CHAPTER 7
SUMMARY AND CONCLUSIONS

7.1 Summary and Conclusions

As a part of performance evaluation, Landuse land cover mapping was done to evaluate if any changes can be made in land usage pattern to get optimum outputs from the command area. It is clearly concluded as under:

- The digital analysis of figure 4.4 to 4.11 clearly shows that the study area is predominantly agricultural area and covers around 80% of the land cover classes of the area. This is positive factor as far as land usage of any irrigation command is considered.
- Figure 4.10 shows that out of 80% cultivable land the 90% of the area is under Rabi cultivation and only 60% of area is cultivated during Kharif.
- It can be concluded that 10% of cultivable land, during Rabi and 40% land during Kharif remains as cultivable fallows.
- The reason behind the some patches remaining as cultivable fallows during both the seasons is attributed to poor irrigation water availability during Rabi season and almost nil during Kharif season.
- Almost all the Kharif cultivation depends either totally on rainfall or limited ground water resource supplied for their preliminary irrigation requirement.
- Also 10% of total 80% shows perennial cultivation, which is classified as Alphalpaha and vegetables.
- For the water scarce region like North Gujarat the cultivation of Alphalpaha which requires very high amount of water proves to water demanding crop.
- The results were derived for two consecutive Rabi season from multi temporal satellite data source i.e. for Rabi 2007-08 and Rabi 2008-09, in Rabi cultivation the predominantly major crop is found to be wheat and Raydo.
- The water bodies occupied of about 6% of total study area, comprising of rivers, streams, canal networks right from branch canals to field
distributaries, ponds, reservoirs and other water storing bodies as analyzed from the results of figure 4.19 and figure 4.13.

- The canals are normally found to be lined on at branch canal level the distributaries’ and minors are appearing in dark black colour which shows they are unlined canals.

- There are no continuous drainage connections, as observed in figure 4.13 within the command. Many paleo channels are reflected in satellite imagery visual interpretation which shows that they have been buried due to scarcity of flowing water.

- Under the category of waste lands two classes are considered, 1) Salt affected and 2) Water logged area.

- There is no salt affected area seen in the command and no water logging is also reflected. The result of figure 4.9 and 4.22 also shows that the area is not having any wet lands on sandy deposits.

- Most of the areas falling under the category of uncultivated land are seen to cultivable fallows. Strategic and judicious use of (surface and ground), irrigation water management can convert all area into cultivated lands.

- The command area, thus does not suffer from water logging and salinity but the water samples of the existing tube well (ground truth details) showed the traces of unsafe ranges of fluorine content (>1.5 mg/l).

- The landuse identifies the study area to be highly potential area for development water harvesting structures. Land use classification category, being the agriculturally predominant area induces recharge.

- The study area is well connected (ref: figure 4.9) with the road network right from national highways to well constructed village road networks. The Unjha railway junction is connecting the area with all major places in India.

- The suitability of the command area for developing recharge structures, as per different parameters has been tested. This exercise can become a part of command area development practice which can be implemented to increase the overall performance of the considered irrigation command.
• For the development of recharge schemes and inter basin connections can be practiced to solve the scarcity of irrigation water.

• It has been concluded from the exercise that the study area falls in the category of excellent to good recharge potential area according to results shown in figure 4.23. The area is having the mild slope of about 3% which is towards natural drainage areas which retains runoff and recharge can be induced which is shown in figure 4.17.

• The geology of the area as shown in figure 4.15 is also recharge inductive as it falls under the category of silty loam and alluvial deposits as per the map no.

• The drainage pattern is discontinuous but well connected giving better prospects of water transfer. This is also excellent factor for practicing water recharge schemes.

• The geological layer shows mainly sand sheet, sand dune of Jantral formation which gives excellent and good recharge capability, other predominant geological feature is flood plain which gives moderate recharge ability.

• Hydro-Geomorphologic units of the study area as reflected in figure 4.16, having identical water bearing and transmitting capabilities, shows the presence of alluvial plains which has excellent water holding and transmitting capacity giving the area high potential for developing recharge areas.

• The rivers within the command are of non-perennial nature which does not give them potential to work as source for recharge activity. The sources of water recharge sources can be developed as induced, injection wells. Intra basin transfer can be practiced for recharge activities.

Following conclusions and recommendations are drawn and suggested from the performance appraisal of the irrigation block 6 of branch canal 3 of the SRBMC of Dharoi irrigation scheme.

• In present study more productive and normal growing season was reflected to be during 2008 compared to 2009. Temporal study of crop growth stage can
be done using Remote sensing, GIS and appropriate satellite data having good temporal and spatial resolution.

- Full canopy stage for winter crops in command area was found to be mid of February for both seasons i.e. 2008 Rabi and 2009 Rabi; Full canopy refers to maximum photosynthetically active growth stage and also considered to be peak water requirement period. Water scheduling must be planned as per water required by a particular crop at particular growth stage and more productive use of agriculture water must be planned.

