

Executive Summary

The National Water Policy of Government of India provides that water should be made available to water short areas by transfer from other areas including transfers from one river basin to another, based on a national perspective, after taking into account the requirements of the areas/basins. Accordingly, long distance inter-basin transfer of water from water surplus basins to water deficit basins has been mooted in our country in order to reduce the regional imbalances in the availability of water. A National Perspective Plan (NPP) was formulated in the year 1980 by the Union Ministry of Irrigation (now Ministry of Water Resources) and the Central Water Commission identifying a number of inter-basin water transfer links in respect of both Peninsular rivers and Himalayan rivers of the country. The Peninsular Rivers Development and the Himalayan Rivers Development Components put together were expected to create an additional irrigation potential of 35 million hectares besides hydropower potential and other benefits.

The interlinking of Parbati-Kalisindh-Chambal Rivers is one of the projects under the Peninsular Rivers Development Component of the NPP. This report deals with feasibility study of Parbati-Kalisindh-Chambal link project. The objective of preparation of the feasibility report is mainly to facilitate firming up of the proposals and for discussions among the concerned States to arrive at broad agreements on the quantum of diversions and utilisations of water, sharing of cost and benefits etc. This report has been prepared keeping in view the various comments offered by concerned State Govts. / Departments on prefeasibility study of the Kalisindh-Chambal link project.

The preliminary feasibility report (PFR) of Kalisindh-Chambal link canal project was prepared and circulated amongst the members of TAC and to the concerned State Govts. in September 1991. The Govt. of Madhya Pradesh in their comments on the prefeasibility report of Kalisindh-Chambal link pointed out that the link proposal was not economically viable on account of its low Benefit-Cost Ratio and Internal Rate of Return. Keeping in view the comments of State Govt., further studies have been done by NWDA to accrue more benefits by increasing the quantum of water for diversion by off-taking the link canal from Parbati River at Patanpur dam instead of Mohanpura dam on river Newaj. Therefore, the proposal has now been modified and renamed as Parbati-Kalisindh-Chambal link project.

In the modified proposal, one additional reservoir at Patanpur across Parbati River has been included in the study. Considering the reservoirs at Patanpur across Parbati, Mohanpura across Newaj and Kundaliya across Kalisindh, the simulation studies have again been carried out for different alternatives considering various options & combinations of reservoirs and canal capacities to optimise the benefits. To optimise the capacities of intermediate reservoirs for minimum storage, the studies have been done in series starting from down

stream most reservoir, considering the operational details and the capacities of destination reservoir i.e. Gandhi Sagar/Rana Pratap Sagar to accommodate bulk transfer of water in monsoon months and demand pattern of seven projects proposed by NWDA in the Upper Chambal sub-basin.

The Parbati-Kalisindh-Chambal link project will comprise the following:

- i. A diversion dam at Patanpur on river Parbati with Full reservoir level (FRL) of 419 metre (m) to divert 464 Mm³ of water from its own catchment to Mohanpura diversion dam through a 55.37 kilometre (km) long canal (including tunnel length of 6.61 km) with full supply level (FSL) of 411.0 m at Patanpur.
- ii. A diversion dam at Mohanpura on river Newaj with Full reservoir level (FRL) of 400.0 m to divert 403 Mm³ of water from its own catchment to Kundaliya reservoir across Kalisindh river through a 73.17 km long canal (including two tunnels of length 1.29 km and 3.1 km) with FSL of 392.0 m at Mohanpura.
- iii. A storage dam at Kundaliya on river Kalisindh with FRL 378 m, gross storage capacity of 1234 Mm³ to transfer 493 Mm³ of water from its own catchment and waters received from Patanpur dam and Mohanpura dam either to:
 - a. Existing Rana Pratap Sagar (RPS) having full reservoir level (FRL) of 352.81 m and live storage capacity of 1566.52 Mm³ through a 115.08 km long water conductor length involving 105.52 km long gravity canal and two tunnels having length of 3.6 km and 5.96 km. This alternative named as Alt- (a).
 - (Or)
 - b. Existing Gandhi Sagar having FRL of 399.89 m and live storage capacity of 7616.74 Mm³. Under this linkage, two alternatives have been studied. In the first alternative named as Alt. (b)-I, the entire water is proposed to be lifted in three stages from Kundaliya reservoir at an off-take level of 368.35 m through pumping reach of length 19.74 km with a lift of about 50.15 m followed by 78.35 km long gravity canal upto Gandhi Sagar. For this alternative, the net requirement of power for lifting the water is 13.31 MW. In second alternative named as Alt (b)-II, the diversion of water is proposed to be carried by gravity from Kundaliya dam for a length of 45 km upto Ahu barrage following same path as in case of Alt (a), linking to RPS and thereafter the link canal with FSL 357 m runs through gravity in the north-west direction for a length of 5 km where a sump well near village Akheri has been proposed. From the sump well, the water is proposed to be pumped in single stage with a lift of about 47.42 m through 3.2 km long pipeline followed by a gravity canal with FSL 404 m for a length of 20.10 km upto Rupania Nalla which ultimately falls into Gandhi Sagar reservoir. In this case, the

