities available in Jayashankar Bhoopalpally district are summarized below. According to Socio Economic Outlook 2015, School dropout rate in the State is generally high and 40 percent of the SC students and 63 percent of ST student's dropout.

Table 5.14 Educational infrastructure of the district

S.no	Educational Institutions	Number
1	Primary Schools	708
2	Upper Primary schools	157
3	High Schools	251
4	Model Schools	9
5	KGBV Schools	16
6	Central Schools	0
7	Junior colleges	48
8	Degree Colleges	21

Primary Education facilities are available in all villages. Other than the above professional colleges like Engineering colleges, Medical Colleges, B.Ed colleges, Colleges for MCA, MBA etc are not available in the district and students have to depend on neighbouring districts, especially Hyderabad city for such higher studies.

5.7.3 Occupational status

Jayashankar Bhupalpally district has a work participation rate of 53% (about 3.3 lakh population) engaged in either main or marginal works. 56% male and 49% female population are working population. 51% of total male population is main (full time) workers and 6% are marginal (part time) workers. For women 39% of total female population is Main and 10% are marginal workers.

5.7.4 Health Infrastructure

Health infrastructure available in the district is mainly obtained from Government sources. As per the data in Planning Department reports (2016), following infrastructure is available for the people in the District.

Table 5.15 Health infrastructure

S.no	District level	Number of Hospitals
1	Allopathic Hospitals (Govt)	
	A Health Sub-Centres	179
	B Primary Health Centres	25
	C Community Health Centres	4
2	Ayurveda Hospitals (incl. Dispensaries)	10
3	Homeopathic Hospitals (incl. Dispensaries)	5
4	Unani Hospitals (incl. Dispensaries)	4
5	Doctors in all Hospitals	51
6	Beds in all Hospitals	332

Table 5.16: Villages of the Study Area

S No	Name of Village	Name of Mandal	Name of District	Distance (Km)	Direction	Population
1	Annaram	Mahadevpur	Bhupalpally	0.78	NE	86
2	Gangaram	Kataram	Bhupalpally	8.13	NW	538
3	Mallaram	Manthani	Peddapalli	9.13	SW	335
4	Lakshmipuram	Kataram	Bhupalpally	8.04	SE	734
5	Pokkur	Chennur	Mancherial	2.98	SW	2200
6	Kommeram	Chennur	Mancherial	4.27	W	2355
7	Asanad	Chennur	Mancherial	7.57	SW	2817
8	Ponnaram	Chennur	Mancherial	8.44	SW	521
9	Nagapuram	Chennur	Mancherial	7.58	SW	384
10	Chakepalle	Chennur	Mancherial	6.25	SW	2222
11	Somanapalli	Chennur	Mancherial	9.09	SW	1613
12	Dugnepalli	Chennur	Mancherial	2.93	NW	2913
13	Beeravelli	Chennur	Mancherial	5.93	SW	506
14	Sunderasala	Chennur	Mancherial	1.00	N	917
15	Vilasagar	Kataram	Bhupalpally	9.25	SE	3632
16	Damarakunta	Kataram	Bhupalpally	6.50	SW	2903

CHAPTER 6.0

ESTIMATION OF QUANTITY & METHOD OF DESILTATION

6.1 Sedimentation Studies

Erosion, transportation and deposition of sediments are natural processes controlled by geological, climatic, physical, vegetative and other related conditions all through the geological times. However, during the present century, because of deforestation and urbanization, the rate of transport of sediments from the watersheds and siltation pose substantial environmental problems and before equilibrium conditions are reached, additional problems are likely to arise.

One of the major problems noticed in agricultural watersheds is that the crop productivity reduces to zero or becomes uneconomical, because of soil erosion (Walling, 1988). There are many theories which can be used to evaluate sediment movements in rivers. It is essential that functional relationship between various physical, geomorphic and sediment related parameters are developed, such that the magnitude of sediment eroded from watershed can be estimated. The increase in sediment yield from the watershed will have an impact on the watershed itself and on the river system and associated reservoirs. The impact of eroded soil on natural system is varied and widespread. The sediment particulates eroded from the watershed move in the downstream directly and in the process influence the drainage channels, flood plains, river beds, wetlands and lakes. The key factors which affect the sediment yield from drainage basin are:

- Hydrology: Rainfall and runoff

- Catchment characteristics: Size of the catchment, slope of the catchment and length of the overland flow.
- Soil characteristics: Soil erodibility, soil transportability, soil texture and structure.
- Nature of drainage network and drainage density.
- Landuse cover: Plant canopy, mulches and plant residues.
- Management practices: Tillage, soil conservation structures, terraces, diversions and bunds.

Of all the factors listed above rainfall and runoff provide the basic energy input to drive the erosion process. Steepness of slope plays an important role in the process of erosion. Soil properties such as soil texture, structure and the land cover, i.e., plant residue, mulches etc have a major role in erosion process.

At the outset, it is clear that, the process of sedimentation is a matter of serious concern in irrigation projects, because it reduces the storage capacity, water supply capability, power generation, discharge control etc of reservoirs, rivers/catchments. The erosion of the catchments changes the ground water regime and results in lowering of water table in some places and rise at the formation of arid zone and marshes respectively. The fertility of the soil, its chemical composition also changes due to catchment erosion.

6.2 Sedimentation Index

An estimate of sediment index must be developed to provide a basis for comparison with management induced sediment yield predictions. The best source of this information is actual long term real data of sediment yield. Another possible source is data from similar or related watersheds.

6.3 Stream Flow and Suspended Sediment Load

Although there is a definite variation in sediment transport rate in a natural stream at a particular location, still there exists a good relationship between the sediment load of the stream and certain hydro- morphological factors. The factors which are considered important in estimating sediment yield of a catchment are drainage area, annual water discharge, relief ratio, mean stream length and total stream length etc., Regression analysis was carried out to know the relation between discharges and sediment load in Kaleshwaram lift irrigation project area. The relationship has been found to be,

$$Y=7.47*10^{-6} x+3401.28, \text{ with } r=0.97$$

Where,

Y= suspended sediment load in tones/year

X=stream flow in m³/year (monsoon flow only)

Table 6.1 Sediment loads in Kaleswaram area of Godavari

Sediment Types	Total load in percent (by weight)
Coarse (Sand)	40.2
Medium (Silt)	35.0
Fine (Clay)	24.8

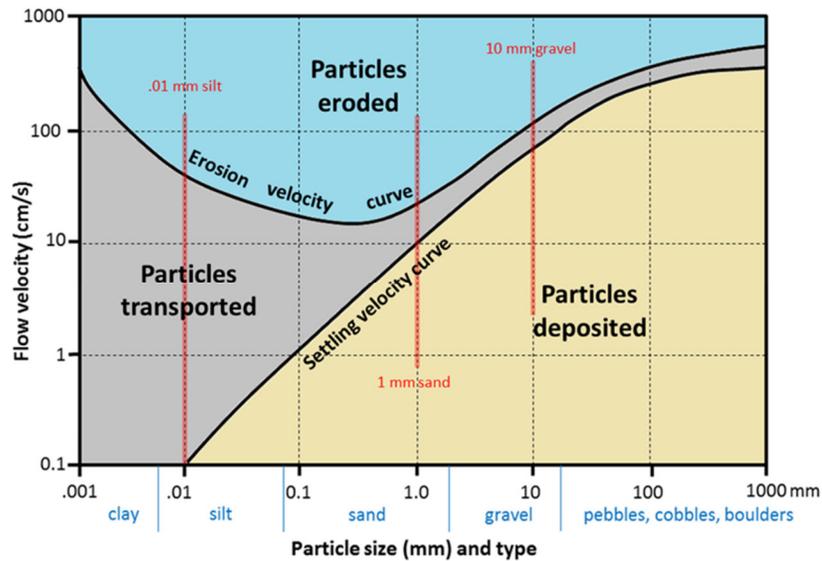
Source: EIA Report on Kaleshwaram Lift Irrigation Scheme

6.4 Deposition rates

The stretch of the River Godavari in Jaisankar Bhupalapalli District is having an elevation difference of 20 meters This indicates gentle slope of the river. The backwater spread area of River Godavari due to construction of Annaram Barriage is 30 KM in the up stream of Barriage.

Below Diagram shows the relation between velocities of stream and sediment deposit and transportation

Figure 6.1 Sediment Deposition Vs Velocity of Flow



The stretch of Annaram Barrage is more or less in plains. The Hydraulic flow pattern of Godavari river The typical rates of deposition observed in the stretches of rivers is estimated between 5 to 8 meters in River Godavari. However, more long-term scientific studies are required for establishing the deposition curves after Kaleshwaram Project is completely operationalized.

6.5 Grain size analysis of sand samples from sand reaches

In order to assess the grain size distribution of sand, samples were taken from existing sand stretches of River Godavari. The results are presented in the table 6.2 below. The result indicates silt and clay content in the samples is zero in the stretches.

Table 6.2

S.No.	Location	Grain Size Distributuion in %				
		Gravel	Sand			Fines
		Gravel (> 4.75mm)	Coarse Sand (4.75 mm to 2.00mm)	Medium sand (2.00 mm to 0.425 mm)	Fine sand (0.425 mm to 0.075 mm)	Fines (Si+Cl), (< 0.075 mm)
1	Vilasagar - 1	0.0	0.5	54.0	45.5	0.0
2	Vilasagar - 2	2.5	4.5	84.0	9.0	0.0
3	Thallagadda-1	2.5	4.5	89.5	3.5	0.0
4	Thallagadda-2	1.0	2.0	87.0	10.0	0.0

Grain size Distribution of sand samples from Reaches

6.6 Estimation of sand to be De-silted

In the sand assessment report, the sand thickness is mentioned as 2 to 3 netere for submergence area of Medigadda barrage but a depth of 3 meter was taken into consideration to estimate the sand availability in the submergence areas of Medigadda. Similarly, the sand thickness is metioned as 1.5 to 3 meter for submergence areas of Annaram barrage but a depth of 3 metres has been taken into consideration to estimate the sand availability as well as for excavation.

Table 6.3 Sand estimates of Reaches

S.No.	Reach Name	Extrent Ha.,	Length Mts	Width M	Depth M	Estimated Quantity, M ³	River	District	Mandal	Village	Distance from Annaram Barrage in Kms
1	Tallagadda 1	37.50	625	600	4	15,00,000	Godavari	Bhupalpally	Mahadevpur	Annaram	0.1
2	Tallagadda 2	37.5	625	600	4	15,00,000	Godavari	Bhupalpally	Mahadevpur	Tallagadda	0.73
3	Damerakunta 1	71.225	1925	370	2	14,24,500	Godavari	Bhupalpally	Kataram	Damerakunta	5.8
4	Damerakunta 2	90.0	2500	360	2	18,00,000	Godavari	Bhupalpally	Kataram	Damerakunta	7.9
5	Laxmipur	26.1	870	300	3	7,83,000	Godavari	Bhupalpally	Kataram	Laxmipur	7.77
6	Vilasagar Block 1	14.1	470	300	3	4,23,000	Godavari	Bhupalpally	Kataram	Vilasagar	10.84
7	Vilasagar Block 2	50.4	1680	300	3	15,12,000	Godavari	Bhupalpally	Kataram	Vilasagar	8.85
8	Mallaram 1	42.5	1250	340	2	8,50,000	Manneru	Peddapally	Manthani	Mallaram	7.6
9	Mallaram 2	83.64	2460	340	2	16,72,800	Manneru	Peddapally	Manthani	Mallaram	8.8

6.7 Method of De-silting

Proclains will be used for removal of sand from the riverbed and loaded into tractors. Loaded sand will be taken to stockyards and un- loaded. Re-loading to tractors/Trucks will be done using loaders in Stockyard.

CHAPTER 7.0

IMPACTS OF DE- SILTING & REMEDIAL MEASURES

Handling of sediments is a major challenge in the design and operation of water resources projects in general including hydropower projects (HPPs) and Lift Irrigation schemes. The sediment deposition has caused huge capacity loss of reservoir and choking of outlets thereby reducing the project life. Besides, they pose severe problems in HPPs & Pumping stations of Lift Irrigation projects, because of their abrasive characteristics.

Reservoir sedimentation inter alia may have the following negative effects:

- Loss of active storage volume, and thus reduced ability to compensate in- and outflows for hydropower, irrigation, drinking water and flood retention;
- Increased turbine/Pump erosion because of higher suspended sediment concentration (SSC) and coarser particles in power waterways due to reduced trap efficiency of the reservoir.
- Changes in approach channel hydraulics leading to difficulties in diversion discharges through the intake. (Applies to barrages and small dams)

The wear of turbines/Pumps by sediments may be high if the water head is over 20 m and very high for further high heads, especially if the abrasive content of sediments such as quartz is high. In some past cases, turbines/Pumps have been abraded too badly for further use after just a few months of operation. This has resulted in high financial losses due to repair costs.

The World Bank in its RESCON (Reservoir Conservation) approach call for

adoption of "life cycle management" approach for designing dam. The RESCON approach is based on the following two messages:

- *"Whereas the last century was concerned with reservoir development, the 21st century will need to focus on sediment management; the objective will be to convert today's inventory of non-sustainable reservoirs into sustainable infrastructures for future generations."*

- *"The scientific community at large should work to create solutions for conserving existing water storage facilities in order to enable their functions to be delivered for as long as possible, possibly in perpetuity."*

The Expert committee on De-siltation of Ganga Basin summarized the following Principles of de-siltation

Principles for desiltation works: The Committee proposed basic principles for planning and execution of desiltation works in rivers. These include:

- (i) Catchment area treatment and watershed development activities, along with suitable agricultural practices and river bank protection/anti-erosion activities are necessary to reduce silt inflow into the river system and must be undertaken in a comprehensive manner;
- (ii) Erosion, movement and deposition of sediment in a river occur naturally. Arrangements should be made to pass the incoming sediment into a river to downstream of the dams/ barrage structures to maintain the sediment equilibrium;
- (iii) The desiltation quantity should not exceed the deposition rate, i.e., the amount of boulders, pebbles, and sand deposited in river bed minus the amount transported downstream each year;
- (iv) Rivers should be provided with sufficient corridor for meandering

without any hindrance to their flow; and

- (v) Precautions must be taken to avoid deposition of sediment loads within the river, and instead they should be deposited on other suitable land.

7.1 Environmental and Other impacts of Sediments:

A summary of environmental and other impacts of sediments in river basins and storage reservoirs are given below.

Table 7.1 Impacts of Sediments in Rivers and Reservoir

Sediment size	Environmental issues	Associated engineering issues
Silts and clays	Erosion, especially loss of topsoil in agricultural areas; gulying	
	High sediment loads to reservoirs	Reservoir siltation
	Chemical transport of nutrients, metals, and chlorinated organic compounds	Problems in Drinking-water supply
	Accumulation of contaminants in organisms at the bottom of the food chain (particulate feeders)	
	Silting of fish spawning beds and disturbance of habitats (by erosion or siltation) for benthic organisms	
Sand	River bed and bank erosion	River channel deposition: navigation problems Instability of river cross-sections
	River bed and bank erosion	Sedimentation in reservoirs
	Habitat disturbance	
Gravel	Channel instability when dredged for aggregate	Instability of river channel leads to problems of navigation and flood-control
	Habitat disturbance	

7.2 Environmental Impacts of De-silting

Though it is always advisable to restrict the sediments flow in to the reservoirs by taking bank protection measures, habitat management measures and watershed management measures. However, De-silting will be necessary to some extent for improving the capacity of reservoirs and reduce the harm to pumping equipments in case of lift irrigation schemes

De-silting, if done indiscriminately, can cause severe impacts on ecology, environment and ground water resources of the area.

Following table summarises the impacts identified of de-silting of sand from Annaram Rerservoir and remeidical measures

Table 7.2 Impacts of De-silting and Remedial Measures

Activity	Environmental Impacts	Possibilities of the impacts in sand reaches of Annaram Barrage	Remedial measures
De-silting proces s	Depletion of ground water if excess sand is de-silted from the river beds	Not likely	The sand reaches proposed to be dredged are in the mandala of Mahadevapur and Kataram Mandals in Mahadevapur District and Manthani Mandal of Peddapalli District. All three mandals are safe in terms of ground water extraction. The Depth of dredging will be between 2 to 3 meters in different stretches.
	Loss of aquatic species, if de-silting is done during monsoon season	De-silting is proposed to be done between November to May	Period of de-silting will be during lean period of water flow in the river

		period and river flow is lean in this period. Also only exposed sand portions will be taken out. Hence loss of aquatic species is not possible	
	Fall of animals in the de-silted stretches in the river bed during cross over	There is possibility of this impact in sand reaches	It suggested to provide barricading of dredging area in the river bead to restrict movement of animals
	Bed erosion due to excessive depth of de-silting	There is possibility of this impact	It is suggested to restrict the depth of sand proposed to be dredged to 50% of possible deposit. The depth however should not be more than 3 meters depth. Ensure atleast 2 meters depth of sand bed is intact while dredging to avoid any bed erosion. Following measures will be taken up 1) Augar sampling of bed will be taken up before arriving at the depth of dredging and same will be norified to supervisory staff. 2) Photographs of the sand reach before and after the dredging shall be maintained 3) Sattellite images shall be taken on the sand reaches and processed images shall be preserved

EIA Report on De-siltation of Sand - Annaram Barriage

	Erosion of River bunds during transportation of sand from river bed to stock points	There is possibility of this impact	Bund protection measures will be taken. Tree plantation will be taken up on the bund on both sides of drive way of the vehicles
	Loss of tree cover on bunds and in stock yards	There is possibility of this impact	Plantations on the bunds shall be taken up by TSMDC
Use of machines like proclains for de-silting	De-silting of excessive depth in the river bed	There is possibility of this impact	Supervisory staff will be notified the depth up to which dredging can be done in each reach depending on assessment of sand depth using augurs. Protection measures of river bed and maintenance of minimum sand depth on the river bed will be kept as sign board in the reaches
	Emissions from Mechanical equipments	There is possibility of this impact	Regular maintenance of vehicles shall be taken up to avoid excessive emission from dredge equipment
	Contamination of river water due to leakages of oil from the machines	There is possibility of this impact	Regular maintenance of vehicles shall be taken up to any oil leakages of the vehicles.
	Disturbance to avions due to noise from the machines	There is possibility of this impact	Regular maintenance of vehicles shall be taken up to avoid excessive noise from dredge equipment
Storage of sand and other de-silted material	Loss of agricultural out put due to use of patta lands for stock yards	There is possibility	The total extent of Patta land proposed to be used for stocking the sand is 192 acres. Adequate lease amounts are fixed with

			Farmers to comensate their crop loss
	Air borne emissions from the storage area	There is possibility of this impact	To avoid air borne emissions from stockyard, it is suggested to provide enclosures al round the stockyard. If material is dry, then sprinkling of water shall be done
	Turbid seep water from wet material dredged joining nearby irrigation fields	There is possibility of this impact	Provide traps in the stockyard to collect any seepage water and use it for plantation purpose.
	Resource loss if silts and clay material is not used	There is possibility of this impact	Silt and clay is not likely to be generated as studies indicates only coarse and fine sand. However if any silt/clay layer comes, same shall be sotred seperately and will be send to farmers , as it will have good fertile value for agriculture
Transport of sand from stock points to user end	Air borne emissions from Hauling road from river bed to stock point and from stock point to other distributin points	There is possibility of this impact	Continuous water sprinkling shall be done on all hauling roads during transportation of sand
	Vehicular emissions from Trasnsport vehicles	There is possibility of this impact	PUC certificates for all trucks and other vehicles shall be maintained
	Air borne emissions of dry sand transported through trucks	There is possibility of this impact	IN case of dry sand transport in trukcs, taurpolin shall be used to avoid in convenience to other road users
Generatio n of	Disposal of Domestic waste water from	There is possibility of this impact	Tempoary toilets maintained in stock yards

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waste due to presence of work force and transport equipment for de-silting	temporary toilets near stock yards		shall be provided with Septic tanks with soak pits
	Waste oil from Vehicles	There is possibility of this impact	Waste oils from transport vehicles shall be send to authorized recylers

CHAPTER 8.0**BUDGET FOR ENVIRONMENTAL REMEDIAL MEASURES**

Based on the suggested measures on possible impacts, following budget estimates are estimated for the proposed and reaches. Estimates for each sand reach

Table 8.1: EMP Budget

S.No	Remedial measure	Capital expenditure In Rs.	Re-curring expenditure per Annum in Rs.
1	Barricading of Dredge area in river bed to avoid fall of animals	-	2,00,000
2	Treen plantations on bunds and stock yards	3,00,000	1,00,000
3	Seep traps at Stock yards to collect seepage water if any	2,00,000	1,00,000
4	Enclosures around the stock yards to avoid dust emissions	4,50,000	Nil
5	Water sprinkling of hauling roads	--	2,00,000
6	Annual sand deposit ratio studies to fix depth of dredging in the reaches	--	3,50,000
7	Environmental Monitoring, Water, Air, Noise and ground water fluctuation in the surrounding areas of sand dredging stretches	--	3,00,000
	Total	9,50,000	12,50,000

Budget allocation and expenditure for all environmental control measures suggested and other measures discussed in the previous chapter shall be done at the level of Vice Chairman & Managing Director of Telangana State Mineral Development Corporation and reports shall be filed.

CHAPTER 9.0

CONCLUSION & RECOMMENDATIONS

Based on the Environmental Impact Assessment studies conducted for de-silting of sand reaches in river Godavari and Maneru the following conclusions are drawn

- De-silting is necessary for improving storage capacity of Annaram Barriage
- Total of 9 reaches are identified, 7 are in River Godavari and 2 are in Maneru river before it confluencing with Godavri
- The Distance of Reaches from Annaram Barriage is between 0.1 Meters to 10.84 meters in the reservoir
- As per the sustainable sand mining guidelines, it is advised to not take up any sand de-silting up to 500 m from any crucial hydraulic structures. As it is expected water impoundment in Annaram Barriage will be up to 1 KM from Barriage even during lean season, It is suggested to not to take up the De-silting of sand in Tallagadda -1 and Tallagadda -2 which are 0.1 Km and 0.73 KM from Annaram Barriage
- Remedial measures as suggested in the report shall be taken up and shall be reviewed at top level of the organization every year
- Monitoring of air, water, soil ,ground water levels shall be done at least quarterly in the surrounding of de-silting sites as well as stock yards
- Other important guidelines of sustainable sand mining management guidelines 2016 shall be followed as out lined below
 - No river bed mining should be taken up during rainy season ie., from 5th June to 15th October in Telangana State
 - The Overall mining depth should be restricted to 3 meters
 - Distance of de-silting from the bank should be 3 meters or

10% of stream width which ever is less

- Streams shall not be diverted for de-silting
- Natural vegetation on the banks shall be protected
- A long term monitoring program on changes in bed elevation, rate of re-plenishment and biotic environment both upstream of down stream of sand reaches are suggested to assess the impacts of de-silting
- Washing, screening, stock piling activities shall not be undertaken in the river bed
- Photograph the sand reaches before and after de-silting and preserve
- Satellite images of de-silt sites shall be maintained annually to observe any impacts on river bed

CHAPTER 10

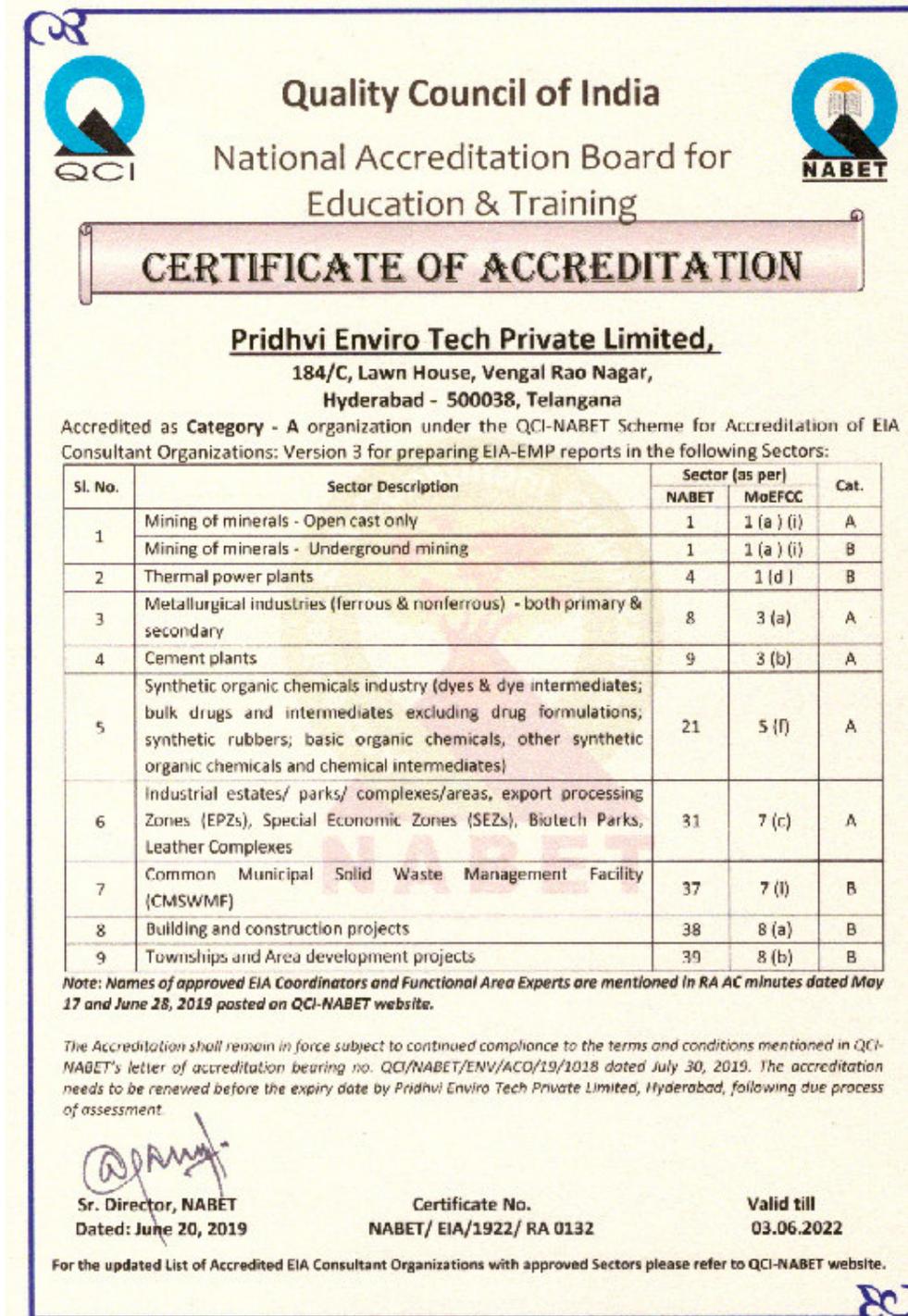
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Pridhvi Envirotech (P) Limited was established by professionals in the field of environment with nearly 30 years of experience with clear vision to serve customers in the field of environment.

Accredited by National Accreditation Board for Education and Training (NABET) under Quality Council of India as consultant for preparation of Environmental Impact Assessments for new and existing industries, Pridhvi Envirotech (P) Limited provides the following services

- Provide complete and one stop consultancy to get Environmental clearances from MOEF and CFE and CFO from state Pollution Control Boards
- Provide complete assistance to industry by conducting legal gap analysis and advise actions to be taken
- Conduct EIA and EMP reports
- Conduct Due diligence audits for mergers and take overs
- Periodical monitoring of effluents/emissions/Hazardous Wastes from MOEF approved laboratory
- Provide assistance to industries to help them in case of legal compliances
- Provide consultancy services in the area of implementation of ISO 14001 systems and OHSAS 18001
- Provide consultancy services in design and execution of effluent treatment plants & Sewage treatment plants
- Provide consultancy services in hazardous waste handling and disposal services
- Waste mapping and audits and provide solutions for waste reduction

- Provide training to personnel on environment and safety management systems, legal requirements and other host of environmental, occupational Health and Safety issues.



ANNEXURE-I

List of Flora and Fauna of the Study Area

LIST OF PLANT SPECIES RECORDED

S.No.	Botanical Name	Common name	Family	Habit	Status
1	<i>Acacia auriculiformis</i> Benth.	Australia thumma	Leguminosae	Tree	Common
2	<i>Acacia chundra</i>		Mimosaceae	Tree	Sparse
3	<i>Acacia leucophloea</i> (Roxb.)	Tella thumma	Leguminosae	Tree	Dominant
4	<i>Acacia nilotica</i> (L.) Delile	Nalla thumma	Leguminosae	Tree	Dominant
5	<i>Aegle marmelos</i> (L.) Corrêa	Velaga	Rutaceae	Tree	Rare
6	<i>Ailanthus excelsa</i> Roxb	Pedda manu	Simaroubaceae	Tree	Dominant
7	<i>Alangium salviifolium</i> (L.f.) Wangerin	Vuduga chettu	Cornaceae	Tree	Sparse
8	<i>Albizia amara</i> (Roxb.) B.Boivin	Konda sigara	Leguminosae	Tree	Sparse
9	<i>Albizia lebbek</i> (L.) Benth.	Dirisanam	Leguminosae	Tree	Common
10	<i>Alstonia scholaris</i> R.BR	Edakula pala	Apocynaceae	Tree	Dominant
11	<i>Anogeissus latifolia</i>	Chirumanu	Combretaceae	Tree	Common
12	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Kadambe	Rubiaceae	Tree	Common
13	<i>Azadirachta indica</i> A.Juss.	Vepa	Meliaceae	Tree	Dominant
14	<i>Bauhinia purpurea</i> L.	Bodhanta	Leguminosae	Tree	Dominant
15	<i>Borassus flabellifer</i> L.	Thadi chettu	Arecaceae	Tree	Dominant
16	<i>Butea monosperma</i> (Lam.) Taub.	Modhuga	Leguminosae	Tree	Sparse
17	<i>Cassia fistula</i> L.	Rela	Leguminosae	Tree	Sparse
18	<i>Cassia siamea</i> Lam.	Seema thangedu	Leguminosae	Tree	Common
19	<i>Casuarina equisetifolia</i>	Sarugudu	Casuarinaceae	Tree	Sparse
20	<i>Ceiba pentandra</i> (L.) Gaertn	Tella buruga	Malvaceae	Tree	Sparse
21	<i>Chukrasia tabularis</i>	Konda vepa	Meliaceae	Tree	Common
22	<i>Citrus limon</i> (L.) Burm. f.	Nimma	Rutaceae	Tree	Sparse
23	<i>Cocos nucifera</i> L.	Kobbari	Arecaceae	Tree	Dominant
24	<i>Dalbergia latifolia</i> Roxb	Jiteegi	Leguminosae	Tree	Sparse
25	<i>Dalbergia sissoo</i> DC.	Sisu	Leguminosae	Tree	Dominant
26	<i>Decalepis hamiltonii</i>	Maredu kommulu	Periplocaceae	Tree	Sparse
27	<i>Delonix regia</i> (Hook.) Raf.	Chittikesaram	Leguminosae	Tree	Dominant
28	<i>Dendrocalamus strictus</i>	Sanna vedru	Graminae	Tree	Dominant
29	<i>Diospyros melanoxylon</i> Roxb	Tunki	Ebenaceae	Tree	Common
30	<i>Dolichandron eatrovirens</i> (Roth)		Bignoniaceae	Tree	Sparse
31	<i>Eucalyptus globulus</i> Labill.	Neelagiri thylam	Myrtaceae	Tree	Common
32	<i>Ficus benghalensis</i> L.	Marri	Moraceae	Tree	Common
33	<i>Ficus hispida</i> L.f.	Medipandu, Bemmedu akulu	Moraceae	Tree	Dominant
34	<i>Ficus microcape</i>		Moraceae	Tree	Sparse
35	<i>Ficus racemosa</i>	Medi	Moraceae	Tree	Common
36	<i>Ficus religiosa</i> L.	Ravi	Moraceae	Tree	Sparse
37	<i>Gmelina asiatica</i> L.		Lamiaceae	Tree	Rare
38	<i>Hardwickia binata</i>	Yepi	Leguminosae	Tree	Common
39	<i>Holarrhena antidysenterica</i>	Pala	Apocynaceae	Tree	Rare
40	<i>Holoptelea integrifolia</i> Planch.	Nemali nara	Ulmaceae	Tree	Rare

41	<i>Lannea coromandelica</i> (Houtt.) Merr.	Gumpena	Anacardiaceae	Tree	Rare
42	<i>Leucaena leucocephala</i> (Lam.) de Wit	Jabarichettu	Leguminosae	Tree	Dominant
43	<i>Limonia acidissima</i> L.	Velaga	Rutaceae	Tree	Common
44	<i>Mangifera indica</i> L.	Mamidi	Anacardiaceae	Tree	Common
45	<i>Morinda tinctoria</i> Roxb.	Maddichettu	Rubiaceae	Tree	Sparse
46	<i>Pavetta indica</i> L.	Lakkapapidi	Rubiaceae	Tree	Dominant
47	<i>Peltophorum pterocarpum</i> (DC.)	Kondachintha	Leguminosae	Tree	Dominant
48	<i>Phoenix sylvestris</i> (L.) Roxb.	Eethachettu	Arecaceae	Tree	Dominant
49	<i>Phyllanthus emblica</i> L.	Usiri	Phyllanthaceae	Tree	Dominant
50	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Sima chinta	Leguminosae	Tree	Dominant
51	<i>Pongamia pinnata</i> (L.) Pierre	Adivi ganuga	Leguminosae	Tree	Dominant
52	<i>Prosopis chilensis</i> (Molina) Stuntz	Mulla thumma	Leguminosae	Tree	Rare
53	<i>Prosopis juliflora</i>	English tumma	Mimosaceae	Tree	Dominant
54	<i>Pterospermum heyneanum</i> G.Don	Duddika	Malvaceae	Tree	Sparse
55	<i>Samanea saman</i> (Jacq.) Merr.	Nidraganeeru	Sapindaceae	Tree	Common
56	<i>Sapindus emarginatus</i> Vahl	Kunkudu	Sapindaceae	Tree	Common
57	<i>Saraca asoca</i> (Roxb.) Willd	Asoka chettu	Leguminosae	Tree	Sparse
58	<i>Soymida febrifuga</i> (Roxb.) A. Juss.	Somi	Meliaceae	Tree	Rare
59	<i>Strychnos nux vomica</i>	Musti	Loganiaceae	Tree	Rare
60	<i>Syzygium cumini</i> (L.) Skeels	Neredu	Myrtaceae	Tree	Common
61	<i>Tamarindus indica</i> L.	Chintha	Leguminosae	Tree	Dominant
62	<i>Tecoma stans</i> (L.) Juss. ex Kunth	Pasupu ganneru	Bignoniaceae	Tree	Dominant
63	<i>Tectona grandis</i> L.f.	Teak	Lamiaceae	Tree	Dominant
64	<i>Terminalia alata</i> Heyne	Nalla Maddi	Combretaceae	Tree	Common
65	<i>Terminalia catappa</i> L.	Badham	Combretaceae	Tree	Dominant
66	<i>Thespecia populnea</i>	Ganga Raavi	Malvaceae	Tree	Dominant
67	<i>Thevetia neriifolia</i>	Pacha ganneru	Apocynaceae	Tree	Dominant
68	<i>Trema orientalis</i>	Boggu chettu	Ulmaceae	Tree	Dominant
69	<i>Xylia xylocarpa</i> Roxb	Konda thangedu	Leguminosae	Tree	Common
70	<i>Ziziphus mauritiana</i> Lam.	Reni	Rhamnaceae	Tree	Sparse
71	<i>Abutilon indicum</i> (L.) Sweet	Thutturubenda	Malvaceae	Shrub	Dominant
72	<i>Agave americana</i> L.	Gitta nara	Asparagaceae	Shrub	Rare
73	<i>Caesalpinia bonduc</i> (L.) Roxb.	Gacha podha	Leguminosae	Shrub	Sparse
74	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Rathna gandhi	Leguminosae	Shrub	Rare
75	<i>Calotropis gigantea</i> (L.) Dryand.	Tella jilledu	Apocynaceae	Shrub	Dominant
76	<i>Calotropis procera</i> (Aiton) Dryand.	Erra jilledu	Apocynaceae	Shrub	Dominant
77	<i>Capparis zeylanica</i> L.		Capparaceae	Shrub	Rare
78	<i>Carissa carandas</i> L.		Apocynaceae	Shrub	Rare
79	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.		Rubiaceae	Shrub	Rare
80	<i>Clerodendrum phlomidis</i> L.f.	Kond-takal	Lamiaceae	Shrub	rare
81	<i>Erythroxylon monogynum</i>	Dedaraaku	Erythroxylaceae	Shrub	Rare
82	<i>Euphorbia cactus</i>	Jemudu	Euphorbiaceae	Shrub	Rare

83	<i>Euphorbia tirucalli L.</i>	Tirukalli	Euphorbiaceae	Shrub	Rare
84	<i>Grewia hirsuta</i>	Jaani Chettu	Tiliaceae	Shrub	Common
85	<i>Grewia flavescens Juss.</i>	Jana	Malvaceae	Shrub	Sparse
86	<i>Helicteres isora L.</i>	Gooba thadu	Malvaceae	Shrub	Sparse
87	<i>Hyptis suaveolens (L.) Poit.</i>	Danthitulasi	Lamiaceae	Shrub	Dominant
88	<i>Ipomoea carnea Jacq.</i>	Rubber mokka	Convolvulaceae	Shrub	Dominant
89	<i>Ixora coccinea</i>	Ramabanam	Rubiaceae	Shrub	Dominant
90	<i>Jasminum roxburghianum Wall. ex</i>	Garuda malli	Oleaceae	Shrub	Sparse
91	<i>Lantana camara L.</i>		Verbenaceae	Shrub	Dominant
92	<i>Leonotis nepetifolia (L.) R.Br.</i>	Rana bheri	Lamiaceae	Shrub	Dominant
93	<i>Opuntia dillenii (Ker Gawl.) Haw.</i>	Naga jamudu	Cactaceae	Shrub	Common
94	<i>Phoenix acaulis</i>	Chitteetha	Palmae	Shrub	Sparse
95	<i>Senna auriculata (L.) Roxb.</i>	Tangedu	Leguminosae	Shrub	Dominant
96	<i>Senna occidentalis (L.) Link</i>	Kasinha	Leguminosae	Shrub	Dominant
97	<i>Solanum pubescens Willd.</i>	Uchintha	Solanaceae	Shrub	Dominant
98	<i>Solanum surattense Burm. f.</i>	Nela vakudu	Solanaceae	Shrub	Dominant
99	<i>Xanthium strumarium</i>	Marula-Mathangi	Asteraceae	Shrub	Dominant
100	<i>Ziziphus oenopolia (L.) Mill.</i>	Parimi	Rhamnaceae	Shrub	sparse
101	<i>Azolla pinnata subsp. africana (Desv.)</i>		Salviniaceae	Hydrophyte	Sparse
102	<i>Eichornia crassipes Solms</i>		Pontederiaceae	Hydrophyte	Sparse
103	<i>Hydrilla Rich.</i>		Hydrocharitaceae	Hydrophyte	sparse
104	<i>Ipomoea aquatica</i>	Thooti Koor	Convolvulaceae	Hydrophyte	Common
105	<i>Lemna minor Hegelm.</i>		Araceae	Hydrophyte	Common
106	<i>Limnophila heterophylla R. Br.</i>		Plantaginaceae	Hydrophyte	Common
107	<i>Marsilea quadrifolia L.</i>		Marsileaceae	Hydrophyte	Sparse
108	<i>Neptunia oleracea Lour.</i>		Leguminosae	Hydrophyte	Common
109	<i>Operculina turpethum (L.) Silva Manso</i>	Erra Tegada	Convolvulaceae	Hydrophyte	Common
110	<i>Typha angustata</i>	Jammu	Typhaceae	Hydrophyte	Dominant
111	<i>Vallisneria L.</i>		Hydrocharitaceae	Hydrophyte	Sparse
112	<i>Acalypha indica L.</i>		Euphorbiaceae	Herb	Dominant
113	<i>Achyranthes aspera L</i>	Uttareni	Amaranthaceae	Herb	Dominant
114	<i>Aerva lanata (L.) Juss</i>	Thelaga pindi	Amaranthaceae	Herb	Dominant
115	<i>Aeschynomene aspera L</i>	Neei jeeluga	Leguminosae	Herb	Dominant
116	<i>Ageratum conyzoides (L.) L.</i>	Vasavi	Asteraceae	Herb	Dominant
117	<i>Aloe vera</i>	Kithanara	Tiliaceae	Herb	Dominant
118	<i>Alternanthera sessilis (L.) R.Br. ex DC.</i>	Ponagantiaku	Amaranthaceae	Herb	Dominant
119	<i>Amaranthus spinosus L.</i>	Mulla thotakoora	Amaranthaceae	Herb	Dominant
120	<i>Amaranthus viridis L.</i>	Chilakathotakoora	Amaranthaceae	Herb	common
121	<i>Andrographis echinoides</i>	Chalavala puri kada	Acanthaceae	Herb	Common
122	<i>Andrographis paniculata</i>	Nela Vemu	Acanthaceae	Herb	Common
123	<i>Apluda mutica L.f.</i>		Poaceae	Herb	Sparse
124	<i>Argemone mexicana L.</i>	Brahmadandi	Papaveraceae	Herb	Dominant

125	<i>Aristida hystrix</i> L.f.		Poaceae	Herb	Common
126	<i>Asparagus racemosus</i>	Pilliteegalu	Asperagaceae	Herb	Dominant
127	<i>Barleria prionitis</i> L.	Pachagorinta	Acanthaceae	Herb	Dominant
128	<i>Blumea mollis</i> (D. Don) Merr.	Kukkapogaku	Asteraceae	Herb	Dominant
129	<i>Boerhavia diffusa</i> L.	Atikimamidi	Nyctaginaceae	Herb	Dominant
130	<i>Borreria hispida</i> Spruce ex K.Schum.		Rubiaceae	Herb	Sparse
131	<i>Catharanthus roseus</i> (L.) G.Don	Billaganneru	Apocynaceae	Herb	Dominant
132	<i>Celosia virgata</i> Jacq.	Guruga	Amaranthaceae	Herb	Common
133	<i>Chloris barbata</i> Sw.	Uppu Gaddi	Poaceae	Herb	Common
134	<i>Chloris virgata</i> Sw.		Poaceae	Herb	Common
135	<i>Chrysopogon lancearius</i> (Hook.f.)		Poaceae	Herb	Sparse
136	<i>Cleome aspera</i> J.König ex DC		Cleomaceae	Herb	Common
137	<i>Cleome viscosa</i> L.	Kukka vominta	Cleomaceae	Herb	Dominant
138	<i>Crotalaria juncea</i> L	Janumu	Leguminosae	Herb	Common
139	<i>Croton bonplandianus</i> Baill.	Vana mokka	Euphorbiaceae	Herb	Dominant
140	<i>Cynodon dactylon</i>	Garika	Poaceae	Herb	Sparse
141	<i>Desmodium dichotomum</i> (Willd.) DC.		Leguminosae	Herb	Sparse
142	<i>Eclipta alba</i> (L.) Hassk.	Guntagalagara	Asteraceae	Herb	Sparse
143	<i>Euphorbia hirta</i> L.	Nanubalu	Euphorbiaceae	Herb	Dominant
144	<i>Evolvulus alsinoides</i> (L.) L		Convolvulaceae	Herb	Dominant
145	<i>Fimbristylis cymosa</i> R.Br.	Pulupu gaddi	Cyperaceae	Herb	Sparse
146	<i>Gomphrena serrata</i> L.	Tella bendumalli	Amaranthaceae	Herb	Common
147	<i>Heteropogon contortus</i> (L.)		Poaceae	Herb	Common
148	<i>Hygrophila auriculata</i> (Schumach.)	Mundla gobbi	Acanthaceae	Herb	Dominant
149	<i>Indigofera hirsuta</i> L.	Kolapattitulu	Leguminosae	Herb	Common
150	<i>Indigofera linnaei</i> Ali		Leguminosae	Herb	Common
151	<i>Justicia procumbens</i> L.		Acanthaceae	Herb	Sparse
152	<i>Leucas aspera</i>	Tummi	Lamiaceae	Herb	Dominant
153	<i>Ludwigia perennis</i> L.	Lavangakaya mokka	Onagraceae	Herb	Common
154	<i>Mimosa pudica</i>	Atthi pathi	Leguminosae	Herb	Dominant
155	<i>Mollugo cerviana</i> (L.) Ser.		Molluginaceae	Herb	Sparse
156	<i>Ocimum canum</i> Sims	Kukka Tulasi	Lamiaceae	Herb	Dominant
157	<i>Oldenlandia umbellata</i> L.	Chiru veru	Rubiaceae	Herb	Dominant
158	<i>Oxalis corniculata</i>	Indian Sorrel	Oxalidaceae	Herb	Dominant
159	<i>Parthenium hysterophorus</i> L.	Vayyaribhama	Asteraceae	Herb	Dominant
160	<i>Pavonia zeylanica</i> Cav.	Karubenda	Malvaceae	Herb	Common
161	<i>Phyllanthus amarus</i>	Nela Usiri	Euphorbiaceae	Herb	Sparse
162	<i>Phyllanthus maderaspatensis</i> L.		Phyllanthaceae	Herb	Sparse
163	<i>Plumbago zeylanica</i> L	Agnimaata	Plumbaginaceae	Herb	Common
164	<i>Portulaca oleracea</i> L.	Pappu Kura	Portulacaceae	Herb	common
165	<i>Rhynchosia beddomei</i> Baker		Leguminosae	Herb	Sparse
166	<i>Ruellia tuberosa</i> L.	Jurbula gadda	Acanthaceae	Herb	Dominant

167	<i>Scoparia dulcis L.</i>	Potti boli	Plantaginaceae	Herb	Common
168	<i>Sesuvium portulacastrum (L.) L.</i>	Thikka Kura	Aizoaceae	Herb	Dominant
169	<i>Sida acuta Burm.f.</i>	Medabirusaku	Malvaceae	Herb	Dominant
170	<i>Sida cordifolia L.</i>	Chiru Benda	Malvaceae	Herb	Dominant
171	<i>Sida spinosa L.</i>	Naga bala	Malvaceae	Herb	Common
172	<i>Sonchus oleraceus (L.) L.</i>		Compositae	Herb	Dominant
173	<i>Sphaeranthus indicus L.</i>	Bodasaramu	Asteraceae	Herb	Dominant
174	<i>Tephrosia purpurea (L.) Pers.</i>	Vempali	Leguminosae	Herb	Dominant
175	<i>Trianthema portulacastrum L.</i>	kadaraku	Aizoaceae	Herb	sparse
176	<i>Tribulus terrestris L.</i>		Zygophyllaceae	Herb	Dominant
177	<i>Tridax procumbens (L.) L.</i>	Gaddichamanthi	Asteraceae	Herb	Dominant
178	<i>Triumfetta pentandra A.Rich.</i>	Chirusitrika	Malvaceae	Herb	Dominant
179	<i>Urena lobata L.</i>	Pedda benda	Malvaceae	Herb	Dominant
180	<i>Vanda tessellata</i>	Kodikalla chettu	Orchidaceae	Herb	Dominant
181	<i>Vernonia cinerea (L.) Less.</i>		Compositae	Herb	Dominant
182	<i>Waltheria indica L.</i>	Nalla Benda	Malvaceae	Herb	Dominant
183	<i>Ziziphus nummularia</i>	Nela regu	Rhamnaceae	Herb	Dominant
184	<i>Brachiaria eruciformis</i>		Poaceae	Grass	Sparse
185	<i>Chloris barbata</i>		Poaceae	Grass	Common
186	<i>Cymbopogon citratus</i>		Poaceae	Grass	Common
187	<i>Cyperus castaneus</i>		Poaceae	Grass	Common
188	<i>Cyperus flavidus</i>		Cyperaceae	Grass	Sparse
189	<i>Cyperus rotundus L.</i>		Cyperaceae	Grass	Sparse
190	<i>Digitaria ciliaris</i>		Poaceae	Grass	Common
191	<i>Eragrostis tenella</i>		Poaceae	Grass	Common
192	<i>Zizania latifolia</i>		Poaceae	Grass	Common
193	<i>Abrus precatorius L.</i>	Gurivinda	Leguminosae	Climber	Dominant
194	<i>Asparagus racemosus Willd.</i>	Pilli Gaddalu	Asparagaceae	Climber	Dominant
195	<i>Cissus quadrangularis L.</i>	Nalleru	Vitaceae	Climber	Dominant
196	<i>Clitoria ternatea L.</i>	Sanku-Pushpamu	Leguminosae	Climber	Dominant
197	<i>Cuscuta reflexa Roxb.</i>		Convolvulaceae	Climber	Dominant
198	<i>Daemia extensa</i>		Asclepidaceae	Climber	Sparse
199	<i>Dioscorea pentaphylla</i>	Adavi gunusuthega	Dioscoreaceae	Climber	Sparse
200	<i>Ipomoea macrantha</i>		Convolvulaceae	Climber	Common
201	<i>Ipomoea nil (L.) Roth.</i>		Convolvulaceae	Climber	Dominant
202	<i>Ipomoea obscura (L.) Ker Gawl.</i>		Convolvulaceae	Climber	Sparse
203	<i>Merremia tridentata (L.) Hallier f.</i>		Convolvulaceae	Climber	Rare
204	<i>Mucuna pruriens (L.) DC.</i>	Dulagondi	Leguminosae	Climber	common
205	<i>Passiflora edulis Sims.</i>	Fashion fruit	Passifloraceae	Climber	Rare
206	<i>Pergularia daemia (Forssk.) Chiov.</i>	Dustapu-Teega	Apocynaceae	Climber	Dominant
207	<i>Rivea hypocrateriformis Choisy.</i>	Bodditeega	Convolvulaceae	Climber	Dominant
208	<i>Tinospora cordifolia (Willd.) Miers.</i>	Tippa teega	Menispermaceae	Climber	Sparse

(* indicates Secondary data from Telangana State Forest Department Working Plan of Ranga Reddy District 2004 to 2014)

LIST OF FAUNA & THEIR CONSERVATION STATUS

Checklist of Mammalian species in the Study Area (* indicates Primary data)

Scientific Name	Common Name	IUCN	IWPA
<i>Rhinopoma hardwickii</i>	Lesser Mouse-Tailed Bat	LC	V
<i>Cynopterus sphinx</i>	Short-Nosed Fruit Bat	LC	V
<i>Pteropus giganteus</i>	Indian flying fox bat	LR/NR	V
<i>Taphozous melanopogon</i>	Black-Bearded tomb bat	LC	V
<i>Hipposideros speoris</i>	Schneider's Leaf-Nosed Bat	LC	V
<i>Bendicota bengalensis</i>	Indian mole rat	LC	V
<i>Bendicota indica</i>	Bandicoot rat	LC	V
<i>Mus booduga</i>	Little Indian Field mouse	LC	V
<i>Mus musculus</i>	House Mouse	LC	V
<i>Rattus rattus</i>	House rat	LC	V
<i>Suncus murinus</i>	Grey musk shrew	LC	V
<i>Sus scrofa</i>	Indian wild boar	LC	III
<i>Funambulus palmarum</i>	Three striped palm squirrel	LC	
<i>Lepus nigricollis nigricollis</i>	Black-naped Hare	LC	IV
<i>Herpestes edwardsii</i>	Grey Mongoose	LC	II

IUCN: International Union for Conservation of Nature and Natural Resources;

EX: Extinct; CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern; DD: Data Deficient. IW(P)A: Indian Wildlife (Protection) Act, 1972.

Source:

- Working plan of Ranga Reddy District Vol II (Forest Department)
- Vivek Menon (2014), *Indian Mammals: A Field Guide*. Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522;
- IUCN (2015). *The IUCN Red List of Threatened Species*. Version 2015-4;

List of AVES either spotted or reported or recorded from the study area

Scientific Name	Common name	IUCN Status	Conservation status as per wildlife protection act,1972
<i>Phalacrocorax niger</i>	Little cormorant	LC	Sch-IV
<i>Ardea cinerea</i>	Grey heron	LC	Sch-IV
<i>Ardea purpurea</i>	Purple heron	LC	Sch-IV
<i>Ardeola grayii</i>	Pond heron	LC	Sch-IV
<i>Bubulcus ibis</i>	Cattle egret	LC	Sch-IV
<i>Egretta garzetta</i>	Little egret	LC	Sch-IV

Scientific Name	Common name	IUCN Status	Conservation status as per wildlife protection act,1972
<i>Ixobrychus cinnamomeus</i>	Chestnut bittern	LC	Sch-IV
<i>Pseudibis papillosa</i>	Black ibis	LC	Sch-IV
<i>Elanus caeruleus</i>	Blackwinged kite	LC	Sch-IV
<i>Haliastur indus</i>	Brahminy kite	LC	Sch-IV
<i>Porphyrio porphyrio</i>	Purple moorhen	LC	Sch-IV
<i>Fulica atra</i>	Coot	LC	Sch-IV
<i>Vanellus indicus</i>	Redwattled lapwing	LC	Sch-IV
<i>Vanellus malabaricus</i>	Yellow-wattled lapwing	LC	Sch-IV
<i>Streptopelia chinensis</i>	Spotted dove	LC	Sch-IV
<i>Psittacula cyanocephala</i>	Blossomheaded parakeet	LC	Sch-IV
<i>Eudynamis scolopacea</i>	Koel	LC	Sch-IV
<i>Tyto alba</i>	Barn owl	LC	Sch-IV
<i>Glaucidium radiatum</i>	Jungle owlet	LC	Sch-IV
<i>Athene brama</i>	Spotted owlet	LC	Sch-IV
<i>Apus affinis</i>	House swift	LC	Sch-IV
<i>Cypsiurus parvus</i>	Palm swift	LC	Sch-IV
<i>Ceryle rudis</i>	Lesser Pied kingfisher	LC	Sch-IV
<i>Merops leschenaultii</i>	Chestnutheaded bee-eater	LC	Sch-IV
<i>Merops philippinus</i>	Bluetailed bee-eater	LC	Sch-IV
<i>Merops orientalis</i>	Small green bee-eater	LC	Sch-IV
<i>Coracias benghalensis</i>	Indian roller	LC	Sch-IV
<i>Megalaima viridis</i>	Small green barbet	LC	Sch-IV
<i>Megalaima haemacephala</i>	Crimsonbreasted barbet	LC	Sch-IV
<i>Pitta brachyura</i>	Indian pitta	LC	Sch-IV
<i>Ermeopterix grisea</i>	Ashycrowned finch-lark	LC	Sch-IV
<i>Hirundo concolor</i>	Dusky crag martin	LC	Sch-IV
<i>Hirundo rustica</i>	Eastern swallow	LC	Sch-IV
<i>Dicrurus adsimilis</i>	Black drongo	LC	Sch-IV
<i>Dicrurus caeruleus</i>	Whitebellied drongo	LC	Sch-IV
<i>Dicrurus paradiseus</i>	Greater racket-tailed drongo	LC	Sch-IV
<i>Artamus fuscus</i>	Ashy swallow-shrike	LC	Sch-IV
<i>Sturnus malabaricus</i>	Greyheaded myna	LC	Sch-IV
<i>Sturnus pagodarum</i>	Brahminy myna	LC	Sch-IV
<i>Acridotheres tristis</i>	Common myna	LC	Sch-IV
<i>Corvus splendens</i>	House crow	LC	Sch-IV

Scientific Name	Common name	IUCN Status	Conservation status as per wildlife protection act,1972
<i>Corvus macrorhynchos</i>	Jungle crow	LC	Sch-IV
<i>Pericrocotus cinnamomeus</i>	Small minivet	LC	Sch-IV
<i>Pycnonotus cafer</i>	Redvented bulbul	LC	Sch-IV
<i>Turdoides affinis</i>	Whiteheaded babbler	LC	Sch-IV
<i>Copsychus saularis</i>	Magpie-Robin	LC	Sch-IV
<i>Saxicoloides fulicata</i>	Indian robin	LC	Sch-IV
<i>Monticola solitarius</i>	Blue rock thrush	LC	Sch-IV
<i>Zoothera citrina</i>	White-throated ground thrush	LC	Sch-IV
<i>Turdus merula</i>	Blackbird	LC	Sch-IV
<i>Parus major</i>	Grey tit	LC	Sch-IV
<i>Parus xanthogenys</i>	Yellowcheeked tit	LC	Sch-IV
<i>Anthus hodgsoni</i>	Indian tree pipit	LC	Sch-IV
<i>Anthus trivialis</i>	Tree pipit	LC	Sch-IV
<i>Motacilla flava</i>	Yellow wagtail	LC	Sch-IV
<i>Dicaeum agile</i>	Thickbilled flowerpecker	LC	Sch-IV
<i>Dicaeum erythrorhynchos</i>	Tickell's flowerpecker	LC	Sch-IV
<i>Nectarinia zeylonica</i>	Purplerumped sunbird	LC	Sch-IV
<i>Nectarinia asiatica</i>	Purple sunbird	LC	Sch-IV
<i>Zosterops palpebrosa</i>	White-eye	LC	Sch-IV
<i>Passer domesticus</i>	House sparrow	LC	Sch-IV
<i>Ploceus philippinus</i>	Baya	LC	Sch-IV
<i>Ploceus manyar</i>	Streaked weaver bird	LC	Sch-IV
<i>Lonchura punctulata</i>	Spotted munia	LC	Sch-IV
<i>Lonchura malacca</i>	Blackheaded munia	LC	Sch-IV
<i>Anser indicus</i>	Bar-headed goose	LC	Sch-IV

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated, R : Resident; RM : Resident Migratory; M: Migratory. All the birds observed from the study area.

Identification Sources:

- Ali, S and Ripley, S.D. 1969. Handbook of the Birds of India and Pakistan together with those of Nepal, Sikkim, Bhutan and Ceylon, 3. Stone Curlews to Owls. Oxford University Press, Bombay, 327pp.
- IUCN 2019. The IUCN Red List of Threatened Species. Version 2018-2. <<http://www.iucnredlist.org>>

- Grimmett, R., Inskipp, C and T. Inskipp, 2001. Pocket Guides to the Birds of the Indian Subcontinent. Cristopher Helm Publishers, Oxford University Press, 384pp.

List of Reptiles either spotted or reported from the study area. (* indicates Primary data)

Scientific Name	Common Name	IUCN	IWPA
<i>Bungarus caeruleus</i>	Krait		Not listed
<i>Dendrelaphis tristis</i>	Common Tree Snake	LC	
<i>Echis carinatus</i>	Saw scaled wiper		
<i>Eryx conicus</i>	Russells earth boa		
<i>Eryx johii</i>	Johns earth boa		
<i>Lycodon aulicus</i>	Common wolf snake		
<i>Naja naja</i>	Indian Cobra	LC	II
<i>Ptyas mucosus</i>	Common Rat snake*	LC	II
<i>Trimeresurus gramineus</i>	Green pit viper	LC	IV
<i>Hemidactylus flaviviridis</i>	North house gecko*		
<i>Cyrtodactylus kacchensis</i>	Black rock gecko*		
<i>Hemimidactylus brooki</i>	House gecko*	LC	
<i>Vipera russelli</i>	Russel Viper*	LR	II
<i>Calotes rouxi</i>	Forest Calottes*	LC	
<i>Calotes versicolor</i>	Common garden lizard*	LC	
<i>Ophisops microlepis</i>	Skink*		
<i>Mabuya carinata</i>	Common Skink*	LC	
<i>Chamaeleon zelanicus</i>	Chameleon*	VU	II

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Sources for Reptiles:

- Indraneil Das (2002). *Snakes & other Reptiles of India*. New Holland Publishers (UK) Ltd pp. 1-144;
- Daniel J.C (2002). *The Book of Indian Reptiles and Amphibians*
- Romulus Whitaker & Ashok Captain (2006). *Snakes of India; Dreko Books, Chennai, pp 1-146;*
- IUCN (2015); *The IUCN Red List of Threatened Species*. Version 2015-4;

List of Amphibians either spotted or reported from the study area.

Scientific Name	Common Name	IUCN	IWPA
<i>Rana hexadactyla</i>	Common green frog *	LC	IV
<i>Bufo melanostictus</i>	Common Indian Toad	LC	IV
<i>Polypedates maculatus</i>	Common Tree Frog	LC	IV
<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	LC	IV

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Sources for Amphibians:

- Ranjit Daniels (2004). Amphibians of Peninsular India
- Romulus Whitaker & Ashok Captain (2006). *Snakes of India*; Dreko Books, Chennai, pp 1-146;
- IUCN (2015); *The IUCN Red List of Threatened Species*. Version 2015-4;
- *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

List of fishes reported from the study area.

1	<i>Order: Osteoglossiformes</i> <i>Suborder: Notopteroidei</i> <i>Family: Notopteridae</i>	<i>Notopterus notopterus</i>	Common
2	<i>Order: Cypriniformes</i> <i>Family: Cyprinidae</i> <i>Subfamily: Danioninae</i>	<i>Barilius barna</i>	Uncommon
3		<i>Barilius bendelisis</i>	Uncommon
4		<i>Salmostoma bacaila</i>	Common
5		<i>Salmostoma clupeoides</i>	Rare
6		<i>Salmostoma untrachi</i>	Uncommon
7		<i>Amblypharyngodon</i>	Common
8		<i>Chela cachius</i>	Uncommon
9		<i>Rasbora daniconius</i>	Common
10		<i>Rasbora rasbora</i>	Uncommon
11		<i>Brachydanio rerio</i>	Uncommon
12		<i>Esomus danricus</i>	Common
13	<i>Sub-family: Cyprininae</i>	<i>Tor khudree</i>	Rare
14		<i>Cirrhinus mrigala</i>	Uncommon
15		<i>Cirrhinus reba</i>	Uncommon
16		<i>Cyprinus carpio</i>	Common
17		<i>Osteobrama belangeri</i>	Uncommon
18		<i>Osteobrama cotio</i>	Uncommon
19		<i>Osteobrama vigorsii</i>	Uncommon
20		<i>Thynnichthys sandkhol</i>	Rare
21		<i>Gonoproktopterus</i>	Uncommon
22		<i>Puntius amphibius</i>	Uncommon
23		<i>Puntius chola</i>	Common
24		<i>Puntius conchoniis</i>	Rare
25		<i>Puntius dorsalis</i>	Uncommon
26		<i>Puntius filamentosus</i>	Uncommon
27		<i>Puntius melanostigma</i>	Rare
28		<i>Puntius sarana sarana</i>	Common
29		<i>Puntius sophore</i>	Common
30		<i>Puntius terio</i>	Rare
31		<i>Puntius ticto</i>	Common
32		<i>Catla catla</i>	Common
33		<i>Labeo boggut</i>	Rare
34		<i>Labeo calbasu</i>	Uncommon
35		<i>Labeo fimbriatus</i>	Uncommon
36		<i>Labeo potail</i>	Uncommon
37		<i>Labeo rohita</i>	Common
38		<i>Labeo sidensis</i>	Uncommon
39	<i>Family: Garrinae</i>	<i>Garra gotyla stenorhynchus</i>	Uncommon
40		<i>Garra mullya</i>	Common
41	<i>Family: Cobitidae</i> <i>Sub-family: Cobitinae</i>	<i>Lepidocephalus guntea</i>	Common
42	<i>Order: Siluriformes</i>	<i>Aorichthys aor</i>	Uncommon

	Family: Bagridae Sub-family: Bagrinae		
43		<i>Aorichthys seenghala</i>	Rare
44		<i>Mystus bleekeri</i>	Common
45		<i>Mystus cavasius</i>	Uncommon
46		<i>Mystus vittatus</i>	Common
47	Family: Siluridae	<i>Wallago attu</i>	Common
48		<i>Ompok bimaculatus</i>	Uncommon
49		<i>Ompok malabaricus</i>	Rare
50	Family: Clariidae	<i>Clarias batrachus</i>	Common
51	Family: Heteropneustidae	<i>Heteropneustes fossilis</i>	Common
52	Super order: Acanthopterygii Order: Cyprinodontiformes Family: Poeciliidae Sub-family: Poeciliinae	<i>Gambusia affinis</i>	Uncommon
53	Order: Perciformes Sub-order: Channoidei Family: Channidae	<i>Channa marulius</i>	Uncommon
54		<i>Channa orientalis</i>	Uncommon
55		<i>Channa punctatus</i>	Common
56		<i>Channa striatus</i>	Common
57	Sub-order: Labroidei Family: Cichlidae	<i>Etroplus maculatus</i>	Common
58		<i>Etroplus suratensis</i>	Uncommon
59		<i>Oreochromis mossambica</i>	Uncommon
60		<i>Oreochromis nilotica</i>	Common
61	Sub-order: Gobiodei Family: Gobiidae Sub-family: Gobiinae	<i>Glossogobius giuris</i>	Common
62	Sub-order: Anabantoidea Family: Belontiidae Sub-family: Trichogasterinae	<i>Colisa fasciatus</i>	Common
63	Family: Trichogasterinae	<i>Osphronemus goramy</i>	Uncommon
64	Order: Synbranchiformes Sub-order: Mastacembeloidei Family: Mastacembelidae Sub-family: Mastacembelinae	<i>Macrognathus pancalus</i>	Uncommon
65		<i>Mastacembalus armatus</i>	Uncommon

Sources:

Barman, R.P. (1993). Pisces: Freshwater Fishes, pp.89-334. In: *State Fauna Series 5, Fauna of Andhra Pradesh*, Part-I. Zoological Survey of India.

Siddiqi, S.Z. and V. Kaza and R. Rao (1991). Limnological investigations on a recent major fish kill (*Notopterus notopterus*) in Hussainsagar, Hyderabad, India. *Pollution Research* 10(4): 191-198.

List of Butterflies either spotted or reported from the study area. (* indicates Primary data)

Scientific Name	Common Name	IUCN	IWPA
<i>Acraea violae</i>	Tawny Coster*	LC	
<i>Danaus chrysippus chrysippus</i>	Plain Tiger *	LC	
<i>Danaus genutia genutia</i>	Striped Tiger*	LC	
<i>Euploea core core</i>	Common Crow*	LC	Sch- IV
<i>Phalanta phalantha phalantha</i>	Common Leopard*	LC	
<i>Precis lemonias lemonias</i>	Lemon Pansy*	LC	
<i>Precis orithya ocyale</i>	Blue Pansy *	LC	
<i>Chilades laius</i>	Lime Blue*	LC	

<i>Everes lacturnus syntala</i>	Indian Cupid *	LC	
<i>Freyeria trochylus</i>	Grass Jewel*	LC	
<i>Jamides celeno aelianus</i>	Common Cerulean *	LC	
<i>Tarucus nara</i>	Rounded Pierrot*	LC	
<i>Colotis etrida</i>	Small Orange Tip*	LC	
<i>Colotis eucharis eucharis</i>	Plain Orange Tip*	LC	
<i>Catopsilia pomona</i>	Common Emigrant*	LC	
<i>Eurema hecabe simulata</i>	Common Grass Yellow*	LC	
<i>Papilio demoleus</i>	Lime Butterfly*	LC	
<i>Papilio polytes polytes</i>	Common Mormon*	LC	
<i>Papilio polytes stichius</i>	Common Mormon *	LC	

Sources:

1. Gunathilagaraj, K., T.N.A. Perumal, K. Jayaram, M. Ganesh Kumar, 1998. Some South Indian Butterflies. Published under Project Lifescape, Indian Academy of Sciences, Bangalore, 270 pp.
2. Kehimkar, I. 2008. The book of Indian butterflies. Bombay Natural History Society and Oxford University Press, Mumbai. 497p.
3. Kunte, K. 2000. India - A Lifescape: Butterflies of Peninsular India. Indian Academy of Sciences, Bangalore, Universities Press. 270p
4. Thulsi Rao, K., M. Prudhvi Raju, S.M. Maqsood Javed and I. Siva Rama Krishna, 2004; A checklist of Butterflies of Nagarjunasagar Srisailam Tiger Reserve, Andhra Pradesh. Zoos' Print Journal 19 (12): 1713-1715.

**Scientific Study report on Impacts of Desiltation
at
MEDIGADDA BARRAGE, JAYASHANKAR BHUPALPALLY DISTRICT
of Telangana**



Report Prepared By:



**TELANGANA STATE MINERAL DEVELOPMENT CORPORATION LIMITED,
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Technical Consultant:

SRI SAI MANASA NATURE TECH PVT LTD, YDERABAD

And
ENVIRON SOFTWARE PVT LTD, BANGALORE

February 2020

DECLARATION BY THE HEAD OF THE TECHNICAL CONSULTANT ORGANIZATION / AUTHORIZED PERSON

I, **E Shyam Sundar**, hereby, confirm that the report on “ **Scientific Study Report On Impacts of Desiltation At Medigadda Barrage of Jayashankar Bhupalapally District, Telangana state**” has been prepared by **M/s Sri Sai Manasa Nature Tech Pvt. Limited (SSMNTPL)** on behalf of and for the use of **Telangana Mineral Development Corporation (TSMDC)**, Govt. of Telangana with due consideration and skills as per our general terms and conditions of business and the terms of agreement with TSMDC. **M/s Environ Software Pvt Ltd, Bangalore** has associated with SSMNT for conducting the mathematical modeling for completing the proposed study.

SSMNTPL is having accreditations to National Accreditation Board for Education & Training (NABET) and Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt of India.

SSMNTPL has prepared this report by incorporating various published information, information collected from relevant TS Govt. Departments and details collected from the interactions from TSMDC & Telangana Mines & Geology Dept. The technical information or conclusion / recommendations herein enclosed have been derived based on the data collected and data provided w.r.t. the project and shall be considered as a Technical Professional Opinion. It shall not be construed as a formal opinion and it does not waive any involved Party's rights & responsibilities or obligations with respect to the study requirements at any phase of the project.

These conclusions will become null and void should SSMNTPL not be kept informed of such modifications or alterations with specific reference to the present document/ report. This document is valid only when presented in full.

Signature :

Name : **E Shyam Sundar**

Designation : **Head Of Organisation**

Name of the Consultant Organization : **Sri Sai Manasa Nature Tech Pvt. Limited.**

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Abbreviations

ABBREVIATIONS

TSMDC: TELANAGANA STATE MINERAL DEVELOPMENT CORPORATION

KLIP: Kaleshwaram Lift Irrigation Project

TMC: Thousand Million Cubic

MMT: Million Metric Tonnes

SSMNT: Sri Sai Manasa Nature Tech

SABS: Suspended and Bedded Sediments

Chapter-1
Introduction

1. INTRODUCTION

1.1. INTRODUCTION

Rivers are dynamic features of the landscape, changing their size, shape and bed material with time and in accordance with changes in water flow and sediment load. The fluvial material that makes up a river bed, banks and floodplain has been carried and deposited there by the river and can be moved again given the right conditions. A river topography can be considered to be relatively stable when its water flow and sediment flux are in balance over time. If there is a change in either of these two factors, then the river will adjust its slope, depth, width, meander pattern, bed composition and vegetation density accordingly. The extent and rate of these adjustments are dependent on the extent and rate of change in the water flow and sediment load

1.2. SILTATION & DESILTATION

Siltation, is water pollution caused by particulate terrestrial clastic material, with a particle size dominated by silt or clay. It refers both to the increased concentration of suspended sediments and to the increased accumulation (temporary or permanent) of fine sediments on bottoms where they are undesirable. Siltation is most often caused by soil erosion or sediment spill.

Siltation is a natural phenomenon in rivers. However, factors such as heavy rainfall, deforestation, structural interventions and enclosure of water in reservoirs increases the rate of siltation in rivers. Siltation results in the reduction in the carrying capacity of rivers and results in floods and loss of created useful storage. Desilting is the removal of fine silt and sediment that has collected in a river in order to restore its natural capacity, without widening or deepening of the river. Desiltation works have the potential to improve the hydraulic performance of a river. However, indiscriminate desilting can cause adverse impacts on a river's ecology and flow.

Desilting is the removal of earthy materials, such as sand and mud, from the bed of a fast-flowing river. These earthy deposits, over time, can lead to blockages which could cause obstructions to the free-flowing movement of water which could in turn lead to flooding. Desilting is generally done along with rubbish collection, plant removal and widening of the river's banks in a process commonly known as desilting.

The dams and reservoirs can be a significant source of sand. Many such structures are silted and their water holding capacity has gone down considerably. Taking up desilting

of such projects can serve dual purpose of increasing the water holding capacity and making available the sand for other usage.

A well-designed structure has to take care of obstruction induced silting and proportionate withdrawal of silt with water so as not to affect the river regime beyond a controlled area upstream or downstream. In this context, need was felt to have scientific studies and empirical evidences so that well informed decision could be arrived at regarding the Desiltation.

1.3. PRESENT STUDY

Telangana State Mineral Development Corporation (TSMDC) is proposing to extract the sand from the river bed of along the stretch of Godavari River and its tributaries. With this view TSMDC has commissioned “**Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana**” and the present report details the same. Main objective of the study is to suggest Desilting the Medigadda Barrage constructed on The River Godavari based on model study and its economic viability. Medigadda Barrage is part of Kaleshwaram Lift Irrigation Project (KLIP).

1.4. BRIEF ABOUT KLIP

“**Kaleshwaram Lift Irrigation Project (KLIP)**” is the biggest Lift Irrigation scheme having three barrages across the River Godavari – 1st barrage at Medigadda, 2nd barrage at Annaram and 3rd barrage at Sundilla. The source point for water lifting is near Medigadda village below the confluence of Pranahita and Godavari Rivers and 20-km downstream of Kaleshwaram.

- ❖ One of the largest irrigations and drinking water project which will not only create new ayacut but also stabilize existing ayacut in the state.
- ❖ The potential for irrigation is 45 Lakh acre per cropping season (including new ayacut and stabilisation of existing ayacut)
- ❖ The water stored by the construction of the barrages at Medigadda, Annaram and Sundilla barrage and reservoirs is conveyed through a canal network to 13 districts of the State.

The KLIP Project envisages construction of three barrages between Yellampally & Medigadda viz.:

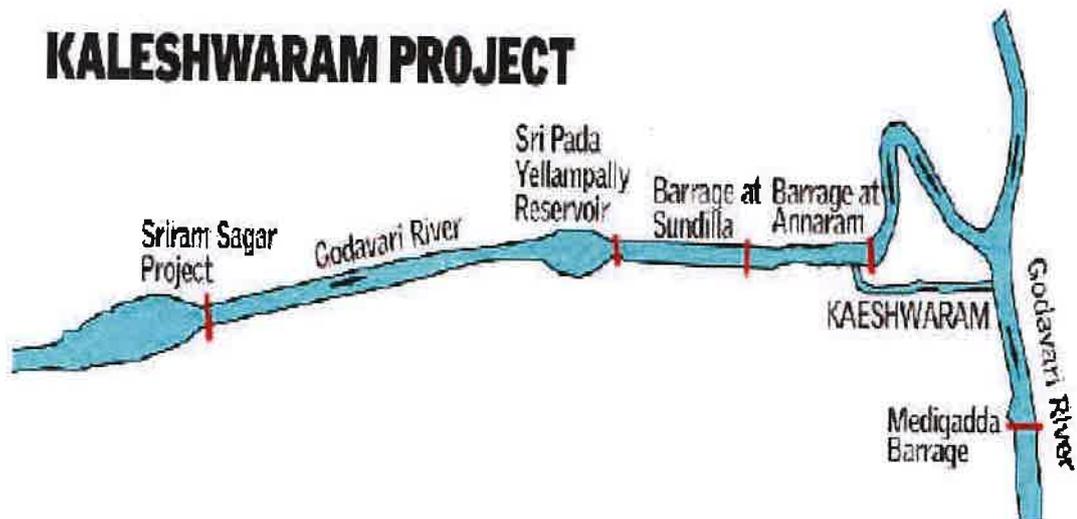
- **Medigadda Barrage** on Godavari near Medigadda (Kaleshwaram) located at 80004'37" E Longitude and 180 42' 48" N Latitude;
- **Annaram Barrage** on Godavari downstream of confluence of Manair River with Godavari river near Annaram located at 79049'02" E Longitude and 180 45' 37" N Latitude; and

Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana

- **Sundilla Barrage** on Godavari downstream of Yellampally barrage near Sundilla located at 79°36'43" E Longitude and 18° 47' 13" N Latitude.



KLIP is aimed at to utilize Godavari water by diverting about 180 TMC for Irrigation purpose (134.5TMC), stabilisation of existing command area (34.5 TMC), drinking water to Hyderabad (30 TMC), drinking water to en route villages (10 TMC) & for industrial uses (16 TMC).



The location map of KLIP on Survey of India (Sol) Topo map is shown in **Figure-1.1**.

