

Chapter 12

Environmental and Ecological Aspects

12.1 General

Survival of the mankind, with its alarming increase in population growth is linked in the long term, requires a stable eco-system and increase in food production, for which the development of water resources is unavoidable. The development of water resources project is linked with change in the environment of the area due to construction of reservoirs because of submergence of land, displacement of population including the flora and fauna and resettlement in the surrounding catchment, denudation of forest, water logging, salinity and alkalinity of soil, water quality and ground water table change, etc.

The environment and ecology is degraded by both inappropriate and lack of development. In respect of disturbance of environment, there are two schools of thoughts. One school holds that eco-system is fragile and highly unstable. It is implicit, therefore, that eco-system should be left as much as possible in its natural state and that its diversity should be preserved at any cost. Modification for the purpose of development should be minimal and confine to the range of tolerance limits of various elements of eco-system. The second school of thoughts assuring that the eco-system is globally stable and there is large element of built in resilience in eco-system. In any case, it is realized that the water resources projects should be planned to be aimed for the sustainable developments of the inter-connected elements that co-exist in the system.

Water resources development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs will alone be considered as a sustainable development. It is, therefore, realized that the water resources projects should be planned, implemented and managed in such a way that the future demands of the growing population have to be met with minimum disturbance to the existing eco-system along with the incorporation of adequate control measures at appropriate stages to mitigate the adverse effects, if any; to maintain the sustainability of the system, in long run.

12.2 Environmental and Ecological Aspects of Inchampalli Reservoir

12.2.1 Submergence by the Inchampalli Reservoir

12.2.1.1 Area of Submergence

The Inchampalli Joint Project when formed will submerge areas in the states of Andhra Pradesh, Maharashtra and Chhattisgarh. The reservoir stretches in the upstream of the dam for about 100 km. The submergence area in the three states is about 94620 ha with 36875 ha in Andhra Pradesh, 24131 ha in Maharashtra and 33614 ha in Chhattisgarh. The submergence area consists of 31.9 % as forests, 38.3 % cultivable lands, 23.3 % open water bodies, 5.8 % shrubs, fallow, rock outcrops and grazing lands and other uses of land being 0.7 %. The river portion of the submergence area namely Godavari and Indravati is 21820 ha. The cultivable land is mostly agricultural land sown by rain-fed crops like jowar and dry paddy. The details of submergence area are given in Table 12.1.

Table 12.1
Details of submergence

Area: ha

SI No	Particulars	Andhra Pradesh	Mahara-shtra	Chhattis-garh	Total	Percent-age
1.	Total submergence area	36875	24131	33614	94620	100
2.	Forest land	9024	14392	6754	30170	31.9
3.	Cultivable lands	15296	5769	15146	36211	38.3
4.	Shrubs, fallows & rock out crop	3744	1263	513	5520	5.8
5.	Open water-bodies	8718	1901	11201	21820	23.3
6.	Other uses	93	806	-	899	0.7

Source: Inchampalli Joint Project Report of Government of Andhra Pradesh-Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

12.2.1.2 Villages and Population

The density of population in the submergence area is about 137 persons per km² whereas it is about 100 persons in the command area and about 113 persons in the catchment area. The details of the villages coming under submergence and the population affected are given in Table 12.2.

Table 12.2
Details of Villages Coming under Submergence and Population Affected

S.No.	Name of the State	No. of villages	Population to be affected
1.	Andhra Pradesh	65	38815
2	Maharashtra	100	43186
3	Chhattisgarh	64	18079
	Total	229	100080

Source:Inchampalli Joint Project Report of Government of Andhra Pradesh-Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

The break-up of the population in the affected areas to be rehabilitated is given in Table 12.3.

Table 12.3
Details of Break-up of Population Affected

Sl. No.	Particulars	Andhra Pradesh	Chhattisgarh	Maharashtra	Total
1	Scheduled caste	11853	1995	9931	23779
2	Scheduled tribe	5272	11739	7168	24179
3	Others	21690	4345	26087	52122
	Total	38815	18079	43186	100080

Source:Inchampalli Joint Project Report of Government of Andhra Pradesh -Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

The scheduled caste and scheduled tribe population percentages in the submergence area is 23.8 % and 24.2 % respectively.

The occupation of the population in the affected areas to be rehabilitated is given in Table 12.4.