net power requirement for lifting the water is 9.03 MW. The alternative (b)-II, linking to Gandhi Sagar has been found more suitable and considered in the study in view to keep the existing power generation at Gandhisagar intact. Also the power needed for lifting the water in single stage is comparatively less. This alternative was also suggested by Govt. of M.P. in their comments on prefeasibility report of Kalisindh-Chambal link. The project also includes installation of pumping station component for lifting of water and construction of seven dams proposed in upper reaches of Chambal.

Amongst the tributaries of Chambal River, Parbati, Newaj (a tributary of Kalisindh) and Kalisindh rivers have sizeable surpluses after meeting the existing and projected requirements for irrigation, domestic & industrial purposes within the basins upto 2050 AD. The provision of import & export, if any, upto each diversion point has been kept undisturbed. The 75% dependable surface water balance at each dam site has been worked out after attaining a minimum irrigation level of 30%, both for areas upstream and downstream of diversion points in the donor sub-basin to have an equitable distribution of water in different sub-basins of Chambal basin.

It is, therefore, proposed to divert the surplus waters of Parbati, Newaj and Kalisindh rivers to Chambal river at Gandhisagar/ Rana Pratap Sagar after providing irrigation facilities in the enroute of link in the Rajgarh, Guna, Shajapur, Mandasaur, Morena/Bhind districts of Madhya Pradesh and Jhalawar, Kota and Chittorgarh districts of Rajasthan.. The Chambal water thus saved, in the upper reaches of Chambal, due to transfer of water through Parbati-Kalisindh-Chambal link at above existing storage on river Chambal, is proposed to be tapped in the seven storage reservoirs/dams identified by NWDA in the upper reaches of Chambal for benefiting the drought prone districts of Ujjain, Shajapur and Dhar of Madhya Pradesh where the present level of irrigation is only 5.44% of culturable area. Irrigation has also been proposed to be extended to an adjoining tehsil of Ratlam district of M.P. in which the level of irrigation of only 8.7% from existing, ongoing and proposed projects is likely to be attained. In addition, augmentation of water in the Chambal River is proposed for irrigation in the existing commands of Kota barrage in Bhind and Morena districts of Madhya Pradesh.

The revised water balance at Patanpur dam on river Parbati, Mohanpura dam on river Newaj & Kundaliya dam on river Kalisindh at 75% dependability are 948 Mm³, 444 Mm³ and 610 Mm³ respectively. Out of the total surface water balance of 2002 Mm³ (948 Mm³ + 444 Mm³ + 610 Mm³) at above storage diversion sites, 1360 Mm³ of water is envisaged to be diverted through Parbati-Kalisindh-Chambal link project.

Out of 1360 Mm³ of water proposed for diversion through Parbati-Kalisindh-Chambal link, 676 Mm³ will be transferred to Chambal River either at Rana

Pratap Sagar or at Gandhisagar (663 Mm³ for upper Chambal projects, 13 Mm³ Ex-Kota barrage) and 684 Mm³ (including transmission losses) is proposed to be utilised in the enroute command. The link will also provide 13.2 Mm³ of water for domestic water supply to the enroute villages.

The enroute irrigation and domestic use of water will be in the areas falling in the districts of Rajgarh, Guna, Shajapur, Mandasaur, Morena/Bhind in Madhya Pradesh and Jhalawar, Kota and Chittorgarh in Rajasthan. Considering the linking to Rana Pratap Sagar i.e. alternative- (a), an area of 65,657 ha will be benefitted by irrigation in Madhya Pradesh and 43,082 ha in Rajasthan enroute. Thus, the link shall be providing irrigation benefits to total area of 1,08,739 ha enroute. In case of linking to Gandhi Sagar, the benefit has been worked out for both the alternative i.e. (b)-I and (b)-II. Adopting the alternative-(b)-I, Irrigation benefits will be 1,18,860 ha (93,649 ha in M.P. and 25,211 ha in Rajasthan) while for alternative-(b)-II, the irrigation benefits will cover an area of 1,17,253 ha (90,474 ha in M.P. and 26,779 ha in Rajasthan).

