Chapter 10
Environmental Impact Assessment and Environment Management Plan

10.0 General

The Bedti - Varada link project (Link I & Link II) envisages diversion of 524 MCM of surplus waters of Bedti river to serve Tungabhadra LBC in Raichur district. The total annual irrigation proposed under the link project 104900 ha. The Govt. of Karnataka will take up Comprehensive Environmental Impact Assessment (CEIA) study and Socio-economic study of the project as per TOR of MoEF& CC, Govt. of India and the findings and recommendations there from would be suitably incorporated in the DPR at a later stage. For the present, the baseline information from secondary sources on various environment related issues are discussed briefly in the present chapter along with a tentative Environmental Management Plan (EMP).

10.1 Objective of the study

The objective of Environmental Impact Assessment (EIA) study is to identify the possible environmental effects due to the proposed Bedti – Varada link project and to suggest measures to mitigate the anticipated adverse impacts on the environment along with Environmental Management Plan (EMP) and Environmental Monitoring Plan.

10.2 The project proposal

The project comprises two link components:

Link I: Bedti Varada to transfer 302 MCM

Link II: Bedti - Dharma to transfer 222 MCM

Two weirs are proposed at Pattanadahalla, and Shalamalahalla in Link I and one barrage is proposed at Suremane in Link II. The conveyance system comprises of canal, tunnels and raising mains. The diverted water will flow through Varada river upto Tungabhadra reservoir.

10.2.1 The project background

The prefeasibility report of Link I: Bedti – Varada was prepared and circulated as part of NPP. However, Govt of Karnataka suggested Link II: Bedti-Dharma as an intra state link for utilising Bedti waters in Tungabhadra reservoir. The present proposal is evolved by merging the above two and more water is proposed to be transferred from Bedti to Varada and then Tungabhadra.

10.2.2 The project justification

The Bedti river is one of the principal west flowing rivers in the Karnataka state with a total catchment area of 3902 Sq.km, which lies in Uttara Kannada, Dharwar and Haveri districts. The Varada river is a tributary of Tungabhadra river which originates in Karnataka state and joins the Tungabhadra river within the state.

Karnataka receives the highest rainfall on western side of Western ghats and the west flowing rivers carry abundant discharges during the monsoon months. Due to steep slope and short lengths of the rivers, the topography of the region does not permit the utilisation of entire waters. Whereas the eastern side of Western ghats receives scanty rainfall as it falls

under rain shadow area and so is chronically drought affected. Hence the available monsoon surplus waters of Bedti basin at Pattanadahalla, Shalamalahalla and Suremane diversion sites is proposed to be diverted to eastern side of Western ghats for further utilisation in the water short Tungabhadra left bank canal command.

Annual water balance of entire Bedti basin at 75% dependability is 4927 ~~5213~~ MCM. Surface water balance at proposed diversion sites of Bedti basin are 181 MCM at Pattanadahalla, 276 MCM at Shalamalahalla and 298 ~~294~~ MCM at Suremane. Considering the net flows at the diversion sites, the divertible quantities have been firmed up from daily simulation study as 114 MCM, 302 MCM (combined) and 222 MCM from Pattanadahalla, Shalamalahalla and Suremane diversion sites respectively.

As per RWBS (TS No. 65), Tungabhadra sub-basin is surplus by about 2597 MCM. However, the water balance up to Tungabhadra dam site is deficit by about 712 MCM. Therefore, the surplus waters of Bedti basin can be utilised in the Tungabhadra command, to meet the deficit of the project to a larger extent.

The link project will bring economic prosperity to the drought-prone area of Raichur district lying at the tail end reaches of Tungabhadra left bank canal command through stabilisation.

10.2.3 The project description

The proposed Bedti–Varada link project comprises the following components:

Bedti - Varada link (Link-I)

1) Proposed Pattanadahalla diversion weir near Siralabail village, across Pattanadahalla stream of Sonda river which is a tributary of Bedti river

with a length of 145 m, pond level of 499.00 m & maximum flood level of 501.00 m.

2) 6.9 km long conveyance system (Tunnel/canal) taking off from Pattanadahalla weir with full supply level of 492.00 m and designed discharge capacity of 22.33 m^3/s which outfalls into a stream leading to Shalamalahalla.
3) Proposed Shalamalahalla diversion weir near Hulgol village across Shalamalahalla stream of Sonda river which is a tributary of Bedti river with a length of 202 m, pond level of 468.00 m and maximum flood level of 470.50 m.
4) A Jackwell cum pump house on upstream of the weir on the right bank of Shalamalahalla weir with suitable forebay.
5) 18.58 km long conveyance system (raising main/tunnel/canal) taking off from the proposed Jackwell cum pump house with full supply level of 468.00 m and designed discharge capacity of 60.50 m^3/s which outfalls into a stream leading to Varada river.

Bedti – Dharma link (Link-II)

1) Proposed Suremane diversion barrage near Suremane village, across the Bedti river with a length of 165 m, pond level of 426.00 m and maximum flood level of 429.44 m.
2) A Jackwell cum pump house on upstream of barrage in the left bank of Bedti river with suitable forebay.
3) 26.88 km conveyance system (raising main/tunnel/canal) taking off from the proposed Jackwell cum pumphouse with full supply level of 426.00 m and designed discharge capacity of 76.40 m^3/s which outfalls into a stream leading to Dharma river/reservoir.

10.3 The study area

The project area lies in Bedti basin and Tungabhadra sub-basin of the Krishna basin covering Uttara Kannada and Raichur districts of Karnataka state. The study area proposed for Environmental Impact Assessment studies and preparation of Environmental Management Plan comprises the following:

1. Catchment area intercepted at each weir/barrage site.
2. Area to be acquired for various project appurtenances including pond submergence.
3. 10 km on either side of the link conveyance system.
4. 10 km radius around the project area from periphery of the project.

5. Command area where stabilization is proposed and riverine areas in the downstream and enroute link canal. However, only direct draining rivers/streams/tributaries and nallas enroute the link canal shall be considered as part of the project.

10.4 Legal status of the project

Though there are numerous direct and indirect benefits that may accrue due to implementation of this project, due weightage needs to be given for the assessment of its social and environmental aspects. One of the important social considerations is the process of public consultation. Appraising articles about the project proposals and associated benefits have been disseminated to the stakeholders in the project area by Govt. of Karnataka.

All the diversion sites and conveyance systems are located mostly in forest area. The forest area to be acquired is 243 ha of which 165 ha is under weir/barrage ponds and 78 ha is for conveyance system. On account of this, there may be some effect on flora& fauna and wildlife. No

monuments and other structures of archaeological importance will be affected due to the project implementation. Similarly, no important minerals are found in the project area. However, at the time of pre-construction stage, the detailed Environmental Impact Assessment Study, Archaeological study and mineral survey will be got done from the expert agencies.

