Sponsored Thesis Project Competition on

"RE-IMAGINING URBAN RIVERS"

(2021)

Project Title: Reviving the Traditional Water System through Cultural Heritage Conservation based on Traditional Knowledge Systems: Kunds of Govardhan

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Executive Summary

Water has long been a key concern of people. Water is often considered to be a purifier in many religions. Traditional knowledge has been created in India in water collection and management of many types. Not just cultural relevance but also long-term protection was supplied by religious associations. These systems are still very important and functional in many regions and threaten growing urbanisation and contemporary advances in water infrastructure.

The sacred-cultural landscape of Govardhan a have traditional water system. Background study has been done to understand the architectural, ecological, and mythological context of the Govardhan hill, its parikrama, Kunds, etc. and how the synthesis of nature and culture have come into existence and the role water system has played. To protect and conserve these water systems, it is important to visualize kunds as a system of multiple elements coming together - as trends have been seen on site, the conservation of built fabric is done extensively, but the ecological and cultural continuum of practices is not taken into consideration.

This thesis proposes to use a nature-based approach to rejuvenate the natural and water heritage of Govardhan and to explore its applications pertinent to the present needs, use it for groundwater recharge, improve groundwater quality, and rainwater harvesting as it was originally designed for. In this cultural landscape, heritage conservation-based approach can be used as a tool for water and ecological rejuvenation.

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1. INTRODUCTION

The Sacred-Cultural Landscape of Govardhan is in *'Braj Bhoomi'* (cultural region spanning across Mathura, Bharatpur, and Hodal) and is home to approx. 40 kunds found in and around 21 Km (7 *kos*) parikrama of Govardhan. Kund is a traditional stepped tank designed to serve as an interface for humans to connect with the divine, maintain ecological cycle by rainwater harvesting along with acting as a flood control system and provide essential services to the community such as water for bathing, domestic use, cattle rearing and drinking purposes. However, change in the cultural value system distanced the community from traditionally community-owned water bodies. This has resulted in negligence of this water heritage, ecological disruption, and loss of traditional knowledge systems. Many of the kunds are either being used for dumping solid waste or are left filthy and algae laden. Further, due to encroachments, these Kunds are on the verge of extinction.

1.1. Aims

To prepare Conservation Plan for Kunds of Govardhan by integrating cultural heritage and ecological conservation.

1.2. Hypothesis

Adapting traditional water management system can help in addressing water scarcity issues which have been a result of degrading the traditional water structures and loss of traditional water conservation knowledge system.

1.3. Objectives

Objectives	Methodology
To identify and gauge the feasibility of natural water system revival.	Geographical character will be firstly assessed from secondary data like reports by CWGB, MoEF etc., and using digital tools like GIS, Bhuvan etc. and then gaps will be identified and resolved, if found any, by primary data collection and site visits.

To identify the cultural and religious association with water bodies.	Water bodies of Govardhan have ritual based significant religious and cultural associations which will be identified through religious texts and from primary data collection.
To document and the Architectural components associated with the traditional water bodies of Govardhan.	Architectural typologies associated with water like kund complexes consists of temples, cenotaphs, ghats, etc. will be identified and how architectural components used strategically to collect, store, and use water kunds to will be determined through primary documentation.
To identify the indigenous water management systems for water conservation.	By understanding community-participatory traditional water management systems developed over a period, through local knowledge sources and by conducting interviews with community members and experts.
To assess the present condition and formalise conservation strategies for the kunds and water systems.	By understanding the present use of the water bodies in contrast to the original intended usage and assessing impact of time and human interaction on ecological and built components.

- Broader objective is to consider cultural heritage conservation as a tool for ecological revival and to look at it as a process as per the concept of *jeernodharanam*, or restore as dynamicity for community use, instead of taking up the monumental approach, not to consider heritage as a mere piece of an artefact by fossilizing it into space-time and also not limiting it, to a recreational place but to include this cultural landscape in the process of sustainable development of the town by eradicating the distance between community and water heritage.
- Govardhan has a vast significance in the overall sacred-cultural landscape of *Braj*. It is a site of great religious importance among *vaishnavites* and is annually visited by billions of people from all over the world. This model can

help establish the *Braj* region as a model for cultural and ecological conservation that redefines the concept of water conservation. The vision is to develop Govardhan as a unique destination that is remembered for both its connection with Krishna's tales and its distinct model of water conservation.

1.4. Scope

- To understand the Traditional water systems in India.
- To document the archetypal configuration of the kunds of different typologies architectural styles, and usage.
- To develop an in depth understanding of interrelationships between ecology and cultural heritage.

1.5. Limitation

- Study of the Govardhan cultural landscape will be limited to establish the context and significance of the kunds.
- Detail documentation of number of kund complexes will be limited.

1.6. Research Question

How can we leverage our natural and cultural heritage to protect environment and to see kunds as a cultural and water resource?

Data/information requirements	Techniques/methods of data collection
Base map demarcating the cultural landscape	Base map to be generated using GIS, AutoCAD, and Google Earth.
Geophysical information	Secondary data like reports by CWGB, MoEF etc., and using digital tools like GIS, Bhuvan etc. Site visits.
Mythological and Cultural associations of water bodies.	Religious texts Interviews Site visits
Generating Architectural drawings like plans, sections, elevation, sketches of kund complexes consisting of temples, cenotaphs, ghats, etc.	Photo documentation Architectural documentation using measuring tap, distometer and analytical sketches etc. Inventory Mapping the activity pattern
Role of Communities in traditional water management systems and by with	Local knowledge sources conducting interviews community members and experts.

1.7. Methodology:

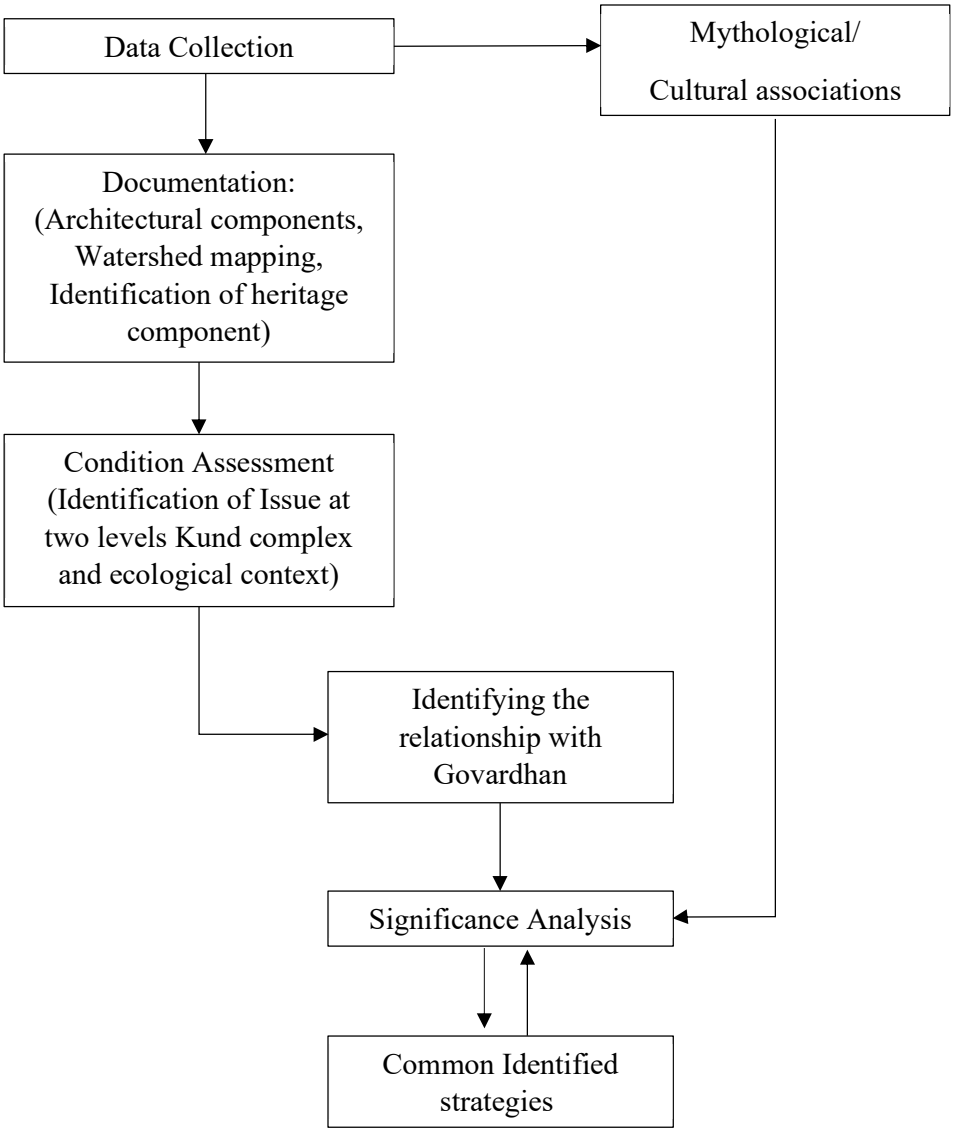


Figure 1: Methodology (Source: Author)

1.8. Expected outcomes:

- A Conservation Management Plan based on traditional water conservation practices to reduce water scarcity, rejuvenate ecology, and conserve cultural heritage in Govardhan.
- Categorizing the water bodies based on usage and assessing the possibility of integrating this water heritage into the present water infrastructure to enhance the water supply of the town and develop a groundwater recharge system which will also validate the traditional water management system.

1.9. Area of Study

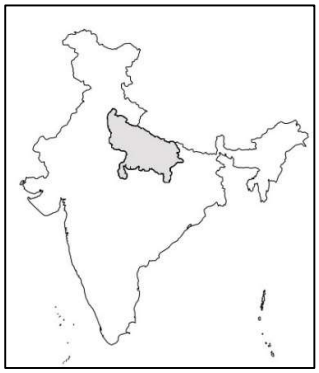


Figure 2. Location of Uttar Pradesh in India

Source:http://www.d-map.com

Redrawn by: Author

Figure 3. Location of Mathura District in Uttar Pradesh

Source:https://commons.wikimedia.org/wiki/File:Uttar_Pradesh_locator_map.svg

Redrawn by: Author

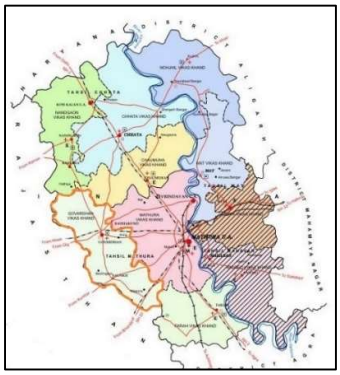


Figure 4. Location of Govardhan Tehsil in Mathura.

Source: District Census Handbook Mathura,

Redrawn by: Author

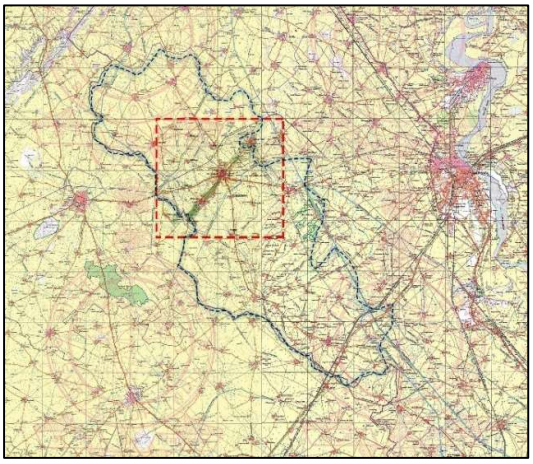


Figure 5. Study area lies in Govardhan tehsil.

Source:Survey of India. Redrawn by: Author

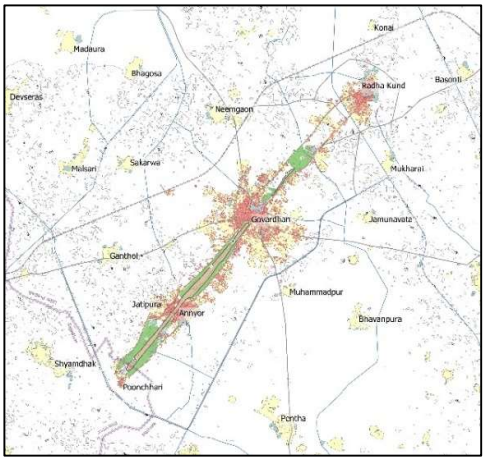


Figure 6. The study region

Source: SRTM and Open Street Map

Drawn by: Author

Govardhan hill is located in the Mathura district of Uttar Pradesh, and a small fraction of the south-west tip of the hill lies in the Bharatpur district of Rajasthan. The study area is in the Govardhan and Mathura tehsil in Mathura district of U.P, and a small fraction of south-west lies in the Deg tehsil of Bharatpur district of Rajasthan. It comprises of 7 villages Poonchari; Anyore, Jatipura, Sakitara, Govardhan Brahman, Govardhan Gorwan, Radha kund Rural; Govardhan and Radha Kund Nagar Panchayat. Considering the census data, the area has a population of 46,000 people and is visited by approximately 1 crore pilgrims annually.

2. LITERATURE REVIEW

2.1. Definitions

Aquifer: An aquifer is a subsurface layer of water-bearing porous rock or unconsolidated minerals. The defining characteristic of an aquifer is its ability to allow for groundwater movement under gravitational or induced pressure(NIUA, 2019)

Kund: A rainwater collection tank or small reservoir where rainwater is collected for consumption (*KUND | Definition of KUND by Oxford Dictionary on Lexico.com also meaning of KUND*, n.d.).

Catchment: It is the total land region where rain, snow, or ice runoff drains into a body of water or a water stream (before the water course joins another river or discharges into a water body)(NIUA, 2019).

Drain: is a natural or artificially constructed channel of different shapes (circular, box, trapezoid) carrying the storm water during monsoon season(NIUA, 2019).

Ecology: It is the sum of all interactions between species and their surroundings. It consists of the composition, distribution, volume, population, and changing states of species within and between ecosystems.(NIUA, 2019).

Embankment: It is a raised earthen, stone, or other material wall used to keep back water inside a water body or water channel; it includes levees built on either side of a river to guard against flooding.(NIUA, 2019).

Floodplain: It is the region of land that can be inundated by floodwaters. These are the places that could be inundated by a base flood, such as places where drainage is or might be impeded by constructed constructions, which have been or might be partially or completely flooded by floodwater from the base flood.(NIUA, 2019).

Lake: in terms of sizes lie between wetlands and ponds. Their catchments are large and may involve more than one catchment. They can cover trans boundaries(NIUA, 2019).

Nala: is local natural stream carrying water or (wastewater) that merges with higher order stream/river in the downstream(NIUA, 2019).

River Basin: It refers to the complete catchment region (of a water body or stream), which includes soil, water, vegetation, and other natural resources(NIUA, 2019).

Watershed: A Watershed is a place where all streams and rainfall are drained into a common exit, such as a reservoir outflow, a mouth of the bay, or a point along the channel stream(*Eyes on the Watershed – Washington Stormwater Center*, n.d.). The terms "watershed," "drainage basin," and "catchment" are occasionally used interchangeably. The drainage divide is made up of ridges and hills that separate two watersheds. Surface water – lakes, streams, reservoirs, and wetlands – as well as all underlying groundwater make up the watershed. Many minor watersheds are included inside larger watersheds(*Lesson 3: Watersheds*, n.d.).

Wetland: is shallow water body where there is permanent water logging. The ecosystem of wetlands supports wide variety of flora and fauna. Wetlands could be near coastal/estuarine environment or on mainland were rivers feed wetlands. Migratory birds often visit wetlands. Livelihood is associated with wetlands. Wetlands could cover small or vast areas of hundreds of square kilometres. An international convention called "Ramsar" is devoted to wetland conservation(NIUA, 2019).

2.2. About Place

2.2.1. *Mathurá: A District Memoir*

The gazetteer described the Goverdhan of the late 18th century. It has mentions of important temples and their patrons, vans, cenotaphs, villages, and Kunds. It also explained the influence and politics of princely states especially the Bharatpur state. It also describes the mythological foundation of Govardhan, its mentions can be found in Ramayana(Growse, 1883).

2.2.2. *Braj: Centre of Krishna Pilgrimage*

This book described Braj as a whole and different towns, villages, vans, and sites. As Govardhan is also part of the Braj region, the book illustrates the place in detail. Book also mentions various archaeological findings in the vicinity of Govardhan, like the possibility of Hindu and Jain shrines at Aring in the post-Gupta period, a Kushana period figure of a female worshipper that once belonged to a Rosika Vihara at 'Alika', an early medieval image of Agni and attendants was discovered

at Narad Kund, an image and an inscription attesting the existence of a Buddhist monastery at Anyor in the early Kushana period and many more.

