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ECOHYDROLOGICAL PERSPECTIVES OF DEGRADING BAOLIS DURING MEDIEVAL PERIOD IN DELHI: traditional practices of water management

Subhash Anand
Ph.D. in Geography and Associate Professor from Department of Geography, Delhi School of Economics, University of Delhi/India.
sanandpv@yahoo.co.in

Pankaj Gautam
M.Phil. Research Scholar, Department of Geography, Delhi School of Economics, University of Delhi/India.
pankajgwahg0202@gmail.com

Harish Kumar
M.Phil. Research Scholar, Department of Geography, Delhi School of Economics, University of Delhi/India.
hkharishkumar.162@gmail.com

ABSTRACT

Baolis are water reservoir in architectural monuments which had been built by various sultanate of Delhi in different time period and most of *Baolis* were built during the medieval time period. The *Baolis* are found throughout the country but all are different in respect of art and architecture. The sultanates of Delhi had built a number of *Baolis* in Delhi to show their control and prestige in the society. There are about 12 *Baolis* existing in Delhi and out of them, four *Baolis* are almost about to extinct and few *Baolis* such as Nizamuddin, Firoz Shah and Rajon ki *Baolis* are being used by local people. This paper comprises the information related with *Baolis* which was built by sultanates of Delhi during the medieval time period in Delhi. Present paper attempts to describe the traditional method of water management as *Baolis* in medieval period and their present status. Study is based on primary as well secondary sources of information and primary survey and personal observation has been conducted and secondary sources of data and information have been used in this paper. Paper concluded that *Baolis* are not having good conditions and these are very much polluted and degraded and its degradation also leads the eco hydrological loss in their adjacent areas. The careless approaches of people towards these *Baolis* are major causes behind the extinction and degradation of these *Baolis*. The community's awareness and participation is only way to protect these *Baolis* from the extinction.

Keywords: Baolis; Architectural; Monument; Medieval; Degradation; Eco hydrology; Pollution; Management.

PERSPECTIVAS ECOHIDROLÓGICAS DE DEGRADAÇÃO DOS BAOLIS DURANTE O PERÍODO MEDIEVAL EM DELHI: práticas tradicionais de gestão da água

RESUMO

Baolis são reservatórios de água em monumentos arquitetônicos que tinham sido construídos por vários sultanatos de Delhi em diferentes períodos de tempo e a maioria dos Baolis foram construídos durante a Idade Média. Os Baolis são

encontrados em todo o país, mas todos são diferentes no que diz respeito à arte e arquitetura. Os sultanatos de Delhi tinham construído uma série de Baolis na cidade, para mostrar seu controle e prestígio na sociedade. Há 12 Baolis existentes em Delhi e, fora dela, quatro Baolis estão prestes a se extinguir e poucos Baolis, como Nizamuddin, Firoz Shah e Rajon ki, estão sendo usados pela população local. Este artigo compreende a informação relacionada com Baolis, que foi construído por sultanatos de Delhi, durante o período medieval na Índia. O presente artigo tenta descrever o método tradicional de gestão da água como Baolis no período medieval e seu status atual. O estudo baseia-se em fontes primárias e secundárias de informação, pesquisa primária e a observação foi conduzida através de fontes secundárias de dados e informações. Concluiu-se que os Baolis não apresentam boas condições devido à poluição e degradação. Essa degradação também leva à perda ecohidrológica em suas áreas adjacentes. As aproximações descuidadas de pessoas nestes locais são as causas principais por trás da extinção e da degradação destes Baolis. A conscientização e participação da comunidade é apenas uma maneira de proteger esses Baolis da extinção.

Palavras-chave: Baolis; Arquitetônico; Monumento; Medieval; Degradação; Ecohidrologia; Poluição; Gestão.

PERSPECTIVAS ECOHIDROLÓGICAS DE LA DEGRADACIÓN BAOLIS DURANTE EL PERIODO MEDIEVAL EN DELHI: prácticas tradicionales de la gestión del agua

RESUMEN

Baolis es el depósito de agua en los monumentos arquitectónicos que habían sido construidos por varios sultanato de Delhi en diferentes períodos de tiempo y la mayoría de Baolis fueron construidos durante el período de tiempo medieval. Los Baolis se encuentran en todo el país, pero todos son diferentes en lo que respecta al arte y la arquitectura. Los sultanatos de Delhi habían construido una serie de Baolis en Delhi para mostrar su control y prestigio en la sociedad. Hay alrededor de 12 Baolis existentes en Delhi y de ellos, cuatro Baolis están a punto de extinguirse y pocos Baolis como Nizamuddin, Firoz Shah y Rajon ki Baolis están siendo utilizados por la gente local. Este artículo comprende la información relacionada con Baolis que fue construida por sultanatos de Delhi durante el período de tiempo medieval en Delhi. El presente trabajo intenta describir el método tradicional de gestión del agua como Baolis en época medieval y su estado actual. El estudio se basa en fuentes primarias y secundarias de información y se realizó una encuesta primaria y personal y se han utilizado fuentes secundarias de datos e información en este documento. El artículo concluyó que Baolis no está teniendo buenas condiciones y estas están muy contaminadas y degradadas y su degradación también conduce a la pérdida ecológica hidrológica en sus áreas adyacentes. Los acercamientos descuidados de la gente hacia estos Baolis son causas principales detrás de la extinción y de la degradación de estos Baolis. La conciencia de la comunidad y la participación es la única manera de proteger a estos Baolis de la extinción.

Palabras clave: Baolis; Arquitectónico; Monumento; Medieval; Degradación; Eco hidrología; Contaminación; Manejo.

