Chapter 12
Environmental and Ecological aspects

12.1 General

To assess environmental, ecological and socio-economic issues of the proposed link project, NWDA engaged the consultancy services of M/s. Consulting Engineering Services (India) Private Limited, New Delhi. (The report was completed during March, 2004). Based on environmental, ecological and socio-economic survey conducted along the entire stretch of the canal and the command area as well as data collected from primary and secondary sources, impacts on environmental, ecological and socio-economic components have been identified.

12.2 Environmental and Ecological Aspects

Impacts are categorized as impacts due to project location, design, construction and operation stages.

12.2.1 Impacts Due to Project Location

12.2.1.1 Impacts on Forest Land

The alignment passes through a number of Reserved and Protected forests, forest plantation and nursery developed by respective state forest departments. Along its stretch through Karnataka, it passes through Agoli R.F., Manchuri R.F. and Billakallu R.F. while in Anantapur district of Andhra Pradesh, it passes through Beluguppa R.F., Kodenu R.F., Kondapalli R.F., Urakonda R.F., Gutturu R.F. and Malakavemula R.F. Besides, this canal also passes through Kasankandi Protected Forest at R.D. 190.108 km, Karnataka State Forest Department Nursery at R.D. 150.428 km, Central Nursery of Andhra Pradesh State Forest Department in Naranji Gundapalli Protected Forest, Forest Plantation of Karnataka State Forest Department at village Alipura, about 50-100 m from the canal at R.D. 206.800 km. About 71 ha of forest land is required to be acquired for the proposed link canal.

Mitigation Measures

In order to compensate the loss of 71 ha of the forest land, compensatory afforestation programme should be implemented on 142 ha of land in consultation with respective State Forest Department. In order to compensate loss of vegetation canal bank plantation is proposed and provision of Rs. 39 lakhs has been made in project cost.

12.2.1.2 Impacts on Wildlife Reserves

The proposed link canal along its entire stretch passes through several reserved forest and Daroji Bear Sanctuary. A total number of 17 wildlife species have been reported. As per the records of respective State Forest Department, four endangered species of wildlife (according to Schedule I of Wildlife (Protection) Act, 1972) i.e. Leopard (Panthere pardus); Indian Wolf (Canis lupus), the Great Indian Bustard (Choriotis nigriceps) and Black Buck (Antelope ceivicapra) are reported from the study area.

Location of proposed link canal will partially affect wildlife due to reduction, disturbance and loss of habitat. The proposed link canal through Daroji Bear Sanctuary will create hindrance in wildlife movement migration path due to canal.

Mitigation Measures

As a large forest area is available, wildlife will temporarily migrate to the higher reaches of forest hence, impact on wildlife and endangered species will be the minimum. As regards the Natural reserve in the form of Daroji Bear Sanctuary, possibilities of realignment should be explored involving minimum protected area. However positive/beneficial impact of proposed Kalvapalli reservoir is that it will provide all season waterfront for wildlife. Provision of Rs. 15 lakhs has been made in the project cost for improvement of Environment and Ecology.

12.2.1.3 Impacts on Grazing Lands

As the proposed alignment does not pass through any notified grazing land along its route, adverse impact on grazing land and thereby animal husbandry operation due to proposed project is not envisaged. On the contrary, availability of water to drought prone areas will improve availability of fodder; thereby improvement in animal husbandry practices is expected. As passageways are proposed wherever the bed level of the intersecting drain is well above FSL of the link canal, any hindrance to the movement of livestock is not envisaged.

12.2.1.4 Impacts on Agricultural Lands

Apart from the 61% of forestland in the project area, the culturable wasteland occupies about 31.6% and uncultivable land accounts for about 7.03%. Irrigation facilities reach out only to 5.18% of the land under cultivation. This reveals that most of the land on the alignment is devoid of agricultural practices due to lack of irrigation or are wastelands. These areas do not envisage any adverse impact due to

project location.

12.3 Impacts Due to Project Design

12.3.1 Hydrological Balance

The canal is proposed to be lined throughout its length and since it is not a perennial canal, seepage is not generally expected. Under normal condition, adverse impacts related to rise in ground water table is not envisaged. However ground water table is expected to rise in the area surrounding the proposed Kalvapalli reservoir but this will benefit the drought prone areas of Anantapur district due to availability of water to wells and tube wells for drinking and irrigation purposes. Similarly, water logging is also not expected except those resulting from periodic flooding, over irrigation, drainage over flow, seepage from canal and inadequate surface drainage conditions. The impact and mitigation measures are discussed in the respective sections.

12.3.2 Impacts on Commuting Networks

There come across several commuting infrastructure like state and national highways, village roads and railway lines along the canal corridor. The proposed activity proposes to take care of these along the entire stretch of the canal.

Mitigation Measures

A total number of 77 crossings are proposed for people, livestock and wildlife in the form of bridges and roads. 7 double lane bridge and 70 single lane bridges have been proposed. In order to cross railway lines three railway bridges of double track and seven single tracks have been proposed.

12.3.3 Impacts on Historical and Cultural Monuments

As per the records of Archeological Survey of India there is no notified site of archeological/historical or cultural importance along the proposed alignment, hence any adverse impact due to proposed project is not expected. Historical place worth mentioning is Kudal-Sangam, the Samadhi of Shri Basaveshwara at the confluence point of River Krishna and Malaprabha, a famous pilgrimage centre about 500 m away from alignment at R.D. 30.932 km. There is a small Durga temple en route the canal on Koppal-Gangavati Road at R.D. 66.40 km and Bhimambika Temple at Ramulu village (R.D. 163.203 km) at about 100 m on left side of the canal. After crossing Chikk Madinal-Gangavati road, canal passes through agricultural fields. The Birrapan Temple falls en route at R.D.

148.546 km.

After crossing Tungabhadra river through aqueduct the canal runs parallel to NH-31. After crossing Hospet road (204.650 R.D.), it passes through agricultural field. The Tayeshwari Temple is also about 50 m from the canal.

Mitigation Measures

In order to avoid adverse impact on religious places en route the canal either the canal should be realigned at these places or the religious places should be shifted in consultation with local people and respective authorities.

12.4 Impacts Due to Construction Works

12.4.1 Impacts on Air Quality

During construction of the proposed link canal, a huge quantity of construction material in the form of boulders, aggregate and soil will be generated during excavation, blasting and tunneling operation. Depending on the local weather conditions, dusts are expected to be generated in the form of fugitive emissions. This may lead to reduce the visibility and the air quality of the immediate vicinity due to SPM loading. This impact on the ambient environment is highly localized and short-term in nature.

Mitigation Measures

The earth material generated during excavation of the canal will be utilized in making embankment for the canal. Excess material if any, will be dumped in identified areas. Suitable reclamation of specific sites would then be undertaken. During all these operation, care would be taken to minimise the fugitive emissions by sprinkling water and compacting the earth materials. The workers would be provided with masks to cease the inhalation of SPMs.

12.4.2 Impacts on Noise Quality

During construction of the canal, noise from the earthmovers and during blasting operations is expected to alter the ambient noise levels. The noise levels of the former are not expected to affect the environment per se but the blasting operation would affect the ambient environment.

Mitigation Measures

Due precaution would be taken to minimise the effects of noise. Work schedule for blasting would be formulated in accordance with the local conditions. The occupational environment would be provided with proper noise insulating/masking devices especially to the workers.

12.4.3 Impacts on Occupational and Public Health

A large number of workers will be deployed during construction of the proposed canal. The solid waste generated in the form of garbage and sewage from labour camps may create health risks at construction sites and may lead to water borne diseases.

Mitigation Measures

In order to avoid health risk and spread of diseases, proper waste disposal system in the form of septic tank/soak pits should be provided. Regular health check up programmes and camps would also be established at selected construction sites.

