Executive Summary

Introduction

The Project for 'Extension of Main Ravi Canal from Basantpur to Upstream of Ranjit Sagar Dam including Power Generation units enroute is envisaged in the State of Jammu and Kashmir (J&K)**.** J&K state lies in the northernmost State of India. The Govt. of J&K has conceived a project to draw water from the foreshore of RSD reservoir near Satwain by constructing an intake structure and extending the existing Ravi Main Canal from Basantpur towards upstream upto the intake structure so that regulated releases, as per the allocated share, maximum upto 1150 cusec are available for the stipulated irrigation potential of 53900 ha. At the same time, it is also contemplated to exploit the available drops from the intake at RSD to Basantpur which is about 88 m to generate power to the extent of 21 MW by constructing 2 Power Houses on the extended portion of the Ravi Main Canal.

Though development of irrigation potential in Kandi Belt of J & K is the main objective of the project, an additional benefit of hydro power generation is also envisaged by utilizing the 2 nos. of falls / drops existing on the proposed alignment of extension of main canal from Basantpur to upstream of Ranjit Sagar Dam near Satwain. These falls / drops are proposed to be utilized for generation of hydro-power to the extent of 21 MW by constructing 2 nos. of power houses. The objectives of the Project are not only limited to enhance the irrigation potential in Kandi Belt, but also to develop the power scenario of the state and to provide the power facility to far-flung areas of the state along the canal alignment, thereby reducing the burden on expenditure being made for purchasing / importing of electricity from other states.

General Feature of the Project

The extended main Ravi canal is proposed to originate from the reservoir at an invert level EL 485.0m and would be ultimately connected to the existing Ravi Canal at EL 397m.

The proposed irrigation-cum-hydro-power development on the extended water conveyance system would be an equivalent system like run-of-the-river scheme. The project envisages construction of Intake with control arrangement by crack opening of service gate for drawl of desired quantum of water from Ranjit Sagar Dam. Total length of the proposed canal is 9.084 KM. Unique requirement for this scheme is the variable gate opening by gate operation to meet seasonal variation of water requirement for irrigation through the system vis-à-vis variable reservoir level. Variation domain in this case would be corresponding to FRL 527.91

and MDDL 485.0. Operation of gate would be done through remote control arrangement. The entire water conveyance system domain is considered in three Phases.

- Phase I – 3170 m
- Phase II – 2120m
- Phase III – 3794m

For **Phase I,** major project components as envisaged during the project formulation stage are:

- Approach Channel
- Intake with auto control arrangement for service gate, beside emergency gate and Trash Rack
- Energy dissipation arrangement just downstream of service gate, to ensure maximum 2.1m/sec velocity
- Free Flow Tunnel, 5.0m x 5.5m D- shape with flow depth of 3.0m
- Balancing arrangement having steady state condition level at EL 488.0
- Pressure Shaft / Penstock
- Surface Powerhouse to accommodate 3 nos. horizontal turbines, operating head 45m
- Transformer yard and Tailrace pool with maximum tail pool level at EL 443.0

For **Phase II** development, tailrace water from Phase - I is proposed to be tapped directly into the Phase - II system through 3m x 3m pressurized RCC duct, crossing the intercepting nalas through Aqueduct and then 3 m D-shape Tunnel to 15m dia. Surge shaft, 3m dia pressure shaft, Penstock and then branching out to feed 3 units in the Phase - II Power house. Maximum water level in Phase - II Tail Pool would be about EL 405m.

In **Phase - III**, water from Phase - II Power House Tail pool would be directly fed into free flow 230 m long RCC duct 5.0m x 3.5m, free flow tunnel 5.0 x 5.5m (3 nos of varying length), Aqueduct 5.0mx 3.5m (446m long) to cross Sukhal nala and open channel of 649 m long upto Basantpur.

Access to the Project Site

The project site falls in Kathua district of Jammu and Kashmir. The intake site at Ranjit Sagar Dam, near Satwain, is about 40 km from Kathua and 32 km from Lakhanpur on Kathua-Lakhanpur-Basohli road. Kathua/Lakhanpur is well connected to Delhi/Jammu by Rail as well as by NH-1A. It takes about 8-10 hours by road/rail to reach Kathua from Delhi and about 2 hours from Jammu.

Irrigation Study

Geology

The proposed water conductor system was geologically examined by taking field traverses along the alignment and in its vicinity. The excavations, both for tunnels and open channels, would intersect sedimentary rocks of Siwalik group, soil cover of cultivated land and alluvium of recent age. All these lithological units of sandstone, clay-stone, conglomerate of these would be intersected by proposed water conductor system at about right angle by virtue of its alignment across the strike direction of these rocks. Thus, the alignment would involve the excavation of both hard and soft litho-units of favourable engineering characteristics.

Hydrology

The predominant end-use envisaged from the project is to provide sustained irrigation in the command of Main Ravi Canal raising its irrigation potential from present 11,134 ha with 166% irrigation intensity to 53900 ha with 168% irrigation intensity after the project.

Since the existing carrying capacity of Main Ravi Canal below Basantpur Pumping Station is 1150 cusec, the extended portion of the canal will also be designed to carry the same discharge. The Govt. of J&K while fixing the above design capacity of the canal has already kept its annual share of 0.69 MAF and net 0.475 MAF for this project in view so as to enable to draw its full share from Ranjit Sagar Dam. The pattern of withdrawals on 10 daily basis as envisaged for supplying water to the crops with 168% intensity of irrigation has been worked out. The MDDL of Ranjit Sagar Dam for irrigation is at EL 485 m.

