Traditional Water Systems of the Cultural Landscape of Govardhan, Mathura

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Abstract

The cultural landscape of Govardhan in Braj Bhoomi (a cultural region spanning Mathura, Bharatpur, and Hodal in India) is the legendary humble adobe of Lord Krishna. The area has a magnificent blend of nature and a cultural connect. Around 49 *kunds* can be found in and around a 21 km (7 *kos*[1]) *parikrama* of Govardhan. *Kunds* have always been a part of the people of Braj for ages. They provide essential services to the community as well as pilgrims, such as water for bathing, domestic use, cattle rearing, drinking purposes. They are a space for social gathering, performing religious rituals, and they provide protection from flood and water scarcity at the same time. This paper aims to highlight the traditional knowledge embedded in the design and construction of these water systems. The paper presents the documentation of the key architectural features and natural components of the *kunds*. They are part of the larger water system in Govardhan that used to provide sustenance for entire settlements in such semi-arid climates. For the protection and conservation of these water systems it is important to visualise *kunds* as a system of multiple elements coming together. The outcome of this research can help in guiding initiatives for future management and conservation of *kunds*.

Key Words: *Kunds*, Water Bodies, Traditional Knowledge Systems, Cultural Heritage, Water Systems, Braj

[1] *According to the Arthashastra, a kos is approximately 3000 metres or 1.8 miles.*

Introduction

Water has always been a central concern for humans. The history of water management can be found in ancient practices and community cultural traditions. Water is regarded as the source of life, and the elixir of eternity in Hindu mythology. The Atharva Veda (2.3.6) prays: "May the waters bring us well-being!" There are several similar explanations of water's purity, usage, sacredness, and symbolism. Water is considered to be a purifier in many religions. In mythology, water's ability to "wash away sins" is linked to the power of sanctity and cosmic meaning (Eliade, 1991). A sequence of consecrations, religious rituals such as pilgrimages and holy baths are required to reach the source and achieve the merit of "living water" (Singh, 1994). All traditions across the world have a special reverence for water, which has led to patronage of building and managing water bodies by communities (Mishra, 2011).

People have often settled along rivers, lakes, and coastlines to guarantee access to vital water resources. In arid to semi-arid regions, which face scarcity of water owing to the environmental conditions and highly varying rainfall patterns, those inhabiting these regions have developed several traditional techniques to harvest rainwater, that has proved to be sustainable over centuries (Ramineni & Bharadwaj, 2021).

Traditional water conservation and management techniques exist in every region of India. For instance, groundwater recharging has been practised traditionally in parts of Delhi, Gujarat, and Rajasthan as a result of low rainfall and extreme weather patterns. Water systems were developed specifically to store water in regions where run-off is relatively higher and more widely distributed. Traditional water management knowledge is based on different usage trends, the soil state of the field, the rainfall pattern of the city, and inter-surface soil fractures. Communities used to choose rainwater harvesting sites based on these characteristics by first planning an outline of anticipated rainwater run-off slopes or directions, and then building drainage outlets for the region's excess water to evacuate. The outlines, elongation, height, and breadth measurements were sketched out to elevate the barriers laterally opposing the water flow-in ditches. The material excavated was used to construct the fences. Hydro-experts preferred this approach because it was the easiest (Husain & Arif, 2014). These systems are still vital and functional in many places and are now under threat with the thrust of urbanisation. Traditional knowledge for water harvesting and management in various forms has developed in India based on various processes of the hydrological cycle, evaporation, condensation, rainfall, streamflow, physiography etc. Religious associations not only provided cultural significance but also long-term protection.

Depending on ecological differences, many trends of rainwater harvesting systems in India have been developed. The northwestern Himalayas make up India's high-land ecological zone, where rain harvesting systems like zings and *kuls* are often used. *Kuls* are small tanks used to collect melting glacial water, whereas zings are used to divert water from glaciers to settlements. India's arid ecological zone include3 the southwestern parts of the Haryana and Punjab states, the Kuchch peninsula, the western parts of Rajasthan, and the northern portion of Gujarat state's Kathiawar peninsula. Rainwater harvesting systems such as *kuis* and dakeriyan are used in the western part of Rajasthan. *Kuis* are subterranean 10-12 metre-deep tanks used for water storage.

Irrigation techniques such as *khadins/dhora* are also used in western Rajasthan. The northern plains, Gujarat, the central highlands, and the Deccan plateau make up the semi-arid ecological area, where *virdas*, which are shallow wells, is practised in low depressions. For groundwater recharge, other rainwater irrigation methods are used, such as *johad*, *baandh*, *nada* (Kavarana, n.d.). In this series of semi-arid traditional water systems, *kunds* are the source of sustenance for the people of Braj and are also symbols of religious significance (Saha et al., 2010).

The cultural landscape of Govardhan is a synthesis of cultural and ecological dimensions blended with a religious belief system. This entire cultural set-up is framed around the Govardhan hill, an elongated geographic natural feature, which changes its visual nature as climate changes. Other elements of this system comprise forests (*vans* and *upvans*) and gardens in small patches abutting water bodies, neighbouring settlements, and *kunds* around which the settlements grow and which feed the locals and pilgrims in the area, and the fertile land serving both as agricultural and grazing lands where human-nature interactions are manifest. The *parikrama* of Govardhan hill and Radha Kund is a sacred dynamic loop holding each of the above components together. Each of these elements is deeply connected, forming a singular system. For the early and childhood years of Krishna's legendary existence, Govardhan was a stage. The Vaishnavites anchored on the floor, designating particular sites for numerous incidents in the life of lord Krishna and creating the countryside from memory and religious scriptures where he performed many *leelas* etc. (Thakur, 2011), making it an associative cultural landscape.

This paper comprehensively documents the traditional water systems of Govardhan, Mathura, in Uttar Pradesh. It also shares some architecture, ecological and cultural practices to revive these water resources.

