



**“Form-1, PFR and Proposed ToR for Obtaining ToR of
ATTAPPADY VALLEY IRRIGATION PROJECT
in District Palakkad, Kerala”**

PROJECT PROPONENT
IRRIGATION DEPARTMENT AND RESEARCH BOARD
IRRIGATION DEPARTMENT,
GOVERNMENT OF KERALA



Right flank of dam & Siruvani river- View from left flank of dam

MCPL/EMD/RV/15-16/02/01

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Prepared By

MANTEC CONSULTANTS PVT. LTD.

*QCI/NABET Accredited EIA Consultant at S.No.104 as per List of Accredited
consultant Organizations/Rev.38/Feb. 08, 2016 and MoEF & NABL approved
Laboratory*

805, Vishal Bhawan, 95 Nehru Place, New Delhi-110019, PH. 011-26429294/95/96,

Fax. 011-26463665/26842531, e-mail: mantec@vsnl.com,

Environment Division, D-36, Sector-6, Noida-201 301, U. P.,

Ph. 0120-4215000, 0120-4215807 Fax. 0120-4215809,

E-mail: environment@manteconsultants.com

Website: www.manteconsultants.com

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1. EXECUTIVE SUMMARY

- The Attappady Valley Irrigation Project (AVIP), a medium irrigation project, envisages the construction of a Concrete gravity dam across Siruvani river, a tributary of Bhavani river at Chittur in Agali Village of Mannarkkad Taluk in Palakkad district of Kerala state. The dam will impound 65 Mm³ (2.29 TMC) of the awarded share of water from Bhavani river basin as against the award of 2.87 TMC as per the Final Order of Cauvery Water Dispute Tribunal (CWDT). There is also a proposal for small power generation of 2.88 MW.
- Attappady Valley Irrigation Project (AVIP) is not a new proposal. The investigation for the AVIP started way back in 1970. The investigations for location of the dam were carried out from 1975 to 1982 with the assistance of geologists from the Geological Survey of India (GSI). After the finalization of the dam alignment, necessary steps for speedy completion of the project were carried out from 1976 onwards. The land acquisition for the project was carried out by a Special Land Acquisition Tahsildar, AVIP and acquisition procedure was initiated for the land for the submergible area of the dam, canals, office and quarters etc. The basic infrastructure facilities like office buildings, inspection bungalows and quarters for supervising staff etc were constructed. The Central Water Commission's (CWC) clearance was not obtained for the project, for want of Final Order of CWDT. Due to non-clearance by CWC and paucity of funds, the works relating to AVIP was held up since 1989. The Final Order of CWDT was released on 05/02/2007 and gazette notification was published by the Government of India vide extraordinary gazette notification dated 19/02/2013, from which date the Final Order of CWDT came into force. In the Final Order of CWDT, Kerala was awarded 6 TMC from the Bhavani river basin and 2.87 TMC is specifically awarded to the AVIP dam project.
- Attappady area, in Palakkad district, is a drought prone tribal area. Demographically, 40 % of the population in Attappady are tribals, who are

generally backward, living below poverty line and depend on cultivation and cattle rearing. The Attappady area is classified as an Integrated Tribal Development Block (ITDP).

- The climate and rainfall pattern of the catchment and command area of the proposed AVIP varies to a great extent. The catchment area being a part of Nilgiri hills of the Western ghats experiences tropical/humid tropical climate. The catchment area is subjected to a high intensity of rainfall characteristics of Western Ghats region where as the command area is a rain shadow region having relatively poor rainfall intensity. The annual average rainfall in the catchment area and command area are 3910mm and 972mm respectively. Due to non-availability of water for agricultural purpose, vast fertile area of Attappady area is slowly turning into wastelands. The command area of the project also experience domestic water scarcity.
- There is no major/medium water retaining structures in the Command area of the project. Most of the available irrigation facilities are private owned lift irrigation systems which are confined to small patches. The farmers rely mainly on rainfed agriculture.
- The Full Reservoir Level (F.R.L) of the dam is fixed at +611.00m and Maximum Water Level (MWL) at +612.00 m. A free board of 1.50 m is provided for wave action and the dam top level is +613.50 m. The length of the dam is 450m and the height of the dam from the deepest point is 51.50m. The Spillway openings are provided to discharge the design flood of 3622 cumecs by means of 4 shutters of size 12m X 12.50 m.
- The canal distribution system is proposed to irrigate a command area of 4900 hectares of land in Sholayur, Agali and Kottathara villages of the Attappady region. Pipes are proposed, so as to reduce land acquisition and also to increase efficiency.
- The submergible area of the dam is 302 ha, out of which the irrigation department has acquired 210 ha of private land. The remaining 92 ha of land to be acquired consists of 73 ha of Vested Forest land. Irrigation

department has submitted necessary application to the Divisional Forest Officer, Mannarkkad for obtaining forest clearance as per Forest Conservation Act, 1980. Necessary application has been submitted to the Divisional Forest Officer, Mannarkkad on 17/01/2014. Due to changes made in application procedure, the online submission has become mandatory, the proposal for which will be submitted shortly.

- Compensatory afforestation, including identification of land required to be handed over to forest department in lieu of forest land used by department, as per rules, will be carried out by the Irrigation department. The species of flora and fauna in the submergence area are neither endemic nor rare or endangered. Considering the benefits to the backward tribal people, the loss of 73 ha of Vested forest land is justifiable.
- No further tribal settlement will be submerged since 51 Nos. of Adivasi families from dam site and reservoir area, have already been shifted and rehabilitated.
- Infrastructure facilities like office buildings, quarters, stores etc were completed. Initial blasting of the rock for foundation of dam was carried out. Structures for river diversion for construction of dam were also completed.
- For construction of the dam, Irrigation department had identified and acquired a quarry namely, Chundakulam quarry, which is near the dam site.
- Geological Survey of India (GSI) had conducted geological investigations on the AVIP dam site at Chittur during 1975 to 1982 in seven Field Seasons which includes 4 Pre-construction stage investigations and 3 Construction stage investigations.
- After the finalization of alignment of dam in 1978, initial blasting for foundation of dam at right flank of dam was carried out partially. The construction of right bank canal for a length of 6.50 km was completed.
- The existing cropping pattern of Attappady region is seasonal crops like paddy, cotton, maize, ragi, groundnut, vegetables, ginger and turmeric and annuals like banana and sugarcane. The cropping pattern needs to be

altered to maximize the yield after improved irrigation facilities, through the project.

- The Siruvani river water conforms to the water quality standards of Central Pollution Control Board (CPCB) for drinking and irrigation purposes.
- The project will benefit the socio-economic environment of the Attappady region, because agriculture is the mainstay of the tribal community and there are no other employment opportunities like industries, construction etc. in the project area.
- Cattle and milk production is another occupation of the tribal's in the Attappady region. The dam will provide congenial conditions for the livestock, providing better grass and fodder.
- Attappady region experiences extreme water scarcity for domestic use. This project will aid in water supply scheme also.
- The two villages Sholayur and Agali come under notified Eco-Sensitive Area (ESA) of Western Ghats vide notification of MoEF No. 1-4/2012-RE(Pt), dated 19.11.2013. Hence, project becomes Category-A and needs Environmental Clearance from MoEFCC, New Delhi.
- The Benefit-Cost ratio of the project is 1.89 and hence the project is economically viable.

Table 1-1 : Salient features of the project

Project Name	Attappadi Valley Irrigation Project
Location	Dam across Siruvani River in Chittur, Agali and Sholayur villages in Mannarkhad taluk, Palakkad district of Kerala State
Latitude /Longitude	11 ⁰ 03'15"N / 76 ⁰ 39'10"E
Project Type	Category A; New Project (multipurpose irrigation)
Toposheet number	58 A/12
Land use	73 ha of vested forest land will be submerged. The cultivable and barren waste lands can be converted as agricultural land with assured water for irrigation.
Proposed CCA	4900 Ha.
General Condition	Yes (Due to being in the notified Eco- Sensitive Area as per the Report of the High Level Working Group on Western Ghats (Kasthurirangan Report). The finalization of ESA in Kerala state is still pending.). Interstate boundary of Kerala-

	Tamilnadu also exists within 5 km radius.
Water demand	2.29 TMC / 65 Mm ³
Sources of water	Siruvani River, a tributary of Cauvery river.
Seismic zone	Zone III
Project Cost	Rs 797 Crores

2. INTRODUCTION OF THE PROJECT / BACKGROUND

INFORMATION

2.1 Identification of the Project Proponent

The Irrigation department under Government of Kerala is responsible for the development of irrigation schemes in the administrative area of Kerala State. For convenience and ease of administration, several Circle offices and under it Divisional offices are formed for different nature of work, different river basins etc.

The Bhavani Basin Division with headquarter at Agali is responsible for the planning and implementation of irrigation projects in the Bhavani river basin in Kerala State. Administratively, the division office is under the control of the Superintending Engineer, Siruvani Project Circle, Palakkad and the Chief Engineer, Project I, Kozhikode. The designs of various components are being carried out under the Chief Engineer, I&D, IDR, Thiruvananthapuram.

2.2 Brief Information about the Project

The Attappady Valley Irrigation Project (AVIP) envisages the construction of a Concrete gravity dam across Siruvani river, a tributary of Bhavani river at Chittur in Agali Village of Mannarkkad Taluk in Palakkad district of Kerala state. The AVIP dam at Chittur is located at 11°03'15.45" N latitude and 76°39'10.08" E longitude and is proposed to impound 65 Mm³ (2.29 TMC) of water including a dead storage of 4.50 Mm³.

In the Final Order of CWDT, Kerala was awarded 6 TMC for the Bhavani basin and 2.87 TMC is specifically awarded to the AVIP dam project.

Attappady Valley Irrigation Project (AVIP) is not a new proposal. For the Environmental Clearance, the proposal can be considered as **new project**. The investigation of the project started in 1970. The investigations for location of the dam were carried out during the period 1975 to 1982 with the assistance of geologists from the Geological Survey of India (GSI). After the finalization of the dam alignment, necessary steps for speedy completion of the project were carried out from 1976

onwards. The land acquisition for the project was carried out by a Special Land Acquisition Tahsildar, AVIP and acquisition procedure was initiated for the land for the submergible area of the dam, canals, office & quarters etc. The basic infrastructure facilities like office buildings, inspection bungalows and quarters for supervising staff etc were constructed. The Central Water Commission's (CWC) clearance was not obtained for the project, for want of Final Order of CWDT. Due to non-clearance by CWC and paucity of funds, the implementation of AVIP was held up since 1989. The Final Order of CWDT was released on 05/02/2007 and gazette notification was published by the Government of India, vide extraordinary gazette notification dated 19/02/2013, from which date the Final Order of CWDT came into force. In the Final Order of CWDT, Kerala was awarded 6 TMC for the Bhavani river basin and 2.87 TMC is specifically awarded to the AVIP dam project.

Based on the Final Order of CWDT, this medium irrigation project can be implemented for the benefit of drought affected tribal areas of Attappady Valley. The project was submitted to SEAC Kerala for obtaining Environment Clearance for the project. But the SEIAA Kerala vide its letter No764/EC1/2015/SEIAA dated 19.10.2015 has delisted the project and had requested the project proponent to approach MoEF &CC for obtaining approval of ToR for EIA study and Environmental Clearance as the Sholayar and Agali villages come under notified ESA.

2.3 Need for the Project and Its Importance to the country or Region

Attappady region in Palakkad district of Kerala state is one of the most drought prone areas in the State of Kerala. The district is having the most backward tribals in the State, majority of them living below poverty line and occupies a lowest position in socioeconomic development. Being a rain shadow region, rain is scarce in Attappady region. Due to non-availability of water for agricultural purpose, vast fertile area of Attappady area is slowly turning into wastelands.

There are no major/medium irrigation works in the Command area of the project except for three small diversion weirs. Since there is practically no storage for the above weirs, crops cannot be irrigated in summer season. Most of the irrigation facilities available are private owned lift irrigation systems and is confined to small

patches near the river banks. Hence, majority of the farmers rely on rainfed agriculture only. Also, there is shortage of water for domestic use during the summer season.

Vast lands of irrigable area in Kottathara, Sholayur and Agali villages are facing the impact of drought during the summer season due to lack of assured water for irrigation. To meet the increased demand for agricultural products, the available as well as the land lying fallow, due to the non availability of water for irrigation, are to be brought under intensive cultivation, for which the project is essential.

The proposed project is undertaken for the sustainable development of the area and by taking up planned irrigation in the area, to enhance the food production for the overall socio-economic development of the area and also to improve living environment of the population by harnessing the vast potential of available water resources, which was otherwise going as a waste.

The AVIP aims to utilize the inflow in the river effectively. The completion of the scheme will facilitate irrigation for a cultivable command area of 4900 Ha.

The resolution passed by the Agali Panchayat, Agali Block Grama Panchayat & Palakkad district Panchayat for implementation of AVIP is enclosed as Annexure No 06, 07 & 08.

2.4 Demand-Supply Gap

Due to growth and development of agriculture and allied sectors in Kerala, serious scarcity of water for domestic and industrial purposes is being envisaged. The acute shortage of irrigation water and shrinking watershed areas in forest regions pose additional problems. The surface water for agriculture was not sufficient due to inadequate storage facilities and ground water availability was poor due to little recharging by natural process and absence of artificial recharging facilities. The state government is implementing several schemes to reduce the adverse effect of water scarcity like rain water harvesting, enhancing efficiency of canal irrigation system, ground water management and watershed management.

2.5 Employment Generation

1. The project will benefit the socio- economic development of the Attappady region, since agriculture is the only sector giving employment and there are

presently no other employment opportunities like industries, construction etc. in the project area.

2. The proposed project will involve labour for construction of dam, water distribution systems and other infrastructure etc. This is likely to be an important sector of employment for the poor, especially the landless rural poor.
3. Increased employment in agriculture due to increased cropping intensity, increased crop area and output from irrigation. Rural poverty levels may therefore be reduced by increased employment opportunities.
4. Cattle rearing and milk production is one of the other main occupation of the tribals in the Attappady region. The dam will provide congenial conditions for the livestock, providing better grass and fodder.
5. The proximity of the Silent Valley National Park (13.70 km from dam site) and Coimbatore city will definitely aid tourist attraction when once the project is implemented.

