

**DETAILED PROJECT REPORT  
ON  
MOOLATHARA RIGHT BANK CANAL  
FROM KORAYAR TO VARATAYAR**



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**Submitted By  
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## 1. SALIENT FEATURES

1	Title of the Project	Extension of Moolathara Right Bank Canal from Korayar to Varattayar
2	Detail of the project location	
	i. District ii. Taluk iii. Corporation/Municipality/ Panchayath iv. Assembly Constituency	Palakkad Chittoor Eruthenpathy Chittoor
3	Implementing Agency/ SPV	KERALA IRRIGATION INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
4	DPR prepared by	KERALA IRRIGATION INFRASTRUCTURE DEVELOPMENT CORPORATION LTD
5	Budget Provision	
6	Budget speech reference	Reply Speech Para: 32 in the revised budget speech for 2016-17
7	Administrative Sanction	Go. (Rt) No. 610/2019/WRD Dated, Tvp, 27/08/2019, for Rs-262.10 Cr.
8	Nature of the Project (New scheme/ Extension)	New Scheme – Extension of existing Moolathara Right Bank Canal beyond Korayar

9	Present Status, if any	Land Acquisition under negotiated purchase for the construction of the canal for a length of 6430m is in the final stages. An amount of Rs. 12.60 crores towards expenditure for land acquisition is already placed at the disposal of the District Collector, Palakkad. The entire acquisition process is completed and 92% of the land is vested with the Department. The land acquisition process of the remaining land is nearing completion. However, it will be ensured that the entire land is within the custody of department/ KIIDC, before tendering the work.
10	Need of the Project.	Area is located in a draught prone area. Annual avg. rainfall is below 100 cm. The project is mainly aiming to fulfil Irrigation, Ground water stabilization, Socio economic development and to meet the drinking and domestic needs of the population in the ayacut coming under Kozhippathy and Eruthiampathy villages in Palakkad District.
11	Details of the proposed scheme. Length	6430m
12	Details of investigations and survey conducted	Investigation works done by KIIDC, alignment approved by Chief Engineer, Projects 1, Irrigation Department, Kozhikode.
13	Total Estimated cost and component wise cost break up and with schedule of rates (year)	Total estimate cost Rs- 282.83 Crores, Item wise cost break up attached separately. As per DSR 2016, C I- 31.06%.
14	Whether detailed estimate attached	Yes
15	Detail of revenue streams	Included in the report
16	Detail of cost benefit analysis (CBR value)	Included in the report
17	Detail of project risks	Included in the report

18.	Detail of project implementation schedule and WBS (Proposed duration to complete the work)	Included in the report
19.	Details of project management organization strategy	Included in the report
20	Details of contract management strategy	Included in the report
21	Details of Statutory clearance	Included in the report
22	Quality control infrastructure and mechanism	Included in the report
23	Operations and maintenance (O&M) arrangements of the project after completion	Included in the report
24	Details of attached drawings	Drawings of structural design of piers and cross sections
25	Other attachments	Google view of site, site plan

### 2. EXECUTIVE SUMMARY

Project area is situated in the rain shadow region of Palakkad gap, viz. Kozhippathy and Eruthiampathy Villages of Chittur Taluk in Palakkad District, which receives less than 1000mm of annual rain fall when compared to the States average of 3000mm. But these regions are having intensive agriculture activity in spite of low water availability.

At present the major source of water for irrigation and domestic use is ground water. Due to years of intensive abstraction, the ground water level in this region has gone down considerably and the areas under Kozhippathy and Eruthiampathy Villages have been categorized as 'over exploited' by the Central Ground Water Board and the State Ground Water Department. Hence considering the acute situation the Government vide G.O (Rt) No. 1403/2012/WRD dated 30.11.2012 had issued Administrative Sanction amounting to Rs. 30.50 crore for the execution of the project -Extension of Moolathara Right Bank Canal from Korayar to Varattayar with the condition that the land required for the construction of the canal shall be obtained under free surrender from the respective land owners. But due to many reasons this did not materialise and in the meeting convened by Hon'ble Chief Minister on 08.04.2015 it was decided that the land required for the canal will be acquired under negotiated purchase. Accordingly, Government vide its order G.O (MS) No.54 /2015/WRD. Dated, 09.06.2015 had accorded Administrative Sanction for the work of Extension of the Moolathara RBC from Korayar to Varattayar (ch:15957m to 22147m), for an estimate amounting to Rs.50.06 crores (Rupees Fifty Crores six lakhs only) including cost of acquisition of land and proposal for constituting a committee for negotiated purchase for acquiring land required for the purpose. But the finalisation of the alignment met with many hurdles and the project got delayed.

In the meantime the Hon'ble Finance Minister in his revised budget speech as well as in his reply speech for the financial year 2016-17 (Reply Speech Para: 32) had announced the implementation of a number of schemes, by funding under a special package through the Kerala Infrastructure Investment Fund Board. Of these the Water Resources Department have been entrusted with a set of - New Projects for Irrigation and Drinking Water with a project out lay of Rs. 147 crores and CHITTOOR - MOOLATHARA RBC - EXTENSION OF MOOLATHARA RIGHT BANK CANAL FROM KORAYAR TO VARATTAYAR is one of the projects, now proposed for execution through Kerala Irrigation Infrastructure Development Corporation Ltd, a SPV under the administrative control of Water Resources Department.

The Water Resources Department, Government of Kerala has issued In-Principle Administrative Sanction for the project amounting to Rs. 262.10 Crores vide its order No. Go. (Rt) No. 610/2019/WRD Dated, TVM 27/08/2019. The proposed total ayacut to be benefited by the implementation of this project is 3575 Ha (Predominantly Coconut and Vegetable).



The project proposal is to extend the MRBC canal from Korayar to Varattayar through the acquired land and to feed an ayacut of 3575 Ha. The CWC guidelines stipulate that, 'the Piped Irrigation System, if implemented properly, can curtail irrigation water demand without compromising with Net Irrigation Requirement (NIR) but by improving the water use efficiency. The estimated overall efficiency with piped irrigation network is of the order of 70-80%'. The DPR is prepared taking into account of minimum water loss and adopting Guidelines of CWC. Right Bank canal system from Moolathara weir is completed up to Korayar and the ayacut under this canal system is at present being irrigated as per the requirement of farmers. The canal portion from Korayar to Varattayar is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity co-efficient.

In this project, the overall improvement of ayacut under MRBC from Korayar to Varattayar is proposed by adopting micro irrigation system in the existing ayacut and thereby increasing its efficiency and the water savings. The objective is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation.

The source of water is from PAP system alone. About 6430m canal is to be constructed to deliver the water at Varattayar. The carrying capacity of the canal is 22m<sup>3</sup>/Sec from the beginning of canal from Moolathara regulator and is maintained throughout. This had an intention to divert the excess flood water, comes from PAP system in Chitturpuzha is now diverting through the existing canal and recharging about 21 check dams constructed in Korayar and Varattayar River. Moreover, the sufficient water could be made available to MRBC, after implementation of the Kuriarkutty – Karappara project or another alternative project. Now the Government also entrusted KIIDC to conduct Investigation of the Second phase extension from Varattayar to Velanthavalam.

Based on the above requirement, a conventional concept design is adopted in preparing DPR. Based on the terrain of the alignment of canal, the canal consists of conduit, syphon, aqueduct and tunnel. A lift irrigation scheme is also proposed by constructing a sump and water tank. From the tank, irrigation network is proposed by gravity flow. The entire irrigation system is proposed with Micro/ Drip Irrigation with electronically controlled spouts. The provision for Improvement of 14 public ponds, to store the flood water is also considered in the DPR. Side protection works at river crossings, aqueduct pillars, footings of aqueduct pillars where soil erosion is severe etc.

are also proposed. Since the existing canal is in a dilapidated stage, there is a considerable loss of water. Even though, the Irrigation Department has arranged some rectification works, which could not be made the canal in a perfect manner. So, the relining/rectification works of canal and sluice out let for the remaining area is included in the DPR.

By the present proposal, by effective water management, the water available during periods of no or less demand in other systems of Chitturpuzha Project and the water reaching Moolathara Regulator during rainy season can be diverted to drought hit areas up to Varattayar and to the check dams in Varattayar & Korayar and also the 14 nos ponds in Eruthiampathy Panchayath between Korayar and Varattayar.

Now the technology is developing day by day. Through EPC contract the canal may construct in an economical, ecological as well as durability and adopting latest technologies. The possibilities such as tunneling through push through method, using conventional and solar energy for lift Irrigation scheme and micro Irrigation network, adopting Bituminous Geo Membrane for open canal lining, adopting other mode of construction of canal, using other pipes than MS pipes such as HDPE/DI /CPVC pipe or any other suitable pipes etc. can be implemented by adopting the EPC contract, taking into the account of the constraints of acquired land width and the required hydraulic particulars.

The Government of Kerala has also accorded Administrative Sanction for implementing the project in EPC mode, vide GO(Rt) No 42/2020/WRD dated 14-01-2020. Being the project is proposed through EPC mode, only a tentative design is adopted and the estimated & project report is prepared, on the assumption that the EPC contractor will design and submit the detailed drawings of various components in the envisaged project.

### **Main components of the Project are:**

#### **1. Appendix A- Fabricating and Supplying 2800mm diameter MS Pipe**

Out of the total length of the 6430m canal portion from Korayar to Varattayar, 5770m length of the canal is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter 12mm shell thickness throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity coefficient. The cost of fabrication and supply of MS pipe is included in this appendix.

Estimate amount – Rs.531920317.10/-

#### **2. Appendix B- Laying MS Pipe**

Laying of 2.8m diameter MS pipe for a length of 5770m in line and levels including cost of earth work excavation in ordinary soil / hard rock, welding of joints and cost of one siphon pipe aqueduct for a length of 210m at road crossing.

Estimate amount – Rs. 172379347.79/-

**3. Appendix C- Steel pedestal supporting structure for MS Pipe**

Steel framed pedestals as supporting structures at 15m intervals are provided where the pipe runs over ground and at the aqueduct across Korayar River. ISHB 200 for main columns, ISMC 100 for horizontal braces and ISA 60X60X10 as diagonals are used for pedestals. The height of structure varies from 7.5m to 15m. RCC M25 grade is used for the Raft foundation of the structure. Structural steel work includes riveted, bolted or welded built up sections for framed pedestal work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer

Estimate amount – Rs. 350588285.19/-

**4. Appendix D- Tunneling for a length of 660m.**

This appendix include provisions for tunneling such as earthwork excavation in all kinds of soil, excavation for adit by tunneling methods in all types of rock, excavation for vertical / inclined shaft in all types of soft / hard rock, removing and hauling muck over fallen due to natural causes such as geological faults etc., providing 25 mm thick guniting to sides of tunnel in CM 1 : 3 proportion by weight, providing and fixing 25mm dia. steel rock bolts, providing, fabricating and fixing in position temporary structural steel supports, steel reinforcement for R.C.C work, drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer and grouting with cement slurry and cost of electric line, lighting and ventilation

Estimate amount – Rs. 128543610.95/-

**5. Appendix E- Regulating shutters at inlet and intermediate locations**

All mechanical works such as supply, fabrication, erection and painting including embedded parts for 6 nos. of Regulating shutters at inlet and intermediate locations are provided in this appendix.

Estimate amount – Rs. 20398733.46/-

**6. Appendix F - Providing inspection chambers**

Inspection Chamber 6mX6mX5m 10 nos. in CC 1:1.5:3 with manholes are provided to carryout periodical inspection and repair works.

Estimate amount – Rs.17205016.97/-

**7. Appendix G -Surplus Water Escape**

Surplus water escapes are proposed at the tail end and two other locations for discharging surplus water to nearby natural stream. This include tank 5mX5mX5m in RCC 1:1.5:3 using 20mm metal, leading canal for 1500m (Avg.) with lining in CC 1:3:6 40mm metal and side protection work for natural stream in CC 1:3:6 40mm graded metal.

Estimate amount – Rs.56242673.54/-

### **8. Appendix H - Side Protection works at river crossings and aqueduct**

Side protection works in CC 1:3:6 using 40mm graded metal is provided for an average height of 5m at the banks of Korayar River where the pipe line crosses the river and also at the abutment portion of aqueduct which are close to the pipe line.

Estimate amount - Rs- 55805113.43/-

### **9. Appendix I- Lift Irrigation Civil Works**

This appendix contains cost of all components for one Lift irrigation scheme including pump house, suction tank, cistern, supply and installation of pump and motor, vacuum pump, starter, supply and laying of suction and delivery pipe (Class K9 Ductile iron pipe), CPVC pipes for distribution system and electrical works.

Estimate amount – Rs. 15628321.69

### **10. Appendix J- Micro Irrigation with electronic controlling devices**

Cost of supply and installation of all components for implementing Micro irrigation / Drip irrigation for garden crops in 3575 Ha of command area is included. By providing Drip Irrigation crop yield will double with 70% saving in irrigation water.

Estimate amount - Rs- 696453758.00/-

### **11. Appendix K- Revival of 14 ponds**

Improvements to 14 public ponds including de-silting and side protection work with DR masonry.

Estimate amount - Rs- 133044221.70/-

### **12. Appendix L Consultancy and Service Charges**

Estimate amount is Rs- 120000000 /-

### **13. Appendix M Land Acquisition**

Estimate amount Rs- 126000000.00/-

### **14. Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal**

The existing canal at initial reaches of MRBC is in a dilapidated stage and the seepage is too severe. Hence relining/rectification works of existing canal is proposed in the appendix. The provision for construction of new sluices, where the sluices are completely damaged is also included in this appendix.

Estimate amount Rs- 93757663.79/-

### **15. Appendix I-1 Lift Irrigation Electrical Works**

Estimate amount Rs - 2543550.62/-

### **16. Appendix I-2 Lift Irrigation Mechanical Works**

Estimate amount Rs - 3905484.11/-

### **17. Appendix L- Soil Investigation**

Provision included for detailed soil investigation such as bore holes and SPT along the alignment of pipe including locations of steel pedestal pipe supports, siphon,



pipe aqueduct and tunnel.

Estimate amount - Rs- 5000000.00/-

**The Total Estimated Cost of the project including provision for 12% GST is Rs- 282.83 Crores.** Detailed estimate with Data Analysis is appended as last pages in the DPR.

### 3. INTRODUCTION

#### 3.1 Aim of Project and Description of work

Water is an essential input for crop production. Serious water shortages are developing in many countries particularly in India and water for agriculture is becoming increasingly scarce in the light of growing water demands from different sectors (IWMI 2010). Agriculture is the largest (81%) consumer of water in India and hence more efficient use of water in agriculture needs to be of top most priority (Surendran et al. 2013). A better understanding of the intricate interactions between climate, water and crop growth needs to be a priority area in India.

In view of rapidly growing population, over exploitation of ground water resources, pollution of surface and ground water resources, coupled with adverse impact of climate change, and considering the development need of our fast growing country, there is an urgent need to promote as well as consolidate the activities of water conservation, optimization of water use efficiency and water demand management in the country, through a holistic and integrated approach. It is apprehended that if the water related challenges are not addressed properly, in a time bound manner, the rapidly growing water demand is likely to lead to water conflicts among different user groups as well as the basin States.

Project area is situated in the rain shadow region of Palakkad gap, which receives less than 1000mm of annual rain fall when compared to the State's average of 3000mm. But these regions are having intensive agriculture in spite of low water availability.

Eruthempathy Panchayat has a tropical dry climate. Temperature remains high throughout the year. This Panchayath receives less amount of rainfall, with an average annual rainfall of 1199.45mm, which is too little for a place with tropical location. Climatic condition of Eruthempathy is largely influenced by Palakkad gap. The lack of rainfall created lot of problems in the agriculture sector (Field Survey).

During the years from 2001 to 2005, the area was well known for its paddy fields with 180 hectares of land under paddy cultivation. Now it has declined to a mere 30 hectares and that to only during the first cropping season. Paddy cultivation in this region has witnessed a steady decline since the last ten years. Not only paddy, area under other agricultural crops also declined dramatically due to the low amount of rainfall (Panchayath Development Report, 2017- 2022).

At present the major source of water for irrigation and domestic use is ground water. Due to years of intensive abstraction, the ground water level in this region has gone down considerably and the areas under Kozhippatty and

Eruthempathy Villages has been categorized as 'over exploited' by the Central Ground Water Board and the State Ground Water Department. Hence considering the acute situation the Government vide G.O(Rt) No. 1403/2012/WRD dated 30.11.2012 had issued Administrative Sanction amounting to Rs. 30.50 crore for the execution of the project –Extension of Moolathara Right Bank Canal from Korayar to Varattayar with the condition that the land required for the construction of the canal shall be obtained under free surrender from the respective land owners. But due to many reasons this did not materialise and in the meeting convened by Hon'ble Chief Minister on 08.04.2015 it was decided that the land required for the canal will be acquired under negotiated purchase. As per the decisions taken in the meeting convened by the Hon'ble Chief Minister on 08.04.2015, the Chief Engineer, Project-I, Irrigation Department had requested the Government for according Administrative Sanction for estimate amounting to Rs. 50.06 crores for the aforesaid proposal and also furnished the details of the land for acquisition and has requested the Government for the sanction for acquiring 5.559 ha of private land through negotiated purchase. In the circumstance reported by Chief Engineer, Project 1 in the letter and as per the decisions taken in the meeting convened by Hon'ble Chief Minister Government vide its order G.O (MS) No.54 /2015/WRD. Dated, 09.06.2015 had accorded Administrative Sanction for the work of extension of the Moolathara RBC from Korayar to Varattayar (ch:15957m to 22147m), for an estimate amounting to Rs.50.06 crores (Rupees Fifty Crores six lakhs only); including the cost for land acquisition. But the finalisation of the alignment met with many hurdles and the project got delayed.

In the meantime the Hon'ble Finance Minister in his revised budget speech as well as in his reply speech for the financial year 2016-17 (Reply Speech Para: 32) had announced the implementation of a number of schemes, by funding under a special package through the Kerala Infrastructure Investment Fund Board. Of these the Water Resources Department have been entrusted with a set of —New Projects for Irrigation and Drinking Water with a project out lay of Rs. 147 crores and CHITTOOR - MOOLATHARA RBC - EXTENSION OF MOOLATHARA RIGHT BANK CANAL FROM KORAYAR TO VARATTAYAR is one of the projects now proposed for execution through Kerala Irrigation Infrastructure Development Corporation Ltd, a SPV under the administrative control of Water Resources Department.

The Water Resources Department, Government of Kerala have now issued In-Principle Administrative Sanction for the project amounting to Rs. 262.10 Crores vide its order No. Go. (Rt) No. 610/2019/WRD Dated, Tvpm, 27/08/2019. The proposed total ayacut to be benefited by the implementation of this project is 3575 Ha (predominantly Coconut and Vegetable). The proposal mainly consists of laying of pipe line for conveyance of water for a length of 6340m which includes construction of an aqueduct across Korayar River, a 660 m tunnel and regulating mechanisms and improvements to 14 public ponds, a lift irrigation scheme, Side Protection works at

river crossings and abutment, micro irrigation to the ayacut with electronically controlled Spouts, etc. By the present proposal, by effective water management, the water available during periods of no or less demand in other systems of Chitturpuzha Project and the water reaching Moolathara regulator during rainy season can be diverted to drought hit areas up to Varattayar and to the check dams in Varattayar & Korayar and also the 14 no's ponds in Eruthiampathy Panchayath between Korayar and Varattayar.

Right Bank canal system from Moolathara weir is complete up to Korayar and the ayacut under this canal system is at present being irrigated as per the requirement of farmers. In this proposal the overall improvement of ayacut under MRBC from Korayar to Varattayar by adopting micro irrigation system in the existing ayacut and thereby increasing its efficiency and the water savings. The objective is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation.

The main canal up to Korayar is already lined and the canal portion from Korayar to Varattayar is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity co-efficient.

The canals are designed for the peak discharge with extra provision for accommodating flood water. However, the MRBC from Korayar up to Varattayar is provided a uniform section. This is to divert the water coming in the Moolathara Regulator in excess of actual requirements during a particular time like November, December to fill the check dams in the Korayar and Varattayar rivers and the ponds in Kozhinjampara Firka. The right bank canal from Moolathara Regulator takes off at +182.00m and command an ayacut of 10,146 Ha. of Kozhinjampara area spreading over the three Panchayats of Kozhinjampara, Eruthiampathy and Vadakarapathy. The canal up to Korayar has already been constructed. This portion is having sufficient capacity for carrying water for the proposed ayacut.



An alteration in the old alignment of the MRBC had been done from ch. 2013m. This had been done to avoid the huge tunnel that was coming in the alignment. As per this the existing Valiyavallampathy branch canal which off takes from Ch. 2013 of MRBC has been widened up to Ch. 12075m to form the MRBC. From the Ch. 12075, the canal is connected to the old alignment of Ch. 6100 m and from there the canal continues. The alternate alignment has got the great advantages of carrying full discharge up to the Kozhinjampara area also, where the drinking water problem is acute.

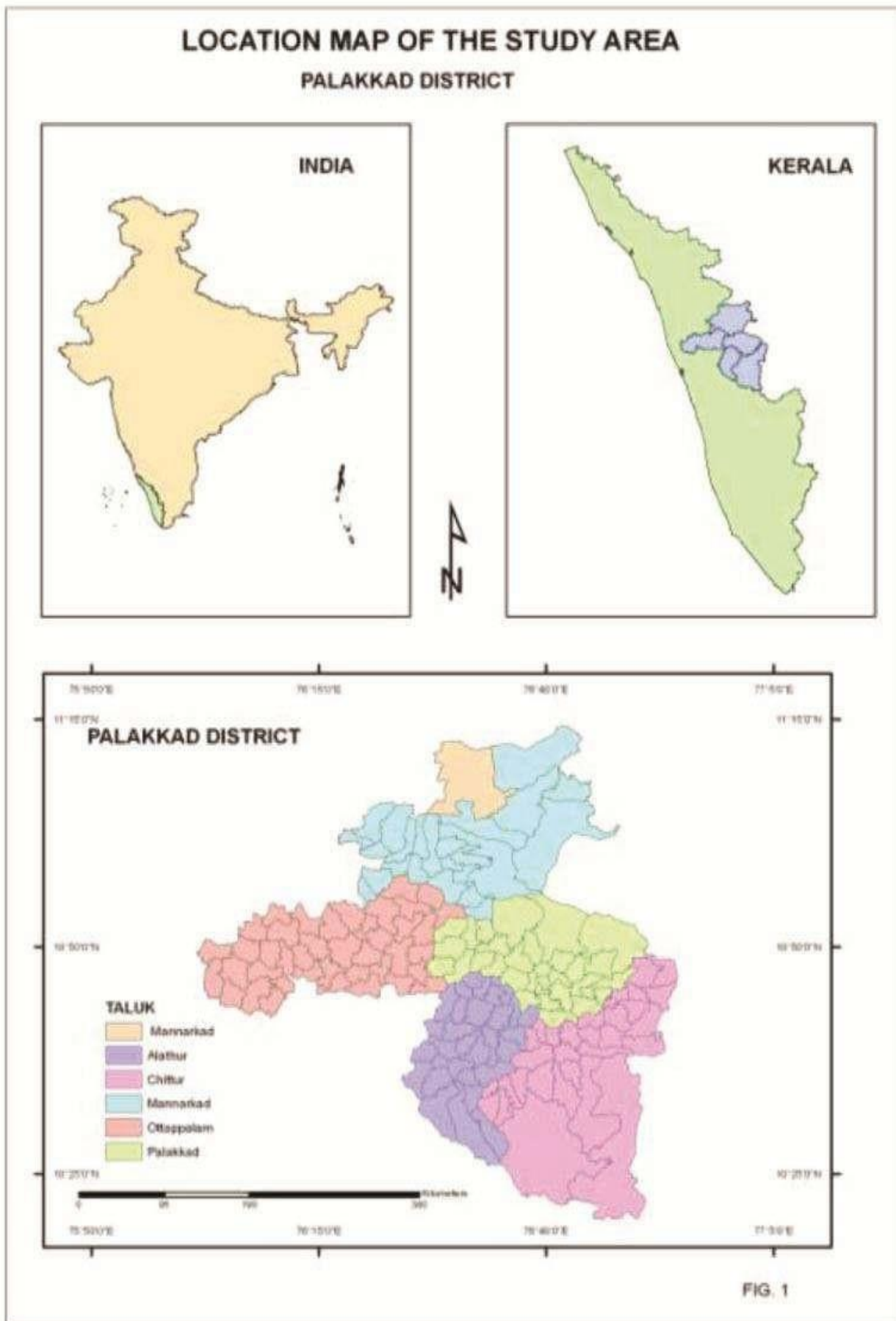
Reach 1 – from Ch - 0 m to 16125 m is the completed portion of canal of MRBC. The designed discharge of the canal in this reach is 22.00 m<sup>3</sup>/sec at full supply depth of 3.00 m and is designed to carry water for irrigation for 10,146 ha plus facility to carry additional water to the 31 check dams in Korayar and Varattayar and the 68 ponds and eris available in this area, whenever additional water is available at Moolathara Regulator.

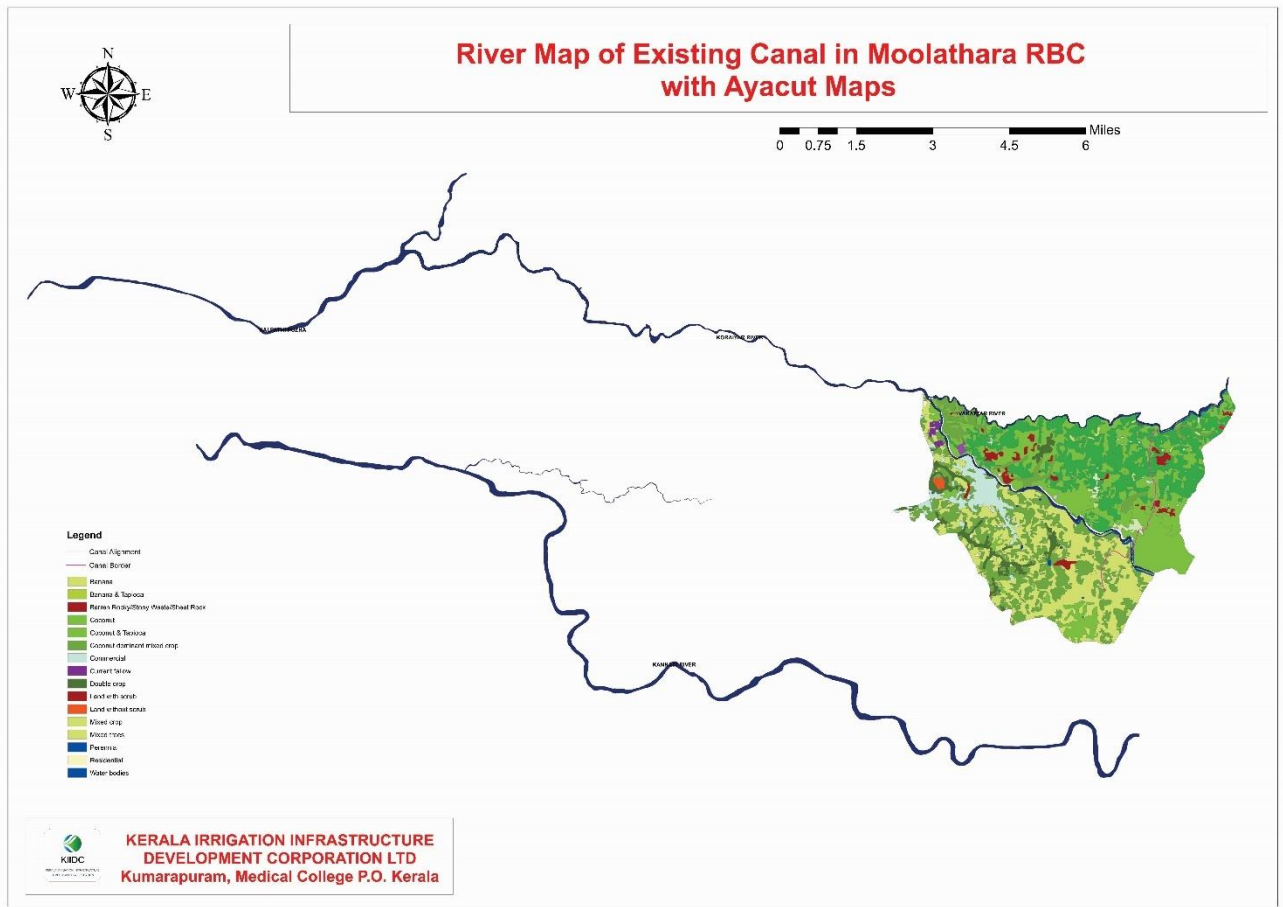
There are nineteen numbers of check dams already built in the river Korayar and Varattayar. Experience show that the filling of the check dams to FRL makes the water table high, and the yield in the wells will be increased drastically.

**The Total Estimated Cost of the project including provision for 12% GST is Rs- 282.83 Crores.**

### **3.2 Location of Project Area and Accessibility**

The project is located in Eruthempathy Panchayath, Chittoor Taluk in Palakkad District between Latitude 10<sup>0</sup> 45' 29.671'' and 10<sup>0</sup> 45' 29.671'' and Longitude 76<sup>0</sup> 52' 2.061'' and 76<sup>0</sup> 53' 0.064''. The project area is accessible by road only.





Canal alignment with Kalpathy puzha, Kannadi river, Korayar and Varattayar

### 3.3 Topography Physiographic and geology of the area

Areas having similar rainfall pattern and soil type are further delineated into zones based on topographical features. For instances, the midland region north of II \_ latitude has a common rainfall pattern and the soil is of typical laterite with B-horizon. It is further delineated into two zones based on the differences in topography with one zone having topographic Model II-b and the other Model II-c. Similarly, the midland region south of II "N has been delineated into two zones based on the differences in topographic features as models II-a and II-b.

Following the above approach and using a matrix built upon altitude, rainfall, soil and topography, the state has been delineated into thirteen agro-climatic zones. Block Panchayat has been taken as the unit for purposes of delineation. All the Blocks, Municipalities and Corporations have been grouped into appropriate agro-

ecological zones. Whenever a Block or Municipality was found to fall in more than one agro-climatic zone, it was assigned to that zone which has the largest area. Though 13 agro-climatic zones have been identified, no Block was assigned to one zone viz. the Riverbank alluvium as it is found scattered in several blocks. This zone is found generally all along the banks of the major rivers. It is found relatively extensively in the lower basins of the Periyar and Pampa river systems. Further, such alluvium deposits are generally found in the paddy fields that form the valley portions of the undulating landscape, which is interspersed with mildly sloping hills. The principal characteristics of each zone are summarized. Each of the zones identified is assigned a popular name. Many of them are currently in vogue and are associated with areas having singular agro-climatic features and cropping patterns.

The State of Kerala which is one of the smallest states in India, holds only 1.30 percent of the total area of the nation. By natural geology, Kerala is divided into three distinct regions viz. high lands, midlands and coastal areas. A wide range of crops ranging from plantation crops and cash crops such as rubber, coconut, tea, coffee, arecanut, cashew nut, spices such as pepper, cardamom, ginger nutmeg, clove are cultivated in Kerala besides food crops such as rice, vegetables, banana and tuber crops.

Palakkad District is one among the 14 districts of the Indian state of Kerala. The city of Palakkad is the district headquarters. Palakkad is bordered on the northwest by the Malappuram District, on the southwest by the Thrissur District, on the northeast by the Nilgiris District and on the east by Coimbatore district of Tamil Nadu. The district is 24.4% urbanised according to the census of 2011. The district is nicknamed "the granary of Kerala" and "Rice bowl of Kerala". Out of the total area of 4,480 km<sup>2</sup> (1,730 sq mi), about 1,360 km<sup>2</sup> (530 sq mi) of land is covered by forests. Most parts of the district fall in the midland region (elevation 75-250 m or 246-820 ft), except the Nelliampathy - Parambikulam area in the Chittur taluk in the south and Attappadi - Malampuzha area in the north, which are hilly and fall in the highland region (elevation > 250 m or 820 ft).

In earlier times, Palakkad was also known as Palakkattussery. Palakkad is the gateway to Kerala due to the presence of the Palakkad Gap, in the Western Ghats. The total area of the district is 4,480 km<sup>2</sup> (1,730 sq mi) which is 11.5% of the state's area with the share of population as 8.22%.

The major rock formation of the Bharathapuzha basin may be classified into 4 groups (i) Crystalline rocks of Archaean age (ii) Sedimentary rocks of tertiary age (iii) Laterite capping over crystalline and sedimentary rocks and (iv) recent and sub recent sediments forming the low-lying areas and river valleys. Residual laterite formations are noticed in ayacut area in the Palghat gap. Large size good granite outcrops are also seen scattered all over the ayacut area. The geologists have classified this part of the nation as a region of high geological stability as the mountain building movements here have ceased to be active long ago. Occasionally, however, very feeble



shocks are felt in some areas, never so far to such an extent as to affect the stability of any structure.

Eruthempathy Panchayath has an average elevation of 180m above mean sea level and the elevated land to the South East and North East is covered by rock structures. The area is divided into two parts, they are:

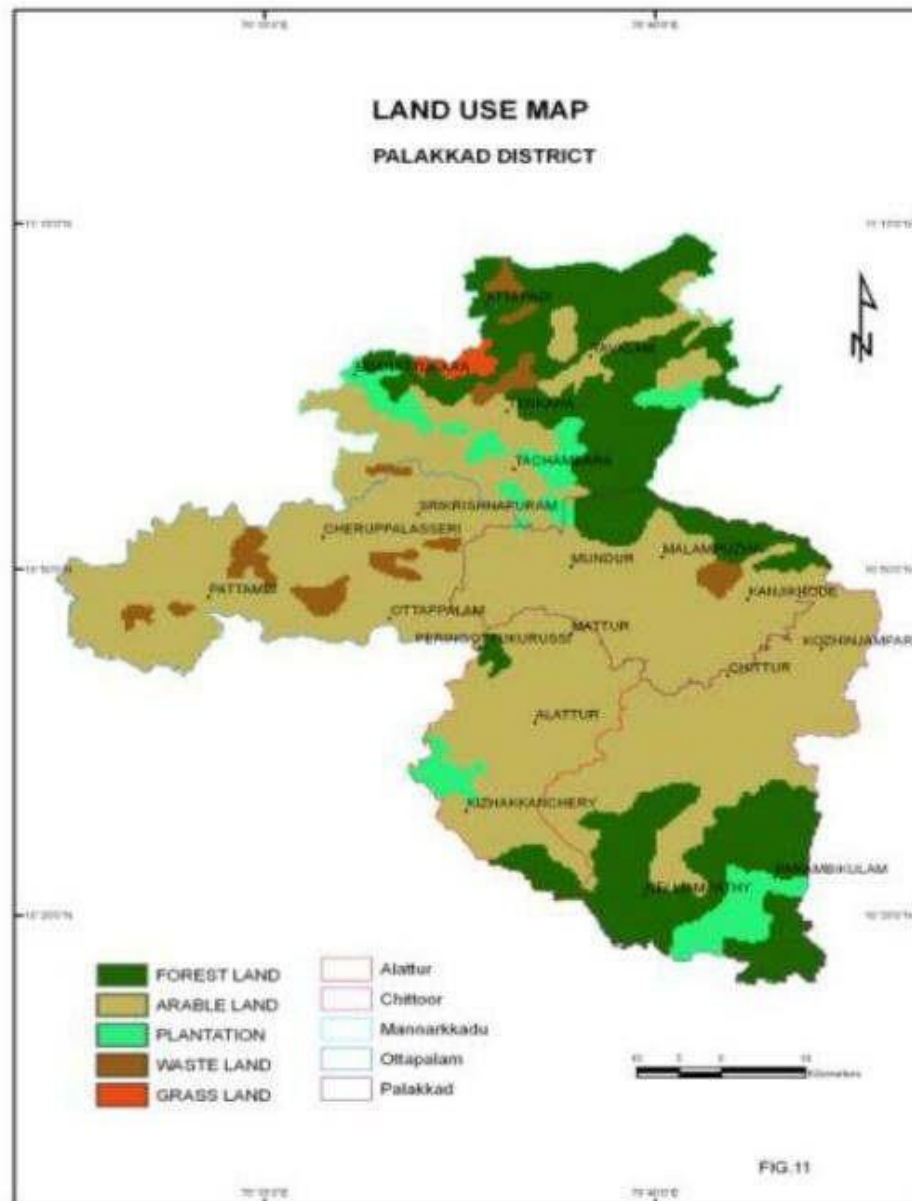
1. The land between Korayar and Varattayar Rivers.
2. The land to the south of Korayar River.

Eruthempathy Panchayath has two rivers namely Korayar River and Varattayar River. Both rivers flow towards West. These rivers are non-perennial in nature with water only during monsoon season. The panchayath is dotted with large number of ponds, but they are also dry during summer season.

Black soil covers almost the entire area of the panchayath which is mainly loamy in texture. This soil which is composed of a variety of minerals and organic substance form the physical support for the plants and fundamental to any form of agriculture. The black soil is also suitable for cultivation of cotton.

### **Land Use**

Land use is defined as the land put under use. The Land cover reflects the biophysical state of the Earth surface including the soil material, vegetation and water. Man is a terrestrial animal. He lives only on land. Therefore, increasing population has brought maximum changes / modification over land. Nowadays, land use and land cover analysis play an important role in the field of Environmental Science and natural resource management.



The land put for several uses is known as land use. Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods. It also has been defined as "the total of arrangements, activities, and inputs that people undertake in a certain land cover type"(D R Khullar, 2014).

The land use of Kerala can be categorized under 9 major categories based on the land use data generated based on the natural resources and environmental base. The predominant land use of the State is a mix of residential and agricultural land uses which constitute 41.38% of total land use. The second highest land use of the state is forest which contribute 23.18% of the total area. The agricultural land use and

plantation and use together constitute 20.18% (Agricultural 10.17% and plantation 10.01%) of the total area. The other category of land uses are water bodies, marshy land, Residential and other built up area which constitute 2.92%, 0.98%, 3.45%, 0.48% of the states total area respectively. The land uses which are not included in the above category are coming under –others category land use which constitute 8.13% of the area of the state. Normally vacant land, Barren land, rocky area etc. are coming under –others category. The above analysis supports the real to ground peculiar scenario of the state in terms of urban rural continuum, highly scattered settlement pattern and traditional homestead type of development with individual houses surrounded by agricultural land mainly of mixed crop cultivation.

Moderate rainfall, thick soil cover and a number of irrigation projects have influenced the development of a particular type of land use in the district. A major portion of the district comes under arable land, which includes both irrigated and unirrigated land. Rice, pulses, vegetables and banana are the major crops grown. The north and south, comprising high hills of the Western Ghats constitute forest land. The area comes under the tropical evergreen forest. Considerable area of the forest land has been converted into plantation for cultivation of tea, pepper, teak and eucalyptus. There are pockets of waste land with thick capping of hard duricrust or exposure of basement rocks.

The dominant crop cultivated in the study area is coconut. Among the vegetable crops tomato is the important one. The details of land use/ land cover of the study area as on 2016 is given below.

Sl No.	Categories	Area in Hectors	Percent
1	Fallow	462	12.51
2	Barren	200	5.42
3	Built up	100	2.70
4	Plantation Crop	1950	52.80
5	Other Crops	921	24.94
6	Water body	60	1.63
	<b>Total</b>	<b>3693</b>	<b>100</b>

### Agro-Ecological Zones

Four parameters that together evolve distinct agronomic environments wherein a distinct cropping pattern flourishes are altitude, rainfall pattern, soil type and topography. The parameters and their levels used for delineating agro-climatic zones are summarized below. The levels of each parameter are broadly determined to avoid

complexity in the process of land evaluation. In reality, there can be several more levels for each parameter (For example, there are 38 soil associations identified in Kerala, at 1:250,000 scale).

**Altitude:** Altitudinal variations influence the temperature regime. High altitude generates temperate climatic conditions in a tropical area like Kerala. Sizeable areas in the high ranges of Idukki and Wayanad districts fall under this category, even though high altitude areas are found all along the Western Ghats. The low altitude region, endowed with humid tropical climate is spread over the entire length of the state.

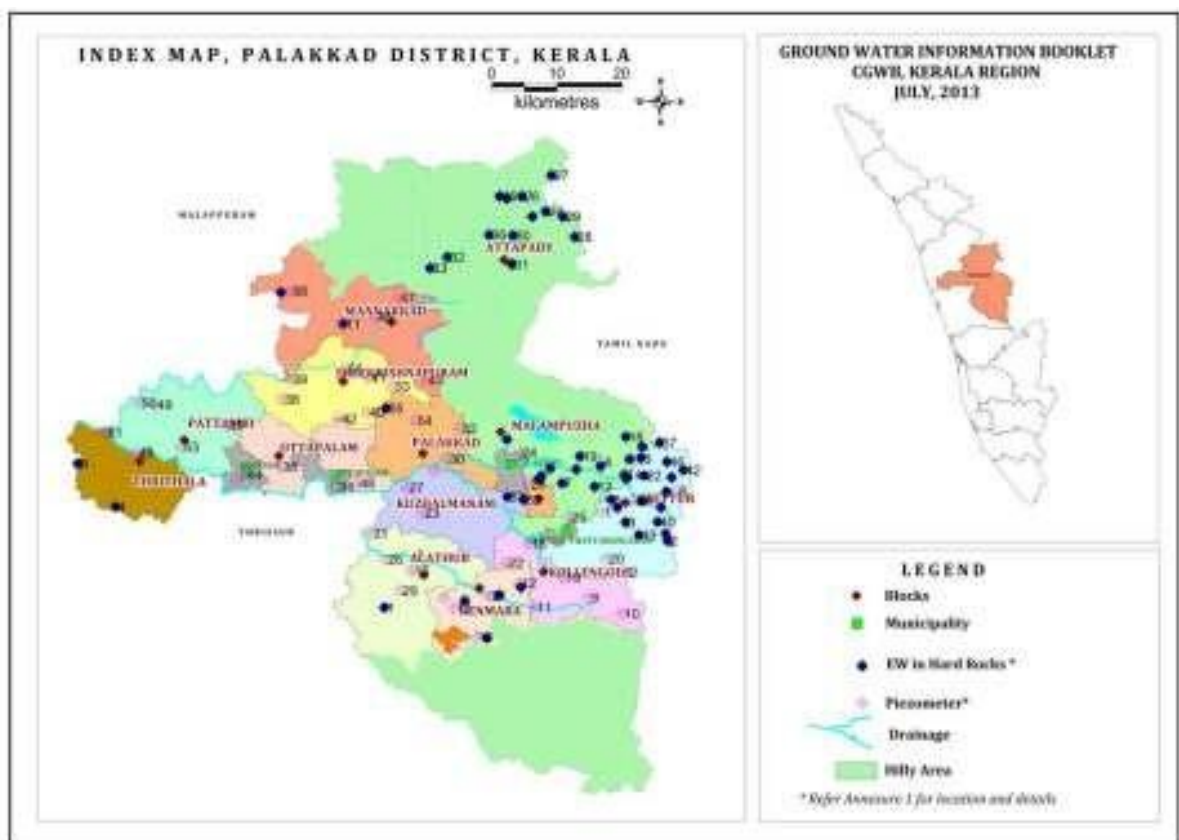
**Rainfall:** The State is relatively rich in rainfall endowment; with an annual precipitation around 2600 mm. Ninety percent of this precipitation is during the two monsoons, June to August (southwest) and October to November (northeast). About 60% of annual rainfall is received during southwest monsoon period and about 30% during northeast monsoon. From December to March there is very little rainfall, but the occasional rainfall during this period is a very critical requirement for cultivation as we still depend upon rainfall for raising many of the crops. The spread of rainfall is relatively better with 6-7 months having rainfall above or nearly around the monthly average. The quantum of annual precipitation is concentrated around lesser periods towards the northern part of the state while it is spread over longer periods in the southern parts. The co-efficient of variation of the annual rainfall is below 20% and hence, agriculture is expected to flourish under relatively stable conditions. However, coefficient of variation of monthly rainfall is high. As a result, stability in production can be ensured only with the support of irrigation at least for most of the major crops so as to increase their production and productivity. The state was divided into two halves namely the areas south and north of 10°N latitude (approximately south and north of Thrissur) with rainfall pattern I and II respectively. The southern region is having relatively well distributed rainfall and June maxima for SW monsoon while the northern region has relatively ill distributed rainfall and July maxima for SW monsoon.

**Soil Types:** Soil type is the third factor for distinguishing specific zones. The major group under the soils of Kerala is laterite and its variations. In the traditional midland region, the dominant soil type is typical laterite with the B-horizon present. The areas skirting the Western Ghats and the high ranges which together form the traditional highland region has lateritic soil where the B-horizon is absent. Red loam is found in the southernmost tip of the state. All these variabilities constitute distinct homogeneous agro-ecological zones, though the rainfall pattern is the same. Distinct zones have been identified based on special soil types such as riverbank alluvium, peaty soil (kari) as in Kuttanad and 'sandy soils, though the rainfall pattern and topographic models are the same. In the coastal area, the texture of the soil- especially of the garden lands is considered as a distinguishing feature in identifying two separate zones one with sandy loam and the other with sandy soil. The soil characteristics of the paddy land such as peaty (kari) and saline soils (pokkali) have also been associated in delineating the zones.

### 3.4 GROUND WATER

Certain pockets in the eastern parts are showing some quality deterioration especially eastern part of Palakkad district where fluoride content is slightly high. The dug wells are showing fluoride in the range of 1 - 5.75 ppm. The higher values are recorded from Kopanur (5.75 ppm). The bore wells are showing high concentration of fluoride, ranging from 0.3 to 3.12 ppm. The highest concentration is reported from Chinna moolathara (EW of CGWB). The water supply bore well of Eruthanpathy is also showing 1.76 ppm of fluoride. The fluoride content can be brought down to permissible limits by mixing with KWA pipe water supply. Inland salinity is noticed from Kadumthuruthi (Yakkara) and Kuduvayoor area. About 1 sq km area is affected in both the areas. The dug wells in the Kadumthuruthi colony (about 40 numbers) area showing high EC (Electrical Conductivity) values in the range of 2000 - 6700 microseimens/cm at 250 C. In the Kuduvayoor area about 25 dug wells are showing high EC values of 756 - 7200 micro seimens/cm at 250 C.

The Coco Cola factory which is extracting groundwater for its products was operating in the Chittur Block and has invited agitation in a big way. The company is presently non-operational. Pepsi ltd Company is operating in the industrial belt of Malampuzha block which is also extracting groundwater for its product.



At present the major source of water for irrigation and domestic use is ground water. Due to years of intensive abstraction, the ground water level in this region has gone down considerably and the area has been categorized as 'over exploited' by the Central Ground Water Board and the State Ground Water Department.

The entire region is facing acute scarcity of drinking water in all the seasons. The ground water source is almost saturated stage, the yield from deep well are dwindled down considerably. Hence the project is socially desirable.

In view of rapidly growing population, over exploitation of ground water resources, pollution of surface and ground water resources, coupled with adverse impact of climate change, and considering the development need of our fast growing country, there is an urgent need to promote as well as consolidate the activities of water conservation, optimization of water use efficiency and water demand management in the country, through a holistic and integrated approach. It is apprehended that if the water related challenges are not addressed properly, in a time bound manner, the rapidly growing water demand is likely to lead to water conflicts among different user groups as well as the basin States

As the project implementation comes into effect the recharging of open wells, as well as bore wells automatically happens. Beyond this the water retaining capacity of the soil reaches to almost to its saturation point during the Kharif irrigating days. So, the recharging of ground water is only a basic phenomenon even in the months of February and April. Quite a large amount of this water can be easily used for irrigation. Whenever there is acute shortage in Irrigation releases and effective conjunctive use of this resource can be made use of.

### **3.5 General climatic condition of the State and Project area in particular**

Even though the mean annual rainfall in the Kerala State is 3000mm, its temporal distribution is highly uneven, resulting in a long dry spell of about 5 to 6 months. Similarly, the unevenness in the spatial distribution causes a moisture stress period of 14 to 15 weeks in south Kerala and 18 to 21 weeks in north Kerala (Vardan 1996). Long term data on rainfall analysis of Kerala showed that intolerably long dry spells are the norm rather than the exception in all seasons (Krishnakumar et al. 2009). The productivity of most of the crops in the State remains almost static or lower when compared with the national average. The uneven rainfall distribution pattern and low water holding capacity of soils, soil moisture stress occurs during summer season and it is considered as one of the major limiting factors for higher productivity in the State.

This project area differs from other areas of Kerala in its climatic condition because of its location in the Palakkad gap. Eruthempathy experience a tropical dry climate. The temperature remains high throughout the year, with March and April being the hottest months with temperature reaching up to 42<sup>0</sup>C. The region



receives rainfall from the South West and North East Monsoon period. The amount of rainfall is comparatively low when compared to other parts of Palakkad district. The average amount of annual rainfall is only 1199.45 mm. Rainfall is the result of water vapour condensing and precipitating, forming droplets that fall from clouds due to gravity. Rain is liquid water in the form of droplets that have condensed from atmospheric water vapour and then precipitated that is, become heavy enough to fall under gravity. Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It provides suitable conditions for many types of ecosystems, as well as water for hydroelectric power plants and crop irrigation (D R Khullar, 2014).

Rainfall is the most common form of precipitation. It is the amount of rain that falls in a place during a particular period. The globally averaged annual precipitation over land is 715 mm (28.1 in), but over the whole Earth it is much higher at 990 mm (39 in). Rainfall is measured using rain gauges.

The Palakkad district has a humid climate with a very hot season extending from March to June in the Western Part of the district whereas it is less humid in the East. The most prominent rainy season is during the South West Monsoon, which sets during the 2nd week of June and extends up to September. About 75% of the annual rainfall is received during the south west monsoon period. During the period from December to May, practically no rain is received. The temperature of the district ranges from 20° C to 45° C. The maximum temperature recorded at Palakkad was 43° C (Ministry of Agriculture, 2010).

Ottappalam, Alathur and Mannarkkad taluks of Palakkad District are having a climate similar to that of other districts of Kerala, whereas Palakkad and Chittur taluks are having rather a dry climate similar to Tamilnadu. The climate is pleasant for most part of the year, exception is on the summer months. There is sufficient rainfall and it receives more rainfall than the extreme southern districts of Kerala. The district is blessed with many small and medium rivers, which are tributaries of the Bharathapuzha River. A number of dams have been built across these rivers, the largest being Malampuzhadam. The largest in volume capacity is the Parambikulam Dam.

Eruthempathy Panchayat has a tropical dry climate. Temperature remains high throughout the year. This Panchayath receives less amount of rainfall, with an average annual rainfall of 1199.45mm, which is too little for a place with tropical location. Climatic condition of Eruthempathy is largely influenced by Palakkad gap. The lack of rainfall created lot of problems in the agriculture sector (Field Survey).

During the years from 2001 to 2005, the area was well known for its paddy fields with 180 hectares of land under paddy cultivation. Now it has declined to a mere 30 hectares and that to only during the first cropping season. Paddy cultivation

in this region has witnessed a steady decline since the last ten years. Not only paddy, area under other agricultural crops also declined dramatically due to the low amount of rainfall (Panchayath Development Report, 2017- 2022).

### 3.6 Soil Type

Soil is a mixture of minerals, organic matter, gases, liquids, and countless organisms that together support life on Earth. Soil is a natural body called the pedosphere which has four important functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of Earth's atmosphere; it is a habitat for organisms; all of which, in turn, modify the soil (Sehgal, 1996).

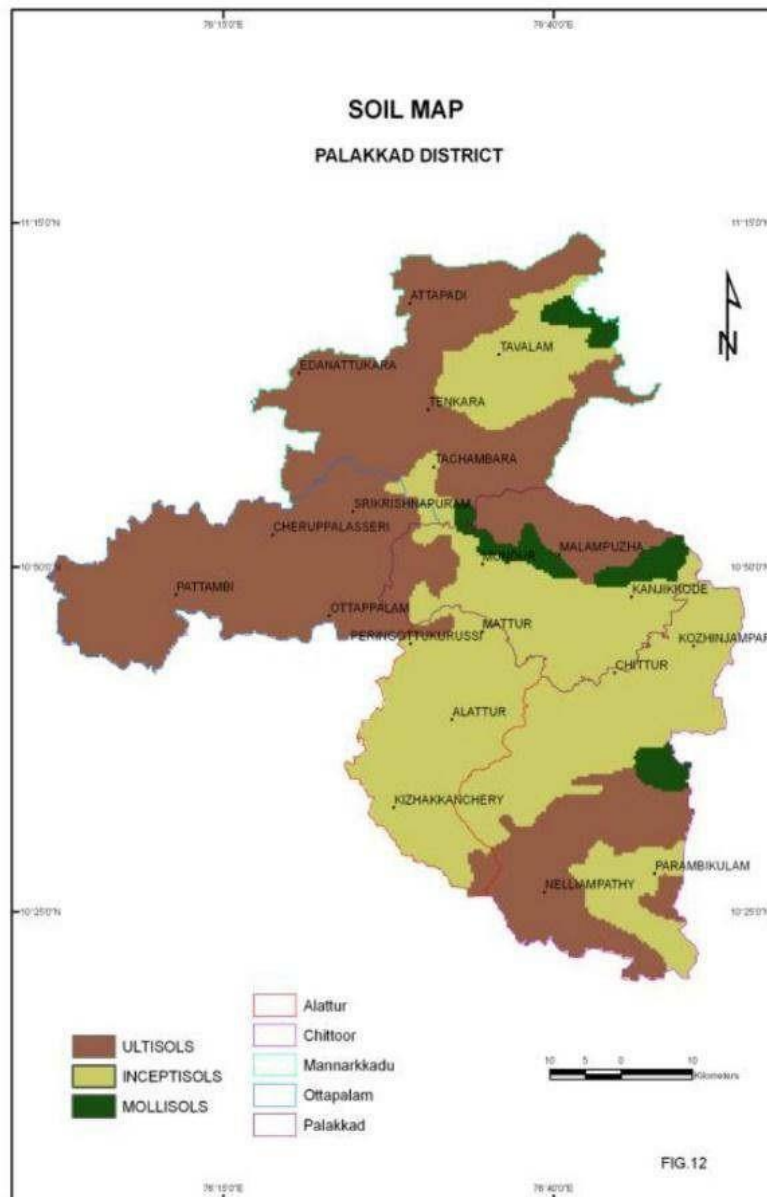
Soil is called the "Skin of the Earth" and interfaces with its lithosphere, hydrosphere, atmosphere, and biosphere. The term pedolith, used commonly to refer to the soil, literally translates 'level stone'. Soil consists of a solid phase of minerals and organic matter, as well as a porous phase that holds gases and water. Soil is a product of the influence of the climate, relief (elevation, orientation, and slope of terrain), organisms, and its parent materials (original minerals) interacting over time. Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion (Wikipedia).

Soil type usually refers to the different sizes of mineral particles in a particular sample. Soil is made up in part of finely ground rock particles, grouped according to size as sand and silts in addition to clay, organic material such as decomposed plant matter. Each component, and their size, plays an important role. For example, the largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, and are chemically active, binding with water and plant nutrients. There are many recognized soil classifications, both international and national (NRCS, 2006).

The soil of Palakkad district is mainly of four types: (1) laterite soil seen in Ottappalam, Alathur, Chittur and Palakkad Taluks (2) Virgin forest soil of Mannarkkad Taluk and Ottappalam Taluk (3) Black soil in Chittur and Attappady Valley which is used for the cultivation of Cotton (4) Peaty soil is found only in Thrithala (Palakkad district statistical handbook, 2014).

Mainly, two types of soils are found in this panchayath. They are;

1. Black soil and
2. Alluvial soil



Black soil covers almost the entire area of the panchayath which is mainly loamy in texture. This soil which is composed of a variety of minerals and organic substance form the physical support for the plants and fundamental to any form of agriculture. The black soil is also suitable for cultivation of cotton.

The soils of Eruthenpathy Panchayath is mainly black soil. Almost the whole area has Fertile Black Soil. Laterite, Alluvial Soils are found very rarely in this region. Alluvial soil is seen nearest to Walayar River (Field Survey).

### 3.7 Soil Erosion

Soil erosion is a naturally occurring process that affects all landforms. In agriculture, soil erosion refers to the wearing away of a field's topsoil by the natural

physical forces of water and wind or through forces associated with farming activities such as tillage (Kim H.Tan ,2005).

Soil erosion can be a slow process that continues relatively unnoticed or can occur at an alarming rate, causing serious loss of topsoil. Soil compaction, low organic matter, loss of soil structure, poor internal drainage, salinization and soil acidity problems are other serious soil degradation conditions that can accelerate the soil erosion process. This Factsheet looks at the causes and effects of water, wind and tillage erosion on agricultural land (Soil Survey Manual,1951).

Mainly Eruthenpathy Panchayath is a plane area. Average elevation above mean sea level is 200m. So, soil erosion in this region is comparatively less.

### 3.8 Soil Quality

Soil quality is a measure of the condition of soil relative to the requirements of one or more biotic species and or to any human need or purpose. According to the United States Department of Agriculture Natural Resources Conservation Service, "Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation." The European Commission's Joint Research Centre proposed a definition, stating that "Soil quality is an account of the soil's ability to provide ecosystem and social services through its capacities to perform its functions under changing conditions" (Hussain,1979).

Soil quality reflects how well a soil performs the functions of maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling, and providing support for plants and other structures. Soil management has a major impact on soil quality (Friend, 1992).

pH : The pH of the soil in 1:2.5 soil water suspensions was determined by digital pH meter (Jackson, 1967).Soil pH is most useful in soil suitability evaluation and management as it provides information about the solubility and thus potential availability or phyto- toxicity of elements for crops subsequently the soil suitability for specific crop. Soil pH is a measurement of the acidity or alkalinity of a soil. On the pH scale, 7.0 is neutral. Below 7.0 acid and above seven is basic or alkaline. The pH scale goes from 0 to 14.as the amount of hydrogen ions in the soil increase, the soil pH decreases thus becoming more acidic. From pH 7 to 0 the soil is increasingly more acidic and from pH 7 to 14 the soil is increasingly more alkaline or basic (USDA 1998). pH value of study area ranges from 6.7 to 7.6. The highest value shows in the sample 19 and lowest in the sample is 1.

EC: The electrical conductivity of the soil was measured in 1:2.5 soil water extract with the help of digital conductivity meter (Jackson, 1967) and the results

were expressed in dS m<sup>-1</sup>. It is well known that the salt affected soils usually occur in arid and semi-arid regions owing to the high evaporation rate. Salt affected soils negatively affected plant growth in several ways. In addition to specific ion toxicities such as Na, Cl and B; causing direct injury to plants (USDA 1998). The value of EC varies from .01 to 1 from the collected soil samples.

**Total Organic Carbon:** The organic carbon content of the soils was determined by Walkley and Black rapid titration method (1956) and the results were expressed in percentage. Soil organic carbon (O.C) indicates the organic matter (O.M) content in the soil which has many benefits such as reservoir of plant nutrients especially N, P and S, also it is important for maintaining micronutrient cations in an available form and complexion Al in 6.5

Less phyto toxic form. In addition, it has a high-water holding capacity hence minimizing the effects of moisture stress. The paramount character of O.M is high negative charges on its surface contributing to cation exchange capacity (CEC) which retains nutrients cations. Conditions where the degradation of organic matter occurs at faster rates coupled with low vegetation cover, thereby leaving less organic carbon in the soils (Nayak et al., 2002). The available phosphorus content was determined by extracting with 0.03N NH<sub>4</sub>F+0.025 N HCl (Bray and Kuntz, 1945) and the phosphorus content was estimated calorimetrically using ascorbic acid method. Phosphorus (P) is an essential Element classified as a macronutrient because of the relatively large amount of p required by plants. the high available P content might possibly be due to the confinement of crop cultivation to the rhizosphere and supplementing of the depleted phosphorus through external sources i.e. fertilizers (Sharma et al., 2008). In collected soil samples the value of P varies from 31 to 35.

**Potassium (K):** The available potassium content was determined in neutral normal ammonium acetate extract using flame photometer (Jackson, 1967). Potassium is an essential plant nutrient and is required in large amounts for proper growth and reproduction of plants. Potassium is considered second only to nitrogen, when it comes to nutrients needed by plants, and is commonly considered as the quality nutrient (USDA 1998).

The Soil Series Description on Eruthempathy Panchayat issued by Soil Survey & Soil Conservation Department is attached as Annexure I.15 and Soil map & suitability classification is attached as Annexure II.19

### **3.9 Overall Development of River-basin**

#### **Bharathapuzha Basin -**

The State of Kerala is blessed with 44 rivers, 41 west flowing rivers and 3 east flowing rivers. Of this, Bharathapuzha Basin is the largest one among the 41 river basins situated in Kerala. About one tenth of the population of Kerala depend on this basin and its resources for survival. This basin is having the severe stress on the water resources during summer compared to any other basin in Kerala. The most important problem to be addressed first in the basin is the water scarcity in summer

season. Even the environmental issues arising in the basin is due to the absence of minimum water flow in the river and most of its tributaries. So to stabilize even the ecological aspects, there should be a minimum flow in the streams and tributaries of the basin.

Bharathapuzha, the longest and largest river of Kerala State, originates from the Anamalai hills, from an elevation of +609.50m takes its course in a western direction flowing through Coimbatore District of Tamil Nadu, Palakkad, Thrissur and Malappuram Districts of Kerala covering a distance of 209 Km before it joins Arabian Sea, at Ponnani. This is the largest river basin of Kerala State having an area of 6186 sq.km, out of which 1786 sq.km, are in the neighbouring state of Tamil Nadu. Main tributaries are (i) Gayathripuzha (ii) Chitturpuzha (iii) Kalpathipuzha & (iv) Thuthapuzha. The Gayathripuzha, one of the major tributaries originates from Anamalai and flows through Kollengode, Nemmara, Alathur, Vadakkencherry, Pazhayannur and finally joins the main river at Mayannur. This tributary has five main sub tributaries namely the Mangalam in which the Mangalam Dam is located, the Ayilurpuzha in which Pothundi dam is located, the Vandazhipuzha in which Meenkara dam is located. The Chitturpuzha also originates from Anamalai and flows through Thathamangalam and joins the main river near Parali, the Chitturpuzha project is located in this tributary. The main sub tributaries of Chitturpuzha are (i) Palar, (ii) Aliyar, (iii) Uppar. The reservoirs have been constructed in the upper reaches of Aliyar by Tamilnadu; Kalpathypuzha has four main sub tributaries namely Korayar, Varattayar, Malampuzha and Walayar sub tributaries respectively. Thuthapuzha originates from the silent valley hills and joins the main river near Pallippuram, Kunthipuzha. Kanjhirapuzha, Ambalakkadavu and Thuppanad streams feed this tributary.

### **Topography of the river basin, reservoir and command area:**

The Bharathapuzha basin can be divided physiographically into 3 zones forming Parallel belts running across the width of the basin namely (i) coastal belt (ii) the mid land and (iii) the high land. The coastal belt is characterised by alluvial sandy deposits with paddy fields and coconut garden. The estuaries in the coastal belt are subjected to saline intrusion. The mid land lying few kilometers from the sea to the east is having slopping surface areas and clustering hills with numerous valleys in between. This region is characterised by late rite formation and consists of typical Kerala ye las or small cultivated water sheds. The high land region comprises mostly of reserve forest. The silent valley forest area is situated in this zone. The proposed ayacut is lying in the Palghat gap in western ghats, in the high lands.

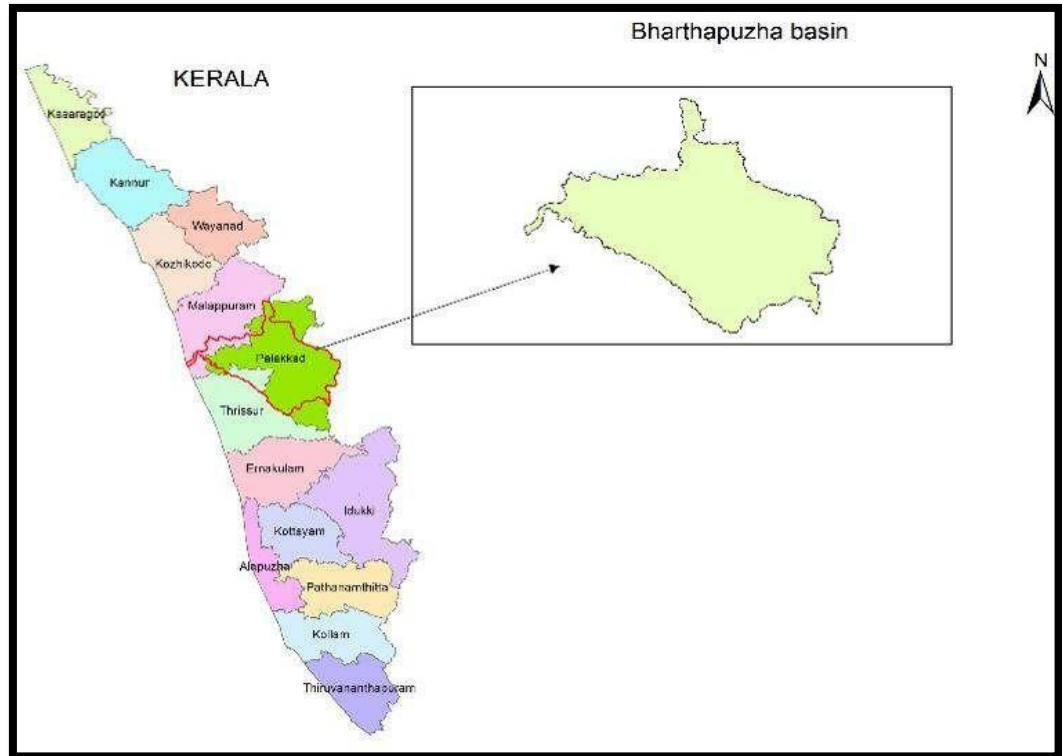
This basin has

- \* 1,25,700 Ha. Wetland
- \* 46,750 Ha. Garden land
- \* 35,400 Ha. Waste land



Out of the 35,400 ha of waste land, 32,000 Ha. area of the waste land can be converted as cultivable land if adequate irrigation facilities are provided.

