BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL SOUTHERN ZONE BENCH AT CHENNAI

APPEAL NO. 56 OF 2022

1.**GUTHA GUNASEKHAR**
S/o Gutha Rama Krishnama Naidu,
Age: 37 Years Nagillavari Palli village,
Peddauppara Palli(Post)
Somala Mandal, Chittoor District
Andhra Pradesh- 517257,
Mail: guthaguna@gmail.com
Mobile: 9886681956. And 12 others ... **APPELLANTS**

VERSUS

1. **UNION OF INDIA**
Union Ministry of Environment, Forest & CC
Rep. by its Secretary
Indira Paryavaran Bhavan
Jorbagh, New Delhi-110003
Mail: secy-moef@nic.in
Phone: 011-24695262, 24695265. And 6 others ..... Respondents

DOCUMENTS FILED BY THE 2ND RESPONDENT A.P SEIAA

Date: 11-04-2023

M/s MADHURI DONTI REDDY
ADVOCATE
STANDING COUNSEL FOR GOVERNMENT OF ANDHRA PRADESH
A.P. POLLUTION CONTROL BOARD
T.T.D. SUPREME COURT OF INDIA
#26, S2, Royal Castle, Gill Nagar Extension, Choolaimedu, Chennai – 600 094.
Mobile: 98407 98460 / 63831 21322, Email: reddymadhuri09@gmail.com

COUNSEL FOR 2ND RESPONDENT

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It is certified that all the documents contained in the above annexure are true copies.

Date: 06-04-2023

Dt: 22.07.2022

To,

The Member Secretary,

State Level Environment Impact Assessment Authority,

Vijayawada,

Andhra Pradesh

Sir,

Sub: Submission of Form I, II and EMP for obtaining Environmental Clearance - Regarding.

Ref: 1. G.O. RT No. 461 Dt: 02.09.2020.

2. MoEF & CC Notification S.O. 3977 (E) Dt: 14.08.2018.

*****

With reference the above subject we would like to bring to your kind notice that Water Resource Department at Tirupati proposed for formation of New Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District to stabilize ayacut through the reservoir to provide 2.5 TMC of drinking water to around 2.76 lakh people and an ayacut / culturable command area of 9700 Hectaresin the upland region and remote areas in Chittoor District by making use of the Punganur Branch Canal.

The project is listed under Category of 1 (c) of EIA Notification and as per the S.O. 3977 of MoEF & CC, Dated: 14.08.2018, it comes under category B2 as specified under item "1 (c) (ii) Irrigation Projects (b) Medium Irrigation System" in the Schedule.

In this regard, we are herewith enclosing Form I, Form II and EMP along with a Demand Draft of Rs.4, 50,000/- vide DD No. 460119 Dt: 05.07.2022 for kind appraisal of the proposal and issue Environmental Clearance.

Thanking you,

Yours faithfully,

22/07/22

Chief Engineer
NTRTelugu Ganga Project,
Tirupati

MANIPAL TECHNOLOGIES LTD., MANIPAL / CTS 2010
निर्गम की तारीख से तीन माह तक वैध
VALID FOR THREE MONTHS FROM THE DATE OF ISSUE

बैंक ऑफ महाराष्ट्र
Bank of Maharashtra

05/07/2022
D D M M Y Y Y Y

Payee's A/c. No. 01172 TIRUPATHI DIST :CHITTOOR 460119

माँग किये जाने पर प्राप्त राशि के निमित्त MEMBER SECRETARY SEIAA ANDHRA PRADESH OR ORDER
ON DEMAND PAY

रुपये Four Lakhs Fifty Thousand Rupees only. ₹ *******450000.00
RUPEES

अदा करें FOR VALUE RECEIVED

Purchaser Name: P L R PROJECTS PVT LTD

कृते बैंक ऑफ महाराष्ट्र FOR BANK OF MAHARASHTRA

एच OT	दर TT	एला OL	दला TL

प्राधिकृत अधिकारी / AUTHORISED OFFICIAL/S
Please sign above

बैंक ऑफ महाराष्ट्र 398-VIJAYWADA BANK OF MAHARASHTRA

MJN-2019 को

⑈460119⑈ 000040000⑆ 16

FORM-2

APPLICATION FOR PRIOR ENVIRONMENTAL CLEARANCE

1	**Details of Project**		
	a.	Name of the Project (s)	Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District by Water Resource Department, Tirupati, Government of Andhra Pradesh
	b.	Name of the Company / Organization	Water Resource Department, Government of Andhra Pradesh, Tirupati.
	c.	Registered Address	Sri K. Hari Narayana Reddy Chief Engineer (FAC) NTR Telugu Ganga Project OPP: S.V. Medical College Old Alipiri Road TIRUPATHI – 517501
	d.	Legal Status of the Company	State Government
	e.	Joint Venture (Yes/No)	No
		If Yes	
		(i) No. of JV Partner ***(Multiple Entries Allowed)***	

Name of the JV Partner	**Share of the JV Partner**	**Address of the JV Partner**	**Email ID of JV Partner**	**Mobile No. of JV Partner**
N.A	N.A	N.A	N.A	N.A

2	**Address for the correspondence**		
	a.	Name of the applicant	Sri K. Hari Narayana Reddy
	b.	Designation (Owner/Partner/CEO)	Chief Engineer (FAC)
	c.	Address	Chief Engineer (FAC), Telugu Ganga Project Water Resource Department of Govt. of Andhra Pradesh, Tirupati
	d.	Pin Code	517501
	e.	e-mail	cetgpskht@gmail.com

	f.	Telephone No.	9440904116
	g.	Fax No	
3	**Category of the Project / Activity as per Schedule of EIA Notification, 2006**		
	a.	Project/ Activity 1 (a) (i).....8(b)	1 (c)
	b.	Category ($A/B_1/B_2$)	B2
		If B_1 or B_2	
		Reason for application at Central Level / State Level (in case of B_2 Projects)	B2 as per notification. Hence, applied at state level
		If Others	Not applicable
	c.	Please Specify	Not applicable
	d.	EAC concerned (for category A Projects only) (Coal mining / Non-coal Mining/ Thermal / River Valley 7 Hydro / Industry-I / Industry-II/ Infrastructure-I / Infrastructure-II / Nuclear & Defence / CRZ	Not applicable as it comes under SEAC
	c.	New/ Expansion/ Modernization/ One time Capacity expansion (only for Coal Mining) / Expansion under Para 7(ii)/Modernization under Para 7(ii) Change of Product Mix under Para 7 (ii))	New
4	**Location of the Project**		
	a.	Plot / Survey / Khasra no.	NA
	b.	Village	Avulapalli
	c.	Tehsil	Somala
	d.	District	Chittoor
	e.	State	Andhra Pradesh
	f.	Pin Code	517257
	g.	Bounded Latitudes (North)	
		From	13°23’19.74”N
		To	13°24’20.58”N
	h.	Bounded Longitudes (East)	
		From	78°45’48.90”N
		To	78°49’19.10”N
	i.	Survey of India Topo Sheet No.	57-K5,57-K6,57-K7,57-K11,57-K15
	j.	Upload Toposheet file(*Upload pdf only*)	Enclosed
	k.	Maximum Elevation Above Means Sea level (AMSL)	
	l.	Upload (KML) File (*Upload KML File only*)	Enclosed

	m.	Distance of nearest HFL from the project boundary within the study			+651m
	n.	Seismic Zone (Zone: 1/2/3/4/5)			Seismic Zone- III
5	**Whether Project is executed in multiple states (Yes/No)?**				**No**
	If yes				
	a.	Number of States in which Project will be Executed (e.g. 1,2,3,4,5,6)			1
	b.	Main State of the project			Andhra Pradesh
	c.	Other state (Multiple Entries Allowed) (If the project to be executed, does not belong to any state, then state category could be selected as 'Other')			
		State	District	Tehsil	Village
6	**Details of Terms of Reference (ToR)**				
	a.	Whether ToR is mandatory for submitting application (Yes/No)			No
		If yes			
	b.	Date of Issue of ToR/Standard ToR			
	c.	MoEF&CC/SEIAA File No.			
	d.	Upload ToR Letter (*PDF only*)			
7	**Details of Public Consultation**				
	a.	Whether the Project Exempted from Public Hearing (Yes/No)?			Yes
		If No,			
		Reason			The proposed project is B2 category and hence public hearing is exempted
	b.	Supporting Document (*Upload pdf only*)			Enclosed
	c.	Whether details of Public Hearing available (Yes/No)?			No
		If yes			
	d.	Reason thereof			
		Supporting Document (*Upload pdf only)*			NA
		If yes			
	e.	Date of Advertisement of Public Hearing			NA
	f.	Copy of advertisement in English (*Upload Pdf only*)			NA

	g.	Whether Public hearing was presided over by an officer of the rank of Additional District magistrate or Above (Yes/No)?	NA
		If Yes	
	h.	Designation of Presiding officer (District Magistrate / District Collector / Deputy Commissioner /other -please specify)	NA
	i.	Copy of duly signed Proceedings of Public hearing in English (Upload pdf only)	NA
	j.	Date of Public Hearing	NA
	k.	Venue of public Hearing	NA
		Village	NA
		Tehsil	NA
		District	NA
		State	NA
	l.	Distance of Public Hearing Venue from Project Proponent (Km)	NA
	m	No. of people attended	NA
	n.	If the multiple public hearing conducted	NA
	o.	Pl give the details of each PH as per (e) to (o) above	NA

8	**Project Configuration / Product (Multiple Entries Allowed)**				
	a.	Whether the project is New (Yes/No)?	Yes		
		If yes			
	b.	Project Configuration -			
		Plant/Equipment/facility	Configuration		Remarks If any
		Irrigation project	Reservoir for water storage		
	c.	Product			
		Product/Activity (Capacity/Area)	Quantity	Unit	Mode of Transport/Transmission of Product
		Water for irrigation and drinking	2.5 TMC	cusecs	NA
		- Unit:- (Tons per Annum (TPA), Mega Watt (MW), Hectares (Ha), kilo litre per Day Tons Crushed per Day (TCD), Cubic Meter per Day, Kilometers (Km), Million Liters per Day (MLD), Others) - Mode of Transport/Transmission of Product (Road, Rail, Conveyor Belt, Pipe Conveyor), Arial Ropeway, Combination of two or three modes, other)			
9	**If Expansion / Modernization/ One Time capacity expansion (only for coal mining / Expansion under Clause 7 (ii) / Modernization under Clause 7 (ii) / Change of Product Mix under Clause 7(ii))**				

	a.	Details of Environmental clearance granted earlier				
		(i)	Date of issue of environmental clearance	NA		
		(ii)	MoFFCC / SEIAA File Number	NA		
		(iii)	Upload EC Letter	NA		
	b.	Details of certified report on compliance of earlier environmental clearance conditions				
		(i)	Details of Regional Office of MoEFCC /Zonal Office of CPCB / SPC3 / UTPCC from which certified report on compliance of earlier environmental clearance conditions obtained	NA		
		(ii)	Letter No	NA		
		(iii)	Status of Compliance	NA		
		(iv)	Certified report on compliance of earlier environmental clearance conditions (Including Monitoring Report) (Upload pdf only)	NA		
		(v)	Date of site Visit	NA		
	c.	Details of Consent to Operate				
		(i)	Whether Consent to operate obtained (Yes/No)?	No		
			If Yes			
		(ii)	Upload Copies of all Consent to operate obtained since inception (Upload pdf only)	NA		
		(iii)	Date of issue	NA		
		(iv)	Valid up to	NA		
		(v)	File No	NA		
		(vi)	Application No	NA		
		(vii)	Upload Copy of Consent to operate valid as on date (Upload Pdf only)	NA		
	d.	Details of Capacity Expansion (Multiple Entries Allowed)			Not Applicable	
		Product / Activity (Capacity/Area)	Quantity From	Quantity To	Unit	Mode of Transport / Transmission of Product
		-	-	-	-	-

		- Unit:- (Tons per Annum (TPA), Mega Watt (MW), Hectares (Ha), kilo litre per Day Tons Crushed per Day (TCD), Cubic Meter per Day, Kilometers (Km), Million Liters per Day (MLD), Others) - Mode of Transport/Transmission of Product (Road, Rail, Conveyor Belt, Pipe Conveyor), Arial Ropeway, Combination of two or three modes, other)				
	e.	Details of Configuration (***Multiple Entries Allowed***)		Not Applicable		
		Plant/Equipment/facility	**Existing Configuration**	**proposed Configuration**	**Final configuration after expansion**	**Remarks if any**
		--		--	--	--
10	**Project Cost**					
	a.	Total Cost of the Project at current price level (in Lakhs)		Rs.66720.0 Lakhs		
	b.	Funds Allocated for Environment Management (Capital) (in lakhs)		205.0 Lakhs		
	c.	Funds Allocated Towards ESC (Entrepreneur Social Responsibility) (in Lakhs)		--		
	d.	Funds Allocated for Environment Management Plan (EMP) (Recurring per Annum) (in Lakhs)		42.0 Lakhs/annum		
11	**Whether project attracts the General Condition specified in the Schedule of EIA Notification (Yes/No)? [provide name of WL/CPA/ESA/Inter-state boundary / International boundary and distance from the project**: Yes					
	If Yes					
	a.	Protected Area Notified Under the Wild Life(Protection) Act.1972		NA		
	b.	Critically Polluted Areas as identified by the Central Pollution Control Board from Time to Time		NA		
	c.	Notified Eco-Sensitive Areas		NA		
	d.	Inter-State Boundaries and international Boundaries		NA		
12	**Whether projects attract the Specific Condition specified in the Schedule of EIA Notification (Yes/No)?: No**					
		If Yes				
	a.	If any Industrial Estate / Complex / Export processing Zones / Special Economic Zones / Biotech Parks / Leather Complex with homogeneous type of such as items 4(d), 4(0), 5(e), 5(0), or those Industrial estates with pre-defined sot of activities (not necessarily homogeneous, obtains prior environmental		NA		

		clearance, individual industries including proposed industrial housing within such estates / complexes will not be required to take prior environmental clearance, so long as the Terms and Conditions for the industrial estate/complex and are complied with (Such estates/complexes must have a clearly identified management with the legal responsibility of ensuring adherence to the Terms and Conditions of prior environmental clearance, who may be held responsible for violation of the same throughout the life of the complex/estate.	

13 Raw material / Fuel Requirement (Multiple Entries Allowed) :

a. Details of Raw Material / Fuel Requirement

Raw material / Fuel	Quantity per Annum	Unit	Source (in case of Import, please specify country and Name of the port from which Raw Material / Fuel is received)	Mode of Transport	Distance of Source from Project Site (in Kilo meters) (In case of import, distance from the port from which the raw material
Water	35.0	KLD	Water tankers	Water tankers	Nearby villages

In case of expansion proposal, total requirement of raw material / fuel shall be given:

- Unit:- (Tons per Annum (TPA), Mega Watt (MW), Hectares (Ha), kilo litre per Day Tons Crushed per Day (TCD), Cubic Meter per Day, Kilometers (Km), Million Liters per Day (MLD), Others)

- Mode of Transport/Transmission of Product (Road, Rail, Conveyor Belt, Pipe Conveyor), Arial Ropeway, Combination of two or three modes, other)

	b.	Upload copy of Linkage / Fuel Supply Agreement / e-auction / Memorandum of Understanding / Letter of Allocation /Captive source / others.	NA

14 Baseline Data (Air / Water / Noise / Soil / Ground water table/ Others) –

	a.	Period of Base Line Data Collection	
		From (DD/MM/YYYY)	01.05.2022
		To (DD/MM/YYYY)	31.05.2022
	b.	Season (Summer / Pre-monsoon / Post-monsoon / Winter)	Pre- Monsoon
	c.	No. Of Ambient Air Quality (AAQ) Monitoring Locations	8
	d.	Details of AAQ Monitoring (*Multiple Entries Allowed*) :-	

	Criteria Pollutants	Unit	Maximum Value	Minimum Value	98 Percentile Value	Prescribed Standard
	PM_{10} (<10µ size)	µg/m^3	51.2	20.7	50.4	100
	$PM_{2.5}$ (<2.5 µ size)	µg/m^3	26.9	11.5	26.4	60
	SO_2	µg/m^3	13.8	6.4	13.5	80
	NO_X (Oxides of Nitrogen)	µg/m^3	18.8	8.4	18.5	80
	Criteria Pollutants: - (PM10, PM2.5, S02, NOx, Others parameters specific to sector) *Unit: - (Micro Gram per Meter Cube, Nano Gram per Meter Cube, Mill Gram per Meter Cube, NA)*					
	e.	No. of Ground Water Monitoring Locations (Multiple Entries Allowed)	4			
	f.	Details of Ground Water Monitoring :				

	Criteria Pollutants	Unit	Maximum Value	Minimum Value	Desirable limit	Maximum permissible limit
	pH	-	7.77	7.51	6.5	8.5
	Turbidity	NTU	0.92	<0.01	1	5
	Total Dissolved Solids	mg/l	632	584	500	2000
	Total Hardness as $CaCO_3$	mg/l	361	221	300	600
	Total Alkalinity as CaCO3	mg/l	424	376	200	600
	Chloride as Cl^-	mg/l	134	106	250	1000
	Flouride as F^{2+}	mg/l	3.44	1.26	1	1.5
	Cadmium as Cd	mg/l	<0.002	<0.002	0.003	0.003
	Criteria Pollutants: - (pH, TSS, TDS, Total Hardness, Chlorides, Fluoride, Heavy Metals, other parameters specific to the sector) *- Unit :- (mg/l, NA)*					
	g.	No. of Surface Water Monitoring Locations	4			
	h.	Details of Surface Water Monitoring (Multiple Entries Allowed)				

	Criteria Pollutants	Unit	Maximum Value	Minimum Value	Classification of inland water body	

	pH	--	8.07	7.65	A	
	DO	mg/l	6.4	5.7	A	
	Biochemical Oxygen Demand (BOD) (3days at 27^0C)	mg/l	3.9	3.2	A	
	Chemical Oxygen Demand (COD)	mg/l	19.2	14.6	A	
	Parameter (pH, DO, BOD, COD, Others parameters specific to the sector) *Unit: (mg/l, NA)*					

	i.	No. of Ambient Noise Monitoring Locations	8
	j.	Details of Noise Monitoring (***Multiple Entries Allowed***)	

		Parameter	**Unit**	**Maximum Value**	**Minimum value**		**Prescribed Standard**
		Leq (Day)	dB(A)	62.5	45.7		Industrial75/ Residential 55
		Leq (Night)	dB(A)	50.2	36.3		Industrial70/ Residential 45
		-Parameter:- (Leq(Day), Leq(Night)) -Unit :- (A-weighted decibels(dB(A))					

	k.	No. of Soil Monitoring Locations (Multiple Entries Allowed):	5

		Parameter	**Unit**	**Maximum Value**	**Minimum Value**	
		pH	-	8.61	6.11	
		Nitrogen as N	Kg/ha	72	54	
		Phosphorus as P	Kg/ha	39	28	
		Potassium as K	Kg/ha	198	161	
		Electric Conductivity	µmhos/cm	128	29.3	
		Parameter:- (pH, N(Nitrogen), P(Phosphorus), K(Potassium), Electric Conductivity *Unit :- (Millisiemens per Centimeter, Milligram per Litre, Percent, Centimeter or Second, Miliiequivalents per 100 Gram, Milligram per Kilogram, Parts per million, Kilogram per hectare, Others)*				

	l	**Ground Water Table**	
	i.	Range of Water Table Pre-Monsoon Season (Meters Below Ground Level (m bgl)	
		From	5.44
		To	25.21
	ii	Range of Water Table Post-Monsoon Season (Meters Below Ground Level (m bgl)	

		From	17.86
		To	3.56
	iii	Whether Ground Water Intersection will be there (Yes / No)?	No
		If Yes	NA
		(i) Upload Copy of Central Ground Water Authority Letter (Upload pdf only)	NA
		(ii) Letter No.	NA
		(iii) Date of issue	NA

15 Details of Water requirement (During Operation) (Multiple Entries Allowed)

a. Details

Source	Quantity in KLD	Method of water withdrawal	Distance from Source	Mode of Transport
Domestic - construction	35.0	Surface	0	Pipeline
Batching Plant	20.0			
Stone Crusher	5.0			
Total	**60.0**			

Source: Surface / Ground Water / Sea / Others
Mode of Transportation: Pipeline / Canal / Others
Method of water withdrawal: Barrage / Weir / Intake well / Jackwel: /Tube well /open well/others

b.	Upload Copy of Permission from Competent Authority (Upload pdf only)	NA
c.	Letter No.	NA
d.	Date of issue	NA
e.	Permitted quantity	NA
f.	Whether Desalination is proposed (Yes/ No)	No
	If Yes	NA
	(i) Desalination capacity (KLD)	NA
	(ii) Quality of Brine (KLD)	NA
	(iii) Mode of Disposal of brine	NA

16 Waste Water Management (During Operation)

	Type / Source	Quantity of Waste Water Generated (Kilo Litre per Day)	Treatment Capacity (Kilo Litre per Day)	Treatment Method	Mode of Disposal	Quantity of Treated Water Used in Recycling / Reuse (Kilo Litre: per Day)	Quantity of Discharged Water (Kilo Litre per Day)
	Domestic Sewage	30	30	Mobile STP		30	30
	Total	13					

	a.	Total Waste Water Generation	30 KLD
	b.	Total Discharged Water	0 KLD
	c.	Total Reused Water	30 KLD

17 Solid Waste Generation Management (Multiple Entries Allowed):

Item	Quantity per Annum	Unit	Distance	Mode of Transport
Solid Waste (Domestic)	30	Tons/day	-	By road

Item:- (Industrial waste, Municipal Solid waste, Fly ash, Bottom Ash, Hazardous Waste (as per Hazardous and Other Waste Management Rules 2016), E Waste, Bio-Medical waste, Construction & Demolition waste, Plastic Waste, Others)
Unit:- (Tons, Kiloliter)
Mode of Disposal:- (Treatment, Storage and Disposal Facility (TSDF), Authorized Recyclers, Landfills, Sanitary Landfills, Others)

18 Air Quality Impact Prediction (Multiple Entries Allowed) –

Criteria pollutants	Unit	Baseline Concentration	Minimum Value	incremental concentration	Total GLC	Prescribed Standard
PM	$\mu g/m^3$	-	-	-	-	100
SO_2	$\mu g/m^3$	-	-	-	-	80
NOx	$\mu g/m^3$	-	-	-	-	80

Parameter:- (PM_{10}, PM, SO_2, NOx, Others parameters specific to the sector) - Unit (Microgram per Meter Cube, NA)

19	**Power Requirement:**		
	a.	Quantity (Kilo Volt Amps (KVA))	
	b.	Source	AP Southern Power Distribution Company Limited (APSPDCL), Tirupati

	c.	Upload Copy of Agreement (*Upload pdf only*)	NA
	d.	Standby Arrangement (Details of DG Sets)	DG Set of 250 KVA
	e.	Stack Height (in m)	250 KVA DG Set stack height- 5 m

20	**Land Ownership Pattern (Prior to the project proposal) in Ha**		
	a.	Forest land	NA
	b.	Private Land	247.668 Ha
	c.	Government Land	278.422 Ha
	d.	Revenue Land	NA
	e.	Other Land	NA
		Total	**526.09 Ha**
21	**Present Land Use breakup in Ha**		
	a.	Agriculture Area	247.668 Ha
	b.	Waste/Barren Area	278.422 Ha
	c.	Grazing / Community Area	NA
	d.	Surface Water bodies	NA
	e.	Settlements	NA
	f.	Industrial	NA
	g.	Forest	NA
	h.	Mangroves	NA
	i.	Marine area	NA
	j.	others (Existing Industry)	NA
		Total	**526.09 Ha**

22 Land requirement for various activities (Multiple entries allowed):

	Description of Activity / Facility / Plant / Others	**Land requirement (Ha.,)**	**Remarks**
	Barrage	NA	
	Approach Roads	NA	
	Tail Race Channel	NA	
	Pen Stock and Surge Shaft	NA	
	Power House	NA	
	Township	NA	

	Muck Disposal			NA	
	Total			NA	
	- Activity/Facility/Plant/ other include: Main Plant, Township, Green belt, Ash pond, Quality area, OB dump Area, Safety zone, Tailing pond, Land fill, Salination Plant, Area for solid waste management, built-up area, others				
23	**Ecological and Environmental Sensitivity (Within 10 Km):- WLS-Wild Life Sanctuaries, Notified Protected areas; ESAs-Eco Sensitive Areas; ESZs-Eco Sensitive Zones)**				
	a.	Details of Ecological Sensitivity –			
		Details of Ecological Sensitivity	Name	Distance from the Project (Km)	Remarks
		Eco-sensitive zone	--	NA	
		Eco-sensitive zone	--	NA	
		-Details of Ecological Sensitivity: - (Criticany Polluted Area, WLS, NPA, SAs, ESZs, Corridors, Wildlife Corridors)			
	b.	Whether NBWL recommendation is required (Yes/No)?		**No**	
		If Yes		--	
		Upload NBWL recommendation in PDF		Not Applicable	
	c.	Details of Environmental Sensitivity		Not Applicable	
		Details of Environmental Sensitivity	Name	Distance from the Project (Km)	
		Water Bodies	Pedda vagu	0.6 Km (Adjacent)	
		Details of Environmental Sensitivity:- (Forest, Archaeological sites, Defence Installations, Others)			
	d.	Whether NoC / Permission from the competent authority is required (Yes/No)?		**No**	
		If Yes		--	
		Upload NoC / Permission from the competent authority in PDF		N.A	
24	**Forest Land**				
		Whether any Forest Land involved (Yes/No)?		NO	
		If Yes			
	a.	Forests Clearance Status (In-Principle(Stage-I) Approval Obtained / Final (Stage-II) Approval Obtained / Forest Clearance Under Process (Stage-I) /Forest Clearance under Process (Stage-II) / Application for Forest Clearance yet to be Submitted)		Not applicable	

		If In-Principle (Stage-I) Approval Obtained,	N.A
		(i) MoEF&CC file number	N.A
		(ii) Date of In Principle (Stage-I) approval	N.A
		(iii) Area diverted	N.A
		(iv) Upload FC Letter (Upload pdf only and attach it as Annexure-FC Letter)	N.A
		Final (Stage-II) Approval obtained,	N.A
		(i) MoEFFCC file number	N.A
		(ii) Date of Final Approval	N.A
		(iii) Date of In-Principle Approval	N.A
		(iv) Area diverted	N.A
		(v) Upload FC Letter (Upload pdf only and Quack it as Annexure-FC Letter)	N.A
		If Forest Clearance under process (Stage-I),	N.A
		(i) MoEFCC file number	N.A
		(ii) Area applied	N.A
		If Forest Clearance under process (Stage-II),	N.A
		(i) MoEFCC file number	N.A
		(ii) Area applied	N.A
	b.	Legal Status of Forest Land (Reserved, Protected, Private, village, other	NA
		If Others	N.A
		Please Specify others	N.A
25	**Tree Cutting, if any**		**Yes**
	a.	No. of Trees Cut for the Project (if Forestland not involved)	Approximately 250 trees such Mango and Coconut trees will be cut
	b.	Details of Tree Cutting and Planting of Trees (Upload pdf Only)	NA
26	**Land Acquisition Status**		
	a.	Acquired Land	To be applied
	b.	Land yet to be acquired	Private Land to be aquired

	c.	Status of Land acquisition if not acquired	NA
27	**Rehabilitation and Resettlement (R&R)**		Applicable
	a.	No. of Villages	3
	b.	No. of Households	170
	c.	No. of PDFs (Project Displaced Families)	170
	d.	No. of PAFs (Project Affected Families)	nil
	e.	Funds Allocated for R&R	84.11 Crores (which include the land acquisition cost)
	f.	Status of R&R (Completed / In-progress / Yet to start)	Started
28	**Whether there is Presence of Scheduled-I Species (Yes/No)?**		**NO**
		if yes,	
	a.	Details of Schedule-I Species	NA
	b.	Whether conservation plan for Schedule-I Species has been prepared (Yes/ No)	NA
		If Yes	
		(i) Upload conservation plan (Upload only PDF)	NA
		(ii) Fund Provision made	NA
		(iii) Period of implementation	NA
	c.	Whether conservation plan for Schedule-I Species has been approved by competent authority (Yes/ No)?	NA
		(i) Upload copy of approval (Upload PDF Only)	NA
		(ii) Letter No.	NA
		(iii) Date of issue	NA
		(iv) Recommendations if any	NA
29	**Whether there is presence of Water Bodies in Core Area (Yes/No)?**		**Yes**
		If Yes	
	a.	Details of Water Bodies in Core area	Pedda Vagu – 0.6 km – East
	b.	Whether there is Diversion required (Yes/No)?	NA
		If Yes	NA

	c.	Details of diversion required			NA
	d.	Details of study conducted			NA
	e.	Whether permission has been obtained from competent authority (Yes/No)?			NA
		(i) Upload copy of permission (Upload PDF Only)			NA
		(ii) Letter No.			NA
		(iii) Date of issue			NA
		(iv) Recommendations if any			NA
30	**Whether there is Presence of Water Bodies in Buffer Area (Yes/No)?**				**Yes**
		If Yes			
	a.	Details of Water Bodies in Buffer area			Chennapatnam Cheruvu
	b.	Direction of water bodies in buffer Area (North / South / East / West / North East/ North West/ South East/ South West)			NW Adjacent
	c.	Distance of Water Bodies in Buffer Area (Kilo Meter)			6.40 km
31	**Man Power Requirement**				
	a.	Permanent employment during construction			0
	b.	Permanent employment during operation			50
	c.	Temporary employment during construction			250
	d.	Temporary employment during operation			0
	e.	No. of working days			300
	f.	Total manpower			300
32	**Green Belt Area**				
	a.	In case of new projects			
	i	Total Area of Green Belt			20.0 Ha
	ii	Percentage of Total Project Area			1.6%
	iii	No of Plants to be planted			5000
	iv	Area allocated for plantation			10 Ha
	v	Upload Green belt Plan (*Upload pdf only*)			Enclosed
	b.	In case of Expansion / Modernization / change in Product mix etc.			NA
	i.	**Description**	**Existing**	**Proposed**	**Total**

		Total Area of Green Belt	-	-	-
		Percentage of Total of Project Area	-	-	-
		No. of Plants	-	-	-
		Funds Allocated	-	-	-
	ii.	Upload Green belt Plan (Upload pdf only)			
33	**Project Benefit (*Multiple entry allowed*)**				
	Type of Project Benefits			**Details of Project Benefits**	
	Social			Drinking water supply to the villages and towns Agricultural activities generates livelihoods Improved ecosystem services and groundwater recharge Substantial Socio-economic benefits Employment development Infrastructural facilities will be improved due to the project	
	(Project benefits shall include environmental, social and others)				
34	**Whether the Project / Activity attracts the provisions of CRZ (Yes/No)?: No**				
III	**Whether proposal is for River Valley & Hydroelectric Project (Yes/No)?: No**				
	If Yes				
	1	Sub Sector: (Multipurpose Project / Hydroelectric Project / Irrigation project)		NA	
	2	Name of the River		NA	
	3	Whether Cumulative Impact Assessment and Carrying Capacity Study of River Basin Carried Out? (Yes/No)		NA	
		if Yes			
		a.	Status of Cumulative Impact Assessment and Carrying Capacity Study of River Basin: (Recommended / Not Recommended,)	NA	
			If Recommended		
		b.	Details of Cumulative Impact Assessment and Carrying Capacity Study of River Basin	NA	
		c.	Upload Relevant Document (Upload pd/ only)	NA	
	4	Type or Project: (Construction of Dam Barrage / Run of the River / lift irrigation Scheme)		NA	
	5	Dam Height (meter) if applicable		NA	

	6	Dam Length (meter) if applicable			NA	
	7	Total Submergence Area (hectare)			526.09	
	8	Details of Gross Command Area (GCA) (hectare)			NA	
	9	Details of irrigable Command Area (ICA) (hectare)			NA	
	10	Details of Culturable Command Area (CCA) (hectare)			9700 ha	
	11	Total Command Area (hectare)			9700 ha	
	12	Powerhouse installed Capacity			NA	
		a.	Type of Powerhouse: (Underground / Surface)		NA	
		b.	Capacity (megawatts)		NA	
		c.	No. of Tunnels		NA	
		d	No. of Units		NA	
		e.	Bank of River (Left /Right / Both)		NA	
	13	Generation of Electricity Annually				
		a.	Quantity of Generation of Electricity Annually (in Gift (GWh)		NA	
		b.	Water availability at various percentages			
		Percentage		**Water availability (Cusecs)**	**Dependable year**	**Remarks**
		At 50%		0		
		At 75%		0		
		At 90%		0		
		c.	Machine Availability (%)		NA	
		d.	Cost of Electricity Generation (in INR)		NA	
		e.	Internal Rate of Return (%)		NA	
		f.	Year of achievement of Internal Rate of Return		NA	
	14	Catchment Area Treatment Plan			NA	
	15	Muck Management Plan				
		a.	**Upload Muck** Management Plan in PDF		NA	
		b.	Total Excavation Muck (Cubic Meter)		NA	
		c.	Utilized for Construction (Cubic Meter)		NA	

		d.	No. of Muck Disposal sites	NA	
		e.	Total Muck Disposal Area (Ha)	NA	
	16.	Fishery Development and Management Plan			
		a.	Upload Fishery Development and Management Plan in PDF	NA	
		b.	No. of Fingerlings	NA	
		c.	No. of Fish Species	NA	
		d.	Name of the umbrella Fish Species (Scientific Name)	NA	
	17	Status of Environmental Flow			
		Season		**Average Inflow (in Million Cubic meter)**	**Percent of flow**
		Non-Lean Non Monsoon		NA	NA
		Monsoon		NA	NA
		Lean		NA	NA
	18	Free Flow Stretch (km)			
	19	Approval of Central Water Commission		NA	
		a.	Approval Reference No.	NA	
		b.	Date of Approval	NA	
		c.	Upload Copy of Approval (Upload pal only)	NA	
		a.	Approval of Reference No.	NA	
	20	Approval of Central Electricity Authority		No	
		a.	Approval Reference No.	NA	
		b.	Date of Approval	NA	
		c.	Upload Copy of Approval (Upload pdf only)	NA	
	21	Details of Coffer Dam(Upstream) if applicable		N.A	
		a.	Quantity of the meter	N.A	
		b.	Length of the dam (m)	N.A	
		c.	Quantity of muck to be used (m3)	N.A	
		d.	Quantity of borrow material to be used (m3)	N.A	
		e.	Decommissioning plan (upload in PDF)	N.A	
	22	Details of Coffer Dam (down stream) if applicable		N.A	

		a.	Quantity of the material (m^3)	N.A
		b.	Length of the darn (m)	N.A
		c.	Quantity of muck to be used (m^3)	N.A
		d.	Quantity of borrow material to be used (m^3)	N.A
		e.	Decommissioning plan (upload in PDF)	N.A
36	**Details of Court cases if any**			
	a		Whether there is any Court Cases pending against the project and/or land in which the project is proposed to be set up (Yes/No)?	No
			If yes	
	b		Details of Court (Districts Court / High Court / NGT / Tribunals / Supreme court of India	N.A
			Name of court: (Districts Court, High Court, NGT, Tribunals)	N.A
	c		Name of the Sub-court	N.A
	d		Case No.	N.A
	e		Orders / Directions of the court, if any and its relevance with the proposed project	N.A
	f		Case Details	N.A
	g		Upload Court Order if any (*Upload pdf Only*)	N.A
37	**Details of Direction issued under Environment (Protection) Act/Air(Prevention & Control of Pollution) Act/Water (Prevention & Control of Pollution) Act(Yes/No)? No**			
	a		Whether any direction issued under Environment (Protection) Act / Air (Prevention & Control of Pollution)) Act / Water (Prevention and Control of Pollution) Act (Yes/No)?	No
			If yes	
	b		Whether any direction issued under Environment (Protection) Act / Air (Prevention & Control of Pollution)) Act / Water (Prevention and Control of Pollution) Act (Yes/No)?	No
	c		Upload copy of directions issued under Environment (Protection) Act Air (Prevention & Control of Pollution)) Act / Water (Prevention & Control of Pollution) Act	N.A
	d		Compliance status of the directions	N.A
38	**Details of EIA Consultant**			
	a.		Have you hired Consultant for preparing document (Yes/No)?	Yes
			If No	
			(i) Reason for not engaging the Consultant	--
			If Yes	

		(1) Accreditation No.	NABET/EIA/2124/RA 0240,
		(ii) Name of the EIA Consultant	SV Enviro Labs & Consultants Dr. G.V.A. Ramakrishna (EIA Co-ordinator) will attend for this project in SEAC meeting.
		(iii) Address	Enviro House, Block-B, IDA, B1, Auto Nagar, Visakhapatnam
		(iv) Mobile No.	9440338628
		(v) Landline No.	0891-2755528
		(vi) E-mail Id	svenviro_labs@yahoo.co.in
		(vii) Category of Accreditation (Eligible for Category A / Eligible for Category B)	Category-A
		(viii) Sector of Accreditation	1(c)
		(ix) Validity of Accreditation	24.04.2024
		(x) Upload Certificate of Accreditation certified by QCl/NABET (Upload Only)	Enclosed
39	**Documents to be attached**		
I	***If Project Type is New / Expansion / Modernization / one-time capacity expansion for coal mining***		
	a.	Upload Copy of EIA/EMP Report	Enclosed
	b.	Upload Copy of Risk Assessment Report	Enclosed
	c.	Upload Copy of Feasibility Report/ Detailed Project Report(DPR) /Detailed Engineering Report /Detailed Conceptual Plan/Approved Mining Plan (in case of Mining proposals) (Upload pdf only)	Enclosed
	d.	Upload Copy of Final Layout Plan (Upload pdf only)	Enclosed
	e.	Upload Cover Letter (Upload pdf only and attach it as Annexure-document of (Cover letter)	Enclosed
	f.	Upload a copy of documents in support of the competence/authority of the person making this application to make application on behalf of the Agency (Upload pdf only and attach it as Annexure-authorization)	Enclosed
	g.	Upload Additional File, if any (Upload pdf only)	Enclosed
	h.	Upload EAC Presentation	Enclosed

	40	**Undertaking**	
	a	I hereby give undertaking that the data and information given in the application and enclosures are true to be best of my knowledge and belief and am aware that if any part of the data and information found to be false or misleading at any stage, the project will he rejected and clearance given, if any to the project will be revoked at our risk and cost. In addition to above. I hereby give undertaking that no activity / construction / expansion has since been taken up	24/07/22
	b.	Name	Mr. K. Hari Narayana Reddy
	c.	Designation	Chief Engineer
	d.	Company	Water Resource Department
	e.	Address	Chief Engineer (FAC) NTR Telugu Ganga Project OPP: S.V. Medical College Old Alipiri Road TIRUPATHI – 517501 Andhra Pradesh

SUBMISSION OF FORM-I TOWARDS ENVIRONMENTAL CLEARANCE

(Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District)

For

Chief Engineer (Projects)

Water Resources Department, Tirupati

Government of Andhra Pradesh

Prepared & Submitted by

SV ENVIRO LABS & CONSULTANTS

Enviro House, Block – B, B-1, IDA Auto Nagar,

Visakhapatnam - 530012

QCI No-NABET/EIA/2124/RA 0240 Dt. 24.10.2024

FORM -1

(I) Basic Information

S. No.	Item	Details
1.	Name of the project(s)	Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District by Water Resource Department, Tirupati, Government of Andhra Pradesh
2.	S. No. in the schedule	1(c)
3.	Proposed capacity/area/length/tonnage to be handled /command area /lease area /number of wells to be drilled.	Construction of Avulapalli Balancing Reservoir (capacity of 2.5 TMC) near Avulapalli to provide to drinking water to around 2.76 lakh people and irrigate an ayacut / culterable command area of 9700 Hectares in Chittoor District.
4.	New/Expansion/Modernization	New for Environmental Clearance
5.	Existing Capacity/Area etc.	NA
6.	Category of Project i.e. 'A' or 'B'	Category – B2 (The project is listed under category of 1(c) of EIA Notification, 2006 and As per the S.O 3977 (E) of MoEF & CC, dated 14th August 2018, and S.O 1886 (E) of MoEF & CC, dated 20th April 2022, the project comes under B2 category as specified under item "1(c) (ii) Irrigation projects (b) Medium Irrigation System" in the SCHEDULE).
7.	Does it attract the general condition? If yes, please specify.	No
8.	Does it attract the specific condition? If yes, please specify.	No
9.	Location Plot/Survey/Khasra No. Village	Detailed map is provided -- Avulapalli

	Tehsil District State	Somala Chittoor Andhra Pradesh
10.	Nearest railway station/airport along with distance in kms.	Madanapalle Road Railway Station is at a distance of 35.5 km from the proposed project site Tirupati Airport is at a distance of 82.30 km from the proposed project site.
11.	Nearest Town, city, district Headquarters along with distance in kms.	Somala Town is at a distance of 7.5 km from the proposed project site. Densely Populated Mandal is Punganur Mandal is at a distance of 20.65 km from the proposed project site. District headquarters Chittoor is at a distance of 35.25 km from the proposed project site
12.	Village Panchayats, Zilla Parishad, Municipal Corporation, Local body (complete postal addresses with telephone nos. to be given)	Avulapalli Village, Somala Mandal, Chittoor district Andhra Pradesh
13.	Name of the applicant	Sri. K. Hari Narayana Reddy Chief Engineer (Projects)
14.	Registered Address	--
15.	Address for correspondence: Name Designation (Owner/Partner /CEO) Pin code E-mail Telephone No.	 Sri K. Harinarayana Reddy Chief Engineer (FAC) NTR Telugu Ganga Project OPP: S.V. Medical College Old Alipiri Road TIRUPATHI – 517501 517501 cetgpskht@gmail.com 9440904116

	Fax No.	
16.	Details of Alternative Sites examined, if any. Location of these sites should be shown on a topo sheet.	Nil
17.	Interlinked Projects	None
18.	Whether separate application of interlinked project has been submitted?	Not applicable
19.	If yes, date of submission	Not applicable
20.	If no, reason	This is an independent new project.
21.	Whether the proposal involves approval/clearance under: if yes, details of the same and their status to be given. i. The Forest (Conservation) Act, 1980? ii. The Wildlife (Protection) Act, 1972? iii. The C.R.Z. Notification, 1991?	 No Forest Land involved in the proposed project site No Wildlife Sanctuary involved in the proposed project site The proposed project does not fall in the CRZ area.
22.	Whether there is any Government Order /Policy relevant /relating to the site?	As per the G.O. RT. No. 461 Dt: 02.09.2020, Water Resources (Projects. III) Department, Government of Andhra Pradesh proposed for formation of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District
23.	Forest land involved (hectares)	Nil
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? a) Name of the Court b) Case No. c) Orders/directions of the Court, if any and its relevance with the proposed project.	Nil

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

S. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	During construction phase of project colony for workers/staff may be required temporarily. There will be permanent change in land use due to formation of new balancing reservoir.
1.2	Clearance of existing land, vegetation and buildings?	Yes	Vegetation will be cleared wherever necessary and infrastructure will be developed.
1.3	Creation of new land uses?	Yes	During construction and operation phase, land use may change.
1.4	Pre-construction investigations e.g. bore houses, soil testing?	Yes	Pre-construction activity like borehole, geological testing is required and carried out for assessment of project viability.
1.5	Construction works?	Yes	The proposed project is for formation of new balancing reservoir which involves the formation of Earth V Bund, Construction of Surplus weir and Construction of Sluice (3 No.'s) etc..,
1.6	Demolition works?	No	Not Applicable.
1.7	Temporary sites used for construction works Or housing of construction workers?	Yes	Infrastructure (roads, labor colony etc.,) will be constructed. Manpower required during construction phase will be acquired on temporary basis from nearby villages.

1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	The proposed project involves formation of Earth V Bund, Construction of Surplus weir and Sluice (3 No.'s), batching plants and other project components
1.9	Underground works including mining or tunneling?	No	Not Applicable
1.10	Reclamation works?	No	No reclamation is required
1.11	Dredging?	No	Not applicable
1.12	Offshore structures?	No	Not applicable
1.13	Production and manufacturing processes?	No	The proposed project is not a manufacturing Industry.
1.14	Facilities for storage of goods or materials?	Yes	Temporary sheds during construction stage
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	**Construction Phase:** The Domestic waste water generation is 30.0 KLD which will be treated in the mobile STP's. The Solid waste generated from the workers camps will be 100 kg/day will be sent to the nearest Municipal dump yard. **Operation Phase - Nil**
1.16	Facilities for long term housing of Operational workers?	No	Majority of manpower will be recruited from local people only. Therefore, no housing scheme proposed.
1.17	New road, rail or sea traffic during Construction or operation?	Yes	New approach road during construction and operation phase. No new rail or sea traffic required.
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	No	Not applicable
1.19	Closure or diversion of existing transport	No	Not envisaged

	routes or infrastructure leading to changes in traffic movements?		
1.20	New or diverted transmission lines or pipelines?	No	Not Applicable
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	Yes	Balancing Reservoir near Avulapalli to stabilize ayacut through the reservoir Chittoor District to provide 2.5 TMC of drinking water to around 2.76 lakh people and an ayacut / culterable command area of 9700 Hectares. Hence impounding/damming is required to utilize the flood waters of Penna River for drinking and Irrigation purposes.
1.22	Stream crossings?	Yes	Muddaleru Vanka Stream is merging into the proposed Avulapalli Balancing Reservoir.
1.23	Abstraction or transfers of water form ground or surface waters?	No	During construction, the source of water is water tankers/bore wells (from local villages)
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	Yes	The proposed project area will be converted into a water catchment area. The proposal is for enhancing the existing Seethamma Cheruvu Capacity of 0.03 TMC to 2.5 TMC by Constructing a new Balancing Reservoir at Avulapalli
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Only temporary and short-term transport as per the requirement. The labour from nearby village will use available public transport.
1.26	Long-term dismantling or decommissioning or restoration works?	No	No dismantling work will be carried in the project.
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	No decommissioning activity proposed.

1.28	Influx of people to an area in either Temporarily or permanently?	Yes	Temporary Influx of people into this area during the construction phase.
1.29	Introduction of alien species?	No	No alien species will be introduced / encouraged.
1.30	Loss of native species or genetic diversity?	No	No native species will be destroyed. However bushes will be cleared at site area.
1.31	Any other actions?	Yes	Green belt will be developed of about 5000 plants at bund areas.

2. **Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non- renewable or in short supply):**

S.No.	**Information/Checklist confirmation**	**Yes/ No**	**Details thereof (with approximate quantities / rates, wherever possible) with source of information data**
2.1	Land especially undeveloped or agricultural land (ha)	No	Government land
2.2	Water (expected source & competing users) unit: KLD	Yes	Source of water is Water tankers/Borewell Fresh water requirement: **Construction Phase:** Domestic : 35.0 KLD Batching Plant : 20.0 KLD Stone Crusher : 5.0 KLD Total: 60.0 KLD **Operation phase: Nil**
2.3	Minerals (MT)	No	Nil
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	Construction material will be required for infrastructure.
2.5	Forests and timber (source – MT)	No	No timber will be used. All the structures are of MS and pre fabricated.

2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	The power requirement is withdrawn from APSPDCL. Mobile DG sets of 4 x 125 KVA will be provided near construction area and 1 x 625 KVA will be provided at the labor camps for alternate power arrangement
2.7	Any other natural resources (use appropriate standard units)	No	--

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Yes	Diesel is being used for DG set, HEM and Transpiration vehicles. Hazardous waste generated will be utilized for lubrication works and remains disposed to APPCB authorized agencies.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases).	No	From past data no such disease registered.
3.3	Affect the welfare of people e.g., by changing living conditions?	Yes	Due to the proposed construction activity, living standards of surrounding people will have positive impact. i.e., ➢ Increase in employment directly or indirectly. ➢ Enhancement in the crop yield which leads for increase in living standards of surrounding villages.

3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Nil
3.5	Any other causes?	No	---

4. Production of solid wastes during construction or operation or commissioning (MT/month)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	No overburden or Spoils will be generated from the proposed project.
4.2	Municipal waste (domestic and or commercial wastes)	Yes	Municipal waste during construction and operation phase which will be disposed off suitably as per EMP.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	Used Oil – 250 LPA – APPCB authorized agencies.
4.4	Other industrial process wastes	No	Nil
4.5	Surplus product	No	No surplus product will be produced.
4.6	Sewage sludge or other sludge from effluent treatment	Yes	Mobile STP will be provided at the worker camps. The sludge generated about 2 -5 kg/day will be used as manure.
4.7	Construction or demolition wastes	No	Temporary sheds will be constructed for the labor.
4.8	Redundant machinery or equipment	No	Nil
4.9	Contaminated soils or other materials	No	Not Applicable
4.10	Agricultural wastes	No	No agricultural waste will be generated.
4.11	Other solid wastes	No	--

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	HSD will be used for DG sets, HEM Transportation Vehicles etc., generated emissions are SOx, NOx, PM. Acoustically enclosed DG sets will be provided in the working areas, HEM & Vehicles will be will be checked regularly.
5.2	Emissions from production processes	No	Not applicable
5.3	Emissions from materials handling including storage or transport	Yes	Emissions from trucks during movement for handling of construction and during operation, negligible quantity of fugitive emissions envisaged. Batching plants will be equipped with bag filter and cyclone separators.
5.4	Emissions from construction activities including plant and equipment	Yes	The equipment will run on HSD.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Dust will be generated during constructional phase.
5.6	Emissions from incineration of waste	No	Not applicable
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	No open air burning.
5.8	Emissions from any other sources	No	--

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	During operation stage the major source of emission is from DG sets and vehicular movement. APC measures with adequate stack height are provided to disperse the pollutants. Batching plants will be equipped with dust control system Acoustically enclosure DG Sets of 4 x 125 KVA near the construction area and 1 x 625 KVA in the labor camps will be provided.
6.2	From industrial or similar processes	Yes	Major sources of noise pollution are D.G. sets, HEM, transportation etc. Following measures are adopted to control the noise and vibration. ➢ DG sets are having inbuilt acoustic enclosure. ➢ Adequate PPE's are provided to the workers. ➢ Noise levels will be kept below 75 decibels at 1m distances from the equipment.
6.3	From construction or demolition	Yes	There shall be intermittent noise due to construction equipment and movement of vehicles.
6.4	From blasting or piling	Yes	There is blasting quantity is occurred in Earth work excavation of cut-off trench for an about 5000 Cum. Booster-1000 Kgs
6.5	From construction or operational traffic	Yes	There will be temporary increase in traffic during construction stage. As the material is available locally and not requires any

			stagnation of material or vehicle stagnation. Further it is also proposed to have vehicle sheds.
6.6	From lighting or cooling systems	No	--
6.7	From any other sources	No	--

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	Yes	During construction stage, Fuel storage will be unloaded through mechanically and all safely precautions considered for safe handling. Negligible spillages due to proposed operations.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	Yes	The domestic wastewater generated is disposed to septic tank followed by soak pit and through STP
7.3	By deposition of pollutants emitted to air into the land or into water	No	All the systems designed to meet the standards
7.4	From any other sources?	No	Nil
7.5	Is there a risk of long term build up of pollutants in the Environment from these sources?	No	Nil

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment.

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	Transport and handling of materials need attention and supervision as per the provisions of Management.
8.2	From any other causes	No	Nil
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	No	The structures are designed with adequate seismic safety factors. Facilities are designed as per applicable standards factoring into probable natural disaster thus safeguarding men and environment against any possible mishap. However, technical parameters for the project are being planned with appropriate factor of safety.

9. Factors which should be considered (such as consequential development) which could lead to Environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
9.1	Lead to development of supporting. facilities, ancillary development or development stimulated by the project which could have impact on the Environment e.g.: • Supporting infrastructure (roads, power	Yes	Lead to development supporting infrastructure (roads, water supply etc) providing infrastructure with water supply for drinking and irrigation facility for the agricultural lands.

	supply, Waste or waste water treatment, etc.) • Housing development • Extractive industries • Supply industries • Other		
9.2	Lead to after-use of the site, which could have an impact on the Environment	No	No impact will occur
9.3	Set a precedent for later developments	No	--
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Project would provide drinking water to the people and livestock, improve the groundwater availability, create better infrastructure, improve livelihood, socio-economic facility.

(III) Environmental Sensitivity

S. No.	Area	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	No	None within 15 km Aerial distance from project areas
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	No	None within 15 km Aerial distance from the proposed project
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	No	None within 15 km Aerial distance from the proposed project. Koundinya Wildlife Sanctuary at 25.0 km due south to the porposed project site
4	Inland, Coastal, Marine or underground	No	None within 15 km Aerial distance from the

	waters		proposed project
5	State, National boundaries	No	None within 15 km Aerial distance from the proposed project
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	Yes	Nearest Road is Tirupati – Punganur (SH - 65) at a distance of 7.5 km.
7	Defence installations	No	None within 15 km aerial distance from plant.
8	Densely populated or built-up area	Yes	Surrounding of 1km radius
9	Areas occupied by sensitive man-made land uses *(Hospitals, schools, places of worship, community facilities)*	Yes	Hospitals and schools are available at more than 2 km radius
10	Areas containing important, high quality or scarce resources *(Ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*	Yes	**Water Bodies** Sitamma Cheruvu & Muddaleru Vagu within the project site Pedda Vagu – 0.6 km – East Chennapatnam Cheruvu – 6.40 km – NW **Reserve /Protected Forests** Avulapalli Durga PF – 60 meters – SW Madirimali West RF – 0.45 km – NW Madirimali East RF – 0.5 km – North Yeddula Konda RF – 7.30 km – NE Kadurukanuma East RF – 8.30 km – North Rayalapeta RF – 8.50 km - SW Kadurukanuma Wast RF – 8.70 km - NW
11	Areas already subjected to pollution or environmental damage. *(Those where existing legal environmental standards are exceeded)*	No	Nil
12	Areas susceptible to natural hazard which	No	It falls in seismic zone –III Moderate

	could cause the project to present environmental problems (*Earthquakes, subsidence, landslides, erosion, flooding for extreme or adverse climatic conditions*)		

STANDARD TEMPLATE FOR EVALUATION OF ALL PROJECTS/ ACTIVITIES

S. No	Information required	Information to be furnished by the proponents
1	Name of the project or activity	Construction of Avulapalli Balancing Reservoir by Water Resource Department Tirupati, Government of Andhra Pradesh
2	Name of the organization/owner.	Sri K. Hari Narayana Reddy Chief Engineer
3	Address for communication	Sri K. Hari Narayana Reddy Chief Engineer (FAC) NTR Telugu Ganga Project OPP: S.V. Medical College Old Alipiri Road TIRUPATHI – 517501
4	Telephone numbers	9440904116
5	Email ID of the organization or contact person	cetgpskht@gmail.com
6	Location of the Proposed project or activity	Construction of Avulapalli Balancing Reservoir near Avulapalli Village, Somala Mandal, Chittoor District Andhra Pradesh
7	Appraisal Category (B2 or B1)	Category - B_2 (The project is listed under category of 1(c) of EIA Notification, 2006 and As per the S.O 3977 (E) of MoEF&CC, dated 14th August 2018, and S.O 1886(E) of MoEF&CC, dated 20th April 2022 it comes under B2 category as specified under item "1(c) (ii) Irrigation projects" in the SCHEDULE).
8	Nearest habitation and distance from the project or activity	Shown in LU/LC map
9	Installed capacity / Production Capacities	Construction of Avulapalli Balancing Reservoir with a capacity of 2.5 TMC, to drinking water to

		around 2.76 lakh people and an ayacut / culterable command area of 9700 Hectares in Chittoor District
10	Specify the Fuel (Coal / CNG / biomass/Others) and quantity required	Diesel for Generators and for batching plant
11	Details of Land use/Land Cover	Enclosed in EMP report
12	Occupancy, ownership of the land in which the activity is proposed: (Government land / Private land / Forest land /Revenue land /Temple land /leased land/ land belongs to other Department)	Government Land
13	If it is a Forest land, the following details shall be furnished: (Whether it is a Reserved forest / Protected forest/Demarcated forest/ National Parks/Sanctuaries/any land in possession of Forest Department.) (The village map with Sy. No. indicating nearest forest boundary line from the site shall be enclosed)	No Forest Land Involved
14	Total investment of the project/activity.	Proposed project cost: Rs. 667.20 Crores
	a. Funds allocated for EMP (capital cost and recurring cost per annum)	Capital Cost : 205.0 Lakhs Recurring Cost: 42.0 Lakhs/annum
15	Brief description of the project with special reference to specific pollution and its control measures.	Enclosed in EMP
16	Compliance report on the following :	
	i. Status of compliance of the conditions and Environmental safeguards stipulated in the earlier clearance letters.	Nil

	ii. Details of the court cases, if any, pending in any Court of Law against the project as well as any directions passed by the Court relating to the project directly or indirectly.	Nil
	iii. Details of the notices, if any, given to the project under Section 5 of the Environmental (Protection) Act, 1986 and Section 18 of the Air (Prevention & Control of Pollution) Act, 1981.	Nil
17	Whether the project attracts the provisions laid under the OM dt. 16.11.2012 issued by the MoE&F, GOI, w.r.t. violation of EIA Notification, 2006 and its amendments thereof? (Yes/No)	No
18	Present stage and status of the project:	Soil testing and borehole data surveys completed and Construction yet to start
19	Name of the Consultant:	SV Enviro Labs & Consultants, Visakhapatnam.

DECLARATION

(a) I/We / **M/s. Water Resource Department** hereby declare that I/We/ our organization does not /do not have conflict of interest with the Chairman and members of SEIAA, A.P.

(b) I/We hereby declare that **Mr. K. Hari Narayana Reddy** of our company / organization is/are authorized to submit the application and to do all necessary correspondence for obtaining Environmental Clearance from State Environmental Impact Assessment Authority, Andhra Pradesh and to attend the meeting (s) of SEIAA, AP to present our case and to clarify the points raised by the Members of SEIAA, AP.

(c) I/we hereby declare that the information furnished above is true to best of my/our knowledge and I/we shall hold personal liability for any deliberate misrepresentation and or concealment of factual information. If the information furnished is found to be false, the EC issued to our organization can be withdrawn and I/we are liable for action as per rules applicable.

Date	Place	**Signature of the Applicant/ project proponent (Name and address of the Applicant)**
22.07.2022	Tirupathi	22/07/22. Chief Engineer (FAC) NTR Telugu Ganga Project Tirupati

(IV) Proposed Terms of Reference for EIA studies:

"I hereby given undertaking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost.

Date: 22.07.2022
Place: Tirupathi

22/07/22

Signature of the applicant with
Name and Full Address
(Project Proponent /Authorized Signatory)

Note:

1. The projects involving clearance under Coastal Regulation Zone Notification, 1991 shall submit with the application a C.R.Z map duly demarcated by one of the authorized agencies, showing the project activities, w.r.t. C.R.Z (at the stage of TOR) and the recommendations of the State Coastal Zone Management Authority (at the state of EC). Simultaneous action shall also be taken to obtain the requisite clearance under the provisions of the C.R.Z Notification, 1991 for the activities to be located in the CRZ.

2. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden thereon (at the state of EC)."

3. All correspondence with the Ministry of Environment & Forests including submission of application for TOR/Environmental Clearance, subsequent clarifications, as may be required from time to time, participation the SEAC Meeting on behalf of the project proponent shall be made by the authorized signatory only. The authorized signatory should also submit a document in support of his claim of being an authorized signatory for the specific project."

ENVIRONMENTAL MANAGEMENT PLAN

Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District

For

Chief Engineer (Projects)

Water Resources Department, Tirupati

Government of Andhra Pradesh

Prepared & Submitted by

SV ENVIRO LABS & CONSULTANTS

Enviro House, Block – B, B-1, IDA Auto Nagar,

Visakhapatnam - 530012

QCI No. NABET/EIA/2124/RA 0240 Valid up to Dated: 24.10.2024

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Annexure –II: Detailed Project Report

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Chapter 1
INTRODUCTION

1.0 GENERAL

Climate change induced affects influences the water resources availability in complex ways. Climate change is going to disrupt the water resources sector, weather patterns leading to extreme rainfall and cyclone events, unpredictable water availability with reference to time and space, water supplies to even basic utilities, and other related sectors or sections. The major climate change consequences related to water resources are increases in temperature, changes in precipitation patterns, and a likely increase in the frequency of flooding and droughts. Climate change may also markedly change the seasonal variation in water flows in rivers or streams exacerbating water scarcity. Climate change tends to increase the frequency and intensity of rainfall; there may be an increase in the occurrence of flooding due to heavy rainfall events in several parts of India. Groundwater recharge may also be affected thereby causing reduction in the availability of groundwater for drinking water in some regions. Such impacts can drastically affect the quantity and quality of water that the living systems need to survive. Climate change exacerbates water stress particularly in areas of limited water resources, which will lead to increased competition for even drinking water. Intergovernmental Panel on Climate Change (IPCC) warned that changing climate system would exacerbate its effects on sections of population currently suffering from drought and flooding (5^{th} Assessment Report of IPCC, 2014).

Thus, the effects of climate change will have adverse direct and indirect impacts on water resources, drinking water provision, livelihoods, human health, ecosystems, regional agriculture, food security, livestock sustenance and overall the society and ecosystems. India, with major share of population and livestock has only around 4% of the world's water resources and about 9% of the world's arable land. Spatial and temporal distribution of rainfall is highly uneven and the impact is more in the southern states of India. One of the predictions of climate change impact is experiencing more frequent, heavy, intense, and short duration rains in the coming years. There has been a significant change in precipitation during last decade in India including the state of Andhra Pradesh. The present water resources availability resulted in scarcity in some of the regions of India. The impact of climate change in India may further aggravate the challenges in water resources availability and its management and governance. Flood Risk Management and storage of water during its

availability is also part of the Climate change impact management. It is apt to act and implement the mitigation and adaptation programs or plans to manage the climate change impact on water resources.

Water availability is becoming less predictable in many places, and may increase the incidences of droughts and / or flooding. Hence, the implementation of the climate change adaptation strategies in advance are necessary to cope up with the climate change induced impacts in water stressed states or regions in a state. One such strategy is to plan the programs well in advance to catch the floodwater when it is available and store it for a later use. Such adaptation programs or projects to reduce the effects of climate change on water will provide basic drinking water, livelihoods and save the lives of people and livestock of the state like Andhra Pradesh or region like Rayalaseema.

Andhra Pradesh is currently facing water shortage particularly in the Rayalaseema region of the state. Rayalaseema region comprising the four districts of Ananthapur, Chittoor, Y.S.R. Kadapa and Kurnool located in the southern part of Andhra Pradesh. Frequent drought occurrence from the 19th century onwards is the prime cause of water scarcity and backwardness of Rayalaseema region, discouraging its economy to stagnation and poverty. In recent past, Rayalaseema has not been able to receive sufficient rainfall due to which the deficiency in terms of rain is at a massive - 47% which is also the highest deficient figure in the entire country (Source: skymetweather). Chronically drought prone Rayalaseema region has become a foster child of the state Andhra Pradesh. The climate in Rayalaseema region is mostly dry with very low annual rainfall. It was found that all four districts of Rayalaseema are more vulnerable to climate change (Rama Rao et al., 2017). The impact of drought in Rayalaseema therefore becomes very significant. Hence, it is very much essential to plan an effective management of the available limited water resources.

The amount of water available in Rayalaseema region is limited during the summer months, and at the same time demand continuing to rise. It could pose serious challenges for drinking water supply, agriculture sector and other livelihood opportunities. Present water management projects / programs/systems are inadequate to meet the challenges of climate change in this region. It made the water supply planners and managers to supply sufficient water at least for drinking. There are possibilities of experiencing extreme pressure for drinking water in the drought-prone Rayalaseema in future. In addition, the prediction of the climate change impact on the water resources made the policy makers to plan the strategies

and policies to implement the climate change adaptation projects, which take into account climate change in relation to the integrated water resource management planning concerning droughts and water scarcity.

The major water resource development and management project in the Rayalaseema regions are Alaganur Balancing Reservoir, Chitravathi Balancing Reservoir, Galeru Nagari Sujala Sravanthi (GNSS), Handri Niva Sujala Sravanthi (HNSS), Velugodu, Gandikota, Gundlakamma, K-C canal systems, Gandikota Lift Irrigation Scheme, Owk Reservoir, Penna Ahobhilam etc. GNSS and HNSS irrigation projects tap water from Srisailam reservoir and distribute it to the dorught prone areas of Rayalaseema region. The water from GNSS project canal join the Gandikota Reservoir located across Penna River of Andhra Pradesh. In the year 2020, around 5,000 cusecs of water was released from Gandikota reservoir after it received around 6,000 cusecs of floodwater from Penna River due to heavy rains in a day. Penna River causes the water level in the Gandikota reservoir to rise significantly. The flood flows from Penna River self-catchment into the Gandikota reservoir during January 2021 estimated as approximately 14120 cusecs. In November 2021, heavy rains caused record flows through Penna River that resulted in cut off major road and rail routes including the Chennai-Kolkata highway.During this very short period, the Penna River got more than 2 lakh cusecs of water from its catchment and the river Papagni, Pincha, Cheyyru etc. were also carried huge amount of flood water flows. It is clear indication that the floodwater is available during monsoon season and it need to be effectively utilized to adapt to the climate change induced impacts in the region. Keeping these in view, Government of Andhra Pradesh started acting through the projects of climate change adaptation in water resources that can tap the water during its availability and use it later when it is necessary.

An adaptation intervention in the form of water project that include how water can be allocated to prevent shortages, and where more water storage is desired to withstand future droughts is the need of the hour. Considering the floodwater availability in the Gandikota reservoir and the probable future climate change impacts and adaptation in water resources management, Government of Andhra Pradesh initiated several projects in the drought prone Rayalaseema region. One such new project is construction of Avulapalli water storage reservoir to sore the water received from the Gandikota reservoir, which on Pennar River, during the period of availability of flood flows that are joining the Gandikota Reservoir. This project envisages storing floodwater during their available and supply of water primarily for

drinking purpose during lean seasons and irrigation if there is any surplus. This project is part of adaptation towards the climate change impact and strategy for resilience in water resources management.

1.1 PROJECT BACKGROUND

The proposed Avulapalli Balancing Reservoirs project is proposed to store water received from Gandikota reservoir. The water is conveyed through the existing gravity canal of HNSS Project. Now the HNSS canal that conveys water to the proposed reservoir is not functioning due to non-availability of water being tail end region. The project aims at meeting the water demand in the drought prone region of Chittoor district in the semi-arid zone of Rayalaseema in the state of Andhra Pradesh. It is proposed to expand the existing carrying capacity of canals and expansion of water storage facilities through this program by providing Pennar Flood water. Due to inadequate floodwater availability and geological characteristics, the desired or designed water could not be released into Punganur Brach Canal (PBC).

The project proposes to provide, long term relief to the people and live stock during the times of drought and famine when even drinking water is scarce and to assist in the reversal of the desertification process by enhancing the conditions of environment and ecology of the area. It provide the basic drinking water supply to the people and contemplated ayacut of approximately 9700 ha. in addition to the supplementing of some of the ponds or tanks situated in the most frequently drought affected areas, further adding feeder facility to the local industry of the region in future.

1.2 JUSTIFICATION FOR PROPOSED PROJECT

Rayalaseema is synonymous with semi-arid and drought prone region, and euphemism diametrically opposite from its prosperous times of mediaeval ages. The region includes the districts of Anantapur, Kurnool, YSR Kadapa and Chittoor, south of the Krishna River in Andhra Pradesh and drained by Krishna and Penna rivers. It has abundant land, mineral and human resources and excellent potential for the establishment of next generation industries in goods and services sector. The main hindrance to the development of region is lack of ‘dependable’ water resources.

Rayalaseema region in Andhra Pradesh receives low rainfall ranging from 500 mm to 650 mm, compared to state average of 960 mm and not properly distributed over time and space.

It is apt to mention here that earlier Ananthapuramu district in AP receives the second lowest rainfall in the country after the desert in Rajasthan.

Water security is intimately connected and tied with food security, livelihood, health, environment, socio-economic development and over-all well-being of any society. The State of Andhra Pradesh consisting 13 districts with 175 Assembly constituencies and 25 Parliamentary constituencies is identified as the three Regions : (i) North Coast Region (Srikakulam, Vizianagaram and Visakhapatnam districts), (ii) Coastal Andhra Region – (East Godavari, West Godavari, Krishna, Guntur, Prakasham and SPSR Nellore districts) and (iii) Rayalaseema Region (YSR Kadapa, Kurnool, Ananthapuramu and Chittoor districts) with more than half of the landed area of the State is fit for cultivation.

Among the three Regions, Rayalaseema Region is mostly a rocky region with some mineral resources and mainly with insufficient ground and surface-water resources, besides in some areas, the alkaline groundwater picks up fluoride. Rayalaseema Region constitutes 41% of the geographical area in the state, whereas the cultivable area is about 36% and the irrigated area is only 20% in the state. The region for which the proposed project is going to serve is facing even drinking water problem due to lack of availability of water. Hence, it is essential to take up such project for the sustenance of the people and livestock and their activity in the area. It helps in mitigating the climate change impact on the local water resources.

1.3 AIM OF THE PROJECT

The aim of the proposed scheme in the name of new formation of Reservoir enhancing the storage capacity of the existing minor irrigation tank near Avulapalli to provide drinking water to around 2.76 lakh people and an ayacut / culterable command area of 9700 ha. in the upland region and remote areas in Chittoor district. The proposed scheme will take the water from the water of 800 cusecs pumped into Punganuru branch canal from the GNSS-HNSS Lift Scheme bringing water from Gandikota reservoir. This facilitate to meet the water demand of the regions that failed to get the water under the existing project with less cost and more effective manner.

1.4 PRESENT PROPOSAL

The proposed formation of Avulapalli reservoir enhancing the storage capacity of the existing minor irrigation tank is part of climate change impact mitigation Project. It is intended to provide drinking water to the people and irrigation facilities in Chittoor districts of Andhra Pradesh. The Govt. of AP have accorded administrative sanction for Rs.2144.50Cr. vide G.O

Rt No.461 Dt: 02-09-2020 for the Avulapalli reservoir construction project. For expansion of carrying capacity and expansion of storage capacity in Chittoor district.

The project is based on the utilisation of surplus floodwater reaching the Gandkota Reservoir on Pennar River. The balancing reservoir is proposed to store the floodwaters, if available, during the monsoon period. The yields from the 48.5 km^2 catchments of the Reservoir is less compared to the proposed storage. Hence, the yields of the self-catchments are taken in to account.

1.5 SCOPE OF THE PROJECT

The formation of the Avulapalli Reservoirs enhancing the storage capacity of the existing minor irrigation tank is part of climate change impact mitigation Project is proposed to provide drinking water to the villages and towns and irrigation water to an ayacut of 23,959 acres.

Location of the Avulapalli Balancing Reservoir: $78^O49'09"$ Longitude and $13^O23'29"$ Latitude Near Avulapalli in Somala(M) of Chittoor District, Andhra Pradesh.

Name of the head Works:			Village			
Avulapalli Reservoir		Avulapalli				
Location of Head Works	:					
Reservoir	:	Longitude		Latitude		
Avulapalli Reservoir		$78^O49'09"$		$13^O23'29"$		
Lies in Earthquake Zone No.		Zone-III				
Project Area Reference						
Degree Sheets		Survey of India Sheets				
		57-K5,	57-K-6,	57-K-7,	57-K-11,	57-K-15

The project includes measures for conjunctive use of water and drainage of surplus water. It also includes review and strengthening of agricultural support services and plan for involvement of beneficiaries in management of the project for self-sustainability in future.

1.6 PROJECT PROPONENT

The Water Resource Department, Government of Andhra Pradesh proposed the Avulapalli balancing reservoir enhancing the capacity of the existing seethamma cheruvu. The reservoir is proposed to meet the water demand in the area (primarily for drinking and then irrigation)

as part of Climate change impact reduction and adaptation along with the Rayalseema Drought mitigation program. The details of the proponent

Designation : Chief Engineer (Projects)

Department : Water Resource Department, Govt. of Andhra Pradesh

Email : cetgpskht@gmail.com

Phone Number : 9440904116

Correspondence Address : Sri K. Harinarayana Reddy
Chief Engineer (FAC),
NTR Telugu Ganga Project
Water Resource Department of Govt. of Andhra Pradesh, Tirupati

1.7 POLICY, LEGAL AND ADMINISTRATIVE STATUTORY

The Ministry of Environment, Forests and Climate Change (MoEF&CC), Govt. of India, has enacted various acts, legislations, guidelines and standards from time to time and is the principal environmental regulatory agency. MoEF&CC has been mandated to formulate environmental policies and accords environmental clearances for different projects in India. The important environmental legislations in India are presented in below table:

Name	**Scope & objective**	**Key areas**	**Operational Agencies/Key player**
Water (Prevention and Control of Pollution) Act, 1974, 1988	Prevention and control of water pollution, and enhancing the quality of water	Control discharge of sewage and industrial effluent	Central and State Pollution Control Boards
Air (Prevention and Control of Pollution) Act, 1981, 1987	Prevention and control of air pollution	Control emission of air pollutants	Central and State Pollution Control Boards
Forest (Conservation) Act, 1980, 1988	To consolidate acquisition of common property such as forest, halt India's rapid deforestation and resulting environmental degradation	Regulates access to natural resources, state has a monopoly right over land, categories forests, restriction on de-reservation and using forest for non-forest purpose	Central and State Pollution Control Boards
Wildlife (Protection) Act, 1972, 1993	To protect wildlife	Creates protected areas (national	Wildlife advisory Boards, Central Zoo

		parks/sanctuaries) categories of wildlife which are protected	Authorities
Environment (Protection) Act, 1986	To provide for the protection and improvement of environment	An umbrella legislation, supplements pollution laws	Central government nodal agency, MoEF&CC can delegate to state departments of environment
EIA Notification 14th Sep 2006 and subsequent amendment thereof	Environment Impact Assessment	Environmental Protection	Project Development, State and Central Government
National Water Policy, 2012	Legislation needed in view of inequalities in distribution and lack of unified perspective in planning, management and use of water resources with due consideration to environmental sustainability and holistic benefit to the people.	To recognize and consider while planning the environmental needs of aquatic eco-system, wetlands and embanked flood plains besides adaptation to strategies to provide a mechanism for dealing with increased variability due to climate change.	State and Central Government
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	To address concerns of farmers and those whose livelihoods is dependent on land being acquired and at the same time facilitating land acquisition in a timely and transparent manner and for ensuring comprehensive package for the land owners for calculation of market value of the land besides comprehensive rehabilitation and resettlement package for land owners.	Social issues	Central and State Government

1.9 SCOPING OF THE PROJECT FOR ENVIRONMENTAL MANAGEMENT

The Government of Andhra Pradesh is planning some environmental management projects as part of climate change impact reduction and adaptation programs in water resources management. As part of such environmental management projects, the water resources department proposed investigation and construction of new "Avulapalli Balancing Reservoir". As the water dependability is more in upper reaches of the HNSS Project command area, the tail end reaches are unable to get water from the HNSS project. The proposed reservoir will get the water from Punganuru branch canal that conveys the take 800 cusecs of water from the Gandikota reservoir through GNSS-HNSS Lift Scheme to meet the water demand of the regions. There is no need to change the scope of the existing HNSS project for which the EC was already accorded. Finally, around 750 cusecs of water will be discharged into the HNSS main canal and 800 cusecs of water will be discharged into the HNSS Punganuru branch canal. There is no need to change the scope of the existing HNSS project for which the EC was already accorded.

The proposed new project Avulapalli Balancing Reservoir has an Ayacut of 9700 ha. which is less <10000 ha. ayacut. As per the SO 3977 (E) € dated 14th August, 2018 and the SO 1886 (E) dated 20th April, 2022 construction of irrigation projects intend for drinking water and having a culturable command area between > 2000 ha and <10000 ha comes under B2 Category.

The proposed new project attracts prior Environmental Clearance as per the EIA notification, 2006 and its subsequent amendments as it has a culturable command area of 9700 ha. As per the S.O 3977 (E) of MoEF&CC, dated 14th August 2018 and the SO 1886 (E) dated 20th April, 2022, it comes under B2 category as specified under item "1(c) (ii) Irrigation projects" in the SCHEDULE. Further, the NGT also directed to get the necessary EC to the new project and as there is component of drinking water supply to remote areas, the processes need to be duly expedited by the concern authorities.

Therefore, it is requested to appraise the proposed project under B2 category as per the EIA notification and subsequent S.Os of MoEF & CC at the earliest and issue the Environmental Clearance.

Chapter 2

PROJECT DESCRIPTION

2.0 General

The project proposes to provide long-term relief to the people and livestock during the times of lean seasons and drought when even drinking water is scare. It would also provide the irrigation water supply to the completed aycut in addition to supplementing some of the ponds or tanks (locally called as Cheruvulu) situated in the most frequently drought affected areas in the Chittoor district. It will also assist the generation of livelihood opportunities through provision of irrigation water supply process and enhancing the conditions of environment of the area.

In order to provide assured drinking water supply to the villages to be served under the proposed Avulapalli reservoir in Chittoor District, the floodwater during their availability in Gandikota reservoir will be lifted through the GNSS-HNSS Lift scheme that is initiated by the Government of Andhra Pradesh. The Avulapalli reservoir is intend to create drinking water to more than 2.7 lakh population as per 2011 census and irrigation facilities in the command region to feed 9367 ha (23,146 Acres) of ayacut of the region.

The project proposes to provide, long-term relief to the people and cattle during the times of drought and famine when even drinking water is scarce and to assist in the reversal of the desertification process by enhancing the conditions of environment and ecology of the area. It would also provide the water supply to the contemplated ayacut in addition to supplementing some of the existing ponds or tanks situated in the most frequently drought affected areas, further adding feeder facility to the local industry in and around Thamballapalle, Madanapalli, Piler and Punganur, Palamaneru, Kuppam Assembly constituencies in future.

2.1 Location of the Project

Name of the Reservoir (Proposed)	Longitude	Latitude	Name of Village Near head Works
Avulapalli Reservoir	78^{O} 49’ 09”E	13^{O} 23’ 29”N	Avulapalli

The location of the project on google map is shown in Fig 2. 1. The location of the project components on 1:50,000 scale toposheet is presented in Fig. 2. 2.

2.2 Ayacut and Capacity Details of Existing Pond Seethamma Cheruvu

The proposed balancing reservoir is a small check dam type pond constructed through expansion of the existing Seethamma Cheruvu, and the Seethamma Cheruvu (MI tank) fore shore area and capacity of the MI is limited.

Proposed Balancing Reservoir / Existing Tank Details							
Name of the Proposed Balancing Reservoir	Name of existing Pond	Existing Ayacut in Acres	Capacity of existing Tank in Mcft	Revised / Enhanced capacity in TMC	Ayacut Proposed Acres/Ha	Drinking water	
						Existing	Design., per year in TMC
Avulapalli	Seethamma Cheruvu	48	28	2.5	23,959Ac 9700Ha	Nill	1.31

2.3 Catchment Area

The catchment area through which runoff is being received by the existing MI tank is approximately 48.5 km^2. The runoff varies with the rainfall and its intensity-duration-frequency apart from the catchment area characteristics. The catchment has sufficient slope as it has hillocks and hills.

2.4 Cascading of Seethamma Cheruvu

Cascading of Seethamma Cheruvu as of now are 1) Somappacheruvu, 2) Vyasappacheruvu, 3) Enkicheruvu, 4) Seetha cheruvu, 5) Korlakuntavaripalli, 6) Kummaranicheruvu, 7) Panyam cheruvu, 8) Ayyapanayanicheruvu, 9) Papireddypalliproject, 10) Agraharam cheruvu

2.5 Elevation of Avulapalli Balancing Reservoir

Table 2.3 Water Levels (EL-m) Avulapalli Balancing Reservoir

Water Levels (EL-m)		
a)	Max. Water Level (M.W.L)	661.50
b)	Full Reservoir Level(F.R.L)	660.00
	T.B.L(Top of the Bund Level	665.00
c)	Minimum Draw Down Level (M.D.D.L.)	638.00
d)	Outlet Levels	
i)	Irrigation	638.00
ii)	Power	------
iii)	Others	-------
e)	Dead storage Level	632.00
f)	Free Board,m	4.00

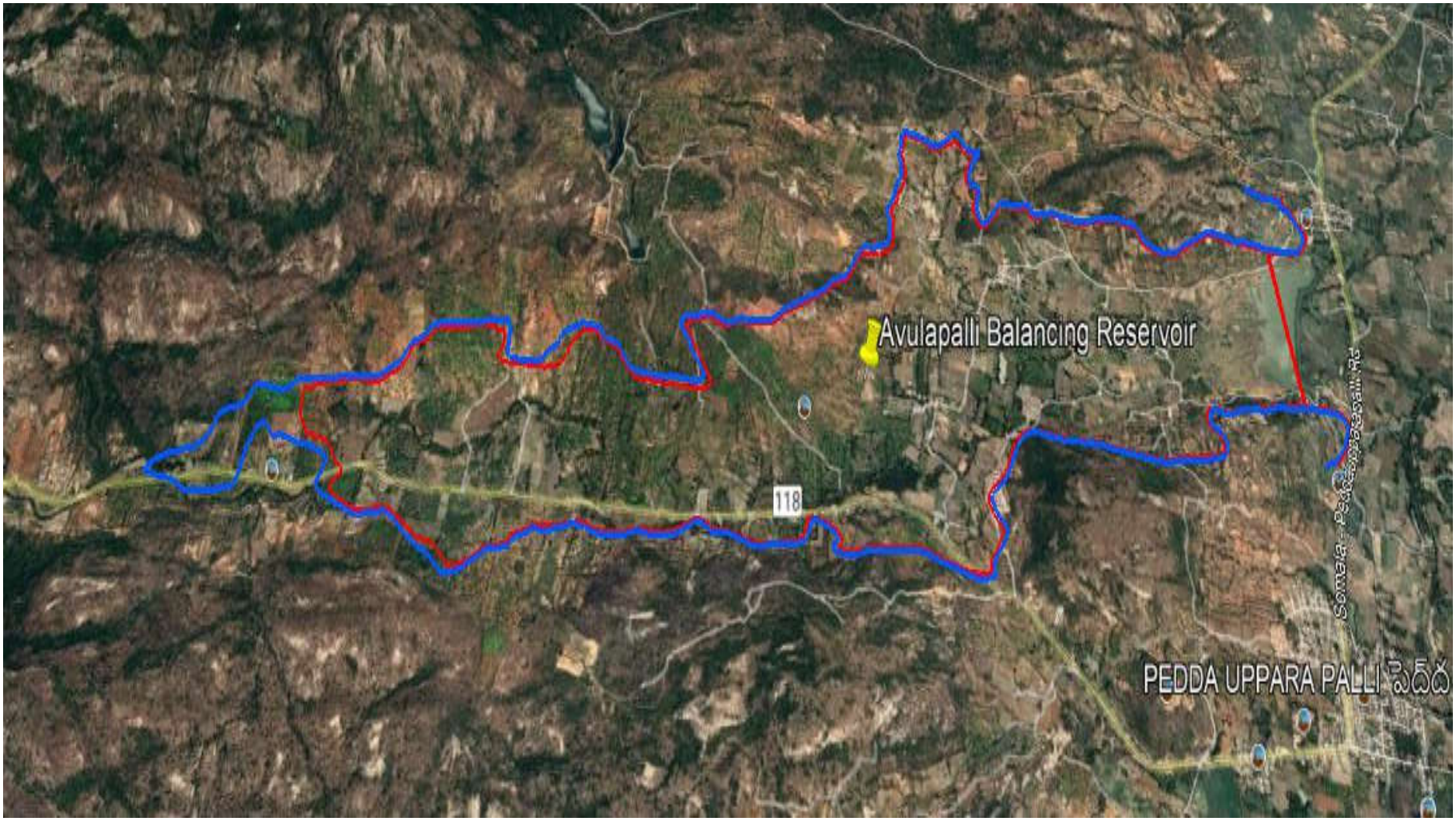


Fig 2.1 Google Image of the Avulapalli Balancing Reservoir

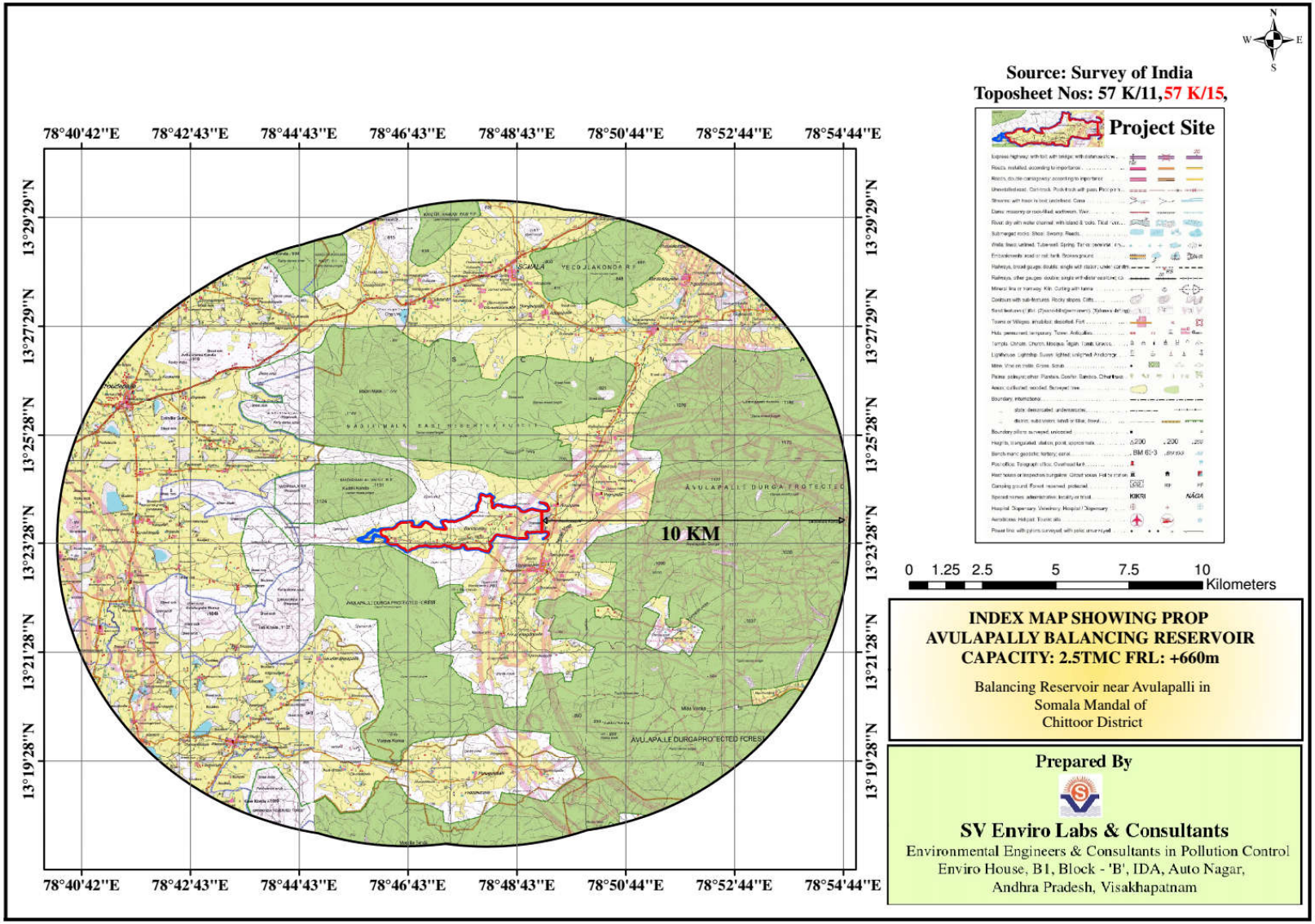


Fig 2.2: Topo map of the study area

2.6 Saddle Bund

The lowest area between two highlands (prominences or peaks) which has two wings which span the divide (the line between the two prominences) by crossing the divide at an angle, and, so is concurrently the Maximum water level of the reservoir plus Free board as highpoint of the Avulapalli Balancing Reservoir which falls off within the boundry of the Avulapalli Balancing Reservoir to avoid the inundation of forest land. That is, the drainage divide is a ridge along the high point of the saddle, as well as between the two peaks and so defines the major reference axis. A saddle can vary from a sharp, narrow gap to a broad, comfortable, sway-backed, shallow valley so long as it is both the high point in the sloping faces which descends to lower elevations and the low area between the two flanking summits. Concurrently, along a different axis, it is the low point between two peaks, so as such, is the likely 'optimal' high point in a pass if the saddle is traversed by a Water. 4 nos of saddle bunds are proposed to avoid the inundation of forest area . The position of saddle bunds are in the contour drawing as given in Fig. 2.5.

2.7 Table 2.4 Contour capacity of the Avulapalli Balancing Reservoir

RESERVOIR CAPACITY TABLE								
Avulapally BR : 2.5 TMC FRL +660								
S.No.	**Individual strip**	**Contour Elevation**	**Contour Area**	**Individual Vol: V=Δh(A1+A2+ Sqrt (A1A2))/3**	**Cft Col D * 35.315**	**Mcft Col E/1000000**	**Tmc Col F/1000**	**Cumulative**
	A	B	C	D	E	F	G	H
1	0		0					
3	106	616	106	35	1248	0.00125	0.00000	0.00000
4	350	617	350	216	7635	0.00764	0.00001	0.00001
5	2328	618	2328	1194	42150	0.04215	0.00004	0.00005
6	8492	619	8492	5089	179710	0.17971	0.00018	0.00023
7	17599	620	17599	12772	451043	0.45104	0.00045	0.00068
8	27781	621	27781	22497	794487	0.79449	0.00079	0.00148
9	37914	622	37914	32716	1155382	1.15538	0.00116	0.00263
10	48207	623	48207	42958	1517048	1.51705	0.00152	0.00415
11	59732	624	59732	53867	1902301	1.90230	0.00190	0.00605
12	81781	625	81781	70468	2488593	2.48859	0.00249	0.00854
13	137013	626	137013	108216	3821648	3.82165	0.00382	0.01236
14	185486	627	185486	160639	5672962	5.67296	0.00567	0.01803
15	273872	628	273872	228248	8060593	8.06059	0.00806	0.02609
16	331316	629	331316	302139	10670024	10.67002	0.01067	0.03676
17	427652	630	427652	378461	13365345	13.36535	0.01337	0.05013
18	571977	631	571977	498069	17589303	17.58930	0.01759	0.06772
19	713879	632	713879	641619	22658776	22.65878	0.02266	0.09038
20	789998	633	789998	751617	26543362	26.54336	0.02654	0.11692
21	892038	634	892038	840502	29682317	29.68232	0.02968	0.14660
22	1013042	635	1013042	951899	33616309	33.61631	0.03362	0.18022
23	1107792	636	1107792	1060064	37436163	37.43616	0.03744	0.21766
24	1229770	637	1229770	1168250	41256757	41.25676	0.04126	0.25891
25	1342677	638	1342677	1285810	45408392	45.40839	0.04541	0.30432

26	1448681	639	1448681	1395343	49276553	49.27655	0.04928	0.35360
27	1588243	640	1588243	1517927	53605601	53.60560	0.05361	0.40720
28	1706443	641	1706443	1646990	58163434	58.16343	0.05816	0.46537
29	1821852	642	1821852	1763833	62289757	62.28976	0.06229	0.52766
30	1927715	643	1927715	1874534	66199182	66.19918	0.06620	0.59386
31	2032440	644	2032440	1979847	69918285	69.91829	0.06992	0.66377
32	2148700	645	2148700	2090301	73818964	73.81896	0.07382	0.73759
33	2302956	646	2302956	2225382	78589381	78.58938	0.07859	0.81618
34	2456105	647	2456105	2379120	84018612	84.01861	0.08402	0.90020
35	2658521	648	2658521	2556645	90287924	90.28792	0.09029	0.99049
36	2811129	649	2811129	2734470	96567812	96.56781	0.09657	1.08706
37	2954784	650	2954784	2882658	101801074	101.80107	0.10180	1.18886
38	3110815	651	3110815	3032465	107091500	107.09150	0.10709	1.29595
39	3259022	652	3259022	3184631	112465247	112.46525	0.11247	1.40841
40	3412954	653	3412954	3335692	117799963	117.79996	0.11780	1.52621
41	3567202	654	3567202	3489794	123242072	123.24207	0.12324	1.64946
42	3767089	655	3767089	3666691	129489208	129.48921	0.12949	1.77895
43	3957161	656	3957161	3861735	136377178	136.37718	0.13638	1.91532
44	4142662	657	4142662	4049557	143010121	143.01012	0.14301	2.05833
45	4327035	658	4327035	4234514	149541862	149.54186	0.14954	2.20788
46	4491070	659	4491070	4408798	155696708	155.69671	0.15570	2.36357
47	4730831	660	4730831	4610431	162817369	162.81737	0.16282	2.52639
							Total	**2.5 TMC**

