FEASIBILITY REPORT

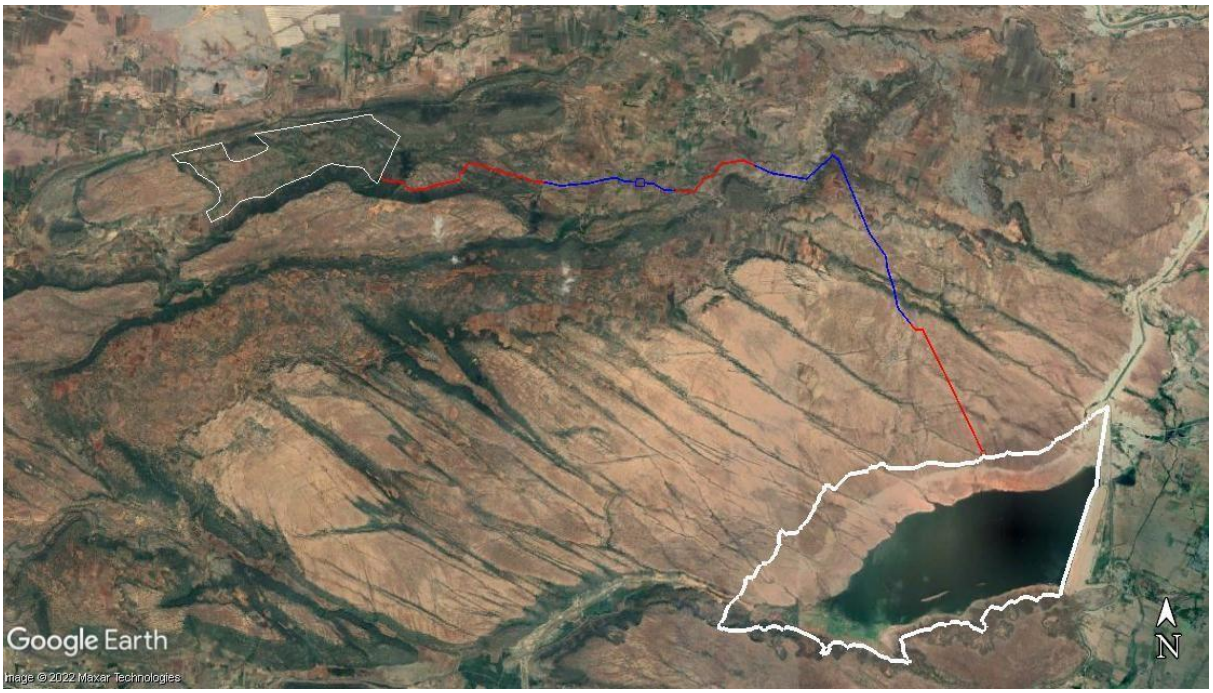
OF

INTEGRATED CORRIDOR

(FOR LAYING OF TRANSMISSION LINE, PIPE NETWORK, AND ROAD)

FROM GORAKALLU RESERVOIR TO LOWER RESERVOIR OF PINNAPURAM IREP

PINNAPURAM VILLAGE OF KURNOOL DISTRICT, ANDHRA PRADESH



HIMACHAL INFRACON PRIVATE LIMITED

March 2022

CONTENT

FEASILIBILITY REPORT

OF

INTEGRATED CORRIDOR

(FOR LAYING OF TRANSMISSSION LINE, PIPE NETWORK AND ROAD)

1. Background:

M/s Himachal Infracon Private Limited (HIPL) is a Private Limited company incorporated in May 2010. The company is having its registered office at 1st Floor, Gyamba House, South End, Lane-IV, Sector-1, New Shimla, Himachal Pradesh and Corporate Office at Plot No: 226, Phase-III, Road No:78, Jubilee Hills, Hyderabad – 500 033.

The company is in the business of Civil, Mechanical and other Engineering works. Besides, the company is also engaged itself in the activities of detailed design & drawingsfor Civil works relating to Power Projects.

Government of Andhra Pradesh (GoAP) has approved 1000MW Solar, 550MW Wind & 1200MW of Pinnapuram Standalone Pumped Storage capacities to Greenko group vide letter no. G.O.MS.No.24 dated 19-07-2018. Subsequently, GoAP have accorded approval vide letter no G.O.MS.64 dated 02-12-2020 to draw water for initial one-time filling quantity of 2.35 TMC which is to be drawn in three water years i.e., not more than 1 TMC per water year and during operation 0.215 TMC of water will be drawn every year for annual water requirement due to net evaporation losses from the existing Gorakallu reservoir, after initial filling.

The Company "HIPL" has bagged the contract from Greenko group for executing works related to laying of pipe network from existing Gorakallu Reservoir to the newly proposed Lower Reservoir of Pinnapuram IREP for initial one-time filling and for annual water requirement (to meet evaporation losses) from the existing Gorakallu reservoir, after initial filling and associated transmission line and road network.

Considering the terrain and presence of forest patches in the proposed alignment, construction of pipe network, transmission line and road is proposed to be taken up within the corridor of 15m width running parallel to each other, connecting existing Gorakallu Reservoir to the newly proposed Lower Reservoir of Pinnapuram IREP. This integration of all three infra-facilities in the same corridor helps to minimize the forest land and also helps in easy maintenance and reduce overall project cost.

The cost of project is estimated to Rs. 140.56 Cr. and it is proposed to construct the project within a period of 2.0 years for construction work and 6 months for preconstruction work. Hence the total construction period will be 2.5 years. The project layout on google imagery is shown in Fig.- 1.

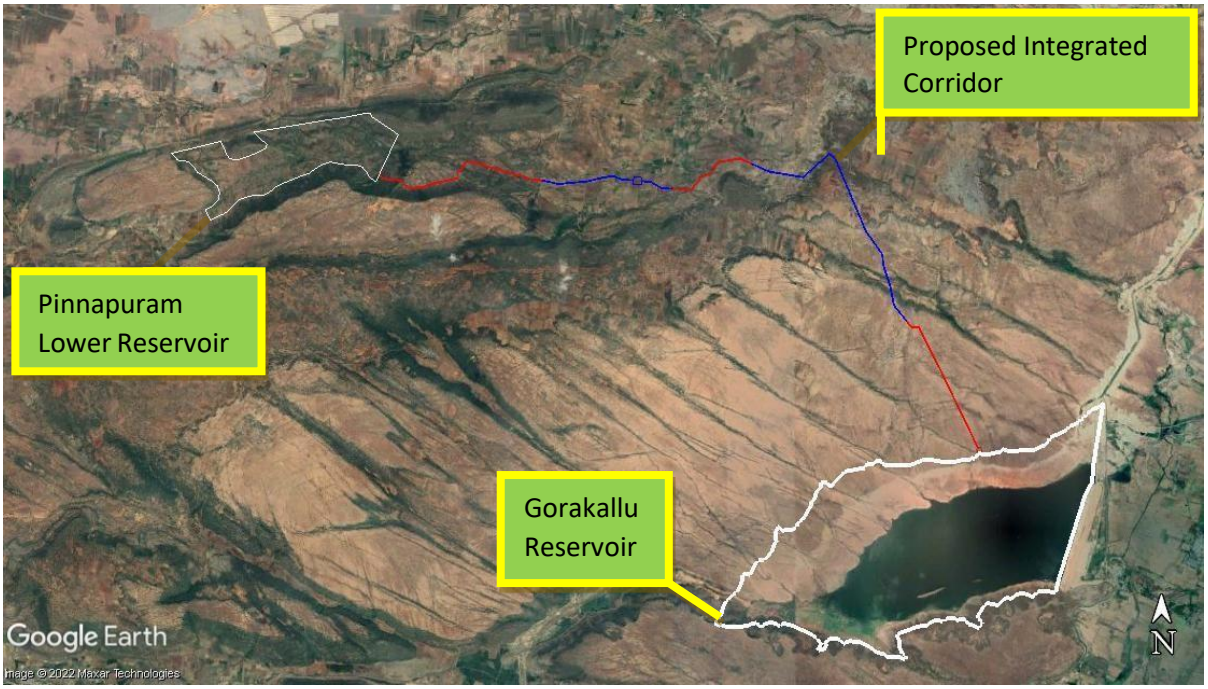


Fig. – 1 Project Layout shown on Google Imagery

2. Existing Gorakallu Reservoir

The Key parameters of Existing Gorakallu Reservoir are given below:

Sl. No.	Parameter	Unit	Value
1	Catchment Area of Reservoir	Sq. Km	77.70
2 (i)	Average Annual Rainfall in the Catchment	mm	635.00
2 (ii)	75% Dependable Rainfall in the Catchment	mm	497.58
3	Discharge from self-catchment area	Cumec	989.01
4	Design Flood Discharge	Cumec	848
5	Full Reservoir Level (FRL)	m	+ 261.00 m
6	Minimum Draw Down Level (MDDL)	m	+ 235.342 m
7	Water Spread area at FRL	Sq. Km	15.10

Sl. No.	Parameter	Unit	Value
8	Live Storage	TMC	10.29
9	Dead Storage	TMC	2.15
10	Gross Storage	TMC	12.44
11	Length of Dam	m	1731
12	Height of Dam	m	48.50

3. Topographical Survey

Topographical maps of (57 I/6) Survey of India were referred for reconnaissance and for finalization of Scheme layout.