Book also describes the Govardhan as a lofty mountain, like a ridge rising not more than thirty meters above the plain. It ranges from Govardhan to Punchhari, with its highest point between Anyor and Jatipura, where Shrinathji's temple is located. The ridge eventually fades to the north-east of the township until, among the thicket on the south-west side of Kusum Sarovar, only a few small rocks are protruding above the ground. Though the ridge is widely known as the legendary Govardhan, it is known locally as 'Giriraj' ('King of Mountains' or 'Mountain King') and is mentioned in several vernacular texts.

More elements in Govardhan, such as Shrinathji's origin story, indicate that the hill was once associated with Balarama to some extent. Sankarshan Kund at Anyor is among the oldest tanks around the hill, and on top of the hill near the village is a shrine called Dhunka Dauji, stones of curious shape that are offered milk. It is also worth noting that the Dan Ghati mukharavind stone depicts a head covered by cobra hoods. These characteristics cannot be taken as conclusive proof that Govardhan was once the centre of a Naga cult, but they suggest a degree of coalescence between the worship of Nagas and the hill(Entwistle, 1987).

2.3. Mythological Associations

2.3.1. *Braj: Centre of Krishna Pilgrimage*

According to the mythology, the presence of Govardhan in Braj has two popular beliefs. According to Gargasamhitd, Govardhan is the son of the mountain Drona of the western island of Shalmali. Sage Pulastya was taking Govardhan to Kashi, but on his way, Govardhan refused to go with him and stayed in Braj. According to Narayan Bhatt's explanation, Govardhan was brought from the Himalayas by Lord Hanuman. (p.59)

The most notable account about Govardhan in Hindu mythology is when Krishna lifts the mountain to provide protection for his people and their cattle under it from the torrential rain that lasts seven days, by Indra, after they decided to worship nature and Govardhan hill itself and instead of worshipping Indra. (p.36)

The Govardhan hill and the river Yamuna are undoubtedly the two natural occurrences that have been worshipped in Braj for the longest. It is worth noting that the most famous Krishna icons at first depicted him lifting Govardhan(Entwistle, 1987).

2.4. Govardhan Parikrama

2.4.1. *Sri Vraja Mandal Parikrama*

The Book has explored the 84 kos parikrama of Braj Mandal. It has covered all the sites situated in the parikrama marg associated with Krishna with a short narration of the mythology along with the physical descriptions of the sites. Govardhan's parikrama and sites associated, villages, temples, vans and kunds as a part of 84 kos parikrama are also described in detail. Description of the Govardhan parikrama begins from the mythology and history associated with Radha Kund and Shyam Kund with the description of ghats and surrounding structures. After this, it moves towards the Kusum Sarovar, Narad Kund, Gval Pokhara, Yugal Kund, Killol kund, Mansi Ganga, the town of Goverdhan, Indradhavaj-vedi, and Jamunavati. From there it proceeds to Parsauli, Paitha Gaon, Vatsavana and then to Anyore gaon, Gauri Kund, Sakarshan Kund, Govind Kund, Naval & Apsara Kund, Sakra Kund, Poonchari, Shyam Dhank, Raghava Pandita cave. Surbhi Kund, Airavat Kund, Hariju Kund, Jatipura, Bichua Kund, Chakreshwar Mahadev. Thereafter, it comes to Sakhi Sthali, Nimgaon, Peraku Bhadra, Konai and Vasati. And then ends at Radha Kund(Sri Srimad Bhaktivedanta Narayana Gosvami Maharaja, 2018).

2.5. Traditional Water Systems in India

2.5.1. *Water resources management: traditional technology and communities as part of the solution*

Traditional water conservation and management techniques exist in every region of the country. For example, due to the extreme weather patterns and low rainfall in areas of Rajasthan, Delhi, and Gujarat are places where groundwater recharging is practised. Water systems developed specifically to store water in regions where runoff 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 intersurface soil fractures. Communities used to select rainwater harvesting sites based on these criteria by first planning an overview of potential rainwater runoff flow slopes or directions, and then preparing drainage outlets for the escape of excess water from the region. To lift the barriers laterally opposite the water flow-in ditches, the outline, elongation, height, and width measurements were chalked out. The material excavated was used to construct the fence. The group hydro-experts preferred this approach because it was the easiest(Husain & Arif, 2014).

2.5.2. Āja Bhī Khāre Haiṃ Tālāba

Book described the ancient indian wisdom of traditional water bodies making and their management. It describes how each section of the communities played their part in building water bodies. Most of these practices were followed from the 5th to 15th century. It also describes the stepwise process of building water bodies and

a detailed nomenclature of components of water bodies and development of the terminologies(Mishra, 2017).

2.6. Report

2.6.1. *Govardhan Hill in Braj, India: Imagined, Enacted and Reclaimed:*

This study outlines the landscape design, planning, and management proposals for various sites like Vans, kunds, tourist and pilgrim facilities and other infrastructure development proposals and envisages the future of Govardhan as a protected cultural landscape. It also suggested further detailed studies like listing and hydrological studies pertaining to the heritage and religious sites of the Govardhan. Sacra, rituals, and festivals have been discussed but there are no or less mentions of traditional knowledge systems(Sinha, 2015). Development and management proposals like Eco-cultural Tourism, Govardhan Heritage Trust, Core and Buffer Zones, Environmental Issues, Sanitation Program, Traffic Management, Road Redesign, Vishram Sthals and Signage, Road and Rural Sanitation Plan, Dan Ghati Welcome Centre are detailed out but there are no proposals for the conservation and management of cultural heritage. Documentation of the kunds is limited to the direct accessibility and connection with the parikrama and those who frequently visited by the parikramarthi's. Proposal for the Radha Shyam Kunds, Kusum Sarovar, Uddhava Kund, Govind Kund focuses on the water purification using modern techniques, development of tourist and pilgrim facilities, extending the catchment areas, lightning, and garden design proposals etc. Studies related to documentation and conservation strategies for kunds, Traditional water management techniques and their connection with the larger hydrological system are not discussed.

2.7. Previous Thesis

2.7.1. *Conservation and Management Plan for Kardam kund and surrounding, Varanasi: SPAB (Conservation 2016-2018)*

The thesis focuses on artificial water structures like kunds, which are associated with pilgrim activities. The Kardam kund, Varanasi, is also a part of the third most important river of Varanasi, i.e., Asi (now turned into a Nala). The thesis aimed to study and document this heritage component at the Kardam kund, including its relation to people and use. Followed by the issues and analysis for the proposals of conservation and management plan(Jaiswal, 2018).

2.8. Research Gap

A wide variety of research in the areas like theology, religious study, cult studies, and ecology have been done and discussed before. Many development plans and reports have been made focusing on tourism and pilgrim infrastructure. As part of

the larger cultural region of Braj, Govardhan has also been discussed in numerous study areas, but significantly less focus has been put into the cultural & architectural heritage and traditional water management system. This thesis attempts to explore the lost traditional and architectural knowledge responsible for the development of water infrastructure in the cultural landscape of Govardhan.

3. THEORETICAL FRAMEWORK

3.1. Cultural Landscape

According to Sauer - "The cultural landscape is shaped by a cultural group from a natural landscape. The agent is culture, the medium is the natural environment, and the cultural landscape is the product. The landscape undergoes transformation through phases, and presumably finally the end of a development cycle, under the influence of a particular culture that changes with time. By introducing a foreign culture, an alien culture, a renewal of the cultural landscape, or a new countryside, remains of an old one are superposed". (Sauer,l. 1925).

Cultural landscapes, according to the 1992 World Heritage Convention, are "combined works of nature and human." They depict the evolution of human civilization and settlement throughout time, as a result of physical limits and/or possibilities posed by their natural environment, as well as external and internal social, economic, and cultural influences.

Three categories of cultural landscapes –

Category 1- Landscape created and designed intentionally by man,

Category 2-Organically evolved landscape subdivided into relic/fossil landscape and continuing landscape and

Category 3- Associative cultural landscapes.

3.2. Indian Cultural Landscape (ICL)

The ICL can be called 'intellectual landscape', a collect of religious, cultural, and physical significance ascribed by the geographical components of the collective memory, grounded in the active engagement of communities for generations (shaped in the real world and real-time – the landscape), empowering nature and land from physical to metaphysical. The ICL is a communal geographical perception storehouse in which memory, information and imagination interact to build the landscape. When associations, ideas and continuity are restored to engage the nation's present minds, the physical shape of the environment that is still surviving will renew itself (Thakur, 2012).

3.3. Traditional knowledge System (TKS)

Traditional knowledge is knowledge, know-how, abilities, and practices that have been produced and maintained within a community that is frequently part of its cultural or spiritual identity and handed on down the generation.

Community Traditional knowledge means information not known to all but only known to a select group of individuals. For example, Tribal Skills. In general, this information is only passed on to the communities verbally.

Sacred traditional knowledge comprises both physical and intangible sacred rights. Sacred tangible rights propose the rights of property in tangible items which are employed for anything sacred or related to it. This category is one example of

Community law on holy sites. There are also sacred intangible rights that include IPP and other immaturities related to traditional holy dance belonging to the community, such as costumes, choreography and pictures.

4. CONTEXTUAL FRAMEWORK

4.1. Govardhan: Ecological Context

4.1.1. Location of Govardhan within the River system

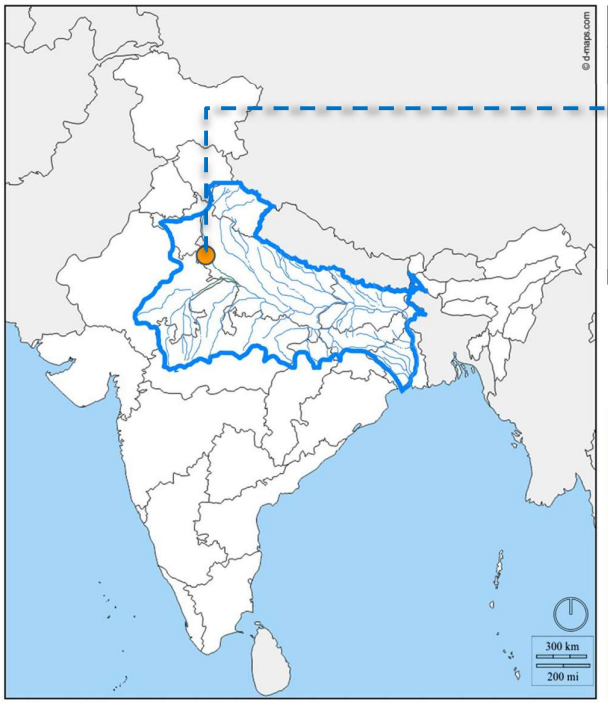


Figure 7. Ganga Basin

Sources:https://d-maps.com

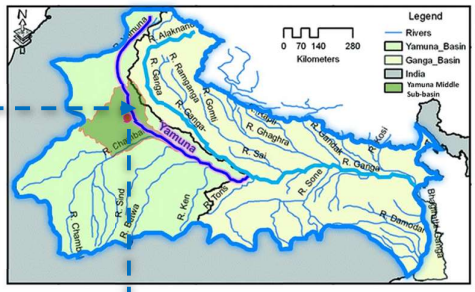


Figure 8. Yamuna Basin in Ganga Basin

Sources:https://d-maps.com

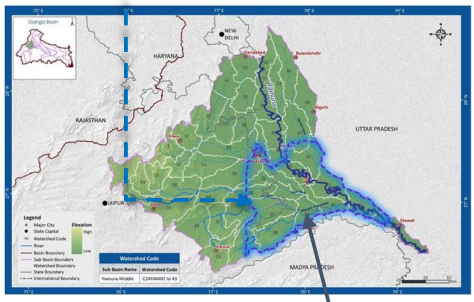


Figure 9. Watershed within Middle Yamuna Basin

Sources:https:// I 17.252.14.242 /Gangokosh/Hydrological %20Units/yamuna_middle .html

Govardhan Hill as a geographic feature has innate connections to the river system of Yamuna. Yamuna River is the biggest tributary of the Ganga. And Govardhan is in Yamuna middle sub-basin.

4.1.2. Govardhan-Yamuna Connection

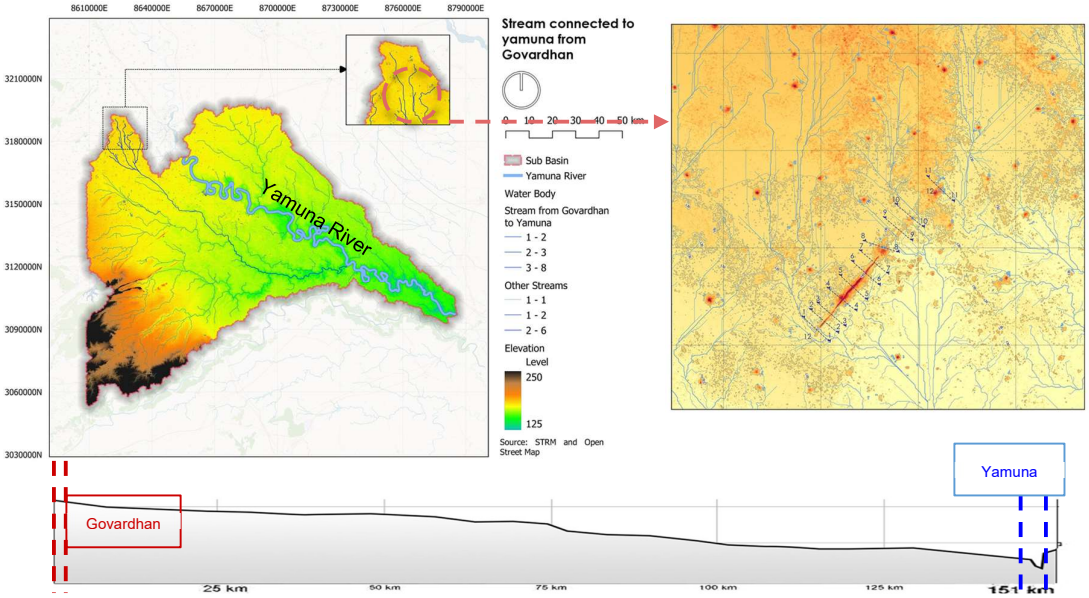


Figure 10. Section Along stream from Govardhan to Yamuna.

Source: Google Earth. Redrawn by: Author

As Govardhan lies in the Yamuna sub basin. The slope of the land is from north to south and southeast direction. River Yamuna also flows from north to south. As we can see in the section Govardhan lies on the average height of 180 meters and Yamuna at 150 meters. Many seasonal streams pass and originate from Govardhan, which eventually get connected to the Yamuna River. This creates a setting where the river, and the slopes of this terrain create a unique beginning of an ecological and cultural setting.

