Draft for comments

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Critique of

Assessment of Cumulative Impacts of Hydroelectric Projects on Aquatic and Terrestrial Biodiversity in Alaknanda and Bhagirathi Basins, Uttarakhand by Wildlife Institute of India, 2012

By

Bharat Jhunjhunwala

The IWMI Report

WII has relied substantially on IWMI Report 107:

An Assessment of Environmental Flow Requirements of Indian River Basins by V. Smakhtin and M. Anputhas, International Water Management Institute, Colombo, Sri Lanka, 2006.

This is welcome. However, some shortcomings of the IWMI Report have crept into the WII Report:

1 IWMI has not considered the requirements of terrestrial ecosystems (Page 7).

2 IWMI recognizes that E-Flows are to be assessed on basis of an agreed objective of certain state of river to be maintained.[1] However, IWMI makes no discussion of the agreed objective.

3 IWMI says that the three factors to determine E-Flows are (1) Ecological sensitivity; (2) Present Condition; and (3) Trend of Change (Page 17-18). However, IWMI does not take into account trend of change, as also WII.

4 IWMI states that it has worked with shift of one FDC table point per class with limited justification. The Desktop Reserve Model (DRM) is more advanced. The E-Flows as per DRM model are estimated at 39.7% of MAR for 'C' Class (Table 5, Page 27) against 28.9 estimated by the shifting FDC curve method (Table 4, Page 22).

[1] "Environmental Flows' is a very simple concept. First of all, this term should always be used in plural, implying that a synonym to environmental flows is an ecologically acceptable flow regime designed to maintain a river in an agreed or predetermined state" (Page 16).

5 IWMI recognizes that socio-economic importance of the river is important for determination of E-Flows (Page 32). This was, however, not considered in IWMI report.

Each of the above points leads to underestimation of E-Flows by IWMI. Thus, there is an inherent bias towards lower E-Flow estimation by WII also.

Bias in scoring system

IWMI developed a scoring system based on 15 parameters to determine the EMC. WII has followed the same. I have problem with five of the 15 parameters. I am reproducing in chart below the ranks given by IWMI for these 5 parameters for the stretch between Rishikesh and Narora; and those given by WII for the Bhagirathi Alaknanda basins.

Sl	Parameter	IWMI score	IWMI rationale (Page 23pp)	WII score	WII rationale	Proposed score by this author	Rational for proposed score
1	Rare and endangered biota	4	4 endangered fish species. 15+ total endangered species	3	There are at least 16 threatened fish species in the reach. Presence of otter reported but no authentic sighting.	5	16 fish species are threatened in Bhagirathi Alaknanda Basin against 4 in Rishikesh Narora Stretch.
2	Unique aquatic biota	4	Ganges dolphin is unique. 60 Fish species are endemic.	4	At least two endemic species who have adapted to local conditions.	5	WII reports existence of 55 RET plant species; 76 fish species, 364 bird species, 35 mammal species (Appendix 5.2, 5.4-5.6). I am unable to find breakup of unique and RET species within these but the total appears to be much more than Rishikesh Narora Stretch.
3	Diversity of aquatic habitat	3	Presence of upstream reservoirs, muddy, sandy banks and fast flowing reaches as well as formation of islands during low flows offer relatively diverse habitats for wildlife.	3	Presence of sandy banks, slow and fast flowing reaches, rafts, lagoons, confluences of different rivers, streams, diversity of substratum, formation of islands during summer and winter offers relatively diverse habitats for fish and other wildlife.	5	IWMI gives a score of 3 to Rishikesh Narora Stretch on basis of upstream diversity. The Bhagirathi Alaknanda Basin has this upstream diversity therefore rank should be much higher.
4	Protected and pristine areas	5	The Brijghat–Naraura stretch is a Ramsar site and the Hastinapur Wildlife Sanctuary is located close to Madhya Ganga barrage.	2	Although small portions of reaches are inside the Protected Areas, majority of reaches are outside and are relatively disturbed due to Hydro Electric Projects such as Tehri Dam, Vishnuprayag project etc., Nayar and Balganga rivers are identified as important fish habitats, where several threatened species congregate to breed.	4	WII only takes note of protected areas and ignores that Bhagirathi Alaknanda Basins have many pristine areas.
5	Human population density as % of main flood plains	5	There is little difference between population density in 'floodplain' subdistricts compared to those further away from the river (532 persons/km2 versus 577).	2	Compared to other parts of Ganges, this stretch has moderate population.	5	IWMI had given score of 5 for similarity of population in floodplain subdistricts and those further away. This is comparison within the area. WII has changed the parameter to compare population in the area with other parts of Ganga. Areas having less population should be given high score as is the case here.
	Other 10 parameters	21		32		32	
	Total	42/65		46/65		56/65	

	EMC	C		C		A/B	

I submit that WII has made a grave error in classifying Ganga as EMC 'C' because of above errors.