The total land acquisition required for execution of the project is 293 ha of which 243 ha is forest land and 50 ha is other land. For forest land, the forest clearance under Forest act 1980 (Conservation) is required. The Govt. of Karnataka has submitted the Bedti–Varada link project for scoping to the Expert Appraisal Committee (EAC) for River Valley and Hydroelectric Projects, MOEF & CC. The proposal was considered by the EAC in its 93rd meeting held on 2nd May, 2016, the minutes of which are furnished as **Annexure: 10.1**. The diversion site area at Shalamalahalla is surrounded by the Western Ghats Eco-Sensitive Zone, the Shalamalahalla Riparian Ecosystem Conservation Reserve and the Bedti Conservation Reserve. The CEIA study will reflect the extent of impact the project will have on the Western Ghats Eco-Sensitive Zone in and the vicinity of the project area. The project will also require the techno-economic clearance from Central Water Commission, Investment clearance from NITI Aayog, and consent from Karnataka Pollution Control Board under Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981. The public hearing is also required to be conducted.

Further, the issues related with land acquisition are to be dealt amicably while acquiring the land for the conveyance system.

While implementing the project due care is to be taken towards various provisions of the National Policy on Land Acquisition and R&R as per the latest land acquisition Bill-2015 (with amendments) along with the policies enunciated by the Govt. of Karnataka if any, regarding land

acquisition. In addition, pre-environmental clearance is required to be obtained from concerned designated authority.

10.5 Baseline environmental data

Before initiating any study for Environmental Impact Assessment of the project, it is essential to identify the baseline levels of relevant environmental parameters which are likely to be affected because of the construction and operation of the proposed project. A scoping matrix must be formulated to discuss various parameters such as air environment, water environment, land environment, biological/terrestrial and aquatic environment which are likely to be affected due to implementation of the project.

10.5.1 Air environment

10.5.1.1 Ambient air quality

The likely sources of air pollution in the study area are emissions from vehicles, burning of fossil fuels, dust arising from unpaved village roads, construction activities and domestic fuel burning. The pollutants are either absorbed by the atmosphere or dispersed effectively. The prime objective of the baseline air quality monitoring known as National Air Quality Monitoring Programme (NAMP) with the objective of assessing the status and trend in the ambient air quality is to evaluate air pollution levels, understand natural cleansing process and to develop ways and means for taking preventive and corrective measures. Under N.A.M.P., four air pollutants viz., Sulphur Dioxide (SO_2), Oxides of Nitrogen as NO_2, Respirable Suspended Particulate Matter (RSPM / PM_{10}) and Fine Particulate Matter ($PM_{2.5}$) have been identified for regular monitoring. The major sources of SPM include soil borne dust, dust from construction activities, resuspension of dust etc. NO_2 is formed in the atmosphere due to

reaction of nitric oxide with ozone and hydrocarbons. Areas with high population and vehicular traffic give rise to high levels of NO_2. Sulphur dioxide (SO_2) is formed due to fossil fuel burning. The major sources of Respirable Suspended Particulate Matter (PM_{10}) are emissions from diesel vehicles and industries where combustion processes take place.

The testing methods that shall be followed for monitoring various ambient air quality parameters and their permissible levels at 24 hourly monitored values as specified in 'National Ambient Air Quality Standards, 2009' for industrial, residential, rural, and other areas are at **Table: 10.1**.

Table: 10.1
National ambient air quality parameters and their standards

Unit: $\mu g/m^3$

Pollutant	Time Weighted Average	Concentration in Ambient Air		
		Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of measurement
Sulphur Dioxide (SO_2)	24 hours	80	80	-Improved West & Gaeke -Ultraviolet fluorescence
Nitrogen Dioxide (NO_2)	24 hours	80	80	-Modified Jacob & Hochheiser-Chemiluminescence
Particulate Matter (size less than 10 µm) or PM_{10}	24 hours	100	100	-Gravimetric -TOEM -Beta Attenuation
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	24 hours	60	60	-Gravimetric -TOEM -Beta Attenuation

Source: 'National Ambient Air Quality Standards, 2009', CPCB

NAMP regularly monitors the ambient air quality at certain locations in the Karnataka state. The latest available information on the parameters measured at Raichur in the project area is given below at **Table: 10.2.**

Table: 10.2

Ambient air quality parameters observed in Raichur city by NAMP

Unit: $\mu g/m^3$

Location / Standards	PM_{10}	$PM_{2.5}$	SO_2	NO_2
KSPCB Office Premises, Raichur	17-186	1-34	2-7	5-27

Source: National Ambient Air Quality Monitoring NAAQMS/45/2019-2020, CPCB

10.5.2 Noise environment

The noise levels shall be monitored continuously for 24 hours at each location set up for the purpose by measuring hourly equivalent noise level. These values will then be used to estimate the day-time and night-time equivalent noise levels. The permissible noise levels specified are (i) for residential areas - 55 dB(A) at day-time and 45 dB(A) at night-time, (ii) for commercial area - 65 dB(A) at day-time and 55dB(A) at night-time, (iii) for industrial area - 75 dB(A) at day-time and 70 dB(A) at night-time and (iv) for silence zone - 50 dB(A) at day-time and 40 dB(A) at night-time.

Karnataka Pollution Control Board has conducted continuous noise monitoring study at 10 locations covering the Bengaluru city as per CPCB protocol. It is aimed at generating long term ambient noise level data and trend at the identified locations, by repeating the monitoring survey every year. There are no ambient noise levels monitored in the vicinity of the project area by KPCB.

10.5.3 Meteorology

Climatologically, the Bedti–Varada link project area has four distinct seasons viz., dry period from January to February, hot period from March to May, south-west monsoon from June to September and north-east monsoon from October to December. The climate is cold from December to February followed by hot season from March to May.

The IMD observatories located in the vicinity of link project area and the target command area are Honavar IMD observatory and Raichur IMD observatory respectively. The normal annual rainfall for the latest 50 years period (1951-2000) computed by IMD, Pune at Honavar and Raichur station are 3728.3 mm and 750.5 mm respectively.

At Honavar, the monthly mean daily maximum and minimum temperature recorded are 33.4^{O} C in November & December and 20.2^{O} C in February, the monthly normal maximum and minimum wind speed observed are 6.0 kmph in June and 3.9 kmph in October, the monthly mean cloud cover varies from 0.9 oktas in February to 7.0 oktas in July, the maximum and minimum relative humidity are 94 % in August and 55 % in December and the annual potential evapotranspiration (PE) is 1383.1 mm.

At Raichur, the monthly mean daily maximum and minimum temperature recorded are 40.4^{O} C in May and 16.6 ^{O} C in December, the monthly normal maximum and minimum wind speed observed are14.0 kmph in July and 7.6 kmph in December, the monthly mean cloud cover varies from 2.6oktas in January to 5.8oktas in July, the maximum and minimum relative humidity are 74 % in September and 23 % in March and the annual potential evapotranspiration (PE) is 1883.1 mm.

10.5.4 Water quality

10.5.4.1 Surface water quality monitoring

There are no G&D sites located on the Bedti river where water quality is being monitored; hence the data of Santeguli G&D site on Aghanashini river maintained by Central Water Commission (CWC) which is adjacent to the Bedti river is adopted for both chemical and physio-chemical analysis for ascertaining the water quality status for entire Bedti river. However, the actual water quality status for Bedti river will be given after conducting the Environmental Impact Assessment studies.

The latest data pertaining to the years 2014 to 2017 on laboratory test results of water samples of Santeguli G&D site have been collected and presented in **Table:10.3**.

