Title: Reuse of irrigation drainage water from command areas: Learning from Traditional *Gonchi* channels in Andhra Pradesh, India

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Abstract

Gonchi seepage channels in Anantapur district of Andhra Pradesh, India are traditional forms of diversion channels used by farmers to divert seepage water from streams and rivers to cultivate food crops. Each such *Gonchi* channel runs for about 3 to 7 km and typically each irrigates 200 to 300 acres. Farmers benefiting from these channels are traditionally organized into strong informal groups and local regulations on allocations and use are still in place in most of the villages. Paddy is the predominant crop cultivated in these areas during October to January period every year.

A field study done on 37 such channels in Pennar river basin revealed that most of them are being maintained well by *Gonchi* committees but few require renovation works that are beyond the capacity of these committees. These channels once used freshwater from rains and seepage flows in streams and river Pennar. After the construction of Mid Pennar Reservoir (MPR) at Penakacherla in Anantapur district in 1968, these seepage channels got rejuvenated by increased inflow of irrigation drainage its command areas. Many seepage channels in Anantapur district may be renovated through systematic re-use of such drainage water from command areas of modern irrigation projects.

Key words: *Gonchi*, Seepage channels, reuse of irrigation drainage

1. Introduction

India has a diverse practice of traditional water conservation, storage, distribution and utilization methods evolved and practised traditionally for centuries. While the methods and technologies differ in configuration and application, there are many commonalities among them. Most of these traditional methods are simple in construction; operation and maintenance. They are low-cost methods and evolved by indigenous communities based on their social, cultural, environmental and economic conditions. More importantly, the spirit of community participation; collective ownership and efficient use of resources are common features in them.

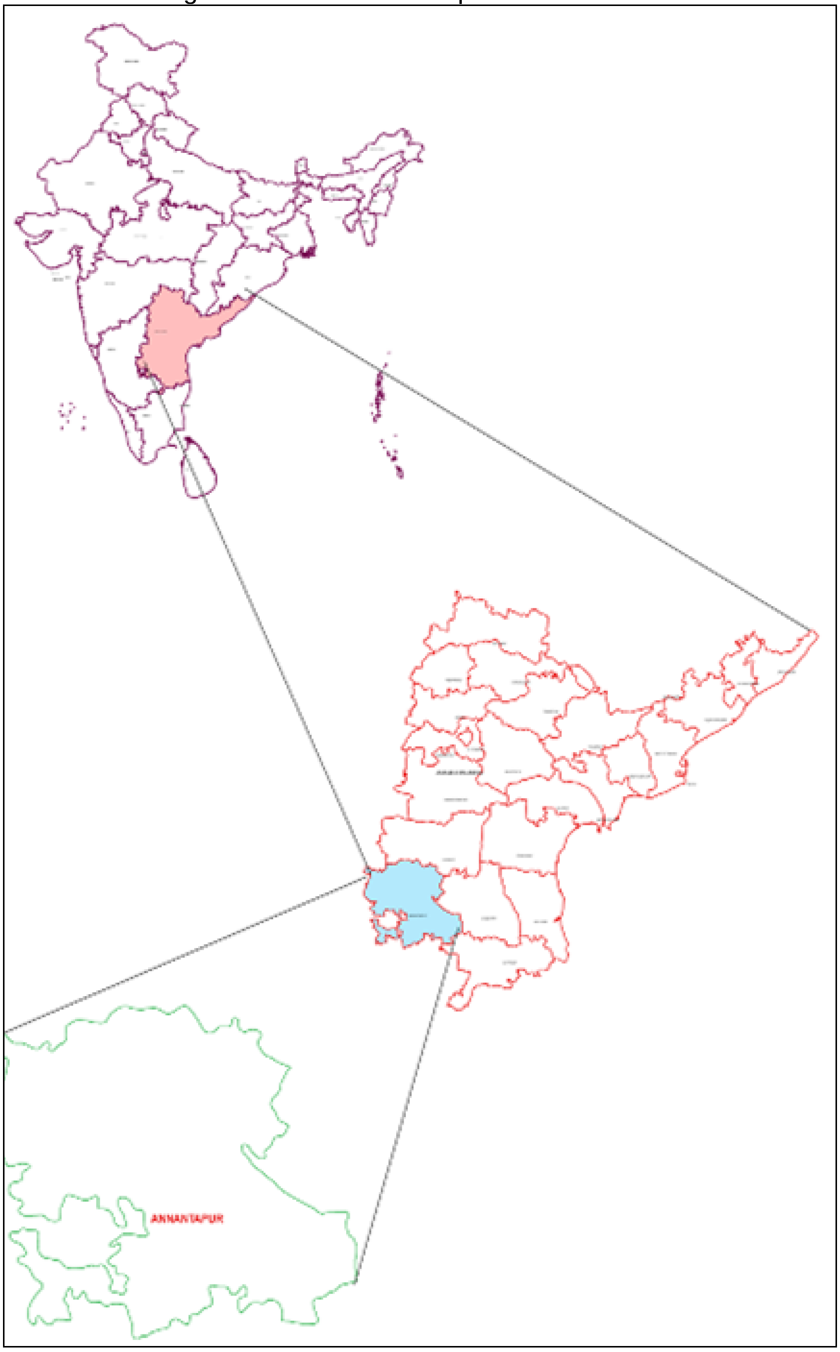
Gonchi seepage channel is one such traditional system in surface water management. The *Gonchi* system of sharing surface water for irrigation in chronic drought-prone district of Anantapur in Andhra Pradesh exists over the last three centuries. The collective effort and concern for equitable distribution of water are the unique features of this system. Local and informal regulations on allocations and distribution of water sustained these systems over centuries.

