SSRG International Journal of Civil Engineering
ISSN: 2348-8352/ https://doi.org/10.14445/23488352/IJCE-V13I8P114

Volume 13 Issue 8, 219-226, August 2026

Review Article

Review of the Incamisana Hydraulic System in Ollantaytambo: A Territorial, Functional, and Symbolic Approach

Heydi Karina Hinostroza Maravi[1], Erick Oswaldo Gamboa Tolentino[2], Jefferson Aldair Huairi Moza[3], Maria Paz Sáez Pérez[4]

[1]*School of Civil Engineering, Universidad Continental, Huancayo, Peru.*
[2]*Department of Civil Engineering, National University of Engineering, Lima, Peru.*
[3]*Department of Civil Engineering, University of Engineering and Technology, Lima, Peru.*
[4]*Department of Architecture, Autonomous University of Granada, España.*

[1]*Corresponding Author : 70345903@continental.edu.pe*

Received: 20 May 2026 Revised: 2 July 2026 Accepted: 24 July 2026 Published: 31 August 2026

Abstract *- This article presents a systematic review of the Incamisana hydraulic system, addressing three approaches: territorial, functional, and symbolic. Within this framework, it presents the importance of water in the Andean context as an important resource for agriculture, organization, and the practice of rituals. This review was conducted using the PRISMA 2020 methodology, considering studies related to water supply, terraces, channels, fountains, and their symbolic interpretation. The results show that Incamisana was supplied by the Patacancha River through channels. In addition, the terraces fulfilled agricultural functions as well as roles in territorial organization. The system also included underground conduits and drop structures. Thus, the evidence indicates that Incamisana was not only a hydraulic infrastructure for water distribution, but was also associated with landscape integration, rituality, and symbolism. This approach makes it possible to understand the system as a reference for interpreting traditional hydraulic solutions and their relationship with the planning of the Andean territory.*

Keywords *- Incamisana, Ollantaytambo, Hydraulic system, Water management, Water symbolism.*

1. Introduction

Agriculture in the Andes has been conditioned by different factors such as soil erosion, climate change, seismic activity, and problems of access to places due to its topography. In response to this situation, societies developed irrigation channel systems, terraces, and constructions for food storage [1]. For this reason, both the availability and control of water were important for agricultural production and the establishment of settlements, as this allowed better organization and increased productivity. Likewise, the construction of their hydraulic system not only solved problems of supply and distribution but also facilitated adaptation to difficult geographical conditions [2]. On the other hand, mountains, snow-capped mountains, caves, springs, lakes, rivers, and rocks were considered sacred, to which offerings were made and whose care was maintained, forming part of a sacred space. In this way, water was a sacred element, as it gave and sustained life. In addition, its movement was understood as a force that gave energy and provided sacred presence to certain places and objects. Therefore, the relationship between stone, channels, and mountains was a combination that responded to elaborate architecture and spirituality [3, 4]. The hydraulic knowledge for the development of the various systems within the site was based on technical knowledge accumulated by earlier Andean societies, who had already carried out works related to irrigation and channel design, since they required controlling slopes for the proper management of discharge and flow, which evidences their knowledge in water management [5].

In this context, Ollantaytambo is located in a strategic area within the Urubamba Valley, at the confluence of the Urubamba River, also known as the Vilcanota, and the Patacancha River, with connections to the mountain edge and the upper Amazonian forest. Its broad visual control over agricultural areas and access routes further explains the importance of this site within the valley. Other relevant features include its advanced urban planning, terraces, and hydraulic system, which formed the basis for the organization of the town and settlement [4, 6]. In turn, the rivers served as the site's main sources of productivity, although they were also associated with risks such as flooding and landslides in areas near riverbanks or on steep slopes [6]. Its hydraulic system is one of the most sophisticated, as it enabled the irrigation of agricultural terraces, secured production, reduced soil erosion, and distributed water across different terrain levels [2]. In addition, aqueducts were used to maintain a constant water supply. Terrain stability was ensured through the precise placement of granite blocks, which also improved water drainage. The terraces helped improve infiltration and increase moisture in the land intended for agriculture, with the aim of reducing surface runoff and improving the stability of the land [7]. On the other hand, in addition to serving an agricultural function, the terraces were also related to other factors, such as economic, political, architectural, ecological, aesthetic, spiritual, military, and administrative aspects [8].

