Inequities in drinking water access:
tiny drops or full flow?

A case-study of the hydrosocial cycle in peri-urban Sultanpur, India

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Afke van der Woude
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A case-study of the hydrosocial cycle in peri-urban Sultanpur, India

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Abstract

This thesis presents a study on inequities in drinking water access in the peri-urban village of Sultanpur, India. It aims to explain how drinking water access is distributed and why inequities occur in this. Three months of field research were conducted in Sultanpur, in which mainly qualitative data were collected through participatory observation and interviews. In-depth knowledge was acquired on the workings of the hydrosocial cycle, a concept through which water is never seen apart from it social context. The research shows that the main drinking water resources in the village are formed by groundwater and a water from a piped network supply. For both of these resources, processes of exclusion and inequitable access were uncovered. These were found to occur importantly along lines of identity, though economic status and spatial characteristics also play a role. Inequities in drinking water access are tightly intertwined with identities of caste and gender, which are constantly (re)produced through daily water interactions and institutions for water provision. Hence, water practices themselves are constitutive of identity. Moreover, the research findings show that drinking water access is contested and political, and largely determined by power relations, also in the changing context of peri-urban areas.

Keywords: drinking water, access, inequity, hydrosocial cycle, peri-urban areas, India

Foreword

In April 2012, one of the biggest adventures of my life was about to start. That month, I travelled to India by myself with the aim of conducting field research for my MSc thesis. I stayed four months in the city of Gurgaon, where I experienced the scorching hot North Indian summer. Though this was a physical challenge for me, there is no better time of year imaginable for researching issues of drinking water access. Doing village fieldwork in a culture completely new and unknown to me was an enriching and life changing experience. The many field visits to Sultanpur taught me about the daily realities and struggles of life in an Indian village. I was amazed at the hospitality and respect with which the people of Sultanpur invited me into their homes and shared their food with me. The countless cups of *chai,* traditional peasant lunches, the curious questions and hundreds of pictures taken were all unforgettable. Thanks to their willingness to cooperate, I was able to gather the data I needed for my research.

This work was carried out with the support of the South Asian NGO SaciWATERs as part of an IDRC supported project on peri-urban water security in South Asia.[1] I am grateful to the colleagues of SaciWATERs, who invited me to India and introduced me in the village of Sultanpur. The Gurgaon research team, small and sociable, was of great support in practical matters, as well as a rich source of knowledge on the topics and area of research. I want to thank Vishal, Sreoshi and Pranay for welcoming me to the team. Without Rohan, my interpreter, I would have gotten nowhere. The effort he put in interpreting all those interviews and conversations, as well as all times he helped me out with practicalities were of vital importance for the research process. Also, his company and friendship made my stay in India even more enjoyable. For that I also want to thank all those other friends who have made me feel at home in India. *Dhaniwad!*

For supervision and guidance, I want to thank Dik Roth and Margreet Zwarteveen of Wageningen University, and Vishal Narain of SaciWATERs. All of their critical comments and contributions have been of great help in the process of doing research and writing this thesis. Their interest and enthusiasm was a source of inspiration and motivation for me to make the best of this research. Furthermore, my family, friends and my boyfriend René: thank you for supporting me during my stay abroad and the process of writing back home. I could not have done this without any of you.

This thesis forms the final project for my Master International Development studies at Wageningen University and is the result of the research I conducted in India. Going abroad and carrying out this research by myself has been a great experience, which also triggered my interest in issues of drinking water access and inequity. I hope that my enthusiasm for the topic is conveyed in my thesis!

Utrecht, January 2013
Afke van der Woude

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[1] More information about this project can be found on: http://www.saciwaters.org/periurban.

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Acronyms and glossary

Acronyms used

BPL: below poverty line

BRICS: group of leading emerging economies, namely Brazil, Russia, India, China and South-Africa.

HUDA: Haryana Urban Development Authority

INR: Indian rupee (also referred to as 'rupee'), one euro was worth 60-70 INR during the fieldwork.

Mgbl: metres below ground level

MDG: Millennium Development Goal

NCR: National Capital Region

PHED: Public Health Engineering Department, the government department (belonging to the municipality of Gurgaon) responsible for public water services in the village.

SaciWATERs: South Asian Consortium for Interdisciplinary Water Resources Studies

SEZ: special economic zone

SGH: (women's) self-help group

List of Hindi words

Chai: Indian tea, traditionally served with milk and sugar.

Karma: idea of reciprocity in Hindu religion, consequences of intentional deeds inflicted upon others (either good or bad), will come back to yourself.

Matka: earthen pot used for storing drinking water.

Panchayat: village council

Pucca: concrete

Purdah: tradition of women staying inside the house, and wearing a veil when they go out.

Rupee: Indian currency, see INR

Sarpanch: village headman

1 Introduction

1.1 Introducing the study

Two women using a hand pump, a family fetching water from a tanker truck and a boy filtering water coming from a piped network supply; what do they have in common? All three pictures on the front page of this thesis are taken in the same village, Sultanpur in the state of Haryana, India. They all show people getting water, though all of them use different resources and means for doing this. These three pictures reflect the variety in ways and means of accessing drinking water I encountered during fieldwork in this village. Not only do the pictures show that drinking water can be accessed in multiple ways, they also reflect that time and effort is involved in this process: walking to a pump, waiting until all pots are filled and carrying them around the village. Something else is striking about the pictures: they all have people in them. This shows that drinking water access is a social matter. It is about human needs, it involves technologies (which are created by people) and the actual work of fetching water is done by the water users themselves. I observed the social interactions involved in accessing drinking water: from women standing in line at a hand pump and discussing the latest village gossip to lower caste members having to ask permission to an owner of a private pump for using it. Access to drinking water, I found, is surrounded by such interactions and, to a large extent, determined by social relations. This is interesting because it contrasts with many policy discourses on how drinking water access can be organized and improved. In those visions, water access is often regarded as a technical question and assumed to be free from ideologies or power politics. In this thesis, I will argue the opposite. Drinking water access is deeply rooted in its social context, determined by power and inequitably distributed. Hence, this is not a hydrological study, but a research on the hydrosocial cycle, as it studies how the way water is accessed in its social context.

An official definition of drinking water is *"the water used for normal domestic purposes, including consumption and hygiene."* (WHO/UNICEF 2008) Clean drinking water is vital for a healthy human life, but many people in the global South lack access to this. Therefore, the challenge of improving water access for the poor has been taken up in the Millennium Development Goals (MDGs). Target 7.C states: to halve by 2015 the proportion of the population without sustainable access to safe drinking water and basic sanitation (UN 2008). On World Water Day in March 2012, the achievement of this goal was celebrated. But as 780 million people worldwide are still lacking adequate water access (UNICEF 2012), challenges remain. The realization of the MDG is measured by the amount of people that have access to an improved drinking water source, which is defined as one that "...*by nature of its construction or through active intervention, is likely to be protected from outside contamination, in particular from contamination with faecal matter."* (ibid.) Hence it seems that if enough of such improved water resources are made available in the right places, water access for all can be achieved. This is not reality, as these developmental discourses fail to take into account the inherent inequities in drinking water access in many places. People who technically might have access to a water resource, e.g. because they live close to it, might socially still be excluded from using it, for instance because of their belonging to a certain social or ethnic group. In some countries, women are excluded, because they are not allowed to go out by themselves, or the elderly, simply because they cannot make the effort of carrying water from a pump. Water access is a complex issue, and always deeply embedded in social contexts. Technology, affordability and perceptions of water quality also play a role in this. So even if the quantitative indicators of the MDG would be attained, more qualitative issues of inequitable water access will remain.