3. PROJECT DESCRIPTION

3.1 Type of Project Including Interlinked and Interdependent Projects, If Any

The Attappady Valley Irrigation Project (AVIP) envisages the construction of a Concrete gravity dam across Siruvani river, a tributary of Bhavani river at Chittur in Agali Village of Mannarkkad Taluk in Palakkad district of Kerala state. The dam will impound 65 Mm³ (2.29 TMC) of the awarded share of water from Bhavani river basin as against the award of 2.89 TMC as per the Final Order of Cauvery Water Dispute Tribunal (CWDT).

The AVIP is a medium irrigation project. The potential head available at the dam can be utilized for power generation also. It is estimated that there is a power potential of 2.88 MW from the project. After power generation, the water can be diverted back to irrigation canal for irrigation purposes.

As per the EIA notification, 2006 and its subsequent amendment, the project is a “**Category A**” project due to applicability of the General Condition because;

- The project component falls in the Western Ghats` Ecologically Sensitive Area.
- Interstate boundary of Kerala-Tamilnadu also exists within 5 km radius.

3.2 Location (Map Showing general location, specific location and project boundary with project layout) with coordinates

The AVIP dam at Chittur is located at 11⁰ 03'15.45" N latitude and 76⁰39'10.08" E longitude in Chittur of Mannarkkad taluk in Palakkad district. The geodetic location of the proposed AVIP is 11⁰02' & 11⁰11' N latitude and 76⁰34' & 76⁰43'E longitudes. It is bounded by Bhavani River in North, Kodungarapallam River in East and Kanjirapuzha Irrigation Project catchment in west.

The total catchment of the Siruvani river above the dam site is 97 km² of which 77 km² is the net catchment area available for the AVIP dam at Chittur. The entire catchment area of the project is in the territory of Kerala state.

The location map of the dam is shown in Figure 3.1 and 3.2. The entire area falls in the Survey of India toposheet no 58 A/12. Plate No 02 depicts the location map of the project area on Toposheet and figure 3.3 and 3.4 presents the Google view of the proposed dam site.

3.3 History of the Project

The investigation for AVIP was started in 1970 and the Project report for Rs 476 lakhs was prepared. The Project report was further revised after detailed investigation. The cost as per the revised project report was 850 lakhs. Taking into account the revised alignment of canals and crop pattern, the Project report has been again revised to Rs 2600 lakhs as per Schedule of rates 1982. The Government of Kerala has accorded sanction for taking up the following preliminary works as shown in Table 3.1.

Expecting clearance of the project by CWC, the Government of Kerala took necessary steps for the implementation of the project. The Geological Survey of India investigated the dam site during 1975, by analysing bore hole details.

Table 3-1: Government Orders relating to works at AVIP

	Government Order No & date	Amount (in lakhs)
1	G.O. 130/73/W &P dated 18-04-1973 for Construction of buildings at Agali, Road to dam site, Land Acquisition etc	Rs. 26.13
2	G.O 285/76/W&P dated 23-07-1976 for Construction of buildings at Dam site, Extension of Electric lines etc	Rs. 17.00
3	G.O 208/77/W &P dated 12-07-1977 for Excavation of Dam foundation, forming RB & LB canal, development of quarries, Constructing Service roads, store sheds, Land Acquisition etc	Rs. 99.65
4	G.O Ms No 104/77/W & P dated 11-10-1977 for the purchase of Special tools and Plants	Rs. 26.00
5	G.O Rt. No 296/81/I&R dated 23-06-1981 sanctioning the preliminary estimate for the work	Rs. 341.78
6	G.O Rt No 394/81/I&R dt 24/08/1981 to carry out works in dam and appurtenant works	Rs. 201.50

LOCATION MAP - AVIP DAM

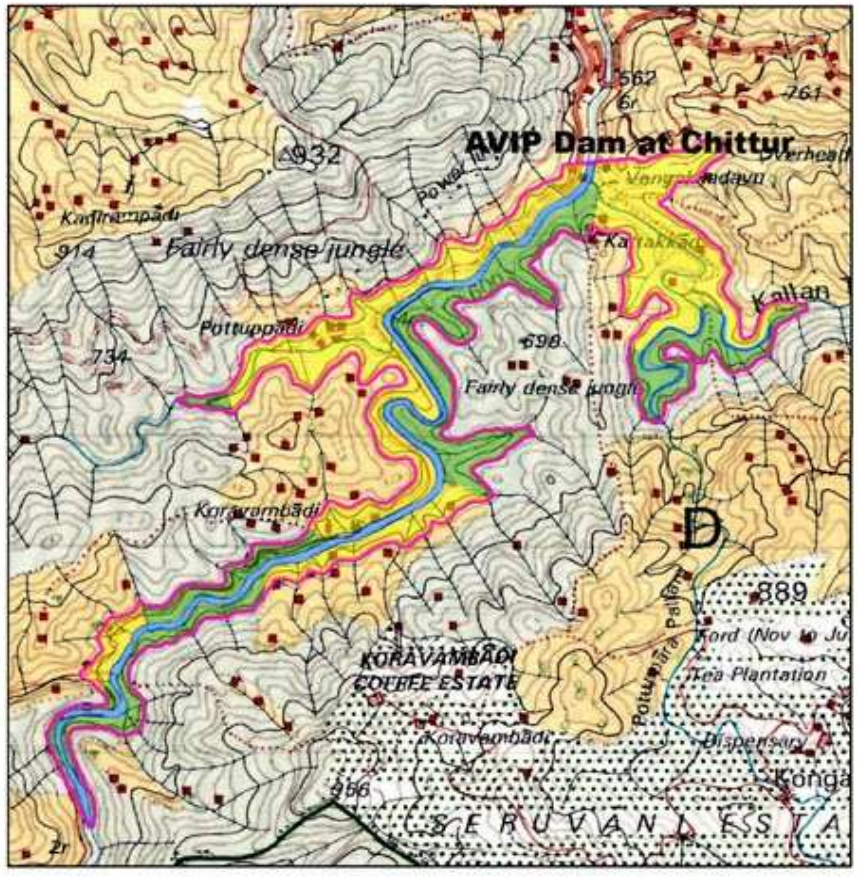
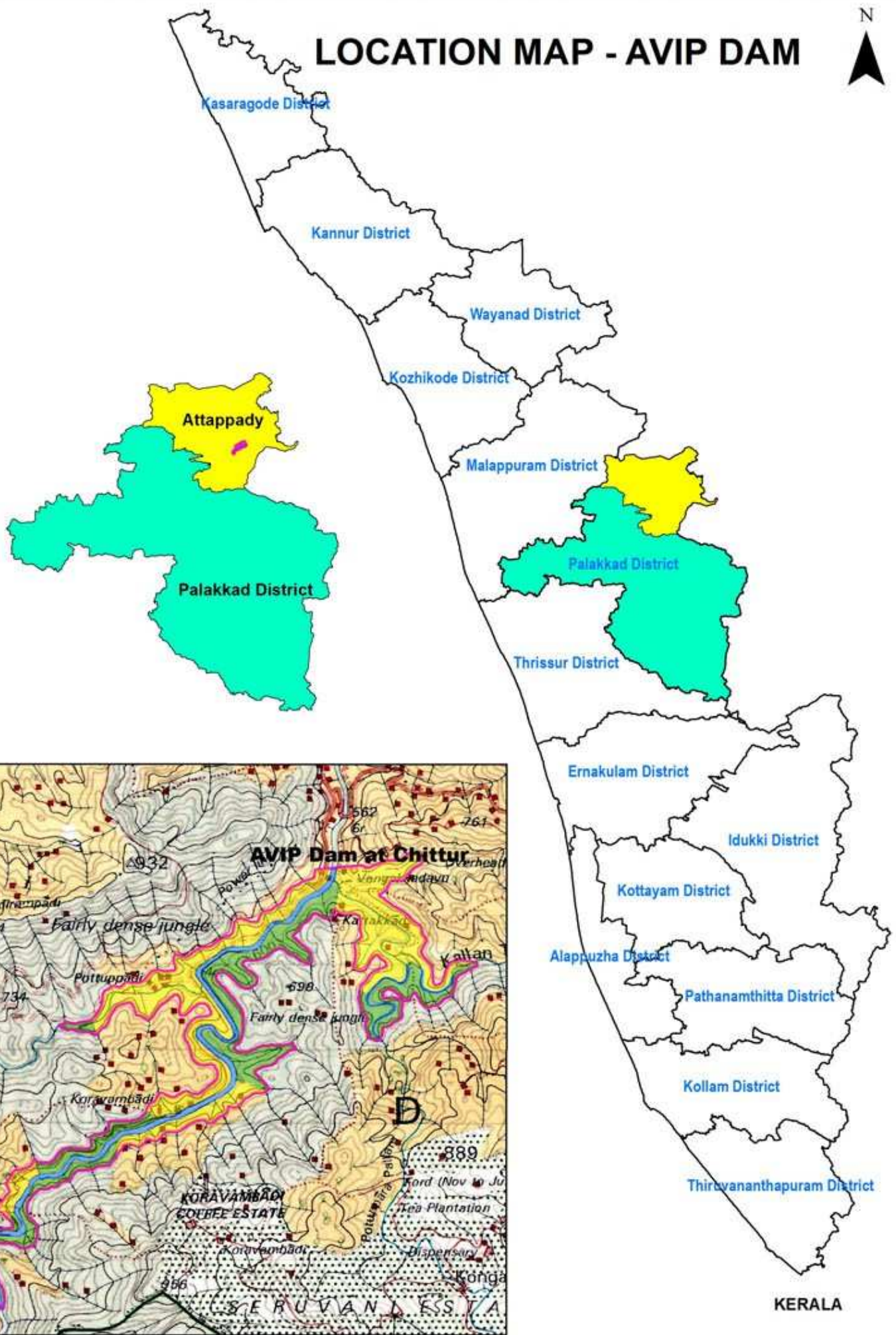


