PLAN B.

INTERACTIVE SERENE SPACES FOR FUTURE WATERSCAPES

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ABSTRACT

The global impact of climate change has necessitated the adoption of effective adaptation strategies, particularly in the realm of water management for the Netherlands in 2050. As our environment undergoes significant transformations, it becomes crucial to draw inspiration from hydrological systems employed by ancient civilizations. By studying the Indus civilization, we can enhance the sustainability and resilience of modern water-stressed regions, ensuring that traditional knowledge is integrated into present-day needs. To address this issue we analyze the fact of creating more awareness of climate change through spiritual architectural interventions. Incorporating traditional knowledge into contemporary water management practices also promotes cultural preservation and fosters a sense of community ownership. By recognizing and valuing the wisdom of ancient civilizations, we establish a stronger connection to our cultural heritage and reinforce the importance of sustainable water practices for future generations (including the problem of drinkwater shortage).

Keywords: *water, traditional ecological knowledge, interactive space, hydrological system, spirituality, ancient civilizations*

I. INTRODUCTION

1.1 BACKGROUND

For about 6,000 years the sea level stayed mostly stable. This enabled humans to set up coastal communities across the world. Since the global temperatures have risen in response to human-induced climate change, ice sheets have melted, releasing great amounts of water into the ocean. According to a 2021 report from the U.N. Intergovernmental Panel on Climate Change (IPCC), a low-emissions scenario could elevate the global sea levels about half a meter above present levels by 2100, and higer-emission scenario could leat to a 2-m rise. By 2150, sea levels could be 5 m higer than they are now. It is also stated that if the sea level continue to rise, there will be “mass exodus of entire population” and also an increase competition for freshwater, land and other resources (World Economic forum, 2023).

1.2 RESEARCH QUESTION(S) AND PROBLEM STATEMENT

The Netherlands has one of the lowest elevations in the world, so it will face many challenges if sea levels continue to rise. The Dutch have long lived with the threat of flooding, and have a lot of experience countering it with infrastructure projects. Therefore they use an interconnected system of dikes, levees and polders to reclaim land from the sea, keep towns and farmland safe from flooding, and became one of the wealthiest countries in the world. Due to the Delta program, sea level will rise ip to about 1 m by 2100. This means that everyone in the Netherlands has some basic protection until 2050 (World Economic Forum, 2023). The Netherlands faces not only the challenge of rising sea levels but also the impact of rivers such as the Rhine, Meuse, and Scheldt (Figure 1). This places a greater responsibility on future generations to address these changes. It is crucial to recognize that it is

not just a matter of our current world plus one meter, but rather our future world plus one meter (World Economic Forum, 2023).

Deltares has outlined several potential strategies for the Netherlands to adapt to the accelerated rise in sea levels. These strategies can be categorized into four distinct approaches: protect-closed, protect-open, advance, and accommodate. In this paper, our focus will be on design strategy number four, as it emphasizes the need to restore the natural space of rivers and the sea and foster a harmonious coexistence with water by elevating buildings on piles and preserving old cities around dikes (Kessler, 2023).

Consequently, it is necessary to examine the societal issues that the Netherlands may encounter in 2050. One of the major concerns is the shortage of drinking water, which is under immense pressure due to climate change and pollution (RIVM, 2023). The RIVM (National Institute for Public Health and the Environment) also highlights several action points, including the reduction of drinking water consumption. Another approach is to establish larger water reserves and promote water retention over longer periods. For instance, storing increased amounts of water in dunes or basins that can be utilized during peak demand in the summer. The Delta Program Freshwater, implemented in the Netherlands, aims to reduce the volume of water flowing into the sea through rivers (RIVM, 2023). In this research paper, our focus will be on the hydrological system, encompassing surface water, groundwater, rainwater, and greywater.

As we consider the future civilization of the Netherlands in 2050, it is valuable to draw lessons from ancient civilizations on how they coexisted with nature and especially with water. In ancient societies, culture and nature form a whole, and spatial organization results from a certain vision of the world (Mendes, 2017). In this scope TEK (Traditional Ecological Knowledge) is a frequently used term to describe the connection between indigenous/ancient communities and the natural world. Considering western societies, the relationship between architecture and social life is not linear, or even mechanistic or deterministic. The spatial structure of architecture can generate two types of effect: (1) structural or political power, (2) cultural, as of awareness, linked to cultural models and the personality system (ways in which individuals get emotionally involved, assert their identity and forge their project for the space) (Mendes, 2017). The second instance exemplifies how architecture can effectively modify people's behavior to create awareness regarding climate change.Therefore several questions arise, such as: *How can we strategically extend urban areas beyond the dikes? In what way can we learn from past civilizations' approaches to addressing water-related challenges, particularly drinking water? How can we foster greater awareness and understanding of climate change, specifically emphasizing the significance of the hydrological cycle, by incorporating Traditional Ecological Knowledge?* This brings us to the following Overall Design Question: *"How can a building interact in a serene way with the hydrological system and simultaneously create visual awareness about climate change based on Traditional Ecological Knowledge for the Netherlands in 2050?"*.

For this paper we consider the following **Thematic Research Question: *"How can we create spaces that establish a serene interaction with the hydrological system, based on Traditional Ecological Knowledge?"*** This brings us the following sub-questions:

- What are the societal challenges that the Netherlands will face in 2050 regarding the hydrological system and its management?
- What does the hydrological system entail, and how does it function within the context of the Netherlands?
- How did ancient civilizations, like Mohenjo-Daro, Lothal, and Dholavira of the Indus Valley Civilization, address the challenges presented by the hydrological system?
- What is Traditional Ecological Knowledge, and how can it contribute to the design and management of spaces that interact serenely with the hydrological system?