INTRODUCTION

These *Baolis* are also known as step wells or water reservoirs. These were developed nearby the residential areas of medieval period. It is because most of the *Baolis* are found in adjoining with fort and elite residential areas. The traditional knowledge and some instrumental information were required for building this kind of water management infrastructure. The *Baolis* were the center for regulation, distribution and accumulation of water in urban areas or residential areas of walled towns in medieval time period. There are number of example of water preservation centers in Delhi and The term *Baoli* /step well is used by various historians for architectural works related with the water conservation methods, which comprises the typical kind of underground water conservation monument that start from surface and connected with underground water. These structures are comprises the one circular well that is connected with huge descending stairs of the structure. These stairs are leading down towards the underground water from surface and these descending stairs also symbolized the level of underground water. Therefore, it also supports the aquatic life of their adjoining areas. These *Baolis* were the basis of water supply; therefore, it was responsible to fulfill the demand of water in urban centers. It is evident through the present location of *Baolis* because these are almost in a city or nearby the city. The most of the reservoirs, ponds, lakes etc. have been developed by rulers throughout the country. Similarly, the rulers of Delhi sultanate have been developed the step wells throughout the capital city. Now, these *Baolis* are losing their art and architecture and moving towards the extinction. The *Baolis* are facing acute problem of pollution and shortage of water leading to dryness and degradation. The continuous over use or exploitation of underground water is might be the cause of dryness of these *Baolis*. The *Baolis* were symbolized the presence of ground water table on the surface because it is connected from the underground water. Now, there are twelve *Baolis* are existing in Delhi and out of these, hardly 6 *Baolis* have water but depth of each *Baolis* differ. Some *Baolis* are still in use and these are being used by the people of local community for religious and cultural purpose. The residential complex of *Nizamuddin ki Baoli*, *Firoz ki Baoli* are used by people throughout the year but *Rajon ki Baoli, Gandhak ki Baoli, Red Fort ki Baoli, Old Fort ki Baoli* and *Agrasen ki Baoli* are often used by the people once a year but among these *Baolis* some are treated as tourist center. The *Baolis* such as *Hindu Rao ki Baoli, Munirka ki Baoli, Dwarka ki Baoli, Kutub Sahib ki Baoli* are transformed into ruins and there is ample

possibility for the extinction of these *Baolis* in coming few years. The *Baoli* of Nizamuddin Dargah is used for religious perspective other than children take bath into this *Baoli*.

The Anangtal *Baoli*, the oldest *Baoli* in Delhi, is a single stage step well. Excavations at this site reveal that the well was probably very large; some steps leading to the water are extant. It used the technique of rainwater harvesting for its storage (SINHA, 2014, p. 33).

STUDY AREA

Delhi have story of number of empires, rulers and their built monumental structure related to their loved ones and these structure comprises unique art and architecture. Delhi is also known as capital city since period of Prithiviraj Chauhan to now. It was re-established as capital city by the British in 1911 AD. Delhi was established as city alongside the bank of river Yamuna between the latitude 28° 24'17" – 28° 53' 00" and the longitude 76° 50' 24" – 77° 20' 37". Delhi has an area of 1484 sq. kilometers with maximum length of 51.90 kilometers and maximum width of 48.48 kilometers. Delhi is administrative, socio-cultural and business center and it comprises highest density in India but population is not uniformly distributed (JOSHI, District census handbook, 2011, p. 14).

Location of *Baolis* is found nearby previous the fort city (figure 1. Location of *Baolis)*. The *Baolis* are one of the best art work done by rulers for local community and are very common feature of medieval art and architecture because most of the monument comprises *Baoli* that was built during period of the 1200 A.D and 1600 A.D.