Issues of water access are rural as well as urban. In this study, the focus is on the 'in-between' area of the *peri-urban.* Urbanization processes in developing countries pose new challenges for urban water supply (Bakker 2010). This is not just the case in cities, but in their hinterlands as well. These peri-urban areas are the spaces where the city expands into, but also function as resource base for urban growth and as a dump-site for urban waste (see e.g. Narain 2009, Swyngedouw 1997). Urbanization can also have consequences for water access of peri-urban dwellers: water can be extracted from peri-urban areas for urban use or water resources can get polluted. Processes of change in peri-urban areas can cause conflict and give rise to new inequities. Hence, these areas are interesting to research; certainly in India, where urbanization rates are high. The city of Gurgaon is an examples of this, due to economic developments and its favourable location close to capital New Delhi it has grown tremendously. Sultanpur is a village located in the district of Gurgaon and is now located in the peri-urban hinterland of Gurgaon. This is the village, where I conducted my research.

In this research, I further examine the social nature of drinking water, illustrated by the case of Sultanpur. For doing this, I conducted extensive fieldwork, consisting of interviews and observation. This provided me with insight in how drinking water access is organized in the village. Two water resources are present in the village: a piped network supply and groundwater. Though both are used for drinking, they are not equally accessible for everyone, and people make motivated choices on which resource they use. In order to gain a deeper understanding of the inequities in drinking water access, I studied the institutions and technologies that play a role in organizing this. Moreover, I looked at the daily experiences people have in obtaining access to drinking water. In order to explain inequities in access between groups and individuals, I examined the role of social identity and power relations. Hereby, I aim to gain a deeper understanding of the workings of the hydrosocial cycle – in which water is studied in its social context – of drinking water in Sultanpur. Hence, this thesis presents an in-depth study of how drinking water access is organized and inequitably distributed.

The research forms my final thesis for the MSc International Development studies at Wageningen University. It was carried out in cooperation with the South Asian Consortium for Interdisciplinary Water Resources Studies (SaciWATERs), as part of their IDRC supported research project on peri-urban areas. In this first chapter, I provide a literature overview, in which I explain the concepts and theories used. After that, the problem statement and research questions are stated. Next, I explain the research design and methods, and the chapter ends with an outline of the rest of this thesis.

Picture 1.1: Girls carrying pots of water home

1.2 Literature overview

In this paragraph I will provide an overview of the theories and concepts to be used in this thesis. Understanding these concepts is essential for making sense of the research findings, as they provide the theoretical framework of my thesis.

1.2.1 Political ecology and the hydrosocial cycle

Political ecology is the main theoretical approach I apply in my research. This is a way of looking to the world in which society and the environment are not seen as two separate entities, but as mutually constituting each other. As I research interactions of humans with and around water, this theory applies to my topic of study. It provides useful analytical tools, such as the hydrosocial cycle. In discussing political ecology, I will elaborate on the main ideas and concepts belonging to this approach , as well as some variants and critiques.

Political ecology

In the current, mainstream, way of looking at the world, nature and society are perceived as two separate phenomena. Human beings and their institutions are generally seen and studied as being distinct from the natural environment and its resources. Political ecology provides a way to move beyond these dichotomies and approaches nature and society as one whole. The approach is specifically focused on processes of ecological change, and how these in turn interplay with politics. In an attempt to bring some unity in the field of literature that exists within political ecology, Briant and Bailey (1997) describe how processes of environmental change influence society, and are likely to reinforce existing inequities between groups. These processes are political, as power relations determine their outcomes.

The environment and the society mutually constitute and affect each other, instead of viewing these as two separate entities, we can see them as a collective. This also holds that distinctions between object and subject do not hold, as all are part of the same whole (Latour 2004). According to political ecologists, the distinction between 'man' and 'nature' was amplified during modernity. In the view of Marxist political-ecologists, this distinction enabled a view on nature as a resource base that could be exploited for production purposes. Opposing this false distinction between society and nature, political ecologists see (produced) environments as the result of social and ecological processes (Heynen et al. 2006: 9). This means that processes of sociological change affect the environment just as well as environmental change influences society. The task of political ecologists is to examine how these processes constitute and affect each other, or as Susan Cutter puts it*: "The aim [of this approach] is to unravel the social relationships that unfold between individuals and social groups and how these, in turn, are mediated by and structured through processes of ecological change."* (Cutter 1995, in Swyngedouw et al. 2002).

Processes of socio-environmental change are often characterized as 'metabolisms' (see e.g. Heynen et al. 2006), in order to symbolize the transformation of the 'natural' environment and resources by human beings and technologies. These (historical) processes of change lead to a socio-spatial distribution of resources, of which the effects are unevenly spread and inequitable, which shows the deeply political nature of these processes (Swyngedouw et al. 2002: 125). Through these processes, some groups benefit, while the sustainability of others might be undermined (Swyngedouw 2009b). In the view of political ecologists, uneven socio-ecological patterns are determined by power. Therefore, understanding the different roles of power (social, economic, political, cultural) is a key

element of political ecology. Social power relations shape the human-environment interaction and the inequalities which occur in these. Political ecology, therefore, pays particular attention to power relations, looking at who benefits and who suffers from particular processes of socio-environmental change (Swyngedouw et al. 2002: 134).

The hydrosocial cycle

Political ecology is a relevant approach for studying water, as *"Changes in the use, management, and socio-political organization of the water cycle and social changes co-determine each other."* (Norgaard 1994, cited in Swyngedouw 2009a: 56) Both hydrological processes and human interventions, determine the eventual way water flows. Unequal distribution of water access can then be seen as an expression of uneven distribution of resources within societies, excluding some and privileging others (Swyngedouw 1997: 329). Swyngedouw (2009a: 57) argues that *"The mobilization of water for different uses in different places is a conflict-ridden process and each techno-social system for organizing the flow and transformation of water (…) shows how social power is distributed in a given society."*

In addition, Jamie Linton (2009, 2011) acknowledges the deeply social nature of water: not only are many water resources controlled (used, polluted) by humans and does the way people use water it determines its flow, water also carries ritual, cultural, religious meanings and purposes. However, modern societies have reduced water to a neutral, natural resource, disconnected from social meanings given to it. The hydrological cycle is a conceptual tool to describe the flow of water across the earth. Linton (2011) argues that this is a tool that has helped to enable the detachment of water from its social context. Instead, he maintains, we should apply the hydrosocial to study the way water flows. Instead of only looking at hydrology and 'natural' factors that constitute flow, this process has to be considered a social and political phenomenon. Swyngedouw (2009a: 56) also argues that we should see the circulation of water as a process that is both physical and social. The hydrosocial cycle brings together water flows and power relations and is therefore an appropriate conceptual tool for studying issues of water access through a political ecology lens. It enables the study of water in its social context: the society through which it flows and the meaning that people attribute to it (Swyngedouw 2009a). Though water flows can be seen as cyclical, the essence of the hydrosocial cycle is not to describe full cyclic processes; rather, it offers a way of studying how water and society mutually and constantly change and affect each other in their interactions and engagements (Linton 2011: 9). The concept should not be seen as an alternative for the hydrological cycle, as this is used to describe another type of process (physical, instead of socio-political).