Topographical survey covering the project area and location of project components have been carried out using Total Stations with 1m contour interval. The topographical survey covers the following components of entire layout of pumping scheme:

For Stage – 1:

Pumping Station – 1 at Gorakallu reservoir

Water Conductor System up to Intermediate Storage tank

Intermediate Storage Tank

For Stage – 2:

Pumping Station – 2 at Intermediate Storage Tank

Water Conductor System up to Proposed Lower reservoir

4. Pumping Scheme:

The Scheme envisages integration of following activities:

a. Construction of Pumping Station - 1 at the edge of Gorakallu reservoir
b. Construction of Pipeline for pumping water from Pumping Station-1 at Gorakallu reservoir to Intermediate Storage Tank
c. Construction of Intermediate Storage Tank
d. Construction of Pumping Station - 2 at Intermediate Storage Tank
e. Construction of Pipeline for pumping water from Pumping Station-2 at Intermediate Storage Tank to proposed Lower reservoir
f. Construction of 33kV Transmission line

g. Construction of Road for material transport and maintenance.

Pinnapuram IREP requires first filling requirement of 2.35 TMC (i.e., maximum live storage capacity of upper reservoir is 1.344 TMC, dead storage capacity of upper and lower reservoirs are 0.573 TMC and 0.432 TMC respectively) and make up water requirement annually of 0.215 TMC. Since there is a constraint in the allocation of water by GoAP to draw water up to 1TMC in one year, it has been planned to lift first filling of water in 2-3 seasons depending upon water availability in the Gorakallu reservoir. Also, it has been proposed to lift 1.0 TMC of water in 90 days and accordingly the pump capacities are provided. The makeup water will be lifted every year in single or more instalments that again depending upon water availability.

Construction of project has been planned in such a way as follows:

- As per the Planned pumping scheme a pump station will be constructed at the edge or just inside the Gorakallu Reservoir on a suitable identified location subject to acceptability of irrigation department.
- The proposed Pumping scheme is envisaged in two stages in which the first stage comprises part of system in lifting operation and partly by under gravity and second stage only with lifting operation.

The key features of two stages of pumping scheme are tabulated below:

Details	**Stage – 1**	**Stage - 2**
Pipe Dia.	1.7m	1.7m
No. of Pipes	1 no.	1 no.
Length of Pipe	9918m	5189m
No. of Pumps	**3 nos.**	**2 nos.**
Capacity of Pump	2.0 MW each	1.20 MW each
Intermediate Storage Tank	Located in between Stage – 1 & Stage – 2	

For construction of pipeline, it is proposed to have land corridor of 15m width for the entire length of pipeline. Out of 15m width, 7.5m width will be utilized as road and it is also proposed to have 33kV transmission line to connect the Pumping Scheme to existing 33 KV substation @ Gani Solar Park PSS-1 for supplying power to start the pumping stations. Accordingly, 33kV transmission line of length 22Km (approx.) will be connected

to existing 33 KV substation @ Gani Solar Park PSS-1 for supplying power to operate the pumping stations for pumping water to lower reservoir. 33kV transmission line poles will be erected at suitable intervals at the center of the 15m width of land acquired. Remaining 7.5m width will be utilized for construction of pipeline for pumping. This considerable width is required for ease of transportation of construction material considering the turning radius, accommodating proper drainage arrangements, carrying out maintenance work etc.

5. SALIENT FEATURES OF THE PROJECT

1		**Name of the Project**	**Pinnapuram Pumping Scheme**
2		**Location**	
	a	Country	India
	b	State	Andhra Pradesh
	c	District	Kurnool
	d	Village near Pumping Station	Chennakkapalle
3		**Geographical Co-Ordinates**	
	a	**Pumping Station – 1 at Gorakallu Reservoir**	
		Latitude	15°34'59.96"N
		Longitude	78°23'20.62"E
	b	**Pumping Station - 2**	
		Latitude	15°37'46.94"N
		Longitude	78°19'40.66"E
4		**Access to Project Site**	
	a	Airport	Hyderabad Rajiv Gandhi International Airport – 248.50 Km from project site Via NH 44
	b	Rail head	Kurnool – 49 Km from Project site
	c	Road	2 Km from Chennakkapalle
	d	Port	Krishnapatnam – 340 Km from Project site via. NH 67
5		**Pumping Scheme**	
	A	**Stage - 1**	
	I	**Pumping Station - 1 at Gorakallu Reservoir**	
	a	Type	Surface

	b	No. of Pumps	3 nos.
	c	Type of Pump	Vertical Turbine
	d	Total Design Discharge of Pump	3.64 Cumec
	e	Rated Head of Pump	130.00m
	f	Pump Capacity	2.0 MW each
	g	No. of Pumps	3
	h	Rated Discharge of Pump	1.21 Cumec each
	II	**Water Conductor System**	
	a	Type	Circular, Steel & Surface
	b	No. of Pipes	1 no.
	c	Dia. of Pipe	1.70 m
	d	Length of Pipe	9918 m
	e	Design Discharge	3.64 Cumec
	III	**Intermediate Storage Tank**	
	a	Type	Surface
	b	Size	105m (L) x 105m (B) x 6.5m
	c	Capacity	55000 Cum
	d	Storage Hours Available	4.20 Hours
	B	**Stage - 2**	
	I	**Pumping Station - 2 at Intermediate Storage Tank**	
	a	Type	Surface
	b	No. of Pumps	2 nos.
	c	Type of Pump	Vertical Turbine
	d	Total Design Discharge of Pump	3.64 Cumec
	e	Rated Head of Pump	60 m
	f	Pump Capacity	1.20 MW
	g	No. of Pumps	2
	h	Rated Discharge of Pump	1.82 Cumec
	II	**Water Conductor System**	
	a	Type	Circular, Steel & Surface
	b	No. of Pipes	1 no.

	c	Dia. of Pipe	1.70 m
	d	Length of Pipe	5189 m
6		**33kV Transmission Line**	
		Incoming point	Gani Solar Park, PSS-1 @ 33 KV level
		Number of circuits	Single circuit
		Type of conductor	ACSR Wolf
		Length of transmission line	22 KMs (appx.)
7		**Estimated Cost**	
	a	Cost of Civil Works	22.77 Cr.
	b	Cost of H&M Works	87.33 Cr.
	c	E&M Works	30.46 Cr.
	d	Total Project Cost with IDC	140.56 Cr.

6. Pumping Scheme Layout

Alternative Studies & Selection of Final Layout:

Three alternative layouts for this scheme were studied:

Alternative – 1:

In Alternative – 1, it is proposed to lift the water from existing Gorakallu reservoir to the proposed upper reservoir of Pinnapuram PSP. As the length of Pipeline for pumping water between the existing Gorakallu reservoir to the proposed upper reservoir is about 12.76 KMs and the static head difference between the existing Gorakallu reservoir and the proposed Upper reservoir is about 230.66 mt, it has been proposed to pump the water in two stages from the existing Gorakallu reservoir to the proposed upper reservoir by implementing intermediate storage tank cum pumping station in between i.e., Stage - I & Stage II will be fully in lifting operation.

Stage-I: Layout having pumping station – 1 at the edge or just inside the Gorakallu Reservoir and Water Conductor System for lifting of water up to Intermediate Storage tank cum Pumping Station - 2. The length of pipeline from Pumping station – 1 to intermediate storage tank is 6.9 Km and the rated head of the pump is about 152.00m. The capacity and number of pumps required will be about 2.3MW and 3nos. respectively.

Stage-II: Layout having Intermediate Storage tank cum Pumping Station - 2 and Water Pipeline for lifting of water up to the proposed Upper Reservoir. The length of pipeline from Pumping station – 2 provided at intermediate storage tank to the proposed Upper reservoir is 5.84Km and the rated head of the pump is about 112m. The capacity and number of pumps required will be about 2.5MW and 2nos. respectively.

The total length of the pipeline in this alternative is 12.76 KMs. As the pipeline is not crossing any villages / houses there is no habitation issues are involved. The total area of land required for this alternative is worked out to about 21.87 Ha. The maximum length of pipeline of about 9.11 Km is coming in forest land area. The maximum area of land required for pumping scheme in this alternative is in forest land and very minimum in private land and the same is worked out to about 16.41 Ha and 5.47 Ha respectively.

The above details of Alternative – 1 is shown in Fig – 2.

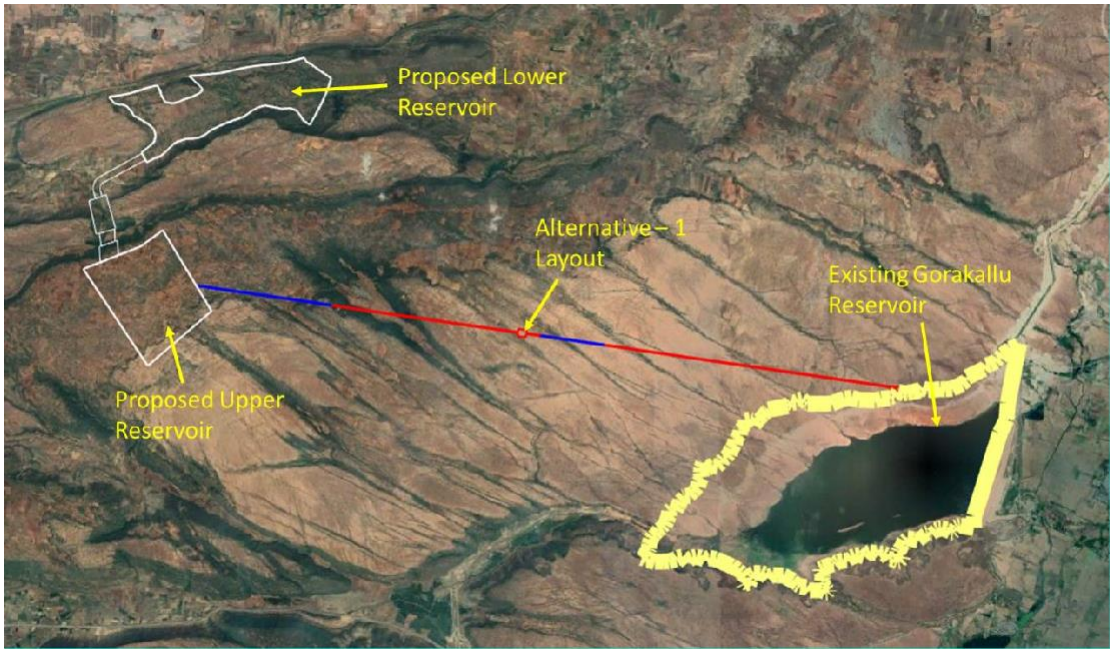


Fig – 2 Showing Alternative – 1 Layout

Alternative – 2:

In Alternative – 2, it is proposed to lift the water from existing Gorakallu reservoir to the proposed Lower reservoir of Pinnapuram PSP. As the length of Pipeline for pumping water between the existing Gorakallu reservoir to the proposed lower reservoir is about 25.01 KMs and the static head difference between the existing Gorakallu reservoir and the proposed lower reservoir is about 104.66 m, it has been proposed

to pump the water in two stages from the existing Gorakallu reservoir to theproposed lower reservoir by implementing intermediate storage tank cum pumping station in between i.e., Stage-I & Stage II will be fully in lifting operation.