Figure 3.1: Location Map of AVIP Scheme

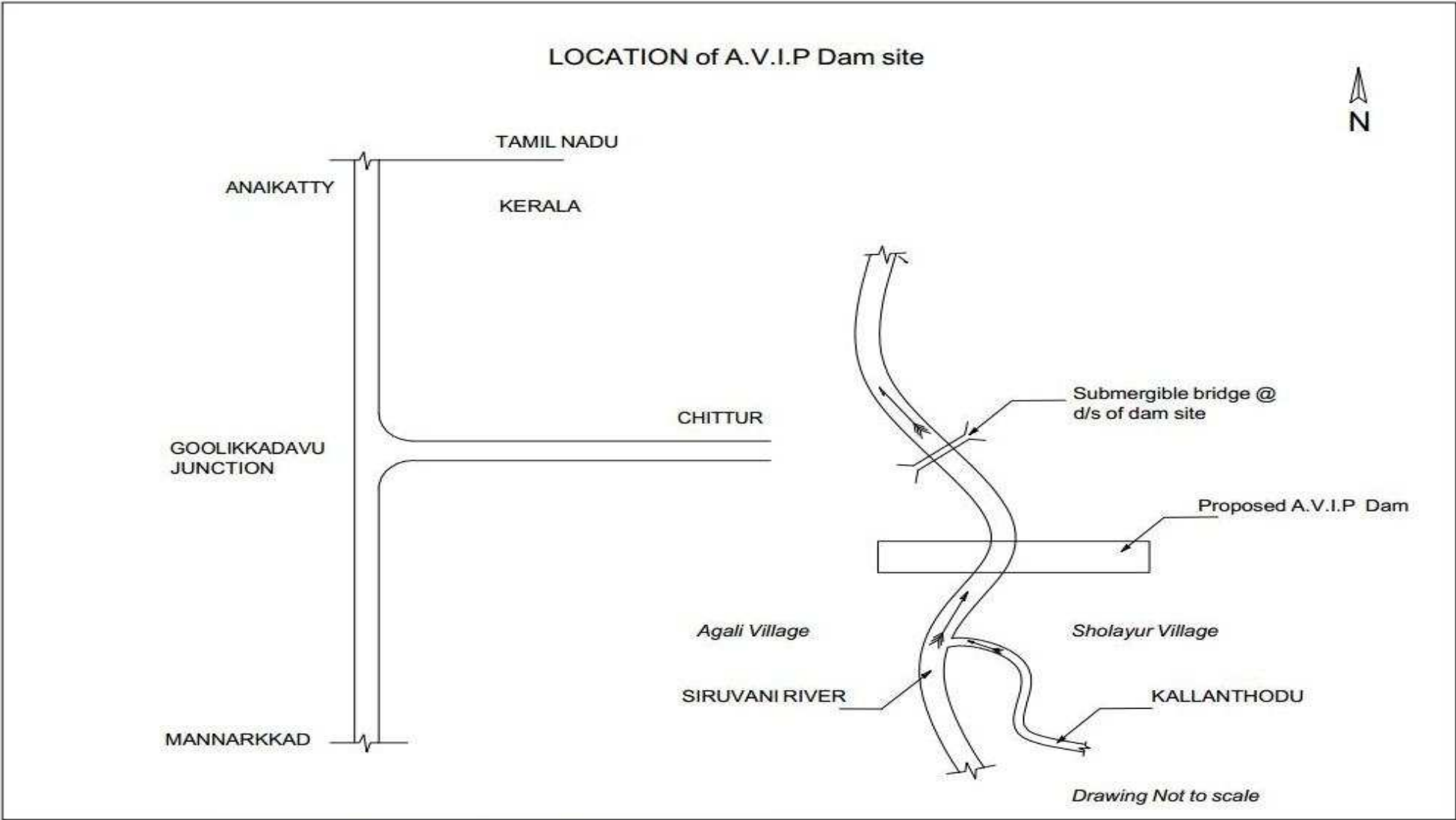


Figure 3.2: Site Map of AVIP Dam

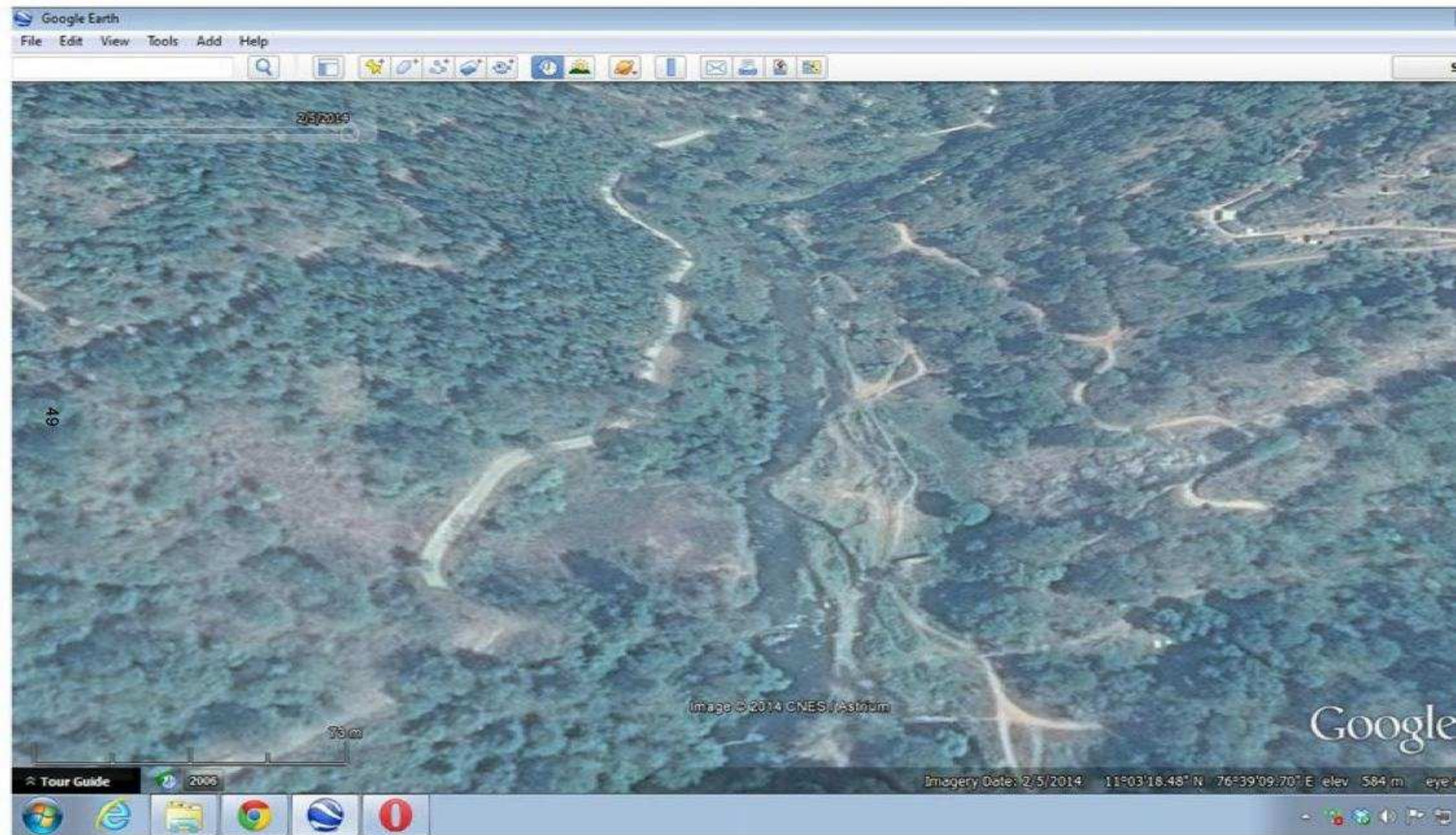


Figure 3.3: Google Earth Image of the AVIP dam at Chittur

Proposed AVIP dam at Chittoor, Attappady



Location of dam: (After confluence point of Siruvani river & Kallanthodu)

Right Flank of dam :-	Latitude: 11 03' 16.11" N	Longitude: 76 39' 14.57" E
Left Flank of dam :-	Latitude: 11 03' 15.21" N	Longitude: 76 39' 08.99" E

Figure 3.4: Google Earth Image with AVIP Dam Superimposed

3.4 Details of Alternate Sites considered and the basis of selecting the proposed site, particularly the environmental considerations gone into should be highlighted

The alignment of the dam proposed during 1975, (AA') was along N88⁰E- S88⁰W. This alignment was analyzed by bore holes considering the rock level and geological characteristics. During 1976-77, another two alignments were also investigated.

- I. Alignment (BB') at 25 m upstream of alignment AA'
- II. Alignment (CC') at 25 m downstream of alignment AA'.

On analysis, the centre alignment AA', was found cost effective.

Again during 1977-78, another two alignments were investigated, to avoid the E-W lineament at the dam site.

- (i) Alignment DD', connecting, 25m upstream of left bank of BB and 17m downstream of right bank of BB', along N82⁰E- S82⁰W.
- (ii) Alignment EE', at 175 m upstream of alignment DD', along N82⁰E- S82⁰W

On analysing the 5 alignments, it was found that the intensity and thickness of shear zones are less at alignment EE' than other lower alignments. The construction of dam along the alignment EE' was found economical relative to lower sites, as rock occurs at higher levels. Considering the advantages of the alignment EE', this alignment was finalized and blasting for foundation was started along EE', at the right flank of the dam. The details of various alignments considered in shown on **Figure 3.5 & Figure 3.6.**

3.5 Investigations by the Geological Survey of India (GSI)

The investigation of the dam started in 1970 and finalizing the alignment of dam was done with the assistance of Geological Survey of India. The Geological Survey of India (GSI) had conducted 6 Geological Investigations in 6 Field Seasons for the Attappady Valley Dam location, during the period 1974 to 1982. During the Field Seasons (F.S) 1974-75, 1976-77 & 1977-78 the various alignments for the dam was investigated by the Irrigation department based on the directions of GSI scientists.

Alternate alignments considered for AVIP dam

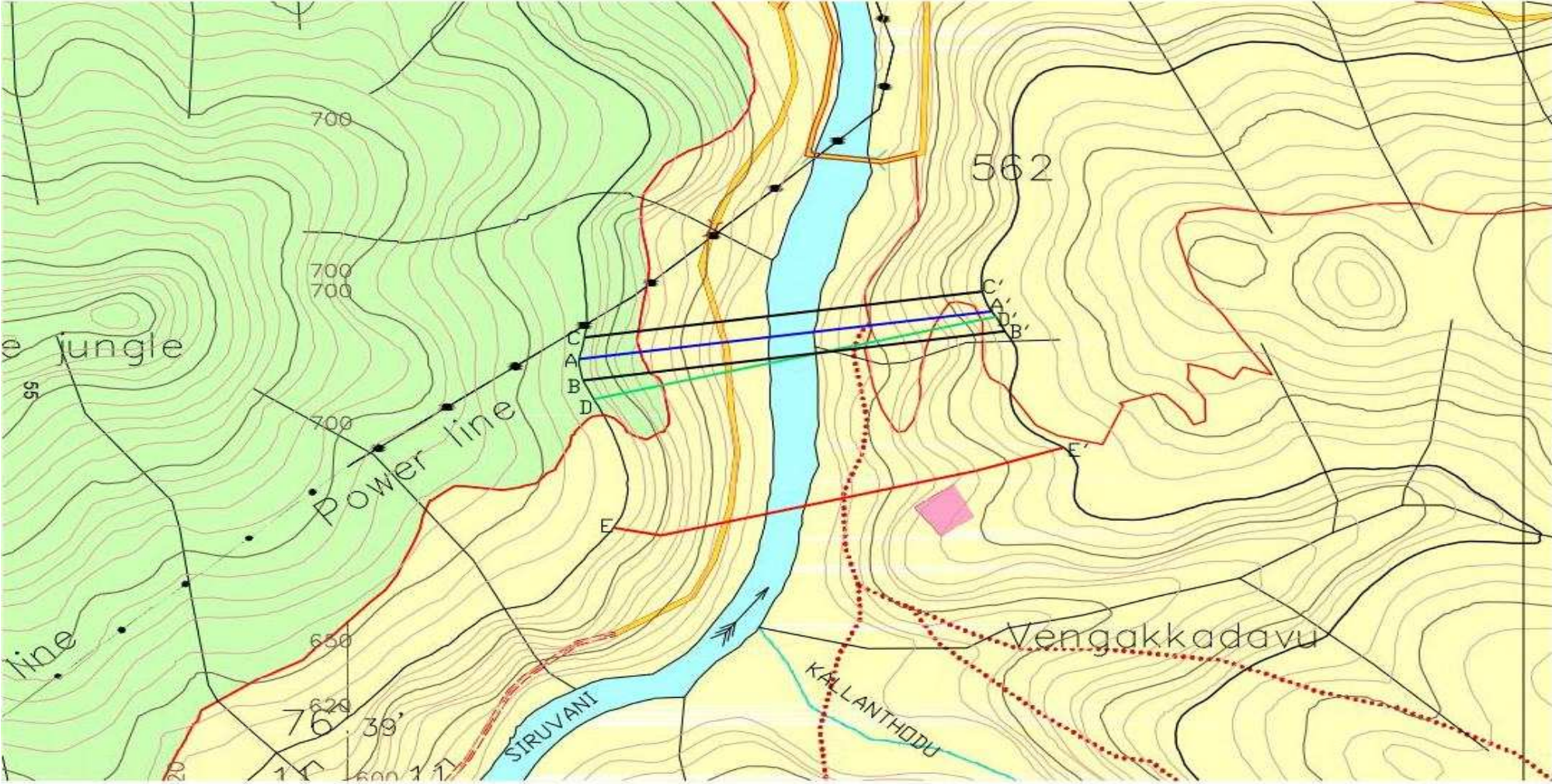


Figure 3.5: Alternate alignment considered for dam shown on Zoomed on Sol Toposheet No 58A12

During 1977-78, the dam alignment was finalized and initial blasting of the rock for construction of foundation of dam was started in the Right flank. The river diversion works were completed for the construction of different blocks of foundation, where blasting were carried out.

The details of the field investigations conducted by GSI are tabulated in the Table 3.2.

Table 3-2: GSI Investigations for AVIP dam site

SI N	Field Seaso	GSI Report & Investigator	Work done
1	1974-75	A Geological Note on the Attappady Valley Irrigation Project, Palghat district, Kerala By <i>G.S. Murthy</i>	Geological Mapping of dam site done in 1:1000 and Seven(7) bore holes were drilled on Left bank
2	1976-77	A Geological Note on the Logging of Boreholes drilled at Attappady Dam site : Attappady Valley Irrigation Project, Palghat district, Kerala By <i>Abdul Moghni</i>	29 bore holes were drilled on 3 alignments (d/s-11, centre 12 & u/s- 6)
3	1977-78	An INTERIM REPORT on A Geological Report on the Attappady Valley Irrigation Project, Palakkad, Kerala state By <i>A.R.Mahendra & Abdul Moghni</i>	9 bore holes were drilled. (Lower site 4 & Upper site 5)
4	1977-78	Pre-construction stage Geological report on Attappady Irrigation Project, Palakkad, Kerala by <i>A.R.Mahendra & Abdul Moghni</i>	Pre construction Stage report and investigated & recommended the Upper Site Alignment.
5	1979-80	Progress Report No: 1 on Construction Stage Geological Investigations of Attappady Valley dam project, Palakkad dist, Kerala	Progress Report No: 1 on Construction Stage Geological Investigation of AVIP dam-(Block 8 & 9 of spillway & dam foundation)
6	1980-81	Progress Report No: 2 on Construction Stage Geological Investigations of Attappady Valley dam project, Palakkad dist, Kerala	Progress Report No: 2 on Construction Stage Geological Investigation of AVIP dam- (Block 1 to 7 of right abutment)

7	1981-82	Geotechnical Note on the foundation of Block No 10 of Attappady Valley Irrigation project, Palakkad dist, Kerala	Construction Stage Geological Investigation of AVIP dam- (Block 10 of foundation)
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The details of the geological investigations on AVIP, is briefly explained below.

3.5.1 Field Season 1974-75

During this period, the geological investigation of the dam site was carried out by Sri. G.S.Murthy, during which detailed geological mapping on a scale 1:1000 was done in the dam site area to bring out the geological and structural features on the base map. Seven bore holes were drilled in the left bank and cores were examined and logged. As cores of all the boreholes were mixed up, it was difficult to reconstruct the cores of individual boreholes.

A set of nine boreholes, three in the right bank, three in the river bed spillway portion and three in the left bank were recommended to a depth of 10 m in hard rock to evaluate the structural and geological conditions.

3.5.2 Field Season 1976-77

During this period, the geological investigation of the dam site was carried out by Sri. Abdul Moghni, during which 29 Boreholes were drilled in dam site and logged. Three alignments, ie centre line alignment (AA'), 25 m upstream alignment (BB') & 25 m downstream alignment (CC') were analysed. The foundation conditions were similar along the 3 alignments and stripping would be almost the same order. It was recommended that, since the volume of the dam would be less along the proposed centre line of dam axis, this alignment may be preferred over the other two alignments.

3.5.3 Field Season 1977-78

During this period, the geological investigation of the dam site was carried out by Sri A.R.Mahendra and Sri. Abdul Moghni, during which in addition to 3 alignments investigated during F.S 1976-77, two more alignments were investigated. ie fourth alignment DD', at 25 m upstream of BB' and another alignment EE' at 175 m upstream of alignment DD'.

The drilling data suggested that the intensity & thickness of the shear zones are likely to reduce towards the upper alignments relative to the lower alignments. The Upper alignment EE' appears to be economical relative to the lower sites as rock occurs at higher levels

3.5.4 Pre-construction stage Geological report (1978)

During this period, the geological investigation of the dam site was carried out by Sri A.R.Mahendra & Abdul Moghni. The Upper Alignment trending ENE-WSW was found suitable for the construction of a Masonry or Concrete dam. Along the left flank, the axis was recommended to be straightened against the proposed upstream kink in axis.

3.5.5 Field Season 1979-1980

During this period, the geological investigation of the dam site was carried out by Sri N.K. Mandwal & Dinkar Srivastava. This was 'Progress Report No: 1 on Construction Stage Geological Investigations of Attappady Valley dam project'. The consolidation grouting and a grout curtain were recommended to prevent any leakage under the dam foundation.