Table 10.3
Test results of water samples at Santeguli G&D site on Aghanashini river

Sl. No.	Character-istic (Para-meter)	Unit	Analysis Result				Drinking water specifications (IS 10500 : 2012)
			2014	2015	2016	2017	Requirement (Acceptable limit)
1	pH		7.150	6.757	7.073	7.080	6.5 to 8.5
2	Dissolved Oxygen	mg/l				6.820	Min. tolerance limit of 6 mg/l as per CPCB class A.
3	Total Dissolved Solids	mg/l		34.000	35.333	34.000	500 mg/l Max
4	Turbidity	NTU					1 NTU Max
5	Total Alkalinity (as $CaCO_3$)	mg/l	17.800	15.192	16.275	16.557	200 mg/l Max

6	Chloride (as Cl)	mg/l	7.218	8.224	7.041	6.256	250 mg/l Max
7	Sulphate (as SO_4)	mg/l	2.216	2.464	3.592	2.557	200 mg/l Max
8	Fluoride (as F)	mg/l	0.063	0.119	0.057	0.042	1.0 mg/l Max
9	Total Hardness (as $CaCO_3$)	mg/l	21.104	19.758	19.686	24.365	200 mg/l Max
10	Calcium (as Ca)	mg/l	5.067	4.933	4.533	4.416	75 mg/l Max
11	Magnesium (as Mg)	mg/l	2.025	1.782	2.005		30 mg/l Max
12	Boron (as B)	mg/l	0.210	0.387	0.222	0.204	0.5 mg/l Max
13	Nitrate (as NO_3-N)	mg/l	0.430	0.488	0.591		10 ppm
14	BOD	mg/l				0.507	Max. tolerance limit of 2 mg/l as per CPCB class A.
15	Silica	mg/l	4.417	11.917	13.473	7.642	----
16	Iron (as Fe)	mg/l	0.125	0.130	0.056	0.242	0.3 mg/l Max

Source: WRIS India web site

It is observed that the pH level of water at Santeguli G&D site ranges between 6.757 and 7.150 during the period from 2014 to 2017. The pH level indicates slightly alkaline nature of the water, and the values are within the acceptable limits of 6.5 to 8.5 as per IS 10500: 2012 specified for drinking and domestic uses. The levels of dissolved oxygen in the collected samples are in the range of 6.820 mg/l and fulfil the CPCB class A minimum tolerance limit of 6 mg/l. The levels of total dissolved solids are well within the maximum acceptable limit of 500 mg/l i.e., ranging from 34.000 to 35.333 mg/l. The range of total alkalinity (as $CaCO_3$) is between 15.192 and 17.800 mg/l and satisfies the maximum acceptable limit of 200 mg/l. The concentration of chloride (as Cl) is in the range of 6.256 to 8.224

mg/l which is within the maximum acceptable limit of 250 mg/l for drinking water quality standards. The concentration of sulphate (as SO_4) is in the range of 2.216 to 3.592 mg/l which is within the maximum acceptable limit of 200 mg/l. The concentration of Fluoride (as F) ranges from 0.042 to 0.119 mg/l which is within the maximum permissible limit of 1.0 mg/l specified for potable water. The range of total hardness (as $CaCO_3$) for the above water samples is from 19.686 to 24.365 mg/l which is within the maximum acceptable limit of 200 mg/l specified for drinking water.

The concentration of calcium (as Ca) is also within the maximum permissible limit of 75 mg/l, ranging from 4.416 to 5.067 mg/l. Other parameters such as Magnesium, Boron, Nitrate, Silica and Iron are also within the respective acceptable limits as per IS 10500: 2012. The Biochemical Oxygen Demand (BOD) is 0.507 mg/l which is within the maximum acceptable limit of 2 mg/l as per CPCB class A tolerance limit. Though the water is suitable for drinking and domestic uses, it cannot be supplied directly without proper filtration and chlorination.

10.5.4.2 Ground water quality monitoring

The ground water quality monitoring in the study area has been done by the CGWB under Hydrology Project by constructing several ground water monitoring wells (dug wells), piezometers and exploratory bore wells. Various parameters viz., the depth of ground water table, rate of groundwater discharge, storativity, transmissivity etc. have been observed. As per the latest district ground water brochures of CGWB (2012/2013), the information on number of monitoring wells, quality and the above stated parameters in the project area are presented in **Table 10.4**.

Table: 10.4
District wise ground water information in the study area

Sl. No.	Parameter	Uttara Kannada	Raichur
1	**Monitoring wells**		
a.	Dug wells	34	54
b.	Piezometers	10	11
2	**Depth to water level range (m bgl)**		
a.	Pre-monsoon water levels	1.91 to 29.88	0.65 to 10.70
b.	Post-monsoon water levels	0.36 to 16.85	0.05 to 11.00
3.	**Groundwater exploration**		
a.	Wells drilled EW- OW- PZ-	 5 4 33	 42 36 -
b.	Depth range (m) Dug wells- Piezometers-	 16 to 47 89 to 200	 9.3 to 100 -
c.	Discharge (l/s) Dug wells- Piezometers-	 0.05 to 3.75 0 to 8.5	 0.1 to 9.0 -
d.	Storativity (S)	NA	$1.77x10^{-2}$ to $9.1x10^{-5}$
e.	Transmissivity (m^2 /day) Dug wells- Piezometers-	 7.1 to 446 2.09 to 24.41	 1.60 to 500

Source: Groundwater information booklet of Uttara Kannada and Raichur districts, CGWB

Shallow aquifers of alluvium along the stream courses, seacoast, creeks, weathered zones of schists, meta-sedimentaries and metavolcanics occurring between the depths of 3 to 20 mbgl and deeper aquifers of fractured and jointed schists, gneisses and meta-volcanics and meta sedimentaries up to 200 mbgl are the major water bearing formations in the Uttara Kannada district whereas the weathered / fractured granitic gneiss are the major water bearing formations in Raichur district.

CGWB is monitoring the ground water quality of both the districts pertaining to the project area through its established monitoring wells. The

water samples are subjected to analysis of various parameters in the Regional Chemical Laboratories of the Board. The parameters analyzed include pH, electrical conductivity (EC), total alkalinity (TA), total hardness (TH), nitrate (NO_3) and fluoride (F).

The analysis of ground water samples of Raichur district revealed that the ground water quality when compared with standards prescribed by BIS (IS-10500-2012) is in general found to be potable. It is also suitable for irrigation purposes in major parts of the district. Groundwater in major parts of Raichur district contains fluoride. Excessive fluoride causes mottling of tooth enamel and skeletal deformation.

While in Uttara Kannada district, the ground water study reveals that the quality of ground water in the urban areas is good and useful for all purposes. At few places, it is observed that the concentrations of NO_3 and SO_4 are found to be considerable. However, these chemical constituents are found within the permissible limits except at few localities.

The hazards of water logging and salinization are not anticipated due to the proposed project.

The water level is subjected to change both due to the natural and man-made causes. Groundwater level is an important indicator for the recharge of the aquifer, ground water extraction and the discharge from the aquifer to surface water. Ground water levels vary significantly over time and season. Decline in ground water levels occur because of low rainfall, changes in land use and over exploitation. Rise in ground water levels occur due to heavy rainfall, changes in land use or artificial recharge to ground water.