By exploring these questions, we can develop insights and innovative solutions that integrate historical wisdom with modern understanding, enabling us to shape a sustainable and resilient future for the Netherlands.

1.3 Case study

It is well documented that all over the world, civilizations flourished allong the river banks. In the Middle East, Egyptian civilisation flourished along the Nile River, Mesopotamian ans sumerian civilisations along Tigris and Euphrate rivers and in India, civilisation flourished along the Indus and Gangetic valleys. In this paper, we have chosen the Indus Civilization, also known as the Harappan culture, as our case study due to the abundance of evidence showcasing their adeptness in efficient water utilization and management (Manasi, 2017). Archaeological excavations provide evidence of the existence of private wells, communal baths, pools, underground drainage systems, flood barriers, and dockyards in the Indus Civilization. It is worth noting that the term "Hindu" initially originated as a Persian geographical term used to refer to the people living beyond the Indus River. Consequently, "Hindu" is primarily a geographical term and does not specifically denote a religion. Hinduism, on the other hand, is fundamentally rooted in the "accumulated treasury of spiritual laws discovered by different individuals at different times" (Manasi, 2017). The ways of life and religious practices played a significant role in safeguarding natural resources, particularly by establishing laws to ensure their protection. The practices employed in ancient times should be revived or reintroduced in a manner that aligns with the present circumstances (Manasi, 2017). In some instances, there was a shared responsibility among individuals to avoid polluting, defiling, degrading, or impacting the quality of water bodies since water was considered precious and belonged to everyone. Furthermore, water was perceived in various forms, such as hot, cold, heated, cooled, and rainwater, each possessing unique qualities. It was recognized as an indispensable resource for consumption, cleansing, relief, hospitality, agriculture, and comfort. In this paper, our focus will be on exploring ancient Indus Civilization sites, namely Mohenjo-Daro, Lothal, and Dholavira, as they played a crucial role in shaping future architectural developments related to water management. Had it not been for water, civilisations would never have flourished this far (Manasi, 2017).

1.4 Traditional Ecological Knowledge

Water is often described as the "life-giver and life-sustainer," a notion that holds true given its vital importance for human survival. As discussed earlier, the Indus Civilization's unique way of life played a significant role in the conservation of different resources, including natural ones (Manasi, 2017). This indigenous way of life is known as Traditional Ecological Knowledge (TEK). It represents experience acquired over thousands of years of direct human contact with the environment (Berkes, 2000). Hence, it is crucial to remember that architecture encompasses more than just fulfilling functional requirements in response to problem-solving. This resulted sometimes in a built structure (Bagulho, 2017). The built structure was sometimes to create ecological awareness. Hence, this will only rise when we combine our rational knowledge with an intuitive or the nonlinear nature of our environment. It is sometimes defined as “the study of systems of knowledge developed by a given culture to classify objects, activities and events (Berkes, 2000). TEK can be described as a collective reservoir of knowledge and beliefs that are passed down through generations via cultural transmission. It encompasses the understanding of the interconnectedness between living beings, including humans, and their environment. Furthermore, TEK is predominantly found in societies that have maintained historical continuity in their practices of resource utilization, often characterized by non-industrial or less technologically advanced lifestyles, with many of these societies being indigenous or tribal in nature (Berkes, 2000).

TEK differs from **scientific ecological knowledge** in a number of substantive ways (Berkes, 2000):

- TEK is mainly qualitative (as opposed to quantitative)
- TEK has an intuitive component (as opposed to being purely rational
- TEK is holistic (as opposed to reductionist)
- TEK, mind and matter are considered together (as opposed to a separation of mind and matter)

- TEK is moral (as opposed to value-free
- TEK is spiritual (as opposed to mechanistic)
- TEK is based on empirical observations and accumulations of facts by trial ans error
- TEK is based on data generated by resource users themselves
- TEK is based on diachronic data, i.e., long time-series on information on one locality.
- TEK is not merely a system of knowledge and practice; it is an integrated system of knowledge and practice and beliefs.

The **social context** of TEK includes the following dimensions (Berkes, 2000):

a. Symbolic meaning through oral history, place names and spiritual relationships
b. A distinct cosmology or world view; a conceptualization of the environment that is different from that of Western science of which ecology is a part
c. Relations based on reciprocity and obligations towards both community members and other beings.

Within the framework of the Indus Civilization, we can observe the embodiment of this idea through the construction of wells. Wells served as the initial form of the renowned stepwells found in India, primarily due to the prevalent water scarcity during that era. The purpose was to impart knowledge to people on the significance of treating and respecting water appropriately. In certain instances, an accompanying building would be present near the stepwell, where individuals would gather or partake in prayer prior to collecting water from the stepwell. This approach exemplifies an effective means of raising awareness about the importance of water by incorporating a spiritually guided TEK into the built structure.

Architecture, being primarily concerned with the measurement and embodiment of space, has traditionally prioritized practical application over theoretical knowledge (Bagulho, 2017). This perspective forms the basis of our intention in this paper: to center our focus on generating awareness through practical implementation, utilizing architecture as our starting point.

