Chapter 8
Water and Irrigation Planning

8.1 General

The proposed Krishna (Nagarjunasagar) - Pennar (Somasila) link canal and the existing Nagarjunasagar Right Bank Canal (NSRBC), both taking-off from the Nagarjunasagar reservoir with full supply level of 151.665 m, together divert a total quantity of 12146 Mm^3 of water annually. The designed utilisation of the existing Nagarjunasagar Right Bank Canal (NSRBC) is 3979 Mm^3, out of which the requirement to the extent of 1623 Mm^3 of the part command of NSRBC is proposed to be met from the waters diverted through the Inchampalli - Pulichintala link canal. The remaining requirement of 2356 Mm^3 is proposed to be met from the diverted water of 12146 Mm^3 as above from the Nagarjunasagar reservoir. Thus the effective diversion through the link works out to 9790 Mm^3 (12146 – 2356 Mm^3).

8.2 Water planning

The total diverted water of 12146 Mm^3 from the Nagarjunasagar cumulatively through the Nagarjunasagar - Somasila link and existing NSRBC is proposed to be utilised as follows:

Unit: Mm^3

1	Requirement of the part command of the existing NSRBC	2356
2	Enroute transmission losses	332
3	Irrigation requirement of the newly proposed command area enroute the Nagarjunasagar - Somasila link in the basin area covered by streams between Gundlakamma and Pennar	908
4	Domestic and industrial requirement in newly proposed command area	124
5	Transfer to Somasila reservoir for use in Pennar and further diversion to southern basins beyond Pennar	8426
	Total	12146

The details of working of the above demands are discussed in the following sections:

8.3 Part command of the existing NSRBC

The requirement of the part command area of the existing NSRBC is proposed to be met from the diverted waters from the Nagarjunasagar and the requirement of the remaining command area of the NSRBC is to be met through the Inchampalli – Pulichintala link.

The extent of the command area of the existing NSRBC proposed to be provided with irrigation from the diverted waters from Nagarjunasagar is 295238 ha. Adopting the net delta of 0.57 m worked out by climatological approach considering the designed cropping pattern of NSRBC and annual intensity of irrigation as 140%, the annual water utilisation of this part command area works out to 2356 Mm^3.

8.4 Transmission losses

The transmission or conveyance losses i.e. the amount of water lost through evaporation and seepage in the link canal during its course from the Nagarjunasagar reservoir to the Somasila reservoir, have been estimated month-wise considering 0.60 cumec per million square metre of wetted area of the canal as per Bureau of Indian Standard Code and the annual losses on this count work out to 332 Mm^3.

8.5 Existing Irrigation in the proposed command area

The link canal in its course from Nagarjunasagar to Somasila passes through the basin area covered by the streams between Gundlakamma and Pennar, where the existing irrigation facilities are minimal and hence it is proposed to provide irrigation to these areas, falling in the Prakasam and Nellore districts of Andhra Pradesh through the link canal.

The gross command area which could be provided with enroute irrigation has been identified to be 376067 ha excluding land covered by water.

8.5.1 Existing irrigation facilities in the command area

The existing irrigation in the proposed command is about 17% of the gross cropped area, indicating that the agriculture in the area is mainly rain-fed. The existing sources of irrigation are mainly tanks and wells. There are about 8000 dug wells, 550 tube wells and 290 tanks and kuntas in the proposed command area. Out of the total area presently being irrigated, 39% is by wells, 34% by tanks, 19% by canals and the rest is by other sources.

The source-wise irrigation in the proposed command area during the year 1993-94 as assessed from Mandal-wise statistics are presented in Table 8.1.

Table 8.1
Source-wise irrigation in the proposed command area during year 1993-94

Unit: ha

Sl. No.	District	Area irrigated by				Total
		Canals	Tanks	Wells	Other sources	
1.	Prakasam					
	Kharif	-	2272	7162	1268	10702
	Rabi	7418	10908	8455	1369	28150
	Annual	7418	13180	15617	2637	38852
2.	Nellore					
	Kharif	9	264	1036	6	1315
	Rabi	1346	1984	746	777	4853
	Annual	1355	2248	1782	783	6168
	Total					
	Kharif	9	2536	8198	1274	12017
	Rabi	8764	12892	9201	2146	33003
	Annual	8773	15428	17399	3420	45020

There are four existing medium irrigation projects namely Paleru - Bitragunta project, Mopad reservoir, Rallapadu reservoir and Nakkalagandi project with a total designed annual irrigation of 13116 ha and designed annual utilisation of 182 Mm^3. Thus the existing irrigation facilities in the proposed command area are very meagre.