Bharathapuzha basin can be divided into 50 watersheds and 290 mini watersheds. Soil erosion is more in the upstream parts of the basin. Dendritic is the

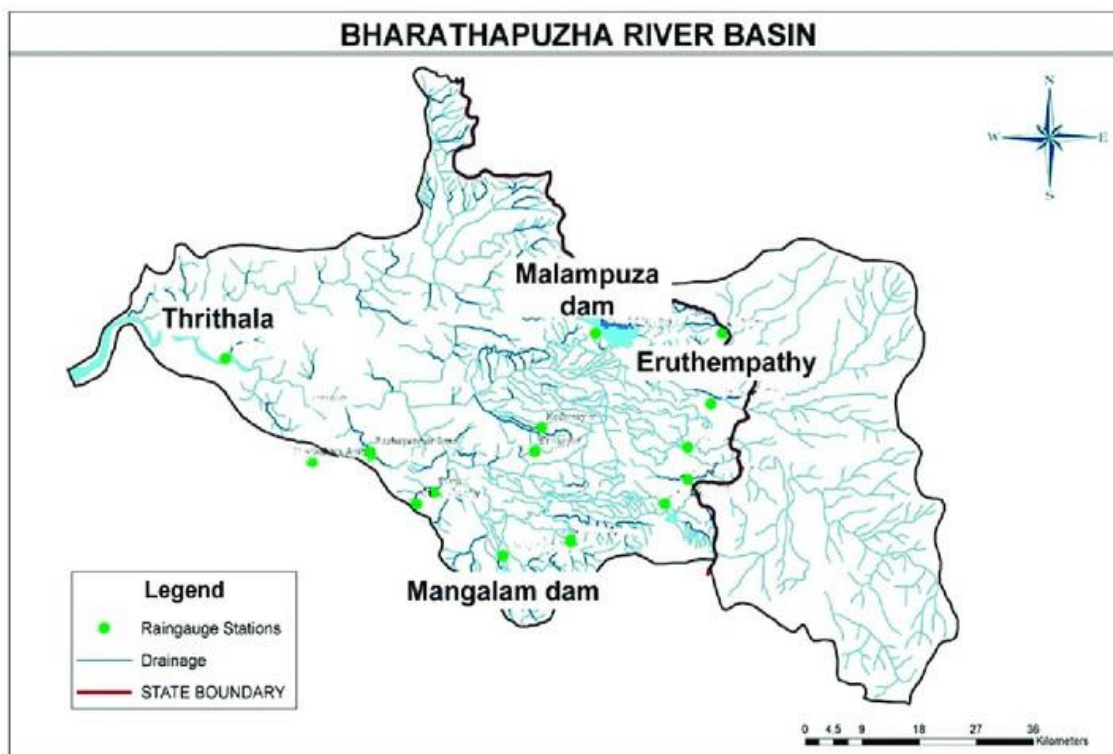


common drainage pattern. 75 % of the population is depending on surface water resources for their irrigation needs, mainly from Bharathapuzha, its tributaries and other water bodies. There are 12 reservoirs in the district associated with two major rivers and its tributaries viz - Parambikulam, Peruvarepallam, Thoonakadavu, Chulliyar, Pothundi, Moolathara, Meenkara, Walayar, Malampuzha, Gayathri, Kanjirapuzha and Mankulam.

Gayathri Irrigation project is considered to be one of the medium projects in Palakkad district, Kerala. This irrigation project consists of two reservoirs namely Meenkara and Chulliyar. Meenkara and Chulliyar rivers are the tributaries of Bharathapuzha. Agriculture is one of the main sources of income of the inhabitants of this area. Paddy is grown intensively in the ayacut of this project under rain fed condition. The Grama Panchayaths coming under Gayathri project are Muthalamada, Kollengode, Elevanchery, Vadavanoor, Pallassana, Puthunagaram, Pattancheri, Koduvayur, Peruvembu.

Meenkara Dam: Meenkara Dam is situated in Kerala state but very close to the Tamilnadu. The distance from Palakkad to Meenkara dam is about 40 Km

and the distance from Pollachi of Tamilnadu is about 20 Kms. The Meenkara Dam Project was taken up in the year 1956 and partially commissioned in 1960 and completed in 1964. The Meenkara dam is an earth dam of length 946m with 30m spillway portion of masonry maximum height of 18.90m. The spillway shutters are vertical lift type of two numbers. The Meenkara Dam or reservoir has water spread area of 249.50ha and capacity of 11.30Mm<sup>3</sup>. The Gayathri Project consists of Meenkara dam ( phase I) from where Left Bank Canal (LBC) starts and the spillway river act as a part of Right Bank Canal (RBC) for a length of 15km. The excess water from Meenkara flow to the Chulliyar dam through the feeder canal. During the course the water from Chulliyar reservoir boosts the Left Bank Canal at Ch.6/700 and leads to a further distance of 14 Kms. The crop pattern existing in the whole ayacut area of Meenkara Reservoir is mainly having an average of 120 days crop period. The water from the dam is mainly used for irrigation purpose.



**Chulliyar Dam:** The Gayathri Project stage II is otherwise known as the Chulliyar dam project. Chulliyar dam is located in Muthalamada panchayath in Palakkad district of Kerala. The Chulliyar dam was taken up in 1961, and Partially commissioned in 1966 and completed in the year 1970. Chulliyar dam is earthen dam of 1200m on one side and masonry dam of 555m on another side. The capacity of Chulliyar dam is 13.70Mm<sup>3</sup> at FRL of 154.08m. Chulliyar Reservoir has a water spread area of 165ha. The sluice for regulating the flow of water to canal is having a size of 1.52×1.83m at a sill level of +136.55m. The dam consists of an earthen dam of 1200m in length with a maximum height of 18.29m and a masonry dam of 555m with a maximum height of 21.60m. The spillway shutters are vertical lift type of three

numbers. The main sources of irrigation are from Meenkara dam and Chulliyar dam. In addition to that the flood water from Moolathara regulator is diverted to Meenkara dam and then to Chulliyar dam through feeder canal. The water in the dam is mainly utilized for irrigation.

There are number of irrigation projects major and minor, existing in the district. The major projects are Malampuzha, Chittoorpuzha, Kuriar Kutty, Karapara, Kanjirapuzha and Attappady Valley Irrigation Project. The major irrigation schemes are irrigating about 90,000 hectares of land and minor schemes irrigating about 2000 hectares of land. The main crops grown under the irrigation scheme are paddy, coconut, aracanut, plantain, grams, vegetables etc.

### **3.10 Fitment of the scheme in overall development of the river basin**

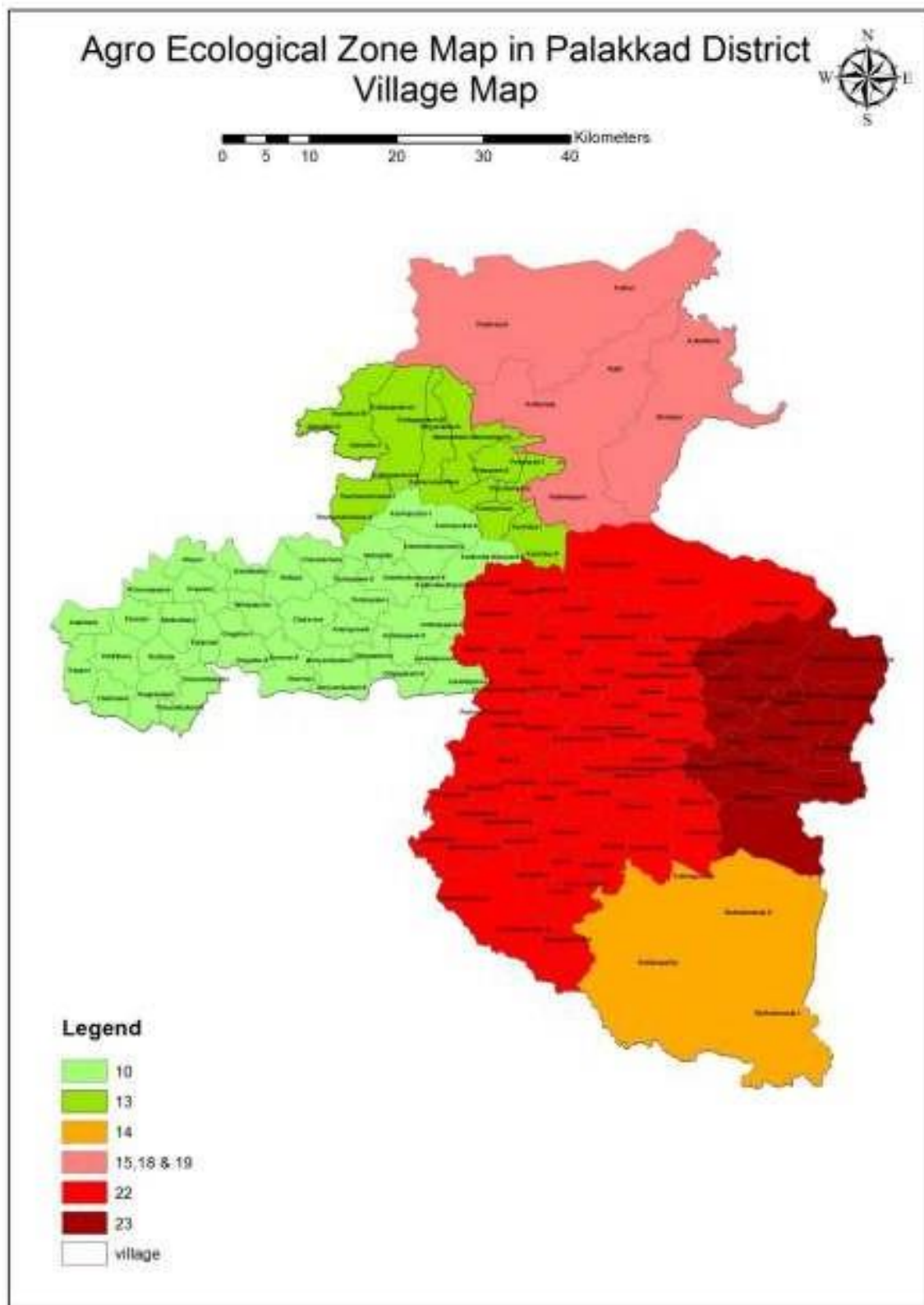
The plight of the population in the proposed project area is much below the subsistence level, that urgent efforts for the amelioration of their existing condition, comprehensive and broad phased planning are needed to develop the area, situated, as it is, at the highest level, in the Palakkad gap. The irrigation needs of the 13453 Ha. area cannot be met from any other source existing or under proposal, other than this project envisaged herein. This project will no doubt be useful in the much-needed development of the area.



There is a sugar factory and a spinning mill in addition to a number of small industries requiring use of water. If this project is implemented, these industries can also be provided with sufficient water. Since the canal is proposed to carry water throughout the year; groundwater level is expected to rise which will benefit the people of the locality. Apart from the direct improvement in the region provided by way of good roads, water supply arrangements, shops, electricity etc. the people of the locality will get many other indirect benefits also, thereby improving the economic status of the people. Once the project is completed there will be a permanent rise of agricultural employment. There is no doubt that the scheme will pave the path to a prosperous era in the under developed eastern belt of Palakkad district.







### 3.11 Socio Economic Aspects

The average size of an operational holding in Kerala is 0.27 ha, as against the national average of 1.68 ha. Nearly 50 percent of the holdings belong to the

marginal farmers (land holding below 1.00 ha), who have an average operational holding of only 0.18 ha. Unlike other States, Kerala has the unique feature of presence of homesteads which consist of the home and its adjoining land owned and occupied by the members of the dwelling unit, including the immediate area surrounding the dwelling unit used for cultivation of trees and vegetables and unused space if any. The home gardens of Kerala have evolved in response to the pressure of a shrinking land resource base, coupled with a high population density, which necessitated a conscious attempt on the part of the farmers to achieve their goals by living within biophysical, ecological and economic constraints.

Palakkad (Palghat) is the land of Palmyrahs and Paddy fields. Palakkad is a major paddy growing area of the State. It is often called as the ‘\_Gateway of Kerala ‘. There is considerable change in the land use and cropping pattern in the district for the last five years. Due to low income from paddy and coconut, farmers are changing the cropping pattern to cash crops like sugarcane, vegetables and flower cultivation. Over dependence on groundwater for domestic, irrigation and industrial purposes in the district has led to the lowering of water table and water scarcity especially along the eastern parts. In most of the areas especially in eastern part of the district decline of water levels necessitates deepening of existing dug wells and putting deep bore wells thereby increasing cost of pumping and quality deterioration. Local enquiry revealed that farmers have taken loan from the banks for putting bore wells and fitting pump sets for irrigation purposes. The district receives on an average 2362mm of rainfall annually. During 1998 the district recorded a good rainfall of 2407 mm and subsequently the rainfall has been decreased considerably.

According to the 2011 census Palakkad district has a population of 2,810,892. This gives it a ranking of 138th in India (out of a total of 640). The district has a population density of 627 inhabitants per square kilo metre. Its population growth rate over the decade 2001-2011 was 7.39%. Palakkad has a sex ratio of 1067 females for every 1000 males, and a literacy rate of 89.32%. Palakkad city has a literacy rate of 94.20%.

<b>Taluk</b>	<b>Population (2011 est.)</b>
Alathur	4,53,425
Chittur	4,46,778
Mannarkkad	4,18,535
Ottappalam	4,43,167
Palakkad	6,21,622
Pattambi	4,23,400
<b>Total</b>	<b>28,09,934</b>



Palakkad District has four types of administrative hierarchies:

Taluk and Village administration managed by the provincial Government of Kerala, Panchayath Administration managed by the local bodies, Parliament Constituencies for the federal government of India, Assembly Constituencies for the provincial government of Kerala. The Palakkad district is a political subdivision within the Indian state of Kerala.





The initial provisional data released by census India 2011, shows that density of Palakkad district for 2011 is 627 people per km<sup>2</sup>. In 2001, Palakkad district density was at 584 people per km<sup>2</sup>. Palakkad district administers 4,482 square kilometers of areas.

Average literacy rate of Palakkad in 2011 were 89.31 compared to 84.35 of 2001. If things are looked out at gender wise, male and female literacy were 93.10 and 85.79 respectively. For 2001 census, same figures stood at 89.52 and 79.56 in Palakkad District. Total literate in Palakkad District were 2,239,492 of which male and female were 1,122,600 and 1,116,892 respectively. In 2001, Palakkad District had 1,938,818 in its district.

With regards to Sex Ratio in Palakkad, it stood at 1067 per 1000 male compared to 2001 census figure of 1066. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio is 967 girls per 1000 boys compared to figure of 963 girls per 1000 boys of 2001 census data.

In census enumeration, data regarding child under 0-6 age were also collected for all districts including Palakkad. There were total 302,297 children under age of 0-6 against 318,884 of 2001 census. Of total 302,297 male and female were 153,696 and 148,601 respectively. Child Sex Ratio as per census 2011 was 967 compared to 963 of census 2001. In 2011, Children under 0-6 formed 10.76 percent of Palakkad District compared to 12.18 percent of 2001. There was net change of -1.42 percent in this compared to previous census of India.

Out of the total Palakkad population for 2011 census, 24.09 percent lives in urban regions of district. In total 676,810 people lives in urban areas of which males are 328,012 and females are 348,798. Sex Ratio in urban region of Palakkad district is 1063 as per 2011 census data. Similarly, child sex ratio in Palakkad district was 959 in 2011 census. Child population (0-6) in urban region was 70,405 of which males and females were 35,933 and 34,472. This child population figure of Palakkad district is 10.95% of total urban population. Average literacy rate in Palakkad district as per census 2011 is 92.45% of which males and females are 95.43% and 89.67% literates respectively. In actual number 560,597 people are literate in urban region of which males and females are 278,745 and 281,852 respectively.

As per 2011 census, 75.91% population of Palakkad districts lives in rural areas of villages. The total Palakkad district population living in rural areas is 2,133,124 of which males and females are 1,031,466 and 1,101,658 respectively. In rural areas of Palakkad district, sex ratio is 1068 females per 1000 males. If child sex ratio data of Palakkad district is considered, figure is 969 girls per 1000 boys. Child population in the age 0-6 is 231,892 in rural areas of which males were 117,763 and

females were 114,129. The child population comprises 11.42% of total rural population of Palakkad district. Literacy rate in rural areas of Palakkad district is 88.31% as per census data 2011. Gender wise, male and female literacy stood at 92.36 and 84.56 percent respectively. In total, 1,678,895 people were literate of which males and females were 843,855 and 835,040 respectively.

Rice is the staple food of the people of Kerala. So, most of the wet cultivable area are paddy fields. The main rice granaries of the State are Kuttanad of Alappuzha, Kole lands of Thrissur and paddy fields of Palakkad. In the area listed above the first two (viz. Kuttanad and Kole lands of Thrissur) are more or less very near or below the sea level, and the intensity of rain is not obstructed by any geographical features of the State. But the third rice granary (viz. Palakkad paddy fields) are at an elevation between +120 M to +220 M above MSL and the intensity of rain is much less, compared to the other areas of the State, due to the geographical features, is situated in the Bharathapuzha Basin.

The only rain received in this area is the south west monsoon. This monsoon starts by June and ends by September. The rest of the period is under the control of severe summer. Cultivation through irrigation is the only successful method which can be followed as far as this area is concerned. So, most of the major and medium lift irrigation schemes, both completed and ongoing are located in this area. There are six major completed irrigation projects in the district namely

- Malampuzha Project
- Mangalam Project
- Pothundy Project
- Gayathri Project
- Walayar Project
- Chitturpuzha Project

These six projects cover an ayacut of 38650 Ha. The eastern part of the district namely Kozhinjampara firka, is not yet fully brought under irrigation. This area lying in the border of Kerala is suffering from acute shortage for even drinking water.



### 3.12 Irrigation Scenario

Irrigation is the method in which water is supplied to plants at regular intervals for agriculture. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growth in grain fields and preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rainfed or dry land farming (Madhusudhana Rao,1993).

Kerala has a wide network of river, rivulets and springs spread over the entire cropped area. Out of the net cropped area of the state only 18% is irrigated. The net area irrigated had decline from 3.99 lakhs hector during 2005-06 to 3.85 lakhs hector in the year 2006-07. The major source of irrigation is well (30%) Government canals (26%) tanks (11%) and private canals (1.25%) respectively. Coconut is the major irrigated crop of the state which accounts for about 36%, followed by paddy (35%), banana(8.34%) arecanut (7%) and vegetables (5%) respectively (Economic review 2007,kerala state planning board).

In Palakkad district about 45% of the total geographical area is cultivated and nearly 86% of the net sown area is irrigated. Paddy, coconut, vegetables, fruits, rubber and spices and condiments are the major crops cultivated in the district. The selection of the crops and crop associations show that variety of crops are sown and are mostly adjusted with soils and irrigation facilities.

The project area which is situated in the rain shadow region of Palakkad gap, viz. Kozhippathy and Eruthiampathy Villages of Chittur Taluk in Palakkad District receives rainfall irregularly so that farmers depend upon different sources for irrigation purposes like Canal, Tank, Tube well, Ponds, Wells etc. Several ponds and canals are found here but all are non-perennial sources. Total ayacut area



under agriculture is 3742 hectares. Paddy is cultivated in 846 hectares, vegetables in 536 hectares, coconut in 1800 hectares, aracanut in 10 hectares, sugarcane in 30 hectares and plantain accounts for 520 hectares.

About 37 hectares of land is devoted for the cultivation of tuber crops. Drip irrigation is used for the cultivation of coconut and vegetables. Sugarcane cultivation needs huge amount of water but the lack of water has led to the decline of sugarcane cultivation. There are 980 wells 53 ponds and 2000 tube wells in the panchayath. Majority of the farmers depends upon well and tube well irrigation. Other irrigation sources such as canals, rivers are occasionally used for irrigation by the people compared to wells and tube wells. (Field Survey)

Irrigation plays a major role in increasing food production. Irrigated land presently accounts for 15 percent of the cultivated land but produces 36 percent of the world's food (FAO 1988). The world 's irrigated land was 8 million hectares in 1800, 48 million hectares in 1900, 94 million hectares in 1950, 198 million hectares in 1970, and about 220 million hectares in 1990 (Jensen et al. 1990). About three-quarters of the irrigated land is presently in the developing countries. In these countries, almost 60 percent of the production of major cereals, primarily rice and wheat, is derived from irrigation. Since higher yields are obtained with irrigated agriculture and because it is less dependent on the vagaries of weather, it assumes special importance in this regard. Expansion of irrigated agriculture could contribute significantly towards achieving and stabilizing food and fiber needs. However, new water supplies for such expansion are limited. Irrigated agriculture is already the largest consumer of developed water resources. At the same time, drainage return from irrigated lands is one of the major causes of waterlogging and of water pollution due to salts, nitrates, agricultural chemicals and certain natural, potentially toxic trace elements.

While only about 15% of the World's cultivated land is irrigated, it accounts for 34-40% of the global harvest. One of the primary objectives of agriculture is to provide the food and fiber needs of human beings. These needs increase as the population increases. The world population was 2.5 thousand million in 1950; 4.9 thousand million in 1985, and 5.3 thousand million in 1990. It is expected to be 8.5 thousand million in 2025 (UN 1991). The population of the developing countries, which is presently over three-quarters of the world's total, accounts for about 90 percent of the expected increase in global population. These growth rates will require an increase in agricultural production of about 40 to 50 percent over the next thirty to forty years, in order to maintain the present level of food intake; a 20 and 60 percent increase for developed and developing countries, respectively.

Growth in crop production can come from increases in arable land, cropping intensity and yield per unit area of cropped land. Irrigation is obviously significant in arid regions where the potential water losses by evaporation and transpiration are greater than the amount of water supplied by precipitation. But supplemental irrigation to meet special or occasional needs is used in sub-humid and



even humid areas. Irrigation is practiced in many countries, but Asia has more than 60% of the total irrigated land in the World. China is in the first place with about 47.5 million ha of irrigated land, followed by India with 45.8 million ha. Table (1). Irrigation land increased by about 43% in the 20 years from 1970 to 1990, but the increase was spotty. Some countries such as USA showed only small increases, and some such as Japan and Egypt has decreases, whereas India, China, the former Soviet Union, and several smaller countries had large increases during this period.

	1970	1975	1980	1985	1990	1991
1. China, People's Republic of	37,630	42,210	44,888	44,036	47,403	47,300
2. India	30,440	35,730	38,478	41,779	45,500	45,800
3. Soviet Union, former	11,100	14,500	17,500	19,689	21,210	21,000
4. United States	16,000	16,690	20,582	19,831	18,771	18,771
5. Pakistan	12,990	13,630	14,680	15,760	16,960	17,000
6. Indonesia	4,370	4,825	5,438	7,059	8,177	8,215
7. Iran	5,200	5,900	4,948	5,740	5,750	5,750
8. Mexico	3,583	4,479	4,980	5,285	5,180	5,200
9. Thailand	1,960	2,419	3,015	3,822	4,300	4,400
10. Spain	2,379	2,818	3,029	3,217	3,401	3,388
11. Romania	731	1,474	2,301	2,956	3,216	3,197
12. Italy	2,561	2,720	2,870	3,000	3,120	3,140
13. Bangladesh	1,098	1,441	1,589	2,073	2,936	3,027
14. Japan	3,415	3,171	3,055	2,952	2,846	2,825
15. Brazil	796	1,100	1,600	2,100	2,700	2,800
16. Afghanistan	2,340	2,430	2,505	2,586	2,760	2,760
17. Egypt	2,843	2,825	2,445	2,497	2,648	2,643
18. Iraq	1,480	1,567	1,750	1,750	2,550	2,550
19. Turkey	1,800	1,980	2,090	2,220	2,370	2,400
20. Sudan	1,625	1,700	1,770	1,848	1,900	1,910
21. Vietnam	980	1,000	1,542	1,770	1,840	1,850
22. Australia	1,476	1,469	1,500	1,700	1,832	1,831
23. Argentina	1,280	1,440	1,580	1,620	1,680	1,690
24. Philippines	830	1,040	1,219	1,440	1,560	1,580
25. Korea, People's Dem. Republic of	500	900	1,120	1,270	1,420	1,440
26. Korea, Republic of	1,184	1,277	1,307	1,325	1,345	1,335
27. Morocco	920	1,060	1,217	1,245	1,270	1,275
28. Peru	1,106	1,130	1,160	1,210	1,280	1,270
29. Chile	1,180	1,242	1,255	1,257	1,265	1,265
30. Bulgaria	1,001	1,128	1,197	1,229	1,263	1,237
31. Greece	730	875	961	1,099	1,195	1,200
32. France	539	680	870	1,050	1,170	1,180
33. South Africa	1,000	1,017	1,128	1,128	1,128	1,130
34. Nepal	117	230	520	760	1,000	1,050
35. Burma (Myanmar)	839	976	999	1,085	1,005	1,003
Total irrigated area	168,321	189,004	210,846	225,015	240,790	241,065

Source: Economic Research Service, 1993.

Table.1

### Direct and Indirect Irrigation Methods

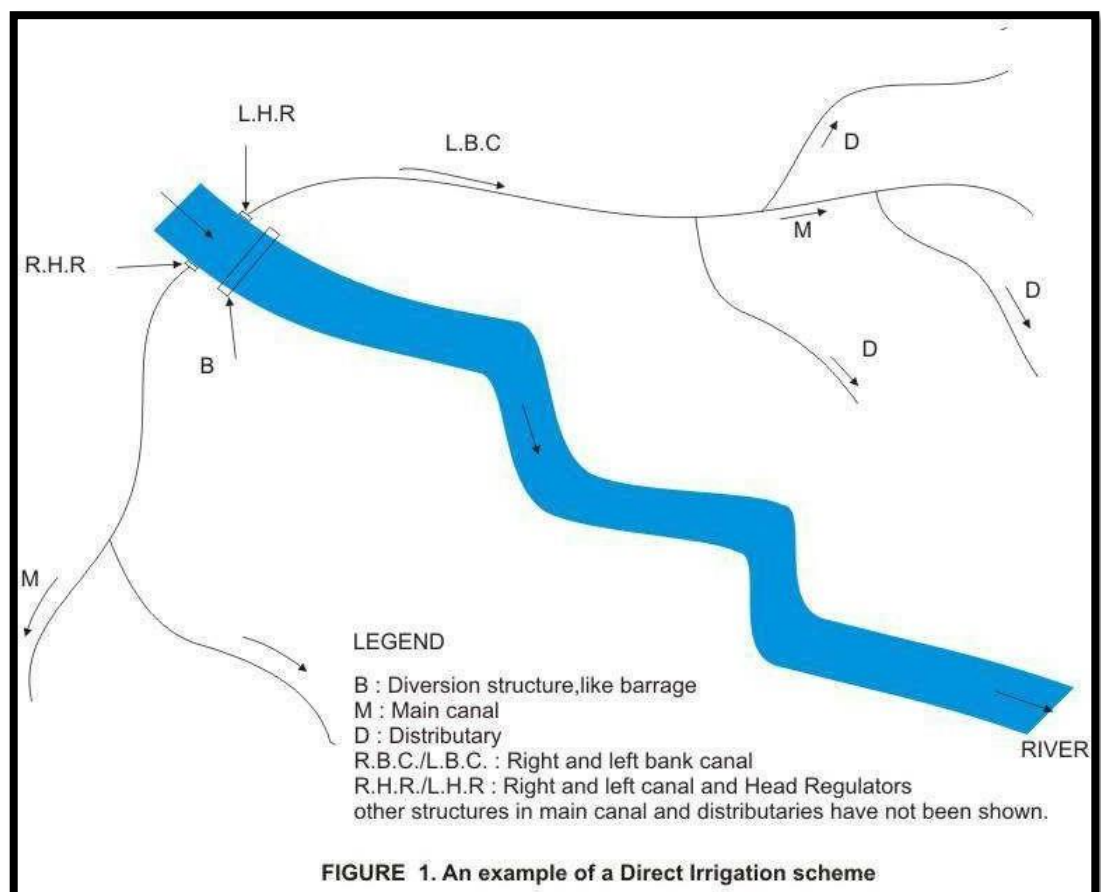
The major and medium surface water schemes are usually classified as either direct or indirect irrigation methods and these are defined as follows:

#### Direct Irrigation method

In this method, water is directly diverted from the river into the canal by constructing a diversion structure like weir or barrage across the river with some pondage to take care of diurnal variations. It also effects in raising the river water level which is then able to flow into the off taking channel by gravity. The flow in the channel is usually controlled by a gated structure and this in combination with the diversion structure is also sometimes called the headwork's.

If the water from such headwork's is available throughout the period of growth of crops irrigated by it, it is called a perennial irrigation scheme. In this type of projects, the water in the off-taking channels from the river carries water throughout the year. It may not be necessary, however, to provide irrigation water to the fields during monsoon. In some places local rainfall would be sufficient to meet the plant water needs. In case of a non-perennial river the off-taking channel would be carrying water only for certain period in a year depending upon the availability of supply from the source.

Another form of direct irrigation is the inundation irrigation which may be called river-canal irrigation. In this type of irrigation there is no irrigation work across the river to control the level of water in the river. Inundation canal off-taking from a river is a seasonal canal which conveys water as and when available in the river. This type of direct irrigation is usually practiced in deltaic tract that is, in areas having even and plane topography. It is feasible when the normal flow of river or stream throughout the period of growth of crop irrigated, is never less than the requirements of the irrigated crops at any time of the base period. A direct irrigation scheme of irrigation using river water diversion head works typically be laid out as in Figure 1.

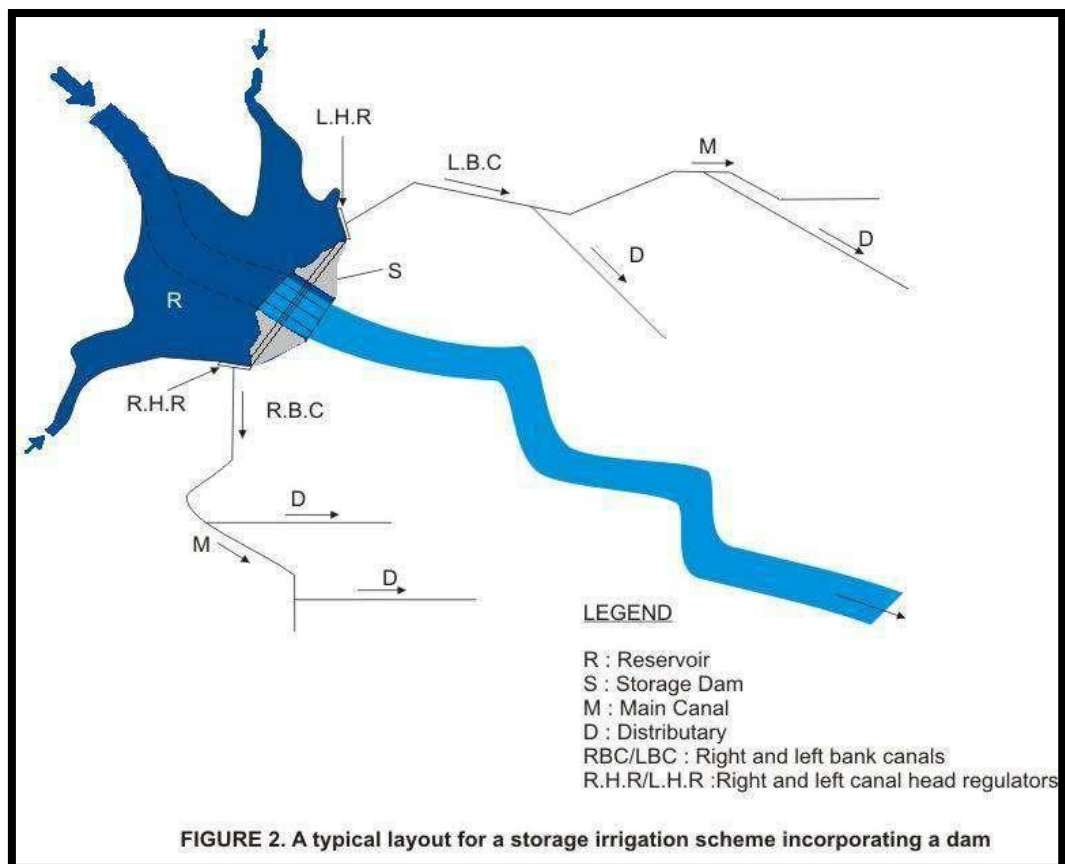


Though the diversion structure raises the river water level and is just sufficient to force some water into the channel, the stored water in the pond created

behind doesn't have sufficient storage volume it may however be able to take care of any diurnal variation in the river water. An example of this scheme is the DVC irrigation project on the Damodar river with the barrage located at Durgapur.

### Storage Irrigation Method

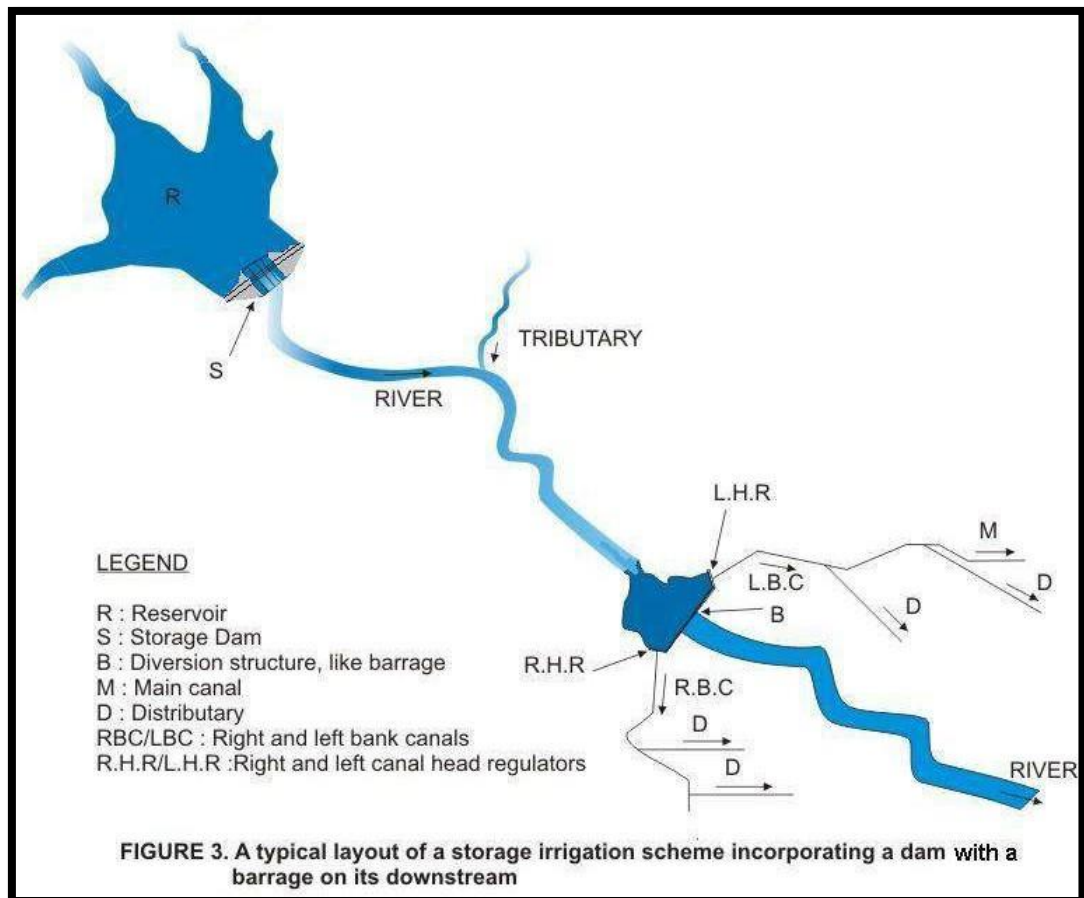
For this type of irrigation schemes part of the excess water of a river during monsoon which otherwise would have passed down the river as a flood is stored in a reservoir or tank found at the upstream of a dam constructed across a river or stream. This stored water is then used for irrigation is adopted when the flow of river or stream is in excess of the requirements of irrigated crops during a certain part of the year but falls below requirements or is not available at all in the river during remaining part of the year. Since the construction site of a storage reservoir is possible in regions of undulating topography, it is usually practiced in non-deltaic areas. A general layout of this irrigation scheme may typically be laid out as shown in Figure 2.



In third type of scheme the storage head works or the dams has to be equipped with ancillary structure like outlet, sluice, spillway, log chutes, etc. The storage created by the dam behind the reservoir is substantial compared to that behind a barrage and may inundate a large tract of land, depending on the topography. The capacity of the reservoir is generally determined systematically by knowing possible withdrawal demands (in this case for irrigation) over the weeks and months of a year and corresponding expected inflows.

An example for this type of scheme is the Indira Sagar project on the Narmada River.

Another type of storage irrigation method envisages the storage of water at some place in the hilly terrain of the river where the construction of the dam is possible. A barrage is constructed at some downstream location, where the terrain is flatter and canals take off as in a usual direct irrigation method. A general layout of such scheme could be represented as in Figure 3.



### Methods of Field Water Application

Irrigation water conveyed to the head or upstream point of a field must be applied efficiently on the whole area such that the crops growing in the either fields gets water more or less uniformly.

Naturally it may be observed that a lot depends on the topography of the land since a large area with uneven topography would result in the water spreading to the low lying areas. The type of crop grown also immensely matter as some like rice, require standing water depths at almost all stages of its growth. Some, like potato, on the other hand, suffer under excess water conditions and require only the right amount of water to be applied at the right time. Another important factor determining the way water is to apply in the fields is the quantity of water available at any point of time. If water is scarce, as what is actually happening in many parts of the country, then it is to be applied through carefully controlled methods with minimum amount of wastage.

Usually these methods employ pressurized flow through pipes which is either sprinkled over the crop or applied carefully near the plant root. On the other hand, when water is rather unlimited during the crop growing season as in deltaic regions, the river flood water is allowed to inundate as much area as possible as long the excess water is available. Another important parameter dictating the choice of the irrigation method is the type of soil. Sometimes water is applied not on the surface of the field but is used to moist the root zone of the plants from beneath the soil surface. Thus, in effective the type of irrigation methods can be broadly divided as under:

- Surface irrigation method
- Subsurface irrigation method
- Sprinkler irrigation system
- Drip irrigation system

### **Surface Irrigation Methods**

In this system of field water application, the water is applied directly to the soil from a channel located at the upper reach of the field. It is essential in these methods to construct designed water distribution systems to provide adequate control of water to the fields and proper land preparation to permit uniform distribution of water over the field.

One of the surface irrigation method is flooding method where the water is allowed to cover the surface of land in a continuous sheet of water with the depth of applied water just sufficient to allow the field to absorb the right amount of water needed to raise the soil moisture up to field capacity,. A properly designed size of irrigation stream aims at proper balance against the intake rate of soil, the total depth of water to be stored in the root zone and the area to be covered giving a reasonably uniform saturation of soil over the entire field.

Flooding method has been used in India for generations without any control what so ever and is called uncontrolled flooding. The water is made to enter the fields bordering rivers during folds. When the flood water inundates the flood plain areas, the water distribution is quite uneven, hence not very efficient, as a lot of water is likely to be wasted as well as soils of excessive slopes are prone to erosion. However the adaptation of this method doesn't cost much.

The flooding method applied in a controlled way is used in two types of irrigation methods as under:

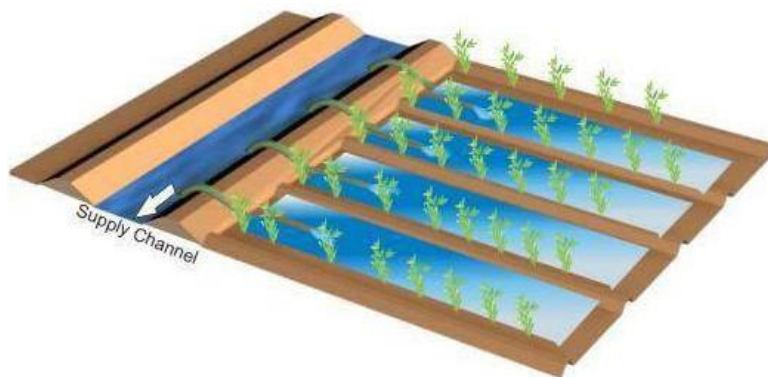
- Border irrigation method
- Basin irrigation method

As the names suggest the water applied to the fields by this inundates or floods the land, even if temporarily. On the other hand there are many crops which

would try better if water is applied only near their root zone instead of inundating. Such an irrigation method is called the Furrow irrigation method.

### **Border irrigation**

Borders are usually long uniformly graded strips of land separated by earth bunds (low ridges) as shown in Figure 4.



**FIGURE 4.** Border irrigation with water being applied to the borders with the help of flexible pipes, acting as siphons

The essential feature of the border irrigation is to provide an even surface over which the water can flow down the slope with a nearly uniform depth. Each strip is irrigated independently by turning in a stream of water at the upper end as shown in Figure 5.



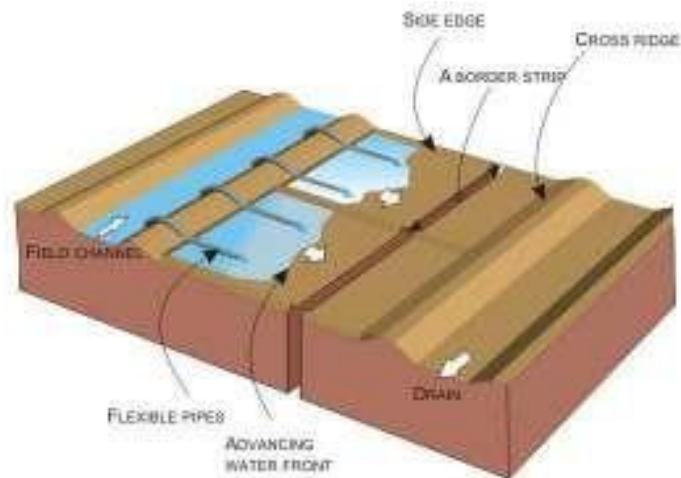


FIGURE 5. Water entering each border strip independently

The water spreads and flow down the strip in a sheet confined by border ridges. When the advancing water reaches the lower end of the border, the stream is turned off.

For uniform advancement of water front the borders must be properly leveled. The border shown in the figures above are called **straight borders**, in which the border strips are laid along the direction of general slope of the field. The borders are sometimes laid along the elevation contours of the topography when the land slope is excessive. Those method of border is called **contour border method** of irrigation (Figure 6).

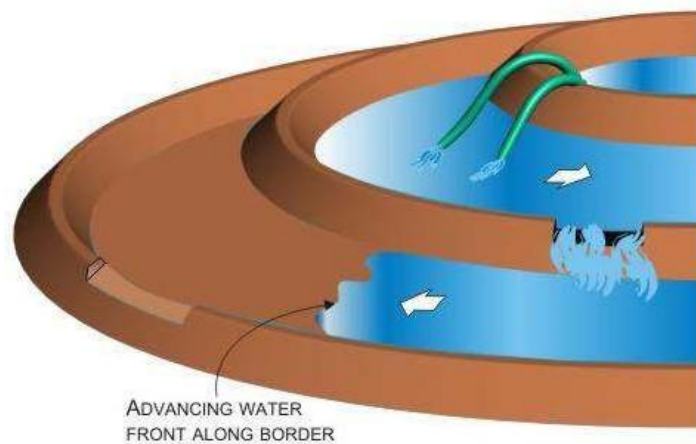


FIGURE 6. Contour border method of irrigation

The straight border irrigation is generally suited to the larger mechanized farms as it is designed to produce long uninterrupted field lengths for ease

of machine operations. Borders can be 800m or more in length and 3 – 30 m wide depending on variety of factors. It is less suited to small scale farms involving hand labour or animal powered cultivation methods.

Generally, border slopes should be uniform, with a minimum slope of 0.05% to provide adequate drainage and a maximum slope of 2% to limit problems of soil erosion.

As for the type of soil suitable for border irrigation, deep homogeneous loam or clay soils with medium infiltration rates are preferred. Heavy, clay soils can be difficult to irrigate with border irrigation because of the time needed to infiltrate sufficient water into the soil. Basin irrigation is preferable in such circumstances.

### Basin Irrigation

Basins are flat areas of land surrounded by low bunds. The bunds prevent the water from flowing to the adjacent fields. The basins are filled to desired depth and the water is retained until it infiltrates into the soil. Water may be maintained for considerable periods of time.

Basin method of irrigation can be formally divided into two, viz; the check basin method and the ring basin method. The check basin method is the most common method of irrigation used in India. In this method, the land to be irrigated is divided into small plots or basins surrounded by checks, levees (low bunds); as shown in Figure 7.

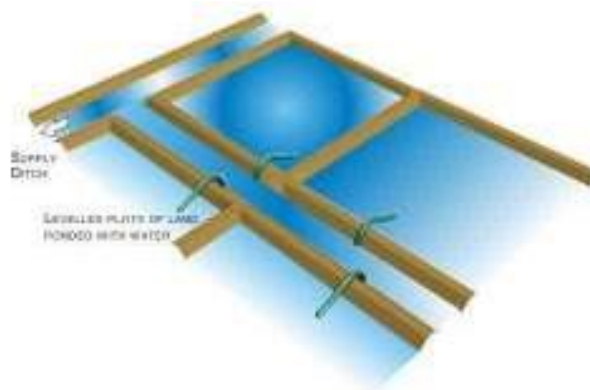


FIGURE 7. Check basin method of irrigation

Each plot or basin has a nearly level surface. The irrigation water is applied by filling the plots with water up to the desired depth without overtopping the levees and the water retained there is allowed to infiltrate into the soil. The levees may be constructed for temporary use or may be semi-permanent for repeated use as for paddy cultivation. The size of the levees depends on the depths of water to be impounded as on the stability of the soil when wet.

Water is conveyed to the cluster of check basins by a system of supply channels and lateral field channels or ditches. The supply channel is aligned on the upper side (at a higher elevation) of the field for every two rows of plot as shown in the figure.

The size of basins depends not only on the slope but also on the soil type and the available water flow to the basins. Generally, it is found that the following holds good for basin sizes.

Basin size should be small if the

1. Slope of the land is steep.
2. Soil is sandy.
3. Stream size to basin is small.
4. Required depth of irrigation application is small.
5. Field preparation is done by hand or animal traction

Basin size can be large if the

1. Slope of the land is flat
2. Soil is clay.
3. Stream size to the basin is large
4. Required depth of the irrigation is large.
5. Field preparation is mechanized.

Basin irrigation is suitable for many field crops. Paddy rice grows best when its roots are submerged in water and so basin irrigation is the best method for use with the crop.

The other form of basin irrigation is the ring basin method which is used for growing trees in orchards. In this method, generally for each tree, a separate basin is made which is usually circular in shape, as shown in Figure 8.

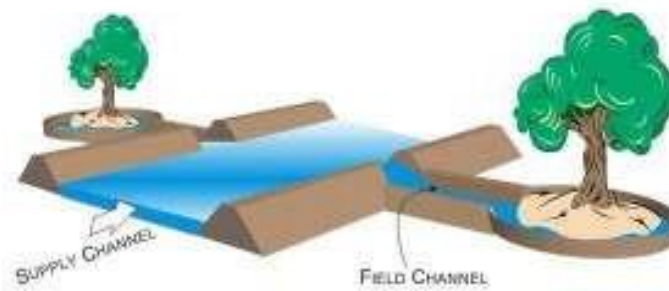


FIGURE 8. Ring basin method of irrigation

Sometimes, basin sizes are made larger to include two more trees in one basin. Water to the basins is supplied from a supply channel through small field channels conveyed the basins with the supply channel. Trees which can be irrigated successfully using the ring basin method include citrus and banana. Basins can also be constructed on hillside. Here, the ridges of the basins are constructed as in contour border method thus making the only difference between the two is in the application of water. In the border method, the water is applied once during an irrigation cycle and is allowed to flow along the field and as the water infiltrates, till the supply is cutoff. In the basin method, as in a rice field the water is higher at a desired level on the basin. Basin irrigation is suitable for many field crops. Paddy rice grows best when its roots are submerged in water and so basin irrigation is the best method for use with this crop.

### **Furrow Irrigation**

Furrows are small channels, which carry water down the land slope between the crop rows. Water infiltrates into the soil as it moves along the slope. The crop is usually grown on ridges between the furrows, as shown in Figure 9. This method is suitable for all row crops and for crops that cannot stand water for long periods, like 12 to 24 hours, as is generally encountered in the border or basin methods of irrigation.

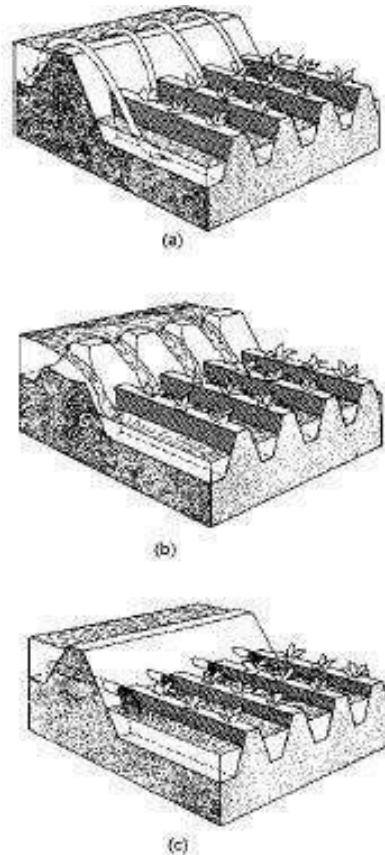


FIGURE 9: Furrow irrigation method of applying water to a field  
(a) Using flexible pipes to siphon out water from field channel  
(b) Using the breach method to apply water to the furrows  
(c) Pipe outlets to deliver water to the furrows  
(Image courtesy: Food and Agriculture Organisation, FAO)

Water is applied to the furrows by letting in water from the supply channel, either by pipe siphons or by making temporary breaches in the supply channel embankment. The length of time the water is to flow in the furrows depends on the amount of water required to replenish the root zone and the infiltration rate of the soil and the rate of lateral spread of water in the soil.

Furrow irrigation is suitable to most soils except sandy soils that have very high infiltration water and provide poor lateral distribution water between furrows. As compared to the other methods of surface irrigation, the furrow method is advantageous as:

- Water in the furrows contacts only one half to one-fifth of the land surface, thus reducing puddling and clustering of soils and excessive evaporation of water.
- Earlier cultivation is possible

Furrows may be straight laid along the land slope, if the slope of the land is small (about 5 percent) for lands with larger slopes, the furrows can be laid along the contours.

Disadvantages of surface irrigation methods

- Loss of water through deep percolation
- Loss of nutrients through leaching beyond root zone
- Ground water pollution through leaching of agrochemicals beyond root zone and surface water pollution through runoff water.
- Salinization / alkalization of soil.
- Plant suffers from water stress due to both water scarcity and water logging.
- Plant nutrient uptake may not be optimum due to unfavourable soil water regime in the root zone.
- Plant is more susceptible to soil borne diseases.
- More Insect pest attack.
- Labour intensive.

### **Subsurface irrigation methods**

As suggested by the name, the application of water to fields in this type of irrigation system is below the ground surface so that it is supplied directly to the root zone of the plants. The main advantages of these types of irrigation is reduction of evaporation losses and less hindrance to cultivation works which takes place on the surface.

There may be two ways by which irrigation water may be applied below ground and these are termed as:

- Natural sub-surface irrigation method
- Artificial sub-surface irrigation method

#### Natural Sub-surface irrigation method

Under favorable conditions of topography and soil conditions, the water table may be close enough to the root zone of the field of crops which gets its moisture due to the upward capillary movement of water from the water table. The natural presence of the water table may not be able to supply the requisite water throughout the crop growing season. However, it may be done artificially by constructing deep channels in the field which may be filled with water at all times to ensure the presence of water table at a desired elevation below the root zone depth. Though this method of irrigation is excellent from both water distribution and labour saving points of view, it is favorable mostly for the following

- The soil in the root zone should be quite permeable
- There should be an impermeable substratum below the water table to prevent deep percolation of water.



- There must be abundant supply of quality water that is one which is salt free, otherwise there are chances of upward movement of these salts along with the moisture likely to lead the conditions of salt incrustation on the surface.

### **Artificial subsurface irrigation method**

The concept of maintaining a suitable water table just below the root zone is obtained by providing perforated pipes laid in a network pattern below the soil surface at a desired depth. This method of irrigation will function only if the soil in the root zone has high horizontal permeability to permit free lateral movement of water and low vertical permeability to prevent deep percolation of water. For uniform distribution of water percolating into the soil, the pipes are required to be very closely spaced, say at about 0.5m. Further, in order to avoid interference with cultivation the pipes have to be buried not less than about 0.4m below the ground surface. This method of irrigation is not very popular because of the high expenses involved, unsuitable distribution of subsurface moisture in many cases, and possibility of clogging of the perforation of the pipes.

### **Sprinkler Irrigation System**

Sprinkler irrigation is a method of applying water which is similar to natural rainfall but spread uniformly over the land surface just when needed and at a rate less than the infiltration rate of the soil so as to avoid surface runoff from irrigation. This is achieved by distributing water through a system of pipes usually by pumping which is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The system of irrigation is suitable for undulating lands, with poor water availability, sandy or shallow soils, or where uniform application of water is desired. No land leveling is required as with the surface irrigation methods. Sprinklers are, however, not suitable for soils which easily form a crust. The water that is pumped through the pump pipe sprinkler system must be free of suspended sediments. As otherwise there would be chances of blockage of the sprinkler nozzles.

A typical sprinkler irrigation system consists of the following components:

- **Pump unit**
- **Mainline and sometimes sub mainlines**
- **Laterals**
- **Sprinklers**

Figure 10 shows a typical layout of a sprinkler irrigation system.



FIGURE 10. The sprinkler irrigation system

The pump unit is usually a centrifugal pump which takes water from a source and provides adequate pressure for delivery into the pipe system.

The mainline and sub mainlines are pipes which deliver water from the pump to the laterals. In some cases, these pipelines are permanent and are laid on the soil surface or buried below ground. In other cases, they are temporary, and can be moved from field to field. The main pipe materials include asbestos cement, plastic or aluminum alloy.

The laterals deliver water from the mainlines or sub mainlines to the sprinklers. They can be permanent but more often they are portable and made of aluminium alloy or plastic so that they can be moved easily.

The most common types of sprinklers that are used are:

- **Perforated pipe system:** This consists of holes perforated in the lateral irrigation pipes in specially designed pattern to distribute water fairly uniformly (Figure 11). The sprays emanating from the perforations are directed in both sides of the pipe and can cover a strip of land 6 m to 15m wide.

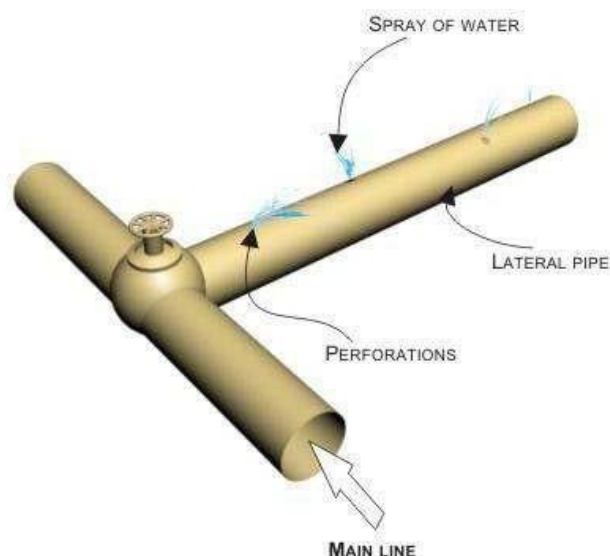


FIGURE 11. Perforated pipe type of sprinkler system

- Rotating head system: Here small sized nozzles are placed on riser pipes fixed at uniform intervals along the length of the lateral pipe (Figure 12). The lateral pipes are usually laid on the ground surface. The nozzle of the sprinkler rotates due to a small mechanical arrangement which utilizes the thrust of the issuing water.

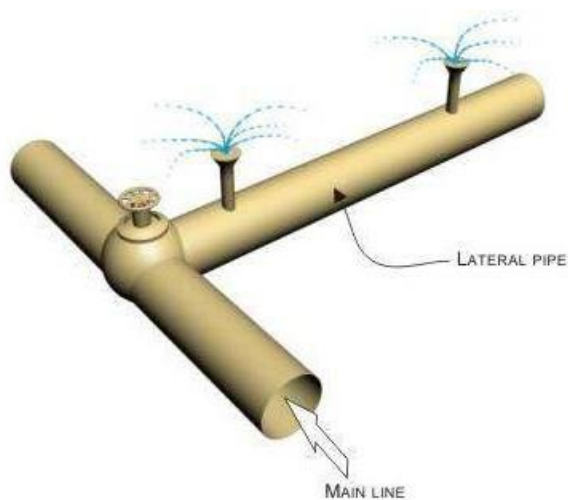


FIGURE 12. Rotating head system of sprinkler irrigation

As such, sprinkler irrigation is suited for most rows, field as tree crops and water can be sprayed over or under the crop canopy. However, large sprinklers are not recommended for irrigation of delicate crops such as lettuce because the large water drops produced by the sprinklers may damage the crop.

Sprinkler irrigation has high efficiency. It however, varies according to climatic conditions; 60% in warm climate; 70% in moderate climate and 80% in humid or cool climate.

Sprinkler irrigation was not widely used in India before the 1980. Although no statistics are available on the total area under sprinkler irrigation, more than 200000 sprinkler sets were sold between 1985 and 1996(with 65000 for 1995-96) according to the National Committee on the use of plastics in agriculture. The average growth rate of sprinkler irrigated area in India is about 25 percent. The cost of installation of sprinkler irrigation depends on a number of factors such as type of crop, the distance from water source.

### **Drip Irrigation System**

Significant water shortage is being experienced in many countries, particularly in India. Since agriculture is the largest water consumer (84%) in India, more prudent use of water in agriculture needs to be the first priority (NITI Aayog, 2015). Water use per unit irrigated area has to be reduced in response to limitations in water availability and other associated environmental and societal problems (Surendran et al., 2014). One of the scientifically proven ways to reduce the total water required for irrigation is to adopt micro irrigation (drip and sprinkler), which can improve crop yield per unit volume of water used (Jayakumar et al., 2015). In Kerala State of India, productivity of most of the crops is low, when compared to other States, mainly due to lack of irrigation and low soil fertility. Only 16% of the gross cropped area is irrigated in the State (State Planning Board, 2011). Even though Kerala receives an average annual rainfall of 3000 mm, its distribution is spatially and temporally uneven. The State experiences a long summer period (Jan – May), resulting in moisture stress for about six months. Hence, irrigation during summer is necessary for improving crop productivity in the State. However, there are limitations to adoption of conventional surface irrigation methods in Kerala such as water scarcity, undulating topography, high infiltration rate and low water holding capacity of the major soil type of the State, namely, lateritic soil (Surendran et al., 2014; Surendran et al., 2015). Under these circumstances, micro irrigation methods such as drip irrigation have relevance in Kerala.

About 80% of the world's irrigated area is under surface irrigation methods, which have a use efficiency of 30-50% only. Drip irrigation was introduced in India for commercial adoption in early seventies and its growth has gained momentum in the last few years only, primarily due to the subsidy extended by Central and State Governments. India ranks first in the area under drip irrigation with

18,97,280 ha (ICID, 2015). Large chunk of money has been provided by Government agencies in India in the form of subsidy to farmers for installing micro irrigation methods including drip irrigation.

Drip irrigation is an efficient method of providing water directly to the root zone, minimizing conventional losses such as deep percolation, runoff and soil erosion. Unlike surface irrigation, drip irrigation is more suitable and economical if it is introduced in water scarce areas with undulating topography, shallow and sandy soils and for widely spaced high value crops. It also permits the utilization of fertilizers, pesticides and other water-soluble chemicals along with irrigation water, resulting in higher profit and better yields and quality of product. Many researchers have attempted to study the impact of drip irrigation and found that it produces the desired positive impacts in terms of water and crop productivity (Narayanamoorthy, 2005; Narayanamoorthy, 2008; Thampan, 2004; Namara et al., 2005; Jat et al., 2011, Indira Devi et al., 2012; Saskia van der Kooij et al., 2013; Jayakumar et al., 2014; Jayakumar et al., 2015). Even though there are several scientifically proven positive effects for micro irrigation methods like drip irrigation, the area under micro irrigation is very low in Kerala (15885 ha), when compared to other States in India such as Maharashtra, Karnataka, Gujarat and Tamil Nadu. Hence, there exists huge potential to increase the area under micro irrigation in the State (Rane, 2011). Adoption rate of drip irrigation in the State is lower than what was predicted due to the difficulties associated with the ecological and socioeconomic constraints that exist in this humid tropical region.

Drip Irrigation system is sometimes called trickle irrigation and involves dripping water onto the soil at very low rates (2-20 litres per hour) from a system of small diameter plastic pipes filled with outlets called emitters or drippers. Water is applied close to the plants so that only part of the soil in which the roots grow is wetted, unlike surface and sprinkler irrigation, which involves wetting the whole soil profile. With drip irrigation water, applications are more frequent than with other methods and this provides a very favourable high moisture level in the soil in which plants can flourish.

A typical drip irrigation system consists of the following components:

- Pump unit
- Control Head
- Main and sub main lines
- Laterals
- Emitters and drippers

The drip irrigation system is particularly suited to areas where water quality is marginal, land is steeply sloping or undulating and of poor quality, where

water or labour are expensive, or where high value crops require frequent water applications. It is more economical for orchard crops than for other crops and vegetables since in the orchards plants as well as rows are widely spaced. Drip irrigation limits the water supplied for consumptive use of plants. By maintaining a minimum soil moisture in the root zone, thereby maximizing the water saving. A unique feature of drip irrigation is its excellent adaptability to saline water. Since the frequency of irrigation is quite high, the plant base always remains wet which keeps the salt concentration in the plant zone below the critical. Irrigation efficiency of a drip irrigation system is more than 90 percent.

Drip irrigation usage in India is expanding rapidly. There is even some Government subsidy to encourage its use. From about 1000 hectare in 1985, the area under drip irrigation increased to 70860 hectares in 1991, with the maximum developments taking place in the following states:

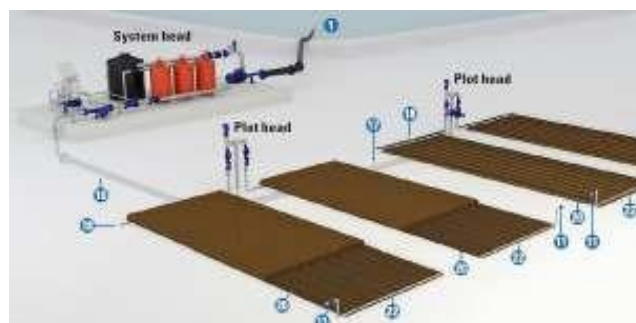
- Maharashtra (32924 hectare)
- Andhra Pradesh (11585 hectare)
- Karnataka (11412 hectare)

The drip irrigated crops are mainly used to irrigate orchards of which the following crops are important ones (according to a 1991 survey):

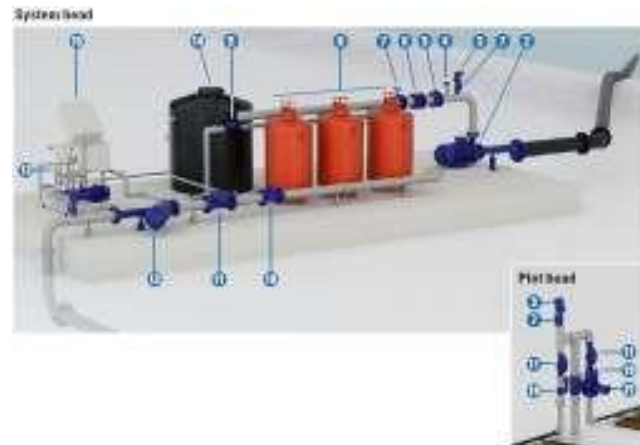
- Grapes (12000 hectare)
- Bananas (6500 hectare)
- Pomegranates (5440 hectare)
- Mangoes

Drip irrigation was also used to irrigate sugarcane (3900 hectare) and coconut (2600 hectare).

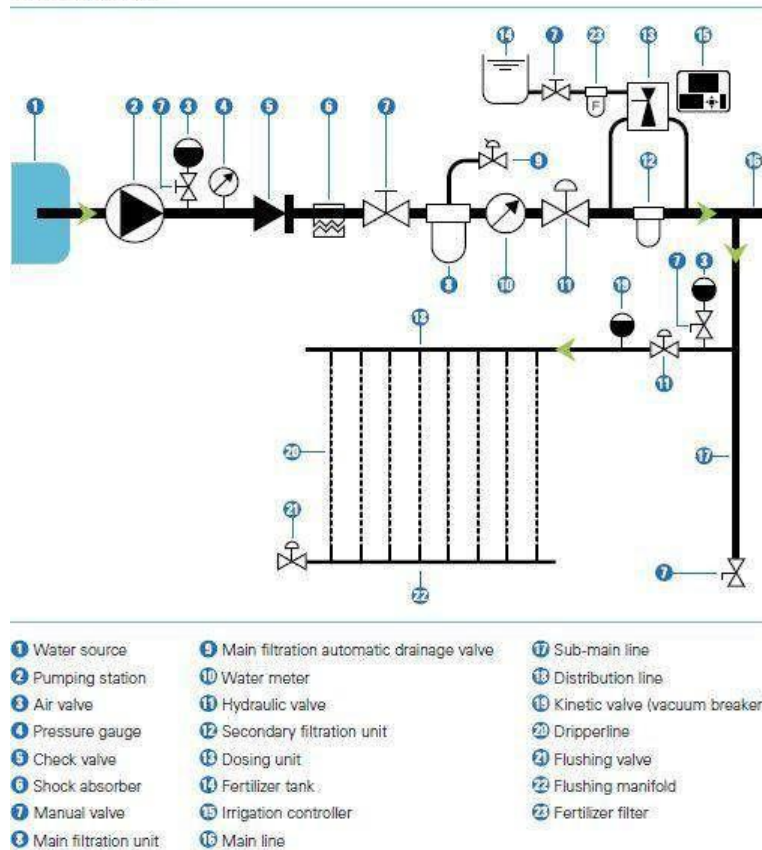
### System components







**Schematic diagram**



The components of drip irrigation system can be grouped into two major heads viz. Control head and Distribution network.