Reduction of biodiversity score

After classifying Bhagirathi Alaknanda Basin in EMC 'C'; and accepting the 28.9 % MSR for the same at Farakka; WII reduces the same to 14.5 to 21.8% on grounds that the biodiversity in the Rishikesh-Farakka stretch is much greater than in the Bhagirathi-Alaknanda Basin.[2] This logic is flawed because the stretch from Rishikesh to Farakka is about 100 km long and has at least three different ecological zones (Rishikesh-Kanpur; Kanpur-Patna and Patna-Farakka). The biodiversity in any one of these zones would be much less. Thus

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[2] Smakhtin and Anputhas (2006) suggested that 28.9% of Mean Annual Runoff (MAR) as Environmental Water Required (EWR) for Ganga River to retain the similar status of the EMC of stretch if it is assessed as 'C' Class. However, Smakhtin and Anputhas (2006) have proposed this EWR for Ganges based on analysis downstream of Ganges that starts from Rishkesh. This downstream stretch of Ganges is considered to have more than 140 species of fishes, of which about 19 species are in threatened categories (Sarkar et al. 2011). Moreover, in the same stretch, two species of crocodile Crocodylus palustris and the Gavialis gangeticus are found. Both are considered endangered (IUCN, 1994). The Common Indian Otter (Lutra lutra), and Smooth Indian Otter (Lutra perspicillata), have also been sighted in this stretch of the river. In addition, endangered Gangetic dolphin, 12 species of freshwater turtles have also been reported in this stretch apart from hundreds of species of aquatic insects. Several thousands of people are also directly dependent on the fisheries resources on this stretch of Ganges. It is not prudent to recommend the same EWR i.e. 28.9% of MAR as suggested by Smakhtin and Anputhas (2006) to Alaknanda and Bhagirathi Basins. Alaknanda and Bhagirathi basins are observed to be having less than half of the aquatic biodiversity when compared to other parts of Ganges. In the absence of larger animals such as dolphin, crocodiles, etc and with 76 species of fishes (in comparison to 143 species reported in the entire Ganges), it has been estimated that 14.5% to 21.8% of MAR may be the Minimum EWR for the aquatic biodiversity of Alaknanda and Bhagirathi basins as a conservative estimate during the lean season. Moreover, calculation of Minimum Environmental Flow (MEF) should also recognize that these releases are ensured specifically for environmental purposes especially to meet the requirements of different life history events of the aquatic biota. They should not include flows necessary for downstream commercial activities or for water supply purposes (Acreman and Dunbar, 2004; Petts, 1996).Therefore, this study has calculated that Minimum EWR for a river stretch that falls in the Mahseer zone and Snow-trout zone should be 21.8% of Mean Seasonal Runoff (MSR). The stretch that falls in the 'No fish zone' may be equal to 14.5 % of MSR as this stretch is devoid of fishes but has other aquatic biota (page 143).

wrong comparison has been made between multi-zone 1000+ km stretch; and single zone 300 km stretch. The biodiversity values in any 300 km stretch between Rishikesh and Farakka would be much less.

Secondly, reducing E-Flow from 28.9% to 14.5-21.8% effectively involved changing the EMC from ‘C’ to ‘D’ and ‘E’. IWMI 2006 calculates E-Flow of 20.0 for ‘D’ class and 14.9 for ‘E’ class. Having once determined EMC of ‘C’ on grounds of biodiversity; WII is doubly using the same data for further reducing it to Class ‘D’ and ‘E’. This is clearly double accounting.

Third, no basis is given for arriving at the figures of 14.5 and 21.8%. Why not 15 and 22%?

Other factors ignored

WII has ignored the following factors that are acknowledged in its own report or IWMI reports for determination of EMC and E-Flows:

1. *Habitats required for recovery: WII states:* “Precise definitions explain “critical habitat' as a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection; habitats that are not currently occupied by the species but that will be needed for its recovery; areas within or outside the geographic range of a species.” These requirements are not considered in arriving at EMC.
2. *Upgrading the River:* IWMI states that EMC should be determined in order to maintain an ecosystem in, or upgrade it to, a desired future state (IWMI 2006:17). The Ganga has been declared as a National River not only to maintain it in its present degraded condition but to upgrade it in consonance with its national importance.
3. *Socioeconomic and cultural importance:* IWMI states that E-Flows have to be determined in relation to the “socio-economic importance” of the river (IWMI 2006:40). This has not been considered by WII.
4. *Riparian and terrestrial life:* IWMI suggested E-Flow of 28.9 % without taking the requirements of terrestrial and riparian life into account (IWMI 2006:7). WII has followed IWMI without taking this in consideration.
5. *Otter and Cheer Pheasant:* Existence of Cheer Pheasant is acknowledged but no strategy for its conservation in view of damage

> from HEPs is made out. Existence of Otter is 'suspected'. I have seen Otter on my land repeatedly. It appears WII has not made adequate efforts to verify its existence.

