PRE-FEASIBILITY REPORT

OF

MEKEDATU BALANCING RESERVOIR AND DRINKING WATER PROJECT

CONSTRUCTION OF A BALANCING RESERVOIR ACROSS RIVER CAUVERY NEAR MEKEDATU FOR PROVIDING DRINKING WATER FACILITIES TO BENGALURU METROPOLITAN REGION AND ITS SURROUNDING AREAS & FOR HARNESSING 400 MW OF HYDROPOWER ANNUALLY

Submitted to

THE DIRECTOR AND MEMBER SECRETARY,
RIVER VALLEY AND HYDROELECTRIC PROJECTS,
MINISTRY OF ENVIRONMENT, FORESTS AND
CLIMATE CHANGE (MOEF), GOVT. OF INDIA
NEW DELHI - 110003.

Submitted by

THE CHIEF ENGINEER,
CAUVERY NEERAVARI NIGAM LIMITED,
IRRIGATION (SOUTH), PUBLIC OFFICES BUILDING,
NEW SAYYAJI RAO ROAD,
MYSORE – 570 024

MAY 2024

Table of Contents

1. Executive Summary

Karnataka State having a geographic area of 1.91,976 Sq. km. happens to be the 8th largest state with a population of 6,11, 95,297 as per 2011 census. The interstate river Cauvery is a major east flowing river and is the only perennial source of water available to provide drinking water to Bengaluru Metropolitan Region. The project site is accessible by road from Bengaluru, and Ramanagara via Kanakapura, nearest rail head is Ramanagara, nearest airport is Bengaluru and sea-port is Mangalore. The objectives of Mekedatu Balancing Reservoir and Drinking Water Project include;

i. Utilizing additional 4.75 TMC of water to provide drinking water facility to Bengaluru Metropolitan Region, its adjoining area etc by way of proposing a scheme to tap water from the foreshore of the intended Mekedatu Balancing Reservoir and Drinking water project.

ii. To regulate the required quantum of water to Tamil Nadu on a monthly basis (in a normal year) as per the CWDT award, as modified by the Hon'ble Supreme Court of India vide its Judgement dated 16.02.2018. It is further proposed to store the flood waters otherwise escaping to sea as it happened in the monsoon of 2018.

iii. Harnessing nearly 400 MW (650.28 MU of renewable energy annually @90 % dependable year) of renewable energy annually by utilizing the fall in the natural bed profile of the Cauvery River upto the State border from the monthly releases effected to (in a normal year) as per the modified award (by the Hon'ble Supreme Court of India vide its Judgement dated 16.02.2018.)

The major components of Mekedatu Balancing Reservoir and Drinking Water Project as planned include;

i. Construction of Concrete Gravity dam at Mekedatu referred to as Mekedatu site with FRL at RL 440.00 metres having a Gross Storage Capacity of 67.16 TMC (1901.97 MCM).

ii. Dam will have a central spillway with radial gates to effectively discharge the design flood with suitable energy dissipating arrangement (Flip bucket) on the downstream side.

iii. Intake structure with water conducting system consisting of required number of penstocks, pressure shafts which will be embedded partly in the body of the dam and the rock mass to feed the water continuously to the generating units.

iv. Underground power house with three caverns is proposed downstream of the dam with an installed capacity of 400 MW with necessary transformers, substation and auxiliaries to evacuate the power generated.

v. Construction of Jackwell cum pump house on the foreshore of the reservoir to lift the required quantum of water along with raising main and Delivery chamber at the identified location to plan for further transportation and distribution.

The possibility of developing power from Mekedatu project has been under examination since 1948, when Kollegal territory was a part of Madras Presidency. However this project was not taken up for investigation till the reorganization of the States in the year 1956. After 1956, initially this project was investigated by the Hydro-Electric Project Investigation Department of GoM and then on by the Karnataka Power Corporation Limited (KPCL) from the year 1986 onwards. KPCL prepared a report titled "Mekedatu Hydroelectric Project – Project Report" in July 1996. However, the further consideration of the same got stalled at that time, directing Govt. of Karnataka to wait for the Award of the Hon'ble Cauvery Water Disputes Tribunal (CWDT).

The Mekedatu Balancing Reservoir And Drinking Water Project is located at Latitude 12º 16' 20'" N Longitude 77º 26' 25'" E in Muguru and Mekedatu villages, Kanakapura and Kollegal Taluks of Ramanagara and Chamarajanagar Districts. The river Cauvery flows over a, length of 800 km up to the sea and has a total catchment area of 81,155 Sq. km. It has its main tributaries as Harangi, Hemavathi, Shimsha, Arkavavathi, Lakshmanathirta, Kabini and Suvarnavatti in the State of Karnataka and Bhavani, Noyyal and Amaravathy in Tamilnadu. The western side of catchment receives south-west monsoon rainfall between June and Sept. of each year and the eastern catchment receives north-east monsoon rainfall between Oct.

and Dec. of each year, and the non-monsoon period rainfall is not significant. The climate in the catchment basin remains dry except for monsoon moths, and the temperature ranges between 19.5°C and 33.7°C and the mean daily minimum temperature varies between 9.1°C and 25.2°C. The plate showing the Index Map of the project is enclosed.

River Cauvery is an interstate river, originating in Karnataka State traversing through Tamil Nadu before draining into Bay of Bengal. The catchment area (totaling to 81,155 Sq. km. up to confluence to sea) lies in the States of Karnataka, Kerala, Tamil Nadu and Puduchery and the respective areas are 34,273 sq.km, 2,866 sq.km., 43,868 sq.km., and 148 sq.km. The lengths of the river in Karnataka State, common Boundary and Tamil Nadu State respectively are 320 km., 64 km., and 357 km.

The yield of river Cauvery was studied by The Cauvery Fact Finding Committee (CFFC) constituted in 1972, which estimated the annual yield of the Cauvery basin at 740 TMC, 670 TMC, and 623 TMC at 50%, 75% and 90% dependability. The subject of sharing of the waters was adjudicated by the Hon'ble Cauvery Water Disputes Tribunal (CWDT). CWDT passed the Award which was notified by the Centre on 19.02.2013. The riparian States approached the Supreme Court through their appeals against the award of the CWDT. The Hon'ble Supreme Court of India, after hearing the petition of the States, adjudicated on sharing of waters (Civil Appeal No. 2453 0f 2007) and delivered its judgment on16.02.2018. As per this judgment, the award has been modified as under;

- The total quantum of water to be made available by the Karnataka state to Tamil Nadu at Biligundlu in a normal year is 177.25 TMC (167.25 TMC + 10 TMC for environmental flows) annually.
- The volume of water allocated to Karnataka on account of drinking water is 6.5 TMC in lieu of 1.75 TMC awarded by the CWDT Tribunal. Thus, 4.75 TMC of water has been allocated additionally for drinking water use of Bengaluru Metropolitan Region.
- The volume of water allocated to Karnataka additionally is 14.75 TMC in all, i.e. 10 TMC (on account of availability of ground water in Tamil Nadu) + 4.75 TMC (for drinking and domestic purposes including such need for the whole city of Bengaluru Metropolitan Region).

2. Introduction of the Project/ Background Information

2.1 Identification of project proponent and project.

Cauvery Neeravari Nigam Limited (CNNL) has been registered as a completely owned company under Government of Karnataka as per the provisions of The Companies Act, 1956 with effect from 04 June 2003. The Nigam aims at reviewing the planning and design aspects and monitoring the progress of the work and tracking field periodically by involving dedicated professional administrators, subject specialist and experienced engineers and other specialists in the field in order to clear bottle necks and ensure time bound progress of work. It has its Registered Office at Surface Water Data Center Building 3rd and 4th floor, Ananda Rao Circle, Bangalore- 560009.

Mekedatu Balancing Reservoir and Drinking Water Project is proposed as a measure to conserve water, preventing energy shortage and provide drinking water facilities to Bangalore cities and surrounding areas in Cauvery basin, Cauvery Neeravari Nigam Ltd., Government of Karnataka is planning to build a balancing reservoir across River Cauvery near Mekedatu. The project on successful implementation will enable in regulating the flow and ensuring that the downstream commitment of allowing 177.25 TMC which includes 10 TMC towards environmental flow to Tamil Nadu is met along with the drinking water facilities to the areas deprived of drinking water needs in Karnataka.

Fig 1: Mekedatu (Goat's leap)

2.2 Brief description of nature of the project

To meet the drinking water needs of the people of Bengaluru Metropolitan area and its surroundings with an additional benefit of harnessing 400 MW of hydro-electric power CNNL has proposed Mekedatu Balancing Reservoir Project through the construction of a balancing reservoir across River Cauvery near Mekedatu. The proposed project provides drinking water facilities (4.75 TMC) to a population of 1,12,42,650 also by regulating the flow and ensuring that the downstream commitment of allowing 177.25 TMC which includes 10 TMC towards environmental flow to Tamil Nadu is met.

The project involves construction of a balancing reservoir, bridge, power house and tail race tunnel. The project requires a total of 5267.59 Ha of land for the construction of project components and submergence of forest, wildlife and revenue land. The proposed project involves submergence of 5160.71 Ha of wildlife, ESZ area and revenue land at a FRL of 440.00 m and R&R activities. Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi are the villages involved under submergence. The land will be acquired as per the Right to Fair Compensation and Transparency in Land Acquisition Act, 2013. The details of the project components and land required for the project is as given below;

Table – 1 Land required for the proposed project

Sl No	Components	Cauvery WLS Area (Ha)	Cauvery WLS ESZ Area (Ha)	Reserve Forest (Ha)	Non Forest/ revenue land (Ha)
1	Approach Road_1	6.71	-	-	-
2	Approach Road_2	2.96	-	-	-
3	Approach Road_3	1.69	-	-	-
4	Approach Road_4	0.68	-	-	-
5	Bridge_1	2.56	-	-	-
6	Dam Site	6.80	-	-	-
7	Diversion Channel	1.19	-	-	-
8	Down Stream Coffer	0.85	-	-	-
9	Power Generation	14.84	-	-	-
10	Power Generation Ø5.60m Lower Horizontal Pressure Shaft	0.21	-	-	-
11	Power Generation Ø6m 'D' Shaped Adit To Tail Race Tunnel	0.54	-	-	-

Sl No	Components	Cauvery WLS Area (Ha)	Cauvery WLS ESZ Area (Ha)	Reserve Forest (Ha)	Non Forest/ revenue land (Ha)
12	Power Generation Ø6m Cable Shaft EL.340.00m TO EL.380.00m	0.22	-	-	-
13	Power Generation Adit To Pressure Shaft Bottom	0.28	-	-	-
14	Power Generation Main Access Tunnel	0.64	-	-	-
15	Power Generation Ø3.25m Lower Horizontal Pressure Shaft	0.01	-	-	-
16	Power Generation Ø5m 'D' Shaped	0.06	-	-	-
17	Power Generation Ø6m 'D' Shaped	0.23	-	-	-
18	Power Generation Power house cavern	0.33	-	-	-
19	Power Generation Surge Gallery	0.12	-	-	-
20	Power Generation Tail Race Tunnel Ø 9.50m Horse Shoe Type L=2150m	4.33	-	-	-
21	Power Generation Tailrace Outlet Portal	0.40	-	-	-
22	Power Generation Transformer Cavern	0.09	-	-	-
23	Pump House	2.27	-	-	-
24	Raising Main	6.16	-	1.74	20.45
25	Submergence	4821.66	196.57	-	142.48
26	Temporary Earth_Roackfill Coffer Dam	2.43	-	-	-
27	Up Stream Coffer Dam	0.75	-	-	-
28	Dam colony	-	-	-	25.64
29	Delivery chamber	-	-	-	1.69
	Total	**4879.02**	**196.57**	**1.74**	**190.26**
		5267.59			

- Concrete Gravity Dam

A dam across Cauvery River is proposed near Mekedatu to store water for utilizing it to generate power. The height of the dam is 99 m. Hard rock is met throughout the dam alignment. As the rock is met at the surface itself, concrete gravity dam is suitable.

- Spillway

The Catchment area at dam site is. 34,273 sq.kms. The maximum flood discharge is 22,654 cumecs. Ogee profile with radial gates is proposed for disposing the flood. The flood depth considered over the spillway crest is 12 m. 18 gates of 15 m x 12 m with 14 piers of 3.5 m thickness and 3 sluice block piers of thickness 6m are proposed. The total length of the spillway between abutments to abutment is 337 m.

- Spillway section

The base width proposed for the Spillway blocks of the dam is 102.08 m. The section is checked at EL 346.00 m. The stresses developed are tabulated and enclosed.

- Transverse Contraction Joints

The total length of the dam is 734.5 m. The founding levels vary to a considerable extent. For block wise construction of the concrete dam, a spacing of 15 m to 25 m is recommended for concrete dams vide IS 6512-1984. In this case, spacings varying from 18 m to 25 m are proposed for transverse contraction joints sealing with PVC joint seals are proposed for arresting leakage.

- Spillway Cap

Ogee shape is proposed for the spillway with u/s and d/s profile, for high ogee overflow spillway. Piers are proposed at 18.5 m c/c with radial gates. This causes tension in the cap. Sufficient reinforcement is to be provided to take care of this. The design head is 12 m for normal condition, when all the 17 gates are operative. This reinforcement may be curtailed to half at a depth of 5 m below crest and discontinued to a depth of 13 m below crest.

- Pier

3.5 m thick RCC peirs with grooves for stop log gates and provision for hoisting arrangements for the operation of the radial gates is proposed. The stability analysis of the pier has been checked at RL: 428.00 m i.e. crest level. The thickness of the pier proposed is 3.5 m and for sluice pier it is 6 m.

- Spillway bridge

7.5 m RCC T- Girder bridge is proposed with 15 m span. Three longitudinal girders of 0.4 m x 1.5 m and three cross girders of 0.3 m x 1.2 m are proposed in one span. The total length of spillway is 337 m.

- Power house intake

The intake structure is located in the three power blocks of the dam from Ch: 0+646.5 m to Ch: 0+703.5m. Three number of steel penstock pipes, two numbers of 5.6 m diameter

(circular) and one number of 6.5 m diameter (circular) are embedded in the power blocks. The centerline of the penstock pipes is fixed at RL 383.00 m considering the MDDL as RL 395.00 m, fulfilling the submergence criteria as per IS stipulations. The Invert level of the Intake is fixed at RL 372.80 m. The height of the Power blocks is around 75 m from the deepest foundation level. A semicircular type trash rack is envisaged in front of Intake. No anti-vortex arrangement of each penstock opening is necessary in this arrangement of Power Intake.

Necessary provisions for locating the service gates to regulate the flow to each penstock pipes and their hoisting arrangements have been made. Provision for emergency gate is not made since there is a Main inlet Valve for each generating unit in the power house. In the power intake structure, Two Vertical lift roller Service gate of size 5.6mx5.6m and 1 No. of Vertical lift roller Service gate of size 6.5m x 6.5m have been proposed. These are operated with the help of individual rope drum hoists located on a platform supported on suitable structural steel frame at the top of the dam. Three Nos. of semi circular trash rack of height 25.25 m between EL 398.25m and EL 372.80m are also envisaged in front of the penstock openings of intake to avoid entry of any debris to the penstocks. RCC breastwall is proposed above EL 398.25m.

- Tunnel (s), Pressure shaft(s)

3 nos. of steel penstock pipes, 2 nos. of 5.6 m dia. and 1 no. of 6.5 m dia. which are embedded in the power blocks and run horizontally for a distance of around 75 m before taking a 90º bend, to form the pressure shafts dropping down to RL 296.50 m. All the three pressure shafts are of length of around 75 m each and are steel lined with cement concrete backing. Each of the 2 Nos 5.6 m diameter Pressure shaft carry a design discharge of 113 cumec and the 6.5 m diameter Pressure Shaft carries a design discharge of 151 cumec. The total design discharge conveyed by the three Pressure shafts is 377 cumec. The water in the Pressure Shaft will have a velocity of 4.6 m/sec. The 6.5 m diameter pressure shaft bifurcates into a 5.6 m diameter branch and a 3.25 m diameter branch near the power house to feed the 120 MW and 40 MW units in the Power house respectively. The other two Pressure Shafts of 5.6 m diameter directly enter the power house to feed the other two units of 120 MW.

The centerline of the penstock at entry in the Intake is kept at RL 383.00 m and the centerline of horizontal portion of pressure shaft at entry to the power house is at RL 296.50 m. The steel penstock is encased with cement concrete 1000 mm thick. The vertical pressure shaft will have backfill concrete lining thickness of 600 mm around the steel liner. Thickness of steel lining has been worked out based on rock quality and strength parameters with due consideration for suitable rock participation.