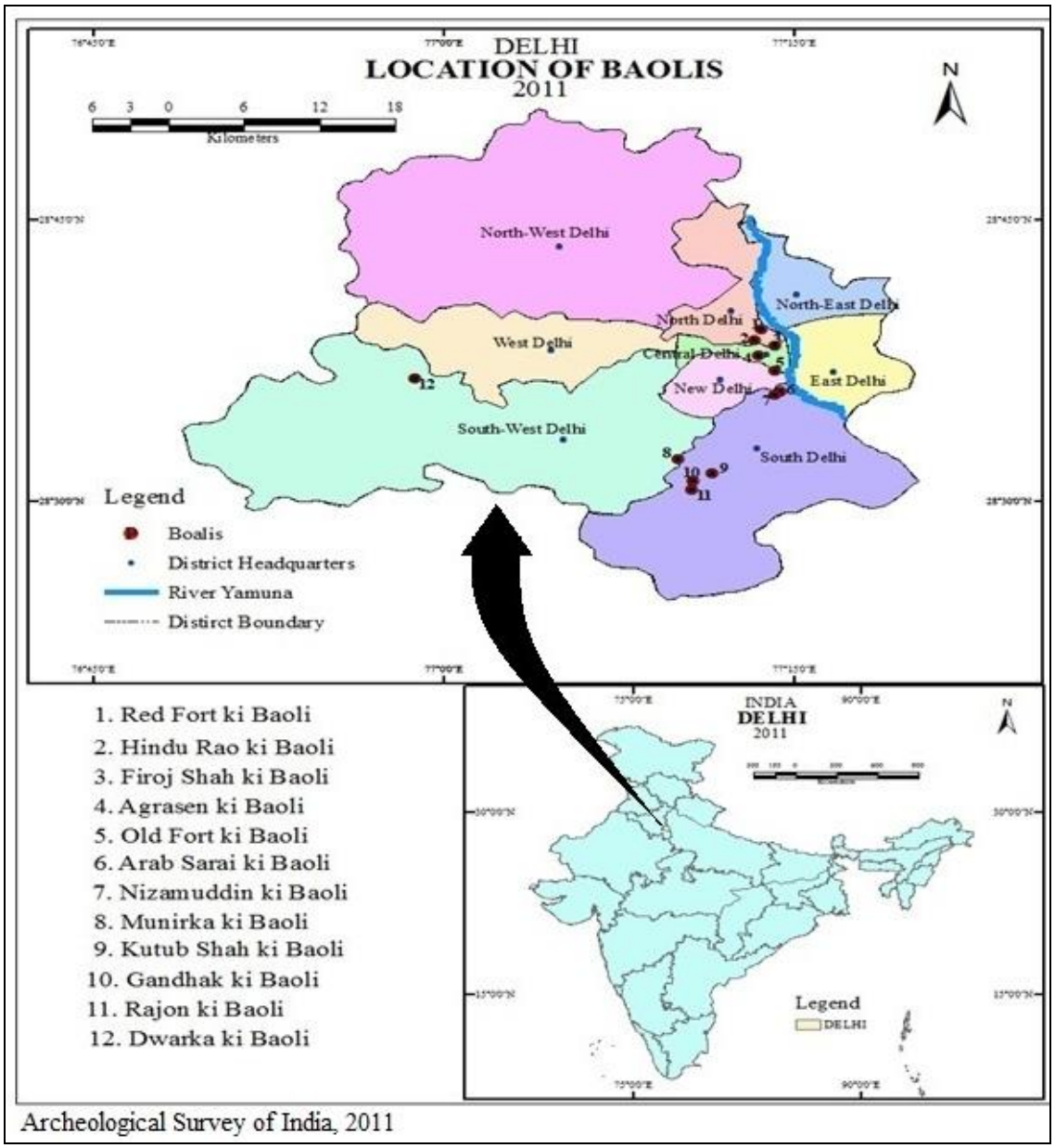


Figure 1 – Location of *Baolis* in Delhi
Source: Archeological survey of India, 2011.

The formations of *Baolis* were attached with cultural traits of rulers irrespective of Hindu or Muslim rulers. These were built during the period of Prithiviraj Chauhan to Bahadur Shah Zafar. Therefore, Delhi has number of water monuments because with change in empire the water architecture of Delhi also has been changed (JOSHI, District census handbook, 2011, p. 14).

UNDERSTANDING THE PROBLEM

Baolis are water monuments which are symbol of water preservation methods used in medieval period in Delhi. These monuments or structure are result of intense knowledge about the water preservation techniques but now these are losing their glory, therefore, the protection of these methods and techniques of water preservation of medieval period is required to preserve these sites in its previous condition because it can help to revive the micro level eco hydrology of the region. The human encroachments in monumental sites are making them vulnerable for extinction because careless attitude of Delhi's people are continuously destroying the art and architecture of these monuments. Few *Baolis* have been lost their original art and structure because of pollution and encroachment of people in monuments. The *Baolis* of Dwarka, Hindu Rao and Kutub Shah have been lost their art and architecture, there only ruins are left. These *Baolis* are unknown by the people of local community and sometimes, they used to throw their waste in these sites and they have make them as the center of waste disposal and pollution. The *Baolis* are degrading because these are treated as garbage dump and the continuous waste disposal have made these sites vulnerable for extinction. These *Baolis* could be proved as good source of fresh water for biota of nearby areas and helps to maintain the environmental conditions. These *Baolis* are also known as step wells and these *Baolis* or water reservoirs were developed nearby the residential areas of medieval period. It is because most of the *Baolis* are found in adjoining with fort and elite residential areas.

There are almost 12 *Baolis* and out of them only 2 *Baolis* are frequently using by the local people at present time and majority of *Baolis* are not in use because of various causes. The Rajon ki *Baoli*, Gandhak ki *Baoli*, Old Fort ki *Baoli*, Arab ki Sarai *Baoli*, and Munirka ki *Baoli* have water but that is polluted and full of solid waste materials. The major issue with these water monuments is careless attitude of people of local community because they are frequently polluting these monuments and destroying the art and architecture. Another issue with these water monuments is dryness which became major cause behind the abundance of these monuments.

Following are some major problems related to *Baolis*:

1. *Baolis* are facing main problem of carelessness, people living near by the *Baolis* do not care about these medieval water reservoirs.

2. *Baolis* are facing acute problem of pollution and it treated by the people as landfill sites and water is so polluted and dirty, full of harmful algae.

3. Some *Baolis* are almost ruined which was not restored by the any organization or institution or the restoration is not taking place in better manner.

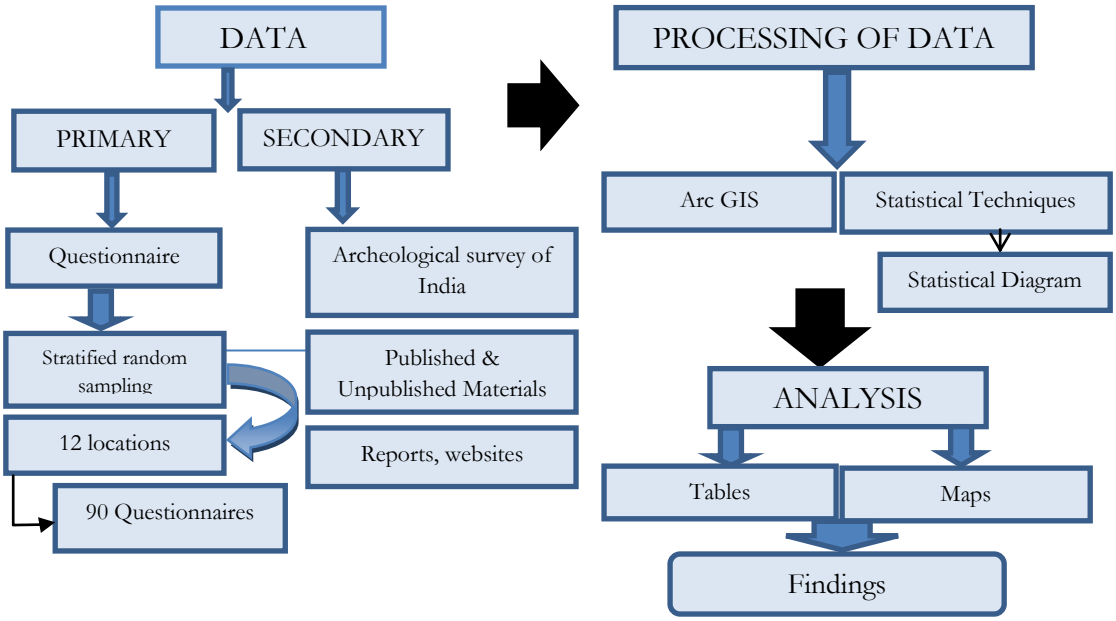
4. Most of the *Baolis* lost their original shape and most part of these *Baolis* are vulnerable to ruined.

