

SCHEDULE A
ASSESSMENT OF RIVER BASINS (RBs) IN SOUTH ASIA

Sr. No.	Details	Response
1	Physical Features - General Information	
1.1	Name of River basin also indicate regional names.	Krishna, Krishnaveni(Source: http://en.wikipedia.org/wiki/Krishna_River)
1.2	Relief Map and Index Map of RB with Country/ State/ Province.	Attached
1.3	Geographical location of the place of origin (Country/District)	Mahabaleshwar, in Satara District, Maharashtra (Source: Second Water and Irrigation Commission Report, GOM, 1999) rises in the Western Ghats at an elevation of about 1337 m just north of Mahabaleshwar
1.4	Area (in Sq. Kms.),	Krishna Basin extends over an area of 258,948 km ² which is nearly 8% of total geographical area of the country. The basin lies in the states of Karnataka (113,271 km ²), Andhra Pradesh (76,252 km ²) and Maharashtra (69,425 km ²). (source: http://wrmin.nic.in/riverbasin/krishna.htm)

1.5	<p>Population (in Millions); Name of population centers/ Cites (duly marked on the map: refer 1.2) having Population -</p> <p>(a) More than 0.5 Million - 1 Million</p>	<p>The population of the basin based on 2001 census was 64.78 millions, out of which 66% live in rural and remaining 34% in urban areas. (Source: National Water Development Authority) Other Important towns are Satara, Karad, Sangli, Kolhapur, Sholapur, in Maharashtra state. Bijapur, Gulbarga, Raichur, Bagalkot, Bellary, Belgaum, Dharwar, Hospet, Davanagere, Badravathi, Chikkamagalur, Tumkur, Chitradurga, Shimoga in Karnataka state and Mahboobnagar, Kurnool, Nandyala, Nalgonda, Miryalaguda, Khammam, Guntur, Gudivada, Machilipatnam in Andhra Pradesh state (Source- Hydrological Data Book 2005)</p>
	(b) More than 1 Million – 10 Million	Pune- 2.5 million, Hyderabad-3.6 million [Census 2001]
	(c) More than 10 Million	Not available
1.6	Approximate areas of upper regime, middle regime and lower regime;	Upstream: Maharashtra (69,425 km ²), Midstream: Karnataka: (113,271 km ²), Downstream; Andhra Pradesh: (76,252 km ²)

1.7	Country and States (Province) in which the basin lies (indicate % area covered);	Mah: 26.8%, Karnataka: 43.8, andhra: 29.4 % As above. Additionally, The total length of the river from source to its outfall into Bay of Bengal is about 1400 km of which 305 km is in Maharashtra, 483 km is in Karnataka and 612 km is in Andhra Pradesh. Source: http://nwda.gov.in/writereaddata/sublink2images/124.pdf
2	Hydrological and Land use Features:	
2.1	Average annual rainfall (in mm); (Support with distribution pattern on Relief Map of RB {at 1.2} - indicating regions receiving high, medium or low rains);	Average annual rainfall is approximately 780 mm through the south bwest monsoons (source:MODELLING STREAM WATER CHEMISTRY USING RIVER BASIN LAND USE CHARACTERISTICS,M. Chandra Sekhar*, K. Surender Reddy*)The Krishna basin receives the major portion of its rainfall during South-West monsoon period. During this period, the basin receives about 80% of its total annual rainfall. The annual rainfall in the Krishna basin varies from 3048 mm to 600 mm. (Source: NWDA)
2.2	Maximum-minimum temperatures in Degree Centigrade	The mean annual surface temperature in the Western Ghats is about 24° C. It increases gradually towards the East and attains a maximum of 29.4° C on the East Coast.During January the mean daily minimum temperature increases from West to East from 15° C in the Western Ghats to about 18° C in the East Coast; the mean daily maximum temperature generally exceeds 30° C in the Western part of the Krishna basin and is only slightly less than 30° C in the eastern parts (Source: NWDA, http://nwda.gov.in/writereaddata/sublink2images/124.pdf)