In a political ecology view, then, human interventions in water flows are political, as they are determined by unequal power relations and are likely to benefit some groups – while excluding others. This makes such interventions contestable (Swyngedouw 2009a: 57). Hence, the way in which access to water is organized is also political and an expression of power. It is not evenly distributed: more access for some (groups) inevitably affects the options of others. One could even say that water does not only flow towards gravity; it can also flow towards power, or money. This is important to understand in the light of the research findings I present further below.

Urban political ecology and peri-urban areas

Many political ecology studies focus on urban areas and the associated resource questions. Cities are considered as sites for resource and power struggles. The urban should not be seen as 'unnatural', but rather as produced environments, in which socio-political interventions transform resources (Heynen et al. 2006: 5). On-going processes of urbanization lead to struggles over distribution of space, capital and resources. Swyngedouw (1997; 2002; 2009b) argues that urbanization is an essentially political ecological process, as it transforms space and environment, as well as people's ideas and interactions. According to Karen Bakker (2010: 7) the different material flows moving through the city and the governance processes involved lead to differentiated patterns and inequitable distribution within the city. This is a topic of study for urban political ecologists. The expansion of cities is not only an issue that leads to struggles within urban areas. It also leads to competition and struggle with the areas around the city. These peri-urban areas form an important concept in my study, as the context that it takes place in. Just like cities, peri-urban areas can be seen as a produced environments which experience processes of socio-environmental change. Narain (2010b: 2) argues that the peri-urban can be understood in three ways, namely as a place, a process and a concept:

- As a place, the peri-urban indicates the rural fringe around the city which is the transition zone between the 'rural' and the 'urban'. These areas feel the effects of urban growth profoundly, as they are a base of urban resources and the place for dumping urban waste.
- However, peri-urban areas are not geographically and institutionally fixed places. The peri-urban can therefore also be seen as a process: in transition between rural and urban ('no longer rural, not yet urban'), with the accompanying flows of goods and services, where the urban and rural meet through interlinked processes.
- As a concept, peri-urban focuses less on time- and space-bound characteristics, but emphasizes the simultaneous presence of rural and urban characteristics and land-uses. This holds that not one peri-urban site is similar to another, but that all are characterized by dynamic and conflicting processes around land, water, environment and community.

In my study, I choose to use the third approach of the peri-urban, as a concept. Hereby I do not want to deny that they form a place and a process. However, focussing too much on these aspects has the risk of blind-staring on the question where and when a place is peri-urban or not. I think the issue should not be of demarking such areas, but of acknowledging that both rural and urban characteristics are simultaneously present. This allows for studying the interactions between these characteristics and the processes of change and conflicts occurring in such areas.

The 'in-between rural and urban'-status of peri-urban areas might lead to piecemeal and unclear jurisdiction, as well as institutional changes. The areas are severely affected by urban developments, but may not be governed by the city. By rural governments too, they can be neglected, as the peri-urban is no longer perceived as rural, or is located at the boundary of the area of governance. This leads to situations where those people affected by urbanization can perform little influence or control over these processes and have to deal with change and uncertainties. (Narain 2010a, b)

Due to on-going processes of urbanization all over the world, peri-urban areas and the issues that arise in these places keep on gaining significance, both in research as well in policy making. These areas form an excellent site for political ecology analysis, due to the resource struggles and

processes of social as well as environmental change taking place here. To fulfil their needs, urban areas need to extract much more resources than are available within the city. Therefore, they need to extract these from outside, which affects the areas around cities functioning as resource base (think of food, water, fuel, commodities, etcetera). Rees (1992) has conceptualized this as the ecological footprint of cities, which far-exceed the actual area that the city physically occupies. Peri-urban areas are eminent examples of this, they function as spaces of expansion, resource bases and dumping sites for urban waste. By supplying materials and absorbing wastes, they are located on the beginning and end of the urban metabolism (through which resources are transformed).

Hence, the concept peri-urban describes a dynamic area, subject to processes of change. Changes brought about by urbanization have consequences for both the space itself and the ideas of its inhabitants. As Narain (2010b: 3, 6) describes: peri-urban areas are subject to processes of socio-environmental change, and the process of peri-urbanization distributes opportunities and risks unequally. Though negative effects of urbanization are likely to be experienced in peri-urban areas, this process should not only be seen as malign, as change gives rise to new opportunities as well.

Insights from feminist political ecology

Feminist political ecology can be regarded as a separate strand within the field of political ecology. It is based on ideas of feminist geography, which focuses on differences and inequities between men and women in the spatial experiences they have. In line with this, feminist political ecology calls for including gender roles in political ecological analysis of power and resources. In the social power relations that determine distribution of resources, the role of gender should not be overlooked, as this can be crucial in determining who gets access to what (Elmhirst 2011). Water is a subject on which a gendered way of looking is very suitable, as it is a resource needed by everyone - it is interacted with on a daily basis, and comes with gendered divisions of labour in almost every culture. Daily interactions with resources materialize the symbolic ideas and perceptions which result in social inequalities (Nightingale 2011: 153). Differentiated interactions with water can then be seen as constituting of social identities. This is also shown by Sultana (2011: 163), who studies the physical experiences that men and women in Bangladesh have in their interactions with resources on a daily basis. She shows how these interactions reproduce and reinforce existing inequities between men and women, but also between different social groups. Yaffa Truelove (2011: 145) criticizes that many *"[…] political ecologists devote less time to everyday practices and the micropolitics of control."* If these daily experiences would be included in political ecology, she argues, a more complete understanding can be acquired of how social and spatial inequities are constructed and experienced (idem: 144). In this thesis, I specifically take in account this micro-level of daily practices of water access, in order to get a true understanding of the struggles around water access.

In a study of the role of gender in processes of water commodification, O'Reilly (2006: 959) argues that feminist political ecology also has its shortcomings. Research in this approach was mainly concerned with either the gendered consequences of changes in the environment, or the environmental consequences of changes in gender relations. In her study on water improvement projects in India she moves beyond this and examines the way meanings of both resources and gender are mutually constructed in processes of interaction with (or struggle over) these resources. Another risk of a feminist approach is that there is an over-focus on gender (often only on women) and that other social characteristics are overlooked. One should not reduce all inequities and social differences to gender issues. Other social identities, such as caste, class and age are just as

important in determining power relations and access over resources (O'Reilly et al. 2009; Ahlers & Zwarteveen 2009). Commenting specifically on the situation in India, Singh et al. (2005) also state that gender is not an all-determining characteristic. Women should not be considered a homogenous group as they are strongly divided along lines of caste and social status.