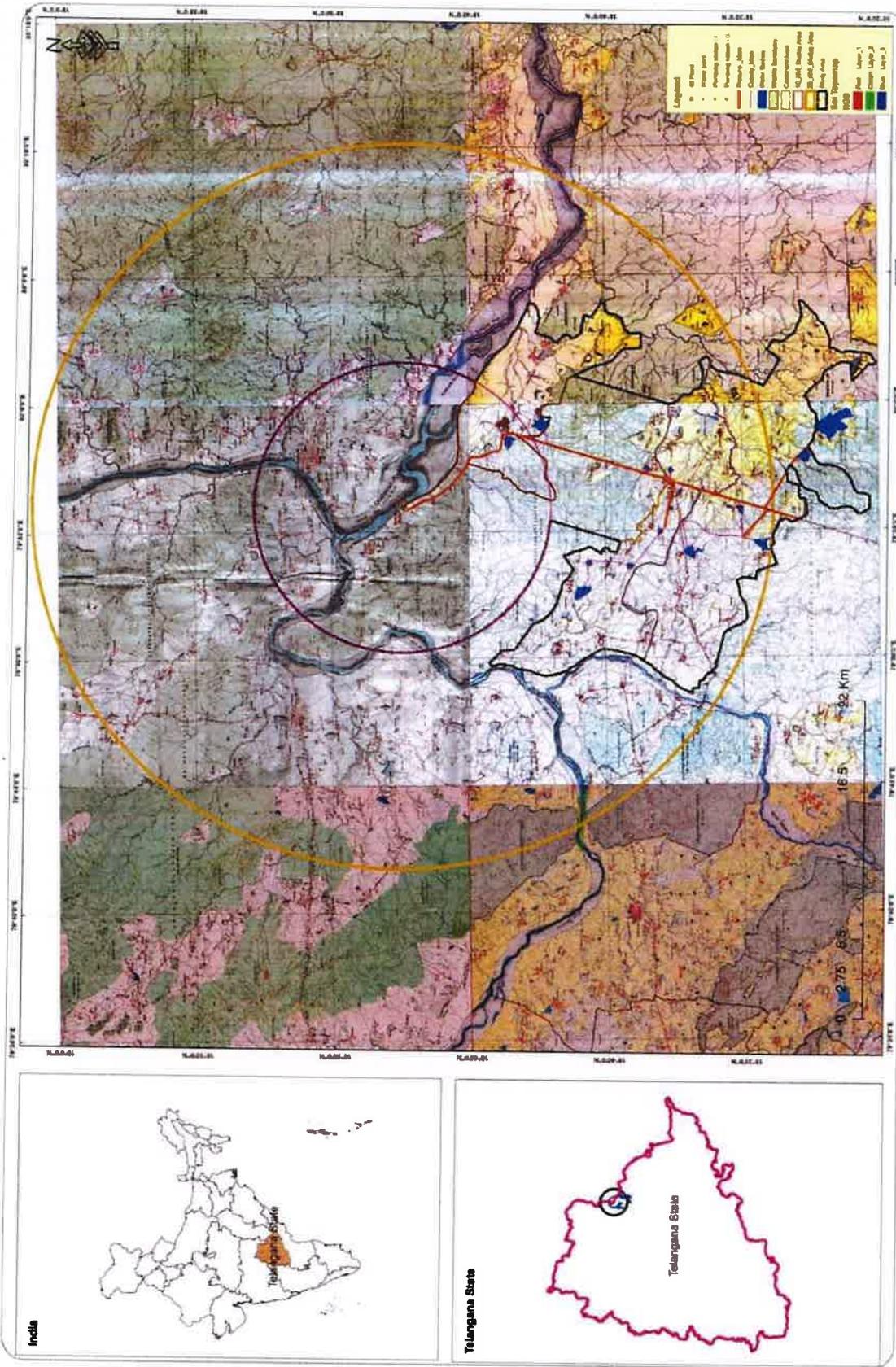


FIGURE 1-1: LOCATION MAP OF KALESHWARAM LIFT IRRIGATION SCHEME ON SOI TOPOSHEET

Medigadda Barrage is the starting point of the KLIP which envisages construction of three barrages between Yellampally & Medigadda. Its objective is to utilize Godavari water for drinking and irrigation. The Barrage/ Project site is located at Medigadda Village, Mahadevpur Mandal, Jayashankar Bhupalapally District in Telangana state. Medigadda Barrage details are given in **Table-1.1**.

TABLE 1-1: MEDIGADDA BARRAGE DETAILS

Bed Level (mts)	Pond Level (mts)	Gross Storage (in TMC)	Number of Gates
89.0	100.0	16.17	85

1.5. ABOUT THE TSMDC

Telangana State Mineral Development Corporation (TSMDC), Govt. of Telangana, has been established on 8th October 2014 with main objective of Exploration & Exploitation of mineral resources and Establish & promotion of mineral based industries.

Main goals of TSMDC are to strive for the development of Mineral development through eco-friendly mining, Development of mining industries by promoting private participation and using modern technology to extract & explore minerals & bringing investors in the development of natural mineral resources.

With increasing construction activity within Telangana State, TSMDC aims to excavate sand from river bed and by desilting the barrages constructed on River Godavari and its tributaries. According to a government estimate, On an average, sand consumption in the State is 12.5 million cubic metres (~ 22.5 MMT) per annum, while the supply of sand by TSMDC is 7 million cubic metres (~13.23 MMT) only, and there is deficit of 5.5 million cubic metres (~10.5 MMT). The deficit of river sand in the State is being met by use of M-sand (4 million cubic metres, ~7.56 MMT) and import from neighbouring States (upto 0.1 million cubic metres).

1.6. SCOPE OF THE STUDY

TSMDC has assigned the study to **M/s Sri Sai Manasa Nature Tech Private Limited (SSMNT)**, Hyderabad to conduct the scientific study along with carrying out mathematical modeling studies for predicting the impact on flow regime due to siltation and de-siltation at Medigadda Barrage. **M/s Environ Software Pvt Ltd, Bangalore** has associated with SSMNT for conducting the mathematical modeling for completing the proposed study.

1.6.1. Objectives and Scope of work

The following are the main objectives of the present study:

- **Hydrodynamic studies**

- Simulate the over land flow conditions prevailing in the study area based on river bathymetry and topography of the study domain and rain fall / runoff data;
- Calibrate the model with the available field data i.e. stream gauge data; and
- Predict the flow conditions in the study domain considering the rainfall for various metrological and hydrological conditions.

➤ **Sedimentation Modeling Studies**

- To study the sedimentation process i.e siltation / de-siltation patterns in the study domain;
- Numerical runs will be carried for overland flow conditions for predicting morphological changes due to the flow regime;
- Numerical modeling studies for erosion, deposition and shoreline changes for various hydrological conditions;
- Modeling studies for predicting the impact on flow dynamics, bed morphology and marine environment due to the proposed de-siltation/dredging; and
- To identify siltation zones in the rivers and to identify shoreline changes if any due monsoon river flows.

➤ **De-Siltation Studies:**

- To study on flow regime due to de-siltation activities;
- To study on sedimentation processes and flow regime due to de-siltation activities; and
- To identify de-siltation material for the stabilization of the bed with marine environmental impacts due to turbidity build up, morphological changes.

1.7. STRUCTURE OF THE REPORT

The present reports detail the following aspects:

1. Introduction & Scope of the study
2. Silt loads and necessity of de-silting
3. Description of Sand Stretches
4. The River Godavari basin
5. District Profile
6. Estimation of quantity and method of de-siltation
7. Impacts of Desilting & Remedial Measures
8. Budget for Environmental Remedial Measures
9. Conclusion and Recommendations
10. Disclosure of Technical Consultants

Chapter-2
Silt Loads and Necessity of Desilting

2. SILT LOADS AND NECESSITY OF DE-SILTING

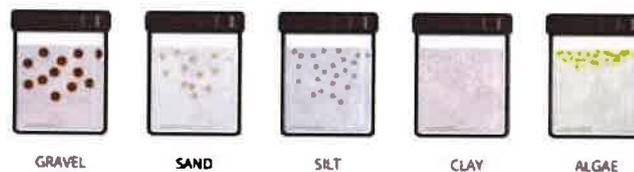
2.1. INTRODUCTION

Erosion, movement and deposit of sediments is a natural process in rivers and Streams. However, factors such as heavy Rainfall, creation of irrigation structures, de-forestation of catchment areas and other man made interentions will increase the siltation of rivers. Siltation will reduce the carrying capacity of the rivers and reduce the storage of reservoirs thus by result in reducing life of reservoirs as well as reduce the intended aims of ther reservoirs for supply of water for various uses.

De-silting is removal of sand, silt and other sediments from rivers beds in order to restore its natural capacity. De-siltation is having potential to improve the hydualic performance of the rivers as well as water reservoirs created for their intended use. However, indesriminate de-silting can cause adverse impacts on rivers ecology and flow.

2.2. SEDIMENTS IN RIVER SYSTEMS

Sediment refers to the conglomerate of materials, organic and inorganic, that can be carried away by water, wind or ice. While the term is often used to indicate soil-based, mineral matter (e.g. clay, silt and sand), decomposing organic substances and inorganic biogenic material are also considered sediment. Most mineral sediment comes from erosion and weathering, while organic sediment is typically detritus and decomposing material such as algae.



These particulates are typically small, with clay defined as particles less than 0.00195mm in diameter, and coarse sand reaching up only to 1.5 mm in diameter. However, during a flood or other high flow event, even large rocks can be classified as sediment as they are carried downstream. Sediment is a naturally occurring element in many bodies of water, though it can be influenced by anthropogenic factors.

2.3. SUSPENDED OR BEDDED?

In an aquatic environment, sediment can either be suspended (floating in the water column) or bedded (settled on the bottom of a body of water). When both floating and settled particles are monitored, they are referred to as SABS: Suspended and Bedded Sediments and illustrated in **Figure-2.1**

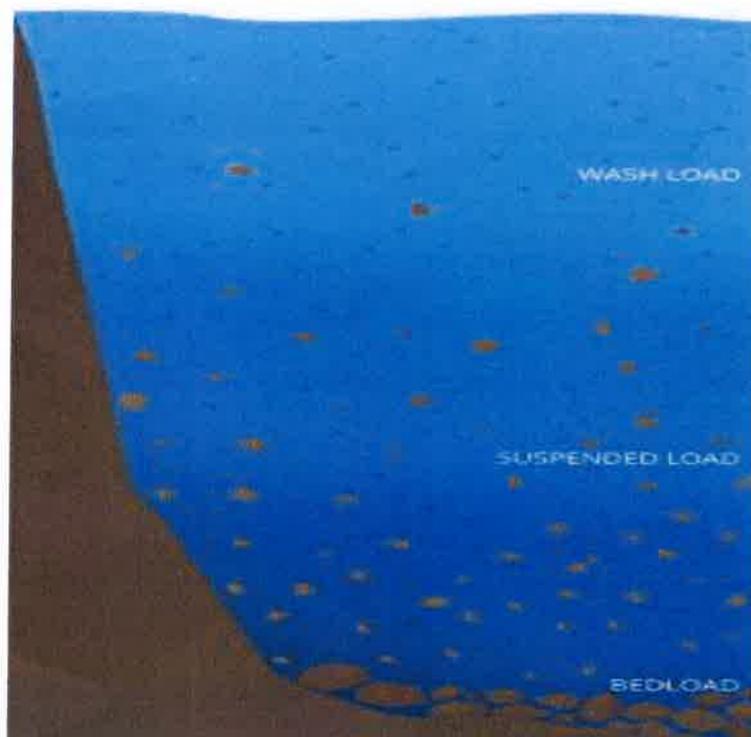


FIGURE 2-1: SUSPENDED SEDIMENT VS SUSPENDED SOLIDS

Fine sediment can be found in nearly any body of water, carried along by the water flow. When the sediment is floating within the water column it is considered suspended. In this application, the terms “suspended sediment” and “suspended solids” are nearly interchangeable. The main difference between the two is in the method of measurement.

2.4. WHAT IS SEDIMENT TRANSPORT?

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. Movement of silt loads in rivers is illustrated in **Figure-2.2**.



FIGURE 2-2: MOVEMENT OF SILT LOADS IN RIVERS

Figure 2.3 depicts movement of Silt loads in Rivers Bedload particles travel with water flow by sliding or bouncing along the bottom.



FIGURE 2-3: BEDLOAD

Bedload is the portion of sediment transport that rolls, slides or bounces along the bottom of a waterway. This sediment is not truly suspended, as it sustains intermittent contact with the streambed, and the movement is neither uniform nor continuous. Bedload occurs when the force of the water flow is strong enough to overcome the weight and cohesion of the sediment. While the particles are pushed along, they typically do not move as fast as the water around them, as the flow rate is not great enough to fully suspend them. Bedload transport can occur during low flows (smaller particles) or at high flows (for larger particles). Approximately 5-20% of total sediment transport is bed load. In situations where the flow rate is strong enough, some of the smaller bedload articles can be pushed up into the water column and become suspended.

2.5. SEDIMENTS LOAD OF RIVER GODAVARI

The average annual run-off and sediment load of River Godavari and other major rivers in India is given in the **Table 2.1**. On the global scale, River Godavari ranks ninth in terms of sediment transport. 50% of total sediment load of all tropical Indian Rivers in the peninsula is contributed by River Godavari.

TABLE 2-1: SEDIMENT TRANSPORT LOAD OF MAJOR INDIAN AND WORLD RIVERS

River	Drainage Area, KM ²		Annual Runoff 10 ⁵ m ³		Sediment Transport Total	
	Godavari	313	147	92	245	170
Krishna	251	360	32	397	4	110
Cauvery	66	243	11	510	1	500
Mahanadi	88	320	54	510	30	700
Narmada	87	892	46	673	69	700
Tapti	49	136	9	713	24	700
Pennar	48	660	5	203	6	900
Brahmani	28	200	16	340	20	400
Mahi	25	501	10	817	9	700

(Source: Paper on Erosion, Transport and deposition of Sediments by the tropical rivers of India by Shri P. Viswanathan, AL Ramanathan & V. Surbramanian)

2.6. BASIN GEOLOGY AND SEDIMENT CONTRIBUTION

The Rock formations in the drainage basin plays key role in controlling the sediment transport by a river. The typical rock formations in the peninsula are Granites and hard rocks, Deccan traps and sedimentary rocks. The description of rock types in the Godavari basin and their relative contribution to annual sediment loads is given in the **Table-2.2**. Sedimentary rocks in the Godavari basin contribute relatively large sediment loads because of their high degree of erodibility. The Deccan traps occupies nearly half of the basin area and contributes to same proportion of sediment. Below table provides contribution of sediment loads by different rock types in Godavari Basin

TABLE 2-2: CONTRIBUTION OF SEDIMENT LOADS BY INDIVIDUAL ROCK TYPES

Rock type	% of basin area	Annual sediment load, Tx10 ⁵	%
Granite and hard rock	39	27	16
Deccan traps	48	87	51
Sedimentary rocks	13	13	33
TOTAL	100	170	100

Source: Paper on Erosion, Transport and deposition of sediments by the tropical rivers of India by Shri P. Viswanathan, AL. Ramanathan & V. Subramanian

2.7. GRAIN SIZE DISTRIBUTION OF SEDIMENTS IN PENINSULAR RIVERS

Below **Table 2.3** presents grain size distribution sediments of River Godavari and other major peninsular rivers.

TABLE 2-3: GRAIN SIZE DISTRIBUTION OF SEDIMENTS LOADS OF PENINSULAR RIVERS

River	Course size fraction (>200 µm)		Medium size fraction (200-75 µm)		Fine size fraction (<75 µm)	
	Range	Mean	Range	Mean	Range	Mean
Godavari	2-60 (2-23)	23 (14)	3-70 (5-30)	33 (19)	39-191 (49-87)	114 (67)
Krishna	0.005-2.2 (2-14)	0.80 (10)	2-3.7 (9-23)	1.7 (22)	1.9-10.4 (63-89)	5.2 (68)
Cauvery	0.002 – 0.7 (9-37)	0.4 (21)	0.0001-0.5 (4-20)	0.2 (12)	0.2-2.7 (43-87)	1.1 (67)

Figures in Parenthesis indicates percentages

(Source: Paper on Erosion, Transport and deposition of Sediments by the tropical rivers of India by Shri P. Viswanathan, AL Ramanathan & V. Surbramanian)

Chapter-3
Description of Sand Stretches

3. DESCRIPTION OF SAND STRETCHES

Based on the observations over the past 5 years and considering the accessibility, twenty three reaches are identified in the riverbed. The details of reaches identified and their distance from the Medigadda Barrage are given below in the Table. 3.1 and are identified in Figure 3.1

TABLE 3-1: LIST OF SAND REACHES IN MEDIGADDA BARRAGE

Sl. No.	Name of the Stockyard	Location	Village	Mandal
1	Mahadevpur-1	18°45'32.63"N 79°59'32.71"E	Mahadevpur	Mahadevpur
2	Mahadevpur-2	18°46'5.44"N 79°59'11.96"E	Kothapeta	Mahadevpur
3	Mahadevpur-3	18°45'33.09"N 79°58'51.15"E	Kothapeta	Mahadevpur
4	Mahadevpur-4	18°45'33.63"N 79°58'10.71"E	Edapally	Mahadevpur
5	Mahadevpur-5	18°45'33.90"N 79°57'49.98"E	Kudhurupally	Mahadevpur
6	Mahadevpur-6	18°45'41.75"N 79°57'29.23"E	Edapally	Mahadevpur
7	Pusukupally-1	18°49'43.39"N 79°53'42.96"E	Pusukupally	Pusukupally
8	Pusukupally-2	18°49'38.28"N 79°53'10.28"E	Pusukupally	Pusukupally
9	Pusukupally-3	18°49'49.74"N 79°52'39.49"E	Pusukupally	Pusukupally
10	Suraram-1	18°43'26.24"N 80° 3'2.23"E	Suraram	Suraram
11	Suraram-2	18°43'40.43"N 80° 2'38.39"E	Suraram	Suraram
12	Begluru-1	18°43'42.32"N 80° 2'16.45"E	Begur	Begluru
13	Begluru-2	18°44'19.50"N 80° 2'6.69"E	Begur	Begluru
14	Elkeshwaram	18°44'21.38"N 80° 1'24.87"E	Bommapur	Elkeshwaram
15	Bommapur-1	18°44'44.13"N 80° 0'55.85"E	Mahadevpur	Bommapur
16	Bommapur-2	18°45'17.23"N 80° 0'47.23"E	Mahadevpur	Bommapur
17	Brahmanpalli-1	18°45'43.71"N 80° 0'2.13"E	Mahadevpur	Brahmanpalli
18	Brahmanpalli-2	18°46'1.38"N 79°59'36.48"E	Mahadevpur	Brahmanpalli
19	Kuntlam-1	18°49'58.17"N 79°51'54.01"E	Balijapur	Kuntlam
20	Kuntlam-2	18°50'25.14"N 79°51'33.15"E	Balijapur	Kuntlam
21	Kuntlam-3	18°50'59.92"N 79°51'30.43"E	Kuntlam	Kuntlam
22	Palugula-1	18°51'8.93"N 79°51'42.82"E	Kuntlam	Palugula
23	Palugula-2	18°51'42.27"N 79°51'12.71"E	Kuntlam	Palugula

3.1. KEY FEATURES OF THE SURROUNDINGS OF REACHES

18 stock yards have been identified near Medigadda Barrage and the list is given in Table-3.2.

Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana

TABLE 3-2: LIST OF STOCK YARDS PROPOSED

SL. No	Sand Reach	Sy.no.	Extent of land (Acres)	Village and Mandal	Type of land
1.	Brahmanapally - 2	72/A,72/B,76/B,77,81/A,72/A,72/B,79,83/A,76/B,80,76/A,82/A,83/B,75/B,75/A,60/B,74,76/A/1	44.12	Brahmanapally	Patta land
2.	Bommapur – 1& 2	114,115/A,82,91/A,114,115/B,115/E,116/B,115,115/B,115/E,115/D,114,116/B,107/A,108,116/A,117/A,117/C,116/A,117C/2,117/B,130,121/1,121/D,210/1,117/B,144/C,144/A,231,233/E,174/C,111B	88.93	Bommapur	Patta land
3.	Mahadevpur - 1	75/A,75/C,75/B,137,126,30/B,64,124/A,136/B,71/A,73/A,128/A,129/A,137/C,71/A,73/A,138/A,123,250/A,123/A,123,123/E,70/B,131,128/B,129/B,120/B,126/B,134,137/A,132,121/A,66,121/E,138/B,408/2,409,412/A,69,51,53/2,85/B	162.91	Mahadevpur	Patta land
4.	Kudurupally	73,108,59/B,85,84/D,40,58/5,80,73,84/D,63/1,65,108,61/A,108,65/A,61/6,108/2,108/37,64/B,108/16,108/22,79/C,79/D,108/2,61,63/B,108,108/32,61/02,66/2,61/D2,65/A,108/26,108/23,64/2,66/1,108/13,77/2,58/5,58/6,101,108,108/21,64/B,108/7,66/A,108/31,108/24,59/B,101,58/6,60/C,84/D/2,85	102.39	Kudurupally	Patta land
5.	Laxmipuram	537/C1,537/C/2, 537/C/2, 537/C/2, 537/C/2, 537/b,537/D,460,501/A,501/B,533,534,473/A,490,502,505,471,376,472,382,452/B,74,389/1,473,459,537/C1,537/C/2, 537/C/2, 537/C/2, 537/C/2, 537/b,537/D,460,501/A,501/B,533,534,473/A,490,502,505,471,376,472,382,452/B,74,389/1,473,459	68.69	Laxmipuram	Patta land
6.	Mahadevpur - 4	27,38,38,27,33,104,104,104,104,104,104,104,104,27,38/C/6,38/C/4,38/C/5,37,38/C/2,38/C/3	28.44	Edapally	Patta land
7.	Begluru	94/A,97,95/2,82/C,82/A,87/A1,97/C2,99/D,97/B,96,99/A, 99/A, 99/A, 99/A, 100,100,100,86,86,86,99B, 99B, 99B, 99B,83/A,68/A/2,63,76/B,61/D,61/F/1,76/A,61/4,64/2,6/G,71,64/1,71,76/A	65.6	Begluru	Patta land
8.	Suraram	116/1,76/B,76/B,77,76/B	3.29	Suraram	Patta land
9.	Elkeswaram	85/A,82/B,87/B,85/B,83/A,87/C,85/B/B	9.06	Elkeswaram	Patta land
10.	Damerakunta	64/3	2.08	Damerakunta	Patta land
11.	Pusukupally	71,71,81,71,71,71,38/A,19,19,19,39/2,38,25/A,25/B,51,29/B,28	31.65	Pusukupally	Patta land
12.	Tallagada	3,13,19/A,48/A,18/15,18,18/6,15/D,16/E,16/E,16/F,3/B,18,5/2,17,18/4,19/4,18/9	27.06	Tallagada	Patta land
13.	Kuntlam - 3	23,83/47,53,55,56,60/3,23/6,24/3,2	90.39	Kuntlam	Patta land

Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana

SL. No	Sand Reach	Sy.no.	Extent of land (Acres)	Village and Mandal	Type of land
		4/3,24,59/1,59/1,57/3,59/1,73/3,73/B,69/3,83/32,83/13,47,73/1,83/7,26/A,16/C,35/36,62,10/18,10/7,10/17,10/B,10/16,8/A,9/A,4/A			
14.	Kuntlam – 1 & 2	10/18,10/7,10/17,10/19,9/B,10/16,10/8,10/6,8/A,9/A,4//A	32.34	Balijapur	Patta land
15.	Mahadevpur – 2 & 3	13/A,13/B,14,26/A,26/B	23.65	Kothapeta	Patta land

Chapter-4
Godavari River Basin

4. GODAVARI RIVER BASIN

4.1. THE RIVER GODAVARI

Godavari River is the second longest river in India after the Ganga, originates in Triambakeshwar of Maharashtra and emptying into Bay of Bengal. The river is also known as Dakshina Ganga and has one of the largest river basins in the Indian subcontinent. Before emptying into Bay of Bengal in the Konaseema region, the river splits into two branches and again splits into another two branches.

Godavari rises at an elevation of 1,067 m in the Western Ghats near Thriambak Hills in the Nashik district of Maharashtra. After flowing for about 1,465 km., generally in south-east direction, it falls into the Bay of Bengal. The length of distance travelled by Godavari River is shown in **Figure- 4.1**. Two branches of Godavari draining into Bay of Bengal in **Figure-4.2**.

The Godavari is the biggest of the east-flowing rivers of the peninsular India and the second largest river draining in India. Godavari basin drains about 9.5% of India's total geographical area. The catchment area of the basin is 3,12,812 sq km extending over the states of Maharashtra (48.6%), Telangana (20% approx.), Madhya Pradesh (10.0%), Andhra Pradesh (3.4% approx.), Chhattisgarh (10.9%), Odisha (5.7%) & Karnataka (1.4%).



FIGURE 4-1: GODAVARI RIVER TRAVERSES ACROSS INDIA

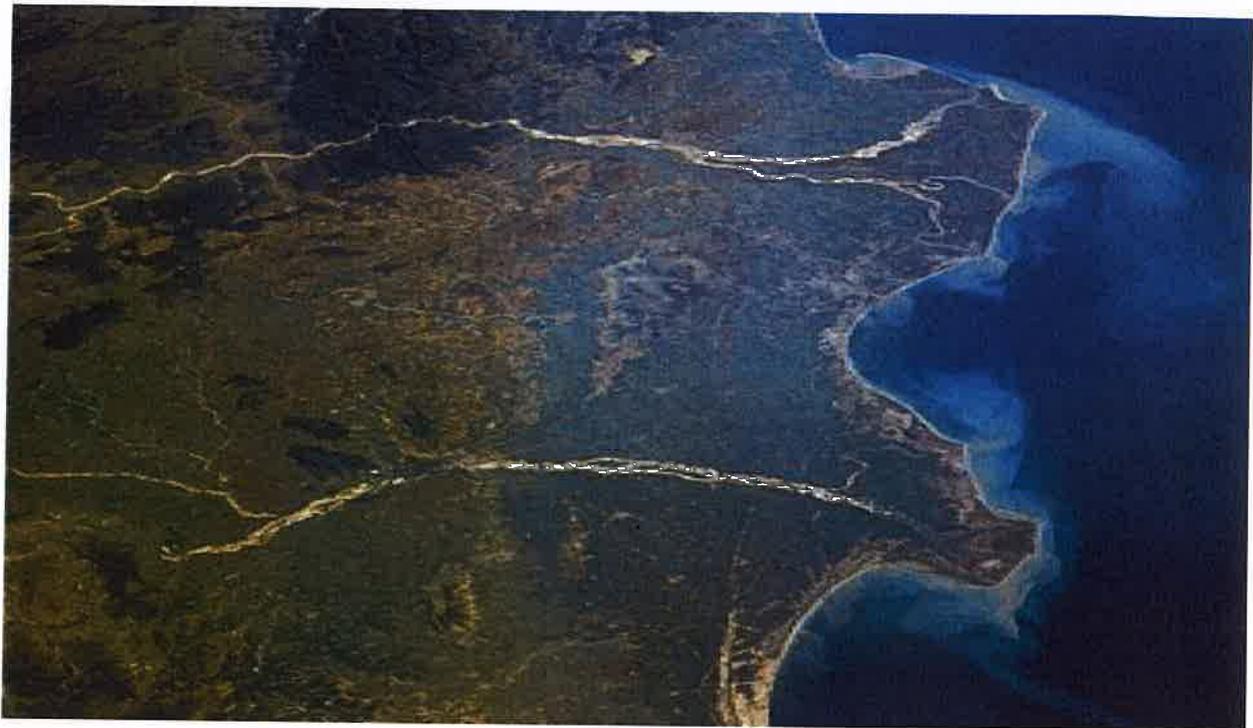
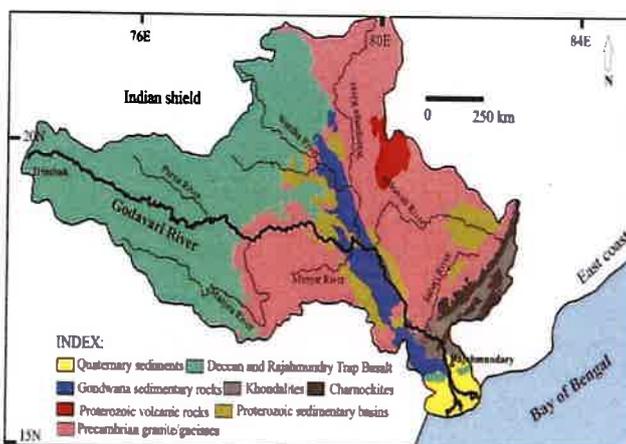


FIGURE 4-2: GODAVARI RIVER DRAINING INTO BAY OF BENGAL

4.2. GEOLOGY AND SEDIMENT TRANSFER IN THE GODAVARI DRAINAGE BASIN



Geomorphologically, the source region is comprised of Sahyadri upland of Maharashtra followed by undulated terrain with chain of elevations and depressions interspersed with low plateau ranges along with plane alluvial deposits and the broad deltaic flats.

The depositional environment of coarse gravel sediment in bottom beds of Godavari valley revealed that the streams are of relatively high energy with prevalent bed load transport, whereas finer silt and clay deposits in upper layers indicate that the streams are of lower inclination and there is fluctuation of climatic conditions.

4.3. GODAVARI IN TELANGANA

Godavari enters into Telangana in Nizamabad district at Kandakurthy where Manjira, Haridra rivers joins Godavari and forms Triveni Sangamam. The river flows along the border between Nirmal and Mancherial Districts in the north and Nizamabad, Jagityal, Peddapalli Districts to its south. About 12 km (7.5 mi) after entering Telangana it merges with the back waters of the Sriram Sagar Dam. The river after emerging through the dam gates, enjoys a wide river bed, often splitting to encase sandy islands. The river receives a minor but significant tributary Kadam River. It then emerges at its eastern side to act as state border with Maharashtra only to later enter into Bhadradi Kothagudem District. In this district the river flows through an important Hindu pilgrimage town – Bhadrachalam.

The river further swells after receiving a minor tributary Kinnerasani River and exits into Andhra Pradesh. **Figure-4.3** depicts the path of River Godavari in Telangana state.

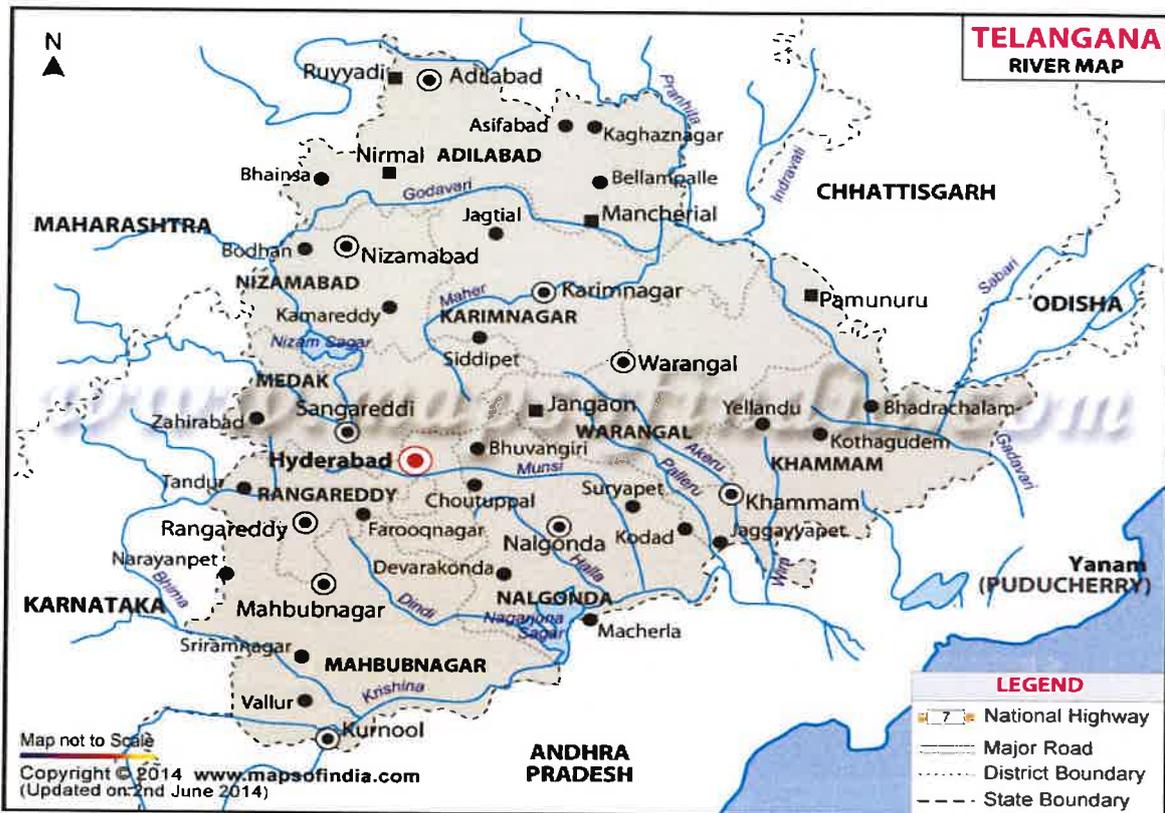


FIGURE 4-3: THE PATH OF RIVER GODAVARI IN TELANGANA STATE

4.4. GODAVARI BASIN BOUNDARIES

The Godavari basin falls in Deccan plateau. Around 32% of Godavari basin area lies in the elevation zone of 500-750 m. The basin is bounded on the north by the Mahadeo Hills, the Satmala Hills comprising a series of table lands varying from 600-1200 m in elevation. The western edge of the basin is formed by an almost unbroken line of the North Sahyadri range of the Western Ghats, from 600-2100 m height. The eastern area of the basin is majorly covered by the Dandakaranya Range with the Eastern Ghats rising from the plains of East Godavari and Vishakhapatnam. Eastern Ghats are not as prominent as Western Ghats. The southern boundary of the basin follows the Harishchandra Range in west, Balaghat Range in the center and the Telangana Plateau in east. Godavari River basin is depicted in **Figure-4.4**.



FIGURE 4-4: RIVER BASIN OF GODAVARI

4.5. MAJOR IRRIGATION PROJECT ON RIVER GODAVARI

The number of dams constructed in Godavari basin is the highest among all the river basins in India. Nearly 350 major and medium dams and barrages had been constructed in the river basin by the year 2012. The major projects on the Godavari River are listed below:

- Gangapur Dam : Gangapur Dam in Nashik over the Godavari river is an earthfill dam and the reservoir known as the Gangapur Bandh Sagar.
- Jayakwadi Dam: Jayakwadi Dam is one of the largest irrigation project in Maharashtra and the dam has a garden and a bird sanctuary. Jayakwadi project along with Jayakwadi Bird Sanctuary and Dnyaneshwar Udyan are major attractions of Maharashtra.
- Babli Barrage: Babhali dam project or Babli barrage across the river Godavari in Maharashtra, located in Nanded district.
- Dowleswaram Barrage: Dowleswaram Barrage is located just before the Godavari river empties into the Bay of Bengal and part of Rajahmundry Municipal Corporation.
- Dummugudem Barrage: Dummugudem Barrage located near Dummugudem is a lift irrigation projects, planned to supply irrigation water to Khammam district in Telangana.
- Vishnupuri Barrage: Vishnupuri Barrage is largest lift irrigation projects in Maharashtra, situated near Nanded city.
- Sriram Sagar Project: Sriram Sagar Project is a unique flood flow water project across river Godavari in Telangana. The project is part of the Godavari River basin irrigation projects, Godavari basin is the highest among all the river basins in India.
- Polavaram Project: Polavaram irrigation project across the Godavari river in Andhra Pradesh state is one of the largest multi purpose irrigation project in India. Under the national river linking project, surplus water of Godavari River basin will be transferred to the Krishna River basin.
- Polavaram dam across the Godavari river is located near the range of the Eastern Ghats and the project will have lift water optuion from Polavaram Right Main Canal.
- Kaleshwaram Lift Irrigation Project: Kaleshwaram project in the village at the juncture of the rivers Godavari and its tributary Pranahita is one of the major irrigation project of Telangana. The Kaleshwaram Lift Irrigation Project is designed with many unique features such as longest tunnel to carry water in Asia, utilize the highest capacity pumps, designed to irrigate 7,38,851 hectares land and has the storage of about 148 tmc ft, will be ready by June 2018.
- Devadula Irrigation Scheme: Devadula lift irrigation scheme is second biggest of its kind in Asia, The project designed to lift water from the River Godavari to drought prone Telangana state.
- Icchampally Project: Icchampally Dam Project will have the huge storage reservoir in India and the site located at downstream of the point where Indravati River joins Godavari river is very favourable to construct dam economically.
- Sripada Yellampalli Project: Sripada Yellampalli project is fourth largest on the Godavari River in Telangana region, located at Yellampalli Village. The project is designed to utilize water for electrical energy, irrigation and to supplying drinking water.

4.6. MAJOR TRIBUTARIES OF RIVER GODAVARI

The major tributaries of the river can be classified as the left bank tributaries which include the Purna, Pranhita, Indravati and Sabari River covering nearly 59.7% of the total catchment area of the basin and the right bank tributaries Pravara, Manjira, Manair together contributing 16.1% of the basin. Table-4.1 details the major tributaries of Godavari River.

TABLE 4-1: MAJOR TRIBUTARIES OF GODAVARI

SI. No.	Name of River	Length (km)	Catchment Area (sq km)
1	Godavari	1465	312812
2	Upper Godavari (Source to Confluence)	675	33502
3	Pravara	208	6537
4	Purna	373	15579
5	Manjira	724	30844
6	Middle Godavari (Between confluence of Manjira and Pranhita)	328	17205
7	Maner	225	13106
8	Penganga	676	23898
9	Wardha	483	24087
10	Wainganga	580	49695
11	Pranhita	721	61093
12	Lower Godavari (Pranhita Confluence to Sea)	462	24869
13	Indravati	535	41655
14	Sabari	418	20427

4.7. RAINFALL

Basin receives 85% of its annual rainfall during south-west monsoon. The rainfall, fairly heavy though irregular and unevenly distributed varies temporally and spatially across the basin. South-west monsoon sets in by July and ends by September entering through the west and south-west coast meets the Sahyadri Range sweeps across the interior of the peninsula. Upper reaches of Godavari Basin lie in the 25-km wide crest zone of Sahyadri which is the belt of heaviest rainfall region in Maharashtra. Annual rainfall varies from 1000 to 3000 mm in this reach. River further enters in the region falling in the rain shadow area of the Sahyadri which

receives less than 600 mm annual rainfall. Rainfall gradually increases to about 900 mm towards the East coast that changes the landscape and the cropping pattern in the eastern Maharashtra, the Wardha-Wainganga sub-basins. Annual rainfall varies from 755 mm to 1531 mm and the average annual rainfall in the basin is 1096.92 mm. Isohyte contours of Rainfall in Godavari Basin is shown in **Figure-4.5**.

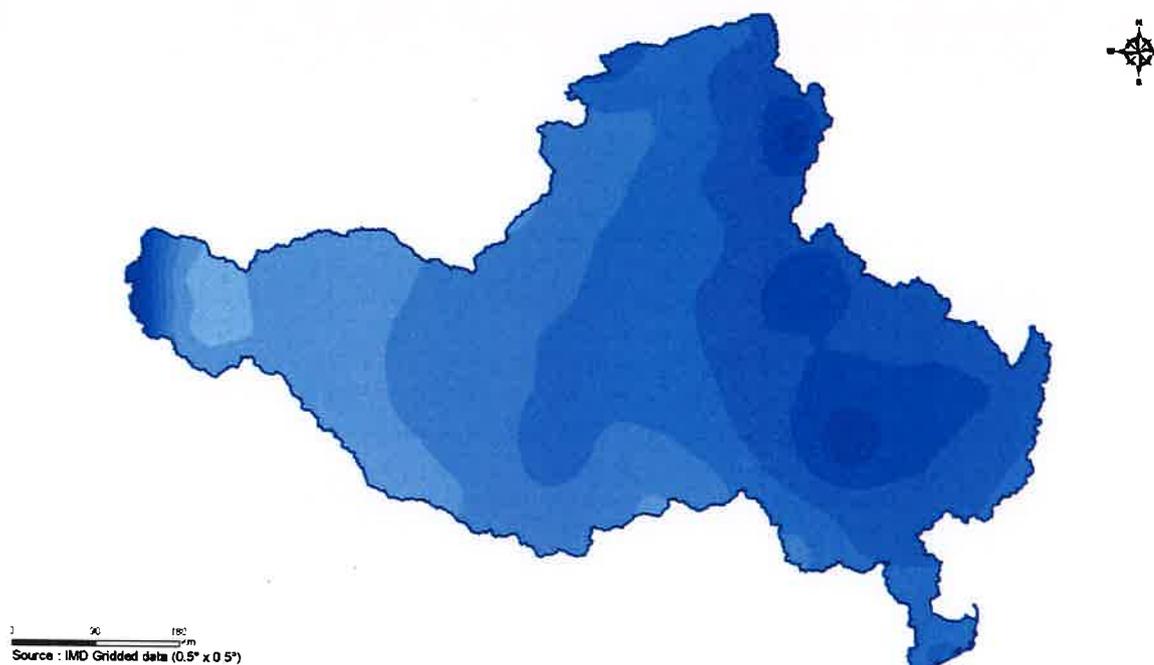


FIGURE 4-5: RAINFALL IN GODAVARI BASIN

4.8. CULTURAL ASPECTS

The river is considered no less than a sister to Ganga and I remember as a child, elders always referring to Godavari as Ganga. Even in Feb 2017, when I visited Nashik, Uttara Deshpande ji (Mother of my SANDRP colleague Parineeta Dandekar) repeatedly referred to Godavari as Ganga. Nashik is important religiously not only as the birth place of this DakshinVahini Ganga, where she refused to fall into the Arabian Sea, but also because of the deep association of the city with Ramayana. Nashik was believed to be a part of Dandakaranya where Lord Ram resided for nearly 14 years in Vanavasa.

All along the river in places like Tapovan, one can find glimpses of this ancient myth worshipped today. On the banks of Godavari in Nashik also stands the Kala Ram Mandir where, in 1930, Babasaheb Ambedkar launched the Kala Ram Mandir Entry Satyagraha, storming the temple which was thus far restricted for the depressed classes. Indeed, Godavari has borne witness to several remarkable happenings at her origin itself. In her

middle reaches in Nanded, Takth Sri Hazur Sahib graces the banks of the river where Guru Gobind Singh breathed his last. The place is one of the five holy places in Sikhism.



FIGURE 4-6: NASHIK KUMBH MELA 2015 ON GODAVARI BANK

4.9. BIODIVERSITY OF THE BASIN



Godavari basin supports significant forest are in the Central India much of this is in the belt of eastern Maharashtra, Chhattisgarh and Telangana states. Wainganga, one of the most important tributary of the Godavari is the stage of Kipling's Jungle Book. Wainganga River Basin is home to two oldest tiger reserves viz. Tadoba Andhari National Park in Maharashtra and Pench National Park in Madhya Pradesh and several other wildlife parks which harbor presence of flagship species such as Royal Bengal Tiger & elephant along with various other species of endangered fauna. The basin is virtually a nexus for critically important tiger corridors of Kanha, Pench, Satpuda, Melghat, Navegaon-Nagzira, Bor and Tadoba tiger reserves. It provides for 16,000 sq km of undisturbed landscape connecting Kanha and Pench tiger reserves which according to National Tiger Conservation Authority (NTCA) and Wildlife Institute of India (WII) is one of the four most viable tiger habitats in the country.

The following are few other wildlife sanctuaries located in the river basin.

- Bor Wildlife Sanctuary
- Eturnagaram Wildlife Sanctuary
- Gautala Wildlife Sanctuary
- Indravati National Park
- Kanger Ghati National Park
- Kawal Wildlife Sanctuary
- Kinnerasani Wildlife Sanctuary
- Kolleru Wildlife Sanctuary
- Manjira Wildlife Sanctuary
- Nagzira Wildlife Sanctuary
- Navegaon National Park
- Painganga Wildlife Sanctuary
- Papikonda Wildlife Sanctuary
- Pench National Park
- Pocharam Forest & Wildlife Sanctuary
- Pranahita Wildlife Sanctuary
- Tadoba Andhari Wildlife Sanctuary
- Tipeswar Wildlife Sanctuary

4.10. FLORA AND FAUNA IN THE BASIN

The Krishna Godavari Basin is one of the main nesting sites of the endangered olive ridley sea turtle. Godavari is also a home to the endangered fringed-lipped carp;

The Coringa mangrove forests in the Godavari delta are the second largest mangrove formation in the country. Part of this has been declared as the Coringa Wildlife Sanctuary, renowned for reptiles. They also provide an important habitat to a wide variety of fish and crustaceans. These forests also act as barriers against cyclones, tropical storms, and storm surges, thus protecting the nearby villages.

The Jayakwadi Bird Sanctuary is another haven for birds located near the town of Paithan spread across the back waters of the NathSagar Reservoir formed by impounding the Godavari by the massive Jayakwadi Dam. Its 341 km² area is dotted by islands within the reservoir which serve as nesting sites for the birds.

The Nandurmadmeshwar Bird Sanctuary is located along the back waters of the Godavari river near Nashik at its confluence with Kadva River.^[26] It is known as the Bharatpur of Maharashtra for the wide diversity of bird life that it harbours.

4.11. WATERFALLS

Duduma Waterfalls is 175 metres (574 ft) high and one of the highest waterfalls in southern India. It is located on the Sileru River which forms boundary between Andhra

Pradesh and Odisha states. The following are a few other waterfalls located in the river basin:

- Bogatha
- Chitrakoot
- Kuntala
- Pochera
- Sahastrakunda
- Teerathgarh

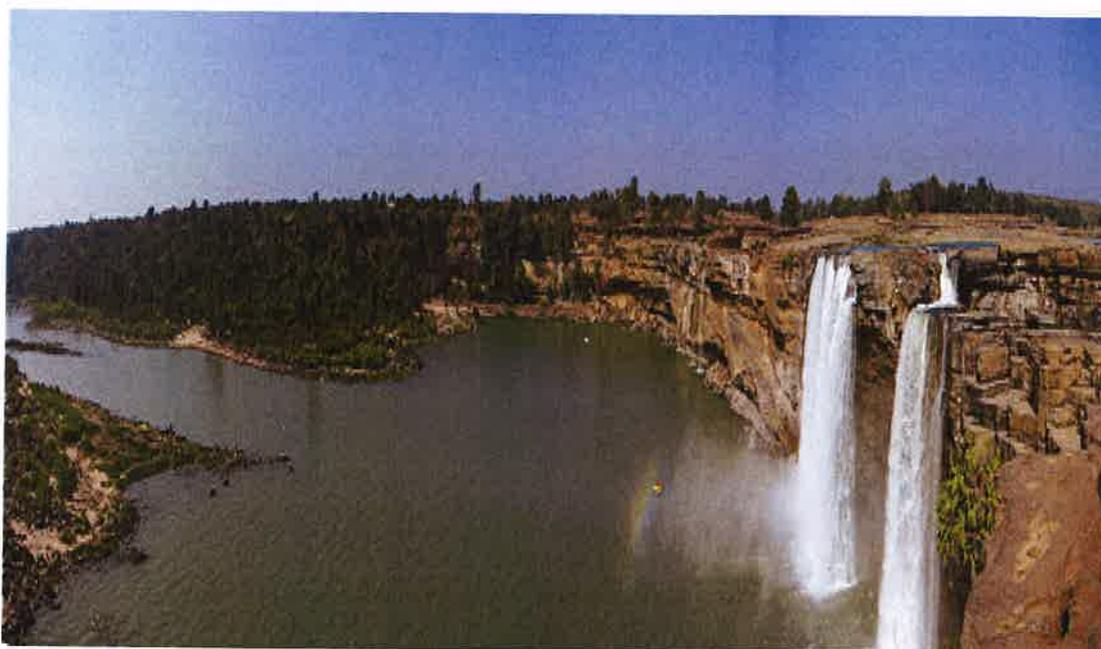


FIGURE4-7: PANORAMIC VIEW OF DOWNSTREAM POND BELOW THE CHITRAKOOTE FALLS

4.12. INTRA STATE RIVER LINKING

Godavari basin is also a major focus of intra-state river link proposals in Maharashtra. Apart from Bhima-Manjara link announced recently, of the total 20 links proposed originally by the GoM 8 links involve Godavari Basin. Status of these linking proposals are given in **Table-4.2**.

TABLE 4-2: STATUS OF RIVER INTERLINKING PROPOSALS

Sl. No.	Name of the Intra-State Link	Rivers	Status of DPR
1	Wainganga (Gosikhurd) – Nalganga (Purna Tapi)	Wainganga & Nalganga	Completed
2	Wainganga – Manjara Valley	Wainganga & Manjara	Completed, not found feasible
3	Upper Ghat – Godavari Valley (Damanganga (Ekdare) – Godavari Valley)	Damanganga & Godavari	Completed
4	Upper Waitarna – Godavari Valley	Waitarna & Godavari	Completed
5	North Konkan – Godavari Valley	Patalganga & Godavari	Completed
6	Sriramsagar Project-Purna-Manjira	Godavari, Purna & Manjira	Completed
7	Wainganga (Gosikhurd) – Godavari (SRSP)	Wainganga & Godavari	Withdrawn by Gov of Maharashtra
8	Jigaon – Tapi – Godavari Valley	Tapi & Godavari	Completed

Government of Telangana has taken up six other projects in the region along with the three projects forming a part of the pact including Lower Penganga & Lendi. Construction of total 10 dams & barrages is involved. **Table-4.3** details the projects taken up by Govt. of Telangana.

TABLE 4-3: LIST OF PROJECTS TAKEN UP BY TELANGANA

Name of the project	Storage (TMC)
Medigadda	26.77
Annaram	2.27
Sandilla	1.08

Chapter-5
District Profile

5. DISTRICT PROFILE

5.1. DISTRICT PROFILE OF JAYASHANKAR BHUPALAPALLY DISTRICT

Jayashankar Bhupalpally is one of 33 Districts in Telangana State. It is located in north latitudes 18°43'14" and east longitudes 79°86'05". Jayashankar Bhupalapally District is formulated after the annexation of some parts of erstwhile Karimnagar and Khammam districts. The district is named after Telangana ideologue, Prof. K. Jayashankar. This is the new district formed after the bifurcation from erstwhile Warangal District and is surrounded by State boundary on its north by Maharashtra State, and Chattisgarh State on its east. The district is surrounded Warangal Rural and Warangal Urban, Mahabubabad and Bhadradri-Kothagudem districts on its south, Peddapalli and Karimnagar districts on its west and Mancheryal district on its northwest. The total geographical area of the district is 5524 sq.km.

Agriculture is the main occupation in rural parts of the district, with paddy, chilli, cotton and turmeric being the chief crops grown in the area. Devadula lift Irrigation and tanks constructed by Kakatiya rulers are the primary sources of irrigation. Industries like Singareni Collieries, Kakatiya Thermal power plant, and some small agriculture-based industries exists in the District. Index Map of the District is shown in **Figure-5.1**.

5.2. ADMINISTRATIVE SETUP

The district comprises 5 towns, 11 Mandals and 2 revenue divisions namely Bhupalapally and Mulugu and 279 villages in 323 gram panchayats. The district headquarters is located at Bhupalapally town. The details of the Administrative Divisions, Mandals, and number of Villages are given in **Table-5.1**. There are 2 assembly constituencies in Bhupalapally district namely Bhupalapally and Manthani. It has a total population of 10,99,560 as per 2011 census.

TABLE 5-1: LIST OF MANDAL AND NUMBER OF VILLAGES

Sl. No.	Name of the Mandal	No. of Villages
1	Bhupalapalli	22
2	Chityal	17
3	Ghanpur(Mulug)	9
4	Kataram	31
5	Mahadevpur	32
6	Mahamutharam	22
7	Malhalrao	22
8	Mogullapalli	17
9	Palimela(New)	17
10	Regonda	18
11	Takumatla(New)	18
District Total		225

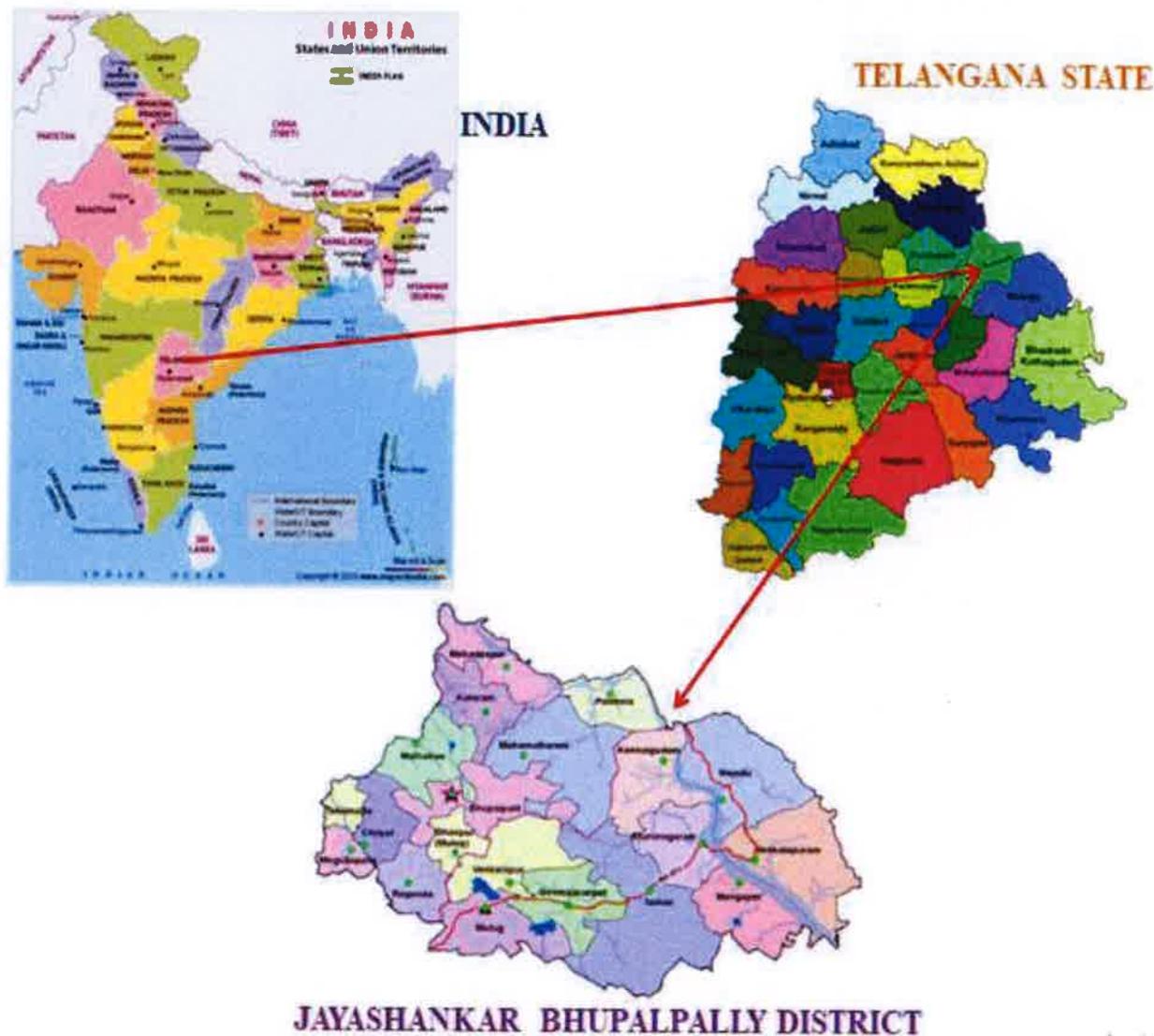


FIGURE 5-1: LOCATION OF JAYASHANKAR BHUPALPALLY

5.3. DEMOGRAPHY

The total population of the district is 7.11 lakhs and the density of the population is 273 per sq.km. Out of the total population, male population accounts for 3.54 lakhs and female are 3.57 lakhs of the total population. The district has a density of 129 persons per sq. km and a sex ratio of 1008 females per 1000 males. The scheduled caste are more predominant with 19.47 percent and scheduled tribes constitute 17.37 percent to the district total population.

5.4. TOPOGRAPHY

Topography is relatively mild and high medium slops. As per the Digital Elevation Map (DEM) as shown in **Figure 5.2** the highest elevation is 140-260 meters in the study district.

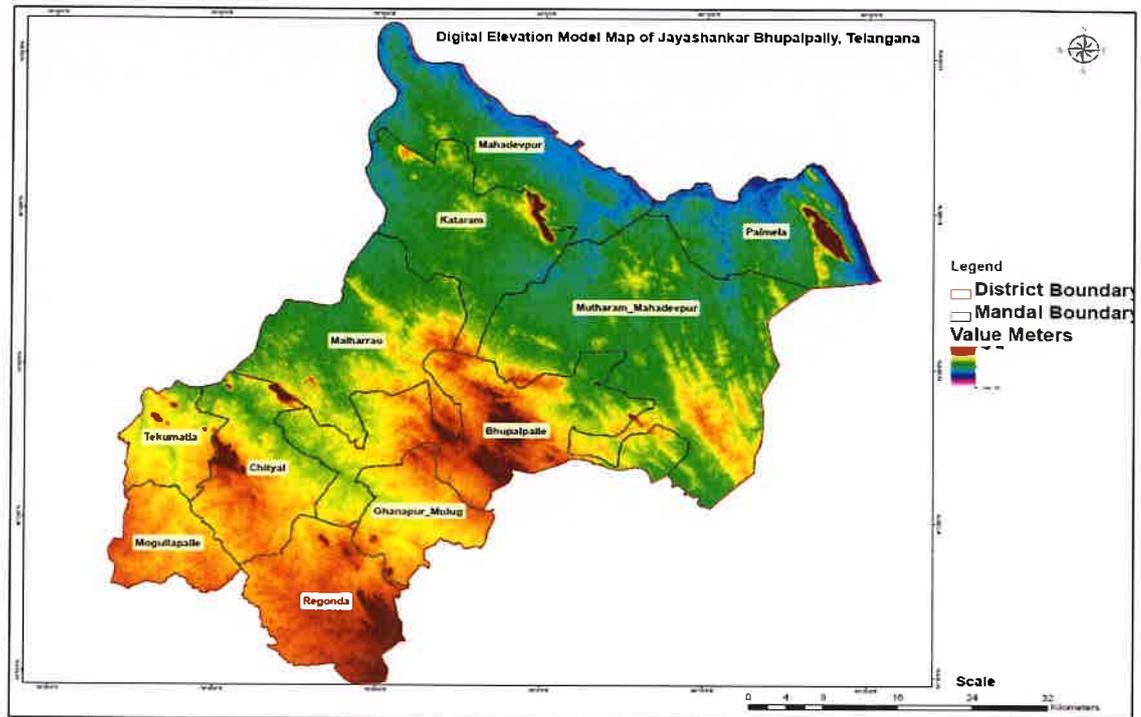


FIGURE 5-2: DIGITAL ELEVATION MAP OF JAYASHANKAR BHUPALAPALLY DISTRICT

5.5. TRANSPORT AND COMMUNICATIONS

The District is well connected by road network with neighboring districts showed in **Figure: 5.3**. This road includes highways of the state, district, and rural roads. National Highway – NH 353C – a spur road of NH-53 and it connects Nagpur (Maharashtra) and Warangal (Telangana) is passing through the district. The district doesn't have railway line. The total road network length of district is 577 km. The nearest airport is at Hyderabad which is located about 235 km from Bhupalapally.

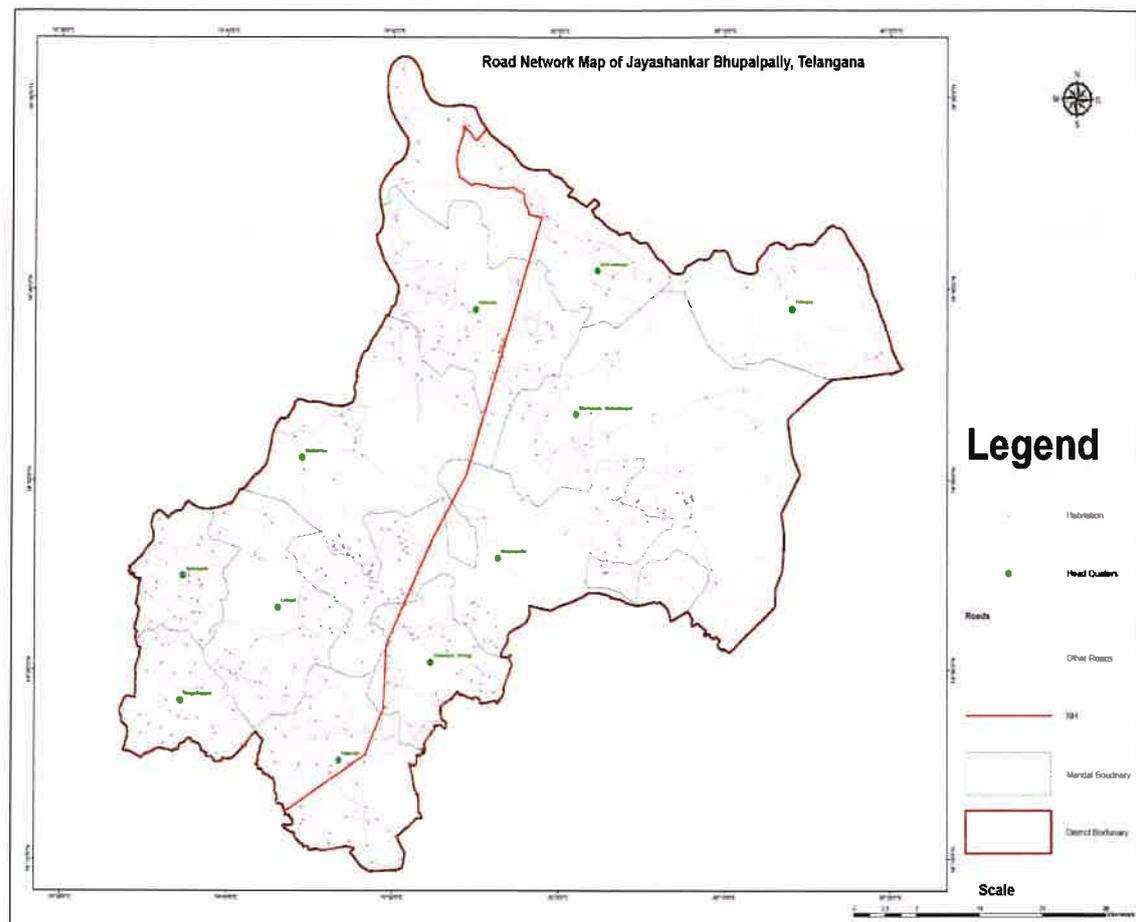


FIGURE 5-3: ROAD NETWORK OF THE JAYASHANKAR BHUPALAPALLY

5.6. LAND USE / LAND COVER CLASSIFICATION

A total of 15 Land use/ Land Cover category have been recorded in Jayashankar Bhupalapally district as per Land Use mapping of district. The percent areal distribution of Land Use/Land Cover (LC/LU) classes has been displayed in **Figure-5.4**. The percentage area among major classified land categories is illustrated below **Table- 5.2**.

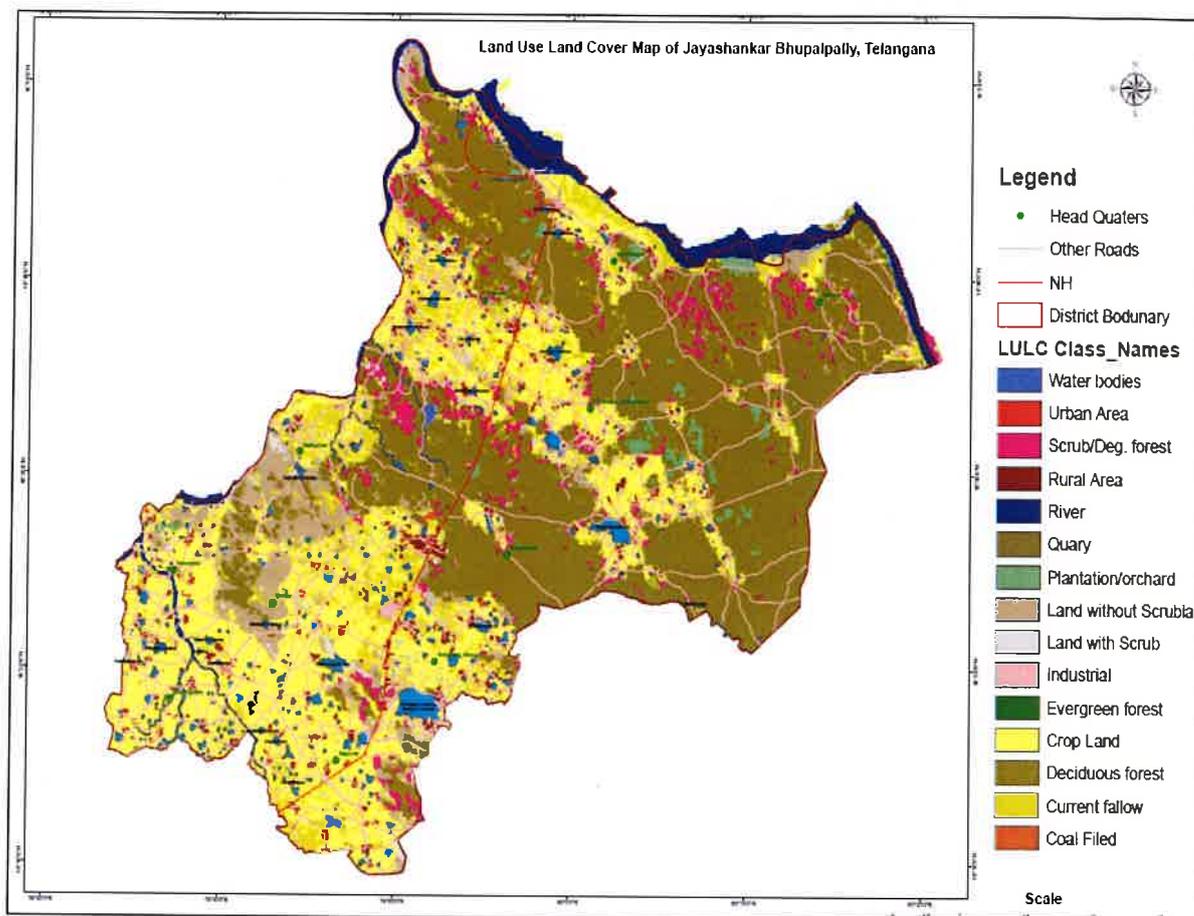


FIGURE 5-4: LAND UTILIZATION AREAS IN JAYASHANKAR BHUPALAPALLY DISTRICT

TABLE 5-2: LAND USE / LAND COVER AREA IN JAYASHANKAR BHUPALAPALLY DISTRICT

Sl. No.	Land Use/ Land Cover category	Area in (Ha)	%
1	Urban	104.48	0.035116
2	Rural	8515.57	2.862243
3	Industrial	263.86	0.088688
4	Double / Triple crop	88808.07	29.85005
5	Current fallow	20200.56	6.789784
6	Plantation/orchard	3191.48	1.072716
7	Evergreen forest	4.96	0.001666
8	Deciduous forest	117366.05	39.44892
9	Scrub/Deg. forest	9358.91	3.145704
10	Land with Scrub	4010.70	1.34807
11	Land without Scrub	22005.35	7.396407

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12	Water bodies	12312.24	4.138373
13	River	11112.51	3.735121
14	Coal Filed	78.55	0.026401
15	Quarry	180.74	0.060749
Total		29,75,14.00	100

5.7. FOREST

The total forest area is around 1,26,730 Ha (42.59%) of total geographical area comprising mainly deciduous forests. The details are given map and photographs below in **Figure-5.5 & 5.6.**

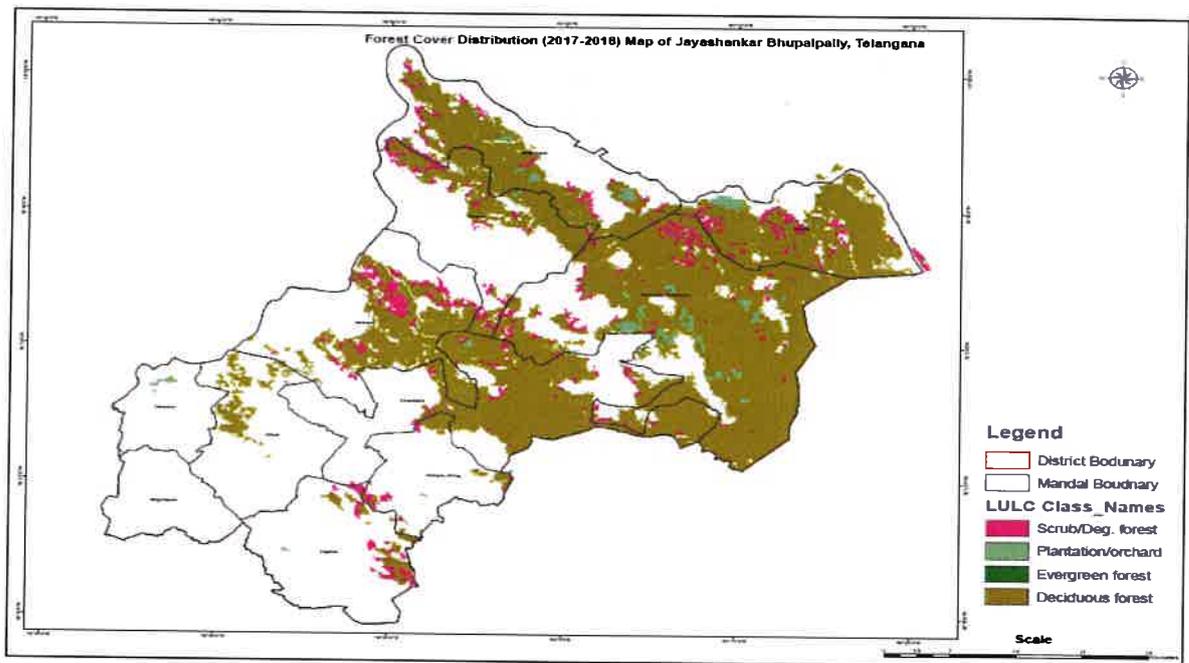


FIGURE 5-5: FOREST GEOGRAPHICAL AREA OF THE JAYASHANKAR BHUPALAPALLY



FIGURE 5-6: PHOTHOGRAPHS OF THE LAND USE AND LAND COVER OF THE DISTRICT.

5.8. SOIL PROFILE OF THE DISTRICT

The topography of the district mainly consists of isolated hills, rain fed tanks, lakes and shrubby deciduous forest. The geographical formations of the district mainly developed from the granite and genesis of the archean period and dharmas of pre-Cambrian period. The soils of the district mainly comprise of sandy loams with patches of shallow black cotton soils and at places even medium black cotton soils. The soils in the district can be divided into red soils, black soils, loams and sandy loams. Red soils occupy about 55% of the district; black soils about 22% and loams about 14% and represented in **Figure-5.7**.

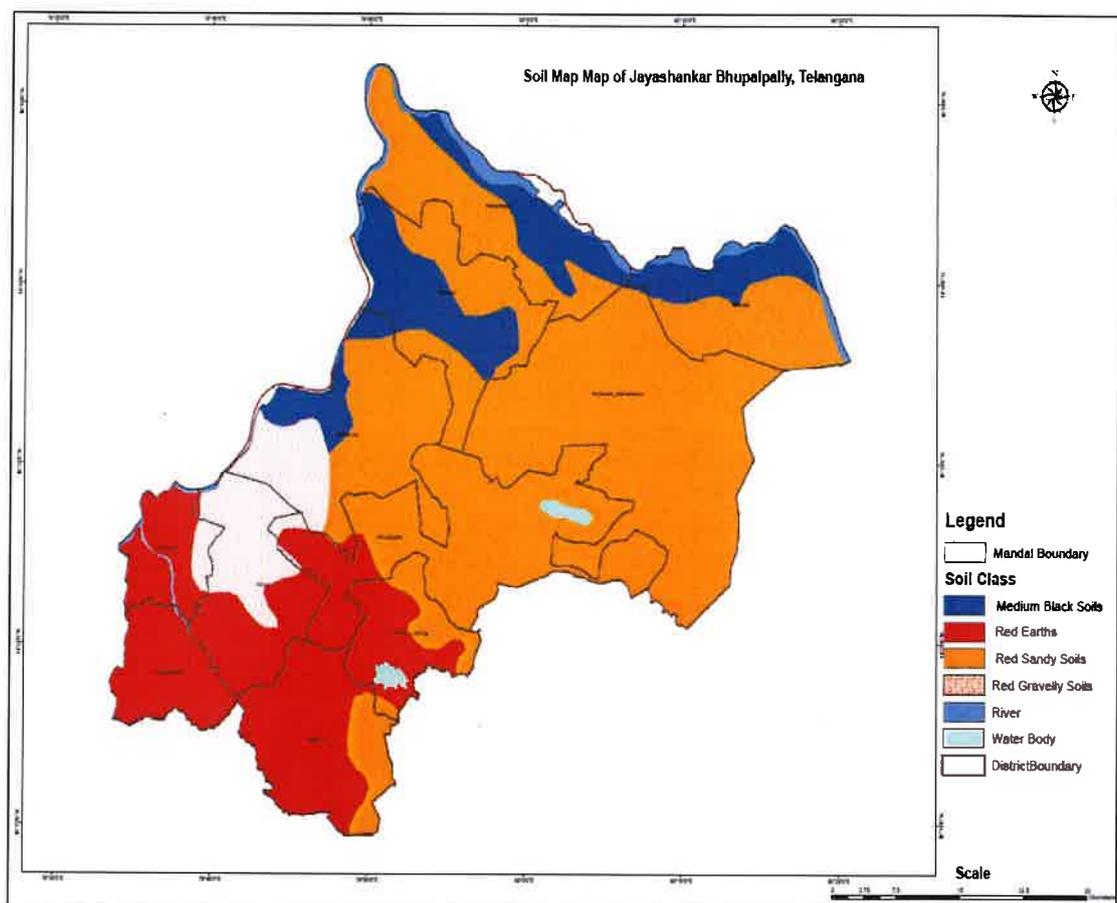


FIGURE 5-7: SOILS TYPES IN THE JAYASHANKAR BHUPALAPALLY DISTRICT

5.9. RAINFALL

The climate of the district is characterized as humidity almost throughout the year with extreme summer and seasonal rainfall. The summer is normally from the month of March to June. The rainy season is followed in the form of South-West monsoon till the middle of October. Retreating monsoon is followed till November. During the period from

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December to February the district experiences good weather with cool temperatures. The maximum and minimum temperatures are recorded in the month of May and December respectively.

The annual average rainfall of the district is 931.4 mm during the monsoon season (Jun–Sep), During other seasons the average rainfall is 11.5 mm for winter (Jan–Feb), 44.4mm for pre – monsoon (Mar–May), 100 mm for post monsoon (Oct– Dec). The **Figure 5.8 & Figure 5.9** shows the rain fall in Jayashankar Bhupalapally District.

The mean minimum and maximum temperature recorded in the district are 9.4° C in December and 47.5° C in May, respectively.

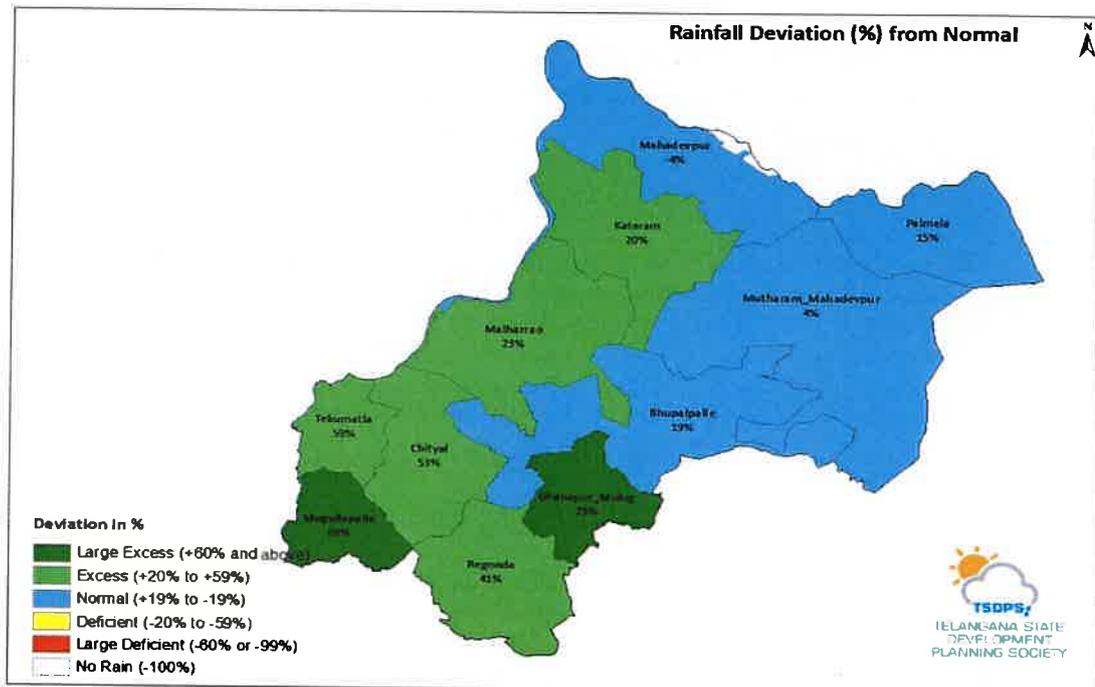


FIGURE 5-8: RAIN FALL DATA OF JAYASHANKAR BHUPALAPALLY DISTRICT

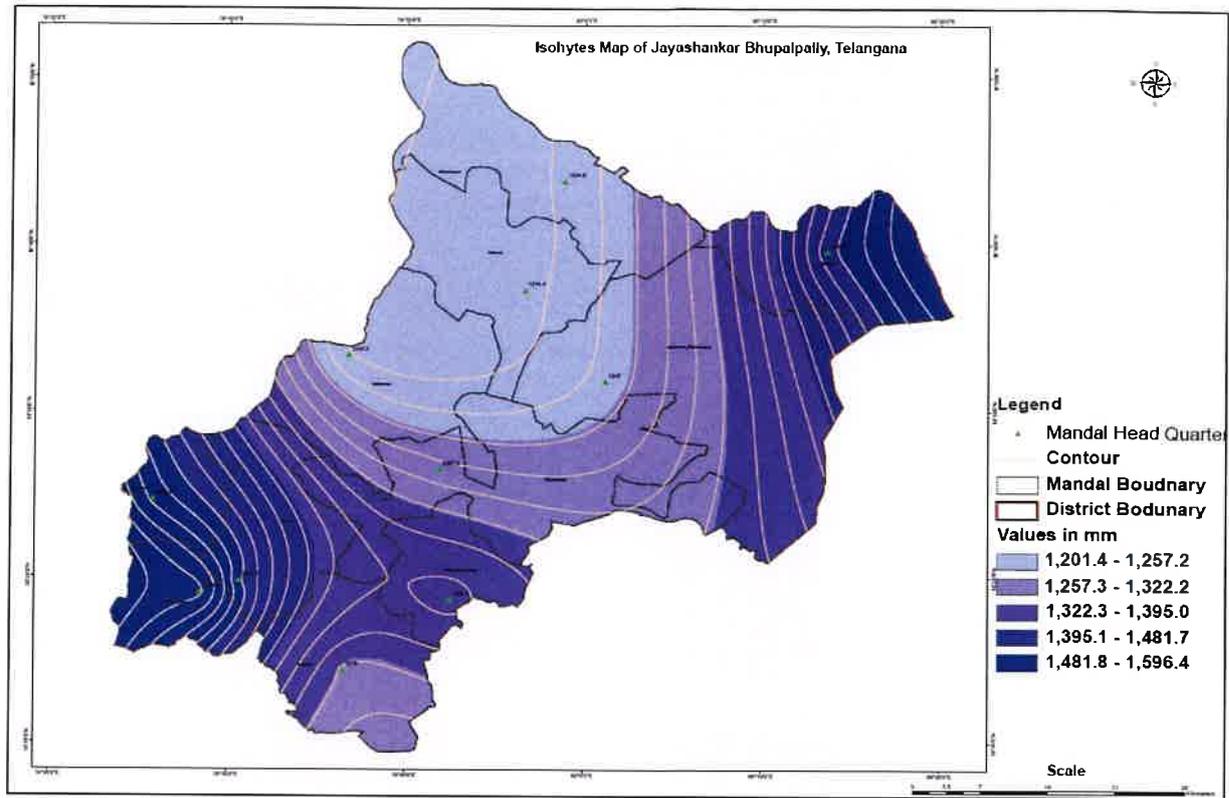


FIGURE 5-9: ISOHYTES OF RAIN FALL DATA OF JAYASHANKAR BHUPALAPALLY DISTRICT

5.10. GROUND WATER PROSPECTS IN THE DISTRICT

Bhupalapally (Jayashankar) district is located in Northern Telangana zone endowed with average annual rainfall of 1088.1 mm per year with most of the precipitation received from south-west monsoon (80%). The balance 20% of the rainfall is distributed between N.E Monsoon, during October–December winter rainfall and hot weather season.

