CHAPTER IV

VALIDATION OF THEMATIC AND NUMERICAL MODELS

4.1 GENERAL

Subsequent to the detection of suitable areas for artificial recharge (Fig 3.19), an attempt was made at the next stage to validate such findings. To do so, two validation techniques were attempted, one through the water level fluctuation studies and the other through the hydrogeochemical evaluation of ground water.

4.2 MODEL VALIDATION THROUGH WATER LEVEL FLUCTUATION STUDIES

4.2.1 Evaluation of Premonsoon Water level data

For the water level fluctuation studies, 13 control wells/observation wells established and monitored by state Ground water, PWD were considered. The north east monsoon season which is yielding rainfall to the Ayyar basin falls during October, November and December, and hence the water level for September month was taken as the premonsoon water level for all the control wells. Therefore, such water level of Semptember months for a period of 19 years (1971 to 1989) was
collected for all the 13 control wells (Table 4-1). Such 19 premonsoon water level data were averaged for each well and thus, the general premonsoon water level data was standardised for each well (Table 4-1). Such average premonsoon water level data were plotted in the respective well locations and contoured (Fig 4.1). Such premonsoon water level contours have shown the shallow water table conditions in the central Mettur - Vadakkupatti region.

4.2.2 Evaluation of Postmonsoon water level data

Similarly, January months water level data were taken as the post monsoon water level data for the area and the water level data were collected for 18 years from 1972 to 1989 and tabulated (Table 4-2). Once again, such 18 monthly data were averaged for each well and added to the table. Such averaged post monsoon water level data were plotted in the respective control well locations and contoured (Fig 4.2). Once again, shallow water table conditions were observed in the central part of the basin during the post monsoonic period also.

4.2.3 Difference between premonsoon and postmonsoon water levels

In the next stage, in order to evaluate the quantum of recharge in each control well, the differences between such averaged postmonsoon and the premonsoon water levels were worked out for each of the control wells independantly (Table 4-3). Such differences between premonsoon and postmonsoon water levels were plotted in the respective control well locations and contoured (Fig 4.3). Such contour map has shown that 2.48 mts of water column was the recharge in the central part of the basin and all along the peripheral parts of the basin, the quantum of recharge was to the tune of 7.02 to 8.22 mts. This has lead to the conclusion that better recharge conditions are there in the peripheral parts of the basin when compared to its central
Fig 4.1

LEGEND

PREMONSOON WATER LEVEL IN METERS
### Table 4-1

**PREMONSOON WATER LEVEL**

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**POSTMONSOON WATER LEVEL**

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Continuation...
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part. However, in order to pictorially represent such pattern of recharge, the mean value was worked out by keeping 2.4 mts as the minima and 8.2 mts as the maxima, such mean value was 5.2 mts. Hence, the areas with more than 5.2 mts of recharge was buffered as the areas of on going natural recharge. This map was superposed over the recharge priority area map(Fig 3.19). Such a superposition has shown that almost both maps were coinciding (Fig 4.4). This indicates that the recharge priority areas identified through thematic and numerical modelling are correct.

4.3 MODEL VALIDATION THROUGH HYDRO GEOCHEMICAL DATA

Bicarbonate content available in ground water is one of the best indicators to judge the recharge. If the repetitive chemical analysis of the same ground water collected after a gap of time indicates addition in bicarbonate value, then the same indicates the addition of newer water into the aquifer (Chebotarev 1955, Freez and Cherry 1979, Balasubramanian et al 1988).

4.3.1 Premonsoon bicarbonate distributions in Ground water

The premonsoon bicarbonate data was collected for 12 control wells of PWD for 19 years from Ground water, PWD (Table 4-4). From such yearly data, the average bicarbonate value was worked out for each well. Such averaged premonsoon data were plotted in the respective well locations and contoured (Fig 4.5). Such contour map has shown that the premonsoonic bicarbonate distribution varies from 213 mg/l to 451 mg/l (Fig 4.5).
Ayyar Basin
Model Validation through Water Level Fluctuation

Legend
- Favourable Areas of Artificial Recharge
  - Deduced from Numerical Modelling
- Areas of Natural Recharge
  - Deduced from Water Level Fluctuation Data
- Areas of Coincidence of Natural and Artificial Recharge Deduced from the Model
- Unfavourable Areas for Artificial Recharge

Fig. 4.4
LEGEND

--- 300 --- BICARBONATE DISTRIBUTION IN GROUND WATER (mg/l)

Fig. 4.5
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Continuation...
4.3.2 Postmonsoon bicarbonate distribution in Ground water

Similarly, the bicarbonate data were collected for the 19 postmonsoon periods from the same 12 control wells from 1972 to 1990 (Table 4.5). From such 19 postmonsoon bicarbonate data, the average value was worked out for each well (Table 4-5). Such averaged postmonsoonic bicarbonate data were plotted in the same way in the respective 12 control well locations and contoured (Fig 4.6). Such postmonsoon bicarbonate distribution contour has shown that the values vary from 152 mg/l to 540 mg/l. Such an increase in bicarbonate maximum from 450 mg/l to 540 mg/l indicated definite addition of younger water, which amounts to the recharge due to monsoon.

4.3.3 Difference between postmonsoon - premonsoon bicarbonate distributions

Hence, in order to pictorially identify such areas where the bicarbonate values had gone up, the difference between postmonsoon and the premonsoon bicarbonate data were worked out (Table 4-6) for each well and wherever the bicarbonate values had gone down in postmonsoon seasons, the negative values were given and wherever it had gone up, positive symbol was given (Table 4-6). Such differences between premonsoon and postmonsoon bicarbonate data were plotted in the respective well locations and contoured (Fig. 4.7). Such contours have shown that the differences between the postmonsoon and the premonsoon bicarbonate data has varied from - 34 to + 138 mg/l, thereby suggesting the mean value of 86 mg/l. So,
Fig. 4.6
AYYAR BASIN
DIFFERENCE BETWEEN POSTMONSOON-PREMOMSOON BICARBONATE DISTRIBUTION

LEGEND
POSTMONSOON-PREMOMSOON BICARBONATE DIFFERENCE (mg/l)
AREAS UNDER MORE THAN MEAN BICARBONATE DISTRIBUTION

Fig. 4.7
Table 4-5

POSTMONSOON BICARBONATE DISTRIBUTION (in mg / litre)

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the area falling more than 86 mg/l bicarbonate value were demarcated as the area of younger water or the areas of natural recharge.

Such areas of recharge deduced from the differences between postmonsoon and premonsoon data (Fig 4.7) has matched well with priority areas 1 & 2 deduced from numerical modelling (Fig 3.19) thus validating the artificial recharge models. Though areas falling under more than mean (80 mg/l) coincide with priority area 1 & 2, the bicarbonate contours of 40 - 80 mg/l matched well with priority area 3 of the eastern rim of the area.

4.4 SYNTHESES

The priority areas identified for artificial recharge through thematic and numerical modelling techniques were validated. Such validation was done through the analysis of premonsoon and postmonsoon water level data and the bicarbonate distributions in premonsoon and postmonsoon data.
Table 4-6

DIFFERENCE BETWEEN PREMONSOON AND POSTMONSOON BICARBONATE DISTRIBUTIONS (in mg/l)

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<th>Postmonsoon HCO$_3$ Distribution (Average)</th>
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