- Penstock and surge shaft

No Surge Shaft / Surge Tank is required as the entire length of water conductor system comprising of embedded upper horizontal penstock, vertical pressure shaft and lower horizontal pressure shaft is around 190 m and hence the ratio of Length(L) to Head (H) is less than 4. Hence there is no necessity of Surge shaft for this water conductor system. However the water conductor system is designed for the pressure rise and checked for negative pressures (as per hydraulic gradient line/ water hammer pressures) due to closing and opening of turbines. However a suitable arrangement in the form of Surge Chamber Cavern is provided to cater to transient condition in the downstream circuit which consists of the the power house, draft tube tunnel, tail race tunnel which is around 2150 m long and the tail race outlet.

Based on the preliminary transient analysis, a Surge Chamber of size 77.5 m (L) x 22 m (W) and 46 m (H) is envisaged. The draft tube tunnels of individual generating units from the power house enter the Surge Chamber at RL 289.00 m and RL 292.00 m for 120 MW units and 40 MW unit respectively. Individual gates are provided to control flow from each draft tubes. A gate operating platform is provided inside the Surge Chamber. Based on the transient analysis for the downstream circuit carried out using WHAMO, developed by USACE, the maximum surge level in the surge chamber is fixed at RL 315.00 m. The minimum surge level is fixed at RL 292.50 m. Required rock supporting measures in the form of grouted rockbolts and shotcrete (SFRS) are provided for the Surge chamber cavern based on the rock mass properties available.

- Underground Power house

For underground power complex sufficient rock cover is available. In general, the granite gneiss with closepet granite and charnokite rocks will be present up to invert level. The granite gneiss rock is good tunnelling medium.

The foliations in rock striking almost N-S to NW-SE and dipping towards west and intersected by two sets of joints requires rock bolting during arch excavation. It is suggested to align the long axis of the power house E-W to get the optimum stability benefits. It is expected that, during power house excavation, good to very good, self supported rock will be met. The invert level of power house is below the river bed; hence seepage is expected during excavation.

It is proposed to house the four generating units, 3 units of 120 MW capacity each and one unit of 40 MW in the underground power house located in the rock mass on the right bank of Cauvery River. The underground power house has a provision for service bay and control room bay, along with unit bays. The width of the power house cavern is tentatively fixed as 22 m. The overall dimension of the powerhouse including service bay and control room building is 139 m (L) x 22 m (W). The dimension of service bay is 30 m (L) x 22 m. The size of Control room / Switch gear room is 25.5 m (L)x 22 m (W). The crown of the power house cavern is at RL 328.50 m, the height of the power house cavern is 42 m upto draft tube invert level at RL 286.50 m. The Power House is proposed to be provided with concrete lining at the crown of the power house. The operating floor and service bay level is tentatively fixed at RL 309.00 m. The generator floor is at RL 304.50 m. Turbine floor is provided at RL 300.00 m. MIV floor is at RL 293.00 m. Provision has been made in the powerhouse to accommodate the control room, the battery room, the switchgear room, the utility room, the DG room and an office with toilet facilities, etc. Four Draft tubes emerge out of the underground power house at the bottom and lead into the Surge Chamber. A ventilation tunnel of 6.0 m diameter is provided at the crown of the underground power house and also connects the Transformer Cavern and Surge Chamber. Cable shaft is also proposed from the transformer / Bus Duct cavern upto the outdoor GIS Building and pothead yard. An access tunnel of 7.0 m dia., D-Shaped is provided to meet the power house at the level of operating floor / Service Bay i.e., RL 309.00 m. A rock mass gap of 40 m is left between the Power house Cavern and Transformer Cavern for stability for the openings / caverns. Required rock supporting measures in the form of grouted rockbolts and shotcrete (SFRS) are provided for the Power house cavern based on the rock mass properties available.

A Transformer cavern is provided to house 4 nos. 3-Phase Transformers catering to the 3 generating units of 120 MW each and one generating unit of 40 MW. The power generated from the generating units of Underground Power house is connected to the transformer in the

Transformer Cavern through 4 nos. bus ducts of sizes 6.0 m (3nos. D-shaped) and 5.0 m (1.0 no. D-shaped) and of lengths 40 m each. The length and width of transformer cavern are 66 m and 16 m respectively. The height of the transformer cavern is 19 m. A rock mass gap of 30 m is left between Transformer Cavern and Surge Chamber cavern to provide the essential stability for the openings/ caverns. Required rock supporting measures in the form of grouted rockbolts and shotcrete (SFRS) are provided for the Transformer cavern and the interconnecting tunnels like the busducts, draft tubes and escape tunnels, based on the available rock mass properties.

- Tail race Tunnels

Tail race tunnels (Two nos.) of 9.5 m dia, Horseshoe Shaped each take off from the Surge Chamber. The tailrace tunnels followed by a tail race channel terminates in a weir overfall structure with its crest at RL 302 m. The lengths of the tail race tunnels & Tail race channel depends upon the location of the meeting the river bed level at RL 302.00 m. Lengths of tail race tunnel is around 2150 m each. These tail race tunnels will be designed as pressure tunnels.

- Switch yard / Pothead yard

The out door GIS and pothead yard is proposed at RL. 385 m. XLPE cables from the transformer cavern are routed from through the ventilation tunnel of 6.0 m diameter, D-shaped and through 6.0 m diameter (circular) cable shaft to GIS building. The generated power is evacauated from the pothead yard through a dedicated double circuit 220 kV transmission line upto the receiving substation of KPTCL.

- Main Access Tunnel, Ventilation Tunnels, Escape Tunnel, Adits

The three caverns namely, Power house cavern (PH), Transformer cavern (TC) and Surge Gallery cavern (SG) are excavated through the proposed ventilation tunnels of size 6.0 m D-Shaped. The ventilation tunnels are connected to the crowns of all these caverns for excavation of caverns. The portal for ventilation tunnel is proposed at RL 360.00 m. The total length of ventilation tunnels is around 1200 m. Suitable approach road is provided to the ventilation tunnel portal.

Main access tunnel of size 7.0 m diameter, D-shaped and length of around 1265 m, provides access to Power house, Transformer and Surge Gallery caverns. For movement of equipment and maintenance, the portal for main access tunnel is proposed at RL 365.00 m. The size of

Main access tunnel is increased to 10 m(W) x 7 m(H) between Power house cavern and Transformer cavern for ease of movement of 3-phase transformer from Transformer Cavern to Service bay in PH cavern.

Escape tunnel of size 4.0 m diameter, D-shaped interconnecting the Power House, Transformer Cavern and Surge Gallery is envisaged for easy escape of personnel in operation stage during case of any contingencies like fire etc. The total length of escape tunnel is around 70m. For the excavation and insertion of steel ferrules in the vertical pressure shaft as well as lower horizontal pressure shaft, a 6.0 m diameter, D-shaped adit to pressure shaft bottom is envisaged. Once the construction of pressure shaft is completed, suitable length of concrete plug will be provided. This adit takes off from Main access tunnel. The total length of adit to the chamber at the pressure shaft bottom is around 410 m. Suitable approach road to the top of pressure shafts are provided.

An adit to tail race tunnel of size 6.0 m diameter, D-Shaped is proposed at mid point length of the tai race tunnel to reduce the construction time of the tail race tunnel. The portal for this adit is proposed be established at RL 365.0 m. The total length of the adit to tail race tunnel is around 750 m.

2.3 Need for the project and its importance to the country and or region.

Karnataka is blessed with major perennial/non-perennial rivers such as Krishna and Cauvery besides 13 West flowing rivers, but still faces severe drought and drinking water scarcity frequently, besides facing acute power shortage. Bangalore Metropolitan Region and areas falling under Cauvery Basin are facing acute drinking water shortage (with these areas having grown substantially in the past few years) due to increase in population. In view of this, CNNL has proposed Mekedatu Balancing Reservoir and drinking water supply scheme to meet the drinking water needs of Bangalore City and energy requirements.

Utilizing additional 4.75 TMC of water (as per modified allocation) to provide drinking water facility to Bangalore Metropolitan Region with a population of 1,12,42,650 by way of proposing a scheme to tap water from the foreshore of the intended Mekedatu Balancing Reservoir and Drinking Water Project. To ensure and release the required quantum of water to Tamil Nadu on a monthly basis in a normal year (177.25 TMC which includes 10 TMC

towards environmental flow) as per the CWDT award, further modified by the Hon'ble Supreme Court of India vide its judgement dated 16/02/2018. Harnessing nearly 400 MW of hydro power annually by utilizing the fall in the natural bed profile of the Cauvery River up to the State border from the monthly releases effected to (in a normal year) as per the modified award (by the Hon'ble Supreme Court of India vide its Judgement dated 16/02/2018)

2.4 Demand-Supply

The proposed project meets the demands of providing drinking water facilities to the areas deprived of drinking water in Bengaluru Metropolitan area and its surroundings in Cauvery Basin of Karnataka along with an additional benefit of harnessing 400 MW of power.

2.5 Imports vs. Indigenous production

Not Applicable

2.6. Export possibility

Not Applicable

2.7. Domestic/ Export markets.

Not Applicable

2.8. Employment Generation (Direct and Indirect) due to the project.

Sl. No.	Project phase	Proposed (Nos.)
1	Construction Phase - Temporary	1500
2	Construction Phase - Permanent	1500
3	Operation Phase - Temporary	25
4	Operation Phase - Permanent	50

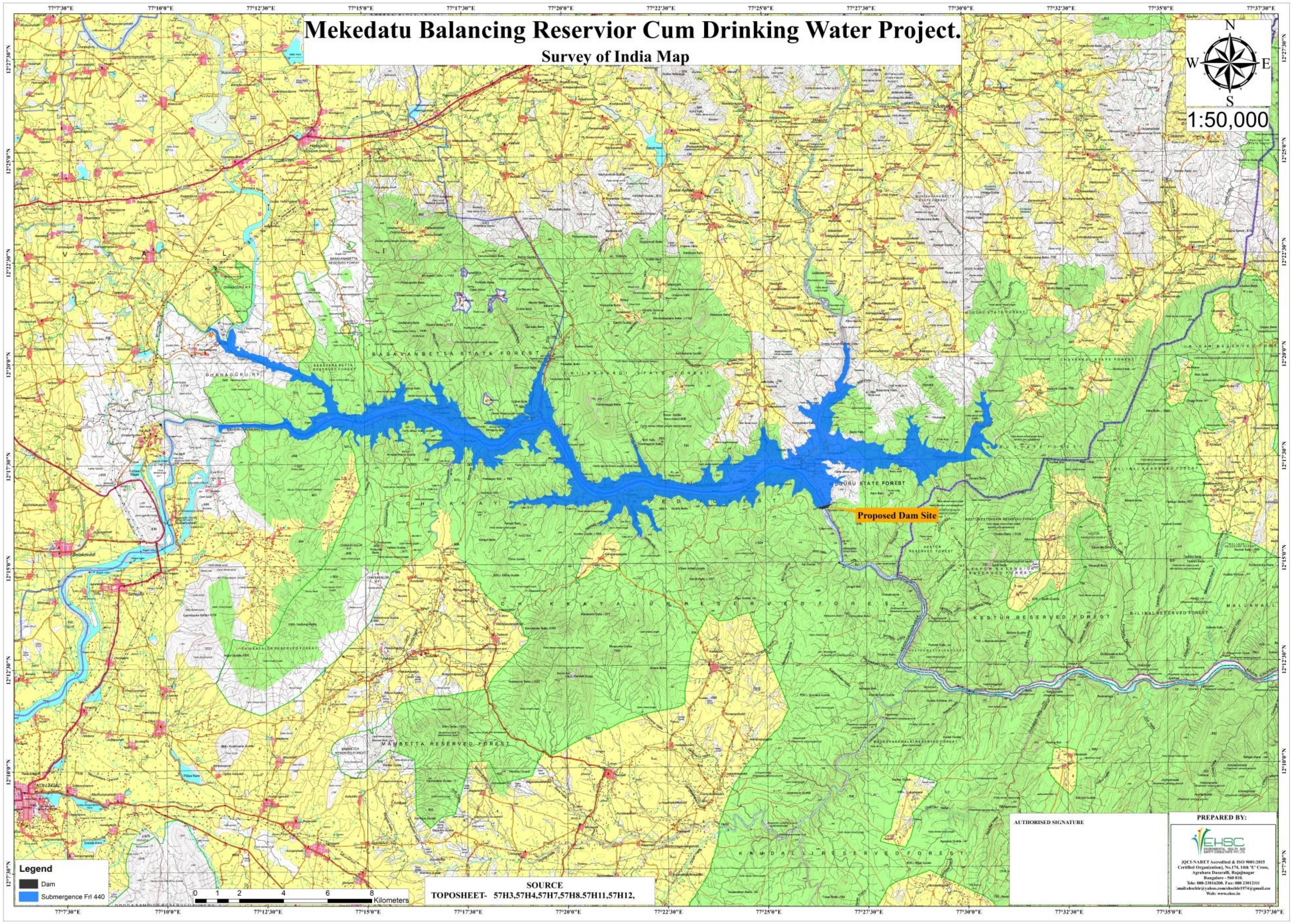


Fig 2: Index map showing proposed Mekedatu balancing reservoir and project components

3. Project Description

3.1. Type of project including interlinked and interdependent project, if any.

The proposed project involves harnessing of 400 MW of hydro power annually and the project components also falls within Cauvery Wildlife Sanctuary (near Mekedatu) and the interstate boundary of Tamil Nadu is located at a distance of 2.73 Km from the proposed tail race tunnel end and 4.48 km from the proposed balancing reservoir. Hence, the proposed project is considered as Category 'A' as per EIA notification, 2006 and its subsequent amendments. The project aims at providing drinking water facilities to a population of 1,12,42,650 of Bengaluru Metropolitan area and its surroundings along with harnessing of 400 MW of power. Therefore, the project requires Environmental Clearance from Ministry of Environment, Forests and Climate Change, Govt. of India, New Delhi.

3.2. Location (map showing general location, specific location, and project boundary & project site layout) with coordinates.

Mekedatu project is located at Latitude 12° 16′ 20" N and Longitude 77° 26′ 25″ E in Muguru and Mekedatu villages, Kanakapura and Kollegal taluks of Ramanagara and Chamarajanagar Districts, Karnataka State. The dam site is located about 3.0 Km downstream of confluence of Arkavathy with Cauvery river called 'Sangama'. While the left flank of the dam falls under Ramanagara District, the right flank falls under Chamarajanagar District. The centerline of the Cauvery river forms the administrative boundary between the two Districts. Location map of the project is shown in Fig.7.

3.3. Details of alternative sites, considered and the basis of selecting the proposed site particularly the environmental considerations gone into should be highlighted.

A study has been carried out to identify the locations which can be considered for selecting the site to locate the balancing reservoir was undertaken using available data, topographical maps and inspection of selected reaches of the rivers. Nearly 3 locations were identified along the Cauvery River between Shivanasamudram and Mekedatu since locating any reservoir in the upstream of Shivanasamudram would deviate the project objectives. The details of the options worked out are given below;

Table 2– Details of the alternative Balancing Reservoirs

No.	Particulars	Balancing Reservoir – 1 (Downstream of proposed Reservoir)	Balancing Reservoir – 2 (Proposed Reservoir)	Balancing Reservoir – 3 (Upstream of proposed Reservoir)
1.	Name of the River	Cauvery	Cauvery	Cauvery
2.	Geographic location	12°15'33.49"N 77°26'51.87"E	12°16'20.91"N 77°26'25.88"E	12°17'16.03"N 77°25'37.30"E
3.	Location of the site as regards to District / Taluk	(1) Kollegal Taluk, Chamarajanagar District (2) Kanakapura Taluk, Ramanagara District (3) Malavalli Taluk of Mandya District		
4.	Elevation of the River bed with respect to Mean Sea Level (m)	348.00	352.00	375.00
5.	FRL (m)	440.00	440.00	470.00
6.	MWL (m)	441.20	441.20	471.20
7.	Height of the Dam (m)	92.00	95.00	95.00
8.	Storage capacity in TMC	68.00	67.16	61.00
9.	Total Land required for the project (Ha)	5807.40	5267.59	5897.40
10.	Cost in Crores.	9900	9000	10500

In case of Balancing Reservoir -1, the river course is narrow and flows very rapidly due to steep bed fall. The accessibility to the project site is quite difficult due to irregular geological formations. The maximum designed flood discharge of 8 Lakh Cusecs would submerge the historical Mekedatu site located at a distance of 500 m downstream of the proposed dam site. The presence of hillock in between obstructs the construction activities thereby widening the submergence of forest area.

Whereas in case of Balancing Reservoir -2, the site is accessible and there will be less submergence of forest land. The site is also having favorable geological formation and availability of founding strata at shallow depth. The site is maintaining safest distance with historical Mekedatu site which is about 1.8 Km downstream. In other words even during the peak flood discharge of 8 Lakh Cusecs, the probability of submergence of historical Mekedatu site will be remote. At this location the river course is normal and wide. The capacity of water storage at this site is in line with hydrological studies to store 67.16 TMC of water.