Research Methodology

This study was undertaken to understand and document the ecological and cultural aspects of water systems from the architectural to the regional level. The following methodology was followed:

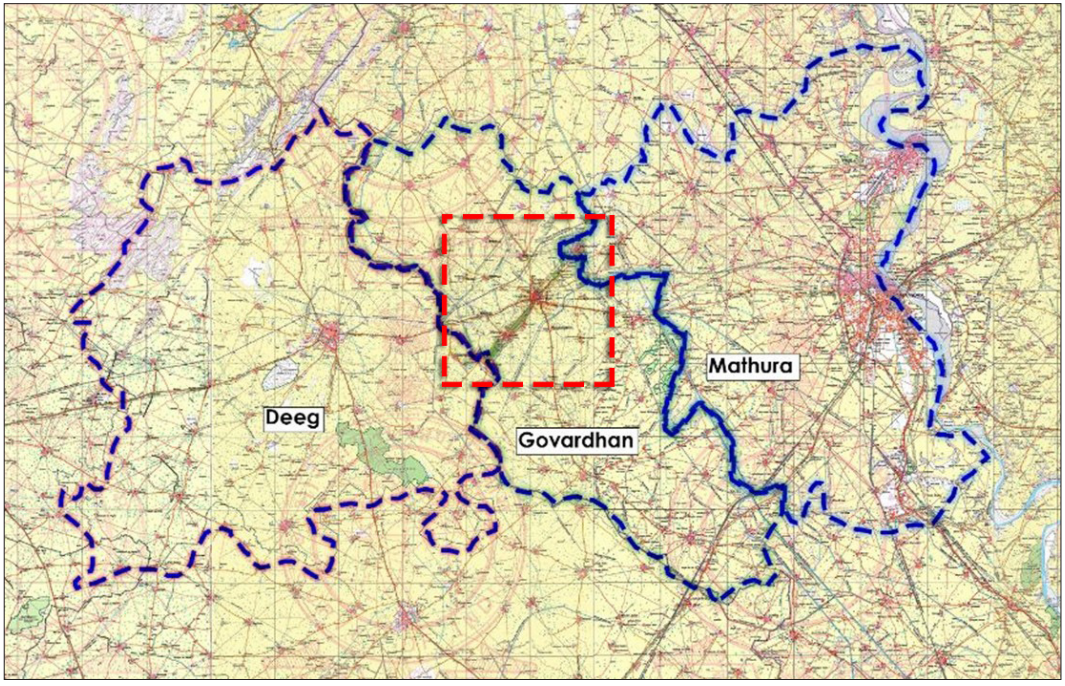
1. To understand the context of the study area, the research began with data collection and documentation of built and natural components. Primary and secondary surveys, as well as literature studies and interviews with various stakeholders have been used to acquire the necessary data for the study.
2. Mythological and cultural associations of *kunds* in terms of Govardhan, Braj, and the larger Krishna myths which also have a ritual based on significance were identified through religious texts and from primary data collection.
3. Based on the primary observation, scaled drawings were prepared by integrating site measurements with GIS mapping.
4. Assessment of the geographical character and watershed delineation was firstly done through secondary data collection using books and reports by the Central Ground Water Board (CGWB), the Ministry of Environment, Forest and Climate Change (MoEF&CC) etc., and using digital tools like GIS, Bhuvan etc. Then these gaps in data were identified and resolved by primary data collection and site visits.

5. Community-participatory traditional water management systems were developed over a period through local knowledge sources and by conducting interviews with community members and experts.
6. Along with this, the perspective through which *kunds* were observed and studied is broadly divided into three heads: architecture, water, and geography. *Kunds* were visualised as a system of multiple elements coming together—as trends observed on site, the conservation of built fabric is done extensively, but the ecological and cultural continuum of practices is not taken into consideration.

Study Area

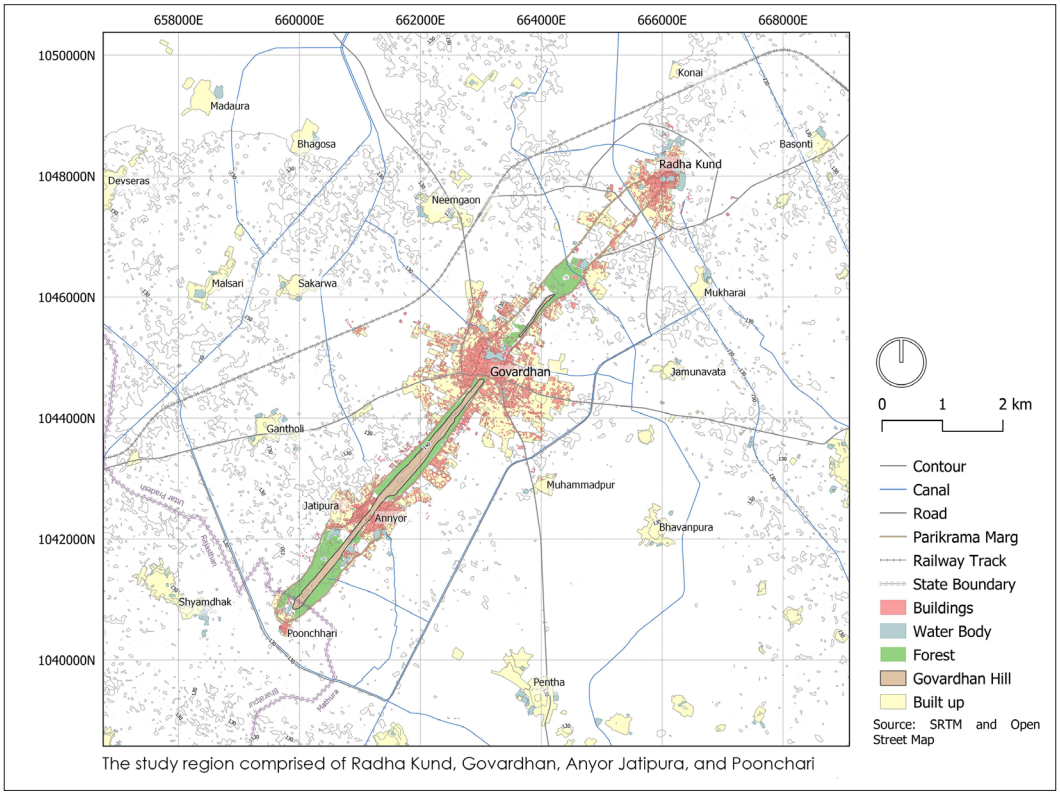
The cultural landscape of Govardhan sprawls around the Govardhan hill (also known as Giriraj Parvat) and Radha Kund, located in the Mathura district of Uttar Pradesh, and a small fraction in the Bharatpur district of Rajasthan. The study area is in the Govardhan and Mathura tehsil in Mathura district of U.P., and in the Deeg tehsil of Bharatpur district of Rajasthan (Figure 1). It comprises seven villages: Poonchari, Anyore, Jatipura, Sakitara, Govardhan Brahman, Govardhan Gorwan, Radha Kund Rural, Govardhan and Radha Kund Nagar Panchayat (Figure 2). Considering the census data, the area has a population of 46,000 (Census & Operations, Uttar Pradesh, 2011). However, being a prime centre for Lord Krishna worship, Govardhan is visited by approximately 1 crore (10 million) pilgrims annually (Udyoh Bandhu, n.d.). In order to sustain this footfall, there is always a need for water management for the residents as well as the visitors.