4.1.3. Geographic Features

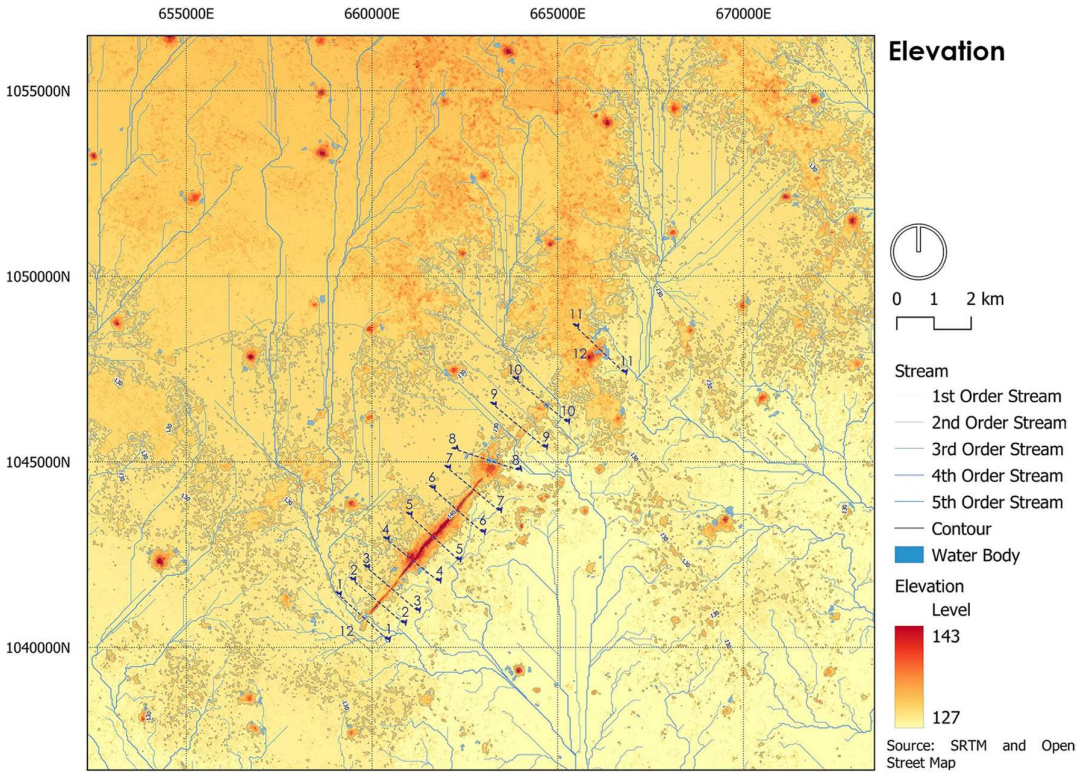


Figure 11. Elevation Map Govardhan

Source: STRM and OSM. Redrawn by: Author

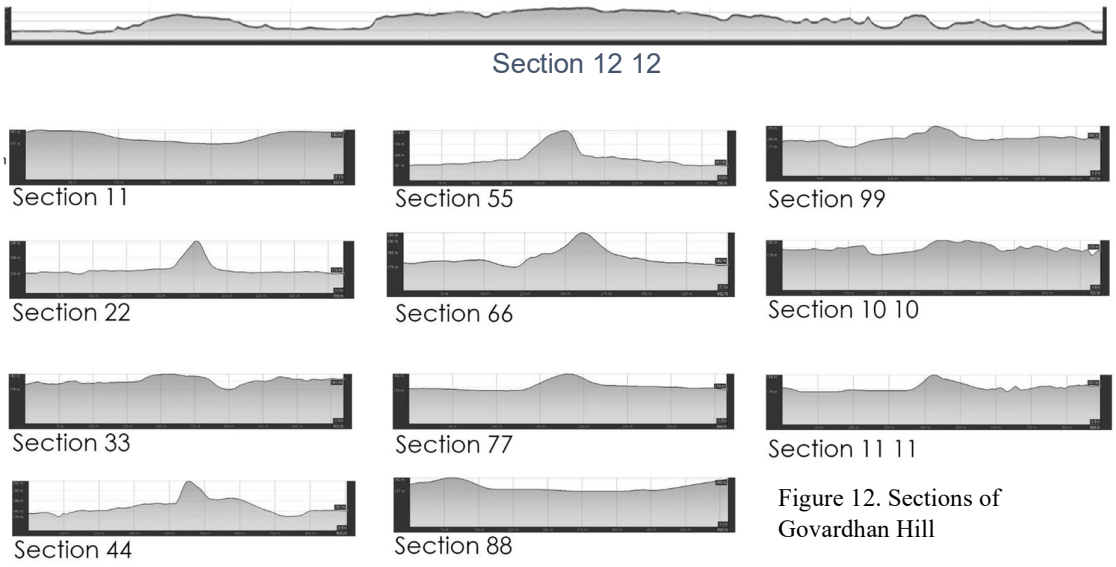


Figure 12. Sections of Govardhan Hill

Source: Google Earth.

Govardhan hill also called as '*Griraaj ji*' is a long, low ridge, of an ancient quartzite part of the Aravalli Mountain range and is the largest in this region, it looks like a huge collection of small rocks due to metamorphosis of the sandstone, which extends altogether for about 8.1 km, rising not more than 100 feet above the surrounding plain.

Figure 13. Govardhan hill is a long, low ridge.

Source:https://youtu.be/iKHK1g13t1U

Figure 14. Govardhan Hill aerial view of the south-west tip.

Source:https://youtu.be/iKHK1g13t1U

Figure 15. Govardhan Hill looks like a huge collection of small rocks due to metamorphosis of the sandstone.

Source:Author

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 developments, and it has been so since ancient times - taking place in mythology and history as well.

4.1.4. Climate data

Figure 16: Map showing Monsoon direction (Source: https://mapsofindia.com/)

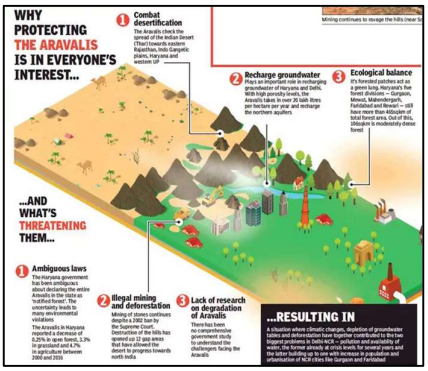


Figure 17. Aravalli as Rain catcher (Source: https://timesofindia.indiatimes.com/ci

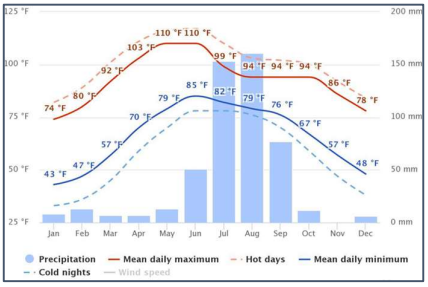
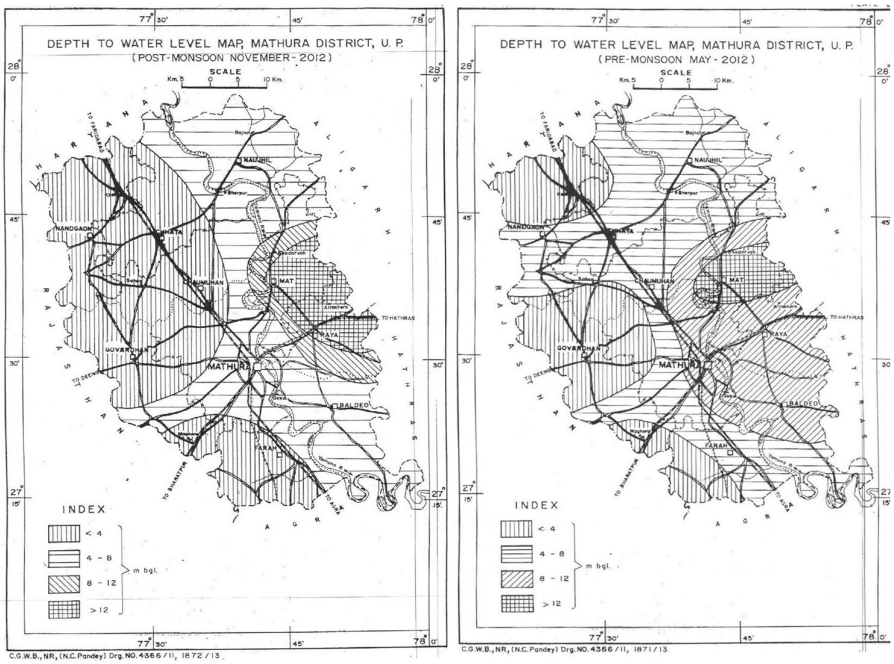


Figure 18: Graph showing annual Rainfall and Temperature

(Source: https://meteoblue.com/)

Govardhan being a part of Aravalli, in addition to its river connections and natural terrain, is also a recipient of a unique rainfall trend that goes through the months of June to September. The water-stream of Yamuna, the terrains of Aravalli, which has high underground water level, in addition to the rain-laden winds coming from the Western Ghats towards Govardhan, creates yet again a potential for enormous water catching capacities, and water-culture, around which this entire tradition of kund construction and design has developed over a period of many years.



Pre-monsoon November - 2012 Post-monsoon May - 2012

Figure 19. Underground water Level Fluctuations Maps

Source: http://cgwb.gov.in/District_Profile/UP/Mathura.pdf

Pre-Monsoon underground Water Level is 3.30 mbgl and Post-Monsoon Water Level increases upto 2.53 mbgl

4.1.5. Govardhan Watershed Delineation

Due to natural alignment of the terrain, ample rainfall and the river system, the rainwater runoff direction is also toward the river 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. It is also observed that these channels also act as source of water for many of the kunds. At time when water is overflowed from the kunds mainly during rainy season water gets released into these channels. In some cases, there is no channel linked to kunds but have larger catchment areas. These two maps show the many orders of streams found in the various catchment areas around Govardhan hill, showing how the rainfall, terrain and streams create a unique interconnected system of water flow and collection.

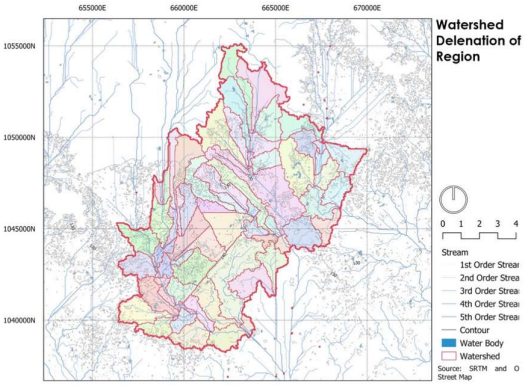


Figure 20. (a) Map showing Watershed of the Govardhan

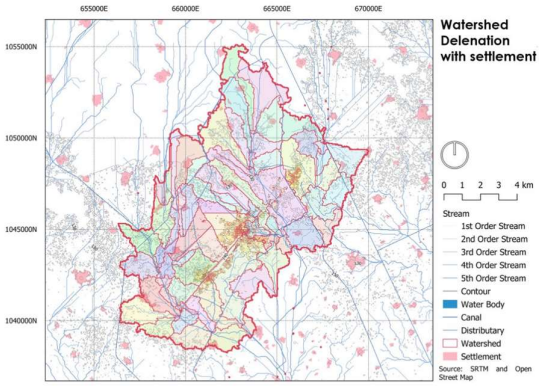


Figure 21. (b) Map showing settlements in Watershed of the Govardhan.

4.1.6. Geomorphology

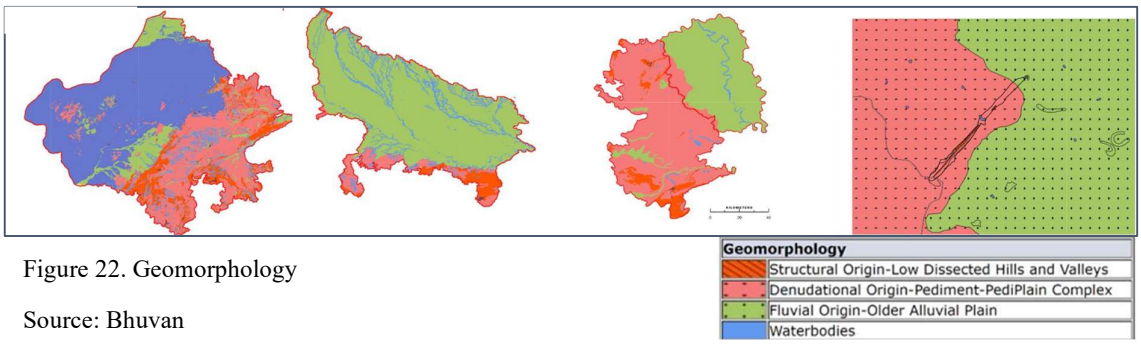


Figure 22. Geomorphology

Source: Bhuvan

4.1.7. Soil Data

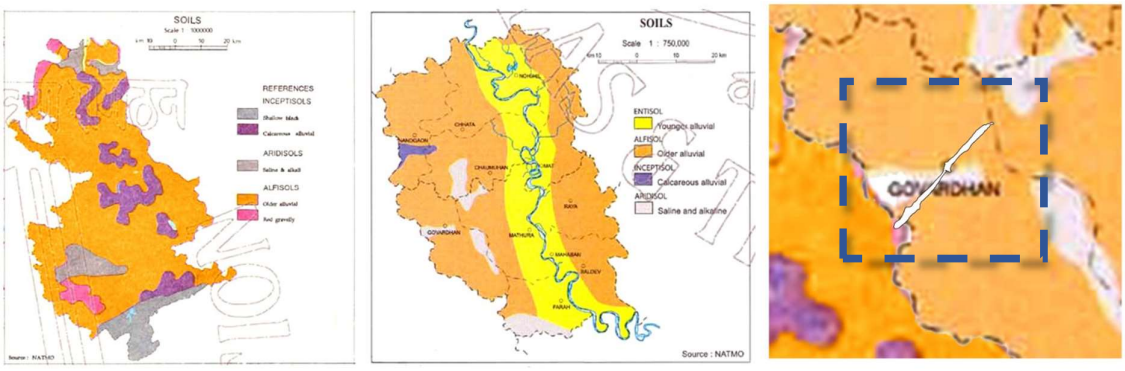


Figure 23. Soil Map

Source: National thematic Atlas

Radha Kund Lies in Older Alluvium Plain. Loamy soils are found in the area. The clay, kankar, (saline efflorescence) are also predominate. And Govardhan being in Denudational origin-pediment-pediplain have low rain runoff water percolation rate. So, to recharge groundwater, it is required for water to stay or get collected to percolate into the ground.

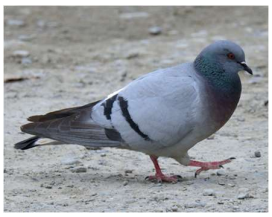
4.1.8. Biodiversity

 Neem Source:https://holisticplantbasedrecipes.com/	 Mango https://en.wikipedia.org/wiki/Mangifera_indica	 Kadamb https://giftingtrees.blogspot.com/
 Guava Source:https://i.pinimg.com/	 Ber Source:https://www.123rf.com/	 Imli Source:https://en.wikipedia.org/wiki/Tamarind
 Shahtoot Source:http://tropical.theferns.info/	 Jamun Source:https://www.southworld.net/	 Chilbil Source:https://commons.wikimedia.org/wiki/File:Holoptelea_integrifolia_06.jpg

 Peelu Source:https://www.picfair.com/	 Karira Source:https://en.wikipedia.org/wiki/Capparis_decidua	 Pipal Source:https://en.wikipedia.org/wiki/Ficus_religiosa
 Babool Source:https://en.wikipedia.org/wiki/Vachellia_nilotica	 Tamala Source:https://www.wikiwand.com/en/Cinnamomum_tamala	 Banyan Source:https://www.ehorticulture.com/

Table 1: Showing Flora found in Govardhan

 Cow Source:http://www.vaisnava.cz/	 Nilgai Source:https://jantakiaawaznews.com/	 Buffalo Source:https://www.exportersindia.com/

 Jackal Source:https://in.pinterest.com/karuneshjohri/wildlife/	 Dog Source:https://businessworldwire.com/	 Monkey Source:Author
 Peacock Source:https://www.indialegallive.com/	 River lapwing Source:https://www.birdsofindia.org/	 Kingfisher Source:https://www.birdsofindia.org/
 Sparrow Source:https://www.allaboutbirds.org/	 Indian Cormorant Source:https://www.wallpaperflare.com/	 Pigeon Source:https://ebird.org/
 Crow Source:https://en.wikipedia.org/wiki/Crow	 Heron Source:https://www.britannica.com/animal/heron	 Parrot Source:https://lafeber.com/

 Turtle Source:Author	 Water Snakes Source:https://sustain.round.glass/photo-story/water-snakes/	 Catfish Source:https://nmcg.nic.in/

Table 2: Showing Fauna found in Govardhan

4.2. Ecological Significance

The Kunds of Govardhan are a larger part of the ecological setting of the Ganga-Yamuna Basin, which makes it part of one of the most significant river basins in India.

Govardhan itself, is an offshore of the Aravalli Ranges, which is one of the oldest mountain ranges in India, making it through ecological and geological age, a significant setting for further settlements to happen.

The Aravalli, as a geological feature, is a rain-catcher, directing the rain-laden winds from the Western Ghats, towards the Govardhan, contributing more to its ecological, agricultural, and culturally contributing phenomenon.

