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A Comparative Evaluation of Stone Spout Management Systems in Heritage and non-Heritage Areas of Kathmandu Valley, Nepal

A thesis submitted in partial fulfilment of the requirement for the Degree of Doctor of Philosophy at Lincoln University by Mira Tripathi

Lincoln University 2016
Abstract of a thesis submitted in partial fulfilment of the requirement for the Degree of Doctor of Philosophy

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by

Mira Tripathi

Management of water resources is a major challenge throughout the world and in many long-established societies people still use traditional water harvesting and management techniques. Despite often being seen as efficient and cost effective, traditional methods are in decline or have been abandoned in many countries. Nevertheless, traditional approaches continue to be useful in some countries, such as Nepal. The extent to which such traditional processes, in this case supply via stone spouts, may survive modernization, while fulfilling socio-cultural and other needs, is the focus of the research. The research develops an understanding of the socio-cultural and other values of stone spouts for the people of the urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley, Nepal, in order to foster ongoing sustainable management of the remaining spouts.

In order to compare the traditional stone spout management systems in both the urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley, three evaluation criteria were identified from the literature to apply to the selected study areas, they are: area must have stone spouts, they needed to have a diverse range of possible users and governance systems and they needed to be logistically acceptable. Likewise, three research questions are addressed in this research: a) what are the impacts of changes in social, cultural, institutional norms and values and how do they influence the stone spout management system? b) How
do modern pipe-line systems and other development activities affect traditional stone spout management systems in heritage and non-heritage areas? c) What are the implications for local communities of the incremental and ongoing loss of traditional stone spout infrastructure in terms of sustainable management of remaining spouts and water supplies?

A meta-theory framework was established which synthesizes Institutional, Attachment, Central Place and Common Property theories, thus forming analytical lenses fundamental to the mixed-method research approach used in research. Field data were collected mainly using face-to-face interviews, focus group discussions, and biophysical data collected and linked to Global Positioning System (GPS) coordinates. To improve the validity and consistency of the data, other data sources (such as on-site observations and document analysis) were used for triangulation purposes.

The results suggest that management of spouts could both be more effective and efficient if their ownership was somehow vested in the local community as was the case with the earlier guthi system. Ongoing population growth, power cut-offs and irregular water supplies to pipe-lines have in recent times increased the “utility value” of spouts. Besides this, the religious, cultural and unique engineering values of spouts provide an incentive for people to think about the preservation and management of spouts in a sustainable way. Beginning at the early analytical assessment of the meta-theory approach, this research returned the somewhat surprising outcome that spout condition is better in non-heritage areas than in heritage areas as the latter are less affected by changing socio-cultural contexts, institutional norms and values and by dissemination of modern pipe-line technology and other development activities. Authorities could clearly be better coordinated and provide both financial and technical support aimed at solving the management issues of spouts. From this study, it is clear that it is unlikely that stone spouts will ever be the complete solution to the problem of water scarcity, but nevertheless, if well-managed this ancient system could continue to play an important role in reducing water stresses in the Kathmandu Valley while concurrently contributing to a range of other social, cultural and economic outcomes.

**Keywords**: Heritage and non-heritage, peri-urban, urban, stone spout, religious value, guthi, meta-theory, water harvesting, social norms, values, traditional system, Nepal.
Acknowledgements

Completion of my doctoral thesis would have been impossible without the support of several people. First and foremost I would like to express my sincere gratitude to my supervisors Professor Dr. Ken Hughey and Associate Professor Dr. Hamish G. Rennie. This accomplishment was possible due to their unconditional support during my hard times which I cannot bear to dwell on right now. Thank you very much professors for supporting me when I was almost broken. Your years of academic and professional experiences, frequent comments, encouragement and most importantly your belief in me sparked a return of my confidence needed to accomplish my dream.

The list of people that I owe a debt of gratitude to also has an overseas component. This research could not have been completed without the generous help of all the respondents in Nepal. So, I therefore thank all community members, experts and planners for providing me invaluable information regarding the stone spouts in Nepal. I am also obliged to Mr Lava Prasad Dhimal for his incredible assistance during my field visits. As well, I am very much indebted to Mr Nuchhe Bhakta Phoju, Om Dhaubadel, Uttam Narayan Bhandel, Bikram Vaidhya and Anil Stapit for their supports during my field visits.

My gratitude extends to the institution of Lincoln University for awarding me a Lincoln University Doctoral Scholarship. This prestigious scholarship made me free from financial problems during my study. Special thanks to my supervisors who encouraged and supported me to apply for this scholarship.

I am thankful to my nieces and newphews for their assistance in transcribing interviews from Nepali to English. Radha Wagle, Milan Dungana, Pratigya Silwal, Rinzin Punjok Lama and Tri Ong will always be remembered for their invaluable help and moral support. Thank you very much Pratigya for the good company during my late night stays in my Forbes Building, office. My friend Mr David Bird, deserves special thanks for being always ready to edit my documents. Thank you very much David, you are wonderful.

I don’t have any words to acknowledge my husband whose role is far and away distant from the traditional role of a husband in Nepalese society. His contribution not only made this study
successful but also encouraged and inspired me to stand against all adverse circumstances I faced during my study. Family management coping with small children and study simultaneously was a challenge for me. Without my husband’s support, once again, it would not be possible for me to conclude my study within three years. As a mother I could not pay much attention to my children especially my son, Manogya, who was only a year old when I started my PhD. I ask absolution and defer with great adoration to my lovely children for their understanding and patience which provided me with such a productive environment for my research. They never complained about my length of stay in my office over weekends, public holidays or the late nights.

Many apologies if I have forgotten to mention some people in this brief acknowledgement. I really appreciate all of you who have supported me.

It is finally over! Once again thank you very much to you all.
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Chapter 1
Introduction

In spite of the earth’s huge amount of water, water shortages have reached crisis point in many countries due to unsustainable management practices. Worldwide, billions of people in many places still have limited access to basic water services (Collins, Kristensen, & Thyssen, 2009). Water resources management is therefore a key challenge for people in many regions. To help overcome this challenge, people in many places still use traditional water harvesting and management techniques that have served them well over time. In some places those traditional techniques may have adopted practices for the sustainable use of water resources by managing and providing sufficient renewal of the resource. Despite being efficient and cost effective, at present, it seems traditional methods are either in decline or have been totally discarded in many countries (UNU-INWEH, 2009). Nevertheless, these traditional approaches have a continued usefulness, and people are still using them in some countries including Nepal. The extent to which such traditional measures may survive the pressures of modernization is one of the drivers of this research.

Human civilization is demonstrated by ongoing cultural progression from the pre-historic period to the modern era. Nepal also has progressed through these cultural phases to the present day culture. Kathmandu Valley is the main centre of cultural development in the history of Nepal, from ancient times to the present (Thanju, 2012). In the early period of Nepalese history, the utilization of water was very much involved with religious beliefs. People worshipped the source of water and managed it according to seasonal and religious situations and circumstances. The environmental, religious, economic and cultural significance of water remained and as the population increased, over the years local people accessed more water sources especially groundwater via stone spouts, wells, ponds, and other delivery mechanisms. Traditional stone spouts were first constructed in the Kathmandu Valley in 570 AD and they were continued until 1829 (Becker-Ritterspach, 1990). Compared with the rest of Nepal, water stone spouts were more prolific in use in the medieval period in the Kathmandu Valley. The construction and utilization of water conduits fulfilled the basic needs of societies of that time. There was an interdependent relationship between the water sources or water stone spouts and local people or societies (Spodek, 2002; UN-Habitat, 2014). Gradually, with
Due to these trends and other forms of modernizations, social cohesion also weakened. Social institutions, norms and values broke down leaving fewer local traditional administrative structures to conserve stone spouts. Despite the age of the traditional infrastructure, the spouts, the drainage lines, and recharge canals, and the reduced groundwater table in many areas, some traditional water spouts have remained operational. They are an example of the technical and engineering skills of the ancient people of Nepal. However, the development of new water supply technologies has brought further traditional construction of such spouts to a standstill. So it is important to conserve the existing spouts by maintaining and encouraging their optimum utilization (Thanju, 2012; UN-Habitat, 2008, 2014).

This study helps to develop a better overall understanding of the roles and need for ongoing traditional water management technologies and to focus greater attention towards preserving them. The unique traditional stone spouts of the Kathmandu Valley demonstrate the human ingenuity in harnessing sub-surface flows and are, as well, an example of outstanding social accomplishment in the form of communal collaboration. This research attempts to show the current values of traditional spouts in providing water to the people for more than a thousand years and their connection with social and cultural norms by comparing their management system between urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley. This is done by comparing the management systems of spouts of two urban and two peri-urban areas having heritage and non-heritage sites in Bhaktapur District (see chapter 3.4 for selection criteria).

An introduction to the common terms used and related to groundwater sources, groundwater resources and their utilization, traditional methods of groundwater utilization in different countries are given in Appendix one. Sections 1.1 and 1.2 next describe the UNESCO world heritage sites and urban and peri-urban areas of the Kathmandu valley which are the
fundamental foci of this research. Sections 1.3-1.6 then give a general background to stone spouts, water supply systems and their importance and conservation issues. Research gaps and significance of the study, research questions and hypotheses and research objectives are then presented from section 1.7 to 1.9. The final section reports the research context and researcher’s background.

1.1 UNESCO World Heritage Sites of Nepal

Worldwide, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has listed 1031 properties as possessing outstanding universal value meriting inclusion in the World Heritage list. Out of these 1031 properties, 10 in Nepal are recorded as World Heritage Sites (Government of Nepal, 2015; UNESCO, 2015). Of these 10, seven are located in Kathmandu Valley (Government of Nepal, 2015).

Kathmandu Valley is recognised as the cultural hub of Nepal. Historic palaces, buildings, shrines and temples in this valley have outstanding universal value with wonderful architectural craftsmanship on display. UNESCO listed the valley in its “World Heritage” list in 1979 using criteria iii, iv and vi (Government of Nepal, 2015; Maharjan, 2013). Kathmandu Valley comprises of seven monument zones which are rich in cultural, religious, historical and architectural values falling within criteria iii, iv and vi. According to Silva (2015),

“Kathmandu Valley is ‘a testimony to the unique “Newāri Culture” which is still alive today ... The cultural traditions [are] manifested in the unique urban society which boasts of one of the most highly developed craftsmanship of brick, timber, and bronze in the world’ (Criterion III); it is ‘comprised of exceptional architectural typologies, ensembles and urban fabric, ... unique to the Kathmandu Valley’ (Criterion IV); and the site is ‘tangibly associated with the unique co-existence and amalgamation of Hinduism and Buddhism with animist rituals and Tantrism. The symbolic and artistic values are manifested in the ornamentation of the buildings, the urban structure and often the surrounding natural environment, which are closely associated with legends, rituals, and festivals’ (Criterion VI).”

The Valley includes three historical palaces: Hanuman Dhoka Durbar Square (Kathmandu district), Patan Durbar Square (Lalitpur district) and Bhaktapur Durbar Square (Bhaktapur district). The region also includes two Buddhist shrines, Boudhanath and Swoyambhu
Mahachaitya, and two Hindu shrines, Changunarayan and Pashupatinath (Government of Nepal, 2015; Maharjan, 2013). Other structures such as open platforms, vernacular houses, traditional rest houses and stone water spouts also contribute to Kathmandu Valley being recognised as a unique heritage site (Amatya, 2007; Government of Nepal, 2015; Maharjan, 2013).

1.2 Urban and Peri-Urban Areas of the Kathmandu Valley

Antrop (2004) and Thapa and Murayama (2010) have both characterised urbanization as a complex process of physical and functional changes of rural landscape and lifestyles into urban forms. There are much better opportunities and fewer social restrictions on livelihood possibilities in urban areas (Farrington, Ramasut, & Walker, 2002). In comparison to the rest of the world, the urbanization process of South Asia is slow (Narain, Khan, Sada, Singh, & Prakash, 2013). However, the urban population of South Asia has gradually increased (Mathur, 2011). The expansion of urban areas generates a new demand for land in surrounding regions that changes prevailing land use patterns in those peripheral areas (Narain, 2009a, 2009b). The growth of urban areas is complemented by the expansion of peri urban areas (Allen, 2003; Farrington et al., 2002; Narain et al., 2013; Narain & Nischal, 2007).

“Peri-urban” is a term that can be used to denote a transitional zone between rural and urban activities and institutions (Farrington et al., 2002; Narain & Nischal, 2007). Different researchers use the term ‘peri-urban’ in different ways, specifically, as a place, a process or a concept (Narain, 2010; Narain & Nischal, 2007; Shrestha, Karki, Shukla, & Sada, 2013). According to Narain and Nischal (2007, p. 261), peri-urban is described:

> As a place, it can refer to rural fringe areas surrounding cities. As a concept, peri-urban could be seen as an interface of rural and urban activities and institutions. As a process, it could be thought of as the two-way flow of goods and services and a transitional stage between rural and urban.

Narain and Nischal (2007) describe the concept of peri-urban as an interface of a heterogeneous mosaic of natural, urban and agro-ecosystems influenced by both urban and rural systems demand for materials and energy flows. From a social perspective, social groups of peri-urban areas are heterogeneous featuring informal settlers, small farmers and entrepreneurs displaying different and competing interests, practices and perceptions. They
are in constant transition and dynamic in nature where the social forms, types and meanings are created, modified and discarded. From an institutional viewpoint, this is a complex analysis because some administrative activities may fall between the urban and rural authorities and peri-urban residents are often burdened and influenced by both urban and rural statutory and customary laws and institutions. The peri-urban dwellers have an opportunity for increasing their income and quality of life by mutual dependency of land use, and the flow of goods and services and resources between the village and adjacent urban areas (Narain et al., 2013; Narain & Nischal, 2007). However, peri-urban areas have faced the problems of the loss of some “rural aspects” such as agricultural land, natural landscape and rural employment opportunities and scarcity of “urban attributes” such as lack of accessibility, lack of services and infrastructure and planning approaches (Allen, 2003; Brook, Bhat, & Nitturkar, 2006). Unplanned land conversion to peri-urban areas deplete water resources and increase pollution and encroachment of water bodies as well (Narain et al., 2013; Narain & Nischal, 2007).

In all developing countries urbanization presents as a dominant phenomenon (Thapa, Murayama, & Ale, 2008). The urbanization rate is very high in Nepal though it is a relatively new phenomenon in comparison with some other countries (Tuladhar, Shrestha, & Shrestha, 2008). The annual expansion rate of urban areas in Nepal is 6.6% which is one of the highest rates in Asia and the Pacific regions (Thapa & Murayama, 2010, 2012). About 15% of the population of Nepal live in an urban area (Thapa et al., 2008; Tuladhar et al., 2008). Kathmandu valley is considered as the most urbanized area of Nepal (Narain et al., 2013; Shrestha et al., 2013). Over the last decade the population of the Kathmandu Valley has increased by 61.30% and the residential area has extended from 3,330 ha to 16,472 ha (Shrestha et al., 2013). Dixit and Upadhya (2005) pointed out that the land use pattern of Kathmandu Valley is rapidly changing due to urbanization. People started to migrate to Kathmandu Valley after the 1950s, at rates which further accelerated after 1992, largely because of the Maoist party movement in Nepal (Sada, Shukla, & Shrestha, 2012). The urban area has expanded outside the traditional core area to adjoining rural areas (Shrestha et al., 2013). This trend led to unprecedented land subdivision in the fringe areas for the construction of houses and other infrastructural facilities and services. Furthermore, suburban areas have been expanded to adjacent countryside without adhering to existing rules and regulations (Dixit & Upadhya, 2005; Pant, 2011).
The annual expansion rate of the residential area of the Valley to the peripheral rural territory increased from 4.78% in 1984 to 27.45% in 2006 (Thapa & Murayama, 2010). Conversion of rural agricultural lands to residential areas might affect the regional hydrological regime of the Kathmandu Valley by reducing the permeable area (Dixit & Upadhya, 2005; Shrestha, Pradhananga, & Pandey, 2012).

Administratively, Kathmandu Valley covers five urban areas: Kathmandu, Bhaktapur, Lalitpur, Kritipur and Madhyapur Thimi and 97 peri-urban and rural villages (Thapa & Murayama, 2012). From these, four areas have been chosen for this study: two urban areas, Bhaktapur Durbar Square and Madhyapur Thimi; and two peri-urban, areas Changunarayan and Jhaukhel (see section 3.4 for selection criteria). Bhaktapur Durbar Square and Changunarayan areas are listed as world heritage sites as mentioned in the previous section. The details of these study areas are presented in the chapter 4. Sections 1.3-1.6 give brief contexts about key aspects of stone spouts.

1.3 Brief Context of Stone Spouts

Stone spouts were the first hydraulic structure used in Nepal, mostly in Kathmandu Valley, to collect and distribute drinking water (Figure 1.1). Water was channelized for some distance from its source and many of the fonts of stone spouts are beautifully constructed with stone and metal crafts in the shape of a crocodile, snake or other animal with the water coming out of the mouth (Pathak, Hiratsuka, & Yamashiki, 2011; UN-Habitat, 2008).

Figure 1.1: Spout in Godabari area.
Stone spouts are found in different shapes and sizes but most are rectangular or square. They are located in a symmetrical manner and constructed to appear from a vertical wall (Pradhan, 1990). Mostly they are made of stone but inside the Royal Palace of Kathmandu, Lalitpur and Bhaktapur and a few in other public places, they have gold-plated stone spouts. Some places also have wooden spouts which are rare. Most stone spouts have one to three water conduits but some have four or five. There are rare stone spouts with more than five conduits (Godhabari Naudhara having nine, Balaju Bayisi Dhara having 22 and Muktinath Dhara having 108 conduits). Muktinath is far from the Kathmandu Valley and is a popular tourist destination (Pradhan, 1990; UN-Habitat, 2008).

Most stone spouts were built in Kathmandu (176), Lalitpur (61) and Bhaktapur (152) districts of Kathmandu Valley (Total 389), in the 5th to 7th centuries during the Lichhavi dynasties (Lukinbeal, n.d.; NGO Forum, 2005, 2009, 2010). More were added until 1829 (Becker-Ritterspach, 1990). The oldest existing stone spout is Mangaldhara of Lalitpur, and the most recent one is Sundhara built in Kathmandu (Becker-Ritterspach, 1990). Shallow aquifers and springs were used as a source of water for stone spouts (UN-Habitat, 2008). Aquifers of the stone spouts were recharged not only by precipitation but also by state canals (also called royal canals or raj kulo in local language) where water was conveyed from the foothills to artificial ponds and infiltrated from ponds to the spouts (UN-Habitat, 2008). State canals, ponds and other water networks were maintained in such a way that stone spouts could supply water with good quality and quantity throughout the year, 24 hours a day (Spodek, 2002; UN-Habitat, 2008). Dixit and Upadhya (2005) have shown that stone spouts are significant features of the Kathmandu Valley used to collect drinking water and as public washing and bathing spots by city dwellers. However, many stone spouts are drying out because of modern construction and the falling water table level of the groundwater of Kathmandu Valley. Out of the total of 389 stone spouts, 34 in Kathmandu, seven in Lalitpur and 29 in Bhaktapur are not working, and 34 in Kathmandu, four in Bhaktapur and seven in Lalitpur have already disappeared (NGO Forum, 2009, 2010). Forty one stone spouts in Bhaktapur and two in Kathmandu have been connected to the Nepali Water Supply Corporation (NWSC) pipeline (NGO Forum, 2009).

The NWSC is able to fulfil less than half of the water demand of city people (Changming, Jingjie, & Kendy, 2001; NGO Forum, 2009). Consequently, many people depend on different age-old
traditional water sources including stone spouts for their water needs. Stone spouts have even been suggested as one of the best alternatives for fulfilling the water needs of the people of Kathmandu, especially for the urban poor (Chapagain, Pandey, Shrestha, Nakamura, & Kazama, 2010; NGO Forum, 2009). Studies show that naturally functioning stone spouts are fulfilling water demands of 10% of the population of Kathmandu Valley (Khaniya, 2005; NGO Forum, 2009; Shrestha & Maharjan, 2016; UN-Habitat, 2008). However, stone spouts are drying out and disappearing, a feature attributed to rapid population growth, unplanned urban structure and haphazard construction of dug-wells along their sources (Spodek, 2002). Furthermore, the cultural linkage to stone spouts continues in Kathmandu Valley. Images of the Hindu and Buddhist gods/goddesses symbolize the religious merits of the stone spouts. There are water festivals such as Rato Matsyendranath and Sithi Nakha Festival, and on these days people worship the water god and clean the water sources including stone spouts (UN-Habitat, 2008).

1.4 Water Supply System to Stone Spouts

Water for the stone spouts is channelized from some distance away from springs or a shallow aquifer typically about 10 metres below the earth’s surface (Upadhya, 2009). Mud, stone, or wooden open pipes were used to transport this water to the outlet where it flows out as a result of gravity (Pradhan, 1990; UN-Habitat, 2008). These pipes are each about a half meter long and are connected together to make the desired length (Dixit & Upadhya, 2005; Upadhya, 2009). Joints are normally sealed with impermeable clay soil called Gathucha in the Newari language (UN-Habitat, 2008). The pipe is covered by two or three levels of brick on all sides. After this point water is collected into distribution vessels, or big earthen pots (called “Athah” in Newari language meaning “the washing pot made of burnt clay”) (UN-Habitat, 2008). These vessels are about one and half meters high and half a meter wide and are spaced at an interval of 5-10 metres meaning they function as a sedimentation basin. If the system is designed correctly and drainage holes are positioned at appropriate levels, clear water to the spout entrance can be guaranteed (Dixit & Upadhya, 2005; Pathak et al., 2011; UN-Habitat, 2008).

To further enhance water quality, filtering systems with various grades of sand, gravel and charcoal were built immediately behind water conduits. Some spouts are constructed as a chain at different levels. The lower level spouts get water drained off from higher level spouts where water filtered naturally due to sedimentation after flowing deliberately designed
distances in between (UN-Habitat, 2008). The side and bottom of the spouts are built using a layer of a particular grey or black soil and waterproof bricks. Unused water or run-off from activities such as clothes washing is normally discharged into agricultural lands or collected in a pond (UN-Habitat, 2008; Upadhya, 2009). This water can be used for different purposes such as cleaning vegetables and other agricultural products, duck and fish farming and sometimes for firefighting. Furthermore, these ponds also help to recharge ground water resources.

1.5 Cultural, Social and Environmental Importance of Stone Spouts in Nepal

The modern concept of drinking and domestic water emphasises the importance of quality and quantity and overlooks the ritual purification-aspects of water. Traditionally, Nepalese society had regarded flowing water as "pure" and "safe" for drinking and household purposes (Prasain, 2003). Water also has a multidimensional symbolism in Hinduism. Prasain (2003) explained that water is considered as one of the five primitive elements of the universe (along with the Ether, Earth, Air, and Fire). Water is also considered as a precious element because there is a traditional belief that as water washes dirt and mud it dissolves sin away. In most of the holy books of Hinduism, water is symbolized as an instrument of purification and expiation. A person would be clean after taking a ritual bath. As water is a purifying element, women should have a bath after delivering a baby and after four days following menstruation. People are also not allowed to enter a house without a bath after the cremation of a dead body. Having a shower is an essential part of Hindu and other rituals before performing any types of religious activities, cleaning sins, or to obtain religious merits (Prasain, 2003).

As noted the present day spout still provides a place for public bathing for a large number of people. Because of the groundwater source, its water is relatively warm in winter and cold in summer (Pradhan, 1990). There are still traditional professional watermen castes called Dhobis from the Newari group in Kathmandu Valley. They and another large number of people still use stone spouts for laundry purposes. Many types of religious functions also occur in association with stone spouts such as in Balaju, in Mathtirtha and in Godhabari Naudhara stone spouts (Pradhan, 2011; Pradhan, 1990). Some stone spouts have religious importance such as water from Mangal and Sundhara stone spouts of Lalitpur and Bhaktapur being used for the daily ritual worship of Krishna temple and Taleju temple of Kathmandu and Bhaktapur respectively (Pradhan, 2011). It is believed that some stone spouts have the capacity to heal, prevent and cure skin diseases, gout and sinosity. Most of the important images of Hindu and
Buddhist pantheons constructed in the walls of stone spouts symbolize the holiness and the shrine. There is also the faith that one can get religious merits equal to visiting all the most important holy places of Hindu and Buddhist religions and having a bath in a stone spout (Pradhan, 2011; Prasain, 2003; Spodek, 2002).

The main source of water for stone spouts is groundwater which is recharged by surface water and state canals (Upadhyya, 2009). State canals still exist in many places and were constructed in the medieval period by malla kings (Upadhyya, 2009). They are important not only for recharging the stone spouts but also maintaining the agri-ecosystem by irrigating cropland. Stone spouts also recharge groundwater. The native people of Kathmandu valley were quite aware of the need to maintain the water quality of those spouts. They formed a social group called guthi which had rules and regulations to maintain water quality. For example, people are still not allowed to wear shoes and are not allowed to use soap in the Alko stone spout of Lalitpur (UN-Habitat, 2008). They cleaned water sources including stone spouts annually during the Sithi Nakha festival in May. This practice still exists in some places of the valley where most residents are local (Prasain, 2003; Spodek, 2002; UN-Habitat, 2008). In summary, traditional stone spouts have their own cultural, social and environmental importance because of the several functions they have and continue to perform.

1.6 Conservation Issues of Stone Spouts

Due to the growing population, urbanization and modernization traditional stone spout management has become an issue today in Kathmandu Valley. Historically, local residents of Kathmandu Valley, called Newar, had responsibility for maintaining stone spouts (UN-Habitat, 2008, 2011). They formed a guthi (social group) who had established a community level trust fund mechanism to provide for the execution of the activities associated with the maintenance of traditional spouts. Guthi were responsible for conducting many cultural festivals in these traditional water spout areas with the aim of encouraging people to protect and conserve the water sources. This group was assigned specific social and religious obligations meaning they were responsible for looking after and maintaining specific shrines, public properties, and stone spouts (Prasain, 2003; Spodek, 2002). Today, significant management issues regarding stone spouts have arisen due to various reasons such as the breaking down of the responsibilities of guthi leading to unclear ownership and subsequent lack of funds. At the same time, the introduction of modern pipe line water supply systems
appear to have reduced the need for the traditional social institutions associated with water supply and management.

Because of the unique historical and cultural associations, UNESCO has listed the traditional water supply system of Kathmandu Valley in its cultural heritage list (Spodek, 2002). Many stone spouts are located in heritage and non-heritage sites in the Kathmandu Valley. Rapid urbanization and new development activities are also becoming a threat to the traditional stone spouts of the Kathmandu Valley. Notably, peri-urban areas are developing fully into urban areas. This development increases the demand for sand which necessitates mining. Groundwater recharge is affected by sand mining and the groundwater table is lowered thus drying traditional water sources (Sada, Shrestha, Karki, & Shukla, 2013). The World Heritage Committee recommended placing some areas of Kathmandu Valley on the list of ‘World Heritage in Danger’ in its 1999 report and also recommended the removal of some areas from the ‘World Heritage Monumental Zones’ due to the haphazard and uncontrolled development activities, urbanization and alterations of historic structures including ancient watering places such as those where there are stone spouts (Spodek, 2002). Modern development has encroached on the traditional infrastructure – the ponds, the canals, and the spout platforms, disrupting the flow of this traditional delivery mechanism.

In summary, stone spouts are known as a special identity of the civilization of Kathmandu Valley (UN-Habitat, 2008, 2014). They were introduced in the kirat dynasty and further expanded during the Lichchhavi and Malla dynasty. A modern piped water supply was first introduced in the Kathmandu valley in 1895. After the introduction of a piped water supply system, this traditional water system had been noticeably neglected in recent decades. This and other cultural and social issues have been described as the cause of the destruction and encroachment on state canals and other infrastructures of stone spouts that has been rapidly increasing in recent times (Khatiwada, Takizawa, Tran, & Inoue, 2002; Un-Habitat, 2011, 2014; UNW-DPC, 2008).

1.7 Research Gap and Significance of the Study

Modern pipe-line water supply systems provide drinking water to every corner of the Kathmandu Valley and thus ancient water heritages have been neglected at community and state levels (Khaniya, 2005). Earlier, state canals and storage ponds contributed to recharging
traditional wells and stone spouts (UN-Habitat, 2008). State canals were constructed to collect the natural spring water from Budhanilkantha, Bageshwori and Tika Bhairav and water was stored in the public ponds in cities for over 1500 years. Water collected in the ponds acted as an aquifer recharge to allow water to infiltrate into the ground and flow out from the stone spouts. In the past, the spout’s platform, the water intake, the water canals, the filtration system and reservoir were made in such a way that they provided the same quantity and quality of water year around. They were an excellent and complete system of sustainable water management. But those infrastructures have been encroached upon and damaged by modern development activities. Thus, there is significant impact upon underground water storage which is the only effective and constant source of water for stone water spouts (Khaniya, 2005; UN-Habitat, 2008). Traditionally, stone spouts were sustained and managed through local efforts and were important in rituals and festivals. For example, the Machchhendranath and Sithi Nakha festival are connected with the sustainable water system (UN-Habitat, 2008). Local people clean the water sources and water infrastructures on these occasions but nowadays these festivals are confined to private level celebration and are no longer effective as a means of water-related heritage.

Both urban and peri-urban areas of Kathmandu Valley have stone spouts. Due to the importance and status of urban and heritage areas, it was assumed that stone spouts might be in a better condition and managed more consistent to their heritage status in heritage as well as urban areas than in peri-urban non-heritage areas. Lessons learnt from urban and heritage areas could then be applied to peri urban and non-heritage areas. Likewise, many investigations have been completed to study the technical aspects (such as water quality and stone spouts quantity) in each district of Kathmandu Valley, by individuals in both the government and non-government sectors. But collective and comparative analysis of socio-cultural aspects of traditional stone spout management systems in urban and peri-urban areas of Kathmandu Valley has received little attention. Limited information is available in this regard even though socio-cultural norms, values and institutions play a vital role in the sustainable management of traditional water spouts. The renovation of the destroyed infrastructure of stone spouts alone is unlikely to be sufficient to manage the traditional spout. Values, customs and rituals are likely to/or are suggested to have an equally important role in this regard. So, this research explores the linkage between traditional knowledge, socio-
cultural beliefs, thoughts, norms and values and their relationship to management of stone spouts in heritage and non-heritage areas of Kathmandu Valley in order to inform opportunities for improved management.

1.8 Research Questions and Hypotheses

Based on the research gaps, this study has focused on answering the following questions:

a) What are the impacts of changes in social, cultural, institutional norms and values and how do they influence the stone spout management system?

b) How do modern pipe-line systems and other development activities affect traditional stone spout management systems in heritage and non-heritage areas?

c) What are the implications for local communities of the incremental and ongoing loss of traditional stone spout infrastructure in terms of sustainable management of remaining spouts and water supplies?

To address these issues, this research will be guided by a set of hypotheses, namely that:

- Stone spouts have an enduring value to ancient architecture and engineering in Kathmandu Valley.
- Stone spout management in heritage areas will be superior to non-heritage areas.
- Indigenous and traditional knowledge and socio-cultural practices, norms and values have been negatively impacted in both heritage and non-heritage sites.
- The “health”/state of stone spouts is an indicator of the socio-cultural cohesion of the community.
- Maintenance of traditional spouts depends on the attitudes and actions of metropolitan and sub-metropolitan decision makers in the Kathmandu Valley.

1.9 Research Objectives

Nepal is a logical site to carry out the proposed research because stone spouts are an integral part of the architectural, artistic, and social fabric of the Kathmandu Valley due to their evolution and continuous use during the last fifteen hundred years (Spodek, 2002). The specific objectives of the research consistent with the research questions and hypotheses are:
• To explore the nature of linkages between indigenous knowledge, socio-cultural norms and values and institutional effects in order to better understood and manage traditional stone spouts within heritage and non-heritage sites of urban and peri-urban areas of Kathmandu valley.

• To investigate the impact of the modern pipe-line water system and other development activities on the religious, socio-cultural and aesthetic importance of traditional spouts in both the aforementioned areas.

• To identify the opportunities and challenges involved in planning, conservation and management of traditional stone spouts.

1.10 Research Context and Researcher’s Background

In the western hill region of Nepal, the area where I was born and raised, we did not have water supply facilities at home, so we had to go to public water spouts to fetch water. Thus, many women spent their entire day time to fetch two pots of water for their household as they had to wait in queue for hours for their turn. Because I have first-hand experience of this type of provision of a vital commodity, I am aware of the social and environmental importance of natural resource infrastructure especially of water resources in the many parts of the country. Even after moving to the Nepalese capital, Kathmandu, my new home is located in close proximity to two water spouts. The water spouts close to my home had steady, ample water flow which enabled many people to procure their water from those ancient mechanisms even though modern water delivery methods were operating, as the spout water was considered tasty and natural with warm water flowing during winter and cold water flowing during summer. As the years passed a lot of infrastructure development took place resulting in one water spout completely drying out while the other site eventually only provided water during the monsoon season (for 3-4 months).

With the increase in private and personal water taps in houses due to modernisation of architectural styles, ancient water spouts sometimes dating from medieval times are regarded as less useful to the point of inconvenience. The neglect of communal water spouts has increased greatly. Stone water spouts situated in the Kathmandu valley have been slowly vanishing over the years. This is why this topic has been chosen for research with the aim of
identifying the values and drivers and whether they are or they are not consistent with an overall aim of preserving and conserving the spouts.

I have trained in natural sciences in Nepal and overseas and have gained knowledge, skills and experience in natural and applied sciences. After graduating in resources engineering and environmental management, I joined an international organization as a natural resource officer and provided technical inputs into the natural resource management process. I was managing and coordinating multi-disciplined development projects focused on natural resources in Nepal. This experience became fundamental in understanding Nepalese society and the usage of resources by different social and economic classes within the society. This has further helped me conceptualise resource management problems of this type. My study of the stone spouts water delivery mechanism of Kathmandu has increased my appreciation for social and cultural resources in general as well as sparking my interest in cultural and social issues. This study may be a good basis for further exploration of these issues, the completed artefact providing guidance to public and government officials for the conservation and management of water spouts.

1.11 Outline of the Thesis

This thesis is comprised of nine chapters. The first chapter contained the general introduction, an overview of world heritage sites and urban and peri-urban areas of Nepal especially Kathmandu Valley. It also has provided a brief context about stone spouts, their importance and key conservation issues; and it has included the research aims, hypotheses and research questions.

Chapter two identifies, links and proposes a meta-theoretical framework to address the research questions. The analytical framework of four different theories; common property theory, institutional theory, attachment theory and central place theory, and their linkages to community members and planners is explained in this chapter.

Chapter three describes the methodology used in this study. This chapter explains the selection criteria of study areas and methods adopted to collect and analyze data. A mixed method approach was used to gather the data from the field in order to achieve the research objectives, answer the research questions and analyse this research via the four theory lenses described in chapter two. Document analysis, direct field visits, face-to-face interviews and
focus group discussions were conducted in the field to gather the information relating to stone spouts. Because of the exploratory nature of the research and the ability for in-depth examining of subject matter, interviews were appropriate for the field study. Quantitative data were mainly collected from field observations, secondary sources, but some quantitative data were derived also from interviews.

Chapter four describes the four study areas. This chapter provides the in-depth information about the status of the study areas which are divided into heritage and non-heritage urban and peri-urban areas of Bhaktapur District.

Chapters five, six and seven present the empirical case study findings. Chapter five details quantitate data about the actual status of stone spouts and chapter six reports the findings generated from qualitative interview data. Chapter seven then explains the linkage of four different theories with the spout management system. Chapter eight then discusses the overall analysis of results presented in the two aforementioned chapters within the context of the theory lenses. This chapter also includes the implications of the research outcomes for ongoing management and practices.

Lastly, conclusions are derived from the comparative evaluation of status and the management systems of stone spouts of and are presented in chapter nine. This chapter also highlights some suggestions for future work.
Chapter 2  
A Meta-Theoretical Framework and Stone Spout Management 
Systems  

2.1 Introduction  
Theory is known as an attempt to model some aspects of the empirical world (Dubin, 1976; Wright & McMahan, 1992). Theories allow researchers to predict and understand the outcome of their research and also to explain the process or sequence of events (Lynham, 2000). Good theories may help to forecast what will happen with an assumed set of values for particular variables and also help to know why this prediction should affect the research (Lynham, 2000; Wright & McMahan, 1992). It may help to design research questions, guide the selection of relevant data and interpret that data (Reeves, Albert, Kuper, & Hodges, 2008). Social researchers apply theory to interpret the social world where socially constructed realities such as social institutions, values and norms and traditions may develop and change, influenced by context and time (Turnbull, 2002). According to Reeves et al. (2008), theories allow the complex and comprehensive conceptual understandings of societal things such as how societies work, how organizations function, and why people have certain ways of interaction. Theories provide different “lenses” to researchers for exploring complicated problems and social issues, focusing their attention on several aspects of the data and providing a framework within which to conduct their analysis. For instance, there are many ways to understand why a culture has formed in a certain way and many lenses can be used to highlight a problem, each may focus on a different aspect of it.  
The purpose of this chapter is to identify and apply key relevant theories to develop a theoretical framework that may help in examining traditional stone spout management systems of the Kathmandu Valley, Nepal. The main theoretical perspective for this study is the social constructionist approach. Other relevant theories, common property, institutional theory, attachment theory and central place are drawn on through a Social Constructionist framework. Exploring each of these theories and relationships under the Social Construction theory umbrella creates a framework for interpreting their inter-relationships and the roles
played by the stone spouts of the Kathmandu Valley, thus informing current and future policy directions. Korsgaard (2007, p. 10) argued that

*Social constructionism is basically about questioning the basic values and constitutive character of what we are investigating.*

Based on this approach, I will describe, analyse and link common property theory, institutional theory, attachment theory and central place theory to develop a meta-theory framework to guide the research (Figure 2.1). Contemporary researchers have typically combined common property and institutional theory in one theoretical lens. However, Agrawal (2001) argues that a focus on ‘commons’ relatively neglects the examination of the important aspects of resource management systems; users associations and external social, institutional and physical environments that effect the stability and the sustainable management of institutions at the local level. So, based on the recognition of many formal and informal institutions involved in managing spouts, it is important to analyse separately their characteristics, functions, roles, potentiality and mandate to govern the spouts.

Figure 2.1 Social Constructionist Meta-Theory Framework
Different researchers describe the concept of meta-theory in different ways. Meta-theory includes the use of different analytic strategies for making sense of a body of research by investigating the ways theories operate within it (Paterson & Canam, 2001). It tells the best way to get to a destination, like a good travel guide it provides the structure and direction of research questions that one asks (Abrams & Hogg, 2004). Meta-theories are examinations of different theories for determining the connection between the theoretical perspective which frames the methods, findings and conclusions of the research (Bondas & Hall, 2007). And meta-theory can be seen as an integration of various specific theories which conceptually and empirically map diverse aspects of the phenomenon under study (Anchin, 2008). It is the theory of theory for studying the underlying assumptions that shape particular theoretical perspectives (Craig, 2013; Wallis, 2010). According to Paterson and Canam (2001), meta-theory explores the theoretical frameworks or lenses as well as the theories that have come from the particular field of study providing the direction to researchers. In this context, Figure 2.1 shows the integration of four social theories and the social construction approach into a meta-theory which helps to understand the importance, role, and management of stone spouts to the local communities of the Kathmandu Valley. Three theories—common property, institutional and attachment are placed on the outer ring of the diagram reflecting the importance they have in perceptions of community identity in the case of stone spouts. Symbolically, central place theory is near the centre of the diagram and represents the importance that culturally significant objects have in local people forming attachments to places, geographical features and culturally iconic symbols such as stone spouts (Hargreaves, 2004). The following section explains social construction theory in brief with a focus on how it connects to the meta-theory framework and analytical lenses.

2.2 Social Construction Theory

In the social sciences, social constructionism has come to be known as one of the most important paradigms and has been widely applied in psychology, sociology and human sciences (Korsgaard, 2007). Social constructionism could be described as a perception which advances the belief that a human life subsists because of social and interpersonal influences. Thus it concentrates on exploring influences of society on individual and communal life rather than genetic inheritance. Thus, social constructionism focuses on the involvedness and interrelationship of the various aspects of people within their societies (Owen, 1995; Turnbull,
There are three basic characteristics of social constructionism: firstly it is argued that reality is socially constructed, secondly it focuses on the constructive force of language and finally it is a strategy of analysis in that people determine the objective reality of society through language, rendering it meaningful and thus being accepted by individuals (Berngartt, 2004; Boghossian, 2001, p. 4).


*Apart from the inherited and developmental aspects of humanity, social constructionism hypothesizes that all other aspects of humanity are created, maintained and destroyed in our interactions with others through time. The social practices of all life begin, are recreated in the present and eventually end.*

Social constructionism is a theoretical orientation that emphasizes the process and meaning of relationships between the individuals and their practice of construction of culture in a varying environment with historical time (Stead, 2004). According to Stead (2004), from a social constructionist viewpoint culture may be illustrated as a social actions, perceptions, meanings and social structure of communal symbols, which are commonly exchanged in the relationships of people with others. However, all people in a culture do not have equal access to all types of resources. Language is regarded as a basis for social interaction to understand the reality of a particular group (McFarlane, 2011).

Generally, the continuum of constructionist approaches ranges from realism to relativism (Järvensivu & Törnroos, 2010; Lincoln, Lynham, & Guba, 2011; McFarlane, 2011). Relativism is considered as a belief which considers everything including physical objects are social products or socially constructed (Hammersley & Atkinson, 2007). This concept implies that there are no objective truth criteria or standards. There are several truths for any set of facts. But Realism is regarded as the view that reality exists only in texts and interpretations of them (Berngartt, 2004; Hammersley & Atkinson, 2007; McFarlane, 2011). The continuum of ontological and epistemological world views, characterising realism and relativism, segments into four viewpoints. ‘Critical realism’ considers that only one, true reality exists but there are
limitations to knowing the truth accurately. The purpose of any research through employing this approach is to move closer to knowing the reality. The truth being in this case a matter of objective, empirical observation and a consensus within the scientific audience. The ‘naive relativist’, adhering to an extreme form of constructionism, believes that there are multiple perspectives to knowledge and truth. The study of knowledge and its creation process is the aim of research guided by this approach. Further, this approach advocates that all knowledge and truth claims are equally good. “Naïve realists” believe that there is only one true reality existing where it is possible to know exactly what that truth consists of. The purpose of research is to model reality through objective and empirical observations. Finally, “moderate constructionists” believe that there are multiple perspectives to knowledge and truth. The purpose of research through employing this approach is to generate new, usable knowledge through multiple views of the truth. The difference between this moderate approach and that of the naive relativist is that the former believes that the truth exists as dialogue, critique and consensus in different communities, usable knowledge as well as empirical evidence (Guba; Järvensivu & Törnroos, 2010; Lincoln et al., 2011). I have adopted moderate constructionism as an approach for studying the stone spout management systems of the Kathmandu Valley, Nepal. The key reason for adopting this approach is because moderate constructionism has the ability to better take into account the multiple constructed, community-bounded realities (Järvensivu & Törnroos, 2010). In addition under this approach, importance is provided to community knowledge creation. According to Järvensivu and Törnroos (2010) this moderate stance acknowledges the possibility of specific local, personal, and community forms of knowledge, but does not accept the positivist argument of a universal truth. It accepts truth as community–based and derivable from empirical data. The moderate constructionist model emphasizes a community-based, multifaceted conception of knowledge comprised of the interacting forms of truth which are generated and validated through critical dialogue and empirical evidence of various communities.

The contribution of a social constructionist approach has two benefits for the study of common property resource management. First, it clearly focuses on the construction of the common property resource users and their perceptions of “things” as resources and their external environment. This approach helps researchers to consider both the internal and contextual factors which influence the motivation of resource users for adopting particular strategies and creating institutional relationship with their resources, e.g., defining water
spouts as common property. Second, it puts aside the limitations associated with collective action (Pagdee, Kim, & Daugherty, 2006). This research is focussed on the construction of social institutions, institutional change and the influences of social values and norms, more specifically on the ability, rights to access, and the ways of interpreting the stone spout’s water delivery resources using a cultural perspective. Using an investigation meta-theory based on four particular streams of social constructionism, namely; institution, place attachment, common property rights and central place, it is argued that a social constructionist perspective helps to understand and illuminate some hitherto less investigated aspects of traditional management systems of the stone spouts in the Kathmandu Valley.

2.3 Lenses of Analysis

The proposed meta-theory (Figure 2.1) synthesizes four social theories, i.e., institutional theory, attachment theory, common property theory and central place theory, under the social construction umbrella explaining their linkages to each other as well as to the stone spouts of the Kathmandu Valley. The application of these theories is the main focus of the research rather than the theories themselves. Key theoretical issues relevant to the research are analysed here using different lenses.

2.3.1 Institutional theory lens

Institutions or groups are a basic unit to analyse society (McFarlane, 2011). The concept of an institution has developed from the early 1900s. Social scientists, economists and development professionals have defined institutions in many different ways. According to Walton (1921), institutions are settled habits of thought which are common to the generality of ‘man’. However, McFarlane (2011) and Vatn (2010) have explained that institutions are now more commonly defined as the conventions, norms and legal rules of a society that provide expectations, stability and meaning for human existence and coordination. Institutions help to normalise life, support values and protect and produce interests concerning resources in society. The traditional understanding of an institution is based on social construction theory which holds that individuals are socially created beings with choices reflecting prevailing norms, values and expectations and thus reflect the institutions that constitute a society. The role of institutions in society is proposed by theories derived from social constructionist perceptions of value formation, behaviour and choice (Vatn, 2005, 2007, 2009, 2010).
Institutional definitions emphasise the social construction process and it has been argued that social construction theory presumes that individuals cannot act rationally without institutional support (Gentle, 2014). Institutional settings based on social rationality have been suggested as suitable approaches for managing and evaluating environmental goods and services and especially important when they are considered as common property resources (Dietz, Ostrom, & Stern, 2003; Vatn, 2009).