□ Control head

The control head of drip irrigation includes the following components:

- **Pump / Overhead Tank**

Pump or an overhead tank is required to provide sufficient pressure in the system. Centrifugal pumps are generally used for low pressure trickle systems. They are easily adjusted to provide constant pressure and have the added safety measure of

non-overloading head characteristic. Pumps are generally recommended for larger areas under drip irrigation, undulating topography, closely spaced crops or where water requirement is comparatively high.

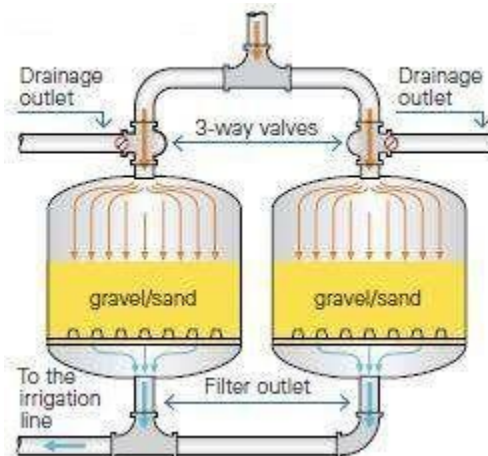
Instead of connecting directly to the pump, an overhead tank having a height of about 3 meters can also be used in certain types of drip system. Overhead tank is generally used for small areas of orchard crops with comparatively lesser water requirement.

- **Filters**

The hazard of blocking or clogging necessitates the use of filters for efficient and trouble-free operation of the drip system. The different types of filters include:

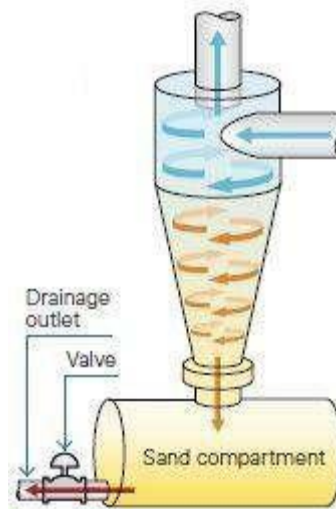
- **Media filter**

Media filter consists of fine gravel and sand of selected sizes placed in a pressurized tank. It is required to remove organic matter such as algae mass and other vegetative material present in the water. The filters are made up of a circular tank filled with layers of coarse sand and different sizes of gravel with a provision of valves for flushing the filter assembly in case of clogging. The media filters are available in different sizes ranging from 500 to 900 mm diameter with an output of 15 to 50 Cum respectively.



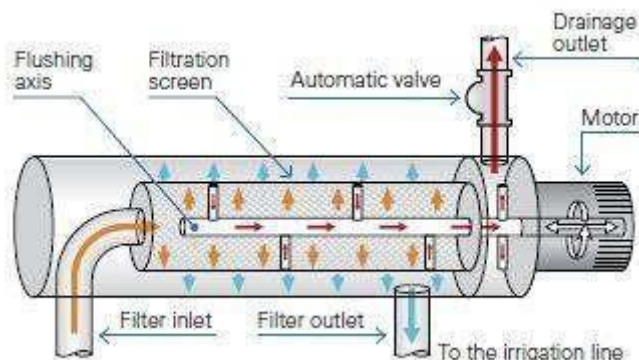
- **Hydro-cyclones or Centrifugal filters**

If the irrigation water is having more sand, hydro-cyclone type filters are required to remove the sand; it is also known as vortex sand separator. Hydro-cyclone type filters are produced in various sizes for different discharges and have been found most suitable for removing particles from water before it enters the drip irrigation system. Hydro-cyclones must be followed by a screen filter as a safeguard.



- **Screen Filter**

The screen filter is fitted in series with the gravel filter in order to further remove the solid impurities like fine sand, dust etc. from the water. In general, the screen filter consists of a single or double perforated cylinder placed in a plastic or metallic container for removing the impurities. Generally, 100 to 200 mesh screens are used in this type of filters. It must be cleaned and inspected periodically for satisfactory operation of any drip system.



- **Disc Filter**

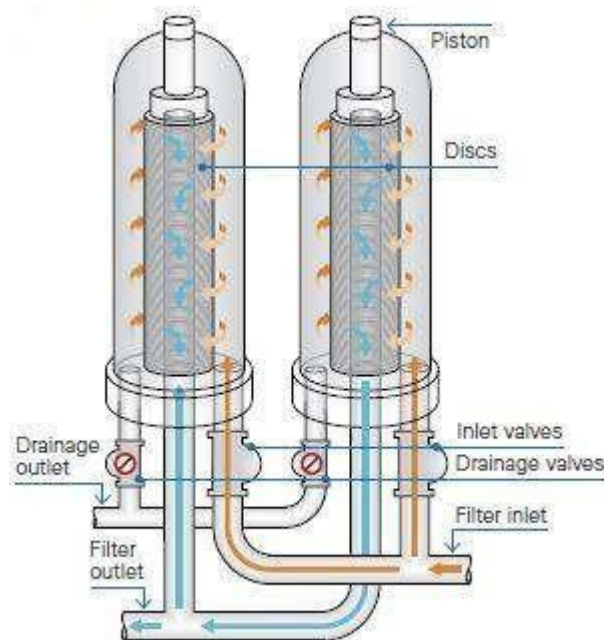
A disc filter is a type of water filter used primarily in irrigation, similar to a screen filter, except that the filter cartridge is made of a number of plastic discs stacked on top of each other like a pile of poker chips. Each disc is covered with small grooves or bumps. The discs (or rings) each have a hole in the middle, forming a hollow cylinder in the middle of the stack. The water passes through the small passages in between and the impurities are trapped behind.

The filtration quality is based on the quantity and size of particles that the filtering element is able to retain. Higher quality filtration simply means cleaner water. This depends on the geometry of the channels, including the size,

length, angle, and number of generated intersection points. The discs are typically color coded to denote the level of filtration. Filtration quality is usually measured in microns, based on the smallest size particle filtered. The typical range is from 25 microns for the finest level of filtration to 400 microns for the coarsest. Sometimes the filtration quality is given as the equivalent mesh size of a comparable screen filter. Typical mesh sizes range from 40 to 600. When using mesh sizes, 40 is the coarsest and 600 is the finest or highest level of filtration.

Disc filters range in size from small units with a 3/4" inlet and outlet used for landscape drip irrigation systems to very large banks of multiple filters manifolded together used for filtering large volumes of water for agricultural and industrial applications.

Some disc filters, especially the smaller ones, must be taken apart and cleaned by hand. Many of the larger ones can be backflushed in such a way that the discs are able to separate and spin during the cleaning cycle. In some cases, a booster pump may be required for backflushing. Disc filters can be used for many types of contaminants, including fine sand and organic matter. However, when used to filter organic matter, they will clog more quickly than a media filter and will have to be cleaned more often. One advantage that the disc filter has over the media filter is that it can backflush more quickly with less flush water.



### Fertilizer Applicators/Fertigation

The direct application of fertilizer through drip irrigation has increased the efficient use of fertilizer along with saving in labour and money. Application of fertilizer into pressurized irrigation system is done by either a by-pass pressure tank, or by venture pump or direct injection system. In by-pass system, by closing main system valve, certain quantity-generally 10% of flow quantity is allowed to by-pass through fertilizer tank. Then the by-passed water along with dissolved fertilizer goes into the system. In the venture-pump type fertilizer application, some water is passed through the venture (decreasing the diameter in taper form) where velocity head is created, due to increase in velocity at the place. This will create a suction head and will suck the fertilizer solution in the system. In direct infection type, pumps of piston type or diaphragm type are used. These pumps operated by the system pressure only, give fixed quantity of fertilizer in the water throughout irrigation.

### Pressure Regulators

Pressure regulators are generally used to decrease the higher system pressure to the lower required system pressure. It controls pressures in one way only i.e. high to low. Pressure regulators are required on a large-scale design. Undulating terrain and sloppy land etc. For normal small system, a simple by-pass valve can be used to control pressure in the system.



Figure: Pressure regulators installed side-by-side allow a greater flow rate.

### Valves or gauges

A zone system using valves to open and close various lines can be used to water several fields or sections of fields from one water source. A backflow/anti-siphon valve is a necessity for a system using a well or municipal source if fertilizers or chemicals are to be injected into the line. Hand-operated gate or ball valves or electric solenoid valves can be used to automate the system using a time clock, water need sensor, or automatic controller box.



Figure: Pressure gauge

### **Distribution Network**

The distribution network mainly constitutes main line, sub-main line and laterals with dripper and other accessories.

### **Main and Sub-main Line**

Generally Rigid PVC and High-density Polyethylene (HDPE) pipes are used as main line. Pipes of 65 mm diameter and above with a pressure rating of 4 to 6 Kg/sq.cm are recommended for main pipes. These pipes laid underground, offer a long life of more than 20 years. For sub-main pipes, Rigid PVC, HDPE or LDPE (Low Density Polyethylene) are recommended. Pipes having an outer diameter ranging from 32 mm to 75 mm with a pressure rating of 2.5 kg/sq.cm are used as sub-mains. These pipes may be laid above the ground or underground.

### **Laterals**

The laterals/drip lines are normally manufactured from LDPE (Low Density Polyethylene). These pipes are generally laid above the ground. Recently a better material than the presently used LDPE i.e., Linear Low-Density Polyethylene gives more protection against ultra violet rays and longer life of pipe than LDPE. Generally, pipes having 10,12,16,20 mm internal diameter with wall thickness varying from 1 to 3 mm are used in drip system.

### **Drippers / Emitters**

Drippers function as energy dissipaters, reducing the inlet pressure head (0.5 to 1.5 atmosphere) to zero atmosphere at the outlet. These drippers are generally manufactured from poly-propylene material.

### **Pressure Compensating Drippers**

This type of dripper gives fairly uniform discharge at pressure varying from 0.3 to 3.5 atm. Generally, the drippers give 2,3,4,8 liters/hr discharge at varying pressure. This type of rippers is provided with a high-quality rubber diaphragm to control pressure. The pressure compensating type drippers are most suitable on slopes and difficult topographic terrains.



### **Other Accessories**

The other accessories include take out/starter, rubber grommet, end plug, joints, tees, manifolds etc.

### **Existing Irrigation Facilities**

Chitturpuzha Irrigation project in Palakkad district, envisages the construction of Moolathara regulator and Thenbaramadakku anicut and re-modeling the existing 3 old anicuts viz. Kunnankattupathy, Nurnee and Nurnee Alankadavu anicuts. The above 4 anicuts are constructed across the river Chitturpuzha, a tributary of Bharathapuzha, and from these independent systems, Irrigation is being provided in Chittur Taluk for the last hundred years by diversion canals. During the early years of 1960, a dam was constructed at Aliyar in the upper reaches of Chitturpuzha by Tamil Nadu Government in the area falling in that State. This reduced the flow of water to the downstream side causing drought in the anicut areas. An Inter State agreement was made between Govt of Kerala and Tamil Nadu. As per the agreement, the total quantity of water to be released annually to Chitturpuzha project is 7250 Mcft (205.3 mcm). Taking into account the availability of water, a consolidated development programme was envisaged combining the scheme and inter linking with other projects like Walayar, Meenkara and Chittur. The Scheme was also intended for the remodeling and extension of the old canal system to irrigate an area of 14940 ha. There are 2 Nos. of lift irrigation schemes in Moolathara LB canal. Its ayacut area is 1200 ha. The CCA of the project is 16,940 hectare and the annual irrigation of the project is 33,880 hectares.

The length of regulator at Moolathara is 144.84 m with 13 vents. The spillway is gravity type with ogee curve. The FRL of the regulator is at +184.405 m and its capacity at this level is 19 Mcft. The road over the regulator is 4.27 m wide at +185.93m.

The Palakkad district experiences humid and sub humid climate. The district receives an average annual rainfall of 2171 mm. Nearly 90 % of the total annual rainfall is received during South West and North East monsoon seasons. The Bharathapuzha and Siruvani with their tributaries drain the entire district. About 45% of the total geographical area is cultivated and nearly 86% of the net sown area is irrigated. Paddy, coconut, vegetables, fruits, rubber and spices and condiments are the major crops cultivated in the district. The selection of the crops and crop associations show that variety of crops are sown and are mostly adjusted with soils and irrigation facilities. The study of crop ranking and crop combinations will provide the existing nature of crop cultivation in the district.

Block level data on agricultural variables of crops cultivated and area under each crop during 2001 and 2011 agricultural year statistics were collected for 13 blocks including municipal areas from Agricultural Departments and Department of Economics and Statistics, Palakkad and Thiruvananthapuram. Based on the ranking of crops and the application of crop combination analysis of Weaver's (1954) minimum

deviation method and Raffiullah's (1956) maximum deviation method, the possible crop associations and crop combination regions are identified and represented with suitable cartographic technique. Agriculture is the dominant activity of Palakkad district. Variety food and non-food crops are cultivated in the district. The major crops cultivated in the district includes paddy, coconut, vegetables, Banana, rubber, fruits and spices and condiments. These crops occupy more than 95% of the total cropped area. Other crops such as tuber, fodder, sugarcane, areca nut, groundnut, pulses, cotton etc shares the remaining 5% of the area. Paddy is the major crop and occupies 31% of the total cropped area of the district in 2011. It is cultivated largely in mid low land plain areas of the district. The red loamy soils with irrigation facilities favors wet paddy cultivation in these areas. Coconut is the second rank crop next to paddy and occupies 21% of the cropping area. Coconut are cultivated mostly on the upland and terraces of the high land areas in the district. Banana and other Fruits occupies 13.5% of the cropped area and Vegetables are cultivated in most of the paddy fields after the harvest of paddy. Spices and condiments share 8.4% of cropped area and cultivated as an intercrop in rubber and coconut cultivated areas in the district. Other crops sugarcane, groundnut, pulses, tapioca, arecanut are also cultivating in Palakkad district.

### **Existing cropping pattern**

The data on existing cropping pattern reveals that the different crops in the ayacut can be classified into 3 categories:

Traditionally in Kerala, there are two crops paddy Virippu and Mundakan. The first crop usually commenced during June-July and is harvested in October. Since the first crop gets maximum benefit of south-west monsoon irrigation requirement is normally very less. Even though the requirement of water is less timely application and actions to face the short fall of rain etc. will be helpful, for improving the yield. Thus, if stabilised irrigation is assured the output can be increased. If adequate Irrigation facilities are given for the ayacut, the second crop can be stabilised, this crop can be developed considerably with good returns.

Sugarcane was cultivated extensively in the Kozhinjampara area because of the sugar factory located in this area. In the earlier years, the farmers in this area gave more importance to cultivate sugarcane. Farmers having their own irrigation arrangements cultivated sugarcane to a great extent. The main variety grown was CO-8021. The crops are harvested during August-September. But due to lack of sufficient water for irrigation, the cropped area under sugarcane came down drastically, which in turn resulted in the closing down of the sugar factory. Now in these areas two cotton crops are usually grown. If sufficient irrigation facilities are provided great developments can be made in this cultivation.

**Projected cropping pattern at Eruthiampathy**

Detailed soil survey to find out the crop pattern has been done. The recommendations made, with preference for each crop has been tabulated separately in the soil survey part. Based on the recommendations the following cropping pattern is proposed. The recommendations have been made considering the intensity of irrigation, that can be made available, with the available water.

Extension of Moolathara Right Bank Canal from Korayar to Varattayar ch: 15630(old) as 0 to 6430m

<b>CROPPING PATTERN IN THE PROJECT AREA</b>			
<b>Sl. No</b>	<b>Name of Crop</b>	<b>Crop Period</b>	<b>Area (Ha)</b>
1	Paddy		30
2	Coconut		1900
3	Coconut with intercrop (Nutmeg, Cocoa, Banana, Fodder grass, Arecanut)		700
	Banana		400
	Other Crops		100
	Fodder Crops		200
4	Vegetables (Total)		
4.a	Vegetables-First Crop	May 20-Aug 20	150
4.b	Vegetables-Second Crop	Sept 20 – Dec 20	80
5	Banana		200
6	Groundnut		
6.a	Groundnut – First Crop	May 20-Aug 20	35
6.b	Groundnut – Second Crop	Sept 20 – Dec 20	35
7	Mango		40
8	Fodder Crops (throughout year)		350
9	Sugarcane		50
10	Tuber Crops	May 1 – Feb 28	150
<b>TOTAL NET AYACUT</b>			<b>3575</b>

**Crop Water Requirements**

It is essential to know the water requirement of a crop which is the total quantity of water required from its sowing time up to harvest. Naturally different crops may have different water requirements at different places of the same country, depending upon the climate, type of soil, method of cultivation, effective rain

etc. The total water required for crop growth is not uniformly distributed over its entire life span which is also called crop period. Actually, the watering stops same time before harvest and the time duration from the first irrigation during sowing up to the last before harvest is called base period. Though crop period is slightly more than the base period, they do not differ from practical purposes. The total depth of water required to raise a crop over a unit area of land is usually called delta. Some typical values of delta for common crops in some regions of India are as follows:

Crop water requirement is calculated based on water depth required for each crop and area sown given in table. 60% percent of whole crop water is consumed by Coconut and vegetables only. Total crop water demand for 2015 is 156394 million liters and Total crop water demand for 2020 is 196394 million liters.

Crop water requirement is the water required by the plants for its survival, growth, development and to produce economic parts. This requirement is applied either naturally by precipitation or artificially by irrigation. Hence the crop water requirement includes all losses like: a) Transpiration loss through leaves (T) b) Evaporation loss through soil surface in cropped area (E) c) Amount of water used by plants (WP) for its metabolic activities which is estimated as less than 1% of the total water absorption. These three components cannot be separated so easily. Hence the ET loss is taken as crop water use or crop water consumptive use. d) Other application losses are conveyance loss, percolation loss, runoff loss, etc., (WL). e) The water required for special purposes (WSP) like puddling operation, ploughing operation, land preparation, leaching, requirement, for the purpose of weeding, for dissolving fertilizer and chemical, etc. Hence the water requirement is symbolically represented as:  $WR = T + E + WP + WL + WSP$  (The other application losses and special purposes are mostly indented for wet land cultivation. Hence for irrigated dry land crop the ET loss alone is accounted for crop water requirement). The estimations of the water requirement of crop are one of the basic needs for crop planning on the farm and for the planning of any irrigation project.

Water requirement calculation for the various ayacuts are provided in detail in the tables enclosed. The entire ayacut of MRBC and CPP have been divided into two sections. The whole system of canals is proposed to be in pipes to have minimum wastage and smaller section of canal. The PAP water will be utilized to cultivate the ayacut of Chitturpuzha project. Sugarcane of Meenakshipuram lift and the 13453 Ha. in Kozhinjampara area. The details of crop wise calculation is tabulated and the total usage of water comes to the release of the PAP water will be 205.29Mm<sup>3</sup>. The interstate agreement condition for all the months and. the requirement of water is also tabulated. It is found that almost all the months the water release is sufficient, except June, December and January for which solution drawn as detailed below.

The ayacut at present have got 19 check dams, in the Korayar and Varayattayar rivers, and a lot of small Eris. Development of irrigation projects and irrigation in all months itself will help to raise the water table.

### **Livestock Water Demand**

Global trend in animal production indicates a rapid and massive increase in the consumption of livestock products. It is predicted that meat and milk consumption will grow at 2.8 and 3.3% per annum, respectively, in developing countries like India where the whole system of rural economy has revolved around livestock production. Providing enough quality water is essential for good livestock husbandry. Water makes up 80% of the blood, regulates body temperature and is vital for organ functions such as digestion, waste removal and the absorption of nutrients. Understanding daily livestock watering needs is key when designing a livestock watering system.

The daily water requirement of livestock varies significantly among animal species. The animal's size and growth stage will have a strong influence on daily water intake. Consumption rates can be affected by environmental and management factors. Air temperature, relative humidity and the level of animal exertion or production level are examples of these factors. The quality of the water, which includes temperature, salinity and impurities affecting taste and odour, will also have an effect. The water content of the animal's diet will influence its drinking habits. Feed with a relatively high moisture content decreases the quantity of drinking water required.

Given that drinking water needs are species-, farm- and management-specific, many producers today are opting to install water-metering equipment to obtain accurate measurements of water use. If medication is ever provided through the livestock's watering system, the meter can be used to ensure proper dose rates.

The main livestock operations would be dairy, goat, pigand, poultry. Water usage for stock drinking purpose and other uses includes cleaning/wash down for cattle, pig and poultry operations.

Number of livestock as per livestock department is 23249. Estimation is done based on livestock water demand which is different for types of animals. There is no additional water requirement as stored water is more than water requirement. 25% of water is reserved for this purpose in all current and future structures.

Water budget analysis of Eruthempathy Panchayath reveals that this region is a severe water insecure or scare place in the Kerala State. Above table shows that existing water availability of this Panchayath is about 1.5283 BCM. Current water demand of this region is about 1.59 BCM and but water demand of this region will increase up to 1.79 in the year 2020. So, water gap of this region increases 0.07 BCM to 0.27 BCM in the year 2020. This study points out that the urgent need of water conservation strategies Eruthempathy Panchayath for survival of man and Bio-diversity.

### **Water Management**

In the 21st century, we are at a crucial juncture in the area of water management. Water managers need to develop creative and innovative solutions as well as develop holistic approaches to solve water crisis. There is always a focus on Blue water or liquid water rather than on Green water or vapour flow. Blue water constitutes only 10 percent of the total freshwater resource, which means that we are focusing only on the one-tenth of the resource base. A new water management approach that integrates blue and green water flows is the need of the hour.

Exploitation of river water by Diversion- The shortage if any, occurs in the months can be met from the natural flow of about 100 cusecs. usually, if an efficient diversion is made at Moolathara and optimum utilisation is ensured. This organisational set up can be achieved through the remodeling of the Head Regulator which is already envisaged.

Utilisation of post monsoon- Usually as a previous custom the cultivation starts here on April 14 (Medam 1, Vishu). This is only because of the fact that during in the previous or incoming week there will be at least one or two heavy rains, which are happening due to the orographic lifting due to heavy heat. This is a well-known fact, as far as the climatology of Kerala is concerned and a certain quantity of this shower received will be enough for the rest of the demand if any in April.

### **3.13 Slope**

Slope is a measure of change in elevation. The slope may be defined as the vertical inclination between the hill top and valley bottom stands with the horizontal line and expressed generally in degree. It is a crucial parameter in several well-known predictive models used for environmental management, including the Universal Soil Loss Equation and agricultural non-point source pollution models. A slope is the rise or fall of the land surface. It is important for the farmer or irrigator to identify the slopes



on the land (Stahler, 1964).

Kerala is said to be the sloped land towards the Arabian Sea (to the western direction). the heavy rainfall slops are the fundamental reason behind the laterisation mainly due to soil erosion and leaching (Wikipedia).

### 3.14 Drought

Drought is a continuous period of dry weather, when an area gets less than its normal amount of rain, over months or even years. Crops and other plants need water to grow, and land animals need it to live. It can become dangerous to people and other animals; causing famine and even creating deserts. A drought is a natural event, caused by other weather events like El Niño and high-pressure systems. Drought can also be triggered by deforestation (people cutting down forests), by global warming, and by diverting rivers or emptying lakes (Britain Meteorological Office,1951).

Eruthempathy Panchayath is a one of the drought prone region in Palakkad district. Drought is a major problem that affects agriculture productivity in this Panchayath. This region is drought prone for 6 to 9 months and also experience severe temperature during the period of April – May months when the temperatures exceed 42<sup>0</sup>C.

Remote sensing techniques make use of electromagnetic radiation in the visible, infrared and microwave regions to collect measurements of reflectance of plants, soils, water and other materials. The Earth Observation satellites which include both geostationary and polar orbiting satellites provide comprehensive, synoptic and multi temporal coverage of large areas in real time and at frequent intervals and 'thus' - have become valuable for continuous monitoring of atmospheric as well as surface parameters related to droughts (Jayaseelan 2005).

Drought assessment involves analysis of spatial and temporal water related data. Several methods were developed to assess the drought quantitatively. Basically, droughts are assessed with reference to nature of water deficit, averaging period, truncation level and regionalization approach (Dracup et al 1980). Over the years, various indices have been developed to detect and monitor droughts. The effects of drought often accumulate slowly over a considerable period of time; they may linger for several years after the drought period ends. As a result, the onset and termination of a drought are difficult to determine precisely and that is why a drought is often referred to as a creeping phenomenon (Mishra et al 2007).

After the various definitions of drought and their groupings to confine the problem, many researchers have attempted to assess drought severity. These studies are grouped under meteorological, hydrological and agricultural aspects, as classified by the National Commission on Agriculture (1976).

### 3.15 Flood

Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some

of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an aerial flood. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, these changes in size are unlikely to be considered significant unless they flood property or drown domestic animals (Majid Hussain, 2012).

The primary effects of flooding include loss of life, damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. There is lack of possibility to occur flood in Eruthempathy region. But in the period of monsoon, there is little bit chance of occurring flood in one or two weeks in some areas.

### **3.16 Aims and Objectives of the Project**

To use the available water resources to the maximum potential in an efficient way catering to the basic needs of every living being and enhancing the livelihoods of rural population to the maximum extent thus alleviating poverty in a sustainable way without compromising the interests of future generations.

Strengthening grass root involvement of all stakeholders including Panchayati Raj Institutions and local bodies in the water security and development schemes e.g. Participatory Irrigation Management (PIM);

Encouraging the adoption/utilization of traditional knowledge in water resources conservation and its management.

To utilize sector level expertise from different levels in government, NGO's, citizens etc. and enhancing livelihood security through water security in rural areas.

The overall improvement of ayacut under MRBC from Korayar to Varattayar by adopting micro irrigation system in the existing ayacut and thereby increasing its efficiency and the water savings. The objective is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation.

### 3.17 Inter State Aspects

The Kerala Government has tapped maximum possible rivers/streams flowing through Palakkad for storage and diversion for irrigation to the commands. But optimum full requirement for irrigation could not be achieved. Hence right from the fifties the possibilities of diversion of water from the neighboring basins were considered by the irrigation planners. One of such schemes was the diversion of water from Chalakkudy basin to Bharathapuzha basin. The main part of the project was to tap the water of Chalakkudy river basin first for power and to lead this water after power generation to the Bharathapuzha Basin to meet the Moolathara Left Bank Canal of Chitturpuzha Project at Ch. 11.60 km. By this it was proposed that the ayacut of the Chitturpuzha project below Ch. 11.60 km of MLBC will be fed by this tail race water. And by this, sufficient water can be supplied to the dry areas of Kozhinjampara by diverting the water reaching at the head works of (Moolathara regulator) Chitturpuzha project as per the Parambikulam Aliyar Project (PAP) agreement by gravity flow and lift arrangements.

But the uncertainty regarding the implementation of KKIP has necessitated finding immediate solutions for the water scarcity problems of Kozhinjampara and adjacent areas, as it is a standing commitment of the Government of Kerala to supply water to this drought prone area where the water scarcity problem still remains unsolved. The Moolathara Right Bank Canal forms a common component of both Kuriyarkutty Karappara Project (KKIP) and Chitturpuzha Project and the same has been constructed for a length of Ch. 15957m upto Korayar river. Extension of Moolathara Right Bank Canal of Chitturpuzha Project was thought of in this context. The formation of the canal has already been completed up to Korayar. Further extension from Korayar to Varattayar is now proposed to be taken up. The present proposal is the overall improvement of ayacut under MRBC from Korayar to Varattayar by adopting micro irrigation system except for paddy in the proposed 3285.14 ha of ayacut and thereby increasing its efficiency. The objective of the scheme is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation. The micro irrigation is proposed to be achieved with drip and sprinkler irrigation with the support of pump sets.

The Parambikulam Aliyar Project (PAP) is an interstate Water Resources Development Project carried out jointly by Tamilnadu and Kerala in India to harness the water of the Bharathapuzha, Chalakudi and Periyar basins for irrigation and power production in both states. The Parambikulam Aliyar basin is located in south western part of the Peninsular India and covers area in Kerala and Tamilnadu States. Bharathapuzha is the second largest west flowing river and its drainage is spread over the above two states. The Parambikulam Aliyar river basin has an undulating topography with maximum contour elevation in the plain is 300m. One third of the basin area (822.73sq.km) is covered with hills and dense forest. The total area of PAP

basin is 2388.72 sq.km. This basin is bounded in north and east by Cauvery basin, south and west by Kerala State. This basin area lies (except the ayacut area) within the coordinates of North latitude between 10° 10'00" to 10°57'20" and East longitudes 76°43'00" to 77° 12'30" (Figure-1). This PAP sub basin comprises of following four sub basins namely Sholayar (403 sq.km), Palar (534 sq km), Aliyar (575 sq km) and Valayar (877 sq.km). This project is planned originally to irrigate 1, 00, 230ha during one season (135 days) each year, the service area was increased by nearly 71% to 1, 71, 050ha without increasing available water resources PAP includes eight reservoirs (Upper Nirar weir, Lower Nirar dam, Sholayar dam, Parambikulam dam, Thunakadavu dam, Peruvaripallam dam, Aliyar dam and Thirumurthy dam). Among this first 6 dams are located in the higher altitudes of the Anamalai hill ranges, and the last 2 dams are located in the plains. The irrigation canals take off and utilize the storages behind these dams to serve the command area.

## 4 STATUS FEASIBILITY STUDIES

By the present proposal, water available during periods of no or less demand in other systems of Chitturpuzha Project and the flood water reaching Moolathara regulator during rainy season can be diverted to drought hit areas up to Varattayar and to the check dams in Varattayar & Korayar and also the 14 nos ponds in Eruthiampathy Panchayath between Korayar and Varattayar. **The proposed total ayacut to be benefited by the implementation of this project is 3575 Ha (predominantly Coconut and Vegetable).**

Right Bank canal system from Moolathara weir is complete up to Korayar and the ayacut under this canal system is at present being irrigated as per the requirement of farmers. In this proposal the overall improvement of ayacut under MRBC from Korayar to Varattayar by adopting micro irrigation system in the existing ayacut and thereby increasing its efficiency and the water savings. The objective is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation.

The main canal up to Korayar is already lined and the canal portion from Korayar to Varattayar is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity co-efficient.

The canals are designed for the peak discharge with extra provision for rush irrigation. However, the MRBC from Korayar up to Varattayar is provided a uniform section. This is to divert the water coming in the Moolathara Regulator in excess of actual requirements during a particular time like November, December to fill the check dams in the Korayar and Varattayar rivers and the ponds and Eries in Kozhinjampara Firka. The right bank canal from Moolathara Regulator takes off at +182.00m and command an ayacut of 10,146 Ha. of Kozhinjampara area spreading over the three Panchayats of Kozhinjampara, Eruthiampathy and Vadakarapathy. The canal upto Korayar has already been constructed. This portion is having sufficient capacity for carrying water for the proposed ayacut.

An alteration in the old alignment of the MRBC has been done from ch. 2013m. This has been done to avoid the huge tunnel coming in the alignment. As per this the existing Valiyavallampathy branch canal which off takes from Ch. 2013 of MRBC has been widened up to Ch. 12075m to form the MRBC. From the ch. 12075, the canal is connected to the old alignment of ch. 6100 m and from there the canal

continues. The alternate alignment has got the great advantages of carrying full discharge up to the Kozhinjampara area also, where the drinking water problem is too much.

- Moolathara Right Bank Canal from Moolathara Regulator to Ch. 2000 m was taken up and constructed in 1978.
- Moolathara Right Bank Canal from Ch. 2000m to Ch. 15951 m ie up to Korayar was taken up and completed during 1976 to 2002.
- In 2015 Administrative Sanction was issued for Rs. 50.60 crore for construction of Moolathara Right Bank Canal from Korayar to Varattayar from Ch. 15951 m to Ch. 22157 m (6206 m.)
- Joint inspection of old alignment by officers of Irrigation Division, Chittoor and KIIDC in June 2016.
- Decided to look for alternate alignment.
- In August 2016, KIIDC has conducted alignment survey to locate the most economical route for the canal and the new alignment has been approved by Chief Engineer, Projects 1, Kozhikode. It involves 46 land owners and all have expressed their willingness to hand over possession of land to Government at reasonable rates. The length of the canal is approximately 6430 m and the expected cost of the project is Rs. 262.10 Crores.
- As the tunnel portion for a length of 2300m with over burden of 20m to 31m is expensive and time consuming;
- As many of the land owners in the old alignment refused to co-operate in the land acquisition process.
- KIIDC carried out detailed investigation of alternate alignments.
- A more feasible alignment was submitted before Chief Engineer, Projects 1 in December 2016 for approval.
- After inspecting the alignment CE, P1 approved the alignment on 23.12.2016.
- KIIDC submitted the proposal for approval of hydraulic particulars to CE, IDRIB on 29.12.2016.
- CE, IDRIB approved the hydraulic particulars on 15.02.2017.

### **Land acquisition**

Land acquisition is required. the alignment of the structure being across land, river and roads demands land acquisition



### Steps taken for acquisition of land

- Chief Engineer, Projects 1 requested Government to issue sanction for acquisition of land for canal construction in the new alignment vide letter dated 12.01.2017.
- Government issued additional authorization for release of Rs. 4 crores to meet land acquisition cost and expenses on other preliminary works for the extension of MRBC on 24.01.2017.
- In 16. 03.2017 Government issued orders for acquisition of 1356.23 cents by negotiated purchase.
- It is understood that the SLMC of revenue department has approved the land acquisition for the project on 22.03.2017.
- Chief Engineer, Projects 1 has requested for release of Letter of Credit to Govt. on 22.03.2017.
- Letter of credit issued.

There is an assurance from local people to make available sufficient land for the project. Certain area has been free surrendered by the public in MRB Canal areas up to Ch. 16125M and from there up to Varattayar the land acquisition is nearing completion. The total expenditure expected for the item is Rs 12.60 Crores.

Many studies conducted by various research institutions like Kerala Agricultural University, Central Plantation Crops Research Institute, Centre for Water Resources Development and Management etc. have shown that irrigation can enhance the productivity of the crops in the State. However, the area with a gross irrigation facility still hovers around 17.0 % (2009-10) of the gross cropped area of the State - a level far below the average for India (38.7%) (DoES 2012). Hence this needs to be improved to attain an improved productivity. Analyses of the secondary data on the yield of paddy in Kerala under irrigated and non-irrigated conditions confirmed that irrigation has a great effect on enhancing the yield levels by about one-sixth (about 500 kg per hectare) to that of the un irrigated level. One of the main reasons for the low irrigation efficiency in the State is the lack of location-specific scientific information on irrigation scheduling for different crops. The present irrigation recommendations for the State are of general nature and does not account for all the soil types and climate in different agro-ecological zones. While studies have identified the influence of one or more parameters on irrigation water requirements, there is a lack of information with respect to Kerala on these parameters when water

requirements are to be aggregated at a regional scale. To achieve effective planning on water resources, accurate information is needed for crop water requirements, irrigation withdrawal as a function of crop, soil type and weather conditions. The rainfall and evapotranspiration ultimately determine water balance, crop water and irrigation requirements of different crops of the region. Studies of such climatic parameters are thus helpful in defining risk levels in arable agriculture. However, a detailed study by comprising all the data on water requirement and availability is also not available under humid tropical Kerala conditions.

## 5. REQUIREMENT/ DEMAND ANALYSIS

Project area is situated in the rain shadow region of Palakkad gap, viz. Kozhippathy and Eruthiampathy Villages of Chittur Taluk in Palakkad District, which receives less than 1000mm of annual rain fall when compared to the State's average of 3000mm. But these regions are having intensive agriculture activity in spite of low water availability.

At present the major source of water for irrigation and domestic use is ground water. Due to years of intensive abstraction, the ground water level in this region has gone down considerably and the areas under Kozhippathy and Eruthiampathy Villages has been categorized as 'over exploited' by the Central Ground Water Board and the State Ground Water Department. Hence the project –Extension of Moolathara Right Bank Canal from Korayar to Varattayar is proposed and Government have issued Administrative sanction for the project amounting to Rs-262 Crores vide Order No- Go. (Rt) No. 610/2019/WRD Dated, TVM, 27/08/2019. **The proposed total ayacut to be benefited by the implementation of this project is 3575 Ha** (predominantly Coconut and Vegetable). The proposal includes construction of an aqueduct across Korayar River and laying of pipes for conveyance of water.

By the present proposal, water available during periods of no or less demand in other systems of Chitturpuzha Project and the flood water reaching Moolathara regulator during rainy season can be diverted to drought hit areas up to Varattayar and to the check dams in Varattayar & Korayar and also the 14 nos ponds in Eruthiampathy Panchayath between Korayar and Varattayar.

Right Bank canal system from Moolathara weir is complete up to Korayar and the ayacut under this canal system is at present being irrigated as per the requirement of farmers. In this proposal the overall improvement of ayacut under MRBC from Korayar to Varattayar by adopting micro irrigation system in the existing ayacut and thereby increasing its efficiency and the water savings. The objective is to minimize the conveyance losses of water in the field such as deep percolation, run off and soil erosion. The crops like coconut, cotton, vegetables etc. are found responding well to micro irrigation.

Implementing Micro Irrigation / Drip Irrigation in the Command area will double the yield from crops with 70% savings in Irrigation water. The irrigation and command area development activities under the project will lead to increase in the production and productivity and a change in the present cropping pattern in agriculture sector. Besides the provision of irrigation facilities, the project will ensure availability of necessary inputs like seeds, fertilizers, insecticides etc. in the required quantities.

The ayacut area includes Kozhinjampara region which is most drought prone area and farmers are clamouring for water for years.

The productivity of all the crops are very low compared to the district and state averages. The marginal productivity of land and labour are very low. Crop failure is a perpetual phenomenon in this region. Hence the project is most deserving and will be a blessing to the people who were badly affected by the vagaries of Monsoon.

The entire region is facing acute scarcity of drinking water in all the seasons. The ground water source is almost saturated stage, the yield from deep well are dwindled down considerably. Hence the project is socially desirable.

The traditional method of depending on deep well for irrigation can be abandoned through the project. Hence the cost of irrigation will be reduced considerably.

The present trend of migration of marginal and small farmers of the area due to acute shortage of water can be arrested by the implementation of the project.

The small and marginal farmers will invest a part of their incremental income on consumer goods, a part on farm development and a part to pay-off the debt owes to the financial institutions. This in return will result overall development of the area.

Significant indirect benefit would flow from the project with increased availability of drinking water, saving in irrigation water by adopting drip irrigation, filling of tanks and ponds, improvement in land value, rural income, social value and increased agricultural activities.

### **Public Cooperation and participation**

The main aim of the project is extension of irrigation facilities to drought hit areas between Varattayar & Korayar. This project is very much appreciated by the people of this district. Some land had already been made available by the local farmers for construction of canal up to Korayar as free surrender. There is acute shortage of even drinking water in this area and the people of this area are clamoring for a project since 1955 at least to quench their thirst. This project is a solution to the irrigation problems faced by the residents of this area which is backward in many respects, and hence can improve the socioeconomic condition of the people. As such, it is expected that this project will be welcomed with much enthusiasm.

There is an assurance from local people to make available sufficient land for the project. Certain area has been free surrendered by the public in MRB Canal areas up to Ch. 16125M and from there up to Varattayar the land acquisition is nearing completion.

The public in the project area crave for this project since so many years, as they are the only group denied of the irrigation facilities while the surrounding

areas are highly benefited by better irrigation facilities. The benefits to the area are not only in the irrigation sector but also in every walk of life and the real outcome and benefit of this project cannot be assessed in terms of money alone.

## 6. FUNCTIONAL DESIGN

### Methodology

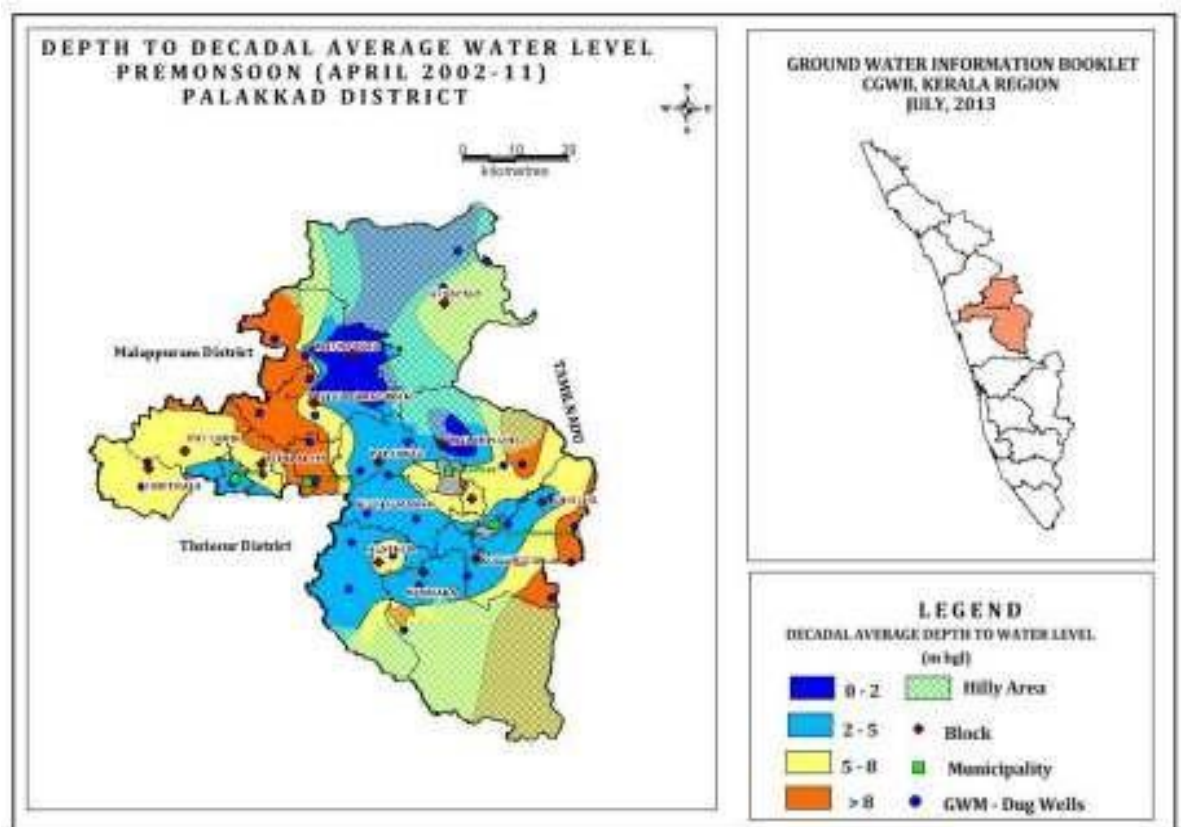
- Estimation of domestic water requirement drafts of Vadakarapathy Panchayath using water foot print calculation.
- Calculating water poverty index in order to estimates the impact and intensity of water scarcity of Vadakarapathy Panchayat.
- Measuring the severity of drought in Vadakarapathy Panchayat using Meteorological and Agriculture drought indices.
- Estimating water budget of Vadakarapathy Panchayat using integrated hydrological modelling.
- Geo spatial technologies such as GIS, GPS and Remote Sensing are adopted for data analysis and cartographic works.
- Conducted field visits to validate the recommended measures with respect to the ground situation and requirement of the local people and Finalization of development plans based on field observation.



## 7. ENGINEERING DESIGN

### 7.1 Hydrology and Water Availability

The readings of rain gauge station available at Moolathara Regulator (under Water Resources Department) and at Eruthiampathy Farm (under Agricultural Department) is adapted for the hydrological calculation. The readings are available for a period of 40 years. Other Hydrological details like temperature, relative humidity, cloud cover, number of frost-free days, wind velocity and evaporation are collected from the nearest available stations. This includes the data available from 2014 onwards from the Automatic Weather Station installed by VFPCCK at Vadakarapathy.



A detailed study of the water reaching the Moolathara regulator has been studied for a period of 20 years. The details reveal that a minimum of 6.1 Mm<sup>3</sup> / month reaches Moolathara even in dry season. Efficient diversion and the management can ensure the optimum utilization of this inflow also. Thereby scarcity of water can be reduced easily.

However, during the periods of heavy rain irrigation requirement will be less, hence provision for storing the surplus water released during the period is also envisaged.

Water table is the surface where the water pressure head is equal to the atmospheric pressure (where gauge pressure = 0). It may be conveniently visualized as the "surface" of the subsurface materials that are saturated with groundwater in given vicinity. However, saturated conditions may extend above the water table as surface tension holds water in some pores below atmospheric pressure. Individual points on the water table are typically measured as the elevation that the water rises to in a well screened in the shallow groundwater (Jamie Bartam.1996). The groundwater may be from infiltrating precipitation or from groundwater flowing into the aquifer. In areas with sufficient precipitation, water infiltrates through pore spaces in the soil, passing through the unsaturated zone. (FAO, 2000).

In order to calculate the total quantum of water that can be made available to Chitturpuzha Project, the total realization at Manacadavu weir (From PAP) in each month (from June to May) is analyzed. 18 years from 2000-01 to 2017-18 is taken for analysis. Details are attached as Annexure A.

The average water available in each month is as shown in the table below.

Month	Average Water available from PAP	
	in Mcft	in Mm3
June	419.17	11.87
July	455.93	12.91
August	745.18	21.10
September	1283.21	36.34
October	1118.96	31.69
November	1488.86	42.16
December	1495.76	42.35
January	1175.89	33.30
February	778.11	22.03
March	460.66	13.04
April	177.19	5.02
May	283.1	8.02
<b>Total</b>	<b>9882.02</b>	<b>279.83</b>

**(a) Water requirement of LBC ayacut**

The different crops and the corresponding ayacut areas of LBC is as shown below.

SI No:	Crop	Ayacut (in Ha)
1	Paddy	9600
2	Coconut	1800

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

Paddy is taken for 2 crops (First crop period from June to 2 September & Second crop period from November to February). The water requirement of different crops is calculated as given below:

Total monthly Water Requirement (in mm) = (ET crop+ Mean percolation) x (No. of days) ET crop= ETy\* Ke

The monthly value of ETo is taken from IMD site.

Mean percolation is taken as 3 mm.

The rainfall data available at Moolathara station is analyzed for 41 years (1975-76 to 2015- 16) and 75 % dependable year is taken for monthly effective rain fall.

Monthly Irrigation water requirement (mm) = Total Monthly water Requirement — Effective rainfall] in the month

Water required for irrigation= Irrigation water requirement x ayacut area

Monthly water requirement of LBC ayacut is as shown below:

Month	Water Requirement in Mm 3			Water Requirement (in Mm 3 by taking 60 % conveyance efficiency)
	Paddy	Coconut	Total	
June	19.6	0.68	20.28	33.81
July	Nil	Nil	Nil	0.00
August	Nil	Nil	Nil	0.00
September	5.64	1.43	7.07	11.78
October	Nil	Nil	Nil	0.00
November	21.37	1.37	22.74	37.90
December	24.99	2.19	27.18	45.30
January	19.87	1.33	21.20	35.35
February	7.66	2.15	9.81	16.35
March	Nil	2.89	2.89	4.81
April	Nil	1.27	1.27	2.12
May	Nil	Nil	Nil	0.00
<b>Total</b>	<b>99.14</b>	<b>13.31</b>	<b>112.45</b>	<b>187.42</b>

The detailed calculation is attached as Annexure B.

**(b) Water Requirement of RBC ayacut**

The water requirement is calculated as explained above. 41-year rain fall data (1969-70 to 2009-10) at Eruthempathy farm is analyzed and 75 % dependable year is taken for the effective rain fall.

Water requirement for RBC ayacut is as given below:

<b>RBC WATER REQUIREMENT IN mm<sup>3</sup></b>													
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
Paddy	0.68	0.67	0.34	0.00	0.00	0.03	0.00	0.24	0.47	0.00	0.11	0.66	<b>3.21</b>
Coconut	3.30	3.08	3.91	0.00	2.64	0.00	0.00	0.00	2.21	0.00	1.20	2.95	<b>19.28</b>
Vegetables	0.02	0.03	0.03	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	<b>0.10</b>
Banana	0.37	0.41	0.46	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.07	0.00	<b>2.04</b>
Groundnut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.01</b>
Fodder grass	0.44	0.40	0.52	0.13	0.37	0.00	0.00	0.00	0.30	0.00	0.21	0.39	<b>2.76</b>
Tuber crops	0.01	0.01	0.03	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.07</b>
Topiaco	0.04	0.04	0.21	0.05	0.15	0.00	0.00	0.00	0.02	0.00	0.00	0.00	<b>0.52</b>
Sugarcane	0.00	0.02	0.03	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.01	0.02	<b>0.11</b>
Pulses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.02</b>
Spices	0.01	0.02	0.02	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	<b>0.08</b>
Floriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.00</b>
<b>Total</b>	<b>4.87</b>	<b>4.68</b>	<b>5.54</b>	<b>0.19</b>	<b>3.97</b>	<b>0.03</b>	<b>0.00</b>	<b>0.24</b>	<b>3.06</b>	<b>0.00</b>	<b>1.60</b>	<b>4.04</b>	<b>28.22</b>

The detailed calculation is attached as Annexure C 1.

- Taking 60 % conveyance efficiency hypothetically for LBC system, about 119.35 Mm<sup>3</sup> (4.215 TMC) water is available for diversion to RBC.
- The months of June, December, January are deficit months, water will not be available for diversion to RBC.
- Since the loss in conveyance is not taken in RBC requirement, this quantum can be ensured at the RBC off take. The water available in the field will depend on the efficiency of the canal system.
- If drip irrigation is adopted for coconut, banana and vegetables, water requirement will be reduced considerably.
- If second crop paddy of LBC ayacut can start by October, more water can be made available in summer months.

As per Government order No.884/2019/WRD dated 30/11/2019 it is ensured 3 TMC of water to distribute through Moolathara RBC of Chitturpuzha Irrigation Project every water year (July 1st to June 30th).

REALISATION AT MANACADAVU WEIR IN MCFT

ANNEXURE A

REALISATION OF MANACADAVU WEIR IN MCFT												
Year	June I	June II	June Tot I	July I	July II	July Total	Aug I	Aug II	Aug total	Sep I	Sep II	Sep total
2000-01	127	119	246	330	177	507	390	421	811	185	729	914
2001-02	33	175	208	181.58	380.47	562.05	431.51	236.34	667.85	724.06	720.84	1444.9
2002-03	30.46	26.81	57.27	169.32	175.24	344.56	285.09	248.29	533.38	528.37	558.01	1086.38
2003-04	1.38	114.23	115.61	49.98	25.76	75.74	13.6	101.88	115.48	330.51	532.53	863.04
2004-05	375.5	196.36	571.86	310.66	298.14	608.8	128.61	97.69	226.3	537.48	395.07	932.55
2005-06	274.58	214.78	489.36	101.3	125.64	226.94	126.75	276.45	403.2	978.17	366.21	1344.38
2006-07	91.57	662.99	754.56	101.57	107.64	209.21	269.24	268.57	537.81	751.97	160.89	912.86
2007-08	330.7	325.62	656.32	273.25	494.02	767.27	1840.63	820.39	2661.02	1355.83	1533.97	2889.8
2008-09	457.91	365.1	823.01	311.89	365.87	677.76	414.8	372.64	787.44	431.09	434.59	865.68
2009-10	77.6	59.97	137.57	257.55	308.83	566.38	353.14	513.88	867.02	651.79	892.99	1544.78
2010-11	373.04	226.66	599.7	171.78	229.38	401.16	328.59	354.19	682.78	547.16	553.94	1101.1
2011-12	381.28	411.54	792.82	357.17	481.12	838.29	639.97	390.51	1030.48	1186.93	681.42	1868.35
2012-13	299.73	171.15	470.88	222.95	159.95	382.9	247.12	225.74	472.86	328.14	298.86	627
2013-14	64.76	181.23	245.99	250.36	380.16	630.52	1081.07	648.13	1729.2	570.16	1062.17	1632.33
2014-15	47.71	98.22	145.93	258.95	299.5	558.45	373.84	331.3	705.14	1571.63	1212.38	2784.01
2015-16	214.36	333.18	547.54	185.77	242.57	428.34	268.78	367.04	635.82	510.93	294.23	805.16
2016-17	290.4	176.54	466.94	174.37	95.69	270.06	152.46	159.52	311.98	313.56	328.23	641.79
2017-18	146.26	69.42	215.68	86.18	65.16	151.34	98.85	135.61	234.46	344.83	494.83	839.66
<b>Average</b>			<b>419.17</b>			<b>455.93</b>			<b>745.18</b>			<b>1283.21</b>

REALISATION OF MANACADAVU WEIR IN MC-ft													
Year	Oct I	Oct II	Oct Total	Nov I	Nov II	Nov Total	Dec I	Dec II	Dec Total	Jan I	Jan II	Jan Total	
2000-01	308	545	853	661	674	1335	641	888	1529	573	619	1192	
2001-02	568.92	423.71	992.63	345.93	403.66	749.59	642.21	616.96	1259.17	519.45	573.5	1092.95	
2002-03	468.7	351.13	819.83	208.46	247.68	456.14	669.2	573.27	1242.47	579.95	673.53	1253.48	
2003-04	266.09	374.8	640.89	401.61	548.72	950.33	128.15	599.62	727.77	291.8	201.18	492.98	
2004-05	128.81	495.14	623.95	531.82	621.72	1153.54	587.31	611.76	1199.07	430.38	640.26	1070.64	
2005-06	511.34	145.25	656.59	316.24	2951.44	3267.68	1768.36	1031.98	2800.34	700.68	689.1	1389.78	
2006-07	379.74	316.6	696.34	214.2	803.62	1017.82	700.58	699.2	1399.78	708.43	748.84	1457.27	
2007-08	1201.76	1851.78	3053.54	1087.58	553.09	1640.67	716.35	1143.71	1860.06	684.81	722.68	1407.49	
2008-09	502.87	663.41	1166.28	332.52	485.63	818.15	696.52	731.43	1427.95	662.29	669.73	1332.02	
2009-10	1270.33	585.51	1855.84	2461.9	985.41	3447.31	558.53	710.67	1269.2	665.18	711.61	1376.79	
2010-11	714.01	550.61	1264.62	840.99	2798.54	3639.53	1836.98	1016.14	2853.12	626.06	655.51	1281.57	
2011-12	591.39	609.29	1200.68	1982.62	1159.24	3141.86	894.02	691.78	1585.8	691.43	686.99	1378.42	
2012-13	309.96	559.21	869.17	279.24	276.4	555.64	557.5	408.8	966.3	444.37	467.21	911.58	
2013-14	664.78	520.07	1184.85	327.34	514.27	841.61	670.99	652.15	1323.14	645.83	702.73	1348.56	
2014-15	693.59	1372.14	2065.73	1170.84	656.94	1827.78	672.11	708.4	1380.51	730.2	754.24	1484.44	
2015-16	88.77	406.31	495.08	384.78	401.27	786.05	2047.75	708.47	2756.22	731.26	700.64	1431.9	
2016-17	215.24	363	578.24	210.17	218.4	428.57	228.68	239.82	468.5	127.3	128.03	255.33	
2017-18	638.17	485.78	1123.95	365.05	377.17	742.22	399.77	475.47	875.24	527.37	481.39	1008.76	
<b>Average</b>			<b>1118.96</b>			<b>1488.86</b>			<b>1495.76</b>			<b>1175.89</b>	



REALISATION OF MANACADAVU WEIR IN MCft													
Year	Feb I	Feb II	Feb Total	Mar I	Mar II	Mar Total	Apr I	Apr II	Apr Total	May I	May II	May Total	May Total
2000-01	446	398	844	641	33	674	80	99	179	25	12	37	
2001-02	401.17	120.22	521.39	269.95	101.72	371.67	67.51	3.1	70.61	26.62	40.37	66.99	
2002-03	306.32	236.58	542.9	178.32	115.88	294.2	8.61	11.9	20.51	16.8	9.29	26.09	
2003-04	229.22	0	229.22	0	0	0	0	0.61	0.61	23.98	30.12	54.1	
2004-05	539.72	599.95	1139.67	145.96	200.36	346.32	73.13	15.66	88.79	13.09	2.35	15.44	
2005-06	594.75	403.34	998.09	280.5	257.39	537.89	9.44	206.25	215.69	162.24	232.71	394.95	
2006-07	599.82	513.57	1113.39	375.54	217.12	592.66	190.3	155.48	345.78	11.91	431.29	443.2	
2007-08	680.12	558.62	1238.74	543.42	417.83	961.25	221.88	172.24	394.12	36.86	361.23	398.09	
2008-09	429.96	269.12	699.08	214.12	93.21	307.33	67.99	72.69	140.68	64.52	54.24	118.76	
2009-10	403.61	264.82	668.43	218.68	185.63	404.31	53.32	114.68	168	139.74	436.81	576.55	
2010-11	448.94	390.5	839.44	288.79	316.71	605.5	50.9	182.72	233.62	92.32	291.61	383.93	
2011-12	573.21	423.72	996.93	354.57	284.82	639.39	77.11	143.27	220.38	134.33	386.32	520.65	
2012-13	209.74	173.08	382.82	61.31	81.34	142.65	10.81	51.35	62.16	155.24	101.64	256.88	
2013-14	505.01	386.14	891.15	363.65	217.24	580.89	87.83	51.47	139.3	175.78	80.47	256.25	
2014-15	716.57	532.44	1249.01	366.81	158.61	525.42	128.57	204.43	333	325.18	358.17	683.35	
2015-16	456.08	448.07	904.15	320.85	179.2	500.05	115.47	68.17	183.64	169.82	390.3	560.12	
2016-	245.11	214.59	459.7	175.01	217.23	392.24	85.91	103.71	189.62	120.98	89.91	210.89	
2017-18	135.27	152.59	287.86	387.07	29.1	416.17	112.9	90.98	203.88	54.8	38.13	92.63	
<b>Average</b>			<b>778.11</b>			<b>460.66</b>			<b>177.19</b>			<b>283.10</b>	

**Average water available from PAP**

Month	Average water available from PAP	
	in MCft	in Mm <sup>3</sup>
June	419.17	11.87
July	455.93	12.91
August	745.18	21.10
September	1283.21	36.34
October	1118.96	31.69
November	1488.86	42.16
December	1495.76	42.35
January	1175.89	33.30
February	778.11	22.03
March	460.66	13.04
April	177.19	5.02
May	283.1	8.02
<b>Total</b>	<b>9882.02</b>	<b>279.83</b>

**LBC WATER REQUIREMENT**

**CALCULATION**

**Cropping Pattern**

LBC WATER REQUIREMENT			
Cropping Pattern			
Sl.No	Crop	Ayacut (in ha)	Remarks
1	Paddy	9600	2 crops ( First Crop from June to September and Second crop from October to February)
2	Coconu	1800	

ANNEXURE B

RAINFALL IN mm (MOOLATHARA STATION) - Annexure B													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall
2016	0	0	0	0	86.1								
2015	0	0	1.8	228.2	348.3	272	197.2	126.9	171.2	59.8	123	10.2	1538.60
2014	0	0	0.6	4.4	100.8	142.1	428.5	348.2	133.1	228.7	17	8	1411.40
2013	0	65	40	42.2	20	333.8	413.95	138.2	132.2	190.2	14.2	15.6	1405.35
2012	2	0	5	51	43.8	205.6	229.3	182.4	402.2	24.4	4	229.3	1196.60
2011	0	16.5	0	197.2	0	524.1	335.3	253.4	144	201.7	372.9	9.4	2054.50
2010	187.5	0	0	50.5	100.5	87.3	262.1	148.8	82.4	102	373.5	53.6	1448.20
2009	0	0	27.6	0	220	206.9	439.8	206	197.2	50.4	177.7	1.4	1527.00
2008	0	16	65.8	5	0	147.6	172.66	129.8	72	207.6	35.8	0	852.26
2007	0	3.2	0	101.4	80.1	254.4	385	193	207.2	174.6	23.2	81.4	1503.50
2006	71	0	198	62.6	133.63	240.2	296.1	227.7	158.9	69.3	374.1	0	1831.53
2005	0	0	16	398.2	105.2	232	737.4	232.5	172.8	109.4	164.7	213.1	2381.30
2004	0	0	0	0	24.7	252.6	218.9	207.1	38.1	100.1	39.1	0	880.60
2003	0	51	0	0	0	90	151.6	111.4	20.5	317.8	95	21.5	858.80
2002	0	0	5	0	48	91	94	156	11	193	66	14	678.00
2001	0	0	0	80	20	340	143	149	6	150	227	0	1115.00
2000	0	14	0	23	0	186	202	380	44	8	86	57	1000.00
1999	0	0	0	56	100	124	364	109	0	333	169	9	1264.00
1998	0	0	7	1	72	318	560	158	81	94	333	272	1896.00
1997	0	0	70	20	79	156	526	310	61	488	367	36	2113.00
1996	0	0	17	58	60	214	486	21	44	240	34	3	1177.00
1995	0	0	0	48	100	117	411	88	238	77	25	0	1104.00



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

Total Rainfall		
Sl No.	Year	Total Rainfall (in mm)
1	2015- 16	1046.4
2	2014-15	1883.9
3	2013-14	1343.95
4	2012-13	1444.41
5	2011-12	1942.6
6	2010 -11	1323.4
7	2009- 10	1617.9
8	2008-09	1013.06
9	2007-08	1405.6
10	2006-07	1551
11	2005-06	2327.13
12	2004-05	1375.3
13	2003-04	832.5
14	2002-03	676
15	2001 -02	1068
16	2000-01	1063
17	1999-00	1145
18	1998-99	1972
19	1997-98	2024
20	1996-97	1211
21	1995-96	1091

Total Rainfall		
Sl No.	Year	Total Rainfall
22	1994-95	2198
23	1993-94	949
24	1992-93	1302
25	1991-92	1277
26	1990-91	1431
27	1989-90	1183
28	1988-89	1410
29	1987-88	2153
30	1986-87	1725
31	1985-86	1443
32	1984-85	1846
33	1983-84	1418
34	1982-83	1328
35	1981-82	2056
36	1980-81	1928
37	1979-80	2063
38	1978-79	1687
39	1977-78	1639
40	1976-77	1083
41	1975-76	1470

Rainfall in Ascending order		
Sl No.	Year	Total
1	2002-03	676
2	2003-04	832.5
3	1993-94	949
4	2008-09	1013.06
5	2015- 16	1046.4
6	2000-01	1063
7	2001 -02	1068
8	1976-77	1083
9	1995-96	1091
10	1999-00	1145
11	1989-90	1183
12	1996-97	1211
13	1991-92	1277
14	1992-93	1302
15	2010 -11	1323.4
16	1982-83	1328
17	2013-14	1343.95
18	2004-05	1375.3
19	2007-08	1405.6
20	1988-89	1410
21	1983-84	1418

Rainfall in Ascending order		
Sl No.	Year	Total
22	1990-91	1431
23	1985-86	1443
24	2012-13	1444.41
25	1975-76	1470
26	2006-07	1551
27	2009- 10	1617.9
28	1977-78	1639
29	1978-79	1687
30	1986-87	1725
31	1984-85	1846
32	2014-15	1883.9
33	1980-81	1928
34	2011-12	1942.6
35	1998-99	1972
36	1997-98	2024
37	1981-82	2056
38	1979-80	2063
39	1987-88	2153
40	1994-95	2198
41	2005-06	2327.13

**Year of Effective Rainfall:**

<b>Year of Effective rainfall 1989-90</b>	
June	29
July	344
August	283
September	27
October	143
November	20
December	0
January	61
February	0
March	15
April	73
May	188
	1183

**Daily Eto as per IMD:**

<b>Month</b>	<b>Daily Eto as per IMD</b>
January	5.35
February	5.23
March	6.19
April	5.24
May	4.89
June	3.49
July	6.45
August	3.6
September	4.04
October	3.7
November	3.93
December	4.81



**RIGHT BANK CANAL WATER REQUIREMENT CALCULATION**

**ANNEXURE C-1**

TABULATION OF AYACUT DETAILS OF EXISTING CANAL ALIGNMENT		
SL.No	AYACUT DETAILS	AREA(Ha)
1	Paddy	
1.1	Paddy (First Crop)	260.00
1.2	Paddy (Second Crop)	275.00
2	Fallow paddy	80.00
3	Vegetable	200.00
3.1	Vegetable(First crop)	60.00
3.2	Vegetable(Second crop)	25.00
3.3	Vegetable(Third crop)	335.00
3.1	Coconut	2800.00
3.2	Banana	500.00
4	Tapioca	100.00
5	Groundnut	10.00
6	Foddercrops	250.00
7	Sugarcane	15.00
8	Tuber crops	14.00
9	Spices	25.00
10	Pulses	3.00
11	Floriculture	5.00

(This is inclusive of the entire Kozhinjampara Firka)

**Crop Water Requirement of Paddy 1st crop - 260Ha**

Crop stage	JUNE			JULY		AUG		SEP	OCT		
	15	10	5	16	15	16	15	30	15		
ET <sub>o</sub> (mm/day)	80mm for Ploughing and Nursery			2.97	3.15	3.15	3.84	3.84	3.86	3.48	
Kc value				1.05	1.05	1.05	1.05	1.05	1.05	0.9	0.9
ET crop (mm/day)				3.1185	3.3075	3.3075	4.032	4.032	4.032	3.474	3.132
Percolation (mm/day)				3	3	3	3	3	3	3	3
Daily water requirement (mm)				6.1185	6.3075	6.3075	7.032	7.032	7.032	6.474	6.132
Periodical water requirement (mm)	80.00	30.59	100.92	94.61	112.51	105.48	194.22	91.98			

**Crop Water Requirement of Paddy 2nd crop - 355Ha**

Crop stage	NOV			DEC		JAN		FEB	MAR	
No . of days	17	8	5	15	16	15	16	28	15	
ET <sub>o</sub> (mm/day)	80mm for Ploughing and 20mm for Nursery			3.31	3.4	3.4	3.58	3.58	4.62	4.45
Kc value				1.05	1.05	1.05	1.05	1.05	0.9	0.9
ET crop (mm/day)				3.4755	3.57	3.57	3.759	3.759	4.158	4.005
Percolation (mm/day)				3	3	3	3	3	3	3
Daily water requirement (mm)				6.4755	6.57	6.57	6.759	6.759	7.158	7.005
Periodical water requirement (mm)	80.00	32.38	98.55	105.12	101.39	108.14	200.42	105.08		