2.3	Average annual yield (discharge) of water in Cubic Meter and the average yield for last past five years	An average annual surface water potential of 78.1 km ³ has been assessed in this basin. Out of this, 58.0 km ³ is utilisable water(http://en.wikipedia.org/wiki/Krishna_River#Krishna_Basin_.5Bfrom_Govt._Of_India_page_.28public_domain.29.5D)
2.4	Major tributaries	Its most important tributary is the Tungabhadra River, which is itself formed by the Tunga River and Bhadra River that originate in the Western Ghats. Other tributaries include the Koyna River, Bhima River {and its tributaries such as the Kundali River feeding into the Upper Bhima River Basin), Malaprabha River, Ghataprabha River, Yerla River, Warna River, Dindi River, Musi River and Dudhganga River. (Source: http://en.wikipedia.org/wiki/Krishna_River#Krishna_Basin_.5Bfrom_Govt._Of_India_page_.28public_domain.29.5D)
2.5	Percentage shares of major water uses & Surface and groundwater abstraction in percentages-Convert intoTable (a.) Agriculture,	Surface Water - 49.55 Cu. Km, 78.12mcm Average annual flows(Source-Hydrological Data Book 2005)
	(b.) Industries,	The Industrial need is assumed to be of the same order as that of domestic water requirement i.e. 936 Mm Krishna river upto Almatti Dam(Source: NWDA)
	(c). Domestic,	The total domestic water requirement has been assessed as 936 Mm ³ , for Krishna river upto almatti Dam(Source: NWDA, GOI,

		http://nwda.gov.in/writereaddata/sublink2images/170.pdf
	e). environmental flows.	Krishna River Basin is characterised as ' highly affected' by flow fragmentation and regulation (Nilsson, et al, 2005). The natural Eman Annual Runoff of the Basin is in the order of 78.1 BCM and the current annual runoff is merely 21.5 BCM. In this situation, in order to maintain the river in Class A, the runoff should be at least 68% of the Natural MAR, Class B: 34.8%, Class C: 18.3%, Class D: 8.4%, etc. Currently no such allocation is in place.(Source: An assessment of environment flow requirements of India river basins, V. Smathkin, M. Anputhas, IWMI, 2006)
2.6	Major cropping pattern	In the upper and the middle reaches, the crop pattern is dominated by sugarcane in command areas. Other crops include pulses, wheat, tobacco (lower reaches)
2.7	Cultivable area under irrigation	12042855 hectares(Source- Integrated Hydrological data book 2005)
2.8	Cultivable area not under irrigation	2788141 hectares (Source- ibid)
2.9	State other Water Uses- eg. Navigation, power, recreation etc.	Hydropower (Koyna Hydro Power Station Maharashtra), and Navigation in some of the stretches in the Delta region.
3	Ecosystem Features	

3.1	Agro-climatic zones	Sub Montane Zone/Transition Zone 1(Source- D:\NeelamRbO2\Agro climatic zones maharashtra.htm)
3.2	Major sub ecosystems (zoogeographical zones)	Evergreen upper reaches, dry deciduous middle reaches and deltaic plains in the lower reaches
3.3	Major soil types	The important soil types found in the basin are black soils, red soils, laterite and lateritic soils, alluvium, mixed soils, red and black soils and saline and alkaline soils.(Source: http://en.wikipedia.org/wiki/Krishna_River#Krishna_Basin_.5Bfrom_Govt._Of_India_page_.28public_domain.29.5D)
3.4	National parks/sanctuaries, lakes, wetlands, etc.	Radhanagari Bison Sanctuary: Kolhapur: Maharashtra, Papikondalu Wildlife Sanctuary, Manjira Wildlife Sanctuary Andhra Pradesh.
3.5	Brief information about the delta region of the basin (area, location, major urban centers in the delta, etc.)	LOCATION LAT. 15°54'N, LONG. 80°58'E with its head at Vijayawada. The delta area is about 6,322 sq kilometers.Krishna delta is extensive region formed by rich alluvial deposits of the Krishna in Andhra Pradesh. Paddy is the main crop here. For some years , the region has been facing severe water shortages due to dams and barrages in the upstream states of Karnataka and Maharashtra. Bachawat tribunal had allocated 180 tmc ft of Krishna waters for the delta (80 tmc ft from the Nagarjunasagar and 100 tmc ft from the catchment below) and steps need to be taken to protect the riparian right of the century-old delta.