12.5 Impacts Due to Project Operation

12.5.1 Impacts on Water Environment

12.5.1.1 Surface Water

Pollution of surface water at proposed Kalvapalli reservoir is expected through silting and sedimentation, nutrient leaching and agricultural run-off. Run-offs from areas of intensive agricultural practices using chemical fertilizers, insecticides and pesticides may lead to eutrophication in the receiving water body. Major cause of eutrophication is nutrient loading in the form of nitrogen (Ammonia NH_3, NH_4), Urea, Nitrate, Nitrites and Phosphorus through agricultural run-off, sewage and fertilizer residue. Eutrophication may cause marked changes in the biota as a result of nutrient enrichment. This would affect the surface water quality through decrease in dissolved oxygen concentration, pH, increase in biochemical and chemical oxygen demand (BOD and COD), chloride, nitrogen, phosphorus, etc. Alteration in the dissolved oxygen concentration may lead to mortality of fishes.

Mitigation Measures

In order to control eutrophication of surface water bodies, effective

control of the use and handling of herbicides, pesticides and chemical fertilizers is required in catchment area of reservoir. The common fertilizers used in the study area include Urea, Diammonium Phosphate (DAP), Compost, Paramphos (N-16, P-20), N.P.K. (19:19:19; 17:17:17; 15:15:15) and the common pesticides used are Leuacron, Carbondazier, Mangnogome, Fenvate rate, Endosulphan, Dimetatde, Diclorowas and 24 enelphas. Eutrophication due to nitrogen can, be controlled through biological treatment such as trickling filters, activated sludge tank, oxidation ponds while that through phosphorus can be controlled through precipitation with lime and iron salts.

To minimise pollution due to agriculture run-off, methods such as contour bunding, provision of surface drainage, command area development, moisture conservation and mulching should be adopted. In order to control aquatic weed growth, regular mechanical deweeding operation should be carried out. Weed control operation varies with the type of weed e.g. Water Hyacinth (Eichharnia cressipes), Hydrilla, Pistia, Azolla, etc. Effective biological control of aquatic weed can be carried out through introduction of silver carp and other fishes in reservoir.

12.5.1.2 Ground Water

As the proposed canal is lined throughout its stretch, normally the rise in ground water level due to seepage and any adverse impacts on ground water quality is not expected. However above mentioned changes in ground water level and quality is expected in villages surrounding the proposed Kalvapalli reservoir.

Rise in ground water level of villages surrounding the proposed Kalvapalli reservoir will have beneficial impact in terms of availability of ground water for domestic and agriculture needs of the local people. Survey conducted by NWDA revealed that no mineral deposits were identified in submergence area of proposed Kalvapalli reservoir. Hence their entry by dissolving into downstream ground water through percolation is ruled out. However contamination of ground water through percolation of fertilizers or pesticides may adversely affect public health through spread of water borne diseases.

Mitigation Measures

In order to prevent ground water pollution, if any, through percolation of fertilizers and pesticides Integrated Pest Management and Integrated Plant Nutrient Management Practices should be implemented in catchment as well as command areas of proposed Kalvapalli reservoir.

12.5.2 Impacts on Soil and Agriculture

The proposed Krishna (Almatti)-Pennar Link Canal envisages to provide en route irrigation to command area on the right side of Narayanpur right bank canal (Middle Krishna), the upper region of Tungabhadra sub-basin on the left side of Tungabhadra LBC and the water-short Vedavathi sub-basin. It will also provide irrigation to the drought prone areas of Anantapur district of Andhra Pradesh in Upper Pennar sub-basin.

The proposed Culturable Command Area (CCA) of the Krishna (Almatti)-Pennar Link Canal Project is 294795 ha. The basin-wise break up of the command area and water requirement of the link canal considering demand for en route irrigation is given in Table 12.1.

Table 12.1
Sub-basin wise Water Requirement for En route Irrigation

Name of Sub-basin	CCA (ha)	Annual irrigation (ha)	Intensity of irrigation (%)	Annual utilization (Mm^3)
Middle Krishna	17015	16334	96	85
Tungabhadra	51360	46224	90	253
Vedavathi	93045	83741	90	505
Upper Pennar	133375	112035	84	871

The proposed Krishna (Almatti) - Pennar link canal along with proposed Kalvapalli reservoir will have positive imparts on the command area as well as to the villages located along the entire stretch. Increase in availability of water (from canal as well as proposed Kalvapalli reservoir) will encourage irrigation facility and agriculture production. Rise in ground water level surrounding villages of Kalvapalli reservoir will have beneficial impacts in terms of availability of water to fulfill local domestic and irrigation demand.

The proposed increase in irrigation facilities will encourage agricultural activities and will step up the production of food grains. Expected crops to be grown are Paddy, Hybrid Jowar, Bajra, Maize, Groundnut, Cotton, Ragi, Chillies, Sugarcane, Pulses and Vegetables.

The cultivators in the command area may be inclined to use modern and improved implements like iron plough, oil engines, electric pumps and tractors and farmers may be able to undertake deep ploughing and

improved agricultural practices under intensive cultivation due to availability of water.

Increase in availability of water for irrigation and agriculture will improve vegetation cover in terms of fodder, thereby improvement in live stock production, animal husbandry practices along with poultry production is envisaged.

Despite the best efforts put in to provide adequate irrigation and to create substantial irrigation potential, adverse effects of irrigation may be seen in some or all the irrigation command areas. Faulty water distribution & management and lack of drainage facilities leading to over irrigation, a large part of land are expected to be waterlogged.

12.5.2.1 Salinity and Water Logging

Water logging, referred here as the saturation of soil with water, resulting from over irrigation, seepage or inadequate drainage. With the rise in water table, minerals and salts in the soil are expected to rise to the surface. Under waterlogged conditions, evaporation from the ground leaves behind the dissolved salts on the surface, which eventually leads to salinisation. Thus, water logging is the forerunner of land salinisation in many cases. Salinisation is referred here as the increase in concentration of total dissolved solids in water and soil.

Water logging damages plant growth by creating an imbalance in the amount of air (oxygen) and water in the soil. Salinisation and alkalization in their early stages of development reduce soil productivity. Salinity problems are expected to develop if salt accumulates in the crop root zone to a concentration that causes yield loss. If allowed to accumulate excessively, it may cause complete salinisation and elimination of all vegetative cover. Hence, an extreme environmental consequence of soil salinity and alkalinity is that the land becomes uncultivable at high levels of salt build-ups in the soil.

Salinity in irrigated areas is the primary cause and is the second major cause of loss of agricultural land. The two major environmental impacts may be envisaged due to salinity are the decline in crop productivity and loss of arable land, which would lead eventually to the loss of habitat and reduction of bio-diversity.

Salt affected soils can also have (indirect) human health impacts as they severely limit the choice of crops, reducing crop diversity and adversely affecting diets and nutritional status of rural people.

A wide range of activities related to an increased intensity of production can contribute to reduced soil fertility. Mono-cropping without a fallow period, rapidly depletes soil fertility as well. The environmental impacts of the loss of fertility due to monoculture and intensification are the reduction in yields (partial and total factor production) and loss of arable land.

The increased use of agro-chemicals, needed to retain productivity under intensification can introduce toxic elements that occur in fertilizers and pesticides. Application of specific types of fertilizers results in the acidification or lowering of soil pH, which has negative impacts on most crop growth. Nitrogenous fertilizers are strongly associated with acidification. It should be noted that acidification is a result of not only N-fertilizer application but also agriculture in general. When crops, in some cases residues, are removed (soil mining), a deficit in soil organic matter and a parallel decrease in levels of base nutrients lead to acidification. However, this process is gradual in comparison to N fertilizers, which can be quite rapid effecting crop yields in a period of three years.

Agrochemical inputs used to increase agricultural productivity have been associated with many negative direct and indirect human health impacts. The risks to human health can be magnified when the users are illiterate, ill trained and do not posses appropriate protective equipment. To mitigate this, the users should be trained how to handle the specific agro-chemical and to use protective equipments to check accidental direct exposure.