1.1. Anantapur district and its water resources

Anantapur District is a chronic drought-prone district located in southern part of Andhra Pradesh State in India (Fig.1). Average annual rainfall of the district is 553 mm against the State average rainfall of 925 mm and its erratic distribution has been a regular feature in the district. The district suffered severe drought for 6 years over last 10 years period (2000-2010) resulting in extensive crop loss; unemployment; suicides among farmers; and mass migration to neighbouring cities and States. There was an exponential increase in number of bore wells in the district over last few decades. Overexploitation of groundwater using bore wells resulted in drying up of many bore wells further leading to crisis situation in agriculture. Farmers who invested in drilling more number of bore wells entering into an insurmountable debt trap. But, many villages of the district could sustain the impact of drought by adopting *Gonchi* system of surface water sharing.

The district is spread over an area of 19.13 square kilo meters with a population of 36,40,478 as per the census in 2001. Pennar, Chitravathi,Papagni, Hagari and Swarnamukhi are major rivers flowing in this district. Chitravathi and Papagni are tributaries of Pennar, whose catchment area covers about 80% of the total area of the district.

Fig.1: Location of Anantapur District in India



The district has total cultivable land of 30,98,800 acres while only 5,35,940 acres (17.3%) has irrigation source from surface water bodies and reservoirs. Out of this, 60% of the lands are irrigated from major irrigation projects ((part of Tungabhadra High Level Canal System) and remaining 40% is irrigated from minor irrigation sources such as small irrigation dams, traditional tanks, ponds, seepage channels etc. Due recurring drought conditions, most of these surface water irrigation sources are only able to harvest and distribute water to part of respective designated command areas. Groundwater is the second major source of irrigation in the district. As per the 4th Minor Irrigation Census, there are 1,11,566 shallow and tube wells in the district irrigating a total area of 2,82,115 acres in 2006-07 (GoAP, 2009).

1.2. Pennar river and Mid Pennar Reservoir

Pennar is one of the major rivers in South India that flow from West to East. Pennar starts its journey from Nandidurg hills in northern part of Karnataka and enters Andhra Pradesh near Perur in Anantapur district. The river flows towards East through Kadapa and Nellore districts before joining Bay of Bengal. The river has a total length of 597 km and traverses mostly in Andhra Pradesh before it joins Bay of Bengal on the east. The Pennar river has a total drainage basin of 55,213 sq.km with 48,276 sq.km in Andhra Pradesh and remaining in Karnataka.

