# Cultural Heritage of Water Spaces in Semi-Arid Regions of India: Oral Histories and Water Management Practices in Dholera, Gujarat.

**Khushi Sanghvi[1] and Priyanka Kanhare[2]**
[1]Bachelor in Interior design, [2]Visitng Faculty, School of Environmental Design and Architecture, Navrachana University, Vadodara, India.
Email: sanghvi.khushi28@gmail.com;la.p.kanhare@gmail.com

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## Abstract

It is well known that water is indispensable for all the people around the world. However, its significance is magnified particularly in the semi-arid areas where water scarcity poses a substantial obstacle to living. Therefore, most communities in these regions face daily challenges in fulfilling fundamental needs due to arid climatic conditions. In this situation, the traditional water spaces become invaluable and there are many communities whose very existence rests on the availability of such spaces. In this context, this research examines how the traditional water management practices have evolved and how occupation-based water dependencies continue to shape the vernacular settlements in India. It focuses on Dholera, Gujarat which is a settlement that has been hardly studied in terms of its traditional water spaces.

This research employs a qualitative case study approach, integrating spatial documentation and ethnographic fieldwork to examine traditional water management practices. It used on-site observations to document the household layouts, water storage systems and daily water-use patterns. Unstructured, spontaneous discussions were employed to generate insights, revealing generations-old knowledge, adaptive strategies and socio-cultural influences on water utilization. Oral histories were collected through these discussions capturing the past narratives while also revealing the current water practices and daily routines of the communities. The findings demonstrate the importance and correlation of socio-economic practices with water spaces, and illustrate their influence on daily life, built environments, and cultural traditions.

The study concludes that the traditional water spaces continue to be relevant and invaluable in the contemporary contexts. It offers documentations of these spaces and an analysis of the evolution of the traditional water management practices in Dholera, Gujarat, India.

**Keywords:** Water Spaces, Oral Histories, Traditional Knowledge, Adaptive Strategies, Vernacular Sensibilities.

## Introduction

Today, access to water has evolved from fetching it from rivers or lakes to doorstep delivery. In fact, in the past, people across different cultures and settlements have been intimately connected to water spaces. They understand their importance and often ponder what they would do if they ran dry. However, this association with water is fading with time as people become less aware of its scarcity and the potential consequences of its depletion. Due to the shifts in association with water, there has in fact been a corresponding transformation in space planning and the anthropometrics of many household spaces. Unsurprisingly, this change has resulted in a loss of traditional vernacular sensibilities related to water and water spaces in many parts of the world and India is no exception.

Consequently, people in various regions of India have become increasingly disconnected from water sources now primarily preserved only in the rural contexts, particularly in the semi-arid regions of India. As a result, the socio-cultural practices once intertwined with water conservation and storage have largely diminished, and in urban areas where water is abundant, this deep connection is almost absent prompted by a constant supply of water at the door-steps and standardized housing layouts based on piped water. Nevertheless, unlike uniformity of urban housing, rural dwellings exhibit diverse space planning, tailored to the unique needs and preferences of each family some of which also relate to the use of water.

In various regions of India, each community engages in distinct activities with water playing the pivotal role as a vital resource characterized by the diversity of the communities. Indeed, their occupations, livelihood and the anthropometrics of spaces also revolve around the storage and use of water. They manifest primarily in the architecture of the rural communities where there is almost always a lack of water or less availability of water. Thus, in such dwellings and communities, there are also specific structures constructed for the storage of water, employing sustainable traditional knowledge to manage water. Undeniably, there is a lot of vernacular sensibility related to dealing with the water as a resource among the local communities who live in and around the semi-arid regions of India. Dholera in Gujarat is one such a notable settlement.

Nevertheless, the idea for this research stems from the deep personal connection the author has with Dholera; it holds significant meanings in my family history. My grandfather spent over 20 years of his adult life there and my family has strong ties to the place. The stories I grew up hearing about Dholera's unique culture, living conditions and the struggles faced by its people always fascinated me also generating deep concerns. I have observed that over the years, Dholera has undergone many changes due to various factors, but one constant challenge has been the scarcity of water. In fact, being a dry region in the semi-arid part of India, availability of water has always been a critical issue. This connection and the enduring struggles of its people inspired me to explore the lives of different communities in Dholera and their relationship with water.

Therefore, this study investigates the evolution of traditional water management practices in vernacular settlements of semi-arid India, focusing on Dholera, Gujarat. It examines how occupation-based dependencies on water have shaped settlement patterns, socio-cultural traditions, and household spatial organization. The research explores the shift from traditional water conservation strategies to contemporary water access systems and the impact of this transition on the local communities.

Its aim is to examine the evolution of traditional water management practices and their impact on settlement patterns, socio-cultural traditions, and spatial organizations. The objectives of this research are to:

1. To document the transformation of water storage and conservation strategies in the rural settlements of Dholera.
2. To identify how spatial planning and the house layouts have adapted to the changing availability water in Dholera.

## Historical and Theoretical Background

Water management practices in semi-arid regions have been at the core of heritage and architecture in India, forming an integral part of cultural traditions and settlement planning. Given the scarcity of water, communities in these regions have developed efficient conservation techniques, ensuring sustainable access to water for drinking, agriculture, and daily domestic activities. Traditional water structures, such as stepwells (known locally as 'Vav' in Gujarat and 'Baolis' in Rajasthan), tanks, and reservoirs, have been constructed not only as utilitarian solutions but also as socio-cultural landmarks. According to Ramineni & Bharadwaj (2021), stepwells had served a dual purpose: providing a functional water source while also acting as gathering spaces for social and religious activities. The construction and use of these facilities and structures have often been deeply embedded in the local traditions, with architectural elements reflecting regional craftsmanship and adaptations to climate.

Often, oral transmission of knowledge about water conservation has been instrumental in preserving these traditional techniques. Thompson (2017) points out that oral histories capture first-hand experiences and indigenous knowledge, ensuring that critical water management practices are passed down through generations. In semi-arid regions, where rainfall is unpredictable, communities have relied on generations-old wisdom to optimize collection of water and methods of storage. For example, 'paniyaru', a traditional water storage system in Gujarat, has been widely used in houses to maintain cool drinking water and reduce wastage. Similarly, 'hauj', a semi-underground water tank, has been integrated into houses and public spaces, ensuring year-round availability of water (Maheshwari et al., 2014). These water spaces have not just been pragmatic solutions but also deeply interwoven with spatial organization and daily life, influencing house designs and communal areas.

However, as urbanization and modern infrastructure has expanded, piped water systems have begun to replace these vernacular conservation strategies. Indeed, this shift has resulted in a disconnection from the water spaces, diminishing awareness of water scarcity and the need for conservation. According to Conesa et al. (2014), this transformation has altered settlement dynamics, reducing the emphasis on water-centric communal spaces leading to the neglect or repurposing of historical water structures. Yet, in many rural settlements, the legacy of water-sensitive architecture persists, as seen in the integration of water tanks, rainwater harvesting techniques, and spatial planning adaptations in modern houses (Srivastava & Chinnasamy, 2024).

The relationship between water and occupation further reinforces its central role in settlement planning. In semi-arid Gujarat, agricultural communities such as the Kheduts (farmers) and Bharwads (pastoralists) have historically depended on traditional water sources to sustain their livelihoods. Farmers rely on canals, wells, and rain-fed irrigation, adapting their cultivation techniques based on seasonal water availability (Ahamad et al., 2023). Pastoralists, on the other hand, plan their migration routes based on the presence of lakes, ponds, or stored water reserves (Bhadra, 2024). In such landscapes, water storage and distribution systems have been designed to meet not just domestic needs but also agricultural and livestock requirements, creating interdependencies between water accessibility and occupation-based land use.

Thus, the interconnected nature of water management, cultural heritage, and spatial planning in semi-arid regions demonstrates how vernacular traditions have historically shaped settlement design. The continuation of oral histories, adaptive architecture, and sustainable conservation practices reflects an enduring relationship between people and water, underscoring the need for integrating traditional wisdom into modern water management strategies.

## Literature Review

There is a lot of research that has examined the water spaces and culture although not much related to Dholera exist. The cultural heritage of water spaces in India has long been associated with vernacular architecture and settlement patterns, particularly in the semi-arid regions where water scarcity has historically dictated spatial organization and conservation practices. According to Hosagrahar (2016), water structures such as stepwells (vavs), tanks

(kalyanis), and reservoirs (talabs) have been essential not only for survival but also have been deeply embedded in the socio-religious fabric of many communities. He points out that these spaces have served multiple functions, acting as communal gathering places, religious sites, and centers of social cohesion.