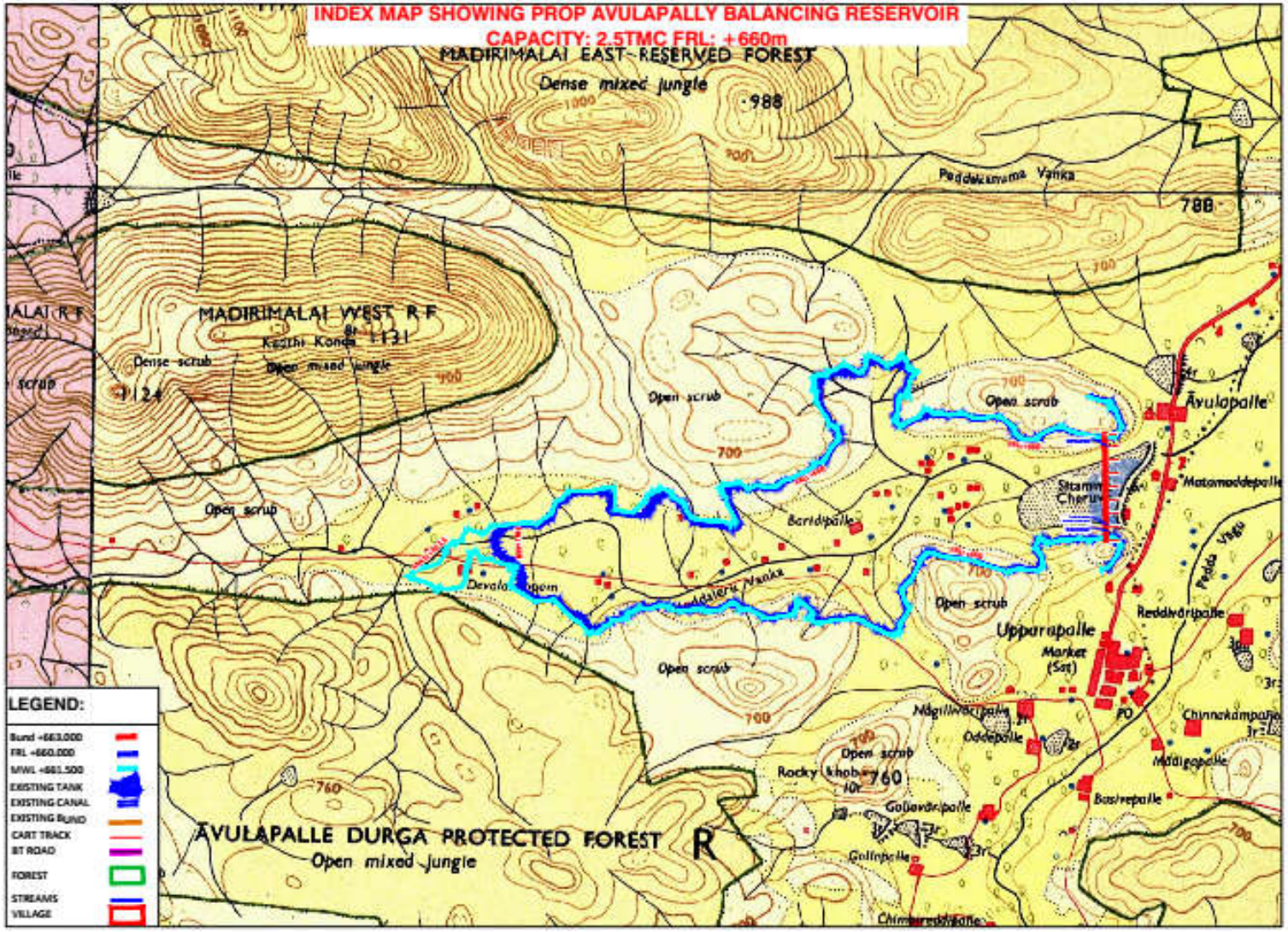


Fig 2.3 Water spread area of proposed Avulapalli Balancing reservoir on Topomap

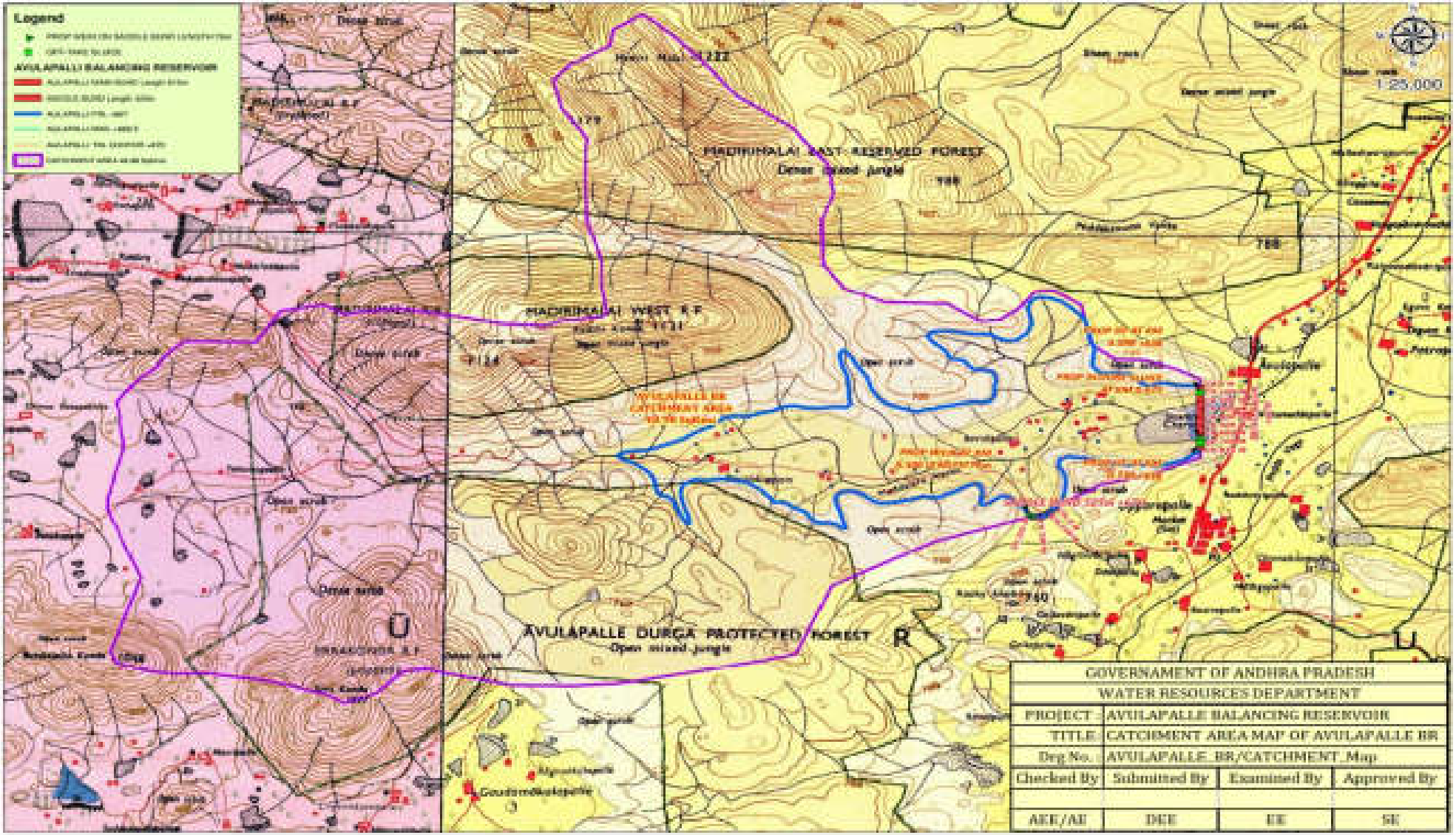


Fig 2.4 Catchment area of the Avulapalli Balancing reservoir

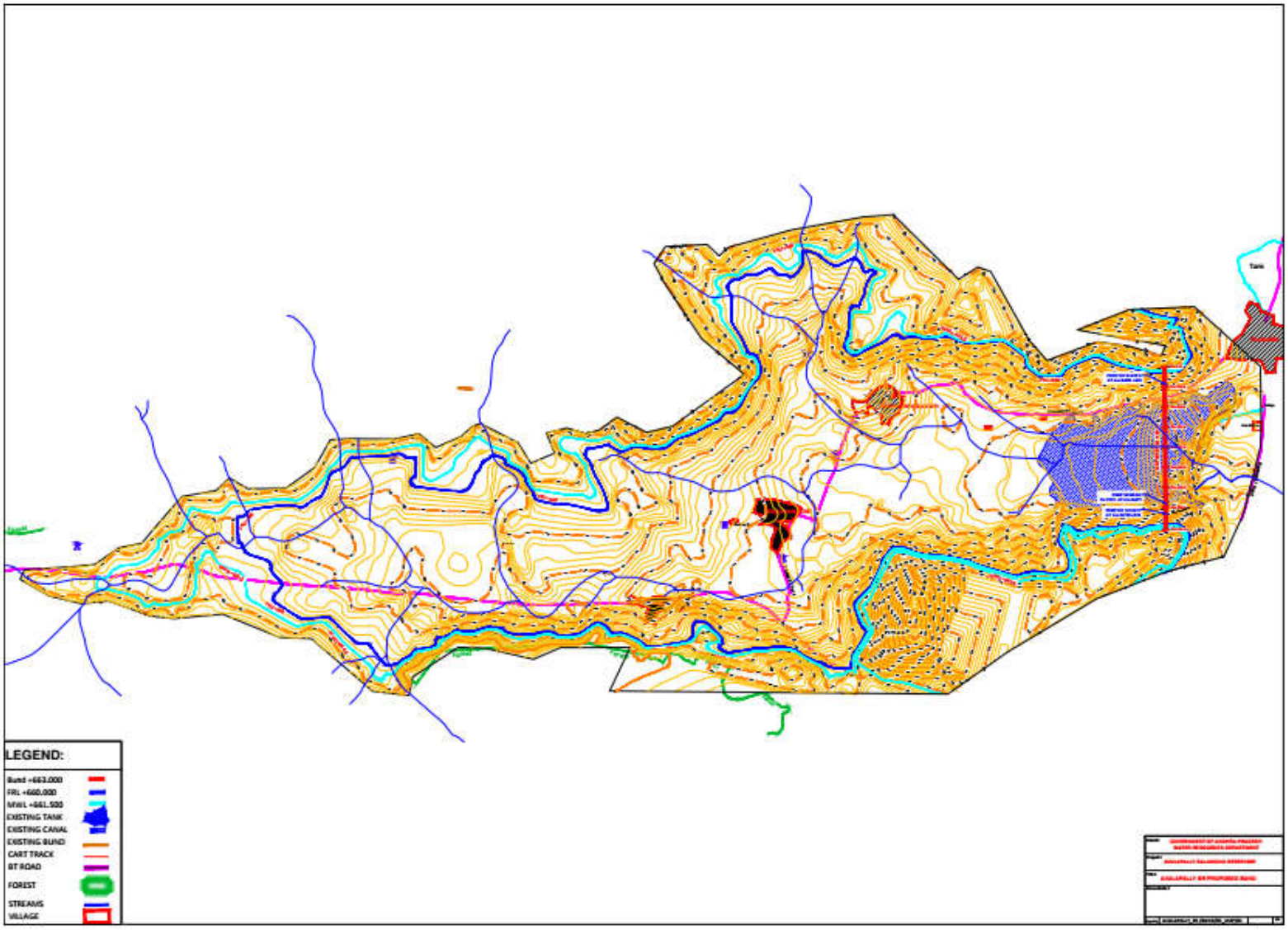


Fig 2.5 Contour map of proposed Avulapalli Balancing Reservoir

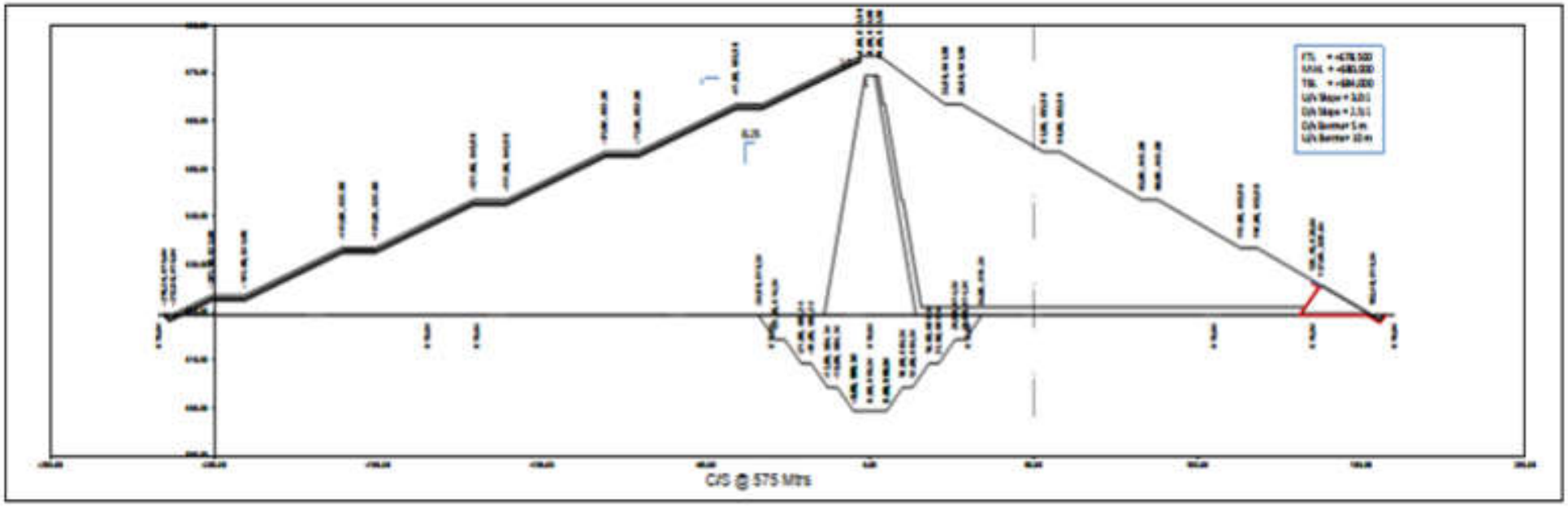


Fig 2.6 Typical Cross Section of Bund

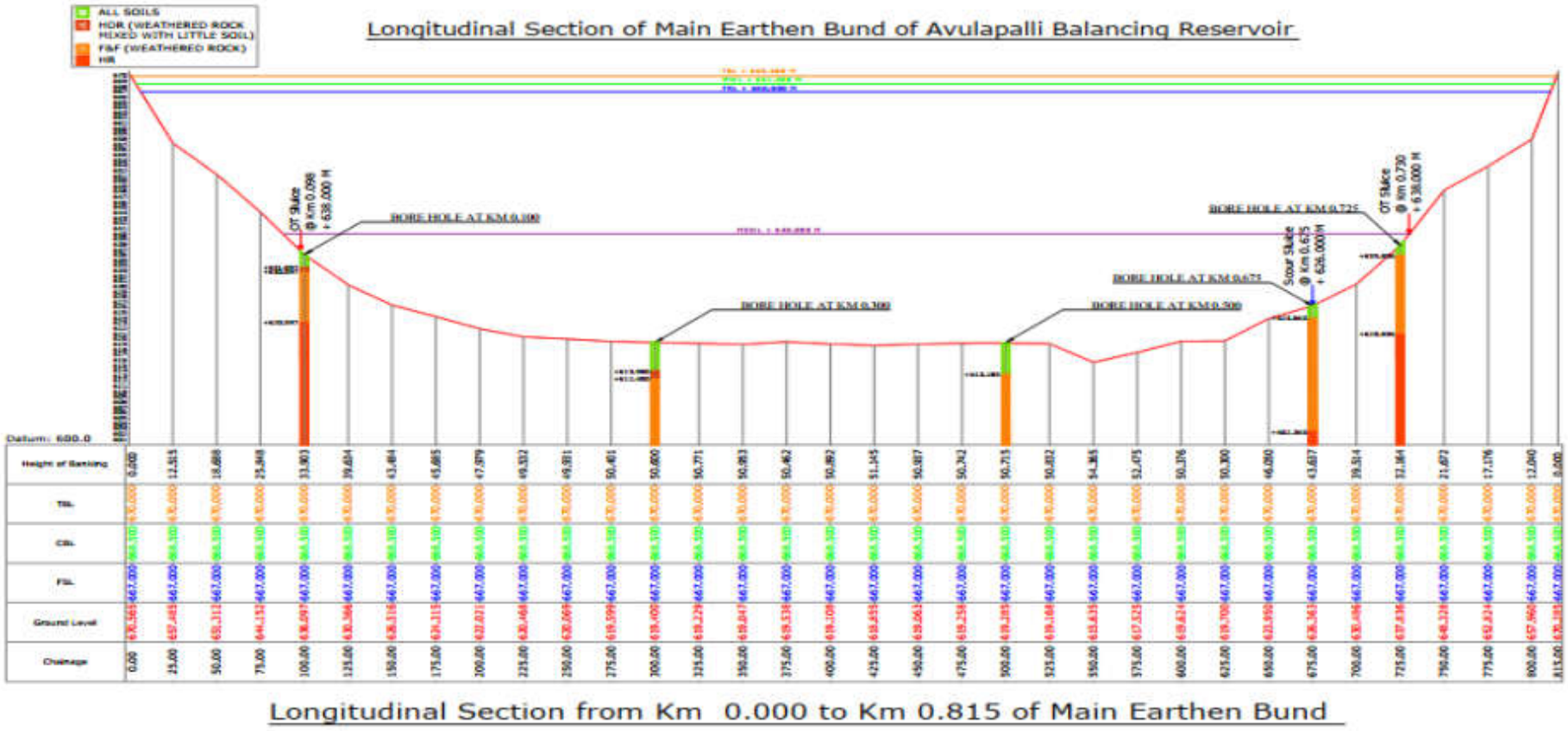


Fig 2.7 Proposed L.S. of the main Earthen Bund

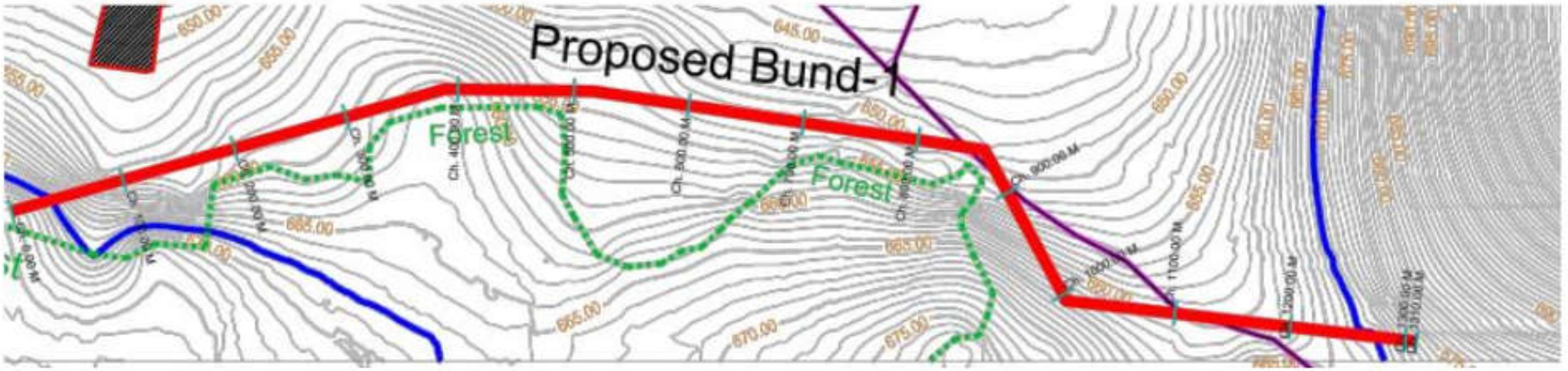


Fig 2.8 Position of Saddle Bund 1

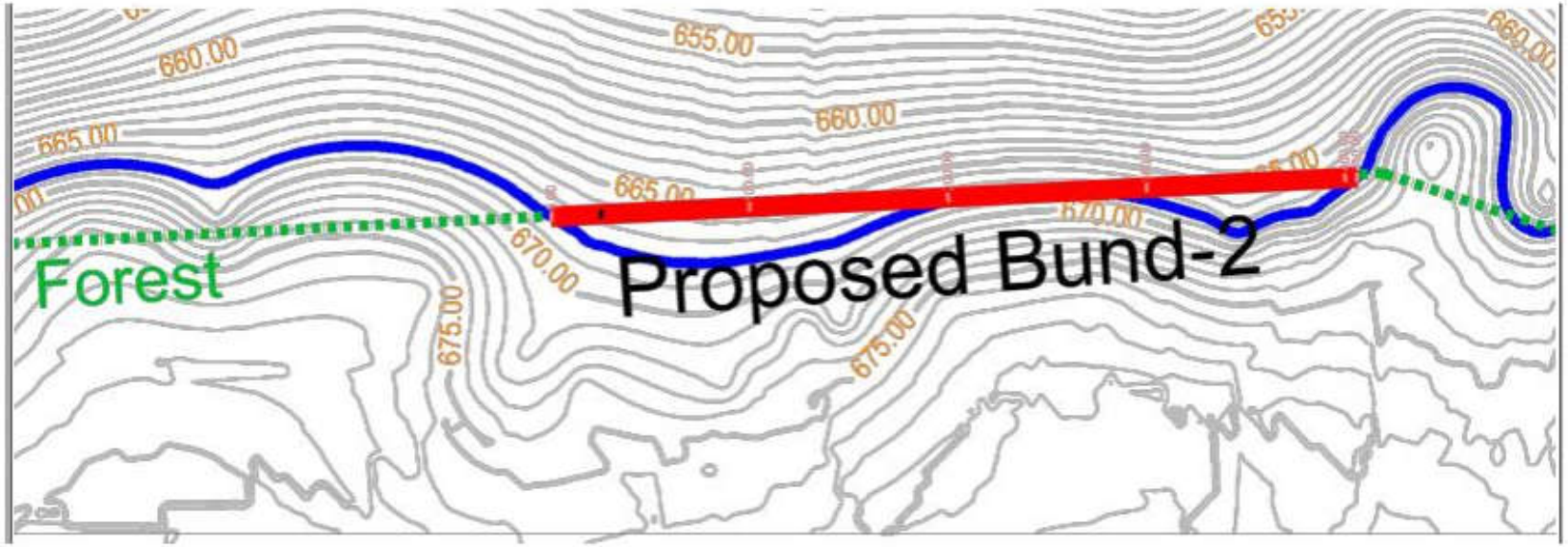


Fig 2.9 Position of Saddle Bund 2

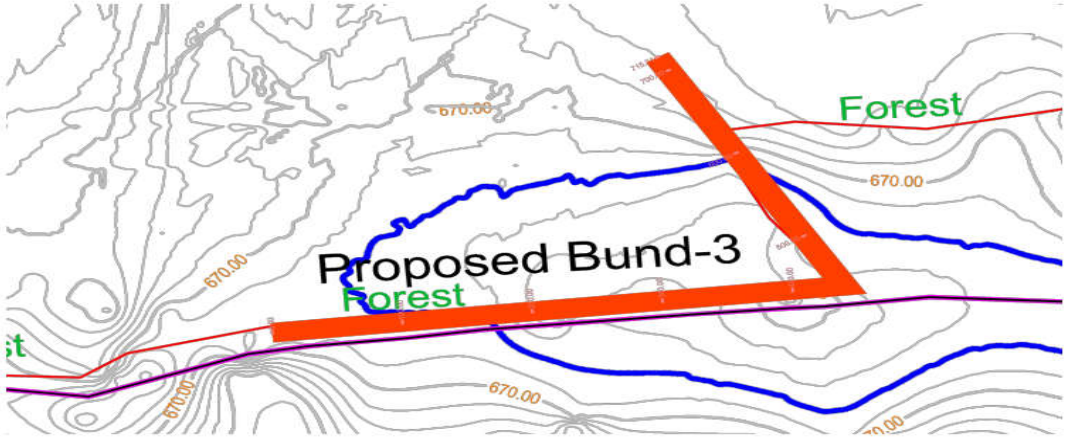


Fig 2.10 Position of Saddle Bund 3

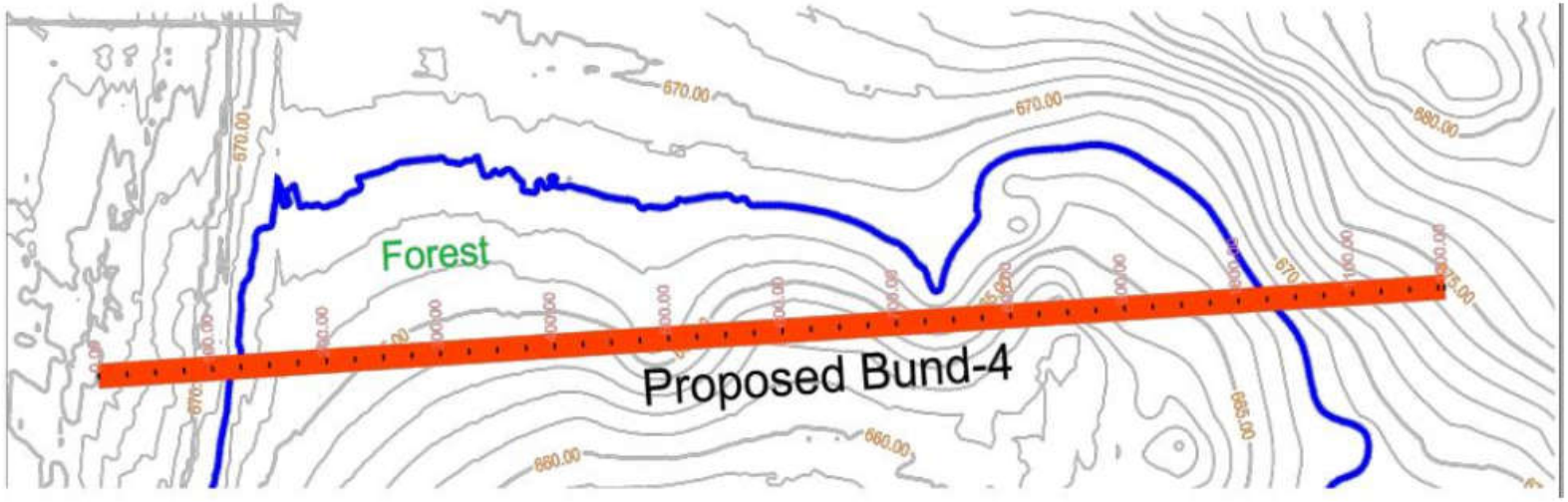


Fig 2.11 Position of Saddle Bund 4

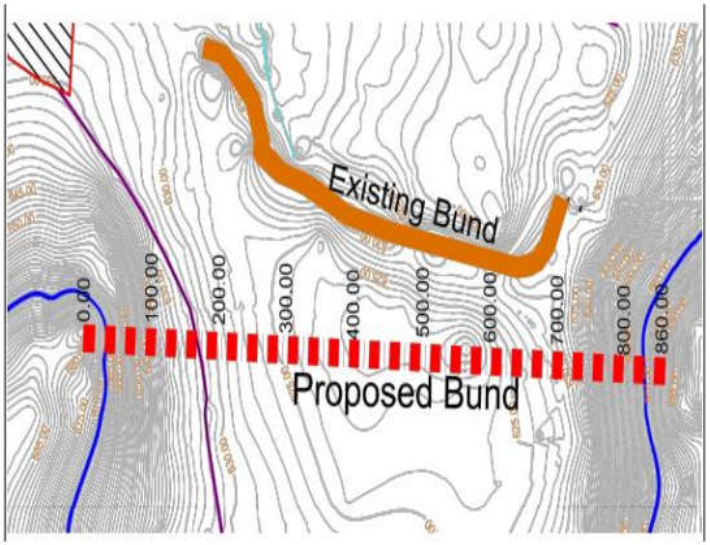


Fig 2.12 Position of Proposed Main Bund and Existing Bund

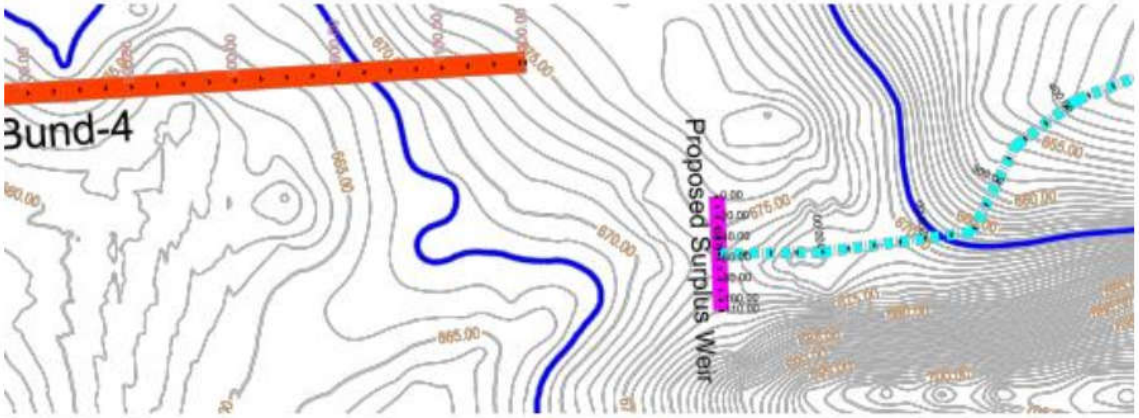


Fig 2.13 Position of Proposed Surplus Weir

2.8 Hydrology

2.8.1 Source of Water for GNSS Main Canal

The main water for the reservoir is the floodwater flowing through the PB canal. The water lifted from Gandikota reservoir on Pennar river will be pumped into the PB canal. The PB canal that receives 800 cusecs of water will be conveyed and part of it will be discharged into the proposed reservoir. The linking canal from the PBC to the proposed Avulapalli reservoir is Shown in Fig 2.14.

2.9 Inflows and Out flows of Gandikota Reservoir from 2013-14 to 2020-21 (upto 30/06/2021)

Table 2.5 Inflows and Outflows of Gandikota Reservoir

S.No.	Year	Inflows (TMC)	Outflows (TMC)
1	2013-14	2.053	0.501
2	2014-15	Nil	Nil
3	2015-16	Nil	Nil
4	2016-17	5.04	2.641
5	2017-18	23.363	15.785
6	2018-19	12.808	10.633
7	2019-20	63.55	56.054
8	2020-21	67.662	44.400

2.10 Source of Water to Avulapalli Balancing Reservoir

The Avulapalli balancing reservoir is proposed to be connected with a gravity canal to the existing HNSS Punganur Branch Canal @ km 210.00.

2.11 Diversion of 7.00 Cumecs

Diversion of 7.00 Cumecs from HNSS-Punganur Branch canal to feed the Avulapalli Balancing Reservoir for assured drinking water supply and irrigation command area facilities to the 1st Punganur constituency of Rompicherla mandal villages,Sodum mandal villages,Pulicherla mandal villages,Somala mandal villages,Punganur mandal villages and 2nd Pileru constituency of Pileru mandal villages,K.V. Palli mandal villages,Kalakada mandal villages,Valmikipuram mandal villages,Gurramkonda mandal villages,Kalikiri mandal villages and nearby villages. Avulapalli Balancing Reservoir with a capacity of 2.5 TMC (Storage Capacity of the Proposed Avulapalli Balancing Reservoir) to supply assured drinking water supply to the Punganur and

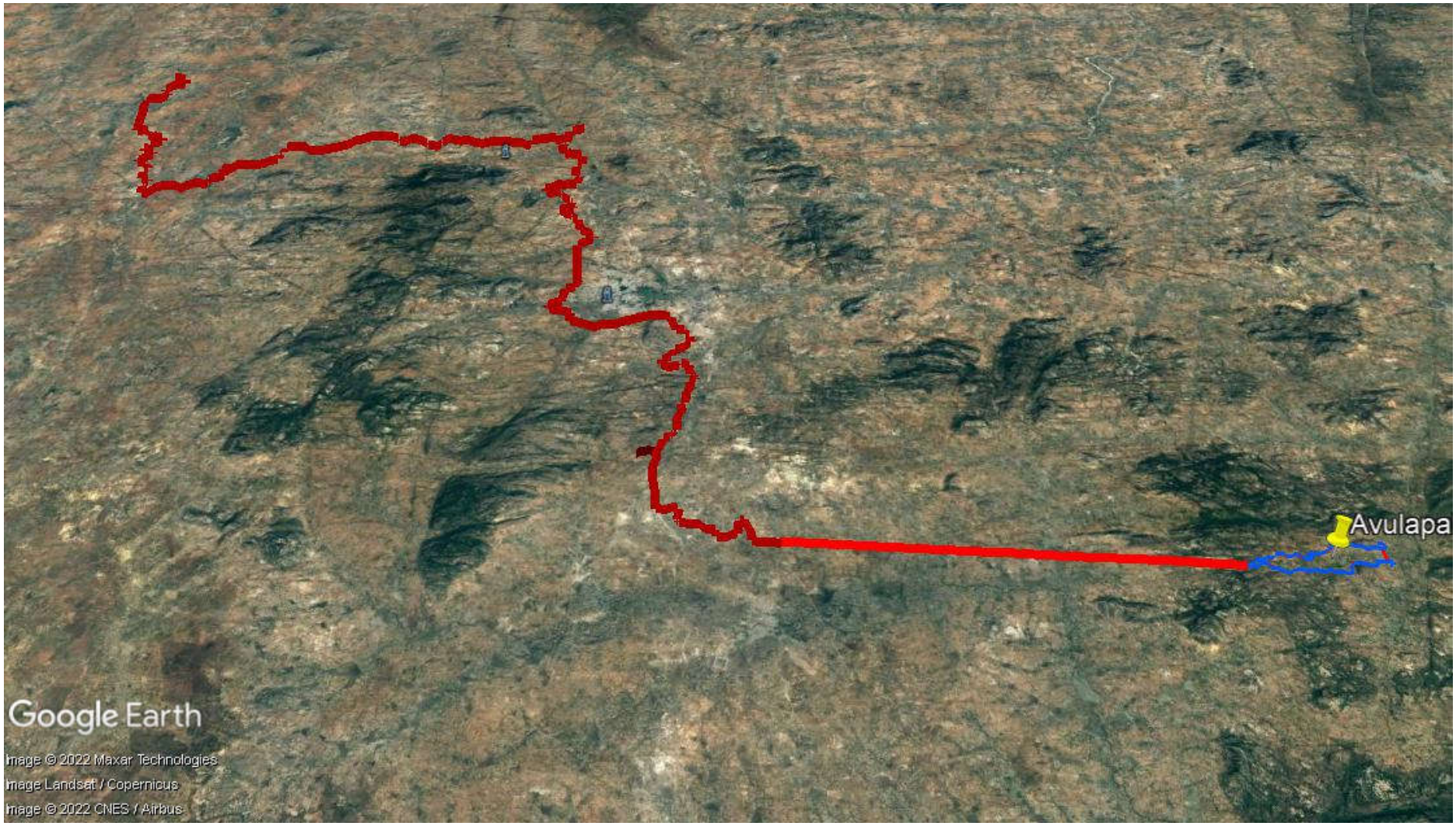


Fig 2.14 Linking canal from PBC to the proposed Avulapalli Balancing Reservoir

Pileru constituencies and the surrounding villages for ultimate population of 2.76 lakh and more .

Diverting from @ Ch at 210.00 Km to feed the Avulapalli Balancing Reservoir.

1. The scheme is passing through Revenue lands only.
2. No existence of Forestland

2.12 Requirements of Embankment

- The embankment, foundation, and abutments must be stable against slumping, sliding and sloughing during construction, during all conditions of reservoir operation and during and following unusual events such as earthquake and flood.
- Seepage through the embankment, foundation, and abutments must be controlled and collected to prevent excessive uplift pressures, piping, sloughing, dissolution and erosion of material into cracks, joints and cavities.
- Because of low yield within the watershed, Avulapalli Balancing Reservoir is designed with a limitation on the rate of seepage. Foundation cutoffs, select core material, upstream impervious blankets, chimney filter and drain systems, blanket drains, finger drains, toe drains, multiple transition filters between core and rockfill shell material, drainage adits and tunnels, drain holes and relief wells are common measures to control and limit seepage. Redundancy and multiple defenses are often necessary and represent sound engineering practice considering the uncertainties at this dam site. Existing dams that do not incorporate typical seepage defense measures may require prompt defensive action should a problem develop.
- Freeboard is ensured with sufficient to prevent overtopping by wave action. An allowance for post-construction settlement of the dam and its foundation, and deformation caused by earthquake is taken into consideration. In addition, 4.00 m freeboard sufficient to pass the maximum design flood, often chosen as the probable maximum flood. Spillways and outlets are accordingly designed with sufficient capacity such that overtopping of the dam does not occur.
- Outer slope protection on both the upstream and downstream slopes to prevent erosion by wave action, reservoir level fluctuations, rainfall and wind. Materials is durable and resistant to wet/dry and freeze/thaw cycles. Materials must resist weather and erosion over long periods.
- The foundations is properly prepared and treated during construction. Unsuitable material must be removed, water entering the foundation must be controlled, and

foundation surfaces must be prepared to receive the first lifts of fill material. If the foundation is a rock surface, the treatment below the core will, at a minimum, include detail cleaning of the rock surface using air and, possibly, water and the application of slush grout and dental concrete, if required. The first few lifts of core material should be as plastic as possible and specially treated to 3 ensure a good bond with the rock foundation.

- The dam must be constructed using appropriate quality control and quality assurance procedures. Appropriate changes to the design must be made during construction should site conditions so indicate. The ultimate performance of the dam depends on careful construction especially regarding foundation treatment, moisture and density control of the fill, and the design and construction of filters and drains.

2.12.1 Soil Materials

Embankment dams are constructed of all types of geologic materials, with the exception of organic soils and peats. The Embankments/Bunds/Saddles are designed to utilize the economically available on-site materials, as this is the bulk of construction. Special zones such as filters, drains and riprap, may come from off-site sources. Soil materials used in embankment dam's portions are obtained by mass production from local borrow pits, or from the fields purchased from the local farmers near by the Dam, and from required excavations where suitable, as this region topography is completely with valleys and ridges, the materials required for construction is best available. Inorganic soils generally are divided into two broad categories for engineering purposes: fine-grained soils and coarse-grained soils. Embankments are constructed of broadly graded soils, which do not fit entirely into either category, or exhibit characteristics of both. Moraine deposits are an important example of these mixed soils. Construction considerations relevant to soils in embankment reservoir also are available in area as tabulated below with leads and distances from the dam site.

2.12.2 Material requirement

Table 2.7 Component Wise Material Requirement

S.No.	Description of item	Material	Quantity as per detailed estimate (m^3)
1	Hearting soil	Earth	419725.5
2	Cut off	Earth	515449.5
3	Casing soil	Earth	3514225.31
4	Dry rubble rock	Rough stone	37299.48

5	Graded filter	Metal	10813.73
6		Sand	10813.73
7	Vertical sand filter	Sand	48478.84
8	Horizontal sand filter	Sand	118372.50
		Metal	118372.5
9	Riprap	Metal	133460.72
		Sand	133460.72
		Rough stone	133460.72
10	CC M15 Parapet wall	Coarse aggregate	527.35
		Fine aggregate	527.35
11	CC M15 chute	Coarse aggregate	2005.84
		Fine aggregate	2005.84
12	CC M15 profile wall	Coarse aggregate	345.0
		Fine aggregate	345.0
13	CC M15 Guide Stone	Coarse aggregate	112.05
		Fine aggregate	112.05
14	Murrum	CNS Soil	749.80
15	30cm Stone d/s Riprap	Stone	1787.24

2.12.3 Source of material

Table 2.8 Material Availability at Source

S.No.	Location	Mandal	Hearting soils (Lead in KM)
	Fore shore area	Somala	
	Somappa cheruve	Somala	10
	Siddayagowni cheruvu	Somala	12
	Chennapatnam cheruvu	Somala	16
	Somappa cheruvu, Kanduru	Chowdepalli	30
	Laddigam cheruvu	Chowdepalli	41
	Chennapatnam cheruvu	Sadum	43
	Vyasappa cheruvu	Sadum	20
	Ayyavani cheruvu	Sadum	18
	Seethamma cheruvu	Sadum	30
	Palem cheruvu	Sadum	23
	Booragamanda cheruvu	Sadum	37
	Boorgamanda	Sadum	---
	Gundluru	Piler	---
	Medikurthi	Kalikiri	---
	Gundloor	Kalikiri	---
Average lead			**25**

2.13 Raw Materials and requirements

Total 100 % components are cement concrete and steel only, there is no fuel requirement

2.13.1 Key materials planning

A. Special Materials

(a) Cement

(b) Steel

(i) Structural

(ii) MS Plates

(iii) Bars & rounds

(iv) Special Steels, if any

(c) Explosives

(i) Gelatin

(ii) Detonators

(iii) Fuse coil

(iv) Explosives-Ammonia Nitrate

(d) Oils and Lubricants

(i) H.S.D. Oil

(ii) Petrol and Lubricants

Work is likely to be carried out through contractors. Hence, no planning of material is required at this stage.

B. Materials - Data

Table 2.9 Data of the materials

Material	Source	Mode of transportation	Distance from nearest to worksite	Mode of transportation
Cement	Manufacturers	Road	50 Km	Trucks
Steel	SAIL	Road	50 Km	Trucks
Explosives		Road	50 Km	Trucks
Oils and Lubricants	Oil Companies	Road	50 Km	Trucks

2.13.2 Construction power requirement & proposed supply arrangement

Power requirement for the construction is insignificant and will be drawn from the local power grid

2.13.3 Plant/Equipment Planning

Work is likely to be taken up through EPC procedure. Agency will take care of this aspect

2.13.4 Blasting

There is blasting quantity is occurred in Earth work excavation of cut-off trench for an about 5000 Cum. Booster - 1000 Kgs

2.13.5 Batching plat details

Wet mix plan 100TPH (Apollo Asphalt DM) Capacity at 308/488(L/S) of Kurnool – Ranipet Road NH 40

2.13.6 Stone crusher details

Stone Crusher at Kondamarri Village in Chowdepalli Mandal of Chittoor District

2.14 Project Cost

The project cost is estimated for formation of Avulapalli Balancing reservoir near Avulapalli Village in Somala Mandal of Chittoor district.

2.10 Details of the project cost

S. No.	Description of Work	Total Amount (Rs)
	Part A	
1	Investigation, preparation of HP's, Desugn and Drawings Approvals etc and submission of LP Schedules etc complete for DPR	14757111
2	Formation of Earthen Bund	3999745717
3	Construction of surplus weir and surplus course	299885510
4	Construction of Sluice (3 Nos)	460727226
5	Provision towards operation and maintenance of civil works components @ 1% for 2 years (i.e. 0.5% per year)	47603585
	Total	4822719148
	Part B	
6	Provision for GST @ 12.0%	578726298
7	NAC @ 0.10%	4822719
8	Provision for Seignorage charges as per statement	292126396

	Part C	
9	Provision for land acquisition and R&R	847184000
10	Provision for watchman quarters, Section officers, Subdivision quarters, Rest house, Generator room etc	19675000
11	Towards scientific instruments like DGPS, Total Station, Autolevels etc	3500000
12	Provision for Shifting of HT and LT lines and power connections	10000000
13	Provision of 33kv Substation, Lighting arrangements on top of the bund including cables, electrical poles, panel boards etc	19800000
14	Provision towards price Adjustment @ 1.0%	48227191
15	Provision for pylon, Foundation stones and inauguration arrangements etc	4000000
16	Provision towards tender publication charges	1000000
17	Provision for departmental QC Lab Equipment and Testing etc	271924
18	Provision for Beautification on bund, plantation, Arch and Gates etc	10000000
19	Provision towards Computers/Laptops, Xerox machine, Printers, Scanners, Photos, Drone video charges etc	2500000
20	Provision towards fixing of HP Boards, Sign Board, KM stones etc	5000000
Grand total		6672000000

Total project cost is Say Rs 66720.0 lakhs

2.15 PHOTOGRAPHS

The photographs of the existing Seethamma Cheruvu that is proposed to be converted as Avulapalli Balancing Reservoir project are presented below.



Fig 2.15 Existing Seethamma Cheruvu



Fig 2.16 Typical photo of Ramakrishnapuram Village



Fig 2.17 Typical photo of Baireddypalli Village



Fig 2.18 Photos of croplands in submergence area




Fig 2.19 Photos of Muddaleru Vanka stream is bringing water into the existing MI pond

Chapter 3

DESCRIPTION OF ENVIRONMENT

3.0 INTRODUCTION

Undersatding of existing environmental settings is necessary before taking up an activity. The existing environmental conditions can be assessed based on monitoring of various attibutes of environment such as air, water, soil, flora and fauna etc. It involves collection of of base line data which is an integral aspect of the preparation of Environmental Impact Assessment. Base line data reflects the present status of Environment before the initiation of any activity. The possible effects due to the proposed construction of Avulapalli balancing reservoir project are estimated and superimposed on the compiled baseline data subsequently to asses the possible environmental impacts.

The study area comprises of core area of the proposed project near Avulapalli, Somala mandal, and it also includes parts of both Kadapa and Chittoor Districts. Baseline data for environmental attributes like ambient air, meteorology, water, land use, soil, geology, noise, socio-economic, ecology and biodiversity etc. were collected in the month of May 2022. The details are presented in this chapter.

3.1 TEMPERATURE AND RAINFALL

The climate of Chittoor falls under the hot semi-arid class (BSh) as per the Koppen-Geiger classification. The climatic patterns in the study area as per IMD, Pune is tabulated below.

Table 3.1 IMD Climatological data of Chittoor District (Tirupathi station)

Month	Temperature ºC		Mean Relative Humidity (%)		Rainfall mm
	Maximum	Minimum	Maximum	Minimum	
January	30	18.8	79	55	17.6
February	33	19.9	74	45	5.1
March	36.8	22.8	68	37	5.2
April	39.2	26.2	65	37	15.9
May	40.3	28	57	38	58.5
June	37.9	27.3	59	45	77
July	35.9	26.1	66	51	117.3
August	35	25.7	68	52	127.3
September	34.9	25.2	71	56	131.7
October	32.8	23.7	77	65	205.2
November	30.2	21.8	80	69	249.1
December	29	19.9	80	65	116.2

(Source-Climatological Normals -1981-2010, IMD)

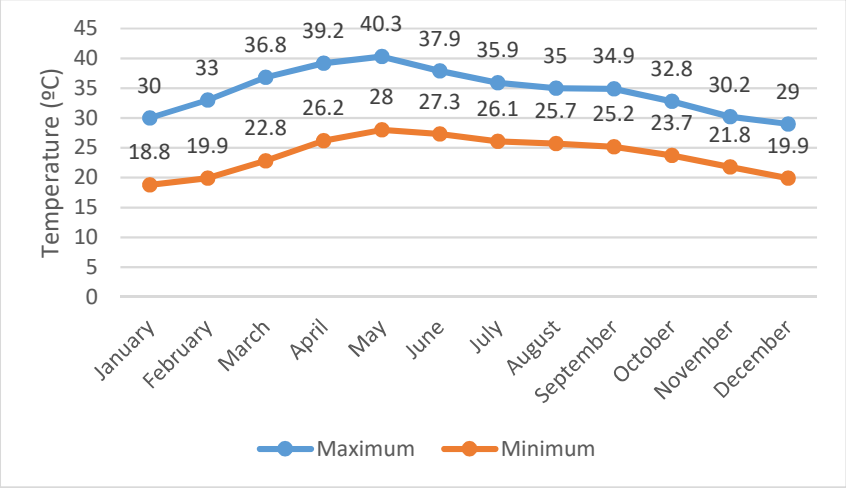


Fig 3.1 Temperature Variations (Maximum and Minimum) during period between 1981-2010

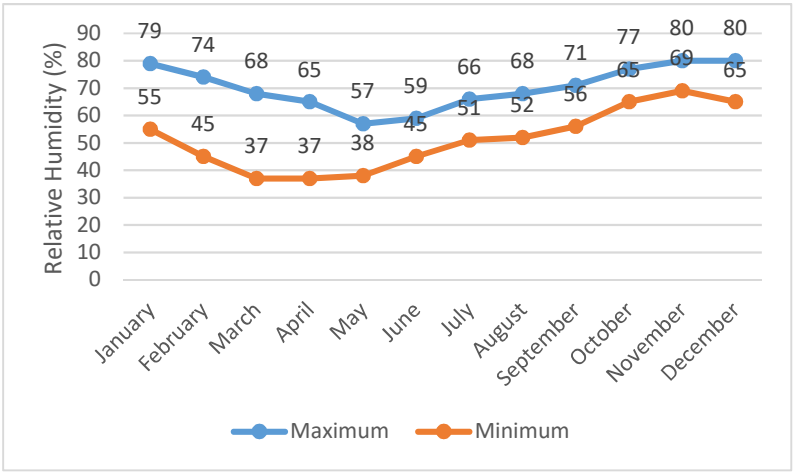


Fig 3.2 Relative Humidity (Maximum and Minimum) during period between 1981-2010

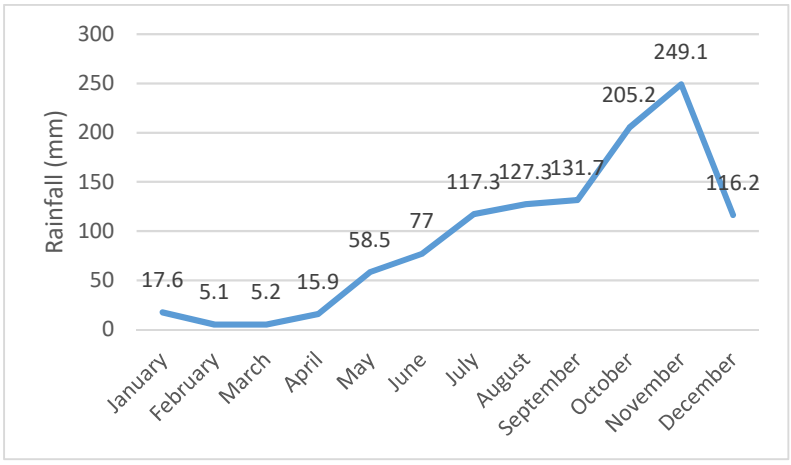


Fig 3.3 Average rainfall during the period between 1981-2010.

Winds

A weather station was installed near the site for hourly monitoring of temperature, humidity and wind velocity for the month of May' 2022 and windrose given in Fig 3.4.

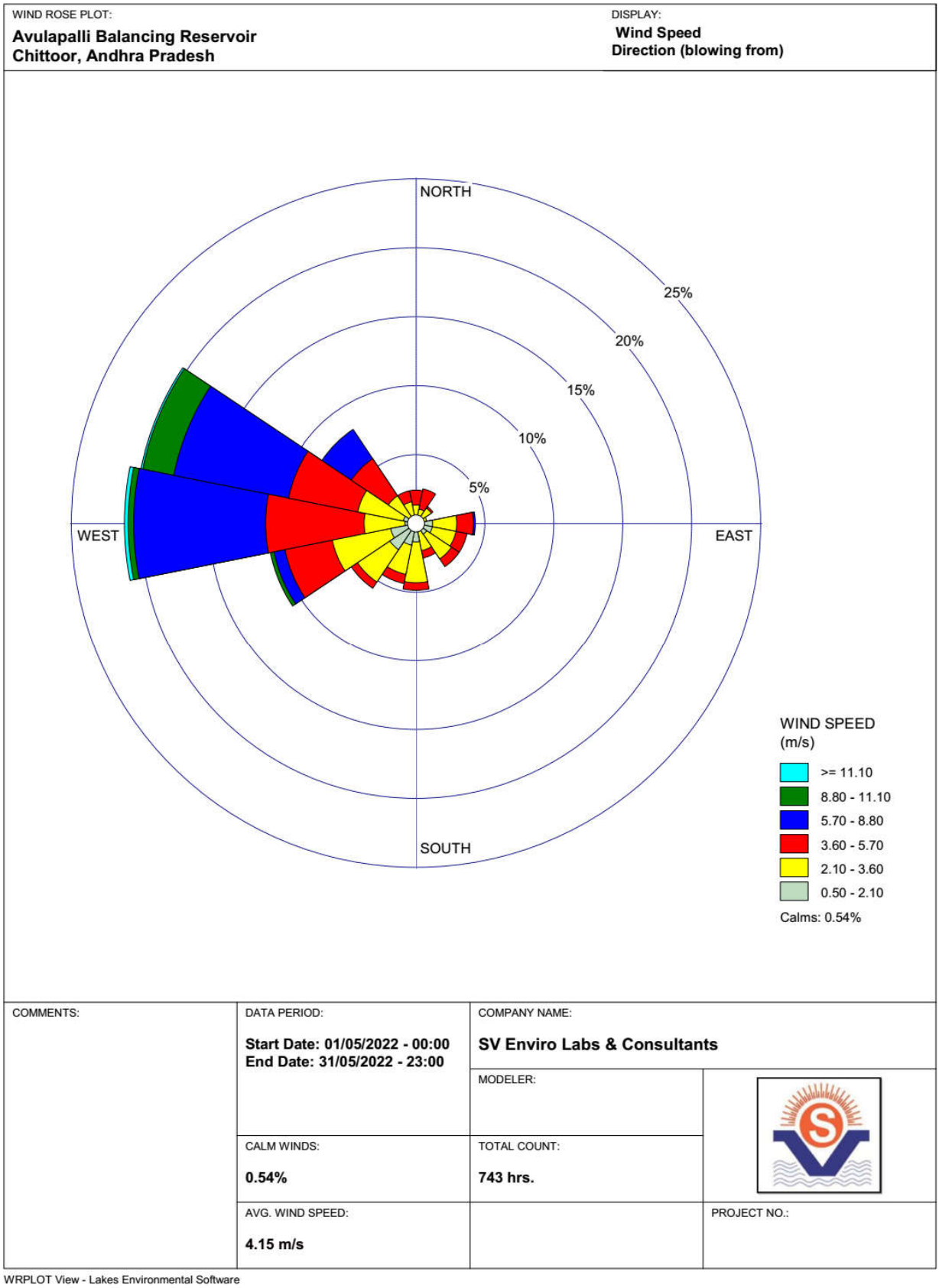


Fig. 3.4 Wind Rose Diagram for the month of May 2022

3.2 AIR ENVIRONMENT

The samples were collected to assess the air quality in the study area. The samples collected were analysed for various air quality parameters.

3.2.1 Selection of Sampling Locations

To assess the baseline ambient air quality a scientifically designed ambient air quality-monitoring network was established. The ambient air quality monitoring stations were selected after a brief study based on the following considerations:

- Meteorological conditions
- Topography of the study area
- Predominant wind direction
- Emission sources
- Receptors sensitivity

Ambient Air Quality monitoring stations were set up at eight locations with due consideration to the above-mentioned points. The locations of the sampling stations are given in the Table 3.2 and the same are show in the Fig 3.5.

3.2.2 Methodology of Sampling and Analysis

Air samples collected were tested for the following parameters

- PM_{10}
- $PM_{2.5}$
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NOx)

The sampling and analysis of ambient air quality parameters was carried out as per the procedures detailed in relevant parts of IS: 5182 (Indian Standards for Ambient Air Quality Test Methods). The methods used for determining the above mentioned parameters and furnished hereunder in the Table 3.3.

3.2.3 Frequency of Sampling: 24 hourly samples for PM_{10}, $PM_{2.5}$, SO_2, NOx, were collected from each station (Table 3.2).

Table 3.2 Location of Ambient Air Quality Monitoring Stations

S.No	Location	Station Code	Direction from Project Site	Distance w.r.t Project Site km	Latitude and Longitude	Environmental Setting
1.	Project site (Ramakrishnapuram)	**A1**	-	-	13°24'0.64"N 78°48'20.01"E	Residential Area
2.	Upparapalle	**A2**	ESE	1.8	13°23'7.29"N 78°49'10.86"E	Residential Area

3.	Reddivaripale	**A3**	E	0.9	13°23'19.76"N 78°49'42.08"E	Residential Area
4.	Patrapalli	**A4**	ENE	1.7	13°24'22.59"N 78°50'13.51"E	Residential Area
5.	Rachettivanipalle	**A5**	N	7.1	13°27'52.56"N 78°48'3.18"E	Residential Area
6.	Goudamukalapalle	**A6**	SW	5.7	13°21'23.52"N 78°45'5.88"E	Residential Area
7.	Durgasamudram	**A7**	WSW	5.8	13°22'35.96"N 78°43'31.61"E	Residential Area
8	Muddireddipalle	**A8**	WNW	6.2	13°24'48.25"N 78°43'40.42"E	Residential Area

Table 3.3 Techniques and detectable limits for Ambient air quality monitoring

S. No.	Parameter	Technique	Technical Protocol	Minimum Detectable Limit
1	PM10 (µg/m3)	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-XXIII)	5.0 µg/m^3
2	PM2.5 (µg/m3)	Fine Particulate Sampler (Gravimetric method)	IS-5182 (Part-XXIV)	5.0 µg/m^3
3	Sulphur dioxide SO2 (µg/m3)	Modified West and Gaeke	IS-5182 (Part-II)	4.0 µg/m^3
4	Oxides of Nitrogen NOx (µg/m3)	Jacob & Hochheiser	IS-5182 (Part-VI)	4.0 µg/m^3

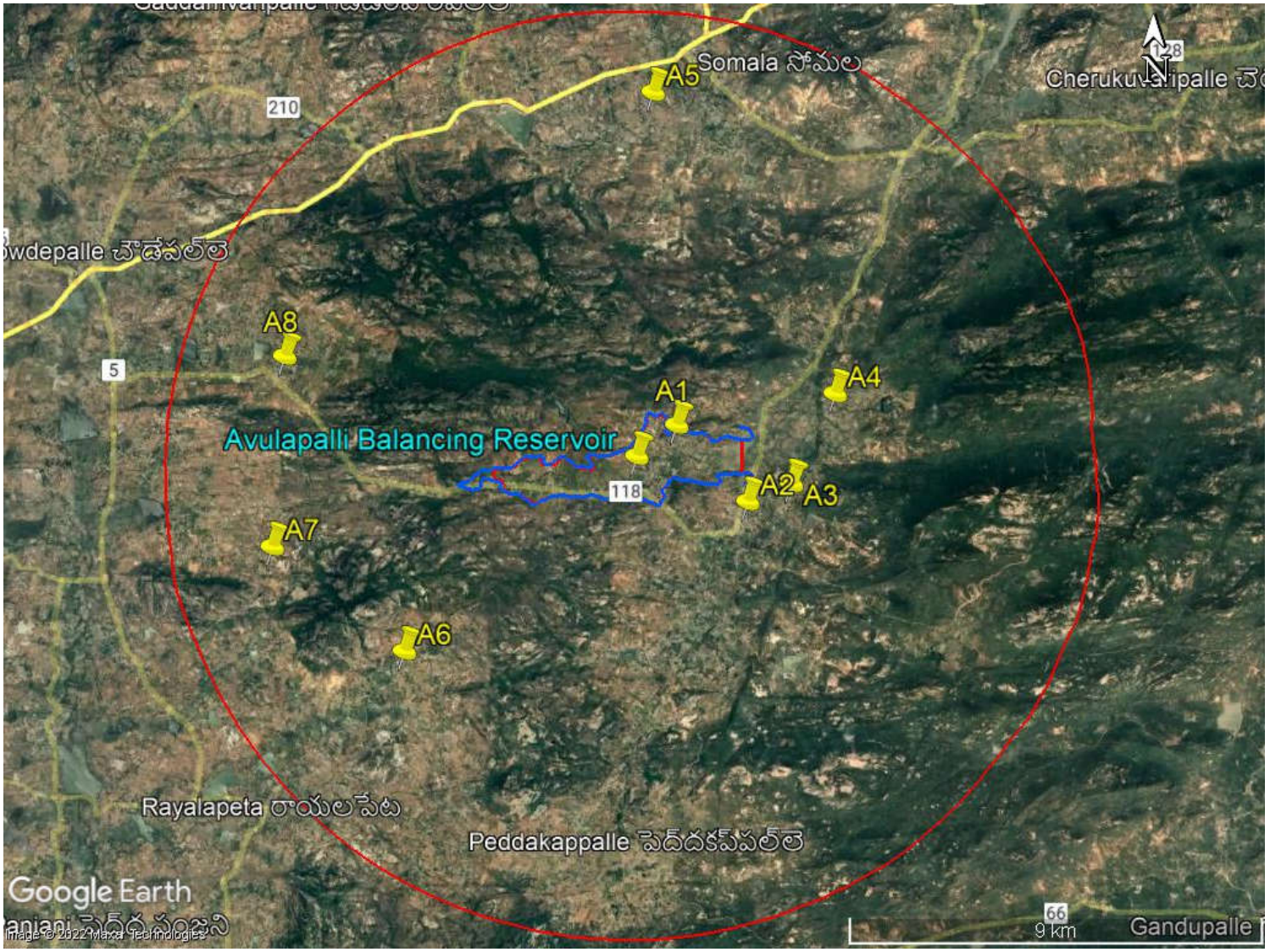
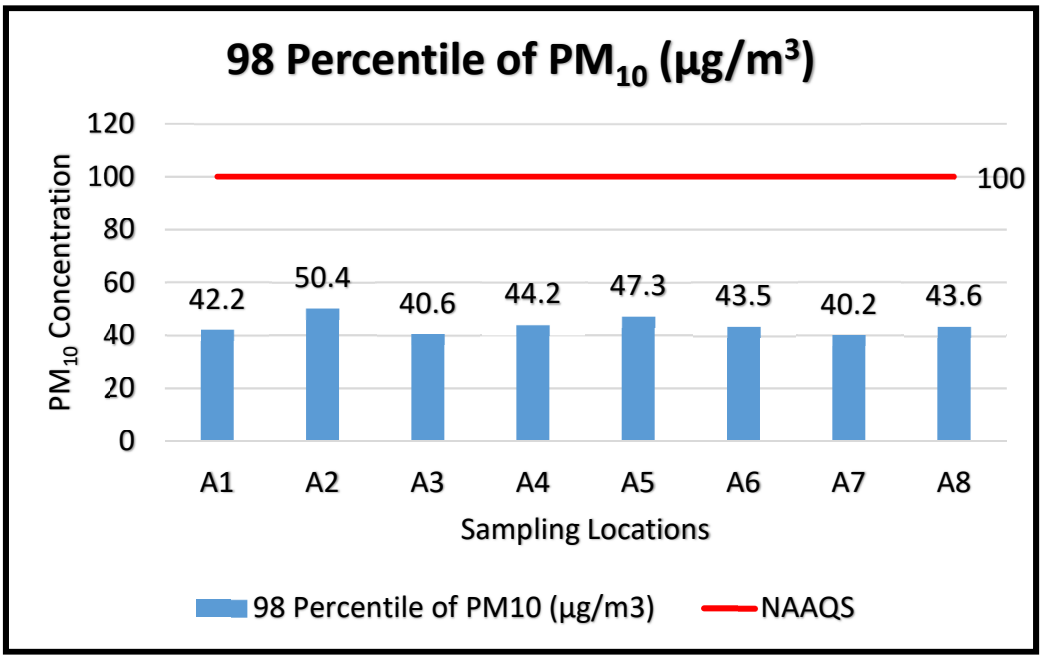
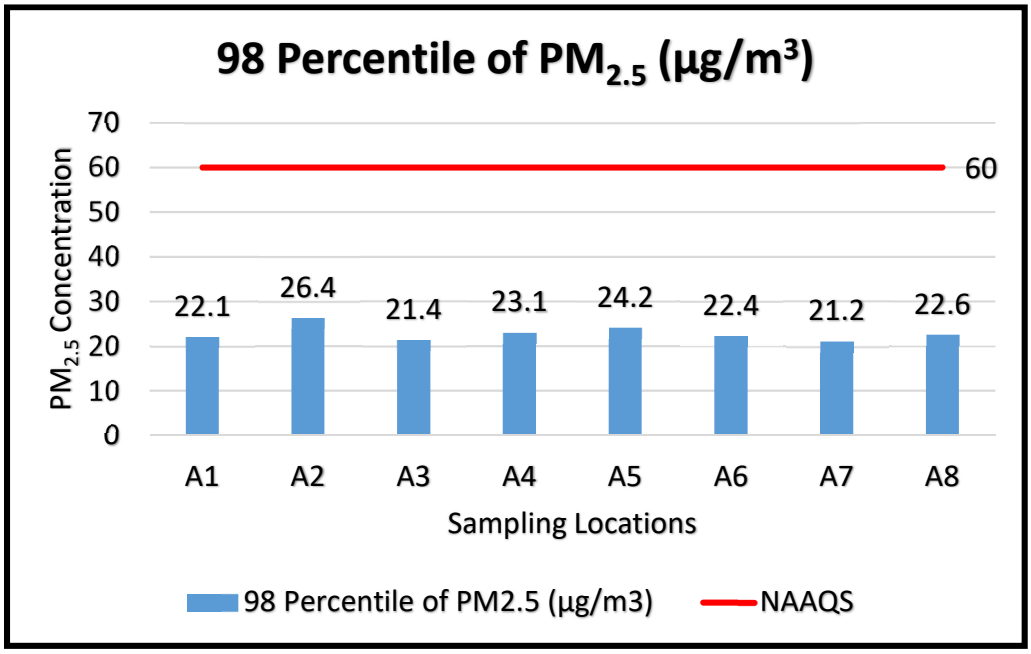


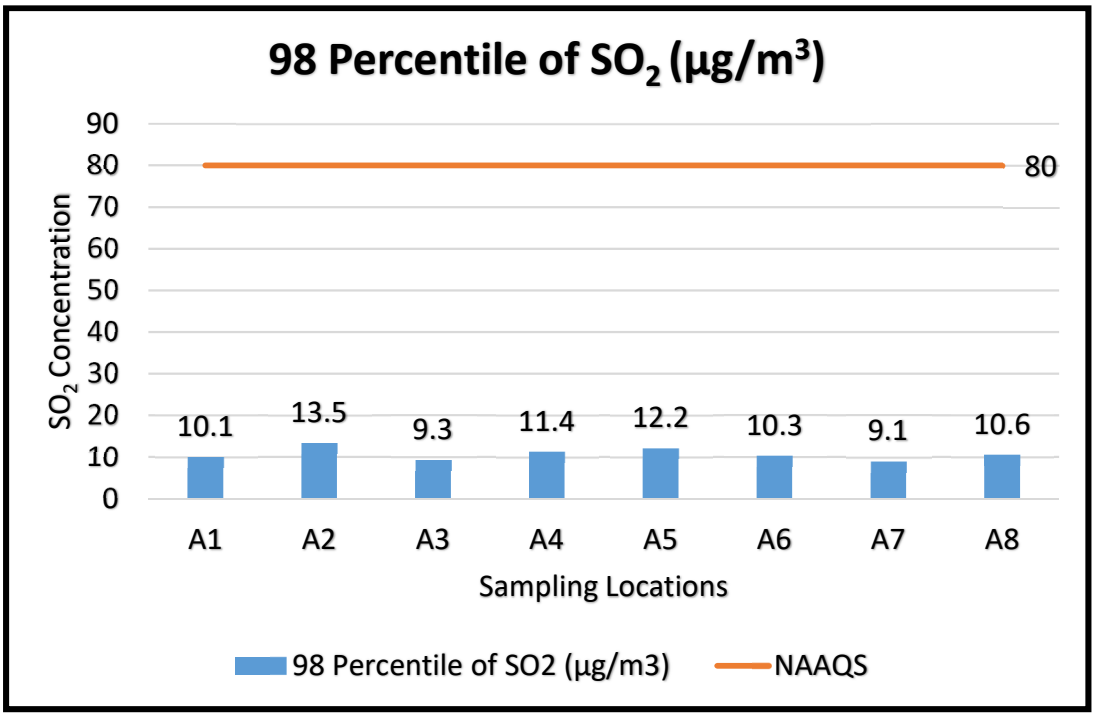
Fig 3.5 AAQ monitoring Locations

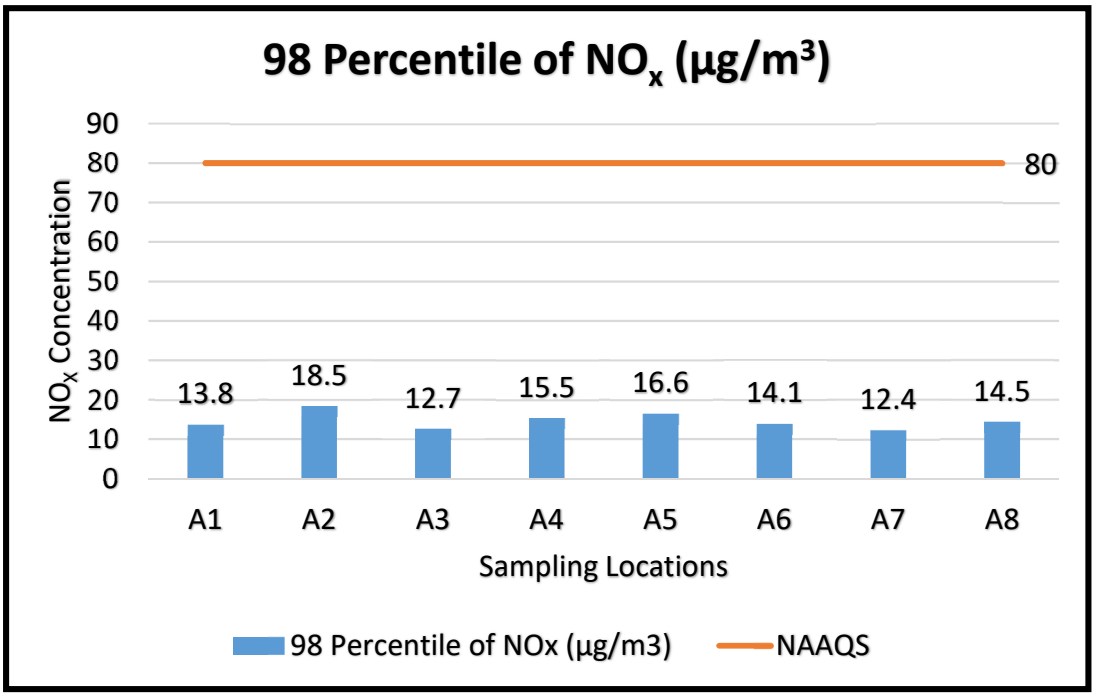
Table 3.4 Summary of Ambient Air Quality in the Study Area

Parameter	PM10(µg/m³)					PM2.5(µg/m³)					SO2(µg/m³)					NOx(µg/m³)				
Monitoring Station	No.of samples	Maximum	Minimum	Average	98th percentile	No. of samples	Maximum	Minimum	Average	98th percentile	No.of samples	Maximum	Minimum	Average	98th percentile	No.of samples	Maximum	Minimum	Average	98th percentile
A1	26	43.4	22.8	31.4	42.2	26	22.4	12.6	16.3	22.1	26	10.3	7.4	8.8	10.1	26	14.0	9.8	11.8	13.8
A2	26	51.2	30.5	38.2	50.4	26	26.9	16.1	19.8	26.4	26	13.8	10.9	12.5	13.5	26	18.8	14.6	16.5	18.5
A3	26	41.8	21.2	29.8	40.6	26	21.6	11.8	15.5	21.4	26	9.5	6.6	8.2	9.3	26	12.9	8.7	10.9	12.7
A4	26	45.3	24.7	33.3	44.2	26	23.4	13.6	17.3	23.1	26	11.6	8.7	10.4	11.4	26	15.8	11.6	13.6	15.5
A5	26	48.6	28.3	35.6	47.3	26	24.6	14.8	18.5	24.2	26	12.4	9.5	11.1	12.2	26	16.9	12.7	14.9	16.6
A6	26	44.2	23.6	32.2	43.5	26	22.8	13.0	16.7	22.4	26	10.5	7.6	9.2	10.3	26	14.3	10.1	12.3	14.1
A7	26	41.3	20.7	29.3	40.2	26	21.5	11.5	15.2	21.2	26	9.3	6.4	7.8	9.1	26	12.6	8.4	10.4	12.4
A8	26	44.5	23.9	32.5	43.6	26	23.0	13.2	16.9	22.6	26	10.8	7.9	9.3	10.6	26	14.7	10.5	12.7	14.5
NAAQ	100(µg/m³)					60(µg/m³)					80(µg/m³)					80(µg/m³)				


98 Percentile of PM10 (µg/m3)
PM10 Concentration
120
100
80
60
40
20
0
42.2
50.4
40.6
44.2
47.3
43.5
40.2
43.6
100
A1
A2
A3
A4
A5
A6
A7
A8
Sampling Locations
98 Percentile of PM10 (µg/m3)
NAAQS


98 Percentile of PM2.5 (µg/m3)
PM2.5 Concentration
70
60
50
40
30
20
10
0
22.1
26.4
21.4
23.1
24.2
22.4
21.2
22.6
60
A1
A2
A3
A4
A5
A6
A7
A8
Sampling Locations
98 Percentile of PM2.5 (µg/m3)
NAAQS





3.2.4 Summary of Ambient Air Quality

On the perusal of above analysis of ambient air quality in the study area, it is evident that all concentrations of the parameters monitored, as shown in Table 3.4, at various locations are well within the specified limits of CPCB. The results are summarized below:

PM_{10}: The highest PM_{10} concentration of 51.2µg/m^3 observed in the ambient air was recorded at station A2 while the lowest PM_{10} concentration was found to be 20.7 µg/m^3 at recorded at station A7. All the monitored values of PM_{10} were well below the specified limit of 100 µg/m^3.
$PM_{2.5}$: The highest $PM_{2.5}$ concentration of 26.9 µg/m^3 observed in the ambient air was recorded at station A2 while the lowest $PM_{2.5}$ concentration was found to be 11.5 µg/m^3 at recorded at station A7. All the monitored values of $PM_{2.5}$ were well below the specified limit of 60 µg/m^3.
SO_2: The highest SO_2 concentration 13.8 µg/m^3 was observed in the ambient air was recorded at station A2 while the lowest SO_2 concentration was found to be 6.4 µg/m^3 at A7. All the monitored values of SO_2 are well below the specified limit of 80 µg/m^3.
NOx: The highest concentration of 18.8 µg/m^3 observed in the ambient air was recorded at station A2 while the lowest NOx concentration was found to be 8.4 µg/m^3 at station A7. All the monitored values of NOx are well below the specified limit of 80 µg/m^3.

3.3 WATER ENVIRONMENT

The water resources, both surface and groundwater play an important role in the development of the area. Likewise, the water resources of the area have been studied to establish the current status of water quality in the area. The parameters of prime importance were selected under physical, chemical inorganic, chemical organic and heavy metal groups. Water samples from ground and surface water sources were collected. The water samples were collected in pretreated sampling cans and transported to laboratory for analysis. Due care was taken during sampling & transportation of these samples.

3.3.1 Surface Water and Ground Water Quality Assessment

In order to assess water quality impacts surface water and ground water samples are collected from the surrounding villages. The samples analyzed for various physical and chemical parameters to know the contamination levels as per the IS Standards.

1. Ground water quality --- IS 10500-2012
2. Surface/canal/sea water quality --- IS 2296 : 1992

3.3.2 Selection of Sampling Locations

Sampling locations (Fig 3.9) were selected on basis of:

a) Drainage pattern
b) Location of residential areas respecting different activities
c) Likely areas those can represent baseline conditions

Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area.

The samples were analyzed in accordance with "Standard Methods for Examination of Water and Wastewater Analysis" published by APHA.

3.3.3 Sampling Techniques

Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area. Parameters like temperature, Dissolved Oxygen (DO) and pH were analyzed at the time of sample collection. The methodology for sample collection and preservation techniques was followed as per the Standard Operating Procedures (SOP) mentioned in Table: 3.5.

Table 3.5 Standard Operating Procedures (SOP) For Water Sampling

Parameter	Sample Collection	Sample Size	Storage/ Preservation
pH	Grab sampling Plastic /glass container	100 ml	On site analysis
Electrical Conductivity	Grab sampling Plastic /glass container	100 ml	On site parameter
Total suspended solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
Total Dissolved Solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
BOD	Grab sampling Plastic /glass container	1000 ml	Refrigeration, 48 hrs
Hardness	Grab sampling Plastic /glass container	100 ml	Add HNO_3 to pH<2, refrigeration; 6 months
Chlorides	Grab sampling Plastic /glass container	100 ml	Not required; 28 days
Sulphates	Grab sampling Plastic /glass container	100 ml	Refrigeration; 28 days
Nitrates	Plastic containers	100 ml	Refrigeration; 48 hrs
Fluorides	Plastic containers only	100 ml	Not required; 28 days
Alkalinity	Plastic/ glass containers	100 ml	Refrigeration; 14 days
Ammonia (NH3-N)	Plastic/ glass containers	500 ml	Add H_2SO_4 to pH<2, refrigeration, 7 days

Parameter	Sample Collection	Sample Size	Storage/ Preservation
Heavy Metals (As, Cd, Mn, Cu, Fe, Zn, Pb etc.)	Plastic/ Glass rinse with 1+1 HNO_3	500 ml	Filter, add HNO_3 to pH>2; Grab sample; 6 months

Source: Standard Methods for the Examination of Water and Wastewater, Published By APHA (American Public Health Association) 23rd Edition 2017

3.3.4 Analytical Techniques

The analytical techniques used for water analysis is given in the Table: 3.6.

Table 3.6 Analytical Techniques for Water Analysis

Parameter	Method
pH	APHA, 4500-H+B
Colour	APHA, 2120-C
Odour	APHA, 2150
Temperature	APHA, 2550-B
Oil & Grease	APHA, 5520-D,5-38
Dissolved Oxygen	APHA, 4500-DC
Electrical conductivity	APHA, 2510-B
Turbidity	APHA, 2130-B
Chlorides	APHA, 4500-Cl, B
Fluorides	APHA, 4500-FD
Total dissolved solids	APHA, 2540-C
Total suspended solids	APHA, 2540-D
Total hardness	APHA, 2340-C
Sulphates	APHA, 4500-SO_4^{-2}-E
Phosphates	APHA, 4500-P C&D
Arsenic	APHA, 3120-B
Calcium	APHA, 3500-Ca B
Magnesium	APHA, 3500-Mg B
Manganese	APHA, 3120-B
Mercury	APHA, 3120-B
Lead	APHA, 3120-B
Copper	APHA, 3120-B
Cadmium	APHA, 3120-B
Iron	APHA, 3120-B

Parameter	Method
Zinc	APHA, 3120-B
Chromium	APHA, 3120-B
Aluminium	APHA, 3120-B
Cyanide	APHA, 4500-CN-E
Coliform organisms	IS 15185
Alkalinity	APHA, 2320-B
COD	APHA, 5220-B
BOD	IS 3025 P:44
Total Kjheldhal Nitrogen	APHA,4500-N_{org} B
Ammonical Nitrogen	APHA, 4500-NH_3 F
Residual Free Chlorine	IS 3025 P:26
Phenolic Compounds (as C_6H_5OH)	APHA, 5530-C

Source: Standard Methods for the Examination of Water and Wastewater, Published By APHA (American Public Health Association) 23rd Edition 2017

3.3.5 Water Sampling Stations

The locations of the water samples collected in the study area are furnished in Table 3.7.

Table 3.7 Water Sampling Stations

Code	Station	Latitude & Longitude	Source of collection
GW1	Baireddypalli	13°23'42.81"N 78°48'0.57"E	Ground water
GW2	Somala	13°28'31.30"N 78°48'27.34"E	Ground water
GW3	Goudamukalapalle	13°21'19.10"N 78°45'4.72"E	Ground water
GW4	Penugolakala	13°19'12.72"N 78°47'58.19"E	Ground water
SW1	Sethamma Cheruvu	13°23'58.83"N 78°49'10.46"E	Surface water
SW2	Muddaleru Vanka	13°23'25.27"N 78°47'8.10"E	Surface water
SW3	Chennapatnam Cheruvu	13°27'45.68"N 78°46'38.46"E	Surface water
SW4	Bonamanda Cheruvu	13°21'29.38"N 78°49'48.70"E	Surface water

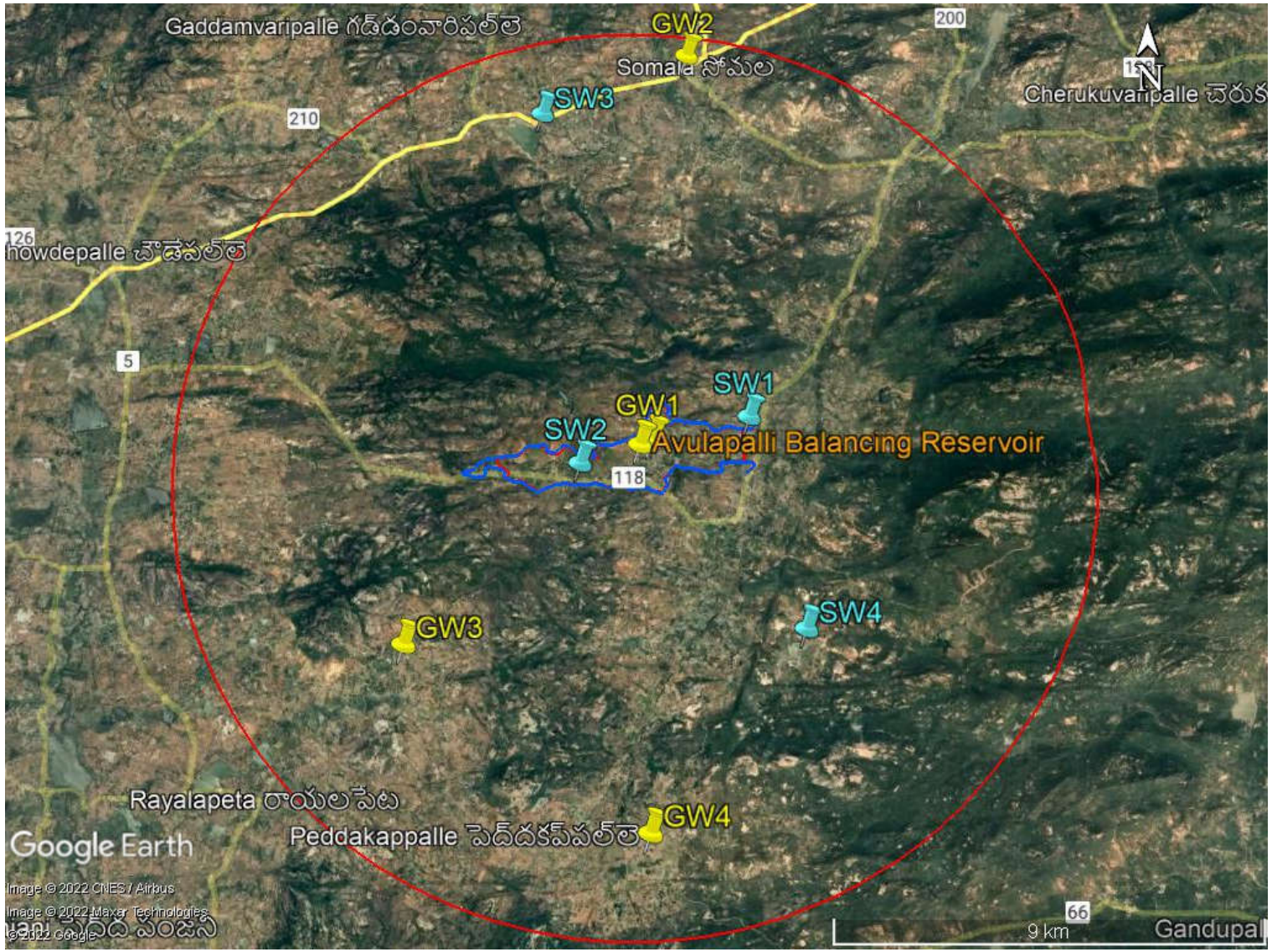


Fig 3.6 Water quality monitoring locations

3.3.6 Ground Water Quality of the Study Area

The water in the region (ground water) has been compared with respect to the Drinking water Quality Standards as IS: 10500. The summarized analysis of results of the ground water quality in the study area are given in the below Table 3.8.

Table 3.8 Ground water quality results

S.No.	PARAMETER	UNIT	GW1	GW2	GW3	GW4	IS:10500-2012 Drinking water specifications	
							Acceptable	Permissible
1.	Color	Hazen	< 1	< 1	< 1	< 1	5	15
2.	Temperature of Water	^0C	27.5	27.3	27.1	27.4	-	-
3.	pH	-	7.77	7.40	7.51	7.48	6.5-8.5	6.5-8.5
4.	Turbidity	NTU	<0.01	0.92	<0.01	<0.01	1	5
5.	Total Dissolved Solids	mg/l	632	584	626	588	500	2000
6.	Total alkalinity (as $CaCO_3$)	mg/l	424	376	405	392	200	600
7.	Total Hardness (as $CaCO_3$)	mg/l	361	221	308	290	200	600
8.	Chlorides as Cl	mg/l	134	106	121	113	250	1000
9.	Calcium as Ca	mg/l	101	50.5	80.9	75.3	75	200
10.	Magnesium as Mg	mg/l	26.7	23.3	25.6	24.8	30	100
11.	Fluoride as F^-	mg/l	1.45	3.44	1.31	1.26	1.0	1.5
12.	Nitrates as NO_3^-	mg/l	1.96	7.04	3.8	2.5	45	45
13.	Sulphates as SO_4^{2-}	mg/l	31.7	98.4	52.5	43.6	200	400

14.	Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	0.01	0.05
15.	Cadmium as Cd	mg/l	<0.002	<0.002	<0.002	<0.002	0.003	0.003
16.	Copper as Cu	mg/l	<0.01	<0.05	<0.01	<0.05	0.05	1.5
17.	Lead as Pb	mg/l	<0.001	<0.001	<0.001	<0.001	0.01	0.01
18.	Iron as Fe	mg/l	0.09	0.12	0.10	0.08	0.3	0.3
19.	Manganese as Mn	mg/l	<0.05	<0.05	<0.05	<0.05	0.1	0.3
20.	Zinc as Zn	mg/l	0.039	0.039	0.035	0.031	5.0	15.0
21.	Dissolved phosphates	mg/l	<0.01	<0.01	<0.01	<0.01	-	-
22.	Phenolic Compounds as C_6H_5OH	mg/l	<0.001	<0.001	<0.001	<0.001	0.001	0.002
23.	Residual Chlorine	mg/l	<0.005	<0.005	<0.005	<0.005	0.2	1.0
24.	E. Coli	CFU/100 ml	Not Detected	Not Detected	Not Detected	Not Detected	Shall not be detectable	Shall not be detectable
25.	Total Coliforms	CFU/100 ml	05	08	10	06	Shall not be detectable	Shall not be detectable

ND - Not Detected.

3.3.7 Summary of Groundwater quality:

- The pH limit for drinking water samples as per IS: 10500:2012 Drinking Water Specifications is 6.5 to 8.5. During the study period, the pH of the groundwater was found to be varying between 7.51 and 7.77. The pH values for all the samples collected in the study area during study period were thus found to be within the acceptable limits.
- The desirable limit for total dissolved solids as per IS: 10500:2012 Drinking water specifications is 500 milligrams per liter (mg/l) whereas the permissible limits in absence of alternate source is 2000 mg/l. In groundwater samples collected from the study area, the total dissolved solids (TDS) were found to be varying between 584 mg/l and 632 mg/l. The TDS of all the samples were below the permissible limit of 2000 mg/l.
- The desirable limit for Chloride is 250mg/l as per IS: 10500:2012 Drinking water specifications whereas the permissible limit of the same is 1,000 mg/l. The Chloride levels in the groundwater samples collected in the study area were ranging from 106 to 134 mg/l
- The desirable limit as per IS: 10500:2012 Drinking water specifications for hardness is 200 mg/l whereas the permissible limit for the same is 600 mg/l. In the groundwater samples collected from the study area, the hardness was found to be varying between 221 mg/l to 361 mg/l.
- Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However, the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. In the groundwater samples of study area, the fluoride values were found to be within a range of 1.26 mg/l to 3.44 mg/l.
- All the heavy metals in all samples were found to be below the permissible limits. An overview of the results obtained reveals that none of parameters were found above the permissible limits of IS: 10500: 2012 Drinking Water Standards.

3.3.8 Surface Water Quality of the Study Area

The water in the region (surface water) has been compared with respect to the IS: 2296. The summarized analysis of results of the surface water quality in the study area are given in the below Table 3.9.

Table 3.9 Surface Water Quality of the Study Area

S. No.	PARAMETER	UNIT	SW1	SW2	SW3	SW4	IS:2296 - Standards
1.	Color	Hazen	<1	<1	<1	<1	-
2.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	-
3.	Turbidity	NTU	11.8	80.2	12.8	14.2	-
4.	pH	-	8.07	7.65	7.81	7.95	6.50 – 8.50
5.	Temperature	^0C	25.4	25.7	25.5	25.8	-
6.	Electrical Conductivity	mmhos/cm	410	326	491	538	-
7.	Total Dissolved Solids	mg/l	256	198	299	328	1500
8.	Total Suspended Solids	mg/l	11	14	12	16	-
9.	Total Alkalinity as $CaCO_3$	mg/l	155	117	162	175	-
10.	Total Hardness as $CaCO_3$	mg/l	109	81.0	126	145	-
11.	Calcium as Ca	mg/l	26.8	19.2	28.5	31.3	-
12.	Magnesium as Mg	mg/l	10.2	8.01	13.5	16.3	-
13.	Chloride as Cl	mg/l	61.4	55.1	72.4	80.5	-
14.	Sulphate as SO_4^{2-}	mg/l	19.6	17.0	21.3	23.5	-
15.	Nitrate as NO_3^-	mg/l	0.20	<1.0	0.31	0.35	-
16.	Iron as Fe	mg/l	0.14	0.11	0.16	0.19	-
17.	Hexavalent Chromium as Cr^{6+}	mg/l	<0.001	<0.001	<0.001	<0.001	0.05
18.	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	0.005
19.	Cyanide as CN	mg/l	<0.002	<0.002	<0.002	<0.002	0.05
20.	Zinc as Zn	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	15
21.	Lead as Pb	mg/l	<0.001	<0.001	<0.001	<0.001	0.01
22.	Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	1.5
23.	Aluminium as Al	mg/l	<0.005	<0.005	<0.005	<0.005	0.1
24.	Manganese as Mn	mg/l	<0.05	<0.05	<0.05	<0.05	5.0
25.	Mercury as Hg	mg/l	<0.001	<0.001	<0.001	<0.001	-
26.	Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	-
27.	Cadmium as Cd	mg/l	<0.002	<0.002	<0.002	<0.002	-
28.	Dissolved Oxygen	mg/l	6.4	5.8	5.9	5.7	5.0 min
29.	Chemical Oxygen Demand	mg/l	14.6	19.2	16.2	18.5	-
30.	Biochemical Oxygen Demand	mg/l	3.2	3.6	3.8	3.9	3.0
31.	Total Kjheldhal Nitrogen	mg/l	< 1.0	< 1.0	< 1.0	< 1.0	-
32.	Free Ammonical Nitrogen	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	-
33.	Oil & Grease	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	-
34.	E. Coli	MPN/100 ml	Absent	Absent	Absent	Absent	Absent
35.	Total Coliforms	MPN/100 ml	110	60	110	110	5000

3.3.9 Surface water quality results are summarized below:

- pH of the surface water collected was found to be neutral with pH ranging from 7.65 to 8.07.
- TDS was found to be varying between 198 mg/l to 328 mg/l. The tolerance limit is 1,500 mg/l as per IS: 2296.
- Total Hardness was found to be ranging between 81 mg/l to 145 mg/l.
- Presence of Nitrate was found to be between 0.2 mg/l to 0.35 mg/l.
- DO was observed to be between 5.7 mg/l to 6.4 mg/l.
- Total coliform in water was found to be between 60 MPN/100ml to 110 MPN/100ml.
- All the heavy metals were found to be within below detectable limits.

3.4 SOIL QUALITY

3.4.1 Selection of sampling Locations

For studying soil profile of the region, sampling locations were selected to assess the existing overall soil conditions around the project site. The study of the soil profile establishes the baseline characteristics and this will help in future for identifying the incremental concentrations if any, due to the project. The sampling locations have been identified with following objectives.

a) To determine the baseline soil characteristics of the study area
b) To determine the impact of the project activities on soil characteristics

3.4.2 Sampling and Analytical Techniques

Five sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features. At each location (Fig 3.11), soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and are homogenized. This is in line with IS: 2720 & Methods of Soil Analysis, Part-1, 2nd edition, 1986 of (American Society for Agronomy and Soil Science Society of America). The homogenized samples were analyzed for physical and chemical characteristics. The soil samples were collected and analyzed once in post monsoon season.

The samples have been analyzed as per the established scientific methods for physico-chemical parameters. The heavy metals have been analyzed by using Atomic Absorption Spectrophotometer. The methodology adopted for each parameter is described in Table: 3.10.

Table 3.10 Analytical Techniques for Soil Analysis

Parameter	Method (ASTM number)
Textural classification	Chart developed by Public Roads Administration
pH	IS 2720 P 26
Electrical conductivity	IS 14767 : 2002
Bulk Density	IS 2720 P 8
Moisture Content	IS 2720 P 2
Nitrogen	IS 14684 : 1999
Phosphorus	Manual Soil Testing in India, Ministry of Agriculture
Potassium	Manual Soil Testing in India, Ministry of Agriculture
Sodium	Manual Soil Testing in India, Ministry of Agriculture
Calcium	Manual Soil Testing in India, Ministry of Agriculture
Magnesium	Manual Soil Testing in India, Ministry of Agriculture
Chlorides	Argentometric Method
Sulphates	IS 2720 P 27 : 1977
Organic Carbon	IS 2720 P 22
Organic Matter	IS 2720 P 22

3.4.3 Details of Soil Sampling Locations

The soil sampling locations and distance from project are mentioned in the below table 3.11.

Table 3.11 Soil Sampling Locations

Code	Location	Latitude and Longitude
S1	Avulapalli	13°24'5.74"N 78°49'30.07"E
S2	Baireddypalli	13°23'46.57"N 78°47'56.43"E
S3	Upparapalle	13°22'51.31"N 78°49'7.20"E
S4	Goudamukalapalle	13°21'16.64"N 78°45'2.86"E
S5	Muddireddipalle	13°24'46.51"N 78°43'42.67"E

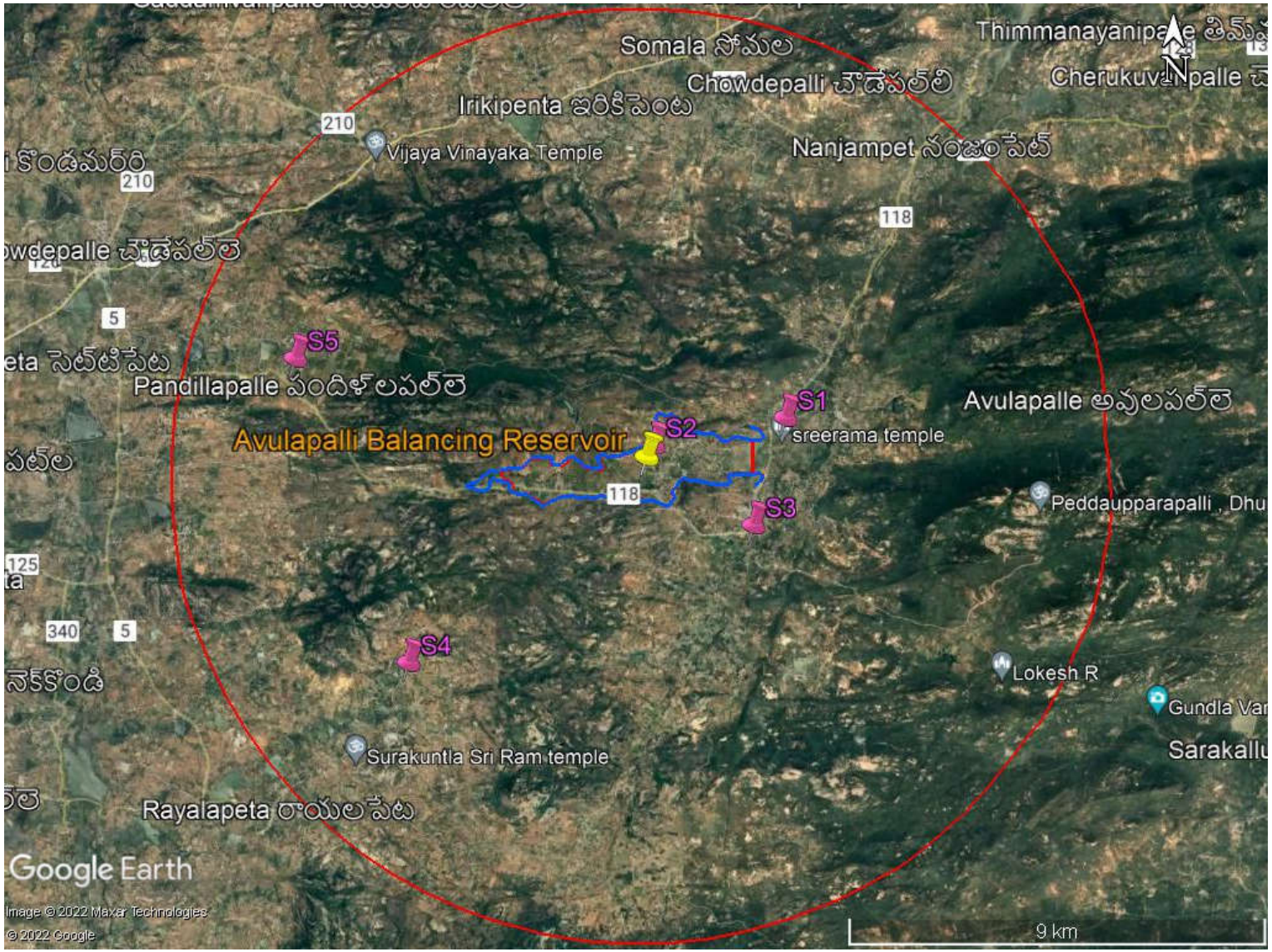


Fig 3.7 Soil quality monitoring locations

3.4.4 Soil Analysis Results in the Study Area

The summarized analysis results of the soil samples in the study area are presented in the Table: 3.12.

Table 3.12 Soil Analysis Results

S.No	Parameter	Unit	S1	S2	S3	S4	S5
1.	pH (1:5) Aq Extract	--	6.11	8.61	7.82	7.53	6.89
2.	Conductivity (1:5 Aq Extract)	μ mhos /cm	29.3	128	124	118	98
3.	Texture						
	(a) Sand	%	47	38	39	41	40
	(b) Silt		18	23	22	19	24
	(c) Clay		35	39	37	40	36
4.	Bulk Density	gm/cm^3	1.32	1.14	1.11	1.19	1.36
5.	Moisture Content	%	6.8	9.2	8.9	9.3	7.1
6.	Available Nitrogen as N	kg/ha	72	59	54	65	69
7.	Available Phosphorous as P	kg/ha	39	31	28	35	37
8.	Available Potassium as K	kg/ha	198	175	161	179	184
9.	Exchangeable Sodium as Na	mg/kg	610	548	532	565	583
10.	Exchangeable Calcium as Ca	mg/kg	5896	5213	5110	5322	5584
11.	Exchangeable Magnesium as Mg	mg/kg	454	405	385	420	441
12.	Water Soluble Chlorides as Cl	mg/kg	447	509	498	530	468
13.	Water Soluble Sulphates as SO_4	mg/kg	96.5	110	101	128	98.5
14.	Organic matter	%	0.49	0.36	0.32	0.39	0.45
15.	Organic Carbon	%	0.28	0.20	0.22	0.25	0.26

3.4.5 Summary of Soil Analysis Data

The analytical results of the soil samples collected during the study period are summarized below.

- The pH of the soil is an important property; vegetation cannot grow in low and high pH value soils. The normal range of pH in the soils is 6.11 to 8.61. The pH values in the

study area are varying from 7.59 to 7.72 indicating that the soils are falling in slightly alkaline category.

- Based on the electrical conductivity, the soils are classified into four groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study areawas found to be varying between 29.3 to 128 micro-mhos per centimeter (µmhos/cm). This is good for germination
- The other important parameters for characterization of soil for irrigation are the primary nutrients – Nitrogen, Phosphorus and Potassium (N, P, K) and the secondary nutrients—Calcium, Magnesium and Sulphur (Ca, Mg, S). The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance, and not on their relative importance.
- Nitrogen encourages the vegetative development of plants by imparting a healthy green color to the leaves. The available Nitrogen as N in the study area was found to be varying between54 to 72 kg/ha. This is good for crops when compared with soil standards.
- Phosphorus influences the vigour of plants and improves the quality of crops. In the study area available, Phosphorus was ranging between 28 to 39 kg/ha. This is considered medium level when compared to soil standards.
- Potassium enhances the ability of the plants to resist diseases, insect attacks, cold and other adverse conditions. The available potassium in the study area varied between 161 to 198mg/kg. This is considered medium to average level when compared to soil standards.
- Organic Carbon in the study area ranged from 0.22 to 0.28%. This is an average sufficient level for crops.

Based on the above results (Table 3.13), the soils in the region were good enough for cultivation of crops.

Table 3.13 Standard Soil Classification

S. No	Soil Test	Classification
1.	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline

		>9.00 very strongly alkaline
2.	Electrical Conductivity (ppm) (1ppm = 640 µmhos)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3.	Organic Carbon	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4.	Nitrogen (Kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5.	Phosphorus (Kg/ha)	Upto 15 very less 16-30 less 31-50 medium 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6.	Potassium (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

Source: Hand Book of Agriculture, ICAR, New Delhi

3.5 NOISE ENVIRONMENT

3.5.1 Identification of Sampling Locations

Noise at different generating sources has identified based on the activities in the village area and the noise at sensitive areas. A detailed survey on noise environment was carried in and around the project site to study the levels of noise, as the high dB (A) levels may cause adverse effect on human beings and associated environment, including structures, domestic animals and natural ecological systems. The locations (Fig 3.8) were identified keeping in view the land use pattern and environmental setting. Spot noise levels were measured using a precision noise level meter at project site and residential areas in all eight locations were covered with in study zone.

3.5.2 Methodology

The monitoring was carried out at each location for a period of 24hrs, once in a season. The locations were identified keeping in view the land use pattern and environmental setting. The

day levels of noise have been monitored during 6 am to 10 pm and the night levels during 10 pm to 6 am. The Ld, Ln and Ldn were calculated based on the hourly Leq values. Spot noise levels were measured using a precision noise level meter at residential areas and project area, in all five locations which were covered with in study zone. The noise levels include vehicular movement and local activities.

Noise levels were recorded for every 15minutes in a clock hour for a continuous 24-hour period at all locations.

3.5.3 Noise Monitoring Locations - The noise monitoring locations along with their distance from project are mentioned in the below Table: 3.14.

Table 3.14 Noise Monitoring Locations

S. No	Location	Station Code	Latitude and Longitude
1	Project site (Ramakrishnapuram)	N1	13°24'1.52"N 78°48'20.56"E
2	Upparapalle	N2	13°23'7.85"N 78°49'10.77"E
3	Reddivaripale	N3	13°23'20.02"N 78°49'42.39"E
4	Patrapalli	N4	13°24'22.26"N 78°50'11.70"E
5	Rachettivanipalle	N5	13°27'52.82"N 78°48'0.09"E
6	Goudamukalapalle	N6	13°21'24.33"N 78°45'4.77"E
7	Durgasamudram	N7	13°22'35.99"N 78°43'32.22"E
8	Muddireddipalle	N8	13°24'47.40"N 78°43'37.44"E

3.5.4 Description of Locations:

N1 – the location has been selected to assess noise levels in the project site. N2, N3, N4, N5, N6, N7 and N8 – the locations have been selected to assess noise levels near to the project in residential areas with light Vehicular Movement.

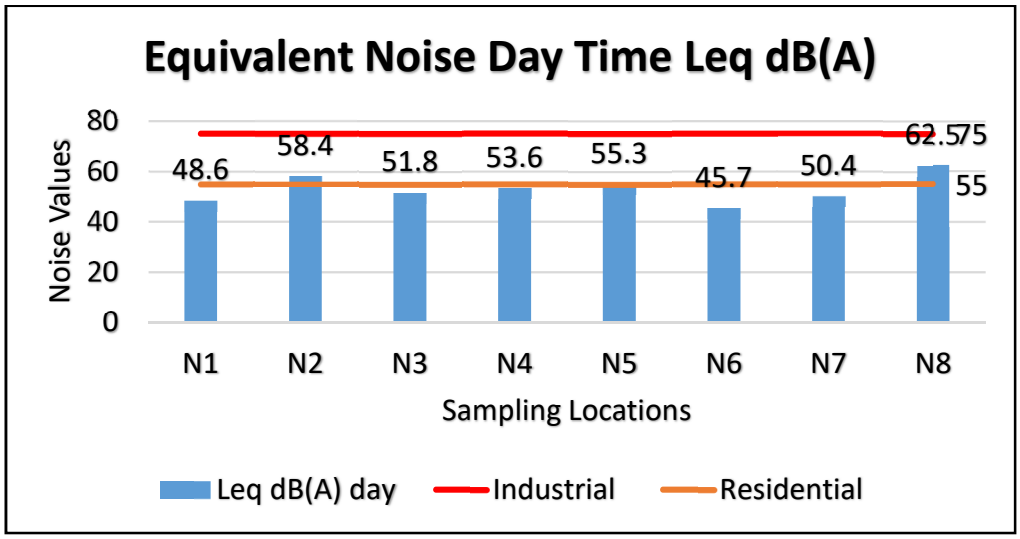
3.5.5 Noise Levels in the Study Area

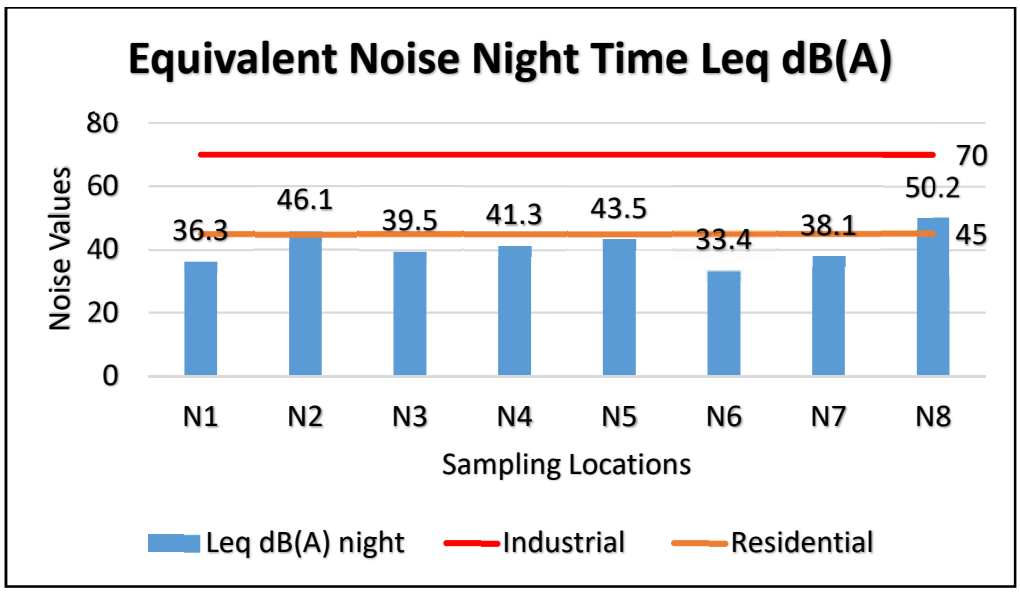
The noise level monitored during the study period is given in Table: 3.15 in the form of Lday, Lnight and Ldn compared with CPCB Standards.

Table 3.15 Noise Levels in the Study Area

Location Code	Environmental Setting	CPCB norms Leq dB(A)		Leq dB(A) day	Leq dB(A) night
		Day	Night		
N1	Project site	75	70	48.6	36.3
N2	Residential	55	45	58.4	46.1
N3	Residential	55	45	51.8	39.5
N4	Residential	55	45	53.6	41.3
N5	Residential	55	45	55.3	43.5
N6	Residential	55	45	45.7	33.4
N7	Residential	55	45	50.4	38.1
N8	Residential	55	45	62.5	50.2

GRAPHICAL PRESENTATION OF NOISE LEVELS IN THE STUDY AREA





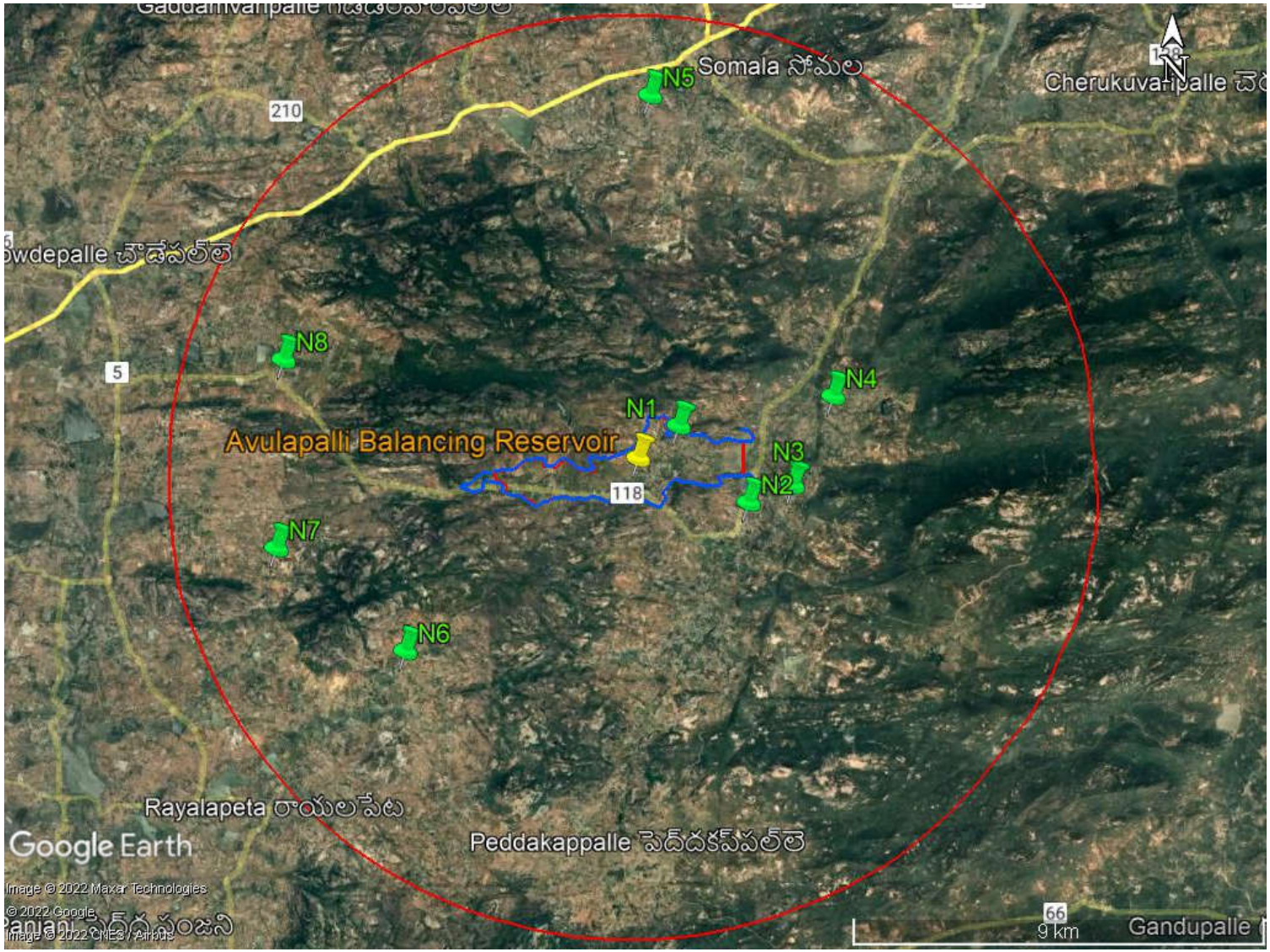


Fig 3.8 Noise monitoring locations

3.6 Geology and Htdrogeology

3.6.1 Geology

The Geological formation in the study area can broadly be divided in to distinct and well-marked groups and older group of Metamorphic rocks belonging to Archean and Younger group of Sedimentary rocks belonging to the Proterozoic age. Archean Rocks that consist of Schist, Gneisses, Quartz veins and basic dykes, occupy the study area. The Archean rocks have suffered considerable degree of tectonic disturbances, because of which the rocks have been metamorphosed and recrystallized.

The Subject area belongs to a hillock with a height of 50-51m gently sloping towards West direction. The area is exposed with multi-Color Granite Sheet Rock intruded with Quartz Veins. This subject area is exposed with sheet rock of pink color granite that is locally named with branded rock of “Multi Colour Granite” of Punganur. Either side of the area intruded in to the Granite Gneisses, it indicating it will be youngest suits of Granittic rocks. The peninsular gneissic complex comprises gneisses, gray granite, and Pink Granite and Gneissic granite. The gneiss in general show banding due to alteration of light colored quartzo-feldspathic minerals and dark colored biotite or hornblende minerals. These rocks may be separated in two distinct groups namely; the massive foliated types occur as low dome shaped hillocks. The intrusive relationship of the granite rock is evident by the presence of tongues and apophyges within the older rocks and the occurrence of xenoliths of the older rocks within the granite (Fig 3.9).

Topographically the area proposed for grant is a pediment hillock gently slopes towards West direction. Generally, it is low-lying plain land with an average altitude of 282 to 333m above M.S.L. and dendritic to sub dendritic drainage is observed. The area is elevated towards East of the hillock and sloping towards West directions. The area is devoid of any forest or tree cover. Its boulders 2-5m size on top and below sheet rock is present in the applied area. There are no prominent natural drainage channels in the area. In general, the area is plain land.

3.6.2 Hydrogeology

The study area is underlain by crystalline formation. Ground water occurs unconfined to confined conditions in both hard rock and soft rock formations. The common ground water abstraction structures are drug wells, dug-cum-bore wells and bore wells and their yields mainly depend on recharge conditions in the area. The depth of open wells ranges from 10m to 13 m whereas bore wells range in depth from 50 to 60 m. The water level ranges from 25 to 30 m below ground level.

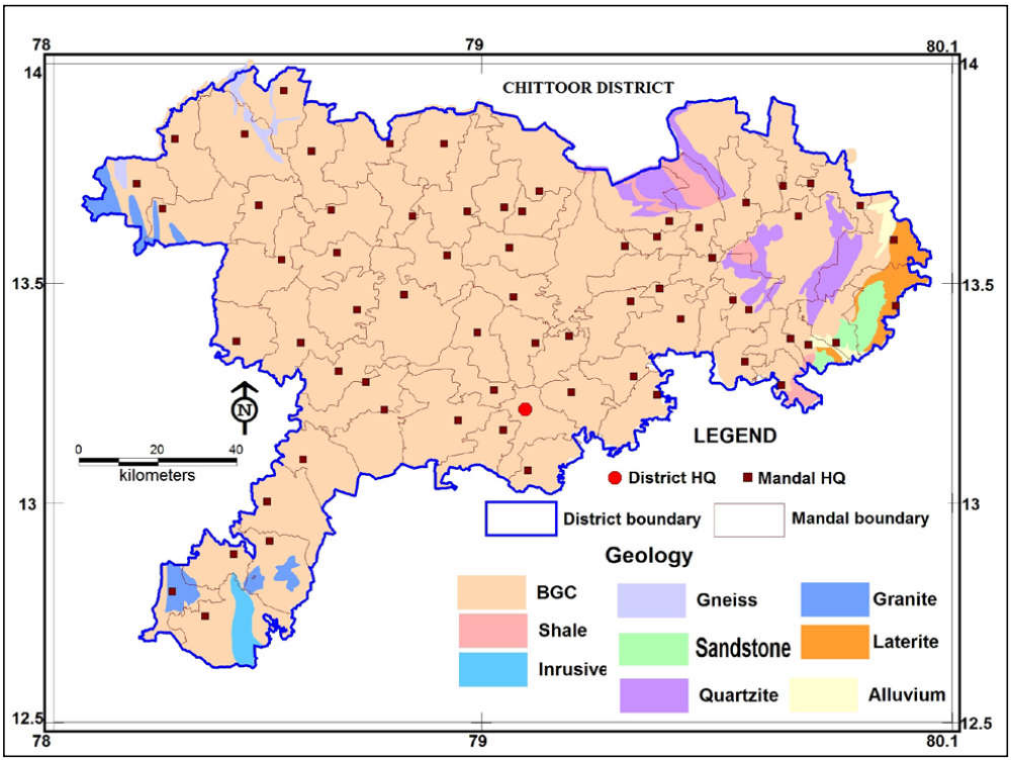


Fig 3.9 Geology of Chittoor District

The occurrence of ground water in the area is under semi-confined conditions through the weathered and fractured formations. The Nagari Quartzites are mostly confined to uplands and hilly areas, which are covered by forest. These formations are massive and compact and possess meagre ground water potential. The ground water development is very less and there is not much habitation in these formations. The alluvium is confined to mostly riverbanks and stream courses with varying width and depth. Ground water development in this formation is mostly by filter points and dug wells. The well yields vary from 3 to 10 lps. With drawdown of 2 to 6 m. They can sustain pumping for 5 to 7 hours/day with fast recovery of water levels. The applied area exists dendritic drainage pattern, and any second order streams are not exists nearby site location. The study area of the drainage pattern South to NE direction. Hydrogeological map of the study area is presented in Fig 3.10.

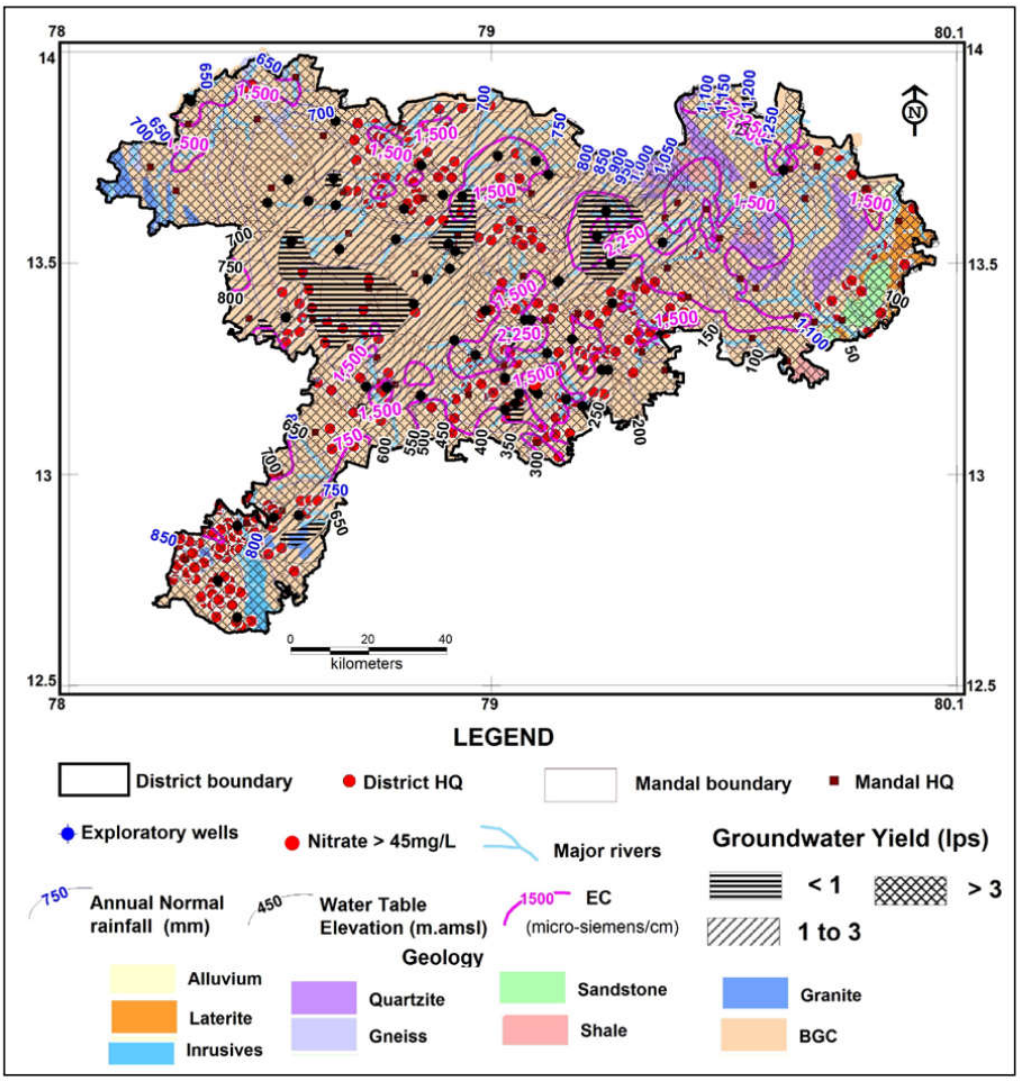


Fig 3.10 Hydrogeology of the Chittoor District

3.7 LAND USE/ LAND COVER

Land use Land Cover map is prepared by adopting interpretation techniques of the image classification. Image classification has been done by using supervised classification of satellite images by running an training sample manage based on colours, various activities has been included in the preparation of Land Use Land Cover Maps such as Satellite Image/Data Acquisition, Preprocessing, Rectification, Ground Truthing etc., Satellite Images are processed and producing LULC maps are being done by using Arc GIS 10.6.