Application of political ecology in this study

In the paragraph above I have explained what political ecology is and how it can be applied. Use of political ecology as main theoretical approach in my study, means that I will look at society and the environment as mutually constituting of each other. Urbanization, and with that the formation of peri-urban areas, can be seen as a process of socio-environmental change. Such processes of change lead to inequitable outcomes for different areas and groups, social relations of power are crucial in determining these outcomes. The hydrosocial cycle offers a tool to understand and describe how water flows through its socio-political context. This is what I will do for the drinking water access situation in the peri-urban village of Sultanpur. For me as a researcher, this holds that I focus on the human interactions with and about water, and that I try to understand inequitable distribution of water access through the associated social power relations. In this thesis, I will try to explain the processes that produce *"inequitable socio-hydrological conditions"* (Swyngedouw 2009a: 57). I will specifically focus on the micro-level of everyday experiences, in order to get a deeper understanding of how inequities in water access in the village come about and are reproduced.

1.2.2 Water access and inequity

In researching access to drinking water, it is important to define what 'access' to resources exactly means. Ribot and Peluso (2003: 154) conceptualize access as *the ability to use or derive benefit from things* (in this case, from drinking water resources and technology). They warn for confusion with *property,* which they define as the *right* to use or derive benefit from things. Hence, access is about a broader range of social relations than only those socially acknowledged means of (property) rights and can also be achieved through informal or 'illegal' practices.

The link between access and informality or illegality relates to *legal pluralism.* In this approach to law, different (types) of legal orders can coexist and overlap, and a clear line between formal and informal does not exist (von Benda-Beckmann et al., 2009). State law, traditional law and religious law coexist and interact with each other. Policy makers might view actions outside of the state law as illegal or at least informal. However, these actions might fit well into more traditional systems of law. Hence, different types of water rights exist, they are context- and location specific, and are of crucial importance in shaping water access. Roth et al. (2005) argue that the role of law is underexposed in the debates about access to resources, and say that different types of law can be used as an asset, but are just as well a factor in shaping inequity. Acknowledging this plurality allows room for negotiating and finding alternatives. Also in this approach, the role of power and agency is emphasized. Power relations shape the use of rights and legal systems, and people's agency make that they are not mere subjects of law, but actively use, select and negotiate their rights and obligations, using law also as a weapon in their struggles for (legitimate) access to resources.

In line with this, Ribot and Peluso (2003) argue that people can draw on bundles of powers to obtain and maintain access to resources. Examples of such bundles of powers are access to capital, technology, authority and social relations. Yaffa Truelove adds to this that (2011: 146) *"[...] the practice of accessing is often achieved via one's positions and relationships within households and*

communities, instead of from one's interaction directly with a local water source." This holds that people depend on a variety of relationships, networks, and political arrangements to obtain and maintain water access. Hence, the concept of access is deeply social, in which people draw on their social, economic and political power and relations in order to access (water) resources. Access is a fluid concept: *"People and institutions are positioned differently in relation to resources at various historical moments and geographical scales [...] changing the nature of power and forms of access and resources.*" (Ribot & Peluso 2003: 154) So once obtained, access is not automatically maintained. Ensuring access to water involves continuous effort and investment. Moreover, changes in the environment (technological, social, or hydrological), can suddenly change individual or group access to water resources. For me as a researcher, this holds that I have taken into account all ways and means employed by the people of Sultanpur obtaining drinking water.

Drinking water access can take various forms: a household connection to a water supply network, a hand pump with potable water at walking distance or a private submersible pump to withdraw groundwater are just some examples. In researching access to water, it is important to take into account what water users themselves consider as good or proper access to drinking water. Quality and quantity of the resource are important factors in this, but also, Singh et al. (2005: 218) state, *social acceptability of access.* In a study on the effectiveness of community water programmes in India, they find that there is too much focus on physical infrastructure, and the socio-cultural context of access practices is often not taken sufficiently into account in such programmes. For instance, they show that in the Indian context, the use of the same public spaces by people from different castes is often considered unacceptable, which has consequences for installation of public water points such as pumps or stand pipes. Such considerations of differential and social acceptability of access, are deliberations I have taken into account in carrying out my research.

Processes of establishing access are determined by social power relations and can involve conflict, causing possible inequities in distribution of water access. Some social groups or individuals have more, easier or better access to resources than others. Lines along which inequities between groups can occur are caste, class, age and gender. Bakker et al. (2008) for instance, argue that (urban) water access is in many cases a problem of distribution rather than availability. They find that in urban centres in the South, the water networks often exclude those people who are not considered as full citizens of the city (e.g. migrants and slum dwellers). In this study of Jakarta, they show the historical spatial biases in water supply networks, but also that people sometimes opt for not using such systems (e.g. because they are considered to be unreliable or too expensive). Swyngedouw (2009b) also argues that in urban areas, access to water is determined by economic power, by including the areas where the rich and powerful live in water supply networks, whereas poorer areas are excluded. Truelove (2011) claims that these inequities can also occur on the micro-level within groups and households, for instance in gender role patterns about the work load of fetching water.

Sanjiv Phansalkar (2007) theorizes about water access and equity issues. He distinguishes between four different types of (in)equity: social (equity between groups), spatial (between locations), gender (between men and women) and intergenerational (related to sustainability, equity between past, present and future in terms of available resources). These (overlapping) connotations show that inequity can occur on different scales, and can take a broad range of forms. Pahansalkar (idem: 2) argues that equity is not the same as equality, as it cannot be defined by giving an absolute standard or minimum, it is embedded in social context. In India, for instance, he finds that Dalit groups (lower

castes) experience inequities in water access, which increase in times of greater water scarcity (idem: 7). Such inequities are encoded and reproduced in the institutions for water access and are also built in the infrastructure of water delivery and can be reproduced through the technologies used (Mosse 1997; Cleaver 2000).

David Mosse (1997: 473) warns for 'over-socializing' water access, as geographic and technical factors still play an important role in determining the water's flow. The importance of technology and infrastructure should not be overseen, as the design of these has consequences for (in)equity. The way a public water network is constructed has important spatial effects, in terms of inclusion and exclusion from the network. Affordability of technology also plays a role: there is quite a difference in being able to afford a hand pump or a motorized pump, in terms of effort involved with accessing water. However, infrastructure and technology can also be seen as embodiments of institutions, knowledge systems, beliefs and practice and embedded in their social context (Cleaver 2000). They are determined by power relations and by their design reproduce these. Social structures, institutions and infrastructure are important determinants of access, but we should not see water users as helpless subjects of these. Rather, they can employ agency in using these for their own benefit, i.e. through the choices they make and the social relations they mobilize. We should also take care to not only focus on groups, as individual choices and capabilities are just as important in understanding water access. Individuals have to negotiate their own space and access on a daily basis, also within their social groups and households (Truelove 2011: 148).

Water can be accessed in multiple ways and with use of multiple techniques and strategies, which can vary from formal to informal and from legal to 'illegal'. Just looking at service networks will not give a complete picture, as many people choose or are forced to access water outside of these structure and have to put a lot of effort in this. The peri-urban village I research, represents a large variety in forms of water access. In researching water access, I will look at costs, time and social and physical effort that water users have to invest in obtaining drinking water. This I will relate to the resources accessed and the quality and quantity of the water obtained from it. I will look at the different options that individuals and social groups have, the practices, institutions and technologies that exist, and the choices water users make in deploying these. Hereby, I aim to come to an understanding of which inequities in access to drinking water exist between groups and individuals, and along which lines these inequities occur.