Oliver (2007) suggests that vernacular water structures reflect indigenous knowledge systems, where architectural design, hydrology, and community practices were harmoniously integrated to create sustainable water management strategies. Similarly, Shiva (2016) argues that water bodies were regarded as sacred entities, with their ritualistic and functional roles deeply intertwined in everyday life. Stepwells, for example, have been designed to store monsoon water while also providing shaded spaces for social activities.

The preservation of water heritage has largely depended on oral traditions and generational knowledge transfer. Widiastuti (2013) emphasizes that traditional communities have historically passed down water management techniques through storytelling, folklore, and communal rituals. This has played a crucial role in ensuring the continuity of indigenous water conservation practices. However, Datta (2016) points out that urbanization and modernization have disrupted this transmission of knowledge, leading to a gradual decline in vernacular water practices and a detachment from historical water spaces.

In semi-arid regions, water availability is a major determinant of livelihoods, settlement patterns, and community well-being. Due to moderate rainfall and high evaporation rates, these areas rely on rainwater harvesting, groundwater extraction, and traditional water conservation techniques to sustain agriculture and domestic water supply (Maheshwari et al., 2014). The role of water infrastructure, including traditional stepwells and modern pipeline systems, has been instrumental in reducing manual water-fetching efforts and improving accessibility (Shiferaw et al., 2002). However, inconsistencies in water distribution still pose challenges, leading to seasonal shortages and fluctuations in supply.

In rural semi-arid villages, water serves as a lifeline for domestic, agricultural, and cultural activities. For example, Maheshwari et al. (2014) emphasize that community wells, water tanks, and reservoirs continue to be critical sources of water despite the increasing penetration of piped water supply systems. Moreover, open water spaces such as ponds and village lakes function as recreational, social, and ecological hubs, reinforcing the historical connection between people and water bodies (Conesa et al., 2014). Over time, water-use practices have evolved, with many traditional activities such as outdoor washing and communal water collection being replaced by indoor facilities and household storage systems (Srivastava & Chinnasamy, 2024).

There is no doubt that water is a crucial resource for all the communities, but for those engaged in water-dependent occupations, its availability directly impacts their livelihoods and cultural practices. In this connection, Ahamad et al. (2023) argue that in semi-arid India, agriculture and livestock-based occupations have historically shaped water conservation strategies. Communities such as farmers and pastoralists in semi-arid regions of India, exemplify this relationship relying on adaptive water management techniques to sustain their livelihoods and settlement structures.

Indeed, agriculture in semi-arid Gujarat is heavily dependent on groundwater and irrigation. Maheshwari et al. (2014) note that farmers in these regions rely on canals, wells, and seasonal rainwater to support their crops. The Khedut community of Dholera for example, follows similar patterns, supplementing their agricultural incomes with construction work to mitigate financial instability. According to Srivastava & Chinnasamy (2024), dual livelihood strategies are a common adaptation in water-scarce rural economies, ensuring income diversification and resilience. Moreover, farmers store drinking water in matkas (clay pots) or larger tanks (paniyaru, hauj) to manage domestic needs, an age-old practice that continues despite the arrival of piped water.

The Bharwad community, a semi-nomadic pastoral group, exemplifies water-dependence for livestock management. Pastoralists follow rainfall patterns and seasonal water availability, ensuring that their animals have access to lakes, ponds, and watering holes during migrations (Conesa et al., 2014).

**Fig. 1:** Farmer, Bharwad and Potter caricature sketch
Source: Author

Bhadra (2024) highlights that pastoralists often develop customized water storage solutions, such as water storage tanks (Avado) and portable water barrels, to sustain their herds. These traditional water conservation techniques are critical in semi-arid landscapes, where access to reliable water sources remains a constant challenge.

Despite extensive research on stepwells and urban water spaces, there remains a critical gap in understanding their role in contemporary rural settlements. While Hosagrahar (2016) emphasizes stepwells as socio-religious spaces and Shiva (2016) highlights their sacred functional importance, neither explores their continued relevance in modern rural communities. Existing literature has primarily examined urban water systems, oral traditions, and domestic arrangements, leaving rural semi-arid regions underexplored.

Rural areas possess a wealth of traditional knowledge that communities utilize in their daily lives to address various challenges. However, the relationship between these communities and their traditional practices often changes due to development, advancements, and modernization as the time progresses. Shifts in thought, changes in occupation and evolving lifestyles lead to the gradual erosion of these traditions. This shift often results in the discontinuation of practices and the loss of associated stories. As the bearers of this knowledge age and pass away, the transfer of wisdom to subsequent generations ceases, resulting in the permanent loss of invaluable traditional narratives and practices.

Moreover, while many studies document the historical significance of water spaces, limited attention has been given to their integration into the present-day settlement planning. This gap highlights the need for further study on how water spaces continue to influence community life in semi-arid settlements like Dholera. By documenting and analyzing vernacular water management strategies, spatial configurations, and cultural interactions with water, this study seeks to bridge the existing knowledge gap. The research contributes to a broader discourse on water heritage, emphasizing the need for sustainable, community-driven water conservation practices in rural India.

## Research Methodology

This study employs a qualitative case study approach to examine traditional water management practices in two rural settlements of Dholera, Gujarat: Pipli (Farmer's House) and Bhadiyad (Bharwad's House). The case study method was employed to pursue an in-depth, context-specific exploration of vernacular water conservation strategies, spatial arrangements, and evolving water-use patterns. A multi-method qualitative approach was used, combining site mapping, spatial documentation, on-site observations, and oral histories to gain a comprehensive understanding of water usage, storage, and adaptation over time.

The first visit focused on an exploratory survey of multiple villages and households to identify the suitable case studies. A total of 15-20 houses from different communities were

observed and assessed based on spatial layout, water storage methods, and the extent of occupational dependence on water. Following this assessment, two case studies were conducted—a farmer's house in Pipli and a Bharwad pastoralist's house in Bhadiyad—as they presented diverse approaches to water conservation and domestic spatial organization.

The second visit was dedicated to site context analysis and historical water system documentation. Site mapping was conducted to record the spatial distribution of wells, water storage tanks, and underground reservoirs. Through ethnographic fieldwork and informal discussions with residents, insights were gathered on the past and present water management practices. Discussions were carried out to reveal information about different types of wells, variations in water quality, seasonal changes in water availability, and modifications in household water systems over time. Given the nature of the vernacular water traditions, no structured interviews or predefined questionnaires were used; instead, spontaneous conversations and on-site engagement allowed for a more authentic and unrestricted flow of information.

The third and fourth visits were dedicated to architectural documentation, spatial mapping, and behavioral observations. Floor plans and sectional drawings of the selected houses were measured, sketched, and later digitized using AutoCAD to ensure precision and accuracy. Observations focused on how the residents interacted with water spaces in their homes, mapping the circulation patterns and the functional use of water storage areas (paniyaru, hauj, matkas, etc.). To further understand the evolution of water accessibility, participants were engaged in retrospective spatial analysis, comparing historical water supply systems with contemporary modifications. These insights were documented through field notes, sketches, and photographs, ensuring a structured approach to qualitative data collection.

A key component of this study was the collection of oral histories, particularly from elder residents and community leaders. These narratives provided first-hand accounts of traditional water conservation techniques, changing settlement dynamics, and generational adaptations to water scarcity. To enhance credibility, multiple sources were consulted, and cross-verification techniques were applied—such as comparing oral accounts with existing physical evidence (e.g., abandoned wells, structural changes in homes, and alterations in water storage areas).

Moreover, to provide a clearer understanding of these narratives, oral histories were later supported with illustrations that visually depict traditional water practices, spatial transformations, and settlement adaptations over time. These illustrations and diagrams helped bridge the gap between verbal accounts and tangible spatial elements, ensuring a more comprehensive representation of historical water management strategies.

By employing a multi-method qualitative approach, this study ensures a rigorous and replicable examination of vernacular water management practices in semi-arid settlements. The combination of site observations, spatial analysis, and on-site engagement provides a comprehensive understanding of how water continues to shape community life and settlement planning in rural Gujarat.