In terms of social construction theory, institutions are humanly constructed formal and informal mechanisms which shape social and individual expectations, interactions, and behaviour. Ostrom (2007) explained institutions as a shared concept used by human beings in repetitive conditions governed by rules, norms and strategies. Institutions are different from organizations. Generally, they are more durable than organizations. Organizations are known as manifestations of institutions (Dovers & Hezri, 2010). The ground rules and standards regulating the behaviours of individuals and groups are established by institutions while organizations carry out their activities within the set of incentives and restrictions provided by institutions (Gentle, 2014).

The word ‘institution’ covers a broad range of social structures in different local and national levels including public, civic and private sectors. Public institutions comprise government agencies which have legal authority to enforce penalties or sanctions backed by state mandated powers of enforcement. Civic institutions are membership based or volunteer organisations which serve the common interest of their members, such as community based organisations or cooperatives which pool and mobilise resources, products, capital and labour. The designation ‘private institution’ covers both profit and non-profit based organisations, such as charities, trusts, foundations and market organisations (Agrawal & Perrin, 2009).

Ostrom (1994) established an Institutional Analysis and Development (IAD) framework for identifying and analysing interaction between the physical environment and sociocultural and institutional realms (Figure 2.2). Her IAD framework involves applying to a given structure a common set of research questions about the importance and connections of various factors in facilitating effective management of common property resources (Madison, Frischmann, & Strandburg, 2010). This framework is useful when processing information about the common property resources and their institutions (Ostrom, 1994). It helps to understand the user
communities, management systems, various property rights involved and the multiple levels of rules in use (Hess & Ostrom, 2005). It can be used to identify links among the features of a physical world with the relevant cultural settings, as well as the users, and the specific rules and regulations of society or local institutions that affect the incentives people face in specific situations. Finally, these evaluation criteria can be applied to identify patterns and outcomes, for instance the ‘sustainability’ of common property resources.

Figure 2.2: A framework for Institutional analysis (Hess & Ostrom, 2005)

Institutional rules are analysed at three different levels of choice possibilities, specifically operational, collective and constitutional (Kenney & Lord, 1999; Schlager & Ostrom, 1992). Operational choice is guided by operational rules that influence the decisions about where, when and how to utilize and manage resources. Rules are made and revised at higher levels such as legislatures, courts, committees and other agencies by using various strategies like bargaining, voting, litigating, or other interactive modes characteristic of this collective choice level. At the constitutional choice level, rules are only changed through constitutional process. Generally, rules made for local institutions are based on operational choices, but may be guided by collective choice rules and may also depend on constitutional choices (Gentle, 2014; Osborne & Rennie, 1999; Schlager & Ostrom, 1992). Schlager and Ostrom (1992) categorise institutional decision-making into a two tier hierarchy consisting of operational and collective-choice rights. The resource users at the operational level are known as authorised users and the most relevant rights at this level are access and withdrawal (Osborne & Rennie, 1999).
Most studies of ‘the commons’ have focused primarily on the importance of institutions in common property resources management. However they tend to overlook important aspects of resource systems, user groups and the external institutional, social and physical environment. These factors affect the institutional longevity and their long-lasting management at the local level (Agrawal, 2001; Cleaver, 2000). Thus, this institutional lens will look carefully at the pattern of user groups, generation of social, institutional and cultural values and norms, and how they evolve, change, shape and affect the institutions. Also examined is the durability of the institutions that are connected with the water usage and management of the stone spouts in Kathmandu Valley.

2.3.2 Common Property theory lens

Common property resources are known as resources that are available to the entire communities of a particular place with no individual having exclusive rights. Pasture lands, waste lands, forests, dumping sites, and rivers are some examples of common property resources (Beck & Nesmith, 2001). Political economists describe common property resources as: 1) government owned property, 2) properties owned by nobody, 3) the property used and protected by a user communities of resource and 4) any common-pool resource utilised by many people without involving any kind of property rights (Schlager & Ostrom, 1992). The terms right and rules are quite often used in the depiction of natural resources. Rights are explained as the product of rules and refer to the authorization of particular actions. Rules are the prescriptions that create the authorizations. So, the term property rights refers to the authority to undertake specific activities in relation to a specific area (Schlager & Ostrom, 1992). In terms of common property resources, Schlager and Ostrom (1992) explained two types of property rights; operational and collective-choice rights. The most appropriate operational-level property rights of common property resources are access and withdrawal rights of the particular resource. Access refers to the right to enter a defined physical property and withdrawal refers to the right to obtain or use the resource. Collective-choice rights include management, exclusion, and alienation. Users that have collective-choice rights may modify or create operational level rules. Similarly, a common property regime is characterised as a property right arrangement where a group of users share their rights and responsibilities towards a resource. Such procedures are more functional with socio-cultural support whereby the resource users are already accustomed to negotiate and cooperate with each other.
(McKean, 2000). Common property is about property rights where common property systems can include a social agreement to have open access and no restrictions. Common property resource boundaries are much more variable. They may be virtually non-existent and allow everybody to participate in the resource use. Alternatively they may be very strongly restrictive where common property rights are contingent on citizenship or on land ownership (McCay, 1997).

Gordon (1954) formulated the theory of common property resources for fisheries to explain the problems of Canadian fishermen which he related to low incomes and overfishing. Later, Hardin (1968) developed “The tragedy of the commons”, relating to grazing rights for a hypothetical village and extrapolated this theory to other common resources. Common pool resources are public goods and have potentiality for congestion, depletion and degradation (Ostrom, 2008; Wade, 1987). ‘The tragedy of the commons’ a seminal article, has provoked strong reactions in those interested in the field of common property resource management. Hardin (1968) stated that the over-exploitation of resources in a commons by individuals for their personal benefit is the main cause of environmental degradation. Hardin (1968) argued that governmental controls or regulations should be instituted. This action, or privatization of common property resources, are solutions to limit the freedom in the commons. However, Hardin (2007) explained that communal management of grazing is more successful and further justified his later elaboration using an example of success of communal land tenure arrangements of the Turkana people in Africa. Privatization and government control have been considered as the solutions to the tragedy of commons traditionally. However, community based management systems with effective governance rules could be a better solution to overcome the tragedy of the commons (Hardin, 2007; Ostrom, 1990).

Common property resource users may develop effective institutions for sustaining the use of common property resources (Agrawal & Benson, 2011). Local institutions are those institutions which exist and operate at the group, community and locality levels. These institutions can be sustained by regular face-to-face interactions within the communities and have the potentiality for collective action by mobilising the resources and joint problem solving. Positive outcomes are not always possible at individual and household levels (Agrawal & Benson, 2011). Several studies of common property resources have documented that users of local resources often develop institutional arrangements to manage and conserve the
common property resources, such as forests, water systems and fisheries. They play a
significant role in sharing the benefits from the commons in a sustainable and equitable way.
Without effective institutions, these common property resources can be under- or over-used
(Agrawal, 2001; Agrawal & Benson, 2011; Pretty & Ward, 2001). Institutions play a vital role
in managing and conserving the common property resources by influencing the transaction
costs of engagement through mobilisation of markets, common property organisations, as
well as facilitating the involvement in political actions (Bromley, 1982).

Communal management practices are common in traditional societies for managing common
property resources (Ruttan, 1998). Generally, traditional and indigenous communities have
developed social institutions to cope with harsh physical and biological environments in
different contexts that help them to regulate the consumption of common property resources
(Gentle, 2014; McKean, 2000). These communities establish institutional norms, values, rules,
and regulations to define their resource boundaries, user rights, resource allocation,
monitoring arrangements, and conflict resolution mechanisms, for the regulation,
conservation and management of resources (Gentle, 2014; Jones, Kriflik, & Zanko, 2005;
Ostrom, 2009). Local institutions have been found to be more successful and effective in the
management and conservation of common property resources such as forests and water
resources than governmental organizations (Agrawal & Benson, 2011; Hardin, 2007; Ostrom,
2009). Such arguments have been found valid for some resources in Nepal. For instance, Lam
(1999) conducted an assessment of 150 farmer and government managed irrigation systems
in Nepal. He used three performance measures for the analysis: physical conditions of the
irrigation systems; quantity of water available in different periods; and agriculture production.
His study showed that farmer-managed irrigation systems were performing better in all three
identified performance areas.

Ostrom (1990, p. 90) developed the following eight design principles as characteristics of
robust institutions that are supportive for their success to manage common property
resources in a sustainable way:

1. Clearly defined boundaries for individuals or households who have rights to withdraw
   resources from the common property resources;
2. Congruence between appropriation, access rules and local conditions;
3. Collective-choice arrangements for the resource regarding participation in the
decision-making process;
4. Accountable and effective monitoring and management system to the resource users;
5. Graduated sanctions for resource users for violating the locally developed rules and regulations;
6. Mechanisms for conflict resolution;
7. Self-determination: secured management rights of local users well recognised by external authorities; and
8. Organisation in the form of multiple layers of nested enterprises.

Worldwide, Ostrom’s design principles have been frequently applied to analyse common property resources. However, there are discussions around each principle at theoretical and operational levels. For instance, the first principle, “defined boundary”, is criticised as it is too rigid, and some say social or geographic boundaries need to be more flexible for making local arrangements more effective (Agrawal, 2001; Blaikie, 2006; Cleaver, 2000). The social mechanisms such as trust, legitimacy and transparency are the important aspects that make institutions more sustainable such as the marine fisheries in Indonesia (Harkes, Novaczek, Persoon, van Est, & Sajise, 2003). Likewise, many scholars have raised questions over the significance of external factors which are not addressed in the design principles. Questions have also been raised about the match between appropriation and equity in rules and practice for resource utilizations (Gentle, 2014).

Collective action is required to manage renewable resource systems like water and forests sustainably. Failure to overcome the problems of collective action leads to the degradation of such natural resources (Poteete & Ostrom, 2004). Ostrom (1990, 1994) illustrated that the effectiveness of collective action of institutions is guided by experience-based principles. Among the most notable of these key principles are that: smaller groups can work more successfully than larger groups; the chances of positive outcomes are higher if there is an equitable distribution of benefits among resource users; and, the introduction of alternative designs to institutions can help to overcome the failures of collective actions. But, there are different viewpoints around the relationship between group size and collective actions. For instance, Agrawal (2000) found that relatively large sized groups were more effective than smaller groups in undertaking effective monitoring and protection of the resources of nine forest councils in Kumaon, India. But there was no significant relationship between the user’s number and the performance of irrigation systems of Nepal. Many studies have shown that
cohesive and culturally similar communities could more readily foster agreement on institutional agreements and decrease the transaction costs for the usage and common property resources management (Adhikari & Lovett, 2006; Gentle, 2014; Lam, 1999; McGinnis & Ostrom, 1996; Schlager & Ostrom, 1992). However, studies of many temperate forests and institutions in Africa, Asia and Latin America show that heterogeneities do not have any material effect on the collective-action success. In fact, heterogeneity is a challenge which can be overcome by more effective institutional design with better rules (Poteete & Ostrom, 2004; Varughese & Ostrom, 2001).

Due to an absence or uncertainty over any form of property rights forests and water are the main areas in which common property theory has developed (Agrawal, 2007; Kerr, 2007). However, some authors use Ostrom’s design principles for governing the cultural heritage as ‘commons’ and preserving traditional knowledge (Buzio & Re, 2012). Based on Mijikenda culture and their relation with forests in Kenya, Buzio and Re (2012) claimed that the direct involvement of the local community represents the optimal solution for the management of cultural heritage. Institutions evolve as informal norms, rules and regulations in use and this may be difficult for outsiders to observe. Planners and legislators cannot decide when or how they should get involved for conserving the commons sustainably (Poteete & Ostrom, 2002). This common property lens focuses on cultural change, on informal local rules and regulations in addition to government policies affecting stone spout management practices. As well there is the topic of alteration of water usage in ways that support or intimidate the status of stone spouts. To summarise I hope to identify the conditions that favour or hinder the development and survival of institutions that are associated with sustainable water use and the preservation of stone spouts as cultural commons.

2.3.3 Attachment theory lens

Place attachment describes an affective connection between individuals and their important places that comprises various actors, social relationships, and places of changing scale (Hernández, Carmen Hidalgo, Salazar-Laplace, & Hess, 2007; Scannell & Gifford, 2010). Alternatively stated, it is a symbolic association with the place that is established by providing emotional values and common sense to a specific place (Abbas, Akbar, Nazgol, & Mohammad, 2013). Human geographers and environmental psychologists have observed the emotional attachment of people and their relations to places for decades and have observed the ways
that individuals associate meaning to place. They have recognised the relationships between places and the experiences of people that cultivate place-related attitudes, behaviours and feelings. However, according to Mazumdar and Mazumdar (1993) place attachment is not only the emotional and cognitive experience, it is a symbolic relationship established by providing culturally shared emotional meaning to a specific place. They categorised the attachment of people to sacred places into three categories. First, attachment to natural landscapes; second, attachment to sacred cities; and last, attachment to architecture (Figure 2.3). Attachment to the natural landscape includes the attachment of people to sacralised and revered natural elements such as rivers, lakes, trees and mountains. For example, Himalaya’s peaks have been revered as the abode of gods and ancestors and water has been used for ritual purification for those of the Hindu religion. Cities like Jerusalem are also considered as sacred because of their cumulative dedication to events, prayers, structures, and mythical heroes. These religious and cultural icons induce a strong sense of place belonging, history and identity. Mecca is also noteworthy as the sacred centre of the earth for Muslim people. Places of worship provide the religious identity for people in that they feel spiritually and spatially close to god and their fellow believers. People form attachments to their domestic residences to varying degrees. Rituals such as worshiping of spirits and ancestors contribute to the perceived sanctity of the family home (Mazumdar & Mazumdar, 1993; Scannell & Gifford, 2010). Material objects have an important role in social life because people depend on them for sustenance, shelter, safety, and entertainment as well as their utility as tools to accomplish tasks (Manzo & Perkins, 2006; Wallendorf & Arnould, 1988).

The thoughts, feelings, and beliefs of people about places influence their behaviours when considering participation in the local planning of such places. Several theories and models have been developed in psychology of environment and communities that examine emotional linkages of people with ‘place’ in relation to place attachment and identity. People’s relationships to place are critical determinants of their level of participation in the local community. Brown, Perkins, and Brown (2003) explained that place attachments and community sense play an important role in efforts for neighbourhood revitalisation. If neighbours are anonymous then people do not tend to stay long enough to establish any emotional relationship with them or the place (Abbas et al., 2013; Brown et al., 2003). Place attachment may arise both in individual and group levels. Personally important memories,
experiences, realizations, and milestones connect the individual to a place. Place attachment encompasses all of the symbolic place meanings that are shared among community members at the group level (Scannell & Gifford, 2010). This form of attachment is a long-term community settlement process whereby groups attach to areas wherein they practice and preserve their culture (Mazumdar & Mazumdar, 1993; Scannell & Gifford, 2010).

![Figure 2.3: A typology of sacred place attachment at both individual and group levels (Mazumdar & Mazumdar, 1993)](image)

Scannell and Gifford (2010) distinguish between the individually or collectively determined meanings of place. According to them, place attachment may happen at both individual and community levels. Individuals have a connection to the place because of their personal memories, experiences that develop and create meaning. Attachment comprises the symbolic meanings of a place that may be shared among the members of the group at the group level of attachment. This type of attachment can be seen in different cultures, genders, and religions in which groups attach to areas wherein they may practice, and thus preserve, their cultures. Culture links the members of the group to place through shared historical experiences, values, and symbols. Some place attachment can occur because of religion at both the individual and group level. Some places become spiritually significant for the person because of personal experiences. For instance, some people are personally attached with their home because of the memories of their ancestors and such homes become sacred for them (Mazumdar & Mazumdar, 1993; Scannell & Gifford, 2010). Physical, social and cultural factors
contribute to and enhance place attachment. Physical influences include facilities available, area status, and the setting or aspect of a place. Social influences may be networks and the social compatibility of the inhabitants. Cultural aspects which contribute to place attachment creation and enhancement are families, society and the occupation by groups with a similar cultural persuasion (Abbas et al., 2013).

Place identity is a dynamic phaenomenon that develops and transfers through existed practice and grows regarding to the physical context via beliefs, preferences, emotions, norms and values (Proshansky, Fabian, & Kaminoff, 1983). If identity and values of individuals are connected with the place, people will form a bond with those places and this bond may impact on their motivation for improving or maintaining the setting, react to alterations, or simply to place in that environment (Hernández et al., 2007; Hull IV, Lam, & Vigo, 1994). Mazumdar and Mazumdar (1993, p. 231) defined place identity as going:

> ...beyond ‘emotional attachment and belonging to particular places’. It is ‘a complex cognitive structure which is characterized by a host of attitudes, values, thoughts, beliefs, meanings and behaviour tendencies’.

Place identity connects place attributes to one’s self identity. In summary, place identity sense and attachments are identified as significant parts of human and environmental connections which influence the establishment of communities in entire of their social, physical, political, and economic aspects (Brown et al., 2003; Manzo & Perkins, 2006). Effective affections to places may motivate people to find, stay, preserve, and enhance places which may valuable to them. Subsequently, community sense and place identity and attachment may contribute for better understanding about neighbourhood spaces to motivate normal people for performing collective action to protect, conserve or enhance their communities as well as participating in gorund level planning procedures (Brown et al., 2003; Hull IV et al., 1994; Manzo & Perkins, 2006; Mazumdar & Mazumdar, 1993; Wallendorf & Arnould, 1988).

The majority of ‘place attachment’ literature has been focused almost exclusively either on ecological or landscape attributes or the sociocultural attributes as predictors of people’s attachments to places (Abbas et al., 2013; Inglis, Deery, & Whitelaw, 2008; Smith & Moore, 2012). However, according to Beckley (2003), people’s overall attachment to place is mixture of attachments of sociocultural attributes and the ecological attributes of the place. This
research illustrates whether both elements contribute importantly to the nature of attachment people have to the stone spouts. It is anticipated that by examining the available evidence through the ‘attachment’ lens a number of interesting questions on the topic are answered. These questions include; how is attachment generated? What are the influences on existing attachment? How can planners use ‘the attachment of people’ in planning in order to engender a sense of ownership of stone spouts? Some people have stronger attachment to places than others (Beckley, 2003; Inglis et al., 2008). So, therefore, people’s attachments to stone spouts increase or decrease according to positive and negative socio-cultural and physical dimensions associated with stone spouts. There may be profound differences between migrants and locals as to their attachment profiles in relation to stone spouts. Each is attached in different ways and for different reasons. I believe that I could make some contribution to the understanding of people’s attachments to stone spouts and their involvement with their reinstatement, preservation and ongoing management.

2.3.4 Central place theory lens

Central Place Theory, originally proposed in 1933 by German geographer Walter Christaller, explains the spatial arrangement, size, and number of settlements. According to Christaller (1933), a “Central Place” is a settlement that provides one or more services for the population living around it (Getis & Getis, 1966). This theory comprises two basic concepts; threshold and range of goods and services. Threshold deals with the minimum population which is required to bring about the provision of a certain range of goods and services, while on the other hand, it explains the average maximum distances people need to travel to obtain these goods and services (Getis & Getis, 1966). This theory may be applied to describe the spatial pattern of urbanization. Taylor, Hoyler, and Verbruggen (2010, p. 27) stated that:

“in central place theory centrality of the location is the basic building block upon which spaces of places are formally constructed.”

The central place hierarchy links the relationship between a central place, higher order place, and its tributary areas, lower order places (Getis & Getis, 1966). Central place theory assumes that the location of economic activities is a non-random occurrence and the highest order places deal the maximum diversity of goods and services (Daniels, 2007). But the central place theory hierarchical structure may not always explain the economic activities locations. Central place theory can also include other interfering factors such as globalization, technological
superiority, industry clusters, and geographic advantages like coastal ports, natural resource
distributions, and the uniqueness of the good or service (Daniels, 2007; Dennis, Marsland, &
individually and collectively by humans to the places they inhabit, to the concept of being a
visitor or entertaining visitors. A further connection is made between place attachment and
the contemporary concept of social sustainability.

Place is defined as a human location and includes social interactions in space and in time which
play a vital role in psychological and social well-being. Social science describes place as a
synonym of “community” which may embrace the cultural and emotional response to the
physical and ecological landscape (Rogers, 1983; Whittle, 1993). The physical place and a
culture have a dynamic relationship as they inform and create each other. Place is also
important for generating and reproducing cultural meanings. Individuals construct spaces,
places, landscapes, regions and environments (Whittle, 1993). The history and leftover
memories from the past can be kept within the concept of place. According to Whittle (1993,
p. 37):

“The cultural and historic meanings attached to those physical remains add to the
layers of meanings in place, just as the relics themselves add to the physical structure
of places, giving them a sense of continuity and permanence”.

Cultural heritage is an aspect of place which relates to the history and cultural identity of the
local society. The destruction of heritage damages the connection between past and present
which is an important feature of stability and meaning in places. So, it is important to keep
material cultural heritage if only to maintain a sense of place. Preserving physical heritage
means maintaining a ‘sense of place’; and places often contain relics from the past known as
‘heritage’ (Whittle, 1993). According to Scannell and Gifford (2010), a “sense of place” is a
universal affective tie of ancestry, emotional feelings and a desire to stay in the place that
fulfils fundamental human needs. The concept ‘sense of place’ considers the social and
geographical context of the locational bond such as aesthetics and a feeling of habitation (Hay,
1998).

Central place theory at its most basic level mainly focuses on the location of economic
activities, explaining why areas have to have a geologically uneven distribution of resources
and influences (Daniels, 2007; Jonasson & Niedomysl, 2010). However, as the theory has
become more studied and applied to different situations, more complex dynamics have evolved such as symbolic and social relations which create situations of uneven resource allocation (Jonasson & Niedomysl, 2010). Thus, the ‘central place theory’ lens in this research may be applied to describe the cultural, the social, or the economic value of water from stone spouts that impacts on the geographical centrality of the spouts in that particular community. This theory lens may also be useful to explain the user distribution for a spout and the real physical settings of the spouts that support the development of social norms, behaviours, rules and regulations associated with these community cultural features.

2.4 Summary
In conclusion, the proposed meta-theory will be useful to explore the patterns of interaction between the physical characteristics of the stone spouts; the spatial organization of these objects, the institutional framework for stone spout management systems; and the social characteristics of the user communities. Due to the unique social and cultural considerations of the Kathmandu Valley and stone spouts themselves, it is better to synthesise a meta-theory from the four source theories drawn on rather than directly using one theory. The meta-theory analytical framework, which also serves as an analytical lenses for the qualitative research to be undertaken, has been used to influence and develop the questions to be used for interviewing community members and planners (Appendix Two). It is sometimes useful to consider the different theories as contributors to analysis within the meta-theory because none of the four theories alone is adequate for this research. For example, Institutional theory is applied to focus on the effectiveness of collective action. Such initiatives depend on various factors such as; the robustness of local rules, and individual and group role functions to manage stone spouts. ‘Common property theory’, in particular, allows the communal systems of usage, management and ownership of stone spouts to be understood and related to ‘Institutional’ and ‘Attachment’ theories. Attachment theory helps understand the strength of affective ties of people to stone spouts with social meanings and beliefs. Central place theory is drawn on in exploring the sense of ‘rootedness’ or ‘centeredness’ of stone spouts and the real physical settings which support the development of the social norms, behaviours, rules and regulations that are associated with the spouts, and the institutional arrangements for managing them. Exploring each of these theories and relationship under the Social Construction theory umbrella creates a framework for interpreting their inter-relationship and
the roles played by the stone spouts of the Kathmandu Valley, thus informing current and future policy directions.
Chapter 3
Research Methodology and Methods

3.1 Introduction

This chapter presents the research methodology and research methods, used in this study. It begins with the research methodology and continues with details of the research framework and methods including study area selection criteria, respondent selection criteria, data collection and the analysis procedures to be applied at each stage of the study. An outline of the limitations of the research methods and the strategies applied to overcome such limitations is then presented. Finally, the chapter is summarised.

3.2 Research Methodology

Research methodology refers to a strategy of enquiry for guiding a set of procedures (Petty, Thomson, & Stew, 2012). Such procedures deal with the rationale, theoretical, political and philosophical backgrounds of any natural or social research. Methodology determines the particular methods with which to conduct any type of research (McGregor & Murnane, 2010; Petty et al., 2012). Methods are the techniques and procedures applied for sampling, data collection, analysis and results presentation (McGregor & Murnane, 2010). Research methodologies have a wider scope than the research methods. Research methodology explains the research methods and the logic behind the use of a particular method in the study (Kothari, 2011). Usually research methodology should answer the following questions:

“...why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why a particular technique of analysing data has been used and a host of similar other questions” (Kothari, 2011, p. 8).

Different scholars have classified research methodologies into various types. For example, according to Sarantakos (2005) qualitative, quantitative and mixed methodologies are the common methodologies for collecting research data. Similarly, Babbie (2010) and Scholz and
Tietje (2002) include case study as a research methodology, but Sarantakos (2005) considers case study as a field research design, not a methodology or method. Based on the data gathered from the field, the research employed in this thesis follows the mixed methodology classification suggested by Sarantakos (2005). This methodology combines both qualitative and quantitative methodologies which are described in the following paragraphs.

Qualitative research methodology is especially effective for describing complex phenomena (Johnson & Onwuegbuzie, 2004). People’s personal perspectives of phenomena can be better described and understood via a qualitative methodology (Johnson & Onwuegbuzie, 2004). Qualitative methodology is flexible as well as effective in conducting cross-case comparisons and analysis as well as identifying intangible factors like ethnicity, social norms and values and religion. Open-ended questions used in a qualitative research methodology are considered as more likely to yield responses that are meaningful and culturally salient, unanticipated and rich and explanatory in nature (Mack, Woodsong, MacQueen, Guest, & Namey, 2005). However, like other research methodologies, the qualitative approach has weaknesses (Babbie, 2007; Johnson & Onwuegbuzie, 2004; Petty et al., 2012; Sarantakos, 2005). Due to the descriptive nature of the data, the reliability and validity of data are considered as important limitations of qualitative research. In addition the researcher’s personal biases may also influence the results of the research (Johnson & Onwuegbuzie, 2004). To address these weaknesses triangulation is used because “it is typically a strategy (test) for improving the validity and reliability of research or evaluation of findings by combining methods” (Golafshani, 2003, p. 603).

Quantitative research methodologies contain data in numerical forms (Bryman, 2006; Mack et al., 2005; Neuman, 2005; Sarantakos, 2005). The hypotheses about the phenomena are tested by structured methods like questionnaires, surveys, and structured observation (Mack et al., 2005). “Closed-ended” question formats which are inflexible in nature are mostly used to acquire the information in this type of quantitative research. The strength of such inflexibility is that it provides a consistency in approach that allows the researcher to compare the response across respondents in a meaningful way (Mack et al., 2005). Respondents’ responses do not determine “why” and “how” questions which are likely to be asked by a researcher.
The selection of a methodology for research is determined by the research questions and theoretical perspectives used in the research (Gray, 2013; Marshall, 1996). Research methodology shapes the research questions and is considered as an integrated and systematic way to answer the research questions (Blessing & Chakrabarti, Springer Science and Business Media/2009; Kothari, 2011; Petty et al., 2012). As the main research question and theoretical perspective of this study concerns community and individual perspectives and their relationship with traditional stone spouts, it is therefore logical to use a qualitative social science research methodology to explore the inner experiences of the study participants. The focus is on discovery rather than testing variables. However, some quantitative data were derived from site visits, individual and focus group interviews (e.g. the number of functioning and non-functioning stone spouts, number of users, age and gender of users, and spatial and temporal changes of stone spouts). Other quantitative data, such as water discharge from stone spouts and date of spout construction, have been collected from secondary sources. Thus, my research followed a mixed methods approach that comprises the integration of qualitative and quantitative research methodologies. This mixed methods approach, as applied here, enabled a sufficient range of subjective and empirical data to be collected for analysis using the four theoretical lenses identified and discussed in Chapter two to address the research questions. Likewise, a mixed methods approach balances the potential weaknesses and holds the complementary strengths of both qualitative and quantitative methods (Bryman, 2006; Dörnyei, 2007; Gentle, 2014; Gray, 2013).

3.3 Research Framework

This section describes the direction of the study, conceptually, via a research framework. A research framework is a theoretical starting point that operates as the concept map for the research (Bhatta, 2008). This entire study is thus divided into three stages to answer the research questions identified in the previous chapter (Figure 3.1).
In the first stage, three research questions were developed regarding the impacts of changes in social, cultural, institutional norms and values and their influence on the stone spout management system. This stage also raised questions regarding the effect of modern pipeline systems and other development activities on the traditional stone spout management systems in heritage and non-heritage areas. The final question developed in this stage was a comparative analysis of spout management systems of four study areas based on four theory lenses.
concerned the implications of the incremental and ongoing loss of traditional stone spout infrastructure in terms of sustainable management of the remaining spouts and water supplies. Additionally, a meta-theory framework has been developed which synthesizes Institutional, Attachment, Central Place and Common Property theories to capture the linkages between indigenous knowledge, socio-cultural norms and values and institutional effects in order to better understand and ultimately inform future management of the traditional stone spout resource of the Kathmandu Valley. The literature review also encompassed identifying and finalizing the study areas.

The second stage identified and justified the mixed-methods approaches (qualitative, quantitative and document analysis) used to gather the data from the field in order to achieve the research objectives, answer the research questions, and analyse the results via the four theory lenses. The aim of using a mixed-methods research approach was to help in generalising the findings of the study by addressing ‘how’ and ‘why’ questions regarding the traditional stone spout management systems of the Kathmandu Valley. Semi-structured interviews were conducted with community members, planners and experts (face-to-face), and focus group discussions were held with community members to collect field data. Document analysis and direct visits to the study area were also classified as data sources. Qualitative data collected from the field were analysed using a text analysis method with the help of NVivo, while quantitative data were analysed via SPSS as discussed in section 3.6.

Stage three of the research involved comparing the stone spout management systems of four study areas based on the four theory lenses. As reported in chapter two, institutions and common property are treated as two separate theoretical lenses for this study because formal and informal institutional arrangements, changing with time, have significantly different roles on the property right regime of spouts. Individual case studies were studied followed by a cross case comparison in order to discover the impact of the modern pipe line water system and other development activities on the religious, socio-cultural and aesthetic importance of traditional spouts within heritage and non-heritage sites of urban and peri-urban areas of the principal study area; Bhaktapur district. After analysing the data, key findings were derived and presented in subsequent chapters. The analysis and discussion of the findings aided understanding of the shortcomings in the existing situations and management of the water
spouts of the study areas that lastly helped to formulate suggestions that might address the gaps for conserving remaining traditional spouts sustainably.

3.4 Selection Criteria for the Study Areas

The research design for this study was based on a comparison of spouts in both heritage and non-heritage areas and urban and peri-urban contexts (see chapter four). The following criteria were used to select the four study areas:

1) They must have stone spouts
2) They needed to have a diverse range of possible users and governance systems and
3) They needed to be logistically acceptable, i.e. easily accessed.

Kathmandu valley was chosen as the general study area as stone spouts were identified as one of a key part of the heritage in creating the World Heritage area (Maharjan, 2013). Additionally, this is the home area for the researcher and accommodation was not problematic (the fieldwork was conducted before the 2015 earthquakes), and aspects of dialect and culture were well understood. The valley also provided opportunities for assessing spouts in urban and peri-urban areas in close proximity to each other and both within and outside the heritage area, thus reducing the number of other variables (e.g., climate). From personal knowledge it was known that the area is ethnically diverse and contains migrant and non-migrant residents. The four particular study areas chosen lay within Bhaktapur district (Table 3.1).

Table 3.1 : The four study areas

<table>
<thead>
<tr>
<th>Urban</th>
<th>Peri-urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage area</td>
<td>Non-heritage area</td>
</tr>
<tr>
<td>Bhaktapur Durbar Square</td>
<td>Madhyapur Thimi (Bode and Nagadesh)</td>
</tr>
<tr>
<td>Heritage area</td>
<td>Non-heritage area</td>
</tr>
<tr>
<td>Changunarayan</td>
<td>Jhaukhel</td>
</tr>
</tbody>
</table>
3.5 Research Methods

This section details the techniques used for gathering empirical data for the study. Field data were collected in Nepal from mid-December 2014 to mid-March 2015. In keeping with the research methodology, this study has used four methods to collect data from the field:

1. Site visit
2. Face-to-face interview
3. Focus group discussions, and

3.5.1 Site visit

Researchers often begin their data collection in the field through site visits even though they use other techniques such as interviewing key informants, or analysing archival records to gather most empirical data (Millen, 2000; Singleton Jr, Straits, & Straits, 1993). This was the approach followed in this research as well.

A visual inspection of all research sites and natural settings of the research contexts including traditional spouts was completed. Time was spent walking off-road to visit the study areas which included nearly extinct ancient artefacts such as state canals, traditional mud and stone pipes (that previously carried water to stone spouts), and the submerged water distribution inlets inside the artificial pond after receiving water via the state canals (Appendix three). Some opportunistic (convenience sampling) face-to-face interviews were conducted with community members when they were collecting water from spouts during these initial site visits. These site visits gave new insights about the context of the study environments and spout users’ perspectives towards the stone spouts.

Different organizations such as the NGO Forum and the Government’s Archeology Department have maps and data relating to the general areas in which stone spouts can be found for the five municipalities of the Kathmandu Valley including Bhaktapur and Thimi municipalities, but no assessment or map of each individual site. Moreover, there are no existing maps and data of stone spouts available for the peri-urban areas of the Kathmandu Valley; not even for the peri-urban heritage area. Thus, to fill this void, locations were recorded using a Global Positioning System (GPS). The “Garmin eTrex 10” device was used to record and collate all GPS data relating to spouts. The degree of accuracy of this device
averaged within four meters for Jhaukhel and Changunarayan and 10 meters for the Bhaktapur and Thimi areas. “Arc Map 10” software was used to make Geographic Information System (GIS) maps of all spouts in the study areas by using GPS data (Appendices, 4, 5, 6 & 7).

The comparative condition of stone spouts was directly observed and field notes taken regarding the observed physical status of spouts. The field notes were also added to the GIS database. Items of interest were; how well the spouts were functioning, the state of the related infrastructure and descriptions of physical surroundings in the various research sites.

Data recorded during the site visits covered the following categories:

1) Water flow

Water flow of all visited spouts was recorded as: good flow, poor flow or no flow (Appendix eight). Data for this study was collected during the dry season, in this case winter. Thus, the category of water flow of the spouts was based on water flowing from the outlets at this time of year and does not represent the average or peak flow periods. If the spouts had a healthy flow and users were able to collect water within a very short period (about five minutes to a fill 20 litre container), this was accepted as “good” water flow. Likewise, spouts where consumers needed to wait longer (sometimes 2-3 hours to a fill 20 litre container) were categorized as having “poor” flow. Some spouts that were recorded as having a “poor” flow are known to flow better in the rainy season. The state of water in these spouts is therefore indicative of their state in a season when one might logically consider the flow was of most value to non-spiritual users. The spouts which were completely dried out for a period of at least two years in all seasons (confirmed in discussion with locals and officials) were recorded in the “no flow” category.

2) Physical status

In this study, physical status of the spouts comprised the related infrastructure and the spout water supply systems. This status of physical spout infrastructure was recorded using four different categories, namely; “encroached”, “pipe-line connection”, “modified” and “original” condition (Appendix nine). Many spouts and their related infrastructure were encroached upon or destroyed in terms of the users having lost substantial space (e.g., for performing festival functions). Modern pipe-lines were connected into spouts in some cases and many spouts were modified by constructing reservoir tanks near their outlets and delivering water...
into spouts by putting on-off systems in place. In some cases stone structures were also replaced by modern water taps. In this research, spouts were considered as “modified” when their infrastructure and water supply systems were totally changed, but the space for user activities was still largely available. However, some spouts were categorized as “pipe-line connection” where a modern pipe-line water system was connected at points which would otherwise have been dry spouts without modification of their main infrastructure. Some spouts were still in their original condition. However, most of the traditional pipes and sedimentation pots have been replaced by modern plastic or metal pipes and a piece of modern pipe was installed into their outlets. Given the minor nature of such changes and the dominance of the original form of the spouts, such spouts were recorded as “original” spouts.

3) Traditional management system of the spouts

The guthi, a social group of people in those areas inhabited by Newars, were assigned to look after the resources including stone spouts and their water networks. Initially, individuals, trusts (Gosthi), VDCs, religious organizations or government officials were the main bodies for maintaining and mobilizing resources. Different guthi were established for a variety of activities. Previously, two types of guthi were established for the purpose of conservation of resources and capital infrastructure after they had been constructed. One of these is Rajya guthi (state guthi), established by the state and the other is Duniya guthi (Public guthi) established by public bodies or initiators of the spouts (Khaniya, 2005). Initially, royal family members and their relatives constructed the ponds, temples and stone spouts and once that was completed this established an institution, a guthi, for their protection and conservation. Such guthis were considered as a Rajya guthi (Khaniya, 2005). Agricultural products came from certain designated cultivatable land allocated for each guthi and this production source became their primary means of income.

Many stone spouts in study areas Valley had guthi to protect, conserve and manage them. Guthi, or the stone spouts governance system, was established by the initiators of a stone spouts or by the state. However, many spouts without guthi were managed by local people. The manager of the stone spout guthi was tasked with performing an annual worship on the establishment day of each particular spout. Thus, the traditional management system of all visited spouts was recorded as; state guthi, local people or initiators of the spout.
3.5.2 Face-to-Face interviews

Amongst qualitative research techniques, interviews are considered an important source of evidence as they are targeted (focussed directly on the case study topic) and insightful (provide perceived causal inferences), although they can be constrained by poorly constructed questions, response bias, and imprecisions due to poor memory and lack of objectivity of the interviewees (Bhattarai, 2013). Standardised questions are not used in a qualitative interview; rather such a qualitative interview is guided by a set of topics to be discussed in depth (Babbie, 2010). The use of open-ended questions for collecting data provides an opportunity for participants to respond in their own words by answering “why” and “how” questions (Mack et al., 2005). Interviews can be classified into different format types, such as structured and unstructured interviews (Yin, 2013). If the script of the interview is prepared earlier and used in the survey it is denoted ‘structured’ and if an outline or a part of the script is prepared beforehand with a provision for flexibility, the interview is termed ‘unstructured’ or ‘semi-structured’ (Neuman, 2005). The conversation between an interviewer and a respondent in semi-structured interviews is guided by the set of questions or figures developed by the researcher prior to the interviews (Babbie, 2010).

Semi-structured, face-to-face interviews were carried out. A total of 96 research participants, from different ethnicities, castes, gender, social status and geographical locations, were interviewed. These included government and non-government officials, experts, and community members who had specialised knowledge, experience and interest in the research topic. Community participants were classified as local, migrant and temporary residential people. Students, seasonal workers and businesspeople who were living on a rental basis were categorised as “temporary residential” people. But the people who had moved permanently from other parts of the country and have their own houses were considered as “migrant people”. Similarly, planners and experts were also categorises as “local” and “other”. The number of planner/expert respondents differed based on the number of experts and individuals available and or present in each research area.

Face-to-face interviews were selected based on non-probability sampling techniques. Purposive/judgmental and ‘snowball’ sampling were undertaken to select the areas having stone spouts and respondents who are relevant (Sarantakos, 2005) from the research areas. In this approach sample units were chosen 'purposively' for the ability of people to provide
detailed information about subject matter. The selection criteria for the respondents included; role, responsibilities, knowledge, and expertise. Primary respondents comprising planners/experts were identified by key informants working for the Department of Archaeology and the sub-metropolitan office of Bhaktapur. These primary respondents then identified secondary respondents who, in turn, identified other respondents that could provide additional information. Also gathered in this ‘snowballing’ net of participants were people who were recommended by other respondents in the community as being particularly worthy of interview. Most participants were approached initially by telephone following their identification by municipality officials and social workers. Other participants were selected by convenience sampling when approached and interviewed while collecting water from stone spouts. Of the 96 participants 30 were convenience sampled (Appendix 11), 42 were identified by informants and 24 were experts/planners (Table 3.2).

Table 3.2: Participants in face-to-face interviews

<table>
<thead>
<tr>
<th>Study area</th>
<th>Community member</th>
<th>Experts/ Planners</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Identified by informants</td>
<td>Convenience sampling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Changunarayan</td>
<td>3</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Jhaukhel</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Bhaktapur Durbar Square</td>
<td>2</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Madhyapur Thimi</td>
<td>3</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total (N=96)</strong></td>
<td><strong>14</strong></td>
<td><strong>28</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

All interviews were conducted following formal oral consent from respondents after explaining the research aims and processes. Interviews ranged from 30-90 minutes based on the level of interest of the respondents, as well as flow and depth of information provided. Face-to-face interviews were carried out at the participants’ workplaces, residence, pasture lands and other suitable meeting places chosen by them. However, all those participants who were subject to convenience sampling interviews were given the opportunity as to whether or not to be interviewed at the spout or elsewhere. All chose the spout. All interviews were recorded with a digital recording device. Generally, two sets of semi-structured questionnaires were used to carry out the ‘face-to-face’ interviews with community members and with
planners and other experts respectively (Appendix two). All interviews were conducted in Nepali (Nepali language) by the researcher. People's narratives regarding the changing scenarios of the stone spout management systems were used to capture their lived experience regarding the pattern of traditional spout use in the research areas. According to the responses of interviewees on specific issues, further questions were asked to acquire more in-depth information. This form of interview helped to uncover the experiences of respondents regarding the issues they are currently being confronted with and served to encourage active participation by them. Semi-structured interviews allowed the researcher the flexibility to adjust questions in order to explore emerging issues while the interview progressed.

Eleven additional interviews with other experts and planners in the Kathmandu Valley were also done in order to triangulate the data. Those in this group were: chief of the Heritage Section of municipalities (Ministry of Federal Affairs and Local Development) of each of Kathmandu and Lalitpur districts, a stone spout conservation committee member of Lalitpur district, a NGO Forum Committee member, official from the Archaeology Department of the government of Nepal, Kathmandu Upatyaka Kanepani (KUKL) Board, UN-Habitat and Centre for Integrated Urban Development (CIUD) and three historians.

3.5.3 Focus group discussions

The focus group interview is a common strategy for qualitative research data collection in the social sciences (Gibbs, 1997; Punch, 2013). The number of participants in each group should vary between a maximum of fifteen and a minimum of four (Gibbs, 1997). The ideal number of participants for focus group discussion is between six and ten people (Gibbs, 1997). However, Krueger (2009) argued that four to six participants in a group are easier to recruit and host and also make a more comfortable atmosphere for participants. Focus groups with more than 10 participants are difficult to control and also limit each individual’s opportunity to share their insights and experiences. Conversely the drawback of a small number of participants in focus groups is that it restricts the total range of experiences on offer. This study followed Krueger’s (2009) approach that comprises four to six respondents in a group for focus group discussions.

The “group effect" or "synergy" is a strength of focus group discussions, where participants both query each other and clarify themselves to each other. This makes the discussion more
than the sum of separate individual interviews (Fern, 1982). According to Gibbs (1997), focus groups can be useful to explore the degree of consensus on a given topic. Focus groups are useful in investigating the linkages between indigenous knowledge, socio-cultural norms, and the subsequent institutional effects (Krueger, 2009). The focus group discussion method is helpful for understanding the attitudes, feelings and beliefs experienced and the reactions of participants to the subject matter, which would not be feasible through other methods such as observation and face-to-face interviews (Gibbs, 1997; Krueger, 2009; Patton, 2002; Punch, 2005). The attitudes, feelings and beliefs of individuals are more likely to be exposed through the social gathering and the interaction in a focus group. By comparison to individual interviews, focus group discussions facilitate a multiplication of the views and emotions of the participants.

Volunteer social workers in each research area identified the respondents for the focus group discussions. They were requested to find members of the “community” that would broadly be representative of the people likely to use stone spouts such as locals, migrants and temporary residential people. All focus group discussions were conducted at the community rest house of the particular research area (these are called “Pati” in Newari and the Nepalese language) or open spaces near to the actual stone spouts. Focus group discussions were organized either in the morning or afternoon based on the availability of participants and each discussion took one to two hours. Research aims and processes were explained and verbal consent was taken from participants before starting the discussions. The elite, educated and people from higher castes dominate the discussions in many focus groups (Kumar, 1987, 1989; Sarantakos, 2005). To minimize such elite domination in this research, all participants were encouraged to express their opinions freely and to listen and respect others’ views. During focus group discussions the participants were requested to discuss the issues relating to traditional spouts using the same question set developed for the face-to-face interviews. Furthermore, they were asked to express their views on the impact of development activities on religious, socio-cultural, and aesthetic themes. Seven group discussions with four to six respondents were completed in each of the four research areas giving a total of 28 focus group discussions. Altogether, 147 participants including 88 men and 59 women were involved in focus group discussions (Table 3.3). All discussions were facilitated by the researcher and audio recorded and transcribed for further analysis.
Table 3.3: Participants in focus group discussions

<table>
<thead>
<tr>
<th>Study area</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changunarayan</td>
<td>23</td>
<td>16</td>
<td>39</td>
</tr>
<tr>
<td>Jhaukhel</td>
<td>15</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Bhaktapur Durbar Square</td>
<td>24</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Madhyapur Thimi</td>
<td>26</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>88</strong></td>
<td><strong>59</strong></td>
<td><strong>147</strong></td>
</tr>
</tbody>
</table>

Normally, it was found that many women did not feel comfortable to speak with outsiders. Thus, total participation of male respondents was higher than female respondents in both face-to-face and focus group discussions. However, more female respondents were available for participation when convenience sampling was conducted.

3.5.4 Document analysis

Documents play a valuable and explicit role in data collection (Foster, 2010). According to Harris (2001), secondary data such as those obtainable from documents, are helpful in reducing the ‘social desirability’ response bias and the natural reluctance to respond to questions with a moral flavour. Where historical information is sought, secondary data generated at the same time as the events being investigated, will overcome many problems of recall. Secondary data allows the researcher to focus on the basic issues at the core of the study.

Document analysis was used in this research as a secondary source of information for gathering qualitative and quantitative data regarding the stone spouts of the Kathmandu Valley and also for triangulation of the data. This data was gathered by investigating published and unpublished documents, by visiting spout-related organizations, institutions, and experts and browsing relevant websites. Secondary data from documents provides insights into the status, problems and use potential of water from stone spouts in both heritage and non-heritage areas of Kathmandu Valley. These documents were classified into three categories; local, national and international. International level documents were retrieved from the internet. However, limited national and local level documents were available online. Consequently, most of the national and local database information were copied (free or purchased) with the permission of the concerned organizations during data collection.
Document analysis was used in this study as a research method especially to triangulate primary data collected from interviews and focus group discussions. Table 3.4 identifies the document sources and type of data reviewed in this study.