4	Water Quality	
4.1	Prevailing water quality standards (e.g. Class I, II, III.etc, indicating permitted uses)	The water quality of river Krishna indicates that pH and DO are meeting the water quality criteria at all the locations except at Sangli and at Hamsala Deevi in Guntur district of Andhra Pradesh.The minimum value of 1.4 mg/l of DO is observed at Sangli in Maharashtra. The BOD concentrations range from 0.4 to 12.2 mg/l. The maximum value of 12.2 mg/l of BOD is observed at Krishna Bridge, Karad in Maharashtra.The maximum count of Faecal Coliform & Total Coliform is observed in river Krishna at Wadapally after confluence with river Musi in Andhra Pradesh.(Source: Water Quality of Rivers in Krishna Basin, Central Pollution Control Board)
4.2	Stretches (along the River) in Kms. with water quality classes indicated	See Attachment (Pollution Data.)

4.3	Sources of Pollution, with data indicating quantum and/or severity.	Severe industrial and civic (sewage) pollution is observed in the stretches where the river (or tributaries) pass through urban/industrial areas e.g.the twin cities of Pune, close to Pimpri-Chinchwad; the city of Solapur, Kolhapur ,Sangli,Miraj (Maharashtra), Hospet, KurnoolGuntur (Karnataka), Vijaywadaand Mahabalipuram i(Andhra Pradesh).
4.4	Prevailing abatement techniques e.g: ETP, STP, legislation,etc.	The Central pollution Control Board and the State Level counterparts are expected to enforce the pollution control abatement Act but have not been very successful so far. Almost 80% of sewage and over 60% of industrial effluents are being dumped into the river system without any treatment
5	Current status of the resource development & potential for development	Dams and other impounding structures and the inter basin transfers have almost completely utilised the potential. In fact there are some years during which practically no river water actually reaches the Bay of Bengal. Such exploration has led to a situation which leads us to catagorise Krishna as a "Closing Basin" though not yet competely closed. There is an enourmous scope for investments in improving water-use efficiency, greater equity in distribution, installation of ETP'S / STP's, shifting from water intensive crops like sugarcane and moving to "sugar- beet" and other cereals and pulses, bringing out water sector-reforms,recycling and reuse of water (especially industrialc& urban): rationalisation of water-use through full-cost pricing & volumetric control of water

		supply.
5.1	Water availability: a. Per capita water availability (in lpcd)	Varies between 250 lpcd (Pune) to 100 lpcd (Hyderabad) less than 1800cu.mts per cap.per year.
	b. Per hectare water availability (in Cubic meters for cultivable command area):	Varies between 8000 cubic meters per/hectar in upper reaches to 2500 cubic meters per/hectar in the drought prone districts of Karnataka, Andra Pradesh and Maharashtra. Average 4000cubic mts per ha.per year
	c. Availability of environmental flows (Current reserve, if any):	Krishna is now approaching the status of a "closing Basin", hence efforts will now have to be made to augeмент Environment flows. This will require well-planned investments.

	d. Availability of ground water/ Average annual ground water abstraction/recharge.	78.12mcm- Average annual flows, Surface Water - 49.55 Cu. Km.(Source- Integrated Hydrological data book 2005) Many parts of the peninsular Krishna basin are 'hard rock' areas and therefore not easily amenable to ground water development.
5.2	Structures: a. Major dams/barrages (with utilization categories):	Stage -I --Radha Nagari, Ghod, Khadakwasla, Vir , Koyna , Tungabhadra 3767.00 - Bhadra- 1780.00 Ghataprabha - - Stage -II - -Upper Krishna- 863.00, Musi Project, Nagararjuna Sagar 6767.00, Sri Sailam 8716.00 -Prakashan Barrage- Total- 41.80mcm (Source- Hydrological data book 2005) mainly for Irrigation purpose and for Hydroelectricity.
	b. Proposed dams:	almost 150
	c. Live storage of major dams:	Major & Medium Projects -20363mcm. (Source- Integrated Hydrological data book 2005)
	d. Live storage through proposed dams:	7.74mcm (Source ibid)
	e. Inter basin transfer systems:	Tungabhadra Dam, Nagarjun Sagar Project and Prakashan Barrage -12666mcm for export to other basins; Total withdrawal 33029mcm, Import from Godavari basin through Sri Ram Sagar Project - 986mcm (Source-Intergrated Hydrological data book 2005)
	f. Any Other:	Koyna Hydro Electric Power Project