## Introduction to the Case Study Region – Dholera, Gujarat

### Water and Life in Dholera: A Historical Perspective

A popular local saying encapsulates the essence of life in Dholera:

" ધૂડ ગાંવ ધોલેરા ને બંદર ગાંવ બારા,
કાથા ગૌ ના રોટલા ખાવા ને પાણી પીવા ખારા,
તોય ધોલેરા સારા "

Translation in English is as follows:

*"A village of dust, Dholera, and a town of ports,*
*Eating rotlas made from stale grains and drinking salty water,*
*Still, we are better at Dholera."*

This proverb reflects the harsh environmental conditions of Dholera—dusty landscapes, limited access to freshwater, and reliance on basic sustenance. Despite these challenges, the saying conveys a sense of resilience and pride among its people, emphasizing their adaptation to water scarcity and the rich cultural identity tied to their land.


**Fig. 2:** Dholera Region in the Map of India, Gujarat
Source: Author

Dholera is situated 30 kilometers away from the vibrant city of Dhandhuka, in the Gulf of Khambhat. Dholera lies within the arid to semi-arid region of western India, where the average annual rainfall is low, and evaporation rates are high, indicating a semi-arid climate. Referred to locally as 'Bandar Gaanv'. It has faced significant water issues both in the past and present. The village possesses a rich history concerning the utilization of water and water spaces, which adds depth to its narrative.

In Early Centuries BCE, this period saw extensive maritime trade networks connecting Dholera with various regions across the Arabian Sea and beyond and till the 16th century Dholera' s prominence emerged as a port city. This is the reason it is popularly known as the Bandar Gaanv where bandar means Port. In 17th century it declined as port city because of the shift in trade routes and emergence of new trading centers. Then it fell under the British Influence, around 1900, Patadyu was discovered which is a natural hot spring. Immediately, this geothermal water source became an essential part of local water traditions, serving both domestic and medicinal purposes.

The water used by the people of Dholera for drinking was directly from the rivers or the lake which was very salty in nature. In 1955, the governor of Gujarat visited Dholera where people offered him salt water to drink which made the governor take a step towards better treated water for drinking. Then, 2 years later in 1957, the first drinkable water pipeline from *Hingoli* to Dholera was laid. Subsequently and slowly, the water treatment plants were constructed and proper pipelines reached the houses.

## Case Studies

To comprehensively analyze water accessibility, consumption patterns, and community adaptations in the Dholera region, two villages—Pipli and Bhadiyad—were selected based on strategic criteria. These villages, situated within the Dholera region were chosen for their

geographic relevance, diverse water supply schedules, accessibility, and proximity, ensuring a well-rounded comparative analysis.

Within these villages, specific households were identified to represent variations in occupation, lifestyle, and age demographics, capturing a holistic view of water usage behaviors. The selection process also considered different water supply timings, enabling an in-depth understanding of how various facilities impact daily life. Most importantly, residents were selected based on their willingness to participate, sharing valuable insights into historical, social, and infrastructural aspects of water management. These case studies offer a micro-level perspective on the broader water challenges in Dholera, enriching the research with real-life narratives and lived experiences.

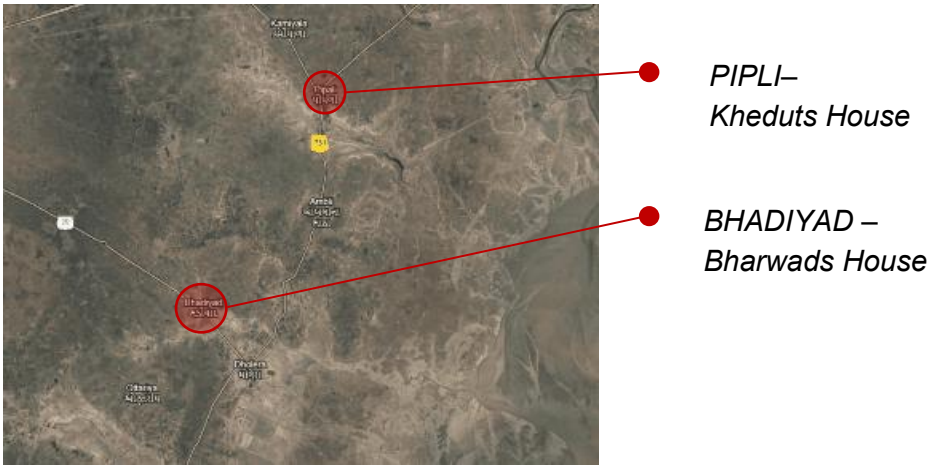



**Fig. 3:** Dholera Region in the Map of India, Gujarat
Source: Author

**Case 1 – Pipli Village – Farmer's House**

Pipli Village, located within the Dholera region of Gujarat, holds strategic importance as part of the Dholera Special Investment Region (SIR). It is home to the region's first Water Treatment Plant (WTP), a critical facility that ensures a reliable supply of treated, potable water to the area. This WTP is a key component in the infrastructure supporting the development of the Dholera Smart City, marking a significant milestone in the region's transformation into a major urban and industrial hub.

In this village, a unique case was identified: a farmer's house where 26 family members live together under one roof. Until recently, the family had sourced water from the lakes, but during the summer when the lakes dried up, they had relied on wells. Different communities in the area had their own wells. However, they now receive water through pipelines for 12 hours a day, as being situated near the water treatment plant.

**Case 2 – Bhadiyad Village – Bharwad's House**

Bhadiyad Village is 17 kilometers away from Pipli. The house identified here represents a pastoral community locally known as Bharwads, who own cows and are engaged in the milk business. The family lives in a 60-year-old wooden house, accommodating six members and a total of 25 cows, including both calves and older ones. While they are Bharwads, they are also partially farmers. The young male of the house work in the fields every day. The daughter-in-law goes to learn work nearby, and the children attend school and spend the rest of their day as they please and Dadi-Jahuben who spends most of her time in home doing household chores.

Jahuben along with her husband Khagarbhai begins their day early at dawn by milking the cow. Jahuben then feeds and tends to the cattle. She then walks to fetch water; balancing pots on her head, often walking to the nearest lake. She comes home and cooks food on Chulha: a traditional stove. Khagarbhai and her son takes the lunch to their working fields. Jahuben then

has to work at home doing the other cleaning chores which includes cleaning the house, washing of utensils in chowkdi and filling water in the Avadi for the cows. She then goes to Patadyu for washing clothes and to take a bath there and returns home. She then takes a rest in the afternoon and then prepares for dinner.

**Site Analysis of Pipli**

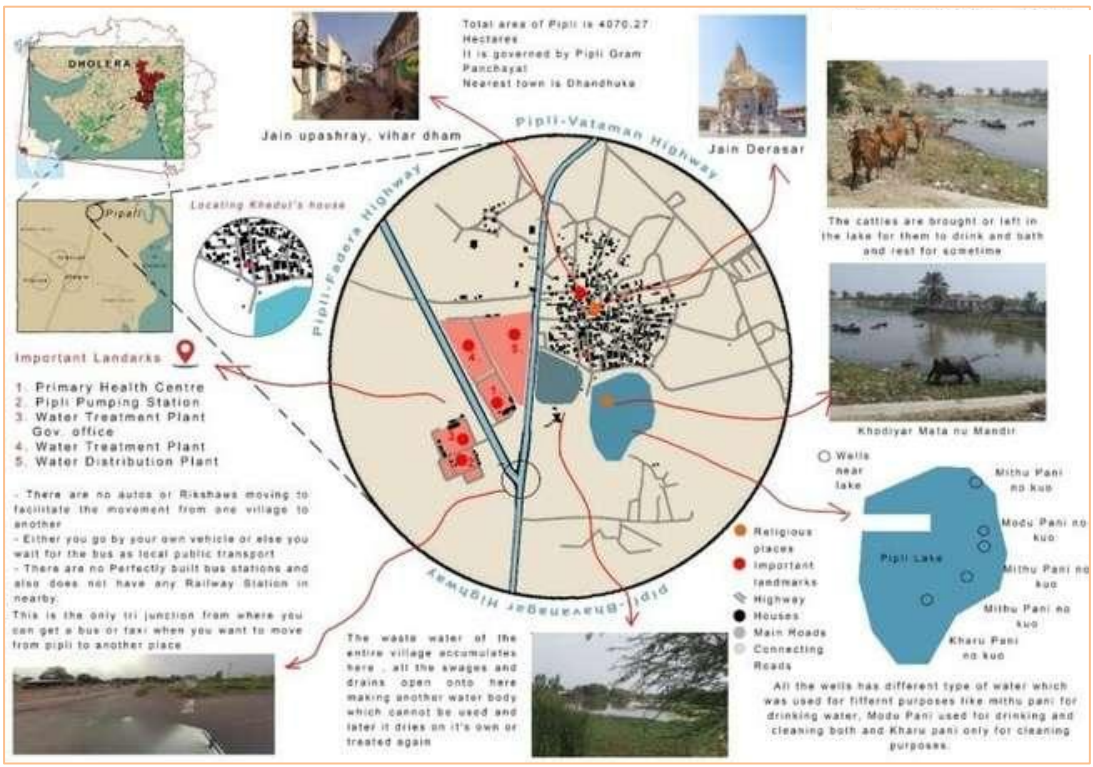



**Fig. 4:** Site Analysis of Pipli Village
Source: Author

The village of Pipli, located in the Dholera region of Gujarat falls under the jurisdiction of the Pipli Gram Panchayat, with Dhandhuka being the nearest urban center offering broader connectivity. Despite being situated along key regional corridors—the Pipli-Vataman and Pipli-Fedara highways—it experiences limited mobility infrastructure. The absence of local auto-rickshaw services and an unreliable public bus system, coupled with the lack of any nearby railway station, restricts intra- and inter-village movements. Water infrastructure in the village is a critical component of its spatial organization and daily life.