**Irrigation Requirement of Paddy 1st crop - 260 Ha**

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement {Water Requirement- Effective Rainfall} (mm)	Total Requirement in Mm <sup>3</sup> (for 260Ha) {Periodical Requirement*(260/100000)}
Jun	15	80.00	66.70	13.30	0.035
Jun	10				
Jun*	5	30.59	82.00	-51.41	0.000
July	31	195.53	218.90	-23.37	0.000
Aug	31	217.99	125.00	92.99	0.242
Sept	30	194.22	14.00	180.22	0.469
Oct	15	91.98	210.60	-118.62	0.000

**0.745**

\* Requirement can be met by rain

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **Irrigation Requirement of Paddy 2nd crop - 335Ha**

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm) {Water requirement- Effective Rainfall} (mm)	Total Requirement in Mm <sup>3</sup> (for 335 Ha) =Periodical Requirement*(335/10000)
Nov	17	80.00	45.7	34.300	0.115
Nov	8				
Nov	5	32.38	45.7	-13.323	0.000
Dec	31	203.67	6.6	197.070	0.660
Jan	31	209.53	6.6	202.929	0.680
Feb	28	200.42	0	200.424	0.671
Mar	15	105.08	4.2	100.875	0.338

**2.464**

### **Coconut - 2800Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day) Etc=Kc*Eto	Effective Rainfall (mm)	Periodical Requirement (mm) PR=Days*Etc	Total Requirement in Mm <sup>3</sup> (for 2800 Ha) TR =Periodical Requirement- Effective Rainfall*(2800/100000)
JAN	31	0.75	5.35	4.0125	6.6	124.388	3.298
FEB	28	0.75	5.23	3.9225	0	109.830	3.075
MAR	31	0.75	6.19	4.6425	4.2	143.918	3.912
APR	30	0.75	5.24	3.9300	121.2	117.900	0.000
MAY	31	0.75	4.89	3.6675	19.4	113.693	2.640
JUN	30	0.75	3.49	2.6175	209.6	78.525	0.000
JUL	31	0.75	6.45	4.8375	219.1	149.963	0.000
AUG	31	0.75	3.6	2.7000	211.9	83.700	0.000
SEP	30	0.75	4.04	3.0300	11.8	90.900	2.215
OCT	31	0.75	3.7	2.7750	210.6	86.025	0.000
NOV	30	0.75	3.93	2.9475	45.7	88.425	1.196
DEC	31	0.75	4.81	3.6075	6.6	111.833	2.947

365

**19.283**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **B. Vegetables - 100Ha**

#### **Crop Water Requirement of 1st crop**

Crop stage	Apr	May			June			July			Aug
No. of days	10	10	10	11	10	10	10	10	10	11	10
ET <sub>o</sub> (mm/day)	4.76	4.28	4.28	4.28	2.97	2.97	2.97	3.15	3.15	3.15	3.84
Kc value	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.86	2.568	2.568	2.568	1.782	1.782	1.782	1.89	1.89	1.89	2.3
Periodical water requirement (mm)	28.56	25.68	25.68	28.25	17.82	17.82	17.82	18.90	18.90	20.79	23.04

#### **Crop Water Requirement of 2nd crop**

Crop stage	Aug	Sep			Oct			Nov			Dec
No. of days	10	10	10	10	10	10	11	10	10	10	10
ET <sub>o</sub> (mm/day)	3.84	3.86	3.86	3.86	3.48	3.48	3.48	3.31	3.31	3.31	3.4
Kc value	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.3	2.316	2.316	2.316	2.088	2.088	2.088	1.986	1.986	1.986	2.04
Periodical water requirement (mm)	23.04	23.16	23.16	23.16	20.88	20.88	22.97	19.86	19.86	19.86	20.40

#### **Crop Water Requirement of 3rd crop**

Crop stage	Dec		Jan			Feb			Mar		
No. of days	10	11	10	10	11	10	10	8	10	10	11
ET <sub>o</sub> (mm/day)	3.4	3.4	3.58	3.58	3.58	4.62	4.62	4.62	4.45	4.45	4.45
Kc value	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.04	2.04	2.148	2.148	2.148	2.772	2.772	2.772	2.67	2.67	2.67
Periodical water requirement (mm)	20.40	22.44	21.48	21.48	23.63	27.72	27.72	22.18	26.70	26.70	29.37

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **B.1 Vegetables 1st crop - 60Ha**

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm)=Water Requirement-Effective Rainfall	Total Requirement in Mm3 (for 60Ha) {Periodical Requirement*60/100000}
April	10	28.56	121.2	0.00	0.000
May	10	25.68	19.4	6.28	0.004
	10	25.68	19.4	6.28	0.004
	11	28.25	19.4	8.85	0.005
June	10	17.82	209.6	0.00	0.000
	10	17.82	209.6	0.00	0.000
	10	17.82	209.6	0.00	0.000
July	10	18.90	219.1	0.00	0.000
	10	18.90	219.1	0.00	0.000
	11	20.79	219.1	0.00	0.000
Aug	10	23.04	211.9	0.00	0.000

**0.013**

### **B.2. Vegetables 2nd crop - 25Ha**

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm)=Water Requirement-Effective Rainfall	Total Requirement in Mm3 (for 25Ha) =Periodical Requirement*25/100000
Aug	10	23.04	211.9	0.00	0.000
Sep	10	23.16	11.8	11.36	0.003
	10	23.16	11.8	11.36	0.003
	10	23.16	11.8	11.36	0.003
Oct	10	20.88	210.6	0.00	0.000
	10	20.88	210.6	0.00	0.000
	11	22.97	210.6	0.00	0.000
Nov	10	19.86	45.7	0.00	0.000
	10	19.86	45.7	0.00	0.000
	11	19.86	45.7	0.00	0.000
Dec	10	20.40	6.6	13.80	0.003

**0.012**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Vegetables 3rd crop - 35Ha

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm)=Water Requirement-Effective Rainfall	Total Requirement in Mm3 (for 35Ha) =Periodical Requirement*35/100000
DEC	10	20.40	6.6	13.80	0.005
	11	22.44	6.6	15.84	0.006
JAN	10	21.48	6.6	14.88	0.005
	10	21.48	6.6	14.88	0.005
	11	23.63	6.6	17.03	0.006
FEB	10	27.72	0	27.72	0.010
	10	27.72	0	27.72	0.010
	8	22.18	0	22.18	0.008
MAR	10	26.70	4.2	22.50	0.008
	10	26.70	4.2	22.50	0.008
	11	29.37	4.2	25.17	0.009

**0.078**

### Banana - 500Ha

Season	Days	Kc	ETo (mm/day)	Etc. (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) PR=Days*Etc.	Total Requirement in Mm3 (for 500Ha) TR {Periodical Requirement-Effective Rainfall*(500/100000)}
NOV	30	0.5	3.93	1.9650	45.7	58.950	0.066
DEC	31	0.5	4.81	2.4050	6.6	74.555	0.000
JAN	30	0.5	5.35	2.6750	6.6	80.250	0.368
FEB	31	0.5	5.23	2.6150	0	81.065	0.405
MAR	31	0.5	6.19	3.0950	4.2	95.945	0.459
APR	28	0.5	5.24	2.6200	121.2	73.360	0.000
MAY	31	1.1	4.89	5.3790	19.4	166.749	0.737
JUN	30	1.1	3.49	3.8390	209.6	115.170	0.000
JUL	31	1.1	6.45	7.0950	219.1	219.945	0.000
AUG	30	1.1	3.6	3.9600	211.9	118.800	0.000
SEPT	31	1.1	4.04	4.4440	11.8	137.764	0.000
OCT	31	1	3.7	3.7000	210.6	114.700	0.000

365

**2.035**



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Ground Nut - 10Ha

#### **Crop Water Requirement of 1st crop**

Crop stage	MAY	JUN	JUL	AUG
No. of days	10	30	31	20
ET <sub>o</sub> (mm/day)	4.17	4.02	3.66	3.18
Kc value	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.5	2.412	2.196	1.908
Periodical water requirement (mm)	25.02	72.36	68.08	38.16

#### **Crop Water Requirement of 2nd crop**

Crop stage	SEP	OCT	NOV	DEC
No. of days	10	31	30	20
ET <sub>o</sub> (mm/day)	3.91	3.25	3.64	4.2
KC value	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.35	1.95	2.184	2.52
Periodical water requirement (mm)	23.46	60.45	65.52	50.40

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Ground Nut

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm) {Water Requirement-Effective Rainfall}	Actual Requirement in Mm <sup>3</sup> (for 10Ha) {Periodical Requirement*10/100000}
MAY	10	25.02	8.5	16.52	0.002
JUN	30	72.36	124	0	0.000
JULY	31	68.08	218.9	0	0.000
AUG	20	38.16	84	0	0.000

**0.002**

### Ground Nut

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm) {Water Requirement-Effective Rainfall}	Actual Requirement in Mm <sup>3</sup> (for 10Ha) {Periodical Requirement*10/100000}
SEP	10	23.46	11.8	11.66	0.001
OCT	30	60.45	210.6	0	0.000
NOV	31	65.52	45.7	19.82	0.002
DEC	20	50.40	6.6	43.80	0.004

**0.008**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **Fodder Grass - 250Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 250Ha) {Periodical Requirement-Effective Rainfall*(250/100000)}
JUN	30	1.1	3.49	3.8390	209.6	115.170	0.000
JUL	31	1.1	6.45	7.0950	219.1	219.945	0.000
AUG	31	1.1	3.6	3.9600	211.9	122.760	0.000
SEP	30	1.1	4.04	4.4440	11.8	133.320	0.304
OCT	31	1.1	3.7	4.0700	210.6	126.170	0.000
NOV	30	1.1	3.93	4.3230	45.7	129.690	0.210
DEC	31	1.1	4.81	5.2910	6.6	164.021	0.394
JAN	31	1.1	5.35	5.8850	6.6	182.435	0.440
FEB	28	1.1	5.23	5.7530	0	161.084	0.403
MAR	31	1.1	6.19	6.8090	4.2	211.079	0.517
APR	30	1.1	5.24	5.7640	121.2	172.920	0.129
MAY	31	1.1	4.89	5.3790	19.4	166.749	0.368

365

**2.764**

### **Tuber crops 14Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 14Ha) {Periodical Requirement-Effective Rainfall*(14/100000)}
jan	31	0.3	5.35	1.6050	6.6	49.755	0.006
feb	28	0.3	5.23	1.5690	0	43.932	0.006
mar	31	1.1	6.19	6.8090	4.2	211.079	0.029
apr	30	1.1	5.24	5.7640	121.2	172.920	0.007
may	31	1.1	4.89	5.3790	19.4	166.749	0.021
jun	30	1.1	3.49	3.8390	209.6	115.170	0.000
july	31	1.1	6.45	7.0950	219.1	219.945	0.000
aug	31	1.1	3.6	3.9600	211.9	122.760	0.000
sep	30	0.3	4.04	1.2120	11.8	36.360	0.003
oct	31	0.3	3.7	1.1100	210.6	34.410	0.000

273

**0.072**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **Tapioca-100Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 100Ha) {Periodical Requirement-Effective Rainfall*(100/100000)}
jan	31	0.3	5.35	1.6050	6.6	49.755	0.043
feb	28	0.3	5.23	1.5690	0	43.932	0.044
mar	31	1.1	6.19	6.8090	4.2	211.079	0.207
apr	30	1.1	5.24	5.7640	121.2	172.920	0.052
may	31	1.1	4.89	5.3790	19.4	166.749	0.147
jun	30	1.1	3.49	3.8390	209.6	115.170	0.000
july	31	1.1	6.45	7.0950	219.1	219.945	0.000
aug	31	1.1	3.6	3.9600	211.9	122.760	0.000
sep	30	0.3	4.04	1.2120	11.8	36.360	0.025
oct	31	0.3	3.7	1.1100	210.6	34.410	0.000

273

**0.518**

### **Sugarcane - 15Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 15Ha) {Periodical Requirement-Effective Rainfall*(15/100000)}
FEB	31	0.9	5.23	4.7070	0	145.917	0.022
MAR	31	0.9	6.19	5.5710	4.2	172.701	0.025
APR	28	0.9	5.24	4.7160	121.2	132.048	0.002
MAY	31	1.05	4.89	5.1345	19.4	159.170	0.021
JUN	30	1.05	3.49	3.6645	209.6	109.935	0.000
JUL	31	1.05	6.45	6.7725	219.1	209.948	0.000
AUG	30	1.05	3.6	3.7800	211.9	113.400	0.000
SEP	31	1.05	4.04	4.2420	11.8	131.502	0.018
OCT	31	1.05	3.7	3.8850	210.6	120.435	0.000
NOV	30	0.85	3.93	3.3405	45.7	100.215	0.008
DEC	31	0.85	4.81	4.0885	6.6	126.744	0.018

335

**0.114**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Pulses 3 Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 3Ha) {Periodical Requirement- Effective Rainfall*(3/100000)}
jan	31	1.15	3.58	4.1170	6.6	127.627	0.004
feb	28	1.15	4.62	5.3130	0	148.764	0.004
mar	31	1.15	4.45	5.1175	4.2	158.643	0.005
apr	30	1.15	4.76	5.4740	121.2	164.220	0.001
may	31	1.15	4.28	4.9220	19.4	152.582	0.004
jun	30	1.15	2.97	3.4155	209.6	102.465	0.000
july	31	1.15	3.15	3.6225	219.1	112.298	0.000
aug	31	1.15	3.84	4.4160	211.9	136.896	0.000
sep	30	1.15	3.86	4.4390	11.8	133.170	0.004
oct	31	1.15	3.48	4.0020	210.6	124.062	0.000

273

**0.018**

### Spices 25 Ha

Season	Days	Kc	ETo (mm/day)	Etc. (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc.}	Total Requirement in Mm3 (for 25Ha) {Periodical Requirement- Effective Rainfall*(25/100000)}
sep	30	0.6	3.86	2.3160	11.8	69.480	0.014
oct	31	0.6	3.48	2.0880	210.6	64.728	0.000
jan	31	0.6	3.58	2.1480	6.6	66.588	0.015
feb	28	0.6	4.62	2.7720	0	77.616	0.019
mar	31	0.6	4.45	2.6700	4.2	82.770	0.020
apr	30	0.6	4.76	2.8560	121.2	85.680	0.000
may	31	0.6	4.28	2.5680	19.4	79.608	0.015
jun	30	0.6	2.97	1.7820	209.6	53.460	0.000

242

**0.084**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Floriculture 5 Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 5Ha) {Periodical Requirement- Effective Rainfall*(5/100000)}
may	25	0.35	4.28	1.4980	19.4	37.450	0.001
jun	30	1	2.97	2.9700	209.6	89.100	0.000
july	31	1	3.15	3.1500	219.1	97.650	0.000
aug	31	1	3.84	3.8400	211.9	119.040	0.000
sep	25	0.35	3.86	1.3510	11.8	33.775	0.001

142

**0.002**

<b>Total requirement of Water in Mm3</b>		
	<b>Crop</b>	<b>Water Requirement (Mm3)</b>
<b>1</b>	<b>Paddy Area</b>	
1.a	Paddy (First crop)	0.745
1.b	Paddy (Second crop) & Fallow paddy	2.464
<b>3</b>	<b>Vegetable</b>	
3.a	Vegetable (First crop)	0.013
3.b	Vegetable (Second crop)	0.012
3.c	Vegetable (Third crop)	0.078
4	Coconut	19.283
5	Banana	2.035
6	Tapioca	0.518
7	Ground nut	0.008
8	Fodder Grass	2.764
9	Sugarcane	0.114
10	Tuber Crops	0.072
11	Pulses	0.018
12	Spices	0.084
13	Floriculture	0.002
		<b>28.210</b>



Extension of Moolathara Right Bank Canal from Korayar to Varattayar

Year	RAINFALL AS RECORDED AT ERITHYAMPATHY ISD FARM IN ERITHYAMPATHY PANCHAYATH (IN mm)												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1969	0.00	0.00	2.40	26.30	142.40	131.50	408.40	67.20	138.60	90.30	0.00	20.30	1027.40
1970	0.00	0.50	0.00	14.00	95.70	212.10	222.40	254.30	59.10	108.20	145.20	145.30	1256.80
1971	3.80	0.00	10.20	51.00	87.00	362.20	205.80	117.10	85.20	247.60	53.00	140.00	1362.90
1972	0.00	0.00	0.00	52.00	181.00	164.00	444.20	79.90	43.00	89.30	113.00	104.00	1270.40
1973	0.00	0.00	31.00	0.00	0.00	334.40	317.20	234.40	0.00	204.70	5.00	42.50	1169.20
1974	0.00	0.00	0.00	0.00	55.40	54.50	343.00	327.40	100.10	7.80	63.00	0.00	951.20
1975	14.60	0.00	41.60	53.00	184.00	408.50	130.80	301.60	181.60	29.00	5.20	1.00	1350.90
1976	0.00	0.00	0.00	106.20	90.00	33.60	133.20	123.30	87.00	220.00	231.40	0.00	1024.70
1977	0.00	26.60	2.00	77.80	60.50	232.90	257.20	162.00	128.80	181.00	255.70	0.00	1384.50
1978	0.00	0.00	0.00	87.80	17.30	244.20	242.60	249.40	15.40	57.60	110.50	45.60	1070.40
1979	0.00	59.00	21.00	68.00	119.80	288.00	330.70	264.10	50.80	57.80	363.80	0.00	1623.00
1980	0.00	0.00	1.20	43.60	196.10	349.10	321.40	189.20	107.80	105.00	151.00	0.00	1464.40
1981	0.00	0.00	72.00	12.00	62.40	309.20	228.70	317.10	128.70	142.00	37.00	2.00	1311.10
1982	0.00	0.00	48.00	62.50	24.50	227.00	229.00	105.00	63.00	99.00	1045.00	1.00	1904.00
1983	0.00	0.00	0.00	0.00	61.00	216.00	254.20	191.00	62.00	151.00	28.00	11.00	974.20
1984	4.00	20.00	36.00	22.00	19.20	361.80	263.80	130.00	36.00	158.00	15.00	36.00	1101.80
1985	27.00	58.00	0.00	75.00	11.00	348.50	133.00	122.00	42.00	27.00	68.00	0.00	911.50
1986	0.00	10.00	3.00	17.00	50.00	254.70	244.30	277.50	20.00	43.30	58.10	21.00	998.90
1987	0.00	0.00	50.00	24.00	89.00	126.00	131.40	127.00	42.00	65.00	119.00	131.00	904.40
1988	0.00	0.00	188.00	165.50	65.00	50.00	250.00	235.50	126.00	12.00	20.00	10.50	1122.50
1989	8.00	19.60	9.00	41.50	91.50	216.20	370.90	119.30	28.40	36.60	7.50	14.20	962.70
1990	14.20	0.00	25.80	74.60	122.70	209.60	219.10	211.90	11.80	210.60	45.70	6.60	1152.60

Extension of Moolathara Right Bank Canal from Korayar to Varattayar

RAINFALL AS RECORDED AT ERITHYAMPATHY ISD FARM IN ERITHYAMPATHY PANCHAYATH (IN mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	6.60	0.00	4.20	121.20	19.40	151.10	652.90	169.50	49.40	133.20	5.90	0.00	1313.40
1992	0.00	32.00	0.00	50.00	101.00	270.00	77.00	201.00	181.00	179.00	0.00	120.00	1211.00
1993	3.00	0.00	14.00	77.00	79.00	111.00	399.00	170.00	77.00	132.00	131.00	45.00	1238.00
1994	0.00	1.00	13.00	33.00	41.00	147.00	411.00	78.00	3.00	103.00	111.00	0.00	941.00
1995	0.00	8.00	40.00	130.00	71.00	272.00	321.00	102.00	71.00	88.00	111.00	0.00	1214.00
1996	15.00	6.00	57.00	184.00	88.00	172.00	445.00	146.00	85.00	334.00	88.00	108.00	1728.00
1997	0.00	0.00	42.00	0.00	155.00	97.00	367.00	257.00	18.00	188.00	358.00	64.00	1546.00
1998	0.00	0.00	0.00	45.00	60.00	330.00	502.00	170.00	93.00	113.00	153.00	104.00	1570.00
1999	0.00	5.00	8.00	31.00	63.00	277.00	377.00	129.00	2.00	44.00	0.00	0.00	936.00
2000	1.00	29.00	0.00	98.00	0.00	211.00	272.00	615.00	63.00	30.00	92.00	34.00	1445.00
2001	0.00	20.00	0.00	40.00	58.00	260.00	167.00	163.00	42.00	123.00	239.00	33.00	1145.00
2002	0.00	0.00	38.00	5.00	56.00	252.00	78.50	163.00	26.80	241.50	59.00	0.00	919.80
2003	0.00	27.00	91.00	60.00	0.00	117.00	191.20	114.40	16.60	214.50	0.00	0.00	831.70
2004	0.00	0.00	29.00	54.20	244.30	469.20	241.50	276.20	66.40	90.40	29.00	0.00	1500.20
2005	0.00	0.00	0.40	92.20	40.20	205.70	546.10	178.30	130.00	73.80	64.50	29.30	1360.50
2006	51.00	0.00	133.50	10.30	204.50	203.80	259.40	159.00	52.00	130.00	70.00	80.00	1353.50
2007	0.00	0.00	0.00	13.00	36.00	408.00	331.00	187.50	195.50	96.50	1.50	1.50	1270.50
2008	0.00	12.50	122.50	21.50	0.50	219.10	241.00	42.20	190.00	343.00	11.00	0.50	1203.80
2009	0.00	0.00	6.00	42.50	19.00	69.50	468.50	119.50	41.00	171.00	226.50	0.00	1163.50
2010	0.00	0.00	8.50	140.50	25.50	140.00	165.00	0.00	0.00	0.00	191.51	7.30	678.31

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

TOTAL ANNUAL RAINFALL		
Sl No:	Year	Total Raifall (mm)
1	69-70	966.5
2	70-71	1298.6
3	71-72	1443.9
4	72-73	1068.4
5	73-74	1193.6
6	74-75	1189
7	75-75	1253.9
8	76-77	995.4
9	77-78	1322.7
10	78-79	1233.1
11	79-80	1596.1
12	80-81	1369.9
13	81-82	1299.7
14	82-83	1830
15	83-84	1014.4
16	84-85	1171.6
17	85-86	820.5
18	86-87	1081.9
19	87-88	1159.9
20	88-89	873.6
21	89-90	1030.4

TOTAL ANNUAL RAINFALL		
Sl No:	Year	Total Raifall (mm)
22	90-91	1066.7
23	91-92	1345
24	92-93	1201
25	93-94	1153
26	94-95	1102
27	95-96	1315
28	96-97	1575
29	97-98	1454
30	98-99	1572
31	99-00	957
32	00-01	1435
33	01-02	1126
34	02-03	998.8
35	03-04	981.2
36	04-05	1305.5
37	05-06	1627
38	06-07	1003.2
39	07-08	1378.5
40	08-09	1114.3
41	09-10	1270.5

RAINFALL IN ASCENDING ORDER		
Sl No:	Year	Total Raifall (mm)
1	85-86	820.5
2	88-89	873.6
3	99-00	957
4	69-70	966.5
5	03-04	981.2
6	76-77	995.4
7	02-03	998.8
8	06-07	1003.2
9	83-84	1014.4
10	89-90	1030.4
11	90-91	1066.7
12	72-73	1068.4
13	86-87	1081.9
14	94-95	1102
15	08-09	1114.3
16	01-02	1126
17	93-94	1153
18	87-88	1159.9
19	84-85	1171.6
20	74-75	1189
21	73-74	1193.6

RAINFALL IN ASCENDING ORDER		
Sl No:	Year	Total Raifall (mm)
22	92-93	1201
23	78-79	1233.1
24	75-75	1253.9
25	09-10	1270.5
26	70-71	1298.6
27	81-82	1299.7
28	04-05	1305.5
29	95-96	1315
30	77-78	1322.7
31	91-92	1345
32	80-81	1369.9
33	07-08	1378.5
34	00-01	1435
35	71-72	1443.9
36	97-98	1454
37	98-99	1572
38	96-97	1575
39	79-80	1596.1
40	05-06	1627
41	82-83	1830

**Year of Effective Rainfall:**

<b>YEAR O F EFFECTIVE RAINFALL 1990-91</b>	
June	209.6
July	219.1
August	211.9
September	11.8
October	210.6
November	45.7
December	6.6
January	6.6
February	0
March	4.2
April	121.2
May	19.4
	1066.7

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Extension of MRBC Canal from Korayar to Varattayar WATER REQUIREMENT CALCULATION FOR PROPOSED ALIGNMENT

#### Coconut - 1900Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day) Etc=Kc* Eto	Effective Rainfall (mm)	Periodical Requirement (mm) PR=Days *Etc	Total Requirement in Mm3 (for 1900 Ha) TR =Periodical Requirement- Effective Rainfall *(1900/ 100000 )	Total Requirement in Mm3 (for 700 Ha) TR =Periodical Requirement- Effective Rainfall*( 700/100 000)
JAN	31	0.75	5.35	4.0125	6.6	124.388	2.238	0.825
FEB	28	0.75	5.23	3.9225	0	109.830	2.087	0.769
MAR	31	0.75	6.19	4.6425	4.2	143.918	2.655	0.978
APR	30	0.75	5.24	3.9300	121.2	117.900	0.000	0.000
MAY	31	0.75	4.89	3.6675	19.4	113.693	1.792	0.660
JUN	30	0.75	3.49	2.6175	209.6	78.525	0.000	0.000
JUL	31	0.75	6.45	4.8375	219.1	149.963	0.000	0.000
AUG	31	0.75	3.6	2.7000	211.9	83.700	0.000	0.000
SEP	30	0.75	4.04	3.0300	11.8	90.900	1.503	0.554
OCT	31	0.75	3.7	2.7750	210.6	86.025	0.000	0.000
NOV	30	0.75	3.93	2.9475	45.7	88.425	0.812	0.299
DEC	31	0.75	4.81	3.6075	6.6	111.833	1.999	0.737
<b>365</b>							<b>13.085</b>	<b>4.821</b>

**Vegetables - 150Ha**

**Crop Water Requirement of 1st crop**

Crop stage	MAY	JUN			JUL			AUG	
No. of days	11	10	10	10	10	10	11	10	10
ET <sub>o</sub> (mm/day)	4.28	2.97	2.97	2.97	3.15	3.15	3.15	3.84	3.84
Kc value	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.568	1.782	1.782	1.782	1.89	1.89	1.89	2.304	2.304
Periodical water requirement (mm)	28.25	17.82	17.82	17.82	18.90	18.90	20.79	23.04	23.04

**Crop Water Requirement of 2nd crop 80Ha**

Crop stage	SEPT	OCT			NOV			DEC	
No. of days	10	10	10	11	10	10	10	10	10
ET <sub>o</sub> (mm/day)	3.86	3.48	3.46	3.46	3.31	3.31	3.31	3.4	3.4
Kc value	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ET crop (mm/day)	2.316	2.088	2.076	2.076	1.986	1.986	1.986	2.04	2.04
Periodical water requirement (mm)	23.16	20.88	20.76	22.84	19.86	19.86	19.86	20.40	20.40



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Vegetables 1st crop - 150Ha

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm)=Water Requirement-Effective Rainfall	Total Requirement in Mm3 (for 150Ha) =Periodical Requirement*150/100000
May	11	28.25	19.4	8.85	0.013
Jun	10	17.82	209.6	0.00	0.000
	10	17.82	209.6	0.00	0.000
	10	17.82	209.6	0.00	0.000
July	10	18.90	219.1	0.00	0.000
	10	18.90	219.1	0.00	0.000
	11	20.79	219.1	0.00	0.000
Aug	10	23.04	211.9	0.00	0.000
	10	23.04	211.9	0.00	0.000

**0.013**

### Vegetables 2nd crop - 80Ha

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm)=Water Requirement-Effective Rainfall	Total Requirement in Mm3 (for 80Ha) =Periodical Requirement*80/100000
Sept	10	23.16	11.8	11.36	0.009
Oct	10	20.88	210.6	0.00	0.000
	10	20.76	210.6	0.00	0.000
	11	22.84	210.6	0.00	0.000
Nov	10	19.86	45.7	0.00	0.000
	10	19.86	45.7	0.00	0.000
	10	19.86	45.7	0.00	0.000
Dec	10	20.40	6.6	13.80	0.011
	10	20.40	6.6	13.80	0.011

**0.031**

**. Banana - 200H**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm)	Total Requirement in Mm3 (for	Total Requirement in Mm3 (for
SEP	30	0.5	4.04	2.02	11.8	60.60	0.10	0.20
OCT	31	0.5	3.7	1.85	210.6	57.35	0.00	0.00
NOV	30	0.5	3.93	1.97	45.7	58.95	0.03	0.05
DEC	31	0.5	4.81	2.41	6.6	74.56	0.14	0.27
JAN	31	0.5	5.35	2.68	6.6	82.93	0.15	0.31
FEB	28	0.5	5.23	2.62	0	73.22	0.15	0.29
MAR	31	1.1	6.19	6.81	4.2	211.08	0.41	0.83
APR	30	1.1	5.24	5.76	121.2	172.92	0.10	0.21
MAY	31	1.1	4.89	5.38	19.4	166.75	0.29	0.59
JUN	30	1.1	3.49	3.84	209.6	115.17	0.00	0.00
JUL	31	1.1	6.45	7.10	219.1	219.95	0.00	0.00
AUG	31	1	3.6	3.60	211.9	111.60	0.00	0.00
<b>365</b>							<b>1.37</b>	<b>2.74</b>

**Ground Nut - 35Ha**

**Crop Water Requirement of 1st crop**

Crop stage	MAY	JUN	JUL	AUG
No. of days	10	30	31	20.00
ETo (mm/day)	4.17	4.02	3.66	3.18
Kc value	0.6	0.6	0.6	0.60
ET crop (mm/day)	2.502	2.412	2.196	1.91
Periodical water requirement (mm)	25.02	72.36	68.08	38.16

**Crop Water Requirement of 2nd crop 35 Ha**

Crop stage	SEP	OCT	NOV	DEC
No. of days	10	31	30	20.00
ET <sub>o</sub> (mm/day)	3.91	3.25	3.64	4.20
KC value	0.6	0.6	0.6	0.60
ET crop (mm/day)	2.346	1.95	2.184	2.52
Periodical water requirement (mm)	23.46	60.45	65.52	50.40

**Ground Nut 2nd crop**

Month	Days	Water Requirement (mm)	Effective Rainfall (mm)	Periodical Requirement (mm) {Water Requirement-Effective Rainfall}	Actual Requirement in Mm <sup>3</sup> (for 35Ha) {Periodical Requirement*35/100000}
Sept	10	23.46	5.00	18.46	0.01
Oct	31	60.45	82.00	0	0.00
Nov	30	65.52	39.10	26.42	0.01
Dec	20	50.40	0.00	50.40	0.02

**0.03**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### **Mango - 40Ha**

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement {Days*Etc}	Total Requirement in Mm3 (for 40Ha) {Periodical Requirement- Effective Rainfall*(40/100000)}
JUN	30	0.9	3.49	3.14	209.6	94.23	0.00
JUL	31	0.9	6.45	5.81	219.1	179.96	0.00
AUG	31	0.9	3.6	3.24	211.9	100.44	0.00
SEP	30	0.9	4.04	3.64	11.8	109.08	0.04
OCT	31	0.9	3.7	3.33	210.6	103.23	0.00
NOV	30	0.9	3.93	3.54	45.7	106.11	0.02
DEC	31	0.9	4.81	4.33	6.6	134.20	0.05
JAN	31	0.9	5.35	4.82	6.6	149.27	0.06
FEB	28	0.9	5.23	4.71	0	131.80	0.05
MAR	31	0.9	6.19	5.57	4.2	172.70	0.07
APR	30	0.9	5.24	4.72	121.2	141.48	0.01
MAY	31	0.9	4.89	4.40	19.4	136.43	0.05

365

**0.35**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### F. Fodder Grass - 350Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 350Ha) {Periodical Requirement-Effective Rainfall*(350/100000)}	Total Requirement in Mm3 (for 200Ha) {Periodical Requirement-Effective Rainfall*(200/100000)}
JUN	30	1.1	3.49	3.84	209.6	115.17	0.00	0.00
JUL	31	1.1	6.45	7.10	219.1	219.95	0.00	0.00
AUG	31	1.1	3.6	3.96	211.9	122.76	0.00	0.00
SEP	30	1.1	4.04	4.44	11.8	133.32	0.43	0.24
OCT	31	1.1	3.7	4.07	210.6	126.17	0.00	0.00
NOV	30	1.1	3.93	4.32	45.7	129.69	0.29	0.17
DEC	31	1.1	4.81	5.29	6.6	164.02	0.55	0.31
JAN	31	1.1	5.36	5.90	6.6	182.78	0.62	0.35
FEB	28	1.1	5.23	5.75	0	161.08	0.56	0.32
MAR	31	1.1	6.19	6.81	4.2	211.08	0.72	0.41
APR	30	1.1	5.24	5.76	121.2	172.92	0.18	0.10
MAY	31	1.1	4.89	5.38	19.4	166.75	0.52	0.29
365							<b>3.87</b>	<b>2.21</b>

### Tuber crops - Cassava - 150Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 150Ha) {Periodical Requirement-Effective Rainfall*(150/100000)}
MAY	31	0.3	4.89	1.47	19.4	45.48	0.04
JUN	30	0.3	3.49	1.05	209.6	31.41	0.00
JUL	31	1.1	6.45	7.10	219.1	219.95	0.00
AUG	31	1.1	3.6	3.96	211.9	122.76	0.00
SEP	30	1.1	4.04	4.44	11.8	133.32	0.18
OCT	31	1.1	3.7	4.07	210.6	126.17	0.00
NOV	30	1.1	3.93	4.32	45.7	129.69	0.13
DEC	31	1.1	4.81	5.29	6.6	164.02	0.24
JAN	31	0.3	5.35	1.61	6.6	49.76	0.06
FEB	28	0.3	5.23	1.57	0	43.93	0.07
273							<b>0.71</b>

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Sugarcane - 50Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 50Ha) {Periodical Requirement- Effective Rainfall*(50/100000)}
DEC	31	0.9	4.81	4.33	6.6	134.20	0.06
JAN	31	0.9	5.35	4.82	6.6	149.27	0.07
FEB	28	0.9	5.23	4.71	0	131.80	0.07
MAR	31	1.05	6.19	6.50	4.2	201.48	0.10
APR	30	1.05	5.24	5.50	121.2	165.06	0.02
MAY	31	1.05	4.89	5.13	19.4	159.17	0.07
JUN	30	1.05	3.49	3.66	209.6	109.94	0.00
JUL	31	1.05	6.45	6.77	219.1	209.95	0.00
AUG	31	1.05	3.6	3.78	211.9	117.18	0.00
SEP	30	0.85	4.04	3.43	11.8	103.02	0.05
OCT	31	0.85	3.7	3.15	210.6	97.50	0.00

335

**0.44**

### Nutmeg - 40Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 40Ha) {Periodical Requirement- Effective Rainfall*(40/100000)}
JUN	30	0.85	3.49	2.97	209.6	89.00	0.00
JUL	31	0.85	6.45	5.48	219.1	169.96	0.00
AUG	31	0.85	3.6	3.06	211.9	94.86	0.00
SEP	30	0.85	4.04	3.43	11.8	103.02	0.04
OCT	31	0.85	3.7	3.15	210.6	97.50	0.00
NOV	30	0.85	3.93	3.34	45.7	100.22	0.02
DEC	31	0.85	4.81	4.09	6.6	126.74	0.05
JAN	31	0.85	5.35	4.55	6.6	140.97	0.05
FEB	28	0.85	5.23	4.45	0	124.47	0.05
MAR	31	0.85	6.19	5.26	4.2	163.11	0.06
APR	30	0.85	5.24	4.45	121.2	133.62	0.00
MAY	31	0.85	4.89	4.16	19.4	128.85	0.01

365

**0.29**

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Araconut -20Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 20Ha) {Periodical Requirement- Effective Rainfall*(20/100000)}
SEP	30	0.9	4.04	3.64	11.8	109.08	0.02
OCT	31	0.9	3.7	3.33	210.6	103.23	0.00
NOV	30	0.9	3.93	3.54	45.7	106.11	0.01
DEC	31	0.9	4.81	4.33	6.6	134.20	0.03
JAN	31	0.9	5.35	4.82	6.6	149.27	0.03
FEB	28	0.9	5.23	4.71	0	131.80	0.03
MAR	31	0.9	6.19	5.57	4.2	172.70	0.03
APR	30	0.9	5.24	4.72	121.2	141.48	0.00
MAY	31	0.9	4.89	4.40	19.4	136.43	0.02
JUN	30	0.9	3.49	3.14	209.6	94.23	0.00
JUL	31	0.9	6.45	5.81	219.1	179.96	0.00
AUG	31	0.9	3.6	3.24	211.9	100.44	0.00

365

**0.17**



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Cocoa - 40Ha

Season	Days	Kc	Eto (mm/day)	Etc (mm/day)	Effective Rainfall (mm)	Periodical Requirement (mm) {Days*Etc}	Total Requirement in Mm3 (for 40Ha) {Periodical Requirement- Effective Rainfall*(40/100000)}
JUN	30	1.05	3.49	3.66	209.6	109.94	0.00
JUL	31	1.05	6.45	6.77	219.1	209.95	0.00
AUG	31	1.05	3.6	3.78	211.9	117.18	0.00
SEP	30	1.05	4.04	4.24	11.8	127.26	0.05
OCT	31	1.05	3.7	3.89	210.6	120.44	0.00
NOV	30	1.05	3.93	4.13	45.7	123.80	0.03
DEC	31	1.05	4.81	5.05	6.6	156.57	0.06
JAN	31	1.05	5.35	5.62	6.6	174.14	0.07
FEB	28	1.05	5.23	5.49	0	153.76	0.06
MAR	31	1.05	6.19	6.50	4.2	201.48	0.08
APR	30	1.05	5.24	5.50	121.2	165.06	0.02
MAY	31	1.05	4.89	5.13	19.4	159.17	0.06

365

**0.42**

**Coconut with intercrops**

Crop	Area	Water requirement	Unit (Ha)	Total
Coconut	700	13.085	1900.00	4.82
Nut meg	40	0.286	40.00	0.29
Arecanut	20	0.173	20.00	0.17
Fodder grass	200	3.871	350.00	2.21
Banana	400	1.371	200.00	2.74
Cocoa	40	0.418	40.00	0.42
<b>Sub total</b>	<b>1400</b>			<b>10.65</b>

<b>Total requirement of Water in Mm3</b>		
2	Coconut	13.09
3	Coconut with inter cops	10.65
4	Vegetables	
4.a	Vegetables -1st crop	0.01
4.b	Vegetables -2nd crop	0.03
5	Banana	1.37
6	Groundnut	
6.a	Groundnut -1st crop	0.01
6.b	Groundnut -2nd crop	0.03
7	Mango	0.35
8	Fodder crops	3.87
9	Sugarcane	0.44
10	Tuber crops	0.71
	<b>Total</b>	<b>30.56</b>

**7.2 DESIGN OF PROJECT COMPONENTS**

- Bed Level of MRBC at Ch. 0.00m - +182.000
- Bed level of MRBC at Ch. 15,630m - +175.740
- New Alignment (Korayar to Varattayar)- 6.430 km
- Varattayar to Velanthavalam- 10.478 km

<b>Bed level of river where canal crosses the river</b>		<b>Elevation at which pipeline crosses the river</b>
Korayar	+157.650	16.55m
Varattayar	+164.750	7.05m
Walayar river at Nattu Iyyer system	+168.750	0.50m

**Canal System**

The main canal up to Korayar is already lined. The 6430m long. The canals are designed for the peak discharge with extra provision for rush irrigation. However, the MRBC from Korayar up to Varattayar is provided a uniform section. This is to divert the water coming in the Moolathara Regulator in excess of actual requirements during a particular time like November, December to fill the check dams in the Korayar and Varattayar rivers and the ponds and Eries in Kozhinjampara Firka. The right bank canal from Moolathara Regulator takes off at +182.00m and command an ayacut of 10,146 Ha. of Kozhinjampara area spreading over the three Panchayats of Kozhinjampara, Eruthiampathy and Vadakarapathy. The canal up to Korayar has already been constructed. This portion is having sufficient capacity for carrying water for the proposed ayacut.

An alteration in the old alignment of the MRBC has been done from ch. 2013m. This has been done to avoid the huge tunnel coming in the alignment. As per this the existing Valiyavallampathy branch canal which off takes from Ch. 2013 of MRBC has been widened up to Ch. 12075m to form the MRBC. From the Ch. 12075, the canal is connected to the old alignment of Ch. 6100 m and from there the canal continues. The alternate alignment has got the great advantages of carrying full discharge up to the Kozhinjampara area also, where the drinking water problem is too much.

### Reach 1 - Ch - O m to 16125 m

This is the completed portion of canal of MRBC. The designed discharge of the canal in this reach is 22.00 m<sup>3</sup>/sec at full supply depth of 3.00 m and is designed to carry water for irrigation for 10,146 ha plus facility to carry additional water to the 31 check dams in Korayar and Varattayar and the 68 and odd ponds and eris available in this area, whenever additional water is available at Moolathara Regulator.

Steel framed pedestals as supporting structures at 15 m intervals are provided where the pipe runs over ground and at the aqueduct across Korayar River. ISHB 200 for main columns, ISMC 100 for horizontal braces and ISA 60x60x10 as diagonals are used for pedestals. The height of structure varies from 7.5m to 15m. RCC M25 grade is used for the Raft foundation of the structure. Structural steel work includes riveted, bolted or welded built up sections for framed pedestal work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer

## **8. FINANCIAL ESTIMATES & COST PROJECTIONS**

The analysis of rates of various items were worked out taking into consideration of the cost of materials, its carriage, handling, storing, labour, share of machines involved etc. As per Government Order vide GO (Rt) No. 112/2014/WRD Thiruvananthapuram dated 31-1-2014, it has been directed to adopt CPWD data and National Building Code guidelines for the works undertaken by Irrigation Department, Government of Kerala. The rates were worked out by using CPWD specifications based on DSR 2016. The current prevailing cost index of 31.06 % has been used for arriving at the rates. The detailed estimate is prepared in PRICE software and is appended.

**The Total Estimated Cost of the project including provision for 12% GST is Rs- 282.83 Crores.**

Great importance is being given for agricultural development in the state and as such, sufficient funds are allotted for irrigation projects. The on-going projects are nearing completion and sufficient funds are available for the execution of the project. The funding for the project is proposed to be obtained from Kerala Infrastructure Development Fund (KIIFB).

The construction of the canal system does require highly sophisticated items of machinery and it is proposed to utilize the available machineries inside India. The machineries proposed to be purchased can be procured from reputed firms in India. Therefore, the problem of Foreign Exchange does not arise.

## **9. REVENUE STREAMS**

The small and marginal farmers will invest a part of their incremental income on consumer goods, a part on farm development and a part to pay-off the debt owes to the financial institutions. This in return will result overall development of the area.

Significant indirect benefit would flow from the project with increased availability of drinking water, saving in irrigation water by adopting drip irrigation, filling of tanks and ponds, improvement in land value, rural income, social value and increased agricultural activities which in turn will contribute to revenue.

## 10. COST BENEFIT ANALYSIS & INVESTMENT CRITERIA

### a. Expected Benefits (Direct) Income from Production

Implementing Micro Irrigation / Drip Irrigation in the Command area will double the yield from crops with 70% savings in Irrigation water. The irrigation and command area development activities under the project will lead to increase in the production and productivity and a change in the present cropping pattern in agriculture sector. Besides the provision of irrigation facilities, the project will ensure availability of necessary inputs like seeds, fertilizers, insecticides etc. in the required quantities. In the assumption that required quantities of input will be available, yield levels have been projected for various years under the "with" project situation. The crop-wise net returns per ha. is taken for CB ratio calculation.

### b. Indirect Benefit

Significant indirect benefit would flow from the project with increased availability of drinking water, saving in irrigation water by adopting drip irrigation, filling of tanks and ponds, improvement in land value, rural income, social value and increased agricultural activities.

The economic analysis has been worked out taking into account the direct benefits accrued from the agricultural production and other indirect benefits in the first five years. The cost benefit ratio works out to **0.31**.



## COST – BENEFIT RATIO

Extension of MRBC Canal from Korayar to Varattayar				
COST BENEFIT RATIO				
A	COST OF CULTIVATION			
Sl.No	Name of Crop	Area (Ha)	Cost of Cultivation per hect	Amount
1	Coconut	1900	49528	9,41,03,200.00
2	Coconut with intercrop (Nutmeg, Cocoa, Banana, Fodder grass & Aracanut)	700	89287	6,25,00,900.00
3	Vegetables			
	<b>First crop</b>	150	L.S	37,50,000.00
	<b>Second crop</b>	80	L.S	20,00,000.00
4	Banana	200	160230	3,20,46,000.00
5	Groundnut			
	<b>First crop</b>	35	L.S	10,00,000.00
	<b>Second crop</b>	35	L.S	10,00,000.00
6	Mango	40	L.S	14,00,000.00
7	Fodder crops	350	L.S	3,00,000.00
8	Tuber crops	150	93439	1,40,15,850.00
9	Sugarcane	50	L.S	35,00,000.00
	<b>TOTAL</b>	<b>3690</b>		<b>21,56,15,950.00</b>

AGRICULTURAL PRODUCE BEFORE IRRIGATION						
	DESCRIPTION	AREA	YIELD PER HECT (kg)	TOTAL YIELD (Kg)	Rate/Kg	Amount
1	Coconut	1900	2600	4940000	31.80	157092000
2	Coconut with intercrop (Nutmeg, Cocoa, Banana, Foddergrass & Aracanut)					
	COCONUT	700	2600	1820000	31.80	57876000
	Nutmeg	40	125	5000	450.00	2250000
	Cocoa	40	400	16000	174.00	2784000
	Foddergrass	200	10,000	2000000	2.50	5000000
	aracanut	20	19500	390000	233.00	90870000
	BANANA	400	25000	10000000	40.00	400000000
3	Vegetables					
	<b>First crop</b>	150	21750	3262500	30.00	97875000
	<b>Second crop</b>	80	21750	1740000	35.00	60900000
4	Banana	200	25000	5000000	40.00	200000000
5	Groundnut					
	<b>First crop</b>	35	844	29540	50.00	1477000
	<b>Second crop</b>	35	844	29540	55.00	1624700
6	Mango	40	8000	320000	60.00	19200000
7	Fodder crops	350	40000	14000000	2.50	35000000
8	Tuber crops	150	25000	3750000	16.00	60000000
9	Sugarcane	50	7200	360000	2.50	900000
						<b>1192848700</b>

AGRICULTURAL PRODUCE AFTER IRRIGATION						
	DESCRIPTION	AREA	YIELD PER HECT	TOTAL YIELD	Rate/Kg	Amount
1	Coconut	1900	5236	9948400	31.80	316359120
2	Coconut with intercrop (Nutmeg,Cocoa,Banana, Foddergrass & Aracanut)					
	COCONUT	700	5236	3665200	31.80	116553360
	nutmeg	40	250	10000	450.00	4500000
	cocoa	40	785	31400	174.00	5463600
	Foddergrass	200	20000	4000000	2.50	10000000
	aracanut	20	39000	780000	233.00	181740000
	BANANA	400	50000	20000000	40.00	800000000
3	Vegetables					
	<b>First crop</b>	150	43500	6525000	30.00	195750000
	<b>Second crop</b>	80	30000	2400000	35.00	84000000
4	Banana	200	50000	10000000	40.00	400000000
5	Groundnut					
	<b>First crop</b>	35	1356	47460	50.00	2373000
	<b>Second crop</b>	35	1356	47460	55.00	2610300
6	Mango	40	16000	640000	60.00	38400000
7	Fodder crops	350	80000	28000000	2.50	70000000
8	Tuber crops	150	45000	6750000	16.00	108000000
9	sugarcane	50	11379	568950	2.50	1422375
						<b>2337171755</b>

BENEFIT		
Value of agricultural produce AFTER Irrigation		2337171755
Value of agricultural produce BEFORE Irrigation		1192848700
Net income from produce, after Irrigation		1144323055
Cost of cultivation		21,56,15,950
Net value of produce after Irrigation		928707105
Present Benefit		928707105
<b>COST</b>		
Capital cost		2828400000
Present Cost (10% of the capital cost)		282840000
Capital cost		
<b>Cost - Benefit Ratio</b>	Present cost/Present benefit	<b>0.30</b>

## Sources

1. Report on cost of cultivation of Important crops in Kerala 2016-17  
(Department of Economics and Statistics 2019) - P96 -106
2. Report from Director General, Economics and Statistics Department
3. Technical Bulletin from CSIR, Central Ground Water Commission
4. Web site from Kerala Agricultural University
5. National Horticultural Board, Ministry of Agriculture, Government of India
6. Data from Department of Agriculture, Government of Kerala
7. Statistical Hand Book Kerala 2017  
(Department of Economics and Statistics, Government of Kerala)
8. Local Market and Public Enquiry

## **11. ENVIRONMENTAL & SUSTAINABILITY ASPECTS**

No impact to the environment is anticipated due to construction of this structure. Since there is no damage to forest the project does not affect wildlife. There is no need of resettlement and rehabilitation as the project does not demand evacuation. Hence environmental impact assessment study for this project is not necessary. This will enhance economic growth as well as living standard of the rural population.

## **12. RISK ASSESSMENT AND MITIGATION MEASURES**

All design aspects have been looked into and hence here is no risk of any Technical lag. Besides there is an assurance from local people to make available sufficient land for the project. Certain area has been free surrendered by the public in MRB Canal areas upto Ch. 16125M and from there up to Varattayar the land acquisition is nearing completion. Hence there is no risk of delay or cost escalation on this account.

There is a need to conduct continuous risk analysis and assessment throughout the period of the contract in order effectively to manage the risks that arise. Risk management during the contract period comprises those activities associated with identifying and controlling the risks that may potentially affect the successful fulfillment of the contract. Risks to the contract include such issues as:

- Lack of capacity of the supplier, particularly if there are significant increases in demand
- Reduction in demand leading to higher unit costs borne by the supplier
- An event which causes an increase in the total of the price to the purchaser
- An event which causes a programme delay
- Supplier staff changes
- Changes to the supplier 's business objectives
- Deterioration in the supplier 's financial standing
- Demand changes that cannot be met by the supplier
- Deterioration of quality
- Market fluctuations for commodities.

When a risk is anticipated or perceived, its management involves the parties working together to identify where the responsibility for it lies, methods of minimizing it and how the risk will be managed. Issues that will be considered for effective management will include:

- Establishing a binding process to encourage early warning of issues such as those mentioned above, as soon as either a supplier or the purchaser becomes aware of them
- Identifying the party best able to control the situation leading to the risk occurring
- Identifying the party best able to control the risk itself
- Identifying who should be responsible if the risk cannot be controlled
- Establishing whether, if the risk is transferred to the supplier, the cost to the project will fall, whether new risks will arise and transfer to the project, and the legal position of any transfer.

## 13. PROJECT MANAGEMENT ORGANISATION

### PROJECT MANAGEMENT ORGANISATION

A proper level of planning is of great importance before a construction project begins and in that the schedule and commodity baselines are established to measure progress. Proper vision for the project must be established before construction is executed. Once the construction begins, progress must be monitored in the field to ensure that the project is progressing as planned. Data from the field monitoring must then be compared with the schedule to track, report, and analyze the progress of construction throughout the project. By tracking and reporting on the project progress, the probability that the project will have the desired outcome is much higher. Knowing that a project is making poor progress in earlier stages will give the project team a greater probability of getting the project back on schedule and finished within the projected completion date.

Presently in addition to the projects that are being handled by KIIDC, the company has been designated as a Special Purpose Vehicle (SPV0105) to undertake many works that are being funded by Kerala Infrastructure Investment Fund Board (KIIFB). Hence for these projects and for the projects to be taken up it is very important that strict cost control as well as conformity to the time schedule is adhered to. Hence proper Project Management from the day one of the implementation of the projects is necessary. KIIDC has already procured the requisite software i.e. Primavera P6 for proper monitoring of the existing projects. At present it is being done with the available staff at the Headquarters of the Company. Now that KIIDC is venturing into more and more projects under funding from KIIFB, it is imperative that a proper Project Management Unit is formed and made operative at the headquarters of the Company with proper interlinking with site personnel for regular monitoring of the progress of works.

Hence the Board of Directors of KIIDC in its 56th meeting had decided that a Project Monitoring Unit as detailed below may be formed.

Project management plan of the PMU will be:

- Plan and progress to be reported - Daily, weekly and fortnightly.
- Plan and progress reports to be sent in the form of excel sheets.
- Progress to be updated in Primavera schedules.
- Primavera to be used to develop and manage work schedule, project cost & resources.



Project management activities of the PMU will be:

- Coordination between different department activities
- Client (government & KIIFB)
- Contractors
- Project related intra-office activities
- Project planning and scheduling
- Project progress monitoring and reporting daily monitoring & reporting
- Work progress reporting to be done by site engineers to Project coordinator/engineer
- Reporting to be done every day before 6 pm
- Daily progress report (DPR) will be sent by Project coordinator/engineer to head of office before 10 am next day
- Reports will be sent in the form of excel sheets
- Progress will be updated in Primavera schedules
- Weekly plan to be developed by project coordinator/engineer from Primavera schedules
- Weekly progress will be reported to head of office
- Progress will be sent in the form of report and excel files
- Fortnight plan and progress
- Fortnight plan and progress report will be sent by Project coordinator/engineer to head of office & KIIFB.

The PMU will have the following personnel under it.

Project coordinator (planning) having a minimum qualification of

- Master's Degree in Construction / project management
- Experience in planning and project management
- Knowledge and experience of Primavera
- Planning Engineer having a minimum qualification of Bachelor of Technology in civil engineering (first class)
- Knowledge of computer software 's including Primavera

### **Organizational set up of KIIDC**

The Kerala Irrigation Infrastructure Development Corporation Ltd (KIIDC) is a wholly owned company of Government of Kerala with a paid-up capital of Rs. 10 crores, for the promotion and development of medium and large-scale irrigation and water supply projects units in the State.

The main objectives to be pursued by the Kerala Irrigation Infrastructure Development Corporation Limited, as per the Memorandum and Articles of Association of the Company are to undertake and execute construction of irrigation and water supply projects of major, medium and small size under any of the schemes such as Build, Own and Operate (BOO), Build, Operate and Transfer (BOT), Build, Own, Operate and Transfer (BOOT), Build, Own, Lease and Transfer (BOLT) anywhere in India. Incidental to this the Company is also authorized to undertake the following:

1. The construction, execution and subsequent maintenance of projects entrusted by the State Government
2. To utilize the water stored in the reservoir created in the river course for any utilities like drinking water, irrigation, domestic, industrial, tourism, or for any other purpose according to the directions of the Government from time to time.
3. To undertake or render any assistance to individual, firm, society, company, corporation, development authority, municipality, panchayath or any department of Government of Kerala with the object of providing irrigation facilities, water supply and distribution system especially to farmers, agriculturists, cultivators and producers so as to improve all types of operation of farming, peri culture, sericulture, horticulture and agriculture and for this to construct wells, ponds, tanks, culverts, canals, bunds, water treatment plants, reservoirs etc.

The present constitution of the Board of Directors of the Company is as hereunder:

1	Shri. K. Krishnankutty	Hon'ble Minister for Water Resources	CHAIRMAN
2	Dr. Vishwas Mehta IAS	Additional Chief Secretary (WRD)	DIRECTOR
3	Sri. Shamsudeen K H	Chief Engineer, IDRIB, Irrigation Department	DIRECTOR
4	Sri. Suresh Kumar S,	Chief Engineer, Kuttanad Development Project	DIRECTOR
5	Sri. Dr. B.Ashok IAS	Managing Director, KWA	DIRECTOR
6	Sri. Binu N Nair	Under Secretary, Finance Department	DIRECTOR
7	Sri. N. Prasanth IAS	Managing Director, KSINC Ltd.	MANAGING DIRECTOR`

At present KIIDC has been entrusted with works related to civil works, irrigation works, micro irrigation works, environmental support works etc by different departments of the Government viz. Water Resources Department, Environment and Climate Change Department, Agriculture Department, Tourism Department, Tribal Welfare Department, Kerala Water Authority, Hill Area Development Authority, State Planning Board etc. The works and projects so under taken by KIIDC have been completed or nearing completion to the utmost satisfaction of the concerned departments / agencies. Considering the performance of the Company in the execution of the projects / works entrusted to it, these departments as well as many new departments have expressed their willingness to entrust more works with the Company during 2017-18 also.

The Government vide its order G.O.(Rt) No. 659 /2017/WRD dated 02.08.2017 have nominated Kerala Irrigation Infrastructure Development Corporation Ltd. As a Special Purpose Vehicle (SPV) of Irrigation Department for undertaking all works proposed for funding under KIIFB subject to the condition that specific in principal sanction for individual items of work shall be issued for each individual work for a group of works upon submission of Detailed Project Report by Kerala Irrigation Infrastructure Development Corporation Ltd./Irrigation Department for those works.

KIIDC have in consultation with the Hon'ble Minister for Water Resources and the Secretary, Water Resources have submitted the following proposal to Government for creation of posts exclusively for attending to works that are being funded by Kerala Infrastructure Investment Fund Board.

Sl no	Name of Post	Equivalent post in different Departments	No of Posts	Duty
1	TEAM LEADER (KIIFB)	Superintending Engineer	1	Overall control of works under KIIFB and reporting to Managing Director, KIIFB
2	DEPUTY GENERAL MANAGER (Monitoring, Quality Control & Planning)	Executive Engineer	1	In charge of Monitoring, Quality Control & Planning and reporting to TL, KIIFB. He will also audit the bills prepared and submitted from the project sites with the assistance of Financial Auditor (KIIFB) and submit the bills to TL (KIIFB).
3	DEPUTY GENERAL MANAGER (TECHNICAL) SOUTH	Executive Engineer (In charge of works from Thiruvananthapuram to Ernakulum)	1	DPR Preparation/vetting, assisting Technical Sanction with PRICE, Tendering, follow-up with KIIFB & in Government Secretariat.
4	DEPUTY GENERAL MANAGER (TECHNICAL) NORTH	Executive Engineer (In charge of works from Thrissur to Kasaragod)	1	DPR Preparation/vetting, assisting Technical Sanction with PRICE, Tendering, follow-up with KIIFB & in Government Secretariat.
5	Assistant General Manager	Assistant Executive Engineer	6	2 each under the control of each DGM. Duties as given under respective DGM
6	Assistant Manager	Assistant Engineers	16	3 each under each AGM (Technical) & 2 each under AGM (QC & Monitoring). Duties as given under the concerned DGM

7	Financial Auditor (KIIFB)	Divisional Accountant	1	Will audit all bills submitted by the respective Subdivisions executing the works and will submit the bills in proper format and order to DGM (MQC&P) for further processing for submission of the same without further delay to KIIFB to payment to Contractors. Will also keep an inventory and all records and pursue all matters for payment of salary of all staff under and including TL (KIIFB), establishment charges of office accommodation, automation of office etc.
8	Superintendent –Est.	Junior Superintendent	1	Will assist FA (KIIFB) in the above matter
9	Senior Assistant (KIIFB)	U D / LD Clerk	2	Will assist Superintendent (Establishment) in the above matter
<p>NB: No supervisory staffs are separately proposed as government vide its letter IRS / 356 / 2017 / WRD dated 03.08.2017 have instructed that Irrigation Department shall execute the project on behalf of KIIDC and Irrigation Department shall check measure the works and raise the bills.</p>				

## 14. CONTRACT MANAGEMENT STRATEGY

Contract management is concerned with the continuous review and management of the contractual terms and / or service level agreement to ensure the outcomes agreed are actually delivered by suppliers. Managing the contracts and relationships is imperative to ensure that:

- The strategic priorities agreed at the outset are delivered in a cost effective and timely manner
- Non-compliance or variation is identified early for escalation and resolution
- Risks and costs are managed
- Reviews are undertaken and lessons learnt inform the commissioning and procurement process to ensure continuous improvement
- In developing the contract strategy, the following issues will be addressed:
  - Nature, scale and significance of the need to the organization
  - Value of need
  - Type of specification - input or output
  - Complexity of the need including innovation level
  - Market capacity.
  - Timescale and phasing.
  - Level of understanding of the need by stakeholders and potential suppliers.

The foundations for effective and successful post-award contract management rely upon careful, comprehensive and thorough implementation of the upstream or pre- award activities. During the pre-award stages, the emphasis will be focused on why the contract is being established and on whether the supplier will be able to deliver in service and technical terms. Management of contracts requires flexibility on both sides and a willingness to adapt the terms of the contract to reflect changing circumstances. It is important to recognize that problems are bound to arise which could not be foreseen when the contract was awarded. The strategy to be adopted will include the below mentioned activities (it may not be necessary to follow every activity for every contract).

### **Drafting specifications and requirements**

A specification is a statement of needs and its purpose is to present to potential suppliers a clear, accurate and comprehensive statement of the project needs in order that they can propose solutions to those needs. The specification is meant to enable the organization to readily evaluate offers, provide the



basis for performance measurement and be a record of evidence in any dispute. The process of preparing the specification will include drafting of the evaluation model criteria. It will be ensured that:

- All the information needed for evaluation has been requested from potential suppliers
- The evaluation covers all the project needs
- The responses are in a format that enables an effective, clear and fair evaluation of offers to be carried out.

### **Establishing the pre-qualification, qualification & tendering procedures (if required)**

Evaluating the suitability of potential suppliers to meet the commercial requirements of the organization is normally undertaken via a pre-qualification system. This is the most efficient method of assessing suitability to meet the required criteria and is carried out prior to inviting them to tender.

The Selection Stage will examine three key areas of questioning relevant to the subject areas of the contract:

- Eligibility in terms of insolvency, grave misconduct, and so on.
- Economic and financial standing
- Capability and capacity for the project and track record in providing similar services.

The pre-qualification or selection of potential suppliers is a critical stage in the overall evaluation and award process.

The key to success at the pre-qualification or selection stage is to strike a balance between the creation of a shorter list of potential suppliers from the list of suppliers indicating an interest, which can be the subject of in-depth evaluation, and a list sufficiently large to ensure that suitable suppliers are actually selected and proceed to the tender invitation.

Information on supplier capability and capacity may be sought through a number of routes, formally and informally. In the case of complex requirements, a Prequalification questionnaire (PQQ) will be issued to those expressing interest. The PQQ will seek the following general information:

- Organization, including ultimate parent details, identity and ownership
- Principal activities (past and present)
- Organizational chart
- Contractor/sub-contracting approach

- Professional/commercial affiliations
- Legal
- Financial
- Capability
- Quality management systems
- Experience and track record.

The procedural matters will be communicated to potential tenderers both in the tender documentation and any advertisements.

### **Drafting Tender documents**

As with drafting specifications, great attention will be paid to ensuring that the contract document as a whole set out clearly, comprehensively and unambiguously, the obligations of the parties to the agreement. All contracts may be different, both in requirement as well as complexity and supplier relationship need. The following schedule will therefore be seen as a checklist and not a prescribed list of matters to be considered for inclusion in every contract:

- Form of agreement or form of tender setting out the contract period and spaces for signatures
- Specification of requirements including the levels of output to be achieved and the performance measurement methodology, relevant information to enable
  - bids to be submitted Conditions of contract or articles of agreement. These may comprise definitions, general terms including changes, alterations and variations clause, notice clause, commercial terms setting out the rights and obligations of the parties, conditions, warranties, confidentiality, intellectual property, indemnity, exit management, data protection, dispute resolution/escalation and termination clauses and ‘standard’ clauses which should appear in all contracts covering such matters as liability, severability, waiver and jurisdiction
- Pricing schedules - particular attention will be given to ensuring that potential suppliers are bidding on the same basis of output required
- Price variation mechanisms applicable to products, services and time-based requirements
- Invoicing and payment terms and methods, invoice content requirements
- Pricing basis including milestone, incentivization, payment reductions for non-compliance, retention, advance, interim
- Implementation and transition plans including knowledge transfer
- Testing methodology

- Acceptance strategy and procedures
- Award criteria
- Dispute resolution procedures including escalation process
- Sub-contractor information
- Contract change procedures arising from both internal or external sources and the consequential need for flexibility in contractual terms
- Contract management arrangements to ensure successful service delivery and the level of control your organisation requires during contract performance
- Communications including frequency, level, detail, content exit/termination strategy and procedures
- Drawings
- Free issue materials schedule.

This list of matters which are not exhaustive will be categorized and arranged clearly and logically into the tender document. Typically this may comprise the following sections:

- Form of tender
- Conditions of contract
- Scope of work or technical specification
- Administrative and tender submission instructions
- Schedule of prices
- Drawings

### **Evaluating tenders**

All tenders received by the appointed day and time will be recorded. This process can range from maintaining a simple clerical record of valid tenders received by the appointed time to the appointment of a tender opening board who record such issues as:

- Who tendered?
- The price quoted if a lump sum or bill of quantities bid
- The organizations which declined to submit
- Rejected bids
- Deviations or qualifications to offers
- Programmes quoted
- The integrity of the tender procedure.

The formal opening procedure is followed by the tender evaluation process which, again, may range from a simple straightforward process to one which is complex, involving many professional disciplines formed into an evaluation team and carried out over a period of time.

Tenders may be initially evaluated under the twin considerations of commercial and technical, the latter possibly carried out without price information, to ensure that the bids are brought to a comparable basis for more a thorough evaluation and study, without the influence of commercial considerations. The criteria for tender evaluation will follow the award criteria set out in the tender documents and communicated to the potential suppliers.

### **Awarding the contract**

Following tender evaluation and, where appropriate, negotiation, the project team will satisfy itself that an offer has been made which meets its requirements in all respects, including budgetary, and consider that it is in a position to accept an offer and award the contract to the tenderer who has made the most economically advantageous offer to the organization. It may then move directly to the award stage or make a recommendation to higher authority levels within the organization for acceptance. The contract award stage comprises of a number of important aspects; communicating the award to the successful tenderer, notifying the unsuccessful tenderers, debriefing unsuccessful tenderers and publishing a contract award.

