Integrated Water Systems in Vernacular Settlements: Temple City of Melukote, Karnataka, India

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Abstract

Settlements in South India have a unique achievement integral to their built environments, which arose out of their geo-climatic necessity to harvest water. The majority of areas in southern India have to depend on seasonal rivers and rain water to meet their needs. Ingenuity and advanced technology for harvesting and using water dating to the 12th century AD, in the case of Melukote, temple city in Karnataka deserves special attention in studies of vernacular traditions.

The paper aims to study this water system with the objective of understanding the traditional water wisdom of the vernacular settlement and management of the water resource distribution at the settlement scale. The role of temple town character, its social fabric had a defining effect on Melukote settlement layout and its water tanks. The study thus focuses on finding out the impact of socio-cultural practices, on distribution and management of water. The paper also aims to document the existing water tanks in the settlement, to highlight the effect of changing time in the character of settlement on the vernacular water system. The findings of the paper reveal the factors such as loss of royal patronage, and cultural shifts led to disuse and dilapidation of otherwise sustainable and integrated systems of water tanks. These insights are important to guide any future intervention and development strategies for this historic town.

Keywords: Vernacular built forms, integrated rainwater harvesting, temple tanks, sociocultural fabric, role of gender, traditions.

Introduction

A major geographical region in southern India has to depend on seasonal rivers and rain water to meet their water needs. The region has rich traditional knowledge systems for harvesting rainwater. Among them, the 12th century, temple town of Melukote in south Karnataka, possesses distinctive vernacular integrated water systems.

Reverence to water, earth and its resources are integral to the sacred traditions in Indian culture. It is important to study and document the traditional practices of Melukote particularly for its integrated water systems to reinvent a cultural heritage and building tradition. The sacred place of water and the necessity to harvest water to structure the water system at vernacular scale for immediate community can add to strengthening a sustainable and self-reliant ecosystem. It is a unique achievement in the vernacular-built environment of India. The paper aims to document the vernacular practices of integrated water systems in South Indian temple city of Melukote, placed on hills, which only relies on rainwater for its sustenance.

The objective is to preserve the knowledge tradition - water wisdom, managing watershed at a vernacular settlement scale, and highlight cultural practices in vernacular water harvesting.

The Background

It is known that ancient civilizations developed around permanent water sources. However, several settlements developed even in arid to semi-arid regions, which faced scarcity of water owing to the environmental conditions and highly varying rainfall patterns (Prinz, 1996). People inhabiting these regions have developed several indigenous techniques to harvest rainwater that have proved to be sustainable over centuries (Mbilinyi, 2005). They overcame the ecological constraints and scarcity of permanent water sources by altering the landscape to harvest the rainwater from hill slopes, rooftops, land surfaces, etc., and augment the groundwater recharge using traditional techniques and simple structures. These systems were unique and peculiar to the geographical regions and are based on centuries of experiments and experience. Water thus collected was judiciously distributed to reduce vulnerability and to drought-proof the region. Traditional systems are an integral part of the socio-cultural traditions and have a great influence on lifestyle, social systems, and the development of settlement patterns. Heritage and cultural legacy can be carried forward only when an ethnic group associates itself and values the identity, practices and beliefs that are hereditary to the place (Suartika *et al.*, 2020).

The South Asian countries of Bangladesh, Bhutan, India, Maldives Nepal, Pakistan and Sri Lanka are bound together by water which acts as a common historical and geographical link (Fanaian, 2018). The earliest evidence of water harvesting in South Asia dates back to Harappan civilization (Bisht, 1993). Dayaratne notes that management of water and its qualities is one of the most revered founding principles of settlements in Sri Lanka (Dayaratne, 2018). The tank cascading systems which are a network of tanks to recycle and reuse water and waterways of Colombo are unique to Sri Lanka (Geekiyanage and Pushpakumara, 2013). In the Himalayan regions, water is revered and regarded so sacred that Pani Dhara marriages are accepted by the society. *Guls, naulas, dharas, lakes, kund, khal, simar* or *gazar* and water mills are some of the water harvesting systems of the Himalayan region. *Naulas* collect water from the subterranean springs and are considered water heritage sites due to their architectural splendor (Rawat and Sah, 2009). The gravity-based water systems like *Karez / qanats* can be seen in Pakistan, Afghanistan, Turkmenistan and some parts of Africa (Hussain *et al.*, 2008). In the multi-cultural and multi-linguistic set up of India, the water systems vary from region to region based on climate, availability of groundwater and rainfall. Some of the rainwater harvesting systems of North India are *Talab, tanka, jhalara, johads, ahar pynes*, etc. Vast stretches of land in peninsular south India lack perineal rivers and depend purely on rainwater as its water source. Sluices, tanks, lakes, wells, etc., are few of the rainwater harvesting systems noted in South India.

In the document 'South Asia - Water Vision for the 21st Century: Vision to Action' released on behalf of South Asia Technical Advisory Committee (SASTAC) and Global Water Partnership (GWP), the South Asia Regional Water Vision 2025, it aims to eradicate poverty in South Asia and improve living conditions of people through coordinated and integrated development and management of water resources of the region. The study suggests the need to capitalize on indigenous knowledge and to foster traditional water harnessing and management technologies for localized developments (Margat and Vallée, 2000).

Studies carried out by the Karnataka State Council for Science and Technology (KSCST) reveal that reviving traditional harvesting systems can unlock 6,000 crore liters of water. Based on KSCST reports, the Government of Karnataka has launched the Jalamrutha scheme for the rejuvenation of traditional water bodies (Rao, 2019). Contrary to this, the Government of Karnataka has earmarked 100 crores and taken up an initiative to lay a water pipeline to supply water from the River Cauvery to Melukote and to fill up ponds and lakes in the area with River Cauvery water (*Star of Mysore*, 2019) instead of reviving the traditional water systems.

The Study Context

Melukote, the study context, a temple town in Southern India was selected for two reasons. Firstly, it is an example of an efficient and enduring vernacular water management knowledge system in the Deccan plateau region, and secondly, it is a vernacular settlement showing how temple towns and water systems were integral to each other. The layout of the vernacular settlement was an outcome of the rituals and regime specific to a temple complex. The principal socio-cultural practices depended on the use of clean water for the temple precinct, beside the day to day needs of residents. The sacred character of water had manifested in the hierarchy of water tanks and their classification for defined uses. For this reason, Melukote is a highly relevant case study for highlighting the spatio-temporal impact of water systems in sacred vernacular settlement complexes.

Research Methodology

This is a descriptive study to understand and document the study context of integrated water systems at the settlement level. The research was structured in the following ways.

