5.1 INTRODUCTION

In the irrigation management sector, evaluation of efficiency and effectiveness are important to know whether a project is fulfilling the objectives or whether the resources are properly utilised. This will definitely help in improving the performance of the particular project and also serve as a guideline for other similar projects. The Central Water commission (CWC) of Government of India has initiated several performance evaluation exercises to understand the status of irrigation in the command areas of irrigation projects (CWC, 2002; CWRDM, 2002). The guidelines of CWC have been followed to the extent possible in the present evaluation.

From the sustainability analysis, it is found that there is a scope for improving the level of water management in the Aliyar sub-basin. The performance of Aliyar system is more influenced by the performance of the CPP than the other two sub-systems. Hence, any improvement in water management in the CPP will improve the overall water management of the Aliyar sub-basin.

The performance of irrigation projects generally varies from project to project. This variation is generally due to aspects such as local irrigation conditions, and attitudes and approach of farmers and officials towards irrigation. The views and opinion of farmers of a particular command area is an important input, which has to be considered and incorporated in decision-making efforts for improving the
performance of the project. This is also important from the point of view of the principles of IWRM.

To understand the onfarm operational efficiency in the downstream reaches of the Aliyar reservoir command, a socio-economic survey was conducted. Data including the details of farmers were collected from the Agriculture Department, Irrigation Department and various panchayaths (local self governments). A field survey in the project area was conducted using customized questionnaires which emphasise stakeholder participation and general considerations. Discharge measurements in the canals of the CPP were also taken up for a short period as part of field investigations to understand the actual conditions in the field.

5.2 PILOT SURVEY

A preliminary survey was conducted among the farmers of command areas of regulators in Tamil Nadu and the command area of the CPP in Kerala by following random sampling. Ten percent of farmers were selected from both the study areas. The coverage was restricted to 10% due to the vastness of command area and limitation of resources and time availability. The following general observations were made based on the preliminary survey:

- There is an increase in the water levels of wells in the command areas due to the recharge of groundwater by water in the canals.

- The land value has increased due to increased water availability in all the command areas.

- The farmers were not ready to increase the area under cropping even if more mechanisation was provided. They indicated that the subsidies provided by the government were not reaching the farmers with small land-holdings and also the selling price of the rice was too low.
• There has not been much change in the total command area but changes in the cultivable area of individual farmers were observed. Some farmers have expanded their area as a result of increased water availability, whereas the reduction in cultivable area was also observed in certain pockets, the reason attributed being labour shortage.

• Shift in crops is observed, mainly from rice to coconut in the command areas of regulators.

• There is considerable temporal variation in the water availability in the command area of RBC of the CPP. Out of the respondents of the RBC, only 27.3% opined that they are getting required quantity of water during 50 to 100% of the supply period. About 18% of farmers at the tail-end do not get water from the canal at all.

• More farmers use well water for irrigation in the CPP command area, whereas in the command areas of regulators in Tamil Nadu, farmers mainly depend on canal water. Source-wise use of water in different command areas is shown in Figure 5.1.

Figure 5.1: Source-wise use of water in different commands
Further, temporal and spatial variations in the water availability were observed within the basins. Water distribution in the command areas of regulators or anicuts was found to be more efficient than in the command of the CPP. The water availability was almost zero for the farmers at the tail-end of the CPP.