1.5 Hydrological system

Before we dive into the cases we need to understand the Hydrological system first. Water, being one of the fundamental elements of nature alongside earth, air, fire, and ether, played a pivotal role in the creation of the universe. It is no surprise that settlements began to emerge near rivers, which served as vital sources of freshwater, giving rise to civilizations such as Mesopotamian, Egyptian and Indus Valley, linked respectively to the Tigris and Euphrates, the Nile and the Indus. Initially abundant, this natural resource gradually became scarce as human populations grew and their activities increased. Consequently, the necessity to store water for drinking, washing, and irrigation purposes emerged. During times of scarcity, conflicts over water became commonplace, transforming what was once a shared resource into a problematic one (Manasi, 2017). We can say that water nowadays also plays various roles within cities, manifesting in different forms and serving different purposes (Figure 1). These include: drinking water for daily use (drinking, cooking); stormwater that needs to be drained from hard surfaces (roofs, streets, etc.) to prevent flooding and keep streets and buildings dry and safe; natural water bodies (e.g., rivers, lakes, brooks); and artificial water bodies and features in open spaces (e.g., fountains, water basins, water streams) contributing to the amenity of cities (improving micro climate, reducing dust and air pollutants, and providing recreation) (Hoyer, 2011). In the Netherlands, an oceanic climate prevails (Figure 2).

II. Method

2.1 Method

The research approach employed is qualitative, incorporating a literature review and case studies. The information was gathered from available literature, plans, and pictures. The focus of the research method revolves around studying the Indus Civilization, also known as the Harappan culture, specifically analyzing the first three significant cities that pioneered the expansion of wells for water storage and harvesting. Additionally, the research delves deeper into the concept of stepwells,

exploring their significance through the lens of traditional ecological knowledge and spirituality. Considering the broad meaning of spirituality, the investigation initially seeks to understand its implications in architecture and its relevance to the Hindu community. The analysis primarily revolves around the architecture and techniques employed in the aforementioned cases. The objective of this analysis is to identify indigenous, sustainable water management tools that can raise awareness about climate change and align with the Hindu way of life in relation to water.

The collected data is analyzed and organized based on the scope of intervention, encompassing the study of the landscape, community, and housing unit scales. Furthermore, analysis is conducted with respect to various themes such as water storage, distribution, access, harvesting, and filtering. Materiality and proportions are also considered within this scope. The characteristics of the landscape are also taken into account to understand how the settlements evolved in terms of water management and harvesting (Figure 3).

In our analysis, we have also included criteria to examine the spiritual and serene aspects of the cases. By considering these criteria, we aim to gain a deeper understanding of the profound and tranquil elements present in each instance (Figure 4).

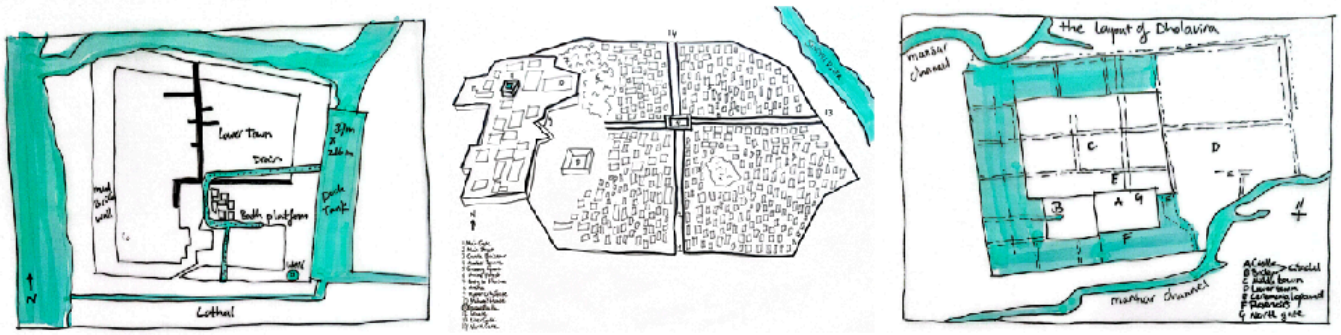
III. Results

3.1 Position of settlement towards water

The ancient Mohenjo-daro and Indus Valley civilizations (Figure 5), which originated in the Indian Peninsula, emerged as early civilizations in the region. Similar to other prominent civilizations of that era, they were characterized as hydraulic civilizations and were situated in close proximity to water sources. When exploring the understanding of Hinduism in ancient India, it is crucial to acknowledge that it was not regarded as a religion or a philosophy but rather as a way of life. The essence of this concept revolved around the embodiment of a singular manifestation of universal truth (Manasi, 2017) (Figure 6).