Mitigation Measures for Water logging and Salinity

1. The following farmer-centric schemes should be undertaken to strengthen the Participatory Irrigation Management (PIM):

   (i) Irrigation scheduling especially Rotational Canal Scheduling
   (ii) Warabandi System
   (iii) Setup of Irrigation/Water Panchayats for every village
   (iv) Establishment of WUAs (Water Users' Associations)
   (v) Development of field channels and field drains within the command of each outlet
   (vi) Land leveling and shaping on an outlet command basis
   (vii) Realignment of field boundaries
   (viii) Establishment of agro-resource centers and agri-clinics
   (ix) Services like thrift and credit promotion
   (x) Strengthening of agricultural extension services
   (xi) Field trails, demonstration and training

2. Formulation and implementation of an effective management of irrigation system aimed at the followings would reduce the problem of water logging and salinity to a large extent.

   (i) Optimal utilization of the created irrigation potential
   (ii) Equitable distribution of water
   (iii) Efficient use of available supplies and
   (iv) Sufficient focus on maintenance aspects

3. The potential problem areas should be identified with a reasonable degree of accuracy as per the specifications laid down to identify lands having limitations of either soil, topography or drainage when used for irrigation leading to water logging and for salinity after a short period of sustained use.

4. Preventive measures can be taken in these areas by constructing field drainage network, if possible and wherever, cost-effective. This will provide adequate arrangement to drain out excess water from the fields.

5. The "bio-drainage" scheme should be undertaken to minimize and control water logging and salinity in severe problem areas as discussed below.

a) Bio-Drainage to Mitigate Water Logging

To prevent the rise of water table above the critical level, attempts are usually made to lower it by installing sub-surface drainage systems. Such systems are expensive and individual farmer cannot afford. Moreover, these pose a problem for the disposal of drainage effluent. Hence it is not recommended to go for such systems. Bio-drainage, which is defined as the process of removing the excess soil water through transpiration using bio-energy of the plant, can be a supplement or an alternative to this engineering solution to avoid rise in the water table and subsequent development of secondary salinisation.

The "bio-drainage" scheme can thus be undertaken to minimize and control water logging and salinity. This has to be carried out by planting trees to transpire water and absorb salts from the soil so that the waterlogged and saline areas can be reclaimed. It should be a preferred option to prevent the development of waterlogged and saline soil, especially in land locked area, where there is no possibility of disposing of saline drainage effluent. Trees should also be planted along the link canal to protect embankments and to check the water logging due to seepage, if any. Trees like eucalyptus and bamboo are effective in

controlling water logging. One more positive aspect of the plantation is that it can supplement to the afforestation programme in the area.

Tree species mainly eucalyptus (Eucalyptus teritiocomis) and bamboo (Bambusa arundinacea) are capable of preventing water logging by controlling the rise of water table. The eucalyptus species can control water table rise up to 1 .95m in the first year and up to 3.56m in the fifth year. Similarly, bamboo species can control water table rise up to 1.09 m in the first year and up to 3.05 m in fifth year. The details are given in Table 12.2.

Table 12.2
Bio-drainage Capacity of Plant Species

Sl. No.	Species	Control of Water Task rise (m)				
		1st year	2nd year	3rd year	4th year	5th year
1.	Eucalyptus (Eucalyptus teritiocornis)	1.95	3.48	3.76	3.64	3.56
2.	Bamboo (Bambusa arundinacea)	1.09	1.86	2.46	2.96	3.05

Source: Thakur, N.P. and Chhabra, R., 1998, CSSR Report, CSSR.

The trees continue to absorb and transpire water throughout the year, the capacity being more in summer and rainy season than in winter. The bio-drainage capacity of the trees is significantly affected by the salinity of the ground water due to its impact on root growth, biomass production and leaf area index.

Due to high transpiration capacity and an ability to extract water from deeper layers containing saline ground water, bio-drainage by trees can control the rise in water table in irrigation command areas and prevent the formation of water logging and eventually the saline water land. Hence, bio-drainage is the best way to lower water table and avoid the problems of disposal of drainage effluent, which otherwise would go to cause problems of increased salinity of natural drainage and fresh water resources. This technique, in addition to improving the environment and providing firewood to the farmers, is economically effective and does not need extra energy for controlling the water table.

b) Bio-Drainage to Mitigate Salinity

Tree species discussed above, viz., Eucalyptus teritiocomis and Bambusa arundinacea only help in removing the drainage surplus water by absorbing it through the roots and transpiring from the leaves, thus

lowering the water table and help in counter acting the harm done by excessive irrigation, or a seepage of the water through the canal. These trees don't bio-harvest the salts as such and don't remove the salt from the soil. But by controlling the water table rise and decreasing the capillary water fringe, the trees help in preventing the accumulation of salts in the root zone.

However, a range of plant species has a role in the restoration of water and salt balances of irrigated areas, which can provide income diversity to agricultural properties damaged by rising water table and increased salinities. These include several tree species, food crops and vegetables. Tree species highly tolerant to water logging/salinity are Casuarina Equisetifolia, Acacia. Food crops tolerant or moderately tolerant to salinity include grains such as barely and wheat. Food crops such as maize, beans and many vegetable crops are sensitive or moderately sensitive to salinity. Pulses such as moong and pigeon peas were relatively more sensitive to irrigation salinity than cereal crops. Thus when soils are affected by salinity, these crops are to be eliminated from local cropping systems and replaced with more tolerant grain crops like barley and wheat.

The direct environmental consequence of abandoned land due to salinity problem is that it creates demand for more new land to be brought under cultivation. Thus it negates environmental benefits in the form of potential land savings, which result from productivity-enhancing technologies.

The potential positive impact of irrigation is the increased productivity or otherwise stated the "land savings" and all environmental benefits resulting from these savings. Whereas, the potential negative impact of decreased productivity due to irrigation induced salinity is the use of more land to produce the same output (i.e. reduced "land savings" or "land-use augmentation"). To make a striking balance between the two so that the negative environmental consequence is parallel to "land savings" generated, yield-increasing agricultural technologies should be implemented.

As it has been observed that the higher cropping intensity and irrigation frequency are associated with greater yield losses. This, in the long term, may result declining crop diversity. To mitigate this, adequate measures should be taken to give economic policy incentives to grow other alternative crops. When the soil conditions deteriorate, the farmers may be advised to revert to low input traditional crop varieties and practices. To minimize the yield loss, intensity of cropping practices and frequency of irrigation should be maintained at optimum level of performance.

12.5.3 Impacts on Fisheries Development

The study revealed that fish species having high commercial value, fast growth and high local demand are available in rivers Krishna, Ghataprabha, Malaprabha, Tungabhadra, Vedavathi, Pennar and in their tributaries. Major water bodies of fishery importance include Almatti Dam, Tungabhadra Dam, Kalvapalli Reservoir and Bukkapattanam Tank. The fish species belong to family Cyprinidae, Cobitidae, Bagridae, Silurdae, Chanidae, Metacembelidae, Notopteridae and Gobide. Some important fishes of the area are Cyprinus carpio, Puntius sophore, Puntius arullus, Rasbora daniconius, Ompok bimaculatus, Wallago attu, Mystus cavasius, Mystus aor, Notopterus, Hotopterus, Channa marullus, Mastacembelus guentheri Mastacembelus arm atus and Macro brachium lanchester.

The entire stretch of the canal runs through drought prone areas. Because of this, no major ponds have been observed during the survey. However, some dry tanks and depressions exist which may subsequently be filled up with water from the proposed canal. These structures may promote Pisciculture.