Stage-I: Layout having pumping station – 1 at the edge or just inside the Gorakallu Reservoir and Water Conductor System for lifting of water up to Intermediate Storage tank cum Pumping Station - 2. The length of pipeline from pumping station – 1 to intermediate storage tank is 11.40 Km and the rated head of the pump is about 63.00m. The capacity and number of pumps required will be about 1.0 MW and 3 nos. respectively.

Stage-II: Layout having Intermediate Storage tank cum Pumping Station - 2 and Water Pipeline for lifting of water up to the proposed Lower Reservoir. The length of pipeline from pumping station – 2 provided at intermediate storage tank to the proposed lower reservoir is 13.62 Km and the rated of the pump is about 109.00 m. The capacity and number of pumps required will be about 2.5MW and 2nos. respectively.

The length of the pipeline in this alternative is too long and is crossing many existing seasonal nala's and main roads in between. Also, the pipeline is crossing the existing Sri Sailam Right Bank Canal (SRBC) in two locations. However, the pipeline is not crossing any villages / houses and hence there is no habitation issues are involved. The total area of land required for this alternative is worked out to about 40.33 Ha. The length of pipeline of about 10.12Km is coming in forest land area. The maximum area of land required for pumping scheme in this alternative is in Private land and minimum in forest land and the same is worked out to about 24.26 Ha and 16.06 Ha respectively.

The above details of Alternative – 2 is shown in Fig – 3.

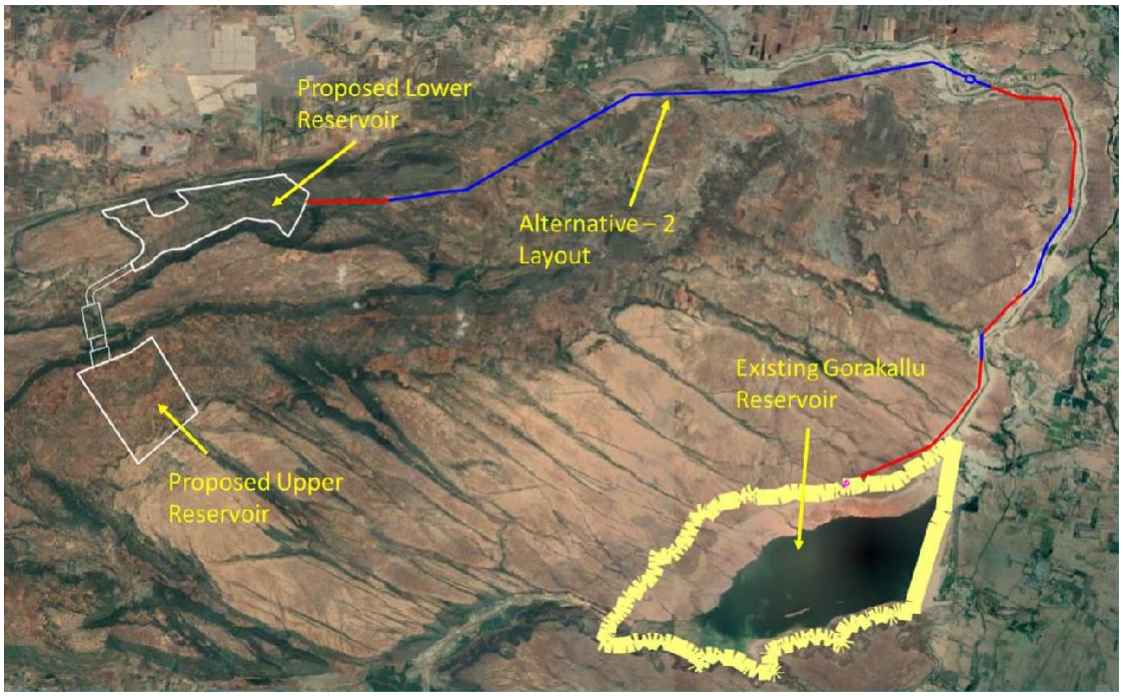


Fig – 3 Showing Alternative – 2 Layout

Alternative – 3:

In Alternative – 3, it is proposed to lift the water from existing Gorakallu reservoir to the proposed Lower reservoir of Pinnapuram PSP. As the length of Pipeline for pumping water between the existing Gorakallu reservoir to the proposed lower reservoir is about 15.107 Km, and the static head difference between the existing Gorakallu reservoir and the proposed lower reservoir is about 119.66m it has been proposed to pump the water in two stages from the existing Gorakallu reservoir to theproposed lower reservoir by implementing intermediate storage tank cum pumping station in between i.e., Stage-I will be in partly lifting operation and partly under gravity and Stage - 2 will be in fully lifting operation.

Stage – 1 – Layout having pumping station – 1 at the edge or just inside the Gorakallu Reservoir and Water Conductor System for lifting of water and as well as discharging through gravity up to Intermediate Storage tank cum Pumping Station - 2. The length of pipeline from pumping station – 1 to intermediate storage tank is 9.92 Km and the rated head of pump is about 130.00m. The capacity and number of pumps required will be about 2.0MW and 3nos. respectively.

Stage – 2: Layout having Intermediate Storage tank cum Pumping Station - 2 and Water Pipeline for lifting of water up to the proposed Lower Reservoir. The length of pipeline from pumping station – 2 provided at intermediate storage tank to the

proposed lower reservoir is 5.19km and the rated head of pump is about 60.00m. The capacity and number of pumps required will be about 1.20 MW and 2 nos. respectively.

The topographical profile of this alternative is most suitable to lay the pipeline. The pipeline is crossing few seasonal nala's (very small in size) and 1-2 minor roads. However, the pipeline is not crossing any villages / houses and hence there is no habitation issues are involved. The total area of land required for this alternative is worked out to about 25.34 Ha. The length of pipeline of about 7.92Km is coming in forest land area. The maximum area of land for pumping scheme in this alternative is in Private land and minimum in Forest land and the same is worked out to 12.76 Ha and 12.58 Ha respectively.

The above details of Alternative – 3 is shown in Fig – 4.

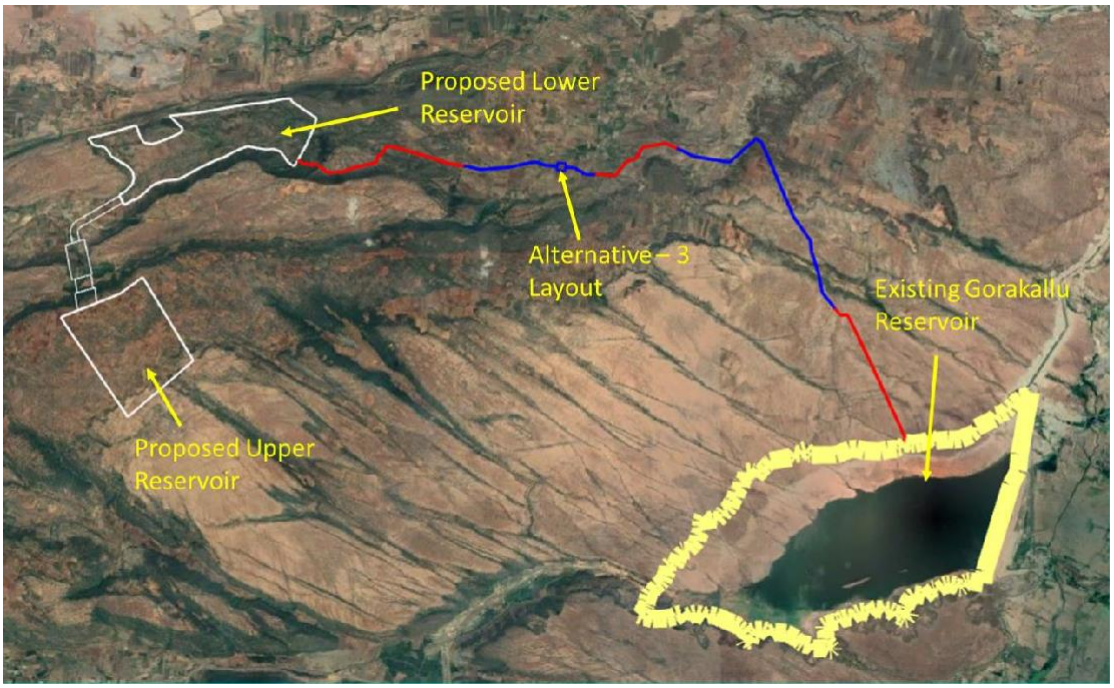


Fig – 4 Showing Alternative – 3 Layout

Selection of Final Layout:

As discussed above in all three alternatives, Alternative – 3 layout has been adopted as final layout considering the following reasons:

- The length of pipeline required in Alternative – 3 layout is 15.107Km which is more than Alternative – 1 layout but less than Alternative – 2 layout. Even with longer length the forest land requirement in this case is the lowest of all three alternatives i.e., about 30% lower than the second closest alternative.