5.3 PERFORMANCE EVALUATION OF THE CPP

5.3.1 General aspects

From the preliminary survey, it was observed that there has been a clear water deficit in the command area of the CPP and the farmers there were facing certain issues which need more attention. Hence, the need for a detailed field survey to understand issues was recognised. A detailed questionnaire was prepared for the purpose, covering general aspects, cropping details, farming practices and economic aspects. The farmers were individually met during the process of survey. The questionnaire used, following the pattern of CWC is given in Appendix 2. The total command area in the CPP is 16940 ha. The command area is spread over 6 panchayaths (local self government), namely, Perumatty, Nalleppilly, Polpully, Thathamangalam, Elapully, and Kozhinjampara with a number of padasekhara samithies (farmer groups) in each panchayat. Details of farmers of these 6 panchayats were collected. Detailed survey was conducted among the farmers to understand the aspirations of farmers about the irrigation system efficiency. Farmers were interviewed through stratified random sampling; care was taken to include farmers from each of the different padasekhara samithies of all the panchayats, each of the branch canals, and also from those belonging to different land size groups and different income groups in the sample. A total of 395 farmers were interviewed with the help of the questionnaire.

The farmers were classified according to their occupation, land-holding size, standard of living, age, literacy and also their period of stay in the command area of the CPP. About 60% of farmers had farming as their main occupation; others
were engaged in other jobs while still remaining as farmers (Figure 5.2).

![Figure 5.2: Main occupation of farmers (%)](image)

The total sample was classified according to land size into 6 categories as detailed in Figure 5.3.

![Figure 5.3: Size of land-holdings of farmers](image)
The land-holding size of the farmers varied from less than 0.5 acres (0.202 ha) to more than 4 acres (1.62 ha). The survey was conducted following almost a uniform coverage among all the 6 groups of farmers. The standard of living of farmers was taken as another variable in the study, which may influence the irrigation culture of farmers. In fact, the high rate of literacy and migration for jobs have contributed to a better standard of living among the people of Kerala State compared to the other states in India.

The farmers were grouped based on their standard of living (high, middle and low income groups); certain indicators were used for grouping, such as area of land-holding, type of house, main income source and facilities available. Majority of the respondents were staying in the command of the CPP for more than 30 years, as given in Figure 5.4. Among the respondents of the irrigated area, 20.25% were from high income group, 47.34% from middle income group and 32.41% from low income group.

![Figure 5.4: Period of stay of farmers in the command of the CPP](image)

Fifty seven percent of the respondents were from 40-60 age group, and thirty one percent were above 60 years. Considering the literacy and education level
of farmers, 36% of the respondents were below graduation but above SSLC (Secondary School Leaving Certificate) level and 42% were below SSLC; 12% of the respondents were graduates.

5.3.2 Impact of CPP- irrigation aspects

All the respondents from the command area stated that they get water from the project, meeting either full or part of their irrigation requirements. Eighteen percent of respondents were getting more than 75% of their requirement where as 33% were getting water less than 50% of their requirement (Figure 5.5). Sixty percent of farmers in Elapully, and 42% in Polpully area opined that they get water less than 25% of the requirement.

![Figure 5.5: Farmers % with respect to extent of irrigation demand met](image)

It was observed that the percentage of tail reach farmers who get required water from the project is less, compared to the head reach and middle reach farmers, which is the real case in most of the irrigation projects in the country. The variation in water availability in head, middle and tail reaches is given in Figure 5.6.
According to 40% of the farmers, the main reasons for not getting water as per the requirements are: (i) the project authorities are not releasing water as and when required; and (ii) the distribution system is defective due to lack of maintenance. Only 18% farmers opined that there was insufficient water in the reservoir to meet the requirements.

Forty nine percent farmers make a decision on crop selection based on their experience, while 20% farmers decide according to water availability and 27% just follow the other farmers. Only 4% farmers make the decision based on the advice from the officials, which indicates that the farmers do not often take the officials into confidence (Table 5.1).

Table 5.1: Response of farmers on crop selection

<table>
<thead>
<tr>
<th>Basis for decision on crop selection</th>
<th>Farmers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on experience</td>
<td>49.3</td>
</tr>
<tr>
<td>As per water availability</td>
<td>20.0</td>
</tr>
<tr>
<td>Follow other farmers</td>
<td>26.4</td>
</tr>
<tr>
<td>Based on advice from the officials</td>
<td>4.3</td>
</tr>
</tbody>
</table>
Around 50% of the respondents opined that the officials were not considerate and sympathetic to the problems of farmers; 39% of respondents opined that officials were reluctant to meet and discuss the problems with the farmers.