Figure 1: Study Area, Govardhan Tehsil of Uttar Pradesh and Deeg Tehsil of Rajasthan



Source: Survey of India. Modified by the authors

Figure 2: The Study Region: Seven Villages and Two Nagar Panchayats



Source: Space Shuttle Radar Topography (SRTM) and OpenStreetMap (OSM). Modified by the authors

The Govardhan hill and associated *kunds* are a natural built form, whose origins can be found in the mythological interpretations of the Vaishnavite legend, which is central to the Indic culture, where lord Krishna takes centrestage in his various forms as the protagonist. The mythic stories of the conflict between Indra and lord Krishna implored the people of Govardhan village to look towards spiritual means of worship, rather than the sacrificial or materiality of worship. The image of lord Krishna lifting this very hill with the tip of his finger to shield the villagers and animals from the wrath of Indra in the form of rain and lightning is of large significance in the Braj Mandal and the larger Indic culture.

The Ecological Context of Govardhan

Govardhan is a part of the western fringe of the Ganga alluvial plain. It lies in an older alluvium plain geomorphological unit. This unit is mainly characterised by yellow clay, kankar and reh. It is represented by alluvium plain, salt affected plain and waterlogged plain. Here the slopes are very high and they mostly form run-off zones (Gupta, 2019). Govardhan lies in the Yamuna middle sub-basin and the slope of the land is towards the Yamuna from north to south and the southeast

direction. Govardhan lies at an average height of 180 metres and the Yamuna at 150 metres. Many seasonal streams pass and originate from Govardhan, which eventually get connected to the Yamuna River.

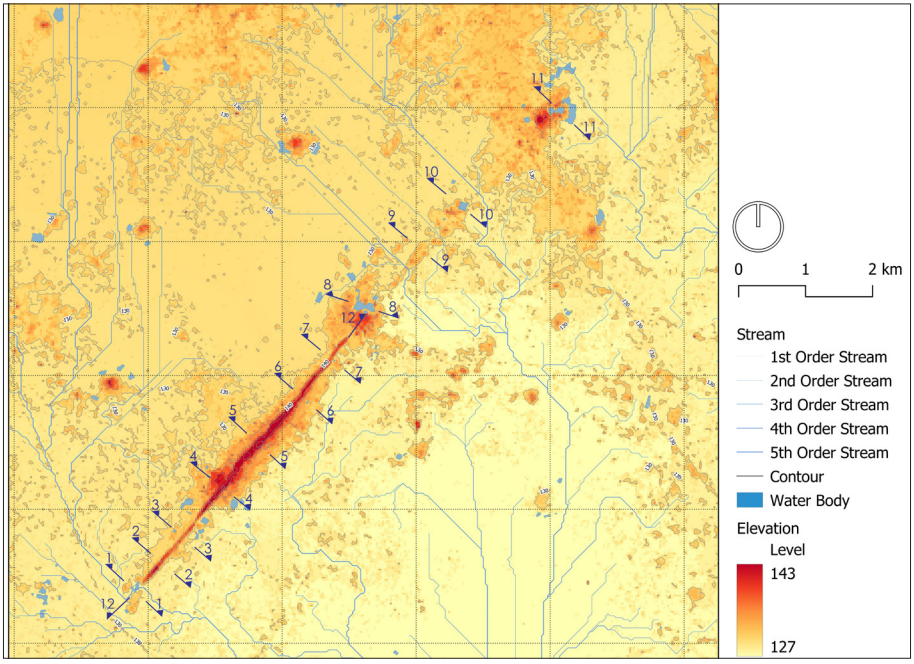
The study area lies at 27°27'22.0"N, 77°25'40.7"E to 27°31'56.7"N, 77°29'55.0"E. The Govardhan hill is a long, low ridge, of an ancient quartzite, part of the Aravalli mountain range (Figure 3) and is the largest in this region. It looks like a huge collection of small rocks due to the metamorphosis of the sandstone, and extends altogether for about 8.1 km (Figure 4), rising up to 30 m above the surrounding plain (Figure 5) (Sinha, 2015). The Aravalli, as a geological feature, is a rain-catcher, directing the rain-laden winds from the Western Ghats towards Govardhan, contributing more to its ecological, agricultural, and cultural ethos.

Undulating topography around the hill allows rainwater to get collected into natural depressions, resulting in ponds, lakes, and wetlands formation. These also act as natural groundwater recharge zones. These natural phenomena make this region suitable for water-centric cultural development and it has been so since ancient times, taking place in mythology and history as well.