Table 12.4
Details of Occupation of Population Affected

Sl. No.	Particulars	Andhra Pradesh	Chhattis-garh	Mahara-shtra	Total
1	Agricultural	10857	6049	9070	25976
2	Industrial	381	-	1730	2111
3	Labour	5557	2622	17706	25885
4	Marginal	847	769	6050	7666
5	Forest based	1032	-	-	1032
	Total	18674	9440	34556	62670

Source: Inchampalli Joint Project Report of Government of Andhra Pradesh-Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

The land holding particulars of cultivators are as given in Table 12.5.

Table 12.5
Details of Cultivators' Land Holding

S. No	Particulars	Andhra Pradesh	Chhattis-garh	Mahara-shtra	Total
1	Below 1 ha	2545	1528	8163	12236
2	1 to 2 ha	1348	1363	635	3346
3	2 ha and above	1847	825	272	2944

Source: Inchampalli Joint Project Report of Government of Andhra Pradesh-Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

The estimated strength of the labour required for the project and its availability from the affected areas are given in Table 12.6.

Table 12.6
Details of Labour Required and Their Availability

Particulars	Andhra Pradesh	Chhattis-garh	Mahara-shtra	Total
Estimated peak labour strength	28000	14000	28000	70000
Skilled	1400	700	1400	3500
Un-skilled	26600	13300	26600	66500
Labour to be recruited from affected population	15400	5900	22100	43400
Skilled	1400	700	1400	3500
Un-skilled	14000	5200	20700	39900

Source: Inchampalli Joint Project Report of Government of Andhra Pradesh-Report on Environmental and Ecological Aspects of Inchampalli Joint Project- Statistical Data Volume-I.

About 90 % of the population-affected are backward and forest based and they can be engaged in the project construction work. The project will give adequate employment opportunity during construction as well as during operation stage to oustees and local population.

12.2.1.3 Resettlement

For re-settlement of the affected population in Andhra Pradesh, a rehabilitation committee will be constituted after the sanction of the project. Compensation will be paid either in cash or land as per request and as per the norms of the State Government communicated from time to time. As regards the re-settlement of affected people 500 to 600 numbers of persons can be settled in the existing villages and 2500 to 3000 families in new settlements. The plan of the rehabilitation centres will be prepared after the sanction of the project with the maximum distance of new settlements being kept at 20 km from the present habitation. New model villages will be constructed providing basic amenities such as drinking water, access roads, schooling facilities, electrical lights, post offices, banks, panchayat ghar, health centres, police station etc to its inhabitants.

In Chhattisgarh, a rehabilitation committee for resettlement of the affected population will be formed after the sanction of the project. About 3335 families will likely to be settled in new settlements. The size of the proposed settlements, layout plan and site for rehabilitation will be decided after the constitution of the committee.

In Maharashtra, various concessions are granted to the project affected persons such as financial assistance for transfer of personal effects, exemption from stamp duty in respect of plots allotted to them, permission to cultivate in the submergence land till they are actually submerged, use of quarry material from forest land as well as from non-forest land with permit issued by Divisional Forest Officer or Local Revenue Officer for construction of their own houses and / or agricultural uses, preferential treatment in the matter of appointment to posts in government offices and in state owned industries, priority and assistance in gaining admission to the Industrial Training Schools and sanction of housing loans with subsidized rate of interest etc. Suitable provision for the resettlement has been made in the Inchampalli project estimate.

12.2.1.4 Compensatory Afforestation

The total submergence of forest land in all the three states is 30170 ha. The land to be acquired for colony, construction of roads etc., for the Inchampalli project is also of forest land which is about 300 ha. To ameliorate adverse impact of loss of forest, it is proposed to provide compensatory afforestation around the periphery of reservoir in consultation and association with the concerned state forest departments. Andhra Pradesh has drawn up proposals for compensatory afforestation for 9024 ha equivalent to the submergence area in Andhra Pradesh. The submergence of forest land in Maharashtra is 14392 ha and a scheme for compensatory afforestation will be drawn up and executed by the forest department as per their normal activities. An extent of 6754 ha forest land will be submerged in Chhattisgarh and compensatory afforestation will have to be drawn to this extent.

12.2.1.5 Development of Aquatic Life

In Andhra Pradesh portion of the submergence area, crocodile breeding grounds are very rare in existence. There are a few fish breeding grounds in the submergence area as well as in the river and its tributaries in the Chhattisgarh portion of the submergence area. As far as Maharashtra is concerned there are no known fish breeding or crocodile breeding grounds.