The basic purpose of land use pattern and classification in an EIA study is to identify the manner in which different parts of land area is utilized or not utilized. Remote sensing data provides reliable accurate baseline information for land use mapping as it is a rapid method of acquiring upto date information of over a large geological area.

Studies on land use aspects of eco-system play an imperative role in identifying susceptible issues and to take appropriate action to uphold ecological equilibrium in the region. The main objective of this section is to provide a baseline status of the study area covering 10 km radius around the proposed plant site so that temporal changes due to the industrial activities on the surroundings can be assessed in future.

The objectives of Land use Pattern are to:

- Determine the present Land use pattern
- Analyze the impacts on Land use due to the proposed projecte in the study area
- Study area with proposed unit as 10 km radius from the core area is considered for land use study.

3.7.1 Methodology

The overall methodology (Fig 3.11) adopted and followed to achieve the objectives of the present study involve the following:

- Procurement of Satellite images.
- Collection of source data of Survey of India (SOI) toposheets. These are the main inputs for the preparation of essential layers
- Atmospheric and Radiometric corrections of Satellite data by using nearest neighborhood resampling technique
- Preparation of basic themes like layout map, transport & settlement map and contour map from the source data. Then updating of layout map, transport map and drainage map from the satellite image by visual interpretation
- Performing image analysis in ArcGIS and Extraction of whole satellite image into study area, processing and producing various maps such as LULC, Contour Maps, Digital Elevation Maps, Drainage Maps
- Preliminary quality check and necessary corrections are carried out for all the maps.

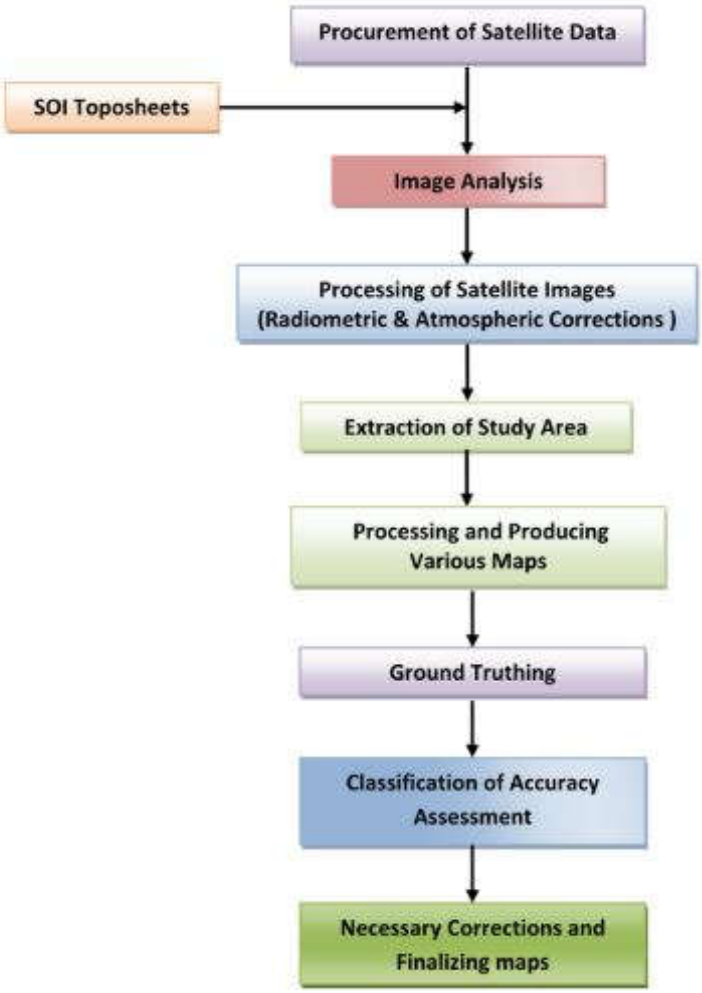


Fig 3.11 Methodology

3.7.2 LULC Study

The LULC Study done for the 10km radius area from the boundary of proposed Avulapalli Balancing Reservoir project site by using visual interpretation techniques in Arc GIS 10.6. Output of the map has been provided in 1:50000 scale, along with LULC MAP 10KM Radius False Colour Composite Map (Fig 3.12) and True Colour Composite map (Fig 3.13) also provided below. The area distributions along with area of different land use classes are listed below table and Fig 3.12.

Total study area for the proposed project is 46414.37 Ha (Table 3.17) based on LULC map (Fig 3.14). Major portion of the study area occupied by Forest with 22375.66 (48.21 %) followed by Scrub with 11810.46 Ha (25.45%), Fallow land with 5954.65 Ha (12.83%), Agricultural fields with 5591.40 Ha (12.05%), water bodies with 437.87 Ha (0.94%), and Habitation with 244.33 (0.53%) (Fig 3.12).

Table 3.17. LU/LC Classification in the study area

S.No.	Classification	Area (Ha)	Percentage (%)
1	Water body	437.87	0.94
2	Scrub	11810.46	25.45
3	Agricultural fields	5591.40	12.05
4	Fallow land	5954.65	12.83
5	Forest	22375.66	48.21
6	Habitation	244.33	0.53
Total		**46414.37**	**100.00**

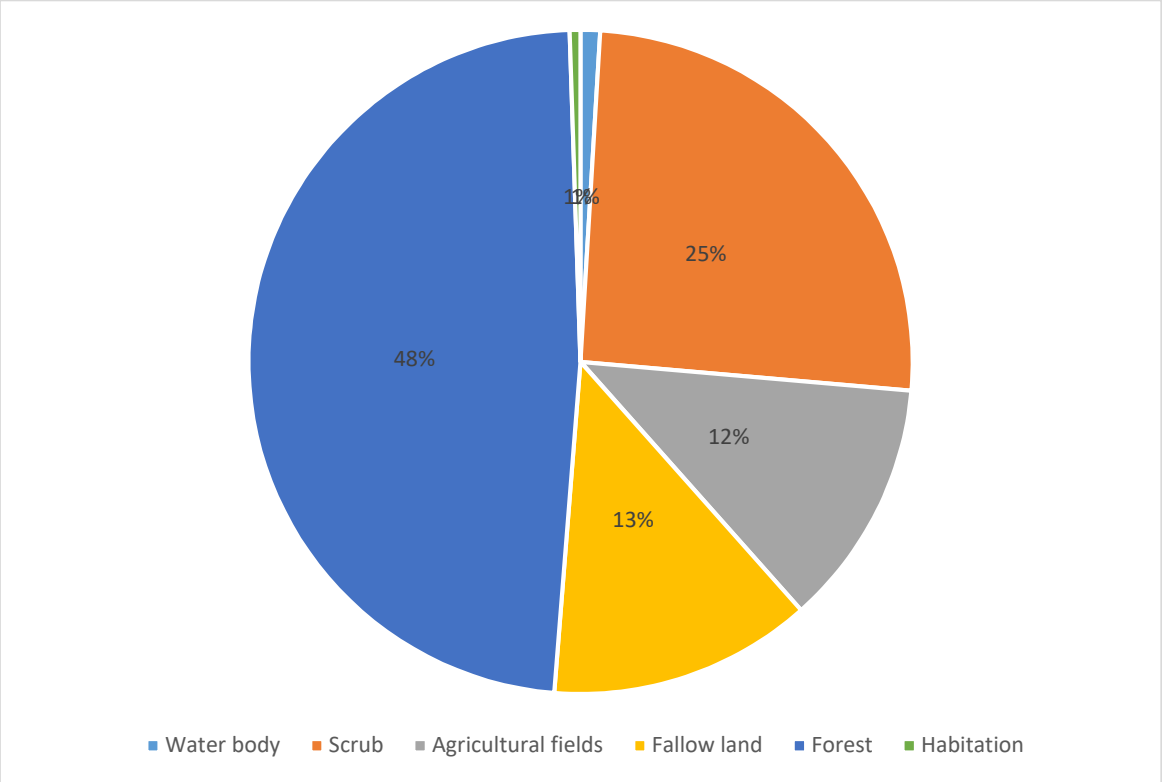


Fig 3.12 LU/LC Statistics

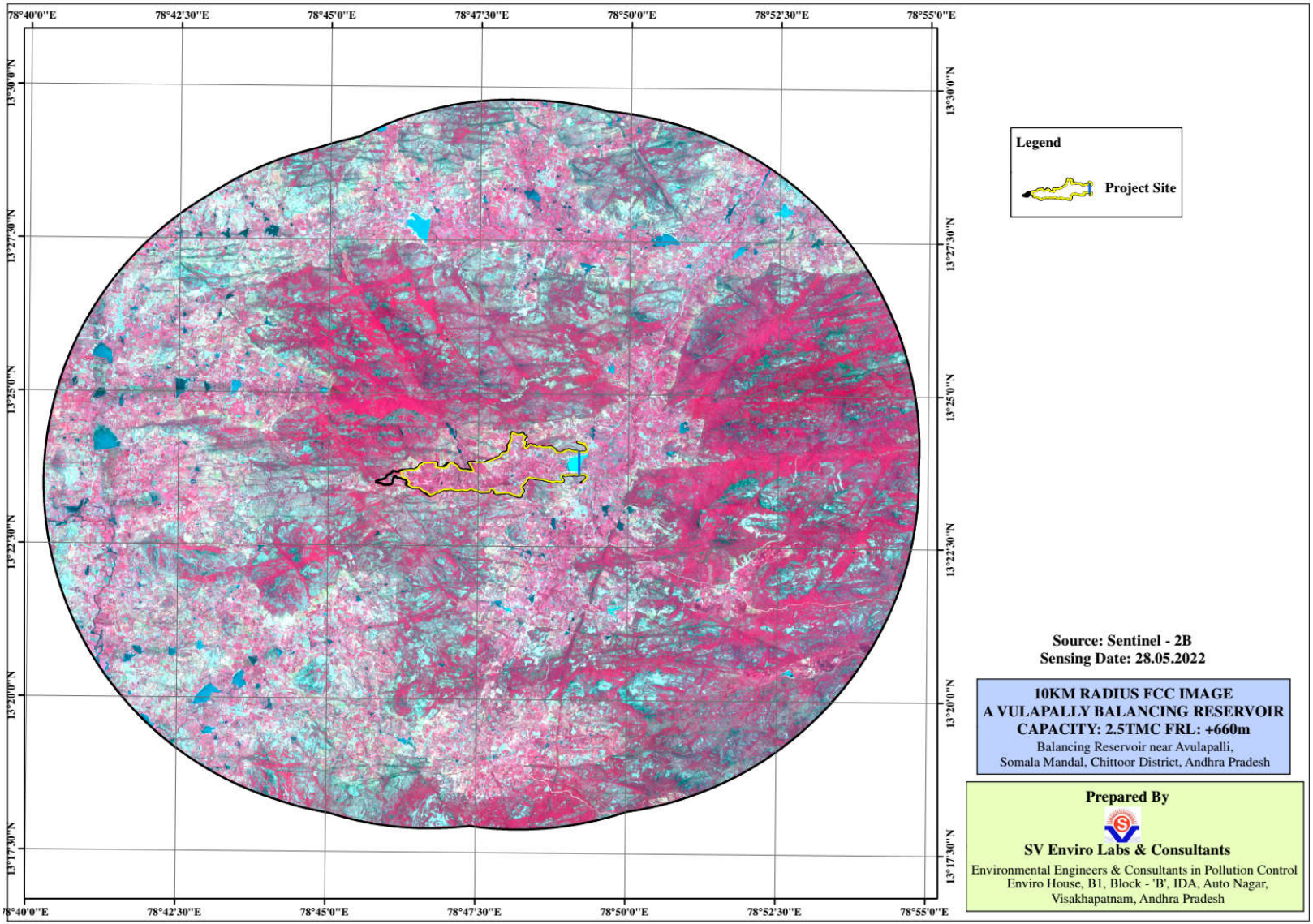


Fig 3.13 False colour composite satellite image

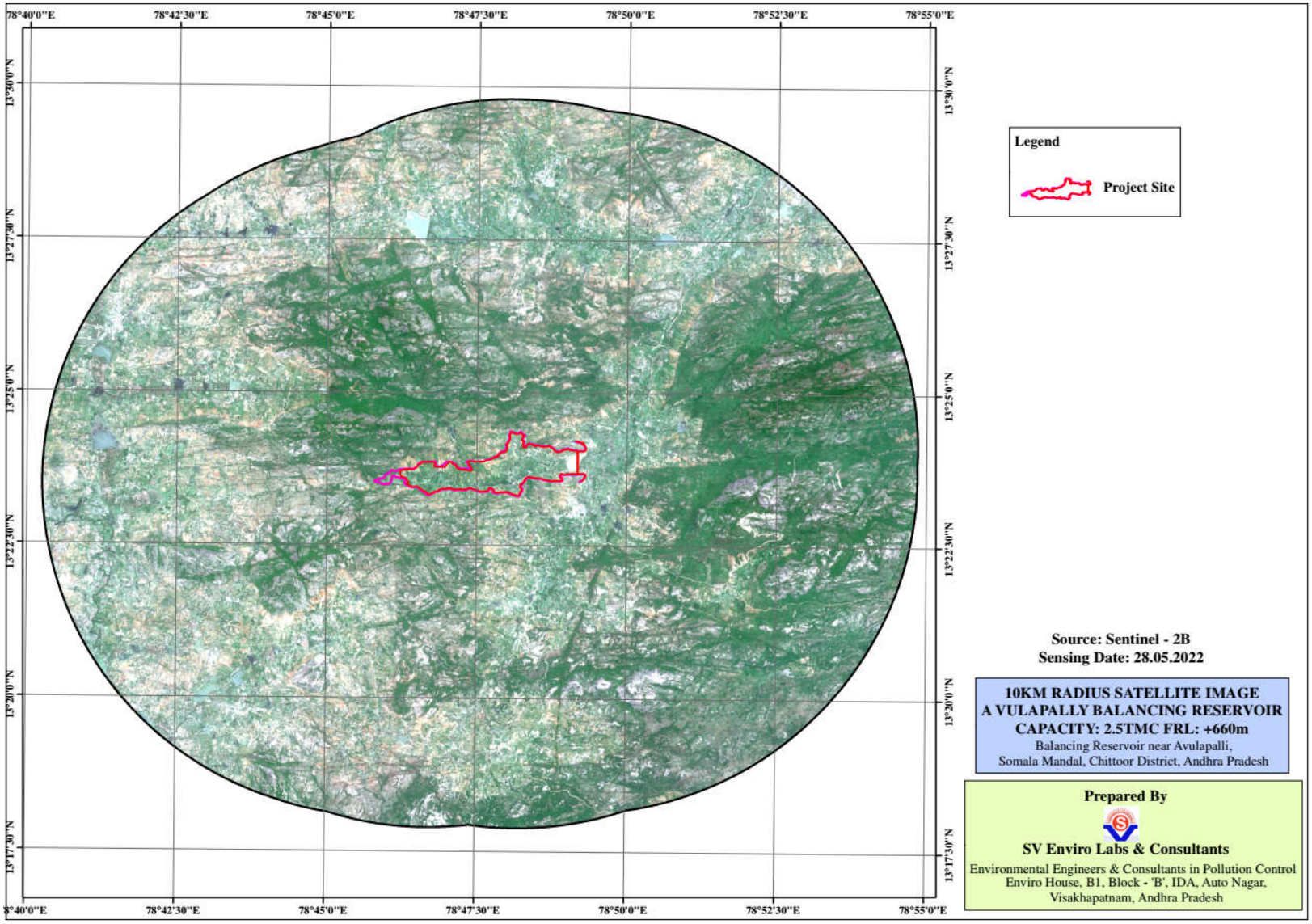


Fig 3.13 Satellite image

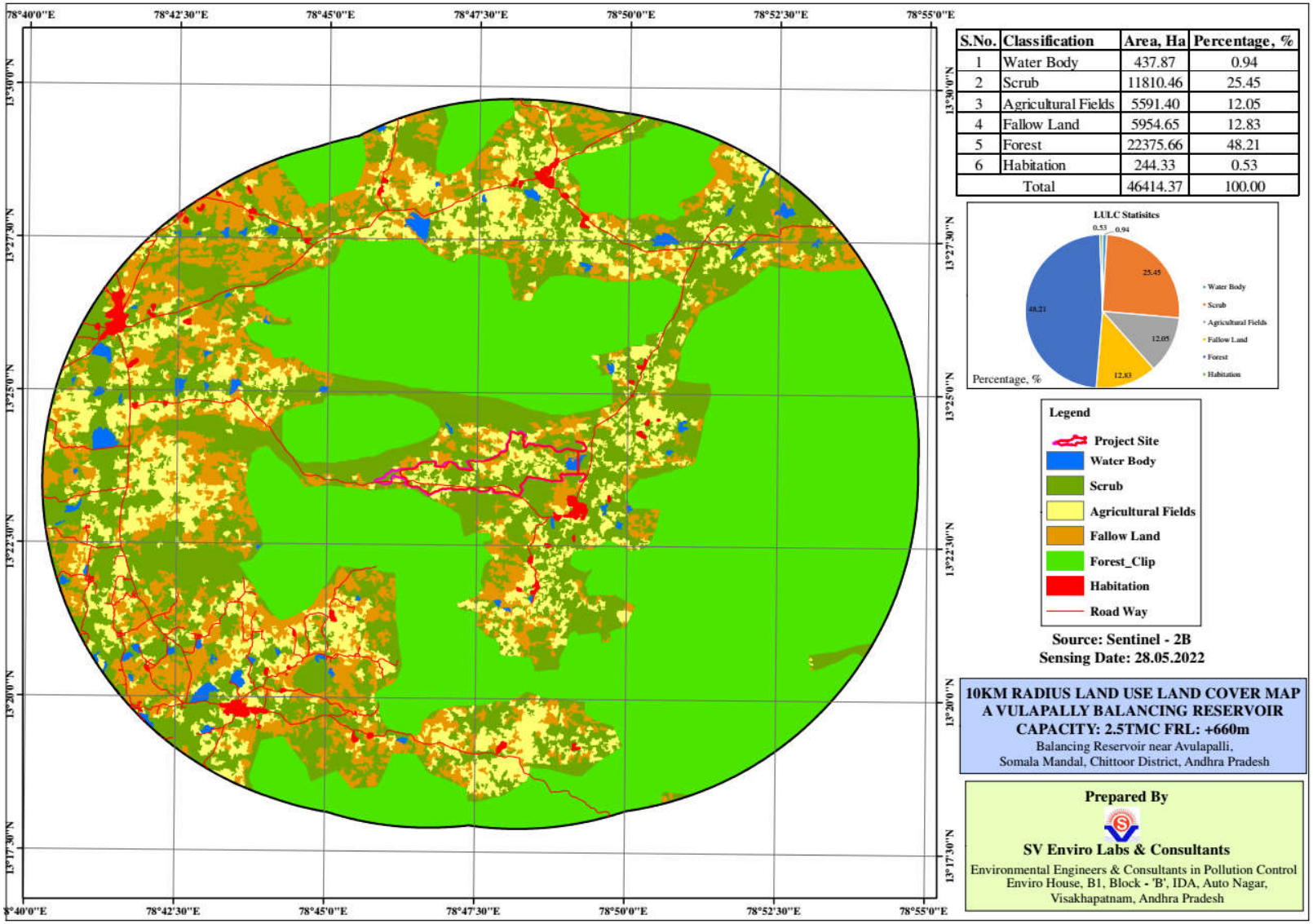


Fig. 3.15 Land use/Land cover map

3.7.3 Digital Elevation Map

A digital elevation model (DEM) is a digital representation of ground surface topography or terrain. It is also widely known as a digital terrain model (DTM). A SRTM DEM file has been used for preparation of Digital Elevation maps. In a DEM each cell having a value corresponding to its elevation. By adding Hill shading tool, a reader can see the relationship between terrain and other things. Digital Elevation Model or Digital Terrain Model map has been shown in the Fig 3.15.

3.7.4 Contour Map

A contour line connects a series of equal elevation points, the contours have been generated in the GIS environment with reference to the mean sea level by using the DEM (Digital Elevation Model) data, the elevation values has been verified. Thereafter final contour map has been prepared with combination of Toposheet and DEM with contour interval of 10 m. In the study area, highest contour observed as 1219m of MSL towards ENE direction of the project site and lowest contour is 462m of MSL that is situated towards SE and North direction of the project site. With reference to the above minimum and contour levels, it represents that the study area is undulated in nature. Contour Map for the proposed project study area has been shown in the below Fig 3.16.

3.7.5 Drainage Map

Drainage Map for the study area has been developed in the GIS Environment by using Digital Elevation Model. Methodology involved for producing of Drainage maps has been discussed below. Strahler method of ordering is used for developing drainage map for the study area. Based on the elevation profiles of the study area drains will be formed as First order, Second Order, Third Order and so on. Accuracy of the maps has been verified by using Ground Truthing Technique. Stream Network of the study area as shown in the Fig 3.17.

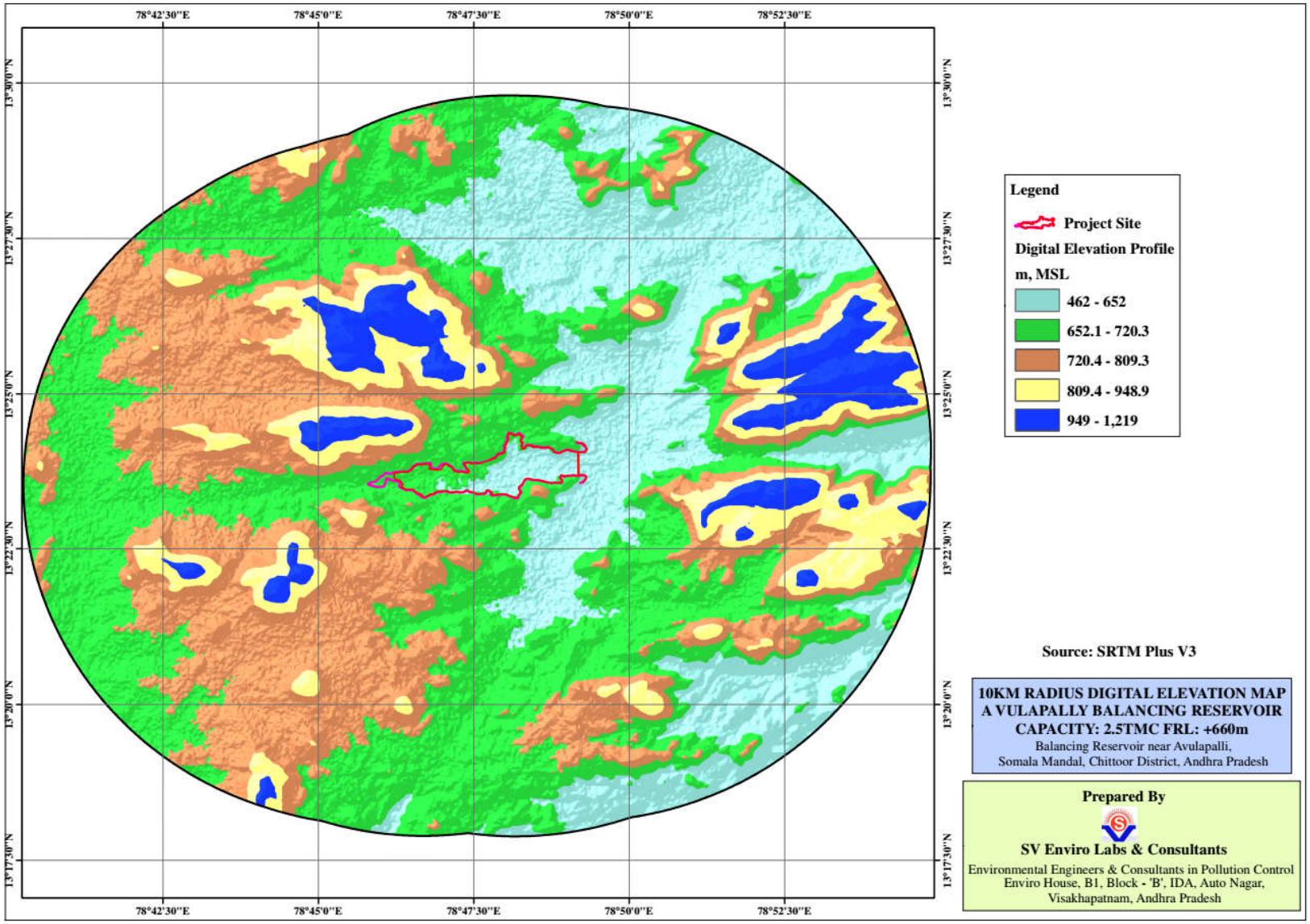


Fig. 3.16 Digital Elevation map

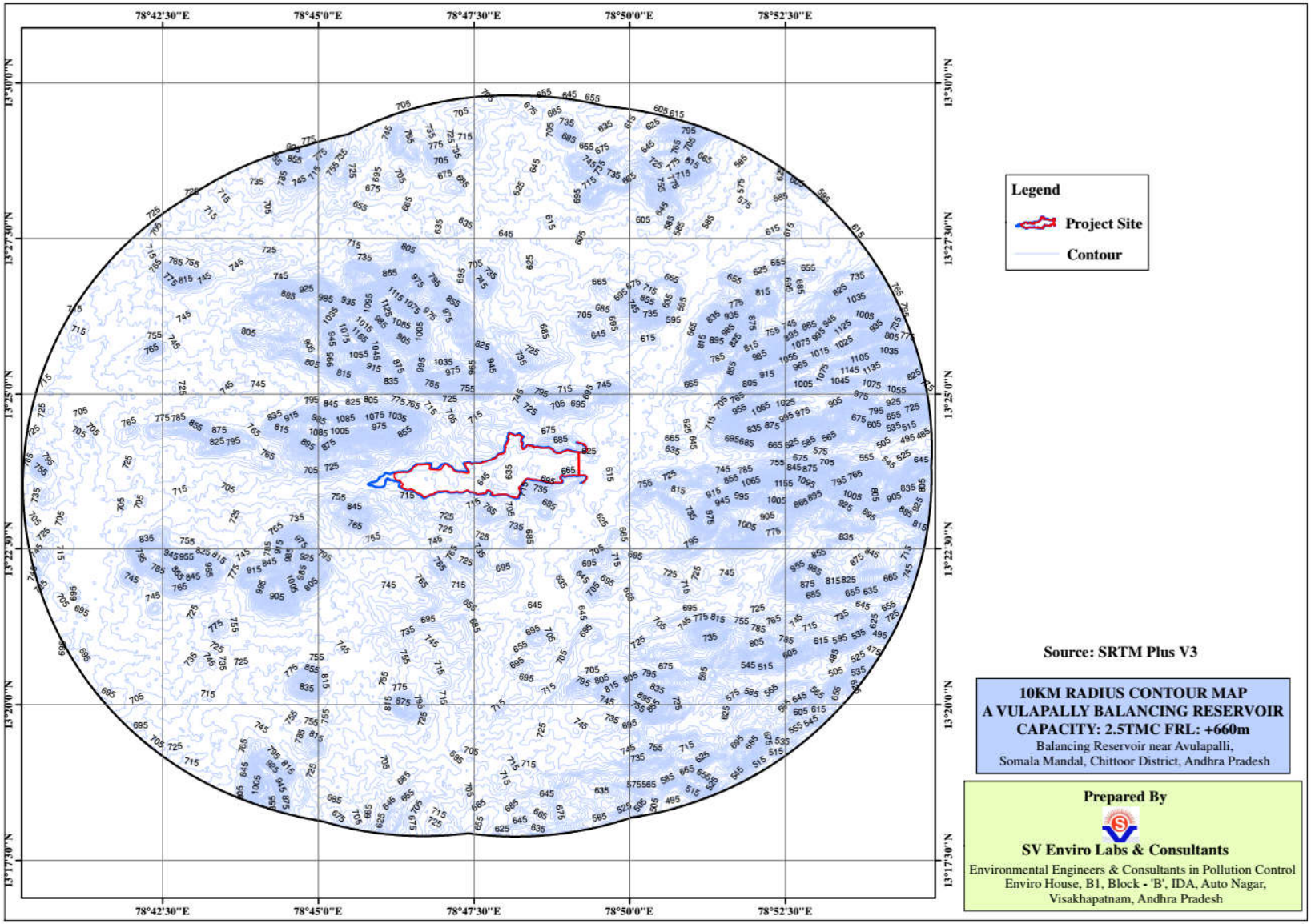


Fig. 3.17 Contour map

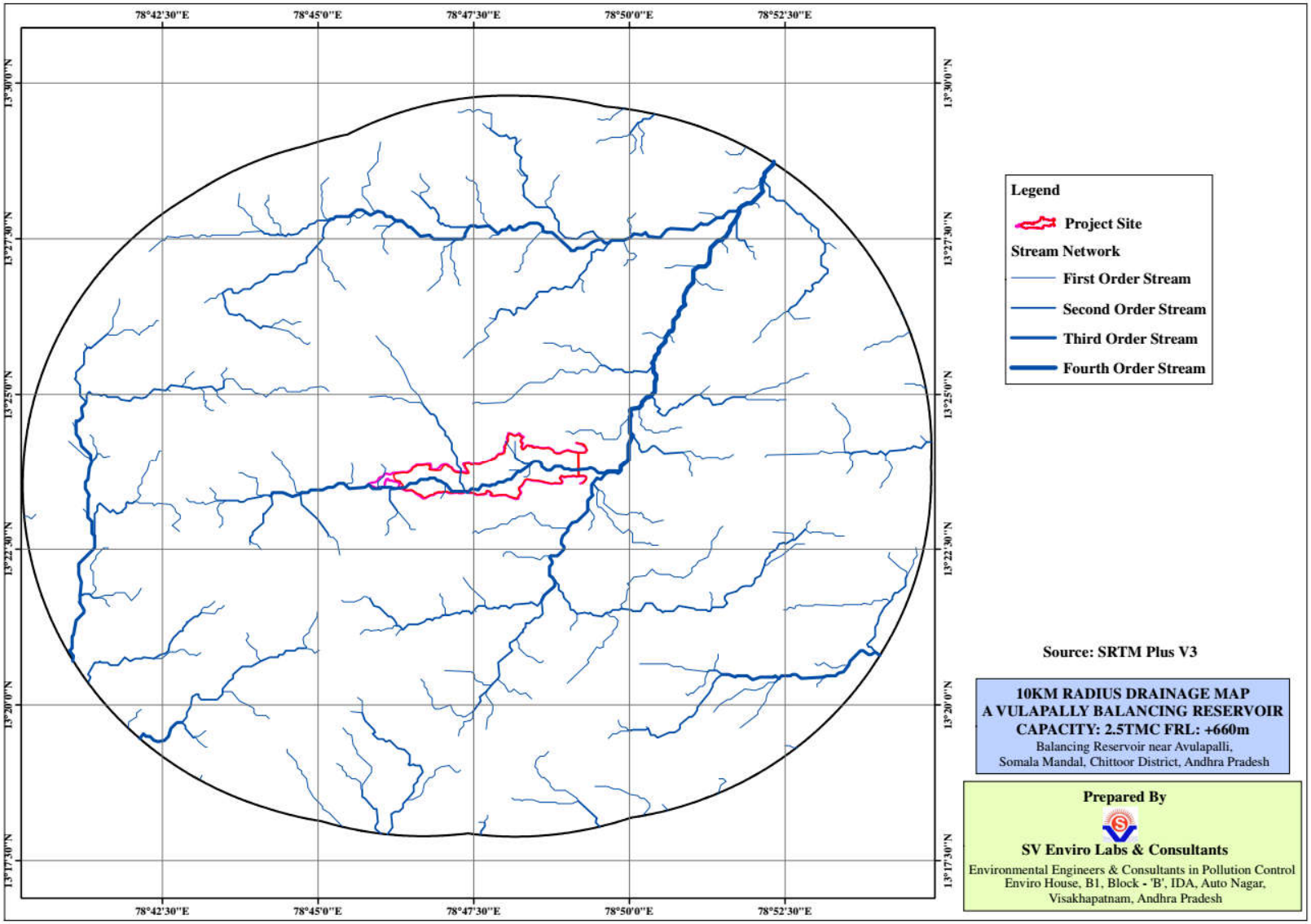


Fig. 3.18 Drainage map

3.8 Biological Environment

3.8.1 Introduction

Environmental degradation and the depletion of natural resources induced by human activities have attracted steadily growing concerns in the last decades. Such concerns made evident the necessity for the planning authorities to count on sound information about the possible environmental consequences of development actions. One of the tools available to satisfy this need is represented by the procedure of Environmental Impact Assessment (EIA). This procedure involves the systematic identification and evaluation of the impacts on the environment caused by a proposed project.

The evaluation of the ecological significance of an area can be undertaken from different perspectives, and consequently with different objectives. One of such perspectives focuses on the conservation of the biological diversity, or biodiversity. This has recently emerged as a key environmental issue to be accounted for in land-use planning: "Biodiversity is now a major driving force behind efforts to reform land management and development practices worldwide and to establish a more harmonious relationship between people and nature". Among the human activities that pose the highest threat to the conservation of biodiversity is the construction of linear infrastructures and roads in particular. Such projects represent artificial elements that cut through the landscape and interfere with the natural habitat conditions. This in turn influences the abundance and distribution of plant and animal species, i.e., the biodiversity of the areas impacted.

3.8.2 Objectives

The main objectives of the biological study were:

- To collect the baseline data for the study along with a description of the existing terrestrial, wetland and aquatic biodiversity.
- To assess the scheduled species in the proposed site (rare, endangered, critically endangered, endemic and vulnerable).
- To identify the locations and features of ecological significance
- To identify the impacts of proposed project before, after and during development

3.8.3 Flora and fauna of Chittoor district

The climate, topography and geology have played an important role impressing the flora and fauna of the district. The district has hills and plateau and elevation ranges up to 1318 metres. The floristic compositions in the forests vary from dry mixed deciduous to thorny scrub with

occasional patches of dry, evergreen growth. The forests of this district broadly classified into the following three principal types.

1. Dry tropical South Indian dry mixed deciduous forests.
2. Southern Cutch thorn forest groups
3. Tropical dry evergreen forests.

The mesophytic type of flora like *Syzygium cumini* (Neredu), *Pongania pinnata* (Kanuga) and large trees of *Terminalia arjuna* (Erramaddi and Tellamaddi) are found. Large trees of Mango, *Phoenix sylvestris* and different types of grass along watercourses are also found. In the forests of this district, wild animals like tiger and panther (*Panthera pardus*) are present in small numbers. Sloth-bear (*Melursus ursinus*) is found still in good numbers in all classes of reserve forests of the district. Wild dog, Wild boar (*Sus cristatus*), Porcupine (*Hystrix indica*), Heyna (*Hyaena striata*) Jungle cat (*Felis chaus*), Jackal (*Canis aureus*), fox (*Velpes bengaleusis*), Wolf (*Canis lugus*) etc., are the other carnivores present in the district. The commonly found herbivore present in the district are Sambur (*Rusa unicolor*), Black buck (*Antelope cervicapse*), Chital, Wild sheep (*Civis cycloceros*), Mouse deer (*Memina indica*), Hare (*Lapium finidus*), Rabbit etc. A number of bird species also exist in this district. Among the birds, the birds of large grey babbler (*Turdiodes Malcolmi*), the Large grey shrike (*Lanius Excubitor*), King Crows, Mynas and Crows, Bee-eaters, Hoopoes, Swifts, Vultures, Eagles, Kites, Owls, Sand grouse, Quails, Partridges, Green Pigeons, Pigeons, Peacocks etc., are found in this district.

3.8.4 Study area

The core areas is covered by Mango plantations, Coconut plantations and agricultural fields, and scrub forest which is very much exposed due to biotic factors in addition, the present condition is highly eroded and is primarily responsible for the development of Thorny-scrub vegetation. In such open low forests, high percentage of thorny and usually a few hardwood species predominate where the canopy is open.

The buffer area comprises of non-forest wastelands, fallow lands and reserved forest which is completely covered by invasive spcies i.e. *Prosopis juliflora* and vegetation covered by few species of shrubs, thorny bushes and some trees. Mesquite (*Prosopis juliflora*), Pongam Tree (*Pongamia pinnata*), Indian Elm (*Holoptelea integrifolia*), Neem (*Azadirachta indica*), Babul (*Acaia nilotica*), Ber (*Ziziphus jijuba*), *Lantana camara*, *Hyptis suaveolens*, *Anisomeles indica*, *Calotropis procera*, *Cassia auriculata*. *Waltheria indica*, *Solanum xanthocarpum*, *Crotalaria* sps, Prickly pear (*Opuntia dillenii*), *Tribulus terrestris* were common wild plants found in the study area.

Mainly croplands, reserved forests, Mango gardens, Lemon gardens and plantations observed the study area. Besides Paddy, all vegetables, flowers, cereals especially Raagi, pulses and oil seeds are grown in the buffer zone. Mango is the most common and widely grown fruit tree in the buffer zone. However, there are many non-cultivable wastelands sparsely covered with thorny bushes of *Maytenus emarginata*, *Prosopis juliflra*, *Acacia nilotica*, *Dolichondrone falcata* as well as *Calotropis gigantea*, *Calotropis procera*, *Cassia auriculata* and others. Sapota, Orange, Guava and Pomegranate are the other major fruit trees. Eucalyptus and Teak are the main pulpwood and timber plantations respectively. There are no National Parks or Wildlife Sanctuaries or Biosphere reserves or important bird areas (IBAs) or Protected Wetlands within the project site.



Fig 3.19 Mango plantations and Crop fileds in the study area



Fig 3.20 Vegetation in the study area

3.8.5 Forest blocks in study area

The details of forest blocks in study area are presented below in the Table 3.18. Horticultural plantations could also be seen in the core and buffer zone of the project such as Mango, Coconut and Lemon plantations.

Table 3.18 Details of the forest blocks in the study area

S.No	Details of forest blocks	Distance KM	Direction
1	Avulapalli Durga Protected Forest	0.06	SW
2	Madiramalai West RF	0.45	NW
3	Madiramalai East RF	0.50	N
4	Kandurukanuma East RF	8.30	N
5	Kandurukanuma West RF	8.70	NW
6	Yeddulakonda RF	7.30	NE
7	Errakonda RF	5.10	SW
8	Gamkonda RF	8.70	SW
9	Rayalapeta RF	8.50	SW

3.8.6 Methodology

3.8.6.1 Flora

Vegetation and plant species composition observed and documented during field visit in and around the mining site in post monsoon season. Besides primary surveys in the mining sites, published literature and various floras were consulted to prepare an inventory of plant species growing at project sites. The vegetation of the study area is highly degraded and some areas consisting water bodies. The plant diversity is classified into various plant groups such as tree, shrubs, herbs, climbers, sedges and grasses. The plant diversity survey in the project area was undertaken during the summer season with the objectives of preparing a checklist of flora in the study area. The list included total plant diversity belonging to various groups such as agricultural crops, vegetable crops, and horticultural crops, natural and aquatic flora.

3.9.6.2 Fauna

Information pertaining to the existence of migratory corridors and breeding habitats of endangered and threatened fauna were assessed based on the information provided by the local inhabitants and forest department personnel. The conservation status of each faunal species recorded from the project areas were ascertained as per schedules of Indian wildlife (protection) Act, 1972 and IUCN -Red Data Book (RDB).The survey of faunal elements of core and buffer zone were assessed as per the following sampling techniques:

Table 3.20 Mode of data collection and parameters considered during the survey

S.No.	Aspect	Data	Mode of data collection	Parameters monitored	Remarks
1	Terrestrial Biodiversity	Primary data collection	By field survey	Flora and faunal diversity	**For floral diversity:** Random survey, Sampling survey/ Forest inventory, walking transect, collection and identification with the help of relevant literature. **For faunal diversity:** Direct and indirect sampling, walking transect, point sampling and nest sampling etc.
2		Secondary data collection	From authentic sources like published literature, AP Forest Department books and BSI and ZSI published articles etc.	Floral, vegetation and forest types studied from Flora of Chittoor district and Flora of Andhra Pradesh.	Data collected from the working plan of the region, forest types from the authentic literature of Vegetation types of India (Champion and Seth) Flora of Andhra Pradesh (Pullaiah et al).
3	Aquatic Biodiversity	Primary data	By field survey	Floral and faunal diversity	For plankton study- Lackey's drops method and light microscope For other aquatic – Random survey,

					opportunistic observations
		Secondary data collection	From authentic sources like AP Forest department and Fisheries department	Flora of Chittoor district and Flora of Andhra Pradesh. Phytoplankton, Zooplankton and aquatic fauna.	Desktop literature review to identify the representative spectrum of threatened species, population and ecological communities.

Protected areas such as Wildlife sanctuaries, National Parks, Biosphere Reserves, Marine Sanctuaries do not exist in the core and around 10 km radius buffer zone of the proposed project.

3.8.7 Flora

An enumeration of plants is "an attempt to describe the quantity and quality of forest trees and many of the characteristics of the land area upon which trees are grown". The objective of flora enumeration of the study area is to provide complete checklist of floristic structure along the entire core and buffer areas for formulating effective management and conservation measures.

3.8.7.1 Floristic composition within the project area

Overall 163 plant species of terrestrial flora and aquatic exists in the cored area, which includes tree species, herbs, shrubs, climbers, grasses and sedges. Details of taxonomic account for all plant life forms are provided in the Table 3.20.

Table 3.20. Floristic composition from Core zone of the study area

S.No.	Scientific name	Habit	Vernacular name	Family
1	*Acacia caesia* (L.) Willd.	Climber	Korintha	Mimosaceae
2	*Acacia chundra* (Rottler) Willd.	Tree	Sandra karra	Mimosaceae
4	*Acacia leucophloea* (Roxb.) Willd.	Tree	Tella thumma	Mimosaceae
5	*Acacia nilotica* (L.) Delile	Tree	Nalla thumma	Mimosaceae
7	*Acacia torta* (Roxb.) Craib	Climber	Konda korintha	Mimosaceae
9	*Aegle marmelos* (L.) Corrêa	Tree	Velaga	Rutaceae

11	*Ailanthus excelsa* Roxb.	Tree	Pedda manu	Simaroubaceae
12	*Alangium salviifolium* (L.f.) Wangerin	Tree	Oodaga chettu	Alangiaceae
13	*Albizia amara* (Roxb.) B.Boivin	Tree	Konda singara	Mimosaceae
14	*Albizia lebbeck* (L.) Benth.	Tree	Dirisana	Mimosaceae
15	*Albizia odoratissima* (L.f.) Benth.	Tree	Chinduga	Mimosaceae
16	*Albizia procera* (Roxb.) Benth.	Tree	Tella chinduga	Mimosaceae
17	*Albizia saman* (Jacq.) Merr.	Tree	Nidrabhangi	Mimosaceae
18	*Allophylus serratus* (Hiern) Kurz	Shrub	Kaki beera	Sapindaceae
19	*Alstonia scholaris* (L.) R. Br.	Tree	Yedaakula paala	Apocynaceae
20	*Anisomeles indica* (L.) Kuntze	Herb	China ranabheri	Lamiaceae
21	*Anisomeles malabarica* (L.) R.Br. ex Sims	Herb	Ranaberi	Lamiaceae
22	*Annona squamosa* L.	Tree	Seethe phalam	Annonaceae
23	*Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Tree	Patchimaanu	Combretaceae
24	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Tree	Chirimaanu	Combretaceae
25	*Azadirachta indica* A.Juss.	Tree	Vepa / Neem	Meliaceae
26	*Azima tetracantha* Lam.	Shrub	Tella uppili	Salvadoraceae
27	*Barringtonia acutangula* (L.) Gaertn.	Tree	Kanapa chettu	Barringtoniaceae
28	*Bauhinia purpurea* L.	Tree	Devakanchanam	Caesalpiniaceae
29	*Bauhinia racemosa* Lam.	Tree	Aarechettu	Caesalpiniaceae
30	*Bauhinia variegata* L.	Tree	Madaka chettu	Caesalpiniaceae
31	*Benkara malabarica* (Lam.) Tirveng.	Tree	Pedda manga	Rubiaceae
32	*Bombax ceiba* L.	Tree	Buruga	Malvaceae
33	*Borassus flabellifer* L.	Tree	Taadi / Taati	Palmaceae
35	*Buchanania axillaris* (Desr.) Ramamoorthy	Tree	Sarapappu	Ancardiaceae
37	*Butea monosperma* (Lam.) Taub.	Tree	Moduga	Fabaceae
38	*Calophyllum inophyllum* L.	Tree	Ponna	Clusiaceae
39	*Calotropis gigantea* (L.) Dryand.	Shrub	Telle jilledu	Asclepiadaceae
40	*Calotropis procera* (Aiton) Dryand.	Shrub	Jilledu	Asclepiadaceae
41	*Campsis grandiflora* (Thunb.) K.Schum.	Shrub	Swarna Gandhi	Bignoniaceae
42	*Canthium parvifolium* Roxb.	Shrub	Balusu	Rubiaceae
43	*Capparis brevispina* DC.	Shrub	Adavi uppi	Capparidaceae
44	*Capparis zeylanica* L.	Shrub	Tella uppili	Capparidaceae
45	*Carissa spinarum* L.	Shrub	Kalivi / Vaaka	Apocynaceae
46	*Cassia fistula* L.	Tree	Rela	Caesalpiniaeae
47	*Cassia roxburghii* DC	Shrub	Seema rela	Caesalpiniaeae

48	*Casuarina equisetifolia* L.	Tree	Sarugudu	Casurinaceae
49	*Catunaregam spinosa* (Thunb.) Tirveng.	Shrub	Nalla balusu	Rubiaceae
50	*Celastrus paniculatus* Willd.	Climber	Maneru	Celastraceae
51	*Chloroxylon swietenia* DC.	Tree	Billudu	Flindersiaceae
52	*Chukrasia tabularis* A.Juss.	Tree	Konda vepa	Meliaceae
53	*Cipadessa baccifera* (Roth) Miq.	Shrub	Chedu beera	Meliaceae
54	*Citrus aurantium* L.	Shrub	Gajanimma	Rutaceae
55	*Citrus limon* (L.) Osbeck	Shrub	Nimma	Rutaceae
56	*Cochlospermum religiosum* (L.) Alston	Tree	Kondagogu	Cochlospermaceae
57	*Cocos nucifera* L	Tree	Kobbari	Arecaceae
58	*Combretum indicum* (L.) DeFilipps	Climber	Teega ganneru	Combretaceae
59	*Commiphora caudata* (Wight & Arn.) Engl.	Tree	Konda maamidi	Burseraceae
60	*Cordia dichotoma* G.Forst.	Tree	Iriki / bankiriki	Cordiaceae
61	*Dalbergia lanceolaria* L.f.	Tree	Nagalla pachari	Fabaceae
62	*Dalbergia latifolia* Roxb.	Tree	Jittegi	Fabaceae
64	*Delonix regia* (Hook.) Raf.	Tree	Turayi	Caesalpiniaceae
65	*Derris scandens* (Roxb.) Benth.	Climber	Nalla teege	Fabaceae
66	*Dichrostachys cinerea* (L.) Wight & Arn.	Shrub	Sarathumma	Mimosaceae
67	*Dillenia indica* L.	Tree	Pedda kalinga	Dilleniaceae
68	*Diospyros malabarica* (Desr.) Kostel.	Tree	Tumiki	Ebenaceae
69	*Diospyros montana* Roxb.	Tree	Jagadagondi	Ebenaceae
70	*Diospyros ovalifolia* Wight	Tree	Kukka tumiki	
71	*Dodonaea viscosa* (L.) Jacq.	Shrub	Bandedu	Sapindaceae
72	*Dolichandrone falcata* (Wall. ex DC.) Seem.	Tree	Niruddi	Bignoniaceae
73	*Dregea volubilis* (L.f.) Benth. ex Hook.f.	Climber	Kalisaku	Asclepiadaceae
74	*Erythrina variegata* L.	Tree	Badisa	Fabaceae
75	*Eucalyptus globulus* Labill.	Tree	Neelagiri	Euphorbiaceae
76	*Falconeria insignis* Royle	Shrub	Devaswaroopi	Euphorbiaceae
77	*Ficus benghalensis* L.	Tree	Marri	Moraceae
78	*Ficus carica* L.	Tree	Atti	Moraceae
79	*Ficus populifolia* Vahl	Tree	Raavi	Moraceae
80	*Ficus racemosa* L.	Tree	Medi	Moraceae
81	*Firmiana simplex* (L.) W.Wight	Tree	Erra poliki	Sterculeaceae
82	*Gardenia gummifera* L.f.	Tree	Bikki	Rubiaceae
83	*Gardenia latifolia* Aiton	Tree	Pedda bikki	Rubiaceae
84	*Getonia floribunda* Roxb.	Climber	Putangi teega	Combretaceae

85	*Givotia moluccana* (L.) Sreem.	Tree	Tella poliki	Euphorbiaceae
86	*Gmelina arborea* Roxb.	Tree	Gummdi teku	Verbenaceae
87	*Gymnosporia emarginata* (Willd.) Thwaites	Shrub	Danthi	Celastraceae
88	*Haldina cordifolia* (Roxb.) Ridsdale	Tree	Bandaru / Rudraganapa	Rubiaceae
89	*Ixora pavetta* Andr	Shrub	Ixora	Rubiaceae
90	*Jacaranda mimosifolia* D.Don	Tree	Swarna sundari	Bignoniaceae
91	*Jatropha curcas* L.	Shrub	Adavi aamudamu	Euphorbiaceae
92	*Kigelia africana* (Lam.) Benth.	Tree	Yenugu thondamu	Bignoniaceae
93	*Lagerstroemia parviflora* Roxb.	Tree	Chennangi	Lythraceae
94	*Lantana camara* L.	Shrub	Lantana	Verbenaceae
95	*Lawsonia inermis* L.	Shrub	Gorinta	Lythraceae
96	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Tree	Ippa	Sapotaceae
97	*Mangifera indica* L.	Tree	Mamidi	Anacardiaceae
98	*Manilkara zapota* (L.) P.Royen	Tree	Sapota	Sapotaceae
99	*Melia azedarach* L.	Tree	Vepa / Neem	Meliaceae
100	*Millingtonia hortensis* L.f.	Tree	Aakaasamalli	Bignoniaceae
101	*Mimosa polyancistra* Benth.	Herb	Udra kampa	Mimosaceae
102	*Mimosa rubicaulis* Lam.	Climber	Korintham	Mimosaceae
103	*Mimusops elengi* L.	Tree	Pogada	Sapotaceae
104	*Moringa oleifera* Lam.	Tree	Munaga	Moringaceae
105	*Mundulea sericea* (Willd.) A.Chev.	Tree	Yerri billu	Fabaceae
106	*Muntingia calabura* L.	Tree	Singapore cherry	Elaeocarpaceae
107	*Murraya koenigii* (L.) Spreng.	Shrub	Karivepaku	Rutaceae
108	*Myrtus communis* L.	Shrub	Panneru jaama	Myrtaceae
109	*Nerium oleander* L.	Shrub	Ganneru	Apocynaceae
110	*Olax scandens* Roxb.	Climber	Nalla dusara	Flindersiaceae
111	*Opuntia elatior* Mill.	Shrub	Jemudu	Cactaceae
112	*Opuntia dillenii* (Ker Gawl.) Haw.	Shrub	Bhrahma Jemudu	Cactaceae
113	*Peltophorum pterocarpum* (DC.) K.Heyne	Tree	Konda chinta	Caesalpiniaceae
114	*Pergularia daemia* (Forssk.) Chiov.	Climber	Dustapa teega	Asclepiadaceae
115	*Phoenix sylvestris* (L.) Roxb.	Tree	Eetha	Palmaceae
116	*Phyllanthus emblica* L.	Tree	Usiri / Amla	Euphorbiaceae
117	*Phyllanthus reticulatus* Poir.	Shrub	Purugudu	Euphorbiaceae
118	*Phyllodium pulchellum* (L.) Desv.	Herb	Deyyapu mokka	Fabaceae
119	*Pithecellobium dulce* (Roxb.) Benth.	Tree	Seema chinta	Mimosaceae
120	*Plumeria rubra* L.	Tree	Nuruvaralu	Apocynaceae

121	*Polyalthia cerasoides* (Roxb.) Bedd.	Tree	Gutti chettu	Annonaceae
122	*Polyalthia korinti* (Dunal) Thwaites	Tree	Nela Gutti	Annonaceae
123	*Polyalthia longifolia* Benth. & Hook. f.	Tree	Ashoka	Annonaceae
124	*Pongamia pinnata* (L.) Pierre	Tree	Kanuga	Fabaceae
125	*Prosopis cineraria* (L.) Druce	Tree	Jammi	Mimosaceae
126	*Prosopis juliflora* (Sw.) DC.	Tree	English thumma	Mimosaceae
127	*Sapindus emarginatus* Vahl	Tree	Kunkudu	Eapindaceae
128	*Sarcostemma secamone* (L.) Bennett	Climber	Chitipala	Asclepiadaceae
129	*Semecarpus anacardium* L.f.	Tree	Nalla jeedi	Ancardiaceae
130	*Senna montana* (Roth) V.Singh	Tree	Konda tangedu	Caesalpiniaeae
131	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Tree	Seema tangedu	Caesalpiniaeae
132	*Soymida febrifuga* (Roxb.) A. Juss.	Tree	Somi	Meliaceae
133	*Spathodea campanulata* P.Beauv.	Tree	Spathodia	Bignoniaceae
134	*Spondias pinnata* (L. f.) Kurz	Tree	Adavimaamidi	Ancardiaceae
135	*Stereospermum chelonoides* (L.f.) DC.	Tree	Tedla paala	Bignoniaceae
136	*Swietenia mahagoni* (L.) Jacq.	Tree	Mahogany	Meliaceae
137	*Syzygium cumini* (L.) Skeels	Tree	Neredu	Myrtaceae
138	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	Tree	Tella ganneru	Bignoniaceae
139	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	Shrub	Nandivardhanam	Apocynaceae
140	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Shrub	Balusu	Rubiaceae
141	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Shrub	Kommi	Rubiaceae
142	*Tecoma stans* (L.) Juss. ex Kunth	Tree	Swarna Ganneru	Bignoniaceae
143	*Tectona grandis* L.f.	Tree	Teku	Verbenaceae
144	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Tree	Tella maddi	Combretaceae
145	*Terminalia bellirica* (Gaertn.) Roxb.	Tree	Thandra	Combretaceae
149	*Terminalia tomentosa* Wight & Arn.	Tree	Nalla maddi	Combretaceae
150	*Thespesia populnea* (L.) Sol. ex Corrêa	Tree	Gangaravi	Malvaceae
151	*Tylophora indica* (Burm. f.) Merr.	Herb	Kukkapala	Asclepiadaceae
152	*Vitex altissima* L.f.	Tree	Nemali adugu	Vitaceae
153	*Vitex negundo* L.	Tree	Nalla vaavili	Vitaceae
154	*Vitex parviflora* A.Juss.	Tree	Nakka neredu	Vitaceae

155	*Vitex trifolia* L.	Climber		Vitaceae
156	*Wrightia arborea* (Dennst.) Mabb.	Tree	Tella pala	Apocynaceae
157	*Ximenia americana* L.	Shrub	Billa nakkeru	Olacaceae
158	*Ziziphus horrida* Roth	Shrub	Tella regu	Rhamnaceae
159	*Ziziphus jujuba* Mill.	Tree	Reguchettu	Rhamnaceae
160	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Tree	Nela regu / Jitregu	Rhamnaceae
161	*Ziziphus oenopolia* (L.) Mill	Climber	Pariki kampa	Rhamnaceae
162	*Ziziphus rugosa* Lam.	Climber	Pedda regu	Rhamnaceae
163	*Ziziphus xylopyrus* (Retz.) Willd.	Tree	Gotti	Rhamnaceae

3.8.7.2 Flora in the buffer zone

Buffer zone of the proposed project is mainly forest and agricultural land. The flora of buffer zone comprises of *Wrightia tinctoria*, *Hollarhena pubescens*, *Diospyros sylvatica*, *Pterospermum xylocarpum*, *Lannea coromandelica*, *Cassia fistula*, *Gmelina arborea* and *Garuga pinnata* trees are growing. Many tree species are planted in the area because of their usefulness, economic and aesthetic values. The tree species observed in the area are, *Mangifera indica*, *Albizia lebbeck*, *Bombax ceiba*, *Dalbergia sissoo*, *Sapindus emarginatus*, and *Tamarindus indica* etc. Flora of the buffer zone provided in the Table 3.21.

Table 3.21 Floristic composition from Core zone of the study area

S.No.	Botanical name	Local name	Family	Life form
1	*Abrus precatorius* L.	Gurivinda	Fabaceae	Climber
2	*Abutilon indicum* (L.) Sweet	Tutturabenda	Malvaceae	Shrub
3	*Acacia auriculiformis* Benth.		Mimosaceae	Tree
4	*Acacia caesia* (L.) Will.	Korintha	Mimosaceae	Climber
5	*Acacia leucophloea* (Roxb.) Wild.	Tella tumma	Mimosaceae	Tree
6	*Acacia nilotica* (L.) Delile	Nallathumma	Mimosaceae	Tree
7	*Acacia planifrons* Wight & Arn.	Godugu thumma	Mimosaceae	Tree
8	*Acaciachundra* (Rottler) Willd.	Sandra karra	Mimosaceae	Tree
9	*Acalypha ciliata* Wall.		Euphorbiaceae	Herb
10	*Acalypha indica* L.	Muripindi	Euphorbiaceae	Herb
11	*Achyranthes aspera* L.	Duchena	Amaranthaceae	Herb
12	*Aegle marmelos* (L.) Corrêa	Maredu	Rutaceae	Tree
13	*Aerva lanata* (L.) Juss.	Pindikura	Amaranthaceae	Herb
14	*Aglaia elaeagnoidea* (A.Juss.) Benth.	Konda anduga	Meliaceae	Tree
15	*Ailanthus excelsa* Roxb.	Pedda manu	Simaroubaceae	Tree
16	*Alangium salviifolium* (L.f.) Wangerin	Oodaga chettu	Alangiaceae	Tree
17	*Albizia amara* (Roxb.) B.Boivin	Chikreni	Mimosaceae	Tree
18	*Albizia lebbeck* L. (Benth.)	Dirisena	Mimosaceae	Tree

19	*Albizia odoratissima* (L.f.) Benth.	Chinduga	Mimosaceae	Tree
20	*Albizia procera* (Roxb.) Benth.	Tella chinduga	Mimosaceae	Tree
21	*Albizia saman* (Jacq.) Merr.	Nidrabhangi	Mimosaceae	Tree
22	*Allamanda cathartica* L.		Apocynaceae	Tree
23	*Allophyllus serratus* (Roxb.) Kurz	Guvva gutti	Sapindaceae	Shrub
24	*Aloe vera* (L.) Burm.f.	Katabanda	Liliaceae	Herb
25	*Alstonia scholaris* (L.) R. Br.	Yedakulapala	Apocynaceae	Herb
26	*Alternanthera tenella* Colla	Mullu ponnaganti	Amaranthaceae	Herb
27	*Alysicarpus monilifer* (L.) DC.	Amera	Fabaceae	Herb
28	*Amaranthus viridis* L.	Thotakura	Amaranthaceae	Herb
29	*Ammannia baccifera* L.	Agnivendramu	Lythraceae	Herb
30	*Anacardium occidentale* L.	Jeedi	Anacardiacae	Tree
31	*Andrographis echioides* (L.) Nees		Acanthaceae	Herb
32	*Anisomeles indica* (L.) Kuntze	Chinna ranaberi	Lamiaceae	Shrub
33	*Annona reticulata* L.	Ramaphalamu	Annonaceae	Shrub
34	*Annona squamosa* L.	Sitaphalamu	Annonaceae	Tree
35	*Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Patchimaanu	Combretaceae	Tree
36	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Chirimaanu	Combretaceae	Tree
37	*Apluda mutica* L.	Adavikorregaddi	Poaceae	Grass
38	*Aristida adscensionis* L.	Katle gaddi	Poaceae	Grass
39	*Aristida setacea* Trin. & Rupr.	Cheepurugaddi	Poaceae	Grass
40	*Artabotrys hexapetalus* (L.f.) Bhandari	Tiga sampangi	Annonaceae	Shrub
41	*Artocarpus heterophyllus* Lam.	Panasa	Moraceae	Tree
42	*Asparagus racemosus* (Kunth) Jessop	Satavari	Liliaceae	Shrub
43	*Asystasia gangetica* (L.) T.Anderson		Acanthaceae	Herb
44	*Azadirachta indica* A.Juss.	Vepa	Meliaceae	Tree
45	*Azima tetracantha* Lam.	Tella uppili	Salvadoraceae	Shrub
46	*Barringtonia acutangula* (L.) Gaertn.	Kanapa chettu	Barringtoniaceae	Tree
47	*Bauhinia purpurea* L.	Peddari	Caesalpiniaceae	Tree
48	*Bauhinia racemosa* Lam.	Aarechettu	Caesalpiniaceae	Tree
49	*Bauhinia variegata* L.	Madaka chettu	Caesalpiniaceae	Tree
50	*Benkara malabarica* (Lam.) Tirveng.	Pedda manga	Rubiaceae	Tree
51	*Boerhavia diffusa* L.	Atikamamidi	Nyctaginaceae	Herb
52	*Boerhavia erecta* L.	Kanne komali	Nyctaginaceae	Herb
53	*Bombax ceiba* L.	Buruga	Malvaceae	Tree
54	*Borassus flabellifer* L.	Thati	Arecaceae	Tree
55	*Boswellia serrata* Roxb. ex Colebr	Konda sambrani	Burseraceae	Tree
56	*Bougainvillea spectabilis* Willd.	Kagithamupulu	Nyctaginaceae	Shrub
57	*Brachiaria mutica* (Forssk.) Stapf	Paragaddi	Poaceae	Grass

58	*Brachiaria reptans* (L.) C.A.Gardner & C.E.Hubb		Poaceae	Grass
59	*Buchanania axillaris* (Desr.) Ramamoorthy	Sarapappu	Ancardiaceae	Tree
60	*Buchanania cochinchinensis* (Lour.) M.R.Almeida	China saara	Ancardiaceae	Tree
61	*Bucida ramosa*(M.Gómez) Alwan & Stace	Adurugaddi	Combretaceae	Tree
62	*Butea monosperma* (Lam.) Taub.	Moduga	Fabaceae	Tree
63	*Caesalpinia crista* L.	Gachakaya	Caesalpiniaceae	Shrub
64	*Calophyllum inophyllum* L.	Ponna	Clusiaceae	Tree
65	*Calotropis procera* (Aiton) Dryand.	Jilledu	Asclepiadaceae	Climber
66	*Calotropis gigantea* (L.) Dryand.	Telle jilledu	Asclepiadaceae	Shrub
67	*Canavalia virosa* (Roxb.) Wight & Arn.	Tammakaya	Fabaceae	Climber
68	*Canthium parvifolium* Roxb.	Balusu	Rubiaceae	Shrub
69	*Capparis zeylanica* L.	Aridonda	Capparaceae	Climber
70	*Capparis brevispina* DC.	Adavi uppi	Capparidaceae	Shrub
71	*Carissa spinarum* L.	Kalivi / Vaaka	Apocynaceae	Shrub
72	*Cassia auriculata* L.	Tangedu	Caesalpiniaceae	Shrub
73	*Cassia fistula*L.	Rela	Caesalpiniaceae	Tree
74	*Casuarina equisetifolia* L.	Sarugudu	Casurinaceae	Tree
75	*Catunaregam spinosa* (Thunb.) Tirveng.	Nalla balusu	Rubiaceae	Shrub
76	*Celastrus paniculatus* Willd.	Maneru	Celastraceae	Climber
77	*Celosia argentea* L.	Gurumu	Amaranthaceae	Herb
78	*Chloris barbata* Sw.	Uppugaddi	Poaceae	Grass
79	*Chloroxylon swietenia* DC.	Billudu	Flindersiaceae	Tree
80	*Chukrasia tabularis* A.Juss.	Konda vepa	Meliaceae	Tree
81	*Cipadessa baccifera* (Roth) Miq.	Chedu beera	Meliaceae	Shrub
82	*Cissus quandrangularis* L.	Nalleru	Vitaceae	Climber
83	*Cissus vitiginea* L.	Adavidraksha	Vitaceae	Shrub
84	*Citrullus colocynthis* (L.) Schrad.	Eriipucha	Cucurbitaceae	Climber
85	*Citrus limon* (L.) Osbeck	Nimma	Rutaceae	Tree
86	*Citrus aurantium* L.	Gajanimma	Rutaceae	Shrub
87	*Citrus limon* (L.) Osbeck	Nimma	Rutaceae	Shrub
88	*Cleome viscosa* L.	Kukkavaminta	Cleomaceae	Herb
89	*Clerodendrum inerme* (L.) Gaertn.	Nillavuppi	Verbenaceae	Shrub
90	*Clitoria ternatea* L.	Shankupuspi	Fabaceae	Climber
91	*Coccinia grandis* (L.) Voigt	Kakidonda	Cucurbitaceae	Climber
92	*Cocculus hirsutus* (L.) W.Theob.	Dusaratiga	Menispermaceae	Climber
93	*Cochlospermum religiosum* (L.) Alston	Kondagogu	Cochlospermaceae	Tree

94	*Cocos nucifera* L	Kobbari	Arecaceae	Tree
95	*Coldenia procumbens* L.	Hamsapadu	Boraginaceae	Herb
96	*Combretum indicum* (L.) DeFilipps	Teega ganneru	Combretaceae	Climber
97	*Commelina benghalensis* L.	Yennadri	Commelinaceae	Sedge
98	*Commiphora caudata* (Wight & Arn.) Engler	Kondaregu	Burseraceae	Tree
99	*Corchorus trilocularis* L.	Bankitutturu	Tiliaceae	Herb
100	*Cordia dichotoma* G.Forst.	Iriki / bankiriki	Cordiaceae	Tree
101	*Crotalaria angulata* Mill.		Fabaceae	Herb
102	*Crotalaria hebecarpa* (DC.) Rudd		Fabaceae	Herb
103	*Crotalaria medicaginea* var. *neglecta* (Wight & Arn.) Baker		Fabaceae	Herb
104	*Crotalaria verrucosa* L.	Giligicha	Fabaceae	Herb
105	*Croton bonplandianus* Baill.	Galivana mokka	Euphorbiaceae	Herb
106	*Cuscuta reflexa* Roxb.	Passiteega	Convolvulaceae	Climber
107	*Cymbopogon citratus* (DC.) Stapf	Nimmagaddi	Poaceae	Grass
108	*Cynodon dactylon* (L.) Pers.	Gariki	Poaceae	Grass
109	*Cyperus arenarius* Retz.		Cyperaceae	Sedge
110	*Cyperus rotundus* L.	Thunga	Cyperaceae	Sedge
111	*Dactyloctenium aegyptium* (L.) Willd.	Crow foot grass	Poaceae	Grass
112	*Dalbergia paniculata* Roxb.	Pachari	Fabaceae	Tree
113	*Dalbergia lanceolaria* L.f.	Nagalla pachari	Fabaceae	Tree
114	*Decalepis hamiltonii* Wight & Arn.	Maredu kommulu	Periplocaceae	Climber
115	*Delonix regia* (Hook.) Raf.	Turayi	Caesalpiniaceae	Tree
116	*Dentella repens* (L.) J.R.Forst. & G.Forst.		Rubiaceae	Herb
117	*Derris scandens* (Roxb.) Benth.	Nalla teege	Fabaceae	Climber
118	*Desmodium triflorum* (L.) DC	Muntamandu	Fabaceae	Herb
119	*Dichanthium annulatum* (Forssk.) Stapf	Sheda grass	Poaceae	Herb
120	*Dichrostachys cinerea* (L.) Wight & Arn.	Veluthuru	Mimosaceae	Tree
121	*Digera muricata* (L.) Mart.	Chenchalakura	Amaranthaceae	Herb
122	*Digitaria ciliaris* (Lam.) Roem. & Schult.		Poaceae	Grass
123	*Dillenia indica* L.	Pedda kalinga	Dilleniaceae	Tree
124	*Diospyros chloroxylon* Roxb.	Erragatha	Ebenaceae	Tree
125	*Diospyros sylvatica* Roxb.	Gaatha	Ebenaceae	Tree
126	*Diospyros malabarica* (Desr.) Kostel.	Tumiki	Ebenaceae	Tree
127	*Diospyros montana* Roxb.	Jagadagondi	Ebenaceae	Tree
128	*Diospyros ovalifolia* Wight	Kukka tumiki		Tree
129	*Dodonaea viscosa* (L.) Jacq.	Bandedu	Sapindaceae	Shrub

130	*Dolichandrone falcata* (Wall. ex DC.) Seem.	Niruddi	Bignoniaceae	Tree
131	*Echinochloa crus-galli* (L.) P.Beauv.	Pedda windu	Poaceae	Herb
132	*Eclipta prostrata* (L.) L.	Guntagalagara	Asteraceae	Herb
133	*Ehretia laevis*(Rottler ex G.Don) Roxb.	Tellapisini	Boraginaceae	Shrub
134	*Eragrostis amabilis* (L.) Wight & Arn.	Udaragaddi	Poaceae	Grass
135	*Eragrostis minor* Host	Goobbai gaddi	Poaceae	Grass
136	*Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.	Chinna garaiki gaddi	Poaceae	Grass
137	*Erythrina variegata* L.	Badisa	Fabaceae	Tree
138	*Eucalyptus globulus* Labill.	Neelagiri	Euphorbiaceae	Tree
139	*Eugenia bracteata* (Willd.) Roxb. Ex DC.	Kundinedu	Myrtaceae	Shrub
140	*Euphorbia heterophylla* L.	Wild Poinsettia	Euphorbiaceae	Herb
141	*Euphorbia hirta* L.	Reddivari nanubalu	Euphorbiaceae	Herb
142	*Euphorbia hypericifolia* L.		Euphorbiaceae	Herb
143	*Evolvulus alsinoides* (L.) L.	Vishnukrantha	Convolvulaceae	Herb
144	*Evolvulus nummularius* (L.) L.		Convolvulaceae	Herb
145	*Falconeria insignis* Royle	Devaswaroopi	Euphorbiaceae	Shrub
146	*Ficus benghalensis* L.	Marri chettu	Moraceae	Tree
147	*Ficus benjamina* L.Mant.	Konda golugu	Moraceae	Tree
148	*Ficus hispida* L.f.	Bodda chettu	Moraceae	Tree
149	*Ficus religiosa* L.	Ravi chettuy	Moraceae	Tree
150	*Ficuscarica* L.	Atti	Moraceae	Tree
151	*Ficuspopulifolia* Vahl	Raavi	Moraceae	Tree
152	*Ficusracemosa* L.	Medi	Moraceae	Tree
153	*Fimbristylis ferruginea* (L.) Vahl		Cyperaceae	Sedge
154	*Firmiana simplex* (L.) W.Wight	Erra poliki	Sterculeaceae	Tree
155	*Flacourtia indica*(Burm.f.) Merr.	Kanru	Flacourtiaceae	Tree
156	*Gardenia gummifera* L.f.	Bikki	Rubiaceae	Tree
157	*Gardenia latifolia* Aiton	Pedda bikki	Rubiaceae	Tree
158	*Getonia floribunda* Roxb.	Putangi teega	Combretaceae	Climber
159	*Givotia moluccana* (L.) Sreem.	Tella poliki	Euphorbiaceae	Tree
160	*Gloriosa superba* L.	Adavi nabhi	Liliaceae	Herb
161	*Glycosmis mauritiana* (Lam.) Tanaka	Golugu	Rutaceae	Shrub
162	*Gmelina arborea* Roxb. ex Sm.	Gummidi teku	Verbenaceae	Tree
163	*Gmelina asiatica* L.	Chiru gummudu	Verbenaceae	Shrub
164	*Grewia rhamnifolia* Heyne ex Roth	Bampudu	Tiliaceae	Shrub
165	*Gymnosporia emarginata* (Willd.) Thwaites	Danthi	Celastraceae	Shrub

166	*Haldina cordifolia* (Roxb.) Ridsdale	Bandaru / Rudraganapa	Rubiaceae	Tree
167	*Hedyotis corymbosa*L.		Rubiaceae	Herb
168	*Hedyotis umbellata* L.		Rubiaceae	Herb
169	*Heliotropium indicum* L.	Nagadanti	Boraginaceae	Herb
170	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Sugandipala	Periplocaceae	Climber
171	*Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.	Kaseri gaddi	Poaceae	Grass
172	*Holarrhena pubescens*Wall. ex G.Don	Tedlapala	Apocynaceae	Shrub
173	*Holoptelea integrifolia*(Roxb.) Planch.	Nemaliadugu	Ulmaceae	Tree
174	*Hugonia mystax* L.	Pisangi	Linaceae	Climber
175	*Hygrophila auriculata*(Schumach.) Heine	Neetigobbi	Acanthaceae	Herb
176	*Hyptis suaveolens* (L.) Poit.	Sirnatulasi	Lamiaceae	Shrub
177	*Ichnocarpus fruitiscens* (L.) R.Br.	Nalla teega	Apocynaceae	Climber
178	*Imperata cylindrica* (L.) Raeusch.	Darbhagaddi	Poaceae	Grass
179	*Indigofera linifolia* (L.f.) Retz.		Fabaceae	Herb
180	*Indigofera linnaei* Ali	Cheragadam	Fabaceae	Herb
181	*Ipomoea aquatica* Forssk.	Thootikura	Convolvulaceae	Climber
182	*Ipomoea marginata* (Desr.) Verdc.	Mettathuti	Convolvulaceae	Climber
183	*Iseilema laxum* Hack.	Errachengali gaddi	Poaceae	Grass
184	*Ixora pavetta* Andr	Ixora	Rubiaceae	Shrub
185	*Jatropha curcas* L.	Nepalam	Euphorbiaceae	Tree
186	*Justicia adhatoda* L.	Addasaramu	Acanthaceae	Shrub
187	*Justicia prostrata* Gamble		Acanthaceae	Herb
188	*Lagerstroemia parviflora* Roxb.	Chennangi	Lythraceae	Tree
189	*Lannea coromandelica* (Houtt.) merr.	Gempena	Anacardiacae	Shrub
190	*Lantana camara* L.	Lantana	Verbenaceae	Shrub
191	*Lepidagathis cristata* Willd.	Suryakantha	Acanthaceae	Herb
192	*Ludwigia perennis* L.	Lavangakaya	Onagraceae	Herb
193	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Ippa	Sapotaceae	Tree
194	*Mangifera indica* L.	Mamidi	Anacardiaceae	Tree
195	*Manilkara zapota* (L.) P.Royen	Sapota	Sapotaceae	Tree
196	*Maytenus emargin*ata (Willd.) Ding Hou	Danthi	Rubiaceae	Shrub
197	*Merremia emarginata* (Burm. f.) Hallier f.	Elikajemudu	Convolvulaceae	Climber
198	*Merremia tridentata* (L.) Hallier f.		Convolvulaceae	Climber
199	*Millingtonia hortensis* L.f.	Aakaasamalli	Bignoniaceae	Tree
200	*Mimosa pudica* L.	Attipatti	Mimosaceae	Herb

201	*Mimosa polyancistra* Benth.	Udra kampa	Mimosaceae	Herb
202	*Mimosa rubicaulis* Lam.	Korintham	Mimosaceae	Climber
203	*Mimusops elengi* L.	Pogada	Sapotaceae	Tree
204	*Mollugo nudicaulis* Lam.	Peddaparipata	Molluginaceae	Herb
205	*Mollugo oppositifolia* L.	Chayuntarashi	Molluginaceae	Herb
206	*Moringa oleifera* Lam.	Munaga	Moringaceae	Tree
207	*Mukia maderaspatana* (L.) M.Roem.	Pottibudamu	Cucurbitaceae	Climber
208	*Neolamarckia cadamba* (Roxb.) Bosser	Kadambam	Rubiaceae	Tree
209	*Nerium oleander* L.	Ganneru	Apocynaceae	Shrub
210	*Nyctanthes arbor-tristis* L.	Parijathamu	Oleaceae	Shrub
211	*Ochna obtusata* DC.	Tammi	Ochnaceae	Shrub
212	*Ocimum basilicum* L.	Vibhudi	Lamiaceae	Herb
213	*Ocimum gratissimum* L.	Nimmatulasi	Lamiaceae	Shrub
214	*Ocimum tenuiflorum* L.	Tulasi	Lamiaceae	Shrub
215	*Olax scandens* Roxb.	Nalla dusara	Flindersiaceae	Climber
216	*Opuntia dillenii* (Ker Gawl.) Haw.	Nagajemudu	Cactaceae	Shrub
217	*Oxystelma esculentum* (L. f.) Sm.	Palakikura	Asclepiadaceae	Climber
218	*Panicum psilopodium* Trin.		Poaceae	Grass
219	*Paspalidium flavidum* (Retz.) A.Camus	Udagaddi	Poaceae	Grass
220	*Passiflora edulis* Sims		Passifloraceae	Climber
221	*Peltophorum pterocarpum* (DC.) K.Heyne	Konda chinta	Caesalpiniaceae	Tree
222	*Pentatropis capensis* (L. f.) Bullock		Asclepiadaceae	Climber
223	*Pergularia daemia* (Forssk.) Chiov.	Dustaputeega	Asclepiadaceae	Climber
224	*Phoenix sylvestris* (L.) Roxb.	Eetha	Palmaceae	Tree
225	*Phyla nodiflora* (L.) Greene	Mosalipappu	Verbenaceae	Shrub
226	*Phyllanthus amarus* Schumach. & Thonn.	Naleusiri	Euphorbiaceae	Herb
227	*Phyllanthus emblica* L.	Usiri	Euphorbiaceae	Tree
228	*Phyllanthus maderaspatensis* L.	Nalla uisirika	Euphorbiaceae	Herb
229	*Phyllanthusreticulatus* Poir.	Purugudu	Euphorbiaceae	Shrub
230	*Pithecellobium dulce* (Roxb.) Benth.	Seema chinta	Mimosaceae	Tree
231	*Plecospermum spinosum* Trecul		Moraceae	Climber
232	*Plumeria rubra* L.	Nuruvaralu	Apocynaceae	Tree
233	*Polyalthia cerasoides* (Roxb.) Bedd. & Hook.f. Bedd.	Chilaka dudduga	Annonaceae	Tree
234	*Polyalthia longifolia* (Sonn.) Thwaites	Naramamidi	Annonaceae	Tree
235	*Polygala arvensis* Willd.		Polygalaceae	Herb
236	*Pongamia pinnata* (L.) Pierre	Kanuga	Fabaceae	Tree
237	*Prosopis juliflora* (Sw.) DC.	Sarkaru tumma	Mimosaceae	Tree
238	*Prosopis cineraria* (L.) Druce	Jammi	Mimosaceae	Tree

239	*Pterolobium hexapetalum* (Roth) Sant. & Wagh		Mimosaceae	Climber
240	*Pupalia lappacea* (L.) Juss.	Antreetha	Amaranthaceae	Herb
241	*Pycreus pumilus* (L.) Nees		Cyperaceae	Sedge
242	*Rhynchosia minima* (L.) DC.	Nela alumu	Fabaceae	Climber
243	*Rivea hypocrateriformis* Choisy	Boddi teega	Convolvulaceae	Climber
244	*Sapindus emarginatus* Vahl	Kunkudu	Eapindaceae	Tree
245	*Sarcostemma secamone* (L.) Bennett	Chitipala	Asclepiadaceae	Climber
246	*Scoparia dulcis* L.		Scrophulariaceae	Herb
247	*Scutia myrtina* (Burm.f.) Kurz	Nallakorintha	Rhamnaceae	Climber
248	*Sebastiania chamaelea* (L.) Müll.Arg.		Euphorbiaceae	Herb
249	*Securinega leucopyrus* (Willd.) Muell.-Arg.	Challamunta	Euphorbiaceae	Shrub
250	*Semecarpus anacardium* L.f.	Nalla jeedi	Ancardiaceae	Tree
251	*Senna montana* (Roth) V.Singh	Konda tangedu	Caesalpiniaeae	Tree
252	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Seema tangedu	Caesalpiniaeae	Tree
253	*Sida acuta* Burm.f.	Chittemu	Malvaceae	Herb
254	*Sida cordata* (Burm.f.) Borss.Waalk.	Chirubenda	Malvaceae	Herb
255	*Solanum surattense* Burm. f.	Nelavakudu	Solanaceae	Herb
256	*Soymida febrifuga* (Roxb.) A. Juss.	Somi	Meliaceae	Tree
257	*Spathodea campanulata* P.Beauv.	Spathodia	Bignoniaceae	Tree
258	*Spermacoce hispida* L.	Madanaku	Rubiaceae	Herb
259	*Stachytarpheta jamaicensis* (L.) Vahl		Verbenaceae	Herb
260	*Stereospermum chelonoides* (L.f.) DC.	Tedla paala	Bignoniaceae	Tree
261	*Streblus aspera* Lour.	Baranika	Moraceae	Tree
262	*Striga angustifolia* (D. Don) C.J. Saldanha		Scrophulariaceae	Herb
263	*Syzygium cumini* (L.) Skeels	Neredu	Myrtaceae	Tree
264	*Tamarindus indica* L.	Chinta	Caesalpiniaceae	Tree
265	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Balusu	Rubiaceae	Shrub
266	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Kommi	Rubiaceae	Shrub
267	*Tecoma stans* (L.) Juss. ex Kunth	Swarnaganneru	Bignoniaceae	Shrub
268	*Tectona grandis* L.f.	Teku	Verbenaceae	Tree
269	*Tephrosia procumbens* (Ham.) Benth.	Vempali	Fabaceae	Herb
270	*Tephrosia purpurea* (L.) Pers.	Vempali	Fabaceae	Herb
271	*Terminalia arjuna*(Roxb.) Wight & Arn	Tella maddi	Combretaceae	Tree
272	*Terminalia bellirica* (Gaertn.) Roxb.	Tadi chettu	Combretaceae	Tree
273	*Terminalia chebula* Retz.	Nalla Karakkaya	Combretaceae	Tree
274	*Terminalia pallida* Brandis	Tella Karakkaya	Combretaceae	Tree

275	*Terminalia tomentosa* Wight & Arn.	Nalla maddi	Combretaceae	Tree
276	*Tinospora sinensis* (Lour.) Merr.	Tippateega	Menispermaceae	Climber
277	*Toddalia asiatica* (L.) lam.	Konda mirapa	Rutaceae	Climber
278	*Tridax procumbens* (L.) L.	Gaddichamanti	Asteraceae	Herb
279	*Triumfetta rotundifolia* Lam.	Banki thuturu	Tiliaceae	Herb
280	*Tylophora indica* (Burm. f.) Merr.	Kukkapala	Asclepiadaceae	Herb
281	*Vernonia albicans* DC.		Asteraceae	Herb
282	*Vernonia cinerea* (L.) Less.	Sahadevi	Asteraceae	Herb
283	*Vitex altissima* L.f.	Nemali adugu	Vitaceae	Tree
284	*Vitex negundo* L.	Nalla vaavili	Vitaceae	Tree
285	*Wattakaka volubilis* (L. f.) Stapf	Paalateega	Asclepiadaceae	Climber
286	*Wrightia tinctoria* (Roxb.) R.Br.	Ankudu	Apocynaceae	Tree
287	*Wrightia arborea* (Dennst.) Mabb.	Tella pala	Apocynaceae	Tree
288	*Ximenia americana* L.	Billa nakkeru	Olacaceae	Shrub
289	*Ziziphus oenoplia*(L.) Miller	Parimi	Rhamnaceae	Climber
290	*Ziziphushorrida* Roth	Tella regu	Rhamnaceae	Shrub
291	*Ziziphusjujuba* Mill.	Reguchettu	Rhamnaceae	Tree
292	*Ziziphusrugosa* Lam.	Pedda regu	Rhamnaceae	Climber
293	*Ziziphusxylopyrus* (Retz.) Willd.	Gotti	Rhamnaceae	Tree

3.8.8 Fauna observations in the study area

As the study area is not isolated from its surroundings by any barrier, there are no chances for any kind of isolation or restriction of any wild animal to the study area. As they are capable of moving from place to place either for food or for shelter or mate. Hence, common lists are prepared based on available secondary data and based on direct observation, indirect or circumstantial evidence such as footprints, feathers, skin, hair, hooves etc. As there are no dense forests or wildlife reserves or other protected areas around proposed project and as the area is surrounded by croplands and villages. Among the mammals, monkeys, squirrels and rats were found. There were no attacks on sheep or goat though sheep and goat rearing is very common. Many terrestrial birds such as Indian Ring dove, Minnows, Finches, Crows, Sparrows, Parrots, Mynas, Swifts, Doves, Pigeons, Egrets and Weaverbirds etc were common. A list of fauna either spotted or reported from the study area is given in Table 3.22. None of the species listed in Schedule I of the Indian Wildlife (protection) Act was found in the study area.

Table 3.22 List of fauna found in the study area

S.No.	Scientific name	Common name	Vernacular name	IUCN category/ IWPA 1972 Schedule
Mammals				
1	*Axis axis*	Spotted deer	Jinka	LC/IV
2	*Petaurista philippensis*	Brown flying squirrel	Chettu udutha	LC/IV
3	*Herpestes edwardsii*	Common Mongoose	Mungisa	LC/II
4	*Vulpes bengalensis*	Bengal fox	Guntanakka	LC/II
5	*Bandicota indica*	Bandicoot Rat	Pandikokku	LC/IV
6	*Bandicota benghalensis*	Lesser Bandicoot	Pandikokku	LC/IV
7	*Funambulus palmarum*	Three striped squirrel	Udutha	LC/IV
8	*Mus muscuius*	House rat	Yeluka	LC/IV
9	*Mus booduga*	Indian field rat	Yeluka	LC/IV
10	*Pteropus giganteus*	Indian flying fox	Gabbilamu	LC/IV
11	*Lepus nigricollis*	Indian hare	Kundelu	LC/IV
12	*Canis aureus*	Jackal	Nakka	LC/II
13	*Hystix indica*	Poprcupine	Mullapandi	LC/III
14	*Funambulus pennant*	Northern palm squirrel	Udutha	LC/IV
15	*Sus scrofa*	Wild boar	Adavipandi	LC/III
Reptiles				
15	*Calotes versicolor*	Garden Lizard	Tonda	LC/IV
16	*Chameleon zeylanicum*	Chameleon	Usaravalli	LC/II
17	*Bangarus caeruleus*	Common Krait	Katlapamu	LC/II
18	*Echis carinatus*	Saw scale wiper	Ralthapinajri	LC/II
19	*Ptyas mucosa*	Ratsnake	Jerripothu	LC/II
20	*Ahaetulla nasuta*	Tree snake	Chettu paamu	LC/II
21	*Dryphis nasutus*	Whip snake	Pasirikapaamu	LC/II
22	*Typhlops porrectus*	Blind snake	Guddipamu	LC/II
23	*Naja naja*	Cobra	Nagupaamu	LC/II
24	*Eutropis carinata*	Grass skink	Nalli keechu	LC/IV
25	*Hemidactylus frenatus*	Wall Lizard	Balli	LC/IV
26	*Calotes versicolor*	Garden lizard	Thonda	LC/IV
Aves				
27	*Acridotheres tristis*	Common myna	Goruvanka	LC/IV
28	*Alcedo atthis*	Common Kingfisher	Lakhumukhi Pitta	LC/IV
29	*Apus affinis*	House swift	Babila	LC/IV
30	*Anthus novaeseelandiae*	Paddy field Pipit	Varimadi Pipit	LC/IV
31	*Ardeola grayi*	Indian pond heron	Guddikonga	LC/IV
32	*Ardea alba*	Great Egret	Tella Konga	LC/IV
33	*Athene brama*	Spotted Owlet	Gudlaguba	LC/IV
34	*Bubulcus ibis*	Cattle Egret	Konga	LC/IV
35	*Burhinus oedicnemus*	Stone curlew	Raati curlew	LC/IV

36	*Butastur teesa*	White eyed buzzard	Tella kannu buzzard	LC/IV
37	*Butorides striatus*	Little green heron	Chaarla konga	LC/IV
38	*Cacomantis merulinus*	Plaintive Cuckoo	Charla Kokila	LC/IV
39	*Calidris minuta*	Little Stint	Chinna stint	LC/IV
40	*Caprimulgus asiaticus*	Indian Night Jar	Maamulu night jar	LC/IV
41	*Centropus sinensis*	Crow pheasant	Jamudu kaki	LC/IV
42	*Charities dubious*	Little ringed plover	China valaya plover	LC/IV
43	*Corvus macrorhynchos*	Jungle Crow	Adavi kaki	LC/IV
44	*Corvus splendens*	Crow	Kaki	LC/IV
45	*Dicrurus adsimilis*	Black drongo	Nalla drongo	LC/IV
46	*Dicrurus caerulescens*	White bellied Drongo	Tella Potta drongo	LC/IV
47	*Dicrurus remifer*	Lesser Rocket tail drongo	Podavu thoka nalla pitta	LC/IV
48	*Dinopium benghalense*	Golden backed wood Pecker	Bangaru vadrangi pitta	LC/IV
49	*Egretta garzetta*	Little Egret	Chinna Tella Konga	LC/IV
50	*Egretta intermedia*	Median egret	Konga	LC/IV
51	*Galerida cristata*	Indian crested lark	Juttu lark	LC/IV
52	*Halcyon smyrnensis*	White breasted Kingfisher	Tella yeda lakhumukhi pitta	LC/IV
53	*Haliaistur indus*	Brahminy Kite	Brahmana gradda	LC/IV
54	*Hemiprocne longipennis*	Crested tree swift	Juttu swift	LC/IV
55	*Himantopus himantopus*	Black winged stilt	Nalla rellala stilt	LC/IV
56	*Hirundo daurica*	Striated swallow	Chaarla pitta	LC/IV
57	*Hirundo rustica*	Common swallow	Swallow	LC/IV
58	*Lanius excubitor*	Grey Shrike	Uudu shrike	LC/IV
59	*Milvus migrans*	Black kite	Peethiri gadda	LC/IV
60	*Motacilla alba*	Pied wagtail	Toka oopu tella chaara pitta	LC/IV
61	*Motacilla flava*	Yellow wagtail	Toka oopu pasupu pitta	LC/IV
62	*Nectarinia lotenia*	Loten's sunbird	Sunbird	LC/IV
63	*Nectarinia asiatica*	Purple sunbird	Yerra sunbird	LC/IV
64	*Nectarinia zeylanica*	Plum rumped sunbird	Yerra veepu sunbird	LC/IV
65	*Netta rufina*	Red crested Pochard	Erra Juttu Baatu	LC/IV
66	*Nettapus coromandelianus*	Cotton teal	Tella paraja	LC/IV
67	*Nycticorax nycticorax*	Night Heron	Sabari konga	LC/IV
68	*Oriolus oriolus*	Golden oriole	Bangaru pitta	LC/IV
69	*Orthotomus sutorius*	Tailor bird	Tailor pakshi	LC/IV
70	*Parus major*	Grey tit	Ooda tit	LC/IV
71	*Passer domesticus*	House sparrow	Pitchuka	LC/IV
72	*Pelargopis capensis*	Spot billed Kingfisher	Chukka mukku lakhumukhi pitta	LC/IV

73	*Phalacrocorax carbo*	Large Cormorant	Pedda neeti kaaki	LC/IV
74	*Phalacrocorax niger*	Little Cormorant	Neeti Kaaki	LC/IV
75	*Pioceus manyar*	Streaked weaver bird	Pedamasale pitta	LC/IV
76	*Pitta porphyria*	Indian Pitta	Pitchuka	LC/IV
77	*Ploceus philippinus*	Baya	Cpmmon weaver	LC/IV
78	*Podiceps ruficollis*	Dab chick	Bugda baathu	LC/IV
79	*Porphyrio porphyria*	Purple moorhen	Erra neeti kodi	LC/IV
80	*Rostratula benghalensis*	Painted snipe	Local migrant	LC/IV
81	*Saxicoloides fulicata*	Indian Robin	Nalla Pitta	LC/IV
82	*Streptopelia chinensis*	Spooted Dove	Chukkala guvva	LC/IV
83	*Streptopelia decaocto*	Collard dove	Valaya guvva	LC/IV
84	*Sturnus contra*	Pied Myna	Gorinka	LC/IV
85	*Tadorna ferruginea*	Brahminy duck	Brahmana baatu	LC/IV
86	*Tephrodornis pondicerianus*	Common wood shrike	Wood shrike	LC/IV
87	*Tringa glareola*	Wood sand piper	Kalap Isuka plover	LC/IV
88	*Tringa nebularia*	Green Shank	Patcha Shank	LC/IV
89	*Tringa ochropus*	Green sandpiper	Patcha Sand piper	LC/IV
90	*Tringa tetanus*	Red Shank	Erra Shank	LC/IV
91	*Vanellus malabaricus*	Yellow wattled lapwing	Pasupu teerturu	LC/IV
92	*Zosterops palpebrosus*	Oriental white eye	Tella kannu pitchuka	LC/IV
Amphibians				
93	*Rana hexadactyla*	Ordinary frog	Kappa	LC/IV
94	*Bufo melanosticatus*	South Indian Toad	Boduru Kappa	LC/IV
95	*Polypedates maculatus*	Tree frog	Chettu kappa	LC/IV
96	*Hyla arborea*	Tree frog	Chettu kappa	LC/IV
97	*Rana tigrina*	Tiger frog	Kappa	LC/IV
Butterflies				
98	*Junonia orytha*	Blue Pansy		LC/IV
99	*Tirumala limniace*	Blue Tiger		LC/IV
100	*Junonia iphita*	Chocolate Pansy		NA/IV
101	*Euploea core*	Common Indian Crow		NA/IV
102	*Delias eucharis*	Common Jezebel		NA/IV
103	*Phalanta phalanta*	Common Leopard		LC/IV
104	*Papilio polytes*	Common Mormon		NA/IV
105	*Neptis hylas*	Common sailor		NA/IV
106	*Parantica algae*	Glassy Tiger		NA/IV
107	*Euchrysops cnejus*	Gram Blue		NA/IV
108	*Hypolimnas bolina*	Great Egg Fly		NA/IV
109	*Junonia atlites*	Grey Pansy		NA/IV
110	*Spialia galba*	Indian Skipper		NA/IV
111	*Junonia lemonias*	Lemon Pansy		NA/IV

3.9 Socio Economic Environment

3.9.1 Introduction

The socioeconomic study includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative aspects. The socio-economic baseline on demographic patterns, economic and livelihood profile and infrastructure facilities, community perception and mitigation measures in the study area. Based on the data is compiled in this section, the impact assessment will predict and evaluate any potential impacts of the proposed project on the local community, livelihoods and other social systems.

3.9.2 Methodology

3.9.2.1 Aim and Objective

The study area presented in the socio-economic baseline comprises of the following:

- To provide an accurate representation of the social, economic and cultural conditions in preposed project located Avulapalli Reservoir, Somala(M), Chittoor Dt., Andhra Pradesh
- To identify the potential socio-economic positive and negative impacts of the proposed project;
- To develop attainable mitigation measures to enhance positive impacts and reduce or avoid negative impacts; and
- To develop management and monitoring measures to be implemented throughout the life of the project.

3.9.2.2 Procedure and data collection

The socio-economic baseline has been prepared in two folds of secondary and primary methods.

- The secondary data source adopted for the study mainly includes review of published secondary data (District Census Statistical Handbooks- 2011 and Primary Census Abstract of Census-2011), and other govt related govt office and web sources of available secondary sources of information as well as select primary consultations in the vicinity of the project area with respect to population, density, household size, sex ratio, social stratification, literacy rate and occupational structure for 10 km radius study area.
- The primary data has been collected from 251 participants from different communities through Individual Survey Questionnaire (ISQ) and Focused Group Discussions (FGD). Collected data were analyzed by using SPSS to identify the significant mean difference and measures the impact of proposed project in various aspects. It also

studies the awareness on the proposed project and community perceptions about the proposed project and other related information.

3.9.3 Brief profile of the district

3.9.3.1 Administrative setup

Chittoor district is in the Southern most part of State so also Rayalaseema Region. The district is bounded on the North by Ananthapur and Y.S.R districts, East by Nellore district, and East & South by Tamilnadu State and West by Kolar district of Karnataka State. The then existing 15 Taluks were reorganized into 66 Mandals corresponding to the revenue Mandals, Mandal Parishads were also formed, which were co-terminus with the revenue Mandals in all cases, except statutory town. The revenue villages of Tirupathi rural and urban Mandals were grouped in one Mandal Parishad and named Tirupathi Mandal Parishad. Further, name of Kammapalle Mandal was changed as Ramachandrapuram.

With regard to population of Chittoor district had population of 4,174,064 of which male and female were 2,090,204 and 2,083,860 respectively. With regard to density are 275 people per sq. km. The average literacy rate was 71.53 compared to 66.77 of 2001. If things are looked out at gender wise, male and female literacy were 79.83 and 63.28 respectively. Total literate in District were 2,667,878 of which male and female were 1,484,794 and 1,183,084 respectively. With regards to Sex Ratio it stood at 997 per 1000 male compared to 2001 census figure of 982. Data regarding child under 0-6 age were total 444,572 children under age of 0-6. Child Sex Ratio as per census 2011 was 931.

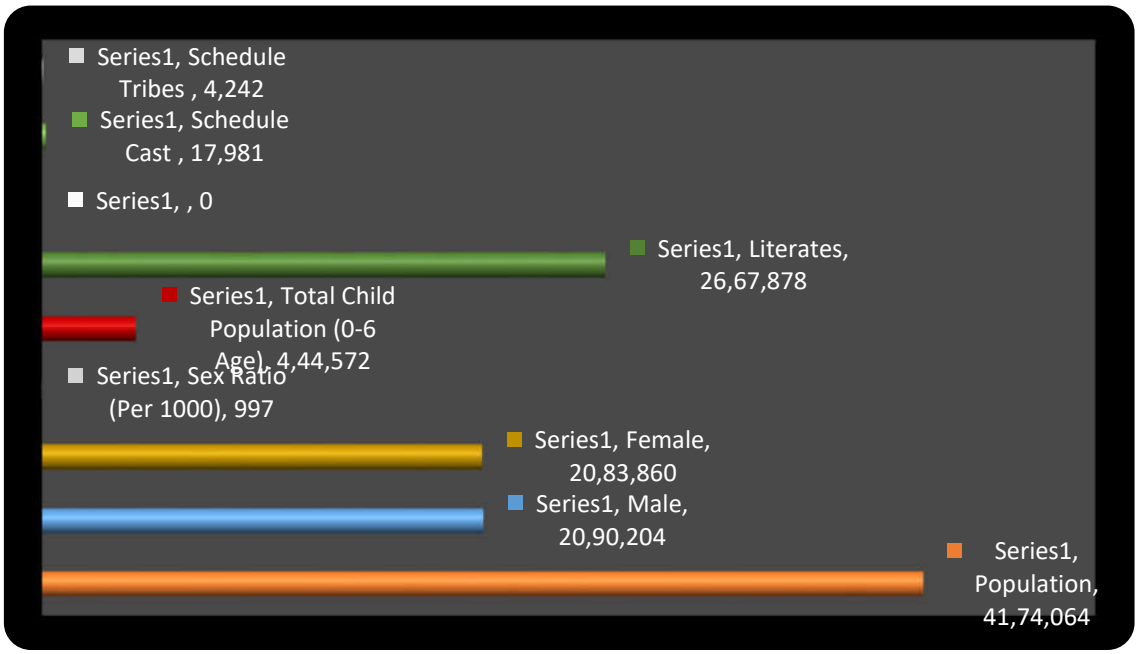


Fig. 3.21 Demographic details of the Chittoor District

3.9.3.2 Demographical detail of the study area

The proposed project area has 6 mandals, namely; Sadum, Somala, chowdalapalli, punganur, peddapanjani and Thavabampalli. The study area has surrounded with 27 villages as per the census of India, the study area has 78,903 populations with 19,642 households. Out of which male are population are 39,476 and female are 39,427. Regarding children, the total of population is 8,660 from boys and girls. The SC and ST population are 13,543 and 1941 respectively. The literacy and illiteracy population are 45,974 and 32,929 (Table 3.23).

3.9.4 Economy and livelihood

The study region i.e. the study area is rich in natural resources like agriculture, Horticulture, Animal Husbandry, Minerals, Agri resources, Dairy Resources, poultry resources, mineral based, forest based, electronic based etc,

3.9.4.1 Agriculture

The Proposed mine location area is an agrarian economy. Area wise, paddy is a major crop grown, followed by Jowar and bajra. Soil and climate are most suitable for plantation crops. Hence, horticulture produces such as mango, grape, sapota, banana and vegetables are grown extensively, over large tracts of land. Sugarcane, groundnut and sunflower are major commercial cops.

Land-Based Livelihoods:

Fruit crops grown in this study are mango, lemon, banana, grapes, guava, cashew nut, and vegetables like tomato, onion, potatoes and brinjal. Mango is grown in almost all the Mandals, mainly in Thavanampalle, Puttur, Bangarupalem, Damala Cheruvu, etc. The major varieties grown are Totapuri, Neelam and Banesha. Chittoor ranks second in the state in production and area under Mango. Banana is grown in over 1,125 Hectors. Kuppam, Chittoor, Satyavedu, Tirupati, Madanapalle, are having increasing area under floriculture, Main flowers cultivated are Jasmine, Crossandra, rose, marigold and chrysanthemum.

3.9.5 Social Infrastructure Facilities

3.9.5.1 Education

The district has seven universities are located in this District. Sri Padmavathi Mahila University is the only Mahila University in the State. In addition, the Veterinary University is the only one in the State. Annibhsent established the first-degree college in the district at Madanapalle in 1915. The first hi& school in the district was PCR High School which was started at Chittoor in 1856.

Table 3.23 Demographical details of the study area

Name of the Village	No of house holds	Total population	Male population	Female population	Below 6 years	SC population	ST population	Literacy	Illiteracy
Somala Mandal									
Nellimanda	731	2699	1370	1329	281	341	48	1548	1151
Irikipenta	813	3265	1648	1617	363	480	103	1809	1456
Somala	1620	6323	3096	3227	656	956	40	3996	2327
S. Nadim Palle	399	1505	769	736	125	339	124	1018	487
Upparapalle	811	3030	1515	1515	296	345	319	1731	1299
Nanjampeta	1226	4531	2277	2254	470	163	122	2676	1855
Chowdepalle Mandal									
Kondamarri	1296	5134	2577	2557	616	722	183	2831	2303
Gaddamvaripalle	970	3879	1989	1890	397	1187	37	2219	1660
Peddayallakuntla	262	1054	547	507	128	252	1	564	490
Chowdepalle	1781	7026	3546	3480	703	1003	136	4829	2197
Pandillapalle	472	1842	954	888	174	359	80	1123	719
Settipeta	258	1134	581	553	115	178	51	582	552
Pudipatla	686	2707	1325	1382	262	549	15	1470	1237
A.Kothakota	563	2250	1094	1156	243	408	4	1224	1026
Durgasamudram	733	2991	1495	1496	380	448	98	1567	1424
Charala	640	2437	1218	1219	258	650	1	1549	888
Punganur Mandal									
Nekkondi	623	2565	1284	1281	244	566	8	1395	1170
Peddapanjani Mandal									
Thurlapalle	320	1403	710	693	145	202	0	917	486
Veerapalle	308	1391	695	696	146	326	19	969	422
Suddagundlapalle	293	1301	647	654	180	281	9	666	635
Kolathur	919	4069	2042	2027	520	611	2	2222	1847
Gamkonda	449	1813	892	921	232	699	24	996	817

Rayalapeta	999	4204	2056	2148	497	672	29	2774	1430
Nagireddipalle	614	2681	1296	1385	359	451	76	1249	1432
Peddakappalle	792	3466	1741	1725	437	437	237	1660	1806
Kogileru	565	2331	1169	1162	272	212	44	1272	1059
Thavanampalle Mandal									
Mallakunta	499	1872	943	929	161	706	131	1118	754
Total	**19642**	**78903**	**39476**	**39427**	**8660**	**13543**	**1941**	**45974**	**32929**

3.9.5.2 Transportation

Broad Gauge double line network Connecting Mumbai- Chennai passes through the Eastren part of the district connecting Renigunta Junction to Arakonam junction from north to south. A Broad gauge single line connecting Chenni – Howrah line from Gudur junction connecting Srikalahasthi-Renigunta-Tirupathi-Pakala-Chittoor- Katpadi Junction passes through from East to South. One more Broad gauge Single line connecting Pakala-Madanapalli Road-Dhrmavaram Junction passes through the district from East -West.

3.9.5.3 Road Network

The following National Highways pass through district from North- South & East -West They are as fallows, NH-40-Connecting Chennai-Chittoor- Hyderabad-Nagpur from South to North.NH-69-Connecting Gudur-Tirupathi-Chittoor-Palamaneru-Mulabagala-Bengaluru, NH-71 Connecting Naidupet-Tirupathi-Vayalpadu-Madanapalle-Kadiri, NH-716 Connecting Renigunta-Nagari-Chennai and NH-42 Connecting-Kadiri-Angallu-Madanapally-Palamaneru-Kuppam-Krishnagiri. In addition to this, R&B and Grampachayat roads connect all 66 Mandal headquarters with road transport.