Incamisana is an area within Ollantaytambo, built to function as an Inca temple, which has a system of fountains and channels intended for the worship of water. Its water supply depended on watersheds originating from the Patacancha Valley, conveyed through a collection network that extended for several kilometers, and its operation was based on gravity, that is, with controlled slopes. On the other hand, in addition to serving a functional purpose, water was understood as a spiritual phenomenon, while the distribution of the channels was related to the social and symbolic order [9]. Likewise, the control of water also represented their dominion over nature and demonstrated the power that the Incas had over the territory, since the distribution of water also extended through the main plazas and routes [6]. Likewise, there is the presence of carved rocks and structures that are related to astronomical contexts, such as the Temple of the Sun and Pinkuylluna Mountain, which produce an effect through the shadow they cast [3]. Within the urban environment, much of the stonework and organization into "kanchas" traversed by channels that distribute water for agricultural use, urban organization, water rituality, and the construction of power in the Andean landscape have been preserved [10].

The objective of this article is to analyze the hydraulic system of Incamisana from a territorial, functional, and symbolic perspective, in order to understand these aspects within the literature and the extent to which they have been addressed to date. In this regard, aspects such as the water supply, the identification and distribution of the hydraulic elements present (such as channels and aqueducts), and their relationship with the agricultural terraces and the settlement are addressed. In addition, the ritual significance of water and its relationship with the architecture of the area are discussed. In this way, the aim is to provide a comprehensive interpretation of the hydraulic system of Incamisana and the aspects related to it, recognizing its value as evidence of territorial planning, hydraulic knowledge, and construction considered to have a symbolic origin.

2. Methodology

The review process was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. This framework allows the review to be reported transparently. Its phases include identification, screening, and eligibility assessment. In this regard, the guideline makes it possible to understand how the records were obtained, which were excluded and for what reasons, and how many studies were ultimately included in the review [11]. The review focused on three dimensions of the Incamisana hydraulic system: territorial, functional, and symbolic dimensions associated with water.

First, keywords were established, from which search strings were developed to broaden and delimit the results. For Scielo, the search was conducted using the term “hydraulic system.” Likewise, for Scopus, the search string was divided into three categories:

1) (“Ollantaytambo” OR “Incamisana” OR “Inkamisana”)
2) (“Inca” OR “Inka”) AND (Hydraulic* OR “Water system” OR “Water management” OR “Flow network” OR Channel*)
3) (“Inca” OR “Inka”) AND (Aqueduct* OR Fountain* OR Topograph* OR Terrace*) AND (Ritual* OR Ceremonial*)

In addition, the studies considered were limited to the period from 2000 to 2026. Furthermore, the eligibility criteria made it possible to determine which studies were included and excluded in the present review. These criteria were as follows

Inclusion Criteria

- Studies directly related to the hydraulic system of Ollantaytambo.
- Other Inca hydraulic systems with comparative relevance to the case of Incamisana.
- Other Inca hydraulic systems with comparative relevance to the case of Incamisana.
- Sources addressing the symbolic, ritual, or ceremonial dimension of water in Inca or Andean contexts.

Exclusion Criteria

- Sources that address Ollantaytambo only from an architectural or tourism perspective, without hydraulic content, or that mention it only incidentally, without developing relevant information.
- Studies that approach water from a general environmental, climatic, or hydrological perspective.
- Studies focused on architecture, heritage conservation, or tourist routes, without any relation to hydraulics, territory, or rituality.