Table 3.4: Document sources and data collected for secondary data

<table>
<thead>
<tr>
<th>Data category</th>
<th>Data sources (Organizations)</th>
<th>Collected Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Level</td>
<td>- VDCs and municipalities</td>
<td>- Municipalities and VDCs’ policies, legislations</td>
</tr>
<tr>
<td></td>
<td>- Jana Jyoti Library of</td>
<td>- Annual reports and profiles of municipalities</td>
</tr>
<tr>
<td></td>
<td>Bhaktapur city</td>
<td>and VDCs</td>
</tr>
<tr>
<td></td>
<td>- Local researchers</td>
<td>- Local newspaper articles, reports on stone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spouts and water resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Research papers</td>
</tr>
<tr>
<td>National Level</td>
<td>- Archaeology Department</td>
<td>- Archaeology related legislations</td>
</tr>
<tr>
<td></td>
<td>of government of Nepal</td>
<td>- 17 Annual reports of Archaeology Department</td>
</tr>
<tr>
<td></td>
<td>- National Library of</td>
<td>of government of Nepal</td>
</tr>
<tr>
<td></td>
<td>Tribuwan university</td>
<td>- National level journals and databases</td>
</tr>
<tr>
<td></td>
<td>- Library of SchEMS</td>
<td>- Reports from NGO Forum, UN-habitat, Centre</td>
</tr>
<tr>
<td></td>
<td>collage</td>
<td>for Integrated Urban Development (CIUD)</td>
</tr>
<tr>
<td></td>
<td>- Library of Bhaktapur</td>
<td>- Newspaper articles on ground water</td>
</tr>
<tr>
<td></td>
<td>campus</td>
<td>resources and stone spouts</td>
</tr>
<tr>
<td></td>
<td>- CIUD, UN-habitat, and</td>
<td>- Research papers, theses</td>
</tr>
<tr>
<td></td>
<td>NGO Forum offices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Internet, Researchers</td>
<td></td>
</tr>
<tr>
<td>International Level</td>
<td>Internet</td>
<td>- Journal articles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- UNESCO world heritage reports</td>
</tr>
</tbody>
</table>

3.6 Questionnaire Design

The literature review identified a meta-theory framework for synthesizing Institutional, Attachment, Central Place and Common Property theories, as detailed in chapter two. Each theory was explored for this study through the focus group discussions and face-to-face interviews. Appendix two illustrates the connection between questionnaire composition and the theories studied.

3.7 Data Compilation and Analysis

There are four phases in qualitative data exploration which embody the data analysis process. They are: a) defining the analysis, b) classifying data, c) making connections between and
among categories of data and, d) conveying the message or write-up (Baptiste, 2001). The
discovery of patterns among the data is the main aim of data analysis (Babbie, 2010; Bhattarai,
2013). Yin (2013) also explains particular data analysis techniques such as pattern matching,
exploration building, time series analysis, and logic modelling as well as cross-case synthesis.

Data analysis in the context of this thesis makes sense of the large volume of information by
reducing voluminous text through coding and classifying into related concepts and ideas. In
this study, all recorded interviews were transcribed in Nepali then translated into English and
thereafter coded and classified using NVivo software. All the transcriptions were done by the
researcher and translations were undertaken by a master degree student of Western
Engineering Campus of Tribhuwan University, Nepal. Then, all the translations were compared
by the researcher with the transcriptions to ensure accuracy.

NVivo is a qualitative data analysis computer software package which helps to organize and
analyze non-numerical or unstructured data. NVivo 10.0 was used to record, store and
organize the transcribed data. Transcriptions of face-to-face interviews and focus group
discussions, field notes, photographs, and GPS location data of stone spouts were loaded into
NVivo 10.0. In addition, data from government and non-governmental organizations and
public documents from secondary sources were also uploaded. Following this the irrelevant
text (such as when sometimes participants talked about their personal problems or current
political issues not related to the research) were removed from uploaded transcriptions by
screening.

The data analysis process starts with a search for key themes via memos and coding (Lofland
& Lofland, 2006). The preliminary analysis included the arrangement of data into four major
themes (institutional, common property, central place and attachment) which were theory-
driven and meaningful. Then, the key themes were coded into the respective nodes while
carefully studying the materials which basically reflected the theoretical framework selected
for the study (Figure 3.2). In NVivo, each theme is known as a “node”. Then the clusters were
analysed according to the objectives of the research by using the content analysis method.

Content analysis involves analysing the written, verbal or visual communication message
(Cole, 1988). It analyses the documents by describing and quantifying phenomena. Through
this process, the researcher can filter the words into fewer content related and theoretical
issues to enhance the understanding of the data. It makes replicable and valid interpretations from data relevant to their context for providing knowledge and new insights.

Figure 3.2: Process of data analysis through NVivo software

Quantitative data such as numbers and water discharges of stone spouts collected from secondary sources and respondent ages and gender collected from face-to-face interviews and focus group discussions were categorized, coded and analysed using Statistical Package for the Social Sciences (SPSS) software (version 21). The next section describes the ethical issues faced in collecting field data. Where appropriate Chi-square tests were applied.

3.8 Ethical Considerations

This study involved collecting data from people in communities and governmental and non-governmental organizations. The well-being of the participants should always be considered before any attempt to answer the research questions whilst conducting research (Mack et al., 2005). According to Mack et al. (2005), there are some core principles of research ethics and these include: “respect for persons”, which includes the respect of the dignity of the respondents; “beneficence”, which associates the minimization of the risk of research and
maximization of the benefits accrued to the participants; “justice”, which involves the participation of people in the study who are anticipate to be benefiting from it; and “respect for communities” which describes having respect for the interests and values of the community under research.

The data required for this research was collected by face-to-face interviews with community members, planners and experts, as well as focus group discussions with community members. Therefore, the involvement of people willing to offer their opinions, experiences and suggestions falls under the scope of Human Ethics Committee (HEC) review for assuring the respondents rights are respected and sustained. HEC approval (Appendix 10) was therefore obtained by following the ethical considerations described by Mack et al. (2005) in accordance with the standards of the HEC. All participants were informed about the voluntary nature of the interview and briefed that they were free to share and express their opinions, or not to answer any question, or to withdraw from the interview at any time and any stage. Ethical considerations were also followed in the process to select the respondents. Any evidence or individual details gathered as a part of this research process were protected and regarded as confidential in the strictest sense. The identities of individual participants are not mentioned anywhere in this research to preserve their anonymity. The views of the communities and focus group discussions were recorded after getting consent from them. All participants were informed from the outset about the aim of the research and availability of the copies of the research after completion of the study. They were also informed that this study might be useful for future policy directions in terms of sustainable management of remaining spouts and water supplies.

3.9 Limitations of the Study

The availability, accessibility, and reliability of secondary information regarding data, facts and maps from governmental and non-governmental organisations remained one of the major limitations for this research. Most data had not been updated for some time. There were no data and maps indicating the location of individual spouts in urban heritage and non-heritage areas of the Kathmandu Valley. Likewise, there were no data available about the spouts of peri-urban areas. So, all the stone spouts of the study area were recorded in GPS and located in GIS map using ArcMap software (version 10). During the analysis, data were transcribed in Nepali then translated into English. There are some words in Newari as well as in Nepali that
cannot be exactly translated into the English language. However, such words are elaborated in sentences for better understanding and to make the concept meaningful. This may constitute a limitation in procurement of the exact interpretation of the respondents’ views.

3.10 Summary

This research is based on a set of research questions which connects to four main theories. In order to properly evaluate those research questions, a mixed-methods approach is used. Field data were collected mainly using interviews and focus group discussions. To improve the validity and consistency of the data, other data sources like the site visits and document analysis were used for triangulation purposes. NVivo 10.0, a computer aided data analysis programme, was used for qualitative data analysis, specifically the text analysis methods. Quantitative data were analysed using SPSS computer software and study areas were mapped by using ArcMap software. The next chapter describes the four research areas.
Chapter 4
Study Area

4.1 Introduction
The preceding chapter set out criteria to select case studies to explore the role and management of stone spouts in Nepal. This chapter details the reasons for selecting Nepal, the Kathmandu Valley and the specific areas within the valley as research areas. Following this a description of existing legal provisions and institutions for conserving the Cultural Heritage Sites in Nepal is presented. The final part of the chapter deals with the details of the study areas.

4.2 Selection of Nepal
History shows that water has been connected with the life style and culture of citizens of Nepal (Shrestha & Shrestha, 2009). Initially, people used water directly from rivers or streams to fulfil their daily needs (Maharjan, 2014). The first water-related infrastructures, such as ponds, canals and stone spouts, were built in the Lichhavi period and they were continued until the Malla and Shah dynasties (Upadhya, 2009). The construction and utilization of water conduits fulfilled the basic needs of societies of that time. There was an interdependent relationship between the water sources or water stone spouts and local people or societies (Spodek, 2002; UN-Habitat, 2014). The Shah and Rana dynasties saw some renovation of the water sources and water stone spouts. They are notably an example of the technical and engineering skills of the ancient people of Nepal. However, the development of new water supply technologies has brought further traditional construction of such spouts to a standstill. Traditional stone spouts of Nepal have their own cultural, social and environmental importance because of the functions they have and continue to perform. So, it is important to conserve the existing spouts by maintaining and encouraging their optimum utilization (Thanju, 2012; UN-Habitat, 2014). Nepal has been selected as a research area to explore the linkage between traditional knowledge, socio-cultural beliefs, thoughts, norms and values and their relationship to management of stone spouts in heritage and non-heritage areas. Compared with the rest of Nepal, water stone spouts were more prolific in use in the medieval period and presently in
the Kathmandu Valley of Nepal than in the rest of the country, thus providing a logical focus for the research.

4.3 Kathmandu Valley

Kathmandu Valley was the original Nepal. Later, this name was extended to describe the whole country (UN-Habitat, 2008, 2011, 2014). The Valley was historically the main gateway of Indo-Tibet trade (UN-Habitat, 2011). It is surrounded by the Mahabharat hills and covers 656 km² land area (Dixit & Upadhya, 2005). This area features three major cities: Kathmandu, Bhaktapur and Lalitpur (also called Patan). The Valley contains the entire area of the Bhaktapur district, 85% of the Kathmandu district and 50% of the Lalitpur district (Pant & Dangol, 2009). These three cities of the Kathmandu Valley are located very close to each other. Lalitpur (Patan) is situated only five kilometres southeast from Kathmandu and similarly Bhaktapur lies 12 kilometres east from Kathmandu (Figure 4.1).

There are many examples of brilliant architectural craftsmanship in Kathmandu Valley including historic palaces, buildings, shrines and temples. These signify that the valley retains outstanding heritage value (Maharjan, 2013). UNESCO listed Kathmandu Valley in 1979 in its ‘Cultural World Heritage list’ with seven monument zones. These zones are: Kathmandu Durbar Square, Patan Durbar Square, Bhaktapur Durbar Square, Boudhanath, Swoyambhu Mahachaitya, Changunarayan and Pashupatinath. This cluster of traditional rest houses, open spaces, urban landscape and other structures like stone waterspouts, and open platforms has made the valley a unique heritage site (Amatya, 2007; Maharjan, 2013; Poudel, 2011).

Urban and rural inhabitants live in the Kathmandu Valley. Agriculture is the primary source of livelihood for the rural people and some urban people (Dixit & Upadhya, 2005; Pant & Dangol, 2009). The densely populated core area of Kathmandu Valley contains 2.51 million population (Central Bureau of Statistics, 2014).
Geological evidence proved that Kathmandu Valley itself was once a lake (Dixit & Upadhya, 2005). Thus, it has a relatively productive aquifer due to fertile sediments from the Lake. The upper unconfined layer of the aquifer provides replenishment for many local shallow wells in Kathmandu Valley as the primary source of water (Dixit & Upadhya, 2005; Haack & Rafter, 2006; Pant, 2011). Primarily, the original inhabitants of Kathmandu Valley (Newars) have
depended on two water sources: *hiti* (stone water spouts at manmade depressions) and *tun*, (springs, dug wells, ponds and water holes) to fulfil their water needs (Shrestha et al., 2012; UN-Habitat, 2008). These traditional water sources are recharged by local aquifers. This basic system was functioning very well until a few decades ago (Shrestha et al., 2012). Modern piped water systems were introduced and expanded in these cities as well as the rest of the country in the late 1800s through public stand taps and private water connections (Shrestha et al., 2012). Gradually, population growth, economic activity, people’s expectations and modern lifestyle have increased the water demand in Kathmandu Valley putting pressure on both surface and ground water resources (Pant & Dangol, 2009; Shrestha et al., 2012; Spodek, 2002; UN-Habitat, 2014).

In summary, stone spouts are known as a special component of the identity of the civilization of Kathmandu Valley (UN-Habitat, 2014). Thus, Kathmandu Valley is the chosen as a study area.

### 4.4 Existing Legal Provisions for Conserving the Cultural Heritage Sites in Nepal

Cultural heritage areas of Nepal have been subject to conservation measures by communities and the state since medieval times, i.e., since the *Malla* regime (Bhatta, 2008). People who built temples, rest houses, stone spouts or any kinds of religious structure were allocated certain land or cash for the maintenance of the infrastructures they had established (Quigley, Gutschow, & Michaels, 1987). This practice was acknowledged as a form of *guthi*. *Guthi* are also established for performing socio-cultural, socio-educational and religious activities either by public institutions or by the private sector (Quigley et al., 1987). In addition *guthi*, *Mallas* also established *Chen Bhadel Adda*, an office, for preserving and restoring the cultural and religious sites which was active until 1952 (Pokharel, 1997). The maintenance and renovation activities were substantially handled by *guthi* and *Chen Bhadel Adda* after the devastating damage of an earthquake in 1934 (Bhatta, 2008). The Department of Archaeology (DoA) was established as an official governmental body in 1953 for conservation, maintenance and the renovation of the cultural heritage monuments in Nepal.

1999 are the legal provisions for conserving cultural heritage including the world heritage areas of Nepal (Bhatta, 2008; Nepal, 2015). Among these acts, the Pasupati Area Development Trust Act 1987 and the Lumbini Development Trust Act 1984 are site specific acts which are only for the Pasupati and Linbini areas. Likewise, the interim Constitution of Nepal 2007 and the Five Year Nation Plans also emphasize the promotion of the cultural heritage areas of Nepal. The following sections explain aspects of the legislation for conservation of cultural heritage areas of Nepal including the Kathmandu Valley.

4.4.1 Five Year National Plans

Beginning in 1975, five year national plans have allocated portions of the national budget for conserving the cultural heritage areas of Nepal (Bhatta, 2008). The Department of Archaeology (DoA) is responsible for conservation works of heritage areas based on the budget assigned in the subsequent Five Year National Plans (National Planning Commission, 2015). These Five Year National Plans focus on conservation and protection of existing and proposed historical, cultural, intellectual, religious and archaeological heritage sites and also emphasize promoting them as tourist destinations (Bhatta, 2008). Employment through tourism in the heritage areas sustained in preserving them is also highlighted in these five year plans.

4.4.2 Ancient Monument Preservation Act (AMPA) 1956

The Ancient Monument Preservation Act (AMPA) was enacted in 1956 and has been amended five times up to 1996. Under this Act, all the infrastructures including temples, houses, religious shrines and stone spouts deemed as having historical, artistic and architectural values which have been built more than a hundred years ago are considered as ancient monuments. Based on this Act, the Department of Archaeology (DoA) has an authority to declare any areas that encompass historical, artistic and architectural values as “Preserved Monument Areas”. Approval should be sought from DoA before commencing any construction activities in such areas. The ancient monuments are classified into two groups based on their ownership. One is private owned and the other is public owned ancient monuments. Likewise, in terms of importance, they are placed into three categories; international, national and local ancient monuments. All public monuments are protected by DoA but private owners have responsibility to look after their private monuments. However, if the private ancient monuments are deemed to have national or international importance,
owners are not allowed to carry out any construction type activities without the permission of DoA.

4.4.3 Trust (Guthi) Corporation Act, 1964

All trusts (guthi) established by any donor in cash or in kind or any properties that create income for the purpose of religious or philanthropic activities are governed through this Act (Sinha & Malla, 2004). The Guthi Cooperation Act, 1964 is the main act providing for the conservation and management associated with all cultural and religious activities including festivals in Nepal (Bhatta, 2008; Maharjan, 2013; Sinha & Malla, 2004). According to the Guthi Corporation Act, 1964, Guthi is defined as:

"Guthi" means and includes a Guthi (trust) endowed by any philanthropist through relinquishment of his or her title to a movable or immovable property or any other income-yielding property or fund for the operation of any shrine (matha) or festival, worship or feast of any God, Goddess or for the construction, operation or maintenance of any temple, shrine (devasthal), rest house (dharmashala), shelter (pati), inn (pauwa), well, tank, road, bridge, pasture, garden, forest, library, school, reading hall, dispensary, treatment facility, house, building or institution for any religious or philanthropic purpose”.

Trusts (guthi) are classified as royal guthi (state guthi, raj guthi), exempt trust (Chhut guthi) and private trust (niji guthi) (Sinha & Malla, 2004). This Guthi Corporation Act, 1964 has many provisions to manage the various guthi land and cultural properties.

4.4.4 Local Administration Act 1971

The protection of public and government properties is the main focus of this Act. This act provides an authority to the Chief District Office (CDO) to keep records, protect and maintain all public infrastructures such as ponds, springs, water spouts and religious rest houses that fall under the administrative boundary of a district (Bhatta, 2008).

4.4.5 Local Self Governance Act 1999

The Act provides the right to the municipalities and Village Development Committees (VDCs) to conserve and manage, preserving both tangible and intangible heritage effects which are located within their administrative boundaries. The municipalities and VDCs can plan and
manage their heritage areas by enforcing their own criteria. However, this Act neither suggests any formal duties to the municipalities or VDCs nor specifies any management or monitoring mechanisms (Bhatta, 2008).

4.4.6 Interim Constitution of Nepal 2007

The fundamental rights of different castes and ethnic groups regarding their education and culture were acknowledged by the Interim Constitution of Nepal, 2007 (Bhatta, 2008). Article 17 of the Constitution specified certain cultural rights of people. Additionally, the Constitution states that the government will undertake activities to promote and protect the traditional cultures as a fundamental right of citizens (Bhatta, 2008; Government of Nepal, 2000).

4.5 Institutions related to Conservation of the Cultural Heritage of Nepal

Many national, international, government and non-government organizations play a vital role in conservation, management, and promotion of cultural heritage at a local and a national level in Nepal. Some international organizations such as UNESCO and UNDP have a significant role in the conservation and development activities in Nepal’s heritage areas. However, most international organizations direct their focus on the World Heritage areas as well as a few monuments (Government of Nepal, 2000). The most important institutions involved in conservation of Nepal’s cultural heritage are presented below:

4.5.1 Government organizations

The Ministry of Culture, Tourism and Civil Aviation (MOCTCA) is the main government body involved in preparing and implementing policy, legislation and programmes to conserve and manage Nepal’s heritage sites. Similarly, other ministries such as the Ministry of Local Development, the Ministry of Land Reform and Management and the Ministry of Physical Planning and Works also have responsibility for conservation and management of cultural heritage. The Department of Archaeology, Guthi Corporation, Municipalities and VDCs, the Department of Urban Development and Building Construction and the Kathmandu Valley Town Development Committee are pivotal government organizations which participate in the conservation of cultural heritage in Nepal. The following sections describe each briefly.
**Department of Archaeology (DoA)**

The Department of Archaeology (DoA) is a prominent government institution which is directly involved in the conservation and management of cultural heritage in Nepal (Nepal, 2015). DoA has a responsibility to pronounce, preserve and maintain the ancient monuments. Likewise, it has responsibilities of recording and mapping existing monuments, preparing building bye laws, and management plans for all existing monument areas (Bhatta, 2008; Nepal, 2015). DoA also has an authority to take necessary actions in cases of unauthorized activity in the heritage areas and monument zones.

**Municipalities and Village Development Committees (VDCs)**

All municipalities and Village Development Committees (VDCs) perform the duties in their areas under the Local Self Governance Act 1999. They are the elected local government bodies and have the responsibility to oversee the overall development activities and issues regarding heritage areas within their administrative boundaries. They have authority to control any unauthorized construction or encroachment to public properties. Regarding the Ancient Monument Zones within their administrative boundaries, the municipalities and VDCs are accountable to ascertain whether activities are conducted according to the plan which was initially approved by the DoA (Bhatta, 2008).

**Nepal Guthi Corporation**

It is believed that guthi system originated in the 7th century in Nepal (Bhatta, 2008). According to Bhatta (2008), about 4000 different types of public and private guthi still exist in Nepal. A distinct Guthi Corporation was established under the Ministry of Land Reform and Management in 1972. The main aim of this corporation is to place the state trusts (Raj guthi) under control of this corporation so they could be operated in a systematic way (Sinha & Malla, 2004). The legislation used to establish this guthi was the Trust (Guthi) Corporation Act, 1964 for preserving historical, religious, and cultural activities (Bhatta, 2008; Maharjan, 2013; Sinha & Malla, 2004). Government centralised all guthi systems of Nepal under the Nepal Guthi Corporation including all guthis of stone spouts.
The Cultural Corporation

The Cultural Corporation was established in 1972 under the Communication Corporation Act. The aim of this corporation is to conduct awareness programmes such as dance or art exhibitions, and short and long term seminars in acting, dancing and music for promoting the cultural heritage of Nepal (Bhatta, 2008). This corporation also has responsibility for organizing festivals and cultural exchange programmes in Nepal, and abroad.

The Nepal National Commission for UNESCO

This Commission was established under the Ministry of Education and Sports. It is responsible for promoting Nepal’s culture through UNESCO to the world. It also has a responsibility to enhance the social, intellectual and economic status of Nepalese people through educational, scientific and cultural activities (Bhatta, 2008; UNESCO, n.d).

4.5.2 Community-based organisations

Many community-based organizations such as NGO Forum Nepal, Historical Stone Spouts and Source Conservation Association (HSSCA), and the Centre for Integrated Urban Development (CIUD) are also working to conserve the cultural heritage of Nepal, especially traditional stone spouts (UN-Habitat, 2008). However, these organizations have limitations such as financial, management and leadership abilities (Bhatta, 2008). Many local clubs and committees are also established by communities to look after the spouts at a local level.

4.5.3 International organizations

The United Nations Development Programme (UNDP), UNESCO, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the World Bank, and the Asian Development Bank (ADB) are examples of the major international organizations that are aiding conservation of cultural heritage in Nepal. However, most of their activities are focused in Kathmandu Valley. These organizations implement specific conservation activities in heritage areas, working via the government of Nepal. UNESCO is especially focused on the preservation and management of world heritage sites of Nepal (Bhatta, 2008).
4.6 Selection of Bhaktapur District as a Research Site

Bhaktapur District is the smallest district among the 75 districts of Nepal (Lamichhane, 2009). It covers 13,846 ha land area with 16 Village Development Committees (VDCs) and two municipalities (District Development Committee, 2011; Khaniya, 2005). Bhaktapur District is famous for its elegant temples, culture, colourful festivals, traditional dances and the typical Newar lifestyle (Khaniya, 2005). Additionally, Khaniya (2005) has drawn attention to particular places of the Bhaktapur District, namely: Durbar Square, Taumadhi Square, Changu Narayan, Suryavinayak and Nagarkot. There are 87 stone spouts, 220 dug-wells and 7207 modern pipelines with 185 public taps in the Bhaktapur sub metropolitan city area (Khaniya, 2005; NGO Forum, 2010). Initially, stone spouts and dug wells were the main water sources of people of Bhaktapur District. Nowadays, they depend on wells, stone spouts, tube wells and pipe-line water to fulfil their daily needs.

Out of the three districts of Kathmandu Valley, Bhaktapur is the only one which has heritage sites in both urban and peri-urban areas. It therefore provides an opportunity to compare both heritage and non-heritage areas of urban and peri-urban areas of Kathmandu Valley within the one administrative district. Similarly, the water sources of Bhaktapur District have similar attributes to those of Kathmandu and Lalitpur districts, so the findings may be relevant to other districts in Kathmandu Valley. This District has a board representation of caste, culture, migrants and indigenous nationalities such as Newars. Four areas, Madhypur Thimi (Nagadesh and Bode area), Bhaktapur Durbar Square, Changunarayan and Jhaukhel, of the Bhaktapur district were selected for this research based on a review of relevant literatures (e.g, journals, reports, documents) and consultation with the Department of Archaeology and the Bhaktapur sub-metropolitan office (Figure 4.2). The relatively small size of the District and proximity to my home base in Kathmandu facilitated field work (see chapter 3, section 3.4 for selection criteria of the study areas).
4.6.1 Bhaktapur Durbar Square area

Bhaktapur, the historic city, was founded in the 9th century (Khaniya, 2005; Lamichhane, 2009). Bhaktapur Durbar Square is a large and spacious conglomeration of stone art, metal art, wood carving, terracotta art and architectural show pieces. It lies in the Bhaktapur sub metropolitan city and covers an area of 6.88km² (Lamichhane, 2009). This city was the capital of Kathmandu Valley between the 12th and 15th centuries (Lamichhane, 2009). It contains some outstanding monuments and architectural masterpieces including Bhaktapur Durbar Square. Bhaktapur city is known as “city of culture”, “city of Devotees”, “Nepal’s cultural Gem” and “Nepal’s Living Heritage” because of its medieval, traditional and cultural identity that has remained unchanged despite modernisation and urbanization (Gautam, 2013, 2014; Khaniya, 2005; Lamichhane, 2009).

One hundred and seventy two temples, monasteries and mosques, 17 patis (public rest houses), 27 sattals (public inns), 19 maths (priest houses), 152 wells, 34 ponds, and 77 stone
water spouts are the main tourist attractions of Bhaktapur city (Karn & Harada, 2001; Lamichhane, 2009). Newar are the indigenous people of the city and they constitute more than 95% of inhabitants (Gautam, 2014).

Bhaktapur Durbar Square is 17km east of Kathmandu city and was listed in the UNESCO Cultural World Heritage list in 1979 (Neupane, K. C, & Pant, 2013). It includes three other squares: Dattatraya Square, Taumadi Square and Pottery Square that contains Buddhist monasteries, a palace, temples, pagoda temples, different sized and shaped ponds, rest houses, and artistically carved stone water spouts (Karn & Harada, 2001; Khaniya, 2005; Lamichhane, 2009; Neupane et al., 2013).

4.6.2 Madhyapur Thimi municipality

The Madhyapur Thimi municipality lies between Bhaktapur sub-metropolitan district on its east and Kathmandu on the west. Its location is about 9 km east from Kathmandu city and 5 km west from Bhaktapur city (Bhatta, 2008; Pant & Dangol, 2009). The land coverage is 11.47 km² and administratively it is divided into 17 wards encompassing 9551 households (NGO Forum, 2010). Madhyapur Thimi is known as “Pottery Town” and “living museum” because of its Newari culture, art, and architecture developed during the Malla and Lichhavi regimes (Bhatta, 2008). Newar are the indigenous and dominant population of the core area of Madhyapur Thimi but migrants are gradually increasing in its peripheral area (Bhatta, 2008; Vaida, 2000). Traditional stone spouts, dug wells and a pipe-line system are the main water sources of this area. There are 62 stone spouts, of which 47 are still working, six are included in the city supply line, and nine are not working in the municipality (NGO Forum, 2010; Pant & Dangol, 2009).

Nagadesh and Bode, the small traditional towns of the Madhyapur Thimi municipality were selected for this research. These areas were included in the Madhypur Thimi municipality in 1996 (Bhatta, 2008; Government of Nepal, 1998). Before that they were independent Village Development Committees (VDCs). There are indigenous Newar communities living inside the core area of Nagadesh and Bode towns and migrants living outside the core areas (Government of Nepal, 1998; Vaida, 2000). More than 90% of people are Newar in the Nagadesh and Bode core area (Government of Nepal, 1998; Vaida, 2000). These areas present as among the best areas to be selected as study areas in the Madhyapur Thimi municipality.
because most of the stone spouts are located in these areas. The *Nagadesh* and *Bode* areas are rich with heritage resources including rest houses, stupas, monuments, and stone spouts (Bhatta, 2008).

**4.6.3 Changunarayan area**

Changunarayan village is located in Changunarayan VDC of Bhaktapur District where the Changunarayan temple is situated. It is 22 km east from Kathmandu and only 6km north from the city of Bhaktapur (Pant & Dangol, 2009). It comprises 74% indigenous *Newar* community within the whole Changunarayan VDC. However, about 98% of households are *Newars* inside the heritage area (Government of Nepal, 2011). It is believed to be the most ancient monument in the whole Kathmandu valley and was built in the third century. It exhibits a number of significant artistic, religious, cultural, historical and archaeological qualities (Bhattarai & Pradhan, 2013). The temple displays more than 1600 years of Nepalese art history presenting some of the best examples of stone, wood and metal craft with ancient stone steps, spouts and ponds (Pant & Dangol, 2009; Riccardi Jr, 1989; Sharma, 1999). Changunarayan temple has been an equally sacred religious site for both Hindu and Buddhists since the very beginning of Nepal’s recorded history (Shrestha, 2015). According to Shrestha (2015), this is a unique temple where people from two different religions offer their reverences showing a rare tradition of religious tolerance and harmony of Hindu and Buddhists. *Newar* are the main inhabitants of the Changunarayan heritage area. “Changunarayan community forest” covers 47.2 ha of the total area of the Changunarayan heritage site. Initially, stone water spouts were the main source of water for Changunarayan village. However, some households have been connected recently to the Changu-Duwakot-Jhaukhel Drinking Water Supply System (CDJ DWSS), only using water from stone spouts for drinking and cooking purposes.

**4.6.4 Jhaukhel area**

The Jhaukhel Village Development Committee (VDC) covers an area of 5.41 km² and it is located 2km from in north from Bhaktapur city (Sada et al., 2013). The VDC is inhabited by 7721 people in 1631 households (Central Bureau of Statistics, 2012). The population has increased overall by 1.56% in the last decade (Sada et al., 2013). *Brahmin, Chhetri* and *Newar* are three major ethnic groups of the Jhaukhel VDC (Vaidya & Krettek, 2014) with 47% being *Newar* (Government of Nepal, 2013). Currently, CDJ DWSS, stands as the largest community drinking water supply, and has been in operation since 1998 to provide water to Jhaukhel VDC.
Groundwater is pumped from two infiltration galleries built near the bank of the Manohara River in Changunarayan VDC. Besides this system, people depend on other public as well as private groundwater sources such as dug well/tube well, springs, stone spouts and other sources (Sada et al., 2013). Forty two percent of households depend on the pipe-line water supply of the CDJ DWSS, followed by 30% dug well/tube well, 17% springs, 9% stone spouts and 2% from other sources for their domestic water (Shrestha et al., 2013). Twelve brick manufacturing industries have been operating in Jhaukhel VDC since 1990 (Shrestha et al., 2013). A large amount of ground water is consumed by industries themselves and by their large number of workers who live in the community to fulfil their water needs. Likewise, 18 mineral water companies are consuming water via deep boring. Table 4.1 summarizes the characteristics of the four study areas.

Table 4.1: Characteristics of the four study areas

<table>
<thead>
<tr>
<th>Research area</th>
<th>Characteristics of area</th>
</tr>
</thead>
</table>
| Bhaktapur Durbar Square (Urban heritage area) | - No migrants  
- 95% indigenous Newar community inside the heritage area  
- Many workers, students and business persons come from outside of Kathmandu Valley for temporary stay  
- People use both stone spouts and pipe-line water  
- Deep water boring in dug wells |
| Madhyapur Thimi (Nagadesh and Bode, urban non-heritage areas) | - 90% indigenous Newar communities live in core areas and migrants live in periphery  
- Few workers, students and business people from outside of Kathmandu Valley  
- Most people use pipe-line systems rather than stone spouts.  
- Deep boring in dug wells |
| Changunarayan (Peri-urban heritage area) | - 74% indigenous Newar community with a few other castes within whole VDC but 98% Newars inside heritage area  
- Few workers, and business people from outside of Kathmandu Valley  
- No migrants  
- Almost all people depend on stone spouts rather than pipe-line systems  
- Sand mining below the Changunarayan community forest area  
- 47.2 ha of heritage area is covered by Changunarayan Community forest |
| Jhaukhel (Peri-urban non-heritage area)  | - 47% local Newars  
- Limited migrants but many seasonal rental people  
- Few workers from outside of Kathmandu Valley  
- Almost all people depend on pipe-line systems rather than stone spouts  
- Many brick kilns inside this area  
- Deep boring by communities and commercial water seller |
4.7 Summary

Kathmandu Valley is a unique cultural site with a heritage identity recognized at national and international levels. The urbanization and expansion of built-up areas to the peripheral rural landscapes of the Kathmandu Valley initiated the formation of peri-urban areas. An urban heritage and a non-heritage and a peri-urban heritage and a non-heritage area of Bhaktapur District have been chosen for comparing stone spout management systems of Kathmandu Valley. The following chapter reports the physical status of stone spouts of the aforementioned four study areas.
Chapter 5
The State of Stone Spouts

5.1 Introduction
This chapter reports on the findings that reflect the general state of spouts in the four study areas. Each of the following sections presents results from the field visit, and from community member, planner and expert interviews. Additionally, document analysis and triangulation have been used to support the results where relevant. Section 5.2 describes the current status of spouts observed during the study area visits. The sections following after 5.2 describe the types and values of spouts and their governing systems as derived from interviews with community members, planners and experts and focus group discussions as well as from document analysis. Lastly, section 5.6 concludes this chapter.

5.2 Current Status of the Stone Spouts

Sixty nine water spouts were located in the study areas. Information about each of the stone spouts found inside the study area is given in Appendix 11. General location data about spouts visited in the study areas are presented in Table 5.1.

<table>
<thead>
<tr>
<th>Category of the area</th>
<th>Study area</th>
<th>Total Number</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Peri-urban</td>
<td>Urban</td>
</tr>
<tr>
<td>Heritage</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>47</td>
</tr>
</tbody>
</table>

The site visit data revealed the different states of the stone spouts in the study area. Based on their observed physical status the spouts are categorised into two main groupings, physical state and flow category (see chapter three, section 3.5.1). The following sections describe these categories.
5.2.1 Physical state of stone spouts

The physical state was categorised into four different groups, namely: original condition, pipe-line connection, modified and encroached (Table 5.2).

Table 5.2: Modification status of stone spouts

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Physical state of the spouts</th>
<th>Total spouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban</td>
<td></td>
<td>Original Condition</td>
<td>Pipe-line connection</td>
</tr>
<tr>
<td>Heritage</td>
<td>Changunarayan</td>
<td>7 (64%)</td>
<td>2 (18%)</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>Jhaukel</td>
<td>8 (73%)</td>
<td>0</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td>50 (72%)</td>
<td>8 (12%)</td>
</tr>
<tr>
<td>Heritage</td>
<td>Bhaktapur Durbar Square</td>
<td>16 (73%)</td>
<td>5 (23%)</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>Madhyapur Thimi</td>
<td>19 (76%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>57 (72%)</td>
<td>9 (12%)</td>
</tr>
</tbody>
</table>

The above table shows that most spouts are in their original condition and the remainder are approximately evenly distributed across the other categories. In the two non-heritage areas, 75% (27 of 36) of spouts are in original condition, while 53% (19 of 36) of those located in urban areas are in original condition. The modified spouts were exclusively in non-heritage areas but 21% (7 of 33) of those that had pipe-line connections are in heritage areas (although in each heritage area the majority of spouts were in original condition). However, in comparing heritage and non-heritage areas of the same urban type, the percentage of spouts in original condition is lower in heritage than in non-heritage areas (Figure 5.1).
5.2.2 Flow status of stone spouts

The flow status of spouts is classified into “good”, “poor” and “no” flow classes (chapter three, section 3.5.1). Of the 69 stone spouts in the study area, 24 had good water flow and 11 had poor flow. A further 34 water spouts were completely dry at the time of the field visit (Table 5.3).

Table 5.3: Flow status of stone spouts

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Flow Status of the spouts</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heritage</td>
<td>Changunarayan</td>
<td>Good flow: 5 (45%)</td>
<td>11 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor flow: 0</td>
<td>11 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No flow: 6 (55%)</td>
<td>11 (100%)</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>Jhaukhel</td>
<td>Good flow: 6 (55%)</td>
<td>11 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor flow: 0</td>
<td>11 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No flow: 5 (45%)</td>
<td>11 (100%)</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heritage</td>
<td>Bhaktapur Durbar Square</td>
<td>Good flow: 1 (5%)</td>
<td>22 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor flow: 4 (18%)</td>
<td>22 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No flow: 17 (77%)</td>
<td>22 (100%)</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>Madhyapur Thimi</td>
<td>Good flow: 12 (48%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor flow: 7 (28%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No flow: 6 (24%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>24 (35%)</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 (16%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>34 (49%)</td>
<td></td>
</tr>
</tbody>
</table>
Overall, spouts in heritage areas had significantly poorer flows (27/33, 82%, had poor or no flow) than those in non-heritage areas (18/36, 50%, had poor or no flow). There is a significant relationship between areas and the flow status of spouts ($\chi^2 (1) = 7.684$, $p = 0.006$. Note: poor flow and no flow data were combined for this analysis). This implies that spouts in peri-urban and urban non-heritage areas have better water flow than those in heritage areas (Figure 5.2).

Figure 5.2: Distribution and flow status of stone spouts (Base map sourced from: http://www.gadm.org)

5.3 Water Collecting Systems in the Study Areas

Results from community member interviews and focus group discussions illustrate that Bhaktapur district went through an additional development stage, namely via the addition of modern water supply infrastructures. However, the traditional water supply systems such as dug-wells, ponds and stone spouts are still in use reflecting the scarcity of water to meet daily needs. During the dry season, in winter, many taps are rendered temporarily out of service. The pipe-line water supply in the study areas can be considered intermittent as service ranges from 2-10 hours per day. As a result, people have kept using stone water spouts as a
complementary source of water along with the private connection of taps or dug/tube wells in individual houses (with some houses having both private tap connections and dug/tube wells) for domestic use; this mixture of sources having been established over generations. However, some people still depend on stone spouts.

Many respondents from face-to-face interviews and focus group discussions explained that many people come from near distances, within 100 metres, while some people come from more than 100 metres, to collect water from stone spouts. However, two thirds (20 of 30) of interviewees during convenience sampling said that they travelled more than 100 metres to collect water from spouts (Table 5.4).

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Respondents Collecting water</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Less than 100 meters</td>
<td>More than 100 meters</td>
</tr>
<tr>
<td>Peri-urban</td>
<td>Changunarayan Heritage Jhaukel</td>
<td>5 (63%)</td>
<td>3 (37%)</td>
</tr>
<tr>
<td></td>
<td>Non-heritage</td>
<td>1 (17%)</td>
<td>5 (83%)</td>
</tr>
<tr>
<td>Urban</td>
<td>Jhaukel</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bhaktapur Durbar Heritage Square</td>
<td>2 (22%)</td>
<td>7 (78%)</td>
</tr>
<tr>
<td></td>
<td>Madhyapur Thimi</td>
<td>2 (29%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>10 (33%)</td>
<td>20 (67%)</td>
</tr>
</tbody>
</table>

5.4 Types of Stone Spouts based on Water Sources and Supply Systems

Normally, shallow aquifers and springs are the water sources for the stone spouts. The analysis of responses from community members, planners and experts, led to categorising the spouts into four types depending on the water supply system feeding them:

1) Spouts fed water directly from springs
2) Spouts supplied water through seepage after harvesting rain water
3) Spouts receiving water via state canals (canals built by the state)
4) Spouts receiving water via Tantric process*

---

* A tube well is a kind of dug well where a long pipe or a steel tube is inserted into an aquifer. A strainer is fitted in the lower end of tube and a pump is fitted at the top end of tube to lift the water. The length of tube depends on the depth of aquifer.
Table 5.5 shows that most spouts are fed by springs except in Bhaktapur Durbar Square area where most spouts are fed by state canal. The following sections report the details of each type of spout based on water sources and supply systems contributing to them and the influence of water sources and supply systems on the state of spouts in all four study areas.

Table 5.5: Stone spouts and their water sources in the study areas.

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Water Source</th>
<th>Total spouts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Spring</td>
<td>Seepage</td>
</tr>
<tr>
<td>Peri-urban</td>
<td>Heritage</td>
<td>11 (100%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Non-heritage</td>
<td>4 (18%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Urban</td>
<td>Heritage</td>
<td>24 (96%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Non-heritage</td>
<td>50 (72%)</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

*Note: “Tantra is that Asian body of beliefs and practices which, working from the principle that the universe we experience is nothing other than the concrete manifestation of the divine energy of the godhead that creates and maintains that universe, seeks to ritually appropriate and channel that energy, within the human microcosm, in creative and emancipatory ways” (White, 2001, p. 9).

5.4.1 Spouts fed water directly from springs

Data from site visits show that all of the spouts of peri-urban areas (Changunarayan and Jhaukhel) are fed water from springs. However, spouts in the urban areas (Bhaktapur Durbar Square and Madhyapur Thimi) have different water sources (Table 5.5).

5.4.2 Spouts supplying water through seepage after harvesting rain water

Three historians interviewed described that rain-fed ponds were constructed as a source of water in historical cities of the Kathmandu Valley over 2000 years ago, during the Kirat regime. Later, in the Lichhavi regime, these ponds were linked to stone spouts and dug wells to supply water to city dwellers. Normally, ponds were built in the higher elevation of the settlements to feed the shallow aquifer of the stone spouts and wells. *Siddha Pokhari* (Pokhari means pond in the Nepali language) of Changunarayan, *Bhaju, Siddi* and *Nah pokhari* of Bhaktapur city are
examples of these ponds found in the study area. Water seeps away from these ponds and eventually emerges from stone spouts. For example, the rain-fed Siddh Pokhari in the hills of Changunarayan is located just above the source (spring) of the stone spout Narayan hiti. Based on the interviews with community members and experts, it is known that the pond helps to increase the water level in the source and also aids the source in its recharge process. When the water level in Sidda phokhari increases, the discharge of Narayan hiti also increases.

There were no spouts in Jhaukhel and Madhyapur Thimi areas which receive water by seepage from rain-fed ponds and the only stone spout of this type visited during the research is called “Gha hiti” in the Golmadi area inside Bhaktapur Durbar Square. However, some community members and experts claimed that the main source of water for Narayan hiti spout is a spring and Gah hiti is made by tantric process. In Table 5.5, I have categorized Gah Hiti as Tantric based and Narayan Hiti as spring based on observations reported by locals (this does not mean that it could not be considered to be sourced both through seepage and Tantric but means if seepage is considered an expression of tantric processes).

5.4.3 Spouts receiving water via state canal

Aquifers of the stone spouts are recharged not only by natural precipitation but also by state canals (also called royal canals or raj kulo in local language). This is because the shallow aquifers, the water sources of the stone spouts, deplete quickly. It was generally agreed that normally, state canals were used to carry surface water such as stream or pond water from the foothills tens of kilometres away to artificial ponds close to stone spouts to augment the aquifer and water infiltrated from ponds to the spouts.

According to experts and community members interviewed and documents analysed, King Jitamitra Malla constructed a state canal in 1678 to feed stone spouts located in Bhaktapur and Lalitpur cities. This canal carried water from “Basuki Muhan” (Basuki spring) of Nagarkot VDC to “Dahagga” (pond in Newari Language) of Chhaling VDC. Water was at first collected in an artificial pond then after the settling out of silts, it was transferred to a relatively small pond only two meters away. Following this, water was transported via stone or mud pipes to the stone spouts via submerged water distribution intakes inside the pond (Appendix three). According to local lore, a pair of ducks having deity power cleaned each pond.
Guards were employed by the state to look after the canal, patrolling it daily. Five to six guards worked together and they did not allow anybody to pollute the precious water. People were allowed to fetch water from state canals in certain designated areas. Water guards opened and closed the Iron Gate valves in certain seasons to enable irrigation. After the construction of pipe-line connected public water supply systems in 1895 in the Bhaktapur District, this state canal started to suffer the effects of prolonged neglect and completely dried out. Another factor leading to this deterioration was the construction of a major road in 1974. Today some 15 kilometres of canal still exist although some stretches appear to be covered or encroached upon by paved roads.

According to Shrestha (1984) and Upadhya (2009), water emanating from this state canal once supplied 56 stone spouts in Bhaktapur cities. Interviews with community members, planners and historians showed 14 stone spouts did not work in Bhaktapur Durbar Square area following this major drying out of the state canal, although two spouts are now receiving water from modern pipe-line connections (Table 5.5 and Appendix 11). However, stone spouts in the study areas of the Cangunarayan, Jhaukhel and Madhyapur Thimi municipalities are not of the variety which are replenished via state canals. They have their own individual water sources as discussed in section 5.3.1. However, one spout in Thimi was built by Tantric process.

5.4.4 Spouts receiving water via Tantric process

Respondents of Bhaktapur Durbar Square still believe that there are many spouts in the Bhaktapur municipality which receive water through Tantric process. According to the recollections of some of those interviewed, when they dug out the water network they found flaming small earthen pots covered by another earthen pot as a lid (called salicha in Newari language) with nuts and coins above the spout. When the lid of the pot was removed the flames subsided and the water flow in the spout also stopped. According to some reports, when the lid was put back the water started to flow again. Because there were no other apparent sources for the water to enter the spouts, the Tantric or divine theories took root. One expert from Bhaktapur added:

*Water route inside the ground might be known by only specific persons. But as they didn’t want to share their knowledge, they said it was all due to tantric process. Or maybe it is true. Personally, I believe tantric practice because I have seen many*
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) project dug ground for putting drainage pipe in Bhaktapur city areas.

Three stone spouts, Gah hiti (also called Golmadi hiti), Indrayani hiti and Bhimsen hiti, in Bhaktapur Durbar Square area were built through Tantric practices. The source of the water for these spouts was previously unclear. When the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) project dug in the eastern direction of Bhimsen hiti about two meters deep in front of the Dattatreya temple, they found a buried earthen bowl with flame covered by brick layers with an inscription clearly written instructing the reader not to dig further otherwise the Bhimsen spout will remain dry for ever. After reading this inscription they did not dig further.