5. *Baolis* are facing the problem of land encroachment within the boundary of *Baoli*, people encroached the land of *Baoli* for their own purpose.

DATA SOURCES AND METHODOLOGY

The present study is required appropriate primary as well as secondary data and information. The research cannot be complete without field observation and primary investigation and the ground reality cannot be understood without interaction with the local people. The methodology was adopted both quantitative as well as qualitative method. The stratified random sampling method has been used for questionnaire survey. The quantitative comprises statistical representation and diagrammatic representation of information with help of Microsoft excel and SPSS. The qualitative method comprises the information related to historical aspect of the *Baolis* and people's perception about *Baolis*. The primary data was collected with organized questionnaire in which major concerns were included. The primary survey was conducted with 90 respondents in total and 9 to 10 from each location site of *Baolis*. The specific areas of survey were colonies which fall nearby the 500 meter of these *Baolis*. The survey was conducted in the months of in year 2016 and it has been completed in 26 day between March to April. The secondary information has been collected from Archeological survey of India office in Rama Krishna puram in Delhi. Which is responsible for caretaking the all *baolis*. There were random observation of *Baolis* and adjoining area has been taken place before organized survey of local community living nearby *Baolis*. The questionnaire has categorized into four part and each part further carry four questions. There are 16 questions in one questionnaire. These questions are specifically cover three major concerns such as what was need of development of *Baolis* in medieval time and its importance. Second part covers the degradation and groundwater connection of *Baolis* in Delhi and Third part cover its present status and role in human life. The first part covers the basic information of respondents. Secondary data and information have been collected from different sources. For the proper implication and utilization of data statistical techniques has been used. The mapping technique has been used for representation of location of *Baolis*.

