



## Dynamics of Rural Water Flows to Quench Urban Thirst: Implications on Local Water Security

**Rajesh Sada and Anushiya Shrestha**

The rapid and haphazard urbanization in Kathmandu and expansion of built-up area in the peripheral rural landscapes has resulted in formation of the peri-urban areas which are now themselves transforming into urban forms, and simultaneously, water diverted or transferred from these areas is rapidly increasing. This paper describes the changing modes of urban oriented water flow from the peri-urban landscape of Kathmandu and the implications of this water transfer on water security of peri-urban areas.

Through series of semi-structured interviews, formal and informal discussions with local people and key informant interviews, the study found that Matatirtha, a peri-urban area, has traditionally been a source of water for the domestic water demand in Kathmandu. However, the social and economic developments have induced a paradigm shift in urban water transfer from the area and promoted the economic benefits as a way of compensating the loss of local water resources. Moreover, the increasing opportunities of economic benefits through water market in absence of a regulatory mechanism has facilitated exploitation of resources and therefore created a need for a strong mechanism, promoting insights for sustainable water resource management to prepare a water secure area.



This is one of a series of Discussion Papers from the Peri Urban Project of SaciWATERS.

**About the authors:**

**Rajesh Sada** obtained his M.Sc in Interdisciplinary Water Resources Management from Nepal Engineering College. Before joining this project, he was engaged as Interdisciplinary Science Associate in Environment Management program of Melamchi Water Supply Project. He also worked as Research Assistant for two years in an IWRM program of Nepal Engineering. Prior to this, he worked as Research officer in Socio-economic, Agro forestry and Environment (SAFE) Concern, Kathmandu, Nepal and as a Ranger in Nepal Swiss Community Forestry Project, Ramechhap, Nepal in various forestry and environment sector. His special interest lies in water resources management, climate change and biodiversity conservation.

**Anushiya Shrestha** is a post graduate in Environmental Science. She completed her Master's degree from Tribhuvan University in 2009. She performed a Case study on "Concrete and Corrugated Roof Rain Water Quality" as a part of Academic exercise for M.Sc in Environmental Science in 2007. She also participated as a Researcher in the research program of Physio-chemical analysis of Water quality of Bagmati River from Sundarijal to Chovar performed by Tri- Chandra Campus affiliated to Tribhuvan University in 2006. She is interested in Water resource management in the context of rural and urban environment.

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For further information please contact:

**SaciWATERS**

H.No. B-87, Third Avenue,

Sainikpuri, Secunderabad - 500 094, Andhra Pradesh, India.

Telefax : +91-04 - 27116721, 27117728

Email : [periurban@saciwaters.org](mailto:periurban@saciwaters.org)

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# People's Experience and Facts of Changing Climate: Impacts and Responses

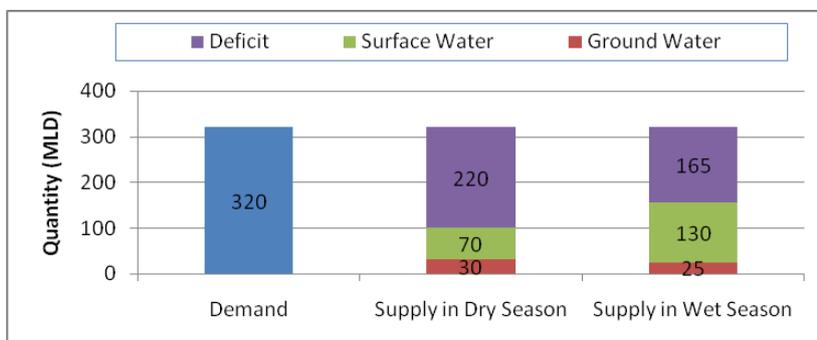
Rajesh Sada<sup>1</sup> and Anushiya Shrestha<sup>1</sup>

## 1. INTRODUCTION

Kathmandu valley has been the most urbanized area in Nepal. The pace of the urban growth in Kathmandu valley has been rapid after 1980 with the increased connectivity of Kathmandu to other parts of the country. The Decade-long conflict has caused an increase in rural to urban migration and there has been 61.23 per cent population growth in Kathmandu in the last decade (CBS, 2012). This process of urbanization and subsequent expansion of the built-up area to the peripheral rural landscape has resulted in an emergence of rural-urban intermediary, differentiated by a mixed rural-urban economy and livelihood, differently referred to as, rural-urban fringe, peri-urban interface and Desakota by different researchers (Allen, 2003; Brook et al., 2003; Narain and Nischal, 2007).