Creation of the reservoir will increase the fish production and development of pisciculture in the region. The reservoir will be used for fisheries development, both culture as well as breeding. The reservoir will be suitable for fish culture being perennial water source, fish will breed in the shallow upper reaches of the reservoir.

Many families will get jobs in the fisheries which will also reduce the resettlement problem.

12.2.1.6 Loss of Minerals and Commercial Timber

No potential coal bearing area will be under submergence due to construction of the dam with a maximum water level and full reservoir level, if placed at 112.77 m. There are no economic mineral occurrences. Mixed forest area of about 9024 ha with 10 to 30 % teak wood will come under submergence.

It appears that no important mineral of importance comes under submergence in the reservoir area in Andhra Pradesh. However, a few Limestone/Dolomite bands of Pakhals and Kotas lying between Bhopalapatnam and Sironcha are depicted in the available geological map of Maharashtra.

The Maharashtra Government has reported that the area which come under submergence is comprises of timber yielding species like Terminals, Tomentosa, Dalbergia, Peniculata, Gimelenn, Arborea, Desisoo etc., and hence the commercial timber yielding variety will be lost by the operation of the project.

The loss of minerals and commercial timber coming in the submergence area of Chhattisgarh has not been estimated so far by the concerned departments.

12.2.1.7 Flora and Fauna at Proposed Inchampalli Project Site

The forest type in the submergence area of Andhra Pradesh is a mixed forest with II to IV quality and density 0.4 to 0.6. The forests in Maharashtra are dry deciduous type thickly wooded and dense. In Chhattisgarh, forest portion contains 47.50 % teak and the remaining 52.5 % is of miscellaneous type. Teak, Ain, Garedi, Khair, Bhura, Bija, Semal, and Karam are the generally found varieties.

The proposed site for Inchampalli project contains a number of wild life habitats. The Singaram sanctuary will be directly affected, as a major part of the sanctuary will be inundated following the construction of the dam. In addition, there are a number of sanctuaries situated in the Adilabad and the Karimnagar districts viz., Pranahita sanctuary and Kawal wild life sanctuary are also likely to be affected by the proposed construction. The proposed dam site for Inchampalli project is the feeding area of a number of wild animals but at present no precise information as to whether the area falls under the migration route of any birds or other animals, is available. 65 ha of Indravati National park in Chhattisgarh fall under the proposed project site. The details of animals and birds found in proposed dam site area is given in Table 12.7.

Table 12.7
List of Fauna and Birds Found in the Proposed Dam Site

Particulars	Andhra Pradesh	Chhattisgarh	Maharashtra
Fauna	Leopard, Jackal, Small Indian Civet, Plan civet, Wild bear, Chital, Sambar, Black Buck, Nilgai, Rhesus Macaques	Wild buffalow, Bison, Barasingha Tiger, Panther, Wild Bear, Bear, Nilgai, Sambar, Chital	Panther, Tigers, Pancories, Tanes, Panthe Pardus, Black buck
Birds	Kostrel, Red Kuaded Marlin, Peregrime Falcon, Shikra, Peafowal, Great Indian Horonbill	Portrige, Pegion, Pheasant, Dover etc	Peafowl, Junglefowl, Sandgrouse, Wood-pecker

So far no rare or endangered species is reported from the project-affected area of Andhra Pradesh and Maharashtra. The wild buffalow and the Barasingha are the endangered species of fauna that is found in the Chhattisgarh portion of the area.

12.2.1.8 Seismicity of the Area

The Godavari river valley in this part of the country is within the NW- SE trending faults. These faults still show moderate seismicity occasionally. The Godavari graben area is in seismic Zone III of the seismic zoning map of BIS. In this zone an earthwork of magnitude 6 or intensity VIII may be expected. The earthquake was of magnitude 5.3 at Badrachalam in 1969.

The earthquakes are known to be triggered by reservoir loading in areas of moderate seismicity. However, magnitude of the triggered earthquake is not anticipated to exceed the magnitude of the largest earthquake expected in the area. In the present case, earthquake may be triggered after reservoir loading and the largest expected earthquake in the area will be in the magnitude of 6.