To avoid confusion between terms, it is useful to shortly discuss control. Control refers to the power to decide over (allocation of) resources. This can e.g. be a government water department determining where the network will reach, or an owner of a private water resource, who can choose whether other people can make use of this resource or not. Control is important in determining who gets access to what, but it is not the same. Mollinga (2008: 10) describes control as "*politically contested resource use*" and adds that water control has three dimensions: *"a technical/physical, an organisational/managerial, and a socio-economic and regulatory."* This refers to the processes in which the water flow, accompanying human behaviour and the institutional structures for this are steered and manipulated.

1.2.3 Water, citizenship and social identity

Karen Bakker (2010: 48) uses an argument made by Chatterjee to distinguish between civil society and political society, analysing that whereas these encompass more or less the same group in the North, in the global South these are not the same. There, civil society consists of only a small group of full 'rights-bearing citizens'. Large populations in the city, such as 'the poor' or 'slum-dwellers', have a relation to the government that can be seen as political. They are not considered as rights-bearing citizens, but rather as groups that have to be cared for on the one hand, but controlled on the other. This holds that members of such populations cannot mobilize their civil rights and make claims upon governments to the extent that civil society members can. The only moment that politicians show interest in these areas are at the time of elections, when the slums are seen as important votebanks. Through systems of patronage and by making promises of improvements, (local) politicians try to buy people's votes, Anand (2010) provides an interesting example of such practices related to improvement of local water networks in Mumbai. According to Bakker, the fragmented water networks in the urban South do not service all inhabitants of the city, as large parts such as slums, are often excluded. This unequal distribution of water access is not just a result of failing governments or market failure, rather *"the distinction between citizens and populations is literally embedded in the city's infrastructure."* (Bakker 2010: 49).

Because of this, Bakker views (formal) water access as a material emblem of citizenship, an acknowledgement of this civil right by the government to certain groups of citizens (and a symbol of political inclusion). In this line, Nikhil Anand (2010: 545) coins the term hydraulic citizenship: "*a form of belonging to the city enabled by social and material claims made to the city's water infrastructure. Produced in a field that is social and physical, hydraulic citizenship is born out of diverse articulations between the technologies of politics and the politics of technology.*" Anand argues that this comes about through processes of pressure, by which water is made available to different social groups in the city. Entitlements of hydraulic citizenship are 'temporary and precarious' (Anand 2010: 559) and have to be constantly defended and renegotiated. This again shows the role of power relations in defining access to water and the political nature of these processes. In a comparable study on the public water network in Chennai, Karen Coelho (2006: 497) shows how a municipal water service is in essence a social exchange between actors. Engineers tend to see this differently, and perceive the water service as a technical construct. However, she argues, their constant interventions and decisions determine the water flow just as much as the technologies of the network.

I have found many studies in which these processes are examined in urban areas. Bakker et al. (2008) show for instance how formal water provision in Jakarta is distributed over an 'archipelagos' of areas, rather than a network. The supply in this city excludes the poor and marginalized areas of this city, as the water supply remains largely confined to elite residential and industrial areas of the city (Bakker et al. 2008: 1899). Reasons for this pattern can be found in the fact that investors see little profit to be made in such areas and the historical construction of the water supply network (in which these areas were not included). Moreover, Bakker (2010) argues, the urban government neglects these areas in policy making, because they are often regarded as illegal settlements. This can be related to her ideas on citizenship and inclusion described above. In a study on water access of the poor in New Delhi, Truelove (2011) also shows how exclusion from official supply networks force members of 'poor' households into extra-legal practices for obtaining water. This induces processes of criminalization of such water users by governments. Thus, Truelove shows, water

practices (co-) produce urban subjectivities and spaces, of which some urban dwellers are able to benefit, while other groups have to deal with exclusion.

Though these processes are relevant for peri-urban areas, they are not the same. Inhabitants of these areas are in many cases not (yet) considered as urban citizens, nor would they consider themselves as such. Nevertheless, the status of their citizenship is important. Are these areas taken into account in urban policy making, or do they find themselves in institutional lacunae? Which changes and effects of urbanization are experienced in such areas, and how are these experienced (positive or negative)? This is one an important issue my thesis, and with a specific focus on the peri-urban my study adds to the existing base of 'urban' literature. However, I also look for such processes within the village itself, where differential access in different locations can be observed. Thinking about the relation between water access and local citizenship can help in understanding such spatial inequities.

Water as a political good
By now it has become clear that water is deeply social and political in nature. Not only can water form a source of political tension at (inter)national levels, but also on a very basic day-to-day level, water is contested. Mollinga (2001: 738) has labelled this the everyday politics of water use. He suggests that analysis on this level should look at "*the way the local social relations of power shape and are shaped by water resource use practices."* Roth et al. (2005: 257-259) also argue that water is always contested, and determined by power and interests. They make a distinction between different forms: contestation of access, the rules involved, decision making processes around this and discourses behind these. At all levels, they argue, these contestations takes place.

Referring to the on-going debates on whether water provision is a public (governmental) or private (corporal) responsibility, Bakker (2010: 105) reflects on the nature of water. She states that it is neither a public nor a private good. It is ambiguous because public and private service providers are simultaneously active in water provision, especially in developing countries. Also, she argues that these two images of water falsely represent a neutral nature, like many policy debates on water tend to. This overlooks the deeply political nature of water. In this light, it is useful to follow a suggestion that Schwartz and Schouten (2007) make, of perceiving water as a *political good* in order to truly understand its political nature. This links well up to a political ecology approach of water access: when water is perceived as a political good, access is determined largely by power and negotiation. Similarly, Anand argues that creating political or social pressure is crucial for obtaining access to water, for the population of Mumbai. Especially in the city, groups have to establish themselves as a deserving political society ('votebank') for local politicians in order to keep the water flowing through the networks of water supply (Anand 2010: 546).

By viewing water as a political good, I can take into account its contested and political nature, which fits in a study of the hydrosocial cycle. Using this concept also means that I study the allocation of power and control over the water flow in the village. This means that I look at local politics and the role of the engineers in deciding where the water flows to. But also on a more day-to-day level, it means that conflict and power struggles over water resources should be taken into account.

Social identity

In the paragraphs above, I have revealed how water plays a role in social interactions and relations between groups and individuals. Water can even, as Linton (2011: 8) says, be seen as a medium of social relations. Because of this, social identity is important in determining and shaping access to water, as well as the practices and interactions related to this. One person can have multiple social identities, both ascribed to the self or ascribed by others. Social identity is important in researching inequities, as these often occur along lines of identity, ascribed to certain social groups. Discourses and perceptions of identity are also important in determining social relations between individuals and groups, as well as labour division (e.g. of fetching water). Related to issues of water access on a daily, micro-level, characteristics such as gender, caste, class, ethnicity and age are important to take into account. During my fieldwork, I specifically found caste and gender to be important, hence, I will give a short explanation of these concepts below.