The settlement hosts essential water-related facilities such as two water treatment plants, a pumping station, a water distribution center, and several traditional wells positioned around the centrally located Pipli Lake. These wells are functionally categorized: "Mithu Pani no Kuo" and are designated for drinking, "Modu Pani no Kuo" for both drinking and cleaning, and "Kharu Pani no Kuo" exclusively for cleaning purposes. This nuanced classification reflects a deep-rooted understanding of water quality and use. The lake itself is multifunctional, also serving as a water source and bathing area for the cattle.

However, the presence of untreated wastewater accumulation forming a secondary water body points to infrastructural limitations and environmental concerns. Furthermore, Pipli is home to significant religious landmarks-Khodiyar Mata nu Mandir, situated adjacent to the lake, highlighting the spiritual and functional integration of water bodies within the cultural framework of the village. The settlement pattern reveals a tightly knit core organized around religious and water landmarks, reinforcing the interconnectedness of ecology, infrastructure, and social life in the village.

## Site Analysis of Bhadiyad

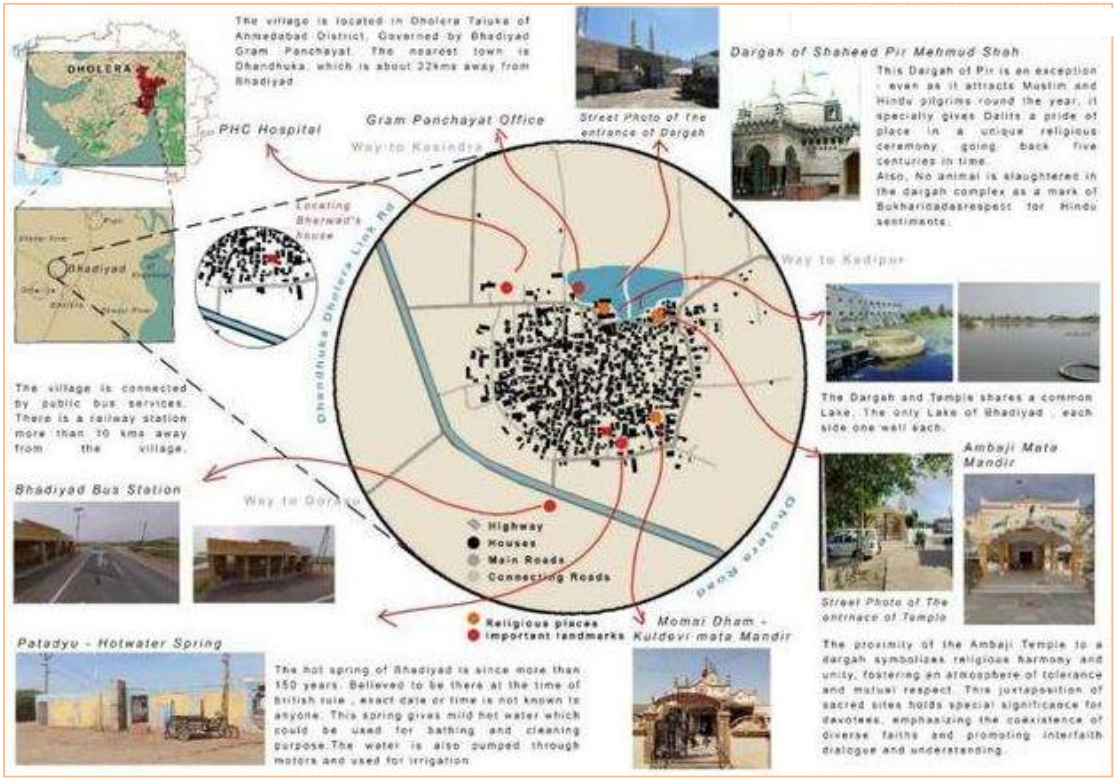



**Fig. 5:** Site Analysis of Bhadiyad Village
Source: Author

The village of Bhadiyad is situated in the Dholera Taluka of Ahmedabad District and is governed by the Bhadiyad Gram Panchayat. Located approximately 22 Kilometres from the nearest town, Dhandhuka, the village benefits from moderate connectivity. It is serviced by public buses, although the closest railway station lies more than 10 kilometres away, indicating limited access to broader transit networks.

The settlement is primarily structured along the Dholera Link Road, which serves as a key arterial route connecting Bhadiyad to the adjacent towns like Goras and Kasindra. Religious landmarks define the spatial and cultural landscape of Bhadiyad. The Dargah of Shaheed Pir Mehmud Shah, a revered Sufi site, and the Ambaji Mata Mandir, a Hindu temple, are situated adjacent to each other and share a common lake—each side owning one well. This spatial proximity and water-sharing arrangement between the Dargah and the temple is emblematic of interfaith harmony and coexistence.

The Dargah, which has a centuries-old history, notably does not permit animal slaughter within its premises as a sign of respect towards Hindu sentiments, reinforcing its inclusive character. Nevertheless, these sacred sites act as focal points for social interaction and religious convergence, further reinforcing Bhadiyad's communal fabric. The village also houses Patadyu, a natural hot water spring believed to date back more than 150 years, possibly to the British colonial period. The spring emits warm water and serves a number of domestic and agricultural purposes, including bathing and irrigation. Water is also pumped through motors for extended use, marking it as a crucial element in the water heritage of Bhadiyad.

The village layout reveals a tightly bound residential fabric, with religious landmarks, community structures, and traditional water resources integrally woven into its spatial organization. The house of the Bharwad family is located near the lake and spring, offering a unique lens into the intersection of livelihood, water access, and cultural practices.

## Findings

It was noted that the settlement patterns of Dholera have been heavily influenced by the availability of water and the conservation practices. Unlike modern drainage systems, historical waste management has relied on natural evaporation through small ditches in front of the houses. Seasonal variations in the availability of water has determined where and how water has been sourced—lakes during the monsoons and hot springs like Patadyu in the drier months. The built environment of the region incorporates water-conscious planning, including underground storage systems, large water storage open structures (Avado), and shared community wells to ensure sustainable water use.

### Oral Histories - Dholera

According to the interviews, life has been very different in the village of Dholera about 40-45 years ago. Their main source of drinking water has been the Dholera lake, despite its slight saltiness (Fig.8) Then, in 1973, a significant change has occurred with the introduction of standposts in the village, providing a more accessible water supply (Fig.9). Dholera has had no formal drainage system; instead, each household has had a small ditch in front of the house to channel wastewater, allowing it to naturally evaporate. When these ditches became overfilled, it was primarily the women of the house who were responsible for cleaning and emptying them. Washing clothes was traditionally done near the lake (Fig.10), but during the dry summer months, when Dholera Lake would dry up, women would travel to Patadyu, a natural hot spring believed to have medicinal properties, to fetch water for the household chores. Patadyu has also been used as a communal washing space and has attracted people of all ages seeking its therapeutic benefits (Fig.13). During the monsoon season, when lakes were replenished, they had become sites of recreation, especially for the young children, who would swim and dive in the water, enjoying the seasonal abundance (Fig.11).

The spatial organization of homes in Dholera reflected water access and cultural norms. Oral histories revealed that 28 years ago, household bathing spaces were incorporated within private rooms, highlighting the importance of privacy, especially for women. One such example is the chowkdi, a raised platform inside a bedroom that served as a bathing area, offering a sense of seclusion in contrast to communal water use practices (Fig.12). Common washrooms were typically located near the fadyu (an open space within the house), where activities such as fetching water from underground tanks and celebrating festivals took place.