- Since almost one third of line is under gravity and rated head requirements are also lower the pipeline cost in this case is lowest of all three.
- The topographical profile of the alignment in Alternative-3 is most suitable and requires very minimal cutting and filling. In Alternative-2 the civil structure requirements are very high because of crossing of existing canal at two locations and crossing of major roads at multiple locations. Construction of all these crossings of roads and canals will cause lot of hinderance to local inhabitants.
- The power requirement of Alternative-1 is highest and Alternative-2 is lower than Alternative-3 but since other advantages on account least Forest land, lower pipeline cost, lower civil cost and least disturbance to local population still Alternative-3 is best suitable for implementation.
- Since power requirement difference in all three alternatives is not very high therefore O&M cost will almost be same in all three cases this adoption of Alternative-3 is suitable from this context as well.

Keeping all these aspects in view Alternative-3 has been proposed to be adopted as this is having least forest land, least cost of construction and minimal or no hindrance to local population.

All three Alternatives are shown in Fig – 5.

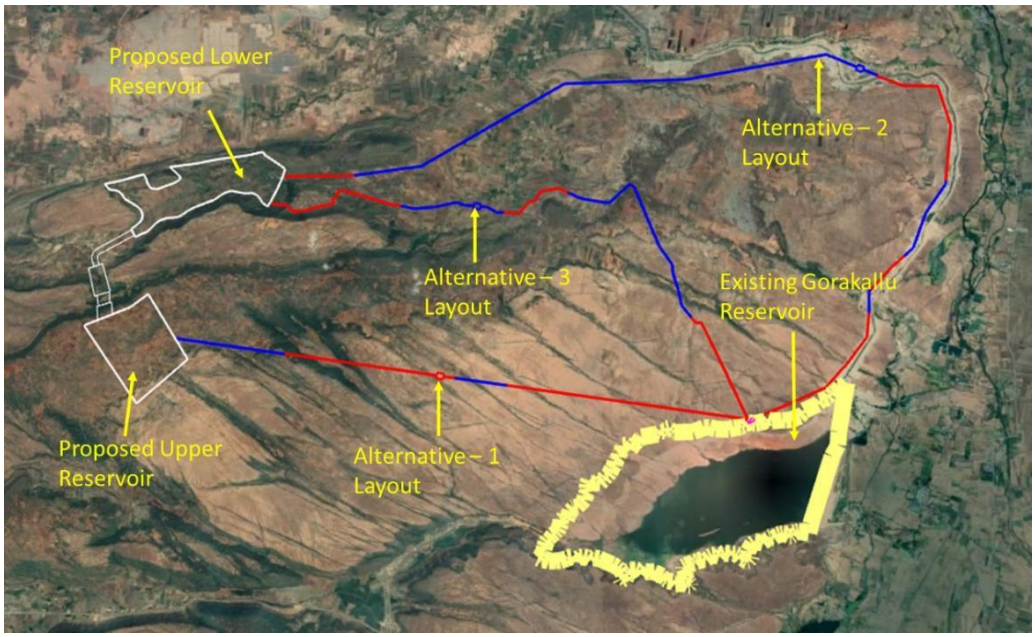


Fig – 5 showing All Three Alternatives

6.1 Scope of Work

The Pinnapuram Pumping Scheme is envisaged to be constructed in two Stages i.e., Stage – I & Stage – II as follows:

Stage – I: (Between Pumping Station - 1 and Intermediate Storage Tank)

- Pumping Station – 1 comprises of 3 nos. each of 2.0 MW pumps operating under a rated head of 130.00 m shall be constructed on the edge or just inside the Gorakallu reservoir.
- Water Conducting System having single pipeline of 6037 m long and 1.70m dia. MS pipe between Ch. 749.02 m and Ch. 6785.95 m where water will be pumped up to the maximum level of EL 355.00m. Between Ch. 6785.95 m and up to Ch. 10667.00 m water will be flowing under gravity with single pipeline of 3881.05 m long up to EL 302.45m.
- Intermediate Storage Tank of size 105m (L) x 105m (B) x 6.5m (H) having 4.20 hours storage capacity with conventional Pumping Station – 2.

Stage – II: (Between Intermediate Storage Tank and Lower Reservoir)

- A surface conventional Pumping Station – 2 having an installation of 2 nos. of each of 1.20 MW pumps operating under a rated head of around 60.00 m.
- Water Conducting System having single pipeline of 5.19Km long and 1.70m dia. MS pipe between Ch. 10794.99m and Ch. 15983.99 m where water will be pumped up to the maximum level of EL 340.00m.

6.2 Details of Stage – 1 Layout:

In Stage-1, water will be pumped from Pumping station - 1 and conveyed through pipeline to fill into the Intermediate Storage Tank. As per the topographic survey and the ground profile along the proposed alignment of pipeline, water will be lifted up to the highest elevation point and from there water will be discharged through gravity up to the Intermediate Storage Tank.

6.2.1 Pumping Station - 1

The Pumping Station is proposed to be constructed at FRL point of Gorakallu Reservoir and draw the water at MDDL EL +235.342m. As the difference in head between FRL & MDDL of existing reservoir is 25.66m, it is proposed to draw water through an approach channel which is to be constructed inside the reservoir up to the MDDL point i.e., EL 235.342m of existing reservoir considering frequent fluctuation in water level

due to daily operation of existing reservoir. The approach channel is provided with a base width of 5m and side slope of 1H:1V. The discharge carrying capacity of approach channel is 3.64 Cumec and the depth of flow in the channel is 1m to draw water at MDDL of EL 235.342m. The length of approach channel is about 715m. The approach channel will be lined with cement concrete and the thickness of lining shall be 150mm.

It has been proposed to have the Pump House which is to be constructed at FRL point of existing Gorakallu Reservoir and its other associated structures on the surface. Also, in front of Pump House, an intake structure has been proposed which will be provided with necessary controlling arrangements in the form of emergency gates to allow / regulate the entry of water inside the Pump House and also a trash rack is proposed to be provided in front of emergency gates to avoid entry of debris. The provision of emergency gate is not only for allowing / regulating the entry of water but also for carrying out maintenance of Pumps in Pump House whenever required.

As the proposed Pump House and intake structure involves little deeper excavation, intricate supporting arrangement for the cut slopes involving anchors etc. will be provided. The size of the Pump House is 19m (L) x 9.5m (W) and the maximum height of Pump House at Gorakallu Reservoir is about 46m. The Pump house shall be equipped with 3 pumps having capacity of 2.0 MW each. The center-to-center distance between the pump units are kept at 3.5m and the floor level / operation level is kept at EL 265.00m which is same as top level of Gorakallu Reservoir. The Pump House is an RCC structure and will have columns, beams etc. 1 No. of EOT crane of suitable capacity shall be installed in erection bay to facilitate erection and repair of Pump equipment's. The Pump house floor shall be designed to carry load of Pumps, live load and thrust transferred through Pumps and other equipment's. The Pump house floor is designed as RCC raft with adequate openings as required for equipment foundations and cable trenches etc.

6.2.2 Water Conductor System (Stage – 1)

The Pumps provided in the Pumping Station - 1 will lift the water under the rated head of 130.00 m. From this Pumping Station - 1, a single pipeline of 1.7m dia. 9.92Km long surface MS pipe will take off to supply water to the Intermediate Storage Tank. The steel pipe will carry a design discharge of 3.64 Cumec. As per the topographic survey and the ground profile along the proposed alignment of pipeline, water will be lifted

up to the highest elevation point of EL 355.00m by pumping and from there water will be discharged under gravity up to the Intermediate Storage Tank.

The total length of steel pipe is freely supported above ground surface and hence suitable anchor blocks will be provided at all bends (i.e., wherever the angle of inclination is changing) and at an intermediate point in long tangents and where the distance between any two bends requiring anchors exceeds 150m. Between the anchor blocks, saddle supports will be provided at suitable intervals wherever required. For construction of pipeline, it is proposed to have land corridor of 15m width for theentire length of pipeline. Out of 15m width, on the right side of water conductor system(i.e., flow towards the lower reservoir side) it is proposed to have 7.5m width of roadfor transportation purpose as well as it is proposed to have 33KV transmission line to connect the proposed pumping scheme from 33 KV substation @ Gani Solar PSS-1 for supplying power to start the pumping stations. Accordingly, 33kV transmission line of length 22 KMs (approx.) will be connected to proposed Pump Houses for supplying power to operate the pumping stations for pumping water to Intermediate Storage Tank. 33kV transmission line poles will be erected at suitable intervals at the center of the width of land acquired. Remaining 7.5m width will be utilized for construction of pipeline for pumping. This considerable width is required for ease of transportation of construction material considering the turning radius, accommodating proper drainage arrangement, maintenance work etc.

6.2.3 Intermediate Storage Tank (Stage – 1)

The Intermediate Storage Tank has been proposed mainly to reduce the pump capacity by reducing the pumping head and also to reduce the thickness of steel pipe for economic reasons.

The Intermediate Storage Tank is located at a distance of about 9.92Km from Pumping Station - 1 at Gorakallu Reservoir. Water will be lifted through steel pipeline from Pumping Station - 1 at Gorakallu Reservoir and will be stored in the Intermediate Storage Tank. The discharge carrying capacity of steel pipeline is 3.64 Cumec. Accordingly, the capacity of Intermediate Storage Tank is proposed for 55000 Cum and the size of Intermediate Storage Tank is worked out to 105m (L) x 105m (W) x 5m (H) which will have storage capacity of 4.20 hours. Keeping the free board of 1.5m, the total height of Intermediate Storage Tank will be 6.5m. The FRL & MDDL (ie. minimum submergence level) of Intermediate Storage Tank is EL 302.45m & EL 297.45m respectively and the top level is kept at EL 303.95m.