Figure 3: Govardhan Hill Aerial View of the Southwest Tip

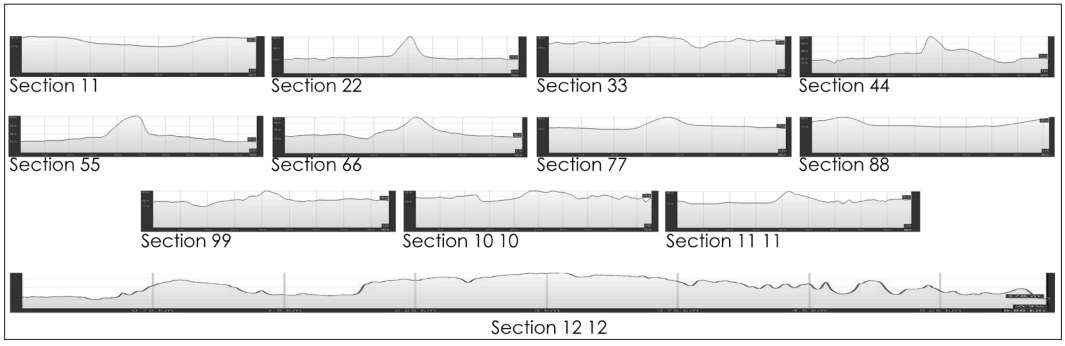
Source: https://youtu.be/iKHK1g13t1U

Figure 4: Elevation Map Govardhan Hill



Source: STRM and OSM. Modified by the authors

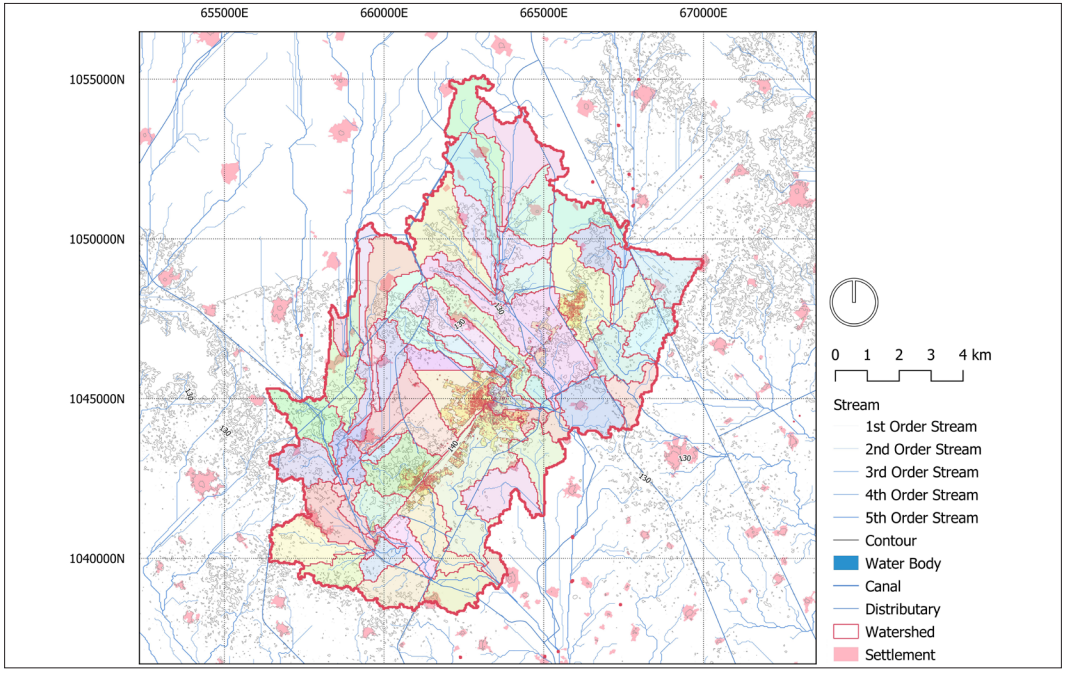
Figure 5: Sections of Govardhan



Source: Google Earth

Due to the natural alignment of the terrain, ample rainfall and the river system, the rainwater run-off is also directed towards the river Yamuna, which results in the formation of many seasonal streams and channels in these areas. With time, some of these streams are lined and converted into small canals (Gupta, 2019). It is observed that these channels also act as sources of water for many of the *kunds*. At times when water overflows from the *kunds*, specially during the rainy season, water gets released into these channels. Some *kunds* are not linked to any channel, and instead depend on much larger catchment areas. Many orders of streams are found in the catchment areas around the Govardhan hill, from where the surface run-off is carried to the *kunds*. The map below shows the unique interconnected system of water flow and collection (Figure 6).

Figure 6: Map Showing Watershed of Govardhan



Source: STRM and OSM. Modified by the authors

The Cultural Context of Govardhan

Govardhan is located in Braj Bhoomi which is the most significant centre of Krishna Bhakti and Vaishnavism. Braj culture is mostly a forest culture. Numerous transcendental lush groves and hills on both sides of the Yamuna are mentioned in the *Braj Bhakti Vilasa* (Gosvami, 2018). According to the *Shrimad Bhagavat Gita*, Braj is lord Krishna's birth and childhood place.

Govardhan is one of the most recognisable features in Krishna mythology, wherein Krishna lifts the hill to shield an entire village from the wrath of the rain god Indra (Entwistle, 1987). Braj, which has been interpreted in many forms, as in the Mathura Mandal (Figure 7) and in the shape of a lotus or the Braj-Kshetra (Figure 8), and Govardhan are believed to be in the very heart of the sacred land of Braj (Rana & Dubey, 1988).

Figure 7: Govardhan Location in Mathura/Braj Mandala

Source: Singh, Rana P.B. and Dubey, Devi Prasad, 1988, Mathura Mandala, Territory and Sacrality

Figure 8: Govardhan's Location, the Very Heart (Hrdaya) of the Sacred Land of Braj

Source: https://vrindavanactnow.com/maps/braja-mandal/

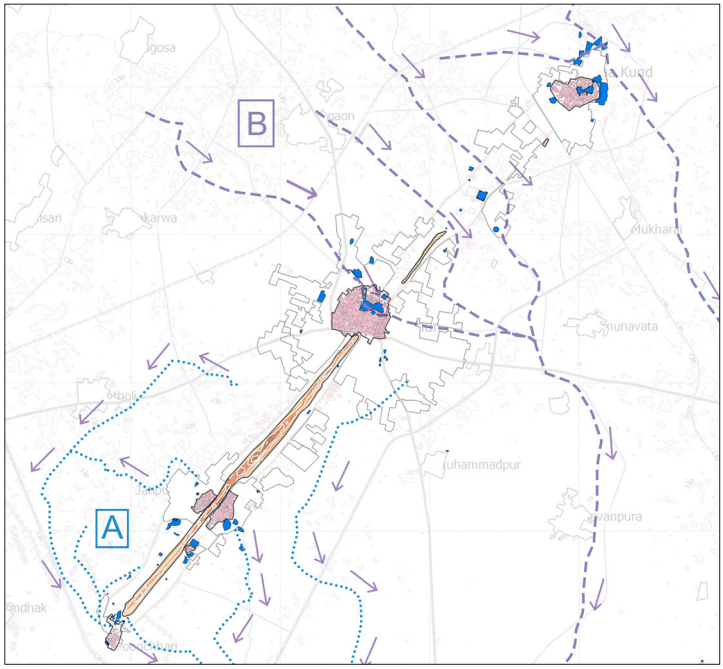
Traditional Water System

Traditional knowledge pertinent to *kunds* and ancient water management systems in Govardhan was tacit knowledge and had to be decoded from the existing architecture and practices. An understanding of this knowledge was developed as a result of the field survey and interviews with experts and residents of the place. Glimpses of this system have been prepared upon interpreting the collective consciousness of the people.

Macro Level

To understand and conserve these *kunds* an understanding of geography and gravity is required, and broadly, there are two types of streams in this area. Stream A represents the flow of water from the top of the hill, eventually forming smaller streams that flow away from the feature. Stream B represents the flow of the water from sources other than the hill, that flows through and around Govardhan (Figure 9). There are three major sources of water to feed the *kunds*, including water from the catchment areas, subterranean water, and canals or channels.