A National Level/Domestic AIRPORT is situated at Renigunta that is 10 km from Tirupati that is well connected with Delhi-Chennai, Bangaluru-Tirupati, Visakhapatnam-Tirupaty, Hyderaba-Tirupaty, Mumbai- TIRUPATY, Kolkata-Tirupaty air routes.

3.9.5.4 Industrial development

Non-linear impervious surfaces are included in the class that is related to trade, manufacturing, distribution and commerce. These are areas where the human activity is observed in the form of manufacturing along with other supporting establishments for maintenance. The industrial area occupies an area of 28.63 sq. km, which is observed in and around towns.

3.9.5.5 Industrial area-Ash / Cooling Pond

These are the portions of industry that are used for temporary storage of ash, contaminated soil, rubble, cooling of hot water or tailing pond associated with the industry. The areas where industrial waste is permanently kept, categorized as other waste that is delineated under this category. A stockpile of storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from earth’s surface is considered under this category. It is observed that this category is found around the industrial areas with an area of 0.48 sq. Km.

3.9.5.6 Mining – Abandoned

These are the areas where large-scale surface operations of removal of economically important ores are carried out in the past, but presently kept abandoned due to various reasons like

economical, operational, viability, disturbances etc. Only 1.27 sq. km has been contributed under this category.

3.9.6 Primary study

The primary research was conducted during the process of survey. It was done in two folds, such as 1) Questionnaire survey method, this is to know the individual perception about this proposed project. This method focuses on socio demographical information of the respondent such as; name, age, gender, profession, community and economical sources of the respondent. It is also focused on five major dimensions of economical, social & cultural, health & wellbeing, personal & psychological and public infrastructure aspects to assess that significant impact differences about this proposed project. Second method is Focused Group Discussion (FGD), this is to identify the collective or community opinions on this project. Here, interviewer would ask the random based questions and community need and expectations also to be included

A primary data were collected from 251 participants of the local communities. This would help to know the community perception on proposed project and advantages and disadvantages by expansion of the work. In the connection, FAE teams have chosen convenient (non-probability) sampling method within the limits of the studied. In this regards, the village of Nadimpalle, Somala, Upparapalli, Chodapall, Kondamarri, Pudipatla, Nekkondi, Veeraplli, Rayalapeta and Pedduru respectively. The primary data were statistically analyzed by using the SPSS 20.0 version to assess the significant different in various demographical variables. The following findings are identified.







Fig. 3.22 Collection of data from public (Source: field study)

3.9.6.1 Major Findings of the Primary Study

- Most of the persons in the study area well aware of the proposed irrigation project.
- The economic benefits with proposed irrigation project in the study area are commonly have direct, indirect, and induced.
- 91% of the participants positively responded that there would be enormous change with proposed project form of employment, to the local people on regular and contractual bases.
- Development of agricultural water resources may have significant changes at various levels, from farm to national levels.
- Changes in production patterns, land and property values, expansion in the use of complementary inputs (such as high yielding variety seeds, fertilizers, pesticides, etc.), and expansion in overall economic activities through backward and forward linkages.
- The impacts of these changes vary greatly from one level to another. Some of the impacts are confined to only farm level, while others spread to the whole project command and others spread to wider region and province/state or national level.
- Generates additional employment on contractual and regular bases that has positive impact on the local economy.
- Would be increased agricultural production, crop productivity, expansion in crop areas, Increase of cropping intensity and crop diversification.
- There is scope to intensification the commercial fish production (in-land fisheries).
- Would be increased benefits of water use in industrial, commercial and residential sectors.
- Environmental benefits of water for in-stream flows, disposal of waste, wildlife, flora and fauna; increased farm forestry and vegetation in irrigated areas.

- Health benefits in the form of sanitation due to better access to water
- Wide range of changes brought by infrastructure investment projects**,** while economic benefits tend to be directly measurable impacts in terms of monetary value and Goods and services.
- Many communities would be benefited in various aspect, such as establishment of related agriculture, horticulture and many other aspects.
- The economic benefits are value-added, taxation revenue Govt. and return on investment.
- It has wide range of changes brought by infrastructure investment projects**.**
- Local transport and infrastructure will be developed, namely roads, are usually provided for free (or at a fee lower than costs).
- All the people in the proposed location villagers will be relocated to the nearest area on R& R act and 81% local participants said villagers would have to migrate due to this proposed project. However, there will be no adverse effect with this change.
- No historical places and temple are found within the study area.
- It was also noticed that there would be loss of agricultural lands; trees dwell due to this project.
- Health and fitness for work of port workers who regularly work in areas or on operations known to include health, hazards should be regularly monitored.

3.9.7 Need assessment or community expectations

A need means something that specifically relates to a particular group or community. It's not usually a universal need, but it's more than an individual need. The Primary consultations survey has ascertained certain key expectations that are also indicative of the local community's attitude towards industrial development in the study area. Local community people have some expectation as a part of corporate social responsibility and other sources.

- 27% looking employment opportunities to the local community during pre and post operations of the project
- 15% Free medical and health related facilities like, quarterly medical camps, ambulance services, and free medicine supply.
- 23% Skill based Training programs for semi and unskilled people based on their interest which will enhance and helpful to people in the study area.
- 22% of the communities are looking for basic Civic amenities
- 13% Free education for poor students, vocational training, formation of self-help groups and Adaptation of schools and community halls for development.

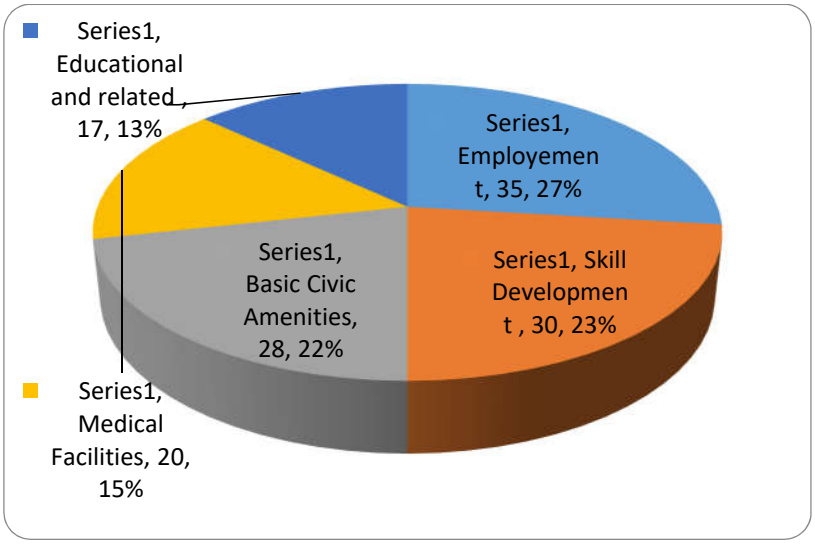


Fig 3.22 Percentage distribution of requirements (Source: Primary Data)

3.9.8 Conclusion

The present Social Impact Assessment study was conducted project in and around the Avulapalli Balancing Reservoir located at Avulapalli Village in Somala Mandal of Chittoor District. It has traditionally involved the use of technical and participatory analytical methods to anticipate change but also encouraging the life cycle of projects to minimize negative outcomes and maximize benefits. The early consideration of social impacts, the alignment of activities with regional and community planning objectives, and meaningful participation of community in decision making are key features. Apart from the SIA process and findings, it can be concluded that most the respondents have positive perception towards implementation of the proposed project.

Chapter 4

ENVIRONMENTAL MANAGEMENT PLAN

4.1 INTRODUCTION

The proposed Avulapalli Balancing Reservoir, a climate change impact management and Rayalaseema drought mitigation project are intended to provide drinking water to around 2.76 Lakh people residing in the villages / towns enroute and medium irrigation project, with CCA of 9700 ha. Therefore, it's falls under category B2 project and hence only Environmental Management Plan (EMP) is required to be prepared. However, it is imperative to assess impacts of the project and formulate mitigation measures, if necessary, and subsequent environmental management plan.

Present chapter identifies and discusses the environmental and social impacts, both positive and negative, associated with the proposed project along with the mitigation and management measures. Based on the evaluation of baseline data and predicted impacts, suitable management plan is prepared in order to enhance the positive outcomes and ameliorate the negative impacts in the sphere of land, water, air, noise, biological and socio-economic environments in a particular area/region. Ensuring the mitigation of all the negative environmental impacts are mitigated to have minimum environmental impacts due to development of the project, it is important to have mitigation and management measures in place and budgeted for. Project related information is sourced from project proponent, Pre-Feasibility Report (PFR) and Detailed Project Report (DPR) of the project to carry out the impact assessment during the project construction and operation phase. Mitigation and management measures have been designed to ensure minimum impacts of the project construction and operation on surrounding environment. Impacts and Mitigation/Management measures are discussed under following heads

1. Mitigation of Impacts due Air Emissions
2. Mitigation of Impacts due to Noise
3. Mitigation of Impacts due to Wastewater Generation
4. Sanitation and Solid Waste Management
5. Facilities in Labour Camp
6. Public Health
7. Energy Conservation Measures
8. Biodiversity Conservation
9. Green Belt Development

For each of the above, potential adverse/positive impacts along with the recommendations for mitigation measures have been discussed in the ensuing paragraphs.

4.2 IMPACTS AND MITIGATION MEASURES

4.2.1 Impacts on Air Quality

During Construction Phase

The construction of the project involves construction of the reservoir bund, excavation of materials, banks formation, 4 nos. of Saddle Bunds, masonry and concrete works at Seethamma Cheruvu which is away from human habitation. The air pollution impact of excavation of ordinary earth and boulders and also rock is directly dependent upon construction methodology, annual rate of excavation, mode of transport within the construction site, mode of screening and method of crushing. The air pollution sources at the proposed site can be broadly classified into three categories, viz. area source, line source and instantaneous point source.

Extraction of stone by various activities in the construction of earthen bund as an area source that includes excavation and activities happening in the excavation area like drilling, blasting, hauling and loading/unloading. The dust emission from these areas will be fugitive in nature. The excavator operations, loading/unloading operations will also cause dust emission though it will be confined to the area of operation of the machinery. The gaseous emission from their operation shall be minimal and limited within the operational area.

Transportation of excavated material from the bund site to either dumping sites or the stone crusher unit are categorized as line source. Since the dumper movement on haul road will be within the dam complex area, no adverse impact shall be felt in the settlement area.

During operation phase

In an irrigation project, air pollution occurs mainly short period during project construction phase only. During operation phase, no major impacts are envisaged on air environment.

4.2.1.1 Mitigation measures

The mitigation measures primarily focused on the dust generation during construction, hauling of material, diesel generators operation. Therefore, the following mitigation measures are recommended

- For all major construction activities locations such as batching plants, bulk material open stock yards, etc curtaining of the site will be done to a height of 1 feet above the heap height to protect the surrounding areas from dust emissions.

- Dust generated due to drilling, blasting, ripping, and vehicular movements will be suppressed though spraying of water during and till half an hour after the operations.
- Water sprinkling with the help of mobile water units such as water tanks and spray nozzles will be done on the haul road and other roads at regular intervals where dust is expected.
- All construction equipment/machinery will be properly maintained and tuned to minimize emissions.
- Speed of the vehicles will be kept within the prescribed limits. The vehicles used for the construction of the reservoir should have Pollution Under Control (PUC) certificate.
- Trucks/ dumpers will not be over loaded above the brim level.
- At the feeding points of stone crusher will be covered and air mist spray shall be carried out and hooded conveyer belts shall be used.
- Mobile DG sets with the capacity of 4×125 kVA and 1× 625kVA shall be used for lighting only during construction phase and they should meet emission and noise standards as per guidelines/standards issued by CPCB.
- The entire contractor's vehicle should have valid PUC certificate and same condition may be enforced on transporters bringing in material for construction.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.
- All the construction workers and other staff, who are directly exposed to dust, should necessarily be provided with dust masks.
- The project authorities will work closely with representatives from the community living in the vicinity of project area to identify areas of concern and to mitigate dust-related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program).

4.2.2 Impacts on Water Quality

During construction phase

Various sources of water pollution in the project area during the construction phase include disposal of effluents with high turbidity from bund and excavation areas, sewage disposal from labour camp, land clearing activities, washing of oil, grease from diesel generator sets, vehicles and construction machinery, etc.

Stratification can limit the mixing of the water body, leading to depletion of DO levels. This can lead to reducing conditions in waters. The annual variation up to MDDL would prevent

formation of any significant temperature stratification. Thus, no problems related to reservoir stratification are anticipated. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir. Therefore, any significant impact on reservoir water quality is not anticipated.

Another significant impact, which can accrue in the reservoir, is the problem of eutrophication in the reservoir. This occurs mainly due to the disposal of nutrient rich effluents from the agricultural fields. However, within the catchment, the proportion of agriculture land irrigated is low. The agro-chemical dosing is low in the area. Even in the post project phase, use of fertilizers in the project catchment area is not expected to raise significantly in view of the maximum rainfed crops being grown in the area.

Considering the low fertilizer usage in the area, significant loading of nutrients is not anticipated. Thus, problems due to eutrophication are not anticipated in the proposed project Apart from ground water recharge from the reservoir area and from application of water in command area, the quality of ground water will also improve in the entire area as the quality of surface water to be applied conforms to class “C” water as per IS:2296-1982.

During the construction phase total fresh water requirement for 250 no.’s of workers will be 35.0 KLD (@ 135 lpcd as per NBC 2016. The waste water generation will be 30.0 KLD which will be treated in the mobile STP’s at the site. Two numbers of temporary worker camps will be provided at different locations of the project and sheds will be removed after completion proposed project.

During Operation Phase

During the operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of O&M staff will reside in the area in a well-designed colony with septic tank and soak pit and other infrastructural facilities, the problem of water pollution due to disposal of sewage is not anticipated. The treated sewage will be reused for gardening and green belt around the colony. Still, the major impacts considered as a part of the study are:

- Changes in flow regime in downstream
- Impact on ground water
- Impacts on waterlogging and soil salinity
- Changes in water quality due to increased use of fertilizers

4.2.2.1 Mitigation measures

During operation there will be groundwater recharge that enhances the groundwater availability in the vicinity. The fluoride concentration in the groundwater is more than the permissible limits. The recharge will dilute the fluoride and thereby enhance the groundwater quality and health of the people using the groundwater for drinking and cooking. To avoid deterioration of water quality of the receiving water body following measures are suggested:

- Conservation of water should be implemented at construction sites to minimize the generation of wastewater. With regards to water quality, wastewater from construction activities would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the wastewater are removed before these are disposed into water body or over land, although effluent is expected to be very less to cause any adverse impact.
- During Construction phase provision of septic tank/ soak pit/STP of adequate capacity for labour camp so that it can function properly for the entire duration of construction phase
- During operation, the nearby project colony should have suitable treatment facilities to treat the sewage generated from the colony
- Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc. All spills and collected petroleum products will be disposed off in accordance with APPCB guidelines.
- Improved availability of irrigation water during Rabi season in the area shall lead to reduced extraction of groundwater for irrigation and domestic uses. The project, by providing water for irrigation will reduce the extraction of groundwater and bring a positive impact on this count.
- The project is designed to carry out irrigation in command area through irrigation system which will not pose any water logging. In fact, there will not be any such as the geological characteristics will not support such logging. Hence, problem of water logging and salinity is not envisaged.
- The fertilizer dose is likely to increase once irrigation is introduced in the command area. Under the best farming practices in case of flood irrigation, only 40% to 50% of the applied fertilizers are used by the crop and the balance finds its way into the aquatic environment through drainage runoff which causes eutrophication of water bodies. However, the irrigation practices included piped irrigation (drip/sprinkler) system has also been planned in the proposed project, this possibility is minimal.

4.2.2.2 Steps to develop Pisciculture and recreation facilities

The reservoirs invariably offer scope for inland fish production for various methods to enhancement higher productivity and income generation for the local community. They have the advantage of enabling quick enhancement of yield due to their small size and easy manoeuvrability of fish stock. The proposed reservoir will be leasing to the registered fishermen co-operative societies to promoting pisciculture and to generate economical help and to maintain fishing rights of Fishermen community. It provides not only livelihoods but also provide the nutritional food. It is envisaged to develop a park on the surroundings of the reservoir. It helps provide the recreational facilities to the people in the area.

4.2.3 Impacts on Noise Environment

During construction phase

Sources of noise will be the vehicles and equipment for excavation and construction at the project site. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area mainly where large-scale construction activity will progress. Additionally, noise levels will increase on approach roads due to increased traffic.

Another cause of concern for noise and vibrations generated due to construction activities are for the wildlife in the area that too mainly for avifauna. Avifauna is scattered in the study area and is not confined in proximity to the proposed construction sites, therefore, such impacts are not significant and also are temporary in nature.

Impact of noise generation due to operation of construction machines and equipment is the exposure of workers operating these machines and others who are working in the surrounding. Such impacts can become significant if they are exposed to high noise for long hours continuously.

In order to predict ambient noise levels due to the mining activities like excavation of earth, sand and aggregates from various sources at different locations assumption that all noise sources are acting as a single source will be generate approximately 91 dB(A).

The average noise levels generated due to proposed crushing activities will be about 88.5 dB(A) which is within the exposure limit of 90 dB(A). The crusher, if provided, within the project area shall be housed in a shed to contain noise. Screening activities shall generate average noise

level of about 96.5 dB (A). Workers in the noise-generating zone will be provided with earmuffs/earplugs besides dust mask.

Occupational Safety and Health Administration (OSHA) of USA has done substantial work to establish the impacts of exposure to high noise levels on humans and have established limits for safe exposure. Continuous exposures to high noise levels affects the hearing ability of the workers/operators and hence, should be avoided. Factories Rules by various state governments has also adopted these limits to check exposure of factory workers to high noise for longer duration.

To prevent impact of high noise exposure on workers, it is recommended that contractors should enforce standards, recommended by Occupational Safety and Health Administration (OSHA) (Table 4.1), during the construction phase.

Table 4.1 OSHA Standards for Noise

Maximum equivalent Continuous noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2
110	½
120	1/2

During operation phase

After completion of the project and during the operational phase the noise levels shall not be impacted as there are no noises emitting sources except the noise created during passing of surplus discharge through spillway, which shall persist for a few hours till the flood subsides.

4.2.3.1 Mitigation measures

Noise will be generated during various construction activities such as excavation, movement of vehicles, operation of construction machines and equipment, operation of DG sets at filling of bund, etc. Noise levels will also increase due to increase in traffic. Continuous exposure of workers to high sound levels may result in annoyance, fatigue, and may cause temporary shift of threshold limit of hearing and even permanent loss of hearing.

- Following mitigation measures will be implemented to minimize the impact of high noise: Contractors will be required to maintain proper functioning of equipment and comply with occupational safety and health standards. DG sets will have a valid Type Approval Certificate and Conformity of Production certificate as per CPCB guidelines.

- All the construction equipment will be required to use available noise suppression devices and properly maintained mufflers.
- Workers in high noise area, will be provided with earmuffs and their use will be monitored (budgeted under PPE head). Workers exposure (time duration) to high noise will also be controlled.
- High noise area, interfacing with community, if any will be provided with noise barriers.
- Minimize the use of noise producing equipment during night hours to avoid the disturbance to locals and wild animals of surrounding area.
- Monitoring of noise levels will be conducted during construction phase of the project. In case of exceeding of pre-determined acceptable noise levels by the machinery; will require the contractor(s) to stop work and remedy the situation prior to continuing construction.
- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.

4.2.4 Solid Waste Management

4.2.4.1 Impacts due to waste generation

The construction of the proposed balancing reservoir will involve an influx of technical staff, labourers and other service providers into the project area. Sewage and solid waste will be generated from the colonies. Most of these technical and non- technical workers will be temporary and will leave the region as soon as the construction phase of the project is completed. Some of the workers will be accompanied by their families. The total migrant population of workers and their families has been estimated as 250 persons during peak construction time. These people will be living in temporary and permanent colonies/ settlements. The main sources of waste generation can be categorized as:

- Municipal waste (includes commercial and residential wastes generated in either solid or semi-solid form excluding industrial hazardous wastes and bio-medical wastes).
- Construction and demolition debris (C&D waste)
- Bio-medical waste
- Hazardous waste (generated from construction machinery and equipment)
- e-Waste (computer parts, Printer cartridges, electronic parts, etc.).

It is essential that from the planning stage, sewage management and solid waste disposal facilities should be conceptualized to maintain the health of the people and the environment.

4.2.4.2 Sanitary and Solid Waste Management

About 250 workers (labour and staff) would be engaged temporarily during peak construction period. It is expected that 60% of the total work force shall be locally available from adjacent areas and thus labour colony shall be designed to house 250 workforces. Proper care must be taken to manage the solid waste generated from the labour colony.

The solid waste generation during the construction phase for the 250 no.'s of workers will be 100 kg/day (@ 0.4 kg/capita/day as per NBC 2016). Proper sanitary facilities would be provided at the labour colonies. Covering community latrines and bathrooms, separately for male and female, will be constructed at appropriate locations; connected to septic tanks and soak pits. Care be taken to avoid mixing of wastewater and sewage with local water body especially during rainy season. Mobile toilets will be provided, separately for male and female workers, at construction sites.

For maintaining the cleanliness of the labour colony and to restrict from disposing the solid waste into the nearby water bodies, no dumping of solid waste should be allowed into any of the water body. Waste segregation – biodegradable and non-biodegradable will be encouraged by awareness programs. Solid waste collection vats will be provided and these will be regularly emptied to land fill site at Punganuru (non-biodegradable) and composting pits (biodegradable) established locally in consultation with local authorities.

The project authority, as principal waste generator, shall, within the territorial area of the project complex/ colony, be responsible for the implementation of the provisions of Solid Wastes Management Rules, 2020, issued by MOEF vide S.O.1357 (E) dated 8th, April 2016, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

4.2.5.3 Collection of Wastes

The project authorities shall prohibit littering of solid wastes in the area under their control by resorting to following:

- Organizing collection of solid waste by community bin collection (Central bin).
- Collection of wastes from office areas.
- Collection of waste from medical facilities and separately disposing it off.
- Collected of waste from residential areas shall be transferred to community bin by hand-driven containerized carts or another small vehicle. Horticulture and construction / demolition wastes or debris shall be separately collected and disposed off. Waste like dry leaves shall not be burnt.

- Collection of vegetable and fruit/meat waste and dry leaves, which are biodegradable in nature to be finally disposed of through aerobic composting.
- The compost thus obtained shall be used for development of flower beds and avenue plantation around colonies and office areas and also in biological measures to be adopted in respect of soil tips developed at muck disposal sites.

4.2.5.4 Storage and Transportation of Wastes

The project authority shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it.

Vehicles used for transportation of wastes shall be covered. Wastes should not be visible to public, nor exposed to open environment preventing their scattering. Transportation vehicles shall be so designed that multiple handling of waste, prior to final disposal, is avoided.

4.2.5.5 Disposal of Municipal Solid Wastes

Land filling shall be restricted to non-biodegradable inert waste and other waste that are not suitable for recycling or for biological processing. Landfill site shall be selected as per criteria mentioned under Schedule I (A) in consultation with local authorities.

4.2.5.6 Awareness Programs

The project authority shall organize awareness programmes to ensure community participation in waste segregation.

4.2.5.7 Construction and Demolition Waste

Apart from the municipal solid waste in labour colony of project area, a lot of waste is expected to be generated on account of construction activities mainly consisting of empty cement bags, iron scrap, packing material, etc. It is expected that most of the iron scrap and packing material would be recycled since it has reuse value and hence, it is proposed that stipulations should be imposed on suppliers and contractors to take away the scrap and packing materials. Surplus construction and demolition waste will be disposed off at pre- identified low-lying area, in consultation with local authorities and the site will be fully restored. Following guidelines shall be followed:

- Construction and demolition waste will be handled in line with the guidelines for handling such wastes given in Construction & Demolition Waste Management Rules, 2016.

- Contractor shall be responsible for segregation of construction and demolition waste and handle the same in consultation with local authority.
- Waste construction material shall be recycled as far as possible and remaining disposed off at designated site in consultation with the local authority.
- Contractor will ensure that there is no littering or deposition of waste so as to prevent obstruction to the traffic or the public or drains.
- Any hazardous waste generated at site such as waste oil, used batteries, empty barrels/containers/liners contaminated with hazardous chemicals/wastes and contaminated cotton rags or other cleaning materials, etc. shall be disposed off in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Log-books shall be maintained for disposal of all types hazardous wastes and shall be submitted with the compliance report.

4.2.5.8 Impacts Due to Fuel Combustion

During construction phase

The increased traffic load in any particular segment of the road will result into direct increase in pollutants released from the vehicles. The rate of emissions of several types of vehicles is presented in the Table 4.2. However, the extent of these impacts, at any given time will depend upon the rate of vehicular emission within a given stretch of the road; and the prevailing meteorological conditions. The impacts will have strong temporal dependence as both factors vary with time. The temporal dependence would have diurnal, seasonal as well as long-term components.

Table 4.2 Emission factors by Vehicle Type (gm/km/vehicle)

CPCB/ARAI (Automotive Research Association of India) – Emission factor development for Indian Vehicles-2008						
Type of vehicles	**Make considered**	**Emission norms**	**Emission factors**			
			CO	**NO_2**	**PM_{10}**	**SO_2**
Trucks (HCV Diesel driven)	Post 2000	BS-II	6.0	9.30	1.24	0.03
Passenger cars (Diesel driven)	Post 2005	BS-II	0.06	0.28	0.015	0.004
Buses (HCV Diesel driven)	Post 2005	BS-II	3.92	6.53	0.30	0.026

*Note: Emission Factor of SO2 is calculated based on Sulphur content calculations considering Bharat Stage IV fuel norms

During construction phase 50 tipper trucks (20 tonne) shall be deployed on the road for carriage of soil and construction material (cement and steel), and crushed stone aggregate/sand.

Following control measures have been suggested to prevent air pollution due to the transportation activities:

- Transport trucks/tippers shall be properly maintained.
- Only PUC certificate issued vehicles shall be used.
- Avoiding of overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it.
- Strict compliance of traffic rules and regulations.
- Fugitive dust would be further minimized by taking up tree plantations, growing grass where soil depth is limited and with least damage to the existing vegetation in and around the construction sites.

During operation phase

The ambient air quality during the operation phase at the muck disposal site is expected to improve as the fugitive dust and flue gas emission sources of air pollution shall be conspicuously absent.

4.2.6 Impact on Soil

During construction phase

Another impact on soil will be during construction period as there will be contamination with dust and surface run-off. Due to various construction activities such as construction of colonies / houses / toilet blocks etc. Soil erosion in the project area is bound to increase. During construction activities, the share of the vegetation cover will be adversely affected which in turn will cause loosening of the soil particles, thus increasing the rate of soil erosion and hence degradation of land environment. Substitute Plantation will mitigate the adverse effect of soil erosion.

During operation phase

No major impacts are envisaged on soil environment during project operation phase

4.2.6.1 Mitigation measures

Measures to conserve soil in-situ, allow more infiltrations opportunity time for rain water and safe disposal of runoff water from arable lands are of prime concern in rain fed areas, since

they directly affect soil erosion rates and consequent crop productivity. The recommended soil and moisture conservation measures are as follows:

- Contour bunds with waste weirs
- Graded bunds/Graded border strips
- Zing terraces with raised waste weirs
- Diversion Drains/Water ways
- Reducing wind erosion of soil by growing wind breaks (vegetation cover)
- Gully plugging
- In over-grazed land silvi pastoral systems, which in irrigated land yield enough green fodder to cattle population
- Grazing animals should be kept in stalls
- Agro forestry and Agro horticulture systems to meet various needs of farmers, crop residue of this adds to the soil and increases carbon content and biotic activity
- Harvesting of runoff and impounding through appropriate structures
- Drainage line treatments to improve the flow and avoid stream course clogging.

4.2.6.2 Water logging

Surface and ground water belong to the same hydrological circle and are independent. In any area or region, where both surface and ground waters are present, irrigation is based usually on the use of former or both the sources. However, in most cases it is done without proper planning for co-ordinated development and optimum benefits. When due consideration is not given for a balanced and harmonised development of the two sources, the environment gets affected and problems such as water logging in certain areas will prevail It is therefore, becomes necessary to take up mitigative measures to avoid water logging. It is therefore, suggested that conjunctive use of water and also necessary drainage system should be developed to overcome the problem of water logging.

4.2.6.3 Soil Drainage

The removal of excess water (free or gravitational/standing or stagnant water) from surface or below surface of the soil so as to create favourable soil conditions for plant growth, is termed as soil drainage. The excess water leads to waterlogging and salt imbalance; thus rendering the land productive to less productive and problematic.

Since most of the area under this project is level to gently sloping the flow of water may not be that rapid under sub-soil conditions. With stabilization of irrigation and assured water

supply, the sub-soil drainage conditions will have to be improved. The ill-effects of poor drainage are enumerated below.

III-effects of Poor drainage

a) Lack of air space in the soil for proper root growth where in availability of O_2 is limited.
b) Some of the toxic substances are produced including H_2S, boric acid in the presence of which even paddy crop is affected. This injury is similar to sulphide injury.
c) Natural vegetation like plantation and orchards will be affected due to waterlogging.
d) Standing water for a long period will give rise to many soil health problems
e) Fertilizers applied will percolate to lower zone or lost due to faster infiltration.

The factors responsible for poor drainage are enumerated below:

a) Soil Type

In clayey and heavy soil the infiltration capacity is low and prone to waterlogged conditions and needs drainage

b) Slope

In areas with in adequate slope and flat areas, the movement of water is slow and results in poor drainage. The command area of the proposed project is mostly levelled to gently sloping, therefore warrants proper drainage is selected as per need.

4.2.6.4 High Rainfall

The excess rainfall received in the absence of proper drains will create waterlogging. The proposed project benefitting in the uplands area therefore, problems of waterlogging due to rainfall are not anticipated.

4.2.6.5 Advantages of drainage

Suitable drainage system has to be provided in the vulnerable areas under this project area localized for irrigated dry (ID) crops. The advantages of proper drainage area as follows

- Drainage makes the command more productive
- Proper drainage makes the entire field more uniform in soil moisture (elimination of wet patches) and results in more effective tillage and harvesting.
- Removal of surplus water from the field increases aerobic microbial activity by permitting air to replace water in more soil pore space. As result the bio-micro-organisms will increase which will decompose more organic matter and thus more potential plant nutrients are made available. Proper drainage decrease potential losses of nitrogen.

- Drainage reduces the building up of toxic substances in soil
- Wider varieties of corps and more valuable crops can be raised in well drained soils.
- Drainage permits deeper penetration by plant roots thereby increasing the availability of nutrients to growing plants resulting in higher crop yields. Deep roots make plant more resistant.

4.2.6.6 Provision of drainage in command

Surface Drainage

Surface drainage is the removal of excess water from rainfall or seepage or irrigation from the surface of lands. Both areas localized for wet and ID crops need surface drainage system. For designing drainage system the following factors are to be considered.

- Intensity of rainfall 1 day, 2 day, 3 day rainfall with certain frequencies (5 years, 10 years)
- Rate of infiltration
- Evaporation rate
- Crops grown during rainy season or at times of heavy rainfall
- Landscape
- Gradient that can be given to the drainage channels
- Outfall conditions

Main Drains

In the project command there are natural drains existing as major gullies. The velocity of flow is low and some time is taken to drain the water to outfalls. Hence in the command, all these main drains are to be strengthened to the extent possible, deepened and wherever required blanks are stabilized. Until and unless these gullies which will serve as main drains are in a conditions to receive and discharge the rainfall or water from excessive irrigation in shorter period, the drainage system cannot give any good results.

All field drains into subsidiary drains to be constructed at right angles to natural drains. The size of these drains should be sufficient to take the excess water of the field drains dropped into it. The field boundaries can be made use of in digging these subsidiary drains.

Field drains

These drains are to be constructed by the individual farmers with proper size so that the excess water from their fields are drained into intermediate drains. Field drains or ditches should be at least 30 cm deep with slide slopes. These should be constructed considering the low spots

which collect water from adjoining higher elevations. Ditches should be as straight as possible. The cross-section of the field drain should be trapezoidal shape.

Soil fertility status

The soil characteristics are presented in chapter 3. It is observed from the available data that soils are low in nitrogen and available P_20_5 while in case of K_2O the status is low to high. The fertility level of soils in respect of nitrogen and phosphorus has to be improved by adequate application of fertilisers as well as organic manure after soil test. The regular extension staffs of Agriculture department generally cater the needs of the farmer. The recommended doses of fertilisers for rice and pulses are given in Table 4.3.

Table 4.3 Recommended Doses of Fertilisers for Rice and Pulses

Sl.No	Crops	Fertiliser dose in Kgs/ha			
		N	P	K	Remarks
1	Kharif irrigated	60-80	30-40	30	N in 2 to 3 splits
	Rabi	100-120	30-40	30	
	Kharif rainfed	60	30-40	30	
	Black gram (ID crop	20	50	As per soil test	
	Green gram	20	50	-	-
	Bengal gram	20	50	-	-

Selection of crops

An initial basket of twelve crops has been assumed for surface irrigation considering present cropping pattern (without project), need for diversification and introduction of each crops.

Irrigation Efficiencies

For the purpose of cropping pattern optimization and evaluation of alternation project configuration, the efficiencies (Table 4.4) are taken into consideration.

Table 4.4 Details of Irrigation Efficiencies

Items	System Efficiency	
	Surface Irrigation (Ponded)	Drip Irrigation (Non Ponded)
Conveyance efficiency(from canal head to outlet head)	90%	90%
Field channel efficiency(from outlet head to field gate	85%	98%
Field application efficiency	79%	96%
Overall Efficiency	54%	80%

4.2.7 Water Management

4.2.7.1 Participatory Irrigation Management Practices (PIM)

Government of Andhra Pradesh has enacted a law on PIM. WUAs are already functioning for utilisation of water from various tanks in the command and hence the local community is already aware of the modern practices and same can be implemented in the command also.

4.2.7.2 Scope of introduction of Modern Drip Irrigation system in the command

The introduction of the drip irrigation techniques has been considered preferable in the command area due to the improved efficiencies in application of water to the field. Currently, the command area does not have any assured water supply and as a consequence, the development of modern methods has been slow. The limited financial capacity and technological awareness of the local farmers has also contributed to this. It is proposed that the drip irrigation may be provided initially in 10% of net CCA distributed in pockets over the entire command area.

4.2.7.3 Rational crop plan with appropriate crop rotation with due share of legumes and cash crops

A sustainable and diversified cropping pattern has to be developed depending on agriculture scenario. Keeping in view the soil fertility aspects, pulse crops have to be in corporates in the crop rotation. Also, cash crops should find a place wherever feasible, to improve farmers conditions and inculcate interest in farmers in the new cropping plan. At present, there is a very limited area under pulse and cash crops. Therefore, crops like greengram, blackgram, groundnut, soybean etc should be incorporated to cover sizeable area in the command area. The crops should be rotated in each field from year to year and monoculture or same rotation in the same field should be avoided. The rotations should be based on established principles. Some of the rotations that can be adopted in the project command area listed below:

1. Paddy –Bengalgram/Maize-Greengram
2. Maize/Jower/Bajra-Bengalgram –Chilies
3. Paddy –Redgram+Groundnut – Vegetables
4 .Soybean – Maize – Vegetables
5. Groundnut+Bajra- Maize – Vegetables
6. Redgrame +Groundnut- Vegetables – Chilies
7. Vegetables – Bengalgram
8. Cotton – Vegetables – Green gram

9. Turmeric – Greengram/Blackgram
10. Castor/Toboco-Vegeables/Fruits/Flowers
11. Greengram – Maize – Sugarcane
12. Maize – Blackgram – Mentha

4.2.8 Integrated Pest Management

Integrated pest management is a system that, in the context of the associated environment and population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains pests' populations at levels below those causing economically unacceptable damage of loss (FAO). It is an ecologically based strategy that focuses on long term solution of pests through a combination of techniques such as use of resistant varieties, biological control, modification of agronomic practices and habitat manipulation. Pesticides are carefully selected and applied to minimize the risks to the human health, beneficial and non-target organisms and environment.

Table 4.5 Recommended integrated pest management measures for insect pests of rice (Crop stage wise)

S. No	Stage	Insect pests	IPM Measures
1	Nursery	Stem borer, gall midge, thrips, root knot nematode, root nematode and white tip nematode	Apply carbofuran 3G @ kg/ ha or phorate 10 G @ 12.5 kg/ha or fipnoril 0.3 G @ 33 kg/ ha of nursery, 5 to 7 days before pulling the seedlings for transplanting In stem borer endemic areas, install pheromone traps with 5 mg lure @ 8 traps/ ha for pest monitoring
2	Planting to panicle initiation stage	Stem borer	Clipping of leaf tips of the seed lings at the time of transplantation will help in destruction of egg masses of stem borer Removal of excess nursery and incorporation into soil Clean cultivation and destruction of stubbles Apply cartap 4 G @ 25 kg / ha or rynaxypyr 0.4 G @ 10 kg / ha or carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipnoril 0.3 G @ 25

			kg / ha or spray cartap hydrochloride 50 WP/SP @ 1000 g / ha or spray cartap hydrochloride 50 WP/SP @ 1000g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chlorpyriphos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha Install pheromone traps with 5 mg lure @ 8 traps / ha for pest monitoring or 20 traps / ha for direct control through mass trapping Inundative release of egg parasitoid, trichogramma japonicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting
3		Gall midge	Growing of resistant varieties as mentioned in table 1 depending on the prevailing biotype in a particular location Apply carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipronil 0.3 kg / ha
4		Leaf folder	Spray cartap hydrochloride 50 WP / SP @ 1000 g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha Inundative release of egg parasitoid, trichogramma japonicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting
5		Hispa	Spray triazophos 40 EC @ 400 ml / ha or quinalphos 25 EC @ 1200 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha or monocrotophos 36 WSC @ 850 ml / ha
6		Whorl maggot	Apply carbofuran 3 G @ 25 kg / ha or Fipronil 0.3 G @ 25 kg / ha or spray monocrotophos 36 WSC @ 850 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha

7		Case worm	Drain water from the field and spray monocrotophos 36 WSC @ 850 ml / ha or quinalphos 25 EC @ 1200 ml / ha or Carbaryl 50 WP @ 900 g / ha
8	Panicle initiation to booting	Stem borer	Spray cartap hydrochloride 50 WP / SP @ 1000 g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or acephate 75 SP @ 950 g / ha
9		Brown plant hopper, white backed plant hopper, Green leaf hopper	Spray buprofezin 20 SC @ 1000 ml / ha or dinotefuran 20 SG @ 200 g / ha or imidacloprid 200 SL @ 125 ml / ha or thiamethoxam 25 WG @ 100 g / ha or clothianidin 50 WDG @ 30 g / ha or ethofenprox 10 EC @ 500 ml / ha or acephate 50 WP @ 750 g / ha or monocrotophos 36 WSC @ 850 ml / ha or BPMC 5- EC @ 600 ml / ha. Repeat application if hopper population persists beyond a week after application If 2 to 3 applications are needed, alternate the recommended insecticides Do not use the same insecticide repeatedly Note: While spraying, nozzle should be directed at basal portion of the plants. Application should be done preferably with powder sprayer that too during evening hours
10		Cut worm	Spray thoroughly with chloropyriphos 20 EC @ 2500 ml / ha or dichlorvos 100 EC @ 600 ml / ha or endosulfan 35 EC @ 1500 ml / haor monocrotophos 36 EC 1500 ml / ha or acephate 50 WP @ 1200 g / ha or Fipronil 5 SC @ 1000 ml / ha during afternoon hours.
11		Gundhi bug	Spray monocrotophos 36 WSC @ 1500 ml / ha or carbaryl 50 WP @ 1500 g / ha during afternoon hours.

			Dust malathion or carbaryl @ 30 kg of the formulation / ha

WG = Water soluble granules, WDG = Water dispersible granules, EC = Emulsifiable concentrate, WP = Wettable powder, WSC = Water soluble concentrate, G = Granules to be broadcast in standing water

4.2.8.1 General Guidelines to be followed in Rice IPM

- Use disease and insect free pure seeds
- Pay more attention to nursery protection
- Ensure timely planting and crop protection during early growth stage
- Maintain field sanitation and adopt clean cultivation
- Provide alleys (30cm width) every 3 meters in the main field
- Apply nitrogen fertilizer in splits (3 – 4 times or adjust when conditions warrant)
- Monitor pest incidence through survey and surveillance program
- Encourage biological control through need based pesticide application
- While applying chemicals, maintain constantly the recommended quantity of pesticide per hectare
- At flowering stage, dust or spray only during afternoon / evening hours. For effective control of brown planthopper and whitebacked planthopper, direct spray or duct towards the basal portion of the plants
- Water depth should not be more than 5.0 cm at the time of granular application and water should be kept impounded 3 to 4 days
- Mix emulsifiable concentrates, wettable powders, water soluble granules and water dispersable granules separately in water and add to the sprayer
- If rainfall occurs within 3 hours after spraying, repeat the spray

Use only recommended dose of pesticide. Use spray fluid volume depending on the stage of the crop, which is as follows:

For high volume spray (hand compression sprayer)

For Nursery	500 to 600 litres / ha
Upto 30 days after planting	200 to 300 litres / ha
Upto 50 days after planting	500 to 600 litres / ha
50 days and beyond	700 to 800 litres / ha

For low volume spray (Powder spray)

30 days after planting	90 litres / ha
40 days after planting	120 litres / ha
60 days after planting	180 litres / ha

Table 4.6 List of varieties resistant to important insect pests of rice

S. No	Insect pests	Released varieties
1	Gall midge	Sneha, Pothana, Kakatiya Erramallelu, Kavya, Rajendradhan 202, Karna, Ruchi, Samridhi, Usha, Asha, MDU 3, Bhuban, Samalei, Orugallu, Abhaya, Shakti, Suraksha, Daya, Pratap, Udaya, IR 36, Shaktiman, Tara, Kshira, Sarasa, Neela, Lalat, Phalguna, Mahaveer, Vibhava, Divya, Dhanya Lakshmi, Surekha, Vikram, Kunti, Triguna, Sita, Samleswari, Karma Mahsuri, Dhanarasi, Mahamaya, Jyothi
2	Brown Plant hopper	Chaitanya, Krishnaveni, Vajram, Pratibha, Makom, Pavizham, Manasarovar, Co-42, Chandana, Nagarjuna, Sonasali, Rasmi, Jyothi, Bhadra, Neela Annanga, Daya, Aruna, Kanaka, Remya, Bharatidasan, Karthika, Vijeta, Cotton dora sannalu, KRH2, PA6201, Hybrid 6129, ADT37
3	White backed hopper	Haryana Basmati, HKR120, Laatha, Narendra 2002, Jitendra, Satyaranjan
4	Green leaf hopper	Vikramarya, Lalat, Khaira, Nidhi, GR12, GR103, Birsa dhan 108, Birsa dhan 104, Prakash, CoRH1

4.2.9 Safety during Construction

An increase in construction activity of balancing reservoir, the number of major accidents during construction stage may occur and created construction related hazards for persons working on the project. The degree of safety achieved in project constructions has a direct bearing on the amount of effort expanded to avoid accidents by those who control the conditions and practices on the project. In order to avoid accidents it should be the overall responsibility of the project authorities to provide measures for the safety of all persons working on the projects. The standards laid down for the safety aspects should be taken during construction work. Construction activities at the site need to take care of safety aspect for all the activities in general and for following critical activities in particular:

- Storage, handling, transportation, and operation of explosives required for blasting activities

- Underground construction work including formation of bund, excavation, and other related activities
- Construction at heights
- Fire safety aspects
- Cross drainage construction work
- Storage, handling, detection, and safety measures for gases, chemicals and flammable liquids
- Movement of vehicles on construction site

All persons need to be made aware of the dangerous conditions and risks involved in their activities. They should be trained to take necessary precautions for their own safety as well as that of others working at site. This should typically involve following the Safe Operating Procedure (SOP) wherever applicable, use of Personal Protective Equipment (PPE) such as helmets, gloves, gum boots, safety harness, etc., remain active and alert without any influence of alcohol or other intoxicating substances during working hours. The safety requirement generally vary according to the type of structure, type of construction methodology, type of strata encountered and number of men and type of machinery deployed at site, therefore, it is important to develop site specific construction safety procedures. Such SOPs need to be incorporated in letter and spirit and all the staff involved need to be sensitized to the importance of safety and trained. A full time safety manager, will be appointed by the project developer with duties of monitoring and audit delegated to other staff members on safety aspects. Apart from procuring the appropriate and adequate number of PPEs it is also important to maintain sufficient number of first aid boxes and some volunteer strained in giving first aid treatment. Further, the outsiders coming to site such as drivers, helpers, etc. also need to be made aware of safety requirement of their activity. This can be achieved by putting posters carrying safety instructions for the benefit of all and giving verbal instructions at the entry point also.

Under this environmental management plan necessary mitigation measures along with a broad cost (indicative) and institutional mechanism for mitigating the impacts has been listed below. The implementation of all the management measures suggested should commence concurrent to project execution, so that all the environmental concerns going to arise may be resolved before the project is commissioned.

S. No.	Environmental issue	Mitigation measures	Responsible agencies execution	Responsible agencies monitoring
Pre-construction stage/Phase				
1	Tree cutting throughout the project area	Relocation / realignment if convenient, to avoid felling of trees.	Contractor	Water resource department
		Required permission from the nodal agency like Forest Department to be obtained by the contractor, if required.		
		Disposal of the trees to be done in a safe manner, in consultation with SE / EE.		
		Plantation of a new tree in at least equal number as no. of trees fell		
2.	Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction to comply with the relevant local norms.	Contractor	Water resource department
		Any discharge standards promulgated under SPCB will be strictly adhered to.		
		Noise limits for construction equipments not to exceed 75 dB (A), measured at one meter from the edge of the equipment in free area.		
3	Disposal of excavation debris and surplus earth, if any	Contractor will make all efforts to use excess earth generated due to excavation. However, if additional soil is required for filling it will be done by excavation from borrow areas. Contractor to identify area for disposal of surplus earth and borrow area for filling and will obtain approval of Executive Engineer before commencement of work.	Contractor	Water resource department
4	Location of disposal site	Location of disposal site will be finalized prior to commencement of the excavation on any section of the project location. Executive Engineer is to approve the disposal site.	Contractor	Water resource department

Construction stage/phase				
5	Planning for Traffic Diversions and inconvenience to neighbourhood	The site control plans shall contain details of temporary diversions, details of arrangements. Public would be informed through signboards. The Contractor will ensure that the diversion/ detour is always maintained in running condition to avoid concerned disruption. The contractor will also inform of changes. The contractor will take all necessary measures for the safety of traffic as well as passage during construction work. However, as the scales of activities are low, highly significant inputs may not occur. The contractor will ensure that all signs, barricades, pavement markings are provided.	Contractor	Water resource department
6	Transporting Construction Materials and Haul Road Management	All vehicles delivering construction materials to the site are to be covered to avoid spillage of materials thus preventing pollution of environment. Contractor is to arrange for regular water sprinkling at least twice a day (i.e., morning, and evening) for dust suppression of the construction sites and unpaved site roads.	Contractor	Water Resource Department
7	Construction water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs and without unbalancing water supply. The contractor will take all precaution to minimize the wastage of water in the construction process.	Contractor	Water Resource Department
8	Emission from Construction	Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained	Contractor	Water Resource Department

	Vehicles, Equipment and Machineries	and confirm that pollution emission levels comply with the relevant requirements of APPCB. The Executive Engineer will be required to inspect regularly to ensure the compliance.		
9	Noise Pollution: Noise from Vehicles, Plants and Equipments	The Contractor will conform the following: All plants and equipment used in construction shall strictly conform to any PCB noise standards. All vehicles and equipment used in construction will be fitted with exhaust silencers and comply with prevailing standards. Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.	Contractor	Water Resource Department
10	Personal Safety Measures for Labour	Contractor will provide: Protective footwear, and gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc. Welder's protective eye-shields to workers who are engaged in welding works Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. -The contractor will strictly follow the statutory child labour act.	Contractor	Water Resource Department

		The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. Contractor will provide facemasks for use to the workers when paint is applied in the form of spray.		
11	Precautionary / Safety Measures during Construction	The contractor will comply with all the precautions as required for the safety of the workmen as per the "Construction Workers (regulation of employment and conditions of service) Act 1996" as far as those are applicable to this contract. The contractor will make sure that during the construction work: All relevant provisions of local laws of the land will be adhered to. Adequate safety measures for workers during handling of materials at site will be taken up. The contractor will comply with good practices regarding safe scaffolding, ladders, working platforms, gangway etc. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.	Contractor	Water Resource Department
12	Risk from Electrical Equipment	The contractor will comply the relevant electrical safety legislations. The Contractor will take adequate precautions to prevent danger from electrical equipment.	Contractor	Water Resource Department

		All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant state codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Executive Engineer.		
13	First Aid	The contractor will arrange for A readily available first aid kit including an adequate supply of sterilized dressing materials and appliances as per local guidelines at every workplace -Suitable transport to take injured or sick person(s) to the nearest hospital.	Contractor	Water Resource Department
14	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/ safety signs, hoardings written in at least Telegu and English wherever required or as suggested by the Executive Engineer.	Contractor	Water Resource Department

List of BIS standards related to safety aspects during various stages of construction, installation, erection of different components and appurtenance of river valley projects, including inspection, observation given in the Table 4.7.

Table 4.7 List of BIS standards related to safety aspects

S.No.	Code Number	Title
1	IS 10386 (Part 1):1983	Safety code for construction, operation and maintenance of river valley projects: Part 1 General aspects
2	IS 10386 (Part 2):1982	Safety code for construction, operation and maintenance of river valley projects: Part 2 Amenities, protective clothing and equipment
3	IS 10386 (Part3):1992	Safety code for construction, operation and maintenance of river valley projects Part 3 Plant & machinery
4	IS 10386 (Part 4):1992	Safety code for construction, operation and maintenance of river valley projects Part 4 Handling, transportation and storage of explosives
5	IS 10386 (Part 5):1992	Safety code for construction, operation and maintenance of river valley

4.2.10 Impact on Increased Traffic

Increased use of existing public infrastructure i.e., road due to vehicular traffic involved in transportation of construction materials and earthmovers may cause congestion on roads. However, the state highway and the national highways in the district in general have been designed keeping in view the futuristic vehicular traffic. At present the level of convenience on the basis of traffic volume is “B” which shall not alter due to increased traffic on highways. However, due to increased traffic the impact shall be prominent on the village road (rural) and the level of confidence shall change from “A” to “B”. The increased traffic shall cause more fugitive dust emission and gaseous pollution, which when added to the existing concentration the resultant concentration shall be within the limits. Regular maintenance of road and copious sprinkling of water shall be carried. Transport trucks/tippers shall be properly maintained. Only PUC certificate issued vehicles shall be used. Avoiding of overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it. Strict compliance of traffic rules and regulations shall be ensured. The movement of trucks/trippers/tractors for loading /transportation within the project area and haul road area shall be regulated by a trained supervisor who shall be responsible for the safety of vehicle movement and prevention of accidents or incidents associated with the vehicular movement.

4.2.11 Impact of Blasting

Blasting is accompanied by the generation of the dust and the fumes and fly rock which pose a significant danger to the people who are in the vicinity of the work site. It also leads to ground vibrations which cause the ground to vibrate in transverse, longitudinal and the vertical direction leading to its damage. Due to blasting the people of the nearby villages are always physiologically impacted as they are constantly under apprehension of damage to their structures. Blasting also causes air overpressure is a transient impulse that travels through the atmosphere. Much of the air overpressure produced by blasting has a frequency below the audible limit of 20 Hz. Air overpressure, both audible and inaudible, can cause a structure to vibrate in much the same way as ground vibrations It is a frequent cause of the complaints as a person senses air overpressure more than vibrations. The noise due to air over pressure is instantaneous a short lived and may cause annoyance to vulnerable people

Blasting shall have adverse impact on fauna using the area contiguous with the surrounding habitation area as habitat. The noise generation has an adverse impact on terrestrial fauna and avi-fauna. Intervention in the project area will impact butterflies and birds which are quite sensitive to noise and human presence. The traffic noise has detrimental effect on the survival rates and breeding success of such fauna which reside in the small habitats along road side communicating using acoustic signals. Sometime as a result of habitat loss and physical disturbance, the fauna shall move from the habitat along road side. Based on the field observations and interaction with local people and forest officials it was noted that the project area does not constitute part of any wildlife migratory routes and mining activities won't affect animal movement.

Mitigation measures

Various measures have been recommended to minimize the adverse impacts due to blasting:

- Proper design & development of blast hole.
- Use of non-electric system of blasting for true bottom hole initiation.
- Use of muffling mats to arrest the dust and fly rock.

Blasting for excavation is permitted only after securing the approval of the authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting is fixed by the authority.

4.2.12 Amenities for Workers and PPEs

Provisions shall be made for the housing of construction labour with all necessary infrastructure and facilities such as mobile toilets, mobile safe drinking water, medical health care, crèche

etc. The housing may be in the form of temporary structure to be removed after completion of the period.

The contractor will make proper arrangements for maintaining high hygienic conditions in the colonies and labour camp, by providing good sanitation and drinking water facilities. Medicine should be distributed free of cost to the labour when required.

For ensuring workers safety and mitigation of impacts of air and noise pollution on workers directly exposed, provisions of Personal Protective Equipment (PPE) will be made. These will include helmets, welding shields, earmuffs, dust masks, safety harness for working at heights, gum boots, etc. In addition, fire extinguishers shall be installed at all critical locations on site during construction.

To ensure occupation health and safety of workers, annual occupation health check of all workers is proposed and budgeted.

4.2.13 Public Health and Allied Facilities

4.2.13.1 Public health

Project construction may bring about some changes in the socio-economic environment of the area including increased threats to the health of the community. Possible threats to public health are briefly discussed below along with the management measures.

- Chances of spread of new diseases in the area due to migrant workers.
- Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase are expected mainly for the labour.
- Chances of occurrence of gastroenteritis, cholera, and typhoid in the labour camp.
- Possibility of some site accidents cannot be ruled out and therefore, use of PPEs should be strictly followed and provisions should be made for emergency medication and ambulance
- Worker's health and hygiene issues need to be addressed to minimize the impact on this count especially for female workers with/without children.

4.2.13.2 Medical facilities

Following medical facility will be provided in the project area to combat water and vector borne diseases and also at construction site to ensure safety and health of workers during the entire construction phase:

One fully equipped ambulance needs to be procured to provide prehospital care to accident victims during construction phase. The ambulance should always be stationed near major construction site where risky operations are taking place.

Provisions have been made for strengthening existing PHCs and PHSCs in the area.

Provisions have been made to assist health department to combat outbreak of water/vector borne diseases.

4.2.13.3 Health extension activities

The health extension activities will have to be carried out in the villages situated within the study area. It is important to inculcate hygienic habits of environmental sanitation especially with respect to water pollution by domestic wastes.

A medico will be engaged to make regular visits to these villages and organize health promotional activities with the active participation of the local village leaders, NGO's and available local health functionaries. The health functionaries would undertake the following tasks as a part of health promotional activities:

Organize awareness programs and medical camps to make people aware about common diseases and communicable diseases like Covid-19, Tuberculosis etc. in the region. This should include poster campaign, awareness camps, medical camps for health check-ups and vaccination/ treatment, etc.

Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency. Close interaction to be maintained with health department functionaries of the state government.

In case of verifiable health problem arising due to activities of the project, necessary health care facilities shall be provided.

4.2.14 Energy Conservation Measures

Energy Conservation Measure (ECM) are to be planned and implemented during construction phase either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count. These measures can affect a variety of resources mainly forest, from negative impact of fuel wood collection by stakeholders as well as by labors during construction period. To mitigate such impacts, feasible measures will be adopted to help minimize pressure on forest.

4.2.14.1 Community kitchen

The project developer would make sufficient arrangement for the establishment of at a community kitchen. This will be established near the project labour colony. The kitchen should provide food to the labour at subsidized rates. The facility should maintain proper hygiene while preparing and supplying food, with adequate arrangement for waste collection and disposal. In addition, two canteens are also proposed for labour near major construction sites to provide tea/snacks at subsidized rates.

4.2.14.2 Kitchen fuel

During the construction period of the project, many families may prefer cooking on their own instead of using community kitchen. The project authority should make LPG and/or kerosene available to these migrant workers. The supply of LPG and kerosene can be ensured on regular basis at subsidized rates.

4.2.14.3 Efficient cooking facilities

Project authority should also take measures for reducing the fuel consumption. The authority should provide pressure cookers and solar cookers to the families of migrant workers as well to local villagers. Accordingly, budget has been allocated for the supply of cookers. This facility will also increase the work efficiency of migrant workers and they will also get proper daily diet.

4.2.14.4 Solar Lantern

Provision of solar lantern has also been made in the project budget and these will be distributed free of cost to labor camps and villagers for use.

Awareness Programmes on Energy Conservation

Special awareness programmes against tree cutting should be held, which should concentrate on the awareness of labor families on environment conservation and sustainable development for the future generations. Thus, issues like saving trees, electricity and water should be covered in such programmes.

4.2.15 Biodiversity Conservation

The main objective of Biodiversity Conservation and Management plan is sustainable use of natural resources, which involves scientific management of natural wealth vis-à-vis developmental activities, is likely to affect these resources. The threats to natural terrestrial and aquatic ecosystem generally arise due to by anthropogenic activities that may arise because of

construction and associated activities of project. A detailed biodiversity conservation and management plan has been proposed and the main objectives of said plan are as follows:

- Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities
- Conservation and preservation of natural habitats in catchment area
- Mitigation and control of project area by taking up afforestation and soil conservation measures
- Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing man animal conflict.

4.2.16 Green Belt Development Plan

Although the vegetation loss due to various project appurtenances will be compensated as a part of compensatory afforestation. However in addition to above, greenbelt around the perimeter of various project appurtenances, selected stretches along the periphery of canals, etc. was developed by Water Resource Department. Saplings of 5000 numbers in 2022-23 financial year and 1000 in 2023-2024 financial year will be developed around the canals, bund areas and quarry sites.

The general consideration involved while developing the greenbelt are:

- Local/nature trees growing upto 10 m or above in height with perennial foliage will be planted around various appurtenances of the proposed project.
- Planting of trees shall be undertaken in appropriate encircling rows around the project site.
- Generally fast growing trees will be planted
- Since, the tree trunk area is normally devoid of foliage upto a height of 3 m, it may be useful to have shrubbery in front of the trees so as to give coverage to this portion.
- The plantation will be at a spacing of 2.5 * 2.5 m. About 5000 trees per hectare will be planted. The project proponents in association with the State Government will also do the plantation and maintenance of the plantation area.

4.2.17 Land Restoration and Landscaping Plan

During construction phase of the project, number of temporary construction sites and working areas will come up. To restore these areas to its original landscape as much as possible and retain its aesthetic values following restoration measures have been suggested.

Different project related activities will require acquisition of government as well as private land. In addition to the habitat disturbance, project related activities will also result in the accumulation of large amounts of temporary dumps at various construction sites, which need to be either relocated or as an alternative can be utilized for landscaping. After completion of the construction work, these areas are required to be restored to their original condition. Various engineering and biological measures have been suggested for the restoration of proposed project affected areas. Following measures would be adopted at for the rehabilitation and landscaping of colony areas and construction sites.

- On completion of construction area will be restored by proper leveling
- Retaining walls will be built to avoid the landslides and slips. Slopes will be covered with geotextiles. The open area will be covered with the vegetation. Ornamental plants and trees will be planted in rows along the roads and lanes, as discussed under green belt.

4.3 EMP DURING VARIOUS PROJECT PHASES

Based on the evaluation of impacts and baseline conditions, an Environmental Management Plan (EMP) has been delineated to mitigate the adverse impacts. The EMP includes formulation, implementation and monitoring of environmental protection measures. The EMP features guidelines and methodologies to be adopted at different stages of the project for mitigating the impacts of various activities. The EMP is herein outlined after taking into account the various Acts, Rules and Regulations/Standards concerned with the environmental management. Thus, it is a planned and integrated programme aimed at ensuring that both identified and unidentified impacts that may arise during the various phases of the project are brought to an acceptable level. EMP has been prepared addressing the issues like:

- Pollution control/mitigation measures for abatement of the undesirable impacts caused during the construction and operation phase of the project.
- Details of management plans (air pollution control devices/measures, utilization of treated sewage, solid waste management plan etc.)
- Institutional set up identified/recommended for implementation of the EMP.
- Post project environmental monitoring programme to be undertaken
- Expenditures for environmental protection measures and budget for EMP.

4.3.1 Cost for implementing Environmental Management Plan

The summary of cost estimate of various environment management plans as contained in this report is provided in Table 4.8.

Table 4.8 Cost estimate of various environment management plans

S.No.	Description	Capital Cost (Rs. Lakh)	Annual recurring cost (Rs. Lakh)
1	Energy Conservation Measures	20.0	--
2	Sanitation and Solid Waste Management	10.0	5.0
3	Compensatory Afforestation	50.0	20.0
4	Greenbelt Management Plan	25.0	10.0
5	Muck disposal Management	55.0	--
6	Labour Management Plan	30.0	--
7	Environmental Safeguards during Construction	20.0	5.0
8	Landscaping and Restoration of construction sites	20.0	--
9	Public Health Delivery System (OHS)	25.0	5.0
10	Environmental Monitoring Program	--	7.0
11	Contingencies	--	10.0
	Grand Total	**255**	**62.0**

Capital EMP budget: Rs. 255 Lakhs

Recurring cost per annum: 62.0 lakhs

Chapter 5

RISK AND DISASTER MANAGEMENT PLAN

5.1 RISK ASSESSMENT

During the development and operation of the project, there are a variety of hazards that might disturb regular activities and result in disasters such as fires, mechanical failure, and explosions, to name a few. The imminent threats or risks shall be explored and addressed, as well as a disaster management strategy established with the goal of taking preventative measures to avert disaster and acting after the disaster to minimise damage. Following problems may be encountered during the construction phase at the project site.

- Accidents due to explosives/blasting
- Failure of stripped slope
- Accidents due to HEMM
- Sabotage in case of magazine

The following safety measures will be strictly followed in the current project to address the above hazards/disasters:

- Handling of explosives, charging and blasting shall be carried out by competent persons only.
- Provision of a safe location for the magazine, complete with suitable fencing and the requisite watch and ward. Adequate safety equipment will be provided at magazine and project site.
- Regular maintenance and testing of all project equipment/machinery and transport vehicles as per manufacturers guidelines
- Entry of unauthorized persons will be prohibited.
- Firefighting and first – aid provisions in the project office/complex area and ensuring periodic checking of worthiness of firefighting and first aid provision.
- All individuals working in hazardous areas should receive training and refresher courses.
- As a part of disaster management plan, a rescue team will be formed by imparting specialized training to select project staff.

5.1.1 Possible Hazards

There are various factors which singularly and severally can cause disaster in irrigation project. The project activity is associated with many hazards which are covered in the following sub sections:

5.1.1.1 Blasting

Blasting accidents are mostly manifested as projectiles that occasionally travel beyond the danger zone and invade the project boundary. It is largely due to overcharging of blast holes and also during secondary blasting. During initial and final blasting operations flying rocks are encountered. If the ground vibration induced by blasting is not correctly scaled in the previous blasting cycle, it might result in displacement of adjacent areas and fallout of loose rock-mass. The following measures are suggested to avoid accidents due to blasting:

- All blasting operations shall be supervised by a competent person appointed for the purpose and strictly conducted as per guidelines contained
- Danger zone area falling within a radius of 500m from the blast site shall be demarcated.
- Guards shall be posted at all access points leading to the blast area to prevent and control movement of persons/ stray animal.
- All employees and equipment shall be cleared off the blast area to a safe location prior to any scheduled blasting; and
- Audible signals such as sirens, whistles and mikes etc., shall be used to caution the workers, passer-by about the scheduled blasting events.

5.1.1.2 Heavy machinery

Most of the accidents during transport of dumpers, excavators, dozers and other transport vehicles are often attributed to mechanical failures and human errors and can be significantly averted by adapting to following:

- All HEMM and transport vehicle movement within the project area should be carried out under the direct supervision and control of the management.
- All project machinery and vehicles should be periodically maintained and weekly checked by a competent person authorized by the management.
- During the day/night, a conspicuous sign board should be provided at each and every bend to guide the operators/drivers; and
- To avoid dangers while reversing the trackless vehicles, especially at the embankment and tripping points, all areas for reversing of vehicles should, as far as possible, be made

man free, and should be a light and sound device to indicate reversing of trucks/project machinery.

5.1.1.3 Storage of explosive

The explosive magazine shall be located outside the project area. For the purpose of transportation of explosives, explosive van shall be deployed. Fire and explosion are the most common hazards connected with the storage, transportation, and handling of explosives. The rules as per Indian Explosive Act-1983 and Explosive Rules-2008 should be followed for handling of explosives, which includes transportation, storage and use of explosives.

5.1.1.4 Fuel storage

All project machinery will run on diesel, and it will be stored in the central workshop area of the project.

5.2 DISASTER MANAGEMENT PLAN

Preparation of "Disaster Management Plan" for any construction of reservoir projects is a prerequisite, as catastrophic situation, which is highly unpredictable, may occur any time in the life span of project. To tackle the catastrophic situation development of an effective "DMP" is imperative to establish co-ordination between District Administration and Project Authority. Line/Assisting agencies from district administration side are Fire Services, Police Department, Medical Services, Consumer Affairs and Public Distribution Department, Transport Department, Communication Department, Meteorology Department, Irrigation and Flood Control Department, Civil Defence Forces and Voluntary Organizations. Coordination and close cooperation among all the agencies involved is essential for the timely and successful implementation of "DMP" to provide relief to the affected at the time of need.

5.2.1 Purpose of the Plan

- Basic purpose of this plan is to develop, implement and maintain an integrated emergency management system for protection of people, property and the environment in the event of emergency.
- The ultimate goal is to reduce the project area's vulnerability to emergency situations in order to save lives and protect property. This will be accomplished by developing capabilities to mitigate the effects of, prepare for, respond to, and recover from emergency situations that may affect the project area.

5.2.2 Scope of the Plan

Well-defined role and responsibilities of assisting agencies in "DMP" is required, so that proper planning, according to the intensity of disaster could be made by agencies. The Chief Co-ordinator assesses identification of the event and its intensity in the affected area. He should be authorized to declare "disastrous situation" based on detailed information available, so that assisting agencies swing in action to mobilize their resources in affected area. Based on the intensity of disaster in project a proper relief programme may be implemented by District Administration with the help of assisting/line agencies. This Disaster Management Plan/Emergency Action Plan covers technological emergencies arising out of construction accidents and covers the following:

5.2.2.1 Inundation

The downstream areas vulnerable to inundation by reservoir failure and subsequent floodwater. The selected reservoir failure and corresponding flood for this purpose corresponds to the extreme conditions that yield maximum possible flow storage at the downstream locations. The extreme condition is estimated from various parameters like breach width, minimum time of failure and Manning's coefficient. The inundation map has to be prepared with the help of water surface elevation profile, which has to be computed for maximum flood discharge elevation and at various downstream locations.

Based on the reservoir failure analysis, the flood wave is expected to inundate some low-lying areas in the five km downstream of the reservoir site. This means that very little time would be available for execution of any rescue and/or evacuation plan. Therefore, the Disaster Management Plan has been devised mostly for preventive measures. As a first measure of the management plan it is suggested that surveillance and monitoring schemes be implemented simultaneously with the design and detailed engineering stage of the project. It should continue during the construction phase through impoundment of reservoir, early operation period, and operation and maintenance phases during the life of the reservoir. On the onset of high discharge period on all dates the electricity, public announcement system, power generator backups etc; should be thoroughly checked.

5.2.2.2 Emergency Scenarios

Emergency scenarios arising out of existing project status and that anticipated in the immediate future expressed by the company management personnel and those of the concerned agencies

and the project risks as envisaged with mutual thinking of the company and agency managements.

5.2.3 Disaster Scenarios for the Avulapalli Reservoir

The disaster scenarios are classified into 2 categories:

A. Natural calamities
   i. Flood
   ii. Landslide
   iii. Earthquake

B. Man-made disaster
   i. Fire
   ii. Explosion
   iii. Fire and Explosion

Flood

Flood can occur due to heavy rainfall, Cloud burst to the upstream, and Heavy debris falling into the canal and bathe reservoir from the adjacent hills or hillocks. It results in possible failure of the reservoir. Under such circumstances, there is a possibility of sudden release of huge quantity of water upto a maximum of 2.5 TMC into the downstream of the Avulapalli. Hence, there should be a offsite warning mechanism covering the Somala manadal in case of any such unwanted happens takes place.

Landslide

Compounded by the heavy rainfall and Geo-morphologic habits the landslides of major and minor scale keep occurring during construction phase. Following areas are susceptible to landslides

a) Water conductor systems
b) Hills or hillocks surrounding the reservoir

Geological Survey of India (GSI) is also associated with Water Resource Department, for supervision and advice on tunneling/ road construction and/or any other vulnerable area of construction.

Earthquake

Chittoor District falls in Zone III as shown in Fig 5.1 below. Hence, prompt actions in managing earthquake are important in minimizing its effect. All structures at project site shall be designed with appropriate/internationally accepted safety margins. In

earthquake-prone areas, structural mitigation comprises property seismic retrofits and the securing of things inside a building to improve home seismic safety.

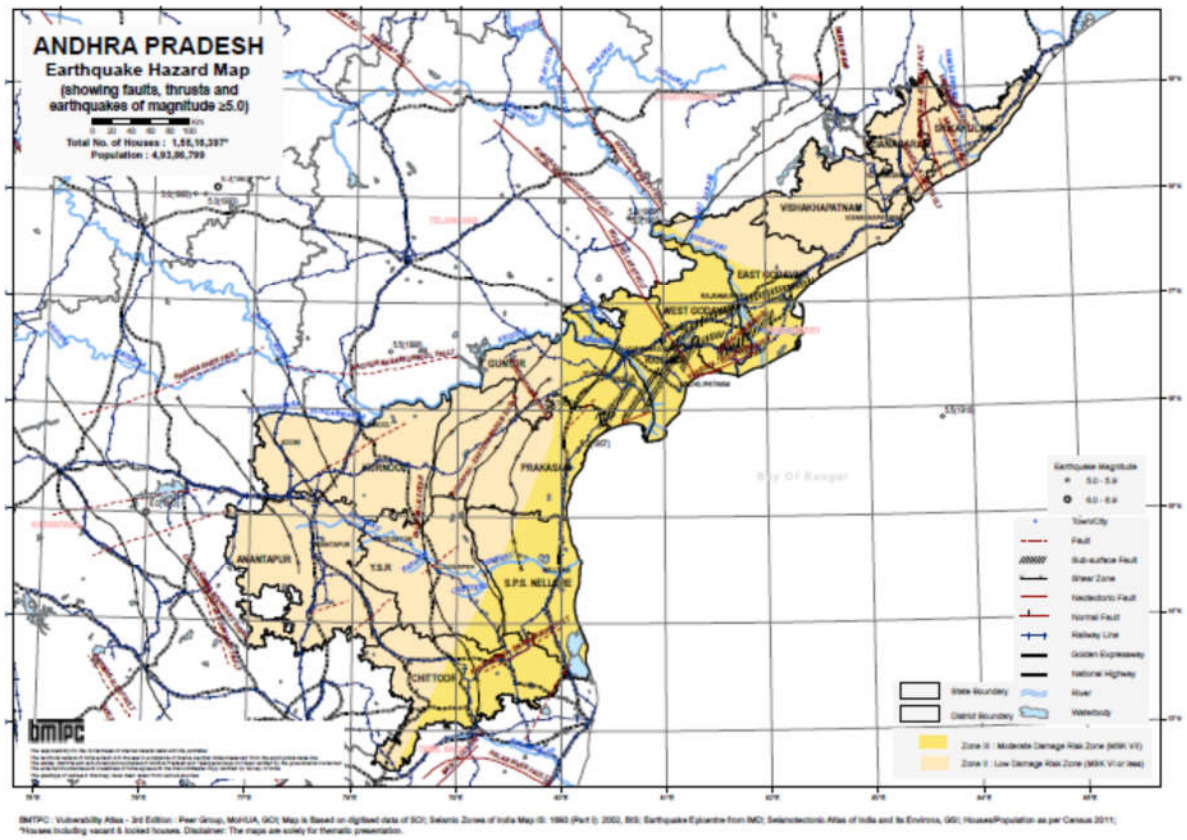


Fig 5.1 Seismic Zones of Andhra Pradesh

Fire and Explosion

Following are the areas where fire or explosion may take place due to improper maintenance or mishandling

a) Transformer and switchgear room area
b) Storages of explosives

Reporting of Incident

Any person (employee of Water Resource Department or contracting agency or Security) who sees the incident shall inform/report to the Emergency Control Centre (ECC) through the nearest office (Water Resource Department, contracting agency/any security point) through telephone/mobile or by shouting.

5.2.4 Communication systems

An efficient downstream warning and communication system is essential for the success of Emergency Preparedness Plan. The population living downstream should be educated about the difference between a high flood and reservoir failure situation. In case of emergencies,

telecommunication plays a critical and crucial role in mitigating the problems faced by people during and after calamity. Any efficient communication system in disaster management should have the following characteristics:

- Reliability
- Ease of maintenance
- Quick deployment
- High tolerance to extreme adverse conditions
- Compatibility on alternative power sources, and
- Fast transportability and easy deployment

5.2.5 Evacuation Plan

The Emergency Action Plan also includes evacuation of people at risk and procedures for implementation are based on the local needs. Generally, the following procedure forms the basis of the plan:

- Demarcation and prioritization of areas to be evacuated
- Notification procedures and evacuation instructions
- Safe routes, transport and traffic control
- Safe areas and shelters, and
- Functions and responsibilities of members of the evacuation team

5.2.6 Key Persons

Following positions of key persons are included project

1. Executive Engineer
2. Dy. Executive Engineer
3. Asst. Executive Engineer
4. Project Executive In charge (from the contracting firm / company)

Project Manager of the site contracting agency assumes the role of IC in case of any emergency. For silent hours (night time or on holidays) the senior security person will handle the emergency with the help of other security personnel till arrival of the seniors.

Chapter 6
ENVIRONMENTAL MONITORING PROGRAM

6.1 INTRODUCTION

Environmental Impacts and mitigation measures are discussed in the previous chapters along with the budget for implementation. To assess the effectiveness of such measures, it is important to monitor environmental parameters on regular basis to take timely corrective and preventive actions as and when required. Environment monitoring program is discussed in the present chapter along with the budgetary estimate for its implementation.

Environmental monitoring provides feedback about the actual environmental impacts of a project after implementation of mitigation and management measures. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. The monitoring program will indicate where changes to procedures or operations are required, in order to reduce impacts on the environment or local population.

6.2 Project Level Monitoring Committee (PLMC)

The effective implementation of the recommendations mentioned in the EMP and monitoring progress should be monitored by the Project Level Monitoring Committee (PLMC). The PLMC will be formed which includes the representative from regional office of MoEF&CC, State Forest Department, District Administration, Environmental experts from Academic Institutions/ State Universities, APPCB, Fisheries department, Project Authorities and NGOs and stakeholders from PAFs/ affected villages. It will start functioning from the date of starting of construction work in the Project and will function until the satisfactory implementation of all the EMPs. At least periodic six monthly monitoring of progress of EMPs will be carried out throughout the construction period. The Committee would also check the level of pollution in air (level of SPM, SOx, NOx), water (chemical and physical parameters), Noise levels and silt load in the rivers etc. as per their requirement.

6.3 Environment Management Cell (EMC)

It has to be proposed to create the Environmental Management Cell (EMC) in the Project as a very strong group dedicated to effective implementation and monitoring of various environmental management plans. This group will also need to have a constant interaction and liaison with all stakeholders and regulatory authorities for smooth implementation of the EMPs.

The Cell would comprise of the officials from Project; however, representatives from Forest/WL Department., District Administration and Project Affected Families/ Villages may also include for their valuable suggestions in the implementation of EMPs. The EMC has been proposed to be formed with the following aims and objectives:-

- Overall planning of environmental management plans in coordination and consultation with concerned State authorities and other stakeholders.
- Coordination with the State Forest & Environment Departments, Fisheries department., etc. with respect to implementation of various plans or programs such as CAT Plan, Biodiversity Management Program, Fisheries Conservation and Management Plan etc.
- Coordination with various departments of the project for effective implementation of the EMPs like Restoration Plan for Quarry sites and Landscaping, Biodiversity Conservation and Management Plan, Rehabilitation & Resettlement and Local Area Development Plan etc.
- Regular monitoring of the statutory provisions of the MoEF&CC, SPCB and other Govt. Agencies
- Regular monitoring of environmental obligations as per Contract Agreement w.r.t. major contracts.
- Data collection from concerned departments and preparation of status report in respect of various ongoing environmental protection measures for the information and appraisal of various regulatory authorities, PLMC and Water resource Department.
- To properly address the queries of stakeholders/ govt. departments regarding EMPs and any other issue pertaining to environmental aspects

6.4 Surface and Ground Water Monitoring

It is proposed to monitor ground water levels at 2 locations in command area twice a year for pre and post monsoon period. In addition, surface water quality will also be monitored at 2 locations twice a year for pre and post monsoon period during the project construction phases i.e. a total of 4 water samples per season for 3 seasons in a year.

6.5 Soil Quality Monitoring

It is proposed to monitor soil quality at 4 locations twice a year for pre and post monsoon period. Parameters proposed to be analyzed shall be; Texture, Porosity, Bulk Density, Water Holding Capacity, pH, Electrical Conductivity, Calcium, Magnesium, Alkalinity, Chloride

Content, Sodium, Organic Carbon, Available Phosphorus, Available Nitrogen, Available Potassium and Salinity.

6.6 Land use/Land cover Monitoring

Land use and land cover needs to be monitored every year for three years during/after commissioning of project using latest high-resolution satellite images.

6.7 Air Quality

Ambient air quality monitoring during construction phase will be carried out as per the requirement of State Pollution Control Board. Three seasons a year monitoring is proposed; spread out near construction sites at four locations during construction phase. The parameters to be monitored are PM10, PM2.5, Sulphur dioxide (SO2) and Nitrogen Oxides (NOx). The frequency of monitoring shall be twice a week for four consecutive weeks at each station for each season.

6.8 Noise

Noise levels from vehicular movement, operation of various construction equipment shall be monitored during construction phase at major construction sites. The frequency of monitoring shall be once in 3 months. A sound level meter will be purchased and monitoring will be carried out inhouse.

6.9 Ecological Monitoring

It is proposed to carry out periodic ecological monitoring in the area to ensure minimum damage to flora and faunal habitat during construction period and also to monitor the implementation of tree plantation. Efficacy of conservation measures implemented under plantation/afforestation and soil conservation measures, and their effects on flora and fauna, survival rate of species planted, and status/ survival rate of bio-engineering and engineering structures for controlling soil erosion which should be evaluated and monitored under the head monitoring of ecosystem. Therefore, once a year monitoring is proposed for 3 years.

6.10 Financial Requirement

Financial requirement has been assessed for above aspects as capital cost is Rs 255 Lakhs and recurring cost is Rs 62.0 Lakhs.

Chapter 7

RESEETLEMENT AND REHABILITATION

7.1 Introduction

The resettlement and rehabilitation plan not only focuses on the mitigation measures of adverse impacts on the project affected families but it also includes measures for community development, local area development, infrastructural development for local population. The implementation of an effective R & R plan is essential. The villages submerged in the Avulapalli Balancing Reservoir have limited accessibility owing to poor road connectivity and poor infrastructural facilities. The present R&R plan is mainly based on the National Policy on Resettlement & Rehabilitation of 2013 and model R&R plan of proposed project, which has been put forward to government of Andhra Pradesh. The R&R plan includes relief packages as per G.O. RT. No. 323 dated 24.06.2020 which has been issued to similar projects in Andhra Pradesh which can be applicable to this project as a comprehensive social development plan for the project affected families.

7.2 Land requirement

The total land requirements for the various components of the proposed project have been estimated about 1300 Acres comprising of 612 Acres of private land, 688 Acres of government land. The breakup of the land requirement for the different project components has been given in Table 7.1.

Table 7.1 Component wise breakup of land required for construction of Avulapalli balancing Reservoir

S.No.	Project Component/ Description	Area(Ha)/type of land			Total Land in acres
		Forest Land	Revenue/ Private Land in acres	State land/ Govt. Land in acres	
1	Avulapalli balancing Reservoir	No	612	688	1300
Allocation of Land Acquisition grant is Rs.58.830 Cr					

7.3 Project affected Villages

The table 7.2 shows the details regarding the displacement of families and population and land acquisition from the project affected villages. A total of 03 Revenue villages are going to be affected directly or indirectly by the construction of project. These three revenue villages are

Ramakrishnapuram, Baireddypalli and Devarlakuppam. The 03 settlements consisting of 170 households are going to be affected out of which 08 households with a population of 08 persons belonging to schedule tribe community are going to be displaced (Table 2). Total 170 households will be displaced by the proposed dam related activities.

Table 7.2 Submergence4 details of Avulapalli Balancing Reservoir

S.No.	Name of the Villages submergence within the Foreshore area	No of dwellings submerging in foreshore					Number of people		
		SC	ST	OBC	OC	Total	OBC/OC	ST	Total
1	Ramakrishnapuram	-	-	28	40	68	471	08	495
2	Baireddypalli	-	-	28	29	57			
3	Devarlakuppam	-	08	18	19	45			
Total						170			

Source: DPR

7.4 Submergence details

The table 7.3 shows the details regarding the submergence area contour levels and Table 7.4 submergence of villages, village wise area in the proposed balancing reservoir. The proposed project does not involve the submergence of any monuments, archaeological sites but temple, school and cattle sheds are involved in submergence.

Table 7.3 Submerging area elevation in Avulapalli Balancing Reservoir

S.No.	Name of the Village	Lowest level	Highest level
1	Devarlakuppam	+642 m	+651 m
2	Baireddypalli	+637 m	+641 m
3	Ramakrsihnapuram	+ 636 m	+643 m

Table 7.4 Village wise submergence of the area (Ha)

S.No	Name of the Village	Area (Ha)
1	Ramkrishnapuram	3.811
2	Baiyareddypalli	5.326
3	Devulakuppam	1.280
Allocation of R&R grant is Rs. 25.88 Cr		

7.5 Resettlement Action Plan

The project proponent has prepared the R&R benefits & plan for Project Affected Families (PAF) as per the "Right to fair compensation and Transparency in Land acquisition, under Rehabilitation & Resettlement Act, 2013". This activity has been completed with focus group discussions and extensive interaction with the local people. Construction of the project will require acquisition of land from the villages located along the project alignment. As per the R&R study carried out for the project, a total of 170 households (PAHs) and 495 persons (PAPs) will be affected by the project. The Report on Resettlement Action Plan (RAP) has been submitted. The document has been examined jointly by Department of Revenue and Department of water resources, Govt. of Andhra Pradesh for this approval has been initiated, the Cost on this account had been incorporated in the Project Costing accordingly Govt of Andhra Pradesh sanctioned for an amount of Rs. 84,11,84,000.,(Eighty four Crores eleven Lakhs and eighty four thousand only) towards Provision for Land Acquisition and R&R.

7.6 Resettlement and Rehabilitation Package

The details of displacement of human settlements and population, livestock and other household assets have been obtained through the field survey whereas the details of land acquisition in different project affected villages have been obtained from the concerned Tehsildar. Necessary consultations were held with the revenue officials, documents regarding land acquisition were obtained, and the data from these documents have been used for preparation of the Resettlement and Rehabilitation plan.

As stated above, the R&R policy adopted for this project is based on the National Policy on Rehabilitation & Resettlement Act, 2013. However, the definitions of various terms referred to in the plan for the purpose of relief, rehabilitation and or resettlement are based on the issued G.O. Rt No. 641dated 14.09.2016 existing norms by the state of Andhra Pradesh for such projects.

7.7 Breakup of the R & R Package

Compensation against

i) Land: Government Land allotted for house plots.

ii) Structures such as buildings etc:

Permanent: 162

Temporary: 08

Type of structures: Concrete structure

Type of valuation

GOVT : 20 Cr

PVT : 23 Cr

School : 30 Lakhs (Not in use)

Temples etc: 50 Lakhs

Cattle shed : 50 Lakhs

Land less grant

Grant for seed and fertilisers : No

BPL families grant : No

Grant for organisations self-employed : No

Grant for construction of cattle shed : No

Transportation grant : No

Rehabilitation grant : As per G.O.Rt.No.641 Dated:14.09.2016

Subsistence grant : No

Annuity policy : No

Marriage grant : No

Tribal grant : No

Fishing rights : Fisheries Department.

Stamp duty and registration charges : No

R & R Colony : No

Compensatory grant disbursement package monitoring Authorities: Joint Collector, Chittoor

Chapter 8
PROJECT BENEFITS

The Water Resources Department, Govt. of Andhra Pradesh proposed the project to provide drinking water to the around 2.71 lakh people and irrigation water facility to irrigate 9700 ha of cultivable land of Chittoor districts of Andhra Pradesh. It brings in long-term relief to the people and the livestock during the times of drought when even drinking water is scare. The people of en-route up land villages along the alignment 4 no. of mandals in Chittoor District will get benefit on the considerable increase in availability of water for drinking and other domestic activities, growth and yield of crops due to supplement of water for irrigation. It may generate livelihood opportunities and will increase the socio-economic status of the people. In the present project, the total ayacut proposed to be covered is 9700 ha in the region based on the water inflows during flood days received in Gandikota Reservoir. The proposed project is to construct the Balancing Reservoir to store the water that received from Punganur Branch Canal. It generates work to the people in the project area during construction phase. The project will help in combating the impact of climate change on water sector in the region, as it is part of adaptation plan and reduction of climate change impact.

The possible benefits due to the construction of Avulapalli Balancing Reservoir are:

- ✓ there will be considerable increase in Ground water levels in upland areas of Chittoor district due to the supply of water to the cultivable lands.
- ✓ Protection and improvement of the overall ecological environment.
- ✓ Improvement in quality of life of people by ensuring availability of organized and flexible schemes and plans for implementing short- term and long-term water supply infrastructure improvements suitable for future development within each uncovered area.
- ✓ Opportunities for improvements in institutional and organizational capacity for sustainable solutions, with possible full cost recovery and coordination among various institutions for cost-effective capital improvements and operation and maintenance activities.
- ✓ With this proposed project, standing horticulture crops like Mango, Sweet Orange, Pomegranate etc. will be protected in drought conditions there by earning profits instead of incurring loss to the farmers. This in turn generates currency to the govt exchequer.

- ✓ With this project, more ayacut will be brought in to cultivation of horticulture crops instead of regular agriculture crops.
- ✓ The proposed project will helpful to establish industrial infrastructure, ancillary industries, processing units, Agro Product industries, Fisheries, Dairy farms etc. in future.
- ✓ The Prestigious Chennai - Bengaluru Industrial Corridor Project which is taken up by the Govt. of India runs through Chittoor, Palamaneru in Chittoor District which is proximity to this proposed project area and water needs to this project will be supplied with this scheme.
- ✓ Improved crop productivity (Crop output per unit water- more crop per drop) Improve the overall GDP of the state.
- ✓ This will reduce the labour migration and improve employment to locals. Positive impact on poverty reduction through increased productivity and increased employment opportunities.
- ✓ This project will enable availability of safe drinking water to the people. This will improve the quality of life and increase the availability of productive time, which can be spent to improve the earnings of the individuals.
- ✓ Improved water resources planning and management for overall economic development. Enhanced ability of farmers to afford better education to their children, build better homes, afford better healthcare, and provide better living conditions to their family.
- ✓ With this proposed project, supplying of water to the ayacut in time and for the required period will enhance the output enormously. It will generate revenue to the farmer rather than incurring heavy loss & debts that occur due to investment before and during the cultivation process of crops.
- ✓ With this project, living standards, social standards, economic standards of people will be improved and upliftment of distressed due to lack of water for irrigation and drinking purposes.
- ✓ The proposed project is intend to create drinking water to more than 2.7 lakh population and irrigation facilities in the command region to feed 9700 ha of ayacut of the region The area of ayacut Mandal wise given in the Table 7.1.

Table 8.1 Mandal wise ayacut details

S.No	Name of the Mandal	Area (Ha)
1	Somala	3981.200
2	Sodum	4645.200
3	Pulicherla	329.600
4	Piler	744.000

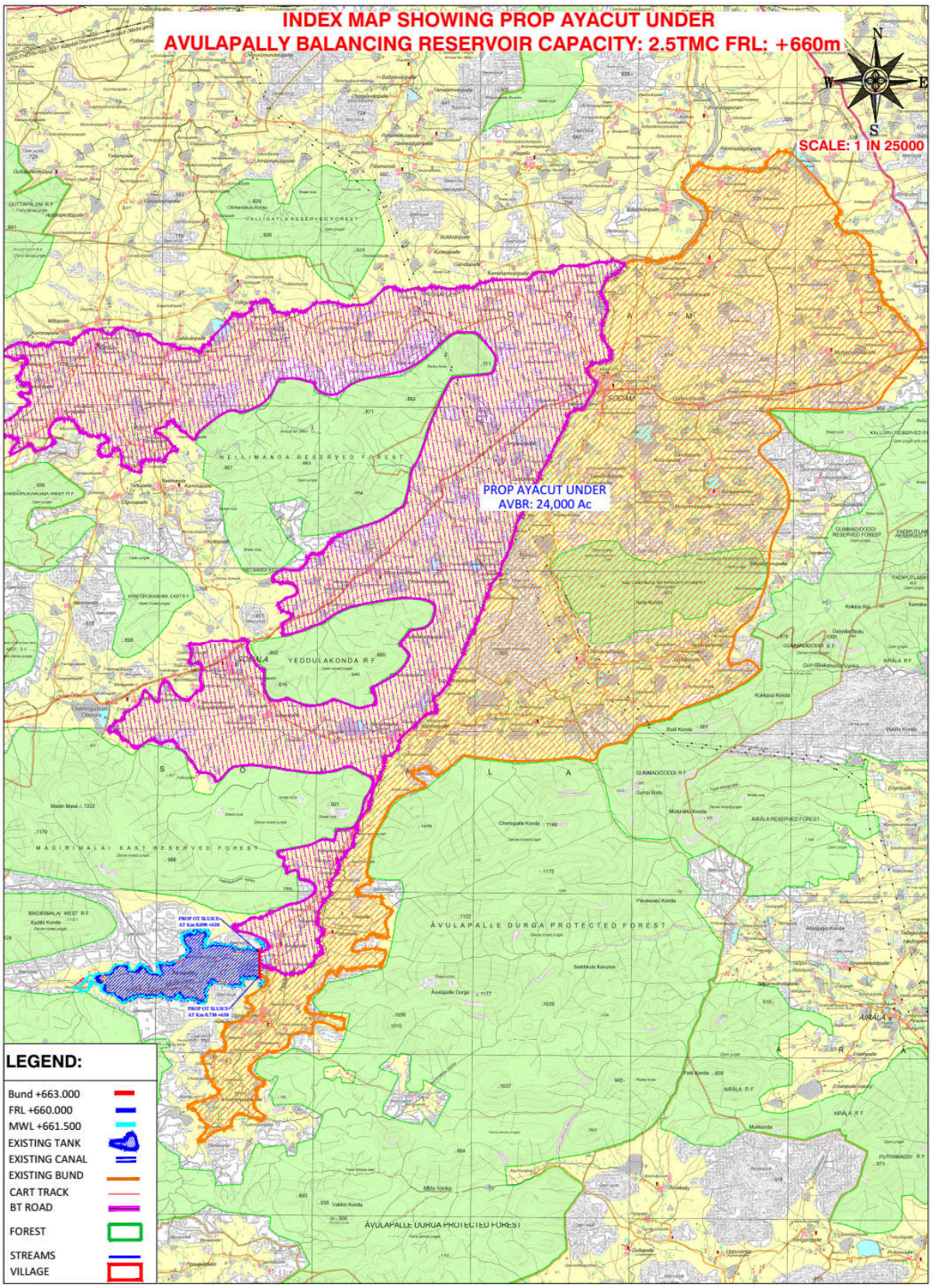


Fig 8.1 Map showing the ayacut under Avulapalli Balancing Reservoir

GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Water Resources Department –"(1) Formation of balancing reservoir near Mudiveedu village in Kurabalakota (M) (2) Formation of balancing reservoir near Nethiguntapalli (V) in Punganur (M) and (3) Formation of balancing reservoir near Avulapalli (V) in Somala (M) of Chittoor District" - Administrative Approval – Accorded – Orders – Issued.

WATER RESOURCES (PROJECTS.III) DEPARTMENT

G.O.RT.No. 461 Dated: 02-09-2020.

Read the following:

	1) From the Chief Engineer, NTR TGP, Tirupati Letter No.CE/NTRTGP/TPT/ TS/T6/IC/CTR /Balancing Reservoirs dt:06-06-2020.
	2) From Chief Engineer, NTR TGP, Tirupati Lr No. CE/NTRTGP/ TPT/ TS/ T6/IC/CTR /Balancing Reservoirs, dt:12-07-2020

&&&&

ORDER:

In the letters 1st and 2nd read above, the Chief Engineer, NTR TGP, Tirupati has requested the Government to accord administrative approval for the following works:

S. No	Name of the work	Amount (Rs. In Crores)
1	Formation of Mudiveedu balancing reservoir near Mudiveedu village in Kurabalakota (M) of Chittoor District	**772.01**
2	Formation of Nethiguntapalle balancing reservoir near Nethiguntapalle village in Punganur (M) of Chittoor District	**781.175**
3	Formation of Avulapalli balancing reservoir near Avulapalli village in Somala (M) of Chittoor District	**707.22**
	Total	Rs.2260.40

2. Government after careful examination of the proposal of Chief Engineer, NTR TGP, Tirupati, hereby accorded administrative sanction for the following works for an amount of **Rs.2144,50,00,000/- (Rupees Two Thousand One hundred Fortyfour Crores and Fifty Lakhs only)** in relaxation of FRBM norms:

S. No	Name of the work	Amount (Rs. in Cr.)
1	Formation of Mudiveedu balancing reservoir near Mudiveedu village in Kurabalakota (M) of Chittoor District	759.50
2	Formation of Nethiguntapalle balancing reservoir near Nethiguntapalle village in Punganur (M) of Chittoor District	717.80
3	Formation of Avulapalli balancing reservoir near Avulapalli village in Somala (M) of Chittoor District	667.20
	Total	**2144.50**

3. The above expenditure is debitable to the HOA:4700 CoI on Major Irrigation – 01 Major Irrigation (Commercial) – MH 133 SKD Galeru Nagari Sujala Sravanthi – GH 11 State Development Schemes – SH 27 C & D – 530 Major Works/531 Major Works.

4. The Chief Engineer, NTR TGP, Tirupati shall take further action in the matter subject to condition that he has to ensure the following before according technical sanction:

i)	The correctness of the provisions, rates and quantities proposed in the estimate.
ii)	CE, CDO approved drawings would be taken for estimate purpose and tenders should be called accordingly.
iii)	As three reservoirs would serve ayacut, they must be localized.
iv)	Any savings for these works shall not be used for any other new component of work.

5. This order issues with the concurrence of Finance (FMU.WR.II) Department vide their UO No. FIN01- FMU0MRAS(WR2)/187/2020-FMU-WR-II, dated:15-08-2020.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

ADITYA NATH DAS
SPECIAL CHIEF SECRETARY TO GOVT

To
The Chief Engineer, NTR TGP, Tirupati.
Copy to:
The ENC (I), Vijayawada.
The Director of Works & Accounts, Vijayawada
The Finance (FMU.WR.II) Department
The PS to Minister (WRD)
The PS to Special Chief Secretary (WRD)
File No ICD01/593/2020-PROJECTS-III(1160914)
SF/SC

//FORWARDED :: BY ORDER//

SECTION OFFICER

GOVERNMENT OF ANDHRA PRADESH

ABSTRACT

WATER RESOURCES DEPARTMENT – Sanction to a total amount of Rs.522.85 Crores (Rupees Five Hundred Twenty Two Crores and Eighty Five lakhs only) for payment to the Project Affected Families / Project Displaced families of 7 villages in Phase- II & III i.e. Thallaproddatur, Chamaluru, Yerraguoi, P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli, Kondapuram Mandal, YSR Kadapa District submerged under Gandikota Reservoir Project for impounding 26.85 TMC water in Gandikota Reservoir – Orders – Issued.

WATER RESOURCES (R&R-A2) DEPARTMENT

G.O.RT.No.323 Dated:24.06.2020.

Read the following:-

1. Go.Ms.No.53, I&CAD (P.W.T.G.P) Department , dated 10.06.2004.
2. G.O.Rt.No.4, Water Resources (R&R-A2) Department, dt:4.1.2017.
3. G.O.Rt.No.619, Water Resources (R&R-A2) Department, dt:4.9.2018.
4. G.O.Rt.No.184, Water Resources (R&R-A2) Department, dt:30.04.2020.
5. From the Commissioner (R&R), Water Resources Department,Letter Rc.No.515/CRR/C/2009, Dt.09.03.2020.
6. From the District Collector, Kadapa,Letter No.Rc.No.C/R&R /37/2019, dated:27.05.2020.

O R D E R:

In the reference 1st read above, the Government have given approval for Gandikota Reservoir. In the reference Second read above Government sanctioned an amount of Rs.479.35 Crores (Rupees Four Hundred seventy nine crores and thirty five lakhs only) to the PAFs/ PDFs of the 14 habitations in Kadapa District under Gandikota Reservoir Project , for their evacuation and rehabilitation to store 12 TMC of water in Gandikota Reservoir Project accordingly to the rehabilitation norms and were evacuated and rehabilitated.

2. In the reference 3rd read above, the Government have sanctioned an amount of Rs.146.295 Crores, with permission to utilize the balance amount of Rs.52.68 Crores (including interest) available out of the amount sanctioned vide G.O.Rt.No.04, Water Resources (R&R-A2) Department, dated:04-01-2017 (total 198.975 Crores) for R.S. Kondapuram village of Kadapa district as this village gets partially submerged within 12 TMC but was not included in the order at reference 2nd read above.

3. The Government have further decided to allow an ex-gratia @ Rs 3.25 lakhs over and above the entitlements (one time measure) according to the old R&R rules both for those who have taken R & R package and individual house as well those who have agreed for One Time Settlement (OTS) foregoing individual houses prospectively. This ex- gratia would be allowed only for balance PDFs of RS Kondapuram and other seven villages who would be displaced when the reservoir is going to store FRL that is 26.85 TMC subject to the condition that the notification for R & R was issued under the old rules (prior to the new LA and R & R Act 2013).

(PTO)

4. As a decision has been taken to store 26.85 TMC in coming monsoon, all the remaining Seven villages have to be resettled and entitlements of PDFs both for OTS and Non OTS, monetary benefits have to be paid including the ex-gratia for only those notified as PDFs under old R&R rules as decide at para 3 above . In the reference 5th and 6th above , Special Commissioner (R&R), Water Resources Department, Vijayawada and Collector, Kadapa , in the District Collector, Kadapa have submitted proposal for sanction of R&R package and OTS with ex-gratia as para 3 above to the PDFs of 07 Villages i.e. Thallaproduttur, Chamuluru, Yerragudi P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli Villages to impounding 26.85 TMC water in Gandikota Reservoir. The details of requirement of funds for remaining 7 villages under submergence of Gandikota Reservoir to store 26.85 TMC of water as detailed below in table 1 (submitted by Special Commissioner (R &R) and Table 2 (submitted by Collector, Kadapa) as below :

Table -1 (Three village)

Sl.No	Name of the Village	Total PDFs	OTS opted PDFs	Amount required @ Rs.6.75 Lakhs and @ Rs. 3.25 lakh ex gratia per PDF(Total Rs 10 lakh)	R&R opted PDFS with housing	Amount required@. 3 .75 Lakhs per PDF and @ Rs. 3.25 lakh ex gratia (total Rs 7 lakh)	Total Amount Required (Rs.in Crores)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Thallaproddatur	2869	1765	176.50	1104	77.28	253.78
2	Chamaluru	587	400	40.00	187	13.09	53.09
3	Yerragudi	525	521	52.10	04	0.28	52.38
Total		**3981**	**2686**	**268.60**	**1295**	**90.65**	**359.25**

Contd...

Table 2 (Four Villages)

S.No.	Name of the Submerged Village	OTS opted PDFs	Amount required for OTS opted	R&R Opted PDFs with	Amount Required for R&R with housing	Total No of PDfs	Total amount required
1	P.Ananthapuram,	677	67.7	0	0	677	67.7
2	Eturu	291	29.1	0	0	291	29.1
3	Regadipalli	175	17.5	99	6.93	274	24.43
4	K.Sugumanchipalli	423	42.3	1	0.07	424	42.37
Total		1566	156.6	100	7	1666	163.6

5. Government, after careful examination of the matter, hereby accord sanction to a total amount of Rs. 522.85 Crores (Rs.359.25 Crores + 163.60 Crores = 522.85) (Rupees Five Hundred Twenty Two Crores and Eighty Five lakhs only) for payment to the 5647 Project Affected Families / Project Displaced Families of 7 villages in Phase- II & III i.e. Thallaproddatur, Chamaluru, Yerragudi, P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli, YSR Kadapa District submerged under Gandikota Reservoir Project for impounding 26.85 TMC water in Gandikota Reservoir. With this all PDFs would be resettled and Gandikota reservoir can be filled upto FRL of 26.85 TMC.

6. The District Collector, Kadapa shall ensure that the disbursement of the above said amount is done at the time of actual relocation and evacuation of the above said PDFs duly making sure that the PDFs getting compensation now under this package should vacate the village and do not settle down in any of the villages notified as submergence villages under Gandikota Reservoir Project. Those who have opted for OTS shall not be eligible for any further R and R package including housing.

7. The expenditure sanctioned above shall be debitable to the following Head of Account: 4700- Capital outlay on Major Irrigation, 01-Major Irrigation - Commercial – M.H.133 SKD GNSS - GH-11 State Development Schemes - SH (49) Resettlement and Rehabilitation - 500 Other Charges -502 R&R cash benefit. The Special Commissioner (R&R), Water Resources Department, Vijayawada / District Collector, Kadapa is requested to follow the drawal procedure as D.V.Bill instead of payment made by means of Cheques in terms of the orders issued vide G.O.Ms.No.171, Finance (EBS.X) Department dt.12.08.2014 and G.O.Ms.No.75,Finance (TFR) Department, dt.3-4-2014 .

(PTO)

8. The Commissioner, R&R and the District Collector, Kadapa shall take necessary further action in the matter accordingly.

9. This orders issued with the concurrence of Finance (FMU-WR.II) Dept., vide their U.O.No. FIN01-FMU0MRAS(WR2)/173/2020-FMU-WR-II, dated :23.06.2020.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

ADITYA NATH DAS,
SPECIAL CHIEF SECRETARY TO GOVERNMENT

To

The Commissioner (R&R), Water Resources Department, Government. of A.P., H.No.59A-21/3-3/1A, Sarswathi Nilayam, 1st Lane, Guttikonda Varadaiah Street, Vijaya Nagar Colony, Auto Nagar Post Office, VIJAYAWADA -520007.(A.P.)
The District Collector, YSR Kadapa District.

Copy to:

The Chief Engineer (Projects), Water Resources Department, Kadapa.
The Accountant General, A.P., Hyderabad.
The Director of Works & Accounts, A.P., Vijayawada.
The District Treasury Officer, Kadapa.
The Pay and Accounts Officer, Kadapa.
The General Administartion (Cabinet) Department (With reference to their Uo.No.63/2020, dated 12.06.2020.
The P.S. to Principal Secretary to Hon'ble Chief Minister.
The P.S. to Hon'ble Minister (Water Resources)
The P.S. to Spl. Chief Secretary to Government. (W.R.D.)
The Finance (FMU-W.R.II) Department.
SF/S.C.

// FORWARDED : : BY ORDER //

SECTION OFFICER

Chapter 5

RISK AND DISASTER MANAGEMENT PLAN

5.1 RISK ASSESSMENT

During the development and operation of the project, there are a variety of hazards that might disturb regular activities and result in disasters such as fires, mechanical failure, and explosions, to name a few. The imminent threats or risks shall be explored and addressed, as well as a disaster management strategy established with the goal of taking preventative measures to avert disaster and acting after the disaster to minimise damage. Following problems may be encountered during the construction phase at the project site.

- Accidents due to explosives/blasting
- Failure of stripped slope
- Accidents due to HEMM
- Sabotage in case of magazine

The following safety measures will be strictly followed in the current project to address the above hazards/disasters:

- Handling of explosives, charging and blasting shall be carried out by competent persons only.
- Provision of a safe location for the magazine, complete with suitable fencing and the requisite watch and ward. Adequate safety equipment will be provided at magazine and project site.
- Regular maintenance and testing of all project equipment/machinery and transport vehicles as per manufacturers guidelines
- Entry of unauthorized persons will be prohibited.
- Firefighting and first – aid provisions in the project office/complex area and ensuring periodic checking of worthiness of firefighting and first aid provision.
- All individuals working in hazardous areas should receive training and refresher courses.
- As a part of disaster management plan, a rescue team will be formed by imparting specialized training to select project staff.

5.1.1 Possible Hazards

There are various factors which singularly and severally can cause disaster in irrigation project. The project activity is associated with many hazards which are covered in the following sub sections:

5.1.1.1 Blasting

Blasting accidents are mostly manifested as projectiles that occasionally travel beyond the danger zone and invade the project boundary. It is largely due to overcharging of blast holes and also during secondary blasting. During initial and final blasting operations flying rocks are encountered. If the ground vibration induced by blasting is not correctly scaled in the previous blasting cycle, it might result in displacement of adjacent areas and fallout of loose rock-mass. The following measures are suggested to avoid accidents due to blasting:

- All blasting operations shall be supervised by a competent person appointed for the purpose and strictly conducted as per guidelines contained
- Danger zone area falling within a radius of 500m from the blast site shall be demarcated.
- Guards shall be posted at all access points leading to the blast area to prevent and control movement of persons/ stray animal.
- All employees and equipment shall be cleared off the blast area to a safe location prior to any scheduled blasting; and
- Audible signals such as sirens, whistles and mikes etc., shall be used to caution the workers, passer-by about the scheduled blasting events.