These areas have traditionally been suppliers of food and the much needed natural resources to the city-land, water, soil and clean air, to sustain urban livelihood and maintain the ecology. Rapid population growth in Kathmandu accompanied by growth in urban water demand led to the transfer of water not only from the rural hinterlands, but also from the dynamic peri-urban areas. Kathmandu Upatyaka Khanepani Limited (KUKL), the water service providing agency in Kathmandu, is capable of supplying only 155 and 100 million litres per day (MLD) of water during wet and dry seasons respectively against a demand of 320 MLD, thus shortages of 165 and 220 MLD in the wet and dry seasons are apparent (KUKL, 2010). Figure 1 shows the current status of water supply situation in Kathmandu valley. This situation has forced people to look for other reliable sources of water which has led to the emergence of different modes of water flow from peri-urban and rural areas to urban cores in Kathmandu. This flow is essentially unregulated and spontaneous and has been constantly evolving after 1990s with the progressively increasing water scarcity in Kathmandu. Moench and Janakarajan (2006) argue that the emergence of different modes of water transfer from rural and peri-urban areas in Kathmandu has been the result of demand for convenient water supply, created by the gap left by the combined services of traditional sources and piped water supply systems in Kathmandu Valley.

Figure 1: Water demand and supply scenario in Kathmandu valley



Source: KUKL, 2010

It is in these realities, this paper tries to discuss the different modes of water flow from rural to urban area with the increasing urban water demand, role of institution to regulate water flow and implication of water flows at local level through the case of Matatirtha Village Development Committee (VDC).

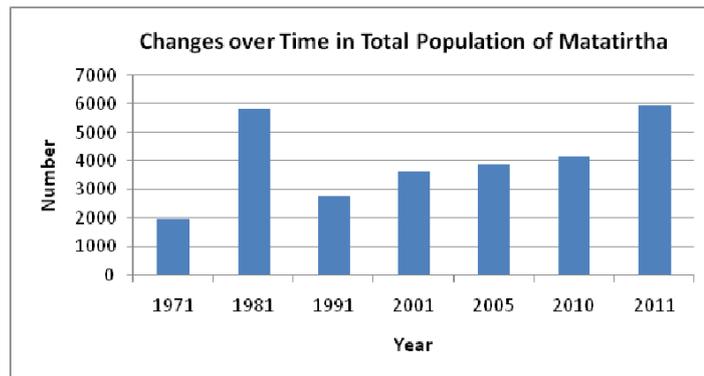
## 1.METHODOLOGY

### 2.1 Study Site

This study was carried out in Matatirtha VDC which lies at 85°14" East and 27° 40" North. It is located in the western part of Kathmandu District and is approximately 5 km away from the urban area and situated on the lap of Chandragiri hills. The landscape of the VDC is rough and undulating with low to medium potential for agriculture. The VDC covers an area of 6.19 km<sup>2</sup> and is inhabited by 1,413 households, with total population of 5,982 people (2,978-female and 3,004-male). Figure 2 shows the population growth in Matatirtha. In 1981, population is higher because of possibility of over enumeration due to the highest monetary incentive

given to the field workers compared to all other censuses (Karki, 1992 as cited in CBS, 2003).

Figure 2: Changing trend in total population at Matatirtha



(Source: CBS, 1971; CBS, 1981; CBS, 1991; CBS, 2001; VDC Profile 2005; VDC, 2010 and CBS, 2012)

Urbanization has been a very recent phenomenon in this VDC starting not more than a decade ago. Major increase in population occurred with increasing immigrants after 1999 as a result of a decade long civil disturbance in the country while infrastructure development took place only after 2006. However, though recently started, the population expansion and land use change from agriculture to residential has been expanding across the VDC.