6.3 Details of Stage – 2 Layout:

In Stage – 2, water will be pumped from pumping station - 2 at Intermediate Storage Tank and conveyed through pipeline to the proposed lower reservoir from the Intermediate Storage Tank. As per the topographic survey and the ground profile along the proposed alignment of pipeline, water will be lifted up to the highest elevation point of the proposed lower reservoir.

6.3.1 Pumping Station – 2 Cum Intake Structure (Stage – 2)

The Stage – 2 Pump house has been proposed to be constructed at Intermediate Storage Tank and its other associated structures on the surface. Also, in front of Pump House, an intake structure has been proposed which will be provided with necessary controlling arrangements in the form of emergency gates to allow / regulate the entry of water inside the Pump House and also a trash rack is proposed to be provided in front of emergency gates to avoid entry of debris. The provision of emergency gate is not only for allowing / regulating the entry of water but also for carrying out maintenance of Pumps in Pump House whenever required.

The size of the Pump House is 15.50m (L) x 9.5m (W) and the maximum height of Pump House at Intermediate Storage Tank is about 11.00m. The Pump house shall be equipped with 2 pumps having capacity of 1.20 MW each and will lift the water under the rated head of 60.00 m. The center-to-center distance between the pump units are kept at 3.5m and the floor level / operation level is kept at EL 303.95m. The Pump House is an RCC structure and will have columns, beams etc. 1 No. of EOT crane of suitable capacity shall be installed in erection bay to facilitate erection and repair of Pump equipment's. The Pump house floor shall be designed to carry load of Pumps, live load and thrust transferred through Pumps and other equipment's. The Pump house floor is designed as RCC raft with adequate openings as required for equipment foundations and cable trenches etc.

6.3.2 Water Conductor System (Stage – 2)

The Pumps provided in the Pumping Station - 2 at Intermediate Storage Tank will lift the water under the rated head of 60m. From this Pumping Station - 2, one no. of 5.19Km long surface MS pipe of 1.7m dia. will take off to supply water to the lower reservoir. The 1 no. of MS pipe will carry a design discharge of 3.64 Cumec.

The total length of MS pipe is freely supported above ground surface and hence suitable anchor blocks will be provided at all bends (i.e., wherever the angle of

inclination is changing) and at an intermediate point in long tangents and where the distance between any two bends requiring anchors exceeds 150m. For construction of pipeline, it is proposed to have land corridor of 15m width for the entire length of pipeline. Out of 15m width, on the right side of water conductor system (i.e., flow towards the lower reservoir side) it is proposed to have 7.5m width of road for transportation purpose as well as it is proposed to have 33KV transmission line from 33 KV substation @ Gani Solar PSS-1 will be connected to the proposed pumping scheme for supplying power to start the pumping stations. Accordingly, 33kV transmission line of length 22 KMs (approx.) will be connected to proposed pump house for supplying power to operate the pumping stations for pumping water to Lower Reservoir. 33kV transmission line poles will be erected at suitable intervals at the center of the width of land acquired. Remaining 7.5m width will be utilized for laying of pipeline for pumping. This considerable width is required for ease of transportation of construction material considering the turning radius, accommodating proper drainage arrangement, maintenance work etc.

The General Layout Plan of Pumping Scheme is shown in Drg. No. Pinna-PS-001.

7. ELECTRO-MECHANICAL EQUIPEMENT

The proposed pumping Scheme has been divided in to two stages i.e., Stage - 1 will be in partly lifting operation and partly under gravity and Stage - 2 will be in fully lifting operation. Stage -1 and stage -2 pumping stations comprises with following electro-mechanical components:

7.1 PUMPING STATION STAGE – 1: From Gorakallu Reservoir to Intermediate Storage Tank

a. Submersible Centrifugal Pumps of suitable capacity to pump required water to lower reservoir with pipes, bends, flanges, dismantling joints etc.

b. Double flanged dual type check valves at delivery side with hardware and gaskets.

c. Hand operated sluice valve at delivery line of each pumps with hardware and gaskets.

d. Air valves of suitable size on header side manifold.

e. Discharge measurement system to measure quantum of water pumping to Lower reservoir

f. Discharge measuring instrument to measure quantum of water drawn from reservoir.

g. 33 kV / 6.6 kV, 5 MVA transformers (2 Nos.) to extend supply to proposed pumping station.

h. 33 KV Outdoor switchyard equipment comprises, breakers, isolators, LAs and protection relays etc.

i. 6.6 KV switchgear panels with incoming/outgoing breakers, bus couplers etc.

j. 6.6 KV FCMA Soft starter panel for each pump.

k. Power and control cables, Instruments, Junction Boxes as required.

l. 6.6 KV Capacitor bank panel to improve power factor up to 0.98.

m. Auxiliary transformer of suitable rating to extend supply to station auxiliaries

n. Cable termination kits, cable trays with accessories

o. 110 V DC battery and battery charger

p. Firefighting, Illumination, and ventilation system

q. Earthing and Lighting protection system

r. Pump Motor set handling equipment, tools & tackles for erection, testing and commissioning

s. Surge protection system as required (Bladder vessel / Zero velocity valves / air / vacuum valves) in complete to protect water conducting system.

7.2 PUMPING STATION STAGE – 2: From Intermediate Storage Tank to Lower Reservoir of Pinnapuram PSP

a. Submersible Centrifugal Pumps of suitable capacity to pump required water to lower reservoir with pipes, bends, flanges, dismantling joints etc.

b. Double flanged dual type check valves at delivery side with hardware and gaskets.

c. Hand operated sluice valve at delivery line of each pumps with hardware and gaskets.

d. Air valves of suitable size on header side manifold.

e. Discharge measurement system to measure quantum of water pumping to Lower reservoir

f. 33KV/6.6 KV, 5 MVA transformer (1 No.) to extend supply to proposed pumping station.

g. 33 KV Outdoor switchyard equipment comprises, breakers, isolators, LAs and protection relays etc.

h. 6.6 KV switchgear panels with incoming/outgoing breakers, bus couplers etc.

i. 6.6 KV FCMA Soft starter panel for each pump.

j. Power and control cables, Instruments, Junction Boxes as required.

k. 6.6 KV Capacitor bank panel to improve power factor up to 0.98.

l. Auxiliary transformer of suitable rating to extend supply to station auxiliaries

m. Cable termination kits, cable trays with accessories

n. 110 V DC battery and battery charger

o. Firefighting, Illumination and ventilation system

p. Earthing and Lighting protection system

q. Pump Motor set handling equipment, tools & tackles for erection, testing and commissioning

r. Surge protection system as required (Bladder vessel / Zero velocity valves / air / vacuum valves) in complete to protect water conducting system.

7.3 BREIF DESCRIPTION ON ELECTRO-MECHANICAL COMPONENTS

7.3.1 PUMPING STATION STAGE -1

Pumping station envisaged with Three (3) numbers of submersible pumps with discharge capacity of each 4370 Cu Mt/Hr @ 130.00M. head coupled with Induction Motor of rating 2.0 MW, 1480 RPM each @ 6.6 KV Voltage level. Switchgear and control room to be constructed to accommodate the MV switchgear and Motor Starters.

A. Constructional features of Pumps

a) Pump Shaft

b) The shaft shall be designed to transmit the maximum rated power at the pump operating speed and shall be of ample stiffness to minimize deflection of the shaft during closed valve starting conditions.

c) Critical speed of pump –motor assembly shall be more than the maximum reverse run away speed.

d) Bearings

e) The pump shall be provided with journal / tilting pad type thrust bearings. Adequate bearing lubrication shall be provided for all operating conditions.

f) All bearings shall be suitable for reverse rotation up to the maximum speed of 125% of reverse speed and shall be suitable for continuous operation at all duties from closed valve to maximum run out.

g) Couplings

h) The pump shall be directly coupled to drive motor shaft through a flexible coupling to take care of the shaft misalignment.

i) Baseplate

j) The base plate and anchor bolts shall be designed to provide rigidity, and torsional and lateral stability of the complete pump and driver assembly under operating and seismic conditions. The base plate shall be capable of resisting the inertia and pressure forces during startup, reverse rotation, and normal operation of the units.

k) Casing

a) Lifting lugs or eyes shall be provided to facilitate handling.

All joints between parts of the pump casing and between the casing and bell-mouth suction shall be of the flanged spotted type accurately machined to ensure perfect fit and alignment. All joints shall be metal to metal and no jointing material shall be used between the flanges.

l) Impeller and diffuser

a) The impeller shall be of rigid construction with blades of aero foil cross section hand dressed and smoothed to the correct profile. All bosses, keys, bolts, and nuts for fixing and locking the impeller shall be of suitable stainless steel. Blades shall be manual adjustable, provided the pump is disassembled.

b) Impellers shall be dynamically balanced after assembly. All surfaces shall be machined to a smooth surface. There shall be no cavities or pockets in which mud or sand can collect and thereby cause unbalance. Impellers shall be keyed on the shaft, and a recessed split collar shall prevent them from slipping vertically. Other equivalent method may be used. Impellers shall be adjustable vertically for best efficiency.