The officials of *Krishibhavans* (local agriculture office), Irrigation Department and *panchayats* were interviewed with a questionnaire prepared for the purpose. The format of the questionnaire prepared for the interview is given in Appendix 3. The collected data include the suggestions given by the officials and also their views on the problems faced by them in discharging their duties. The survey revealed that there was not much coordination among the officials of *Krishibhavans* and Irrigation Department. All officials had clear perception regarding the necessity of coordination and interaction among the various departments and agencies. Majority of officials opined that non-availability of water on time in required quantity is the main problem faced by the farmers. Other concern pointed out by the officials was the absence of a uniform cropping pattern, which is a prerequisite for following a uniform schedule of operation for the system. The main problem faced by the officials in carrying out their duties was pointed out as the lack of timely allocation of funds for maintenance of the system, and shortage of staff.

From the survey conducted, it is observed that there is scope for improvement of water management in the Aliyar basin in general and the CPP in particular. A better coordination among the officials of Irrigation and Agricultural Departments should be brought about and the farmer-officer relations enhanced so that the advice of the irrigation officials are taken seriously by the farmers while considering the selection of crops, especially with regard to the second crop.

### 5.3.3 Other suggestions and recommendations

Other suggestions and recommendations of farmers and officials are highlighted below.
By assessing the surplus water available during the monsoon, and incorporating this aspect while planning reservoir releases, a better balancing can be achieved. Possibilities for increasing the storage provision in the lower reaches by designing new conservation structures to tap this surplus water may be investigated. Artificial recharge measures may be explored for using this surplus to recharge the aquifer. The groundwater availability can be studied in detail and the possibilities for conjunctive use of surface and groundwater for irrigation probed into.

The farmers, whose lands were close to the canal, got more water and the availability diminished as the distance between their land and the canal increased; the water availability is practically zero for the farmers at the tail-end. This shows the inefficiency of the canal network. No action has been initiated to make water available to the farmers at the tail-end so far. As a solution to this problem, the Warabandhi System (weekly turn irrigation recommended by the CWC, and practised in several command areas in the country) is recommended in all canal networks to make water available at the tail-end. For purposes of internal distribution of water on an outlet area among co-sharers, list or time schedule showing order of turn, field number in units, name of co-sharer, area of the units, length of turn in strict proportion of area, any addition or deduction and length of turn are allotted. This system was evolved in India with the diversion of water from the rivers of North India for irrigation purposes during the colonial period. Water delivery is managed in the common interest, ensuring an equitable distribution of the available water to the many, instead of a supply sufficient to cover all the needs of a few, by means of a range of governance and onfarm mechanisms (CBIP, 1981). Details of Warabandhi System are given in Appendix 4.

There is a tendency to convert area under rice to other crops and in order to restrict this, provision of subsidies may be improved for manures, tools and machineries and seeds. Though the Government is presently providing subsidies, these
are not properly reaching the farmers with an average or below average land-holding. So, if proper measures are taken by the Government to provide subsidies for the farmers with small land-holdings also, it can be an encouragement for them to cultivate rice. Another problem faced by the rice farmers is the low market value; the authorities may intervene in this matter and try to improve the situation. All these gain importance in a state like Kerala where legislative measures are in vogue to protect rice fields (Government of Kerala, 2008).

Another suggestion of the irrigation officials was the utilisation of dead storage of around 150 Mm$^3$ of Parambikulam reservoir of the PAP which cannot be used by Tamil Nadu because of the level of their off take. However, several policy issues are involved in all these proposals/suggestions.