Power Potential Study

The capacity of the power houses and energy generated based on the pattern of 10-daily water withdrawal, as envisaged for planning the irrigation requirements is done. The power generated at the Power House-I vary from 3.67 MW to 12 MW and that for Power House-II varies from 2.99 to 9.77 MW. The variation in power generated would decide the installed capacity of Power House -I as 3 machines of 4 MW each and that of Power House-2 to be 3 machines of 3 MW each.

Civil Engineering Work

Roads

The total length of project road network has been assessed tentatively as under:

Sl. No.	Name of Road	Length (m)
1	Powerhouse-I	2500
2	Powerhouse-II	2000
3	Open Channel	700
4	Other Project Components	800
	Total	**6000**

Offices

A residential complex and a main office complex may be constructed at Basantpur Village. In addition to this, to facilitate construction activities, site offices at Intake, Powerhouse-I, Powerhouse-II and near existing pumphose have been proposed. Provision for offices and residences has been made in accordance with organization chart proposed for Operation & Maintenance.

Approach Channel

For drawl of water from the reservoir at an elevation 485m, construction of an approach channel from the reservoir creek near Satwain upto the tunnel intake is envisaged.

Water Conveyance System and Power House

Water Conveyance system has been considered under three specific domains. Phase I and Phase II for Irrigation–cum-Hydro Power and Phase III for irrigation. Water Conveyance System for the project consists of Tunnels, Channels, RCC Ducts and Aqueducts for the following stretches:

Phase	Component	Size, m	RD (m)		Length m	Remarks / Invert EL
			From	To		
Phase I RD 0 To RD 3170 Free Flow	Approach Channel		-60	0	60	485.0
	Intake Structure	3.0x3.0	0	17	17	485.0
	Transition	3.0 to 6.4	17	27	10	485 to 482m
	Energy dissipation	6.4x6.4	27	52	25	Basin invert EL482m
	Transition	6.4 to 5.0	52	57	5	482.0 to 485.0
	T1	5.0X5.5	57	2770	2713	Invert EL485m
		Longitudinal slope 1 in 1200				

	Forebay, Power Intake, Pressure shaft Penstock & **Power House-I**	FSL at Forebay EL 488 m , TWL at PH-I EL 443				
Phase II RD 3170 To RD 5290 Pressure Flow	T2	Tunnels 3.0 X3.0	3220	3310	90	
	T3		3450	3530	80	
	T4		3570	3740	170	
	T5		3880	3990	110	
	T6		4090	4530	440	
	T7		4690	4930	240	
	T8		5050	5160	110	
	D1	RCC Ducts 3.0×3.0	3315	3450	135	
	D2		3530	3575	45	
	D3		4535	4690	155	
	D4		4935	5045	110	
	A1	Aqueducts 3.0X 3.0	3740	3875	135	
	A2		3990	4090	100	
	Surge Shaft, Pressure shaft Penstock & **Power House-II**	TWL at PH-II EL 405				
Phase III RD 5290 TO RD 9084 Free Flow	A3	Aqueducts 5.0 X 3.5	6250	6706	446	Sukhal Nala Inlet & Exist invert EL 401.25 & EL 401.00
	D5	RCC Duct 5.0 X 3.5	5340	5570	230	
	D6		7415	7485	70	
	D7		8330	8435	105	
	T9	Tunnels 5.0 x 5.5	5570	6250	680	Longitudinal slope 1 in 1200
	T10		6750	7420	670	
	T11		7485	8330	845	
	Open Channel		8435	9084	649	
			Elevation at terminating point			EL 397.0

Construction Schedule

Since all the work will be done through EPC contracts, the project would not need to procure any large quantity of heavy construction equipment. However, considering the nature of the project a limited number of construction equipment like dumpers, shovels, trucks, dozers besides normal vehicles for personnel have to be procured. The procurement of a substantial part of these would be done in the first year of project execution. Workshop for maintenance of vehicles will also be set up. The bulk of the infrastructure works are proposed to be

completed in the first 28 months from the start of project. The execution of the work of the Project and installation of generating units is feasible and will be completed in 3 years time form the date of start for the project. This includes the initial 6 months devoted mainly to development of infrastructure works. Assuming careful attention to the phased plan for execution of various works, the project could start yielding benefits from the 37th month after start of construction work at site.

Cost Estimation

The project is estimated to be of 410.28 Crores INR excluding transmission cost. The cost estimate does not include Interest During Construction (IDC). The breakdown of cost estimate is given below:

Sl. No.	Description	Amount (Rs Lakhs)
1	Civil works	27513.69
2	Electro-Mechanical work	13514.88
	Total Rs. In Lakhs :	41028.57
	Total Rs. In Crore :	**410.28**

Conclusion

Project involves general civil works and could be completed within 36 months. The project would afford design energy of 108.99 GWh 95% available in one dependable year. The 1st year and Levellised Tariff of generation are assessed as Rs. 4.59 per unit and Rs. 3.78 per unit respectively. The proposed project will enhance irrigation potential of the Kandi Belt of the state and also power generated through two proposed power houses shall be used to meet the electricity demand of the state.