Further in case of location of Balancing Reservoir – 3, the downstream flow of the water is turbulent flow due to the influx of floods from Arkavathy river which is joining the River Cauvery downstream of this site. Moreover, there might be afflux due to backwater effect in Arkavathy river resulting in temporary submergence of additional forest land when there is a

release of heavy floods of 8.0 Lakh cusecs. The water level at this location would reach up to Shivanasamudram and will submerge major portions of the existing power house affecting the generation to a great extent. This may call for complete relocation of the power house if it has to meet the original power generation. The forest area submergence at this location is more in view of maximum water spread. At this site there is no rapid fall in the natural bed slope required for hydroelectric power generation.

Considering the above merits and demerits of each location, the Balancing Reservoir -2 location would be ideal in terms of technoeconomic feasibility, less forest submergence with good geological formation to store the available water. Hence, BGthis location has been selected as a part of DFR for which the CWC had accorded in-principle approval and directed the Government of Karnataka to proceed further for preparation of DPR. Map showing the location of alternative sites is enclosed as **Annexure-1**.

3.4. Size & magnitude of operation

Construction of Mekedatu Balancing Reservoir with FRL at RL 440 m (with a flexibility of 5 m on either side and storage capacity of 67.16 TMC annually) with an installed capacity of 180 MW in the first stage and another 220 MW in the ultimate stage with an annual generation of 400 MW. The proposed project also provides drinking water facilities to a population of 1,12,42,650.

3.5. Project description with process details (a schematic diagram/flow chart showing the project layout, components of the project etc) should be given.

The project comprises of major components such as Mekedatu balancing reservoir, bridge power house, tail race tunnel and approach roads and the drawings area given as **Annexure 2**. The details of the construction activities are listed below:

- Construction of Concrete Gravity dam at Mekedatu referred to as Mekedatu site with FRL at RL 440.00 metres having a Gross Storage Capacity of 67.16 TMC (1901.97 MCM).
- Dam will have a central spillway with radial gates to effectively discharge the design flood with suitable energy dissipating arrangement (Flip bucket) on the downstream side.

- Intake structure with water conducting system consisting of required number of penstocks, pressure shafts which will be embedded partly in the body of the dam and the rock mass to feed the water continuously to the generating units.
- Underground power house with three caverns is proposed downstream of the dam with an installed capacity of 400 MW with necessary transformers, substation and auxiliaries to evacuate the power generated.
- Construction of Jackwell cum pump house on the foreshore of the reservoir to lift the required quantum of water along with raising main and Delivery chamber at the identified location to plan for further transportation and distribution.

The extent of submergence of the land on the upstream of the Dam with the proposed FRL at RL 440.00 m is 5167.08 Ha.

Technical details of the project components are as given below;

1. Reservoir

Sl.No.	Particulars	Details	
Reservoir			
1	Water levels (EL.m)		
	a) Maximum Water level (MWL)	441.20 m	
	b) Full Reservoir level (FRL)	440.00 m	
	c) Minimum Draw Down Level	395.00m	
	d) Outlet levels	359.00m	
	i) Irrigation	Nil	
	ii) Power	379.75m	
	iii) Others (Please Specify)	359.00m (River sluice)	
	e) Dead Storage Level	395.00m	
2	Free Board (m)	3.576 m	
3	Wave height (m)	2.630 m	
4	Live Storage (M.cum)	59.46 TMC (1683.90 MCM)	
5	Capacity (M.cum)		
	a) Maximum Water Level		
	b) Full Reservoir Level	67.16 TMC (1901.97 MCM)	
	c) Minimum Draw Down Level	7.7 TMC (218.06 MCM)	
	d) Dead Storage Level	7.7 TMC (218.06 MCM)	
6	Flood absorption capacity (M.cum)		
	a) Below FRL	NA	
	b) Between FRL & MWL	NA	
7	Sedimentation (M.cum) and levels		
	Total Sediment	**50 years**	**100 years**

Sl.No.	Particulars	Details	
	b) Above MDDL	Nil	Nil
	c) Below MDDL	89.70 M cum	179.40 M cum
	d) Encroachment on Live Storage	Nil	Nil
	b)New zero elevation	RL 370.48 m	RL 375.76
8	Average Monthly evaporation losses from reservoir (Mcum)	The value of evaporation considered is that of KRS as per actual measurement. The same has been considered for the proposed project. **Month** — **Evaporation value** June 4.199 July 3.212 August 3.195 September 3.293 October 4.048 November 3.319 December 3.187 January 3.122 February 3.048 March 3.408 April 4.885 May 5.120	
9	Seepage in the reservoir	NA	

2. Head works

Sl.No.	Particulars		Details	
Head Works				
1	Dam		Concrete Gravity Dam (Length 734.5 m)	
2	Embankment Dam			
	(a)	Type of Dam	NA	
	(b)	Length of Dam at Top	NA	
	(c)	Top Width	NA	
	(d)	Maximum Height above GL	NA	
	(e)	Dyke(s)	NA	
	(f)	Type of cut off and maximum	NA	
3	Masonry and Concrete Dam (Non-over flow section)			
			Left side	Right Side
	(a)	Type of Dam	Concrete	Concrete
	(b)	EL of top	445.00 m	445.00 m
	(c)	EL of deepest foundation	352.00 m	352.00 m
	(d)	Length at top	179.50 m	218.00 m
	(e)	Length at River bed	--	--
	(f)	Width at top	7.5 m	7.5 m
	(g)	Width at deepest bed level	90.8 m	90.8 m
	(h)	Maximum height above deepest foundation level	95.0 m	95.0 m

Sl.No.	Particulars	Details
4	Spillway (over flow section)	
(a)	Type of spillway (Ogee/chute/side channel/tunnel/syphon/any other	Ogee
(b)	Full Reservoir level	440.00 m
(c)	Maximum Water Level	441.20 m
(d)	Length	337 m
(e)	Maximum height above the deepest foundation	99.00 m
(f)	Crest level	428.00 m
(g)	Number of gates	18
(h)	Type of gates	Radial
(i)	Size of Gate	15 x 12 m
(j)	Maximum Discharge Capacity	
	(i)FRL	(19054 Cumecs) 6.73 Lakhs Cusecs at FRL
	(ii)MWL	(22650 Cumecs) 8 Lakhs Cusecs at MWL
(k)	Flood lift	
(l)	Tail water level	
	(i)Maximum	369.60 m
	(ii)Minimum	352.50 m
(m)	Type of energy dissipation arrangements	Flip bucket
(n)	Type of hoisting arrangement and its capacity	Rope drum Hoist (140T)
5	River sluice(s), Irrigation/Power	River sluice
(a)	Purpose	To meet downstream releases in line with CWDT Award
(b)	Number	3
(c)	Size(m)	3.0 x 3.0 m
(d)	Sill level	359.00 m
(e)	Discharge capacity at | (M^3/s)	
	(i)Full reservoir level	762.4 m^3/sec at EL 440.00 m
	(i)Minimum draw down level	502.3 m^3/sec at EL 395.00 m
(f)	Number of gates	3
(g)	Type of gates	Vertical lift
(h)	Size of gate	3.0 x 3.0 m
(i)	Type of hoist arrangement and its capacity	Hydraulic hoist 700 T capacity

3. Power

Sl.No.	Particulars	Details
Power		
1	Type –Conventional/Pumped	Conventional Storage
2	Installed capacity (MW)	3×120 MW + 1×40 MW=400 MW
3	Load Factor	18.56% (Annual)

Sl.No.	Particulars	Details
4	Annual Energy	90% Dependable Energy
	(a)Firm	169.13 MU
	(b)Seasonal	481.15 MU
	(c)Total	650.28 MU
5	Off peak requirement for pumping	--
6	Cost per kW installed	--
7	Cost per kW at the bus bar	--
8	Head Race Channel /Tunnel	
9	(a)Length(m)	Not applicable, since water conductor system consists of Horizontal and Vertical pressure shafts.
	(b)Shape	
	(c)Size(m)	
	(d)Rock type reach-wise-RMR/Q	
	(e)Rock cover reach-wise	
	(f)Free/Pressure flow	
	(g)Lining type-PCC/RCC/Steel	
	(h)Reach-wise Design Internal & external	
	(i)Thickness of lining (m)	
	(j)Design Discharge (/s)	
	(k)Invert level at (EI-m)	
	(l)Gate-No. Type & size	

4. Intakes

Sl.No.	Particulars	Details
Intakes (Upper intake)		
1	Type & size of intake	Semicircular type, 2 nos, 6.5 m Radius, one of 7.5 m Radius.
2	Energy profile with details of transition	Elliptical profile, as per IS guidelines.
3	Stability of the slope/cut around intake	Stable cut slopes in rock
4	Design velocity through trash rack and bellmouth	0.5 m/sec
5	Submergence of the entry below water level	Submergence below water level is 12 m above the bellmouth top 1 service gate for each penstock Vertical lift wheeled gates. Size: 2nos.of 5.6m x 5.6m,1 of 6.5m x 6.5m. operating by Hydraulic hoist. Capacities for 6.5 m dia, 160 T / for 5.6 dia,
6	Intake gates-Number. Type. Size	
7	Details of anti-vortex arrangements	
8	Type of hoisting arrangement and its capacity	

Sl.No.	Particulars	Details
9	Lower Intake (for pumped storage scheme) i. Type & Size of intake ii. Entry profile with details of transition iii. stability of the slope/cuts around intake iv. Design velocity through trash rack and bellmouth v. Submergence of the entry below water level vi. Intake gates-Number. Type. Size vii. Details of anti-vortex arrangements	Not Applicable

5. Surge Tank/Shaft

Sl.No.	Particulars	Details
Surge tank /Shaft		
1	Nos. & Location (HRT/TRT or	1No. on TRT side
2	Type height & size	45m (H) & 22m (W) × 775 m
3	Orifice-size & position (or any other relevant details)	Surge chamber cavern D/S Power House
4	Top level	EL.328.00m
5	Bottom level	El. 281.50m
6	Steady state level	El. 302.5m
7	Capacity	-
8	Lower expansion Chamber Size and location	No
9	Upper expansion Chamber- Size and location	No
10	Max. Surge Level (El-m)	El.315m
11	Min. Surge level (El-m)	El.292.5m
12	Size of gates and capacity of hoists	No gates

6. Penstocks/pressure shafts

Sl.No.	Particulars	Details
Penstocks/pressure shafts		
1	Number, diameter, & length	2no. 5.6 m Ø circular+1No. 6.5 m Ø, L=285m before bifurcation
2	Inclination	Vertical & Horizontal
3	Liner type	Steel
4	Grade of steel	ASTM 517F
5	Reachwise rock cover	73.5m for Horizontal Portion

Sl.No.	Particulars	Details	
6	Reachwise rock properties-RMA/Q	80/19.8	
7	Reachwise rock participation factor –computed & adopted	50%	
8	Reachwise liner thickness	1st Reach=16mm, 2nd Reach=20mm, 3rd Reach=25 mm	
9	Necessity for heat treatment if any	Yes	
10	Bifurcation / trifurcation	Bifurcation	
11	Gate Number: Type & Capacity	2no. 5.6m×5.6m+1no. 6.5m×6.5m	Rope drum Hoist
12	Size of gate and capacity of hoists.	2no. 150t, 1no. 160t	

7. Power House

Sl.No.	Particulars	Details
Power House		
1	Power House	Underground
	(a) Type (Surface or Under Ground)	--
	(b) Orientation	--
	(c) Rock types encountered-RMR/Q Value	Granite
	(d) Major wedge formations, if any	--
	(e) Rock ledge dimension between cavities	40m Between PH & TC
	(f) Maximum head(m)	138 m
	(g) Minimum head(m)	90m
	(h) Average head(m)	103 m
	(i) Head loss in water conductor system	3 m
	(j) Design head(m)	120 m
	(k) Dimensions (m)	139(L)×22m(W) × 42m
	(l) Unit Capacity	3×120MW+1×40MW
	(m) Installed capacity (MW)	400 MW
	(n) Type of turbine	Vertical Francis
	(o) Type of generator	SYNCHRONOUS
	(p) Type of power house crane	EOT, 2×225MT capacity
	(q) Number and size of draft tube gates/bulk head capacity of hoists	3No. 8m×8m+1No. 6m×6m, 150 T/ 100 T Rope drum hoist
2	Switch Yard Type Voltage level No. of incoming and outgoing bays	GIS - Overground 220 kV 4 Outgoing Bays

Sl.No.	Particulars	Details
3	Transformer Cavern Dimension Orientation Rock type encountered – RMR/Q Values Major wedge ormations, if any Rock ledge-dimension between cavities	16m(W) x 78m(L) Parallel to Power House cavern. Hard rock 40 m Between PH & TC

8. Tail Race Channel and tunnel

Sl.No.	Particulars	Details
1	**Tail Race Channel**	
	(a) Shape & Size	Rectangular Shape 35 (L) x 45 (B)
	(b) Length	35m
	(c) Recovery Slope	--
	(d) Side Slope	1:5
	(e) Max. Tail Water Level (El-	EL:305m
	(f) Min. Tail Water Level (El-m)	EL:302m
	(g) Average tail water level (El-	EL:302m
	(h) Tail water level	EL:303.3m
	(i) Tail water level corresponding to max	EL:315.0m
	(j) HFL of recipient river channel at outfall	EL:315.0m
2	**Tail Race Tunnel**	
	(a) Number Shape & Size	Horse Shoe, 2 No. & 9.5 m Diameters
	(b) Length	2150m
	(c) Reach wise Rock cover	Ranges between 65 m to 155 m
	(d) Reach wise Rock properties-RMR/Q	80/19.80
	(e) Type of lining	Concrete lining
	(f) Max. Tail Water Level	EL:305 m
	(g) Min. Tail Water Level	EL:302 m
	(h) Avg. Tail Water Level	--
	(i) Tail water level	EL.303.30 m
	(j) Tail water level	EL. 315.0 m
	(k) HFL Of recipient river	EL. 315.0 m
	(l) TRT gate number, type, size	2 no. rope drum hoist 130 T capacity for gate of size 9.5 m × 9.5 m.