3.5.6 Field Season 1980-1981

During this period, the geological investigation of the dam site was carried out by Sri N.K. Mandwal & Dinkar Srivastava. This was 'Progress Report No: 2 on Construction Stage Geological Investigations of Attappady Valley dam project'. During this F.S 1980-81, the geotechnical evaluation of dam foundation and appurtenant works was carried out. The field work included the detailed geological mapping of 4100 sq.m of area in 1:200 scale, encompassing foundation blocks 1 to 7 forming right abutment of dam. The consolidation grouting and a grout curtain were recommended to prevent any leakage under the dam foundation.

3.5.7 Field Season 1981-1982

During this period, the geological investigation on the foundation of Block No 10 of the dam site was carried out by Sri D.V.Raju. It was recommended to prepare

the foundation with an upstream slope.

3.6 Studies by Kerala Engineering Research Institute (KERI), Peechi

The model studies of the Spillway, energy dissipation structures & Canal Sluice were conducted by KERI, Peechi during the period 1981 to 1987 for analysing the performance of various structures.

3.7 Central Water Commission (C.W.C) Clearance

A Project report for Rs. 842 lakhs was prepared in 1976 and the Proforma report was forwarded to the Central Water Commission (CWC) in 09/1976. Replies to all comments were also furnished by 12/1978. But CWC in their letter No 10/54/75-T.E/320 dated 18/01/82 informed that clearance to the project was pending for want of agreement on Cauvery waters.

3.8 Infrastructural Works taken up till date

After the finalization of the alignment of dam, blasting of the rock, for foundation of dam was started in the Block 1 to 7 on Right flank of the dam and is partially completed. The structures for the river diversion, for construction of the dam were also completed. The construction of the right bank canal system for water distribution upto 6.50km was also completed.

For providing access to man and material, to the dam site at Chittur, 7.50 km road was constructed from Goolikkadavu junction, in the Mannarkkad- Anaikatty road, by the Irrigation department by acquiring forest and private land. A utility bridge at downstream side of the Dam site was also completed.

The permanent Division office building, Sub Division office building, recreation club building, Bachelors accommodation, two store houses and staff quarters etc. at Agali Campus, the Project House and the staff quarters at V.V. Colony and dispensary building, staff quarters, Bachelors quarters, 4 store houses , workshop buildings at Chittur have already been completed.

3.9 Cauvery Water Disputes Tribunal (CWDT)

The Cauvery Water Disputes Tribunal (CWDT) was constituted by the Government of India on 2nd June 1990 to adjudicate the water dispute regarding inter-state river Cauvery and the river valley thereof. The Tribunal had also passed an Interim Order in June, 1991 and further Clarificatory Orders on the Interim Order in April, 1992 and December, 1995.

The Cauvery Water Disputes Tribunal had submitted its Final Order, reports and decision under Section 5 (2) of Inter-State River Water Disputes Act, 1956 to Government on 5th February, 2007 but was not published in official gazette.

The Hon`ble. Supreme Court of India directed the Central Government to publish the decisions of the CWDT in the official gazette as needed by Section 6 of Inter- State River Water Disputes Act, 1956. The CWDT final order was published by Government of India in Extraordinary Gazette dated 19th February 2013, from which date, the CWDT final order is in effect. The copy of Final Order of CWDT and relevant pages of CWDT order is shown in Annexure 02, 03 and 04.

In the Final Order of CWDT, Kerala was awarded 30 TMC of water, of which 6 TMC is for Bhavani basin, out of it, 2.87 TMC of water is earmarked for AVIP.

The AVIP is designed to utilize 2.29 TMC of water from the allotted share of 2.87 TMC of water from Bhavani river basin as per CWDT Final Order.

3.10 Alternatives to the Project

Ground water conditions are not ideal for irrigation in Attappady area and hence cannot be considered. The fields for farming and plantations area are on the valley sides. Substantial amount of ground water is expected down below the valley, near the banks of the Siruvani river. But it could be cumbersome and expensive to haul water up at the flanks of the valley. Also, considering the unique environment hydro-geologic and socio-economic aspects of the region, ground water exploitation is not recommended. The ground water potential of the area is also less in comparison to other parts of the state.

Siruvani river is the principal stream in Attappady region. The tributaries of

Siruvani river are small and seasonal. Ponds and tanks are geomorphologically not possible in highly undulating terrains of Attappady area. If irrigation is to be provided by surface water from Siruvani river, water have to be pumped from river up the flanks of the valley where irrigation is needed. This entails twin problems. Firstly, it is an expensive proposal and secondly the river may not carry enough water throughout the year.

The proposal for constructing a series of small dams instead of a Single dam at Chittur was also considered. But on analysis, it was noted that the area under submergence will be more for a series of dams instead of a Single dam. Also the storage achieved with series of small dams will also be negligible & hence will not be cost effective.

Moreover, 70 % of the land required for the submergence area for proposed dam at Chittur have been acquired. Changing the alignments and proposal will create problems for the inhabitants who had lost their fertile land for dam at Chittur and the loss for the Government due to already incurred cost for the project.

After exploring all the possibilities, it is concluded that **no alternatives exists, other than a Single dam at Chittur, the Attappady Valley Irrigation Project .**

3.11 'In-principle' Approval for the project

On the wake of Final Order of CWDT, Government of Kerala have issued "In principle' approval for the AVIP vide G.O (Rt) No 1031/2012/WRD dt 22/08/12 of Water Resources (Interstate Water Cell) Department, for speeding up the implementation of the project. The copy of the Government Order is appended in Annexure 05

3.11.1 Present Status of the Project

From 1989, there was no progress in the implementation of this project due to uncertainty in the clearance of the project by C.W.C & paucity of funds. The infrastructure facilities made for the project are lying idle. The local people are also frustrated as even though their lands have been acquired for the project, the project has yet not materialised. Till date 16 Crores have been utilized for the works and

establishment of the Project.

Due to unavailability of water, vast area of Attappady region is slowly turning to wasteland year by year. Due to failing monsoons, people also face severe drinking water scarcity in addition to water for irrigation purposes. This affects their living standards by directly affecting their farm & livestock output.

There is an immediate need of an irrigation project at Attappady for the well being of the backward tribal people. The submergence area of the dam consists of 73 Ha of vested forest, for which forest clearance is required. The necessary application for Forest Clearance has already been submitted to the Divisional Forest Officer (DFO), Mannarkkad and steps have been taken for identifying the land required for compensatory afforestation in lieu of forest land required for the project.

3.12 Size or magnitude of operation

The Attappady Valley Irrigation Project (AVIP) envisages the construction of a Concrete gravity dam across Siruvani river, a tributary of Bhavani river at Chittur in Agali Village of Mannarkkad Taluk in Palakkad district of Kerala state. The dam will impound 65 Mm³ (2.29 TMC) of the awarded share of water from Bhavani river basin as against the award of 2.87 TMC as per the Final Order of the Cauvery Water Dispute Tribunal (CWDT).

This project when implemented can irrigate an ayacut area of 4500 ha including 515 ha of land already under cultivation. Water from storage dam at Chittur can be used for irrigating 4900 ha of land by water distribution system of 84 km length including main canals and branch canals.

The project will aid in 0.05 Mm³ of drinking water supply to Agali, Sholayur and Kallamala villages. In addition to irrigation & drinking water supply, a power generation of 2.88 MW is proposed by utilizing the head available at dam.

3.13 Raw material required along with estimated quantity, likely source, marketing area of final products, mode of transport of raw material and finished products.

The main raw materials required for the construction of dam are cement, coarse aggregate & fine aggregates. The aggregates can be easily obtained from nearby Chundakulam quarry, which is acquired by the department. The natural sand can be replaced with M-sand obtained from the quarry. The cement required can be easily brought to site from Mannarkkad or from Coimbatore city. The approximate quantity of materials required for construction is tabulated in Table 3.3.

Table 3-3: Quantity of materials required for construction of dam

Material	Quantity
Cement	82400 tonne
Fine aggregate (M-Sand)	105400m ³
Coarse aggregate (Stone)	204000 m ³

3.14 Project description with process details (schematic diagram/flow chart showing the project layout, components of the project etc).

The salient features of the AVIP project is shown in Table 3.4.

Table 3-4: Salient Features of AVIP Project

SI No	Details	Salient Features
1	Name of the Project	Attappady Valley Irrigation Project
2	Type of Project	Multipurpose
3	Location	
	Dam	Across Siruvani river, in Chittur, Agali & Sholayur Villages in Mannarkkad taluk, Palakkad district of Kerala State
	Latitude	11 ⁰ 03' 15" N
	Longitude	76 ⁰ 39' 10" E
3.1	River basin	
	(a) Name	Bhavani river basin

	(b) Located in	Siruvani river
	(c) State	Kerala
3.2	River/ Tributary	Siruvani river, which is a tributary of Bhavani & hence Cauvery river
3.3	State/ District/ Taluk/ Villages in which the following are located	
	(a) Reservoir	Kerala / Palakkad / Mannarkkad/ Agali & Sholayur
	(b) Head works	Kerala / Palakkad / Mannarkkad/ Agali & Sholayur
	(c) Command area	Kerala / Palakkad / Mannarkkad/ Agali, Sholayur & Kottathara
	(d) Power house	Kerala / Palakkad / Mannarkkad/ Agali & Sholayur
3.5	Location of the Head works	
	Latitude	11 ^o 03' 15" N
	Longitude	76 ^o 39' 10" E
	Earth quake Zone No	Zone III
3.6	Project area reference to	
	Survey of India Toposheet No	58 A / 12
3.7	Access to the Project	
	(a) Airport	Coimbatore (64 km)
	(b) Railway Station	Coimbatore (55 km)
4	Interstate aspects of the project	
	(a) Catchment area within the State	96 km ²
	(b) Catchment area of the Project	77 km ²
	(c) Submergence due to the project	
	i) In the state	302 ha
	ii) In other states	NIL
	(d) Water allocation for the State	Since Siruvani river is a tributary of Cauvery river, the utilization of water is as per Final Order of the Cauvery Water Dispute Tribunal

		(CWDT). CWDT allotted 30 TMC of water for Kerala, of which 6 TMC is from Bhavani river basin in Kerala. In the Final Order of CWDT, 2.87 TMC is specifically allocated for the AVIP dam project
	(e) Committed utilization	2.87 TMC
	Upstream projects	Siruvani dam, which is located at 10.97° N & 76.64° E. This dam is mainly built to cater the drinking water requirement of Coimbatore city
	Downstream projects	There are no other irrigation projects in the downstream of this proposed project within Kerala state
6	Irrigation	
	Area under irrigation	4900 ha
	Gross Irrigated Area	6150 ha
7	Flood control	NIL
8	Water supply	The reservoir will aid the drinking water schemes for Kallamala, Sholayur & Agali villages.
9	Industrial & other purposes	NIL
10	Hydrology	
10.1	Catchment	
	Catchment area at head works site	
	(a) Gross	96 km ²
	(b) Intercepted	
	(i) By existing projects	19 km ²
	(ii) By ongoing projects	NIL
	(c) Unintercepted	77 km ²
10.2	Catchment area classification according to mode of precipitation	
	(a) Rainfed	77 km ²
	(b) Snowfed	NIL
10.3	Precipitation	

	Catchment area Record from		
		Annual Rainfall	
	(a) Average	3590 mm	
	(b) Maximum	7816 mm (in 1959)	
	(c) Minimum	2400 mm (in 1965)	
	Command Area		
	Annual yield calculated at the proposed site (M.cum) period of record 1971 to 2008 from the gauge station at Chittur dam site		
	(a) Maximum	511 Mm ³	
	(b) Minimum	5.58 Mm ³	
	(c) Average	196 Mm ³	
	(d) Dependable (50%)	155 Mm ³	
	Climatic data	Minimum	Maximum
	Air Temperature	10 °C	37 °C
	Wind Speed (km/hr)	0.50	16
	Maximum discharge		
	Design flood	3622 Cumecs (As per Flood Estimation Report for East flowing rivers for Cauvery Sub basin by CWC with annual average rainfall of 60 cm, & spillway discharge of 435 cumecs from upstream Siruvani dam, the design flood is estimated as 3622 cumecs.)	
	Reservior		
	Gross storage at FRL	65.00 Mm3	
	Live storage	60.50 Mm3	
	Dead storage	4.00 Mm3	
	Sedimentation rate	1.107 M cum/year(value adopted from the studies of siltation studies of Bharatapuzha river with similar catchment characteristics	
	Submergence		

	Land & property submerged	at FRL
	(a) Villages affected	
	i) Fully	Nil
	ii) Partially	Three villages are partially affected. (Agali, Sholayur & Kallamala)
	(b) Land affected	
	i) Gross	302 ha including Vested forest land
	ii) Forest	73 ha (Vested forest land)
	iii) Roads	
	1. Chittur - Kattekkad Road	2 km
	2. Kattekkad - Maranatty Road	4 km
	3. Chittur - Pothupady Road	2 km
	Head works (Dam)	
	Type of dam	Concrete gravity dam
	Length of dam	450 m
	Bed Level of the river at dam site	+562.00 m
	Rock level in the river bed	+562.00 m
	Full Reservoir Level (FRL)	+611.00 m
	Maximum Water Level (MWL)	+612.00 m
	Height of the dam from rocky bed	51.50 m
	Free board	1.50 m
	Spillway	
	Total Length	50 m
	No of shutters	4 numbers
	Size of shutters	12 m X 12.50 m
	Crest level	+599.00 m

	Maximum discharge capacity	3622 cumecs	
	Water distribution System		
	Name of canal	Length(km)	
	Combined canal	6.000	
	RBC 2 nd Reach	7.750	
	Anaikatty Branch Reach 1	9.000	
	Anaikatty Branch Reach 2	8.320	
	LBC 1st reach	12.630	
	Kalkandi Branch Reach 1	6.000	
	Kalkandi Branch Reach 2	5.000	
	Vellamari Branch	5.500	
	Kallamala Branch Reach 1	9.000	
	Kallamala Branch Reach 2	8.000	
	Kallamala Branch Reach 3	6.000	
	TOTAL	83.200	
	Cropping pattern	Existing	Proposed
	Paddy	25	300
	Sugarcane	10	1040
	Ground nut	45	700
	Maize	25	150
	Cotton	5	200
	Banana	80	2400
	Vegetables	25	1360
	TOTAL	215	6150
	Cost of the project	Rs 79700 Lakhs	
	Benefits from food production	Rs 18300 Lakhs	

	Benefit Cost ratio calculated as per CWC guidelines	1.89
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3.14.1 Calculation of Design Flood

The design flood is calculated based on the guidelines of Central Water Commission. The design flood was calculated as per Flood Estimation Report for East flowing rivers for Cauvery Sub basin by CWC with annual average rainfall of 60 cm. The spillway discharge of 435 cumecs from upstream Siruvani dam was also considered for calculation of design flood. The design flood calculated comes to 3622 Cumecs.