The canal linkage would help in cross migration of fish species and increase the fish population. There will be wide spread freshwater aquaculture that would give a new dimension to the fisheries extension programme. Interested entrepreneurs of the command area, with the help of the superintending Engineer of the concerned canal circle can have fish farms to undertake improved & innovative aquaculture activities. Culturing of these species will increase the fishery productivity in the area. Due to the proposed project, the fish production potential is expected to rise marginally above the current production potential. As the canal is meant for irrigation in the command areas only it is difficult to estimate the fish production potential due to the link canal. The fisheries development will certainly enhance employment opportunity for local people. The details of fisheries development plan may be prepared in consultation with the respective state fisheries department, is given in Table 12.3.

Table 12.3
Current District-wise Fish Production Potential

Sl. No.	District / Taluk	State	Fish Production Potential (MT)
1.	Bagalkot	Karnataka	182
2.	Bijapur	Karnataka	1660
3.	Raichur	Karnataka	3410
4.	Chitradurga	Karnataka	5897
5.	Bellary	Karnataka	10395

Construction of proposed reservoir at Kalvapalli will lead to improvement of wetland fisheries and aquaculture practices. Due to formation of reservoir physical parameters like depth & surface area, limnological parameters such as decrease in water temperature, dissolved oxygen concentration, increase in nutrients, sedimentation, redox-potential, change in biota and increase in biological production will create new environment suitable for rearing of fishes and thereby increase the fishery potential. Improvement in aquaculture practices is expected through establishment of breeding, seedling and fish farms in villages in the vicinity of the proposed reservoir. Establishment of fishery cooperative society will improve economic status of people through employment opportunities in the field of fishery.

12.5.4 Impacts on Urban Development

The proposed Krishna (Almatti)-Pennar Link Canal envisages to provide en route irrigation to command area on the right side of Narayanpur right bank canal (Middle Krishna), the upper region of Tungabhadra sub-basin on the left side of Tungabhadra LBC and the water-short Vedavathi sub-basin. It will also provide irrigation to the drought prone areas of Anantapur district of Andhra Pradesh in Upper Pennar sub-basin.

The proposed link canal passes through 4 sub-basins namely Middle Krishna Sub-basin, Tungabhadra Sub-basin, Vedavathi Sub-basin and Upper Pennar Sub-basin. The general soil type along the stretch of the canal is black cotton and red soil, suitable for wet and dry crops under irrigated conditions. Red soil is predominantly found in the Anantapur districts of Andhra Pradesh. Black cotton soil is suitable to raise irrigated crops like jowar, bajra, pulses and groundnut. Major irrigation crops expected to grow under different river basins in the command area are shown in Table 12.4.

Table 12.4
Major Crops of the Irrigation Command Area

Sl. No.	Crops	Middle Krishna Sub-basin	Tungabhadra Sub-basin	Vedavathi Sub-basin	Upper Pennar Sub-basin
1.	Paddy	✓	✓	✓	✓
2.	Jowar	✓	✓	✓	✓
3.	Bajra	✓	✓	✓	✓
4.	Groundnut	✓	✓	✓	✓
5.	Vegetables	✓	✓	✓	-
6.	Cotton	✓	✓	✓	✓
7.	Ragi	-	✓	✓	
8.	Chillies	-	✓	-	✓
9.	Pulses	-	-	-	✓
10.	Maize	✓	✓	✓	✓

Agricultural development due to canal irrigation may result in the following:

(i) Improvement in Cropping Pattern
(ii) Extension of agricultural activities
(iii) Improved agricultural technologies and practices both mechanized and semi- mechanized
(iv) Increased productivity and crop yield

The following impacts of agricultural development are expected to be seen in the urban/semi-urban settlements within and the adjoining the CCA.

(i) Increased trade and commercial practices related to agricultural commodities, implements and technologies.
(ii) Increased capacity utilization of existing food and agro-processing industries
(iii) Proliferation of agro-based industries, food preservation and processing industries
(iv) Setting up of Agro-Resource Centres and Agri-Clinics

The list of urban, semi-urban settlements on which the impact of agricultural development specially the agro-based industries are expected, is given in Table 12.5.

Table 12.5
Urban and Semi-Urban Settlements

Sl. No.	Name	Type of Settlement	District	State
1.	Bommanhal	Mandal Headquarter	Anantapur	Andhra Pradesh
2.	Kanekal	Mandal Headquarter	Anantapur	Andhra Pradesh
3.	Beluguppa	Mandal Headquarter	Anantapur	Andhra Pradesh
4.	Atmakur	Mandal Headquarter	Anantapur	Andhra Pradesh
5.	Kudair	Mandal Headquarter	Anantapur	Andhra Pradesh
6.	Kanaganapalle	Mandal Headquarter	Anantapur	Andhra Pradesh
7.	Ramagiri	Mandal Headquarter	Anantapur	Andhra Pradesh
8.	Chennekothapalle	Mandal Headquarter	Anantapur	Andhra Pradesh
9.	Kothacheruvu	Mandal Headquarter	Anantapur	Andhra Pradesh
10.	Puttaparti	Mandal Headquarter	Anantapur	Andhra Pradesh
11.	Bukkapatnam	Mandal Headquarter	Anantapur	Andhra Pradesh
12.	Hungund	Taluk Headquarter	Bijapur	Karnataka
13.	Mudgai	Taluk Headquarter	Raichur	Karnataka
14.	Gangawati	Taluk Headquarter	Bellary	Karnataka
15.	Sandur	Taluk Headquarter	Bellary	Karnataka
16.	Kalyandurg	Mandal Headquarter	Anantapur	Andhra Pradesh
17.	Rayadurg	Mandal Headquarter	Anantapur	Andhra Pradesh
18.	Penukonda	Mandal Headquarter	Anantapur	Andhra Pradesh
19.	Anantapur	District Head quarter	Anantapur	Andhra Pradesh

20.	Dharmavaram	Mandal Headquarter	Anantapur	Andhra Pradesh
21.	Hospet	Taluk Headquarter	Bellary	Karnataka
22.	Lingsugur	Taluk Headquarter	Raichur	Karnataka
23.	Kustangi	Taluk Headquarter	Raichur	Karnataka
24.	Sindhur	Taluk Headquarter	Bellary	Karnataka
25.	Bagalkot	Taluk Headquarter	Bijapur	Karnataka
26.	Muddebihal	Taluk Headquarter	Bijapur	Karnataka
27.	Bellary	District Head quarter	Bellary	Karnataka

12.5.5 Impacts on Socio-economic and Health Environment

A survey has been undertaken in the command area to determine the socio-economic condition and the response of the people to the proposed link canal project. The surveyed households responded to the formatted questionnaire to react to the prospect of proposed irrigation in the command area. Out of the total population surveyed, 85% of the population was of the opinion that the proposed project would have positive impact on their socio-economic well being. 5% of the surveyed population envisaged negative impacts due to the project and 10% of the surveyed population abstained to comment on the issue.

Degraded surface water due to possible eutrophication of water bodies in and around Kalvapalli reservoir and aquatic weed growth may form a breeding ground for a variety of vectors and pathogens. The common pathogens responsible for water borne diseases are Salmonella, Shigella, Leptospira, Enteropathogenic, Escherichia cok, Francisella, Vibrio, Mycobacterium, human enteric viruses, Cyst of Entamoeba hystolytica and parasitic worms i.e. Nematodes (Round Worms) and Platyhelminthes (Tape Worm and fiukes).

Major water borne diseases are Gastroenteritis with diarrhoea, fever & vomiting and Typhoid (Salmonella typhi). Shigella is the most commonly identified cause of acute diarrhoea while Escherichia coil is responsible for Gastro-enteritis & diarrhoea. Vibrio cholera causes cholera and Mycobacterium is responsible for tuberculosis. Amoebic dysentery is caused by parasitic protozoa Entamoeba hystolytica. The parasitic worm includes round worms, tapeworms, flukes and Ascans. During field visit common water borne diseases were reported to be Typhoid, Ascariasis, Diarrhoea and Malaria.