Auxiliary and incidental benefits that will occur by the commissioning of this scheme are of immense value to the people of the area. Ground water will get supplemented through the seepage of surface water used for irrigation and will increase in water table. The scarcity of drinking water in these dry areas will be mitigated considerably. The afforestation programme could be implemented on canal banks resulting in environmental improvement. The communication system will improve because of canal roads and CD works raising marketing opportunities. The formation of the reservoirs will help tourism development, fisheries and aquaculture, bird sanctuaries etc. Besides, there will be an increase in employment opportunities during the construction of project.

Interlinking river development programmes, particularly those that include the development of one or more dams and reservoirs, can produce far-reaching changes in the environment of the region. Environmental effects, or changes resulting from project development, may occur upstream, on site, downstream or along the link project as well as changes in population distribution and land use in the near vicinity of reservoir area as well as other zones due to increased development for irrigated agriculture, industry or other purposes (fisheries, resettlement). Adequately planned such big projects provide major economic benefits. However, as with many other developments, there may be direct & indirect adverse environmental & social effects (costs) as well as beneficial environmental impacts secondary to the initial project purposes. With careful planning, adverse effects can be minimized or mitigated, and secondary beneficial effects enhanced. Net benefits from the link project often will increase when it becomes regional development project that integrate irrigation, power generation and municipal water supply with catchment area management, conservation, tourism, fisheries and rural development. Thus, environmental & socio-economic analysis is one of the ways in which resource development project can be analysed, to identify and minimise potential resource

conflicts/adverse environmental effects, thus enhancing overall project viability. It was felt necessary to carry out a study to assess the likely effects on various aspects such as socio-economic and environmental impacts. The work of rapid Socio-economic survey/studies and Ecological as well as Environmental impact assessment studies of this link project has been awarded to RITES Ltd. (A Govt. of INDIA Enterprise, Gurgaon, Haryana) during the month of June 2005.

The total estimated cost of P.K.C. link canal project at 2002-2003 price level are Rs. 298902/- lakh, Rs. 312547/- lakh and Rs. 305830/- lakh for alternative (a), alternative (b)-I and alternative (b)-II respectively. The schedule of construction of the link project is planned for a period of 8 years including pre-construction year. The annual benefits accrued from the project for alternative (a), alternative (b)-I and alternative (b)-II are estimated to be in the order of Rs. 66433.60 crore, 68834.08 crore, 68432.28 crore (2002-2003 price level) respectively. While working out the cost of the scheme, the cost of link canal, cost of head works including cost of proposed 7 reservoirs in upper reaches of Chambal and cost of command area development are considered as cost of the link project. The cost of head works (Patanpur, Mohanpura and Kundaliya) for link canal have been worked out on actual basis as estimated in the cost estimate of Patanpur, Mohanpura and Kundaliya dams. An unit rate per ha of annual irrigation of Kushalpur ongoing medium project in Rajgarh district of Madhya Pradesh for working out the cost of seven storage/diversion dams in upper Chambal basin. However, actual cost of B-Land for Patanpur, Mohanpura and Kundaliya dams as per respective cost estimates and proportionate cost for seven other storage/diversion dams in upper Chambal basin has been utilized in the cost of Unit-I Head Works. The cost of canals including tunnels and pumping stations covered in Unit-II have been estimated on the basis of actual cost estimate adopting unified schedule of rates 2002-03 of Govt. of Madhya Pradesh. The electricity charges for pumping of the water in the reach of Kundaliya to Gandhi Sagar have been considered as Rs. 1.80 per unit. The annual cost is computed at 10% of interest including cost of land development @ Rs.3000/- per ha, depreciation @ 1 % of the cost of project, depreciation on the pumping system @ 8.33 % and for raising mains @3.33%.

The Benefit-Cost ratio for the Parbati- Kalisindh-Chambal link project as a whole has been computed based on the corresponding annual costs and annual benefits from this project, which comes to 1.67, 1.59 and 1.63 for Alt-(a), Alt-(b-I), Alt-(b-II) respectively. The internal rate of return (I.R.R.) of the project has also been worked out as 14.00% for all the above three alternatives.