

# **Chapter 4**

## **Surveys and investigations**

### **4.1 General**

The alignment of the Krishna (Almatti) – Pennar link canal presented in this report is the result of various alternative alignments studied during toposheet study and pre-feasibility study stages. Subsequently, survey and investigations of the alignment finally selected have been carried out in order to study the technical and economical viability of this proposed project. Details of these field surveys and investigations are presented in the following sections.

### **4.2 Topographical Surveys**

#### **4.2.1 Canal and Canal Structures**

The centerline of the link canal marked on the toposheets of scale 1:50000 at the pre-feasibility study stage were transferred to the ground with the help of village maps of the respective areas. Temporary benchmarks (TBM) were established along the canal alignment by connecting these points to the nearest GTS benchmarks. By using these TBMs, levels were taken at 100 m interval along the canal alignment by double leveling for preparing the longitudinal section of the canal alignment. These levels were checked for their accuracy by cross connecting with other GTS benchmarks that are available in the vicinity. Cross sections were taken at 400 m interval along the alignment by single leveling with levels at 100 m interval along the cross sections extending up to 200 m on either side of the alignment. Wherever appreciable change in topography was noticed along the alignment, levels were taken at closer intervals.

Block leveling was carried out at the places where the canal crosses natural streams and other man-made structures like, roads, railway lines etc. Levels were taken at 50 m grid interval covering 300 m on either side of the centerline of the link canal. In case of river/stream crossings, levels were taken to a distance of 100 m from the firm banks on either side of the streams.

#### **4.2.2 Reservoir Survey**

The present proposal envisages using the Almatti dam as off take point. This dam is already constructed and hence separate reservoir survey has not been done. The link canal crosses the Pennar River at Kalvapalli village. At this crossing, Kalvapalli dam is proposed. Survey of the Kalvapalli reservoir has been carried out by taking block levels. The area of submergence of Kalvapalli reservoir at its FRL of 475.0 m is 1323 ha. The corresponding gross storage capacity is 83 Mm<sup>3</sup>.

#### **4.2.3 Tunnel and Adits Survey**

Block leveling at 50 m interval was carried out for the proposed five tunnels along the alignment 500 m on either side of the centerline of the tunnel alignments and up to its full length and extending up to 300 m before entry and after exit points.

#### **4.3 Archaeological Surveys**

There are no structures or monuments of archaeological importance in the entire length of link canal or in the submergence area of proposed reservoir at Kalvapalli.

#### **4.4 Mineral Surveys**

There are no mineral deposits available in the canal alignment and command area.

#### **4.5 Communication Surveys**

Entire command area under the link canal is well served by a wide network of existing NH-7 and NH-13, State Highways, District roads, Zilla Parishad roads, etc., connecting almost all the villages. National Highway No.13 and broad-gauge main lines of South Central Railway connecting Wadi - Guntakal - Tirupati run through the command area. The meter gauge line connecting Bijapur and Gadag pass through Almatti village. There is a wide network of telephone lines in the area providing good communication facilities.

## **4.6 Drainage Surveys**

No detailed surveys for identification of the extent of drainage facilities to be provided in the command area are conducted so far. It is generally observed that the proposed command area is well drained by various rivers/streams like Malaprabha, Tungabhadra, Pedda Hagari (Vedavathi), Chinna Hagari, Muskinalla, Narihalla, Hirehalla, etc., and as such, no serious drainage problems are anticipated in this area on implementation of this project. However, enough provision is made in the estimate for providing new drainage facilities such as field drains and channels to connect the area to the natural drains and for improving the existing drainage facilities. Sample drainage survey will have to be taken up at a later stage of project development.

## **4.7 Construction Material Investigation**

### **4.7.1 Fine and Coarse Aggregate**

Central Soil and Material Research Station (CSMRS) has engaged for carrying out construction material survey. 11 rock quarries and 10 river sand quarries were identified by NWDA for the supply of coarse and fine aggregate for the Project. 14 samples from the rock quarries and 12 samples from sand quarries were collected by CSMRS and analysed.