Figure 6

L-R; Lothal, Mohenjo-Daro, Dholviara. Source: Author

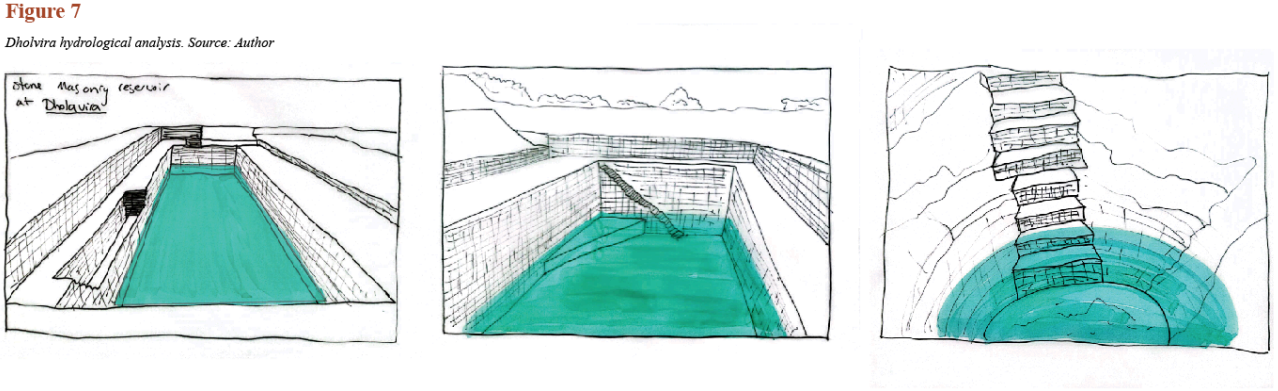


3.1.1 Dholavira:

The scarcity of rainfall in the region prompted the inhabitants to employ dams in order to redirect water towards water wells and reservoirs. Notably distinct from other areas, this site was divided into three distinct sections, with each section enclosed by sturdy stone walls. Remarkably, evidence of a well-structured water management system can be observed, shedding light on the architectural and planning prowess of the ancient civilization (Architectural and planning aspect of Ancient Civilization, 2017). This case serves as an excellent demonstration of effective water harvesting, storage, distribution, and accessibility (through stairs) for all members of the community (Figure 7).

Figure 7

Dholvira hydrological analysis. Source: Author



3.1.2 Lothal:

In ancient times, the people of Lothal participated in extensive trade with various regions, including Iraq, Persia, Egypt, and parts of the Middle East, facilitated by the presence of artificial dockyards. Excavations have revealed the remains of an impressive artificial brick dockyard, comprising a vast tank that served as a docking area for boats and ships arriving from the sea and navigating through a river channel. This extraordinary structure, measuring 216m x 37m, holds the distinction of being the world's first tidal dockyard, showcasing the remarkable architectural and planning achievements of the ancient civilization (Architectural and planning aspect of Ancient Civilization, 2017). The dockyard serves as a notable example of how water accessibility and storage were effectively incorporated into their design (Figure 8).

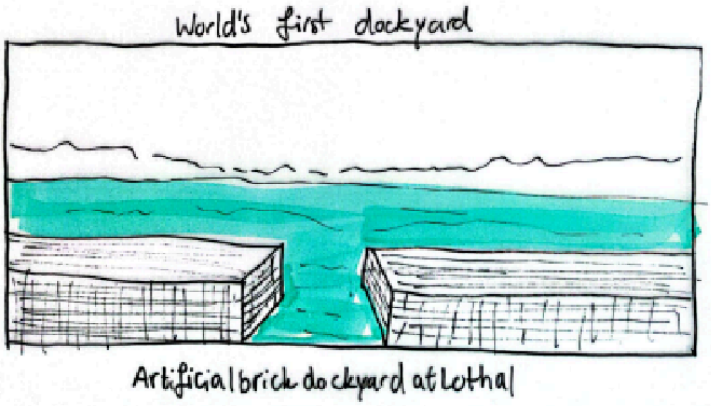


Figure 8

Lothal Hydrological analysis. Source: Author

3.1.3 Mohenjo-Daro:

Context

In the Sindhi language, the name Mohenjo-daro translates to "Mount of Dead," and it is situated between the Saraswati and Indus rivers. Mohenjo-daro was the largest site of the Indus Valley Civilization and was meticulously planned as an urban center. The presence of standardized bricks, whether sun-dried or baked, is another indication of careful planning. The dimensions of these bricks followed a consistent ratio, with a length-to-breadth-to-height proportion of 4:2:1. The city's layout suggests that the drainage system was established first, with houses subsequently constructed alongside them. This arrangement ensured that domestic wastewater would flow into the street drains, necessitating that each house have at least one wall facing a street. These design considerations reveal the architectural and planning aspects of the ancient civilization at Mohenjo-daro (Architectural and planning aspect of Ancient Civilization, 2017) (Figure 9).

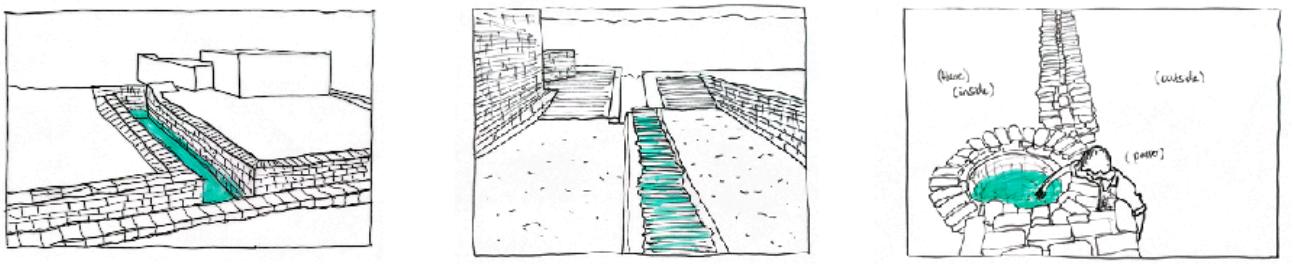


Figure 9

Mohenjo-Daro Hydrological analyzis. Source: Author

Domestic architecture

Many of the residential buildings in Mohenjo-daro featured a central courtyard, surrounded by rooms on all sides. This courtyard likely served as a focal point for various activities, such as cooking and weaving, especially during hot and dry weather. An interesting aspect is the evident concern for privacy, as there are no windows in the walls at the ground level. Additionally, the main entrances were strategically designed to avoid direct views of the interior or the courtyard. Another notable feature is the presence of wells in many houses. These wells were often located in a room accessible from the outside, possibly for use by passersby. The wells were constructed using wedge-shaped bricks to create a sturdy circular structure. Some of these bricks were specifically designed with grooves to prevent ropes from sliding sideways when drawing water from the well (Architectural and planning aspect of Ancient Civilization, 2017) (Figure 10).