## 5.4 DISCHARGE MEASUREMENT IN CPP CANAL NETWORK

An attempt was made to measure the flows as part of the field work, to have a feel of the real conditions in the farmers’ fields. Data on flows are expected to help in performance evaluation. For flow measurement in the study area, surface float was used. Though current meter is used as the standard instrument for the flow measurement as per IS 3911-1994 of Bureau of Indian Standards, the code also recommends the use of surface float under certain conditions: i) velocities of flow being beyond the calibrated range of the current meters, ii) the flow being such that there is the danger of losing the current meter, and iii) there being lack of facilities for the use of current meter. Considering the flow and the conditions of the canal in the CPP, float observations were found to be suitable. The design of surface float was done as per the specifications of IS 3911-1994 (Figure 5.7). Wood was used as the material for the fabrication of the float.
At different canal sections, straight stretches of about 400 m length were identified for velocity measurement. One main canal stretch in Perumatty *panchayath* and the branch canal stretches of other *panchayaths* were identified for sample flow measurement. In each canal stretch, measurement was taken at two reaches, one at the head reach and the other towards the tail-end. The canal network of the LBC and RBC are given in Figures 5.8 and 5.9 respectively.

The velocity(*V*), depth(*d*), and sectional details were measured; area of section (*A*) was computed and discharge estimated. The observed flow (*Q_a*) and depth of flow (*d*) were then compared with the design flow (*Q_d*) and design full supply depth (*FSD*) at the respective sections. A comparison of the full supply and actual flows in these canals is given in Table 5.2.
Figure 5.8: CPP Left Bank Canal (LBC) system
Figure 5.9: CPP Right Bank Canal (RBC) system
Table 5.2: Comparison of the observed and design flows

<table>
<thead>
<tr>
<th>Canal</th>
<th>Reach</th>
<th>FSD, m</th>
<th>Q_d, m³/s</th>
<th>d, m</th>
<th>A, m²</th>
<th>V, m/s</th>
<th>Q_a, m³/s</th>
<th>Q_a/Q_d</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perumatty</td>
<td>I</td>
<td>1.80</td>
<td>10.2</td>
<td>1.75</td>
<td>8.27</td>
<td>1.10</td>
<td>7.91</td>
<td>77.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>1.80</td>
<td>10.2</td>
<td>1.75</td>
<td>8.27</td>
<td>1.00</td>
<td>7.19</td>
<td>70.5</td>
<td></td>
</tr>
<tr>
<td>Kozhinjampara</td>
<td>I</td>
<td>0.45</td>
<td>0.15</td>
<td>0.40</td>
<td>0.42</td>
<td>0.26</td>
<td>0.09</td>
<td>62.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.45</td>
<td>0.15</td>
<td>0.40</td>
<td>0.42</td>
<td>0.26</td>
<td>0.09</td>
<td>61.3</td>
<td></td>
</tr>
<tr>
<td>Thathamangalam</td>
<td>I</td>
<td>0.60</td>
<td>0.58</td>
<td>0.50</td>
<td>0.45</td>
<td>1.26</td>
<td>0.49</td>
<td>85.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.60</td>
<td>0.58</td>
<td>0.50</td>
<td>0.45</td>
<td>1.15</td>
<td>0.45</td>
<td>78.0</td>
<td></td>
</tr>
<tr>
<td>Nalleppilly</td>
<td>I</td>
<td>0.50</td>
<td>0.52</td>
<td>0.24</td>
<td>0.65</td>
<td>0.54</td>
<td>0.30</td>
<td>57.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.50</td>
<td>0.52</td>
<td>0.24</td>
<td>0.65</td>
<td>0.53</td>
<td>0.30</td>
<td>56.7</td>
<td></td>
</tr>
<tr>
<td>Elapully</td>
<td>I</td>
<td>0.90</td>
<td>0.65</td>
<td>0.25</td>
<td>0.50</td>
<td>0.31</td>
<td>0.13</td>
<td>20.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.90</td>
<td>0.65</td>
<td>0.25</td>
<td>0.50</td>
<td>0.31</td>
<td>0.13</td>
<td>20.5</td>
<td></td>
</tr>
<tr>
<td>Polpully</td>
<td>I</td>
<td>0.75</td>
<td>0.75</td>
<td>0.33</td>
<td>0.69</td>
<td>0.48</td>
<td>0.28</td>
<td>37.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.75</td>
<td>0.75</td>
<td>0.33</td>
<td>0.69</td>
<td>0.47</td>
<td>0.28</td>
<td>37.2</td>
<td></td>
</tr>
</tbody>
</table>