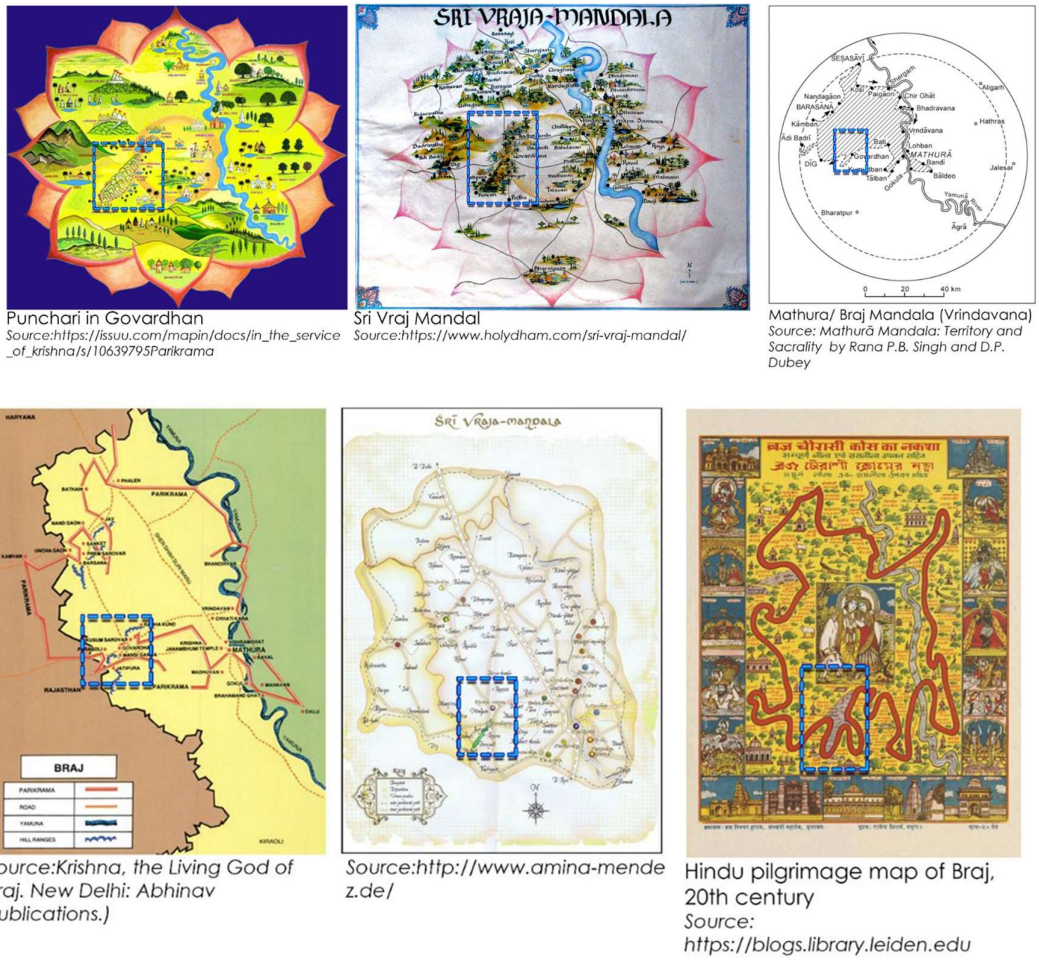
The combination of the river-flow, and the rainfall happening in regular intervals, creating an environment that is in equilibrium, creating an important and unique ecological setting, creating a stage for a unique setting for flora, fauna, and human growth.

The Kunds naturally become a source of sustenance for the settlements in and around the Govardhan. The flat-lands, the river-flows, water percolation and the rainfall contribute to the formation of kunds.

4.3. Govardhan: Mythological Context

4.3.1. Govardhan in Braj

Braj as a landscape exists not only in the physical and ecological realms but also takes a very specific, geometric, representation in the minds of the believers. In these series of maps the physical reality of settlements around the Braj Mandal are represented to be part of various layouts. The actual distance between these settlements is not represented but an imaginative notion of faith and the psychological state of belief is fully represented through art works and paintings. Among these representation Govardhan, which is marked in these various maps prove that Govardhan irreplaceable part of the larger Braj Landscape.



Punchari in Govardhan
Source:https://issuu.com/mapin/docs/in_the_service_of_krishna/s/10639795Parikrama

Sri Vraj Mandal
Source:https://www.holydham.com/sri-vraj-mandal/

Mathura/ Braj Mandala (Vrindavana)
Source: Mathurā Mandala: Territory and Sacrality by Rana P.B. Singh and D.P. Dubey

Source:Krishna, the Living God of Braj. New Delhi: Abhinav Publications.)

Source:http://www.amina-mendez.de/

Hindu pilgrimage map of Braj, 20th century
Source: https://blogs.library.leiden.edu

Figure 24. Govardhan in Braj Mandal

4.3.2. Beliefs associated with the origin of Govardhan Hill

In the Hindu mythology Govardhan takes an important part in multiple origin stories where the hill itself bought from other sacred place and eventual is placed in this geographic region giving it an air of divine nature. The pilgrims and people living in the area constantly connect to its natural feature the divine nature of Himalaya sometimes even becoming a parallel to mount Kailash itself so naturally

everything around this feature becomes sacred or important to the people. In the second chapter of the *Vrndavan-khanda* of the *Garg-Samhita*, *Sri Gargacaraya* describes Govardhan's *Avirbhav*, or arrival in this world, and the receiving of the name "*Giriraj*."

Another mythology about Govardhan hill is that Lord Ram's monkey army was bringing various stones to build a bridge to Lanka. This occurred during the *Treta Yuga* when Lord Rama was preparing to assault Lanka. Hanuman was transporting Govardhan from the Himalayas to assist in the construction of the bridge. On the fifth day, while Hanuman was carrying Govardhan across Braj, *Nal* and *Neel*, who monitored the bridge's construction, claimed that it was finished, and no more stones were required. Hanuman was in Braj Mandal when he heard this, and he placed Govardhan there.

Figure 25. Pulastya Rishi bringing Govardhana to Vraja.

Source:Sree Vraja Manda/ Parikrama

Figure 26. Shree Hanuman carrying Govardhana to Braj.

Source:Sree Vraja Manda/ Parikrama

4.3.3. Mythological Associations

नः पुरो जनपदा न ग्रामा न गृहा वयम् ।

वनौकसस्तात नित्यं वनशैलनिवासिनः ॥ २४ ॥

-Srimad-Bhagavatam 10.24.24

"My dear father, our home is not in the cities or towns or villages. Being forest dwellers, we always live in the forest and on the hills."

Figure 27. Krishna lifting the Govardhan Hill.

Source:https://www.britishmuseum.org/collection/object/ A_ J 960-071/6-0-16

Figure 28. Krishna Revered by Indra Arriving on a White Elephant, 1720

Source:https://www.gettyimages.in/

Braj culture is mostly a forest culture. Over 137 transcendental lush groves on both side of the Yamuna are mentioned in the *Brajbhaktivilas*. Braj is Lord Krishna's birthplace, according to the Shrimad Bhagavat Gita. Lord Krishna came in Mathura around 5000 years ago and conducted his numerous pastimes around the region until he was 11 years old.

Govardhan is one of the most recognizable features in the Krishna mythology wherein Krishna lifts the entire hill to shield the entire village from the wrath of the rain god Indra eventually becoming the part of Hindu mythology, These Artistic interpretations of the same event display the penetration of the thought into the artist's mind.

4.4. Emergence of Govardhan

Arrival of Saints: In the 16th century India where bhakti movement gaining momentum in the large history of the nation. Bhakti saints namely *Vallabhacharya* and Chaitanya *Mahaprabhu* visit the region of the Braj and thus began a long reinterpretation of the landscapes of the Braj Mandal as the part of the Hindu mythology. Hence Govardhan and its surrounding becomes the earthly representation of lord Krishna himself. People in the surrounding villages identified hill as the part of the cultural fabric and it became central to many poojas in the area such as *Annakut* also known as Govardhan pooja. The main purpose behind the mountain worship has always been conservation and protection of the vulnerable and precious natural resources.

4.4.1. Madhavendra Puri (1420-1490 C.E.)

He belonged to the Madhva School and was the guru of *Ishwara Puri, Chaitanya Mahaprabhu's* guru. He is said to have discovered a hidden idol of Gopal (*Shrinath ji*, the Lord of Braj) at the Govardhan hill, which he served for two years before passing it on to *Vallabhacharya*.

Figure 29. Pratham Milan, Shrinathji Revealing Himself To Vallabhacharya On Mount Govardhan.

Sources:https://www.britishmuseum.org/collection/object I A_ 1938-0108-0-3

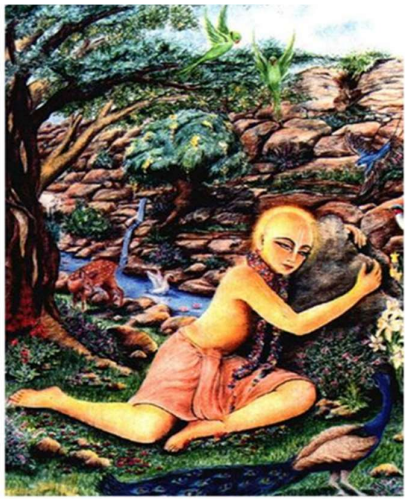


Figure 30. Caitanya embracing Govardhan hill on his first visit.

Source:https:/www.dollsofindia.com

4.4.2. Vallabhacharya (1479-1530 C.E.)

He worshipped the deity he received from Madhavendra Puri, which is widely regarded to be the current image of Shrinath ji, the Pushtimarg (Vallabha) sect's primary god. Shrinath ji's religion grew more formal during his journey to Braj, requiring the mediation of brahmins serving as priests, who followed the conventional brahmanical style of devotion centred on courtly ceremonial. Braj's people joyfully embraced this new form of worship and devotion. The foundations for a temple were placed in 1499 C.E., and the deity was established in 1519 C.E. The next significant stage was the construction of a temple, for which the foundations were built in 1499 C.E. and the deity was established in 1519 C.E.

4.4.3. Chaitanya Mahaprabhu (1485-1527 C.E.)

His journey to Braj in 1515 C.E. heralded the beginning of the region's renaissance. Many Bengali followers were motivated by Chaitanya to settle in Braj and begin worshipping various deities of Lord Krishna, setting the stage for large-scale temple construction later. When Sri Caitanya Mahaprabhu arrived in Govardhan, He rushed straight to the first stone He saw and hugged it. His eyes welled up with tears of love as he embraced Him with such dedication and passion. He identified Radha and Krishna kund twin lakes near Govardhan.

Chaitanya instructed: Govardhan is indistinguishable from Krishna. There is no difference between his body and Krishna's body. However, our acharyas caution us that unless we are paramhans or it is particularly under the directions and blessings of the acharyas, we should never take any Govardhan sila from Govardhan hill or climb on it.

4.5. Govardhan Pooja

कृष्णस्त्वन्यतमं रूपं गोपविश्रम्भणं गतः ।

शैलोऽस्मीति ब्रुवन् भूरि बलिमादद् बृहद्वपुः ॥ ३५ ॥

Srimad-Bhagavatam 10.24.35-6

"Kṛṣṇa then assumed an unprecedented, huge form to instill faith in the cowherd men. Declaring "I am Govardhana Mountain!" He ate the abundant offerings."

Krishna (Shrinathji) and the Dancing Gopis. Pichhavai from the Temple of Nathdvara, Rajasthan

Source:https://commons.wikimedia.org/

Nathdwara Srinathji in the Govardhan leela pose, at the autumn Annakuta Festival.

Source:https://www.britishmuseum.org/

Govardhan Pooja in U.P.

Sources:https://spiderimg.amarujala.com/

Annakut festival.

Sources:https://commons.wikimedia.org/wiki/File:Govardhan_Puja.jpg

Govardhan Pooja in Betul, M.P.

Sources:https://www.patrika.com/

Govardhan Pooja Nathdwara, Rajasthan.

Sources:https://udaipurtimes.com/

Figure 31. Govardhan Pooja.

Because of this protection through cultural process Govardhan, Krishna both have been interpreted in different forms in various poojas in different forms across Govardhan. These representations become part of artistic works as well.

5. GOVARDHAN: A SACRED CULTURAL LANDSCAPE

5.1. Mapping of attributes of Cultural Landscape of Govardhan

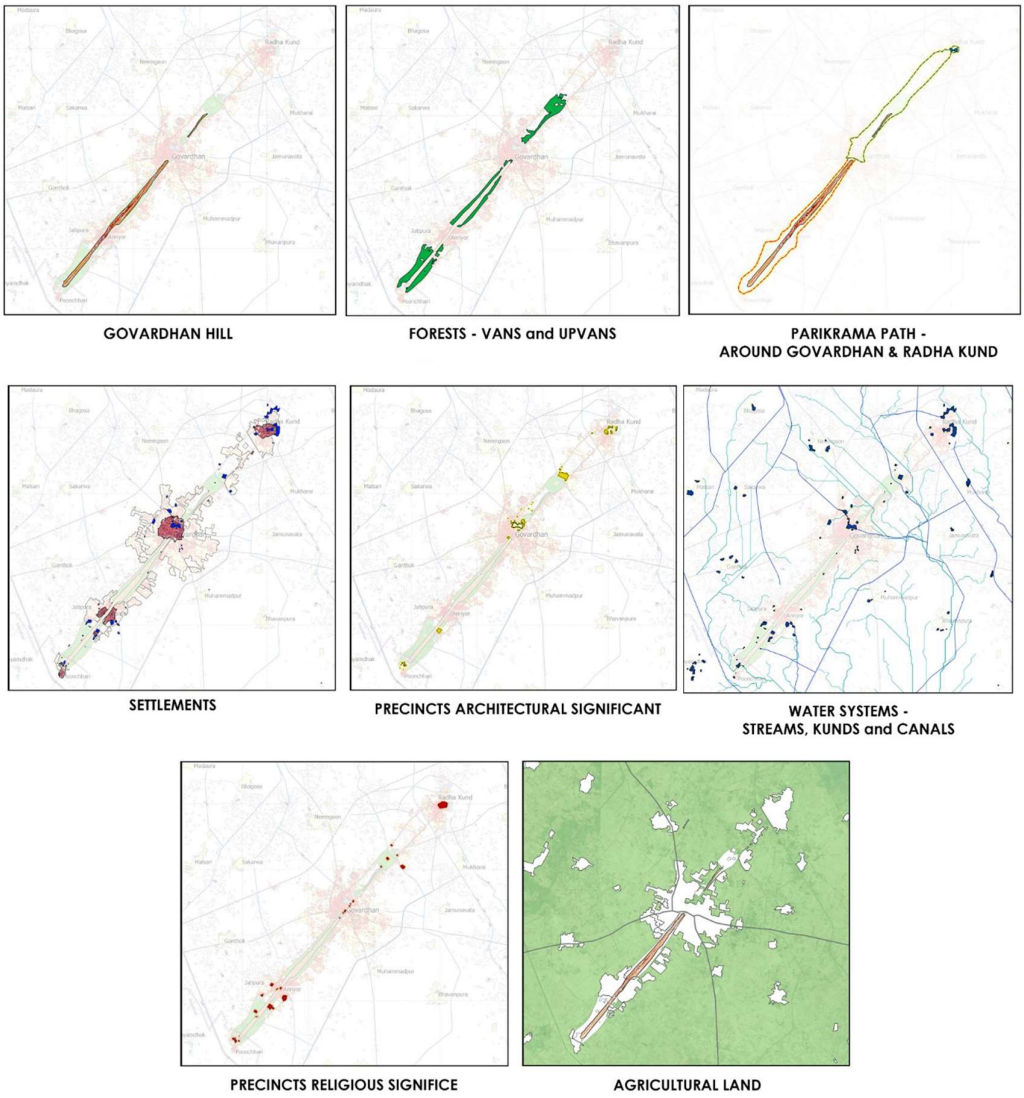


Figure 32. Mapping of Govardhan Cultural Landscape.

These are various maps represents the various attributes of sacred cultural landscape. Govardhan hill, Forests Van and Upvan, Parikrama of Govardhan Hill and Radha Kund Settlements, Precincts of Architectural and Religious significance, and Agricultural Land. This mapping prove that each element is deeply connected and forming a singular system.

5.2. Elements of Govardhan as a Sacred Cultural Landscape

5.2.1. The Govardhan Hill

The mythical form around which the entire culture is formed. An elongated geographic natural feature, which changes its visual nature, as climate changes.

5.2.2. Forests (Vans and Upvans)

The small patches of forests and gardens, abutting water bodies and settlements.

5.2.3. Ponds - (Kunds)

The infrastructure around which settlements grow and used to feed both localities and pilgrims in the area.

5.2.4. The Land

Serving both as agricultural and grazing lands for the people in the region, the land is where human-nature interactions manifest

5.2.5. People

The people itself, become the cultural apparatus through which the beliefs and mythos of Govardhan continues to manifest and exist today.

5.2.6. Fauna

An important part of the landscapes of Govardhan, the fauna of the land, are as important as the people, since it takes a central part in their belief systems, and mythos.

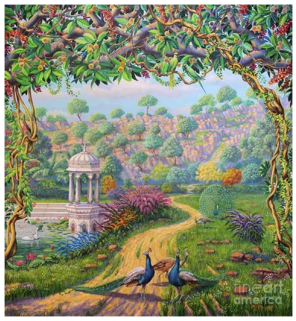
According to UNESCO an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element."

For early and childhood years of Krishna's existence Govardhan was becoming a stage. The *Vaishnavites* anchored on the floor, which designates the particular site for an incident in the life of Krishna, created the countryside from memory and religious scriptures. Makes it a cultural associative landscape.