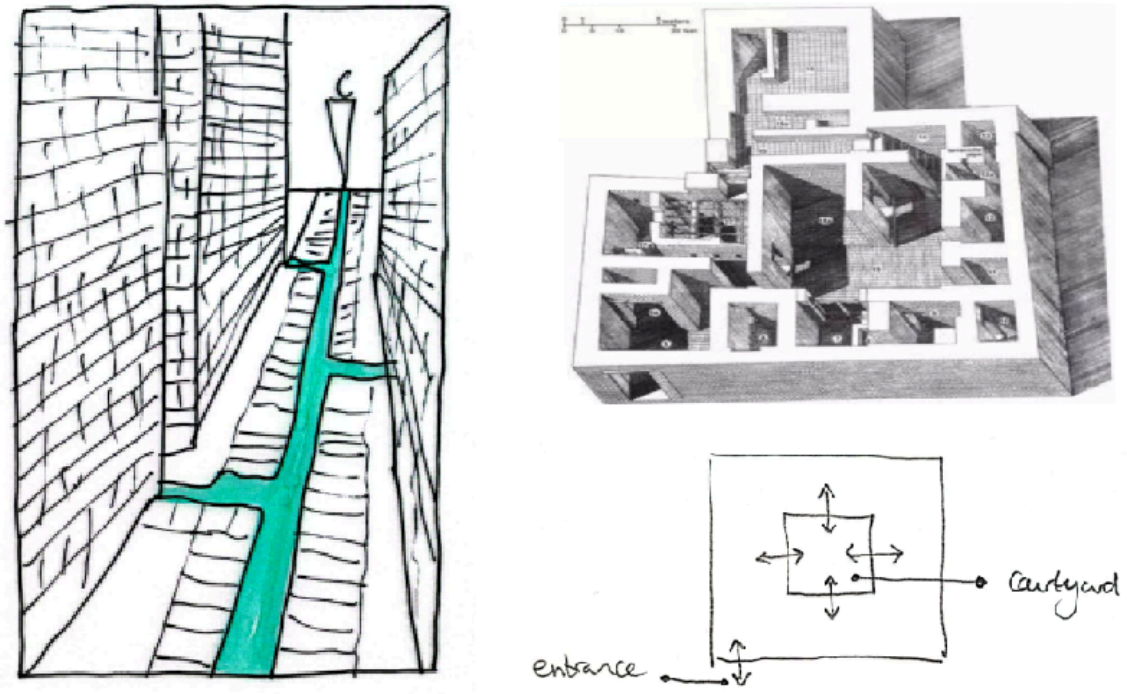


Figure 10

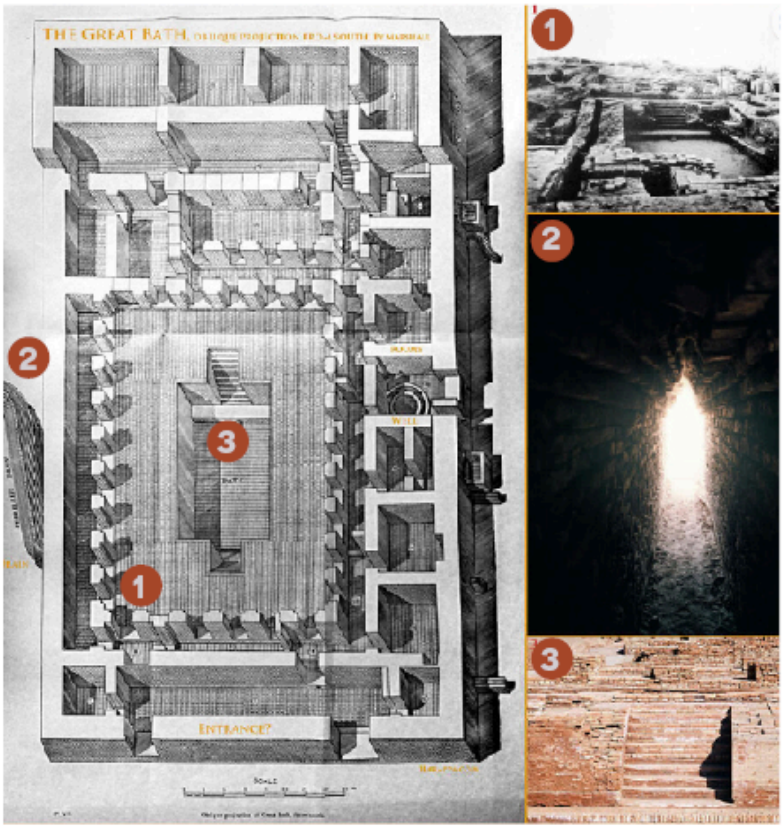
Domestic water destribution. Source: Author & https://www.slideshare.net/PushprajPatil3/architectural-and-planning-aspect-of-ancient-civilization