The eligibility criteria were established with the purpose of selecting studies closely related to the objective of the study, covering the hydraulic, functional, and symbolic aspects. This ensured the exclusion of topics that mention it indirectly and do not address it in detail, focusing instead on other aspects, such as archaeological or environmental ones.

2.1. Identification of Studies

This section identified the number of records obtained according to the search string used in each database. The Scopus search yielded 31, 120, and 13 results for search strings 1, 2, and 3, respectively. Likewise, in Scielo, 150 records were identified; therefore, the total number of results from both databases was 314 records. Subsequently, an initial duplicate removal process was carried out, resulting in 14 duplicate records. Finally, 10 studies were not considered because neither the abstract nor the document was found, leaving a total of 290 studies for subsequent evaluation.

2.2. Screening and Eligibility

At this stage, the titles and abstracts of the 290 records obtained were reviewed, allowing studies that were not related to the research topic to be excluded, resulting in the exclusion of a total of 237 records, leaving 53 records. Then, the full texts of the resulting studies were accessed and obtained. However, 23 documents could not be accessed, leaving them excluded and resulting in 30 records. Once all the texts were available, a more detailed analysis was conducted for each one by evaluating the eligibility criteria (inclusion and exclusion) in order to assess the relevance of the content, its relationship with the research objective, and its usefulness. Based on this analysis, studies that did not meet the conditions were excluded, including 13 studies due to their limited relevance to the hydraulic system, 4 studies because they focused on water from an environmental and climatic perspective, and finally, 1 study because it was a review. In this way, a reduced body of collected information was obtained, and the final inclusion stage was continued.

2.3. Inclusion

This section is the final stage of the selection of the studies that will form part of the review, thus considering the documents that are relevant to the topic in order to fulfill the objective of this research, so that, after the entire screening process, a total of 12 studies were obtained, as shown in Figure 1.