3.15 Availability of water its source, energy/power requirement and sources Water Availability

The Attappady Valley Irrigation Project (AVIP) envisages the construction of a Concrete gravity dam across Siruvani river, at Chittur in Mannarkkad taluk, Palakkad district, in Kerala to impound 65 Mm³ (2.29 TMC) of water including a dead storage of 4 Mm³.

For assessing the availability of water, the observations from the gauge station at Chittur was analysed. The average yield from the Siruvani river for a period of 1971 to 2008, is 155 Mm³ (5.48 TMC) which is adequate for the project.

3.16 Quantity of wastes to be generated (liquid and solid) and scheme for their Management/disposal.

During Construction stage, sewage will be generated as a liquid waste from labour camps. Septic tanks and Soak pits will be designed and constructed as per IS 2470 Part –I and Part – II, ensuring that there will not be any direct discharge of sewage into the water.

The debris/waste generated during blasting and construction phase will be removed/ reused as per standard procedures/ methods.



Partially completed blasting for foundation on Right flank of dam



Partially completed blasting at Right flank of dam
View from right flank end of dam

Figure 3.7: Recent Photographs of Dam Site



Left flank of dam

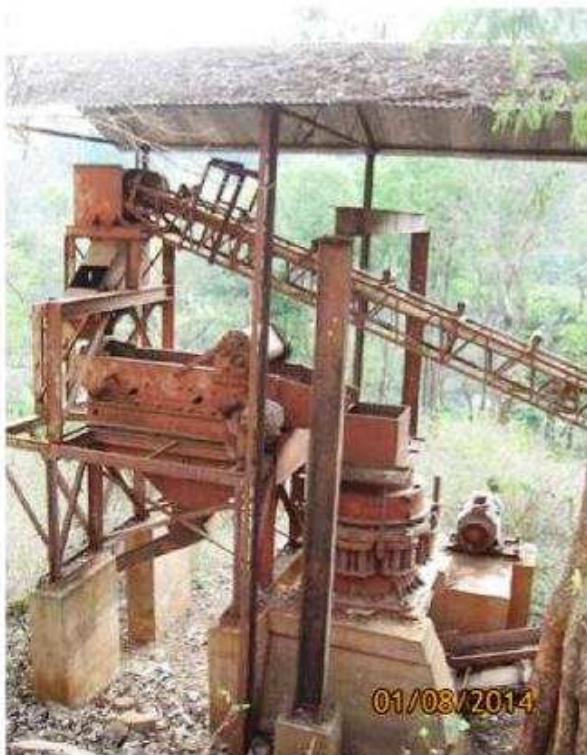


Right flank of dam & Siruyani river- View from left flank of dam

Figure 3.8: Recent Photograph of dam site



Stores at Chittur dam site



Crusher near dam site at Chittur



Entrance arch of AVIP dam site

Figure 3.9: Recent Photograph of dam site

4. SITE ANALYSIS

4.1 Connectivity

The proposed dam site at Chittur is well accessible from the Mannarkkad-Anaikatty road from Goolikadavu junction. A 7.50 km wide road was constructed by the Irrigation department for the movement of man & machinery for construction of the dam. This road, namely Goolikadavu- Chittur road was formed in 1980 by acquiring forest as well as private land.

The nearest railway station is Coimbatore Junction and nearest airport is Coimbatore International Airport.

4.2 Landform, Land use & Land Ownership

The total land area of Attappady area and its land use is tabulated as in Table 4.1 below

Table 4-1: Landuse/Landcover of the Attappady area

Land use/ Land cover categories	Area (sq.km)	% of Total Area
(a) Forest	444.07	60.00
Ever green/ Semi ever green (dense)	146.16	19.63
Ever green/ Semi ever green (open)	40.38	5.42
Deciduous (dense)	125.15	16.80
Deciduous (open)	104.79	14.07
Degraded / Under utilized	21.55	2.89
Shrub	1.08	0.14
Blank	1.16	0.16
Plantation	3.80	0.51
(b) Agricultural lands	130.30	17.49
Kharif crop area (Single crop)	44.87	6.02
Kharif and Rabi area (double crop)	7.15	0.96
(c) Fallow	0.63	0.08
Agricultural Plantation (mixed)	77.65	10.42
(d) Waste land/ Degraded lands	156.64	21.03
Land with or without scrub	88.96	11.95
Barren rocky/ stony waste	3.10	0.42
Permanent fallow	64.61	8.67
(e) Water bodies (Major rivers)	10.72	1.43
(f) Road, Streams etc	3.27	0.44
TOTAL	745.00	100.00

4.3 Topography

Attappadi is an extensive mountain valley at the headwaters of the Bhavani River nestled below the Nilgiri Hills of the Western Ghats. It is bordered to the east by Coimbatore district in Tamil Nadu, on the north by the Nilgiris, south by the Palghat taluk and on the west by Karimba-I and II, Pottassery-I and II, and Mannarghat revenue villages of Mannarghat taluk of the Palghat District and Ernad taluk of the Malappuram district. The elevation of Attappadi valley ranges from 750 meters (2,460 ft) to the Malleswaram peak at 11°6'32"N 76°33'8"E which rises to 1,664 meters (5,459 ft) from the center of the valley. The Bhavani River flows from the Northwest around the mountain in a tight bend past Attappadi village and continues to the Southeast (source: wikipedia).

The topographic contour survey map of the submergence area of AVIP dam is shown in Plate No 04. The project area is superimposed on Survey of India Toposheet and is shown in Plate No 02.

4.4 Existing Land use Pattern

The details of the existing land use is presented in Plate No 06.

4.4.1 Silent Valley National Park

The nearest Protected Forest area/ Wild life sanctuary is the Silent Valley National Park which is about 13.50 km from the dam site and hence AVIP doesn't come under the general conditions for Environmental Clearance as per Environmental Protection Act 1980. AVIP being in the downstream of Silent Valley area would not affect its environment & ecology.

4.4.2 Catchment Area

The available catchment area above the dam site at Chittur is 77 km². The catchment area is covered with dense forest, almost inaccessible. The natural vegetation comprises of evergreen and deciduous forests.

4.4.3 Command Area

In the command area the terrain is having undulating topography with moderate slopes and scanty vegetation/ permanent fallow.

4.4.4 Submergence Area

The submergence area of the AVIP is 302 Ha, of which 73 Ha is Vested Forest Area. Already, 210 Ha of private land have been acquired by the Irrigation department. Remaining 19 ha of private land and 73 ha of Forest land is to be acquired. The necessary application has been submitted to the Divisional Forest Officer, Mannarkkad for obtaining forest clearance.

The cadastral details of the submergence area is shown in figure No 7.1

4.5 Existing Infrastructure

Most of the irrigation facilities available in Attappady area are private owned and confined to small patches only. Rainfed agriculture is the only option to the poor tribal farmers in Attappady area which increases their vulnerability.

Soil conservation works have been done in the land of 93% tribal and 79% settler households under Kundah Soil conservation project. The major soil conservation works adopted in Kundah project were terracing and contour bunding.

Being a backward and predominantly tribal area, a special tribal development block was established in 1962 and all development activities were channelized through this block. The State Government made this block the first Integrated Tribal Development Project (ITDP) block after the State Planning Board assessed it the most backward block.

Since then a number of schemes and projects, such as the Attappadi Farming Society, Attappadi Goat Farm, and the Western Ghats Development Project were started for tribal development. Attappady Wasteland Comprehensive Environmental Conservation Project (AWCECOP) was begun in 1996 with the objective of halting the processes of ecological and social deterioration and improving the economic base of the affected communities. The Attappady Hills Area Development Society (AHADS) has been considered as the Project Implementation Agency (PIA) for the implementation of AWCECOP, with development assistance from the Japan International Cooperation Agency (JICA). Now AHADS is almost winded up and now only a dam which can cater the domestic & irrigation needs of the Attappady valley can create overall development to the area.

All villages in the Attappady are well connected by roads maintained by the Public Works Department and Local Self Government Department. In the

education sector, there are two colleges namely IHRD College of Applied Science & Government College, Attappady is functioning at Agali. For healthcare, a Super Specialty Hospital is functioning at Kottathara with numerous Primary Health Centres. Since, Attappady area is a good milk producing area, MILMA, a Government of Kerala enterprise for dairy products is having a chilling plant at Kottathara. For breeding and development of indigenous variety of goat of Attappady, known as 'Attappady Black', a Goat Farm is also functioning at Kottathara.

Considering the quick accessibility from Attappady to Mannarkkad and other local markets at Attappady, the transportation of agricultural inputs and other items to nearby markets are very convenient

4.6 Soil Classification

The common soil scapes in the region are represented by loamy-skeletal mixed Typic Ustropepts, moderately deep, well drained soils. The soils are moderately calcareous and gravelly loam with moderate surface gravelliness on gently sloping foothills and valleys with moderate erosion. The region comes under hot humid-per humid ecoregion with red and lateric and alluvium derived soils having a growing period of 210 to 270 days & more.

The foothills and valleys and gently sloping uplands with valleys have predominantly loamy, gravelly loam and gravelly clay soils with high base saturation. Soil depth varies from moderately shallow to very deep. The soil erodibility is classified as moderate to rock outcrops.

The study of soil of ayacut revealed that the soil is rich in Nitrogen and organic content and soil is suitable for irrigating crops. The compaction of the soil is mostly normal and suitable for easy root penetration. Chemical analysis of soil in the area reveals that the soils are neutral with pH ranging between 6.23 and 7.52 and hence the soil is suitable for most types of crops. The electrical conductivity of the soil varies from 0.35 to 1.12 dS/m. No salinity was observed and all crops can be grown without any toxicity. The availability of Phosphorous ranges from low to medium where as Potassium ranges from medium to good. Organic carbon present in soil was found to range between medium and very good (0.50 to 1.51 %).

A comparison of the soil characteristics within the identical soil elsewhere revealed that much increase in the yield could be expected by way of irrigation alone in this soil.

4.7 Climatic data from Secondary sources

4.7.1 Rainfall

Attappady area falls in the leeward side of the Western Ghats. Annual precipitation is more than 3000 mm just 50km away in the west of Attappady. In Attappady area, annual average rainfall is only around 1000mm.

In the western part of Attappady, the intensity of South-west monsoon & North-East monsoon are more or less equal, but in eastern part, the intensity of North-East monsoon is more than South-west monsoon.

The catchment area of AVIP is subjected to a high intensity of rainfall characteristics of Western Ghats region where as in the command area it is relatively poor. The catchment area receives rainfall in both North-East monsoon and South-west monsoon, while the command area receives rains mainly from North-East monsoon only. It is a common phenomena for the command area to remain parched during the period of South-west monsoon, while the river is flooded consequent to high intensity rainfall in the catchment area. The annual average rainfall in the catchment area and command area are 3910mm and 972mm respectively.

The rainfall details obtained from the department operated rain gauge station near Chittur dam site shown an average rainfall of 1156 mm over a period of 1995 to 2010.

4.7.2 Temperature

The temperature ranges from 10⁰ C to 37⁰ C. The minimum temperature is experienced during December- January and the maximum during March- April. During the summer, the maximum temperature goes upto 37⁰ C and the minimum being 22⁰ C.

4.7.3 Humidity

The Attappady area experiences comparatively low relative humidity except during

the monsoon season. During the monsoon season, the relative humidity ranges from 75 % to 89% and during the other seasons, it ranges from 45% to 74%.

4.7.4 Wind

The wind velocity ranges from 0.5 km/hr to 16 km/hr. The speed of wind varies from season to season.

4.7.5 Sunshine

The sunshine hours in the Attappady region varies from less than 1 hour during the monsoon and 10 hours in the summer season.

5. PLANNING BRIEF

5.1 Planning Concept (type of industries, facilities, transportation etc) town and country planning/development authority classification

At present no stable irrigation facility is available for large tracts of irrigable area in Kottathara, Sholayur and Agali villages in Attapaddy area. In order to meet the increasing demand of agricultural products, it is necessary to utilize the available land in the most efficient manner possible. Most of the fields depend entirely on monsoons. Failure or untimely occurrence of the monsoon causes severe damage to crops. The scheme aims to utilize the inflow in the catchment effectively. The completion of the scheme will facilitate irrigation for a cultivable command area of 4900 Ha.

The usage of pipe canal system for water distribution system instead of conventional canal system is considered. The pipe distribution system will reduce the overall cost and increase the efficiency of the project. Moreover, extend of land required for canal system will be drastically reduced and hence cost of land acquisition incurred will also reduce.

5.1.1 Existing cropping pattern

The existing crops that are being cultivated in the command area under two categories.

1. Seasonal crops like paddy, cotton, maize, groundnut and vegetables.
2. Annuals like sugarcane and banana.

Existing Crop period and area are listed below in Table 5.1.

Table 5-1: Existing Crop Pattern in the area

Sl no	Crop	Area in ha.	Period of crop	Remarks
1	Paddy 1 st Crop	25	June to September	
2	Sugar Cane	80	November to October	
3	Ground nut	45	May to September	

4	Maize	5	September to January	
5	Cotton	5	September to February	
6	Banana	50	June to April	
7	Vegetables	15	October to January	Vegetables are cultivated in the area used for paddy cultivation
	Total	225		

5.1.2 Proposed Cropping Pattern

The proposed cropping pattern is so designed that maximum return is envisaged through scientific cultivation and systematic irrigation. More economical crop like vegetables and pulses are accommodated in the projected cropping pattern taking into consideration of the land irrigation classification and agro climatic condition so as to get maximum cropping intensity and net return. Maximum emphasis is given for efficient utilization of the command area for achieving the full benefit due to irrigation. Details of Existing/ Projected cropping pattern is appended in Table 5.1 & 5.2.