Indian society is structured and controlled by the caste system. This system is closely linked to the Hindu religion and its philosophies and has existed for over 2000 years. Some authors say that over time, it has become much more rigid and structuring, than at its earliest times (see Joshi and Fawcett 2005). The caste system divides all groups of society in separate, hierarchical castes, which have their own community and profession, and determines people's social status by birth. It goes as far as to label the lowest caste members (*Dalit* or *Harijan* [2]) as 'untouchable', because of the 'dirty' jobs they are ordained to do, such as cleaning gutters and handling garbage. This system was abolished by the government after independency in 1947, and should officially not exist anymore. Now, efforts are made to combat discrimination of low caste members and to give them more opportunities. However, the caste system is still present in the way people think about each other and is actively reproduced through marrying practices; it stratifies society by determining people's social status. Members of the low castes are still often treated as lower-class citizens and have to work in menial jobs. But caste relations and occupations are changing, and more and more people start to work in other jobs than their traditionally determined occupation. If members of lower castes have access to education, they are able to climb the social ladder.

The caste system is filled with ideas on purity and impurity, in which water is an important medium of both cleansing and pollution. The highest castes are regarded as most pure and the low castes have to bear the label of being unclean . Higher caste members can become polluted through interactions with lower caste members, e.g. by sharing a meal, drinking from the same water resource or even just being in the same space. This leads to processes of physical exclusion of lower castes (who generally are not in a powerful position) from certain spaces and resources, such as using the same water well or pump. Nightingale (2011: 156) also perceives that in Hindu South Asia *"Water is particularly important as a substance that confers purity."* Water has intrinsic purity and is thus used for cleaning after such, but can become polluted easily. Because of this, higher caste members might try to exclude lower caste members from using their water resources. If this is not possible, they might perform cleaning rituals of the resource, as to symbolically wash of the lower castes' pollution. Joshi and Fawcett (2005: 56) argue that this makes water instrumental in determining inequality through caste practices.

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[2] These are terms used for the outcastes, the lowest in the hierarchy of the caste system. Dalit means 'untouchable'; Harijan is a more positive name coined by Gandhi, meaning 'child of the sun'.

Gender is not about the biological differences between men and women. Instead, it is about the social and cultural meaning attributed to these differences and the practices that follow from this (Oakley 1972, cited in Zwarteveen 2006). This makes gender a useful concept for studying social relations and divisions of labour between sexes. Hence, thinking about gender does not mean only thinking about women (which many project workers and even researchers do); it is about taking both sexes and their interactions and work patterns into account. O'Reilly (2006) argues that water work is often associated with women's work, as women are responsible for the household chores for which water is needed in many cultures. Also, it is often assumed that women have a 'natural' relation with the environment and its resources, through sustained interactions with these. However, she argues, these are social constructs just like other ideas on role patterns of gender. Gender identities can be constructed *through* the daily interactions with water (O'Reilly et al. 2009).

Considering women as a homogeneous social group is a risk when studying gender. 'Women' are just as much characterized by other social identities, such as caste or ethnicity, and therefore they will not necessarily consider themselves as a social group with shared interests (see e.g. Singh et al. 2005; O'Reilly 2006). All people hold multiple, different identities. The study of intersectionality focuses on how the interaction and intersection of these identities contributes to social inequity (Butler 1997, cited in Nightingale 2011). In my study, I focus on the intersection of caste, class and gender identities and how these constitute inequitable water access for groups and individuals.

Similar to caste interactions, gender interactions in South Asia also have spatial effects. The most characteristic of this is the tradition of *purdah*, which is mainly practiced by higher castes in India. Purdah literally means veil or curtain and comprises a tradition to protect wives, daughters and daughters-in-law from the outside world by keeping them inside the house and not letting them go out alone. Hence, they stay behind the curtain, even if they go out when these women cover their face with a veil or scarf. Singh et al. (2005) argue that gender relations create different working spaces for men and women in India, because women are less free to go outside the house premises. Hence, accessing water resources outside of the house becomes more of a male responsibility for families that practice purdah. This is closely interrelated with caste practices and traditions: "*The higher the position in the social hierarchy, the more closely are women associated with their domestic space.{...} As one moves down the social hierarchy, the rigidity of these norms decreases and women may show greater mobility.*" (Singh et al. 2005: 219)

The above shows that social identities like caste and gender can play an important role in interactions with water and in achieving drinking water access. The intersection of such identities is interesting to examine: what are, for instance, the options that a low caste woman has for accessing water; and how are these different from a male higher caste land owner? I focus on identity in my analysis of drinking water access in Sultanpur, because inequities are likely to occur along these lines. This does not mean that I aim to establish hierarchical or exclusive categories of identity, this does not match with a view on identity as fluid and dynamic. Rather, I examine the complex relations between identity, inequity, power and drinking water access.

1.2.4 Water governance, institutions and community

Some final useful concepts are water governance, institutions and community, as they provide more insight in how processes of resource allocation happen on different scales. Franks and Cleaver (2007: 304) define water governance *as "the system of actors, resources, mechanisms and processes which mediate society's access to water."* Governance processes have variable outcomes for different groups of people, and are hence inherently complex and political. Bakker (2010: 44) also defines governance as political: the process of decision making which is structured by institutions and shaped by ideological preferences. Linton (2001: 9) argues that the concept of the hydrosocial cycle has brought about an understanding of water *governance* - involving people, politics and relationships - instead of the technics of water *management*. In policy making, water is often assumed to be politically neutral and the issues around it to be solved with technical interventions. Tania Li (2007; in Bakker 2010: 40) describes the technical and neutral way of presenting water issues and policies as 'rendering technical'. A technical approach overlooks the fact that water is often deeply endowed with cultural practices and how its flow is determined by power relations, and that water is, in fact, a political good. Molle (2008) argues that policy discourses on water, for instance debates about privatization, are not neutral, but highly ideological. Hence, we should be careful in seeing water as a neutral resource and critical of policy interventions that assume this.

I understand institutions to be the patterns of behaviour and collective action that people undertake to organize access to water, but also the rules and norms that mediate these. They consist of sets of formal and informal rules and norms that shape interaction of humans with each other and with nature (Agrawal 1999, cited in Narain 2010b).[3] Institutions are context specific and play a role in establishing or reproducing social relations and inequities (Mosse 1997: 495). Hence, they should not automatically be seen as a solution for inequities in water access, as they themselves embody discourses of social inequities and power relations, and can thus reproduce social differences (Cleaver 2000). Cleaver (2002) argues that institutions are often not consciously crafted, but come about through processes of *bricolage*. He is critical of instrumental and robust views of institutions, and maintains that they come about through disorganized and subconscious processes. Institutions are deeply embedded in social structures and relations, and can be virtually invisible for an outsider. The relationship between individuals and institutions is dynamic, as agency can be employed in dealing with institutions. Just as identities are not singular and fixed, institutions are also fluid and dynamic, moreover they are complex and rooted in their context.