Mid Pennar Reservoir (MPR) is a medium irrigation project built on Pennar river near Penakacharla in Pamidi mandal of Anantapur district in 1968. The project irrigates a command area of 49,226 acres through its North and South canals. Paddy is the predominant crop cultivated in this command area, though irrigation planning was done for Irrigated Dry (ID) crops in 50% of the command area. Following table 1 presents the details of these canals and area irrigated:

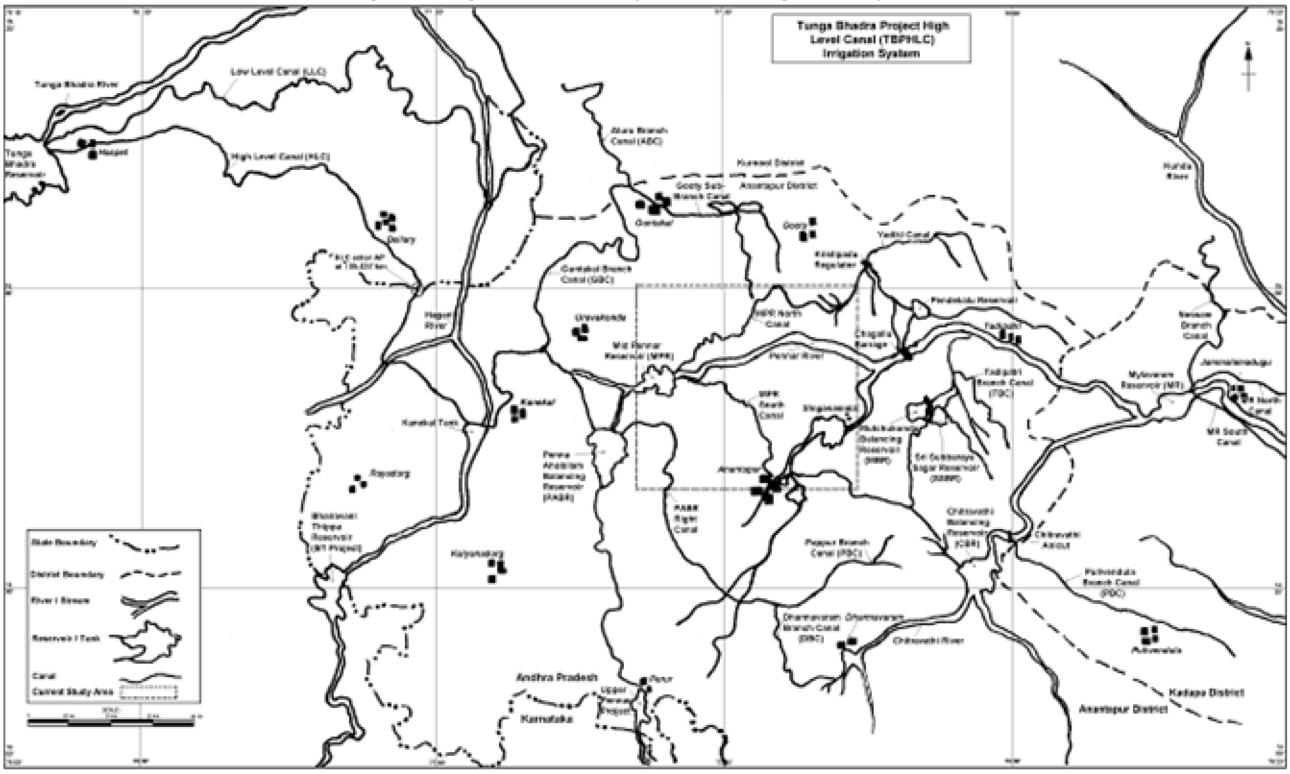
Table 1: Details of MPR canals

Canal	Length (km)	No. of Distributaries	Total command area (acres)
South Canal	96.7	29	36,052
North Canal	58.5	19	13,174

Source: I & CAD Department, Government of Andhra Pradesh

The High Level Canal (HLC) of Tunga Bhadra project on Tunga Bhadra river feeds the MPR dam with annual allocation of 6.19 Thousand Million Cubic Feet (TMCft), as per the Bachawat Award on sharing Krishna river waters among Karnataka, Maharastra and Andhra Pradesh states (refer Fig.2 for location of MPR dam and its canals). Both South and North canals of MPR traverse through several villages wherein traditional *Gonchi* seepage channels are existing for several centuries. In essence, inter-basin transfer of water from Tunga Bhadra dam to MPR augmented the water availability and utilization in Pennar basin after 1968. This new water that entered the hydrological cycle of the Pennar river, after being used as irrigation water, is again seeping into the *Gonchi* channels.