Figure 9: Types of Streams in Govardhan



Source: STRM and OSM. Modified by the authors

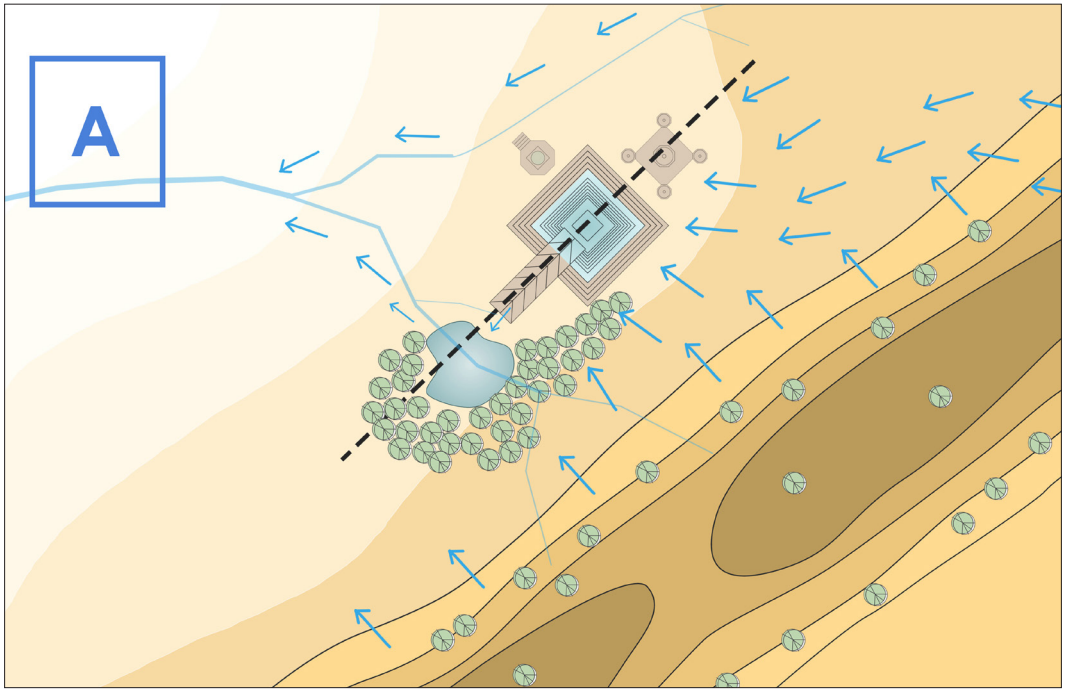
Meso Level

Based on the topography and nature of rainwater run-off, the design of the kund also changes. Two types of water systems have been developed, depending on the patterns of the stream flow.

Type A

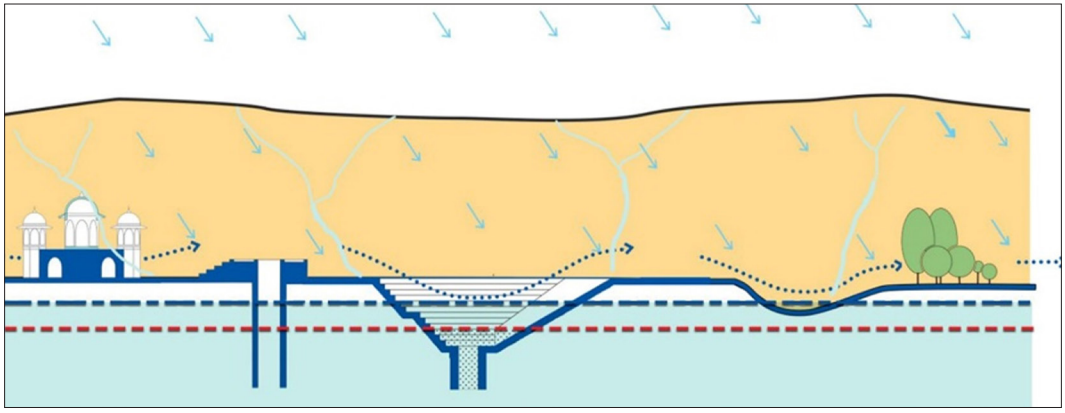
This type of water system is found in the *kunds* near higher terrain or built near the hill. A majority of these *kunds* are used for both religious as well as utility purposes, and also designed to facilitate ground water recharge (Figure 10). At the time of rainfall, water from the catchment gets collected in the *kunds*, leading to ground water recharge in this area. The water overflowing from these *kunds* exits to the *pokhar* towards a lower elevation. During the dry season when water level decreases in the *kunds*, the water quality deteriorates due to an increase in micro-organisms and silt deposits, making it appear slimy. As a security measure, the recharged water can then be extracted from wells adjacent to the kund, making it a critical component of these water systems. In Figure 11 the red dotted line represents the pre-monsoon underground water level while the blue line represents the post-monsoon level. Within the study area, the Apsra Kund, Naval Kund, Hariju Kund, Rudra Kund, Sankarshan Kund, Govind Kund represent this category of *kunds*.