5.3. Kund

Radha Krishna performing raas in Radha Kund

Source:https://sriradhakund.wordpress.com/



Contemporary Imagination of Govardhan's landscape

Source:https://www.vrindavanart.com/

Painting of Pratham Milap shown in the foreground in Anyore Village

Source:https://www.artisera.com/

Apsara and Naval Kund in Poonchari

Source: In the Service of Krishna

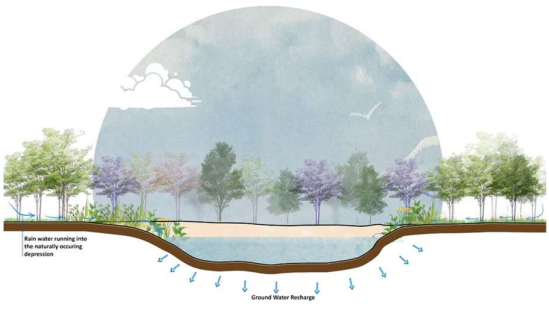
by Mapin Publishing

Vallabhacharya Baithak in Radha Kund representing Radha & Shyam kund with eight kund of Asthasaki

Source:http://blog.nathdwaratemple.org/

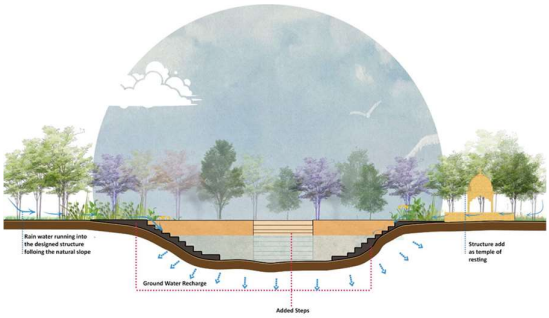
Figure 33. Kunds in Arctistic Imagination of Braj.

These are artistic works representing in many forms notice how kunds are the important part of representation of artworks of Govardhan. Hence proving the kunds holds an important place in imagination of Govardhan.



(a)

Source: http://www.vaisnava.cz/



(b)

Figure 34. Typical Kund design approach adopted in this region (a) in a natural setting where rainwater is getting collected into the depression and naturally occurring flora and fauna. (b) Designed architectural device creating space for human interaction with the ecosystem.

Source: Author

Kund is a stepped tank of a particular architectural design, can also be looked like an expression of a cultural landscape. Kunds are like architectural devices designed with combination of nature, which not only allows the human's interaction with ecology but also acts as an interface to connect with the divine. Kunds also provided essential services to communities like drinking water, as a source of harvesting rainwater, and as a flood control system. Kunds are an essential part of settlement growth, since the Vedic era, till today, becoming part of the mythical *Vaishnavite* narrative that took form in the 15th Century onwards.

5.4. Significance of Govardhan

The Govardhan natural form, and its 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 in his various forms take the centre stage, as protagonist. The mythic stories of the conflict between Indra and Lord Krishna, exploring the people of Govardhan village, to look towards spiritual means of worship, rather than sacrificial or materiality of worship is central to the plot. The imagery of 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 lighting is stuff of legend in the Braj Mandal, and the larger Indic culture.

Chronologically, the settlements and the villages around the Govardhan Hill, must have been a result of the rich soil, rainwater climactic systems, and the river-basins' confluence. Vedic age settlements must have been a systemic part of this part of the area, with ecology, geography and terrain contributing to the factor of water percolation and storage. This technique has penetrated through to the cultural fabric of the region, throughout history, becoming an essential part of the natural and built fabric of Govardhan.

Sometime during the rise of Buddhism in the region, this area was a centre of settlements and learning in the Buddhist philosophy and theology. Archaeological digs in the nearby regions have proved the same. The kunds were not religiously linked, and hence the construction, and identification of potential kunds by the people - were continuing despite the cultural shift from Hinduism to Buddhism, parallelly as settlements grew. As the populace and the growth of settlements happened, so did the number of kunds.

In the 12-14th CE, during the Bhakti movement, gurus like *Chaitanya Mahaprabhu* and *Vallabhacharya*, reinterpreted the region where Govardhan stood, and reinforced the mythology of Krishna and interpreted the Braj Mandal. This, and the resurgence of populist Hindu movements like the Bhakti movement in the area, recognition of the region, as a sacred space started to happen. This led to the interpretation of every flora, fauna, and village and built form to be related to the Krishna mythology, and kunds, or its primitive form of ponds, or talabs, forests or vans, or groves like upvans, became the canvas on which this rich mythology was rendered.

This reinterpretation was reinforced into the collective consciousness of the people of the Braj Mandal, and the larger Hindu culture in India, becoming central to the Hindi pantheon's earthly built expression. From the 15th CE, there is string of architectural patronage, by the hands of Mughals, Rajputs and Jats, who constantly

ruled the area, and led with patronage, defining its current built fabric - which is composed of ghats, burjs, temples, chattris, and cenotaphs.

Despite after almost seventy years of Independence, and two centuries of colonial rule before that, these kunds have constantly been in a state of use, and a sign of continuum, showing how these religious and utilitarian infrastructure are an important part of the Govardhan region sustaining populations, cultural relationships, and artistic imagery.

6. SITE STUDY AND DOCUMENTATION

6.1. Documentation Techniques

- Preparation of a detailed Site plan using GIS.
- Identification of Architectural Component, overall issues, activities, and source of water of Kunds and assigning icons to each for kund documentation.
- Delineation of Watershed of Govardhan.
- Documentation of all the kunds within the defined watersheds using a Measuring tape, distrometer.
- Inventory (refer Annexures).
- Photo Documentation.
- Interviews with locals and Experts.
- Sketching.

6.2. Documentation Methodology

The methodology to document kunds entails the major process of data collection, documentation of various components and the broad-level condition assessment to understand the built and unbuilt fabric of the kunds. Along with this, mythological and cultural associations in terms of Braj, Govardhan and the larger Krishna mythos establishes the relationship of this built component - eventually forming an analysis of significance, which would help in strategizing the guidelines moving forward.

The perspective through which kunds are observed and studied, are broadly divided into three heads - architecture, water, and geography, which will be made clear through further explanation in the report**.**

6.3.Site Plan

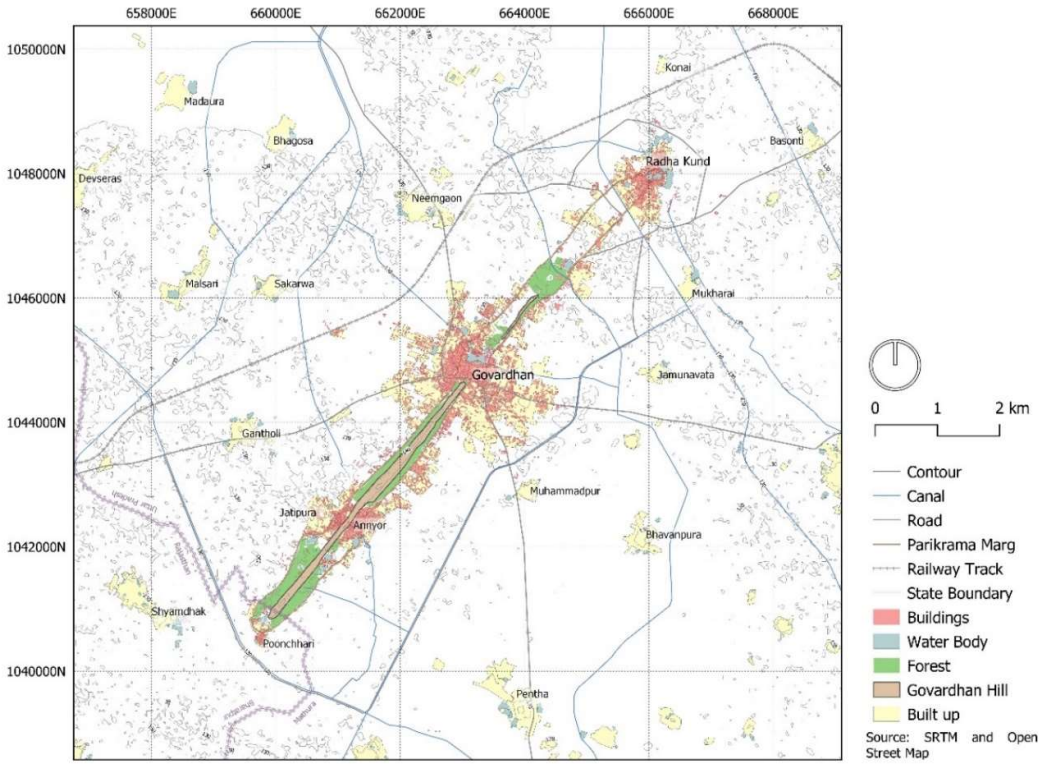
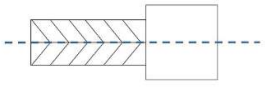
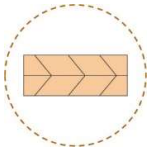
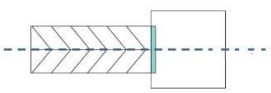
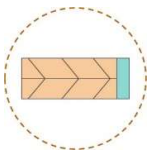
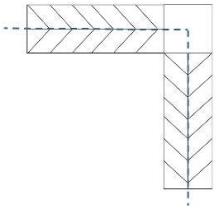
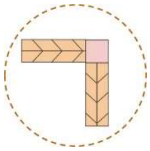
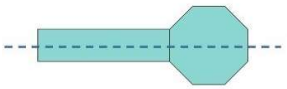
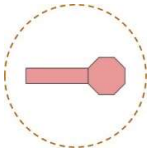
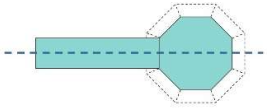
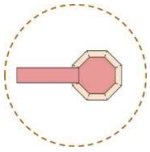
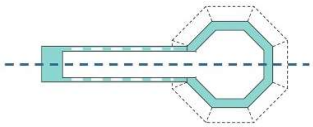
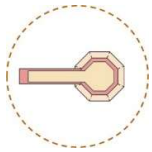
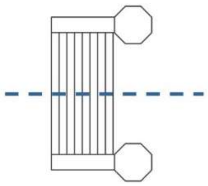
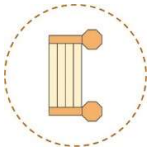


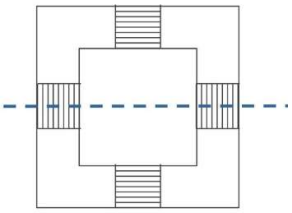
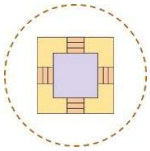
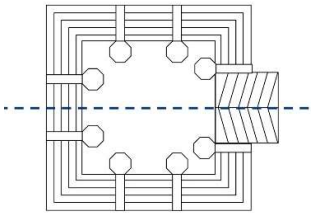
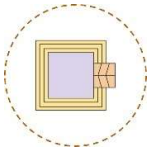
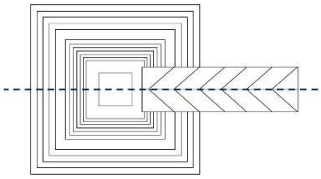
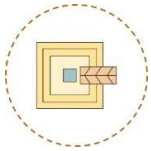
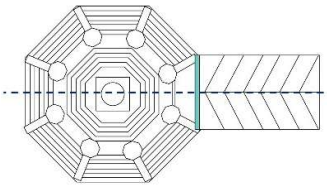
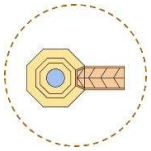
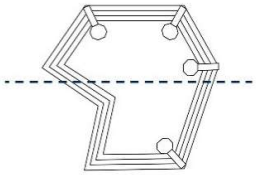
Figure 35. Site Plan Govardhan.

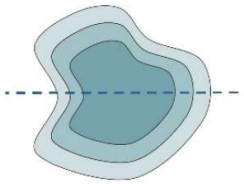
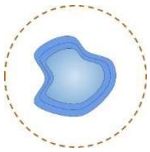
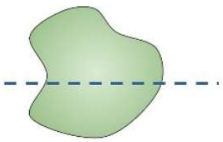
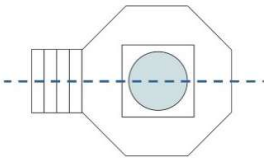
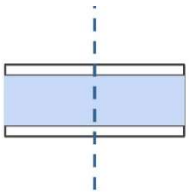
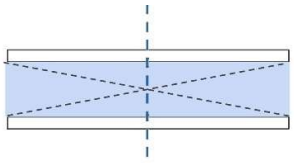
Sources:STRM and Open Stree Map. Redrawn by: Author

6.4. Identified Architectural Component of Kunds

Component	Component Drawing	Icon	Description
Gau Ghat Type 1			It is an architectural element in kunds, where cows and other animals use the component for access of water. The design is dependent on the depth of the kund. Majorly three types of gau ghat design are seen at Govardhan, of which sketches are shown.
Gau Ghat Type 2			

Gau Ghat Type 3			(1) where depth of water-and-bed is comparatively less (2) where depth of water-and-bed enough for drowning (3) where depth of water-and-bed is largest, but access to the depths of water is desirable. The most common material found in the design, is sandstone framing, with lime mortar with bricks.
Burj Type 1			Type (1) is constructed with bricks and sandstone, and comparatively smaller, and is the most common archetype of a burj.
Burj Type 2			Type (2) is larger, compared to type (1), and has more space to be used on top at the surface.
Burj Type 3			Type (3) is the most ornate among all three, with structural considerations made, for it to be accessible within the burj itself, making it a unique form in the architecture of kunds.
Ghat Type 1			Type (1) is a commonly found design of a ghat, and accessible for any one direction, and made with two burjs on either side.

Ghat Type 2			Type (2) is a different design, with edging done on all sides of the kund, filled with brick and lime concrete. These two components - Ghat and a Burj, form the fundamental vocabulary with which kunds are created.
Ghat Type 3			Type (3) the ghats are lined all around the kund, and to provide structural integrity, burjs are interspersed between the horizontal stretch creating one single kund.
Ghat Type 4			Type (4) follows the same principle, however on an irregular polygon, following the natural edge of a kund, without changing the natural form of the pond, on which construction happens.
Ghat Type 5			Type (5), (6) ghats are designed on the principle of a simple well - the more depth, since major water source is deep in the ground, from natural aquifers, rather than rainfall or water percolation on the surface. The architectural vocabulary, materials and design is like other ghats, with exception of the great depth that it has.
Ghat Type 6			

			Most of the kunds in proximity of Govardhan hill are of this type.
Kaccha Ghat			Kaccha Ghats are manually dug ghats, with no specified built edges in brick or stone.
Pokhar			Pokhars are naturally dug depressions in and around ghats, when water is overflowed from the ghats, it goes into these pokhars, acting like overflow sluices.
Well			Wells are commonly found across Govardhan. It is a security measure, against kunds where water quality is decreased or lost, then wells are used to get water.
Canal			Artificially built by man, to feed the kunds and pokhars, with water. 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, playing an important part of exchanging or levelling of water, in order for equitable distribution.

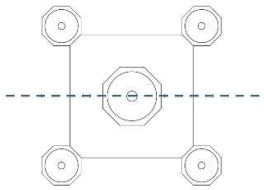
Chattri			The Chattris found in the various kunds of Govardhan act as shelter for the people using them or involving pilgrimage. The materials involved in construction are bricks, lime concrete and sandstone, composed on an arcuated structural systems.

Table 3. Identified Architectural components of Kunds

6.5. Water System

Figure 36. Stream Order.

Source:http://www.cotf.edu/

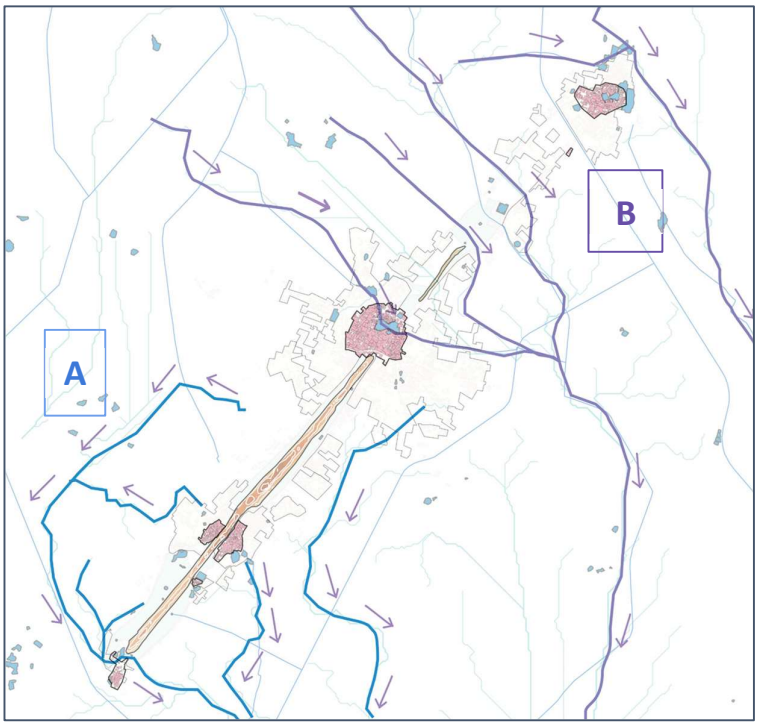


Figure 37. Types of Stream in Govardhan.