According to respondents, water flows in Chhatra hiti of Madhyapur Thimi through Tantric process. Local people clean the spout once a year before Sithi Nakha (start of the rainy season). The water flows automatically after cleaning the spout up to the start of winter season. This spout was adjacent to the Ganesha temple (main God of Newar communities) earlier. It caused difficulty in praying in the temple and to perform a festival there. So, it was shifted about 20 meters below the temple around 30 years ago. However, there is no effect on water flow. Thus, it was called the Tantric spout.

### 5.5 Value of Stone Spouts

This section examines the specific religious values of stone spouts in the study areas. All 69 spouts in the study areas have functional values (Appendix 11). However, 24 spouts have both functional and specific religious values (Table 5.6 and Appendix 12).

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Religious value</th>
<th>Total Spouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban</td>
<td>Changunarayan</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Jhaukhel</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Urban</td>
<td>Bhaktapur Durbar Square</td>
<td>10*</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Madhyapur Thimi</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td><strong>69</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Three spouts (bul bul, bidhyapit and pubaha) were once used for both religious and functional purposes but are now dry and only refilled by pipe-line once a year for a religious event.*
Interview data shows that 45% (10 of 22) of spouts in Bhaktapur Durbar Square, 36% (4 of 11) in Jhaukhel, 27% (3 of 11) in Changunarayan and 28% (7 of 25) in Madhayapur Thimi area have religious values areas (Figure 5.3). The following sub sections detail the religious value of spouts in the study.

Figure 5.3: Distribution of stone spouts having religious values (Base map sourced from: http://www.gadm.org)

5.5.1 Religious Value of stone spouts in the Changunarayan area

Findings from community member interviews and focus group discussions show that in Newar communities, the relatives of the dead as part of their beliefs use spouts which are located a short distance away from those used by the departed. They no longer use the spout which this relative regularly used. On the 11th day after the passing, all the relatives gather in the house of the dead and they proceed to the stone spout crying and wailing along the way. On reaching the spout they offer beaten rice to the soul of the departed, take a bath and return back home. Nowadays, as modern people are sometimes openly scornful of the custom of crying on the way to the spout, this ritual is virtually extinct. In Newar communities, close family members of a dead person can be considered as pure after having a bath in the stone spout on the 10th
day after a person dies. From the 45th day after passing, water from the spout is offered to Shiva (Hindu’s god) every day for one year, thus ensuring that the soul will eternally rest in peace. This commitment to the god Shiva can only be made from spouts which are adorned with his image. In the areas where Newar culture predominates, most spouts feature Shiva. At the ceremonies where Newars worship their ancestors, their culture permits them only to use spout water. Besides this, Narayan hiti, Gah hiti and Sarashowti hiti of the Changunarayan have special religious significance.

Only water from Narayan hiti (stone spout) is allowed to be used at Changu Narayan temple for the purposes of worshipping. There are two stone spouts at one platform at Narayan hiti. One of these spouts was for offering water to Changu Narayan, the other one being for the public. Leather items were prohibited at the spouts. The lower caste people and women experiencing their period were not permitted to use that spout. This spout formerly used to offer water to the Changu Narayan was locked by the Bhandel (one caste of Newar assigning to carry water for Changu Narayan temple). Later the other spout at this location completely dried out. Subsequently the local people broke through the priest’s shackles and started to use the Changu Narayan’s spout. Nowadays, the same spout is used for offering water to Changu Narayan as well as for fulfilling the daily needs of local people. To this day the Bhadel is compelled to attend the spout around 3.00 am with the necklace of keys of the Changu Narayan as well as the customary water vessel. The big padlocks of the Changu Narayan temple are distinctive as they are made of silver. Further restrictions are placed on the Bhadel as they are performing this ritual in that they must be barefoot and any persons accompanying them are not permitted to use their exact footsteps. It is believed that the temple keys have power such that even dogs, tigers or ghosts for that matter cannot harm the water carrier.

The Narayan hiti stone spout was also important to the Newar culture in matters concerning the touching of pigs. If they did happen to come into contact with any pigs or pork, they had to shave their head and bath in Narayan hiti to recover purity. Failure to perform this ritual could lead to a Newar being prevented from entering their dwelling. One community member said:

When I was about 7 years old, I touched a pig. My parents sent me in Narayan hiti to take a bath because I won’t be pure without taking a bath in Narayan hiti. It was winter and I still remember that day how I managed to shower in Naryan hiti.
Narayan hiti is importantly associated with the Changu Narayan temple. The fact that the spout is referred to in the inscription of the temple highlights its importance. Historically there were two idols featured in the Narayan hiti. There was an idol of Garuda Narayan at the spout’s centre which was stolen some time ago. This was a tragic event as the Garuda Narayan idol feature was an exact replica of that in Changu Narayan temple. This duplication of symbolism strengthened the ties between the spout and the temple and was a main reason why only the water from the Narayan hiti is used in Changu Narayan ceremonies.

Water from Gah hiti is used to make squash on the occasion of Akshya tritiya, which falls at the end of April. This tonic is given to local people as well as visitors to the area. A big copper pot called Khasi in Newari language is used to store and feed a batch of juice which lasts for the whole day. Another spout named “Saraswati hiti” was buried under rubble till 1990. It was excavated and made functional around 1990. In Saraswoti hiti a feast is organized during “Fagu Purnima” and “Basanta Panchami” in March. This feast marks the start of the festival of colour.

5.5.2 Religious Value of stone spouts in the Jhaukhel area

Spouts in the Jhaukhel area have their own religious and functional values. Drinking, bathing, washing and feeding to animals are the common functional usage categories of all spouts. The Magar tole, Taleju Bhawani, VDC and Ram mandir spouts have special religious and cultural values (Appendix 11).

Taleju temple is located inside Bhaktapur Darbar Square area. Data from community member interviews and focus group discussions indicates that water from Taleju hiti, located in Jhaukhel, is used to worship the goddess Taleju. Hifale are people specifically assigned to bring water to Taleju temple and those who take the blood of the sacrificed buffaloes in the Taleju temple (“Hi” means blood and “fale” means the one who takes). These designated water carriers from Bhaktapur come to take water to the Taleju temple once a year. Once a year, on the eighth day of Dashain (main festival of Nepali Hindu people), Hifale take two pots of water from Taleju hiti and offer only that water for the whole year to the Taleju goddess. After the offering of water from Taleju hiti and following worship, the sacrificing ceremony begins. Sadly, Taleju hiti has been dry for the last 9-10 years. However, Hifale have a secret water source which lasts only 2-3 months each year. Hifale from Bhaktapur clean this source
and the water flows from the time of the cleaning ceremony which is around autumn. Local people only used water from this spout for washing clothes and bathing purposes. They are not allowed to bring water into their houses. They are constrained by the belief that if they cook food from this water it would render the cooking process ineffective. Women experiencing their menstrual period are not allowed to use this spout. Should a woman use the spout at this time of the month then the mythology prescribes that snakes will emerge from not only that spout but all the spouts in the surrounding area and deny entry to all and sundry. Furthermore, it is widely believed that should the water be sullied by a whole series of miscellaneous wrongdoings such as washing socks or lingerie, the water flow will simply cease, and only flow for permitted uses.

Water from VDC and Ram Mandir spouts was traditionally used for offering to the gods and goddess of that small temple. Both spouts have been mostly dry for around the last 15 years. Sometimes water flows but only in the rainy season. Magar tole hiti is the oldest spout of Jhaukhel. This is the only original spout still operating using traditional earthen pipes. Magar communities use water from this spout during their funeral ceremonies and whilst worshiping ancestors.

5.6.3 Religious Value of stone spouts in the Bhaktapur Durbar Square area

Based on findings from community member interviews and focus group discussions, out of the 22 stone spouts in the Bhaktapur Durbar Square area, ten, namely Pubaha, Bulbul, Bhimsen, Tripura, Sallaganesh, Indrayani, Beta, Tripura, Bidhya pit and Yechhesori hiti have significant cultural and religious value (Appendix 11). Gah hiti was dismantled 40 years ago to provide sufficient parade space to enable the performing of Bhairav Jatra (pulling chariot of God Bhairav), however, the buried spout can still be seen on the former site.

Water from Sallaganesh hiti is used daily to clean the statue of Buddha before devotees proceed to worship him, in much the same way Indrayani hiti is used to provide water for the Indrayani temple. Of the remaining spouts, many people still hold the belief that if they bathe in Beta hiti they would receive divine protection in that Nava grahas (the nine planetary gods in Hinduism) would never trouble them. Sadly, for the holders of this conviction this particular spout was another receiving water from the state canal and nowadays is dry. The Harisiddi festival is held every 12 years in Bhaktapur city. Performers at this major festival traditionally
stayed at rest houses near Yessesori hiti for a week and subsequently used water from Yessesori hiti. The drying out of this famous spout – another state canal sourced outlet has meant alternative arrangements have to be made.

Although the malfunction of spouts formerly connected to the state canal supply has dealt a major blow to the spouts of this area some important spouts have had attempts to re-establish them. Such is the case with Lu hiti located near the Taleju temple meaning water from this source was considered with significant spiritual merit. The Bhaktapur municipality installed a pipe-line water supply system into this spout to reactivate the spout and attract tourists, however this venture was only a partial success in terms of water flow.

On the occasion of Janai Purnima (festival celebrated annually in July), people bathe in nine east facing spouts (Figure 5.3). After cleansing in all nine spouts, they eat nine types of meals, change nine pair of clothes and look through the ninety nine windows of the Bhaktapur Durbar. They possess the belief that performing these tasks will ensure they reach heaven. These nine spouts are collectively called Gupu hiti in Newari. Five spouts named Bidhayapith hiti, Tripura hiti, Bhimsen hiti, Bulbul hiti and Pubaha hiti are east facing stone spouts located inside this study area. The remaining four are situated outside the Bhaktapur Durbar Square area. Only Bhisen hiti has regular water flow, Tripura hiti has pipe-line connection and the other three mentioned in the research are already dried out. Nowadays, people connect modern water pipes into these spouts for one day, that of Janai Purnima for ceremonial bathing.

In addition to the aforementioned cultural intricacies, people believe that water from spouts has medicinal value. Water from Golmadi hiti (also called Gah hiti) is used to heal skin diseases.

5.6.4 Religious Value of stone spouts in the Madhyapur Thimi area

Seven spouts (Mahadev mandir, Tada hiti, Nil Barahi, Gorakhnath, Thangacha hiti, Chhatra hiti and Bata hiti) possess significant religious value in the Madhyapur Thimi study area (Appendix 11). The Newar community of Madhyapur Thimi use water from spouts while worshipping their ancestors once a year. According to them, stone spouts have flowing water which is significantly more pure than the water from other sources and therefore this water should be saved for special occasions.
Like the people of Bhaktapur city, inhabitants of Madhyapur Thimi also take a bath in the nine east facing stone spouts of that vicinity during the Janai Purnima festival. Two of these east facing spouts which were located in the area covered by this research are Thangacha hiti and Chhatra hiti. Mahadev mandir, Tada hiti, Nil Barahi, Gorakhnath and Bata hiti have temples in close proximity so the water sourced from these prominent spouts have significant religious value as an offering to the gods and goddesses of those particular temples.

5.7 Governing System of Stone Spouts

Previously, the stone spouts of the Kathmandu Valley were managed by either state guthi, the initiator of spouts or the local people (see chapter three). There was a guthi established by the state to look after the stone spouts of the Changunarayan areas. Three people worked together every day and were given 18 muri (about 1152 kg) rice per year grown from land owned by guthi for them as a payment for services rendered. Likewise, Nhu hiti and Gah hiti of Madhyapur Thimi, also had guthi appointed by their initiators to conserve them. In the Bhaktapur area the state established a guthi and employed 5-6 people to look after the spouts and state canal in that area (Table 5.7). After the enactment of the Land Reform Act in 1964, most lands owned by guthi were privatized and thereafter the stone spouts started to be ignored. However, state guthi (named Taleju Guthi) of “Lu hiti” in the Bhaktapur Durbar Square area is still active although the spout is dry (Figure 5.4). This guthi performs worship ceremony each year after cleaning the spout on the anniversary of the establishment day of Lu hiti.

Table 5.7: Governing system of stone spouts

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Traditional Management System</th>
<th>Total spouts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initiator of spouts</td>
<td>State Guthi</td>
</tr>
<tr>
<td>Peri-urban</td>
<td>Changunarayan</td>
<td>0</td>
<td>4 (36%)</td>
</tr>
<tr>
<td></td>
<td>Jhaukhel</td>
<td>0</td>
<td>1 (9%)</td>
</tr>
<tr>
<td>Urban</td>
<td>Heritage Bhaktapur Durbar</td>
<td>2 (9%)</td>
<td>6 (27%)</td>
</tr>
<tr>
<td></td>
<td>Square</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-heritage Madhyapur Thimi</td>
<td>8 (32%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>10 (15%)</td>
<td>12 (17%)</td>
</tr>
</tbody>
</table>
Findings show that all spouts in peri-urban areas were managed by local people and state *guthi*. However, initiators of spouts played a role in managing spouts only in urban areas. Likewise, state *guthi* had a significant role to conserve spouts only in heritage areas. The “initiator of spouts” and “local people” were combined as “other management” compared with “state *guthi*” for performing the Chi-Square test. There was a significant relationship between area and the management systems of the spouts \((\chi^2 (1) = 7.340, p = 0.007)\). This implies that spouts in both urban and peri-urban heritage areas are more likely to be conserved by state *guthi* than those in non-heritage areas (Figure 5.4).

![Figure 5.4: Governing system of spouts in the study areas (Base map sourced: http://www.gadm.org)](http://www.gadm.org)

### 5.8 Summary

Spouts are categorised into four types: spouts fed water directly from sources/springs, spouts supplied water through seepage after harvesting rain water, spouts receiving water via state canal and spouts receiving water via Tantric process. The findings show that most water spouts, located in urban and peri-urban non-heritage areas are still in original condition with good water flow. Furthermore, most spouts in both urban heritage and peri-urban heritage areas are fed water via modern pipe-line connection. Likewise, all the spouts located in the
study areas have functional values but out of the total 45% (10 of 22) of spouts located in urban heritage (Bhaktapur Durbar Square) and 36% (4 of 11 located in Jhaukhel) in peri-urban non-heritage area have significant religious value. Furthermore, findings show that, most spouts were managed by local people and state guthi in the heritage areas and initiators were important in urban areas. Table 5.8 summarises the overall findings of the empirical study and shows physical and flow status, water sources, religious value and governing systems of spouts.
Table 5.8: Summary of findings of the chapter

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Total Spouts</th>
<th>Physical status of the spouts</th>
<th>Flow status of the spouts</th>
<th>Water sources</th>
<th>Religious value of spouts</th>
<th>Governing system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heritage</td>
<td>11</td>
<td>-64% of spouts are in original condition, 18% have pipe-line connection and 18% are encroached.</td>
<td>- 45% of spouts have good flow and 55% are dry.</td>
<td>-All spouts are fed by spring.</td>
<td>- 27% of spouts have religious value.</td>
<td>- 36% of spouts were managed by state guthi and 64% were managed by local people.</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>11</td>
<td>-73% of spouts are in original condition and 27% are modified.</td>
<td>- 55% of the spouts have good flow and 45% are dry.</td>
<td>- All spouts are fed by spring.</td>
<td>- 36% spouts have religious value.</td>
<td>- 91% of spouts were managed by local people and 9% were managed by state guthi.</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heritage</td>
<td>22</td>
<td>- 73% of spouts are in original condition, 23% have pipe-line connection and 4% are encroached.</td>
<td>- 5% of spouts have good flow, 18% have poor flow and 77% are dry.</td>
<td>- 64% of spouts are fed by state canal, 18% are fed by spring, 14% are fed by Tantric practice and 4% are fed by seepage.</td>
<td>- 45% of spouts have religious value.</td>
<td>- 64% of spouts were managed by local people, 27% were by state guthi and 9% were managed by the initiators of the spouts.</td>
</tr>
<tr>
<td>Non-heritage</td>
<td>25</td>
<td>-76% spouts are in original condition, 12% are encroached, 8% are modified and 4% have pipe-line connection.</td>
<td>- 48% spouts have good flow, 28% have poor flow and 24% are dry.</td>
<td>- All spouts are fed by spring except one which is built by Trantric process.</td>
<td>- 28% of spouts have religious value.</td>
<td>- 64% of spouts were managed by local people, 32% were by initiators of spouts and 4% were managed by the state guthi.</td>
</tr>
<tr>
<td>Total Spouts</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 6

Influences of Socio-cultural, Institutional Norms, and Values and Development Activities on Stone Spout Management Systems

6.1 Introduction

This chapter presents the findings generated from qualitative data collected in the four study areas using the methods described in chapter three. Information gathered during the field visits are analysed based on the research questions and objectives of the study.

The chapter begins with a brief account of characteristics of the respondents involved in the study and then moves into the details of the results. Respondent characteristics are reported in the next section. Overall findings are reported in relation to research questions: a) in the next section namely, what are the impacts of changes in social, cultural, institutional norms and values and how do they influence the stone spouts management system? And b) in the third section namely, how do the modern pipe-line systems and other development activities affect traditional stone spout management systems in heritage and non-heritage areas? Each section explains the results analysed from field visits and interviews conducted with community members, planners and experts. Where appropriate, findings regarding demographics, age and gender, are also made. A summary of the findings is presented at the end of the chapter.

6.2 Respondent Characteristics

For analysis purposes the respondents interviewed were divided into different age groups. Respondents between 18 to 35 years old were designated as the young group, 36 to 50 years were labelled as the middle age group and those older than 50 formed the old category. The characteristics of respondents interviewed face-to-face and involved in focus group discussions in the four study areas are summarized in Table 6.1 and Table 6.2.
<table>
<thead>
<tr>
<th>Category of area</th>
<th>Respondents</th>
<th>Age Group (years)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18-35 M</td>
<td>F</td>
</tr>
<tr>
<td>Peri-urban heritage (Changunarayan)</td>
<td>Community Members</td>
<td>Local</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Migrant</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporary resident</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Planners/Experts</td>
<td>Local</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>-</td>
</tr>
<tr>
<td>Peri-urban non-heritage (Jhaukhel)</td>
<td>Community Members</td>
<td>Local</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Migrant</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporary resident</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>-</td>
</tr>
<tr>
<td>Urban heritage (Bhaktapur Durbar Square)</td>
<td>Community Members</td>
<td>Local</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Migrant</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporary resident</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Planners/Experts</td>
<td>Local</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Migrant</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporary resident</td>
<td>1</td>
</tr>
<tr>
<td>Urban Non-heritage (Madhyapur Thimi)</td>
<td>Community Members</td>
<td>Local</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Migrant</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Planners/Experts</td>
<td>Local</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>
### Table 6.2: Age and gender characteristics of focus group discussions’ respondents in the study areas

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Respondents</th>
<th>Age Group (years)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Respondents</td>
<td>18-35</td>
<td>36-50</td>
</tr>
<tr>
<td>Peri-urban heritage (Changunarayan)</td>
<td>Local</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Migrant</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Temporary resident</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Peri-urban non-heritage (Jhaukhel)</td>
<td>Local</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Migrant</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Temporary resident</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Urban heritage (Bhaktapur Durbar Square)</td>
<td>Local</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Migrant</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Temporary resident</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Urban Non-heritage (Madhyapur Thimi)</td>
<td>Local</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Migrant</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Temporary resident</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>

Tables 6.1 and 6.2 show that there are more male respondents than female in both face-to-face interviews and focus group discussions. Many women did not want to speak with strangers, some of them also thought that men knew more about stone spouts than women. However, there were more females in convenience sampling (see Table 3.2). Usually, women do all household works including water harvesting in Nepal. So, female respondents were more than male during the convenience sampling. This helped to include more women views about spouts for this study. All interviewees said that there are no migrants in urban and peri-urban heritage areas. However, temporary inhabitants were more numerous in the urban areas than in the peri-urban areas. Similarly, most experts and planners were also local residents in all study areas.
6.3 Traditional Institutions/Ceremonies for Management of Stone Spouts

Initially, stone spouts were maintained through guthi (local institution) and Sithi Nakha (Festival of local inhabitants, Newars). This section describes the findings relating to the socio-cultural and institutional beliefs, norms, and values that were put into practice at least 40 years ago for managing the stone spouts in the four study areas.

6.3.1 Sithi Nakha

Becker-Ritterspach (1990) explained that maintenance of stone spouts including their water distribution networks was historically a huge challenge. A local historian interviewed has also explained that King Jitamitra of Bhaktapur instituted a strict law on the cleaning and maintenance of the water network supporting stone spouts. Current guidelines for water source maintenance were developed at a Sithi Nakha. Most planners and experts interviewed in all study areas stated that the Sithi Nakha festival of Newar communities was associated with a tradition of cleaning traditional water sources including stone spouts. However, most community respondents of Changunarayan and Jhaukhel argued that the festivals for them were limited to celebration activities. Those that uphold the cleaning tradition argue that this festival is celebrated on one of the driest days in June, so it was very much appropriate that at this time Newar communities worship water sources including stone spouts and perform cleaning and maintenance on them. It was believed that Naag (snakes), which in spiritual form are water gods, emerge from the water on this day to provide divine support for the efforts of the populace at large. They move out from the water source thus providing opportunities for people to clean their water sources. Lime or chopped herbal plants were traditionally sprayed into the water bodies after cleaning the infrastructural components to provide further water purification. At this time the dug wells were covered off and water was not used for four consecutive days after the major cleaning process.

6.3.2 Guthi

Most experts interviewed stated that in ancient times, provision of water in Nepal was considered largely as a religious activity. In many holy books such as Shiva Puran and other Purans recorded that inhabitants worshipped and managed their water sources according to their situations and circumstances. Inscriptions of Lichhavi and Saka Sambat (506 A.D.)
convey that water spouts and ponds should be managed via “Paniya Gosthi”. Later on, this word “Gosthi” (which means seminar in the Nepali language) was misspelled and transcribed into “guthi”. Likewise, “lanjgval Panchalika” (water management committees) were established to manage all water related activities. Gah hiti and Gamdhoka hiti of the Changunarayan area are mentioned in the inscriptions from the Licchavi period. According to the inscription, Bishnu Gupta King of Licchavi built nearby stone spouts for the wellbeing of his father.

As described in section 3.5.1, initially guthi were the main institutions in Newar communities allowing for the protection and conservation of the resources and infrastructures they had established. According to two historians interviewed, guthi were very active in the Lichhavi and Malla period and continued during the Rana regime as well in the Bhaktapur District. Guthi had strict rules and regulations which governed their means of operation with inscriptions to keep records of the established correct procedures. The end goal was always to ensure the continued functioning of the particular resource the guthi was initially set up to govern.

Hiti guthi, the governance system of stone spouts was established either by the state or initiators of spouts (see section 3.5.1.). According to all planners and experts, this system was adapted for the maintenance of water spouts from the initial model first seen in the Lichhavi regime. Previously, most stone spouts of the Bhaktapur District had guthi to protect, conserve and manage them. These guthi for stone spouts, were funded by the income that came from agricultural land. The initiators or the managers of the hiti guthi (stone spout’s guthi) were tasked with performing an annual worship on the establishment day of each particular spout. They became accustomed to maintaining and cleaning the spouts before worship.

All community members interviewed during face-to-face interviews and focus group discussions explained that there was a guthi established by the state to look after the stone spouts of the Changunarayan (peri-urban heritage) area. Three people (called “Dhalapa” in Newari language, meaning water guard) worked together every day and were given 18 muri (about 1152 kg) of rice per year grown from land owned by the guthi as a payment for services rendered. They patrolled every day from the water source to each stone spout.
located in the existing Changunarayan heritage areas. They had responsibilities to guard, maintain and repair the water sources, earthen canals, earthen pots (known as “athah”), as well as any other spout infrastructure or images. The guards also ensured people followed the rules and regulations established for using water from spouts. An old interviewee stated that:

*I was around 10 years old and it was during the morning time. I was busy washing my clothes. I put my clothes on an image of God built at the top of spout. I did not know that Dhalapa was watching me. Water from my clothes was dropping to the images as well as into the spout. Suddenly, I felt something bang on my bottom (laughs). I saw Dhalapa staring at me with his big stick. I ran away because I had violated the rules and polluted the water.*

According to most old respondents, guards employed by guthi must visit the water source and spouts at least once a day. If they find any part of the water network or spouts broken, eroded by landslide, blocked, or polluted they will provide for notification so repair can follow. Earthen pots called “Athah” were kept in different places and mugs were kept nearby for travellers to drink water. Local people were known to sometimes make use of those pots as well. The guards were also tasked with checking this inventory and furnishing replacements if too many were stolen or broken. The earthen pipes were used to convey water. If the pipe leaked, the guards would mend them. Leaks were often plugged with sticky special paste made by Pinus’ resin and brick powder. The ‘tools of trade’ of the guards were stick, spade, and sickle. They cleared the grasses that grew in the waterways. One respondent said:

*I often followed “Dhalapa” when I was a child. They used to get angry if someone polluted the “Athah” or misplaced, or broke or stole the mugs. People used to damage the earthen pipes and they got angry. They had to mend the pipes and convey the water again.*

Likewise, according to 28 community members, eight interviewed (five male and three female), and 20 discussed in four focus groups (12 male and eight female), only the Taleju hiti of Jhaukhel (peri-urban non heritage) area was governed by state guthi. A large area of
agricultural land was assigned for this guthi. People from Bhaktapur city used to come to clean and maintain Taleju hiti, for example:

_When I was about 8 to 10 years old, people from Bhaktapur city tidied up the water sources. There are three spouts inside this Taleju hiti and each spout had a nice water flow. It has been more than 15 years now and nobody cares about this spout. May be it’s because the guthi land was privatised. No one wants to work for free._

Similarly, eight of the spouts at Madhyapur Thimi were governed by guthi managed by the initiators whereas only one spout was governed by state guthi (see Tables 5.7). The initiators of spouts or managers hired by initiators cleaned and maintained spouts at least once a year before performing an annual worship on the establishment day of each particular spout. They also had responsibilities to save the infrastructure and images from destruction and robbery. Most experts described that guthi had also encouraged people to clean spouts at Shiti Nakha and other auspicious days such as Khasi Sahnu (the New Year day of Bikram Era in mid-April), Disi Charhe (the day before full moon in January), Fagu Punhi (the full moon day in March), Naag Panchami (described in section 6.3.3) and Yenya Punhi (the full moon day in September). Guthi mobilised entire neighbourhoods to manage and maintain stone spouts.

According to two local experts interviewed in the Bhaktapur Durbar Square area, water spout management was inextricably linked to the management of a state canal. King Jitamitra, who built one such state canal, wrote rules and regulations in a stone inscription to maintain the state canal Lu hiti and its pond. It was written that a higher priority should be given to water for drinking water than that for irrigation. There was a provision of punishment for violation of these rules. A guthi was established and five or six people were appointed by the state to conserve and maintain the spouts and state canal in the Bhaktapur municipality area. Two planners and two experts explained that there were two guthi established by initiators of spouts and six guthi established by the state in the Bhaktapur Durbar Square area (see Tables 5.7). They conserved and maintained water networks and spout infrastructures in this area. The guthi also regularly cleaned and worshiped spouts in their establishment days and other auspicious days such as Shiti Nakha, Khasi Sahnu, Disi Charhe, Fagu Punhi, Naag Panchami and Yenya Punhi.
6.3.3 Naag Panchami

*Naag Panchami*, a feast to worship snakes, is celebrated on the 5th day of the new moon in August. People perform an annual worship to please *Naag* (snakes) on this day. Most community respondents illustrated that local people held beliefs that *Naag* and water gods were closely associated with particular stone spouts, this being true in all study areas. It was a commonly retained belief that if citizens polluted water spouts, *Naag* deities would get annoyed and cause plague and sickness. These beliefs had a residual benefit in guiding public behaviour in favour of stone spout conservation. It was customary for local people to worship *Naag* deities once a year in July. However, any sicknesses at all would typically increase this rate of worship.

6.3.4 Social Taboos/ other customs

Traditionally, not only *guthi* but also the individual local people themselves in the community could be proactive in cleaning and maintenance of spouts. Beliefs and thoughts helped to motivate societies and individuals to maintain them.

In the Chanjunarayan (peri-urban heritage) area, most of the old male and female community respondents explained that the women going through their monthly period and lower caste people were not allowed to make use of *Narayan hiti*. The rulers maintained that since caste was determined based on the activities performed by people and the lower caste people did the work which was unsanitary such as cleaning toilets, leather works or field works, this functional demarcation effectively barred them from the spouts. According to them, a cultural boundary was created to keep people bounded with rules. Likewise, leather items, the innerwear of men and women, and footwear were not allowed to be washed at the spout. Wearing shoes had also been banned in spout. But now all such discrimination has been discontinued.

In the past people strongly held the belief that worshipping the water sources helped to increase the flow of water in stone spouts. One woman respondent in Changunarayan stated that:

> You may believe it or not, it depends on you. But the water flow still increases after worshipping at the source of our Imadol spout. Young people laugh when we talked about it but it is true.
Three old local male respondents in Changunarayan stated that Naag (snake) does not like cement. When people start to maintain a water source of spouts by cement, Naag got annoyed and spouts were dried out. One respondent explained:

When I was the Bhadel (main priest) of Changunarayan temple, I remove the cement at the source of Narayan hiti and the water flowed nicely. I cleaned and operated the source. When my turn was over the others ignored and they again used cement at the water source. The water source again dried up.

According to a female respondent interviewed and six respondents discussed during three focus group discussions, in Taleju spout of Jhaukhel (peri-urban non-heritage) area women having their monthly period were not allowed to enter the spout’s platform. Likewise, washing of socks and underwear or the wearing of shoes were also prohibited. Shoes had to be removed before approaching this spout.

Five female and six male respondents said that washing clothes was not allowed to avoid pollution in the Bata hiti of Madhyapur Thimi. Four respondents during a focus group discussion said that there was also a myth that if the Debama hiti was allowed to be polluted, the Lord of the snake would exact revenge by not allowing local people to fall asleep. Furthermore, they added that polluters of stone spouts were liable to discover sores and wounds all over their bodies, especially their private parts. Those who urinate in the spouts could have their private parts damaged especially men. More specifically the sensation is like exposure to the hottest chillies. To avoid or reverse these punishments one must offer cow’s milk or decorate the spout with the image of a snake made from cotton; these remedies are held to be more effective than hospital treatment.

In addition, two female respondents said that at Lahapati khwa hiti spout users were not allowed to keep clothes on top of the spout either washed or unwashed. If someone did this unknowingly, the belief was that something bad would follow to the transgressor.

According to most respondents interviewed in the Bhaktapur Durbar Square area, if menstruating women or lower caste people went into the Bhimsen hiti, the spout simply stopped functioning. According to two experts, there is an inscription inside the palace of Bhaktapur Durbar Square decreeing that the spout should be kept clean and the land should not be encroached. Should anyone disobey this command, he or she will be cursed.
to live as a parasite for the next life. Washing clothes or dishes and bathing was prohibited in and on the bank of Bhaktapur state canal.

As described before most of respondents agreed that it was not allowed to keep clothes on top of stone spouts knowingly or unknowingly. This is still regarded as a sin in all study areas. According to respondents, there is an image of Bhagirath featured at all spouts. Locals held the belief that the god Bhagirath brought water to earth for people and not wearing footwear was a sign of respect to him. It is also considered as a sin to walk across the top of spouts.


All interviewees believed that traditionally, stone spouts were sustained and managed through local efforts and were important in rituals and festivals. Local people, especially Newars, cleaned the water sources and water infrastructures on these occasions. According to a 93 year old interviewee in the Changunarayan area, nowadays festivals such as Sithi Nakha have reduced in importance as conserving resources. Therefore the festivals cannot be relied on to provide the spout infrastructure with a thorough supply of clean each year.

Most temporary residents interviewed in Changunarayan and Jhaukhel stated that they have never seen local people clean stone spouts in Sithi Nakha. One young local interviewee from Changunarayan and one young female migrant from Jhaukhel area said that they were not aware of any efforts by locals to clean the water sources in Sithi Nakha. They thought of it as only a normal festival. However, Sithi Nakha has been officially declared as the national day of water networks maintenance in the Kathmandu Valley. Some respondents from Chaangunarayan area hold that the Sithi Nakha festival is for maintaining dug wells and not for the upkeep of stone spouts. According to most temporary residents and migrant respondents, Newars in the Changunarayan and Jhaukhel never clean and maintain their stone spouts at Sithi Nakha time. Although they enthusiastically celebrate the Sithi Nakha, they used to clean only dug wells on that day but nowadays they do not clean any water resources at all. One young temporary resident interviewee in Changunarayan explained:
No there is not any tradition of cleaning the stone spout in Sithi Nakha here in Changu. May be it is done in the city area because I have never heard of cleaning stone spouts, wells and ponds in Sithi Nakha. We clean it whenever it gets dirty. We only celebrate Sithi Nakha as a festival not for cleaning of water sources.

Field data show that people from the urban areas, Bhaktapur Durbar Square and Madhyapur Thimi, still clean and maintain their water resources including stone spouts but not with the same fervour as before. Most young respondents interviewed in the Madhyapur Thimi and Bhaktapur Durbar Square areas reported that Sithi Nakha is for celebration not for work. They do not like to clean spouts on that day as it is reserved for western style recreation. According to them, spouts should only be cleaned if and when they become dirty. All old respondents of Madhyapur Thimi and Bhaktapur Durbar Square areas reported that in bygone days they enjoyed cleaning all water sources including stone spouts together in Sithi Nakha. According to them, but now as in many other cultures the new generation do not choose to listen to them. One of the respondents in Bhaktapur Durbar Square related:

Once I told my grandson to join people for cleaning the water spout in Sithi Nakha. He asked me why should he need to clean spout as we have our own water system at home? For the young generation festivals are only for fun. I am worried one day people will not even know Sithi Nakha was related to water sources management.

Findings shows that after the enactment of the Land Reform Act of 1964, spout guthi are no longer active in the study areas. Most lands owned by guthi were privatized under this Act and thereafter the resources that were the stone spouts started to be ignored, for example one respondent in the Changunarayan area stated:

The guards were given the rice grains as the payment. My father was one of them. I grew up eating that rice. When I was young, I used to go with my father with the paste made by the resin from “Salla” (Pinus) tree and brick powder. My father, I, and my uncle blocked the leakage of the earthen pipe using the paste. We had to go daily. Later, more than 40 years ago, the rice grains were stopped being given to us and we stopped going there. After that nobody was interested and the water sources and spouts are getting worse.
Most experts and planners explained that most of the hiti guthi (stone spout guthi) in the study areas are no longer active except Lu hiti in Bhaktapur. The Lu hiiti is dry nowadays and has state guthi. They said that guthi do nothing else except performing annual worship for this spout. People clean the spout if they feel motivated to serve and it is noticeably dirty. Although there are some attempts to co-ordinate local cleaning efforts these are few and far between.

Three respondents (two female and one male) interviewed from the Bhaktapur Durbar Square area explained that after the privatization of the guthi land 40 years prior nobody accepted responsibility to look after the state canal of Bhaktapur. So, the two ponds, where water was collected by a state canal and distributed to stone spouts were encroached. The state canal was further damaged to the point of destruction after a road was constructed beside it. One female respondent stated that:

*Our family utilized water from the state canal for household needs and for irrigation. The water was so clean. Guards did not allow people to pollute the water and they came every day and mended the canal, when needed. It all seems like a dream now.*

All planners interviewed stated that after the endorsement of Muluki Yen, an Act, in 1951 people were not allowed to discriminate based on castes. According to them, although this was for the most part seen as positive, it was part of a general unravelling of the social fabric of beliefs surrounding the stone spouts and other water infrastructure features. Most young respondents in all study areas did not retain sufficient spiritual beliefs to perform annual worships and other social taboos such as the prohibition of washing undergarments, leather items, and shoes and the regulations preventing menstruating women from maintaining or using the water spouts. However, they agreed that cleaning water resources and water networks might help to increase water flow before performing the worships. The main impacts of changes in social, cultural, and institutional norms and values and how they influence the stone spouts management system are outlined below.

### 6.4.1 Clogging of drainage

The water drainage network is an important feature of stone spouts. The drainage systems of spouts discharge waste water either into agricultural lands or into ponds adjacent to the spouts. It was observed during the field visits that waste water from most of the stone
spouts of Madhyapur Thimi is directed to agricultural fields outside the settlements directly. However, most spouts in the Bhaktapur Durbar Square area have their own pond to discharge waste water into them. Likewise, only, Gamdhoka hiti of Changunarayan and Taleju hiti and Karki tole dhara of Jhaukhel featured adjacent ponds to discharge water. Water was drained to cultivated land from other spouts in those areas.

All respondents reported that drainage clogging is of paramount concern for most spout systems of the Madhyapur Thimi areas. People throw away covers from soap cakes, rotten and unwanted parts of vegetables, water bottles, and packaging from convenience foods into the spouts. After abandoning the regular cleaning of stone spouts many spouts such as Garchahiti, Nil Bahari hiti, Gahn hiti and Tahra hiti have been afflicted by water clogging problems. Respondents explained that sometimes, they use mechanical pumps to remove water from these spouts. Similarly, Lakila and Magar Tole dhara of Jhaukhel and Indrayani hiti of Bhaktapur Durbar Square areas are struggle to operate due to the blockage of drainage systems.

6.4.2 Encroachment on pond and spout areas

Old respondents in all study areas believed that earlier people were reluctant to allow any encroachment onto ponds and spout areas. They believed this was sinful and also there were strict social rules and regulations to punish the people who transgressed. One respondent in the Bhaktapur Durbar Square area explained:

*Nowadays, the young generation do not believe about sin and goodness. We are still scared to pollute the spout areas but they do not believe. They started to build houses in spout’s pond area. I cannot even imagine myself doing that. It’s a sin for me.*

It was noticed during the field visits that the ponds at Gamdhoka hiti in Changurayan area and Taleju, and Karki tole dhara in Jhaukhel area were already encroached. Likewise, many spouts of the Bhaktapur Durbar Square area also lost adjacent areas and ponds due to encroachment. Two ponds, where water was collected from the state canal of Bhaktapur were also encroached and 56 spouts of Bhaktapur city area had dried out (as described in chapter three).
6.4.3 Decline of inscriptions and images

One young respondent from the Changunarayan area said that the stone spout inscription of *Gah hiti* was misused. During the field visit it was noticed that the stone inscription in Changunarayan and the water conduits in Jhaukhel areas were used for personal private purposes such as *Gah hiti* inscription was used as a scrub stone and water conduits were used to build a fence and clothes washing purpose. Similarly, most respondents mentioned that many images of *Gun hiti, Narayan hiti* and *Gah hiti* had been stolen. Furthermore, many images from the Bhaktapur Durbar Square, Jhaukhel and Madhyapur Thimi spouts have also disappeared.

6.4.4 Destruction of spout infrastructure

According to most respondents, after the decommissioning of the *guthi* system in the Changunarayan area, the water network of *Gah, Gamdhoka* and *Gun hiti* collapsed because of landslides and had been left as was. None saw it as their responsibility to look after these spouts. Thus, these spouts have been dried out for around 30 years. During this period, *Gun hiti* and *Balambu tole hiti* (also called 108 step spout) were encroached on and all traditional materials of this spout were destroyed and misused. In similar fashion the infrastructure of *Gamdhoka* and *Gah hiti* have also been compromised. Now, however, a modern pipe-line system has been connected by the Japanese Student Association of Nepal (JUSAN) into these two spouts to supply water.

Likewise, field data show that all the traditional water conduits were replaced in the Changunarayan area and Jhaukhel area except *Magar tole dhara*. People shifted and modified *Sarki gaun dhara* in the Jhaukhel area. Most respondents of the Madhyapur Thimi and Bhaktapur Durbar Square areas also explained that after modernization cultural beliefs were diminished and people destroyed and replaced the spouts’ water networks and infrastructure with modern technology without any hesitation. Similarly, people also do not hesitate to build dug wells inside the platforms of stone spouts. For example, dug wells were built inside *Nuh* and *Bagdgara hiti* of Madhyapur Thimi, *VDC dhunge dhara* and *Hanju gaun dhara* of Jhaukhel and *Gah hiti* (*Golmadi hiti*) of Bhaktapur Durbar Square areas.
6.4.5 Dumping waste

During the field visits it was noticed that nowadays people do not hesitate to dump waste into dried spout areas. For example, Sandaha spouts of Changunarayan area, Sichako hiti, Tindhara and Nil Barahi spout of Madhyapur Thimi and Ram mandir and Lakila spout of Jhaukhel areas have turned into dumping sites. However, in comparison to other study areas, the platforms of spouts in Bhaktapur Durbar square are cleaner except Indrayani hiti.

6.4.6 Decreasing water flow

Most old respondents of all the study areas agreed that under the social climate in bygone eras certain days were designated to clean and maintain the water sources, water networks and platforms of stone spouts. They had their own rules and regulations which facilitated timely maintenance. The entire neighbourhood used to work together to clean water sources. However, nowadays, cleaning of spouts is either a declining trend or being totally ignored in all the study areas. Thus, the water flow to and from spouts is compromised in all the study areas. For example, one old respondent from Madhyapur Thimi exclaimed:

“Tarha hiti” means “spout with a big flow” in the Newari language. Twenty years ago this spout had a big water flow. It took a few seconds to fill a 20 litre of water jar. Likewise, when we put our head under the water outflow for bathing, we felt like our head had been washed off.

Furthermore, many respondents from Changunarayan reported that the Narayan hiti water flow is also decreasing. According to most respondents interviewed and as discussed in focus groups, all spouts described as having poor flow in Table 5.3 used to enjoy good, steady flow even in winter, the turning point being 30 years ago.

Table 6.3 summarises the changes of institutional, socio-cultural norms and values and the subsequent impacts on traditional stone spouts within the study areas.
<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Changes in traditional institutions/ ceremonies</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban</td>
<td>Heritage</td>
<td>Changunarayan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No guthi system</td>
<td>Most images of spouts were stolen.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No cleaning in Sithi Nakha</td>
<td>Most of spouts’ plate forms are dirty.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No regular worshipping and cleaning from society and household level</td>
<td>“Athah” and Earthen pipes were replaced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Most images of spouts were stolen.</td>
<td>Inscription of Gah hiti was misused.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Most of spouts’ plate forms are dirty.</td>
<td>Gun and Balambu tole (108 step spout) hiti were encroached.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• “Athah” and Earthen pipes were replaced.</td>
<td>All the traditional bricks and other building materials of Gun hiti were stolen.</td>
</tr>
<tr>
<td></td>
<td>Non-heritage</td>
<td>Jhaukhel</td>
<td>Most spouts dried out (See Table 5.3).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Most spouts were modified (see Table 5.2) and dried out.</td>
<td>Narayan hiti is more polluted and water flow also decreased.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Drainages were blocked in Lakila and Magar tole’s spouts.</td>
<td>Wastes were dumped into Sangdaha1 and Sangdaha2 spouts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Taleju spout was polluted and dried out guthi’s land was privatized.</td>
<td>Modern pipe-pieces were connected into the mouth of all spouts except Narayan hiti.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Traditional pipes were replaced from all spouts except Magar tole’s spout.</td>
<td>All the ponds used for collecting waste water from spouts were encroached.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ram mandir, Lakila and VDC dhara were polluted and images were stolen.</td>
<td>Most spouts were modified (see Table 5.2) and dried out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dug- wells were built inside the Hanju gaun and VDC dhara.</td>
<td>Drainages were blocked in Lakila and Magar tole’s spouts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Most of spouts plate forms were dirty and destroyed.</td>
<td>Taleju spout was polluted and dried out guthi’s land was privatized.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sarki gaun dhara has been shifted.</td>
<td>Traditional pipes were replaced from all spouts except Magar tole’s spout.</td>
</tr>
<tr>
<td>Category of area</td>
<td>Study Area</td>
<td>Changes in traditional institutions/ ceremonies</td>
<td>Impact</td>
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</tr>
</tbody>
</table>
| **Urban**        | Bhaktapur Durbar Square | • Most *guthi* no longer exist except *Lu hiti Guthi*  
• No proper cleaning in *Sithi Nakha*  
• Social, cultural and traditional norms and values were disobeyed. | • State canal is encroached.  
• Most spouts are dried out and are connected with modern pipe-lines (see Table 5.2).  
• Drainage is blocked in *Indrayeni hiti*.  
• Most of spouts are dirty and images are destroyed and stolen.  
• Most of drainage ponds of spouts are dried out  
• Stone spouts’ areas are encroached such as *Gah hiti* and *BulBul hiti*.  
• Water flow is decreased in most of the spouts. |
| **Non-heritage** | Madhyapur Thimi   | • No *guthi* System  
• No proper cleaning in *Sithi Nakha*  
• No annual worship in *Nuh* and *Gahn hiti*. | • *Thangacha hiti* is dirty and in high risk of landslide.  
• More than half spouts have poor and no flow (see Table 5.3).  
• *Nil barahi* and *Garcha hitis*’ water drainages are blocked.  
• Water flow of *Garcha and Gahn hiti has been* diverted due to damage by mice.  
• Very dirty and slippery platform of *Lakha pati Khawa: hiti*.  
• Waste dumping site nearby *Sichako, Gorkhanath* and *Bata hiti*.  
• *Sichako, Tindhara and Nilbarahi hiti* turned to dumping site.  
• Dug wells are built inside *Nuh* nd *Bhansi hiti*.  
• Thick Iron layer in *Tarha hiti*.  
• Some spouts are modified, encroached and pipe-line connected (see Table 5.2).  
• Images are stolen end earthen pipes are replaced in most of hiti including *Debama hiti*. |
6.5 The Impact of the Modern Pipe-line Water System and Other Development Activities on the Religious, Socio-cultural and Aesthetic Importance of Traditional Spouts

According to experts interviewed and documents analysed the pipe-line water supply system was first introduced in Nepal in 1895. The Rana Prime Minister, Bir Shamsher installed a piped drinking water supply system in Kathmandu Valley accessed through limited private and public stand posts. The Department of Water Supply and Sewerage (DWSS) was established in 1972 to provide a water and sanitation program all over the country. Nepal Water Supply Corporation (NWSC) was responsible for supplying supply pipe-line water under the DWSS until 2008 in the Kathmandu Valley. After that, Kathmandu Upatyaka Khane pani Limited (KUKL) was the main body responsible for the distribution of drinking water in the Valley. As discussed in earlier sections, stone spouts have been widely used in the Kathmandu Valley since ancient times. However, after the development of the modern water supply system, stone spouts started to be ignored and also further construction ceased. The following sections describe the activities that have impacted the religious, socio-cultural and aesthetic importance of traditional spouts in all the study areas.

