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Submergence Region of Daudhan Dam–Ken-Betwa Interlinking Project

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Abstract*: Interlinking of rivers is a mega project undertaken by the Government of India and is planned for a total of 30 grand projects. This paper identifies the Daudhan dam project as part of the proposed Ken-Betwa link and examines inundated regions of Panna tiger reserve after completion of the dam and adjoining reservoir. The analysis shows that 5635 Ha of land upstream of the proposed dam will be submerged after construction. There is also a significant concern that the submerged region is mostly sensitive area and it divides Panna tiger reserve into two parts across the river from each other.
Keywords: Interlinking, Environmental impact, Betwa, Ken, irrigation, submerged area, Panna tiger reserve, wildlife sanctuary, water levels.

I. INTRODUCTION

The burgeoning demographic pressures have tremendous impact on earth's natural resources including water; being an essentialresource for survival and sustenance of life. The demand of this natural gift has been increasing exponentially. India depends heavily on various river networks, perennial or otherwise, for the requirement of water resource, a huge portion of which is rain-fed. Irregularity in monsoon rain distribution over the year leads to an imbalanced regional growth and a severe maldistribution of water, thereby affecting the socio-economic and political scenario of the area. The concept of interlinking of rivers was put forth from time to time in order to rationalize the distribution of water from a water surplus region to a water deficit region, further gaining traction by the National Water Policy (Ministry of Water Resources, 2012).

The proposal indicates a total of thirty interlinking projects (Figure 1) currently pegged at 11 Lakh crore, which aim to substantially augment the existing 140 million hectares of irrigation potential to 175 million hectares and add 34 Gigawatts of hydroelectric capacity to the grid by 2050 (Jolly, 2016). Ken Betwa link has been presented as the first among the five 'priority links' that will divert 1,074 million cubic metres annually from the Ken river to the Betwa river, 221 km to the south, crossing over from the states of Madhya Pradesh to Uttar Pradesh.

Figure 1: Interlinking Projects in IndiaSource: (Jolly, 2016)

A. *What is interlinking of rivers?*

The Cambridge dictionary defines interlinking as- "to cause to join or connect together, with the parts joined often having an effect on each other" (Cambridge Dictionary, 2017).

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Interlinking of rivers (ILR) is a project which links two or more river basins by establishing a network of canals, increasing access to rivers by these canals and reducing the flow of water to the sea. Surplus water in some rivers can be diverted to water-deficit rivers by depending on these canals (National Water Development Agency, n.d.).

ILR is deemed vital in India where approximately 78% of the total land is drought prone (Department of Land Resources, Ministry of Rural Development, n.d.) and various water management practices are being looked into. The situation is also projected to exacerbate by 2050 and thus larger scale solutions are sought, even at the cost of environmental and socio-economic degradation of the affected regions (Jolly, 2016 and Mazoomdar, 2017).

II. INTERLINKING KEN – BETWA LINK PROJECT

Ken Betwa link has been declared as a national project by the Government of India as the first among the five 'priority links' that will divert 1,074 million cubic metres annually from the flood-prone Ken river to the drought-prone Betwa river basin, over a length of 221 km (Figure 2). The quantity of water received by Betwa from Ken basin, after considering in basin demands and downstream commitments earmarked for providing irrigation in Madhya Pradesh and Uttar Pradesh, is 1020 million cubic meters (Mazoomdar, 2017 and Goswami, 2016).

Figure 2: Interlinking River Project Ken – BetwaSource: (Indian express, 2016)

This link canal (Figure 2) will provide irrigation to water stressed areas of upper Betwa basin of Madhya Pradesh by way of substitution and also to areas of Madhya Pradesh & Uttar Pradesh which are on its route. Ken Multipurpose Project (KMPP) envisaged by the Madhya Pradesh state government will also be irrigated as part of the undertaking of Ken-Betwa River linking.

The drafted allocation of water provides for drinking water facility & enroute irrigation of 47,000 ha in Chhatarpur & Tikamgarh districts of Madhya Pradesh and Hamirpur & Jhansi districts of Uttar Pradesh. There are downstream commitments of 1,375 Mm3 for M.P. and 850 Mm3 of water for U.P. as well (The Hans India, 2016).

The project is also facing a lot of criticism due to the impact of the Daudhan dam and the inundated region upstream of it. A study commissioned by the Union environment, forests and climate change ministry has concluded that the project will be highly detrimental to the Panna tiger reserve (Lenin, 2016 and Koshy, 2016).

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III.PANNA TIGER RESERVE AND DAUDHAN DAM

Panna tiger reserve is a national park located in Panna and Chhatarpur districts of Madhya Pradesh. It has an area of 60,323 Ha and a buffer area of 115,727 Ha as shown in Figure 3. It is one of the only large chunks of wildlife habitat remaining in North Madhya Pradesh in the otherwise fragmented forest landscape of the region. Panna was given the Award of Excellence in 2007 as the best maintained national park of India by the Ministry of Tourism of India.