1. Site visit of the context study area to generate settlement layout drawings and document geographical, architectural and urban characteristics of the town in the context of hydrology of the site.
2. Conduct a comprehensive descriptive survey to gather background information, historical development of the settlement and water bodies with the purpose of identifying patterns, perspectives, awareness, inclination of local residents towards the water systems, to understand the sociocultural character of the water tanks, rituals and behavior around the water tanks, threats these traditions and knowledge systems face in changing times. As the character of the study was qualitative in nature, authors resorted to non-probability sampling techniques. Convenience sampling was undertaken due to the constraints of time, language barrier, and technical understanding of the matter from the perspective of the respondent, and lastly, the willingness of people to participate.
3. Conduct interviews to obtain and academic perspectives of experts and scholars who have worked on Melukote and Vernacular water systems. Mr. Lakshmi Thathachar[1] was interviewed. He is a resident of Melukote, and has a deep understanding of built forms, traditions, socio-cultural practices, religious practices, gender specific roles in religious practices, and most importantly, water systems of the city from both an academic and a user perspective. These inputs were crucial to obtain an understanding of the threats these traditions and knowledge systems face in changing times.
4. Detailed interviews with residents to gather data on spatio-temporal practices around sacred water and temple structures, gender specific accessibility and social inclusiveness, and resilience of these vernacular water systems.
5. Second part of the study required field observations to document the layout and planning characteristics of these water bodies and their integration system at a settlement level. The drawings were generated based on site measurements and super-imposed on satellite imagery from Google Earth. The purpose of these drawings was to identify the number of the water bodies as they are today. Secondly, schematic layouts in relationship with the existing built form and in relation to each other along the slope and contours of the settlements, sections of the settlement pertinent to water flows and water collection were generated (Fig. 5, 6, 12, 21, 22).
6. The outcomes of the field survey combined with focused documentary survey were translated into topographic maps overlaid with water systems to gain holistic perspectives about the hydrology of the settlement.

[1] Prof. Lakshmi Thathachar was a Professor of Sanskrit at Bangalore University before setting up the Academy of Sanskrit Research at Melukote.

Given the limitation of travel time to Melukote from Bangalore, the interviews had the following Characteristics:

1. Conducted during the daytime.
2. Were semi-structured due to the language barrier. As the subject was technical in nature and awareness based, not everyone was able to answer structured questionnaires. The interview relied on the willingness and time of people to engage with authors.
3. The authors were able to interview people active around the water tanks and wells compared to those staying indoors due to reservation of the people. The sample set can be regarded as a convenience sample (non-probability sample).
4. Communicated in Kannada language to obtain clear inputs.
5. About 50 women from different communities were approached out of which 35 were willing to engage. About 75 men were approached from different social groups out of which 50 responded. About 15 children sat down with authors to describe their day-to-day activities around water tanks and wells.
6. Different people were comfortable devoting their time for this process. Women and children engaged for typically 10 minutes' duration. Men folks were more forthcoming and engaged anywhere between 10-25 minutes with the author given their circumstances.
7. Question and answers kind of structured interviews were not possible for want of knowledge gap.
8. Collation of information was based on informal discussion and memo writing on site which were further refined to desk notes. These notes were comprehensively analyzed to bring to surface the common themes and observations of the community members on the subject.
9. The findings of the semi-structured interviews have been collated and discussed in the below sections. Few pictures of the author on the site have been enclosed in the appendix of the paper.
10. The most recurring questions of the interviews the respondents replied to are also enclosed in the appendix.

Background of Melukote

The temple town of Melukote is located in Pandavapura Taluk of Mandya District, Karnataka and about 50km away from the historic city of Mysore. It covers an area of 1.5 sq. miles. Melukote's history goes back to the early 12th century. It is believed that Srivaishnava Saint Sri Ramanujacharya spent 12 years of his life in Melukote. A small sect of Srivaishnavite Brahmins who followed the Saint settled in Melukote. Topographically, the town of Melukote is located on a hillock and a flat stretch at the top of the hillock which provides enough area for habitation (Radhika, 1998). Lack of a permanent source of water necessitated the inhabitants to come up with unique rainwater harvesting practices. With the support of kings and chieftains, the residents built multiple tanks at various strategic locations to collect every drop of rainwater that falls on the hill slopes (Natampalli, 1998).

Melukote is a culturally rich vernacular settlement and is home to heritage complexes including many ancient temples of which most important are the *Cheluvanarayanaswamy* temple and the *Yoga Narasimhaswamy* temple. Each of the temples are dotted with temple tanks. The tanks serve not only the ecological purpose but also stitch together the socio-cultural and religious fabric.

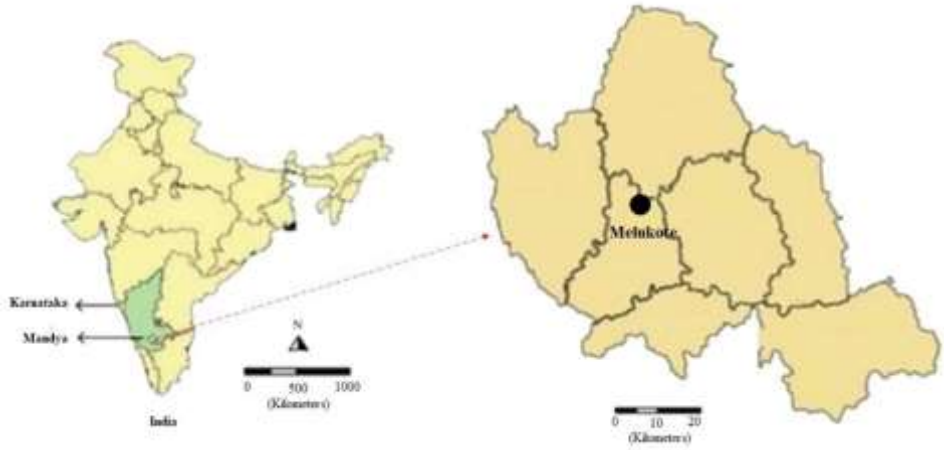


Fig. 1: Location of Melukote.
Source: Author

Geology and geo-morphology of Melukote

The hill town of Melukote lies at 12°39'N 76°40'E / 12.65°N 76.67°E latitude and longitude. The climate of Melukote is warm, oppressive, and overcast in the wet season and the dry season is hot and partly cloudy (Radhika, 1998). Soil in Melukote town is loamy and sandy in nature.

Melukote hill ranges are part of a broken series of conspicuous peaks called Yadugiri, Yadavagiri and Yadhushiladeepa overlooking the Cauvery delta. These peaks reach the altitude of 1159m amsl, 1064m amsl, 1050m amsl and 1046m amsl and 150m above the surrounding plain (Central Ground Water Board, 2013). The rocks of the Mysore plateau belong to the Archaeozoic or the Archean era which are a million years old. They belong to the oldest part of the earth known as the Shield areas (Radhika, 1998).

Melukote is made up mainly of gneiss, amphibolite and close pet granite, and at some places, the granite rock intrudes into the gneisses. Among the different rock types, gneiss are predominant (Babitha Rani *et al.*, 2017). The topography falls in the medium to high slope gradient. Melukote receives an annual rainfall of 610.9 mm, which would be sufficient for the settlement to thrive if the rainwater percolates into the ground.

However, the geo-morphology and topography of the town impedes rainwater percolation and results in heavy runoff. Most of the rainwater that would have otherwise drained down the slopes of the hillock is intercepted by the strategically located tanks which capture every drop of rain. These tanks help channel the percolation of water and improve the groundwater level.

