Irrigation Strategy in Bhal Area (A Case study of Bhal Area)

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Abstract— Water is the necessity for the human, animal and agriculture life. Water is given to crop by irrigation for the growth of the crop. Different lands have different strategy of water, some type of crops need more water for its growth and some crops need lesser water. Some types of soil have different problems like black cotton soil which swells and shrinks quickly. Bhal area is that type of area where the traditional system to apply water for irrigation to crop were not successful. And finally through carrying out different types of survey works, it is concluded that underground pipe line system is the best for irrigation. This system is more suitable than other system. This paper examines the factors underlying irrigation development in Bhal area, reviews the water supply situation, and describes trends in water demand and irrigated agriculture. The overall water management in the region is assessed and recent trends in investments in the water sector, with a focus on large-scale irrigation systems. It concludes that in this context of accelerating demand and declining irrigation investments, new water development is not the primary solution to water resource challenges in the region. Much greater attention is needed on water policy and management reform to improve the efficiency and equity of irrigation and water supply systems. In order to pay for future investments, irrigated agriculture needs to produce high-value crops for both local consumption and exports into competitive world markets. Policies to officially transfer management responsibilities from agencies to farmers - and to privatize urban water supply and sanitation - are increasingly important. The complex tradeoffs across sectors and across water uses can best be managed through integrated water management at the river basin level—but developing appropriate institutions for intersectoral water allocation remains an important challenge under the fragmented management structure in most of Bhal area. Thus, the challenges for water policymakers in the region are great, but a strategy that focuses on river basin management, irrigation management transfer and privatization, and market-based water allocation can effectively address these challenges. Overall, the paper concludes that Bhal area should focus on (1) Creating Additional Surface Storage, (2) Preserving surface water, (3) Controlling Groundwater and controlling salinity, (4) Encouraging general efficiency of irrigation water use, (5) Enhancing yields through improved farming practices.

Key words: Irrigation, Bhal, Strategy, Black cotton soil, Swelling, Water

I. INTRODUCTION

Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

A. Purpose of Irrigation:

Providing insurance against short duration droughts, Reducing the hazard of frost (increase the temperature of the plant), Reducing the temperature during hot spells, Washing or diluting salts in the soil, Softening tillage pans and clods, Delaying bud formation by evaporative cooling, Promoting the function of some microorganisms, to supply water partially or totally for Crop Need, To cool both the soil and the plant, to leach excess salts, to improve groundwater storage, to facilitate continuous cropping, to enhance fertilizer application fertigation.

B. Necessity of Irrigation:

i) Uncertainty of monsoon rainfall: 80% of rainfall in India is received during monsoon period. Monsoon rainfall is very uncertain. So irrigation is very important for supply of water to plants when needed, ii) Uneven distribution of rainfall: To compensate the uneven distribution in an area, supplemental irrigation is needed, iii) Effect of winter rainfall (N-India): Supplemental irrigation is inevitable in the regions due to poor rainfall, iv) Cultivation of high yielding crops: High yielding crops produce heavy biomass and economic yield. Higher biomass need more water for its production. Hence supplementation of water as irrigation is essential. Difference in water holding capacity of the soil: Sandy soil - low WHC – frequent irrigation. Clay soil - high WHC – frequency is less.

C. Advantages of Irrigation:

Increase of food production, Modify soil or climate environment – leaching, Lessen risk of catastrophic damage caused by drought, Increase income & national cash flow, Increase labor employment, Increase standard of living, Increase value of land, National security thus self sufficiency, Improve communication and navigation facilities, Domestic and industrial water supply, Improve ground water storage, Generation of hydro-electric power.

D. Disadvantages of Irrigation:

Water logging, Salinity and alkalinity of land, aeration of soil, Pollution of underground water, results in colder and damper climate causing outbreak of diseases like malaria.