Fig 3: Proposed Mekedatu Balancing Reservoir location

Fig 4: Proposed bridge location

Fig 5: D/s of proposed bridge location

Fig 6: Proposed Power House location

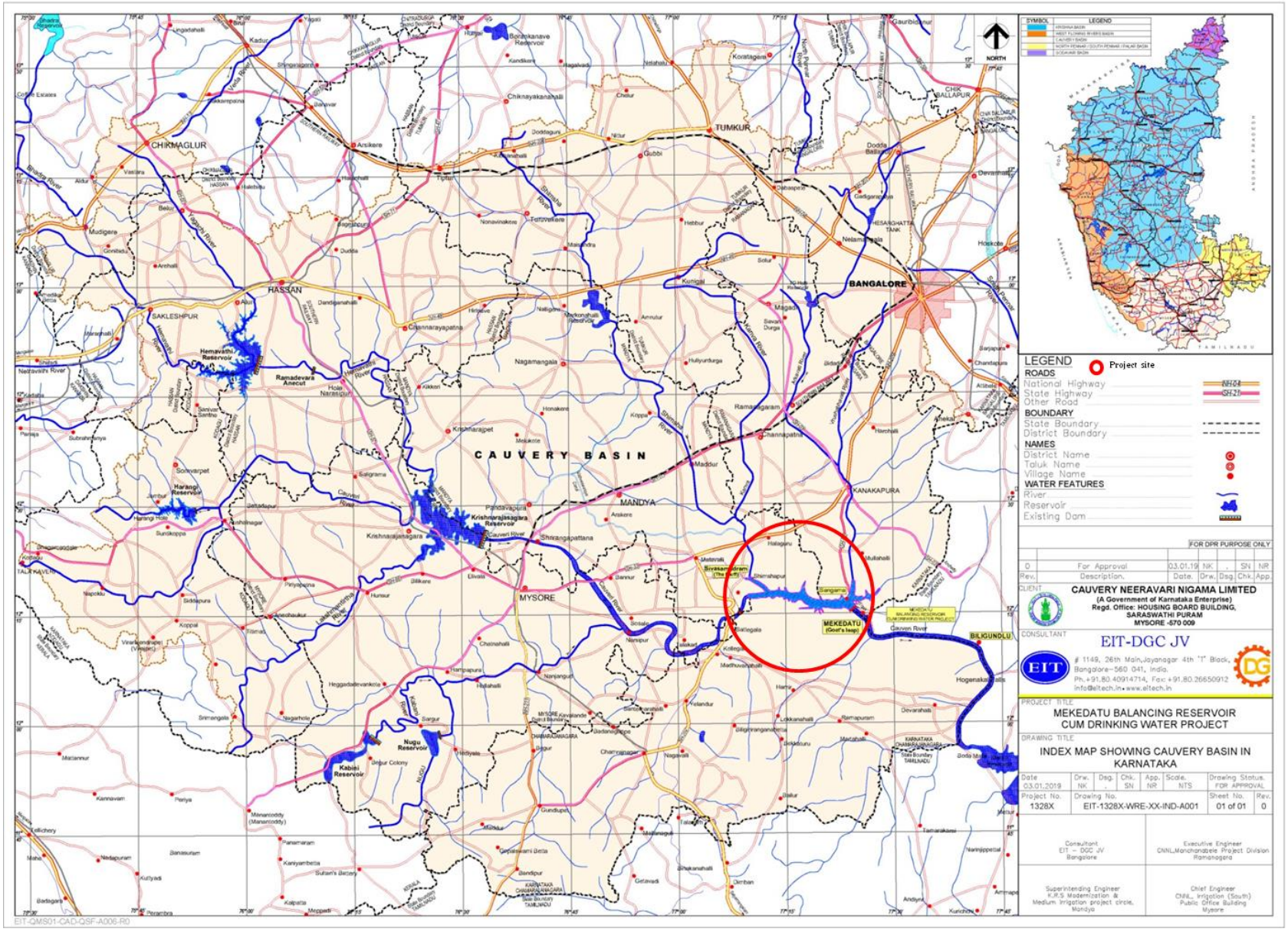


Fig 7: Location map of the proposed scheme

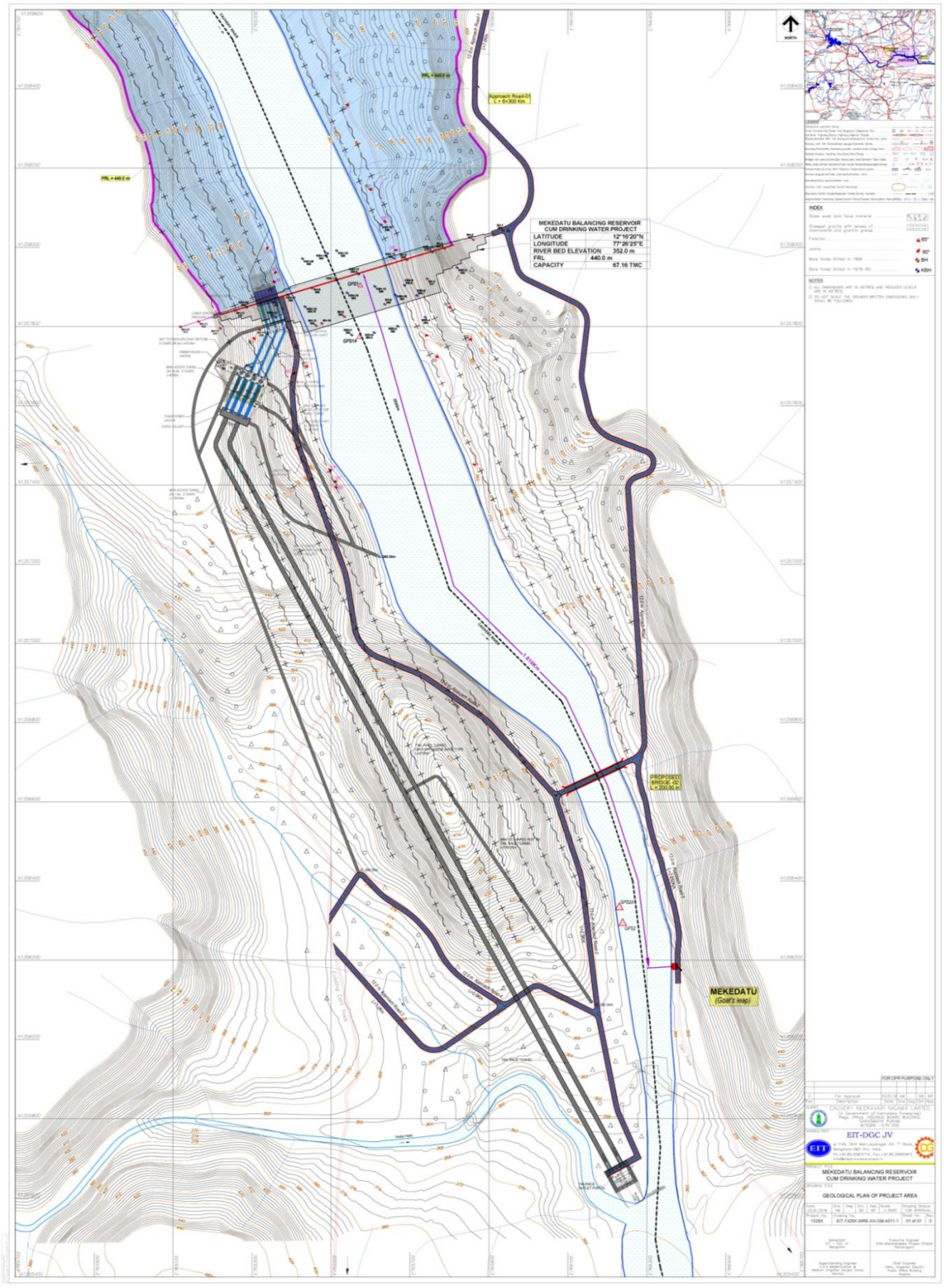


Fig 8: Map showing general arrangement of the project components

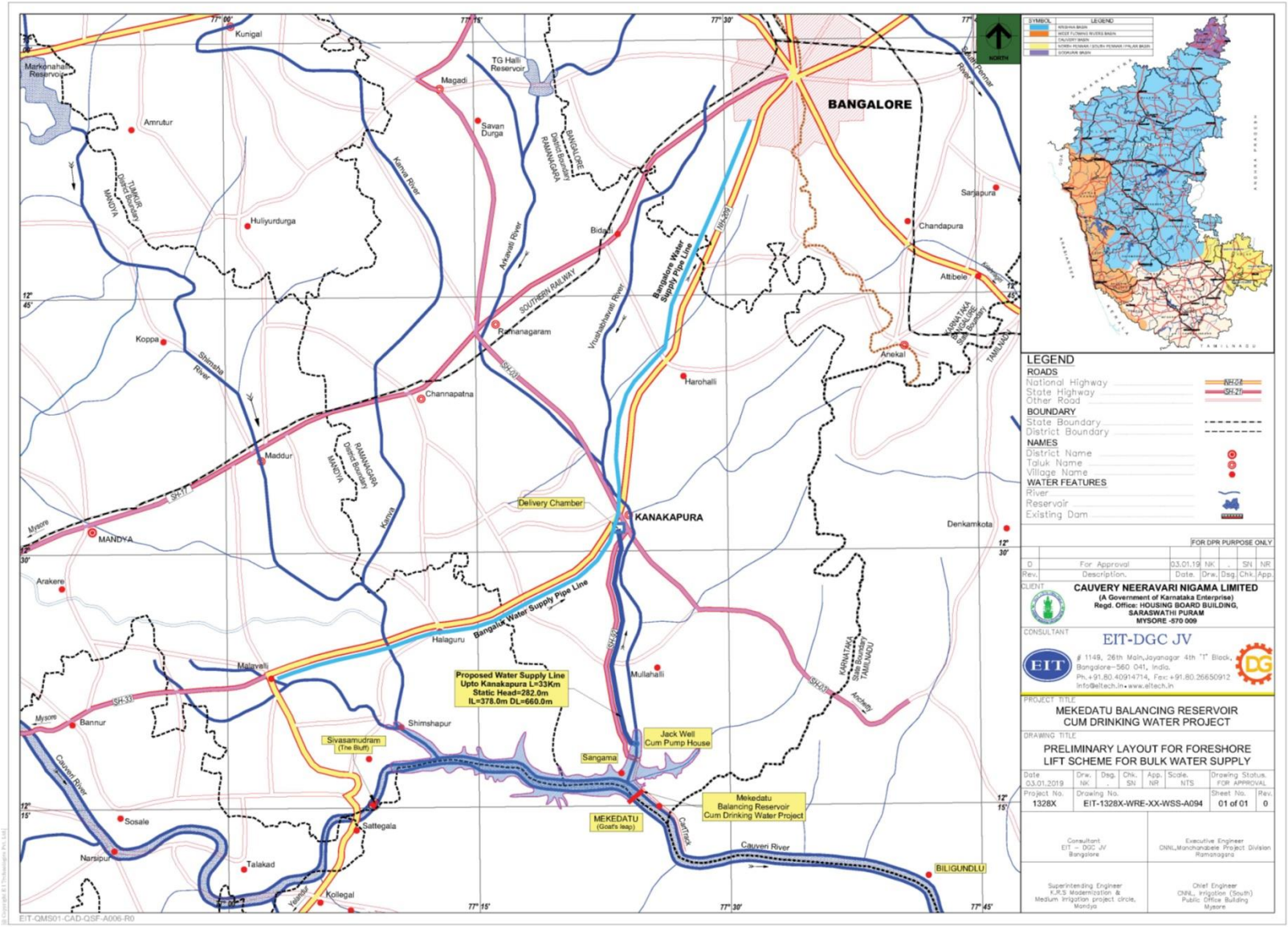


Fig 9: Map showing preliminary layout for foreshore lift scheme for bulk water supply

3.6. Raw material required along with estimated quantity, likely source, marketing area of final products, mode of transport of raw material and finished products.

Raw materials required for the construction purpose are as follows;

Components	Explosive in MT	Sand in cum	Coarse aggregate in cum	Cement in MT	Reinforced steel in MT	Structural Steel in MT
Dam and allied works	562.00	929735	2258218	634344	12327	3087
Pressure Shaft/ Penstock	70	7260	12975	6235	-	3055
Tunnel related works	990	97245	178755	83485	-	-
Power House Cavern	245	9920	17740	8555	1900	30
Transform Cavern	45	980	1755	1045	115	0
Surge Chamber Cavern	125	5035	8995	5335	515	-
Total	**2037**	**1050175**	**2478438**	**738999**	**14857**	**6172**

3.7. Resource optimization/recycling and reuse envisaged in the project, if any, should be briefly outlined.

The proposed project involves storage of water through the construction of reservoir in order to meet the drinking water needs of people and the same is also utilized in harnessing 400 MW (annually) of hydro-electric power. Resource optimization through generation of hydropower (renewable energy), adopting solar lightings and appliances at dam colony, reutilization of treated water for flushing and gardening purposes at dam colony will be ensured.

3.8. Availability of water, its source, Energy/ Power requirement & source water requirement

The river Cauvery originates in the Brahmagiri range Western Ghats in Talakaveri of Coorg district. It traverses through Karnataka and Tamil Nadu before draining into the Bay of Bengal. It has many tributaries in Karnataka as well as in Tamil Nadu and Kerala.

Major dams have been built across Cauvery both in Tamil Nadu as well as in Karnataka. It is to be noted that beyond KRS (127 km distance) and Kabini (175 km distance) upto the State border with Tamil Nadu, no major water retaining structures are present and/or envisaged. Thus, CWDT while giving its order has clearly indicated that nearly 80 TMC of water will be received from the independent catchment below KRS and Kabini.

As per CWDT Award, Karnataka is supposed to release 192 TMC of water (as measured at Biligundlu CWC G &D station in a normal year). However, Hon'ble Supreme Court of India

vide its judgement dated 16.02.2018, modified the CWDT award and allocated additional 14.75 TMC of water to Karnataka correspondingly reducing the releases to Tamil Nadu from 192 TMC to 177.25 TMC (in a normal year). The additional 14.75 TMC allocated to Karnataka consists of 10 TMC for various uses (to be decided by GoK) and 4.75 TMC exclusively for drinking water supply to Bengaluru Metropolitan Region and surrounding areas.

Emphasis was laid on providing drinking water to Bengaluru Metropolitan Region and surrounding areas by the Hon'ble Supreme Court considering its global status.

The Cauvery Water Disputes Tribunal, while giving its judgement considered the area of Bangalore in Cauvery basin to be about 33% and accordingly allocated share of drinking water to it. However, due to expansion of Bangalore under the name Bruhat Bengaluru Mahanagara Palike and further as Bengaluru Metropolitan Area and Bengaluru Metropolitan Regional Development Authority, additional areas in the Cauvery Basin have been amalgamated.

It could be seen that originally, the extent of area falling under Cauvery Basin was only 33 % (also as per CWDT Award) and as per the latest amalgamation of areas under Bengaluru Metropolitan Regional Development Authority, the extent of area falling under Cauvery Basin has increased to 73.47 %.

In view of the above increase in the area and subsequent increase in the population (whose drinking water needs are to be met with), present supply is not sufficient to cater to this increased drinking water requirement. Hence it has become necessary to augment the supply by proposing new project /s and one such project envisaged is Mekedatu Balancing Reservoir and Drinking Water project which can serve the purpose.

Cauvery is the only perennial source of water available and any project or proposal to provide drinking water can only be from this source.

GoK having realized the need for basic and fundamental rights of its people in the region to be provided with safe and potable drinking water had made an appeal to the Hon'ble Supreme Court of India requesting for additional allocation over and above the allocation as per the CWDT award (Civil Appeal No. 2453 of 2007).

On 16.2.2018, the Supreme Court passed an order partially modifying the CWDT award. The Order allocated 284.75 TMC as Karnataka's share of Cauvery water and reduced the

total flow to be ensured at Biligundlu from 192 TMC to 177.25 TMC. The Order has not specified how the reduction of 14.75 TMC is to be effected in the monthly distribution. For the purpose of preparing the working tables, the following distribution in a normal year is adopted in this report, based on the past monthly flows at Biligundlu reducing the releases proportionately.

Monthly Flows to be assured at Biligundlu in the Light of Supreme Court Order													
Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Volume of Flow, TMC	9.18	31.25	45.95	34.76	20.22	13.79	7.35	2.75	2.5	2.5	2.5	2.5	177.25

Detailed computation of the working tables shows that the main project objectives of releasing mandated quantum of water to Tamil Nadu at 50% dependability and providing drinking water to Bangalore Metropolitan Region can be met.

Clause XXVIII of the final order of the Tribunal states thus,

"Nothing in the order of this Tribunal shall impair the right or power or authority of any State to regulate within its boundaries the use of water or to enjoy the benefit of water within that State in a manner not inconsistent with the order of this Tribunal".

As per the above order of CWDT, the water flowing in a State can be regulated within its boundaries for using it and enjoying the benefit of the same. Karnataka, by building Mekedatu balancing reservoir and drinking water project would be ensuring releases as per the order (both by CWDT and Hon'ble Supreme Court),

Sub point No 391 of the order of the Hon'ble Supreme Court of India states thus

"At this juncture, we need to recount that as per the National Water policies, not only drinking water has been placed at the top of the other requirements in the order of priority but it has also been predicated that adequate drinking water facilities should be provided for the entire population, both in urban and rural areas and that drinking water should be made a primary consideration. It was declared as well that drinking water needs of Human being and animals should be the first charge on any available water".