Fig. 2: Google Earth Snapshot showing the topography of Melukote.
Source: Google Earth (2020)

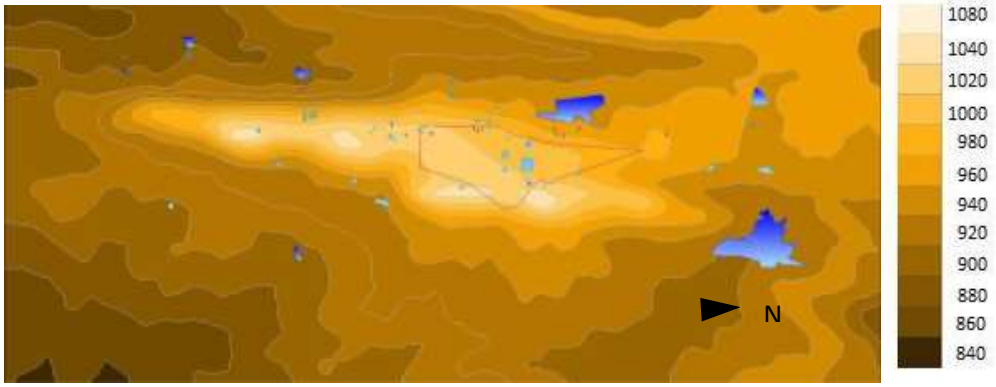


Fig. 3: Topographic map of Melukote.
Source: Author

Historical context of Melukote

The growth of the Melukote settlement was progressive and acquired patronage from regional rulers over a period of time. The evolution of the Melukote settlement as a temple town can be classified into various stages as explained in Fig. 4.

- Before the arrival of Sri Ramanujacharya: Melukote was earlier known as Thirunarayanapuram, an individual principality. Image of Lord Narayana was already present on the hillock even before the arrival of Sri Ramanujacharya.
- After the arrival of Sri Ramanujacharya: Sri Ramanujacharya fled from Tamil Nadu owing to the rough times prevailing there under the rule of Cholas and moved to Thondanur (Narasimhiengar and F., 1915). As per the local oral knowledge, once Sri Ramanujacharya learnt of the deity of Adinarayana in Thiruvananthapuram, he unearthed it from an anthill and installed it in Melukote.
- During Hoysala and Vijayanagara Patronage: Melukote got its name by King Visnuvardhana during the Hoysala period who helped with the renovation of Melukote carried out by Sri Ramanujacharya.

Recent Times: *Academy for Sanskrit Research* is a recent addition to the map of Melukote in 1978 towards the South of the town beyond the *Raya Gopura*[2]. Though Melukote has successfully retained the essence of vernacular architecture, a certain level of compromise can be witnessed in the newly built houses, which can be ascribed to the changing socio-cultural scene.

[2] Gopura mark the entry to the temple complex, and are typically extensively ornate in character. Local landmarks.

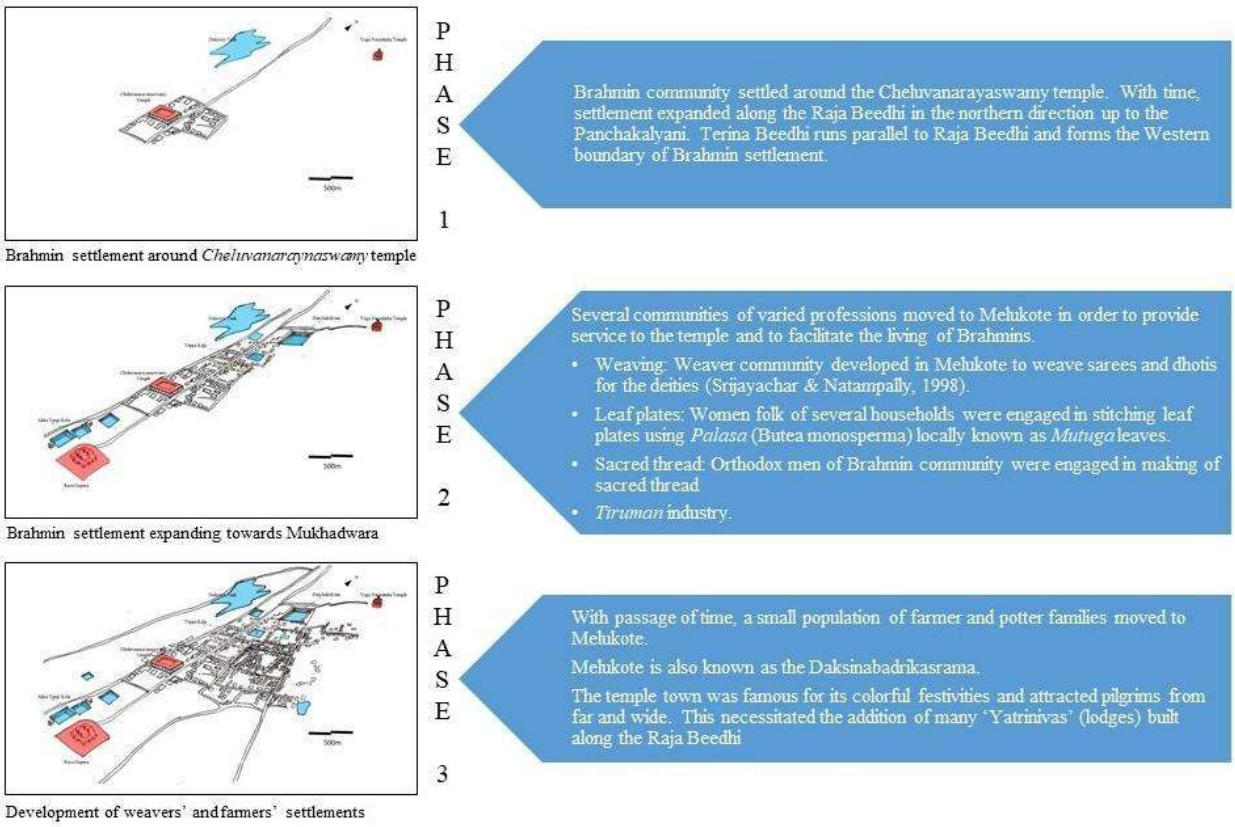


Fig. 4: Development of Melukote during royal patronage.
Source: Author

Historic town planning principles of Melukote

Melukote was laid out on ancient town planning principles of India. The *Cheluvanarayanaswamy* temple, *Yoganarasimha* temple and *Panchakalyani* formed the core area of the town. The iconic *Raya Gopura* defined the southern entry while *Mukhadwara* or *Pete Bagilu*[3] defined the northern entry of the town originally. However, the town has expanded beyond the *Mukhadwara*. Towards the south beyond the *Raya Gopura* is the forest extending all the way up to the highest place of Melukote on the rocks where *Dhanushkoti* is located. Melukote is a linear development in the North-South orientation along the *Raja Beedhi*. *Terina Beedhi* runs parallel to *Raja Beedhi*. It gets its name because of the procession route during the utsavas. Secondary streets branch out from the *Raja Beedhi* in the East-West direction and lead to the settlement area with clusters of dwellings.