**Fig. 6:** Illustrations of Women filling drinking water from lake
Source: Author

**Fig. 7:** Illustration of women using Standpost for filling water
Source: Author

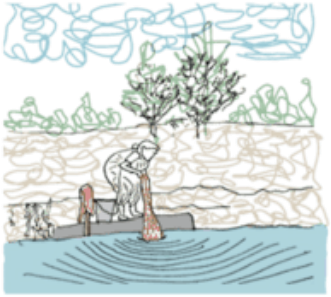


**Fig. 8:** Illustrations of Women washing clothes lakeside
Source: Author

**Fig. 9:** Illustration of Kids jumping into lakes for fun
Source: Author

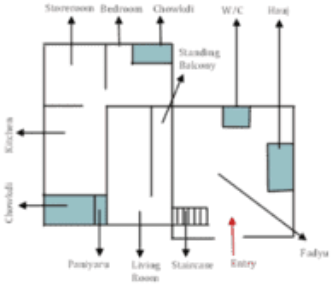



**Fig. 10:** Layout of the house plan
Source: Author

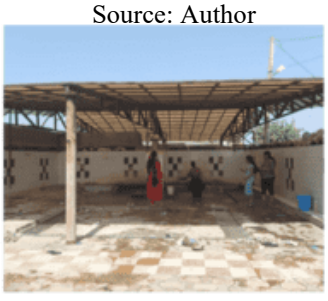


**Fig. 11:** Patadyu- Hot water spring in Dholera
Source: Author

**Pipli House: Oral Narratives**

In the past, the residents of Pipli relied on lakes for water, but during the summer droughts, they depended on community-specific wells. Today, they receive piped water from the village corporation for 12 hours daily, though it is hard and slightly brown due to its source near a water treatment plant. Historically, the Bharwad community, who once owned cattle, gradually sold their livestock for financial reasons and now primarily engage in agriculture, supplemented by daily wage and construction work. Their 40-year-old house accommodates 26 family members across the households of five brothers, each maintaining separate living spaces with personal kitchens, while sharing common sanitation facilities. Traditional "paniyaras" (water storage pots) remain integral to their daily lives. A street drain runs through the house but does not cause sanitation issues, as rainwater naturally cleans it during monsoons. Previously, open defecation was common, with villagers carrying water for sanitation.

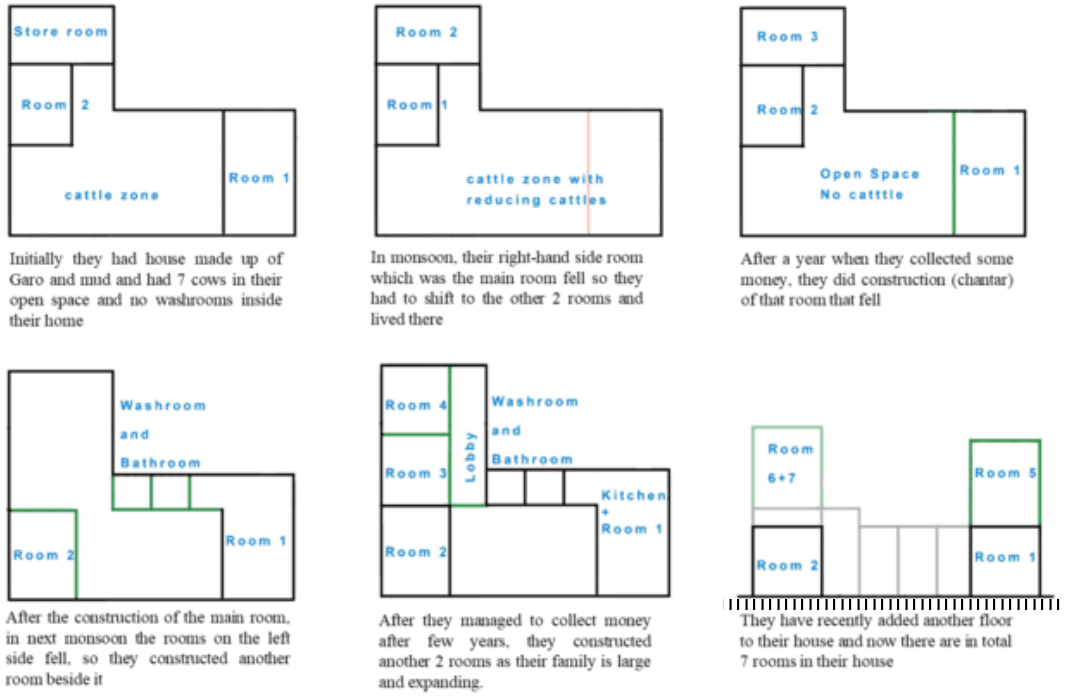



**Fig. 12:** Plan that changes - Incremental use of the layout of the house
Source: Author

The spatial transformation of the Pipli house (Fig.14) reflects shifts in household structure, occupation, and lifestyle over time. Initially, the house incorporated a dedicated cattle zone, emphasizing the reliance of the family on livestock for sustenance and income. However, as economic conditions changed, the number of cattle has reduced, leading to a reconfiguration of spaces—eventually converting the cattle zone into an open space for domestic use.

The addition of washrooms and bathrooms marks a significant shift in sanitation practices, moving from open defecation to more structured sanitation facilities. The evolution of room configurations suggests a growing need for privacy and functionality, as individual rooms now cater to different family members while maintaining shared areas for interaction.

This progressive adaptation of space highlights the impact of changing water availability, economic needs, and social structures on rural dwellings in Pipli.

## Documentation and Analysis

Following section presents the spatial organization and daily activities within the selected houses through measured drawings and activity mapping. This documentation provides a foundation for understanding how water accessibility influences household routines and spatial adaptations.