Fig.2: Tunga Bhadra Project HLC Irrigation System



Source: Index Map of TBPHLC system, I & CAD Dept., Andhra Pradesh (undated)

1.3. Gonchi channels in Penna river basin

Gonchi is a local system of sharing surface water diverted by gravity from natural streams and rivers. The system *'Gonchi'*, is developed by the local people and being practised since more than three centuries. Each Gonchi system caters to the irrigation needs of about 200-300 acres of paddy (rice) cultivation. In some fo these channels, two crops of paddy is cultivated, once during October-January and a second crop during

January-March. There are few such Gonchi systems in practice even now all along the course of Pennar river and Thadakaleru, a natural stream in Pennar river basin. At the head of these channels, farmers prepared large pits (locally called *talipiri*) on stream / river bed from which the oozed water will be diverted to the channel by gravity flow. In case of low flows in the stream, they sometimes block water flow by constructing a temporary structure to raise water level and divert water from the main stream to the required channel.

1.4. Farmers committees in Gonchi channels

A *Gonchi* committee consisting of all farmers in the command area manages the water use; distribution; and maintenance of the system in a participatory approach. Each of the committee members contributes voluntary labour to de-silt the diversion and distribution channels every year before rains. The diverted water is distributed equitably in proportion to the land holding of each farmer. Precise measurement and distribution of water is done using a wooden plank (locally called *pantham*) with grooves on it. These planks are used at different places in the distribution channels to regulate and allocate water to all in an equitable and systematic manner. Such a plank that is used at different places in command area is named as '50 acre plank', '30 acre plank' etc., depending on the area irrigated by that plank.

To maintain and manage *Gonchi*, a representative is selected among the committee members in consensus. He will be treated as the elderly person (in local language, *Pinna Pedda / Gonchigadu*) and will be responsible to manage the affairs of the committee smoothly. He will mediate and resolve any disputes arising in sharing water and authorized to give a final verdict in such cases. Members form norms and regulations that need to be followed by everyone without any exemption. The responsibility of regulating water to different fields will be assigned to a person called *Neerugatti,* who will be appointed by the members together and paid a share of their crop to him.

2. Methods

2.1. Tracing the history of seepage channels

Though the seepage channels existed for few centuries, not much historical evidences and documentation is available on them. During early 20th century, the British engineers carried out extensive studies on the status of traditional tanks and irrigation channels in Anantapur, Kadapa, Chittoor and Kurnool districts in Andhra Pradesh. These details were documented in the form of Descriptive Memoirs of Irrigation Works (British Government in India, 1922).

Pennar river was divided into sub-basins and further into minor basins for the purpose of this enumeration. British engineers identified each seepage channel, described its physical condition and identified any major repair works to be done. Estimates for the same were prepared and compared with the revenue in terms of taxes assessed from the command areas of these traditional irrigation sources. Though primary purpose of British government in this documentation is to maximize their revenues from these irrigation sources, these documents reflect their systematic and precise work and hence can be treated as an important historical document and authentic reference for researchers.

These memoirs describe some of the present day seepage channels as diversion channels from the Pennar river diverting river water through gated sluices. This reveals that these channels were originally diversion channels but later converted as seepage channels when river flows reduced over a period of time. Following Fig.3 presents sample pages from these memoirs.

Fig.3: Sample pages from the memoirs

No. XXII, PENNER KUNTA CHANNEL.

Ayacut 122·20 acres. Assessment Rs. 636-3-0

This channel has its head in the bed of the Penner river about 2 miles north-west of No. 6 Koppalakonda village in Anantapur taluk. It has an average bed width of 6 feet, side slopes $1\frac{1}{2}$ to 1 and bed fall 1 foot per mile and can carry 6 cusecs with a depth of water 1·1 feet.