As per the ground water study by CGWB the pre-monsoon depth and post-monsoon depth to water levels were measured in both Uttara Kannada and Raichur districts. The results are furnished in **Table 10.4** above.

As per the assessment of dynamic ground water resources by CGWB, Govt. of India as of March 2020, the details on ground water resources in Uttara Kannada and Raichur districts are given in **Table-10.5.**

Table-10.5
Dynamic groundwater resources in the study area

Sl. No	Details	District	
		Uttara Kannada	Raichur
1.	Annual net ground water availability (MCM)	918.41	620.08
2.	Total annual ground water draft for all purposes (MCM)	224.34	298.33
3.	Projected demand for domestic uses by 2025 AD (MCM)	36.03	45.20
4.	Stage of ground water development (%)	24.43	48.11

Source: National Compilation of Dynamic Ground Water Resources of India, 2020, CGWB

10.5.5 Land environment

10.5.5.1 Land use

The present land use and land cover information of the proposed command area has already been discussed in **Chapter: 8 Irrigation Planning and Command Area Development**. However, the land use and land cover are expected to be changed due to the developmental activities of the project.

10.5.5.2 Mineral deposits

Mineral surveys have not been carried out at head works and along the canal alignment due to the time constraint and covid situation. However, the same will be carried out during the preconstruction stage.

10.5.5.3 Historical/Archaeological monuments

Archaeological surveys have not been carried out at the project area due to the time constraint and covid situation. However, the same will be carried out during the preconstruction stage.

10.5.5.4 Geology

The Bedti –Varada link (Link-I and Link-II) project lies in the Bedti basin and the Tungabhadra sub-basin. The head works and conveyance system both lie in the Bedti basin in Uttara Kannada district of Karnataka state and the command area proposed under the link project in Tungabhadra sub-basin falls in Raichur district of Karnataka State.

Geologically, the area of Uttara Kannada district is underlain by the peninsular gneissic complex of Archean formations & meta-sedimentary and metavolcanics sequence of Dharwar super group & younger intrusive of granites. During sub-recent to recent age, these rocks have undergone laterisation resulting in a cover of laterite varying thickness. Alluvial deposits of limited thickness occur along the major drainage course of Bedti river. The basic dykes (gabbro & dolerite) are common intrusive, especially in the eastern & southern sectors of area.

Granites, gneisses and Dharwar schists are the main rock formations in the region of Raichur district. They are grouped as hard rock as they do not have any primary porosity.

10.5.5.5 Soils in the project command area

Target command area of the link project planned for stabilisation of existing irrigation under the Tungabhadra LBC lies in Raichur district of Karnataka state.

Soil surveys were not conducted in the vicinity of the project area. However, based on the particulars contained in the Hydro-geological Atlas of Karnataka, brought out by the Central Ground Water Board, the command area under TBLBC is predominantly covered by red loamy soils and to a lesser extent by medium black soils and deep black soils.

The quality of various types of soils in the project area shall be monitored during the CEIA study of the link project. The soil capability classification and soil & land irrigability classification of various types of soils in the command area has already been discussed in **Chapter: 8 Irrigation Planning and Command Area Development**.

10.5.6 Terrestrial ecology

10.5.6.1 Delineation of flora in study area

The project region (specially the Uttara Kannada district) has great biodiversity of flora with many economically and medicinally important plants. A great variety of plant species are found in this region. The presence of ecologically sensitive areas has been identified in the study area which will be taken care of with due consideration. Moreover, the detailed survey will be done during the CEIA study of the link project.

10.5.6.2 Status of fauna

Uttara Kannada district's high rainfall supports lush forests which are home to a variety of flora and fauna. Several Karnataka's tiger reserves are in the project area such as Anshi and Kali Tiger Reserves in Uttara Kannada district. Two wildlife sanctuaries viz., Dandeli and Bhimgadare in the vicinity of the project area. Wildlife species such as tiger, black panther, leopard, cat, gaur, asian elephant, sambar and a range of birds and reptiles are found in this region.

10.5.6.3 Status of fish fauna

As far as economic importance is concerned, the scope of fish and fisheries development in Uttara Kannada district is of prime interest. There is a rich diversity of fish and fisheries in the Uttara Kannada district. There are many species that have been introduced in the inland water of Uttara Kannada district. Relatively, the scope of fish and fisheries in Raichur district does not have that much economic importance. During CEIA study, the fish fauna specific to the project area will be detailed.

10.5.7 Public health

10.5.7.1 Medical and health facilities in the project command area

The existing public health facilities in Uttar Kannada and Raichur districts are good as indicated in **Table-10.6.**

Table-10.6
Medical Health Facilities Available

Sl. No.	Particulars	Uttara Kannada District	Raichur district
1	**Allopathic hospitals**		
	PHC (Primary Health Centres)	85	50
	Sub Centres	14	12
2	**Indian medicine hospitals:**	10	6
3	**Govt. hospitals**	109	68
4	**Private hospitals**	503	79
5	**Total hospitals**	612	147
4	**No. of doctors**		
	Govt.	238	169
	Private	763	440

Source: Department of Statistics, Uttara Kannada, and Raichur district

Uttara Kannada district is relatively better placed with 612 hospitals against Raichur which has 147 hospitals.

10.5.7.2 Drinking water supply

As per 'Economic Survey of Maharashtra 2020-21', the National Rural Drinking Water Programme (NRDWP), a flagship programme of Govt. of India is being implemented in the State. This programme aims at providing safe and adequate drinking water in rural areas. Government of India has also launched "Jal Jeevan Mission" during 2019 in order to provide safe and adequate drinking water to all rural households. The main objective of this Mission is to provide Functional Household Tap Connection (FHTC) to all the rural households by 2024. Under centrally sponsored Jal Jeevan Mission, Government of Karnataka has launched new programme Called "Mane manege Gange" and intended to provide Functional Household Tap Connections (FHTC) to all rural households by 2023 at the rate of 55 LPCD in the State.

The people living in areas in the vicinity of the link project mainly depend on bore wells, dug wells and hand/motorised pumps for drinking water supply. As per the studies conducted by CGWB, the people living in Uttara Kannada & Raichur districts rely on bore wells, piped water supply schemes and mini water supply schemes. Uttara Kannada district has about 6607 nos. of borewells, 689 nos. of piped water supply schemes and 786 nos. of mini water supply schemes while Raichur district has about 7036 nos. of borewells, 352 nos. of piped water supply schemes and 528 nos. of mini water supply schemes.

10.5.7.3 Sanitation

Adequate sanitation is essential for the protection & promotion of individual's and community health. Karnataka has been the forerunner in

putting forth concerted efforts to implement total sanitation in the rural parts of the State. To accelerate and achieve universal sanitation coverage and to put focus on safe sanitation "Swachh Bharat Mission" was launched on 2nd October 2014.

Lack of proper sanitary facilities and sanitary waste disposal in the rural area are the root causes of many diseases. In the project area, the rural areas are lacking in drainage system. Even in the semi-urban areas, open drainage systems exist, which expose the sewage to the disease transmitting organisms like flies, insects, germs, etc., These organisms contaminate the water and food to be consumed by the people leading to water borne diseases like diarrhoea, amoebiasis, gastroenteritis, etc. Open air defecation is still a predominant practice in all the villages in project area which is a potential hazard for spreading of diseases in the area.