II. METHOD OF IRRIGATION

A. Types of Irrigation System:

(A) Surface irrigation: (a) Flooding method, (b) Furrow method, (c) Contour farming. 
(B) Sub-surface irrigation (C) Sprinkler irrigation (D) Drip irrigation

Other methods of irrigation are also described as: - Free flooding, Contour laterals, Border strips, Check basin, Basin flooding, Zigzag method.
1) **Surface irrigation:**

   a) **Flood Irrigation:**
   Flood irrigation is an irrigation technique in which a field is essentially flooded with water which is allowed to soak into the soil to irrigate the plants. The big problem with flood irrigation is that all the water do not reach the plants. Up to 40% is lost through evaporation and runoff.

   b) **Furrow irrigation:**
   Furrow irrigation is conducted by creating small parallel channels along the field length in the direction of predominant slope. Water is applied to the top end of each furrow and flows down the field under the influence of gravity. The spacing between adjacent furrows is governed by the crop species, common spacing typically range from 0.75 to 2 metres. Furrow irrigation is particularly suited to broad-acre row crops such as cotton, maize and sugar cane. It is also practiced in various horticultural industries such as citrus, stone fruit and tomatoes.

Fig. 1: Furrow irrigation

2) **Contour farming:**
   The practice of tilling sloped land along lines of consistent elevation in order to conserve rainwater and to reduce soil losses from surface erosion. These objectives are achieved by means of furrows crop rows and wheel tracks across slopes, all of which act as reservoirs to catch and retain rainwater, thus permitting increased infiltration and more uniform distribution of the water.

Fig. 2: Contour farming irrigation

3) **Sprinkler Irrigation:**
   In the sprinkler method of irrigation, water is sprayed into the air and allowed to fall on the ground surface somewhat resembling rainfall. The spray is developed by the flow of water under pressure through small orifices or nozzles. The pressure is usually obtained by pumping. With careful selection of nozzle sizes, operating pressure and sprinkler spacing, the amount of irrigation water required to refill the crop root zone can be applied nearly uniform at the rate to suit the infiltration rate of soil.

Fig. 4: Sprinkler irrigation

4) **Drip Irrigation:**
   Drip irrigation, also known as trickle irrigation or micro irrigation or localized irrigation, is an irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, etc.

Fig. 5: Drip irrigation

B. **Other Method of Surface Irrigation:**

1) **Border Strip Irrigation:**
   This farm is a recent conversion to irrigated dairy farming, 1997/98 being the second season of operation. The total area of the farm is 200 ha, with an effective farm area of approximately 192 ha. Of this approximately 165 ha is irrigated. The irrigation system is a border strip system with 24 meter wide strips. These strips are twice the width of the traditional border strip design. Length of borders range from about 200 meters to 300 meters.

Fig. 6: Border strip irrigation

2) **Check Basin Irrigation:**
   Check basins are rectangular or square small plots surrounded by levees or checks basins. It is also possible to
construct basins on sloping land, even when the slope is quite steep. The flatter the land surface, the easy to construct basins. Potatoes, beet, carrots, rice, citrus, banana, clover, tobacco

Fig. 7: Check basin irrigation

3) **Basin Flooding:**
Special type of check flooding. Adopted specially for “Orchard trees. One or more trees are generally placed in the basin; Surface is flooded as in check method by ditch water.

Fig. 8: Basin flooding irrigation

4) **Free flooding:**
Ditches are excavated in the field, Movement of water is not restricted, it is sometimes called “wild flooding”. It is suitable for close growing crops, pastures etc. and this method may be used on rolling land (topography irregular) where borders, checks, basins and furrows are not feasible.

Fig. 9: Free flooding irrigation

III. **STUDY AREA**

Command area of Sardar Sarovar Narmada Project is characterized by wide diversity of agroclimatic and socio-economic features. The command area therefore has been divided into 13 regions. Region 7 is known as ‘Bhal’ area. The area is covered under command of Vallabhipur Branch Canal offtaking from Ch.70.680 km. of Saurashtra Branch Canal. The area is situated in Dholka and Dhandhuka Talukas of District Ahmedabad, Barvala Taluka of District Botad and some portion of Taluka Bhavnagar of District Bhavnagar. The area is situated between boundaries of Ahmedabad-Rajkot Highway, Vallabhipur Branch Canal & Sea coast of Bay of Cambay comprising of 1.40 lacs ha.