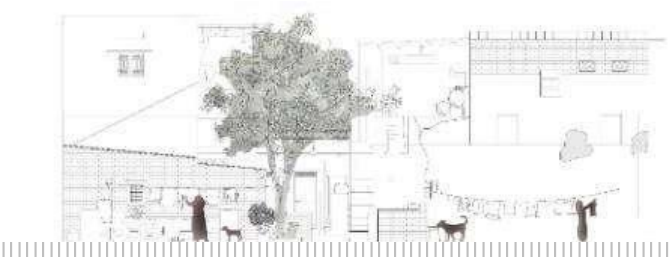


**Fig. 13:** Elevation of Farmer's House
Source: Author

**Fig. 14:** Picture context of the Pipli House
Source: Author

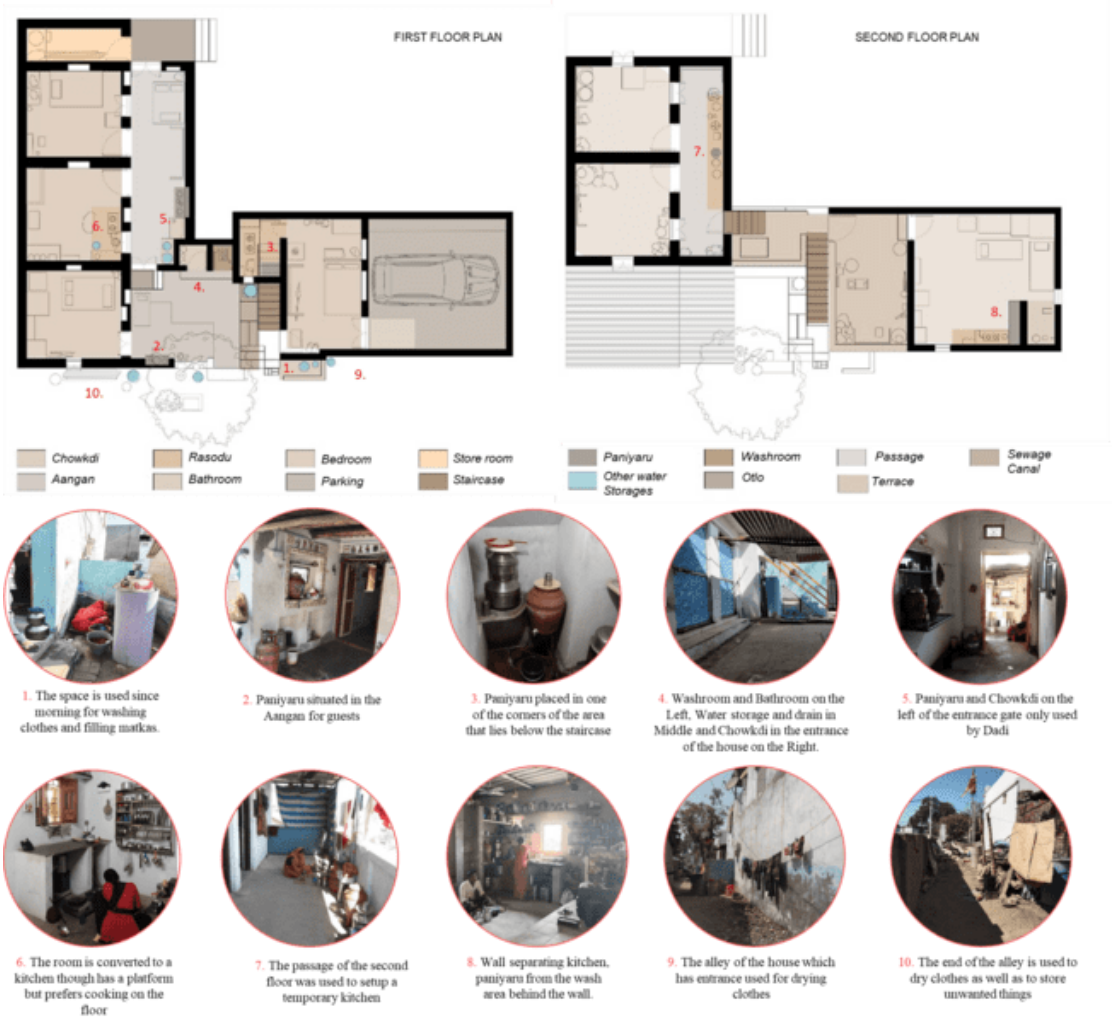



**Fig. 15:** Pipli House Plan and activities related to water spaces
Source: Author

The placement of spaces within the house is carefully designed to ensure accessibility and functionality for all the residents. The bathroom and washroom are centrally located, making them easily accessible to everyone. Moreover, the chowkdi (washing area) at the entrance allows people to clean their hands and feet before entering, maintaining hygiene. A secondary chowkdi near Dadi's room ensures that she doesn't need to go outside for her daily tasks, highlighting an age-inclusive design. For water accessibility, multiple paniyarus (water storage spaces) are positioned strategically. The paniyaru at the entryway ensures convenience for guests, while two additional ones near the guest rooms cater to personal use. Bedrooms of the house functions as a self-sufficient living unit, incorporating sleeping, cooking, bathing,

storage, pooja, and relaxation spaces within a single area. This reflects traditional multi-functional spatial planning. The kitchen in the passage has been initially a temporary cooking space, indicating the flexibility of space utilization based on household needs.

**Fig. 16:** Before/After of Drain
Source: Author

**Fig. 17:** Before/After of their main Room
Source: Author

At the entrance of the house, an open drain traverses through the aangan (courtyard), channeling wastewater away from the dwelling. According to the family, the presence of this open drain has not caused any discomfort or sanitation concerns. Despite being uncovered, it does not emit unpleasant odors, as the wastewater either evaporates naturally under sunlight or is absorbed by the ground. During the monsoon season, rainwater naturally cleans the drain. However, the family recently opted to cover the drain, not due to functional issues, but to enhance the aesthetic appearance of the space (Fig. 16).

In response to the evolving spatial needs, the family has extended this side of the building by constructing an additional room. During the initial site visit, this space has functioned primarily as a resting and dining area. By the time of the second visit, the family had further modified the layout, introducing a chowkdi—a traditional kitchen platform—within the same area (Fig. 17). A high partition wall has been erected to demarcate the kitchen and paniyaru (water storage or usage area) from the adjacent washing zone, reflecting a shift towards spatial organization aligned with practical and cultural sensibilities.

**Fig. 18:** Before/After of Drain
Source: Author

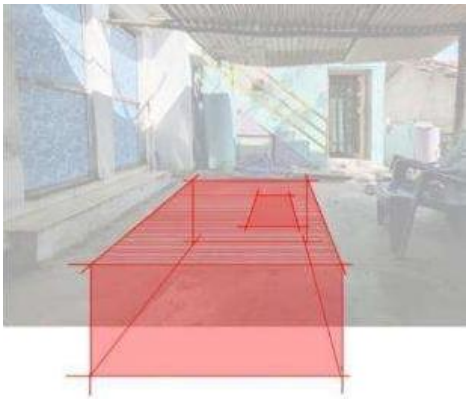
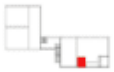


**Fig. 19:** People's idea of building an underground water tank – Hauj
Source: Author

During the initial visit, it was noted that the gallery space on the second floor had temporarily adapted to function as a kitchen. However, by the time of the subsequent visit, this arrangement had changed—the kitchen had been removed and replaced with a traditional swing, indicating a shift in the functional use of this semi-open transitional space (Fig. 18). Furthermore, during the conversation with the residents, they shared their intention to construct an underground water tank (hauj) in the central courtyard, located directly in front of the main

entrance. The proposed addition highlights their evolving infrastructural needs and the desire to enhance on-site water storage capacity in response to the changing household requirements (Fig. 19).

**Spatial Study of the wet areas of the House**

| Parameters/ Name of the space | Chowkdi | | | Bathroom Washroom | Paniyaru | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Photo |  |  |  |  |  |  |  |  |  |
| Placement |  Right in Entry |  In osri |  Inside bedroom |  In front of the Entry |  In aagnu, near bedroom 1 | Inside kitchen | Verandah |  Inside House near Kitchen and Bedrooms | Verandah |
| Adjacent Spaces | - Entrance<br>- Bedroom | - Bedroom<br>- Otlo | - Bedroom<br>- Paniyaru<br>- Kitchen | - Aangan<br>- Bedroom<br>- Otlo | - Fadyu<br>- Avedi | - Aangnu<br>- Entry | - Paniyaru<br>- Otlo | - Chowkdi<br>- Kitchen<br>- Bedroom | - Bedrooms |
| Nature of the Space | Open | Enclosed | Enclosed | Enclosed | Open | Enclosed | Enclosed | Enclosed | Open |
| Area | 1.30 m² | 0.87 m² | 1.58 m² | 2.5 m² | 0.30 m² | 0.70 m² | 0.58 m² | 0.63 m² | - |
| Form of the space | Cuboidal | Rectangular | Cuboidal | Cuboidal | Cuboidal | Cubical | Cuboidal | Cuboidal | Rectangular |
| Direction ( Standing in centre of the area facing north ) | East | North West | East | North | South | North East | North | East | East |
| Used by | Females | Dadi and Girls | Who access the room | Everyone | Everyone | Who access the room | Dadi and others | Who access the room | Who access the room |

| Parameters/ Name of the space | Rasodu | | | | Chulha | Clothes drying area |
|---|---|---|---|---|---|---|
| Photo |  |  |  |  |  |  |
| Placement |  Near Bedroom 1 |  Inside Bedroom 2 |  Inside Bedroom 3 |  In Verandah |  Outside house |  Before Entrance near Chowkdi |
| Adjacent Spaces | - Bedroom | - Bedroom<br>- verandah | - Chowkdi<br>- Bedroom<br>- Pooja Room | - Bedroom | - Entrance | - Chokdi<br>- Entrance |
| Nature of the Space | Enclosed | Enclosed | Enclosed | Open | Open | Open |
| Area | 3.08 m² | 2.22 m² | 1.78 m² | 2.40 m² | 0.10 m² | 1.30 m² |
| Form of the space | Cuboidal | Cuboidal | Cuboidal | Free | Cuboidal | Cuboidal |
| Direction ( Standing in centre of the area facing north ) | North | North West | East | North | South West | South East |
| Used by | Females | Females | Females | Females | Everyone | Females |

**Fig. 20:** Spatial Analysis of the wet spaces of Pipli House
Source: Author

**Bhadiyad House: Oral Narratives**

The family has been residing in a 60-year-old traditional wooden house, deeply rooted in the cultural and agricultural heritage of the region. They belong to a close-knit community, where cousin brothers live in proximity, each family occupying separate houses—some being fully constructed (pucca makaan) while others remain old and semi-permanent (kachcha makaan). Farming has been their primary occupation for generations, and they store dry grass for months to sustain their cattle. They also collaborate with fellow farmers and Bharwads, exchanging services such as providing grazing land for cattle in return for renting tractors for agricultural purposes. This mutual exchange system has been a longstanding practice across neighboring villages. Access to drinking water has transformed over time—earlier, women had to walk 1.5 km to fetch water from a well near Ambaji Mandir, but with the installation of a water line seven years ago, the supply has become more convenient, albeit available only every six to seven days.