Material of Construction

Bell mouth, pump bowls	NI-CI conforming to IS 210 grade FG-260 Ni2 (min)
Suction casing	Confirming to CS ASTM A216/216M WCB.
Impellers for V.T. Pumps	Stainless steel AISIS-410 with anti-

	abrasive special alloys coating (SSCA 6NM)
Impellers shaft for V.T. Pumps	Stainless steel AISI ST-410
Column pipes, line shaft protection tube	Mild steel IS 2062 EFW/ERW pipes Seamless MS
Flexible coupling	Forged steel conforming to IS 3495 Wearing
Rings for V.T. Pumps	Gun metal/ stainless steel as appropriate
Column flanges	Mild steel IS 2062
Nut bolts and washers up to bottom of head	Stainless steel AISI ST 304/316 discharge
Line shaft	Stainless steel AISI-410
Line shaft coupling	Stainless steel AISI-410
Line shaft bearing	Thornden/Equivalent
Pump shaft bearing	Thornden/Equivalent
Discharge head	MS Confirming to IS 2062
BOWL bearing	THORDON BEARING SXL Type
Strainer	Ni-Cr or galvanized steel
Pressure filters Body and flanges filter Media Sealing material	MS fabricated S 304 CAF

The pumps shall comply with the requirement of the following:

1. IS 5120/HI 2.3: Vertical Pumps Technical Requirements
2. HI 2.4: Vertical pumps installation, operation, and maintenance
3. IS 9137, IS 1710, IS 10981: Code for acceptance tests
4. IS 1710 of 1972: Performance testing of Vertical Turbine Pumps
5. HI 2.6: Tests on Vertical Pumps
6. IS 325: Three Phase Induction Motors.
7. IS 1271: Thermal Evaluation and classification of electrical insulation.
8. IS 4691: Degree of protection provided by enclosure for rotating machinery.
9. IS 4728: Terminal marking and direction of rotation for rotating electrical machinery
10. IS 6362: Designation of methods of cooling for rotating electrical machines.
11. IS 4029: Guide for testing three phase induction motors.
12. IS 2253: Designation for type of co insulation mounting arrangements rotating electrical machinery.

13. IS 900: Code of practice for installation and maintenance of induction motors.
14. IS 4729: Measurement and evaluation of vibration or rotating electrical machines.
15. IS 4889: Methods of determination of efficiency of rotating electrical machines.
16. IS 2060: Dynamic balancing.
17. IS 4054: Air Brake Switches.
18. IS 2516: Circuit Breakers.
19. IS 10118: Switch gear and control gear selection and maintenance-code of practice.
20. IS 2419: Panel mounted indicating and recording instruments.
21. IS 3042: Earthing.
22. IS 1554: PVC insulated electric cable for working voltage up to and including 1100V.

B. Constructional Features of Induction Motor:

Motors shall be three phase, squirrel cage, induction type, continuously rated for the heaviest specified duty, totally enclosed and suitable for operation on 6.6 kV electricity supply. Motors shall comply in all respects with the latest IS/IEC standards and shall be designed to run at high power factor and efficiency at the prescribed plant duty. The limit of temperature rise shall be for the appropriate Class of insulation quoted. Class F insulation shall be provided, but with Class B temperature rise limitations. The motors shall be able to operate within +/-10% voltage variation and +/-5% frequency variation. The Motors shall be complete in all respects including all monitoring and control instrumentations.

A. Pump and Motor Parameters

Type of pumps	Submersible Centrifugal pumps
Pump efficiency	86.5%
Each Motor capacity	2000 KW
Motor efficiency	95.4%
Motor Power Factor	0.85

C. Safety Valves

The following safety valves shall be envisaged at each pump delivery side and before common header

- Double flanged Dual Plate Check Valve conforming to API 594 PN 1.6: NB 450 mm.- 1no.
- DI Sluice Valve, Hand wheel operated as per IS 14846 PN 1.6: NB 450 mm-1 no.
- 80 mm dia. Air Valve PN 1.6 on header side manifold – 1 no.

7.3.2 PUMPING STATION STAGE -2

Pumping station envisaged with Two (2) numbers of submersible centrifugal pumps with discharge capacity of each 6555 Cu Mt/Hr @ 60 Mtr. head coupled with Induction Motor of rating 1200 kW, 1480 RPM each @ 6.6 KV Voltage level. These pumps sets shall be installed in the Pumphouse with suitable lifting arrangements for pump motor sets, MV Switchgear and Motor Starters and other plant accessories.

B. Constructional features of Pumps

Submersible centrifugal type directly coupled to wet type submersible motor for pumping water confirming to latest Indian / EU / ISO Standards with duty point flow rate and heads. Impellers should be made of abrasion resistant stainless steel; statically and dynamically balanced. Main pump body should be made of corrosion resistant, Zinc free, closely grained casted steel confirming to ASTM A216/216M WCB / DI FG 260: IS 210. Pump shaft, coupling, suction grid & retaining valves should be made of stainless steel of SS410. Non-returning valve with Strainer incorporated with the pump. The suction strainer shall be of SS304.

C. Constructional Features of Induction Motor:

Motors shall be three phase, squirrel cage, induction type, continuously rated for the heaviest specified duty, totally enclosed and suitable for operation on 6.6 kV electricity supply. Motors shall comply in all respects with the latest IS/IEC standards and shall be designed to run at high power factor and efficiency at the prescribed plant duty. The limit of temperature rise shall be for the appropriate Class of insulation quoted. Class F insulation shall be provided, but with Class B temperature rise limitations. The motors shall be able to operate within +/-10% voltage variation and +/-5% frequency variation. The Motors shall be complete in all respects including all monitoring and control instrumentations.

D. Pump and Motor Parameters

Type of pumps	Submersible Centrifugal pumps
Pump efficiency	86.5%
Each Motor capacity	1200 KW
Motor efficiency	95.4%
Motor Power Factor	0.85

E. Safety Valves

The following safety valves shall be envisaged at each pump delivery side and before common header

- Double flanged Dual Plate Check Valve conforming to API 594 PN 1.0 NB 700 mm.- 1 no.
- DI Sluice Valve, Hand wheel operated as per IS 14846 PN 1.0: NB 700 mm. 1 no.
- 200 mm dia. Air Valve PN 1.0 on header side manifold. -1 no.

7.4 POWER SUPPLY

Incoming power supply to pumping stations will be extended from Gani Solar Park 33KV PSS which is nearer to proposed pumping station and will be stepped down to 6.6 KV through 2 nos of **33 KV/6.6 KV** , ONAN, 7.5 MVA power transformers with **On Load Tap Changer with range of +5% to -25%** for stage-1 and through 1 No. of **33 KV/6.6 KV** , ONAN, 5 MVA power transformers with **On Load Tap Changer with range of +5% to -25% for** stage -2.

7.5 33 KV OUTDOOR SUBSTATION

Each pumping station shall be equipped with 33 KV outdoor substation with suitable rated circuit breakers, disconnectors, Current and Potential transformers (for metering and protection), and associated structures and accessories. Protection and Control Panel shall be considered for each power transformer.

7.6 6.6 KV SWITCHGEAR

A. AT PUMPING STATION STAGE-1

6.6 kV switchgear shall be of metal clad indoor type with IP 54 protection 6.6 KV Switchgear shall have two (2) numbers of incoming feeders, Three (3) numbers of outgoing feeders for Pump Motors, one (1) number of bus coupler and one (1) number of auxiliary transformer feeder.

B. AT PUMPING STATION STAGE-2

6.6 KV switchgear shall be of metal clad indoor type with IP 54 protection. 6.6 KV Switchgear shall have two (2) numbers of incoming feeders, Two (2) numbers of outgoing feeders for Pump Motors, one (1) number of bus coupler and one (1) number of auxiliary transformer feeder.

The bus bar in 6.6 kV Switchgear shall be electrical grade AL. The panel shall be in complete shape with all accessories including CTs, metering, motor protection relays indication lamps, Cable & wiring accessories, gland plates etc.

7.7 FCMA SOFT STARTERS

Each motor shall be provided with 6.6 kV Line side Flux Compensated Magnetic Amplifier (FCMA) / Air Core reactor type **soft start panel** and shall be of indoor, metal clad with separate metal enclosed compartments comprises the following:

(i) control, metering and current transformers
(ii) shorting switch
(iii) busbars
(iv) power cable terminations
(v) push buttons with indicating lamps.

The rating of the starter shall be able to start the Motors at +/-10% voltage and +/-5% frequency variations with maximum starting current of 3 x rated full load current of the motor.

7.8 CAPACITOR BANK PANELS

3 phase, 6.6 kV delta connected Capacitor Panels with all switching and safety equipment shall be provided at each pumping station which shall deliver the reactive power to improve the power factor of the system to 0.98 at -10% of voltage variation as measured at the incomer of the 6.6 kV Switchgear.

7.9 LOW VOLTAGE AUXILIARY SYSTEM

The low voltage system at each pumping station shall be derived from a 6.6 kV/415V, 63 kVA Auxiliary Transformer. The main requirement of LV system is for illumination, Battery Charger input and MV Switchgear auxiliaries. LV Panel shall be simplex type, single front, compartmentalized switchgear, indoor type. The bus bar shall be of electrical grade AL. The panel shall be in complete shape with all accessories including CTs, metering, indication lamps, Cable & wiring accessories, gland plates etc.

7.10 PUMP MOTOR CONTROL UNIT (PMU)

Multi-channel PMU with Modbus communication shall be envisaged for continuous monitoring of Pump & Motor healthiness by means of measuring the Drive end and Non drive end bearing temperatures, winding temperatures, connection chamber water leakage detection, stator body water leakage detection etc.

7.11 DISCHARGE MEASUREMENT SYSTEM

Magnetic flow meter type / Ultrasonic type flow measurement system with all necessary accessories shall be provided on main header of both pumping stations to measure the quantum of water drawn from Gorakallu reservoir and to measure quantum of water to be lifted up to lower reservoir.

7.12 DC SYSTEM

DC System shall be provided at each pumping station for control of motors and protection panels. The Battery Bank shall be **100 Ah (app)** at 1.8 end of cell voltage at 20 deg C, 110V, VRLA Type with suitable number of cells. One number of float cum boost battery charger of suitable rating shall be provided to suite the load conditions and the charging requirements of the batter bank. The battery charger shall have suitable number of integral outgoing feeders for all the pumping station accessories.