Figure 10: Schematic Plan of Type A Stream Water System



Source: Authors

Figure 11: Schematic Section of Type A Stream Water System

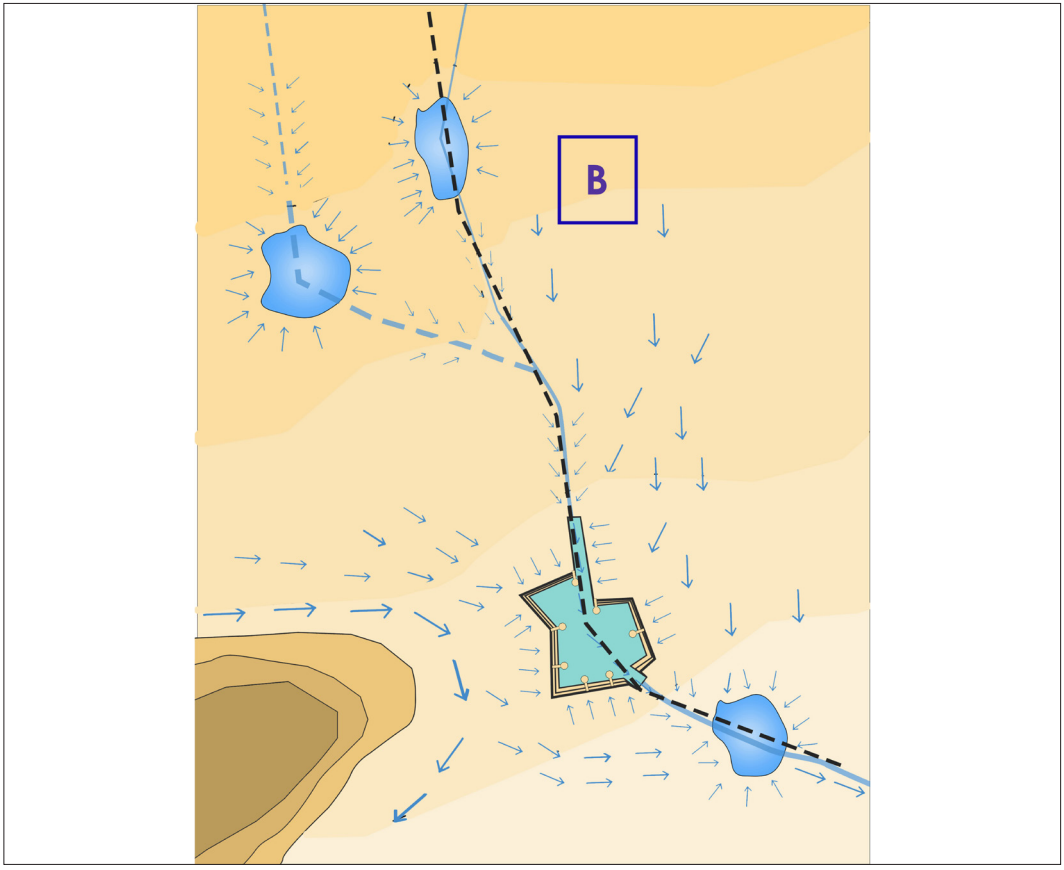


Source: Authors

Type B

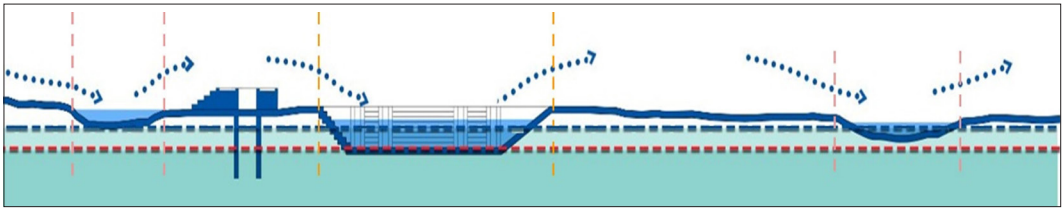
The water systems in the *kunds* which are away from the hill and spread along the Parikrama Marg till the Radha Kund are fed by the water streams formed on flatlands during rain, by canals and subterranean water. This particular type of system is mostly seen where post-rainfall rainwater gushes into the streams and channels that fill the *kunds*. The size of these water systems, in terms of the number of water bodies connected to each other, as well as the size of the *kunds*, is comparatively larger. Within the study area, rainwater collected in the water bodies situated on the northern offshore of Govardhan flows towards the *kunds*. The water further flows towards lower areas on the southern side. This creates an interconnected network of water bodies within the area (Figures 12 & 13). Radha Kund, Kusum Sarovar, Narad Kund, Uddhav Kund, Mansi Ganga and Ratna Kund are of this type.

Figure 12: Schematic Plan of Type B Stream Water System



Source: Authors

Figure 13: Schematic Section of Type B Stream Water System

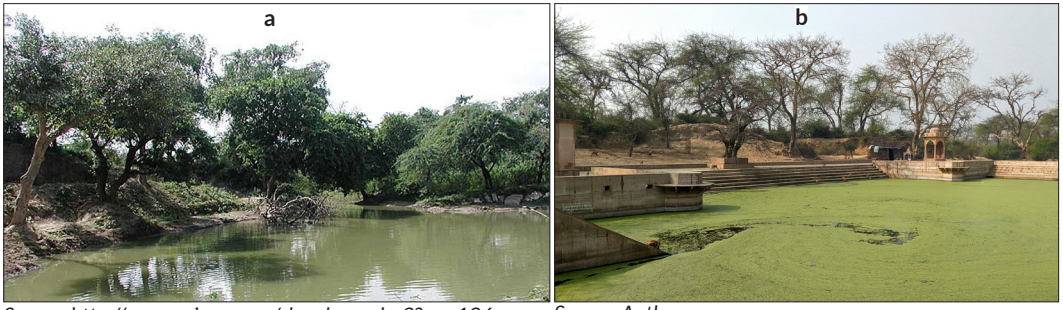


Source: Authors

Micro Level

Each water system is composed of a number of different kinds of *kunds*, connected to each other through the existing channels. Even within a system, these *kunds* vary in terms of their usage and size, which practically determine their architectural design. As its definition states, a kund is a stepped tank of a particular architectural design and can also be looked at as an expression of a cultural landscape. In Govardhan, *kunds* are like architectural elements designed in balance with nature, which not only allow human interaction with ecology but also act as an interface to connect with the Divine (Figures 14 &15). *Kunds* also facilitate essential community services like provision of drinking water, rainwater harvesting and flood control. *Kunds* have played an essential role in the growth of settlements since the Vedic era, resulting in their inclusion in the mythical Vaishnavite narrative that took form in the 15th century.

Figure 14: (a) Saurabhi Kund in its Natural State; (b) Saurabhi Kund Post Building Ghat

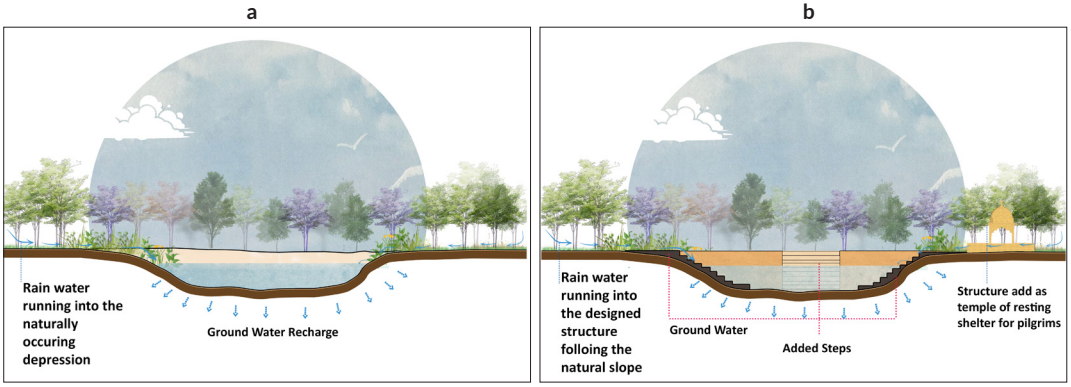


Source: http://www.vaisnava.cz/clanek_en.php3?no=186 *Source: Author*

Over the years, *kunds* have proven essential for the sustenance of living systems of the towns, making their place in the architectural vocabulary of the Mughal, Rajput and Jat eras of the region, and becoming instigators of artistic and creative forms of expression (Entwistle, 1987). The location of *kunds* around the Govardhan hill and parikrama, indicates their direct association with the mythological and religious practices.