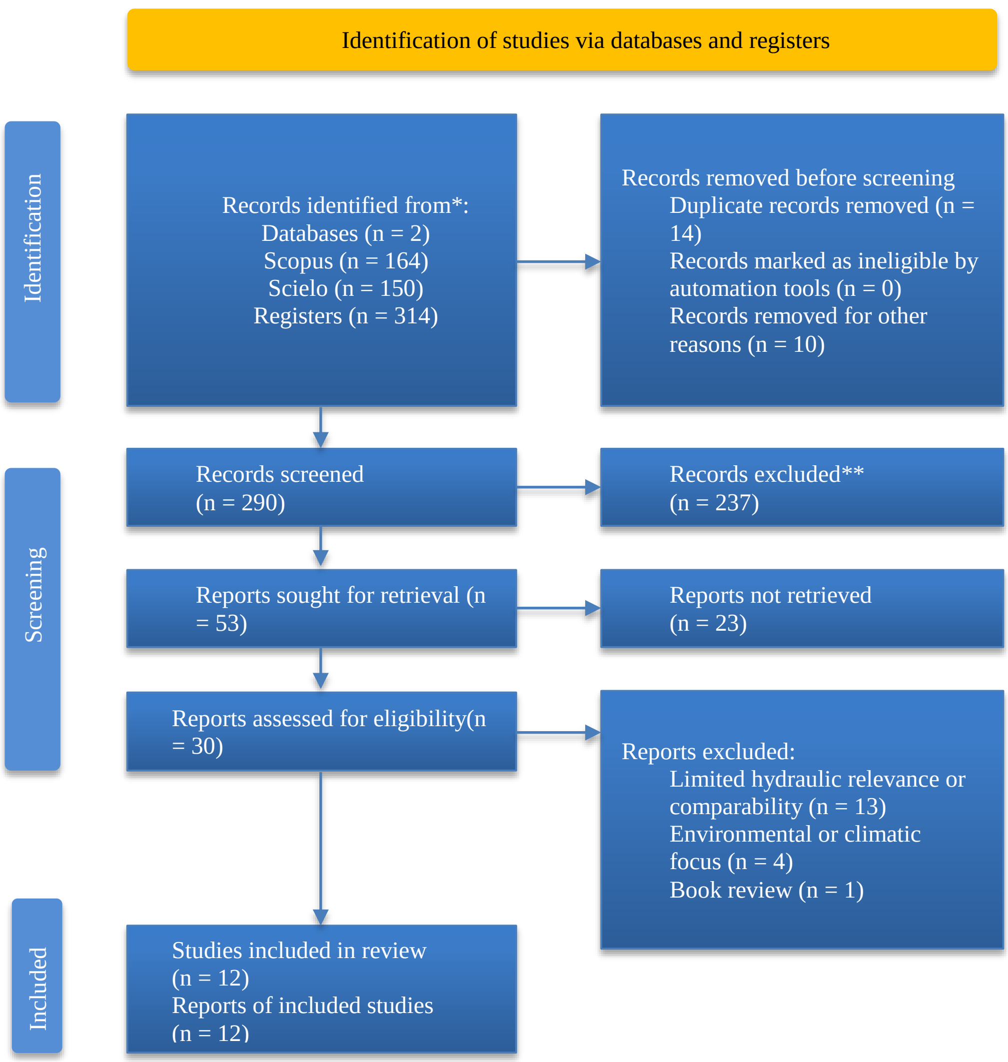

Fig. 1 PRISMA 2020 flow diagram, M.J. Page et al. [11]

3. Results

3.1. Water Collection Sources

Incamisana is considered a place with a strategic location, as it was situated in an area that the Incas called "Tinku," or confluence, because it united the Patacancha and Vilcanota rivers (also known as the Urubamba) [12]. For the water supply of the area, there was a water intake network connected to the Patacancha River, located in the upper areas of the Yanamayo community, which is situated at an elevation of more than 4,500 m above sea level (m a.s.l.). [13]. Thanks to this system, water was collected upstream and transported through channels built along the hillside, allowing it to supply the ceremonial fountains of the area [9].

Before considering these water supply sources, the Incas evaluated different alternatives, including the Pumaphaqcha ravine as a source. However, this option was discarded because it presented limitations related to its contributing area and unstable terrain; therefore, the Patacancha River was ultimately selected through the Huaca channel [12]. Patacancha is a sub-basin of the Vilcanota basin, covering an area of approximately 144.7 km² and extending north of the town of Ollantaytambo. The Chalhuancacocha lakes are also located within this sub-basin. Within the mountain analysis conducted for Incamisana, four contributing sub-basins were identified: Yuracmayo, San Pablo, Paq'chapata, and Puma Paqcha or Media Luna. These areas collect runoff and are associated with watercourses such as Machamayo, Paq'chapata, and Media Luna, which discharge into the Patacancha River [9].

Incamisana was directly associated with two possible water supply inlets. The first came from the Patacancha River and then divided into two channels: Huaca and Manyaraki. The second was associated with the Media Luna sector through the Bandolista channel. However, this should be considered only a possible supply route, since although its alignment suggests that it may have extended toward Incamisana, part of it is buried, and its full continuity has not been completely confirmed [9, 12]. Likewise, the Huaca channel conveyed water both to the temple and to the agricultural areas located on the valley floor for irrigation.

3.2. Agricultural Terraces and Settlement

The settlement of Ollantaytambo is divided within the urban area into two separate sectors: Qosqo Ayllu and Araccama Ayllu, which are separated by the Patacancha River. The former is the residential sector, which still preserves its original layout, with houses organized into rectangular blocks and narrow streets. Araccama, in contrast, has an administrative and ceremonial character, with more open spaces, including Manyaraqui Plaza, which serves as the entrance to the archaeological complex [6, 14]. Figure 2 shows a general view, illustrating both the settlements and the archaeological area. In addition, the site is surrounded by an extensive agricultural landscape, as it is located between the confluences of the Patacancha and Urubamba rivers, where broad areas of fields, terraces, and cultivated land were developed.