10.5.7.4 Water borne and communicable diseases

Water borne diseases like diarrhoea, gastroenteritis and hepatitis are prevalent in the project area due to inadequate sanitation. There is a prevailing threat of spreading of periodical epidemics due to poor drainage facilities and low economic status of the people living in unplanned settlements. Further, in the project area in view of the likelihood of migrant labour being deployed in the constructional activities, special care needs to be taken to avoid spread of communicable diseases and other health hazards.

10.5.7.5 Nutrition

Many children in the rural areas suffer from malnutrition due to under nourishment. Non availability of balanced food at affordable prices to feed the children adequately, improper cooking habits, low crop yields and persistent worm infestations due to lack of proper sanitation are acting synergistically leading to nutritional problems. Malnutrition is by and large

the result of poverty, ignorance, illiteracy and lack of proper knowledge of nutrition value of different foods in these areas. Malnutrition leads to recurrence of infections thereby reducing the full working capacity of the people.

10.6 Environmental Impact Assessment

Environmental Impact Assessment (EIA) consists of a systematic investigation of both positive and negative impacts on the physical, biological, and socio-economic environment which would be caused or induced due to implementation of a proposed project.

The EIA & EMP and Socio-economic aspects in respect of Bedti - Varada link project are yet to be carried out by the project proponent through the accredited consultancy agencies. Therefore, these aspects are discussed briefly in general terms in the following paras.

10.6.1 Impact on air environment

10.6.1.1 Impact on air quality

(a) Construction phase:

(i) Pollution due to fuel combustion by various equipment

The operation of various construction equipment requires combustion of fuel. Normally, diesel is used as a fuel in such equipment. The major pollutant which gets emitted because of diesel combustion is SO_2. The SPM emissions are minimal due to the low ash content in diesel. The short-term increase in SO_2, even after assuming that all the equipment are operating at a common point, is quite low. Hence, no major impact is anticipated on this account.

(ii) Fugitive emissions from various sources

During construction phase, a lot of construction materials like sand, fine aggregate, etc. are to be stored at various sites. Normally, due to

blowing of winds, especially when the environment is dry, some of the stored material can get entrained in the atmosphere. Some emissions will occur from crushing plants and the DG sets. However, such impacts are normally visible only in and around the construction sites. The impacts on this account are generally, insignificant in nature.

(iii) Impacts due to vehicular movement

During construction phase, the movement number of vehicles is anticipated as they will be used for transportation of construction materials for short term. However, no major impact on ambient air quality is anticipated due to increase in vehicular movement during construction phase.

(b) Operation phase

No major impacts are envisaged during operation phase.

10.6.2 Impact on noise environment

(a) Construction phase

Due to increased transport vehicles movement / traffic volume, use of earth moving machinery and other machinery etc. at the time of construction of the project, the impacts on ambient noise levels are expected. The main impacts would be due to excavation, drilling operations, road rollers, crawler tractors, dumpers, concrete mixers, concrete matching plants, stone crushers, air compressors, D.G sets, construction of pump houses, construction of tunnels, installation of raising mains etc. The possible impacts due to project proposal on noise environment are however, not expected to be significant which will be assessed in detail during the CEIA study.

(b) Operation phase

No major impacts are expected during operation phase.

10.6.3 Impacts on water resources and quality

(a) Construction phase

(i) Impacts due to sewage generation from labour camps

The major sources of water pollution during project construction phase are the sewage generated from the labour camps/colonies. The project construction is likely to last for a period of 5 years. A large number of workers and technical staff are likely to migrate during project construction phase. Presently, the employment opportunities in the area are limited. Therefore, during the project construction phase, many of the locals may get employment. It has been observed during construction phase of many such projects, the major works are contracted out and they bring their own skilled labour. Mostly, it is only in the unskilled category, that locals get employment. The disposal of sewage without treatment could lead to adverse impact on land or water environment in which the effluent from the labour camps/colonies are disposed.

Disposal of sewage water is an essential part of the EMP. Sufficient no. of community toilets need to be provided in the labour camps/colonies. The wastewater generated from the colonies will have to be collected and disposed in specifically designed soak pits and septic tanks. The wastewater and sewage generated should not be allowed to flow into the rivers and streams of the area. Efforts shall be made to ensure that treated effluent is disposed only in such water bodies, which are not used for meeting domestic water requirements.

(ii) Impacts due to runoff from construction sites

Substantial quantities of water would normally be used in the construction activities. With regard to water quality, waste water from construction activities would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the waste water are removed before these are disposed into water body or overland. Similarly, effluents due to washing from truck parking area, workshop, etc. would have high concentration of oil and grease. The effluent quality on account of this may be too small to cause any adverse impact. It can, however, be treated by oil and separator unit, so as to ameliorate even the marginal adverse impacts likely to accrue on this account.

(b) Operation phase

(i) Impact on downstream users

302 MCM (Link-I) and 222 MCM (Link-II) of surplus waters from proposed Pattanadahalla/Shalamalahalla weirs and Suremane barrage respectively are planned to be diverted through the Bedti–Varada link canal to augment the existing command area under Tungabhadra left bank canal. Since only weirs and barrage are being constructed and monsoon surplus water after deducting in basin requirement for drinking, irrigation, industrial and other purposes is proposed to be diverted, there will not be any adverse impact to the population of the surrounding and downstream areas as abundant water flows down these structures.

(ii) Impact on existing projects/water bodies upstream

The water needs of existing projects/water bodies upstream of the proposed diversion points have been duly considered in the planning of the link project. No water body is likely to get submerged due to the creation of

the ponds at the proposed weirs/barrage. Therefore, this project will not have any impact on the functioning of upstream existing projects/water bodies.

(iii) Impacts on downstream water quality due to diversion of water

The Bedti–Varada link project is envisaged to transfer surplus waters of Bedti basin to Tungabhadra sub-basin.

The quantity of diversion is arrived after deducting the existing, ongoing, and future water requirements of upstream as well as downstream committed releases. Also, the diversion is during only monsoon period that too from weirs/barrage, which are not major storages. Hence there will not be any changes in downstream water quality as adequate flows still would be available even after implementation of the link project.

(iv) Changes in water quality due to increased use of fertilisers

The fertilizer dose is likely to increase once irrigation is introduced in the command area. Under the best farming practices, only 40-50% of the applied fertilizers is used by the crop and the balance finds its way into the aquatic environment through drainage runoff. An unexpected intense shower immediately after the spread of fertilizer may bring even greater amount of nutrients as a part of the runoff into the receiving water body.

To compensate the nutrient removal by crops, additional dose of nutrients, i.e., fertilizers dosing may need to be given. Wash down of fertilizers and organic matter rich in nutrients from the surrounding agricultural fields cause eutrophication of water bodies. Over growth of aquatic weeds affects the survival of aquatic organisms through depletion of oxygen, change in odour and taste of water. With the introduction of irrigation, the drainage system (natural or man-made) is likely to contain

much higher level of nutrients. The climatic condition in the project area may also supplement the proliferation of eutrophication in the project area. Thus, in the project operation phase, there will be increased probability of eutrophication in the water bodies receiving agricultural runoff. Also, use of fertilisers and other agro-chemicals in farming for increasing agricultural production will affect the quality of ground water as well. Therefore, it would be worthwhile to take up precautionary measures to test the quality of ground water periodically in order to adopt suitable corrective measures from time to time.