Great Bath

The Great Bath, an architectural marvel, comprised a large rectangular tank situated within a courtyard, encircled by a corridor on all sides. The tank itself was meticulously constructed, with bricks coated in plaster and sealed with a layer of natural tar, ensuring its water-tightness. Access to the tank was provided by two sets of steps located on the northern and southern sides, expertly constructed by placing bricks on edge and utilizing a gypsum mortar to maintain water tightness. Adjacent to the Great Bath were rooms on three sides, one of which contained a substantial well. The water from the tank flowed into a spacious drain. Across a nearby lane to the north, a smaller building could be found, housing eight bathrooms evenly distributed on both sides of the corridor. A drainage system ran alongside the corridor, facilitating the management of waste. The exceptional nature of this structure, coupled with its contextual significance, has led scholars to propose that it served a specific ritual bathing purpose (Architectural and planning aspect of Ancient Civilization, 2017). Situated within the central area of the open quadrangle, there exists a sizable swimming bath measuring approximately 12 meters in length and 7 meters in width. The bath is sunken about 2.5 meters below the courtyard's pavement and is equipped with a flight of steps at each end. Adjacent to these steps, low platforms were provided to offer convenience to bathers, ensuring the water depth was suitable for their comfort. The bath itself was filled using water sourced from the nearby well, strategically located within the complex (Marshall, 1996). Some scholars also consider the Great Bath to be a potential precursor to the development of stepwells in later periods (Mingren, 2021). Their main intention was to harvest and store water for sustainable future use (Perumal, 2022). As we explore various cases involving access, storage, harvesting, and distribution of water, there remains one aspect that requires further elaboration: water-filtering techniques (Figure 11)

Figure 11

The Great Bath. Source: (Marshall, 1996)

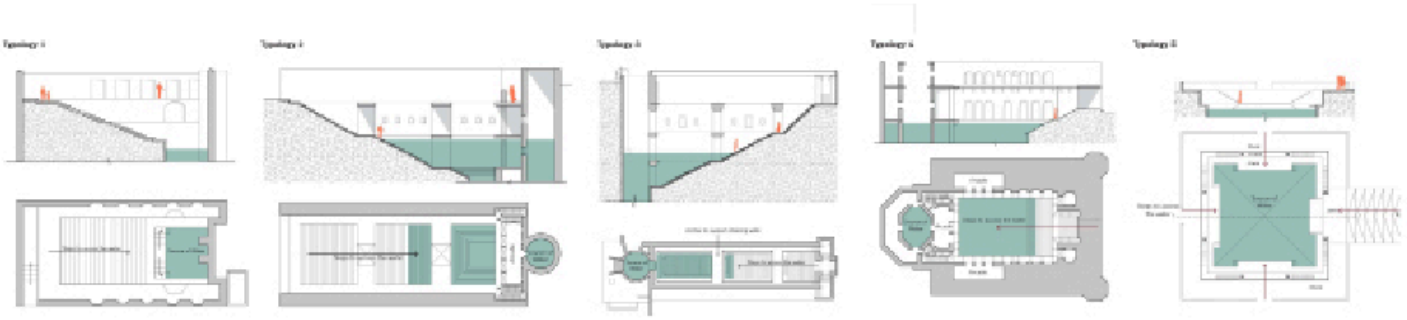


Water filtering in general:
Ancient texts provide descriptions of various methods for water purification, including the storage of water in copper vessels, exposure to sunlight, and filtration through charcoal. Additionally, the practice of adding alum to purify water can be traced back to both the Egyptian and Indus civilizations (Smith, 2017).

3.2 TEK and Spiritual architecture

As mentioned earlier, Traditional Ecological Knowledge (TEK) is deeply intertwined with spiritual beliefs and a way of life. In Hindu mythology, water carries profound symbolism, representing the boundary between heaven and earth. Over the course of centuries, stepwells and stepped ponds, known by various names such as Bavadis, Bawadis, Baolis, or Vavs, have played a vital role as traditional water systems, providing essential resources to communities across generations. These architectural structures not only served the practical purpose of water provision but also served as significant gathering places for social, cultural, and touristic interactions. We can also say that Stepwells are the inverted versions of Ziggurats (temples in Mesopotamia). Stepwells and stepped ponds have a distinct connection to the semi-arid regions of Gujarat and Rajasthan, which were once part of the ancient Indus Valley Civilization, encompassing notable sites such as Mohenjo-Daro, Lothal, and Dholavira (Chandna, 2019) (Figure 12). It has been reported that around 3000 stepwells have been constructed in the North Indian states of Gujarat and Rajasthan (Perumal, 2022).

Figure 12
Stepwell Typology. Source: (Chanda, 2019)



3.2.1 Technique

Rephrased: Many stepwells were constructed using eroded rock sourced from the Western Himalaya, which was refined over centuries of farming to create a high-quality alluvium soil within the wells. This natural soil acts as an effective filter, allowing the stepwell to function like an underground aquifer, with larger sediment settling at the top. The intriguing aspect of stepwells is that they served not only as water collection infrastructure but also as spaces for social gathering and leisure. The inverted pyramid design of these subterranean landscapes created a cool microclimate, providing respite from the hot weather above ground. Consequently, stepwells became significant public spaces of architectural importance and served as central gathering points for communities. Additionally, the presence of water in these stepwells attracted a diverse range of wildlife, including bees, fish, lizards, parrots, pigeons, and turtles, fostering vibrant ecosystems. With each monsoon, the stepwells would be replenished, supporting new life. As functional, religious, and social infrastructures, these stepwells played a crucial role in facilitating communal activities such as bathing, conversation, and congregation (Step Well / Getrapt Waterreservoir, 2011).

What is the concept of spiritual architecture within the Hindu civilization, and how can we translate it into tangible visualizations that can be incorporated into design?

3.2.2 Spiritual architecture

Spirituality is about the The spirit of the place.“Spirit appears closely connected with “life” and the platonic “idea” of the essence (Charrin, 1992). The spiritual and mystical movements, both in the Western and Eastern traditions, highlight the importance of nurturing and developing one's spirit and consciousness to attain a deeper understanding and wholehearted engagement with the fundamental "Truth" and the principle of life. Spirituality involves the illumination and awakening of the mind, allowing architecture to transcend mere utilitarian purposes and offer a profound spiritual fulfillment and satisfaction (Charrin, 1992).