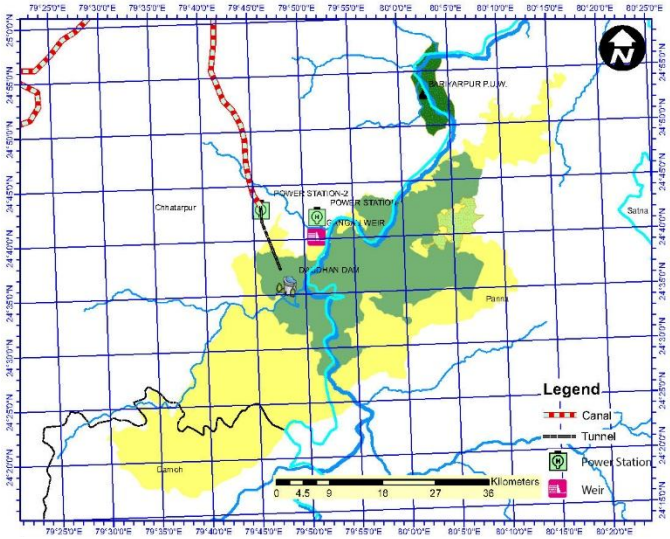

Figure 3: Daudhan dam location within Panna tiger reserveSource: Derived from (Panna Tiger Reserve, n.d.)

Daudhan dam is proposed within the Panna Tiger reserve as shown in Figure 3. It will be built to a sluice level of 240 meters and a maximum water level of 288 meters above mean sea level. The tunnels for the Ken Betwa link and for the KMPP will have invert levels of 262 and 249 meters above mean sea level respectively (Figure 4).

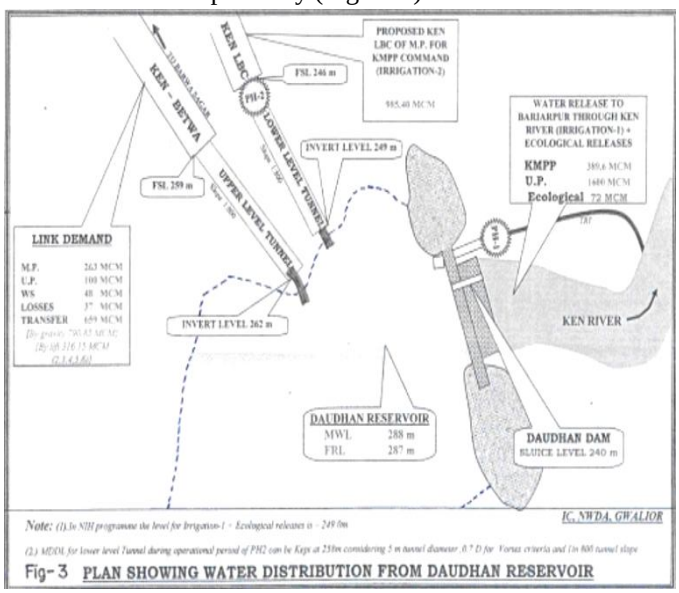

Figure 4: Water distribution from Daudhan damSource: (R. L. Sahu, 2015)

The dam will be used to produce electricity, irrigate KMPP specified regions and send water to replenish the Betwa River. NWDA claims that 8,650 Ha of land area will be submerged of which 6,400 ha will be the forest area. The EIA of the project calculates that 4141 Ha of land will be submerged (National Water Development Agency, 2015). These conflicting statements lend little credence to the seriousness of the ecological impact of this project on Panna tiger reserve.

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IV. CALCULATION OF SUBMERGED REGION

NASA's Shuttle Radar Topographic Mission (SRTM) has provided digital elevation data (DEMs) for over 80% of the globe. The SRTM data is available as 3 arc second (approx. 90m resolution) DEMs. The vertical error of the DEM's is reported to be less than 16m. They are produced from a global seamless dataset to allow easy mosaicking and superimposition (USGS, 2008).

SRTM 90m Digital Elevation Database v4.1 is used to calculate a drainage basin and streams originating and passing through the region. There are some problems with the accuracy of the data at smaller scales, but such data is widely used for macro-scale analysis similar to the current one.

