APPENDIX 4

The computational procedure followed in developing the planning module is described below:

1. Estimation of the crop water requirement using Modified Penman method. The daily climate data required for computing the crop water requirement were collected for the last 15 years from the nearest meteorological station at Kilnachippattu.

2. Computation of the water requirement at each outlet (minor head) considering its area, the application efficiency and the distribution efficiency along with the crop water requirement. An application efficiency of 85 per cent and the distribution efficiency of 85 per cent were used in the present computation.

3. Computation of the cumulative minor demand considering the requirement of each minor and loss along the distributary canal. Loss along the distributary canal (as it is unlined) is considered to be 2 per cent per kilometre, based on the measurements in a few canals.

4. Computation of the demand at each distributary canal head is done from the cumulative minor demand. The demand is represented in terms of volume of water and number of days of operation required ("ON" days) for each rotation for each distributary canal considering the discharge capacity of the canal (Figure 6.3a).

5. There is an option to include or exclude the groundwater potential available in the distributary command, when planning
for the season is done. The demand along the distributary canal is computed considering the groundwater available in the distributary canal. Presently, rise and fall method is used to estimate the groundwater by considering the groundwater level fluctuations of the representative wells of the distributary canal, the number of wells in each distributary canal and the specific yield of the aquifer (Figure 6.3b). Other methods such as NABARD procedure has not been used as they require too many assumptions on parameters, which may not hold in the field operations.

6. The demand of each distributary canal is computed at the main canal head considering the demand at the distributary canal head and the losses in the main canal. The main canal loss is considered to be 1 per cent per kilometre. Both the main canals are lined.

7. The distributary canals are ranked for operation according to the weights obtained as explained in section 6.4. The distributary canals are selected for operation according to their rank, until the sum of their demand is within the capacity of the main canal (Figure 6.3d).

8. The distributary canals are not ranked for operation, when there is supply to the tanks. This is for the reason that the supply to the direct command is generally closed when there is supply to the tanks to avoid the conflicts among the farmers of both the commands.

9. The tanks are supplemented with canal water in three spells in January, February and March to meet the wet crop (rice) in the indirect command. The requirement of each tank command is
estimated considering the crop water requirement and the losses. The net demand for each tank is computed according to the storage available in each tank. The demand is computed in terms of number of days considering the capacity of the tank feeder (TANK DAYS) so as to release the canal water. Then, the total demand of all the tanks is computed considering the conveyance losses. This total demand is also represented in terms of number of days considering the capacity of the main canal (TSUPPLY DAYS). Water is released to the tanks either as per the TANK DAYS or as per TSUPPLY DAYS whichever is less (Figure 6.3c).

10. The daily total demand at the main canal head is computed both for the commands of the LBC and the RBC. Then, the target (planned) operation is done considering the storage in the reservoir, the evaporation loss and the demands of the Sathanur command. It is possible to do such an operation as the reservoir storage is known before the start of the season and the inflow is relatively lesser during the irrigation season (post monsoon season) in this system. This will serve as a guideline to foresee the system performance and to modify the plan, if necessary.

The actual reservoir operation is carried out considering the actual inflow, sharing of the inflow between Sathanur command and old ayacut and other field conditions. The demand of the Sathanur command is met from Sathanur credit storage in the reservoir. Similarly, the demand of the old ayacut is met from its credit. The deficit is computed when the available water is less than the demand. The target reservoir operation helps the manager to choose a plan without deficit (Figure 6.3e).

The following procedure is adopted to compute the parameters used in the monitoring module.
1. Response to the rainfall occurring in the field is made as follows: The depth of effective rainfall useful for the plant growth is computed from the actual rainfall using a factor. Dastane (1977) has given a detailed discussion of the different methods available for estimating the effective rainfall such as USDA - SCS method, Percentage method, Standard irrigation depth method and Vietnam method. Most of them have been empirically derived based on the local conditions. Therefore, a set of factors to compute the effective rainfall for different amount of rainfall has been prepared in consultation with the experienced agronomists, irrigation engineers and a few farmers. For a rainfall of upto 15 mm, 75 per cent is effective (factor is 0.75); for rainfall upto 30 mm 60 per cent is effective (factor is 0.60) and for a rainfall upto 50 mm, 50 per cent is effective (factor is 0.50) and for a rainfall upto 75 mm, 30 per cent is effective (factor is 0.30). Nevertheless, these factors can be refined during the field implementation of the MIS.

Once the effective rainfall depth (EFF RAIN DEPTH) is computed, the rainfall contribution days (RAIN CONT DAYS) can be computed from the depth of daily requirement in the distributary canal. Being the post monsoon season, it is considered that the contribution days may not exceed five days, from the current day (Figure 6.4a).

2. The farmers' requests for releases on additional days other than the scheduled days are met as follows: The requests from different canals are prioritised according to the water delivery performance of the distributary canals till the previous rotations. Requests are met in two ways.

If the reservoir storage is in excess (EXCESS) of the targetted
reservoir storage (available from the planned reservoir operation) on that day, the requests are met from this excess storage. Otherwise, the requests are accommodated through internal adjustments in the days of operation in the subsequent rotations. Changes for the requests are made on the first day of each rotation, so that farmers get information of the updated schedule for the rotation (Figure 6.4b).

3. The managerial diagnosis is provided to trace the causes for the tailend of the distributary canal not getting water on the days of operation. The diagnosis proceeds either along the distributary canal or along the main canal reach, according to the actual discharge at the head of the distributary canal under reference.

If the target discharge is equal to the actual discharge at the head of the distributary canal under reference, then the diagnosis proceeds along that distributary canal to trace the causes such as physical system problem, extra water drawn by the farmers and checking for the changes in losses in the canal and thus helps the manager in taking corrective measures.

If the target discharge is less than or not equal to the actual discharge at the distributary canal head, then the diagnosis proceeds along the main canal reach upstream of the distributary canal under reference. First, it proceeds to the distributary canal just upstream of the present canal and checks for the actual and target discharge in that canal. If the actual discharge is less than the target discharge in the upstream distributary canal also, then it checks for the total target in the main canal reach (total of the target discharges of all the distributary canals under operation on that day below that point indicated as TOTAL TARGET) and the
actual flow in the main canal reach (indicated as TOTAL ACTUAL). If the total actual is less than the total target, then it checks for the changes in losses in the main canal reach and computes the new targets. If the total actual is not less than total target, the procedure is repeated for the distributary canals and reaches, upstream of the current distributary (Figure 6.4c).

The **evaluation module** essentially deals with computation of the different performance indicators.

1. It computes the water delivery performance indicators such as Delivery Performance Ratio, IQR, MIQR, Depth of water supplied per ha and Reliability of the water delivery for each rotation and season as well. Delivery Performance Ratio is computed daily as well as it supports the manager in day-to-day operations.

2. A questionnaire has been devised to conduct the Farmer’s Response Survey. This questionnaire include general information of the farmer, water management practices adopted, information pertaining water delivery services provided, information on farmer-agency interaction, information on availability of inputs and other services provided and farm budget.

   The response of the farmers to different questions can be analysed outletwise, distributarywise and for the main canal as well. It computes the response in percentage for each outlet and cumulative percentage for the distributary canals and the main canal. Correlation between two variables can also be made to compare the performance.

3. This module has provisions to compute the productivity of water, productivity of land, cropping intensity and income-expenditure
associated with the provision of water delivery (self sufficiency of the system).

The parameters and the database used in the computation of the modules can be refined during the field implementation of the MIS. The MIS has facility to accommodate such changes.