5.1.1.2 Heavy machinery

Most of the accidents during transport of dumpers, excavators, dozers and other transport vehicles are often attributed to mechanical failures and human errors and can be significantly averted by adapting to following:

- All HEMM and transport vehicle movement within the project area should be carried out under the direct supervision and control of the management.
- All project machinery and vehicles should be periodically maintained and weekly checked by a competent person authorized by the management.
- During the day/night, a conspicuous sign board should be provided at each and every bend to guide the operators/drivers; and
- To avoid dangers while reversing the trackless vehicles, especially at the embankment and tripping points, all areas for reversing of vehicles should, as far as possible, be made

man free, and should be a light and sound device to indicate reversing of trucks/project machinery.

5.1.1.3 Storage of explosive

The explosive magazine shall be located outside the project area. For the purpose of transportation of explosives, explosive van shall be deployed. Fire and explosion are the most common hazards connected with the storage, transportation, and handling of explosives. The rules as per Indian Explosive Act-1983 and Explosive Rules-2008 should be followed for handling of explosives, which includes transportation, storage and use of explosives.

5.1.1.4 Fuel storage

All project machinery will run on diesel, and it will be stored in the central workshop area of the project.

5.2 DISASTER MANAGEMENT PLAN

Preparation of "Disaster Management Plan" for any construction of reservoir projects is a prerequisite, as catastrophic situation, which is highly unpredictable, may occur any time in the life span of project. To tackle the catastrophic situation development of an effective "DMP" is imperative to establish co-ordination between District Administration and Project Authority. Line/Assisting agencies from district administration side are Fire Services, Police Department, Medical Services, Consumer Affairs and Public Distribution Department, Transport Department, Communication Department, Meteorology Department, Irrigation and Flood Control Department, Civil Defence Forces and Voluntary Organizations. Coordination and close cooperation among all the agencies involved is essential for the timely and successful implementation of "DMP" to provide relief to the affected at the time of need.

5.2.1 Purpose of the Plan

- Basic purpose of this plan is to develop, implement and maintain an integrated emergency management system for protection of people, property and the environment in the event of emergency.
- The ultimate goal is to reduce the project area's vulnerability to emergency situations in order to save lives and protect property. This will be accomplished by developing capabilities to mitigate the effects of, prepare for, respond to, and recover from emergency situations that may affect the project area.

5.2.2 Scope of the Plan

Well-defined role and responsibilities of assisting agencies in "DMP" is required, so that proper planning, according to the intensity of disaster could be made by agencies. The Chief Co-ordinator assesses identification of the event and its intensity in the affected area. He should be authorized to declare "disastrous situation" based on detailed information available, so that assisting agencies swing in action to mobilize their resources in affected area. Based on the intensity of disaster in project a proper relief programme may be implemented by District Administration with the help of assisting/line agencies. This Disaster Management Plan/Emergency Action Plan covers technological emergencies arising out of construction accidents and covers the following:

5.2.2.1 Inundation

The downstream areas vulnerable to inundation by reservoir failure and subsequent floodwater. The selected reservoir failure and corresponding flood for this purpose corresponds to the extreme conditions that yield maximum possible flow storage at the downstream locations. The extreme condition is estimated from various parameters like breach width, minimum time of failure and Manning's coefficient. The inundation map has to be prepared with the help of water surface elevation profile, which has to be computed for maximum flood discharge elevation and at various downstream locations.

Based on the reservoir failure analysis, the flood wave is expected to inundate some low-lying areas in the five km downstream of the reservoir site. This means that very little time would be available for execution of any rescue and/or evacuation plan. Therefore, the Disaster Management Plan has been devised mostly for preventive measures. As a first measure of the management plan it is suggested that surveillance and monitoring schemes be implemented simultaneously with the design and detailed engineering stage of the project. It should continue during the construction phase through impoundment of reservoir, early operation period, and operation and maintenance phases during the life of the reservoir. On the onset of high discharge period on all dates the electricity, public announcement system, power generator backups etc; should be thoroughly checked.

5.2.2.2 Emergency Scenarios

Emergency scenarios arising out of existing project status and that anticipated in the immediate future expressed by the company management personnel and those of the concerned agencies

and the project risks as envisaged with mutual thinking of the company and agency managements.

5.2.3 Disaster Scenarios for the Avulapalli Reservoir

The disaster scenarios are classified into 2 categories:

A. Natural calamities
   i. Flood
   ii. Landslide
   iii. Earthquake

B. Man-made disaster
   i. Fire
   ii. Explosion
   iii. Fire and Explosion

Flood

Flood can occur due to heavy rainfall, Cloud burst to the upstream, and Heavy debris falling into the canal and bathe reservoir from the adjacent hills or hillocks. It results in possible failure of the reservoir. Under such circumstances, there is a possibility of sudden release of huge quantity of water upto a maximum of 2.5 TMC into the downstream of the Avulapalli. Hence, there should be a offsite warning mechanism covering the Somala manadal in case of any such unwanted happens takes place.

Landslide

Compounded by the heavy rainfall and Geo-morphologic habits the landslides of major and minor scale keep occurring during construction phase. Following areas are susceptible to landslides

a) Water conductor systems
b) Hills or hillocks surrounding the reservoir

Geological Survey of India (GSI) is also associated with Water Resource Department, for supervision and advice on tunneling/ road construction and/or any other vulnerable area of construction.

Earthquake

Chittoor District falls in Zone III as shown in Fig 5.1 below. Hence, prompt actions in managing earthquake are important in minimizing its effect. All structures at project site shall be designed with appropriate/internationally accepted safety margins. In

earthquake-prone areas, structural mitigation comprises property seismic retrofits and the securing of things inside a building to improve home seismic safety.

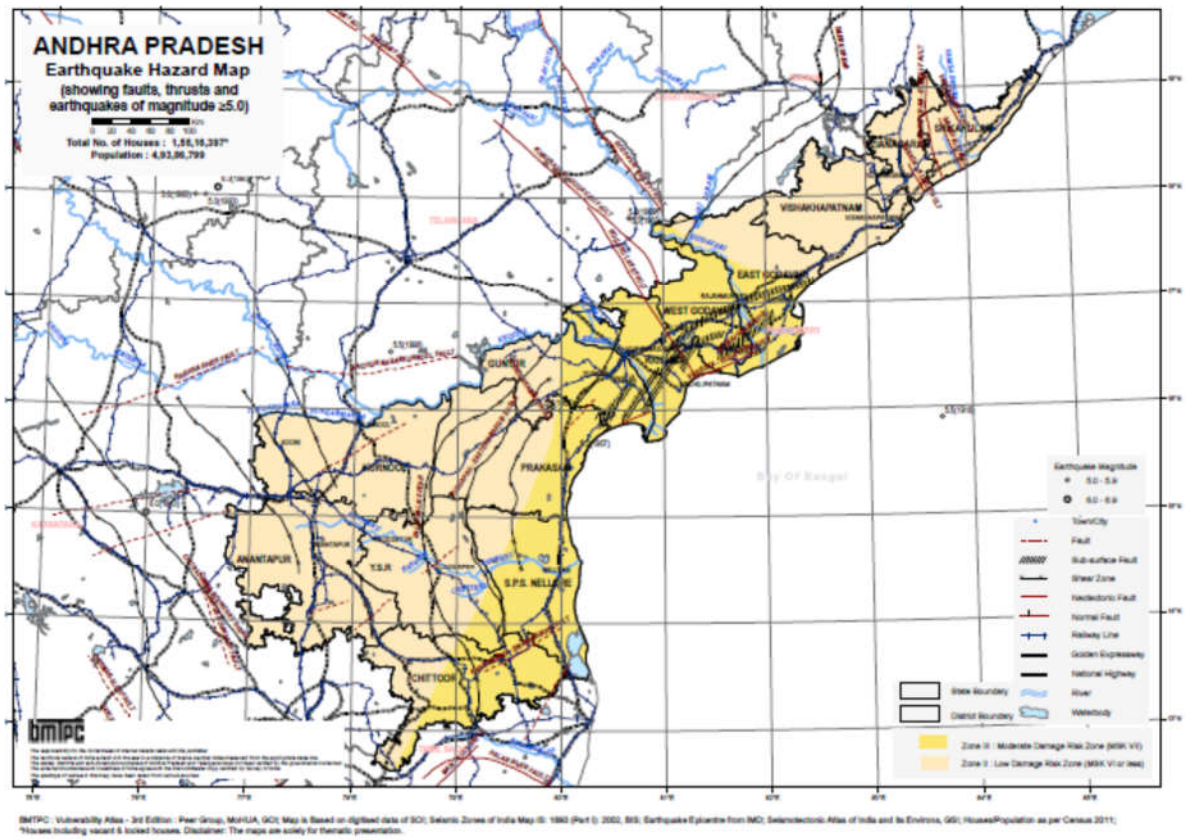


Fig 5.1 Seismic Zones of Andhra Pradesh

Fire and Explosion

Following are the areas where fire or explosion may take place due to improper maintenance or mishandling

a) Transformer and switchgear room area
b) Storages of explosives

Reporting of Incident

Any person (employee of Water Resource Department or contracting agency or Security) who sees the incident shall inform/report to the Emergency Control Centre (ECC) through the nearest office (Water Resource Department, contracting agency/any security point) through telephone/mobile or by shouting.

5.2.4 Communication systems

An efficient downstream warning and communication system is essential for the success of Emergency Preparedness Plan. The population living downstream should be educated about the difference between a high flood and reservoir failure situation. In case of emergencies,

telecommunication plays a critical and crucial role in mitigating the problems faced by people during and after calamity. Any efficient communication system in disaster management should have the following characteristics:

- Reliability
- Ease of maintenance
- Quick deployment
- High tolerance to extreme adverse conditions
- Compatibility on alternative power sources, and
- Fast transportability and easy deployment

5.2.5 Evacuation Plan

The Emergency Action Plan also includes evacuation of people at risk and procedures for implementation are based on the local needs. Generally, the following procedure forms the basis of the plan:

- Demarcation and prioritization of areas to be evacuated
- Notification procedures and evacuation instructions
- Safe routes, transport and traffic control
- Safe areas and shelters, and
- Functions and responsibilities of members of the evacuation team

5.2.6 Key Persons

Following positions of key persons are included project

1. Executive Engineer
2. Dy. Executive Engineer
3. Asst. Executive Engineer
4. Project Executive In charge (from the contracting firm / company)

Project Manager of the site contracting agency assumes the role of IC in case of any emergency. For silent hours (night time or on holidays) the senior security person will handle the emergency with the help of other security personnel till arrival of the seniors.

INDEX MAP SHOWING PROP AVULAPALLY BALANCING RESERVOIR
CAPACITY: 2.5TMC FRL: +660m

MADIRIMALAI EAST RESERVED FOREST
Dense mixed jungle
988
1000
900
Peddakanuma Vanka
788
700
MADIRIMALAI WEST R F
Kadthi Konda 1131
Dense scrub
Open mixed jungle
1124
Open scrub
Ävulapalle
Stamm Cheruvu
Matamoddepalle
Baridipalle
Devalakuppam
Reddivāripalle
Upparapalle
Market (Sat)
PO
Nāgillivāripalle
Oddepalle
Chinnakampalle
Mādigapalle
Basivepalle
Gollavāripalle
Gollapalle
Chimpireddipalle
Rocky knob
760
AVULAPALLE DURGA PROTECTED FOREST R
Open mixed jungle
FRL: +660
MWL +661.5

LEGEND:

- Bund +663.000
- FRL +660.000
- MWL +661.500
- EXISTING TANK
- EXISTING CANAL
- EXISTING BUND
- CART TRACK
- BT ROAD
- FOREST
- STREAMS
- VILLAGE

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SV Enviro Labs and Consultants, Visakhapatnam

B1, Block-B, IDA, Auto Nagar, Visakhapatnam, Andhra Pradesh

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including opencast/underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Chemical fertilizers	16	5 (a)	A
5	Synthetic organic chemicals industry	21	5 (f)	A
6	Distilleries	22	5 (g)	A
7	Industrial estates/ parks/ complexes/areas, export processing Zones(EPZs), Special Economic Zones(SEZs), Biotech Parks, Leather Complexes	31	7 (c)	B
8	Ports, harbours, breakwaters and dredging	33	7 (e)	A
9	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
10	Building and construction projects	38	8 (a)	B
11	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated March 29, 2022 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/22/2310 dated April 13, 2022. The accreditation needs to be renewed before the expiry date by SV Enviro Labs and Consultants, Visakhapatnam following due process of assessment.

Sr. Director, NABET
Dated: April 13, 2022

Certificate No.
NABET/EIA/2124/RA 0240

Valid up to
Oct 24, 2024

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to the QCI-NABET website.

Statement of Inflows & Outflows of Somasila Project from 2017-18 to 2022-23 (upto 29.10.2022)

Year	Inflow	Delta + Kanupur	SKFFC	Kavali Canal	NFC	SFC	Losses	Surplus to Pennar River	Total Outflow
2017-2018	76.843	24.79	22.35	10.40	5.88	4.08	4.133	–	71.633
2018-2019	50.25	25.01	12.98	6.15	3.95	1.15	4.184	–	53.424
2019-2020	173.145	46.270	67.63	10.38	10.926	5.108	5.133	5.283	150.730
2020-2021	375.332	31.978	72.66	9.33	10.323	4.439	8.190	222.612	359.532
2021-2022	415.63	28.356	31.255	14.928	8.44	5.70	8.707	308.699	406.085
2022-Till Date	142.653	10.000	33.00	4.35	0.74	1.04	2.50	82.293	133.926

29/10/22

Superintending Engineer
Somasila Project Circle, Nellore

YEAR WISE INFLOWS AND OUT FLOWS OF GANDIKOTA RESERVOIR

up to 31.10.22

Sl. No	YEAR	INFLOWS			Outflows	REMARKS
		SELF CATCHMENT	FLOOD FLOW CANAL	TOTAL		
1.	June'13 to May'14	0.159	3.075		1.274	
2	2014 to 2015	-	-	-	-	
3	2015 to 2016	-	-	-	-	
4	2016 to 2017	-	5.04	5.04	2.641	
5	2017 to 2018	5.00	18.363	23.363	15.785	
6	2018 to 2019	-	12.808	12.808	10.629	
7	2019 to 2020	7.26	56.29	63.55	57.657	
8	June 2020 to May 2021	22.98	44.169	67.149	44.025	
9	2021 to 2022	46.66	8.6	55.26	51.25	
10	2022 to 2023 up to 31.10.22	61.43	1.68	63.11	60.40	

SUPERINTENDING ENGINEER
S.K.D.G.N.S.S. (P) Circle,
KADAPA.

MINUTES OF THE REVIEW MEETING HELD ON 08.05.2022 AT 11-00 AM IN THE CHAMBERS OF THE CHIEF ENGINEER, NTR TELUGU GANGA PROJECT, TIRUPATI ON ACTION PLAN FOR CREATING SUSTAINABLE AND RELIABLE SOURCE FOR DRINKING WATER SUPPLY IN WESTERN PART OF CHITTOOR DISTRICT BY FORMING AVULAPALLI BALANCING RESERVOIR, UTILISING SELF YIELD RUNOFF FROM LOCAL CATCHMENT AREA IN THE FIRST PHASE

The Chief Engineer, NTR TGP Unit, Tirupati conducted a review meeting with the Superintending Engineer of Irrigation Circle, Chittoor, Executive Engineer, Irrigation Division, Madanapalle along with the field engineers with an objective to work out action plan for the construction of Avulapalle Reservoir in Punganur Assembly Constituency in phased manner.

Officers Present:

1.Sri Vijayakumar Reddy,
Superintending Engineer, Irrigation Circle, Chittoor.
2.Sri T.Surendra Reddy ,
Executive Engineer, Irrigation Division, Madanapalle ,
3.Smt. M.Prasanna Kumari,
Deputy Executive Engineer, Irrigation Sub Division, Piler
4.Sri C.Shabareesh Kumar,
Assistant Executive Engineer,
5. Sri O.Bharath Kumar,
Assistant Executive Engineer.

******

The Superintending Engineer of the Irrigation Circle, Chittoor and the Executive Engineer, Irrigation Division Madanapalle have reported that the formation of Avulapalle Balancing Reservoir, with a contemplated storage of 3.50TMC in Somala Mandal of Punganur Assembly Constituency is getting delayed due to litigations raised by some people in the name of farmers in the Court of Law with an intention to stall execution of the Avulapalle Reservoir.

The Chief Engineer, NTR TGP Unit, Tirupati has informed that the project is intended to provide long-term relief to the people and live stock during the times of drought and famine to assure drinking water whenever scarce and to help in the reversal of the desertification process by improving environment and ecology of the area. It would provide drinking water facility to approximately 2.76 lakh people in – Punganur and Piler Assembly Constituencies. The Chief Engineer has reiterated the priorities of the Govt in bringing relief at the earliest to the people of chronically drought prone areas by creating storage and distribution network of drinking water by proposing alternative reliable action plan.

The Superintending Engineer, Irrigation Circle, Chittoor has suggested to take up the construction of Avulapalle Balancing Reservoir in phased manner (Phase one and phase two) as submitted to the NGT earlier. The Superintending Engineer has reported that the run-off yield from self-catchment is estimated at 2.50 TMC, which can be impounded in the proposed Avulapalle Reservoir. Therefore, it is now proposed to take up the Avulapalle Reservoir work with storage capacity limiting to 2.50TMC in the first phase for providing assured drinking water to approximately 2.76 lakhs and 9700 ha of ayacut and can be improved in second phase with additional storage of 1.00TMC later, based on the availability of funds and the water from other sources.

The Chief Engineer with due diligence accepted the above view of all the concerned engineers and on various merits of the proposal, it is construed to take up the proposed Avulapalle Reservoir by taking up execution of works in phased manner as already submitted to the NGT earlier. The first phase of construction shall be for augmenting to the supply of the drinking water to approximately 2.76 lakh people and 9700ha of ayacut with a storage capacity of 2.50TMC. The Chief Engineer, NTR TGP Unit directed the field engineers to expedite execution of the first phase of Avulapalle Reservoir duly chalking out an action plan for resolving issues, if any, and obtain clearances required for first phase of the reservoir on top priority so as to achieve the intended objectives of the Government to supply drinking water to the needy people and water to the contemplated ayacut under Phase-I.

08/05/22.

Chief Engineer,
NTR Telugu Ganga Project,
Tirupati.

08/05/2022

Superintending Engineer,
Irrigation Circle,
Chittoor.

8/5/22

Executive Engineer,
Irrigation Division,
Madanapalle.

08/05/2022

Deputy Executive Engineer,
Irrigation sub Division,
Piler.

8/5/22

Assistant Executive Engineer
Irrigation section ,
Thavanampalle.

8/5/22

Assistant Executive Engineer
Section No.III,
CWSS Sub Div-2,Chittoor.

YEAR WISE OUT FLOWS OF SITHAMMA CHERUVU

S.No	Year	Outflows in TMC
1	2016	1.427
2	2017	1.876
3	2018	1.427
4	2019	1.876
5	2020	3.447
6	2021	2.889

04/11/2022

Superintending Engineer
Irrigation Circle
Chittore

GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Water Resources Department – "Investigation and Construction of Lift Schemes to lift water from GNSS to HNSS" - Administrative Approval – Accorded – Orders – Issued.

WATER RESOURCES (PROJECTS.III) DEPARTMENT

G.O.RT.No. 444 Dated: 26-08-2020.

Read the following:

1)	From Chief Engineer (P), Kadapa Lr. No:CE(P)/WRD/KDP/TS2/ Chakrayapet/ 2020 / Dt:30-05-2020.
2)	From the Engineer-in- Chief (I), Vijayawada Letter No.ENC (I)/DCE (GDS)/OT2/ AEE5/CHAKRAYAPETA LI SCHEME, Dt:17.06.2020.
3)	From the Chief Engineer (P), Kadapa, Lr.No: CE(P)/WRD/KDP/TS2/ Chakrayapet/2020, Dt:20.07.2020.

&&&&

ORDER:

In the letter 1st read above, the Chief Engineer (P), Kadapa has requested the Government to accord administrative approval for the estimate for the work "Investigation and Construction of Lift Schemes to lift water from GNSS to HNSS" for an amount of Rs.5139.00 Crores.

2. In the letter 2nd read above, the ENC (I), Vijayawada has requested the Government to consider the replies of the Chief Engineer(P), Kadapa letter dated:20.07.2020 while according administrative approval for the subject work.

3. Government after careful examination of the proposal of Chief Engineer (P), Kadapa, hereby accorded administrative sanction for the work "Investigation and Construction of Lift Schemes to lift water from GNSS to HNSS" for an amount of Rs.5036,00,00,000/- (Rupees Five Thousand and Thirty Six Crores only) in relaxation of FRBM norms subject to condition that the CE has to ensure the following before according technical sanction:

i)	The correctness of quantities, leads, rates and data proposed in the estimate.
ii)	Approved Designs and drawings by competent authority have to be obtained i.e., CE, CDO
iii)	Detailed estimates have to be obtained for each of the components/items of the proposed LS provisions.
iv)	As per the revised Sand Policy of the Govt. the Sand rate have to be adopted.
v)	The Present proposal shall not overlap any other works/packages.
vi)	As per GO Ms No.11, dt.11.2.2020, the Seigniorage charges have to be worked out and shown in the abstract as LS provision.

4. The above expenditure is debitable to the HOA:4700 Col on Major Irrigation – 01 Major Irrigation (Commercial) – MH 133 SKD GNSS – GH 11 State Development Schemes – SH 27 – 530 Major Works/531 Major Works.

5. The Chief Engineer (Projects), Kadapa shall take further action accordingly.

6. This order issues with the concurrence of Finance (FMU.WR.II) Department vide their UO No. FIN01-FMU0MRAS(WR2)/186/2020-FMU-WRII,Dated:15-08-2020.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

ADITYA NATH DAS, IAS
SPECIAL CHIEF SECRETARY TO GOVT

To
The Chief Engineer (Projects), Kadapa.
Copy to:
The ENC (I), Vijayawada.
The Director of Works & Accounts, Vijayawada
The Finance (FMU.WR.II) Department
The PS to Minister (WRD)
The PS to Special Chief Secretary (WRD)
File No ICD01/MJIR/267/2020-PROJECTS-III(1155189)
SF/SC

//FORWARDED :: BY ORDER//

SECTION OFFICER

SAFETY CONSIDEDRATIONS IN EARTH BUND OF AVULAPALLI BALANCING RESERVOIR CONSIDERING EARTHQUAKE CONDITION

Avulapalli Balancing Reservoir is proposed near Avulapalli (V), in Somala (M), of Chittoor District. The proposed project location is at Longitude 78° 28'28.68"E and Latitude 13° 24'5.40"N.

As per the project site location, the dam falls under Seismic Zone- II of seismic zones of India map which has the horizontal coefficient of 0.06 with Importance factor of 3 as per IS: 1893-1984(PART- 1) "Criteria for earthquake resistant design of structures".

The Design / Stability analysis of Earth bund is finalized considering various loading conditions including earthquake condition for steady seepage on downstream and reservoir full on upstream in line with provisions in Appendix A(clause 5.1.1) of IS 7894-1975 duly adopting minimum desired factor of safety value. The design seismic forces are computed on the basis of importance factor of the structure and its soil foundation system. The factor of safety values obtained for steady seepage with seismic condition is 1.518 and for sudden drawdown with seismic condition is 1.197 against the minimum desired value of 1.0 which implies that the earth dam designed is very much safe against seismic force.

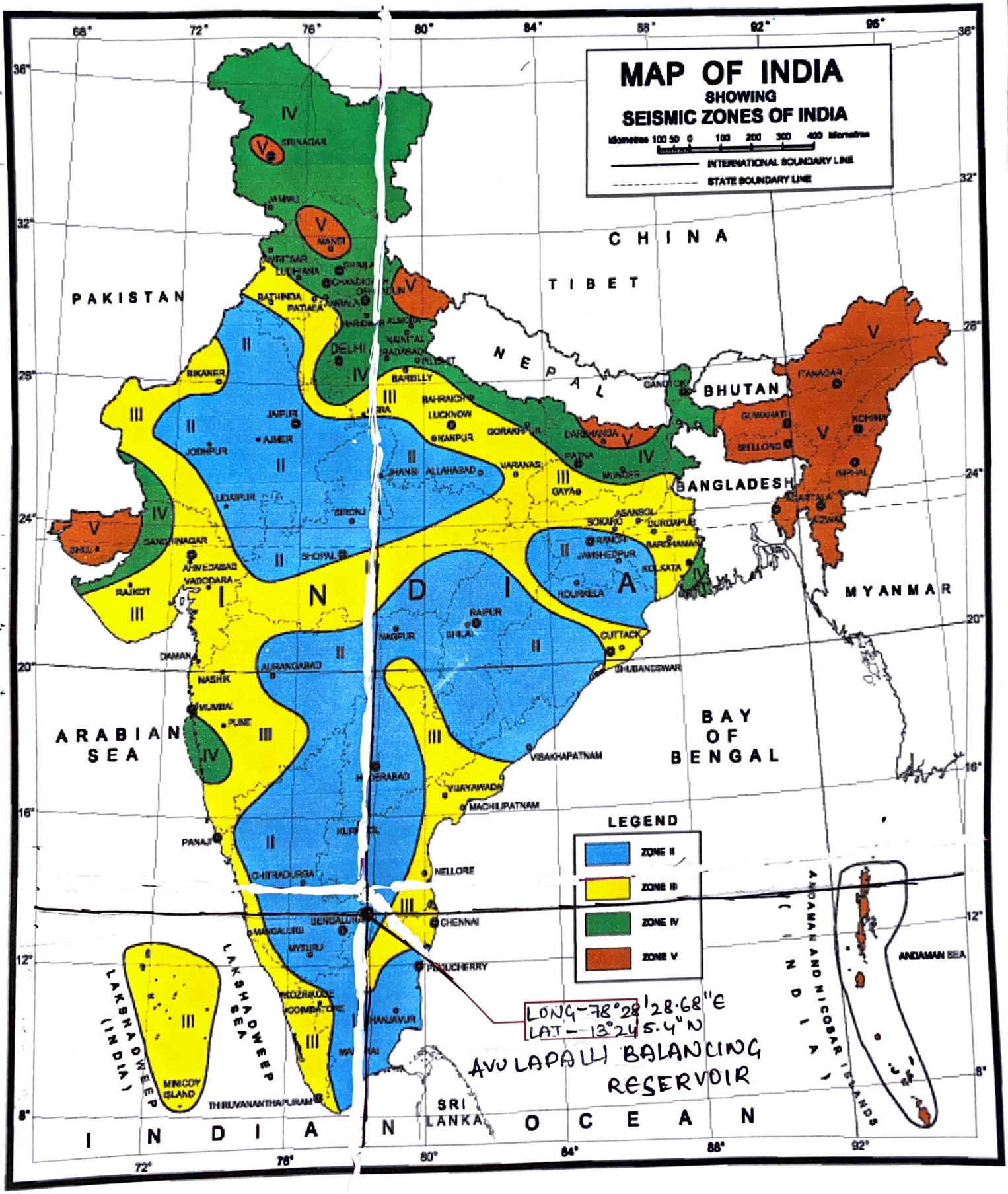
As the project site falls under seismic Zone-II which has the lowest horizontal seismic coefficient of 0.06 and in the stability analysis the influence of seismic load is already considered, approval of seismic design parameters separately by Central Water Commission and National Commission of Seismic Design Parameters (NCSDP) is not required and need not be considered.

Further it is pertinent to state that, Central Designs Organisation of Water Resources Department of Government of Andhra Pradesh is an ISO-9001-2015 accredited organisation which is an apex body for approval of designs and drawings pertaining to Irrigation structures taking up by the Government since 1978 which has dealt with various challenging designs right from major dams/reservoirs to irrigation structures network which are functioning very well since their operation.

Encl: Seismic Zone Map

23/11/2022

Chief Engineer,
Central Designs Organisation,
Vijayawada.


MAP OF INDIA
SHOWING
SEISMIC ZONES OF INDIA
INTERNATIONAL BOUNDARY LINE
STATE BOUNDARY LINE
LEGEND
ZONE II
ZONE III
ZONE IV
ZONE V
CHINA
TIBET
PAKISTAN
NEPAL
BHUTAN
BANGLADESH
MYANMAR
ARABIAN SEA
BAY OF BENGAL
INDIA
SRI LANKA
INDIAN OCEAN
LAKSHADWEEP (INDIA)
LAKSHADWEEP SEA
ANDAMAN AND NICOBAR ISLANDS (INDIA)
ANDAMAN SEA
DELHI
SRINAGAR
JAMMU
AMRITSAR
LUDHIANA
BATHINDA
PATIALA
NAINITAL
BAREILLY
BIKANER
JAIPUR
AJMER
JODHPUR
LUCKNOW
KANPUR
GORAKHPUR
PATNA
VARANASI
GAYA
ALLAHABAD
JHANSI
GANGTOK
ITANAGAR
GUWAHATI
SHILLONG
KOHIMA
IMPHAL
AGARTALA
AIZWAL
SILIGURI
DURGAPUR
ASANSOL
SOREMO
RANCHI
JAMSHEDPUR
KOLKATA
BARRACKPORE
ROURKELA
BHOPAL
GANDHINAGAR
AHMEDABAD
VADODARA
RAJKOT
DIU
LUDHIANA
RAIPUR
BHILAI
NAGPUR
CUTTACK
BHUBANESWAR
DAMAN
AURANGABAD
NASHIK
MUMBAI
PUNE
VISAKHAPATNAM
VIJAYAWADA
MACHILIPATNAM
HYDERABAD
PANAJI
KURNOOL
CHITRADURGA
NELLORE
BENGALURU
MANGALURU
MYSURU
CHENNAI
PUDUCHERRY
KOZHIKODE
COIMBATORE
THANJAVUR
MADURAI
MINICOY ISLAND
THIRUVANANTHAPURAM
LONG-78°28'28.68"E
LAT-13°24'5.4"N
AVULAPALLI BALANCING RESERVOIR

SITE INSPECTION REPORT OF MUDIVEEDU BALANCING RESERVOIR, NETHIGUNTAPALLI BALANCING RESERVOIR AND AVULAPALLI BALANCING RESERVOIR IN CHITTOOR DISTRICT WITH RESPECT TO O. A. NO. 137 OF 2021 (SZ) IN THE MATTER OF GUTHA GUNASEKHAR AND ORS. VS UNION OF INDIA AND ORS.

1.0 Preamble

The Hon'ble National Green Tribunal (NGT), Southern Zone (SZ) vide order dated 29.11.2021 in O.A. No. 137 of 2021 (SZ) in the matter of Gutha Gunasekhar and Ors. Vs Union of India and Ors. has issued the following directions:

"2. The learned Senior Advocate appearing for the State of Andhra Pradesh submitted that a perusal of Environmental Clearance (EC) will go to show that it is not for completion of the work, but for starting the construction work. After the Environmental Clearance (EC) were obtained, due to passage of time and also change of circumstances, they feel that it is not profitable and feasible to have independent projects, instead they want to have a combined project together with some modifications, for which, certain preliminary investigation has to be conducted and that is only undergoing, which includes preparation of Detailed Project Report (DPR).

3. The MoEF&CC is the authority to come with a reply statement regarding the action of the State of Andhra Pradesh, whether it is proper or not, in view of the allegations made by the applicant."

In compliance to above, MoEF&CC, New Delhi vide letter no. L-11011/17/2021-IA-I(RV) dated 09.12.2021 has requested Integrated Regional Office (IRO), Vijayawada to verify the factual status of allegations made in O.A. 137 of 2021 (SZ).

In compliance to above directions, Dr. Suresh Babu Pasupuleti, Scientist 'D' from Ministry's Integrated Regional Office (IRO), Vijayawada has conducted site inspection of Mudiveedu balancing reservoir, Nethiguntapalli balancing reservoir and Avulapalli balancing reservoir in Chittoor District on 26.12.2021. During the visit, the following officials were present:

Officials from HNSS Project:

1. Sri. K. Harinarayana Reddy, Chief Engineer, NTR TGP Tirupati.

2. Sri. P. Vijay Kumar Reddy, Superintending Engineer, Irrigation Circle, Chittoor.
3. Sri T. Surendra Reddy, Executive Engineer, Irrigation Division, Madanapalle.
4. Sri G. Suresh Babu, Deputy Executive Engineer, Irrigation Sub-Division, Thambalapalli, Madanapalli.
5. Sri. S.Gane Naik, Deputy Executive Engineer, Irrigation Sub-Division , Punganur.
6. Smt M. Prasanna kumari, Deputy Executive Engineer, Irrigation sub - Division, Pileru.
7. Sri P. Nagendra, Assistant Executive Engineer, Irrigation Section, Mulakalacheruvu.

Officials from GNSS Project:

1. Sri S.C. Ramu Naik, Executive Engineer, NTR TGP Division No.1, Kadapa.
2. Sri E. Saradhi, Deputy Executive Engineer, NTR TGP Sub Division No. 4, Pulivendula.
3. Sri. Y. Pradeep Reddy, Assistant Executive Engineer, NTR TGP Sub Division No. 4, Pulivendula.
4. Sri. S. Arif Basha, Assistant Executive Engineer, NTR TGP Sub Division No. 4, Pulivendula.

2.0. Existing GNSS and HNSS Projects

2.1. Galeru Nagari Sujala Shravati (GNSS) Project

The Galeru Nagari Sujala Shravati (GNSS) Project is contemplated for providing irrigation to 2.60 Lakhs in two districts of YSR Kadapa and Chittoor duly utilizing 38 TMC of surplus flood water from Krishna river out of which 10.87 TMC of water is allocated for irrigating contemplated ayacut of 1,05,000 acres in Chittoor district.

The Environmental Clearance (EC) has obtained to the GNSS Project vide letter no. J-12011/18/2006-IA-I dated 21.06.2006 for drawl of 38 TMC of surplus flood water from Krishna river to provide irrigation facilities to 2.60 Lakh acres in two districts of Kadapa and Chittoor.

2.2. Handri Neeva Sujala Shravanti (HNSS) Project

The Handri Neeva Sujala Shravanti (HNSS) Project Project is contemplated for providing irrigation facilities of 6.025 lakh acres in the four drought prone Districts of Rayalaseema i.e., Kurnool, Anathapur, YSR Kadapa and Chittoor Dist, duly utilizing 40 TMC of flood waters of Krishna River out of which 9.29 TMC of water is allocated to Chittoor District for irrigating contemplated ayacut of 1,81,400 acres.

The Environmental Clearance (EC) is obtained to the HNSS Project vide letter no. J-12011/10/2006-IA-I dated 08.05.2006 for utilization about 40 TMC of flood water for providing irrigation facilities of 6.025 lakh acres in the four Districts of Rayalaseema i.e., Kurnool, Anathapur, YSR Kadapa and Chittoor Dist.

Details of implementation status of both GNSS and HNSS projects area as follows:

Sl No.	Name of the Project	Name of the District	Water allocation in TMC	Ayacut Contemplated in Acres	Ayacut Created in Acres
1	HNSS PROJECT	Kurnool	5.320	80,000	45,300
		Ananthapur	22.91	3,08,500	6,000
		Kadapa	2.48	32,600	21,785
		Chittoor	9.29	1,81,400	14,250
			40.00	**6,02,500**	**87,335**
2	GNSS PHASE-I	Kadapa	27.13	35000	4,000
3	GNSS PHASE-II	Kadapa		120000	0
		Chittoor	10.87	1,05,000	0
			38.00	**2,60,000**	**4,000**

It has been informed that the ayacut contemplated both in GNSS and HNSS projects is yet to be realized and the tail end areas are not even getting the water required for drinking. To meet the drinking, domestic, Industrial and Irrigation needs in the most backward and chronically drought pone areas, it is proposed to inter connect both this projects to complement each other.

3.0. Proposed Scheme

The two Projects (HNSS & GNSS) are under execution at different stages in various districts of Rayalaseema. However, Chittoor district is not able to get

its legitimate allocated share of water and thus could not develop ayacut. Further the Chittoor District is not having any potential perennial river to meet its needs which necessitated the present proposal to supplement the water.

It has been stated that the proposed ayacut in Chittoor District could not be achieved through GNSS Project due to urbanization of canal alignments, ayacut areas and Reserve Forest lands required for GNSS Main Canal, which necessitated to complete the present interlinking. The Proposed ayacut under HNSS in Chittoor Dist could not be achieved due to insufficient carrying capacities of HNSS Canal System and inadequate storage facilities.

It has been stated that the present proposal is interlinking of HNSS & GNSS Projects which are included in Para 10 under Article 11 of A.P State Reorganization Act, 2014 as ongoing projects proposed for utilizing the flood water of Krishna river as per the right bestowed on the state of Andhra Pradesh by KWDT-I.

The Government of Andhra Pradesh vide G.O. Rt. No. 444 WR (Projects III) Dept., dated 26.08.2020 has accorded administrative approval for Rs. 5036.00 Crores for the work "Investigation and Construction of Lift Schemes to lift water from GNSS to HNSS".

It is proposed to supply water to tail end reaches of HNSS in YSR Kadapa and Chittoor Districts by diverting 2000 cusecs of water from KM 56.00 of G.N.S.S. Main canal.

The proposed GNSS-HNSS Lift Scheme is envisaged to provide irrigation water to enroot tanks originating at Km 56.000 on GNSS Main Canal near Pamuluru village to culminating at Punganur Branch canal at Km 79.600 near Jagadamvaripalle of Mulkalacheruvu mandal besides filling of Kaletivagu Reservoir, Veligallu Reservoir, Srinivasapuram and Adavipalli Reservoir.

The main aim of the proposed GNSS-HNSS Lift Scheme is to provide irrigation water to contemplated ayacut to tail end of HNSS Project in Chittoor district and upland and remote areas in YSR Kadapa district.

The land acquisition required being taken up as per norms under Right to Fair compensation and Transparency in Land Acquisition Act 2013.

The detailed flow diagram of HNSS, GNSS and Lift Scheme of HNSS&GNSS projects is enclosed as Annexure-I. The colour codes are as follows:

Green	–	HNSS Project
Blue	–	GNSS Project
Red	–	Proposed Lift Scheme project

The said Lift Scheme is designed to serve for stabilization of ayacut of 2,91,000 acres in the mandals of Chakrayapet, Ramapuram, Lakkireddipalli, Rayachoty, Veeraballi, Sundupalli etc., in YSR Kadapa district and Thamballapalli, Peddamandyam, KV Palle, PTM, B.Kothakota , Mandanapalli etc., in Chittoor district.

As the water dependability is more in HNSS Project, the tail end reaches are unable to get water in HNSS Project and the scheme is proposed to serve contemplated ayacut under HNSS Project with less cost and more effective.

The GNSS-HNSS Lift Irrigation Scheme is proposed mainly with MS Pressure Mains (MS Pipes), which are placing at an average depth of 1.20 m (shallow depth) below ground level and then refilling the trench with excavated soils to its original profile, so that there would be no effect on environment.

The system Reservoirs namely Veligallu; Srinivasapuram and Adavipalli Reservoirs are the existing reservoirs and it is proposed to impound the said reservoirs with lifted GNSS waters.

The Kaletivagu Reservoir; Kallurupalli tank and Nayunicheruvu tanks are also the existing small tanks. By impounding the said tanks and Reservoirs with GNSS Lifted waters, there would be no impact on environment. Further, neither any one of the villages nor habitation is being effected in lieu of proposing GNSS-HNSS Lift Irrigation Scheme.

By utilizing 2000 Cusecs of GNSS waters from Km 56.000 of GNSS Main Canal by means of lift, it is made feasible to serve drought affected areas of YSR Kadapa and Chittoor district besides providing drinking water facilities and to tail end ayacut of HNSS Scheme.

4.0. Observations during Site Inspection

The undersigned has visited the following reservoirs on 26.12.2021:

1. Avulapalli Reservoir
2. Mudivedu Reservoir
3. Nethiguntapalli Reservoir
4. Pedderu

5. Narayanacheruvu Reservoir

As per the discussions held, the details of each reservoir are as follows:

4.1. Avulapalli Reservoir

The Avulapalli balancing reservoir is proposed across the stream of Seethamma Cheruvu Vanka Near Avulapalli (V) in Somala (M) of Chittoor Dist.

The source of water for Avulapalli balancing reservoir is by gravity from the existing HNSS Punganur branch canal at km 210.00 to draw 3.5 TMC of water.

Land Acquisition: total extent of land required is 1300 acres out of which private land is 607 acres and Government land is about 693 acres. There is no requirement of Forest land for the reservoir.

Resettlement and Rehabitation: Bireddipalli and Devalakuppam, H/O of Devalakuppam (V) in Somala (M) in Chittoor Dist. will be affected due to formation of Avulapalli balancing reservoir.

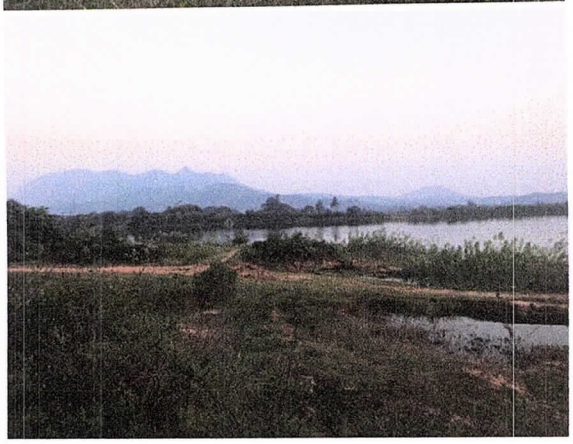
The satellite image of the reservoir is as follows:

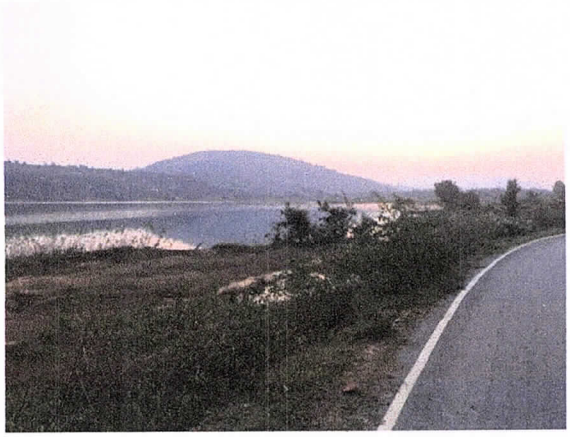


Photographs taken during the visit of Avulapalli balancing reservoir is as follows:

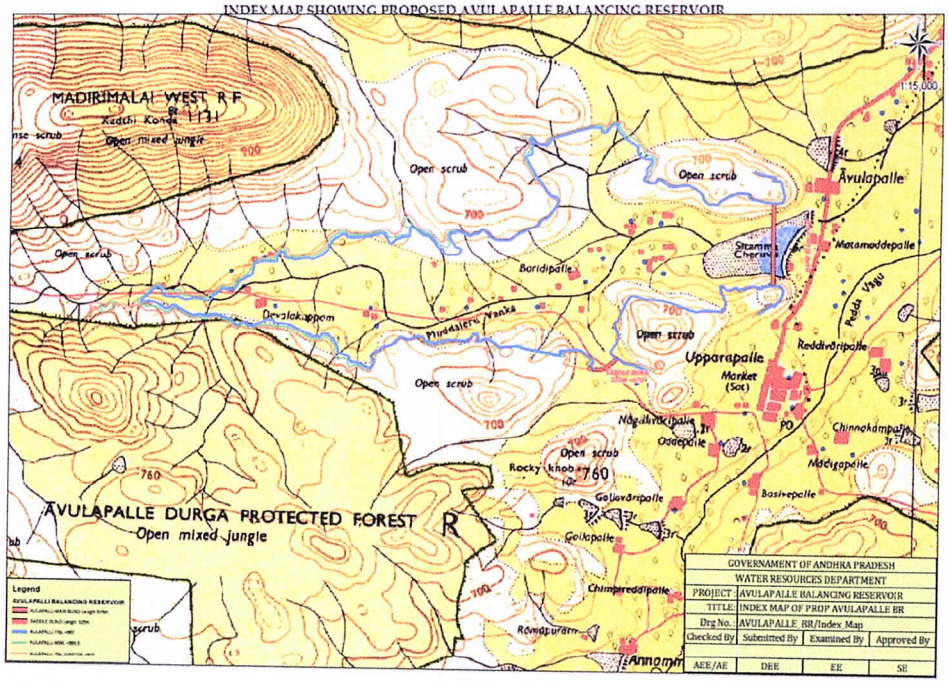








Index map of Avulapalli balancing reservoir is as follows:



4.2. Mudivedu Reservoir

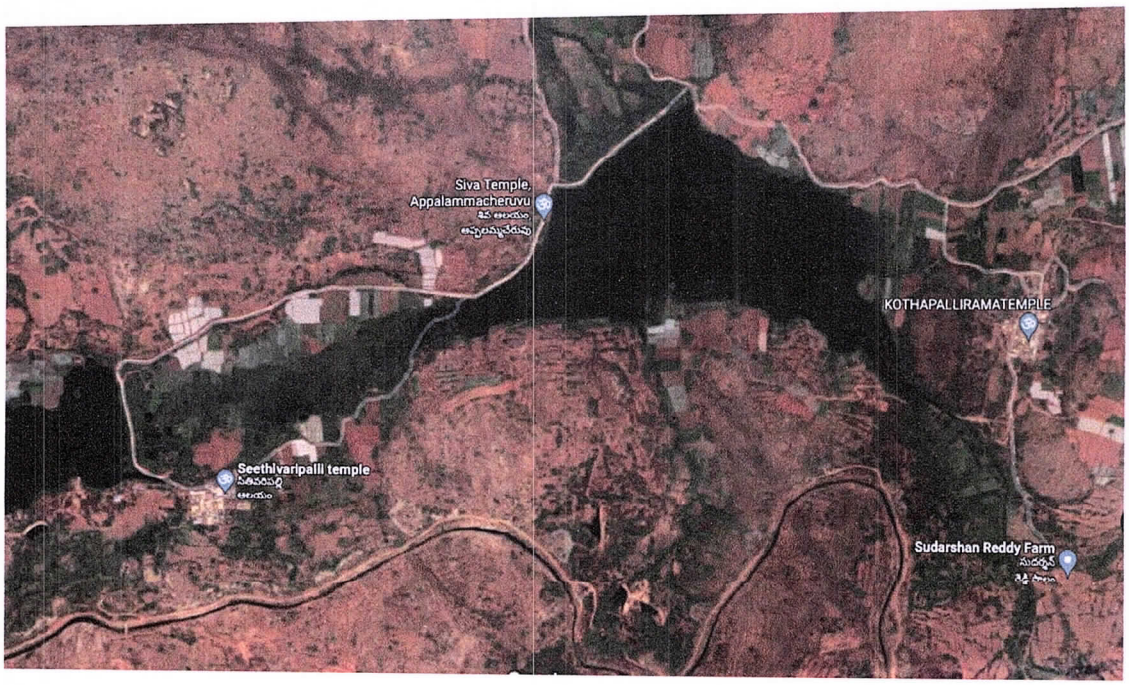
The Mudivedu reservoir is proposed near Mudivedu (V) in Kurabalakota (M) of Chittoor District.

The source of water for Mudivedu balancing reservoir is by gravity from the existing HNSS Punganur branch canal (proposed to enhance the present water carrying capacity of 380 cusec to 1180 cusecs by widening) at Ch: 125.400 to 2.00 TMC of water.

Land Acquisition: total extent of land required is 1123 acres out of which private land is 867 acres and Government land is about 256 acres. There is no requirement of Forest land for the reservoir.

About 190 houses in Kothapalli, Diguvaseethevaripalli, Dinnemedapalli, H/o of Pitchalavandlapalli of Kurabalakota (M) and Choutakuntapalli H/o Kotavuru (V) of B. Kothakakota (M) will be affected by the formation of Mudivedu balancing reservoir.

The satellite image of the reservoir is as follows:



Photographs taken during the visit of Mudivedu balancing reservoir is as follows:

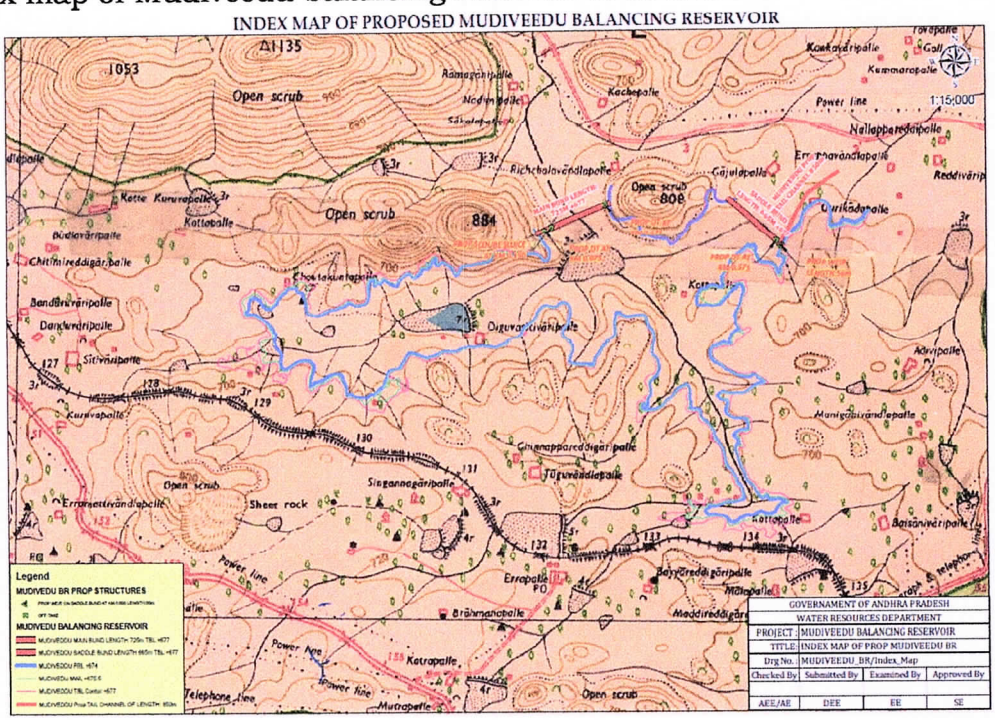








Index map of Mudiveedu balancing reservoir is as follows:



4.3. Nethiguntapalli Reservoir

Nethiguntapalli balancing reservoir proposed across the stream of Yathalamma Cheruvu vanka near Nethigulapalli (V) in Punganur (M) of Chittoor Dist.

The source of water for Nethiguntapalli balancing reservoir is by lift from the existing HNSS Punganur branch canal at Km 180.400 to draw 1.00 TMC of water.

Land Acquisition: total extent of land required is 867 acres out of which patta land is 181 acres and the remaining 686 acres are road, gutta, kaluva, kunta, pasalamethi bhoomi, grama kantamu. There is no requirement of Forest land for the reservoir.

About 30 houses of Yetigadda Kammavaripalli village of Mittachinthavaripalle Grama Panchayath in Punganur Mandal of Chittoor Dist. will be affected by the Nethiguntapalli balancing reservoir.

The satellite image of the reservoir is as follows:

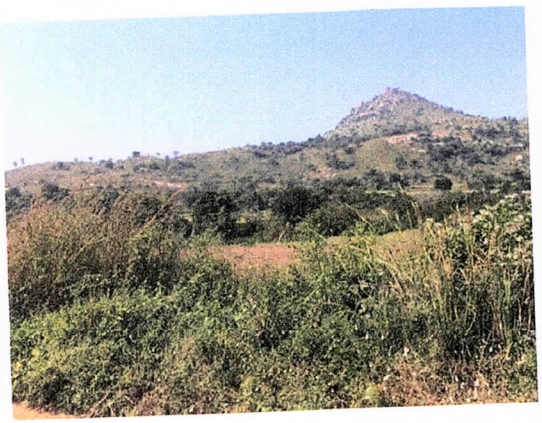


4.4. Pedderu and Narayanacheruvu Reservoirs

In addition to above three reservoirs, the undersigned also visited Pedderu and Narayancheruvu resrrvoirs. The photographs taken during the visit are as follows:

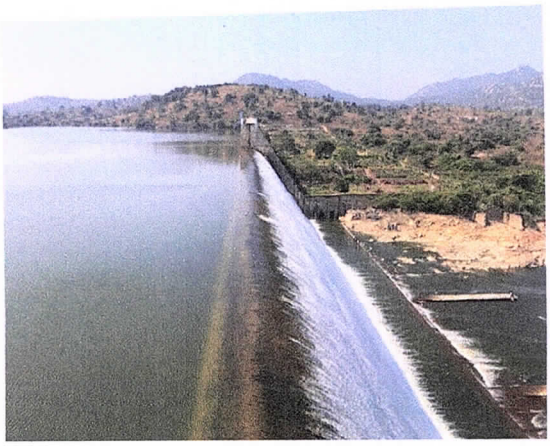
Photographs taken during the visit of Pedderu is as follows:





Photographs taken during the visit of Narayanacheruvu Reservoirs is as follows:





5.0. Conclusions

As per the observations made during site inspection, discussions held and information provided by Project Proponent, the following conclusions were made:

The proposed scheme of Interlinking of HNSS & GNSS Projects by Lift scheme is under planning and DPR preparation stage.

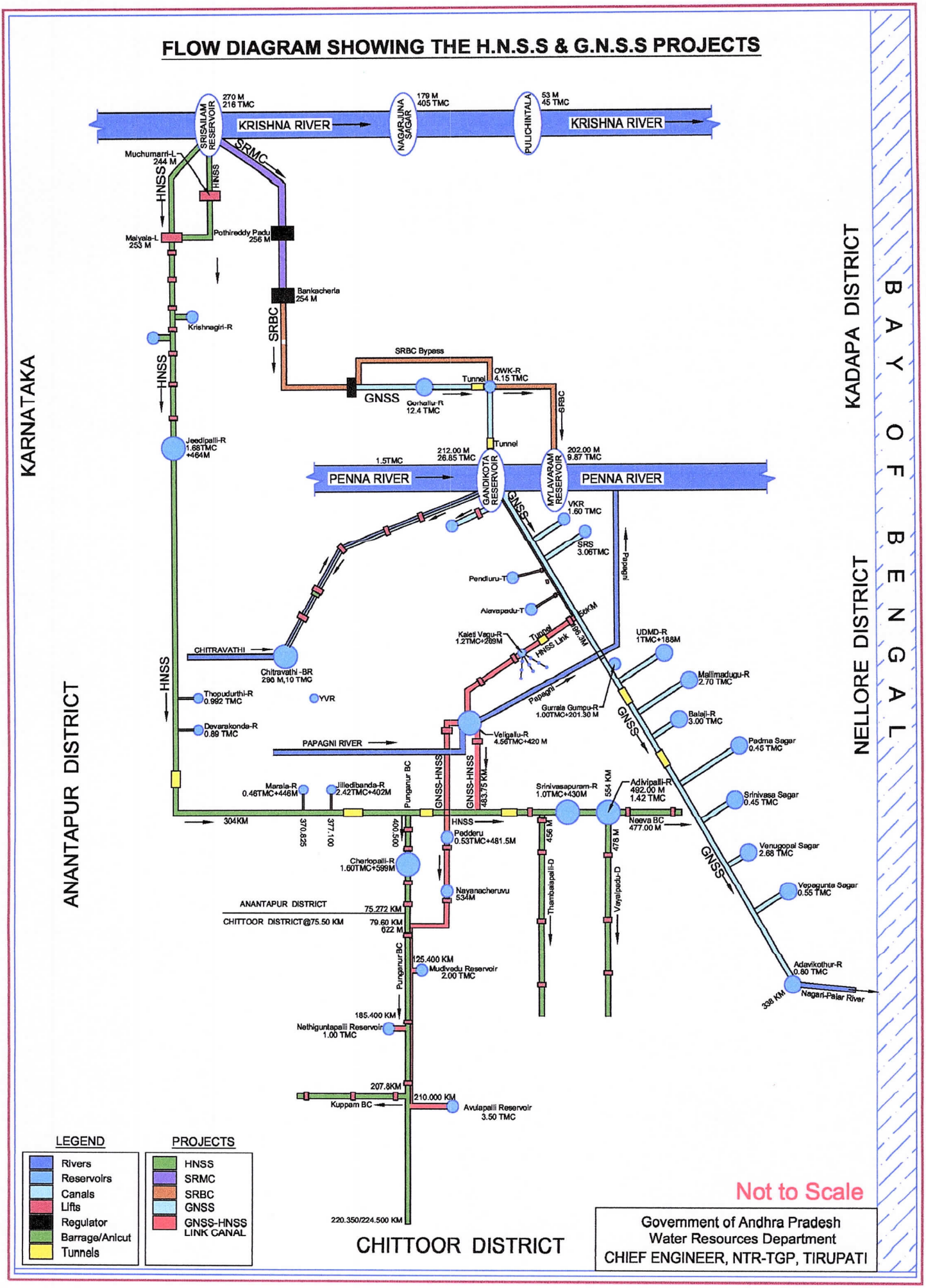
The allegations made by applicant in O.A. No. 137 of 2021 (SZ) were the drilling activities for testing of soil strength which is a part for preparation of Detailed Project Report (DPR) of each reservoir.

As per the discussions held, it has been observed that the activities taken up at Avulapalli balancing reservoir are for preparation of DPR and during the day of inspection, no sign of any construction activities were observed.

No constructional activities/project implementation activities are being taken up by the project proponent.

(डॉ। सुरेश बाबु पसुपुलेटी)
(Dr. Suresh Babu Pasupuleti)
संयुक्त निदेशक (एस) / वैज्ञानिक 'डी'
Joint Director (S) / Scientist 'D'

FLOW DIAGRAM SHOWING THE H.N.S.S & G.N.S.S PROJECTS



ENVIRONMENTAL MANAGEMENT PLAN

Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District

For

Chief Engineer (Projects)

Water Resources Department, Tirupati

Government of Andhra Pradesh

Prepared & Submitted by

SV ENVIRO LABS & CONSULTANTS

Enviro House, Block – B, B-1, IDA Auto Nagar,

Visakhapatnam - 530012

QCI No. NABET/EIA/2124/RA 0240 Valid up to Dated: 24.10.2024

DECLARATION

This is to declare that the preparation of Environmental Management Plan for the proposed "Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District" was carried out by the Department of Environmental Science, Engineering and Management, A.U. College of Engineering, Andhra University, Visakhapatnam in association with M/s S.V. Enviro Labs & Consultants, Enviro House, IDA, Autonagar, Visakhapatnam. The 'Construction of Avulapalli Balancing Reservoir near Avulapalli Village in Somala Mandal of Chittoor District" was proposed by the Chief Engineer (Projects), Water Resources Department, Tirupati, Government of Andhra Pradesh. It was submitted to the SEIAA, Andhra Pradesh to obtain Environmental clearance under the EIA notification, 2006 and its subsequent amendments.

Signature:

Prof. S. Bala Prasad
Department of Environmental Science, Engineering and Management,
A.U. College of Engineering,
Andhra University,
Visakhapatnam

Head of the Department of Environmental Science, Engineering and Management
A.U. College of Engineering
Andhra University
Visakhapatnam-530 003
Andhra Pradesh, India

Signature:

Name: M. Murali Krishna
Designation: Managing Partner
Name of the EIA consultant organization: SV Enviro Labs & Consultants
NABET Certificate No. & Issue Date: NABET/EIA/2124/RA 0240 Dt: 13.04.2022 Valid up to: 24.10.2024

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ANNEXURES

Annexure –I: G.O.RT. No. 461

Annexure –II: G.O. RT. No. 323

Chapter 1
INTRODUCTION

1.0 General

Climate change induced affects influences the water resources availability in complex ways. Climate change is going to disrupt the water resources sector, weather patterns leading to extreme rainfall and cyclone events, unpredictable water availability with reference to time and space, water supplies to even basic utilities, and other related sectors or sections. The major climate change consequences related to water resources are increases in temperature, changes in precipitation patterns, and a likely increase in the frequency of flooding and droughts. Climate change may also markedly change the seasonal variation in water flows in rivers or streams exacerbating water scarcity. Climate change tends to increase the frequency and intensity of rainfall; there may be an increase in the occurrence of flooding due to heavy rainfall events in several parts of India. Groundwater recharge may also be affected thereby causing reduction in the availability of groundwater for drinking water in some regions. Such impacts can drastically affect the quantity and quality of water that the living systems need to survive. Climate change exacerbates water stress particularly in areas of limited water resources, which will lead to increased competition for even drinking water. Intergovernmental Panel on Climate Change (IPCC) warned that changing climate system would exacerbate its effects on sections of population currently suffering from drought and flooding (5^{th} Assessment Report of IPCC, 2014).

Thus, the effects of climate change will have adverse direct and indirect impacts on water resources, drinking water provision, livelihoods, human health, ecosystems, regional agriculture, food security, livestock sustenance and overall the society and ecosystems. India, with major share of population and livestock has only around 4% of the world's water resources and about 9% of the world's arable land. Spatial and temporal distribution of rainfall is highly uneven and the impact is more in the southern states of India. One of the predictions of climate change impact is experiencing more frequent, heavy, intense, and short duration rains in the coming years. There has been a significant change in precipitation during last decade in India including the state of Andhra Pradesh. The present water resources availability resulted in scarcity in some of the regions of India. The impact of climate change in India may further aggravate the challenges in water resources availability and its management and governance. Flood Risk Management and storage of water during its

availability is also part of the Climate change impact management. It is apt to act and implement the mitigation and adaptation programs or plans to manage the climate change impact on water resources.

Water availability is becoming less predictable in many places, and may increase the incidences of droughts and / or flooding. Hence, the implementation of the climate change adaptation strategies in advance are necessary to cope up with the climate change induced impacts in water stressed states or regions in a state. One such strategy is to plan the programs well in advance to catch the floodwater when it is available and store it for a later use. Such adaptation programs or projects to reduce the effects of climate change on water will provide basic drinking water, livelihoods and save the lives of people and livestock of the state like Andhra Pradesh or region like Rayalaseema.

Andhra Pradesh is currently facing water shortage particularly in the Rayalaseema region of the state. Rayalaseema region comprising the four districts of Ananthapur, Chittoor, Y.S.R. Kadapa and Kurnool located in the southern part of Andhra Pradesh. Frequent drought occurrence from the 19th century onwards is the prime cause of water scarcity and backwardness of Rayalaseema region, discouraging its economy to stagnation and poverty. In recent past, Rayalaseema has not been able to receive sufficient rainfall due to which the deficiency in terms of rain is at a massive - 47% which is also the highest deficient figure in the entire country (Source: skymetweather). Chronically drought prone Rayalaseema region has become a foster child of the state Andhra Pradesh. The climate in Rayalaseema region is mostly dry with very low annual rainfall. It was found that all four districts of Rayalaseema are more vulnerable to climate change (Rama Rao et al., 2017). The impact of drought in Rayalaseema therefore becomes very significant. Hence, it is very much essential to plan an effective management of the available limited water resources.

The amount of water available in Rayalaseema region is limited during the summer months, and at the same time demand continuing to rise. It could pose serious challenges for drinking water supply, agriculture sector and other livelihood opportunities. Present water management projects / programs/systems are inadequate to meet the challenges of climate change in this region. It made the water supply planners and managers to supply sufficient water at least for drinking. There are possibilities of experiencing extreme pressure for drinking water in the drought-prone Rayalaseema in future. In addition, the prediction of the climate change impact on the water resources made the policy makers to plan the strategies

and policies to implement the climate change adaptation projects, which take into account climate change in relation to the integrated water resource management planning concerning droughts and water scarcity.

The major water resource development and management project in the Rayalaseema regions are Alaganur Balancing Reservoir, Chitravathi Balancing Reservoir, Galeru Nagari Sujala Sravanthi (GNSS), Handri Niva Sujala Sravanthi (HNSS), Velugodu, Gandikota, Gundlakamma, K-C canal systems, Gandikota Lift Irrigation Scheme, Owk Reservoir, Penna Ahobhilam etc. GNSS and HNSS irrigation projects tap water from Srisailam reservoir and distribute it to the dorught prone areas of Rayalaseema region. The water from GNSS project canal join the Gandikota Reservoir located across Penna River of Andhra Pradesh. In the year 2020, around 5,000 cusecs of water was released from Gandikota reservoir after it received around 6,000 cusecs of floodwater from Penna River due to heavy rains in a day. Penna River causes the water level in the Gandikota reservoir to rise significantly. The flood flows from Penna River self-catchment into the Gandikota reservoir during January 2021 estimated as approximately 14120 cusecs. In November 2021, heavy rains caused record flows through Penna River that resulted in cut off major road and rail routes including the Chennai-Kolkata highway.During this very short period, the Penna River got more than 2 lakh cusecs of water from its catchment and the river Papagni, Pincha, Cheyyruetc. were also carried huge amount of flood water flows. It is clear indication that the floodwater is available during monsoon season and it need to be effectively utilized to adapt to the climate change induced impacts in the region. Keeping these in view, Government of Andhra Pradesh started acting through the projects of climate change adaptation in water resources that can tap the water during its availability and use it later when it is necessary.

An adaptation intervention in the form of water project that include how water can be allocated to prevent shortages, and where more water storage is desired to withstand future droughts is the need of the hour. Considering the floodwater availability in the Gandikota reservoir and the probable future climate change impacts and adaptation in water resources management, Government of Andhra Pradesh initiated several projects in the drought prone Rayalaseema region. One such new project is construction of Avulapalli water storage reservoir to sore the water received from its catchment. The Avulapalli reservoir is made through expansion of storage capacity of the existing minor irrigation tank. The additional water required for the reservoir will be taken from the Gandikota reservoir, which on Pennar

River, during the period of availability of flood flows that are joining the Gandikota Reservoir. This project envisages storing floodwater during their available and supply of water primarily for drinking purpose during lean seasons and irrigation if there is any surplus. This project is part of adaptation towards the climate change impact and strategy for resilience in water resources management.

1.1 Project background

The proposed Avulapalli Balancing Reservoirs project is proposed to store water received from self-catchment initially and additional water from Gandikota reservoir. The additional water required in addition to the water yield from the self-catchment is conveyed through the existing gravity canal of HNSS Project. Now the HNSS canal in this area that conveys water to the proposed reservoir is not being utilised due to non-availability of water being the tail end region. The project aims at meeting the water demand in the drought prone region of Chittoor district in the semi-arid zone of Rayalaseema in the state of Andhra Pradesh. In future, it is necessary to expand the existing carrying capacity of canals and expansion of water storage facilities through another program to convey the additional water providing it through tapping of the Pennar Flood water. The construction of the reservoir project will be taken up in two phases (Phase 1 and Phase 2) as submitted to the Honorable NGT. The first phase is predominantly for drinking water and second phase will be for the irrigation requirements.

The project proposes to provide, long term relief to the people and live stock during the times of drought and famine when even drinking water is scarce and to assist in the reversal of the desertification process by enhancing the conditions of environment and ecology of the area. The first phase of the project provides the basic drinking water supply to the approximately 2.76 lakh people and contemplated ayacut of approximately 9700 ha. in addition to the supplementing of some of the ponds or tanks situated in the most frequently drought affected areas, further adding feeder facility to the local industry of the region in future.

1.2 Justification for proposed project

Rayalaseema is synonymous with semi-arid and drought prone region, and euphemism diametrically opposite from its prosperous times of mediaeval ages. The region includes the districts of Anantapur, Kurnool, YSR Kadapa and Chittoor, south of the Krishna River in Andhra Pradesh and drained by Krishna and Penna rivers. It has abundant land, mineral and

human resources and excellent potential for the establishment of next generation industries in goods and services sector. The main hindrance to the development of region is lack of 'dependable' water resources.

Rayalaseema region in Andhra Pradesh receives low rainfall ranging from 500 mm to 650 mm, compared to state average of 960 mm and not properly distributed over time and space. It is apt to mention here that earlier Ananthapuramu district in AP receives the second lowest rainfall in the country after the desert in Rajasthan.

Water security is intimately connected and tied with food security, livelihood, health, environment, socio-economic development and over-all well-being of any society. The State of Andhra Pradesh consisting 13 districts with 175 Assembly constituencies and 25 Parliamentary constituencies is identified as the three Regions : (i) North Coast Region (Srikakulam, Vizianagaram and Visakhapatnam districts), (ii) Coastal Andhra Region – (East Godavari, West Godavari, Krishna, Guntur, Prakasham and SPSR Nellore districts) and (iii) Rayalaseema Region (YSR Kadapa, Kurnool, Ananthapuramu and Chittoor districts) with more than half of the landed area of the State is fit for cultivation.

Among the three Regions, Rayalaseema Region is mostly a rocky region with some mineral resources and mainly with insufficient ground and surface-water resources, besides in some areas, the alkaline groundwater picks up fluoride. Rayalaseema Region constitutes 41% of the geographical area in the state, whereas the cultivable area is about 36% and the irrigated area is only 20% in the state. The region for which the proposed project is going to serve is facing even drinking water problem due to lack of availability of water. Hence, it is essential to take up such project for the sustenance of the people and livestock and their activity in the area. It helps in mitigating the climate change impact on the local water resources.

1.3 Aim of the project

The aim of the proposed scheme (phase 1) in the name of new formation of reservoir enhancing the storage capacity of the existing minor irrigation tank near Avulapalli to provide drinking water to around 2.76 lakh people and an ayacut / culturable command area of 9700 ha. in the upland region and remote areas in Chittoor district. The construction of the reservoir, to store water to its full capacity upto 3.5TMC, will be taken up in two phases. In the first phase the water yield from the self-catchment will be utilised for storage upto 2.5 TMC. In future, as part of the second phase, the water of 800 cusecs pumped into Punganuru

branch canal from the GNSS-HNSS Lift Scheme bringing water from Gandikota reservoir will be stored. This facilitates to meet the water demand of the regions that failed to get the water under the existing project with less cost and more effective manner.

1.4 Present proposal

The proposed formation of Avulapalli reservoir enhancing the storage capacity of the existing minor irrigation tank is part of climate change impact mitigation project. It is intended to provide drinking water to the people and irrigation facilities in Chittoor districts of Andhra Pradesh. The Govt. of AP have accorded administrative sanction for Rs.2144.50Cr. vide G.O Rt No.461 Dt: 02-09-2020 for the Avulapalli reservoir construction project.

The proposed overall project, to store a total of 3.5 TMC water, is based on the utilisation of water from its catchment and additional water from the surplus floodwater / stormflows reaching the Gandkota Reservoir on Pennar River. The balancing reservoir is proposed to store the floodwaters from the self-catchment and external source like Gandikota reservoir, if available, during the monsoon period. The yields from the self-catchments of the reservoir are less compared to the total proposed storage of 3.5 TMC. The water yield of the catchment is sufficient for 2.5 TMC storage capacities only.

Hence, it is decided to take in to account the yields of the self-catchments for the present project under phase 1 of the total contemplated project. Therefore, the present proposal is to construct the reservoir to store water upto 2.5 TMC only. If the phase 2 of the project, to store water to the additional capacity, is to be taken up later, it needs the external linkage to the surplus water from the Gandikota reservoir or any other possible source. Therefore, at present it is proposed to take up the first phase of the project (with a storage capacity of 2.5 TMC) only based on the flows from self-catchment to supply drinking water to 2.76 lakh people and irrigation water to 9700 ha.

1.5 Scope of the project

The formation of the Avulapalli Reservoirs enhancing the storage capacity of the existing minor irrigation tank is part of climate change impact mitigation project is proposed to provide drinking water to approximately 2.76 lakh people in the villages and towns and irrigation water to an ayacut of 23,959 acres under phase 1.

Location of the Avulapalli Balancing Reservoir: $78^{O}49'09"$ Longitude and $13^{O}23'29"$ Latitude Near Avulapalli in Somala(M) of Chittoor District, Andhra Pradesh.

Name of the head Works:			Village			
Avulapalli Reservoir		Avulapalli				
Location of Head Works	:					
Reservoir	:	Longitude		Latitude		
Avulapalli Reservoir		78^{O}49'09"		13^{O}23'29"		
Lies in Earthquake Zone No.		Zone-III				
Project Area Reference						
Degree Sheets		Survey of India Sheets				
		57-K5,	57-K-6,	57-K-7,	57-K-11,	57-K-15

The details of the project are available in the Detailed Project Report (DPR). The project includes measures for conjunctive use of water and drainage of surplus water. It also includes review and strengthening of agricultural support services and plan for involvement of beneficiaries in management of the project for self-sustainability in future.

1.6 Project proponent

The Water Resource Department, Government of Andhra Pradesh proposed the Avulapalli balancing reservoir enhancing the capacity of the existing seethamma cheruvu. The reservoir is proposed to meet the water demand in the area (primarily for drinking and then irrigation) as part of Climate change impact reduction and adaptation along with the Rayalseema Drought mitigation program. The details of the proponent

Designation : Chief Engineer (Projects)

Department : Water Resource Department, Govt. of Andhra Pradesh

Email : cetgpskht@gmail.com

Phone Number : 9440904116

Correspondence Address : Sri K. Harinarayana Reddy
Chief Engineer (FAC),
NTR Telugu Ganga Project
Water Resource Department of Govt. of Andhra Pradesh, Tirupati

1.7 Policy, Legal and Administrative Statutory

The Ministry of Environment, Forests and Climate Change (MoEF&CC), Govt. of India, has enacted various acts, legislations, guidelines and standards from time to time and is the principal environmental regulatory agency. MoEF&CC has been mandated to formulate environmental policies and accords environmental clearances for different projects in India. The important environmental legislations in India are presented in below table:

Name	Scope & objective	Key areas	Operational Agencies/Key player
Water (Prevention and Control of Pollution) Act, 1974, 1988	Prevention and control of water pollution, and enhancing the quality of water	Control discharge of sewage and industrial effluent	Central and State Pollution Control Boards
Air (Prevention and Control of Pollution) Act, 1981, 1987	Prevention and control of air pollution	Control emission of air pollutants	Central and State Pollution Control Boards
Forest (Conservation) Act, 1980, 1988	To consolidate acquisition of common property such as forest, halt India's rapid deforestation and resulting environmental degradation	Regulates access to natural resources, state has a monopoly right over land, categories forests, restriction on de-reservation and using forest for non-forest purpose	Central and State Pollution Control Boards
Wildlife (Protection) Act, 1972, 1993	To protect wildlife	Creates protected areas (national parks/sanctuaries) categories of wildlife which are protected	Wildlife advisory Boards, Central Zoo Authorities
Environment (Protection) Act, 1986	To provide for the protection and improvement of environment	An umbrella legislation, supplements pollution laws	Central government nodal agency, MoEF&CC can delegate to state departments of environment
EIA Notification 14th Sep 2006 and subsequent amendment thereof	Environment Impact Assessment	Environmental Protection	Project Development, State and Central Government
National Water Policy, 2012	Legislation needed in view of inequalities in distribution and lack of unified perspective in planning, management and use of water	To recognize and consider while planning the environmental needs of aquatic eco-system,	State and Central Government

	resources with due consideration to environmental sustainability and holistic benefit to the people.	wetlands and embanked flood plains besides adaptation to strategies to provide a mechanism for dealing with increased variability due to climate change.	
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	To address concerns of farmers and those whose livelihoods is dependent on land being acquired and at the same time facilitating land acquisition in a timely and transparent manner and for ensuring comprehensive package for the land owners for calculation of market value of the land besides comprehensive rehabilitation and resettlement package for land owners.	Social issues	Central and State Government

1.8 Scoping of the project for Environmental Management

The Government of Andhra Pradesh is planning environmental management projects as part of climate change impact reduction and adaptation programs in water resources management. As part of such environmental management projects, the water resources department proposed investigation and construction of new "Avulapalli Balancing Reservoir". The actual proposed reservoir, to store water upto 3.5 TMC, is to get water from its self-catchment and the additional water from Punganuru branch canal that conveys the take 800 cusecs of water from the Gandikota reservoir through GNSS-HNSS Lift Scheme to meet the water demand of the regions. The balancing reservoir is proposed to store the floodwaters from the self-catchment and external source like Gandikota reservoir, if available, during the monsoon period. The yields from the catchments of the reservoir are less compared to the total proposed storage of 3.5 TMC. The water yield of the catchment is sufficient for 2.5 TMC storage capacities only. Hence, for the present project, the yields of the self-catchments are

taken in to account as part of phase 1 of the total project. Therefore, it is proposed to take up the first phase of the project (with a storage capacity of 2.5 TMC) for the environmental management based on the flows from self-catchment to supply drinking water and irrigation water to 9700 ha.

The proposed new project Avulapalli Balancing Reservoir has an Ayacut of 9700 ha. which is less <10000 ha. ayacut. As per the SO 3977 (E) ₹ dated 14th August, 2018 and the SO 1886 (E) dated 20th April, 2022 construction of irrigation projects intend for drinking water and having a culturable command area between > 2000 ha and <10000 ha comes under B2 Category.

The proposed new project attracts prior Environmental Clearance as per the EIA notification, 2006 and its subsequent amendments as it has a culturable command area of 9700 ha. As per the S.O 3977 (E) of MoEF&CC, dated 14th August 2018 and the SO 1886 (E) dated 20th April, 2022, it comes under B2 category as specified under item "1(c) (ii) Irrigation projects" in the SCHEDULE. Further, the NGT also directed to get the necessary EC to the new project and as there is component of drinking water supply to remote areas, the processes need to be duly expedited by the concern authorities.

Therefore, it is requested to appraise the proposed project under B2 category as per the EIA notification and subsequent S.Os of MoEF&CCat the earliest and issue the Environmental Clearance.

Chapter 2

PROJECT DESCRIPTION

2.0 General

The project proposes to provide long-term relief to the people and livestock during the times of lean seasons and drought when even drinking water is scare. It would also provide the irrigation water supply to the completed aycut in addition to supplementing some of the ponds or tanks (locally called as Cheruvulu) situated in the most frequently drought affected areas in the Chittoor district. It will also assist the generation of livelihood opportunities through provision of irrigation water supply process and enhancing the conditions of environment of the area.

In order to provide assured drinking water supply to the villages to be served under the proposed Avulapalli reservoir in Chittoor District, it is envisaged to utilise the floodwater during their availability from its self-catchment and additional water based on the availability in Gandikota reservoir. The Avulapalli reservoir phase 1 is intend to create drinking water to about 2.76 lakh population and irrigation facilities in the command region to feed 9367 ha (23,146 Acres) of ayacut of the region.

The project proposes to provide, long-term relief to the people and cattle during the times of drought and famine when even drinking water is scarce and to assist in the reversal of the desertification process by enhancing the conditions of environment and ecology of the area. It would also provide the water supply to the contemplated ayacut in addition to supplementing some of the existing ponds or tanks situated in the most frequently drought affected areas, further adding feeder facility to the local industry in and around Thamballapalle, Madanapalli, Piler and Punganur, Palamaneru, Kuppam Assembly constituencies in future.

2.1 Location of the Project

Name of the Reservoir (Proposed)	Longitude	Latitude	Name of Village Near head Works
Avulapalli Reservoir	78^{O} 49’ 09”E	13^{O} 23’ 29”N	Avulapalli

The location of the project on google map is shown in Fig 2. 1. The location of the project components on 1:50,000 scale toposheet is presented in Fig. 2. 2.

2.2 Ayacut and Capacity Details of Existing Pond Seethamma Cheruvu

The proposed balancing reservoir is a small dam type pond constructed through expansion of the existing Seethamma Cheruvu, and the Seethamma Cheruvu (MI tank) fore shore area and capacity of the MI is limited.

Table 2.1: Proposed Balancing Reservoir / Existing Tank Details

Name of the Proposed Balancing Reservoir	Name of existing Pond	Existing Ayacut in Acres	Capacity of existing Tank in Mcft	Revised / Enhanced capacity in TMC	Ayacut Proposed Acres/Ha	Drinking water	
						Existing	Design., per year in TMC
Avulapalli	Seethamma Cheruvu	48	28	2.5	23,959Ac 9700Ha	Nill	1.31

2.3 Catchment Area

The catchment area through which runoff is being received by the existing MI tank is approximately more than 48.5 km^2. The runoff varies with the rainfall and its intensity-duration-frequency apart from the catchment area characteristics. The catchment has sufficient slope as it has hillocks and hills. As of the self-catchment can yield upto 2.5 TMC which will be used as the inflows to the present proposed phase 1 construction of the reservoir.

2.4 Cascading of Seethamma Cheruvu

Cascading of Seethamma Cheruvu as of now are 1) Somappacheruvu, 2) Vyasappacheruvu, 3) Enkicheruvu, 4) Seetha cheruvu, 5) Korlakuntavaripalli, 6) Kummaranicheruvu, 7) Panyam cheruvu, 8) Ayyapanayanicheruvu, 9) Papireddypalliproject, 10) Agraharam cheruvu

2.5 Elevation of Avulapalli Balancing Reservoir

Table 2.3 Water Levels (EL-m) Avulapalli Balancing Reservoir

Water Levels (EL-m)		
a)	Max. Water Level (M.W.L)	661.50
b)	Full Reservoir Level(F.R.L)	660.00
	T.B.L(Top of the Bund Level	665.00
c)	Minimum Draw Down Level (M.D.D.L.)	638.00
d)	Outlet Levels	
i)	Irrigation	638.00
ii)	Power	------
iii)	Others	-------
e)	Dead storage Level	632.00
f)	Free Board,m	4.00

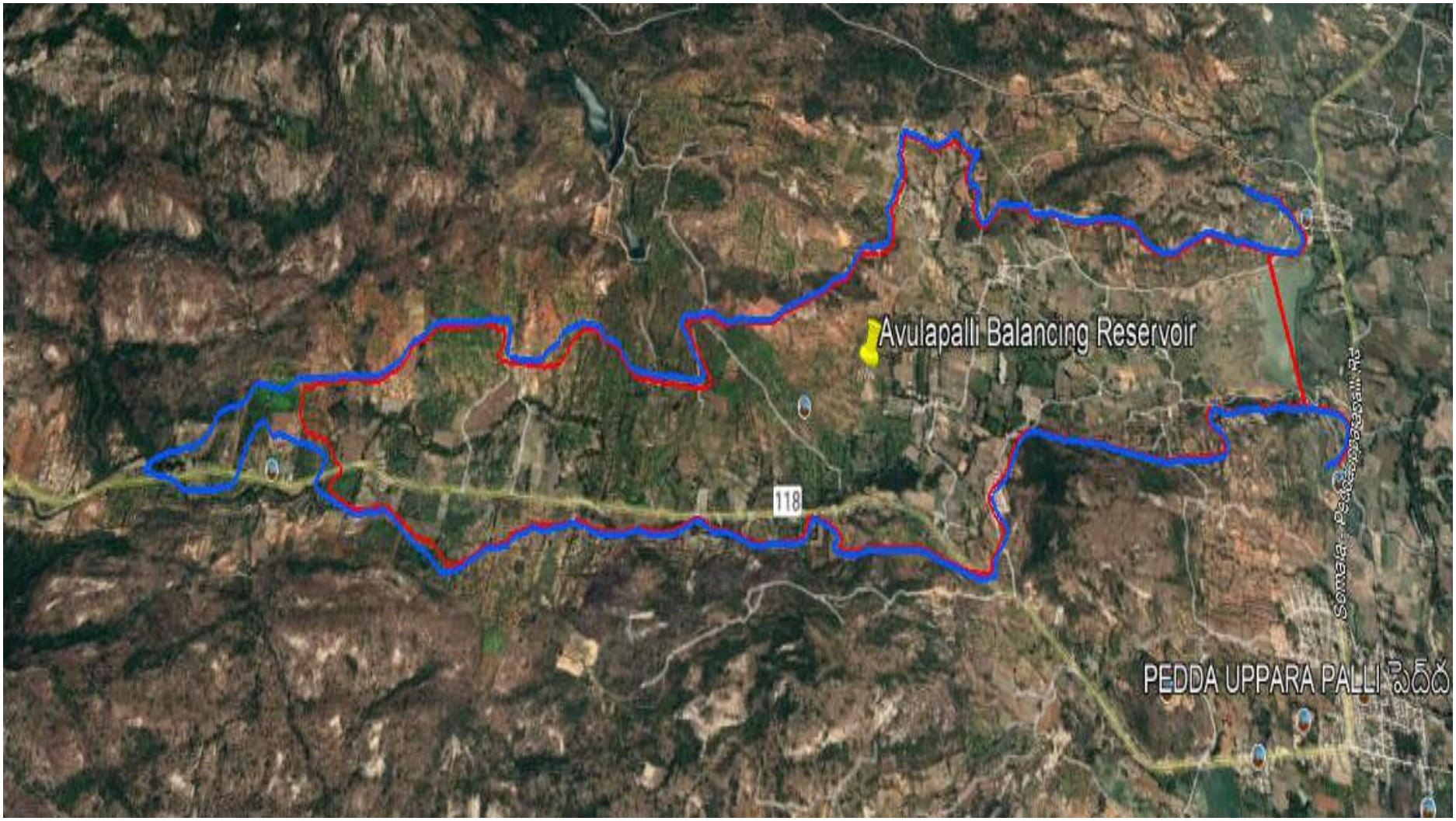


Fig 2.1 Google Image of the Avulapalli Balancing Reservoir

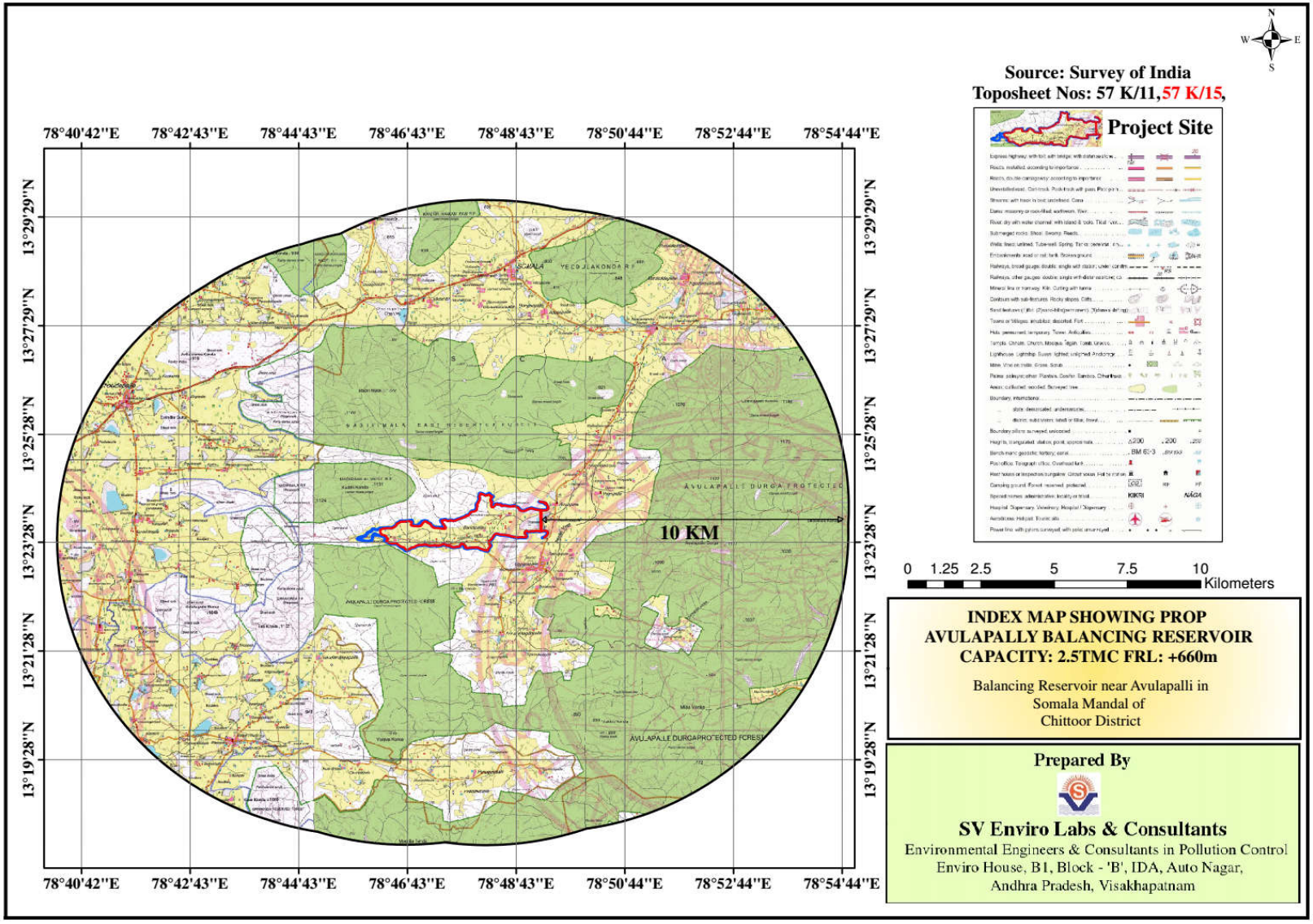


Fig 2.2: Topo map of the study area

2.6 Saddle Bund

The lowest area between two highlands (prominences or peaks) which has two wings which span the divide (the line between the two prominences) by crossing the divide at an angle, and, so is concurrently the Maximum water level of the reservoir plus Free board as highpoint of the Avulapalli Balancing Reservoir which falls off within the boundary of the Avulapalli Balancing Reservoir to avoid the inundation of forest land. That is, the drainage divide is a ridge along the high point of the saddle, as well as between the two peaks and so defines the major reference axis. A saddle can vary from a sharp, narrow gap to a broad, comfortable, sway-backed, shallow valley so long as it is both the high point in the sloping faces which descends to lower elevations and the low area between the two flanking summits. Concurrently, along a different axis, it is the low point between two peaks, so as such, is the likely 'optimal' high point in a pass if the saddle is traversed by a Water. 4 nos of saddle bunds are proposed to avoid any inundation of forest area . The position of saddle bunds are in the contour drawing as given in Fig. 2.5.

2.7 Table 2.4 Contour capacity of the Avulapalli Balancing Reservoir

RESERVOIR CAPACITY TABLE								
Avulapally BR : 2.5 TMC FRL +660								
S.No.	**Individual strip**	**Contour Elevation**	**Contour Area**	**Individual Vol: V=Δh(A1+A2+ Sqrt (A1A2))/3**	**Cft Col D * 35.315**	**Mcft Col E/1000000**	**Tmc Col F/1000**	**Cumulative**
	A	B	C	D	E	F	G	H
1	0		0					
3	106	616	106	35	1248	0.00125	0.00000	0.00000
4	350	617	350	216	7635	0.00764	0.00001	0.00001
5	2328	618	2328	1194	42150	0.04215	0.00004	0.00005
6	8492	619	8492	5089	179710	0.17971	0.00018	0.00023
7	17599	620	17599	12772	451043	0.45104	0.00045	0.00068
8	27781	621	27781	22497	794487	0.79449	0.00079	0.00148
9	37914	622	37914	32716	1155382	1.15538	0.00116	0.00263
10	48207	623	48207	42958	1517048	1.51705	0.00152	0.00415
11	59732	624	59732	53867	1902301	1.90230	0.00190	0.00605
12	81781	625	81781	70468	2488593	2.48859	0.00249	0.00854
13	137013	626	137013	108216	3821648	3.82165	0.00382	0.01236
14	185486	627	185486	160639	5672962	5.67296	0.00567	0.01803
15	273872	628	273872	228248	8060593	8.06059	0.00806	0.02609
16	331316	629	331316	302139	10670024	10.67002	0.01067	0.03676
17	427652	630	427652	378461	13365345	13.36535	0.01337	0.05013
18	571977	631	571977	498069	17589303	17.58930	0.01759	0.06772
19	713879	632	713879	641619	22658776	22.65878	0.02266	0.09038
20	789998	633	789998	751617	26543362	26.54336	0.02654	0.11692
21	892038	634	892038	840502	29682317	29.68232	0.02968	0.14660
22	1013042	635	1013042	951899	33616309	33.61631	0.03362	0.18022
23	1107792	636	1107792	1060064	37436163	37.43616	0.03744	0.21766
24	1229770	637	1229770	1168250	41256757	41.25676	0.04126	0.25891
25	1342677	638	1342677	1285810	45408392	45.40839	0.04541	0.30432

26	1448681	639	1448681	1395343	49276553	49.27655	0.04928	0.35360
27	1588243	640	1588243	1517927	53605601	53.60560	0.05361	0.40720
28	1706443	641	1706443	1646990	58163434	58.16343	0.05816	0.46537
29	1821852	642	1821852	1763833	62289757	62.28976	0.06229	0.52766
30	1927715	643	1927715	1874534	66199182	66.19918	0.06620	0.59386
31	2032440	644	2032440	1979847	69918285	69.91829	0.06992	0.66377
32	2148700	645	2148700	2090301	73818964	73.81896	0.07382	0.73759
33	2302956	646	2302956	2225382	78589381	78.58938	0.07859	0.81618
34	2456105	647	2456105	2379120	84018612	84.01861	0.08402	0.90020
35	2658521	648	2658521	2556645	90287924	90.28792	0.09029	0.99049
36	2811129	649	2811129	2734470	96567812	96.56781	0.09657	1.08706
37	2954784	650	2954784	2882658	101801074	101.80107	0.10180	1.18886
38	3110815	651	3110815	3032465	107091500	107.09150	0.10709	1.29595
39	3259022	652	3259022	3184631	112465247	112.46525	0.11247	1.40841
40	3412954	653	3412954	3335692	117799963	117.79996	0.11780	1.52621
41	3567202	654	3567202	3489794	123242072	123.24207	0.12324	1.64946
42	3767089	655	3767089	3666691	129489208	129.48921	0.12949	1.77895
43	3957161	656	3957161	3861735	136377178	136.37718	0.13638	1.91532
44	4142662	657	4142662	4049557	143010121	143.01012	0.14301	2.05833
45	4327035	658	4327035	4234514	149541862	149.54186	0.14954	2.20788
46	4491070	659	4491070	4408798	155696708	155.69671	0.15570	2.36357
47	4730831	660	4730831	4610431	162817369	162.81737	0.16282	2.52639
							Total	**2.5 TMC**