7.13 CABLES AND CABLE TRAYS

The MV Cables shall be of 6.6 KV Unearthed, Al conductor, XLPE insulated, Insulation screen of semiconducting compound, inner sheath of PVC material confirming to ST2 compound, Armoured, and outer sheath of EPR/PVC material confirming to ST2 compound. The cable shall be suitable for water immersion. The Low Voltage shall be FRLS, 1.1kV Grade, Cu Conductor, XLPE Insulated, Multi Core, Armoured, Outer sheath of PVC ST2 type compound confirming to IS: 7098 Part 1. The cables shall be terminated with suitable cable lugs and cable glands. Each terminal shall be provided with ferrules at both ends of the connections.

Cable trays shall be of MS heavy duty Ladder / perforated cable trays and shall include all bends, joints, fish plates etc. of suitable quantity with all connecting accessories.

7.14 ILLUMINATION SYSTEM

The illumination system shall be cover all the operational areas of the pumping stations and complete in all respects including lighting DBs, Conduits, wiring, luminaries and installation accessories. The luminaries shall be of LED type. The lux levels shall be as per IS 6665 and IS 3646.

7.15 EARTHING AND LIGHTNING PROTECTION

Earthing of control room of stage-1, Pumping station of stage -2 & outdoor yard will be done as per IEEE 80 latest issue after measuring the soil resistivity. The overall ground mat resistance shall be maintained less than 0.5Ω.

A lightning protection system will be provided as per IS - 2309 and Indian Electricity Rules. The protections will consist of roof conductors, air terminals and down conductors and will be provided for outdoor Switch Yard / Control room of stage -1 pumping station and Stage -2 pumping station.

7.16 FIRE FIGHTING SYSTEM

The proposed fire protection system shall be designed to provide adequate safety measures in the area as per applicable requirements of fire safety guidelines by means of considering fire alarm, detection system, portable fire extinguishers, sand buckets etc.

7.17 VENTILATION SYSTEM

Adequate number of split A/Cs and exhaust fans shall be provided in control rooms, battery and charger rooms, toilets etc. in line with HVAC guidelines.

7.18 SPARES

Spares shall be considered as per OEM recommendation to minimize the down time.

8. Construction Planning and Schedule

It is proposed to construct the project within a period of 2.0 years for construction work and 6 months for preconstruction work. Hence the total construction period will be 2.5 years. At the time of peak construction work in the project, around 60 persons may be engaged. The majority of about 40 nos. from the local population/surrounding Villages and balance persons of about 20 nos. will be skilled /semiskilled from other area.

Then after commissioning of the project, about 20 persons will be required for operations which might be from local areas or migrated from another area.

9. Cost Estimates

The Civil Cost Estimates of the project are based on the rates of major items of works prepared based on SSR of Andhra Pradesh & local prevailing rates are adopted for the items not covered by the SSR wherever quantification has not been possible at the present stage of design, lumpsum provisions have been made based on judgement / experience of other projects. The H&M and E&M cost are based on the budgetary offer received from the vendors.

The capital cost of the project includes all costs associated with investigations, design, construction and maintenance during construction period of the project.

Description of Item	**Cost in Crores**
Cost of Civil Works	22.77 Cr.
Cost of H&M Works	87.33 Cr.
Cost of E&M Works	30.46 Cr.
Total cost of the Project	**140.56 Cr.**

10. ENVIRONMENTAL ASPECTS:

The present proposal is for construction of pipe network, transmission line and road which are proposed to be taken up within the corridor of 15 m width running parallel to each other connecting existing Gorakallu Reservoir to the newly proposed Lower Reservoir of Pinnapuram IREP.

The geographical co-ordinates of the existing Gorakallu Reservoir are Latitude 15°34'59.96"N & Longitude 78°23'20.62"E. and that of the Lower Reservoir of Pinnapuram IREP are Latitude 15° 37' 26" N and Longitude 78° 15' 30" E.

Description	**Details**
General Conditions	
Interstate Boundary	Telangana – Andhra Pradesh 37 Km
Airport	Kurnool – 21 Kms
District head	Kurnool – 35 Kms
Nearest Road	SH - 31 Road – Hussaina Puram - Gadivemula - 3.5KM – N
Port	Krishnapatnam Port
Nearest Villages	Pinnapuram Village – 8.0km Chennakkapalle Village – 680 metersGani Village – 4.0 Km
Ecologically SensitiveAreas/ National Park/ Wildlife Sanctuary	Rollapadu wildlife sanctuary – 10.30 Km
Critically Polluted Area(s)	NA
Accessibility	
Approach Road	SH - 31 Road – Hussaina Puram - Gadivemula-3.5KM – N
SH/ NH Roads	SH - 31 Road – Hussaina Puram - Gadivemula -3.5KM – N SH –48 Road–Gadivemula - Venkateswarapuram – 5.6 km - E NH - 40 Road – Kurnool to Chittoor – 10.0 Km - S
Railway Station	Kurnool – 35 Kms
Nearest Town	Kurnool – 35 Kms
Forest	Gani RF adjacent Nallamala RF – 23.14 km
Major Water Bodies	Krishna River – 32 Km Gorkallu Balancing Reservoir 0.02 Km Alaganuru Reservoir - 8.90 Km Velugoda Balancing Reservoir – 25 Km

Distance from the existing Gorakallu Reservoir to Lower Reservoir of Pinnapuram IREP is about 15.20 Km. The Details of land breakup is given in table below:

Khasra / Forest Comp. No Wise Land Break Up (Ha)

S. No	Village	Survey No.	Extent of Non-Forest land (Ha)	Extent of Forest land (Ha)	Total Extent
1	Gorakallu	Forest Comp No-93	-	3.03	
2	Gorakallu	Forest Comp No-94	-	1.86	
3	GANI	Forest Comp No-111	-	0.15	
4	GANI	Forest Comp No-112	-	3.13	
5	GANI	Forest Comp No-113	-	0.06	
6	GANI & PINNAPURAM	Forest Comp No-114	-	1.76	
7	GANI	1010	0.48		
8	GANI	1012	0.01		
9	GANI	1011	0.15		
10	GANI	998	0.09		
11	GANI	969	0.43		
12	GANI	1018	0.64		
13	GANI	1023	0.05		
14	GANI	1037	0.23		
15	GANI	1035	0.03		
16	GANI	1042	1.28		
17	GANI	1051B	0.84		
18	GANI	1046C	0.13		
19	GANI	1046H	0.59		
20	GANI	1047	0.08		
21	GANI	1049	0.31		
22	GANI	1010	0.48		
23	LK THANDA(CHENNAKKAPALLE)	Forest Comp No-106	-	2.59	
24	CHENNAKKAPALLE	457/B	2.38		
25	CHENNAKKAPALLE	451/G	0.10		
26	CHENNAKKAPALLE	722	0.12		
27	CHENNAKKAPALLE	723	0.20		
28	CHENNAKKAPALLE	724	0.02		
29	CHENNAKKAPALLE	725	0.14		
30	CHENNAKKAPALLE	726	0.45		
31	CHENNAKKAPALLE	727	0.01		
32	CHENNAKKAPALLE	728	0.10		
33	CHENNAKKAPALLE	786	0.01		
34	CHENNAKKAPALLE	458	0.10		

S. No	Village	Survey No.	Extent of Non-Forest land (Ha)	Extent of Forest land (Ha)	Total Extent
35	CHENNAKKAPALLE	459	0.25		
36	CHENNAKKAPALLE	785	0.11		
37	CHENNAKKAPALLE	642	0.13		
38	CHINDUKURU	734	1.40		
39	CHINDUKURU	789	0.03		
40	CHINDUKURU	741	0.07		
41	CHINDUKURU	787	0.17		
42	CHINDUKURU	786	0.40		
43	CHINDUKURU	745	0.09		
44	GADIGAREVULA	561	0.14		
45	GADIGAREVULA	563	0.12		
46	GADIGAREVULA	584/D	0.11		
47	GADIGAREVULA	565	0.20		
48	GADIGAREVULA	568	0.57		
Total (Acr)			**31.52**	**31.09**	**62.62**
Total (Ha)			**12.76**	**12.58**	**25.34**

Village Wise Land Break Up (Ha)

TOTAL ABSTRACT							
S.No	Village	Non-Forest Area		Forest Area		Total (Acr)	Total (Ha)
		Acr	Ha	Acr	Ha		
1	GORAKALLU			12.08	4.89	12.08	4.89
2	GANI	13.20	5.34	12.60	5.10	25.80	10.44
3	CHENNAKKAPALLE	10.18	4.12	6.34	2.59	16.58	6.71
4	CHINDUKURU	5.34	2.16			5.34	2.16
5	GADIGAREVULA	2.82	1.14			2.82	1.14
Total						**62.62**	**25.34**

The proposed project area falls in Gorakallu beat the compartments no 93, 94 and Ghani beat the compartments no 106, 111, 112, 113, 114 at Gani RF range of Kurnool Forest Division of Kurnool Circle of Andhra Pradesh Forest Department.

The area proposed for diversion falls under Group 6 - Tropical Thorn Forest type and belong to Subgroup 6A/C1, 6A/DS1 and 6A/DS2 as per the Champion and Seth (1968) classification of forest types.

The most common tree species are Azadirachta indica, Ziziphus mauritiana, Bauhinia racemosa, Cassia fistula and Holoptelia integrifolia. Capparis divaricata, Calotropis gigantea, Dodonaea viscosa, Lantana camara, Ziziphus xylopyrus and Justicia adhatoda are the common shrubs reported in the area.