Source: Author

A method of assigning a number order to the connections in a network stream is called stream ordering. This is an order in which different kinds of stream are distinguished and classified according to how often they are affluent. Knowing the stream sequence might show some of its features.

To understand and conserve these kunds understanding of Geography and Gravity is required 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 while Stream B Represents the flow of the water from sources other than the hill that flows through and around Govardhan. Broadly there are three major sources of water to feed the kunds as represented Water from the Catchment Areas, Subterranean water and Canals or Channels.

6.6. Water Systems in Kunds

6.6.1. Type A

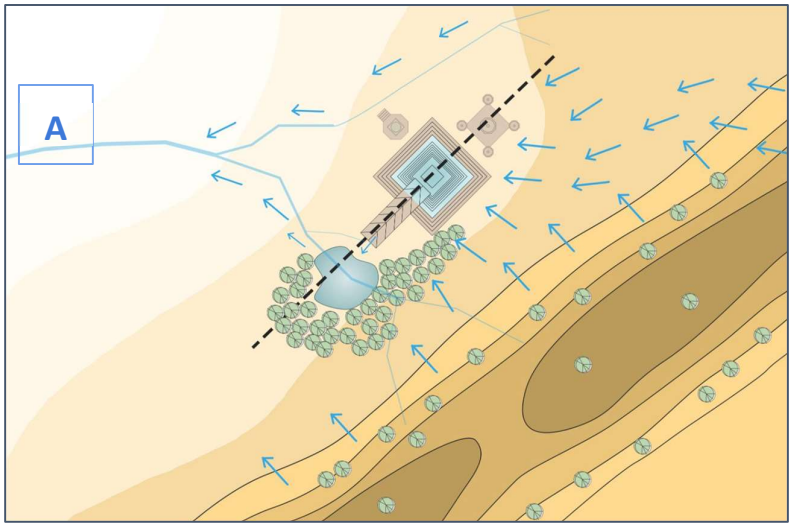


Figure 38. Plan type A Stream water system.

Source:Author

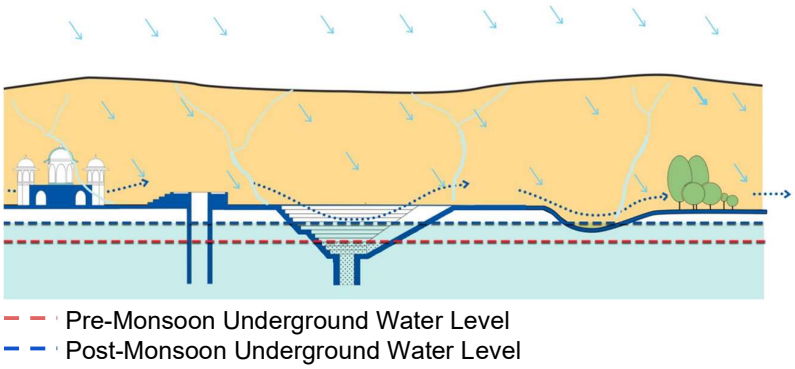


Figure 39. Section.

Source:Author

This type of water-system is found in kunds near a higher terrain or built near hills. Here majority kunds are designed to reach groundwater levels. During rainfall, the water from the hill and catchments flows into the kunds, which then recharge the groundwater. And when the water level decreases and kund water become dense. The recharged water then can be used through wells which makes them as a very important part of the water systems.

The blue line represents the upper level of the water Post Monsoon Underground Water Level, and the red line represents the underground water level pre monsoon.

6.6.2. Type B

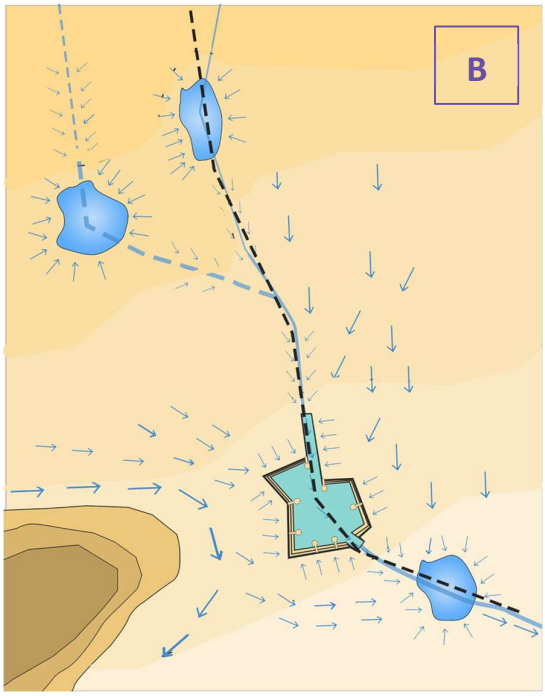


Figure. 40

Plan type B Stream water system.

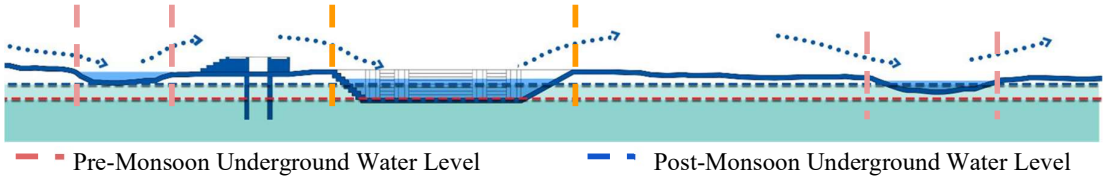


Figure 41. Section

Source: Author

The water-systems in kunds away from the hill, are fed off water streams formed on flat lands during rain, canals, and subterranean water. This particular type of system is seen in the trend where post-rainfall, and normal time, rainwater gushes into the streams and channels and fills into the kunds and *pokhars*.

6.7. Kund Watershed Delineation

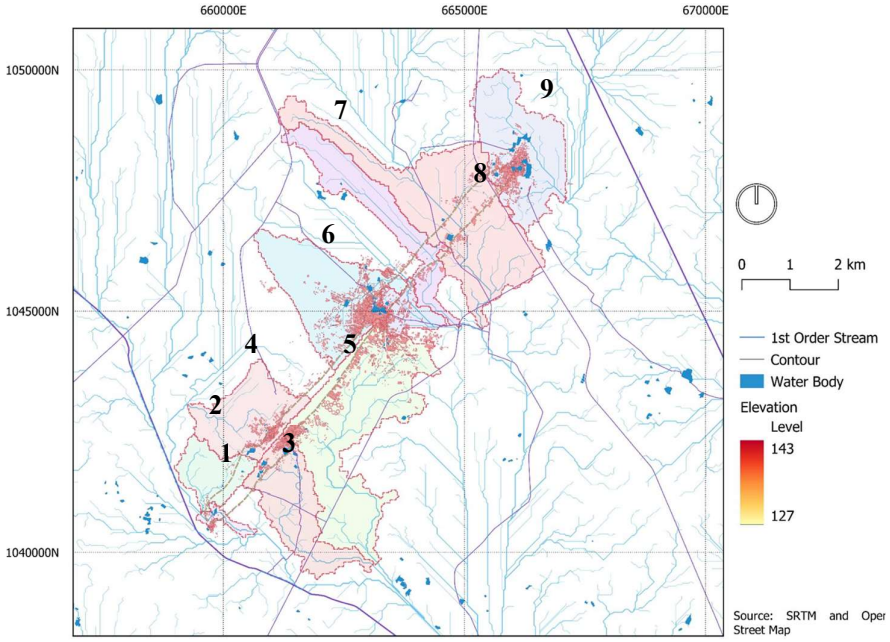


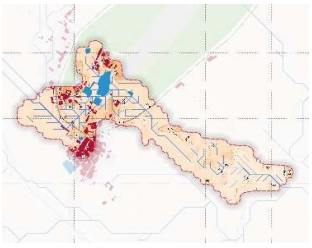
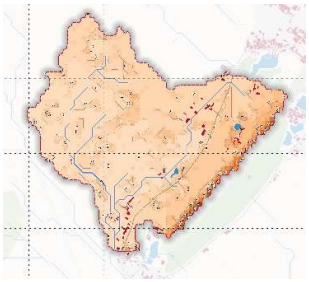
Figure 42. Kund Watershed Delineation

Source:Author

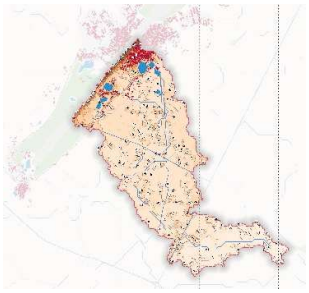
Watershed	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Name of Micro Watershed	Apsara Kund	Surbhi Kund	Govind Kund	Harij u Kund	Danyavartan Kund	Mansi Ganga	Jawahar Kund	Kusum Sarovar	Radha Kund

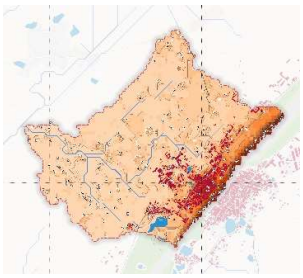
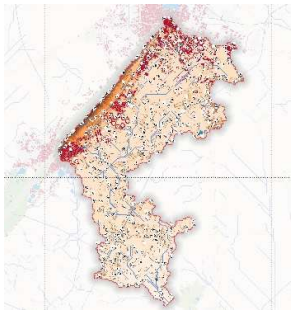
This map represents micro watershed of the Govardhan hill through which kund are fed on water it is divided into 9 Subgroups of which names are written in the table.

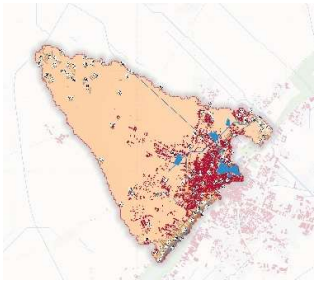
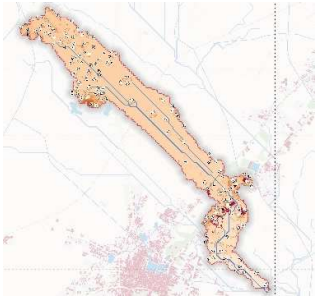
6.8. Identified Kunds within the delineated Watershed

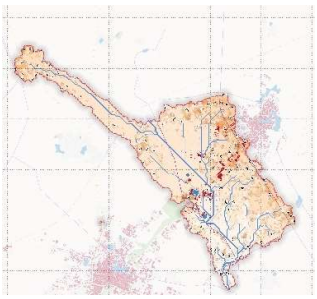
W.S. No.	Watershed Drawing	Identified Kund	Description of Kunds
1.		 Apsara Kund  Naval Kund	Apsara and Navall kunds found in poochri both these kunds are square in plan ghat lead into the water there are no burjs in the design but there one straight and one L shaped Gau ghats. Both kunds are connected through culvert. There are seven wells found as associated sources of water There are wells in different spots, according to locals this no is because of the changing water quality but at some place as it is observed these follows caste-based system.
2.		 Surbhi Kund  Kishori Kund	Kishori kund is one of the few remaining kunds where not many transformations have been done. As per preliminary observation and not the chemical composition the quality of the water is better than the other

			kunds and it has been used by residents for bathing and washing clothes. It does not have aquifer as source of water but only the rainwater received from the catchment area. Surabhi Kund lies on the right-hand side of the Govardhan Parikrama Marg and have a high religious significance and the kund has been renovated in the year 2005-06 where ghats on the four side have been added along with chhatris and stone paving around. Now Kund it is dependent on the irrigation canal on the north-eastern side for the water. Earlier Kund also use to receive water from the catchment area which also consists of the Govardhan hill on the easter side.

3.		 Govind Kund  Sankarshan Kund  Gauri Kund	Govind Kund is in the rectangular shaped kund with ghats on all four sides and with octagonal burjs. Its proximity with Govardhan hill, the higher terrain and the slope created allows extra water to store in this kund. An underground arched channel allowed extra water to exit in the *pokhar* on the south side. This kund have high regard in mythology and hence has high religious value and high ecological value. Similarly, Sankarshan Kund high religious value with it association is the only kund associated to Balram the elder brother of Krishna. It has been heavily transformed in 2017.

4.		 Rudra Kund  Vishnu Kund  Hariju Kund	Rudra kund is also one of its kind considering that it had a solid bed made of Lime concrete and bricks and technically worked like tank. Vishnu kund a square shaped kund and considering that it has a very little religious associations its nature is more of utility. Hariju Kund is one of octagonal shape and one of its kind kund in Govardhan with seven wells in the vicinity. And have a high ecological value due to presence of a large pokhar adjacent to it and have a large catchment area
5.		 Charanamrat Kund  Danivartan Kund	Danivartan and Charnamrit Kunds are unique in a way where both the kunds have ghats in the middle.

6.		 Mansi Ganga  Pathwari Kund  Chamunda Kund  Chamunda Kund	Mansi Ganga which is the largest kund and is in the centre of 7 kos parikrama is connected to a monsoon channel on the northwest side of the kund. Large size of the kund allowed most of the water to stay in kund while the overflowed water goes out via channel on the southeast direction through the gau ghat. While smaller kunds like Brahma Kund and Panchteerth Kund are connected to Mansi Ganga through underground aquifers.
7.		 Jawahar Kund  Gawal Pokhra	Jawahar kund is a square shaped kund and like vishnu kund except the bridges on gau ghat. Ratna kund have important religiou association and has been restored recently.

8.		 Kusum Sarovar  Uddhav Kund  Narad Kund	Uddhav Kund, Kusum Sarovar and Narad Kund are part of the same water system have large catchment area as source of water on the northern side. Being on the higher side rainwater from catchments flowed into the kunds. Here Kusum Sarovar and Narad Kund releases the overflowed water in the channel running along but Uddhav kund does not have direct linkages with the canal but is connected to the Kusum Sarovar. Kusum sarovar have high architectural Value. Contributions from King of Orrcha and Raja of Bharatpur Sooraj mal contribution in constructing cenotaphs in Kusum Sarovar leads to the High Architectural value.

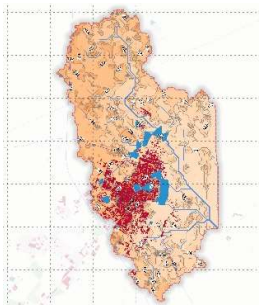
9.		 Radha Kund  Shyam Kund  Shiv Khor Kund  Malyhari Kund  Lalita Kund  Bhanu Khor	Radha Kund, Shyam Kund, Lalita kund, Astha sakhi kund and bhanu khor are part of a single water system Radha Kund is connected to sham kund through Culverts shyam kund is connected to lalita kund by a channel and Lalita to Asthsakhi other than kunds it has a huge catchment and conection with Shiv Khor, Bhanu Khor, Malyhari and Balram Kund.

Table 4. Identified Kunds of Govardhan

(For detail documentation drawings-Refer Annexure)

6.9. Analysis, and Inferences

6.9.1. Value assessment

Historic Value: Kunds have been built with architectural patronage, by the hands of Mughals, Rajputs and Jats, who consistently ruled the area, and led with patronage.

Architectural Value: Kunds are essential to the sustenance of the living systems of the towns, becoming a stage for architectural vocabulary of the Mughal, Rajput, and Jat Era of the region, and becomes stages for growth in artistic and creative forms of expression. Assessment is based on the aesthetic, and variety of architectural components and how it is helping in the water management and storing systems.

Religious Value: Location around the Govardhan hill and parikrama, direct association with Krishna Mythology and events, and ritual and religious practices.

Cultural Value: Kund being part of social infrastructure places social gathering and interaction between community and pilgrims among themselves and between each other.

Ecological Value: Kunds comprises various built and unbuilt components which become an integral part of ecology as they help in thriving ecology and groundwater recharge. The rainfall happening in regular intervals, creating an environment that is in equilibrium, creating an important and unique ecological setting, creating a stage for a unique setting for flora, fauna and human growth

6.9.2. Inferences

The kunds are part of the larger water-system in Govardhan that used to provide sustenance for entire settlements, in such semi-arid climates.

These kunds are essentially part of a larger ecosystem where rainfall, ground water aquifers and built environments join to form a unique typology in the landscapes of Govardhan.

The kunds are part of the mythic narratives of Braj and Govardhan, as an archetypal setting of imagined cultural landscapes.

These kunds are a significant piece of built component, as it is a signature of a long-lasted, rooted, and culturally thriving environments, as well as a confluence of a natural environment of natural settings.

Kunds are also a significant part of a route of cultural and religious parikramas throughout the cultural landscape and is an important part which ensures the continuum of these parikramas.