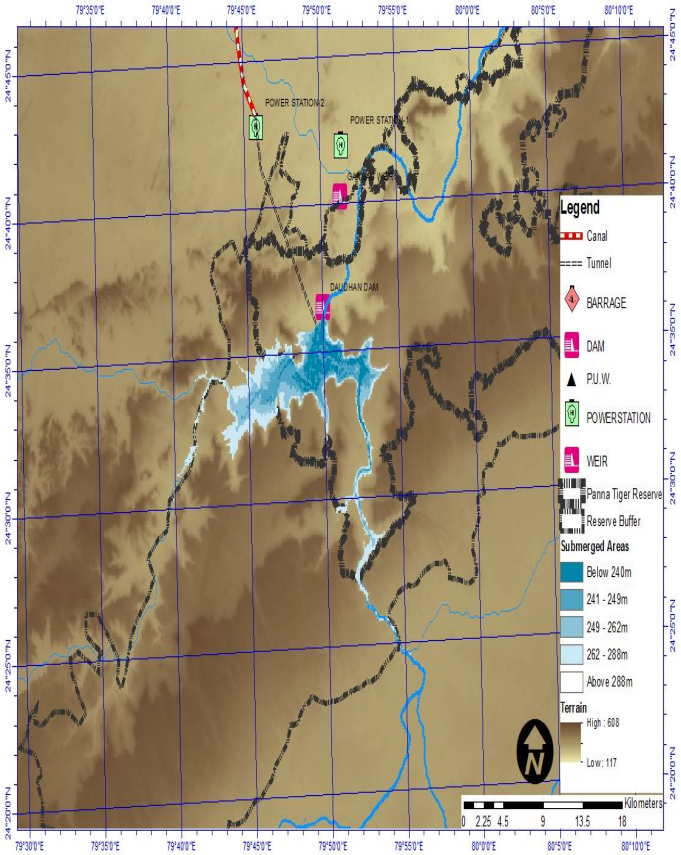

Figure 5: Submerged areas within and beyond Panna tiger reserve Source: Derived from SRTM data (USGS, 2008) and (Panna Tiger Reserve, n.d.)

Water streams are calculated from the DEM itself by calculating the watershed and the water accumulation areas. Since water maintains its own level, areas which will be submerged post construction of the dam can be assumed by the levels mentioned in Figure 4 (240m, 249m, 262m and 288m above mean sea level) and can be directly used to ascertain the levels of elevation which will be submerged. These can then be isolated from the raster DEM available and can classify the submerged areas upstream of the Daudhan dam.

The submerged areas at the lowest level (240m) is expected to be perennial, considering that the dam's sluice level is on 240m and the dam cannot expel water from below that level. The analysis shows that this area is to the tune of 959.85 Ha of which 939.60 Ha lies within Panna tiger reserve itself (refer Table 1).

Similarly, the submerged zones pertaining to levels 249m and 262 meters can also be considered to be submerged for a majority of the year for the smooth functioning of the KMPP and the Ken-Betwa interlinking project. They submerge 1,274.94 Ha and 1,310.58 Ha total area, of which 965.52 Ha and 757.35 Ha are within Panna itself (refer Table 1). Cumulatively, 3,545.37 Ha of land in total and 2,662.47 Ha within Panna is submerged within these three zones (refer Table 2).

The areas under these submerged zones (Table 1) show that approximately 3,623 Ha of land is being submerged within the boundary of Panna Tiger reserve and 5,635 Ha if we also add surrounding buffer forest areas when the dam is operating at the maximum designed capacity.

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TABLE 1: SUBMERGED AREAS BY ZONE

Submerged zone	Pixel Count	Total Area (sqm)	Total Area (Ha)	Total Area within Panna (Ha)
Below 240m	1185	95,98,500	959.85	939.60
From 240-249m	1574	1,27,49,400	1,274.94	965.52
From 249-262m	1618	1,31,05,800	1,310.58	757.35
From 262-288m	2580	2,08,98,000	2,089.80	960.66
Totals	6957	5,63,51,700	5,635.17	3,623.13

Source: By Author

TABLE 2: CUMULATIVE AREAS PER SUBMERGENCE ZONE

Submerged zone	Total Area (Ha)	Total Area within Panna (Ha)
Below 240m	959.85	939.60
Below 249m	2,234.79	1,905.12
Below 262m	3,545.37	2,662.47
Below 288m	5,635.17	3,623.13

Source: By Author

V. CONCLUSIONS

The analysis shows that all of the submerged areas lie within the forest itself while 64.3% of it lies specifically within Panna tiger reserve. Although this value is approximate due to the nature of SRTM data, it still shows an enormous zone being submerged.

Further, although these values would account to only 6% of the total forest cover within the boundaries of Panna, it lies next to the river and is therefore a particularly sensitive zone. Looking at it spatially, the reservoir formed will also divide up the area of the tiger reserve and disrupt the movement patterns of the wildlife.