### **Service delivery management**

This activity is concerned with the fundamental aspect of contract management, that of ensuring that the actual service provided by the supplier is in accordance with the agreed standards and prices. The ability to measure the performance of the supplier - sometimes called vendor rating - and to provide feedback is critical to successful contract management and supplier development. Performance measures to cover all aspects of a contract should be designed to suit the requirements of a particular contract and should be set out in the contract documentation to ensure suppliers are fully aware of both the measures and the measurement methodology before any contract is awarded. It is important that the performance measures selected provide clear and demonstrable evidence of the success (or otherwise) of the relationship and, in principle, issues such as the following will be covered:

- Cost and value obtained
- Performance and customer satisfaction
- Delivery improvement and added value delivery capability
- Benefits realized
- Relationship strength and responsiveness.

Performance measurement can be an expensive and time-consuming activity, and as such may be carried out on a selective and prioritized basis, proportionate to the value and importance of the contract to the organisation. This is particularly important when time and resources are very limited. Suppliers of high value, high risk goods and services may be closely monitored, possibly involving frequent regular meetings at site or any other suitable locations.

### **Contract administration**

This activity is concerned with the practicalities of the relationship between the organization and the supplier and the operation of the routine administrative and clerical functions. Whilst the level of significance and extent of the activity will vary according to the particular contract, one of the main areas critical to successful contract administration is contract maintenance and change control.

Changes will almost inevitably occur during the period of a contract and managing these changes is a particularly important activity. A formal change control procedure may be designed and set out in the original contract documentation to avoid misunderstanding and ambiguity about roles, responsibilities and the actions to be taken in any given situation. These change control procedures will be initiated at the earliest opportunity, post-contract award. They will include procedures to keep all contract documentation up to date and consistent so that all parties have a common view of the agreed changes.

A formal framework, defining responsibilities and reporting arrangements will be designed and set out clearly in the contract documentation. The information called for may range from a complete suite of performance measurement reports to exception reporting. The design of reports will reflect the need for flexibility in the type and detail of the information required during the contract period and the recipients possible need for access to greater detail. In addition, regular reporting - monthly or quarterly- may also be addressed as and when needed.

### **Assessment of risk**

There is a need to conduct continuous risk analysis and assessment throughout the period of the contract in order effectively to manage the risks that arise. Risk management during the contract period comprises those activities associated with identifying and controlling the risks that may potentially affect the successful fulfillment of the contract. Risks to the contract include such issues as:

- Lack of capacity of the supplier, particularly if there are significant increases in demand
- Reduction in demand leading to higher unit costs borne by the supplier
- An event which causes an increase in the total of the price to the purchaser
- An event which causes a programme delay
- Supplier staff changes
- Changes to the supplier 's business objectives
- Deterioration in the supplier 's financial standing
- Demand changes that cannot be met by the supplier
- Deterioration of quality
- Market fluctuations for commodities.

When a risk is anticipated or perceived, its management involves the parties working together to identify where the responsibility for it lies, methods of minimizing it and how the risk will be managed. Issues that will be considered for effective management will include:

- Establishing a binding process to encourage early warning of issues such as those mentioned above, as soon as either a supplier or the purchaser becomes aware of them
- Identifying the party best able to control the situation leading to the risk occurring
- Identifying the party best able to control the risk itself
- Identifying who should be responsible if the risk cannot be controlled
- Establishing whether, if the risk is transferred to the supplier, the cost to the project will fall, whether new risks will arise and transfer to the project, and the legal position of any transfer.

### **Contract closure**

This stage concerns the activities associated with closing the project down, whether in accordance with the contract or as a result of early termination. The procedure is designed (where and if applicable) to:

- Ensure completion of all administrative matters
- Record that all technical issues have been completed
- Determine the extent of any liquidated damages to be deducted from the contract price
- Record the end of the retention and guarantee periods and the date of the final inspection carried out
- Record the date of release of retention and/or bank guarantees

To agree a statement of specific limits on continuing contractual obligations after completion of work and any on-going obligations following the end of guarantees or maintenance periods

- Record any materials reconciliation
- Transfer any assets, including data and intellectual property
- Record the process of final contract payments and a summary of the financial payments and received
- Summarise claims made against or received from the supplier

Ensure the retention of records relating to the contract to counter any subsequent claims that may be brought

On completion of this activity, agreement will be reached on all technical and commercial aspects of the contract. The agreement will require the signature of the parties to a document which records the acceptance of the work or service, the obligations fulfilled and the price paid or to be paid.

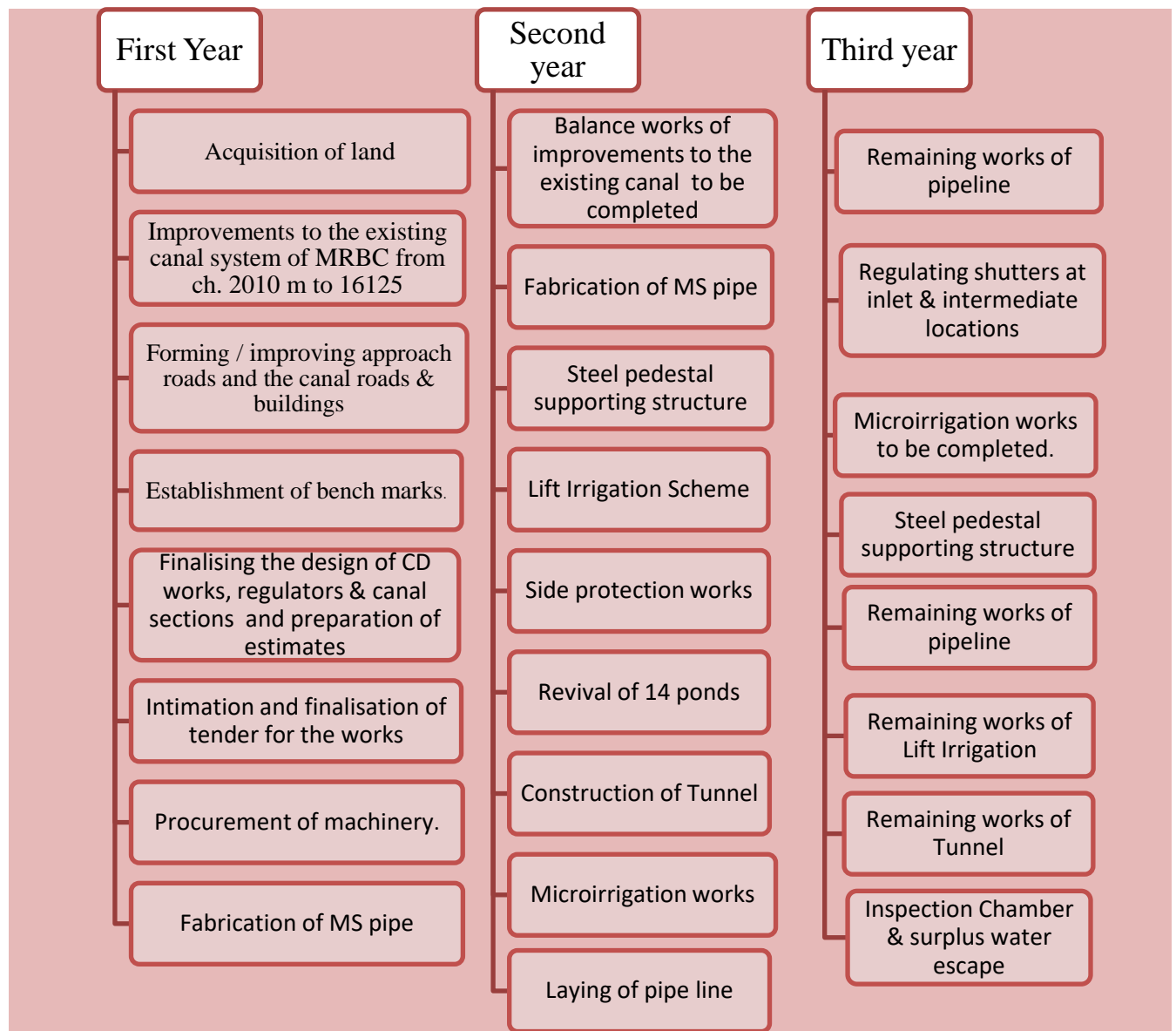
## 15. IMPLEMENTATION SCHEDULE & WBS

### Project Phasing

The irrigation part of the job is proposed to be completed within a period of 3 years. The first reach of Canal i.e. from Om to 2010M has already been completed. The Valiyavallam Pathy canal from Ch. 12075 M to 16125M has also been completed.

### Year-wise construction programme

The works to be executed in the successive years are:



## Land Acquisition

- Land acquisition is required. the alignment of the structure being across land, river and roads demands land acquisition
- Steps taken for acquisition of land
- CE, P1 requested Government to issue sanction for acquisition of land for canal construction in the new alignment vide letter dated 12.01.2017.
- Government issued additional authorization for release of Rs. 4 crores to meet land acquisition cost and expenses on other preliminary works for the extension of MRBC on 24.01.2017.
- In 16. 03.2017 Government issued orders for acquisition of 1356.23 cents by negotiated purchase.
- It is understood that the SLMC of revenue department has approved the land acquisition for the project on 22.03.2017.
- CE, P1 has requested for release of Letter of Credit to Govt. on 22.03.2017.
- Letter of credit issued.

Work Breakdown Structure of the entire project is given below.



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

Sl. No	Project Component	Estimate Cost (Lakhs)	2019	2020	2020	2020	2020	2021	2021	2021	2021	2022	2022	2022	2022
			Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
I	Land Acquisition														
II	DPR/Estimate Report														
III	Soil Investigation														
IV	Tender Finalisation														
V	Work Execution														
1	Fabricating and Supplying 2800mm diameter MS Pipe														
2	Laying MS Pipe														
a	Earthwork Ordinary Soil/Hard Rock														
b	Filling Jamuna Sand														
c	Construction of siphon pipe aqueduct														
d	Laying MS pipe														
3	Steel pedestal supporting structure for MS Pipe														
4	Tunneling for a length of 660m.														
5	Regulating shutters at inlet and intermediate locations														
6	Providing inspection chambers														
a	Earthwork Excavation														
b	CC 1:4:8														
c	Steel Reinforcement														
d	RCC 1:1.5:3														
e	Cast Iron Manhole														
7	Surplus Water Escape														
a	Earthwork Excavation														
b	CC 1:4:8														
c	CC 1:3:6														
d	RCC 1:1.5:3														
8	Side Protection works at river crossings and aqueduct														
	Earthwork Excavation														
	CC 1:3:6														
9	Lift Irrigation														
	Construction of Pump House														
	EW Excavation for suction chamber and cistern														
	CC 1:4:8														
	RCC 1:1.5:3														
	Suction & Delivery pipes														
	Laying of PVC distributories														
	Electrical works														
10	Micro Irrigation with electronic controlling devices														
11	Revival of 14 ponds														
	Earthwork Excavation														
	DR Masonry														
12	Spouts & Shutters - Corrective measures of existing canal														

## **16. STATUTORY CLEARANCES**

It is understood that no other statutory clearance is needed for implementing the project.

## 17. QUALITY MANAGEMENT PLAN

KI IDC is an ISO 9001:2008 (certificate no: 32949-A01) certified company with its own quality manual and quality assurance inventories. In addition, KI IDC has been strictly following the QC Manual and QC Laboratory Manual and has been conducting workshops to keep the engineers under KI IDC and the Contractors and their supervisory staff abreast with the latest developments in this field.

The KI IDC team will ensure that the works executed in the project follow the Kerala Public Works Department Quality Control Manual. As envisaged in the manual a three tier Quality control mechanism will be followed.

### **First tier QC testing:**

In first-tier QC testing, the contractor has to carry out the required tests at his own cost during the course of a work. First tier quality control tests are mandatory for all projects including maintenance and repair works, estimated cost of which is above Rs 15 Lakhs.

### **Second tier QC testing:**

Second tier QC checks/tests will be done by KI IDC on a random basis. The frequency of the test shall be as per that mentioned in the PWD manual or as specified in the contracts.

### **Third tier QC testing:**

As per clause 2406 of the revised PWD Manual 2012, Technical audit shall be done by an external agency/expert empaneled for the purpose after the construction of a project is completed. This will form the third tier of QC system. The technical audit work will be entrusted with reputed agencies like College of Engineering, Trivandrum.

### **Operation and Maintenance Plan**

Once the construction is completed the project will be under the charge of a section officer. Periodic maintenance shall have to be taken up for the structure. A maintenance estimate is prepared and sanctioned annually to ensure smooth functioning of the project. In the operational part lascars shall be trained for lifting of shutters. Care shall be taken to ensure that flooding does not take place.

## **18. OPERATIONS & MAINTENANCE PLAN**

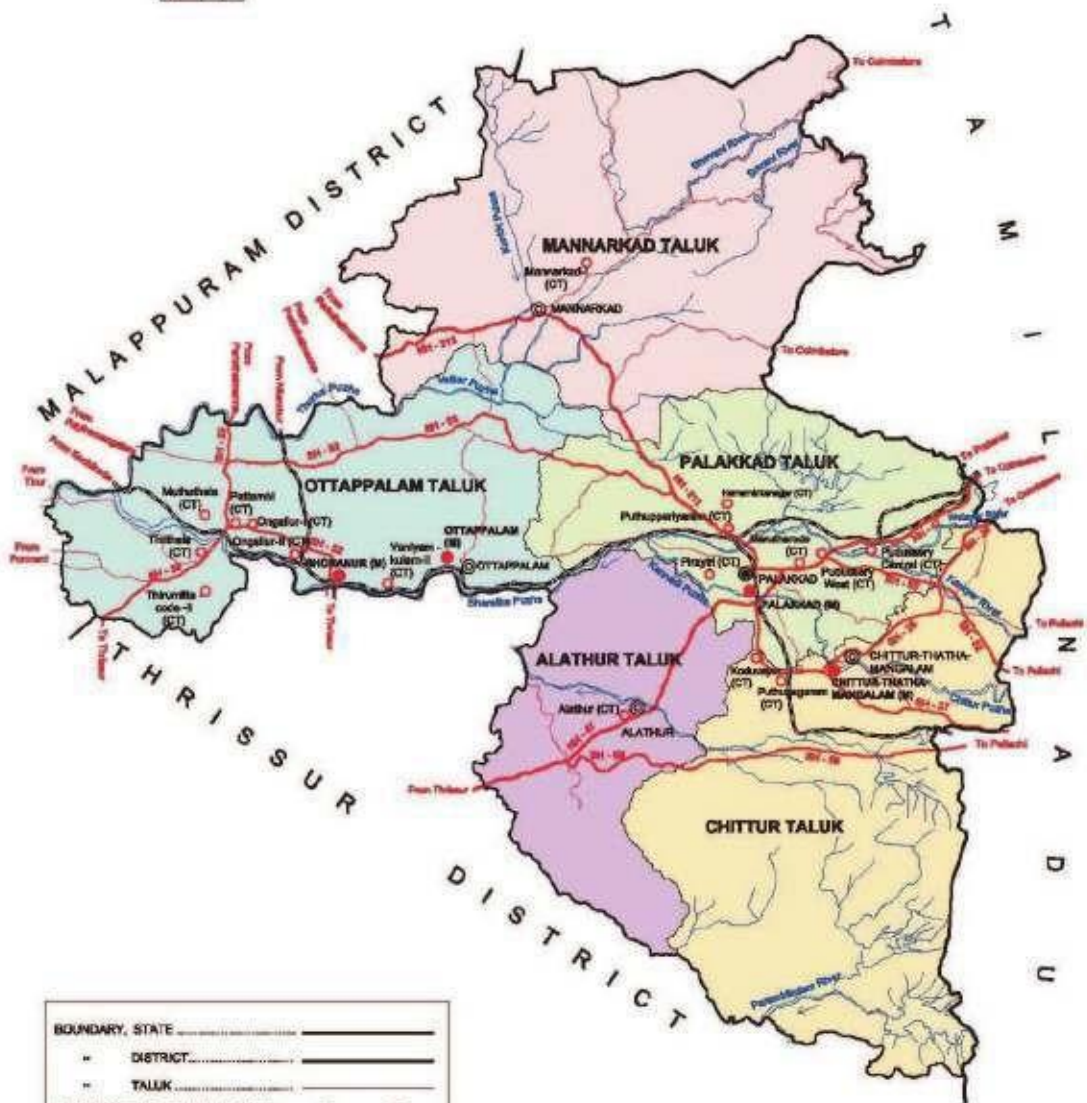
Once the construction is completed the project will be under the charge of field officers. Periodic maintenance shall have to be taken up for the proper functioning of the project. Maintenance Funds shall be earmarked exclusively for the project to ensure smooth functioning of the project.

Operational measures include:

- Implementation of scheduled water use practice to provide efficient water use.
- Keeping the irrigation system in good working order by guarding, supervision, periodical maintenance and repair.
- Prevention of excess water into irrigation system and diversion of surplus water.
- Control of water losses and improvement of system efficiency.
- Organization of irrigation water accounting.
- Control of proper water use and ground water conditions

INDIA  
KERALA  
**PALAKKAD DISTRICT**

NUMBER OF TALUKS	: 5
• STATUTORY TOWNS	: 4
• CENSUS TOWNS	: 17
• OUT GROWTHS	: 0
• VILLAGES	: 131
TOTAL AREA OF THE DISTRICT	: 4480 Sq. Km.

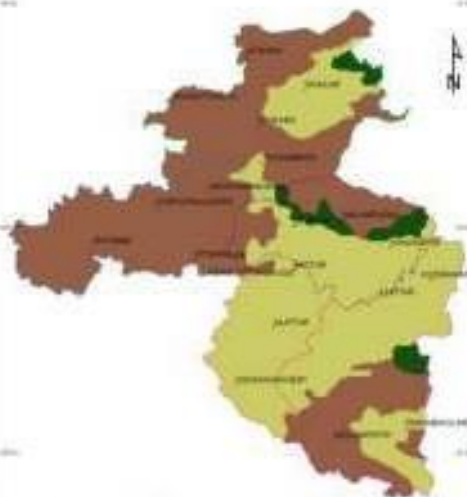


BOUNDARY, STATE	—————
• DISTRICT	—————
• TALUK	—————
HEADQUARTERS : DISTRICT, TALUK	⊙ ⊠
NATIONAL HIGHWAY	————— NH - 27
STATE HIGHWAY	————— SH - 27
OTHER IMPORTANT ROADS	.....
RAILWAY LINE, BROAD GAUGE	—————
RIVER AND STREAM	~~~~~
STATUTORY TOWN / CENSUS TOWN	⊙ ⊠

District headquarters is also the Taluk headquarters



SOIL MAP  
PALANKAD DISTRICT



- |   |           |   |          |
|---|-----------|---|----------|
|  | HILSOIL   |  | Water    |
|  | ACCEPTOIL |  | Canal    |
|  | MOUNTAIN  |  | Mountain |
|   |           |  | Canal    |
|   |           |  | Canal    |

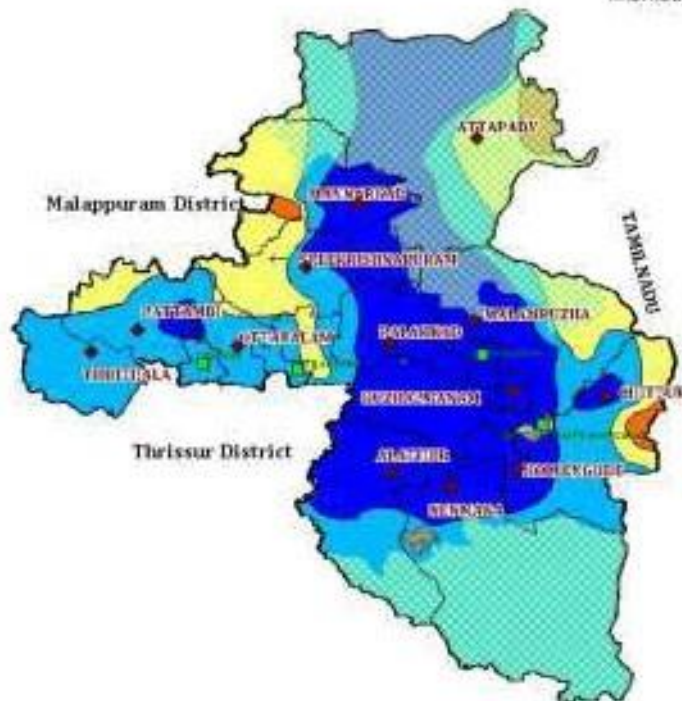






# DEPTH TO DECADAL AVERAGE WATER LEVEL PALAKKAD DISTRICT

0 10 20  
kilometres











## GROUND WATER INFORMATION BOOKLET CGWB, KERALA REGION JULY, 2013



### LEGEND

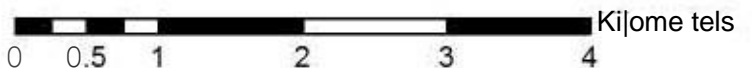
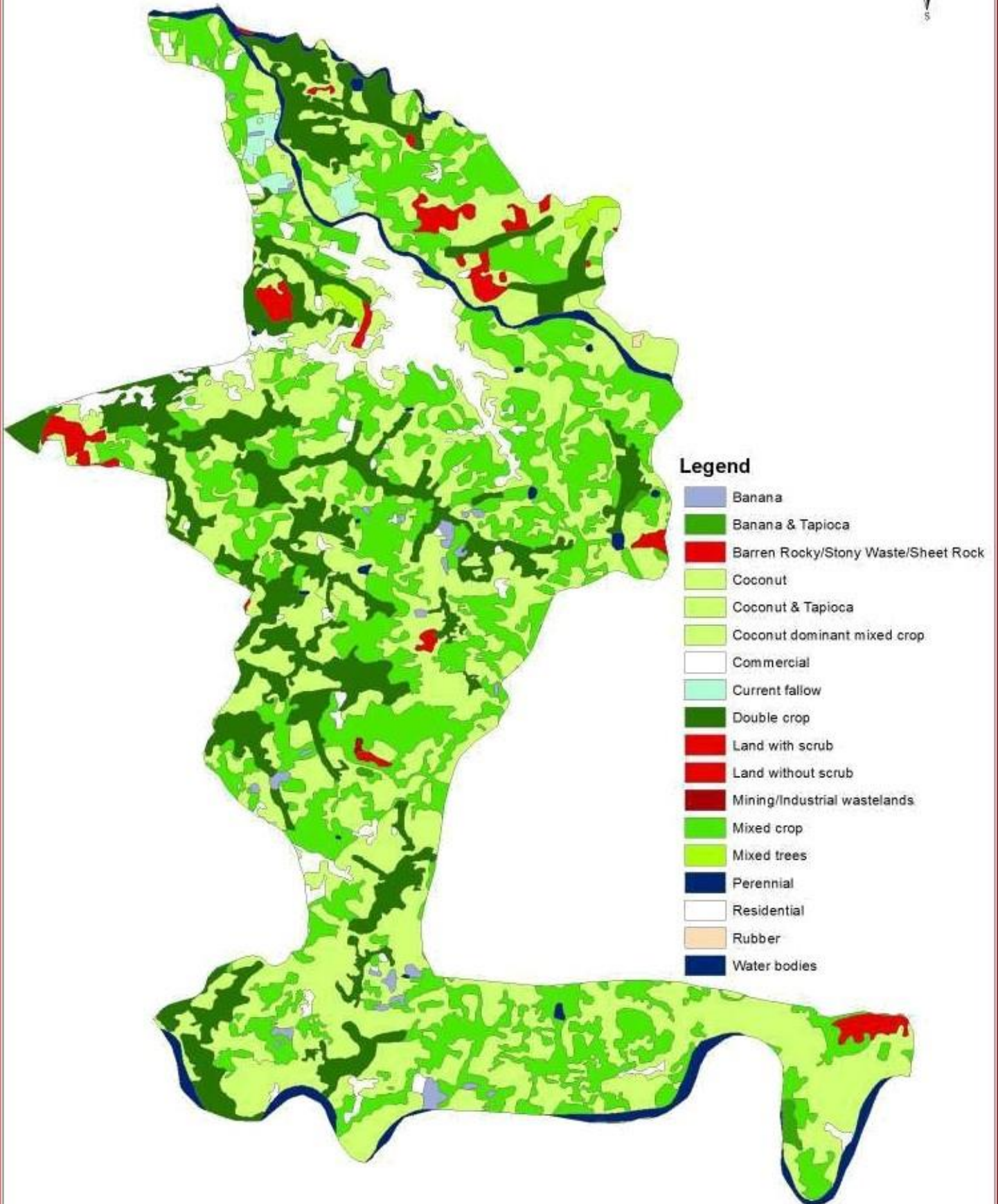
DECADAL AVERAGE DEPTH TO WATER LEVEL  
(m bgl)

- |   |       |  |                 |
|---|-------|--|-----------------|
|   | 0 - 2 |   | Hilly Area      |
|   | 2 - 5 |   | Block           |
|   | 5 - 8 |   | Municipality    |
|  | > 8   |  | GWM - Dug Wells |

# LAND USE MAP INLAHADI DISTRICT

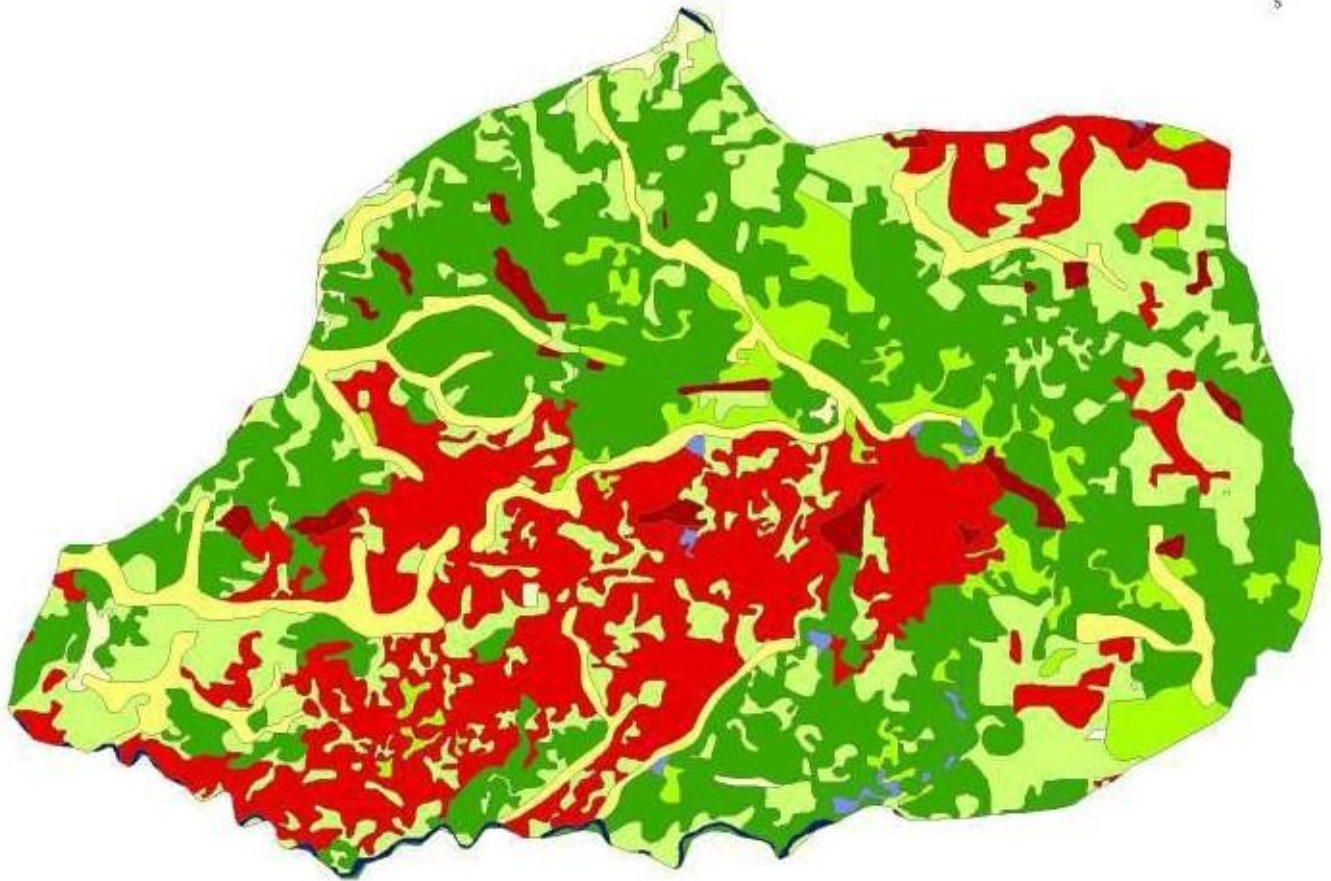


# Land Use Map of Kozhinjanpara Panchayath



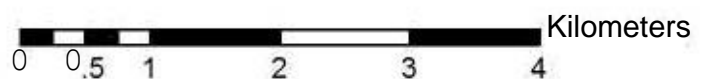


# Land Use Map of Vadakarapathy Panchayath

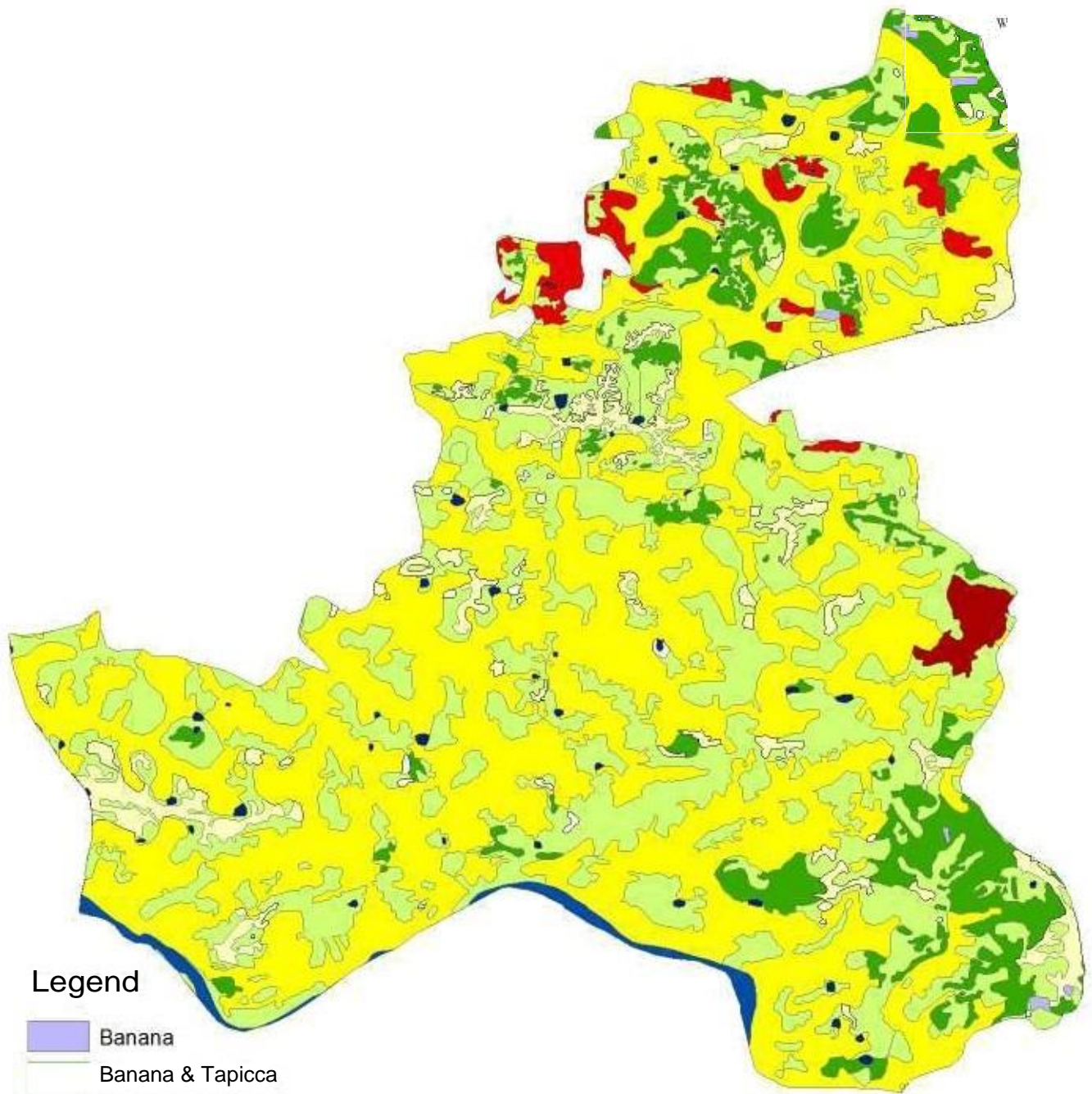


## Legend

-  Banana
-  Banana & Tapioca
-  Barren Rocky/Stony Waste/Sheet Rock
-  Coconut dominant mixed crop
-  Commercial
-  Double crop
-  Land with scrub
-  Land without scrub
-  Mining/Industrial wastelands
-  Mixed crop
-  Mixed trees
-  Perennial
-  Residential



# Land Use Map of Nalleppilly Panchayath



## Legend

- Banana
- Banana & Tapioca
- Barren rocky/Stony Waste/Sheet Rock
- Coconut
- Coconut/Onion/Other fixed crop
- Commercial
- Double crop
- Land with scrub
- Land without scrub
- Mixed crop
- Paddy
- Residential
- Water bodies
- Nalleppilly



**Name of work : Extension of Moolathara Right Bank Canal from Korayar to Varattayar****ESTIMATE REPORT**

Extension of Moolathara Right Bank Canal from Korayar to Varattayar .... Project area is situated in the rain shadow region of Palakkad gap, which receives less than 1000mm of annual rain fall when compared to the State's average of 3000mm. But these regions are having intensive agriculture in spite of low water availability. .. By the present proposal, water available during periods of no or less demand in other systems of Chitturpuzha Project and the flood water reaching Moolathara regulator during rainy season can be diverted to drought hit areas up to Varattayar and to the check dams in Varattayar & Korayar and also the 14 nos ponds in Eruthiampathy Panchayath between Korayar and Varattayar..... The proposed total ayacut to be benefited by the implementation of this project is 3575 Ha (predominantly Coconut and Vegetable).... Moolathara Right Bank canal system from Moolathara weir is complete up to Korayar and the ayacut under this canal system is at present being irrigated as per the requirement of farmers. The main canal up to Korayar is already lined and the 6430m long canal portion from canal portion from Korayar to Varattayar is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter, 12mm shell thickness throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity co-efficient....Main components of the Project are:1. Appendix A- Fabricating and Supplying 2800mm diameter MS PipeOut of the total length of the 6430m canal portion from Korayar to Varattayar, 5770m length of the canal is proposed as free flow in cylindrical MS Pipe 2.8m inner diameter 12mm shell thickness throughout, to minimize seepage losses and to have a reduced area of cross section, and also to take advantage of low rugosity co-efficient. The cost of fabrication and supply of MS pipe is included in this appendix. Estimate amount – Rs.531920317.10/-2. Appendix B- Laying MS PipeLaying of 2.8m diameter MS pipe for a length of 5770m in line and levels including cost of earth work excavation in ordinary soil / hard rock, welding of joints and cost of one siphon pipe aqueduct for a length of 210m at road crossing. Estimate amount – Rs. 172379347.79/-3. Appendix C- Steel pedestal supporting structure for MS PipeSteel framed pedestals as supporting structures at 15m intervals are provided where the pipe runs over ground and at the aqueduct across Korayar River. ISHB 200 for main columns, ISMC 100 for horizontal braces and ISA 60X60X10 as diagonals are used for pedestals. The height of structure varies from 7.5m to 15m. RCC M25 grade is used for the Raft foundation of the structure. Structural steel work includes riveted, bolted or welded built up sections for framed pedestal work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer Estimate amount – Rs. 350588285.19/-4. Appendix D- Tunneling for a length of 660m. This appendix include provisions for tunneling such as earthwork excavation in all kinds of soil, excavation for adit by tunneling methods in all types of rock, excavation for vertical / inclined shaft in all types of soft / hard rock, removing and hauling muck over fallen due to natural causes such as geological faults etc., providing 25 mm thick guniting to sides of tunnel in CM 1 : 3 proportion by weight,



providing and fixing 25mm dia. steel rock bolts, providing, fabricating and fixing in position temporary structural steel supports, steel reinforcement for R.C.C work, drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer and grouting with cement slurry and cost of electric line, lighting and ventilation Estimate amount – Rs. 128543610.95/-5.

Appendix E- Regulating shutters at inlet and intermediate locations All mechanical works such as supply, fabrication, erection and painting including embedded parts for 6 nos. of Regulating shutters at inlet and intermediate locations are provided in this appendix. Estimate amount – Rs. 20398733.46/-6.

Appendix F - Providing inspection chambers Inspection Chamber 6mX6mX5m 10 nos. in CC 1:1.5:3 with manholes are provided to carryout periodical inspection and repair works. Estimate amount – Rs.17205016.97/-7.

Appendix G -Surplus Water Escape Surplus water escapes are proposed at the tail end and two other locations for discharging surplus water to nearby natural stream. This include tank 5mX5mX5m in RCC 1:1.5:3 using 20mm metal, leading canal for 1500m (Avg.) with lining in CC 1:3:6 40mm metal and side protection work for natural stream in CC 1:3:6 40mm graded metal. Estimate amount – Rs.56242673.54/-8.

Appendix H - Side Protection works at river crossings and aqueduct Side protection works in CC 1:3:6 using 40mm graded metal is provided for an average height of 5m at the banks of Korayar River where the pipe line crosses the river and also at the abutment portion of aqueduct which are close to the pipe line. Estimate amount - Rs- 55805113.43/- 9.

Appendix I- Lift Irrigation Civil Works This appendix contains cost of all components for one Lift irrigation scheme including pump house, suction tank, cistern, supply and installation of pump and motor, vacuum pump, starter, supply and laying of suction and delivery pipe (Class K9 Ductile iron pipe), CPVC pipes for distribution system and electrical works. Estimate amount – Rs. 15628321.69 10.

Appendix J- Micro Irrigation with electronic controlling devices Cost of supply and installation of all components for implementing Micro irrigation / Drip irrigation for garden crops in 3575 Ha of command area is included. By providing Drip Irrigation crop yield will double with 70% saving in irrigation water. Estimate amount - Rs- 696453758.00/-11.

Appendix K- Revival of 14 ponds Improvements to 14 public ponds including de-silting and side protection work with DR masonry. Estimate amount - Rs- 133044221.70/-12.

Appendix L Consultancy and Service Charges Estimate amount is Rs- 120000000 /-13.

Appendix M Land Acquisition Estimate amount Rs- 126000000.00/-14.

Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal The existing canal at initial reaches of MRBC is in a dilapidated stage and the seepage is too severe. Hence relining/rectification works of existing canal is proposed in the appendix. The provision for construction of new sluices, where the sluices are completely damaged is also included in this appendix. Estimate amount Rs- 93757663.79/-15.

Appendix I-1 Lift Irrigation Electrical Works Estimate amount Rs - 2543550.62/-16.

Appendix I-2 Lift Irrigation Mechanical Works Estimate amount Rs - 3905484.11/-17.

Appendix L- Soil Investigation Provision included for detailed soil investigation such as bore holes and SPT along the alignment of pipe including locations of steel pedestal pipe supports, siphon, pipe aqueduct and tunnel. Estimate amount - Rs- 860490.00/- The

Total Estimated Cost of the project including provision for 12% GST is Rs- 282.83 Crores.



Other Engineering Organisations

**PRICE**



## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### General Abstract

(Dsor year: **2016**, Cost Index Applied for this estimate is **31.06%**)

SI No	Heading Description	Amount
1	Appendix A- Fabricating and Supplying 2800mm diameter MS Pipe	531920317.10
2	Appendix B- Laying MS Pipe	172379347.79
3	Appendix C- Steel pedestal supporting structure for MS Pipe	350588285.18
4	Appendix D Tunneling for a length of 660m	128543610.94
5	Appendix E- Regulating shutters at inlet and intermediate locations	20398733.46
6	Appendix F - Providing inspection chambers	17205016.97
7	Appendix G -Surplus Water Escape	56242673.54
8	Appendix H Side Protection works at river crossings and Eris	55805113.42
9	Appendix I- Lift Irrigation Civil Works	15628321.68
10	Appendix J- Micro Irrigation	696453758.00
11	Appendix K- Revival of pond	133044221.69
12	Appendix L- Consultancy and Service Charges	12000000.00
13	Appendix M Land Acquisition	12600000.00
14	Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal	93757663.79
15	Appendix I.1- LIFT IRRIGATION ELECTRICAL PART	2543550.62
16	Appendix I.2- Lift Irrigation Mechanical Part	3905484.11
17	APPENDIX O -SOIL INVESTIGATION	860490.00
	Provision for GST payments (in %) @	<b>12.0%</b>
	Amount reserved for GST payments	<b>303033190.59</b>
	Total	<b>2828309778.59</b>
	Lumpsum for round off	<b>0.00</b>
		<b>TOTAL Rs 2828309778.59</b>
		<b>Rounded Total Rs 2,82,83,09,779</b>
Rupees Two Hundred Eighty Two Crore Eighty Three Lakh Nine Thousand Seven Hundred and Seventy Nine Only		

(Cost Index Applied for this estimate is 31.06%)

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Abstract Estimate

(Dsr year: **2016**, Cost Index Applied for this estimate is **31.06%**)

<b>1 Appendix A- Fabricating and Supplying 2800mm diameter MS Pipe</b>	
1	od50401/2019_2020 Manufacturing and supplying 2800mm dia MS pipe of various length with shell thickness 12mm including painting with 2 coats of red oxide primer, l
Net Total Quantity	
5770.000 metre	
Say 5770.000 metre @ Rs 92187.23 / metre	
<b>Rs 531920317.10</b>	
<b>2 Appendix B- Laying MS Pipe</b>	
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil
Net Total Quantity	
235369.317 cum	
Say 235369.317 cum @ Rs 165.07 / cum	
<b>Rs 38852413.16</b>	
2	2.7.3 Earth work in excavation by mechanical means (Hydraulic excavator )/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.Hard rock (blasting prohibited
Net Total Quantity	
26250.000 cum	
Say 26250.000 cum @ Rs 812.31 / cum	
<b>Rs 21323137.50</b>	
3	od50390/2019_2020 Supplying and filling Jamuna sand including watering, ramming consolidating and dressing complete.
Net Total Quantity	
9485.000 cum	
Say 9485.000 cum @ Rs 1202.80 / cum	
<b>Rs 11408558.00</b>	
4	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)
Net Total Quantity	
114.584 cum	
Say 114.584 cum @ Rs 6309.95 / cum	
<b>Rs 723019.31</b>	
5	5.1.2 Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level:1:1:5:3 (1 cement 1.5 coarse sand :3 graded stone aggregate 20 mm nominal size
Net Total Quantity	
492.023 cum	

Say 492.023 cum @ Rs 8145.84 / cum		<b>Rs 4007940.63</b>
6	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, buttersesses, plinth and string courses etc.	
Net Total Quantity		816.400 sqm
Say 816.400 sqm @ Rs 496.19 / sqm		<b>Rs 405089.52</b>
7	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more	
Net Total Quantity		49204.300 kilogram
Say 49204.300 kilogram @ Rs 74.18 / kilogram		<b>Rs 3649974.97</b>
8	od50398/2019_2020 Laying MS Pipe 2800mm diameter including welding joints in line and levels as directed by Departmental officers at site.	
Net Total Quantity		5570.000 metre
Say 5570.000 metre @ Rs 16518.71 / metre		<b>Rs 92009214.70</b>
<b>3 Appendix C- Steel pedestal supporting structure for MS Pipe</b>		
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil	
Net Total Quantity		27483.300 cum
Say 27483.300 cum @ Rs 165.07 / cum		<b>Rs 4536668.33</b>
2	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)	
Net Total Quantity		3790.800 cum
Say 3790.800 cum @ Rs 6309.95 / cum		<b>Rs 23919758.46</b>
3	5.33.1 Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work upto plinth level	
Net Total Quantity		9434.881 cum

Say 9434.881 cum @ Rs 8448.78 / cum		<b>Rs 79713233.90</b>
4	5.9.1 Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases of columns, etc for mass concrete	
Net Total Quantity		19305.001 sqm
Say 19305.001 sqm @ Rs 254.19 / sqm		<b>Rs 4907138.20</b>
5	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more	
Net Total Quantity		943488.100 kilogram
Say 943488.100 kilogram @ Rs 74.18 / kilogram		<b>Rs 69987947.26</b>
6	10.2 Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	
Net Total Quantity		1873179.000 kg
Say 1873179.000 kg @ Rs 88.66 / kg		<b>Rs 166076050.14</b>
7	13.63.1 Painting with aluminium paint of approved brand and manufacture to give an even shade.Two or more coats on new work	
Net Total Quantity		16146.000 sqm
Say 16146.000 sqm @ Rs 89.65 / sqm		<b>Rs 1447488.90</b>
<b>4 Appendix D Tunneling for a length of 660m</b>		
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil	
Net Total Quantity		1201.000 cum
Say 1201.000 cum @ Rs 165.07 / cum		<b>Rs 198249.07</b>
2	od51641/2019_2020 Excavation for adit by tunnelling methods in all types of rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, scaling excavated surface, removing and hauling excavated muck outside adit upto specified dump area and all other ancillary operations etc., complete with all leads and lifts	
Net Total Quantity		8289.600 cum
Say 8289.600 cum @ Rs 4852.75 / cum		<b>Rs 40227356.40</b>

3	od51643/2019_2020 Excavation for vertical / inclined shaft in all types of soft / hard rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, shoring, strutting, scaling excavated surface, removing and hauling excavated muck outside shaft upto specified dump area and all other ancillary operations etc., complete with all leads and all lifts	
Net Total Quantity		10597.500 cum
Say 10597.500 cum @ Rs 3963.97 / cum		<b>Rs 42008172.07</b>
4	od51645/2019_2020 Removing and hauling muck overfallen due to natural causes such as geological faults etc., out of tunnel including cost of all materials, machinery, labour, ventilation, drainage, lighting, breaking any large fragments by blasting if necessary with all other ancillary operations and disposing off the same in specified dump area or as directed etc., complete with all leads and all lifts.	
Net Total Quantity		2770.000 cum
Say 2770.000 cum @ Rs 748.01 / cum		<b>Rs 2071987.70</b>
5	od51646/2019_2020 Providing 25 mm thick guniting to sides and arch of tunnel in CM 1 : 3 proportion by weight including cost of all materials, machinery, labour, ventilation, lighting, drainage and all other ancillary operations etc., complete with all leads and all lifts.	
Net Total Quantity		6735.300 per sqm
Say 6735.300 per sqm @ Rs 1216.79 / per sqm		<b>Rs 8195445.69</b>
6	od51647/2019_2020 Providing and fixing 25 mm dia. steel rock bolts with one end provided with mechanical /wedge type anchorage and other end provided with threads for fixing washers and nuts including cost of all materials, machinery,labour, ventilation, lighting, drainage, drilling 32 mm dia holes, providing 150 mm long 20 mm thick steel tapered wedge, providing 10 mm thick and 200 x 200 mm size plate washer and nuts, driving bolt, fixing washers and nuts, tightening bolt by torque wrench and all other ancillary operations etc., complete with all leads and all lifts.	
Net Total Quantity		4966.500 metre
Say 4966.500 metre @ Rs 2214.05 / metre		<b>Rs 10996079.33</b>
7	od51649/2019_2020 Providing, fabricating and fixing in position temporary structural steel supports as per details and dismantling and conveying the same to other place or outside tunnel before concreting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cutting,bending, welding, grinding, and all other ancillary operations etc., complete with all leads and all lifts.	
Net Total Quantity		25.000 MT
Say 25.000 MT @ Rs 43925.61 / MT		<b>Rs 1098140.25</b>
8	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more	

		Net Total Quantity	168382.500 kilogram
		Say 168382.500 kilogram @ Rs 74.18 / kilogram	<b>Rs 12490613.85</b>
9	od51658/2019_2020 Drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer or stooper drills as directed to specified depth for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cleaning holes, and all other ancillary operations etc., complete.		
		Net Total Quantity	1382.000 per metre
		Say 1382.000 per metre @ Rs 729.42 / per metre	<b>Rs 1008058.44</b>
10	od51659/2019_2020 Grouting cement slurry in grout holes under specified pressure for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, redrilling wherever necessary, and all other ancillary operations etc., complete with all leads and all lifts.		
		Net Total Quantity	103650.000 kg
		Say 103650.000 kg @ Rs 27.43 / kg	<b>Rs 2843119.50</b>
11	od51660/2019_2020 Cost of electric line, lighting and ventilation as per requirement at site		
		Net Total Quantity	1.000 L.S
		Say 1.000 L.S @ Rs 7406388.65 / L.S	<b>Rs 7406388.65</b>
<b>5 Appendix E- Regulating shutters at inlet and intermediate locations</b>			
1	85.101 Supply of MS plates conforming to IS 2062GrB including cost of conveyance charges		
		Net Total Quantity	60143.040 kg
		Say 60143.040 kg @ Rs 64.18 / kg	<b>Rs 3859980.31</b>
2	85.102 Supply of MS Tees, Angles, Joists, ISMB, ISMC conforming to IS2062GrA/B including cost of conveyance charges		
		Net Total Quantity	10626.000 kg
		Say 10626.000 kg @ Rs 66.13 / kg	<b>Rs 702697.38</b>
3	od50859/2019_2020 Cost of MS bolts and nuts		
		Net Total Quantity	700.800 kg
		Say 700.800 kg @ Rs 94.60 / kg	<b>Rs 66295.68</b>
4	85.107 Supply of MS round bar including cost of conveyance charges		
		Net Total Quantity	23.520 kg
		Say 23.520 kg @ Rs 64.18 / kg	<b>Rs 1509.51</b>

5	85.108 Fabrication, erection and commissioning of Structural steel Embedded parts in IS2062 Grade and accessories as per approved specifications, drawings and directions of deptl officer at site including cost of labour , machinery , incidental and handling charges etc complete but excluding cost of material already supplied	
		Net Total Quantity 28174.980 kg
		Say 28174.980 kg @ Rs 75.59 / kg <b>Rs 2129746.74</b>
6	od50880/2019_2020 Fabrication, Supply, erection and assembling in correct position and alignment by welding SS Embedded parts in 304L Grade like roller track, seal track, Seal seat etc as per approved specifications, drawings and directions of deptl officer at site including cost of all materials,labour,machinery for planing,welding, shearing, grinding etc,lead and lift, conveyance, incidental and handling etc complete	
		Net Total Quantity 2787.120 kg
		Say 2787.120 kg @ Rs 587.53 / kg <b>Rs 1637516.61</b>
7	85.110 Fabrication and supply of Structural steel wheel gate and accessories as per approved specifications, drawings and directions of deptl officer at site including cost of labour, machinery, all leads and lifts, incidental and handling charges etc complete but excluding cost of material already supplied	
		Net Total Quantity 172854.000 kg
		Say 172854.000 kg @ Rs 62.86 / kg <b>Rs 10865602.44</b>
8	85.112 Painting all the exposed surfaces of the gate and embedded parts with two coats of epoxy coal tar black paint confirming to IS14948 with a minimum film thickness of 150+/-5 microns per each coat over two coats of priming coat applied with zinc primer containing not less than 85% of zinc dry film with a film thickness of 70+/-5 microns , so that the total film thickness of all coats including priming coat at any rate is not less than 350microns over the grit blasted and cleaned surface to class A standard of IS 14177 including cost of all materials , labour charges , cost of testing all painting materials, all incidental charges, hire of T&P etc complete as per the direction of departmental officer at site	
		Net Total Quantity 1401.900 sqm
		Say 1401.900 sqm @ Rs 809.89 / sqm <b>Rs 1135384.79</b>
<b>6 Appendix F - Providing inspection chambers</b>		
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil	
		Net Total Quantity 2954.881 cum
		Say 2954.881 cum @ Rs 165.07 / cum <b>Rs 487762.21</b>



2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)	
Net Total Quantity		155.520 cum
Say 155.520 cum @ Rs 5869.06 / cum		<b>Rs 912756.21</b>
3	5.2.2 Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up tot floor five level excluding cost of centering, shuttering, finishing and reinforcement :1:1.5:3( 1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		842.712 cum
Say 842.712 cum @ Rs 9365.29 / cum		<b>Rs 7892242.27</b>
4	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	
Net Total Quantity		2668.800 sqm
Say 2668.800 sqm @ Rs 496.19 / sqm		<b>Rs 1324231.87</b>
5	5.9.3 Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs, landings, balconies and access platform	
Net Total Quantity		360.000 sqm
Say 360.000 sqm @ Rs 553.47 / sqm		<b>Rs 199249.20</b>
6	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more	
Net Total Quantity		84271.200 kilogram
Say 84271.200 kilogram @ Rs 74.18 / kilogram		<b>Rs 6251237.62</b>
7	od50857/2019_2020 Supplying and fixing cast iron manhole cover as directed by Departmental officials	
Net Total Quantity		10.000 each
Say 10.000 each @ Rs 13753.76 / each		<b>Rs 137537.60</b>
<b>7 Appendix G -Surplus Water Escape</b>		
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil	

		Net Total Quantity	22830.325 cum
		Say 22830.325 cum @ Rs 165.07 / cum	<b>Rs 3768601.75</b>
2	5.2.2 Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up tot floor five level excluding cost of centering, shuttering, finishing and reinforcement :1:1.5:3( 1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)		
		Net Total Quantity	175.730 cum
		Say 175.730 cum @ Rs 9365.29 / cum	<b>Rs 1645762.41</b>
3	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)		
		Net Total Quantity	682.596 cum
		Say 682.596 cum @ Rs 5869.06 / cum	<b>Rs 4006196.88</b>
4	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)		
		Net Total Quantity	5050.501 cum
		Say 5050.501 cum @ Rs 6309.95 / cum	<b>Rs 31868408.78</b>
5	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.		
		Net Total Quantity	675.841 sqm
		Say 675.841 sqm @ Rs 496.19 / sqm	<b>Rs 335345.55</b>
6	5.9.1 Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases of columns, etc for mass concrete		
		Net Total Quantity	11325.000 sqm
		Say 11325.000 sqm @ Rs 254.19 / sqm	<b>Rs 2878701.75</b>
7	5.9.6 Centering and shuttering including strutting, etc. and removal of form for:Columns, Pillars, Piers, Abutments, Posts and Struts		
		Net Total Quantity	4800.000 sqm
		Say 4800.000 sqm @ Rs 613.16 / sqm	<b>Rs 2943168.00</b>

8	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more		
		Net Total Quantity	118583.020 kilogram
		Say 118583.020 kilogram @ Rs 74.18 / kilogram	<b>Rs 8796488.42</b>
<b>8 Appendix H Side Protection works at river crossings and Eris</b>			
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil		
		Net Total Quantity	527.600 cum
		Say 527.600 cum @ Rs 165.07 / cum	<b>Rs 87090.93</b>
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)		
		Net Total Quantity	551.600 cum
		Say 551.600 cum @ Rs 5869.06 / cum	<b>Rs 3237373.50</b>
3	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)		
		Net Total Quantity	4420.000 cum
		Say 4420.000 cum @ Rs 6309.95 / cum	<b>Rs 27889979.00</b>
4	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more		
		Net Total Quantity	331500.000 kilogram
		Say 331500.000 kilogram @ Rs 74.18 / kilogram	<b>Rs 24590670.00</b>
<b>9 Appendix I- Lift Irrigation Civil Works</b>			
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil		
		Net Total Quantity	1914.006 cum
		Say 1914.006 cum @ Rs 165.07 / cum	<b>Rs 315944.97</b>

2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)	
Net Total Quantity		30.754 cum
Say 30.754 cum @ Rs 5869.06 / cum		<b>Rs 180497.07</b>
3	5.1.2 Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level:1:1:5:3 (1 cement 1.5 coarse sand :3 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		113.314 cum
Say 113.314 cum @ Rs 8145.84 / cum		<b>Rs 923037.71</b>
4	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	
Net Total Quantity		893.120 sqm
Say 893.120 sqm @ Rs 496.19 / sqm		<b>Rs 443157.21</b>
5	13.7.1 12 mm cement plaster finished with a floating coat of neat cement of mix:1:3 ( 1 cement : 3 fine sand)	
Net Total Quantity		701.600 sqm
Say 701.600 sqm @ Rs 297.24 / sqm		<b>Rs 208543.58</b>
6	2.31 Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared	
Net Total Quantity		556.000 sqm
Say 556.000 sqm @ Rs 9.44 / sqm		<b>Rs 5248.64</b>
7	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil	
Net Total Quantity		4955.513 cum
Say 4955.513 cum @ Rs 218.08 / cum		<b>Rs 1080698.28</b>
8	4.1.10 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size)	

		Net Total Quantity	270.844 cum
		Say 270.844 cum @ Rs 5516.38 / cum	<b>Rs 1494078.42</b>
9	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with:Cement mortar 1:6 (1 cement : 6 coarse sand)		
		Net Total Quantity	3.825 cum
		Say 3.825 cum @ Rs 5197.64 / cum	<b>Rs 19880.97</b>
10	13.33.2 Pointing on stone work with cement mortar 1:3 ( 1 cement : 3 fine sand):Raised and cut pointing		
		Net Total Quantity	4.080 sqm
		Say 4.080 sqm @ Rs 400.65 / sqm	<b>Rs 1634.65</b>
11	4.10 Providing and laying damp-proof course 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size).		
		Net Total Quantity	3.060 sqm
		Say 3.060 sqm @ Rs 344.82 / sqm	<b>Rs 1055.15</b>
12	4.13 Applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil.		
		Net Total Quantity	3.060 sqm
		Say 3.060 sqm @ Rs 120.44 / sqm	<b>Rs 368.55</b>
13	4.17 Making plinth protection 50 mm thick of cement concrete 1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.		
		Net Total Quantity	4.800 sqm
		Say 4.800 sqm @ Rs 590.29 / sqm	<b>Rs 2833.39</b>
14	2.25 Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m.		
		Net Total Quantity	886.039 cum
		Say 886.039 cum @ Rs 164.81 / cum	<b>Rs 146028.09</b>

15	5.33.1 Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work upto plinth level	
Net Total Quantity		163.200 cum
Say 163.200 cum @ Rs 8448.78 / cum		<b>Rs 1378840.90</b>
16	4.1.3 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:2:4 (cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		28.800 cum
Say 28.800 cum @ Rs 7184.64 / cum		<b>Rs 206917.63</b>
17	50.6.1.2 Solid block masonry using pre cast solid blocks (Factory made) of size 40x20x20cm or nearest available size confirming to IS 2185 part I of 1979 for super structure up to floor two level thickness 20cm and above in: CM 1:6 ( 1 cement: 6 coarse sand) etc complete.	
Net Total Quantity		4.769 cum
Say 4.769 cum @ Rs 5533.78 / cum		<b>Rs 26390.60</b>
18	5.37.2 Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centering, shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in-charge. Note:- Cement content considered in this item is @330 kg/cum. Excess /less cement used as per design mix is payable/recoverable separately.All work above plinth level upto floor V level	
Net Total Quantity		0.810 cum
Say 0.810 cum @ Rs 9852.04 / cum		<b>Rs 7980.15</b>
19	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more	
Net Total Quantity		49350.500 kilogram
Say 49350.500 kilogram @ Rs 74.18 / kilogram		<b>Rs 3660820.09</b>

20	19.19.1.1 Providing and fixing in position Pre-cast R.C.C. manhole cover and frame of required shape and approved quality.L D - 2.5Rectangular shape 600x450 mm internal dimensions	
Net Total Quantity		5.000 each
Say 5.000 each @ Rs 1406.34 / each		<b>Rs 7031.70</b>
21	22.23.1 Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels/ subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer in-charge. The product performance shall carry guarantee for 10 years against any leakage. For vertical surface two coats @ 0.70 kg per sqm	
Net Total Quantity		556.000 sqm
Say 556.000 sqm @ Rs 613.49 / sqm		<b>Rs 341100.44</b>
22	22.23.2 Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels/ subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer in-charge. The product performance shall carry guarantee for 10 years against any leakage. For horizontal surface one coat @ 1.10 kg per sqm.	
Net Total Quantity		546.000 sqm
Say 546.000 sqm @ Rs 474.90 / sqm		<b>Rs 259295.40</b>
23	13.44.1 Finishing walls with water proofing cement paint of required shade: New work (Two or more coats applied @ 3.84 kg/10 sqm)	
Net Total Quantity		948.000 sqm
Say 948.000 sqm @ Rs 77.06 / sqm		<b>Rs 73052.88</b>



24	5.33.2 Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work above plinth level upto floor V level	
Net Total Quantity		374.400 cum
Say 374.400 cum @ Rs 9501.92 / cum		<b>Rs 3557518.85</b>
25	5.34.1 Extra for providing richer mixes at all floor levels. Note:- Excess/less cement over the specified cement content used is payable/ recoverable separately.Providing M-30 grade concrete instead of M-25 grade BMC/RMC. (Note:- Cement content considered in M-30 is @ 340 kg/cum).	
Net Total Quantity		322.500 cum
Say 322.500 cum @ Rs 91.09 / cum		<b>Rs 29376.53</b>
26	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)	
Net Total Quantity		948.000 sqm
Say 948.000 sqm @ Rs 188.46 / sqm		<b>Rs 178660.08</b>
27	10.26.1 Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works, including applying priming coat of approved steel primer.M.S. tube	
Net Total Quantity		8431.651 kg
Say 8431.651 kg @ Rs 120.64 / kg		<b>Rs 1017194.38</b>
28	10.25.2 Item Shifted to head 14 as item 14.74Steel work welded in built up sections/framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	
Net Total Quantity		542.702 kg
Say 542.702 kg @ Rs 112.65 / kg		<b>Rs 61135.38</b>
<b>10 Appendix J- Micro Irrigation</b>		

1	od270721/2019_2020 Design and laying, testing and commissioning of Drip irrigation facilities to the ayacut area, Providing drawings, including cost and conveyance of all materials, labour charges, trenching in all classes of soil, all accessories such as filtration units, PVC feeder main PVC Net work, Sub main PVC Network, Valves & Fertigation units, drippers and driplines, Automation control, including Automatic filtration unit, Watermeter, Net Beat wireless controller, gravel filter with back wash valve, Irrigation Valve and accessories, Air valve and Accessories, stabilizer, spike supporter, Isolation transformer, antenna mounting poles Electrical cable and accessories, float switch etc complete, including operation and maintenance for a period 5years.	
Net Total Quantity		3575.000 Hecter
Say 3575.000 Hecter @ Rs 194812.24 / Hecter		<b>Rs 696453758.00</b>
<b>11 Appendix K- Revival of pond</b>		
1	2.31 Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared	
Net Total Quantity		25959.000 sqm
Say 25959.000 sqm @ Rs 9.44 / sqm		<b>Rs 245052.96</b>
2	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil	
Net Total Quantity		65138.805 cum
Say 65138.805 cum @ Rs 165.07 / cum		<b>Rs 10752462.54</b>
3	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil	
Net Total Quantity		7773.488 cum
Say 7773.488 cum @ Rs 218.08 / cum		<b>Rs 1695242.26</b>
4	50.2.3.1 Pumping or Bailing out water and removing slush etc by using pump set including cost of labour, oil hire charges of pumpset, etc complete	
Net Total Quantity		3340.000 hour
Say 3340.000 hour @ Rs 189.18 / hour		<b>Rs 631861.20</b>

5	60.7.1 DRY RUBBLE MASONRY _ Dry rubble without concrete levelling course masonry with good quality blasted rubble including packing to compactness to lines and levels cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site	
Net Total Quantity		19644.822 cum
Say 19644.822 cum @ Rs 2515.43 / cum		<b>Rs 49415174.60</b>
6	7.2.1 Random rubble masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) at window sills, ceiling level and the like.Cement mortar 1:6 (1 cement : 6 coarse sand)	
Net Total Quantity		3337.950 cum
Say 3337.950 cum @ Rs 6284.52 / cum		<b>Rs 20977413.53</b>
7	4.1.2 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:1/2:3 (cement : 1 1/2 coarse sand : 3 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		1430.824 cum
Say 1430.824 cum @ Rs 7764.85 / cum		<b>Rs 11110133.74</b>
8	4.1.5 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		1483.157 cum
Say 1483.157 cum @ Rs 6457.33 / cum		<b>Rs 9577234.19</b>
9	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)	
Net Total Quantity		2698.742 cum
Say 2698.742 cum @ Rs 5869.06 / cum		<b>Rs 15839078.72</b>
10	4.3.2 Centering and shuttering including strutting, propping etc. and removal of form work for:Retaining walls, return walls, (any thickness) including attached pilasters, buttresses, plinth and string courses fillets, kerbs and steps etc.	
Net Total Quantity		9732.750 sqm
Say 9732.750 sqm @ Rs 496.19 / sqm		<b>Rs 4829293.22</b>

11	5.9.3 Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs, landings, balconies and access platform		
		Net Total Quantity	454.160 sqm
		Say 454.160 sqm @ Rs 553.47 / sqm	<b>Rs 251363.94</b>
12	5.9.5 Centering and shuttering including strutting, etc. and removal of form for:Lintels, beams, plinth beams, girders bressumers and cantilevers		
		Net Total Quantity	80.040 sqm
		Say 80.040 sqm @ Rs 449.40 / sqm	<b>Rs 35969.98</b>
13	5.9.19 Centering and shuttering including strutting, etc. and removal of form for:Weather shade, Chajjas, corbels etc., including edges		
		Net Total Quantity	2.240 sqm
		Say 2.240 sqm @ Rs 683.81 / sqm	<b>Rs 1531.73</b>
14	5.30 Add for plaster drip course / groove in plastered surface or moulding to R.C.C. projections.		
		Net Total Quantity	2.800 metre
		Say 2.800 metre @ Rs 44.76 / metre	<b>Rs 125.33</b>
15	13.1.2 12 mm cement plaster of mix:1:6 (1 cement : 6 fine sand).		
		Net Total Quantity	56.400 sqm
		Say 56.400 sqm @ Rs 210.15 / sqm	<b>Rs 11852.46</b>
16	5.22A.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete above plinth level.Thermo - Mechanically Treated bars of grade Fe-500D or more		
		Net Total Quantity	100157.681 kg
		Say 100157.681 kg @ Rs 74.18 / kg	<b>Rs 7429696.78</b>
17	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)		
		Net Total Quantity	6.560 sqm
		Say 6.560 sqm @ Rs 188.46 / sqm	<b>Rs 1236.30</b>