These systems help the sustenance of a large number of people, flora, and fauna and associated living systems that are necessary for the continuation of this agricultural setting.

7. IDENTIFIED ISSUES, GUIDELINES AND RECOMMENDATIONS

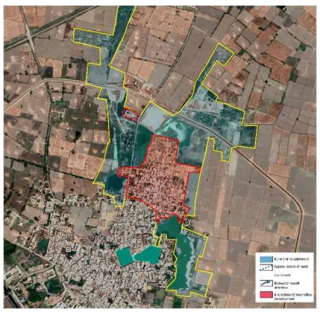
पाली पाडल नीमगांव, पानी नांय तीन गांव।

"Three village Pani Paalad and Nemgaon does not have water at all."

The phrase spoken by a Brajwasi living in neemgaon waiting for a water tanker to arrive after being asked for directions to a lost kund. Pani palad neem gaam pani nay teen gaam. Which translate to 'three villages Pani Paalad and Neemgaon does not have water at all. This expresses the pain and difficulties faced by communities in these three villages of Govardhan pertaining to availability of water. This colloquial phrase represents water scarcity in this region despite in the presence of such rich traditional water conservation system and been part of rich environment conservation-based mythology. This phrase is representative of all the issues found in the studies and analysis and is real tangible problem which this thesis attempt to address.

7.1. Identified issues

Identified Issue	Image of Issue	Causes	Recommendations
Natural Streams disrupted		Transformation due to agricultural practices, infrastructural developments including road construction and urban sprawl.	Mapping and identification of natural streams is to be done. According to the streamline new transformation should be regulated. Design provisions like inclusion of culverts in both existing and new infrastructure development, regulating slopes change in agriculture fields.

Watershed/ Catchment Area Transformed		Insensitive infrastructure developments causing topographical transformation	Delineation of the catchment boundary, Identifying the rainwater runoff natural drainage, provision for rooftop rainwater discharge in kunds and regulating new topographical transformation. Integrating it with Watershed Development Programs.
Loss of Natural Vegetation and wetland (Pokhar)		Development pressure leading to encroachment of Vans/upvans and vegetation in catchment areas which further triggers soil erosion	Ecosystem Approach needs to be adopted. Along with watershed restoration, dedicated wetland (pokhar) needs to be re-established, which helps in rejuvenation of vegetation.
Silt deposition		Soil erosion is a major contributing factor in silt deposition. Due to disconnect between community and water system causing disruption in desiltation practices	Natural Vegetation in water inlet streams can help in reducing soil erosion. De-silting on regular interval depending on the amount of silt deposition

Cultural Misuse		Religious activities like immersion of idols, flowers, diyas etc. in excessive amount are also responsible for water pollution	Restriction on immersion of idols, flowers, diyas etc.
Wastewater Discharge and solid waste dumping		Since the water bodies no longer used traditionally led to a disconnect with the community. Abandoned polluted water bodies become solid waste dumping zones and natural slope toward water bodies makes it easier to discharge wastewater into them.	Restricting the water discharge. Alternate wastewater treatment at community level should be developed which can be further used to recharge the water bodies or can be used for agriculture purposes
Eutrophication/ Algae growth		Water flowing from agriculture fields contains excessive amounts of nitrogen, phosphorus, fertilizers, also untreated sewage containing organic waste and detergent	Overuse of chemical-based fertilizers in agriculture fields, wastewater discharge, should be prohibited.

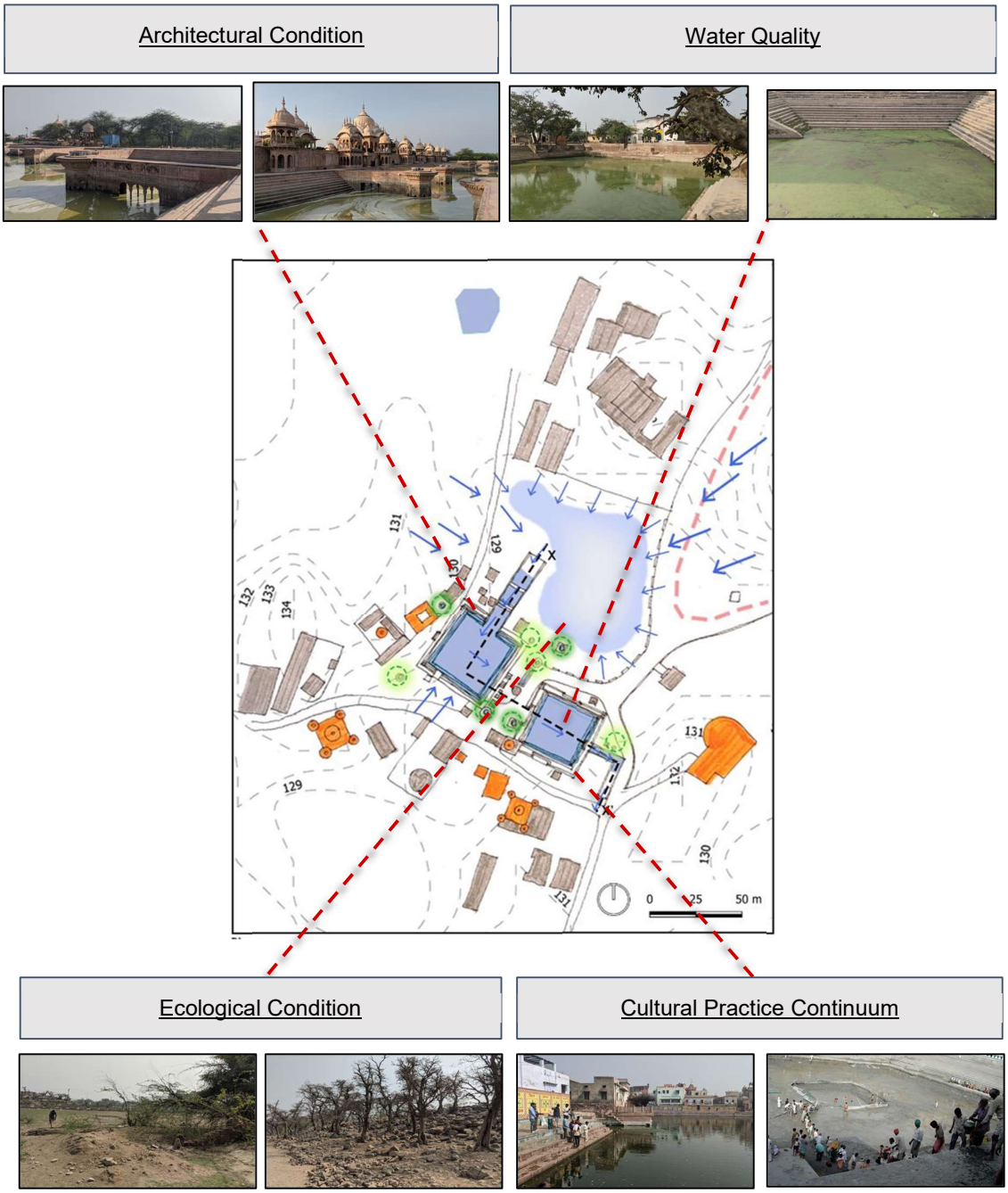
		discharge into Kunds make them overly enriched with nutrients which results in Eutrophication and excessive amount of algae growth. Which make kunds as "dead zones" that are incapable of supporting life.	
Loosening of Masonry Structural collapse Use of incompatible materials and finishes like concrete retaining wall and cement finish New addition over existing built structure	  	Construction activities in the proximity or over the historic Built fabric suffering structural damage. Presence of chemicals in water causes adverse effects like roughened surfaces, chipping of sandstone removal of material, and loss of carved details etc. on built fabric. Vegetation growth in the masonry causes structural damage to ghats, burjs etc	Adopting an Ecosystem Approach in which instead of encompassing the water body by a defined boundary the whole watershed must be managed. Construction activities must be regulated and should be thought more rationally, impact on both ecology and Built fabric must be analyzed. Grouting and re-pointing the masonry Collapsed masonry should be reconstructed following the existing profile and original construction technique.

			Removal of incompatible material and replacing it with traditional material. New structural additions should be removed. Architectural components which are the essential structural elements like burj and ghats should be reconstructed using traditional techniques. Removal of vegetation Cleaning the surface of sandstone and lime algae and soot by scraping with safe chemicals and, Brushing and cleaning using.
Insensitive Restoration		Religious associations, lack of understanding of traditional and scientific conservation practices leading to insensitive and inadequate restoration practices. Lack of Acknowledgement of a Waterbody and kunds as a Land Use	Identified water systems should be acknowledged in the development plans as a separate land use category. The capacity building of communities should make them aware that their local water bodies are of environmental and economic importance, that pollution and destruction of these water bodies have adverse repercussions, and

		Category. As a result, there are no rules and regulations to prevent such practices. There are no defined guidelines for the conservation of traditional water bodies. Lack of Participation and Capacity Building.	that suitable preservation and management techniques are adopted.
Restricted entry		Newer restoration has led to gated enclosures.	This water should be accessible by everyone at any point of time. Any kind of gated or restricted entry should not be there for anyone including animals like cows.

Table 5. Identified issues

7.2. Approach for Conservation of Kunds in Govardhan



Source:https://harekrsna.com/

Figure 43. Apsara and Naval Kund.

Source:Author

In order to protect and conserve these water systems, it's important to visualize kunds as a system of multiple elements coming together - as trends have been seen on site, the conservation of built

fabric is done extensively, but the ecological and cultural continuum of practices is not taken into consideration.

Hence, to protect these kunds, all these elements should be bought together as one framework lens through which protection and conservation of water-systems should be carried.

In short, it is not enough to protect the kund, it is important to protect, the water, its quality, the cultural practice, architecture and how these aspects come together.

7.3.Integrated Conservation Framework

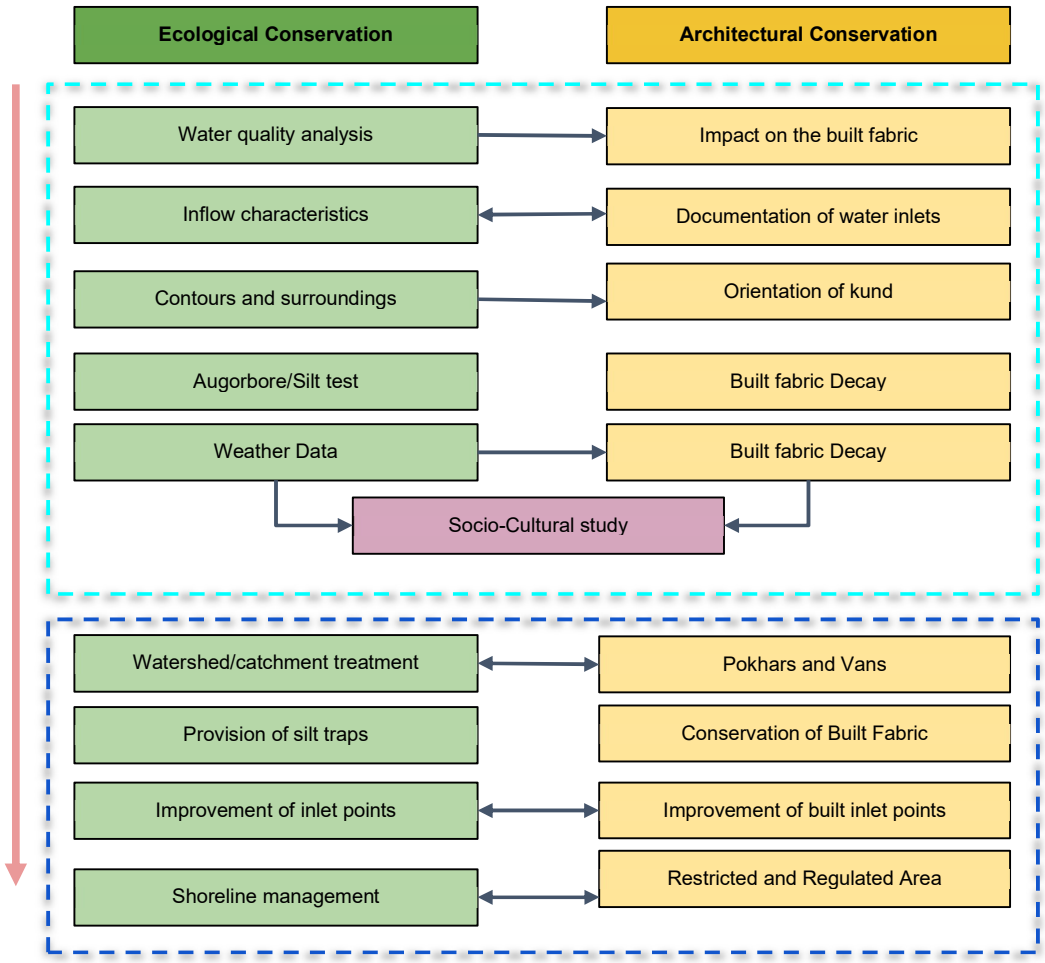


Figure 44. Proposed Integrated Framwork

Source Ecological Conservation: Sub Regional Plan for Haryana Sub-Region of NCR-2021

An integrated approach can be adopted where ecological conservation strategies and architectural conservation play other hand with each other. The light blue box represents analysis and dark blue represent implementation strategies. Ecological framework has been borrowed from Strategies for the augmentation and rejuvenation of water source by National Capital Region Planning Board. There are many components between architectural and ecological conservation which can be interrelated. Like while doing the assessment of a kund the condition of the built fabric especially

underwater fabric can be esteemed on the quality of water. The orientation of the kunds is directly related with the geographical setting which is an important part of ecological analysis. Similarly, during implementation improving natural water inlets points are connected to the architectural inlet elements in case of kunds. So as Shoreline management for ecology protection and Restricted and Regulated Area (Buffer Zones) in case of built heritage can be integrated.

7.4. Demarcating the Buffer Zone of the Natural Streams

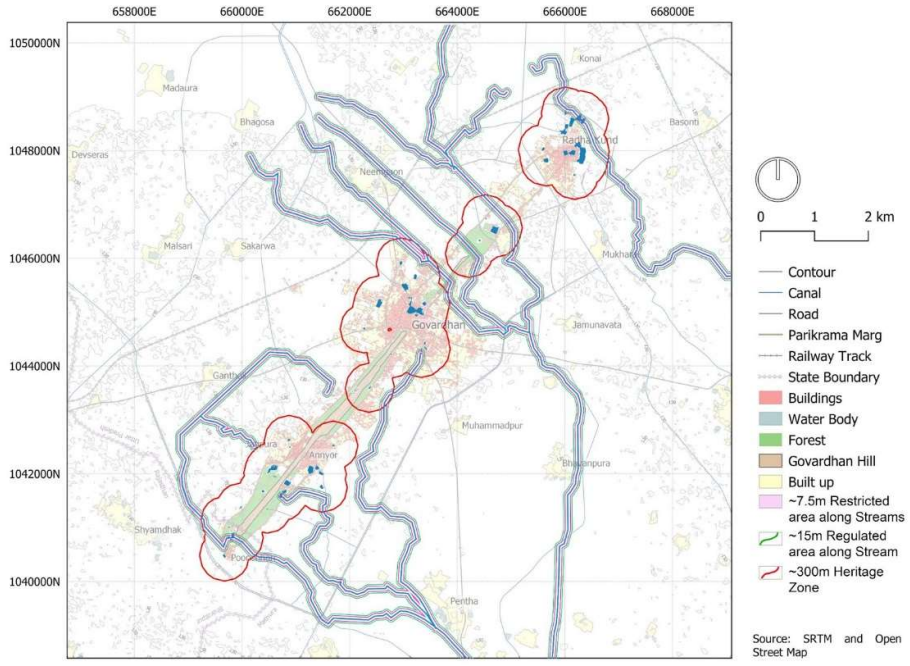


Figure 45. Demarcating the Buffer Zone

Source Author

For regional level proposal all identified stream of the study area which need to be protected are demarcated and the buffer zones have been delineated along with recommendation for both the zones. The older settlements are found to be developed away from the streams so as not to obstruct these streams flowing in the reason. The newer settle has been seen obstructing the streams hence affecting this water system.