## 2.2 Methods

The study is based on qualitative research design involving series of focus group discussions, semi-structured interviews with local residents, and direct field observation to capture the information on different modes of water flows from Matatirtha to different areas over the years and their experiences and perceptions on the positive and negative implications of the water transfer in terms of local water security. The information collected was substantiated through discussions with key informants that included local political leaders, key functionaries of water users committees, water entrepreneurs, government and non-governmental officials. Secondary sources of data have been used to validate the findings from the formal and informal interactions.

## 3. Results and Discussion

### 3.1 Changing Modes of Water Transfer

Matatirtha VDC is well known for its rich water resources endowment in Kathmandu district. It endows three major spring water sources namely, Bhusunkhel or Khwanglang, Luwangkot and Dharapani which have been supplying water not solely for local needs but also to the expanding urban population. The modes of water flow from Matatirtha to different parts of Kathmandu have been discussed in three sections in the paper.

#### 3.1.1 Water for All: Sharing Water as Social Capital

Generally, water has been considered as a social good in rural areas of Nepal. Considering the principle of water as social good, water has been transferred from rural areas to the different urban parts of Kathmandu Valley. According to the local people, water transfer from Matatirtha started during the Rana regime, in the ruling period of Chandra Shamsher. Drinking water was supplied from the Bhusunkhel Spring Source to major parts of today's Lalitpur Sub-Metropolis and Kirtipur Municipality. After 1948, due to the increasing water scarcity within the VDC, water supply to Lalitpur was stopped while the supply to Kirtipur was stopped only 3-4 years ago. Drinking water supply from this VDC to adjoining Satungal VDC began in 1968. This traditional mode of rural to urban water supply in Matatirtha was driven by the social value associated with water considered as social good and serving this precious resource was considered an auspicious activity. Supply of water to the neighboring Naikap and Tinthana VDCs also started with the same social motive and traditional understanding.

#### 3.1.2 Harnessing Water as a natural resource: Community Resource

With increasing urbanization, there have been changes in the historical modes of water supply system from Matatirtha to the neighboring VDCs. Satungal, being the major exit for Matatirtha to the urban area, the historical mode of free water supply has been continued as an exchange to the need of Matatirtha to use the road along Satungal.

Water supply to Tinthana and Naikap which started with the same traditional value has undergone change from water as a social good to economic good. The local government at Matatirtha in co-ordination with the Spring Conservation Committee, an independent committee functioning in the Matatirtha, has started collection of revenue for the water provisioning to these VDCs since 2002 (Table 1). The revenue generated has been used for construction of basic infrastructures within the VDC, allocating a major portion of it for initiating and expanding the piped water supply in different parts of Matatirtha.

In addition to the neighboring VDCs, rich water resource in Matatirtha has also been an attraction for the several urban oriented water based industries. There are 12 other industries of different scales in operation in Matatirtha VDC which include foot wear industry, plastic industry, dying industries, hotel and resorts. Local government has been collecting revenue from urban oriented water based industries functioning in Matatirtha. According to the Matatirtha VDC profile (2010), the total annual revenue collected from these operational industries amount to around NPR. 2,00,000. Highland Distillery established in the year 1993 has been diverting water from Bhusunkhel spring for its water needs and is the highest tax payer with around NPR.70, 000 per year. These urban oriented water based industries have been an income source for the local administration at Matatirtha.

Table 1: VDCs with water supplied from Matatirtha and revenue collection

S.N	Name of VDC with supplied water	Starting year	Revenue collected (NPR)	Volume of water Supplied (inch)	Use of collected revenue
1	Satungal	1968	Free	4	-
2	Naya Naikap	2002	600000/-	1	Piped Water Supply
3	Tinthana	2010	3600000/-	1.5	Piped Water Supply
4	Old Naikap	2010	1800000/-	1	Piped Water supply

Source: Primary survey

The creation of employment opportunity in the growing industries has been a major benefit perceived by local people, both male and female in Matatirtha. This has been a better attraction over the traditional agriculture based livelihood in this hilly VDC. According to the local people, this has been a cause of growing shortage of labour for agricultural activities in the VDC. However, the local people have been demanding for the need to increase engagement of local people over labour from other areas.