Fig. 2 Relationship between the settlement, valley, and agricultural landscape

As shown in Figure 3, the terraces occupied a large portion of the hillside and enabled the production of maize, tubers, and other crops, which supported imperial authority and were therefore an important component of settlement organization [15]. Thus, maize could be cultivated on the lower-altitude terraces, while more cold-resistant crops, such as tubers and quinoa, were grown in higher areas [16]. In this regard, it is estimated that the district contains nearly 2,400 hectares of Inca and pre-Inca terraces, which helped sustain a population of up to 100,000 people [1]. However, near the town, the Incas created approximately 270 hectares of agricultural terraces primarily intended for maize cultivation, channeling about 17.26 km of the Vilcanota and Patacancha rivers, in addition to constructing irrigation and drainage infrastructure [8, 17].

(a)

(b)

Fig. 3 General view of the terraces: (a) Lower section and entrance to the temple of the sun, and (b) Upper hillside section.

The channels distributed water among the fields; therefore, the organization of the irrigation system was essential. This indicates that production depends on coordination among channels, fields, and farmers. Accordingly, any problem in the channels could affect the fields, since they were interconnected through the same irrigation network [17]. Another important aspect is that the agricultural terraces also functioned as risk-mitigation structures, stabilizing the settlement and slopes, preventing landslides, and controlling erosion. These were constructed with a three-layer system, having large stones as a base, followed by gravel and sand, and finally the agricultural soil. With this, it was ensured that water did not accumulate, ensuring better drainage [12, 17, 18].

3.3. Operation and components of the Hydraulic Network: Channels and Fountains

The hydraulic network is composed of channels, fountains, underground conduits, and drop structures. These were organized in such a way as to ensure an organized system that allowed its route to be divided into three sectors: Incamisana, Fountain House Complex, and Princess Fountain Complex. In the case of Incamisana, the water route begins from a bifurcation of the supply channel. This allowed the water to be divided into two groups of fountains. On the other hand, in the Upper Misana sector, there are three fountains with a cascade flow, which makes it different from the others, since the water does not emerge as a jet, but instead has the behavior of a sheet of water on the surface. Likewise, the water continues towards the Lower Misana sector. In this area, the Manyaraki channel enters the system and joins with three major conduits, transporting the water towards the southern end of the complex. The water leaving Lower Misana is conducted to the sectors where the Fountain House Complex is located, which contains elements such as the King's Bath and the Rock Fountain; after that, the water is conducted outside the site. In the case of the Princess Fountain Complex, it is supplied through the Mañyaraki channel; however, its main source has not yet been defined [9]. In Figure 4, the Princess Bath or Ñusta Bath is observed, considered mainly as a ceremonial fountain, in addition to having a controlled flow. In Figure 5, a fountain with two jets is presented, and it is located next to the Water Temple, which is shown in Figure 6.

Fig. 4 Princess bath or bath of the Ñusta

Fig. 5 Water fountain near the "Water Temple"

Fig. 6 Water temple

The aqueducts are underground conduits and are shown in Figures 7 and 8. These are located beneath three internal terraces, while a third one is located beneath an adjacent path [9]. This allowed a connection with the southern sector. This underground system extends through channels approximately 270 feet long, discharging into the temple entrance sector, where four ceremonial fountains are located. These conduits were not pressurized and mainly served to convey water from the fountains in the northern sector toward the southern part of the complex [12]. Hydraulic drop structures were integrated into the system, helping to connect changes in elevation. This allowed water to fall between the stone basins and continue its course.