6.5.1 Establishment of the modern pipe-line system

Most respondents said that the collapse of guthi systems is the main cause of the decline of Gamdhoka, Gah and Gun hiti (spouts) in the Changunarayan area. According to them, these spouts’ water sources, water networks and infrastructures were badly damaged and were completely buried for about 30 years. The Japanese Student Association of Nepal (JUSAN) renovated the whole water networks and the infrastructures of Gah and Gamdhoka spouts in 1996. A modern pipe-line was connected in these two spouts from their previous water source. The stone spouts are opened for four hours in the morning and two hours in the evening. JUSAN gave the spouts a complete refurbishment which resulted in a new look for the Gamdhoka spout. However, the Gun hiti was encroached and Balambu tole hiti (also called 108 step spout) completely disappeared because it was neglected by locals after they were able to obtain water from the pipe-line connection to the Gah and Gamdhoka spouts.

A planner explained that The Changu-Duwakot-Jhaukhel Drinking Water Supply System (CDJ DWSS), a large community initiative, has operated since 1998. Groundwater is extracted from
the bank of the Manohara River in Changunarayan VDC to provide drinking water to the inhabitants of three VDCs, Changunarayan, Duwakot and Jhaukhel. Likewise, Changunarayan Brihat Khane Pani Yojana (Changunarayan Multiple Drinking Water Scheme) has also operated since 1995 (2052 B.S.) in Changunarayan VDC. It has become apparent that stone spouts were ignored as modern-pipe line water delivery systems have been installed in almost every household. However, people from the Changunarayan temple area do not use water from the Changunarayan Multiple Drinking Water Scheme for drinking purposes. They only use this water for washing, bathing and animal feeding. They obtain drinking water from the Gaha and Gamdhoka spouts.

According to 14 respondents (eight male, six female) interviewed face-to-face and 25 (15 male and 10 female) from seven focus group discussions, most houses in the Changunarayan area have pipe-line connection either from CDJ DWSS or as a result of the Changunarayan Multiple Drinking Water Scheme. As a result many related that use of the spouts had become a superfluous daily activity or an extra supply in case of emergencies. After the introduction of pipe lines, people started neglecting stone spouts with the result that they were gradually destroyed and ultimately descended into debris. Two young male respondents interviewed face-to-face and eight (five male and three female) from three focus group discussions opined that having water on tap at dwellings completely negates the need for an additional source. For them, water is water whether or not it comes from stone spouts or via the pipe-line. However, an older community respondent argued that as a rule the younger generation have no appreciation as to the importance of stone spouts in a cultural sense. It was also offered that maybe people who cannot afford to install pipeline water technology use water from spouts. He further added:

*People are attracted towards the new technology and they ignore the old tradition. If the pipelines are removed only then the spouts will be put in to operation. They do not know that the old things are durable. The pipeline does not work if there is no electricity. But the spouts flow naturally. Young people need to understand this.*

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**Note:** B.S. is the abbreviation of Bikram Sambat. It is an official calendar of Nepal which is about 56 years and 8 and months ahead of the English Calendar. The current Nepali year based on the Nepali calendar is 2072 B.S.
there is no existence of the stone spouts, there is no way for the future generations to know about their structure.

Likewise, Shrestha et al. (2013) reported that there are 11 community drinking water supply schemes in the whole of the Jhaukhel VDC. All of these water supply systems are dependent on ground water as a primary source. Of these 11 schemes the Changu-Duwakot-Jhaukhel Drinking Water Supply System (CDJ DWSS) is the largest. Most respondents interviewed seemed to be of the opinion that on the one hand ground water extraction for these water supply schemes affects the stone spouts by depleting their water flow while simultaneously all spouts are suffering from neglect.

Virtually, all community interviewees in Jhaukhel area stated that they had used stone spouts in earlier times but now they predominately drink water from pipe-line supply system. Water is thought with good reason to be from sewage contamination at Dahal gaun spout. Again virtually all of the women respondents of Dahal Gaun in the Jhaukhel VDC agreed that there was a scarcity of water before establishment of CDJ DWSS water supply system in their village. This scarcity caused long queues at times before the pipe-lines were introduced. According to most old community respondents, families from other areas did not want to marry their daughters in Jhaukhel before modern water supply systems because of water scarcity.

The “Dhimal community water supply schemes” was also established (in 1998) in Dahal Gaun. All respondents in Jhaukhel agreed that the pipeline system caused the spouts to be neglected. After the installation of the pipe-line water supply systems they use stone spout as an occasional alternative. The only time focus falls onto the spouts is when the pipe-line malfunctions. One respondent in Yando tole stated that:

> Everyone has the pipeline now so no one cares about the stone spouts. It has been more 10 years since the Yando tole Dhara (spout) has been dried out. Water is diverted by mice harrowing the water network of it. Water is still seeping through the wall there. If we cement it, the water will again flow there. But no one needs it and why would we bother to fix it.

Another female respondent stated that pipe-line water supply is better for her because she does not have to go out on rainy days. However, she agreed that the actual taste of the water from the spout is better than that from the modern pipe-line system. Four migrant
respondents interviewed stated that earlier the technology was not so well developed and people had no other alternatives. So, they built the stone spouts. Now there is a pipeline catering for everybody in their house. Life is better now. One of them even suggested to the researcher that it was counterproductive to spend time researching about the old technology. According to respondents who hold opinions such as these, no one cares about the spouts in this modern era.

All interviewees agreed that people in Jhaukhel are using spouts as an alternative to modern water supply technology. However, they only need water from stone spouts during funeral ceremonies. This practice stems from the still entrenched caste system, each group having their own stone spout for performing funeral ceremonies. For instance, Dahal people use the Dahagaun spout during their 13 day funeral ceremonies and Dhimal people use another spout. Magar communities use the magar tole spout for worshiping their ancestors. The water from the wells, pipelines and ponds is considered impure during funeral ceremony.

An expert and a historian explained that private water supply networks were connected by the Bhaktapur Development Project (BDP) at the household level in 1980. According to responses offered by 18 interviewees (ten male and eight female) in face-to-face and 35 respondents (21 male and 14 female) participating in focus group discussions, it was after the introduction of modern water supply technology and privatization of guthi land, that the state canal started to be ignored. A big earthquake in 1934 damaged and further contributed to the systemic dysfunction. Water from the state canal was channelized after collecting and filtering it into two ponds. These ponds also were encroached. Nobody assumed responsibility for repair of the state canal. Householders were content that they had their own pipe-line connection and did not need stone spouts anymore. However, most respondents mentioned that even the pipe-line water supply is not providing regular water these days. Sometimes water is supplied only once in five days.

Furthermore, most respondents during face-to-face interviews and focus group discussions reported that the introduction of the modern pipe-line system was the main cause of the dramatic reduction in usage of the stone spouts in the Madhyapur Thimi areas. An old respondent interviewed stated that the modern pipe-line system was introduced in Madhyapur Thim area in 2022 B.S (1965 A.D.). After the introduction of the pipeline system locals started to ignore and neglect stone spouts. Most respondents stated that they now had
modern pipe-line water supply systems installed in their houses. So, they have stopped going to stone spouts. However, they had been accustomed to using the spouts when the modern pipeline does not function. Moreover, two female respondents interviewed in face-to-face and four respondents during focus group discussions stated that they still use stone spouts, but only for drinking water. That being the case most respondents when face-to-face interviewed claimed that they use the stone spouts for bathing and washing purposes and that they use pipe-line water for drinking. This group asserted that spout water has become more polluted and is therefore not good for drinking. One woman respondent further added that she prefers piped water, the reason being this source is more convenient than the spouts with no need to wait in a queue. Twenty two respondents (12 male and 10 female) during five focus group discussions stated that every community in Nagadesh and Bode areas has access to their private or public modern pipe-line system or dug well. So, they did not need spouts. One old respondent during a face-to-face interview stated:

In our time it was very costly to install the pipeline. Only those who could afford installed it. Stone spouts were there to provide water for free for everybody. Now the pipe-line water is easily available. Everyone has pipeline in their house so no one cares about spouts. When we were young, we had to depend on the stone spouts.

Two interviewees who were from the family of the initiator of the spouts stated that there was no one to look after stone spouts since the pipeline has been installed and therefore the spouts have been ignored. It was felt that most people only come to spouts when the pipeline system was not working. Nowadays, the children come to play in Gahn hiti making the spout water and surrounds dirty. There were 39 respondents (22 male and 17 female) identified in seven focus group discussions that reported that it had been 10 years since they stopped drinking water from Garcha hiti. The sewage pipe has been installed near the source of this spout. Adding to the decline was the disposal from the sewage pipe contaminating the source. Officials tested the water quality of this spout at one stage and it was recommended to locals not to drink water from Garcha hiti.

Most respondents from Madhyapur Thimi area agreed that only the Nhu hiti has not been affected because the local people have preserved the spout. But the other spouts have been ignored after the pipeline systems were introduced. One planner also agreed that the modern pipe-line system is the main cause of the decline of the stone spouts. He explained that
development and destruction come together. Earlier there was no source of water so people built stone spouts. After that wells were dug. Then the pipelines were introduced. Thus, fresh and clean water was easily available. But slowly people started ignoring spouts. They started polluting the spouts and the decline of the spouts began. This situation was made worse by land encroachment for development purposes. He noted further that the government does the maintenance work but the conservation work should be done by the local people themselves. In the absence of local support the government will not always take responsibility for maintenance. According to this planner, people remember the spout only when the pipeline does not work. When the pipeline functions, they stop thinking about spouts.

6.5.2 The Establishment of the Mohan Shamsher water tank

_Rana Prime Minister Mohan Shamsher_, built a water tank in 1985 B.S. (1928 A.D.) in the Changunarayan VDC ward number nine for the purpose of providing drinking water for the locals. According to four respondents (one male and three female) in face-to-face interviews and 17 (nine male and eight female) from four group discussions, after the introduction of this modern tank people ignored the _sangdaha_ spouts. So, as a result, both spouts dried out within 20 years. Following this, modern water reticulation was installed in the area between the two _Sangdaha_ spouts as a result of using modern infrastructure to circulate the water from this tank. In other words, a new pipeline was installed instead of repairing those stone spouts. According to one planner and two experts interviewed, this is a classic example of using new technology for the sake of it (Figure 6.1). However, a community respondent argued that local governmental bodies and investors could be benefitting financially by constructing a new structure rather than maintaining a traditional one. He further added that here is yet another possible reason for the rejection of traditional water delivery mechanisms in favour of new technologies.
6.5.3 Road and other Infrastructure construction

All respondents in Changunarayan confirmed that one stone spout in the Mohan shamsher tank vicinity was buried while constructing a road in this area. This Puriyeko dhara (means buried spout) was totally neglected after water from the Changunarayan-Duwakot-Jhaukhel Drinking Water Supply System (CDJ DWSS) began to be used. According to three interviewees (one male and three female) face-to-face interviewed and 16 (nine male and seven female) discussed in five groups, they have their pipe-line water supply system and the fact that the spout was hidden from sight and required work to uncover and restore was a serious deterrent to any locals seeking to restore the traditional water delivery systems.

Six respondents (five male and one female) interviewed from Jhaukhel area reported that after construction of the road called Mandev Marg which leads to Bhaktapur from Changunarayan, which began about 15 years ago, the spout called VDC dhunge dhara has been progressively drying out. The water source of this spout lies in the actual road itself. The water source was about 1.5 metres down and was bounded by a brick wall that had been covered by the slab over which the water was conveyed to the spout.

Similarly, most respondents stated that construction of modern houses was another cause of drying out of spouts in the Jhaukhel area. People from other districts have migrated to the
area. According to them houses have been built over many of the water sources of spouts. The *Deep jyoti* women’s committee building is an example, constructed on top of VDC *dhunge dhara*. Due to the residential influx the water sources and network of spouts were not only compromised but the surface disturbance from a natural state also slows down the recharge rate of ground water. According to five respondents (three male and two female) face-to-face interviewed and 13 (eight male and five female) discussed in three groups, water flowed 24 hours a day from *VDC dhunge dhara* prior to the residential construction programme. The situation was only made worse when the women’s development committee authorised deep boring inside the spout’s platform. Three respondents (two male and one female), from face-to-face interviews and 24 (11 male and 13 female) from six focus group discussions, reported that a furniture factory, a hospital, a cottage industry office, the *Saja Prakashan* office, a milk Processing facility and the VDC building were constructed near the source of *Ram Mindir* that causes the *Ram Mandir* and *VDC dhunge dhara* to dry out.

Four male respondents in face-to-face interviews and nine (six male and three female) from two focus group discussions, in the Jhaukhel area said that the water source of *Ram mandir* and the *VDC dhunge dhara* was left concealed in the foundation of the buildings. Despite requests to the owners not to bury the source and instead install a water extraction mechanism as part of the plans, no such action was taken and as a result the spouts dried out. A further group of participants (seven in all) pointed out that there had been much interference with the group of ponds that traditionally supplied some stone spouts. Once again many of these ponds have been in-filled to provide more housing sites. Construction of toilets was also mentioned by 14 interviewees during three focus group discussions as the main cause of pollution of the spouts in the Jhaukhel area. At *Yando tole dhara* it was discovered that the cause of the progressive drying out of the spout was the diversion of the original water source to the pond.

Likewise, according to all experts interviewed in Bhaktapur Durbar Square area, stone spouts are predominately recharged from shallow aquifers. It is therefore highly likely that the flow of groundwater has been disturbed by the construction of pipe-lines, drainage and the erection of buildings. Most respondents interviewed face-to-face and those who participated in focus groups mentioned that the BDP which began in 1974 was the main cause behind the reduction and drying out of most stone spouts in the Bhaktapur Durbar Square area. This
project was carried out under joint cooperation between the Governments of Nepal and Germany. It was theorised that restoring and expanding the modern water supply system, as well as constructing a modern sewerage system by laying concrete pipes and paving streets had broken the traditional pipes, water networks and paths of almost all stone spouts. One expert stated:

_The construction work of BDP was guided by the contract documents. They did not include the local people in the construction activities. They did not know the underground water networks and channels of the spouts. So, most of the water networks were damaged at that time._

Most respondents from both face-to-face interviews and focus group discussions agreed that construction of buildings, sewer systems and road networks obstructed not only the natural water flow to spouts but also considered the possibility that the water from their traditional sources might have been diverted into the new drains. According to those who hold these opinions, the spouts of the Bhaktapur Durbar Square area definitely face the problem of sources drying and the blockage of drainage due to improper and inconsiderate construction of buildings and roads. Drainage systems of the spouts were also blocked due to improper maintenance of the outlets. For example, _Indrayani hiti_ has now turned into a pond because of thoughtless obstruction of its outlet. One woman respondent during focus group discussion stated:

_People build houses and roads that block the sources and outlets of spouts. I am worried about Indrayani and Balakhu hiti. These spouts could be buried due to throwing away of waste by the people._

Encroachment of the spouts’ platforms is another problem in the Bhaktapur Durbar Square area. It was clearly noticed during the field visits that the _Bulbul, Jangam_ and _Layaku_ hitis’ platforms had been commandeered for private business purposes. Likewise, most respondents pointed out that waste water from many stone spouts in the Bhaktapur Durbar Square area drained into ponds. Theses ponds helped to recharge the ground water. However, most of these ponds have been encroached or completely dried out for construction purposes. Furthermore, two male respondents in Madhyapur Thimi area pointed out that earlier there were many forests and fewer houses. But now all the forests have been logged and many
sources have been buried during the construction of the houses. Likewise, 32 respondents, 21 male and 11 female, in focus group discussions reported that road construction is an important reason for the drying of the spouts in Madhupur Thimi area. One old respondent added:

*When I was young I often came to maintain the spout source nearby our house. There were only 8-10 other houses near the water source. Later since the residential dwellings have increased, the source has dried.*

According to several respondents interviewed and those present at focus groups, prior to the construction of the main road, people from Bhaktapur city used to travel to Kathmandu through the Madhyapur Thimi area. So, most of the spouts were constructed beside the main path to provide the water to the travellers. More than 50 years ago, a paved road was constructed over the old walking path. One female respondent remarked that the “Tindhara” spout has been buried for 30 years. While build the road construction workers deposited sand and stones right over the top of the spout. According to this respondent the spout platform was noted for its beauty. There were two points of entry with extensive intricate brickwork. There were images of Buddha and other goddesses all around the spout. The water used to flow 24 hours a day. Now everything is buried and the environment has been contaminated. Another respondent added that it’s been more than 20 years since the Dhmu phant hiti was also buried during road construction. Now vehicles run right over where the spout was. Another old focus group discussion participant explained that Nil barahi hiti is also affected by road construction. The outlet of this spout was blocked after road construction. He added:

*Earlier I used to come here and open the blockage. But the vehicle drivers drove so recklessly that I was scared so I stopped coming here. I stopped coming here and after that no one has cleaned it.*

According to 11 (nine male and two female) respondents present during three focus group discussions, the roads have caused the Thangacha hiti to be eroded in Madhyapur Thimi area.

### 6.5.4 Pinus species plantations

The Constitution and operational plan of Changunarayan community forest show that this forest covers a total land area of 47.2 ha of land. Most community respondents interviewed and in groups claimed that due to the planting of Pinus trees the water sources to the stone
spouts were dried up in the Changunarayan area. According to them, most of the spouts are located right below the *Pinus* forest. When *Pinus* trees grew up, water flow in spouts was noticeably decreased and as well many seemed to dry up (see Table 5.4). They have a view that in future if *Pinus* trees were replaced by other deciduous forest species the water sources of spouts would be recharged again. One respondent added:

> *Salla (Pinus) trees were planted in Changunarayan in 1978 A.D. (2035 B.S.). When they grew up the water started drying up. It’s been 40 years the spouts are dried. Water was flowing from Sangdaha spouts until the “salla” tree were small. But when they grew, water dried even though we did worship sources of spouts many times.*

However, another young respondent argued:

> *Trees help to increase the water flow rather than decreasing it. We should be scientific. The water has dried due to global warming. Some religious people think that the water dried due to the ill effect cast by the god of the snake. But I do not believe these unorthodox views. These thoughts are senseless.*

Two planners and an expert also agreed that the pine forest is one reason for the drying of stone spouts in the Changunarayan area. According to them, a general lack of cultural awareness is another cause of the neglect surrounding the stone spouts. Spouts could be operated by sourcing water from the *Mohan Shamsher Tank* if local people were more aware of their options. When the pipeline was introduced, the spouts subsequently were ignored. The government not only did not provide any cultural conservation initiatives for the spouts but seemed complicit along with the populace in allowing the spouts to deteriorate.

### 6.5.5 Sand mining

Many respondents were convinced that sand mining below the Changunarayan community forest area also may be a factor in the interruption and cessation of water from the original sources to the spouts. According to five interviewees (four male and one female) in face-to-face interviews and 11 (seven male and four female) in five focus group discussions, the government gets a huge amount of tax revenue from sand and gravel mining. So, they allow mining for immediate fiscal benefits. The sand was mined earlier from the *Manohara* River, but when a landslide occurred in the Changunarayan temple area, this was stopped. One respondent said:
It would affect a lot if it was mined here. But down there is like “what harm would one ant do to an orange” situation. They mine sand and clay one year and next year they bury the mine. They do not know it would cause erosion in the whole Changu heritage area including water spouts. The younger generation doesn’t believe that this soil erosion is due to the sand mining. Our Government should consider this and pay attention. Miners should be penalized for this. The administration should stop this work at once.

Most respondents in the Changunarayan area believe that sand mining had not directly affected the source of the stone spouts but soil erosion as a result of this activity has affected this world heritage area including the water spouts. According to them, sand mining is more dangerous than the deep boring which has been occurring to a lesser extent. The spouts have been dried and the landslide has occurred indirectly as a consequence of the mining activities.

Similarly, sand mining was began in Jhaukhel in 1978 to provide material for construction of the Araniko Highway (Shrestha et al., 2013). Two experts explained that three mines have been operating in Jhaukhel. According to them, sand mining has significantly affected the recharge of groundwater. Ultimately the ground water table is diminishing which creates negative effects for the stone spout water flow rate in the Jhaukhel area.

6.5.6 Deforestation

Most community interviewees agreed that there used to be a dense forest near the source of water spouts in the Changunarayan area. But as the population increased people settled in the forest regions and made use of this resource by cutting trees. Also they started using the water from the source directly. As a result, the source has begun to dry up because of the deforestation, and the recharge rate has also decreased. According to eight respondents (one from face-to-face interviews and seven from focus group discussions), there was a big “Nepalese Hog Plum” near the source of Kapah hiti. When it was cut down the water started to dry up. Because of an increase in settlements, forests are declining. The “Sindur Khwa” ponds above the spouts have also gone dry. The ponds themselves were sources of water located above the spouts. Respondents believed that the forests were actually an important component of nature contributing to the existence of water sources.
Findings from interviews show that shortly after the establishment of the pipe-line system, *Kapah hiti* was deemed to have been somehow polluted. Before the water from this spout was used for drinking but in a matter of five years locals found that they can only use water from this spout for washing cleaning, bathing and animal feeding purposes. There is speculation that somehow waste water has corrupted the water source. One male respondent stated:

> People from the higher region (Changunarayan temple area) are polluting the Kapah hiti. They did not realize that we were drinking water from there. If we suggest this to them they ask for money to construct septic tank. They say that if we construct a septic tank for them, then they will not dispose waste water there. Some suggested us using pipe-line water. We thought it was better to use pipe-line rather than fighting with them.

### 6.5.7 Legal and political obstructions

Most respondents said that people should get permission from the Archaeology Department (from government) before constructing or maintaining any infrastructures inside a heritage area. People are only allowed to use traditional bricks and other construction materials to maintain water spouts, but such bricks are a comparatively expensive building material. Locals cannot afford costly upkeep by themselves and the government provides only a limited budget for maintaining spouts. For example, in 2014, locals refused to take 20 thousand Nepalese rupees (200 USD) targeted for the repair of stone spouts in Changunarayan. According to them that amount was not sufficient to buy even 100 traditional bricks.

Most community respondents agreed that history brings to their notice that political instability is another factor affecting the management of spouts in the Changunarayan area. They stated that when the local government body changed, their decision also changed with regard to an important spout management initiative. Political parties are considered to ‘only favour their members’ and not good works or deeds.

### 6.5.8 Dug wells for household and irrigation purposes

The Environment and Public Health Organization (ENPHO) recorded 70 public water supply systems comprising 11 stone spouts, 29 springs, 26 dug wells and four tube wells in the Jhaukhel VDC as at 2011, all of which depend on ground water as a water source. Of the 70
systems, 51 are used for drinking and domestic purposes while the remainder are used for irrigation and other functions. Most planners, experts and community respondents interviewed confided that in addition to these public water supply systems, there are many private dug wells and tube wells in the Jhaukhel area that rely on groundwater as sources. According to them, now there are dug wells and tube wells ‘everywhere’, although, unfortunately the actual total number of facilities is not known. This increasing trend of constructing private dug wells and tube wells for household and irrigation purposes was also confirmed during field visits. The deep boring of wells for irrigation is conventional near most paddy fields.

Most respondents stated that in addition to private pipe-line water connection they have their own dug wells or tube wells at their houses. According to them, a significant number of householders have engaged in deep boring in the last 10 years, mechanically pumping the water for household and other uses. This has placed demands on the availability of ground water further contributing to the decline of stone spouts. Most respondents agreed that people renting accommodation and the labourers from the brick industries still use spouts. One woman respondent during convenience sampling stated:

**We have tube wells. But now the pumping machine is damaged. So, I came here otherwise I wouldn’t come here. It’s been more than 5 years since we dug a well in our place. Before that we drank water from here (Hanju gaun spout). Sometimes we go to the spout but only when there is power cut off. Stone spouts are now only for the people who are renting.**

Almost all interviewees agreed that water from the source of spouts has been dispersed to the dug and tube wells. Since people have started to use modern water harvesting technologies, no one takes responsibility for caring for the spouts.

Likewise, 22 respondents (12 male and 10 female) during six focus group discussions and nine respondents (three males and six females) during face-to-face interviews reported that due to the increase in population there is insufficient water available in the Bhaktapur Durbar Square area. In response to the shortage people started to dig more private wells. This activity has further disturbed the ground water level and compromised the path of the water. Nowadays, according to many participants, there are deep dug-wells in every house as an alternative to the pipe-line water supply system. Thus, water does not flow naturally into the
spouts. Most respondents agreed that deep boring has caused the sources of spouts to dry up by the diversion to dug-wells.

Similarly, 19 respondents from six focus group discussions in Madhyapur Thimi area reported that contractors and owners undertake deep boring and well-establishment near the water sources of spouts prior to constructing the dwellings. They have the belief that all the water from the sources of spouts is then diverted to the wells and the stone spouts have dried up because the well is dug deep enough so as to capture virtually all the usable water. However, one male respondent during the discussion stated firmly that he does not fully agree. According to this participant, wells are dug 10-15 metres down and the stone spout sources are just 1.5-3 metres below the ground level. So, therefore, the wells do not affect the spout. Three young local male respondents stated the contrary opinion that deeper wells poach water from the older shallower sources. According to them, that is the reason that when the new houses were built wells then spouts started drying up. One of them further added:

"On one occasion a dug-well was started by digging near the water source in “Naya basti” to build a house. First, I did not allow the operation. But the contractor said that well is dug 6-16 meters down and the stone spout is just 1.5-3 meters below the ground level. So the well does not affect the spout. I also thought it was logical. So I allowed the digging of the well nearby the spout source."

Five interviewees (three male and two female) echoed earlier remarks that now every house has the dug-well system in Madhyapur Thimi as an alternative to the pipe-line system. However, another respondent said that recently a group of locals excavated a public well but the water was yellowish. So, they now use the well water to clean vegetables and in their bathrooms and bring water from Nhu hiti and Debama hiti for drinking requirements.

6.5.9 Deep boring for the brick industries

All the planners and experts interviewed stated that there have been 12 brick industries operating in the Jhaukhel VDC since 1990. As high water use intensive industries, they are using groundwater via deep boring for their manufacturing process. According to Shrestha et al. (2013) 63 million litres of ground water is annually extracted by these industries for the single purpose of brick production. In addition, they also pump ground water, about 27.3 million litres annually, for their large workforce via dug wells.
Most respondents interviewed in the Jhaukhel area mentioned that the brick factories have had a pronounced effect on the level of water available for stone spouts. There is further concern about the sheer number of access bores attributed to the brick industry. They have the view that stone spouts use ground water from about 3-6 metres deep but these industries are using water from at least 30 metres depth. Moreover, there is further speculation that the brick industries have caused a large part of the land to dry due to high temperatures created during the manufacturing process. Currently there is a move by government to remove the brick industries from Jhaukhel. One local expert added:

*The chimney of brick industries can dry 200-300 meter deep and 50 meter wide land area around it. As well the digging of land has caused the water level to disappear or to shift to other places. We protested against it and in 2056B.S. (1999 A.D.) we had agreement on allowing the existing factory to run but not allowing a new factory to be established. The management of the brick factories was the main issue at the recent municipality’s council meeting.*

However, three male respondents interviewed from the community argued that it is not a good idea to remove the brick factories from Jhaukhel. They reasoned that if they remove the brick factories what will be their income source? Where will they go to get bricks? Although this industry has caused problems for the environment and the stone spouts, they have also provided income for many people.

Furthermore, one expert said that earlier there were many brick factories in Madhyapur himi. However locals protested and they were closed 20 years ago. According to him, when there were forests and trees the brick factories did not have much effect. But when all the forests were cleared the spouts and ponds started drying up.

Four respondents (one male and three female) from the two focus group discussions and one female respondent from the face-to-face interviews in Madhyapur Thimi area reported that *Gah hiti* did not need efforts to clean the water earlier as it was known to be clean. Later the carpet industry was established nearby and the workers employed in that industry allegedly polluted the spout.
6.5.10 Deep boring for commercial purposes

All experts reported that water bottling industries have extracted ground water in Jhaukhel, beginning in 2002. Currently, 18 privately owned commercial industries have been operating to supply water in bottles. They also sell ground water to private tankers and tractors. It was common to see 10-20 tankers and tractors per day carrying water during the field visit. The water market for tankers and tractors is centred on Bhaktapur city. However, the processed water in bottles and jars has been supplied to buyers inside and outside of Kathmandu Valley. According to the experts, ground water has been extracted from at least 18 to 37 meters depth for commercial purposes. Thus these industries further contribute to the decline of operational spouts. According to most community respondents, the private water sources as well as the stone spouts are drying out because of these industries.

6.5.11 Partition of land

All local people (Newar) interviewed and those who discussed it in focus groups agreed that the last 15 years has seen a significant migration to the peripheral area south of Bode and Nagadesh. This migration and the fact that it was tied to the Maoist political movement were commented on by many respondents. These new migrants settled in the “Naya basti” which means new settlement. The settled area is the location of most of the water sources for the spouts. With the growing demand for more land and the decline in perceived cultural value of the stone spouts local people were willing to profit by partitioning and selling off parcels of land to the migrants for housing.

When respondents were asked in face-to-face interviews and focus group discussions questions regarding the interest of people from this new settlement area in conserving the water spouts, the majority of local people commented that migrants do not have any concern for the spouts. Two male respondents mentioned that they went many times to talk to migrants about conservation of the sources of spouts but frequently such conversations ended in disputes or ill feeling. Moreover, the new settlers followed the established pattern of digging their own private wells. Seven women respondents (two face-to-face interviewed and five from four focus group discussions) reported that water flow of Thangacha and Debama hiti is decreased because of the proliferation of buildings in “Naya basti”. They further elaborated that now it is difficult to maintain and clean the sources of spouts because
of the need to work around the new settlers. The settlers themselves appear unwilling to participate in any community initiatives designed to restore the spouts to their former standard. One local expert interviewed also had a negative impression about the migrants regarding conservation of spouts in Madhyapur Thimi area. He commented:

_The spouts are still functioning in the area where the Newar population is greater. Newar people love their tradition more. It is difficult to preserve the spout in “Naya basti”. The migrants stay for 2-3 years, then sell the land in higher price and shift to the other place. They do not know about the historical things here and also do not care as well. They just come here to exploit the better infrastructure and economic opportunities._

Most local people during focus group discussions agreed that not only the migrants but they themselves are also equally responsible for the deterioration in the condition of the spouts. They are the ones who started plans for the sub-division of the land around the sources of spouts that ultimately caused the water to become polluted or decreased in flow. In some cases people even made use of the bricks that protected the earthen pipes for construction purposes. A significant consensus was observed among the respondents that the division of land into small plots and the construction activities on these plots in the “Naya basti” not only decreased the water flow of spouts but also dried the sources feeding them. In the rainy season the water was even more contaminated when people started ploughing the land above the source. According to four women respondents, the people living in rented accommodation just use the water from spouts. These renters do not care about the maintenance of the spout. They believe that conservation of spouts is only the responsibility of local people. It was also reported that the non-interest of the renters and migrants and allegations of vandalism and destruction by locals have led to numerous disputes. One local expert respondent during focus group discussion added:

_Until we are in charge of the place we can’t do anything. Now we lost our power by plotting our lands and selling them to outsiders. People who are wealthy and who have power come here to settle. We are like helpless kids to them so they don’t listen to us. They do not care about the monuments and they do not have any attachment with our ancient properties like stone spouts._

Most migrants interviewed in Madhyapur Thimi area mentioned that they have their own dug wells or pipe-line connections. Therefore, they are not using water from spouts. They did not
have sufficient information regarding the importance of their land as spout sources. One respondent from “Naya basti” and another from the core area reported that they recall making a verbal agreement with the people who sub-divided the area around the sources of the spouts. The agreement was that they would undertake their construction activities without disturbing the spout sources and infrastructure. However, that agreement never came into practice.

6.5.12 Improper plantation

Ten respondents (seven male and three female) advanced the theory that the roots of the “Peepal” (*Ficus religiosa*) tree were instrumental in drying out the *VDC dhara* in the Jhaukhel area. These roots broke the earthen pipes and they leaked. Locals had in the past removed roots many times but after the construction of the road they stopped caring about the functioning of that spout.

Likewise, three respondents (two male and one female) face-to-face interviewed said that the water flow of *Han hiti* in the Madhyapur Thimi area has also decreased because of plant roots. One estimated that water flow had decreased by 60 percent. According to them, tree roots have caused the earthen pipes to break and leak. Last year locals cut the branches off the offending tree. It was further explained that the released water seeps into the hill which has become green and lush as a result. One of them further added that if the water leaks a certain way, the hill will be eroded and if the action is not taken soon the spout will be transported away by a landslide.

Table 6.4 summarises the impact of the modern pipe-line water system and other development activities on traditional spouts of all the study areas.
Table 6.4: The impact of the modern pipe-line water system and other development activities on the traditional stone spouts of all study areas

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Development Activities</th>
<th>Impact on spouts</th>
</tr>
</thead>
</table>
| Peri-urban       | Changunarayan    | • CDJ DWSS and Changunarayan Multiple Drinking Water Scheme  
• Establishment of *Mohan Shamsher Water Tank*  
• Road construction  
• *Pinus* species plantations  
• Sand mining  
• Deforestation  
• Legal and Political Obstructions  
• Drinking Water Supply Schemes  
• Road and other infrastructures construction  
• Dug wells for household and Irrigation purposes  
• Deep boring for the brick industries  
• Deep boring for commercial purposes  
• Sand mining | • Ignored stone spouts  
• “*Athah*” and Earthen pipes were replaced by modern pipes.  
• *Sandhaha* 1 and *Sandhaha* 2 spouts dried out  
• Encroached *Puriyeko dhara*  
• Water sources were dried up  
• Soil erosion affected the spouts  
• Decreased recharge rate of spouts  
• Difficulties for maintaining spouts |                                                                                                                                                                                                                                      |
|                  | Jhaukhel         | • Sand mining  
• Stone spouts affected by depleting the ground water level  
• Availability of ground water further contributing to the decline of stone spouts  
• *Ram Mandir* and *VDC dhungedhara* have been progressively drying out  
• Increased pollution  
• Water from the source of spouts has been dispersed to the dug and tube wells  
• A large part of the land to dry due to high temperatures created during the manufacturing process of brick  
• Commercial water selling industries contribute to the decline of operational spouts  
• Significantly affected the recharge of groundwater |                                                                                                                                                                                                                                      |
<p>| Non-heritage     |                  | |                                                                                                                                                                                                                                      |</p>
<table>
<thead>
<tr>
<th>Category of area</th>
<th>Study Area</th>
<th>Development Activities</th>
<th>Impact on spouts</th>
</tr>
</thead>
</table>
| Urban            | Bhaktapur Durbar Square         | • Introduction of modern pipe-line system  
• Encroachment of state canal and its ponds  
• Bhaktapur Development Project (BDP)  
• Deep boring for dug-wells | • Ignored spouts and encroachment of their platforms  
• The stone spouts recharged by state canal were dried out  
• Disturbances of water supply networks and Paths  
• Sources drying and the blockage of drainage  
• Water sources dry up by diverting water to dug-wells |
|                  | Madhyapur Thimi                 | • Introduction of modern pipe-line system  
• Partition of land  
• Dug-wells nearby the spout sources  
• Deforestation and Construction of road  
• Carpet industry  
• Connecting spout source into Modern pipe-line system | • Spouts have been ignored  
• Using most stone spouts only for bathing and washing purpose  
• Polluting the spouts and demolition of the spout’s infrastructures  
• Water from the sources drained into the wells and the spouts dried up  
• High risk of landslide in spout area.  
• *Gah hiti* has been polluted  
• No water in *Sanutar hiti* |
6.6 Summary

The findings show that after the introduction of pipe-line systems all spouts have suffered from neglect in all study areas. Furthermore, modern water supply technologies and other development activities such as construction of roads and establishments of brick industries not only encroached the infrastructures of spouts but also destroyed the water networks of spouts. The exploitation of ground water for domestic, commercial and irrigation purposes has lowered the water table and led to drying up the spouts of all the study areas. Likewise, the trend of dividing of land into commercial small plots has broken down the continuity of the supply systems of traditional stone spouts.

Similarly, nowadays there is no guthi system to provide regular income sources to manage water spouts. So, lack of funds, stewardship responsibilities and modernization are the main concerns for ongoing sustainable management of spouts in all study areas. Correspondingly, traditional institutions, festivals, customs and taboos were effective forces to conserve, manage and maintain the stone spouts in all study areas. Each area had their own rules and regulations to manage the spouts. Stone inscriptions with explicit rules and regulations for utilization and management of spouts had typically been kept inside the spouts. After the modernisation and privatisation of guthi land under the Land Reform Act in 1964, all stone spouts gradually deteriorated forced into decline due to the lack of an effective social incentive to maintain and care for them. Some people contend that since they no longer use the resources, they do not need to spend time maintaining them. The next chapter will link the stone spout management systems with the theoretical framework of research in all the four study areas.
Chapter 7
Linkage of the Meta-theory Framework with Stone Spout Management Systems

7.1 Introduction

In Chapter two a meta-theoretical framework was identified and discussed in relation to the integration of four different theory lenses, namely common property theory, institutional theory, attachment theory and central place theory. This chapter examines the role of each of these theories in the management of stone spouts in both urban and peri-urban heritage and non-heritage areas. Outcomes are based on the perceptions, knowledge and experiences of community members as well as experts and planners.

The next section of the chapter presents the aspects of common property theory and property rights and focuses on support for the management of the spouts. Section three explains roles and responsibilities, capacity, as well as the obligation and willingness of formal and informal institutions to manage spouts. The following section examines attachment theory and explores the level of affection that people hold for stone spouts and the role that the views of these people have in terms of stone spout management. Section five then explores central place theory in terms of proximities of spout users to spouts and how this affects the management of the spouts. Finally, the chapter concludes by summarising the key points arising from consideration of these four theories regarding stone spout management.

7.2 Property Rights and Stone Spout Management

Common property theory mainly concerns the relationship between property rights and the participation of users in the governance and management of common property resources (Schlager & Ostrom, 1992). The nature and the degree of ownership over the resources influence user participation in managing common property resources, in this case stone spouts.

This section explores the management regime for stone spouts in all the study areas by linking ideas around property rights, incentives and the participation of users in stone spout management arrangements. Effective participation of users is essential to manage common
property resources, in this case stone spouts. This section reports the factors that constrain user participation with the major factors discussed in the sections that follow.

7.2.1 Property rights

Adequate incentives are required to enhance people’s participation in stewardship and management of common property resources. Schlager and Ostrom (1992) explained that property rights provide users with the incentives to participate in this process by vesting authority and control over the resources and also assisting to reinforce collective action. Such motivation is based on four different varieties of property rights: the right to access and withdrawal, the right to manage, the right to exclude and the right to alienate (Agrawal, 2001; Schlager & Ostrom, 1992). Table 7.1 shows the bundles of rights held by different rights holders of stone spouts across the study areas.

Table 7.1: Right holders and associated bundles of rights

<table>
<thead>
<tr>
<th>Right holders</th>
<th>Right to access and withdrawal</th>
<th>Right to manage</th>
<th>Right to exclude</th>
<th>Right to alienate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiators</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Traditional (state) guthi</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Archaeology Department</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Nepal Guthi Corporation</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Municipality</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Users</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>

Table 7.1 shows that only initiators (who established spouts) possess all four bundles of rights, while traditional guthi (state guthi) have all rights except right to alienate. However, the rights (to manage, to exclude and to alienate) of traditional guthis were transferred to the government after the centralization of the traditional guthi systems (established by both state and initiators) via the Nepal Guthi Corporation (see 4.5.1 for details). Before the implementation of the Trust (Guthi) Corporation Act, 1964, it also had the right to alienate.
This centralised system not only broke down the *guthi*, institutional and social structures but also collapsed the whole management systems of the stone spouts.

Likewise, the Archaeology Department and Nepalese Guthi Corporation of the Nepalese Government hold rights of access and withdrawal, as well as the right to manage and the right to alienate but they do not have the right to exclude. However, they need to gain permission from the government before applying the right to alienate. In the same way, municipalities do not have the rights to exclude and rights to alienate although they have rights to access and use and rights to manage. The users possess the rights of access and withdrawal and rights to manage but they do not have rights to exclude and rights to alienate.

7.2.2 Incentives

Field data and documents reveal that initially, initiators of spouts and the state allocated some agricultural land as an incentive to look after and manage stone spouts at least in the four study areas. Nine interviewees (six male and three female) from face-to-face interviews and 16 respondents (nine male and seven female) during four focus groups in Changunarayan area said that the state employed three guards to look after and maintain the stone spouts at Changunarayan and the state canal in the Bhaktapur area. According to these reports, the guards received rice as payment for their endeavours. However, nowadays there is no such rule and the stone spouts and their water networks are virtually ignored. The system of keeping guard (*Dhalapa*) was discontinued as the Land Reform Act 1964 has privatized the *guthi* lands. These fields are those which previously were given to the guards in lieu of a regular wage. Most respondents in the Changunarayan area said that earlier the *guthi* actually paid the wages to three or sometimes four workers who cleaned the spouts. There is no traditional *guthi* system now. Thus, there is no one to accept responsibility for the performance of such maintenance responsibilities.

Likewise, 12 respondents (seven male and five female) in five focus group discussions and nine (six male and three male) in face-to-face interviews said that peoples’ participation in management of *Nhu* and *Gah hitis* in Madhyapur Thimi area has decreased after the privatization of *guthi* land allocated for caretaker reimbursement. Most experts, including all historians, also explained that lands allocated for *guthi* were privatized and important information and inscriptions regarding spouts were lost or simply discarded. According to the
historians, without the *guthi* systems and the income from *guthi* lands, *guthi* members and the spouts’ guards were reluctant to share the knowledge, information and wisdom they had accumulated regarding the spouts to the new generations. They further elaborated that this fallout from the social upheaval might be one explanation as to the apparent disinterest shown by the younger generation towards the importance and the management systems of the stone spouts.

The incentive structures associated with common property resources are determined by the dependency of the people on particular resources. In early days, people with a high dependency on stone spouts would have a strong incentive to participate in conserving and managing them. According to most respondents during face-to-face interviews and focus group discussions in all study areas, previously as there were no alternative sources of water, people used to keep the spouts clean and take care of them. But now as there are other sources of water such as pipe-lines and dug/tube wells people have started to ignore issues surrounding the conservation and management of stone spouts.

### 7.2.3 Communal ownership

One characteristic of common property resources and the provision of public goods is the course of action known as ‘free-riding’ which is deemed an important consideration for those governing common property resources. All respondents believe that stone spouts are used communally. However, almost nobody takes responsibility to maintain and conserve them. The *guthi* used to take care of them but now *guthis* are entities from past history. According to participants, most rest houses near to stone spouts have been deteriorated into a dilapidated condition. Two historians mentioned that most people remember stone spouts, only when their pipelines stop working. This reduced dependency of the users to the spouts has decreased the feeling of ownership and responsibility towards them and significantly contributed to a “tragedy of the commons”.

Eleven (six female and five male) face-to-face interview respondents and nineteen (eleven male and eight female) respondents from the seven focus group discussions in the Changunarayan area admitted that they do not look after the stone spouts. According to them, it is the responsibility of the Archaeological Department and the municipality. One older female respondent during focus group discussions added:
Before guthi used to take care of the spouts in Changunarayan area but now the guthi is also collapsed. New generations do not even know how to maintain the spouts. Earlier, we used to enjoy cleaning spouts with friends together. After the collapse of guthi and the establishment of the pipeline system, everything stopped. We are grown old now no one cares about spouts. People only use water from spouts when the pipeline does not work.

Three (two male and one female) temporary residents of the Jhaukhel area related that they work for four months during the winter and spring seasons in a brick factory and then return back to their original dwelling places. They used water from spouts sometimes for washing and bathing purposes. According to them, they are the outsiders. Maintaining and conserving the spouts are not their responsibilities. It is the responsibility of locals. One respondent said that:

*No one cares about the Magar tole spout. Since this spout is located nearby the Magar (one caste of Nepal) community, the other people think that only they (Magar) should maintain it.*

Two respondents from *Magar tole* agreed with him. They said that only people from *Magar tole* maintain the spouts even though other people use this spout. Likewise, two male migrants and two female temporary residents of the Madhyapur Thimi area explained that they are using the spouts but not frequently. Visitors, vendors and travellers also use the spouts. These people also feel that they are not accountable to clean and maintain the spouts. This is regarded by them as the work of the municipality or the Archaeology Department.

Seven (five female and two male) local respondents from face-to-face interviews and 33 (20 male and 13 female) participants from the seven focus group discussions in Madhyapur Thimi also mentioned that migrants and temporary respondents just come to collect water from stone spouts but they are not interested in looking after the spouts.

Similarly, seven (five female and two male) local respondents in two focus group discussions held in the Madhyapur Thimi area and 13 respondents (nine female and four male) in four focus group discussions from the Bhaktapur Durbar Square area agreed that if the pipeline system functions well and water flows regularly they do not need stone spouts. One female respondent in the Madhyapur Thimi area reported that they have pipeline taps everywhere so they do not need spouts. Similarly, one male respondent during the focus group discussion
noted that a spout in Bode has been buried under the road. However, it does not make any difference for them as the water had already dried up and they have their own pipe-line system.

Most respondents reported that they considered stone spouts and their ponds to be public properties. According to them, people have the mentality that they do not care about common property resources like stone spouts. They care only about themselves. So, people encroached upon public areas and built houses and roads that blocked the sources of spouts. One older respondent in the Bhaktapur Durbar Square area said that younger generations have a feeling of “me” and “mine”, not “we” and “ourselves” like their generations have. He elaborated that the younger generation do not know even what stone spouts are and why they are important for them. They, according to the older participants, consider the spouts as an ornament of the areas.

Most local respondents from the Jhaukhel, Madhyapur Thimi and Bhaktapur areas reported that spout destruction occurs because they (respondents) do not own the spouts and cannot exclude the migrants and temporary residents. That explains why local people have less motivation to protect and manage spouts. However, they still use spouts for different religious and various other purposes.