Mitigation Measures

In order to control pathogenic organisms eutrophication control measures as well as deweeding operation should be carried out regularly. Provision of medical facilities and vaccination programmes should be conducted regularly in selected villages along the proposed

alignment and villages surrounding proposed Kalvapalli reservoir. Existing medical facilities in villages along the proposed alignment includes Health Centre, Primary Health Centre & Sub Centre, Dispensaries, Family Planning Centre, Nursing Homes, Maternity and Child Welfare Centre, T.B. Clinic and Registered Private Practitioners.

12.6 Environment Management Plan

For proper implementation of mitigation measures, following Environment Management Plan (EMP) has been suggested.

12.6.1 EMP for Construction Phase

The EMP for construction phase should comprise the following:

a) Dust Suppression measures such as sprinkling of water to be carried out regularly during construction material handling /over hauling activities.
b) Stringent construction material handling /overhauling regulations are to be followed.
c) Within the construction site, suitable drainage system with traps for arresting the sediment load shall be provided prior to disposal of waste in to the natural drainage system around the site.
d) Adequate safety measures complying with the occupational safety manuals shall be adopted to prevent accidents/hazards to the construction workers.
e) The construction personnel exposed to high noise levels shall be provided with protective gears such as earmuffs. The labour sheds shall be located away from the construction site.
f) Housing facilities for all construction workers shall be provided with the following amenities.

    i) Adequate potable water supply to meet all requirements of the construction personnel.
    ii) Sanitary facilities such as dry pit latrines
    iii) Solid waste collection and disposal system
    iv) Primary health facilities at construction site
    v) Fuel for cooking

12.6.2 EMP for Operation Phase

A suitable Environmental Management Plan is worked out for implementation during operation phase. Key players in the implementation of EMP and the structure of Environmental Management Cell have been discussed in subsequent sections. The major thrust of

Environmental Management during operation stage is on the following aspects:

a) Maintenance of canal to prevent seepage and water logging
b) Maintenance of cross drainage structures to prevent failures
c) Maintenance of green belt

12.6.3 Post Project Monitoring Plan

To identify the effectiveness of mitigative measures suggested in preserving the environmental quality in the area, the parameter to be monitored have been listed out in respect of water quality, soil quality and ecology.

12.6.4 Budget for EMP

The budgetary cost estimate for implementation of the EMP works out to Rs.126.83 lakhs for Compensatory Afforestation, Canal Bank Plantation and cost of monitoring equipments.

12.7 Resettlement and Rehabilitation (R & R) Plan

The Kalvapalli reservoir is proposed across the river Pennar with FRL 475 m, gross storage capacity of 83 Mm^3 and live storage capacity of 73 Mm^3.

Only two villages of the Kalvapalli area are fully affected by submergence due to the proposed Kalvapalli balancing reservoir. In order to provide resettlement and rehabilitation to the project affected persons (PAPs), a resettlement and rehabilitation (R&R) plan is proposed.

The main objective of the R & R plan is to restore the social and economic standard of living of the PAPs after they are shifted to the new settlement sites, as they were enjoying in their previous native villages.

The R&R Plan envisaged as composed of two distinct components, namely, resettlement and rehabilitation. The resettlement package broadly includes assistance to PAPs for shifting to new sites with provisions of essential civic amenities and services. The rehabilitation package is conceptualized around a development strategy with a long-term perspective. The basic thrust of this strategy is to bring about a socio-economic transformation of the PAPs so as to improve the quality of their life.

12.7.1 Number of Project Affected Persons (PAPs)

The submergence area of 1323 ha due to the reservoir encompasses two villages of the Kalvapalli area of the Anantapur district of Andhra Pradesh. The number of PAPs is 1333 and the number of affected houses is 249.

12.7.2 Socio-Economic Impacts and Benefits

12.7.2.1 Socio-Economic Impacts

i) Displacement of People due to Submergence

Due to the proposed reservoir the area of submergence at FRL is 1323 ha. As there are two villages fully affected due to submergence, the displacement of population involved is 1333. Assuming 80% of the total land area under submergence as the amount of land lost by the PAPs, the total land area lost by PAPs is 1058.4 ha. Further assuming 80% of the total land areas lose as the cultivable land; the total cultivable land lost by the PAPs amounted to 846.72 ha.

ii) Loss of Public Amenities due to Submergence

The basic amenities which are likely to be affected due to submergence of two villages are educational facilities, water and sanitation, primary health care, post & telegraph facilities. Some of the basic amenities in the form of drinking water sources like wells and hand pumps, telecommunication facilities in the form of post offices and transportation/communication facilities in the form of road networks are likely to be affected.

12.7.2.2 Post Project Benefits

The post project benefits, which would accrue to the inhabitants of the project-affected area, are:

i) Adequate supply of water for irrigation and house hold consumption
ii) Agriculture and horticulture development and extension
iii) Veterinary extension and animal husbandry development
iv) Improved pisciculture
v) Permanent waterfront for wildlife
vi) Recreation in the Reservoir
vii) Improvement in overall quality of life

12.7.3 Rehabilitation Action Plan (RAP)

A rehabilitation Action Plan (RAP) is proposed to provide a broad conceptual and ideological framework for rehabilitation of the PAPs. The need of a RAP is felt for the project concerned because of the following factors:

i) The post project scenario may transform to a semi-urban environment. This may lead to a rise in the cost of living whereas the scope of income from traditional sources of living is likely to be reduced. Thus, PAPs may find it difficult to make both ends meet in the new setting.

ii) Improper rehabilitation and resettlement may cause discontentment and alienation amongst the project affected population.

The objectives of the Rehabilitation Action Plan (RAP) are:

i) To provide financial and other support to the PAPs so that they regain their previous standard of living, if not improve, within a reasonable transition period.
ii) To pay compensation for loss of land, houses and all other immovable properties to the PAPs as per the Land Acquisition Act (LAA).
iii) Improve the quality of life; facilities connected with education, health care, women and child welfare, care for the aged and the disabled.
iv) Assist the PAPs in regaining their income in the initial stages in such a way so that they can be self-sufficient and not depend on the project authorities for long. The project authorities can slowly phase out their assistance and leave the PAPs to depend on their own economic activities and social lifestyle.

The main features of RAP are discussed in the following sections.

12.7.3.1 Identification of Resettlement Sites

For resettlement of the displaced families, adequate and suitable land should be identified which is free from all encumbrances so that there is no difficulty in recording the land in favour of the resettlers. The site so selected should be very close to the previous areas far as practicable, and those displaced persons that are left with their balance agricultural land unsubmerged can continue to cultivate them even after shifting. Representative of the oustees and voluntary organizations/NGO will be involved in the process of identification of such settlement sites at

difference places.

12.7.3.2 Development Plan for Settlement Sites

Resettlement planning should begin immediately after the basic baseline survey is completed. Planning should be made for each displaced/affected village and resettlement site and should have a distinct, time frame for all activities.

12.7.3.3 Payment of Compensation

All compensation money due should be paid to the displaced persons well before the date of their shifting. In order to ensure that there is no misuse or abuse of the money, the government may insist on depositing the entire money in the bank account in the joint name with one of the government functionary being the other signatory and allow the withdrawal of the money subsequently for proper usage.