It should also be noted that the analysis excludes the downstream impact of such an exercise in infrastructure creation and only concerns itself with the inundated area upstream of the river. Similarly, the paper also does not delve in the aspects of volume of water and how it will affect the Betwa (through the proposed link) or Yamuna further downstream.

VI. RECOMMENDATIONS

There are already recommendations that the proposed height of Daudhan dam be lowered and that zones be earmarked for wildlife to cross the river (Economic Times, 2015 and Koshy, 2017). These already assume that the dam itself is the only solution for irrigation and power generation.

Alternatives to large scale dams and their feasibility have also been discussed by various committees including the World commission of dams in their report but not within the context of Ken-Betwa link or the Daudhan dam itself (World commission on dams, 2000).

Looking only at the aspects of inundation and the scale of the reservoir, the paper recommends a series of micro-hydel projects which could in affect harvest a similar amount of water and energy, but could also have much smaller disruption on the biodiversity of Panna (International water power and dam construction, 2016).

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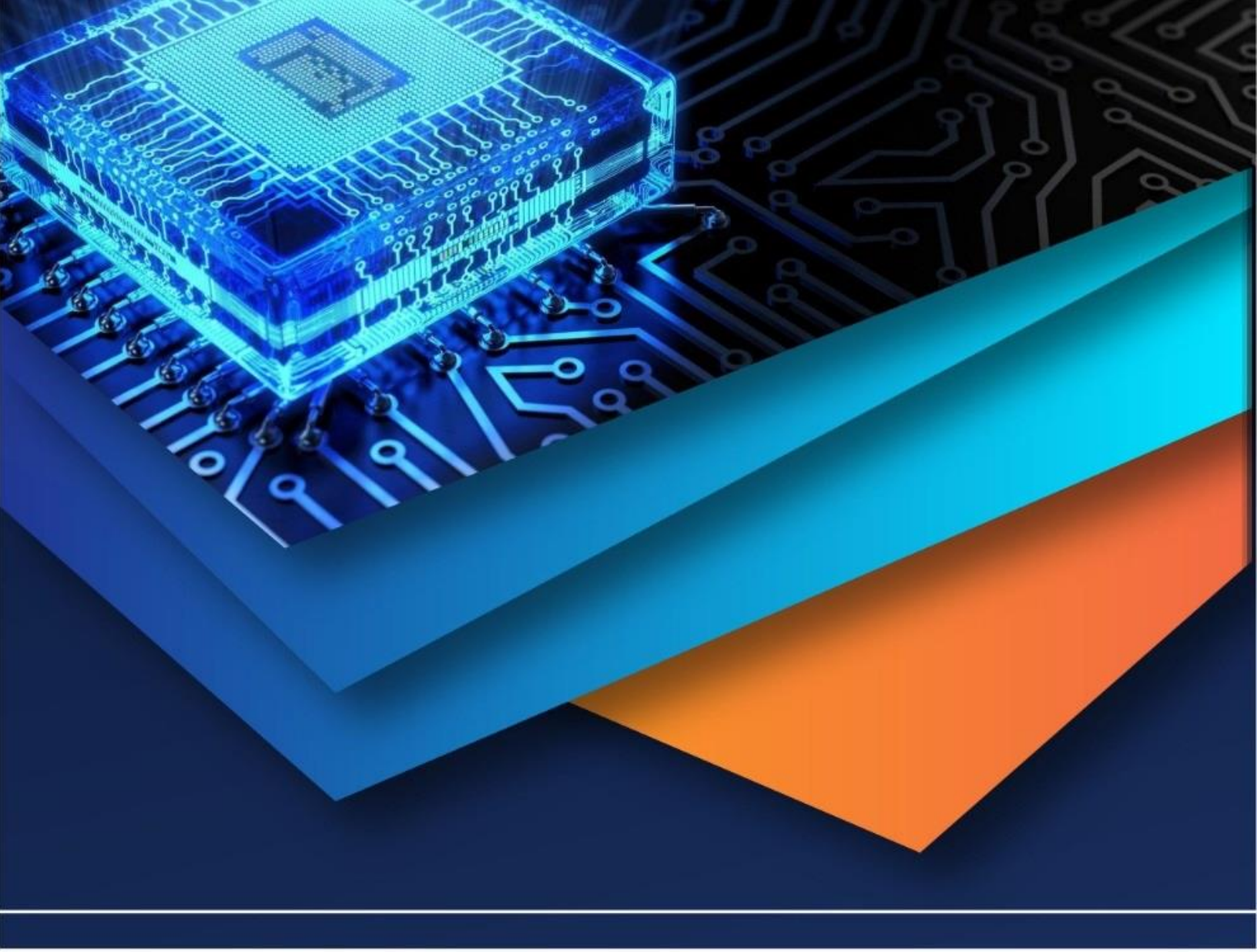

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