METHODOLOGY FRAMEWORK

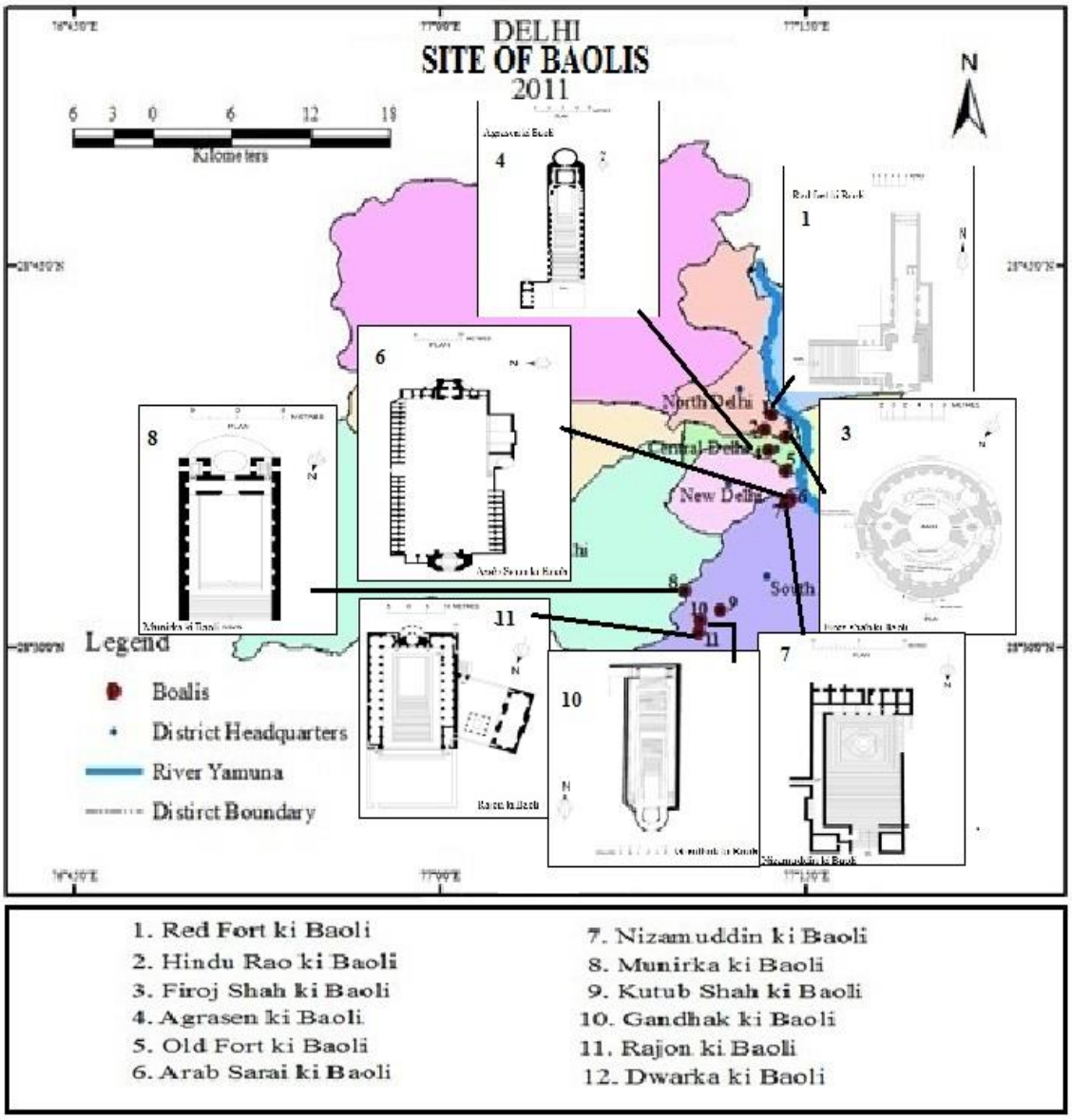


RESULTS AND DISCUSSIONS

Art and Architecture

The traditional Indian architectural methods had been used for the development of *Baolis* and the majority of *Baolis* had been developed during the medieval time in Delhi and north India. "The step wells were constructed in the south western region of Gujarat around 600 AD from there it spread north to Rajasthan and subsequently to north and west India. Initially used as an art form by Hindus, the construction of these step wells hit its peak during Muslim rule from the 11th to 16th century." (DAVIES, 1989, 26) From the 14th century to 17th century most of the step wells were developed in north India with indo-Iranian art. The Indian and Iranian art were together used for the development of step wells. It happened because Indian traditional art and Indian artists have been also contributed in the building of these structures. The Iranian architecture has been used by Indian artist for building these step wells. The Sultans of Delhi wanted to construct their structures according to principles of Persian art therefore, they had brought their designers or architect from Iran and west Asia but they had to hire Indian craftsmen who had their own kind of knowledge about the construction of buildings and ideas and methods. These ideas and methods were mixed with Iranian designs during the construction of buildings. Most common phenomena were that the designs were developed by Muslim designer and

building was constructed by Hindu craftsman. The origin of mixed Indo-Iranian art had become most common during medieval time period. The Indian art were consist of carving of god and goddesses from all sides, on walls, pillars and roof as well. The Hindu art has consisted of the square pillar for support their temples. The Iranian art were consist of the pointed arched, geometrical designs and use of stones and colored stones. The geometrical art is very unique feature during the medieval time and most of the building structure has been developed on the basis of this technique. The designs and sites of *Baolis* have been described in Figure 1 in which the original designs of eight *Baolis* have been described.



Fugure 1 – Design and Sites of *Baolis* in Delhi
Source: Archeological survey of India, 2011.

The (Figure 1) comprises the original design or framing of *Baolis* that consist of unique rectangular frames and sites in Delhi. The designs of these *Baolis* have comprises similar kind of north-south combination and circular well in the last section of the *Baolis*. The common features in these *Baolis* are huge stairs which move downwards towards the rectangular pond and these ponds are connected with well at last.

Development of *Baolis*

Baolis were developed for various purposes during the medieval time period. *Baolis* were generally built by king, sultans and elite of ruler's families. All these people comprise the political or social-cultural powers. So, the construction of *Baolis* was influenced by their own political or socio-cultural or economic profits. Here, the associated approaches which were probably responsible for the development of *Baolis* have been asked from the people residing near by the *Baolis*. The "earliest example of bath-like pond reached by steps is found at Uperkot caves in Junagadh. These caves are dated to the 4th century. Navghan Kuvo, a well with circular staircase, in vicinity is another example. It is possibly built in Western Satrap (200-400 AD) or Maitraka (600-700 AD) period though some place it as late as the 11th century. Nearby Adi Kadi ni Vav is constructed either in second half of the 10th century or 15th century."(JUTTA, 1981, p.20)

The *Baolis* were center of socio-cultural and political discussion. The *Baolis* were developed for supporting the caravans and travellers and their animals. The *Baolis* could be developed for political purposes such as contest over of political dominance on local community for example the *Baoli* of Nizamuddin was developed on contest between Tughlaq and Nizamuddin. The *Baolis* were center of water distribution at some places otherwise, it was economic and political center. Some evidence described that there cultural events were organized by local administrator or Amir. *Baolis* as political entity, *Baolis* were treated as political center during the medieval period because it was center of public gathering and local administrator solve the disputes here, and it was the center of distribution and management of water resources at local level. The *Baolis* were symbol of prosperity of ruler, who cares their subject very well. These were politically operated by local administrator who's responsible for distribution of water in city and adjoining areas and collection of revenue from water source. There were no direct reach of common people to these *Baolis*. These *Baolis* were also constructed for support the caravans and travellers who passes from this way. The perception of local community has been described

that *Baolis* were built for various purpose and the causes have been also described on the basis of perception of people regarding the development of *Baolis*. Perception of people about *Baolis* described that the importance of various causes behind the building of these *Baolis* (Figure 3).