There are no semi-critical, critical and overexploited Mandals in the district. All eleven mandals in the district are under safe category. Ground water occurs in all most all geological formations and its potential depends upon the nature of geological formations, geographical setup, incidence of rainfall, recharge and other hydrogeological characters of the aquifer.

5.11. GROUND WATER QUALITY OF THE DISTRICT

The groundwater quality in the district in general is suitable for both domestic and irrigation purposes. Ground water quality in general is within the permissible limits and health standards.

5.12. DRAINAGE

The district falls in the drainage basin of River Godavari. The collective pattern of streams and their course constituent's drainage pattern. Factors like slope, geological features and topography are reflected in the drainage patterns. **Figure-5.10 & Figure 5.11** shows the area constitutes dendrite pattern of drainage system and water sheds respectively covering 225 villages of Jayashankar Bhupalapally District. **Figure-5.12** identifies water sheds in basin catchment area.

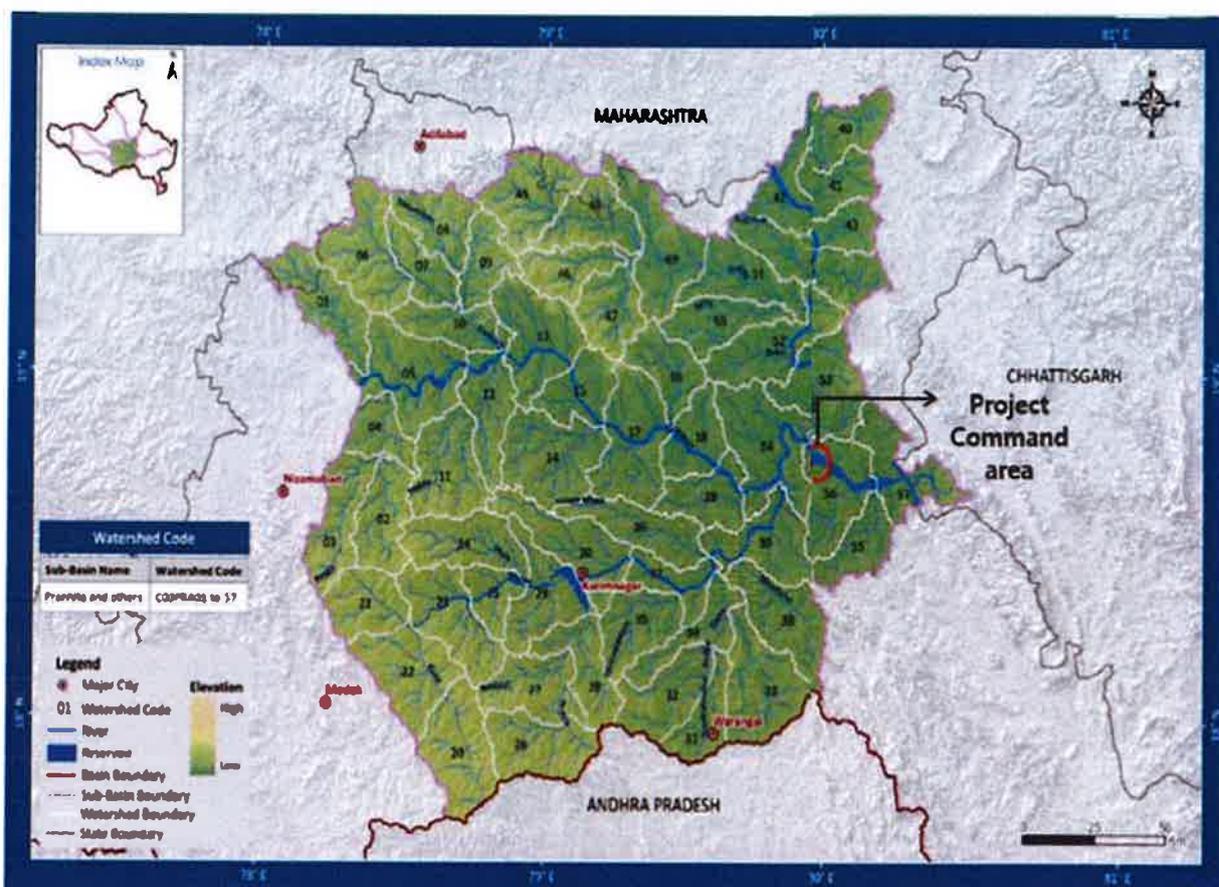


FIGURE 5-10: GODAVARI RIVER AREA CONSTITUTES DENDRITE PATTERN OF DRAINAGE SYSTEM

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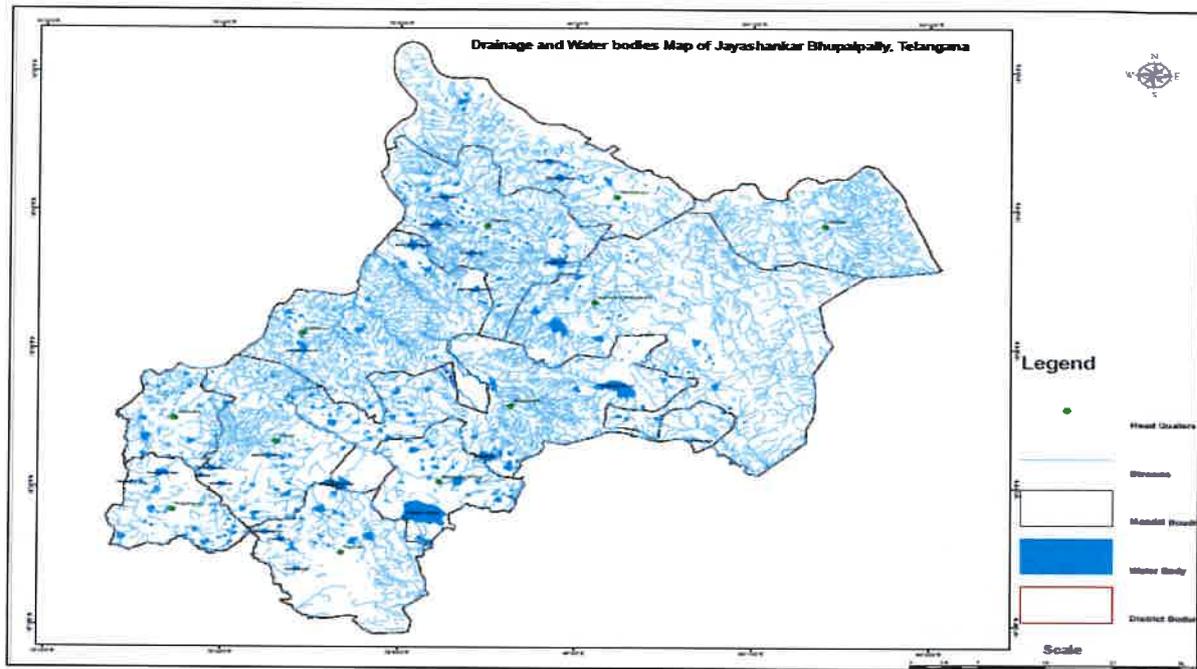


FIGURE 5-11: DRAINAGE NETWORK AND SURFACE WATER OF JAYASHANKAR BHUPALAPALLY DISTRICT

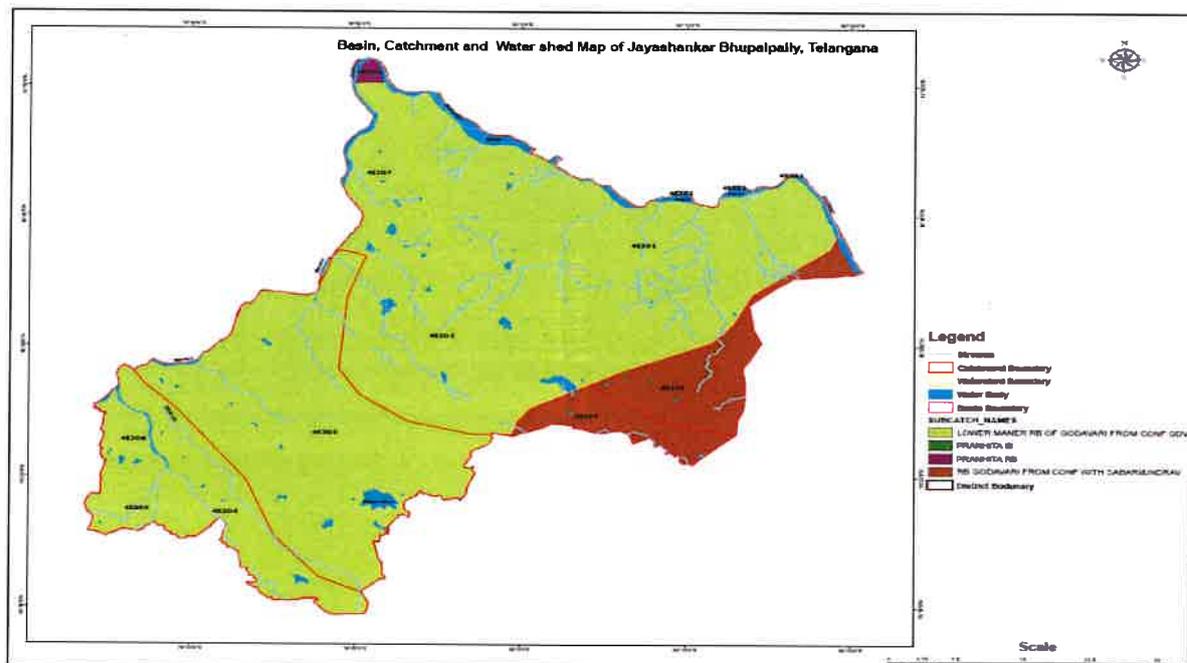


FIGURE 5-12: BASINS CATCHMENT AREA & WATER SHEDS

5.13. IRRIGATION RESOURCES IN THE DISTRICT

The irrigation projects created in Jayashankar Bhupalapally are represented in **Table-5.3** and **Figure-5.13**.

TABLE 5-3: LIST OF IRRIGATION PROJECTS IN JAYASHANKAR BHUPALAPALLY

Sl. No.	Particulars	Nos	Ayacut in Ha	Storage in MCM
1	Major	1	33500	449.56
2	Medium	5	11773	157.98
3	Minor	2075	52377	702.88
4	LI	12	2241	30.07
Total		2,093	99,891	1,340.49

Source: Irrigation Division, Jayashankar Bhupalapally District

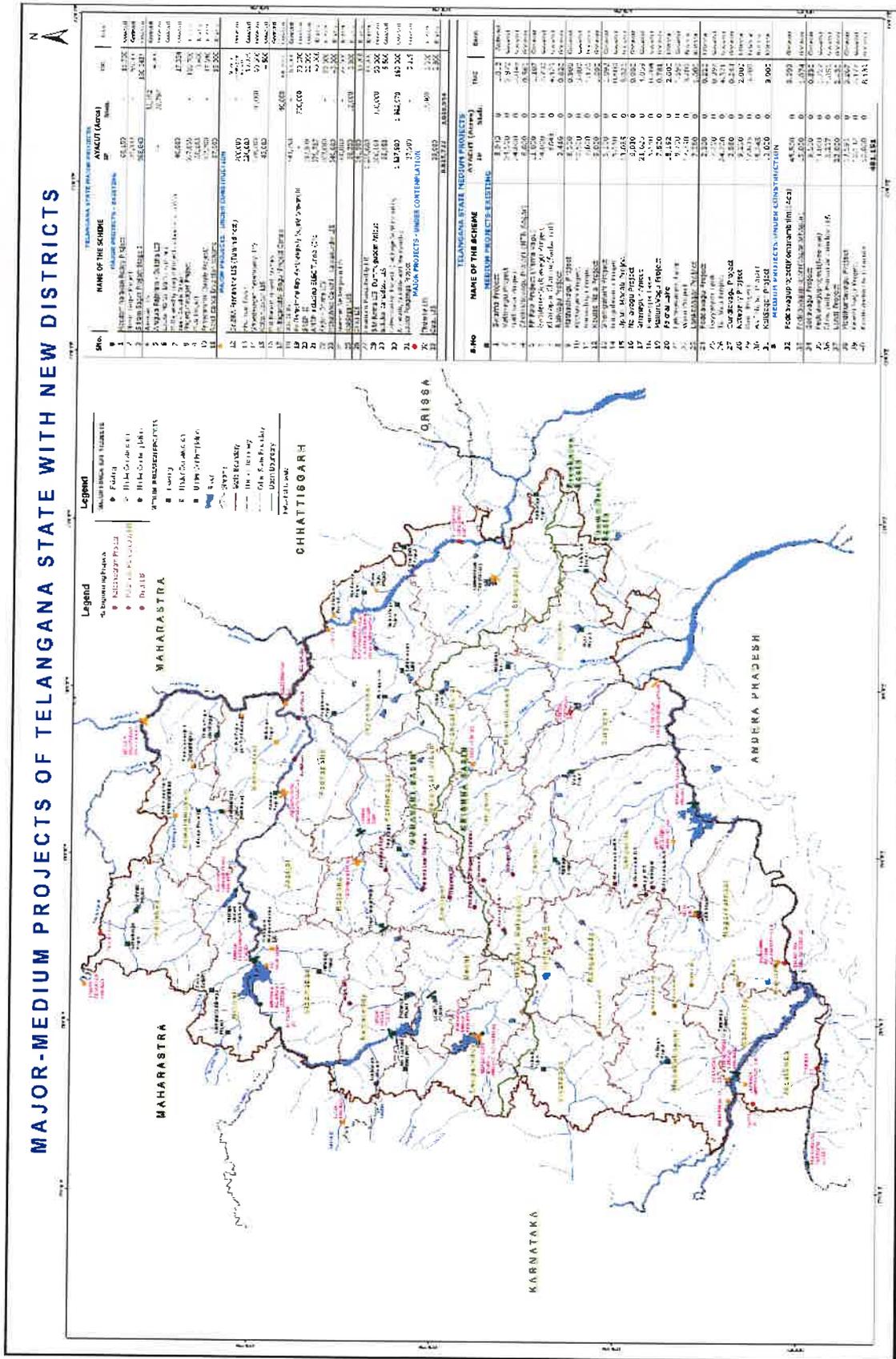


FIGURE 5-13: THE MAJOR AND MINOR IRRIGATION PROJECTS

5.14. GEOLOGY AND MINERAL WEALTH

The main rock types observed in the command area is Barren Measures belongs to middle Permian age, Barakar formation belongs to lower Permian age, sandstone, Clay & limestone bands of kota formation, Red Clay Lime pellet rocks and fine to medium sand stone of maleri formation, Ferruginous & calcerious sanstone with some red clay beds of bhimaram formation and Red mudstone with calcerious sand of Yerrapalli formation belongs to upper Gondwana group of cretaceous to Permo Carboniferous age, sandstone siltstone & claybeds with coal seams of kamthi formation belongs to lower Gondwana group of cretaceous to permo carboniferous age and sullaval sandstone of upper proterozonic age. Geology map given in **Figure-5.14**.

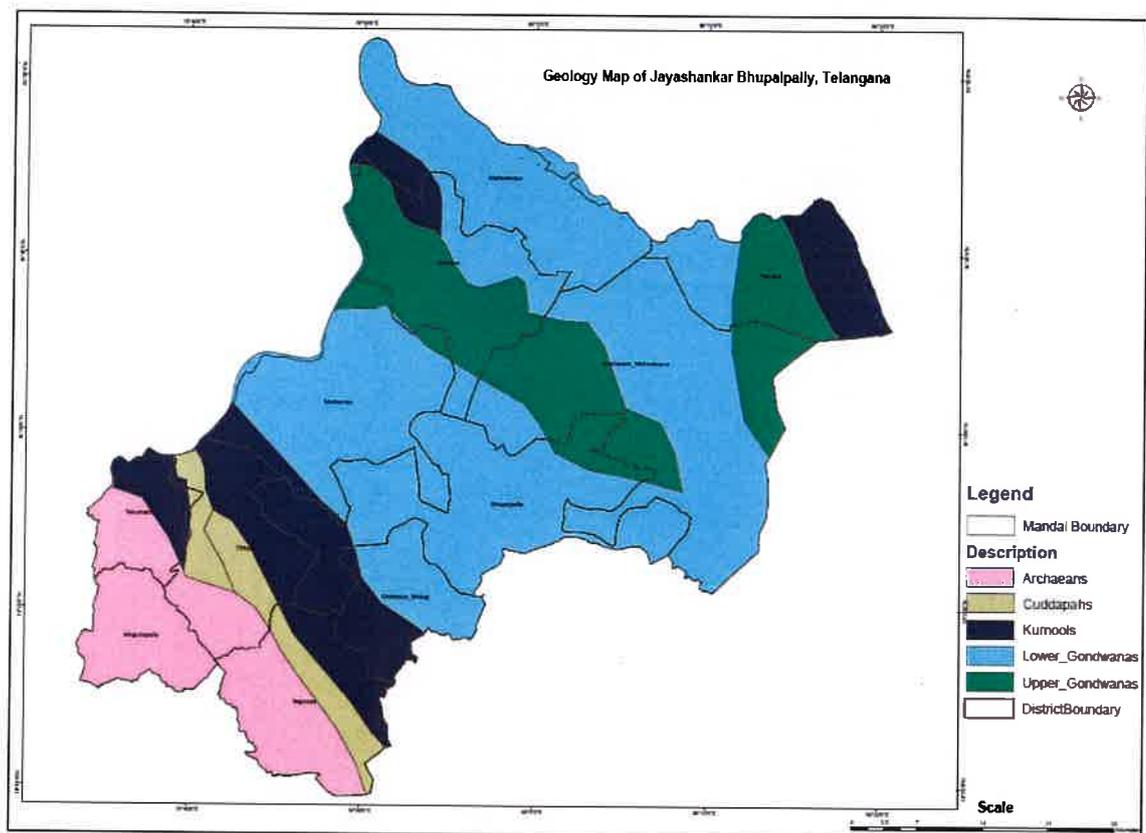


FIGURE 5-14: GEOLOGY MAP

Chapter-6
Estimation of Siltation & Desiltation

6. ESTIMATION OF SILTATION & DESILTATION

6.1. SEDIMENTATION STUDIES

Erosion, transportation and deposition of sediments are natural processes controlled by geological, climatic, physical, vegetative and other related conditions all through the geological times. However, during the present century, because of deforestation and urbanization the rate of transport of sediments from the watersheds and siltation pose substantial environmental problems and before equilibrium conditions are reached, additional problems are likely to arise.

One of the major problems noticed in agricultural watersheds is that the crop productivity reduces to zero or becomes uneconomical, because of soil erosion (Walling, 1988). There are many theories which can be used to evaluate sediment movements in rivers. It is essential that functional relationship between various physical, geomorphic and sediment related parameters are developed, such that the magnitude of sediment eroded from watershed can be estimated. The increase in sediment yield from the watershed will have an impact on the watershed itself and on the river system and associated reservoirs. The impact of eroded soil on natural system is varied and widespread. The sediment particulates eroded from the watershed move in the downstream directly and in the process influence the drainage channels, flood plains, river beds, wetlands and lakes. The key factors which affect the sediment yield from drainage basin are:

- ✓ Hydrology: Rainfall and runoff
- ✓ Catchment characteristics: Size of the catchment, slope of the catchment and length of the overland flow.
- ✓ Soil characteristics: Soil erodibility, soil transportability, soil texture and structure.
- ✓ Nature of drainage network and drainage density.
- ✓ Landuse cover: Plant canopy, mulches and plant residues.
- ✓ Management practices: Tillage, soil conservation structures, terraces, diversions and bunds.

Of all the factors listed above rainfall and runoff provide the basic energy input to drive the erosion process. Steepness of slope plays an important role in the process of erosion. Soil properties such as soil texture, structure and the land cover, i.e., plant residue, mulches etc have a major role in erosion process.

At the outset, it is clear that, the process of sedimentation is a matter of serious concern in irrigation projects, because it reduces the storage capacity, water supply capability, power generation, discharge control etc of reservoirs, rivers/catchments. The erosion of the catchments changes the ground water regime and results in lowering of water table in some places and rise at the formation of arid zone and marshes respectively. The fertility of the soil, its chemical composition also changes due to catchment erosion.

6.2. SEDIMENTATION INDEX

An estimate of sediment index must be developed to provide a basis for comparison with management induced sediment yield predictions. The best source of this information is actual long-term real data of sediment yield. Another possible source is data from similar or related watersheds.

6.3. STREAM FLOW AND SUSPENDED SEDIMENT LOAD

Although there is a definite variation in sediment transport rate in a natural stream at a particular location, still there exists a good relationship between the sediment load of the stream and certain hydromorphological factors. The factors which are considered important in estimating sediment yield of a catchment are drainage area, annual water discharge, relief ratio, mean stream length and total stream length etc. Sediment loads in Godavari River are given in Table-6.1.

TABLE 6-1: SEDIMENT LOADS IN KALESWARAM AREA OF GODAVARI

Sediment Types Total load in	Percentage by weight
Coarse (Sand)	40.2
Medium (Silt)	35.0
Fine (Clay)	24.8

Source: EIA Report on Kaleshwaram Lift Irrigation Scheme

Regression analysis was carried out to know the relation between discharges and sediment load in Kaleshwaram lift irrigation project area. The relationship has been found to be:

$$Y=7.47*10^{-6} x+3401.28, \text{ with } r=0.97$$

Where,

Y= suspended sediment load in tones/year

X=stream flow in m³/year (monsoon flow only)

6.4. DEPOSITION RATES

The stretch of the River Godavari in Jayashankar Bhupalapally District is having an elevation difference of 20 meters This indicates gentle slope of the river. The backwater spread area of River Godavari due to construction of Medigadda Barriage is 30 KM in the upstream of Barriage. Figure 6.1 shows the relation between velocities of stream and sediment deposit and transportation

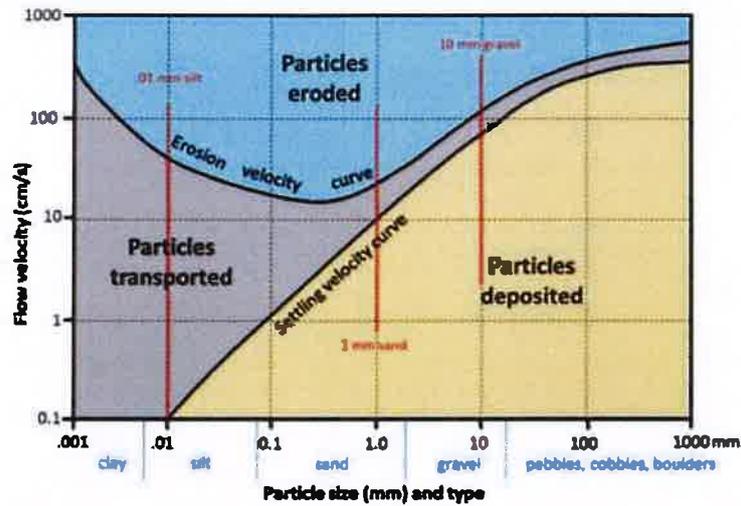


FIGURE 6-1: SEDIMENT DEPOSITION VS VELOCITY OF FLOW

The stretch of Medigadda Barrage is more or less in plains. Godavari River typical rates of deposition observed in the stretches of rivers is estimated between 5 to 8 meters in River Godavari. However, more long-term scientific studies are required for establishing the deposition curves after Kaleshwaram Project is completely operationalized.

6.5. ESTIMATION OF SAND TO BE DESILTED

In the sand assessment report, the sand thickness is mentioned as 2 to 3 meter for submergence areas of Medigadda barrage. But a depth of 3 meters was taken into consideration to estimate the sand availability in the submergence areas of Medigadda.

Table-6.1 provides estimation of sand proposed to be desilted from different reaches based on depth of sand deposits assessed.

TABLE 6-1: SAND ESTIMATES OF REACHES

Sl. No.	Name of the Stockyard	Location	Village	Mandal	Distance from Medigadda Barrage, m	Length, mts	Width, mts	Thickness, mts	Volume, m ³	Area, Ha.
1	Mahadevpur-1	18°45'32.63"N 79°59'32.71"E	Mahadevpur	Mahadevpur	10,146	580	1000	3	1740000	58
2	Mahadevpur-2	18°46'5.44"N 79°59'11.96"E	Kothapeta	Mahadevpur	11,228	580	1000	3	1740000	58
3	Mahadevpur-3	18°45'33.09"N 79°58'51.15"E	Kothapeta	Mahadevpur	11,198	580	1000	3	1740000	58
4	Mahadevpur-4	18°45'33.63"N 79°58'10.71"E	Edapally	Mahadevpur	12,228	580	1000	3	1740000	58
5	Mahadevpur-5	18°45'33.90"N 79°57'49.98"E	Kudhurupally	Mahadevpur	12,797	580	1000	3	1740000	58
6	Mahadevpur-6	18°45'41.75"N 79°57'29.23"E	Edapally	Mahadevpur	13,451	580	1000	3	1740000	58
7	Pusukupally-1	18°49'43.39"N 79°53'42.96"E	Pusukupally	Pusukupally	22,948	930	600	3	1674000	55.8
8	Pusukupally-2	18°49'38.28"N 79°53'10.28"E	Pusukupally	Pusukupally	23,661	930	600	3	1674000	55.8
9	Pusukupally-3	18°49'49.74"N 79°52'39.49"E	Pusukupally	Pusukupally	24,598	930	600	3	1674000	55.8
10	Suraram-1	18°43'26.24"N 80°3'2.23"E	Suraram	Suraram	2,878	865	600	3	1557000	51.9
11	Suraram-2	18°43'40.43"N 80°2'38.39"E	Suraram	Suraram	3,713	865	600	3	1557000	51.9
12	Begluru-1	18°43'42.32"N 80°2'16.45"E	Beglur	Begluru	4,290	900	700	3	1890000	63.0
13	Begluru-2	18°44'19.50"N 80°2'6.69"E	Beglur	Begluru	5,176	900	700	3	1890000	63.0
14	Elkeshwaram	18°44'21.38"N 80°1'24.87"E	Bommapur	Elkeshwaram	6,205	1000	800	3	2400000	80
15	Bommapur-1	18°44'44.13"N 80°0'55.85"E	Mahadevpur	Bommapur	7,298	800	900	3	2160000	72
16	Bommapur-2	18°45'17.23"N 80°0'47.23"E	Mahadevpur	Bommapur	8,087	800	900	3	2160000	72
17	Brahmanpalli-1	18°45'43.71"N 80°0'2.13"E	Mahadevpur	Brahmanpalli	9,643	500	900	3	1350000	45
18	Brahmanpalli-2	18°46'1.38"N 79°59'36.48"E	Mahadevpur	Brahmanpalli	10,567	500	900	3	1350000	45
19	Kuntiam-1	18°49'58.17"N 79°51'54.01"E	Baijiapur	Kuntiam	25,873	1000	500	3	1500000	50
20	Kuntiam-2	18°50'25.14"N 79°51'33.15"E	Baijiapur	Kuntiam	26,826	1000	500	3	1500000	50
21	Kuntiam-3	18°50'59.92"N 79°51'30.43"E	Kuntiam	Kuntiam	27,495	1000	500	3	1500000	50
22	Palugula-1	18°51'8.93"N 79°51'42.82"E	Kuntiam	Palugula	27,340	1250	400	3	1500000	50
23	Palugula-2	18°51'42.27"N 79°51'12.71"E	Kuntiam	Palugula	28,661	1250	400	3	1500000	50

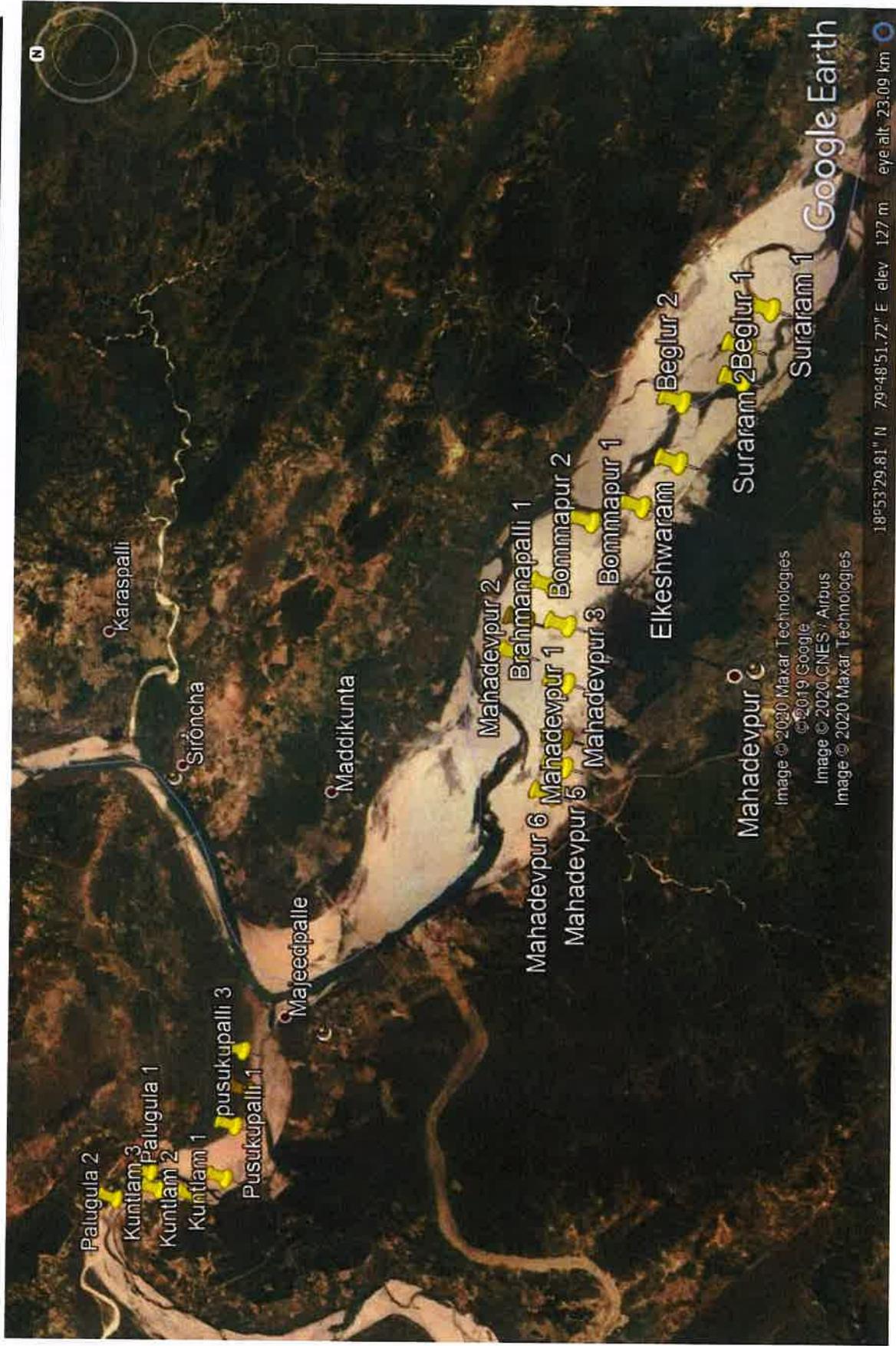


FIGURE 6-3: LOCATION OF THE STOCKYARDS

6.6. HYDRODYNAMIC MODEL

Basic governing equations

The basic governing equations of flow are solved numerically in simulation of elevations and currents in the coastal environments. These equations are formulated based on incompressible flow and vertically integrated hydrostatic distribution since the vertical acceleration of the flow is much smaller than the pressure gradient. After applying these assumptions, the basic governing equations of flow momentum can be written in the conservation form as follows:

Continuity equation:

$$\frac{\partial \eta}{\partial t} + \frac{\partial uH}{\partial x} + \frac{\partial vH}{\partial y} = 0$$

Momentum equations:

The two depth-averaged momentum equations can be written as

$$\begin{aligned} \frac{\partial uH}{\partial t} + \frac{\partial u^2H}{\partial x} + \frac{\partial uvH}{\partial y} &= fvH - gH \frac{\partial \eta}{\partial x} + H \frac{\partial}{\partial x} \left(K_x \frac{\partial u}{\partial x} \right) + H \frac{\partial}{\partial y} \left(K_y \frac{\partial u}{\partial y} \right) + \tau_{ux} - \tau_{bx} \\ \frac{\partial vH}{\partial t} + \frac{\partial vuH}{\partial x} + \frac{\partial v^2H}{\partial y} &= -fuH - gH \frac{\partial \eta}{\partial y} + H \frac{\partial}{\partial x} \left(K_x \frac{\partial v}{\partial x} \right) + H \frac{\partial}{\partial y} \left(K_y \frac{\partial v}{\partial y} \right) + \tau_{vy} - \tau_{by} \end{aligned}$$

where, t = time; x, y are Cartesian co-ordinates; u and v are depth averaged velocity components in the x and y directions, respectively; f = Coriolis parameter; g = acceleration due to gravity; K_x, K_y diffusion coefficients in the x and y directions, respectively; η = water elevation with respect to mean sea level, H = total water depth at any instant.

6.7. MODEL DESCRIPTION

Dedicated software Hydrodyn-FLOSOFT & Hydrodyn-SEDSOFT for prediction of water elevations and currents and sedimentation processes in the seas and estuaries developed at Environ Software (P) Ltd, Bangalore, based on solving the hydrodynamic equations numerically through coupled way using the present state-of-art of technology has been used.

▪ **Model Input**

- Catchment area = 10000 sq. Km
- Topographical Elevation from upstream to downstream = 140m to 65m
- Length of the Pranhita river to reservoir area = 43Km
- Length of the Godavari river to reservoir area = 73Km
- d_{50} size = 0.05m to 0.001m

▪ **Model Assumptions**

Seventeen major rivers were identified in the river network system as shown in **Figure 6.4**. The flow rates are calculated at all seventeen rivers based on the catchment area **Table.6.2** and imposed as a flux boundary conditions for modeling studies. The geometry of river and Reservoir has been calculated from terrestrial maps.

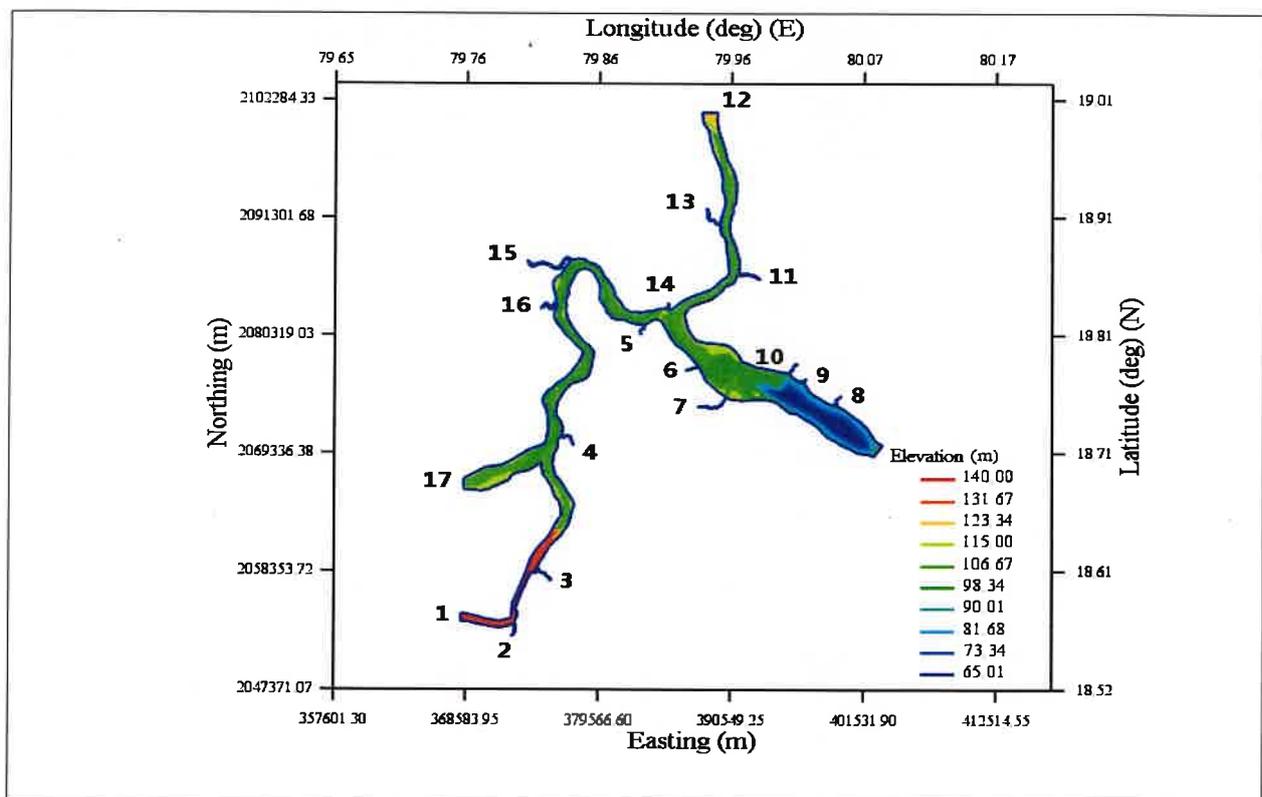


FIGURE 6-4: FLOW RATES AT DIFFERENT UPSTREAM OF RIVERS

TABLE 6-2: FLOW RATES OF RIVERS & RIVULETS FLOWING INTO GODAVARI

Boundary	Flow rate (m ³ /s)
River flow Boundary 1	60.92654
River flow Boundary 2	200.8981
River flow Boundary 3	747.8710
River flow Boundary 4	11.68175
River flow Boundary 5	0.4496090x10 ⁻⁰³
River flow Boundary 6	545.4820
River flow Boundary 7	500.3950
River flow Boundary 8	14.80802
River flow Boundary 9	333.0857
River flow Boundary 10	482.2852
River flow Boundary 11	294.9628
River flow Boundary 12	0.1078165x10 ⁻⁰¹
River flow Boundary 13	131.4757
River flow Boundary 14	268.0366
River flow Boundary 15	104.1746
River flow Boundary 16	738.8201
River flow Boundary 17	786.0733

Similarly, ambient sediment concentration in the study domain is assumed as 10 mg/l and it will become maximum up to 50 mg/l.

6.8. HYDROLOGICAL MODELLING STUDIES

The software has been used for river network system in the Pranhita and Godavari basin including Medigadda Barrage to study the siltation / de-siltation processes.

The general layout of the study domain covering the total catchment area (about 10000 sq. km) is shown in **Figure 6.5**. The terrain features of the study domain is shown in **Figure 6.6**. Similarly, FEM mesh generated for the study domain is presented in the **Figure 6.7**. Also, the interpolated elevations along the rivers are presented in the **Figure 6.8**. The elevations in the Pranhita and Godavari rivers varied from 65m to 140m.

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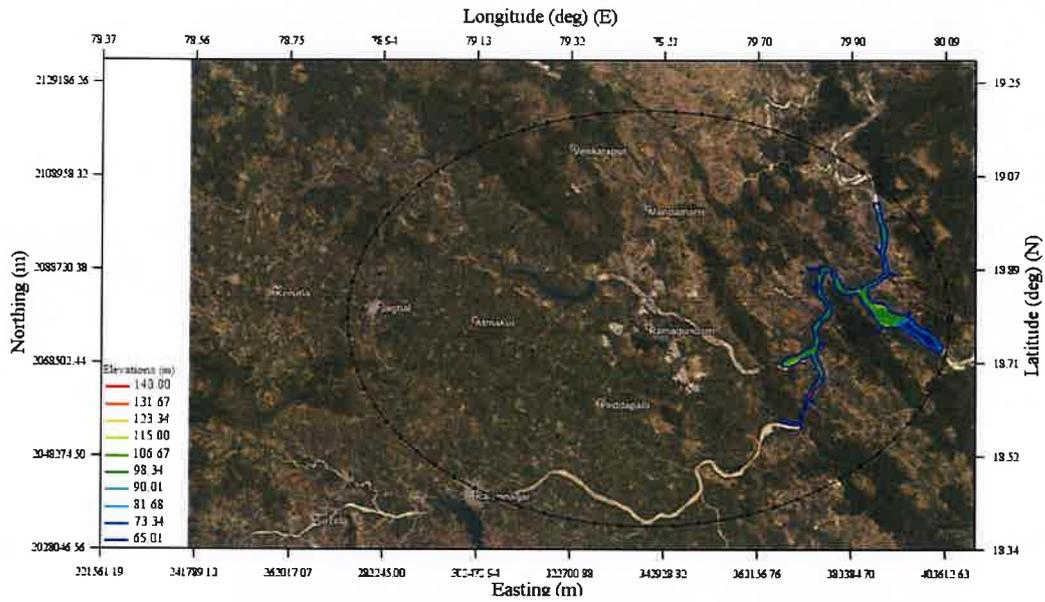


FIGURE 6-5: GENERAL LAYOUT OF THE CATCHMENT AREA.



FIGURE 6-6: TERRAIN FEATURES OF THE STUDY DOMAIN

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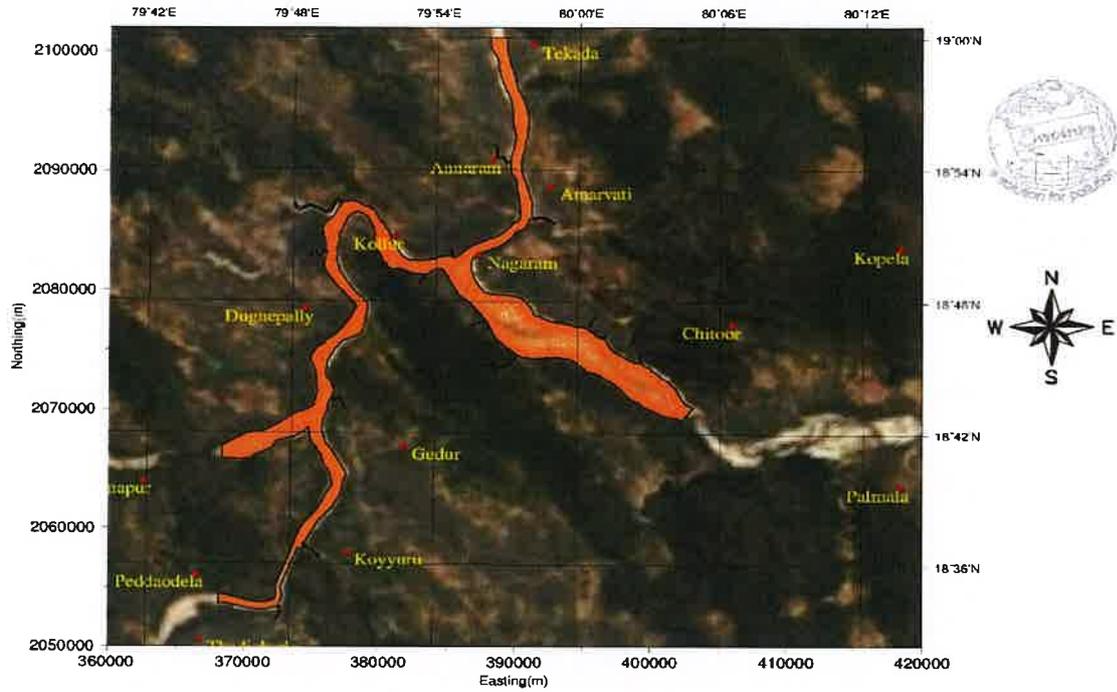


FIGURE 6-7: FEM mesh of the study Domain

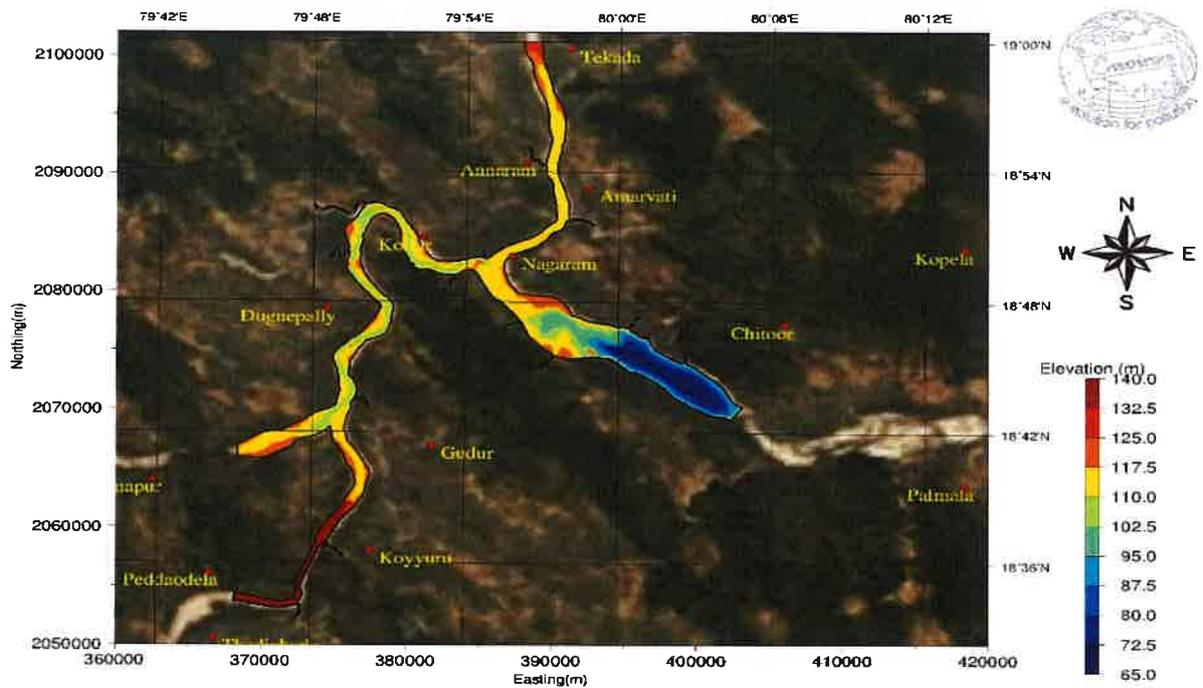


FIGURE 6-8: ELEVATION OF STUDY DOMAIN

6.9. MODEL SETUP

The study area including terrain features is graphically shown in Fig.3.3. The computational domain of the model is selected from upstream to downstream - between the geographical coordinates given by: Longitude - 79° 40' 24.82' E & 80° 14' 23.57" E and Latitude - 18° 32' 9.49" N & 19° 0' 32.53" N) to predict the water levels and currents in the study domain. The model domain is divided into various triangular meshes and generated the elements in the study domain.

6.10. BED ROUGHNESS

The bottom roughness in the domain varies according to bed sediment grain sizes. The bed consists of various sizes of sand. Depending upon bed configuration and sediment sizes, the d50 size varies from 0.05m to 0.001m. In the present study constant Manning's roughness coefficient was selected based on the validation and the same was used for carrying out various computational runs for the prediction of hydrodynamic parameters in the river flow field.

6.11. INITIAL AND BOUNDARY CONDITIONS

The initial conditions for the model are selected based on still water conditions. The FEM technique has been adopted to take care of river bank shape and make fine mesh near the river bank. The grid is non-uniform both in x and y directions and it is a fine mesh.

The open boundary conditions identified are upstream and downstream & river banks as closed boundaries and tributaries are acting as source / sink. The boundary conditions selected are as follows:

- I. different flow rates at 17 locations at upstream of rivers
- II. no flow across the barrage. In this model, diffusion coefficients for horizontal exchange of momentum vary with the space.

The maximum rainfall of 80mm per day has been considered for the present simulation study. The total catchment area calculated is about 10000 sq. Km. The different flow rates are applied 17 different locations in the upstream of river. The model results of velocity and water depth in the study domain are shown in **Figure 6.6** to **Figure 6.9** respectively.

6.12. HALF RESERVOIR CAPACITY

The software has been run using the inputs discussed in the above sections i.e. river flows from the catchment area. The computation run has been continued till the reservoir storage reached to half its capacity. The computed flow velocities and water

elevations in the entire river system of study area are shown in Figure 6.9 and Figure 6.10 respectively.

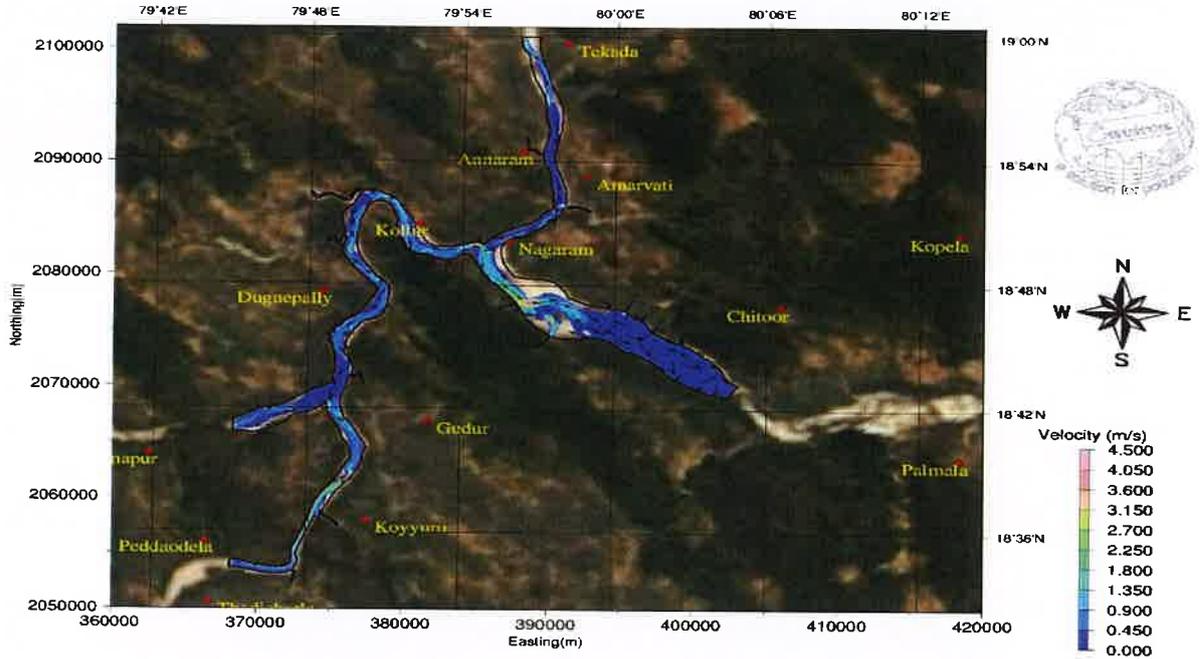


FIGURE 6-9: FLOW VELOCITY OF STUDY DOMAIN WITH HALF CAPACITY

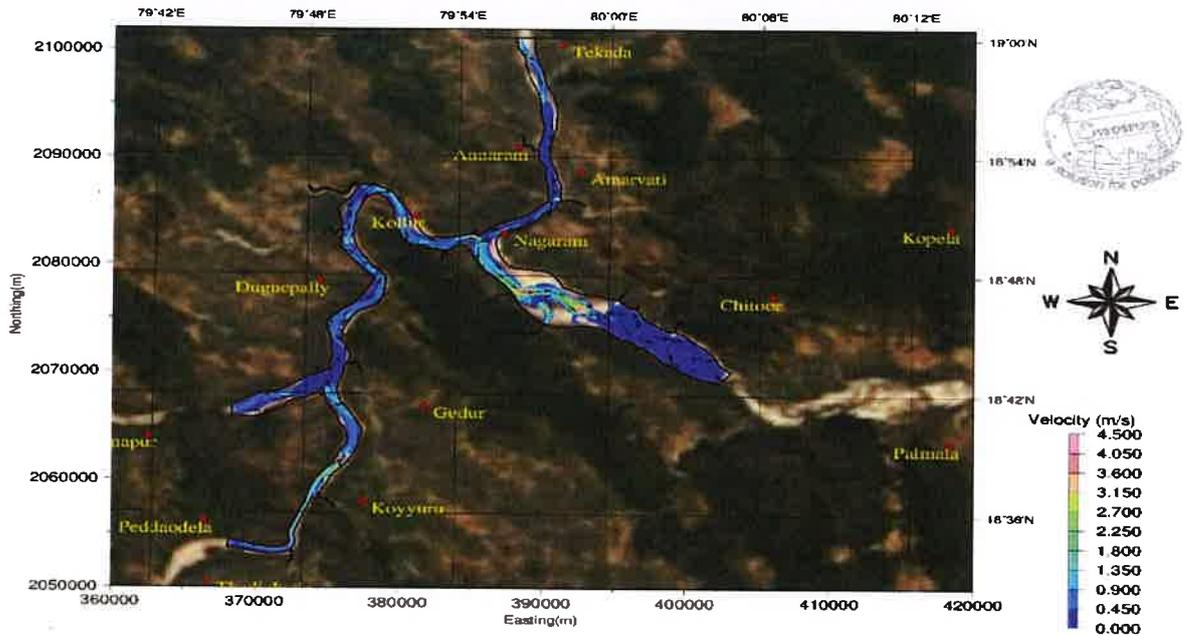


FIGURE 6-10: FLOW VELOCITY OF STUDY DOMAIN WITH FULL CAPACITY

It can be seen from the figures that the velocity varies from 0.45 m/sec to 4.5 m/sec in the study area. The maximum velocity is observed near the reservoir as compared to other region due to narrow flow region. From the figures it is clearly observed that the velocity is increased with contraction of flow area.

Figure 6.11 shows the variation of water depth in the entire river basin. It can be seen from the figures that the water depths are varied from 0.5m to 28.0m. The maximum water depth during half capacity is found to be 28 m in the reservoir.

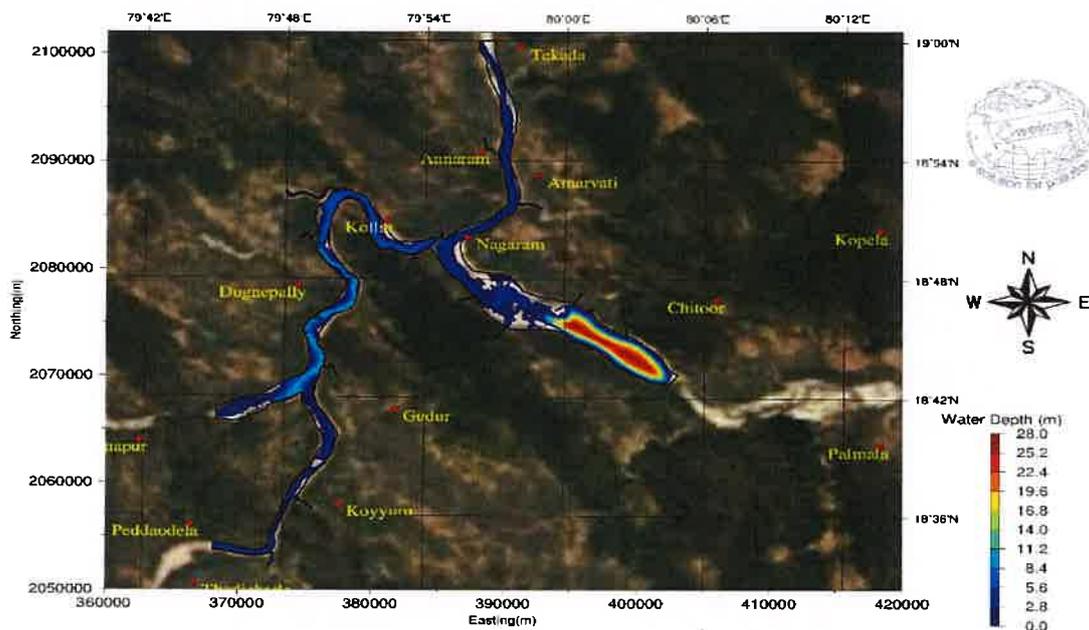


FIGURE 6-11: WATER DEPTH OF STUDY DOMAIN WITH HALF CAPACITY

6.13. CASE-2: FULL RESERVOIR CAPACITY

The software has been run using the inputs discussed in the above sections i.e. river flows from the catchment area. The computation has continued till the reservoir storage reached to full its capacity. The computed flow velocities and water elevations in the entire river system of study area shown in **Figure 6.12** and **Figure 6.13** respectively.

It can be seen from the figures that the velocity varies from 0.45 m/sec to 4.5 m/sec in the study area. The maximum velocity is observed near the reservoir as compared to other region due to narrow flow region. From the figures it is clearly observed that the velocity is increased with contraction of flow area.

Figure 6.13 shows the variation of water depth in the entire river basin. It can be seen from the figures that the water depths are varied from 0.5m to 40.0m. The maximum water depth during full capacity is found to be 40 m in the reservoir.

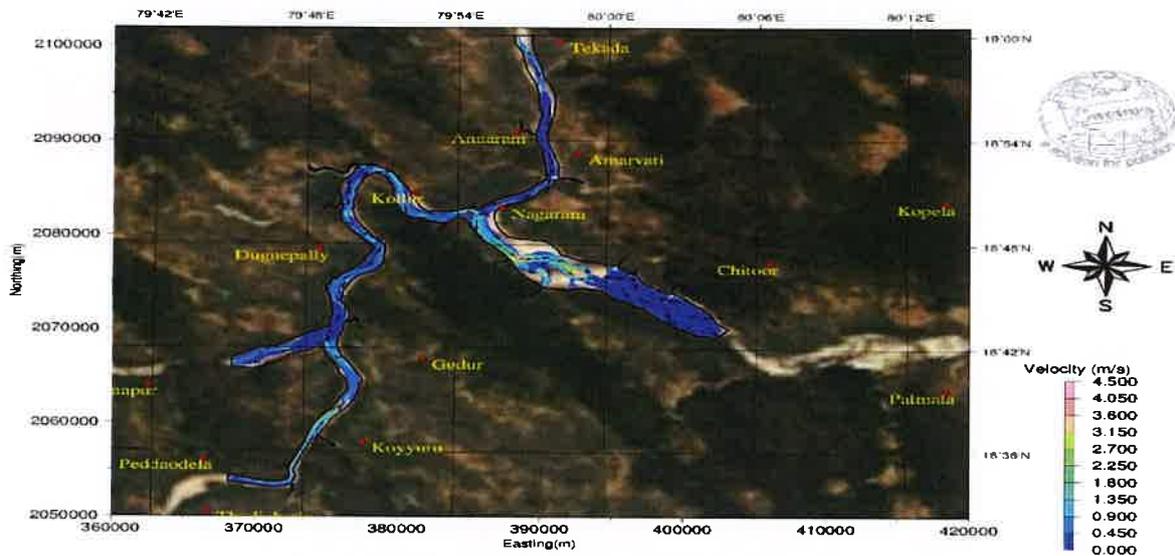


FIGURE 6-12: FLOW VELOCITY OF STUDY DOMAIN WITH FULL CAPACITY

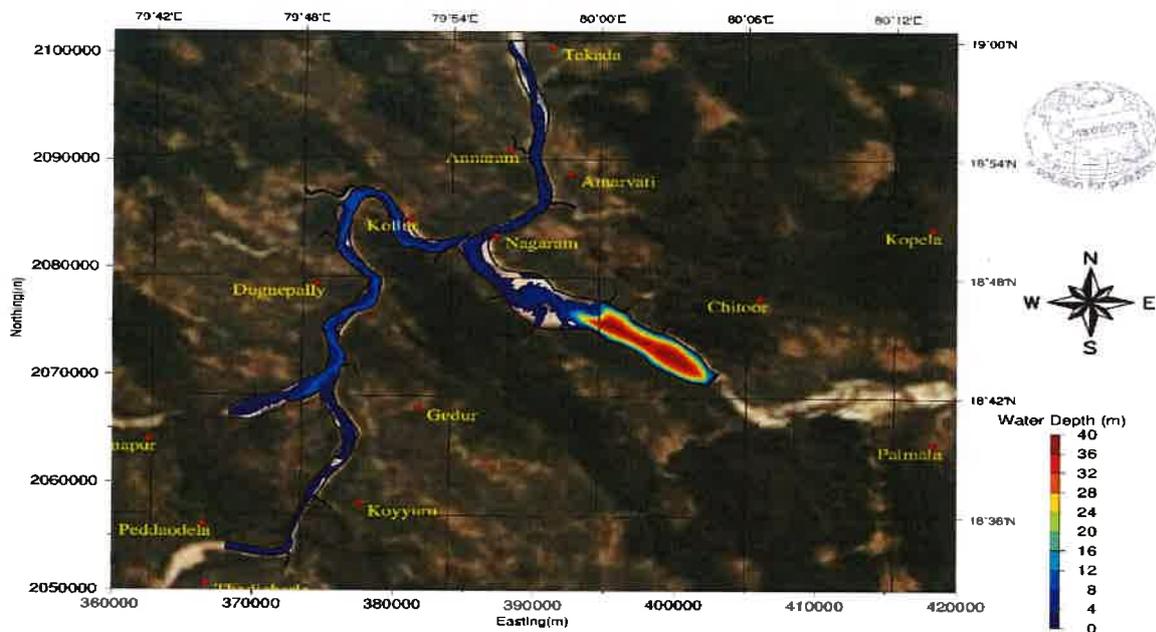


FIGURE 6-13: WATER DEPTH OF STUDY DOMAIN WITH FULL CAPACITY

6.14. IMPACT OF FLOW REGIME DUE TO DE-SILTATION

After the predicting the siltation processes in the river network system, four zones were identified in the study domain, where there was more siltation as shown in Figure 6.14. The model has been run after desilting for 1 m depth at the four zones as shown in Figure 6.15 to study the flow and sedimentation processes in the river system.

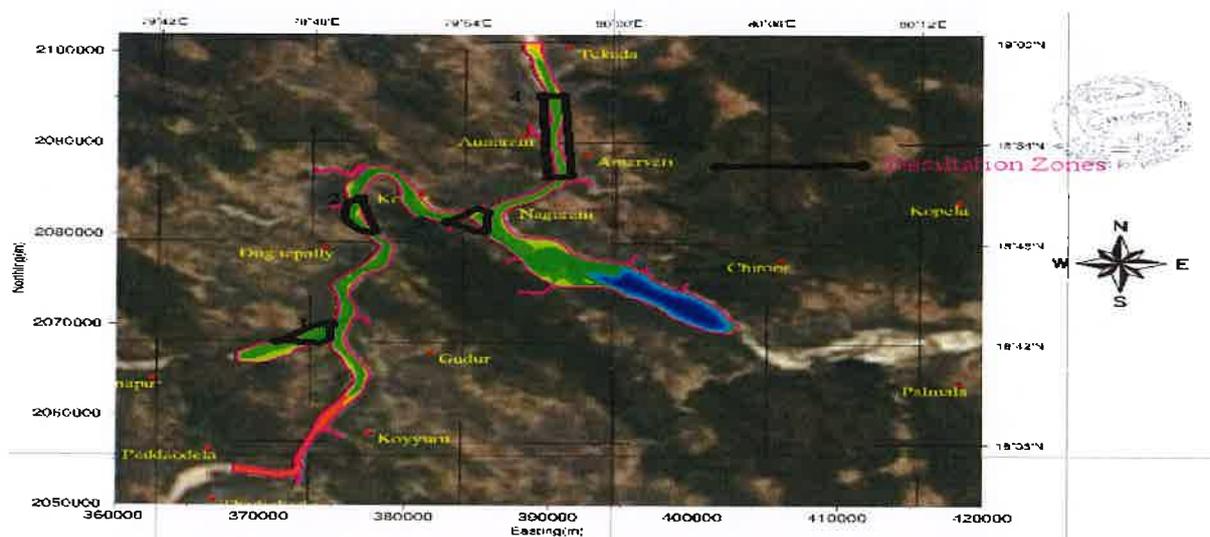


FIGURE 6-14: DEPOSITION ZONES IN THE STUDY DOMAIN

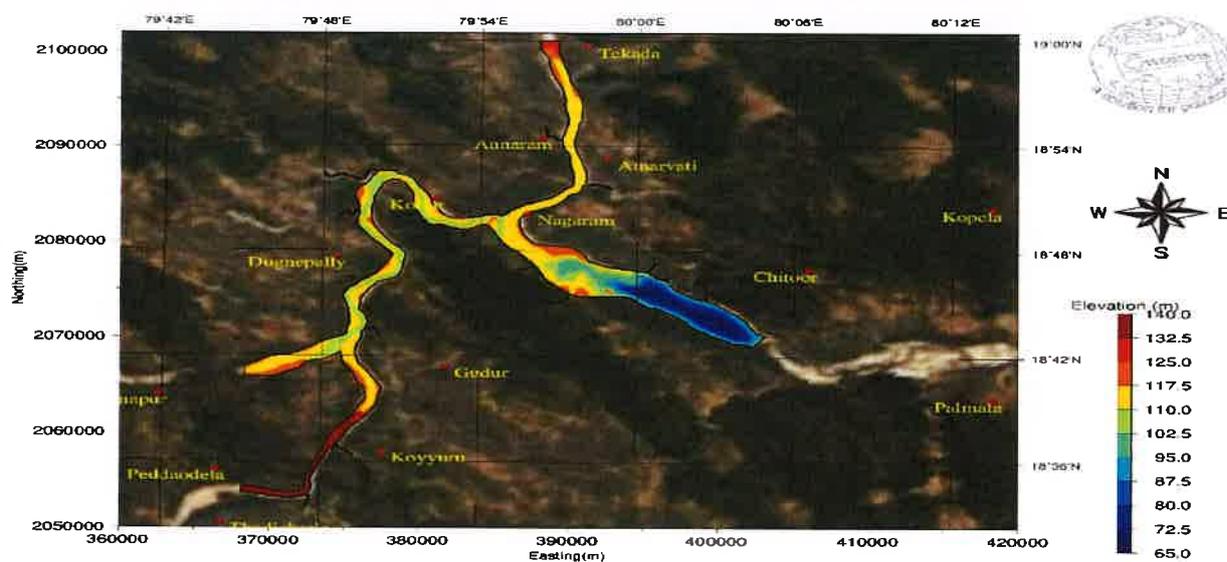


FIGURE 6-15: ELEVATION AFTER DESILTING IN THE SELECTED ZONES

➤ **Case 1: Half Reservoir Capacity**

The software runs have been made with new bathymetry and the results of velocity and water depth after desilting are shown in Figure 6.16 and Figure 6.17.

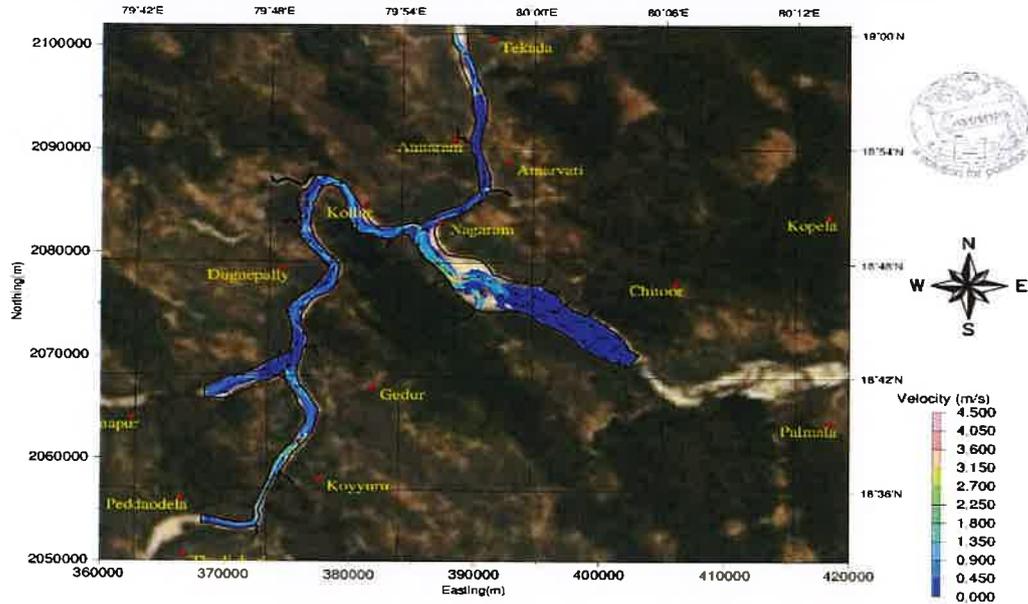


FIGURE 6-16: CHANGE IN THE FLOW VELOCITY DUE TO DESILTING DURING HALF STORAGE RESERVOIR CAPACITY

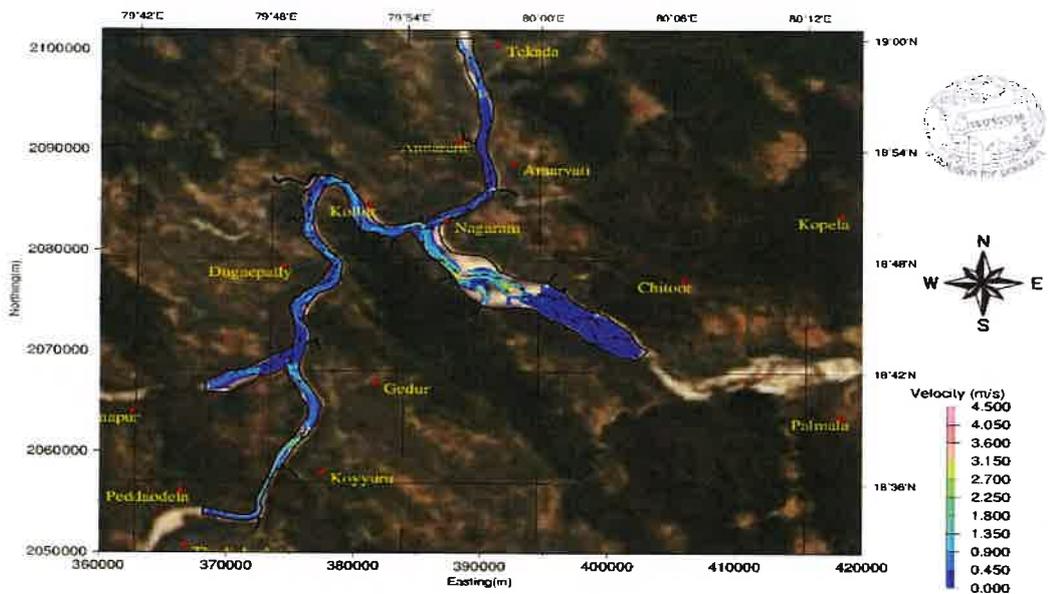


FIGURE 6-17: CHANGE IN THE FLOW VELOCITY DUE TO DESILTING DURING FULL STORAGE RESERVOIR CAPACITY

The maximum water depth after reservoir half is found to be 28-m from the **Figure 6.18**. The impact of de-siltation in the selected zones increased the velocity of 0.02m/s at the selected zones and reduced the water levels by 0.6m. The increase in the velocity will leads to erosion of river bed in the selected zones.

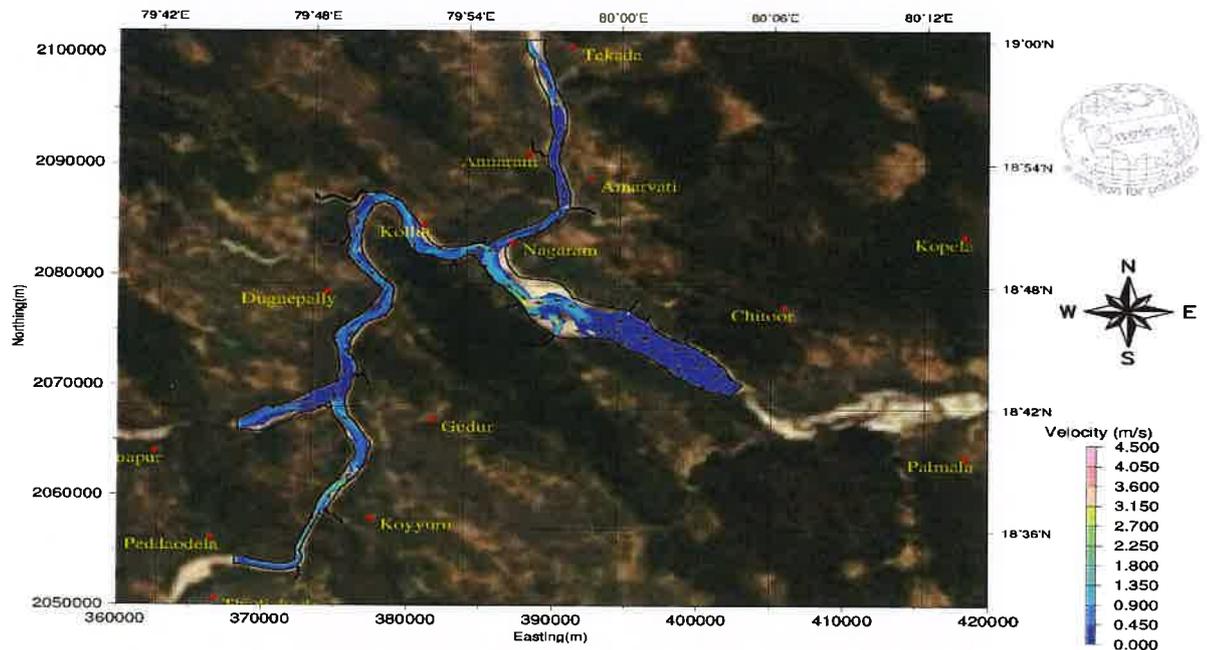


FIGURE 6-18: CHANGE IN THE FLOW VELOCITY DUE TO DESILTING DURING HALF STORAGE RESERVOIR CAPACITY

➤ **Case-2: Full Reservoir Capacity**

The software runs have been made with new bathymetry and the results of velocity and water depth after desilting are shown in **Figure 6.19** to **Figure 6.20** respectively.

The maximum water depth after reservoir full is found to be 40 m from the **Figure 6.20**. From the results it is clear that the overall water depth in the selected zones was reduced to 0.6m and current is increased by 0.2 m/sec. The increase in the velocity will leads to erosion of river bed in the selected zones.

Figure 6.19 and **Figure 6.20** show the variation of water depth in the study domain during half and full reservoir capacity. The maximum water depth during half reservoir capacity is found to be 28 m from the **Figure 6.20**. Also, the maximum water depth after reservoir full is found to be 40 m from the **Figure 6.20**. From the results it is clear that the overall water depth in the selected zones was reduced to 0.6m and current is increased by 0.2 m/sec.

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FIGURE 6-19: CHANGE IN THE FLOW VELOCITY DUE TO DESILTING DURING FULL STORAGE RESERVOIR CAPACITY

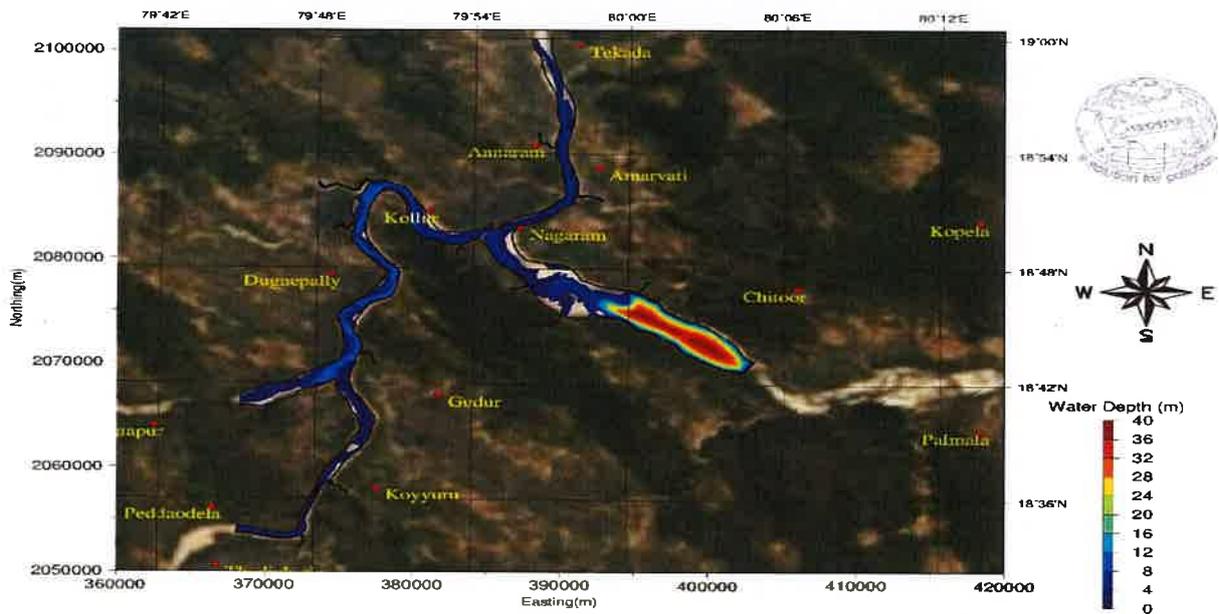


FIGURE 6-20: CHANGE IN WATER DEPTH DUE TO DESILTING WITH FULL CAPACITY

6.15. MODELING OF SEDIMENTATION PROCESSES (SILTATION/DE-SILTATION) IN THE MEDIGADDA STUDY AREA

The morphological changes results in the fine suspended solids being carried along with the river as a fine suspension move along on the bed. The medium and heavier grain particles travel as an entrainment into the water body and tend to settle in the water flow path during stagnant water condition, and carried over into the downstream. This suspension entrainment and bed movement depends upon the change in flow velocities in the water flowing areas.

6.16. SEDIMENT TRANSPORT SIMULATION

Simulation of sediment transport in the study area was carried out with the Hydrodyn-SEDSOFT model for various seasons Hydrodyn-SEDSOFT is a 2D sediment transport model (Cohesive and non-Cohesive) and predicts the process of erosion, transport and deposition of sediment.