- Crop acreage was found to be 75% of total cropped area during Rabi 2008 and 65% during Rabi 2009, showing more productive season during Rabi 2008. High spatial resolution satellite data like IRS P6 LISS III product can be used to predict the crop yield and crop acreage during the particular season. This data can be further used for agro-economic analysis.

- Major crop of the study area during the Rabi season 2007-08 and 2008-09 was found to be Wheat and Raydo. The soil analysis results revealed that area has silty clay loam, and soil depths upto 105 m which is highly suitable for the cultivation of wheat.

- Reference Crop evapotranspiration for the area was found to be 5.65 mm/day and average Crop evapotranspiration was found to be 3.39 mm/day for the month of February 2008 and the water requirement for particular season of Rabi crop estimated as 1050 mm on basis of average values. Such exercise can be done on monthly basis and during entire growing season real time irrigation scheduling must be practiced using spatial crop coefficient values, spatial reference Crop evapotranspiration and spatial evapotranspiration maps and water requirements must be worked out.

- Adequacy and Equity are maintained well at the head reaches of the canal distributaries and decreases at the lower reaches. This is attributed to illegal water thefts at the head reaches and very poor maintenance of canal
structures, outlets and gates which induces the spillage, wastage and overdraft of the water.

- Rapid appraisal process focused on the requirement of maintenance of irrigation structures like gates, outlets and distributory level distribution system. The lining, desilting and weeding is strongly recommended.

- Water User Associations must be emphasized to educate and direct the farmers to practice the equitable distribution of water and do water budgeting with scientific cropping practices and adopting suitable irrigation methods. Special training camps should be organized for this.

- More female participation their involvement in the decision making must be emphasized by the WUAs as it is very less as much as 5%. Compared to their involvement in decision making, they are rather involved in physical labor i.e. about 49% female participate only as farm workers.

- Only 3% of canal network as per percentage of Water User Association shows more than 75% structures maintained in good condition as against 56% 3% of canal network as per percentage of Water User Association shows only 25% canal structures maintained in good state, which is a very alarming situation for lack of maintenance.

- From total Water Users Associations (WUAs), 30% of WUAs could provide equitable water to less than 25% of farmers under their control compared to that only 3% of WUAs could provide equitable supply to 75% farmers under their management. This emphasis on importance of improving operation management strategies.

- The conveyance efficiencies was found to be as high as 97% for Main canal running across block 6 i.e. from chainage 3900 Km to 4140 Km and 96% for chainage 4140 Km to 4340 Km. The conveyance efficiencies of branch canal were also good ranging from 97% at head to 73% at tail but it decreased at distributory level upto 66% for M5L distributory.
• Linear Optimization of cropping pattern using optimum surface and limited ground water proves to be best exercise for better returns and increase the over all productivity of the irrigation scheme in terms of food grain production and revenue generation.

• Different permutation and combination of cropping pattern must be exercised to develop the strategy, on year to year basis to get maximum revenue generation. To maximize net benefit the crop which generates more revenue in terms of market price and utilizes less ground and surface water must be selected.

7.2 Important Contributions of the Work

• Land Use Land Cover Maps are generated for the study area using two types of Satellite Data Products i.e. IRS P6 LISSIII and LANDSAT VII Thematic Mapper sensors. These maps can be used for land use planning, Wet land analysis, Soil moisture detection etc.

• The Elevation maps can be used for various Infrastructure development concerned to irrigation and ground water development sites.

• The potential Water rechargeable sites have been identified which can serve useful for locating harvesting structures and do water shed development in the command area.

• Remote Sensing based performance indices like NDVI and SAVI are generated and equity and Adequacy are worked out based on that for two distributors M3LA and M5L.

• Crop Water requirement is worked out using average of spatial Crop Evapotranspiration maps generated. An attempt has been made to practice irrigation scheduling.

• Thorough Soil analysis is done to check the suitable soil for existing cropping pattern.
• Rapid Appraisal process (RAP) is applied for the study area which shows the thrust areas of immediate concern to improve the performance of command. It also suggests the remedial actions to be implemented over the existing Participatory Irrigation Management practice.

• Optimized Cropping pattern suggested as result of Constrained Linear programming can be practiced to increase the Net benefit from agriculture production.

7.3 Scope for future Work

• From the generated Land use Land cover map the land use planning can be done by giving prioritation to irrigation for fertile lands, to improve the performance of any irrigation scheme.

• Sustainability of groundwater resources can be continuously monitored to evaluate the rate of depletion of aquifer layer, using RS and GIS technique.

• Performance parameters like equity, adequacy and agricultural productivity can be evaluated using Thermal Infrared (TIR) data product.

• Irrigation scheduling can be planned for whole season for all crops during the year based on Remote sensing based Crop evaporation data using Surface Energy Balance (SEBAL) technique.

• Crop growth stages must be studied for any command and water must be provided according to need during the particular stage

• Based on available moistures at root zone layers, on farm efficiencies can be evaluated to supply optimum and necessary water.