7.2.4 Management funding

Insufficient financial support affects the management of common property like stone spouts. Sixteen interviewees (10 male and six female) participating in face-to-face interviews and 31 respondents (22 male and nine female) during the seven focus group discussions in the Changunarayan area stated that neither the government nor other heritage conservation related organizations are genuinely interested in the conservation of spouts. According to them, no one listens to locals who advocate for better conservation measures. The budget for the current conservation and development activities is allocated only for the urban areas focussing primarily on the Changunarayan temple, not for the ancient spouts. One local respondent during focus group discussions aggressively stated:

All the ancient properties including stone spouts in our area have been damaged and the budget allocated for our area is all misused. This is the religious area where all the
funeral activities take place. In future, I am not going to cast a vote for any leader here. I will chase them away, if they come here to ask for votes.

Two planners in the Changunarayan area also agreed that the amount provided for the conservation of spouts is not sufficient. One planner said that 20,000 Nepali rupees (about 200 US dollars) were allocated by VDC for the conservation of the two stone spouts at Kapa and Pucchre hiti in 2013. For 2015, 10,000 Nepali rupees (100 US dollars) have been assigned by VDC for the maintenance of spouts. According to the planners, users refused to take the money provided in 2013. They proclaimed that this paltry sum was not sufficient to buy construction materials for the spouts. So in the end the funds were frozen. One planner said that considering the views of the users and after doing a field survey his office concluded that the amount of money provided for the maintenance of spouts was insufficient. They continue to hope a more realistic sum will be furnished.

All local planners in the Changunarayan and Jhaukhel areas readily admitted that up until recently they have not kept conservation of stone spouts as a priority in their programmes. They hope to get more budgeted funds for upcoming years as a result of a fresh development in the local government scene namely that the Changu VDC and Jhaukhel VDC merged into a Changunarayan municipality in 2014 (just prior to interviews). The planners hope that a result of this merger will be that they can prioritize the management of spouts in their areas of responsibility. But all respondents in both peri-urban and urban non-heritage areas are concerned that priority is given for the world-heritage sites and not necessarily for their areas. However, almost all the planners argued that there are other organizations who are interested in working in world heritage sites, and the money obtained from tourists is also available for development and maintenance of world heritage sites such as the Changunarayan and Bhaktapur Durbar Square areas. Further comments on this issue were that this extra money creates the perception that non-heritage areas are ignored as well as an acknowledgement that it is only natural to expect that world heritage sites will be afforded a higher priority.

Most planners and all experts in all study areas have at some stage in their responses expressed grave concerns regarding the functional state of the remaining spouts. According to them, the conservation activities of spouts are largely reflective of public demand. However, most community respondents said that if those policy makers at the national level decide that stone spouts deserve a higher priority than currently prevails or more important
consideration than that reflected by public demand then they would do well to assign specific funds especially earmarked for the purpose of spout reinstatement and conservation.

Three (two male and one female) respondents interviewed and five (three male and two female) participants in two focus group discussions in the Jhaukhel area raised the issue of no money being allocated in the budget for the maintenance of their Lakila and Yando tole spouts and this being the case they have no intention of maintaining the spouts using their own resources. The most frequently used justification of this position was that everyone has a pipeline in their houses. Therefore, it does not make economic sense for people to spend their own money to maintain spouts. However, for the sake of preserving ancient artefacts they will maintain them if someone else provides the funds. These sentiments were echoed by a few respondents in the Madhyapur Thimi and Bhaktapur Durbar Square areas. The planners confirmed the view among public servants that local municipal budgets cannot be allocated without local demand for specific outcomes.

Almost all planners agreed that maintenance or renovation of the spouts was not possible with such a little amount of money. They felt that significant amounts of money should be allocated to renovate the spouts as is archaeologically appropriate. A few thousand Nepali rupees assigned for all the spouts seems like “a cumin seed in an Elephant’s mouth”. Otherwise, the Government and other conservation related organizations will risk being insulted by having locals reject the inadequate funds as happened in the case of Changunarayan.

All local level planners in all study areas pointed out that they have some discretion to allocate the budget at a local level for programmes which are competing for funds. According to them, they have two kinds of budget: local level and national level. The national level budget is allocated by government for fixed programmes. However, the local level budget needs to be divided at the local level under health, drinking water, education and other categories based on local demand. The municipalities or VDCs can decide how much of the budget is to be invested under which category in their areas. In this context, they can also formulate the budget at the local level for spouts. However, the community respondents in face-to-face interviews and focus group discussions have different views. They said that there is a huge bias in favour of elite people while separating the national and local level budgets for development activities. A powerful person can allocate more money in his/her area. If money
is assigned to stone spouts in the national level budget then it is easier to carry out the management activities on the spouts. Otherwise, if the money is tagged to the topic of “Development” at the local level then it may not be used for stone spouts. It can be used in other works based on the influences of the elite people.

7.2.5 Policy, rules and regulations

Users’ participation in managing and governing the common property resources is influenced by the formal and informal rules and regulations such as operational rules, constitutional rules and collective decision-making rules (Schlager & Ostrom, 1992). Modifications in such rules change the structure of incentives which influence the decision of users in management and governance of common property resources. In the context of the stone spout management regimes in Nepal, due to the absence of formal policy, rules and regulations users have no clearly defined property rights (mentioned in Table 7.1) that give them strong incentives to manage spouts.

An official from the Archaeology Department of the Government of Nepal and all planners and experts mentioned that there are no policies, rules and regulations prevailing at the national level specifically relating to the preservation of stone spouts. However, spouts are conserved under the Ancient Monument Preservation Act (AMPA) 1956 (See section 4.4.2 for details). They added that a national workshop was conducted in 2007 which produced a common declaration on stone spouts and its source conservation (Appendix 13). However, it has not been implemented and all the community respondents are unaware of it. According to a consensus of opinion from experts and historians, importance is also not given to stone spouts while planning and implementing water related programmes. Water from the source of stone spouts is in some cases even tapped by modern pipe-line systems. Most experts further elaborated that, without proper rules and regulations it becomes difficult to stop encroachment on stone spout platforms and their ponds in the more urban, Bhaktapur Durbar Square and Madhyapur Thimi, areas. Likewise, most community respondents in all study areas also remarked that they had never heard about the rules and regulations for the conservation of stone spouts. A common theme was that locals were unaware of anybody being punished when they encroached or destroyed any stone spout infrastructure. One respondent gave an example of Bulbul hiti of the Bhaktapur Durbar Square area, the idol of Lord Shiva which was near the stone spout and now has been removed. As the idol occupied some valuable retail
space, the perpetrators quite simply removed the idol from its position and extended their retail premises.

All respondents agreed that regulations governing spout usage or the lack thereof may become more important as increased demand for water puts pressure on modern pipelines and households turn to the spouts as an alternative. For this reason alone the policy has to be made at the national level for preserving them. One expert stated:

*There has been no policy regarding the stone spout management in Nepal. Government only works in those areas which are easily noticeable like Lumbini and Pashupati temple. But they do not care about the spouts. They have not done any research or inventory regarding the spouts. Related personnel and organizations such as Archaeology Department and municipalities are not also taking responsibility to conserve them. They wait till the structure of spouts is completely destroyed then they can say that budget is not enough to restore spouts.*

### 7.3 Institutions in Stone Spout Management

Institutional arrangements are important in implementing an appropriate property rights regime for managing common property resources (Agrawal, 2001). These institutional arrangements provide administration and enforcement supports to users for exercising their property rights (Agrawal & Ostrom, 2001). An overview of the various institutions involved in stone spout management is given in section 4.5. This section provides a reflection on the roles and potential of these institutions in stone spout management driven by consideration of institutional theory. Based on this theory, the effectiveness of institutions for managing common property resources, in this case spouts, is analysed in the following sub sections.

#### 7.3.1 Effectiveness of governmental organizations

All experts reported that the existing institutional arrangements for stone spouts in all study areas are not sufficient for conserving them. They mostly mentioned that the governmental institutions have no policy and specific plan to support users in stone spout management. However, the traditional *guthi* system was effective in managing spouts by applying and integrating social and cultural norms, rules and regulations.
Fifteen respondents interviewed (10 male and five female) and 22 (13 male and nine female) community members during six focus group discussions in the Changunarayan area recognized the role of government institutions in supporting users in stone spout management. As reported by them there are no national government and non-government organisations involved now in the conservation of stone spouts in their area. Most respondents reported that the support offered by local level government offices was both inadequate and ineffective. However, they highlighted that these institutions play a vital role in providing financial and technical support for the maintenance of spouts. Stone spouts can be operated for another 10-20 years or longer if institutions became involved actively in maintaining and cleaning them in a timely fashion. Recently the Changu Development Committee has been established by local people to tidy up the Changu heritage area including stone spouts. Five male respondents during two focus group discussions explained that the government ignores stone spouts in this area. It only focuses on the maintenance of spouts in the city area, Bhaktapur Durbar Square area, because they can earn more money from tourists there. As Changu does not have much income, it is ignored and no conservation work has been done. So, they established Changu Development Committee in 2071 B.S. (2014 A.D.). It has not done any significant work towards the conservation and maintenance of stone spouts but they are planning to begin maintenance of the spouts very soon.

An older female respondent in one of the focus group discussions had a similar experience. She mentioned that the traditional guthi system was more effective in maintaining the spouts. She related:

> When we had the guthi system, stone spouts were maintained properly. Now, people from Nepal Guthi Corporation (see 4.5.1) come only once a year. They use water from Gah hiti to make juice on the occasion of “Akshyatritiya”. However, they do not clean the spouts. The cleaning and maintenance is done by the local people occasionally.

Most respondents reported that political instability also has had a negative effect on spout management. One expert in the Changunarayan area lamented that politics has ruined everything in their area. According to them, local people are ignorant of the budget and spout related activities that government officials plan for the Changu area. Most respondents agree that programmes and activities sponsored by government are not transparent. One respondent said:
Governmental and non-governmental officials only give funding if we have a strong connection with them. I am working in a local club. Since, I have some connections with them. So, we receive funding when we need it.

Most respondents in the Jhaukhel area also mentioned that neither the Department of Archaeology nor the VDC have done anything for conserving stone spouts in their area. One respondent reported:

_We have no expectation from the Department of Archaeology. There is no one employed at the policy making level who thinks about the ancient properties like stone spouts. Now the Jhaukhel VDC has been reformed as a Changunarayan municipality. Maybe municipality will do something._

Similarly, a vast majority of respondents in the study areas are also dissatisfied with the Nepal Guthi Corporation. They reported that the Nepal Guthi Corporation does nothing except providing juice once a year in the Changunarayan area. According to locals in 2014 they did not even get around to providing juice. Therefore, understandably local people worry if even this aspect is not continued, their tradition and culture relating to spouts will be under threat. Conversely, the field data showed that there seemed to be a lack of interest when it came to asking the Nepal Guthi Corporation to continue this juice providing ritual. One respondent during a focus group discussion reported:

_Who will spend money to go and debate with them? They won’t listen to us. I am sure; they will accuse us of not providing them with any incentive, so they stopped it. Who will go and waste time with them? I think it’s better to forget about it, if they do not come next year as well._

On the other hand all the planners including Nepal Guthi Corporation argued that the limited number of staff, limited budget and limited information about traditional stone spouts were hindering them in increasing their effectiveness regarding stone spout management. One planner affiliated to the municipality stated:

_The government is focused on fulfilling the water needs rather than conserving the spouts. Here is a scarcity of water in the Kathmandu Valley. The water should not be wasted in the spout. If it is needed we have to modify the spouts by constructing tanks to store the water._
Another planner from the municipality further stated:

*Our main job is to provide drinking water to the people. The heritage conservation is our secondary importance. The DoA is responsible for heritage conservation.*

Yet another local planner described similar experiences:

*The Archaeology Department does not take interest to conserve the spouts. When the municipality wants to operate the spouts, the DoA interferes. Local people also only search for the spout when there is scarcity of water.*

Likewise, nine respondents (seven male and two female) in face-to-face interviews and 31 respondents (20 male and 11 female) during the seven group discussions in the Madhyapur Thimi area and five (four male and one female) respondents in face-to-face interviews and 19 respondents (eight male and 11 female) during the seven group discussions in the Bhaktapur Durbar Square area have the same contention that the Archaeological Department has not done anything effective in conserving spouts and other historical monuments. According to this group, the officers are not responsibly fulfilling their duty. The Department has not even done an inventory of the spouts in its area.

Twelve respondents (eight male and four female) during focus group discussions in the Madhyapur Thimi area reported that they went to the DoA to inquire about maintaining the *Garcha and Thangacha hiti*. The DoA asked them to bring the photographs of the spouts, so they could think about it. The Thimi Municipality also provided 100,000 Nepali rupees (1000 US Dollar) for the maintenance of these spouts. But locals told them that they needed a minimum of 300,000 Nepali rupees (3000 US dollars). After that the matter was not discussed anymore. Respondents further mentioned that they have no knowledge as to which documents are required by the offices. As a result of lacking the correct information locals have maintained and cleaned the spouts sometimes by their own efforts. However, one respondent reported that the District Development Committee (DDC) had conserved and maintained many spouts including *Bata hiti* which was on the verge of obsolescence.

One respondent during focus group discussion in *Nagadesh* commented in jest:

*The Archaeology Department does nothing. I don’t even think it knows there is the place called Nagadesh. The Archaeological Department becomes old now. It needs to be renovated itself before renovating the spouts.*
Furthermore, 25 (15 male and 10 female) respondents during five focus group discussions stated that they went to the municipality many times to stop well-drilling in “Nayabasti” but officials did not listen to them. According to these contributors, contractors give money to the municipality, so they allow that. Many spouts are drying up because of drilling but the municipality does not care. Similarly, three (two male and one female) respondents explained that the water channel of Han hiti is at high risk from land slide damage. They went to the Soil Conservation Office and the DoA many times to ask for support. They further added that officials from the Soil Conservation Office did a field survey and said flatly that they did not have enough funds to conserve the spout. According to these respondents, government officials only think about their own profit. If they get a benefit, they maintain it; otherwise they do not. Likewise, they continued that theme in the Thimi municipality where they had a condition that if locals wanted to receive support from the municipality, they should allow them to build a rest house nearby Han hiti. This was so the Chettri (one type of caste) community could perform their funeral ceremony there. According to interviewees, people refused the municipality support because if the rest house was constructed they believed it would be a magnet for drug users and gamblers. That being the case it would be difficult for women and children to collect water. So, ultimately the municipality did not maintain the spout. One participant shared his experience:

I went to the Soil Conservation Office in Bhaktapur. They sent me to the Kathmandu branch. I went there with the letter given by the Soil Conservation Office and waited for about an hour for the senior officer. After arriving he said that there is no fund now and asked me to come back in 2-4 years’ time. In that time the spout will be eroded. Maybe I am poor so he didn’t listen to me. If some educated people went there they could do something. I silently returned home. We are the labour group people and I need to work every day to feed my family. So, I don’t have time to go there again. I am also not sure that they will listen to me again.

Likewise, most respondents in the Bhaktapur Durbar Square area commented that maintaining and renovating of spouts is very expensive. The DoA have their own norms to repair historic monuments. So, they neither let local people do this by themselves nor provide financial support to users. However, a planner affiliated to the DoA argued that they look after the total heritage monuments not only the stone spouts. So, it would sometimes be difficult
to meet the public demands regarding restoring the spouts. Most respondents agreed that the Bhaktapur municipality supports them to maintain spouts in their areas. According to them, the Bhaktapur municipality is richer than the DoA. It has renovated and maintained many ponds that recharge spouts. They further explained that the Nepal Guthi Corporation does nothing for spout conservation but the municipality sometimes opens the blockage of the drainage of Indrayani hiti.

Interestingly all planners reported that they follow a bottom up approach while planning their development activities. If the users ask them to perform maintenance of spouts, they always grant them respect and support them as much as and as soon as they can. One planner emphasized:

*We do renovation and maintenance of spouts but first we need to know which spout needs to be maintained. The local people should inform us first.*

### 7.3.2 Effectiveness of non-governmental and community based organizations

Seven respondents (four male and three female) in face-to-face interviews and 11 (eight male and three female) community members during three focus group discussions explained that after the connection of the pipe-line system into *Gah hiti* and *Gamdhoka hiti* the locals then proceeded to form rules and regulations to ensure efficient operation. According to them, they have employed a person to release water from the main storage tank to these two spouts. He opens the tank for four hours daily. Monthly, ten rupees is collected from every household to provide a salary to this person. However, locals still need to open the spouts by themselves as these spouts are also locked to prevent wastage and misuse of water. They have rules that every house opens the spout for 3-4 days. Then the key is given to another house. Likewise, they further described that the VDC allowed them to use 55% of the money collected from the *Changu Narayan* temple and the tourist taxes for the maintenance of the Changunarayan area (only inside the world heritage area). They said that sometimes this money is used to maintain the stone spouts as well. However, recently, Changu VDC has converted to the Changunarayan municipality. So, there is some confusion as to whether the new municipality will continue with this system of rules or not.

Similarly, nine respondents (four male and five female) during two focus group discussions in the Jhaukhel area mentioned that *Guthi* land of *Tajelu Dhara* now belongs to the Nepal Guthi
Corporation. But Nepal Guthi Corporation does not use income from guthi land to maintain this spout as people used to do before. All these respondents said that this is a spout with historical significance. The Archaeological Department and Nepal Guthi Corporation know about this but they have yet to demonstrate that they care. Neither did they provide funds to the local youth club. Three young male respondents during a focus group discussion explained that the youth club collected 400,000 Nepali rupees (4000 US dollars) and renovated the Taleju spout five years ago. They renovated most of the infrastructure supporting the spout. According to them, they are keen to conserve the spout even though the water does not flow. They will not let it be demolished because this spout has its own significant cultural importance. They want to let future generations know why people are too respectful to pollute this spout. Likewise, the Environment and Public Health Organization (ENPHO) and the Women Development Committee have also constructed a deep well and water tanks to operate the VDC dhara again.

In the same way, all the experts and three male respondents in face-to-face interviews in the Madhyapur Thimi area explained that the NGO Forum did an inventory of the spouts but this did not produce any active conservation measures. However, World Vision (INGO) helped locals build a tank to collect water for Sanyasi dhara. Similarly, a planner reported that GIZ also helped to maintain some spouts in the Madhyapur Thimi area ten years ago. He further explained that UDLE (Urban Development through Local Effort), GIZ and DDC (District Development Committee) collaborated to form the Madhyapur Thimi conservation development programme which operated from 1999 to 2007. During that time they maintained a number of spouts. After that effort no other person or organisation has assumed responsibility.

Most respondents in the Bhaktapur Durbar Square area explained that they were aware that the Bhaktapur Development Project (BDP) launched by GIZ performed renovation and maintenance of some spouts 30 years ago in their area. They also mentioned that the NGO forum came once to do the inventory of spouts around the city area. Furthermore, all respondents in all study areas said that they have their own local clubs and community based groups assigned to tidy up their territories. These clubs and local communities clean the spouts sometimes while they clean their localities.
7.4 Application of Attachment Theory to Stone Spout Management

The theory of attachment originates with the explanation of interpersonal relationships between human beings (Bretherton, 1992). However, it is contextualized here to show the multiple, potential and emotional relationships of users with stone spouts in all study areas. The various narratives from respondents during the field visit show the level and type of users’ bond with stone spouts. The relationship of people with the spouts varies with individual circumstance and cultural context. This section explores the attachment patterns displayed by users with respect to spouts.

7.4.1 Spiritual affection

Most old respondents in the study areas considered that water from spouts is pure (sacred), more so than that in the pipe-line systems. So, their daily rituals start with offering water from the spout to the gods. These respondents further emphasized that Hindu and Buddhist deities are carved in and around the spouts. Thus, they wanted to conserve the spouts as an important cultural heritage.

One young respondent in Changunarayan explained why Gah hiti is located near the Changunarayan temple. According to him, pilgrims come there to worship at the Changunarayan temple, so this spout provides water to them and water from this spout is used to make juice once a year for the occasion of Akshyatritiya. That is why he was proactive in wanting to conserve this particular spout. Likewise, five Newar respondents (three male and two female) reported that they offer water to the God Mahadev and the departed soul from the 45th day after the death of a person for one year. Most spouts have the idol of Mahadev displayed. Therefore they do not have to go far to perform the ritual. Similarly, all respondents said that they need Narayan hiti to offer water to the Changu Narayan temple. Furthermore, one older Newar respondent related that people from the Bhandel caste need to have a bath in Narayan hiti before performing rituals to be a priest of the Changunarayan temple.

All respondents in the Jhaukhel area reported that Taleju Dhara is their pride because only water from that spout is offered to the Taleju temple in the Bhaktapur Durbar Square. Similarly, all Newar respondents in Madhyapur Thimi and Bhaktapur Durbar Square area said
that at least the nine east facing spouts that they bathe in Janai Purnima should be preserved, otherwise their culture will suffer. One older female respondent said:

> I offer water from the spout to the god every day. It is our old tradition. Most of the old people come to the spout to worship. I never use pipe-line water to perform my daily rituals.

Another female temporary resident also added:

> I see most Newar people offer water and worship gods in the spouts. I don’t know why. Maybe that’s their tradition. However, very few of the younger generation do it.

Most respondents in all study areas attempted to explain that in Hindu religion, there is the culture of worshipping the god early in the morning after bathing. Usually most spouts have images of gods and goddesses whom they worship. According to them, people who do not have temples nearby their houses can come to spouts to worship. Similarly, water flowing from spouts is considered to be as holy as the water of the Ganga River. They said that if they take a bath or clean their face in spouts, it is equal to paying homage to the Sapta Sindhu (seven holy rivers including Mandakini, Ganga, Kaveri etc). They also held strong beliefs that water from some spouts such as Gah hiti of the Bhaktapur Durbar Square area have the capacity to cure diseases. Most respondents in all study areas said that they worshiped Naag only in stone spouts.

### 7.4.2 Alternative to pipe-line (utility value)

Most women respondents in all study areas mentioned that stone spouts should be maintained and conserved because of insufficient water supply from pipelines. Stone spouts are therefore more reliable for them. Moreover, they related that for poor and temporary residents who cannot afford modern pipe-line connections, spouts are still reliable sources of water to fulfil daily needs.

Most respondents who live around Changu hill (around Changunarayan temple) in the Changunarayan area were found to use only water from stone spouts for drinking. Two male respondents in face-to-face interviews and 18 respondents (nine male and nine female) during three group discussions mentioned that Sarashwoti hiti was excavated about 30 years ago when there was a scarcity of water in Changu hill.
Most women respondents reported that they want stone spouts as an alternative to the pipeline system. All women respondents in Jhaukhel and Bhaktapur Durbar Square explained that earlier the women had to go very far to collect water. Now, they are using ground water through pipe-line systems and dug wells. However, power is cut off up to 18 hours per day during winter. They further emphasized that water cannot be pumped out without electricity. Five women respondents in face-to-face interviews and seven during group discussions reported that they have a scarcity of water in their area. Sometimes water is provided only once or twice a week via their pipe-line. This situation is worst in winter. Sometimes, they do not know whether the water supply is on or off in their private and public taps. So, they want stone spouts as an easy substitute to the modern water supply system. One female respondent added:

_We need to conserve and maintain the spouts. The pipeline and the wells are not permanent because they need power in order to operate. But water flows in the spouts 24 hours in a day._

Likewise, three (two male and one female) temporary residents in Jhaukhel, five (two male and three female) in Bhaktapur Durbar Square area and five (four female and one male) in Madhyapur Thimi explained that water from the pipeline is available once every two to five days. Therefore stone spouts are important and convenient for people in that particular situation. According to them, not all people have access to pipelines in their houses. If the spouts are there, they can have water anytime when they need. One female temporary resident in Madhyapur Thimi explained:

_I always fetch water from the spout. Water only comes in the morning and in the evening in the house where I live. I cannot collect water as I have to go to work at that time. So, I like the spout because I can come here any time to collect water._

Most young respondents in Bhaktapur Durbar Square area wanted to renovate and maintain spouts to attract tourists. According to them, tourists come to see historical monuments. If the spouts were maintained, more tourists could be attracted and locals could benefit from the income generated. One young respondent further added that the spouts are their heritage as well. They are even located inside the World Heritage Site. According to him, one significant attraction for tourism in their area may be the spouts. He also added that people can do the
research about different aspects of spouts as well to provide the prospective tourists with information.

### 7.4.3 Social bond

All older respondents recalled how in earlier days stone spouts played a vital role to strengthen bonds between people. According to them, they were the major places where people could chat and discuss everything they may want to about their society. Mostly women came to collect water from the spouts. They brought news about their localities and this helped to inform locals as to what is going on in the surrounding areas. Spouts were a good place to find labourers to work, in earlier times. These older people further explained that the modern-pipeline system has isolated people. People used to gather at the stone spouts and talk to each other. People had to wait for their turn as the spout was public. At this time they used to share their joy and sorrow with each other. It taught them to be social and patient.

One older respondent shared her experience:

> I got married when I was nine years old. Our spout was the place where I felt comfortable. I was always happy to collect water from there because I could make a friend there, had a rest and could chat with them. I used to forget my painful life, when I was there.

Another older respondent had a similar opinion:

> The spout was the junction point to talk about different issues. The Spout was cleaned once or twice a year together. It would be fun and we would get time to know each other more. The pipeline system has made people lonely.

However, most local young and two older respondents during focus group discussions have different views about these former days. One young and two older respondents in Changunarayan and one young respondent in the Thimi area reported that spouts have both advantages and disadvantages. People can share their joys and their problems while collecting water from the spout. On the other hand, they can also create unnecessary disputes among people. Likewise, one temporary resident in the Madhyapur Thimi area said that people can have a get together around the spouts. According to her, she becomes lazy sitting alone in the house all day. She can make friends and feel nice about herself. She feels better if she is coming to the spout each day and chatting with friends. One historian and an expert also agreed that
spouts help to increase mutual understanding and strengthen bonds as people interact with each other while fetching water especially among the women who are more predisposed to share their sorrows and emotions.

7.4.4 Taste and quality
Most respondents in all study areas shared the belief that water from stone spouts is available readily and can be used for drinking purposes without boiling. They also pointed out that water from spouts is warmer in winter and colder in summer because of ground water and earthen pipes.

Four male respondents in face-to-face interviews and 25 (10 male and 15 female) during five focus groups discussions in the Changunarayan area stated that water from the pipeline is manually treated while that from stone spouts is naturally treated. They further added that they prefer naturally treated water comes from spouts. According to responses, almost all people drink water directly from spouts without boiling. There have been no reports of sickness caused by drinking spout water.

Two respondents in Jhaukhel explained that according to their grandfathers the royal family from Bhaktapur Durbar (palace) sent washer men to wash their clothes in VDC Dhara because it was considered that clothes became cleaner and shinier when they were washed in this particular spout. Most respondents in the Jhukhel area also said that water from both VDC and Ram mandir Dhara spouts was fresh and tasty before but now is less so as some sources have dried up. Likewise, three respondents (two female and one male) in face-to-face interviews said that water from spouts tastes good. One of them reported that he used to visit the karki tole spout from the brick factory to collect water because of the taste.

Likewise, six women respondents in face-to-face interviews and seventeen (ten male and seven female) respondents during six focus group discussions in the Madhyapur Thimi area reported that water from spouts seems warm in winter and cold in summer. However, nowadays many earthen pipes were replaced by plastic or steel pipes and water from spouts appears cold in winter and hot in summer just like the pipe-line system. Similarly, two male respondents in face-to-face interviews said that they checked the quality of water from Nhu hiti and discovered that water quality is good in this spout. They further elaborated that water from a spout is considered fresher and purer than pipeline water. Furthermore, according to
them, if the pipe is corroded and iron is mixed in the water this can be dangerous for health. Such problems do not occur in earthen pipes. One respondent during convenience sampling in Madhyapur Thimi related:

*Water from Debma hiti is cleaner. There is no need to boil it. I feel water is tastier than water we have in my home town, Kavre. I prefer water from spouts when I come to visit Thimi area.*

However, one woman respondent has a different view. She stated:

*Everywhere people started to drink water from the pipeline. I liked the taste of the pipeline water more than the spouts. So, now I use water from pipe-line for drinking purpose even though spout nearby my house has good quality water.*

Moreover, one woman respondent said that water taste is good and the clothes are cleaner when washed in Bhansi hiti especially white clothes. Most respondents in the Bhaktapur Durbar Square area also have the same view that water from spouts possesses better taste and is better quality and is warmer in winter and colder in summer. Overall the taste and quality of drinking water is perceived to be better from spouts in all study areas.

### 7.4.5 Funeral rituals

Most Newar respondents in the Changunarayan area reported that spouts are important for them for performing funeral rituals. They explained that one cannot bathe in the same spout while performing funeral rituals where the dead person used water before when he/she was alive. For this reason the stone spout has more importance in the Newar community of the Changunarayan area. According to the Newar contributors in days gone by people had to bathe in any stone spout to enter the house after the funeral procession. Still they prefer spouts even though now they can bathe in pipeline water taps.

Similarly, 15 respondents (nine male and six female) during three focus group discussions and four (two male and two female) respondent face-to-face interviews explained that every community has their own spout which is used during the funeral ceremony in Jhaukhel area. For example, Dahal community used *Dahal Gaun Dhara* for 13 days to perform their funeral rituals. They have a special house nearby the spout to perform funeral rituals where they stay during such occasions. They drink water from this spout after using the purifying medicine. Likewise, an expert said that the Magar community use the *Magar tole dhara* during funeral
ceremonies. According to them, water from the well, pipeline and pond is considered impure in this community while performing funeral rituals or worshipping ancestors once a year.

Moreover, most local respondents in the MadhyapurThimi and Bhaktapur Durbar Square areas were able to reflect on life before pipelines. In those days people used spouts to have a bath before entering their houses after returning from the funeral. Otherwise, they were considered impure. According to them, this tradition is still followed and as far as possible by using stone spouts. Three Newar male respondents also described that in Newari culture, when anyone dies in a family, they need to offer water to Lord Shiva (Mahadev) for one year which is done by a son or by any male member of the family. It would be convenient for them to offer water from spouts because most spouts have idols of Lord Shiva. Thus, they want to conserve stone spouts.

7.4.6 Token of ancestors

Field data in all the study areas show that all respondents still want to preserve spouts as their ancestors’ souvenir to them. All respondents stated that stone spouts are their ancestors’ possession and heritage. According to them, they reflect their history and the idols and statues in the spouts give them religious feelings. Similarly, they mentioned that they are afraid that if they are not aware in time, it would be too late to preserve most spouts. Thus, spouts should not be demolished even though they are dry. They want to preserve them by installing water from modern pipe-lines. However, they agreed that the pipe should not be visible as it disturbs the beauty of the spouts. One male respondent explained:

    Spouts are our identity. I would be very happy if all the spouts in our area were renovated. They should not be demolished as they are our ancestor’s asset even though the water does not flow.

Almost all the young respondents have the same view, in all study areas, that spouts should be made functional by maintaining the sources. According to them, they should be conserved to show future generations how their ancestors fulfilled their water needs before modern technology. They also emphasized that spouts are the identity of the Kathmandu Valley and could be an income source from tourists.
7.5 Central Place Concept regarding Stone Spout Management

Central place theory describes the arrangements, size and number of settlements which provide the services for the people living around them (Daniels, 2007; Getis & Getis, 1966). Central place theory is used here to help understand the views and characteristics of users who collect water in a location in their home range, the central place. Users are very selective when choosing spouts that are not far from their house, and located in a central place since they have to spend time and energy carrying water back to their house. This section describes the distances travelled by users to obtain water from the spouts and why they prefer particular spouts.

As described in section 5.4 and Table 5.4 all respondents during convenience sampling identified a range of factors such as control of access to other water sources, cultural, utility and amenity factors such as taste, freshness and other quality related water factors that potentially motivate them to collect water from stone spouts at various distances.

The study areas, except Bhaktapur Durbar Square and Madhyapur Thimi as they are similar, are reported separately because there is a large difference in the numbers and density of stone spouts and people living in each area. In comparison to peri-urban areas, the majority of spouts in the urban areas, Bhaktapur and Madyapur Thimi, are found within or in the vicinity of settlements and also have a high density of spouts themselves and people living there. Generally, people also do not need to go far to collect water from spouts in these latter areas.

Three female respondents during two focus group discussions in Changunarayan area stated that most of the time they go to Gah and Gamdhoka hiti (which less than or equal to around 100 metres from their houses) and in winter sometimes they go to Narayan and Sarashwoti hiti when water does not come from these spouts. Moreover, three female respondents admitted that they came to spouts from more than 100 metres because they liked the taste of the water. Five (two male and three female) local respondents in face-to-face interviews and seven (four male and three female) during three focus group discussions stated that they use spouts more than 100 metres away while performing their funeral rituals.

Likewise, five female and two male respondents in face-to-face interviews and 11 respondents (eight female and three male) during three focus group discussions in Jhaukhel reported that
they have always experienced water scarcity in winter. So, they are used to travelling more than 100 metres to collect water. According to them, the people of Dhimal gaun and the Dahal gaun used to go wherever necessary to find water. Nowadays, when some of the pipelines do not work, they have to travel more than 100 metres to collect water from the spouts. Likewise, most respondents explained that people from Bhaktapur city travel a distance up to four km to take water from the Taleju temple once a year.

Similarly, most respondents in the Madhyapur Thimi and Bhaktapur Durbar Square areas stated that most Newar settlements have stone spouts near to their houses, often less than 100 meters away. Six (three female and three male) respondents explained that when the pipeline system does not function in Bode and Nagadash, people walk about 1 km to Bata hiti to collect water. Five respondents (three male and two female) in Madhyapur Thimi explained that they come to collect water from Nhu hiti and Sulecha hiti from more than 100 metres because they like the taste of the water. Most participants stated that several temporary residents travel further than 100 metres to spouts for washing and bathing purposes. According to these frequent users, spouts are more crowded on a Saturday. People from far distances also come for bathing and washing purposes on that day. One respondent related that the water flow was large in all three Tin dhara spouts in bygone days. So, people from far away (about two kilometres) used to come there to collect drinking water, bathe and wash clothes.

Five female respondents during focus group discussions explained that they always collect water from their own vicinity, less than 100 metres away. According to them, the people living in other localities do not allow them to collect water. Most respondents in all study areas said that the majority of spouts are located within the immediate vicinity of inhabitants. The spouts located outside the settlements are constructed to serve water for travellers, laundry persons, pilgrims or for irrigation of pasture or gardens. According to respondents, they sometimes go to spouts further away if there are more people using their local spout and they need to stay longer in a queue. One female respondent during convenience sampling in the Madhyapur Thimi area reported that:

_Nhu hiti is nearer to my house but there are more people in there now. So, I have to queue up. There is few people in Debama hiti. So, I come here._

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Likewise, most respondents during convenience sampling in all study areas except Changunarayan reported that in winter they travelled around or more than 100 metres to collect water from spouts (Figure 7.1). However, this information collected from convenience sampling may or may not represent opinions of all respondents. According to these respondents, in winter, many pipe-line taps are rendered temporarily out of service and most spouts nearby their houses also have poor water flow. So, most spouts are always crowded and people go far away to wherever they can get water easily. They said that sometimes they walk more than one km to fetch water from spouts. According to reports there are more people in the morning than in the evening at the spouts. So it takes more time in the morning to collect water. Sometimes they queue for 3-4 hours before collection during winter. However, in summer (in rainy season), they said water flow in spouts and in pipe-lines increases. So, they do not need to travel far to collect water. In the context of Changunarayan, most respondents in Changu hill said that pipe-line has been connected into the Gah and Gamdhoka hiti. So, they do not need to travel far to collect water. Likewise, most respondents in Kapa hiti, Narayan hiti and Sarashowti hiti areas said that they live nearby spouts which have good water flow. So, they also do not need to travel far.

![Chart showing distances travelled by respondents collecting water from more or less than 100 meters from stone spouts during winter.](chart.png)

**Figure 7.1:** Distances travelled by convenience sampled respondents collecting water from more or less than 100 meters from stone spouts during winter.
7.6 Summary

Four theories were applied to thinking about people and their relationship to stone spouts and their management. There are clear insights come from this theory analysis. Investigations indicate that due to the absence of ownership responsibility stone spouts are gradually drying up and the infrastructure and decorations are decaying. The institutional analysis then reinforces this view by showing that Government and non-government organisations including Nepal Guthi Corporation and the community itself are also apathetic and ineffective in conservation of spouts. By contrast, the analysis of attachment theory surprisingly showed that there was a relatively high degree of attachment both amongst the old people and even amongst some young people. This was then reinforced by the final examination of central place theory which indicates that indeed stone spouts are important for people for utilitarian and other reasons. From the utilitarian point of view they are important because during winter in three of the four study areas they provide alternative supplies of water when water supply from the modern pipe-line system is unavailable due to power cuts or for other reasons. Likewise, the existence of operational spouts also help to conserve local culture. In the next chapter these four theories will be analysed against the findings from both the bio-physical research (chapter five) and from qualitative interviews (chapter six and seven).
8.1 Introduction

This chapter discusses the key findings of the empirical research from earlier chapters in relation to theories and knowledge developed from the literature. Chapter two provided an insight into the meta-theory used to collect and analyse data for this study. Chapter three described the methodology applied and chapter four explained the study areas chosen for analysis. Chapters five and six evaluated the physical status and management systems of stone spouts in both urban and peri-urban heritage and non-heritage areas of Kathmandu Valley respectively. Chapter seven then analysed the management system of spouts in relation to four specific theories. The evaluation of the physical state and management systems of spouts demonstrates surprisingly that spout condition is comparably better in non-heritage areas than in heritage areas. It is important, therefore, not only to critically discuss the findings of the urban and peri-urban heritage and non-heritage areas in order to understand the reasons behind the poor condition of the spouts in the former but also to understand the wider theoretical implications of the findings in terms of better management of the remaining spouts.

This chapter is organized in the following way. Section 8.2 looks at the impacts of changes in socio-cultural and institutional norms and values on spout management systems in relation to the first research question which is “what are the impacts of changes in social, cultural, institutional norms and values and how do they influence the stone spout management systems?” Section 8.3 deals with the impacts of modern pipe-line systems and other development activities on spout management systems in relation to research question two, which is “how do the modern pipe-line systems and other development activities affect traditional stone spout management systems in heritage and non-heritage areas?” The final two sections, 8.4 and 8.5, explore the implications of the four theories, institutional, common property, attachment and central place, as a meta-theory context for sustainable management of remaining spouts and their water networks in relation to research question three, which is “what are the implications for local communities of the incremental and
ongoing loss of traditional stone spout infrastructure in terms of sustainable management of
remaining spouts and water supplies?"

8.2 Influence of Changing Socio-cultural and Institutional Norms and Values
on Spout Management Systems

Very few documents exist regarding the status of stone spouts located in the urban areas of
Nepal. Those that do provide some information about only the spouts which are located in
urban areas of Kathmandu Valley. In contrast, this study has analysed the physical and socio-
cultural aspects of 69 stone spouts located in both the peri-urban and urban areas of
Kathmandu Valley. Out of a total of 69 spouts, 22 are located in peri-urban areas and 47 are
found in urban areas; as first discussed in chapter five. Those spouts located in non-heritage
areas are in better physical condition and are functioning better than those in the heritage
areas. This contradicts the primary hypothesis of the study.

This study has shown not surprisingly that all 69 stone spouts studied have been negatively
impacted to greater or lesser degrees by human activities. None are in perfect condition but
those spouts located in non-heritage areas overall have better water flow, and lesser pipe-line
connections than those in the heritage areas.

Further analysis of the perceptions of people living in the heritage areas shows that
historically, spouts were sustained or managed partially through superstition and belief driven
actions. For instance, traditional beliefs regarding the worship of naag and other water deities,
avoiding wearing shoes and washing undergarments, excluding women going through their
monthly period and excluding the lower caste who did unsanitary works such as cleaning
toilets were all driven by such social systems. Cooperative community efforts helped also to
manage and maintain the spouts until approximately the mid-1980s. Findings show that
people used to clean spout platforms, water sources and open and clean their drains while
worshiping water deities, thus helping maintain spouts. Initially, people held strong beliefs
that violating the social or cultural rules and damaging or polluting spouts might be risky for
them, inviting retaliation from water deities. Furthermore, traditionally, guthi had
responsibilities for maintaining stone spouts. After the enactment of the Land Reform Act of
1964 and the breaking down of the caste system due to modernization the guthi system
gradually disappeared. This study has highlighted that both heritage areas are affected to a
greater extent than the non-heritage areas due to the privatization of guthi lands. For example, no private or public groups accepted responsibility to look after the state canal that fed water to most spouts of the urban heritage area after the guthi stopped functioning about 40 years ago. Likewise, most spouts in the peri-urban heritage area lost their water quality and flow when water guards and their source of income; the guthi lands, became obsolete.

Findings further show that it was considered a sin to desecrate the spout infrastructures in the past but nowadays people do not possess as firmly entrenched spiritual values. Partially due to the relaxation of prior social controls most of the traditional water channels, earthen pipes and other traditional structures, were replaced by modern pipes. Many spouts were modified or connected with modern pipe-lines and their platforms were also encroached. Furthermore, images and inscriptions attached to spouts were misused or stolen and the state canal that provided water to many spouts in the urban heritage area was also encroached. Following these events people withdrew financial support and became less aware of social imperatives to manage spouts thus leading to the more pronounced deterioration of spouts in heritage areas than that experienced in the non-heritage areas.

In contrast to this, initially the majority of spouts in the non-heritage areas were managed by local people and the initiators of spouts. Therefore, it became clear that the spouts in non-heritage areas are less affected by the privatization of guthi lands and the breakdown of guthi systems than the spouts in heritage areas. Additionally, the analysis of perceptions of people outlined in chapter six shows that local people in non-heritage areas are less dependent on government organizations to conserve and manage the spouts than in heritage areas. For example, local people in the Jhaukhel and Madhyapur Thim areas have collected money to maintain the Taleju and Nuh hiti by themselves. Outcomes of the study also reveal that some castes in non-heritage areas rely on their specific spouts to perform funeral rituals for a full 13 days following bereavements. These spouts as a result came to be more frequently cleaned while performing funeral rituals and worshiping naag. Similarly, research results demonstrate that some people in non-heritage areas still do not want to change traditional pipes and sedimentation tanks. Such perceptions create social pressures which help keep spouts in close to original condition. For example, out of the 69 spouts studied, Mogar Tole Dhara in the Jhaukhel area is the only spout remaining which still has earthen pipes and the traditional sedimentation tank. This combination of ownership and spiritual connection appears to
explain why the majority of spouts located in non-heritage areas are in better overall condition and have suffered less impact from changing socio-cultural beliefs, thoughts and traditional institutional norms and values than those in heritage areas.

Also important in this analysis is the finding that in heritage areas, permission should be obtained from the Department of Archaeology before constructing or maintaining any infrastructure relating to spouts. Furthermore, traditional bricks and other appropriate construction materials should be used for maintaining them. Such traditional materials cannot be sourced with the limited budget such as is currently provided by the government. Accordingly, results from this research demonstrate that local users in both heritage areas of Changunarayan and Bhaktapur Durbar Square are not willing to sustain and conserve spouts as there is not a sufficient supply of technical and financial support to maintain them to a culturally acceptable standard.

Comparing peri-urban and urban areas, spouts are more degraded in the urban Bhaktapur Durbar Square and Madhyapur Thimi areas than the peri-urban areas in terms of: clogging of drains, encroachment on ponds and spout areas, destruction of infrastructures, damage and theft of inscriptions and images, reducing or drying of water flow and dumping wastes. These outcomes are similar to those reported by Kharel (2016) who found that Konti hiti in the Patan area was turning into a dumping site after losing its water flow. This is due to the prevalence of building and other construction activities. Sithi Nakha is considered as a common day for water resources maintenance in Newar communities of the Kathmandu Valley (Khaniya, 2005; NGO Forum, 2011; UN-Habitat, 2008). However, this study reveals that the Sithi Nakha festival is not associated with the tradition of cleaning of stone spouts in the peri-urban areas. Field data show that local people in peri-urban areas celebrate the Sithi Nakha festival but cleaning water resources especially spouts is not a part of the festival. Only the people in the urban areas, Madhyapur Thimi and Bhaktapur Durbar Square, clean the water sources including spouts during Sithi Nakha. However, this is not done to the same extent as in the past.
8.3 The Combined Effects of Modern Pipe-line Systems and Other Development Activities on Spout Management Systems

Several scholars have identified modern-pipe lines and other development activities as adversely affecting traditional spouts of Kathmandu Valley (K.C., n.d.; Khaniya, 2005; Muzzini & Aparicio, 2013; Spodek, 2002; UN-Habitat, 2008). This study supports the contention that neglect of maintenance and continued construction of traditional spouts initially ceased after pipe-line water first became available in Kathmandu Valley in 1895. All spouts in the study areas were gradually neglected or completely abandoned after the introduction of new water technology and pipe-line water supply systems. For instance, Sarashwoti, and Gamdhoka and Gahhiti in the Changunarayan peri-urban heritage area, were completely forgotten for about 30 years and a modern water tap was placed between the sangdaha spouts which have now been dry for over 20 years. Results from this research confirm that after the establishment of public water taps and dug/tube wells and private pipe-line connections in the Bhaktapur Durbar Square urban heritage area, traditional spouts and the state canal that fed water to spouts started to suffer from the effects of neglect.

Currently, there are 11 drinking water schemes using groundwater as a source in the Jhaukhel peri-urban non-heritage area (Shrestha et al., 2013). The majority of respondents in the Jhaukhel area assumed that water flow in spouts has been constricted and in some cases completely dried out because of the demands on groundwater by these water schemes for domestic, commercial and industrial purposes. Findings from this study, based on field visits and people’s perceptions, further reveal that most spouts in the Madhyapur Thimi, urban non-heritage area are also badly affected by extraction of groundwater via dug/tube wells and deep boring, primarily by migrants.