IV. **STRATEGY OF BHAL AREA**

A. **Strategies Decided In Past:**

1) In Mahi-Kadana and Ukai-Kakrapar projects consist up similar nature of soil, the canals with banking in coastal area are not functioning satisfactorily and breaching occurs often. The time has proved that the traditional system of canal in banking is likely to cause problems and reliability and adverse effect of raising ground water table and salinity on surface.

Fig. 10: Narmada Canal Command Area

B. **Survey Work in 1992:**

1) All the canals between 20’ and 30’ contour should be in full cutting. Lining of these canals should not be taken up, so that, they work as drains also during monsoon and prevent rise in water table. (2) Irrigation shall be done by lifting water from canals for which lift irrigation units of about 40-50 ha. each chak be formed. (3) The FSL of canals be kept below ground level, preferably below root zone to control water logging. (4) In view of paucity of irrigation water available from SSP (Water allowance at plant of 227 mm/ha. for Region 4 and 252 mm/ha. for Region 7), it has to be used most economically, ruling out any possibility of using this water for leaching down of salts. As the farmers have to make efforts to lift water for field application and in conveyance upto fields, the water requires to be used judiciously by the farmers, and the operational losses requires to be considerably reduced avoiding water logging and salinity problems.
C. Survey Work in 2001:
First meeting of the study group was held on 2001. Based on the above study, the recommendations of the study group for the irrigation strategy for the Bhal area were as under:

1. Distributaries, Minor & Sub-minor Canals should be constructed in partial cutting or banking or partial banking or bad banking with lining as per conventional method of gravity flow. (A) A limited irrigation water should be given 25 cm/year per ha by gravity method in one or two watering. (3) Appropriate cropping pattern of short duration and high yielding should be adopted in addition to existing crop pattern of wheat, gram and cotton. (4) Crop should be grown to be requiring limited water. (5) If possible, village tanks to be filled by nearest canal.

D. Survey Work in 2010:
Area below and about 7.5 m GTS RL has been found under inundation depending upon frequency and nature of flood, precipitation nature and occurrence, drainage, and Tidal effect. (1) The area is under flood zone affected by 9 big rivers namely, Limbdi-Bhogavo, Bhadar, Lila, Utavali, Khalkhalio, Padalio, Keri, Ghelo and Kalubhar. When any 2 to 3 rivers’ flood and Tide in Gulf of Khambhat occur simultaneously the affected area comes. (4) Under severe situation of sheet flow of about 0.90 m to 1.20 m resulting in inundation. (2) In situation of sheet flow, there is every possibility of washing out the small canals and overtopping the banks etc. In the year 2007 flood water overtopped VBC at various locations in spite of 0.90 m Free Board. Naturally distributaries and minors are approximate at 0.50 m and 1.00 m lower than VBC because of cut off to be given at H.R. and less Free Board. (3) Due to poor construction quality of soil i.e. it is mostly composed of CH & MH type which is not suitable for earth work in embankment, huge quantity of good soil shall have to be conveyed from very long leads, which may lead to high construction cost.