Table 5-2: Proposed Crop Period and Area

Sl. no	Crop	Present area in Ha.	Proposed area in Ha.	Period of crop
	Annuals			
1	Banana	50	2,400	June to April
2	Sugarcane	80	1,040	November to October
	Total Area	130	3,440	
	1st Crop			
1	Paddy 1 st	25	200	May to September
2	Ground Nut	45	700	May to September
3	Vegetables	5	560	June to September
	Total Area	115	1,460	
	2nd Crop			

1	<i>Paddy 2nd</i>	<i>0</i>	<i>100</i>	September to January
2	<i>Cotton</i>	<i>5</i>	<i>200</i>	September to February
3	<i>Maize</i>	<i>5</i>	<i>150</i>	September to January
4	<i>Vegetables</i>	<i>10</i>	<i>400</i>	October to January
	<i>Total Area</i>	<i>20</i>	<i>850</i>	
	<i>3rd Crop</i>			
1	<i>Vegetables</i>	<i>0</i>	<i>400</i>	January to April
	<i>Total Area</i>	<i>NIL</i>	<i>400</i>	
	<i>Gross Crop Area</i>	<i>225</i>	<i>4,900</i>	

5.1.3 Crop water requirement

Water requirement based on the average climate data has been worked out. Monthly water requirement for different crops for the proposed cropping pattern has been worked out considering 60% field efficiency. The total monthly irrigation requirement for the total gross cultivable command area of 4,900 Ha is worked out as per Penman's method. Efficiency of the scheme is taken as 85%. The maximum water demand is worked out in March, which is 14.96 Mm³.

5.2 Population Projection

The scheme is proposed to be completed in a period of 4 years from the start of construction. The work is proposed to be carried out through contractors under departmental supervision. Under a Chief Engineer, a Circle Office stationed at Agali, exclusively for this project is proposed. Under the circle office, two Division offices headed by an Executive Engineer each, one having jurisdiction over the dam and Right Bank Canal system and the other in charge of Left Bank canal system are to be set up. Two subdivision offices under each Division and 2 section offices under each sub divisions are essential for executing the project. It is estimated that the project requires 6,29,000 number of man-days including both skilled and non skilled category.

A schematic diagram of the proposed organisational set up is given in Figure 5.1.

5.3 Land use planning

The existing land use pattern is shown in Plate No 06 and the proposed land use will be based on change in cropping pattern with increased benefits from irrigation.

5.4 Assessment of Infrastructure Demand (Physical & Social)

The infrastructure will be assessed in the nearby villages. As per the reconnaissance survey conducted till present, improvement in the health and education is envisaged. The area is considered among one of the backward areas of Kerala, a detailed and comprehensive infrastructure development plan shall be prepared as per the ToR granted by MoEFCC for conducting the EIA studies and preparation of various management plan for EMP.

5.5 Amenities/Facilities

Proper site services such as First Aid, Canteen / Rest Shelter, Drinking Water, etc. will be provided to the construction workers. Various facilities to be provided during construction and operation of the project are as follows:

1. Electricity shall be provided by transmission lines and DG sets.
2. Drinking water will be provided to the workers by Tankers during construction. During O&M stage, forebays shall be used for drinking water supply.
3. To provide the first aid for any sort of injuries encountered during the construction operation, one small first aid room shall be provided. First aid kit and sufficient stock of material / medicines needed for first aid shall be provided as per requirement.
4. In future if women workers are employed, arrangement for a small crèche shall be made as per the requirement.
5. Necessary arrangement shall be made for conducting refresher course as laid down in vocational training rules to upgrade skills of the persons involved in the project.

Proposed Organisational setup for the AVIP project

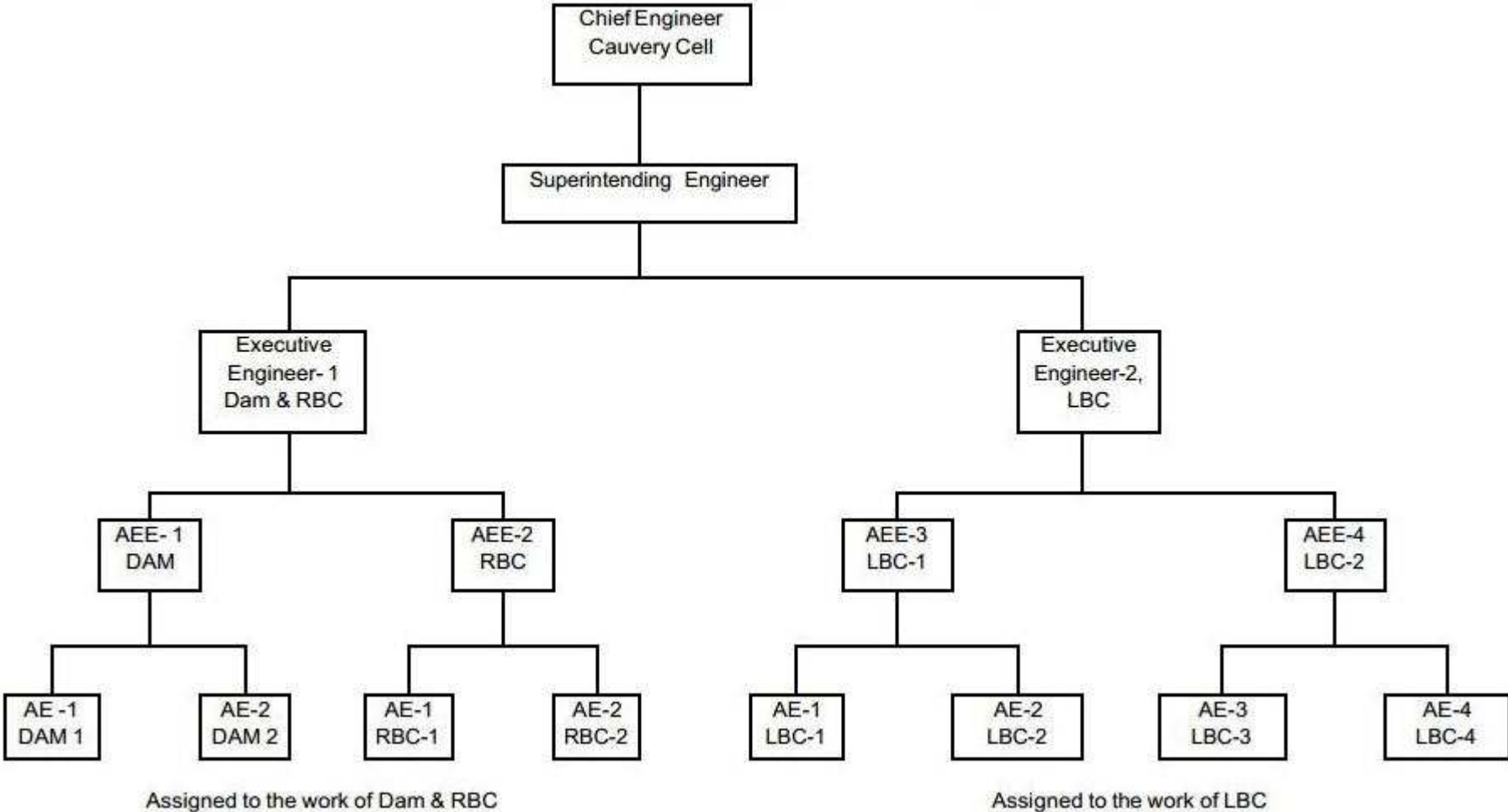


Figure 5.1: Proposed Organization Chart of AVIP

6. PROPOSED INFRASTRUCTURE

6.1 Industrial Area (Processing Area)

The project works are planned to be awarded on contract. The earth moving and other equipment required for the works are to be procured and maintained by the Contractors. The project will have at its disposal only small and minimum equipment required for support services, maintenance of transports for project personnel and power house. As such, small workshops are planned for repair and maintenance purpose only. Besides workshops, construction of explosive magazine, warehouse or storage area for cement, steel and other construction material are envisaged.

6.2 Residential Area (Non Processing Area)

To facilitate project construction, residential and office facilities would require to be created, keeping in mind the facilities required during O&M stage also. For this a residential complex and a main office complex may be constructed in any nearby Village. In addition to this, to facilitate construction activities, site offices at dam, reservoir, off take points are proposed. Provision for offices and residences shall be made in accordance with organization chart proposed for Operation & Maintenance. Colonies for labours and construction facilities are to be developed by the contractors at project site for which specific clause/clauses would be stipulated in the contract documents. The existing residential buildings and offices being used by the irrigation department have also been considered while proposing accommodations to be provided during construction and O&M stage. Total no of project colonies and households will be estimated and proposed once the ongoing investigation survey is conducted.

6.3 Green Belt

There is no risk of emission of poisonous effluents/ pollutants during the constructional or operational phase of the project. The major environmental impact by the project is due to the submergence of 302 ha of land, which include 73 ha of vested forest land. Since the vested forest area does not have endemic or rare species of flora & fauna, the loss of forest area by submergence is minimal. Also compensatory afforestation as per rules is proposed.

The other ecological disturbance will be noise & air pollution during construction phase. Efforts will be made to minimize the adverse impacts as per prevailing standard remedial measures. The debris during construction phase will be disposed as per rules. Steps have been taken for obtaining the Forest Clearance for diversion of 73 ha of forest land and for identification of suitable land for compensatory afforestation in lieu of forest land that will be submerged..

6.4 Social Infrastructure

51 tribal families who were residing in the area of submergence of the proposed project, has already been rehabilitated and resettled by the Irrigation department. The canal alignment is so proposed to minimize the acquisition of land and maximising the area of ayacut that can be irrigated. Also, since pipes are proposed, instead of conventional canal system, extend of land to be acquired will be less.

6.5 Connectivity

There is good connectivity from the State PWD road connecting Mannarkkad to Anaikatty State Highway, from Goolikkadavu junction, to the AVIP dam site at Chittur.

The dam site can be accessed from railway station Palakkad Junction and through Tamil Nadu from Coimbatore railway station.

6.6 Drinking Water Management

Drinking water storage facility is proposed to be provided at site during construction phase from Siruvani river or by means of wells.

6.7 Sewerage System

The sewage generated from the labour camps shall be treated in the Septic Tank and Soak Pits designed and constructed as per IS 2470 Part-I and Site selected for habitation of workers will be so selected that pollution can be kept minimum.

The debris/waste during construction phase will be disposed as per standard procedure.

6.8 Industrial Waste Management

Muck generated from the construction activities will be used as aggregate for construction to the maximum possible extent, if found suitable from laboratory tests. The balance muck will be dumped in a proper manner with due compaction in layers in the designated dumping areas. Further, after completion of excavation works of the major components, the dump areas will be covered with vegetation and side slope with or stone pitching so as to minimize rain cut/soil erosion thus making the slope stable. The generated muck to some extent will be useful for the construction of roads, land development of low-lying areas, aggregate for concrete work etc

6.9 Solid Waste Management

Apart from muck generation, other material i.e. scraps; inert concrete waste and plastic waste generation is envisaged. These waste materials will be separated at source and then collected in suitable bins. Covered trucks shall be put in place for collection of these waste from different locations and transfer it to disposal site. Various disposal options i.e. landfill waste to energy or incineration etc are available. This will be studied in detail during preparation of EIA/EMP report..

6.10 Power Requirement & Supply/ Source

During the execution of the proposed project, the power required can be met from Kerala State Electricity Board, which is having a well connected network in Attappady. By optimal planning and utilization of power resources, the adverse impacts on the environment can be minimized during construction and operational phase.

7. REHABILITATION AND RESETTLEMENT (R&R) PLAN

The investigation of the AVIP was started in 1970 and Land acquisitions for the project were carried out under The Special Land Acquisition Tahisldar, AVIP Project, Agali. Most of the land required for the project have been acquired as per the Land Acquisition Act 1961 and compensations paid to the land holder/ occupant.

7.1 Land Acquisitions

The land acquisitions for the project area which includes land for road, dam site, submergence area, quarters and office buildings etc were started from 1976 onwards under Special Land Acquisition Tahisldar, AVIP. The details of the land requirement for the dam at Chittur, is shown in Table 7.1.

Table 7-1: Details of Land Requirement for the Dam

Type of Land	Forest Land	Private Land	Total
Required	73 ha	229 ha	302 ha
Already Acquired	-	210 ha	210 ha
Balance to be acquired	73 ha	19 ha	92 ha

The details of land acquired for various components are shown in Table 7.2.

Table 7-2: Land acquired for various components of Project

SI No	Details of land acquired	Area (ha)
1	Submergible area due to dam	210 ha
2	Goolikkadavu-Chittoor road	7.80 ha
3	Canals	16.38 ha
3	Service road to dam site	4.11 ha
4	Link road to Valley View colony	0.54 ha
5	AVIP Colony road	1.27 ha
6	Site for dumping earth excavated from dam site	2.05 ha
7	Quarters at Chittur dam site and Division Office & Camp Quarters at Agali	15.46 ha

For the construction of Goolikadavu-Chittoor road and dam, 3.081 ha and

10.7030 ha of Vested forest land was transferred to Irrigation department under Kerala Private Forests (Vesting and Assignment) Act 1971. An additional area of 73 ha of Vested Forest land is required for submergence area of the dam. Necessary application is submitted to the Divisional Forest Officer, Mannarkkad for diversion of 73 ha of forest land, under Forest Conservation Act 1980. Necessary application has been submitted to the Divisional Forest Officer, Mannarkkad on 17/01/2014. Due to changes made in application procedure, the online submission has become mandatory, the proposal for which will be submitted shortly.

The Government Orders for transfer of forest land is shown in Annexure 09 & 10. The abstract of the Award of Land Acquisition details is tabulated in Table 7.3. The cadastral details of submergence area due to dam are shown in Figure 7.1.