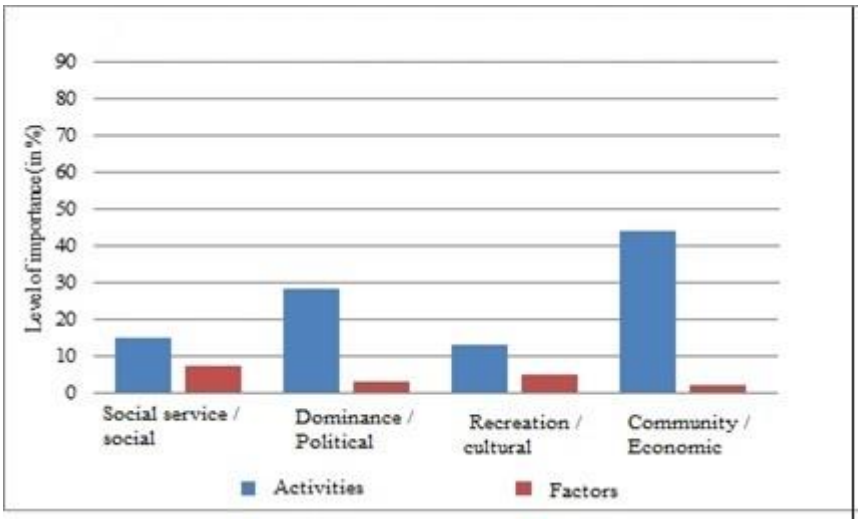


Figure 3 – People's perception about development of Baolis
Source: Primary survey.

Importance of baolis: *Baolis* as socio-cultural entity, *Baolis* were center of social and cultural events. These *Baolis* were center of social elites people belongs to higher societies were living nearby and *Baolis* were developed within the boundary of walled city. It was found that no one *Baoli* was constructed outside the walled city. *Baolis* were generally constructed for urban people, it is because urban center needed much amount of water and these *Baolis* were main source to fulfill the excess demand of water in urban areas. The socio-cultural events were organized near by the *Baolis* and the caravan represents their cultural activities near by the *Baolis*. The travellers were rested near by the *Baolis* because their animal needed water for drink.

The step well may have originated to ensure water during periods of drought. The water is considered sacred from the time of Vedas and the steps to reach water level in artificially construed reservoirs can be found in the sites of Indus Valley Civilization such as Dholavira and Mohenjodaro. Mohenjodaro has 'cylindrical brick lined wells' which may be the predecessors of the step well (LIVINGSTONE and BEACH, 2002, p. 19).

Baolis as economic entity, the *Baolis* were center of revenue collection during the medieval period because public gathering were taken place nearby these *Baolis*. The revenue from urban people was collected here. The elites of urban area were generally held their

meetings nearby *Baolis*. These *Baolis* were guarded by soldiers of sultanates. This kind of protection arrangement described the economic and political importance of *Baolis* at that time.

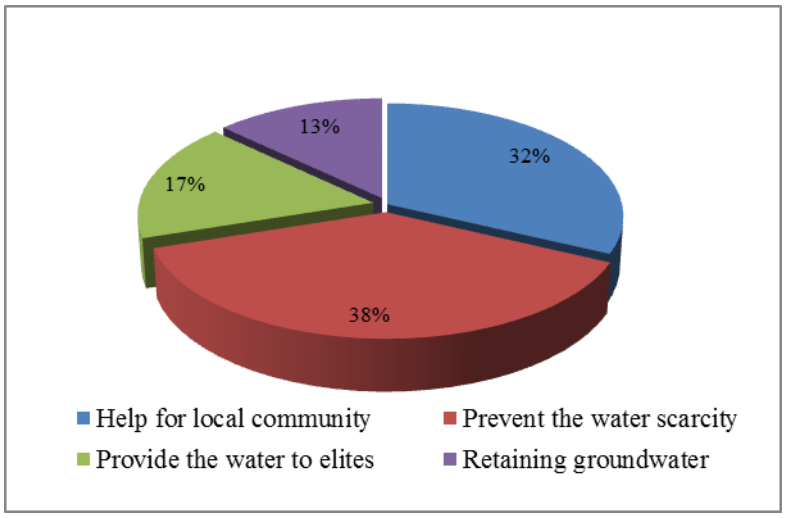


Figure 4 – Perception of local community about importance of *Baolis*
Source: Primary survey.

The *Baolis* were politically, socially and economically were important for rulers as well as subject of the rulers. Figure 4 describe the some issues that could be cause behind the development of *Baolis*. The *Baolis* were played very important role during the scarcity of water and in the absence of rainfall. At that time, these *Baolis* were provided the water to people of urban area and it was integrated way of preserving the water resource which help during the lack of water in city. It was an alternative source of water provided to the place of sultan's as well.

Present Status of Baolis

The *Baolis* are not the new feature in Indian traditional water harvesting technique but it was modified by the invader or later sultans of Delhi. These structures were constructed with mixed Indo-Iranian art and majority of water structure were built during the time of sultans of Delhi. The *Baolis* are still in use but most of them are degraded. Some are at last stage of extinction and few are completely destroyed. Specifically those *Baolis* are still in use are not in very good conditions.

Gandhak ki *Baoli*: it comprises five floor along with circular portion of well in south. The wall was developed from masonry stones and floor from stones. The Square pillars have been used in this *Baoli*, and it also denote the time period of Muslim arrival in

India. It was built from the material extracted from Jain Temple in Qutub complex. It is belongs to Iltutamish's reign (1210-1236 A.D) (MEHTA, 2014, p. 16). The Gandhak ki *Baoli* is closed at now in 2016 because some children's had been found dead and the nature of water is very acidic therefore it was closed for public use in 2015.

Figure 5 – a. Five floors of Gandhak ki *Baoli*. b. Top two floor of Gandhak ki *Baoli*.
Source: Primary survey.

The Figure 5a. represents the five floors of these *Baoli* and Figure 5b. represents the top two floor of this *Baoli* which are showing the spot of seepage on the walls of this *Baoli*. The last floor has some amount of water but that is covered by algae.

Agrasen ki *Baoli*: it is very finest step well in Delhi. This comprises four floors along with a deep well in north. It very wide and big step well comprises 108 steps and well depth will be 150 feet deep. The arched niches were used for decoration and building up walls. The domed chamber was build up by random masonry stones and roof was build up by stones.