Hydrodyn-SEDSOFT was driven with the hydrodynamic flow and using standard parameters which describe the erosion and settling characteristics of the sediment. Simulation runs to be carried by specifying sediment composition in the river.

The numerical simulation of the sediment transport under existing conditions, the model was adjusted to include the effects of the river bottom changes. The instantaneous rates of sediment erosion and deposition were simulated and the predicted river bed morphology over a period of time obtained for reservoir capacity.

6.17. INPUT DATA

The following input data used for the sediment transport modeling studies:

- Sediment Discharge(mg/l) along open boundary :50
- Ambient sediment (mg/l) :10

Consolidation data

- Consolidation coefficient (kg/m) :100
- Dry sediment weight after 1 year of consolidation data (kg/m³) :2400

Resuspension data

- Resuspension rate (kg/sec/m²) :0.0018

Shear stress data

- Maximum shear stress for Deposition (kg/m/s²) :0.3
- Maximum shear stress for Erosion (kg/m/s²) :0.29
- Minimum shear stress for Deposition (kg/m/s²) :0.08
- Minimum shear stress for Erosion (kg/m/s²) :0.22

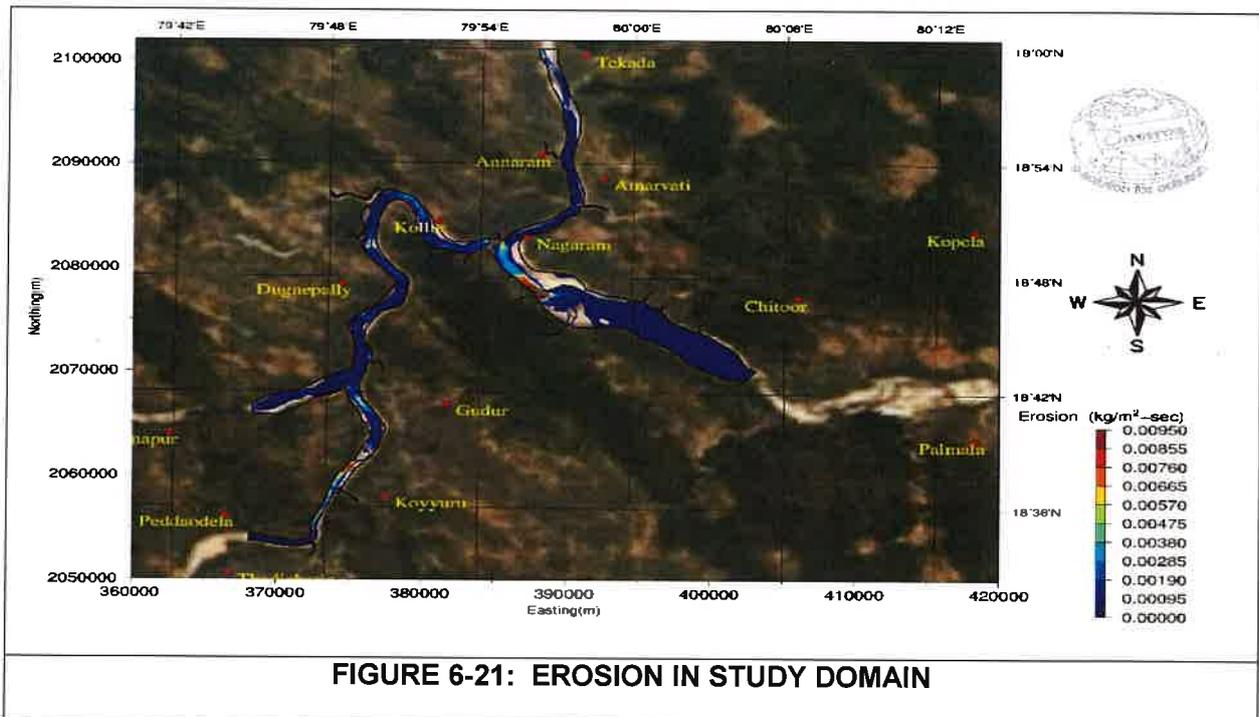
Bed Sediment Properties

- Sed Comp (100%) :100
- Sed Dens (Kg/m³) :2200

Flow currents: Simulated results from Hydrodyn-FLOSOFT. The software has been run with input data as discussed in the above section and continued the simulation till the reservoir capacity reaches to its full capacity. The model output results showing erosion, deposition and bed levels at various locations in the study area are shown in **Figure 6.21 to Figure 6.23**. The study domain has been divided into three sections (**A.1.1 of Annexure-1**) to better visualize the features of terrain information as well as model outputs.

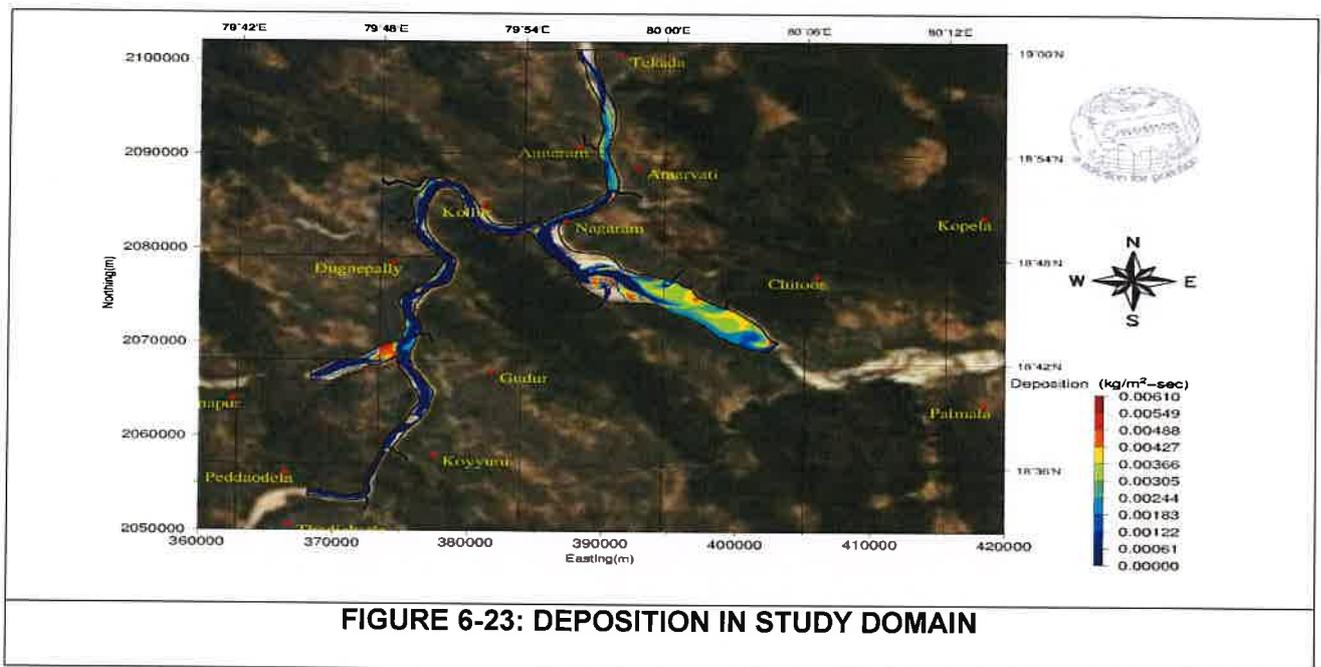
6.18. EROSION

Figure 6.21 shows the variation of rate of sediment erosion at different locations in the study domain. **Figures.A2.1 - A2.3 in Annexure-2** show the variation of sediment erosion rate in three sections. It can be seen from the figure that the erosion rate is found to be more at the mouth of the reservoir and in some portions of upstream river network system. The maximum erosion rate is found to be in the order of 0.0095 Kg/m²-sec.



6.19. DEPOSITION

Figure 6.23 show the variation of rate of sediment deposition at different locations in the study domain. Figures.A2.4 - A2.6 of Annexure -2 show the variation of sediment deposition rate in three sections. It can be seen from the figure that the deposition is high in the reservoir portion and some portions in the river system, where the flow currents are lesser than critical velocity. Figure-6.23 shows the maximum sediment deposited zones in the study area. Maximum sediment deposition rate is found to be in the southern part of river system, about 0.00610 kg/m²-sec. But in the northern part of river system, deposition rate decreased to 0.00244 kg/m²-sec. Also, in the reservoir region, sediment deposition rate is varied from 0.00183 kg/m²-sec to 0.00488 kg/m²-sec.



6.20. RIVER BED MORPHOLOGY

The variation of Bed morphology in the study domain is shown in Figure 6.24. Figures.A2.7 - A2.9 of Annexure-2 show the morphological changes of river bed in three sections. From the figure, it is clear that the maximum bed level of 0.01m is found in the southern river system of the study domain where the deposition is more. In the northern river system, the bed level varies from 0.02m to 0.04m. The variation of bed level in the reservoir region is in the range of 0.03m to 0.05m.

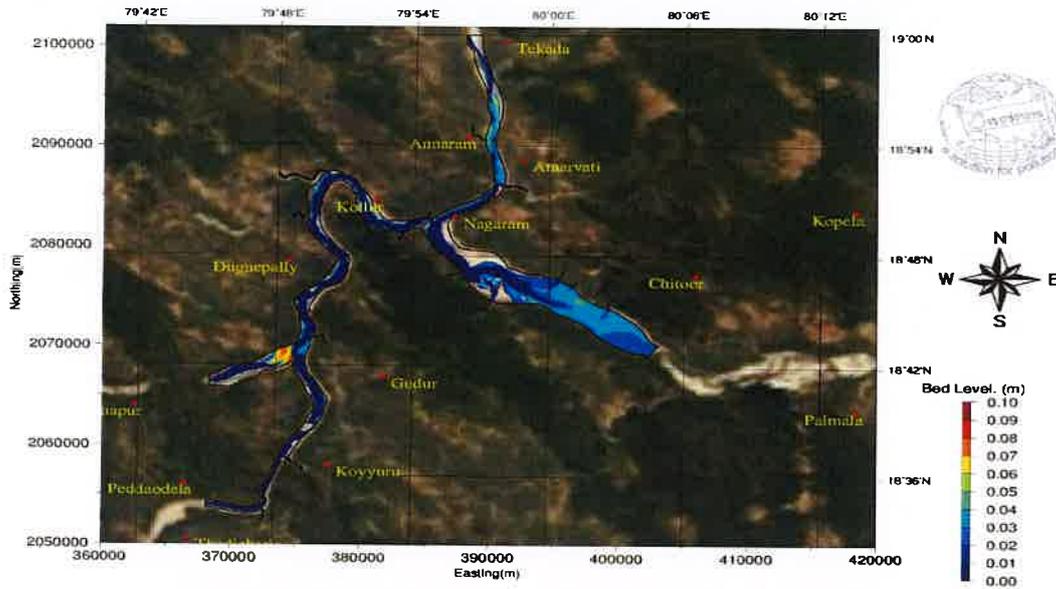


FIGURE 6-24: BED LEVEL IN STUDY DOMAIN

6.21. SUMMARY

Sediment Transport Simulations were carried out for the entire river system including Medigadda barrage. From the above results it can be conclude that the siltation and de-siltation zones were identified in the river system. Deepening (Desiltation) the river bed in the selected zones is significant in flow regime and in sedimentation (Siltation / De-siltation) processes. Also, observed that de-siltation causes increased flow velocity and reduced water elevation at selected zones.

Chapter-7
Impacts of Desilting & Remedial Measures

7. IMPACTS OF DE- SILTING & REMEDICAL MEASURES

Handling of sediments is a major challenge in the design and operation of water resources projects in general. The sediment deposition has caused huge capacity loss of reservoir and choking of outlets thereby reducing the project life. Besides, they pose severe problems in Pumping stations of Lift Irrigation projects, because of their abrasive characteristics.

Reservoir sedimentation inter alia may have the following negative effects:

- Loss of active storage volume, and thus reduced ability to compensate in- and outflows for hydropower, irrigation, drinking water and flood retention;
- Increased turbine/Pump erosion because of higher suspended sediment concentration (SSC) and coarser particles in power waterways due to reduced trap efficiency of the reservoir.
- Changes in approach channel hydraulics leading to difficulties in diversion discharges through the intake. (Applies to barrages and small dams)

The World Bank in its RESCON (Reservoir Conservation) approach call for adoption of "life cycle management" approach for designing dam. The RESCON approach is based on the following two messages:

- *"Whereas the last century was concerned with reservoir development, the 21st century will need to focus on sediment management; the objective will be to convert today's inventory of non-sustainable reservoirs into sustainable infrastructures for future generations."*
- *"The scientific community at large should work to create solutions for conserving existing water storage facilities in order to enable their functions to be delivered for as long as possible, possibly in perpetuity."*

The Expert committee on De-siltation of Ganga Basin summarized the following Principles of de-siltation Principles for desiltation works: The Committee proposed basic principles for planning and execution of desiltation works in rivers. These include:

- (i) Catchment area treatment and watershed development activities, along with suitable agricultural practices and river bank protection/anti-erosion activities are necessary to reduce silt inflow into the river system and must be undertaken in a comprehensive manner;

- (ii) Erosion, movement and deposition of sediment in a river occur naturally. Arrangements should be made to pass the incoming sediment into a river to downstream of the dams/ barrage structures to maintain the sediment equilibrium;
- (iii) The desiltation quantity should not exceed the deposition rate, i.e., the amount of boulders, pebbles, and sand deposited in river bed minus the amount transported downstream each year;
- (iv) Rivers should be provided with sufficient corridor for meandering without any hindrance to their flow; and
- (v) Precautions must be taken to avoid deposition of sediment loads within the river, and instead they should be deposited on other suitable land.

7.1. ENVIRONMENTAL AND OTHER IMPACTS OF SEDIMENTS

A summary of environmental and other impacts of sediments in river basins and storage reservoirs are given in **Table-7.1**

TABLE 7-1: IMPACTS OF SEDIMENTS IN RIVERS AND RESERVOIR

Sediment size	Environmental issues	Associated engineering issues
Silts and clays	<ul style="list-style-type: none"> ▪ Erosion, especially loss of topsoil in agricultural areas; gulying ▪ High sediment loads to reservoirs ▪ Chemical transport of nutrients, metals, and chlorinated organic compounds ▪ Accumulation of contaminants in organisms at the bottom of the food chain (particulate feeders) ▪ Silting of fish spawning beds and disturbance of habitats (by erosion or siltation) for benthic organisms 	Reservoir siltation Drinking-water supply
Sand	<ul style="list-style-type: none"> ▪ River bed and bank erosion ▪ River bed and bank erosion ▪ Habitat disturbance 	<ul style="list-style-type: none"> ▪ River channel deposition: navigation problems ▪ Instability of river cross-sections ▪ Sedimentation in Reservoirs
Gravel	<ul style="list-style-type: none"> ▪ Channel instability when dredged for aggregate ▪ Habitat disturbance 	Instability of river channel leads to problems of navigation and flood- control

7.2. ENVIRONMENTAL IMPACTS OF DE-SILTING

Though it is always advisable to restrict the sediments in the reservoirs by taking many river and bank protection measures, habitat management measures and watershed management measures. However, dredging will be necessary to some extent for improving the capacity of reservoirs and reduce the harm to pumping equipments in case of lift irrigation schemes

De-silting, if done indiscriminately, can cause severe impacts on ecology, environment and ground water resources of the area.

Following Table-7.2 summarizes the impacts identified of de-silting of sand from Medigadda Barrage and remedial measures.

TABLE 7-2: IMPACTS IDENTIFIED OF DE-SILTING OF SAND FROM MEDIGADDA RERSERVOIR AND REMEDIAL MEASURES.

Activity	Environmental Impacts	Possibilities of the impacts in sand reaches of Medigadda Barrage	Remedial measures
De-silting process	Depletion of ground water if excess sand is de-silted from the river beds	Not likely	The sand reaches proposed to be dredged are in the mandala of Mahadevapur and Kataram Mandals in Mahadevapur District and Manthani Mandal of Peddapalli District. All three mandals are safe in terms of ground water eplotation. The Depth of desilting will be between 2 to 4 meters in different stretches.
	Loss of aquatic species, if de-silting is done during monsoon season	De-silting is proposed to be done between February to June period and river flow is lean in this period. Also only exposed sand portions will be taken out. Hence loss of aquatic species is not possible	Period of de-silting will be during lean period of water flow in the river

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	Fall of animals in the de-silted stretches in the river bed during cross over	There is possibility of this impact in sand reaches	It suggested to provide barricading of desilting area in the river bead to restrict movement of animals
	Bed erosion due to excessive depth of de-silting	There is possibility of this impact	It is suggested to restrict the depth of sand proposed to be dredged to 50% of possible deposit. The depth however should not be more than 3 meters depth. Ensure atleast 2 meters depth of sand bed is intact while desilting to avoid any bed erosion. Following measures will be taken up 1) Augr sampling of bed will be taken up before arriving at the depth of desilting and same will be norified to supervisory staff. 2) Photographs of the sand reach before and after the dreding shall be maintained 3) Sattellite images shall be taken on the sand reaches and processed images shall be preserved
	Bed erosion due to excessive depth of de-silting	There is possibility of this impact	It is suggested to restrict the depth of sand proposed to be dredged to 50% of possible deposit. The depth however should not be more than 3 meters depth. Ensure atleast 2 meters depth of sand bed is intact while desilting to avoid any bed erosion. Following measures will be taken up 4) Augr sampling of bed will be taken up before arriving at the depth of desilting and same will be norified to supervisory staff. 5) Photographs of the sand reach before and after the dreding shall be maintained 6) Sattellite images shall be taken on the sand reaches and processed images shall be preserved

	Erosion of River bunds during transportation of sand from river bed to stock points	There is possibility of this impact	Bund protection measures will be taken. Trees plantation will be taken up on the bund on both sides of drive way of the vehicles
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7.3. METHOD OF DE-SILTING

De-silted sand will be loaded into tractors using loaders/ manually. The tractors will unload the desilted material at the nearby stockyard from where the de-silted material will be transported by tractors/trucks to the consumer end points.

TSMDC has established online monitoring system for the sand transportation from stockyard to the end users by deploying GPS enabled trucks.

Chapter-8
Budget for Environmental Remedial Measures

8. BUDGET FOR ENVIRONMENTAL REMEDIAL MEASURES

Based on the suggested measures on possible impacts, following budget estimates are estimated for the proposed and reaches. Estimates for each sand reach

TABLE 8-1: EMP BUDGET

Sl. No.	Remedial measure	Capital Expenditure, INR	Recurring Expenditure, INR
1	Barricading of Dredge area in river bed to avoid fall of animals	2,00,000-00	1,00,000-00
2	Tree plantations on bunds and stock yards	1,00,000-00	1,00,000-00
3	Seep traps at Stock yards to collect seepage water if any	1,00,000-00	50,000-00
4	Enclosures around the stock yards to avoid dust emissions	2,50,000-00	Nil
5	Water sprinkling on haul roads	2,00,000-00	1,50,000-00
6	Annual sand deposit ratio studies to fix depth of desilting in the reaches	--	2,50,000-00
7	Environmental Monitoring, Water, Air, Noise and ground water fluctuation in the surrounding areas of sand desilting stretches	--	3,00,000-00
	TOTAL	8,50,000-00	9,50,000-00

Chapter-9
Conclusions

9. CONCLUSIONS

Based on the modeling study carried out to predict the water elevations and sedimentation processes in the river network system as well as in reservoir, the following conclusions can be drawn:

9.1. HYDROLOGICAL MODELING STUDIES

- The catchment area was considered as 10000 Sq. km for calculating the runoff flow into the river and reservoir system.
- Simulated the over land flow in the catchment area based on topography and rainfall/ runoff data.
- Predicted the water levels and fluxes at different locations in the upstream of the river network system of Medigadda barrage.
- Predict the variation of water levels in the reservoir with respect to runoff flows.
- Predicted the fluxes at different locations in the river network system as well as in the reservoir.
- Flow regime changes computed in the case of de-siltation of river system at some stretches.
- It can be concluded that de-siltation in the river system helps locally in case of floods. But this is not a better practice, but it is suitable in case of tidal rivers where the navigational depths are to be maintained.
- It is recommended that suitable river training works are to be introduced at critical zones of erosion / deposition.

9.2. SILTATION AND DE-SILTATION MODELING STUDIES

- Sediment Transport modelling studies were carried out for the entire river system including Medigadda barrage.
- Identified siltation and de-siltation zones in the river system and studied the impact associated with the sedimentation processes.
- The changes predicted in the sedimentation (Siltation / De-siltation) processes seem to be significant due to deepening (desilting) the river bed in the selected zones.
- Observed that de-siltation causes increased flow velocity, results erosion in the selected zones.
- Predicted the sediment transport from the overland / catchment area based on the flow condition and deposited in the reservoir.
- **As a result of siltation in the reservoir, the total sediment deposition estimated as 32,500 m³ in case of full storage reservoir capacity.**

Chapter-10

Disclosure of Technical Consultants

10. DISCLOSURE OF TECHNICAL CONSULTANTS

10.1 INTRODUCTION

The consultant engaged for the preparation of the EIA/EMP of the project is **M/s. Sri Sai Manasa Nature Tech Pvt. Ltd.** Realizing the need for multi-disciplinary and pragmatic approach to environment management, a few dedicated experience started M/s. Sri Sai Manasa Nature Tech Pvt. Ltd. company as a consultancy organization in 2006 registered as company and **ISO 9001:2015** Certified Company and accreditation by **NABET "A"** category for open cast mines. Our team consists of specialists in environmental consulting, regulatory compliance and review, site investigation, emergency response, environmental laboratory, site assessment, and data usability-related experience. These individuals have worked together on similar projects, and the leaders have been commended by their clients for accomplishment on other successful projects.

M/s. Sri Sai Manasa Nature Tech Pvt. Ltd. has its own Environmental laboratory with a name of **KIWIS Eco Laboratory** at Pragathi Nagar, Hyderabad under EPA (Environmental Protection Act) from the **MoEF&CC, Govt. of India, New Delhi** and by National Accreditation Board for testing and Calibration Laboratories (**NABL**).

The list of the project team has been summarized below:

Sl. No.	Name & Designation	Qualification	Experience
1	Dr. Ch. Rajani Kumari Chairman & Managing Director	M. Sc. (Environment Science) Ph.D	17 years of experience in the field of EIA Studies and Environmental Management
2	E. Shyam Sundar Head of Organization	M.SC., M.Phil, PGDES	31 years of experience in Environmental Consultancy & Advisory services, Due Diligence & Compliance Auditing
3	Ms. Reshma Thakur EIA Coordinator & FAE	M.Tech (Env. Engg.)	14 years of experience in the field of EIA Studies and Environmental Management.
4	Mr. A. Mohan Reddy	MSW	8 years of experience in Socio Economics & demography
5	Dr. Desi Sreekanth	M.Sc. Ph. D	6 years of experience in Effluent Treatment & Pollution Control technology
6	Dr. Siva Damaraju	M.Sc. Ph. D	6 years of experience in Effluent Treatment & Pollution Control technology

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Sl. No.	Name & Designation	Qualification	Experience
7	Dr. Smaranya Haque	M.Sc., PhD	8 years of experience in Impacts Assessment
8	Mr. I Durga Prasad	M.A (Econimics)	Socio Economy & Demography expert
9	Mr. Sundara Rao	M.Sc.	Soil Conservation expert
10	Mr. NH Reddy	M.Tech	Hydrogeology and Geology expert



ABOUT ENVIRON

Environ Software (P) Ltd was **incorporated in October 1998** and is located at Bangalore- the silicon valley of INDIA. It has a team of highly skilled and dedicated staff, specializing in Coastal Engineering, Hydraulics, Mechanical Engineering and Computer Science & Engineering. Environ is a multi-disciplinary software development and consulting firm focusing primarily on solutions to problems involving Air, Water and Soil pollution through the in-house, state-of-the-art computational tools. It is capable of solving a wide variety of coastal and marine pollution related problems that include prediction of currents and tides, flood forecasting, morphological changes of estuarine bed and effects on marine population due to discharge of various industrial pollutants and construction of marine structures.

The company is also capable of predicting the spread of various pollutants in air media, emitted from the industries and vehicles. Environ also provides numerical solution to the problems related to sub-surface flows and transport of pollutants. The company also provides full service on field monitoring studies to measure and assess conditions in oceans, coastal areas, lakes, rivers and in air pollution monitoring.

Apart from dealing with complex environmental issues the company is developing a sophisticated Computational Fluid Dynamics (CFD) software, with appropriately chosen numerical methods and physical models for solving Fluid flow, Heat Transfer and Radiation problems. It is capable of solving incompressible, compressible, and two phase flows etc, with different integrated solvers. The company is also concentrating on the development of dedicated software for a specific application because the user is more oriented in many other things than looking for new developments in numerical methods.

Environ products are absolutely user friendly which requires minimal training. The highlights of the products of Environ are interactive, high quality Pre- and Post-Processor utilities which promises enhanced performance.

Environ was developed softwares for Library Automation, Institutional Management and Company Automation etc. based on client/Server, Internet/ e-Business and Wireless Application tools.

STRATEGIC AREAS

Scientific Simulation Software

Scientific simulation software products are self-contained, absolutely user friendly and integrated with pre- and post processor utilities.

- **Air Pollution Simulation Models (APSM)**
- **Surface Water Pollution Simulation Models (SWPSM)**
- **Ground Water Pollution Simulation Models (GWPSM)**
- **Noise Pollution Simulation Models (NPSM)**

- **Fluid Dynamics Simulation Models (FDSM)**

Client/Server Applications

- **Library Management System for complete library automation**
- **Customized Application Development viz. Inventory control, Accounts etc.**
- **Medical Transcription Monitoring System.**

Internet and e-Business Development

- **Complete e-business solution**
- **Business to Customer and Business to Business Solutions**
- **Web Design and Consultancy**
- **Support & Maintenance of launched web sites**
- **Wireless Applications**

Consultancy Services offered

- **Modeling of Air ,Water ,Ground Water Pollution & Fluid Dynamic and Heat Transfer Applications**
- **Environmental Modeling & Impact Assessment**
- **Risk Assessment/Analysis**
- **Hazardous Waste water Management**

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Annexure - 1

ANNEXURE 1

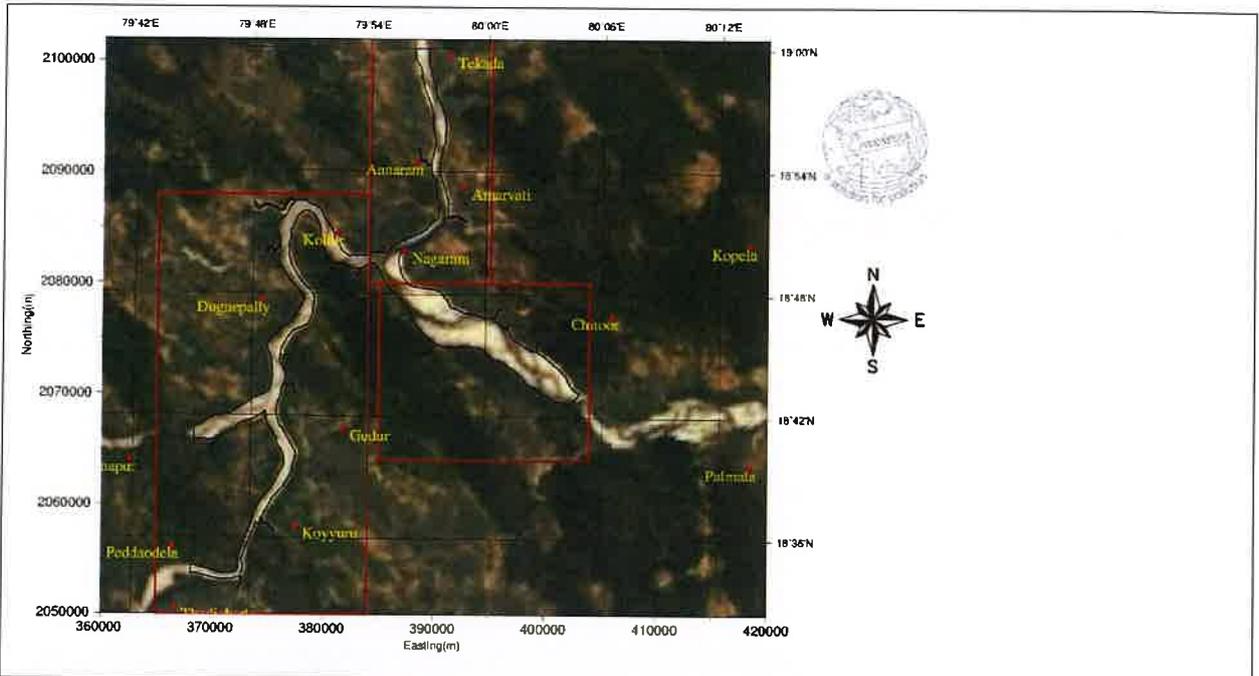


Fig.A1.1 Selected sections in the study domain

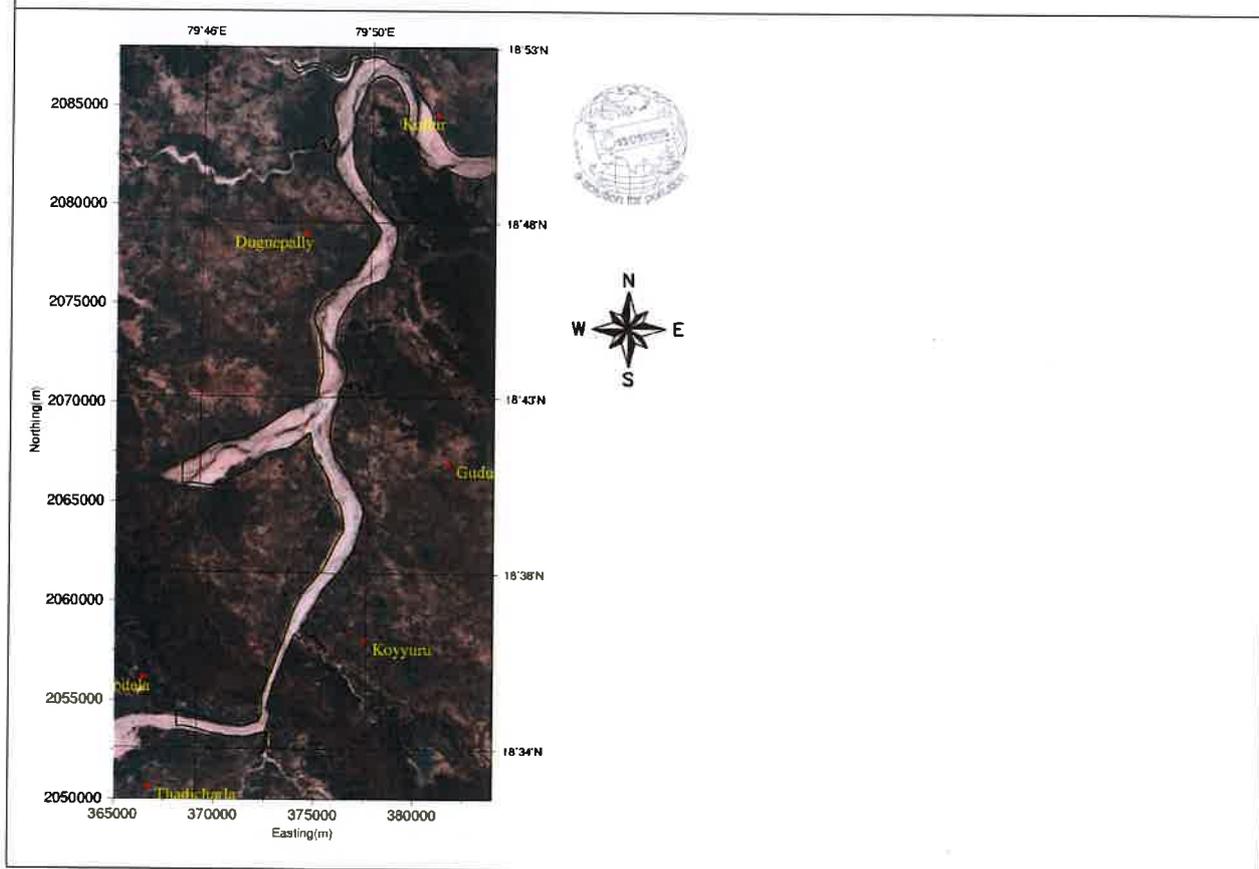


Fig.A1.2 Zoomed up portion of general layout of the study domain (Section 1)

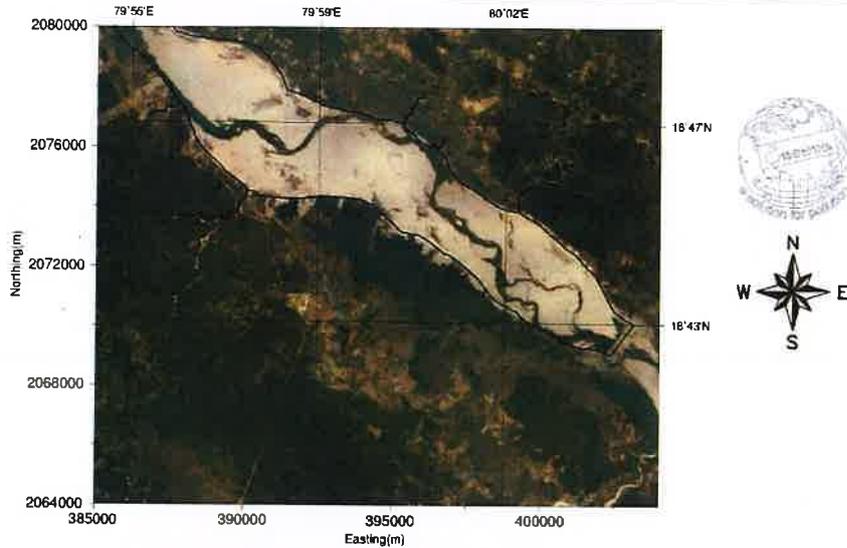


Fig.A1.3 Zoomed up portion of general layout of the study domain (Section 2)

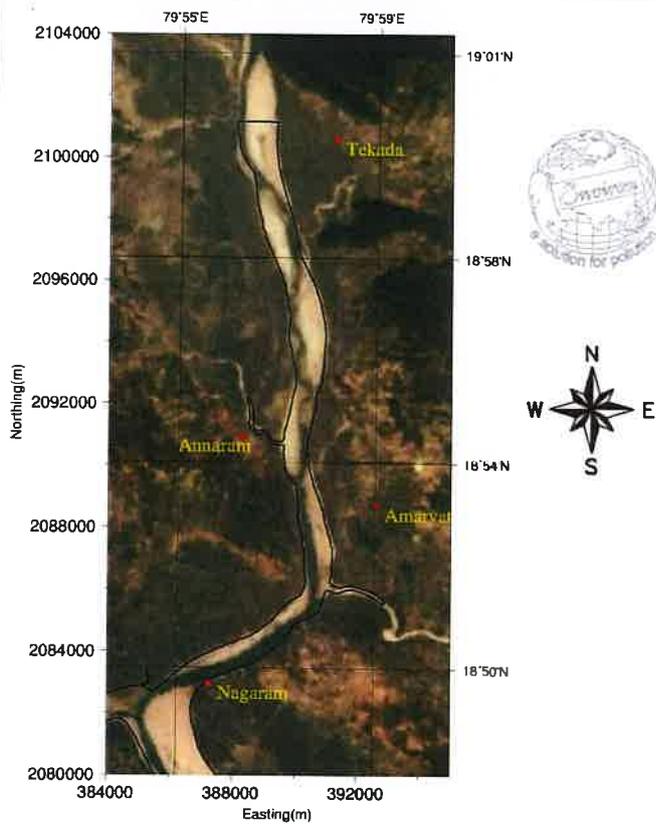


Fig.A1.4 Zoomed up portion of general layout of the study domain (Section 3)

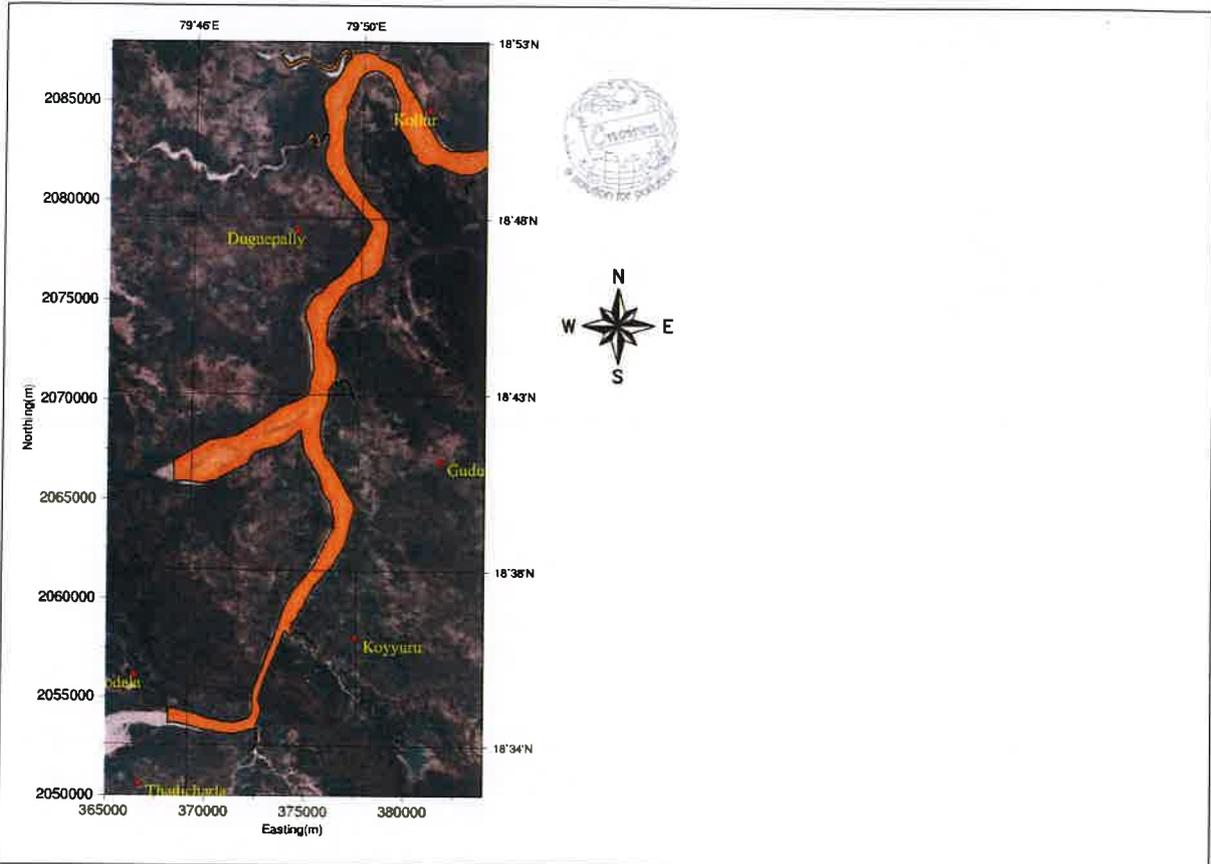


Fig.A1.5 Zoomed up portion of FEM mesh of the study Domain (section 1)

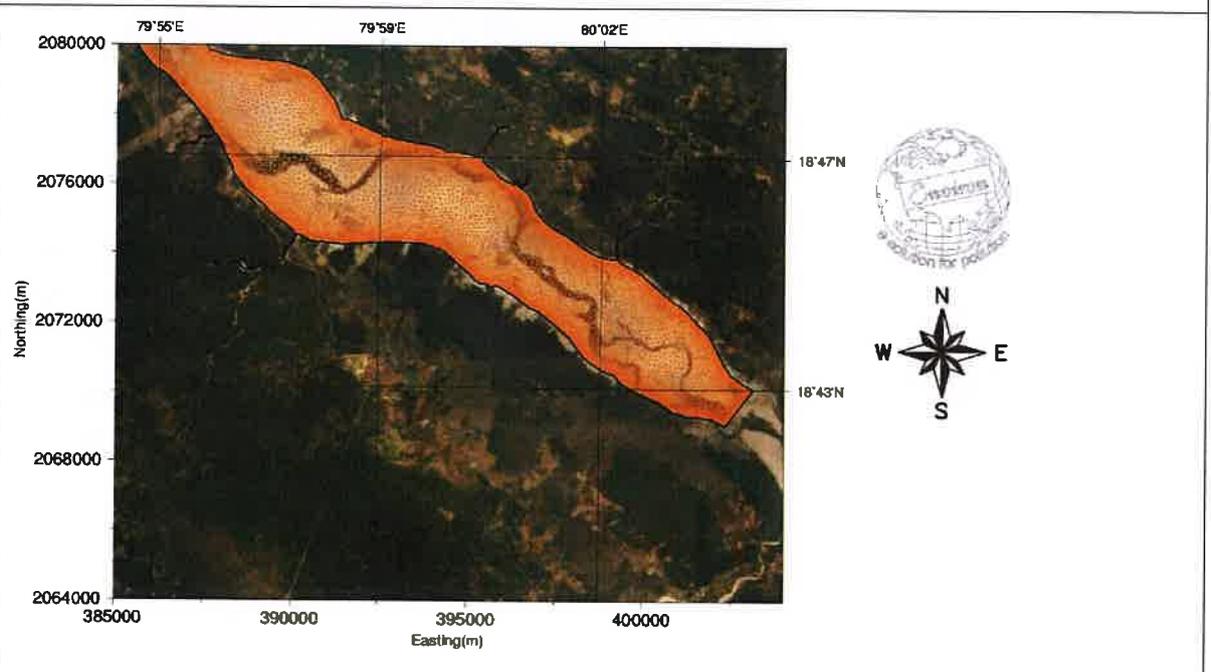
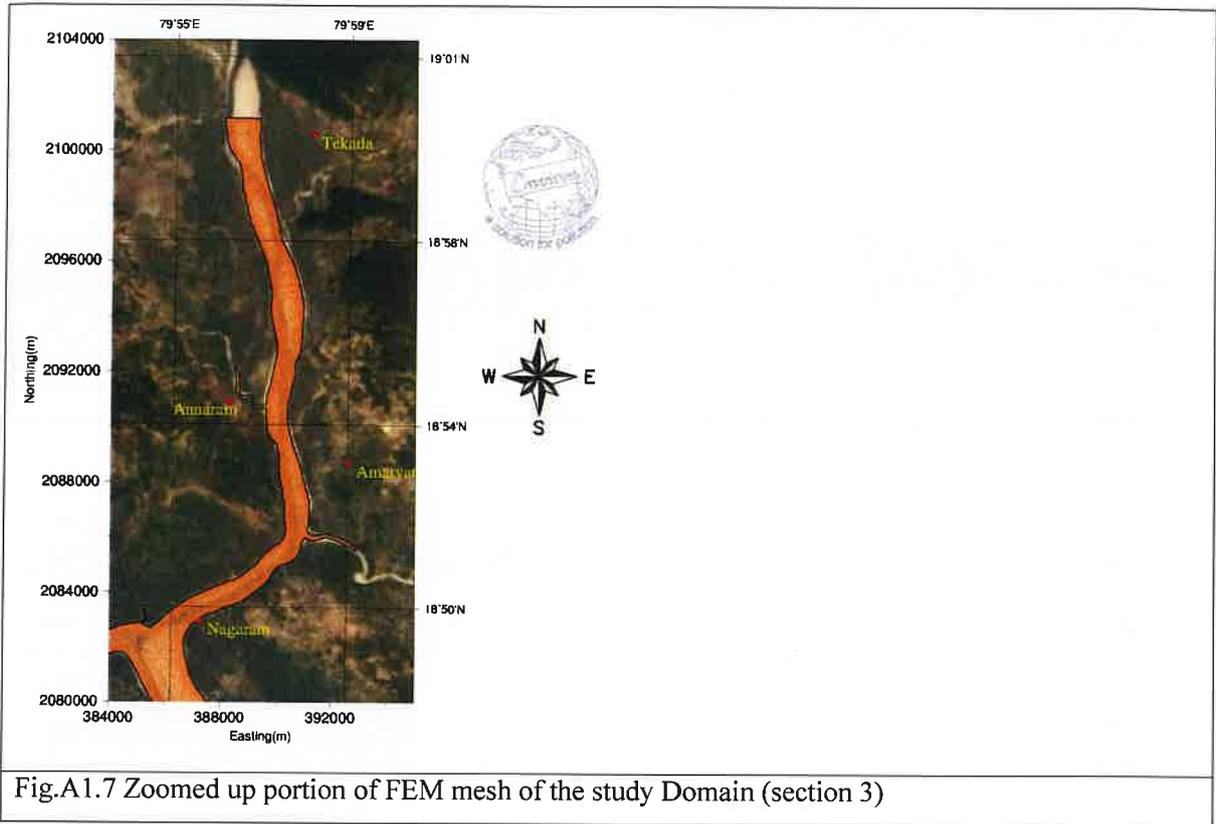


Fig.A1.6 Zoomed up portion of FEM mesh of the study Domain (section 2)

Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana



Scientific Study report on Impacts of Desiltation at Medigadda Barrage of Jayashankar Bhupalapally District of Telangana

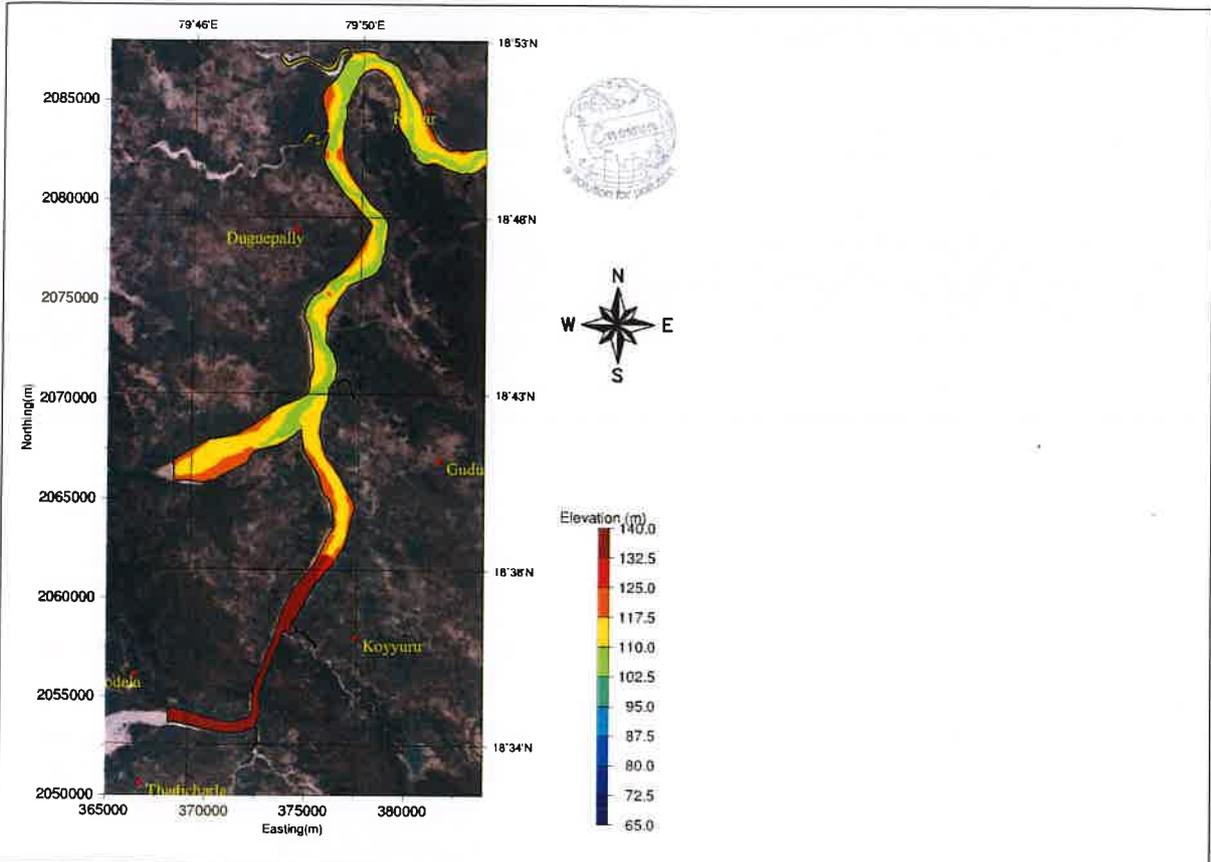


Fig.A1.8 Zoomed up portion of Elevation of study domain (section 1)

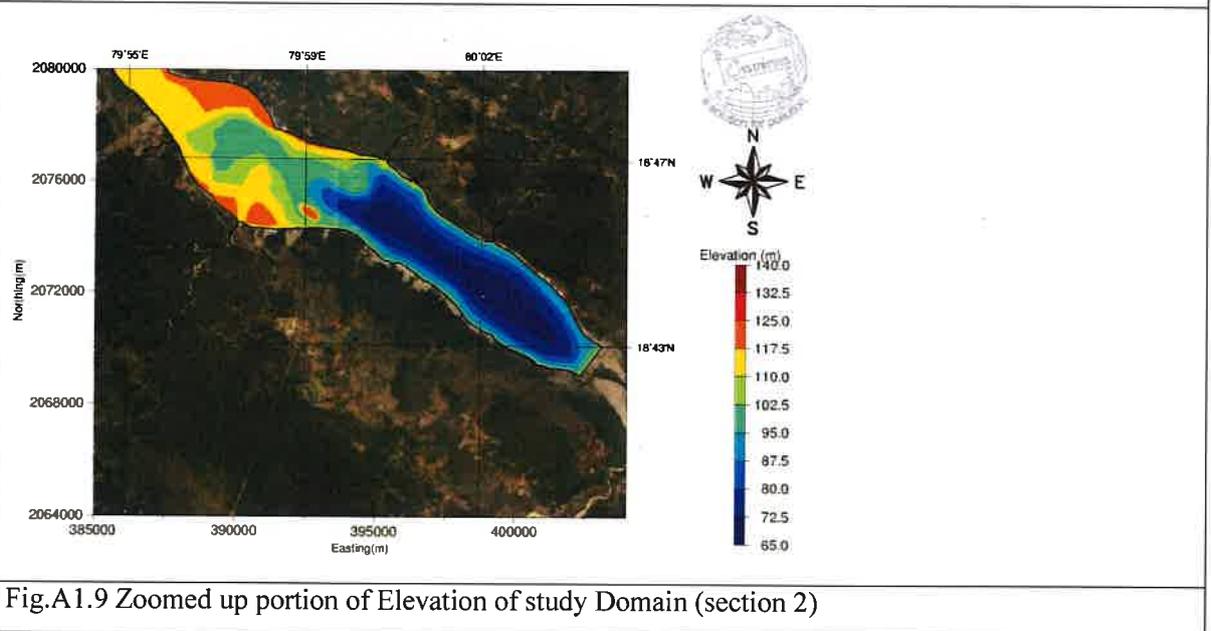


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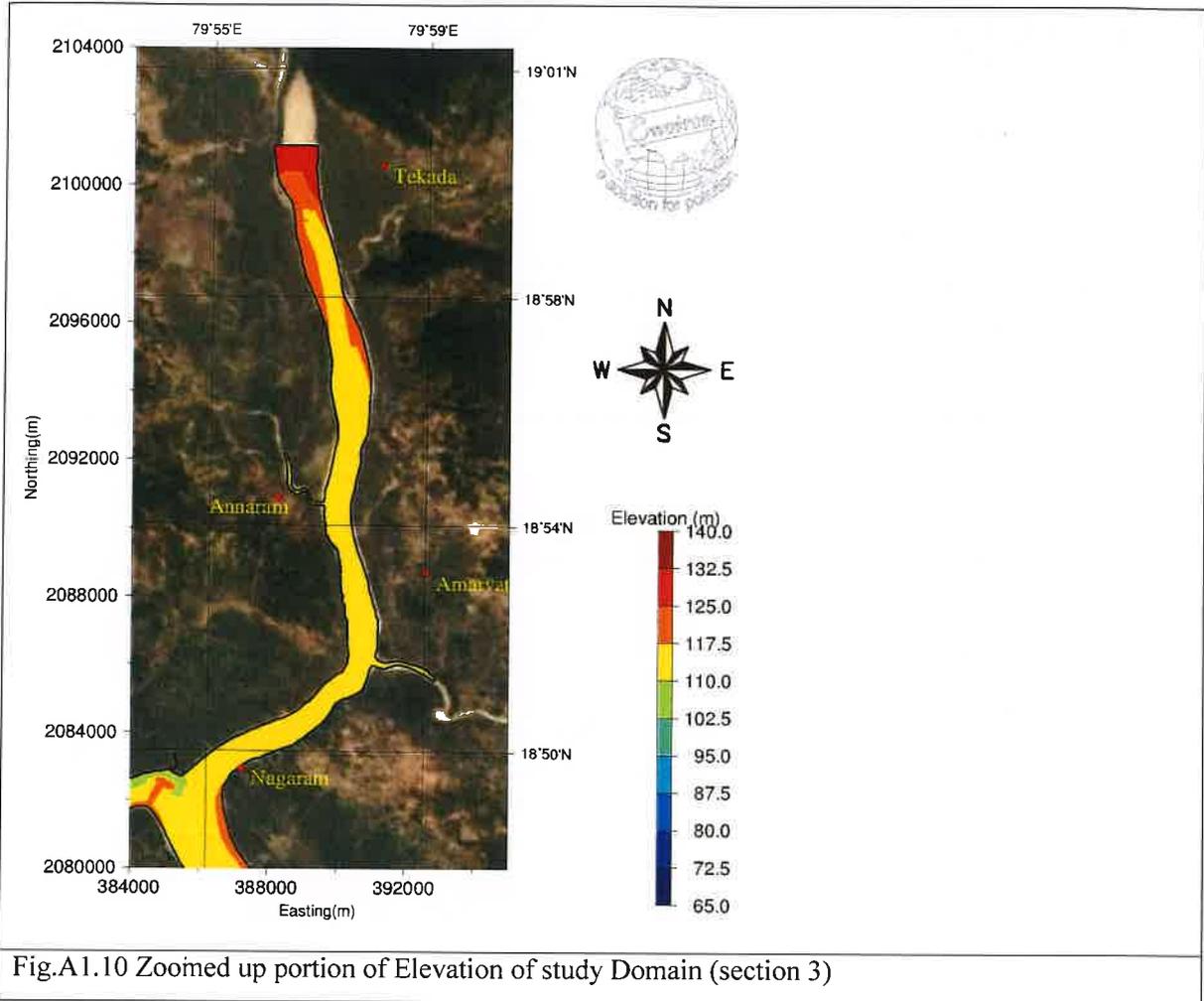


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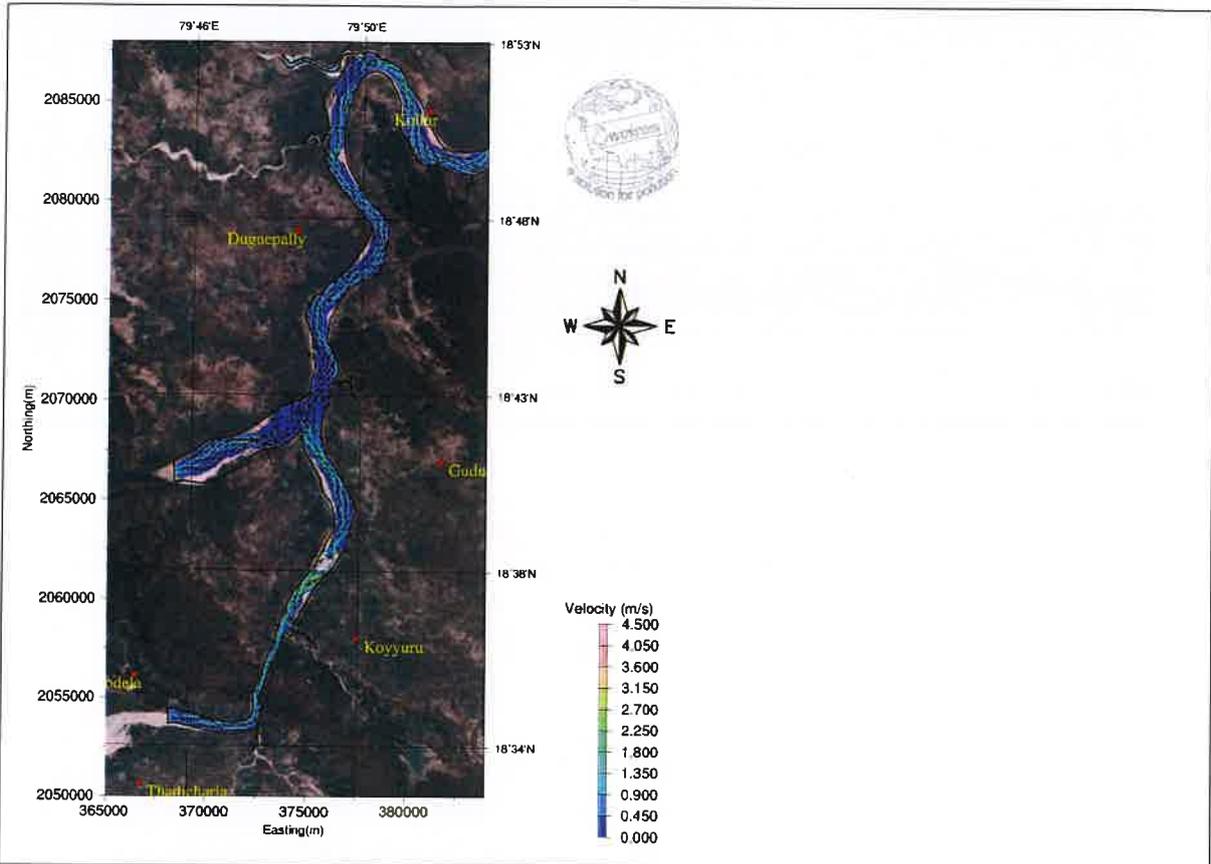


Fig.A1.11 Zoomed up portion of Flow velocity of study Domain with half capacity (section 1)

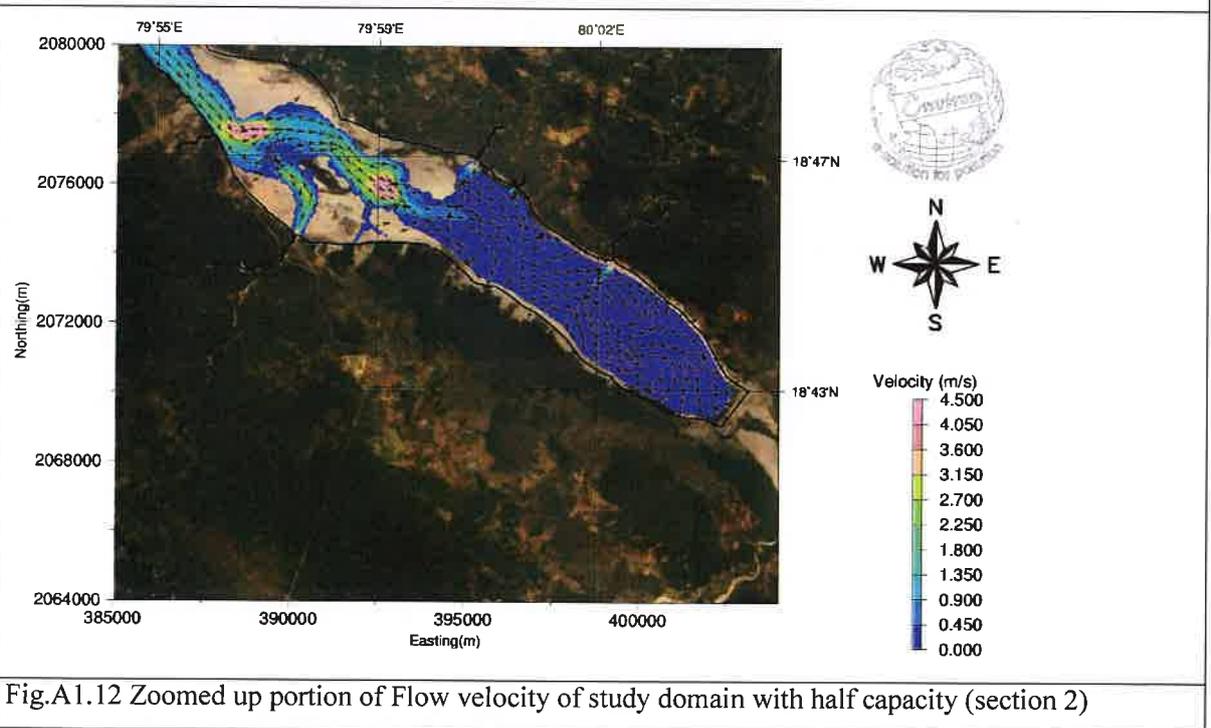


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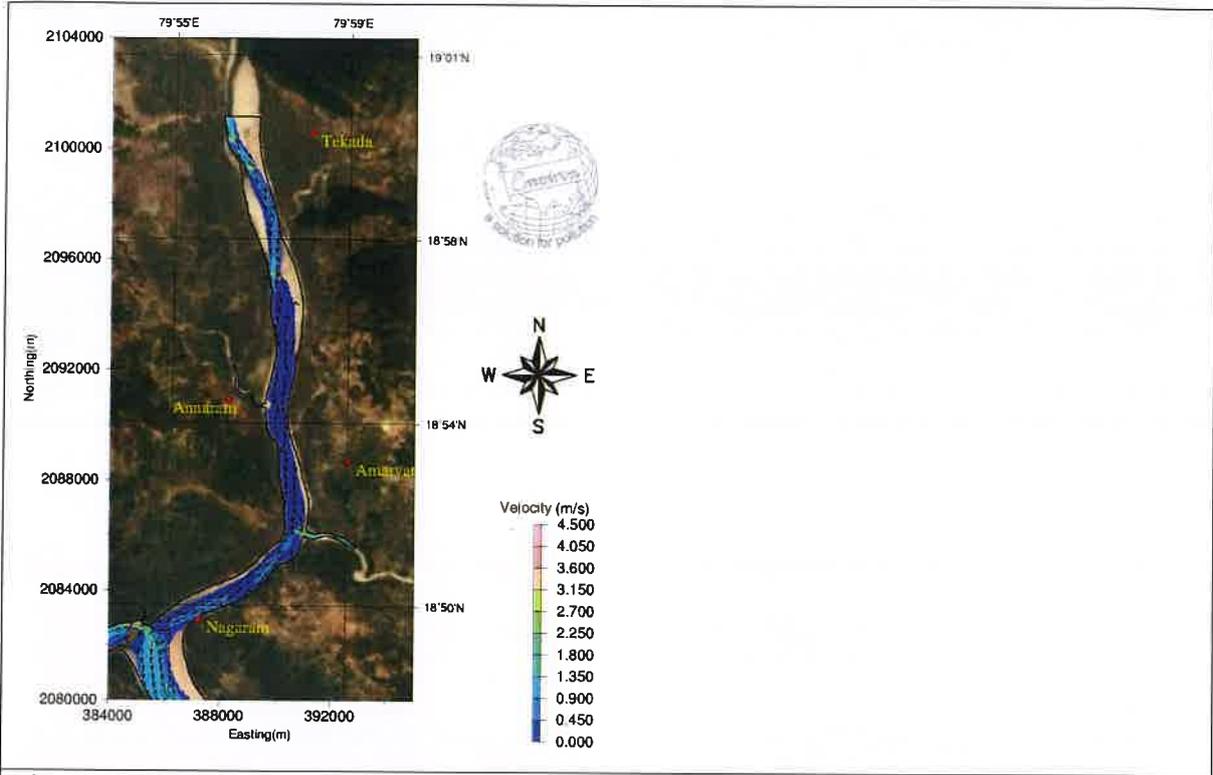


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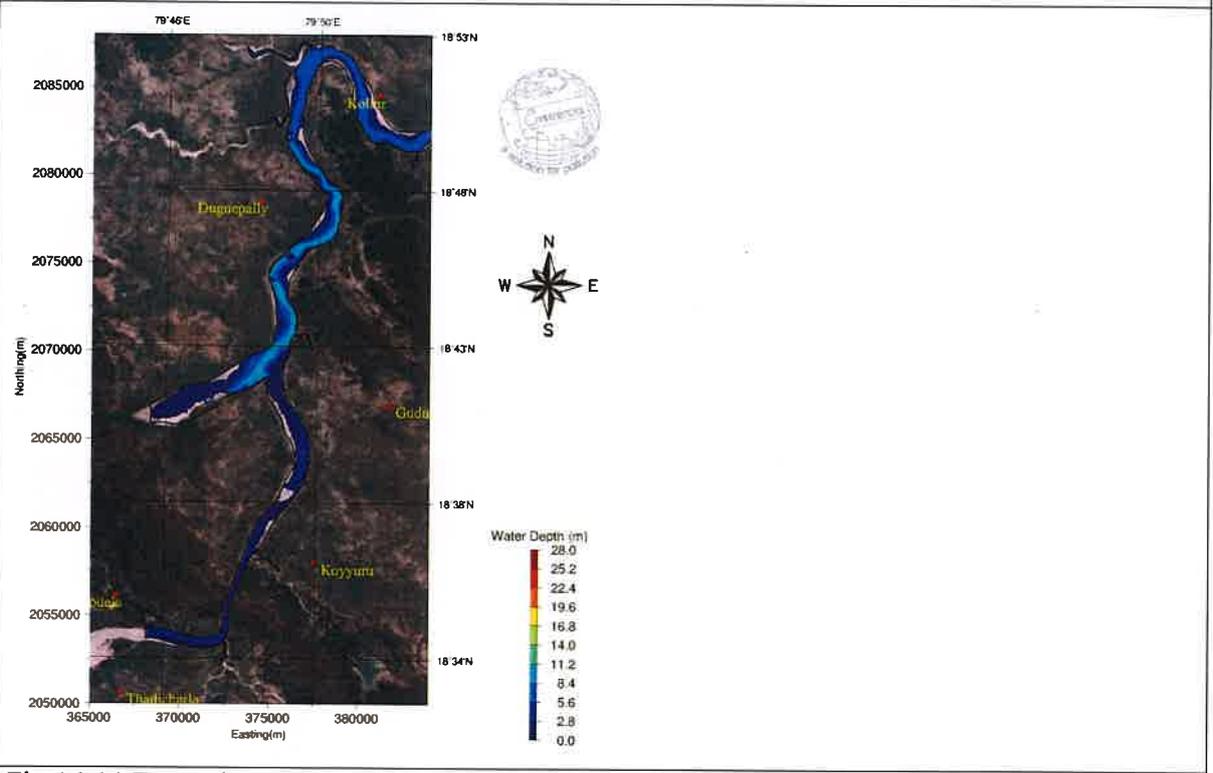


Fig.A1.14 Zoomed up portion of Water Depth of study domain with half capacity (section 1)

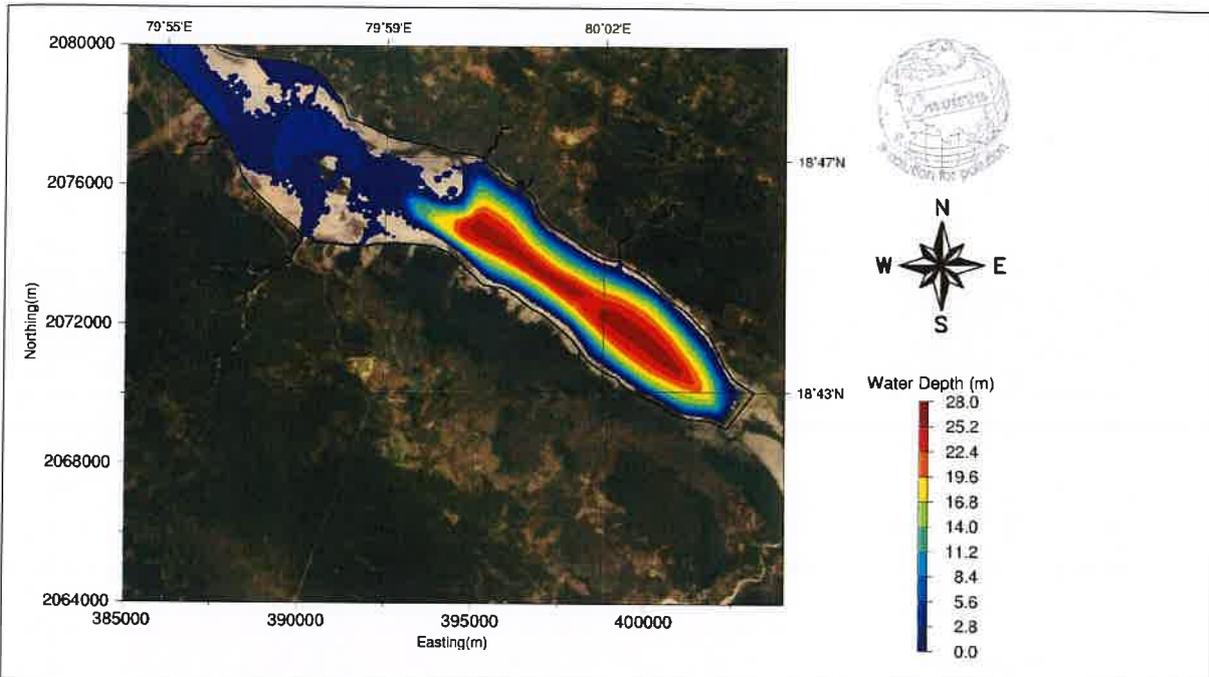


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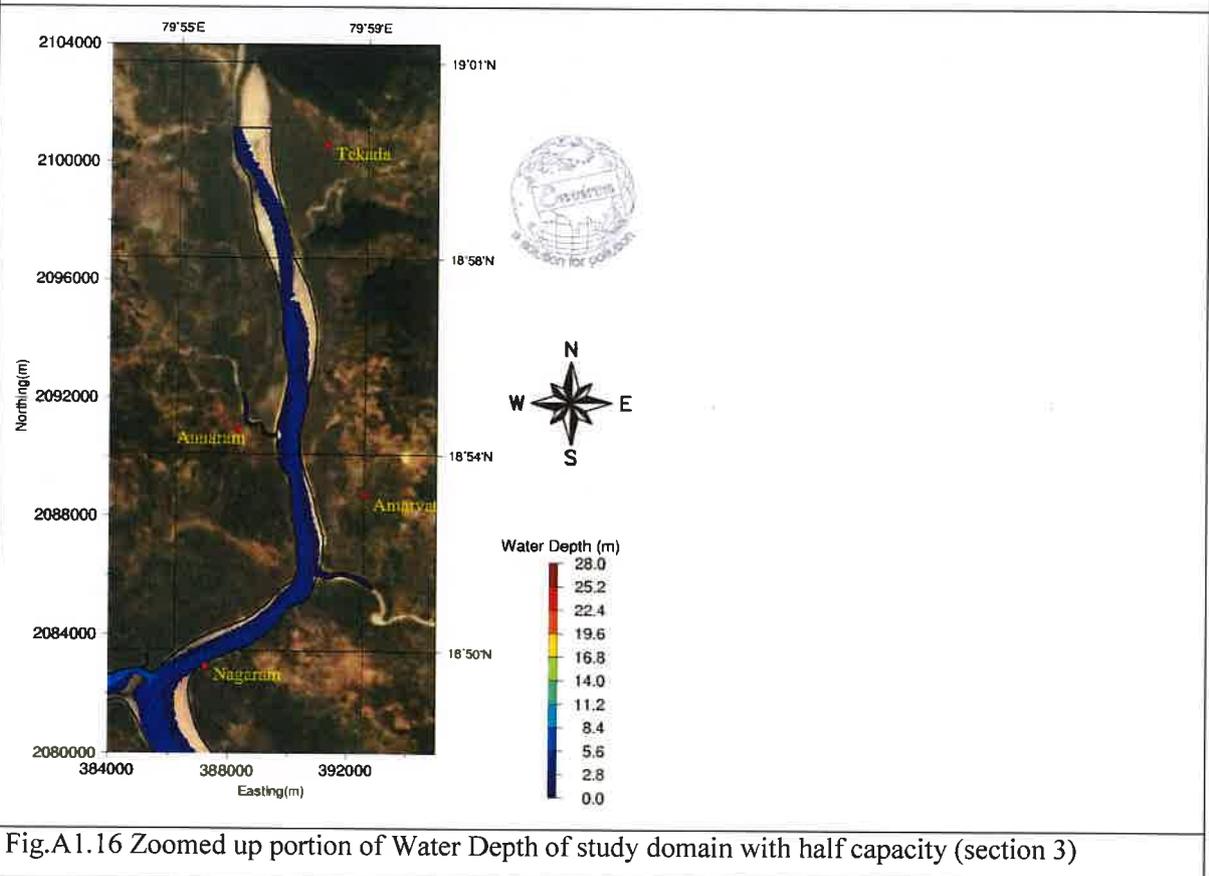


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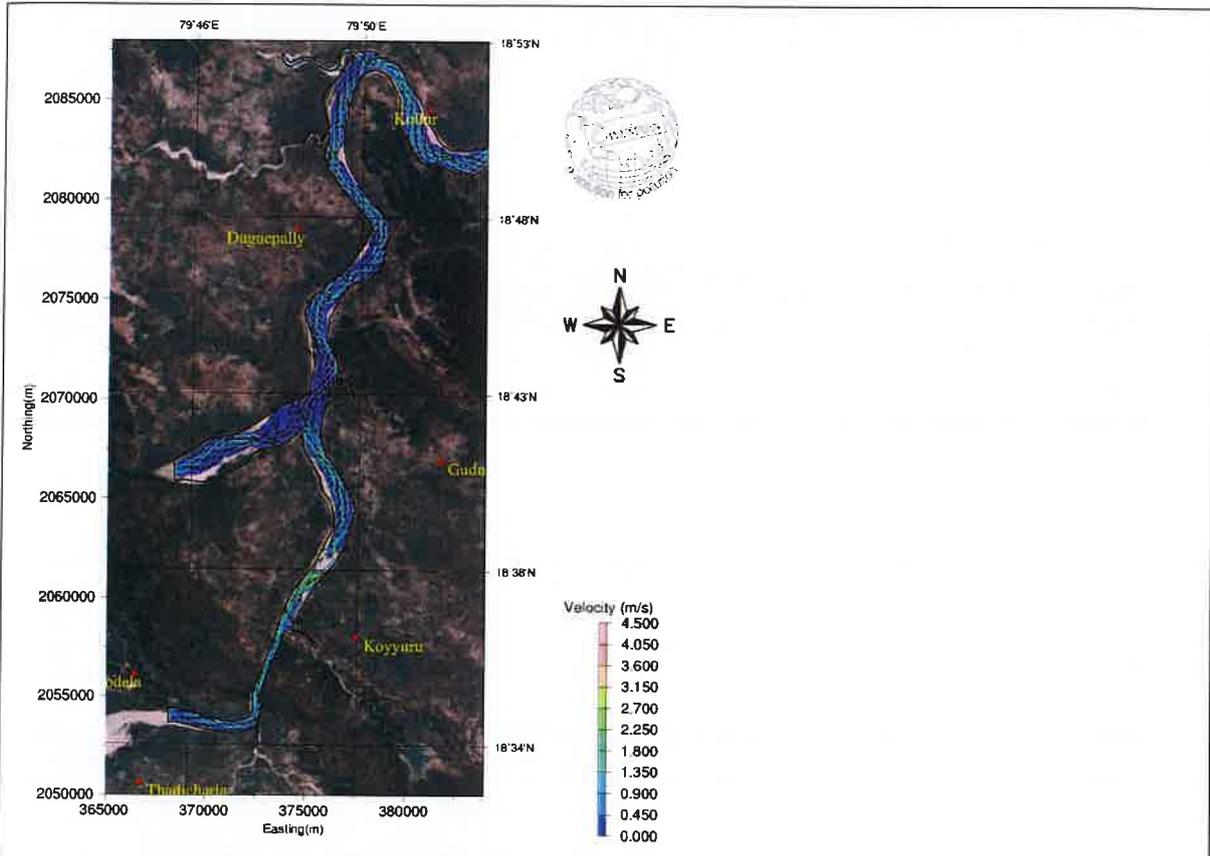


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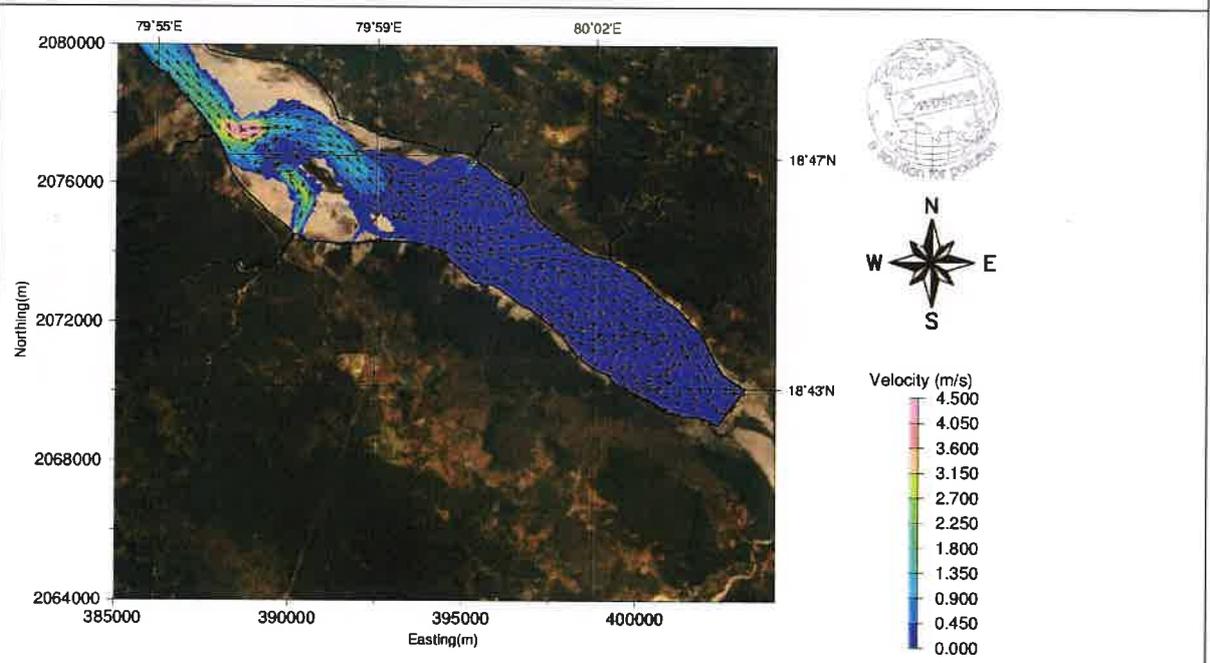