The channel is in fair order. Irrigation is carried on by means of cuts.

No. XXIII, PENNER KONDA CHANNEL.

Ayacut 272·55 acres. Assessment Rs. 1,451-3-0.

This spring channel has its head about $2\frac{1}{4}$ miles north-east of Ramapuram, a hamlet of No. 5 Penakacherla village, Anantapur taluk.

The channel has an average bed width of 6 feet, side slopes $1\frac{1}{2}$ to 1 and bed fall 4·71 feet per mile and can carry 8·32 cubic feet per second during dry season with a depth of water one foot. The channel is intercepted by one cross drainage whose catchment area is 1·65 square miles and maximum flood discharge of 417 cusecs and the channel gets filled up when the cross drainage vanka is in floods and it is dug in the bed of the vanka when necessary. Irrigation is carried on by means of cuts. The usual clearance of the channel is attended to by the ryots.

Source: British Government in India (1922,89)

ISOLATED WORKS

No. CCXXI, PALEM PENNER CHANNEL.

Ayacut 91·25 acres. Assessment Rs. 456-14-0.

This spring channel has its head in the bed of the Penner about $1\frac{1}{4}$ miles south-west of No. 35, Katrimala village, Gooty taluk, above an anicut 67 feet long. At the head of the channel there is a head sluice having a vent one foot wide and $1\frac{1}{2}$ feet high.

The channel has an average bed width of 4 feet, side slopes $1\frac{1}{2}$ to 1 and bed fall $2\frac{1}{2}$ feet per mile and can discharge 3·97 cubic feet per second with a depth of water one foot.

The channel is intercepted by two cross drainages, the first having a free catchment basin of 1·78 square miles with a maximum flood discharge of 438 cusecs and the second one having a free basin of 10·56 square miles and a combined basin of 13·27 square miles with a maximum flood discharge of 1,680 cusecs. There are no masonry works and the channel, which gets filled up during floods, is dug in the bed of the vanka when necessary.

Source: British Government in India (1922,89)

2.2. Field study on *Gonchi* channels

A detailed field study is carried out along the course of the river Penna in Anantapur district during last one year (2010-2011) to understand the spread of seepage channels in Pennar basin; present state of these channels; present functional state of farmers' committees; affect of reuse of drainage water on extent of command area, cropping and water quality.

A team of field workers visited 28 villages along the river Pennar and interacted with the farmers about the past and present status of 37 such seepage channels. Also, the team visited the origin of each seepage channel and studied their entire course from origin (*talipiri*) to the distribution points in the command areas to map the course and to understand the condition of the channels and cross-drainage structures in totality. Points where repairs and renovations need to be done were also identified in each of these seepage channels. GPS points were collected for origin and different intermediate points of the channels. From the topographical maps, satellite images and field GPS survey, a map locating all 37 channels is prepared.

Following Table 2 presents number of channels studied in each mandal (an administrative unit) within the Pennar river basin in Anantapur district and Fig.4 presents two photographs representing a typical seepage channel.

Table 2: Seepage Channels studied in Pennar river basin

Location of Channels	Mandal	Villages	Total Channels
Channels originating from Pennar River	Garladinne, Singanamala, Pamidi, Pedda Vaduguru	16	25
Channels originating from Thadakaleru stream	Bukkarayasamudram, Singanamala, Anantapur	10	10
Channels originating from Pooletivagu stream	Pamidi	2	2

Fig.4: Origin and Channel portion of a typical seepage channel

Talipiri of a seepage channel on the Pennar river bed

Seepage channel taking water to the command area

2.3. Irrigation water quality analysis

Irrigation water samples from MPR canals and seepage channels were collected and got tested for its suitability for irrigation. Since irrigation drainage water enters and augments flows in seepage channels, the quality of water in MPR canals and that of seepage channels are obviously different. A total of five samples, one from the south canal of MPR; two from seepage channels originating from Pennar river; and two more from seepage channels originating from Thadakaleru stream were collected during April 2011.