Upon observing the settlement pattern on site, it can be noted that there is a clear hierarchy of spaces. There is a distinction in the settlement pattern with no overlaps between any of the communities in a way that if one does not belong to a certain community, they are unlikely to enter the neighborhood. Despite various invasions by various kingdoms and their influences, the conscious site planning remains unaltered to date (Keskar, 1998).

[3] Pete means town and Bagilu means doorway, essentially Pete Bagilu means entrance gateway to the town.

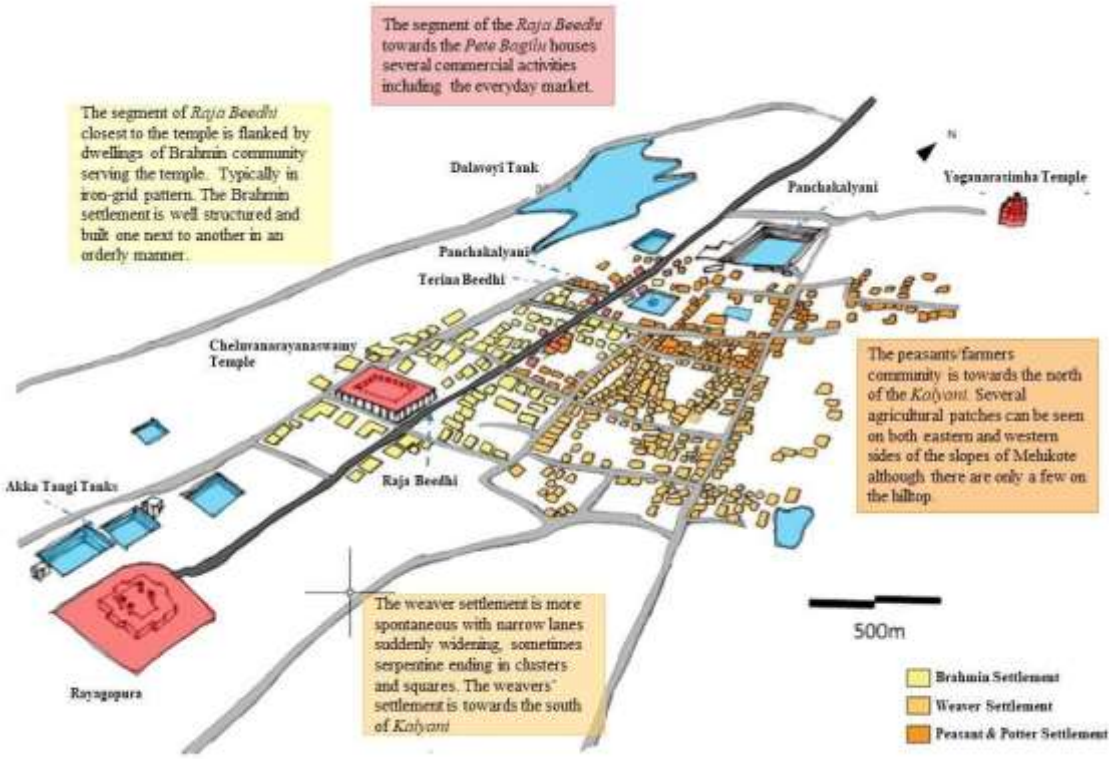
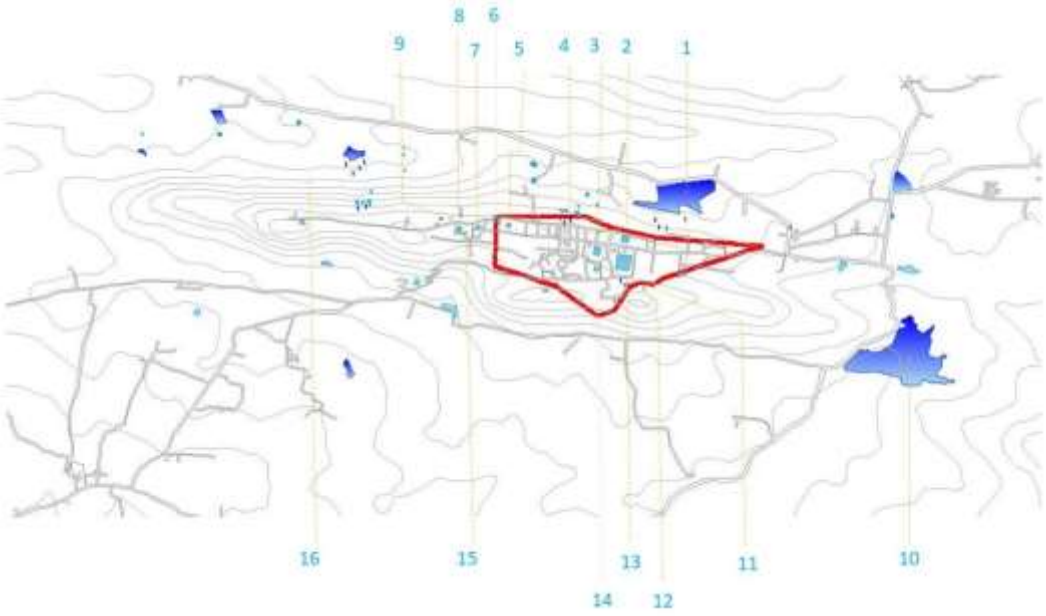


Fig. 5: Town planning Principles of Melukote.
Source: Author

Planning principles of the integrated water system at Melukote

The principal idea behind the integrated water management systems is to evaluate water management systems holistically across sectors at various levels and layers. These concepts are constituents of integrated water management including assessment of watershed management, understanding water systems at different planning scales:- domestic scale, meso level, water tanks system, macro settlement levels and most importantly the sacred water tanks dedicated for temples. For a temple town like Melukote, which is very rich in heritage, it is necessary to develop an understanding of the underlying cultural traditions and belief corpus along with their influence on these water systems from a socio-cultural perspective.

Melukote and the areas around have been dotted with 108 water tanks and ponds (Kumar, 2016), which are positioned strategically to collect every drop of rain that falls on the hill slopes. This only tells us about the ingenuity of the earlier communities, their understanding of the micro watershed and the technology to effectively manage a vital resource. Major waterbodies were identified based on observational study and indicated on the map. Other waterbodies mapped were as seen in the satellite image.



1 – Dalavoyi Lake
2 – Puttanarasi Kola
3 – Teppa Kola
– Akka Tangi Kola
7 – Nakshatra Kola
8 – Ayedu Kola
11 – Ganeshana Kola
12 – Narasimha Kola
13 - Panchakalyani

Fig. 6: Water tank mapping of Melukote at settlement level based on field studies and contour mapping based on satellite image from Google Earth.
Source: Author

In the literary translation, '*Melu*' means top and '*kote*' means fort. It was once a secondary fort of Hoysala and was plundered many times. The innumerable ponds in excess of the needs of the people was possibly meant to cater to the sudden rise in the water demand during wars. There are several cave-like and tunnel-like openings just above the water level in many wells, which makes one speculate the existence of long interconnected tunnels or places to hide valuables during enemy invasions (Jayashree, 1998).