The 10-daily yield series at Mekedatu has been developed at the project site which are as follows;

Table -2: Monthly Flows at Biligundlu (Mcft)

Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Annual
1974-75	1443	48894	120444	55871	43393	15064	11845	3672	2777	2020	3066	8188	316678
1975-76	13883	71783	136132	83824	56153	48421	12715	6389	4104	5834	7743	8426	455408
1976-77	4388	5552	28701	28208	16594	10841	5447	3304	2662	3076	5942	13461	128175
1977-78	6231	41570	48500	49663	86701	35522	15071	8742	4148	4398	8516	8595	317656
1978-79	19503	75397	137794	58549	31091	28734	11905	7682	6219	4648	7720	11349	400589
1979-80	9820	32109	137048	52960	28956	27895	14254	7220	4828	3630	5416	7339	331476
1980-81	29795	181454	89530	40872	33409	21605	13503	8479	4275	5283	5606	9136	442946
1981-82	21283	27492	151892	98375	39866	28170	16826	8317	5922	5293	5365	8276	417078
1982-83	14122	19155	62752	26817	23436	18264	12806	8222	7950	5660	5467	9660	214312
1983-84	10748	23770	58366	49774	28123	21187	16108	10110	9548	10630	7050	9253	254669
1984-85	27272	91848	50944	30115	57494	20020	14298	7681	4014	4790	5668	6342	320485
1985-86	14165	21457	37397	27209	22369	16789	13826	6599	5065	3587	3550	3711	175722
1986-87	3342	11494	47190	27934	30796	26616	12815	10666	10728	4731	3547	4736	194595
1987-88	5171	3392	5688	10573	23648	18514	12104	4965	7088	4164	4548	7563	107417
1988-89	4485	18821	33170	55304	20427	13766	10518	10976	8331	5385	4688	5476	191346
1989-90	4380	29353	36429	25518	29880	17223	12126	6873	8496	4528	4867	7229	186903
1990-91	4752	16311	43182	18688	15827	18223	12932	6696	4297	4606	5220	7056	157790
1991-92	14258	77866	84959	31184	41147	41887	20616	9477	5019	4317	4633	5210	340576
1992-93	16695	61486	99197	53083	47688	31278	15981	8870	4708	5369	5989	8239	358582
1993-94	7721	26585	57395	24244	42711	21639	16496	9340	5188	4493	5941	8608	230361
1994-95	8138	118622	60896	52680	68373	36357	16937	9117	5371	4725	6181	6600	393998
1995-96	5111	23993	24418	48152	31623	19925	11680	12388	4548	4295	5071	4308	195512
1996-97	5236	19742	37132	40438	67153	23196	19428	9261	4883	6663	6304	7367	246804
1997-98	5673	27652	82947	29579	35227	37704	23460	9986	5327	5673	6858	6960	277045
1998-99	3923	40455	40594	43158	44951	30333	17432	8159	5468	6299	7544	10829	259146
1999-00	12038	29695	56794	16921	68838	34454	20581	9480	6077	5718	6929	6130	273656
2000-01	6133	22033	41950	59497	103547	27586	20923	9367	5710	5835	8827	7835	319243
2001-02	8249	27580	25996	24488	38096	29175	14409	6736	4190	4500	4461	3919	191800
2002-03	3360	7897	21634	13773	17946	19104	9812	6476	4545	2368	1503	1543	109960
2003-04	1408	2441	13397	13385	18010	11178	6464	2503	1523	701	2059	2489	75557
2004-05	11094	23767	42883	28863	30512	19863	9114	3980	2956	3401	3763	3712	183906
2005-06	3865	36733	87333	53373	90867	51108	24566	9366	4507	7520	5906	8768	383912
2006-07	12480	62940	69480	27579	25260	25434	12605	5304	4279	5165	4040	4003	258568
2007-08	3516	83355	88470	60382	48955	25781	12632	3729	3588	7629	7085	8501	353623
2008-09	7765	10946	58437	39308	35747	20440	15489	4537	3689	4335	3918	5509	210119
2009-10	4967	39040	33954	55514	27312	21840	11740	5337	3477	4418	6912	8148	222657
2010-11	7674	9230	24585	25393	28085	61171	17489	5996	4909	6590	9627	11008	211756
2011-12	9306	31055	37344	56371	32924	32406	14268	5503	4476	4593	6250	5954	240451
2012-13	4117	4153	11120	20759	21799	11787	12267	4222	4311	2280	2047	1576	100438
2013-14	11610	68909	73739	31128	22254	19878	7874	4061	2271	3099	3800	4954	253577
2014-15	5942	34379	60385	41342	37802	16698	10413	3973	1571	2594	5202	8302	228603
2015-16	12594	27259	26478	22345	19038	28435	9230	3683	1918	1924	1371	2011	156287
2016-17	2772	15507	14645	20074	7847	3173	1941	703	306	332	136	1330	68765

Table-3: Monthly Total Inflows into Four Karnataka Reservoirs (Mcft)

Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1974-75	2535	102400	123026	36858	21187	5762	4003	1636	1521	1415	1177	2587
1975-76	69917	82747	150143	68412	35490	17363	4106	2937	2893	3051	5409	2789
1976-77	2199	41172	55527	32081	6893	11322	2516	1293	1298	1280	2674	7234
1977-78	28704	101702	52170	52836	50586	24675	8780	1868	1292	1663	5193	7055
1978-79	61932	110338	158467	45422	18677	16462	5337	3623	1317	2277	4552	4142
1979-80	29514	80035	154318	31665	17144	17922	5353	0	3902	1405	4019	7483
1980-81	73646	209861	93801	41608	22883	15148	6661	1850	962	1144	0	4504
1981-82	41261	78947	173311	60739	23639	14157	5659	4235	1390	1244	416	3309
1982-83	24047	58118	105515	18344	13287	8803	4071	2850	459	39	0	1291
1983-84	24170	74116	100404	44653	27622	11735	8118	3245	2710	5559	2315	2668
1984-85	67682	128377	67706	29714	42229	5827	5546	3267	697	463	2752	2212
1985-86	46966	51034	73225	22702	14674	10376	7554	2364	528	0	341	2158
1986-87	32284	59495	101434	21664	12754	17026	2889	3328	30	0	0	0
1987-88	8199	26320	35416	20842	28643	15824	7684	1799	603	0	1438	1285
1988-89	9463	73335	69139	42949	16675	6488	6456	1302	0	924	283	1231
1989-90	20988	103288	70774	28962	21442	9167	6879	1238	1101	0	0	0
1990-91	29253	72689	103797	24753	22672	15234	8139	1622	824	0	2695	2118
1991-92	45152	167152	94872	23427	26971	14337	3883	232	0	0	0	3894
1992-93	75890	115611	116533	61958	34989	34469	8474	1371	0	0	1043	3804
1993-94	22157	79562	95951	21105	36549	10650	5434	308	0	0	1379	2419
1994-95	52072	197063	83175	58403	56120	21648	6597	2228	1033	980	3875	7112
1995-96	10312	93515	50877	81054	17400	13126	5562	946	232	0	1800	0
1996-97	35176	77922	65506	32429	53715	10535	11481	1816	559	0	0	4310
1997-98	8092	106652	133868	29609	22532	24484	9561	1286	1800	1485	2573	4045
1998-99	21489	111808	65800	45155	40649	19326	10151	1408	1938	0	2215	9660
1999-00	32897	104247	74272	18631	53376	13248	7875	1009	141	753	1193	1726
2000-01	36930	76797	88512	57864	42896	9846	11275	1573	1044	542	6259	4136
2001-02	36214	80806	67298	26006	24219	15348	6244	1271	301	0	138	920
2002-03	18566	26323	78175	20659	35673	15047	6257	1887	836	986	1282	227
2003-04	12102	41161	43697	18336	19960	6289	4114	1391	665	289	1061	9042
2004-05	59165	47133	103571	19435	21305	11622	2997	1448	923	1125	1166	1680
2005-06	16495	121325	117787	56518	50834	19866	10715	2303	922	905	2171	11156
2006-07	39434	134207	93947	40022	20721	18943	9205	2561	984	474	36	288
2007-08	28191	183845	113486	70376	46147	18794	14195	5424	3090	7678	4652	2843
2008-09	21507	48651	106939	43416	38692	16761	10037	3732	1347	846	1082	1619
2009-10	4913	146019	61418	78153	40062	27298	16229	7181	459	0	677	3666
2010-11	13299	48795	60254	52011	40765	62122	19660	7243	1766	1183	5005	3964
2011-12	40736	69868	72409	75693	33533	26924	15703	7673	3594	1899	3307	2427
2012-13	5776	33442	63009	49165	16645	11386	6056	1938	1088	1354	688	711
2013-14	55709	156402	92196	36521	21769	11139	9469	3573	919	84	605	5206
2014-15	18070	111433	97196	59584	30693	9580	14040	3843	983	872	1075	4771
2015-16	61599	43408	34250	25258	20089	19495	7084	2548	1023	644	661	447
2016-17	15132	58216	41941	18129	4504	2360	2130	1048	0	597	569	990

Table-4: Cumulative Total Inflows into Four Karnataka Reservoirs (Mcft)

Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1974-	2535	104935	227961	264819	286006	291768	295771	297407	298928	300343	301520	304107
1975-	69917	152664	302807	371219	406709	424072	428178	431115	434008	437059	442468	445257
1976-	2199	43371	98898	130979	137872	149194	151710	153003	154301	155581	158255	165489
1977-	28704	130406	182576	235412	285998	310673	319453	321321	322613	324276	329469	336524
1978-	61932	172270	330737	376159	394836	411298	416635	420258	421575	423852	428404	432546
1979-	29514	109549	263867	295532	312676	330598	335951	335951	339853	341258	345277	352760
1980-	73646	283507	377308	418916	441799	456947	463608	465458	466420	467564	467564	472068
1981-	41261	120208	293519	354258	377897	392054	397713	401948	403338	404582	404998	408307
1982-	24047	82165	187680	206024	219311	228114	232185	235035	235494	235533	235533	236824
1983-	24170	98286	198690	243343	270965	282700	290818	294063	296773	302332	304647	307315
1984-	67682	196059	263765	293479	335708	341535	347081	350348	351045	351508	354260	356472
1985-	46966	98000	171225	193927	208601	218977	226531	228895	229423	229423	229764	231922
1986-	32284	91779	193213	214877	227631	244657	247546	250874	250904	250904	250904	250904
1987-	8199	34519	69935	90777	119420	135244	142928	144727	145330	145330	146768	148053
1988-	9463	82798	151937	194886	211561	218049	224505	225807	225807	226731	227014	228245
1989-	20988	124276	195050	224012	245454	254621	261500	262738	263839	263839	263839	263839
1990-	29253	101942	205739	230492	253164	268398	276537	278159	278983	278983	281678	283796
1991-	45152	212304	307176	330603	357574	371911	375794	376026	376026	376026	376026	379920
1992-	75890	191501	308034	369992	404981	439450	447924	449295	449295	449295	450338	454142
1993-	22157	101719	197670	218775	255324	265974	271408	271716	271716	271716	273095	275514
1994-	52072	249135	332310	390713	446833	468481	475078	477306	478339	479319	483194	490306
1995-	10312	103827	154704	235758	253158	266284	271846	272792	273024	273024	274824	274824
1996-	35176	113098	178604	211033	264748	275283	286764	288580	289139	289139	289139	293449
1997-	8092	114744	248612	278221	300753	325237	334798	336084	337884	339369	341942	345987
1998-	21489	133297	199097	244252	284901	304227	314378	315786	317724	317724	319939	329599
1999-	32897	137144	211416	230047	283423	296671	304546	305555	305696	306449	307642	309368
2000-	36930	113727	202239	260103	302999	312845	324120	325693	326737	327279	333538	337674
2001-	36214	117020	184318	210324	234543	249891	256135	257406	257707	257707	257845	258765
2002-	18566	44889	123064	143723	179396	194443	200700	202587	203423	204409	205691	205918
2003-	12102	53263	96960	115296	135256	141545	145659	147050	147715	148004	149065	158107
2004-	59165	106298	209869	229304	250609	262231	265228	266676	267599	268724	269890	271570
2005-	16495	137820	255607	312125	362959	382825	393540	395843	396765	397670	399841	410997
2006-	39434	173641	267588	307610	328331	347274	356479	359040	360024	360498	360534	360822
2007-	28191	212036	325522	395898	442045	460839	475034	480458	483548	491226	495878	498721
2008-	21507	70158	177097	220513	259205	275966	286003	289735	291082	291928	293010	294629
2009-	4913	150932	212350	290503	330565	357863	374092	381273	381732	381732	382409	386075
2010-	13299	62094	122348	174359	215124	277246	296906	304149	305915	307098	312103	316067
2011-	40736	110604	183013	258706	292239	319163	334866	342539	346133	348032	351339	353766
2012-	5776	39218	102227	151392	168037	179423	185479	187417	188505	189859	190547	191258
2013-	55709	212111	304307	340828	362596	373735	383204	386778	387696	387780	388385	393590
2014-	18070	129503	226699	286283	316976	326557	340596	344439	345422	346294	347369	352140
2015-	61599	105008	139258	164516	184605	204100	211184	213732	214756	215400	216061	216508
2016-	15132	73348	115289	133418	137922	140282	142411	143459	143459	144057	144626	145616
Average	30361	121146	201098	240810	271413	287916	296388	298878	299769	300499	302076	305108

Table-5: Ratios of Monthly Cumulative Inflows to the Average

Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1974-75	0.083	0.866	1.134	1.100	1.054	1.013	0.998	0.995	0.997	0.999	0.998	0.997
1975-76	2.303	1.260	1.506	1.542	1.498	1.473	1.445	1.442	1.448	1.454	1.465	1.459
1976-77	0.072	0.358	0.492	0.544	0.508	0.518	0.512	0.512	0.515	0.518	0.524	0.542
1977-78	0.945	1.076	0.908	0.978	1.054	1.079	1.078	1.075	1.076	1.079	1.091	1.103
1978-79	2.040	1.422	1.645	1.562	1.455	1.429	1.406	1.406	1.406	1.410	1.418	1.418
1979-80	0.972	0.904	1.312	1.227	1.152	1.148	1.133	1.124	1.134	1.136	1.143	1.156
1980-81	2.426	2.340	1.876	1.740	1.628	1.587	1.564	1.557	1.556	1.556	1.548	1.547
1981-82	1.359	0.992	1.460	1.471	1.392	1.362	1.342	1.345	1.345	1.346	1.341	1.338
1982-83	0.792	0.678	0.933	0.856	0.808	0.792	0.783	0.786	0.786	0.784	0.780	0.776
1983-84	0.796	0.811	0.988	1.011	0.998	0.982	0.981	0.984	0.990	1.006	1.009	1.007
1984-85	2.229	1.618	1.312	1.219	1.237	1.186	1.171	1.172	1.171	1.170	1.173	1.168
1985-86	1.547	0.809	0.851	0.805	0.769	0.761	0.764	0.766	0.765	0.763	0.761	0.760
1986-87	1.063	0.758	0.961	0.892	0.839	0.850	0.835	0.839	0.837	0.835	0.831	0.822
1987-88	0.270	0.285	0.348	0.377	0.440	0.470	0.482	0.484	0.485	0.484	0.486	0.485
1988-89	0.312	0.683	0.756	0.809	0.779	0.757	0.757	0.756	0.753	0.755	0.752	0.748
1989-90	0.691	1.026	0.970	0.930	0.904	0.884	0.882	0.879	0.880	0.878	0.873	0.865
1990-91	0.964	0.841	1.023	0.957	0.933	0.932	0.933	0.931	0.931	0.928	0.932	0.930
1991-92	1.487	1.752	1.527	1.373	1.317	1.292	1.268	1.258	1.254	1.251	1.245	1.245
1992-93	2.500	1.581	1.532	1.536	1.492	1.526	1.511	1.503	1.499	1.495	1.491	1.488
1993-94	0.730	0.840	0.983	0.908	0.941	0.924	0.916	0.909	0.906	0.904	0.904	0.903
1994-95	1.715	2.056	1.652	1.622	1.646	1.627	1.603	1.597	1.596	1.595	1.600	1.607
1995-96	0.340	0.857	0.769	0.979	0.933	0.925	0.917	0.913	0.911	0.909	0.910	0.901
1996-97	1.159	0.934	0.888	0.876	0.975	0.956	0.968	0.966	0.965	0.962	0.957	0.962
1997-98	0.267	0.947	1.236	1.155	1.108	1.130	1.130	1.124	1.127	1.129	1.132	1.134
1998-99	0.708	1.100	0.990	1.014	1.050	1.057	1.061	1.057	1.060	1.057	1.059	1.080
1999-00	1.084	1.132	1.051	0.955	1.044	1.030	1.028	1.022	1.020	1.020	1.018	1.014
2000-01	1.216	0.939	1.006	1.080	1.116	1.087	1.094	1.090	1.090	1.089	1.104	1.107
2001-02	1.193	0.966	0.917	0.873	0.864	0.868	0.864	0.861	0.860	0.858	0.854	0.848
2002-03	0.612	0.371	0.612	0.597	0.661	0.675	0.677	0.678	0.679	0.680	0.681	0.675
2003-04	0.399	0.440	0.482	0.479	0.498	0.492	0.491	0.492	0.493	0.493	0.493	0.518
2004-05	1.949	0.877	1.044	0.952	0.923	0.911	0.895	0.892	0.893	0.894	0.893	0.890
2005-06	0.543	1.138	1.271	1.296	1.337	1.330	1.328	1.324	1.324	1.323	1.324	1.347
2006-07	1.299	1.433	1.331	1.277	1.210	1.206	1.203	1.201	1.201	1.200	1.194	1.183
2007-08	0.929	1.750	1.619	1.644	1.629	1.601	1.603	1.608	1.613	1.635	1.642	1.635
2008-09	0.708	0.579	0.881	0.916	0.955	0.958	0.965	0.969	0.971	0.971	0.970	0.966
2009-10	0.162	1.246	1.056	1.206	1.218	1.243	1.262	1.276	1.273	1.270	1.266	1.265
2010-11	0.438	0.513	0.608	0.724	0.793	0.963	1.002	1.018	1.021	1.022	1.033	1.036
2011-12	1.342	0.913	0.910	1.074	1.077	1.109	1.130	1.146	1.155	1.158	1.163	1.159
2012-13	0.190	0.324	0.508	0.629	0.619	0.623	0.626	0.627	0.629	0.632	0.631	0.627
2013-14	1.835	1.751	1.513	1.415	1.336	1.298	1.293	1.294	1.293	1.290	1.286	1.290
2014-15	0.595	1.069	1.127	1.189	1.168	1.134	1.149	1.152	1.152	1.152	1.150	1.154
2015-16	2.029	0.867	0.692	0.683	0.680	0.709	0.713	0.715	0.716	0.717	0.715	0.710
2016-17	0.498	0.605	0.573	0.554	0.508	0.487	0.480	0.480	0.479	0.479	0.479	0.477