Fig. 7 Outlet sector of the aqueducts running beneath the platforms of the three internal terraces

Fig. 8 Close-up view of the aqueducts

At the final part of the system, water was distributed through openings into underground channels, continuing its course toward other sectors. In addition, unfinished fountains are found in both the upper and lower sectors, since the system was never fully completed; it was still under construction when the site was abandoned [9]. Beyond the fountains located within the ceremonial complex, Ollantaytambo also preserves channels within the urban area, crossing the streets and distributing clean water from the mountains for sanitary and utilitarian purposes [10]. In total, the complex integrated 16 fountains; however, only 12 became operational, while 4 were never completed because the site was abandoned in the sixteenth century. Moreover, the fountains featured highly elaborate designs with finely carved stonework, highlighting their religious importance and their connection with the cult of water [9].

Finally, the most recent studies confirm that all of this was the basis of the urban design of Ollantaytambo. The organization of the channels has a relationship with the polygonal granite stone walls that ensure, and with this ensure, that the terrain is stable and has good drainage [2, 6]. The use of different types of finishes on the stones of the channels and fountains had a hierarchical context, because the most sacred areas had the most polished stones and the most complex water systems [6].

3.4. Water as a Ritual and Symbolic Feature

In Inca cosmology, water was not only an important resource for irrigation but was also regarded as a form of living energy. The movement of water through springs, rivers, channels, or carved rocks reinforced its sacred character, giving it a spiritual dimension associated with life and fertility. Incamisana was designed for the cult of water, and its importance can be explained by the way its hydraulic elements were distributed. Religious worship of water is also evidenced by its ornamental designs, which expressed the religious significance of the site. In addition, the confluence of the Patacancha and Vilcanota rivers reinforced its sacred character, as such spaces were considered to carry a stronger symbolic meaning [9, 12].

On the other hand, in addition to its symbolism, the control of water was considered a way of expressing power, demonstrating their dominance over nature and the territory by capturing water through elaborate hydraulic systems. In fact, the Incas considered that, by having carved rocks animated with water, they acquired greater power, since this functioned as a living huaca linked to the mountain [6]. Furthermore, architecture was also related to rituality, since the northern sector of Incamisana was the heart of the temple and where the priests had performed rituals linked to water and supernatural entities. The entrance to the temple is also indicated as a ceremonial entrance, since as visitors approached, they could see and hear the water falling into the fountains. This combination of the water's path, its sound, and the carved rock made Incamisana a space of rituality. The construction is oriented in that aspect, where the meaning of water was religious, corresponding to a design planned between engineering and ritual practices [12]. Also, there is the presence of a sacred rock, niches, and carvings on the cliff next to the first fountains, which would be related to the remains of Inca ancestors, connecting the cult of water with the memory of the ancestors. This relationship is important because, in the Inca worldview, ancestors could intervene in the balance of water and fertility [9].

4. Discussions

The hydraulic system of Incamisana is one of several existing systems, such as Tipón, Machu Picchu, and

Pachacamac, within the Inca tradition of water management. However, although it fulfilled agricultural and domestic functions, its design was intended as a "Water Temple," forming part of a ceremonial space with fountains, channels, carved rocks, and a watercourse that produced a visual and sensory experience through the sound generated in places of offering and worship [9, 12].

Compared with Tipón, this system distributes water to agricultural platforms, reservoirs, urban areas, and ceremonial sectors. Its surface and underground channels made it possible to regulate the flow to maintain different moisture levels across thirteen agricultural platforms. Thus, compared with Incamisana, Tipón's system was oriented primarily toward productive control and water management in the terraces [9, 20]. For Incamisana, its fountains were intended to make the movement of water visible [20].

With respect to Machu Picchu, the approach is different, since the hydraulic system is supplied from a natural spring developed by the Incas themselves, which is fed by a 749-meter canal. The path of the water was by gravity, reaching the first supply sector, which was the royal residence, demonstrating a hierarchy considered according to their social and political status, and which was related according to those who received the water first. In Incamisana, there is a hierarchical organization, although more related to the ceremonial route, with important fountains near the complex where the main offerings were carried out [9, 21]. In contrast to Incamisana, the Pachacamac system expressed water symbolism in a different way, as water was associated with a broader landscape involving a lagoon, myth, oracle, and pilgrimage [22].