12.3 Environmental and Ecological Aspects of Nagarjunasagar Reservoir

The existing Nagarjunasagar reservoir on river Krishna is proposed to be utilized as the tail end reservoir for the link project. No additional storage is proposed to be created in the Nagarjunasagar reservoir for the purpose of the link project and the reservoir will be used without any change in its capacity. Hence, there would be no adverse impacts connected to the building-up of storages such as those on the ecological balance, hydrological regime, submergence of forests and other areas, rehabilitation and resettlement of affected population etc. The minimum draw down level for Nagarjunasagar reservoir has already been fixed duly considering the possibility of sedimentation and no extra siltation is expected due to the link project. The Nagarjunasagar project has been commissioned long back and no reservoir induced seismic activity is observed in the vicinity of this project.

12.4 Impact of the Link Canal

Major impact of the link canal could be on account of land acquisition for construction of the main and lead canals, rehabilitation and resettlement of the affected population in the affected villages, environmental impact due to formation of canal water body and introduction of irrigation in the command area enroute the link canal; these are discussed in the subsequent paragraphs.

12.4.1 Land Acquisition

A total land of 11679.60 ha needs to be acquired, of which 7483.00 ha will be for main canal, lead canal and borrow areas, 14.60 ha for rehabilitation colonies, 34.00 ha for offices and staff colonies, 30.00 ha for pump houses and 5.00 ha for power house. Out of the total land to be acquired as above, 6833.60 ha is patta land, 4774.00 ha is forest land and 72.00 ha is government land other than forest.

12.4.1.1 Forest Land

The proposed link canal passes through the following reserved forests viz. Singaram, Tadcherla, Mulug, Nayakpalli and Nelical forests. About 4774.00 ha of forest land is to be acquired for the construction of canal. Out of this area, 4113.00 ha will be submerged due to the formation of intermediate reservoirs at Peddavagu and Tummalagutta. Generally

these forests are dry deciduous. Teak is the most valuable forest produce in this area. The other forest produce is Bamboo, Anduk, Nallamadi and Satin type. Compensatory afforestation as per the norms, is to be taken-up in consultation with the Department of Forests, in the degraded forest lands and other waste lands available nearby the affected forestland. In addition to this, spoil banks of the link canal are proposed to be used for social forestry. Suitable provision for the cost of afforestation is made in the estimate for the construction of the link project.

12.4.1.2 Flora and Fauna

There are no endangered species in the link project area. The trees that are commonly seen in this region are Teak, Maddi, Tirman, Anduk, Anbus or Tuniki, Soppera, Tapsi, Soppera, Gumpena, Bojja, Satin or Billudi, Bijasal, Chinnangi, Usirikai, Somi, Tani, Karka and Sundra etc. The mammals that are generally found in this region are Buffalo, Goat, Cow, Dog, Horse, Domestic cat, Squirrel, Horse rat, Pig, Jungle cat, Fox, Rabbit etc.

12.4.2 Rehabilitation and Resettlement of affected Population

The link canal passes through the periphery of nine villages viz. Jojipet, Timmaraopet, Papayyapet, Koyyalagudem, Bollepalli, Nayakpalli, Katrepalli, Parvatamgudem and Padamatigudem (Parvatgudem) affecting these villages partially. About 1140 people of these villages will be affected. The measures proposed to be adopted for the rehabilitation and resettlement of the affected people is dealt in the following paragraphs. The assessment of the requirements of rehabilitation is based on the general information collected from the local agencies.

i) Housing

The village-wise, category-wise distribution of the affected population is given in Table 12.8.

Table 12.8
Village-wise Distribution of Affected Population

Sl. No	Name of village	Category			Total population affected
		MIG	LIG	EWS	
1	Jojipet	-	-	60	60
2	TimmaraoPET	-	40	60	100
3	Papayyapet	-	72	40	112
4	Koyyalagudem	-	100	44	144
5	Bollepalli	-	80	-	80
6	Nayakpalli	128	120	160	408
7	Katrepalli	-	68	-	68
8	Parvatamgudem	60	40	-	100
9	Padamatigudem (Parvatgudem)				
	Total	188	520	432	1140

Considering 4 members for each family, the number of families to be rehabilitated would be 285. It is proposed to allot a modestly constructed house to each of the affected family for their quick resettlement. Depending upon the economic status of the displaced families, plots of area 350, 250 and 200 sq.m per family with a built-up areas of 70, 50 and 30 sq.m are proposed for the Middle Income Group (MIG), Lower Income Group (LIG) and Economically Weaker Sections (EWS) respectively. It is proposed to rehabilitate the affected population in the model villages with basic amenities for health, education, water supply, sanitary, markets, recreation, communications etc. proposed to be constructed nearby the affected villages.

ii) Rehabilitation Grants and Maintenance Allowance

As per general norms, all project-affected people who are not allotted agricultural land should be given alternative employment or other amenities for restoration to their original trade within a reasonable time. One time rehabilitation grant of Rs 10000/- per family and a maintenance allowance of Rs 1000/- per family per month for one year are proposed as per the norms.