Table-6: Annual Abstracts of Mekedatu Reservoir Working Tables

	Initial Level	Inflow*	At Biligundlu		
			Obligation	Met	Excess
1	2	3	4	5	6
Year	m	Mcft	Mcft	Mcft	Mcft
1985-86	440.00	167647	139718	139718	0
1986-87	425.16	186178	151154	151154	0
1987-88	418.48	104240	89193	89193	0
1988-89	398.85	184724	137503	137503	0
1989-90	406.88	178023	158946	158946	0
1990-91	397.98	148924	148924	149665	741
1991-92	394.95	331276	177250	223593	46343
1992-93	440.00	349282	177250	297091	119841
1993-94	440.00	221838	165980	169751	3771
1994-95	440.00	384698	177250	332521	155271
1995-96	440.00	187914	165564	165564	0
1996-97	421.40	237953	176784	176784	0
1997-98	433.01	268628	177250	204718	27468
1998-99	440.00	250150	177250	198047	20797
1999-2000	440.00	264369	177250	212275	35025
2000-01	440.00	310025	177250	257968	80718
2001-02	440.00	182853	155890	155890	0
2002-03	424.61	104818	104818	123992	19174
2003-04	394.95	71139	71139	71139	0
2004-05	394.95	174938	163604	163604	0
2005-06	394.95	375111	177250	274117	96867
2006-07	440.00	249268	177250	197968	20718
2007-08	439.49	344365	177250	291312	114062
2008-09	440.00	202693	177250	177250	0
2009-10	423.46	214618	177250	177250	0
2010-11	412.79	206086	177250	177250	0
2011-12	406.45	231480	177250	177250	0
2012-13	414.34	96251	96251	105755	9504
2013-14	394.95	244277	177250	177250	0
2014-15	414.09	219740	177250	177250	0
2015-16	407.45	148746	130432	130432	0
2016-17	394.95	63302	63302	63302	0
Average	**424.56**	**242141**	**157973**	**200187**	**42214**

3.8.1 Power Requirement

Construction phase: The total Power requirement would be 10 MVA. The details are as follows;

Sl.No.	Particulars	Power requirement
1	Air Compressors	1 MVA
2	Aggregate Processing Plant	2 MVA
3	Batching Plant	1 MVA
4	Dewater Pumps	1 MVA
5	Grout Pumps	0.5 MVA
6	Facilities	2 MVA
7	Welding Machine	2.5 MVA
8	Bending Machine	
	Total	**10 MVA**

The activities in the Head Race Tunnel, Surge Shaft & Penstocks will be supplemented with the help of temporary power supply from DG sets (4 Nos. x 500 KVA).

Operation phase: A total of 400 MW of hydropower will be generated during operation phase. The total power requirement during operation phase is 4 MW and 3 Nos. of DG sets with capacity 500 KVA each will be used as back up. The power during operation phase will be sourced from Captive plant, DG set, transmission lines/state power supply

3.9. Quantity of wastes generated (liquid and solid) and scheme for their Management/disposal.

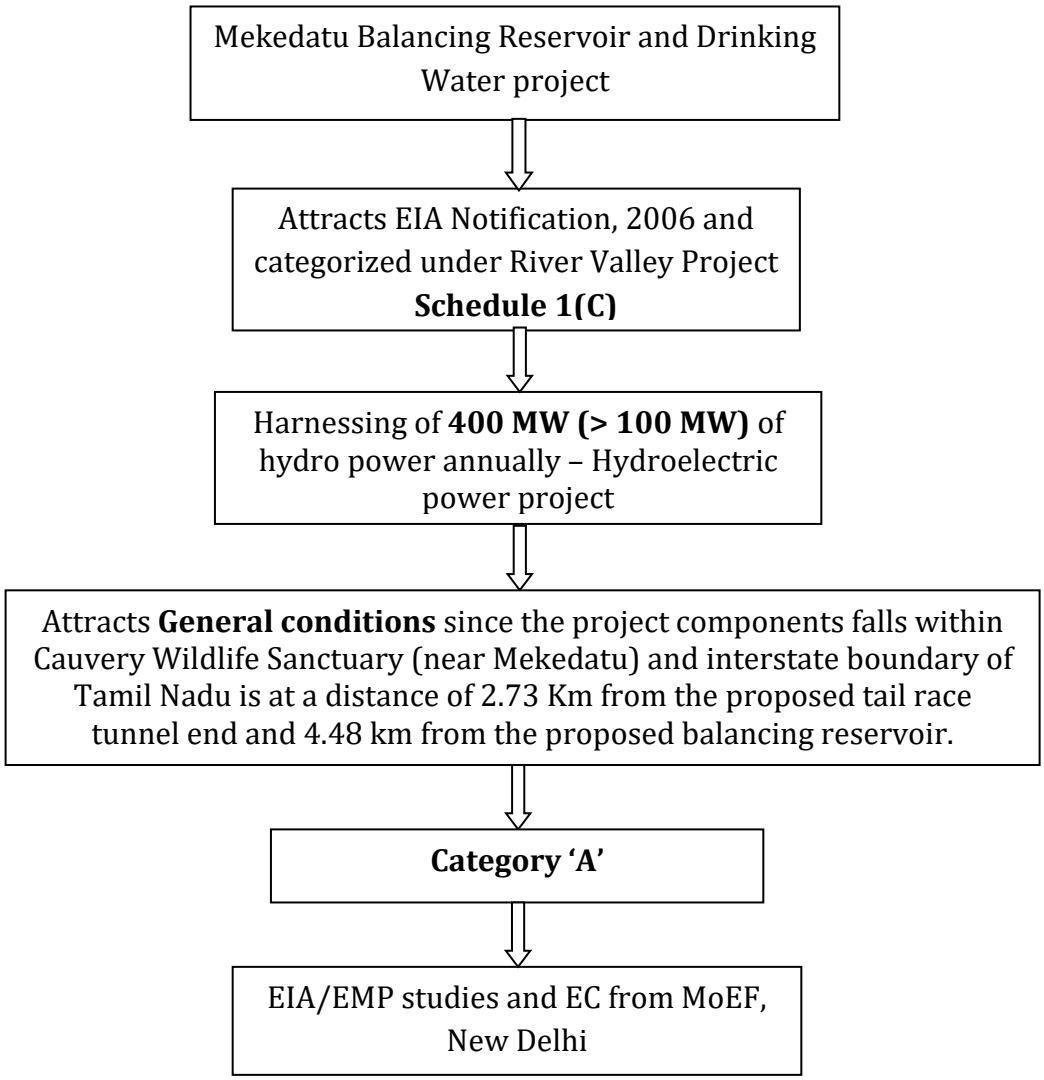
Sewage (570 KLD) generated from the workers colony will be treated in Model STP of capacity 100 KLD x 3 Nos. during construction phase. Further, the capacity of the STP will be increased based on load generated. During operation phase, sewage (46 KLD) will be treated in STP of capacity 50 KLD located at Dam colony. Sludge (6 TPA during construction phase and 0.78 TPA during operation phase) from the STP.

Details of waste generated during construction and operation phase are as follows;

Type of Waste	**Source**	**Total Qty. (MT/A)**	**Mode of disposal**
Construction phase			
Domestic waste-Organic	Workers colony	163.62	Organic waste will be treated in organic waste convertor and sold as manure for farmers
Domestic waste-Inorganic	Workers colony	109.08	Inorganic waste will be handed over to local municipal waste collectors
STP sludge	wastewater from workers area	5.757	Sold as compost to farmers

Type of Waste	Source	Total Qty. (MT/A)	Mode of disposal
Used oil and oil soaked cotton waste	DG sets	1	stored in leak proof containers and handed over to KSPCB authorized recyclers
Biomedical waste	Workers colony	18	stored separately and will be handed over to KSPCB authorized recyclers
Operation phase			
Domestic waste-Organic	Dam site staff and dam colony	20.79	Organic waste will be treated in organic waste convertor and used as manure for gardening at dam site and colony and sold as manure to farmers
Domestic waste-Inorganic	Dam site staff and dam colony	13.86	Inorganic waste will be handed over to local municipal waste collectors
STP sludge	wastewater from Dam site staff and dam colony	0.78	Used as compost for gardening at dam site and colony
Used oil and oil soaked cotton waste	DG sets	0.75	Stored in leak proof containers and handed over to KSPCB authorized recyclers
e waste	Dam site office and dam colony	1	Stored in leak proof containers and handed over to KSPCB authorized recyclers
Biomedical waste	Dam site office and dam colony	9.6	Stored separately and will be handed over to KSPCB authorized recyclers
Battery waste	Dam site office and dam colony	1	Stored separately and will be handed over to KSPCB authorized recyclers
Plastic waste	Dam site office and dam colony	2.5	Stored seperately and will be handed over to KSPCB authorized recyclers

3.10. Schematic representations of the feasibility drawing which give information of EIA purpose



4. Site Analysis

4.1. Connectivity

1. Approachable roads

a. Connectivity from Bangalore (Left flank)

Mekedatu dam site can be accessed from Bangalore by NH 209 upto Kanakapura covering a distance of 63 Km and thereafter through SH 3 for a length of 2 Km and through SH 92 upto Arkavathy river crossing covering a length of 31 Km. From Arkavathy river crossing, the dam site has to be accessed by cart track for a length of 3.0 km which leads to left flank of the Mekedatu dam site. The dam site is located 97 Km south of Bangalore.

b. Connectivity from Ramanagara (Left flank)

Mekedatu dam site can be accessed from Ramanagara by SH 3 via Kanakapura covering a distance of 30 Km and thereafter through SH 3 for a length of 2 Km and thereafter through SH 92 upto Arkavathy river crossing covering a length of 31 Km. From Arkavathy river crossing, the dam site has to be accessed by cart track for a length of 3.0 km which leads to left flank of the Mekedatu dam site. The dam site is located 66 Km south east of Ramanagara.

c. Connectivity from Chamarajanagar (Right flank)

Connectivity to the right flank is limited in view of hilly terrain and forest. There are no well established roads except tracks which are maintained by forest authorities.

Hence in terms of connectivity Mekedatu dam site is well connected to the left flank.

2. Nearest Railway stations

The nearest railway stations include Channapatna Railway Station at a distance of 49.94 Km and Ramanagara Railway Station at a distance of 52.28 Km.

3. Nearest Airport

Bengaluru International Airport (Kempegowda International Airport) at a distance of 125 Km.

4.2. Land form, land use and land ownership.

Geographically, Kanakapura Taluk is about 412.78 in sq.km, Ramanagara is about 3576 sq.km out of which forest (69,946 Ha), Cultivated area about (1,75,539 Ha). The district with major

part sloping towards south and south east forming Pediplain interspersed with hills all along the western part with the elevation in the range of 996 m and 1467 m mostly in the granitic terrain.

The Pediplain form major part of the district underlain by gneisses and granites with the highest pediplain in the range of 850 m to 950 m amsl. Rocky upland pediplain and plateau constitute erosional topography. Major part of pediplain constitutes low relief area having matured dissected rolling topography with erosional landscape covered by layers of red soil of varied thickness. Major parts of the pediplain are dissected by streamlets flowing in southerly direction. An alluvial valley with low relief of 600 – 650 m is located in Kanva plain. These Taluks geomorphology majorly consist of Rocky uplands, Plateaus, and Flat topped hills. Cauvery basin is one of the main water source flowing within the district.

The project site is surrounded partly by rocky boulders with pockets of water flow. At Shivanasamudram, the Cauvery River branches off into two parts and falls through a height of 91 m. in a series of falls and rapids. The falls at this point is utilized for power generation in the upstream of this project site. The power station at Shivanasamudram was built as early as 1902. The two branches of the river join after the falls and flows through a narrow gorge which is the present project site known as "Mekedatu" and continues its journey and forms the boundary between Karnataka and Tamil Nadu States for a distance of 64 km.

4.3. Topography (along with map)

The Cauvery Catchment basin is bounded on the north by the ridges separating it from Krishna and Pennar basins, and the basin area is covered by the streams between Palar and Cauvery on the south and by the Eastern Ghats on the east and by Western Ghats on the west. The upper reach of the basin is covered with hill ranges of the Western Ghats and the basins area is broad and open with gently undulating country. In the north – west and south, there are a number of hill ranges which have steep slopes. The maximum length of Cauvery basin from west to east is 540 km in Karnataka. The maximum width from north to south is 255 km.

4.4. Environmental Sensitivity

The proposed project falls within the Cauvery Wildlife Sanctuary which is part of Mysore Elephant Reserve (ER) and also a corridor for tigers and elephants. The project falls within the Cauvery Wildlife Sanctuary involving Arkavathy River, Cauvery River, Basavanabetta SF,

Chilandwadi SF, Chikkayaldur RF, Mugguru RF, Chavarkal SF, Dhanaguru RF, Bheemeshwari Fishing Camp and Galibore Fishing Camp. The project requires a total of 5267.59 Ha of land for the construction of project components and submergence of forest, wildlife and revenue land. The proposed project involves submergence of 5160.71 Ha of wildlife, forest and revenue land at a FRL of 440.00 m. It involves 4821.66 Ha of land belonging to Cauvery Wildlife Sanctuary, 196.57 Ha of land belonging to Cauvery WLS ESZ area and 190.26 Ha of revenue land. Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi are the villages involved under submergence.

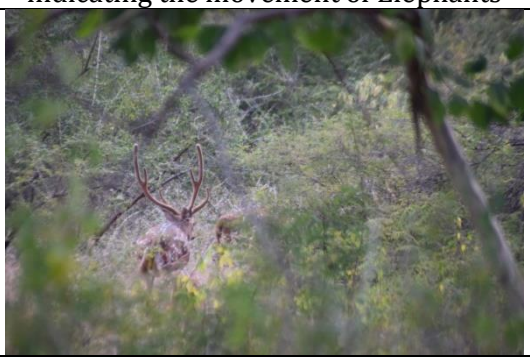
Cauvery Wildlife Sanctuary forms part of the tiger & elephant corridor. Cauvery Wildlife Sanctuary is connected to Biligiri Ranganathaswamy Temple Tiger Reserve through Malai Mahadeswara Wildlife Sanctuary and Edyarahalli-Doddasampige Reserved Forests corridor on the south-western side and the Sanctuary is connected to Bannerghatta National Park through Ramdevarabetta-Chavarkal Reserve Forest corridor on the northern side.

The riparian forest of the Cauvery Wildlife Sanctuary is the only habitat in the State of Karnataka for near threatened (International Union for Conservation of Nature) species of grizzled giant squirrel (*Ratufa macroura*) which is endemic to southern India and Sri Lanka and Honey badgeror/ Ratel (*Mellivora capensis*) has been camera trapped and recorded.

The river Cauvery flowing at middle of the Wildlife Sanctuary remains home for the endangered and endemic fish species called Deccan Mahsheer (*Tor khurdee*), an important freshwater flagship species, vulnerable species like smooth-coated otter (*Lutra perspicillata*), Oriental small clawed otter (*Aonyx cinerea*) and common otter (*Lutra lutra*) and other aquatic species like mugger or the marsh crocodile (*Crocodylus palustris*) and soft shelled turtle (*Aspideretes gangeticus*).

Sanctuary also supports the Endangered Indian Pangolin (*Manis crassicaudata*), an Endemic Madras tree shrew (*Anathana ellioti*) and Near Threatened and Endemic Kollegal ground gecko (*Geckoella collegalensis*). Critically endangered white-rumped vulture (*Gyps bengalensis*) and Indian vulture (*Gyps indicus*), Near Threatened Red-headed Vulture (*Sarcogyps calvus*) and some of the rare and vulnerable bird species reported from Cauvery includes Nilgiri wood-pigeon (*Columba elphinstonii*), greater spotted eagle (*Clanga clanga*), whitenaped tit (*Parus nuchalis*),

Pied-crested Tit (*Parus nuchalis*), and yellow-throated bulbul (*Pycnonotus xantholaemus*) and the Sanctuary support some of the migratory birds like European bee-eater (*Merops apiaster*), western Ghats species like Indian courser (*Cursorius coromandelicus*) and Malabar parakeet (*Psittacula columboides*) and is important wintering area for the globally threatened Greater Spotted Eagle (*Aquila clanga* or *Clunga clunga*).

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Hanuman Langurs at the project site</td><td>Elephant Scat at the project location indicating the movement of Elephants</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Presence of Orchid in the U/s of proposed reservoir location</td><td>Spotted Deers at project site</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion with Forest officials at site</td><td>Camera Traps installed by Forest Department for estimation of fauna</td></tr>
</table>

Map showing the proposed Mekedatu balancing reservoir, Eco-sensitive Zone and boundary of Cauvery Wildlife Sanctuary is given in figure 10.