7.2 Tribal families affected

At present there are no tribal settlements in the submergence area of 302 ha of the dam. Till date 51 adivasi families have been rehabilitated from the reservoir area and resettled by Irrigation department at Vengakkadavu Ooru. For the displaced Adivasi families from the submergence area, accommodation was provided by the Irrigation department at Vengakkadavu Ooru, by construction of houses.

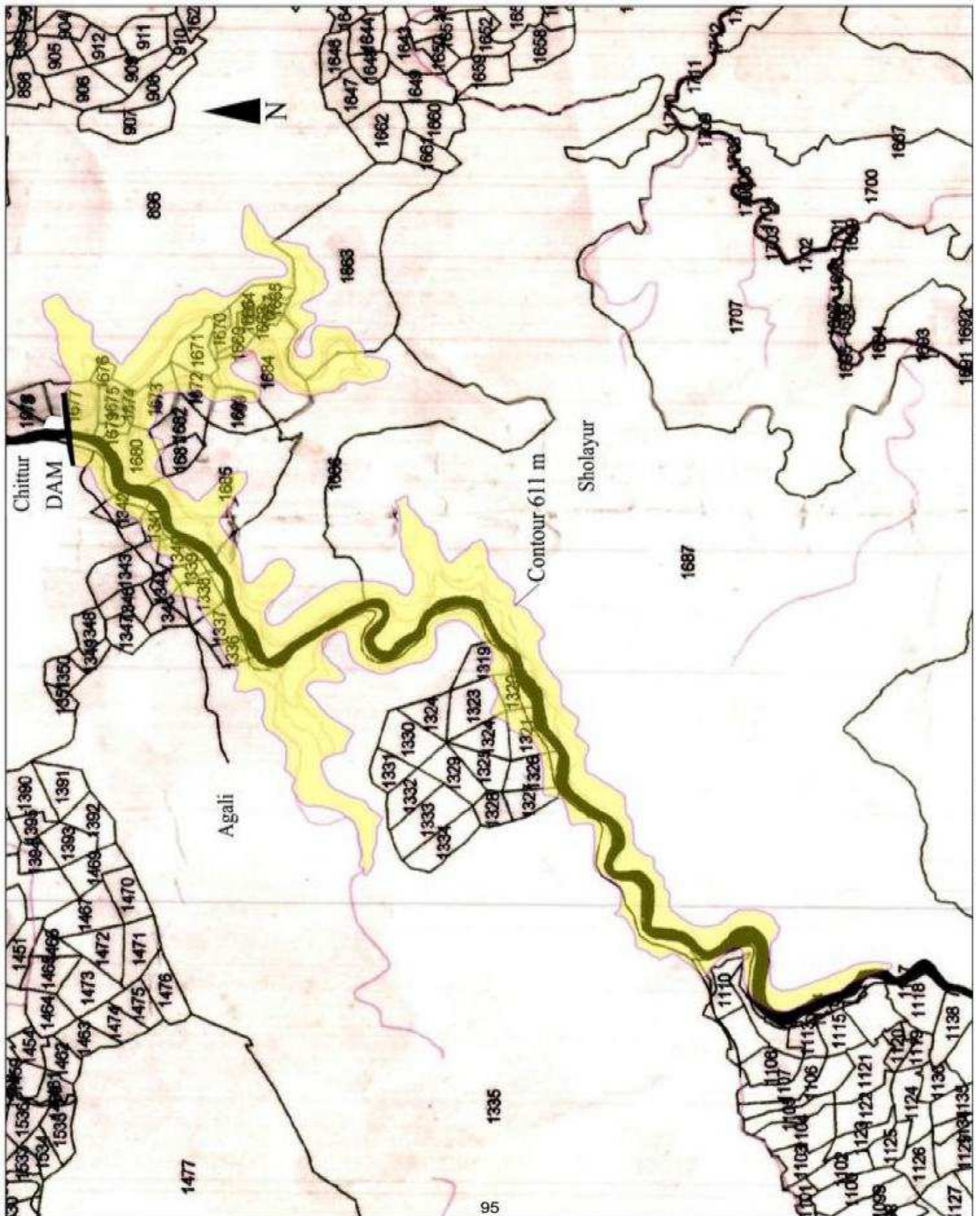


Figure 7.1: Cadastral Map of Submergence Area of AVIP Dam at Chittur

Table 7-3: Details of Land Acquisition for AVIP Project

S.No	Reference	Award and Date	Village	Survey Nos.	Extent of land in hectares	Purpose	Amount granted Rs.
1	A.39/76	1/76,20/8/76	Agali	1086/2,1087/15,1096/8,1097/3,1087/14,1096/11,1096/12	0.3858	Formation of Block 1 of Goolikkadavu-Chittoor Road	1819.80
2	A.40/76	2/76,26/8/76	Agali	1171/6,1173/2,1173/3	1.2320	Formation of Block 3 of Goolikkadavu-Chittoor Road	6573.40
3	A.95/76	3/76,30/8/76	Agali	1311/2,1313/4,1314/3,1314/6	0.6588	Formation of Block 12 of Goolikkadavu-Chittoor Road	5025.20
4	A.67/76	4/76,30/8/76	Agali	1316/2,1316/8,1316/10,1316/12	0.4555	Formation of Block 1 of Goolikkadavu-Chittoor Road	2903.70
5	A.194/76	5/76,9/9/76	Agali	1288/4,1289/3	0.5220	Formation of Block 1 of Goolikkadavu-Chittoor Road	2872.05
6	A.42/76	6/76,13/9/76	Agali	1182/10,1182/11,1185/15,1182/13	0.4468	Formation of Block 6 of Goolikkadavu-Chittoor Road	5556.00
7	A.41/76	7/76,27/9/76	Agali	1178/2,1179/3,1180/7,1181/5,1181/6,1181/8	0.9550	Formation of Block 5 of Goolikkadavu-Chittoor Road	9779.00
8	A.125/76	8/76,22/10/76	Agali	1308/3,1309/2,1310/5,1310/7	0.3840	Formation of Block 11 of Goolikkadavu-Chittoor Road	7237.80
9	A.94/76	1/77,21/1/77	Agali	1174/2,1175/10,1177/4,1175/12,1177/6	0.8694	Formation of Block 4 of Goolikkadavu-Chittoor Road	13308.00
10	A.188/76	2/77,21/1/77	Sholayoor	865/3,871/2	1.3580	Formation of Block 5 of Site for Staff Quarters at Dam Site.	7375.20
11	A.189/76	3/77,28/3/77	Sholayoor	866/5,866/6,866/7	0.7486	Formation of Block 6 of Site for Staff Quarters at Dam Site.	6008.15
12	A.553/76	4/77,29/3/77	Agali	1285/2	0.2480	Formation of Goolikkadavu-Chittoor Road	9446.00

13	A.552/76	5/77,29/3/77	Agali	1054/2,1098/7,1098/10,1172/1,1172/4, ,1172/5	1.4900	Formation of Block 2 of Goolikkadavu-Chittoor Road	
14	1	6/77,29/3/77	Sholayoor	867/1,867/2	1.9180	Formation of Block 6 of Site for Staff Qruters at Dam Site.	16908.50
15		7/77,293/77	Agali	1313/2,1313/5,1314/2,1314/4,1314/5, 1314/7,1314/8	1.1233	Formation of Block 2 of Site for Staff Qruters at Dam Site.	24396.56
16	A.114/76	8/77,29/3/77	Agali	1316/3,1316/4,1316/5,1316/9,1316/11, ,1116/13	1.3450	Formation of Block 1 of Site for Staff Qruters at Dam Site.	29126.65
17	A.406/77	9/77,30/3/77	Sholayoor	868	1.2700	Formation of Block 3 of Site for Staff Qruters at Dam Site.	9218.18
18	A.207/77	10/77,14/7/77	Sholayoor	1677/6	0.0050	Establishment automatic rain guage at Chittoor	22.08
19	A.207/77	11/77,15/7/77	Agali	1317/5	0.1450	Formation of Block 14 of Goolikkadavu-Chittoor Road	1156.94
20	A.206/77	12/77,20/7/77	Sholayoor	854/2	0.3400	Formation of additional land for Block 2 of Site for Staff Qruters at	4045.40
21	A.891/76	13/77,22/7/77	Agali	1318/6	0.6400	Formation of additional land for Block 1 of Site for Staff Qruters at	6059.03
22	A.747/77	14/77,27/12/77	Agali	1309/3,1310,88,1311/4	0.3140	Formation of additional land for Block 2 of Site for Staff Qruters at	1297.80
23	A.413/77	1/78,14/3/78	Sholayoor	896/2,1677/7,1678/2	4.0410	Block 1 of dam site at Chittoor	29198.86
24	A.290/77	2/78,18/3/78	Sholayoor	1676/1,1676/2	0.8060	Block 3 of submergible area	7656.46
25	A.	3/78,21/3/78	Agali	1087/16,1087/17	0.0170	Additional land for Block 1 of Goolikkadavu-Chittoor Road	1907.01
26	A.1002/77	4/78,21/3/78	Sholayoor	1674/ ,1679/	1.0690	Block 4 of submergible area	13104.32

27	A.1247/77	5/78,29/3/78	Sholayoor	1675/1,1675/2,1675/3,1675/4	2.3500	Block 2 of submergible area	37129.13
28	A.1147/77	6/78,29/3/78	Agali	1169/2,1170/3,1170/5,1174/3,1174/4	2.9310	Construction of Division office and staff qurters at agali	28862.94
29	A.1146/77	7/78,30/3/78	Sholayoor	869,870/1,896/3,1678/1	7.8140	Formation Block 2 of dam site at Chittoor	126765.12
30	A1242/77	08/78	Agali	1170/1, 1171/7	0.2563	Additional land for divisional office at Agali	
31	A.114/77	9/78,30/3/78	Agali	1341/1,1341/2,1341/3	2.3500	Block 3 of submergible area	93774.96
32	A.746/77	10/78,30/3/78	Agali	1317/2,1317/3,1317/4,1317/6,1317/7	1.9015	Formation Block 1 of dam site at Chittoor	56620.08
33	A.124/78	11/78,30/3/78	Agali	1340/1,1340/2,1340/3	2.8840	Block 4 of submergible area	38073.16
34		12/78,30/3/78	Mannarkkad II	128/10	0.0125	Block 2 of Panthanthodu extension Canal	286.31
35		13/78,30/3/78	Mannarkkad II	312/2,314/2	0.9320	Block 2 of Panthanthodu extension Canal	18902.18
36		14/78,30/3/78	Mannarkkad II	312/2	0.0105	Block 2 of Panthanthodu extension Canal	119.43
37		15/78,24/4/78	Mannarkkad II	65/9,65/10,65/11,129/24,129/25	0.8176	Block 1 of Panthanthodu extension Canal	9334.77
38		16/78,24/4/78	Mannarkkad II	129/28	0.2250	Block 1 of Panthanthodu extension Canal	1371.30
39		17/78,2/6/78	Mannarkkad II	128/12	0.1000	Block 2 of Panthanthodu extension Canal	2306.20
40		18/78					

41		19/78,8/9/78	Sholayoor	1670/	0.8900	Block 9 of submergible area	5873.59
42		20/78,10/10/78	Mannarkkad II	308/2	0.2480	Block 2 of Panthanthodu extension Canal	5874.19
43	A.115/78	21/78,24/11/78	Agali	1352/2	1.5800	Block 2 of submergible area	34215.86
44	A.1076/77	22/78	Sholayoor	1673/1,2,3	4.0360	Block 5 of submergible area	
45	A.690/78	23/78,27/11/78	Agali	1288/3,1288/6	2.0531	Dumbing of soil of eartheh excavated from the dam site	54750.49
46	A.249/78	24/78,29/11/78	Sholayoor	1671/1,1671/2,1671/3,1671/4,1671/5,1671/6	3.2600	Block 7 of submergible area	49711.66
47	A.1124/78	1/79,29/1/79	Sholayoor	1668/ ,1669/	1.5840	Block 10 of submergible area	27134.00
48	A.609/78	02/79	Sholayoor	1672/1,3,1682/ 2	2.8150	Block 6 of submergible area	
49	A.1389/78	3/79,31/1/79	Sholayoor	1664/1,1664/2,1664/3,1664/4	2.9800	Block 11 of submergible area	85824.68
50	A.1390/78	4/79,31/1/79	Sholayoor	1665/ ,1666/	0.9500	Block 12 of submergible area	10612.37
51	A.1388/78	5/79,31/1/79	Agali	1667/1,1667/2,1667/3	0.7720	Block 16 of submergible area	12849.33
52	A.1393/78	6/79,28/2/79	Agali	1342/1,1342/2,1342/3,1342/4	2.6861	Block 1 of submergible area	26146.47
53	A.866/78	7/79,28/2/79	Agali	1959/3,1959/5,1959/6,1959/8,1959/11,1959/13,1959/10	2.2940	Block 4 of panthanthodu extension canal	28380.46
54	A.1650/78	8/79,28/2/79	Agali	1316/6,1316/7,1316/14,1317/11	4.1125	Formation of Service road to dam site	63275.36

55	A.690/78	23/78,27/11/78	Agali	1288/3,1288/6	2.0531	Dumping of soil of earthen excavated from the dam site	54750.49
56	A.1749/78	10/79,12/3/79	Sholayoor	1683/2	2.0260	Block 13 of submergible area	78489.97
57	A.1391/78	11/79,16/3/79	Sholayoor	1684/2	8.6700	Block 14 of submergible area	223215.21
58	A.706/78	12/79,28/5/79	Vadakkanthara	1416,1417,1418,1436/5	0.7039	Store shed at Vadakkanthara	153675.99
59	A.132/79	12/79,28/5/79	Sholayoor	1686/3	13.1727	Block 16 of submergible area	351038.16
60		13/79					
61		14/79					
62	A.123/79	15/79,10/4/79	Sholayoor	854/6	0.8120	Additional land for block 10 of submergible area	13566.50
63	C.1830/79	16/79,18/4/79	Sholayoor	1686/2	6.4358	Block 15 of submergible area	61781.04
64		17/79,31/5/79	Sholayoor	848/11,848/17,856	5.6230	Site for quarry at Choondakkulam and road to quarry	60370.09
65		18/79					
66	A.513/79	19/79,20/8/79	Sholayoor	1677/1,1678/3	0.5720	Block 1 of submergible area	24145.49
67	A.458.79	20/79,30/8/79	Sholayoor	1685/2	5.6897	Block 15 of submergible area	349098.17
68	A.793/79	21/79,30/10/79	Agali	1336/1,1336/2,1337/2,1337/3	3.6900	Block 7 of submergible area	129392.59