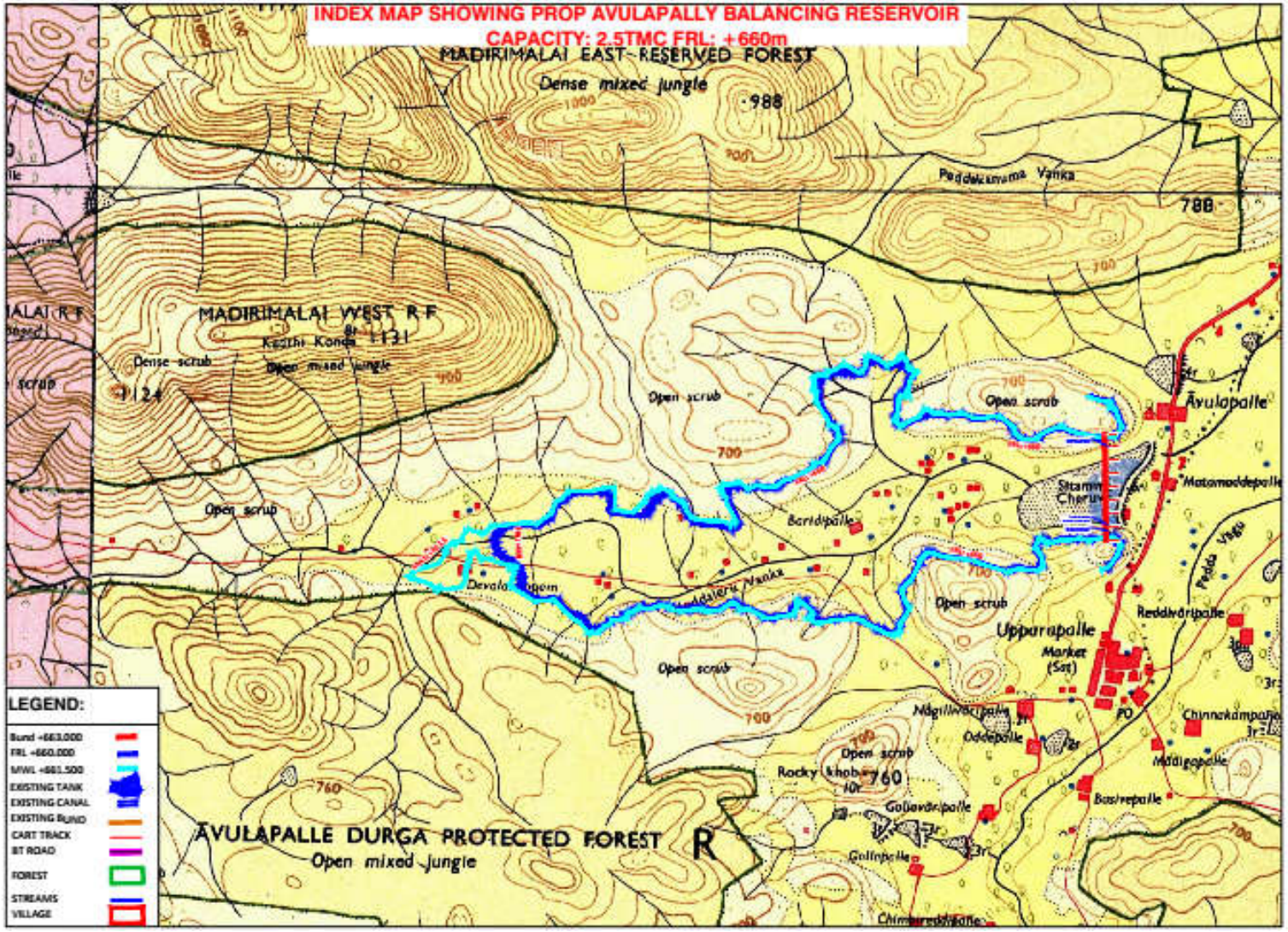


Fig 2.3 Water spread area of proposed Avulapalli Balancing reservoir on Topomap

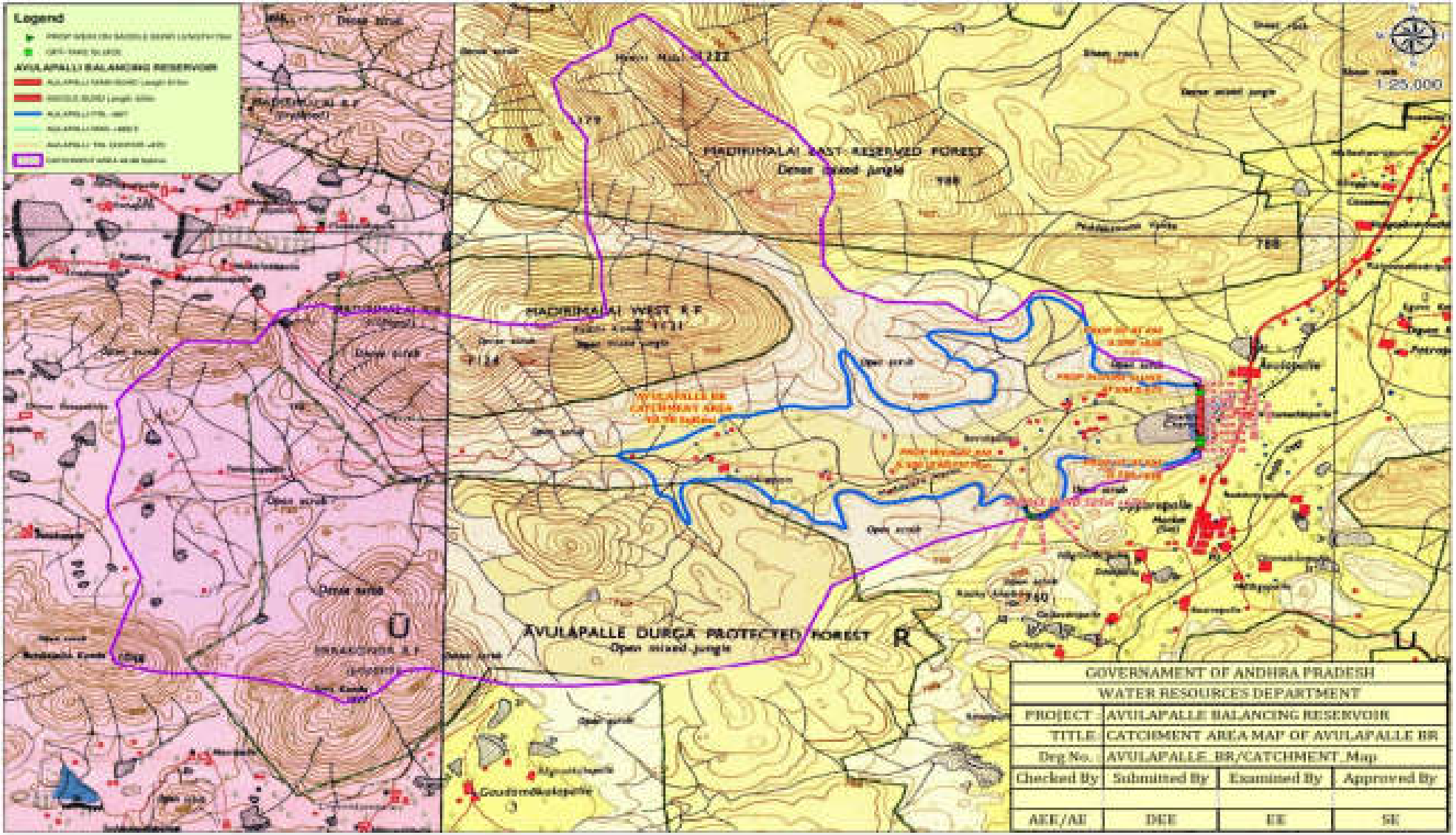


Fig 2.4 Catchment area of the Avulapalli Balancing reservoir

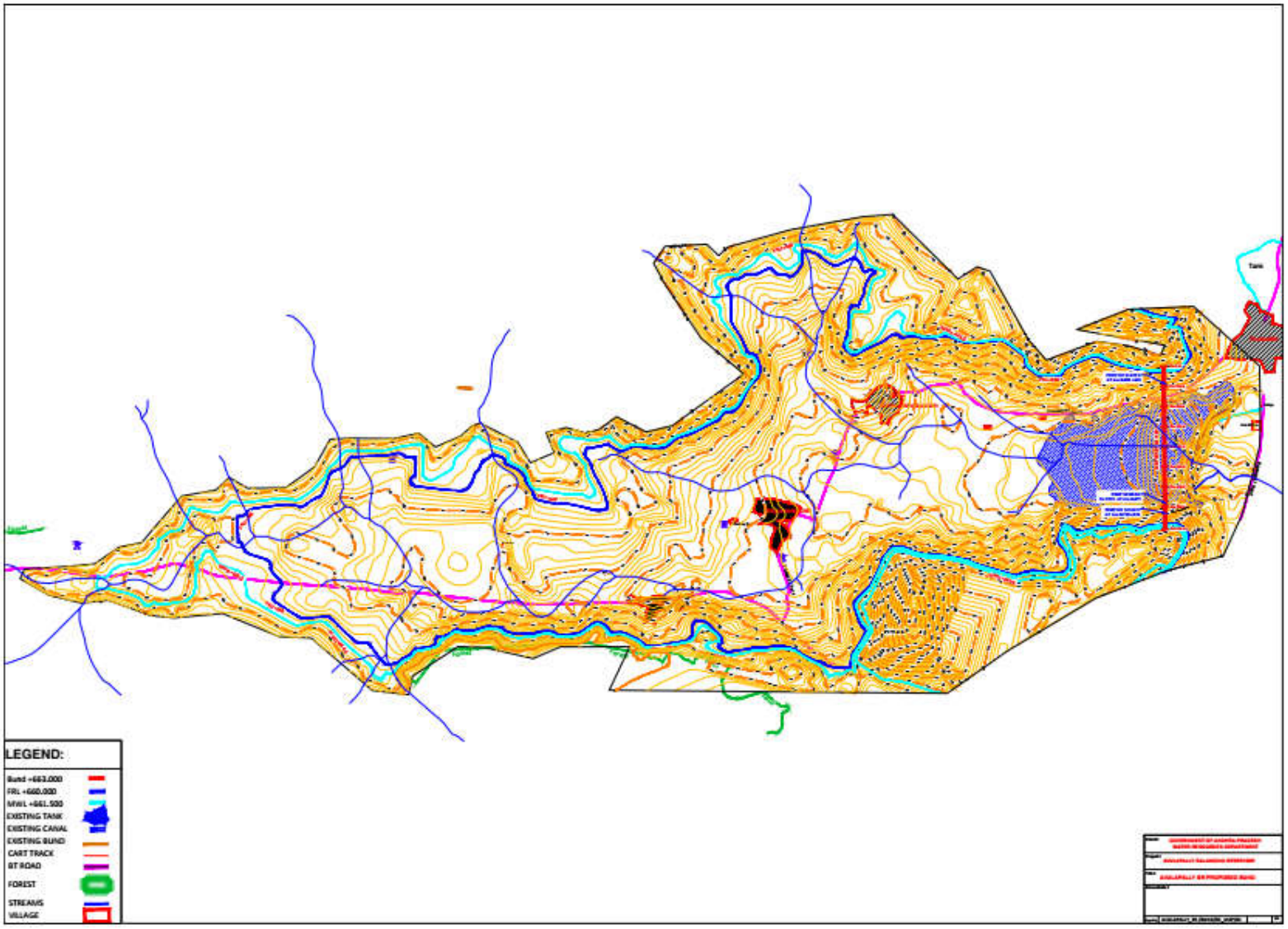


Fig 2.5 Contour map of proposed Avulapalli Balancing Reservoir

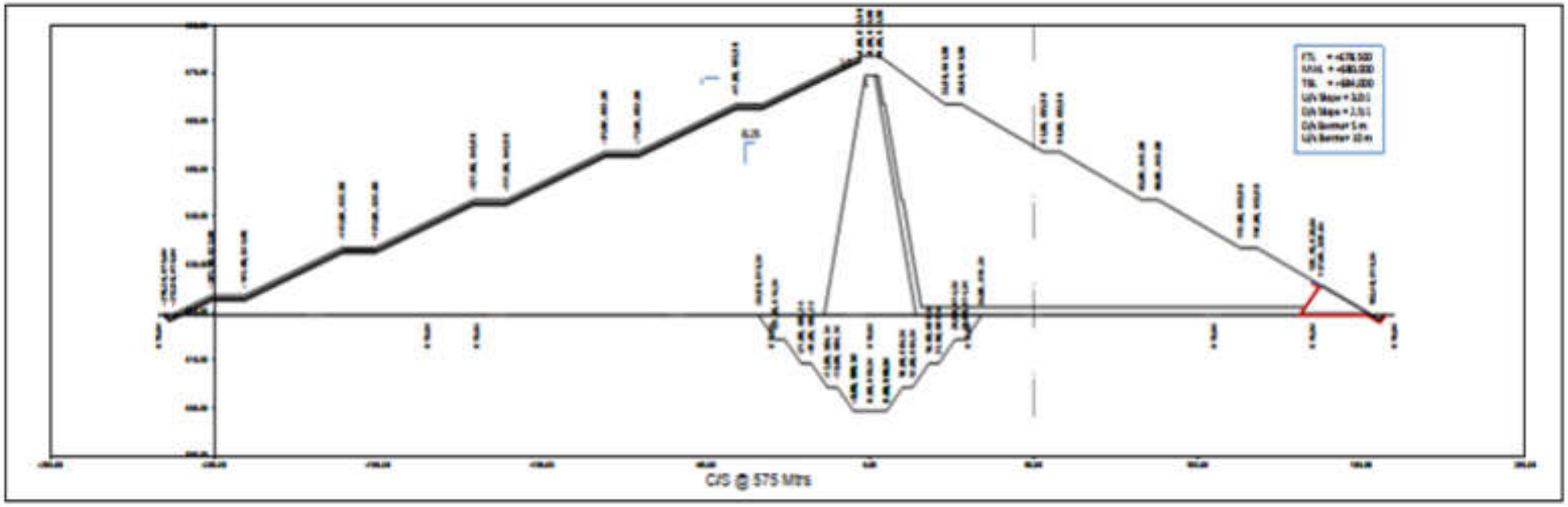


Fig 2.6 Typical Cross Section of Bund

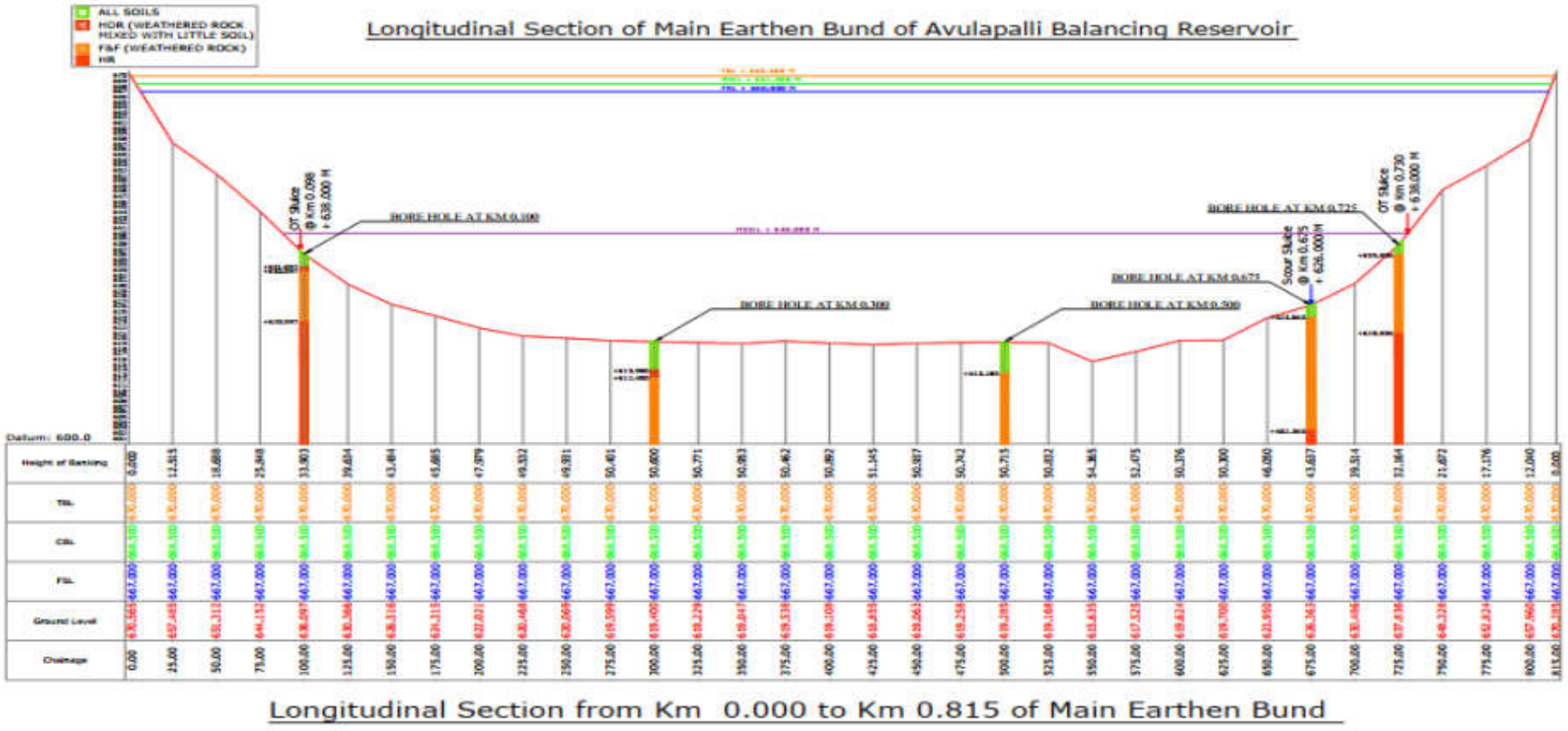


Fig 2.7 Proposed L.S. of the main Earthen Bund

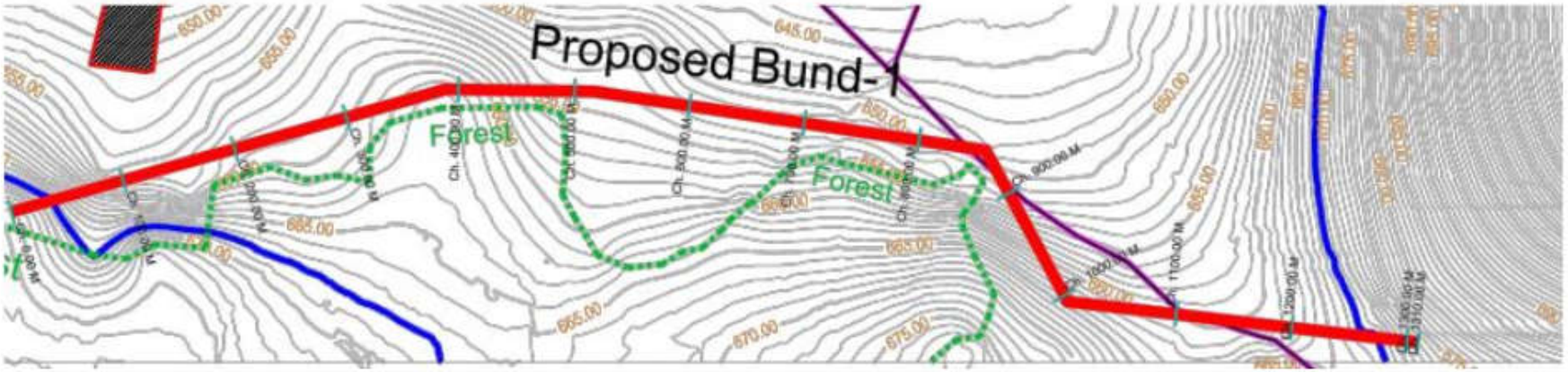


Fig 2.8 Position of Saddle Bund 1

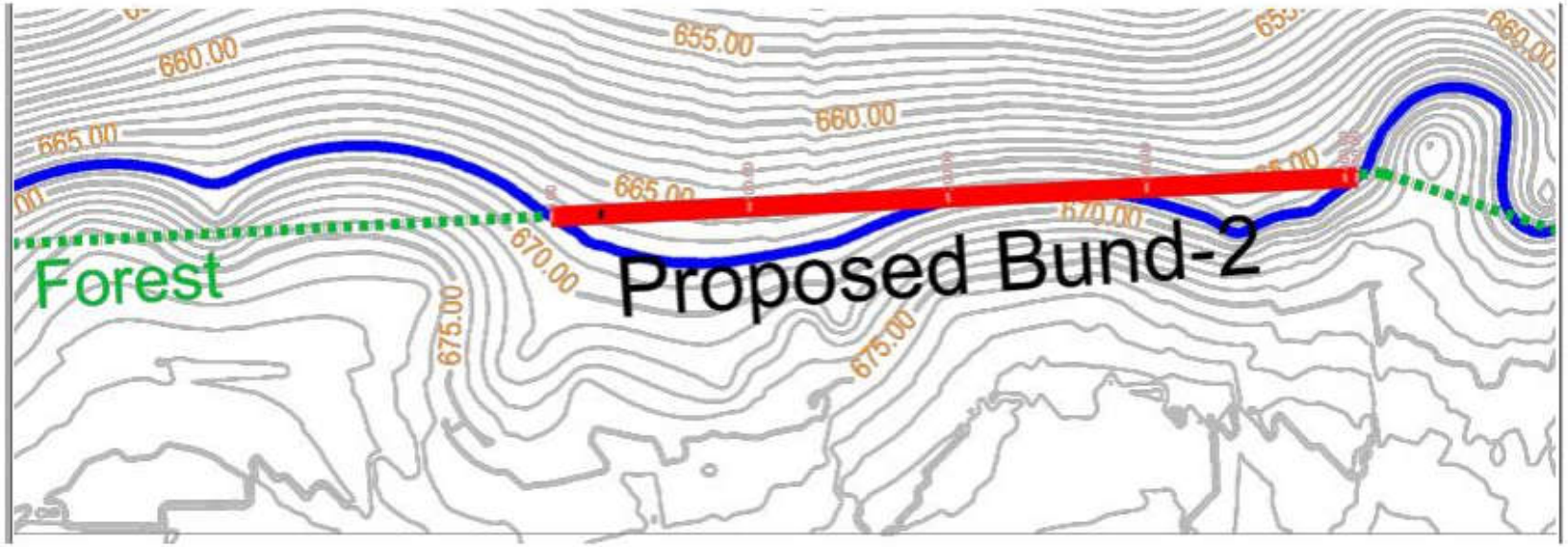


Fig 2.9 Position of Saddle Bund 2

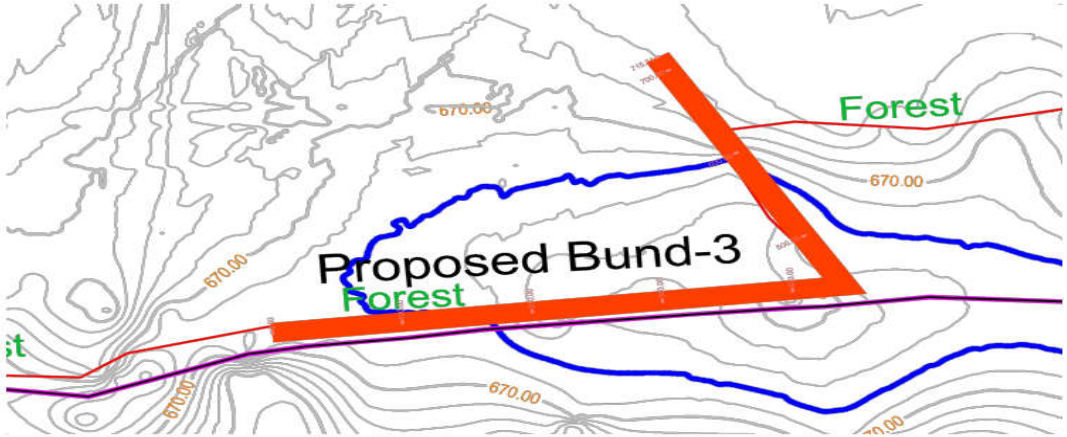


Fig 2.10 Position of Saddle Bund 3

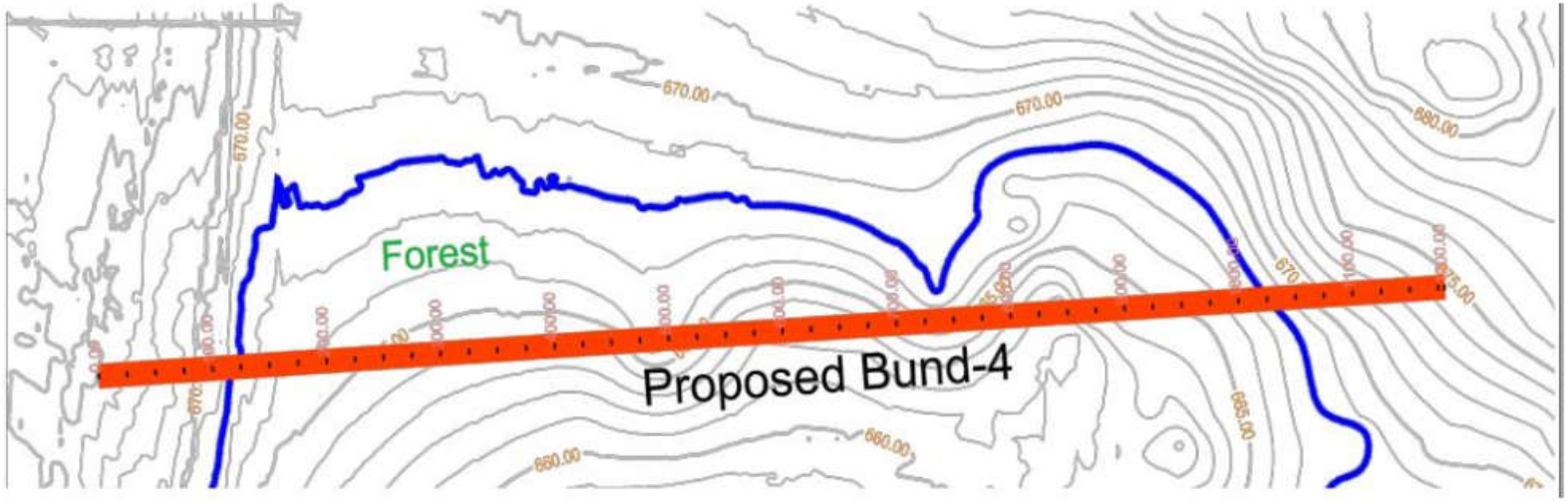


Fig 2.11 Position of Saddle Bund 4

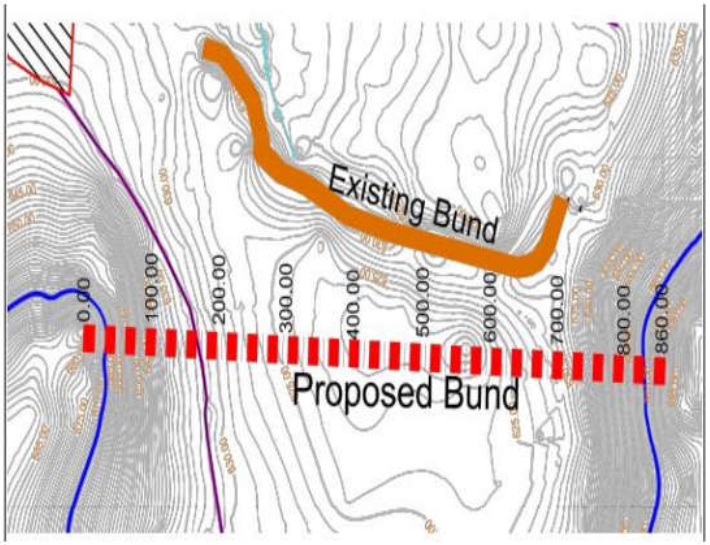


Fig 2.12 Position of Proposed Main Bund and Existing Bund

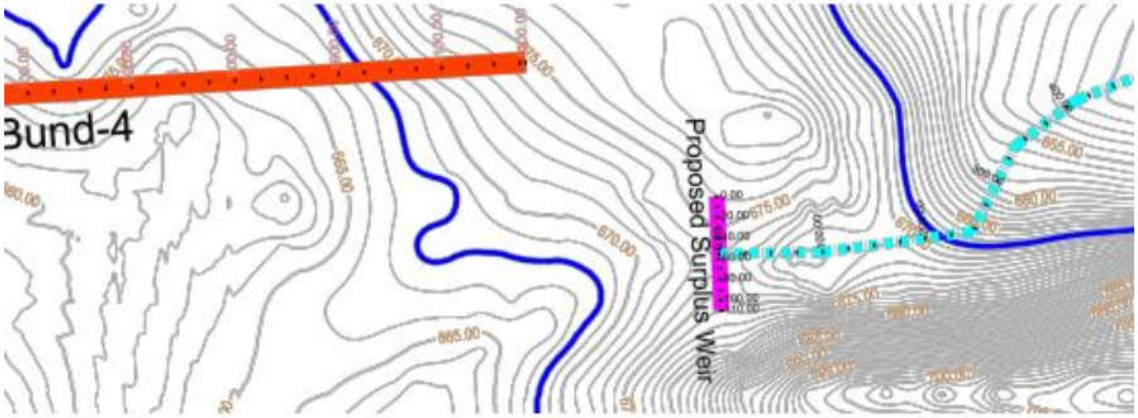


Fig 2.13 Position of Proposed Surplus Weir

2.8 Hydrology

2.8.1 Source of Water for GNSS Main Canal

The main water for the total actual capacity of the reservoir of 3.5 TMC is from its own catchment and additional floodwater flowing through the PB canal. It is envisaged as part of future plans, if taken up, to use the water lifted from Gandikota reservoir on Pennar river linking it to the PB canal to get the additional water for the additional storage capacity. If it is decided, at a later stage after construction of the phase 1 part of the reservoir, to explore the possibility for expansion upto 3.5 TMC, then it is necessary to take up the external linkage from PB canal to get the flood water from Gandikota reservoir. The possible linking canal from the PBC to the proposed Avulapalli reservoir is Shown in Fig 2.14.

However, the present proposal is only to construct the reservoir upto 2.5 TMC which is based on the flows from the catchment. There is no external linkage is proposed under phase 1 of the project. Therefore, the present proposal of the construction of the reservoir is independent of any of the external water resources.

2.9 Inflows and Out flows of Gandikota Reservoir from 2013-14 to 2020-21 (upto 30/06/2021)

Table 2.5 Inflows and Outflows of Gandikota Reservoir

S.No.	Year	Inflows (TMC)	Outflows (TMC)
1	2013-14	2.053	0.501
2	2014-15	Nil	Nil
3	2015-16	Nil	Nil
4	2016-17	5.04	2.641
5	2017-18	23.363	15.785
6	2018-19	12.808	10.633
7	2019-20	63.55	56.054
8	2020-21	67.662	44.400

2.10 Source of Water to Avulapalli Balancing Reservoir

The total Avulapalli balancing reservoir is proposed to be constructed for inflows from the catchment and additional external water tapped by connecting it with a gravity canal to the existing HNSS Punganur Branch Canal @ km 210.00. If the second phase is taken up in future, then it requires the following external connectivity. However, the present proposal is only for phase1and the capacity under this phase is 2.5 TMC only. Hence, there is no necessity for any

external connectivity. The possible external linkage for the additional capacity of the reservoir is as follows which may be explored in future as part of second phase.

2.11 Diversion of 7.00 Cumecs

It is necessary to get approval from the government for the external channel. Then only it will be considered as part of future program which may provide an opportunity for enhancing the capacity of the Avulapalli reservoir capacity to 3.5 TMC under phase 2. As it may be taken up at a later stage after obtaining the relevant permission and approvals, the details are presented here.

Diversion of 7.00 Cumecs from HNSS-Punganur Branch canal to feed the Avulapalli Balancing Reservoir for assured drinking water supply and irrigation command area facilities to the 1st Punganur constituency of Rompicherla mandal villages, Sodum mandal villages, Pulicherla mandal villages, Somala mandal villages, Punganur mandal villages and 2nd Pileru constituency of Pileru mandal villages, K.V. Palli mandal villages, Kalakada mandal villages, Valmikipuram mandal villages, Gurramkonda mandal villages, Kalikiri mandal villages and nearby villages. Avulapalli Balancing Reservoir with a capacity of 2.5 TMC (Storage Capacity of the Proposed Avulapalli Balancing Reservoir) to supply assured drinking water supply to the Punganur and Pileru constituencies and the surrounding villages for ultimate population of more than the proposed 2.76 lakh under phase 1 .

Diverting from @ Ch at 210.00 Km to feed the Avulapalli Balancing Reservoir.

1. The scheme is passing through Revenue lands only.
2. No existence of Forestland

2.12 Requirements of Embankment

- The embankment, foundation, and abutments must be stable against slumping, sliding and sloughing during construction, during all conditions of reservoir operation and during and following unusual events such as earthquake and flood.
- Seepage through the embankment, foundation, and abutments must be controlled and collected to prevent excessive uplift pressures, piping, sloughing, dissolution and erosion of material into cracks, joints and cavities.
- Because of low yield within the watershed, Avulapalli Balancing Reservoir is designed with a limitation on the rate of seepage. Foundation cutoffs, select core material, upstream impervious blankets, chimney filter and drain systems, blanket drains, finger drains, toe drains, multiple transition filters between core and rockfill shell material,

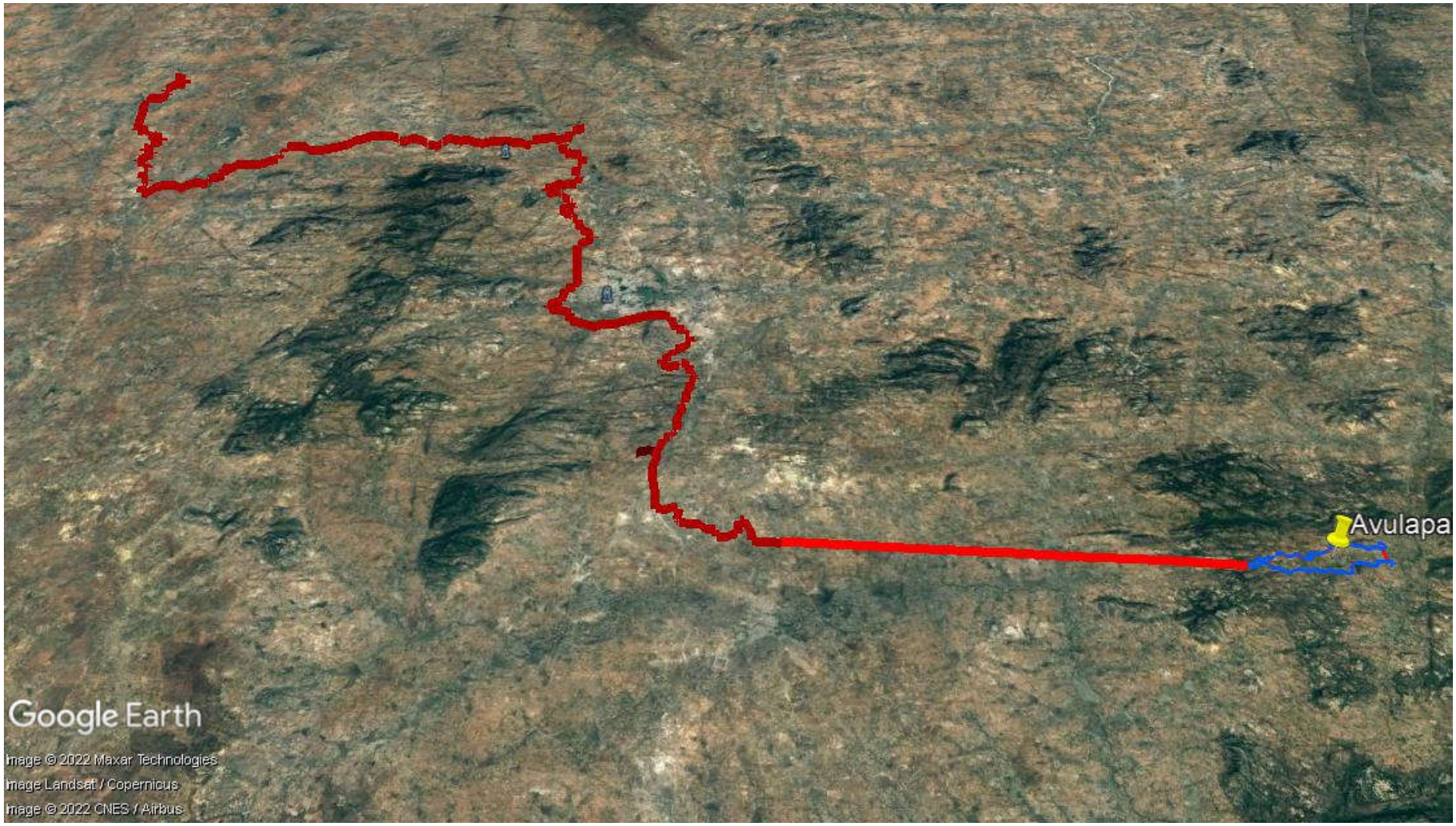


Fig 2.14 The Possible Linking Canal from PBC to the Proposed Total Avulapalli Balancing Reservoir (3.5 TMC)

drainage adits and tunnels, drain holes and relief wells are common measures to control and limit seepage. Redundancy and multiple defenses are often necessary and represent sound engineering practice considering the uncertainties at this dam site. Existing dams that do not incorporate typical seepage defense measures may require prompt defensive action should a problem develop.

- Freeboard is ensured with sufficient to prevent overtopping by wave action. An allowance for post-construction settlement of the dam and its foundation, and deformation caused by earthquake is taken into consideration. In addition, 4.00 m freeboard sufficient to pass the maximum design flood, often chosen as the probable maximum flood. Spillways and outlets are accordingly designed with sufficient capacity such that overtopping of the dam does not occur.
- Outer slope protection on both the upstream and downstream slopes to prevent erosion by wave action, reservoir level fluctuations, rainfall and wind. Materials is durable and resistant to wet/dry and freeze/thaw cycles. Materials must resist weather and erosion over long periods.
- The foundations is properly prepared and treated during construction. Unsuitable material must be removed, water entering the foundation must be controlled, and foundation surfaces must be prepared to receive the first lifts of fill material. If the foundation is a rock surface, the treatment below the core will, at a minimum, include detail cleaning of the rock surface using air and, possibly, water and the application of slush grout and dental concrete, if required. The first few lifts of core material should be as plastic as possible and specially treated to 3 ensure a good bond with the rock foundation.
- The dam must be constructed using appropriate quality control and quality assurance procedures. Appropriate changes to the design must be made during construction should site conditions so indicate. The ultimate performance of the dam depends on careful construction especially regarding foundation treatment, moisture and density control of the fill, and the design and construction of filters and drains.

2.12.1 Soil Materials

Embankment dams are constructed of all types of geologic materials, with the exception of organic soils and peats. The Embankments/Bunds/Saddles are designed to utilize the economically available on-site materials, as this is the bulk of construction. Special zones such as filters, drains and riprap, may come from off-site sources. Soil materials used in embankment

dam's portions are obtained by mass production from local borrow pits, or from the fields purchased from the local farmers near by the Dam, and from required excavations where suitable, as this region topography is completely with valleys and ridges, the materials required for construction is best available. Inorganic soils generally are divided into two broad categories for engineering purposes: fine-grained soils and coarse-grained soils. Embankments are constructed of broadly graded soils, which do not fit entirely into either category, or exhibit characteristics of both. Moraine deposits are an important example of these mixed soils. Construction considerations relevant to soils in embankment reservoir also are available in area as tabulated below with leads and distances from the dam site.

2.12.2 Material requirement

Table 2.7 Component Wise Material Requirement

S.No.	Description of item	Material	Quantity as per detailed estimate (m^3)
1	Hearting soil	Earth	419725.5
2	Cut off	Earth	515449.5
3	Casing soil	Earth	3514225.31
4	Dry rubble rock	Rough stone	37299.48
5	Graded filter	Metal	10813.73
6	Sand filling	Sand	10813.73
7	Vertical sand filter	Sand	48478.84
8	Horizontal sand filter	Sand	118372.50
		Metal	118372.5
9	Riprap	Metal	133460.72
		Sand	133460.72
		Rough stone	133460.72
10	CC M15 Parapet wall	Coarse aggregate	527.35
		Fine aggregate	527.35
11	CC M15 chute	Coarse aggregate	2005.84
		Fine aggregate	2005.84
12	CC M15 profile wall	Coarse aggregate	345.0
		Fine aggregate	345.0
13	CC M15 Guide Stone	Coarse aggregate	112.05
		Fine aggregate	112.05
14	Murrum	CNS Soil	749.80
15	30cm Stone d/s Riprap	Stone	1787.24

2.12.3 Source of material

Table 2.8 Material Availability at Source

S.No.	Location	Mandal	Hearting soils (Lead in KM)
	Fore shore area	Somala	
	Somappa cheruve	Somala	10
	Siddayagowni cheruvu	Somala	12
	Chennapatnam cheruvu	Somala	16
	Somappa cheruvu, Kanduru	Chowdepalli	30
	Laddigam cheruvu	Chowdepalli	41
	Chennapatnam cheruvu	Sadum	43
	Vyasappa cheruvu	Sadum	20
	Ayyavani cheruvu	Sadum	18
	Seethamma cheruvu	Sadum	30
	Palem cheruvu	Sadum	23
	Booragamanda cheruvu	Sadum	37
	Boorgamanda	Sadum	---
	Gundluru	Piler	---
	Medikurthi	Kalikiri	---
	Gundloor	Kalikiri	---
Average lead			**25**

2.13 Raw Materials and requirements

Total 100 % components are cement concrete and steel only, there is no fuel requirement

2.13.1 Key materials planning

A. Special Materials

(a) Cement

(b) Steel

(i) Structural

(ii) MS Plates

(iii) Bars & rounds

(iv) Special Steels, if any

(c) Explosives

(i) Gelatin

(ii) Detonators

(iii) Fuse coil

(iv) Explosives-Ammonia Nitrate

(d) Oils and Lubricants

(i) H.S.D. Oil

(ii) Petrol and Lubricants

Work is likely to be carried out through contractors. Hence, no planning of material is required at this stage.

B. Materials - Data

Table 2.9 Data of the materials

Material	Source	Mode of transportation	Distance from nearest to worksite	Mode of transportation
Cement	Manufacturers	Road	50 Km	Trucks
Steel	SAIL	Road	50 Km	Trucks
Explosives		Road	50 Km	Trucks
Oils and Lubricants	Oil Companies	Road	50 Km	Trucks

2.13.2 Construction power requirement & proposed supply arrangement

Power requirement for the construction is insignificant and will be drawn from the local power grid.

2.13.3 Plant/Equipment Planning

Work is likely to be taken up through EPC procedure. Agency will take care of this aspect

2.13.4 Blasting

There is blasting quantity is occurred in Earth work excavation of cut-off trench for an about 5000 Cum. Booster - 1000 Kgs

2.13.5 Batching plat details

Wet mix plan 100TPH (Apollo Asphalt DM) Capacity at 308/488(L/S) of Kurnool – Ranipet Road NH 40

2.13.6 Stone crusher details

Stone Crusher at Kondamarri Village in Chowdepalli Mandal of Chittoor District

2.14 Project Cost

The project cost is estimated for formation of Avulapalli Balancing reservoir near Avulapalli Village in Somala Mandal of Chittoor district. These costs are originally for the total project under phase 1 and phase 2. These costs are arrived at in the year 2020. However, these budgets

may not be sufficient for the construction of the total project. As the present proposal is for the construction of the phase 1 part, the expenditure made will be met through the already made budget allocations. The present budget may not be sufficient for the completion of the total project upto 3.5 TMC storage capacity. Therefore, in future, a decision may be taken on the additional budgets necessary for the expansion project (phase 2) based on the scenario after completion of phase 1 project.

Table 2.10 Details of the Proposed Project Cost

S. No.	Description of Work	Total Amount (Rs)
	Part A	
1	Investigation, preparation of HP's, Design and Drawings Approvals etc and submission of LP Schedules etc complete for DPR	14757111
2	Formation of Earthen Bund	3999745717
3	Construction of surplus weir and surplus course	299885510
4	Construction of Sluice (3 Nos)	460727226
5	Provision towards operation and maintenance of civil works components @ 1% for 2 years (i.e. 0.5% per year)	47603585
	Total	4822719148
	Part B	
6	Provision for GST @ 12.0%	578726298
7	NAC @ 0.10%	4822719
8	Provision for Seignorage charges as per statement	292126396
	Part C	
9	Provision for land acquisition and R&R	847184000
10	Provision for watchman quarters, Section officers, Subdivision quarters, Rest house, Generator room etc	19675000
11	Towards scientific instruments like DGPS, Total Station, Autolevels etc	3500000
12	Provision for Shifting of HT and LT lines and power connections	10000000
13	Provision of 33kv Substation, Lighting arrangements on top of the bund including cables, electrical poles, panel boards etc	19800000
14	Provision towards price Adjustment @ 1.0%	48227191

15	Provision for pylon, Foundation stones and inauguration arrangements etc	4000000
16	Provision towards tender publication charges	1000000
17	Provision for departmental QC Lab Equipment and Testing etc	271924
18	Provision for Beautification on bund, plantation, Arch and Gates etc	10000000
19	Provision towards Computers/Laptops, Xerox machine, Printers, Scanners, Photos, Drone video charges etc	2500000
20	Provision towards fixing of HP Boards, Sign Board, KM stones etc	5000000
Grand total		6672000000

Total project cost is Say Rs 66720.0 lakhs

2.15 PHOTOGRAPHS

The photographs of the existing Seethamma Cheruvu that is proposed to be converted as Avulapalli Balancing Reservoir project are presented below.



Fig 2.15 Existing Seethamma Cheruvu



Fig 2.16 Typical photo of Ramakrishnapuram Village



Fig 2.17 Typical photo of Baireddypalli Village



Fig 2.18 Photos of croplands in submergence area



Fig 2.19 Photos of Muddaleru Vanka stream is bringing water into the existing MI pond

Chapter 3

DESCRIPTION OF ENVIRONMENT

3.0 Introduction

Undersatding of existing environmental settings is necessary before taking up an activity. The existing environmental conditions can be assessed based on monitoring of various attibutes of environment such as air, water, soil, flora and fauna etc. It involves collection of of base line data which is an integral aspect of the preparation of Environmental Impact Assessment. Base line data reflects the present status of Environment before the initiation of any activity. The possible effects due to the proposed construction of Avulapalli balancing reservoir project are estimated and superimposed on the compiled baseline data subsequently to asses the possible environmental impacts.

The study area comprises of core area of the proposed project near Avulapalli, Somala mandal, and it also includes parts of both Kadapa and Chittoor Districts. Baseline data for environmental attributes like ambient air, meteorology, water, land use, soil, geology, noise, socio-economic, ecology and biodiversity etc. were collected in the month of May 2022. The details are presented in this chapter.

3.1 Temperature and Rainfall

The climate of Chittoor falls under the hot semi-arid class (BSh) as per the Koppen-Geiger classification. The climatic patterns in the study area as per IMD, Pune is tabulated below.

Table 3.1 IMD Climatological data of Chittoor District(Tirupathi station)

Month	Temperature ºC		Mean Relative Humidity (%)		Rainfall mm
	Maximum	Minimum	Maximum	Minimum	
January	30	18.8	79	55	17.6
February	33	19.9	74	45	5.1
March	36.8	22.8	68	37	5.2
April	39.2	26.2	65	37	15.9
May	40.3	28	57	38	58.5
June	37.9	27.3	59	45	77
July	35.9	26.1	66	51	117.3
August	35	25.7	68	52	127.3
September	34.9	25.2	71	56	131.7
October	32.8	23.7	77	65	205.2
November	30.2	21.8	80	69	249.1
December	29	19.9	80	65	116.2

(Source-ClimatologicalNormals -1981-2010, IMD)

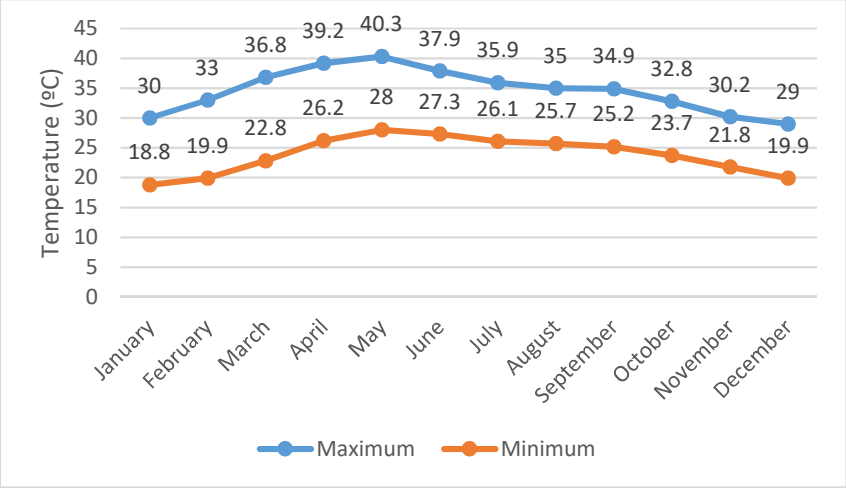


Fig 3.1 Temperature Variations (Maximum and Minimum) during period between 1981-2010

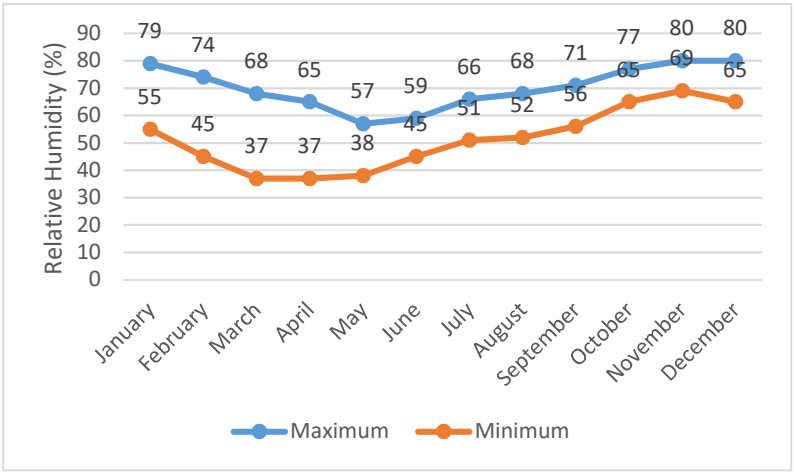


Fig 3.2 Relative Humidity (Maximum and Minimum) during period between 1981-2010

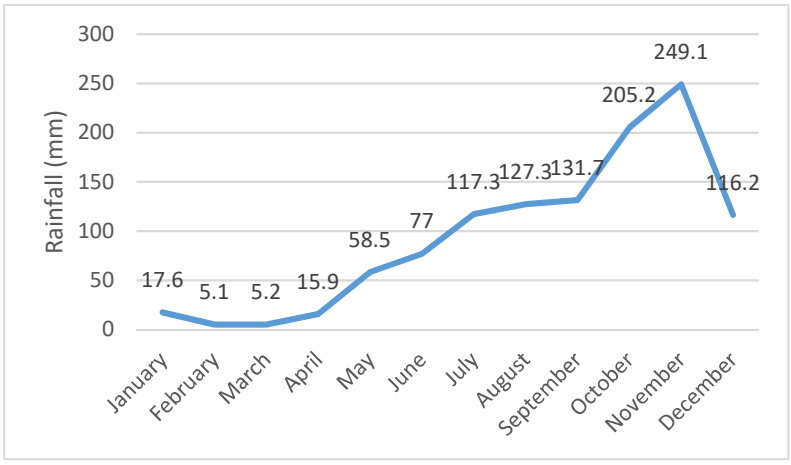


Fig 3.3Average rainfall during the period between 1981-2010.

Winds

A weather station was installed near the site for hourly monitoring of temperature, humidity and wind velocity for the month of May' 2022 and windrose given in Fig 3.4.

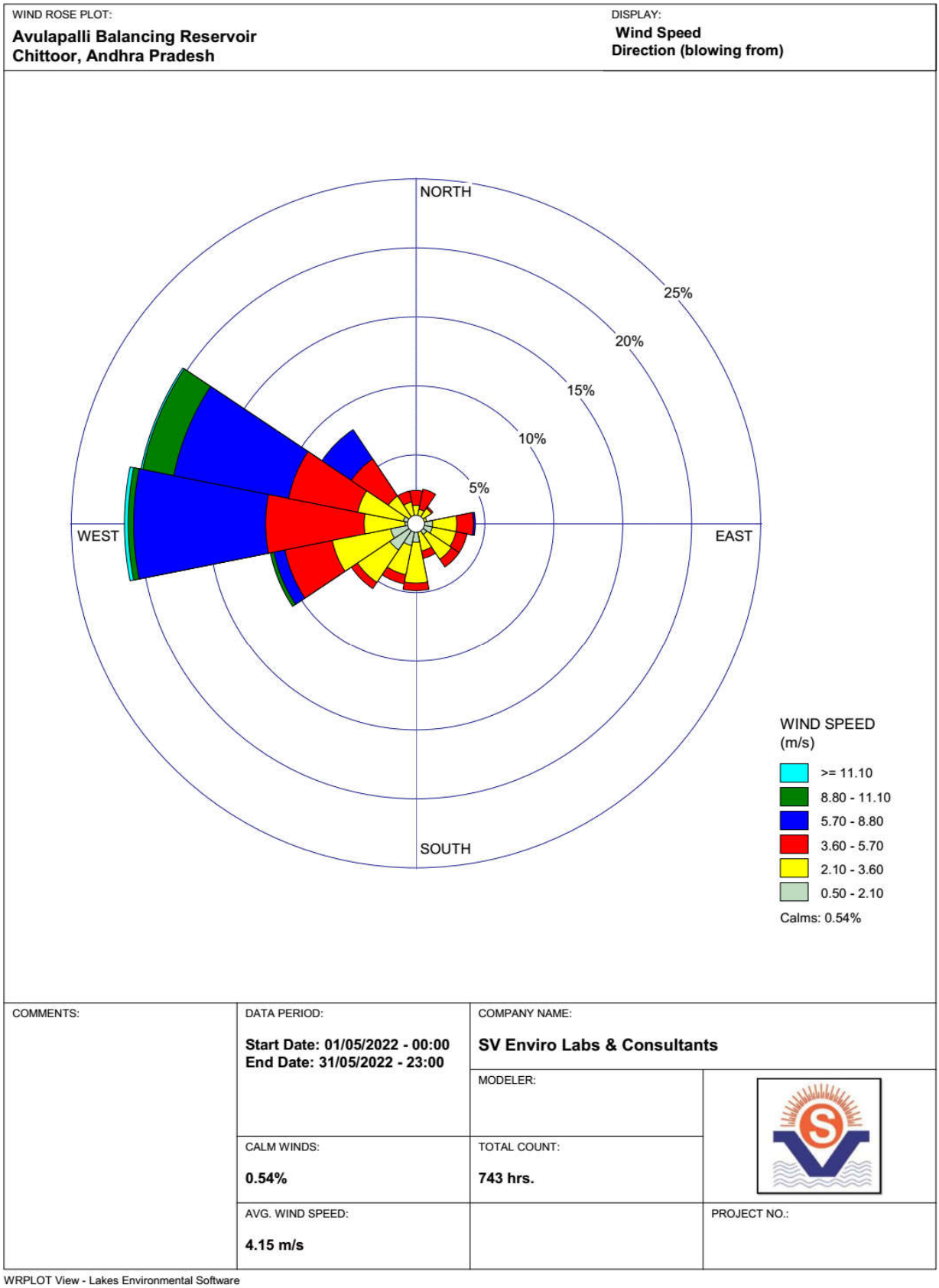


Fig. 3.4 Wind Rose Diagram for the month of May 2022

3.2 Air Environment

The samples were collected to assess the air quality in the study area. The samples collected were analysed for various air quality parameters.

3.2.1 Selection of Sampling Locations

To assess the baseline ambient air quality a scientifically designed ambient air quality-monitoring network was established. The ambient air quality monitoring stations were selected after a brief study based on the following considerations:

- Meteorological conditions
- Topography of the study area
- Predominant wind direction
- Emission sources
- Receptors sensitivity

Ambient Air Quality monitoring stations were set up at eight locations with due consideration to the above-mentioned points. The locations of the sampling stations are given in the Table 3.2 and the same are show in the Fig 3.5.

3.2.2 Methodology of Sampling and Analysis

Air samples collected were tested for the following parameters

- PM_{10}
- $PM_{2.5}$
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NOx)

The sampling and analysis of ambient air quality parameters was carried out as per the procedures detailed in relevant parts of IS: 5182 (Indian Standards for Ambient Air Quality Test Methods). The methods used for determining the above mentioned parameters and furnished hereunder in the Table 3.3.

3.2.3 Frequency of Sampling: 24 hourly samples for PM_{10}, $PM_{2.5}$, SO_2, NOx, were collectedfrom each station (Table 3.2).

Table 3.2Location of Ambient Air Quality Monitoring Stations

S.No	Location	Station Code	Direction from Project Site	Distance w.r.t Project Site km	Latitude and Longitude	Environmental Setting
1.	Project site (Ramakrishnapuram)	**A1**	-	-	13°24'0.64"N 78°48'20.01"E	Residential Area
2.	Upparapalle	**A2**	ESE	1.8	13°23'7.29"N 78°49'10.86"E	Residential Area

3.	Reddivaripale	**A3**	E	0.9	13°23'19.76"N 78°49'42.08"E	Residential Area
4.	Patrapalli	**A4**	ENE	1.7	13°24'22.59"N 78°50'13.51"E	Residential Area
5.	Rachettivanipalle	**A5**	N	7.1	13°27'52.56"N 78°48'3.18"E	Residential Area
6.	Goudamukalapalle	**A6**	SW	5.7	13°21'23.52"N 78°45'5.88"E	Residential Area
7.	Durgasamudram	**A7**	WSW	5.8	13°22'35.96"N 78°43'31.61"E	Residential Area
8	Muddireddipalle	**A8**	WNW	6.2	13°24'48.25"N 78°43'40.42"E	Residential Area

Table 3.3 Techniques and detectable limits for Ambient air quality monitoring

S. No.	Parameter	Technique	Technical Protocol	Minimum Detectable Limit
1	PM10 (µg/m3)	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-XXIII)	5.0 µg/m^3
2	PM2.5 (µg/m3)	Fine Particulate Sampler (Gravimetric method)	IS-5182 (Part-XXIV)	5.0 µg/m^3
3	Sulphur dioxide SO2 (µg/m3)	Modified West and Gaeke	IS-5182 (Part-II)	4.0 µg/m^3
4	Oxides of Nitrogen NOx (µg/m3)	Jacob & Hochheiser	IS-5182 (Part-VI)	4.0 µg/m^3

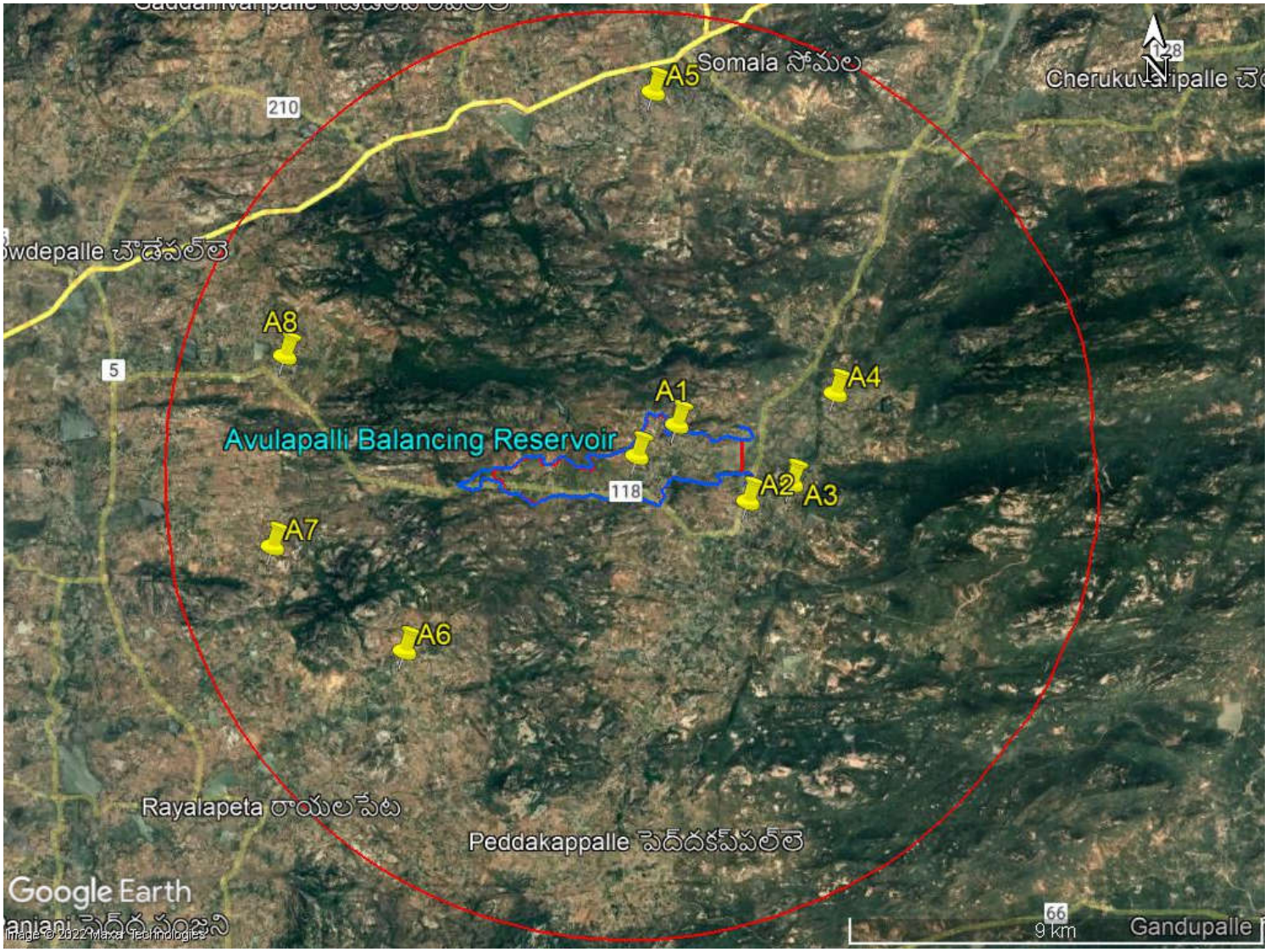
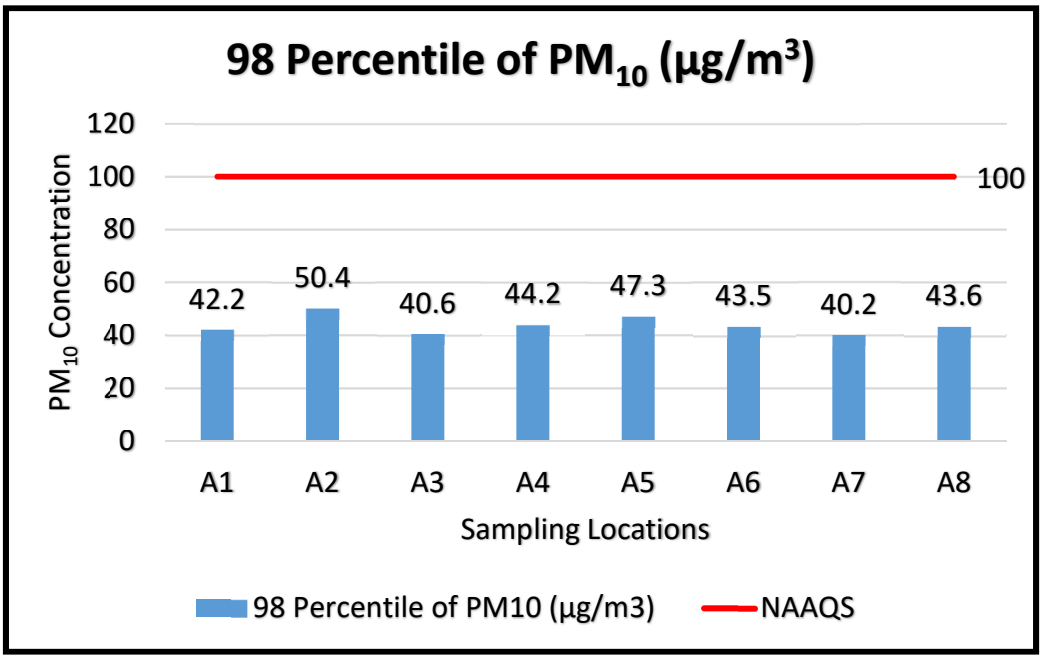
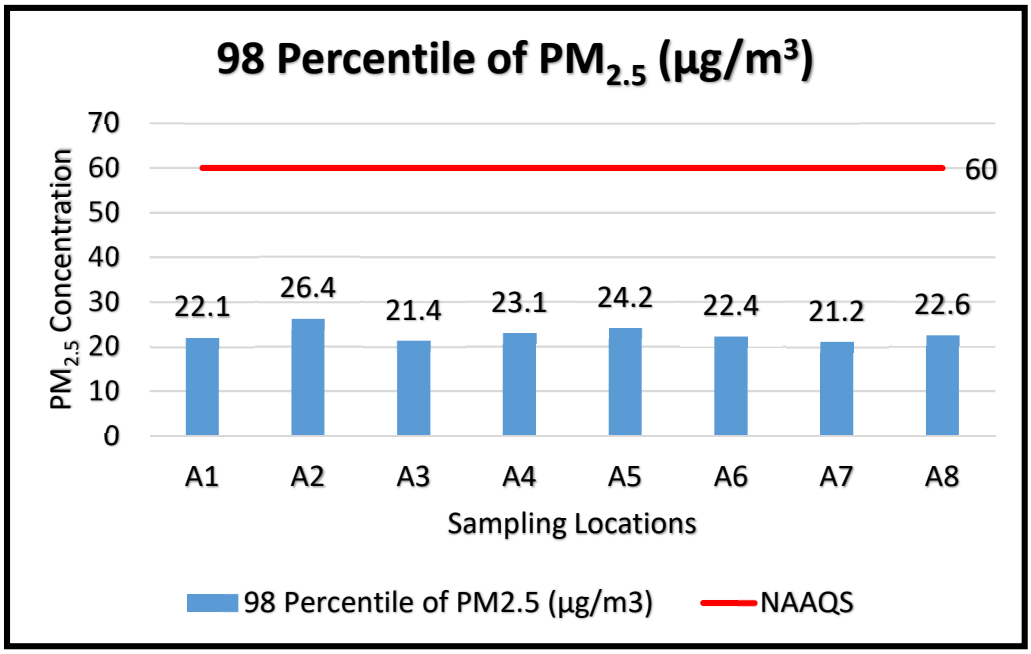


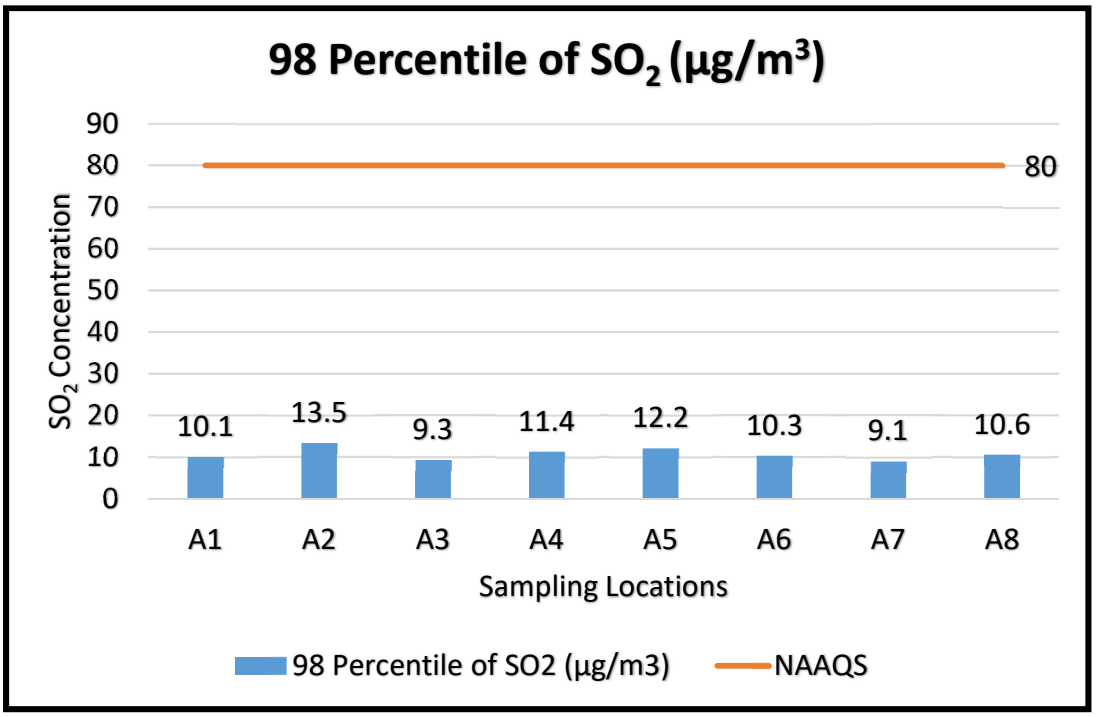
Fig 3.5 AAQ monitoring Locations

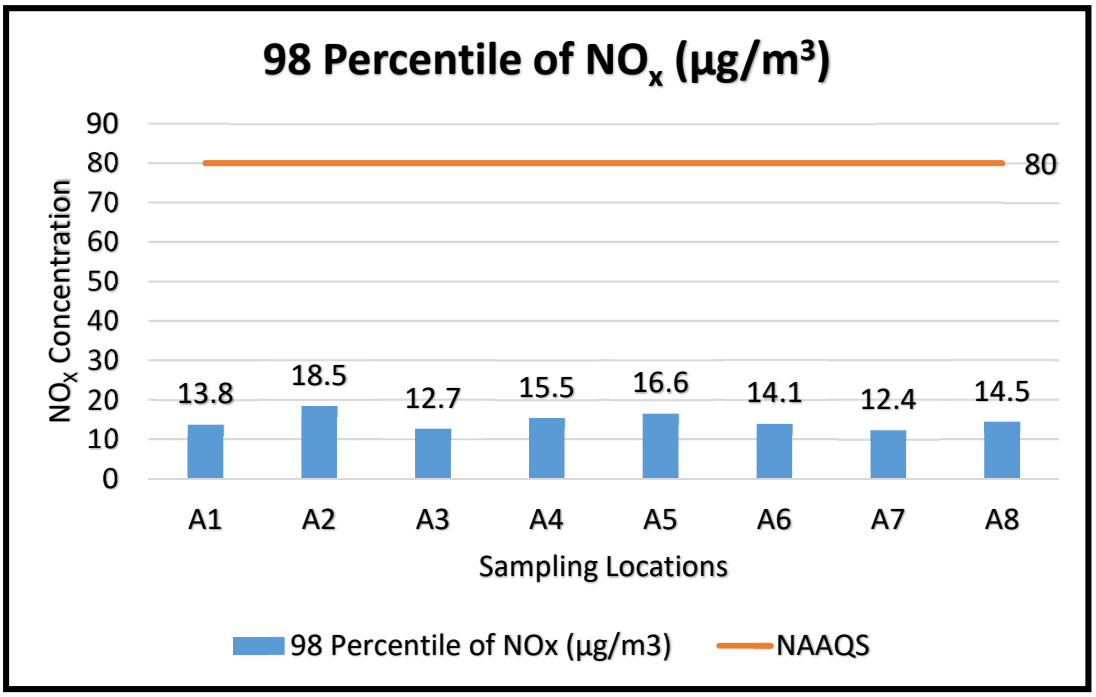
Table 3.4 Summary of Ambient Air Quality in the Study Area

Parameter	PM10(µg/m³)					PM2.5(µg/m³)					SO2(µg/m³)					NOx(µg/m³)				
Monitoring Station	No.of samples	Maximum	Minimum	Average	98th percentile	No. of samples	Maximum	Minimum	Average	98th percentile	No.of samples	Maximum	Minimum	Average	98th percentile	No.of samples	Maximum	Minimum	Average	98th percentile
A1	26	43.4	22.8	31.4	42.2	26	22.4	12.6	16.3	22.1	26	10.3	7.4	8.8	10.1	26	14.0	9.8	11.8	13.8
A2	26	51.2	30.5	38.2	50.4	26	26.9	16.1	19.8	26.4	26	13.8	10.9	12.5	13.5	26	18.8	14.6	16.5	18.5
A3	26	41.8	21.2	29.8	40.6	26	21.6	11.8	15.5	21.4	26	9.5	6.6	8.2	9.3	26	12.9	8.7	10.9	12.7
A4	26	45.3	24.7	33.3	44.2	26	23.4	13.6	17.3	23.1	26	11.6	8.7	10.4	11.4	26	15.8	11.6	13.6	15.5
A5	26	48.6	28.3	35.6	47.3	26	24.6	14.8	18.5	24.2	26	12.4	9.5	11.1	12.2	26	16.9	12.7	14.9	16.6
A6	26	44.2	23.6	32.2	43.5	26	22.8	13.0	16.7	22.4	26	10.5	7.6	9.2	10.3	26	14.3	10.1	12.3	14.1
A7	26	41.3	20.7	29.3	40.2	26	21.5	11.5	15.2	21.2	26	9.3	6.4	7.8	9.1	26	12.6	8.4	10.4	12.4
A8	26	44.5	23.9	32.5	43.6	26	23.0	13.2	16.9	22.6	26	10.8	7.9	9.3	10.6	26	14.7	10.5	12.7	14.5
NAAQ	100(µg/m³)					60(µg/m³)					80(µg/m³)					80(µg/m³)				


98 Percentile of PM10 (µg/m3)
PM10 Concentration
120
100
80
60
40
20
0
42.2
50.4
40.6
44.2
47.3
43.5
40.2
43.6
100
A1
A2
A3
A4
A5
A6
A7
A8
Sampling Locations
98 Percentile of PM10 (µg/m3)
NAAQS


98 Percentile of PM2.5 (µg/m3)
PM2.5 Concentration
70
60
50
40
30
20
10
0
22.1
26.4
21.4
23.1
24.2
22.4
21.2
22.6
60
A1
A2
A3
A4
A5
A6
A7
A8
Sampling Locations
98 Percentile of PM2.5 (µg/m3)
NAAQS





3.2.4 Summary of Ambient Air Quality

On the perusal of above analysis of ambient air quality in the study area, it is evident that all concentrations of the parameters monitored, as shown in Table 3.4,at various locations are well within the specified limits of CPCB. The results are summarized below:

PM_{10}: The highest PM_{10} concentration of 51.2µg/m^3 observed in the ambient air was recorded at station A2 while the lowest PM_{10} concentration was found to be 20.7 µg/m^3 at

recorded at station A7. All the monitored values of PM_{10} were well below the specified limit of 100 µg/m^3.

$PM_{2.5}$: The highest $PM_{2.5}$ concentration of 26.9 µg/m^3 observed in the ambient air was recorded at station A2 while the lowest $PM_{2.5}$ concentration was found to be 11.5 µg/m^3 at recorded at station A7. All the monitored values of $PM_{2.5}$ were well below the specified limit of 60 µg/m^3.

SO_2: The highest SO_2 concentration 13.8 µg/m^3 was observed in the ambient air was recorded at station A2 while the lowest SO_2 concentration was found to be 6.4 µg/m^3 at A7. All the monitored values of SO_2 are well below the specified limit of 80 µg/m^3.

NOx: The highest concentration of 18.8 µg/m^3 observed in the ambient air was recorded at station A2 while the lowest NOx concentration was found to be 8.4 µg/m^3 at station A7. All the monitored values of NOx are well below the specified limit of 80 µg/m^3.

3.3 Water Environment

The water resources, both surface and groundwater play an important role in the development of the area. Likewise, the water resources of the area have been studied to establish the current status of water quality in the area. The parameters of prime importance were selected under physical, chemical inorganic, chemical organic and heavy metal groups. Water samples from ground and surface water sources were collected. The water samples were collected in pretreated sampling cans and transported to laboratory for analysis. Due care was taken during sampling & transportation of these samples.

3.3.1 Surface Water and Ground Water Quality Assessment

In order to assess water quality impacts surface water and ground water samples are collected from the surrounding villages. The samples analyzed for various physical and chemical parameters to know the contamination levels as per the IS Standards.

1. Ground water quality --- IS 10500-2012
2. Surface/canal/sea water quality --- IS 2296 : 1992

3.3.2 Selection of Sampling Locations

Sampling locations (Fig 3.9) were selected on basis of:

a) Drainage pattern
b) Location of residential areas respecting different activities
c) Likely areas those can represent baseline conditions

Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area.

The samples were analyzed in accordance with "Standard Methods for Examination of Water and Wastewater Analysis" published by APHA.

3.3.3 Sampling Techniques

Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area. Parameters like temperature, Dissolved Oxygen (DO) and pH were analyzed at the time of sample collection.

The methodology for sample collection and preservation techniques was followed as per the Standard Operating Procedures (SOP) mentioned in Table: 3.5.

Table 3.5Standard Operating Procedures (SOP) For Water Sampling

Parameter	Sample Collection	Sample Size	Storage/ Preservation
pH	Grab sampling Plastic /glass container	100 ml	On site analysis
Electrical Conductivity	Grab sampling Plastic /glass container	100 ml	On site parameter
Total suspended solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
Total Dissolved Solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
BOD	Grab sampling Plastic /glass container	1000 ml	Refrigeration, 48 hrs
Hardness	Grab sampling Plastic /glass container	100 ml	Add HNO_3 to pH<2, refrigeration; 6 months
Chlorides	Grab sampling Plastic /glass container	100 ml	Not required; 28 days
Sulphates	Grab sampling Plastic /glass container	100 ml	Refrigeration; 28 days
Nitrates	Plastic containers	100 ml	Refrigeration; 48 hrs
Fluorides	Plastic containers only	100 ml	Not required; 28 days
Alkalinity	Plastic/ glass containers	100 ml	Refrigeration; 14 days

Parameter	Sample Collection	Sample Size	Storage/ Preservation
Ammonia (NH3-N)	Plastic/ glass containers	500 ml	Add H_2SO_4 to pH<2, refrigeration, 7 days
Heavy Metals (As, Cd, Mn, Cu, Fe, Zn, Pb etc.)	Plastic/ Glass rinse with 1+1 HNO_3	500 ml	Filter, add HNO_3 to pH>2; Grab sample; 6 months

Source: Standard Methods for the Examination of Water and Wastewater, Published By APHA (American Public Health Association) 23rd Edition 2017

3.3.4 Analytical Techniques

The analytical techniques used for water analysis is given in the Table: 3.6.

Table3.6Analytical Techniques forWater Analysis

Parameter	Method
pH	APHA, 4500-H+B
Colour	APHA, 2120-C
Odour	APHA, 2150
Temperature	APHA, 2550-B
Oil & Grease	APHA, 5520-D,5-38
Dissolved Oxygen	APHA, 4500-DC
Electrical conductivity	APHA, 2510-B
Turbidity	APHA, 2130-B
Chlorides	APHA, 4500-Cl, B
Fluorides	APHA, 4500-FD
Total dissolved solids	APHA, 2540-C
Total suspended solids	APHA, 2540-D
Total hardness	APHA, 2340-C
Sulphates	APHA, 4500-SO_4^{-2}-E
Phosphates	APHA, 4500-P C&D
Arsenic	APHA, 3120-B
Calcium	APHA, 3500-Ca B
Magnesium	APHA, 3500-Mg B
Manganese	APHA, 3120-B
Mercury	APHA, 3120-B
Lead	APHA, 3120-B
Copper	APHA, 3120-B
Cadmium	APHA, 3120-B

Parameter	Method
Iron	APHA, 3120-B
Zinc	APHA, 3120-B
Chromium	APHA, 3120-B
Aluminium	APHA, 3120-B
Cyanide	APHA, 4500-CN-E
Coliform organisms	IS 15185
Alkalinity	APHA, 2320-B
COD	APHA, 5220-B
BOD	IS 3025 P:44
Total Kjheldhal Nitrogen	APHA,4500-N_{org} B
Ammonical Nitrogen	APHA, 4500-NH_3 F
Residual Free Chlorine	IS 3025 P:26
Phenolic Compounds (as C_6H_5OH)	APHA, 5530-C

Source: Standard Methods for the Examination of Water and Wastewater, Published By APHA (American Public Health Association) 23rd Edition 2017

3.3.5 Water Sampling Stations

The locations of the water samples collected in the study area are furnished in Table 3.7.

Table3.7Water Sampling Stations

Code	Station	Latitude & Longitude	Source of collection
GW1	Baireddypalli	13°23'42.81"N 78°48'0.57"E	Ground water
GW2	Somala	13°28'31.30"N 78°48'27.34"E	Ground water
GW3	Goudamukalapalle	13°21'19.10"N 78°45'4.72"E	Ground water
GW4	Penugolakala	13°19'12.72"N 78°47'58.19"E	Ground water
SW1	Sethamma Cheruvu	13°23'58.83"N 78°49'10.46"E	Surface water
SW2	Muddaleru Vanka	13°23'25.27"N 78°47'8.10"E	Surface water
SW3	Chennapatnam Cheruvu	13°27'45.68"N 78°46'38.46"E	Surface water
SW4	Bonamanda Cheruvu	13°21'29.38"N 78°49'48.70"E	Surface water

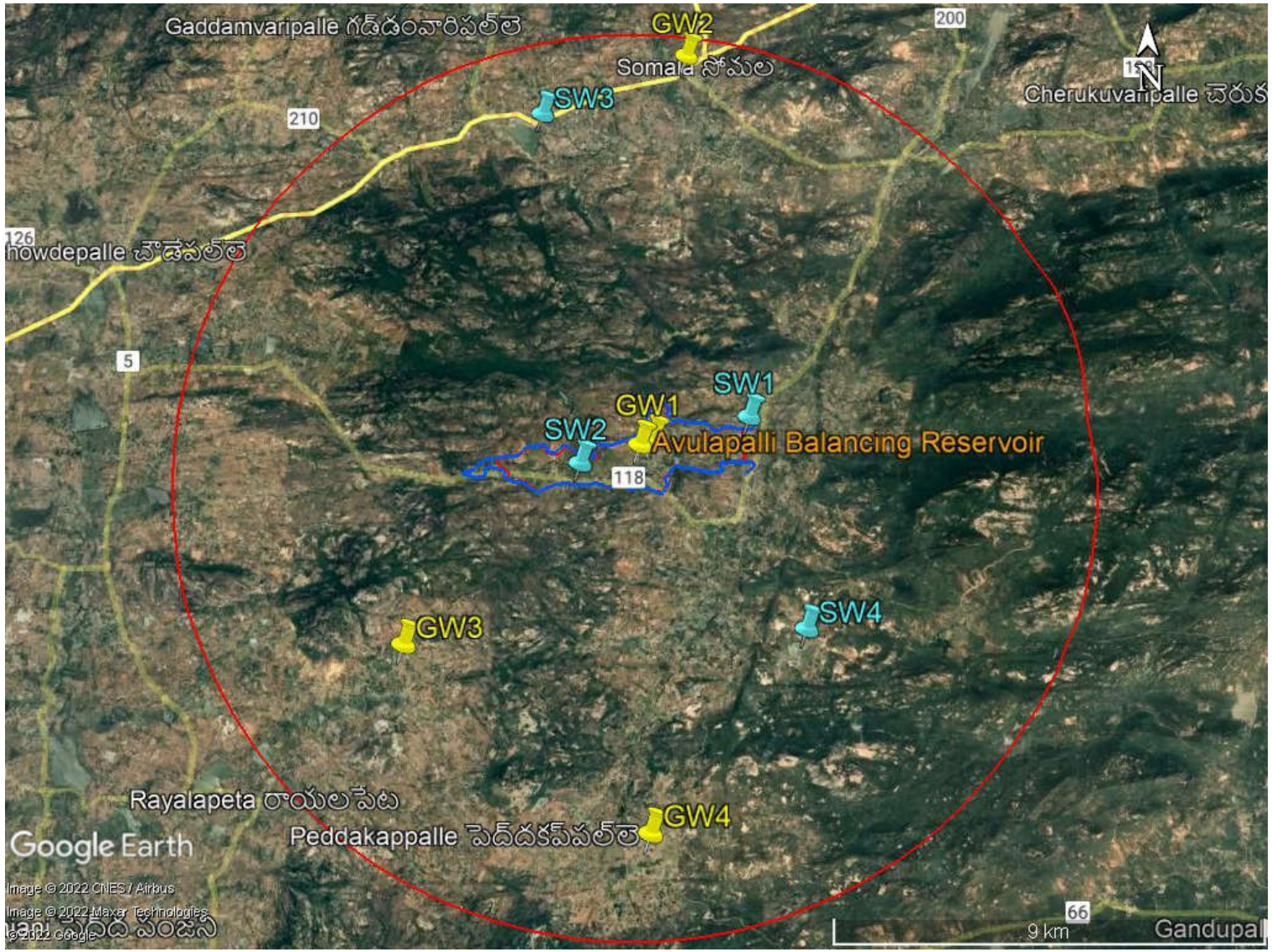


Fig 3.6 Water quality monitoring locations

3.3.6 Ground Water Quality of the Study Area

The water in the region (ground water) has been compared with respect to the Drinking water Quality Standards as IS: 10500. The summarized analysis of results of the ground water quality in the study area are given in the below Table 3.8.

Table3.8 Ground water quality results

S.No.	PARAMETER	UNIT	GW1	GW2	GW3	GW4	IS:10500-2012 Drinking water specifications	
							Acceptable	Permissible
1.	Color	Hazen	< 1	< 1	< 1	< 1	5	15
2.	Temperature of Water	^0C	27.5	27.3	27.1	27.4	-	-
3.	pH	-	7.77	7.40	7.51	7.48	6.5-8.5	6.5-8.5
4.	Turbidity	NTU	<0.01	0.92	<0.01	<0.01	1	5
5.	Total Dissolved Solids	mg/l	632	584	626	588	500	2000
6.	Total alkalinity (as $CaCO_3$)	mg/l	424	376	405	392	200	600
7.	Total Hardness (as $CaCO_3$)	mg/l	361	221	308	290	200	600
8.	Chlorides as Cl	mg/l	134	106	121	113	250	1000
9.	Calcium as Ca	mg/l	101	50.5	80.9	75.3	75	200
10.	Magnesium as Mg	mg/l	26.7	23.3	25.6	24.8	30	100
11.	Fluoride as F^-	mg/l	1.45	3.44	1.31	1.26	1.0	1.5
12.	Nitrates as NO_3^-	mg/l	1.96	7.04	3.8	2.5	45	45
13.	Sulphates as SO_4^{2-}	mg/l	31.7	98.4	52.5	43.6	200	400

14.	Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	0.01	0.05
15.	Cadmium as Cd	mg/l	<0.002	<0.002	<0.002	<0.002	0.003	0.003
16.	Copper as Cu	mg/l	<0.01	<0.05	<0.01	<0.05	0.05	1.5
17.	Lead as Pb	mg/l	<0.001	<0.001	<0.001	<0.001	0.01	0.01
18.	Iron as Fe	mg/l	0.09	0.12	0.10	0.08	0.3	0.3
19.	Manganese as Mn	mg/l	<0.05	<0.05	<0.05	<0.05	0.1	0.3
20.	Zinc as Zn	mg/l	0.039	0.039	0.035	0.031	5.0	15.0
21.	Dissolved phosphates	mg/l	<0.01	<0.01	<0.01	<0.01	-	-
22.	Phenolic Compounds as C_6H_5OH	mg/l	<0.001	<0.001	<0.001	<0.001	0.001	0.002
23.	Residual Chlorine	mg/l	<0.005	<0.005	<0.005	<0.005	0.2	1.0
24.	E. Coli	CFU/100 ml	Not Detected	Not Detected	Not Detected	Not Detected	Shall not be detectable	Shall not be detectable
25.	Total Coliforms	CFU/100 ml	05	08	10	06	Shall not be detectable	Shall not be detectable

ND - Not Detected.

3.3.7 Summary of Groundwater quality:

- The pH limit for drinking water samples as per IS:10500:2012 Drinking Water Specifications is 6.5 to 8.5. During the study period, the pH of the groundwater was found to be varying between 7.51and7.77. The pH values for all the samples collected in the study area during study period were thus found to be within the acceptable limits.
- The desirable limit for total dissolved solids as per IS: 10500:2012 Drinking water specifications is 500 milligrams per liter (mg/l) whereas the permissible limits in absence of alternate source is 2000 mg/l. In groundwater samples collected from the study area, the total dissolved solids (TDS) were found to be varying between 584mg/l and 632mg/l. The TDS of all the samples were below the permissible limit of 2000 mg/l.
- The desirable limit for Chloride is 250mg/l as per IS: 10500:2012 Drinking water specifications whereas the permissible limit of the same is 1,000 mg/l. The Chloride levels in the groundwater samples collected in the study area were ranging from 106 to 134 mg/l
- The desirable limit as per IS: 10500:2012 Drinking water specifications for hardness is 200 mg/l whereas the permissible limit for the same is 600 mg/l. In the groundwater samples collected from the study area, the hardness was found to be varying between221mg/l to 361mg/l.
- Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However, the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. In the groundwater samples of study area, the fluoride values were found to be within a range of 1.26 mg/l to 3.44 mg/l.
- All the heavy metals in all samples were found to be below the permissible limits.An overview of the results obtained reveals that none of parameters were found above the permissible limits of IS: 10500: 2012 Drinking Water Standards.

3.3.8 Surface Water Quality of the Study Area

The water in the region (surface water) has been compared with respect to the IS: 2296. The summarized analysis of results of the surface water quality in the study area are given in the below Table 3.9.

Table 3.9Surface Water Quality of the Study Area

S.No.	PARAMETER	UNIT	SW1	SW2	SW3	SW4	IS:2296 - Standards
1.	Color	Hazen	<1	<1	<1	<1	-
2.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	-
3.	Turbidity	NTU	11.8	80.2	12.8	14.2	-
4.	pH	-	8.07	7.65	7.81	7.95	6.50 – 8.50
5.	Temperature	^{0}C	25.4	25.7	25.5	25.8	-
6.	Electrical Conductivity	mmhos/cm	410	326	491	538	-
7.	Total Dissolved Solids	mg/l	256	198	299	328	1500
8.	Total Suspended Solids	mg/l	11	14	12	16	-
9.	Total Alkalinity as $CaCO_3$	mg/l	155	117	162	175	-
10.	Total Hardness as $CaCO_3$	mg/l	109	81.0	126	145	-
11.	Calcium as Ca	mg/l	26.8	19.2	28.5	31.3	-
12.	Magnesium as Mg	mg/l	10.2	8.01	13.5	16.3	-
13.	Chloride as Cl	mg/l	61.4	55.1	72.4	80.5	-
14.	Sulphate as SO_4^{2-}	mg/l	19.6	17.0	21.3	23.5	-
15.	Nitrate as NO_3^-	mg/l	0.20	<1.0	0.31	0.35	-
16.	Iron as Fe	mg/l	0.14	0.11	0.16	0.19	-
17.	Hexavalent Chromium as Cr^{6+}	mg/l	<0.001	<0.001	<0.001	<0.001	0.05
18.	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	0.005
19.	Cyanide as CN	mg/l	<0.002	<0.002	<0.002	<0.002	0.05
20.	Zinc as Zn	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	15
21.	Lead as Pb	mg/l	<0.001	<0.001	<0.001	<0.001	0.01
22.	Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	1.5
23.	Aluminium as Al	mg/l	<0.005	<0.005	<0.005	<0.005	0.1
24.	Manganese as Mn	mg/l	<0.05	<0.05	<0.05	<0.05	5.0
25.	Mercury as Hg	mg/l	<0.001	<0.001	<0.001	<0.001	-
26.	Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	-
27.	Cadmium as Cd	mg/l	<0.002	<0.002	<0.002	<0.002	-
28.	Dissolved Oxygen	mg/l	6.4	5.8	5.9	5.7	5.0 min
29.	Chemical Oxygen Demand	mg/l	14.6	19.2	16.2	18.5	-
30.	Biochemical Oxygen Demand	mg/l	3.2	3.6	3.8	3.9	3.0
31.	Total Kjheldhal Nitrogen	mg/l	< 1.0	< 1.0	< 1.0	< 1.0	-
32.	Free Ammonical Nitrogen	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	-
33.	Oil & Grease	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	-
34.	E. Coli	MPN/100 ml	Absent	Absent	Absent	Absent	Absent
35.	Total Coliforms	MPN/100 ml	110	60	110	110	5000

3.3.9 Surface water quality results are summarized below:

- pH of the surface water collected was found to be neutral with pH ranging from 7.65 to 8.07.
- TDS was found to be varying between198mg/l to 328 mg/l. The tolerance limit is 1,500 mg/l as per IS: 2296.
- Total Hardness was found to be ranging between81 mg/l to 145 mg/l.
- Presence of Nitrate was found to be between0.2 mg/l to 0.35 mg/l.
- DO was observed to be between5.7 mg/l to 6.4 mg/l.
- Total coliform in water was found to be between60 MPN/100ml to 110 MPN/100ml.
- All the heavy metals were found to be within below detectable limits.

3.4 Soil Quality

3.4.1 Selection of sampling Locations

For studying soil profile of the region, sampling locations were selected to assess the existingoverall soil conditions around the project site. The study of the soil profile establishes thebaseline characteristics and this will help in future for identifying the incrementalconcentrations if any, due to the project. The sampling locations have been identified withfollowing objectives.

a) To determine the baseline soil characteristics of the study area
b) To determine the impact of the project activities on soil characteristics

3.4.2 Sampling and Analytical Techniques

Five sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features. At each location (Fig 3.11), soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and are homogenized. This is in line with IS: 2720 & Methods of Soil Analysis, Part-1, 2nd edition, 1986 of (American Society for Agronomy and Soil Science Society of America). The homogenized samples were analyzed for physical and chemical characteristics. The soil samples were collected and analyzed once in post monsoon season.

The samples have been analyzed as per the established scientific methods for physico-chemical parameters. The heavy metals have been analyzed by using Atomic Absorption Spectrophotometer.The methodology adopted for each parameter is described in Table: 3.10.

Table 3.10Analytical Techniques for Soil Analysis

Parameter	Method (ASTM number)
Textural classification	Chart developed by Public Roads Administration
pH	IS 2720 P 26
Electrical conductivity	IS 14767 : 2002
Bulk Density	IS 2720 P 8
Moisture Content	IS 2720 P 2
Nitrogen	IS 14684 : 1999
Phosphorus	Manual Soil Testing in India, Ministry of Agriculture
Potassium	Manual Soil Testing in India, Ministry of Agriculture
Sodium	Manual Soil Testing in India, Ministry of Agriculture
Calcium	Manual Soil Testing in India, Ministry of Agriculture
Magnesium	Manual Soil Testing in India, Ministry of Agriculture
Chlorides	Argentometric Method
Sulphates	IS 2720 P 27 : 1977
Organic Carbon	IS 2720 P 22
Organic Matter	IS 2720 P 22

3.4.3 Details of Soil Sampling Locations

The soil sampling locations and distance from project are mentioned in the below table 3.11.

Table 3.11Soil Sampling Locations

Code	Location	Latitude and Longitude
S1	Avulapalli	13°24'5.74"N 78°49'30.07"E
S2	Baireddypalli	13°23'46.57"N 78°47'56.43"E
S3	Upparapalle	13°22'51.31"N 78°49'7.20"E
S4	Goudamukalapalle	13°21'16.64"N 78°45'2.86"E
S5	Muddireddipalle	13°24'46.51"N 78°43'42.67"E

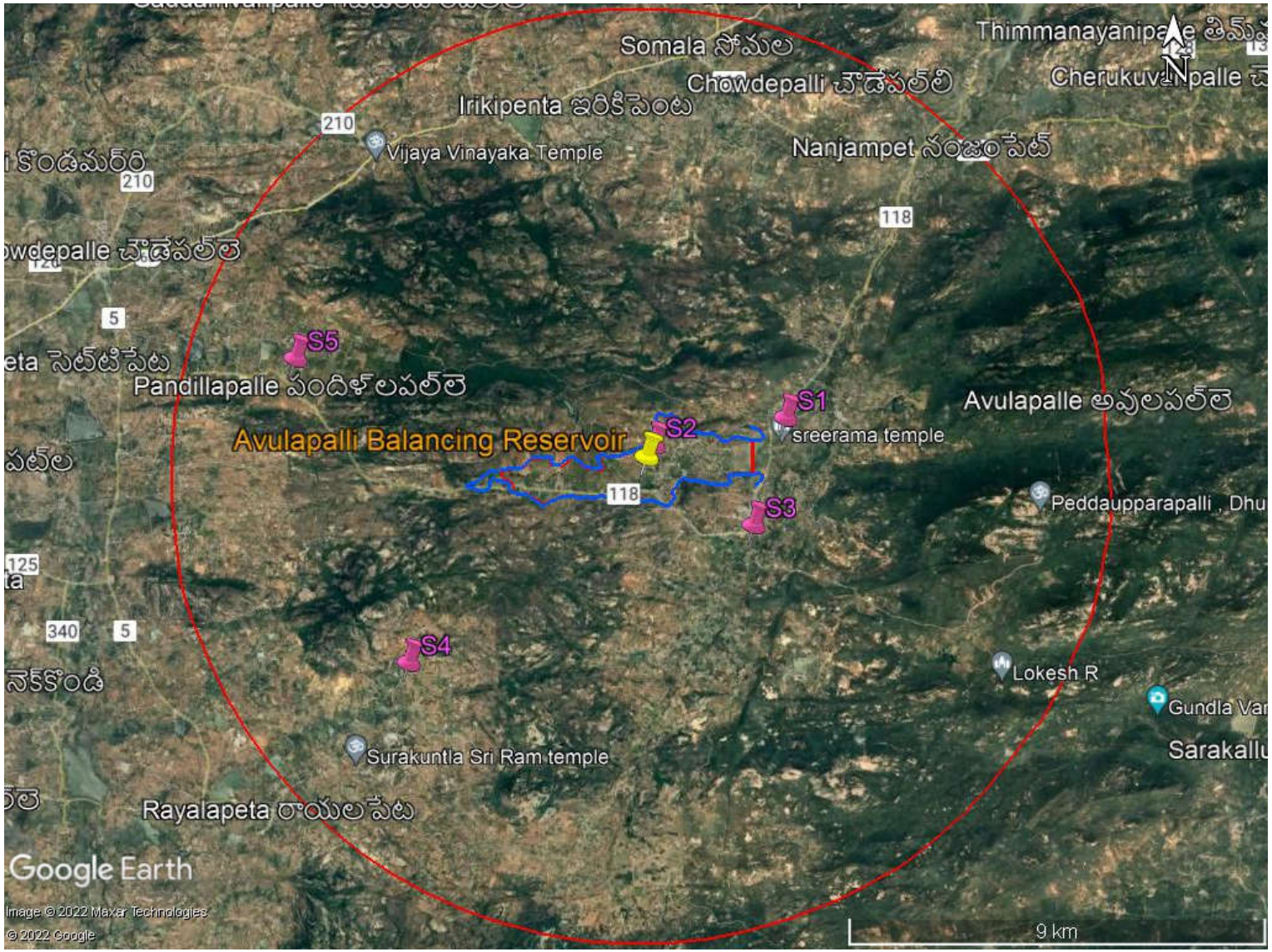


Fig3.7 Soil quality monitoring locations

3.4.4 Soil Analysis Results in the Study Area

The summarized analysis results of the soil samples in the study area are presented in the Table: 3.12.

Table3.12 Soil Analysis Results

S.No	Parameter	Unit	S1	S2	S3	S4	S5
1.	pH (1:5) Aq Extract	--	6.11	8.61	7.82	7.53	6.89
2.	Conductivity (1:5 Aq Extract)	μ mhos /cm	29.3	128	124	118	98
3.	Texture						
	(a) Sand	%	47	38	39	41	40
	(b) Silt		18	23	22	19	24
	(c) Clay		35	39	37	40	36
4.	Bulk Density	gm/cm^3	1.32	1.14	1.11	1.19	1.36
5.	Moisture Content	%	6.8	9.2	8.9	9.3	7.1
6.	Available Nitrogen as N	kg/ha	72	59	54	65	69
7.	Available Phosphorous as P	kg/ha	39	31	28	35	37
8.	Available Potassium as K	kg/ha	198	175	161	179	184
9.	Exchangeable Sodium as Na	mg/kg	610	548	532	565	583
10.	Exchangeable Calcium as Ca	mg/kg	5896	5213	5110	5322	5584
11.	Exchangeable Magnesium as Mg	mg/kg	454	405	385	420	441
12.	Water Soluble Chlorides as Cl	mg/kg	447	509	498	530	468
13.	Water Soluble Sulphates as SO_4	mg/kg	96.5	110	101	128	98.5
14.	Organic matter	%	0.49	0.36	0.32	0.39	0.45
15.	Organic Carbon	%	0.28	0.20	0.22	0.25	0.26

3.4.5 Summary of Soil Analysis Data

The analytical results of the soil samples collected during the study period are summarized below.

- The pH of the soil is an important property; vegetation cannot grow in low and high pH value soils. The normal range of pH in the soils is 6.11 to 8.61. The pH values in

the study area are varying from 7.59 to 7.72 indicating that the soils are falling in slightly alkaline category.

- Based on the electrical conductivity, the soils are classified into four groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study areawas found to be varying between 29.3 to 128 micro-mhos per centimeter (µmhos/cm). This is good for germination
- The other important parameters for characterization of soil for irrigation are the primary nutrients – Nitrogen, Phosphorus and Potassium (N, P, K) and the secondary nutrients—Calcium, Magnesium and Sulphur (Ca, Mg, S). The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance, and not on their relative importance.
- Nitrogen encourages the vegetative development of plants by imparting a healthy green color to the leaves. The available Nitrogen as N in the study area was found to be varying between54 to 72 kg/ha. This is good for crops when compared with soil standards.
- Phosphorus influences the vigour of plants and improves the quality of crops. In the study area available, Phosphorus was ranging between 28 to 39 kg/ha. This is considered medium level when compared to soil standards.
- Potassium enhances the ability of the plants to resist diseases, insect attacks, cold and other adverse conditions. The available potassium in the study area varied between 161 to 198mg/kg. This is considered medium to average level when compared to soil standards.
- Organic Carbon in the study area ranged from 0.22 to 0.28%. This is an average sufficient level for crops.

Based on the above results (Table 3.13), the soils in the region were good enough for cultivation of crops.

Table 3.13 Standard Soil Classification

S. No	Soil Test	Classification
1.	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline

		>9.00 very strongly alkaline
2.	Electrical Conductivity (ppm) (1ppm = 640 µmhos)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3.	Organic Carbon	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4.	Nitrogen (Kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5.	Phosphorus (Kg/ha)	Upto 15 very less 16-30 less 31-50 medium 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6.	Potassium (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

Source: Hand Book of Agriculture, ICAR, New Delhi

3.5 Noise Environment

3.5.1 Identification of Sampling Locations

Noise at different generating sources has identified based on the activities in the village area and the noise at sensitive areas. A detailed survey on noise environment was carried in and around the project site to study the levels of noise, as the high dB (A) levels may cause adverse effect on human beings and associated environment, including structures, domestic animals and natural ecological systems. The locations (Fig 3.8) were identified keeping in view the land use pattern and environmental setting. Spot noise levels were measured using a precision noise level meter at project site and residential areas in all eight locations were covered with in study zone.

3.5.2 Methodology

The monitoring was carried out at each location for a period of 24hrs, once in a season. The locations were identified keeping in view the land use pattern and environmental setting. The

day levels of noise have been monitored during 6 am to 10 pm and the night levels during 10 pm to 6 am. The Ld, Ln and Ldn were calculated based on the hourly Leq values. Spot noise levels were measured using a precision noise level meter at residential areas and project area, in all five locations which were covered with in study zone. The noise levels include vehicular movement and local activities.

Noise levels were recorded for every 15minutes in a clock hour for a continuous 24-hour period at all locations.

3.5.3 Noise Monitoring Locations -The noise monitoring locations along with their distance from project are mentioned in the below Table: 3.14.

Table3.14 Noise Monitoring Locations

S. No	Location	StationCode	Latitude andLongitude
1	Project site (Ramakrishnapuram)	N1	13°24'1.52"N 78°48'20.56"E
2	Upparapalle	N2	13°23'7.85"N 78°49'10.77"E
3	Reddivaripale	N3	13°23'20.02"N 78°49'42.39"E
4	Patrapalli	N4	13°24'22.26"N 78°50'11.70"E
5	Rachettivanipalle	N5	13°27'52.82"N 78°48'0.09"E
6	Goudamukalapalle	N6	13°21'24.33"N 78°45'4.77"E
7	Durgasamudram	N7	13°22'35.99"N 78°43'32.22"E
8	Muddireddipalle	N8	13°24'47.40"N 78°43'37.44"E

3.5.4 Description of Locations:

N1 – the location has been selected to assess noise levels in the project site. N2, N3, N4, N5, N6, N7 and N8 – the locations have been selected to assess noise levels near to the project in residential areas with light Vehicular Movement.

3.5.5 Noise Levels in the Study Area

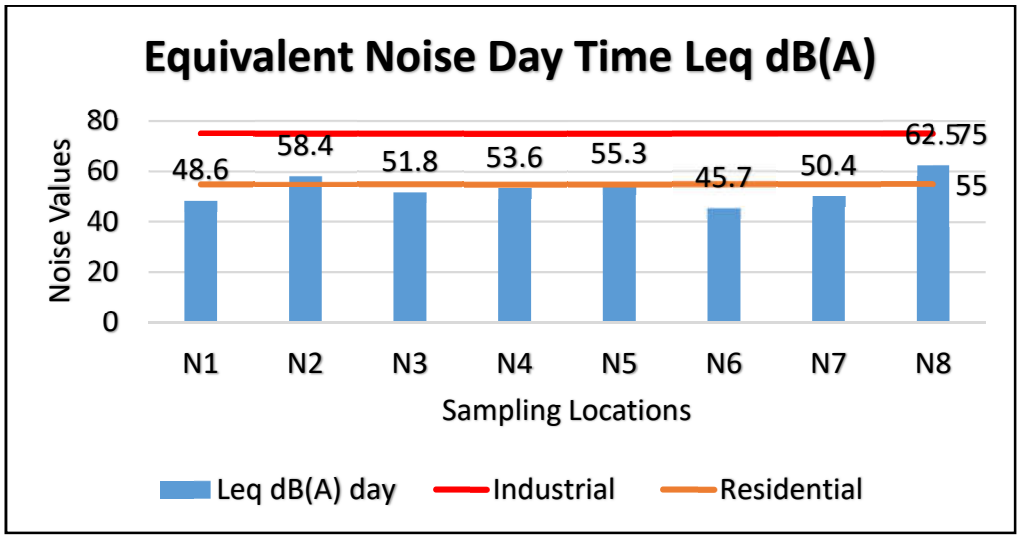
The noise level monitored during the study period is given in Table: 3.15 in the form of Lday, Lnight and Ldn compared with CPCB Standards.

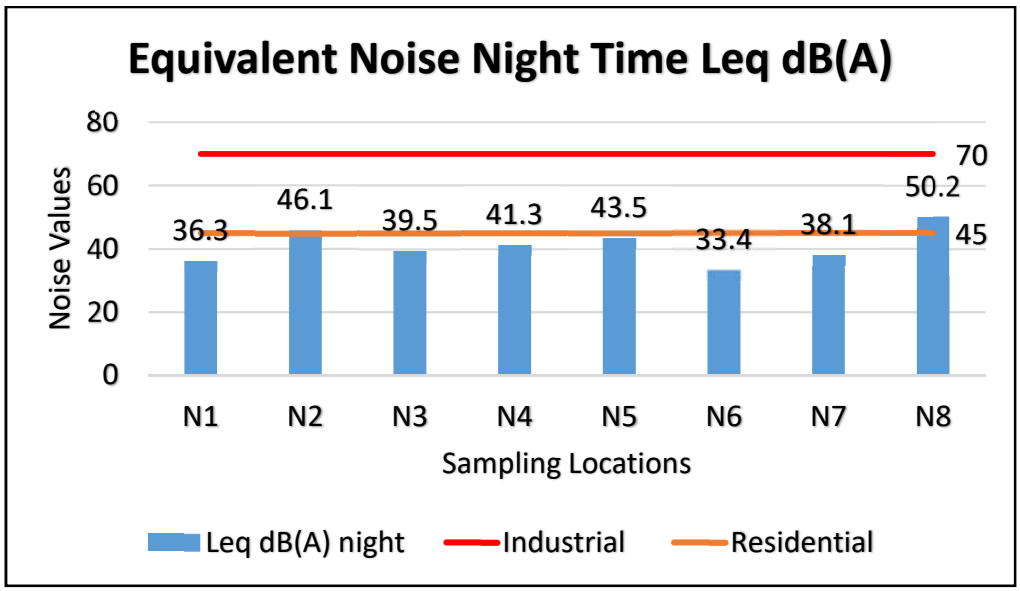
Table 3.15 Noise Levels in the Study Area

Location Code	Environmental Setting	CPCB norms Leq dB(A)		Leq dB(A) day	Leq dB(A) night
		Day	Night		
N1	Project site	75	70	48.6	36.3

N2	Residential	55	45	58.4	46.1
N3	Residential	55	45	51.8	39.5
N4	Residential	55	45	53.6	41.3
N5	Residential	55	45	55.3	43.5
N6	Residential	55	45	45.7	33.4
N7	Residential	55	45	50.4	38.1
N8	Residential	55	45	62.5	50.2

GRAPHICAL PRESENTATION OF NOISE LEVELSIN THE STUDY AREA





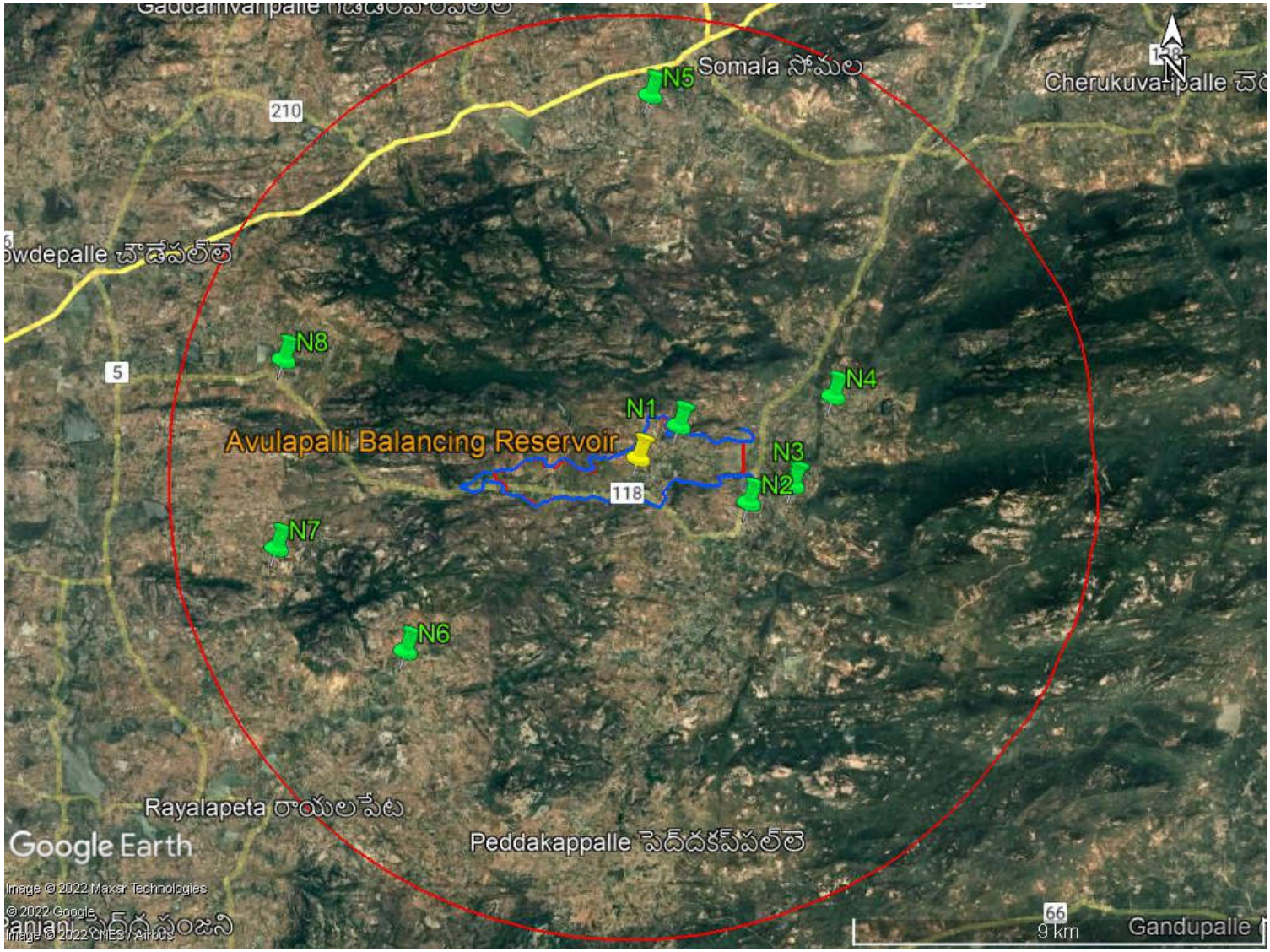


Fig3.8 Noise monitoring locations

3.6 Geology and Hydrogeology

3.6.1 Geology

The Geological formation in the study area can broadly be divided in to distinct and well-marked groups and older group of Metamorphic rocks belonging to Archean and Younger group of Sedimentary rocks belonging to the Proterozoic age. Archean Rocks that consist of Schist, Gneisses, Quartz veins and basic dykes, occupy the study area. The Archean rocks have suffered considerable degree of tectonic disturbances, because of which the rocks have been metamorphosed and recrystallized.

The Subject area belongs to a hillock with a height of 50-51m gently sloping towards West direction. The area is exposed with multi-Color Granite Sheet Rock intruded with Quartz Veins. This subject area is exposed with sheet rock of pink color granite that is locally named with branded rock of “Multi Colour Granite” of Punganur. Either side of the area intruded in to the Granite Gneisses, it indicating it will be youngest suits of Granittic rocks. The peninsular gneissic complex comprises gneisses, gray granite, and Pink Granite and Gneissic granite. The gneiss in general show banding due to alteration of light colored quartzo-feldspathic minerals and dark colored biotite or hornblende minerals. These rocks may be separated in two distinct groups namely; the massive foliated types occur as low dome shaped hillocks. The intrusive relationship of the granite rock is evident by the presence of tongues and apophyges within the older rocks and the occurrence of xenoliths of the older rocks within the granite (Fig 3.9).

Topographically the area proposed for grant is a pediment hillock gently slopes towards West direction. Generally, it is low-lying plain land with an average altitude of 282 to 333m above M.S.L. and dendritic to sub dendritic drainage is observed. The area is elevated towards East of the hillock and sloping towards West directions. The area is devoid of any forest or tree cover. Its boulders 2-5m size on top and below sheet rock is present in the applied area. There are no prominent natural drainage channels in the area. In general, the area is plain land.

3.6.2 Hydrogeology

The study area is underlain by crystalline formation. Ground water occurs unconfined to confined conditions in both hard rock and soft rock formations. The common ground water abstraction structures are drug wells, dug-cum-bore wells and bore wells and their yields mainly depend on recharge conditions in the area. The depth of open wells ranges from 10mto 13 m whereas bore wells range in depth from 50 to 60 m. The water level ranges from 25to 30 m below ground level.

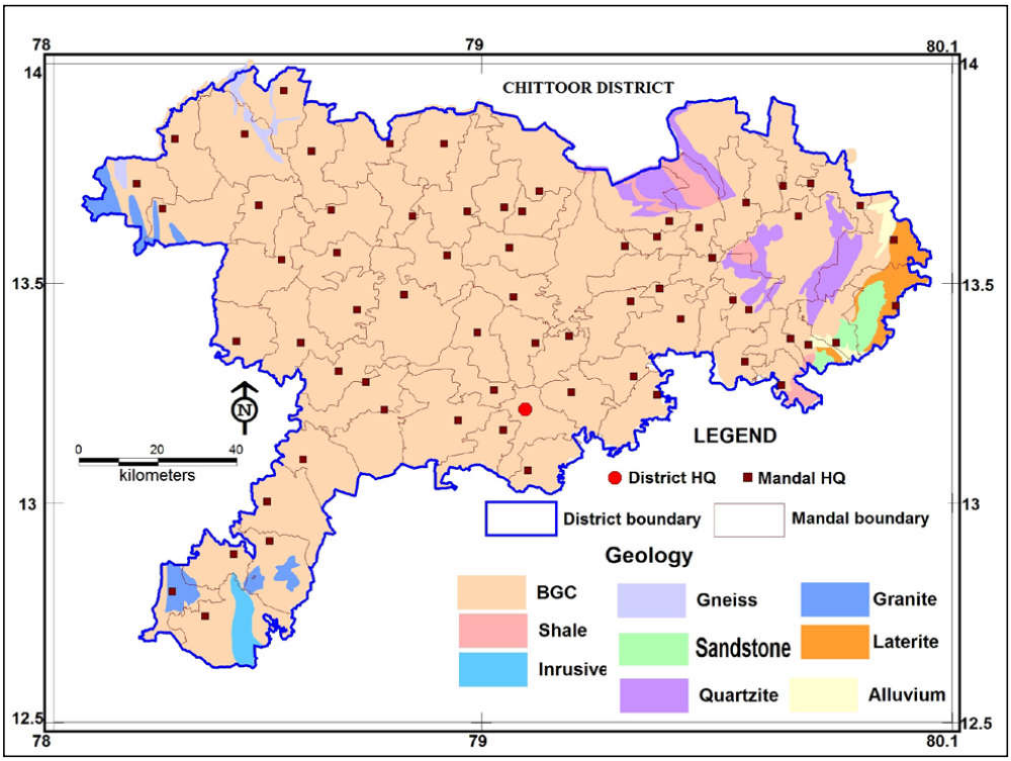


Fig 3.9 Geology of Chittoor District

The occurrence of ground water in the area is under semi-confined conditions through the weathered and fractured formations. The Nagari Quartzites are mostly confined to uplands and hilly areas, which are covered by forest. These formations are massive and compact and possess meagre ground water potential. The ground water development is very less and there is not much habitation in these formations. The alluvium is confined to mostly riverbanks and stream courses with varying width and depth. Ground water development in this formation is mostly by filter points and dug wells. The well yields vary from 3 to 10 lps. With drawdown of 2 to 6 m. They can sustain pumping for 5 to 7 hours/day with fast recovery of water levels. The applied area exists dendritic drainage pattern, and any second order streams are not exists nearby site location. The study area of the drainage pattern South to NE direction. Hydrogeological map of the study area is presented in Fig 3.10.