12.7.3.4 Resettlement and Rehabilitation (R&R) Facilities

1) Shifting
2) House Construction
3) Civic amenities
4) Allotment of land
5) Rehabilitation cash grant/cash compensation in lieu of "Land for land"
6) Land development cost
7) Subsistence/maintenance allowance
8) Grant for fertilizers and seeds
9) Alternative strategies

12.7.4 Resettlement and Rehabilitation (R&R) Measures

12.7.4.1 Compensation for Houses

The following measures are suggested for resettlement:

i) Each PAF losing house would be allotted a house plot of 200 sq.m size, free of cost.

ii) PAF can retrieve material from their houses being acquired. Free transportation of retrievable material and household belongings or Rs.2, 000 to each house owner.

iii) House construction assistance of Rs.1,00,000 to each PAF displaced/losing homestead.

iv) If the PAF losing house desires to construct his house at a place other than the proposed resettlement site, then the head of PAF will receive an amount of Rs.1,32,000 as compensation for submerged house. The details are given below:

Details of Compensation for each submerged house	**Amount**
1) Cost of land for construction of house	Rs. 30,000
2) Assistance for shifting to the new site	Rs. 2,000
3) Assistance for construction of house	Rs. 1,00,000
Total	**Rs. 1,32,000**

As mentioned earlier, about 249 families are likely to lose their houses. A plot of 200 sq.m will be provided to each of the displaced family. The total land requirement for the 249 houses will be about 4.98 ha. Total land requirement for construction of houses and other infrastructures will be about 2.5 times more. Thus the total land requirement will be 12.45 ha. The estimate for resettlement of 249 PAFs is Rs.256.47 lakhs (Table 12.6). The alternative land would be provided by the project authorities in consultation with the Collector. For construction of house, each displaced family will be provided with an assistance of Rs.1 lakh for construction of house. This construction assistance will be adjusted with the cost of construction of house at new resettlement sites/villages.

Table 12.6
Compensation for Houses coming under Submergence

Sl. No.	**Particulars**	**Unit**	**Rate (Rs.)**	**Compensation (Rs. Lakh)**
1	Cost of land for resettlement site	12.45 ha	20,000	2.49
2	House construction assistance	249 PAFs	1,00,000	249.00
3	Assistance for shifting to the new site	249 PAFs	2,000	4.98
	Total	**-**	**-**	**256.47**

If few families propose to shift to some other area of their choice, a cash amount of Rs.132,000/house owned can be paid.

12.7.4.2 Infrastructure Development

The following civic amenities are suggested in the prescribed scale and manner in the new village or in the extended part of any existing village established for the purpose of resettlement of PAPs. The expenditure on all these aspects shall be the part of the project cost.

i) Water supply for drinking purpose
ii) One primary school with playground in each resettlement village
iii) Tar topped internal approach roads and link roads to the main road
iv) Electric supply at least one point at each house
v) Sewer network and latrines in each house
vi) Land for market and future expansion of the resettlement village
vii) One community building in each resettlement village

About 249 houses will be acquired, which needs to be resettled. Thus, an approximate population of about 1333 needs to be resettled. It is proposed to resettle such a population in adjacent to the existing villages where wasteland can be acquired. The details of expenditure on development of infrastructure facilities will be about Rs.40 lakhs (Table 12.7).

Table 12.7
Expenditure on Development of Infrastructure Facilities

Sl. No.	Facilities	Criteria	Unit	Unit Cost (Rs. lakh)	Total cost (Rs. lakh)
1.	Water Supply	For two resettled village	1	2	2
2.	Primary school	For two resettled village	1	5	5
3.	Approach roads	For two resettled village	5 km	5	25
4.	Lighting	One for each resettled village	1	4	4
5.	Community building	One for each resettled village	1	4	4
Total					**40**

12.7.4.3 Area Development Activities

The Area Development Activities (ADA) suggested on the project often leads to direct as well as indirect impacts on the socio-economic environment of the region. The acquisition of land or house or both are

the direct impacts. The indirect effects include the loss of business opportunities due to acquisition of a village either fully or partly. The objective of the Area Development Activities is to eliminate the suffering to the local population to some extent. The various measures include:

i) One Primary health centre (PHS) for the area with free medical, immunization, and family planning facilities.

ii) 1 Post office for the area with telephone facilities.

The cost required for various measures is expected to be of the order of Rs.55 lakhs. The details are given in Table 12.8. The operation cost for PHCs will be borne by the state government.

Table 12.8
Cost of Area Development Activities

Sl.No.	Item	Cost (Rs. Lakh)
1.	One Public Health Centre @ Rs. 20 lakhs	20
2.	One Post Office @ 5 lakhs	5
Total		**25**

12.7.4.4 Rehabilitation Measures

Compensation will be given to the PAFs who are losing about 1058.4 ha (80% of the total submergence area) land due to submergence under the reservoir. The rehabilitation policy proposed for the project proposes "land for land" compensation for the families losing cultivable land if equivalent amount of cultivable land is available in the areas near to their existing settlement sites, or "cash compensation in lieu of lands".

In the first case, the alternative land to the families would be decided and allotted by the State Government in accordance with the section-4 of Land Acquisition Act. However, such land has to be identified in the periphery and near the submergence area, which could be developed as cultivable area after suitable reclamation measures. The same area could be allotted to families losing cultivable lands/orchards.

The detail of compensation for the families losing cultivable land is mentioned in Table 12.9. The figure of "cash compensation in lieu of land for land" arrived at Rs.22,000 per hectare (land cost Rs.20,000 per ha plus compensation for standing crops Rs.2000 per ha), which is totally tentative and indicative for budgetary estimation only. The compensation package is to be finalized by the project authorities in consultation with the concerned district Collector.

Table 12.9
Compensation for Cultivable Land under Submergence

Sl. No.	Particulars	Land (ha)	Rate (Rs./ha)	Compensation (Rs. In lakhs)
1.	Compensation for cultivable land	846.72	20,000	169.34
2.	Compensation for standing crops	846.72	2,000	16.93
Total				**186.27**

12.7.5 Participation of Project Affected Persons (PAPs)

Involvement of affected communities in planning and implementation of rehabilitation programmes according to their felt needs and socio-economic conditions is of vital importance. To obtain co-operation, participation and feedback, PAPs need to be systematically informed about their options and rights and consulted during preparation and implementation of resettlement plan. In the proposed project, co-operation and participation of PAPs in the R&R process could be ensured through their involvement in each of the following stages.

12.7.5.1 Preparation of RAP

As a part of participatory planning, community meetings shall be held on a routine basis to explain about the project and the R&R policy of the project. A proper direct communication with the PAPs may negate politicalisation of the R&R process. The communication with the PAPs can also be through the Village Level Committee (VLC).

12.7.5.2 Implementation of RAP

The State Government will be involved in the implementation of RAP particularly during the identification of land to be allotted to PAPs. They shall also be consulted in finding out alternative economic opportunities to supplement their household income. However, some NGO groups will also be associated who can interact directly with the project authorities and the PAPs.

12.7.6 Institutional Arrangements

12.7.6.1 Role of Institutions

The project implementing authority would focus on three critical aspects during the implementation stage:

i) Organisation of Orientation and Awareness Seminars

ii) Establishment of a Resettlement Unit
iii) NGOs with experience in social development and good track record in resettlement and rehabilitation will be partners in RAP implementation.
iv) Apex committee may be formed which would coordinate the issue of land acquisition and look into various grievance redressals of the PAPs in the specified district.

The entire procedure for the Resettlement Implementation Programme will be carried out by two main institutions i.e. The Resettlement Unit and the Apex Committee.

Resettlement Unit will play a coordinating role for land acquisition and compensation, relocation and resettlement, distribution of most of the project provided assistance as well as enabling PAP access to most government programmes. This unit will consist of:

i) Representative from project implementing authority
ii) R&R Office Representative
iii) Representatives from Non-Governmental Organisation
iv) Representative of PAPs

The Apex Committee will monitor the implementation of R&R plan and advice accordingly. This committee will consist of:

i) District Collector
ii) R&R Officer
iii) Representative from project implementing authority
iv) Revenue Officer (Land Acquisition)
v) Representative of Forest Department
vi) Representative of PAPs

In matters of training of PAPs, the R&R Officer and the NGO would communicate with the local ITI, as necessary, to fix up the training programme and organize loans and assistance for establishment of small business units.