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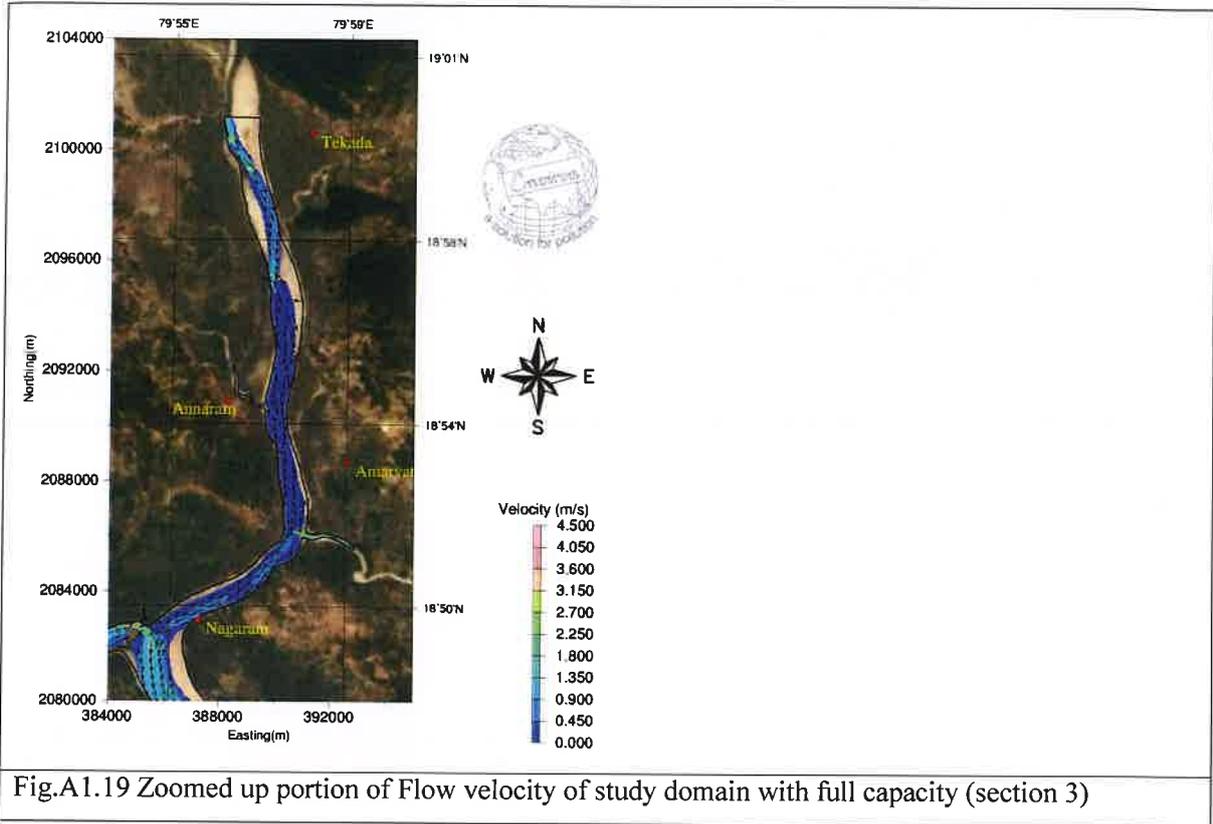


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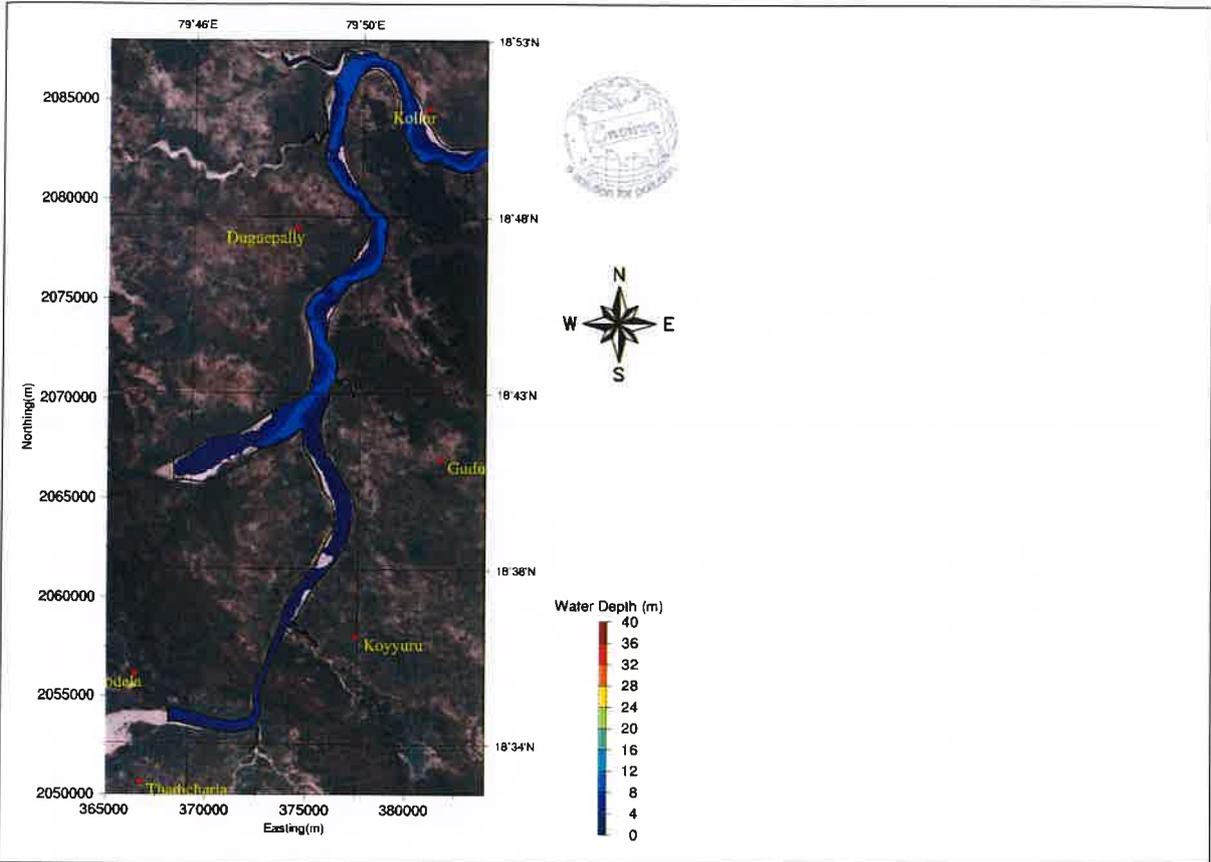


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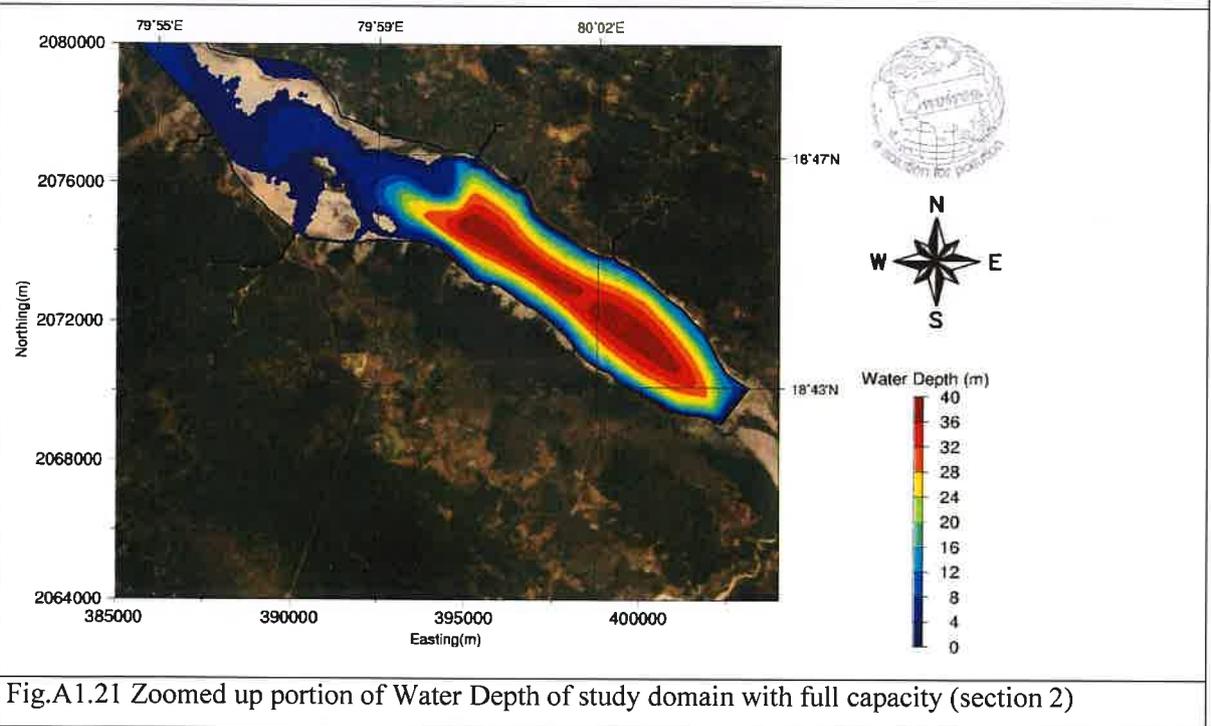


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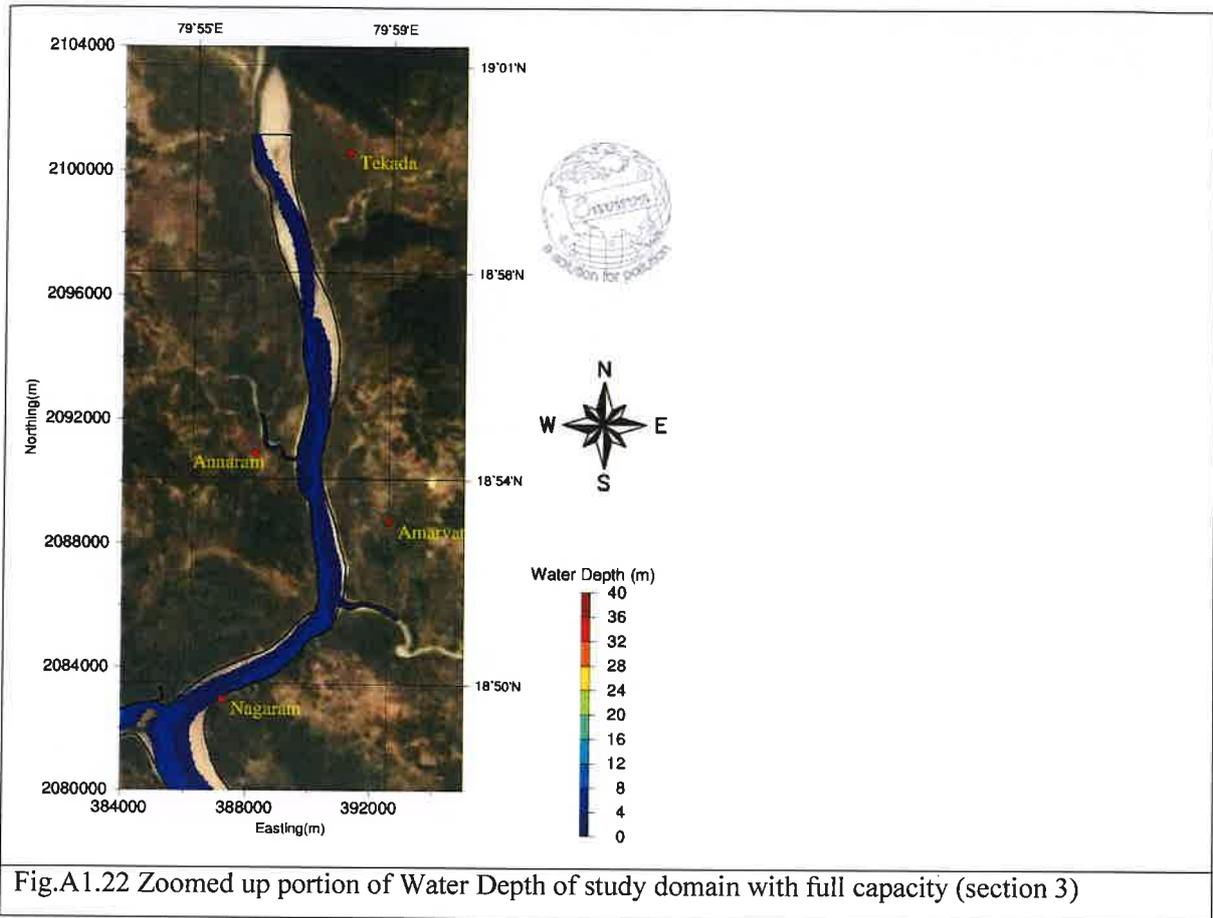


Fig.A1.22 Zoomed up portion of Water Depth of study domain with full capacity (section 3)

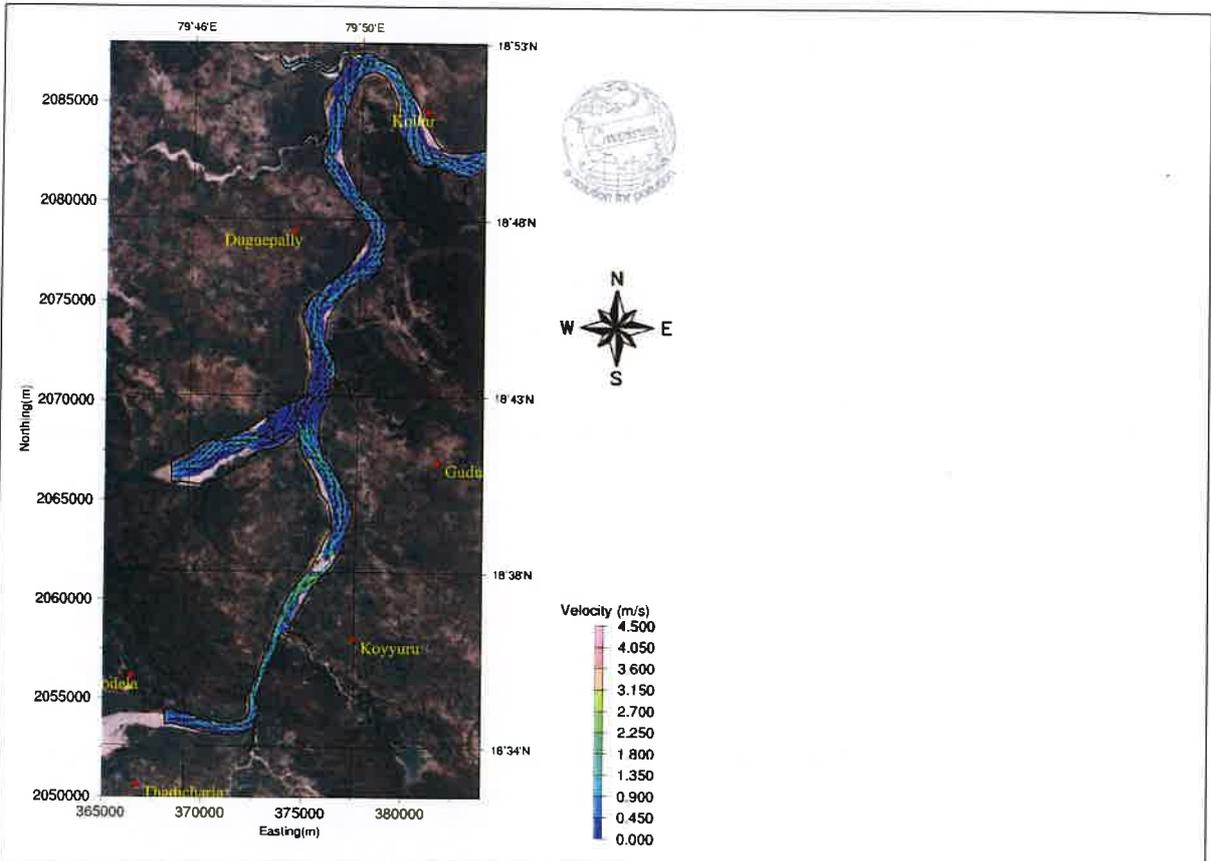


Fig.A1.23 Change in flow velocity of due to dredging with half capacity (section 1)

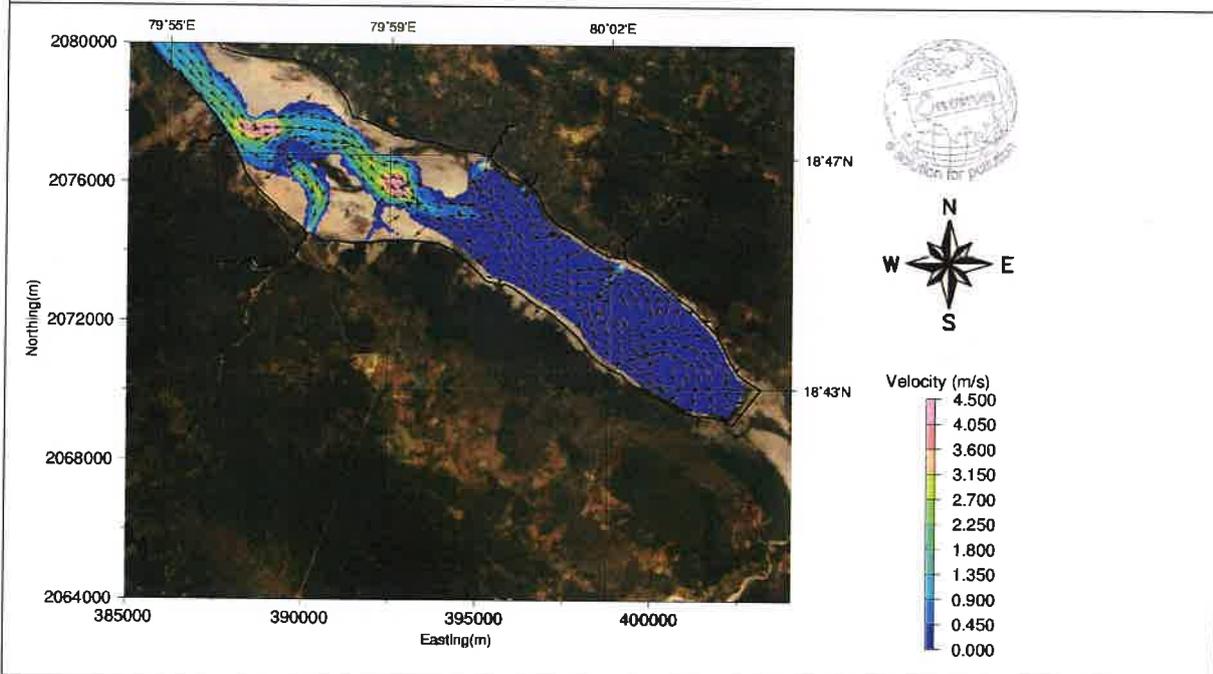


Fig.A1.24 Change in flow velocity due to dredging with half capacity (section 2)

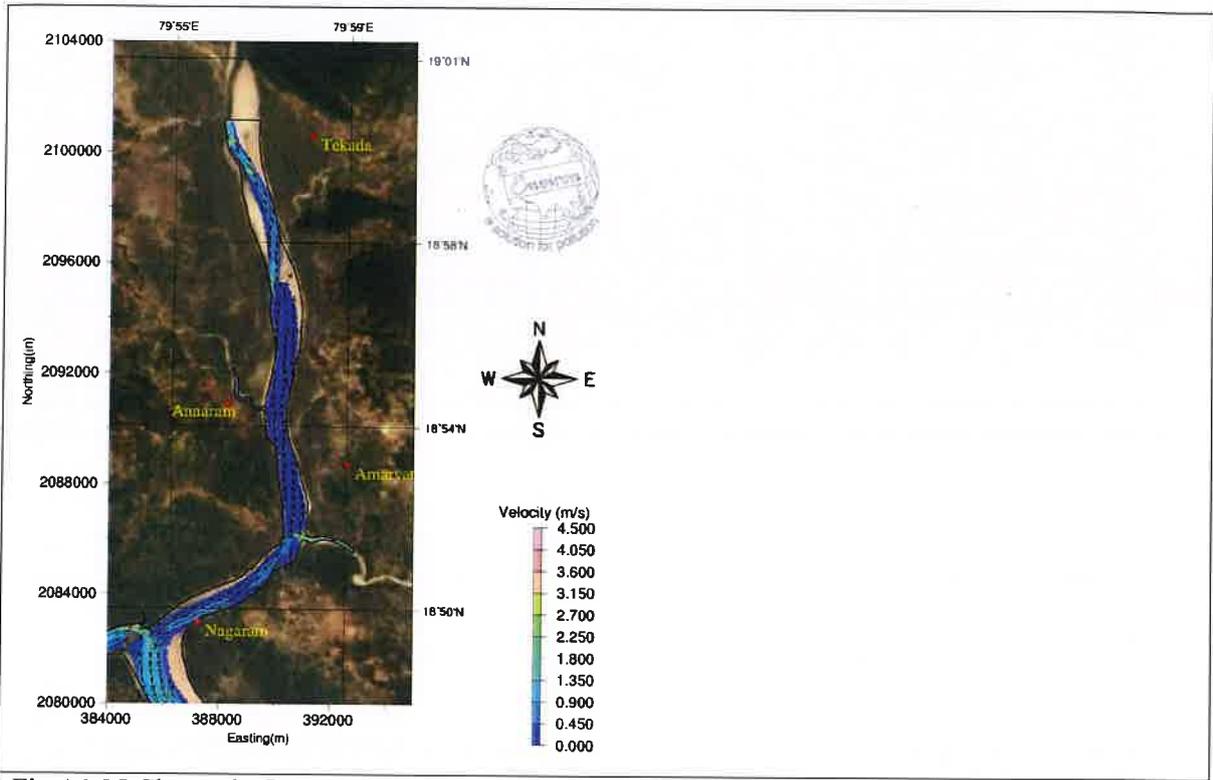


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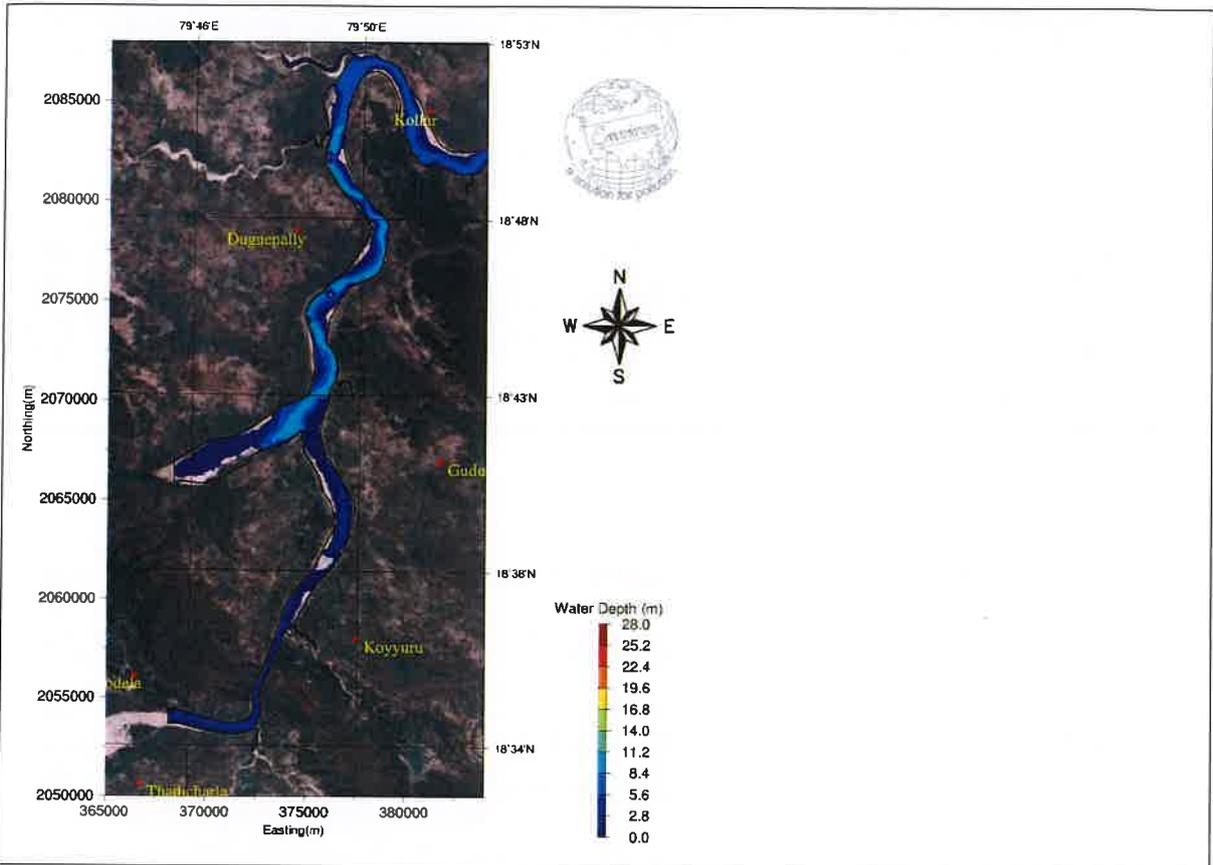


Fig.A1.26 Change in water depth due to dredging with half capacity (section 1)

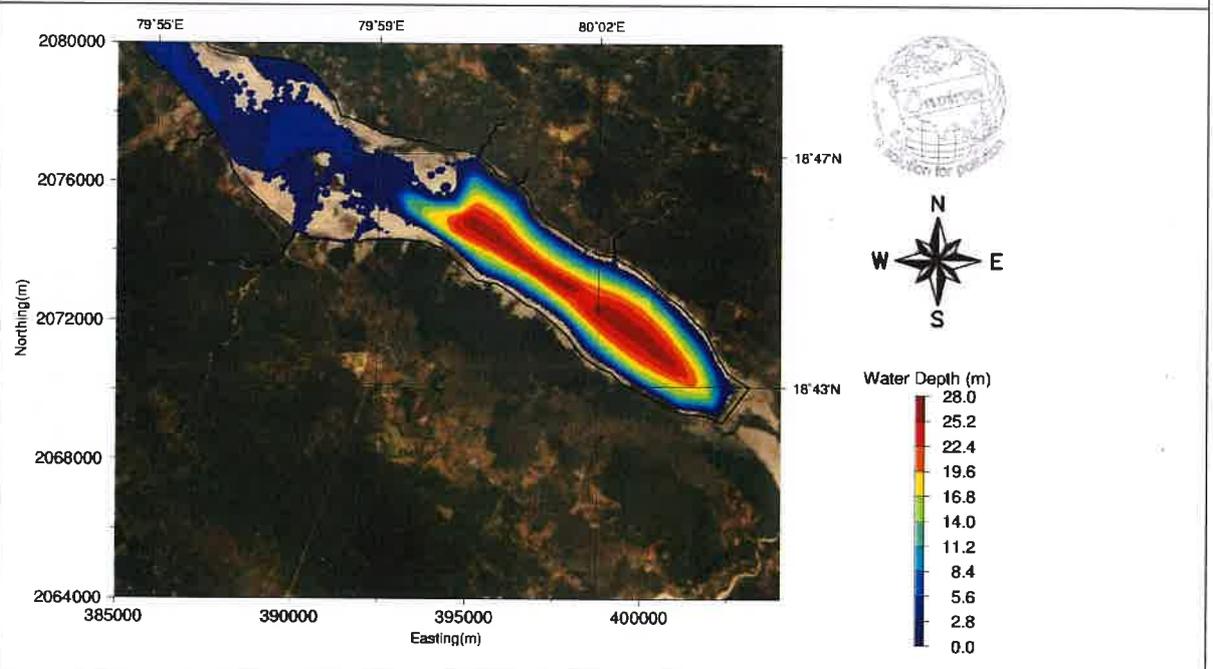


Fig.A1.27 Change in water depth due to dredging with half capacity (section 2)

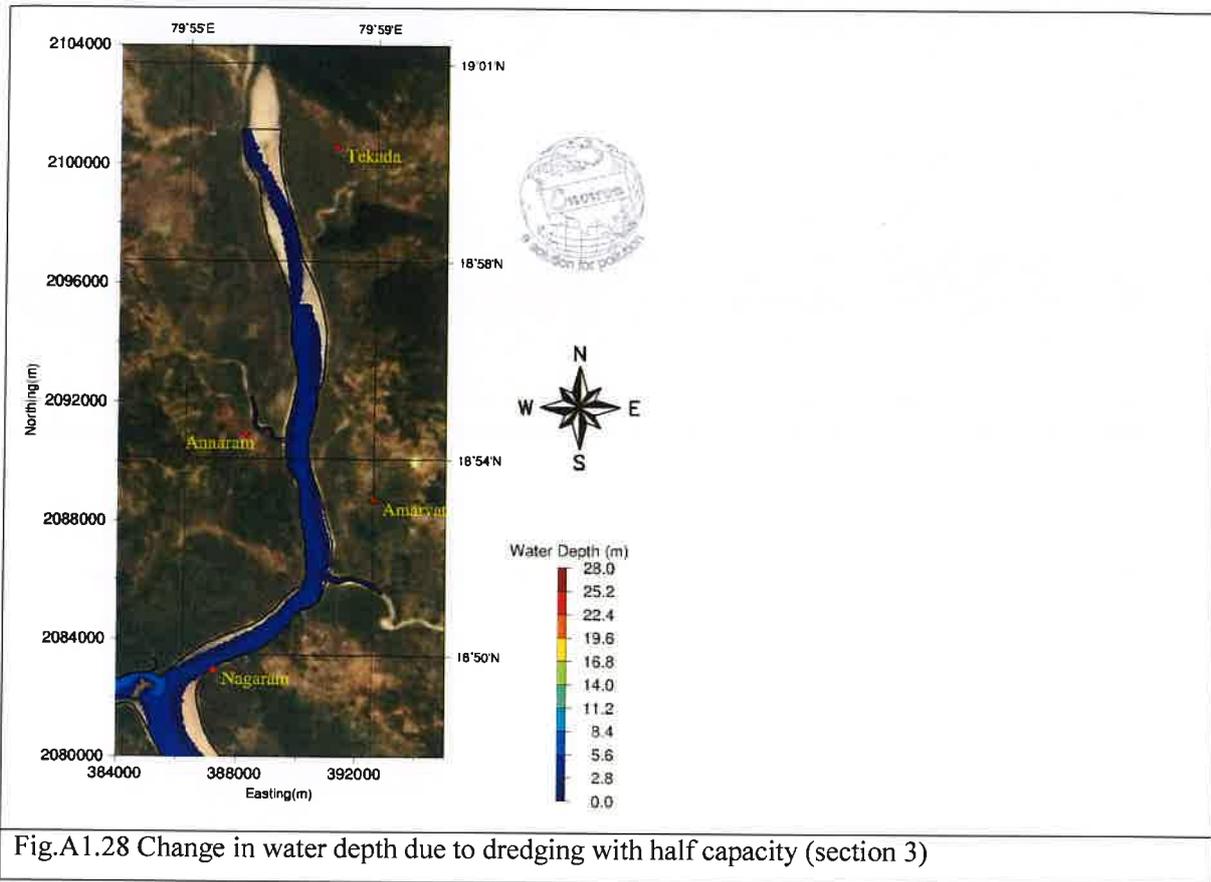


Fig.A1.28 Change in water depth due to dredging with half capacity (section 3)

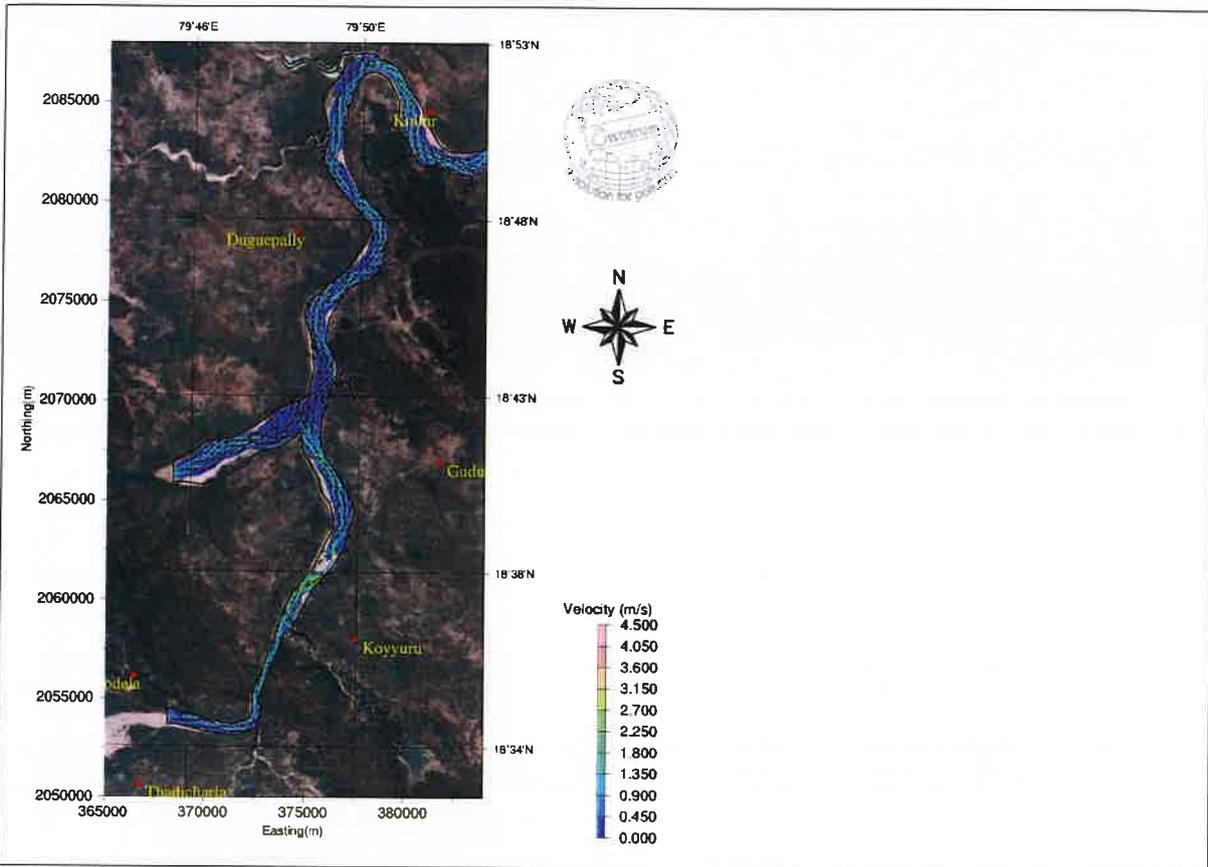


Fig.A1.29 Change in flow velocity due to dredging with full capacity (section 1)

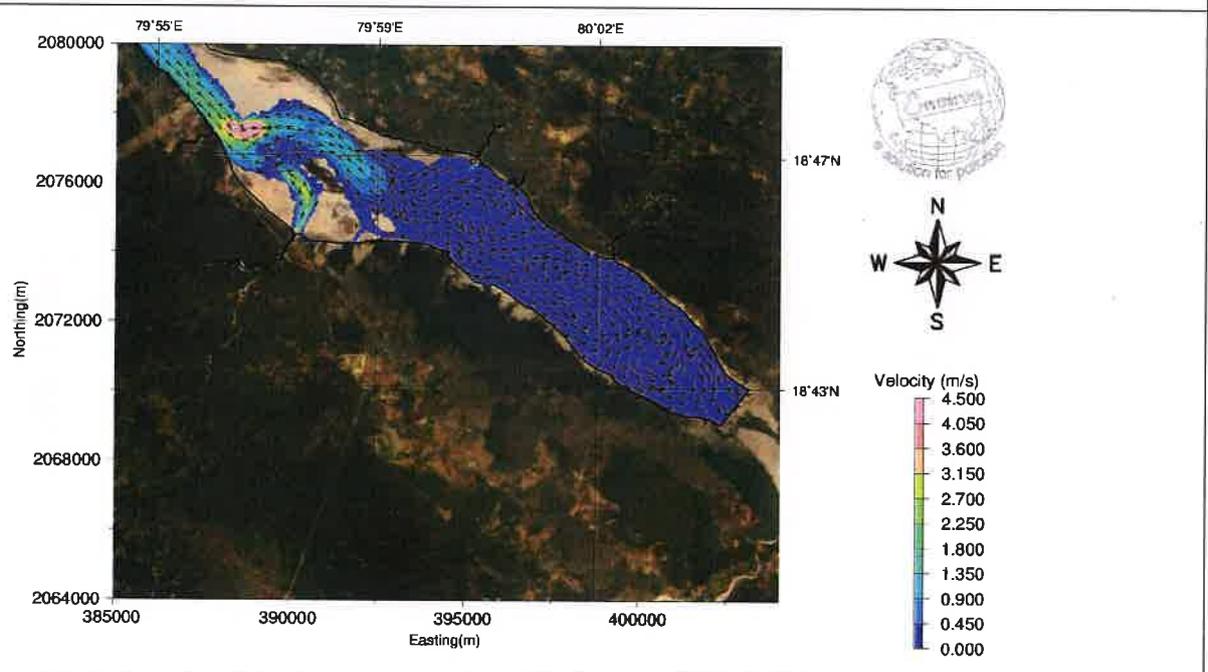


Fig.A1.30 Change in flow velocity due to dredging with full capacity (section 2)

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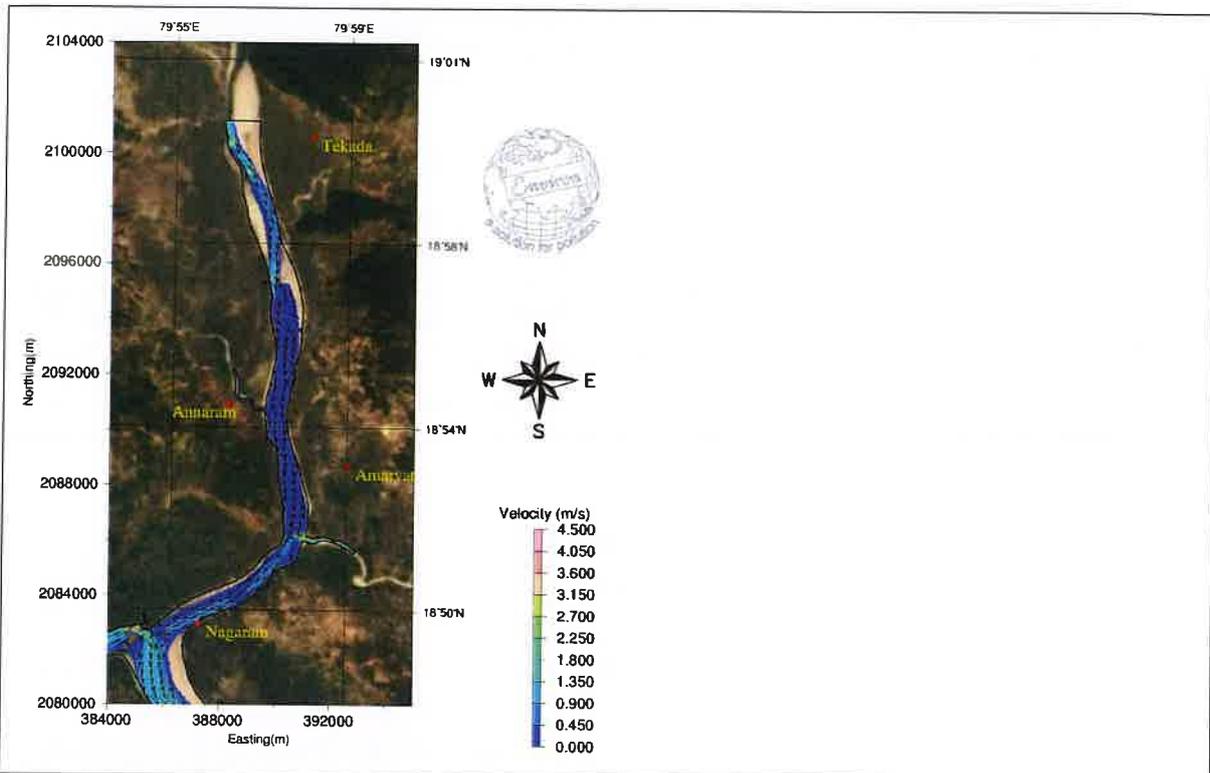


Fig.A1.31 Change in flow velocity due to dredging with full capacity (section 3)

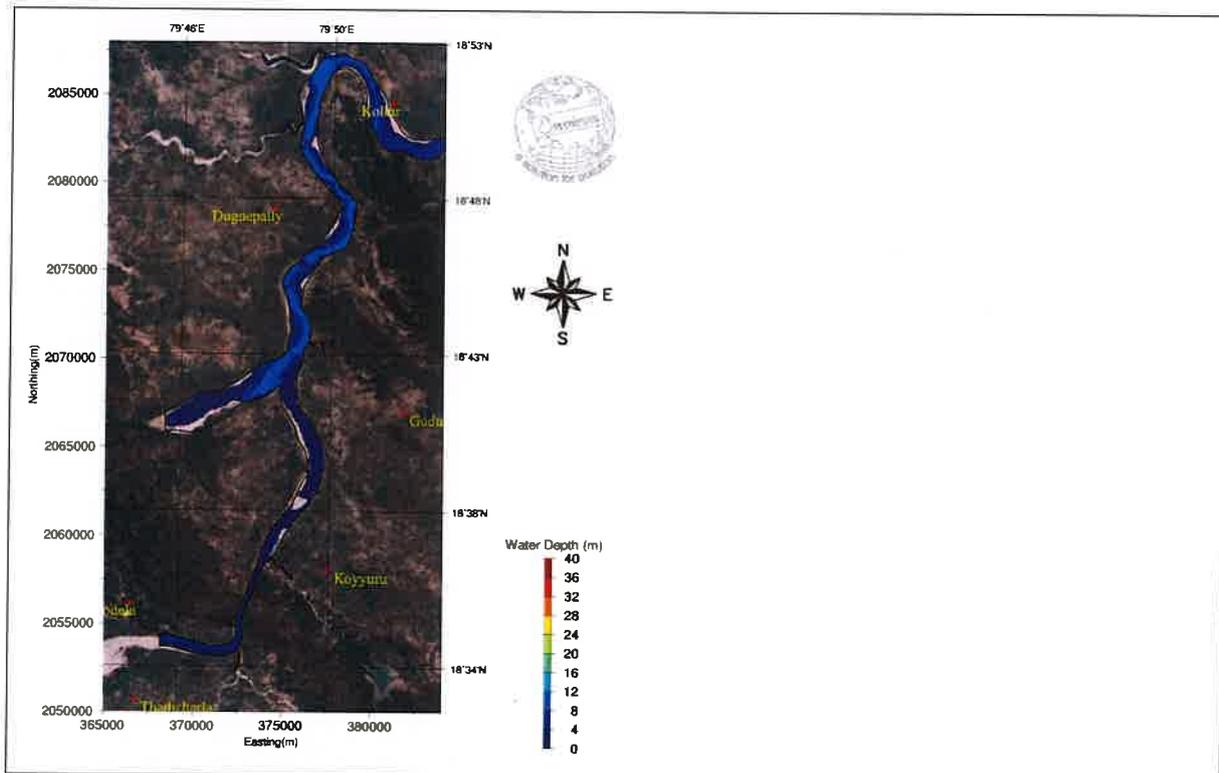


Fig.A1.32 Change in water depth due to dredging with full capacity (section 1)

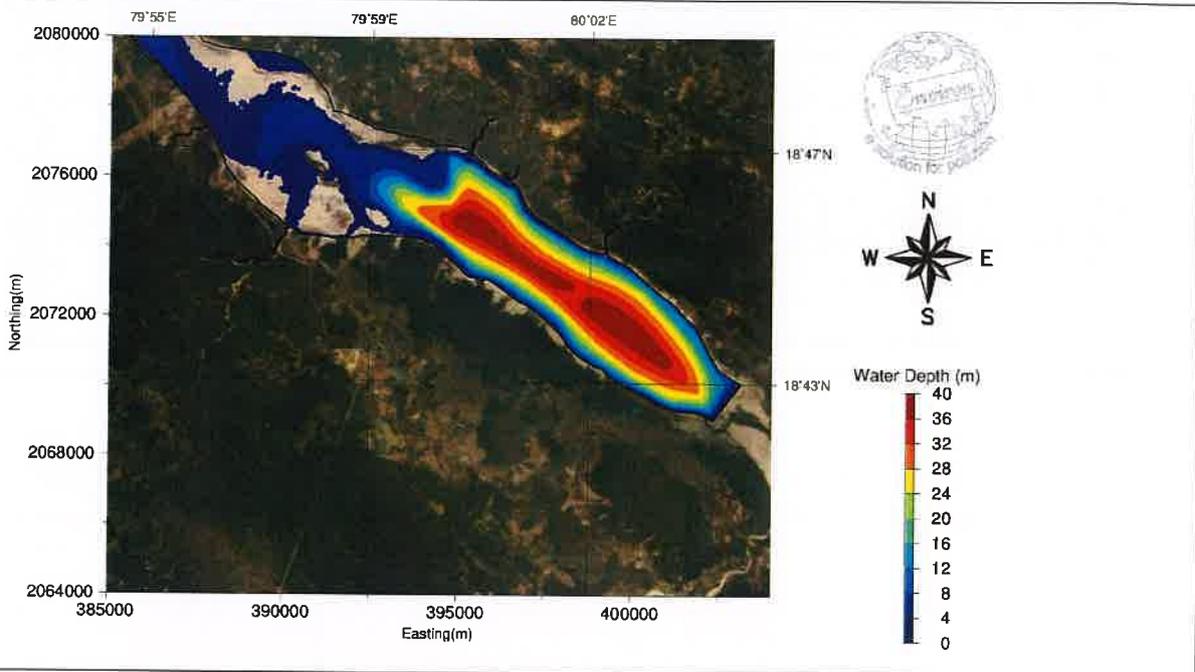


Fig.A1.33 Change in water depth due to dredging with full capacity (section 2)

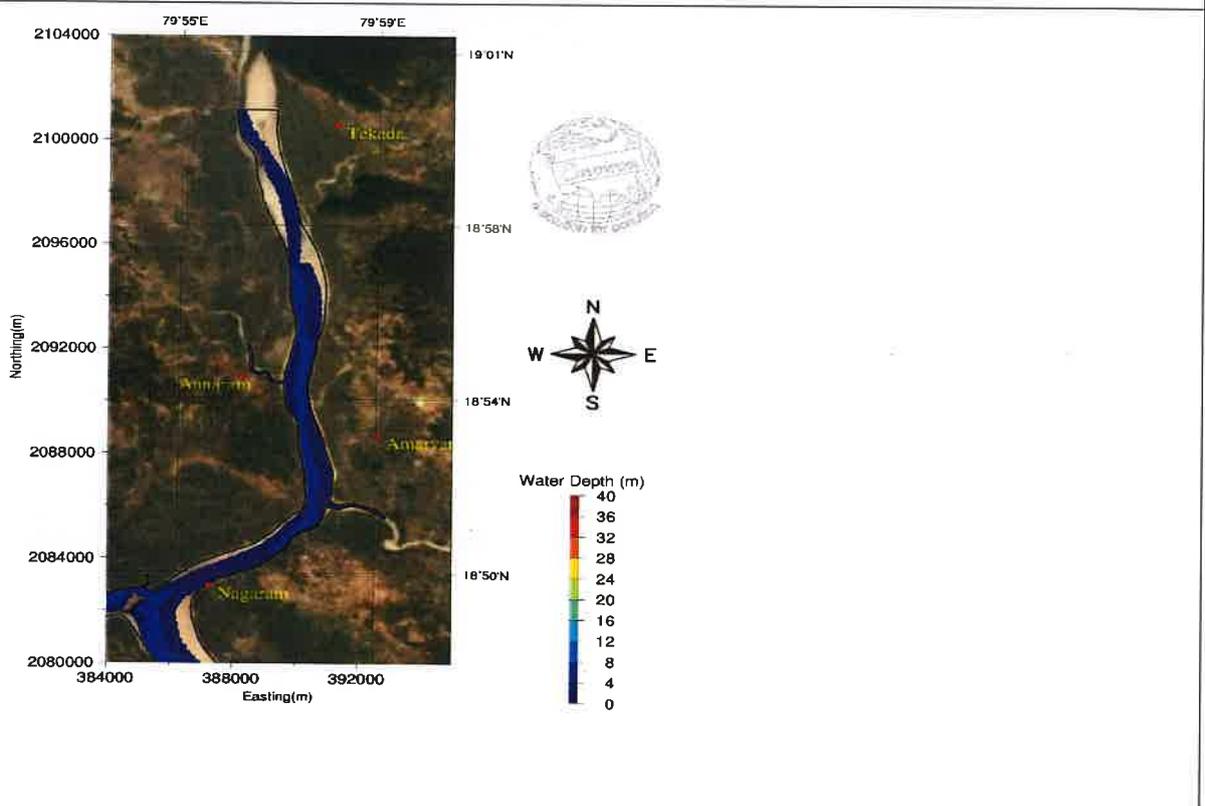


Fig.A1.34 Change in water depth due to dredging with full capacity (section 3)

Annexure-2

ANNEXURE 2

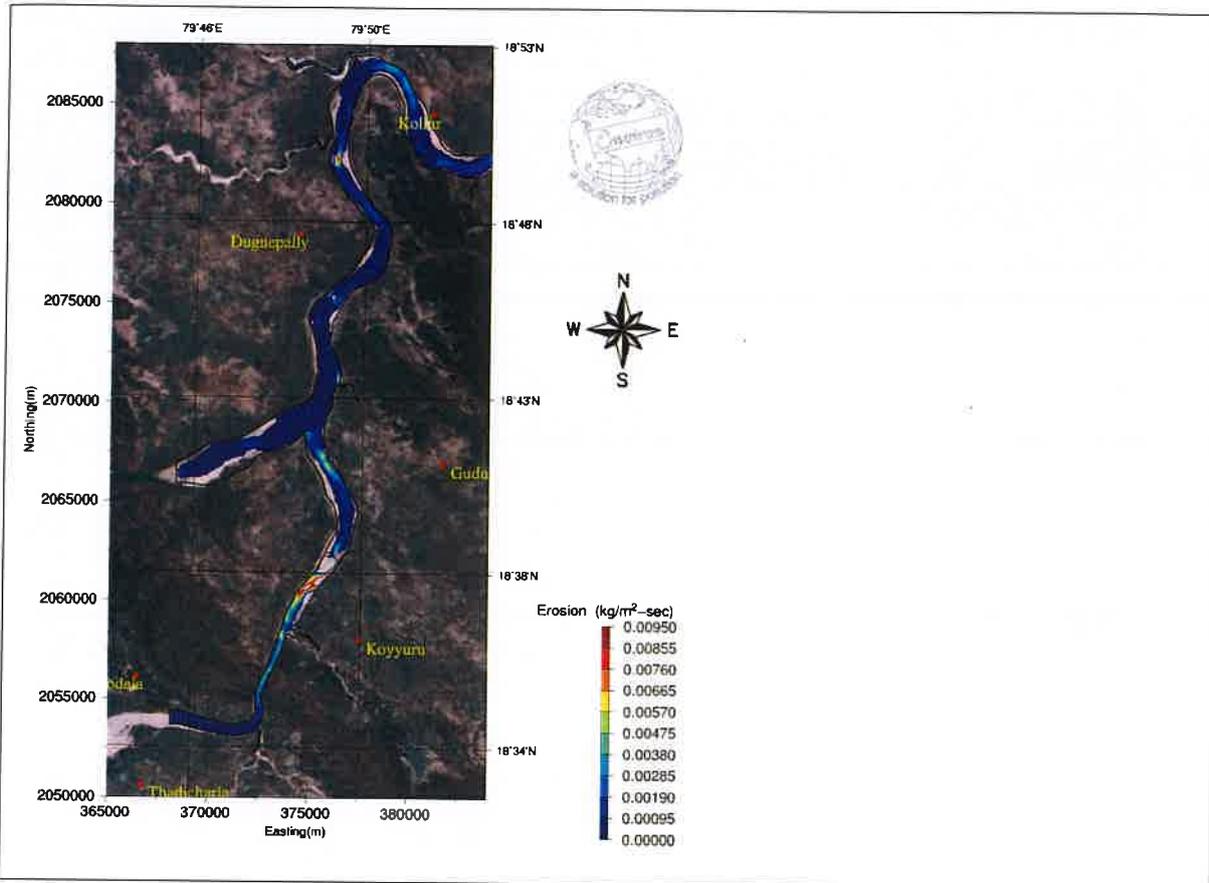


Fig.A2.1 Erosion in zoomed up portion of study Domain (section 1)

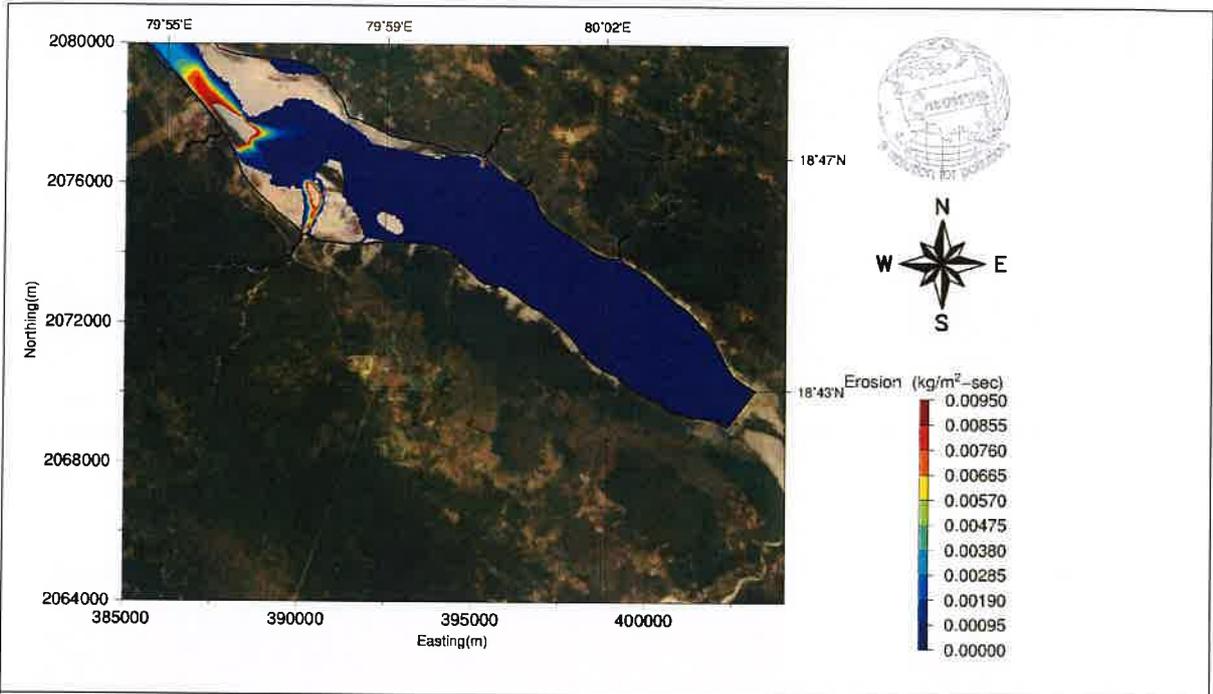


Fig.A2.2 Erosion in zoomed up portion of study Domain (section 2)

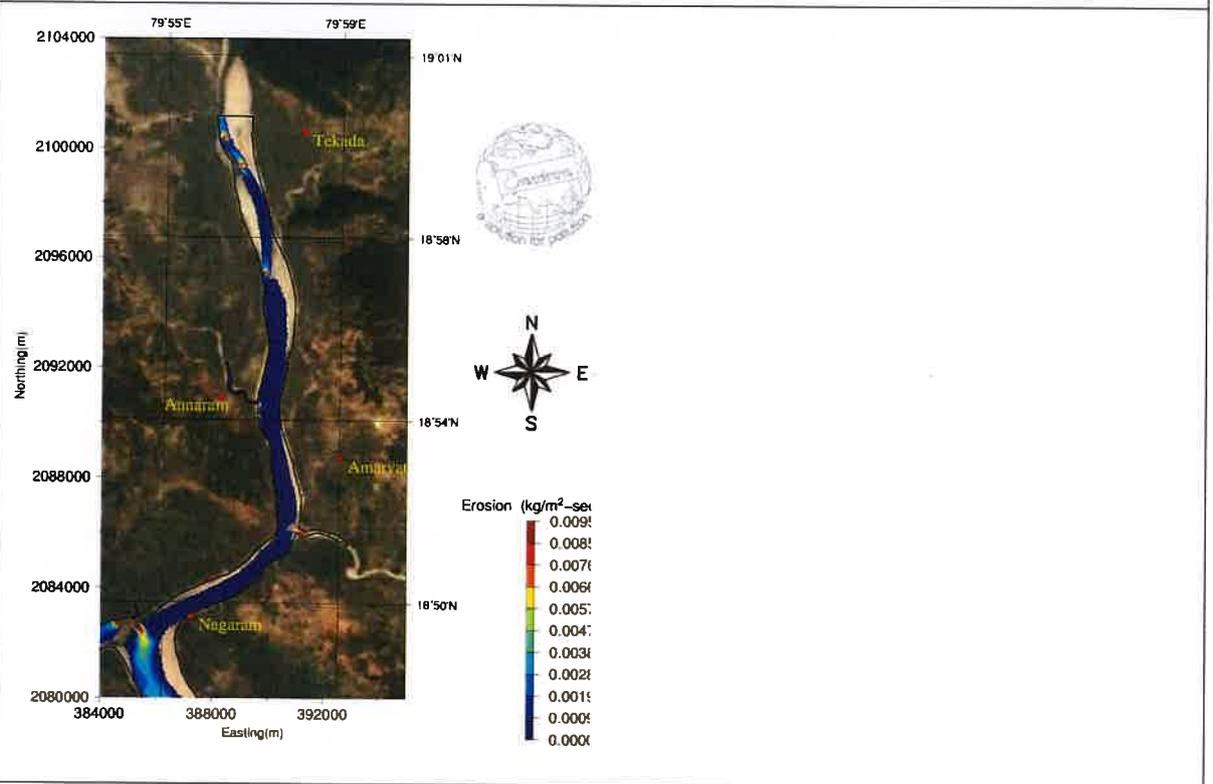


Fig.A2.3 Erosion in zoomed up portion of study Domain (section 3)

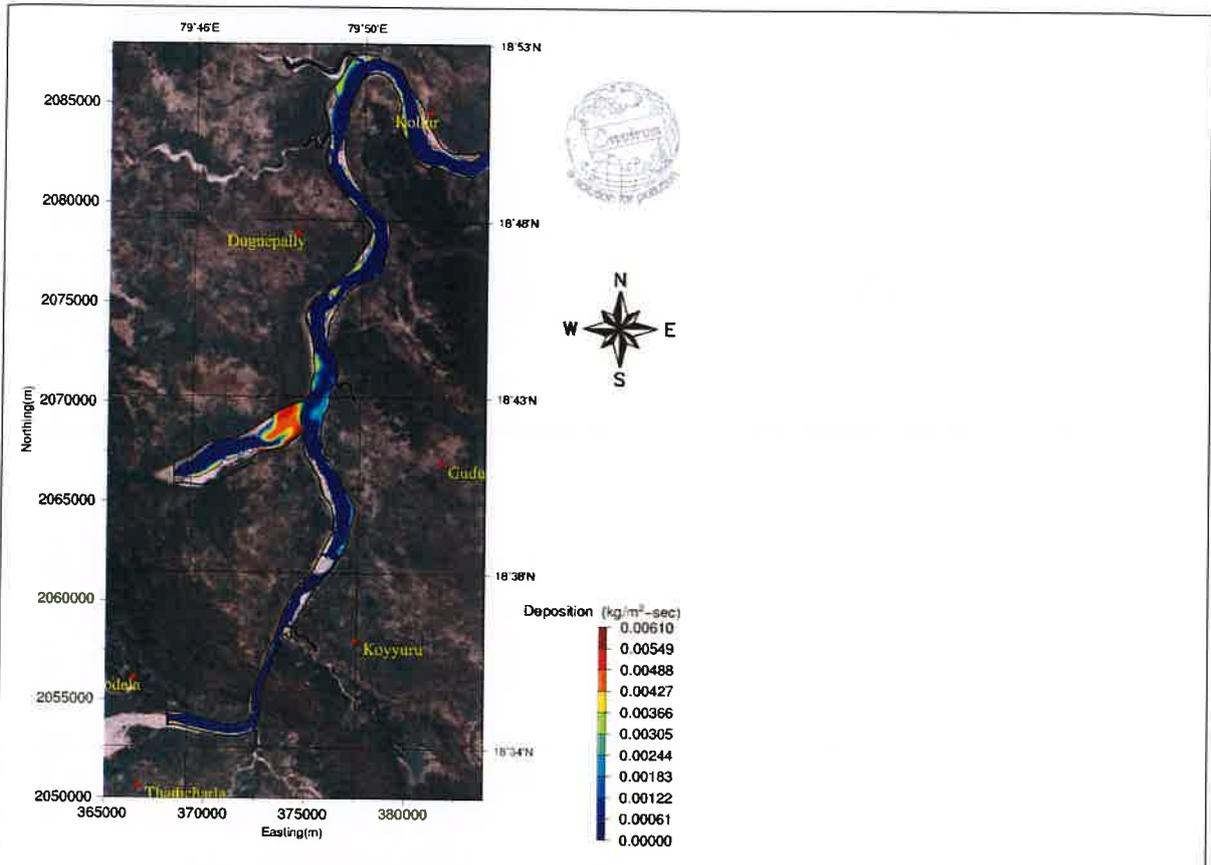


Fig.A2.4 Deposition in zoomed up portion of study Domain (section 1)

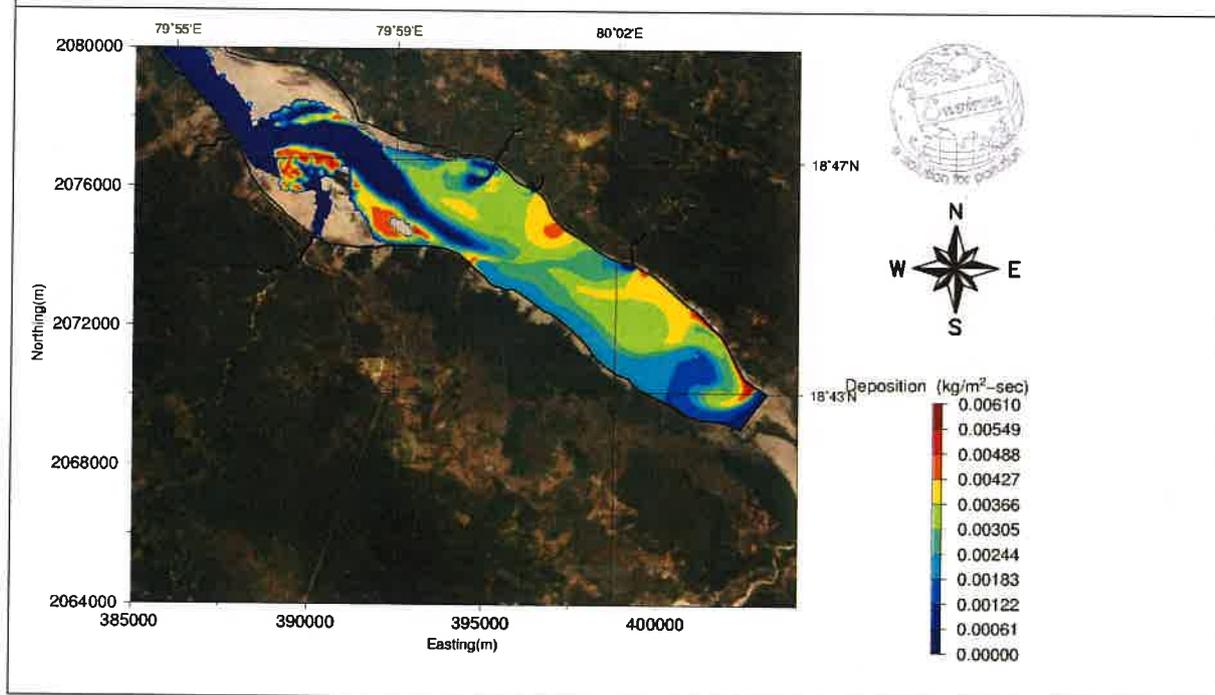


Fig.A2.5 Deposition in zoomed up portion of study Domain (section 2)

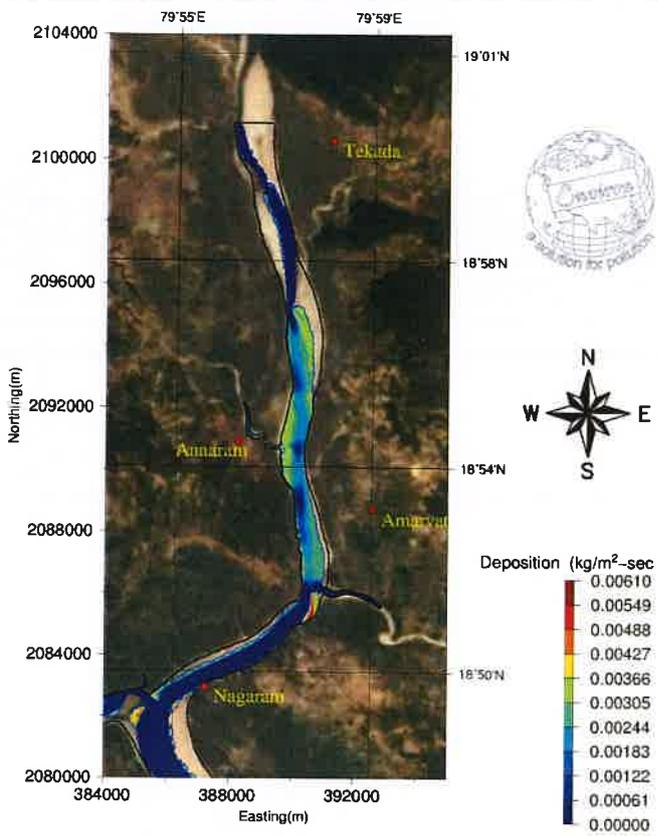


Fig.A2.6 Deposition in zoomed up portion of study Domain (section 3)

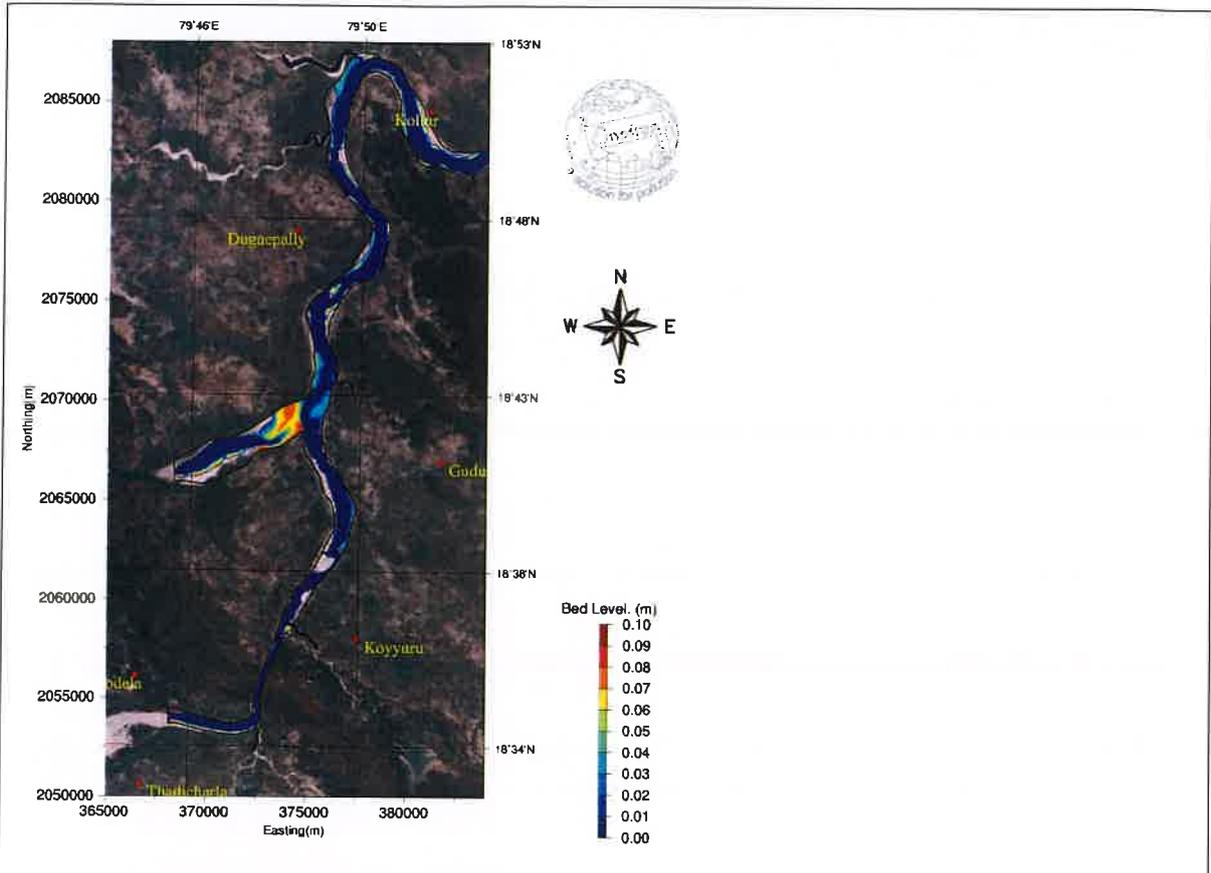


Fig.A2.7 Bed level in zoomed up portion of study Domain (section 1)

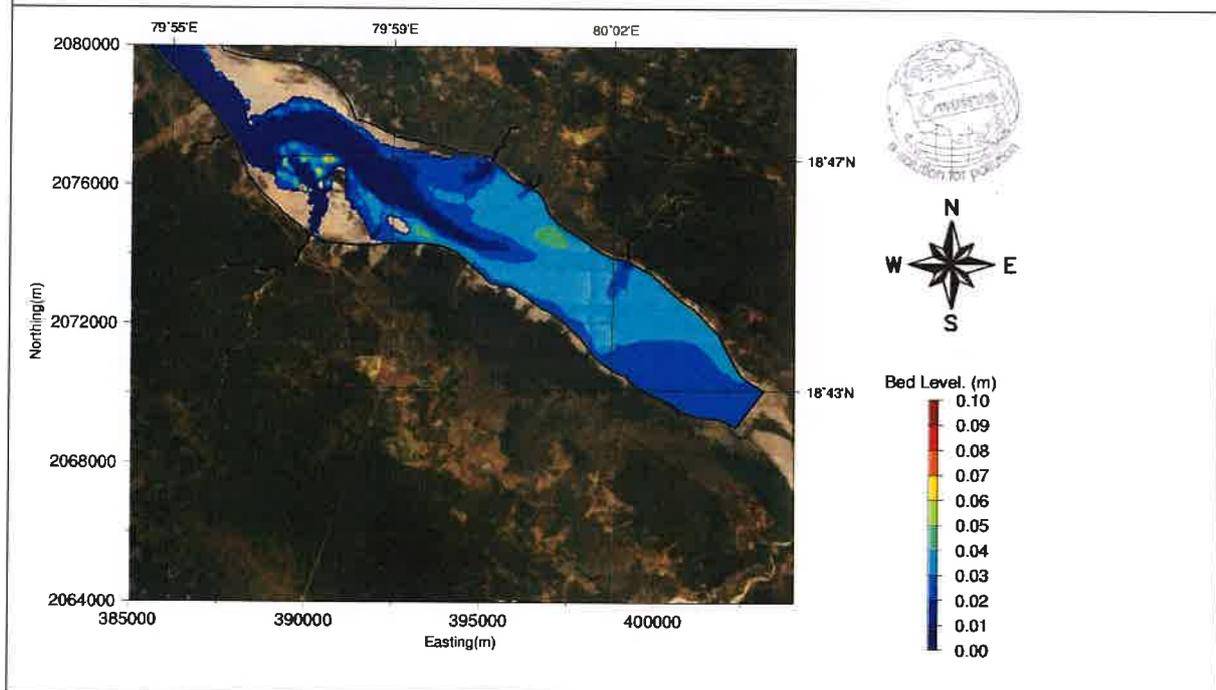


Fig.A2.8 Bed level in zoomed up portion of study Domain (section 2)

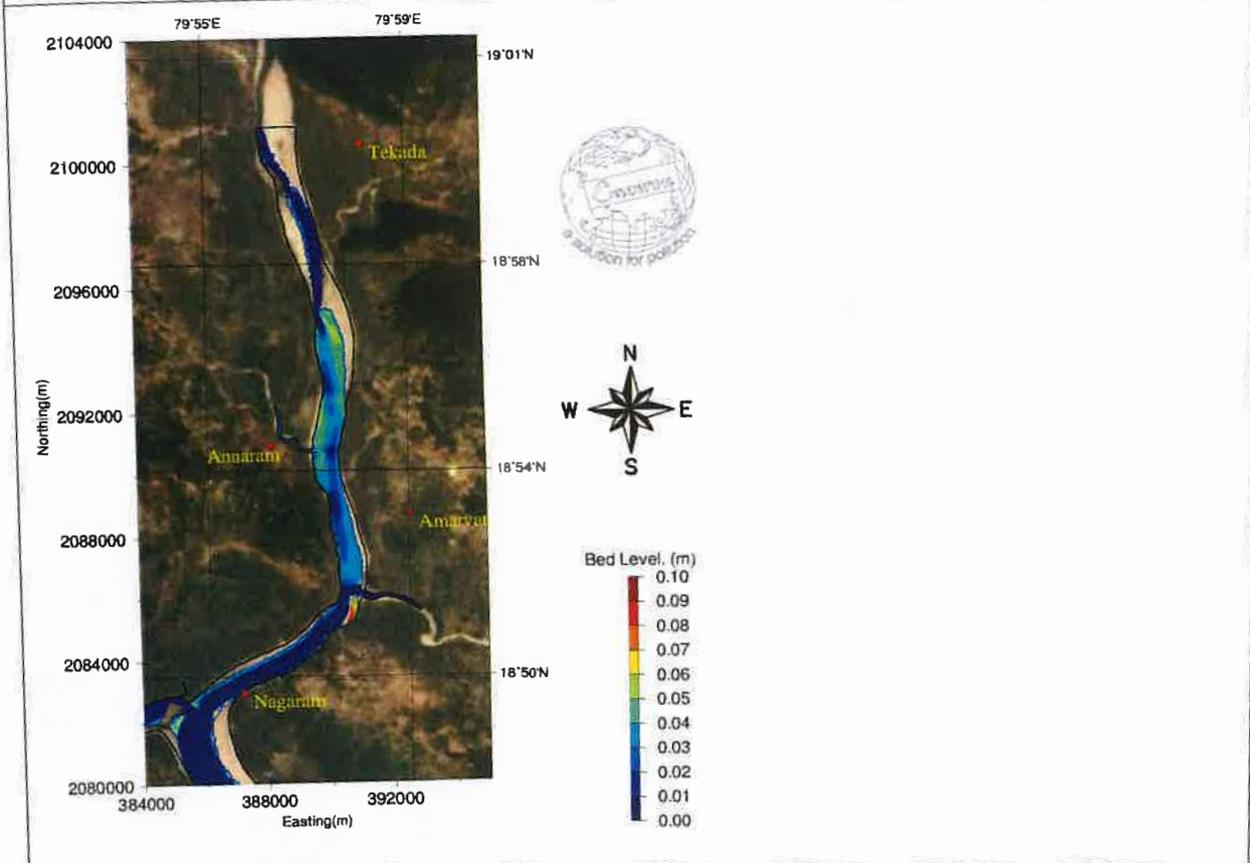


Fig.A2.9 Bed level in zoomed up portion of study Domain (section 3)

DECLARATION BY THE HEAD OF THE TECHNICAL CONSULTANT ORGANIZATION / AUTHORIZED PERSON

I, **E Shyam Sundar**, hereby, confirm that the **DISTRICT SURVEY REPORT FOR JAYASHANKAR BHUPALAPALLY** has been prepared by **M/s Sri Sai Manasa Nature Tech Pvt. Limited (SSMNTPL)** on behalf of and for the use of **Mines & Geology, Govt. of Telangana state** with due consideration and skills as per our general terms and conditions of business and the terms of agreement with TSMDC.

SSMNTPL is having accreditations to National Accreditation Board for Education & Training (NABET) and Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt of India.

SSMNTPL has prepared this report by incorporating various published information, information collected from relevant TS Govt. Departments and details collected from the interactions from Mines & Geology Department, Govt. of Telangana & TSMDC. The technical information or conclusion / recommendations herein enclosed have been derived based on the data collected and data provided w.r.t. the project and shall be considered as a Technical Professional Opinion. It shall not be construed as a formal opinion and it does not waive any involved Party's rights & responsibilities or obligations with respect to the study requirements at any phase of the project.

These conclusions will become null and void should SSMNTPL not be kept informed of such modifications or alterations with specific reference to the present document/ report. This document is valid only when presented in full.

Signature :

Name : **E Shyam Sundar**

Designation : **Head Of Organisation**

Name of the Consultant Organization : **Sri Sai Manasa Nature Tech Pvt. Limited.**

PREFACE

The Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, made Environmental Clearance (EC) for mining of minerals mandatory through its Notification of 27th January, 1994 under the provisions of Environment Protection Act, 1986. Keeping in view the experience gained in environmental clearance process over a period of one decade, the MoEF&CC came out with Environmental Impact Notification, SO 1533 (E), dated 14th September 2006. Now again Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India amended the notification S.O. 141(E) Dated 15th January, 2016 vide S.O. 3611(E) Dated 25th July, 2018. It has been made mandatory to obtain environmental clearance for different kinds of development projects as listed in Appendix-X of the Notification.