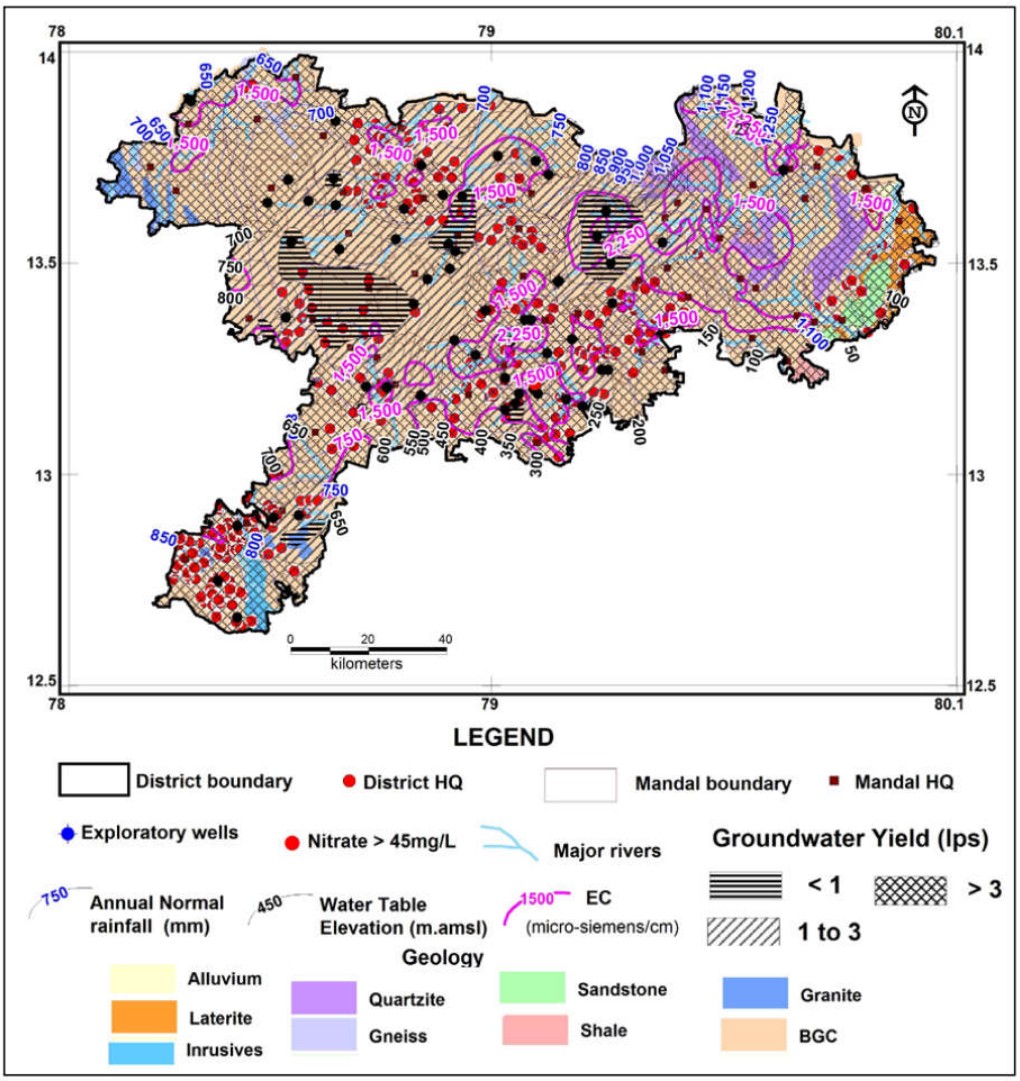


Fig 3.10 Hydrogeology of the Chittoor District

3.7 Land Use/ Land Cover

Land use Land Cover map is prepared by adopting interpretation techniques of the image classification. Image classification has been done by using supervised classification of satellite images by running an training sample manage based on colours, various activities has been included in the preparation of Land Use Land Cover Maps such as Satellite Image/Data Acquisition, Preprocessing, Rectification, Ground Truthing etc., Satellite Images are processed and producing LULC maps are being done by using Arc GIS 10.6.

The basic purpose of land use pattern and classification in an EIA study is to identify the manner in which different parts of land area is utilized or not utilized. Remote sensing data provides reliable accurate baseline information for land use mapping as it is a rapid method of acquiring upto date information of over a largegeological area.

Studies on land use aspects of eco-system play an imperative role in identifying susceptible issues and to take appropriate action to uphold ecological equilibrium in the region. The main objective of this section is to provide a baseline status of the study area covering 10 km radius around the proposed plant site so that temporal changes due to the industrial activities on the surroundings can be assessed in future.

The objectives of Land use Pattern are to:

- Determine the present Land use pattern
- Analyze the impacts on Land use due to the proposed projecte in the study area
- Study area with proposed unit as 10 km radius from the core area is considered for land use study.

3.7.1 Methodology

The overall methodology (Fig 3.11) adopted and followed to achieve the objectives of the present study involve the following:

- Procurement of Satellite images.
- Collection of source data of Survey of India (SOI) toposheets. These are the main inputs for the preparation of essential layers
- Atmospheric and Radiometric corrections of Satellite data by using nearest neighborhood resampling technique
- Preparation of basic themes like layout map, transport & settlement map and contour map from the source data. Then updating of layout map,transport map and drainage map from the satellite image by visualinterpretation
- Performing image analysis in ArcGIS and Extraction of whole satelliteimage into study area, processing and producing various maps such asLULC, Contour Maps, Digital Elevation Maps, Drainage Maps
- Preliminary quality check and necessary corrections are carried out forall the maps.

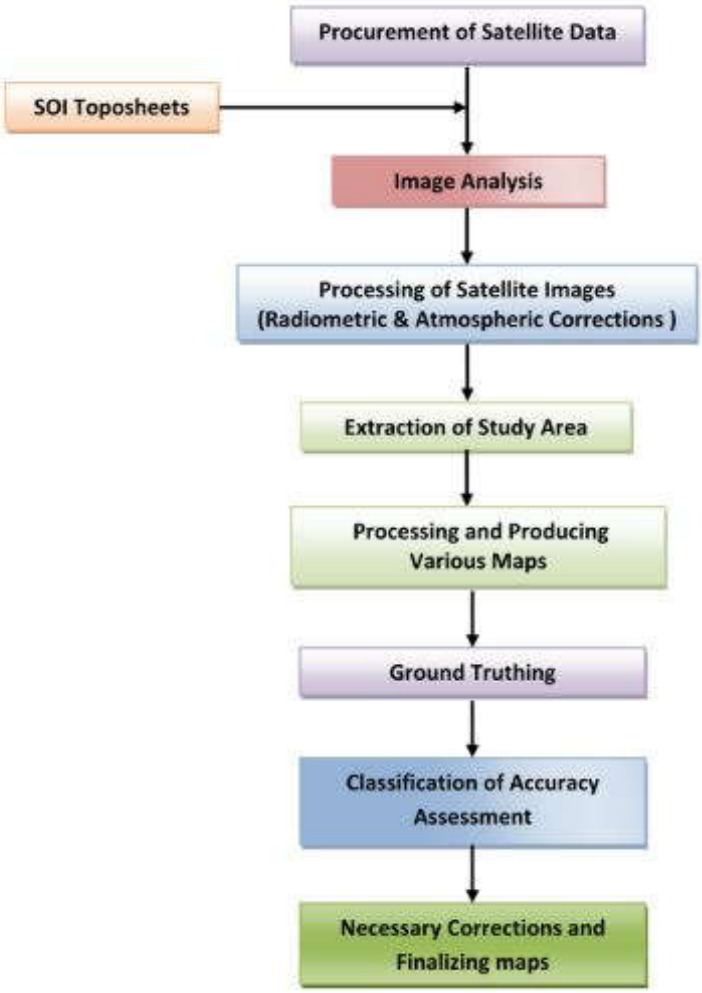


Fig 3.11 Methodology

3.7.2 LULC Study

The LULC Study done for the 10 km radius area from the boundary of proposed Avulapalli Balancing Reservoir project site by using visual interpretation techniques in Arc GIS 10.6. Output of the map has been provided in 1:50000 scale, along with LULC MAP 10KM Radius False Colour Composite Map (Fig 3.12) and True Colour Composite map (Fig 3.13) also provided below. The area distributions along with area of different land use classes are listed below table and Fig 3.12.

Total study area for the proposed project is 46414.37 Ha (Table 3.17) based on LULC map (Fig 3.14). Major portion of the study area occupied by Forest with 22375.66 (48.21 %) followed by Scrub with 11810.46 Ha (25.45%), Fallow land with 5954.65 Ha (12.83%), Agricultural fields with 5591.40 Ha (12.05%), water bodies with 437.87 Ha (0.94%), and Habitation with 244.33 (0.53%) (Fig 3.12).

Table 3.17. LU/LC Classification in the Study Area

S.No.	Classification	Area (Ha)	Percentage (%)
1	Water body	437.87	0.94
2	Scrub	11810.46	25.45
3	Agricultural fields	5591.40	12.05
4	Fallow land	5954.65	12.83
5	Forest / green cover	22375.66	48.21
6	Habitation	244.33	0.53
Total		**46414.37**	**100.00**

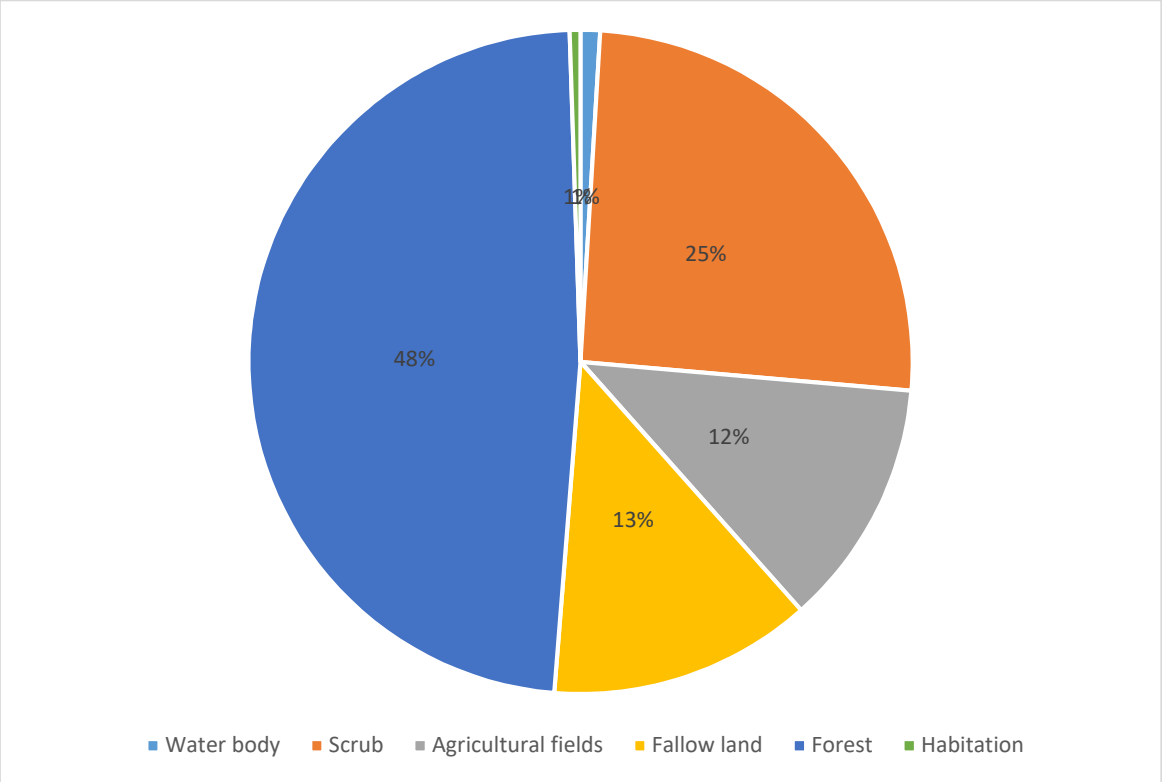


Fig 3.12 LU/LC Statistics

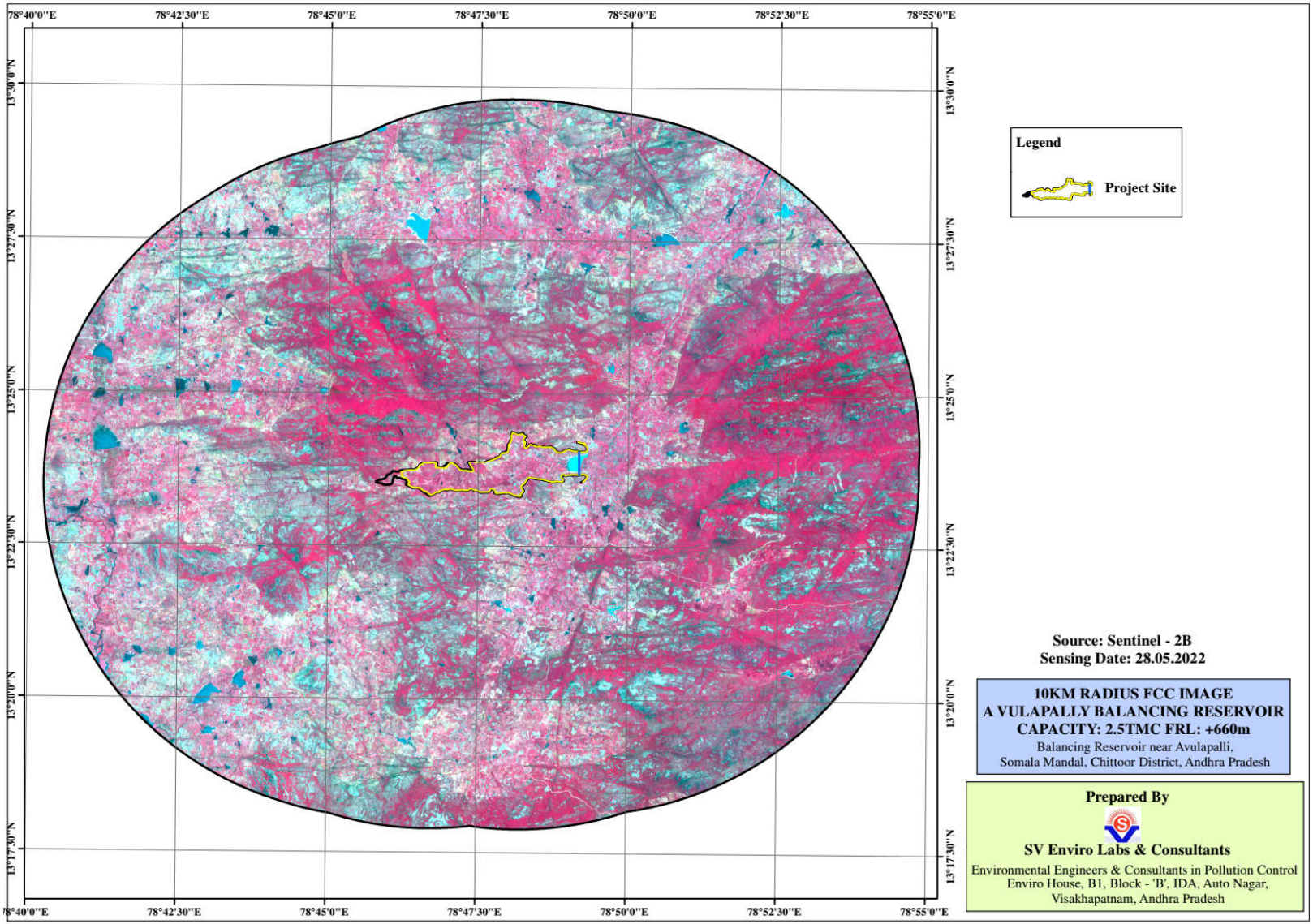


Fig 3.13 False colour composite satellite image

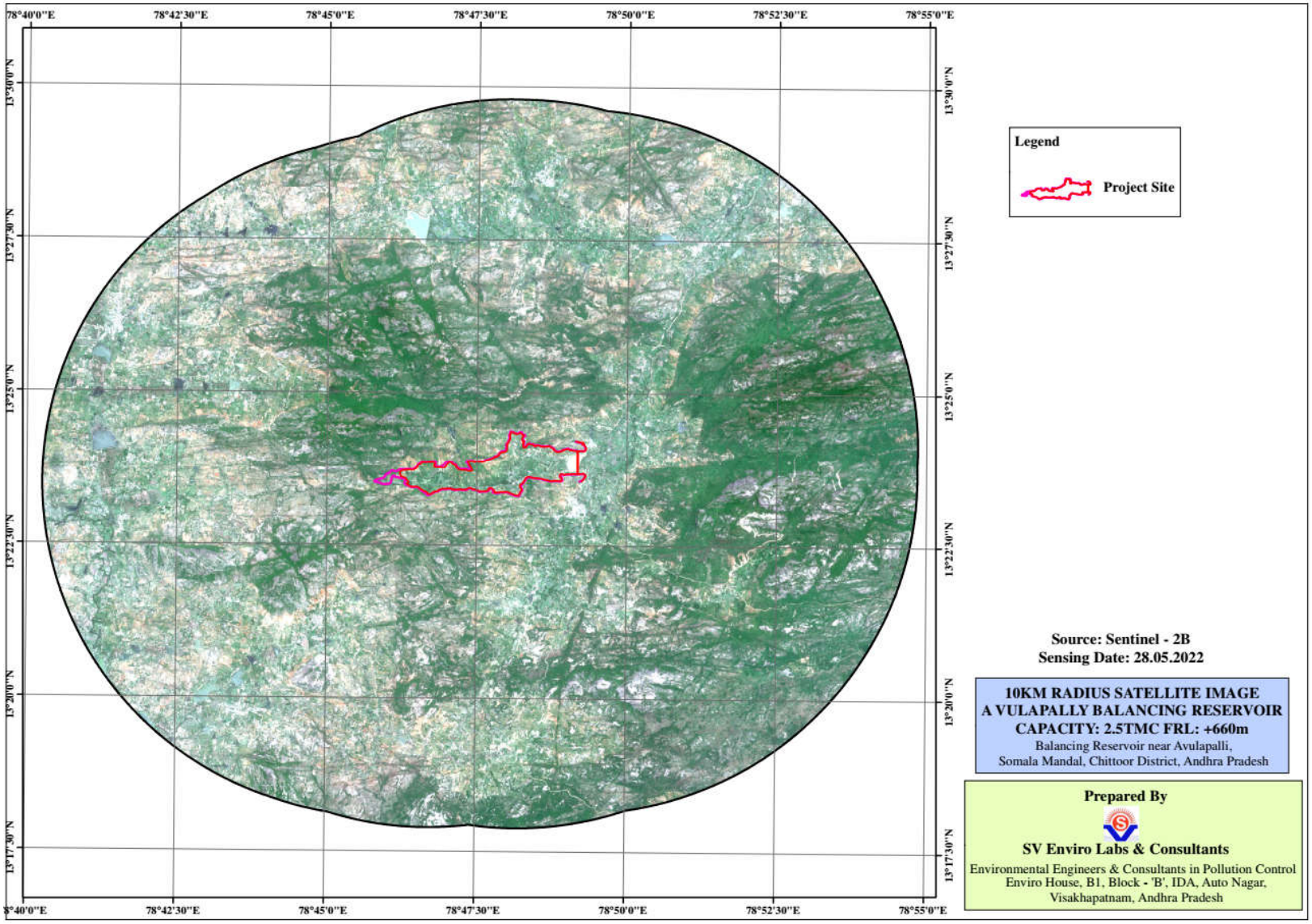


Fig 3.14 Satellite image

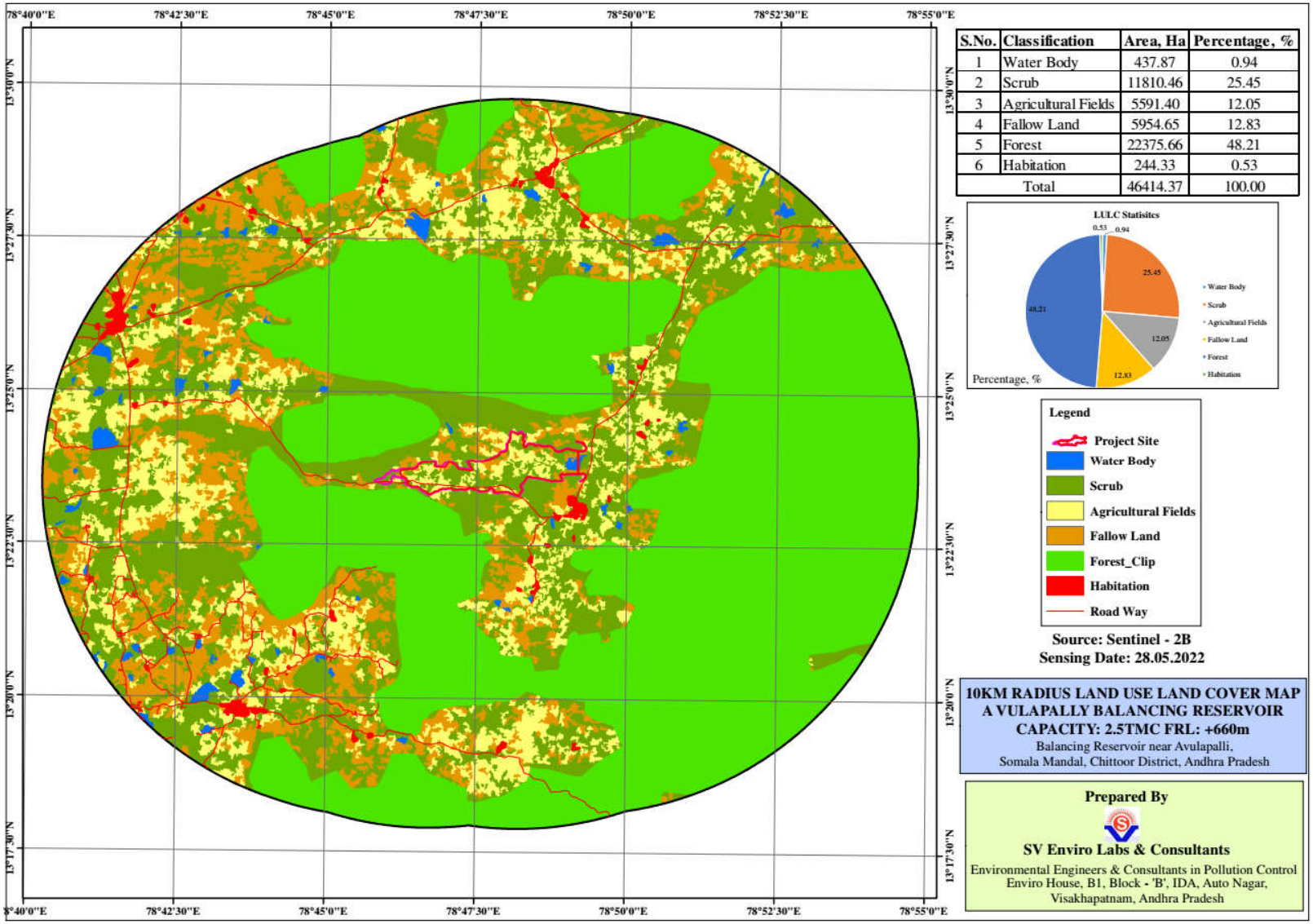


Fig. 3.15 Land use/Land cover map

3.7.3 Digital Elevation Map

A digital elevation model (DEM) is a digital representation of ground surface topography or terrain. It is also widely known as a digital terrain model (DTM). A SRTM DEM file has been used for preparation of Digital Elevation maps. In a DEM each cell having a value corresponding to its elevation. By adding Hill shading tool, a reader can see the relationship between terrain and other things. Digital Elevation Model or Digital Terrain Model map has been shown in the Fig 3.15.

3.7.4 Contour Map

A contour line connects a series of equal elevation points, the contours have been generated in the GIS environment with reference to the mean sea level by using the DEM (Digital Elevation Model) data, the elevation values has been verified. Thereafter final contour map has been prepared with combination of Toposheet and DEM with contour interval of 10 m. In the study area, highest contour observed as 1219m of MSL towards ENE direction of the project site and lowest contour is 462m of MSL that is situated towards SEand North direction of the project site. With reference to the above minimum and contour levels, it represents that the study area is undulated in nature. Contour Map for the proposed project study area has been shown in the below Fig 3.16.

3.7.5 Drainage Map

Drainage Map for the study area has been developed in the GIS Environment by using Digital Elevation Model. Methodology involved for producing of Drainage maps has been discussed below. Strahler method of ordering is used for developing drainage map for the study area. Based on the elevation profiles of the study area drains will be formed as First order, Second Order, Third Order and so on. Accuracy of the maps has been verified by using Ground Truthing Technique. Stream Network of the study area as shown in the Fig 3.17.

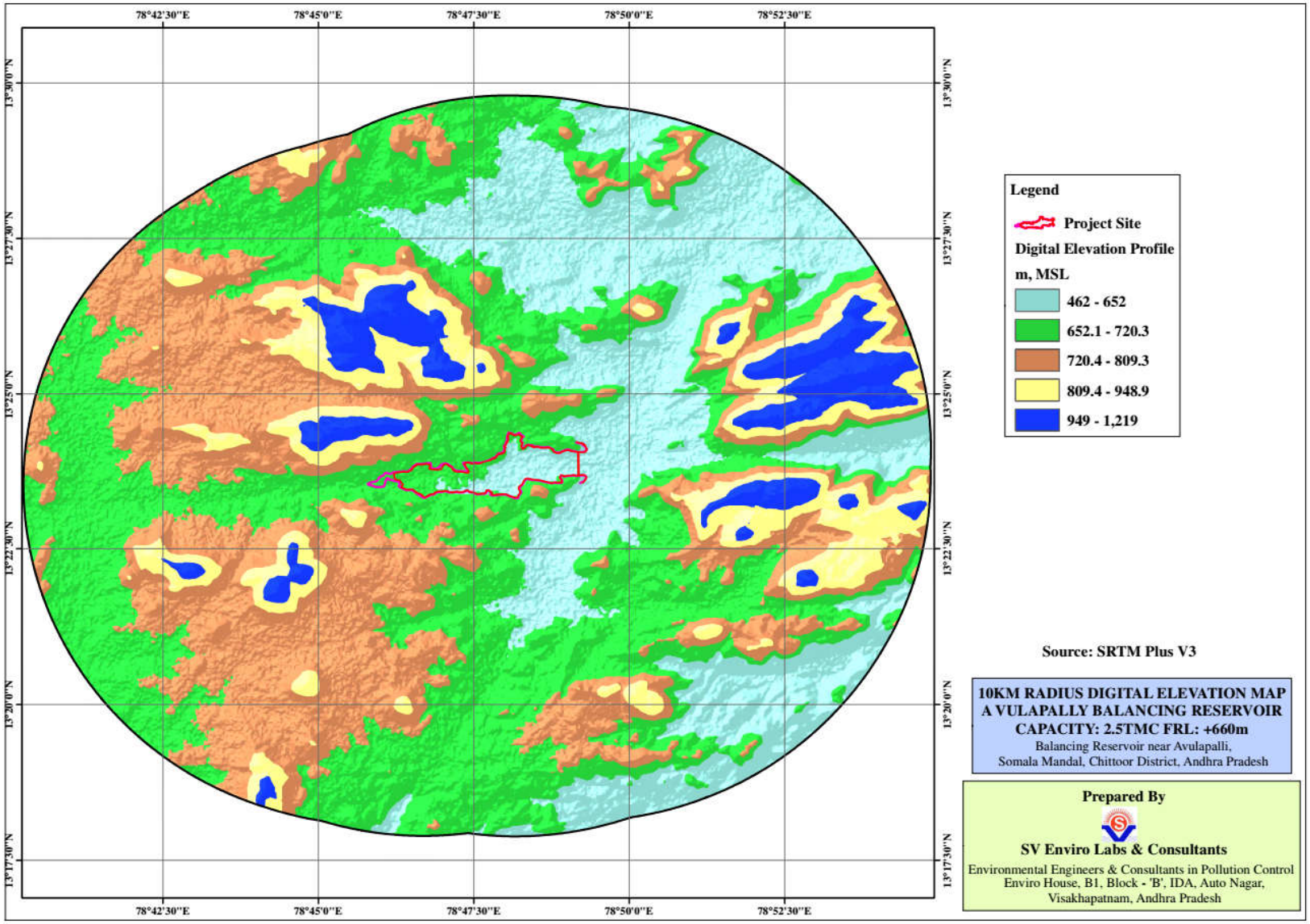


Fig. 3.16 Digital Elevation map

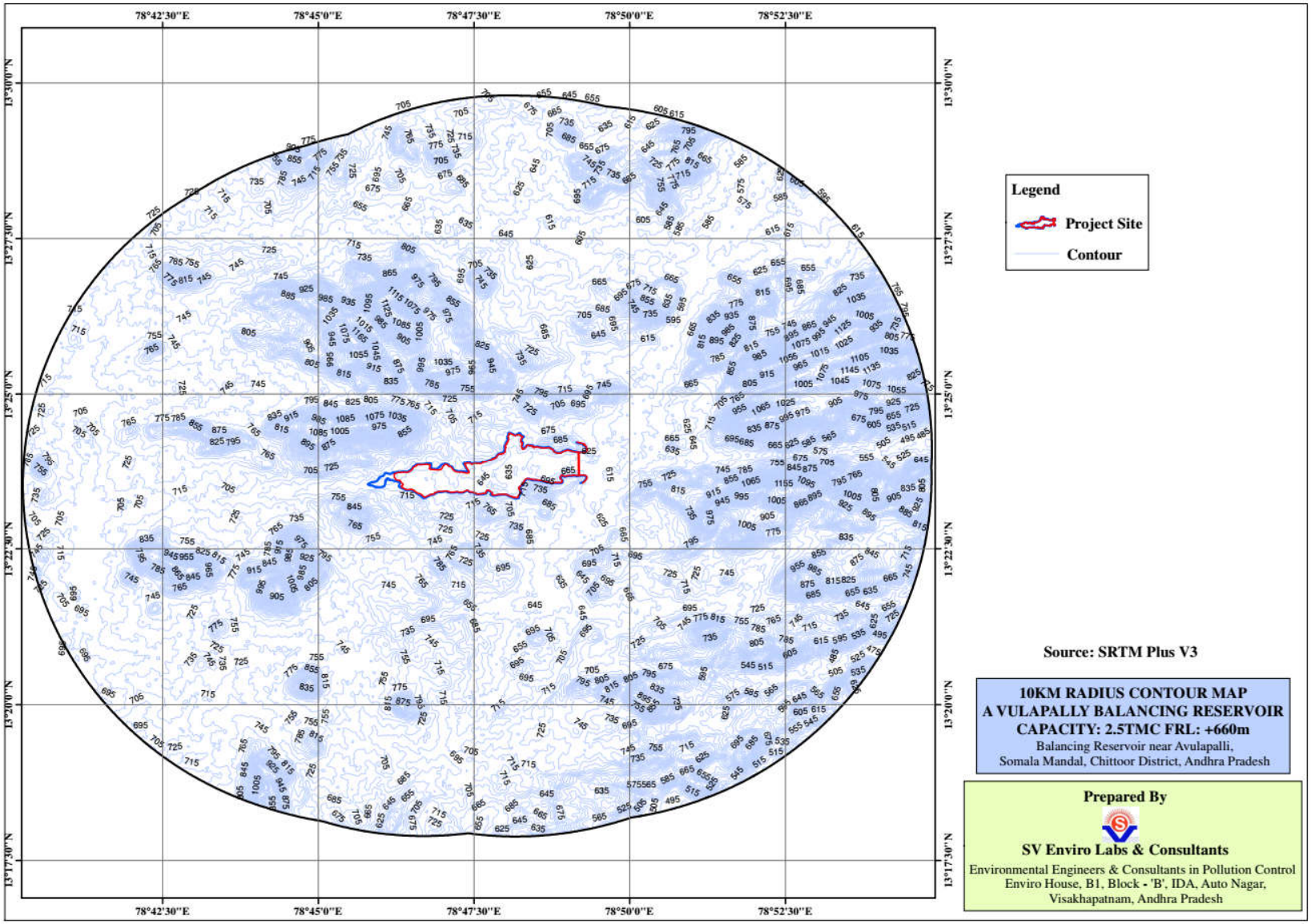


Fig. 3.17 Contour map

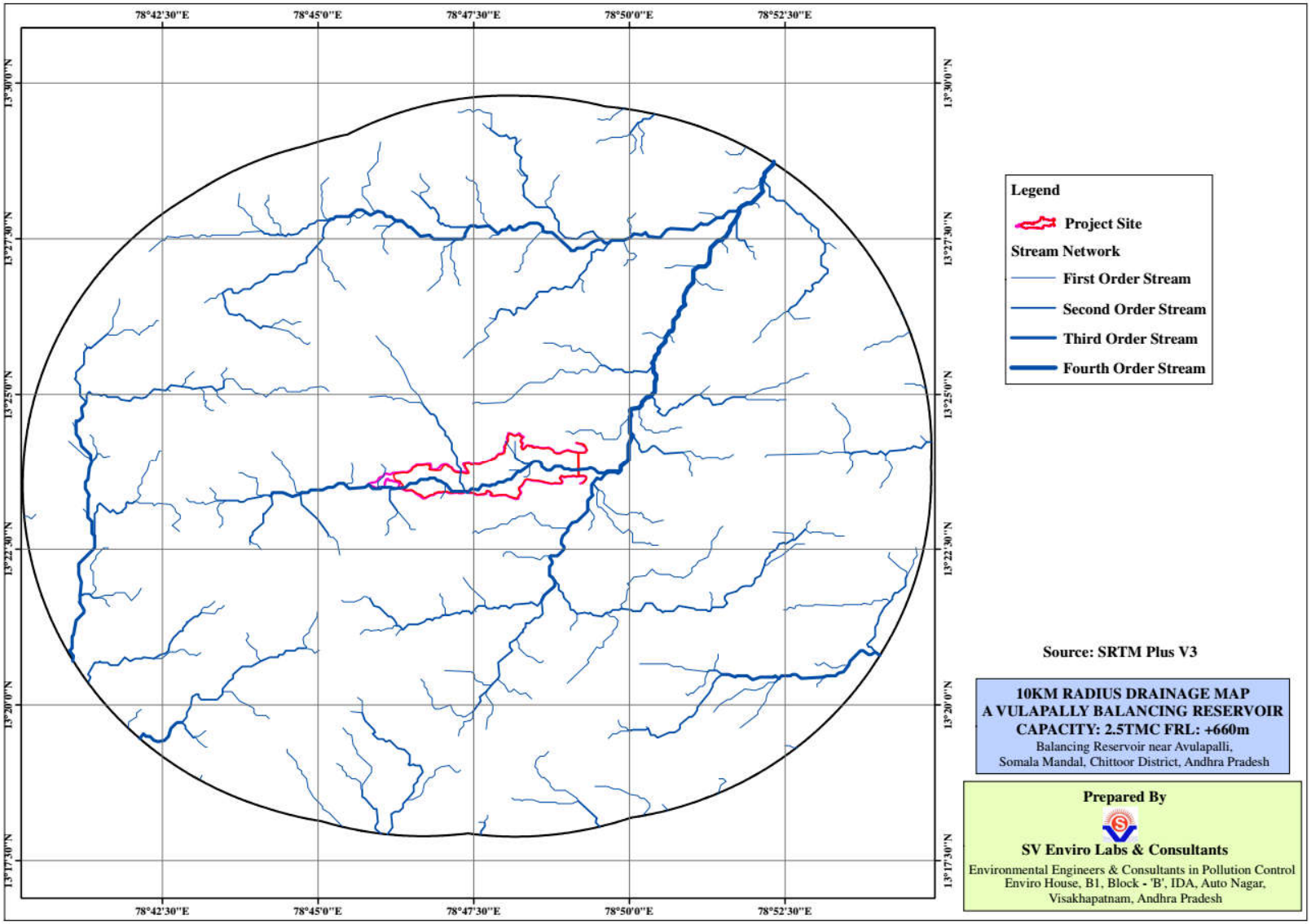


Fig. 3.18 Drainage map

3.8 Biological Environment

3.8.1 Introduction

Environmental degradation and the depletion of natural resources induced by human activities have attracted steadily growing concerns in the last decades. Such concerns made evident the necessity for the planning authorities to count on sound information about the possible environmental consequences of development actions. One of the tools available to satisfy this need is represented by the procedure of Environmental Impact Assessment (EIA). This procedure involves the systematic identification and evaluation of the impacts on the environment caused by a proposed project.

The evaluation of the ecological significance of an area can be undertaken from different perspectives, and consequently with different objectives. One of such perspectives focuses on the conservation of the biological diversity, or biodiversity. This has recently emerged as a key environmental issue to be accounted for in land-use planning: "Biodiversity is now a major driving force behind efforts to reform land management and development practices worldwide and to establish a more harmonious relationship between people and nature". Among the human activities that pose the highest threat to the conservation of biodiversity is the construction of linear infrastructures and roads in particular. Such projects represent artificial elements that cut through the landscape and interfere with the natural habitat conditions. This in turn influences the abundance and distribution of plant and animal species, i.e., the biodiversity of the areas impacted.

3.8.2 Objectives

The main objectives of the biological study were:

- To collect the baseline data for the study along with a description of the existing terrestrial, wetland and aquatic biodiversity.
- To assess the scheduled species in the proposed site (rare, endangered, critically endangered, endemic and vulnerable).
- To identify the locations and features of ecological significance
- To identify the impacts of proposed project before, after and during development

3.8.3 Flora and fauna of Chittoor district

The climate, topography and geology have played an important role impressing the flora and fauna of the district. The district has hills and plateau and elevation ranges up to 1318 metres. The floristic compositions in the forests vary from dry mixed deciduous to thorny scrub with

occasional patches of dry, evergreen growth. The forests of this district broadly classified into the following three principal types.

1. Dry tropical South Indian dry mixed deciduous forests.
2. Southern Cutch thorn forest groups
3. Tropical dry evergreen forests.

The mesophytic type of flora like *Syzygium cumini* (Neredu), *Pongania pinnata* (Kanuga) and large trees of *Terminalia arjuna* (Erramaddi and Tellamaddi) are found. Large trees of Mango, *Phoenix sylvestris* and different types of grass along watercourses are also found. In the forests of this district, wild animals like tiger and panther (*Panthera pardus*) are present in small numbers. Sloth-bear (*Melursus ursinus*) is found still in good numbers in all classes of reserve forests of the district. Wild dog, Wild boar (*Sus cristatus*), Porcupine (*Hystrix indica*), Heyna (*Hyaena striata*) Jungle cat (*Felis chaus*), Jackal (*Canis aureus*), fox (*Velpes bengaleusis*), Wolf (*Canis lugus*) etc., are the other carnivores present in the district. The commonly found herbivore present in the district are Sambur (*Rusa unicolor*), Black buck (*Antelope cervicapse*), Chital, Wild sheep (*Civis cycloceros*), Mouse deer (*Memina indica*), Hare (*Lapium finidus*), Rabbit etc. A number of bird species also exist in this district. Among the birds, the birds of large grey babbler (*Turdiodes Malcolmi*), the Large grey shrike (*Lanius Excubitor*), King Crows, Mynas and Crows, Bee-eaters, Hoopoes, Swifts, Vultures, Eagles, Kites, Owls, Sand grouse, Quails, Partridges, Green Pigeons, Pigeons, Peacocks etc., are found in this district.

3.8.4 Study area

The core areas is covered by Mango plantations, Coconut plantations and agricultural fields, and scrub forest which is very much exposed due to biotic factors in addition, the present condition is highly eroded and is primarily responsible for the development of Thorny-scrub vegetation. In such open low forests, high percentage of thorny and usually a few hardwood species predominate where the canopy is open.

The buffer area comprises of non-forest wastelands, fallow lands and reserved forest which is completely covered by invasive spcies i.e. *Prosopis juliflora* and vegetation covered by few species of shrubs, thorny bushes and some trees. Mesquite (*Prosopis juliflora*), Pongam Tree (*Pongamia pinnata*), Indian Elm (*Holoptelea integrifolia*), Neem (*Azadirachta indica*), Babul (*Acaia nilotica*), Ber (*Ziziphus jijuba*), *Lantana camara*, *Hyptis suaveolens*, *Anisomeles indica*, *Calotropis procera*, *Cassia auriculata*. *Waltheria indica*, *Solanum xanthocarpum*,

Crotalaria sps, Prickly pear (*Opuntia dillenii*), *Tribulus terrestris* were common wild plants found in the study area.

Mainly croplands, reserved forests, Mango gardens, Lemon gardens and plantations observed the study area. Besides Paddy, all vegetables, flowers, cereals especially Raagi, pulses and oil seeds are grown in the buffer zone. Mango is the most common and widely grown fruit tree in the buffer zone. However, there are many non-cultivable wastelands sparsely covered with thorny bushes of *Maytenus emarginata*, *Prosopis juliflra*, *Acacia nilotica*, *Dolichondrone falcata* as well as *Calotropis gigantea*, *Calotropis procera*, *Cassia auriculata* and others. Sapota, Orange, Guava and Pomegranate are the other major fruit trees. Eucalyptus and Teak are the main pulpwood and timber plantations respectively. There are no National Parks or Wildlife Sanctuaries or Biosphere reserves or important bird areas (IBAs) or Protected Wetlands within the project site.



Fig 3.19 Mango plantations and Crop fileds in the study area



Fig 3.20 Vegetation in the study area

3.8.5 Forest blocks in studyarea

The details of forest blocks in study area are presented below in the Table 3.18. Horticultural plantations could also be seen in the core and buffer zone of the project such as Mango, Coconut and Lemon plantations.

Table 3.18 Details of the forest blocks in the study area

S.No	Details of forest blocks	Distance KM	Direction
1	Avulapalli Durga Protected Forest	0.06	SW
2	Madiramalai West RF	0.45	NW
3	Madiramalai East RF	0.50	N
4	Kandurukanuma East RF	8.30	N
5	Kandurukanuma West RF	8.70	NW
6	Yeddulakonda RF	7.30	NE
7	Errakonda RF	5.10	SW
8	Gamkonda RF	8.70	SW
9	Rayalapeta RF	8.50	SW

3.8.6 Methodology

3.8.6.1 Flora

Vegetation and plant species composition observed and documented during field visit in and around the mining site in post monsoon season. Besides primary surveys in the mining sites, published literature and various floras were consulted to prepare an inventory of plant species growing at project sites. The vegetation of the study area is highly degraded and some areas consisting water bodies. The plant diversity is classified into various plant groups such as tree, shrubs, herbs, climbers, sedges and grasses. The plant diversity survey in the project area was undertaken during the summer season with the objectives of preparing a checklist of flora in the study area. The list included total plant diversity belonging to various groups such as agricultural crops, vegetable crops, and horticultural crops, natural and aquatic flora.

3.9.6.2 Fauna

Information pertaining to the existence of migratory corridors and breeding habitats of endangered and threatened fauna were assessed based on the information provided by the local inhabitants and forest department personnel. The conservation status of each faunal species recorded from the project areas were ascertained as per schedules of Indian wildlife (protection) Act, 1972 and IUCN -Red Data Book (RDB).The survey of faunal elements of core and buffer zone were assessed as per the following sampling techniques:

Table 3.19 Mode of data collection and parameters considered during the survey

S.No.	Aspect	Data	Mode of data collection	Parameters monitored	Remarks
1	Terrestrial Biodiversity	Primary data collection	By field survey	Flora and faunal diversity	**For floral diversity:** Random survey, Sampling survey/ Forest inventory, walking transect, collection and identification with the help of relevant literature. **For faunal diversity:** Direct and indirect sampling, walking transect, point sampling and nest sampling etc.
2		Secondary data collection	From authentic sources like published literature, AP Forest Department books and BSI and ZSI published articles etc.	Floral, vegetation and forest types studied from Flora of Chittoor district and Flora of Andhra Pradesh.	Data collected from the working plan of the region, forest types from the authentic literature of Vegetation types of India (Champion and Seth) Flora of Andhra Pradesh (Pullaiah et al).
3	Aquatic Biodiversity	Primary data	By field survey	Floral and faunal diversity	For plankton study- Lackey's drops method and light microscope For other aquatic – Random survey, opportunistic

					observations
		Secondary data collection	From authentic sources like AP Forest department and Fisheries department	Flora of Chittoor district and Flora of Andhra Pradesh. Phytoplankton, Zooplankton and aquatic fauna.	Desktop literature review to identify the representative spectrum of threatened species, population and ecological communities.

Protected areas such as Wildlife sanctuaries, National Parks, Biosphere Reserves, Marine Sanctuaries do not exist in the core and around 10 km radius buffer zone of the proposed project.

3.8.7 Flora

An enumeration of plants is "an attempt to describe the quantity and quality of forest trees and many of the characteristics of the land area upon which trees are grown". The objective of flora enumeration of the study area is to provide complete checklist of floristic structure along the entire core and buffer areas for formulating effective management and conservation measures.

3.8.7.1 Floristic composition within the project area

Overall 163 plant species of terrestrial flora and aquatic exists in the cored area, which includes tree species, herbs, shrubs, climbers, grasses and sedges. Details of taxonomic account for all plant life forms are provided in the Table 3.20.

Table 3.20. Floristic composition from Core zone of the study area

S.No.	Scientific name	Habit	Vernacular name	Family
1	*Acacia caesia* (L.) Willd.	Climber	Korintha	Mimosaceae
2	*Acacia chundra* (Rottler) Willd.	Tree	Sandra karra	Mimosaceae
4	*Acacia leucophloea* (Roxb.) Willd.	Tree	Tella thumma	Mimosaceae
5	*Acacia nilotica* (L.) Delile	Tree	Nalla thumma	Mimosaceae
7	*Acacia torta* (Roxb.) Craib	Climber	Konda korintha	Mimosaceae
9	*Aegle marmelos* (L.) Corrêa	Tree	Velaga	Rutaceae
11	*Ailanthus excelsa* Roxb.	Tree	Pedda manu	Simaroubaceae

12	*Alangium salviifolium* (L.f.) Wangerin	Tree	Oodaga chettu	Alangiaceae
13	*Albizia amara* (Roxb.) B.Boivin	Tree	Konda singara	Mimosaceae
14	*Albizia lebbeck* (L.) Benth.	Tree	Dirisana	Mimosaceae
15	*Albizia odoratissima* (L.f.) Benth.	Tree	Chinduga	Mimosaceae
16	*Albizia procera* (Roxb.) Benth.	Tree	Tella chinduga	Mimosaceae
17	*Albizia saman* (Jacq.) Merr.	Tree	Nidrabhangi	Mimosaceae
18	*Allophylus serratus* (Hiern) Kurz	Shrub	Kaki beera	Sapindaceae
19	*Alstonia scholaris* (L.) R. Br.	Tree	Yedaakula paala	Apocynaceae
20	*Anisomeles indica* (L.) Kuntze	Herb	China ranabheri	Lamiaceae
21	*Anisomeles malabarica* (L.) R.Br. ex Sims	Herb	Ranaberi	Lamiaceae
22	*Annona squamosa* L.	Tree	Seethe phalam	Annonaceae
23	*Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Tree	Patchimaanu	Combretaceae
24	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Tree	Chirimaanu	Combretaceae
25	*Azadirachta indica* A.Juss.	Tree	Vepa / Neem	Meliaceae
26	*Azima tetracantha* Lam.	Shrub	Tella uppili	Salvadoraceae
27	*Barringtonia acutangula* (L.) Gaertn.	Tree	Kanapa chettu	Barringtoniaceae
28	*Bauhinia purpurea* L.	Tree	Devakanchanam	Caesalpiniaceae
29	*Bauhinia racemosa* Lam.	Tree	Aarechettu	Caesalpiniaceae
30	*Bauhinia variegata* L.	Tree	Madaka chettu	Caesalpiniaceae
31	*Benkara malabarica* (Lam.) Tirveng.	Tree	Pedda manga	Rubiaceae
32	*Bombax ceiba* L.	Tree	Buruga	Malvaceae
33	*Borassus flabellifer* L.	Tree	Taadi / Taati	Palmaceae
35	*Buchanania axillaris* (Desr.) Ramamoorthy	Tree	Sarapappu	Ancardiaceae
37	*Butea monosperma* (Lam.) Taub.	Tree	Moduga	Fabaceae
38	*Calophyllum inophyllum* L.	Tree	Ponna	Clusiaceae
39	*Calotropis gigantea* (L.) Dryand.	Shrub	Telle jilledu	Asclepiadaceae
40	*Calotropis procera* (Aiton) Dryand.	Shrub	Jilledu	Asclepiadaceae
41	*Campsis grandiflora* (Thunb.) K.Schum.	Shrub	Swarna Gandhi	Bignoniaceae
42	*Canthium parvifolium* Roxb.	Shrub	Balusu	Rubiaceae
43	*Capparis brevispina* DC.	Shrub	Adavi uppi	Capparidaceae
44	*Capparis zeylanica* L.	Shrub	Tella uppili	Capparidaceae
45	*Carissa spinarum* L.	Shrub	Kalivi / Vaaka	Apocynaceae
46	*Cassia fistula* L.	Tree	Rela	Caesalpiniaeae
47	*Cassia roxburghii* DC	Shrub	Seema rela	Caesalpiniaeae
48	*Casuarina equisetifolia* L.	Tree	Sarugudu	Casurinaceae
49	*Catunaregam spinosa* (Thunb.) Tirveng.	Shrub	Nalla balusu	Rubiaceae
50	*Celastrus paniculatus* Willd.	Climber	Maneru	Celastraceae

51	*Chloroxylon swietenia* DC.	Tree	Billudu	Flindersiaceae
52	*Chukrasia tabularis* A.Juss.	Tree	Konda vepa	Meliaceae
53	*Cipadessa baccifera* (Roth) Miq.	Shrub	Chedu beera	Meliaceae
54	*Citrus aurantium* L.	Shrub	Gajanimma	Rutaceae
55	*Citrus limon* (L.) Osbeck	Shrub	Nimma	Rutaceae
56	*Cochlospermum religiosum* (L.) Alston	Tree	Kondagogu	Cochlospermaceae
57	*Cocos nucifera* L	Tree	Kobbari	Arecaceae
58	*Combretum indicum* (L.) DeFilipps	Climber	Teega ganneru	Combretaceae
59	*Commiphora caudata* (Wight & Arn.) Engl.	Tree	Konda maamidi	Burseraceae
60	*Cordia dichotoma* G.Forst.	Tree	Iriki / bankiriki	Cordiaceae
61	*Dalbergia lanceolaria* L.f.	Tree	Nagalla pachari	Fabaceae
62	*Dalbergia latifolia* Roxb.	Tree	Jittegi	Fabaceae
64	*Delonix regia* (Hook.) Raf.	Tree	Turayi	Caesalpiniaceae
65	*Derris scandens* (Roxb.) Benth.	Climber	Nalla teege	Fabaceae
66	*Dichrostachys cinerea* (L.) Wight & Arn.	Shrub	Sarathumma	Mimosaceae
67	*Dillenia indica* L.	Tree	Pedda kalinga	Dilleniaceae
68	*Diospyros malabarica* (Desr.) Kostel.	Tree	Tumiki	Ebenaceae
69	*Diospyros montana* Roxb.	Tree	Jagadagondi	Ebenaceae
70	*Diospyros ovalifolia* Wight	Tree	Kukka tumiki	
71	*Dodonaea viscosa* (L.) Jacq.	Shrub	Bandedu	Sapindaceae
72	*Dolichandrone falcata* (Wall. ex DC.) Seem.	Tree	Niruddi	Bignoniaceae
73	*Dregea volubilis* (L.f.) Benth. ex Hook.f.	Climber	Kalisaku	Asclepiadaceae
74	*Erythrina variegata* L.	Tree	Badisa	Fabaceae
75	*Eucalyptus globulus* Labill.	Tree	Neelagiri	Euphorbiaceae
76	*Falconeria insignis* Royle	Shrub	Devaswaroopi	Euphorbiaceae
77	*Ficus benghalensis* L.	Tree	Marri	Moraceae
78	*Ficus carica* L.	Tree	Atti	Moraceae
79	*Ficus populifolia* Vahl	Tree	Raavi	Moraceae
80	*Ficus racemosa* L.	Tree	Medi	Moraceae
81	*Firmiana simplex* (L.) W.Wight	Tree	Erra poliki	Sterculeaceae
82	*Gardenia gummifera* L.f.	Tree	Bikki	Rubiaceae
83	*Gardenia latifolia* Aiton	Tree	Pedda bikki	Rubiaceae
84	*Getonia floribunda* Roxb.	Climber	Putangi teega	Combretaceae
85	*Givotia moluccana* (L.) Sreem.	Tree	Tella poliki	Euphorbiaceae
86	*Gmelina arborea* Roxb.	Tree	Gummdi teku	Verbenaceae
87	*Gymnosporia emarginata* (Willd.) Thwaites	Shrub	Danthi	Celastraceae

88	*Haldina cordifolia* (Roxb.) Ridsdale	Tree	Bandaru / Rudraganapa	Rubiaceae
89	*Ixora pavetta* Andr	Shrub	Ixora	Rubiaceae
90	*Jacaranda mimosifolia* D.Don	Tree	Swarna sundari	Bignoniaceae
91	*Jatropha curcas* L.	Shrub	Adavi aamudamu	Euphorbiaceae
92	*Kigelia africana* (Lam.) Benth.	Tree	Yenugu thondamu	Bignoniaceae
93	*Lagerstroemia parviflora* Roxb.	Tree	Chennangi	Lythraceae
94	*Lantana camara* L.	Shrub	Lantana	Verbenaceae
95	*Lawsonia inermis* L.	Shrub	Gorinta	Lythraceae
96	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Tree	Ippa	Sapotaceae
97	*Mangifera indica* L.	Tree	Mamidi	Anacardiaceae
98	*Manilkara zapota* (L.) P.Royen	Tree	Sapota	Sapotaceae
99	*Melia azedarach* L.	Tree	Vepa / Neem	Meliaceae
100	*Millingtonia hortensis* L.f.	Tree	Aakaasamalli	Bignoniaceae
101	*Mimosa polyancistra* Benth.	Herb	Udra kampa	Mimosaceae
102	*Mimosa rubicaulis* Lam.	Climber	Korintham	Mimosaceae
103	*Mimusops elengi* L.	Tree	Pogada	Sapotaceae
104	*Moringa oleifera* Lam.	Tree	Munaga	Moringaceae
105	*Mundulea sericea* (Willd.) A.Chev.	Tree	Yerri billu	Fabaceae
106	*Muntingia calabura* L.	Tree	Singapore cherry	Elaeocarpaceae
107	*Murraya koenigii* (L.) Spreng.	Shrub	Karivepaku	Rutaceae
108	*Myrtus communis* L.	Shrub	Panneru jaama	Myrtaceae
109	*Nerium oleander* L.	Shrub	Ganneru	Apocynaceae
110	*Olax scandens* Roxb.	Climber	Nalla dusara	Flindersiaceae
111	*Opuntia elatior* Mill.	Shrub	Jemudu	Cactaceae
112	*Opuntia dillenii* (Ker Gawl.) Haw.	Shrub	Bhrahma Jemudu	Cactaceae
113	*Peltophorum pterocarpum* (DC.) K.Heyne	Tree	Konda chinta	Caesalpiniaceae
114	*Pergularia daemia* (Forssk.) Chiov.	Climber	Dustapa teega	Asclepiadaceae
115	*Phoenix sylvestris* (L.) Roxb.	Tree	Eetha	Palmaceae
116	*Phyllanthus emblica* L.	Tree	Usiri / Amla	Euphorbiaceae
117	*Phyllanthus reticulatus* Poir.	Shrub	Purugudu	Euphorbiaceae
118	*Phyllodium pulchellum* (L.) Desv.	Herb	Deyyapu mokka	Fabaceae
119	*Pithecellobium dulce* (Roxb.) Benth.	Tree	Seema chinta	Mimosaceae
120	*Plumeria rubra* L.	Tree	Nuruvaralu	Apocynaceae
121	*Polyalthia cerasoides* (Roxb.) Bedd.	Tree	Gutti chettu	Annonaceae
122	*Polyalthia korinti* (Dunal) Thwaites	Tree	Nela Gutti	Annonaceae
123	*Polyalthia longifolia* Benth. & Hook. f.	Tree	Ashoka	Annonaceae
124	*Pongamia pinnata* (L.) Pierre	Tree	Kanuga	Fabaceae
125	*Prosopis cineraria* (L.) Druce	Tree	Jammi	Mimosaceae
126	*Prosopis juliflora* (Sw.) DC.	Tree	English thumma	Mimosaceae

127	*Sapindus emarginatus* Vahl	Tree	Kunkudu	Eapindaceae
128	*Sarcostemma secamone* (L.) Bennett	Climber	Chitipala	Asclepiadaceae
129	*Semecarpus anacardium* L.f.	Tree	Nalla jeedi	Ancardiaceae
130	*Senna montana* (Roth) V.Singh	Tree	Konda tangedu	Caesalpiniaeae
131	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Tree	Seema tangedu	Caesalpiniaeae
132	*Soymida febrifuga* (Roxb.) A. Juss.	Tree	Somi	Meliaceae
133	*Spathodea campanulata* P.Beauv.	Tree	Spathodia	Bignoniaceae
134	*Spondias pinnata* (L. f.) Kurz	Tree	Adavimaamidi	Ancardiaceae
135	*Stereospermum chelonoides* (L.f.) DC.	Tree	Tedla paala	Bignoniaceae
136	*Swietenia mahagoni* (L.) Jacq.	Tree	Mahogany	Meliaceae
137	*Syzygium cumini* (L.) Skeels	Tree	Neredu	Myrtaceae
138	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	Tree	Tella ganneru	Bignoniaceae
139	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	Shrub	Nandivardhanam	Apocynaceae
140	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Shrub	Balusu	Rubiaceae
141	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Shrub	Kommi	Rubiaceae
142	*Tecoma stans* (L.) Juss. ex Kunth	Tree	Swarna Ganneru	Bignoniaceae
143	*Tectona grandis* L.f.	Tree	Teku	Verbenaceae
144	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Tree	Tella maddi	Combretaceae
145	*Terminalia bellirica* (Gaertn.) Roxb.	Tree	Thandra	Combretaceae
149	*Terminalia tomentosa* Wight & Arn.	Tree	Nalla maddi	Combretaceae
150	*Thespesia populnea* (L.) Sol. ex Corrêa	Tree	Gangaravi	Malvaceae
151	*Tylophora indica* (Burm. f.) Merr.	Herb	Kukkapala	Asclepiadaceae
152	*Vitex altissima* L.f.	Tree	Nemali adugu	Vitaceae
153	*Vitex negundo* L.	Tree	Nalla vaavili	Vitaceae
154	*Vitex parviflora* A.Juss.	Tree	Nakka neredu	Vitaceae
155	*Vitex trifolia* L.	Climber		Vitaceae
156	*Wrightia arborea* (Dennst.) Mabb.	Tree	Tella pala	Apocynaceae
157	*Ximenia americana* L.	Shrub	Billa nakkeru	Olacaceae
158	*Ziziphus horrida* Roth	Shrub	Tella regu	Rhamnaceae
159	*Ziziphus jujuba* Mill.	Tree	Reguchettu	Rhamnaceae
160	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Tree	Nela regu / Jitregu	Rhamnaceae
161	*Ziziphus oenopolia* (L.) Mill	Climber	Pariki kampa	Rhamnaceae
162	*Ziziphus rugosa* Lam.	Climber	Pedda regu	Rhamnaceae
163	*Ziziphus xylopyrus* (Retz.) Willd.	Tree	Gotti	Rhamnaceae

3.8.7.2 Flora in the buffer zone

Buffer zone of the proposed project is mainly forest and agricultural land. The flora of buffer zone comprises of *Wrightia tinctoria*, *Hollarhena pubescens*, *Diospyros sylvatica*, *Pterospermum xylocarpum*, *Lannea coromandelica*, *Cassia fistula*, *Gmelina arborea* and *Garuga pinnata* trees are growing. Many tree species are planted in the area because of their usefulness, economic and aesthetic values. The tree species observed in the area are, *Mangifera indica*, *Albizia lebbeck*, *Bombax ceiba*, *Dalbergia sissoo*, *Sapindus emarginatus*, and *Tamarindus indica* etc. Flora of the buffer zone provided in the Table 3.21.

Table 3.21 Floristic composition from Core zone of the study area

S.No.	Botanical name	Local name	Family	Life form
1	*Abrus precatorius* L.	Gurivinda	Fabaceae	Climber
2	*Abutilon indicum* (L.) Sweet	Tutturabenda	Malvaceae	Shrub
3	*Acacia auriculiformis* Benth.		Mimosaceae	Tree
4	*Acacia caesia* (L.) Will.	Korintha	Mimosaceae	Climber
5	*Acacia leucophloea* (Roxb.) Wild.	Tella tumma	Mimosaceae	Tree
6	*Acacia nilotica* (L.) Delile	Nallathumma	Mimosaceae	Tree
7	*Acacia planifrons* Wight & Arn.	Godugu thumma	Mimosaceae	Tree
8	*Acaciachundra* (Rottler) Willd.	Sandra karra	Mimosaceae	Tree
9	*Acalypha ciliata* Wall.		Euphorbiaceae	Herb
10	*Acalypha indica* L.	Muripindi	Euphorbiaceae	Herb
11	*Achyranthes aspera* L.	Duchena	Amaranthaceae	Herb
12	*Aegle marmelos* (L.) Corrêa	Maredu	Rutaceae	Tree
13	*Aerva lanata* (L.) Juss.	Pindikura	Amaranthaceae	Herb
14	*Aglaia elaeagnoidea* (A.Juss.) Benth.	Konda anduga	Meliaceae	Tree
15	*Ailanthus excelsa* Roxb.	Pedda manu	Simaroubaceae	Tree
16	*Alangium salviifolium* (L.f.) Wangerin	Oodaga chettu	Alangiaceae	Tree
17	*Albizia amara* (Roxb.) B.Boivin	Chikreni	Mimosaceae	Tree
18	*Albizia lebbeck* L. (Benth.)	Dirisena	Mimosaceae	Tree
19	*Albizia odoratissima* (L.f.) Benth.	Chinduga	Mimosaceae	Tree
20	*Albizia procera* (Roxb.) Benth.	Tella chinduga	Mimosaceae	Tree
21	*Albizia saman* (Jacq.) Merr.	Nidrabhangi	Mimosaceae	Tree
22	*Allamanda cathartica* L.		Apocynaceae	Tree
23	*Allophyllus serratus* (Roxb.) Kurz	Guvva gutti	Sapindaceae	Shrub
24	*Aloe vera* (L.) Burm.f.	Katabanda	Liliaceae	Herb
25	*Alstonia scholaris* (L.) R. Br.	Yedakulapala	Apocynaceae	Herb
26	*Alternanthera tenella* Colla	Mullu ponnaganti	Amaranthaceae	Herb
27	*Alysicarpus monilifer* (L.) DC.	Amera	Fabaceae	Herb
28	*Amaranthus viridis* L.	Thotakura	Amaranthaceae	Herb
29	*Ammannia baccifera* L.	Agnivendramu	Lythraceae	Herb
30	*Anacardium occidentale* L.	Jeedi	Anacardiacae	Tree

31	*Andrographis echioides* (L.) Nees		Acanthaceae	Herb
32	*Anisomeles indica* (L.) Kuntze	Chinna ranaberi	Lamiaceae	Shrub
33	*Annona reticulata* L.	Ramaphalamu	Annonaceae	Shrub
34	*Annona squamosa* L.	Sitaphalamu	Annonaceae	Tree
35	*Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Patchimaanu	Combretaceae	Tree
36	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Chirimaanu	Combretaceae	Tree
37	*Apluda mutica* L.	Adavikorregaddi	Poaceae	Grass
38	*Aristida adscensionis* L.	Katle gaddi	Poaceae	Grass
39	*Aristida setacea* Trin. & Rupr.	Cheepurugaddi	Poaceae	Grass
40	*Artabotrys hexapetalus* (L.f.) Bhandari	Tiga sampangi	Annonaceae	Shrub
41	*Artocarpus heterophyllus* Lam.	Panasa	Moraceae	Tree
42	*Asparagus racemosus* (Kunth) Jessop	Satavari	Liliaceae	Shrub
43	*Asystasia gangetica* (L.) T.Anderson		Acanthaceae	Herb
44	*Azadirachta indica* A.Juss.	Vepa	Meliaceae	Tree
45	*Azima tetracantha* Lam.	Tella uppili	Salvadoraceae	Shrub
46	*Barringtonia acutangula* (L.) Gaertn.	Kanapa chettu	Barringtoniaceae	Tree
47	*Bauhinia purpurea* L.	Peddari	Caesalpiniaceae	Tree
48	*Bauhinia racemosa* Lam.	Aarechettu	Caesalpiniaceae	Tree
49	*Bauhinia variegata* L.	Madaka chettu	Caesalpiniaceae	Tree
50	*Benkara malabarica* (Lam.) Tirveng.	Pedda manga	Rubiaceae	Tree
51	*Boerhavia diffusa* L.	Atikamamidi	Nyctaginaceae	Herb
52	*Boerhavia erecta* L.	Kanne komali	Nyctaginaceae	Herb
53	*Bombax ceiba* L.	Buruga	Malvaceae	Tree
54	*Borassus flabellifer* L.	Thati	Arecaceae	Tree
55	*Boswellia serrata* Roxb. ex Colebr	Konda sambrani	Burseraceae	Tree
56	*Bougainvillea spectabilis* Willd.	Kagithamupulu	Nyctaginaceae	Shrub
57	*Brachiaria mutica* (Forssk.) Stapf	Paragaddi	Poaceae	Grass
58	*Brachiaria reptans* (L.) C.A.Gardner & C.E.Hubb		Poaceae	Grass
59	*Buchanania axillaris* (Desr.) Ramamoorthy	Sarapappu	Ancardiaceae	Tree
60	*Buchanania cochinchinensis* (Lour.) M.R.Almeida	China saara	Ancardiaceae	Tree
61	*Bucida ramosa*(M.Gómez) Alwan & Stace	Adurugaddi	Combretaceae	Tree
62	*Butea monosperma* (Lam.) Taub.	Moduga	Fabaceae	Tree
63	*Caesalpinia crista* L.	Gachakaya	Caesalpiniaceae	Shrub
64	*Calophyllum inophyllum* L.	Ponna	Clusiaceae	Tree
65	*Calotropis procera* (Aiton) Dryand.	Jilledu	Asclepiadaceae	Climber
66	*Calotropis gigantea* (L.) Dryand.	Telle jilledu	Asclepiadaceae	Shrub
67	*Canavalia virosa* (Roxb.) Wight & Arn.	Tammakaya	Fabaceae	Climber

68	*Canthium parvifolium* Roxb.	Balusu	Rubiaceae	Shrub
69	*Capparis zeylanica* L.	Aridonda	Capparaceae	Climber
70	*Capparis brevispina* DC.	Adavi uppi	Capparidaceae	Shrub
71	*Carissa spinarum* L.	Kalivi / Vaaka	Apocynaceae	Shrub
72	*Cassia auriculata* L.	Tangedu	Caesalpiniaceae	Shrub
73	*Cassia fistula*L.	Rela	Caesalpiniaceae	Tree
74	*Casuarina equisetifolia* L.	Sarugudu	Casurinaceae	Tree
75	*Catunaregam spinosa* (Thunb.) Tirveng.	Nalla balusu	Rubiaceae	Shrub
76	*Celastrus paniculatus* Willd.	Maneru	Celastraceae	Climber
77	*Celosia argentea* L.	Gurumu	Amaranthaceae	Herb
78	*Chloris barbata* Sw.	Uppugaddi	Poaceae	Grass
79	*Chloroxylon swietenia* DC.	Billudu	Flindersiaceae	Tree
80	*Chukrasia tabularis* A.Juss.	Konda vepa	Meliaceae	Tree
81	*Cipadessa baccifera* (Roth) Miq.	Chedu beera	Meliaceae	Shrub
82	*Cissus quandrangularis* L.	Nalleru	Vitaceae	Climber
83	*Cissus vitiginea* L.	Adavidraksha	Vitaceae	Shrub
84	*Citrullus colocynthis* (L.) Schrad.	Eriipucha	Cucurbitaceae	Climber
85	*Citrus limon* (L.) Osbeck	Nimma	Rutaceae	Tree
86	*Citrus aurantium* L.	Gajanimma	Rutaceae	Shrub
87	*Citrus limon* (L.) Osbeck	Nimma	Rutaceae	Shrub
88	*Cleome viscosa* L.	Kukkavaminta	Cleomaceae	Herb
89	*Clerodendrum inerme* (L.) Gaertn.	Nillavuppi	Verbenaceae	Shrub
90	*Clitoria ternatea* L.	Shankupuspi	Fabaceae	Climber
91	*Coccinia grandis* (L.) Voigt	Kakidonda	Cucurbitaceae	Climber
92	*Cocculus hirsutus* (L.) W.Theob.	Dusaratiga	Menispermaceae	Climber
93	*Cochlospermum religiosum* (L.) Alston	Kondagogu	Cochlospermaceae	Tree
94	*Cocos nucifera* L	Kobbari	Arecaceae	Tree
95	*Coldenia procumben*s L.	Hamsapadu	Boraginaceae	Herb
96	*Combretum indicum* (L.) DeFilipps	Teega ganneru	Combretaceae	Climber
97	*Commelina benghalensis* L.	Yennadri	Commelinaceae	Sedge
98	*Commiphora caudata* (Wight & Arn.) Engler	Kondaregu	Burseraceae	Tree
99	*Corchorus trilocularis* L.	Bankitutturu	Tiliaceae	Herb
100	*Cordia dichotoma* G.Forst.	Iriki / bankiriki	Cordiaceae	Tree
101	*Crotalaria angulata* Mill.		Fabaceae	Herb
102	*Crotalaria hebecarpa* (DC.) Rudd		Fabaceae	Herb
103	*Crotalaria medicaginea* var. *neglecta* (Wight & Arn.) Baker		Fabaceae	Herb
104	*Crotalaria verrucosa* L.	Giligicha	Fabaceae	Herb
105	*Croton bonplandianus* Baill.	Galivana mokka	Euphorbiaceae	Herb
106	*Cuscuta reflexa* Roxb.	Passiteega	Convolvulaceae	Climber
107	*Cymbopogon citratus* (DC.) Stapf	Nimmagaddi	Poaceae	Grass

108	*Cynodon dactylon* (L.) Pers.	Gariki	Poaceae	Grass
109	*Cyperus arenarius* Retz.		Cyperaceae	Sedge
110	*Cyperus rotundu*s L.	Thunga	Cyperaceae	Sedge
111	*Dactyloctenium aegyptium* (L.) Willd.	Crow foot grass	Poaceae	Grass
112	*Dalbergia paniculata* Roxb.	Pachari	Fabaceae	Tree
113	*Dalbergia lanceolaria* L.f.	Nagalla pachari	Fabaceae	Tree
114	*Decalepis hamiltonii* Wight & Arn.	Maredu kommulu	Periplocaceae	Climber
115	*Delonix regia* (Hook.) Raf.	Turayi	Caesalpiniaceae	Tree
116	*Dentella repens* (L.) J.R.Forst. & G.Forst.		Rubiaceae	Herb
117	*Derris scandens* (Roxb.) Benth.	Nalla teege	Fabaceae	Climber
118	*Desmodium triflorum* (L.) DC	Muntamandu	Fabaceae	Herb
119	*Dichanthium annulatum* (Forssk.) Stapf	Sheda grass	Poaceae	Herb
120	*Dichrostachys cinerea* (L.) Wight & Arn.	Veluthuru	Mimosaceae	Tree
121	*Digera muricata* (L.) Mart.	Chenchalakura	Amaranthaceae	Herb
122	*Digitaria ciliaris* (Lam.) Roem. & Schult.		Poaceae	Grass
123	*Dillenia indica* L.	Pedda kalinga	Dilleniaceae	Tree
124	*Diospyros chloroxylon* Roxb.	Erragatha	Ebenaceae	Tree
125	*Diospyros sylvatica* Roxb.	Gaatha	Ebenaceae	Tree
126	*Diospyros malabarica* (Desr.) Kostel.	Tumiki	Ebenaceae	Tree
127	*Diospyros montana* Roxb.	Jagadagondi	Ebenaceae	Tree
128	*Diospyros ovalifolia* Wight	Kukka tumiki		Tree
129	*Dodonaea viscosa* (L.) Jacq.	Bandedu	Sapindaceae	Shrub
130	*Dolichandrone falcata* (Wall. ex DC.) Seem.	Niruddi	Bignoniaceae	Tree
131	*Echinochloa crus-galli* (L.) P.Beauv.	Pedda windu	Poaceae	Herb
132	*Eclipta prostrata* (L.) L.	Guntagalagara	Asteraceae	Herb
133	*Ehretia laevis*(Rottler ex G.Don) Roxb.	Tellapisini	Boraginaceae	Shrub
134	*Eragrostis amabilis* (L.) Wight & Arn.	Udaragaddi	Poaceae	Grass
135	*Eragrostis minor* Host	Goobbai gaddi	Poaceae	Grass
136	*Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.	Chinna garaiki gaddi	Poaceae	Grass
137	*Erythrina variegata* L.	Badisa	Fabaceae	Tree
138	*Eucalyptus globulus* Labill.	Neelagiri	Euphorbiaceae	Tree
139	*Eugenia bracteata* (Willd.) Roxb. Ex DC.	Kundinedu	Myrtaceae	Shrub
140	*Euphorbia heterophylla* L.	Wild Poinsettia	Euphorbiaceae	Herb
141	*Euphorbia hirta* L.	Reddivari nanubalu	Euphorbiaceae	Herb
142	*Euphorbia hypericifolia* L.		Euphorbiaceae	Herb
143	*Evolvulus alsinoides* (L.) L.	Vishnukrantha	Convolvulaceae	Herb
144	*Evolvulus nummularius* (L.) L.		Convolvulaceae	Herb

145	*Falconeria insignis* Royle	Devaswaroopi	Euphorbiaceae	Shrub
146	*Ficus benghalensis* L.	Marri chettu	Moraceae	Tree
147	*Ficus benjamina* L.Mant.	Konda golugu	Moraceae	Tree
148	*Ficus hispida* L.f.	Bodda chettu	Moraceae	Tree
149	*Ficus religiosa* L.	Ravi chettuy	Moraceae	Tree
150	*Ficuscarica* L.	Atti	Moraceae	Tree
151	*Ficuspopulifolia* Vahl	Raavi	Moraceae	Tree
152	*Ficusracemosa* L.	Medi	Moraceae	Tree
153	*Fimbristylis ferruginea* (L.) Vahl		Cyperaceae	Sedge
154	*Firmiana simplex* (L.) W.Wight	Erra poliki	Sterculeaceae	Tree
155	*Flacourtia indica*(Burm.f.) Merr.	Kanru	Flacourtiaceae	Tree
156	*Gardenia gummifera* L.f.	Bikki	Rubiaceae	Tree
157	*Gardenia latifolia* Aiton	Pedda bikki	Rubiaceae	Tree
158	*Getonia floribunda* Roxb.	Putangi teega	Combretaceae	Climber
159	*Givotia moluccana* (L.) Sreem.	Tella poliki	Euphorbiaceae	Tree
160	*Gloriosa superba* L.	Adavi nabhi	Liliaceae	Herb
161	*Glycosmis mauritiana* (Lam.) Tanaka	Golugu	Rutaceae	Shrub
162	*Gmelina arborea* Roxb. ex Sm.	Gummidi teku	Verbenaceae	Tree
163	*Gmelina asiatica* L.	Chiru gummudu	Verbenaceae	Shrub
164	*Grewia rhamnifolia* Heyne ex Roth	Bampudu	Tiliaceae	Shrub
165	*Gymnosporia emarginata* (Willd.) Thwaites	Danthi	Celastraceae	Shrub
166	*Haldina cordifolia* (Roxb.) Ridsdale	Bandaru / Rudraganapa	Rubiaceae	Tree
167	*Hedyotis corymbosa*L.		Rubiaceae	Herb
168	*Hedyotis umbellata* L.		Rubiaceae	Herb
169	*Heliotropium indicum* L.	Nagadanti	Boraginaceae	Herb
170	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Sugandipala	Periplocaceae	Climber
171	*Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.	Kaseri gaddi	Poaceae	Grass
172	*Holarrhena pubescens*Wall. ex G.Don	Tedlapala	Apocynaceae	Shrub
173	*Holoptelea integrifolia*(Roxb.) Planch.	Nemaliadugu	Ulmaceae	Tree
174	*Hugonia mystax* L.	Pisangi	Linaceae	Climber
175	*Hygrophila auriculata*(Schumach.) Heine	Neetigobbi	Acanthaceae	Herb
176	*Hyptis suaveolens* (L.) Poit.	Sirnatulasi	Lamiaceae	Shrub
177	*Ichnocarpus fruitiscens* (L.) R.Br.	Nalla teega	Apocynaceae	Climber
178	*Imperata cylindrica* (L.) Raeusch.	Darbhagaddi	Poaceae	Grass
179	*Indigofera linifolia* (L.f.) Retz.		Fabaceae	Herb
180	*Indigofera linnaei* Ali	Cheragadam	Fabaceae	Herb
181	*Ipomoea aquatica* Forssk.	Thootikura	Convolvulaceae	Climber
182	*Ipomoea marginata* (Desr.) Verdc.	Mettathuti	Convolvulaceae	Climber
183	*Iseilema laxum* Hack.	Errachengali	Poaceae	Grass

		gaddi		
184	*Ixora pavetta* Andr	Ixora	Rubiaceae	Shrub
185	*Jatropha curcas* L.	Nepalam	Euphorbiaceae	Tree
186	*Justicia adhatoda* L.	Addasaramu	Acanthaceae	Shrub
187	*Justicia prostrata* Gamble		Acanthaceae	Herb
188	*Lagerstroemia parviflora* Roxb.	Chennangi	Lythraceae	Tree
189	*Lannea coromandelica* (Houtt.) merr.	Gempena	Anacardiacae	Shrub
190	*Lantana camara* L.	Lantana	Verbenaceae	Shrub
191	*Lepidagathis cristata* Willd.	Suryakantha	Acanthaceae	Herb
192	*Ludwigia perennis* L.	Lavangakaya	Onagraceae	Herb
193	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Ippa	Sapotaceae	Tree
194	*Mangifera indica* L.	Mamidi	Anacardiaceae	Tree
195	*Manilkara zapota* (L.) P.Royen	Sapota	Sapotaceae	Tree
196	*Maytenus emargin*ata (Willd.) Ding Hou	Danthi	Rubiaceae	Shrub
197	*Merremia emarginata* (Burm. f.) Hallier f.	Elikajemudu	Convolvulaceae	Climber
198	*Merremia tridentata* (L.) Hallier f.		Convolvulaceae	Climber
199	*Millingtonia hortensis* L.f.	Aakaasamalli	Bignoniaceae	Tree
200	*Mimosa pudica* L.	Attipatti	Mimosaceae	Herb
201	*Mimosa polyancistra* Benth.	Udra kampa	Mimosaceae	Herb
202	*Mimosa rubicaulis* Lam.	Korintham	Mimosaceae	Climber
203	*Mimusops elengi* L.	Pogada	Sapotaceae	Tree
204	*Mollugo nudicaulis* Lam.	Peddaparipata	Molluginaceae	Herb
205	*Mollugo oppositifolia* L.	Chayuntarashi	Molluginaceae	Herb
206	*Moringa oleifera* Lam.	Munaga	Moringaceae	Tree
207	*Mukia maderaspatana* (L.) M.Roem.	Pottibudamu	Cucurbitaceae	Climber
208	*Neolamarckia cadamba* (Roxb.) Bosser	Kadambam	Rubiaceae	Tree
209	*Nerium oleander* L.	Ganneru	Apocynaceae	Shrub
210	*Nyctanthes arbor-tristis* L.	Parijathamu	Oleaceae	Shrub
211	*Ochna obtusata* DC.	Tammi	Ochnaceae	Shrub
212	*Ocimum basilicum* L.	Vibhudi	Lamiaceae	Herb
213	*Ocimum gratissimum* L.	Nimmatulasi	Lamiaceae	Shrub
214	*Ocimum tenuiflorum* L.	Tulasi	Lamiaceae	Shrub
215	*Olax scandens* Roxb.	Nalla dusara	Flindersiaceae	Climber
216	*Opuntia dillenii* (Ker Gawl.) Haw.	Nagajemudu	Cactaceae	Shrub
217	*Oxystelma esculentum* (L. f.) Sm.	Palakikura	Asclepiadaceae	Climber
218	*Panicum psilopodium* Trin.		Poaceae	Grass
219	*Paspalidium flavidum* (Retz.) A.Camus	Udagaddi	Poaceae	Grass
220	*Passiflora edulis* Sims		Passifloraceae	Climber
221	*Peltophorum pterocarpum* (DC.) K.Heyne	Konda chinta	Caesalpiniaceae	Tree
222	*Pentatropis capensis* (L. f.) Bullock		Asclepiadaceae	Climber

223	*Pergularia daemia* (Forssk.) Chiov.	Dustaputeega	Asclepiadaceae	Climber
224	*Phoenix sylvestris* (L.) Roxb.	Eetha	Palmaceae	Tree
225	*Phyla nodiflora* (L.) Greene	Mosalipappu	Verbenaceae	Shrub
226	*Phyllanthus amarus* Schumach. & Thonn.	Naleusiri	Euphorbiaceae	Herb
227	*Phyllanthus emblica* L.	Usiri	Euphorbiaceae	Tree
228	*Phyllanthus maderaspatensis* L.	Nalla uisirika	Euphorbiaceae	Herb
229	*Phyllanthusreticulatus* Poir.	Purugudu	Euphorbiaceae	Shrub
230	*Pithecellobium dulce* (Roxb.) Benth.	Seema chinta	Mimosaceae	Tree
231	*Plecospermum spinosum* Trecul		Moraceae	Climber
232	*Plumeria rubra* L.	Nuruvaralu	Apocynaceae	Tree
233	*Polyalthia cerasoides* (Roxb.) Bedd. & Hook.f. Bedd.	Chilaka dudduga	Annonaceae	Tree
234	*Polyalthia longifolia* (Sonn.) Thwaites	Naramamidi	Annonaceae	Tree
235	*Polygala arvensis* Willd.		Polygalaceae	Herb
236	*Pongamia pinnata* (L.) Pierre	Kanuga	Fabaceae	Tree
237	*Prosopis juliflora* (Sw.) DC.	Sarkaru tumma	Mimosaceae	Tree
238	*Prosopis cineraria* (L.) Druce	Jammi	Mimosaceae	Tree
239	*Pterolobium hexapetalum* (Roth) Sant. & Wagh		Mimosaceae	Climber
240	*Pupalia lappacea* (L.) Juss.	Antreetha	Amaranthaceae	Herb
241	*Pycreus pumilus* (L.) Nees		Cyperaceae	Sedge
242	*Rhynchosia minima* (L.) DC.	Nela alumu	Fabaceae	Climber
243	*Rivea hypocrateriformis* Choisy	Boddi teega	Convolvulaceae	Climber
244	*Sapindus emarginatus* Vahl	Kunkudu	Eapindaceae	Tree
245	*Sarcostemma secamone* (L.) Bennett	Chitipala	Asclepiadaceae	Climber
246	*Scoparia dulcis* L.		Scrophulariaceae	Herb
247	*Scutia myrtina* (Burm.f.) Kurz	Nallakorintha	Rhamnaceae	Climber
248	*Sebastiania chamaelea* (L.) Müll.Arg.		Euphorbiaceae	Herb
249	*Securinega leucopyrus* (Willd.) Muell.-Arg.	Challamunta	Euphorbiaceae	Shrub
250	*Semecarpus anacardium* L.f.	Nalla jeedi	Ancardiaceae	Tree
251	*Senna montana* (Roth) V.Singh	Konda tangedu	Caesalpiniaeae	Tree
252	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Seema tangedu	Caesalpiniaeae	Tree
253	*Sida acuta* Burm.f.	Chittemu	Malvaceae	Herb
254	*Sida cordata* (Burm.f.) Borss.Waalk.	Chirubenda	Malvaceae	Herb
255	*Solanum surattense* Burm. f.	Nelavakudu	Solanaceae	Herb
256	*Soymida febrifuga* (Roxb.) A. Juss.	Somi	Meliaceae	Tree
257	*Spathodea campanulata* P.Beauv.	Spathodia	Bignoniaceae	Tree
258	*Spermacoce hispida* L.	Madanaku	Rubiaceae	Herb
259	*Stachytarpheta jamaicensis* (L.) Vahl		Verbenaceae	Herb
260	*Stereospermum chelonoides* (L.f.) DC.	Tedla paala	Bignoniaceae	Tree

261	*Streblus aspera* Lour.	Baranika	Moraceae	Tree
262	*Striga angustifolia* (D. Don) C.J. Saldanha		Scrophulariaceae	Herb
263	*Syzygium cumini* (L.) Skeels	Neredu	Myrtaceae	Tree
264	*Tamarindus indica* L.	Chinta	Caesalpiniaceae	Tree
265	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Balusu	Rubiaceae	Shrub
266	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Kommi	Rubiaceae	Shrub
267	*Tecoma stans* (L.) Juss. ex Kunth	Swarnaganneru	Bignoniaceae	Shrub
268	*Tectona grandis* L.f.	Teku	Verbenaceae	Tree
269	*Tephrosia procumbens* (Ham.) Benth.	Vempali	Fabaceae	Herb
270	*Tephrosia purpurea* (L.) Pers.	Vempali	Fabaceae	Herb
271	*Terminalia arjuna*(Roxb.) Wight & Arn	Tella maddi	Combretaceae	Tree
272	*Terminalia bellirica* (Gaertn.) Roxb.	Tadi chettu	Combretaceae	Tree
273	*Terminalia chebula* Retz.	Nalla Karakkaya	Combretaceae	Tree
274	*Terminalia pallida* Brandis	Tella Karakkaya	Combretaceae	Tree
275	*Terminalia tomentosa* Wight & Arn.	Nalla maddi	Combretaceae	Tree
276	*Tinospora sinensis* (Lour.) Merr.	Tippateega	Menispermaceae	Climber
277	*Toddalia asiatica* (L.) lam.	Konda mirapa	Rutaceae	Climber
278	*Tridax procumbens* (L.) L.	Gaddichamanti	Asteraceae	Herb
279	*Triumfetta rotundifolia* Lam.	Banki thuturu	Tiliaceae	Herb
280	*Tylophora indica* (Burm. f.) Merr.	Kukkapala	Asclepiadaceae	Herb
281	*Vernonia albicans* DC.		Asteraceae	Herb
282	*Vernonia cinerea* (L.) Less.	Sahadevi	Asteraceae	Herb
283	*Vitex altissima* L.f.	Nemali adugu	Vitaceae	Tree
284	*Vitex negundo* L.	Nalla vaavili	Vitaceae	Tree
285	*Wattakaka volubilis* (L. f.) Stapf	Paalateega	Asclepiadaceae	Climber
286	*Wrightia tinctoria* (Roxb.) R.Br.	Ankudu	Apocynaceae	Tree
287	*Wrightia arborea* (Dennst.) Mabb.	Tella pala	Apocynaceae	Tree
288	*Ximenia americana* L.	Billa nakkeru	Olacaceae	Shrub
289	*Ziziphus oenoplia*(L.) Miller	Parimi	Rhamnaceae	Climber
290	*Ziziphushorrida* Roth	Tella regu	Rhamnaceae	Shrub
291	*Ziziphusjujuba* Mill.	Reguchettu	Rhamnaceae	Tree
292	*Ziziphusrugosa* Lam.	Pedda regu	Rhamnaceae	Climber
293	*Ziziphusxylopyrus* (Retz.) Willd.	Gotti	Rhamnaceae	Tree

3.8.8Fauna observations in the study area

As the study area is not isolated from its surroundings by any barrier, there are no chances for any kind of isolation or restriction of any wild animal to the study area. As they are capable of moving from place to place either for food or for shelter or mate. Hence, common lists are

prepared based on available secondary data and based on direct observation, indirect or circumstantial evidence such as footprints, feathers, skin, hair, hooves etc. As there are no dense forests or wildlife reserves or other protected areas around proposed project and as the area is surrounded by croplands and villages. Among the mammals, monkeys, squirrels and rats were found. There were no attacks on sheep or goat though sheep and goat rearing is very common. Many terrestrial birds such as Indian Ring dove, Minnows, Finches, Crows, Sparrows, Parrots, Mynas, Swifts, Doves, Pigeons, Egrets and Weaverbirds etc were common. A list of fauna either spotted or reported from the study area is given in Table 3.22. None of the species listed in Schedule I of the Indian Wildlife (protection) Act was found in the study area.

Table 3.22 List of fauna found in the study area

S.No.	Scientific name	Common name	Vernacular name	IUCN category/ IWPA 1972 Schedule
Mammals				
1	*Axis axis*	Spotted deer	Jinka	LC/IV
2	*Petaurista philippensis*	Brown flying squirrel	Chettu udutha	LC/IV
3	*Herpestes edwardsii*	Common Mongoose	Mungisa	LC/II
4	*Vulpes bengalensis*	Bengal fox	Guntanakka	LC/II
5	*Bandicota indica*	Bandicoot Rat	Pandikokku	LC/IV
6	*Bandicota benghalensis*	Lesser Bandicoot	Pandikokku	LC/IV
7	*Funambulus palmarum*	Three striped squirrel	Udutha	LC/IV
8	*Mus muscuius*	House rat	Yeluka	LC/IV
9	*Mus booduga*	Indian field rat	Yeluka	LC/IV
10	*Pteropus giganteus*	Indian flying fox	Gabbilamu	LC/IV
11	*Lepus nigricollis*	Indian hare	Kundelu	LC/IV
12	*Canis aureus*	Jackal	Nakka	LC/II
13	*Hystix indica*	Poprcupine	Mullapandi	LC/III
14	*Funambulus pennant*	Northern palm squirrel	Udutha	LC/IV
15	*Sus scrofa*	Wild boar	Adavipandi	LC/III
Reptiles				
15	*Calotes versicolor*	Garden Lizard	Tonda	LC/IV
16	*Chameleon zeylanicum*	Chameleon	Usaravalli	LC/II
17	*Bangarus caeruleus*	Common Krait	Katlapamu	LC/II
18	*Echis carinatus*	Saw scale wiper	Ralthapinajri	LC/II
19	*Ptyas mucosa*	Ratsnake	Jerripothu	LC/II
20	*Ahaetulla nasuta*	Tree snake	Chettu paamu	LC/II
21	*Dryphis nasutus*	Whip snake	Pasirikapaamu	LC/II
22	*Typhlops porrectus*	Blind snake	Guddipamu	LC/II
23	*Naja naja*	Cobra	Nagupaamu	LC/II

24	*Eutropis carinata*	Grass skink	Nalli keechu	LC/IV
25	*Hemidactylus frenatus*	Wall Lizard	Balli	LC/IV
26	*Calotes versicolor*	Garden lizard	Thonda	LC/IV
Aves				
27	*Acridotheres tristis*	Common myna	Goruvanka	LC/IV
28	*Alcedo atthis*	Common Kingfisher	Lakhumukhi Pitta	LC/IV
29	*Apus affinis*	House swift	Babila	LC/IV
30	*Anthus novaeseelandiae*	Paddy field Pipit	Varimadi Pipit	LC/IV
31	*Ardeola grayi*	Indian pond heron	Guddikonga	LC/IV
32	*Ardea alba*	Great Egret	Tella Konga	LC/IV
33	*Athene brama*	Spotted Owlet	Gudlaguba	LC/IV
34	*Bubulcus ibis*	Cattle Egret	Konga	LC/IV
35	*Burhinus oedicnemus*	Stone curlew	Raati curlew	LC/IV
36	*Butastur teesa*	White eyed buzzard	Tella kannu buzzard	LC/IV
37	*Butorides striatus*	Little green heron	Chaarla konga	LC/IV
38	*Cacomantis merulinus*	Plaintive Cuckoo	Charla Kokila	LC/IV
39	*Calidris minuta*	Little Stint	Chinna stint	LC/IV
40	*Caprimulgus asiaticus*	Indian Night Jar	Maamulu night jar	LC/IV
41	*Centropus sinensis*	Crow pheasant	Jamudu kaki	LC/IV
42	*Charities dubious*	Little ringed plover	China valaya plover	LC/IV
43	*Corvus macrorhynchos*	Jungle Crow	Adavi kaki	LC/IV
44	*Corvus splendens*	Crow	Kaki	LC/IV
45	*Dicrurus adsimilis*	Black drongo	Nalla drongo	LC/IV
46	*Dicrurus caerulescens*	White bellied Drongo	Tella Potta drongo	LC/IV
47	*Dicrurus remifer*	Lesser Rocket tail drongo	Podavu thoka nalla pitta	LC/IV
48	*Dinopium benghalense*	Golden backed wood Pecker	Bangaru vadrangi pitta	LC/IV
49	*Egretta garzetta*	Little Egret	Chinna Tella Konga	LC/IV
50	*Egretta intermedia*	Median egret	Konga	LC/IV
51	*Galerida cristata*	Indian crested lark	Juttu lark	LC/IV
52	*Halcyon smyrnensis*	White breasted Kingfisher	Tella yeda lakhumukhi pitta	LC/IV
53	*Haliaistur indus*	Brahminy Kite	Brahmana gradda	LC/IV
54	*Hemiprocne longipennis*	Crested tree swift	Juttu swift	LC/IV
55	*Himantopus himantopus*	Black winged stilt	Nalla rellala stilt	LC/IV
56	*Hirundo daurica*	Striated swallow	Chaarla pitta	LC/IV
57	*Hirundo rustica*	Common swallow	Swallow	LC/IV
58	*Lanius excubitor*	Grey Shrike	Uudu shrike	LC/IV
59	*Milvus migrans*	Black kite	Peethiri gadda	LC/IV
60	*Motacilla alba*	Pied wagtail	Toka oopu tella chaara pitta	LC/IV
61	*Motacilla flava*	Yellow wagtail	Toka oopu pasupu pitta	LC/IV

62	*Nectarinia lotenia*	Loten's sunbird	Sunbird	LC/IV
63	*Nectarinia asiatica*	Purple sunbird	Yerra sunbird	LC/IV
64	*Nectarinia zeylanica*	Plum rumped sunbird	Yerra veepu sunbird	LC/IV
65	*Netta rufina*	Red crested Pochard	Erra Juttu Baatu	LC/IV
66	*Nettapus coromandelianus*	Cotton teal	Tella paraja	LC/IV
67	*Nycticorax nycticorax*	Night Heron	Sabari konga	LC/IV
68	*Oriolus oriolus*	Golden oriole	Bangaru pitta	LC/IV
69	*Orthotomus sutorius*	Tailor bird	Tailor pakshi	LC/IV
70	*Parus major*	Grey tit	Ooda tit	LC/IV
71	*Passer domesticus*	House sparrow	Pitchuka	LC/IV
72	*Pelargopis capensis*	Spot billed Kingfisher	Chukka mukku lakhumukhi pitta	LC/IV
73	*Phalacrocorax carbo*	Large Cormorant	Pedda neeti kaaki	LC/IV
74	*Phalacrocorax niger*	Little Cormorant	Neeti Kaaki	LC/IV
75	*Pioceus manyar*	Streaked weaver bird	Pedamasale pitta	LC/IV
76	*Pitta porphyria*	Indian Pitta	Pitchuka	LC/IV
77	*Ploceus philippinus*	Baya	Cpmmon weaver	LC/IV
78	*Podiceps ruficollis*	Dab chick	Bugda baathu	LC/IV
79	*Porphyrio porphyria*	Purple moorhen	Erra neeti kodi	LC/IV
80	*Rostratula benghalensis*	Painted snipe	Local migrant	LC/IV
81	*Saxicoloides fulicata*	Indian Robin	Nalla Pitta	LC/IV
82	*Streptopelia chinensis*	Spooted Dove	Chukkala guvva	LC/IV
83	*Streptopelia decaocto*	Collard dove	Valaya guvva	LC/IV
84	*Sturnus contra*	Pied Myna	Gorinka	LC/IV
85	*Tadorna ferruginea*	Brahminy duck	Brahmana baatu	LC/IV
86	*Tephrodornis pondicerianus*	Common wood shrike	Wood shrike	LC/IV
87	*Tringa glareola*	Wood sand piper	Kalap Isuka plover	LC/IV
88	*Tringa nebularia*	Green Shank	Patcha Shank	LC/IV
89	*Tringa ochropus*	Green sandpiper	Patcha Sand piper	LC/IV
90	*Tringa tetanus*	Red Shank	Erra Shank	LC/IV
91	*Vanellus malabaricus*	Yellow wattled lapwing	Pasupu teerturu	LC/IV
92	*Zosterops palpebrosus*	Oriental white eye	Tella kannu pitchuka	LC/IV
Amphibians				
93	*Rana hexadactyla*	Ordinary frog	Kappa	LC/IV
94	*Bufo melanosticatus*	South Indian Toad	Boduru Kappa	LC/IV
95	*Polypedates maculatus*	Tree frog	Chettu kappa	LC/IV
96	*Hyla arborea*	Tree frog	Chettu kappa	LC/IV
97	*Rana tigrina*	Tiger frog	Kappa	LC/IV
Butterflies				
98	*Junonia orytha*	Blue Pansy		LC/IV
99	*Tirumala limniace*	Blue Tiger		LC/IV

100	*Junonia iphita*	Chocolate Pansy		NA/IV
101	*Euploea core*	Common Indian Crow		NA/IV
102	*Delias eucharis*	Common Jezebel		NA/IV
103	*Phalanta phalanta*	Common Leopard		LC/IV
104	*Papilio polytes*	Common Mormon		NA/IV
105	*Neptis hylas*	Common sailor		NA/IV
106	*Parantica algae*	Glassy Tiger		NA/IV
107	*Euchrysops cnejus*	Gram Blue		NA/IV
108	*Hypolimnas bolina*	Great Egg Fly		NA/IV
109	*Junonia atlites*	Grey Pansy		NA/IV
110	*Spialia galba*	Indian Skipper		NA/IV
111	*Junonia lemonias*	Lemon Pansy		NA/IV

3.9 Socio Economic Environment

3.9.1 Introduction

The socioeconomic study includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative aspects. The socio-economic baseline on demographic patterns, economic and livelihood profile and infrastructure facilities, community perception and mitigation measures in the study area. Based on the data is compiled in this section, the impact assessment will predict and evaluate any potential impacts of the proposed project on the local community, livelihoods and other social systems.

3.9.2 Methodology

3.9.2.1 Aim and Objective

The study area presented in the socio-economic baseline comprises of the following:

- To provide an accurate representation of the social, economic and cultural conditions in preposed project locatedAvulapalli Reservoir, Somala(M), Chittoor Dt., Andhra Pradesh
- To identify the potential socio-economic positive and negative impacts of the proposed project;
- To develop attainable mitigation measures to enhance positive impacts and reduce or avoid negative impacts; and
- To develop management and monitoring measures to be implemented throughout the life of the project.

3.9.2.2 Procedure and data collection

The socio-economic baseline has been prepared in two folds of secondary and primary methods.

- The secondary data source adopted for the study mainly includes review of published secondary data (District Census Statistical Handbooks- 2011 and Primary Census Abstract of Census-2011), and other govt related govt office and web sources of available secondary sources of information as well as select primary consultations in the vicinity of the project area with respect to population, density, household size, sex ratio, social stratification, literacy rate and occupational structure for 10 km radius study area.
- The primary data has been collected from 251 participants from different communities through Individual Survey Questionnaire (ISQ) and Focused Group Discussions (FGD). Collected data were analyzed by using SPSS to identify the significant mean difference and measures the impact of proposed project in various aspects. It also studies the awareness on the proposed project and community perceptions about the proposed project and other related information.

3.9.3 Brief profile of the district

3.9.3.1 Administrative setup

Chittoor district is in the Southern most part of State so also Rayalaseema Region. The district is bounded on the North by Ananthapur and Y.S.R districts, East by Nellore district, and East & South by Tamilnadu State and West by Kolar district of Karnataka State. The then existing 15 Taluks were reorganized into 66 Mandals corresponding to the revenue Mandals, Mandal Parishads were also formed, which were co-terminus with the revenue Mandals in all cases, except statutory town. The revenue villages of Tirupathi rural and urban Mandals were grouped in one Mandal Parishad and named Tirupathi Mandal Parishad. Further, name of Kammapalle Mandal was changed as Ramachandrapuram.

With regard to population of Chittoor districthad population of 4,174,064 of which male and female were 2,090,204 and 2,083,860 respectively. With regard to density are 275 people per sq. km. The average literacy rate was 71.53 compared to 66.77 of 2001. If things are looked out at gender wise, male and female literacy were 79.83 and 63.28 respectively. Total literate in District were 2,667,878 of which male and female were 1,484,794 and 1,183,084 respectively. With regards to Sex Ratio it stood at 997 per 1000 male compared to 2001

census figure of 982. Data regarding child under 0-6 age were total 444,572 children under age of 0-6. Child Sex Ratio as per census 2011 was 931.

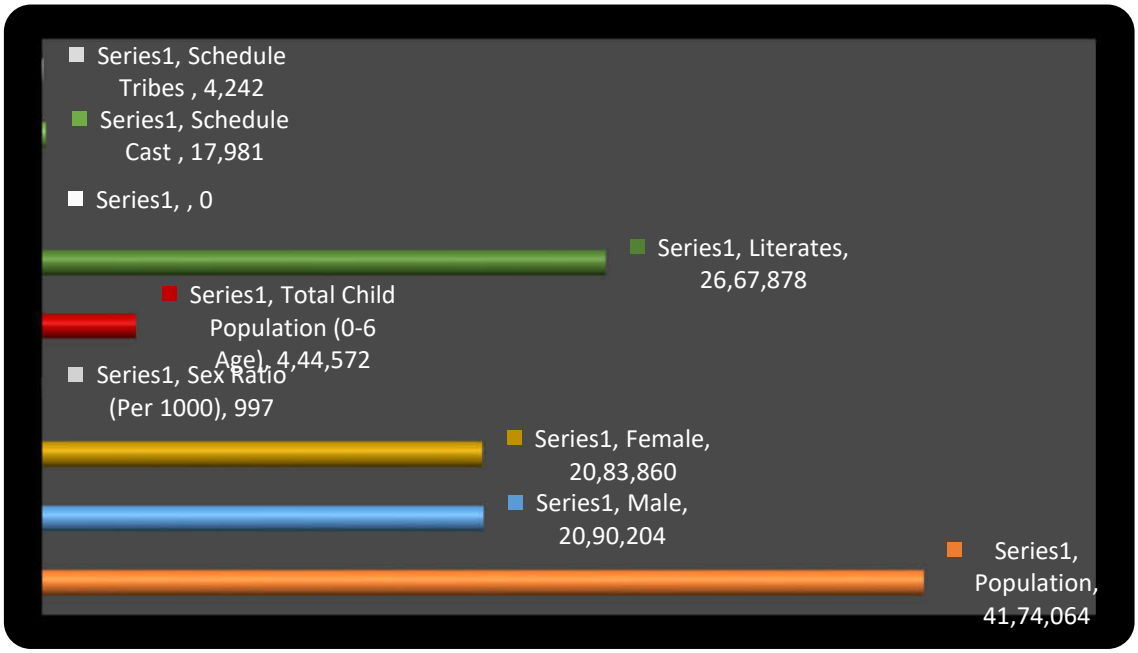


Fig. 3.21 Demographic details of the Chittoor District

3.9.3.2 Demographical detail of the study area

The proposed project area has 6 mandals, namely; Sadum, Somala, chowdalapalli, punganur, peddapanjani and Thavabampalli. The study area has surrounded with 27 villages as per the census of India, the study area has 78,903 populations with 19,642 households. Out of which male are population are 39,476 and female are 39,427. Regarding children, the total of population is 8,660 from boys and girls. The SC and ST population are 13,543 and 1941 respectively. The literacy and illiteracy population are 45,974 and 32,929 (Table 3.23).

3.9.4 Economy and livelihood

The study region i.e. the study area is rich in natural resources like agriculture, Horticulture, Animal Husbandry, Minerals, Agri resources, Dairy Resources, poultry resources, mineral based, forest based, electronic based etc,

3.9.4.1 Agriculture

The Proposed mine location area is an agrarian economy. Area wise, paddy is a major crop grown, followed by Jowar and bajra. Soil and climate are most suitable for plantation crops. Hence, horticulture produces such as mango, grape, sapota, banana and vegetables are grown extensively, over large tracts of land. Sugarcane, groundnut and sunflower are major commercial cops.

Table3.23 Demographical details of the study area

Name of the Village	No of house holds	Total population	Male population	Female population	Below 6 years	SC population	ST population	Literacy	Illiteracy
Somala Mandal									
Nellimanda	731	2699	1370	1329	281	341	48	1548	1151
Irikipenta	813	3265	1648	1617	363	480	103	1809	1456
Somala	1620	6323	3096	3227	656	956	40	3996	2327
S. Nadim Palle	399	1505	769	736	125	339	124	1018	487
Upparapalle	811	3030	1515	1515	296	345	319	1731	1299
Nanjampeta	1226	4531	2277	2254	470	163	122	2676	1855
Chowdepalle Mandal									
Kondamarri	1296	5134	2577	2557	616	722	183	2831	2303
Gaddamvaripalle	970	3879	1989	1890	397	1187	37	2219	1660
Peddayallakuntla	262	1054	547	507	128	252	1	564	490
Chowdepalle	1781	7026	3546	3480	703	1003	136	4829	2197
Pandillapalle	472	1842	954	888	174	359	80	1123	719
Settipeta	258	1134	581	553	115	178	51	582	552
Pudipatla	686	2707	1325	1382	262	549	15	1470	1237
A.Kothakota	563	2250	1094	1156	243	408	4	1224	1026
Durgasamudram	733	2991	1495	1496	380	448	98	1567	1424
Charala	640	2437	1218	1219	258	650	1	1549	888
Punganur Mandal									
Nekkondi	623	2565	1284	1281	244	566	8	1395	1170
Peddapanjani Mandal									
Thurlapalle	320	1403	710	693	145	202	0	917	486
Veerapalle	308	1391	695	696	146	326	19	969	422
Suddagundlapalle	293	1301	647	654	180	281	9	666	635
Kolathur	919	4069	2042	2027	520	611	2	2222	1847
Gamkonda	449	1813	892	921	232	699	24	996	817

Rayalapeta	999	4204	2056	2148	497	672	29	2774	1430
Nagireddipalle	614	2681	1296	1385	359	451	76	1249	1432
Peddakappalle	792	3466	1741	1725	437	437	237	1660	1806
Kogileru	565	2331	1169	1162	272	212	44	1272	1059
Thavanampalle Mandal									
Mallakunta	499	1872	943	929	161	706	131	1118	754
Total	**19642**	**78903**	**39476**	**39427**	**8660**	**13543**	**1941**	**45974**	**32929**

Fruit crops grown in this study are mango, lemon, banana, grapes, guava, cashew nut, and vegetables like tomato, onion, potatoes and brinjal. Mango is grown in almost all the Mandals, mainly in Thavanampalle, Puttur, Bangarupalem, Damala Cheruvu, etc. The major varieties grown are Totapuri, Neelam and Banesha. Chittoor ranks second in the state in production and area under Mango. Banana is grown in over 1,125 Hectors. Kuppam, Chittoor, Satyavedu, Tirupati, Madanapalle, are having increasing area under floriculture, Main flowers cultivated are Jasmine, Crossandra, rose, marigold and chrysanthemum.