18	22.7.1 Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc. consisting of following operations: a) Applying a slurry coat of neat cement using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-Charge over the RCC slab including adjoining walls upto 300 mm height including cleaning the surface before treatment. b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 ( 1 cement : 5 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-Charge over 20 mm thick layer of cement mortar of mix 1:5 ( 1 cement : 5 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer - in- Charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-Charge. d) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 ( 1 cement : 4 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer - in- Charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep. e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by Engineer in Charge:With average thickness of 120 mm and minimum thickness at khurra as 65 mm	
Net Total Quantity		2.640 sqm
Say 2.640 sqm @ Rs 1356.01 / sqm		<b>Rs 3579.87</b>
19	13.46.1 Finishing walls with Acrylic Smooth exterior paint of required shade:New work (Two or more coat applied @ 1.67 ltr/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm)	
Net Total Quantity		21.920 sqm
Say 21.920 sqm @ Rs 125.88 / sqm		<b>Rs 2759.29</b>
20	13.52.1 Finishing with Epoxy paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete.On steel work	
Net Total Quantity		0.540 sqm
Say 0.540 sqm @ Rs 160.55 / sqm		<b>Rs 86.70</b>
21	9.48.2 Providing and fixing M.S. Grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete.Fixed to openings/ wooden frames with rawl plugs screws etc	
Net Total Quantity		8.532 kg
Say 8.532 kg @ Rs 147.38 / kg		<b>Rs 1257.45</b>

22	9.1.1 Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately).Second class teak wood	
Net Total Quantity		0.065 cum
Say 0.065 cum @ Rs 121549.04 / cum		<b>Rs 7900.69</b>
23	9.7.1 Providing and fixing panelling or panelling and glazing in panelled or panelled and glazed shutters for doors, windows and clerestory windows (Area of opening for panel inserts excluding portion inside grooves or rebates to be measured), Panelling for panelled or panelled and glazed shutters 25 mm to 40 mm thick:Second class teak wood	
Net Total Quantity		0.270 sqm
Say 0.270 sqm @ Rs 2669.76 / sqm		<b>Rs 720.84</b>
24	9.5.1.1 Providing and fixing panelled or panelled and glazed shutters for shutters for doors, windows and clerestory windows, including ISI marked M.S. pressed butt hinges bright finished of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer - in-charge.Second class teak wood35 mm thick shutters	
Net Total Quantity		2.114 sqm
Say 2.114 sqm @ Rs 3339.61 / sqm		<b>Rs 7059.94</b>
25	9.126.1 Providing and fixing 12 mm thick panelling or panelling and glazing in panelled or panelled and glazed shutters for doors, windows and clerestory windows ( area of opening for panel inserts excluding portion inside grooves or rebates to be measured). Panelling for panelled and glazed shutters 25 mm to 40 mm thick.Marine plywood conformingto IS : 710	
Net Total Quantity		1.050 sqm
Say 1.050 sqm @ Rs 1895.91 / sqm		<b>Rs 1990.71</b>
26	13.69.1 Polishing on wood work with ready mixed wax polish of approved brand and manufacture:New work	
Net Total Quantity		2.640 sqm
Say 2.640 sqm @ Rs 121.49 / sqm		<b>Rs 320.73</b>
27	9.86.1 Providing and fixing bright finished brass casement stays (straight peg type) with necessary screws etc. complete:300 mm weighing not less than 330 gms	
Net Total Quantity		1.000 no
Say 1.000 no @ Rs 221.69 / no		<b>Rs 221.69</b>

28	9.96.1 Providing and fixing aluminium sliding door bolts, ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868), transparent or dyed to required colour or shade, with nuts and screws etc. complete:300x16 mm	
Net Total Quantity		1.000 no
Say 1.000 no @ Rs 278.44 / no		<b>Rs 278.44</b>
29	9.97.3 Providing and fixing aluminium tower bolts, ISI marked, anodised(anodic coating not less than grade AC 10 as per : 1868), transparent or dyed to required colour or shade, with necessary screws complete:200x10 mm	
Net Total Quantity		1.000 no
Say 1.000 no @ Rs 99.80 / no		<b>Rs 99.80</b>
30	9.53 Providing 40x5 mm flat iron hold fast 40 cm long including fixing to frame with 10 mm diameter bolts, nuts and wooden plugs and embeddings in cement concrete block 30x10x15 cm 1:3:6 mix ( 1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		8.000 each
Say 8.000 each @ Rs 155.44 / each		<b>Rs 1243.52</b>
31	9.100.1 Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete:125 mm	
Net Total Quantity		1.000 no
Say 1.000 no @ Rs 66.97 / no		<b>Rs 66.97</b>
32	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	
Net Total Quantity		420.000 sqm
Say 420.000 sqm @ Rs 496.19 / sqm		<b>Rs 208399.80</b>
33	19.15.1 Providing M.S. foot rests including fixing in manholes with 20x20x10 cm cement concrete blocks 1:3:6 (1 cement : 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) as per standard design.With 20x20 mm square bar	
Net Total Quantity		10.000 each
Say 10.000 each @ Rs 351.18 / each		<b>Rs 3511.80</b>
<b>12 Appendix L- Consultancy and Service Charges</b>		
Lump-Sum Total		<b>Rs 12000000.00</b>
<b>13 Appendix M Land Acquisition</b>		

Lump-Sum Total		<b>Rs 126000000.00</b>
<b>14 Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal</b>		
1	2.3.1 Banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller, or wooden or steel rammers, and rolling every 3rd and top-most layer with power roller of minimum 8 tonnes and dressing up, in embankments for roads, flood banks, marginal banks, and guide banks etc., lead up to 50 m and lift up to 1.5 m :All kinds of soil	
Net Total Quantity		28000.000 cum
Say 28000.000 cum @ Rs 353.53 / cum		<b>Rs 9898840.00</b>
2	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil	
Net Total Quantity		12719.325 cum
Say 12719.325 cum @ Rs 218.08 / cum		<b>Rs 2773830.40</b>
3	od265908/2019_2020 Fabrication of structural steel gate and accessories as per approved specifications, drawings and directions of departmental officer at site including cost of labour ,machinery ,all leads and lifts, incidental and handling charges etc complete but excluding cost of material already supplied Rate analysis for 10 qtl fabrication	
Net Total Quantity		405.868 kg
Say 405.868 kg @ Rs 36.36 / kg		<b>Rs 14757.36</b>
4	15.2.1 Demolishing cement concrete manually / by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in-Charge.Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)	
Net Total Quantity		526.273 cum
Say 526.273 cum @ Rs 1306.73 / cum		<b>Rs 687696.72</b>
5	4.1.3 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:2:4 (cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		1290.393 cum
Say 1290.393 cum @ Rs 7184.64 / cum		<b>Rs 9271009.16</b>
6	4.1.5 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	



		Net Total Quantity	2206.628 cum
		Say 2206.628 cum @ Rs 6457.33 / cum	<b>Rs 14248925.18</b>
7	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)		
		Net Total Quantity	4879.526 cum
		Say 4879.526 cum @ Rs 5869.06 / cum	<b>Rs 28638230.87</b>
8	5.22A.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete above plinth level.Thermo - Mechanically Treated bars of grade Fe-500D or more		
		Net Total Quantity	11025.000 kg
		Say 11025.000 kg @ Rs 74.18 / kg	<b>Rs 817834.50</b>
9	60.7.4 DR PACKING FOR APRONS - Rough stone dry packing for apron with good quality blasted rubble including packing to compactness to lines levels, cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site		
		Net Total Quantity	8400.000 cum
		Say 8400.000 cum @ Rs 2600.69 / cum	<b>Rs 21845796.00</b>
10	85.101 Supply of MS plates confirming to IS 2062GrB including cost of conveyance charges		
		Net Total Quantity	364.556 kg
		Say 364.556 kg @ Rs 64.18 / kg	<b>Rs 23397.20</b>
11	85.102 Supply of MS Tees, Angles, Joists, ISMB, ISMC confirming to IS2062GrA/B including cost of conveyance charges		
		Net Total Quantity	276.320 kg
		Say 276.320 kg @ Rs 66.13 / kg	<b>Rs 18273.04</b>
12	85.114 Painting all the exposed surfaces of the gate and embedded parts with two coats of epoxy coal tar black paint confirming to IS14948 with a minimum film thickness of 150+/-5 microns per each coat over two coats of priming coat applied with zinc primer containing not less than 85% of zinc on dry film with a film thickness of 70+/-5 microns , so that the total film thickness of all coats including priming coat at any rate is not less than 350 microns after cleaning the surface using hand and power tool cleaning including cost of all materials, labour charges , cost of testing all painting materials, all incidental charges, hire of T&P etc. complete as per the direction of department officers at site		
		Net Total Quantity	18.240 sqm
		Say 18.240 sqm @ Rs 416.41 / sqm	<b>Rs 7595.32</b>

13	od265989/2019_2020 Erection of shutter in correct position including cost of all materials labour etc complete	
Net Total Quantity		3.000 no
Say 3.000 no @ Rs 1040.47 / no		<b>Rs 3121.41</b>
14	od265990/2019_2020 Supply of locking arrangements including cost of all materials ,labour ,hire charges and conveyance	
Net Total Quantity		6.000 each
Say 6.000 each @ Rs 232.30 / each		<b>Rs 1393.80</b>
15	od265996/2019_2020 supply and fabrication of screw rod of dia 50mm including cost of all materials ,labour, hire charges and conveyance etc complete	
Net Total Quantity		8.000 metre
Say 8.000 metre @ Rs 2599.64 / metre		<b>Rs 20797.12</b>
16	od265999/2019_2020 providing base and nut arrangement for hoisting the shutter including cost of all materials labour etc complete	
Net Total Quantity		3.000 no
Say 3.000 no @ Rs 7563.22 / no		<b>Rs 22689.66</b>
17	od266004/2019_2020 Erection of base and nut and screw rod etc in correct position and alignment, trial run including cost of all materials labour etc complete	
Net Total Quantity		3.000 no
Say 3.000 no @ Rs 1882.73 / no		<b>Rs 5648.19</b>
18	85.115 Cost of painting with 2 coats of enamel paint over 1 coat of zinchromate primer as per IS1477:1994 after hand and power tool cleaning including cost of all materials, labour charges, cost of testing all painting materials, all incidental charges, hire of T&P etc. complete as per the direction of department officers at site	
Net Total Quantity		6.515 sqm
Say 6.515 sqm @ Rs 143.91 / sqm		<b>Rs 937.57</b>
19	15.9.2 Demolishing stone rubble masonry manually / by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer -in-Charges:In cement mortar	
Net Total Quantity		6.225 cum
Say 6.225 cum @ Rs 1318.07 / cum		<b>Rs 8204.99</b>

20	60.7.9 RR with Departmental. Stone - Random rubble masonry using departmental rubble in foundation and plinth including through and bond stone and levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) upto plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand).	
Net Total Quantity		4.500 cum
Say 4.500 cum @ Rs 3695.09 / cum		<b>Rs 16627.91</b>
21	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with:Cement mortar 1:6 (1 cement : 6 coarse sand)	
Net Total Quantity		12.845 cum
Say 12.845 cum @ Rs 5197.64 / cum		<b>Rs 66763.69</b>
22	4.3.2 Centering and shuttering including strutting, propping etc. and removal of form work for:Retaining walls, return walls, (any thickness) including attached pilasters, buttresses, plinth and string courses fillets, kerbs and steps etc.	
Net Total Quantity		626.177 sqm
Say 626.177 sqm @ Rs 496.19 / sqm		<b>Rs 310702.77</b>
23	5.22.1 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelMild steel and Medium Tensile steel bars	
Net Total Quantity		417.270 kg
Say 417.270 kg @ Rs 72.48 / kg		<b>Rs 30243.73</b>
24	4.1.2 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:1/2:3 (cement : 11/2 coarse sand : 3 graded stone aggregate 20 mm nominal size)	
Net Total Quantity		568.100 cum
Say 568.100 cum @ Rs 7764.85 / cum		<b>Rs 4411211.29</b>
25	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)	
Net Total Quantity		78.271 cum
Say 78.271 cum @ Rs 6309.95 / cum		<b>Rs 493886.10</b>
26	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)	

		Net Total Quantity	442.677 sqm
		Say 442.677 sqm @ Rs 188.46 / sqm	<b>Rs 83426.91</b>
27	13.1.1 12 mm cement plaster of mix:1:4 ( 1 cement : 4 fine sand)		
		Net Total Quantity	158.040 sqm
		Say 158.040 sqm @ Rs 226.67 / sqm	<b>Rs 35822.93</b>
<b>15 Appendix I.1- LIFT IRRIGATION ELECTRICAL PART</b>			
1	90.14.1.1 Fabrication, supply, conveyance, installation testing and commissioning of floor or wall mounting, dust and vermin proof, cubicle type MV panel board comprising of the following components/ devices & complying to IS 8623. Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments will be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. Supply and fabrication of MV panel board using 2.00mm CRCA sheet, powder coated (excluding base frame)		
		Net Total Quantity	10.000 sqm
		Say 10.000 sqm @ Rs 2613.01 / sqm	<b>Rs 26130.10</b>
2	90.14.2.2 Supply and providing 3mm SMC sheet as shrouding for bus interconnection / terminations etc. including required nut & bolt etc.		
		Net Total Quantity	1.000 sqm
		Say 1.000 sqm @ Rs 3932.69 / sqm	<b>Rs 3932.69</b>
3	90.14.3.1 Supply and providing heavy duty 'A' section neoprene gasket in the panel board 'A' section neoprene beeding suitable for 1.60/ 2.00 mm sheet		
		Net Total Quantity	30.000 metre
		Say 30.000 metre @ Rs 46.31 / metre	<b>Rs 1389.30</b>
4	90.14.4 Supply and fabrication conveyance and installation of base frame of panel board using 75 x 40 mm rolled steel channel (ISMC)		
		Net Total Quantity	4.000 metre
		Say 4.000 metre @ Rs 953.58 / metre	<b>Rs 3814.32</b>

5	90.14.5 Supply and fabrication conveyance and installation of angle iron frame work for wall mounting panel board		
		Net Total Quantity	30.000 kg
		Say 30.000 kg @ Rs 140.18 / kg	<b>Rs 4205.40</b>
6	90.14.6 Supply and providing copper bus bars including finger type SMC bus bar supports in the bus chamber, suitable size nut & bolt, providing heat shrink sleeves etc. as required.		
		Net Total Quantity	1500.000 Cum cm
		Say 1500.000 Cum cm @ Rs 6.00 / Cum cm	<b>Rs 9000.00</b>
7	90.14.7 Supply and providing copper earth bus in the panel board		
		Net Total Quantity	400.000 Cum cm
		Say 400.000 Cum cm @ Rs 6.00 / Cum cm	<b>Rs 2400.00</b>
8	90.14.10.17 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.320A/400A, 50/55 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC		
		Net Total Quantity	1.000 no
		Say 1.000 no @ Rs 29303.55 / no	<b>Rs 29303.55</b>
9	90.14.10.14 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.250A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC		
		Net Total Quantity	2.000 no
		Say 2.000 no @ Rs 26641.95 / no	<b>Rs 53283.90</b>
10	90.14.10.11 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.125A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC		
		Net Total Quantity	2.000 no
		Say 2.000 no @ Rs 17713.50 / no	<b>Rs 35427.00</b>
11	90.14.11.6 MCCB AccessoriesSupply and fixing 250 - 400A earth fault module of MCCB with builtin CBCT.		
		Net Total Quantity	1.000 no

		Say 1.000 no @ Rs 6902.52 / no	<b>Rs 6902.52</b>
12	90.14.11.14	MCCB Accessories Supply and fixing rotary handle, Direct type (including BUC handle with door interlock ) in the existing MCCB of rating up to 250 A	
		Net Total Quantity	4.000 no
		Say 4.000 no @ Rs 1165.20 / no	<b>Rs 4660.80</b>
13	90.14.11.15	MCCB Accessories Supply and fixing rotary handle, External type (including BUC handle with door interlock ) in the existing MCCB of rating up to 315-630 A	
		Net Total Quantity	1.000 no
		Say 1.000 no @ Rs 2150.20 / no	<b>Rs 2150.20</b>
14	90.14.11.17	MCCB Accessories Supply and fixing kastel interlock kit up to 250A.	
		Net Total Quantity	2.000 no
		Say 2.000 no @ Rs 3020.65 / no	<b>Rs 6041.30</b>
15	90.14.24.23	Supply & fixing the following Power Capacitors 3 phase delta connected in positon and giving connection.10 KVAR, 3 phase, 440 V, delta connected, standard duty Metalised Poly Propylene Capacitor, Box Type, suitable for direct connection to motors.	
		Net Total Quantity	1,000 each
		Say 1.000 each @ Rs 2231.98 / each	<b>Rs 2231.98</b>
16	od272309/2019_2020	Supply and fixing 2A 'C' curve SPMCB in the existing panel board and giving connection.	
		Net Total Quantity	6.000 each
		Say 6.000 each @ Rs 262.49 / each	<b>Rs 1574.94</b>
17	od272312/2019_2020	Supply and installation of digital multi function meter (V,A,F) in the existing panel board and giving connection	
		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 1797.19 / each	<b>Rs 1797.19</b>
18	od272313/2019_2020	Supply and installation of LED indicator (R,Y,B) in the existing panel board and giving connection	
		Net Total Quantity	3.000 Day
		Say 3.000 Day @ Rs 193.94 / Day	<b>Rs 581.82</b>
19	od273809/2019_2020	Supply and providing earth fault relay in the existing panel board and giving connection as required	
		Net Total Quantity	1.000 each

Say 1.000 each @ Rs 7238.98 / each		<b>Rs 7238.98</b>
20	od273810/2019_2020 Supply and providing 50/5A neutral CT in suitable enclosure and giving connection as required.	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 5991.48 / each		<b>Rs 5991.48</b>
21	od273811/2019_2020 Supply and installation of 200KVA copper wound oil immersed indoor 11kV/433V, Vector DYN-11, with off circuit tapping from + 5% to -10% in steps of 2.5 %, first fill of oil upto MOL in conservator, with HV cable box suitable for XLPE cable and LV cable box suitable for single run of PVCA cable with all standard fittings and accessories conforming to IS : 1180(Level-2) (Make Unipower/Intrans/KEL.)	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 596793.00 / each		<b>Rs 596793.00</b>
22	od273812/2019_2020 Supply, installation testing and commissioning of Out door Load Break Switch HT metering panel consisting of the following: 1. 11KV, 26.2KA, 630A Load Break Switch with earth switch - 1no. 2. CT ratio 10/5, 10VA, SL;0.2S - 3nos. 3. Fixed type PT of ratio:11KV/110V, 25VA, CL:0.2S - 1no. 4 . HT HRC fuse of 20A - 3nos. 5. Seal Off bushings - 1no. 6. shunt trip coil, 230V AC - 1no. 7. Space heater with thermostat - 1no. 8. 400A aluminium bus bars and support insulators - 1set. 9. Provision for fixing TOD meter.	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 205945.00 / each		<b>Rs 205945.00</b>
23	od274287/2019_2020 Supply, installation, testing and commissioning of oil immersed star delta starter suitable for 125 HP motor as required.	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 135355.00 / each		<b>Rs 270710.00</b>
24	90.14.24.28 Supply & fixing the following Power Capacitors 3 phase delta connected in position and giving connection.30 KVAR, 3 phase, 440 V, delta connected, standard duty Metalised Poly Propylene Capacitor, Box Type, suitable for direct connection to motors.	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 6558.05 / each		<b>Rs 6558.05</b>
25	od274685/2019_2020 Supply and fixing 250A TPN SDU on existing angle iron frame work using suitable steel fastners.	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 14063.63 / each		<b>Rs 28127.26</b>

26	8.4.2 Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 11 KV grade offollowing size in the existing masonry open duct as required.Above 120 sq. mm and upto 400 sq. mm	
Net Total Quantity		25.000 metre
Say 25.000 metre @ Rs 73.39 / metre		<b>Rs 1834.75</b>
27	90.12.40.25 Supply & laying of one No. PVC insulated and PVC sheathed armoured copper power cable of 1.1 KV grade of the following sizes in the existing masonry open duct as required.3.5 core 120 sq mm	
Net Total Quantity		30.000 metre
Say 30.000 metre @ Rs 5520.11 / metre		<b>Rs 165603.30</b>
28	90.12.40.28 Supply & laying of one No. PVC insulated and PVC sheathed armoured copper power cable of 1.1 KV grade of the following sizes in the existing masonry open duct as required.3.5 core 240 sq mm	
Net Total Quantity		30.000 metre
Say 30.000 metre @ Rs 10609.11 / metre		<b>Rs 318273.30</b>
29	90.12.41.10 Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured copper power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.3 core 35 sq mm with factory made clamp	
Net Total Quantity		15.000 metre
Say 15.000 metre @ Rs 1405.77 / metre		<b>Rs 21086.55</b>
30	90.12.39.14 Supply & laying of one number PVC insulated and PVC sheathed armoured copper power cable of 1.1KV grade of the following sizes in the existing RCC/ HUME / STONE WARE/ GI/ DWC pipe as required.3 core 120 sq mm	
Net Total Quantity		60.000 metre
Say 60.000 metre @ Rs 4669.11 / metre		<b>Rs 280146.60</b>
31	10.2.4 Supplying and making outdoor cable end jointing with cast resin compound, including lugs and other jointing materials, for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required:300 sq. mm	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 4364.30 / each		<b>Rs 4364.30</b>
32	10.4.4 Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required:300 sq. mm	



		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 8462.54 / each	<b>Rs 8462.54</b>
33	9.1.21	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.3 1/2X 35 sq. mm (32mm)	
		Net Total Quantity	2.000 set
		Say 2.000 set @ Rs 369.59 / set	<b>Rs 739.18</b>
34	9.1.29	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.3 1/2X 240 sq. mm (62mm)	
		Net Total Quantity	4.000 set
		Say 4.000 set @ Rs 1296.18 / set	<b>Rs 5184.72</b>
35	5.5	Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. (but without charcoal/ coke and salt ) as required.	
		Net Total Quantity	6.000 set
		Say 6.000 set @ Rs 9889.79 / set	<b>Rs 59338.74</b>
36	5.14	Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.	
		Net Total Quantity	100.000 metre
		Say 100.000 metre @ Rs 914.80 / metre	<b>Rs 91480.00</b>
37	5.15	Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.	
		Net Total Quantity	50.000 metre
		Say 50.000 metre @ Rs 169.07 / metre	<b>Rs 8453.50</b>
38	90.12.7.2	Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured aluminium power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.2 core 6 sq mm with factory made clamp	
		Net Total Quantity	15.000 metre
		Say 15.000 metre @ Rs 182.32 / metre	<b>Rs 2734.80</b>
39	od275050/2019_2020	Supply and installation of 3 Phase, 4 wire, 110 V (L-L), -/1 A CT or -/5A CT, accuracy class 0.2, TOD meter	

		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 41741.52 / each	<b>Rs 41741.52</b>
40	od275051/2019_2020	Supply of 3x300sq.mm 11KV XLPE armoured aluminium conductor cable	
		Net Total Quantity	25.000 metre
		Say 25.000 metre @ Rs 2075.00 / metre	<b>Rs 51875.00</b>
41	od275052/2019_2020	Supply, installing, testing and commissioning of Fire Extinguisher dry chemical powder type ISI mark, 5 kg capacity with initial charger and installation brackets.Make - Safex / Warrior / Intime	
		Net Total Quantity	2.000 each
		Say 2.000 each @ Rs 2200.99 / each	<b>Rs 4401.98</b>
42	od275053/2019_2020	Supply of 11KV electrical gloves (Vidyut)	
		Net Total Quantity	2.000 each
		Say 2.000 each @ Rs 580.00 / each	<b>Rs 1160.00</b>
43	od275055/2019_2020	Supply of Bosch professional tool kit (GSB550)	
		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 5517.00 / each	<b>Rs 5517.00</b>
44	od275056/2019_2020	Supply and providing 2.5mm thick, 11KV grade, synthetic elastometric fire retardant insulating sheet	
		Net Total Quantity	5.000 sqm of door area
		Say 5.000 sqm of door area @ Rs 1669.00 / sqm of door area	<b>Rs 8345.00</b>
45	od275073/2019_2020	Providing and fixing 51N earth fault relay (MC-12) in the panel board and giving connections.	
		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 11298.10 / each	<b>Rs 11298.10</b>
46	1.10.3	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit,with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FRLSPVC insulated copper conductor single core cable etc as required.Group C	
		Net Total Quantity	6.000 point
		Say 6.000 point @ Rs 992.12 / point	<b>Rs 5952.72</b>

47	1.12 Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit along with 1 No 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	
Net Total Quantity		25.000 metre
Say 25.000 metre @ Rs 220.18 / metre		<b>Rs 5504.50</b>
48	1.31 Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 3 pin 5/6 amps modular socket outlet and 5/6 amps modular switch, connection etc. as required. (For light plugs to be used in non residential buildings).	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 410.22 / each		<b>Rs 820.44</b>
49	1.32 Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 6 pin 5/6 & 15/16 amps modular socket outlet and 15/16 amps modular switch, connection etc. as required.	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 532.10 / each		<b>Rs 1064.20</b>
50	90.3.19.3 Supply conveyance, installation, testing and commissioning the light fittings of following types made from CRCA sheet 0.5mm thickness with all accessories and lamps directly on wall and giving connections with 16/0.20 mm 3 core PVC insulated and sheathed round copper conductor flex wire or extending the original wiring and giving connections as required 1200 mm 1X20W LED Lamp with box type fixture	
Net Total Quantity		4.000 each
Say 4.000 each @ Rs 1174.12 / each		<b>Rs 4696.48</b>
51	90.4.5.2 Supply, conveyance, installation, testing and commissioning of ceiling fans of the following sizes using standard accessories excluding resistance type regulator, wiring the down rod with 16/0.20mm PVC insulated and PVC sheathed 650/1100V grade 3 core round copper conductor flex wire or with extended original wiring etc. as required. 1200mm sweep -5star rated ceiling fan complete with 300mm down rod , canopies, shackles and blades and resistance type regulator working on 230V/240V single phase A/C	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 1857.50 / each		<b>Rs 3715.00</b>
52	90.11.1.14 Supply and installation of sheet steel, phosphatised and painted, dust and vermin proof enclosure of MCB DB including copper /brass bus bar, neutral link, earth bus and DIN rail suitable for fixing MCB/ isolator etc. fixed on wall using suitable anchor bolts or fixed in recess including cutting hole on the wall , making good the damages, colour washing etc. as required 4 way (8+12) - double cover TPN vertical DB with provision for fixing 4P MCB / Isolator/ RCCB/ RCBO as incoming and SP/ TP MCB as outgoing (IP 42/43)	

		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 6466.17 / each	<b>Rs 6466.17</b>
53	2.13.2	Supplying and fixing following rating, four pole, 415 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.63 amps	
		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 888.59 / each	<b>Rs 888.59</b>
54	2.15.3	Supplying and fixing following rating, four pole, (three phase and neutral), 415 volts, residual current circuit breaker (RCCB), having a sensitivity current upto 300 milliampere in the existing MCB DB complete with connections, testing and commissioning etc. as required.63 amps	
		Net Total Quantity	1.000 each
		Say 1.000 each @ Rs 3017.00 / each	<b>Rs 3017.00</b>
55	2.10.1	Supplying and fixing 5 amps to 32 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.Single pole	
		Net Total Quantity	6.000 each
		Say 6.000 each @ Rs 226.73 / each	<b>Rs 1360.38</b>
56	2.10.4	Supplying and fixing 5 amps to 32 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.Triple pole	
		Net Total Quantity	2.000 each
		Say 2.000 each @ Rs 917.42 / each	<b>Rs 1834.84</b>
57	od275074/2019_2020	Laison charges towards preparation of various detailed drawings for submission to Chief Electrical Inspectorate TVM (excluding necessary scrutiny fee) and modified the scheme if necessary;and finally submitting the completion report to the authority and conducting inspection (excluding inspection fee) and transportation and other incidental expenses.	
		Net Total Quantity	1.000 L.S
		Say 1.000 L.S @ Rs 100000.00 / L.S	<b>Rs 100000.00</b>
<b>16 Appendix I.2- Lift Irrigation Mechanical Part</b>			
1	od296161/2019_2020	Supply, Erection, Testing and Commissioning of Centrifugal Pump set 1 no (KRTK 100-401/354 UG-S) Motor Rating 38 KW, Speed 4 Pole capable of lifting 150 m3 per hour against a total head of 55m with all accessories. Make: KSB or Equivalent 	
		Net Total Quantity	2.000 each

Say 2.000 each @ Rs 471276.07 / each		<b>Rs 942552.14</b>
2	18.72.1 Providing and laying S & S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329:100 mm dia Ductile Iron Class K- 7 Pipes	
Net Total Quantity		25.000 metre
Say 25.000 metre @ Rs 1214.07 / metre		<b>Rs 30351.75</b>
3	18.72.2 Providing and laying S & S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329:150 mm dia Ductile Iron Class K-7 pipes	
Net Total Quantity		1500.000 metre
Say 1500.000 metre @ Rs 1756.34 / metre		<b>Rs 2634510.00</b>
4	18.30.4 Providing flanged joints to double flanged C.I./ D.I pipes and specials, including testing of joints:150 mm diameter pipe	
Net Total Quantity		250.000 no
Say 250.000 no @ Rs 318.54 / no		<b>Rs 79635.00</b>
5	85.102 Supply of MS Tees, Angles, Joists, ISMB, ISMC conforming to IS2062GrA/B including cost of conveyance charges	
Net Total Quantity		3026.000 kg
Say 3026.000 kg @ Rs 66.13 / kg		<b>Rs 200109.38</b>
6	od298687/2019_2020 Providing and Laying 100 mm DI Dia DI bends including cost of material, gasket nut and bolt, labour for fitting and conveyance	
Net Total Quantity		2.000 each
Say 2.000 each @ Rs 3113.49 / each		<b>Rs 6226.98</b>
7	od298842/2019_2020 providing and Flxing 150x100 DI concentric reducer of standard specification including cost of material, gasket, nut and bolt, labor for fitting and conveyance	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 7005.18 / each		<b>Rs 7005.18</b>
8	od298998/2019_2020 Providing and fixing 100 mm DI equal "T" of standard specification including cost of material, gasket, nut and bolt, labour for fitting and conveyance	
Net Total Quantity		1.000 each
Say 1.000 each @ Rs 5093.68 / each		<b>Rs 5093.68</b>
<b>17 APPENDIX O -SOIL INVESTIGATION</b>		

1	56.1.a Mobilization including transportation of all necessary plan and equipment's and materials of boring field testing and sampling and demobilization after completing the work For machine boring		
		Net Total Quantity	5.000 set
		Say 5.000 set @ Rs 15798.00 / set	<b>Rs 78990.00</b>
2	56.3.a.1 Boring with rotary power drilling equipment's in all types of soil having N value less than 50 excluding hard rock soft rock, or medium rock for strata upto 10m. Including conducting necessary S.P.T and recovery of un disturbed soil samples at 5m.intervals. For ordinary soil.		
		Net Total Quantity	250.000 metre
		Say 250.000 metre @ Rs 923.00 / metre	<b>Rs 230750.00</b>
3	56.11.a Compilation of all field data with recommendation for a suitable foundation after conducting necessary lab test (report in triplicate) Machine boring for 5 bore holes.		
		Net Total Quantity	50.000 set
		Say 50.000 set @ Rs 10000.00 / set	<b>Rs 500000.00</b>
4	56.7 Conducting standard penetration test in bore hole at any depth.		
		Net Total Quantity	250.000 each
		Say 250.000 each @ Rs 203.00 / each	<b>Rs 50750.00</b>
		Provision for GST payments (in %) @	<b>12.0%</b>
		Amount reserved for GST payments	<b>303033190.59</b>
		Total	<b>2828309778.59</b>
		Lumpsum for round off	<b>0.00</b>
		<b>TOTAL Rs 2828309778.59</b>	
		<b>Rounded Total Rs 2,82,83,09,779</b>	
Rupees Two Hundred Eighty Two Crore Eighty Three Lakh Nine Thousand Seven Hundred and Seventy Nine Only			

(Cost Index Applied for this estimate is 31.06%)

## Extension of Moolathara Right Bank Canal from Korayar to Varattayar

### Detailed Estimate

(Dsor year: **2016**, Cost Index Applied for this estimate is **31.06%**)

SI No	Description	No	L	B	D	CF	Quantity	Remark	
<b>1 Appendix A- Fabricating and Supplying 2800mm diameter MS Pipe</b>									
1	od50401/2019_2020 Manufacturing and supplying 2800mm dia MS pipe of various length with shell thickness 12mm including painting with 2 coats of red oxide primer, I								
		1	5770.000				5770.000		
		Total Quantity						5770.000 metre	
		Total Deducted Quantity						0.000 metre	
		Net Total Quantity						5770.000 metre	
		Say 5770.000 metre @ Rs 92187.23 / metre						<b>Rs 531920317.10</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark	
<b>2 Appendix B- Laying MS Pipe</b>									
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil								
		1	2710.000	7.000	11.600		220052.000		
	For Syphon	2	3.14*3.7*3 .7		10.600		911.316		
	-Do-	1	210.000	7.000	9.800		14406.001		
		Total Quantity						235369.317 cum	
		Total Deducted Quantity						0.000 cum	
		Net Total Quantity						235369.317 cum	
		Say 235369.317 cum @ Rs 165.07 / cum						<b>Rs 38852413.16</b>	
2	2.7.3 Earth work in excavation by mechanical means (Hydraulic excavator )/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.Hard rock (blasting prohibited								
		1	1250.000	7.000	3.000		26250.000		
		Total Quantity						26250.000 cum	
		Total Deducted Quantity						0.000 cum	

	Net Total Quantity						26250.000 cum	
	Say 26250.000 cum @ Rs 812.31 / cum						<b>Rs 21323137.50</b>	
3	od50390/2019_2020 Supplying and filling Jamuna sand including watering, ramming consolidating and dressing complete.							
		1	2710.000	7.000	0.500		9485.000	
	Total Quantity						9485.000 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						9485.000 cum	
	Say 9485.000 cum @ Rs 1202.80 / cum						<b>Rs 11408558.00</b>	
4	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)							
	Syphon foundation	2	3.14*3.7*3 .7		0.600		51.584	
	Below syphon pipe	1	210.000		0.300		63.000	
	Total Quantity						114.584 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						114.584 cum	
	Say 114.584 cum @ Rs 6309.95 / cum						<b>Rs 723019.31</b>	
5	5.1.2 Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level:1:1:5:3 (1 cement 1.5 coarse sand :3 graded stone aggregate 20 mm nominal size)							
	syphon foundation	2	3.14*3.7*3 .7		0.500		42.987	
	-do- below pipe	1	210.000	4.000	0.300		252.000	
	Syphon well sw	2	3.14*(7*7- 6*6)/4		10.000		204.100	
	deduction for pipe sw	2	3.14*1.5*1 .5		0.500		-7.064	
	Total Quantity						499.087 cum	
	Total Deducted Quantity						-7.064 cum	
	Net Total Quantity						492.023 cum	
	Say 492.023 cum @ Rs 8145.84 / cum						<b>Rs 4007940.63</b>	
6	5.9.2							



	Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.							
	syphon sw outer	2	3.14*7		10.000		439.600	
	-do-inner	2	3.14*6		10.000		376.800	
	Total Quantity						816.400 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						816.400 sqm	
	Say 816.400 sqm @ Rs 496.19 / sqm						<b>Rs 405089.52</b>	
7	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth level Thermo - Mechanically Treated bars of grade Fe-500D or more							
		1	492.043			100.0	49204.300	
	Total Quantity						49204.300 kilogram	
	Total Deducted Quantity						0.000 kilogram	
	Net Total Quantity						49204.300 kilogram	
	Say 49204.300 kilogram @ Rs 74.18 / kilogram						<b>Rs 3649974.97</b>	
8	od50398/2019_2020 Laying MS Pipe 2800mm diameter including welding joints in line and levels as directed by Departmental officers at site.							
		1	5570.000				5570.000	
	Total Quantity						5570.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						5570.000 metre	
	Say 5570.000 metre @ Rs 16518.71 / metre						<b>Rs 92009214.70</b>	
Sl No	Description	No	L	B	D	CF	Quantity	Remark
<b>3 Appendix C- Steel pedestal supporting structure for MS Pipe</b>								
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil							
	Foundation	234	9.000	4.500	2.900		27483.300	
	Total Quantity						27483.300 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						27483.300 cum	
	Say 27483.300 cum @ Rs 165.07 / cum						<b>Rs 4536668.33</b>	

2	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)								
		234	9.000	4.500	0.400		3790.800		
		Total Quantity					3790.800 cum		
		Total Deducted Quantity					0.000 cum		
		Net Total Quantity					3790.800 cum		
		Say 3790.800 cum @ Rs 6309.95 / cum					<b>Rs 23919758.46</b>		
3	5.33.1 Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work upto plinth level								
		234	9.000	4.500	0.800		7581.600		
		234*10	0.600	0.600	2.200		1853.281		
		Total Quantity					9434.881 cum		
		Total Deducted Quantity					0.000 cum		
		Net Total Quantity					9434.881 cum		
		Say 9434.881 cum @ Rs 8448.78 / cum					<b>Rs 79713233.90</b>		
4	5.9.1 Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases of columns, etc for mass concrete								
		234	27.000	1.100			6949.801		
		234*10	2.400	2.200			12355.200		
		Total Quantity					19305.001 sqm		
		Total Deducted Quantity					0.000 sqm		
		Net Total Quantity					19305.001 sqm		
		Say 19305.001 sqm @ Rs 254.19 / sqm					<b>Rs 4907138.20</b>		
5	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more								
		1	9434.881			100.0	943488.10 0		

										Total Quantity	943488.100 kilogram
										Total Deducted Quantity	0.000 kilogram
										Net Total Quantity	943488.100 kilogram
										Say 943488.100 kilogram @ Rs 74.18 / kilogram	<b>Rs 69987947.26</b>
6	10.2	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.									
	Avg. weight of all supports	1	1873179.000							1873179.000	
										Total Quantity	1873179.000 kg
										Total Deducted Quantity	0.000 kg
										Net Total Quantity	1873179.000 kg
										Say 1873179.000 kg @ Rs 88.66 / kg	<b>Rs 166076050.14</b>
7	13.63.1	Painting with aluminium paint of approved brand and manufacture to give an even shade.Two or more coats on new work									
		234	15.000		5.750	0.5				10091.250	
		234	9.000		5.750	0.5				6054.750	
										Total Quantity	16146.000 sqm
										Total Deducted Quantity	0.000 sqm
										Net Total Quantity	16146.000 sqm
										Say 16146.000 sqm @ Rs 89.65 / sqm	<b>Rs 1447488.90</b>
SI No	Description	No	L	B	D	CF	Quantity	Remark			
<b>4 Appendix D Tunneling for a length of 660m</b>											
1	2.6.1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil									
		1	1.000				1.000				
	At inlet and outlet	2	10.000	10.000	6.000		1200.000				
										Total Quantity	1201.000 cum
										Total Deducted Quantity	0.000 cum
										Net Total Quantity	1201.000 cum
										Say 1201.000 cum @ Rs 165.07 / cum	<b>Rs 198249.07</b>
2	od51641/2019_2020										

	Excavation for adit by tunnelling methods in all types of rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, scaling excavated surface, removing and hauling excavated muck outside adit upto specified dump area and all other ancillary operations etc., complete with all leads and lifts						
		1	660.000	3.14*2*2			8289.600
	Total Quantity						8289.600 cum
	Total Deducted Quantity						0.000 cum
	Net Total Quantity						8289.600 cum
	Say 8289.600 cum @ Rs 4852.75 / cum						<b>Rs 40227356.40</b>
3	od51643/2019_2020 Excavation for vertical / inclined shaft in all types of soft / hard rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, shoring, strutting, scaling excavated surface, removing and hauling excavated muck outside shaft upto specified dump area and all other ancillary operations etc., complete with all leads and all lifts						
		3	500.000	3.14*1.5*1 .5			10597.500
	Total Quantity						10597.500 cum
	Total Deducted Quantity						0.000 cum
	Net Total Quantity						10597.500 cum
	Say 10597.500 cum @ Rs 3963.97 / cum						<b>Rs 42008172.07</b>
4	od51645/2019_2020 Removing and hauling muck overfallen due to natural causes such as geological faults etc., out of tunnel including cost of all materials, machinery, labour, ventilation, drainage, lighting, breaking any large fragments by blasting if necessary with all other ancillary operations and disposing off the same in specified dump area or as directed etc., complete with all leads and all lifts.						
		1	2770.000				2770.000
	Total Quantity						2770.000 cum
	Total Deducted Quantity						0.000 cum
	Net Total Quantity						2770.000 cum
	Say 2770.000 cum @ Rs 748.01 / cum						<b>Rs 2071987.70</b>
5	od51646/2019_2020 Providing 25 mm thick guniting to sides and arch of tunnel in CM 1 : 3 proportion by weight including cost of all materials, machinery, labour, ventilation, lighting, drainage and all other ancillary operations etc., complete with all leads and all lifts.						
		660	3.14*3.25				6735.300
	Total Quantity						6735.300 per sqm
	Total Deducted Quantity						0.000 per sqm

						Net Total Quantity	6735.300 per sqm
						Say 6735.300 per sqm @ Rs 1216.79 / per sqm	<b>Rs 8195445.69</b>
6	od51647/2019_2020 Providing and fixing 25 mm dia. steel rock bolts with one end provided with mechanical /wedge type anchorage and other end provided with threads for fixing washers and nuts including cost of all materials, machinery,labour, ventilation, lighting, drainage, drilling 32 mm dia holes, providing 150 mm long 20 mm thick steel tapered wedge, providing 10 mm thick and 200 x 200 mm size plate washer and nuts, driving bolt, fixing washers and nuts, tightening bolt by torque wrench and all other ancillary operations etc., complete with all leads and all lifts.						
		1	2310.000		2.150		4966.500
						Total Quantity	4966.500 metre
						Total Deducted Quantity	0.000 metre
						Net Total Quantity	4966.500 metre
						Say 4966.500 metre @ Rs 2214.05 / metre	<b>Rs 10996079.33</b>
7	od51649/2019_2020 Providing, fabricating and fixing in position temporary structural steel supports as per details and dismantling and conveying the same to other place or outside tunnel before concreting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cutting,bending, welding, grinding, and all other ancillary operations etc., complete with all leads and all lifts.						
		1	25.000				25.000
						Total Quantity	25.000 MT
						Total Deducted Quantity	0.000 MT
						Net Total Quantity	25.000 MT
						Say 25.000 MT @ Rs 43925.61 / MT	<b>Rs 1098140.25</b>
8	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more						
		1	660.000	3.14*(3.5* 3.5-3*3)/4		100.0	168382.50 0
						Total Quantity	168382.500 kilogram
						Total Deducted Quantity	0.000 kilogram
						Net Total Quantity	168382.500 kilogram
						Say 168382.500 kilogram @ Rs 74.18 / kilogram	<b>Rs 12490613.85</b>
9	od51658/2019_2020 Drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer or stooper drills as directed to specified depth for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cleaning holes, and all other ancillary operations etc., complete.						

		1	691.000			2.000		1382.000	
	Total Quantity							1382.000	per metre
	Total Deducted Quantity							0.000	per metre
	Net Total Quantity							1382.000	per metre
	Say 1382.000 per metre @ Rs 729.42 / per metre							<b>Rs 1008058.44</b>	
10	od51659/2019_2020 Grouting cement slurry in grout holes under specified pressure for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, re-drilling wherever necessary, and all other ancillary operations etc., complete with all leads and all lifts.								
		1	1382.000				75.0	103650.00	0
	Total Quantity							103650.000	kg
	Total Deducted Quantity							0.000	kg
	Net Total Quantity							103650.000	kg
	Say 103650.000 kg @ Rs 27.43 / kg							<b>Rs 2843119.50</b>	
11	od51660/2019_2020 Cost of electric line, lighting and ventilation as per requirement at site								
		1						1.000	
	Total Quantity							1.000	L.S
	Total Deducted Quantity							0.000	L.S
	Net Total Quantity							1.000	L.S
	Say 1.000 L.S @ Rs 7406388.65 / L.S							<b>Rs 7406388.65</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark	
<b>5 Appendix E- Regulating shutters at inlet and intermediate locations</b>									
1	85.101 Supply of MS plates conforming to IS 2062GrB including cost of conveyance charges								
		6	10023.840				60143.040		
	Total Quantity							60143.040	kg
	Total Deducted Quantity							0.000	kg
	Net Total Quantity							60143.040	kg
	Say 60143.040 kg @ Rs 64.18 / kg							<b>Rs 3859980.31</b>	
2	85.102 Supply of MS Tees, Angles, Joists, ISMB, ISMC conforming to IS2062GrA/B including cost of conveyance charges								
		6	1771.000				10626.000		



							Total Deducted Quantity	0.000 kg	
							Net Total Quantity	2787.120 kg	
							Say 2787.120 kg @ Rs 587.53 / kg	<b>Rs 1637516.61</b>	
7	85.110	Fabrication and supply of Structural steel wheel gate and accessories as per approved specifications, drawings and directions of deptl officer at site including cost of labour, machinery, all leads and lifts, incidental and handling charges etc complete but excluding cost of material already supplied							
		6	28809.000				172854.00 0		
							Total Quantity	172854.000 kg	
							Total Deducted Quantity	0.000 kg	
							Net Total Quantity	172854.000 kg	
							Say 172854.000 kg @ Rs 62.86 / kg	<b>Rs 10865602.44</b>	
8	85.112	Painting all the exposed surfaces of the gate and embedded parts with two coats of epoxy coal tar black paint confirming to IS14948 with a minimum film thickness of 150+/-5 microns per each coat over two coats of priming coat applied with zinc primer containing not less than 85% of zinc dry film with a film thickness of 70+/-5 microns , so that the total film thickness of all coats including priming coat at any rate is not less than 350microns over the grit blasted and cleaned surface to class A standard of IS 14177 including cost of all materials , labour charges , cost of testing all painting materials, all incidental charges, hire of T&P etc complete as per the direction of departmental officer at site							
		6	233.650				1401.900		
							Total Quantity	1401.900 sqm	
							Total Deducted Quantity	0.000 sqm	
							Net Total Quantity	1401.900 sqm	
							Say 1401.900 sqm @ Rs 809.89 / sqm	<b>Rs 1135384.79</b>	
Sl No	Description	No	L	B	D	CF	Quantity	Remark	
<b>6 Appendix F - Providing inspection chambers</b>									
1	2.6.1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil							
	Insp. Chamber	10	7.200	7.200	5.700		2954.881		
							Total Quantity	2954.881 cum	
							Total Deducted Quantity	0.000 cum	
							Net Total Quantity	2954.881 cum	



	Say 2954.881 cum @ Rs 165.07 / cum						<b>Rs 487762.21</b>	
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)							
	Foundation	10	7.200	7.200	0.300		155.520	
	Total Quantity						155.520 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						155.520 cum	
	Say 155.520 cum @ Rs 5869.06 / cum						<b>Rs 912756.21</b>	
3	5.2.2 Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up tot floor five level excluding cost of centering, shuttering, finishing and reinforcement :1:1.5:3( 1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)							
	side walls	10	25.600	0.400	5.000		512.001	
	Bottom slab	10	7.200	7.200	0.400		207.361	
	Top slab	10	6.800	6.800	0.300		138.720	
	Pipe openeings	2*2	3.140	(1.4*1.4)	0.600		-14.770	
	Manhole	2	1.000	1.000	0.300		-0.600	
	Total Quantity						858.082 cum	
	Total Deducted Quantity						-15.370 cum	
	Net Total Quantity						842.712 cum	
	Say 842.712 cum @ Rs 9365.29 / cum						<b>Rs 7892242.27</b>	
4	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.							
	walls out side	10	27.200		5.400		1468.800	
	walls inside	10	24.000		5.000		1200.000	
	Total Quantity						2668.800 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						2668.800 sqm	
	Say 2668.800 sqm @ Rs 496.19 / sqm						<b>Rs 1324231.87</b>	
5	5.9.3 Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs, landings, balconies and access platform							

	top slab	10	6.000	6.000			360.000	
	Total Quantity						360.000 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						360.000 sqm	
	Say 360.000 sqm @ Rs 553.47 / sqm						<b>Rs 199249.20</b>	
6	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth level Thermo - Mechanically Treated bars of grade Fe-500D or more							
	842.712 *120kg/m3	1	842.712			100.0	84271.200	
	Total Quantity						84271.200 kilogram	
	Total Deducted Quantity						0.000 kilogram	
	Net Total Quantity						84271.200 kilogram	
	Say 84271.200 kilogram @ Rs 74.18 / kilogram						<b>Rs 6251237.62</b>	
7	od50857/2019_2020 Supplying and fixing cast iron manhole cover as directed by Departmental officials							
		1	10.000				10.000	
	Total Quantity						10.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						10.000 each	
	Say 10.000 each @ Rs 13753.76 / each						<b>Rs 137537.60</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>7 Appendix G -Surplus Water Escape</b>								
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed. All kinds of soil							
	Inlet chamber	3	6.200	6.200	5.700		657.325	
	Leading channel	3	500.000	(8+3)/2	2.500		20625.000	
	foundation SP wall of natural stream	3*2	100.000	1.800	0.600		648.000	
	Bed protection of natural stream	3	100.000	10.000	0.300		900.000	
	Total Quantity						22830.325 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						22830.325 cum	

	Say 22830.325 cum @ Rs 165.07 / cum						<b>Rs 3768601.75</b>	
2	5.2.2 Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up tot floor five level excluding cost of centering, shuttering, finishing and reinforcement :1:1.5:3( 1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)							
	Side walls	3	21.600	0.400	5.000		129.601	
	Base slab	3	6.200	6.200	0.400		46.129	
	Total Quantity						175.730 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						175.730 cum	
	Say 175.730 cum @ Rs 9365.29 / cum						<b>Rs 1645762.41</b>	
3	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)							
	Foundation SP wall natural stream	3	2*100	1.800	0.600		648.000	
	Foundation chamber	3	6.200	6.200	0.300		34.596	
	Total Quantity						682.596 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						682.596 cum	
	Say 682.596 cum @ Rs 5869.06 / cum						<b>Rs 4006196.88</b>	
4	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)							
	Leading Channel lining	3	500.000	10.070	0.100		1510.500	
	SP wall natural stream	3	100*2	(1.6+.6)/2	4.000		2640.001	
	Stream bed protection	3	100.000	10.000	0.300		900.000	
	Total Quantity						5050.501 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						5050.501 cum	
	Say 5050.501 cum @ Rs 6309.95 / cum						<b>Rs 31868408.78</b>	
5	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including							

	attached pilasters, butteresesses, plinth and string courses etc.							
	Side wall chamber outside	3	23.200		5.400		375.841	
	Side wall chamber inside	3	20.000		5.000		300.000	
	Total Quantity						675.841 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						675.841 sqm	
	Say 675.841 sqm @ Rs 496.19 / sqm						<b>Rs 335345.55</b>	
6	5.9.1 Centering and shuttering including strutting, etc. and removal of form for:Foundations, footings, bases of columns, etc for mass concrete							
	Lining leading channel	3	500.000	7.070			10605.000	
	Foundation SP wall stream	3*2	100*2	0.600			720.000	
	Total Quantity						11325.000 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						11325.000 sqm	
	Say 11325.000 sqm @ Rs 254.19 / sqm						<b>Rs 2878701.75</b>	
7	5.9.6 Centering and shuttering including strutting, etc. and removal of form for:Columns, Pillars, Piers, Abutments, Posts and Struts							
	SP wall stream	3	100*4	4.000			4800.000	
	Total Quantity						4800.000 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						4800.000 sqm	
	Say 4800.000 sqm @ Rs 613.16 / sqm						<b>Rs 2943168.00</b>	
8	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more							
		175.73				100.0	17573.000	
		5050.501				20.0	101010.020	
	Total Quantity						118583.020 kilogram	
	Total Deducted Quantity						0.000 kilogram	
	Net Total Quantity						118583.020 kilogram	

		Say 118583.020 kilogram @ Rs 74.18 / kilogram					Rs 8796488.42	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>8 Appendix H Side Protection works at river crossings and Eris</b>								
1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil							
	River crossing Korayar(foundation)	1	200.000	2.900	0.300		174.000	2*2*50=200
	River crossing Varattayaryar(foundation)	1	200.000	2.900	0.300		174.000	2*2*50=200
	Aqueduct abutment	4	20.000	2.900	0.300		69.600	
	Super passage at river crossings	1	200.000	1.500	0.300		90.000	5*2*20=200
	Protective measures to footing of aqueduct (L.S)	1	1.000	1.000	1.000	20.0	20.000	
Total Quantity							527.600 cum	
Total Deducted Quantity							0.000 cum	
Net Total Quantity							527.600 cum	
Say 527.600 cum @ Rs 165.07 / cum							<b>Rs 87090.93</b>	
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)							
	River crossing Korayar(foundation)	1	200.000	2.900	0.300		174.000	2*2*50=200
	River crossing Varattayaryar(foundation)	1	200.000	2.900	0.300		174.000	2*2*50=200
	Aqueduct abutment	4	20.000	2.900	0.300		69.600	
	Super passage at river crossings	1	200.000	1.900	0.300		114.000	5*2*20=200
	Protective measures to footing of aqueduct (L.S)	1	1.000	1.000	1.000	20.0	20.000	
Total Quantity							551.600 cum	

Total Deducted Quantity							0.000 cum	
Net Total Quantity							551.600 cum	
Say 551.600 cum @ Rs 5869.06 / cum							<b>Rs 3237373.50</b>	
3	4.1.6 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)							
	River crossing Korayar(foundation)	1	200.000	1.550	5.000		1550.000	2*2*50=200
	River crossing Varattayaryar(foundation)	1	200.000	1.550	5.000		1550.000	2*2*50=200
	Aqueduct abutment	4	20.000	1.550	5.000		620.000	
	Super passage at river crossings	1	200.000	1.000	3.000		600.000	5*2*20=200
	Protective measures to footing of aqueduct(L.S)	1	1.000	1.000	1.000	100.0	100.000	
Total Quantity							4420.000 cum	
Total Deducted Quantity							0.000 cum	
Net Total Quantity							4420.000 cum	
Say 4420.000 cum @ Rs 6309.95 / cum							<b>Rs 27889979.00</b>	
4	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelThermo - Mechanically Treated bars of grade Fe-500D or more							
STEEL								
	Steel Quantity	1	4420.000	1.000	1.000	75.0	331500.000	75 kg of steel for 1 cum cement concrete
Total Quantity							331500.000 kilogram	
Total Deducted Quantity							0.000 kilogram	
Net Total Quantity							331500.000 kilogram	
Say 331500.000 kilogram @ Rs 74.18 / kilogram							<b>Rs 24590670.00</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>9 Appendix I- Lift Irrigation Civil Works</b>								

1	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil							
	Suction chamber foundation	1	6.200	6.200	0.800		30.753	
	Cistern foundation	1	6.200	6.200	0.800		30.753	
	PUMP HOUSE							
		1	3.000	2.000	0.500		3.000	
	SUMP WATER TANK 1-EARTHWORK EXCAVATION							
	Excavation	1	18.000	14.000	6.000		1512.000	
	OVERHEAD WATER TANK-EARTHWORK EXCAVATION							
		1	15.000	15.000	1.500		337.500	
	Total Quantity						1914.006 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						1914.006 cum	
	Say 1914.006 cum @ Rs 165.07 / cum						<b>Rs 315944.97</b>	
2	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)							
	suction chamber foundation	1	6.200	6.200	0.400		15.377	
	cistern foundation	1	6.200	6.200	0.400		15.377	
	Total Quantity						30.754 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						30.754 cum	
	Say 30.754 cum @ Rs 5869.06 / cum						<b>Rs 180497.07</b>	
3	5.1.2 Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level:1:1:5:3 (1 cement 1.5 coarse sand :3 graded stone aggregate 20 mm nominal size)							
	suction chamber base slab	1	5.800	5.800	0.400		13.457	
	cistern base slab	1	5.800	5.800	0.400		13.457	

	suction chamber side walls	1	21.600	5.000	0.400		43.200	
	cistern side walls	1	21.600	5.000	0.400		43.200	
	Total Quantity						113.314 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						113.314 cum	
	Say 113.314 cum @ Rs 8145.84 / cum						<b>Rs 923037.71</b>	
4	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, buttersesses, plinth and string courses etc.							
	suction chamber outside	1	23.200	5.800			134.560	
	cistern outside	1	23.200	5.800			134.560	
	suction chamber inside	1	20.000	5.000			100.000	
	cistern inside	1	20.000	5.000			100.000	
	<b>SUMP WATER TANK 1-CENTERING AND SHUTTERING</b>							
	walls	2	34.000		4.000		272.000	
	cross wall	2	7.000		4.000		56.000	
	slab	1	12.000	8.000			96.000	
	Total Quantity						893.120 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						893.120 sqm	
	Say 893.120 sqm @ Rs 496.19 / sqm						<b>Rs 443157.21</b>	
5	13.7.1 12 mm cement plaster finished with a floating coat of neat cement of mix:1:3 ( 1 cement : 3 fine sand)							
	suction chamber inside	1	20.000	5.000			100.000	
	cistern inside	1	20.000	5.000			100.000	
	suction chamber top	1	21.600	0.500			10.800	
	cistern top	1	21.600	0.500			10.800	
	<b>SUMP WATER TANK 1-PLASTERING</b>							
	Walls	1	40.000		6.000		240.000	
	cross wall	1	8.000		6.000		48.000	
	base slab	1	12.000	8.000			96.000	



	cover slab	1	12.000	8.000			96.000		
	Total Quantity						701.600 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						701.600 sqm		
	Say 701.600 sqm @ Rs 297.24 / sqm						<b>Rs 208543.58</b>		
6	2.31 Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared								
	PUMP HOUSE-CLEARING SITE								
	site clearance	1	3.000	2.000			6.000		
	SUMP WATER TANK 1-CLEARING SITE								
	Clearing	1	15.000	10.000			150.000		
	OVERHEAD WATER TANK-SITE CLEARING								
	Site clearing	1	20.000	20.000			400.000		
	Total Quantity						556.000 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						556.000 sqm		
	Say 556.000 sqm @ Rs 9.44 / sqm						<b>Rs 5248.64</b>		
7	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10-sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil								
	PUMP HOUSE -EARTH WORK EXCAVATION								
	long wall	2	2.950	0.750	0.750		3.319		
	short wall	2	1.950	0.750	0.750		2.194		
	OVERHEAD WATER TANK-EXCAVATION								
		4	15.000	15.000	5.500		4950.000		
	Total Quantity						4955.513 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						4955.513 cum		
	Say 4955.513 cum @ Rs 218.08 / cum						<b>Rs 1080698.28</b>		
8	4.1.10 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40								

	mm nominal size)							
	PUMP HOUSE-PCC							
	long wall	2.950	0.750	0.100			0.222	
	short wall	1	2.000	1.000	0.100		0.200	
		2.950	0.750	0.100			0.222	
	PUMP HOUSE-CC FLOORING							
	flooring	1	2.000	1.000	0.100		0.200	
	OVERHEAD WATER TANK-PCC							
	PCC	4	15.000	15.000	0.300		270.000	
	Total Quantity						270.844 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						270.844 cum	
	Say 270.844 cum @ Rs 5516.38 / cum						<b>Rs 1494078.42</b>	
9	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with:Cement mortar 1:6 (1 cement : 6 coarse sand)							
	PUMP HOUSE -RR MASONRY							
	for foundation	1	6.800	0.600	0.600		2.448	
	for basement	1	6.800	0.450	0.450		1.377	
	Total Quantity						3.825 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						3.825 cum	
	Say 3.825 cum @ Rs 5197.64 / cum						<b>Rs 19880.97</b>	
10	13.33.2 Pointing on stone work with cement mortar 1:3 ( 1 cement : 3 fine sand):Raised and cut pointing							
	PUMP HOUSE							
		1	6.800		0.600		4.080	
	Total Quantity						4.080 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						4.080 sqm	
	Say 4.080 sqm @ Rs 400.65 / sqm						<b>Rs 1634.65</b>	
11	4.10 Providing and laying damp-proof course 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size).							

PUMP HOUSE									
		1	6.800		0.450		3.060		
	Total Quantity						3.060 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						3.060 sqm		
	Say 3.060 sqm @ Rs 344.82 / sqm						<b>Rs 1055.15</b>		
12	4.13 Applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil.								
PUMP HOUSE									
		1	6.800		0.450		3.060		
	Total Quantity						3.060 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						3.060 sqm		
	Say 3.060 sqm @ Rs 120.44 / sqm						<b>Rs 368.55</b>		
13	4.17 Making plinth protection 50 mm thick of cement concrete 1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.								
PUMP HOUSE									
		1	8.000	0.600			4.800		
	Total Quantity						4.800 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						4.800 sqm		
	Say 4.800 sqm @ Rs 590.29 / sqm						<b>Rs 2833.39</b>		
14	2.25 Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m.								
PUMP HOUSE-EARTH FILLING									
	filling	1	2.000	1.000	0.300		0.600		
PUMP HOUSE-EARTHWORK EXCAVATION									
	long wall	2.950	0.750	0.750			1.660		
	short wall	2	1.950	0.750	0.750		2.194		

PUMP HOUSE-PCC								
long wall	2	2.950	0.750	0.100		0.443		
short wall	2	1.950	0.750	0.100		0.293		
PUMP HOUSE-RR MASONRY								
for foundation	1	6.800	0.600	0.600		2.448		
SUMP WATER TANK 1-EARTHWORK WORK EXCAVATION								
Excavation	1	18.000	14.000	6.000		1512.000		
SUMP WATER TANK 1-PCC								
PCC	1	12.000	8.000	0.300		28.800		
WALLS								
walls	1	40.000	0.300	6.000		-72.000		
cross wall	1	8.000	0.300	6.000		-14.399		
inner space	1	12.000	8.000	6.000		-576.000		
Total Quantity						1548.438 cum		
Total Deducted Quantity						-662.399 cum		
Net Total Quantity						886.039 cum		
Say 886.039 cum @ Rs 164.81 / cum						<b>Rs 146028.09</b>		
15	5.33.1	<p style="text-align: center;"><b>Other Engineering Organisations</b></p> <p>Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work upto plinth level</p>						
SUMP WATER TANK 1-RCC WORKS-WALLS								
walls	1	40.000	0.300	6.000		72.000		
cross wall	1	8.000	0.300	6.000		14.400		
SUMP WATER TANK 1-RCC WORKS-FOR COVER SLAB								
Slab	1	12.000	8.000	0.300		28.800		
SUMP WATER TANK 1-RCC WORKS-BASE SLAB								
Slab	1	12.000	8.000	0.500		48.000		
Total Quantity						163.200 cum		
Total Deducted Quantity						0.000 cum		
Net Total Quantity						163.200 cum		

	Say 163.200 cum @ Rs 8448.78 / cum						<b>Rs 1378840.90</b>
16	<p>4.1.3 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:2:4 (cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</p>						
	SUMP WATER TANK 1-PCC						
	PCC	1	12.000	8.000	0.300		28.800
	Total Quantity						28.800 cum
	Total Deducted Quantity						0.000 cum
	Net Total Quantity						28.800 cum
	Say 28.800 cum @ Rs 7184.64 / cum						<b>Rs 206917.63</b>
17	<p>50.6.1.2 Solid block masonry using pre cast solid blocks (Factory made) of size 40x20x20cm or nearest available size confirming to IS 2185 part I of 1979 for super structure up to floor two level thickness 20cm and above in: CM 1:6 ( 1 cement: 6 coarse sand) etc complete.</p>						
	PUMP HOUSE-BRICK WORK						
	walls	1	6.800	0.200	3.000		4.080
	parapet	1	7.600	0.200	0.800		1.217
	DEDUCTION						
	D	1	1.000	0.200	2.100		-0.420
	V	1	0.900	0.200	0.600		-0.108
	Total Quantity						5.297 cum
	Total Deducted Quantity						-0.528 cum
	Net Total Quantity						4.769 cum
	Say 4.769 cum @ Rs 5533.78 / cum						<b>Rs 26390.60</b>
18	<p>5.37.2 Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centering, shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in -charge. Note:- Cement content considered in this item is @330 kg/cum. Excess /less cement used as per design mix is payable/recoverable separately.All work above plinth level upto floor V level</p>						
	PUMP HOUSE-RCC WORK						
	roof	1	2.600	1.600	0.120		0.500

	lintel	1	6.800	0.200	0.150		0.205	
	sunshade	1	2.800	0.600	0.0625		0.105	
	Total Quantity						0.810 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						0.810 cum	
	Say 0.810 cum @ Rs 9852.04 / cum						<b>Rs 7980.15</b>	
19	5.22.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth level Thermo - Mechanically Treated bars of grade Fe-500D or more							
	PUMP HOUSE-ABOVE PLINTH							
	roof	1	0.500			100.0	50.000	
	lintel	1	0.205			100.0	20.500	
	sunshade	1	0.200			100.0	20.000	
	SUMP WATER TANK 1-STEEL REINFORCEMENT							
	walls	1	86.400		100.000		8640.000	
	cover slab	1	28.800		100.000		2880.000	
	base slab	1	48.000		100.000		4800.000	
	OVERHEAD WATER TANK-ABOVE PLINTH							
	beam	1	6.900		100.000		690.000	
	slab	1	112.500		100.000		11250.000	
	walls	1	210.000		100.000		21000.000	
	Total Quantity						49350.500 kilogram	
	Total Deducted Quantity						0.000 kilogram	
	Net Total Quantity						49350.500 kilogram	
	Say 49350.500 kilogram @ Rs 74.18 / kilogram						<b>Rs 3660820.09</b>	
20	19.19.1.1 Providing and fixing in position Pre-cast R.C.C. manhole cover and frame of required shape and approved quality. L D - 2.5 Rectangular shape 600x450 mm internal dimensions							
	SUMP WATER TANK 1-MAN HOLE							
	Man hole	1					1.000	
	OVERHEAD WATER TANK-RCC MANHOLE							
	Man hole	4					4.000	
	Total Quantity						5.000 each	
	Total Deducted Quantity						0.000 each	

		Net Total Quantity					5.000 each	
		Say 5.000 each @ Rs 1406.34 / each					<b>Rs 7031.70</b>	
21	22.23.1	<p>Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage &amp; water treatment plant, tunnels/ subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e. by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer in-charge. The product performance shall carry guarantee for 10 years against any leakage. For vertical surface two coats @ 0.70 kg per sqm</p>						
		SUMP WATER TANK 1						
		1	34.000		4.000		136.000	
		OVERHEAD WATER TANK						
		4	15.000		7.000		420.000	
		Total Quantity					556.000 sqm	
		Total Deducted Quantity					0.000 sqm	
		Net Total Quantity					556.000 sqm	
		Say 556.000 sqm @ Rs 613.49 / sqm					<b>Rs 341100.44</b>	
22	22.23.2	<p>Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage &amp; water treatment plant, tunnels/ subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e. by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer in-charge. The product performance shall carry guarantee for 10 years against any leakage. For horizontal surface one coat @ 1.10 kg per sqm.</p>						
		SUMP WATER TANK 1						
		1	12.000	8.000			96.000	
		OVERHEAD WATER TANK						
		2	15.000	15.000			450.000	
		Total Quantity					546.000 sqm	

		Total Deducted Quantity					0.000 sqm	
		Net Total Quantity					546.000 sqm	
		Say 546.000 sqm @ Rs 474.90 / sqm					<b>Rs 259295.40</b>	
23	13.44.1	Finishing walls with water proofing cement paint of required shade:New work (Two or more coats applied @ 3.84 kg/10 sqm)						
		OVERHEAD WATER TANK-PAINTING						
	on walls	4	15.000		7.000		420.000	
	on beams	4	15.000		1.300		78.000	
	base slab	1	15.000	15.000			225.000	
	top slab	1	15.000	15.000			225.000	
		Total Quantity					948.000 sqm	
		Total Deducted Quantity					0.000 sqm	
		Net Total Quantity					948.000 sqm	
		Say 948.000 sqm @ Rs 77.06 / sqm					<b>Rs 73052.88</b>	
24	5.33.2	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer - in-charge. Note:- Cement content considered in this item is @ 330 kg/ cum. Excess or less cement used as per design mix is payable or recoverable separately.All work above plinth level upto floor V level						
		OVERHEAD WATER TANK-BEAMS						
	Beam(23x50)	4	15.000	0.230	0.500		6.900	
	bottom slab	1	15.000	15.000	0.500		112.500	
	side walls	4	15.000	0.500	7.000		210.000	
	slab	1	15.000	15.000	0.200		45.000	
		Total Quantity					374.400 cum	
		Total Deducted Quantity					0.000 cum	
		Net Total Quantity					374.400 cum	
		Say 374.400 cum @ Rs 9501.92 / cum					<b>Rs 3557518.85</b>	
25	5.34.1	Extra for providing richer mixes at all floor levels. Note:- Excess/less cement over the specified cement content used is payable/ recoverable separately.Providing M-30 grade concrete instead of M-25 grade BMC/RMC. (Note:- Cement content considered in M-30 is @ 340 kg/cum).						