### 3.1.3 Commercial Water Supply: Water as Private Property

According to Shrestha (2011), water transfer from this village to quench the thirst of urban dwellers was started in 1996 whereas water market in Kathmandu has started since late 1980s and gained momentum after 1990. The private water supply service in Matatirtha started in the same period through "Sunshine Beverage" owned by a local water entrepreneur and there has been no cessation for this business since then. The water entrepreneurs operating in Matatirtha have been extracting water either from springs originating in the privately owned land or by installing shallow or deep tube wells in privately owned or leased-in lands (Figure 3). Besides, water entrepreneurs with power have also been diverting water from public springs for commercial water supply. The water in the form of bottled water or tanker supply is either directly supplied to the consumers or sold to the water tanker intermediaries who own tankers but do not own the water source. These tanker intermediaries either supply the purchased tanker water directly to the consumers or further operate their bottling water industries based on the purchased water.

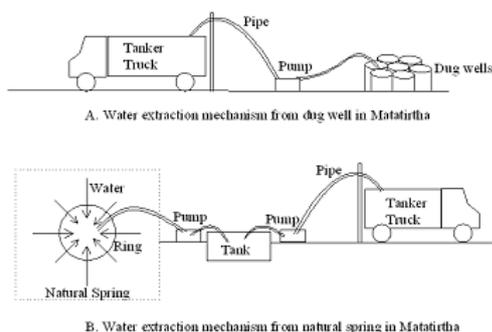


Figure 3: Water extraction mechanism at Matatirtha (Source: Shrestha, 2011)

The study found fourteen water extraction points in the village (Table 2) which included wells and springs in private land, spring in public land and one from deep bores. A total of 35 tankers of varying sizes (5,000, 7,000, 8,000, 10,000 and 12,000) have been transferring water to urban areas from this village (Figure 4). Thirty two of these are owned by water entrepreneurs within VDC whereas three belong to entrepreneurs from outside. Additionally, ten water bottling industries are being operated. According to Matatirtha VDC profile (2010), around 170 trips of water supply by water tanker that approximates to 1.2 million litres of water, is supplied to different places of the Kathmandu Metropolis as well as to other parts of Kathmandu valley on a daily basis. The public service centers such as bus parks, hotels in the city where there is huge demand of water, the residential areas in Balaju, Thamel, New Road, Baneshwor and Kalanki are considered as the major consumers by the water entrepreneurs based in Matatirtha.

The price of a tanker of water is on an average NRs. 1,500 for a tanker size of 6,000 litres and NPR. 2,500 for a tanker size of 12,000 litres. Once the water reaches the city, water is sold at even higher prices for those demanding smaller volumes for domestic needs. In the cases, where a farmer leases out the land for water extraction, each farmer is paid NPR. 200 and 400 for every 6,000 and 12,000 litres respectively. Currently, all the interest has been in earning income from the rich groundwater and spring sources from the area without any concern for groundwater recharge and springs protection for sustainable water use. Water business in Matatirtha has been a good source of earning for the land owners with high groundwater table and the water entrepreneurs involved in the operation of water tanker. Furthermore, the growing water business in Matatirtha has also been an attractive income source for the entrepreneurs from different parts of Kathmandu, mostly those in the neighboring VDCs mainly Satungal, Machhegaun, Tinthana, Kirtipur, Dhungeadda. These entrepreneurs from outside the VDC have been engaged in the commercial water