Another significant improvement has been the construction of a hauj (water tank) eight years ago, which has eliminated the need to travel to Patadyu for washing and bathing. The family even keeps a turtle in the hauj, believing that it helps clean the water naturally. Additionally, the government's 'Har Ghar Shauchalaya'- (Washroom in every Home) scheme has facilitated the construction of a new washroom with proper sewage and water connections, making sanitation more accessible.

## Transformation of Spaces and the Present-Day Living

The house has undergone functional adaptations over time, integrating both traditional and modern elements to suit the changing needs. The Garo flooring on the second floor and tiles on the ground floor reflect a mix of old and new materials. Despite owning a stove, the family continues to cook on a chulha, using cow dung cakes (Chaan) as an economical and sustainable fuel source, helping them conserve gas and reduce expenses. The house is also structured to accommodate their livestock, with designated spaces for their 25 cows and calves, ensuring their comfort and well-being. A specific room is reserved for resting calves, and the family has built Avado's (watering areas) for their cattle. Milking follows a strict routine, with morning milk kept for home use and evening milk sold to the village dairy for additional income.

Another interesting practice is that the family does not bathe their cows or buffaloes, a concept unfamiliar to them, highlighting a unique cultural perspective on livestock care. Moreover, their house includes a multi-functional space, where one of the rooms is rented out to laborers during the crop season and later repurposed as a storage area. These adaptations reflect the evolving lifestyle of the family, balancing traditional practices with practical adjustments to meet their daily needs.

## Documentation and Analysis

Following section presents the spatial organization and daily activities within the selected houses through measured drawings and activity mapping. This documentation provides a foundation for understanding how water accessibility influences household routines and spatial adaptations.

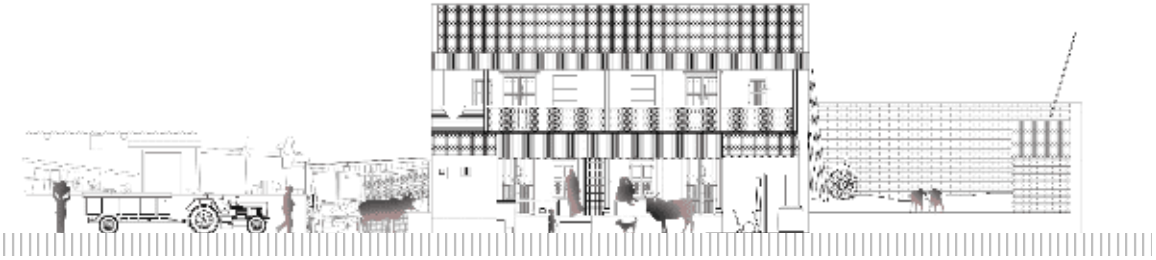


**Fig. 21:** Elevation of Bharwad's House
Source: Author

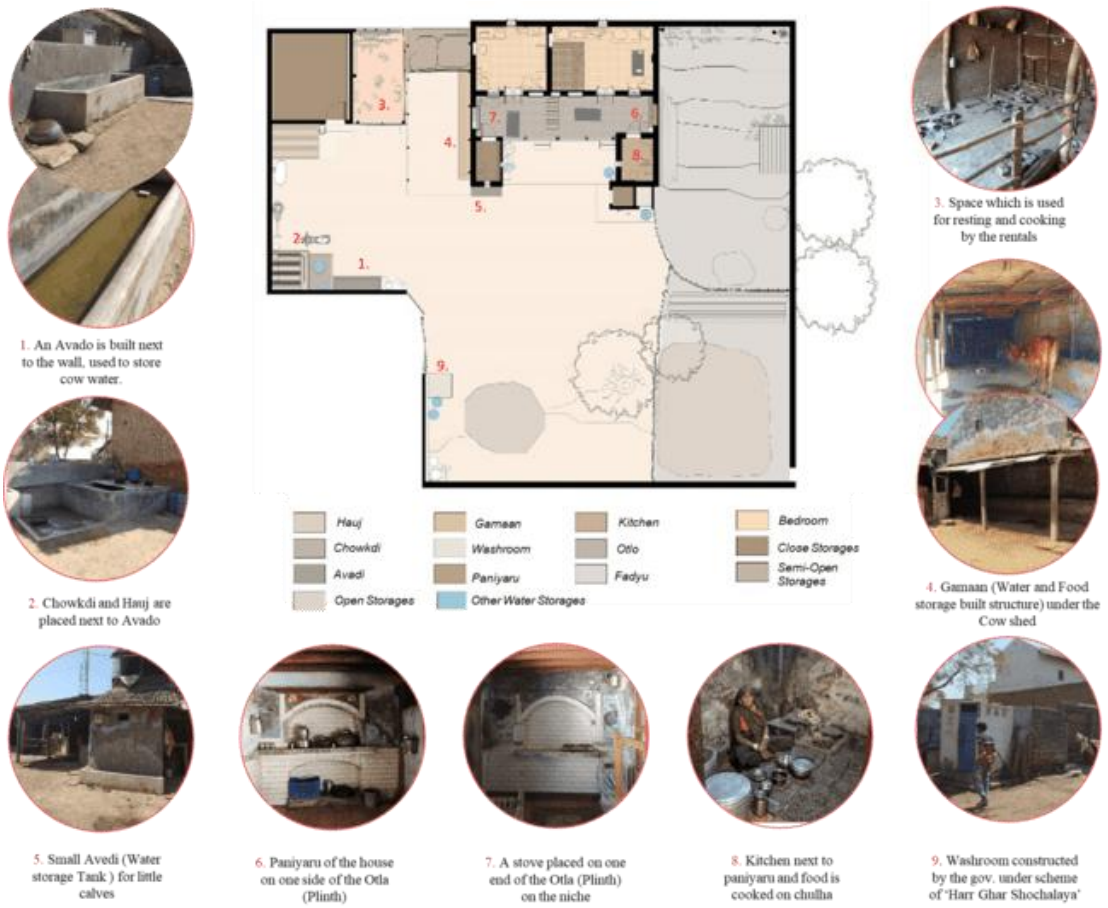



**Fig. 22:** Bhadiyad House Plan and activities related to water spaces
Source: Author

The house is designed with flexible spaces that adapt to the needs of the family. The private areas, such as the bedroom and cattle resting space are used by specific family members and livestock, whereas semi-private and common spaces serve multiple purposes. A notable feature is the multi-functional room, which transitions from a bedroom to a storage area when required. Essential water-related spaces such as the hauj (water tank), chowkdi (outdoor washing area), and a common washroom are situated outside the main house, reflecting a communal approach to sanitation and water use. The kitchen and paniyaru (water storage space) are located within the house, ensuring easy access for daily cooking and water-related tasks. Unlike modern houses with designated living rooms, this family relies on the Otlo (raised veranda) in front of the bedrooms as a gathering and resting area. The space seamlessly connects to the kitchen, paniyaru, and storerooms, emphasizing an integrated spatial layout. The aangan (courtyard) and vado (open cattle enclosure) are expansive, providing ample space for livestock movement. Various storage areas—open, semi-open, and closed—are strategically placed to accommodate their agricultural produce, milk, cow dung, and fodder, essential for their livelihood and self-sustaining way of life.

When I was working on the documentation of the house, the daughter in law of one of the family members asked me a question as she thought that I am doing some job because of I had visited their place. She asked if I could also help them by providing jobs. The young lady of age 23–mother of 2 kids asked me:

"Tamara pase kai kaam hoi to kejo' Mai silai krta sikhiyu che (Do you have any Job to offer? I have learnt doing sewing work)!!

I then asked where she is looking for a job? Outside or in the village? She replied: 'Ghar betha thai sake evu' ( a job that could be done from home).