Based on its relationship with other systems, Incamisana shares three patterns: the design of gravity-fed channels for water conveyance, the integration of water with terraces, settlements, and landscape control, and, finally, the relationship between water, rock, and rituality. In Incamisana, all of these elements are concentrated within a limited space and organized around the cult of water. Thus, the hydraulic system fulfilled technical, agricultural, political, and ritual functions, since, beyond distributing and conveying water with precise flow control, it can be understood as a construction of authority and meaning within the landscape.

5. Conclusion

The hydraulic system of Incamisana shows that water management was not only practical but also carried a deeper meaning, as water connected the territory, agriculture, architecture, and rituals. Likewise, this system was supplied mainly by the Patacancha River and relied on a network of channels for water conveyance. However, it did not depend on a single source, since water was transported from the higher areas of the complex.

The terraces were spaces for cultivation, but also for adapting the terrain, controlling erosion, and improving drainage, allowing water to circulate in a controlled manner between the fields and terraces, as well as in urban sectors. For distribution, Incamisana included canals, fountains, and underground conduits, thus allowing water to be distributed to various sectors of the site; however, some unfinished canals are still present because they were abandoned during their construction process. On the other hand, the route showed different ways in which the water behaved, such as sheets and jets that fell into the stone pools. All of this suggests that they were also designed with the purpose of generating visual and auditory experience. This is related to its symbolic dimension, also considering the presence of carved rocks, which reinforce that context.

Its comparison with other hydraulic systems, such as Tipón, Machu Picchu, and Pachacamac, shows that Incamisana had a relationship more focused on the cult of water, thus having a more important effect in relation to rituality. For this reason, unlike the other systems, Incamisana stands out for its ceremonial character and the way in which water was presented in the temple. In this way, the hydraulic engineering of Incamisana and its territorial organization help to understand its symbolic perspective. Likewise, the hydraulic system of Incamisana shows great Inca knowledge about water and their ability to adapt to the landscape with a functional and sacred approach.

The reviewed literature shows that most of them have been studied within the last 30 years, but with certain limitations, since, in the last 10 years, progress in understanding more about the site has been little studied. Based on this, future research is recommended to further deepen the study of the hydraulic system through field studies, incorporating topographic surveys and digital tools, in order to have a greater understanding of the current behavior within the site. On the other hand, a comparison of hydraulic systems among the different ceremonial spaces in Peru, where other hydraulic systems are present, could be evaluated to identify similarities in design and functioning, which could be relevant to assess their relationship with the needs of current engineering. In this way, it can be understood as a basis for reflecting on modern solutions and linking them with sustainable construction.

References

[1] A. Kendall and A. Chepstow-Lusty, Cultural and Environmental Change in the Cuzco Region of Peru: Rural Development Implications of Combined Archaeological and Palaeoecological Evidence, BAR International Series 1478, pp. 185-197, 2006. [Google Scholar]

[2] Doris Esenarro et al., "Spatial, Functional, and Constructive Analysis of the Water Resource at the Archaeological Center of Tipon, Cusco, Peru, 2023," *Heritage*, vol. 7, no. 12, pp. 6629-6656, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[3] Steven Roland Gullberg, "*The Cosmology of Inca Huacas*," Ph.D. Thesis, James Cook University, Townsville, Australia, pp. 1-431, 2009. [CrossRef] [Google Scholar] [Publisher Link]

[4] Maya Ishizawa, "A Study on the Conservation and Regeneration of Andean Cultural Landscape: Ollantaytambo Village as a Case Study," *Journal of the City Planning Institute of Japan*, vol. 43, no. 3, pp. 523-528, 2008. [CrossRef] [Google Scholar] [Publisher Link]