8.5.2 Current agriculture scenario and existing cropping pattern

The total area available for cultivation in the proposed command area as estimated by the National Remote Sensing Agency (NRSA) from remotely sensed satellite data is 230808 ha. The net sown area is 205697 ha, of which 55298 ha is cultivated during both Kharif and Rabi seasons, 143151 ha exclusively in Kharif and 7248 ha in Rabi season.

The principal crops grown in the area are red gram, jowar, groundnut, bajra, paddy and oil seeds during the Kharif season and paddy, tobacco, groundnut and chillies during the Rabi season. Paddy, tobacco

and pulses are the main crops each being cultivated in about 20% of the net sown area in the proposed command.

8.6 Proposed irrigation in the command area

8.6.1 Soil and land irrigability classification

The entire proposed command area was assessed for irrigability classification by NRSA making use of the thematic maps generated by them from the remotely sensed satellite data of the area. The land irrigability classification details of the proposed command area based on the characteristics of both soils and lands available in the area as per the report prepared by NRSA are as follows:

1	Area of land with moderate limitations for sustained use under irrigation	2.03 lakh ha
2	Area of land with severe to very severe limitations for sustained use under irrigation	1.43 lakh ha
3	Area not suitable for sustained use under irrigation temporarily or other wise	0.30 lakh ha
	Total	3.76 lakh ha

The area under item 1 above i.e. 2.03 lakh ha of the command area is considered to be the possible command area, which could be provided with irrigation. Out of this area, 34983 ha is occupied by forest, scrubs and barren land. Thus the net culturable area available for irrigation is 168017 ha.

8.6.2 Layout of branch canals / distributaries and their commands

The 1: 25000 scale toposheets with contours at 5 m interval of the command area prepared and supplied by the Survey of India were used for the purpose. Considering the information on ground elevation available on these maps, the branch canals network was drawn with the branch canals/distributaries running mostly along the ridges between the local streams, with their commands on both the sides extending upto the streams, which in turn form the exterior boundaries of the command under each of the branches. The layout of the branch canals/distributaries so finalised was then transposed to the land irrigability maps of the same area in 1:50000 scale prepared and supplied by the NRSA. The irrigable area under each of the branch canals was then measured by planimeter on the NRSA maps. The areas under each of the branches so measured were adjusted to match with the gross irrigable area of 2.03 lakh ha (given by NRSA) in the entire

command area, so as to finally arrive at the branch-wise irrigable areas. After deducting the forest, scrub and barren land, the net irrigable area is determined to be 168017 ha.

In all, the total command area is divided into 8 branch canals and branch-wise net irrigable areas are given in Table 8.2.

Table 8.2
Branch canals with their irrigable areas in the command

Name of the branch canal	**Irrigable area (ha) (CCA)**
Mangapuram	9997
Kellampally	24614
Kuchipudi	35302
Kanigiri	17268
Chundi	73943
Pamur	1891
Varikuntapadu	2173
Narravada	2829
Total	**168017**

8.6.3 Suggested cropping pattern

The cropping pattern suggested for future minor projects in the preliminary water balance study report of the basin area covered by the streams between Gundlakamma and Pennar prepared by NWDA has been adopted without any change for the proposed command area under the link canal. This cropping pattern has been suggested taking into account the soils available in the basin area and prevailing agricultural/irrigation practices. The intensity of irrigation is considered as 100%. The proposed cropping pattern for irrigation of the command area enroute the link canal is given in Table 8.3.

Table 8.3
Proposed cropping pattern for irrigation under the link canal

Crops	% of CCA
Kharif	
Paddy	15
Jowar	10
Bajra	4
Cotton	9
Fodder	4
Chillies	4
Tobacco	4
Groundnut	5
Pulses	5
Rabi	
Paddy	10
Jowar	10
Groundnut	10
Pulses	5
Fodder	5
Total	**100**

8.6.4 Crop water requirement

The crop water requirement has been computed using climatological approach. There are three IMD observatories at Ongole, Cuddapah and Nellore around the proposed command area. Normal monthly values of potential evapotranspiration and rainfall of all the three observatories are available in the IMD publication. These have been used in computing the net irrigation requirements of different crops as per the suggested cropping pattern. The gross irrigation requirements of the crops have been worked out considering an irrigation efficiency of 70% for the crops as under minor schemes except paddy for which 80% is considered. Considering the extent of irrigable areas under each of the 8 branch canals and crop wise delta, the month-wise and branch-wise water requirements are computed. The annual water requirement for enroute irrigation is estimated to be 908 Mm^3.