The timing of the sampling is also deliberately chosen to understand the extent of influence of irrigation drainage water on the suitability of water from seepage channels for irrigation. Since normal monsoon ends in September in a year, for April next there will be a gap of six months after the end of rainy season. By that time, most of the freshwater flows in river and stream dissipate. Seepage channels will be functioning (irrigating second crop in their command areas) mostly using the seepage that is emerging from the entry of irrigation drainage from the canal command areas up-steam.

3. Findings and Discussion

3.1. Present Physical State of Seepage channels

Most of the 37 seepage channels that are studied are in functional condition irrigating about 7,000 acres of land. Farmers are able to cultivate one or two crops, primarily Paddy, depending on the availability of seepage water. Though they are in functional state, very few are in perfectly maintained and kept in order. In most of these functional channels, continuous growth of weeds, grasses is a regular problem. As the channels are dug through loose sandy soils, frequent silting up of the channel is resulting in blockage of flow of water. This situation warrants very frequent clearing of these channels from silt and grasses, in absence of which water flow to crops is affected.

Over-all, farmers committees, ably guided by the headmen, are carrying out routine maintenance (bush clearance, removing grasses and de-silting the origin and main channels) by mobilizing all farmers in the command areas. Those who do not attend to such maintenance works are fined by Rs.100 to Rs.150 per day. Those who do not attend maintenance works throughout the season are fined by Rs.1000 to 2000. The committee headman maintains all these details and records. Farmers are also taking up minor repairs of channel structures like diversion walls, pipe structures across roads and other channel revetment works (see Fig.5). Any money remaining balance after such repairs is used to celebrate village festivals and to distribute sweets among the member farmers.

Fig.5: Structural repairs required and maintenance works by farmers

	
Broken side wall of a seepage channel	Farmers collectively removing weeds and de-silting the seepage channel

3.2. Farmers regulations and management systems

Strong unity among farmers and local regulations by farmers committees are unique and outstanding features in the management of these seepage channels. These regulatory systems and collective approach has been practised for time immemorial. All the farmers in the command area, irrespective of caste, class and political affiliations, come together and unite in all matters related to seepage channels.

All key decisions are taken in farmers meetings facilitated by the headman. Typically, before the start of crop season (in August-September) farmers meet to discuss availability of water; maintenance works to be done; and area to be cultivated by each one so as to match the water availability. Based on the decisions of this meeting, headman calls the farmers for the maintenance work on a day already declared and informed to all. Once the farmers start sowing seeds, equal water distribution is ensured by the *Neerukatti.* Whenever there is a need for maintenance, they meet and carry out the works during the crop period, so that water is available to the standing crops throughout the season. During second crop season (generally January to April), generally less water flows in the seepage channels due to the absence of rains. The headman and farmers committees take extra care to see that all farmers get their due share of water when limited water is available. In such situations, each farmer is given water for one hour time on a rotation basis throughout the day and night. A clock is kept at a public place and headmen ensure proper allocation of water and compliance by the farmers.

The *Gonchi* system has clear norms and regulations across all the villages studied. Following are the major norms and regulations that are characteristic of the system:

- Each member shall contribute labour in proportion to their land area in the command area towards de-siltation and repair works of diversion channel every year to enable smooth flow of water by gravity
- All the members shall abide by the decisions of the committee regarding water sharing depending on the availability and designed cropping pattern
- Members should share water in proportion to the land area they own in the command. In case of water shortage, members restrict cultivation area in proportion to their land holding

- The responsibility of regulating water to different fields is assigned to a person called *Neeruganti*. Each member pays in cash or grains to *Neerugatti* as per the decision taken in the *Gonchi* committee every season
- Those who do not contribute labour for regular maintenance of channels are fined Rs.100 to 150 per day. *Gonchi* headman will collect this money and keep the accounts. Those not contributing labour throughout the season are fined Rs.1000 to 2000.
- If any farmer does not cooperate with *Neerugatti* and tried to over-draw water, he or she will be fined and water supply to his or her field will be discontinued
- No person, either within the village or from outside shall indulge in sand mining or drilling bore wells in and around the seepage channels. Encroachments onto the channel areas are not permitted, either on the bed of the river or outside
- Equitable water distribution by using wooden plant or using a clock by rotational supply method. Every farmer shall abide by the decision of the headman in this regard.