Spiritual Characteristics of architecture

Architecture, as a significant component of our lives, has a profound impact on our emotions, senses, and perceptions, surpassing its influence on our physical well-being. Every aspect of a space that can be perceived through our five senses—sight, hearing, touch, smell, and taste—has the potential to shape our feelings and memories of that space. A positive memory of a place is often formed when individuals experience an inherent sense of enjoyment, happiness, comfort, serenity, security, and relaxation, especially following a period of stress. The way architects design the built environment directly influences people's behavior, actions, and interactions within that space (Nejati, 2010).

First and foremost, there is a longing for harmony and integration among all the elements of a project, including its surroundings and site, reflecting the ideal of "organic" unity. This ideal aligns with the concept of the "Whole" or the "One" and emphasizes the interconnectedness of all aspects. Additionally, there is a deep desire for a mystical union with this "Whole," which is evident in the deliberate blending of buildings with a natural environment, creating a seamless integration between the constructed and the natural (Charrin, 1992).

Secondly, in accordance with this vision, there is a yearning to transcend dualism within this unified whole. This is expressed artistically through a perpetual equilibrium of opposing forces, such as the interplay between horizontal and vertical elements, as well as the dynamic relationship between openness and enclosure. This architectural approach embraces the interaction of contrasting polarities, such as the tangible and intangible, and the actual and virtual (Charrin, 1992).

Thirdly, there is an aspiration to evoke the vibrant and generative energy inherent in this unified whole, often referred to as the potential or life force. This is achieved through the use of dynamic, sculptural, and evolving compositions that embody a distinct "organic" notion of harmony and perfection (Charrin, 1992).

Fourthly, there is a deliberate use of materials in accordance with their inherent qualities, which reflects a desire to perceive the essence or spirit within them. This approach emphasizes the act of "taking things as they are," evoking a sense of enlightenment and being fully aware of the world. It relies more on intuitive understanding of the nature of materials rather than on a strictly rationalized theory, and it encompasses ideas of simplicity and sincerity in architectural design. This is exemplified by the deliberate juxtaposition of natural materials such as stone and wood with artificial ones like glass and concrete (Charrin, 1992) (See Figure 4).

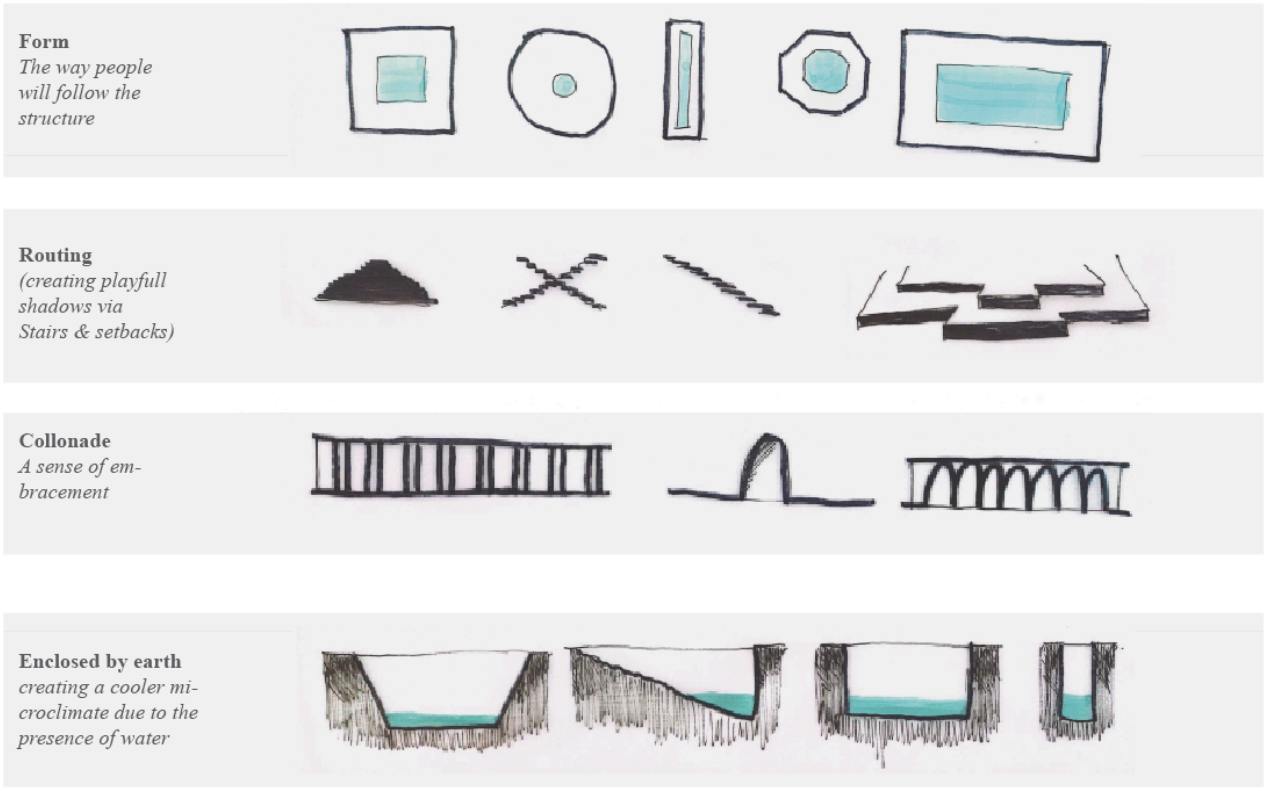
3.2.3 Conclusion of cases

We have examined several examples using the analytical criteria proposed by Charrin (1992) and Nejati (2010), as indicated in (Figure 4). Our findings reveal that all five types are present in these cases. However, the presence of water adds an additional layer of richness to the experience. Water not only reflects the structure itself but also carries a profound symbolic meaning associated with life (Figure 13-26).