69		22/79					
70	A.879/79	23/79,27/11/79	Agali	1140/3,1141/11,1318/10	0.0825	Site for Colony wall and Pump house	432.85
71	C.909/79	24/79,12/12/79	Agali	1338/2,1338/3,1338/4,1338/5,1338/6,1345/2	2.7110	Block 6 of submergible area	83563.20
72	C.878/79	25/79,20/12/79	Agali	1339/1,1339/2,1339/3,1339/4,1339/5,1339/6,1339/7,1339/8,1339/9,1343/2,	2.4940	Block 5 of submergible area	120681.74
73	C.1291/79	1/80,25/1/1980	Sholayoor	854/3	2.2135	Staff quarters at Chittoor	37996.81
74		2/80,21/2/80	Sholayoor	896/4	1.8130	Block 1 Of dam site	40898.75
75	A.1071/79	3/80,26/2/80	Sholayoor	853/7,853/8,853/10,853/12	3.3037	Block 2 of R.B Canal	88500.51
76	A.1070/79	4/80,29/2/80	Sholayoor	848/18,855/4,855/5,855/7,857/1,857/4,858/6,858/10,858/11,858/12,859/7,85	4.6378	Block 1 of R.B Canal	60407.37
77	A.795/79	5/80,10/3/80	Sholayoor	1681/2	0.3200	Block 19 of submergible area	4894.31
78	A.794/79	6/80,1/3/80	Sholayoor	1680/2	3.3075	Block 18 of submergible area	93112.99
79		7/80,	Sholayoor	896/part	14.0000	Block 8 of submergible area	
80	A.1460/79	8/80,24/3/80	Sholayoor	1682/3	0.3000	Block 18 of submergible area	8573.71
81	A.513/79	9/80,28/3/80	Sholayoor	1677/2,1677/3,1677/4,1677/5	3.5440	Block 1 of submergible area	105024.16

82	A.1281/79	10/80,29/3/80	Mannarkkad II	129/30	0.0320	Pathanthodu extension canal	549.00
83	C.1392/79	11/80,25/6/80	Sholayoor	866/9	0.0350	Quarry road at Chittoor	486.84
84		12/80,28/6/80	Agali	1335/2	42.0587	Block 4 of submergible area	1375618.29
85	C.1458/79	13/80,30/8/80	Sholayoor	847/2,848/19	1.6160	R.B Canal	11001.21
86		14/80					
87	C.1572/79	15/80,23/10/80	Agali	1318/11,1318/12,1318/13	3.4605	Block 16 of submergible area	83158.41
88	C.1082/80	16/80,13/11/80	Sholayoor	896/8	3.0134	Block 25 of submergible area	284810.40
89	C.760/80	17/80,27/11/80	Sholayoor	842/6,842/7,762/4	1.8015	Block 4 of R.B Canal	19437.04
90	C.261/82	1/81,31/1/81	Mannarkkad II	31/6,64/6,68/8,68/9,68/10,69/4,65/5,70/1,72/14,72/15,72/16,72/17,72/18,72	1.2926	Block 1 of Thenkara Branch Canal	64429.92
91	C.758/80	2/81,25/2/81	Mannarkkad II	72/20,72/22	0.2830	Block 1 of Thenkara Branch Canal	8809.40
92	C.756/80	3/81,18/3/81	Sholayoor	1683/3,1684/3,1685/3	2.0680	Block 13 of submergible area	43591.67
93	C.759/80	4/81,19/3/81	Agali	1319/2	2.7310	Block 10 of submergible area	157070.90
94	A.1432/80	1/82,8/3/82	Sholayoor	762/6,840/3,841/7,842/8,	0.9050	Block 5 of R.B Canal	15953.65
95		Feb-82					

96	A.1287/81	3/82,27/3/82	Sholayoor	896/6	0.0425	Block 7 of submergible area	4263.34
97	A.257/81	4/82,29/3/82	Sholayoor	810/2	2.3440	Block 7 of R.B Canal	11631.84
98	A.700/81	5/82,30/3/82	Agali	2019/2,2019/3	2.3330	Block 15 of submergible area	111103.33
99	A.1425/81	6/82,30/3/82	Mannarkkad II	76/4,76/10,76/11,76/14,76/15,76/16,7 6/17,77/16,77/17,78/8,78/10,78/11,11	1.6702	Block 2 of Thenkara Branch Canal	71326.56
100	A.939/82	7/82,31/3/82	Sholayoor	896/9	1.9560	Dam site	21940.84
101	A.390/81	8/82,29/5/82	Agali	1321/2,1321/3	3.2320	Block 7 of submergible area	84648.51
102	A.238/81	9/82,7/8/82	Mannarkkad II	314/5	0.0250	Additional land for Panthanthodu Canal	761.61
103	A.638/81	10/82,27/8/82	Mannarkkad II	113/14,114/14,114B/3,306/24,306/20, 306/19,306/17,306/16,111/12,305/12,	2.0785	Block 3 of Thenkara Branch Canal	130835.83
104		10/82,	Agali	1288/7,8,1310/1	0.4660	for constructing adivasi ooru at Chittur	
105		13/82	Agali	1153/2,5,7,8	1.2750	AVIP Colony road	
106	A.1425/80	14/82,31/12/82	Mannarkkad II	242/14	0.1175	Block 3 of Thenkara Branch Canal	7970.75
107		1/83,	Sholayoor	753/5	0.6660	Block IV of RBC	
108	A.1130/82	2/83,30/3/83	Agali	2019/4,2019/5	2.2416	Block 14 of submergible area	594501.57
109	A.242/83	3/83,30/3/83	Agali	1143/7,1143/8,1143/9,1144/6,1144/8, 1144/9,1153/6,1162/5	0.5415	Link road connecting VV colony	2923.59

110	A.966/84	4/83,24/1/83	Mannarkkad II	116/5,116/16	0.0240	Thenkara Branch Canal	1015.00
111		1/84,20/3/84	Sholayoor	858/15	0.5540	Block 1 of R.B Canal	188007.15
112		1/85,	Agali	1318/1,14,15	44.7080	Block XVIII of submergible area	
113		6/85,	Sholayoor	762/9	0.5600	Block 5 of R.B Canal	20863.15
114		17/86	Agali	1318/14	5.5625	Block XVII of submergible area	912371.10
				Total Land Acquired	293.5015	Total Amount Given	6479652.88

8. PROJECT SCHEDULE & COST ESTIMATES

8.1 Likely Date of Start of Construction and Likely Date of Completion

The detailed estimate of the Attappady Valley Irrigation Project is prepared as per Guidelines for Preparation of Detailed Project report of Irrigation & Multipurpose Projects, 2010 published by the Central Water Commission (CWC). The rates adopted for the estimates are based on Delhi Schedule of Rates (DSR) 2013.

The estimated cost of the Project as per DSR 2013 with Cost Index of 1.36 for Palakkad district comes to Rs.797 /- Crores. The General Abstract of the Project is shown in Table 8.1 & 8.2.

8.1.1 Classification of Units

The project work has been grouped into the following units:

Classifications of Project Works

- I. Works
 - i) Unit-I: Head Works i.e.,(Dam & appurtenant works)
 - ii) Unit-II Canal Works i.e.,(Water distribution works)
- II. Establishment
- III. Tools & Plant
- IV. Suspense
- V. Receipts & Recoveries on Capital Account

8.2 Benefit Cost Ratio

The Benefit Cost Ratio has been worked out as per the approved guidelines of the Technically Advisory Committee, Central Water Commission, duly calculating yield before irrigation and anticipated yield after providing irrigation. The B.C. Ratio thus works out to 1.89. For the calculation of B.C ratio, the yield from diary production, which is another major occupation of the people of Attappady, is not taken and hence the actual benefits by the project will be more.

The details of B.C. Ratio calculation is shown at Table 8.1.

Table 8-1: General Abstract of Cost Estimation

ATTAPPADY VALLEY IRRIGATION PROJECT				
<u>GENERAL ABSTRACT OF COST</u>				
	Unit - I Head Works Rs. in lakhs	Unit - II Canals Rs. in lakhs	Unit - II Electricity Rs. in lakhs	Total Rs. in lakhs
<u>Direct Charges</u>				
I	Works	53113.65	20865.97	73979.61
II	Establishment (10% of I works less 'B' land)	4326.13	401.55	4727.68
III	Ordinary Tools and Plant	450.00	46.60	496.60
		57889.78	21314.12	825.00
	<u>Deduction towards Receipts and Recoveries</u>	1218.53	1.53	1220.06
	Net Amount	56671.25	21312.59	825.00
<u>Indirect charges</u>				
a	Audit and Account charges 1% of I Works	531.14	208.66	739.80
b	Abatement of Land Revenue 5% of land cost	86.94	32.25	119.18
		618.07	240.91	858.98
	Total	57289.32	21553.50	79667.82
	Amount in Crores	573.00	216.00	8.25

Table 8-2: Attappady valley irrigation scheme abstract of cost

SI.No.	Particulars	Head Works	Canals	Electricity	Total
1	A. Preliminary	20.00	60.00		80.00
2	B. Land	1738.73	644.96		2383.69
3	C. Works	45000.00	13390.00		58390.00
4	D. Regulators		249.75		249.75

5	E. Falls and Drops				
6	F. Cross Drainage Works		1565.60		1565.60
7	G. Bridges		256.50		256.50
8	H. Inlet & Escapes		12.00		12.00
9	I. Navigation works				
10	J. Power Plants & Civil works				
11	K. Buildings	180.00	116.90		296.90
12	L. Earthwork		1940.18		1940.18
13	M. Plantation	35.00	35.18		70.18
14	N. Tanks & Reservoirs				
15	O. Miscellaneous	160.00	16.00		176.00
16	P. Maintenance	492.13	46.60		538.73
17	Q. Special Tools and Plant	12.25	6.88		19.13
18	R. Communication	3837.50	437.50		4275.00
	S. Power Plant & Electrical				
19	System				
20	T. Water Supply Works				
21	U. Distributories		1680.00		1680.00
22	V. Water Courses & Field				
	Channels		123.30		123.30
23	W. Drainage	1510.00	203.00		203.00
24	X. Environment and Ecology		70.00		1580.00
25	Y.Losses on Stock	128.04	11.62		139.66
26	Power Generation			825.00	825.00
	Total	53113.65	20865.97	825.00	74804.61

Table 8-3: Cost-Benefit Ratio of the AVIP Project

BENEFIT-COST RATIO		
ANNUAL BENEFITS		
I Irrigation		
i	Value of Agriculture production in post-project period (Certified by the State Agriculture Department)	= Rs 18336 /-
ii	Value of Agriculture production in pre-project period	= Rs 248.99 /-
	Net Irrigation Benefit	= Rs 18087.01 /-
	TOTAL BENEFIT	= Rs 18087.01 /-
ANNUAL COST		
	Total cost of Project including cost of Hydro Power station	= Rs 79700 /-
1	Interest on the capital at 10% of total cost of Project	= Rs 7970 /-
2	Depreciation charges at 2% of total cost of Project	= Rs 1594 /-
	Total Annual Cost	= Rs 9564 /-
	BC ratio	= 1.89

9. ANALYSIS OF PROPOSAL (FINAL RECOMMENDATIONS)

9.1 Financial and Social Benefits with Special Emphasis on the Benefit to the Local People Including Tribal Population, If Any, In the Area

Attappady area in Palakkad district of Kerala, is a drought prone tribal area of Kerala. Demographically, 40 % of the population in Attappady are tribals who are generally backward and live below poverty line. The project will benefit the socio-economic development of the Attappady region, since agriculture is the only sector giving employment and there are no other employment opportunities like industries, construction etc. in the project area.

The majority of the tribal population will benefit from this Irrigation project. Agriculture sector and diary sector will get benefit directly from the project. Irrigation is important to the health of the agricultural industry. Improving the viability of individual farming and increasing the efficiency & economic stability of the command areas and also contributing to the economic and social objectives of the Kerala State are the expected outcomes of the proposed scheme.

Some of the project benefits are listed below:-

- The AVIP mainly aims at developing irrigation facilities in the Attappady Valley and since there is no other source of irrigation other than the available scanty rainfall, it can be emphatically stated that the project would benefit the socio- economic environment of the area.
- Also in the Attappady area, by improving farm output through improved irrigation facilities, the living standards of the people will increase.
- The project being multipurpose one, will benefit in domestic water supply and power generation in addition to irrigation.
- Project improves yields through reduced crop loss due to erratic, unreliable or insufficient rainwater supply.
- The irrigation facilities will help in cultivating the land which are lying fallow. This would lead to improved employment & income.
- The project would also provide congenial conditions for the livestock, providing better grass and fodder.

-
- Increased health benefits—improved sanitation due to better access to water.
 - Positive impact on poverty reduction through increased productivity and increased employment opportunities.
 - Increased food security at national, regional and local levels.
 - The increased labour opportunities for women increase the household income has resulted in the greater power of women in the household.
 - Increased employment in agriculture due to increased cropping intensity, increased crop area and output from irrigation
 - Increased employment outside agriculture from increased crop output in related industries such as input industry (backward linkages) and output processing industries (forward linkages) – Examples include Oil Industry, food processing industries, biscuit industries, etc
 - The construction of the dam will generate employment opportunities to the tribals as well as others as labour and other ancillary & auxiliary services.
 - The project will lead to improvement in infrastructure facilities such as transport, roads, means of communication, electricity, medical facilities for the staff etc. This will eventually help the local people.

9.2 Conclusion

The positive impacts due to the construction and implementation of the AVIP will outweigh the negative ones. Since the Benefit-Cost ratio is 1.89, the project is economically feasible. Moreover, by the implementation of this project, we can make use of Kerala's share of water as per the Final Order of Cauvery Water Dispute Tribunal (CWDT) for the development of this backward tribal area. Otherwise, the expenditure incurred till date for this project for construction, land acquisition & establishment charges etc and the eligible share of Cauvery water for the state may go waste.