It has been established that spouts in three (Jhaukhel, Bhaktapur Durbar Square and Madhyapur Thimi) of the four study areas have dried out because of the demands on groundwater by affordable modern technology such as pumping or deep boring. In contrast, another finding is that most respondents in the peri-urban heritage Changunarayan area have strong beliefs that the groundwater table in this area has been depleted following the establishment of pine trees in the Chagunarayan Community Forest. No studies have been undertaken to examine this assertion.
Based on people’s perceptions reported in chapters six and seven, this research found that the majority of spouts in urban areas lost or reduced their water flow due to the reduction of open spaces, encroachment onto the recharging areas of ponds that supply spouts, the construction of roads and buildings, the construction of private or public dug/tube wells near spout’s sources, the construction of drainage and pipelines crossing the water networks of spouts and finally the connecting of water sources of spouts into modern pipe-line systems. For example, most respondents assumed that many spouts in the Bhaktapur Durbar Square area dried out after the construction of sewer systems in city areas of Bhaktapur by the Bhaktapur Development Project (BDP). Likewise, Sanutar hiti in Madhyapur Thimi was thought to have dried out due to connection of its water source into the modern pipe-line system. These results are supported by the findings of Shrestha and Maharjan (2016) and UN-Habitat (2008) where they reported development activities have destroyed spouts’ recharging ponds and the underground water path to them.

In contrast, findings of this study confirm that in the peri-urban areas, deforestation, the digging of deep boreholes for irrigation, the water demands of the brick industries and other commercial purposes and also sand mining activities have affected the flow status of spouts. In addition, road construction, dug/tube wells and building construction also have compromised some spouts in the Jhaukhal area.

Upadhya (2009) noted that hundreds of spouts have become dry in the Kathmandu Valley because of urban encroachment. As reported in Chapter six, the findings from the peri-urban and urban non-heritage Madhyapur Thimi and Jhaukhel areas also suggest that land partition for migrants and construction activities have affected the water sources and water distribution networks of the spouts in these areas. The research results from this study accord with the hypothesis that spouts in Kathmandu Valley are affected by the modern pipe-line systems and other development activities, but also identify the importance of land tenure, social frameworks and social change. The next sections explore these and related findings from more theoretical perspectives.

### 8.4 The Social Construction of Spouts

By utilising the meta-theory framework of social construction reported in Chapter two, spouts and their various contextual constructions in all study areas have been examined through four
theory lenses, namely common property, institutional, attachment and central place. As stated in chapter two and clarified in chapter three, common property theory relating to property rights has been adopted as a separate analytical lens in this research. The following are explorations of the multiple contextual constructions of spouts observed through these four theories which help to explain and understand the importance, role, and management of stone spouts for the local communities of the Kathmandu Valley. Using Andrews’ (2012, p. 1) definition of “reality” as a subjective experience of everyday life, “construction realities” of spouts can be describing as an experience, perception and fact about spouts and in this thesis the focus is on the way these constructions affected managing spouts. In particular, these construction realities reveal the existing social status of spouts in the study areas.

In the following analysis, a framework for analysing the social construction realities through the examination of the four theory lenses is presented. These draw out key aspects and show how they reinforce the maintenance of spouts or alternatively may lead to their further degradation. The discussion of each lens is summarised in tables at the end of each section. In each table, positive and negative social construction realities are listed based on social construction aspects identified in interviews. Positive social construction realities are those that act to help to maintain or manage the spouts in a sustainable way and negative construction realities lead to degradation of spouts. From qualitative survey data reported in chapter six and then built on in chapter seven, it can be derived that “utility value” of spouts is the key driver followed by “token of ancestors” an aspect which pressures and obliges people to conserve spouts in a sustainable way. Those drivers considered most important for each lens are highlighted by bold highlighting and shading in the respective tables.

8.4.1 Constructions based on the common property theory lens

McKean (2000) described a common property regime as a property right arrangement where a group of users share their rights and responsibilities towards a resource, in this study spouts. Results show that management funding, property rights, policy, rules, regulations, incentives and lack of communal ownership are the main current construction aspects of spouts found while observing through the common property lens reported in chapter seven. Ostrom (1990) identified key “design principles” as essential elements for institutions in managing common property resources. If institutions do not comply with design principles, they may fail to sustain the common property resources (Adhikari, Kingi, & Ganesh, 2014). The weakness of
the current spout management regime can be highlighted through applying Ostrom’s (1990) design principles as an analytical framework (Table 8.1). Strengthening of the parts of spout management regimes identified as lacking, using the framework, could be helpful to improve institutional strength.

Table 8.1: Evaluation of Ostrom (1990) design principles against spout management regimes

<table>
<thead>
<tr>
<th>Design principles</th>
<th>Weakness of spout management regime based on design principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear boundaries</td>
<td>- No clear definition of users.</td>
</tr>
<tr>
<td></td>
<td>- People are not interested in maintenance especially migrants and rental people.</td>
</tr>
<tr>
<td>Congruent rules</td>
<td>- Rituals, socio-cultural norms and values are gradually breaking down.</td>
</tr>
<tr>
<td>Collective choice arrangements</td>
<td>- Lack of communal ownership and responsibility over spouts.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>- Absence of monitoring arrangements.</td>
</tr>
<tr>
<td>Graduated sanctions</td>
<td>- No legal authority to impose a punishment for encroaching on platforms, stealing images and deteriorating spout infrastructures.</td>
</tr>
<tr>
<td>Conflict resolution</td>
<td>- No conflict resolution mechanisms.</td>
</tr>
<tr>
<td>Rights to organise institutions</td>
<td>- Right to devise institutions by users for managing spouts is not recognised by the national level.</td>
</tr>
<tr>
<td>Nested units</td>
<td>- No multiple levels of institutional arrangements for the management of spouts.</td>
</tr>
</tbody>
</table>

Management of common property resources through public participation depends on the nature of ownership and property rights (Agrawal, 2001; Schlager & Ostrom, 1992). This research shows that a lack of a sense of communal ownership significantly affects the management system of spouts in all study areas. In the past, spouts were usually publically operated and collectively managed through the *guthi* system. *Guthi* held all rights to access, manage and exclude, although not to alienate. However, the *guthi* systems were disassembled after all the rights regarding managing spouts were handed to the Nepal Guthi Corporation and Department of Archaeology (DoA) and all *guthi* lands were also privatized under the Land Reform Act 1964. Problems have followed in the management of the spouts identified in the study areas, especially in both peri-urban and urban heritage and urban non-heritage areas after the privatization of *guthi* lands. This alienation of the local community and the transfer of responsibility to external, disconnected bodies, has resulted in no individuals or groups
being sufficiently motivated to maintain the spouts. Effectively, the centralization of ownership by the government destroyed the common property nature of these spouts. Consequently, the traditional sense of spout management for the benefit of the community seems to be yielding to an ‘every man for himself’ mentality. Communities that depend on spouts had been able to sustainably manage them for centuries through the guthi systems. The breakdown of the guthi system and subsequent privatization of guthi land continues to facilitate the alienation of people from spouts and therefore invalidating the social organization which formerly managed them. For example, the state canal and spouts in the Bhaktapur Durbar Square and Changunaryan, heritage areas, were significantly compromised after water guards employed by the guthi were no longer able to look after them.

Lightfoot (1996) reported that the traditional water harvesting system qanat (see Appendix 1 one for details) has been abandoned in Syria, Pakistan, Iran and Oman since the 1970s. The reason for this is that groundwater tables have been falling there because of over pumping via tube wells. The introduction of other modern water harvesting technologies also has contributed in these aforementioned countries to the degradation of the qanats. The results from this research are substantially in agreement with the findings of Lightfoot (1996) in that it illustrates widespread use of the pumped dug/tube wells has contributed to depletion of water flow in the spouts in all areas, but that has been exacerbated in some areas especially in Jhaukhel peri-urban non-heritage area by commercial water supply companies and brick industries deep water boring activities.

The research reveals that migrants and temporary respondents think that managing and preserving the spouts is the responsibility of the local people even though they use spouts more often than long term householders. Likewise, many local people and the younger generation also think that conservation and maintenance of spouts is the responsibility of the Department of Archaeology or the Nepal Guthi Corporation. Amongst the other findings however was that government bodies were not giving enough resources to the local community to sustainably conserve and manage the spouts. The funding allocated for management of spouts is universally seen to be insufficient. For example, people from the peri-urban heritage area refused to accept the small budget allocated by government. Additionally, it was also established that people’s dependency on spouts decreased after the
introduction of the modern pipe-line system which has subsequently made people accept less responsibility towards upkeep of the spouts.

In contrast UN-Habitat (2008) and Sada et al. (2013) reported that irregularity and uncertainty of municipality water supply has also pressured people of the Kathmandu Valley to construct dug/tube wells within their properties. Findings from this research tend to support with these previous studies. For example, respondents from the peri-urban non-heritage, Jhaukhel, and both urban heritage and non-heritage areas, confirmed that one of the major reasons attributed to the constriction of the water flow or complete drying out of spouts is the proliferation of dug/tube wells in their areas. However, while these results are generally in accord with Sada et al. (2013), they also show that people in the Jhaukhel (peri-urban) area are drawing on groundwater resources regardless of whether they have a modern pipe-line connection because the modern system is unable to totally meet their daily needs. These people have become accustomed to satisfying their day-to-day water requirements as an individual household unit rather than committing to the maintenance of a communal system such as the spouts.

The research results confirm that there is a widely held contention that the absence of policy, rules and regulations regarding the spouts has created obstacles toward managing them in a sustainable way. This finding was also highlighted by Shrestha, Sada, and Shukla (2015) and UN-Habitat (2008). Without a strong regulatory mechanism, there are no compelling incentives that require people to conserve spouts or groundwater resources. The ad hoc harvesting of groundwater via deep boring and dug/tube wells accelerates the declining groundwater tables in all of the peri-urban non-heritage, urban heritage and non-heritage areas.

Prior research has shown that increased land values especially in urban areas, ignorance, change of habits, and self-indulgence of people have increased the rate of encroachment over ponds and other recharge areas as well as the infrastructures of spouts (Chapagain et al., 2010; Shrestha et al., 2015; Shrestha & Maharjan, 2016; UN-Habitat, 2008). Results of this study confirm those earlier observations in both peri-urban and urban areas.

Table 8.2 shows existing positive and negative construction realities of construction aspects of spouts based on common property theory.
Table 8.2: Negative and positive social construction realities using a common property theory lens. Note that bold heading in social construction aspect rows indicate the most important driver of the analysis

<table>
<thead>
<tr>
<th>Social construction aspects</th>
<th>Positive (reinforcing spout maintain) construction realities</th>
<th>Negative (spout degrading) construction realities</th>
</tr>
</thead>
</table>
| Property rights             | - DoA, Nepal Guthi Corporation and Municipality have authority to manage spouts. | - Privatization of *guthi* lands.  
- Community alienated from spouts.  
- Government gives priority to build modern pipe-lines than maintaining spouts. |
| Policy, rules & regulations | - Ancient Monument Preservation Act (AMPA) 1956 & Trust (Guthi) Corporation Act 1964 are especially designed to conserve traditional properties including spouts. | - No particular policy, rules and regulations are developed to manage spouts.  
- Breakdown of *guthi* system.  
- Ad hoc harvesting of groundwater. |
| No communal ownership       | - Local people are still interested in managing spouts.  
- Some areas maintain remnants of traditional informal rules.  
- Some religious beliefs, rituals and rules still practised. | - DoA and Nepal Guthi Corporation are seen as responsible for breakdown of pre-existing informal rules.  
- Ongoing privatization of common areas (e.g., encroachment of ponds and recharge areas).  
- Ongoing degradation of spiritual and social value signifiers (modification & destruction of infrastructures, inscriptions and images, misused or stolen images and inscriptions attached to the spouts).  
- Degradation of utility value of water and spout areas (e.g., through pollution).  
- Overexploitation, privatization of land and groundwater for domestic, commercial and industrial purposes.  
- Younger people consider modern pipe-line water supply systems as a convenient system than spouts.  
- In comparison to previous times, less dependency of people on spouts. |
<table>
<thead>
<tr>
<th>Social construction aspects</th>
<th>Positive (reinforcing spout maintain) construction realities</th>
<th>Negative (spout degrading) construction realities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives</td>
<td>- Limited financial and technical incentives are available from government, non-government and community based organizations for managing the spouts.</td>
<td>- Insufficient &amp; ineffective incentives force people to neglect maintenance and continued construction of traditional spouts. - Limited human resources to maintain spouts to a culturally acceptable standard.</td>
</tr>
<tr>
<td>Management funding</td>
<td>- Funds are allocated for maintaining spouts from government &amp; non-government organisations. - Some tourist taxes collected from Changu Narayan temple are sometime used to maintain spouts in peri-heritage area. - Initiator and community owned or valued spout maintenance achieved.</td>
<td>- Lack of communal sense of ownership and sense that responsibility lies elsewhere means community does not self-fund or acquire funds and rejects offered inadequate funding as a protection action. - Low priority from government or other heritage conservation organizations for managing spouts relative to perceived higher value assists (e.g., temples).</td>
</tr>
</tbody>
</table>
8.4.2 Constructions based on an Institutional theory lens

As reported in chapter two, institutional theory is linked with property rights and determines the bureaucratic functions and distributions of power across different governing levels of formal and informal institutions involved in governing common property resources. The social construction of spouts as viewed through the ‘institutional theory’ lens has a variety of implications to consider for those interested in their conservation. Institutions have a vital role in supporting people to muster collective action to conserve and manage common resources (Agrawal & Ostrom, 2001). Possessing the prestigious honour of being the first hydraulic structure used in Nepal with rare architecture and engineering value, spouts could have reasonably expected to be highly placed in terms of securing attention from government and non-government organizations seeking to conserve them. Contrary to these expectations, however, this study found that government and other organizations show a distinct lack of commitment regarding the preservation and maintenance of spouts in the study areas. These organisations have insufficient financial and technical resources and little interest in managing spouts. Thus, they have not yet produced any policy, plans, or ideas on how to conserve the spouts.

As far as the responsibility for conservation is concerned, the Department of Archaeology (DoA) and Nepal Guthi Corporation are the main government organizations charged with conserving Nepalese spouts. However, the research reveals that the existing levels of support from these organizations, financial and technical, have proven unsatisfactory, especially in comparison to traditional guthi systems. This finding further supports the contention of UN-Habitat (2008) where it was stated that the centralized guthi system under the Nepal Guthi Corporation was an erroneous policy of the Nepalese government. This study also confirms that the Nepal Guthi Corporation, the DoA and other governmental institutions are unable to meet the increasing needs and demands of local communities to conserve and manage the spouts in both urban and peri-urban areas. Results from interviews and focus groups show that currently no government or non-government organizations are even operating in the peri-urban (Changunarayan and Jhaukhel) areas in terms of spout management or conservation. Government bodies display no serious intentions to continue or supplant the traditions that were carried out for centuries. For example; juice feeding from the Gah hiti was discontinued by Nepal Guthi Corporation in 2014. Water flow from Narayan hiti
(Changunarayan) and Taleju dhara (Jhaukhel) is gradually decreasing every year, yet in cultural terms it is considered mandatory for worship at Chanunarayan and Taleju temples located in the heritage areas. However, JUSAN, World Vision, GIZ, ENPHO and UDLE (international and national non-governmental organizations) had renovated some spouts before 20 years in both peri-urban and urban areas as mentioned in chapter six.

In contrast to national government efforts, some community based organizations such as Changu Development Committee in Changunarayan, and local clubs in Jhaukhel, Madhyapur Thimi and Bhaktapur Durbar Square areas have started to maintain and conserve spouts. These clubs and local communities sometimes clean the spouts while they clean their localities and also have collected money for maintaining spouts when necessary. However, their current activities are not at a level which is sufficient to conserve the existing spouts.

Although insufficient the above examples do contribute to an understanding of how institutions may assist local communities to conserve and manage spouts. It is clear from this research that both national and local government organizations and non-governmental organizations are ineffective in conserving spouts in both peri-urban and urban areas. People from non-heritage areas have alleged that these governmental organizations focus their programs only in heritage areas. Notwithstanding this, this study has established that people from heritage and urban areas are similarly dissatisfied with the state of activities attempting to conserve and manage spouts. It has become apparent that current knowledge, skill and financial capacity within the community based government and non-government organizations are inadequate, opaque and ineffective with respect to the conservation and maintenance of spouts in all study areas. Local communities also have limited information about the resources provided by different organizations and the procedures to get these resources which in theory are provided for them. For example, research findings show that users from Madhyapur Thimi do not know the procedures to ask DoA for technical and financial support for maintaining Han, Garcha and Thankgacha hiti. Table 8.3 demonstrates existing positive and negative aspects of construction realities of these government, non-government and community based organizations.
Table 8.3: Negative and positive social construction realities using an institutional theory lens (Note that bold heading in social construction aspect rows indicate the most important driver of the analysis).

<table>
<thead>
<tr>
<th>Social construction aspects</th>
<th>Positive (reinforcing spout maintaining) realities</th>
<th>Negative (spout degrading) realities</th>
</tr>
</thead>
</table>
| Government Organizations    | - DoA and Nepal Guthi Corporation are responsible for conserving spouts. | - Limited budget, technical support and information about spouts.  
- Programmes and activities sponsored by governmental organizations are not transparent.  
- Less interested to continue traditions related to spouts.  
- Limited data available regarding spouts.  
- Distinct lack of commitment regarding the preservation and maintenance of the spouts. |
| Non-governmental organizations | - Renovated some spouts and their water networks about 10 to 30 years ago.  
- Data are available only for urban spouts. | - Currently, no specific plan to support users in stone spout management.  
- Not sufficient information regarding spouts. |
| Community based organizations | - Show interest to conserve spouts.  
- Collect funds from household level to maintain spouts.  
- Clean spouts sometimes. | - Current activities are not sufficient & effective to conserve the spouts due to the expensiveness of traditional materials.  
- No regular maintenances.  
- Local communities have limited information about the provided services and services seeking mechanisms for conserving and maintaining spouts. |

8.4.3 Constructions based on the attachment theory lens

The Attachment theory lens defines the affective bonds between people and their important places that includes different actors, social relationships, and places of varying scale (see chapter two for details). Outcomes of the study show that some people are attracted towards stone spouts due to the taste of the water that they have become highly accustomed to. It was found that most respondents in both the peri-urban and urban areas held strong beliefs that spouts have better water quality than the water from modern pipe-line systems or dug/tub wells. This finding is supported by Bajracharya (2014) who reported that water quality of spouts is within the National Drinking Water Quality Standard (NDWQS) and World Health Organisation (WHO) indicating it needs minor treatment such as disinfection before using.
Findings reveal that many people have an affection for the natural flow of spouts. Research results have uncovered that respondents are sufficiently aware of this fact as they frequently mentioned that spouts have a natural water flow and they do not need pump extraction like dug/tub wells. Natural flow of spouts would act as a by-product for managing the groundwater table. While traditional stone spouts in the Kathmandu Valley cannot replace modern water supply systems such as the pipe-line system, they still have an importance in the management of groundwater in a sustainable way. Spouts minimize over harvesting of groundwater because they rely on an entirely man-made gradient flow system under gravity to tap groundwater without utilization of any external power sources. Spouts do not disturb the natural groundwater table balance whereas the application of external force via pumps can induce aquifer depletion. This is another reason that people do not want to see the spouts destroyed or desecrated.

Moreover, results from this study demonstrate that working together in communities to maintain the spouts means they can still be enjoyed by users who will only have to pay a nominal operation and maintenance cost each without a huge investment. For example, many older respondents mentioned that they still miss the days that they used to go together to clean the water sources, networks and the platforms of spouts. Furthermore, mechanically-pumped wells are often privately owned, and, as a result, the traditional ‘ties that bind’ in societies are in danger of breaking down. Yet, as has been stated, many residents especially migrants now widely prefer pumped dug/tube wells and seem willing to allow spouts to languish. However, local older people still want to conserve spouts as a symbol of the strong social bonds they cherished in bygone days.

Another attachment feature is that the water from stone spouts is largely used to perform daily and other ancestral rituals (Becker-Ritterspach, 1990; UN-Habitat, 2008). Findings confirm that older people prefer spouts as a source to collect the water they regard as sacred for their daily rituals and worships. Most Hindus and Buddhists have spiritual affiliation with spouts as different images of their most significant deities have been carved around spout platforms. Moreover, the nine east facing spouts are considered as holy spouts to bathe in once a year on a special day in urban areas. Likewise, findings make it apparent that spouts are necessary to perform funeral rituals especially in the peri-urban area. For example,
different castes have different special spouts in which to perform their funeral rituals in the Jhaukhel area.

One of the most interesting findings of this study relates to younger people who consider modern pipe-line water supply systems as a convenient system and they prefer these methods to fulfil their water needs over the spouts. However, notwithstanding these opinions, they are against disestablishment, modification, or connection of pipe-lines into spouts. Results demonstrate that younger respondents in both the urban and peri-urban areas do not believe in adherence to the socio-cultural rules, regulations, customs and taboos that are important to the conservation and management of spouts. However, they still respect the spouts as a token of their ancestors and share this sentiment with the older group which means that people in general want spout conservation. An example of this is, the younger people in the Jhaukhel area who collected money and repaired a Taleju spout (this event is mentioned in Chapter seven). Moreover, many young people want to manage spouts as ornaments in their living spaces for attracting tourists. People also consider spouts as a gift from their ancestors’. Therefore, they want to conserve remaining spouts in a sustainable way. Table 8.4 demonstrates existing positive and negative construction realities of spouts based on attachment theory lens.
Table 8.4: Negative and positive social construction realities using an attachment theory lens. Note that bold heading in social construction aspect rows indicate the most important driver of the analysis.

<table>
<thead>
<tr>
<th>Social construction aspects</th>
<th>Positive (reinforcing spout maintaining) realities</th>
<th>Negative (spout degrading) realities</th>
</tr>
</thead>
</table>
| **Spiritual affection**    | Water from spout is considered sacred and better quality.  
- Still some temples cannot be worshipped without water from spouts such as *Changunarayan & Taleju* temples.  
- Spouts are still used to perform cultural and daily rituals. | - Less aware of social imperatives.  
- Violation of entrenched spiritual values.  
- Relaxation of prior social controls. |
| **Token of ancestors**     | People still want to preserve spouts as their ancestors’ souvenir to them.  
- People want to show future generations how their ancestors fulfilled their water needs. | - Activities are not done in reality regarding spouts conservation as it needs to be. |
| **Taste & quality**        | Water from spouts is warmer in winter and colder in summer.  
- Some people like the taste of the water that they have become highly accustomed to.  
- Some people think that water from spouts has better quality than the pipe-lines. | - Replacement of traditional earthen pipes and sedimentation tank (*Athah*) by modern pipes has affected the water temperature in summer and winter.  
- Deposit of waste nearby or into the spout’s platform has affected the quality of spouts. |
| **Social bond**            | Local older people still want to conserve spouts as a symbol of the strong social bonds they cherished in previous days.  
- Spouts help people to socialise and be patient while waiting their turn to collect water. | - Younger generation is not interested in maintaining spouts during festivals such as *Sithi Nakha*.  
- The traditional ties that bind societies are in danger of breaking down due to private water connection in households. |
| **Funeral rituals**        | Rely on spouts to perform particular funeral rituals especially in peri-urban areas. | - Less interest to maintain spouts after performing the rituals. |
8.4.4 Constructions based on the central place theory lens

The notion of the range of a good is the key element in central place theory (Garrison, 1958). Study results the ideas of Daniels (2007), Garrison (1958) and Getis and Getis (1966) who suggested that the cornerstone of central place theory involves the average maximum distances people need to travel to obtain goods and services. The range of distances around a central place, the home, from which people need to travel to the spouts to obtain water, is recorded in this study simply as within or beyond 100 metres distance (Table 8.5).

After the introduction of modern water supply systems in 1895, the convenience and pride of having a private water connection into one’s house eventually led to spouts being ignored and abandoned (NGO Forum, 2010; UN-Habitat, 2008). Study findings also show that from 1895 when modern pipe-line systems were introduced people began to think that pipe-line supply was better than spout water supply. However, the pipe-line supply increasingly became more and more uncertain and unreliable due to high population growth, power cuts and change of socio-economic distribution in the city especially in urban areas. Finding shows that water scarcity has forced many people back to the stone spouts which meanwhile have been ignored and abandoned (Figure 8.1). Findings highlighted by this research mean the current social construction realities of people attracted towards spouts through the central place theory lens can be identified.

![Figure 8.1: Conceptual model of changing use pattern over time of spouts and pipe-line systems](image_url)
Figure 8.1 demonstrates that from 570 to 1895 AD, usage of spouts is increased. However, when the modern pipe-line was begun in 1895, usage of spouts decreased and the usage of pipe lines increased until around 2000. After 2000, because of the uncertainty of pipe-line water supply, people started to realise the utility value of spouts. This observation is supported by Shrestha and Maharjan (2016) who have reported that Kathmandu Upatyaka Khanepani Limited (KUKL) fulfils only 33% of total water demand while the remaining 77% is fulfilled by stone spouts, dug/tube wells and private water tankers. Thus, from 2000 onward the importance of spouts gradually increased. Findings derived from chapters six and seven reveal that currently, “utility value” is the biggest driver motivating people to conserve spouts (Table 8.5).

Table 8.5: Negative and positive aspects of construction realities using a central place theory lens. (Note that bold heading in social construction aspect rows indicates the most important driver of the analysis.)

<table>
<thead>
<tr>
<th>Social construction aspects</th>
<th>Positive (reinforcing spout maintaining) realities</th>
<th>Negative (spout degrading) realities</th>
</tr>
</thead>
</table>
| Water collection ≤ 100 meters | - Used as an alternative to fulfil daily water needs.  
- Water regarded as sacred for daily rituals and worship. | - Not maintained properly as they need to be. |
| Water collection ≥ 100 meters | - Especially used to perform rituals and to continue traditions such as juice feeding and to bathe in east facing spouts.  
- Some people like the taste of water from particular spouts.  
- Useful in winter when pipe-line are temporarily out of services. | - People have ‘out of sight out of mind’ mentality after fulfilling their need.  
- People are less responsible towards upkeep of spouts. |
| Utility value | - 10% of the urban population depend on spouts.  
- Irregularity and uncertainty of pipe-line water supply has forced people back to the stone spouts.  
- Excavated and renovated some spouts.  
- Some spouts are continued by connecting pipe-line water into them.  
- More convenient for rental people.  
- An income source from tourists.  
- People desire to keep using spouts as an alternative source of water along with their private water sources.  
- Meeting the water needs of the urban poor, especially among the people who could not afford deep boring and water from tankers.  
- Manage groundwater table in sustainable way. | - People mostly remember spouts when power is cut-off or pipe-line is discontinued.  
- Modern water tap is placed in between or inside of some spouts instead of maintaining spouts. |
Outcomes of this research suggest that spouts could be a particularly effective system considering the level of increasing water scarcity in the Kathmandu Valley. These results are in agreement with UN-Habitat’s (2008) findings which showed that stone spouts are still in daily use thus reflecting the scarcity of water in terms of meeting day-to-day needs. Results reveal that during the dry season, in winter, water from pipe-line systems is furnished only for two hours per day, and sometimes once a week for two hours in the urban Bhaktapur Durbar Square and Madhyapur Thimi areas. Water cannot be readily obtained when the power is cut off on average 12 hours per day in winter. So, people increasingly want to keep using spouts as an alternative source of water along with their private water sources such as taps or dug/tube wells in their houses in both peri-urban and urban areas.

Water-related tension in the Kathmandu Valley has gradually increased crowding around spouts every year which had previously been ignored or abandoned (UN-Habitat, 2008). Stone spouts have started to gain a reputation for meeting the water needs of the urban poor, especially among the people who could not afford deep boring and water from tankers. It was reported that 10% of the urban population depend on spouts to fulfil their water needs (Bajracharya, 2014; NGO Forum, 2010; Shrestha & Maharjan, 2016). Shrestha and Maharjan (2016) reported that poor households who cannot afford to pay for municipal pipe-line water systems use water from spouts extensively. This study’s results concur with this earlier study. Indeed, as reported in chapters six and seven, people can use water from spouts free of cost. Therefore it is of no surprise that this research shows that people in the urban, Bhaktapur Durbar Square and Madhyapur Thimi, areas especially people renting who have low income and no suitable time to arrange for pipe-line water supply, prefer spouts to satisfy their daily water needs. Furthermore, some rental respondents from urban areas mentioned that stone spouts became alternative water source for them because municipal water supply operated during morning hours only. This was inconvenient because during this time they were at or travelling to work. Stone spouts are still of great importance to this group for washing clothes and bathing during daytime hours.

Results show that older people start the day by offering water to gods and goddesses which is respected as virtuous. These results also further support the idea of Pradhan (2011) where it is mentioned that offering water to thirsty people is considered as a holy act by the Hindu
religion. Therefore, in previous times, stone spouts were deliberately constructed in the vicinity of communities.

In contrast to the peri-urban environment, it has been found that most spouts in urban areas were located near settlement areas. The findings of this study reveal that generally, most people in the urban, Madhyapur Thimi and Bhaktapur Durbar Square, areas travel ≤ 100 metres to collect water from spouts. However, people from peri-urban, Changunarayan and Jhaukhel, areas collect water from spouts located ≥ 100 metres away. It was found that the situation is different in the winter season. Due to the inadequacies of the pipe-line water supply resulting sometimes in little or no flow from spouts, people in urban areas are also forced to travel more than 100 metres to fetch water from other more fruitful spouts. Moreover, the taste, quality, and religious and cultural values also motivate people to travel further distances to collect water from spouts. For example, people from the Bhaktapur Durbar Square and Changunarayan areas need to often travel some distance to collect water for offering to gods. Similarly, some people travel greater distances to perform their funeral activities in the peri-urban areas and people from urban areas use east facing spouts to bathe in once a year as described in chapter five. These special spouts may be a few kilometres from their settlements. Table 8.5 shows that “utility value” is the single most important key driver that has motivated people to conserve spouts.

8.5 Application of the Meta-theory to Better Management of the Remaining Spouts

This social constructionist perspective when applied to spouts serves to highlight some easily overlooked areas of stone spout management. This section explores the application of the meta-theoretical context which involves using four specific theories within the context of social constructionism, namely: common property, institutional, attachment, and central place theories, with the end goal being the conservation and maintenance of the remaining spouts in all study areas. Before moving ahead with a detailed understanding of the implications learnt by exploring the meta-theory, I have presented the “construction realities” of spouts schematically (Figure 8.2) in order to show how they are linked to the meta-theoretical context and how they are linked within and with each level so as to assist further exploration.
Figure 8.2 demonstrates the multiple contextual constructions observed through the social construction lenses. Furthermore, it presents the interaction of constructions within and across the four theory lenses. The bold highlighted construction aspects have more importance in the interactions as discussed in section 8.4. Closed arrows show the direct connections and dotted arrows show the indirect interactions within and across the construction realities. Similarly, arrow heads indicate the relative strength direction of the interactions. These interactions help to explain the attitudes and activities of people and institutions toward spouts that ultimately lead to the currently ignored or abandonment status of spouts. Furthermore, through the analysis of interviews, it was found that positive factors of “construction realities” are typically dominated by negative factors (Tables 8.2, 8.3, 8.4 and 8.5) which have ultimately led to damage to spouts. Therefore, most spouts in all study areas are either ignored or abandoned. “Communal ownership” and “government organisations” were identified as spout decline drivers and “utility value” and “token of ancestors” were identified as spout use drivers. So, “Utility value” is the most dominating construction followed by “token of ancestors” that determine current and future spout conservation activities. As set out in the final research question, this section focuses on exploring the practical implication of the meta-theory in ongoing spout management.
Figure 8.2: Connections between social construction of spouts & the four theory lenses used for analysis indicating drivers of use and decline (Note: Key and secondary drivers were identified through analysis of interviews. Arrow heads indicate the relative strength direction of the interactions.)
What is apparent from the research is that once a spout dries up or water flow is reduced that spout is usually abandoned. Modern pipe-line systems and other development activities play a vital role in leading to toward this neglect and abandonment of the spouts, certainly in the study areas in question. However, at present many spouts and spout infrastructures have not yet totally collapsed. There have been some instances where spouts have been repaired and brought back into use even after abandonment. For example, Sarashowti, Gah and Gamdhoka hiti of Changunarayan are once again being utilised and maintained. As pointed out in chapters six and seven, local communities still desire a measure of spout presence to fulfil their religious, cultural and utility requirements. Moreover, the research findings illustrate that architectural, ornamental and ancestral are the other more culturally inspired values which attract the older and younger generations in both peri-urban and urban areas to advocate for spout preservation, the exceptions to this being migrants plus a certain section of the population that predominantly inhabit rental properties.

One of the key insights into the management of spouts that became apparent from the analysis performed in section 8.4 is the realisation that conservation of spouts is a collective societal endeavour. It is also clear that for the collective approach to work communities must have support of appropriate institutions. That said, the current financial and technical support provided by government, non-government, and community based organizations is disorganised and inadequate to sustainably manage the existing stock of spouts. This lesson is one the authorities should absorb if they are to effectively govern for better management of a valuable cultural resource.

Another insight from the aforementioned analysis outlined in section 8.4 is that since the guthi system was reappraised and recognised as an effective system for spout conservation, ownership vested in local communities can be an option for managing the spouts to minimize the “tragedy of the commons” problems associated with spouts. As revealed in the survey results, local clubs in both the peri-urban and urban areas have already started assuming some collective community responsibility toward the cleaning and maintenance of some spouts. These local clubs may be provided with even more of an incentive towards preservation if they were allocated a share of the property rights, an option which is discussed in section 7.2.

In addition, the distance of spouts from settlements also contributes to the likelihood of better management, by advantaging some spouts as better suited to any management initiatives
over others. For example, research outcomes show that in most cases, respondents prefer to utilise spouts near their houses and obviously they would prefer an offer of a contribution towards maintenance for spouts which they frequent most often.

This latter finding hints at another key insight from the study; that the distance of spouts from users influences the management and conservation activities which are appropriate for them. This awareness gained by viewing the conservation of spouts through the central place theory lens aids policy makers in predicting the optimal location and magnitude of efforts thus further incentivising communal efforts. These results further support the ideas of Derudder and Witlox (2004) and Wang (1999) with respect to the spatial arrangement of urban environments. Furthermore, successful management initiatives can only enhance the water flow and increase communal attraction towards spouts. As highlighted previously, Narayan hiti and Taleju hiti in the peri-urban areas have special religious values and management initiatives can incentivise this community so that this sentiment is fostered and prolonged. The management issues of spouts such as decreasing water flow, encroachment, pollution and the destruction of infrastructures relevant to any spout in close proximity to users can be addressed by efficient collaboration between government, non-government and community based institutions. Local planners should work closely with their Ministry to develop activities that showcase the best of what each particular spout has to offer.

It is apparent when considering the insights and conclusions arising from the preceding discussion, that the meta-theory approach resulting from a synthesis of the four main theories is very useful in informing the sustainable management of the remaining spouts.

8.6 Summary

This chapter discussed the results related to research questions in the broader context of the literature. While no spouts are in pristine condition, those in non-heritage areas are in better condition than those in heritage areas. This finding appears surprising. Further analysis using four social construction theory lenses into stone spouts linked to a meta-theory provided explanatory insight. This analysis provided a firm basis to the claim that the meta-theory approach could provide an important perspective to support and make sustainable the management activities providing stewardship for the remaining spouts in both the peri-urban and urban areas. Management of spouts could be more effective and efficient, if the
ownership is somehow vested in the local community like the previous guthi system. Ongoing population growth, power cuts and irregular water supply of pipe-lines have increased the “utility value” of spouts. Besides this, the religious, cultural and unique engineering values of spouts provide an incentive for people to think about the preservation and management of spouts in a sustainable way. Authorities could clearly provide both financial and technical support aimed at solving the management issues of spouts.
Chapter 9

Conclusion

9.1 Introduction

The purpose of this research was to identify the existing values of traditional spouts that have been supplying water for many years to the residents of Kathmandu Valley, Nepal and to demonstrate their linkage with socio-cultural and institutional norms and values. This was to be accomplished by comparing the spout management systems serving the urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley. In order to achieve this, the study focussed on three research questions which are outlined in chapter one. This chapter first summarises the key findings based on the overall analysis and the discussions undertaken in chapters 5, 6, 7 and 8 against the research questions and hypotheses. The next sections, 9.3, 9.4, and 9.5, discuss the limitations, implications and contributions of research respectively. Section 9.6 makes some recommendations for management of spouts. Section 9.7 then explains new areas for future research. Finally, there is a brief overall conclusion to the thesis.

9.2 Key Findings of Research

This study was based on qualitative and quantitative data collected from interviews with planners and experts and community members as well as field observations of 69 stone spouts in the urban and peri-urban heritage and non-heritage areas of the Bhaktapur district of Kathmandu Valley, Nepal. The detailed empirical findings of the study were presented in chapters five, six and seven. The key findings of this study are:

- A spout’s general condition is better in non-heritage areas of both urban and peri-urban areas because they are less likely to be affected by changing socio-cultural circumstances, institutional norms and values as well as by modern pipe-lines and other developmental activities.
- Indigenous knowledge, beliefs, and thoughts, together with socio-cultural and institutional norms and values provide a foundation for the management of
traditional stone spouts within both urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley.

- The modern pipe-line water supply systems and other development activities have a negative impact on the religious, socio-cultural and aesthetic importance of traditional spouts in both urban and peri-urban heritage and non-heritage areas of the Kathmandu Valley.

The following sections evaluate these key findings against the three research questions and the hypotheses.

9.2.1 What are the impacts of changes in social, cultural, institutional norms and values and how do they influence the stone spouts management system?

Historically, the guthi system of stone spout management was formed by the local Newar people. Communities then possessed inherent social and cultural obligations that enabled sustainable management of the water sources and infrastructure supporting the traditional spouts in the Kathmandu Valley. The research findings show that the breakdown of the guthi and the caste systems in the mid-20th century, fading social beliefs and trends of following western style celebrations, of, for example, the Sithi Nakha without the once complementary activity of spout cleaning, have all reduced social cohesion and support for managing spouts. A major turning point in this deterioration of many traditional spouts was identified as the centralisation of guthi systems under the Nepal Guthi Corporation. Communities lost their ownership of spouts after this centralisation. This and other factors have caused the neglect and drying up of spouts in all study areas. Thus, the hypothesis that indigenous and traditional knowledge and socio-cultural practices, norms and values have been negatively impacted in both heritage and non-heritage sites, has been confirmed. Moreover, the loss of these has affected the quality of the remaining spouts.

Some spouts in the study areas possess religious significance. In earlier times bathing and deference respect to the images adorning spouts was executed with the full acceptance that these were spiritually meritorious acts. Nowadays, in many areas the situation has changed so much that some spout sites have become dumps for waste. The study findings were that the aforementioned decline was actually worse in the heritage areas. Thus the hypothesis that the negative impacts would be more pronounced in the non-heritage areas is rejected.
9.2.2 How do the modern pipe-line systems and other development activities affect traditional stone spout management systems in heritage and non-heritage areas?

This study has explored the existing situation and the management efforts toward traditional stone spouts that have been used over many centuries in Kathmandu Valley. However, unfortunately, in some people’s eyes these traditional water delivery mechanisms are either regarded as useless or given less importance following the introduction of modern pipe-line and private water tap connections at the domestic level. This research found that most spouts lack both conservation and maintenance attention. Water sources and the associated networks are affected by urban expansion and population growth. Similarly, construction of buildings and other development activities such as roads and sewer systems have blocked, encroached and damaged recharge areas, underground water networks and the water sources of spouts which has generally left the traditional spout stock in a very weak and dilapidated condition. This situation confirms the acceptance of the hypothesis mentioned in chapter one that the spouts in Kathmandu Valley have been adversely affected by the modern pipe-line systems and other development activities. However, as mentioned, spouts in non-heritage areas are less affected than those in heritage areas, somewhat surprisingly.

9.2.3 What are the implications for local communities of the incremental and ongoing loss of traditional stone spout infrastructure in terms of sustainable management of remaining spouts and water supplies?

This research shows that insufficient supply of water from pipe-line systems is attracting people nowadays toward using and valuing more highly the spouts in the Kathmandu Valley. The findings of this study highlighted the requirement of adequate financial and technical support from government and non-government organizations, communal ownership, awareness, policy, institutional and political will and control mechanisms over encroachment, constructions and new development activities for sustainable management of remaining spouts and their water networks in the Kathmandu Valley.

The study results also demonstrate that there is insufficient attention given by authorities such as the Department of Archaeology, the Nepal Guthi Corporation, VDCs and the local municipalities to the conservation of traditional stone spouts, despite their great potential to
contribute towards fulfilling the water needs of people in the Kathmandu Valley. Limited support has been provided by these governmental organisations to conserve and maintain spouts. This means that the final hypothesis of the study which states that the maintenance of traditional spouts depends on the attitudes and actions of decision makers is accepted.

It is also accepted that government and non-government organisations are responsible for the conservation, and maintenance of spouts in the Kathmandu Valley. Therefore, this study has shown that it is important to develop strong levels of coordination among the responsible authorities to carry out these activities for the remaining spouts in the Kathmandu Valley.

9.3 Limitations of the Research

This study comes with the methodological limitation that affects the generalization of its results. Since this study was carried out in the urban and peri-urban heritage and non-heritage areas of Bhaktapur district, findings may not be easily generalised to other parts of the country. However, use of the same approach would be useful for better understanding the existing status and management systems of spouts in other parts of the country.

Community members, planners and experts were the primary source of information for this study. Although field visits and documents helped to triangulate the data, respondents may have biased interpretations or limited knowledge regarding the effect of the changing socio-cultural and institutional norms and values and development activities on spout management systems. The findings, implications and recommendations presented here must be seen within the context of these limitations.

9.4 Implications of the Research

The findings of this study have a number of implications for future practices. This section describes how the outcomes of this research contribute to existing knowledge on traditional water harvesting systems at the methodological, theoretical and policy-making levels. The research methodology of this study demonstrated that the use of a mixed methods (qualitative and quantitate) model is an effective approach to understanding the bio-physical and existing management regime of spouts. Both quantitative and qualitative data have been used to report and analyse the state of stone spouts in the study areas of the Kathmandu Valley. For example in a quantitative sense, this has included GPS spout location data, a major
contribution of this study (see section 9.5), the number of stone spouts, spout flow quality, and the numbers of original, modified and pipe-line connected spouts. And in a more qualitative context, it has involved recording and analysing the perception of planners, experts and community members about the existing status and management system of the spouts.

As a methodological implication, this research has developed a research framework and criteria for the selection of study areas (see chapter three) that proved appropriate for comparing the spout management systems between urban and peri-urban heritage and non-heritage areas of Kathmandu Valley. A similar research framework and evaluation criteria could be used in comparing the management of different traditional water harvesting systems in other countries, examples being qanats in Iran and kundis in India.

As discussed in chapter two, this study has used a meta-theory approach as an analytical construct to explore the attachment, property rights, institutional and spatial arrangement of spouts to primarily provide for better management of them. The meta-theory concept used has demonstrated its applicability and value to enable investigation of the pattern of interaction between the physical characteristics of the traditional water harvestings systems and the social characteristics of the user communities. In particular, this study could be a good basis for a possible application of central place theory to understand the importance of distances for users and managers of other common property resources similar to spouts.

The research has identified a number of factors that policy makers and users of spouts may find useful to focus their attention on when considering future management of spouts especially exploring the possibilities of restoring state canals, recharge ponds, returning the ownership of spouts to the users and control mechanisms for encroachment, pollution, and over-exploitation of groundwater.

9.5 Contributions of the Research

This research has contributed in many ways to the body of knowledge regarding traditional water provision systems in modern society. Linking socio-cultural perspectives to the management of spouts is itself novel as previous researchers have often focused on technical issues such as water quantity and quality. Findings from this study enhance understanding about changing socio-cultural and institutional norms and values and their role in conserving and sustainably managing the remaining spouts in the Kathmandu Valley. The comparative
evaluation between urban and peri-urban heritage and non-heritage areas does not appear to have been previously undertaken.

Another major contribution is the inventory and detailed physical study of spouts in the peri-urban areas of the Bhaktapur district. This study used GPS data for cataloguing the actual location of spouts in all study areas. Because this information was collected just prior to the devastating earthquake of 25th April 2015, this study could help find and identify changes in the bio-physical status and situation of spouts in all study areas since the earthquakes and assist an assessment of the impacts of the earthquakes and the roles spouts may play in the vulnerability and resilience of their associated communities.

This research has confirmed the importance of policy and legal provisions in order to manage spouts sustainably. There is a need for policy, rules and regulations regarding users’ ownership and property rights of the spouts and groundwater as well as control mechanisms to control further ill-treatment of them. Such a policy may include consideration of how to re-establish a sense of community ownership of spouts, such as the guthi system.

The application of the meta-theory concept drives this research beyond the general impact study of modern pipe-line and other development activities. To my knowledge, this is the first study which has used four theory lenses to evaluate traditional stone spout management systems in Nepal. Indeed it may be the first study of its kind in the more general area of heritage infrastructure management globally. This research thus opens a new avenue for applying a meta-theory approach to explore and analyse other aspects of spouts as well as other similar traditional infrastructure in Nepal and elsewhere (e.g., qanat in Iran).

9.6 Recommendations

Insufficient and ineffective legal provisions, poor coordination among national and local level government and non-government organisations, breakdown of traditional institutions, such as the guthi system, and social and cultural norms and values have contributed to the decline of traditional spouts in the Kathmandu Valley. To address decline and to potentially reverse it, some key recommendations at national and local levels are suggested as follows:
National (policy) level

- There is an absence of policy, rules and regulations regarding stone spouts in Nepal. So, legislation may be required to address specific management issues of spouts and ground water extraction. It would be better to specify the specific role of different organisations in the legislation.

- This study suggests that the Declaration of the National Convention on Stone Spouts of 2007 (DNCSS 2007) needs to be implemented for improving the existing status of spouts in the Kathmandu Valley.

- Strong cooperation and coordination is important among national and local level institutions to carry out conservation activities of spouts. The Department of Archaeology (DoA) is the main government body responsible for managing spouts. Therefore, the DoA could initiate spout management activities in concert with other government and non-government organisations such as the Guthi Corporation, community based organisations and the municipalities.

- It would be wise to give priority for the conservation of spouts while implementing development activities. Coordination should be achieved among concerned government institutions such as Department of Water Supply and Sewerage, Department of Road and Department of Urban Development and Building Constructions for adequate control mechanisms regarding potentially haphazard development activities.