3.9.5 Social Infrastructure Facilities

3.9.5.1 Education

The district has seven universities are located in this District. Sri Padmavathi Mahila University is the only Mahila University in the State. In addition, the Veterinary University is the only one in the State. Annibhsent established the first-degree college in the district at Madanapalle in 1915. The first hi& school in the district was PCR High School which was started at Chittoor in 1856.

3.9.5.2 Transportation

Broad Gauge double line network Connecting Mumbai- Chennai passes through the Eastren part of the district connecting Renigunta Junction to Arakonam junction from north to south.A Broad gauge single line connecting Chenni – Howrah line from Gudur junction connecting Srikalahasthi-Renigunta-Tirupathi-Pakala-Chittoor- Katpadi Junction passes through from East to South.One more Broad gauge Single line connecting Pakala-Madanapalli Road-Dhrmavaram Junction passes through the district from East -West.

3.9.5.3 Road Network

The following National Highways pass through district from North- South & East -West They are as fallows, NH-40-Connecting Chennai-Chittoor- Hyderabad-Nagpur from South to North.NH-69-Connecting Gudur-Tirupathi-Chittoor-Palamaneru-Mulabagala-Bengaluru, NH-71 Connecting Naidupet-Tirupathi-Vayalpadu-Madanapalle-Kadiri, NH-716Connecting Renigunta-Nagari-Chennai and NH-42 Connecting-Kadiri-Angallu-Madanapally-Palamaneru-Kuppam-Krishnagiri. In addition to this, R&B and Grampachayat roads connect all 66 Mandal headquarters with road transport.

A National Level/Domestic Airport is situated at Renigunta that is 10 km from Tirupati that is well connected with Delhi-Chennai, Bangaluru-Tirupati, Visakhapatnam-Tirupaty, Hyderaba-Tirupaty, Mumbai- Tirupaty, Kolkata-Tirupaty air routes.

3.9.5.4 Industrial development

Non-linear impervious surfaces are included in the class that is related to trade, manufacturing, distribution and commerce. These are areas where the human activity is observed in the form of manufacturing along with other supporting establishments for maintenance. The industrial area occupies an area of 28.63 sq. km, which is observed in and around towns.

3.9.5.5 Industrial area-Ash / Cooling Pond

These are the portions of industry that are used for temporary storage of ash, contaminated soil, rubble, cooling of hot water or tailing pond associated with the industry. The areas where industrial waste is permanently kept, categorized as other waste that is delineated under this category. A stockpile of storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from earth's surface is considered under this category. It is observed that this category is found around the industrial areas with an area of 0.48 sq. Km.

3.9.5.6 Mining – Abandoned

These are the areas where large-scale surface operations of removal of economically important ores are carried out in the past, but presently kept abandoned due to various reasons like economical, operational, viability, disturbances etc. Only 1.27 sq. km has been contributed under this category.

3.9.6 Primary study

The primary research was conducted during the process of survey. It was done in two folds, such as 1) Questionnaire survey method, this is to know the individual perception about this proposed project. This method focuses on socio demographical information of the respondent such as; name, age, gender, profession, community and economical sources of the respondent. It is also focused on five major dimensions of economical, social & cultural, health & wellbeing, personal & psychological and public infrastructure aspects to assess that significant impact differences about this proposed project. Second method is Focused Group Discussion (FGD), this is to identify the collective or community opinions on this project. Here, interviewer would ask the random based questions and community need and expectations also to be included

A primary data were collected from 251 participants of the local communities. This would help to know the community perception on proposed project and advantages and

disadvantages by expansion of the work. In the connection, FAE teams have chosen convenient (non-probability) sampling method within the limits of the studied. In this regards, the village of Nadimpalle, Somala, Upparapalli, Chodapall, Kondamarri, Pudipatla, Nekkondi, Veeraplli, Rayalapeta and Peddururespectively. The primary data were statistically analyzed by using the SPSS 20.0 version to assess the significant different in various demographical variables. The following findings are identified.



Fig. 3.22Collection of data from public (Source: field study)

3.9.6.1 Major Findings of the Primary Study

- Most of the persons in the study area well aware of the proposed irrigation project.
- The economic benefits with proposed irrigation project in the study area are commonly have direct, indirect, and induced.
- 91% of the participants positively responded that there would be enormous change with proposed project form of employment, to the local people on regular and contractual bases.

- Development of agricultural water resources may have significant changes at various levels, from farm to national levels.
- Changes in production patterns, land and property values, expansion in the use of complementary inputs (such as high yielding variety seeds, fertilizers, pesticides, etc.), and expansion in overall economic activities through backward and forward linkages.
- The impacts of these changes vary greatly from one level to another. Some of the impacts are confined to only farm level, while others spread to the whole project command and others spread to wider region and province/state or national level.
- Generates additional employment on contractual and regular bases that has positive impact on the local economy.
- Would be increased agricultural production, crop productivity, expansion in crop areas, Increase of cropping intensity and crop diversification.
- There is scope to intensification the commercial fish production (in-land fisheries).
- Would be increased benefits of water use in industrial, commercial and residential sectors.
- Environmental benefits of water for in-stream flows, disposal of waste, wildlife, flora and fauna; increased farm forestry and vegetation in irrigated areas.
- Health benefits in the form of sanitation due to better access to water
- Wide range of changes brought by infrastructure investment projects**,** while economic benefits tend to be directly measurable impacts in terms of monetary value and Goods and services.
- Many communities would be benefited in various aspect, such as establishment of related agriculture, horticulture and many other aspects.
- The economic benefits are value-added, taxation revenue Govt. and return on investment.
- It has wide range of changes brought by infrastructure investment projects**.**
- Local transport and infrastructure will be developed, namely roads, are usually provided for free (or at a fee lower than costs).
- All the people in the proposed location villagers will be relocated to the nearest area on R& R act and 81% local participants said villagers would have to migrate due to this proposed project. However, there will be no adverse effect with this change.
- No historical places and temple are found within the study area.

- It was also noticed that there would be loss of agricultural lands; trees dwell due to this project.
- Health and fitness for work of port workers who regularly work in areas or on operations known to include health, hazards should be regularly monitored.

3.9.7 Need assessment or community expectations

A need means something that specifically relates to a particular group or community. It's not usually a universal need, but it's more than an individual need. ThePrimary consultations survey has ascertained certain key expectations that are also indicative of the local community's attitude towards industrial development in the study area. Local community people have some expectation as a part of corporate social responsibility and other sources.

- 27% looking employment opportunities to the local community during pre and post operations of the project
- 15% Free medical and health related facilities like, quarterly medical camps, ambulance services, and free medicine supply.
- 23% Skill based Training programs for semi and unskilled people based on their interest which will enhance and helpful to people in the study area.
- 22% of the communities are looking for basic Civic amenities
- 13% Free education for poor students, vocational training, formation of self-help groups and Adaptation of schools and community halls for development.

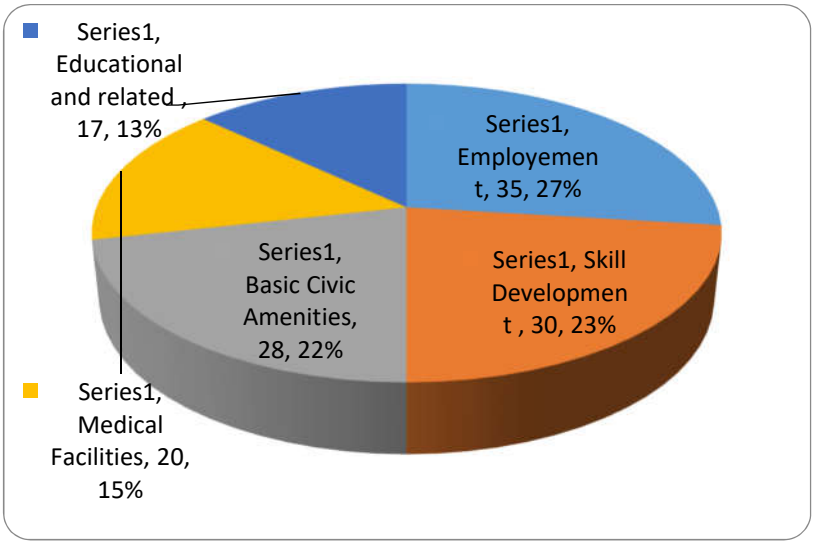


Fig 3.23 Percentage distribution of requirements (Source: Primary Data)

3.9.8 Conclusion

The present Social Impact Assessment study was conducted project in and around the AvulapalliBalancing Reservoir located at Avulapalli Village in Somala Mandal of Chittoor District. It has traditionally involved the use of technical and participatory analytical methods to anticipate change but also encouraging the life cycle of projects to minimize negative outcomes and maximize benefits. The early consideration of social impacts, the alignment of activities with regional and community planning objectives, and meaningful participation of community in decision making are key features. Apart from the SIA process and findings, it can be concluded that most the respondents have positive perception towards implementation of the proposed project.

Chapter 4

ENVIRONMENTAL MANAGEMENT PLAN

4.1 Introduction

The proposed Avulapalli Balancing Reservoir, a climate change impact management and Rayalaseema drought mitigation project are intended to provide drinking water to around 2.76 Lakh people residing in the villages / towns enroute and medium irrigation project, with CCA of 9700 ha as part of first phase of the project. Therefore, it falls under category B2 project and hence only Environmental Management Plan (EMP) is required to be prepared. However, it is imperative to assess impacts of the project and formulate mitigation measures, if necessary, and subsequent environmental management plan.

Present chapter identifies and discusses the environmental and social impacts, both positive and negative, associated with the proposed project along with the mitigation and management measures. Based on the evaluation of baseline data and predicted impacts, suitable management plan is prepared in order to enhance the positive outcomes and ameliorate the negative impacts in the sphere of land, water, air, noise, biological and socio-economic environments in a particular area/region. Ensuring the mitigation of all the negative environmental impacts are mitigated to have minimum environmental impacts due to development of the project, it is important to have mitigation and management measures in place and budgeted for. Project related information is sourced from project proponent, Pre-Feasibility Report (PFR) and Detailed Project Report (DPR) of the project to carry out the impact assessment during the project construction and operation phase. Mitigation and management measures have been designed to ensure minimum impacts of the project construction and operation on surrounding environment.Impacts and Mitigation/Management measures are discussed under following heads

1. Mitigation of Impacts due Air Emissions
2. Mitigation of Impacts due to Noise
3. Mitigation of Impacts due to Wastewater Generation
4. Sanitation and Solid Waste Management
5. Facilities in Labour Camp
6. Public Health
7. Energy Conservation Measures
8. Biodiversity Conservation
9. Green Belt Development

For each of the above, potential adverse/positive impacts along with the recommendations for mitigation measures have been discussed in the ensuing paragraphs.

4.2 Impacts and Mitigation Measures

4.2.1 Impacts on Air Quality

During Construction Phase

The construction of the project involves construction of the reservoir bund, excavation of materials, banks formation, 4 nos. of Saddle Bunds, masonry and concrete works at Seethamma Cheruvu which is away from human habitation. The air pollution impact of excavation of ordinary earth and boulders and also rock is directly dependent upon construction methodology, annual rate of excavation, mode of transport within the construction site, mode of screening and method of crushing. The air pollution sources at the proposed site can be broadly classified into three categories, viz. area source, line source and instantaneous point source.

Extraction of stone by various activities in the construction of earthen bund as an area source that includes excavation and activities happening in the excavation area like drilling, blasting, hauling and loading/unloading. The dust emission from these areas will be fugitive in nature. The excavator operations, loading/unloading operations will also cause dust emission though it will be confined to the area of operation of the machinery. The gaseous emission from their operation shall be minimal and limited within the operational area.

Transportation of excavated material from the bund site to either dumping sites or the stone crusher unit are categorized as line source. Since the dumper movement on haul road will be within the dam complex area, no adverse impact shall be felt in the settlement area.

During operation phase

In an irrigation project, air pollution occurs mainly short period during project construction phase only. During operation phase, no major impacts are envisaged on air environment.

4.2.1.1 Mitigation measures

The mitigation measures primarily focused on the dust generation during construction, hauling of material, diesel generators operation. Therefore, the following mitigation measures are recommended

- For all major construction activities locations such as batching plants, bulk material open stock yards, etc curtaining of the site will be done to a height of 1 feet above the heap height to protect the surrounding areas from dust emissions.

- Dust generated due to drilling, blasting, ripping, and vehicular movements will be suppressed though spraying of water during and till half an hour after the operations.
- Water sprinkling with the help of mobile water units such as water tanks and spray nozzles will be done on the haul road and other roads at regular intervals where dust is expected.
- All construction equipment/machinery will be properly maintained and tuned to minimize emissions.
- Speed of the vehicles will be kept within the prescribed limits. The vehicles used for the construction of the reservoir should have Pollution Under Control (PUC) certificate.
- Trucks/ dumpers will not be over loaded above the brim level.
- At the feeding points of stone crusher will be covered and air mist spray shall be carried out and hooded conveyer belts shall be used.
- Mobile DG sets with the capacity of 4×125 kVA and 1×625kVA shall be used for lighting only during construction phase and they should meet emission and noise standards as per guidelines/standards issued by CPCB.
- The entire contractor's vehicle should have valid PUC certificate and same condition may be enforced on transporters bringing in material for construction.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.
- All the construction workers and other staff, who are directly exposed to dust, should necessarily be provided with dust masks.
- The project authorities will work closely with representatives from the community living in the vicinity of project area to identify areas of concern and to mitigate dust-related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program).

4.2.2 Impacts on Water Quality

During construction phase

Various sources of water pollution in the project area during the construction phase include disposal of effluents with high turbidity from bund and excavation areas, sewage disposal from labour camp, land clearing activities, washing of oil, grease from diesel generator sets, vehicles and construction machinery, etc.

Stratification can limit the mixing of the water body, leading to depletion of DO levels. This can lead to reducing conditions in waters. The annual variation up to MDDL would prevent formation of any significant temperature stratification. Thus, no problems related to reservoir stratification are anticipated. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir. Therefore, any significant impact on reservoir water quality is not anticipated.

Another significant impact, which can accrue in the reservoir, is the problem of eutrophication in the reservoir. This occurs mainly due to the disposal of nutrient rich effluents from the agricultural fields. However, within the catchment, the proportion of agriculture land irrigated is low. The agro-chemical dosing is low in the area. Even in the post project phase, use of fertilizers in the project catchment area is not expected to raise significantly in view of the maximum rain fed crops being grown in the area.

Considering the low fertilizer usage in the area, significant loading of nutrients is not anticipated. Thus, problems due to eutrophication are not anticipated in the proposed project Apart from ground water recharge from the reservoir area and from application of water in command area, the quality of ground water will also improve in the entire area as the quality of surface water to be applied conforms to class “C” water as per IS:2296-1982.

During the construction phase total fresh water requirement for 250 no.’s of workers will be 35.0 kLd (@ 135 lpcd as per NBC 2016.The waste water generation will be 30.0 kLd which will be directed to the septic tank / soak pit at the site. Two numbers of temporary worker camps will be provided at different locations of the project and sheds will be removed after completion proposed project.

During Operation Phase

During the operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of O&M staff will reside in the area in a well-designed colony with septic tank and soak pit and other infrastructural facilities, the problem of water pollution due to disposal of sewage is not anticipated. The treated sewage will be reused for gardening and green belt around the colony. Still, the major impacts considered as a part of the study are:

- Changes in flow regime in downstream
- Impact on ground water
- Impacts on waterlogging and soil salinity

- Changes in water quality due to increased use of fertilizers

4.2.2.1 Mitigation measures

During operation there will be groundwater recharge that enhances the groundwater availability in the vicinity. The fluoride concentration in the groundwater is more than the permissible limits. The recharge will dilute the fluoride and thereby enhance the groundwater quality and health of the people using the groundwater for drinking and cooking. To avoid deterioration of water quality of the receiving water body following measures are suggested:

- Conservation of water should be implemented at construction sites to minimize the generation of wastewater. With regards to water quality, wastewater from construction activities would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the wastewater are removed before these are disposed into water body or over land, although effluent is expected to be very less to cause any adverse impact.
- During Construction phase provision of septic tank/ soak pit of adequate capacity for labour camp so that it can function properly for the entire duration of construction phase
- During operation, the nearby project colony should have suitable treatment facilities to treat the sewage generated from the colony
- Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc. All spills and collected petroleum products will be disposed off in accordance with APPCB guidelines.
- Improved availability of irrigation water during Rabi season in the area shall lead to reduced extraction of groundwater for irrigation and domestic uses. The project, by providing water for irrigation will reduce the extraction of groundwater and bring a positive impact on this count.
- The project is designed to carry out irrigation in command area through irrigation system which will not pose any water logging. In fact, there will not be any such as the geological characteristics will not support such logging. Hence, problem of water logging and salinity is not envisaged.
- The fertilizer dose is likely to increase once irrigation is introduced in the command area. Under the best farming practices in case of flood irrigation, only 40% to 50% of the applied fertilizers are used by the crop and the balance finds its way into the aquatic environment through drainage runoff which causes eutrophication of water

bodies. However,the irrigation practices included piped irrigation (drip/sprinkler) system hasalso been planned in the proposed project, this possibility is minimal.

4.2.2.2 Steps to develop Pisciculture and recreation facilities

The reservoirs invariably offer scope for inland fish production for various methods to enhancement higher productivity and income generation for the local community. They have the advantage of enabling quick enhancement of yield due to their small size and easy manoeuvrability of fish stock. The proposed reservoir will be leasing to the registered fishermen co-operative societies to promoting pisciculture and to generate economical help and to maintain fishing rights of Fishermen community.It provides not only livelihoods but also provide the nutritional food. It is envisaged to develop a park on the surroundings of the reservoir. It helps provide the recreational facilities to the people in the area.

4.2.3 Impacts on Noise Environment

During construction phase

Sources of noise will be the vehicles and equipment for excavation and construction at the project site. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area mainly where large-scale construction activity will progress. Additionally, noise levels will increase on approach roads due to increased traffic.

Another cause of concern for noise and vibrations generated due to construction activities are for the wildlife in the area that too mainly for avifauna. Avifauna is scattered in the study area and is not confined in proximity to the proposed construction sites, therefore, such impacts are not significant and also are temporary in nature.

Impact of noise generation due to operation of construction machines and equipment is the exposure of workers operating these machines and others who are working in the surrounding. Such impacts can become significant if they are exposed to high noise for long hours continuously.

In order to predict ambient noise levels due to the mining activities like excavation of earth, sand and aggregates from various sources at different locations assumption that all noise sources are acting as a single source will be generate approximately 91 dB(A).

The average noise levels generated due to proposed crushing activities will be about 88.5 dB(A) which is within the exposure limit of 90 dB(A). The crusher, if provided, within the project area shall be housed in a shed to contain noise. Screening activities shall generate average noise level of about 96.5 dB (A). Workers in the noise-generating zone will be provided with earmuffs/earplugs besides dust mask.

Occupational Safety and Health Administration (OSHA) of USA has done substantial work to establish the impacts of exposure to high noise levels on humans and have established limits for safe exposure. Continuous exposures to high noise levels affects the hearing ability of the workers/operators and hence, should be avoided. Factories Rules by various state governments has also adopted these limits to check exposure of factory workers to high noise for longer duration.

To prevent impact of high noise exposure on workers, it is recommended that contractors should enforce standards, recommended by Occupational Safety and Health Administration (OSHA) (Table 4.1), during the construction phase.

Table 4.1 OSHA Standards for Noise

Maximum equivalent Continuous noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2
110	½
120	1/2

During operation phase

After completion of the project and during the operational phase the noise levels shall not be impacted as there are no noises emitting sources except the noise created during passing of surplus discharge through spillway, which shall persist for a few hours till the flood subsides.

4.2.3.1 Mitigation measures

Noise will be generated during various construction activities such as excavation, movement of vehicles, operation of construction machines and equipment, operation of DG sets at filling of bund, etc. Noise levels will also increase due to increase in traffic. Continuous exposure of workers to high sound levels may result in annoyance, fatigue, and may cause temporary shift of threshold limit of hearing and even permanent loss of hearing.

- Following mitigation measures will be implemented to minimize the impact of high noise: Contractors will be required to maintain proper functioning of equipment and comply with occupational safety and health standards. DG sets will have a valid Type Approval Certificate and Conformity of Production certificate as per CPCB guidelines.
- All the construction equipment will be required to use available noise suppression devices and properly maintained mufflers.
- Workers in high noise area, will be provided with earmuffs and their use will be monitored (budgeted under PPE head). Workers exposure (time duration) to high noise will also be controlled.
- High noise area, interfacing with community, if any will be provided with noise barriers.
- Minimize the use of noise producing equipment during night hours to avoid the disturbance to locals and wild animals of surrounding area.
- Monitoring of noise levels will be conducted during construction phase of the project. In case of exceeding of pre-determined acceptable noise levels by the machinery; will require the contractor(s) to stop work and remedy the situation prior to continuing construction.
- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.

4.2.4 Solid Waste Management

4.2.4.1 Impacts due to waste generation

The construction of the proposed balancing reservoir will involve an influx of technical staff, labourers and other service providers into the project area. Sewage and solid waste will be generated from the colonies. Most of these technical and non- technical workers will be temporary and will leave the region as soon as the construction phase of the project is completed. Some of the workers will be accompanied by their families. The total migrant population of workers and their families has been estimated as 250 persons during peak construction time. These people will be living in temporary and permanent colonies/ settlements. The main sources of waste generation can be categorized as:

- Municipal waste (includes commercial and residential wastes generated in either solid or semi-solid form excluding industrial hazardous wastes and bio-medical wastes).
- Construction and demolition debris (C&D waste)
- Bio-medical waste

- Hazardous waste (generated from construction machinery and equipment)
- e-Waste (computer parts, Printer cartridges, electronic parts, etc.).

It is essential that from the planning stage, sewage management and solid waste disposal facilities should be conceptualized to maintain the health of the people and the environment.

4.2.4.2 Sanitary and Solid Waste Management

About 250 workers (labour and staff) would be engaged temporarily during peak construction period. It is expected that 60% of the total work force shall be locally available from adjacent areas and thus labour colony shall be designed to house 250 workforces. Proper care must be taken to manage the solid waste generated from the labour colony.

The solid waste generation during the construction phase for the 250 no.'s of workers will be 100 kg/day (@ 0.4 kg/capita/day as per NBC 2016). Proper sanitary facilities would be provided at the labour colonies. Covering community latrines and bathrooms, separately for male and female, will be constructed at appropriate locations; connected to septic tanks and soak pits. Care be taken to avoid mixing of wastewater and sewage with local water body especially during rainy season. Mobile toilets will be provided, separately for male and female workers, at construction sites.

For maintaining the cleanliness of the labour colony and to restrict from disposing the solid waste into the nearby water bodies, no dumping of solid waste should be allowed into any of the water body. Waste segregation – biodegradable and non-biodegradable will be encouraged by awareness programs. Solid waste collection vats will be provided and these will be regularly emptied to land fill site at Punganuru (non-biodegradable) and composting pits (biodegradable) established locally in consultation with local authorities.

The project authority, as principal waste generator, shall, within the territorial area of the project complex/ colony, be responsible for the implementation of the provisions of Solid Wastes Management Rules, 2020, issued by MOEF vide S.O.1357 (E) dated 8th, April 2016, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

4.2.4.3 Collection of Wastes

The project authorities shall prohibit littering of solid wastes in the area under their control by resorting to following:

- Organizing collection of solid waste by community bin collection (Central bin).
- Collection of wastes from office areas.

- Collection of waste from medical facilities and separately disposing it off.
- Collected of waste from residential areas shall be transferred to community bin by hand-driven containerized carts or another small vehicle. Horticulture and construction / demolition wastes or debris shall be separately collected and disposed off. Waste like dry leaves shall not be burnt.
- Collection of vegetable and fruit/meat waste and dry leaves, which are biodegradable in nature to be finally disposed of through aerobic composting.
- The compost thus obtained shall be used for development of flower beds and avenue plantation around colonies and office areas and also in biological measures to be adopted in respect of soil tips developed at muck disposal sites.

4.2.4.4 Storage and Transportation of Wastes

The project authority shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it.

Vehicles used for transportation of wastes shall be covered. Wastes should not be visible to public, nor exposed to open environment preventing their scattering. Transportation vehicles shall be so designed that multiple handling of waste, prior to final disposal, is avoided.

4.2.4.5 Disposal of Municipal Solid Wastes

Land filling shall be restricted to non-biodegradable inert waste and other waste that are not suitable for recycling or for biological processing. Landfill site shall be selected as per criteria mentioned under Schedule I(A) in consultation with local authorities.

4.2.4.6 Awareness Programs

The project authority shall organize awareness programmes to ensure community participation in waste segregation.

4.2.4.7 Construction and Demolition Waste

Apart from the municipal solid waste in labour colony of project area, a lot of waste is expected to be generated on account of construction activities mainly consisting of empty cement bags, iron scrap, packing material, etc. It is expected that most of the iron scrap and packing material would be recycled since it has reuse value and hence, it is proposed that stipulations should be imposed on suppliers and contractors to take away the scrap and packing materials. Surplus construction and demolition waste will be disposed off at pre-

identified low-lying area, in consultation with local authorities and the site will be fully restored. Following guidelines shall be followed:

- Construction and demolition waste will be handled in line with the guidelines for handling such wastes given in Construction & Demolition Waste Management Rules, 2016.
- Contractor shall be responsible for segregation of construction and demolition waste and handle the same in consultation with local authority.
- Waste construction material shall be recycled as far as possible and remaining disposed off at designated site in consultation with the local authority.
- Contractor will ensure that there is no littering or deposition of waste so as to prevent obstruction to the traffic or the public or drains.
- Any hazardous waste generated at site such as waste oil, used batteries, empty barrels/containers/liners contaminated with hazardous chemicals/wastes and contaminated cotton rags or other cleaning materials, etc. shall be disposed off in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Log-books shall be maintained for disposal of all types hazardous wastes and shall be submitted with the compliance report.

4.2.4.8 Impacts Due to Fuel Combustion

During construction phase

The increased traffic load in any particular segment of the road will result into direct increase in pollutants released from the vehicles. The rate of emissions of several types of vehicles is presented in the Table 4.2. However, the extent of these impacts, at any given time will depend upon the rate of vehicular emission within a given stretch of the road; and the prevailing meteorological conditions. The impacts will have strong temporal dependence as both factors vary with time. The temporal dependence would have diurnal, seasonal as well as long-term components.

Table 4.2 Emission factors by Vehicle Type (gm/km/vehicle)

CPCB/ARAI (Automotive Research Association of India) – Emission factor development for Indian Vehicles-2008						
Type of vehicles	**Make considered**	**Emission norms**	**Emission factors**			
			CO	**NO_2**	**PM_{10}**	**SO_2**
Trucks (HCV Diesel driven)	Post 2000	BS-II	6.0	9.30	1.24	0.03
Passenger cars	Post 2005	BS-II	0.06	0.28	0.015	0.004

(Diesel driven)						
Buses (HCV Diesel driven)	Post 2005	BS-II	3.92	6.53	0.30	0.026

*Note: Emission Factor of SO2 is calculated based on Sulphur content calculations considering Bharat Stage IV fuel norms

During construction phase 50 tipper trucks (20 tonne) shall be deployed on the road for carriage of soil and construction material (cement and steel), and crushed stone aggregate/sand.

Following control measures have been suggested to prevent air pollution due to the transportation activities:

- Transport trucks/tippers shall be properly maintained.
- Only PUC certificate issued vehicles shall be used.
- Avoiding of overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it.
- Strict compliance of traffic rules and regulations.
- Fugitive dust would be further minimized by taking up tree plantations, growing grass where soil depth is limited and with least damage to the existing vegetation in and around the construction sites.

During operation phase

The ambient air quality during the operation phase at the muck disposal site is expected to improve as the fugitive dust and flue gas emission sources of air pollution shall be conspicuously absent.

4.2.5 Impact on Soil

During construction phase

Another impact on soil will be during construction period as there will be contamination with dust and surface run-off. Due to various construction activities such as construction of colonies / houses / toilet blocks etc. Soil erosion in the project area is bound to increase. During construction activities, the share of the vegetation cover will be adversely affected which in turn will cause loosening of the soil particles, thus increasing the rate of soil erosion and hence degradation of land environment. Substitute Plantation will mitigate the adverse effect of soil erosion.

During operation phase

No major impacts are envisaged on soil environment during project operation phase

4.2.5.1 Mitigation measures

Measures to conserve soil in-situ, allow more infiltrations opportunity time for rain water and safe disposal of runoff water from arable lands are of prime concern in rain fed areas, since they directly affect soil erosion rates and consequent crop productivity. The recommended soil and moisture conservation measures are as follows:

- Contour bunds with waste weirs
- Graded bunds/Graded border strips
- Zing terraces with raised waste weirs
- Diversion Drains/Water ways
- Reducing wind erosion of soil by growing wind breaks (vegetation cover)
- Gully plugging
- In over-grazed land silvi pastoral systems, which in irrigated land yield enough green fodder to cattle population
- Grazing animals should be kept in stalls
- Agro forestry and Agro horticulture systems to meet various needs of farmers, crop residue of this adds to the soil and increases carbon content and biotic activity
- Harvesting of runoff and impounding through appropriate structures
- Drainage line treatments to improve the flow and avoid stream course clogging.

4.2.5.2 Water logging

Surface and ground water belong to the same hydrological circle and are independent. In any area or region, where both surface and ground waters are present, irrigation is based usually on the use of former or both the sources. However, in most cases it is done without proper planning for co-ordinated development and optimum benefits. When due consideration is not given for a balanced and harmonised development of the two sources, the environment gets affected and problems such as water logging in certain areas will prevail It is therefore, becomes necessary to take up mitigative measures to avoid water logging. It is therefore, suggested that conjunctive use of water and also necessary drainage system should be developed to overcome the problem of water logging.

4.2.5.3 Soil Drainage

The removal of excess water (free or gravitational/standing or stagnant water) from surface or below surface of the soil so as to create favourable soil conditions for plant growth, is termed

as soil drainage. The excess water leads to waterlogging and salt imbalance; thus rendering the land productive to less productive and problematic.

Since most of the area under this project is level to gently sloping the flow of water may not be that rapid under sub-soil conditions. With stabilization of irrigation and assured water supply, the sub-soil drainage conditions will have to be improved. The ill-effects of poor drainage are enumerated below.

III-effects of Poor drainage

a) Lack of air space in the soil for proper root growth where in availability of O_2 is limited.
b) Some of the toxic substances are produced including H_2S, boric acid in the presence of which even paddy crop is affected. This injury is similar to sulphide injury.
c) Natural vegetation like plantation and orchards will be affected due to waterlogging.
d) Standing water for a long period will give rise to many soil health problems
e) Fertilizers applied will percolate to lower zone or lost due to faster infiltration.

The factors responsible for poor drainage are enumerated below:

a) Soil Type

In clayey and heavy soil the infiltration capacity is low and prone to waterlogged conditions and needs drainage

b) Slope

In areas with in adequate slope and flat areas, the movement of water is slow and results in poor drainage. The command area of the proposed project is mostly levelled to gently sloping, therefore warrants proper drainage is selected as per need.

4.2.5.4 High Rainfall

The excess rainfall received in the absence of proper drains will create waterlogging. The proposed project benefitting in the uplands area therefore, problems of water logging due to rainfall are not anticipated.

4.2.5.5 Advantages of drainage

Suitable drainage system has to be provided in the vulnerable areas under this project area localized for irrigated dry (ID) crops. The advantages of proper drainage area as follows

- Drainage makes the command more productive
- Proper drainage makes the entire field more uniform in soil moisture (elimination of wet patches) and results in more effective tillage and harvesting.

- Removal of surplus water from the field increases aerobic microbial activity by permitting air to replace water in more soil pore space. As result the bio-micro-organisms will increase which will decompose more organic matter and thus more potential plant nutrients are made available. Proper drainage decrease potential losses of nitrogen.
- Drainage reduces the building up of toxic substances in soil
- Wider varieties of corps and more valuable crops can be raised in well drained soils.
- Drainage permits deeper penetration by plant roots thereby increasing the availability of nutrients to growing plants resulting in higher crop yields. Deep roots make plant more resistant.

4.2.5.6 Provision of drainage in command

Surface Drainage

Surface drainage is for the removal of excess water from rainfall or seepage or irrigation from the surface of lands. Both areas localized for wet and ID crops need surface drainage system. For designing drainage system the following factors are to be considered.

- Intensity of rainfall 1 day, 2 day, 3 day rainfall with certain frequencies (5 years, 10 years)
- Rate of infiltration
- Evaporation rate
- Crops grown during rainy season or at times of heavy rainfall
- Landscape
- Gradient that can be given to the drainage channels
- Outfall conditions

Main Drains

In the project command there are natural drains existing as major gullies. The velocity of flow is low and some time is taken to drain the water to outfalls. Hence in the command, all these main drains are to be strengthened to the extent possible, deepened and wherever required blanks are stabilized. Until and unless these gullies which will serve as main drains are in a conditions to receive and discharge the rainfall or water from excessive irrigation in shorter period, the drainage system cannot give any good results.

All field drains into subsidiary drains to be constructed at right angles to natural drains. The size of these drains should be sufficient to take the excess water of the field drains dropped into it. The field boundaries can be made use of in digging these subsidiary drains.

Field drains

These drains are to be constructed by the individual farmers with proper size so that the excess water from their fields are drained into intermediate drains. Field drains or ditches should be at least 30 cm deep with slide slopes. These should be constructed considering the low spots which collect water from adjoining higher elevations. Ditches should be as straight as possible. The cross-section of the field drain should be trapezoidal shape.

Soil fertility status

The soil characteristics are presented in chapter 3. It is observed from the available data that soils are low in nitrogen and available P_20_5 while in case of K_2O the status is low to high. The fertility level of soils in respect of nitrogen and phosphorus has to be improved by adequate application of fertilisers as well as organic manure after soil test. The regular extension staffs of Agriculture department generally cater the needs of the farmer. The recommended doses of fertilisers for rice and pulses are given in Table 4.3.

Table 4.3 Recommended Doses of Fertilisers for Rice and Pulses

Sl.No	Crops	Fertiliser dose in Kgs/ha			
		N	P	K	Remarks
1	Kharif irrigated	60-80	30-40	30	N in 2 to 3 splits
	Rabi	100-120	30-40	30	
	Kharifrainfed	60	30-40	30	
	Black gram (ID crop	20	50	As per soil test	
	Green gram	20	50	-	-
	Bengal gram	20	50	-	-

Selection of crops

An initial basket of twelve crops has been assumed for surface irrigation considering present cropping pattern (without project), need for diversification and introduction of each crops.

Irrigation Efficiencies

For the purpose of cropping pattern optimization and evaluation of alternation project configuration, the efficiencies (Table 4.4) are taken into consideration.

Table 4.4 Details of Irrigation Efficiencies

Items	System Efficiency	
	Surface Irrigation (Ponded)	Drip Irrigation (Non Ponded)
Conveyance efficiency(from canal head to outlet head)	90%	90%
Field channel efficiency(from outlet head to field gate	85%	98%
Field application efficiency	79%	96%
Overall Efficiency	54%	80%

4.2.6 Water Management

4.2.6.1 Participatory Irrigation Management Practices (PIM)

Government of Andhra Pradesh has enacted a law on PIM. WUAs are already functioning for utilisation of water from various tanks in the command and hence the local community is already aware of the modern practices and same can be implemented in the command also.

4.2.6.2 Scope of introduction of Modern Drip Irrigation system in the command

The introduction of the drip irrigation techniques has been considered preferable in the command area due to the improved efficiencies in application of water to the field. Currently,the command area does not have any assured water supply and as a consequence, thedevelopment of modern methods has been slow. The limited financial capacity andtechnological awareness of the local farmers has also contributed to this. It is proposed that the drip irrigation may be provided initially in 10% of net CCA distributed in pockets over theentire command area.

4.2.6.3 Rational crop plan with appropriate crop rotation with due share of legumes and cash crops

A sustainable and diversified cropping pattern has to be developed depending on agriculture scenario. Keeping in view the soil fertility aspects, pulse crops have to be in corporates in the crop rotation. Also, cash crops should find a place wherever feasible, to improve farmers conditions and inculcate interest in farmers in the new cropping plan. At present, there is a very limited area under pulse and cash crops. Therefore, crops like greengram,blackgram, groundnut, soybean etc should be incorporated to cover sizeable area in the command area. The crops should be rotated in each field from year to year and monoculture or same rotation in the same field should be avoided. The rotations should be based on established principles. Some of the rotations that can be adopted in the project command area listed below:

1. Paddy –Bengalgram/Maize-Greengram
2. Maize/Jower/Bajra-Bengalgram –Chilies
3. Paddy –Redgram+Groundnut – Vegetables
4 .Soybean – Maize – Vegetables
5. Groundnut+Bajra- Maize – Vegetables
6. Redgrame +Groundnut- Vegetables – Chilies
7. Vegetables – Bengalgram
8. Cotton – Vegetables – Green gram
9. Turmeric – Greengram/Blackgram
10. Castor/Toboco-Vegeables/Fruits/Flowers
11. Greengram – Maize – Sugarcane
12. Maize – Blackgram – Mentha

4.2.7 Integrated Pest Management

Integrated pest management is a system that, in the context of the associated environment and population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains pests' populations at levels below those causing economically unacceptable damage of loss (FAO). It is an ecologically based strategy that focuses on long term solution of pests through a combination of techniques such as use of resistant varieties, biological control, modification of agronomic practices and habitat manipulation. Pesticides are carefully selected and applied to minimize the risks to the human health, beneficial and non-target organisms and environment.

Table 4.5 Recommended integrated pest management measures for insect pests of rice (Crop stage wise)

S. No	Stage	Insect pests	IPM Measures
1	Nursery	Stem borer, gall midge, thrips, root knot nematode, root nematode and white tip nematode	Apply carbofuran 3G @ kg/ ha or phorate 10 G @ 12.5 kg/ha or fipnoril 0.3 G @ 33 kg/ ha of nursery, 5 to 7 days before pulling the seedlings for transplanting In stem borer endemic areas, install pheromone traps with 5 mg lure @ 8 traps/ ha for pest monitoring
2	Planting to panicle initiation stage	Stem borer	Clipping of leaf tips of the seed lings at the time of transplantation will help in destruction of egg masses of stem borer

			Removal of excess nursery and incorporation into soil Clean cultivation and destruction of stubbles Apply cartap 4 G @ 25 kg / ha or rynaxypyr 0.4 G @ 10 kg / ha or carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipnoril 0.3 G @ 25 kg / ha or spray cartap hydrochloride 50 WP/SP @ 1000 g / ha or spray cartap hydrochloride 50 WP/SP @ 1000g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chlorpyriphos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha Install pheromone traps with 5 mg lure @ 8 traps / ha for pest monitoring or 20 traps / ha for direct control through mass trapping Inundative release of egg parasitoid, trichogrammajaponicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting
3		Gall midge	Growing of resistant varieties as mentioned in table 1 depending on the prevailing biotype in a particular location Apply carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipronil 0.3 kg / ha
4		Leaf folder	Spray cartap hydrochloride 50 WP / SP @ 1000 g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha Inundative release of egg parasitoid, trichogrammajaponicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting

5		Hispa	Spray triazophos 40 EC @ 400 ml / ha or quinalphos 25 EC @ 1200 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha or monocrotophos 36 WSC @ 850 ml / ha
6		Whorl maggot	Apply carbofuran 3 G @ 25 kg / ha or Fipronil 0.3 G @ 25 kg / ha or spray monocrotophos 36 WSC @ 850 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha
7		Case worm	Drain water from the field and spray monocrotophos 36 WSC @ 850 ml / ha or quinalphos 25 EC @ 1200 ml / ha or Carbaryl 50 WP @ 900 g / ha
8	Panicle initiation to booting	Stem borer	Spray cartap hydrochloride 50 WP / SP @ 1000 g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or acephate 75 SP @ 950 g / ha
9		Brown plant hopper, white backed plant hopper, Green leaf hopper	Spray buprofezin 20 SC @ 1000 ml / ha or dinotefuran 20 SG @ 200 g / ha or imidacloprid 200 SL @ 125 ml / ha or thiamethoxam 25 WG @ 100 g / ha or clothianidin 50 WDG @ 30 g / ha or ethofenprox 10 EC @ 500 ml / ha or acephate 50 WP @ 750 g / ha or monocrotophos 36 WSC @ 850 ml / ha or BPMC 5- EC @ 600 ml / ha. Repeat application if hopper population persists beyond a week after application If 2 to 3 applications are needed, alternate the recommended insecticides Do not use the same insecticide repeatedly Note: While spraying, nozzle should be directed at basal portion of the plants. Application should be done preferably with powder sprayer that too during

			evening hours
10		Cut worm	Spray thoroughly with chloropyriphos 20 EC @ 2500 ml / ha or dichlorvos 100 EC @ 600 ml / ha or endosulfan 35 EC @ 1500 ml / haormonocrotophos 36 EC 1500 ml / ha or acephate 50 WP @ 1200 g / ha or Fipronil 5 SC @ 1000 ml / ha during afternoon hours.
11		Gundhi bug	Spray monocrotophos 36 WSC @ 1500 ml / ha or carbaryl 50 WP @ 1500 g / ha during afternoon hours. Dust malathion or carbaryl @ 30 kg of the formulation / ha

WG = Water soluble granules, WDG = Water dispersible granules, EC = Emulsifiable concentrate, WP = Wettable powder, WSC = Water soluble concentrate, G = Granules to be broadcast in standing water

4.2.7.1 General Guidelines to be followedin Rice IPM

- Use disease and insect free pure seeds
- Pay more attention to nursery protection
- Ensure timely planting and crop protection during early growth stage
- Maintain field sanitation and adopt clean cultivation
- Provide alleys (30cm width) every 3 meters in the main field
- Apply nitrogen fertilizer in splits (3 – 4 times or adjust when conditions warrant)
- Monitor pest incidence through survey and surveillance program
- Encourage biological control through need based pesticide application
- While applying chemicals, maintain constantly the recommended quantity of pesticide per hectare
- At flowering stage, dust or spray only during afternoon / evening hours. For effective control of brown planthopper and whitebackedplanthopper, direct spray or duct towards the basal portion of the plants
- Water depth should not be more than 5.0 cm at the time of granular application and water should be kept impounded 3 to 4 days
- Mix emulsifiable concentrates, wettable powders, water soluble granules and water dispersable granules separately in water and add to the sprayer
- If rainfall occurs within 3 hours after spraying, repeat the spray

Use only recommended dose of pesticide. Use spray fluid volume depending on the stage of the crop, which is as follows:

For high volume spray (hand compression sprayer)

For Nursery	500 to 600 litres / ha
Upto 30 days after planting	200 to 300 litres / ha
Upto 50 days after planting	500 to 600 litres / ha
50 days and beyond	700 to 800 litres / ha

For low volume spray (Powder spray)

30 days after planting	90 litres / ha
40 days after planting	120 litres / ha
60 days after planting	180 litres / ha

Table 4.6 List of varieties resistant to important insect pests of rice

S. No	Insect pests	Released varieties
1	Gall midge	Sneha, Pothana, KakatiyaErramallelu, Kavya, Rajendradhan 202, Karna, Ruchi, Samridhi, Usha, Asha, MDU 3, Bhuban, Samalei, Orugallu, Abhaya, Shakti, Suraksha, Daya, Pratap, Udaya, IR 36, Shaktiman, Tara, Kshira, Sarasa, Neela, Lalat, Phalguna, Mahaveer, Vibhava, Divya, Dhanya Lakshmi, Surekha, Vikram, Kunti, Triguna, Sita, Samleswari, Karma Mahsuri, Dhanarasi, Mahamaya, Jyothi
2	Brown Plant hopper	Chaitanya, Krishnaveni, Vajram, Pratibha, Makom, Pavizham, Manasarovar, Co-42, Chandana, Nagarjuna, Sonasali, Rasmi, Jyothi, Bhadra, NeelaAnnanga, Daya, Aruna, Kanaka, Remya, Bharatidasan, Karthika, Vijeta, Cotton dorasannalu, KRH2, PA6201, Hybrid 6129, ADT37
3	White backed hopper	Haryana Basmati, HKR120, Laatha, Narendra 2002, Jitendra, Satyaranjan
4	Green leaf hopper	Vikramarya, Lalat, Khaira, Nidhi, GR12, GR103, Birsadhan 108, Birsadhan 104, Prakash, CoRH1

4.2.8 Safety during Construction

An increase in construction activity of balancing reservoir, the number of major accidents during construction stage may occur and created construction related hazards for persons working on the project. The degree of safety achieved in project constructions has a direct bearing on the amount of effort expanded to avoid accidents by those who control the

conditions and practices on the project. In order to avoid accidents it should be the overall responsibility of the project authorities to provide measures for the safety of all persons working on the projects. The standards laid down for the safety aspects should be taken during construction work. Construction activities at the site need to take care of safety aspect for all the activities in general and for following critical activities in particular:

- Storage, handling, transportation, and operation of explosives required for blasting activities
- Underground construction work including formation of bund, excavation, and other related activities
- Construction at heights
- Fire safety aspects
- Cross drainage construction work
- Storage, handling, detection, and safety measures for gases, chemicals and flammable liquids
- Movement of vehicles on construction site

All persons need to be made aware of the dangerous conditions and risks involved in their activities. They should be trained to take necessary precautions for their own safety as well as that of others working at site. This should typically involve following the Safe Operating Procedure (SOP) wherever applicable, use of Personal Protective Equipment (PPE) such as helmets, gloves, gum boots, safety harness, etc., remain active and alert without any influence of alcohol or other intoxicating substances during working hours. The safety requirement generally vary according to the type of structure, type of construction methodology, type of strata encountered and number of men and type of machinery deployed at site, therefore, it is important to develop site specific construction safety procedures. Such SOPs need to be incorporated in letter and spirit and all the staff involved need to be sensitized to the importance of safety and trained. A full time safety manager, will be appointed by the project developer with duties of monitoring and audit delegated to other staff members on safety aspects. Apart from procuring the appropriate and adequate number of PPEs it is also important to maintain sufficient number of first aid boxes and some volunteer strained in giving first aid treatment. Further, the outsiders coming to site such as drivers, helpers, etc. also need to be made aware of safety requirement of their activity. This can be achieved by putting posters carrying safety instructions for the benefit of all and giving verbal instructions at the entry point also.

S.No.	Environmental issue	Mitigation measures	Responsible agencies execution	Responsible agencies monitoring
Pre-construction stage/Phase				
1	Tree cutting throughout the project area	Relocation / realignment if convenient, to avoid felling of trees.	Contractor	Water resource department
		Required permission from the nodal agency like Forest Department to be obtained by the contractor, if required.		
		Disposal of the trees to be done in a safe manner, in consultation with SE / EE.		
		Plantation of a new tree in at least equal number as no. of trees fell		
2.	Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction to comply with the relevant local norms.	Contractor	Water resource department
		Any discharge standards promulgated under SPCB will be strictly adhered to.		
		Noise limits for construction equipments not to exceed 75 dB (A), measured at one meter from the edge of the equipment in free area.		
3	Disposal of excavation debris and surplus earth, if any	Contractor will make all efforts to use excess earth generated due to excavation. However, if additional soil is required for filling it will be done by excavation from borrow areas. Contractor to identify area for disposal of surplus earth and borrow area for filling and will obtain approval of Executive Engineer before commencement of work.	Contractor	Water resource department
4	Location of disposal site	Location of disposal site will be finalized prior to commencement of the excavation on any section of the project location. Executive Engineer is to approve the	Contractor	Water resource department

		disposal site.		
Construction stage/phase				
5	Planning for Traffic Diversions and inconvenience to neighbourhood	The site control plans shall contain details of temporary diversions, details of arrangements. Public would be informed through signboards. The Contractor will ensure that the diversion/ detour is always maintained in running condition to avoid concerned disruption. The contractor will also inform of changes. The contractor will take all necessary measures for the safety of traffic as well as passage during construction work. However, as the scales of activities are low, highly significant inputs may not occur. The contractor will ensure that all signs, barricades, pavement markings are provided.	Contractor	Water resource department
6	Transporting Construction Materials and Haul Road Management	All vehicles delivering construction materials to the site are to be covered to avoid spillage of materials thus preventing pollution of environment. Contractor is to arrange for regular water sprinkling at least twice a day (i.e., morning, and evening) for dust suppression of the construction sites and unpaved site roads.	Contractor	Water Resource Department
7	Construction water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs and without unbalancing water supply. The contractor will take all precaution to minimize the wastage of water in the construction process.	Contractor	Water Resource Department

8	Emission from Construction Vehicles, Equipment and Machineries	Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of APPCB. The Executive Engineer will be required to inspect regularly to ensure the compliance.	Contractor	Water Resource Department
9	Noise Pollution: Noise from Vehicles, Plants and Equipments	The Contractor will conform the following: All plants and equipment used in construction shall strictly conform to any PCB noise standards. All vehicles and equipment used in construction will be fitted with exhaust silencers and comply with prevailing standards. Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.	Contractor	Water Resource Department
10	Personal Safety Measures for Labour	Contractor will provide: Protective footwear, and gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc. Welder's protective eye-shields to workers who are engaged in welding works Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. -The contractor will strictly follow the statutory child labour act.	Contractor	Water Resource Department

		The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. Contractor will provide facemasks for use to the workers when paint is applied in the form of spray.		
11	Precautionary / Safety Measures during Construction	The contractor will comply with all the precautions as required for the safety of the workmen as per the "Construction Workers (regulation of employment and conditions of service) Act 1996" as far as those are applicable to this contract. The contractor will make sure that during the construction work: All relevant provisions of local laws of the land will be adhered to. Adequate safety measures for workers during handling of materials at site will be taken up. The contractor will comply with good practices regarding safe scaffolding, ladders, working platforms, gangway etc. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.	Contractor	Water Resource Department
12	Risk from Electrical Equipment	The contractor will comply the relevant electrical safety legislations. The Contractor will take adequate precautions to prevent danger from electrical equipment.	Contractor	Water Resource Department

		All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant state codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Executive Engineer.		
13	First Aid	The contractor will arrange for A readily available first aid kit including an adequate supply of sterilized dressing materials and appliances as per local guidelines at every workplace -Suitable transport to take injured or sick person(s) to the nearest hospital.	Contractor	Water Resource Department
14	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/ safety signs, hoardings written in at least Telegu and English wherever required or as suggested by the Executive Engineer.	Contractor	Water Resource Department

Under this environmental management plan necessary mitigation measures along with a broad cost (indicative) and institutional mechanism for mitigating the impacts has been listed below. The implementation of all the management measures suggested should commence concurrent to project execution, so that all the environmental concerns going to arise may be resolved before the project is commissioned.

List of BIS standards related to safety aspects during various stages of construction, installation, erection of different components and appurtenance of river valley projects, including inspection, observation given in the Table 4.7.

Table 4.7 List of BIS standards related to safety aspects

S.No.	Code Number	Title
1	IS 10386 (Part 1):1983	Safety code for construction, operation and maintenance of river valley projects: Part 1 General aspects
2	IS 10386 (Part 2):1982	Safety code for construction, operation and maintenance of river valley projects: Part 2 Amenities, protective clothing and equipment
3	IS 10386 (Part3):1992	Safety code for construction, operation and maintenance of river valley projects Part 3 Plant & machinery
4	IS 10386 (Part 4):1992	Safety code for construction, operation and maintenance of river valley projects Part 4 Handling, transportation and storage of explosives
5	IS 10386 (Part 5):1992	Safety code for construction, operation and maintenance of river valley

4.2.9 Impact on Increased Traffic

Increased use of existing public infrastructure i.e., road due to vehicular traffic involved in transportation of construction materials and earthmovers may cause congestion on roads. However, the state highway and the national highways in the district in general have been designed keeping in view the futuristic vehicular traffic. At present the level of convenience on the basis of traffic volume is “B” which shall not alter due to increased traffic on highways. However, due to increased traffic the impact shall be prominent on the village road (rural) and the level of confidence shall change from “A” to “B”. The increased traffic shall cause more fugitive dust emission and gaseous pollution, which when added to the existing concentration the resultant concentration shall be within the limits. Regular maintenance of road and copious sprinkling of water shall be carried. Transport trucks/tippers shall be properly maintained. Only PUC certificate issued vehicles shall be used. Avoiding of

overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it. Strict compliance of traffic rules and regulations shall be ensured. The movement of trucks/trippers/tractors for loading /transportation within the project area and haul road area shall be regulated by a trained supervisor who shall be responsible for the safety of vehicle movement and prevention of accidents or incidents associated with the vehicular movement.

4.2.10 Impact of Blasting

Blasting is accompanied by the generation of the dust and the fumes and fly rock which pose a significant danger to the people who are in the vicinity of the work site. It also leads to ground vibrations which cause the ground to vibrate in transverse, longitudinal and the vertical direction leading to its damage. Due to blasting the people of the nearby villages are always physiologically impacted as they are constantly under apprehension of damage to their structures. Blasting also causes air overpressure is a transient impulse that travels through the atmosphere. Much of the air overpressure produced by blasting has a frequency below the audible limit of 20 Hz. Air overpressure, both audible and inaudible, can cause a structure to vibrate in much the same way as ground vibrations It is a frequent cause of the complaints as a person senses air overpressure more than vibrations. The noise due to air over pressure is instantaneous a short lived and may cause annoyance to vulnerable people

Blasting shall have adverse impact on fauna using the area contiguous with the surrounding habitation area as habitat. The noise generation has an adverse impact on terrestrial fauna and avi-fauna. Intervention in the project area will impact butterflies and birds which are quite sensitive to noise and human presence. The traffic noise has detrimental effect on the survival rates and breeding success of such fauna which reside in the small habitats along road side communicating using acoustic signals. Sometime as a result of habitat loss and physical disturbance, the fauna shall move from the habitat along road side. Based on the field observations and interaction with local people and forest officials it was noted that the project area does not constitute part of any wildlife migratory routes and mining activities won't affect animal movement.

Mitigation measures

Various measures have been recommended to minimize the adverse impacts due to blasting:

- Proper design & development of blast hole.
- Use of non-electric system of blasting for true bottom hole initiation.
- Use of muffling mats to arrest the dust and fly rock.

Blasting for excavation is permitted only after securing the approval of the authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting is fixed by the authority.

4.2.11 Amenities for Workers and PPEs

Provisions shall be made for the housing of construction labour with all necessary infrastructure and facilities such as mobile toilets, mobile safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structure to be removed after completion of the period.

The contractor will make proper arrangements for maintaining high hygienic conditions in the colonies and labour camp, by providing good sanitation and drinking water facilities. Medicine should be distributed free of cost to the labour when required.

For ensuring workers safety and mitigation of impacts of air and noise pollution on workers directly exposed, provisions of Personal Protective Equipment (PPE) will be made. These will include helmets, welding shields, earmuffs, dust masks, safety harness for working at heights, gum boots, etc. In addition, fire extinguishers shall be installed at all critical locations on site during construction.

To ensure occupation health and safety of workers, annual occupation health check of all workers is proposed and budgeted.

4.2.12 Public Health and Allied Facilities

4.2.12.1 Public health

Project construction may bring about some changes in the socio-economic environment of the area including increased threats to the health of the community. Possible threats to public health are briefly discussed below along with the management measures.

- Chances of spread of new diseases in the area due to migrant workers.
- Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase are expected mainly for the labour.
- Chances of occurrence of gastroenteritis, cholera, and typhoid in the labour camp.
- Possibility of some site accidents cannot be ruled out and therefore, use of PPEs should be strictly followed and provisions should be made for emergency medication and ambulance
- Worker’s health and hygiene issues need to be addressed to minimize the impact on this count especially for female workers with/without children.

4.2.12.2 Medical facilities

Following medical facility will be provided in the project area to combat water and vector borne diseases and also at construction site to ensure safety and health of workers during the entire construction phase:

One fully equipped ambulance needs to be procured to provide prehospital care to accident victims during construction phase. The ambulance should always be stationed near major construction site where risky operations are taking place.

Provisions have been made for strengthening existing PHCs and PHSCs in the area.

Provisions have been made to assist health department to combat outbreak of water/vector borne diseases.

4.2.12.3 Health extension activities

The health extension activities will have to be carried out in the villages situated within the study area. It is important to inculcate hygienic habits of environmental sanitation especially with respect to water pollution by domestic wastes.

A medico will be engaged to make regular visits to these villages and organize health promotional activities with the active participation of the local village leaders, NGO's and available local health functionaries. The health functionaries would undertake the following tasks as a part of health promotional activities:

Organize awareness programs and medical camps to make people aware about common diseases and communicable diseases like Covid-19, Tuberculosis etc. in the region. This should include poster campaign, awareness camps, medical camps for health check-ups and vaccination/ treatment, etc.

Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency.Close interaction to be maintained with health department functionaries of the state government.

In case of verifiable health problem arising due to activities of the project, necessary health care facilities shall be provided.

4.2.13 Energy Conservation Measures

Energy Conservation Measure (ECM) are to be planned and implemented during construction phase either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count. These measures can affect a variety of resources mainly forest, from negative impact of fuel wood collection by

stakeholders as well as by labors during construction period. To mitigate such impacts, feasible measures will be adopted to help minimize pressure on forest.

4.2.13.1 Community kitchen

The project developer would make sufficient arrangement for the establishment of at a community kitchen. This will be established near the project labour colony. The kitchen should provide food to the labour at subsidized rates. The facility should maintain proper hygiene while preparing and supplying food, with adequate arrangement for waste collection and disposal. In addition, two canteens are also proposed for labour near major construction sites to provide tea/snacks at subsidized rates.

4.2.13.2 Kitchen fuel

During the construction period of the project, many families may prefer cooking on their own instead of using community kitchen. The project authority should make LPG and/or kerosene available to these migrant workers. The supply of LPG and kerosene can be ensured on regular basis at subsidized rates.

4.2.13.3 Efficient cooking facilities

Project authority should also take measures for reducing the fuel consumption. The authority should provide pressure cookers and solar cookers to the families of migrant workers as well to local villagers. Accordingly, budget has been allocated for the supply of cookers. This facility will also increase the work efficiency of migrant workers and they will also get proper daily diet.

4.2.13.4 Solar Lantern

Provision of solar lantern has also been made in the project budget and these will be distributed free of cost to labor camps and villagers for use.

Awareness Programmes on Energy Conservation

Special awareness programmes against tree cutting should be held, which should concentrate on the awareness of labor families on environment conservation and sustainable development for the future generations. Thus, issues like saving trees, electricity and water should be covered in such programmes.

4.2.14 Biodiversity Conservation

The main objective of Biodiversity Conservation and Management plan is sustainable use of natural resources, which involves scientific management of natural wealth vis-à-vis

developmental activities, is likely to affect these resources. The threats to natural terrestrial and aquatic ecosystem generally arise due to by anthropogenic activities that may arise because of construction and associated activities of project. A detailed biodiversity conservation and management plan has been proposed and the main objectives of said plan are as follows:

- Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities
- Conservation and preservation of natural habitats in catchment area
- Mitigation and control of project area by taking up afforestation and soil conservation measures
- Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing man animal conflict.

4.2.15 Green Belt Development Plan

Although the vegetation loss due to various project appurtenances will be compensated as a part of compensatory afforestation. However in addition to above, greenbelt around the perimeter of various project appurtenances, selected stretches along the periphery of canals, etc. was developed by Water Resource Department. Saplings of 5000 numbers in 2022-23 financial year and 1000 in 2023-2024 financial year will be developed around the canals, bund areas and quarry sites.

The general consideration involved while developing the greenbelt are:

- Local/nature trees growing upto 10 m or above in height with perennial foliage will be planted around various appurtenances of the proposed project.
- Planting of trees shall be undertaken in appropriate encircling rows around the project site.
- Generally fast growing trees will be planted
- Since, the tree trunk area is normally devoid of foliage upto a height of 3 m, it may be useful to have shrubbery in front of the trees so as to give coverage to this portion.
- The plantation will be at a spacing of 2.5 * 2.5 m. About 5000 trees per hectare will be planted. The project proponents in association with the State Government will also do the plantation and maintenance of the plantation area.

4.2.16 Land Restoration and Landscaping Plan

During construction phase of the project, number of temporary construction sites and working areas will come up. To restore these areas to its original landscape as much as possible and retain its aesthetic values following restoration measures have been suggested.

Different project related activities will require acquisition of government as well as private land. In addition to the habitat disturbance, project related activities will also result in the accumulation of large amounts of temporary dumps at various construction sites, which need to be either relocated or as an alternative can be utilized for landscaping. After completion of the construction work, these areas are required to be restored to their original condition. Various engineering and biological measures have been suggested for the restoration of proposed project affected areas. Following measures would be adopted at for the rehabilitation and landscaping of colony areas and construction sites.

- On completion of construction area will be restored by proper leveling
- Retaining walls will be built to avoid the landslides and slips. Slopes will be covered with geotextiles. The open area will be covered with the vegetation. Ornamental plants and trees will be planted in rows along the roads and lanes, as discussed under green belt.

4.3 Environmental Management Plan during various Project Phases

Based on the evaluation of impacts and baseline conditions, an Environmental Management Plan (EMP) has been delineated to mitigate the adverse impacts. The EMP includes formulation, implementation and monitoring of environmental protection measures. The EMP features guidelines and methodologies to be adopted at different stages of the project for mitigating the impacts of various activities. The EMP is herein outlined after taking into account the various Acts, Rules and Regulations/Standards concerned with the environmental management. Thus, it is a planned and integrated programme aimed at ensuring that both identified and unidentified impacts that may arise during the various phases of the project are brought to an acceptable level.EMP has been prepared addressing the issues like:

- Pollution control/mitigation measures for abatement of the undesirable impacts caused during the construction and operation phase of the project.
- Details of management plans (air pollution control devices/measures, utilization of treated sewage, solid waste management plan etc.)
- Institutional set up identified/recommended for implementation of the EMP.
- Post project environmental monitoring programme to be undertaken

- Expenditures for environmental protection measures and budget for EMP.

4.3.1 Cost for implementing Environmental Management Plan

The summary of cost estimate of various environment management plans as contained in this reportis provided in Table 4.8.

Table 4.8 Cost estimate of various environment management plans

S.No.	Description	Capital Cost (Rs. Lakh)	Annual recurring cost (Rs. Lakh)
1	Energy Conservation Measures	20.0	--
2	Sanitation and Solid Waste Management	10.0	5.0
3	Compensatory Afforestation	50.0	20.0
4	Greenbelt Management Plan	25.0	10.0
5	Muck disposal Management	55.0	--
6	Labour Management Plan	30.0	--
7	Environmental Safeguards during Construction	20.0	5.0
8	Landscaping and Restoration of construction sites	20.0	--
9	Public Health Delivery System (OHS)	25.0	5.0
10	Environmental Monitoring Program	--	7.0
11	Contingencies	--	10.0
	Grand Total	**255**	**62.0**

Capital EMP budget: Rs. 255 Lakhs

Recurring cost per annum: 62.0 lakhs

Chapter 5

RISK AND DISASTER MANAGEMENT PLAN

5.1 Risk Assessment

During the development and operation of the project, there are a variety of hazards that might disturb regular activities and result in disasters such as fires, mechanical failure, and explosions, to name a few.The imminent threats or risks shall be explored and addressed, as well as a disaster management strategy established with the goal of taking preventative measures to avert disaster and acting after the disaster to minimise damage.Following problems may be encountered during the construction phase at the project site.

- Accidents due to explosives/blasting
- Failure of stripped slope
- Accidents due to HEMM
- Sabotage in case of magazine

The following safety measures will be strictly followed in the current project to address the above hazards/disasters:

- Handling of explosives, charging and blasting shall be carried out by competent persons only.
- Provision of a safe location for the magazine, complete with suitable fencing and the requisite watch and ward.Adequate safety equipment will be provided at magazine and project site.
- Regular maintenance and testing of all project equipment/machinery and transport vehicles as per manufacturers guidelines
- Entry of unauthorized persons will be prohibited.
- Firefighting and first –aid provisions in the project office/complex area and ensuring periodic checking of worthiness of firefighting and first aid provision.
- All individuals working in hazardous areas should receive training and refresher courses.
- As a part of disaster management plan, a rescue team will be formed by imparting specialized training to select project staff.

5.1.1 Possible Hazards

There are various factors which singularly and severally can cause disaster in irrigation project. The project activity is associated with many hazards which are covered in the following sub sections:

5.1.1.1 Blasting

Blasting accidents are mostly manifested as projectiles that occasionally travel beyond the danger zone and invade the project boundary. It is largely due to overcharging of blast holes and also during secondary blasting. During initial and final blasting operations flying rocks are encountered. If the ground vibration induced by blasting is not correctly scaled in the previous blasting cycle, it might result in displacement of adjacent areas and fallout of loose rock-mass. The following measures are suggested to avoid accidents due to blasting:

- All blasting operations shall be supervised by a competent person appointed for the purpose and strictly conducted as per guidelines contained
- Danger zone area falling within a radius of 500m from the blast site shall be demarcated.
- Guards shall be posted at all access points leading to the blast area to prevent and control movement of persons/ stray animal.
- All employees and equipment shall be cleared off the blast area to a safe location prior to any scheduled blasting; and
- Audible signals such as sirens, whistles and mikes etc., shall be used to caution the workers, passer-by about the scheduled blasting events.

5.1.1.2 Heavy machinery

Most of the accidents during transport of dumpers, excavators, dozers and other transport vehicles are often attributed to mechanical failures and human errors and can be significantly averted by adapting to following:

- All HEMM and transport vehicle movement within the project area should be carried out under the direct supervision and control of the management.
- All project machinery and vehicles should be periodically maintained and weekly checked by a competent person authorized by the management.
- During the day/night, a conspicuous sign board should be provided at each and every bend to guide the operators/drivers; and

- To avoid dangers while reversing the trackless vehicles, especially at the embankment and tripping points, all areas for reversing of vehicles should, as far as possible, be made man free, and should be a light and sound device to indicate reversing of trucks/project machinery.

5.1.1.3 Storage of explosive

The explosive magazine shall be located outside the project area. For the purpose of transportation of explosives, explosive van shall be deployed. Fire and explosion are the most common hazards connected with the storage, transportation, and handling of explosives. The rules as per Indian Explosive Act-1983 and Explosive Rules-2008 should be followed for handling of explosives, which includes transportation, storage and use of explosives.

5.1.1.4 Fuel storage

All project machinery will run on diesel, and it will be stored in the central workshop area of the project.

5.2 Disaster Management Plan

Preparation of "Disaster Management Plan" for any construction of reservoir projects is a prerequisite, as catastrophic situation, which is highly unpredictable, may occur any time in the life span of project. To tackle the catastrophic situation development of an effective "DMP" is imperative to establish co-ordination between District Administration and Project Authority. Line/Assisting agencies from district administration side are Fire Services, Police Department, Medical Services, Consumer Affairs and Public Distribution Department, Transport Department, Communication Department, Meteorology Department, Irrigation and Flood Control Department, Civil Defence Forces and Voluntary Organizations. Coordination and close cooperation among all the agencies involved is essential for the timely and successful implementation of "DMP" to provide relief to the affected at the time of need.

5.2.1 Purpose of the Plan

- Basic purpose of this plan is to develop, implement and maintain an integrated emergency management system for protection of people, property and the environment in the event of emergency.
- The ultimate goal is to reduce the project area's vulnerability to emergency situations in order to save lives and protect property. This will be accomplished by developing capabilities to mitigate the effects of, prepare for, respond to, and recover from emergency situations that may affect the project area.

5.2.2 Scope of the Plan

Well-defined role and responsibilities of assisting agencies in “DMP” is required, so that proper planning, according to the intensity of disaster could be made by agencies. The Chief Co-ordinator assesses identification of the event and its intensity in the affected area. He should be authorized to declare “disastrous situation” based on detailed information available, so that assisting agencies swing in action to mobilize their resources in affected area. Based on the intensity of disaster in project a proper relief programme may be implemented by District Administration with the help of assisting/line agencies.This Disaster Management Plan/Emergency Action Plan covers technological emergencies arising out of construction accidents and covers the following:

5.2.2.1 Inundation

The downstream areas vulnerable to inundation by reservoir failure and subsequent floodwater. The selected reservoir failure and corresponding flood for this purpose corresponds to the extreme conditions that yield maximum possible flow storage at the downstream locations. The extreme condition is estimated from various parameters like breach width, minimum time of failure and Manning’s coefficient. The inundation map has to be prepared with the help of water surface elevation profile, which has to becomputed for maximum flood discharge elevation and at various downstream locations.

Based on the reservoir failure analysis, the flood wave is expected to inundate some low-lying areas in the five km downstream of the reservoir site. This means that very little time would be available for execution of any rescue and/or evacuation plan. Therefore, the Disaster Management Plan has been devised mostly for preventive measures. As a first measure of the management plan it is suggested that surveillance and monitoring schemes be implemented simultaneously with the design and detailed engineering stage of the project. It should continue during the construction phase through impoundment of reservoir, early operation period, and operation and maintenance phases during the life of the reservoir. On the onset of high discharge period on all dates the electricity, public announcement system, power generator backups etc; should be thoroughly checked.

5.2.2.2 Emergency Scenarios

Emergency scenarios arising out of existing project status and that anticipated in the immediate future expressed by the company management personnel and those of the

concerned agencies and the project risks as envisaged with mutual thinking of the company and agencymanagements.

5.2.3 Disaster Scenarios for the Avulapalli Reservoir

The disaster scenarios are classified into 2 categories:

A. Natural calamities
   i. Flood
   ii. Landslide
   iii. Earthquake
B. Man-made disaster
   i. Fire
   ii. Explosion
   iii. Fire and Explosion

Flood

Flood can occur due to heavy rainfall, Cloud burst to the upstream, and Heavy debris falling into the canal and bathe reservoir from the adjacent hills or hillocks. It results in possible failure of the reservoir. Under such circumstances, there is a possibility of sudden release of huge quantity of water upto a maximum of 2.5 TMC into the downstream of the Avulapalli. Hence, there should be a offsite warning mechanism covering the Somalamanadal in case of any such unwanted happens takes place.

Landslide

Compounded by the heavy rainfall and Geo-morphologic habits the landslides of major and minor scale keep occurring during construction phase. Following areas are susceptible to landslides

a) Water conductor systems
b) Hills or hillocks surrounding the reservoir

Geological Survey of India (GSI) is also associated with Water Resource Department, for supervision and advice on tunneling/ road construction and/or any other vulnerable area of construction.

Earthquake

Chittoor District falls in Zone II as shown in Fig 5.1 below. As per the project site location, the dam falls under Seismic Zone- II of seismic zones of India map which has the horizontal coefficient of 0.06 (which is low) with Importance factor of 3 as per IS: 1893- 1984(PA.RT-1) "Criteria for earthquake resistant design of structures". These aspects were covered in the

stability analysis the influence of seismic load is already considered. The Design / Stability analysis of Earth bund is finalized considering various loading conditions including earthquake condition for steady seepage on downstream and reservoir full on upstream in line with provisions in Appendix A(clause 5.1.1) of IS 7894-1975 duly adopting minimum desired factor of safety value. The design seismic forces are computed based on importance factor of the structure and its soil foundation system. The factor of safety values obtained for steady seepage with seismic condition is 1.518 and for sudden drawdown -with seismic condition is 1.197 against the minimum desired value of 1.0, which implies that the earth dam designed is very much safe against seismic force.

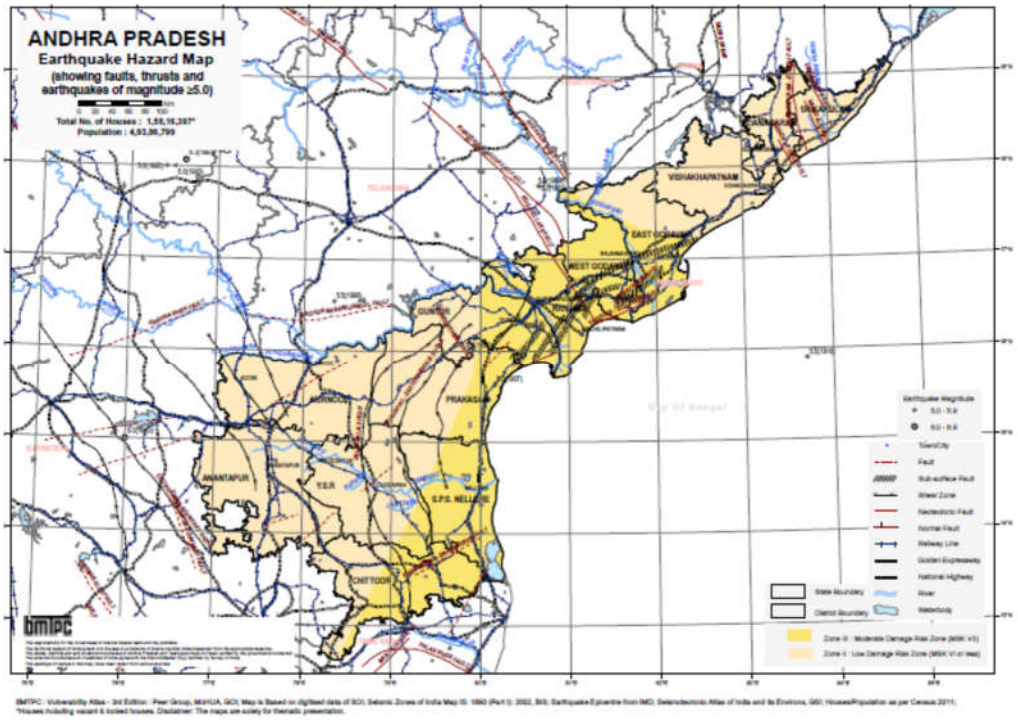


Fig 5.1 Seismic Zones of Andhra Pradesh

Fire and Explosion

Following are the areas where fire or explosion may take place due to improper maintenance or mishandling

a) Transformer and switchgear room area
b) Storages of explosives

Reporting of Incident

Any person (employee of Water Resource Department or contracting agency or Security) who sees the incident shall inform/report to the Emergency Control Centre (ECC) through the nearest office (Water Resource Department, contracting agency/any security point) through telephone/mobile or by shouting.

5.2.4 Communication systems

An efficient downstream warning and communication system is essential for the success of Emergency Preparedness Plan. The population living downstream should be educated about the difference between a high flood and reservoir failure situation. In case of emergencies, telecommunication plays a critical and crucial role in mitigating the problems faced by people during and after calamity. Any efficient communication system in disaster management should have the following characteristics:

- Reliability
- Ease of maintenance
- Quick deployment
- High tolerance to extreme adverse conditions
- Compatibility on alternative power sources, and
- Fast transportability and easy deployment

5.2.5 Evacuation Plan

The Emergency Action Plan also includes evacuation of people at risk and procedures for implementation are based on the local needs. Generally, the following procedure forms the basis of the plan:

- Demarcation and prioritization of areas to be evacuated
- Notification procedures and evacuation instructions
- Safe routes, transport and traffic control
- Safe areas and shelters, and
- Functions and responsibilities of members of the evacuation team

5.2.6 Key Persons

Following positions of key persons at the site included for the project

1. Executive Engineer
2. Dy. Executive Engineer
3. Asst. Executive Engineer
4. Project Executive In charge (from the contracting firm / company)

Project Manager of the site contracting agency assumes the role of IC in case of any emergency. For silent hours (night time or on holidays) the senior security person will handle the emergency with the help of other security personnel till arrival of the seniors.

Chapter 6
ENVIRONMENTAL MONITORING PROGRAM

6.1 Introduction

Environmental Impacts and mitigation measures are discussed in the previous chapters alongwith the budget for implementation. To assess the effectiveness of such measures, it is important to monitor environmental parameters on regular basis to take timely corrective andpreventive actions as and when required. Environment monitoring program is discussed in the present chapter along with the budgetary estimate for its implementation.

Environmental monitoring provides feedback about the actual environmental impacts of a project after implementation of mitigation and management measures. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. The monitoring program will indicate where changes to procedures or operations are required, in order to reduce impacts on the environment or local population.

6.2 Project Level Monitoring Committee (PLMC)

The effective implementation of the recommendations mentioned in the EMP and monitoring progress should be monitored by the Project Level Monitoring Committee (PLMC).The PLMC will be formed which includes the representative from regional office of MoEF&CC, State Forest Department, District Administration, Environmental experts from Academic Institutions/ State Universities, APPCB, Fisheries department, Project Authorities and NGOs and stakeholders from PAFs/ affected villages. It will start functioning from the date of starting of construction work in the Project and will function until the satisfactory implementation of all the EMPs. At least periodic six monthly monitoring of progress of EMPs will be carried out throughout the construction period. The Committee would also check the level of pollution in air (level of SPM, SOx, NOx), water (chemical and physical parameters), Noise levels and silt load in the rivers etc. as per their requirement.

6.3 Environment Management Cell (EMC)

It has to be proposed to create the Environmental Management Cell (EMC) in the Project as a very strong group dedicated to effective implementation and monitoring of various environmental management plans. This group will also need to have a constant interaction

and liaison with all stakeholders and regulatory authorities for smooth implementation of the EMPs.

The Cell would comprise of the officials from Project; however, representatives from Forest/WL Department., District Administration and Project Affected Families/ Villages may also include for their valuable suggestions in the implementation of EMPs. The EMC has been proposed to be formed with the following aims and objectives:-

- Overall planning of environmental management plans in coordination and consultation with concerned State authorities and other stakeholders.
- Coordination with the State Forest & Environment Departments, Fisheries department., etc. with respect to implementation of various plans or programs such as CAT Plan, Biodiversity Management Program, Fisheries Conservation and Management Plan etc.
- Coordination with various departments of the project for effective implementation of the EMPs like Restoration Plan for Quarry sites and Landscaping, Biodiversity Conservation and Management Plan, Rehabilitation & Resettlement and Local Area Development Plan etc.
- Regular monitoring of the statutory provisions of the MoEF&CC, SPCB and other Govt. Agencies
- Regular monitoring of environmental obligations as per Contract Agreement w.r.t. major contracts.
- Data collection from concerned departments and preparation of status report in respect of various ongoing environmental protection measures for the information and appraisal of various regulatory authorities, PLMC and Water resource Department.
- To properly address the queries of stakeholders/ govt. departments regarding EMPs and any other issue pertaining to environmental aspects

6.4 Surface and Ground Water Monitoring

It is proposed to monitor ground water levels at 2 locations in command area twice a year for pre and post monsoon period. In addition, surface water quality will also be monitored at 2 locations twice a year for pre and post monsoon period during the project construction phases i.e. a total of 4 water samples per season for 3 seasons in a year.

6.5 Soil Quality Monitoring

It is proposed to monitor soil quality at 4 locations twice a year for pre and post monsoon period. Parameters proposed to be analyzed shall be; Texture, Porosity, Bulk Density, Water Holding Capacity, pH, Electrical Conductivity, Calcium, Magnesium, Alkalinity, Chloride Content, Sodium, Organic Carbon, Available Phosphorus, Available Nitrogen, Available Potassium and Salinity.

6.6 Land use/Land cover Monitoring

Land use and land cover needs to be monitored every year for three years during/after commissioning of project using latest high-resolution satellite images.

6.7 Air Quality

Ambient air quality monitoring during construction phase will be carried out as per the requirement of State Pollution Control Board. Three seasons a year monitoring is proposed; spread out near construction sites at four locations during construction phase. The parameters to be monitored are PM10, PM2.5, Sulphur dioxide (SO2) and Nitrogen Oxides (NOx). The frequency of monitoring shall be twice a week for four consecutive weeks at each station for each season.

6.8 Noise

Noise levels from vehicular movement, operation of various construction equipment shall be monitored during construction phase at major construction sites. The frequency of monitoring shall be once in 3 months. A sound level meter will be purchased and monitoring will be carried out inhouse.

6.9 Ecological Monitoring

It is proposed to carry out periodic ecological monitoring in the area to ensure minimum damage to flora and faunal habitat during construction period and also to monitor the implementation of tree plantation. Efficacy of conservation measures implemented under plantation/afforestation and soil conservation measures, and their effects on flora and fauna, survival rate of species planted, and status/ survival rate of bio-engineering and engineering structures for controlling soil erosion which should be evaluated and monitored under the head monitoring of ecosystem. Therefore, once a year monitoring is proposed for 3 years.

6.10 Financial Requirement

Financial requirement has been assessed for above aspects as capital cost is Rs 255 Lakhs and recurring cost is Rs 62.0 Lakhs.

Chapter 7

RESETTLEMENT AND REHABILITATION

7.1 Introduction

The resettlement and rehabilitation plan not only focuses on the mitigation measures of adverse impacts on the project affected families but it also includes measures for community development, local area development, infrastructural development for local population. The implementation of an effective R & R plan is essential. The villages submerged in the Avulapalli Balancing Reservoir have limited accessibility owing to poor road connectivity and poor infrastructural facilities. The present R&R plan is mainly based on the National Policy on Resettlement & Rehabilitation of 2013 and model R&R plan of proposed project, which has been put forward to government of Andhra Pradesh. The R&R plan includes relief packages as per G.O. RT. No. 323 dated 24.06.2020 which has been issued to similar projects in Andhra Pradesh which can be applicable to this project as a comprehensive social development plan for the project affected families.

7.2 Land requirement

The total land requirements for the various components of the proposed project have been estimated about 1300 Acres comprising of 612 Acres of private land, 688 Acres of government land. The breakup of the land requirement for the different project components has been given in Table 7.1. The submerged area under first phase is 473 ha (1168 ac) only. When the second phase work is planned, then the rest of the area (132 ac) need to be considered as submerged area.

Table 7.1 Component wise breakup of land required for construction of Avulapalli balancing Reservoir

S.No.	Project Component/ Description	Area(Ha)/type of land			Total Land in acres
		Forest Land	Revenue/ Private Land in acres	State land/ Govt. Land in acres	
1	Avulapalli balancing Reservoir	No	612	688	1300
During phase 1 the total area under submergence is estimated as 1168 ac.					
Allocation of Land Acquisition grant is Rs.58.830 Cr					

7.3 Project affected Villages

The Table 7.2 shows the details regarding the displacement of families and population and land acquisition from the project affected villages. A total of 03 Revenue villages are going to be affected directly or indirectly by the construction of project. These three revenue villages are Ramakrishnapuram, Baireddypalli and Devarlakuppam. The 03 settlements consisting of 170 households are going to be affected out of which 08 households with a population of 08 persons belonging to schedule tribe community are going to be displaced (Table 2). Total 170 households will be displaced by the proposed construction of reservoir related activities.

Table 7.2 Submergence details of Avulapalli Balancing Reservoir

S.No.	Name of the Villages submergence within the Foreshore area	No of dwellings submerging in foreshore					Number of people		
		SC	ST	OBC	OC	Total	OBC/OC	ST	Total
1	Ramakrishnapuram	-	-	28	40	68	471	08	495
2	Baireddypalli	-	-	28	29	57			
3	Devarlakuppam	-	08	18	19	45			
Total						**170**			

Source: DPR

7.4 Submergence Details

The table 7.3 shows the details regarding the submergence area contour levels and Table 7.4 submergence of villages, village wise area in the proposed balancing reservoir. The proposed project does not involve the submergence of any monuments, archaeological sites but temple, school and cattle sheds are involved in submergence.

Table 7.3 Submerging area elevation in Avulapalli Balancing Reservoir

S.No.	Name of the Village	Lowest level	Highest level
1	Devarlakuppam	+642 m	+651 m
2	Baireddypalli	+637 m	+641 m
3	Ramakrsihnapuram	+ 636 m	+643 m

Table 7.4 Village wise submergence of the area (Ha)

S.No	Name of the Village	Area (Ha)
1	Ramkrishnapuram	3.811
2	Baiyareddypalli	5.326

3	Devulakuppam	1.280
Allocation of R&R grant is Rs. 25.88 Cr		

7.5 Resettlement Action Plan

The project proponent has prepared the R&R benefits & plan for Project Affected Families (PAF) as per the "Right to fair compensation and Transparency in Land acquisition, under Rehabilitation & Resettlement Act, 2013". This activity has been completed with focus group discussions and extensive interaction with the local people. Construction of the project will require acquisition of land from the villages located along the project alignment. As per the R&R study carried out for the project, a total of 170 households (PAHs) and 495 persons (PAPs) will be affected by the project. The Report on Resettlement Action Plan (RAP) has been submitted. The document has been examined jointly by Department of Revenue and Department of water resources, Govt. of Andhra Pradesh for this approval has been initiated, the Cost on this account had been incorporated in the Project Costing accordingly Govt of Andhra Pradesh sanctioned for an amount of Rs. 84,11,84,000.,(Eighty four Crores eleven Lakhs and eighty four thousand only) towards Provision for Land Acquisition and R&R.

7.6 Resettlement and Rehabilitation Package

The details of displacement of human settlements and population, livestock and otherhousehold assets have been obtained through the field survey whereas the details of land acquisition in different project affected villages have been obtained from the concerned Tahsildar. Necessary consultations were held with the revenue officials, documents regarding land acquisition were obtained, and the data from these documents have been used for preparation of the Resettlement and Rehabilitation plan.

As stated above, the R&R policy adopted for this project is based on the National Policy on Rehabilitation & Resettlement Act, 2013. However, the definitions of various terms referred to in the plan for the purpose of relief, rehabilitation and or resettlement are based on the issued G.O. Rt No. 641dated 14.09.2016 existing norms by the state of Andhra Pradesh for such projects.

7.7 Breakup of the R & R Package

Compensation against

i) Land: Government Land allotted for house plots.

ii) Structures such as buildings etc:

Permanent: 162

Temporary: 08

Type of structures: Concrete structure

Type of valuation

GOVT : 20 Cr

PVT :23 Cr

School : 30 Lakhs (Not in use)

Temples etc:50 Lakhs

Cattle shed:50 Lakhs

Land less grant

Grant for seed and fertilisers : No

BPL families grant :No

Grant for organisations self-employed: No

Grant for construction of cattle shed : No

Transportation grant : No

Rehabilitation grant : As per G.O.Rt.No.641Dated:14.09.2016

Subsistence grant : No

Annuity policy : No

Marriage grant : No

Tribal grant : No

Fishing rights : Fisheries Department.

Stamp duty and registration charges: No

R & R Colony : No

Compensatory grant disbursement package monitoring Authorities: Joint Collector, Chittoor

Chapter 8
PROJECT BENEFITS

The Water Resources Department, Govt. of Andhra Pradesh proposed the project after completion of phase one, will provide drinking water to the around 2.76 lakh people and irrigation water facility to irrigate 9700 ha of cultivable land of Chittoor districts of Andhra Pradesh. It brings in long-term relief to the people and the livestock during the times of drought when even drinking water is scare. The people of en-route up land villages along the alignment 4no.of mandals in Chittoor District will get benefit on the considerable increase in availability of water for drinking and other domestic activities, growth and yield of crops due to supplement of water for irrigation. It may generate livelihood opportunities and will increase thesocio-economic status of the people. In the present project, the total anticipated ayacut proposed to be covered is 9700 ha in the region based on the water inflows during flood days received into the Reservoir. It generates work to the people in the project area during construction phase. The project will help in combating the impact of climate change on water sector in the region, as it is part of adaptation plan and reduction of climate change impact.

The possible benefits due to the construction of Avulapalli Balancing Reservoir are:

- ✓ There will be considerable increase in Ground water levels in upland areas of this part of Chittoor district due to the supply of water to the cultivable lands.
- ✓ Protection and improvement of the overall ecological environment.
- ✓ Improvement in quality of life of people by ensuring availability of organized and flexible schemes and plans for implementing short- term and long-term water supply infrastructure improvements suitable for future development within each uncovered area.
- ✓ Opportunities for improvements in institutional and organizational capacity for sustainable solutions, with possible full cost recovery and coordination among various institutions for cost-effective capital improvements and operation and maintenance activities.
- ✓ With this proposed project, standing horticulture crops like Mango, Sweet Orange, Pomegranate etc. will be protected in drought conditions there by earning profits instead of incurring loss to the farmers.This in turn generates currency to the govt exchequer.

- ✓ With this project, more ayacut will be brought in to cultivation of horticulture crops instead of regular agriculture crops.
- ✓ The proposed project will helpful to establish industrial infrastructure, ancillary industries, processing units, Agro Product industries, Fisheries, Dairy farms etc. in future.
- ✓ The Prestigious Chennai - Bengaluru Industrial Corridor Project which is taken up by the Govt.of India runs through Chittoor, Palamaneru in Chittoor District which is proximity to this proposed project area and water needs to this project will be supplied with this scheme.
- ✓ Improved crop productivity (Crop output per unit water- more crop per drop) Improve the overall GDP of the state.
- ✓ This will reduce the labour migration and improve employment to locals. Positive impact on poverty reduction through increased productivity and increased employment opportunities.
- ✓ This project will enable availability of safe drinking water to the people. This will improve the quality of life and increase the availability of productive time, which can be spent to improve the earnings of the individuals.
- ✓ Improved water resources planning and management for overall economic development. Enhanced ability of farmers to afford better education to their children, build better homes, afford better healthcare, and provide better living conditions to their family.
- ✓ With this proposed project, supplying of water to the ayacut in time and for the required period will enhance the output enormously. It will generate revenue to the farmer rather than incurring heavy loss & debts that occur due to investment before and during the cultivation process of crops.
- ✓ With this project, living standards, social standards, economic standards of people will be improved and upliftment of distressed due to lack of water for irrigation and drinking purposes.
- ✓ The proposed project is intend to create drinking water to more than 2.76 lakh population and irrigation facilities in the command region to feed 9700 ha of ayacut of the region The area of ayacut Mandal wise given in the Table 7.1.

Table8.1Mandal wise ayacut details

S.No	Name of the Mandal	Area (Ha)
1	Somala	3981.200
2	Sodum	4645.200
3	Pulicherla	329.600
4	Piler	744.000

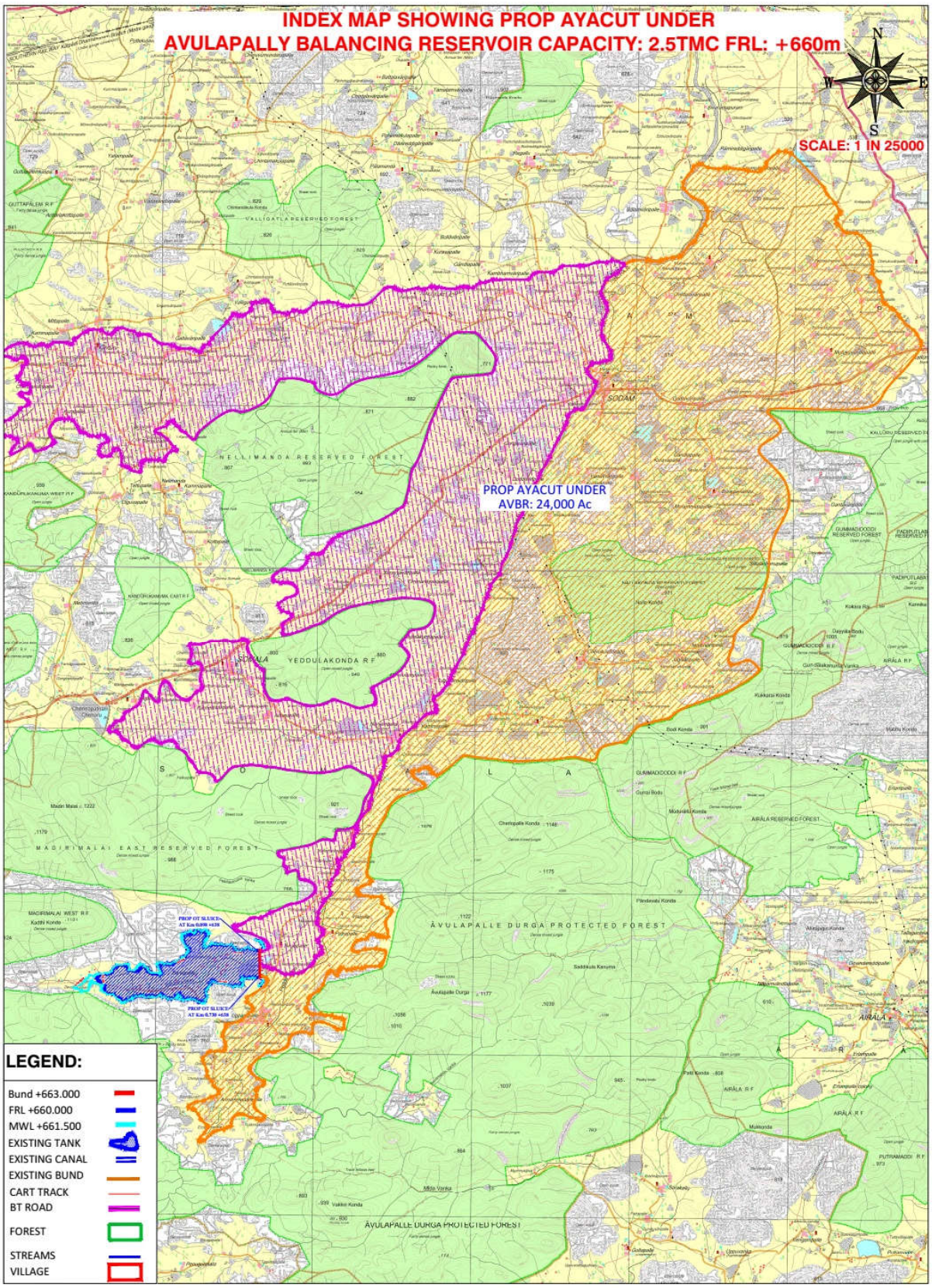


Fig 8.1 Map showing the ayacut under Avulapalli Balancing Reservoir

GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Water Resources Department –"(1) Formation of balancing reservoir near Mudiveedu village in Kurabalakota (M) (2) Formation of balancing reservoir near Nethiguntapalli (V) in Punganur (M) and (3) Formation of balancing reservoir near Avulapalli (V) in Somala (M) of Chittoor District" - Administrative Approval – Accorded – Orders – Issued.

WATER RESOURCES (PROJECTS.III) DEPARTMENT

G.O.RT.No. 461 Dated: 02-09-2020.

Read the following:

	1) From the Chief Engineer, NTR TGP, Tirupati Letter No.CE/NTRTGP/TPT/ TS/T6/IC/CTR /Balancing Reservoirs dt:06-06-2020.
	2) From Chief Engineer, NTR TGP, Tirupati Lr No. CE/NTRTGP/ TPT/ TS/ T6/IC/CTR /Balancing Reservoirs, dt:12-07-2020

&&&&

ORDER:

In the letters 1st and 2nd read above, the Chief Engineer, NTR TGP, Tirupati has requested the Government to accord administrative approval for the following works:

S. No	Name of the work	Amount (Rs. In Crores)
1	Formation of Mudiveedu balancing reservoir near Mudiveedu village in Kurabalakota (M) of Chittoor District	**772.01**
2	Formation of Nethiguntapalle balancing reservoir near Nethiguntapalle village in Punganur (M) of Chittoor District	**781.175**
3	Formation of Avulapalli balancing reservoir near Avulapalli village in Somala (M) of Chittoor District	**707.22**
	Total	Rs.2260.40

2. Government after careful examination of the proposal of Chief Engineer, NTR TGP, Tirupati, hereby accorded administrative sanction for the following works for an amount of **Rs.2144,50,00,000/- (Rupees Two Thousand One hundred Fortyfour Crores and Fifty Lakhs only)** in relaxation of FRBM norms:

S. No	Name of the work	Amount (Rs. in Cr.)
1	Formation of Mudiveedu balancing reservoir near Mudiveedu village in Kurabalakota (M) of Chittoor District	759.50
2	Formation of Nethiguntapalle balancing reservoir near Nethiguntapalle village in Punganur (M) of Chittoor District	717.80
3	Formation of Avulapalli balancing reservoir near Avulapalli village in Somala (M) of Chittoor District	667.20
	Total	**2144.50**

3. The above expenditure is debitable to the HOA:4700 CoI on Major Irrigation – 01 Major Irrigation (Commercial) – MH 133 SKD Galeru Nagari Sujala Sravanthi – GH 11 State Development Schemes – SH 27 C & D – 530 Major Works/531 Major Works.

4. The Chief Engineer, NTR TGP, Tirupati shall take further action in the matter subject to condition that he has to ensure the following before according technical sanction:

i)	The correctness of the provisions, rates and quantities proposed in the estimate.
ii)	CE, CDO approved drawings would be taken for estimate purpose and tenders should be called accordingly.
iii)	As three reservoirs would serve ayacut, they must be localized.
iv)	Any savings for these works shall not be used for any other new component of work.

5. This order issues with the concurrence of Finance (FMU.WR.II) Department vide their UO No. FIN01- FMU0MRAS(WR2)/187/2020-FMU-WR-II, dated:15-08-2020.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

ADITYA NATH DAS
SPECIAL CHIEF SECRETARY TO GOVT

To
The Chief Engineer, NTR TGP, Tirupati.
Copy to:
The ENC (I), Vijayawada.
The Director of Works & Accounts, Vijayawada
The Finance (FMU.WR.II) Department
The PS to Minister (WRD)
The PS to Special Chief Secretary (WRD)
File No ICD01/593/2020-PROJECTS-III(1160914)
SF/SC

//FORWARDED :: BY ORDER//

SECTION OFFICER

GOVERNMENT OF ANDHRA PRADESH

ABSTRACT

WATER RESOURCES DEPARTMENT – Sanction to a total amount of Rs.522.85 Crores (Rupees Five Hundred Twenty Two Crores and Eighty Five lakhs only) for payment to the Project Affected Families / Project Displaced families of 7 villages in Phase- II & III i.e. Thallaproddatur, Chamaluru, Yerraguoi, P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli, Kondapuram Mandal, YSR Kadapa District submerged under Gandikota Reservoir Project for impounding 26.85 TMC water in Gandikota Reservoir – Orders – Issued.

WATER RESOURCES (R&R-A2) DEPARTMENT

G.O.RT.No.323 Dated:24.06.2020.

Read the following:-

1. Go.Ms.No.53, I&CAD (P.W.T.G.P) Department , dated 10.06.2004.
2. G.O.Rt.No.4, Water Resources (R&R-A2) Department, dt:4.1.2017.
3. G.O.Rt.No.619, Water Resources (R&R-A2) Department, dt:4.9.2018.
4. G.O.Rt.No.184, Water Resources (R&R-A2) Department, dt:30.04.2020.
5. From the Commissioner (R&R), Water Resources Department,Letter Rc.No.515/CRR/C/2009, Dt.09.03.2020.
6. From the District Collector, Kadapa,Letter No.Rc.No.C/R&R /37/2019, dated:27.05.2020.

O R D E R:

In the reference 1st read above, the Government have given approval for Gandikota Reservoir. In the reference Second read above Government sanctioned an amount of Rs.479.35 Crores (Rupees Four Hundred seventy nine crores and thirty five lakhs only) to the PAFs/ PDFs of the 14 habitations in Kadapa District under Gandikota Reservoir Project , for their evacuation and rehabilitation to store 12 TMC of water in Gandikota Reservoir Project accordingly to the rehabilitation norms and were evacuated and rehabilitated.

2. In the reference 3rd read above, the Government have sanctioned an amount of Rs.146.295 Crores, with permission to utilize the balance amount of Rs.52.68 Crores (including interest) available out of the amount sanctioned vide G.O.Rt.No.04, Water Resources (R&R-A2) Department, dated:04-01-2017 (total 198.975 Crores) for R.S. Kondapuram village of Kadapa district as this village gets partially submerged within 12 TMC but was not included in the order at reference 2nd read above.

3. The Government have further decided to allow an ex-gratia @ Rs 3.25 lakhs over and above the entitlements (one time measure) according to the old R&R rules both for those who have taken R & R package and individual house as well those who have agreed for One Time Settlement (OTS) foregoing individual houses prospectively. This ex- gratia would be allowed only for balance PDFs of RS Kondapuram and other seven villages who would be displaced when the reservoir is going to store FRL that is 26.85 TMC subject to the condition that the notification for R & R was issued under the old rules (prior to the new LA and R & R Act 2013).

(PTO)

4. As a decision has been taken to store 26.85 TMC in coming monsoon, all the remaining Seven villages have to be resettled and entitlements of PDFs both for OTS and Non OTS, monetary benefits have to be paid including the ex-gratia for only those notified as PDFs under old R&R rules as decide at para 3 above . In the reference 5th and 6th above , Special Commissioner (R&R), Water Resources Department, Vijayawada and Collector, Kadapa , in the District Collector, Kadapa have submitted proposal for sanction of R&R package and OTS with ex-gratia as para 3 above to the PDFs of 07 Villages i.e. Thallaproduttur, Chamuluru, Yerragudi P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli Villages to impounding 26.85 TMC water in Gandikota Reservoir. The details of requirement of funds for remaining 7 villages under submergence of Gandikota Reservoir to store 26.85 TMC of water as detailed below in table 1 (submitted by Special Commissioner (R &R) and Table 2 (submitted by Collector, Kadapa) as below :

Table -1 (Three village)

Sl.No	Name of the Village	Total PDFs	OTS opted PDFs	Amount required @ Rs.6.75 Lakhs and @ Rs. 3.25 lakh ex gratia per PDF(Total Rs 10 lakh)	R&R opted PDFS with housing	Amount required@. 3 .75 Lakhs per PDF and @ Rs. 3.25 lakh ex gratia (total Rs 7 lakh)	Total Amount Required (Rs.in Crores)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Thallaproddatur	2869	1765	176.50	1104	77.28	253.78
2	Chamaluru	587	400	40.00	187	13.09	53.09
3	Yerragudi	525	521	52.10	04	0.28	52.38
Total		**3981**	**2686**	**268.60**	**1295**	**90.65**	**359.25**

Contd...

Table 2 (Four Villages)

S.No.	Name of the Submerged Village	OTS opted PDFs	Amount required for OTS opted	R&R Opted PDFs with	Amount Required for R&R with housing	Total No of PDfs	Total amount required
1	P.Ananthapuram,	677	67.7	0	0	677	67.7
2	Eturu	291	29.1	0	0	291	29.1
3	Regadipalli	175	17.5	99	6.93	274	24.43
4	K.Sugumanchipalli	423	42.3	1	0.07	424	42.37
Total		1566	156.6	100	7	1666	163.6

5. Government, after careful examination of the matter, hereby accord sanction to a total amount of Rs. 522.85 Crores (Rs.359.25 Crores + 163.60 Crores = 522.85) (Rupees Five Hundred Twenty Two Crores and Eighty Five lakhs only) for payment to the 5647 Project Affected Families / Project Displaced Families of 7 villages in Phase- II & III i.e. Thallaproddatur, Chamaluru, Yerragudi, P.Ananthapuram, Yeturu, Regadipalli & K.Sugumanchipalli, YSR Kadapa District submerged under Gandikota Reservoir Project for impounding 26.85 TMC water in Gandikota Reservoir. With this all PDFs would be resettled and Gandikota reservoir can be filled upto FRL of 26.85 TMC.

6. The District Collector, Kadapa shall ensure that the disbursement of the above said amount is done at the time of actual relocation and evacuation of the above said PDFs duly making sure that the PDFs getting compensation now under this package should vacate the village and do not settle down in any of the villages notified as submergence villages under Gandikota Reservoir Project. Those who have opted for OTS shall not be eligible for any further R and R package including housing.

7. The expenditure sanctioned above shall be debitable to the following Head of Account: 4700- Capital outlay on Major Irrigation, 01-Major Irrigation - Commercial – M.H.133 SKD GNSS - GH-11 State Development Schemes - SH (49) Resettlement and Rehabilitation - 500 Other Charges -502 R&R cash benefit. The Special Commissioner (R&R), Water Resources Department, Vijayawada / District Collector, Kadapa is requested to follow the drawal procedure as D.V.Bill instead of payment made by means of Cheques in terms of the orders issued vide G.O.Ms.No.171, Finance (EBS.X) Department dt.12.08.2014 and G.O.Ms.No.75,Finance (TFR) Department, dt.3-4-2014 .

(PTO)

8. The Commissioner, R&R and the District Collector, Kadapa shall take necessary further action in the matter accordingly.

9. This orders issued with the concurrence of Finance (FMU-WR.II) Dept., vide their U.O.No. FIN01-FMU0MRAS(WR2)/173/2020-FMU-WR-II, dated :23.06.2020.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

ADITYA NATH DAS,
SPECIAL CHIEF SECRETARY TO GOVERNMENT

To

The Commissioner (R&R), Water Resources Department, Government. of A.P., H.No.59A-21/3-3/1A, Sarswathi Nilayam, 1st Lane, Guttikonda Varadaiah Street, Vijaya Nagar Colony, Auto Nagar Post Office, VIJAYAWADA -520007.(A.P.)
The District Collector, YSR Kadapa District.

Copy to:

The Chief Engineer (Projects), Water Resources Department, Kadapa.
The Accountant General, A.P., Hyderabad.
The Director of Works & Accounts, A.P., Vijayawada.
The District Treasury Officer, Kadapa.
The Pay and Accounts Officer, Kadapa.
The General Administartion (Cabinet) Department (With reference to their Uo.No.63/2020, dated 12.06.2020.
The P.S. to Principal Secretary to Hon'ble Chief Minister.
The P.S. to Hon'ble Minister (Water Resources)
The P.S. to Spl. Chief Secretary to Government. (W.R.D.)
The Finance (FMU-W.R.II) Department.
SF/S.C.

// FORWARDED : : BY ORDER //

SECTION OFFICER