Further, in pursuance to the order of Hon'ble Supreme Court dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. States etc., prior environmental clearance has now become mandatory for mining of minor minerals irrespective of the area of mining lease; And also in view of the Hon'ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals, The Ministry of Environment, Forest and Climate Change in consultation with State governments has prepared Guidelines on Sustainable Sand Mining detailing the provisions on environmental clearance for cluster, creation of State Environment Impact Assessment Authority and proper monitoring of minor mineral mining using information technology and information technology enabled services to track the mined out material from source to destination.

The SEIAA and SEAC will scrutinize and recommend the prior environmental clearance of mining of minor minerals on the basis of District Survey Report. This will be a model and guiding document which is a compendium of available mineral resources, geographical set up, environmental and ecological set up of the district and replenishment of minerals and is based on data of various departments, published reports, journals and websites

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ABBREVIATIONS

MoEF&CC:	Ministry of Environment, Forests & Climate Change
EC:	Environmental Clearance
TSMDC:	Telangana State Mineral Development Corporation Limited
CFE:	Consent for Establishment
CFO:	Consent for Operation
WALTA:	Water, Land and Trees Act
MMT:	Million Metric Tonnes
CBM:	Cubic Meter
DEAC:	District Environment Appraisal Committee
DEIAA:	District Environment Impact Assessment Authority
Ha:	Hectare
HC:	High Court
IBM:	Indian Bureau of Mines
SEIAA	State Environment Impact Assessment Authority
DEIAA:	District Environment Impact Assessment Authority
SCCL:	Singareni Collieries Company Limited
DLSC:	District Level Sand Committee
TSPDCL:	Telangana State Power Generation Corporation Ltd .
TMC:	Thousand million cubic feet
NAAQS:	National Ambient Air Quality Standards
CPCB:	Central Pollution Control Board
RSPM:	Respirable Suspended Particulate Matter
mbgl:	Meters Below Ground Level
JB:	Jayashankar Bhupalapally

DISTRICT SURVEY REPORT OF JAYASHANKAR BHUPALAPALLY

As per Gazette Notification No. S.O. 3611 (E) New Delhi dated 25-07-2018 of Ministry of Environment, Forest and Climate Change, a survey shall be carried out with assistance of Water Resources Department, Forest Department, Geology and Mining Department and Revenue Department in the District for preparation of District Survey Report as per Sustainable Sand Mining Guidelines vide S.O. 3611(E) Dated 25th July, 2018.

OBJECTIVES:

The main objective of the preparation of District Survey Report (as per the Sustainable Sand Mining Guideline, 2016) is to ensure the following –

- Identification of areas of aggradations or deposition where mining can be allowed; and
- Identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited; and
- Calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.
- Identification of mineral wealth in the district

The detailed study has been made to cover sand mining locations, area and overview of mining activity in the district with all its relevant features pertaining to geology and mineral wealth in replenishable and non-replenishable areas of rivers, stream and other sand sources. The mineral potential is calculated based on Joint Inspection by District Level Sand Committee (DLSC). The area for removal of the mineral in a river or stream is decided depending on geomorphology and other factors. The District Survey Report shall form the basis for application for Environmental Clearance, preparation of reports and appraisal of projects. The report shall be updated once every in five years.

CHAPTER-1

1. INTRODUCTION

Jayashankar Bhupalapally (JB) is formulated after the annexation of some parts of erstwhile Karimnagar, Warangal and Khammam districts. The district is named after Telangana ideologue, Prof. K. Jayashankar. JB district is bounded on the north by Maharashtra, on the east by Chattisgarh, on the south by Mulugu district, on the west by Warangal Rural & Urban, Peddapalli and Karimnagar districts and Mancheryal district on its northwest. The total geographical area of the district is 5524 sq.km. The JB district administrative boundaries at a glance is given in Figure-1.1

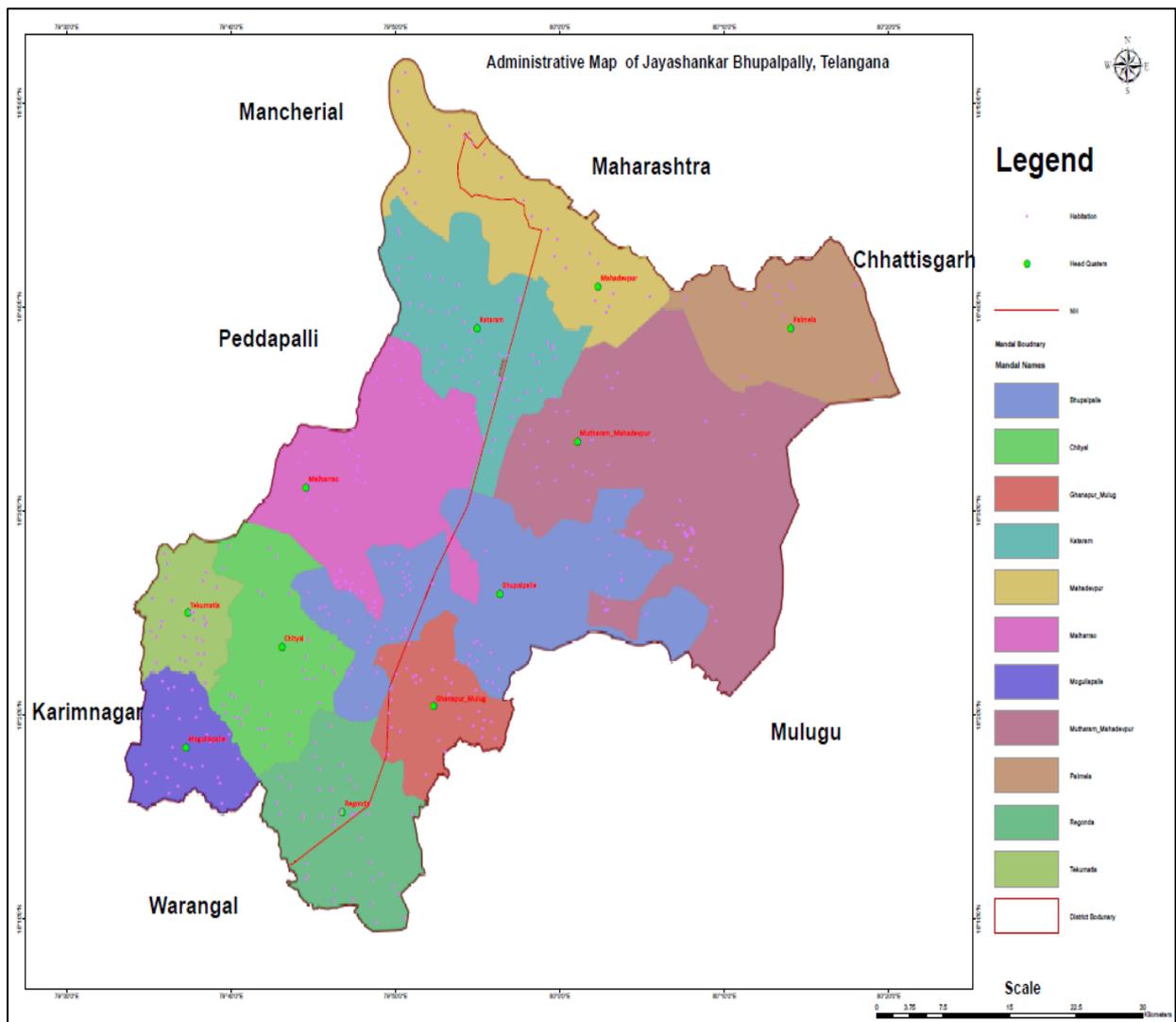


Fig:1.1 Administrative Boundaries of Jayashankar Bhupalapally District

1.1 Acts Governing Sand Extraction

1.1.1 The operative portion of WALTA Rules, 2004 with regards “Sand Mining” as per Rule 23 is extracted below;

“In areas where sand mining is affecting groundwater regime, such areas shall be notified by the Panchayat Raj and Rural Development Department. Mining and transportation of sand shall be prohibited in notified overexploited ground water micro basins. For other areas, the following conditions shall apply for mining sand.

- (a) (i) Sand extraction upto III order Streams will be permitted in notified areas. However, sand extraction by mechanical means is banned. Also, transportation of sand from these notified areas out of the local jurisdiction i.e. Mandal is banned.
- (ii) In IV order streams, sand extraction shall be restricted to specified areas.
- (iii) In V order and above streams like Godavari, Krishna, Penna etc., sand mining will be permitted without affecting the existing sources for Irrigation, drinking water or industrial purpose.
- (b) The allottees shall not carryout quarrying within 500m of any existing structure such as bridges, dams, weirs or any other cross drainage structure.
- (c) Vehicles carrying sand shall not ply over the flood banks except at crossing points or bridges or on a metal road.
- (d) Permission to sand quarrying shall not be granted within 500 m of any ground water extraction structure(s) either for irrigation or drinking water purposes.
- (e) The streams / rivers where the thickness of sand is quite good (more than 8.00 m) the depth of removal may be extended to 2.00 m but in no case beyond two meters.
- (f) Sand quarrying shall not be permitted in streams within 15 m or 1/5 of the width of the stream bed from the bank whichever is more.
- (g) Sand mining shall not be permitted in streams where the thickness of sand deposition is less than 2.00 m.

- (h) The depth of sand extraction shall be restricted to one meter particularly in minor streams where the thickness is more than 3.00 m and less than 8.00 m.
- (i) Sand quarrying shall be restricted to depths above the water table recorded during monsoon and in no case be allowed to affect the water table.

The MOEFCC constituted a group under Chairmanship of Secretary (E&F) in march 2009, to study and deliberate the environmental aspects of quarrying minor minerals considering environmental damage and the legal issues related to sustainable minor mineral extraction. The group prepared a report "Environmental Aspects of Quarrying of Minor Minerals" in March-2010. The following recommendations are therefore made by the Group for river bed mining:

- (a) In the case of Mining leases for river bed sand mining, specific river stretches should be identified and mining permits/lease should be granted stretch wise, so that the requisite safeguard measures are duly implemented and are effectively monitored by the respective Regulatory Authorities.
- (b) The depth of mining may be restricted to 3m/water level, whichever is less.

For carrying out mining in proximity to any bridge and/or embankment, appropriate safety zone should be worked out on case to case basis, taking into account the structural parameters, locational aspects, flow rate etc, an no mining should be carried out in the safety zone so worked out.

The honorable supreme court of India vide its order dated 27.2.2012 in I.A. No.12-13 of 2011 in SLP (C) No.19628-19629 of 2009 titled Deepak Kumar etc. v/s State of Haryana &Ors. has inter alia ordered "*We, in the meanwhile, order that leases of minor mineral including their renewal for an area of less than five hectares be granted by the States/Union Territories only after getting environmental clearance from the MoEFCC.*"

The apex court examined the environmental concerns vis a vis mining of minor minerals, and observed that extraction of alluvial material from within or near a streambed has a direct impact on the stream's physical habitat characteristics, which include bed elevation, substrate composition and stability, in-stream roughness elements, depth, velocity, turbidity, sediment transport, stream discharge and temperature and noted that altering these habitat

characteristics can have deleterious impacts on both in-stream biota and the associated riparian habitat. Hon'ble Apex Court observed that "We are of the considered view that when we are faced with a situation where extraction of alluvial material within or near a river bed has an impact on the rivers physical habitat characteristics, like river stability, flood risk, environmental degradation, loss of habitat, decline in biodiversity, it is not an answer to say that the extraction is in blocks of less than 5 hectares, separated by 1 kilo meter, because their collective impact may be significant, hence the necessity of a proper environmental assessment plan".

The MOEFCC, in response to the above said directions of the apex court issued an OM No.L-11011/47/2011-IA.II(M) dated 18.05.2012 stating inter alia that all mining projects of minor minerals including their renewal, irrespective of the size of the lease would henceforth require prior EC and that the projects of minor minerals with lease area less than 5 ha would be treated as Category "B" as defined in EIA Notification, 2006.

Government of Telangana, in response to the directions issued by the honorable supreme court of India in the case of Deepak Kumar Vs State of Haryana, formulated a robust sand mining policy in December 2014. The policy identified three sources of sand i.e., rivers and streams, desilting of reservoirs and de-casting of private pattalands. The sand available in first and second order streams were allocated for usage by local body and villagers for extracting sand to meet domestic/community needs, while sand extraction from 3rd to 5th order streams was to be conducted in accordance with WALTA rules and regulations.

CHAPTER 2

2. OVERVIEW OF MINING ACTIVITY OF THE DISTRICT:

Jayashankar Bhupalapally (JB) district is known for its rich mineral resources. The main mineral resources found in district are Dolomite, Laterite, Color Granite, Coal, Stowing Sand and ordinary sand, building & road construction Stones, etc. Altogether, there are 34 leases both major and minor minerals are found in Jayashankar Bhupalapally district. The mining in all these leases is regulated as per different Minerals Concession Rules of Telangana state. A total 9 Coal Mining leases are granted in the district and operated by “The Singareni Collieries Company Limited” (SCCL)- a Government coal mining company jointly owned by the Government of Telangana and Government of India & “Telangana State Power generation corporation ltd (TSPDCL)”. At present, 2 Dolomite quarry leases, 1 Laterite leases, 2 quarry leases for Color Granite operated by private owners and 19 No’s of Desilting areas operated by Telangana State Mineral Corporation Private Limited (TSMDC) for river sand in the district. A brief account of mineral resources available in the district as follows in Table 2.1 & list of mining Leases with Locations are available at Table 2.2

Table 2.1: Availability of Minerals

S No	District	Major Mineral /Fuel	Minor Mineral
1	Jayashankar Bhupalapally	Coal	Dolomite
		Stowing Sand	Laterite
			Granite
			Red Metal
			Gravel
			Morum
			Ordinary Earth Sand

Table 2.2: The List of Mining Leases in the District with locations, area and Period of Validity

S No	Minor Mineral Name	No of leases	Location	Extant (Ha)	Classification of Land	Lease Period (Years)
1	Dolomite	02	284, Nawabpet (V), Chityal (M)	4.04	Patta Land	20
			284, 284,286 & 287 Nawabpet (V), Chityal (M)	4.04	Patta Land	20
2	Laterite	01	Compt. No 612 of Jakaram-III, Reserve Forest	04.8	Reserve Forest	20
3	Colour Granite	02	180 & 180/1	3.0	Govt Land	20
			210 of Metpally (v), Mogillapally (m)	1	Govt Land	20
Major Mineral Name						
4	Coal	06	Comp No.383, 389, 390 (P),Bhupalapally (V & M)	2405.9	Govt & patta Land	20
			385,387,388 of Bhupalapally	144.0	Pattaland	30
			Dhnarmaraopet villages og Ghanpur	603.1	Forest & pattaland	30
			63 & 64 OF Dharmapur (V) Ghanpur (M)	616.38	Govt & Pattaland	30
			401 & 404 of Jangiad Bhupalapally	128.77	Forest Land	30
			Tadicherla and Kapuram , Malhar Rao (M)	875.45	304.46 Ha Pattaland 570.67 Ha Govt Land 38.00 Forest Land	30
5	Stowing Sand	01	Kudurupally (V) Mahadevpur (M)	208.8	Govt. Land	30

2.1 Telangana State Mining Policy

The Government of Telangana introduced New Sand Mining Policy, 2014 Vide Go.Ms.No.38, Ind & Com Dept, dt. 12.12.2014 and framed Telangana State Sand Mining Rules, 2015 Vide Go.Ms.No.3, Ind & Com Dept, dt. 08.01.2015 for effective regulation of sand and entrusted the responsibility on Telangana State Mineral Development Corporation, State PSU for systematic extraction and supply of sand at affordable price. A brief summary of Sand Mining Policy of Telangana State given in Fig: 2.1 & Table 2.3

I. Sources of sand availability

- (1) River-bed sand extraction.
- (2) De-siltation of irrigation projects.
- (3) De-casting sand from pattalands abutting to the riverbed to make the land suitable for cultivation.

II. Role of Collectors

Collectors should make sand available for local uses

- a) Free of cost
 - Sand can be extracted from I, II & III order streams for Weaker Section Housing Schemes on a certificate issued by the District Collector or any authorized officer.
 - For own use basing on actual requirement to be certified by Panchayat Secretary.
- b) For local use of sand in Government works including Mission Bhagiratha on payment of Seigniorage Charge.
- c) Excavation shall be manual and transportation shall be only by bullock carts/Tractors only.
- d) Where I, II & III order streams do not have sand, Collectors are permitted to go for excavation from IV, V & VI order streams for the above purposes in the above said manner by earmarking less than 5 Ha area by obtaining necessary Statutory Clearances like Environment Clearance, Mining Plan, Consent for Establishment (CFE) and Consent for Operation (CFO).

III. Sand extraction in streams/rivers

- 1) Sand in I, II & III order streams will be left to the Local Body and Villagers for domestic needs, Government sponsored Housing Schemes for which no seigniorage charges are collected. For Local Body buildings like schools, community halls etc., extraction of sand will be allowed from these streams subject to payment of seigniorage fee. The excavation and transportation of sand shall be manual and no mechanical means be allowed and no sand be transported outside the local jurisdiction.
- 2) Sand in IV and V order streams will be allowed for exploitation subject to WALTA Rules and Regulations.
- 3) The identification of sand in IV and V order streams will be done by the Mines and Geology Department in consultation with the Irrigation, Revenue, Ground Water Departments. Based on this identification, the District Level Sand Committee will meet and give a feasible area report.
- 4) Sand mining from rivers in tribal areas are governed by the provision of the Panchayats Extension to Scheduled Areas (PESA) Act of 1996, PESA Rules of 2011 and the WALTA Rules of 2004. The extraction of sand is being taken up by tribal societies.
- 5) The feasible areas will be allotted to TSMDC for excavation, regulation and supply of sand after obtaining Statutory clearances like EC, Mining Plan, Environment Management Plan, CFE and CFO from Pollution Control Board.

IV. Sand sourced in the process of desiltation of reservoirs

DLSC shall notify the reservoirs proposed for de-siltation in consultation with the Department of I&CAD. Notified reservoirs shall be handed over to the TSMDC Ltd for de-siltation.

V. Sand extraction from Pattalands

In case of the sand de-cast in pattalands, the pattadar shall be allowed to de-cast sand to make the land fit for agriculture. On application by the Pattadar to

Assistant Director of Mines & Geology, a Joint Inspection will be conducted along with Tahsildar, Mandal Agriculture Officer and Ground Water Department. Based on the inspection report, the District Collector shall submit proposals to TSMDC for de-casting of sand from pattalands by entering into agreement with pattadar.

VI. Issue of waybills for sand transportation

- 1) The Panchayat Secretary of concerned Gram Panchayat shall issue way bills as prescribed by Mandal Authority for local use from I, II & III order streams. Sand from these sources are also used for 2BHK scheme wherever there is availability. The District shall be treated as a unit for free movement of sand within jurisdiction.
- 2) In case of issue of way bills for sand from pattalands, sand bearing area in IV & V order streams and desiltation of reservoirs, the TSMDC issues way bills online through net banking and citizen service centres.
- 3) In case of sand reaches allotted to 2BHK by TSMDC or the concerned MRO where the reach falls issue way bills.
- 4) In case of sand reaches allotted to I&CAD the concerned ADMG where reach falls will issue waybills

VII. Sand Monitoring Committee

- i) The Government has constituted the District Level Sand Committee to monitor identification of sand bearing areas in IV & V for extraction shall be by the District Level Sand Committee (DLSC), the Collector shall be the Chairman of the DLSC and also consisted with members.
- ii) The Government has constituted state level committee to monitor sand mining policy in the state under chairman ship of Chief Secretary of Government of Telangana.
- iii) The Chairman, DLSC shall order for joint inspection for identified sand bearing areas and obtain reports from the following departments
 - a. Ground Water Department
 - b. Irrigation & Conservator of River

- c. Revenue Department
- d. Mines & Geology Department
- iv) The Chairman, DLSC shall finalize the specified sand bearing areas

VII. Role of TSMDC

TSMDC shall extract sand following sources

- Specified sand bearing areas by obtaining approved Mining Plan, Environmental clearances, consent for opinion from competent authorities.
- The specified sand bearing areas located in scheduled areas shall operate as per the PESA Rules through the tribal Co-operative societies.
- TSMDC shall select raising contractor through strict bidding process by E-procurement.
- TSMDC shall establish stockyard near to the reach by keeping container and CC Cameras with adequate manpower.

For de-casting of sand TSMDC Geofence the area allotted (pattaland)

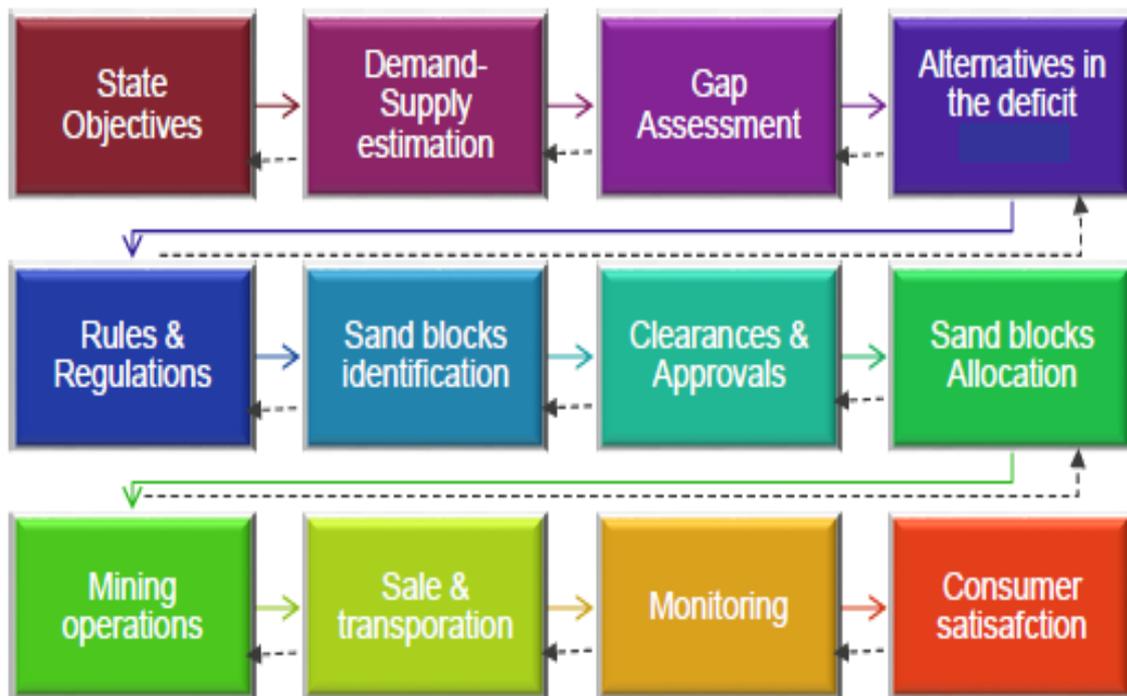


Fig: 2.1 Summary of sand mining policy of Telangana

Table: 2.3 Summary of sand mining policy of Telangana

S No	Activity	Responsibility	Sub-Activity	Timelines	IT Usage
1	Identification of sand reaches	District Level Sand Committee (Under chairmanship of District Collector)	<ul style="list-style-type: none"> • Identification of sand-bearing area as per the WALTA Act & Rules and demarcating the area with definite co-ordinates and depth to be permitted • Examination of the JIR prepared by the Joint Inspection Team • Assessing feasibility of sand mining in the identified areas 	1-2 months	Offline
2	Allotment of sand reaches	Department of Mines & Geology, Telangana	<ul style="list-style-type: none"> • Allotment of the sand bearing area on submission of statutory clearances on nomination basis 		Online
		TSMDC	<ul style="list-style-type: none"> • Execution of lease deed in Form-S1 with Assistant Director of Mines and Geology concerned • Selection of mining contractors to carry out operations through competitive bidding 	1 month	Online
3	Clearances & Approvals (Mining Plan, Environment clearance, Consent to Establishment & Operate)	TSMDC	<ul style="list-style-type: none"> • Obtain approval of the mining plan from the Deputy Director of Mines & Geology of the Region concerned • Obtain Environmental Clearance (EC) from State Environment Impact Assessment Authority • Obtain Consent for Establishment (CFE)/ Consent for Operation (CFO) from Telangana State Pollution Control Board 	3 – 6 months	Online
4	Operations and Monitoring	Contractor	<ul style="list-style-type: none"> • Mining and loading operations are conducted by the mining contractors appointed by TSMDC 	Continuous	Online
		Department of Mines & Geology, Telangana	<ul style="list-style-type: none"> • District Level Task Force under the chairmanship of District Collector periodically review quarrying and transportation of sand. • District Collector nominate officers to form check 	Continuous	Online

			squads to conduct quarry inspection, surprise route checks and imposition of penalty.		
5	Transportation	Transporters	<ul style="list-style-type: none"> Setting of transportation charges based on travel distance Delivering the sand to customers 	Continuous	Online
		TSMDC	<ul style="list-style-type: none"> Registration of transporting vehicles Issuance of “Weighment Slip” by the department 	Continuous	Online
		State Government	<ul style="list-style-type: none"> Recently introduced Sand taxi concept: an online mechanism for booking sand with delivery to customer door step 		Online
6	Sales	TSMDC	<ul style="list-style-type: none"> Getting orders through online sand portal of TSMDC 	Continuous	Online

2.2 Demand & Supply Assessment of the Telangana State

On an average, sand consumption in the State is 12.5 million cubic metres (~ 22.5 MMT) per annum, while the supply of sand by TSMDC is 7 million cubic metres (~13.23 MMT) only, and there is deficit of 5.5 million cubic metres (~10.5 MMT). The deficit of river sand in the State is being met by use of M-sand (4 million cubic metres, ~7.56 MMT) and import from neighbouring States (Up to 0.1 million cubic metres).

Scientific demand-supply assessment and the resultant gap can help the State Government to frame policy for allocation of sand reaches and to adopt business models along with framing policy for alternatives of sand. Further, the following two methods are suggested for estimation of sand demand:

RBI Index based methodology. The State-wise demand of sand in India for FY17 has been estimated based on the following factors:

- India's construction GVA [RBI's Handbook of Statistics on Indian Economy]
- India's State-wise construction GVA [RBI's Handbook of Statistics on Indian Economy]
- Conversion factor- Normative cement to sand mixture ratio of 1:2.5

In this method, based on the data released by **RBI** (Handbook of Statistics on Indian Economy), ratio of construction **GVA** of State with construction GVA of India is calculated. Further, that number is multiplied by the cement sales. Once cement consumption is known, the same is multiplied by the factor of 2.5 to derive the sand consumption. Further, normalization has been done based on the population. Based on the above methodology, demand has been calculated.

Cement consumption-based methodology

In this method, the demand of sand is based on cement consumption multiplied by a conversion factor in terms of assuming a normative cement to sand consumption ratio. Following inputs are required for estimation.

Inputs:

1. Cement consumption
2. Conversion factor - cement to sand consumption ratio

Cement consumption can be obtained from cement sales considering any of the following sources:

1. Sales data from sales tax officials/ GST officials (State Revenue department/ Tax Department)
2. Cement companies for the sales data
3. Sales data from cement dealers present

Conversion factor has been considered, as 2.5, as explained in detail in the methodology using RBI data. Based on this, demand of sand can be derived. This is another suitable, and indirect method for demand estimation of sand.

Alternate options for natural sand

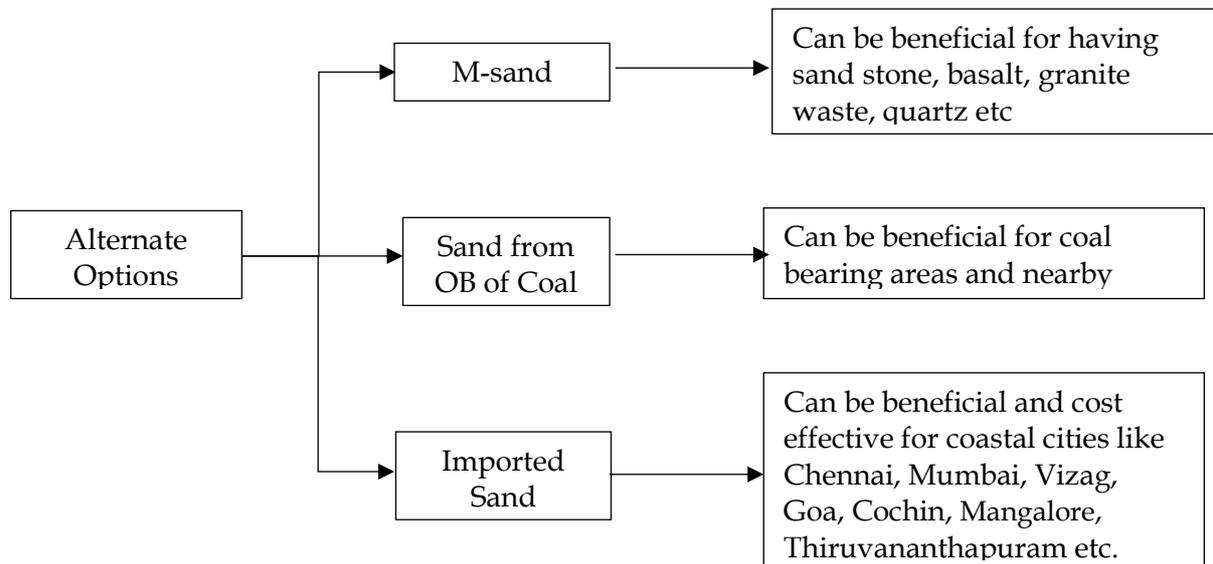
After estimation of gap derived from demand supply assessment, need to analyse the alternate options for sand available. Considering the large deficits in demand and supply of sand, alternate options need to be promoted, as:

- Alternate options can cater to the needs of monsoon season/ peak season
- Alternate supply option will reduce dependence & demand on river sand
- Supply of alternatives may reduce prices of river sand
- Supply of alternatives may lead to conservation of natural resources.

The following three alternatives are proposed:

- M-sand
- Sand segregation from overburden(OB) of coal mines
- Import of sand

Figure 2.2 Alternate options for river sand



2.3 Sand Availability estimation in Jayashankar Bhupalapally District

The river Godavari along with some tributaries (The Manjra, Pranhita, & Indravati) are flowing through this district. Telangana Government has completed the major Kaleshwaram Lift Irrigation Scheme with two barrages in this district. Major source of sand is sand bearing areas within Godavari river also desiltation of the reservoirs and some pattalands. The **Kaleshwaram Lift Irrigation Scheme (KLIS)** is a prestigious project serving almost 45 lakh acre of irrigation besides providing drinking water to 10 districts including Hyderabad. To have designed capacity of water storage in these reservoirs of Annaram and Medigadda, desiltation is must to get benefit for investment. In this regard, both the reservoirs are taken up for desiltation and as per the engineering estimates the total quantity of silt available is 4,13,45,000 CBM out of which 1,58,39,096.55 CBM was already taken out. Number of desilting aras running along with quantity available is at Table 2.4

Apart from the above, there are sand bearing areas within Godavari river which require desiltation to ensure proper flow of water in the Godavari river. The sand extraction in these reaches is carried out as per the EC, CFE and CFO obtained from SEIAA and PCB. The third source of sand available is pattalands. The agricultural land which are abutting the Godavari river is getting silt which is making this land unfit for cultivation. Sand is removed from these

pattalands after joint inspection is carried out and after approval by the District Level Sand committee and to make the land fit for agriculture. List of sand bearing areas along with quantities of sand available given in Table 2.5

Table 2.4: List of location of Desilting areas along with consolidated quantities of sand resources in Jayashankar Bhupalapally District

S. No	Stock Yard Name	Location (Village)	Area in He	Quantity (CBM)	Period of validity
1	Suraram-2	Suraram	51.9	1557000	1 year
2	Begur-1	Begur	63	400000	1 year
3	Begur-2	Begur	63	1350000	1 year
4	Elkeswaram	Bommapur	80	2400000	1 year
5	Bommapur-1	Mahadevpur	72	2160000	1 year
6	Bommapur-2	Mahadevpur	72	2160000	1 year
7	Brahmanapally-2	Mahadevpur	45	1350000	1 year
8	Mahadevpur-1	Mahadevpur	58	1740000	1 year
9	Mahadevpur-2	Kothapeta	58	1740000	1 year
10	Mahadevpur-3	Kothapeta	58	1740000	1 year
11	Mahadevpur-4	Edapally	58	1740000	1 year
12	Mahadevpur-5	Kudhurupally	58	1740000	1 year
13	Puskupally-2	Puskupally	55.8	1674000	1 year
14	Puskupally-3	Puskupally	55.8	1674000	1 year
15	Kuntlam-1	Balijapur	50	1500000	1 year
16	Kuntlam-2	Balijapur	50	1500000	1 year
17	Kuntlam-3	Kuntlam	50	1500000	1 year
18	Palugula-1	Kuntlam	50	1500000	1 year
19	Palugula-2	Kuntlam	50	1500000	1 year
20	Brahmanapally-1	Mahadevpur	45	13,50,000	1 year
21	Suraram-1	Suraram	51.9	15,57,000	1 year
22	Pusukapally-1	Pusukapally	55.8	16,74,000	1 year
23	Mahadevpur-6	Mahadevpur	58	17,40,000	1 year
24	Tallagadda-1	Annaram	37.5	15,00,000	1 year
25	Tallagadda-2	Tallagadda	37.5	15,00,000	1 year
26	Damarakunta-1	Damarakunta	71.225	14,24,0500	1 year
27	Damarakunta-2	Damarakunta	90.0	18,00,000	1 year
28	Laxmipur	Laxmipur	26.1	7,83,000	1 year
29	Vilasagar Block-1	Vilasagar	14.1	4,23,000	1 year
30	Vilasagar Block-1	Vilasagar	50.4	15,12,000	1 year

Table 2.5: List of location of Sand Bearing areas along with consolidated quantities of sand resources in Jayashankar Bhupalapally District

S. No	River	Location of the Reach	I- Order	II- Order	III- Order	IV Order	V Order	Quantity in CBM
1	Godavari	Kavalapalli (V), Chityala (M)					V	200000
2	Godavari	Mahadevpur (V&M)					V	28435000
3	Godavari	Bommapur (V), Mahadevpur M)					V	10312500
4	Godavari	Ambatpalli-1 (V),- Mahadevpur M)					V	1,00,000
4	Godavari	Ambatpalli-2 (V),- Mahadevpur M)					V	1,00,000
5	Godavari	Ambatpalli-3 (V),- Mahadevpur M)					V	1,00,000
6	Godavari	Ambatpalli-4 (V),- Mahadevpur M)					V	1,00,000
7	Godavari	Pedampeta-1 (V),- Mahadevpur M)					V	1,00,000
8	Godavari	Pankena (V),-1, Palimella (M)					V	1,00,000
9	Godavari	Pankena (V)-2, Palimella (M)					V	1,00,000
10	Godavari	Pankena (V)-3, Palimella (M)					V	1,00,000
11	Godavari	Pankena (V) -4, Palimella (M)					V	1,00,000
12	Godavari	Lenkalagadda(V)- 1, Palimela (M)					V	1,00,000
13	Godavari	Lenkalagadda(V)- 2, Palimela (M)					V	1,00,000

Table 2.6: Details of Royalty or revenue receipt in last three years from minor minerals

S. No	Year	Royalty (Rs. in Lakhs)
1	2017-18	310,25,56410
2	2018-19	424,00,00080
3	2019-20	375,62,93400

Table 2.7: Details of Production of Sand or Minor Mineral in last three Years

S. No	Year	Sand (in CBM)
1	2017-18	5170927.35
2	2018-19	7066666.80
3	2019-20	6260489.00

2.4 Sustainable Sand Mining Practices in the district:-

The Sustainable sand mining guidelines as per SEIAA Proceeding dated 07.05.13 and MoEF &CC Guidelines, 2016 have been followed where in following criteria were observed for delineation of New Sand Mines:-

- ❖ To ensure that sand mining is done in environmentally sustainable and socially responsible manner.
- ❖ To ensure availability of adequate quantity of aggregate in sustainable manner
- ❖ To improve the effectiveness of monitoring of mining and transportation of mined out material
- ❖ Ensure conservation of the river equilibrium and its natural environment by protection and restoration of the ecological system
- ❖ Avoid aggradations at the downstream reach especially those with hydraulic structures such as jetties, water intakes etc.
- ❖ Ensure that the rivers are protected from bank and bed erosion beyond its stable profile.
- ❖ No obstruction to the river flow, water transport and restoring the riparian rights and in stream habitats.
- ❖ Avoid pollution of river water leading to water quality deterioration.

- ❖ To prevent depletion of ground water reserves due to excessive draining out of ground water
- ❖ To prevent ground water pollution by prohibiting sand mining on fissures where it works as filter prior to ground water recharge
- ❖ To maintain the river equilibrium with the application of sediment transport principles in determining the locations, period and quantity to be extracted
- ❖ Streamlining and simplifying the process for grant of environmental clearance (EC) for sustainable sand mining

2.5 Process of the deposition of the sediments in the rivers of the district:

The deposition in a river bed is more pronounced during rainy season although the quantum of deposition varies from stream to stream depending upon numbers of factors such as catchment, lithology, discharge, river profile and geomorphology of the river course. where annual deposition is one meter, but it is noticed that during flood season whole of the pit so excavated is completely filled up and as such the excavated area is replenished with new harvest of minerals.

In order to calculate the mineral deposits in the stream beds, the mineral constituents have been categorized as clay, silt, sand, bajri and boulder. However, during present calculation, the waste material i.e. silts which vary from 10 to 20% in different streams has also been included in the total production. Further the Survey of India Toposheets are used as base map to know the extent of river course. The mineral reserves have been calculated depending upon the depth although there are some portions in the river beds such as channel bars, point bars and central islands where the annual deposition is raising the level of river bed thus causing shifting of the rivers towards banks resulting in to cutting of banks and at such locations, removal of this material upto the bed level is essential to control the river flow in its central part to check the bank cutting. While calculating the mineral potentials, the mineral deposits lying in the sub tributaries of that particular stream/river has not been taken into consideration. Since these mineral deposits are adding annually.

CHAPTER 3

3. GENERAL PROFILE OF THE DISTRICT

3.1 Administrative Setup

The district comprises 11 Mandals and 1 revenue division namely Bhupalapally and 225 villages. The district headquarters is located at Bhupalpally town. There are 2 assembly constituencies in district, they are Bhupalapally and Manthani

The details of the administrative Divisions, Mandals and number of villages are given in Table - 3.1.

Table: 3.1 Jayashankar Bhupalapally district list of Mandal and number of Villages		
S. No.	Name of the Mandal	No. of Villages
1	Bhupalapally	22
2	Chityal	17
3	Ghanpur(Mulug)	9
4	Kataram	31
5	Mahadevpur	32
6	Mahamutharam	22
7	Malhalrao	22
8	Mogullapalli	17
9	Palimela(New)	17
10	Regonda	18
11	Takumatla (New)	18
Total		225

3.2 Demography

The total population of the district is 7.11 lakhs and the density of the population is 273 per sq.km. Out of the total population, male population accounts for 3.54 lakhs and female are 3.57 lakhs of the total population. The district has a density of 129 persons per sq. km and a sex ratio of 1008 females per 1000 males. The scheduled caste are more predominant with 19.47 percent and scheduled tribes constitute 17.37 percent to the district total population.

3.3 Topography

Topography is relatively mild and high medium slops. As per the Digital Elevation Map (DEM) (Fig:3.1) the highest elevation is 140-260 meters in the study district.

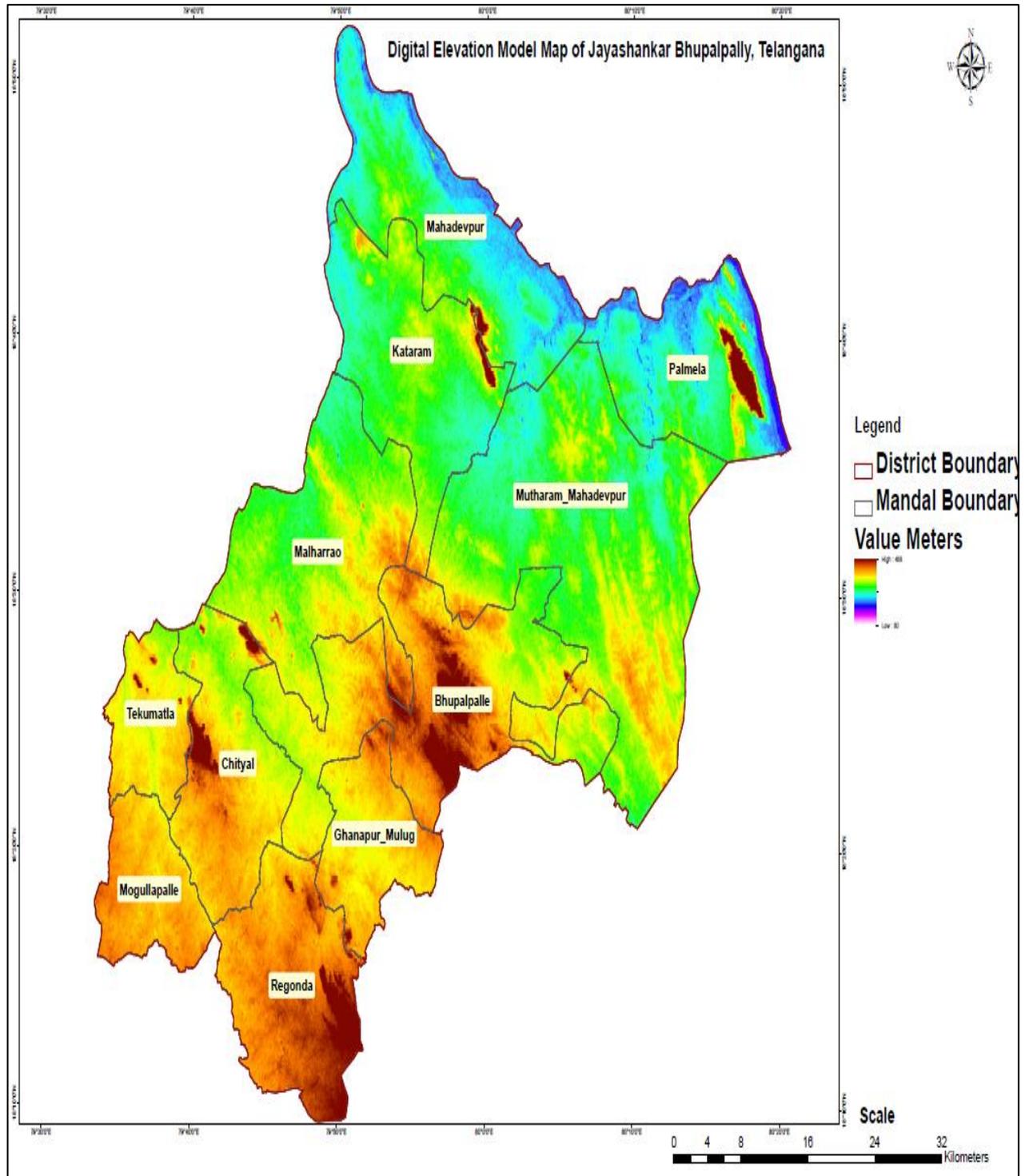


Fig:3.1 Digital Elevation Map of Jayashankar Bhupalapally District

3.4 Transport and Communications

The District is well connected by road network with neighbouring districts showed in (Figure: 3.2). This road includes highways of the state, district, and rural roads and National highway (NH) 353C which traverses the states of Maharashtra and Telangana through the district. The district doesn't have railway line. The total road network length of district is 577 km. The nearest airport is at Hyderabad which is located about 235 km from Bhupalpally.

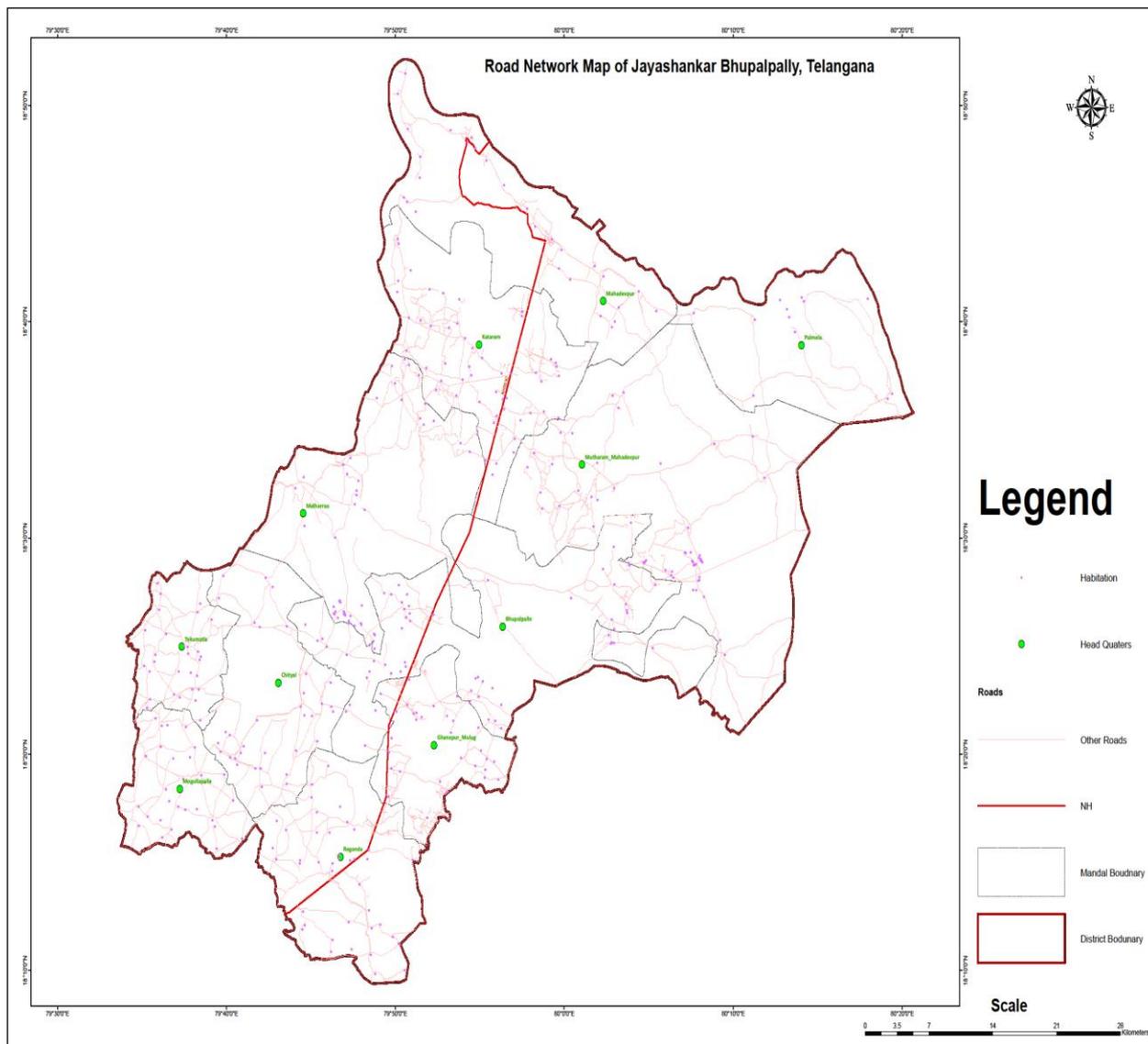


Fig: 3.2 Road Network of the Jayashankar Bhupalpally

3.5 Air Pollution

The minimum and maximum level of Particulate Matter <math> <2.5\mu </math> recorded within the district were in the range of 13 to 29 $\mu\text{g}/\text{m}^3$. The minimum and maximum level of Particulate Matter <math> <10\mu </math> recorded within the district were in the range of 52 to 77 $\mu\text{g}/\text{m}^3$. The 24-hourly average values of Particulate Matter <math> <2.5\mu </math> & <math> <10\mu </math> were compared with the national ambient air quality standards (Table 3.2) and found that the district recorded values within the applicable limits of residential and rural area limits.

Table 3.2 Industrial Air Pollutants in Jayashankar Bhupalapally district

Station name		Jayashankar Bhupalapally	Type: Industrial /Domestic		
			Year -2019		
S. No	Parameter	Method of analysis	Units	Result	Standards* NAAQS- 2009
1	PM ₁₀	Gravimetric	$\mu\text{g}/\text{m}^3$	69	100
2	PM _{2.5}	Gravimetric	$\mu\text{g}/\text{m}^3$	28	60
3	SO ₂	West and Geake	$\mu\text{g}/\text{m}^3$	9.7	80
4	NO _x	Jacob & Hochheisser modified method	$\mu\text{g}/\text{m}^3$	32.82	80

Standards* - National Ambient Air Quality Standards(NAAQS),

Central Pollution Control Board (CPCB) Notification, New Delhi, the 18th November, 2009

§ Respirable Suspended Particulate Matter (RSPM)

CHAPTER 4

4. LAND USE / LAND COVER CLASSIFICATION

A total of 15 Land use/ Land Cover category have been recorded in Jayashankar Bhupalapally district as per LU/LC mapping of district. The percent areal distribution of LU/LC classes has been displayed in Fig: 4.1. The percentage area among major classified land categories is illustrated below Table- 4.1

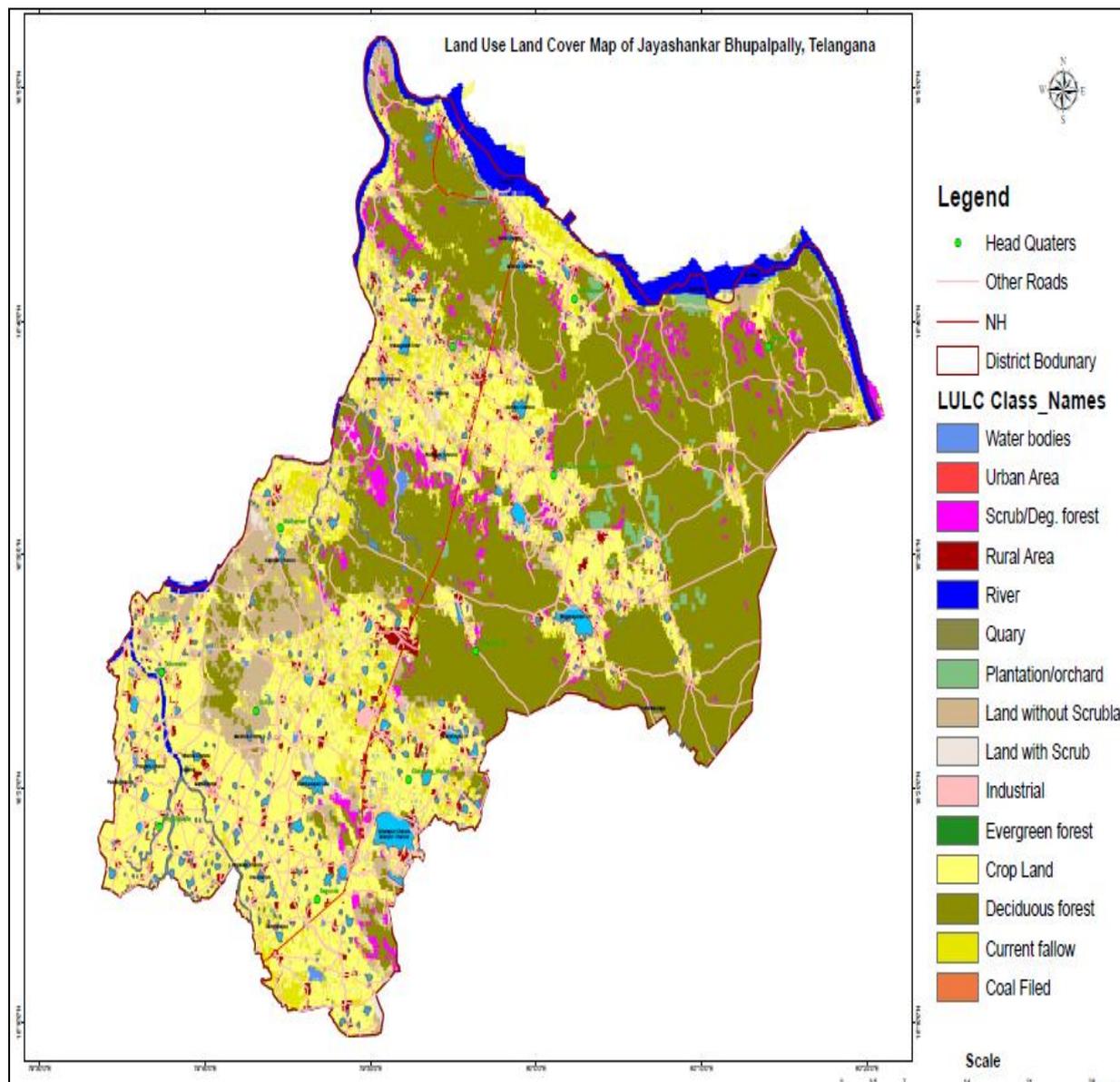


Fig: 4.1 Land Utilization area in Jayashankar Bhupalapally District

Table: 4.1 Land Use / Land Cover area in Jayashankar Bhupalapally District

S.No	Land Use/Land Cover category	Area in (Ha)	% of Total geographical area
1	Urban	104.48	0.035116
2	Rural	8515.57	2.862243
3	Industrial	263.86	0.088688
4	Double / Triple crop	88808.07	29.85005
5	Current fallow	20200.56	6.789784
6	Plantation/orchard	3191.48	1.072716
7	Evergreen forest	4.96	0.001666
8	Deciduous forest	117366.05	39.44892
9	Scrub/Deg. forest	9358.91	3.145704
10	Land with Scrub	4010.70	1.34807
11	Land without Scrub	22005.35	7.396407
12	Water bodies	12312.24	4.138373
13	River	11112.51	3.735121
14	Coal Filed	78.55	0.026401
15	Quarry	180.74	0.060749
	Total	29,75,14.00	100

4.1 Forest:

The total forest area is around 1,26,730 Ha (42.59%) of total geographical area comprising mainly deciduous forests. The details are given map and photographs below in Figure 4.2 & 4.3 respectively.

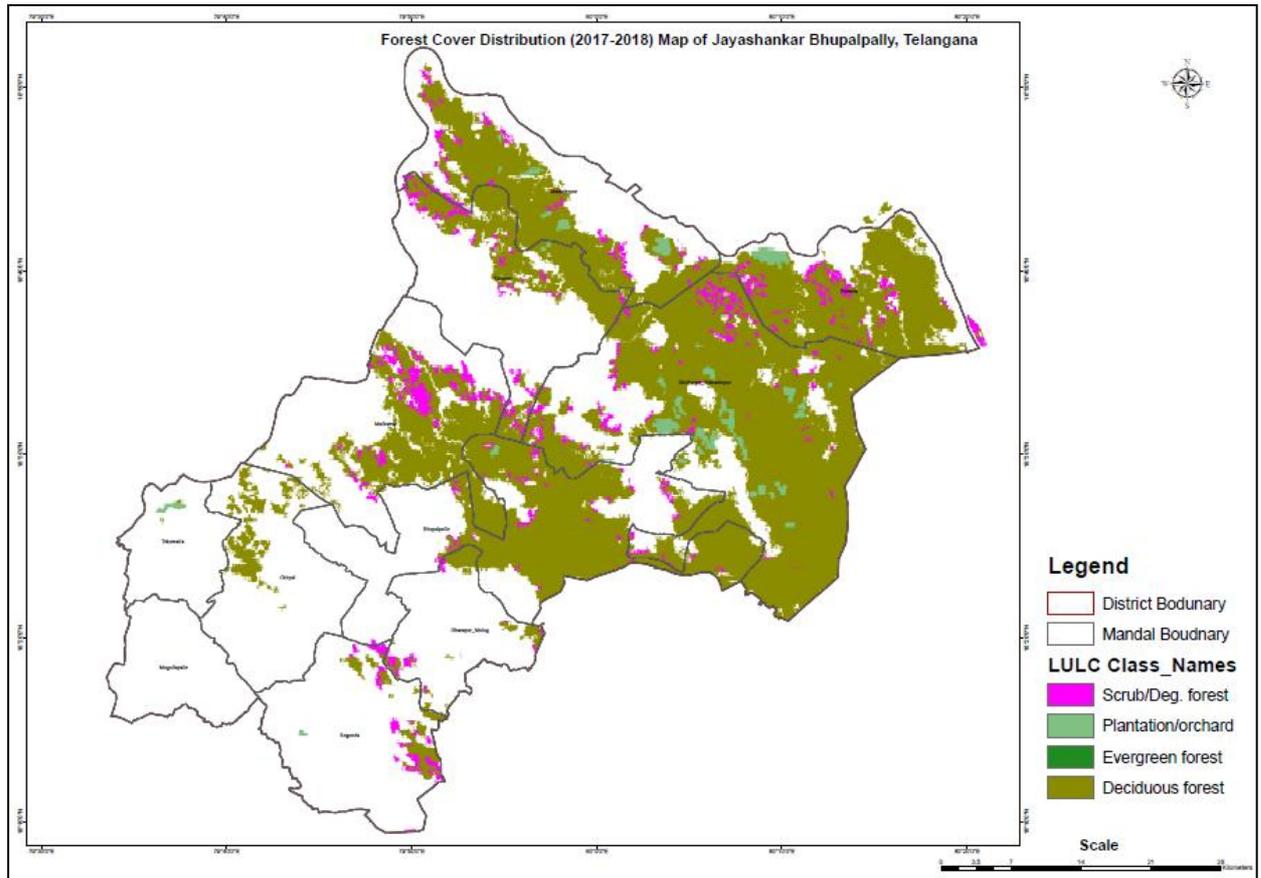


Fig: 4.2 Forest geographical area of the Jayashankar Bhupalapally



Land use in Bhupalapally District



Cotton Field



MI Tank at Mahadevpur



Mahadevpur Reserve Forest

Fig:4.3 Photographs of the Land Use and Land Cover of the District.

CHAPTER 5

5. SOIL PROFILE OF THE DISTRICT

The topography of the district mainly consists of isolated hills, rain fed tanks, lakes and shrubby deciduous forest. The geographical formations of the district mainly developed from the granite and genesis of the archean period and dharma's of pre-Cambrian period. The soils of the district mainly comprise of sandy loams with patches of shallow black cotton soils and at places even medium black cotton soils. The soils in the district can be divided into red soils, black soils, loams and sandy loams. Red soils occupy about 55% of the district; black soils about 22% and loams about 14% and represented in Fig: 5.1.

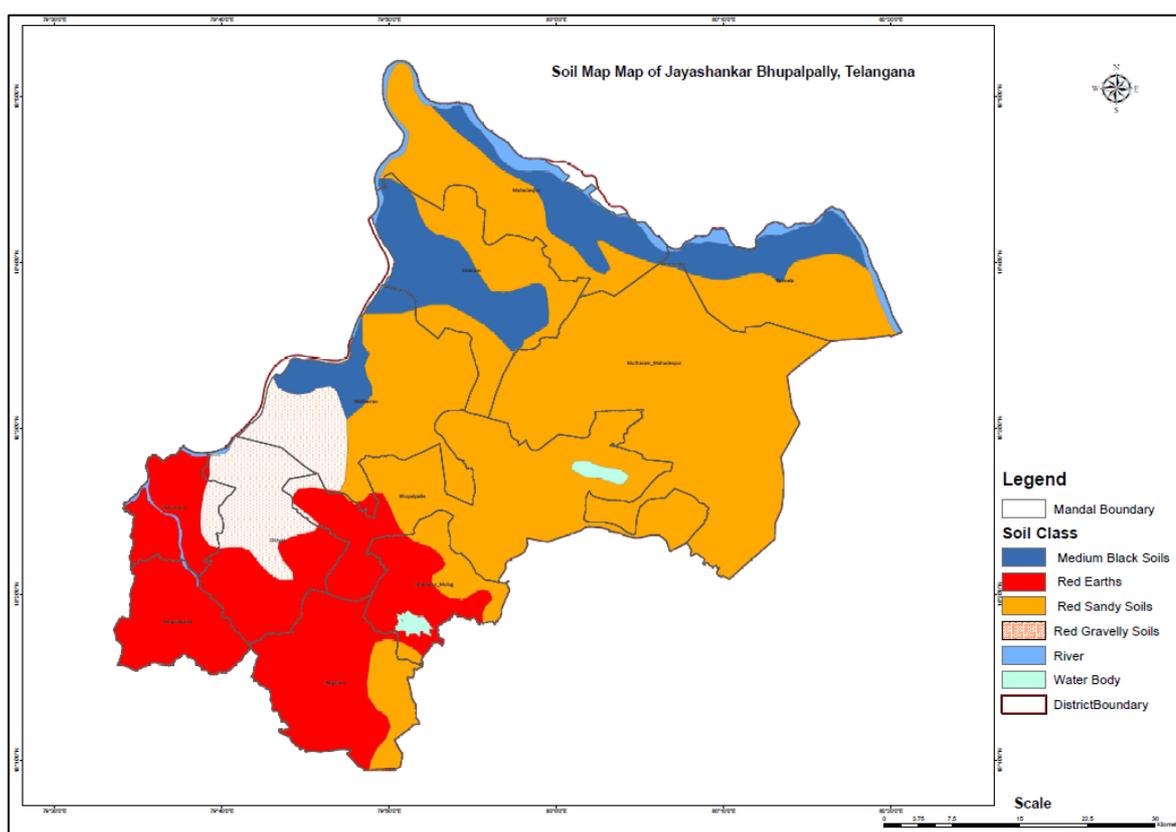


Fig: 5.1 Soils types in the Jayashankar Bhupalapally district

5.1 Rainfall

The climate of the district is characterized as humidity almost throughout the year with extreme summer and seasonal rainfall. The summer is normally from the month of March to June. The rainy season is followed in the form of South-West monsoon till the middle of October. Retreating monsoon is followed till November. During the period from December to February the district experiences good weather with cool temperatures. The maximum and minimum temperatures are recorded in the month of May and December respectively.

The annual average rainfall of the district is 931.4 mm during the monsoon season (Jun–Sep), During other seasons the average rainfall is 11.5 mm for winter (Jan–Feb), 44.4mm for pre – monsoon (Mar–May), 100 mm for post monsoon (Oct– Dec) and represented in Table 5.1. The Fig: 5.2 & 5.3 shows the rain fall data in Jayashankar Bhupalapally District.

The mean minimum and maximum temperature recorded in the district are 9.4° C in December and 47.5° C in May, respectively.

Table: 5.1. Jayashankar Bhupalapally District Rainfall data for Annual year 2018-19

S No	District	Annual Rainfall(mm) for year 2018-19				
1	Jayashankar Bhupalapally	Monsoon				
		June	July	August	Sep	Total
		15.8	347.12	300.9	125.0	931.4
		Post-Monsoon				
		Oct	Nov	Dec		
		76.0	19.0	5.8		100.8
		Winter				
		Jan	Feb			
		6.2	5.3			11.5
		Pre Monsoon				
		March	April	May		
		7.0	13.4	24.0		44.4
	Total				1088.1	

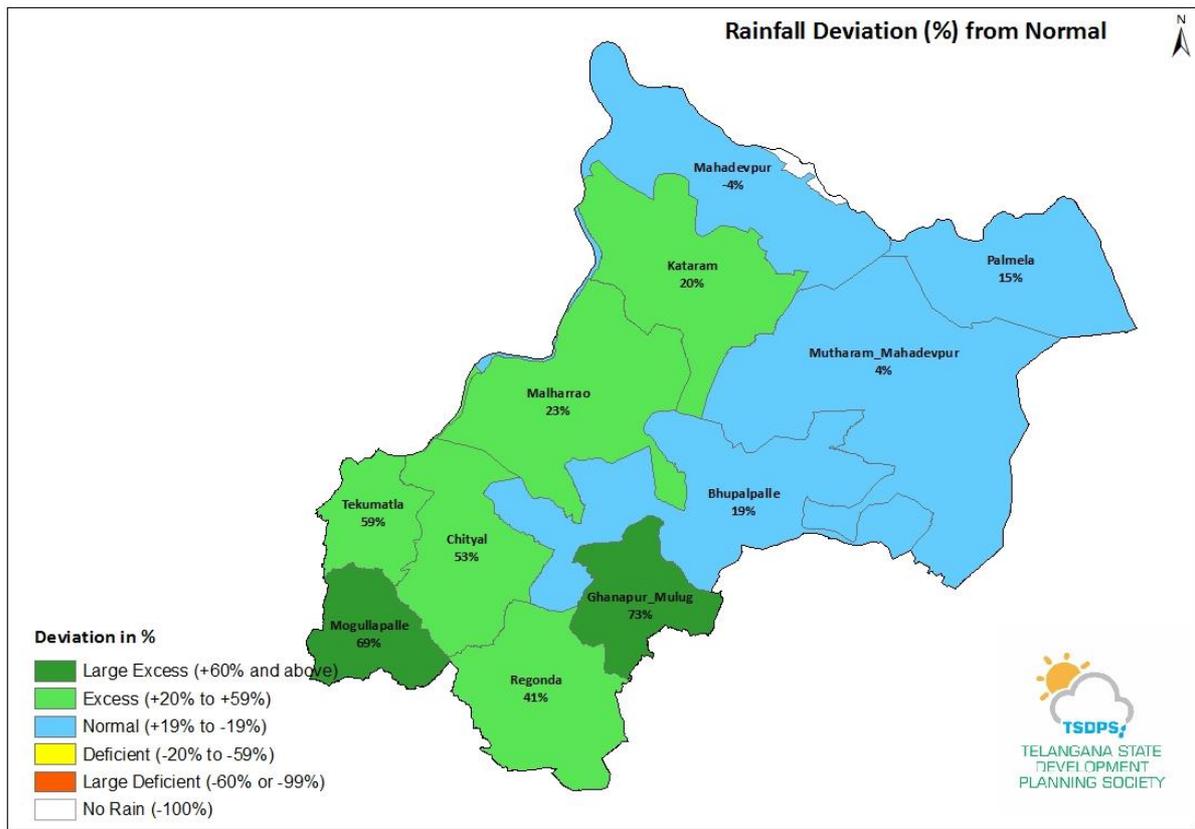


Fig: 5.2 Rain Fall Data of Jayashankar Bhupalapally District

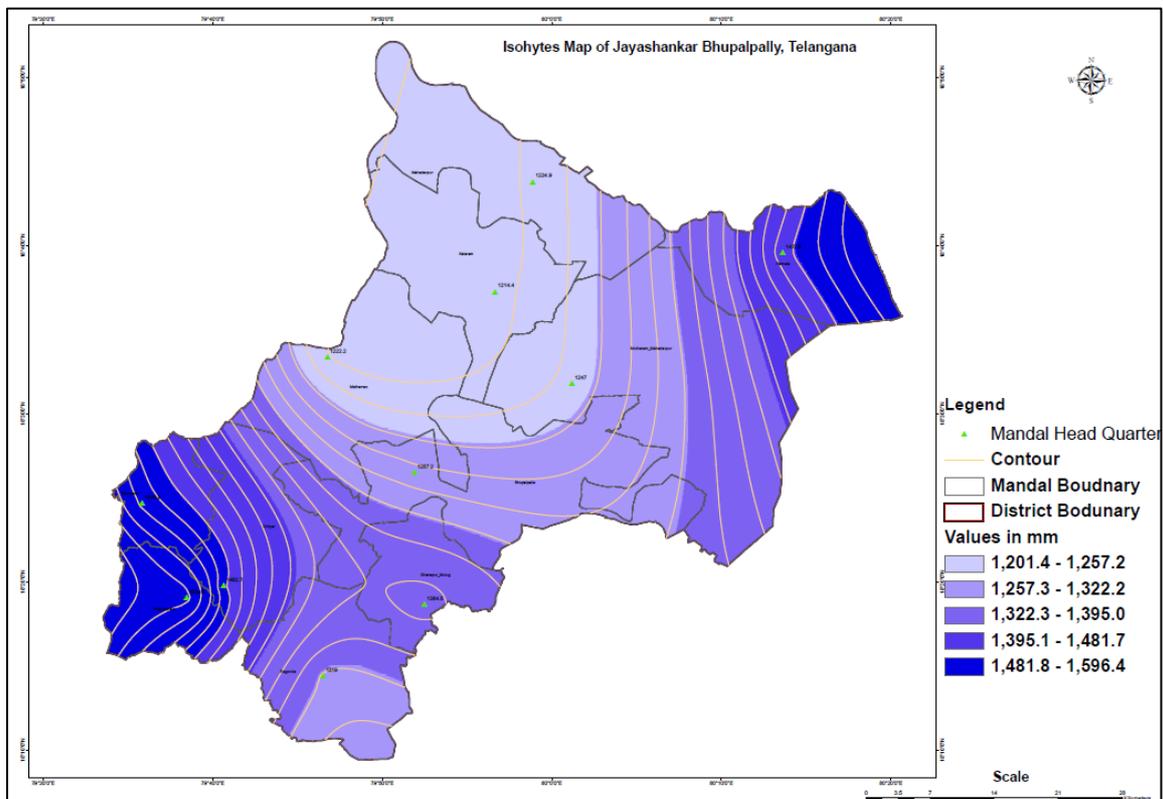


Fig 5.3 Isohyet of Rain Fall Data of Jayashankar Bhupalapally District

5.2 Ground Water Prospects in the District

Jayashankar Bhupalapally district is located in Northern Telangana zone endowed with average annual rainfall of 1088.1 mm per year with most of the precipitation received from south-west monsoon (80%). The South- West Monsoon is generally confined to the months of June-September. The balance 20% of the rainfall is distributed between N.E Monsoon, during October–December winter rainfall and hot weather season.

There are no semi-critical, critical and overexploited Mandals in the district. All eleven Mandals in the district are under safe category. Ground water occurs in all most all geological formations and its potential depends upon the nature of geological formations, geographical setup, incidence of rainfall, recharge and other hydrogeological characters of the aquifer. In consolidated formations ground water occurs under unconfined to semi-confined conditions. Ground water is developed in these formations by dug wells, dug cum bore wells and bore wells tapping weathered and fractured zones. The ground water levels of the district are ranges from minimum of 2 m bgl (metre below ground level) to maximum of 35 m bgl.

5.2.1 Aquifers

(i) Semi-consolidated Formations

This group consists of mainly conglomerates, sandstones and shales of lower and upper gondwana members. Groundwater occurs in unconfined and confined conditions in these formations. The groundwater potential widely varies in the shallow and deeper aquifers occurring in these lithounits.

(ii) Shallow Phreatic Aquifers:

The Talchir boulder bed is favourable for sinking open wells, the depth of wells varies from 8 to 13 m in general and the yields range from 15 to 30 m³/day. These form poor aquifers and are tapped only for domestic needs. The Maleri and Chikiala formations are predominantly clayey and form poor aquifers.

(iii) Deeper Confined Gondwana Aquifers:

The yields of deeper bore wells of ~ 100 m tapping the Talchir formation range from 5 to 20 m³/hr and the specific capacity of the wells ranges from 10 to 55 lpm/m . The Barakar formation form poor aquifers. The sandstone horizons of 50 to 80 m tapping in these wells have discharges of 56 to 72 m³/day at drawdown 19 to 23 m. The specific capacity of wells ranges from 27 to 330 lpm/m dd and the aquifer transmissivity ranges between 128 and 396 m²/day. The Kamthi sandstones extend up to 446 m bgl, the potential zones can be classified in to three groups, viz. top up to 100 m, middle between 100 to 250 m and bottom beyond

250 m bgl. The lower group comprising of gritty sandstones have low to moderate yields of 324 to 1936 m³/day, transmissivity ranging from 70 to 135 m²/day and storage coefficient of 3.7 x 10⁻⁴. The middle group consisting of coarse to medium grained sandstones with intercalation of clays have moderate yields of 1180 m³/day with a transmissivity value of 70 m²/day and storage coefficient of 1.6 x 10⁻⁴. The upper Kamthi sandstones comprising of coarse to gritty sandstones have very high yields ranging from 1909 to 3896 m³/day, transmissivity ranging from 225 to 740 m²/day and storage coefficient varying from 2.6 x 10⁻⁴ to 8.4 x 10⁻⁵. The deeper sandstone aquifers of Maleri and Chikiala extending down to 220 m bgl occur under highly confined conditions. The discharges are around 2615 m³/day at drawdown of 22 m. The transmissivity and storage coefficient are around 126 m²/day and 7.98 x 10⁻⁴ respectively and many of these aquifers giving rise to artesian/flowing wells.

(iv) Unconsolidated Formations (Soft Rocks)

The yields of dug wells and dug-cum-bore wells are as high as 300 m³/day. Alluvium occurs either as terrace deposits or flood plains extending to an area of 125 sq km along the western bank of the Godavari River. The yields of the shallow wells tapping alluvium vary from 30 to 60 m³/day and that of the filter point wells from 720 to 960 m³/day for a drawdown of 1 to 15 m.

5.2.2 Groundwater Status

The State groundwater Department has made groundwater observations total 11 Mandals in the district. Based on the monthly groundwater levels observations in Figure 5.4 & groundwater recharge and ground water draft in the Mandals has arrived at the following:

I.	Annual recharge / Water availability	734.52 MCM
II.	Existing / Present gross groundwater draft	202.46 MCM
III.	Groundwater available for future alone / projected use	532.23 MCM
IV.	Groundwater availability for future / projected irrigation Development	532.23 MCM
V.	Groundwater categorization of Mandals	
a)	Total No of Mandals	11
b)	Safe category Mandals	11
c)	Semi-critical Mandals	-
d)	Critical Mandals	-
e)	Over exploited Mandals	-

Source: PMSKY

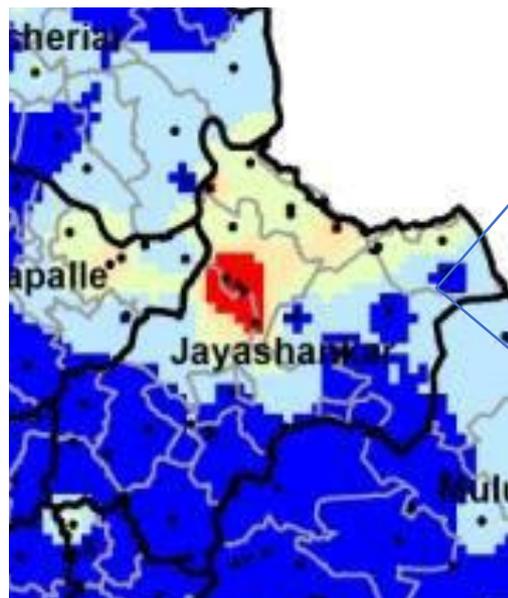
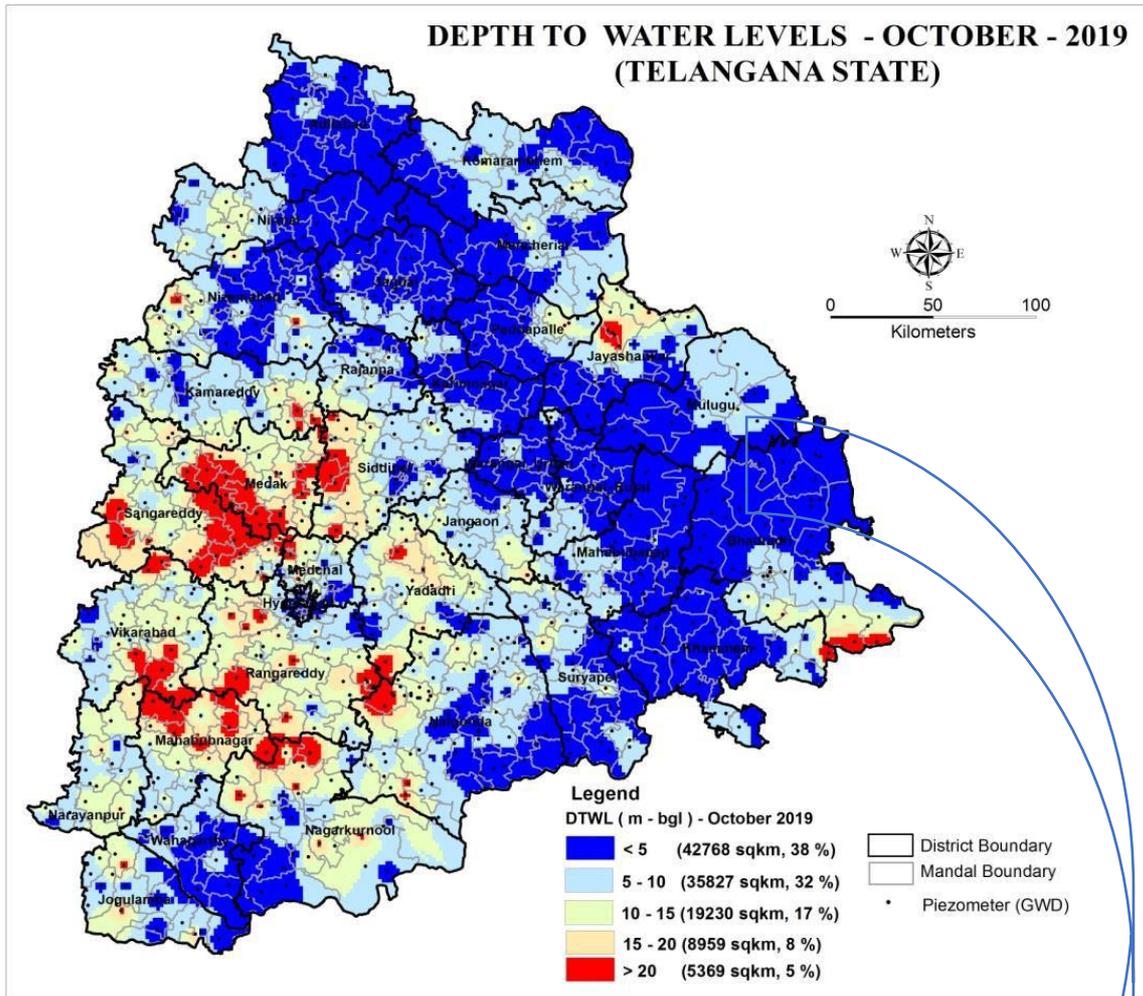


Fig: 5.4 Ground water Level of the Jayashankar Bhupalapally District

5.2.3 Depth to water Level Fluctuation

The pre and post monsoon water level and fluctuation in shallow aquifer based on the data of Department of Ground Water Board of Telangana presented in Table 5.2 & Figure 5.5.