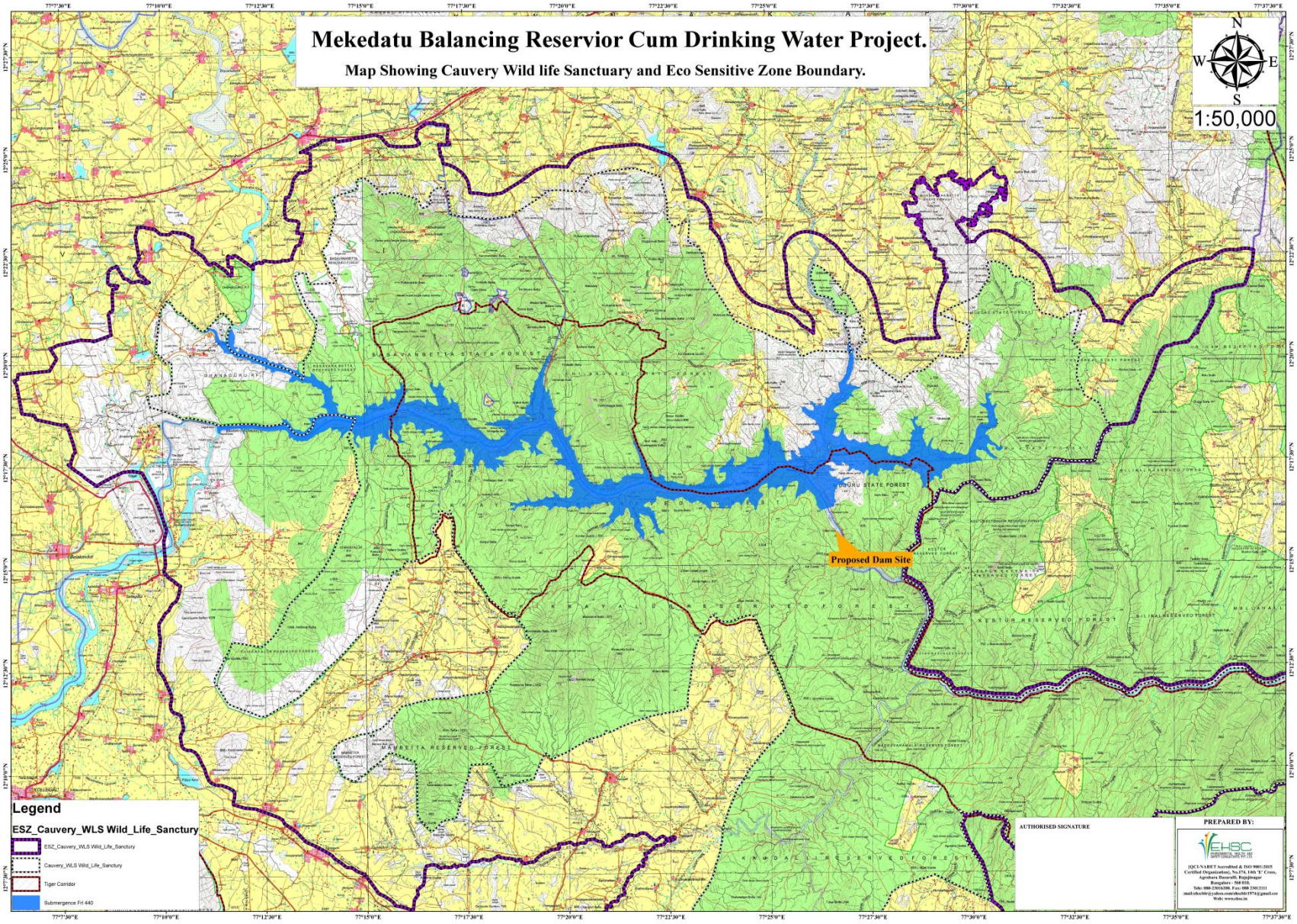


Fig 10: Map showing Protected Areas and Mekedatu Balancing Reservoir

The Mysore Elephant Reserve (ER) was notified by the Karnataka Government in November, 2002 (Vide GO FEE 231 FWL 2000, 25/11/2002). Therefore, Cauvery WLS of core area and its surrounding State and Reserve Forests such as Ragihalli RF, Muggur SF, Chilandwadi SF, Basavanabetta SF, Chikkayaldur RF, Mambatta SF, Madeshwaramale RF, Kaudalli RF, Hanur RF and Yedevarahalli RF of buffer area is a part of Mysore ER.

4.5. Existing Infrastructure

Project site is approachable by SH92 until Sangama followed by cart roads maintained by Forest Authorities.

4.6. Soil Classification

The predominant soil types in the project area includes red sandy loam and along the riverbank here and there in patches black cotton soil is also found. Soils are shallow on hilltop and deep in valleys. The clayey soils are confined to low lying localities in patches and sand deposits are found all along the riverbed. The condition of soil varies considerably from place to place in structure, composition, depth etc., depending on the local configuration of the ground.

4.7. Climatic data from secondary sources

The proposed project falls in Kanakapura Taluk of Ramanagara District and Kollegal Taluk of Chamarajanagar District. Therefore, the Agro-climatic zones of Ramanagara District fall under Eastern Dry Zone and Chamarajanagar District fall under Southern Dry Zone. The normal rainfall in the project area is 854 mm and varies from 822 mm at Kanakapura to 868 mm at Magadi. December to March represents very low rainfall months. The rainfall occurs in nearly 49 rainy days. The pre monsoon period has a normal of 345 mm (35%), SW monsoon period has 363 mm (37%) and the NE monsoon period receive 263mm (27%) rainfall. It is observed that there is not much variation in the distribution of rainfall during pre monsoon, SW monsoon and NE monsoon periods of the year

Ramanagara District: The Maximum and minimum temperature of the command area is 34˚C and 16˚C respectively with an annual rainfall of 854mm and varies from 822 mm at Kanakapura to 868 mm at Magadi. The humidity is lowest during the dry season and highest during the monsoon period with an average value of about 49% and 86% respectively. The

winds are predominantly from south west during the summer monsoon and from north east during the winter monsoon.

Chamarajanagar District: The Maximum and minimum temperature of the command area is 34˚C and 16.4˚C respectively with an annual rainfall of 811.75mm. Relative humidity ranges from 69 to 85% in the morning and in the evening it ranges from 21% to 70%. The wind speed ranges from 8.4 to 14.1 kmph.

4.8. Social Infrastructure available

In the close proximity of the project site, educational, religious and transportation facilities are found at Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi. The habitants have a good transportation facility as these are accessible easily. Overall it is clearly seen that the social infrastructure in and around the project site is of a good standard.

5. Planning

5.1. Planning concept (type of industries, facilities, transportation, etc.,) Town and Country Planning Development authority classification.

Project site is approachable by SH92 until Sangama followed by cart roads maintained by Forest Authorities. Cauvery Neeravari Nigama Limited is responsible for the implementation of the proposed project to provide drinking water facilities and generate hydro-electric power.

5.2. Population Projection.

Population of about 1,12,42,650 belonging to Bengaluru Metropolitan area and its surroundings in the Cauvery Basin will be benefited with drinking water facilities. Influx of labourers will be only during construction phase, only few people will be employed for operation and maintenance of the project.

5.3. Land use planning (breakup along with green belt etc.)

The project requires a total land of 5267.59 Ha. Out of which, 4879.02 Ha of land belongs to Cauvery Wildlife Sanctuary, 196.57 belongs to Cauvery WLS ESZ area, 1.74 Ha of Reserve Forest, 190.26 Ha of revenue land. The proposed project includes submergence of 5160.71 Ha of wildlife, ESZ area and revenue land at a FRL of 440.00 m. Villages namely Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi are the areas under submergence. Compensatory afforestation will be undertaken in consultation with Karnataka Forest Department. However, on successful implementation of the project during the operation phase the biological environment of the area improves instantly.

5.4. Assessment of Infrastructure Demand (Physical & Social).

The proposed project meets the demands of providing drinking water facilities to a population of 1,12,42,650 belonging to Bengaluru Metropolitan area and its surroundings in the Cauvery Basin along with generation of 400 MW of hydro-electric power.

5.5. Amenities/facilities

Proper site services such as First Aid, Canteen / Rest Shelter, Drinking Water will be provided to the construction workers.

6. Proposed Infrastructure

6.1. Industrial Area (Processing area)

Not applicable

6.2. Residential Area (non processing area)

Not applicable

6.3. Green Belt

The proposed project involves submergence of 160.71 Ha of wildlife, ESZ area and revenue land at a FRL of 440.00 m. Therefore, several floral species are involved in submergence. However, Compensatory afforestation will be carried out with due consultation of Karnataka Forest Department.

6.4. Social Infrastructure

In the close proximity of the project site, educational, religious and transportation facilities are found at Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi. The habitants have a good transportation facility as these are accessible easily. Overall it is clearly seen that the social infrastructure in and around the project site is of a good standard.

6.5. Connectivity Traffic and Transportation Road/Rail/Metro/Water ways etc.,

Project site is approachable by SH92 until Sangama followed by cart roads maintained by Forest Authorities. The nearest railway stations includes Channapatna Railway Station at a distance of 49.94 Km and Ramanagara Railway Station at a distance of 52.28 Km. Bengaluru International Airport (Kempegowda International Airport) at a distance of 125 Km.

6.6. Sewerage System

Sewage (570 KLD) generated from the workers colony will be treated in Model STP of capacity 100 KLD x 3 Nos. during construction phase. Further, the capacity of the STP will be increased based on load generated. During operation phase, sewage (46 KLD) will be treated in STP of capacity 50 KLD located at Dam colony. The treated water will be reused for dust suppression purpose during construction phase and flushing and gardening during operation phase.

6.7. Industrial waste management

Not Applicable

6.8. Solid waste management

Type of Waste	Source	Total Qty. (MT/A)	Mode of disposal
Construction phase			
Domestic waste-Organic	Workers colony	163.62	Organic waste will be treated in organic waste convertor and sold as manure for farmers
Domestic waste-Inorganic	Workers colony	109.08	Inorganic waste will be handed over to local municipal waste collectors
STP sludge	wastewater from workers area	5.757	Sold as compost to farmers
Used oil and oil soaked cotton waste	DG sets	1	stored in leak proof containers and handed over to KSPCB authorized recyclers
Biomedical waste	Workers colony	18	stored separately and will be handed over to KSPCB authorized recyclers
Operation phase			
Domestic waste-Organic	Dam site staff and dam colony	20.79	Organic waste will be treated in organic waste convertor and used as manure for gardening at dam site and colony and sold as manure to farmers
Domestic waste-Inorganic	Dam site staff and dam colony	13.86	Inorganic waste will be handed over to local municipal waste collectors
STP sludge	wastewater from Dam site staff and dam colony	0.78	Used as compost for gardening at dam site and colony
Used oil and oil soaked cotton waste	DG sets	0.75	Stored in leak proof containers and handed over to KSPCB authorized recyclers
e waste	Dam site office and dam colony	1	Stored in leak proof containers and handed over to KSPCB authorized recyclers
Biomedical waste	Dam site office and dam colony	9.6	Stored separately and will be handed over to KSPCB authorized recyclers

Type of Waste	Source	Total Qty. (MT/A)	Mode of disposal
Battery waste	Dam site office and dam colony	1	Stored separately and will be handed over to KSPCB authorized recyclers
Plastic waste	Dam site office and dam colony	2.5	Stored seperately and will be handed over to KSPCB authorized recyclers

6.9. Power requirement & Supply/Source

Construction phase: The total Power requirement would be 10 MVA. The details are as follows;

Sl.No.	Particulars	Power requirement
1	Air Compressors	1 MVA
2	Aggregate Processing Plant	2 MVA
3	Batching Plant	1 MVA
4	Dewater Pumps	1 MVA
5	Grout Pumps	0.5 MVA
6	Facilities	2 MVA
7	Welding Machine	2.5 MVA
8	Bending Machine	
	Total	**10 MVA**

The activities in the Head Race Tunnel, Surge Shaft & Penstocks will be supplemented with the help of temporary power supply from DG sets (4 Nos. x 500 KVA).

Operation phase: A total of 400 MW of hydropower will be generated during operation phase. The total power requirement during operation phase is 4 MW and 3 Nos. of DG sets with capacity 500 KVA each will be used as back up. The power during operation phase will be sourced from Captive plant, DG set, transmission lines/state power supply

7. Rehabilitation and Resettlement (R&R) Plan

7.1. Policy to be adopted (Central/State) in respect of the project affected persons including home ouster, land ouster, and landless labourers (a brief outline to be given).

The project requires a total land of 5267.59 Ha. Out of which, 4879.02 Ha of land belongs to Cauvery Wildlife Sanctuary, 196.57 Ha belongs to ESZ area of Cauvery WLS, 1.74 Ha of Reserve Forest land, 190.26 Ha of revenue land. The land will be acquired as per the Right to Fair Compensation and Transparency in Land Acquisition Act, 2013, Forest (Conservation) Act, 1980 and Wildlife (Protection) Act, 1972. Villages namely, Madivala (Mahalli), Kongedoddi (Chelandvadi SF), Sangama (Chelandvadi SF), Bommasandra (Chelandvadi SF) and Muthathi are the areas under submergence. The project involves R&R activities.

The details of the land to be acquired are given below;

Sl No	Components	Cauvery WLS Area (Ha)	Cauvery WLS ESZ Area (Ha)	Reserve Forest (Ha)	Non Forest/ revenue land (Ha)
1	Approach Road_1	6.71	-	-	-
2	Approach Road_2	2.96	-	-	-
3	Approach Road_3	1.69	-	-	-
4	Approach Road_4	0.68	-	-	-
5	Bridge_1	2.56	-	-	-
6	Dam Site	6.80	-	-	-
7	Diversion Channel	1.19	-	-	-
8	Down Stream Coffer	0.85	-	-	-
9	Power Generation	14.84	-	-	-
10	Power Generation Ø5.60m Lower Horizontal Pressure Shaft	0.21	-	-	-
11	Power Generation Ø6m 'D' Shaped Adit To Tail Race Tunnel	0.54	-	-	-
12	Power Generation Ø6m Cable Shaft EL.340.00m TO EL.380.00m	0.22	-	-	-
13	Power Generation Adit To Pressure Shaft Bottom	0.28	-	-	-
14	Power Generation Main Access Tunnel	0.64	-	-	-
15	Power Generation Ø3.25m Lower Horizontal Pressure Shaft	0.01	-	-	-
16	Power Generation Ø5m 'D' Shaped	0.06	-	-	-
17	Power Generation Ø6m 'D' Shaped	0.23	-	-	-

Sl No	Components	Cauvery WLS Area (Ha)	Cauvery WLS ESZ Area (Ha)	Reserve Forest (Ha)	Non Forest/ revenue land (Ha)
18	Power Generation Power house cavern	0.33	-	-	-
19	Power Generation Surge Gallery	0.12	-	-	-
20	Power Generation Tail Race Tunnel Ø 9.50m Horse Shoe Type L=2150m	4.33	-	-	-
21	Power Generation Tailrace Outlet Portal	0.40	-	-	-
22	Power Generation Transformer Cavern	0.09	-	-	-
23	Pump House	2.27	-	-	-
24	Raising Main	6.16	-	1.74	20.45
25	Submergence	4821.66	196.57	-	142.48
26	Temporary Earth_Roackfill Coffer Dam	2.43	-	-	-
27	Up Stream Coffer Dam	0.75	-	-	-
28	Dam colony	-	-	-	25.64
29	Delivery chamber	-	-	-	1.69
	Total	**4879.02**	**196.57**	**1.74**	**190.26**
		5267.59			

Fig 10: Submergence of hutments (temporary structures) at Sangama

Fig 11: Area under submergence – Kongedoddi Village

Fig 12: Area under submergence – Madavala Village

Fig 13: Area under submergence – Muthathi Village

Fig 14: Area under submergence – Bommasandra Village

Fig 15: Area under submergence – Dry deciduous forests near Madavala village

8. Project Schedule & Cost Estimation

8.1. Project Schedule

The total developmental period of the entire proposed project will be about 4 years (48 months).

8.2. Cost Estimates

The total cost estimated for the proposed project is Rs 9,000 Crores.

9. Analysis of proposal (Final recommendation)

9.1. Financial and social benefits with special emphasis on the benefit to the local people including tribal population, if any, in the area

The Cost of the project works out to Rs. 9000.00 Crores. Project will provide drinking water to nearly 100 lakh people (135 lpcd) and generate power of 737.52 Mu (400 MW) annually by utilizing the elevation difference (in the bed level between the project site and the State border) out of the releases effected to as per the CWDT Award further modified by the Hon'ble Supreme court of India dated 16/02/2018. BC Ratio of the project is 1.67.

10. Interstate Aspects

The Cauvery River, is an inter-State river which originates in the State of Karnataka and falls into Bay of Bengal in Tamil Nadu. The catchment area of the basin lies in the States of Karnataka, Kerala, Tamil Nadu and Pondicherry. Cauvery traverses from West to East for a length of about 800 km through Karnataka and Tamil Nadu.