(v) Impacts due to effluent from project colony

During project operation phase, due to absence of any large scale construction activities, the cause and source of water pollution will be much different. Since, only a small number of O&M staff will reside in the area in a well designed colony which will have a sewage treatment plant and other infrastructure facilities, the problems of water pollution due to disposal of sewage may not be anticipated.

(vi) Recharge of groundwater

The Bedti -Varada link project is planned to divert surplus water from Bedti basin to water short Tungabhadra sub - basin, for augmentation of irrigation in the existing command area of Tungabhadra left bank canal in Raichur district which will incidentally result in rise in ground water levels.

10.6.4 Impact on land environment

(a) Construction phase

Majority of the environmental impacts during construction phase are temporary in nature, lasting mainly upto the construction phase. The

major impacts anticipated on land environment during this stage are discussed below.

(i) Acquisition of land

About 293 ha of land is required for construction of the link project. Weirs are proposed to be constructed on Pattanadahalla and Shalamalahalla rivers and a barrage on Bedti river near Suremane in the Bedti -Varada link project. The head works viz. weirs, barrage and pump houses are on river/riverbanks and are located in forest areas. Submergence/acquisition of land to an extent of 178ha is involved under the ponds/head works created, out of which 165 ha is forest land and just 13 ha is other land. Most of the part of the conveyance system also lies in forest land and only to a little extent in other land. The link wise submergence and land acquisition details are given in **Table-10.7**. Since the submergence under the weirs/barrage is limited to river banks, no habitations are involved and no families will be affected. Actual land to be acquired will be worked out at the time of implementation of the project.

Table 10.7 Details of land to be acquired for the link project

Sl. No.	Component	Link-I	Link-II	Total
1	Head works	117.42	60.38	177.80
	(i) Forest	104.97	60.38	165.35
	(ii) Other land	12.45	0.00	12.45
2	Conveyance	44.05	71.51	115.56
	(i) Forest	26.72	50.77	77.49
	(ii) Other land	17.33	20.74	38.07
3	**Total**	**161.47**	**131.89**	**293.36**
	(i) Forest	**131.69**	**111.15**	**242.84**
	(ii) Other land	**29.78**	**20.74**	**50.52**

(ii) Environmental degradation due to immigration of labour

There is likely a huge influx of construction labour, technical and other work force for construction and related activities and service providers including their families in the project area. Congregation of labour force is likely to create problems of sewage disposal, solid waste management and cutting of trees for meeting their fuel requirements etc.

(iii) Operation of construction equipment

During construction phase, various types of equipment will be brought to the site. These include batching plant, earth movers, etc. The siting and storage of these construction equipment would require significant amount of space. The site for storage of construction material and equipment will have to be selected in such a way that it causes minimum adverse impact on various aspects of environment. Efforts shall be made that such facilities are located on government or panchayat land only, so that hardships caused as a result of land acquisition, though temporarily on this account are minimized to the extent possible.

iv) Soil erosion

Due to various construction activities such as construction of colonies / houses / toilet blocks etc. soil erosion in the project area is bound to increase. During construction activities, the share of the forest cover will be adversely affected which in turn will cause loosening of the soil particles, thus increasing the rate of soil erosion and hence degradation of land environment. Substitute plantation will have to be planned to mitigate the adverse effect of soil erosion.

(v) Solid waste management

Facilities for collection and conveyance of solid waste/municipal wastes which will be generated from the labour camps/colonies of the project area have to be developed.

(vi) Waste (muck) generation and disposal

The proposed project envisages construction of head works viz., weirs on Pattanadahalla and Shalamalahalla, barrage on Bedti river near Suremane and conveyance system of total length 25.48 km in Link-I and 26.88 km in Link-II (including canal/tunnel/raising mains). Therefore, the construction of project is expected to generate huge muck and lots of biomass leading to the degradation of land and environment. Therefore, appropriate actions shall have to be taken for use and disposal of muck safely to avoid hazards and to mitigate the adverse impacts on environment.

(vii) Impact on mineral resources

No minerals of economic importance are found in the project area. However, as per the findings of the detailed study at preconstruction stage on deposits of minerals in the project area, appropriate measures, as necessary will have to be taken.

(viii) Impact due to construction of roads

There is a well-developed network of National Highways (NH), State Highways (SH) and district and village roads in the project area. Only cart-tracks will have to be improved and new approach roads to quarry sites, labour colonies, construction sites and material and equipment stores will have to be constructed. Therefore, no adverse impact on land in this aspect is anticipated.

(b) Operation phase

(i) Water logging and salinity

The tail end reaches of command area of Tungabhadra left bank canal which the link canal is proposed to augment is an acute drought-prone zone and a dry area. Therefore, no water logging, salinity and flooding problems of serious nature are anticipated in the command area during the operation phase.

10.6.5 Impact on biological environment

10.6.5.1 Terrestrial environment

10.6.5.1.1 Impact on forest cover and protected area

(a) Construction phase

During project construction phase, labour population is likely to congregate near various construction sites. The workers and other population groups residing in the area may use fuel wood (if no alternate fuel is provided). To minimize impacts, community kitchens will have to be provided. These community kitchens shall use Liquefied Petroleum Gas or kerosene as fuel.

(b) Operation phase

The proposed Bedti -Varada link project head works are located in Western ghats which is obviously the forest area. The proposed conveyance system viz., canal/tunnel and raising mains will also pass mostly through forest area. The total forest land that needs to be acquired for the project is 243 ha. The impacts due to acquisition of forest land shall be mitigated through compensatory afforestation measures and implementation of a detailed set of bio-diversity conservation measures that will be outlined in the Environmental Management Plan of the proposed CEIA study.

10.6.5.2 Impact on aquatic ecology

Since the monsoon surplus waters are only proposed to be diverted from Bedti basin and that too after considering the minimum environmental flow in the river, there may not be any adverse impact on aquatic ecology including the fisheries and endangered species. The ecosystem of the study area, impact on bio-accumulation and bio-magnification in aquatic life and biota of the area will be studied at pre-construction stage and suitable measures will be taken accordingly.

10.6.6 Impacts on socio-economic environment

(a) Construction phase

i) Impact of Influx or Migration of Labour

The construction phase will last for about 5 years. There is likely to be a huge influx of labour force and technical staff (along with their families) to the project area. The project will open a large number of jobs to the local population. Job opportunities drastically improve in this area. The adequacy of infrastructure will generally be a problem during the initial construction phase. Though the construction workers can be subsidized for certain facilities like health, education etc, the facilities of desired quality cannot often be made available in the initial stages. The adequacy of water supply, sewage treatment, housing, etc should therefore, be ensured before and adequate measures will have to be taken at the very start of the project.

(ii) Impacts on public health due to water borne diseases

(a) Construction Phase - The construction phase of the project can lead to increase in incidence of various water borne and vector borne diseases. Therefore, adequate precautions / control measures are to be undertaken.