Minutes of all meetings are recorded along with process and conclusions drawn in the form of resolutions and are maintained as a permanent record. Part of the fines collected is used to celebrate any village festivals or other celebrations. Disputes amongst members of *Gonchi* system, will be resolved by informing the issue to the headmen and other senior members in the committee, selected for the purpose.

3.3. Impact of irrigation drainage from MPR dam on seepage channels

During the field study on 37 seepage channels, present extent of command area for each was collected from respective *Gonchi* committees. These details for some of the channels were compared with the command area details given in the Descriptive Memoirs of Irrigation Work prepared by British engineers around in 1922, in Table 3 below.

Table 3: Comparison of command areas in 1922 and 2010

Sl.	**Village**	**Mandal**	**Present study in 2010**		**Details given in memoirs of 1922***	
			Seepage channel	**Irrigated area in 2010 (acres)**	**Total Command area (acres)**	**Average irrigated area in previous 5 years (acres)**
1.	Koppalakonda	Garladinne	Konda Kaluva	670	273	267
			Kunta Kaluva	550	122	121
2.	Kesavapuram	Garladinne	Pedda Kaluva	400	199	174
			Chinna Kaluva	350	151	147
3.	Kathrimala	Pamidi	Eguva Kaluva	100	98	62
			Diguva Kaluva	100	80	49
4.	Palyam	Pamidi	Eti Kaluva	150	91	59
5.	Apparajipet	Pamidi	Apparajipet Eti Kaluva	200	148	121
6.	Kandlapalli	Pamidi	Eti Kaluva	120	104	90

* Source: British Government in India (1922), numbers rounded-off removing fractions

This data clearly indicated that there is a considerable increase in the command areas of seepage channels after 1922. Farmers from field also report this increase, but only after the construction of Mid Pennar Reservoir in 1968. Secondly, while many of the seepage channels were functioning as diversion channels from the river and streams, in contrast to today's channels that are diverting water from huge pits (*Talipiris*) for collecting seepage water. Therefore, channels that were once fed by river diversion works, were in later years converted as seepage channels by digging *Talipiri* at the head of the channels. Entry of new water through MPR dam augmented the seepage flows in seepage channels and increased their command areas after 1970s. This increased availability of irrigation drainage water in villages along Pennar river, and city drainage water from Anantapur feeding the Thadakaleru stream, command areas laterally expanded in many channels. With availability of seepage for longer period of time, farmers also started cultivating second crop during January-April after the harvest of Paddy during October-January.

3.4. Irrigation water quality

Electrical Conductivity (EC), Sodium Adsorption Ratio (SAR), pH and Residual Sodium Carbonate (RSC) are the key parameters that determine the suitability of water for irrigation purposes. Water samples collected from the MPR South canal and four seepage channels were subjected to testing of Electrical Conductivity (EC), Carbonates (CO_3), Bi-carbonates (HCO_3), Chlorides (Cl_2), Sulphates (SO_4), Calcium (Ca), Magnesium

(Mg) and Sodium (Na). Based on the analysis, Residual Sodium Carbonate (RSC) and Sodium Adsorption Ratio (SAR) were calculated. Following Table 4 presents the water quality test results for all five samples:

Table 4: Water quality test results

Sl.	Source of Sample	EC (micro mohs / cm)	SAR	pH	RSC (milli equivalents / litre)
1.	MPR south canal	720	2.68	7.72	-0.72
2.	Seepage channel in Palyam village	750	1.28	7.69	0.20
3.	Seepage channel in Patha Kalluru village	1180	3.36	7.85	4.60
4.	Thadakaleru stream	2020	6.28	7.43	4.60
5.	Seepage channel in Madirepalli village (fed by Thadakaleru)	2250	6.70	7.86	4.20

3.4.1. Electricity Conductivity (EC):

EC is one of the parameters that have a strong influence on water availability to the plants, after irrigation water is applied to the field. More EC indicates the presence of salts and minerals in dissolved and free form in water. When EC is high, plants need to compete with the free ions in water to take water. Reduction of water availability to plants results in crop withering and reduced yields. Normally when EC is less than 700 micro mohs / cm, that water is considered fit for irrigation in all respects. Water with higher values upto 3000 is still suitable but the plants have to overcome certain degree of stress to take water.