The stepwell resembles a fissure in the earth, revealing its life-sustaining fruit: water. This powerful imagery reinforces the vital role that water plays in sustaining life. The interplay between the architectural elements and the presence of water creates a captivating environment that goes beyond mere aesthetics. It evokes a deeper appreciation for the interconnectedness of nature and the fundamental significance of water as a symbol of life. The physical presence of water in the stepwell

not only enhances its visual appeal but also provides a sensory experience that engages the visitor. The coolness emanating from the water creates a refreshing and invigorating sensation, playing with the senses and adding an extra dimension to the overall ambiance (Figure 27).

Figure 27
Design guidelines. Source: Author.



IV. Conclusion

To cultivate spaces that foster a harmonious relationship with the hydrological system, it is essential to cultivate awareness among individuals. Drawing insights from Traditional Ecological Knowledge (TEK), we discover various approaches to address the challenges of sustainable living within the realm of architecture. Often, spirituality plays a crucial role in awakening a profound connection to the natural world, instilling a transformative attitude in humans. This approach is especially relevant as the Netherlands faces the impending issue of drinking water scarcity, projected to become critical by 2050. Similarly, the Indus Civilization faced similar challenges, highlighting the importance of addressing water usage and conservation. Architecture, in this context, transcends its conventional role as a technical or functional response to societal needs. It becomes a powerful tool for crafting human-centered spaces, where cultural norms and regulations seamlessly merge with the natural environment. It is a practice that harmonizes society within nature, bringing forth visible manifestations of human existence. However, the advancement of modern science has contributed to a distinct separation between our understanding of nature and society, resulting in a loss of the anthropocentric worldview.

Through our examination of fourteen cases, we have recognized the presence of spirituality within architectural design. Furthermore, the inclusion of water in these spaces adds a profound layer of significance. Water not only reflects the physical structures but also carries symbolic connotations associated with life itself. In our analysis, we have also explored the cases through the lens of access, distribution, harvesting, filtering, and storage of water.

We can conclude that the interplay between architectural elements and the presence of water creates enchanting environments that surpass mere aesthetics. These spaces evoke a deep understanding of the interconnectedness of nature and the intrinsic value of water as a symbol of life. The tangible presence of water within the stepwells not only enhances their visual allure but also offers a sensory experience that captivates visitors. The coolness emanating from the water provides a refreshing and invigorating sensation, engaging the senses and enriching the overall ambiance. This paper therefore resulted in a design guideline.

V. References

1. Bagulho, F. (2017). If It's Space, It's Social. In *Architecture and the Social Sciences*. 21-31, https://doi.org/10.1007/978-3-319-53477-0_3

2. Berkes, F., Colding, J., & Folke, C. (2000). REDISCOVERY OF TRADITIONAL ECOLOGICAL KNOWLEDGE AS ADAPTIVE MANAGEMENT. *Ecological Applications*, *10*(5), 1251–1262. https://doi.org/10.1890/1051-0761(2000)010

3. Chandna, A. (2019). *Stepwells of Jaipur – Circular Water Stories*. https://circularwaterstories.org/analysis/stepwells-of-jaipur/

4. Charrin, F. (1992). Spirit, a keyword of organic architecture. *Journal of Architecture*, *441*.

5. Hoyer, J. (2011). *Water Sensitive Urban Design: Principles and Inspiration for Sustainable Stormwater Management in the City of the Future*.

6. Kessler, R. (2023). *Sea level rise looms, even for the best-prepared country on Earth*. Mongabay Environmental News. https://news.mongabay.com/2023/03/sea-level-rise-looms-even-for-the-best-prepared-country-on-earth/

7. Marshall, J. (1996). *Mohenjo-daro and the Indus Civilization: Being an official account of Archaeological Excavations at Mohenjo-daro carried out by the Government of India between the years 1922 and 1927* (Vol. 1).

8. Mendes, M. A. (2017). Interdisciplinary Relations Between Social Sciences and Architecture: Tensions, Ambiguities and Complementarities. In *Architecture and the Social Sciences*. https://doi.org/10.1007/978-3-319-53477-0_4

9. Mingren. (2021). The Forgotten Stepwells: Masterpieces from India's Past. *Ancient Origins Reconstructing the Story of Humanity's Past*. https://www.ancient-origins.net/ancient-places-asia/forgotten-stepwells-thousands-masterpieces-engineering-architecture-021219

10. Selvaraj, T., Devadas, P., Perumal, J. L., Zabaniotou, A., & Ganesapillai, M. (2022). A Comprehensive Review of the Potential of Stepwells as Sustainable Water Management Structures. *Water*, *14*(17), 2665. https://doi.org/10.3390/w14172665

11. Smith, L. C. (2017). Historical Perspectives on Water Purification. In *Elsevier eBooks* (pp. 421–468). https://doi.org/10.1016/b978-0-12-809330-6.00012-x

12. *Step well / Getrapt waterreservoir*. (2011, September 12). HKB Stedenbouwkundigen. https://hkblabla.wordpress.com/2011/09/12/step-well-getrapt-waterreservoir/

13. World Economic Forum (2023, April 3). *Here's how sea level rise is threatening even the most prepared countries*. Here's how sea level rise is threatening even the most prepared countries | World Economic Forum (weforum.org)