OVERHEAD WATER TANK-FOR WALLS									
	botoom slab	1	15.000	15.000	0.500		112.500		
	side walls	4	15.000	0.500	7.000		210.000		
	Total Quantity						322.500 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						322.500 cum		
	Say 322.500 cum @ Rs 91.09 / cum							<b>Rs 29376.53</b>	
26	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)								
OVERHEAD WATER TANK-PLASTERING									
	on walls	4	15.000		7.000		420.000		
	on beams	4	15.000		1.300		78.000		
	base slab	1	15.000	15.000			225.000		
	top slab	1	15.000	15.000			225.000		
	Total Quantity						948.000 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						948.000 sqm		
	Say 948.000 sqm @ Rs 188.46 / sqm							<b>Rs 178660.08</b>	
27	10.26.1 Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works, including applying priming coat of approved steel primer.M.S. tube								
OVERHEAD WATER TANK-HAND RAILS									
	hand rail(horizontal)	1	15.000			4.11	61.651		
	hand rail(vertical)	60	45.000			3.1	8370.000		
	Total Quantity						8431.651 kg		
	Total Deducted Quantity						0.000 kg		
	Net Total Quantity						8431.651 kg		
	Say 8431.651 kg @ Rs 120.64 / kg							<b>Rs 1017194.38</b>	
28	10.25.2 Item Shifted to head 14 as item 14.74Steel work welded in built up sections/framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works								
OVERHEAD WATER TANK-LADDER									
	ladder inside(vertical)	2	4.000			7.01	56.080		

	l a d d e r inside(horizontal)	10	0.400			4.07	16.281	
	l a d d e r outside(vertical)	2	26.000			7.01	364.520	
	l a d d e r outside(horizontal)	65	0.400			4.07	105.821	
Total Quantity							542.702 kg	
Total Deducted Quantity							0.000 kg	
Net Total Quantity							542.702 kg	
Say 542.702 kg @ Rs 112.65 / kg							<b>Rs 61135.38</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>10 Appendix J- Micro Irrigation</b>								
1	od270721/2019_2020 Design and laying, testing and commissioning of Drip irrigation facilities to the ayacut area, Providing drawings, including cost and conveyence of all materials, labour charges, trenching in all classes of soil, all accessories such as filtration units, PVC feeder main PVC Net work, Sub main PVC Network, Valves & Fertigation units, drippers and driplines, Automation control, including Automatic filtration unit, Watermeter, Net Beat wireless controller, gravel filter with back wash valve, Irrigation Valve and accesorries, Air valve and Accessories, stabilizer, spike supporter, Isolation transformer, antina mounting poles Electrical cable and accessories, float switch etc complete, including operation and maintenance for a period 5years.							
Other Engineering Organisations <b>DRIP IRRIGATION</b>								
	Drip Irrigation including Operation & Maintenance	1				3575.0	3575.000	3575 hecters of ayacut area
Total Quantity							3575.000 Hecter	
Total Deducted Quantity							0.000 Hecter	
Net Total Quantity							3575.000 Hecter	
Say 3575.000 Hecter @ Rs 194812.24 / Hecter							<b>Rs 696453758.00</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>11 Appendix K- Revival of pond</b>								
1	2.31 Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared							
	Ayya gounder kulam 1	1	240.000	3.000			720.000	
	Ayya gounder kulam 2	1	263.000	3.000			789.000	

	Chambakkulam	1	254.000	3.000			762.000	
	Kallukkad Kulam	1	264.000	3.000			792.000	
	Pudayanimedu potta kulam	1	425.000	3.000			1275.000	
	pudayanimedu kulam	1	548.000	3.000			1644.000	
	chambanathodu kulam 1	1	121.000	3.000			363.000	
	chambanathodu kulam 2	1	341.000	3.000			1023.000	
	ISDF Kulam2	1	111.000	3.000			333.000	
	ISDF Kulam 1	1	212.000	3.000			636.000	
	Thenakulam	1	347.000	3.000			1041.000	
	Doraiswami kulam	1	5028.000	3.000			15084.000	
	Ayyappan kovil kulam	1	223.000	3.000			669.000	
	Chulli kulam	1	276.000	3.000			828.000	
						Total Quantity	25959.000 sqm	
						Total Deducted Quantity	0.000 sqm	
						Net Total Quantity	25959.000 sqm	
						Say 25959.000 sqm @ Rs 9.44 / sqm	<b>Rs 245052.96</b>	
2	2.6.1 Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.All kinds of soil							
						silt removal		
	Ayya gounder kulam 1	1	3141.000		1.500		4711.500	
	Ayya gounder kulam 2	1	4222.000		0.915		3863.130	
	Chambakkulam	1	4495.000		1.855		8338.225	
	Kallukkad Kulam	1	4169.000		2.517		10493.373	
	Pudayanimedu potta kulam	1	6315.000		1.661		10489.215	
	pudayanimedu kulam	1	12864.000		1.301		16736.064	
	chambanathodu kulam 1	1	964.000		2.008		1935.712	
	chambanathodu kulam 2	1	5746.000		1.050		6033.300	

	ISDF Kulam2	1	111.000		1.690		187.590		
	ISDF Kulam 1	1	212.000		0.958		203.096		
	Thenakulam	1	347.000		2.330		808.510		
	Doraiswami kulam	1	301.000		2.940		884.940		
	Ayyappan kovil kulam	1	223.000		1.690		376.870		
	Chulli kulam	1	276.000		0.280		77.280		
	Total Quantity						65138.805 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						65138.805 cum		
	Say 65138.805 cum @ Rs 165.07 / cum						<b>Rs 10752462.54</b>		
3	<p>2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil</p>								
	Ayya gounder kulam 1	1	240.000	2.200	0.900		475.200		
	Ayya gounder kulam 2	1	263.000	2.200	0.900		520.740		
	Chambakkulam	1	254.000	2.200	0.900		502.921		
	Kallukkad Kulam	1	264.000	2.200	0.900		522.720		
	Pudayanimedu potta kulam	1	425.000	2.200	0.900		841.501		
	pudayanimedu kulam	1	548.000	2.200	0.900		1085.041		
	chambanathodu kulam 1	1	121.000	2.200	0.900		239.581		
	chambanathodu kulam 2	1	341.000	2.200	0.900		675.181		
	ISDF Kulam2	1	111.000	2.200	0.900		219.781		
	ISDF Kulam 1	1	212.000	2.200	0.900		419.761		
	Thenakulam	1	347.000	2.200	0.900		687.061		
	Doraiswami kulam	1	301.000	2.200	0.900		595.980		
	Ayyappan kovil kulam	1	223.000	2.200	0.900		441.540		
	Chulli kulam	1	276.000	2.200	0.900		546.480		
	Total Quantity						7773.488 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						7773.488 cum		

		Say 7773.488 cum @ Rs 218.08 / cum					Rs 1695242.26	
4	50.2.3.1 Pumping or Bailing out water and removing slush etc by using pump set including cost of labour, oil hire charges of pumpset, etc complete							
		Bailing out of water						
	Ayya gounder kulam 1	1	200.000				200.000	
	Ayya gounder kulam 2	1	220.000				220.000	
	Chambakkulam	1	230.000				230.000	
	Kallukkad Kulam	1	275.000				275.000	
	Pudayanimedu potta kulam	1	300.000				300.000	
	pudayanimedu kulam	1	400.000				400.000	
	chambanathodu kulam 1	1	70.000				70.000	
	chambanathodu kulam 2	1	300.000				300.000	
	ISDF Kulam2	1	50.000				50.000	
	ISDF Kulam 1	1	150.000				150.000	
	Thenakulam	1	320.000				320.000	
	Doraiswami kulam	1	300.000				300.000	
	Ayyappan kovil kulam	1	250.000				250.000	
	Chulli kulam	1	275.000				275.000	
		Total Quantity					3340.000 hour	
		Total Deducted Quantity					0.000 hour	
		Net Total Quantity					3340.000 hour	
		Say 3340.000 hour @ Rs 189.18 / hour					Rs 631861.20	
5	60.7.1 DRY RUBBLE MASONRY _ Dry rubble without concrete levelling course masonry with good quality blasted rubble including packing to compactness to lines and levels cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site							
		DR Basement						
	Ayya gounder kulam 1	1	240.000	2.000	0.600		288.000	
	Ayya gounder kulam 2	1	263.000	2.000	0.600		315.600	
	Chambakkulam	1	254.000	2.000	0.600		304.800	
	Kallukkad Kulam	1	264.000	2.000	0.600		316.800	

	Pudayanimedu potta kulam	1	425.000	2.000	0.600		510.000		
	pudayanimedu kulam	1	548.000	2.000	0.600		657.600		
	chambanathodu kulam 1	1	121.000	2.000	0.600		145.200		
	chambanathodu kulam 2	1	341.000	2.000	0.600		409.200		
	ISDF Kulam2	1	111.000	2.000	0.600		133.200		
	ISDF Kulam 1	1	212.000	2.000	0.600		254.400		
	Thenakulam	1	347.000	2.000	0.600		416.400		
	Doraiswami kulam	1	301.000	2.000	0.600		361.200		
	Ayyappan kovil kulam	1	223.000	2.000	0.600		267.600		
	Chulli kulam	1	276.000	2.000	0.600		331.200		
	Parakulam	1	1.000	2.000	0.600		1.200		
	DR Wall protection								
	Ayya gounder kulam 1	1	240.000	1.300	2.925		912.600		
	Ayya gounder kulam 2	1	263.000	1.300	2.925		1000.058		
	Chambakkulam	1	254.000	1.300	2.925		965.835		
	Kallukkad Kulam	1	264.000	1.300	2.925		1003.860		
	Pudayanimedu potta kulam	1	425.000	1.300	2.925		1616.063		
	pudayanimedu kulam	1	548.000	1.300	2.925		2083.770		
	chambanathodu kulam 1	1	121.000	1.300	2.925		460.103		
	chambanathodu kulam 2	1	341.000	1.300	2.925		1296.653		
	ISDF Kulam2	1	111.000	1.300	2.925		422.078		
	ISDF Kulam 1	1	212.000	1.300	2.925		806.130		
	Thenakulam	1	347.000	1.300	2.925		1319.468		
	Doraiswami kulam	1	301.000	1.300	2.925		1144.553		
	Ayyappan kovil kulam	1	223.000	1.300	2.925		847.958		
	Chulli kulam	1	276.000	1.300	2.925		1049.490		
	Parakulam	1	1.000	1.300	2.925		3.803		
	Total Quantity						19644.822 cum		
	Total Deducted Quantity						0.000 cum		

	Net Total Quantity						19644.822 cum	
	Say 19644.822 cum @ Rs 2515.43 / cum						<b>Rs 49415174.60</b>	
6	7.2.1 Random rubble masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) at window sills, ceiling level and the like.Cement mortar 1:6 (1 cement : 6 coarse sand)							
	RR Wall for 85 cm height							
	Ayya gounder kulam 1	1	240.000	1.000	0.850		204.000	
	Ayya gounder kulam 2	1	263.000	1.000	0.850		223.550	
	Chambakkulam	1	254.000	1.000	0.850		215.900	
	Kallukkad Kulam	1	264.000	1.000	0.850		224.400	
	Pudayanimedu potta kulam	1	425.000	1.000	0.850		361.250	
	pudayanimedu kulam	1	548.000	1.000	0.850		465.800	
	chambanathodu kulam 1	1	121.000	1.000	0.850		102.850	
	chambanathodu kulam 2	1	341.000	1.000	0.850		289.850	
	ISDF Kulam2	1	111.000	1.000	0.850		94.350	
	ISDF Kulam 1	1	212.000	1.000	0.850		180.200	
	Thenakulam	1	347.000	1.000	0.850		294.950	
	Doraiswami kulam	1	301.000	1.000	0.850		255.850	
	Ayyappan kovil kulam	1	223.000	1.000	0.850		189.550	
	Chulli kulam	1	276.000	1.000	0.850		234.600	
	Parakulam	1	1.000	1.000	0.850		0.850	
	Total Quantity						3337.950 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						3337.950 cum	
	Say 3337.950 cum @ Rs 6284.52 / cum						<b>Rs 20977413.53</b>	
7	4.1.2 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:1/2:3 (cement : 11/2 coarse sand : 3 graded stone aggregate 20 mm nominal size)							
	RCC Belt inbetween DR							
	Ayya gounder kulam 1	1	240.000	1.300	0.150		46.800	

	Ayya gounder kulam 2	1	263.000	1.300	0.150		51.286	
	Chambakkulam	1	254.000	1.300	0.150		49.530	
	Kallukkad Kulam	1	264.000	1.300	0.150		51.480	
	Pudayanimedu potta kulam	1	425.000	1.300	0.150		82.875	
	pudayanimedu kulam	1	548.000	1.300	0.150		106.860	
	chambanathodu kulam 1	1	121.000	1.300	0.150		23.596	
	chambanathodu kulam 2	1	341.000	1.300	0.150		66.495	
	ISDF Kulam2	1	111.000	1.300	0.150		21.645	
	ISDF Kulam 1	1	212.000	1.300	0.150		41.340	
	Thenakulam	1	347.000	1.300	0.150		67.665	
	Doraiswami kulam	1	301.000	1.300	0.150		58.695	
	Ayyappan kovil kulam	1	223.000	1.300	0.150		43.486	
	Chulli kulam	1	276.000	1.300	0.150		53.820	
	at leading drain							
	Ayya Gounder kulam1 (at bed of the drain)	1	80.000	1.200	0.100		9.601	
	Ayya Gounder kulam 1 (at side wall)	2	80.000	0.350	0.600		33.600	
	Ayya Gounder kulam 2(at bed of the drain)	1	100.000	1.200	0.100		12.000	
	Ayya Gounder kulam 2(at side wall)	1	100.000	0.350	0.600		21.000	
	Chambakkulam (at bed of the drain)	1	100.000	1.200	0.100		12.000	
	Chambakkulam (at side walls)	1	100.000	0.350	0.600		21.000	
	Kallukkad kulam(at bed of the drain)	1	75.000	1.200	0.100		9.000	
	Kallukkad kulam(at side wall)	1	75.000	0.350	0.600		15.750	
	Pudayanimedu potta kulam(at bed of the drain)	1	100.000	1.200	0.100		12.000	



Pudayanimedu potta kulam(at side wall)	1	100.000	0.350	0.600	21.000	
Pudayanimedu potta kulam(at the bed of the drain)	1	150.000	1.200	0.100	18.000	
Pudayanimedu kulam (at side wall)	1	150.000	0.350	0.600	31.500	
chambanthodu kulam 1 (at bed of the drain)	1	140.000	1.200	0.100	16.800	
chambanthodu kulam 1(at side wall)	1	140.000	0.350	0.600	29.400	
chambanthodu kulam2 (at the bed of the drain)	1	150.000	1.200	0.100	18.000	
chambanthodu kulam2 (at side wall)	1	150.000	0.350	0.600	31.500	
ISDF Kulam2 (at bed of the drain)	1	140.000	1.200	0.100	16.800	
ISDF Kulam 2 (at side wall)	1	140.000	0.350	0.600	29.400	
ISDF Kulam1(at bed of the drain)	1	150.000	1.200	0.100	18.000	
ISDF Kulam1(at side walls)	1	150.000	0.350	0.600	31.500	
Thena kulam(at bed of the drain)	1	200.000	1.200	0.100	24.000	
Thena kulam(at side walls)	1	200.000	0.350	0.600	42.000	
Dorai swami kulam (at bed of the drain)	1	200.000	1.200	0.100	24.000	
Dorai swami kulam (at side wall)	1	200.000	0.350	0.600	42.000	
Ayyappan kovil kulam(at bed of drain)	1	180.000	1.200	0.100	21.600	
Ayyappan kovil kulam(at side wall)	1	180.000	0.350	0.600	37.800	
Chulli kulam (at bed of the drain)	1	200.000	1.200	0.100	24.000	

	chulli kulam(at side wall)	1	200.000	0.350	0.600		42.000	
	Total Quantity						1430.824 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						1430.824 cum	
	Say 1430.824 cum @ Rs 7764.85 / cum						<b>Rs 11110133.74</b>	
8	4.1.5 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)							
	Ayya gounder 1							
	wearing coat on DR surface	1	240.000	0.600	0.075		10.800	
	Toe wall	1	240.000	0.300	0.600		43.200	
	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	5.000	0.400	0.150		0.900	
	side lining for d/s	1	115.000	0.100	2.600		29.901	
	Ayya gounder 2							
	wearing coat on DR surface	1	263.000	0.600	0.075		11.835	
	Toe wall	1	263.000	0.300	0.600		47.340	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.400	0.150		0.600	
	side lining for d/s	1	130.000	0.100	2.600		33.801	
	chambakkulam							
	wearing coat on DR surface	1	254.000	0.600	0.075		11.430	
	Toe wall	1	254.000	0.300	0.600		45.720	
	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	1.000	0.400	0.150		0.180	
	side lining for d/s	1	125.000	0.100	2.600		32.500	
	kallukkad kulam							
	wearing coat on DR surface	1	264.000	0.600	0.075		11.880	
	Toe wall	1	264.000	0.300	0.600		47.520	

	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	5.000	0.400	0.150		0.900	
	side lining for d/s	1	130.000	0.100	2.600		33.801	
	pudayanime du pottakulam							
	wearing coat on DR surface	1	425.000	0.600	0.075		19.125	
	Toe wall	1	425.000	0.300	0.600		76.500	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.400	0.150		0.600	
	side lining for d/s	1	210.000	0.100	2.600		54.600	
	pudayanime du kulam							
	wearing coat on DR surface	1	548.000	0.600	0.075		24.660	
	Toe wall	1	548.000	0.300	0.600		98.640	
	step bottom	4	5.000	0.600	0.150		1.800	
	step top	4	5.000	0.400	0.150		1.200	
	side lining for d/s	1	275.000	0.100	2.600		71.500	
	chambanthodu kulam 1							
	wearing coat on DR surface	1	121.000	0.600	0.075		5.445	
	Toe wall	1	121.000	0.300	0.600		21.780	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.400	0.150		0.600	
	side lining for d/s	1	61.000	0.100	2.600		15.861	
	chambanthodu kulam 2							
	wearing coat on DR surface	1	341.000	0.600	0.075		15.345	
	Toe wall	1	341.000	0.300	0.600		61.380	
	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	5.000	0.400	0.150		0.900	
	side lining for d/s	1	170.000	0.100	2.600		44.200	
	ISDF kulam 1							
	wearing coat on DR surface	1	212.000	0.600	0.075		9.540	

	Toe wall	1	212.000	0.300	0.600		38.160	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.400	0.150		0.600	
	side lining for d/s	1	105.000	0.100	2.600		27.300	
	ISDF kulam 2							
	wearing coat on DR surface	1	111.000	0.600	0.075		4.995	
	Toe wall	1	111.000	0.300	0.600		19.980	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.600	0.150		0.900	
	side lining for d/s	1	60.000	0.100	2.600		15.601	
	Thena kulam							
	wearing coat on DR surface	1	347.000	0.600	0.075		15.615	
	Toe wall	1	347.000	0.300	0.600		62.460	
	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	5.000	0.400	0.150		0.900	
	side lining for d/s	1	175.000	0.100	2.600		45.500	
	Dorai swami kulam							
	wearing coat on DR surface	1	301.000	0.600	0.075		13.545	
	Toe wall	1	301.000	0.300	0.600		54.180	
	step bottom	2	5.000	0.600	0.150		0.900	
	step top	2	5.000	0.400	0.150		0.600	
	side lining for d/s	1	151.000	0.100	2.600		39.261	
	ayyappan kovil kulam							
	wearing coat on DR surface	1	223.000	0.600	0.075		10.035	
	Toe wall	1	223.000	0.300	0.600		40.140	
	step bottom	3	5.000	0.600	0.150		1.350	
	step top	3	120.000	0.100	2.600		93.601	
	Chullikulam							
	wearing coat on DR surface	1	276.000	0.600	0.075		12.420	

	Toe wall	1	276.000	0.300	0.600		49.680		
	step bottom	2	5.000	0.600	0.150		0.900		
	step top	2	5.000	0.600	0.150		0.900		
	Side wall lining	1	140.000	0.100	2.600		36.400		
	Total Quantity							1483.157 cum	
	Total Deducted Quantity							0.000 cum	
	Net Total Quantity							1483.157 cum	
	Say 1483.157 cum @ Rs 6457.33 / cum							<b>Rs 9577234.19</b>	
9	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)								
	Ayya gounder 1								
	Pcc for foundation	1	240.000	2.200	0.300		158.400		
	Ayya gounder 2								
	Pcc for foundation	1	263.000	2.200	0.300		173.580		
	chambakulam								
	Pcc for foundation	1	254.000	2.200	0.300		167.641		
	kallukkad kulam								
	Pcc for foundation	1	264.000	2.200	0.300		174.240		
	pudayanimedu pottakulam								
	Pcc for foundation	1	425.000	2.200	0.300		280.500		
	Pudayanimedu kulam								
	Pcc for foundation	1	548.000	2.200	0.300		361.680		
	Chambanthodu kulam 1								
	Pcc for foundation	1	121.000	2.100	0.600		152.460		
	chambanthodu kulam 2								
	Pcc for foundation	1	341.000	2.200	0.300		225.060		
	ISDF KULAM 1								
	Pcc for foundation	1	212.000	2.200	0.300		139.921		
	ISDF KULAM 2								
	Pcc for foundation	1	111.000	2.200	0.300		73.260		
	Thena kulam								
	Pcc for foundation	1	347.000	2.200	0.300		229.020		

Doraiswami kulam							
Pcc for foundation	1	301.000	2.200	0.300		198.660	
Ayyappan kovil kulam							
Pcc for foundation	1	276.000	2.200	0.300		182.160	
Chullikulam							
Pcc for foundation	1	276.000	2.200	0.300		182.160	
Total Quantity						2698.742 cum	
Total Deducted Quantity						0.000 cum	
Net Total Quantity						2698.742 cum	
Say 2698.742 cum @ Rs 5869.06 / cum						<b>Rs 15839078.72</b>	
10	4.3.2 Centering and shuttering including strutting, propping etc. and removal of form work for:Retaining walls, return walls, (any thickness) including attached pilasters, buttresses, plinth and string courses fillets, kerbs and steps etc.						
Ayya gounder 1							
Wearing coat on DR Surface	1	240.000		0.075		18.000	
Toe wall	1	240.000		0.600		144.000	
leading channel	2	130.000		1.200		312.000	
step	3	5.600		0.150		2.520	
belt	1	240.000		0.300		72.000	
Ayya gounder 2							
Wearing coat on DR Surface	1	263.000		0.075		19.725	
Toe wall	1	263.000		0.600		157.800	
leading channel	2	150.000		1.200		360.000	
step	2	5.000		0.150		1.500	
belt	1	263.000		0.300		78.900	
Chambakkulam							
Wearing coat on DR Surface	1	254.000		0.075		19.050	
Toe wall	1	254.000		0.600		152.400	
leading channel	2	150.000		1.200		360.000	
step	3	5.600		0.150		2.520	
belt	1	254.000		0.300		76.200	

Kallukkad kulam							
Wearing coat on DR Surface	1	240.000		0.075		18.000	
Toe wall	1	264.000		0.600		158.400	
leading channel	2	125.000		1.200		300.000	
step	3	5.600		0.150		2.520	
belt	1	264.000		0.300		79.200	
Pudayanimedu potta kulam							
Wearing coat on DR Surface	1	425.000		0.075		31.875	
Toe wall	1	425.000		0.600		255.000	
leading channel	2	160.000		0.600		192.000	
step	2	5.600		0.150		1.680	
belt	1	425.000		0.300		127.500	
Pudiyamedu kulam							
Wearing coat on DR Surface	1	548.000		0.075		41.100	
Toe wall	1	548.000		0.600		328.800	
leading channel	2	200.000		0.600		240.000	
step	4	200.000		0.150		120.000	
belt	1	548.000		0.300		164.400	
Chambanthodu kulam 1							
Wearing coat on DR Surface	1	121.000		0.075		9.075	
Toe wall	1	121.000		0.600		72.600	
leading channel	2	190.000		0.600		228.000	
step	2	5.600		0.150		1.680	
belt	1	121.000		0.300		36.300	
Chambanthodu kulam 2							
Wearing coat on DR Surface	1	341.000		0.075		25.575	
Toe wall	1	341.000		0.600		204.600	
leading channel	2	200.000		1.200		480.000	
step	3	5.600		0.150		2.520	

	belt	1	341.000		0.300		102.300	
ISDF KULAM 2								
	Wearing coat on DR Surface	1	111.000		0.075		8.325	
	Toe wall	1	111.000		0.600		66.600	
	leading channel	2	190.000		1.200		456.000	
	step	2	5.600		0.150		1.680	
	belt	1	111.000		0.300		33.300	
ISDF KULAM 1								
	Wearing coat on DR Surface	1	212.000		0.075		15.900	
	Toe wall	1	212.000		0.600		127.200	
	leading channel	2	210.000		1.200		504.000	
	step	2	5.600		0.150		1.680	
	belt	1	212.000		0.300		63.600	
Thena kulam								
	Wearing coat on DR Surface	1	347.000		0.075		26.025	
	Toe wall	1	347.000		0.600		208.200	
	leading channel	2	240.000		1.200		576.000	
	step	3	5.600		0.150		2.520	
	belt	1	347.000		0.300		104.100	
Doriswami kulam								
	Wearing coat on DR Surface	1	301.000		0.075		22.575	
	Toe wall	1	301.000		0.600		180.600	
	leading channel	2	245.000		1.200		588.000	
	step	2	5.600		0.150		1.680	
	belt	1	301.000		0.300		90.300	
Ayyappankovil kulam								
	Wearing coat on DR Surface	1	223.000		0.075		16.725	
	Toe wall	1	223.000		0.600		133.800	
	leading channel	2	235.000		1.200		564.000	



	step	3	5.600		0.150		2.520		
	belt	1	223.000		0.300		66.900		
	Chulli kulam								
	Wearing coat on DR Surface	1	276.000		0.075		20.700		
	Toe wall	1	276.000		0.600		165.600		
	leading channel	2	250.000		1.200		600.000		
	step	2	5.600		0.150		1.680		
	belt	1	276.000		0.300		82.800		
	Total Quantity						9732.750 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						9732.750 sqm		
	Say 9732.750 sqm @ Rs 496.19 / sqm						<b>Rs 4829293.22</b>		
11	5.9.3 Centering and shuttering including strutting, etc. and removal of form for:Suspended floors, roofs, landings, balconies and access platform								
	PUMP HOUSE-ROOF								
	roof	1	2.600	1.600			4.160		
	Other Engineering Organisations OVERHEAD WATER TANK-SLABS								
	base slab	1	15.000	15.000			225.000		
	cover slab	1	15.000	15.000			225.000		
	Total Quantity						454.160 sqm		
	Total Deducted Quantity						0.000 sqm		
	Net Total Quantity						454.160 sqm		
	Say 454.160 sqm @ Rs 553.47 / sqm						<b>Rs 251363.94</b>		
12	5.9.5 Centering and shuttering including strutting, etc. and removal of form for:Lintels, beams, plinth beams, girders bressumers and cantilevers								
	PUMP HOUSE -LINTEL								
	lintel	1	6.800		0.300		2.040		
	OVERHEAD WATER TANK-FOR BEAMS								
	B(23X50)	4	15.000		1.300		78.000		
	Total Quantity						80.040 sqm		
	Total Deducted Quantity						0.000 sqm		

		Net Total Quantity					80.040 sqm	
		Say 80.040 sqm @ Rs 449.40 / sqm					<b>Rs 35969.98</b>	
13	5.9.19	Centering and shuttering including strutting, etc. and removal of form for:Weather shade, Chajjas, corbels etc., including edges						
		PUMP HOUSE -SUNSHADE						
	sunshade	1	2.800	0.800			2.240	
		Total Quantity					2.240 sqm	
		Total Deducted Quantity					0.000 sqm	
		Net Total Quantity					2.240 sqm	
		Say 2.240 sqm @ Rs 683.81 / sqm					<b>Rs 1531.73</b>	
14	5.30	Add for plaster drip course / groove in plastered surface or moulding to R.C.C. projections.						
		PUMP HOUSE						
		1	2.800				2.800	
		Total Quantity					2.800 metre	
		Total Deducted Quantity					0.000 metre	
		Net Total Quantity					2.800 metre	
		Say 2.800 metre @ Rs 44.76 / metre					<b>Rs 125.33</b>	
15	13.1.2	12 mm cement plaster of mix:1:6 (1 cement : 6 fine sand).						
		PUMP HOUSE-12mm plastering						
	walls inside	1	6.000		3.000		18.000	
	walls outside	1	7.600		3.000		22.800	
	top of roof	1	2.400	1.400			3.360	
	top of sunshade	1	2.800	0.700			1.960	
	parapet	1	7.600		1.700		12.920	
		DEDUCTION						
	D	1	1.000		2.100		-2.100	
	V	1	0.900		0.600		-0.540	
		Total Quantity					59.040 sqm	
		Total Deducted Quantity					-2.640 sqm	
		Net Total Quantity					56.400 sqm	
		Say 56.400 sqm @ Rs 210.15 / sqm					<b>Rs 11852.46</b>	

16	5.22A.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete above plinth level.Thermo - Mechanically Treated bars of grade Fe-500D or more							
	steel quantity	1	1430.824		70.000		100157.68 1	70 kg for 1 cum
	Total Quantity						100157.681 kg	
	Total Deducted Quantity						0.000 kg	
	Net Total Quantity						100157.681 kg	
	Say 100157.681 kg @ Rs 74.18 / kg						<b>Rs 7429696.78</b>	
17	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)							
	PUMP HOUSE -6mm plastering							
	bottom of roof	1	2.000	1.000			2.000	
	bottom of sunshade	1	7.600	0.600			4.560	
	Total Quantity						6.560 sqm	
	Total Deducted Quantity						0.000 sqm	
	Net Total Quantity						6.560 sqm	
	Say 6.560 sqm @ Rs 188.46 / sqm						<b>Rs 1236.30</b>	
18	22.7.1 Other Engineering Organisations Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc. consisting of following operations: a) Applying a slurry coat of neat cement using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-Charge over the RCC slab including adjoining walls upto 300 mm height including cleaning the surface before treatment. b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 ( 1 cement : 5 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-Charge over 20 mm thick layer of cement mortar of mix 1:5 ( 1 cement : 5 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer - in- Charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-Charge. d) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 ( 1 cement : 4 coarse sand ) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer - in- Charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep. e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by Engineer in Charge:With average thickness of 120 mm and minimum thickness at khurra as 65 mm							
	roof	1	2.200	1.200			2.640	

					Total Quantity	2.640 sqm		
					Total Deducted Quantity	0.000 sqm		
					Net Total Quantity	2.640 sqm		
					Say 2.640 sqm @ Rs 1356.01 / sqm		<b>Rs 3579.87</b>	
19	13.46.1	Finishing walls with Acrylic Smooth exterior paint of required shade:New work (Two or more coat applied @ 1.67 ltr/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm)						
		PUMP HOUSE -PAINTING						
	walls inside	1	6.000		3.000		18.000	
		DEDUCTION						
	D	1	1.000		2.100		-2.100	
	V	1	0.900		0.600		-0.540	
		PUMP HOUSE-PAINTING						
	bottom of roof	1	2.000	1.000			2.000	
	botoom of sunshade	1	7.600	0.600			4.560	
					Total Quantity	24.560 sqm		
					Total Deducted Quantity	-2.640 sqm		
					Net Total Quantity	21.920 sqm		
					Say 21.920 sqm @ Rs 125.88 / sqm		<b>Rs 2759.29</b>	
20	13.52.1	Finishing with Epoxy paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete.On steel work						
		PUMP HOUSE-PAINTING						
	V	1	0.900		0.600		0.540	
					Total Quantity	0.540 sqm		
					Total Deducted Quantity	0.000 sqm		
					Net Total Quantity	0.540 sqm		
					Say 0.540 sqm @ Rs 160.55 / sqm		<b>Rs 86.70</b>	
21	9.48.2	Providing and fixing M.S. Grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete.Fixed to openings/ wooden frames with rawl plugs screws etc						
		PUMP HOUSE-MS GRILLS						
	Grills	12	0.900		0.790		8.532	



		Net Total Quantity						2.114 sqm
		Say 2.114 sqm @ Rs 3339.61 / sqm						<b>Rs 7059.94</b>
25	9.126.1	Providing and fixing 12 mm thick panelling or panelling and glazing in panelled or panelled and glazed shutters for doors, windows and clerestory windows ( area of opening for panel inserts excluding portion inside grooves or rebates to be measured). Panelling for panelled and glazed shutters 25 mm to 40 mm thick.Marine plywood conformingto IS : 710						
		PUMP HOUSE-SHUTTERS						
	D	1	1.000		2.100	0.5	1.050	
		Total Quantity						1.050 sqm
		Total Deducted Quantity						0.000 sqm
		Net Total Quantity						1.050 sqm
		Say 1.050 sqm @ Rs 1895.91 / sqm						<b>Rs 1990.71</b>
26	13.69.1	Polishing on wood work with ready mixed wax polish of approved brand and manufacture:New work						
		PUMP HOUSE						
	D	1	1.000		2.100		2.100	
	V	1	0.900		0.600		0.540	
		Total Quantity						2.640 sqm
		Total Deducted Quantity						0.000 sqm
		Net Total Quantity						2.640 sqm
		Say 2.640 sqm @ Rs 121.49 / sqm						<b>Rs 320.73</b>
27	9.86.1	Providing and fixing bright finished brass casement stays (straight peg type) with necessary screws etc. complete:300 mm weighing not less than 330 gms						
		PUMP HOUSE						
		1					1.000	
		Total Quantity						1.000 no
		Total Deducted Quantity						0.000 no
		Net Total Quantity						1.000 no
		Say 1.000 no @ Rs 221.69 / no						<b>Rs 221.69</b>
28	9.96.1	Providing and fixing aluminium sliding door bolts, ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868), transparent or dyed to required colour or shade, with nuts and screws etc. complete:300x16 mm						
		PUMP HOUSE						

		1					1.000	
	Total Quantity						1.000 no	
	Total Deducted Quantity						0.000 no	
	Net Total Quantity						1.000 no	
	Say 1.000 no @ Rs 278.44 / no						<b>Rs 278.44</b>	
29	9.97.3 Providing and fixing aluminium tower bolts, ISI marked, anodised(anodic coating not less than grade AC 10 as per : 1868), transparent or dyed to required colour or shade, with necessary screws complete:200x10 mm							
	PUMP HOUSE							
		1					1.000	
	Total Quantity						1.000 no	
	Total Deducted Quantity						0.000 no	
	Net Total Quantity						1.000 no	
	Say 1.000 no @ Rs 99.80 / no						<b>Rs 99.80</b>	
30	9.53 Providing 40x5 mm flat iron hold fast 40 cm long including fixing to frame with 10 mm diameter bolts, nuts and wooden plugs and embeddings in cement concrete block 30x10x15 cm 1:3:6 mix ( 1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)							
	PUMP HOUSE-HOLD FASTNER							
	D	6					6.000	
	V	2					2.000	
	Total Quantity						8.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						8.000 each	
	Say 8.000 each @ Rs 155.44 / each						<b>Rs 1243.52</b>	
31	9.100.1 Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete:125 mm							
	PUMP HOUSE							
		1					1.000	
	Total Quantity						1.000 no	
	Total Deducted Quantity						0.000 no	
	Net Total Quantity						1.000 no	
	Say 1.000 no @ Rs 66.97 / no						<b>Rs 66.97</b>	

32	5.9.2 Centering and shuttering including strutting, etc. and removal of form for:Walls (any thickness) including attached pilasters, buttersesses, plinth and string courses etc.							
<b>OVERHEAD WATER TANK-FOR WALLS</b>								
	side walls	1	60.000		7.000		420.000	
Total Quantity							420.000 sqm	
Total Deducted Quantity							0.000 sqm	
Net Total Quantity							420.000 sqm	
Say 420.000 sqm @ Rs 496.19 / sqm							<b>Rs 208399.80</b>	
33	19.15.1 Providing M.S. foot rests including fixing in manholes with 20x20x10 cm cement concrete blocks 1:3:6 (1 cement : 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) as per standard design.With 20x20 mm square bar							
<b>OVERHEAD WATER TANK</b>								
		10					10.000	
Total Quantity							10.000 each	
Total Deducted Quantity							0.000 each	
Net Total Quantity							10.000 each	
Say 10.000 each @ Rs 351.18 / each							<b>Rs 3511.80</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>12 Appendix L- Consultancy and Service Charges</b>								
Lump-Sum Total							<b>Rs 12000000.00</b>	
SI No	Description	No	L	B	D	CF	Quantity	
Remark	<b>13 Appendix M Land Acquisition</b>							
Lump-Sum Total							<b>Rs 126000000.00</b>	
SI No	Description	No	L	B	D	CF	Quantity	
Remark	<b>14 Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal</b>							
1	2.3.1 Banking excavated earth in layers not exceeding 20 cm in depth, breaking clods, watering, rolling each layer with 1/2 tonne roller, or wooden or steel rammers, and rolling every 3rd and top-most layer with power roller of minimum 8 tonnes and dressing up, in embankments for roads, flood banks, marginal banks, and guide banks etc., lead up to 50 m and lift up to 1.5 m :All kinds of soil							
<b>CLEARING SITE</b>								
		2	7000.000	2.000			28000.000	
Total Quantity							28000.000 cum	
Total Deducted Quantity							0.000 cum	



	Net Total Quantity						28000.000 cum	
	Say 28000.000 cum @ Rs 353.53 / cum						<b>Rs 9898840.00</b>	
2	2.8.1 Earth work in excavation by mechanical means (Hydraulic excavator) /manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.All kinds of soil							
	EARTHWORK EXCAVATION							
	Sidewall	2	7000.000	0.300	2.000		8400.000	
	Foundation	2	7000.000	0.500	0.300		2100.000	
	Bed	1	7000.000	3.170	0.100		2219.000	
	Chinnamoolathara shutter							
	for column to support shutter	2	0.900	0.900	0.200		0.325	
	Total Quantity						12719.325 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						12719.325 cum	
	Say 12719.325 cum @ Rs 218.08 / cum						<b>Rs 2773830.40</b>	
3	od265908/2019_2020 Fabrication of structural steel gate and accessories as per approved specifications, drawings and directions of departmental officer at site including cost of labour ,machinery ,all leads and lifts, incidental and handling charges etc complete but excluding cost of material already supplied Rate analysis for 10 qtl fabrication							
	CHINNAMOOLATHARA							
	S K I N PLATE(CHINNAMOOLATHARA)1	1	1.200	1.400	0.006	7850.0	79.128	
	SCREW RPD PLATE (CHINNAMOOLATHARA)	2	0.200	0.250	0.006	7850.0	4.711	
	karimann							
	skin plate(karimann)	2	1.200	1.200	0.006	7850.0	135.648	
	screw rod plate (karimann)	4	0.200	0.250	0.006	7850.0	9.421	
	Chinnamoolathara							
	horizontal stiffners (ISMC 100)	1	1.200		9.200		11.040	

	horizontal stiffner (ISA 65X65x6)	2	1.200		5.800		13.920		
	vertical stiffner (ISA 65X65X6)	4	1.400		5.800		32.480		
	Karimann								
	horizontal stiffner (ISMC 100)	2	1.200		9.200		22.080		
	horizontal and vertical stiffners (ISA 65 X 65 X 60)	14	1.200		5.800		97.440		
	Total Quantity						405.868 kg		
	Total Deducted Quantity						0.000 kg		
	Net Total Quantity						405.868 kg		
	Say 405.868 kg @ Rs 36.36 / kg						<b>Rs 14757.36</b>		
4	15.2.1 Demolishing cement concrete manually / by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in-Charge.Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)								
	DEMOLISHING WALLS								
	Side walls	2	420.000	0.300	2.050		516.600		
	Urgent rectification to canal spouts								
	side wall	31	1.300	0.075	3.200		9.673		
	Total Quantity						526.273 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						526.273 cum		
	Say 526.273 cum @ Rs 1306.73 / cum						<b>Rs 687696.72</b>		
5	4.1.3 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:2:4 (cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)								
	P.C.C								
	Wearing coat	1	7000.000	3.200	0.050		1120.000		
	Haunch	2	7000.000	0.075	0.150		157.500		
	Karimann shutter								
	Wearing coat	1	2.000	1.000	0.050		0.100		
	rgent rectification to canal spouts								

	wearing coat	31	1.800	0.500	0.050		1.396	
	bed	31	1.500	2.000	0.050		4.650	
	step	31*3	1.100	(.40*.30)/2			6.138	
	reducing dia of pipe area - $(22/7 * .1 * .1) - (22/7 * .05 * .05) = .0236$	43	0.600	0.0236			0.609	
	Total Quantity						1290.393 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						1290.393 cum	
	Say 1290.393 cum @ Rs 7184.64 / cum						<b>Rs 9271009.16</b>	
6	4.1.5 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)							
	P.C.C							
	Side wall	2	7000.000	0.075	2.000		2100.000	
	Top wall	2	7000.000	0.075	0.100		105.000	
	urgent rectification to canal spouts							
	bed lining	31*2	3.500	0.100	0.075		1.628	
	Total Quantity						2206.628 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						2206.628 cum	
	Say 2206.628 cum @ Rs 6457.33 / cum						<b>Rs 14248925.18</b>	
7	4.1.8 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 nominal size)							
	P.C.C							
	Bed	1	7000.000	3.170	0.100		2219.000	
	Foundation	2	7000.000	0.500	0.300		2100.000	
	Karimann shutter							
	For column to support shutter	3	0.900	0.900	0.200		0.487	
	Bed	1	3.000	1.000	0.100		0.301	
	chinnamoolathara shutter							

	for column to support shutter	2	0.900	0.900	0.200		0.325		
	urgent rectification to canal spouts								
	foundation bed	31	1.300	2.300	0.250		23.173		
	top step	31	1.100	1.200	0.150		6.138		
	bed portion	31	1.500	2.000	0.100		9.300		
	urgent rectification to canal spouts								
	sloped portion	31*2*2	1.500		(0+2)/2		186.000		
	vertical portion	31*2	0.600		3.000		111.600		
	vertical inside	31	1.100		3.000		102.301		
	back side	31	1.100		3.000		102.301		
	side	31*2	0.300		1.000		18.600		
	Total Quantity						4879.526 cum		
	Total Deducted Quantity						0.000 cum		
	Net Total Quantity						4879.526 cum		
	Say 4879.526 cum @ Rs 5869.06 / cum						<b>Rs 28638230.87</b>		
8	5.22A.6 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete above plinth level. Thermo - Mechanically Treated bars of grade Fe-500D or more								
	STEEL REINFORCEMENT								
	Haunch	1	157.500			70.0	11025.000	70 kg of sttel for 1 cum cement concrete	
	Total Quantity						11025.000 kg		
	Total Deducted Quantity						0.000 kg		
	Net Total Quantity						11025.000 kg		
	Say 11025.000 kg @ Rs 74.18 / kg						<b>Rs 817834.50</b>		
9	60.7.4 DR PACKING FOR APRONS - Rough stone dry packing for apron with good quality blasted rubble including packing to compactness to lines levels, cost and conveyance of all materials labour charges etc. complete as per direction of Departmental officers at site								
	DRY RUBBLE								
	Side wall	2	7000.000	0.300	2.000		8400.000		
	Total Quantity						8400.000 cum		

Total Deducted Quantity							0.000 cum	
Net Total Quantity							8400.000 cum	
Say 8400.000 cum @ Rs 2600.69 / cum							<b>Rs 21845796.00</b>	
10	85.101 Supply of MS plates confirming to IS 2062GrB including cost of conveyance charges							
Supply and fabrication of shutters								
skin plate (karimann)	2	1.200	1.200	0.006	7850.0	135.648		
screw rod plate (karimann)	4	0.200	0.250	0.006	7850.0	9.421		
chinnamoolathra								
skin plate(chinnamoolathara)	1	1.200	1.400	0.006	7850.0	79.128		
screw rod plate (moolathara)	2	0.200	0.250	0.006	7850.0	4.711		
Hoist Arrangement								
Base plate and top plate	4*3	0.400	0.300	0.012	7850.0	135.648		
Total Quantity							364.556 kg	
Total Deducted Quantity							0.000 kg	
Net Total Quantity							364.556 kg	
Say 364.556 kg @ Rs 64.18 / kg							<b>Rs 23397.20</b>	
11	85.102 Supply of MS Tees, Angles, Joists, ISMB, ISMC confirming to IS2062GrA/B including cost of conveyance charges							
karimann								
Horizontal stiffener (ISMC 100)	2	1.200			9.2	22.080		
Horizontal stiffeners (ISA 65X65X60)	14	1.200			5.8	97.440		
Chinamoolathara								
Horizontal stiffeners (ISMC 100)	1	1.200			9.2	11.040		
Horizontal stiffener (ISA 65X65X6)	2	1.200			5.8	13.920		
Vertical stiffeners(ISA 65X65X6)	4	1.400			5.8	32.480		

Hoist arrangement									
	Hoist beam (ISMC 100)	2*3	1.800			9.2	99.360		
	Total Quantity						276.320 kg		
	Total Deducted Quantity						0.000 kg		
	Net Total Quantity						276.320 kg		
	Say 276.320 kg @ Rs 66.13 / kg						<b>Rs 18273.04</b>		
12	85.114 Painting all the exposed surfaces of the gate and embedded parts with two coats of epoxy coal tar black paint confirming to IS14948 with a minimum film thickness of 150+/-5 microns per each coat over two coats of priming coat applied with zinc primer containing not less than 85% of zinc on dry film with a film thickness of 70+/-5 microns , so that the total film thickness of all coats including priming coat at any rate is not less than 350 microns after cleaning the surface using hand and power tool cleaning including cost of all materials, labour charges , cost of testing all painting materials, all incidental charges, hire of T&P etc. complete as per the direction of department officers at site								
Chinamoolathara									
	Horizontal stiffner (ISMC 100)	1	1.200			0.3	0.360		
	Horizontal stiffners (ISA 75X75X10)	2	1.200			0.3	0.720		
	Vertical stiffners (ISA 75X75X10)	4	1.400			0.3	1.680		
CHINAMOOLATHRA									
	Skin plate (chinnamoolathara)	1	1.200	1.400		2.0	3.360		
	screw rod plate	2	0.200	0.250		2.0	0.200		
karimann									
	horizontal stiffner (ISMC 100)	2	1.200			0.3	0.720		
	Horizontal and vertial stiffners (ISA 75 X 75 X 10)	14	1.200			0.3	5.040		
KARIMANN									
	Skin plate (karimann)	2	1.200	1.200		2.0	5.760		
	screw and rod plate (karimann)	4	0.200	0.250		2.0	0.400		
	Total Quantity						18.240 sqm		







	Say 6.225 cum @ Rs 1318.07 / cum						<b>Rs 8204.99</b>	
20	60.7.9 RR with Departmental. Stone - Random rubble masonry using departmental rubble in foundation and plinth including through and bond stone and levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) upto plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand).							
	Karimann shutter							
	Canal wall	1	30.000	0.500	0.300		4.500	
	Total Quantity						4.500 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						4.500 cum	
	Say 4.500 cum @ Rs 3695.09 / cum						<b>Rs 16627.91</b>	
21	7.1.1 Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) up to plinth level with:Cement mortar 1:6 (1 cement : 6 coarse sand)							
	Karimann shutter							
	Canal wall	1	20.000	0.500	0.300		3.000	
		1	50.000	0.500	0.300		7.500	
		1	6.700	0.500	0.700		2.345	
	Total Quantity						12.845 cum	
	Total Deducted Quantity						0.000 cum	
	Net Total Quantity						12.845 cum	
	Say 12.845 cum @ Rs 5197.64 / cum						<b>Rs 66763.69</b>	
22	4.3.2 Centering and shuttering including strutting, propping etc. and removal of form work for:Retaining walls, return walls, (any thickness) including attached pilasters, buttresses, plinth and string courses fillets, kerbs and steps etc.							
	Karimann shutter							
	Groove gap	2	1.200		0.200		0.480	
	bed	3	2.800		0.400		3.360	
	column	3	2.000		2.300		13.800	
	intermediate beam	2	1.200		0.600		1.440	
	column capital	7	0.350		0.900		2.205	
	slab	2	1.200		1.200		2.880	

	groove	2	2.800		0.200		1.120		
	side	2*2	1.200		0.200		0.960		
	canal wall	2*2	3.000		1.200		14.400		
	Groove gap	2	1.200		0.200		-0.480		
	chinnamoolathara shutter								
	bed	2	2.800		0.400		2.240		
	column	2	2.000		4.000		16.000		
	intermedte beam	3	1.200		0.450		1.620		
	column capital	4	0.350		0.900		1.260		
	slab	1	1.200		1.200		1.440		
	groove side	1	2.800		0.200		0.560		
	side	2	1.200		0.200		0.480		
	groove	1	1.200		0.200		-0.240		
	urgent rectification to canal spouts								
	sloped portion	31*2*2	1.500		(0+2)/2		186.000		
	vertical portion	31*2	0.600		3.000		111.600		
	vertical inside	31	1.100		3.000		102.301		
	back side	31	1.100		3.000		102.301		
	side	31*2	0.300		1.000		18.600		
	top step	31*3	1.100		0.300		30.690		
		31*3*2	0.400		(.3/2)		11.160		
	Total Quantity						626.897 sqm		
	Total Deducted Quantity						-0.720 sqm		
	Net Total Quantity						626.177 sqm		
	Say 626.177 sqm @ Rs 496.19 / sqm						<b>Rs 310702.77</b>		
23	5.22.1 Steel reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding all complete upto plinth levelMild steel and Medium Tensile steel bars								
	Karimann shutter								
		1	3.122		70.000		218.540		
	chinnamoolathara shutter								
		1	2.839		70.000		198.730		
	Total Quantity						417.270 kg		

		Total Deducted Quantity					0.000 kg	
		Net Total Quantity					417.270 kg	
		Say 417.270 kg @ Rs 72.48 / kg					<b>Rs 30243.73</b>	
24	4.1.2 Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:1/2:3 (cement : 11/2 coarse sand : 3 graded stone aggregate 20 mm nominal size)							
Karimann shutter								
	bed	3	0.700	0.700	0.400		0.588	
	column	3	0.500	0.500	2.300		1.725	
	column capital	7	0.350	0.300	0.300		0.221	
	slab	2	0.350	0.300	0.300		0.063	
	intermediate beam	4	1.200	0.150	0.150		0.108	
	groove	2	1.200	0.200	0.200		-0.096	
chinnamoolathara shutter								
	bed	2	0.700	0.700	0.400		0.392	
	column	2	0.500	0.500	4.000		2.000	
	column capital	4	0.350	0.300	0.300		0.126	
	slab	1	1.200	1.200	0.200		0.288	
	intermediate beam	3	1.200	0.150	0.150		0.081	
	groove	1	1.200	0.200	0.200		-0.048	
urgent rectification to canal spouts								
	sloped portion	31*2*2	1.500		(0+2)/2		186.000	
	vertical portion	31*2	0.600		3.000		111.600	
	vertical inside	31	1.100		3.000		102.301	
	back side	31	1.100		3.000		102.301	
	side	31*2	0.300		1.000		18.600	
	top step	31*3	1.100		0.300		30.690	
		31*2*3	0.400		(.3/2)		11.160	
		Total Quantity					568.244 cum	
		Total Deducted Quantity					-0.144 cum	
		Net Total Quantity					568.100 cum	
		Say 568.100 cum @ Rs 7764.85 / cum					<b>Rs 4411211.29</b>	
25	4.1.6							

	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:1:3:6 ( 1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size)							
	Karimann shutter							
	Canal wall	2	3.000	0.500	1.200		3.600	
	urgent rectification to canal spouts							
	sloped wall	31*2	1.500	0.300	(0+2)/2		27.900	
	vertical	31*2	0.300	0.300	3.000		16.741	
	back wall	31	1.100	0.300	3.000		30.690	
	deduct pipe portion (.15*.5*22/7)=.071m2	31	0.071	0.300			-0.660	
						Total Quantity	78.931 cum	
						Total Deducted Quantity	-0.660 cum	
						Net Total Quantity	78.271 cum	
						Say 78.271 cum @ Rs 6309.95 / cum	<b>Rs 493886.10</b>	
26	13.16.1 6 mm cement plaster of mix:1:3 ( 1 cement : 3 fine sand)							
	Karimann shutter							
	column	3	2.000		2.300		13.800	
	capital	7	0.350		0.900		2.205	
	side	7	0.300		0.300		0.630	
	slab	2*2	1.200		1.200		5.760	
	beam	4	1.200		0.600		2.880	
	canal wall	2	3.000		1.700		10.200	
	groove	2	1.200	0.200			-0.480	
	chinnamoolathara shutter							
	column	2	2.000		4.000		16.000	
	capital	4	0.350		0.900		1.260	
	side	4	0.300		0.300		0.360	
	slab	2	1.200		1.200		2.880	
	beam	3	1.200		0.600		2.160	
	urgent rectification to canal spouts							
	sloped wall	31*2	1.500		(0+2)/2		93.000	
	inner wall	31	1.100		3.000		102.301	

	side	31*2	0.300		3.000		55.800	
	top	31*2	2.500		0.300		46.500	
		31	1.700		0.300		15.810	
	top step	31	1.100		2.100		71.611	
Total Quantity							443.157 sqm	
Total Deducted Quantity							-0.480 sqm	
Net Total Quantity							442.677 sqm	
Say 442.677 sqm @ Rs 188.46 / sqm							<b>Rs 83426.91</b>	
27	13.1.1 12 mm cement plaster of mix:1:4 ( 1 cement : 4 fine sand)							
Karimann shutter								
	wall	2	50.000		1.500		150.000	
		1	6.700		1.200		8.040	
Total Quantity							158.040 sqm	
Total Deducted Quantity							0.000 sqm	
Net Total Quantity							158.040 sqm	
Say 158.040 sqm @ Rs 226.67 / sqm							<b>Rs 35822.93</b>	
Sl No	Description	No	L	B	D	CF	Quantity	Remark
<b>15 Appendix I.1- LIFT IRRIGATION ELECTRICAL PART</b>								
1	90.14.1.1 Fabrication, supply, conveyance, installation testing and commissioning of floor or wall mounting, dust and vermin proof, cubicle type MV panel board comprising of the following components/ devices & complying to IS 8623. Fabrication of fully partitioned, dust and vermin proof enclosure for panel assembly as per form 4 of IS 8623 (with latest amendments) using CRCA sheet as per approved design and requirement, with front and rear access facility, bus bar chambers, hinged doors for all switch gear compartments, earthing the doors using 4 sq mm braided copper conductor, providing necessary cut-outs for mounting meters, relays, indication lamps, bus bar interconnection etc, detachable covers for bus bar chamber and cable alley, powder coating the assembly after subjecting to 7 tank process etc as required. CRCA sheet alone be used for the fabrication. Angles/ flats/ slotted angles etc shall not be used for the fabrication of panel assembly. The measurments will be taken the area of the complete sheets used for panel board including partitions, folding, shrouding etc. Supply and fabrication of MV panel board using 2.00mm CRCA sheet, powder coated (excluding base frame)							
	CRCA SHEET	10					10.000	
Total Quantity							10.000 sqm	
Total Deducted Quantity							0.000 sqm	
Net Total Quantity							10.000 sqm	
Say 10.000 sqm @ Rs 2613.01 / sqm							<b>Rs 26130.10</b>	

2	90.14.2.2 Supply and providing 3mm SMC sheet as shrouding for bus interconnection / terminations etc. including required nut & bolt etc.						
	SMC SHEET	1					1.000
	Total Quantity						1.000 sqm
	Total Deducted Quantity						0.000 sqm
	Net Total Quantity						1.000 sqm
	Say 1.000 sqm @ Rs 3932.69 / sqm						<b>Rs 3932.69</b>
3	90.14.3.1 Supply and providing heavy duty 'A' section neoprene gasket in the panel board 'A' section neoprene beeding suitable for 1.60/ 2.00 mm sheet						
	Neoprene gasket	30					30.000
	Total Quantity						30.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						30.000 metre
	Say 30.000 metre @ Rs 46.31 / metre						<b>Rs 1389.30</b>
4	90.14.4 Supply and fabrication conveyance and installation of base frame of panel board using 75 x 40 mm rolled steel channel (ISMC)						
	STEEL CHANNEL	4					4.000
	Total Quantity						4.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						4.000 metre
	Say 4.000 metre @ Rs 953.58 / metre						<b>Rs 3814.32</b>
5	90.14.5 Supply and fabrication conveyance and installation of angle iron frame work for wall mounting panel board						
	90.14.5	30					30.000
	Total Quantity						30.000 kg
	Total Deducted Quantity						0.000 kg
	Net Total Quantity						30.000 kg
	Say 30.000 kg @ Rs 140.18 / kg						<b>Rs 4205.40</b>
6	90.14.6 Supply and providing copper bus bars including finger type SMC bus bar supports in the bus chamber, suitable size nut & bolt, providing heat shrink sleeves etc. as required.						
	90.14.6	1500					1500.000

	Total Quantity						1500.000	Cum cm
	Total Deducted Quantity						0.000	Cum cm
	Net Total Quantity						1500.000	Cum cm
	Say 1500.000 Cum cm @ Rs 6.00 / Cum cm						<b>Rs 9000.00</b>	
7	90.14.7 Supply and providing copper earth bus in the panel board							
	COPPER EARTH	400					400.000	
	Total Quantity						400.000	Cum cm
	Total Deducted Quantity						0.000	Cum cm
	Net Total Quantity						400.000	Cum cm
	Say 400.000 Cum cm @ Rs 6.00 / Cum cm						<b>Rs 2400.00</b>	
8	90.14.10.17 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.320A/400A, 50/55 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC							
	90.14.10.17	1					1.000	
	Total Quantity						1.000	no
	Total Deducted Quantity						0.000	no
	Net Total Quantity						1.000	no
	Say 1.000 no @ Rs 29303.55 / no						<b>Rs 29303.55</b>	
9	90.14.10.14 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.250A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC							
	90.14.10.14	2					2.000	
	Total Quantity						2.000	no
	Total Deducted Quantity						0.000	no
	Net Total Quantity						2.000	no
	Say 2.000 no @ Rs 26641.95 / no						<b>Rs 53283.90</b>	
10	90.14.10.11 Supply, conveyance and fixing the following types & current rated control gears & switchgears conforming to IS 13947 suitable for 440 V, 50 Hz, AC supply in the existing panel assembly as required.125A, 35/36 kA (Ics=100%Icu), 4 pole, current limiting type MCCB with microprocessor based release with overload setting of 50 - 100% having adjustable OL & SC							
	90.14.10.11	2					2.000	





	Supply & fixing the following Power Capacitors 3 phase delta connected in position and giving connection. 10 KVAR, 3 phase, 440 V, delta connected, standard duty Metalised Poly Propylene Capacitor, Box Type, suitable for direct connection to motors.						
	90.14.24.23	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 2231.98 / each						<b>Rs 2231.98</b>
16	od272309/2019_2020 Supply and fixing 2A 'C' curve SPMCB in the existing panel board and giving connection.						
	od272309/2019_2020	6					6.000
	Total Quantity						6.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						6.000 each
	Say 6.000 each @ Rs 262.49 / each						<b>Rs 1574.94</b>
17	od272312/2019_2020 Supply and installation of digital multi function meter (V,A,F) in the existing panel board and giving connection						
	od272312/2019_2020	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 1797.19 / each						<b>Rs 1797.19</b>
18	od272313/2019_2020 Supply and installation of LED indicator (R,Y,B) in the existing panel board and giving connection						
	od272313/2019_2020	3					3.000
	Total Quantity						3.000 Day
	Total Deducted Quantity						0.000 Day
	Net Total Quantity						3.000 Day
	Say 3.000 Day @ Rs 193.94 / Day						<b>Rs 581.82</b>
19	od273809/2019_2020 Supply and providing earth fault relay in the existing panel board and giving connection as required						
	od273809/2019_2020	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each

	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 7238.98 / each						<b>Rs 7238.98</b>
20	od273810/2019_2020 Supply and providing 50/5A neutral CT in suitable enclosure and giving connection as required.						
	od273810/2019_2020	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 5991.48 / each						<b>Rs 5991.48</b>
21	od273811/2019_2020 Supply and installation of 200KVA copper wound oil immersed indoor 11kV/433V, Vector DYN-11, with off circuit tapping from + 5% to -10% in steps of 2.5 %, first fill of oil upto MOL in conservator, with HV cable box suitable for XLPE cable and LV cable box suitable for single run of PVCA cable with all standard fittings and accessories conforming to IS : 1180(Level-2) (Make Unipower/Intrans/KEL.)						
	od273811/2019_2020	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 596793.00 / each						<b>Rs 596793.00</b>
22	od273812/2019_2020 Supply, installation testing and commissioning of Out door Load Break Switch HT metering panel consisting of the following: 1. 11KV, 26.2KA, 630A Load Break Switch with earth switch - 1no. 2. CT ratio 10/5, 10VA, SL:0.2S - 3nos. 3. Fixed type PT of ratio:11KV/110V, 25VA, CL:0.2S - 1no. 4 . HT HRC fuse of 20A - 3nos. 5. Seal Off bushings - 1no. 6. shunt trip coil, 230V AC - 1no. 7. Space heater with thermostat - 1no. 8. 400A aluminium bus bars and support insulators - 1set. 9. Provision for fixing TOD meter.						
	od273812/2019_2020	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 205945.00 / each						<b>Rs 205945.00</b>
23	od274287/2019_2020 Supply, installation, testing and commissioning of oil immersed star delta starter suitable for 125 HP motor as required.						
	od274287/2019_2020	2					2.000
	Total Quantity						2.000 each
	Total Deducted Quantity						0.000 each

	Net Total Quantity						2.000 each
	Say 2.000 each @ Rs 135355.00 / each						<b>Rs 270710.00</b>
24	90.14.24.28 Supply & fixing the following Power Capacitors 3 phase delta connected in position and giving connection.30 KVAR, 3 phase, 440 V, delta connected, standard duty Metalised Poly Propylene Capacitor, Box Type, suitable for direct connection to motors.						
	90.14.24.28	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 6558.05 / each						<b>Rs 6558.05</b>
25	od274685/2019_2020 Supply and fixing 250A TPN SDU on existing angle iron frame work using suitable steel fastners.						
	od274685/2019_2020	2					2.000
	Total Quantity						2.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						2.000 each
	Say 2.000 each @ Rs 14063.63 / each						<b>Rs 28127.26</b>
26	8.4.2 Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 11 KV grade of following size in the existing masonry open duct as required.Above 120 sq. mm and upto 400 sq. mm						
	8.4.2	25					25.000
	Total Quantity						25.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						25.000 metre
	Say 25.000 metre @ Rs 73.39 / metre						<b>Rs 1834.75</b>
27	90.12.40.25 Supply & laying of one No. PVC insulated and PVC sheathed armoured copper power cable of 1.1 KV grade of the following sizes in the existing masonry open duct as required.3.5 core 120 sq mm						
	90.12.40.25	30					30.000
	Total Quantity						30.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						30.000 metre
	Say 30.000 metre @ Rs 5520.11 / metre						<b>Rs 165603.30</b>
28	90.12.40.28 Supply & laying of one No. PVC insulated and PVC sheathed armoured copper power cable of 1.1 KV						

	grade of the following sizes in the existing masonry open duct as required.3.5 core 240 sq mm						
	90.12.40.28	30					30.000
	Total Quantity						30.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						30.000 metre
	Say 30.000 metre @ Rs 10609.11 / metre						<b>Rs 318273.30</b>
29	90.12.41.10 Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured copper power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.3 core 35 sq mm with factory made clamp						
	90.12.41.10	15					15.000
	Total Quantity						15.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						15.000 metre
	Say 15.000 metre @ Rs 1405.77 / metre						<b>Rs 21086.55</b>
30	90.12.39.14 Supply & laying of one number PVC insulated and PVC sheathed armoured copper power cable of 1.1KV grade of the following sizes in the existing RCC/ HUME / STONE WARE/ GI/ DWC pipe as required.3 core 120 sq mm						
	90.12.39.14	60					60.000
	Total Quantity						60.000 metre
	Total Deducted Quantity						0.000 metre
	Net Total Quantity						60.000 metre
	Say 60.000 metre @ Rs 4669.11 / metre						<b>Rs 280146.60</b>
31	10.2.4 Supplying and making outdoor cable end jointing with cast resin compound, including lugs and other jointing materials, for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required:300 sq. mm						
	10.2.4	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 4364.30 / each						<b>Rs 4364.30</b>
32	10.4.4 Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all						

	accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required:300 sq. mm						
	10.4.4	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 8462.54 / each						<b>Rs 8462.54</b>
33	9.1.21 Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.3 1/2X 35 sq. mm (32mm)						
	9.1.21	2					2.000
	Total Quantity						2.000 set
	Total Deducted Quantity						0.000 set
	Net Total Quantity						2.000 set
	Say 2.000 set @ Rs 369.59 / set						<b>Rs 739.18</b>
34	9.1.29 Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.3 1/2X 240 sq. mm (62mm)						
	9.1.29	4					4.000
	Total Quantity						4.000 set
	Total Deducted Quantity						0.000 set
	Net Total Quantity						4.000 set
	Say 4.000 set @ Rs 1296.18 / set						<b>Rs 5184.72</b>
35	5.5 Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. (but without charcoal/ coke and salt ) as required.						
	5.5	6					6.000
	Total Quantity						6.000 set
	Total Deducted Quantity						0.000 set
	Net Total Quantity						6.000 set
	Say 6.000 set @ Rs 9889.79 / set						<b>Rs 59338.74</b>
36	5.14 Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.						