5.3	Command area of major dams	14632902 hectares(Source- Integrated Hydrological data book 2005)
5.4	<p>Agencies functioning in the basins:</p> <p>a. Public agencies/ CSOs which construct/ implement the infrastructures projects:</p> <p>b. Private agencies/ CSOs involved in infrastructure development</p>	<p>Maharashtra Krishna Valley Development Corporation, as the River basin planning and development Agency appointed statutorily by Government of Maharashtra, Irrigation Department, Hydro Electric Power Corporation and Public Works Department of Maharashtra, Karnataka and Andhra Pradesh. Yes, the Maharashtra Water Resource Regulatory Authority Act provides for an opportunity for the Maharashtra Krishna Valley Development Corporation to get into private-public partnerships and private sector participation.</p>
6	<p>Existence of National/State/Provincial Laws or Notifications relating to water- Management / use/development/opportunity for private sector participation or for privatization of water resources</p>	<p>Krishna Water Tribunal, Maharashtra Water Resource Regulatory Authority, National and State Water policies of Maharashtra, Karnataka and Andhra Pradesh. Tungabhadra Board of Karnataka. Maharashtra Krishna Valley Development Corporation, Irrigation Departments of Maharashtra, Karnataka and Andhra Pradesh.</p>

<p>7</p>	<p>Key Issues: Critical issues in water resources development and management in the basin- that constrain economic and social development.</p>	<ol style="list-style-type: none"> 1. There is a longstanding dispute between Maharashtra, Karnataka and Andhra Pradesh regarding the sharing of water. The Krishna river water disputes Tribunal Award has been reopened recently and negotiations have begun afresh. 2. There is an excessive use of scarce water for sugarcane cultivation which has unsustainably skewed the cropping pattern in the states of Maharashtra, Karnataka and partly Andhra Pradesh as well. 3. There is an unequal distribution of water wherein barely 15 to 16% of the areable lands get over 90% of the water for irrigation, while the rest has to be satisfied with unreliable and inadequate rainfall. 4. A large quantity of water is being transferred from Krishna, which is a water scarce basin, to western coastal areas (about 20% of Maharashtra share i.e. .2 billion Cubic mts.) for hydro-power generation and then released into the Arabian sea without being for any other purpose. 5. Industrial effluents and urban sewage are causing severe pollution as over 70% being released into the river system without treatment. 6. The Krishna is facing excessive withdrawal and a large consumptive use of water (over exploitation). Consequently the river is not likely to dry out before it discharges water in the Bay of Bengal. This situation will soon lead to a phenomenon described as a "closing basin".
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SCHEDULE B
ASSESSMENT OF RIVER BASINS (RBs) IN SOUTH ASIA

Sr. No.	Details	Response
1	Legal / Political Mandate	
1.1	Is there any RBO? If yes, Give Name.	Maharashtra Krishna Valley Development Corporation,(Source- http://www.mahagovind.org/default_en.htm) The Karnataka Krishna basin Development Authority.
1.2	How has it been constituted? (Statutory/ Voluntary/ Any other form).	Statutory

1.3	<p>State objectives and organizational structure of the RBO in outline & enclose brochures. 1. Does the RBO have the responsibility and technical capacity to coordinate integrated water resources planning in the basin. 2. Does the RBO have a proactive and efficient data management and information dissemination process to inform all stakeholders of basin conditions, water resource availability, and major issues?</p>	<p>Was initially brought into existence in 1995 expressly to develop (dams /canals) water resource and impound upto 600tmc of water, which was declared as the share water for Maharashtra State -as per the Award declared by the Krishna Water Dispute Tribunal(KWDT). It was also expected to prepare a master plan for quick completion and/or implementation of the ongoing and proposed projects. The MKVDC has the capacity to coordinate IWRM- practices in planning for the river basin, but sadly it has not yet made use of this potential. The RBO does not disseminate information on its own to other stakeholders, but due to the existence of the Right to Information Act such information is provided when specifically demanded by private citizens.</p>
1.4	<p>Functioning level of the RBO (watershed/micro basin/sub-basin/basin, etc.)</p>	<p>Basin level.</p>
1.5	<p>What are the major activities carried out by the RBO since inception?</p>	<p>MKVDC is responsible for survey, Planning, Design, Construction and Management of Major, Medium and Minor Irrigation Projects in Krishna Basin. Provision for Urban and industrial purposes , collection of water charges. It is also authorised to raise capital by way of "bonds" from open market.</p>