[5] María Cecilia Páez, and Luciano López, "Irrigation Channels from the Calchaquí Valley (Province of Salta, Argentina)," *Journal of Archaeological Science: Reports*, vol. 27, pp. 1-10, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[6] Carlos Guillermo Vargas Febres et al., "A Comparative Architectural Study between the Inca Llaqta of Ollantaytambo (Peru) and the Mogao Caves in Dunhuang (China)," *Journal of Chinese Architecture and Urbanism*, vol. 8, no. 1, pp. 1-15, 2026. [CrossRef] [Google Scholar] [Publisher Link]

[7] Nicolás Palacios-Prado et al., "Encoded Landscapes: A Link between Inka Wall Orientations and Andean Geomorphology," *Land*, vol. 13, no. 4, pp. 1-24, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[8] Philpi Jensen, "*The Role of Terraces in the Inca Empire*," M.A. Thesis, Carleton University, Ottawa, ON, Canada, pp. 1-124, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[9] B.M. Doran, "*Hydraulic Analysis and Simulation of the Incamisana at Ollantaytambo, Peru*," M.S. Thesis, University of Virginia, Charlottesville, VA, USA, 2012. [Google Scholar]

[10] Pablo Garcia, "Archaeological Restoration and Heritage Actions in Ollantaytambo," *Heritage*, vol. 1, no. 2, pp. 392-413, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[11] M.J. Page et al., "The Prisma 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," *BMJ*, vol. 372, pp. 1-9, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[12] Kenneth R. Wright, *Incamisana: Engineering an Inca Water Temple*, World Environmental and Water Resources Congress, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[13] J.M. Quispe Quispe, and W. Aucapuma Conde, "*Irrigation Management Plan in the Patacancha Sub-Basin, Ollantaytambo District - Cusco*," Professional Thesis, National University of San Antonio Abad of Cusco, 2011. [Google Scholar] [Publisher Link]

[14] Ginger Pigeon, "*Inca Architecture: The Function of a Building in Relation to Its Form*," U.G. Thesis, University of Wisconsin-La Crosse, La Crosse, WI, USA, pp. 1-42, 2011. [Google Scholar] [Publisher Link]

[15] R. Alexander Hunter, "The Structural Transformation of Ollantaytambo's Inka Ecology under Spanish Rule," *Antiquity*, vol. 99, no. 403, pp. 203-220, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[16] R. Alexander Hunter, "Land Access, Land Use, and Agricultural Practice: Political Ecologies of Servitude at Colonial Ollantaytambo (1550–1770)," *Journal of Political Ecology*, vol. 32, no. 1, pp. 1-26, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[17] Steve Kosiba, and R. Alexander Hunter, "Fields of Conflict: A Political Ecology Approach to Land and Social Transformation in the Colonial Andes (Cuzco, Peru)," *Journal of Archaeological Science*, vol. 84, pp. 40-53, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[18] Nicola Masini et al., "Non Invasive Subsurface Imaging to Investigate the Site Evolution of Machu Picchu," *Scientific Reports*, vol. 13, pp. 1-17, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[19] Charles R. Ortloff, "Tipon: Insight into Inka Hydraulic Engineering Practice," *Latin American Antiquity*, vol. 30, no. 4, pp. 724-740, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[20] Kenneth R. Wright, *Tipon: Water Engineering Masterpiece of the Inca Empire*, American Society of Civil Engineers, 2006. [CrossRef] [Google Scholar] [Publisher Link]

[21] Kenneth R. Wright, "The Masterful Water Engineers of Machu Picchu," *Water*, vol. 13, no. 21, pp. 1-12, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[22] Denise Pozzi-Escot et al., "Traces in the Desert: Use of New Technologies for the Study and Valorization of the Pachacamac Sanctuary—Lima, Peru," *NPJ Heritage Science*, vol. 6, pp. 1-12, 2018. [CrossRef] [Google Scholar] [Publisher Link]