River Cauvery after originating traverses in Karnataka for a length of 320 km before entering Tamil Nadu with a common boundary of 64k. It passes through Tamil Nadu for a length of 357 km before draining in to the Bay of Bengal.

Award of Cauvery Water Dispute Tribunal

The Cauvery Fact Finding Committee (CFFC), constituted in 1972, utilized flow data of all the available gauge discharge sites as well as the utilization under the various irrigation systems in the Tamil Nadu and Karnataka and worked out the yield at Krishnarajasagara, Mettur and Lower Coleroon Anicut (LCA).

The Committee has estimated the yield at 50%, 75% and 90% dependability at three salient points of the river. Since there are reservoirs at Krishnarajasagara and Mettur, they decided that the yield figures would be of high degree of reliability if assessed at these points.

Table - 7: Yield in the Cauvery basin

Description	50% dependable yield (TMC)	75% dependable yield (TMC)	90% dependable yield (TMC)
KRS	219.4	187.8	167.6
Mettur	507.8	451.4	414.2
Lower Coleroon anicut	740	670	623

The area permitted and the quantum of water as apportioned by the Tribunal is given below.

Table - 8: Area permitted and the quantum of water as apportioned by the Tribunal

Sl. No.	Description	States				Total
		Kerala	Karnataka	Tamil Nadu	UT of Puducherry	
1	Area (lakh acres)	1.93	18.85	24.71	0.43	45.92
2	Irrigation requirement (TMC)	27.9	250.62	390.85	6.35	675.72

Sl. No.	Description	States				Total
		Kerala	Karnataka	Tamil Nadu	UT of Puducherry	
3	Domestic & Industrial water requirement projected for 2011 (TMC)	0.35	1.85	2.73	0.27	5.2
4	Water requirement for environmental protection (TMC)	-	-	-	-	10
5	Inevitable escapes into sea (TMC)	-	-	-	-	4
6	Share in balance water (based on population) (TMC)	1.51	17.64	25.71	0.22	45.08
	Total	**29.76**	**270.11**	**419.29**	**6.84**	**740**
	Say	**30**	**270**	**419**	**7**	**726+14** **740**

The Tribunal has ordered the tentative monthly deliveries during a normal year to be made available by the State of Karnataka at the Inter-State contact point presently identified as Biligundlu gauge and discharge station located on the common border as 192 TMC, but however a choice of any other contact point between Biligundlu and Mettur in the common reach has been clearly given, which has been split up into a monthly pattern.

Table -9: Details of Yield and quantum of water to be made available by Karnataka.

No	Description			TMC
1	Total yield of the basin at 50% dependability.(CFFC)			740
2	Yield at Mettur reservoir (CFFC)			508
3	Yield generated in Tamil Nadu area above Mettur reservoir and below			25
4	(a) Yield available below Mettur (740 - 508)			232
5	(b) Deducting following uses:			
6	(i)	Allocation to Kerala in Bhavani sub basin	6	20
	(ii)	(Amaravathy) Pambar sub basin	3	
	(iii)	Allocation to UT of Puducherry	7	
	(iv)	Inevitable escapades' into sea	4	
7	(c) Balance available for use in Tamil Nadu (232-20)			212
8	Total water available for use in Tamil Nadu (212 + 25)			237
9	Allocated share of Tamil Nadu			419
10	Balance to be made available at the Interstate contact point (419 - 237)			182

No	Description	TMC
11	Allocation for environmental protection to be made available at that point	10
12	Total delivery to be made at the Interstate border (182 + 10)	192

The Tribunal, in its unanimous decision in 2007, determined the total availability of water in the Cauvery basin at 740 thousand million cubic (TMC) feet at the Lower Coleroon Anicut site, including 14 TMC (10 TMC for environmental protection + 4 TMC for Inevitable escapages in to the sea) for environmental protection and escapages into the sea. The final award makes an annual allocation of 419 TMC to Tamil Nadu in the entire Cauvery basin, 270 TMC to Karnataka, 30 TMC to Kerala and 7 TMC to Puducherry.

The final award of the Cauvery Water Disputes Tribunal (CWDT) notified by the Centre on 19.02.2013 has settled the definition of a normal year and irrigation season which has been the bone of contention between Karnataka and Tamil Nadu.

A “normal year” shall mean a year in which the total yield of the Cauvery basin is 740 TMC. A “water year” shall mean a year commencing on June 1 and ending on May 31 and the “irrigation season” shall mean the season beginning on June 1 and ending on January 31 of the next year.

In a normal year, Karnataka has to make available to Tamil Nadu at Biligundlu 192 TMC on monthly basis. This comprises of 182 TMC towards the allocated share of Tamil Nadu, in addition to 10 TMC for environmental purposes. In a distress year, the allocated shares shall be proportionately reduced among the States of Kerala, Karnataka, Tamil Nadu and Puducherry.

The Cauvery includes the main river, all its tributaries and all other streams contributing water directly or indirectly to it. The award authorizes the Board/Authority to monitor the monthly releases with the help of the States concerned and the Central Water Commission for five years. Thereafter, if any modification/adjustment is needed in the schedule, it may be worked out in consultation with the party-States and help of the CWC “without changing the annual allocation amongst the parties”.

Judgement of Hon'ble Supreme Court of India – Civil Appeal No 2453 0f 2007

In the Hon'ble Supreme Court of India, a Civil Appeal no 2453 of 2007 was filed against the verdict of the Cauvery Water Disputes Tribunal. After hearing the case, the Hon'ble Supreme Court on 16/02/2018 gave its judgement.

In the wake of the judgement of Supreme Court on the pleadings of the States concerned, the following reference need to be considered as of paramount importance as far as implementation of Mekedatu Balancing Reservoir & Drinking Water Project is concerned.

In Point no 11 - Final Water Allocation amongst States and further under Point no 12 – Monthly Schedule for delivery of water at Inter State Contact points, Sub Point no 287, Page 331, the Supreme court on delivering of 177.25 TMC by the State of Karnataka to Tamil Nadu at the inter-state border states:

"In this regard, the three components contributing to the annual quantum of water to be delivered by the State of Karnataka at the inter-state contact point were identified as herein below:

- Flows coming in the River Cauvery from the uncontrolled catchment of Kabini sub-basin downstream of the Kabini Reservoir, the catchment of main stream of Cauvery river below Krishnarajasagara, uncontrolled flows from Shimsha, Arkavathy and Suvarnavathy sub-basins and various other small streams
- Regulated releases from Kabini Reservoir; and
- Regulated releases from Krishnarajasagara reservoir."

Sub point no 289, Page 333 & continued in Page 334, the Supreme court states thus:

"It was also made clear that in case the yield was less in a distress year, the allocated shares would be proportionately reduced amongst the States involved by the Regulatory Authority. Having regard to the fact that the irrigation season starts form 1st of June and the normal date of onset of South West monsoon in Kerala is of the same date so much so that any delay in the advent of monsoon would affect the inflows and consequently dislocate the schedule of releases from Krishnaraja Sagara & Kabini Reservoirs, the Tribunal felt it to be advisable that at the end

of May each year, as much storage as was possible during a good year should be consciously conserved as that would help in adhering to the schedule of monthly deliveries".

This is precisely the intention of proposing the Mekedatu Balancing Reservoir cum Drinking Water project by Karnataka.

The Supreme Court has also dwelt in detail the different Clauses of the Final order and decision of the Cauvery Tribunal.

Reference to Clause XVIII is of relevance to be quoted here states thus:

"Nothing in the order of this tribunal shall impair the right or power or authority of any State to regulate within its boundaries the use of water, or to enjoy the benefit of waters within the State in a manner not inconsistent with the order of this tribunal"

Regarding the drinking water requirement of Karnataka particularly with reference to Bangalore, The Hon'ble Supreme Court vide Page no 441, Sub point no 390, states thus:

"Apart from the fact that there is no basis whatsoever for the tribunal of having quantified the water requirement for urban population to be 8.70 TMC as well as for rural population to be 8.52 TMC, its assumption that 50 % thereof would be met from ground water only in view of its perception that wells and tube wells in urban and rural areas cater to the substantial requirement of drinking water, in our view, is unacceptable and cannot be sustained. That apart, in the context of Bengaluru City, especially in view of the growth and rise of population in space and time, the Tribunal's approach of confining the entitlement of its population in general to only 1/3rd of their requirement only in view of the location of 1/3rd of its physical entity within the Cauvery Basin demands scrutiny. True it is, the concept of a basin and the beneficial uses of the water thereof ought to be traced generally to the sites and population thereof located in the basin, nevertheless, the principles of apportionment and the conception of reasonable and equitable share perceived for such uses comprehend a basin State addressing the social and economic needs of its community as a whole. Territorial or geographical demarcation for extension of beneficial uses of an inter-state river basin cannot always be strictly construed."

Further continue to state thus: "We are inclined to think so as the perception of a basin State inheres in it a degree of flexibility in approach in a unique fact situation to justify a warrantable flexibility and departure from such rigoristic approach. We are disposed to think so, for the city

of Bengaluru, as an evident phenomenon, has burgeoned over the years and has grown today into a progressively sophisticated, sprawling, vibrant and a much aspired seat of intellectual excellence particularly in information technology and commercial flourish. It has transformed into a nerve centre of contemporaneous significance and its population is daily on the rise, thus registering an ever enhancing demand for all civic amenities. Having regard to its exclusive attributes, it is incomparable in many ways not only to other urban areas in the State, but also beyond. The requirements of its dependent population as a whole for drinking and other domestic purposes, therefore, cannot justifiably, in the prevailing circumstances, be truncated to their prejudice only for consideration of its physical location in the context of the river basin, We think so since the city of Bengaluru cannot be segregated having an extricable composition and integrated whole for the purposes of the requirements of its inhabitants, more particularly when the same relates to allocation of water for domestic purposes to meet their daily errands. It will be inconceivable to have an artificial boundary and deny the population the primary need of drinking water. We hold so in the special features of the case keeping in view the global status the city has attained and further appreciating the doctrine of equitable proportionality on the bedrock of pressing the needs."

Sub point no 391 states thus:

"At this juncture, we need to recount that as per the National Water Policies, not only drinking water has been placed at the top of the other requirements in the order of priority, but it has also been predicated that adequate drinking water facilities should be provided for the entire population, both in urban and rural areas and that drinking water should be made a primary consideration. It was declared as well that drinking water needs of human beings and animals should be the first charge on any available water. Article 14 of the Berlin rules also mandates that in determining and equitable and reasonable use, the States shall first allocate water to satisfy vital human needs".

Sub Point 392 states thus;

"In view of the above, we are constrained to observe that the approach of the tribunal cannot be approved in the facts and circumstances indicated hereinabove. We are, thus, of the considered opinion that the allocation of water for drinking and domestic purposes for entire city of Bengaluru has to be accounted for. Noticeably, Karnataka had claimed 14.52 TMC, i.e., 6.52 TMC

for existing water schemes for Bengaluru and 8.00 TMC for the ongoing drinking water schemes for the city as in June, 1990. It had demanded 30 TMC as drinking water requirement for the city with the projection of 2025. Having regard to the percentage of decennial growth, as has been adopted by the Tribunal, in 2011, the demand of Karnataka for drinking water requirement for Bengaluru Metropolitan Region would be in the vicinity of 24 TMC. Even excluding the computation for urban population of the State to be 8.70 TMC as arrived at by the Tribunal and that too without any basis and accepting the water requirement of rural population to be 8.52 TMC though also without any basis, the total figure representing drinking and domestic water requirement of the urban and rural population would be 32.50 TMC rounded upto 33 TMC in comparison to 46 TMC as claimed by Karnataka in its statement. Having rejected the assumption that 50 % of the drinking water would be met from ground water, this 33 TMC would, in our estimate, be a safe and acceptable figure qua drinking water requirement of the State of Karnataka for its urban and rural population. By applying the consumptive percentage of 20 %, the volume of water to be allocated to Karnataka on this count would be 6.50 TMC in lieu of 1.75 TMC awarded by the Tribunal, i.e., an increase by 4.75 TMC".

Sub Point No 393 states thus:

"Qua the view against transbasin diversion, suffice it to state that not only in the context of Bengaluru Metropolitan Region, for the reasons cited herein above, a digression from the confines of the concept of in-river basin would be justified, since the National Water Policy of 1987, in categorical terms, enjoined that water should be made available to water short areas by transfer from other areas including transfers from one river basin to another. This very conspicuously emphasizes on an inclusive comprehension and in a deserving case like Bengaluru Metropolitan Region, it would not be incompatible with the letter and spirit of the factors that ought to inform the determination of reasonable and equitable share of water in an interstate river as well as of the National policies formulated for planning and development of the precious natural resource involved".

Further, while revising the allocation amongst competing States, Hon'ble Supreme Court vide point X.10, Sub point 396, Page 447 states thus:

"The river Cauvery originates in Karnataka and eventually after its full flow through the other riparian States of the basin assimilates in the bay of Bengal. With the evolution of the principle of

equitable apportionment which is really to ensure equal justice to the basin States, the concept of prescriptive right or right to the natural flow of any inter-state river has ceased to exist. Having regard to the historical facts which demonstrate the constraints suffered by Karnataka resulting in its limited access and use of the surface flow of Cauvery in spite of being the upper riparian state, compared to Tamil Nadu, then madras presidency, as well as severally drought conditions in its 28 districts/ taluks, we are inclined to award an additional 14.75 TMC in all, i.e., 10 TMC (on account of availability of ground water in Tamil Nadu) + 4.75 TMC (for drinking and domestic purposes including such need for the whole city of Bengaluru). On these considerations, we consider Karnataka to be more deserving amongst the competing States to be entitled thereto. Out of this, 14.75 TMC would be deducted from the quantum allocated by the Tribunal in favour of Tamil Nadu. In other words, the final allocation of the shares in view of this determination would be as hereunder,

Table-10: Allocation of water as per CWDT Award

Sl.No.	Share of the waters	Quantity in TMC
1	Karnataka	284.75 TMC (270 + 14.75)
2	Tamil Nadu	404.25 TMC (419 - 14.75)
3	Kerala	30.00
4	UT of Puduchery	7.00
5	Environmental Protection	10.00
6	Inevitable escapages into the Sea	4.00
	Total	740.00

Sub Point 397 states thus

"As a consequence of the aforesaid allocation, the State of Karnataka would now be required to make available at the inter-state border with Tamil Nadu, i.e., at Biligundlu, 177.25 TMC of water for the basin. Apart from the modifications effected hereinabove, no interference with the determination and findings recorded by the Tribunal, in view of the scrutiny of the available materials on record, is called for".

Sub Point 400 states thus

"In view of the reduction in the quantum of water, now required to be released by Karnataka at the inter-state border with Tamil, Nadu, i.e., at Biligundlu, there would be logically, a proportionate decrease in the monthly releases as worked out by the Tribunal. However, the same pattern therefore, as modified by it would be maintained for the reduced releases.

Sub Point 404 (vii), Page 460 states thus

"This court in Re: Presidential reference (Cauvery Water Disputes tribunal) has held that waters of an inter-state river passing through corridors of the riparian States constitute a National Asset and no single State can claim exclusive ownership of its water. In this context, the principle of equitable apportionment internationally recognized by the Helsinki Rules, Camione rules and Berlin Rules which have also been incorporated in the 1987 to 2002 national Water policies, have been regarded to be the guiding factor for resolving disputes qua apportionment of water of an inter-state river.

"It is obligatory to clearly state that in view of the acute scarcity of the water resources and the intensely contested claims of the States, it is expected that the allocations hereby made would be utilized for the purposes earmarked and accepted and no deviancy is shown in carrying out the verdict of this court".

In view of the above early implementation of the project is necessary in view of providing drinking water supply and ensuring monthly downstream flow as stated by the Hon'ble Supreme Court.

****

REFERENCES

1. Mekedatu Balancing Reservoir and Drinking Water Project, Detailed Project Report. (Jan 2019), *E I Technologies Pvt. Ltd*., Vol-1, 2 &3 and Hydrology report.
2. Final Notification declaring Eco Sensitive Zone around Cauvery Wildlife Sanctuary, Karnataka, (Notification No: 74.S.O. 2733 dt: 22.08.2017), *Ministry of Environment, Forest and Climate Change, Govt. of India*. http://www.envfor.nic.in/content/esz-notifications
3. Management Plan of Cauvery Wildlife Sanctuary, *Karnataka Forest Department*, http://aranya.gov.in
4. Central Ground Water Board, Ground Water Information Booklet, Chamarajanagar District, Karnataka, *Ministry Of Water Resources, Government Of India* (November 2008).
5. Central Ground Water Board, Ground Water Information Booklet, Ramanagara District, Karnataka, *Ministry Of Water Resources, Government Of India* (January 2013).