	5.14	100					100.000	
	Total Quantity						100.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						100.000 metre	
	Say 100.000 metre @ Rs 914.80 / metre						<b>Rs 91480.00</b>	
37	5.15	Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.						
	5.15	50					50.000	
	Total Quantity						50.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						50.000 metre	
	Say 50.000 metre @ Rs 169.07 / metre						<b>Rs 8453.50</b>	
38	90.12.7.2	Supply, laying and clamping of 1 no. PVC insulated and PVC sheathed armoured aluminium power cable, 1.1 KV grade of the following sizes using clamps noted along with the cables, spacing of clamps not exceeding 60cms, making good the damages , colour washing etc. as required.2 core 6 sq mm with factory made clamp						
	90.12.7.2	15					15.000	
	Total Quantity						15.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						15.000 metre	
	Say 15.000 metre @ Rs 182.32 / metre						<b>Rs 2734.80</b>	
39	od275050/2019_2020	Supply and installation of 3 Phase, 4 wire, 110 V (L-L), -/1 A CT or -/5A CT, accuracy class 0.2, TOD meter						
	od275050/2019_2020	1					1.000	
	Total Quantity						1.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						1.000 each	
	Say 1.000 each @ Rs 41741.52 / each						<b>Rs 41741.52</b>	
40	od275051/2019_2020	Supply of 3x300sq.mm 11KV XLPE armoured aluminium conductor cable						
	od275051/2019_2020	25					25.000	
	Total Quantity						25.000 metre	
	Total Deducted Quantity						0.000 metre	

	Net Total Quantity						25.000 metre	
	Say 25.000 metre @ Rs 2075.00 / metre						<b>Rs 51875.00</b>	
41	od275052/2019_2020 Supply, installing, testing and commissioning of Fire Extinguisher dry chemical powder type ISI mark, 5 kg capacity with initial charger and installation brackets.Make - Safex / Warrior / Intime							
	od275052/2019_2020	2					2.000	
	Total Quantity						2.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						2.000 each	
	Say 2.000 each @ Rs 2200.99 / each						<b>Rs 4401.98</b>	
42	od275053/2019_2020 Supply of 11KV electrical gloves (Vidyut)							
	od275053/2019_2020	2					2.000	
	Total Quantity						2.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						2.000 each	
	Say 2.000 each @ Rs 580.00 / each						<b>Rs 1160.00</b>	
43	od275055/2019_2020 Supply of Bosch professional tool kit (GSB550)							
	od275055/2019_2020	1					1.000	
	Total Quantity						1.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						1.000 each	
	Say 1.000 each @ Rs 5517.00 / each						<b>Rs 5517.00</b>	
44	od275056/2019_2020 Supply and providing 2.5mm thick, 11KV grade, synthetic elastometric fire retardant insulating sheet							
	od275056/2019_2020	5					5.000	
	Total Quantity						5.000 sqm of door area	
	Total Deducted Quantity						0.000 sqm of door area	
	Net Total Quantity						5.000 sqm of door area	
	Say 5.000 sqm of door area @ Rs 1669.00 / sqm of door area						<b>Rs 8345.00</b>	
45	od275073/2019_2020 Providing and fixing 51N earth fault relay (MC-12) in the panel board and giving connections.							

	od275073/2019_2020	1					1.000	
	Total Quantity						1.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						1.000 each	
	Say 1.000 each @ Rs 11298.10 / each						<b>Rs 11298.10</b>	
46	1.10.3 Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVCinsulated copper conductor single core cable in surface / recessed medium class PVC conduit,with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FRLSPVC insulated copper conductor single core cable etc as required.Group C							
	1.10.3	6					6.000	
	Total Quantity						6.000 point	
	Total Deducted Quantity						0.000 point	
	Net Total Quantity						6.000 point	
	Say 6.000 point @ Rs 992.12 / point						<b>Rs 5952.72</b>	
47	1.12 Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit along with 1 No 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.							
	1.12	25					25.000	
	Total Quantity						25.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						25.000 metre	
	Say 25.000 metre @ Rs 220.18 / metre						<b>Rs 5504.50</b>	
48	1.31 Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 3 pin 5/6 amps modular socket outlet and 5/6 amps modular switch, connection etc. as required. (For light plugs to be used in non residential buildings).							
	1.31	2					2.000	
	Total Quantity						2.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						2.000 each	
	Say 2.000 each @ Rs 410.22 / each						<b>Rs 820.44</b>	
49	1.32 Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 6 pin 5/6 & 15/16 amps modular socket outlet and 15/16 amps modular							



	switch, connection etc. as required.						
	1.32	2					2.000
	Total Quantity						2.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						2.000 each
	Say 2.000 each @ Rs 532.10 / each						<b>Rs 1064.20</b>
50	90.3.19.3 Supply conveyance, installation, testing and commissioning the light fittings of following types made from CRCA sheet 0.5mm thickness with all accessories and lamps directly on wall and giving connections with 16/0.20 mm 3 core PVC insulated and sheathed round copper conductor flex wire or extending the original wiring and giving connections as required 1200 mm 1X20W LED Lamp with box type fixture						
	90.3.19.3	4					4.000
	Total Quantity						4.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						4.000 each
	Say 4.000 each @ Rs 1174.12 / each						<b>Rs 4696.48</b>
51	90.4.5.2 Supply, conveyance, installation, testing and commissioning of ceiling fans of the following sizes using standard accessories excluding resistance type regulator, wiring the down rod with 16/0.20mm PVC insulated and PVC sheathed 650/1100V grade 3 core round copper conductor flex wire or with extended original wiring etc. as required. 1200mm sweep -5star rated ceiling fan complete with 300mm down rod , canopies, shackles and blades and resistance type regulator working on 230V/240V single phase A/C						
	90.4.5.2	2					2.000
	Total Quantity						2.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						2.000 each
	Say 2.000 each @ Rs 1857.50 / each						<b>Rs 3715.00</b>
52	90.11.1.14 Supply and installation of sheet steel, phosphatised and painted, dust and vermin proof enclosure of MCB DB including copper /brass bus bar, neutral link, earth bus and DIN rail suitable for fixing MCB/ isolator etc. fixed on wall using suitable anchor bolts or fixed in recess including cutting hole on the wall , making good the damages, colour washing etc. as required 4 way (8+12) - double cover TPN vertical DB with provision for fixing 4P MCB / Isolator/ RCCB/ RCBO as incoming and SP/ TP MCB as outgoing (IP 42/43)						
	90.11.1.14	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each

	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 6466.17 / each						<b>Rs 6466.17</b>
53	2.13.2 Supplying and fixing following rating, four pole, 415 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.63 amps						
	2.13.2	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 888.59 / each						<b>Rs 888.59</b>
54	2.15.3 Supplying and fixing following rating, four pole, (three phase and neutral), 415 volts, residual current circuit breaker (RCCB), having a sensitivity current upto 300 milliampers in the existing MCB DB complete with connections, testing and commissioning etc. as required.63 amps						
	2.15.3	1					1.000
	Total Quantity						1.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						1.000 each
	Say 1.000 each @ Rs 3017.00 / each						<b>Rs 3017.00</b>
55	2.10.1 Supplying and fixing 5 amps to 32 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.Single pole						
	2.10.1	6					6.000
	Total Quantity						6.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						6.000 each
	Say 6.000 each @ Rs 226.73 / each						<b>Rs 1360.38</b>
56	2.10.4 Supplying and fixing 5 amps to 32 amps rating, 240/415 volts, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.Triple pole						
	2.10.4	2					2.000
	Total Quantity						2.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						2.000 each

	Say 2.000 each @ Rs 917.42 / each						<b>Rs 1834.84</b>	
57	od275074/2019_2020 Laison charges towards preperation of various detailed drawings for submission to Chief Electrical Inspectorate TVM (excluding necessary scrutiny fee) and modified the scheme if necessary;and finally submitting the completion report to the authority and conducting inspection (excluding inspection fee) and transportation and other incidental expenses.							
	od275074/2019_2020	1					1.000	
	Total Quantity						1.000 L.S	
	Total Deducted Quantity						0.000 L.S	
	Net Total Quantity						1.000 L.S	
	Say 1.000 L.S @ Rs 100000.00 / L.S						<b>Rs 100000.00</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark
<b>16 Appendix I.2- Lift Irrigation Mechanical Part</b>								
1	od296161/2019_2020 Supply, Erection, Testing and Commissioning of Centrifugal Pump set 1 no (KRTK 100-401/354 UG-S) Motor Rating 38 KW, Speed 4 Pole capable of lifting 150 m3 per hour against a total head of 55m with all accessories. Make: KSB or Equivalent 							
	Horizontal Centrifugal Pump							
	2 pumps including one standby pump	2					2.000	
	Total Quantity						2.000 each	
	Total Deducted Quantity						0.000 each	
	Net Total Quantity						2.000 each	
	Say 2.000 each @ Rs 471276.07 / each						<b>Rs 942552.14</b>	
2	18.72.1 Providing and laying S & S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329:100 mm dia Ductile Iron Class K- 7 Pipes							
	Pipeline from well	1	25.000				25.000	
	Total Quantity						25.000 metre	
	Total Deducted Quantity						0.000 metre	
	Net Total Quantity						25.000 metre	
	Say 25.000 metre @ Rs 1214.07 / metre						<b>Rs 30351.75</b>	
3	18.72.2 Providing and laying S & S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329:150 mm dia Ductile Iron Class K-7 pipes							
	Pipe leading to storage tank 150 mm	1	1500.000				1500.000	



	150 x 100 DI Concentric Reducer	1						1.000	
	Total Quantity							1.000	each
	Total Deducted Quantity							0.000	each
	Net Total Quantity							1.000	each
	Say 1.000 each @ Rs 7005.18 / each							<b>Rs 7005.18</b>	
8	od298998/2019_2020 Providing and fixing 100 mm DI equal "T" of standard specification including cost of material, gasket, nut and bolt, labour for fitting and conveyance								
	100 mm DI Equal T	1						1.000	
	Total Quantity							1.000	each
	Total Deducted Quantity							0.000	each
	Net Total Quantity							1.000	each
	Say 1.000 each @ Rs 5093.68 / each							<b>Rs 5093.68</b>	
SI No	Description	No	L	B	D	CF	Quantity	Remark	
<b>17 APPENDIX O -SOIL INVESTIGATION</b>									
1	56.1.a Mobilization including transportation of all necessary plan and equipment's and materials of boring field testing and sampling and demobilization after completing the work. For machine boring								
	Mobilization	5						5.000	
	Total Quantity							5.000	set
	Total Deducted Quantity							0.000	set
	Net Total Quantity							5.000	set
	Say 5.000 set @ Rs 15798.00 / set							<b>Rs 78990.00</b>	
2	56.3.a.1 Boring with rotary power drilling equipment's in all types of soil having N value less than 50 excluding hard rock soft rock, or medium rock for strata upto 10m. Including conducting necessary S.P.T and recovery of undisturbed soil samples at 5m.intervals. For ordinary soil.								
	Bore holes	250						250.000	
	Total Quantity							250.000	metre
	Total Deducted Quantity							0.000	metre
	Net Total Quantity							250.000	metre
	Say 250.000 metre @ Rs 923.00 / metre							<b>Rs 230750.00</b>	
3	56.11.a								

	Compilation of all field data with recommendation for a suitable foundation after conducting necessary lab test (report in triplicate) Machine boring for 5 bore holes.						
		50					50.000
	Total Quantity						50.000 set
	Total Deducted Quantity						0.000 set
	Net Total Quantity						50.000 set
	Say 50.000 set @ Rs 10000.00 / set						<b>Rs 500000.00</b>
4	56.7 Conducting standard penetration test in bore hole at any depth.						
		250					250.000
	Total Quantity						250.000 each
	Total Deducted Quantity						0.000 each
	Net Total Quantity						250.000 each
	Say 250.000 each @ Rs 203.00 / each						<b>Rs 50750.00</b>
	Provision for GST payments (in %) @						<b>12.0%</b>
	Amount reserved for GST payments						<b>303033190.59</b>
	Total						<b>2828309778.59</b>
	Lumpsum for round off						<b>0.00</b>
							<b>TOTAL Rs 2828309778.59</b>
							<b>Rounded Total Rs 2,82,83,09,779</b>
Rupees Two Hundred Eighty Two Crore Eighty Three Lakh Nine Thousand Seven Hundred and Seventy Nine Only							

(Cost Index Applied for this estimate is 31.06%)

## Data Analysis

## Appendix A- Fabricating and Supplying 2800mm diameter MS Pipe

1 Specification Code: od50401/2019\_2020

**od50401/2019\_2020 :Manufacturing and supplying 2800mm dia MS pipe of various length with shell thickness 12mm including painting with 2 coats of red oxide primer, I**

Making pipe 3m length

Area of sheet -  $3 \times 3.14 \times 2.812 = 26.489 \text{m}^2$   $26.489 \text{m}^2 \times 94.2 \text{kg/m}^2 = 2495.264 \text{kg}$  say - 24.9526 qtl

Code	Description	Unit	Quantity	Rate	Amount
1013	Mild steel sheets for tanks  	quintal	24.95260	3775.00	94196.07
2205	Steel   (carriage)	tonne	2.49500	92.24	230.14
MR	Cutting charge for MS Pipes  	metre	20.66000	120.00	2479.20
MR	Rolling cahрге for MS Pipe  	kg	2495.2640 0	24.00	59886.34
MR	Chipping charge for MS Pipes  	metre	20.66000	492.00	10164.72
MR	Welding by electric plant  	cm	2073.4720 0	4.00	8293.89
13.50.3	Rate as per item number 13.50.3 of SH: Finishing   (2 x 3 x 3.14 x 0.406)	sqm	52.97800	25.05	1327.30
0128	Mate  	Day	1.00000	407.00	407.00
0116	Fitter(grade1)  	Day	1.00000	487.00	487.00
13.9.1	Rate as per item number 13.9.1 of SH: Finishing	sqm	52.97800	202.07	10705.07
5.22.5	Rate as per item number 5.22.5 of SH: Reinforced Cement Concrete	kilogram	206.17000	61.39	12655.98
				<b>TOTAL</b>	<b>200832.71</b>
	cost for 3.0 metre				200832.71
	cost for one metre				66944.23
	say				66944.23

	Add Water Charges @ 1.0%				<b>669.44</b>
	Add CPOH @ 15.0%				<b>10142.05</b>

	Cost index <b>31.06 %</b>				14431.50
	Total with Cost index				92187.23
	Say				92187.23

## Appendix B- Laying MS Pipe

1 Specification Code: od50390/2019\_2020

**od50390/2019\_2020 :Supplying and filling Jamuna sand including watering, ramming consolidating and dressing complete.**

Details of cost for 10 cum

MATERIAL:

Code	Description	Unit	Quantity	Rate	Amount
6501	Sand zone V (jamina)  	cum	10.00000	600.00	6000.00
2335	Jamuna sand   LABOUR:	cum	10.00000	103.77	1037.70
0114	Beldar  	Day	0.89000	368.00	327.52
0115	Coolie  	Day	1.07000	368.00	393.76
0101	Bhisti  	Day	0.35000	407.00	142.45
<b>TOTAL</b>					<b>7901.43</b>
	cost for 10.0 cum				7901.43
	cost for one cum				790.14
	say				790.14

	Add Water Charges @ 1.0%				<b>7.90</b>
	Add CPOH @ 15.0%				<b>119.70</b>
	Cost index <b>31.06 %</b>				285.05



	Total with Cost index				1202.80
	Say				1202.80

2 Specification Code: od50398/2019\_2020

od50398/2019\_2020 :Laying MS Pipe 2800mm diameter including welding joints in line and levels as directed by Departmental officers at site.

Code	Description	Unit	Quantity	Rate	Amount
MR	Cutting charge for MS Pipes  	metre	17.66000	120.00	2119.20
MR	Chipping charge for MS Pipes  	metre	17.66000	492.00	8688.72
MR	Welding by electric plant  	cm	1773.4700 0	4.00	7093.88
0128	Mate  	Day	0.33000	407.00	134.31
0116	Fitter(grade1)  	Day	0.33000	487.00	160.71
0028	Hire and running charges of crane 20 tonne capacity	Day	2.00000	9300.00	18600.00
TOTAL					36796.82
	cost for 3.0 metre				36796.82
	cost for one metre				12265.61
	say				12265.61

	Add Water Charges @ 1.0%				<b>122.65</b>
	Add CPOH @ 15.0%				<b>1858.23</b>
	Cost index <b>31.06 %</b>				2272.20
	Total with Cost index				16518.71
	Say				16518.71

Appendix D Tunneling for a length of 660m

1 Specification Code: od51641/2019\_2020

**od51641/2019\_2020 :Excavation for adit by tunnelling methods in all types of rock including cost of all materials,<br>machinery, labour, ventilation, lighting, drainage, scaling excavated surface, removing and<br>hauling excavated muck outside adit upto specified dump area and all other ancillary<br>operations etc., complete with all leads and lifts**

Code	Description	Unit	Quantity	Rate	Amount
MR	Excavation for adit by tunnelling methods in all types of rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, scaling excavated surface, removing and hauling excavated muck outside adit upto specified dump area and all other ancillary operations etc., complete with lead upto 500 m and all lifts.	cum	1.00000	4178.00	4178.00
TOTAL					4178.00
cost for one cum					4178.00
	say				4178.00

	Add Water Charges @ 1.0%				<b>41.78</b>
	Add CPOH @ 15.0%				<b>632.96</b>
	Cost index <b>31.06 %</b>				-0.01
	Total with Cost index				4852.75
	Say				4852.75

2 Specification Code: od51643/2019\_2020

**od51643/2019\_2020 :Excavation for vertical / inclined shaft in all types of soft / hard rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, shoring, strutting, scaling excavated surface, removing and hauling excavated muck outside shaft upto specified dump area and all other ancillary operations etc., complete with all leads and all lifts**

Code	Description	Unit	Quantity	Rate	Amount
MR	Excavation for vertical / inclined shaft in all types of soft / hard rock including cost of all materials, machinery, labour, ventilation, lighting, drainage, shoring, strutting, scaling excavated surface, removing and hauling excavated muck outside shaft upto specified dump area and all other ancillary operations etc., complete with all leads and all lifts	cum	1.00000	3412.80	3412.80
TOTAL					3412.80
cost for one cum					3412.80
	say				3412.80

	Add Water Charges @ 1.0%				34.12
	Add CPOH @ 15.0%				517.03
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				3963.97
	Say				3963.97

Other Engineering Organisations

3 Specification Code: od51645/2019\_2020

**od51645/2019\_2020 :Removing and hauling muck overfallen due to natural causes such as geological faults etc., out of tunnel including cost of all materials, machinery, labour, ventilation, drainage, lighting, breaking any large fragments by blasting if necessary with all other ancillary operations and disposing off the same in specified dump area or as directed etc., complete with all leads and all lifts.**

Code	Description	Unit	Quantity	Rate	Amount
MR	Removing and hauling muck overfallen due to natural causes such as geological faults etc., out of tunnel including cost of all materials, machinery, labour, ventilation, drainage, lighting, breaking any large fragments by blasting if necessary with all other ancillary operations and disposing off the same in specified dump area or as directed etc., complete	cum	1.00000	644.00	644.00
TOTAL					644.00

					cost for one cum	644.00
		say				644.00

	Add Water Charges @ 1.0%				<b>6.44</b>
	Add CPOH @ 15.0%				<b>97.56</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				748.01
	Say				748.01

4 Specification Code: od51646/2019\_2020

od51646/2019\_2020 :Providing 25 mm thick guniting to sides and arch of tunnel in CM 1 : 3 proportion by weight including cost of all materials, machinery, labour, ventilation, lighting, drainage and all other ancillary operations etc., complete with all leads and all lifts.

Code	Description	Unit	Quantity	Rate	Amount
MR	Providing 25 mm thick guniting to sides and arch of tunnel in CM 1 : 3 proportion by weight including cost of all materials, machinery, labour, ventilation, lighting, drainage and all other ancillary operations etc., complete with all leads and all lifts.	per sqm	1.00000	1047.60	1047.60
				<b>TOTAL</b>	<b>1047.60</b>
				cost for one per sqm	1047.60
	say				1047.60

	Add Water Charges @ 1.0%				<b>10.47</b>
	Add CPOH @ 15.0%				<b>158.71</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				1216.79
	Say				1216.79

5 Specification Code: od51647/2019\_2020

od51647/2019\_2020 :Providing and fixing 25 mm dia. steel rock bolts with one end provided with mechanical /wedge type anchorage and other end provided with threads for fixing washers and nuts including cost of all materials, machinery,labour, ventilation, lighting, drainage, drilling 32 mm<br>dia holes, providing 150 mm long 20 mm thick steel tapered wedge, providing 10 mm thick and 200 x 200 mm size plate washer and nuts, driving bolt, fixing washers and nuts, tightening bolt by torque wrench and all other ancillary operations etc., complete with all leads and all lifts.

Code	Description	Unit	Quantity	Rate	Amount
MR	Providing and fixing 25 mm dia. steel rock bolts with one end provided with mechanical /wedge type anchorage and other end provided with threads for fixing washers and nuts including cost of all materials, machinery,labour, ventilation, lighting, drainage, drilling 32 mm dia holes, providing 150 mm long 20 mm thick steel tapered wedge, providing 10 mm thick and 200 x 200 mm size plate washer and nuts, driving bolt, fixing washers and nuts, tightening bolt by torque wrench and all other ancillary operations etc., complete with all leads and all lifts.	metre	1.00000	1906.20	1906.20
				TOTAL	1906.20
				cost for one metre	1906.20
				say	1906.20

	Add Water Charges @ 1.0%				<b>19.06</b>
	Add CPOH @ 15.0%				<b>288.78</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				2214.05
	Say				2214.05

6 Specification Code: od51649/2019\_2020

od51649/2019\_2020 :Providing, fabricating and fixing in position temporary structural steel supports as per

details and dismantling and conveying the same to other place or outside tunnel before concreting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cutting, bending, welding, grinding, and all other ancillary operations etc., complete with all leads and all lifts.

Code	Description	Unit	Quantity	Rate	Amount
MR	Providing, fabricating and fixing in position temporary structural steel supports as per details and dismantling and conveying the same to other place or outside tunnel before concreting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cutting, bending, welding, grinding, and all other ancillary operations etc., complete with all leads and all lifts.	tonne	1.00000	37818.00	37818.00
TOTAL					37818.00
cost for one MT					37818.00
	say				37818.00

	Add Water Charges @ 1.0%				<b>378.18</b>
	Add CPOH @ 15.0%				<b>5729.42</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				43925.61
	Say				43925.61

7 Specification Code: od51658/2019\_2020

od51658/2019\_2020 :Drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer or steeper drills as directed to specified depth for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cleaning holes, and all other ancillary operations etc., complete.

Code	Description	Unit	Quantity	Rate	Amount
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MR	Drilling 35 mm diameter grout holes in concrete / rock by percussion drilling using jack hammer or stooper drills as directed to specified depth for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, cleaning holes, and all other ancillary operations etc., complete.	metre	1.00000	628.00	628.00
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TOTAL					628.00
cost for one per metre					628.00
	say				628.00

	Add Water Charges @ 1.0%				6.28
	Add CPOH @ 15.0%				95.14
	Cost index 31.06 %				0.00
	Total with Cost index				729.42
	Say				729.42

8 Specification Code: od51659/2019\_2020

**od51659/2019\_2020 :Grouting cement slurry in grout holes under specified pressure for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, redrilling wherever necessary, and all other ancillary operations etc., complete with all leads and all lifts.**

Code	Description	Unit	Quantity	Rate	Amount
MR	Grouting cement slurry in grout holes under specified pressure for consolidation / contact grouting including cost of all materials, machinery, labour, ventilation, lighting, drainage, redrilling wherever necessary, and all other ancillary operations etc., complete with all leads and all lifts.	kg	1.00000	23.62	23.62
TOTAL					23.62
cost for one kg					23.62
	say				23.62

	Add Water Charges @ 1.0%				<b>0.23</b>
	Add CPOH @ 15.0%				<b>3.57</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				27.43
	Say				27.43

9 Specification Code: od51660/2019\_2020

od51660/2019\_2020 :Cost of electric line, lighting and ventilation as per requirement at site

Code	Description	Unit	Quantity	Rate	Amount
MR	Cost of electric line, lighting and ventilation as per requirement at site	L.S	1.00000	6376572.2 3	6376572.2 3
TOTAL					6376572.23
cost for one L.S					6376572.23
	say				6376572.23

	Add Water Charges @ 1.0%				<b>63765.72</b>
	Add CPOH @ 15.0%				<b>966050.6 9</b>
	Cost index <b>31.06 %</b>				-0.01
	Total with Cost index				7406388. 65
	Say				7406388. 65

Appendix E- Regulating shutters at inlet and intermediate locations

1 Specification Code: od50859/2019\_2020



## od50859/2019\_2020 :Cost of MS bolts and nuts

Code	Description	Unit	Quantity	Rate	Amount
MR	MS bolts and nuts	kilogram	1.00000	81.45	81.45
TOTAL					81.45
cost for one kg					81.45
	say				81.45

	Add Water Charges @ 1.0%				<b>0.81</b>
	Add CPOH @ 15.0%				<b>12.33</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				94.60
	Say				94.60

## 2 Specification Code: od50880/2019\_2020

Other Engineering Organisations

**od50880/2019\_2020 :Fabrication, Supply, erection and assembling in correct position and alignment by welding SS Embedded<br>parts in 304L Grade like roller track, seal track,Seal seat etc as per approved specifications, drawings<br>and directions of deptl officer at site including cost of all materials,labour,machinery for planing,<br>welding, shearing, grinding etc,lead and lift, conveyance, incidental and handling etc complete**

Code	Description	Unit	Quantity	Rate	Amount
MR	Fabrication, Supply, erection and assembling in correct position and alignment by welding SS Embedded parts in 304L Grade like roller track, seal track,Seal seat etc as per approved specifications, drawings and directions of deptl officer at site including cost of all materials,labour,machinery for planing, welding, shearing, grinding etc,lead and lift, conveyance, incidental and handling etc complete	kg	1.00000	505.84	505.84
TOTAL					505.84
cost for one kg					505.84

	say				505.84
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	Add Water Charges @ 1.0%				<b>5.05</b>
	Add CPOH @ 15.0%				<b>76.63</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				587.53
	Say				587.53

Appendix F - Providing inspection chambers

1 Specification Code: od50857/2019\_2020

**od50857/2019\_2020 :Supplying and fixing cast iron manhole cover as directed by Departmental officials**

Code	Description	Unit	Quantity	Rate	Amount
3860	560 mm dia cover with frame (Heavy duty)	each	1.00000	9000.00	9000.00
9977	Carriage	L.S	13.52000	1.73	23.39
9999	Sundries	L.S	6.76000	1.73	11.69
<b>TOTAL</b>					<b>9035.08</b>
cost for one each					9035.08
	say				9035.08

	Add Water Charges @ 1.0%				<b>90.35</b>
	Add CPOH @ 15.0%				<b>1368.81</b>
	Cost index <b>31.06 %</b>				3259.51
	Total with Cost index				13753.76
	Say				13753.76

## Appendix J- Micro Irrigation

1 Specification Code: od270721/2019\_2020

**od270721/2019\_2020 :Design and laying, testing and commissioning of Drip irrigation facilities to the ayacut area, Providing drawings, including cost and conveyence of all materials, labour charges, trenching in all classes of soil, all accessories such as filtration units, PVC feeder main PVC Net work, Sub main PVC Network, Valves & Fertigation units, drippers and driplines, Automation control, including Automatic filtration unit, Watermeter, Net Beat wireless controller, gravel filter with back wash valve, Irrigation Valve and acceesories, Air valve and Accessories, stabilizer, spike supporter, Isolation transformer, antina mounting poles Electrical cable and accessories, float switch etc complete, including operation and maintenance for a period 5years.**

Code	Description	Unit	Quantity	Rate	Amount
MR	Drip Irrigation	Hecter	1.00000	167724.70	167724.70
				<b>TOTAL</b>	<b>167724.70</b>
				<b>cost for one Hecter</b>	<b>167724.70</b>
	say				<b>167724.70</b>

## Other Engineering Organisations

	Add Water Charges @ 1.0%				<b>1677.24</b>
	Add CPOH @ 15.0%				<b>25410.29</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				194812.2 4
	Say				194812.2 4

## Appendix N-Relining of Spouts and Shutters-Corrective measures of existing canal

1 Specification Code: od265908/2019\_2020

**od265908/2019\_2020 :Fabrication of structural steel gate and accessories as per approved specifications, drawings and directions of departmental officer at site including cost of labour ,machinery ,all leads and lifts, incidental and handling charges etc complete but excluding cost of material already supplied<br>Rate**

## analysis for 10 qtl fabrication

Code	Description	Unit	Quantity	Rate	Amount
MR6033	Oxygen gas	cum	20.00000	65.00	1300.00
MR6034	Acetylene gas	cum	6.60000	220.00	1452.00
MR6035	Welding electrodes confirming to IS 814 E 4212	no	340.00000	11.00	3740.00
MR6036	Welding electrodes (LH) confirming to IS 814 E 4212	no	87.50000	18.00	1575.00
MR6038	Use rate welding holder set	hour	53.50000	7.35	393.23
MR6039	Use rate gas cutting torch set	hour	5.00000	10.00	50.00
MR6040	Wire brush	no	1.00000	25.00	25.00
MR6041	cotton waste	kg	5.00000	40.00	200.00
MR6045	Welding transformer with fuel charge	hour	55.00000	45.89	2523.95
MR6051	Drilling machine with fuel and crew charge	hour	4.00000	272.38	1089.52
9999	Sundries	L.S	110.00000	1.73	190.30
0160	Technician	Day	2.00000	775.00	1550.00
0102	Blacksmith 1st class	Day	4.00000	487.00	1948.00
0161	Helper (Technician)	Day	20.00000	368.00	7360.00
0116	Fitter(grade1)	Day	7.00000	487.00	3409.00
<b>TOTAL</b>					<b>26806.00</b>
	cost for 1000.0 kg				26806.00
	cost for one kg				26.81
	say				26.81

	Add Water Charges @ 1.0%				<b>0.26</b>
	Add CPOH @ 15.0%				<b>4.06</b>
	Cost index <b>31.06 %</b>				5.21
	Total with Cost index				36.36
	Say				36.36

2 Specification Code: od265989/2019\_2020

od265989/2019\_2020 :Erection of shutter in correct position including cost of all materials labour etc complete

Code	Description	Unit	Quantity	Rate	Amount
0116	Fitter(grade1)	Day	0.25000	487.00	121.75
0160	Technician	Day	0.25000	775.00	193.75
0161	Helper (Technician)	Day	1.00000	368.00	368.00
TOTAL					683.50
cost for one no					683.50
	say				683.50

	Add Water Charges @ 1.0%				<b>6.83</b>
	Add CPOH @ 15.0%				<b>103.55</b>
	Cost index <b>31.06 %</b>				246.58
	Total with Cost index				1040.47
	Say				1040.47

3 Specification Code: od265990/2019\_2020

od265990/2019\_2020 :Supply of locking arrangements including cost of all materials ,labour ,hire charges and conveyance

Code	Description	Unit	Quantity	Rate	Amount
MR	locking arrangement	each	1.00000	200.00	200.00
TOTAL					200.00
cost for one each					200.00
	say				200.00

	Add Water Charges @ 1.0%				<b>2.00</b>
	Add CPOH @ 15.0%				<b>30.30</b>
	Cost index <b>31.06 %</b>				0.00
	Total with Cost index				232.30
	Say				232.30

4 Specification Code: od265996/2019\_2020

od265996/2019\_2020 :supply and fabrication of screw rod of dia 50mm including cost of all materials ,labour, hire charges and conveyance etc complete

Code	Description	Unit	Quantity	Rate	Amount
MR	cost for EN 8 53MM rod	kg	15.00000	75.00	1125.00
2205	Steel	tonne	0.02600	92.24	2.40
MR	hire charges for lathe	Day	0.50000	413.00	206.50
0157	Operator (Pile/Special machine)	Day	1.00000	487.00	487.00
0100	Bandhani	Day	0.25000	407.00	101.75
0115	Coolie	Day	0.25000	368.00	92.00
9999	Sundries	L.S	5.00000	1.73	8.65
TOTAL					2023.30
cost for one metre					2023.30
	say				2023.30

	Add Water Charges @ 1.0%				<b>20.23</b>
	Add CPOH @ 15.0%				<b>306.52</b>
	Cost index <b>31.06 %</b>				249.57
	Total with Cost index				2599.64
	Say				2599.64

5 Specification Code: od265999/2019\_2020

od265999/2019\_2020 :providing base and nut arrangement for hoisting the shutter including cost of all materials labour etc complete

Code	Description	Unit	Quantity	Rate	Amount
MR	cost of base plate	kg	15.00000	120.00	1800.00
MR	cost of nut	kg	10.00000	120.00	1200.00
MR	cost of top plate	kg	10.00000	120.00	1200.00
MR	locking cover with lock	each set	1.00000	500.00	500.00
1034	Bolts and nuts up to 300 mm in length	quintal	0.01000	5100.00	51.00
MR6061	Grease	kg	1.00000	280.00	280.00
0116	Fitter(grade1)	Day	0.25000	487.00	121.75
0100	Bandhani	Day	0.25000	407.00	101.75
0115	Coolie	Day	0.25000	368.00	92.00
MR	hire charges for lathe	Day	1.00000	413.00	413.00
0157	Operator (Pile/Special machine)	Day	1.00000	487.00	487.00
<b>TOTAL</b>					<b>6246.50</b>
cost for one no					6246.50
say					6246.50

	Add Water Charges @ 1.0%				<b>62.46</b>
	Add CPOH @ 15.0%				<b>946.34</b>
	Cost index <b>31.06 %</b>				307.91
	Total with Cost index				7563.22
	Say				7563.22

6 Specification Code: od266004/2019\_2020

od266004/2019\_2020 :Erection of base and nut and screw rod etc in correct position and alignment, trial run

including cost of all materials labour etc complete

Code	Description	Unit	Quantity	Rate	Amount
0116	Fitter(grade1)	Day	0.50000	487.00	243.50
0100	Bandhani	Day	1.00000	407.00	407.00
1034	Bolts and nuts up to 300 mm in length	quintal	0.10000	5100.00	510.00
MR	hire charges for tools and plants	L.S	1.00000	100.00	100.00
<b>TOTAL</b>					<b>1260.50</b>
cost for one no					1260.50
	say				1260.50

	Add Water Charges @ 1.0%				<b>12.60</b>
	Add CPOH @ 15.0%				<b>190.96</b>
	Cost index <b>31.06 %</b>				418.66
	Total with Cost index				1882.73
	Say				1882.73

Appendix I.1- LIFT IRRIGATION ELECTRICAL PART

1 Specification Code: od272309/2019\_2020

od272309/201 Supply and fixing 2A 'C' curve SPMCB in the existing panel board and giving 9\_2020 : connection.

Code	Description	Unit	Quantity	Rate	Amount
MR	2A 'C' curve SPMCB	each	1.00000	184.00	184.00
	Add Cartage@1.00				1.84
	total				185.84
Total Cost of Materials					185.84
1001	Wireman	Day	0.04000	447.00	17.88
1007	Khallasi	Day	0.04000	368.00	14.72



TOTAL	218.44
Add CPOH @ 15%	32.77
cost for one each	251.0
Say	251.0

Cost index <b>31.06 %</b>	67.04
Total with Cost index	318.04
Say	318.04

2 Specification Code: od272312/2019\_2020

od272312/201 Supply and installation of digital multi function meter (V,A,F) in the existing panel 9\_2020 : board and giving connection

Code	Description	Unit	Quantity	Rate	Amount
MR1743	Multifunction meter to read:V, A, F , 3 phase accuracy class 0.5	each	1.00000	1694.92	1694.92
	Add Cartage@1.00				16.95
	total				1711.87
Total Cost of Materials					1711.87
1001	Wireman	Day	0.08000	447.00	35.76
1007	Khallasi	Day	0.08000	368.00	29.44
TOTAL					1777.07
cost for one each					1777.0
Say					1777.0
Cost index <b>31.06 %</b>					.00
Total with Cost index					1777.00
Say					1777.00

3 Specification Code: od272313/2019\_2020

od272313/201 Supply and installation of LED indicator (R,Y,B) in the existing panel board and  
9\_2020 : giving connection

Code	Description	Unit	Quantity	Rate	Amount
MR	LED indicator	each	1.00000	150.00	150.00
	Add Cartage@1.00				1.50
	total				151.50
Total Cost of Materials					151.5
1001	Wireman	Day	0.04000	447.00	17.88
1007	Khallasi	Day	0.04000	368.00	14.72
TOTAL					184.1
cost for one Day					184.0
Say					184.0
Other Engineering Organizations Cost index 31.06 %					.00
Total with Cost index					184.00
Say					184.00

4 Specification Code: od273809/2019\_2020

od273809/201 Supply and providing earth fault relay in the existing panel board and giving  
9\_2020 : connection as required

Code	Description	Unit	Quantity	Rate	Amount
MR	earth fault relay	each	1.00000	6000.00	6000.00
	Add Cartage@1.00				60.00
	total				6060.00
Total Cost of Materials					6060.0

1003	Lineman	Day	0.20000	447.00	89.40
1001	Wireman	Day	0.20000	447.00	89.40

TOTAL					6238.8
Add CPOH @ 15%					935.82
cost for one each					7175.0
Say					7175.0
Cost index <b>31.06 %</b>					2164.57
Total with Cost index					9339.57
Say					9339.57

5 Specification Code: od273810/2019\_2020

od273810/201 Supply and providing 50/5A neutral CT in suitable enclosure and giving 9\_2020 : connection as required.

Code	Description	Unit	Quantity	Rate	Amount
MR	50/5A neutral CT	each	1.00000	4000.00	4000.00
	Add Cartage@1.00				40.00
	total				4040.00
MR	metal enclosure for neutral CT	each	1.00000	1000.00	1000.00
	Add Cartage@1.00				10.00
	total				1010.00
Total Cost of Materials					5050.0
1001	Wireman	Day	0.15000	447.00	67.05
1007	Khallasasi	Day	0.15000	368.00	55.20
TOTAL					5172.25
Add CPOH @ 15%					775.84
cost for one each					5948.0

Say	5948.0
Cost index <b>31.06 %</b>	1803.81
Total with Cost index	7751.81
Say	7751.81

6 Specification Code: od273811/2019\_2020

Supply and installation of 200KVA copper wound oil immersed indoor 11kV/433V, Vector DYN-11, with off circuit tapping from + 5% to -10% in steps of od273811/201 2.5 %, first fill of oil upto MOL in conservator, with HV cable box suitable for XLPE 9\_2020 : cable and LV cable box suitable for single run of PVCA cable with all standard fittings and accessories conforming to IS : 1180(Level-2) (Make Unipower/Intrans/KEL.)

Code	Description	Unit	Quantity	Rate	Amount
MR	200KVA copper wound oil immersed indoor 11kV/433V, Vector DYN-11 transformer	each	1.00000	485000.00	485000.00
	Add Cartage@1.00				4850.00
	total				489850.00
MR	Conveyance and installation charge @6% of material	L.S	1.00000	29100.00	29100.00
TOTAL					518950.0
Add CPOH @ 15%					77842.50
cost for one each					596793.0
Say					596793.0
Cost index <b>31.06 %</b>					349939.04
Total with Cost index					946732.04
Say					946732.04

7 Specification Code: od273812/2019\_2020

od273812/2019\_2020 : Supply, installation testing and commissioning of Out door Load Break Switch HT metering panel consisting of the following: 1. 11KV, 26.2KA, 630A Load Break Switch with earth switch - 1no. 2. CT ratio 10/5, 10VA, SL;0.2S - 3nos. 3. Fixed type PT of ratio:11KV/110V, 25VA, CL:0.2S - 1no. 4 . HT HRC fuse of 20A - 3nos. 5. Seal Off bushings - 1no. 6. shunt trip coil, 230V AC - 1no. 7. Space heater with thermostat - 1no. 8. 400A aluminium bus bars and support insulators - 1set. 9. Provision for fixing TOD meter.

Code	Description	Unit	Quantity	Rate	Amount
MR	Cost of LBSMP (Intrans - 0.2S class CTPT unit with LBS and metering provision, )	each	1.00000	165000.00	165000.00
	Add Cartage@1.00				1650.00
	total				166650.00
MR	Loading,unloading and positioning	L.S	1.00000	2500.00	2500.00
MR	Installation charge @6% of material cost	L.S	1.00000	9933.00	9933.00
<b>TOTAL</b>					179083.0
Add CPOH @ 15%					26862.45
cost for one each					205945.0
Say					205945.0
Cost index <b>31.06 %</b>					178577.14
Total with Cost index					384522.14
Say					384522.14

8 Specification Code: od274287/2019\_2020

od274287/2019\_2020 : Supply, installation, testing and commissioning of oil immersed star delta starter suitable for 125 HP motor as required.

Code	Description	Unit	Quantity	Rate	Amount
MR	oil immersed star delta starter suitable for 125 HP motor	each	1.00000	110000.00	110000.00
	Add Cartage@1.00				1100.00
	total				111100.00
MR	Conveyance and installation charge @6% of material cost	L.S	1.00000	6600.00	6600.00
TOTAL					117700.0
Add CPOH @ 15%					17655.00
cost for one each					135355.0
Say					135355.0
Cost index <b>31.06 %</b>					79367.62
Total with Cost index					214722.62
Say					214722.62

### Other Engineering Organisations

9 Specification Code: od274685/2019\_2020

od274685/201 Supply and fixing 250A TPN SDU on existing angle iron frame work using suitable 9\_2020 : steel fastners.

Code	Description	Unit	Quantity	Rate	Amount
MR	250A TPN SDU in enclosure (L&T FN250)( L&T SK9568 MRP Rs.14880/- less 20% Discount less	each	1.00000	11904.00	11904.00
	Add Cartage@1.00				119.04
	total				12023.04
MR	steel fastner 75x6mm	each	4.00000	5.00	20.00
	Add Cartage@1.00				0.20
	total				20.20

Total Cost of Materials					12043.24
1001	Wireman	Day	0.12000	447.00	53.64
1007	Khallasi	Day	0.24000	368.00	88.32

TOTAL					12185.2
Add CPOH @ 15%					1827.78
cost for one each					14013.0
Say					14013.0
Cost index <b>31.06 %</b>					4301.72
Total with Cost index					18314.72
Say					18314.72

10 Specification Code: od275050/2019\_2020

od275050/201 Supply and installation of 3 Phase, 4 wire, 110 V (L-L), -/1 A CT or -/5A CT, 9\_2020 : accuracy class 0.2, TOD meter

Code	Description	Unit	Quantity	Rate	Amount
MR1759	3 Phase, 4 wire, 110 V (L-L), -/1 A CT or -/5A CT, accuracy class 0.2, TOD meter	each	1.00000	35169.49	35169.49
	Add Cartage@1.00				351.69
	total				35521.18
Total Cost of Materials					35521.18
1001	Wireman	Day	0.50000	447.00	223.50
1007	Khallasi	Day	1.00000	368.00	368.00
TOTAL					36112.68
Add CPOH @ 15%					5416.90
cost for one each					41530.0
Say					41530.0

Cost index <b>31.06 %</b>	12687.81
Total with Cost index	54217.81
Say	54217.81

11 Specification Code: od275051/2019\_2020

od275051/201  
9\_2020 : Supply of 3x300sq.mm 11KV XLPE armoured aluminium conductor cable

Code	Description	Unit	Quantity	Rate	Amount
MR872	3 core 300 sqm stranded compact circular aluminium conductor, conductors screened with extruded semi conducting compound XLPE insulated, insulation screened with extruded semi conducting compound in combination with copper tape (0.3KA for I sec.) cores laid up, inner sheath of PVC tape, galvanized steel flat strip armoured, and overall PVC sheathed cable conforming to IS: 7098 part II 1985 with latest amendments	metre	1.00000	1804.24	1804.24
TOTAL					1804.24
Add CPOH @ 15%					270.64
cost for one metre					2075.0
Say					2075.0
Cost index <b>31.06 %</b>					.00
Total with Cost index					2075.00
Say					2075.00

12 Specification Code: od275052/2019\_2020



od275052/2019\_2020 : Supply, installing, testing and commissioning of Fire Extinguisher dry chemical powder type ISI mark, 5 kg capacity with initial charger and installation brackets. Make - Safex / Warrior / Intime

Code	Description	Unit	Quantity	Rate	Amount
MR2379	Fire Extinguisher-DCP 5 Kg Type	each	1.00000	1695.00	1695.00
	Add Cartage@1.00				16.95
	Add necessary specials@5.00				84.75
	total				1796.70
Total Cost of Materials					1796.7
1004	Fitter, Grade 1	Day	0.20000	447.00	89.40
TOTAL					1886.1
Add CPOH @ 15%					282.92
cost for one each					2169.0
Say					2169.0
Cost index 31.06 %					680.27
Total with Cost index					2849.27
Say					2849.27

13 Specification Code: od275053/2019\_2020

od275053/2019\_2020 : Supply of 11KV electrical gloves (Vidyut)

Code	Description	Unit	Quantity	Rate	Amount
MR	11KV electrical gloves	each	1.00000	499.00	499.00
	Add Cartage@1.00				4.99
	total				503.99
TOTAL					503.99

Add CPOH @ 15%	75.60
cost for one each	580.0
Say	580.0

Cost index <b>31.06 %</b>	180.02
Total with Cost index	760.02
Say	760.02

14 Specification Code: od275055/2019\_2020

od275055/2019\_2020 : Supply of Bosch professional tool kit (GSB550)

Code	Description	Unit	Quantity	Rate	Amount
MR	Bosch professional tool kit (GSB 550)	each	1.00000	4750.00	4750.00
	Add Cartage@1.00				47.50
	total				4797.50
<b>TOTAL</b>					4797.5
Add CPOH @ 15%					719.62
cost for one each					5517.0
Say					5517.0
Cost index <b>31.06 %</b>					1713.62
Total with Cost index					7230.62
Say					7230.62

15 Specification Code: od275056/2019\_2020

od275056/2019\_2020 : Supply and providing 2.5mm thick, 11KV grade, synthetic elastometric fire retardant insulating sheet

Code	Description	Unit	Quantity	Rate	Amount
MR2069	2.50 mm thick, 11 kV, Synthetic elastomeric fire retardant insulating sheet	sqm	1.00000	1652.54	1652.54
	Add Cartage@1.00				16.53
	total				1669.07
TOTAL					1669.07
cost for one sqm of door area					1669.0
Say					1669.0
Cost index <b>31.06 %</b>					.00
Total with Cost index					1669.00
Say					1669.00

16 Specification Code: od275073/2019\_2020

od275073/201 Providing and fixing 51N earth fault relay (MC-12) in the panel board and giving 9\_2020 : connections.

Code	Description	Unit	Quantity	Rate	Amount
MR	MC-12 relay	each	1.00000	9600.00	9600.00
	Add Cartage@1.00				96.00
	total				9696.00
Total Cost of Materials					9696.0
1003	Lineman	Day	0.12000	447.00	53.64
1007	Khallasi	Day	0.12000	368.00	44.16
TOTAL					9793.8
Add CPOH @ 15%					1469.07
cost for one each					11263.0
Say					11263.0

Cost index <b>31.06 %</b>	3463.31
Total with Cost index	14726.31
Say	14726.31

17 Specification Code: od275074/2019\_2020

od275074/2019\_2020 :  
Laison charges towards preperation of various detailed drawings for submission to Chief Electrical Inspectorate TVM (excluding necessary scrutiny fee) and modified the scheme if necessary;and finally submitting the completion report to the authority and conducting inspection (excluding inspection fee) and transportation and other incidental expenses.

Code	Description	Unit	Quantity	Rate	Amount
MR	Laison charges	L.S	1.00000	100000.00	100000.00
TOTAL					100000.0
cost for one L.S					100000.0
Say					100000.0
Cost index <b>31.06 %</b>					.00
Total with Cost index					100000.00
Say					100000.00

Appendix I.2- Lift Irrigation Mechanical Part

1 Specification Code: od296161/2019\_2020

od296161/2019\_2020 :Supply, Erection, Testing and Commissioning of Centrifugal Pump set 1 no (KRTK 100-401/354 UG-S) Motor Rating 38 KW, Speed 4 Pole capable of lifting 150 m3 per hour against a total head of 55m with all accessories.<br>Make: KSB or Equivalent<br>

Code	Description	Unit	Quantity	Rate	Amount
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MR	Horizontal Centrifugal Pump KRTK 100-401/354 UG-S	each	1.00000	398000.00	398000.00
4.1.3	Rate as per item number 4.1.3 of SH: Concrete work	cum	0.10000	4719.72	471.97
15.2.1	Rate as per item number 15.2.1 of SH: Dismantling and Demolishing	cum	0.05000	858.42	42.92
0116	Fitter(grade1)	Day	2.00000	487.00	974.00
0117	Assistant Fitter or 2nd class fitter	Day	2.00000	448.00	896.00
0115	Coolie	Day	4.00000	368.00	1472.00
0010	Hire charges of Derrick monkey rope	Day	2.00000	800.00	1600.00
MR6058	Chain block	Day	2.00000	48.00	96.00
MR	Conveyance	L.S	1.00000	500.00	500.00

				TOTAL	404052.89
				cost for one each	404052.89
	say				404052.89

	Add Water Charges @ 1.0%				<b>4040.52</b>
	Add CPOH @ 15.0%				<b>61214.01</b>
	Cost index <b>31.06 %</b>				1968.63
	Total with Cost index				471276.07
	Say				471276.07

2 Specification Code: od298687/2019\_2020

**od298687/2019\_2020 :Providing and Laying 100 mm DI Dia DI bends including cost of material, gasket nut and bolt, labour for fitting and conveyance**

Code	Description	Unit	Quantity	Rate	Amount
MR	DI Bend	no	1.00000	1500.00	1500.00
MR	Rubber Gasket	no	2.00000	250.00	500.00

MR	Bolt & Nut	no	16.00000	10.00	160.00
MR	Conveyance	L.S	1.00000	200.00	200.00
0116	Fitter(grade1)	Day	0.20000	487.00	97.40
0161	Helper (Technician)	Day	0.40000	368.00	147.20

TOTAL					2604.60
cost for one each					2604.60
	say				2604.60

	Add Water Charges @ 1.0%				<b>26.04</b>
	Add CPOH @ 15.0%				<b>394.59</b>
	Cost index <b>31.06 %</b>				88.24
	Total with Cost index				3113.49
	Say				3113.49

3 Specification Code: od298842/2019\_2020

od298842/2019\_2020 :providing and Fixing 150x100 DI concentric reducer of standard specification including cost of material, gasket, nut and bolt, labor for fitting and conveyance

Code	Description	Unit	Quantity	Rate	Amount
MR	150x100 DI Concentric Reducer	no	1.00000	4350.00	4350.00
MR	Rubber Gasket	no	2.00000	200.00	400.00
MR	Bolt and Nut	no	20.00000	12.00	240.00
MR	Conveyance	L.S	1.00000	400.00	400.00
0116	Fitter(grade1)	Day	0.40000	487.00	194.80
0161	Helper (Technician)	Day	0.80000	368.00	294.40
TOTAL					5879.20
cost for one each					5879.20
	say				5879.20

	Add Water Charges @ 1.0%				<b>58.79</b>
	Add CPOH @ 15.0%				<b>890.69</b>
	Cost index <b>31.06 %</b>				176.48
	Total with Cost index				7005.18
	Say				7005.18

4 Specification Code: od298998/2019\_2020

od298998/2019\_2020 :Providing and fixing 100 mm DI equal "T" of standard specification including cost of material, gasket, nut and bolt, labour for fitting and conveyance

Code	Description	Unit	Quantity	Rate	Amount
MR	DI Equal T- 100 mm	no	1.00000	2100.00	2100.00
MR	Rubber Gasket	no	3.00000	200.00	600.00
MR	Bolt & Nut	no	32.00000	12.00	384.00
MR	Conveyance	LS	1.00000	500.00	500.00
0116	Fitter(grade1)	Day	0.50000	487.00	243.50
0161	Helper (Technician)	Day	1.00000	368.00	368.00
<b>TOTAL</b>					<b>4195.50</b>
cost for one each					4195.50
	say				4195.50

	Add Water Charges @ 1.0%				<b>41.95</b>
	Add CPOH @ 15.0%				<b>635.61</b>
	Cost index <b>31.06 %</b>				220.60
	Total with Cost index				5093.68
	Say				5093.68

MICRO IRRIGATION -DRIP IRRIGATION - DATA					
	Design and laying, testing and commissioning of Drip irrigation facilities to the ayacut area, Providing drawings, including cost and conveyance of all materials, labour charges, trenching in all classes of soil, all accessories such as filtration units, PVC feeder main PVC Net work, Sub main PVC Network, Valves & Fertigation units, drippers and driplines, Automation control, including Automatic filtration unit, Watermeter, Net Beat wireless controller, gravel filter with back wash valve, Irrigation Valve and accessories, Air valve and Accessories, stabilizer, spike supporter, Isolation transformer, antina mounting poles Electrical cable and accessories, float switch etc complete, including operation and maintenance for a period 5years.				
	Data for 114 Ha				
SI No	Item Description	Unit	Qty	Unit rate (Rs)	Amount (Rs)
<b>A</b>	<b>Filtration unit</b>				
1	NET 100 A CI 2" QRV BSP 2W POLY BLUE	Each	2	23109.25	46218.50
2	GF 3"-50M3/HR WITH BW ASSLY. BIS-IND	Each	4	28363.53	113454.12
3	NAVC 10 2" COMBINATION AV PN10 BSP	Each	4	5985.3	23941.20
4	PRESSURE GAUGE 250 GLZ 8 BAR 1/4" BSP	Each	6	605	3630.00
5	BUTTERFLY VALVE LEVER OPER. 6" LP-IND	Each	4	4069.69	16278.76
6	SWING CHECK VALVE 6"	Each	2	5466.75	10933.50
7	GI Fittings/Manifold	Each	1	300000	300000.00
	<b>Sub total A</b>				514456.08
<b>B</b>	<b>Feeder Main PVC Network</b>				
1	PVC PIPE 140MM -06KG/CM2-IND	Each	270	422	113940.00
2	PVC PIPE 180MM -06KG/CM2-IND	Each	1956	705	1378980.00
3	PVC PIPE 200MM 6 KG/CM2-IND	Each	810	858	694980.00
4	PVC PIPE 225MM -08KG/CM2-IND	Each	1530	1657	2535210.00
5	NAVK 10 2" KINETIC AV PN10 BSP	Each	12	3227.06	38724.72
	<b>Sub total B</b>				4761834.72
	<b>Total: ( A+B )</b>				5276290.80
	Transportation cost	2%		2%	105525.82
	Miscellaneous			2%	105525.82
	PVC Fittings & Accessories	Ha	114	9900	1128600.00
	Installation cost	Ha	114	3700	421800.00
					7037742.43
	<b>Drip System- Total Cost</b>				7037742.43
	<b>Trenchwork and Blasting Work</b>				
A	Main PVC Pipe Trench and Backfilling work	Cum	4714	98.8	465743.20
B	Hard rock trenching & blasting(If required) 20% of entire excavation length	Cum	943	204.1	192466.30
C	Road Crossing (Approx)	Each	5	40000	200000.00
					858209.50
	<b>Total</b>				858209.50



	<b>Drip System + Trench Work- Total</b>				<b>7895951.93</b>
	<b>System Cost /Ha</b>				<b>69262.74</b>
<b>Drip Irrigation System</b>					
<b>A</b>	<b>Submain PVC Network</b>				
1	PVC PIPE 40MM -06KG/CM2-IND	Each	2190	34	74460.00
2	PVC PIPE 63MM -04KG/CM2-IND	Each	13890	52	722280.00
3	PVC PIPE 75MM -04KG/CM2-IND	Each	3480	71	247080.00
4	PVC PIPE 90MM -04KG/CM2-IND	Each	1440	103	148320.00
5	PVC PIPE 110MM -04KG/CM2-IND	Each	1950	170	331500.00
6	PVC PIPE 140MM -04KG/CM2-IND	Each	630	270	170100.00
	<b>Sub total-A</b>				1693740.00
<b>B</b>	<b>Valves &amp; fertigation units</b>				
1	PP BALL VALVE 1.25" (40MM) PLAIN-IND	Each	30	259	7770.00
2	PP BALL VALVE 2.0"(63MM) PLAIN-IND	Each	65	419	27235.00
3	PP BALL VALVE 3"(90MM) PLAIN-IND	Each	1	824	824.00
4	PVC FLUSH VALVE 63MM-IND	Each	110	88.24	9706.40
5	NETAFIM 2" VENTURI WITH ASSLY.-IND	Each	60	2647.06	158823.60
					204359.00
6	Fittings & accessories	20%		20%	40871.80
	<b>Sub total B</b>				245230.80
<b>C</b>	<b>Drippers &amp; driplines</b>				
1	PE PIPE 16/2.5/1.1-1.3MM CL-II 400M IND	Mtr	164000	8.24	1351360.00
2	DRIPNET PC AS 16008 3.0L/H 0.50M 500MIND	Mtr	165000	16.93	2793450.00
4	RUBBER GROMMET OD DIA 16*ID 10.7 MM	EA	8000	2.71	21680.00
5	START NIPPLE 16 MM -IND	EA	8000	1.76	14080.00
6	NIPPLE 16 MM BARB- IND	EA	8000	1.76	14080.00
8	END CAP 16/17 MM- IND	EA	14000	2.12	29680.00
9	REDUCER 17X16 MM BARB-IND	EA	47000	1.76	82720.00
10	TEE 16 MM BARB- IND	EA	47000	3.16	148520.00
11	WINDER SMALL DRIPLINE-INDIA	EA	60	2892.74	173564.40
	<b>Sub total C</b>				4629134.40
	<b>Total: ( A+B+C )</b>				6568105.20
	Transportation cost	2%		2%	131362.10
	<b>Drip System- Total Cost</b>				<b>6699467.30</b>
	<b>Trenchwork and Blasting Work</b>				
A	Submain PVC Pipe Trench and Backfilling work	Cum	15917	98.8	1572599.60
B	Hard rock trenching & blasting(If required) 10% of entire excavation lengthh	Cum	1592	204.1	324927.20
					1897526.80
	<b>Total</b>				1897526.80
	<b>Drip System + Trench Work- Total</b>				<b>8596994.10</b>
	<b>System Cost /Ha</b>				<b>75412.23</b>

	<b>AUTOMATION-CMT SYSTEM</b>				
	<b>Automatic Filtration ( ScreenGuard )</b>				
1	SG A H 6" 7,900 7,900 BSTD 130M DC CON DC SOL ( 150 m3)	Each	1	3,42,137.50	342137.50
2	Inlet & Outlet Manifold -6" for Filtration	Each	1	2,00,000.00	200000.00
	<b>Watermeter</b>				
3	ARAD WSTSB 6" BSTD EV 100L MID	Each	1	71,410.00	71410.00
4	ARAD WSTSB 4" BSTD EV 100L MID	Each	6	45,500.00	273000.00
5	ARAD WSTSB 3" BSTD EV 10L MID	Each	4	39,812.50	159250.00
	<b>NetBeat Wireless Controller</b>				
6	MCU-DISP-433-1DO-1AI	Each	1	5,10,159.38	510159.38
7	NetBeat Pro Subscription Plan	Each	1	50,000.00	50000.00
8	AC DC LATCH TILE FOR MCU	Each	1	60,513.53	60513.53
9	NB-LORA ANTENNA CABLE 10M	Each	1	1,500.00	1500.00
10	NetRTU-433-8DO	Each	11	61,000.00	671000.00
11	NB-LORA ANTENNA CABLE 5M	Each	11	1,500.00	16500.00
12	ANALOG IN TILE FOR MCU	Each	1	75,994.00	75994.00
	<b>Gravel Filter Backwash Valve</b>				
13	DOR PL BF 3*2 VIC S/F 3WNO-L.P AQAC BSP (Filter Backwash Valve 3")	Each	4	32,078.00	128312.00
14	ARKAL 3 QUICK FLANGE	Each	8	2,958.00	23664.00
	<b>Irrigation Valve &amp; Accessories</b>				
15	S75PL 3"R H BSP ELE AQDC 3WNC	Each	30	12,388.89	371666.70
16	DOROT PILOT 29-100-8MM	Each	30	6,912.50	207375.00
17	DOROT BRACKET (5/8)	Each	30	214.29	6428.70
18	BERMAD CON.TUBE T CON.8*1/8 FT98/2GR.NPT	Each	100	95.71	9571.00
19	BERMAD CONTR. TUBE ELBOW CONN.8*1/4 FT58	Each	100	77.14	7714.00
20	BERMAD CONT.TUBE TEE CON.POL. 8*8*8FT98	Each	100	88.81	8881.00
21	BERMAD CONTR. TUBE ELBOW CONN.8*1/8 FT28	Each	100	77.14	7714.00
22	BERMAD CONTR.TUBE TEE CON.8*1/8*8 FT98/1	Each	100	95.71	9571.00
23	BERMAD 1/8 CHECK VALVE ASSY GRAY	Each	100	755.26	75526.00
24	TUBE PE 8MM NO-STRIPE 100M	Each	100	16.25	1625.00
	<b>Air valves &amp; Accessories</b>				
25	NAVc 10 2" COMBINATION AV PN10 BSP	Each	10	5,985.30	59853.00
	<b>TOTAL</b>				
					<b>3349365.81</b>
	ADD INSTALLATION CHARGES - 5 %				167468.29
	ADD TRANSPORTATION CHARGES - 2%				66987.32
	<b>Grand total-1</b>				<b>3583821.42</b>
	<b>LOCAL PURCHASE ITEMS-SUPPLY</b>				
1	SERVO STABILIZER 1KVA-1 PHASE(INPUT 150 TO 300V & OUTPUT OF 230VOLT)	Each	1	20,000.00	20000.00

2	SPIKE SUPPRESSOR , ISOLATION TRANSFORMER, HI-Lo VOLTAGE PROTECTOR	Each	1	7,000.00	7000.00
3	ANTENNA MOUNTING POLE 5 MTRS ,FOUNDATION, PROTECTION BOX FOR RTUS & VALVE	Each	12	25,500.00	306000.00
4	ANTENNA MOUNTING POLE 10 MTRS	Each	1	13,000.00	13000.00
5	Lithium Battery for RTU	Each	12	2,000.00	24000.00
6	ELECTRICAL CABLES & ACCESSORIES FOR Head control Units	SET	1	10,000.00	10000.00
7	Float switch & Accessories	SET	1	10,000.00	10000.00
8	Electrical panel board with pump starters	SET	1	2,50,000.00	250000.00
9	Electrical Cables & ACCESSORIES FOR RTUs	SET	12	1,000.00	12000.00
	<b>Total-2</b>				652000.00
	<b>Grand total-2</b>				<b>652000.00</b>
	<b>Grand Total A+B</b>				<b>4235821.42</b>
	<b>System Cost /Ha</b>				<b>37156.33</b>
	<b>Main Data</b>				
1	<b>PROJECT ENGINEERING &amp; DESIGN SERVICES</b>				
a	Conduction of contour survey, individual farm boundary survey and preparation and submission of drawings for approval etc., where ever required	Ha	1	1120	1120.00
b	Provision for preparation of designs and drawings etc	Ha	1	560	560.00
	<b>2 DRIP IRRIGATION SYSTEM</b>				
a	Primary Filtration ,Feeders main , infield valves,Safety accessories & drip system etc complete	Ha	1	69262.74	69262.74
b	Main & Submain PVC , infield manual valves,Fertigation equipment ,Pressure regulator, & drip manifold accessories etc complete	Ha	1	75412.23	75412.23
c	Wireless automation for drip operation	Ha	1	37156.33	37156.33
	<b>3 SERVICES</b>				
a	Operation & Maintenance of individual farmer field	Ha	1	1120	1120
b	Formation of WUA & Agronomy services	Ha	1	224	224
	<b>4 Additional Aminties</b> such as motor and pumpset, storage space (building)etc	LS		10000	<b>10000</b>
	Total cost per Ha				<b>194855.29</b>