Suitable provision under the rehabilitation and resettlement component to take care of the above proposed measures of rehabilitation has been made in the estimate for construction of the link canal.

12.4.3 Environmental Impact

12.4.3.1 Groundwater

The groundwater in the command area fluctuates between 2.46 and 18.51 m in pre-monsoon season and between 0.91 and 20.00 m in the post-monsoon season below ground level as per the data observed by the AP State Groundwater Board. The fluctuation data at the observation wells in and around the command area, available groundwater potential, draft etc. based on district-wise CGWB statistics are dealt in Chapter on Command Area Development. The groundwater potential is moderate in the command area.

In general, the groundwater quality within the command area is satisfactory. The total dissolved solids in the groundwater vary in the range of 462 mg /l to 1460 mg/l. The conductivity values of most of the village waters are in the range of 748 μ mhos/cm to 2200 μ mhos/cm. The pH ranged between 7.1 and 8.6. Chloride and fluoride values in the ground water are in the range of 38.5 mg/l to 390 mg/l and 0.45 mg/l to 1.71 mg/l respectively. Sodium concentration is observed in the range of 20.5 mg/l to 257 mg/l. Most of the parameters are well within the drinking water standards (IS 10500) except few parameters. The water can be used for agriculture and other domestic purposes and can also be used for drinking after pre-treatment. Moreover, the fresh water supplies through the link canal will enhance the quality of groundwater.

The maximum ground water level in the pre-monsoon is 18.51 m below ground level. It means the general groundwater level is deep. The three districts in the command area viz. Warangal, Nalgonda and Khammam are draught prone and water logging problems are unlikely in these areas. However, seepage from canal and irrigated fields may cause water level rise in the short and long terms, which may lead to water logging and salinity conditions in some pockets and suitable schemes should be devised to use the additional water accrued from seepage as a part of command area development programme.

12.4.3.2 Surface Water

The analysis of surface water from the command area showed pH value ranging between 8.3 and 9.4 during both the pre-monsoon and post-monsoon seasons indicating alkalinity and hardness of water. During post-monsoon the water bodies were observed to be turbid due to

presence of dissolved solids and silt. Electrical conductivity values were ranged between 350 to 515 $\mu\text{mhos/cm}$. Water quality shows that the alkalinity and hardness values are consistent during both the seasons. The alkalinity values are in the range of 107 to 145 mg/l. The dissolved oxygen in the source is ranging between 4.9 to 5.8 mg/l, which implies sustainability of aquatic life. The other physio-chemical values were well within the prescribed limits for all the seasons (IS 2296).

There will be tremendous increase in the surface water availability in the region which would enhance the drinking water supply and its quality in the entire command area, after the implementation of this link canal scheme. Many natural drains are crossed by the link canal where cross drainage works are proposed and hence interference with their flows is avoided. The regeneration from the command area is likely to add to the available flows in these natural drainages, by which the salinity ingression would get reduced.

12.4.3.3 Flood Control

The live storage capacity of the reservoir is 4285 Mm^3 and hence has good flood control capacity. The reservoir receives about two to three floods during July and August months each spanning for two to three days. Since the reservoir has a large capacity, it could absorb considerable floodwaters and suitable reservoir operation could be devised based on the advance flood warnings so that the flood damages downstream of the structure could be greatly reduced or nullified.

The proposed Inchampalli dam has a 1075.50 m long spillway with 48 vents of size 18.00 x 15.24 m with a maximum flood discharging capacity of 97268 cumec and is capable of discharging the flood flows to the Godavari river downstream. In addition, two canal escapes are proposed at suitable locations along the link canal to drain out the excess flows, if any, into the natural streams nearby the link canal which help in controlling the floods effectively.

12.4.3.4 Pollution and Industrial Development

The proposed command area does not have any major industries at present and no development projects to be taken-up in the immediate future and as such the area is free from industrial pollution.