Table: 5.2 List of Deep Water Level Mandals (>20 m bgl) During October-2019

S.No	Mandal	District	Village	Water Level Pre Monsoon 2019	Water Level Post Monsoon 2019	Fluctuation of water Level
1	Kataram	Bhupalpally	Medipally	20.59	20.75	-0.16
2	Kataram	Bhupalpally	Regulagudem	36.0	33.49	2.51
3	Kataram	Bhupalpally	Shankarampally 125(D)	30.6	25.76	4.84
4	Kataram	Bhupalpally	Shankarampally 47	26.35	24.18	2.17
5	Mahadevpur	Bhupalpally	Ambatipalli	23.72	20.98	2.74
6	Mahadevpur	Bhupalpally	Annaram	32.38	21.41	10.97

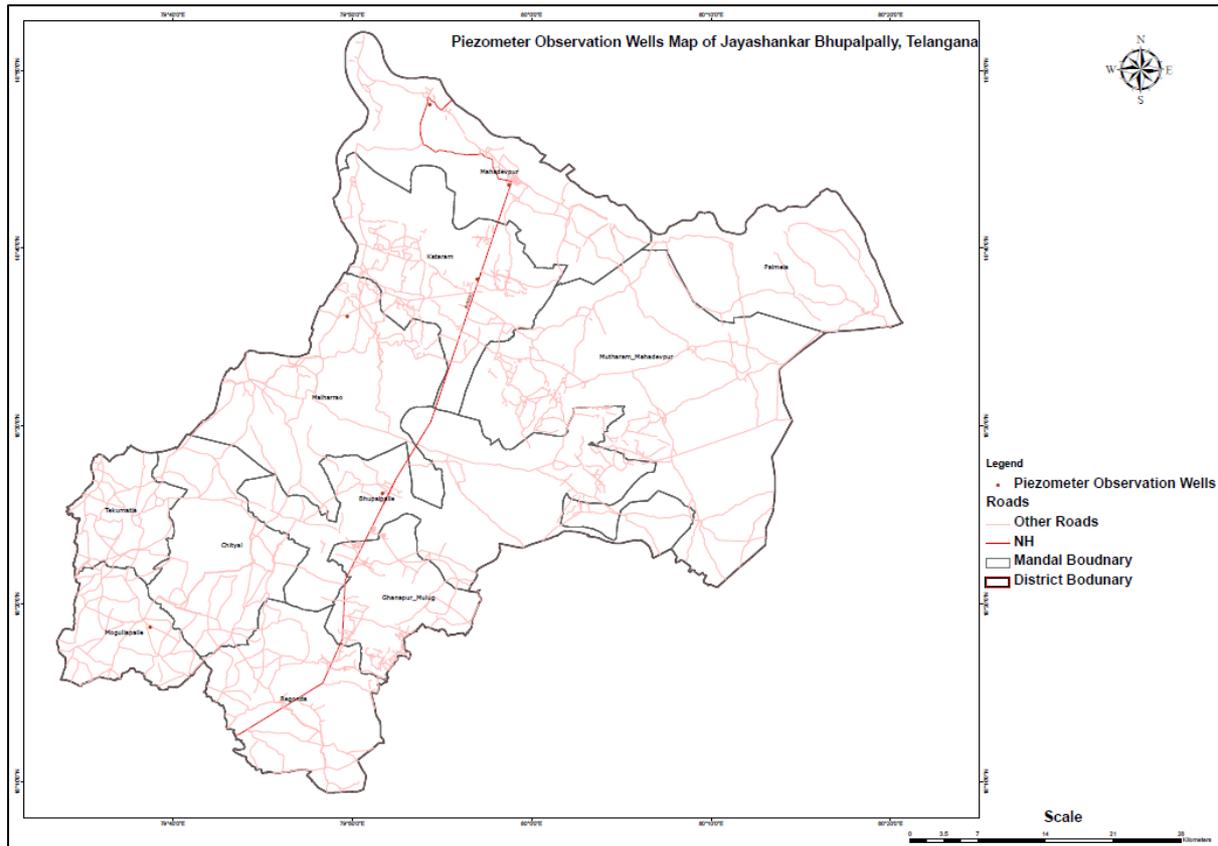


Fig:5.5 Piezometer observation of wells of Jayashankar Bhupalapally District

5.3 Ground Water Quality of the District

The groundwater quality in the district in general is suitable for both domestic and irrigation purposes. Ground water quality in general is within the permissible limits as per CPCB standards.

CHAPTER 6

6. IRRIGATION RESOURCES IN THE DISTRICT

6.1 Drainage

The district falls in the drainage basin of River Godavari. The collective pattern of streams and their course constituent's drainage pattern. Factors like slope, geological features and topography are reflected in the drainage patterns. The Fig:6.1, 6.2 & 6.3 shows the area constitutes dendrite pattern of drainage system and water sheds respectively covering 225 villages of Jayashankar Bhupalapally District. Catchment & Sub catchment of watershed network list is provided in below Table 6.1 & Table 6.2.

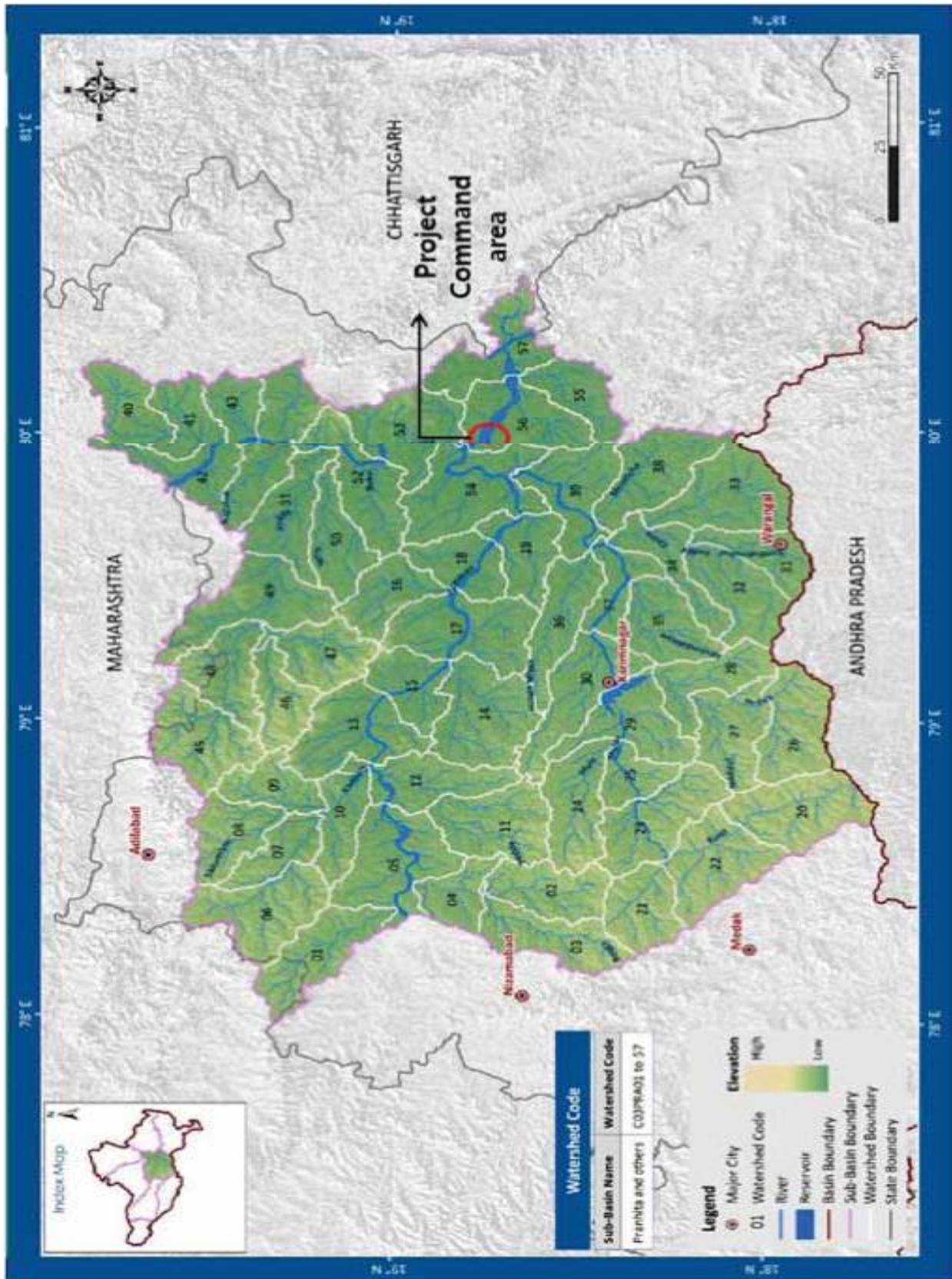


Fig:6.1. Godavari river area constitutes dendrite pattern of drainage system

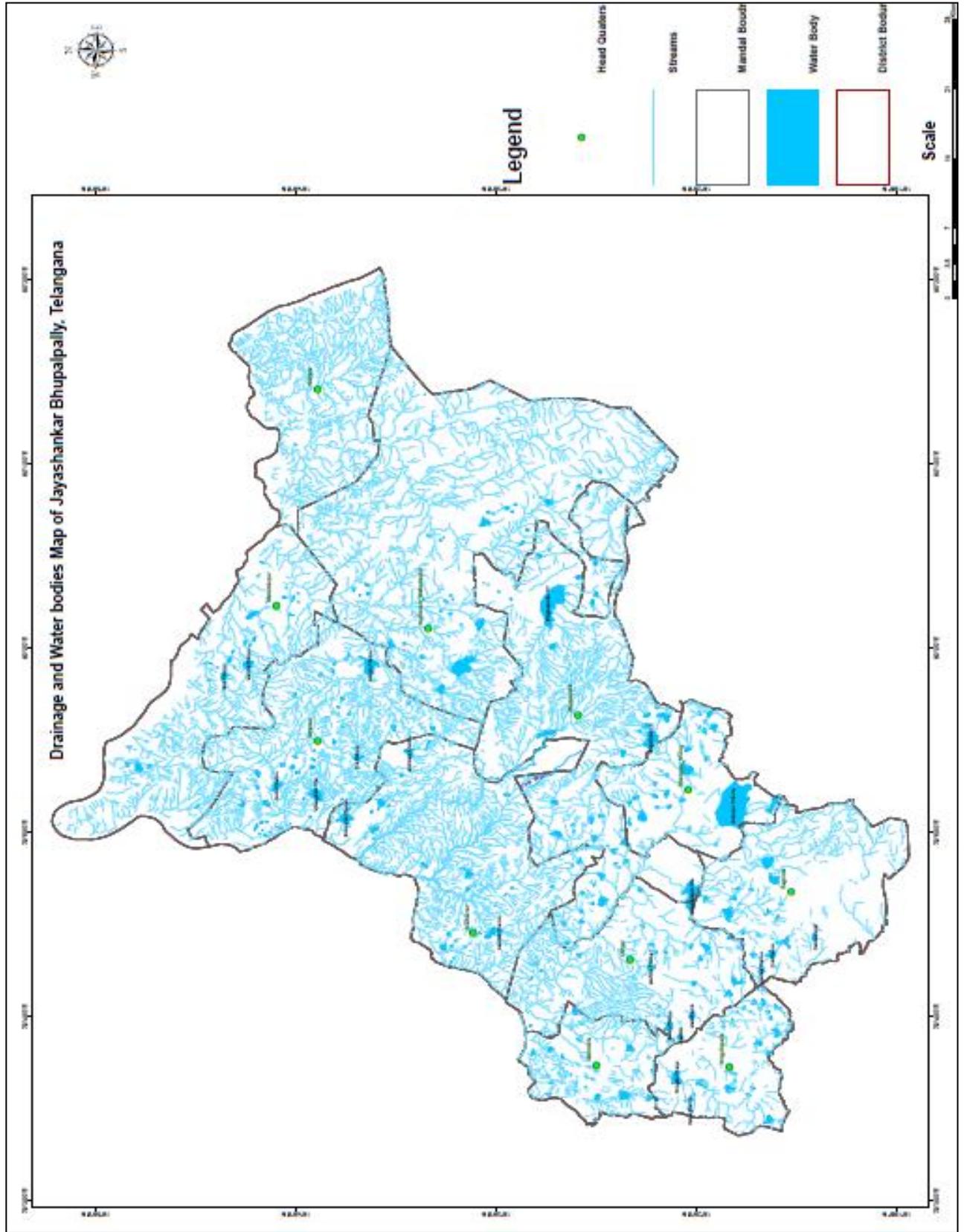


Fig: 6.2 Drainage Network and Surface water of Jayashankar Bhupalapally District

Table 6.1: Catchment of Water Shed Network of Jayashankar Bhupalapally

Basin name	Catchment name	Sub Catchment name	Watershed Name	Area (Ha)
Godavari	Indravati to Pochampad upstream & Pra	Pranhita Inner bed	Telanilu	84.26
		Pranhita River bed	Golla	1116.86
		Lower maner RB of godavari from conf gdv	Hussain miyan	12838.10
			Pedda	93895.40
			Ghanpur	48886.20
	Godavari delta to confl with Indravathi	Rb godavari from conf with sabari&indrav	Rallagu	17419.20
	Indravati conf to Pochampad upstream & pra	Lower maner rb of godavari from conf gdv	Kesapatnam	7863.84
			Moruyancha	73603.80
			Salivagu	20069.60
	Godavari delta to confl with Indravati	Rb godavari from conf with sabari&indrav	Laknavarum	9298.02
	Indravati conf to Pochampad upstream & pra	Lower Maner rb of godavari from conf gdv	Chinna-pedda	7233.77
	Total Area			292309.05

Table 6.2: Sub Catchment of Water Shed Network of Jayashankar Bhupalapally

Basin	Catchment	Subcatch name	Water shed name	Area Ha	No of Watershed
Godavari	Indravati conf to Pochampad upstream& Pranhita	Lower Maner rb of Godavari from conf Godavari	Hussain miyan	12838	7
			Pedda	93895	
			Ghanpur	48886	
			Kesapatnam	7864	
			Moruyancha	73604	
			Salivagu	20070	
			Chinna-pedda	7234	
	Indravati conf to Pochampad upstream & pra	Pranhita ib	Telanilu	84	1
		Pranhita rb	Golla	1117	1
	Godavari delta to confl. with Indravati		Rb godavari from conf with Sabari &Indravati	Rallagu	17419
			Laknavarum	9298	
				292309.05	11

6.2 Irrigation Development

Any irrigation development plan for District or State, requires a detailed analysis of the available waters from the existing Major, Medium and Minor irrigation projects /schemes in the district / State in terms of irrigation potential created and irrigation potential utilised by each project or schemes as the case may be as per the information provided by the concerned agencies either in the form of volume Million Cubic Metre (MCM) or total extent of area irrigated during kharif and rabi seasons for the given years.

The Second category of water is rainfall precipitation during the monsoon particularly during crop growing periods which is mostly the rainfall received during June to September from south-west monsoon and October - December north-east monsoon periods.

The third source of irrigation is ground water providing irrigation through dug wells, tube/bore wells to the extent of total area irrigated in the Mandal or sub Mandal levels. Ground water availability is assessed as per the Mandals / sub Mandal's identified as safe, semi critical, critical and over exploited as per the classification based on the ground water recharge, groundwater usage and identified gap in groundwater availability in the Mandal / sub-Mandal (Mandal). The major and minor irrigation projects are represented in Fig: 6.4 & Table 6.3

Table: 6.3. The major and minor irrigation projects in the District

S No	Existing Irrigation Potential	Ayacut in Ha				Storage in MCM		
		Nos	Created	Present max irrigation of normal year in recent 5 Y	Gap Ayacut	Created	Present Existing	Storage Gap
1	Major	1	33500	33500	-	449.56	449.56	0.00
2	Medium	5	11773	10103	1,670	157.98	135.57	22,41
3	Minor	2075	52377	29926	22,451	702.88	393.81	309.07
4	LI	12	2241	1074	1,167	30.07	16.68	13.39
	Total	2,093	99,891	74,063	25,288	1,340.49	995.62	344.87

Source: Irrigation Division, Jayashankar Bhupalapally District

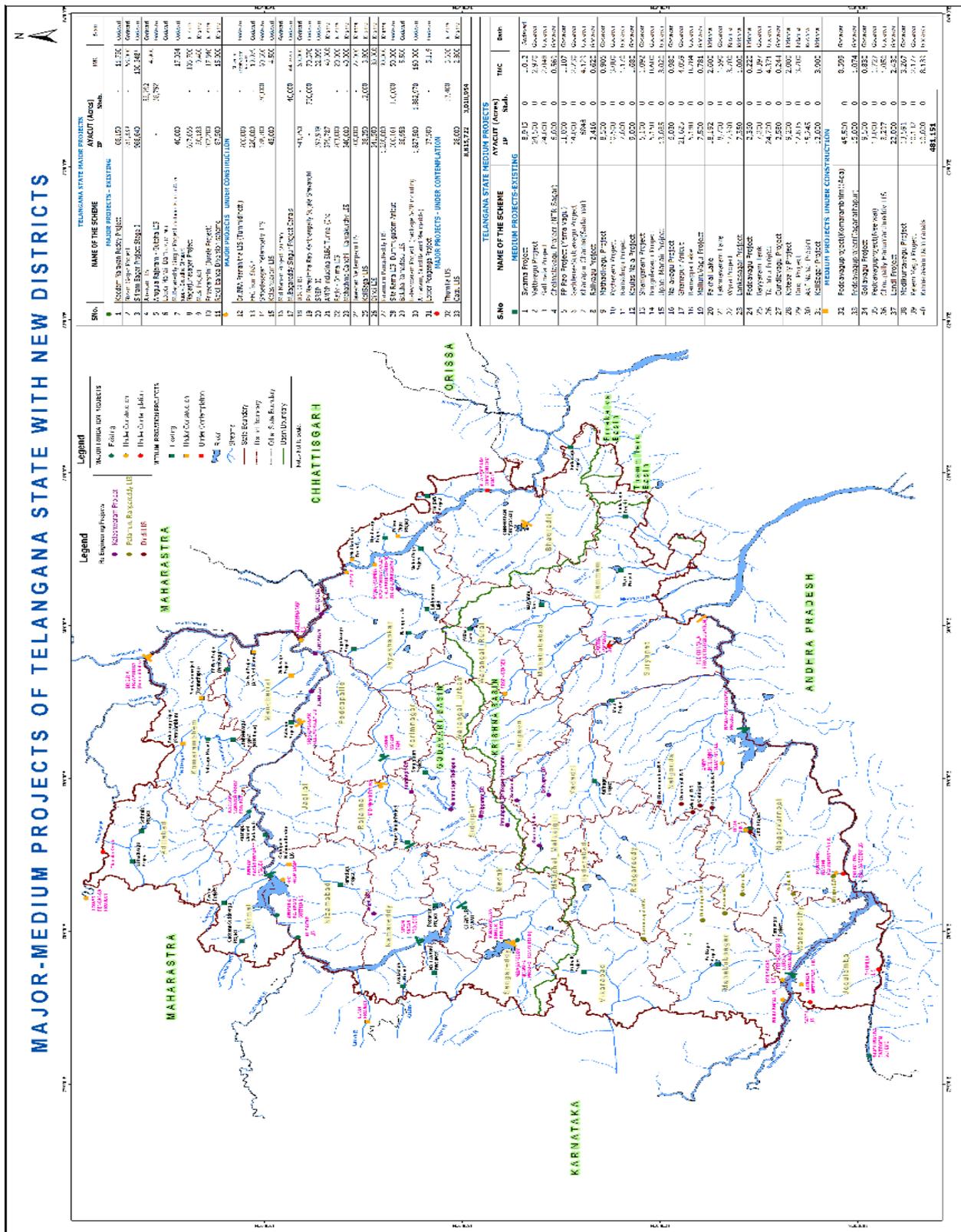


Fig: 6.4 The major and minor irrigation projects

6.2.1 Kaleshwaram Project

- ❖ One of the largest irrigations and drinking water project located at Kaleshwaram, in Mahadevapur Mandal taken up by Telangana state. Along with new ayacut creation, it would also stabilize existing ayacut in the state.
- ❖ The potential for irrigation is 45 Lakh acre per cropping season.
- ❖ The water stored by the construction of the barrages at Medigadda, Annaram and Sundilla barrage and reservoirs is conveyed through a canal network to 13 districts of the State.



Fig: 6.5 Kaleshwaram Project

6.2.2 Boggulavagu Project:

Boggulavagu project is a medium irrigation scheme proposed across a local stream called Boggulavagu a tributary of Maniar river of Godavari basin to benefit backward areas of Jayashankar Bhupalapally district. The site of the Boggulavagu Reservoir across Boggulavagu stream is situated about 6.5 Km south west of Rudraram (V), Malhar Rao Mandal, Jayashankar Bhupalapally district and 96 Km from Karimnagar. The ayacut proposed under the reservoir is 2084 Ha.(5150 acres) consisting of 708 Hect.(1750 acres) wet kharif and remaining 1376 Ha(3400 acres) is I,D rabi.

Table: 6.4. Details of Catchment Area

S No	Class	Area in
1	Free Catchment Area	8,443.0 Ha
2	Intercepted Catchment Area	1,243.2 Ha
3	Catchment Area Combine	9,686.6 Ha

6.2.3 Minor Irrigation Tanks

Jayshankar Bhupalapally District has 2,550 water bodies of per survey report (2019). All water bodies providing irrigation restored under the flagship programme called Mission Kakatiya.

6.2.4 Filling of MI Tanks

The scheme envisages lifting of 4.5 TMC of water for providing irrigation facilities for an ayucut of 18,211 Ha in the upland areas to provide drinking water to enroute villages, which otherwise flows off to Bay of Bengal. Out of 4.5 TMC 0.3 TMC is utilized for drinking water purpose . Totally 14 MI tanks are being proposed. Of which, all are existing except new tank. List of tanks being benefited by the scheme is as follows.

CHAPTER 7

7. AGRICULTURAL RESOURCES IN THE DISTRICT

Agriculture is the main occupation in rural parts of the district, with paddy, chilli, cotton, and turmeric being the chief crops grown in the area. The crops grown in kharif and rabi seasons both under irrigated and rainfed conditions are broadly classified under cereals, coarse cereals, pulses, oilseeds, fibre crops and other crops. Major crops grown in the district are paddy, maize, jowar, bajra, and among pulses, greengram, blackgram, redgram and predominantly grown. Among oilseeds sunflower, groundnut, etc are grown. Among fibre crops cotton is the major and most predominant crop grown extensively in the district. The area sown during kharif is 1,77,377 ha and in rabi 61,738 ha with gross area grown in 2016-17 is 178111 ha as per the details furnished in Table – 2.1.

Table 7.1 Jayashanka Bhupalapally District Agriculture Scenario

S.No	Crop type	Sown Ha	
		Khariff	Rabi
1	Paddy	24716	21321
2	Chillies	7116	7851
3	Cotton	60981	175
4	Cereals	62937	17840
5	Pulses	1417	3180
6	Course Cereals	2890	4621
7	Oil seeds	207	1688
8	Any other crops	17113	5062
Total		1,77,377	61,738

Source: Dept. of Agriculture, Telangana & PMSKY

CHAPTER 8

8. GEOLOGY AND MINERAL WEALTH OF THE DISTRICT

The main rock types observed in the command area is Barren Measures belongs to middle Permian age, Barakar formation belongs to lower Permian age, sandstone, Clay & limestone bands of kota formation, Red Clay Lime pellet rocks and fine to medium sand stone of maleri formation, Ferruginous & calcerious sanstone with some red clay beds of bhimaram formation and Red mudstone with calcerious sand of Yerrapalli formation belongs to upper Gondwana group of cretaceous to Permo Carboniferous age, sandstone siltstone & claybeds with coal seams of kamthi formation belongs to lower Gondwana group of cretaceous to permo carboniferous age and sullaval sandstone of upper proterozonic age. Geology map given below **Fig:8.1**:

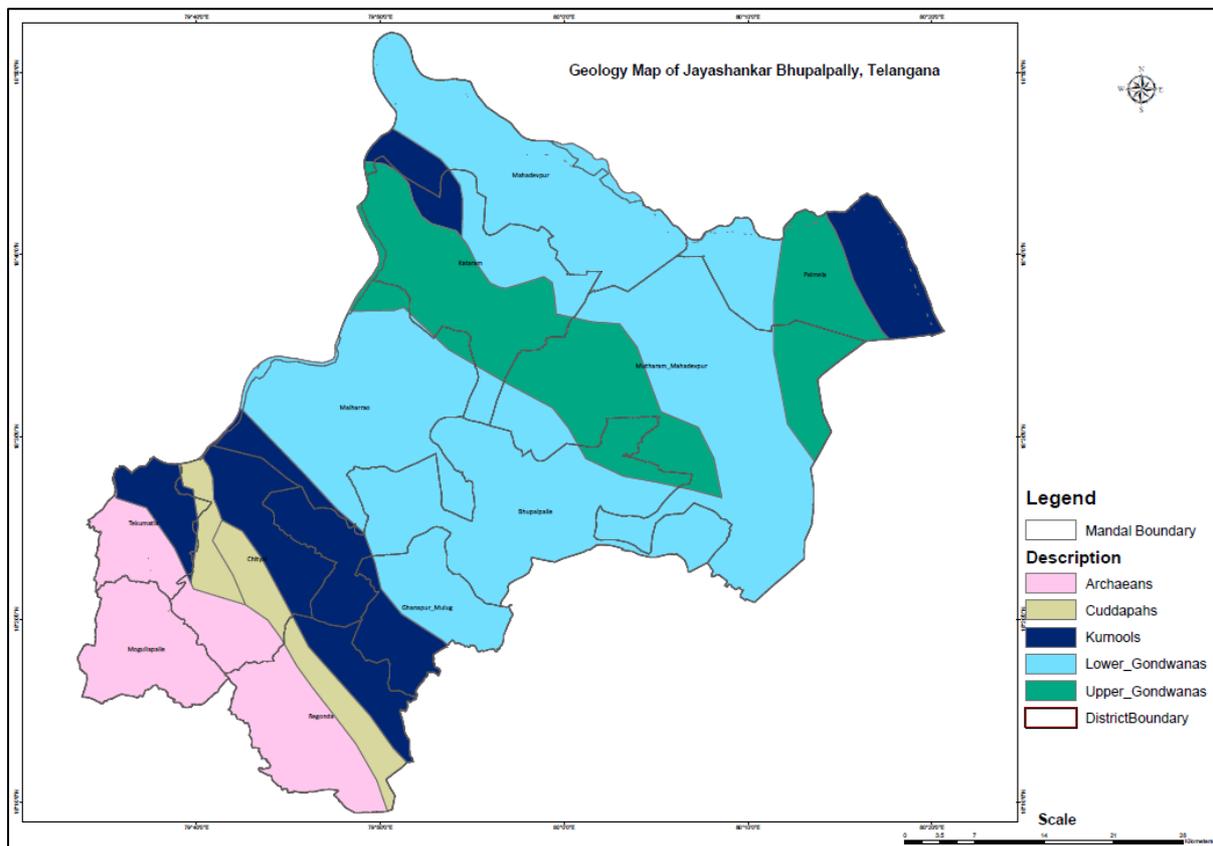


Fig: 8.1 Geology of the Jayashankar Bhupalapally

8.1 Geomorphology of the District

The district is broadly classified under Deccan Trap Plateau Region. The area can be demarcated into pediplain with different hydro-geomorphic units, like shallow/moderately weathered pediplain, pediment-inselberg complex, denudational/structural hills, residual hills,

linear ridges, flood plains, and fluvial units. The major part of the district is composed of granitic rocks represented by a pediment-pediplain complex with inselbergs and residual hills standing out prominently besides the linear ridges made of dolerites.

The pediplain with pediment-inselberg complex covers about 30% area in the district, and can be well observed in the granite-gneissic areas in the form of different gradational weathering units with erosional landforms like residual and denudational hills, inselbergs, mounds, tors, and ridges. The north portion is hilly and has a rugged topography and the eastern portion is more or less a plain country covered by dense forest. The western half of the district is a pediment-pediplain complex with residual hills of granite standing out prominently in a flat country. These areas constitute matured, dissected, undulating and rolling topography with erosional land slope covered by a layer of red loamy soil of moderately uniform thickness. The prominent hills in the district are north of Bhupalapally, Nekkonda and conspicuous dyke ridges. The eastern half of the area is a pediplain on sedimentary rocks of Pakhal and Gondwana Group of formations. The quartzites and sandstones stand out in the pediplain forming structural ridges.

CHAPTER 9

9. CONCLUSION:

The mining of minor & major mineral resources found in district are Dolomite, Laterite, Color Granite, Coal, Stowing Sand and ordinary sand, building & road construction Stones, etc. Altogether, there are 34 leases both major and minor minerals are located in Jayashankar Bhupalapally district.

The Ordinary sand, Color granite, Dolomite and Laterite Produced in the District area help in the development of infrastructures in rural and urban areas to fulfill the demands of development locally and in the adjoining districts of Telangana state. The deposits of mineral “sand” available in the rivers, reservoirs in district area replenished from time to time naturally. It fulfills the requirement of infrastructure development in rural and urban areas without harming river environmental systems. The Color granite produced in the district area is also exported to so many other countries due to their attracting natural colors.

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**Study Report of
Environment Impact Assessment on De-siltation of
ANNARAM BARRAGE & MEDIGADDA BARRAGE
JAYASHANKAR BHUPALPALLY DISTRICT TELANGANA**



**Report Prepared By
TELANGANA STATE MINERAL DEVELOPMENT CORPORATION
LTDHYDERABAD**

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And
PRIDHVI ENVIRO TECH PVT. LTD., Hyderabad*

05 January 2021

Study Report of Environment Impact Assessment on De-siltation of Annaram and Medigadda Barrages Jayashankar Bhupalpally District, Telangana

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Study Report of Environment Impact Assessment on De-siltation of Annaram and Medigadda Barrages Jayashankar Bhupalpally District, Telangana

EXECUTIVE SUMMARY:

Telangana State Mineral Development Corporation Ltd., (TSMDC) Undertaking of Government of Telangana has conducted the Environment Impact Assessment study on de-silting activities in the Godavari river stretches of Annaram and Medigadda reservoirs, which are part of Kaleshwaram Lift Irrigation Scheme (KLIS) Project in Telangana.

The de-siltation of the reservoirs has been taken up with an aim to provide designed water storage capacity for the said reservoirs and make out proper shape of the reservoir bed depending on the depth of sedimentation /silt available. It is estimated that a total sedimentation/silt of 2,19,64,494.0 M³ in Medigadda Reservoir and 20,56,241.5 M³ in Annaram reservoir has deposited which need to be de-silted in order to maintain required water storage capacity of reservoirs and to maintain the life of reservoirs. Out of this, so far TSMDC has de-silted 2,37,61,239 M³ in both reservoirs together.

Protection of river bunds have been done by constructing guide walls up to 1.5 Km upstream of the barrages and flood banks have been constructed from 1.5 Km to 8.85 Km on right side and 11 Km on left side of Annaram Barrage. For Medigadda Barrage flood banks have been constructed from 1.5 Km to 6.3 Km.

Regarding the impacts of de-siltation on the environment, the following points have been observed:

- The Ground water conditions in the Mandals of Mahadevpur, Kataram and Manthani Mandals, where the de-silting locations are identified are under safe extraction conditions as per the Central Ground water Board observations and no major variations were reported in ground water levels due to de-siltation. The quality of water in both River Godavari and ground water nearer to de-siltation areas found to be meeting the drinking water standards
- Based on the information from Directorate of Economics and statistics, the crop yields are observed to be increasing from 2014-15 to 2019-20 which indicates there is no impact on agricultural yields near the stock yards and transportation routes. Similarly the fishery yields have steadily increased from 2011-12 to 2018-19 in the area. No fish kill is observed in both reservoirs due to de-silting as it has been done only when the river bed is totally dry and without water.
- No impacts are found on flora and Fauna of the areas near to the de-siltation locations and stockyards. Further TSMDC has taken up development of green belt with 200 sapling in each stock yards at periphery and road side, as part of Harithaharam programme of Government of Telangana.

- Use of existing R&B and Irrigation Roads for transportation of de-silted materials, the traffic loads are meeting road capacities as prescribed by IRC guide lines. Further the ambient air quality did not show any major negative impacts owing to the measures taken by TSMDC like wetting of roads, stabilizing the internal stockyard roads through gravel, covering the lorries through tarpaulin and maintain traffic regulating mechanism like division of trucks plying in different routes, using mostly existing Irrigation roads and maintaining no entry timings.

Environmental Impacts due to de-silting, stock piling at stockyards and transportation of desilted material have been detailed in the report However Remedial measures for mitigation of impacts are suggested as follows.

- A budget estimate of Rs. 13 lakhs of capital expenditure and Rs. 11 lakhs of recurring expenditure per every year is suggested for implementation various Environmental Management measures
- Regular Environmental monitoring of water, air, noise in the surroundings of the de-siltation points and stockyards study of ground water fluctuation and changes in biotic environment is suggested.
- Long-term data collection on silt replenishment, bed erosion and bank erosion is suggested
- In order to make the stockyards used for storing de-silted material fit for the agriculture, at least 6-inches soil with silt on the surface shall be removed before handing it over to the landowner. Further, soil reconditioning works need to be carried out by TSMDC in consultation with the Agriculture Dept. after conducting necessary soil tests.

CHAPTER -1: INTRODUCTION

1.1 THE RIVER GODAVARI

Godavari River is the second longest river in India after the Ganga, originates in Triambakeshwar of Maharashtra and emptying into Bay of Bengal. The river is also known as Dakshina Ganga and has one of the largest river basins in the Indian subcontinent. Before emptying into Bay of Bengal in the Konaseema region, the river splits into two branches and again splits into another two branches.

Godavari rises at an elevation of 1,067 m in the Western Ghats near Thriambak Hills in the Nashik district of Maharashtra (**Figure-1.1**). After flowing for about 1,465 km., generally in south-east direction, it falls into the Bay of Bengal (**Figure-1.2**).

Godavari basin drains about 9.5% of India's total geographical area. The catchment area of the basin is 3,12,812 sq km extending over the states of Maharashtra (48.6%), Telangana (20% approx.), Madhya Pradesh (10.0%), Andhra Pradesh (3.4% approx.), Chhattisgarh (10.9%), Odisha (5.7%) & Karnataka (1.4%).



FIGURE 1.1: GODAVARI RIVER TRAVERSES ACROSS INDIA



FIGURE 1.2: GODAVARI RIVER DRAINING INTO BAY OF BENGAL

1.2 GODAVARI IN TELANGANA

Godavari enters into Telangana in Nizamabad district at Kandakurthy where Manjira, Haridra rivers joins Godavari and forms Triveni Sangamam. About 12 km (7.5 mi) after entering Telangana it merges with the back waters of the Sriram Sagar Dam. The river after emerging through the dam gates, enjoys a wide river bed, often splitting to encase sandy islands. The river flows along the border between Nirmal and Mancherial Districts in the north and Nizamabad, Jagityal, Peddapalli Districts to its south. The river receives a minor but significant tributary Kadam River. It then emerges at its eastern side to act as state border with Maharashtra and later enter into Bhadradi Kothagudem District. In this district the river flows through an important Hindu pilgrimage town – Bhadrachalam.

The river further swells after receiving a minor tributary Kinnerasani River and exits into Andhra Pradesh. **Figure-1.3** depicts the path of River Godavari in Telangana state.

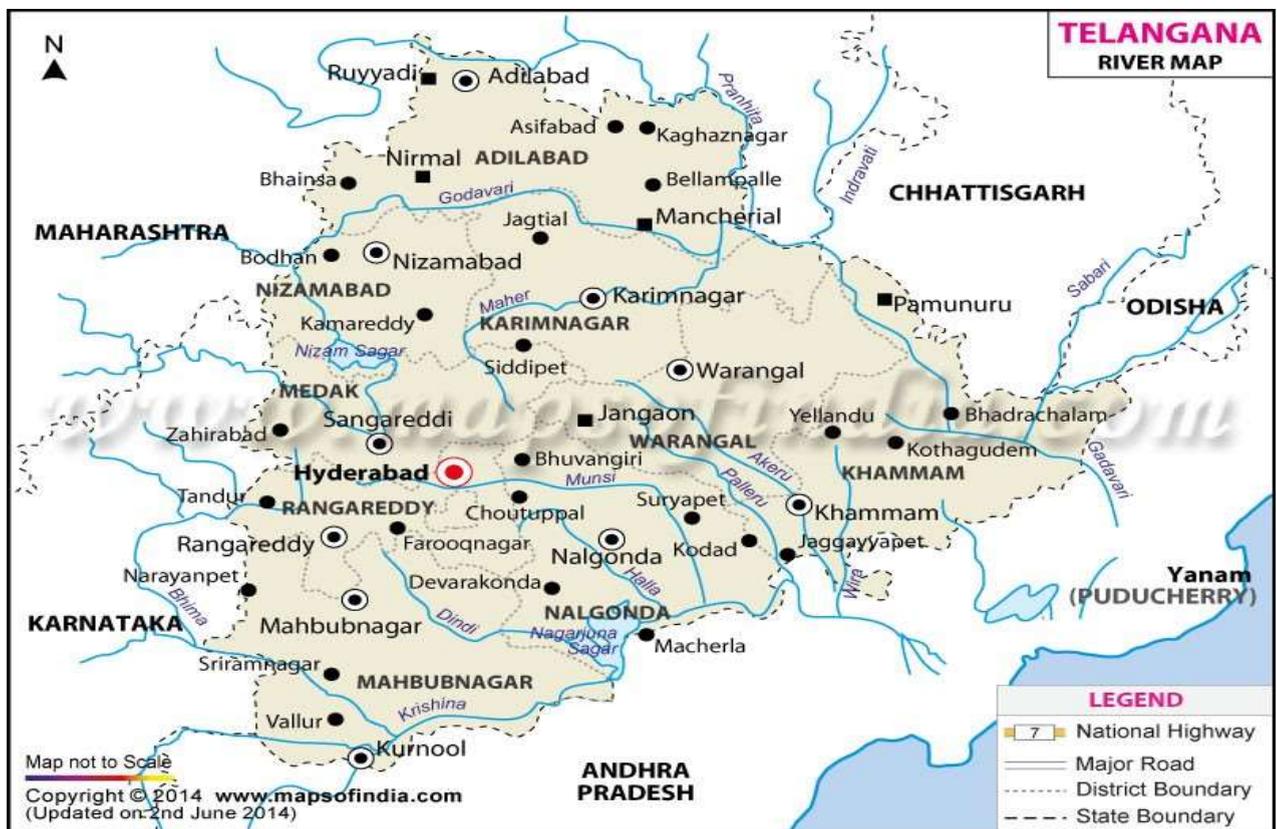


FIGURE -1.3: THE PATH OF RIVER GODAVARI IN TELANGANA STATE

1.3 Kaleshwaram Lift Irrigation Scheme (KLIS) Project

The project is formulated & designed after careful planning and realistic approach with a main aim of providing irrigation water to the uplands and also drinking water. Kaleshwaram project contemplated for lifting 195 TMC of water to irrigate an ayacut of 18,25,700 acres in 13 districts of Telangana state by constructing a Barrage across River Godavari below the confluence of Pranahita at Medigadda near Kaleshwaram and by constructing two more barrages between Medigadda and Sripada Yellampoally project (SYP) at Annaram and Sundilla to convey the water from Medigadda to SYP by lift. Further, it is also proposed to stabilize about 18,82,970 acres of ayacut under SRSP (Sriram Sagar Project) Stage I & II, flood flow canal, singur project and Nizam Sagar project.

Description of Medigadda Barrage

Medigadda Barrage is located at Medigadda Village, Mahadevpur Mandal, Jayashankar Bhupalapally District in Telangana state on Godavari near Medigadda (Kaleshwaram) at 80° 04'37" E Longitude and 18° 42' 48" N Latitude. Medigadda Barrage details are given in **Table-1.1**.

TABLE-1.1: MEDIGADDA BARRAGE DETAILS

Bed Level (mts)	Pond Level (mts)	Gross Storage (in TMC)	Number of Gates
89.0	100.0	16.17	85

The length of the Water spread area at FRL for Medigadda Barrage is 39-km with width of river ranging between 0.75 mm to 1.4 km.

Description of Annaram Barrage

Annaram Barrage constructed across river Godavari downstream of confluence of Manair river with Godavari river at Annaram (V), Mahadevpur (M) in Jayashankar Bhupalapally District at Geo Co-ordinates of 79°49'02" E Longitude and 18°45' 37" N Latitude. Annaram Barrage details are given in **Table-1.2**

TABLE-1.2: ANNARAM BARRAGE DETAILS

Bed Level (mts)	Pond Level (mts)	Gross Storage (in TMC)	Number of Gates
107.0	119.0	9.44	68

The length of the Water spread area at FRL for Annaram Barrage is 31-km with width ranging between 0.75 mm to 1.4 km. Annaram Barrage is at upstream of Medigadda barrage at a distance of 50-km.

1.4 Scope of Study

TSMDC has proposed to conduct the study on impacts of Diltation of Annaram Barrage and Medigadda Barrage and assigne the study to **M/s Pridhvi Enviro Tech Pvt. Limited**, Hyderabad and **M/s Sri Sai Manasa Nature Tech Private Limited (SSMNT)**, Hyderabad respectively.

- The proposed study consists of the following:
- Estimation of the siltation loads in Annaram Barrage and Medigadda Barrage
- Evaluation of Impacts of Desiltation & remedial measures taken
- Environmental Management measures undertaken and proposed by TSMDC
- Monitoring Plan
- Conclusions

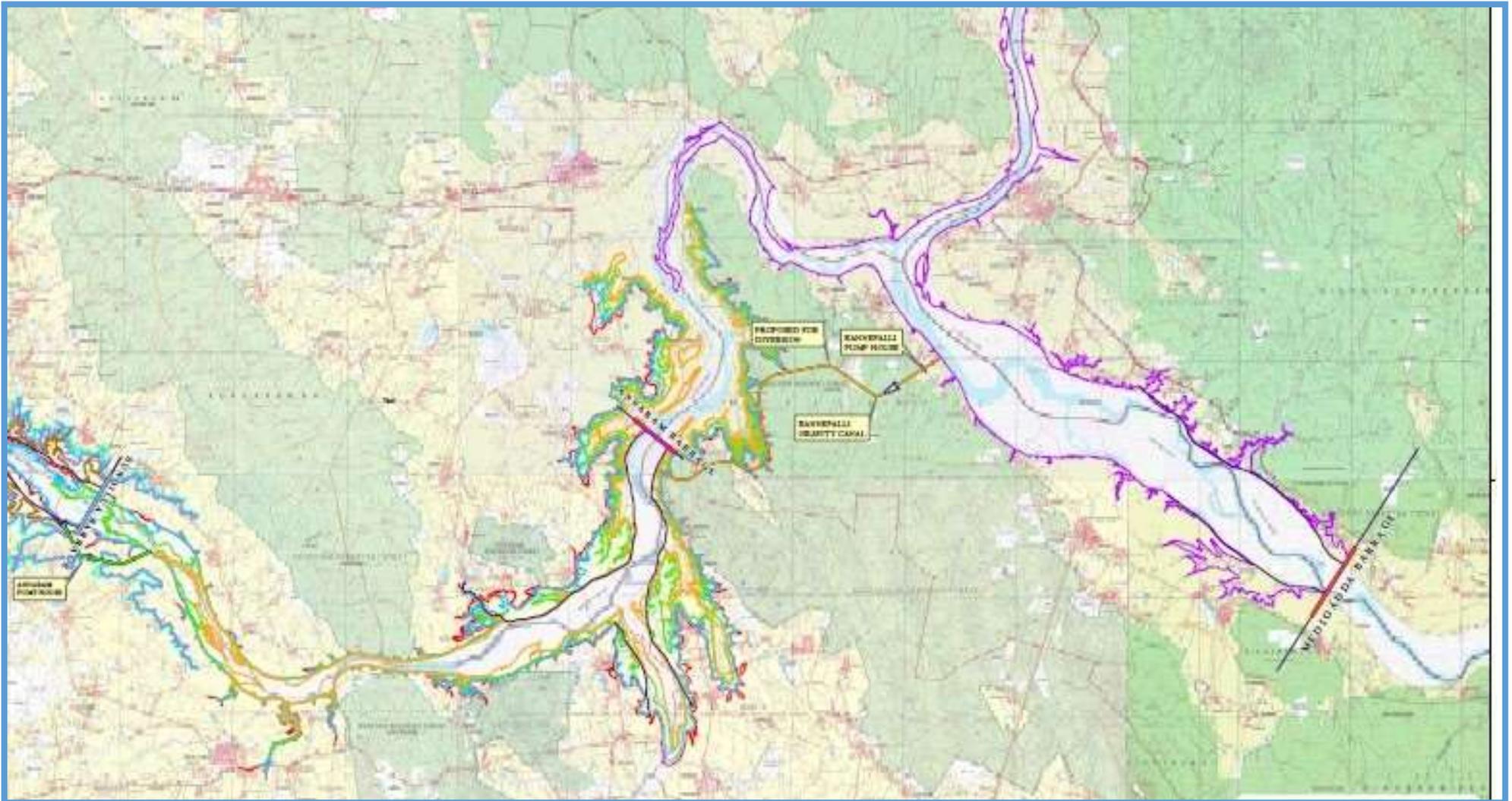


FIGURE - 1.4: MAP SHOWING THE LOCATION OF SUNDILLA, ANNARAM AND MEDIGADDA BARRAGES ACROSS RIVER GODAVARI IN TELANGANA STATE

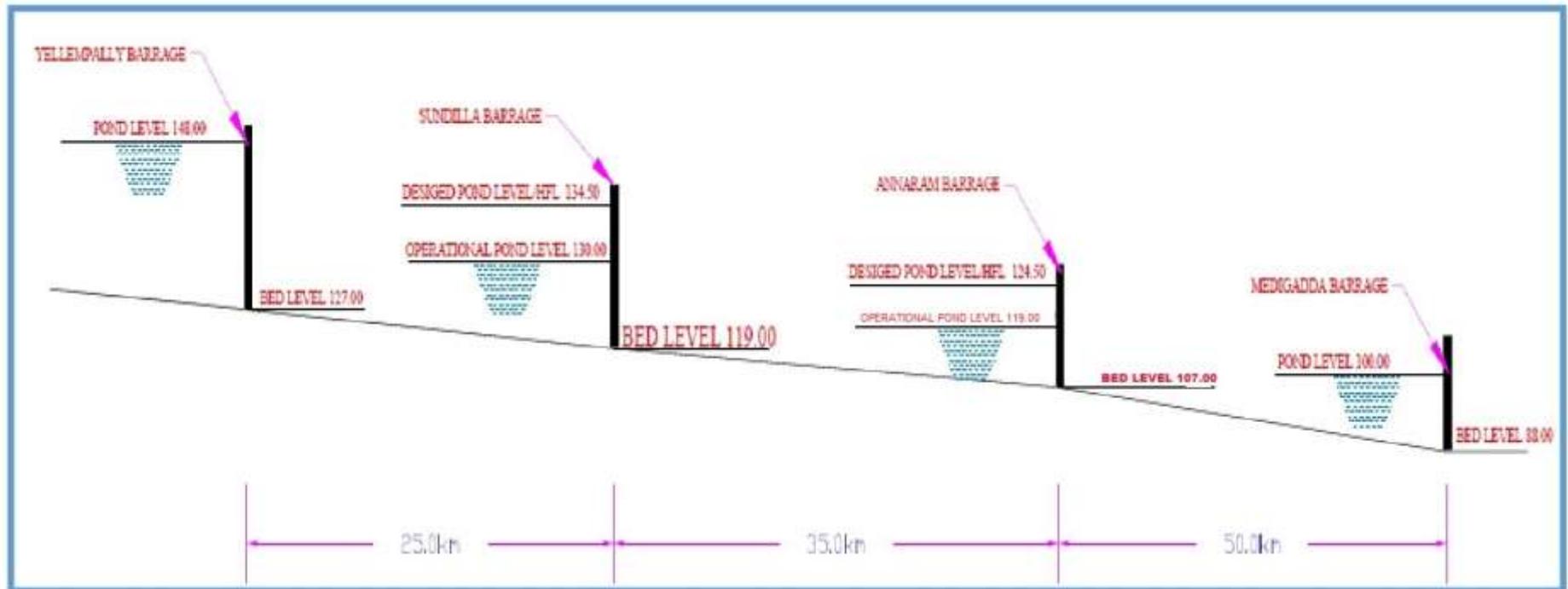


FIGURE -1.5: BED LEVELS & POND LEVELS OF SUNDILLA, ANNARAM AND MEDIGADDA BARRAGES

CHAPTER -2: DE-SILTATION

2.1 Introduction

Siltation process is subjected to several factors including physiography, geology, meteorology, hydrology and flow characteristics of the particular reach along with river. However, it results in loss of reservoir storage thereby reducing its benefits and reduced serviceable life.

2.2 De-siltation at Annaram Barrage & Medigadda Barrage

The length of water spread at full reservoir level is 39-kms for Medigadda Barrage and 31- kms for Annaram Barrage. The width of Godavari at these barrages ranges between 0.75 km to 1.4 km. Annaram barrage is located at 50-km distance on the upstream of Medigadda barrage. The crest level of the barrage bay is fixed at 1 mtr above the river bed level and hence there will be de-siltation in the upstream of the barrage. The thickness of the sand level as per the bore hole data available at many places ranges between 7.5 to 9.5 mtrs. At some places sand dunes have been formed. To make proper shape of the reservoir bed, the de-siltation is taken upto a maximum 3-mts depending on the depth of the sand available to maintain the storage capacity to the reservoir.

In case of Medigadda barrage, out of 39 kms of water spread area the de-siltation is taken upto

28.66 kms of water spread area wherever it is required with an average width of 700 mtrs and upto a maximum of 3 mtr as per the need to maintain the shape and to restore the storage capacity of the reservoir.

At present, no de-siltation activity is going on since both the barrages are at FRL level. The sand available at the stock yards is being disposed.

2.3 De-Siltation Areas

Based on the observations over the past 5 years and considering the accessibility, the de-siltation area is divided into 32 reaches in both the barrages.

De-siltation Areas of Annaram Barrage

The details of de-siltation reaches identified and their distance from the Annaram Barrage are given below in the **Table 2.1** and are identified in **Figure 2.1**

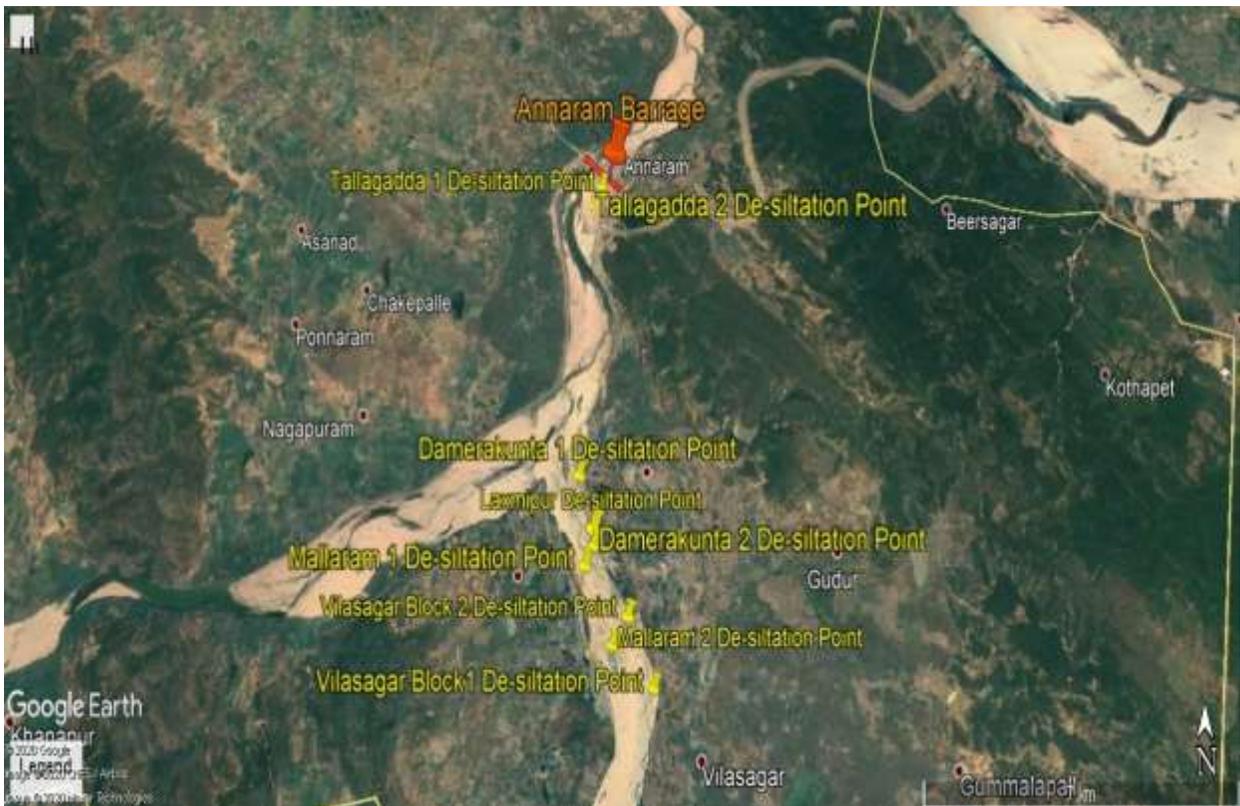
TABLE 2.1: LIST OF DE-SILTATION REACHES IN ANNARAM BARRAGE

Sl. No.	De-siltation Point Name	Location	Area Ha.	Length Mts	Width M	Distance from Barrage in Kms
1	Tallagadda 1*	180 45' 43.25" 790 49' 26.1"	37.50	625	600	0.1
2	Tallagadda 2*	180 45' 16.26" 790 49' 26.29"	37.5	625	600	0.73
3	Damerakunta 1	180 42' 22.62" 790 48' 51.12"	71.225	1925	370	5.8

4	Damerakunta 2	180 41' 30.45" 790 49' 19.88"	90.0	2500	360	7.9
5	Laxmipur	180 41' 33.77" 790 49' 18.5"	26.1	870	300	7.77
6	Vilasagar Block 1	180 40' 8.41" 790 50' 3.18"	14.1	470	300	10.84
7	Vilasagar Block 2	180 41' 4.69" 790 49' 40.01"	50.4	1680	300	8.85
8	Mallaram 1	180 40' 56.76" 790 49' 14.55"	42.5	1250	340	7.6
9	Mallaram 2	180 40' 56.76" 790 49' 14.55"	83.64	2460	340	8.8

* The de-siltation done in these reaches during the construction stage of Barrage

FIGURE 2.1: DE-SILTATION REACHES IN ANNARAM BARRAGE



De-siltation Areas of Medigadda Barrage

The details of de-siltation reaches identified and their distance from the Medigadda Barrage are given below in the **Table. 2.2** are identified in **Figure 2.2**

TABLE 2.2: LIST OF DE-SILTATION REACHES IN MEDIGADDA BARRAGE

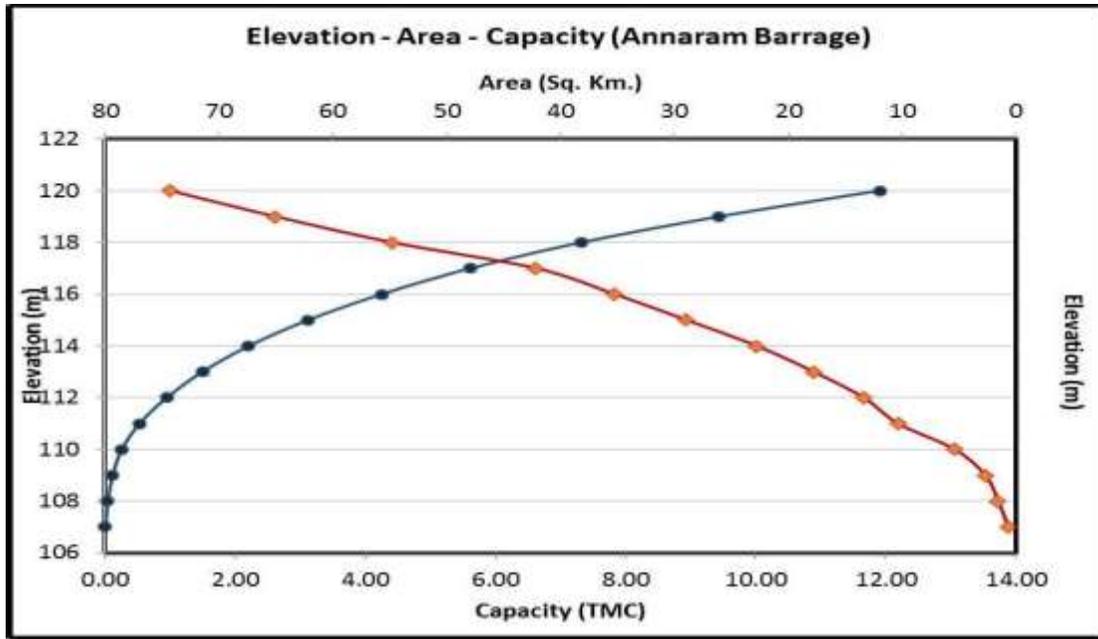
Sl. No.	Name of the Stockyard	Location	Area, Ha.	Length, mts	Width, mts	Distance from Barrage, m
1	Mahadevpur-1	18°45'32.63"N 79°59'32.71"E	58	580	1000	10,146
2	Mahadevpur-2	18°46'5.44"N 79°59'11.96"E	58	580	1000	11,228
3	Mahadevpur-3	18°45'33.09"N 79°58'51.15"E	58	580	1000	11,198
4	Mahadevpur-4	18°45'33.63"N 79°58'10.71"E	58	580	1000	12,228
5	Mahadevpur-5	18°45'33.90"N 79°57'49.98"E	58	580	1000	12,797
6	Mahadevpur-6	18°45'41.75"N 79°57'29.23"E	58	580	1000	13,451
7	Pusukupally-1	18°49'43.39"N 79°53'42.96"E	55.8	930	600	22,948
8	Pusukupally-2	18°49'38.28"N 79°53'10.28"E	55.8	930	600	23,661
9	Pusukupally-3	18°49'49.74"N 79°52'39.49"E	55.8	930	600	24,598
10	Suraram-1	18°43'26.24"N 80° 3'2.23"E	51.9	865	600	2,878
11	Suraram-2	18°43'40.43"N 80° 2'38.39"E	51.9	865	600	3,713
12	Begluru-1	18°43'42.32"N 80° 2'16.45"E	63.0	900	700	4,290
13	Begluru-2	18°44'19.50"N 80° 2'6.69"E	63.0	900	700	5,176
14	Elkeshwaram	18°44'21.38"N 80° 1'24.87"E	80	1000	800	6,205
15	Bommapur-1	18°44'44.13"N 80° 0'55.85"E	72	800	900	7,298
16	Bommapur-2	18°45'17.23"N 80° 0'47.23"E	72	800	900	8,087
17	Brahmanpalli-1	18°45'43.71"N 80° 0'2.13"E	45	500	900	9,643
18	Brahmanpalli-2	18°46'1.38"N 79°59'36.48"E	45	500	900	10,567
19	Kuntlam-1	18°49'58.17"N 79°51'54.01"E	50	1000	500	25,873
20	Kuntlam-2	18°50'25.14"N 79°51'33.15"E	50	1000	500	26,826
21	Kuntlam-3	18°50'59.92"N 79°51'30.43"E	50	1000	500	27,495
22	Palugula-1	18°51'8.93"N 79°51'42.82"E	50	1250	400	27,340
23	Palugula-2	18°51'42.27"N 79°51'12.71"E	50	1250	400	28,661

FIGURE 2.2: DE-SILTATION REACHES IN MEDIGADDA BARRAGE



The Elevation - Area - Capacity Curve for Annaram barrage is given in **Table 2.3** and **Figure-2.3**.

Elevation (m)	Area (Sq. Km)	Capacity (TMC)	Capacity (MCM)
107	0.67	0	0
108	1.55	0.04	1.13
109	2.69	0.11	3.12
110	5.37	0.25	7.08
111	10.35	0.52	14.73
112	13.37	0.94	26.62
113	17.76	1.49	42.2
114	22.77	2.2	62.3
115	28.94	3.12	88.36
116	35.28	4.25	120.36
117	42.18	5.62	159.16
118	54.83	7.32	207.3
119	65.08	9.44	267.34
120	74.36	11.9	337.01



----- Elevation Vs Storage;----- Elevation Vs Area

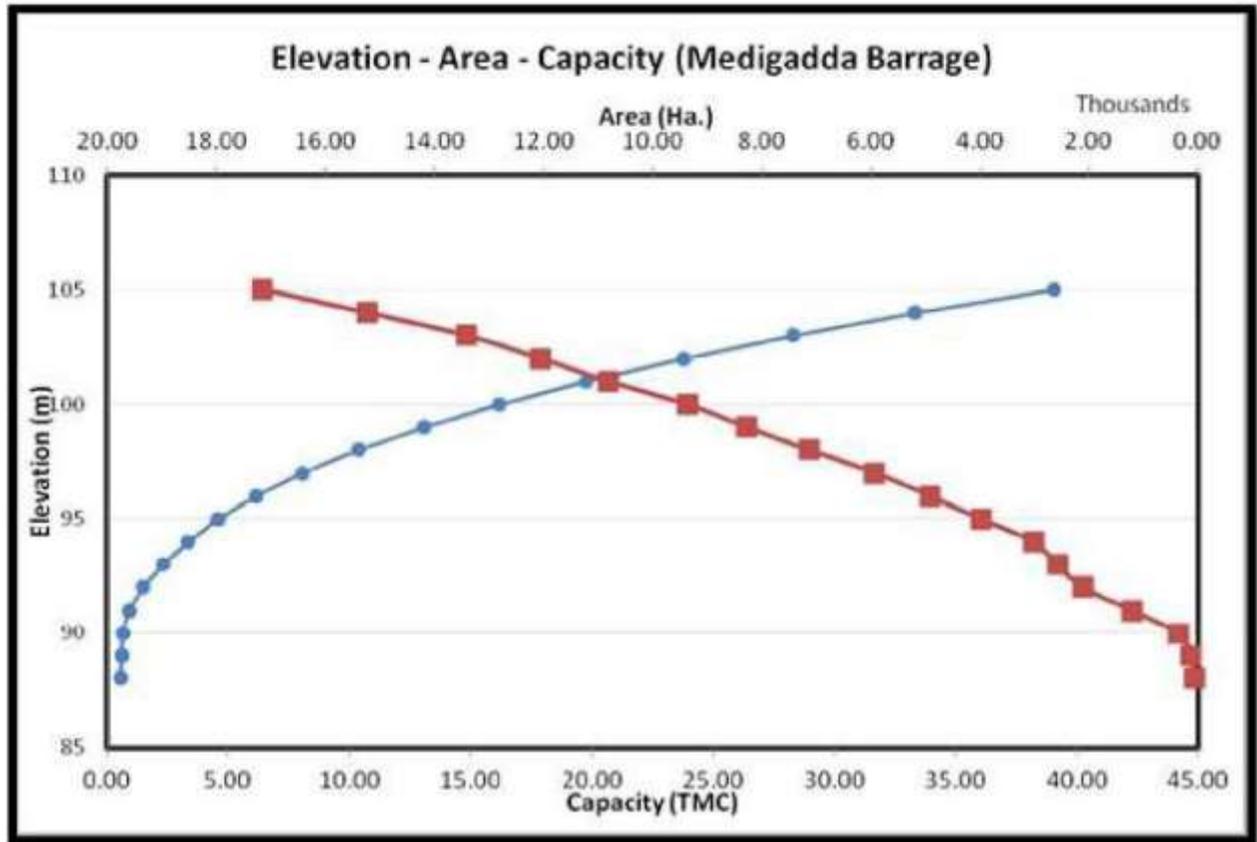
FIGURE -2.3: DESIGNED EVELATION – AREA – CAPACITY CURVE FOR ANNARAM BARRAGE

2.5 Designed Elevation – Area - Capacity Curves of Medigadda Barrage

The Elevation - Area - Capacity Curve for Medigadda barrage is given in **Table 2.4** and **Figure-2.4**.

Elevation (m)	Area (Ha)	Capacity (MCM)	Capacity(TMC)
88	55.78	16.43	0.58
89	123.70	16.71	0.59
90	359.25	18.41	0.65
91	1212.58	25.77	0.91
92	2115.75	42.20	1.49
93	2583.08	65.70	2.32
94	3016.03	93.74	3.31
95	3979.71	128.57	4.54
96	4927.40	173.04	6.11
97	5925.70	227.41	8.03
98	7132.24	292.55	10.33
99	8275.03	369.58	13.05
100	9364.79	457.93	16.17
101	10815.55	558.75	19.73
102	12050.90	673.17	23.77
103	13412.78	800.32	28.26
104	15227.76	943.62	33.32

105	17167.31	1105.61	39.04
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----- Elevation Vs Storage;----- Elevation Vs Area

FIGURE-2.4: DESIGNED EVELATION – AREA – CAPACITY CURVE FOR MEDIGADDABARRAGE

2.5 Estimation of Sediment Deposition in Annaram & Medigadda Barrages

Central Water Commission (CWC) measures sediment load at Mancherial H.O. station on Godavari river and Tekra H.O. location on the Pranhita river, which is a tributary of the Godavari and meet with Godavri river from left side at about 20 km upstream of the Medigadda barrage. Mancherial H.O. is located just downstream of the Yellempally barrage. Location of the these two H.O. stations along with barrages are marked on a Google earth image as shown in Figure 2.5.

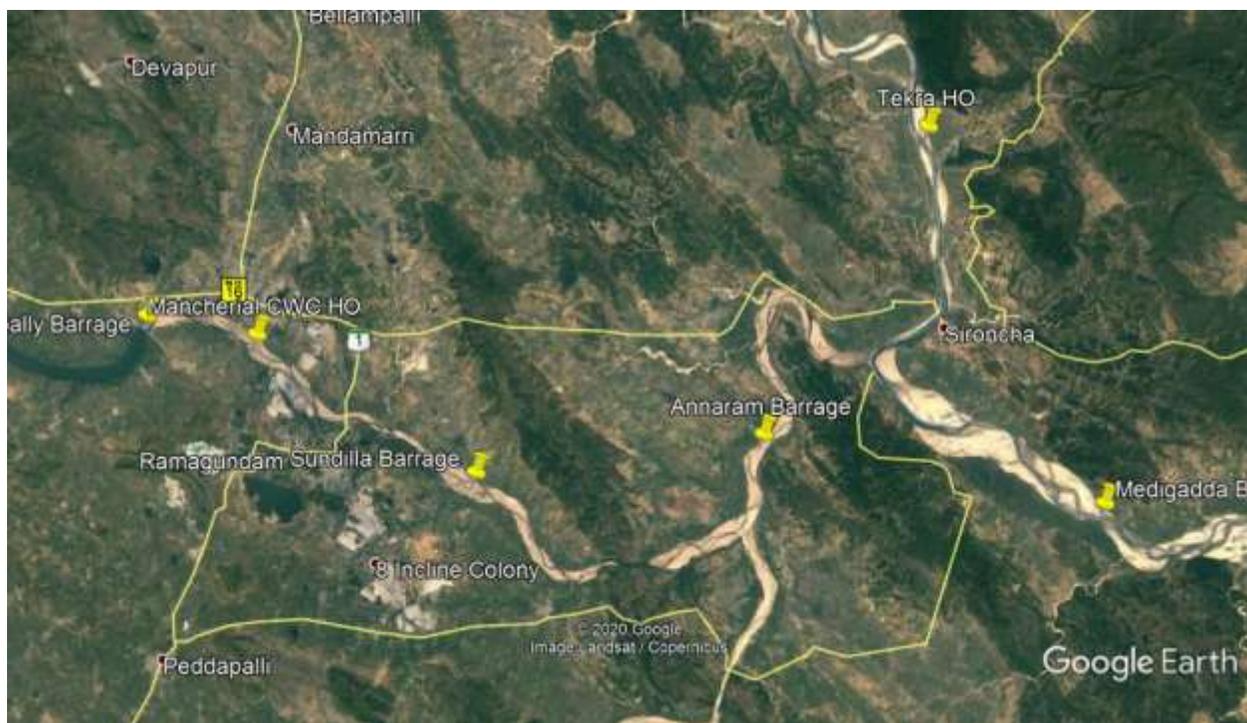


Figure 2.5: Location of the CWC H.O. stations on Godavari river and its tributary

Manair river joins the Godavari river from right side downstream of the Mancherial H.O. station and upstream of the Annaram barrage. Thus sediment inflow in the reservoir of the Annaram barrage is equal to summation of the sediment inflow at Mancherial H.O. station and sediment inflow from the Manair river minus sediment trapped in the Sundilla barrage. Sediment load data for Manair river is not available.

Annual sediment load at Mancherial station for the year 2014 to 2109 is obtained from the Water Year Book (Vol. II) Suspended Sediment Year Book, Godavari Circle, Hyderabad and given in Table 1, which indicates that the total sediment load at Mancherial station in last five year = 18,56,770 m³.

Table 2.5: Sediment Load and Inflow at Mancherial H.O. Station of CWC

Sl. No.	Year	Sediment, MT	Inflow, MCM
1	2014-15	90,676	1,017
2	2015-16	64,964	1,124
3	2016-17	21,31,879	8,081
4	2017-18	10,307	231
5	2018-19	8,02,981	2,071
	TOTAL	31,00,807 MT 18,56,770 m3	12,524
	Total per year	3,71,354.1 m3/yr	2,504.8 MCM/yr

Source: Water Year Book (Vol. II) Suspended Sediment Year Book, Godavari Circle, Hyderabad

Sundilla barrage is constructed between Mancherial HO station and confluence of the Mannair river with Godavari river. As this barrage will trap a part of the sediment load coming from Mancherial, the sediment load downstream of the Sundilla barrage will be lower than the sediment load at Mancherial.

In the absence of the measured sediment load in the Manair river, it may be estimated using empirical equation incorporating the meteorological data, flow data, catchment area and its characteristics etc. The storage capacity of the three dams over the Manair river are given in **Table 2.6**.

Table 2.6: Storage Capacities of Manair Dams

Lower Manair	380.98 MCM
Upper Manair	61.44 MCM
Mid Manair	732.55 MCM
Total	1174.97 MCM

The following empirical equation relating the annual sediment yield with total annual runoff is given in the EIA report of Kaleshwaram Lift Irrigation project

$$Y=7.47*10^{-6}X+3401.28, \quad \text{with } r=0.97 \quad (1)$$

Where: Y= suspended sediment load in tones/year; X=stream flow in m³/year (monsoon flow)

The above equation has been used herein to estimate sediment load in the Manair river. Catchment area of the Manair river is 13,106 sq. km with annual average rain fall of 932 mm. The data was taken from “Discharge Year Book, Vol. I dated December 2018. Table -1, Page ii”.

Considering runoff coefficient = 0.60, the annual runoff from the catchment = 13106 x 10⁶x 0.932/1000000 x 0.60 = 7328.88 MCM per annum.

With total storage of the Lower Manair, Mid Manair and Upper Manair Reservoirs, the annual flow in Manair river at its confluence with Godavari river is estimated as 6153.91 MCM (7328.88 – 1,174.97)

With the flow of 6153.91 MCM, the sediment load is estimated using the above formula as 246828 MT (412203 m³) for 5 years.

The measured sediment load in Pranhita river at Tekra H.O. station for the period 2014 to 2019 are given in **Table 2.7**. The total sediment load in five years comes out to be 22364687.43 m³.

Table 2.7: Sediment Load and Inflow at Tekra Station of CWC

Sl. No.	Year	Sediment, MT	Inflow MCM
1	2014-15	66,05,929	20,833
2	2015-16	1,09,33,161	20,904
3	2016-17	1,06,82,703	32,726
4	2017-18	12,22,599	13,416
5	2018-19	79,04,636	31,842
	Total	3,73,49,028 MT 2,23,64,687.43 m ³	1,19,721 MCM
	Annual	44,72,937 m ³ /yr	23,944.2 MCM/yr

Source: Water Year Book (Vol. II) Suspended Sediment Year Book, Godavari Circle, Hyderabad

Sediment passing downstream through a barrage can be assessed by computing trap efficiency of the reservoir using the following equation of Heinmann (1981)

$$Trap\ efficiency\ TE = 100 \times \left(\frac{K}{0.012 + 1.02K} \right) \quad (2)$$

K = reservoir capacity in m³ /mean annual flow in m³/hour

Annual flow in Godavari river at Mancherial =	2,504.8	MCM/yr
Inflow from Manair river =	6,153.91	MCM/yr
Inflow from Paranhita river =	23,944.2	MCM/yr
Sediment load at Mancherial in Godavari river =	3,71,354.1	m ³ /yr
Sediment inflow from Manair river =	4,12,203.0	m ³ /yr
Sediment inflow from Paranhita river =	44,72,937.0	m ³ /yr
Reservoir capacity of the Sundilla barrage =	8.83	TMC

Reservoir Capacity of the Annaram barrage = 9.44 TMC

Reservoir capacity of the Medigadda barrage = 16.17 TMC

Annual inflow in the Annaram barrage = Flow at Mancheril + Inflow from Manair river - Reservoir capacity of the Sundilla barrage

$$= 2504.8 + 6153.91 - 8.83 \times 10^3 \times 0.3048^3 = 8408.70 \text{ MCM}$$

Annual inflow in the Medigadda barrage = Inflow in Annaram barrage+ Inflow from Paranhita river - Reservoir capacity of the Medigadda barrage

$$= 8408.70 + 23944.2 - 10.37 \times 10^3 \times 0.3048^3 = 32059.25 \text{ MCM}$$

Computation of the sediment deposition in the reservoir of the barrages is carried out in the **Table 2.8**.

Table 2.8: Computation of sediment deposition in the reservoir of the Barrages

Sl. No.	Barrage	Annual Inflow (MCM)	Reservoir capacity (TMC)	Annual Inflow (m ³ /hr)	Reservoir capacity (m ³)	K	TE	Annual inflow of Sediment (m ³)	Annual trapped sediment (m ³)	Annual sediment outflow (m ³)
1	Sundilla	2504.8	8.83	285936.1	250037755	874.5	98.04	371354.1	3,64,067.7	7,286.4
2	Annaram	8408.7	9.44	959894.1	293645699	305.9	98.04	419489.4	4,11,248.3	8,241.1
3	Medigadda	32059.2	16.17	3659729	457883409	125.1	98.03	4481178.1	43,92,899.0	88,279.3
Total trapped sediment in Annaram reservoir in five years, m ³									20,56,241.5	
Total trapped sediment in Medigadda reservoir in five years, m ³									2,19,64,494.0	
Total trapped sediment in Annaram and Medigadda reservoirs, m ³									2,40,20,735.5	
Total desilted sediment, m ³									2,37,61,239.0	

The total silt load deposited in Annaram and Medigadda Barrages in last 5 years is 2,40,20,735.5 m³, which is less than the desilted volume of the sediment from both the reservoirs.

CHAPTER -3: IMPACT ASSESSMENT

3.1 Impact Assessment

The de-siltation can Impact Water Quality, Ground water levels, biological environment. Air quality can be impacted due to transportation of desilted material.

3.2 Transportation Impacts on Road Capacities

The desilted material is being transported using the existing Irrigation Roads and R&B roads only. The roads from the Annaram Barrage and Medigadda barrage are connected to the National High Way 353C connecting Sakoli (MH) to Atmakur (Telangana). The transportation routes from De-siltation reaches to stock yards and to the NH 353 C is shown in the **Figure – 3.1**.

FIGURE – 3.1: DESILTED MATERIAL TRANSPORTATION ROUTE



Medigadda Barrage to NH-353 C via Kudthurupally Road – 13.3 Km

Kuntlam to NH-353 C Road length - 10.4 Km

Annaram to NH-353 C Road length – 24.5 Km

Annaram to Peddapalli Road Length – 72.2 Km

The Irrigation roads, R&B Roads and NH-353C are having 7-m width. The total desilted material to be transported per day on these roads is 33068 Tons. With 30-T trucks, about 1,103 trucks per day are required, approximately 368 trucks and 736 trucks from Annaram Barrage area and Medigadda barrage area respectively. Converting the trucks in Passenger Car Units (PCU), the truck volumes accounts for 3307 PCUs per day.

As per IRC guidelines, a two-lane road (7-m) with earthen shoulders can handle 5,000 Trucks (15,000 PCU/ day). Hence, the road capacity with respect to traffic volumes is much below the IRC guidelines.

3.3 AIR QUALITY

The project area comprises rural environment. Sources of air pollution affecting the region currently are vehicular traffic, dust arising from unpaved village roads and domestic fuel burning. The air environment around project site is free from any significant pollution source. Therefore, ambient air quality is quite good in and around the project area. Vehicles and stationary equipment will impact air quality along the transportation route through emissions from the engines and equipment, fugitive emissions due to material handling, etc. Air quality is likely to be impacted due to the transportation of desilted material to the stockyards. In order to assess the impacts, the ambient air quality data has been examined.

The Ambient Air Quality monitoring as per the NAMP program of CPCB is being monitored throughout the country. Few locations close to the Annaram & Medigadda Barrage areas have been identified and represented in the **Figure -3.2** and AAQ values are given in **Table-3.1**

FIGURE – 3.2: NAMP SAMPLING LOCATIONS



TABLE-3.1: AAQ AT NAMP LOCATIONS

AAQ Parameters	Sl. No.	NAMP Sampling Location	2016	2017	2018	2019	2020	Limits as per NAAQMS
SO ₂	1	Godavarikhani	8.1	7.7	9.4	9.1	7.1	80
	2	DIC Building, Karimnagar	6.5	7.2	8.5	9.0	7.5	
	3	Mandamarri/ Adilabad	4.6	5.2	5.9	5.2	4.8	
NO _x	1	Godavarikhani	28.0	26.0	40.64	54.53	44.18	80
	2	DIC Building, Karimnagar	23.6	26.1	39.3	54.22	45.17	
	3	Mandamarri/ Adilabad	18.4	20.7	23.1	24.8	23.3	
PM ₁₀	1	Godavarikhani	NA	NA	48	NA	NA	100
	2	DIC Building, Karimnagar	NA	NA	46	NA	NA	
	3	Mandamarri/ Adilabad	33	31	32.2	45.1	NA	
PM _{2.5}	1	Godavarikhani	68	75	105.1	106.75	72.5	60
	2	DIC Building, Karimnagar	52	74	98.8	105.16	96.1	
	3	Mandamarri/ Adilabad	65	65	68.95	73.91	72	

All Values are in $\mu\text{g}/\text{m}^3$

NAMP locations mentioned above are far from the de-siltation areas and falling in the coal bearing areas which cannot taken into consideration for measuring the air quality. However, the ambient air quality in de-siltation locations is monitored by TSMDC during November 2019 near Annaram Barrage and Medigadda Barrage de-siltation areas and the AAQ levels are given in **Table-3.2**. The values are meeting the NAAQMS norms indicating no major impacts due to the transportation of desilted material.