Melukote is considered to be an *alaya* and is a house to several *tirthas*. *Raja Beedhi* the central spine of the town along which the settlements have developed is in the lowest point of the valley area of the hill, which ensures an easy, continuous supply of water to the residences (Keskar, 1998). Similarly, the settlements have been designed to be water sufficient and have dedicated water tanks that serve each of the communities separately. For example, the water tank supplying water to the weaver's community is located to the East of the weavers' area with natural boundaries on three sides and few steps on the fourth side. It can be noted that women and children carry water from these tanks. This tank provides water for drinking purposes.

At macro, meso and micro level:- Upon understanding the macro level and meso level planning of Melukote, it can be noted that the vernacular settlement has been profoundly shaped by the vedic texts as a yogabhumi (Swamiji, 1998). At the same time, the technology of rainwater harvesting employed has proven its enduring character over a period of centuries.

At **Macro** level: - The planning of these water tanks systems is such that, once all the tanks on the hill top are full, overflow of these tanks fills up the *Dalavoyi* tank at the foot of the hill towards the West of Melukote and *Hosakere* tank located to the North. The outflow of these larger tanks is connected to *Tondanur* tank also known as *Moti Talab* located farther away towards the South. This system ensured no wastage of rainwater from any part of the hill.

At **Meso** level: - The influence of Atharva Veda philosophies of triguna can be seen in the grouping of the tanks. Around the town, there are many tanks and they are in sets of three. Each set represents the human characters. The tank representing *sarvaguna*[4] has pure water whereas the tanks representing *rajoguna*[5] and *tamoguna*[6] have ordinary and turbid water respectively. A scientific justification to this system of planning is that the *rajoguna* and *tamoguna* tanks act as filtration pits collecting all forms of impurities including leaves, twigs, sticks, etc. allowing only pure water to overflow into the *sarvaguna* tank thus leaving the first two tanks turbid (Swamiji, 1998).

At **Domestic** level:- The houses are the smallest units of the society that provide glimpses of larger built environments (Kotharkar and Manoramabai, 2012). Every house in Melukote reflects the concept of simplicity of living. The design and layout have evolved based on the socio-cultural requirements. The houses have a *jagali*[7] in the front, which leads to the *padasale*, the living space that is used to entertain guests. Dining opens out from the living area and has an attached kitchen area. The backyard is for utilities with a bathroom and a women's chamber. There is a small tank for storing the water. Earlier, houses lacked toilets and open defecation was carried out in the fields as it was considered a healthier practice (Poornima *et al.*, 1998)

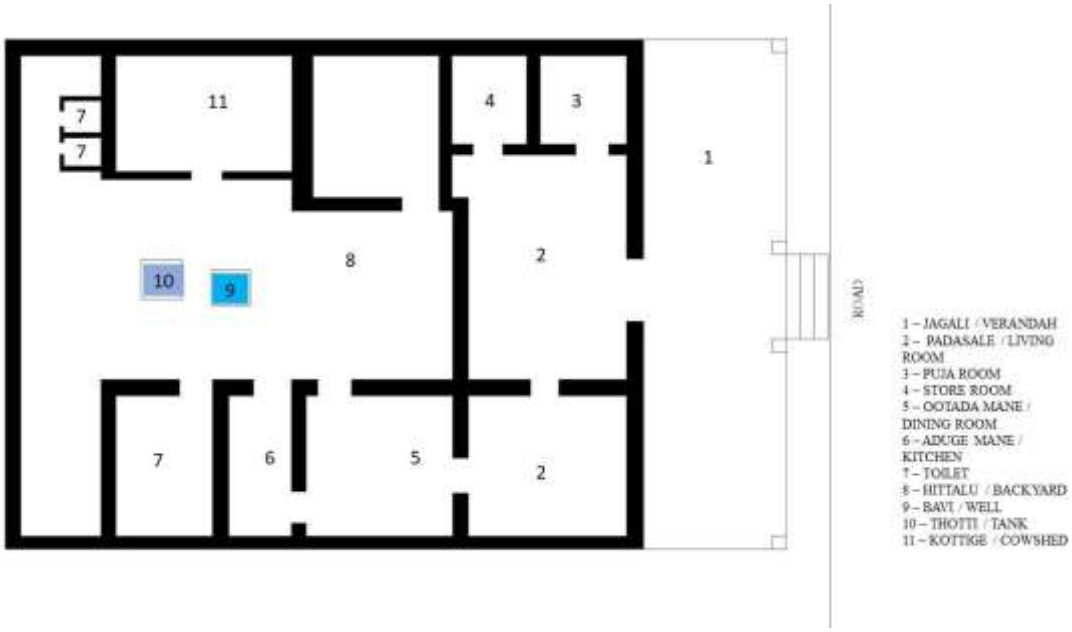


Fig. 7: Plan of a typical vernacular house on Raja Beedhi - King's avenue highlighting location of water wells inside the houses (Thotti/tank, bavi/well).
Source: Author

[4] means bestowed with all the great qualities
[5] means passion and active
[6] means darkness and chaotic
[7] a raised platform adjoining the front wall of a building (as a house, temple, public hall, etc.) used as a sit-out.

Fig. 8: Jagali of a house on Rajabeedhi
Source: Author

Fig. 9: Living room of a weaver's house
Source: Author

Many tanks of Melukote have been contributions by various rulers during the course of time. According to D'Attilio, Vijayanagara rulers rarely took upon themselves to directly construct the tanks (D'Attilio, 1995) but encouraged the private initiative to develop irrigation systems by providing land grants and tax exemptions (Davison-Jenkins, 1997). Local committees were appointed to oversee the maintenance of the irrigation tanks; water taxes and contributions from temples were reinvested for this purpose. The primary aspect of sustenance of tanks can be attributed to community maintenance.

Water tanks and reverence in the context of temple towns - South India

The genesis of Melukote is centered around worshipping lord Vishnu. The elaborate settlement that grew around the initial altars acquired the identity of a temple town. The water that becomes integral to rituals is revered and thus protected. Cult water and reverence for water become a basis of legends and ceremonies (Kasimova, R. R., Ziyadullayev, A. R., & Ziyadullayeva, 2019). Water is given a godly status and is revered. As per Hindu philosophy, water is considered divine, the basis of life and elixir of immortality (Singh, 1994), and one of the panchabhutas or the five elements of Nature (Kamya Ramachandran, 2003).

The Srivaishnavite Brahmins of Melukote follow Agamas that prescribe the mode and method of worship known as utsavas. Majority of the utsavas are public festivals and practices revolve around water tanks. Some of the utsavas celebrated in Melukote are *Nityotsava, Vairamudi Brahmotsava, Annakoti Utsava, Vasantotsava, Pallavotsava, Tiruvadippuram, Sikyotsava, Pavitrotsava, Navaratri and Vijayadasami, Krttika Dipotsava, Margasirotsava, Moksotsava, Rathasapthami, Angamani Utsava, Allum Tallu carupu, Punarvasu Utsava, Teppotsava, Ramanujacarya Tirunaksatra* (Bhattar, 1998).