Being an essential component of the social infrastructure, these have become places of social gathering and interaction among the local and pilgrim communities. With their multiple built and unbuilt components, *kunds* have become an integral part of the ecosystem. They create an environment that has an equilibrium, and a stage for a unique ecological setting for flora, fauna, and human growth.

Figure 15: Typical Kund Design Approaches Adopted in the Region

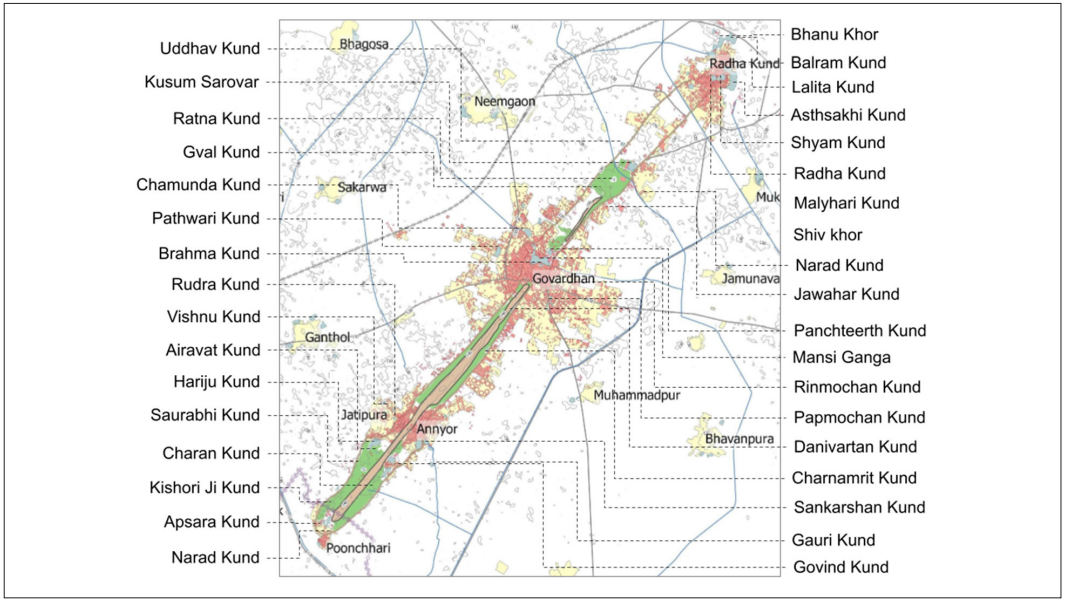


Note: (a) In a natural setting where rainwater is getting collected into the depression, with naturally occurring flora and fauna. (b) Designed architectural elements creating space for human interaction with the ecosystem.

Source: Authors

The extensive use of these *kunds* over ages reflects their religious, social, and infrastructural significance in sustaining the population, cultural relationships, and artistic imagery within the Govardhan region. At present, there are around 49 *kunds* of different shapes and sizes, in and around the 7 kos (mile) or 21 km parikrama of the Govardhan hill and Radha Kund (Figure 16).

Figure 16: *Kunds* Sprawled in the Cultural Landscape of Govardhan



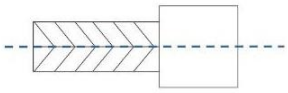
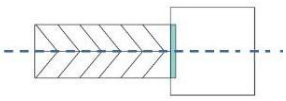
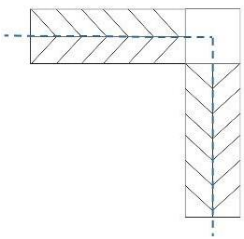
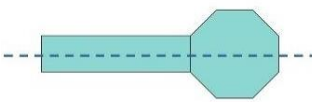
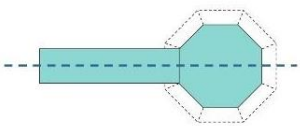
Source: STRM and OSM. Redrawn by the authors

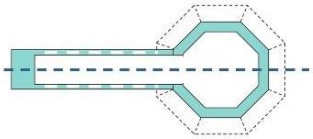
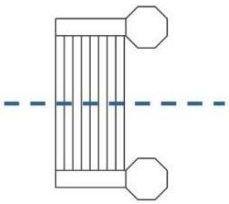
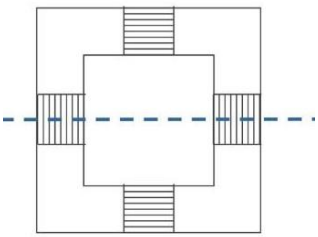
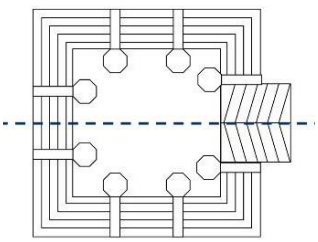
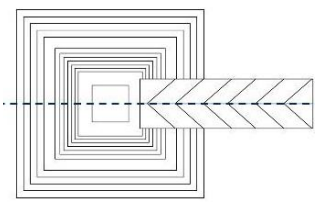
Identified Architectural Component of Kunds

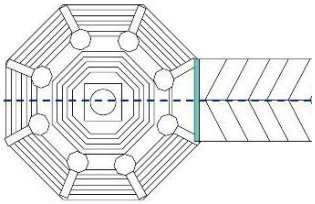
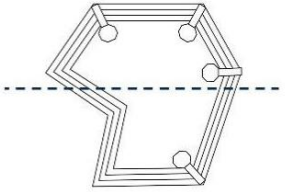
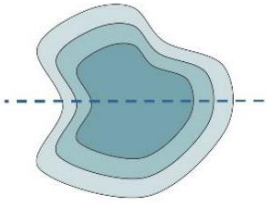
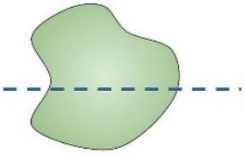
These *kunds* are built out of red sandstone and locally backed lakhori bricks, which are abundantly available in the adjoining areas of Rajasthan. Some of the tanks are built using boulders all around. They are generally used for drinking, bathing, and cattle use.

