

Chapter7

Reservoirs

7.0 General

The precipitation in the country is uneven both in respect of space and time and is confined to only monsoon season. Some parts of the country receive much more than the country's normal rainfall leading to flood like situation while other parts due to lack of rainfall over the extended period suffer from extreme droughts. To overcome such adverse circumstances, the transfer of water from water surplus basin to water deficit basin becomes necessary. Weirs and barrages play a significant role in conservation of surplus water during monsoon and its transfer to the needy areas without involvement of major submergence and R & R issues. Under the Bedti - Varada link, it is proposed to divert the water from Bedti basin to water short tail end area of Tungabhadra left bank command area of Tungabhadra basin. The components of Bedti - Varada link project are discussed below.

Components of Bedti -Varada link project

The link project involves construction of the following components:

Link-I: Bedti - Varada link

- 1) Proposed Pattanadahalla diversion weir near Siralabail village, across the Pattanadahalla stream of Sonda river which is a tributary of Bedti river with a length of 145m, pond level of 499.00m & maximum water level of 501.00m.
- 2) 6.9 km long conveyance system (Tunnel/canal) off takes from the proposed weir with pond level of 499.00m and the designed discharge capacity of 22.33 m³/s which will fall into the stream leading to Shalamalahalla.

- 3) Proposed Shalamalahalla diversion weir near Hulgol village across Shalamalahallastream of Sonda river which is a tributary of Bedti river with a length of 202m, pond level of 468.00m and maximum water level of 470.50 m.
- 4) A jackwell and pump house on upstream of the weir on the right bank of Shalamalahalla with suitable forebay.
- 5) 18.58 km long conveyance system (Raising main/tunnel/canal) taking off from the proposed jackwell cum pumphouse with pondlevel of 468.00m at the designed discharge capacity of 60.50m³/s which will fall into the stream leading to Varada river.

Link-II: Bedti - Dharma link

- 1) Proposed Suremane diversion barrage near Suremane village, across the Bedti river with a length of 165 m, pond level of 426.00 m and maximum water level of 429.44m.
- 2) A jackwell cum pump house on u/s of barrage on the left bank of Suremane with suitable forebay.
- 3) 26.88 km conveyance system (Rising main/tunnel) taking off from the proposed jackwell cum pumphouse with pond level of 426.00m at the designed discharge capacity of 76.40m³/s which will outfall into the stream leading to Dharma river/reservoir.

7.1 Pattanadahalla weir

Pattanadahalla weir is proposed on Pattanadahalla stream, a tributary of Bedti river near Siralabail village. The latitude and longitude of the proposed weir site are 14°40' 15" N and 74°41' 18" E respectively with the intercepting an area of 52.80 Sq.km. The river bed level at the weir site is

491.00m and the pond level of the proposed weir is 499.00m. The capacity of weir at pond level is 0.54MCM. A tunnel will be provided in the foreshore to draw a designed quantity of 22.33m³/s with suitable mechanism to regulate the water discharge.

7.1.1 Fixation of storage and weir levels

The pond level of the proposed Pattanadahallaweir is 499.00 m. The submergence area at pond level of the weir will be 17.88ha which is confined to river banks only. The pond level will be kept unaltered for regulating diversion of flood flows into the proposed link canal. The top bund level of the proposed weir is at 503.00 m. The proposed Ogee shape weir is designed for maximum flood discharge of 824 m³/s.

7.1.2 Water quality

There are no G&D sites located on the Bedti river. Hence, the data of Santeguli G&D site on Aghanashini river maintained by Central Water Commission (CWC) which is adjacent to the Bedti river is adopted for both chemical and physio-chemical analysis for ascertaining the water quality status for entire Bedti river.

The latest data pertaining to the years 2014 to 2017 on laboratory test results of water samples of Santeguli G&D site have been collected and presented in **Table: 7.1**.

Table: 7.1
Test results of water samples at Santeguli G&D site on Aghanashini river