## Spatial Study of the Wet Areas of the House

| Parameters/ Name of the space | Avado | Avedi | Chowkdi | Hauj | Gamaan | Washroom | Rasodu | Paniyaru | Aangnu |
|---|---|---|---|---|---|---|---|---|---|
| Photo |  |  |  |  |  |  |  |  |  |
| Placement |  Near Entry in Open Area |  Outside house |  In Open area besides Hauj |  Corner of Open Area |  Oppo. to Avado |  Near Entry in Open Area |  Inside House near Paniyaru |  Inside House near Kitchen and Bedrooms |  Open Area |
| Adjacent Spaces | - Chowkdi<br>- Fadyu<br>- Gamaan | - Store Room<br>- Aangnu | - Avado<br>- Hauj<br>- Aangnu | - Chowkdi<br>- Aangnu | - Fadyu<br>- Avedi | - Aangnu<br>- Entry | - Paniyaru<br>- Otlo | - Rasodu<br>- Otlo<br>- Bedrrom | All Spaces except bedrooms |
| Nature of the Space | Open | Open | Open | Semi-Closed | Semi-Open | Closed | Closed | Semi- Open | Open |
| Area | 2.48 m² | 1.17 m² | 3.50 m² | 5.61 m² | 5.04 m² | 2.25 m² | 6.03 m² | 0.82 m² | 356.40 m² |
| Form of the space | Cuboidal | Cuboidal | Rectangular | Cuboidal | Cuboidal | Cuboidal | Cuboidal | Cuboidal | Irregular |
| Direction ( Standing in centre of the area facing north ) | South | South West | South | South | South West | South East | North West | North West | All sides |
| Used by | Dadi Cows | Dadi Cows | Everyone except cows | Everyone except cows | Dadi Cows | Everyone except cows | Dadi Daughter in Law | Dadi Bahus | Everyone |

**Fig. 23:** Spatial Analysis of the wet spaces of Bhadiyad House
Source: Author

## Discussion

The historical water practices in Dholera highlight a gradual but significant shift from communal and environmentally dependent systems to more private and structured forms of water access and use. The transition from lake-dependent water collection to standposts and then to the laying of pipelines reaching everyone's houses has marked an infrastructural milestone, altering daily routines, especially for women. Gender roles were distinctly visible in water management, with women responsible for wastewater maintenance and long-distance water collection during the dry seasons. Furthermore, the evolution of bathing spaces from public to private-exemplified by the chowkdi-illustrates growing concerns about privacy and gendered spatial organization, reflecting broader socio-cultural changes within the domestic realm. This transition also signals an adaptation to evolving notions of hygiene, dignity, and domestic modernity.

The spatial organization of houses in the villages studied reflects a highly adaptive and context-responsive design sensibility. In Pipli, the evolution of domestic layouts is not governed by formal principles such as Vaastu Shastra, but by the pragmatic needs of the household. The case study of the Pipli house illustrates this adaptive logic, wherein the built form has undergone incremental transformations aligned with changes in occupation, household structure, and daily practices. This flexibility underscores the dynamic relationship between livelihood patterns and spatial use. In contrast, Bhadiyad presents a more static spatial configuration. Here, the stability of occupation and the availability of sufficient space to meet the domestic needs have limited the impetus for architectural transformations. The comparison reveals that spatial adaptability is often necessitated by shifting the socio-economic conditions and occupational transitions, making the house a living entity that evolves in response to human needs, particularly where constraints—whether spatial, economic, or occupational—demand such evolution.

A gradual, resource-based approach to house-building has emerged as a common pattern across the villages studied, driven by the economic limitations and adaptive priorities. Most families in both Pipli and Bhadiyad do not have the financial means to construct a complete house in one phase. Instead, construction is approached incrementally; spaces are

built, repaired, or transformed in alignment with the evolving needs and available resources. A similar principle governs the construction of water storage systems such as hauj (underground water tanks), which serve as critical infrastructural elements in a region with infrequent water supply. In Bhadiyad, where municipal water is supplied only once a week, the presence of a hauj is indispensable and had been prioritized by the family early on, with construction completed around seven years ago.

In contrast, the household in Pipli, though similarly aspirational, deferred the construction of the hauj until the completion of their primary living areas. This decision has been informed by their relatively better water access, as the village benefits from daily water supply due to the proximity of a treatment plant. The comparison highlights how infrastructural decisions—particularly concerning water—are strongly influenced not only by economic capacity but also by local supply patterns and daily needs, reinforcing the idea that the architecture of water is deeply embedded in the socio-economic context.

It is noted that in the rural context, water-related work is handled mainly by the women. They are the ones who fetch water from the tanks or the wells, store it, and make sure it is used for cooking, washing, and cleaning. Even when the water supply is limited, they manage daily tasks around it. In many households, men do not even get water for themselves for drinking—women bring it to them when asked. This shows how water work is still seen as the responsibility of the woman. In farming families, women also help in the fields, but they still have to finish all the water-related chores at home before and after fieldwork. However, slight shifts in gender roles are emerging, with home-based income opportunities like sewing and handicrafts offering women a degree of economic participation without challenging domestic expectations. This duality of persistence and slow transformation underlines the need for culturally sensitive but progressive gender interventions in rural spatial and social planning.

## Conclusion

This research documents the evolving relationship between domestic spatial arrangements and water management practices in the rural settlements of Pipli and Bhadiyad in Dholera. It highlights the deep interdependence between water availability, spatial configuration, and occupation-based routines within households in semi-arid areas. Despite sharing a regional context, Pipli, Bhadiyad, and Dholera exhibit distinct adaptations shaped by occupation, economic capacity, and access to infrastructure—demonstrating that water strategies are not merely functional but are deeply embedded in socio-economic and cultural frameworks.

From decentralized water storage in Bhadiyad due to limited supply, to evolving spatial configurations in Pipli shaped by occupational shifts and the historical water-use traditions of Dholera preserved through oral narratives, this study demonstrates how water remains central to shaping not only space, but also the identity and rhythms of daily life in these communities. These nuanced understandings are crucial in documenting a form of vernacular resilience that is rapidly disappearing under modern infrastructural systems.

The methodology employed in this study—particularly the use of immersive field visits, informal conversations, oral narratives, and spatial documentation—proved instrumental in uncovering nuanced, lived realities that more rigid or structured methods may have overlooked. By engaging directly with the residents in their everyday settings, the research was able to capture intangible elements of household dynamics, water-use habits, and spatial decision-making. Informal dialogues allowed for unfiltered storytelling, which revealed intergenerational practices, socio-cultural beliefs, and evolving household strategies in response to water availability. The layered approach of mapping physical spaces alongside oral histories offered a multi-dimensional understanding of water as both a utilitarian and symbolic resource.

In fact, this methodological flexibility enabled the research to document subtleties in spatial transitions and community behavior that standard surveys or questionnaires may not have been able to register, making the study more grounded, contextual, and reflective of everyday life in the semi-arid vernacular settlements.

## References

Ahamad, F., Tyagi, S.K., Singh, M. & Sharma, A.K. (2023) Groundwater in arid and semi-arid regions of India: A review on the quality, management, and challenges. *Springer.*

Bhadra, M. (2024). Vernacular water conservation traditions by pastoral community: Study of Virdas, Banni Grasslands, Kutch. London: Taylor & Francis

Conesa, F.C., Devanthéry, N., Balbo, A.L. & Madella, M. (2014) Use of satellite SAR for understanding long-term human occupation dynamics in the monsoonal semi-arid plains of North Gujarat, India. *Remote Sensing*; 6(11):11420-11443.

Datta, A. (2016). The illegal city: Space, law and gender in a Delhi squatter settlement, London: Taylor & Francis.

Hosagrahar, J. (2016). Cultural heritage, the UN sustainable development goals, and the new urban agenda. BDC. Bollettino del Centro di Studi per la Disegno del Città, 16(1), 37–52. Rome, Italy: Gangemi Editore.

Maheshwari, B., Varua, M., Ward, J., Packham, R. & Dave, S. (2014). The role of transdisciplinary approach and community participation in village-scale groundwater management: Insights from Gujarat and Rajasthan, India. *Water,* 6(11), 3386-3408.

Oliver, P. (2007). Built to meet needs: Cultural issues in vernacular architecture. Routledge.

Ramineni, S., & Bharadwaj, M. (2021). Integrated water systems in vernacular settlements: Temple City of Melukote, Karnataka, India. ISVS e-Journal, 8(3), 34–53.

Shiferaw, B., Anupama, G. V., Nageswara Rao, G. D., & Wani, S. P. (2002). Socioeconomic characterization and analysis of resource-use patterns in community watersheds in semi-arid India (Working Paper Series No. 12). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). 44.

Shiva, V. (2016) Water wars: Privatization, pollution, and profit. London: *South End Press.*

Srivastava, A. & Chinnasamy, P. (2024) Watershed development interventions for rural water safety, security, and sustainability in semi-arid region of Western India. London: *Springer.*

Widiastuti, Indah. (2013). The Living Culture and Typo-Morphology of Vernacular Houses in Kerala. ISVS e-journal. Vol. 2, 41-53