Another useful term in this context is community. This term is often used to denote some kind of homogeneous group. But this is a romanticized view in which internal conflicts, power disparities and processes of exclusion are often overlooked (Moretto 2006). Mehta (2001) warns that notions of 'user' and 'community' need to be de-homogenised to accommodate variations in terms of class, caste, gender and occupation. Along such lines, it can be identified which groups face difficulty in obtaining water access. However, such categorizations should be handled with care and not applied too rigidly, as they also have internal variations. Communities should not be seen as isolated islands, as they are based in and interact with wider political and geographic structures (Mosse 1997: 495). Cleaver (2000) argues that communities manage their common resources through institutions that are deeply embedded in social structures and history. These complex contexts should be taken into account in studying community practices.

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[3] This differs from organizations: more formal bodies with a specified common objective (Narain 2010b: 9).

1.3 Problem statement and research questions

Problem statement and research objectives

Several political ecologists formulate the need to further research and empirically substantiate processes of socio-environmental change and the associated resource distribution (e.g. Swyngedouw 2009b, Heynen et al. 2006, Truelove 2011). More insight is needed in how power relations determine the outcomes of such processes. If water is perceived as a political good, there is a need to further understand the workings of power for the allocation of water resources in the hydrosocial cycle. It is important to see which consequences these processes have at the level of people's daily experiences and water-related interactions. There is a need to understand how these interrelate with social identities and institutions and how these play a role in (re)producing inequities in water access at the micro-level.

As such experiences and situations vary between locations, it is interesting to see how these play out in specific contexts. My research is situated in a peri-urban context and aims to research how practices around drinking water access are affected by the changes that occur in such an environment. A changing context gives rise to new threats and opportunities and can affect patterns of inclusion and exclusion. The question is who can benefit from such processes and who is negatively affected by them. As much political ecology research has mainly focused on distribution of resources within the city, my research can add by providing insight into these areas, which can be seen as the frontiers of the city and the places where the effects of urbanization are both positively and negatively experienced.

This is scientifically interesting to research, but can serve a practical goal as well. Many groups in the global South face large challenges in obtaining (clean) drinking water. More knowledge on how water access is distributed and organized in specific localities can contribute to improve access for groups who currently face obstacles in obtaining this. As urbanization in the global South is an on-going process, more knowledge on how these processes play out in peri-urban areas is very relevant. In my study, I demonstrate how a technical and neutral approach to water issues by policy makers does not do justice to the issues it aims do address. An approach which 'renders technical' the issues of water access has a risk of ignoring the complex social relations of power which are crucial for creating inequities, and might even reproduce these. Greater understanding of the context and complexities of the hydrosocial cycle can lead to greater sustainability and inclusion in projects and policy for improving drinking water access.

Research questions

This problem statement leads to the following main research question:

How is drinking water access distributed in the peri-urban village of Sultanpur and how can inequities in this be explained?

By answering this question, I aim to unravel the complex social processes and interactions that constitute water access. Hereby, my research can contribute to generating sociological knowledge on access to resources and the accompanying power relations and patterns of social inequity and exclusion. As explained above, I selected a political ecology approach for doing this. This means that I will look at the role of power relations in creating inequitable access. I look at society and the environment as two mutually constituting parts of a collective, and will hence take both into account in my analysis, as well as the role of technology. In explaining along which lines inequities occur, I specifically look at the role of social identity and how this interrelates with inequities in drinking water access. In this process, I study how the existing inequities are being reproduced through the institutions and the daily interactions people in the village have with and about drinking water.

In order to thoroughly answer this question I formulated the following six sub-questions, which will be answered in the following chapters. Hereby, I hope to be able to provide a complete answer to the main research question.

- *Which water resources exist in Sultanpur and for which purposes are these used?*
- *Which institutions, organizations, infrastructure and technology exist for organizing drinking water access and how do these function?*
- *What is the burden of obtaining drinking water for users in terms of work-load, money and time-investment and who is responsible for this?*
- *How does the distribution of drinking water access interrelate with social identity?*
- *Which actors have power over distribution of drinking water access and how is this used?*
- *How are inequities in drinking water reproduced through daily interactions and institutions?*
- *Do villagers experience significant changes in water access due to processes of urbanization?*

1.4 Methodology

1.4.1 Research design

The study was designed as case-study, as this allows for thorough investigation of a phenomenon in its context (Green & Thorogood 2010). A case-study provides a detailed and intensive analysis of one or several cases (Bryman 2008: 49). Therefore, it is useful for acquiring a deep understanding of the processes going on in a certain place. The place where this study takes place is the peri-urban village of Sultanpur. Its aim is to not only explain the distribution and inequities in drinking water access, but also to understand the reasons and processes behind this. In this, it is important to take the specific geographical, hydrological and environmental context into account, as these are all of influence on determining where and how drinking water can be accessed. And for getting a true insight in processes of exclusion and inequities in drinking water access, social processes in the village are crucial to understand. Through prolonged and in-depth research, involving many interactions with the people of the village, a case-study allowed me with the ability to understand the situation in Sultanpur.

A desire for deeper understandings and in-depth knowledge, calls for a qualitative research methodology. Qualitative research is oriented on context and process and is focused on dealing with unstructured information (Bryman 2008: 23-24). The information required for this study is mainly unstructured: I aim to examine social processes of inclusion and exclusion, of organizing (obtaining, maintaining or losing) access, power relations and change processes. These processes cannot be easily mapped and understood in a quantitative study, as that would be focused on more structured and numerical information. Therefore, I found qualitative methods more appropriate to use. However, I did not exclude quantitative data completely from this research: numbers and statistics are of importance as well for understanding distribution of water access. Therefore, I also collected some quantitative data. In the research methods below, I will further specify which methods I used how and for which purpose.

The type of research design I apply does put limitations on generalizability of the results found (Bryman 2008: 51), as the results cannot be simply applied to other contexts. In this study though, generalizability is not the main purpose, as it aims to understand these phenomena in a specific context. But even though the results might not be seen as generalizable, the findings of my study can be of use in other cases as well. In the light of on-going processes of urbanization, providing insight in the processes going on in the village of Sultanpur can produce useful information for other peri-urban contexts. Moreover, this study provides a deeper understanding of processes of distribution of water access and the human interactions with this resource, which can be used for understanding processes of in- and exclusion in other places as well.

1.4.2 Scope and limitations of the research

For the case-study, I selected one village in peri-urban Gurgaon. This village is Sultanpur, which has a population of 5000 people and is located about 15 kilometres from the centre of Gurgaon. The village was selected in cooperation with my host-organization SaciWATERs, who have contacts and a history of research in several villages on the peri-urban fringes of Gurgaon. The four chief villages where this organization carries out their research were selected in a scoping study (see Narain 2010a). Because of the established contacts and the existing knowledge about these villages, it was convenient to select one of them for my research. Initially, my plan was to select two villages in peri-

urban Gurgaon and do fieldwork in both of these, so that a comparison could be made. However, time constraints limited me to investigating only one village. Moreover, the differences between the villages in the region did not seem to be so large that it would really add new perspectives to the study. Focusing on only one village allowed me with more time to build rapport with its inhabitants and carry out a thorough case-study. The village of Sultanpur was selected as it shows an interesting blend of traditional and modern characteristics. It is in many ways a typical Indian village, but the effects of encroaching urbanization start to become visible. It is home to a mixture of castes, and it also shows a diverse picture in terms of drinking water resources (both a piped network and groundwater supply are used; and public as well as private water resources are present). Also, easy accessibility and willingness of village authorities to welcome me into the village were important factors for its selection. A thorough introduction to the research site by the colleagues of SaciWATERs enabled me -as a foreign outsider- to access the village without difficulties.