In this case, since EC is slightly more than 700 in samples (1) and (2), that water is considered suitable for irrigation. In case of (3), the EC is slightly higher therefore crops grown using this water may face some degree of water stress. In case of (4) and (5), EC values are even higher and hence may create considerable physiological water stress on crops grown.

3.4.2. Sodium Adsorption Ratio (SAR):

When sodium content in the irrigation water is higher it results in ‘Sodium Hazards’, such as reduction of permeability and increased salinity of soil. Presence of sodium cations relatively more than calcium and magnesium leads to adsorption of sodium ions on soil particles replacing the later ones. This leads to changes in soil texture, reducing the permeability and increasing the salinity of soil. Sodium adsorption over a period of time increases the soil salinity and seriously affects the crop yields. SAR is an effective measure to evaluate the Sodium Hazards of irrigation water.

Generally, water with SAR values between 0 and 3 are considered suitable for irrigation and between 3 and 9 are considered suitable under specified circumstances. Anything more than 9 is considered unfit for irrigation. When water with SAR in the range of 3 and 9 is used, adequate drainage from farm land has to be ensured and its is recommended to cultivate crops resistant to salinity.

Since SAR values of (1) to (3) samples are almost in the range of 0 to 3, these waters may be considered suitable for irrigation. Samples (4) and (5) have medium levels of SAR and hence the water may be used by taking care of good drainage facility and preferably growing salinity-resistant crops.

3.4.3. Residual Sodium Carbonate (RSC):

Presence of carbonates and bi-carbonates also influence the quality of water and its suitability for irrigation. When Sodium Carbonate is more, the water will be having higher pH values and when used for irrigation deposits the Sodium Carbonate in soil making it ‘alkaline’ in nature. This can be recognized by change in the colour of soil to deep black. Normally, water with RSC value of 1.25 milli equivalent / litre or less is considered ideal for irrigation. When RSC values are more than 2.50, that water is treated as unfit for irrigation.

In case of (1) and (2), RSC values are less than 1.25 and hence they are found to be fit for irrigation. But, the RSC of sample (3) is 4.60 indicates unsuitability for irrigation. Though RSC is higher, the pH values are normal for this water sample. Also, in case of (4) and (5), RSC values are much higher than 2.5 but pH values are normal. More investigation on the soil quality in the command areas of this seepage channels is required to ascertain the soil quality and any indications of salinity / alkalinity due to the use of such water for irrigation.

4. Conclusion

The system *'Gonchi'*, is developed by the local people, being practiced for centuries with required changes as per the changing resource and socio-economic conditions. This strong community regulation system clearly depicts distribution system being adopted with equity as a major concern. It is an outstanding system wherein collective efforts of communities is not only ensuring food security but also reaping communal harmony in these villages. The common principles of community action that bind farmers together in these systems are:

- Collective community action
- Participation and Accountability
- Equity in sharing and distribution of water resources
- Concern for needs and demands of neighbours
- Coexistence and sharing of available resource
- Controlled withdrawal of groundwater resources
- Social regulations in water use
- Sustainable use of water resources

All these principles are quite relevant in the present day scenario of recurring drought conditions and increasing conflicts between various stakeholders in the context of dwindling surface and groundwater resources.

Reuse of drainage water, which has happened by chance in Pennar river basin, has been attempted earlier in USA and elsewhere. But, reuse of drainage water in combination of freshwater flows and seepages through the natural hydrological processes is found to be more acceptable and promising, in terms of technical feasibility and acceptability by farmers. There are number of such seepage channels in Anantapur district and may be present in other locations as well. Emergence of new irrigation projects, such as the Penna Ahobilam Balancing Reservoir (PABR) project in Anantapur, opens up new opportunities and possibilities of rejuvenation and augmenting these traditional channels all along its main canals and around command areas. If a systematic study in entire district is done and approach is adopted, all those channels can be rejuvenated and put back to use, contributing to the food production and income security of many small and marginal farmers.

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