12.7.6.2 NGO Partnership

The NGOs will work as a link between the project and the affected community. It will educate PAPs on the need to implement the project on aspects relating to Land Acquisition and R&R measures and ensure utilization of various grants being extended to them under the R&R entitlement package. Specifically, the selected NGOs will:

i) Develop a rapport between the PAPs and the project authorities.
ii) Develop micro level plans for R&R in consultation with the PAPs and the project authorities. The NGOs will explain to the PAPs the options available for their R&R and assist them in making their choices.
iii) Assist PAPs in getting compensation for their land and properties acquired.
iv) Help PAPs identify suitable land for relocation.
v) Help project authorities in making arrangements for smooth relocation of the PAPs and their business.
vi) Ensure that benefits due to the PAPs under R&R policy are provided to the PAPs.
vii) Ensure proper utilization various grants to PAPs of available under R&R package.
viii) Assist PAPs in getting benefits from various government development programmes, particularly for house construction.
ix) Help PAPs to redress their grievances in the district level R&R Committee.

12.7.6.3 Selection of NGO

It is extremely important for the success of the R&R component to select an NGO, which is capable, genuine and committed to the task assigned. Key quality criteria include:

i) Acceptability to the PAPs
ii) Well acquaintance with the language and culture of the affected areas
iii) Having local presence in the project district, either through direct implementation of own programmes or through networking with local NGOs
iv) Availability of trained staff
v) Appropriate mechanisms for monitoring
vi) Track record in participatory management
vii) Competency, transparency and accountability

12.7.6.4 Contracting NGOs

NGOs will be involved in the implementation of the RAP through mutually agreed upon terms and conditions with specific responsibility and in-built accountability. A Memorandum of Understanding (MoU) will be signed with selected NGOs indicating the tasks to be performed and the amount to be paid for their services. The payment to the NGO will be linked to the performance of the task assigned and the time period. The payment will be arranged on a quarterly basis to be released on

certification of completing the designated task. The monitoring and evaluation component of the RAP will include the performance of the contracted NGO.

12.7.7 Implementation Schedule

The PAPs would receive adequate counseling and assistance before handing over their assets, so that they do not have to face any undue difficulties, before the commencement of project. Project works will not start in any segment unless and until RAP has been implemented and mutual agreement reached on compensation and assistance between the PAPs and the project authorities.

The first step in the RAP implementation is to notify and publicize a cut-off date. For legal title-holders, it is the date of issuing the notification "under the" act of 1894 and its amendment in 1957.

The Resettlement Unit will issue an Entitlement Identity Card to each of the PAPs. These identity cards will contain details of the type of losses and type of entitlements. The R&R Officer of the Resettlement Unit and the PAP concerned will verify these cards.

The RAP implementation for the project would take two years from the date of formation of Resettlement Unit. The R&R Officer of the LA Department would inform from time to time on a monthly basis the project implementing authority about the progress of RAP implementation. Only after the required feedback from the resettlement unit, the project implementing authority would initiate the works.

12.7.8 Income Restoration

A major objective of the RAP is to restore and improve the economic livelihood and standard of living of the PAPs. For the purpose, certain schemes have to be incorporated in the RAP by which job skills training and credit for micro enterprises will be made available to the affected people. Providing employment to the local people will enable them to participate in the benefits of the project.

Both short term and long term strategies would be followed for income restoration of PAPs. Short-term income restoration aims at restoring PAPs income in the period immediately before and after relocation. These include the following:

i) One time relocation allowances
ii) Free transport to resettlement sites

iii) Free or subsidized items
iv) Transitional allowances or grants until adequate income is generated with special allowances for vulnerable groups
v) Providing employment to the PAPs to the project itself.

Short-term income restoration strategies may also include full compensation for land, structures and all other assets before relocation.

Long-term income restoration strategies involve land and non-land based economic activities that will provide a sustained source of income over a longer period of time so as to restore and if possible, improve the PAPs standard of living. These programmes are either project financed or government financed.

The key steps in income restoration programmes are:

i) Analysis of the economic activities of all PAPs
ii) Test training and income generating programmes with selected PAPs on a trial basis
iii) Evaluation of the programmes and providing additional assistance, if required

In case of loss of farmland, providing land in replacement is recognized as the best and most sustainable option for income restoration. However, as replacement land is hard to find, cash compensation is the only alternative. The market/replacement value of the land would have to be deposited in the bank accounts of the PAPs. Such money will be released for buying replacement land. This will discourage use of compensation money for consumption purposes.

12.7.9 Grievance Redressal

12.7.9.1 Grievance Redressal Procedure

The RAP needs a mechanism to ensure that the benefits are effectively transferred to the beneficiaries in a transparent manner after proper disclosure and public consultation with the affected population. There is also, the need for an efficient grievance redressal mechanism for assisting PAPs in resolving queries and complaints and in requital of grievances. Such queries relate mainly to disputes about ownership of assets, identification of legal heirs of deceased property owners as well as a few non-land related issues.

To redress grievances it is suggested that the Project Level Committee created for RAP implementation should also handle this responsibility. This Committee would hear complaints and encourage dispute settlement

through mediation and conciliation to avoid unnecessary litigation.

12.7.9.2Grievance Redressal Committees

The Grievance Redressal Committees would be set up to:

i) Provide information and assistance to PAPs on resolving problems arising out of land acquisition issues and eligibility for entitlements under RAP;
ii) Record, categorize and prioritize the grievances of PAPs;
iii) Attempt disposal of such complaints within a reasonable period, say, one month;
iv) Inform project authority of difficult cases within one month; and
v) Provide a feedback to the aggrieved parties about their grievances and decisions of the project authority.

The Committee will meet regularly (at least once a month) during implementation of the RAP, suggested corrective measures at the field level itself and fix responsibilities for implementation of its decisions. The Committee should ordinarily deliver its decision within a month of the registration of a case.

The PAPs will be informed through public consultations that they have a right to grievance redressal from the project authorities. The Project Level Committee and the NGOs will take the first step towards this end. The PAPs can approach the Project Level Committee for presenting their grievances or queries to the project authorities.

At the community level, Project Level Committee will have the power to resolve matters either by providing information or through necessary follow-up action. If it rejects some grievances for not being relevant, it may explain the reasons to the PAP.

The District Collector will hear appeals against the decisions of the Committee and his decisions will be final and not contested in any other forum except in a court of law. Even in cases where the matter has gone to the court, the NGOs will continue their effort to settle the issue, and expedite the implementation of R&R programme. An additional option may be provided to the PAPs by forming Lok-Adalats at Block level. The PAPs may avail of the Lok-Adalat facility before approaching a court of law. The Collector of the concerned district may advise the Revenue Department to update land records by effecting mutations wherever necessary.

12.7.9.3Information Dissemination

Press Notes and Handouts in local language should be distributed among all the affected persons highlighting the prospects of amicable and steady settlement of disputes, through various forums.

12.7.9.4 Conciliation Mediation

In compensation cases, compromise/consent to a specific price of land/structure is important and is usually obtained through a series of conciliation, negotiation and mediation. Such mediation/conciliation may be held at the appointed places by the Committee under the Chairmanship of senior officers. Willingness of the PAPs to take part in these proceedings with an open mind may be solicited. If this fails to arrive at mutually acceptable solution, the case may be brought up before Lok Adalat before taking recourse to a court of law.

12.7.10 Monitoring and Evaluation

The monitoring of the RAP would involve both Internal and External Monitoring. The monitoring relates to the progress of a resettlement and involves, analysis and reporting of its progress. Evaluation of the RAP is to take place after the RAP has been implemented.

An external agency, may be an NGO, might be hired for monitoring and evaluation of the RAP. The hiring criteria must be the same as that for hiring the implementing agency/NGO. The budget, etc., for hiring the external monitoring and evaluation agency would be the same as that of implementation agency. It would, however, depend on project implementing authority to decide whether they will have such an agency for monitoring and evaluation work.