Agrasen ki *Baoli* located near by the Barakhamba road at Hetley road in New Delhi. This *Baoli* became the tourist center after the restoration done by Archeological Survey of India (ASI). But it completely dry, there is no water at well. The well is almost 150 to 160 feet deep but extremely dry. The chajjas and roof are a little ruined otherwise most part are repaired by ASI.

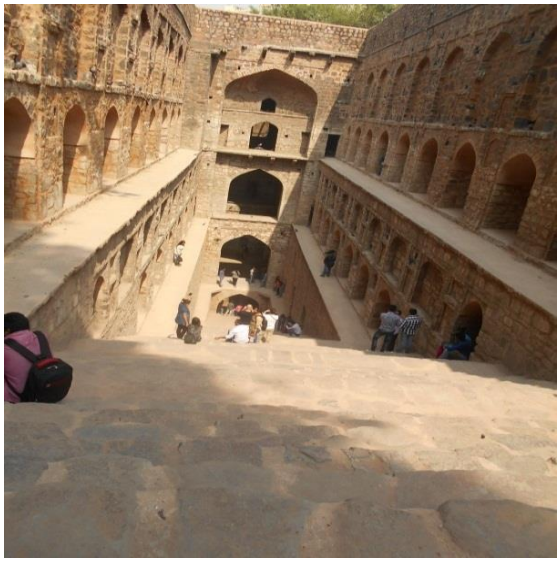
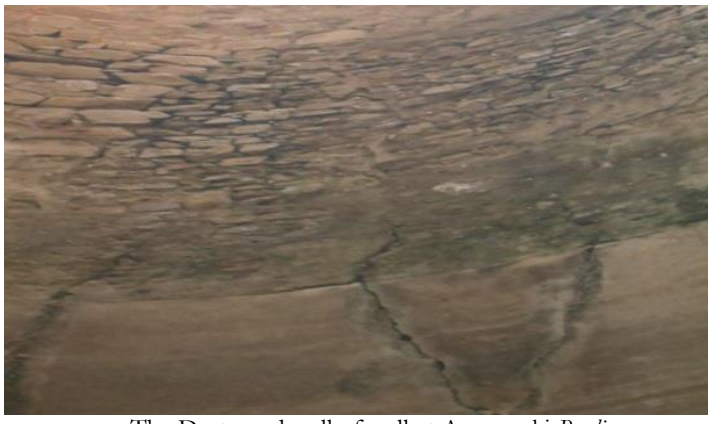


Figure 6 – a. Dried steps of Agrasen ki *Baoli*

b. Roof covered with bats of Agrasen ki *Baoli*



c. The Destroyed wall of well at Agrasen ki *Baoli*
Source: Primary survey.

Figure 6a. represents the dried condition of *Baoli* and people are treating it as tourist place and Figure 6b. represents condition of roof of this *Baoli* that is covered by the bats and the Figure 6c. represents the condition of destroyed wall of it well that is almost 150-160 feet. The wall of well is also covered with algae and some patches of seepage can be seen.

Rajon ki *Baoli*: This is located in Qutub complex in Mehrauli. It is rectangular in shape and step leading downward from north to south and well consist at south wall. This was very well decorated with arches and chajjas at top. It belongs to 1506 A.D. It has total 66 steps out of them 41 steps and three floors are visible now and other are under water. It was restored by ASI but it needs further restoration because after the renovation it is not in good condition.

Figure 7 – a. Water covered with algae at Rajon ki *Baoli* b. renovated roof at Rajon ki *Baoli*

c. Square and round Pillars at Rajon ki *Baoli* d. Polluted well at Rajon ki *Baoli*
Source: Primary survey.

This *Baoli* is located in Mehrauli and it is not used by the people of local community and ASI as well. The Figure 7a. represents the conditions of water that is very much polluted and it is covered with very thick algae. This comprises five floors and each floor has been restored by ASI because most part of this *Baoli* was ruined. The Figure 7b. represents the top floor that has been restored in its previous form and shape but not in proper way and other floors were also not restored properly and most of the sections of this *Baoli* are not restored and those required restoration. The Figure 7c. represents the square pillars of this *Baoli* and the last Figure 7d. represents the polluted well of this *Baoli*.

> Its appearance is like a courtyard of the medieval period with passages marked by stylized carved symmetrical arches spanning the columns in North Indian architectural style, which form the three sides of the baoli. There are rooms at each floor which once provided a cool resting place for people. With its incised plaster work, the baoli is an elegant architectural edifice. When built the water used to reach up to the third stage (DAS, Indian Express, 2009).

The surface of water in the well is covered with solid waste pollutant. The stairs that goes to roof are also required some consensus.

Nizamuddin ki *Baoli*: This *Baoli* was constructed under the supervision of Hazrat Nizamuddin during the time period of 1321-1322 A.D. and it was located in north of Dargah in complex. The wall has been extinct and encroachment in *Baoli* is clearly visible. The people believed that water is sacred. It is 180 feet deep as people said. Once in year, the water in *Baoli* became acidic.

Figure 8 – a. Children's bathing in Nizamuddin ki *Baoli* b. Ruined walls of Nizamuddin ki *Baoli*
Source: Primary survey.

The Figure 8a. represents the condition of *Baoli* of Nizamuddin where children's are bathing and another Figure 8b. represents the conditions of wall of this *Baoli*. The wall of this *Baoli* is almost degraded. This is concerned as sacred place for one community therefore it is still in use. This *Baoli* has lost their infrastructure and new encroachment taken place. This *Baoli's* area was occupied by local people. Water is polluted and people do not recognize the importance of this *Baoli* except the sacred importance.