Melukote is an abode of several tirthas or sanctified ponds and has a sense of reverence attached to them. These tirthas are the centers of cultural sensitivity with several legends woven around then. They are bound by a strict code of conduct. *Ashtatirthas* are the eight sacred tirthas in the following order: *Veda, Darbha, Abja (Padma), Yadava, Palasa, Parasara, Narayana, Acyutapadakhya* (*Vaikuntaganga* or *Tottilamadu)*. Below listed are some of the rituals that revolve around the tanks of Melukote (Filliozat, 1998; B, K and Gowda, 2010).

Table 1: Rituals related to tanks, Source: (Filliozat, 1998; B, K and Gowda, 2010)

For temple	Water for the temple usage is extracted only from dedicated temples tanks/kalyanis
Vairamudi	Lamps are lit along the steps of Panchakalyani
Teppotsava	Originally, a specially constructed raft decorated with lights on al sides housing the Lord used to set afloat on Teppakola post sunset. But it is carried out now in Pushkarini/Panchakalyani as Teppakola is in disuse. Reflection of lights in water is a scene to watch.
Astatirtha	God's sathari/sandals are taken in procession to the astatirthas and immersed in each tank amidst recitation of mantras following which devotees take ad dip in the holy water especially women desirous of getting children.
Others	Residents of villages around Melukote who regard Cheluvanarayanaswamy as their hereditary deity, take a bath in the Kalyani, collect water in a fresh pot, clean a place around the Kalyani, decorate it and place a kalasa at that place. A dasayya performs the worship of the kalasa. People who have taken an oath bring the articles of their vow (harake) for money.

Fig. 10: Nityotsava procession at Melukote.
Source:- Author

Fig. 11: Pilgrims participating in Vairamudi Festival.
Source:- Deccan Herald, 11.4.17

Panchakalyani is the most important tank and is the focal point of the entire settlement (Fig. 5). It is located at the foothill of *Yoganarasimha* hill and is associated with *Cheluvanarayanaswamy* temple. *Panchakalyani* is a perineal tank. *Annamaya, Pranamaya, Manomaya, Vijnanamaya* and *Anandamaya* are the 5 wells connected to it. Though the first four wells dry up sometimes, *Anandamaya* located at the foot of Lord Varaha never dries up. These wells act as the barometer indicating the groundwater level at all times.

Dhanushkoti located at the southern tip situated on top of the hill is a mysterious source of perineal water. Water from Dhanushkoti flows down to *Vedapushkarani* and then to *Chikkayyana tank* before entering the famous *Akka-Tangi kola*, the twin tanks located to the southwest of Melukote (B, K and Gowda, 2010). Surprisingly, water in *Akka kola* is saline water whereas the *tangi kola* has sweet water representing the *asuri* and *daivi* attributes. *Teppakola* gets its name from the fact that *Teppa* means "raft" and *kola* means "pond." This tank was originally used for the *float festival*[8]. Currently it is highly polluted and is used for washing laundry. Sometimes the children of the town use it for swimming as well.

[8] Theppotsavam, or Theppothsava or float festival is carried out in South Indian Hindu temples mainly in Tamil Nadu and Andhra Pradesh where the principal idol of the temples is decorated and taken in procession through the tank of the temple. (Mallik *et al.*, 2018).

The water tank system of Melukote

Tanks can be classified based on the **shapes**; the **bed**, the **purpose** it is used for; and on the **sopanas/steps**. The tanks of Melukote are of various shapes like square, rectangular, star, plus, octagonal and circular. Square and rectangular are most common of those. Cakrakatte and Bindu Madhava kola are examples of circular and plus shaped tanks respectively. The bed of the tank is stone paved, bedrock or has bare soil with vegetation (Fig. 12).

Fig. 12: Representation of classification of Tanks based on Tank Bed.
Source: Sketches by Author based on field studies

Based on the purpose, tanks are classified as temple tanks that are associated with temples and the water from these tanks is utilized exclusively for the temples and associated rituals. These are large as compared to other tanks. Panchakalyani is a classic example of a temple tank. Ritual Tanks, these tanks are similar to the temple tanks and many rituals related to the festivals are carried out here. Teppakola near the Mukhadwara is an example of ritual tank and is used to carry out the Teppotsava or the float festival. Drinking Water Tanks, supply drinking water to the community. Celuva Arasu kere at the base of Kulasekaralvar temple is an example of a drinking water tank. Domestic Tanks are used for the purpose of washing clothes, for cattle, etc. Open Wells or kupas, there are several public open wells for common usage. Along with these, many households have up to two independent open wells for personal use. Vokkarane is an example of an open well.

Fig. 13: Dhanushkoti.
Source: Author

Fig. 14: Panchakalyani.
Source: Author

Fig. 15: Open wells for public use.
Source: Author

Fig. 16: Pagadaya vokkarni.
Source: Author

Fig. 17: Akka Tangi Kola.
Source: Author

Fig. 18: Dalavoyi Lake.
Source: Author

Fig. 19: Water tank for vokkaligara/Farmer's area.
Source: Author

Fig. 20: Water tank for nekarara/weaver's area.
Source: Author

Structural features of the water tanks at Melukote

It was observed that locally available materials such as the unburnt cut stones are used for the construction of the tanks. Some of the tanks are built using boulders all around and only one side is made of stone slabs. In these tanks, mud is used for the joints. Examples are *Ningayyana kola*, and *Doddayyana kola*. Generally, these ponds are not used for drinking purposes. Some of the tanks are lined with neatly cut stone slabs that are skillfully laid to avoid any gaps, which act as retaining walls. No mud or mortar has been used for the joints to allow easy percolation of water. These stones also impart medicinal properties to the water.

The bottom of the tanks has either a bedrock, is stone paved or has vegetation (Fig. 12) which aid in the recharge of the aquifers and improving the groundwater level which is later extracted through personal wells for household usage (Natampalli, 1998). The cross section of the tanks is truncated trapezoidal. The tanks are lined with sopanas or steps on all sides to ascend and descend. The purpose of providing the steps leading to the base of the tank is to aid fetching of water during dry seasons when the water levels in the tanks are low and to make bathing easier for the people (Rao, 1998). The steps in *tirthas* are even but in residences they are uneven. *Sopanas* are built following the direction of flow of water. Because flow of water in Melukote is predominantly North to South, steps can be seen along the northern side of the tanks. *Celuvaraja kola* has sopana on the north and western sides indicating the flow of water (Natampalli, 1998). Thobus/thoombus are plug-like structures that regulate the water level in the tanks and drain out the tank when unplugged mechanically. Overflow of Ganeshana kola and other kolas on Narasimha hill drain into kalyani after passing through a filtration pit located at the Northeast corner of Kalyani to sieve out impurities like leaves and sticks (Fig. 22). Stone pipelines have been laid out interlacing the tanks together to carry surplus water from one tank to another (Fig. 23).