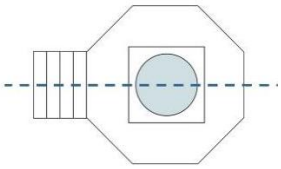
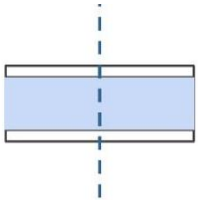
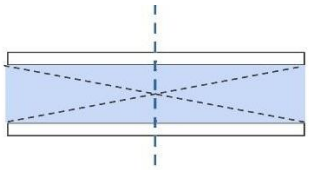
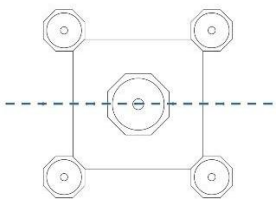
The different components found in the *kunds* of Govardhan along with their schematic, are detailed out in the table below.

Table 1: Architectural Components of *Kunds*

Component	Schematic Drawing	Description
Ghat and Burj are the key components of any *kund*.		
Gau Ghat Type 1		It is an architectural element in *kunds*, which is used by cows and other animals to access water. Its design depends on the depth of the kund. Majorly three types of *Gau ghat* design are seen in Govardhan, primarily depending on the depth of water: (1) where the depth of water and bed is comparatively less, (2) where the depth of water and bed is enough for drowning, (3) where the depth of water and bed is large, but access to the depth of water is also required. The most common material found in the design of this component is sandstone framing with lime mortar and bricks.
Gau Ghat Type 2		
Gau Ghat Type 3		
Burj Type 1		This is constructed with bricks and sandstone, is comparatively smaller in size, and is the most common type of burj.
Burj Type 2		This is larger in size when compared to Type 1, and provides more space on top of the surface for use.

Component	Schematic Drawing	Description
Ghat and Burj are the key components of any *kund*.		
Burj Type 3		This is the most ornate design among all three, with a number of structural considerations for access within the burj itself, making it a unique form in the architecture of *kunds*.
Ghat Type 1		This is a common design of a ghat, which is easily accessible by anyone, and is constructed with two burjs on either side.
Ghat Type 2		This is a different design of a ghat with an edge developed on all sides, and is filled with brick and lime concrete.
Ghat Type 3		This is lined all around the kund, providing structural integrity within the system. The burjs are interspersed through the horizontal stretch, creating one single kund.
Ghat Type 4		This follows the same principle as the above ghat, however on an irregular polygon shaped kund. It follows the natural edge of a kund, without changing its natural form, on which the construction is done.

Component	Schematic Drawing	Description
Ghat and Burj are the key components of any *kund*.		
Ghat Type 5		This type of ghat is designed on the principle of a simple well, with a lot of depth. It depends on the underground water sources and water from natural aquifers, rather than on rainfall or water percolation from the surface. The architectural detail, material used and design is like other ghats, except that it has much greater depth. Most of the *kunds* in the proximity of Govardhan hill are of this type.
Ghat Type 6		
Kaccha Ghat		These are manually dug ghats, with no specified built edges, and usually constructed in brick or stone.
Pokhar		These are naturally dug depressions, developed in and around the ghats. The overflowing water from the ghats goes into the *pokhars*, which essentially act like overflow sluices.

Component	Schematic Drawing	Description
Ghat and Burj are the key components of any *kund*.		
Well		These are commonly found across Govardhan. They act as a security measure for the *kunds* with degrading water quality. In such cases the wells are used to get water.
Canal		Artificially built by man, these are used to feed water into the *kunds* and *pokhars*. Most of the canals are open in nature, carrying water across the region.
Culvert		Culverts are commonly found, either in between a pokhar and a kund, or sometimes between two *kunds* for exchanging or levelling of water to ensure equitable distribution.
Chattri		These are found in various *kunds* of Govardhan. They act as a shelter for the people using them. These are usually constructed with bricks, lime concrete, and sandstone, and are composed of arcuated structural systems.

Source: Authors

Kunds are an important part of the socio-cultural fabric of Govardhan, and essential for the local communities and pilgrims visiting the area. Activities such as bathing, religious rituals, social and religious gatherings, domestic usage of water, washing etc. are heavily dependent on the local *kunds*. They also play a significant role in the social fabric of any place, by becoming catalysts for communication and recreation, on serving as activity spaces in a locality.

Discussion

During this research, an attempt was made to comprehend and document Govardhan's traditional water systems. The *kunds* of Govardhan are an important part of the ecological setting of the Yamuna basin. Govardhan itself is offshore of the Aravalli ranges, making it a significant setting for restoring the crucial balance between nature and settlements. These *kunds* are a part of the

larger water system in Govardhan, and have been serving as an essential component for sustaining large settlements, especially in such semi-arid climates. They are a part of the mythic narratives of Braj and Govardhan, as an archetypal setting of imagined cultural landscapes. *Kunds* are also integrated in the routes of cultural and religious *parikramas* and ensure their continuum. These systems help in the sustenance of a large number of people, flora and fauna, and their associated living systems.

However, the rapid urban sprawl and encroachment in present times is reducing the size of these water bodies and disrupting the natural interconnected network of water flow. Catchment areas used to be covered with sacred groves or vans, that are an integral part of the ecosystem, but are now vanishing, causing soil erosion during rainfall. This causes a large quantity of silt, mud, and pollutants to get deposited on the surface of the kund, further reducing the ground water percolation and rendering these water bodies unsuitable for use. When it comes to development and restoration of the urban water bodies, the traditional techniques are usually not followed, and non-scientific approaches are adopted around these sacred and ecologically sensitive sites. As a result, the symbiotic relation between heritage, the ecosystem, and community has been completely disrupted. The *kunds* were once part of the open space system of the town, but now their degradation is heavily impacting their function as a community space.

Conclusion

Water resources are an essential part of our ecosystem. By protecting this system, we are addressing a serious concern, which is adequate availability of good quality water. Traditional knowledge of designing these water systems is helpful in the design and revival of *kunds* and other traditional water systems. In the case of Govardhan, the topography of the landscape is such that it allows rainwater to be captured in shallow depressions with large catchment areas. Religious association with these water bodies has led to multiple initiatives for their improvement. It has also led to architectural developments. To further utilise these water bodies, *kunds* were built all around the *parikrama* of Govardhan. They have been serving the water requirement of the local residents and pilgrims for generations, and have also played a key role in development of the cultural landscape of Govardhan. Regular protection and proper management are required to keep the water free from pollutants and ensure adequate quantity of water, which is essential to maintain the ecosystem balance. These structures also served as rainwater recharge zones. They have evolved using the age-old wisdom and knowledge of geography, developed over hundreds of years. The *kunds* are a significant built component of the landscape, as they are a signature of an enduring, rooted, and culturally thriving environment, and are also in confluence with the natural environment.

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Conflict of Interest

Authors have no conflict of interest to declare.

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