S.N	Names	Northing	Easting	Years of initiation
1	Sunshine Beverage (Dela Mineral Water Bottling/Matatirtha Khanepani Tanker)*	27°40'31.8"	85°13'27.4"	2000
	Duwa Food Products and Beverage Water Bottling/ Machhenarayan Tanker Water *	27°40'36.6"	85°14'27.9"	2001
	Natural Matatirtha Khanepani Pvt Ltd*	27°40'36.2"	85°14'29.6"	2008
2	Alpine Spring Mineral Water	27°40'35.4"	85°14'24.6"	2008
3	Himal Mineral Water Udyog	27°40'37.0"	85°14'25.4"	2009
4	Himsikhar Khanepani	27°40'37.3"	85°14'33.2"	2009
5	Shree Ganesh Khanepani	27°40'37.4"	85°14'22.8"	2009
6	24 Carat Spring Mineral Water ( <i>Public spring</i> )	27°40'36.5"	85°14'32.7"	2009
7	Nepal Khanepani ( <i>commercial deep boring</i> )	27°40'36.0"	85°14'18.1"	2010
8	Gud Khanepani	27°40'29.5"	85°14'36.5"	2008
9	New Matatirtha Khanepani	27°40'37.6"	85°13'33.8"	2008
10	Prakash Khanepani	27°40'35.9"	85°14'31.8"	2007
11	Gopal Khanepani Matatirtha	27°40'36.5"	85°14'27.1"	2006
12	Jiwanta Khanepani	27°40'35.6"	85°14'25.2"	2009
13	Ganesh Khanepani	27°40'37.6"	85°14'23.2"	2008
14	Hanro Mineral Water	27°40'37.3"	85°14'21.8"	2010
*= <i>s</i> pring in private land, 1 <sup>st</sup> - 7 <sup>th</sup> own both tanker and bottling industry, 8 <sup>th</sup> -13 <sup>th</sup> are only commercial water extraction points and neither own tanker nor bottling industry and 14 <sup>th</sup> owns bottling industry but doesn't own tanker)				

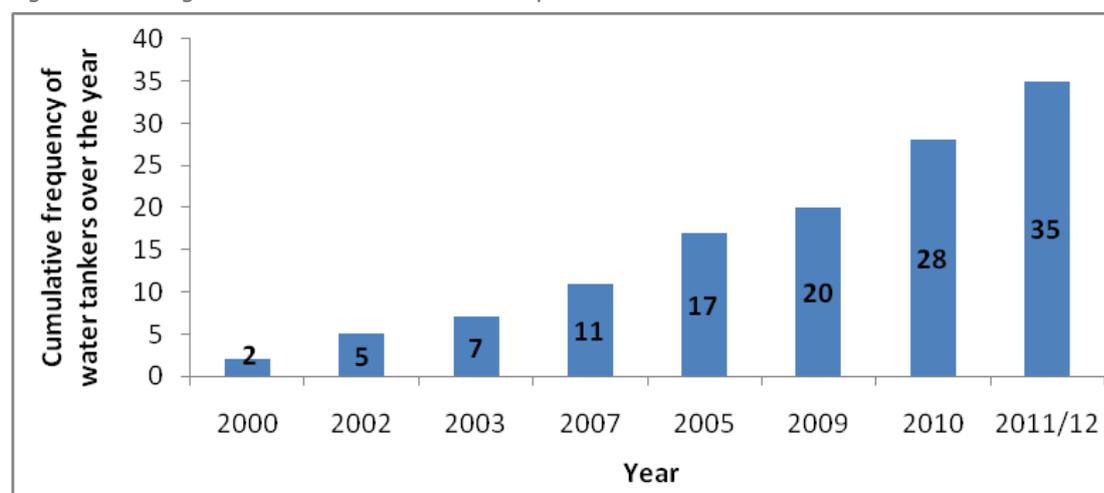
business through partnership with the local water entrepreneurs. Figure 4: Growing Trend of Private Water Tankers Operated in Matatirtha

Table 2: Water extraction points in Matatirtha

S.N	Names	Northing	Easting	Years of initiation
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* = spring in private land, 1 <sup>st</sup> -7 <sup>th</sup> own both tanker and bottling industry, 8 <sup>th</sup> -13 <sup>th</sup> are only commercial water extraction points and neither own tanker nor bottling industry and 14 <sup>th</sup> owns bottling industry but doesn't own tanker)				

Source: Primary survey- 2011

Figure 4: Growing Trend of Private Water Tankers Operations in Matatirtha



Source: Primary survey-2011

### 3.2 Implications of Rural Urban Water Transfer on Local Water Supply

The household water management in the past decades was a real hardship primarily for women in Matatirtha while agriculture has mainly remained rain-fed in this hilly VDC. Currently, eight different

community based water supply schemes are functional in Matatirtha for domestic water supply. Seven of these water supply schemes have been tapping water from three major springs while one is based on the ground water extracted from borewells. Among these, seven schemes have been supplying water through private taps, only Dharapani Khanepani has been serving through public taps. A part of the investment for these community water supply schemes serving water to the local people have been managed through revenue generated from the water sold to neighboring VDCs.