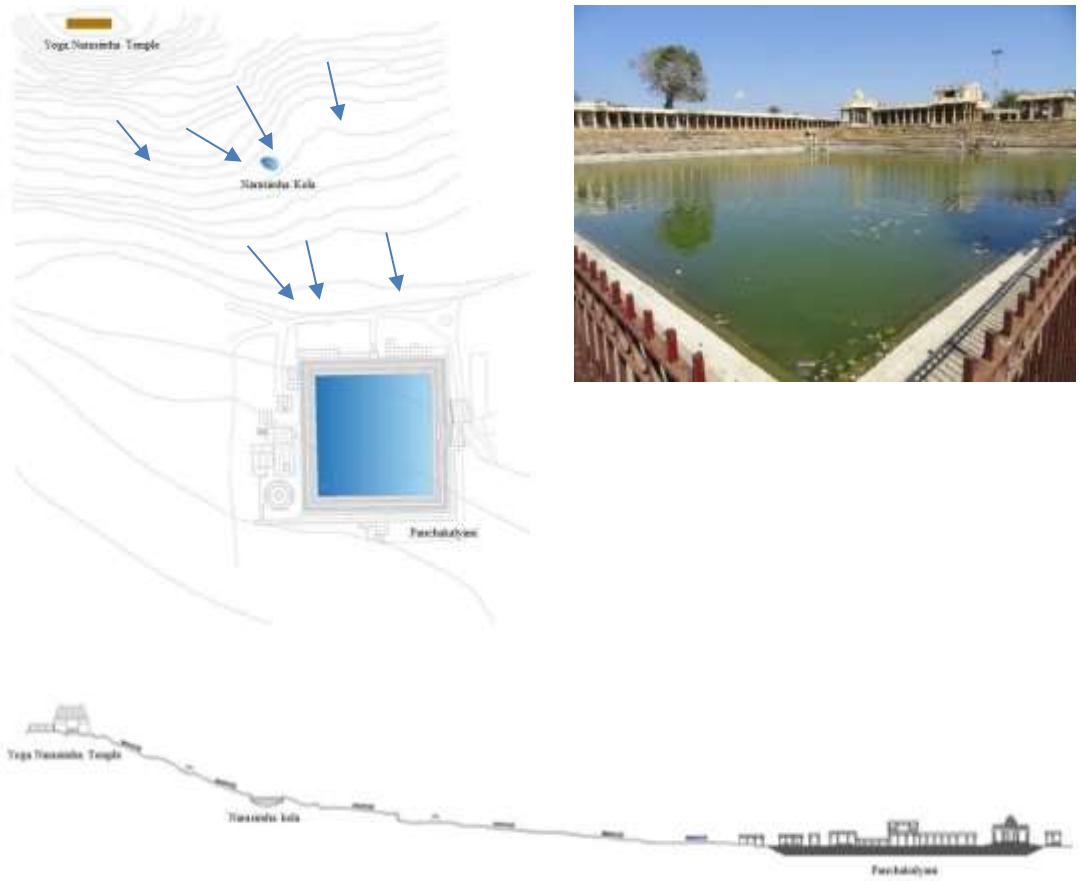


Fig. 21: Representation of strategic placement and capacity of water tanks to harvest rainwater. Section taken along the slope Yoga Narasimha Hillock cutting through Kalyani.
Source: Author

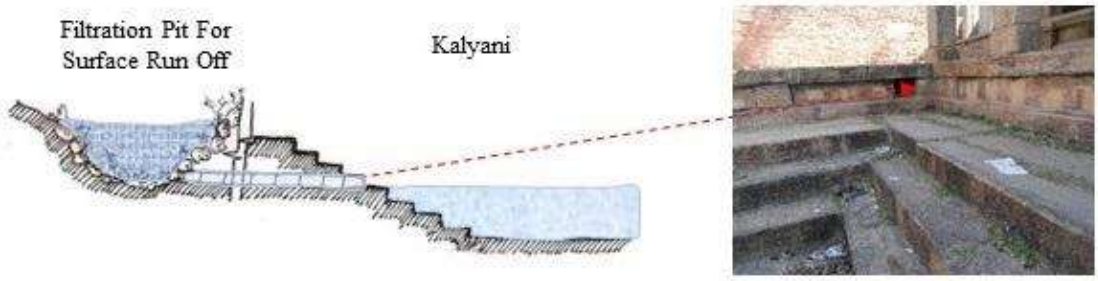


Fig. 22: Representation of traditional filtration technique and structure specific to Panchakalyani at Melukote.
Source: Author

Fig. 23: Traditional stone pipelines placed along the road to channelize rain water runoff to the water tanks.
Source: Author

Fig 24: Traditional water control system constructed in stone - Thobu/Thoombu to regulate the flow of water out of the Panchakalyani into lower tanks
Source: Author

Findings from the on-site interviews

Review of the semi-structured interviews helped gain perspective into the various underlying layers of the waterbodies. Due to the language barrier and qualitative nature of the study, the findings were generic and heuristic in character. The principal impressions were translated on the spatial map for the settlement and water system of settlement to understand the patterns that emerge from culture and practices of the people of the temple town (Fig. 25). The emergent themes of interviews have been organized and discussed in following sections.

a. Spatio-temporal practices around sacred water and temple structures

A temple town is a distinctive settlement style in the vernacular context and acquires a unique identity by virtue of its specialized activity regime. The societal fabric of such towns is strictly stratified and predominantly exclusive in the social accessibility character of spatial forms.

The efficiency of water systems in such settings depends not only on the technological aspects, but also on how the society distributes the water resource by means of controlling accessibility, division of resources and quantitative differentiation in resource allocation.

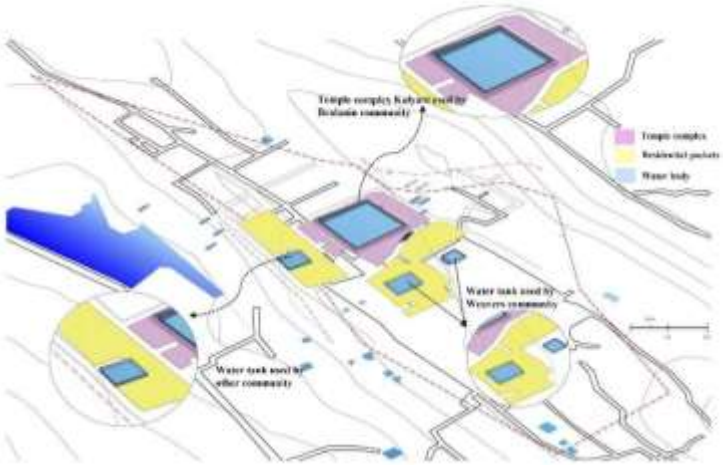


Fig. 25: Practices around waterbodies.
Source Author

b. Environmental importance of water tanks

1. The temple tanks along with other village tanks fulfilled the community's water requirements.
2. They harvest and store rainwater that is used for consumption throughout the year.
3. The most important function of tanks is that they act as percolation points within the precincts of inhabitation of a town.
4. The tanks help maintain the equilibrium of the ecosystem and provide different habitats for various flora and fauna.
5. Even though Melukote is rocky, the tanks support the growth of a fair number of hardy trees, fruit bearing, flower bearing and medicinal plants

c. Socio-cultural Importance of Tanks

1. Water tanks of Melukote play multifarious roles both tangible and intangible.
2. Along with tangible values such as ecological and economic, they provide a platform for social interaction during various religious and cultural celebrations.
3. The backyards of many households open up to the Teppakola. Spaces that required water like kitchen, bathroom, and the cowsheds were in the backyard. The edges of Teppa kola were used for washing utensils and for washing clothes. They encouraged a good degree of interaction.
4. The utsavas that are celebrated in Melukote and the related traditions and practices revolve around the water tanks.
5. These utsavas are indeed occasions which bring people together irrespective of caste, creed, status or any barriers whatsoever.
6. Many movies have been shot around Panchakalyani and Akka-Tangi Kolas. These attract a lot of attention towards these tanks.