The health risk specific to water resources projects usually emanate from congregation of labour at various construction sites. During construction phase, new groups come and go constantly keeping the human population in a flux. These groups are usually housed in temporary dwellings without proper sanitary conditions and water supply. Only, in the final stages, colonies for project maintenance, townships etc. are built. Population migration indicated by actual or possible opportunity for work can aggregate problems as a result of housing difficulties, overcrowding, rise in cost of living and some un-predicted social problems as well as introduction of new sources of diseases. Immigrants immunologically may become susceptible to the endemic diseases prevalent in the areas of development.

Many of the immigrant population could be reservoirs of infection for various communicable diseases. Once they settle in labour camps / colonies, there could be increased incidence of various diseases. This aspect needs to be looked into with caution, and efforts may have to be made to ensure that a thorough check-up of the labour population congregating in the area is conducted. Those affected by any ailments need to be properly quarantined, particularly if they are suffering from communicable diseases.

Operation phase - Improvement in availability of water, increased agricultural production, availability of diversified food, strengthening of educational and health facilities significantly improves public health in project area. On the other hand, water resources development also has negative impacts, since it could increase the habitat of certain vectors like mosquitoes. The project may create favourable conditions for breeding of new pathogens or vectors such as mosquitoes, etc. Most of the water borne

diseases can largely be prevented by adequate hygiene. With the increased water availability, quality of water being supplied is expected to improve and the incidence of water borne diseases is likely to reduce. However, adequate measures in the form of strict public health measures shall be proposed in the EMP.

10.6.7 Impacts on micro climate

The increase in surface area of water, irrigation and vegetation cover in the project area may moderate the temperature, i.e. lead to reduction in the number of days of high temperature, if not in the maximum temperature itself. The higher humidity as a result of higher evapo - transpiration is likely to raise the minimum temperature and increase the occurrence of fogs during the cooler months.

10.6.8 Beneficial impact

The areas coming under the command of link canal proposal are water short. The link proposal will cater to the irrigation requirements in these areas resulting in increased agricultural and industrial production and create continuous, steady and all-round prosperity. By implementing the link proposal, the living standards of the people along with their socio-cultural and economic conditions will get improved in the region.

10.6.8.1 Impact matrix

An impact matrix indicating the beneficial / adverse impacts relating to physical, biological, financial, and socio-economic conditions are given in **Table 10.8.**

Table 10.8
Impact matrix

Sl. No.		Impact	Bedti - Varada link project
A		**Physical Impacts**	
	i)	Sedimentation	No siltation, as no new reservoirs are proposed
	ii)	Seismic	Nil
	iii)	Forest area submerged	Minimum to the extent of 165 ha
	iv)	Other areas submerged	13 ha
	v)	Change in hydrological regime of river	Nil
	vi)	Ground water recharge	Ground water recharge will happen in the canal portion, along the river of Varada and also in the command area.
	vii)	Resources impact aspect	Nil
	viii)	Irrigated area	104900 ha
	ix)	Hydropower	Nil
	x)	Historical monuments and archaeological structures submerged	Prima facie no. It will be known after conducting archaeological survey at pre-construction stage.
	xi)	Salinity intrusion in delta and estuaries	Nil
	xii)	Salinity in irrigated land	Not expected
	xiii)	Water logging	Not expected
	xiv)	Availability of drinking water	14 MCM
	xv)	Availability of water for industrial use	24 MCM
	xvi)	Quantity of water diversion	302 MCM (Link-I) 222 MCM (Link-II)
B		**Biological Impacts**	
	i)	Public health aspect	No hazards are expected
	ii)	Wild animals and birds	Will be known after conducting CEIA study
	iii)	Other species	Will be known after conducting CEIA study
	iv)	Availability of Biomass	Increases
C		**Impact on Human Life**	
	i)	Socio-cultural aspect	Considerable improvement in present socio-economic conditions and living

Sl. No.		Impact	Bedti - Varada link project
			standards of the people in the project vicinity is likely.
	ii)	Resettlement plans	Nil
	iii)	Tourism	Likely to get a boost
	iv)	Total land acquisition	About 293 ha
	v)	Water quality downstream of ponds	Will not get affected

10.7 Environmental Management Plan

A detailed Environmental Management Plan (EMP) will be evolved along with CEIA studies of the project. However, for DPR purpose these aspects are discussed briefly in general as under.

10.7.1 Controlling air quality at construction sites

10.7.1.1 Air pollution control

(a) Construction phase

Due to the construction of weirs/barrage, approach channels, canal, tunnel, pump house and colonies, it is presumed that on macroscopic scale, no major adverse impact on air quality is anticipated.

Control of emissions: Emissions from construction vehicles, equipment and DG sets, and transportation traffic will cause minor air quality impacts. However, these impacts can be managed by the following measures:

- Proper maintenance of construction equipment to minimize the exhaust gases.
- Construction equipment shall be turned off when not in use.
- Unnecessary idling of construction vehicles shall be prohibited.
- Effective traffic management shall be undertaken to avoid significant delays in and around the project area.
- Prompt repair and maintenance of roads.

- Location of DG sets and other emission generating equipment shall be decided keeping in view the predominant wind direction and stack height of DG sets to be kept in accordance with CPCB norms.

Dust control: To minimize dust generation during construction phase, the following measures shall be taken:

- Identification of construction limits.
- Stockpiling of excavated material will be covered or staged offsite location.
- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed and/or mulched.
- Stockpiled soils and trucks hauling soil, sand, and other loose materials will be covered.
- Effective traffic management at site.

(b) Operation phase

No negative impacts are expected during operation phase.

10.7.1.2 Noise control

(i) Noise generation from construction equipment:

The construction equipment, vehicles, DG sets etc. shall be properly maintained and occupational safety and health standards shall be complied. The construction equipment will be required to use available noise suppression devices and properly maintained mufflers.

- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.
- Whenever possible the staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided.

- A proper routine and preventive maintenance procedure for the DG sets should be set and followed in consultation with the manufacturer which would help to prevent noise levels from prolonged use.

(ii) Noise generation from controlled blasting operations

- Controlled blasting will be done as per the provisions of Indian Explosives Act.
- Blasting will not be undertaken during night hours.
- Workers at blasting sites will be provided with proper earplugs and helmets.
- Explosives used for controlled blasting will be kept in safe custody under lock and key as per the provisions of Indian Explosives Act.

(iii) Noise due to crusher:

The exposure to labour operating the crushers shall be restricted up to 30 minutes on a daily basis. Alternatively, the workers need to be provided with earmuffs or plugs, to attenuate the noise level near the crusher by at least 15 dB(A). The exposure to noise level in such a scenario is to be limited upto 4 hours per day.

10.7.2 Water pollution management

10.7.2.1 Surface water quality

(i) Since the surplus water during monsoon is proposed for diversion, quality of water is likely to be better. The parameters such as pH, temperature, electrical conductivity, turbidity, total hardness, total dissolved solids, DO, BOD, COD, Ca, Mg, chlorides, sulphates, nitrates, iron and zinc analysed in the adjacent Aghanashini river by Central Water Commission are considered to be applicable for testing the quality of diverted water as no data is available for Bedti river.

However, the surface water quality in Bedti river and its streams needs to be monitored at pre-construction stage. Maintaining aquatic ecology is essential to make the aquatic fauna flourish.

(ii) Sewage generated from various labour camps during project construction phase shall be treated in a sewage treatment plant prior to its disposal in natural streams or designated sites.