While the local people appreciate the water provided by the community water supply service, with increasing urbanization, the increasing competition over the water resources for domestic, industrial and commercial purposes has been their growing concern. The hours of water supply available from the eight community water schemes have been declining over the years. There has been growing realization and acceptance among the households that water supply constraint would increase in future. The adaptive strategies of the households have been to obtain private connection instead of depending on public stand posts and digging private wells and constructing large sized underground water tank or roof top water storage tanks to meet the water needs for several days. Similarly, getting connection to more than one water supply schemes for future water security has been another interesting practice in the area. This is essentially a planned adaptation to the possible shortage of water in future.

The local people have perceived this primarily as a consequence of massive extraction of water for the commercial urban water supply and growing commercial activities within the VDC along with the increasing water demand at the household level. Though documentation on the water extraction from the area is not yet been available, the current water extraction in the VDC is more apparent to be higher than the critical extraction rate. Excessive and inequitable extraction of water resource has generated concern among the people with regard to the sustainability of the water resource in the area. This has raised questions about the prior-appropriation water right, equity issues, water insecurity and vulnerability of these communities in the context of the accelerating pace of urbanization.

### **3.3 Role of Local Government as a Regulatory Body**

Local government and other local actors are best placed to identify local needs and priorities and provide an adequate solution to them. Local decision-making, supported by adequate resources can support positive rural-urban linkages (Tacoli, 2003). Activating the Local Self Governance Act-1999, that empowers VDC office as the custodian of natural resources within the VDC, Matatirtha VDC spearheaded to regulate the exploitation of water resource in Matatirtha. Through an agreement among the water entrepreneurs, VDC officials and local people, guidelines for regulating the commercial water extraction (both water tankers and bottling industries) operating in the village were drafted and VDC officially initiated licensing process as a means of regulating the rampant water extraction and was envisioned to be enforced starting July 16, 2009. The agreement restricted the use of water sources for commercial purposes without the permission of the VDC office. It also prohibited water extraction through deep boring and restricted the water entrepreneurs to dig wells with depth exceeding 30 feet. The VDC enforced a levy of NRs. 10,000 per year from the water bottling industries and NRs. 1,000 for small tanker per month and NRs. 1,200 for large tanker per month. The agreement also laid out terms and conditions concerning the protection of the local environment and the water sources and frameworks for conflict resolution holding the right to prohibit water business in case of drought condition or natural hazards in the area.

While the water entrepreneurs in the VDC claimed to provide employment to the local people, the local people felt that despite the existence of employment opportunities in bottling industries tanker water supply still continues to be an activity of over-exploiting of resources increasing the threat of water insecurity in the near future. Considering this, the VDC office imposed a restriction on the water tanker entrepreneurs and by placing a limit on the volume of water that could be extracted from the VDC while promoting bottling industries which is expected to create employment opportunities for the people, particularly women, at the local level.

This was a commendable effort by the local government to stop the exploitation of the water resource while continuing the benefits from the same water resources through a regulated water business. However, water entrepreneurs being economic, social and politically powerful, the attempt to regulate the commercial water trading within the VDC is hardly implemented. While the water entrepreneurs have been claiming to possess legal rights through formal registration provided by Valley Water Supply Tanker Entrepreneurs Association and Water Bottling Association, the local government has still not approved this mechanism and has been lobbying for the regulatory agreement made at the local level. Currently, the agreement has been dissolved. Though VDC officials have been working for the reorientation in regulating increasing water exploitation, so far no major achievement has been made for future water security in Matatirtha.