River Bed Connectivity

WII clearly recognizes that making of a barrier prevents downward flow of sediments and debris; and upward migration of fish.

> River continuity is essential for the overall functioning of the system. There is ample available evidence indicating the overall importance of connectivity and continuity in the river corridor for regional biodiversity by maintaining the river corridor functioning for meta-populations, gene flow and species dispersal (WII 2012:58).
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> Dam or any construction across rivers is always a barrier for fish which move from one part of stream/ river to another as part of its life cycle processes. These structures are always detrimental to the survival of fishes especially on migrants which use different habitats for different life history requirements. There are a minimum of 17 species of migrant fishes (either long distance or local migrants) found in the Alaknanda and Bhagirathi basins, which include three species of Mahseer that are long distance migrants. Mahseer migrate from main river to smaller streams for spawning, or downstream of river to upstream for the same. Any obstacle such as dam/barrage across river will break this normal migratory behaviour which would ultimately affect the breeding cycle. Therefore, there would be decline in population that has already been observed due to Tehri Dam, which has prevented migration of Mahseer upstream.
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> Fish passes are often believed to be an engineering mitigation measure for reducing impacts on fish, especially migrants. In general, the efficiency of fish passes is considered low and fish migrations are severely affected… Fish lift that may work better in facilitating movements of fish in the Himalayan Rivers needs to be designed and monitored… As per the barrier effect, all sub-basins falling in the fish zone will be impacted.

I had met scientists at WII and suggested that WII may consider suggesting that a partial obstruction be made on the river bed to divert part of the water for generation of hydropower and leave the remaining part in free flow somewhat like the opening left in the Bhimgoda Barrage at Haridwar. An artificial reservoir can be made to store water for generating peaking power. This suggestion has not been considered by WII.

Generating hydropower from a partial obstruction would be more expensive. However, the benefits to economy and ecology would be tremendous. Economic benefits would include increase in non-use values and increase of fishing and sand harvesting. It was necessary to make an analysis of these benefits and costs of such alternative. This omission is glaring because WII recognizes the need to consider strategic alternatives:

> 8.3.4 Strategic options for regulating impacts of Hydro Electric Projects
> At the global level there is an increasing consensus on the need to manage water, water related processes and biodiversity in a sustainable manner. However, at the local level, water related developments are still taken for granted often without due regards to biodiversity conservation. A key challenge for decision makers is how to balance energy and human demands with conservation imperatives. Broad guidelines on reducing the impact of development projects (e.g. dams) on wetlands (Box 8.1) can guide the regulatory principles in the context of water resource planning in Uttarakhand State, depending on the stages in which the development of hydropower project has progressed (WII 2012:198).

The strategic option of making a partial obstruction has not even been considered.

Cost-Benefit Analysis

WII variously recognizes that the benefits from generation of hydropower have to be reckoned in relation to the costs and benefits to environment:

> The benefits of energy planning are often more immediate, important and obvious to society to satisfy many of the priority needs and reap economic benefits. The benefits of biodiversity conservation are often less evident and immediate, but are nonetheless important as biodiversity values continue to decline and threats associated with this loss to human well-being become ever-increasing (WII 2012:182).

WII quotes the Ramsar convention favourably:

> Incorporate long-term social benefit and cost considerations into the process from the very initial stages of project preparation WII 2012:182)

WII recognizes that costs of other sources of energy are high but concludes without any basis whatsoever that costs of hydropower are less. In the introduction WII says:

> In the last 50 years, although the role of hydropower in meeting the power requirement of the country has increased in terms of output, its share in the mix of power has significantly reduced and is *far below the desirable level* (WII 2012:I-5, italics provided).

WII has here started with the assumption that share of hydropower is less. In the next Para it is stated:

> Hydrocarbons and coal release a large amount of green house gases and particulate matter which pollutes the atmosphere and may also contribute to global warming. Wind, tidal and geothermal related power plants can be located only in very specific and limited areas where suitable conditions exists, moreover, cost of power production by these plants is invariably high. Solar energy requires panels which are made from rare earth elements. The rare earth elements are expensive and available at

> the moment only in very limited regions of the world and hence have to be imported. Moreover, cost of production of solar panels by the present known technology is high and large scale use of solar energy in the next few decades seems unlikely. Material required to generate nuclear energy (nuclear fuel) is available only with large constraints and serious environmental hazards are associated with this form of electrical energy generation in case of an accident. The occurrence of such accidents, however few, are serious environmental hazards. *Considering the above, hydropower generation appears to be a viable alternative to meet the ever increasing power demand* (WII 2012:I-5).