The introduction of irrigation is likely to give an impetus for the growth of agro- based industries leading to some pollution in a few limited pockets of the area where strict measures may have to be undertaken to control the pollution. However, this is not expected to lead to any large-scale pollution.

12.4.3.5 Aquatic Life

There is no separate information in respect of fish production within and surroundings of Inchampalli - Nagarjunasagar link command area. The formation of the link canal is not likely to cause any impact on the aquatic life.

12.4.3.6 Public Health

The area as at present does not come under malaria zone and no health risks are involved. However, formation of a water body in the shape of the link canal and conversion of the hitherto dry area into wet area might result in introduction of water borne diseases unless precautionary measures are taken. Introduction of irrigation to the draught prone areas and seepages through the link canal will result breeding of mosquitoes. Hence the mosquito borne diseases like Malaria, Viral Encephalitis and Filariasis etc., are likely to occur.

Adequate supplies of medicines to the public health centres will have to be ensured to prevent and contain the flare up of epidemics, apart from creating adequate infrastructural facilities for the same. Efficient water management is absolutely necessary for maintaining public health in the command area.

12.4.3.7 Water Logging and Salinity

The groundwater table is well below the root zone of the crops. However, the irrigation supplies to the command area would add to the groundwater recharge. This might lead to rise in the groundwater table to some extent but not to the alarming levels so as to cause water logging and salinity. Moreover, serious water logging problems are not anticipated since the command area is having a slope of 1 in 500 to 1 in 1200. Adequate natural drainages are also available in the area to drain the water from the command area. Though no serious water logging problems are anticipated, studies and regular observations on the

behavior of the soils in the area will have to be carried out for a few years before and after introduction of irrigation in the area.

12.4.3.8 Climate and Ecology

The construction of the link canal is not likely to cause any significant changes ecologically in the area. The climatic and ecological conditions of the area continue to remain more or less the same even after construction of the link canal.

12.4.3.9 Natural Resources

The availability of minerals in and around the command area is assessed. No mineral resources are likely to be lost as a result of construction of the link canal.

12.4.4 Beneficial Impacts of the Link Canal

12.4.4.1 General Benefits

The link project would greatly help in improving the general prosperity of the region on account of the following aspects.

- i) By taking over the command of 178055 ha of Kakatiya Canal Stage – II of SRSP Stage – II and 109250 ha of SLBC, agricultural production would be increased by nearly 3 to 4 times. This would lead to substantial rise in the average annual income of the local population, as they are mostly dependent on agriculture.
- ii) Agricultural development by introduction of irrigation would give impetus to agro-based, small scale and cottage industries, dairy and poultry development, development of communication network, infrastructural, health and educational facilities, rise in the economic activities, rise in the living standards of the general public and several other aspects of socio-economic development.
- iii) Environmental enhancement of the region on account of the afforestation programmes on the banks of link canal, branch canals and distributaries.
- iv) Adequate protected and fresh assured drinking water supplies to the rural and urban population, major chunk of which is hitherto suffering from acute shortages of potable drinking water.

- v) The link project would create a lot of employment opportunities to the local population during its construction spreading over considerable number of years. The continuous and increased agricultural operations due to irrigation and development in industrial, infrastructural and economic aspects would largely enhance the continued employment opportunities even after construction of the link project.

12.4.4.2 Employment Generation During Construction of the Project

The data on employment generation in respect of Upper Ganga Canal Development & Modernization project (Govt. of U.P) has been taken into consideration for assessing the employment generation in this project. This project is one of the nine irrigation projects considered by the Advisory Group on Expenditure and Employment Generation in Major and Medium Irrigation projects set up by Central Water Commission in their study. As this project suits the scenario of the proposed link canal project in its nature, the employment norm of 35 persons / Rupees one crore invested (1991-92) achieved in this project has been taken into account for arriving at the employment likely to be generated during the construction of the link canal project.

The total estimated cost of the Inchampalli - Nagarjunasagar link canal project is 26289 crore (based on 2003-2004 price level). The employment generation potential of the project following the norms as mentioned above will be 28900 personnel per annum in the order of 6150 in the technical and 22750 in the non-technical categories. The technical category comprises of 1865 engineers, 2050 other technical, 2235 skilled and semi-skilled personnel whereas the non-technical category comprises of 17350 un-skilled and 5400 administrative personnel, annually.