1.6	What are the proposed activities of the RBO?	<p>With the promulgation of the maharashtra Water Resources Regulation (Act) in 2005, the MKVDC has been empowered to carry out all functions expected of an RBO I.e. preparing basin and sub-basin plans with stakeholder participation, publishing all relevant data on river hydrology/ potential for water saving & efficient use, creating platformsand fora for stakeholder negotiations, participation,procedures & mechanisms for conflict resolution,carrying out studies regarding pollution conjuctive use of ground water, volumetric supply & pricing, equitable distribution, environmental flows required etc.</p>
1.7	Details of Contact person/s (Name, designation and contact numbers, address, & emails).	<p>Er. KolawaleExecutive Director M.K.V.D.C. Pune Phone (Off):020-26135263Fax:020-26134931 Er. R.D.KoganolikarChief Engineer,M.K.V.D.C. Pune Phone (Off):020-26127466 Er. P.C.ZapakeChief Engineer (ID)M.K.V.D.C. Pune Phone</p>

		(Off):020-26120505 Er. E.B. Patil Chief Engineer,(Specified Projects) Pune Phone (Off):020-26120130
1.8	Presence of a regulatory framework wherein national or regional supra basin authority regulates the functioning of the RBO	The Krishna Water-Dispute-Tribunal(KWDT) has been appointed recently by the Government of India to deal with issues related to water allocation, flood control etc.
1.9	Legal/political mandate wherein stakeholders can appeal for redress/decision and conflict resolution	The State Governments concerned i.e.Maharashtra, Karnataka and Andhra Pradesh can appeal for redressal to the KWDT, but there is no provision enabling stakeholders to appeal.
1.10	Does the RBO have an appellate authority?	Yes, and when unresolved the issues can be taken to MWRRA. Although an enabling constitutional provision exists, although a river Board for Krishna as a "whole" has not been appointed.
1.11	Is the RBO an autonomous body?	Yes, but very limited

1.12	Is it regulated by a supra basin authority, if so, how?	No
1.13	Is the RBO authorized to raise capital for management and/or implementation in open market?	The MKVDC has raised capital between 1996-2000 in the form of bonds from open market.
1.14	Does the RBO receive direct budgetary grants?	Yes, from the Government of Maharashtra.
1.15	Nature of mandate for delegation of powers and/or functions (within RBO's constitution) to the lowest possible scales so as to encourage stakeholder participation.	All powers are centralised and directly used by the government through a minister appointed by the Government of Maharashtra as a Managing Director.
1.16	Policy of the RBO on – (i) Water allocation between users/sectors/sub-basins; and	As of now, a policy on allocation of water between sub-basins has not been enunciated.
	(ii) Procedures and processes for determining the above.	
1.17	Presence of Trans-boundary Water Agreement or Treaty in case of a trans-boundary basin,	The entire basin lies within India so no Transboundary Treaty is necessary.
1.18	Presence of a 'Tribunal' appointed in case of intra basin or inter basin disputes	Krishna Water Disputes Tribunal appointed by the Government of India to resolve interstate disputes mainly Maharashtra, Karnataka and Andhra Pradesh.

1.19	Is the RBO responsible for preparing Basin Management Plan. If yes, please enclose a copy	Yes, A River Basin Management Plan has not yet been prepared but it is on the drawing board, because the Maharashtra Water Resource Regulatory Authority requires time for the preparation of such a plan.
2	Processes of community/stakeholder participation in the functioning of the RBO	
2.1	Are the stakeholders from the basin included in the governing body of the RBO?	No
2.2	Elaborate the nature and frequency of public consultation initiated by the RBO	No consultation but public hearings are conducted to new proposed projects as per the Environmental Impact Assessment notification under the Environment Protection Act.
2.3	Elaborate efforts at outreach/communication by the RBO.	No out reach activities, since it still functions like a quasi- governmental department.
2.4	Elaborate efforts made for creation of participatory platforms at minor/major tributary or watershed levels for encouraging participation .	No efforts have been made.
2.5	Interaction of the RBO with organizations working in water management at different watershed/ micro basin, sub-basin or basin level	Interactions are nominal by way of press- notes etc.

2.6	Stakeholder participation sought by the RBO for preparing Basin Management Plan	No
3	Conflict resolution and negotiations	This role has not been played out as yet, although it is now mandated under the MWRRA
3.1	Involvement of the RBO in negotiations between stakeholders at various levels through an appellate authority mentioned above;	No, such negotiations have taken place so far.
3.2	Negotiation and participation encouraged at mini/micro basins for consensus building and/or conflict management.	No