- Partition of land and unauthorized commercial exploitation of groundwater should be strictly controlled and monitored by implementing legal provisions and especially including the need to consider impacts on stone spouts and the associated community relationship with them.

- It is essential to provide sufficient incentives, such as property rights, technical and financial support, to enhance conservation activities. Similarly, education and awareness programmes need to be launched to make the public aware of the importance of cultural heritage resources such as spouts particularly targeting new residents in areas.

- A detailed inventory of spouts and identification of the physical location of spouts, traditional and local institutions, local culture, and economic activities is required to plan the conservation activities effectively for ensuring the continuity of spout management activities.
- There is a necessity to promote an environment and foster motivation to conserve and transfer the traditional knowledge, skill and technology to manage remaining spouts in a sustainable way.

**Local (management) Level**

Users at local levels ought to have a primary role in managing and conserving the spouts. The following suggestions are given at a local level for improving the existing status of the remaining spouts:

- It is important to identify the most vulnerable spouts and to register concern to authorities for management requirements. Community based organisations can play a supervisory role to identify vulnerable spouts and to coordinate with different organisations for the purpose of conserving them.

- Coordination and mutual accountability is essential between local governmental bodies such as VDCs and municipalities and community based institutions. Community members, political leaders and experts also need to be included while planning and designing the spout management activities at local levels.

- An effective plan is needed to implement conservation activities through public participation. As a local government body, municipalities and VDCs could play proactive roles in planning and implementing conservation activities at a local level.

- Protection of water sources, images, traditional earthen pipes and other construction materials and prevention from damaging, encroaching and polluting spouts and their water networks are needed to be controlled at a local level.

- It is recommended new migrants and other newcomers be made aware of the social norms and values which have been practiced for centuries and, at the same time to include recent migrants and new comers in the spout management activities.

### 9.7 Future Research

This research has opened new avenues of subjects that are in need of further investigation. Most respondents pointed out *pinus* plantations as the main cause for reducing or drying out
the water flow of spouts in the Changunarayan area. In light of this widespread perception, it is important to conduct a detailed study to discover the technical problems associated with reducing water flow or drying out of spouts in the Changunarayan areas. Similarly, outcomes of this study explain that exploitation of groundwater through dug/tube wells has been the most important factor leading to reduced water flow at source. Further research could address issues related to aquifers and the recharge potential of spouts.

“Utility value” is recognized as a major factor that incentivises people nowadays to become involved in the conservation of spouts. Therefore, future research is required to explore and examine community level strategies and options to include local people especially migrants and rental tenants in the process of managing spouts. The results demonstrate that participation in spout related activities has increased social cohesion. Thus, it is important to further explore the level of social cohesion promoted by spouts and the additional implications for managing common property.

Finally, spouts have an enduring value to ancient architecture and engineering in Kathmandu Valley. Studying these delivery mechanisms will preserve ancient indigenous knowledge of hydrology and engineering. Further research needs to be carried out to manage this cost effective traditional technology to augment other water delivery processes and so better cope with the impact of population growth, global warming and other social and economic driving forces.

The recommendations above all have potential application to heritage related infrastructure at a global level.

9.8 Conclusion

This research found that socio-cultural beliefs, thoughts and traditional institutional norms and values have contributed to management of stone spouts within heritage and non-heritage sites of the urban and peri-urban areas of the Kathmandu Valley. The study further shows that spout condition is better in non-heritage areas than in heritage areas because the latter are less affected by changing socio-cultural contexts, institutional norms and values and by modern pipe-line and other development activities. Despite this conclusion it is very unlikely stone spouts will ever be the complete solution to the problem of water scarcity, but
nevertheless, this ancient system could continue to play an important role in reducing water stresses in Kathmandu Valley.
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Appendices

Appendix one

Common terms used and related to ground water sources

Aquifer and Groundwater

An aquifer is simply a large underground natural reservoir of water Morris et al. (2003, p. 73). It has an underground layer of permeable rock, gravel, sand or soil containing large amounts of water called ground water. The pores of sandstones, unconsolidated gravels and limestones are interconnected and are filled with water in aquifers, which supplies a valuable base flow of water for wells, rivers and springs during the dry season. Aquifers can extend from a few square kilometres to thousands of square kilometres in size (Rahi & Halihan, 2013). Groundwater is a crucial resource to support the various ecosystems that depend on it. More than 95% of the Earth’s liquid fresh water is estimated to be stored in aquifers (Morris et al., 2003; Rahi & Halihan, 2013). Worldwide, about two billion people and 40 percent of food production rely directly on aquifers for drinking purposes and irrigation (Rahi & Halihan, 2013). According to Safe Drinking Water Foundation, SDWF, (2014) about 160 million people of China depend on the Huang-Huai-Hai aquifer for drinking water. Rahi & Halihan (2013) have reported that the largest cities of developing countries such as Jakarta, Dhaka, Lima, and Mexico City collect one-third of their drinking water from groundwater.

Based on the geological contexts, aquifers are broadly classified into confined and unconfined (Kirsch, 2009). Confined aquifers are covered by an impermeable or semi-permeable strata of sediments, like clay, that prevents them from being directly recharged by surface processes such as precipitation or surface water. In this zone atmospheric pressure is always less than water pressures. A confined aquifer can be thought of as a natural tank that holds the groundwater. But the unconfined aquifer does not have any obstacles that isolate them from the surface recharging process. It is bounded by permeable consolidated sediments and the upper surface of the geological formations are fully saturated, and the height to which it is saturated is known as the water table. It is recharged directly from the infiltration of rainwater and surface water (Kirsch, 2009). Morris et al. (2003) state that aquifers play a vital role in the
hydrological cycle to store and consequently to release the water. The discharged water from aquifer plays two major roles. First, it maintains and sustains river flows, springs and wet lands that benefit the environment. Secondly, people exploit aquifers directly for drinking and household use, irrigation and commercial purpose. In an area, where rainfall is not sufficient to meet human demands, groundwater could be the only source of freshwater at least for certain periods during a year or decade.

**Spring**

A spring is a transition location of groundwater to surface water with a defined and large amount of flow that emerges as a pool or stream-like flow (Alfaro & Wallace, 1994; Brune, 2002; Springer & Stevens, 2009). Geological formations and the topographical features such as shape and elevation of the land surface, determine how groundwater reaches the Earth’s surface and where it forms a spring. When the water table intersects the topographically depressed Earth’s surface, many seepages and small springs are formed. But the geological formations such as faults and fractures of rocks and the semi permeable layers of sediments may force large amounts of water to the surface to form a large spring (Springer & Stevens, 2009).

Springer and Stevens (2009) classified springs into 12 different groups based on geologic origin, chemical and their physical properties; (1) Caves (2) Exposure (3) Fountains (4) Geysers (5) Gushets (6) Hanging gardens (7) Holocene (8) Hillslope (9) Hypocrene (10) Limnocrene (11) Mound forms and (12) Rheocrene. According to them, a “cave spring” forms within a cave made by the dissolution of the rocks, most common in karst environments and is not directly connected to surface flow. When the groundwater is exposed at the Earth’s surface without movement, such as in sinkholes, this type of spring is called an exposure spring. A Fountain spring occurs when the water from a confined aquifer is pressurized by CO₂. It is a cool-water artesian spring. The other type of rare spring is a geyser, a natural hot spring that occurs erratically and explosively. Old Faithful is the most famous geyser spring which is in the Yellowstone National Park of the United States. A Gushet spring occurs from perched, unconfined aquifers along fractures and discharge from cliff faces. Similarly, a hanging garden spring is a complex and multi-habitat spring that occurs along geologic contacts and seep, drip or discharge onto underlying walls. Usually heleocrene springs occur in marshy or wet meadow locations. Hillslope springs occur from non-vertical hill slopes at 30-60 degree slopes
from confined or unconfined aquifers and normally have indistinct or multiple sources. A hypocrene spring is that type of spring in which the groundwater level comes near, but never reaches, the Earth’s surface. All the discharge is consumed by evaporation or transpiration process and there is no surface flow of the water. Limnocrene springs occur as one or more lentic pools from confined or unconfined aquifers. A mound form spring is that type of spring which occurs from precipitate mounds or peat mounds. Finally, a rheocrene spring is that type of spring where water discharge occurs like a flowing stream (Springer & Stevens, 2009; Stevens, Kloeppel, Springer, & Sada, 2004).

1. Groundwater Resources and their Utilization

Groundwater is one of the most important and valuable renewable natural resources available in the world (Morris et al., 2003). It is a large reservoir of freshwater that can be used in a drought period. The natural purification process has made it more valuable as a source of potable water. In comparison to surface water, groundwater is usually higher quality, less polluted, less infected and has a seasonally less fluctuating flow and is much more uniformly distributed over large areas. Groundwater can be found very often in those areas where there is limited or no surface water. Some countries such as Denmark, Malta, and Saudi Arabia depend only on groundwater as a source of water. Likewise, groundwater is the most important part of total water resources in some countries, for instance, 95% in Tunisia, 83% in Belgium, 75% in the Netherlands, Germany and Morocco. In most European countries, such as Austria, Belgium, Denmark, Hungary, Romania and Switzerland groundwater consumption is more than 70% of total water utilization (Morris et al., 2003; Zektser & Lorne, 2004). A report of Zektser and Lorne (2004) has shown that groundwater also plays a crucial role to address the domestic and potable water supply demand in Australia and some Asian and African countries as well.

High quality groundwater is essential for drinking and household purposes. European Economic Commission data has revealed that most of the European cities use groundwater as the main source of their water supply (Shah, Roy, Qureshi, & Wang, 2003). For example, Budapest, Copenhagen, Hamburg, Munich, Rome and Vienna are almost entirely dependent on groundwater for their water supply and for some cities, such as Amsterdam and Brussels, groundwater meets more than half of the total water demand. Some countries like Bulgaria, Hungary, and Russia have water legislation. Countries strict rules that require domestic and
drinking water demand be fulfilled from fresh groundwater. Special permission is required
from nature- protecting institutions to use fresh groundwater for other purpose such as
industry and irrigation. Zektser and Lorne (2004) have reported that groundwater is widely
used for irrigation in those countries which have arid and semiarid climates. In the United
States, Iran and Algeria 45%, 58% and 67 % respectively, of the total land area is irrigated from
groundwater respectively. The Libya a farming system has also depended on groundwater.

Most Asian countries use the bulk of groundwater in their agricultural sector but other
countries use it for urban and industrial sectors (Shah et al., 2003). For instance India, Nepal,
Bangladesh, Pakistan and China use nearly half of the world’s total annual use of groundwater,
over 300 km³ per year, for irrigation (Shah et al., 2003). Groundwater has no significant role in
Southeast Asia where surface water is sufficiently available but in India, northern Sri Lanka,
Pakistan and North China, it has played a vital role to support a dynamic agriculture sector.
Overall, groundwater addresses 50% of drinking water needs, 20% of irrigation water needs
and 40% of industrial water needs worldwide (Qureshi & Barrett-Lennard, 1998; Shah et al.,
2003; Zektser & Lorne, 2004).

The groundwater resources are closely interrelated with other components of their
surroundings. Any change in atmospheric precipitation leads to change in those components
of the groundwater such as quality and quantity. Likewise, any alteration in groundwater may
result in environmental changes (Shah et al., 2003; Zektser & Lorne, 2004). Accordingly,
surface water discharge and agricultural production may decrease and land surface may
subside due to intensive groundwater exploitation. The quantity and quality of groundwater
may decrease due to leaking water mains and sewers, soak ways for storm runoff and over
withdrawal (Lerner & Tellam, 1992).

Though groundwater has a great advantage to meet the human water needs there are also
some negative side effects of excessive withdrawal of it. Population growth and rapid
urbanization and the expansion of irrigated land play a role to increase water demands
resulting in overexploitation of renewable groundwater resources. According to Custodio
(2002, p. 259),“When the total amount of abstraction from an aquifer is, or will be close to, or
greater than the total recharge over several years, it is often said that there is overexploitation
of ground water.” Overexploitation of groundwater became a modern concern in the 1970s
and after the 1980s it became serious in the northern part of the North China Plain. Groundwater depression cones have developed and expanded due to the rapid reduction of water levels in both unconfined and confined aquifers of this area (Changming et al., 2001). Case studies from several areas of the south-western United States explained key principles leading to cause-effect relationships of extreme extraction of groundwater. Zektser, Loaiciga, and Wolf (2005) focused on four major impacts associated with groundwater withdrawal: decrease of stream flow and lake levels, decrease or dismissal of vegetation, land subsidence and seawater intrusion.

On the one hand, groundwater utilization has supported the agrarian economies and millions of livelihoods. On the other hand, it has generated chronic resource reduction and quality deterioration problems. There are three main concerns in the Asian context about groundwater use. First, depletion of quantity due to overexploitation; Second, water logging and saline intrusion; and finally, incremental pollution because of agricultural, industrial and other human activities (Shah et al., 2003). Furthermore, some wetlands may depend on groundwater for water supply and other problems due to the overexploitation of groundwater might be the wetland desiccation. Loss of vegetation and modification of species and ecology are other possible environmental problems of overexploitation of groundwater (Shah et al., 2003; Zektser & Lorne, 2004). Industries and inadequate sewerage systems are the main sources pollutants in cities of both developed and developing countries (Lerner & Tellam, 1992).

2. Traditional Methods of Groundwater Exploitation in Different Countries

As we know, in the distant past, human beings spent most of their time hunting and gathering food. They only started to grow crops and tame animals in the last 9,000-10,000 years (Mays, 2010). Irrigation was used as a first development of hydraulic technology after they began to grow crops. Hydraulic technology was first introduced in 287 B.C. long before Archimedes (Mays, 2010). Water exploitation techniques were a main part of the water supply systems in ancient periods (Beckers, Berking, & Schütt, 2013; Mays, 2010). According to Beckers et al. (2013) different types of water harvesting techniques were discovered in different countries for water supply during the Bronze Age or earlier and some of these still exist and are even in use today. The following are some of the traditional technologies which are used to collect the ground water and which are relevant to the research.
Hand-dug Well

Artificially made holes that reach the groundwater table are called water wells. It is assumed that “scoop holes” or the “hand-dug shallow well” might have been the first hydraulic structure in the world that were used to exploit ground water (Beckers et al., 2013). Several types of wells were used for collecting drinking water in Minoan settlements around 1900 BC. The depth of wells was no more than 20 meters and the diameter did not exceed 5 meters (Mays, Koutsoyiannis, & Angelakis, 2007). This traditional technology of consuming groundwater is still used in rural areas of the developing world. Clays, sands, gravels and mixed soils with small boulders are suitable to dig such type of well. The diameter of the well might be 1.2 to 1.5 meters providing enough working space for workers. The volume of water below the standing water table in the well plays a role as a reservoir to meet water demands during the day time and should refill itself during periods when there is no water extraction. Water is fetched either by a bucket and windlass above an access hole, or a hand pump depending upon the yield of water available in the well. If the aquifer of the well has seasonal variance, artificial techniques are sometimes combined to recharge the groundwater. For instance, water from a mountain stream is channelized in Granada, Spain to recharge the hand-dug well (Beckers et al., 2013; WaterAid, 2013).

Qanat

The first invention of hydraulic technology for irrigation in Iran was the qanat. This technology is still being used in farm lands and homes in many parts of Iran the same way it was used thousands of years ago (Kuros & Khaneiki, 2007). About 3000 years ago, natural springs are believed to have inspired Iranians to dig qanats. A qanat is used to bring groundwater to the Earth’s surface regularly by the gravitational force. An underground tunnel is used to bring water from the higher elevations of groundwater to the earth surface at lower elevations. Series of vertical shafts or wells are used for excavation of tunnels to provide air and light and are also used to haul debris to the surface. The workers can also get access to the tunnel. Vertical shafts also help workers to get the right direction under the ground. The uppermost part of these vertical shafts, the deepest well which is sunk in the saturated layers, is known as the mother well. The pile of soil, aforementioned dam, is constructed upstream above the mother well so that it can control the flow behind itself and can recharge the aquifer (Beckers et al., 2013; Kuros & Khaneiki, 2007). The oldest qanats have been found in the northern part
of Iran and were built around 3000 years ago. Qanats can be as short as one kilometre and as long as 71 km long (one with 2115 vertical shafts is found in the ancient city of Zarch in Iran) (Kuros & Khaneiki, 2007). Qanats were used in different countries but were called by different names. For example, it was known as kahriz in Afghanistan, Turkey, Turkistan and Pakistan, kanerjing in China, falaj in the United Arab Emirates and Oman, falladj in Yemen, kenayat in Syria, kazima, foggara and fughara in North Africa and wasserstollen in Europe especially in Germany. Qanats are still being used in Syria, Jordan, Cyprus, Saudi Arabia, Oman, Yemen, Turkey, Pakistan, Afganistan, Turkistan, Egypt and North Africa, Morocco, Algeria, Libiya, Egypt, North and South America, Chile, Japan and Germany (Beaumont, 1973; Beckers et al., 2013; Kuros & Khaneiki, 2007; Lightfoot, 1996; Sutton, 1984).

**Fountain**

Originally, springs were the main source of water for fountains and people from many cities, towns and villages of different countries used them for drinking and other household purposes. Ancient people constructed stone basins to collect and hold the drinking water. But nowadays fountains are used for decoration, recreation and entertainment purposes. Fountains can be seen today to decorate city parks and squares and holy places such as temples (Dialynas & Angelakis, 2012).

The ancient Greeks were supposed to be the first to use fountains which supplied water by gravitational force (Dialynas & Angelakis, 2012). History shows that fountains were found in Athens, Corinth and other ancient Greek cities in the 6th century BC. Water was brought to these fountains from springs and rivers. Athenian rulers constructed the main fountain, the Enneacrounos, in Athens in the 6th century BC. This fountain supplied water to the city dwellers which had nine large cannons, or spouts. Stone or the marbles were used to make fountains in Greece. Water flowed through bronze pipes and emerged from the head of a lion or the muzzle of animals (Dialynas & Angelakis, 2012; Koutsoyiannis, Zarkadoulas, Angelakis, & Tchobanoglous, 2008; Mays et al., 2007). Likewise, the fountain of 99 spouts in L’Aquila, which was built in 1272, is a historic monument of Italy (Heritage, 2014). In the past, this fountain was served water for various uses such as laundry and was an important water source for town dwellers. It was also believed that these fountains were the foundation of the L’Aquila town (Heritage, 2014).
Many ancient societies in South America also introduced water technologies during the same periods that water technology was developing in other parts of the world (Mays & Gorokhovich, 2010). The Inca spring collection technology is a good example of ancient groundwater and hydraulic engineering and still exists in Machu Picchu (Wright, Zegarra, & Lorah, 1999). Water is supplied to 16 fountains through a small canal. Those fountains were used to serve domestic water to 300 people when the Inca Emperor governed in Monte Machu Picchu (Wright, Kelly, & Zegarra, 1997). The hydraulic work and the 16 fountains of Machu Picchu symbolise the pinnacle of the architectural and engineering works of the Inca civilization and its innovative groundwater-handling abilities. An adequately sized main canal carries large and small flows to address the seasonal variation of the spring in wet and dry seasons (Bingham III, 2004; Mays & Gorokhovich, 2010; Wright et al., 1997; Wright et al., 1999).

To further enhance water quality filtering systems with various grades of sand, gravel and charcoal were built immediately behind water conduits. Some spouts are constructed as a chain at different levels. The lower level spouts get water drained off from higher level spouts where water filtered naturally due to sedimentation after flowing deliberately designed distances in between (UN-Habitat, 2008). The side and bottom of the spouts are built using a layer of a particular grey or black soil and waterproof bricks. Unused water or run-off from activities such as clothes washing is normally discharged into agricultural lands or collected in a pond (UN-Habitat, 2008; Upadhya, 2009). This water can be used for different purpose such as washing agricultural products, duck farming and sometimes for firefighting. Moreover, these ponds also helps to recharge.
## Appendix Two

### Linkage of Questionnaire’s with Theory

Linkage of Questionnaire’s with Theory (Note: AT= Attachment Theory, CP= Common Property Theory, IT= Institutional Theory, CPT= Central Place Theory)

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>AT</th>
<th>CP</th>
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<tbody>
<tr>
<td><strong>For Community Representatives</strong></td>
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<tr>
<td>1. Opening question - How long have you lived in this area and what do you consider your home town/city?</td>
<td>✓</td>
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<tr>
<td>2. Why have you chosen to live here (suburb)? Is there anything in particular that you like about this area? If so why?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>3. Where do you get most of your water from to fulfil your daily needs? Have you collected water from stone spouts? If so, why?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>4. What are the important values of this stone spout? Which of these value is most important to you and why?</td>
<td>✓</td>
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<td>5. When did you start to collect water from stone spouts and why?</td>
<td>✓</td>
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<tr>
<td>6. Have you always collected water from the same spout? If not, why not? If yes, why?</td>
<td>✓</td>
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<tr>
<td>7. What is the name and location and the meaning of name of the stone spout from where your water is collected?</td>
<td>✓</td>
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<td>8. Do you know, what the water sources are, and where are they situated and how water gets to stone spouts?</td>
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<td>- About stone spouts generally</td>
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<td>9. To your understanding, by whom and when was your stone spout constructed? And why that area was selected for it?</td>
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<tr>
<td>10. How frequently do you go to collect water from your stone spout? Does seasonality make any differences to you in terms of collecting water from your stone spout? If yes then how?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>11. How long does it take you to reach your stone spout? Once at the water source, how long does it take you to get water? How do you typically travel to the spout? Where do you typically come from to get the water?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>12. Does everyone get an equal opportunity to collect water from this stone spout? Are there any rules and regulations, formal and social, for collecting water from it?</td>
<td>✓</td>
<td>✓</td>
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<td>13. Who are the users of your nearest stone spout and how far are they living away from it (km)?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>14. Do you have any knowledge about how the stone spout is decorated and what are the images around the wall, railings, steps and other structures? Are there any cultural beliefs regarding these images?</td>
<td>✓</td>
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<td>- About your stone spout</td>
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<td><strong>For Community Representatives</strong></td>
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<td>15. Can you please tell me about any religious/cultural value of this water spout? Is there any <em>Tantric</em> belief in its evolution?</td>
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<td>16. Historically, how do the community get involved in the maintenance of stone spouts? Is the community still involved in managing them? If so, how?</td>
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<td>• About stone spouts generally</td>
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<td>17. What changes have you observed in stone spout conservation and management practices over time?</td>
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<td>• About stone spouts generally</td>
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<tr>
<td>18. Is there still any <em>Guthi</em> or other conservation committee responsible for cleaning stone spouts? If so, how frequently do they clean them? Is there any festival like <em>Sithi Nakha</em> to maintain stone spouts?</td>
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<td>19. Are there any historically written rules and regulations to conserve your stone spout? Or are there other laws?</td>
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<td>✔</td>
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<td>20. Are there any temples that still use water only from your stone spout and are there any water festivals that take place in water spout area?</td>
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<td>21. Are there other spaces rather than temples where people use only stone spout water?</td>
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<td>• From your stone spout</td>
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<tr>
<td>• From stone spouts generally</td>
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<tr>
<td>22. What are the community’s rules and regulations for maintenance of your stone spout?</td>
<td></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>23. Is the stone spout still functioning well? Have you observed any changes of water quality and quantity over time? If yes then what changes and over what time period?</td>
<td></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>24. Do you have connection of pipe-line water supply or dug or tube well in your house?</td>
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<td><strong>For Community Representatives</strong></td>
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<td>26. How is the stone spout recharged nowadays? Are there still state canals and ponds to recharge it?</td>
<td>✓</td>
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<td>27. Has water collecting practices for businesses created problems to you or your stone spouts?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>28. What are the problems this stone spout is facing and how do you describe the nature and causes of those?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>29. To what extent has government carried out activities to conserve and manage your stone spout? Are you satisfied with these government activities?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>30. Are there any non-governmental organizations working to conserve your stone spout? Are the communities involved and the information about their activities made available for the communities?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>31. Has a planner included your community in their organization’s stone spout management activities? If so, have community views been considered in the decision making process?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>32. Should anything else be done to conserve and manage your stone spout?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>33. Is there any value in terms of collecting drinking water from having this stone spout still operating for another 10-20 years? What actions if any would the community have to take to protect the historical and cultural and social value of the stone spout?</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>34. Do you think stone spouts have a role in increasing social bonds/ties within the community?</td>
<td>✓</td>
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<td>• About your stone spout</td>
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<td>• About stone spouts generally</td>
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<tr>
<td>35. Would you be prepared to contribute towards maintenance of this stone spout and its water network? And if so how?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>36. Do you want to add something regarding stone spouts?</td>
<td>✓</td>
<td>✓</td>
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<td>• About your stone spout</td>
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<td>• About stone spouts generally</td>
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</table>
1. How long have you lived in this area and what do you consider your home town/city?  

2. Do you think stone spout conservation and maintenance is important in Kathmandu Valley? If so, how do you describe the participation of communities and governmental and non-governmental organizations in the management of stone spouts? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

3. Are there any decision/policy/norms developed at the national level to benefit all the stone spouts of Kathmandu Valley? Do these differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

4. Is there any budget allocated for stone spout management activities at the national level? If yes then what proportion of the total budget? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

5. Do local governmental organizations have specific guidelines or funds to conserve and maintain stone spouts in Kathmandu Valley? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

6. Are there any specific legal provisions to protect stone spout infrastructure and their water networks (like state canals and ponds) from encroachment? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

7. To what extent does the heritage site conservation strategy include stone spout conservation and management activities in both urban and peri-urban areas?  

8. How do you prioritise your activities between stone spouts?  

9. Are there different rules and regulations for heritage and non-heritage sites to conserve the stone spouts in urban and peri-urban areas?  

10. Are stone spout management activities submitted in Village Development Committee (VDC) and Municipality annual plans? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

11. How is the relationship between governmental and non-governmental organizations and social institutions like *Guthi* and stone spout conservation committees, functioning? Are the social institutions included in local level development activities especially in water spout management? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?  

12. Do legal provisions given by other legislation for modern pipe-line water supply and other development activities influence the conservation and management of stone spouts? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?
(For Planners/Experts)

<table>
<thead>
<tr>
<th>Question</th>
<th>AT</th>
<th>CP</th>
<th>IT</th>
<th>CPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Are there any recent changes in the way Nepal operates politically that have affected the conservation and management practices for stone spouts? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>14. Are management of stone spouts and their water networks an integral part of your organization’s purpose? If so, what types of activities is your organization doing? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>15. What is your organization’s role in conserving and maintaining stone spouts and their networks? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>16. Is there any potential for coordination and cooperation and is this occurring across sectors and at different levels (national/local) of governmental and non-governmental organizations to conserve and manage stone spouts? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>17. In your opinion, are there any other agencies/departments that should be involved in the protection, conservation and management of stone spouts of heritage and non-heritage areas of urban and peri-urban areas of Kathmandu Valley that are not already involved?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>18. To your knowledge, what barriers and problems are faced by stone spouts and their water networks in both heritage and non-heritage areas of urban and peri-urban areas of the Kathmandu Valley?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>19. Is there any policy issues regarding stone spouts and their water networks that occur between organizations and what is the process for resolving these? Does this differ between heritage and non-heritage areas as well as urban and peri-urban areas?</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>20. Finally, do you have anything to say regarding the stone spouts of both heritage and non-heritage sites of urban and peri-urban areas?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Appendix Three

Traditional pipes and State canal

Figure 1: Stone pipe

Figure 2: Mud pipe

Figure 3: State canal

Figure 4: Submerged water distribution inlets inside a pond
## Appendix Four

Global Potioning System (GPS) data of Bhaktapur Darbar Square Stone spouts (B= Bhaktapur municipality)

<table>
<thead>
<tr>
<th>Stone Spout</th>
<th>Address</th>
<th>N</th>
<th>E</th>
<th>Elevation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhimsen dharo</td>
<td>B- 3</td>
<td>27.67350</td>
<td>085.43464</td>
<td>1340m</td>
<td>East: bhimsen temple, West: restaurant, North: house, South: footpath</td>
</tr>
<tr>
<td>Salla ganesh dharo</td>
<td>B- 3</td>
<td>27.67395</td>
<td>085.43504</td>
<td>1316m</td>
<td>East: pati, West: temple, North: house, South: Pond footpath</td>
</tr>
<tr>
<td>Balkumari dharo</td>
<td>B - 3</td>
<td>27.67393</td>
<td>085.43452</td>
<td>1331m</td>
<td>East: bare land, West: footpath, North: house, South: Pond</td>
</tr>
<tr>
<td>Palkhel dharo</td>
<td>B- 7</td>
<td>27.67254</td>
<td>085.43338</td>
<td>1349m</td>
<td>East: house, West: footpath, North: Footpath, South: Footpath</td>
</tr>
<tr>
<td>Golmadi dharo</td>
<td>B - 7</td>
<td>27.67260</td>
<td>085.43259</td>
<td>1352m</td>
<td>East: Footpath, West: shiv temple, North: Footpath, South: Footpath</td>
</tr>
<tr>
<td>Bul Bul dharo</td>
<td>B-8</td>
<td>27.67196</td>
<td>085.43045</td>
<td>1303m</td>
<td>East: Footpath, West: house, North: house, South: house</td>
</tr>
<tr>
<td>Tripura hiti</td>
<td>B-8</td>
<td>27.67275</td>
<td>085.43016</td>
<td>1336m</td>
<td>East: Footpath, West: footpath, North: footpath, South: house</td>
</tr>
<tr>
<td>Balakhu hiti</td>
<td>B-8</td>
<td>27.67261</td>
<td>085.42913</td>
<td>1304m</td>
<td>East: School, West: Library, North: School, South: Parking</td>
</tr>
<tr>
<td>Layaku hiti</td>
<td>B-13</td>
<td>27.67213</td>
<td>085.42854</td>
<td>1326m</td>
<td>East: house, West: temple, North: German stone, South: Pasupati temple</td>
</tr>
<tr>
<td>Lu hiti</td>
<td>B-13</td>
<td>27.67273</td>
<td>085.42870</td>
<td>1351m</td>
<td>East: Footpath, West: army barek, North: Pati, South: Municipality</td>
</tr>
<tr>
<td>Malati hiti</td>
<td>B-13</td>
<td>27.67238</td>
<td>085.42822</td>
<td>1338m</td>
<td>East: golden gate, West: municipality, North: Pati, South: Art Gallary</td>
</tr>
<tr>
<td>Stone Spout</td>
<td>Address</td>
<td>N</td>
<td>E</td>
<td>Elevation</td>
<td>References</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------</td>
<td>------------</td>
<td>------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Yechhesori hiti</td>
<td>B-11</td>
<td>27.67176</td>
<td>085.42871</td>
<td>1348m</td>
<td>East: house, West: temple, North: Resturant, South: house</td>
</tr>
<tr>
<td>Pubaha hiti</td>
<td>B-11</td>
<td>27.67120</td>
<td>085.42896</td>
<td>1383m</td>
<td>East: house, West: house, North: house, South: house</td>
</tr>
<tr>
<td>Beta hiti</td>
<td>B-11</td>
<td>27.67052</td>
<td>085.42932</td>
<td>1309m</td>
<td>East: house, West: Bare land, North: Pati, South: house</td>
</tr>
<tr>
<td>Gah hiti</td>
<td>B-12</td>
<td>27.67032</td>
<td>085.42892</td>
<td>1305m</td>
<td>East: Dug well, West: house, North: house, South: footpath</td>
</tr>
<tr>
<td>Jangam hiti</td>
<td>B-12</td>
<td>27.67101</td>
<td>085.43801</td>
<td>1336m</td>
<td>East: house, West: house, North: house, South: house</td>
</tr>
<tr>
<td>Dhubanjar hiti</td>
<td>B-8</td>
<td>27.67178</td>
<td>085.43005</td>
<td>1339m</td>
<td>East: house, West: house, North: house, South: house</td>
</tr>
<tr>
<td>Bidhya pith hiti</td>
<td>B-8</td>
<td>27.67270</td>
<td>085.43079</td>
<td>1363m</td>
<td>East: house, West: house, North: house, South: house</td>
</tr>
<tr>
<td>Patingal hiti</td>
<td>B-6</td>
<td>27.67226</td>
<td>085.43422</td>
<td>1313m</td>
<td>East: road, West: open space, North: pati, South: house</td>
</tr>
<tr>
<td>Khauma tole hiti</td>
<td>B-15</td>
<td>27.67249</td>
<td>085.42682</td>
<td>1322m</td>
<td>East: Main gate West: school, North: Road, South: Road</td>
</tr>
<tr>
<td>Indrayani hiti</td>
<td>B-15</td>
<td>27.67339</td>
<td>085.42713</td>
<td>1358m</td>
<td>East: School West: Temple, North: Road, South: Pati</td>
</tr>
<tr>
<td>Byasi hiti</td>
<td>B-15</td>
<td>27.67465</td>
<td>085.42757</td>
<td>1328m</td>
<td>East: Road West: Municipality house, North: Road, South: house</td>
</tr>
</tbody>
</table>
## Appendix Five

### GPS data of Madhyapur Thimi Stone spouts (MT = Madhyapur Thimi municipality)

<table>
<thead>
<tr>
<th>Stone Spout</th>
<th>Address</th>
<th>N</th>
<th>E</th>
<th>Elevation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nhu hiti</td>
<td>MT= 5</td>
<td>27.68591</td>
<td>085.38341</td>
<td>1316m</td>
<td>East: house, West: house, North: Pati, South: road &amp; houses.</td>
</tr>
<tr>
<td>Thangacha hiti</td>
<td>MT= 5</td>
<td>27.68630</td>
<td>085.38305</td>
<td>1314m</td>
<td>East: house, West: house, North: house, South: road.</td>
</tr>
<tr>
<td>Mahadev mandir hiti</td>
<td>MT= 7</td>
<td>27.68296</td>
<td>085.38618</td>
<td>1309m</td>
<td>East: road, West: house, North:  mahadev temple, South: road.</td>
</tr>
<tr>
<td>Tarha hiti</td>
<td>MT= 4</td>
<td>27.68282</td>
<td>085.38503</td>
<td>1324m</td>
<td>East: Bare land, West: house, North: Modern building, South: Paved road.</td>
</tr>
<tr>
<td>Tindhara</td>
<td>MT= 4</td>
<td>27.68223</td>
<td>085.38024</td>
<td>1306m</td>
<td>East: house &amp; road, West: Road, North: house &amp; road, South: Army barek.</td>
</tr>
<tr>
<td>Bankha Bazar</td>
<td>MT= 4</td>
<td>27.68293</td>
<td>085.38574</td>
<td>1355m</td>
<td>East: house &amp; road, West: house, North: house &amp; road, South: Gravel road.</td>
</tr>
<tr>
<td>Sulecha hiti</td>
<td>MT= 7</td>
<td>27.68254</td>
<td>085.39002</td>
<td>1317m</td>
<td>East: house, West: house, North: house &amp; road, South: house.</td>
</tr>
<tr>
<td>Dumuphart hiti</td>
<td>MT= 2</td>
<td>27.69458</td>
<td>085.39252</td>
<td>1318m</td>
<td>Buried in rod</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Stone Spout</th>
<th>Address</th>
<th>N</th>
<th>E</th>
<th>Elevation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lokha hiti</td>
<td>MT= 3</td>
<td>27.69911</td>
<td>085.39375</td>
<td>1312m</td>
<td>East: ghar, west: ghar, North: mulani, South: bode.</td>
</tr>
<tr>
<td>Nil barahi hiti</td>
<td>MT= 3</td>
<td>27.69988</td>
<td>085.39455</td>
<td>1322m</td>
<td>East: Khahare, west: khet, North: bari, South: nilbarahi.</td>
</tr>
<tr>
<td>Han hiti</td>
<td>MT= 3</td>
<td>27.69347</td>
<td>085.39375</td>
<td>1349m</td>
<td>East: bari, west: khet, North: khet, South: house.</td>
</tr>
<tr>
<td>Sanutar hiti</td>
<td>MT= 3</td>
<td>27.69164</td>
<td>085.39163</td>
<td>1344m</td>
<td>East: road, west: road, North: Temple, South: road.</td>
</tr>
<tr>
<td>Chhatra hiti</td>
<td>MT=4</td>
<td>27.68394</td>
<td>085.38399</td>
<td>1387m</td>
<td>East house, west: Siddiganesh temple, North: house, South: house.</td>
</tr>
<tr>
<td>Lahapati khawa: hiti</td>
<td>MT=4</td>
<td>27.68386</td>
<td>085.38416</td>
<td>1308 m</td>
<td>East house, west: bareland, North: house, South: house.</td>
</tr>
<tr>
<td>Sincha hiti</td>
<td>MT= 6</td>
<td>27.68408</td>
<td>085.38387</td>
<td>1323m</td>
<td>East: bamboo, west: house North: house, South: cultivated land.</td>
</tr>
<tr>
<td>Bhansi hiti</td>
<td>MT= 6</td>
<td>27.68357</td>
<td>085.38145</td>
<td>1317m</td>
<td>East: footpath, west: footpath, North: house, South: road.</td>
</tr>
<tr>
<td>Batahiti</td>
<td>MT= 3</td>
<td>27.69184</td>
<td>085.38639</td>
<td>1325m</td>
<td>West: bare land, east: Bode ma.vi, North: bareland, South: bareland.</td>
</tr>
</tbody>
</table>
Appendix Six

GPS data of Changunarayan stone spouts (C = Chanunarayan VDC)

<table>
<thead>
<tr>
<th>Stone spout</th>
<th>Address</th>
<th>N</th>
<th>E</th>
<th>Elevation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sangdahahiti</td>
<td>C-11</td>
<td>27.71299</td>
<td>085.42467</td>
<td>1393m</td>
<td>East: footpath, West; Watertank, North: bareland, South: Sandaha</td>
</tr>
<tr>
<td>Sangdaha hiti</td>
<td>C-11</td>
<td>27.71347</td>
<td>085.42406</td>
<td>1420m</td>
<td>East: footpath, West; ficus tree, North: footpath, South: house</td>
</tr>
<tr>
<td>Puriyeko dhara</td>
<td>C-8</td>
<td>27.71577</td>
<td>085.42461</td>
<td>1398m</td>
<td>East: footpath, West; CF, North: WH pillar, South: CF</td>
</tr>
<tr>
<td>Kapah hiti</td>
<td>C-8</td>
<td>27.71854</td>
<td>085.42802</td>
<td>1338m</td>
<td>East: Footpath, West; house, North: house, South: footpath</td>
</tr>
<tr>
<td>Kapah hiti</td>
<td>C-8</td>
<td>27.71875</td>
<td>085.42852</td>
<td>1448m</td>
<td>East: Footpath, West; house, North: house, South: footpath</td>
</tr>
<tr>
<td>Kapah hiti</td>
<td>C-8</td>
<td>27.71862</td>
<td>085.42878</td>
<td>1453m</td>
<td>East: Footpath, West; house, North: house, South: footpath</td>
</tr>
<tr>
<td>Narayan hiti</td>
<td>C-8</td>
<td>27.71857</td>
<td>085.43126</td>
<td>1443m</td>
<td>East: CF, West; house, North: CF, South: CF</td>
</tr>
<tr>
<td>Sarashowti hiti</td>
<td>C-8</td>
<td>27.71078</td>
<td>085.43153</td>
<td>1396m</td>
<td>East: Cultivated land, West; house, North: house, South: CF</td>
</tr>
<tr>
<td>Gah hiti</td>
<td>C-8</td>
<td>27.71636</td>
<td>085.42957</td>
<td>1539m</td>
<td>East: Stone wall, West; house, North: Pati, South: footpath</td>
</tr>
<tr>
<td>Gun hiti</td>
<td>C-8</td>
<td>27.71562</td>
<td>085.42801</td>
<td>1509m</td>
<td>East: Bare Land, West: CF, North: Footpath, South: footpath</td>
</tr>
<tr>
<td>Gamhoka hiti</td>
<td>C-8</td>
<td>27.71622</td>
<td>085.42661</td>
<td>1507m</td>
<td>East: House, West: Bare Land, North: Bare Land, South: Pokhari</td>
</tr>
</tbody>
</table>
## Appendix Seven

**GPS data of Jhaukhel stone spouts (J= Jhaukhel VDC)**

<table>
<thead>
<tr>
<th>Stone Spout</th>
<th>Address</th>
<th>N</th>
<th>E</th>
<th>Elevation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dahal gaun koDhara</td>
<td>J-2</td>
<td>27.70177</td>
<td>085.42997</td>
<td>1364m</td>
<td>East: footpath+house, West: kiriya putri trust, North: house, south: footpath+house</td>
</tr>
<tr>
<td>Sarki gaun koDhara</td>
<td>J-6</td>
<td>27.69687</td>
<td>085.42721</td>
<td>1378m</td>
<td>East: road, West: bamboo bush, North: khet +footpath, south: footpath+khet</td>
</tr>
<tr>
<td>Taleju Dhara</td>
<td>J-6</td>
<td>27.69596</td>
<td>085.43095</td>
<td>1360m</td>
<td>East: footpath, West: cul.land, North: footpath, south: footpath</td>
</tr>
<tr>
<td>karki tole dhara</td>
<td>J-7</td>
<td>27.69169</td>
<td>085.43285</td>
<td>1347m</td>
<td>East: footpath, West: bamboo bush, North: cul.land, south: footpath+cul.land</td>
</tr>
<tr>
<td>VDC dhunge dhara</td>
<td>J-6 &amp;7 boarder</td>
<td>27.69381</td>
<td>085.43105</td>
<td>1383m</td>
<td>East: road, West: dugwell, North: cooperative’s house, south: shiv temple</td>
</tr>
<tr>
<td>VDC ram mandir dhunge dhara</td>
<td>J-6 &amp;7 boarder</td>
<td>27.69336</td>
<td>085.43103</td>
<td>1378m</td>
<td>East: temple, West: road, North: Ram mandir, south: cul.land</td>
</tr>
<tr>
<td>Magar tole dhunge dhara</td>
<td>J-7</td>
<td>27.68971</td>
<td>085.43010</td>
<td>1351m</td>
<td>East: road, West: cul.land, North: house, south: shiv temple</td>
</tr>
</tbody>
</table>
Appendix Eight
Flow status of spout

Figure 1: Good Flow

Figure 2: Poor flow

Figure 3: No flow
Appendix Nine

Physical status of spout

Figure 1: Original condition

Figure 2: Modified spout

Figure 3 (a): Encroached spout

Figure 3(b): Encroached spout
Appendix Ten

Human Ethics Committee Apporoval Letter

Application No: 2014-40

Title: A Comparative Evaluation of Stone Spout Management Systems in Heritage and non-Heritage Areas of Kathmandu Valley, Nepal

Applicant: Mira Tripathi

The LincolnUniversity Human Ethics Committee has reviewed the above noted application. Thank you for your response to the questions which were forwarded to you on the Committee’s behalf.

I am satisfied on the Committee’s behalf that the issues of concern have been satisfactorily addressed. I suggest you clarify in the RIS how much time will be required if participants agree to participate in both a focus group and an interview (I assume it would be 60-90 minutes each – i.e. 2-3 hours in total).

I am pleased to give final approval to your project. Please note that this approval is valid for three years from today’s date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely

Caitriona Cameron

Acting Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.
Appendix Eleven

Information about each of the stone spouts found inside the study area

Key features of stone spouts found in the study areas (B= Bhaktapur Municipality, MT= Madhyapur Thimi municipality, C= Changunarayan VDC and J= Jhaukhel VDC, * = spouts used during convenience sampling)

<table>
<thead>
<tr>
<th>Stone spouts</th>
<th>Address Code</th>
<th>Modification status (See section 3.5.1 for details)</th>
<th>Flow Status (See section 3.5.1 for details)</th>
<th>Functiona l value (See section 5.6 for details)</th>
<th>Religious value (See section 5.5 for details)</th>
<th>Water source (See section 5.5 for details)</th>
<th>Traditional Management system (See section 3.5.1 for details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bhimsen dharo*</td>
<td>B - 3</td>
<td>Original Condition</td>
<td>Good flow</td>
<td>√</td>
<td>√ (water used in Bhimsen temple &amp; bathing in Janai Purnima)</td>
<td>Tantric process</td>
<td>Local people</td>
</tr>
<tr>
<td>2 Salla ganesh dharo</td>
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## Appendix Twelve

### Spouts having religious value

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<tr>
<td>19</td>
<td>Sarashowti hiti</td>
<td>Good flow</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Gah hiti</td>
<td>No flow</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Taleju Dhara</td>
<td>No flow</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>VDC dhunge dhara</td>
<td>No flow</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>VDC ram mandir dhunge dhara</td>
<td>No flow</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Magar tole dhunge dhara</td>
<td>Good flow</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix Thirteen

Declaration on National Convention on Stone Spouts (DNCSS 2007)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>The ownership of traditional water sources including stone spouts be given to local authorities.</td>
</tr>
<tr>
<td>2.</td>
<td>The policy lacking in the field of stone spouts and source conservation will be addressed by the Government of Nepal.</td>
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<tr>
<td>3.</td>
<td>Local authorities will take the responsibilities of preparing maps of stone spout system from source to sink along with cadastral mapping.</td>
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<tr>
<td>4.</td>
<td>Historical stone spouts will be declared as national heritage.</td>
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<tr>
<td>5.</td>
<td>Conserve water sources and water path passing through private land. For the conservation of watersheds and aquifers the government will declare the area as watershed area.</td>
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<td>6.</td>
<td>Annual budget for stone spout and source conservation will be allocated.</td>
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<tr>
<td>7.</td>
<td>The municipalities will organise local communities including women into formal users’ groups and strengthen them for the conservation of stone spouts and sources.</td>
</tr>
<tr>
<td>8.</td>
<td>Promote and celebrate Sithinakha festival as national festival of sanitation and organise programmes of traditional water sources conservation on that day.</td>
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<td>9.</td>
<td>Promote studies on stone spouts, conduct researches and incorporate the subject in various levels of curricula.</td>
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<tr>
<td>10.</td>
<td>Promulgation of acts to control unauthorised use of ground water that hampers the stone spout system.</td>
</tr>
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<td>11.</td>
<td>Bring concrete programmes on stone spouts and source conservation by national and international non-governmental organisations.</td>
</tr>
<tr>
<td>12.</td>
<td>Adopt concrete policies, programmes and resources for the conservation of stone spouts and source by local and central government.</td>
</tr>
</tbody>
</table>

Source: (UN-Habitat, 2008)