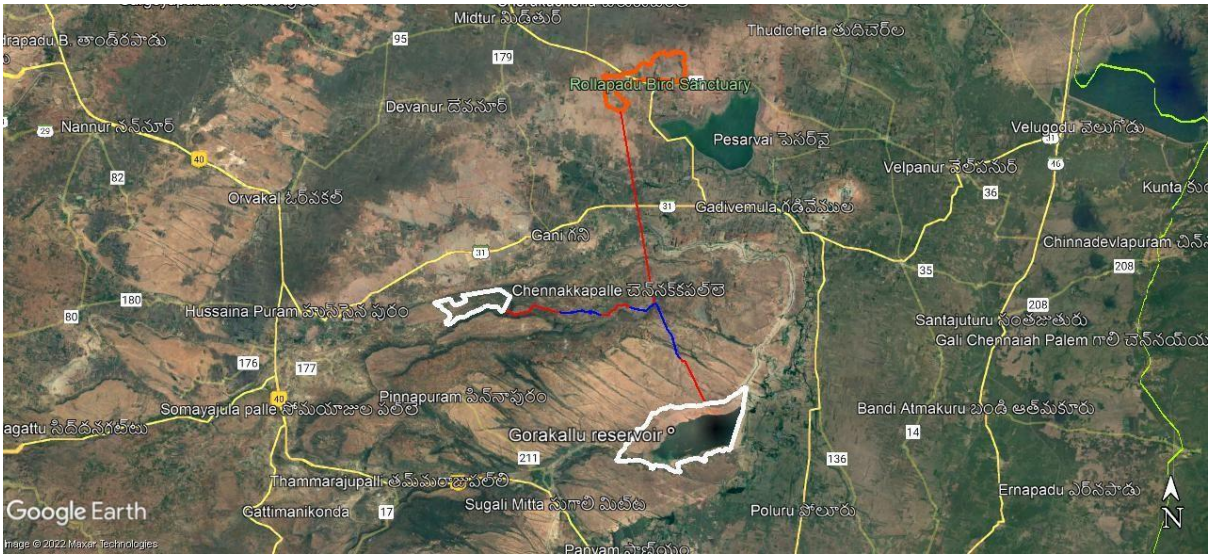
List of Faunal Species reported as per Kurnool Forest Division Working Plan

S. No.	Family	Scientific Name	Common Name	Conservation Status	
				WPA 1972	IUCN 2018.1
1.	Canidae	Canis aureus naria	Asiatic Jackal	II	LC
2.	Canidae	Cuon alpinus	Wild Dog	II	EN
3.	Cercopithecidae	Macaca radiata	Bonnet monkey	II	LC
4.	Cercopithecidae	Semnopithecus entellus	Grey Langur	II	LC
5.	Emballonuridae	Taphozous longimanus	Long-armed Sheath tailed Bat	V	LC
6.	Felidae	Viverricula indica	Small Indian Civet	II	LC
7.	Herpestidae	Herpestes auropunctatus	Small Indian Mongoose	V	LC
8.	Herpestidae	Herpestes edwardsii	Indian Grey Mongoose	II	LC
9.	Hystricidae	Hystrix indica	Porcupine	III	LC
10.	Leporidae	Lepus nigricollis	Common hare	IV	LC
11.	Muridae	Bandicota indica	Large Bandicoot Rat	V	LC
12.	Muridae	Mus booduga	Field Mouse	V	LC
13.	Muridae	Mus musculus	House mouse	V	LC
14.	Muridae	Rattus rattus	House rat	V	LC
15.	Pteropodidae	Cynopterus sphinx	Short-nosed Fruit Bat	V	LC
16.	Pteropodidae	Pteropus giganteus	Indian flying fox	V	LC
17.	Sciuridae	Funambulus palmarum	Indian Palm Squirrel	IV	LC
18.	Soricidae	Suncus murinus	House Shrew	V	LC
19.	Suidae	Sus scrofa	Wild Boar	III	LC
20.	Tupaiidae	Anathana ellioti	Madras Tree Shrew	V	LC
21.	Vespertilionidae	Pipistrellus coromandra	Indian Pipistrelle	V	LC

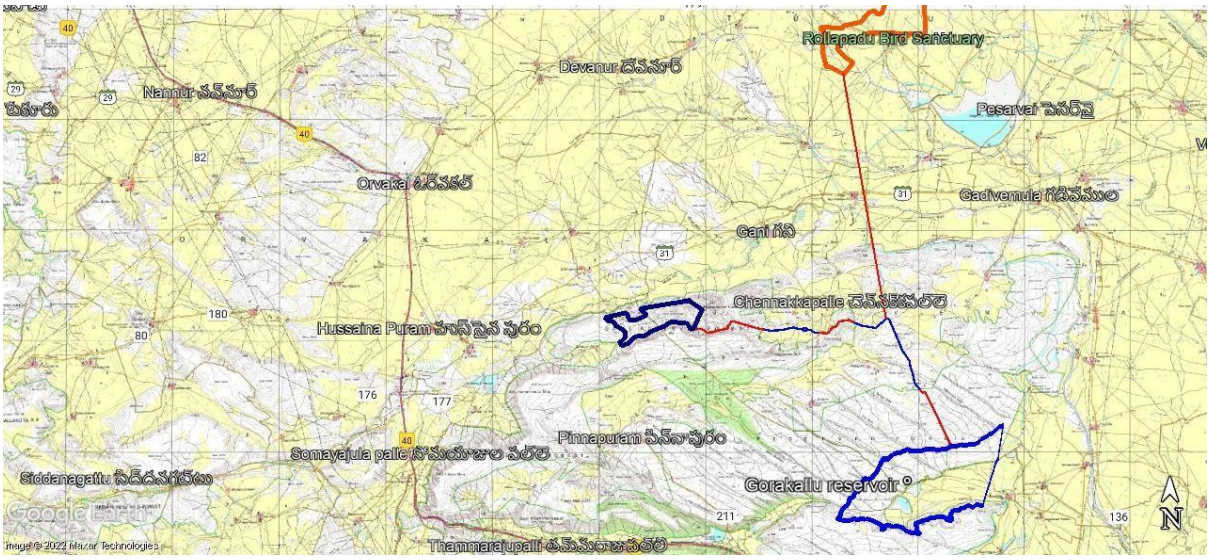
IUCN- International Union for Conservation of Nature; WPA – Wildlife (Protection) Act; EN –Endangered; LC - Least Concern; NE: Not Assessed.

The Rollapadu Wildlife Sanctuary is the nearest notified Protected Area which is located at an aerial distance 10.30 km.

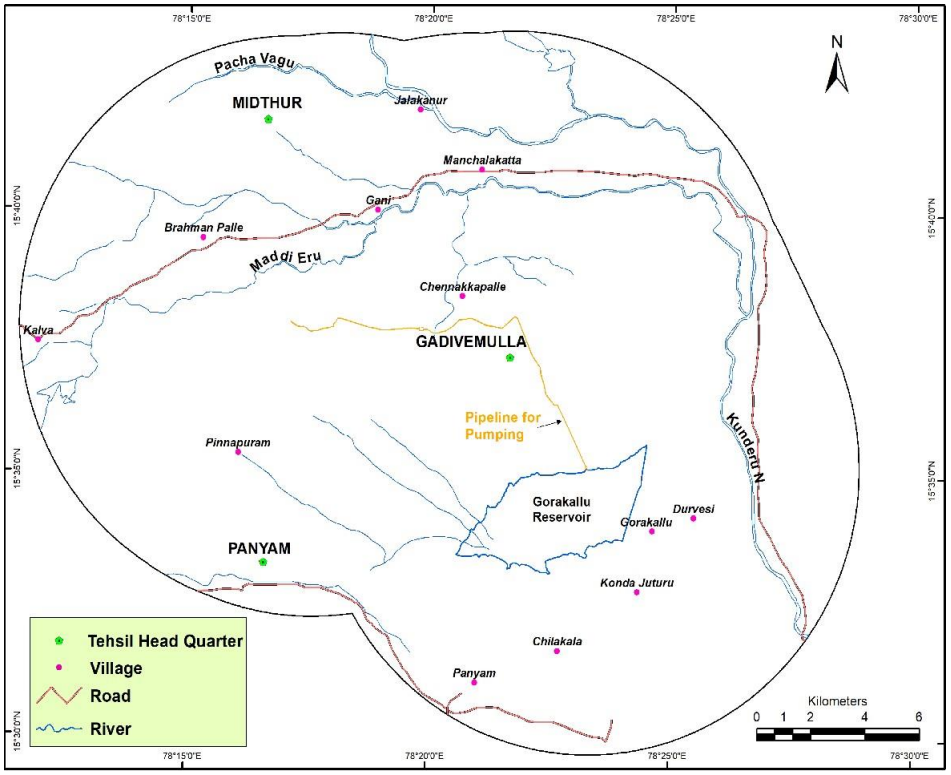
There is no sensitive ecological area / protected forest area such as National Park, Wildlife Sanctuary, Elephant Corridor in the proposed integrated corridor route alignment.



Google Map Shows Distance between the Project boundry to Rollapadu Wildlife Sanctuary



Topo Map Shows Distance between the Project boundry to Rollapadu Wildlife Sanctuary



Map showing settlements located within 10 km from integrated Corridor

The initial construction works along the alignment involves land clearance, cutting, filling and levelling which may cause loss of vegetation. This will be irreversible impact. Care to be taken to avoid the thick vegetation as far as possible. This will minimize the tree loss. Clearing of forest area is involved along the route alignment, hence the compensatory afforestation is required so that the loss of vegetal cover can be compensated, and amount required for compensation will be paid as per the norms of Forest Conservation Act.

The removal of herbaceous vegetation from the soil and loosening of the topsoil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimized through adoption of mitigate measures like paving and surface treatment and water sprinkling.

No significant impacts on aquatic ecology of the Gorakallu reservoir and disturbance to the aquatic fauna of the area is envisaged.

The major source of air pollution is the vehicular traffic, dust arising from unpaved village roads and domestic fuel burning.