Sl. No.	Character-istic(Para-meter)	Unit	Analysis result				Drinking water specifications (IS 10500: 2012)
			2014	2015	2016	2017	Requirement (Acceptable limit)
1	pH		7.150	6.757	7.073	7.080	6.5 to 8.5
2	Dissolved Oxygen	mg/l				6.820	Min. tolerance limit of 6 mg/l as per CPCB class A.
3	Total Dissolved Solids	mg/l		34.000	35.333	34.000	500 mg/l Max
4	Turbidity	NTU					1 NTU Max
5	Total Alkalinity (as CaCO ₃)	mg/l	17.800	15.192	16.275	16.557	200 mg/l Max
6	Chloride (as Cl)	mg/l	7.218	8.224	7.041	6.256	250 mg/l Max
7	Sulphate (as SO ₄)	mg/l	2.216	2.464	3.592	2.557	200 mg/l Max
8	Fluoride (as F)	mg/l	0.063	0.119	0.057	0.042	1.0 mg/l Max
9	Total Hardness (as CaCO ₃)	mg/l	21.104	19.758	19.686	24.365	200 mg/l Max
10	Calcium (as Ca)	mg/l	5.067	4.933	4.533	4.416	75 mg/l Max
11	Magnesium (as Mg)	mg/l	2.025	1.782	2.005		30 mg/l Max
12	Boron (asB)	mg/l	0.210	0.387	0.222	0.204	0.5 mg/l Max
13	Nitrate (as NO ₃ -N)	mg/l	0.430	0.488	0.591		10ppm
14	BOD	mg/l				0.507	Max. tolerance limit of 2 mg/l as perCPCB class A.
15	Silica	mg/l	4.417	11.917	13.473	7.642	----
16	Iron (asFe)	mg/l	0.125	0.130	0.056	0.242	0.3 mg/l Max

Source: WRIS India web site

It is observed that the pH level of water at Santeguli G&D site ranges between 6.757 and 7.150 during the period from 2014 to 2017. The pH level indicates slightly alkaline nature of the water, and the values are within the acceptable limits of 6.5 to 8.5 as per IS 10500: 2012 specified for drinking and domestic uses. The levels of dissolved oxygen in the collected samples are in the range of 6.820 mg/l and fulfill the CPCB class A minimum tolerance limit of 6 mg/l. The levels of total dissolved solids are well within the maximum acceptable limit of 500 mg/l i.e., ranging from 34.000 to 35.333 mg/l. The range of total alkalinity (as CaCO₃) is between 15.192 and 17.800 mg/l and satisfies the maximum acceptable limit of 200 mg/l. The concentration of chloride (as Cl) is in the range of 6.256 to 8.224 mg/l which is within the maximum acceptable limit of 250 mg/l for drinking water quality standards. The concentration of sulphate (as SO₄) is in the range of 2.216 to 3.592 mg/l which is within the maximum acceptable limit of 200 mg/l. The concentration of Fluoride (as F) ranges from 0.042 to 0.119 mg/l which is within the maximum permissible limit of 1.0 mg/l specified for potable water. The range of total hardness (as CaCO₃) is from 19.686 to 24.365 mg/l which is within the maximum acceptable limit of 200 mg/l specified for drinking water.

The concentration of calcium (as Ca) is also within the maximum permissible limit of 75 mg/l, ranging from 4.416 to 5.067 mg/l. Other parameters such as Magnesium, Boron, Nitrate, Silica and Iron are also within the respective acceptable limits as per IS 10500: 2012. The Biochemical Oxygen Demand (BOD) is 0.507 mg/l which is within the maximum acceptable limit of 2 mg/l as per CPCB class A tolerance limit. Though the water is suitable for drinking and domestic uses, it cannot be supplied directly without proper filtration and chlorination.

7.1.3 Sedimentation

The proposed Pattanadahalla weir catchment is mostly covered by thick forest and by rocks at fringes. As such, silt load is expected to be very small. The accumulated silt can be removed during the non-monsoon period.

7.1.4 Life of weir

The sediment trapped at Pattanadahalla weir can be removed easily during the non-monsoon period. Hence, the life of the weir is considered as 100 years.

7.1.5 Area of submergence

The submergence area of Pattanadahalla weir at full pond level will be 17.88ha which is confined to the river banks only.

7.1.6 Flood absorption

As the storage capacity of Pattanadahalla weir will be confined to the river banks only, no flood control is anticipated by the project.

7.2 Shalamalahalla weir

Shalamalahalla weir is proposed on Shalamalahalla stream, a tributary of Bedti river near Hulgol village. The latitude and longitude of the proposed weir site are 14°42'26"N and 74°48'31"E respectively with the intercepting area of 169.42 Sq.km. The river bed level at the weir site is 458.00m and the pond level of the weir will be at 468.00 m. The capacity of proposed weir at pond level is 4.32MCM. Jackwell cum pump house from the foreshore on the right side of Shalamalahalla weir with designed discharge capacity of 60.50m³/s is proposed.

7.2.1 Fixation of weirlevels

The pond level of the proposed Shalamalahallaweiris 468.00 m. The submergence area at pond level of the weir will be 88.53ha which is confined to river banks only. The top bund level of proposed weir is at 472.50 m. The proposed ogee shape weir is designed for maximum flood discharge of 1567 m³/s.