Fig. 26: Teppakola, earlier used for float festivals, is losing its revered character - women can be seen washing clothes in Teppakola.
Source: Author

Fig. 27: Teppakola continues to be a site for social interaction, children can be seen swimming in Teppakola.
Source: Author

d. Role of gender

In the Indian socio-cultural context, all social relations are gendered; that is they are based on the notion of gender. Though not much research has been carried out so far regarding the role of gender in water management in Melukote, but by studying the settlements and water system, and interviews on site to find out how men and women of different communities engaged with the water bodies and participated during rituals, following patterns on gender and accessibility can be discerned.

1. A highly developed water culture exists in Melukote based on the religious connotations. Women and traditions are considered inseparable threads. It is women who can throw light on the tradition and culture of a place.
2. Women are typically restricted when it comes to revered water tanks, not because of barring norms, but by facilitating water supplies right to domestic quarters of Brahmin communities. The Brahminical houses along the *Raja Beedhi* have individual open wells in their backyards and women do not have to go out to fetch water.
3. On the contrary, the *Nekara*/weaver and *Vokkaliga*/farmer communities have their designated tanks, from which the women carry water for domestic purposes. Each community is drawn to their water tanks for their daily needs, which thus become the activity and interaction hotspots.
4. Interestingly, in the cattle rearing community both men and women share the responsibility of fetching water from the public water bodies.
5. Some religious ceremonies are carried out by women alone. Some of these ceremonies are to promote harvest to ensure prosperity and to secure good luck in marriages.
6. During festivals like *Tulasankramana, Tulasi Puja, Piratti festival, Kodai Kondattam* and *Pongal*, women join hands, sing together and feel blissful.
7. As part of their daily chores, women go to *Kalyani* to take a bath.
8. There is a spatio-temporal distinctiveness of the water system design which manifests in maintaining intercommunity social segregation and intracommunity interaction.

Findings from expert interviews

Interview with the residents; academic and Sanskrit scholar Prof. M.A. Lakshmi Thatachar, ex-president of Academy of Sanskrit Research, Melukote was carried out to understand the temporal changes the tanks have undergone and change in the mindset of the people and what possibly led to the disuse of the tanks. The discussion, in particular with Prof. M.A. Lakshmi Thathachar reveals that Melukote has stood the test of time in retaining its essence as a temple town, but what gives Melukote its uniqueness is the ancient rainwater harvesting system and the embedded culture. A system so unique is slowly succumbing to the changes due to a lack of funds to maintain the tanks, lack of active community engagement except during festivals, easy source of water supply by municipality, urbanization and change of attitude, increasing insensitivity and negligence that has taken over due to the lack of use. Many tanks in Melukote are highly polluted and in disuse.

Both discussions and field studies reveal that the stone pipelines that once connected the tanks have been obstructed. Most tanks have either been covered or filled and built upon. One such example is Nakshatra kola in the premises of the Academy for Sanskrit Research. The supply of water for the household needs is currently being met by pumping water from the Tondanur tank which is about 300m below Melukote.

Fig. 28: Poor maintenance and lack of funds leading to dilapidation of water tanks
Source Author

Fig. 29: Dedicated temple tank also poorly maintained and unusable
Source Author

Fig. 30: Lack of awareness leading to disruption of rain water drains. Image showing a garbage dump at one such drain.
Source Author

Discussion

In this study an attempt has been made to understand and document Melukote's traditional water management systems which is an example of once efficient vernacular rainwater harvesting system in peninsular southern India. Based on the above findings, the following understandings have been made:

1. Rain water is a highly reliable source of clean water useful for human and animal needs in a settlement. If surplus, the same can be used even for irrigation purposes. In Melukote, the principal temple tanks harvested the rain water and aided in groundwater recharge making water available throughout the year for community use. Across the settlement watershed, smaller water tanks were built to harvest rainwater runoff from dedicated channels along the roads and each water tank was allocated a functional character like temple use, domestic use, community use, irrigation, and animal rearing. It has been noted from field study that few water tanks provided for irrigation.
2. A rain water harvesting system must be planned and laid out as a long-term investment for meeting a region's water demands. Literature studies for Melukote reveal that uninterrupted royal patronage and encouragement to expand the traditional water system facilitated sustenance of the settlement. It may be noted here that the settlement has thrived only on the integrated rainwater harvesting and management system for centuries. It did not depend on any river water supply. It may be noted that the Government of Karnataka has proposed schemes to pump river water supply to this settlement but not considering reviving the traditional vernacular water systems.
3. If harvested properly and stored properly, water can be saved from considerable types of pollutants: pathogens, wastes, etc. The social norms discouraged mixing of uses of water tanks each of which served a dedicated function. Special attention was given to the filtration process of water tanks for drinking and temple uses. Mixing of water from one tank to another was also controlled through traditional devices such as thobu/thoombu. Tanks that were prone to higher pollution due to location or design were designated for non-potable uses. Surplus water collected in the tanks at lower elevation was released for irrigation purposes.
4. Traditions built around water tanks in Melukote give an opportunity for socio-cultural interaction. Because the social dynamics changed over the last few decades and social fabric was disrupted, people's association has diminished since the provision of municipal water supply. The dependence of water tanks reduced leading to their gradual disuse and poor maintenance. Thirdly, lack of patronage and lack of funds for maintenance of water tanks which have religious character has led to the poor situation of these water tanks in the present days.
5. Protecting heritage sites with living traditional knowledge systems provide a deep connection with vernacular knowledge systems and efforts must be made to conserve them actively. The Government of Karnataka has recognized the rainwater harvesting system of Melukote as a heritage. In order to protect this system and to ensure continuous supply of water to the tanks, digging any bore wells in the temple town has been prohibited by law. Private organizations like Infosys are working towards the revival of Panchakalyani.

Conclusions

Melukote once thrived purely on the harvested rainwater. The success of the water harvesting system could primarily be attributed to the association that the locals had with the water bodies like reverence, dependence for day-to-day needs and occupational dependency and more importantly to the patronage that was extended towards the maintenance of these water bodies. Though the occupations and the lifestyles of the people largely remain the same, the dependence on water bodies for occupation and domestic uses is currently limited due to the supply of municipal water to individual households. There are no allocated funds for the maintenance of these water bodies. The association that the people once felt towards the water

bodies has reduced merely to reverence and culture. Alternate sources of water supplies have led to the gradual disregard for old systems and have resulted in the neglect and disuse of the water bodies. A combined initiative by local authorities and people to maintain the water bodies can help in keeping the vernacular water system relevant in today's context.

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