7.4.1. Recommendations for Buffer zones

15m Streamside Zone

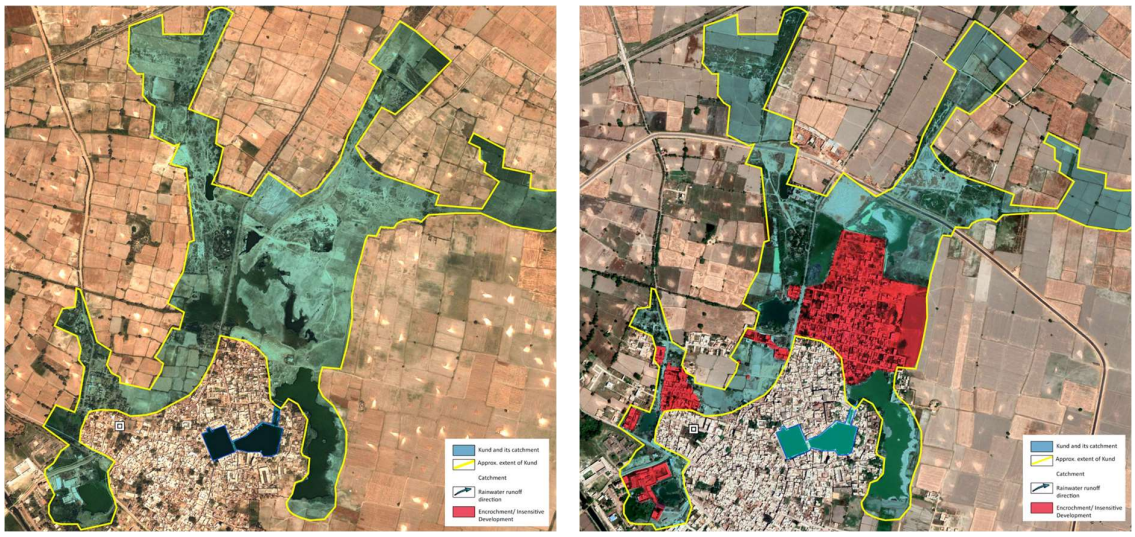
1. Maintains the stream ecosystem's physical and ecological integrity.
2. The following uses are strictly prohibited inside this zone:
    - Structures for flood control
    - Right-of-way for utilities
    - Footpaths
    - Where possible, use road crossings.

3. The Streamside Zone features natural vegetation that has not been tampered with.

Next 15m Outer Zone

1. Provides a buffer between upland development and the Streamside Zone, protecting critical components of
2. The stream.
    - Only biking or hiking pathways, as well as storm water management facilities, are permitted within the Outer Zone, with the agreement of the authorities. Authorities have permitted recreational usage.
    - Removing the canopy of older trees
3. In order for run-off to be absorbed, the shrub layer and herbaceous ground cover must be preserved in the Middle Zone.

7.5. Proposal for Radha Kund



(a) (b)

Figure 46. Radha Kund has a wider extent than the kund as can be seen in satellite image (a) of April 2003, it's very evident in the image (b) of April 2020 the pokhar/wetland around the kund has encroached.

Source: Google Earth. Redrawn by Author

Urban sprawl and encroachments are frequently reducing the size of kund and disrupting the natural network causing a flood-like situation in newly developed area. Catchment areas usually have sacred groves or vans that are an integral part of the ecosystem are now vanished and causing soil erosion during rainfall. This mixes a large quantity of silt, mud and the contaminants on the surface of the kund, which lowers water percolation and renders it dangerous to use.

7.6. Area Level proposal for Radha Kund

This is the representation of the map area around Radha Kund. Where it shows the situation of the kund and newly developed town which urban sprawl. Affecting the natural flow of the stream and destroying the catchment area, eventually affecting the kund as well. According to the following proposal is being derived- Which entails the cleaning digging and lining of these streams and connecting them with these water bodies re-establishing them as the water as they originally were.

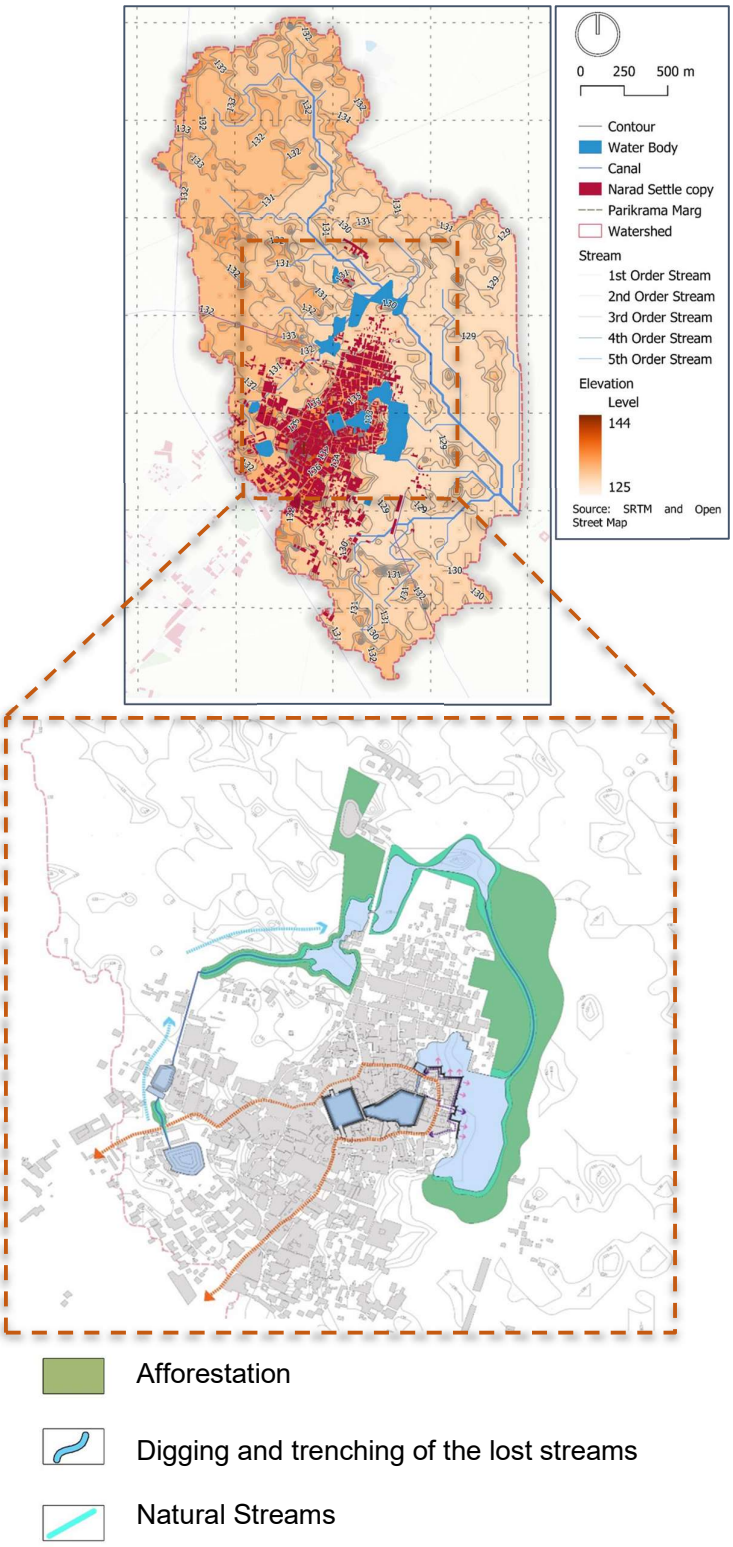


Figure 47. Area Level Proposal for Radha Kund.

7.7. Kund Level Proposal

Considering the number of pilgrims in approaching the area around *Asthasakhi Kund* the new ghats following the traditional construction techniques have been proposed to distress the water usage in Radha kund. The blocked channel is proposed to be opened and other issues related to build component which are facing threat have been taken into consideration as well.

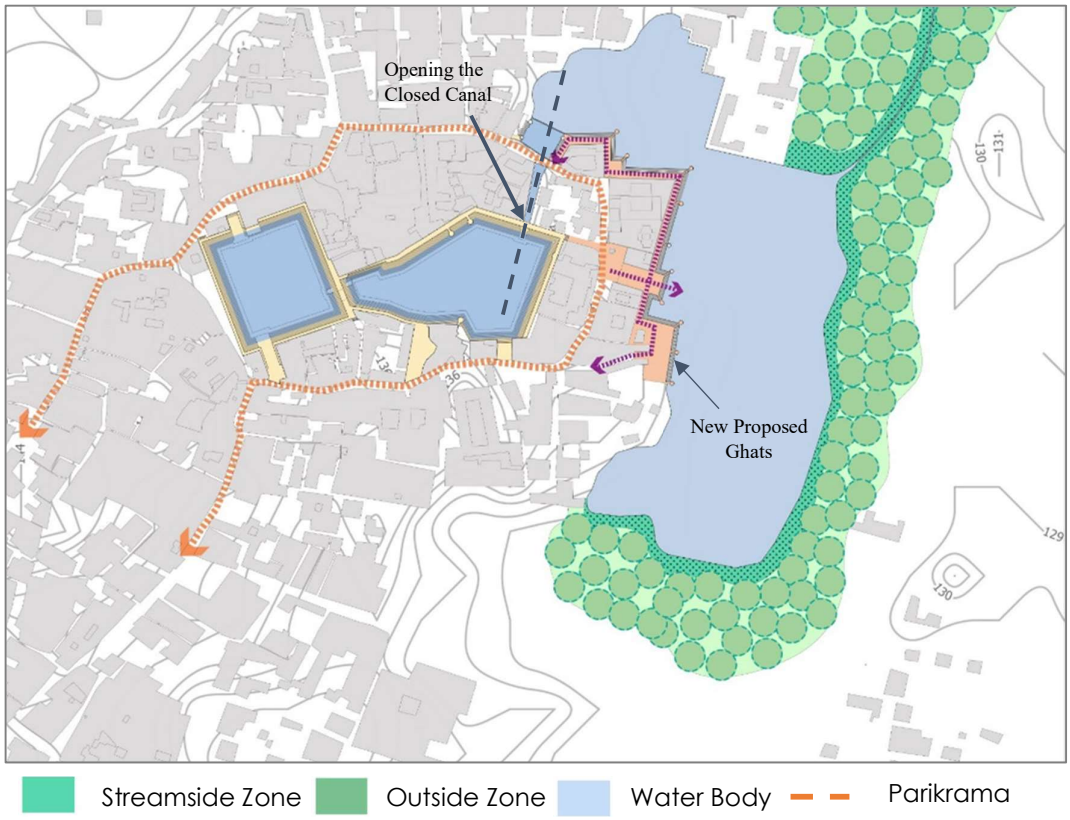


Figure 48. Proposed Plan Radha Kund.

Source: Author

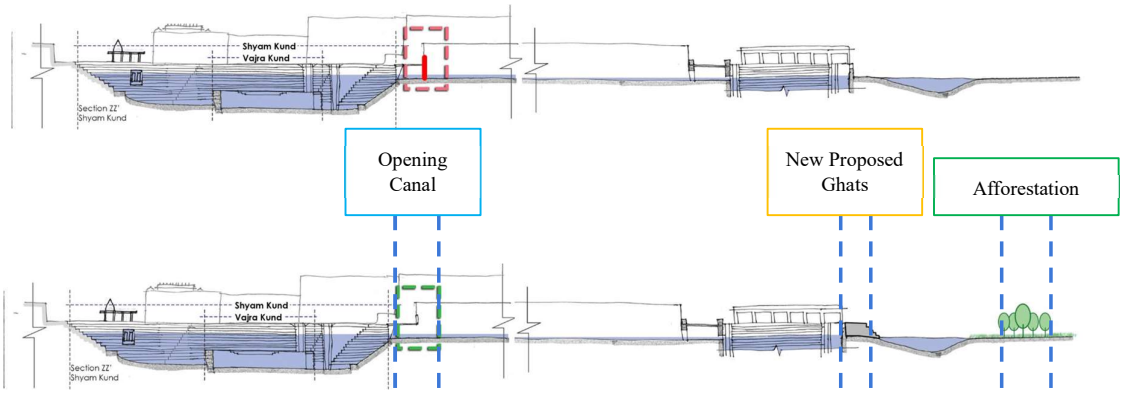


Figure 49. Proposed Section Radha Kund.

Source: Author

7.8. Proposal to Build new Kunds and as Rainwater Harvesting Zones

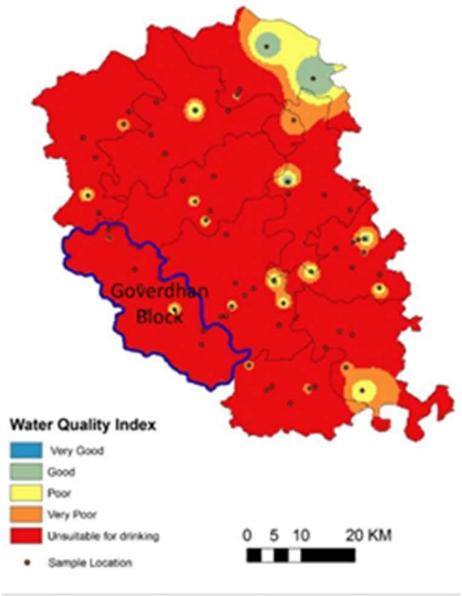


Fig. 50. As shown in the groundwater quality index of district Mathura, Govardhan lies in the Unsuitable for drinking zone due to the presence of heavy metal.

Source:Ahmed, Salman. (2017). Ground Water Quality Assessment in Parts of Mathura. 10.13140/RG.2.2.20569.77929.

Mathura district in the Indo Gangetic basin system has a high amount of Total Dissolved Solids, along with sodium and Manganese concentrations which makes groundwater unsuitable for drinking and irrigation purposes.

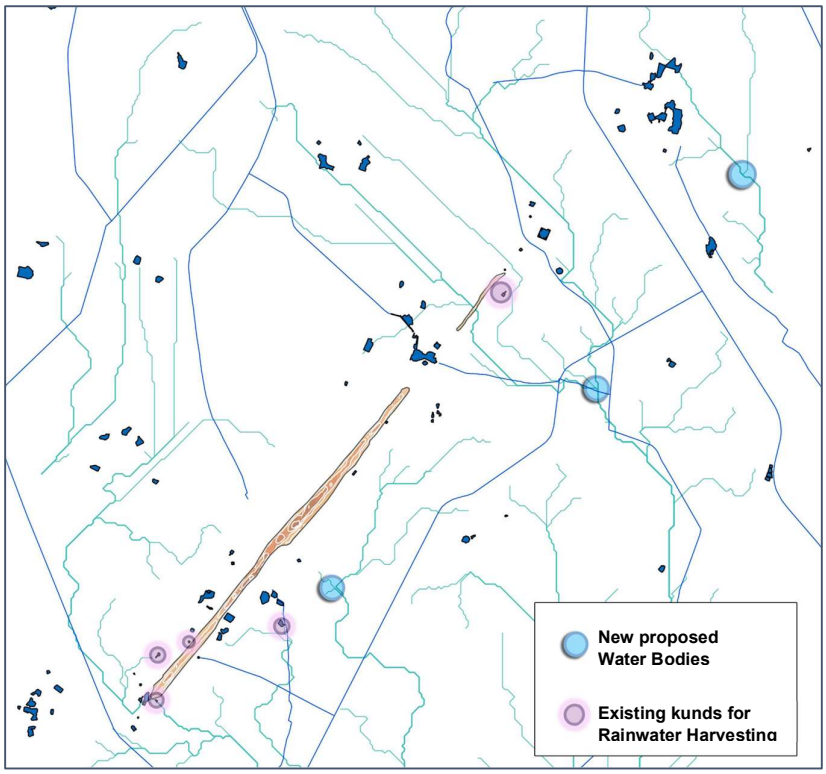


Figure 51. Proposal for New kunds and Rainwater Harvesting.

Source: Author

Ongoing Tradition of building Water structure which has been disrupted even after the huge population and increase in demand for water supply.

So, along the conservation proposal for existing water structure existing new possible spots has been identified based on-stream delineation and the existing Kunds which have are of low or non-religious importance has been proposed to develop as rainwater harvesting zones.

7.9. Conclusion

Water systems are an essential part of our living systems if we protect this system, we are protecting our mechanism of life and addressing a serious problem plaguing our nation that is availability of water. Traditional knowledge involved in to designing of these water systems are an essential component in the design and construction of these kunds and water system and hence it is not enough to have conservation process but integrate them into the lager design framework.

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CERTIFICATE OF COMPLETION

This is to certify that this thesis project titled "**Reviving the Traditional Water System through Cultural Heritage Conservation based on Traditional Knowledge Systems: Kunds of Govardhan**" was carried out by Sh. **Aman Sharma**, a student of **Master of Architecture (Conservation)**, at the **School of Planning and Architecture, Bhopal**. The research for this project was undertaken under the guidance of the afore-mentioned institute and completed during the period of **08-02-2021** to **19-05-2021**.

This project was shortlisted under the *Sponsored Thesis Project Competition on "RE-IMAGINING URBAN RIVERS"* (2021) hosted by the National Institute of Urban Affairs (NIUA) and the National Mission for Clean Ganga (NMCG).

This report has been submitted by the student as a final deliverable under the competition. All parts of this research can used by any of the undersigning parties.

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