To reduce air pollution, TSMDC is sprinkling water on all the roads leading to National Highway and all vehicles are covered with tarpaulin cloth.

TABLE-3.2: AAQ NEAR ANNARAM & MEDIGADDA BARRAGES

Pollutant	Maximum	Minimum	Mean	98 th Percentile
1) Location: Annaram				
PM ₁₀	58.2	51.8	54.62	57.92
PM _{2.5}	25.74	19.80	23.25	25.73
SO ₂	16.3	13.7	15.26	16.25
NO _x	22.1	18.7	20.05	21.69
CO	0.3	0.1	0.23	0.3
2) Location: Gundrathpally				
PM ₁₀	57.8	51.3	54.57	57.71
PM _{2.5}	26.4	20.10	23.46	26.26
SO ₂	16.90	13.5	15.34	16.85
NO _x	21.70	18.1	20.06	21.61
CO	0.4	0.1	0.26	0.4
3) Location: Damerakunta				
PM ₁₀	55.2	48.7	52.88	55.06
PM _{2.5}	24.7	20.7	22.76	24.65
SO ₂	17.8	14.4	15.69	17.57
NO _x	23.5	19.1	20.23	22.44
CO	0.3	0.1	0.18	0.3
4) Location: Mallaram				
PM ₁₀	56.1	47.6	52.31	55.41
PM _{2.5}	25.1	21.3	22.79	24.5
SO ₂	17.8	15.2	16.12	17.66

NO _x	24.1	19.2	20.28	22.77
CO	0.3	0.1	0.21	0.3
5) Location: Vilasagar				
PM ₁₀	54.9	46.2	52.11	54.62
PM _{2.5}	26.1	22.3	23.51	25.64
SO ₂	17.9	14.8	16.34	17.85
NO _x	24.5	19.2	20.7	24.32
CO	0.4	0.1	0.24	0.4
6) Location: Arenda				
PM ₁₀	57.6	50.4	53.15	56.5
PM _{2.5}	25.3	20.4	23.32	25.21
SO ₂	18.4	15.3	16.39	18.17
NO _x	24.5	19.3	20.86	24.32
CO	0.4	0.1	0.25	0.4
7) Location: Venkatapur				
PM ₁₀	58.2	51.3	54.39	57.92
PM _{2.5}	24.9	19.6	23.24	24.85
SO ₂	17.9	15.4	16.41	17.85
NO _x	24.5	19.4	21.29	24.18
CO	0.4	0.2	0.25	0.4
8) Location: Lashmipur				
PM ₁₀	57.1	50.3	54.18	57.01
PM _{2.5}	25.4	20.3	23.33	25.26
SO ₂	17.4	14.5	16.3	17.3
NO _x	23.6	20.1	21.35	23.23
CO	0.4	0.2	0.25	0.35
9) Location: Kannepalli				
PM ₁₀	54.9	46.2	52.11	54.62
PM _{2.5}	26.1	22.3	23.51	25.64
SO ₂	17.9	14.8	16.34	17.85
NO _x	24.5	19.2	20.7	24.32
CO	0.4	0.1	0.24	0.4
10) Location: Kudhurupally				
PM ₁₀	57.9	50.5	53.25	56.05
PM _{2.5}	25.1	20.1	22.21	25.19
SO ₂	18.4	15.4	16.36	18.19
NO _x	23.5	19.3	21.25	23.18
CO	0.4	0.1	0.23	0.4
11) Location: Mahadevapur				
PM ₁₀	57.8	50.4	53.59	56.82
PM _{2.5}	24.9	19.6	23.24	24.85
SO ₂	17.9	15.4	16.41	17.85
NO _x	24.8	19.4	20.59	24.25
CO	0.4	0.2	0.25	0.4
12) Location: Suraram				
PM ₁₀	56.4	51.2	53.22	56.03
PM _{2.5}	24.3	21.3	22.14	21.62
SO ₂	17.5	15.7	16.5	18.2
NO _x	22.9	20.5	21.34	23.22
CO	0.4	0.2	0.25	0.35

3.4 Water Quality– Surface & Ground Water

The water quality of Godavari River is being monitored as part of NWMP Program by CPCB at various location from its origin to its merger with Bay of Bengal. The water quality at selected

locations in the upstream and downstream of Annaram Barrage and Medigadda Barrages is shown in the **Figure– 3.3**. The water quality data before (2016) and after (2017- 2020) the contraction of Barrages and De-siltation activities has been compared in the **Table -3.3**.

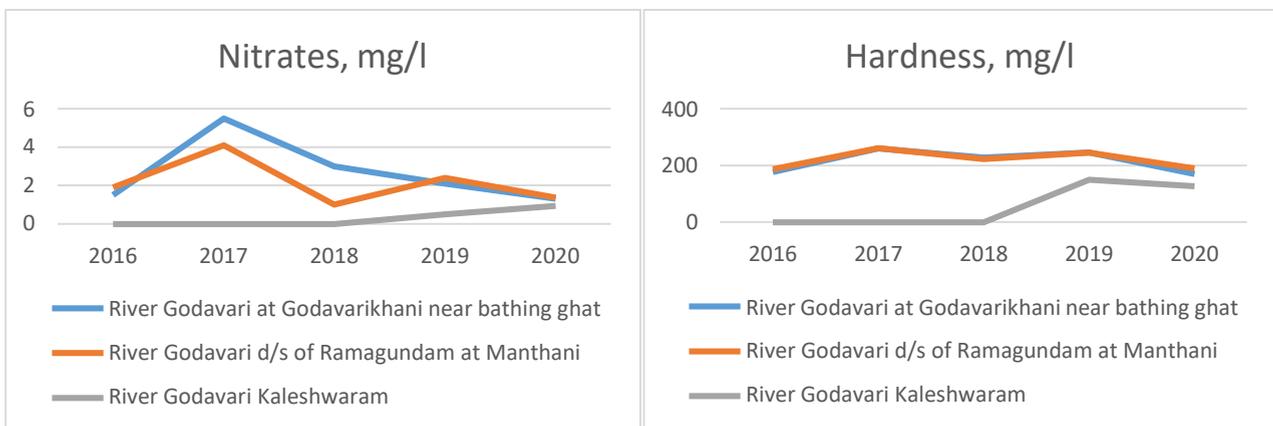
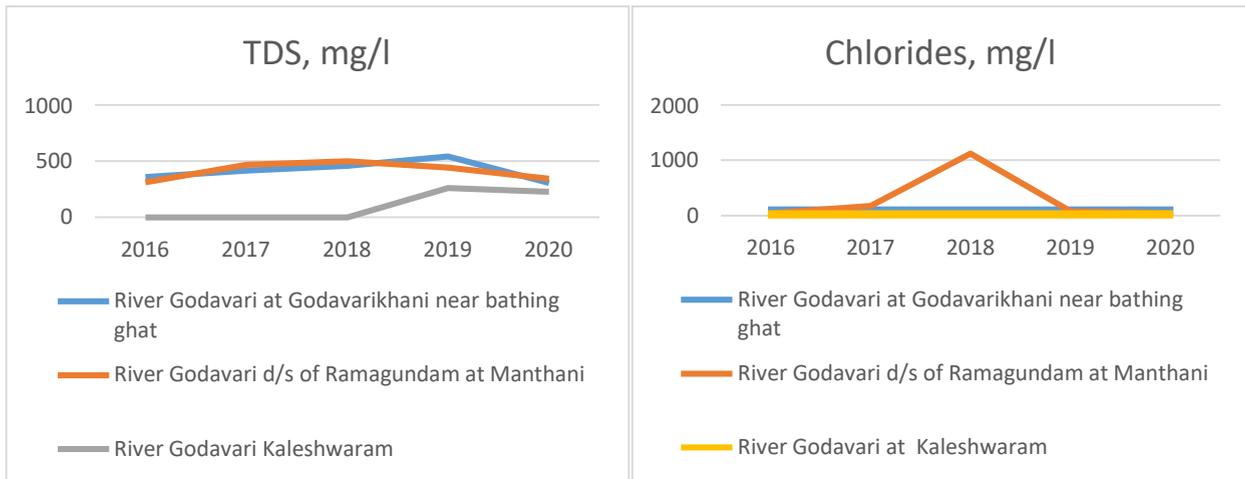


FIGURE – 3.3: NWMP SAMPLING LOCATIONS

TABLE-3.3: NWMP WATER QUALITY

	NWMP Sampling Location	2016	2017	2018	2019	2020	Limits
TDS, mg/L	River Godavari at Godavarikhani near bathing ghat	361	416	458	542	307.6	500
	River Godavari d/s of Ramagundam at Manthani	311	469	499	443	342.2	
	River Godavari Kaleshwaram	NA	NA	NA	262	228.5	
Chlorides, mg/L	River Godavari at Godavarikhani near bathing ghat	47	75	92	112	42.8	250
	River Godavari d/s of Ramagundam at Manthani	43	176	1123	78	50.1	
	River Godavari Kaleshwaram	NA	NA	NA	41	33.11	
Nitrates, mg/L	River Godavari at Godavarikhani near bathing ghat	1.5	5.5	3	2.1	1.308	45
	River Godavari d/s of Ramagundam at Manthani	1.9	4.1	1	2.4	1.372	
	River Godavari Kaleshwaram	NA	NA	NA	0.5	0.94	
Hardness, mg/L	River Godavari at Godavarikhani near bathing ghat	177	260	228	246	170.6	300
	River Godavari d/s of Ramagundam at Manthani	187	261	223	245	190.3	
	River Godavari Kaleshwaram	NA	NA	NA	150	127.3	

Limits as per IS:10500-2012



It was found that the water quality is meeting the limits prescribed by IS:10500 – 2012. The river water quality was at downstream of Annaram & Medigadda Barrages is matching with the water quality in the upstream which indicates that there is no impact of De-siltation on river water quality.

Ground Water

The data pertaining to ground water levels and ground water quality has been collected and enclosed as **Table -3.4, Table-3.5** and **Table-3.6**. The location of bore wells is shown in **Figure-3.4**. The ground water table data has shown depletion trend owing to increase in no. of crops, which necessitated the drawl of ground water due the less than normal rainfall in the years 2015 to 2019. The ground water withdrawal has been supported by increased consumption due to increased crop production since 2014-15 to 2019 – 20. However, all the mandals in Jayashankar Bhupalapally district falls in safe category.

One of the major objectives of the project is to restore the ground water level to its original state by the way of shifting from usage of groundwater for irrigation to conjunctive use of surface and groundwater for the same.



FIGURE – 3.4: LOCATIONS OF BOREWELLS MONITORED BY STATE GROUND WATER DEPARTMENT



FIGURE – 3.5: LOCATIONS OF SAND REACHES IN THE JAYASHANKARA BHUPALAPALLI DISTRICT

Ground Water Levels in Javashankar Bhupalapally District, Telangana

TABLE - 3.4: PRE-MONSOON GROUND WATER LEVELS

Sl. No.	Mandal	Village	Long_GIS	Lat_GIS	Apr-15	May-15	Apr-16	May-16	Apr-17	May-17	Apr-18	May-18	Apr-19	May-19	Apr-20	May-20
1	Mahadevpur	Ambatipalli	80.0619	18.6957	17.38	17.43	19.00	19.30	20.65	20.68	23.07	22.53	24.14	23.72	24.43	24.23
2	Mahadevpur	Annaram	79.8431	18.7624	12.9	13.05	15.00	15.25	22.45	19.98	33.26	27.72	35.75	32.38	16.32	15.12
3	Mahadevpur	Kaleswaram	79.9054	18.8031	10.84	10.8	12.98	10.79	13.6	12.23	16.94	14.61	15.77	14.13	14.98	12.42
4	Mahadevpur	Mahadevpur -125D	79.9800	18.7300	N/A	15.4	13.01	14.12	14.32							
5	Mahadevpur	Mahadevpur 199D	79.9800	18.7300	N/A	13.44	12.35	13.46	12.41							
6	Mahadevpur	Mahadevpur 75NC	79.9819	18.7206	12.7	13.25	13.94	14.10	14.03	14.47	16.35	16.54	15.88	12.12	14.11	15.16

TABLE - 3.5: POST-MONSOON WATER LEVELS

Sl. No.	Mandal	Village	Long_GIS	Lat_GIS	Oct-15	Nov-15	Oct-16	Nov-16	Oct-17	Nov-17	Oct-18	Nov-18	Oct-19	Nov-19
1	Mahadevpur	Ambatipalli	80.0619	18.6957	17.69	11	18.42	18.72	21.01	20.75	20.95	21.57	20.98	21.32
2	Mahadevpur	Annaram	79.8431	18.7624	N/A	10.75	11.95	13.34	23.09	24.1	23.23	23.94	21.41	18.76
3	Mahadevpur	Kaleswaram	79.9054	18.8031	N/A	10.7	10.21	10.3	15.03	13.48	15.33	14.76	11.65	10.54
4	Mahadevpur	Mahadevpur -125D	79.9800	18.7300	N/A	N/A	N/A	N/A	N/A	N/A	11.17	11.78	10.75	12.64
5	Mahadevpur	Mahadevpur 199D	79.9800	18.7300	N/A	N/A	N/A	N/A	N/A	N/A	10.54	10.89	10.30	10.44
6	Mahadevpur	Mahadevpur 75NC	79.9819	18.7206	11.55	12.55	12.15	12.06	14.08	14.35	13.41	13.52	12.90	11.56

Water level in meters below ground level (m bgl)

N/A* =Data not available

Source: Ground Water Department, GoTS.

GROUND WATER DEPARTMENT. GOVERNMENT OF TELANGANA

Ground Water Quality in Jayashankar Bhupalapally District, Telangana

TABLE - 3.6: WATER QUALITY DATA – TOTAL DISSOLVED SOLIDS (TDS) IN mg/l

Sl. No.	Village	Mandal	Lat_GIS	Long_GIS	PM 2013	PoM 2013	PM 2014	PoM 2014	PM 2015	PoM 2015	PM 2016	PoM 2016	PM 2017	PoM 2017	PM 2018	PoM 2018	PM 2019	PoM 2019
1	Ambatipalli	Mahadevpur	18.696	80.062	481	289	411	352	184	218	N/A	N/A	260	264.96	134	236	131	346
2	Annaram	Mahadevpur	18.762	79.843	394	582	854	911	744	815	375	618	432	270.08	576	588	696	577
3	Kaleswaram	Mahadevpur	18.803	79.905	302	198	129	307	218	237	N/A	296	257	186.88	125	242	205	104
4	Mahadevpur II	Mahadevpur	18.721	79.982	108	N/A	196	151	145	N/A	N/A	171	122	226.56	95	240	104	112

N/A =Data not available

3.5 FLORA & FAUNA

3.5.1 Flora of Area

Most of the region of Annaram and Medigadda is dry and mesophytic conditions. Vegetation is limited to river side, pond side and roadside apart from reserved forests.

Core zone: The project site is near Godavari River, aquatic ecosystem with few common shrubs and herbs.. There are no REET species present in the core zone. No migratory corridors or breeding grounds for faunal species present here.

The most commonly seen shrubs are *Calotropis procera* and *Zizyphus jujube* and herbs are common grass species grown naturally. Apart from that few weeds are commonly seen at few places are *Euphorbia hirta*, *Aerva lanata*, *Croton bonplianum* and *Parthenium hysterophorus*. The faunal composition generally with aves and fish fauna. In aves, Mynas, Sparrows, Bar headed Goose, Swifts are seen. A detailed list of shrubs, herbs and ornamental plants present in the Core zone is mentioned in Annexure.

Buffer zone is mostly with human habitations and few Reserve Forests. The common species found at roadside and village wood land are given. Buffer area is mainly village woodland. Some part of the buffer area is under reserve forest. This area is having good number of tree species having mesophytic adaptation. Most of the region is plain with red soil. Hence vegetative survey mainly conducted on Trees. The floral quantification has been done in the reserve forest areas where quadrat method has been adopted. There are no endangered and endemic plants present in the buffer and core zones. There are few medicinal, timber / fuel wood, fodder and other socio-economic purposes. The faunal composition was also estimated.

Based on the direct and indirect evidences. *Lannea coromandelica*, *Soymida febrifuga*, *Xylia xylocarpa*, *Syzygium cumini*, *Phoenix sylvestris*, *Dalbergia sissoo*, *Prosopis juliflora*, *Tectona grandis*, *Mangifera indica*, *Terminalia alata*, *Lantana camara*, *Saraca asoca*, *Strychnos nux vomica*, *Gmelina asiatica*, *Hardwickia binata*, *Azadirachta indica*, *Leucaena leucocephala*, *Morinda tinctoria* and *Holarrhena antidysenterica* are commonly seen in the reserve forested area. *Albizia procera*, *Albizia lebeck*, *Delonix regia*, *Azadirachta indica*, *Peltoforum sp.*, *Terminalia catapa*, *Psidium guava*, *Dalbergia sissoo* and *Tamarindus indica* are predominant near villages. A detailed list of plantations, floral and faunal species present in the buffer zone. Aquatic ecosystem, the study area comprises of few small and medium sized tanks. These ponds provide the suitable habitat for fresh water aquatic and semi aquatic plants. *Hydrilla*, *Ipomoea aquatic*, *Lemna minor*, *Limnophila heterophylla*, *Marsilea quadrifolia*, *Neptunia oleracea* *Operculina turpethum*, *Neptunia oleracea*, *Typha angustata* are most common in the study area.

There were no REET category species of aquatic and semi aquatic plants in the study area.

Table - 3.7: Biodiversity indices values of the sampling sites in buffer zone

Dominance D	0.056
Shannon H	2.912
Simpson 1-D	0.944
Evenness e ^{H/S}	0.976
A/F value	0.045

3.5.2 Distribution pattern (A/F ratio)

The ratio between abundance and frequency was used to interpret the distribution pattern of species (Whitford, 1949). Distribution pattern of species in the study area is identified as random distribution as the value of A/F ratio is **0.045**.

This random distribution of species is mainly due to various ecosystems present in the buffer zone. The Shannon indices value of study area is **2.912** indicates **Good diversity** (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). Population size and Dominance of the species is **6%** and Evenness is around **98%** (Indicates the species are evenly distributed in core and buffer zones). This might be due to contiguous patches of Eucalyptus and Subabul species and natural species such Azadirachta indica, Phoenix, Prosopis juliflora (near the villages), Peltophorum pterocarpum and Delonix regia (near roadside). The present study indicates A<B<C>D>E in frequency classification and as per the Raunkiaer's law of frequency, classification indicates that species diversity is distributed maximum for 40 to 60%. This result indicates that all most all plants frequency is more or less equal due to some of the plant species such as Xylia xylocarpa, Syzygium cumini, Phoenix sylvestris, Dalbergia sissoo, Prosopis juliflora, Tectona grandis, Mangifera indica, Terminalia alata and Lantana camara are **frequently found** floral species throughout the region.

3.5.3 Fauna within the Core and buffer zones:

Throughout the study area, there no direct evidence of wild animal species observed. From the secondary source (local people near villages) it is also revealed that presence of common snakes exists here. Common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaverbirds, Mynas, Black drangos, Crows, Sparrows are sighted here.

3.5.4 Endemic, Threatened and Endangered Species

From the present survey it appears that none of the terrestrial species are under endangered and threatened species, and not listed in the Schedule I o the Indian Wildlife (Protection) Act, 1972 as amended in 1991.

3.5.5 Terrestrial fauna of the Core area and the Buffer zone

As the animals, especially vertebrates move from place to place in search of food, shelter,

mate or other biological needs, separate lists for core and buffer areas are not feasible. However, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are few reserve forest blocks in the buffer zone, they are in the form of small and isolated patches. As these forest blocks are surrounded by villages on all sides, they are subject to biotic pressures of grazing and cutting. As such, there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area. There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere Reserve or Elephant Corridor or other protected areas within 10 km radius from core area. It is evident from the available records, reports and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows.

The Mammalian species directly sighted or recorded during field survey and also from literature review are Nilgai, Leopard, Little Indian Field mouse, Wild Boar, House Mouse, Indian Palm Squirrel, Golden Jackal, Spotted Deer, Indian Fox .

The Avian Species includes Common Crow, House sparrow, common Myna, Jungle crow, Common Wood Shrike, Bulbul, Jangle Babbler, Indian Robin, Spotted munia etc.

Reptiles like Indian Rock Python, checkered keel back, Green vine snake, Indian Rat Snake, Eastern Russells viber, Spectacled cobra, Garden Liaazard, Amphibians like Fergusons toad, Indian green frog, Ant Frog, Narrow-mouthed frog, Indian bull frog etc, are present in core and buffer area.

It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act

3.5.6 Damage of Flora Fauna due to de-siltation:

The data of flora and faunal species before de-siltation process started along with the construction of barrages of Medigadda and Annaram and after the construction of barrages are comparable and no damage is observed. The de-siltation occurred in the riverbed of Godavari, where large sand and silt is exposed and with a varying depths of 8 meters and above. Except few shrubs, no natural habitation is removed. The stock yard areas of de-silted material are nearer to de-siltation reaches and are primarily agricultural lands. Total extent of 168.06 acres and 863.113 acres of patta lands were taken for stockyards in Annaram area and Medigadda area respectively from farmers on lease basis.

The tree density estimated in the area is 10 trees per hectare, which is commonly observed in the area.

Desilted material is stocked in the stock yard lands without cutting any existing trees. Since already laid roads are used, no tree are cut for laying the roads. Within the stock

yards, no specific road is laid. Vehicles will move without causing any damage to the trees. However, TSMDC has planted nearly 200 saplings in each stock yard at periphery.

3.6 CROP YIELD

Impact of transportation of desilted material is another area of concern due to its effect on the surrounding agricultural lands. The crop yield data has been collected from Directorate of Economics & Statistics. The data has been compiled for the years 2014-15 to 2019-20 for the entire district. The data clearly indicating that the crop yield was not only increasing but also the area of crops have increased over the years.

This is clear indication that the transportation of desilted material is having no major impacts on crops and agriculture lands.

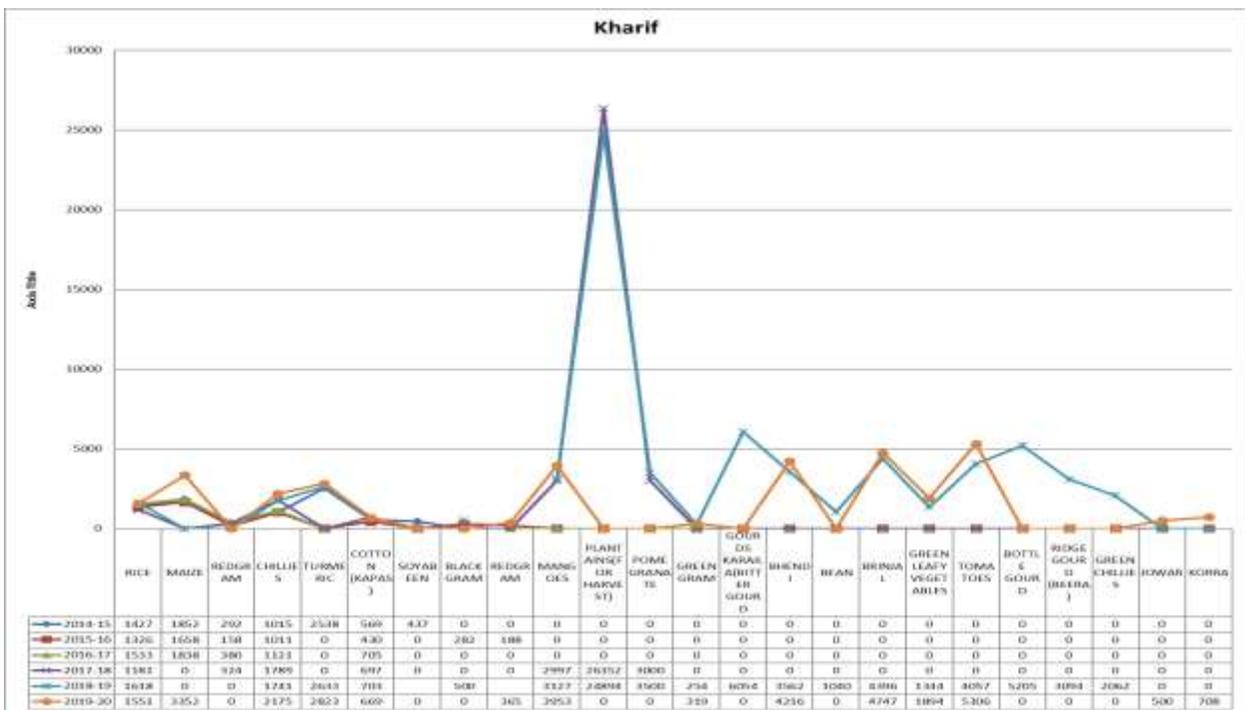


Figure-3.6a: Crop-wise Yield of Manthani from 2014-15 to 2019-20 (Kharif)

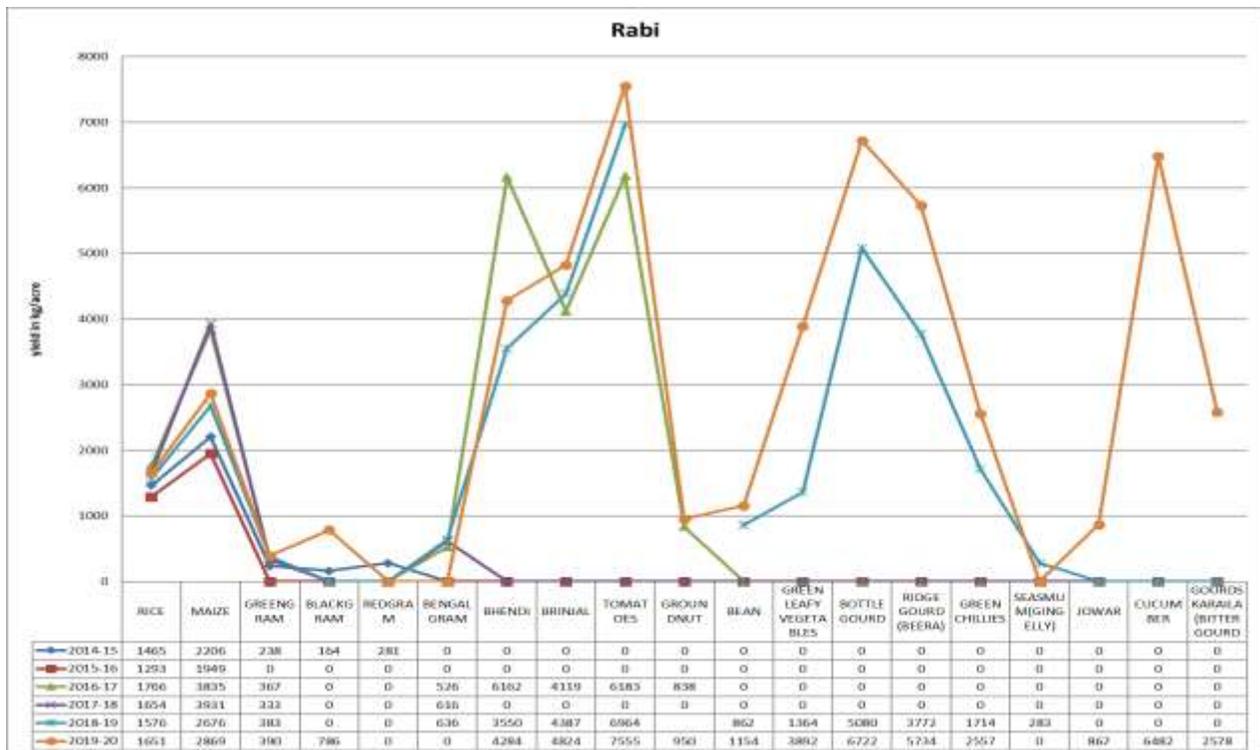


Figure-3.6b: Crop-wise Yield of Manthani from 2014-15 to 2019-20 (Rabi)

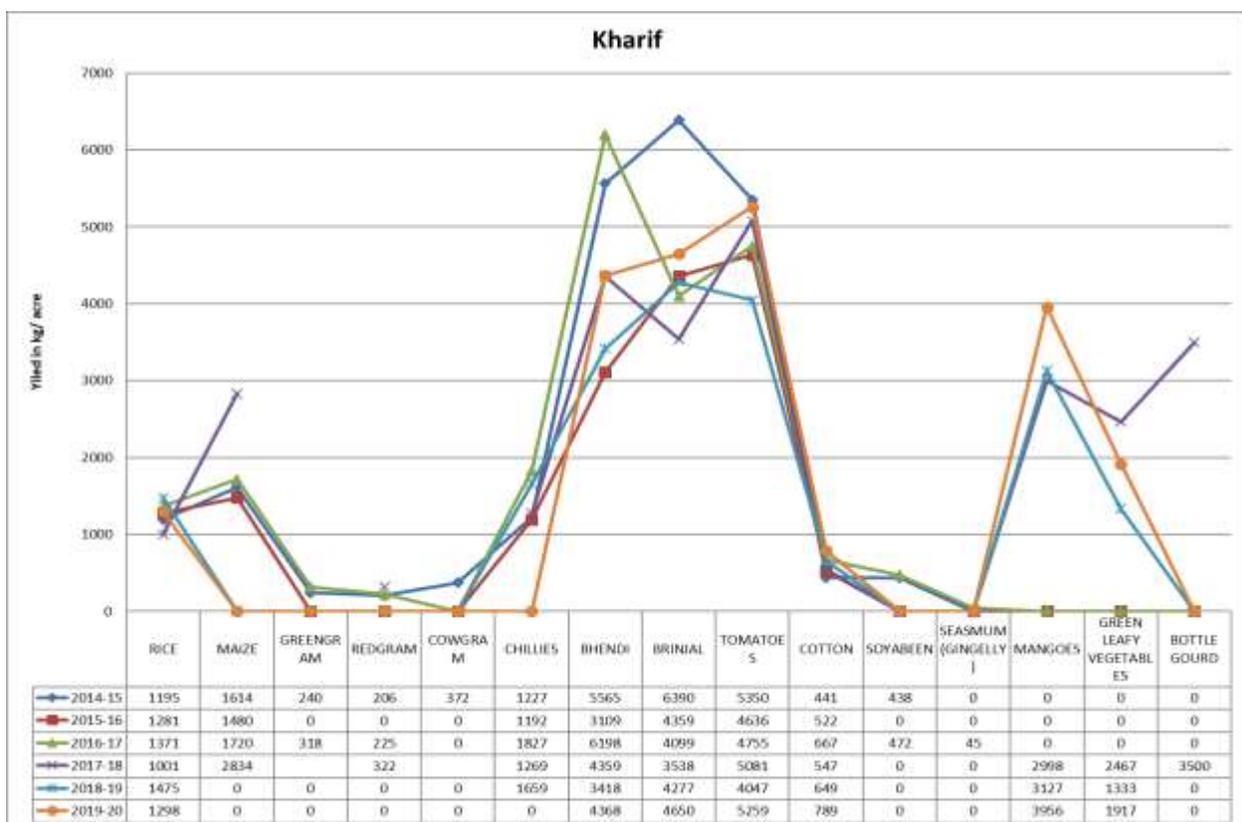


Figure-3.7a: Crop-wise Yield of Kattaram from 2014-15 to 2019-20 (Kharif)

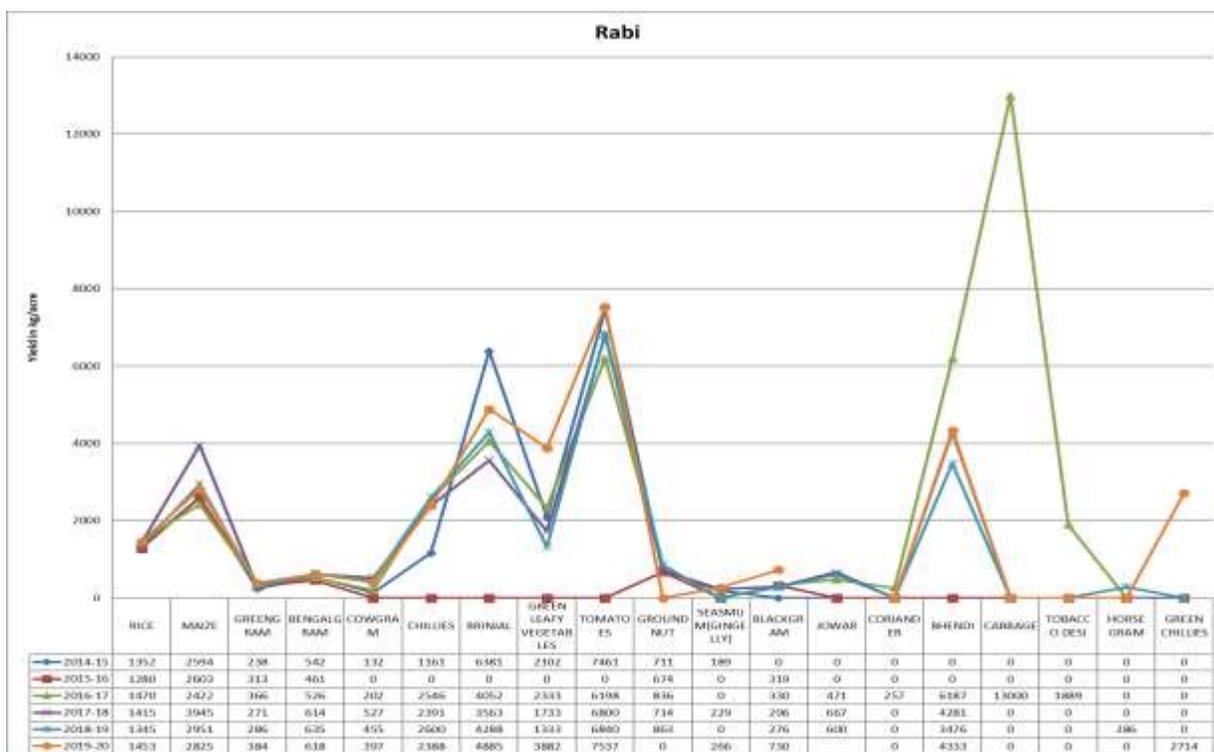


Figure-3.7b: Crop-wise Yield of Kattaram from 2014-15 to 2019-20 (Rabi)

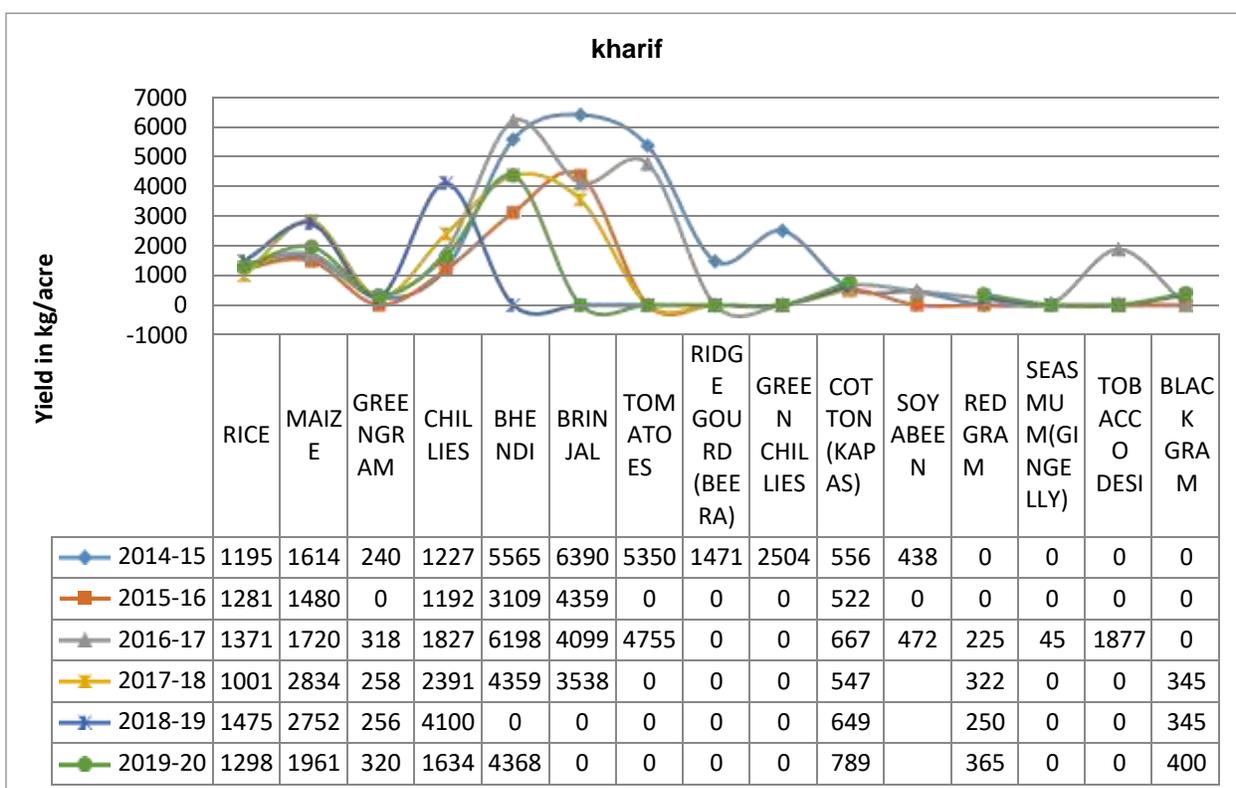


Figure-3.8a: Crop-wise Yield of Mahadevpur from 2014-15 to 2019-20 (Kharif)

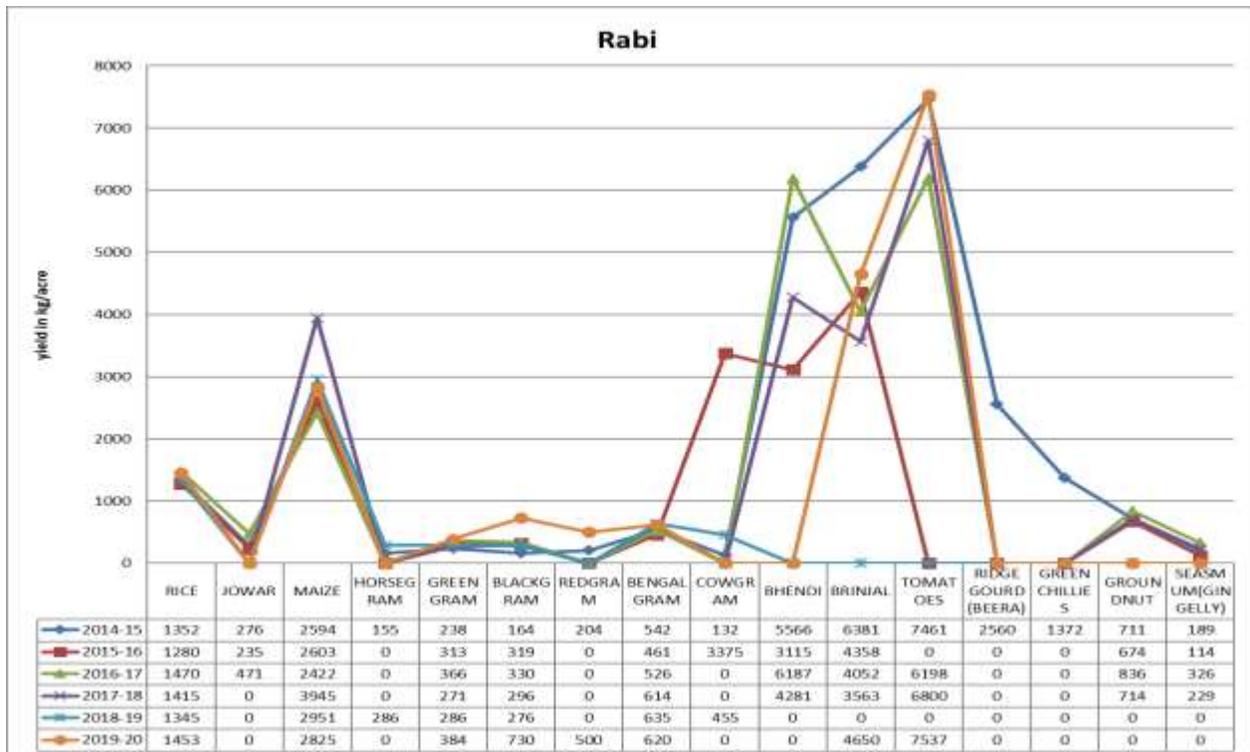


Figure-3.8b: Crop-wise Yield of Mahadevpur from 2014-15 to 2019-20 (Rabi)

3.7 Fisheries Conservation and Management Plan

A water resources project may have adverse or beneficial effects on the fish fauna, depending upon the particular situation and the fish fauna inhabiting the concerned river. Similarly it has various impacts on the people, the livelihood of which depends on the fish. The construction of the dam leads the fragmentation of habitat, modification in hydrologic regime and may have adverse effects on the indigenous and migratory fish.

3.7.1 Fishery Resources of Jayashankar Bhupalapally District

Jayashankar Bhupalapally District is having 524 Fish rearing tanks with waterspread of 16,115 Hectares. There are 103 fishermen co-operative societies and 7711 Fishermen are members of these societies. With construction of Medigadda and Annaram Barrages, the fishery resources improved substantially. Government of Telangana accorded top priority for development of inland fisheries with implementation of Kaleshwaram Project with large impounding of water in Godavari River stretches.

Table-3.8: Fish & Prawn Production of District from 2011-12 to 2018-19 in Tons

Year	2011-12	2012- 13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Production in Tons	4,410	4, 503	6,002	7,699	6,415	7143	7465	7890

Source : Statistical Year Books of Directorate of Economics and Statistics

As can be seen, there is steady growth of Fish production in the District. There are no incidents of fish kills reported in the District either before or after the De-siltation in Annaram and Medigadda barrages.

3.8 SOCIO-ECONOMIC IMPACTS

Most of the desilted material is sand and is being used for construction of Irrigation projects, Mission Bhagiratha Project meant for providing drinking water, Weaker Section Housing Program and also for providing infrastructure project and buildings leading to overall development of the state.

With the Kaleshwaram Project barrage in place water is impounded in Godavari river for about 150 kms and even during the lean period water is available in this area which is helping lot of fish culture development. Lot of Fishermen Cooperative Societies are getting benefitted. Further, ground water level also increased in spite of increase in the area irrigated. With the increased levels of groundwater, the power consumption is reduced due to less load on the electric motors pumping the water.

Lot of direct and indirect employment was provided to locals by way of stockyard incharges and traffic volunteers.

Lot of people are getting indirect employment by way of establishing eateries and other public utility stores. Near the sand reaches and the stock yards, locals have set up the canteens/ hotels which are providing secondary employment to at least 200 extended families earning a sizable income to look after lively hood for their families.

The eligible working people in about 40 villages which are around these stockyards are getting huge income @ Rs.500 per truck by way of spreading or covering the tarpaulin on the sand lorries.

70,45,01,000-00 INR is the amount earned by locals in surrounding 40 villages during April 2016-Sep 2020 due to de-siltation and transportation activities of TSMDC.

For Dust Suppression, 10 tractor mounted water sprinklers are engaged by TSMDC. Each of the tractor is being paid Rs. 52,000/- per month.

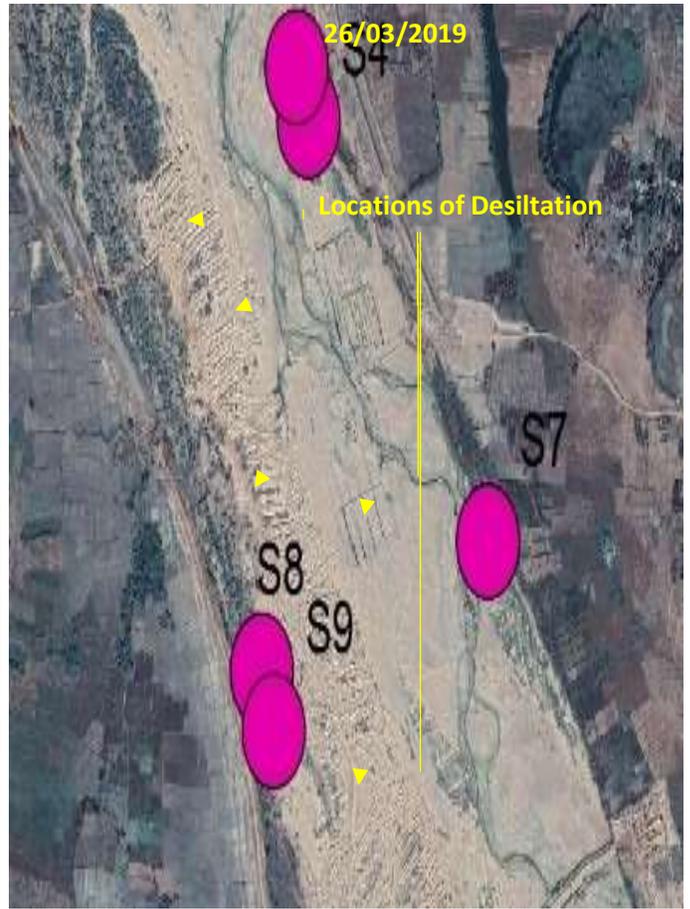
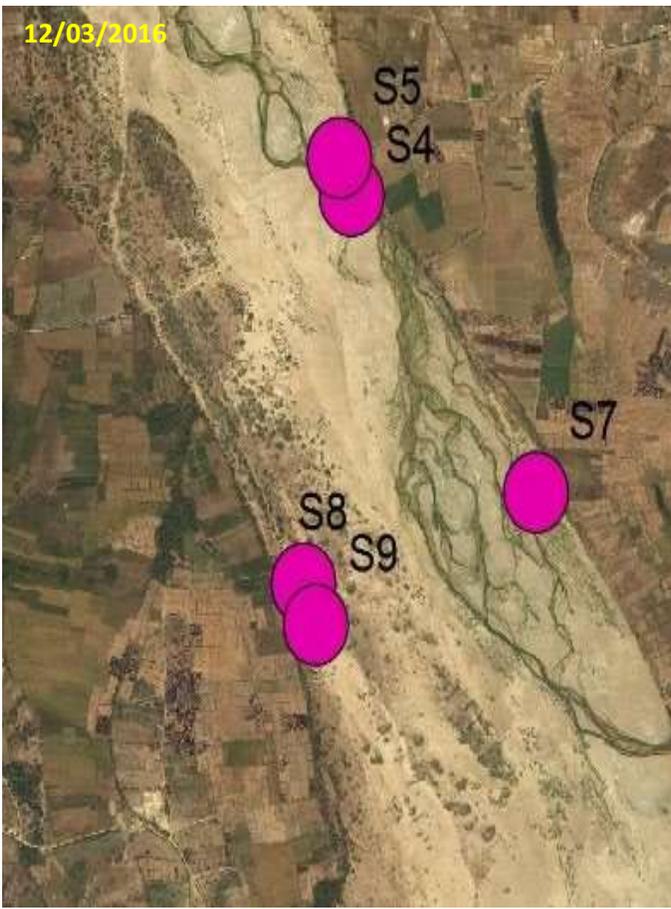
3.9 SATELLITE IMAGES

The high-resolution Google maps of the river stretch indicates the De-siltation activities after 2016 and the De-siltation did not change the river course as well as width of the river as indicated by the below **Figure – 3.9** and **Figure-3.10**

FIGURE-3.9: HIGH RESOLUTION GOOGLE MAPS OF MEDIGADDA BARRAGE



FIGURE-3.10: HIGH RESOLUTION GOOGLE MAPS OF ANNARAM BARRAGE



CHAPTER -4 ENVIRONMENTAL MANAGEMENT PLAN

It is always advisable to restrict the sediments flow in to the reservoirs by taking bank protection measures, habitat management measures and watershed management measures. However, De-silting will be necessary to some extent for improving the capacity of reservoirs and reduce the harm to pumping equipment in case of lift irrigation schemes.

De-silting, if done indiscriminately, can cause severe impacts on ecology, environment and ground water resources of the area.

Following **Table-4.1** summarizes the impacts identified of de-silting of sand from Annaram and Medigadda Reservoirs and remedial measures

Table – 4.1: Impacts of De-silting and Remedial Measures

Activity	Environmental Impacts	Impacts due to Desilting at Annaram & Medigadda Barrage	Remedial measures
De-silting process	Depletion of ground water if excess sand is de-silted from the river beds	Not likely	The de-siltation points are in the Mahadevapur and Kataram Mandals in Jayashankar Bhupalapally District and Manthani Mandal of Peddapalli District. All three mandals are safe in terms of ground water extraction. The Depth of de-siltation will be between 2 to 3 meters in different stretches depending on sand and silt deposition
	Loss of aquatic species, if de-silting is done during monsoon season	De-silting is proposed done during lean period of flow in the river Also only exposed silt portions will be taken out. Hence loss of aquatic species is not possible	Period of de-silting will be during lean period of water flow in the river
	Fall of animals in the de-silted stretches in the river bed during cross over	There is possibility of this impact in sand reaches	It suggested to provide barricading of de-siltation area in the reservoir bed to restrict movement of Animals
	Bed erosion due to excessive depth of de-silting	There is possibility of this impact	It is suggested to restrict the depth of sand proposed to be de-silted as per the need to maintain the shape of the reservoir bed. However, the depth of de-siltation shall not be more than 3 mts.

			<p>1) Augar sampling of bed will be taken up before arriving at the depth of de-siltation and same will be notified to supervisory staff.</p> <p>2) Photographs of the area to be desilted before and after the de-siltation shall be maintained</p> <p>3) Satellite images shall be taken for the de-siltation areas and processed images shall be preserved</p>
	Erosion of River bunds during transportation of sand from river bed to stock points	There is possibility of this impact	Protection of river bunds have been done by constructing guide walls up to 1.5 Km upstream of the barrages and flood banks have been constructed from 1.5 Km to 8.85 Km on right side and 11 Km on left side of Annaram Barrage. For Medigadda Barrage flood banks have been constructed from 1.5 Km to 6.3 Km.
	Loss of tree cover on bunds and in stock yards	There is possibility of this impact	Plantations on the bunds and stock yards shall be taken up by TSMDC
	Disturbance to avions due to noise from the machines	There is possibility of this impact	Regular maintenance of vehicles shall be taken up to avoid excessive noise from dredge equipment
Storage of de-silted material	Loss of agricultural output due to use of patta lands for stock yards	There is possibility	The total extent of Patta land proposed to be used for stocking the sand is 168.06 acres in Annaram Barrage de-siltation area and 863.113 acres in case of Medigadda Barrage area. Adequate lease amounts are fixed with Farmers to compensate their crop loss
	Air borne emissions from the storage area	There is possibility of this impact	To avoid air borne emissions from stockyard, it is suggested to provide enclosures all round the stockyard. If material is dry, then sprinkling of water shall be done
	Turbid seep water from wet material dredged joining nearby irrigation fields	There is possibility of this impact	Provide traps in the stockyard to collect any seepage water and use it for plantation purpose.
	Resource loss if silts and clay material is not used	There is possibility of this impact	Silt and clay is not likely to be generated as studies indicates only coarse and fine sand. However if any silt/clay layer comes, same shall be stored separately and will be send to farmers, as it will have good fertile value for agriculture
Transport of sand from stock points to user end	Air borne emissions from Hauling road from river bed to stock point and from stock point to other distribution points	There is possibility of this impact	Continuous water sprinkling shall be done on all hauling roads during transportation of sand
	Vehicular emissions from Transport vehicles	There is possibility of this impact	PUC certificates for all trucks and other vehicles shall be maintained

	Air borne emissions of dry sand transported through trucks	There is possibility of this impact	IN case of dry sand transport in trucks, tarpaulin shall be used to avoid in convenience to other road users
Generation of waste due to presence of work force and transport equipment for de-silting	Disposal of Domestic waste water from	There is possibility of this impact	Temporary toilets maintained in stock yards
	temporary toilets near stock yards		shall be provided with Septic tanks with soak pits
	Waste oil from Vehicles	There is possibility of this impact	Waste oils from transport vehicles shall be send to authorized recyclers

4.1 AIR/ ROAD IMPROVEMENTS DONE BY TSMDC

Mitigation Measures being undertaken

- Sprinkling of water through water tankers
- Route specification to divide the vehicular traffic while issuing sand order
- Maintaining timings/no clash timings for transport vehicle moment to reduce Dust/Air/ Sound Pollution
- Hardening the surface for vehicle moment in the stockyard/ reach to stockyard by putting gravel thereby reducing dust emission
- Use of existing irrigation roads and R&B roads only so as to there is no disturbance to the villages/patta lands
- Plantation of trees twice a year during February and July.
- Covering the trucks with tarpaulin for reducing the dust / air pollution.

4.2 GREEN BELT DEVELOPMENT

Canal bank plantation

The total length of canal system is 1843 km. It is proposed to develop plantation on both side of link channels, which would seedling should be raised in a nursery and one year old seedling should be planted. Seedling is proposed to be planted at an interval of 1m x 1 m x 3 rows on both side of the canals.

Compensatory Afforestation plan

Biological Environment is the major environmental issue to cover under baseline status of the project area. The major forest types in the project area are:

- Southern tropical dry deciduous forests
- Pure teak forests
- Mixed teak forests
- Southern tropical dry miscellaneous forests

The Kaleswaram irrigation project acquired forest land to an extent of 3168.131 hectares for the construction of canals, tunnels, pump houses and reservoirs. As per the norms, the MoEFCC clearance has been obtained for the diversion of forest land to an extent of 3168.131 ha in 8

different forest divisions as shown in **Table -4.2** v.i.z., Mahadevpur, Karimnagar – Sircilla, Siddipet, Yadadri, Medak, Nizamabad, Banswada and Nirmal divisions for constructions involved in Kaleshwaram project

Table –4.2: Division wise, Package wise extent of Forest land acquired forthe Project

Sl. No.	District	Division	Package no.	Forest land acquired (ha)
1	Prof. Jayashanker Bhupalpally	Mahadevpur (Medigadda barrage & Lift system)	Medigadda barrage & Lift system	338.4826
2.	Rajanna sircilla	Karimnagar + Sircilla	9,10	445.9565
3.	Siddipet	Siddipet	10,12,14,15	1407.439
4.	Yadadri Bhongir	Yadadri	14,15	109.5738
5.	Medak	Medak	18	194.0711
6.	Nizamabad	Nizamabad	21,22	323.3667
7.	Kamarddy	Banswada	22	26.6844
8.	Nirmal	Nirmal	27	322.5574
	Total			3168.1315

(Source: Forest Department, Govt. of Telangana)

In regards to compensatory afforestation plan, MoEFCC has issued the following guidelines:

“The legal status of forest land shall remain unchanged. Compensatory afforestation over the non-forest land equal in extent to the forest land being diverted shall be raised on identified land within a period of three years with effect from the date of issue of Stage-II.

clearance and maintained thereafter in accordance with the approved plan in consultation with the State Forest Department at the cost of the user agency. The proposed CA shall be revised and at least 1600 tall plants per hectare (3168.131 ha x 1600 = 5069010 plants) shall be planted over identified non-forest land. CA will be carried out in large size pits (0.60m x 0.6 m x 0.6 m). Good soil will be brought to replace existing inert soil dug out from the pits and at least 2 years tall plants shall be planted with provision for ten years on subsequent maintenance. 25% of revised CA cost will be deposited extra by the user agency for Soil and Moisture Conservation (SMC) activities on the CA land.

Penal Compensatory Afforestation shall be done over the double the area of 3.9694 ha used by the user agency in violation on degraded forest land in the State and deposit the required fund in Compensatory Afforestation Fund maintained by CAMPA (Compensatory Afforestation Fund Management and Planning Authority)

The Forest Department shall prepare a plan of action to utilize the water potential available nearby

for the benefit of forest crop and also to the wild animals. The water shall be provided from the reservoir to the Forest Department for raising and maintenance of plantations and nurseries around the site whenever required, free of charge”.

The afforestation work will be carried out by the Forest Department. The area proposed for diversion in hectares in the divisions of the districts for which the acceptance for the estimation of demand was obtained. The statement of CA areas accepted under NFL & DFL along with planting points is shown in **Table -4.3**.

Table –4.3: Details of Proposed area approved for Kaleshwaram project

S. No.	District	Division	Area proposed for diversion in ha	Area taken for CA in ha				No. of planting points				
				CA NFL to be taken over	CA proposed in NFL	CA DFL	Total area for CA	CA NFL	CA DFL	Bund planting in DFL - Km	Bund stabilisation planting points	Total No. of planting points
1	Bhupalpally	Mahadevpur	338.4826	0	0	272	272.000	0	302192	29	50750	352942
2	Rajanna Sircilla	Karimnagar-Sircilla	445.9565	1467	1400.00	300	1700.000	560000	333300	45	78750	972050
3	Jagtiyal	Jagtiyal	0.0000	500.92	154.00	0	154.000	30800	0	21.76	38080	68880
4	Warangal Urban	Warangal Urban	0.0000	177.775	136.775	0	136.775	54710	0	0	0	54710
5	Siddipet	Siddipet	1407.4390	304	300	206	506.245	313648	343196	48	84000	740844
6	Peddapalle	Peddapalle	0.0000	453.2955	198.198	453.2955	651.494	39640	503611	20	35000	578251
7	Nalgonda	WLM Nsagar	0.0000	308.2894	308.2894	0	308.289	123316	0	0	0	123316
8	Nalgonda	Nalgonda	0.0000	155.614	155.614	0	155.614	62246	0	0	0	62246
9	Yadadri Bhuvanagiri	Yadadri Bhuvanagiri	109.5738	0	0	187.40	187.400	0	191137	0	0	191137
10	Nizamabad	Nizamabad	323.3667	0	0	217	217.000	0	241087	43	75250	316337
11	Kamareddy	Banswada	26.6844	0	0	63	63.000	0	69993	20	35000	104993
12	Medak	Medak	194.0711	0	0	582	582.000	0	969612	72.00	126000	1095612
13	Nirmal	Nirmal	322.5574	0	0	365	365.000	0	405515	0	0	405515
14	Mancherial	Mancherial	0.0000	0	0	35	35.000	0	58310	11	19250	77560
		Total	3168.1315	3367.1389	2653.121	2680.696	5333.817	1184359	3417954	309.760	542080	5144393

(Source: Forest Department, Govt. of Telangana)

The user agency has identified 3367.1389 ha for CA under Non-Forest Land (NFL), of which 2653.121 ha is proposed for CA in NFL which is favorable for plantation and the rest of the land will be utilized for ANR (Assisted Natural Regeneration), SMCs (Soil & Moisture Conservation) works, etc. A total of 2680.696 ha identified in DFL (Degraded Forest land). Total area for CA is 5333.817 ha. Total number of planting points under NFL & DFL for Kaleshwaram project in 14 divisions includes 51,44,393. The total budget to carry out CA is Rs. 72230.383 lakhs (Rs.722.3 Crores).

The local species suggested for plantation under compensatory afforestation are given in **Table-4.4**.

Table –4.4: Species suggested for plantation under Compensatory Afforestation Plan

Sl. No.	Scientific name	Vernacular name
1	<i>Aegle marmelos</i>	Maredu, Bilvamu, Tripathra
2	<i>Azadirachta indica</i>	Vepa, Nimba
3	<i>Butea monosperma</i>	Moduga, Palasa, Kimsukamu
4	<i>Madhuca longifolia</i> var. <i>latifolia</i>	Ippa, Pedda ippa
5	<i>Pithecellobium dulce</i>	Seemachintha
6	<i>Syzygium cumini</i>	Neredu, Allaneredu
7	<i>Ficus benghalensis</i>	Marri, Peddamarri
8	<i>Tectona grandis</i>	Teku
9	<i>Bambusa bambos</i>	Veduru, Bongu veduru
10	<i>Mangifera indica</i>	Mamidi
11	<i>Holoptelea integrifolia</i>	Nemalinara
12	<i>Ficus religiosa</i>	Raavichettu
13	<i>Ficus racemosa</i>	Medi, Atthipandu
14	<i>Manilkara hexandra</i>	Palachettu
15	<i>Senna auriculata</i>	Tangedu
16	<i>Diospyros melanoxyton</i>	Beediaku, Thunikaku
17	<i>Canthium parviflorum</i>	Balusu
18	<i>Terminalia arjuna</i>	Tellamaddhi, Vegamaddhi, Tittumaddhi
19	<i>Acacia nilotica</i>	Nallathumma, Nallathumma, Babbula
20	<i>Dalbergia sissoo</i>	Sinsupa, Iridi, Sissoo
21	<i>Buchanania cochinchinensis</i>	Chinnamori, Jarumamidi, Chinnasara
22	<i>Cassia fistula</i>	Rela

4.3 CLOSURE PLAN AT STOCKYARDS

All the stack yards for storing the desilted material are patta lands taken by TSMDC on lease basis. After desiltation, the stock yard land will be handed over to farmers to use for agricultural purposes.

In order to make the stockyard fit for the agriculture, at least 6-inches sandy soil on the surface be removed before handing it over to the landowner. Further, before soil reconditioning works need to be carried by TSMDC in consultation with the Agriculture Dept. after conducting necessary soil tests.

CHAPTER -5 MONITORING PLAN

5.1 EMP BUDGET

Based on the suggested measures on possible impacts, following budget estimates are estimated for the proposed and reaches. Estimates for each sand reach

TABLE 5-1: EMP BUDGET

Sl. No.	Remedial measure	Capital Expenditure, INR	Recurring Expenditure, INR
1	Barricading of Dredge area in river bed to avoid fall of animals	2,00,000-00	1,00,000-00
2	Tree plantations on bunds and stock yards	3,00,000-00	1,00,000-00
3	Seep traps at Stock yards to collect seepage water if any	2,00,000-00	1,00,000-00
4	Enclosures around the stock yards to avoid dust emissions	4,50,000-00	Nil
5	Water sprinkling on haul roads	2,00,000-00	1,50,000-00
6	Annual silt deposit ratio studies to fix depth of de-silting in the reaches	--	3,50,000-00
7	Environmental Monitoring, Water, Air, Noise and ground water fluctuation in the surrounding areas of sand de-silting stretches	--	3,00,000-00
	TOTAL	13,00,000-00	11,00,000-00

5.2 MONITORING PLAN

All the environmental parameters viz. air, water, noise, soil will be monitored regularly in order to detect any changes from the baseline status. Monitoring program will be followed till the mining operations continue as per the following schedule

Table-5.2: Monitoring Schedule for Environmental Parameters

Particulars	Monitoring Frequencies	Duration of Station	Important Monitoring Parameters
Surface / Ground water	Once in Quarter	Grab	As per IS 10500:2012
Ground Water Levels near De-siltation reaches	Once in Quarter	Grab	As per IS 10500:2012

Ambient air monitoring Covering Stock yards, transportation Route, De-siltation yards	Once in a Quarter.	24 hr.	As per Gazette notification dt:18.11.09
Noise Monitoring near Stock yards, transportation Route, De-siltation yards	Once in a quarter	8 hr.	As per noise pollutions rules 2000
Soil Sampling	Once in a year	Grab	PH, Conductivity, Sulphate, Nitrate, Phosphates, Alkalinity & texture.
Silt Deposition measurement	Before and after de-siltation season		Using bore and Auger
Satellite mapping of de-silted areas	Once in a year to study morphological changes	-	LISS IV Satellite data

CHAPTER -6 CONCLUSIONS

De-siltation due to deposition of silt/ gravel/ sand make the morphological changes in river course as well as effect the reservoir capacities. In order to maintain the design flows and reservoir capacities, it is essential to desilt the reservoir in order to maintain the intended use and life of reservoir.

While selecting the desilting areas, TSMDC has to carry out the real time study the siltloads by following various scientific methodologies to estimate the actual siltation.

The Desiltation may impact the Air Quality, Ground water Quality & Ground water levels, Soil & agricultural activates near the stockyards, biodiversity in the region. But as seen from the data collected and Studies conducted, no adverse impacts recorded. However, various mitigation measures already implemented by TSMDC have protected the status of environment in the vicinity of Desiltation areas as well as stockyards, as described above in detail. Further, the desiltation also contributed to the socio-economic development in about nearby 40 villages.

As part of sediment management, the following aspects will be adhered to while selecting de-siltation reaches:

- No desilting will be done within 150 m distance from the intake structures for safeguarding structural integrity.
- No De-siltation activities will be taken up in 200-m upstream and 800-m down stream of any structure
- No De-siltation will be taken up within 150-m of any bridge crossing to safeguard the structural integrity of the bridge.
- No de-silting will be taken up within 60-m of any pipelines that is buried 3 m or below the river bed and within 150-m from any pipeline that is buried less than 3 m below the river bed.
- No De-siltation will be taken up within 60-m of the most upstream and downstream point of the bank stabilization structure.

GOVERNMENT OF TELANGANA
 ENVIRONMENT, FORESTS, SCIENCE & TECHNOLOGY (FOR.III) DEPARTMENT

Letter No.10 /For.III/A2/2018

Dated:8-1-2018.

From
 The Principal Secretary to Government,
 EFS&T Department,
 Telangana Secretariat.



To
 The Member Secretary,
 State Environment Impact Assessment Authority,
 Hyderabad(w.e).

Sir,

Sub: EFS&T Deptt. - Kaleswaram Project in Karimnagar District of
 Telangana by I&CAD Department, Government of Telangana-
 Environment Clearance (EC) - Reg.

Ref: From the Director, GoI, MoEF&CC(IA.I. Division), No. J-12011/1/
 2017-IA-I(R), dated: 22.12.2017.

I am to enclose a copy of the reference cited together with its
 enclosures for necessary action in the matter .

Yours faithfully,

for Principal Secretary to Government

EC)
 misc & concerned
 LRS.
 11/11

No. J-1201/1/2017-IA-I (R)
Government of India
Ministry of Environment, Forest & Climate Change
(I.A. Division)



Indira Paryavaran Bhavan
3rd Floor, Vayu Wing
Jor Bagh Road
New Delhi — 110 003

Dated: 22nd December, 2017

To,

Shri B. Hariram
The Chief Engineer
Kaleshwaram Project
1st Floor, Jalasoudha Building
Errumanzil
Hyderabad - 500082.

Subject: Kaleshwaram Project in Karimnagar District of Telangana by I & CAD
Department, Government of Telangana - Environmental Clearance (EC)
- regarding.

Sir,

This has reference to your letter No.CE/KPH/DCE-3/DEE-3/AEE-9/EIA&EMP/Vol.II/2017 dated 16.11.2017 and 26.11.2017 on the above mentioned subject.

The above referred proposal was considered by the Expert Appraisal Committee (EAC) for River Valley & Hydroelectric Projects in its meeting held on 5.12.2017. The comments and observations of EAC on the project may be seen in the Minutes of the meeting which are available on the web-site of this Ministry.

3. The Public Hearings were conducted in 15 Districts (i.e. Karimnagar on 22.8.2017, Nizamabad on 22.8.2017, Medchal-Malkajgiri on 22.8.2017, Yadagdri-Bhunanagiri on 22.8.2017; Peddapally on 23.8.2017, Nalgonda on 23.8.2017, Sangareddy on 23.8.2017, Kamareddy on 23.8.2017; Nirmal on 24.8.2017, Jagityal on 24.8.2017, Medak on 26.8.2017, Jayashankar-Bhupalapally on 26.8.2017, Manchiryal on 26.8.2017, Rajanna Sircilla on 26.8.2017 & Siddipet on 26.8.2017) of Telangana and 1 District (Gadchiroli on 27.9.2017) of Maharashtra as per the provisions of EIA Notification, 2006.

4. The project envisages construction of a barrage across River Godavari in near Medigadda village in Karimnagar District of Telangana for diversion of 180 TMC of water for providing irrigation facility in 7,38,851 ha covering 7 Districts namely Adilabad, Karimnagar, Nizamabad, Warangal, Medak, Nalgonda and Rangareddy Districts. It is also proposed to stabilize the existing command area of 7,62,028 ha of area. The project is also proposes to provide drinking water facility for Hyderabad and Secunderabad cities. Total land requirement is about 37,852 ha. Out of which

3168.1315 ha is forest land and 34,684 ha is private land. The total submergence area is about 18,302 ha. In addition to Medigadda barrage, 2 more barrages between Medigadda and Sripada Yellampally Project are likely to be constructed, one at Annaram and the other at Sundilla. The total length of water canal system is about 1,832 km. This project lies in the interstate boundary with submergence of 174.37 ha of area in Maharashtra State. Total estimated cost of the project is about Rs. 80,499.71 Crores and proposed to be completed in 3 years.

5. It was noted that the project involves (i) diversion of 180 TMC water from Godavari river, (ii) additional 20 TMC water will be drawn from Yellampally barrage, (iii) 10 TMC of water from self-yield tanks and (iv) 25 TMC of water from utilizable groundwater; put together 225 TMC of net water availability. Out of this, 30 TMC of water will be used for providing drinking water facility for twin cities of Hyderabad and Secunderabad, 10 TMC of water to en-route villages, 16 TMC of water for industrial purpose, 134.5 TMC for irrigation facility in 7,38,851 ha of new command area and 34.5 TMC of water for stabilization of 7,62,028 ha of area. The CWC has cleared water availability vide letter No. 6-231/2017-PA(S)/1327-28 dated 30.10.2017 for the project.

6. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and clarification furnished in response to its observations, have recommended for grant of Environmental Clearance for the project mentioned above. Accordingly, the Ministry of Environment, Forest & Climate Change hereby accords necessary environmental clearance for the above project as per the provisions of Environment Impact Assessment Notification, 2006 and its subsequent amendment in 2009, subject to compliance of following conditions:

Part – A - Specific Conditions:

- i. The Catchment Area Treatment (CAT) Plan as has been proposed in the Chapter-9 of EMP (9.1 - CAT Plan; November, 2017) shall be implemented in consultation with the Telangana State Forest Department. The allocated grant of Rs. 362.04 Crores for this purpose should be fully utilized and not be diverted for any other purpose. As per plan, the area of CAT is 32.83 Sq.km.
- ii. The project involves acquisition of 34,684 ha of land. The R&R benefits for the land losing will have to comply with the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act, 2013 or any other act which would be beneficial to the project oustees. Adequate publicity of the compensation package should be circulated in the affected villages. All R&R issues shall be completed before commissioning of the project.
- iii. Construction work to be carried-out after following due procedure of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 as applicable to the State of Telangana (21/2017) as amended by Act.

- iv. A Monitoring Committee for R&R shall be constituted which shall include representatives of project affected persons including representative from SC/ST category and a woman beneficiary.
- v. All commitment made during the public hearing should be fulfilled completely by the project proponent and record maintained, if any.
- vi. The Command Area Development (CAD) Plan as proposed in the EIA/EMP report (November, 2017) shall be strictly implemented.
- vii. Consolidation and compaction of the generated muck should be carried-out in the muck dumping sites. As proposed in the muck disposal plan, out of 1480 lakh m³ muck generated, the entire to be utilized for service road & inspection paths, embankments, land leveling, filling trenches, and construction material for CD works, road etc. and restoration works for canal banks should be strictly adhered. The muck disposal sites shall be reclaimed/ restored with vegetation once capacity is utilized. Allocated amount of Rs.32.79 crores for this purpose should be fully utilized and not be diverted for any other purpose.
- viii. The proposed compensatory afforestation programme in 5333.817 ha of degraded forest area with twenty two (22) local plant species identified for the programme shall be undertaken strictly in consultation with State Forest Department. The allocated amount of Rs. 722.30 Crores for this purpose should be fully utilized and not to be diverted for any other purpose.
- ix. To enhance the environment of project site, greenbelt, as proposed in the EIA/EMP report (November, 2017) shall be developed. The proposed greenbelt shall be developed in the barrages of the project and reservoirs periphery of 110.20 km and canal bank of 116.334 km of the project proposed with local plant species in consultation with State Forest Department should be taken-up strictly. The allocated grant of Rs. 19.21 Crores should be fully utilized this purpose and not be diverted for any other purpose.
- x. The Fisheries Development Plan as proposed in the EIA/EMP (November, 2017) for the conservation of fish in river & reservoir shall be implemented completely in consultation State Fisheries Department. A budget of Rs. 485 Crores provided for fisheries development plan should be utilized fully for this purpose and not to be diverted for any other purpose.
- xi. The proposed Biodiversity Conservation and Management Plan as proposed in the EIA/EMP report (November, 2017) should be implemented in consultation with State Forest Department. The allocated grant of Rs. 3.36 Crores should be fully utilized this purpose and not be diverted for any other purpose.
- xii. Water User Association's (WUAs) / Co-operative shall be formed and involvement of the whole community for disciplined use of available waters shall be ensured.

- xiii. Conjunctive use of surface water shall be planned to check water logging as well as increase productivity.
- xiv. The equipment likely to generate high noise levels during the construction period or otherwise shall meet the ambient noise level standards as notified under the Noise Pollution (Regulation and Control) Rules, 2000, as amended in 2010 under the Environment Protection Act (EPA), 1986. Ambient Noise level monitoring shall be conducted on a monthly basis during the period of construction at suitable locations and copy of the test reports to be submitted to Regional Office, MoEF & CC, Chennai on six monthly basis.
- xv. The On Farm Development (OFD) works shall be completed and WUAs (Water User Associations) shall be made functional before commencement of irrigation.
- xvi. Occurrence of stagnant pools/slow moving water channels during construction and operation of the project providing breeding source for vector mosquitoes and other parasites. The river should be properly channelized so that no small pools and puddles are allowed to be formed. Even after taking precautions, due to un-foreseen situations, breeding of mosquito and resultant malaria or mosquito borne diseases can increase. If such a situation arises, it will be the responsibility of project authorities to take all steps i.e. residual insecticidal spray in all the project area and surrounding 3 km area keeping the flight range of mosquitoes in consideration.
- xvii. Any other clearance from any other organization/department if required should be obtained.
- xviii. The submergence area is very large, micro-climatic change conditions in the project area during construction/post-construction period to be brought-out/reported at regular intervals.
- xix. Plans for greenbelt development and reservoir rim treatment have to be made in consultation with State Forest Department. Preference shall also be given to plant local indigenous species.
- xx. Solid waste generated, especially plastic waste should not be disposed of as landfill material. It should be treated with scientific approach and recycled.
- xxi. Six monthly compliance reports shall be submitted to Regional Office, MoEF & CC, Chennai until completion of the modernization works.

Part - B. General Conditions:

- i. Adequate arrangements for providing free fuel like LPG shall be made at the project cost for the labour engaged in the construction work so that indiscriminate felling of trees is prevented.
- ii. Medical facilities as well as recreational facilities shall also be provided to the labourers.

- iii. The labourers to be engaged for construction works shall be thoroughly examined by health personnel and adequately treated before issuing them work permit.
 - iv. Water sprinkling arrangements shall be made to suppress the fugitive emissions and on monthly basis, ambient air quality to be monitored during the period of construction.
 - v. Potable drinking water and proper sanitary facilities shall be provided for the labour force.
 - vi. Restoration of construction area including dumping sites of excavated materials shall be ensured by leveling, filling up of borrow pits, landscaping etc. The area should be properly treated with suitable plantation.
 - vii. Environmental parameters shall be monitored and six monthly monitoring reports shall be submitted to the concerned Regional Office of the Ministry, Chennai.
7. The Project Proponent shall provide full cooperation and all required documents / data to the Officials from concerned Regional Office of the Ministry, Chennai who would be monitoring the implementation of environmental safeguards.
8. The responsibility of implementation of environmental safeguards and carrying out environmental monitoring rests fully with Irrigation & CAD Department, Government of Telangana.
9. Besides the above stated conditions, the Project Proponent shall also implement all environmental safeguards, as proposed in the EIA/EMP report and other reports from time to time. The Regional Office of the Ministry, Chennai shall monitor implementation of EMP at regular intervals.
10. The Environmental Management Plan (EMP) shall be strictly adhered to and a sum of Rs. 16230.43 crores, the budgetary provisions for the implementation of EMP, shall be fully utilized and not to be diverted to any other purpose. In case of revision of the project cost or due to price level change, the cost of EMP shall also be updated proportionately
11. In case of change in the scope of the project, the same shall be intimated to the Ministry and fresh approval, if required, shall be taken from the Ministry.
12. The Ministry reserves the right to add additional safeguard measures subsequently, if found necessary and to take action including revoking of the clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time-bound and satisfactory manner.
13. This clearance letter is valid for a period of 10 years from the date of issue of this letter for commencement of construction work of the project.
14. A copy of the clearance letter shall be marked to concerned Panchayat/Zilla Parishad/ Municipal Corporation, Urban local body and local NGO, if any, from whom any suggestion/representations were received while processing the proposal. The clearance letter shall also be put on website by the project proponent.

15. State Pollution Control Board / Committee shall display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's / Tehsildar's Office for 30 days.

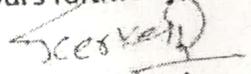
16. The project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the State Pollution Control Board / Committee and may also be seen at Website of the Ministry of Environment, Forest & Climate Change at <http://www.moef.nic.in>.

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17. After 5 years of the commissioning of the Project, a study shall be undertaken regarding impact of the project on the environment and downstream ecology. The study shall be undertaken by an independent agency, decided in consultation with the Ministry.

18. The project proponent shall also submit six monthly reports on the status of compliance of stipulated EC conditions including the results of monthly monitored data (both in hard copies as well as by email) to the respective Regional Office of MoEF&CC, Chennai.

19. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days from the date of issue, as prescribed under Section-16 of the National Green Tribunal Act, 2010.

Yours faithfully,


(Dr.S. Kerketta)
Director

Copy to:

1. The Secretary, Ministry of Water Resources, RD & GR, Shram Shakti, Bhawan, Rafi Marg, New Delhi 1.
2. The Special Chief Secretary, Irrigation & CAD Department, Government of Telangana, 5th Floor, B-Block, Secretariat, Hyderabad - 500 001.
- ✓ 3. The Principal Secretary, Environment, Forests, Science and Technology Department, Government of Telangana, 3rd Floor, D-Block, Secretariat, Hyderabad-500 001.
4. The Chief Engineer, Project Appraisal Directorate, Central Water Commission, Sewa Bhawan, R.K. Puram, New Delhi-110066.
5. The Addl. PCCF (Central), Regional Office (SR), Ministry of Environment, Forest & Climate Change, Regional Office (SEZ), 1st and 2nd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai - 600034.
6. The Member Secretary, Telangana State Pollution Control Board, Payavaran Bhawan, Industrial Estate, Sanath Nagar, Hyderabad.
7. Guard file/Notice Board.


(Dr.S. Kerketta)
Director