Firozshah ki *Baoli*: this *Baoli* is still in use and it is closed for tourists and local people because its structure is more vulnerable to destroy. This is circular in shape with three stories and its water is distributed by the Delhi Jal Board in nearby the residential colonies. The water of this *Baoli* is usable and it also a sacred place for one of the community.

Kutub Shah ki *Baoli*: this *Baoli* is extinct, there nothing is left. This *Baoli* seems like just deep boundary wall and its depth will be between 5 to 10 feet. It was filled with waste. This *Baoli* is almost 25 meter away at west side from Kutub Shah ki Majar. But nobody knows that it was *Baoli* during that time. Even the security guard was unaware about this fact. This *Baoli* is connected with Majar through an underground path that starts from front of the Majar of Kutub Shah.

The well of Kutub Shah ki *baoli* that is degraded and full of dust and waste. This well is being used by the local community as waste disposal center (Figure 9).

Figure 9 – Dried and extinct well of Kutub ki *Baoli*
Source: Primary survey.

Hindu Rao ki *Baoli*: this is almost extinct there only ruins are left, the original structure has been destroyed and few of them are left. The steps are degraded and water reservoir is almost destroyed. It seems like a landfill sites and it was abandoned by the people and local authority.

Figure 10 – a. ruined stairs of Hindu Rao ki *Baoli* b. ruined structure of Hindu Rao ki *Baoli*
Source: Primary survey

The Figure 10a. represents the destroyed stairs of this *Baoli* because these stairs are almost eroded or degraded and Figure 10b. represents the ruined structure of its cabins and walls.

Old fort ki Baoli: this *Baoli* was closed by the ASI for tourist and local community. there is water at lower segment of B*aoli* but that is not more than 10 feet and that water is seems like very Acidic in nature. Its structure is in very good condition. The walls at the lower section of this *Baoli* are covered with algae. Now, these *Baolis* are abandoned by the people of local community in dark shades with very careless attitude. These *Baolis* have

been reached the last stage of their extinction. Very few of them are in good condition because of efforts done by government and other institutions. Day by day, the *Baolis* are degrading and reached the last stage of extinction.

Step wells are dark and barely visible from the surface; stepped ponds are illuminated with the light from the sun. Also, step wells are quite linear in design compared to the rectangular shape of stepped ponds (LIVINGSTONE and BEACH, 2002, p. 23).

Eco Hydrological Degradation of *Baolis*

The *Baolis* are our lost architecture related to integrated water conservation methods used during the medieval period. These water reservoir or *Baolis* requires proper management and care for restoration because it helps in maintaining the eco hydrological relationship. The presence of water into the *Baolis* described the favorable conditions for the development of eco hydrological regime. It is evident that the presence of water in *Baolis* has relation to biota. The eco hydrological regime could be revive through the restoration of these *Baolis*. The presence of clean water provides favorable conditions for ecological development. These *Baolis* are continuously degrading because of lack of awareness among Delhi's people. These *Baolis* are take care by archeological survey of India but people's participation is also required for maintenance of these *Baolis*.

The spatio-temporal changes in the traditional water bodies of Delhi along with the processes and forces behind the water quality change, and the eco hydrological consequences of the changing status of traditional water bodies. In 1970, the total number of water bodies was 807 with an area of 14.41 km^2, which declined by 21 per cent to 640, having an area of 8.51 km^2 in 2008. About 108 (per cent) dry water bodies have disappeared and this contributes to loss of 4.47 km^2, i.e. 6 per cent of the area under the dry water bodies. It shows that there is not only decline in the total number of water bodies but there is deterioration in the quality of water bodies (SINGH et al. 2013, p. 363).

Local community responses for degradation of *Baolis*

Most of the *Baolis* are used by local community and those are not used by the local community, are at last stage of extinction. Therefore, the importance of local community should be recognized for maintaining the actual condition of all these water monuments because local community could provide good support to government agencies in

maintenance and restoration of these water monuments. For example the people of local community reside nearby the *Baolis* of Nizamuddin, Firoz Shah Kotla, Rajon, and Gandhak have good engagement with it. These *Baolis* for various purposes rather religious or cultural etc. therefore, a little care has been taking place for these *Baolis* otherwise they will not provide their concern for these *Baolis*. It is because at now they are just using these *Baolis* for their rituals and cultural sects but neither they nor authority provide a good concern for caring of these *Baolis*. These *Baolis* are over controlled by one of the community on the background of religion, hence, they see these monuments as religious set ups. They never care about these monuments only government authority has been maintaining these monuments after removal of basic art and structure. The local community believed that the lands of *Baolis* are belongs to them, therefore, they encroached the land of these monuments but what about the structure? They never concerned about the structure that is also belongs to them. It is also happens because most of the people are unaware about these monument. They never understand the importance of the *Baolis* beyond the religious center.

CONCLUDING REMARKS

Baolis are water monuments which symbolized integrated architecture related with water conservation during the medieval period. The development of water reservoirs was in tradition during this period therefore the sultanates of Delhi was used to for building this kind structure. These *Baolis* were built by various sultanates and Amir's for different purposes and these *Baolis* were the center of public gathering at that time. These *Baolis* were playing an important role in the life of common people of walled city. These *Baolis* are also helpful for the maintenance of eco hydrological regime in these areas. There is dire need of enhance awareness among the local communities and government should formulate special plans and policies for its maintenance, conservation and management in order to maintain sustainability of urban environment of Delhi. The *Baolis* have very significant role in the life of urban people from a long history when it was started to build up and now it is useful as well. It is supporting the eco hydrology of nearby area and helps into the growth of green areas. From the analysis of data it is clearly described that various causes were responsible for development of *Baolis* at that time and now it is useful in various ways. The significance of these *Baolis* is very supportive for ecology and human environment. The visual images also described the actual situation of *Baolis*.

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