(iii) The effluent generated from the crushers will have high-suspended solids and needs to be treated before disposal. Settling tanks of appropriate size for treatment of effluent from various crushers should be provided. The sludge from the various settling tanks can be collected once in 15 days and will be disposed at the site designed for disposal of municipal solid wastes from the labour camps. The sludge after drying could also be used as covering material for landfill at the disposal site.

10.7.2.2 Ground water quality

(i) Groundwater in major parts of Raichur district contains higher concentrations of fluoride, nitrate, and EC values. Water has to be treated for fluoride before it is utilized for drinking purpose. In general, fluoride, nitrate, iron, and salinity are the important constituents affecting the ground water quality.

(ii) Several piezometers at close spacing need to be established in entire study area to monitor the changes in water levels and quality. The data on water fluctuations and quality would be collected and verified for both pre and post project scenarios. However, the hazards of water logging and salinisation are not anticipated due to the project.

10.7.3 Land management plan

10.7.3.1 Disposal of muck/excavated material

The proposed project envisages construction of head works viz., weirs on Pattanadahalla and Shalamalahalla, barrage on Bedti river near Suremane and conveyance system of total length of 25.48 km in Link-I and 26.88 km in Link-II (including canal/tunnel/raising mains). Therefore, construction of the project is expected to generate huge muck. A part of the excavated material of the canal in deep-cut reaches can be used in filling the embankment reaches and balance muck/excavated material requires to be suitably disposed off at disposal sites in the project area, to be suitably identified in such a manner to occupy the least space. This is to be dumped along the streams/river course and in low-lying areas by taking precautionary measures in scientific manner without creating hazards to the environment.

10.7.3.2 Restoration plan for quarry sites

The link project requires a significant quantity of construction material. The aggregate required for concrete is proposed to be met from the identified nearby stone quarries at three locations in Uttara Kannada district, which is suitable for use in concrete.

The fine aggregates (sand) required for the project is proposed to be met from the crushed sand from the four identified rock quarry sites in Uttara Kannada district since river sand is not available in abundance in west flowing rivers. The quarrying operations are semi-mechanized in nature. Quarrying is normally done by cutting a face of the hill. A permanent scar is likely to be left, once quarrying activities are over. With the passage of time, the rock from the exposed face of the quarry under the

action of wind and other erosion forces get slowly weathered and after some time they become a potential source of landslide. Thus, it is necessary to implement appropriate slope stabilization measures to prevent the possibility of soil erosion and landslides in the quarry sites. After excavation of the required material these quarry sites will be restored by adopting appropriate engineering, bio-engineering and biological measures.

10.7.3.3 Silt transfer

Weirs are proposed on Pattanadahalla and Shalamalahalla streams and barrage is proposed on Bedti river near Suremane to divert the monsoon surplus water. The silt can be easily removed during non-monsoon period in Pattanadahalla and Shalamalahalla weir sites and in Suremane barrage as under sluices are provided for transfer of accumulated silt. Hence, there will not be any silt accumulation at the diversion sites or in the canal/raising mains and as such no adverse impact on this account is apprehended.

10.7.3.4 Command area management

Objective of the Bedti - Varada link project is to divert the surplus water from Bedti river for stabilising the irrigation in the existing command area under Tungabhadra LBC in Raichur district of Karnataka. No new command area is proposed for irrigation.

Therefore, no land development works, or drainage system are required in the link command area. Since, the command area is in drought prone area, the chances of stagnation of water are minimum, thereby water logging and salinity is not anticipated in the command area.

10.7.3.5 Public health management

There is a scope of spread of water-borne/epidemic/communicable diseases during construction phase of the project. Therefore, special care needs to be taken to avoid such health hazards.

Some preventive/curative measures are given as under:

(i) Well maintained labour camps to be provided for the project workers with all basic sanitary facilities.

(ii) Provision of safe drinking water and proper drainage facilities.

(iii) Regular organisation of health check-ups and provision of required medical treatments of the diseases in labour colonies/camps. Providing and maintaining first aid kits at strategic locations.

(iv) The quality of water needs to be monitored in terms of electrical conductivity, total dissolved salts, fluorides, chlorides, nitrates, pH and sodium adsorption ratio besides pathological and bacteriological parameters.

(v) Frequent chlorination of the drinking water

(vi) Proper planning and provision of sewage waste disposal under total sanitation programme in the region

10.7.3.6 Management of flora and fauna

The copious rainfall and topography of the catchment provide the ideal conditions for the rich growth of varied flora in the catchment. The flora can generally be classified as trees, shrubs, and creepers. A variety of dominant and co-dominant species of trees, shrubs and creepers exist in the evergreen, semi-evergreen, moist deciduous forest and green land. A variety

of rich fauna viz., the mammalian and reptilian fauna are found in the catchment. Fishes and birds of many kinds are also found in the river.

The link project involves construction of weirs and barrage and diversion of water is mostly through raising mains/tunnels. No management of the flora and fauna along the conveyance system including action plan for alternate breeding grounds is therefore needed.

10.7.3.7 Earthquake management

Only two weirs and one barrage with conveyance system of 25.48 km in Link-I and 26.88 km in Link-II are involved in the proposal. Also, the link project falls under the Seismic Zone-II in Uttar Kannada district of Karnataka state which is considered to be least active. Therefore, no earthquake management measures are considered necessary. However, the seismic study will be carried out at pre-construction stage and if required, appropriate measures will be taken accordingly.

10.7.3.8 Protection of sensitive and archaeological monument sites

The Archaeological study in the project area will be done at pre-construction stage and accordingly necessary measures will be taken.

10.7.4 Environment Monitoring Programme

Environmental Monitoring is an essential tool in relation to environmental management as it provides the basis for rational management decisions regarding impact control. Environmental monitoring shall be performed during construction, commissioning and operation phases of the project to ensure that the adverse impacts have been mitigated efficiently and to verify the impact predictions. The monitoring program will indicate

where the changes to procedures or operations are required to reduce the impacts on the environment or local population as essential as described under para 10.6.

10.7.5 Cost of Environmental Management Plan

A lump sum tentative provision of Rs. 2421 lakh has been kept in the estimate towards implementation of EMP. The details are given in **Table 10.9**.

Table 10.9
Cost for Implementation of Environmental Management Plan (EMP)

Unit: Rs. lakh

Sl. No.	Description of item	Link-I	Link-II	Total
1.	Bio-diversity conservation viz., afforestation and protection of rare or endangered species	449	547	996
2.	Environmental management in labour camps viz. establishment of fuel depots	75	70	145
3.	Public health& health delivery system viz., controlling of water and soil borne diseases, malaria etc.	60	180	240
4.	Restoration, stabilisation and landscaping of construction sites	150	55	205
5.	Green belt development	100	–	100
6.	Air, water and noise pollution control measures	110	35	145
7.	Energy conservation measures	30	20	50
8.	Public health measures (Labour camp)	80	100	180
9.	Environmental monitoring programme during construction& operation phases and meteorological parameters	110	80	190
10.	Improvement of drainage in the target command area	100	70	170
	Total	**1264**	**1157**	**2421**

However, the actual cost will be considered in the project estimate after carrying out EIA & EMP study of the link project by the project proponent through an accredited and reputed consultant.