7.2.2 Water quality

The latest data pertaining to the years 2014 to 2017 on laboratory test results of water samples of Santeguli G&D site have been collected and presented in **Table 7.1**.

7.2.3 Sedimentation

The proposed Shalamalahalla weir catchment is mostly covered by thick forest and by rocks at fringes. As such, the silt load is expected to be very less. The accumulated silt can be removed during the non-monsoon period.

7.2.4 Life of weir

The sediment trapped at Shalamalahallaweir can be removed easily during the non-monsoon period. Hence, the life of the weir is considered as 100 years.

7.2.5 Area of submergence

The submergence area of Shalamalahalla weir at full pond level will be 88.53ha which is confined to the river banks only.

7.2.6 Flood absorption

As the storage capacity of Shalamalahalla weir will be confined to river banks only, no flood control is anticipated by the project.

7.3 Suremane barrage

The catchment area up to the Suremane diversion site is 2078 Sq.km. The diversion structure is to be designed for maximum flood discharge of 5639 m³/s. Since the maximum flood discharge is substantial, a barrage is proposed at Suremanedivesion site. The latitude and longitude of the proposed barrage site are 14°52' 53" N and 74°47'13" E respectively. The river bed level at the barrage site is 419.50m and the pond level of the proposed weir is 426.00 m. 4 nos. of under sluices with clear width of 7.50m each with crest level at 420 m and 9 nos. of river sluices with clear width of 12m each with crest level at 421 m are proposed. Also, the jackwell cum pump house from the foreshore on the left side of the barrage with designed discharge capacity of 76.40 m³/sec is proposed.

7.3.1 Fixation of storage and barrage levels

The pond level of the proposed Suremanebarrage is 426.00 m. The submergence area at FRL of the barrage will be 54.38ha which is confined to banks of the river only. Maximum water level will be at 429.44 m. Radial

gates are proposed to the river sluices of size 12m x 5m. The capacity of proposed barrage at pond level is 2.71MCM.

7.3.2 Water quality

The latest data pertaining to the years 2014 to 2017 on laboratory test results of water samples of Santeguli G&D site have been collected and presented in **Table 7.1**.

7.3.3 Sedimentation

The proposed Suremanebarrage submergence area is mostly covered by thick forest and by rocks at fringes. As such, silt load is expected to be less in comparison to other basins entirely with the open catchment. The under sluice will be provided for removal of silt accumulation.

A sediment inflow rate of 398.61m³/Sq.km/year of catchment as proposed by KPCL has been considered in the Bedti basin. The calculated annual silt accumulation comes out to be 828312m³ which will be passed through the proposed under sluice easily.

7.3.4 Life of barrage

The sediment trapped at Suremane barrage can be flushed through the under sluice provided. Hence, life of the barrage is considered as 100 years.

7.3.5 Area of submergence

The submergence area of Suremane barrage at full pond level will be 54.38ha which will be confined to the river banks only.

7.3.6 Flood absorption / barrage operation policy

As the storage capacity of Suremane barrage will be confined to the river banks only, no flood control is anticipated by the project.

7.4 Land acquisition-property submerged-rehabilitation

The submergence area is confined only to the river banks at all the three diversion sites and hence there are no issues of land submergence and resettlement & rehabilitation.

The salient features of the Suremane barrage and Pattanadahalla and Shalamalahalla weirs are presented in **Annexure: 7.1**.

7.5 Effect of the link project on the life of Tungabhadra reservoir

The existing Tungabhadra reservoir on river Tungabhadra have accumulated silt from its own catchment and there is reduction in its capacity to that extent. However the silt from the transferred water will be negligible as the transfer is by lift and the water proposed to be transferred is allowed to settle in small reservoirs before reaching Tungabhadra reservoir. However, It is essential to look into the sufficiency of the reservoir to accommodate the transferred water.

7.6 Capacities and sufficiency of the balancing reservoirs

The Bedti - Varada link project is envisaged to divert about 524 MCM of Bedti water to Tungabhadra project through two components of link. The entire quantity will reach Tungabhadra reservoir as no enroute irrigation is

proposed. Hence, it is necessary to verify the sufficiency of storage with the available average ten daily storage data provided by Central Water Commission (CWC) for the past ten years vis-a-vis the link discharges into the reservoir. The details are furnished in **Annexure 7.2**.

The space available on ten daily basis in Tungabhadra reservoir after addition of water through the link canal is shown in **Fig 7.1**. This is just indicative and the detailed simulation has been described in **Chapter-5 “Hydrology & Water Assessment”**.