12.7.10.1 Internal Monitoring
a) Monitoring Process

Internal monitoring will be based upon a computerized card system kept in the monitoring office recording the entitlements due and received by each affected household. This would be supplemented by periodic surveys designed to measure changes against the baseline established during the initial census and survey work. Such periodic surveys would focus upon the receipt of entitlements by people affected and on the benefit indicators. Monitoring indicators will be selected to address the specific contents of the activities and entitlement matrix.

The contents of internal monitoring in a nutshell are:

i) Activities of RAP
ii) Entitlement
iii) Time frame
iv) Periodic system of survey

b) Key Indicators

Key indicators for monitoring are mentioned below on the basis of the nature of monitoring process:

I. Budget and Time Frame

i) Have land acquisition proceedings been completed?
ii) Have all settlement staff been appointed and mobilized?
iii) Are resettlement activities on line with the implementation plan?
iv) Have resettlement agencies received and disbursed the funds on time?
v) Have all lands been acquired from the landholders in agricultural and urban areas in time for project implementation?

II. Delivery of Entitlement

i) Have all PAPs received entitlement according to numbers and categories of loss mentioned in the entitlement matrix including payments on time?
ii) Have all PAPs received the agreed transport costs, relocation costs, and allowances, according to schedule?
iii) Have income and livelihood restoration activities for landholders been implemented? Where PAPs trained and provided with jobs?
iv) Has credit has been disbursed? Have income generating activities started
v) Have affected business establishments received entitlement, including transfer and payments for net losses resulting form lost business and stoppage of production?

III. Consultation, grievance and special issues.

i) How many PAPs know their entitlement?
ii) Have PAPs used the grievance redressal procedures? If yes, what was the outcome?
iii) How well conflicts have been resolved?

IV. Benefit Monitoring

i) Changes that have occurred in patterns of occupation and resource use compared to the pre-project situation.

ii) Change that has occurred in income and expenditure pattern compared to pre-project situation.
iii) Changes in key social and cultural parameters relating to living standards.

c) Reporting

The frequency of reporting for internal monitoring is once every month during the span of 12 months of the RAP implementation in the project.

12.7.10.2 External Monitoring

An independent agency not associated with the project execution will be engaged to carry out mid term and end term evaluation of the project. The independent agency will also evaluate the performance of the NGOs and the R&R Cell. Criteria for selecting an external agency for Monitoring and Evaluation should take into account their experience in the field and comprehensive knowledge of R&R needs of the PAPs. The agency would be an external agency, which has not participated in the planning or implementation responsibilities. The entire expenditure of this agency would be a part of the project cost. Disbursement of fees to the monitoring and evaluating agency would be made on a monthly basis by project implementing authority. The fees will include salary of the staff along with overhead costs including transport etc. The period or contract of the external monitoring agency should be 18 months, which could be extended if required.

a) Monitoring Process

The external monitoring process in a nutshell is:

i) Verification of results of internal monitoring;
ii) Regular site visits for corrective measures and suggestive actions;
iii) Assessment as to whether resettlement objectives, namely livelihood and living standards have been restored and enhanced;
iv) Efficiency and effectiveness of RAP and guidelines for future resettlement plans; and
v) Appropriateness of resettlement entitlements and suitability to conditions of PAPs.

The external team would set up its own database for monitoring and evaluation, building up the projects own record system. For comparability, the entire survey would encompass sample frame before and after resettlement conditions. Survey analysis should judge the efficiency, impact and sustainability of the implementation procedure.

b) Key Indicators

Key indicators for external monitoring are given below:

i) Were depreciation aspects in valuation of land and assets taken care of?
ii) Were compensation payments sufficient to replace lost assets?
iii) How much do PAPs know about resettlement procedures and entitlement?
iv) Do they know if these have been met?
v) How much do PAPs know about grievance procedures and conflict resolution procedures?
vi) Were PAPs and assets correctly evaluated?
vii) Was the time frame sufficient to meet the objectives?
viii) Were there unintended impacts on employment or income?

c) Reporting

As a feedback to the Resettlement Unit, the external agency will submit monthly reports on the progress of the RAP implementation identifying issues and concerns that require attention. The monitoring agency, would in the entire life cycle of the R&R implementation, monitor the progress of the project and suggest the areas needed to be corrected or reconsidered, to the implementing agency. On the basis of the monthly report the project implementing authority will take corrective measures.

12.7.11 Budget for R&R

The proposals for R&R are tentative and modifications may take place in the later stages. Since the identification of resettlement land has not been made and it is not sure that the land so identified will be acceptable to PAPs, changes have to be made in the R&R Plan as well as in the budget estimate. The budget estimate for implementing R & R Plan is estimate at Rs.509.74 lakhs. The details are given in Table 12.10.

Table 12.10
Budgetary Estimate for R&R Plan

Sl.No.	Activity	Cost (Rs. Lakh)
1	**Resettlement**	
	Cost of land required for resettlement site	2.49
	Compensation for residential houses	249.00
	Assistance for shifting to the new site	4.98
	Development of infrastructure facilities	40.00
	Area development activities	25.00
	Miscellaneous expenses (monitoring & evaluation, operation or land acquisition office and contingencies)	2.00
2	**Rehabilitation**	
	Compensation for cultivable land	169.34
	Compensation for standing crops	16.93
	Total compensation	186.27
	Total (1+2)	**509.74**

12.8 Environmental Benefits

The proposed Krishna (Almatti) - Pennar link canal along with proposed Kalvapalli reservoir will impart various environmental benefits to the command area as well as to the villages located along the entire stretch.

12.8.1 Increase in Agricultural Production

Introduction of irrigation in about 234589 ha of land would increase the agricultural production by nearly 3 to 4 times. This would lead to substantial rise in the annual income of the local people, as they are mostly dependent on agriculture.

12.8.2 Improvement in Cropping Pattern and Agricultural Practices

The cultivators in the command area may be inclined to use modern and improved implements like iron plough, oil engines, electric pumps and tractors and farmers may be able to undertake deep plough and improved agricultural practices under intensive cultivation due to availability of water.

12.8.3 Industrial and Socio-Economic Development

Agricultural development by introduction of irrigation would give impetus to agro based small scale industries, dairy and poultry development, development of communication network, infrastructure, health and education facilities, rise in economic activities, rise in the living standard of general public and several other aspects of socio-economic development.

12.8.4 Promote Pisciculture

Construction of proposed reservoir at Kalvapalli will lead to improvement of wetland, fisheries and aquaculture practices. Due to formation of reservoir, physical parameters like depth & surface area, limnological parameters such as decrease in water temperature, dissolved oxygen concentration, increase in nutrients, sedimentation, redose-potential, change in biota and increase in biological production will create new environment suitable for rearing of fishes and thereby increase the fishery potential. Improvement in aquaculture practices is expected through establishment of breeding, seeding and fish farms in villages in the vicinity of the proposed reservoir. Establishment of fishery cooperative society will improve economic status of people through employment opportunities in the field of fishery.

The entire stretch of the canal runs through drought prone areas. Because of this, no major ponds have been observed during the survey. However, some dry tanks exist which may subsequently be filled up with water from the proposed canal. These structures may promote pisciculture.

12.8.5 Improvement in Vegetation Cover

Increase in availability of water for irrigation and agriculture will improve vegetation cover in terms of fodder, thereby improvement in live stock production, animal husbandry practices along with poultry production. Afforestation programme on the banks of link canal, branch canal and distributaries will enhance environment.

12.8.6 Employment Generation

The data on employment generation in respect of Upper Ganga Canal Development and Modernization Project (Govt. of U.P) has been taken into consideration for assessing the employment generation in this report. 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 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 Krishna (Almatti) - Pennar link canal project is Rs.6599.80 crore. The employment generation potential of the project following the norms as mentioned above will be 14200 personnel per annum in the order of 3000 in the technical and 11200 in the non-technical categories. The technical category comprises of 940 engineers, 955 other technical, 1105 skilled and semi-skilled personnel whereas the non-technical category comprises of 8550 unskilled and 2650 administrative personnel, annually.