12.4 Impact Matrix

An impact matrix including the beneficial/adverse impacts relating to physical, biological and socio-economic aspects is given in Table 12.9.

Table 12.9
Impact Matrix of Inchampalli - Nagarjunasagar
Link Project

Impact	Assessment
(A) Physical Impacts	
(i) Sedimentation	The expected rate of siltation of Inchampalli reservoir is 1.25 Acre-feet / sq.mile per year. The reservoir is planned with a life of 100 years. No significant additional sedimentation is expected at Nagarjunasagar. The available dead storages at Inchampalli and Nagarjunasagar are adequate.
(ii) Seismic	The Godavari graben area is in seismic Zone III of the seismic Zoning map of BIS. In this zone, earthquake may be triggered after reservoir loading and the largest expected earthquake is of magnitude 6 or intensity VIII. The dam may be designed for an earthquake of magnitude 6. Reservoir induced seismic activity is not observed in the vicinity of Nagarjunasagar project.
(iii) Forest area submerged	34283 ha of forest area will be submerged on account of Inchampalli reservoir and intermediate reservoirs at Peddavagu and Tummalagutta. Suitable provision has been made in the estimate of the link project for compensatory afforestation.
(iv) Other area submerged	An area of 64450 ha consisting of both private and government land will be submerged on account of construction of the proposed Inchampalli dam. Adequate provision towards cost of acquisition is kept in the estimate.
(v) Groundwater recharge	The groundwater condition will improve along the link canal and in the command area due to irrigation.
(vi) Natural resources	Loss of commercial timber is reported from Andhra Pradesh and Maharashtra portions of the submergence area respectively. Loss of mineral resources is unlikely.

(vii) Irrigated area	An annual area of 287305 ha will be provided with irrigation by the link project. The area currently under irrigation from canals under existing medium projects in the proposed command is below 25000 ha which would also get stabilised.
(viii) Hydro power	13 Units of 75 MW each with reversible turbines are proposed to be installed at the main dam. 15 units of 5 MW each are proposed to be installed at Musi.
(ix) Pump houses	4 pump houses on main canal and 2 pump houses on lead canal are proposed to lift the water to negotiate the level difference in the topography.
(x) Historical monuments and archaeological structures	No historical monuments or archeological structures are affected by the construction of the link project.
(xi) Salinity intrusion in delta and estuaries	Lean season flows in natural drainages do not get reduced but get increased to some extent. Thus salinity intrusion would be reduced.
(xii) Salinity in irrigable area	No serious impact is anticipated.
(xiii) Water logging	No serious impact is anticipated.
(xiv) Availability of drinking water	As the link canal is planned for providing domestic water to en route areas, availability of water for drinking would improve.
(xvi) Quantity of water diversion	16426 Mm ³ at the off-take point.
(B) Biological impacts	
(i) Public health aspects	No hazards are expected. Infrastructures for health aspects are likely to improve.
(ii) Wild animals and birds	Wild buffalo and Barasingha are the endangered species reported from Chhattisgarh portion of the submergence area. No rare or endangered species is reported from the project area of Andhra Pradesh and Maharashtra.
(iii) Other species	No adverse impacts are expected.
(iv) Availability of bio-mass	Increases
C. Socio Economic Impacts	
(i) Socio-economic aspects	Tremendous socio-economic upheaval expected.

(ii) Resettlement plans	The resettlement of very few (1140 nos) affected people from 9 partially affected villages on account of construction of the link canal in model colonies with all basic amenities is planned. Adequate provision for R&R is made in the estimate.
(iii) Land acquisition	A total area of 11679.60 ha of land is to be acquired for the purpose of laying the link canal. Suitable provision is made in the link canal project estimate.
(iv) Farmers to be benefited	All the farmers of the land holdings of the command area will get irrigation facilities.
(v) Water quality downstream of storage	Water quality in the streams will improve with the addition to the lean season flows.
(vi) Employment generation	Tremendous potential for employment generation during the construction of the link project and continued large-scale employment opportunities thereafter, are expected.
(vii) Infrastructure development	Impetus to various infrastructure development aspects like industries, agricultural and related activities, communications, economic activities, health, education and all other spheres of socio-economic aspects is expected.
(viii) General prosperity	The living standards of the population substantially will improve and the general prosperity of the region would get boosted during and after implementation of the link canal project.