### **3.4 Growing Grievances Towards Free Water Supply to Satungal**

Free water supply to Satungal VDC has been a prime reason put forward by the water entrepreneurs in

Matatirtha for not paying the tax imposed by the local government. According to the local people, the traditionally established water supply mechanism to Satungal diverted only one inch of water yield from Bhusunkhel spring located at Matatirtha. With increasing water demand in Satungal, the diversion was increased to two inches around a decade ago. Around five years back with establishment of Dhaulagiri Residential Complex in Satungal, the water supply was further increased to four inches. The local people of Matatirtha claim that Satungal VDC has been making money out of free water service provided by Matatirtha by collecting a water service charge for supplying water to the households of Satungal.

The next dissatisfaction of the local people of Matatirtha is that they have paid road tax to Satungal VDC while Satungal VDC has been enjoying free water service from Matatirtha. Though in the past, the exit through Satungal was tax free, after the constitution of Satungal-Matatirtha Road Consumers Committee in 2003, Satungal has been collecting tax from vehicles plying along the road. This gradually generated grievances among the residents of Matatirtha. There has been growing dissatisfaction about the exchange of services (water services and the road services) among the two neighboring VDCs with one continuing to provide free service while the other increasingly charging road tax.

The water entrepreneurs have been completely against free water supply to Satungal and considered the need of bringing Satungal VDC under tax before the local authority implements any regulation to control water market operated by local people of Matatirtha itself. Local authority at Matatirtha however has not made any attempt towards changing the traditional mode of water supply to Satungal envisioning the likely impact on the social capital.

#### 4.CONCLUSION

Rapid population growth and urbanization accompanied by escalating urban water demand is increasing water transfer from rural and peri-urban areas to urban areas. Not only urban areas but peri-urban areas like Matatirtha VDC is also facing rapid population growth resulting in an increase in water demand within the village itself. Simultaneously, the social and economic developments have induced a paradigm shift in urban water transfer from this peri-urban area, promoting the economic benefits as a way of compensating for the loss of local water resources. Moreover, in the absence of regulatory mechanism, the increasing opportunity of economic benefits through water business has facilitated exploitation of resources. The widespread extraction of water resources without any concern for the environment has raised people's worries for the sustainability and security of the local resource. However, attempts of the local government to regulate water exploitation has not been successful. This has created a need for strong mechanism promoting sustainable water resource management so as to ensure peri-urban and urban water security.

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## Water Security in Peri Urban South Asia: Adapting to Climate Change and Urbanization

Working primarily on water security issues in Peri-Urban South Asia, across India, Bangladesh and Nepal, the project's main concerns are the rapidly changing peri-urban landscapes due to urbanisation and implications for water security in specific locations in the larger context of climate change. As an action research project, working across four locations in South Asia, it will serve as a basis for capacity-building at the grass roots level to address concerns of the poor, marginalised and other vulnerable communities to water security and seek to understand the dynamics of adaptation in the specific locations, for action and policy agenda at the regional level. It will build their capacities to cope with climate change induced water in-security.

[www.saciwaters.org/periurban](http://www.saciwaters.org/periurban)

### Coordinating Institution:

The project is being coordinated by **SaciWATERs**, Hyderabad, India. SaciWATERs focuses on transforming water resources knowledge systems, key ideas being an interdisciplinary approach to understanding water resources issues, from a pro-poor, human development perspective, with an emphasis on exchange, interaction and collaboration at South Asia level.

### Partner Institutions:

**Bangladesh University of Engineering and Technology (BUET)** is the oldest and leading university in Bangladesh in the area of technology. IWFM is a premier institute for the advancement of knowledge and development of human resources in water and flood management.

**Nepal Engineering College (NEC)** was established in 1994, as a non-profit organization under private sector initiative, to function as center for advanced learning in engineering and allied sciences. It has been offering the Interdisciplinary Water Resources Management (IWRM) Program since the beginning July, 2007 under the support of Crossing Boundaries (CB) Project funded by Government of the Netherlands.

### Project Support:

This project is supported by Canada's **International Development Research Centre (IDRC)**. IDRC is one of the world's leading institutions in the generation and application of new knowledge to meet the challenges of international development. For nearly 40 years, IDRC has worked in close collaboration with researchers from the developing world in their search for the means to build healthier, more equitable, and more prosperous societies.

#### Project Partners

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**SaciWATERs**



#### Project Support

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