E. Survey Work in 2012:
1) Irrigation Strategies Recommended By the Committee:
(1) In consideration of coverage of more area under agriculture activity by farmers than at initial planning stage of the project in 90’s due to growing of salt tolerant species, reduction in class of salinity due to prolonged irrigation, committee recommended inclusion of all such area in the CCA during detail design without going into nitigity of approval given and allocation of water. (2) The entire area covered under Dholera SIR Needs irrigation facilities in consultation with DSIR Authorities. (3) Construction of distributaries and sub distributaries proposed in conventional mode with earthen embankments. Distribution systems of minors and sub minors proposed with underground pipe network, except few minors in initial reach of the distributaries where inundation is not observed. Construction of only distributaries to be taken up first in conventional gravity flow with earthen embankment providing proper protection against inundation along with some pilot projects of UGPL minors at initial reach and tail reach of distributaries. Upon successful implementation of pilot project, large scale construction of UGPL system to be taken up. (4) Planning of distribution system of minors and sub minors in conventional mode to be revised for providing underground pipe network for maximized use of available head in the distributaries. Accordingly the service area of a minor in conventional mode of average 500 ha. may be revised into a service area of smaller size under one piped minor directly off taking from the parent distributary. As such, number of off takes of pipe minors from distributaries would be increased, accordingly. (5) Where long term irrigation water supply is not to be made i.e. T.P.scheme No. 1 & 2 of Dholera SIR, where early development of SIR is in process, UGPL system to be provided also for distributaries/sub distributaries’ for economically feasible length. (6) For better functioning of distributaries’ sufficient nos of escapes be provided with tail channel/pipe out falling into natural nalla or govt. waste land. (7) In first instant construction of only UGPL minors with delivery point of chak area are recommended. The farmers may arrange from the head chamber of chak to their field. (8) All field level effort, with extension services be made for educating the farmers for a common ‘khet talavdi’ under a service area or chak. (9) Where supply is required to be made with power, the system should be so designed that the farther end is terminated with residual head of 1.2 to 1.5 mt. (10) Where supply is possible with gravity with available head of 20 cm. at farther point necessary pump cleaning system to be provided. (11) Where supply of irrigation water with gravity or pumping with consent of WUA is possible but farmers are not ready for ‘khet talavdi’ piped network to be constructed only up to minors. (12) Where the head is not available in the system enabled to deliver water up to the field and at the same time, farmers are not ready to take-up the running and maintenance cost of the pumping system once established at SSNNL cost, at such locations instead of providing pumping systems, delivery only upto the water level (-) 1.0 mt. be covered in the system. However where the area below (-) 1.0 mt. remains more than 50 ha, then delivery up to (-) 1.5 mt. or more may be allowed in the system. Water be made available in a open well with local arrangement. So that farmer wise pumping is possible, there also some sorts of arrangement to avoid entry of silt and inundated water into inletting pipe be provided. Facility of power cleaning to be made.

Fig. 11: Image of Khet Talavadi

V. REPORT OF BHAL COMMITTEE
1) At present to construct only distributaries in such area and land acquisition for only distributaries to be done first.
2) After completion of distributaries dialogues with the beneficiary farmers to be done for whether to go for advance irrigation practice like micro irrigation system or not to be decided.
3) Method of irrigation to be adopted, construction of minors & sub minor canals and suitable drainage strategy to prevent water logging to be decided afterwards.

VI. CONCLUSION

It has been observed that during recent years, due to development of farm technique has now been & making use of saline water in irrigation for ground of salinity resistant specially designed species of various crops, much more area which earlier remained uncultivated has now been brought under cultivation by the personal efforts of individual farmers. Alternatively, as the construction of the branch canal is completed, construction of major distributaries in advance stage, addition of new area even otherwise developed as reformed soil is not possible. (1) All the distributaries to be constructed up to its full length with proper surface protections to embankments against inundation. Distribution systems of minors and sub minors are proposed with underground pipe network, except few minors in initial reach of the distributaries where inundation is not observed. (2) Construction of only distributaries be taken up first in conventional gravity flow with earthen embankment providing proper protection against inundation along with some pilot projects of UGPL minors at initial reach and tail reach of distributaries. Upon successful implementation of pilot project, large scale construction of UGPL system is taken up. However, it is imperative that Bhal area shall focus on: (i) creating additional surface storage; (ii) surface water preservation particularly by lining canals in saline areas and watercourse improvement; (iii) groundwater conservation and salinity control by discouraging excessive tube-well use; (iv) encouraging general efficiency of irrigation water use through improved land management techniques including land-leveling and also by changing the cropping pattern; and (v) yield enhancement through improved farming practices, adopting hybrid seeds, and increased fertilizer and pesticide use. This, together with a clear vision that the Bhal Irrigation system will be publically owned and operated but with sensible institutional reform (including the increased price of canal waters) which would increase water use efficiency without destabilizing the entire system of existing irrigation entitlements, is the recommended strategy for the future.

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