It was observed that the flow at all sections were well below the design flow. Further, it was observed that the total flows in the branch canals were much less than the expected flows, especially towards the tail end, in comparison to the flow in the main canal reach; this is indicative of the conveyance losses taking place in the canals. The observed discharge at the Elapully branch canal was only about 21% of the design discharge and that observed at the Polpully branch canal was about 37% of the design discharge, when the main canal was supplying about 78% of the design discharge.

5.4.1 Efficiency computation based on area concept

Area concept Performance Efficiency (P.E.) is calculated as the ratio of area actually irrigated (A_a) to proposed area of irrigation by the project (A_p)

Proposed area to be irrigated under the CPP = 16940 ha.

Area actually irrigated = 8562 ha.
\[ P.E. = \frac{A_a}{A_p} \]  
(5.12)

\[ P.E. = \frac{8562}{16940} = 0.50543 \ (50.54 \%) \, . \]

5.5 SUMMARY OF PERFORMANCE EVALUATION

Based on the survey conducted among the farmers and officials, following suggestions are made for improving the performance of the CPP.

Hydrology related:

- Water distribution has to be made more effective by adopting proper operation and maintenance mechanisms and introducing appropriate measures for monitoring. This is expected to ensure reliable water supply.

- Storage capacity of the Kambalathara eri (small pondage) and Vengalakayam eri may be increased.

- An irrigation calendar has to be prepared and water distribution should strictly follow it.

- Maintenance works and repair works may be done before the commencement of water supply for the season. Also, silt removal may be taken up under the supervision of irrigation officials. The schemes of Government of India to provide job opportunities to the unemployed and economically weaker sections like MNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) can help in the maintenance works. Maintenance works of canals under CADA (Command Area Development Authority) may be taken up on a priority basis. Wherever possible, lining of canals may be attempted.

- A review of the PAP agreement may be considered, especially in the context of problems faced by the farming community.
Socio-economic related:

- Farmers may as far as possible adopt a uniform cropping pattern in the command area. Advice of the officials of the Irrigation Department may be taken into account while selecting the crops to be grown, especially the second crop. There is a hesitation among farming community to change the crops/variety of crops and also to move away from their traditional agricultural practices.

- Mechanisation of agriculture may be given priority. This can help in finding a solution to the problems associated with labour.

- Farmer-officer relations may be improved. Farmers can be sensitised by providing them an opportunity to visit the farms of successful farmers and motivating them by appraising of the possible financial gain from farming.

Administration related:

- Irrigation and Agricultural Departments may possibly be brought under the umbrella of the same Ministry to improve coordination in the agricultural sector.

- Vacancies of Assistant Engineers and other officials may be filled up considering the importance of agriculture in the region.

- Funds may be allocated for carrying out required maintenance of canal network especially that coming under the CADA.

Flow measurements at various locations of the canal network were done to have an idea on the conveyance losses, which have a bearing on the performance efficiency of the network. The losses were found to be very high. Various factors are responsible for the under performance of the project. Proper scheduling of the water release, regular maintenance of the canals, and providing appropriate incentive for farmers involved in cultivation of rice and such crops may set the right condition for better and effective use of the valuable water resources in the command areas. In general, it is observed that, by ensuring stakeholder participation into the decision-making process, the efficiency can be improved. Stakeholder participation is one of the key principles of IWRM, as enunciated at the Dublin Conference (ICWE, 1992).