8.7 Domestic and industrial requirements of the proposed command area

The requirement of water for domestic consumption in the rural and urban areas and for livestock has been computed by projecting the rural and urban human population and livestock of the proposed command area and to the towns (urban) situated outside the command area to the right side of the link canal alignment, within a distance of 20 km and not involving lifts more than 100 m from link, to 2050 AD by considering the per capita daily requirement of 70, 200 and 50 litres for the rural, urban and livestock population respectively.

The rural and urban population of the command area for the year 1991 have been estimated on proportionate area basis from the mandal-wise census data of 1991. The total population of the command area in 1991 (including the population on the right side of canal upto a distance of 20 km whose domestic need were considered from the link) was 7.02 lakh and has been projected to 2050 AD using compound growth rates as suggested by UNO in their 1994 publication. Out of the total projected population, 60.7% is urban population and remaining as rural population.

The existing urban population is deducted from the projected urban population presuming that its domestic requirement is already being met by existing sources and only the remaining urban population is considered for working out the urban domestic requirement to be provided by the link canal.

The total livestock in the command area as estimated on proportionate area basis from census data of 1987 is 1.91 lakh and it was projected to 2050 AD assuming an annual compound growth rate of 1%.

The water requirement for the entire urban and 50% of the rural population is proposed to be met from the surface water resources, which work out to 55 Mm^3.

In the absence of relevant data to estimate the industrial water needs, the industrial requirement has been assumed to be the same as the domestic water requirement, which works out to 69 Mm^3. Thus the total domestic and industrial water requirement of the enroute area to be supplied from the Nagarjunasagar – Somasila link canal is estimated to be 124 Mm^3.

8.8 Transfer to the Somasila reservoir

In addition to meeting the enroute irrigation and domestic requirements, the link canal is proposed to transfer 8426 Mm^3 of water to the Somasila reservoir in the Pennar basin. As per the water balance study report of the Pennar delta sub-basin, there will be a surface water deficit of 1453 Mm^3 at 75% dependability in this sub-basin. As such at the ultimate stage, the Somasila reservoir may not be able to meet fully the needs of the project along with those of the Pennar delta. It is proposed to make up fully the deficit of 1453 Mm^3 of the Pennar delta sub-basin from 8426 Mm^3 of water proposed to be transferred to the Somasila reservoir through the Nagarjunasagar – Somasila link. The balance transferred water and the water transferred from Srisailam - Pennar link would be used for providing assured irrigation to the command under Kandaleru - Poondi canal, domestic water supply to Chennai city, domestic and irrigation requirements of enroute command area under the Pennar (Somasila) - Cauvery (Grand anicut) link and for further transfer to Cauvery and beyond for utilisation in these river basins.

The monthly distribution of the diversions of water from Nagarjunasagar to Somasila have been decided duly considering simulation studies for the Somasila reservoir as available in the Preliminary Feasibility Report of the Somasila - Grand Anicut Link and also the possible monthly diversions through the Nagarjunasagar - Somasila link on simulation of the Nagarjunasagar reservoir. With the monthly diversion pattern so derived and by transfer of water to Somasila reservoir through the N-S link, it could be expected that all the demands of the Pennar delta, Somasila project and other demands as planned under Somasila - Grand anicut link would be met with the required rate of success. This is because the quantum of transfer of water to Somasila and its monthly distribution pattern are more or less the same as those considered for the simulation of Somasila reservoir in the Pre feasibility report of Somasila - Grand anicut link.

8.9 Month-wise distribution pattern of water for various demands from N-S link

The month-wise distribution pattern of various demands from the Nagarjunasagar - Somasila link is shown in Table 8.4.

Table 8.4

Month-wise distribution pattern of water for various demands from the link (excluding demand for part command of existing NSRBC)

Unit: Mm^3

Month	Proposed command		Transmi-ssion loss	Diversion to Somasila	Total
	Irrigation Use	Domestic and Industrial uses			
Jun.	39	10	4	-	53
Jul.	161	11	46	1183	1401
Aug.	157	11	51	1183	1402
Sep.	102	11	47	1196	1356
Oct.	18	11	38	1058	1125
Nov.	67	10	27	716	820
Dec.	92	10	40	1039	1181
Jan.	95	10	36	909	1050
Feb.	77	10	27	734	848
Mar.	61	10	14	408	493
Apr.	39	10	2	-	51
May	-	10	-	-	10
Total	908	124	332	8426	9790