Here costs associated with other sources of power are enumerated. I have given a copy of my book *Economics of Hydropower* to WII scientists. Costs enumerated by me in the study include:

- Trapping of sediments leading to coastal erosion, decline in flood-recession agriculture and downstream fishing.
- Deterioration of quality of water leading to loss of value to pilgrims and biota.
- Methane emissions.
- Submergence of forests leading to less carbon sequestration, decline in terrestrial biodiversity and grazing.
- Increase in Reservoir Induced Seismicity and landslides.
- Increase in malaria and other water-borne diseases.
- Loss of aquatic, terrestrial and riparian biodiversity.
- Loss of river rafting and tourism.
- Loss of aesthetic and non-use values of free-flowing rivers.
- Loss of soul due to relocation of peoples and temples.
- Loss of fishing and sand harvesting.

WII has ignored these costs and only considered the loss of aquatic biodiversity:

> Before a decision is taken to harness this considerable hydropower potential in the basin under study it is necessary to understand the cumulative impact of development of this hydropower potential on the response components of the ecosystem. In view of the above an attempt is made in this study to assess the cumulative impact of hydropower projects in Alaknanda and Bhagirathi Basins (WII 2012:I-5).

WII recognizes that a 'wide range' of costs of hydropower are mentioned by critics but fails to apply its mind to these:

> Critics of Hydro Electric Projects express their concerns about the wide range of negative environmental and related social impacts, from the destruction of unique biodiversity to the displacement of vulnerable human populations (WII 2012:4).

The WII study recognizes but ignores various costs of hydropower.

Benign Dams

WII correctly recognizes that the environmental impacts of smaller HEPs are less. On this basis it gives green light to some smaller HEPs. However, it fails to recognize that these smaller HEPs also provide less economic benefits. The correct criterion for assessing a small HEP is not that its costs are less. The correct criterion is whether the (small) benefits are larger than the (small) costs. WII recommends small HEPs even if they have miniscule benefits:

> The qualifiers for bad dams include (a) a large reservoir surface area; (b) larger areas of natural habitats under flooding and consequent loss of wildlife; (c) a large river with much aquatic biodiversity damaged; (d) a relatively shallow reservoir (sometimes with a fairly short useful life); (e) few or no downriver tributaries; (f) water quality problems due to the decay of submerged forests; (g) location in the lowland tropics or subtropics, conducive to the spread of vector-borne diseases; and (h) serious problems with floating aquatic weeds (WII 2012:122).
>
> On the contrary, an environmentally benign dam is typified by (a) a relatively small reservoir surface area (often in a narrow gorge with a high head and even a tunnel); (b) little loss of natural habitats and wildlife; (c) a relatively small (often highland) river with little aquatic biodiversity at risk; (d) a deep reservoir which silts up very slowly; (e) many downriver tributaries; (f) little or no flooding of forests; (g) no tropical diseases (often due to high elevations or temperate latitudes); and (h) no aquatic weed problems (i) and low number or no oustees. Generalizing from these findings, a useful rule of thumb is that usually *the most environmentally benign hydroelectric dam sites are on upper tributaries*, while the most problematic ones are on the large main stems of rivers (WII 2012:122).

Here small HEPs are supported even if they have much smaller benefits.

Factual error regarding Srinagar HEP

WII has given green light to the Srinagar HEP (under construction) on incorrect data. I reproduce below the score sheet for Srinagar and Kotlibhel 1B projects from Appendix 6.2 of WII report:

Sub-basin/Projects	River	Type	Capacity (MW)	Status	River Length Affected (score)	Forest Area Loss (score)	Total Impact Potential Score	Impact Potential Value (%)	Category
Srinagar	Alaknanda	Storage	330	Under-Construction	1	1	2	20	L
Kotlibhel IB	Alaknanda	Storage	320	Proposed	2	1	3	30	M

It is seen that the low score of Srinagar project is wholly due to lower length of river affected.

This low score of length of river affected is based on the data given at Table 3.2, which are reproduced below:

Table 3.2 List of 70 Hydro Electric Projects on Alaknanda and Bhagirathi river basins.

S.No.	Project Name	River	Capacity (MW)	River length affected (m)	Forest land take (ha)	Forest area submerged (ha)
60.	Srinagar	Alaknanda	330	4500	339	68.73
38.	Kotlibhel 1B	Alaknanda	320	27500	146.05	453.7

River length affected of Srinagar project is shown as 4500 meters. This is the length of river affected due to the diversion canal up to the power house below the dam. A 30 km long reservoir will be made upstream of the dam. This length of river affected has been ignored. As a result, Srinagar HEP, which has equally devastating impact as that of Kotlibhel 1B downstream, is wrongly given clean chit.