### **4.7.2 Bricks**

Brick manufacturing units are not available in the vicinity of canal alignment and major CD works locations. Bricks of good quality are reported to be available in the vicinity of command area of the project and at nearby towns such as Hospet, Almatti, Bellary, Anantapur and Dharmavaram.

### **4.7.3 Cement and Steel**

Cement and steel can be received at the nearest railheads and can be transported to stores/stock yards to be established near work sites.

### **4.7.4 Soils for Embankments**

The soils from canal excavation wherever suitable are proposed to be made use of during the construction of embankments. Additional quantity of 61.355 Mm<sup>3</sup> earth is proposed to be taken from borrow areas along the alignment. Borrow area survey was entrusted to CSMRS.

## **4.8 Hydrological and Meteorological Investigations**

The Krishna basin, being one of the important river systems in peninsular India possesses adequate network of rain gauge stations, river gauging sites and also a number of IMD observatories.

## **4.9 Soil Surveys in Command Area**

No field soil survey was carried out in the command area. From the available soil maps prepared by National Bureau of Soil Survey and Land Use Planning, it is found that gravelly clay soils, gravelly loam soils, clay soils, calcareous soils, loamy soils are the predominant soils available in the command area.

## **4.10 Geo-technical and Geophysical Investigations along the Canal Alignment**

Geological investigation was carried out by Geological Survey of India at various appurtenant structures of the projects i.e., five tunnels and three C.D. works across Malaprabha, Chinna Hagari and Vedavathi and proposed dam site at Kalvapalli. Drilling of 27 boreholes in all for these major structures was suggested by Geological Survey of India. For each tunnel, three boreholes were recommended, one at the centre and the other two at entry and exit points. Similarly, three holes were recommended for each major CD work, one at the centre of the river and the other two at the banks. Accordingly, drilling was carried out through Central Water Commission. Tunnel at No.1, which is at RD 0.70 km from the off take at Almatti dam, passes through the lower Kaladgi quartzite underlain by the basement granite gneiss. The other 4 tunnels are passing through massive granites. In the case of three major river crossings across Malaprabha, Chinna Hagari and Vedavathi, where aqueducts are planned, closepet granite as well as green schist / metabasalt, green schist / metabasalt and closepet granite respectively, form the foundation. In the case of Kalvapalli dam, granite gneiss with lenses of amphibolite intruded by dolerite would be a foundation medium. In situ permeability tests and standard penetration tests were carried out in the drill holes by CSMRS. Logging of core samples extracted from the boreholes was done by Geological Survey of India. In order to ascertain the sub-surface strata all along the canal alignment, trial pits were excavated wherever the canal bed is within 3 m from the natural ground. Soil samples collected from the trial pits were tested by

CSMRS in their laboratory. In other reaches, where the canal bed is more than 3 m below the natural ground, geological investigations with electrical resistivity method were carried out through Government College of Engineering, Pune University, Pune.

#### **4.11 Environmental, Ecological and Socio-economic Surveys**

To ensure environmental, ecological and socio-economic feasibility of the proposed project, the NWDA engaged the Consulting Engineering Services (India) Private Limited (CES), New Delhi to conduct the environmental, ecological and socio-economic studies in respect of the proposed link canal. To fulfill these requirements, CES carried out the following tasks:

- i) Collection of baseline information regarding environmental, ecological and socio-economics aspects.
- ii) Assessment of likely environmental and ecological impacts related to project location, design, structure and operation of the proposed link canal.
- iii) Assessment of socio-economic conditions of the people along the canal alignment as well as the command area of the project.
- iv) Formulation of Environmental Management Plan (EMP), mitigation measures and post project environmental monitoring programme for implementation.
- v) Formulation of Resettlement and Rehabilitation (R&R) Plan for the Project Affected Persons (PAPs).
- vi) Preparation and communication of Interim, Draft and Final Reports on the above mentioned studies.

Details of the survey conducted as well as data collected for primary and secondary sources, impacts on environmental, ecological and socio-economic components are given in Chapter on "Environmental & Ecological Aspects".