Doing research in only one village enabled me to acquire in-depth knowledge and a thorough understanding of the place, people, and the processes going on. My interpreter and I were able to build rapport and to establish relations of trust with the people in the village. We were able to go back to the same people more than once, asking for additional information or cross-checking statements. In this period, we were able to speak to a broad range of people and learn about their experiences and opinions. Furthermore, we were around long enough to experience some critical events in the village, such as pipes and hand pumps breaking down and the beginning of a new pipeline construction project. Doing fieldwork in the heat of summer was not an easy task, but it did give me the opportunity to experience situations of water scarcity in the village. These situations provided me with insight in the villagers' water worries and their search for alternatives.

For this study, I conducted three months of fieldwork, in the period from April to July 2012, I visited the village 25 times. During these visits, I was supported by a local interpreter. The fieldwork period can roughly be divided in three phases: a first phase of broad orientation and getting acquainted with the village and its inhabitants; a second phase in which I focused on the specific (caste) communities and localities within the village, in order to learn more about their water access and vulnerabilities; and a final phase that consisted of fact checking and filling information gaps.

Limitations in doing research were posed by my role as (white) foreign researcher. This obviously attracted attention in the village, which made the situation less 'normal' than usual. However, as my stay lasted, I felt that the people had gotten used to my presence, and were less distracted from their daily activities and interactions. By respecting local traditions and keeping an open and flexible attitude, I tried to blend in as much as possible. My inability to speak the local language posed another limitation, which I overcame by using an experienced interpreter. However, even then, things can get 'lost in translation' and his presence and interpretations will have had an influence on the research results. My own perceptions and attitude on the research process and results should also not be forgotten. By being aware of this and keeping a critical and reflexive attitude (Bryman 2008: 500) in all stages of the
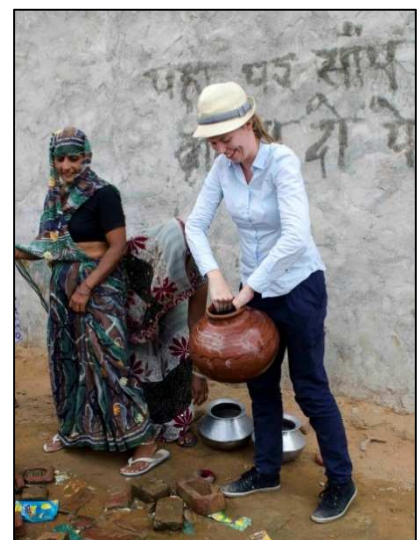
Picture 1.2: Conducting participatory observation

process, I hope to have mitigated these influences. Finally, the limited time span of the research and can be seen as a limitation. I was not able to experience any other season than summer, while that would have been interesting as well, in order to see the changes in the water situation. However, the hot and dry summer gives rise to water conflicts and scarcity; and is in that sense the most interesting time to visit. A more prolonged stay would also have enabled me to gain a greater understanding of the complex processes of peri-urban change going on. As an outsider, it is difficult to grasp these in such a short time-span. However, the aim of my study is to find out how these are experienced by the locals themselves; by discussing these issues with the villagers, I have acquired insight in what these processes mean for them.

1.4.3 Research Methods

In order to increase validity and reliability of the results, I used multiple research methods. This is in line with a triangulation approach: by using different methods or sources of data in research, the findings are more credible (Bryman 2008: 379). The approach makes this a mixed-method research, though most methods used are of qualitative nature, as I have mentioned above. The specific research methods used for this study are outlined below:

Participatory observation was an important method to gain insight in the field of research. This methods allows for the researcher to observe the relations, arrangements and interactions that take place (Bryman.: 286). It enabled me to see the villagers in their daily (water-related) routines and interactions. By keeping my eyes and ears open I was able to see the distances walked, the technology used, the amount of water carried around, etcetera. I specifically took into account those moments of the day in which the water rush was most visible (early morning and late afternoon) and made an effort to be present at these times, to see and experience the interactions at the main public water resources.

In order to acquire information from the village inhabitants about their water situation, *semi-structured interviews* were conducted. Semi-structured means that I conducted these interviews in an open and unstructured manner, without predetermined questions and answers. I listed the topics for discussion on a topic list, by which I ensured that the main topics were covered. Two versions of the topic lists used can be found in appendix 2 of this thesis. Most often, I did not even need to use this list, as the topics were all in my head. The subjects for discussion also came up during the interviews and the list was adapted during the fieldwork period, so I kept a flexible and inductive approach. Most interviews were recorded and I kept notes during the conversations; I transcribed these notes and recordings soon after the fieldwork. I coded and systematically analysed all interview transcripts with use of Excel and MaxQDA.

For deciding on whom to interview, I used a combination of convenience and snowball sampling (Bryman 2008: 100). With this type of sampling, one is led by the availability and through contacts with people in the field (idem: 304). I attempted to speak to as many different actors possible, in terms of age, gender, occupation and social status, to get a complete view on differences in water access in the villages. Also, in terms of type of water use and resources, I interviewed different people. I took both the household level and the individual level into account, as opinions and perceptions and ideas might differ between household members. For instance, I found ideas about how much time and effort is needed for fetching water from the public hand pump to be different between those who use the water and those who actually fetch the water. Altogether, I interviewed

many people and I was able to generate a broad perspective on the water situation and accessing practices and institutions in the village.

A couple of times, the opportunity presented itself of talk to a group of villagers. Specifically the times when the local women's self-help groups (SHG) held their monthly meetings, were useful for discussing issues with a group of village people. Also a couple of times, a group of men was found to be sitting together, and willing to discuss some issues with us. Though such meetings were not organized in advance, these opportunities did prove very useful for raising discussions and identifying core issues and problems in the village, and can therefore be regarded as *focus groups*. In the appendix, a list of these groups is included.

Apart from the bulk of interviews conducted among water users, I also interviewed some key actors several times. These key actors were identified as important stakeholders in organizing water provision in the village and were therefore very interesting to discuss issues with. These key actors included the village headman (*sarpanch*) and two local government officials of the Public Health Engineering Department (PHED) of Gurgaon – responsible for water supply to the village. Two other interviews with experts on water provision in the region were conducted as well, with scientists and NGO workers specialized in the topic of study. An overview of these interviews can also be found in the appendix. The expert knowledge available with the colleagues of SaciWATERs also formed a valuable source of information.

Other methods were used as well, in order to get a more complete picture of the water situation and context of Sultanpur. Documentary sources formed an important base of secondary data for this study. For this thesis, I also carried out a literature study, using both scientific and non-scientific resources (e.g. websites and newspapers). Village records and data available with SaciWATERs provided important additional information too. These form part of the quantitative data used in this study. I also attempted to collect some quantitative data from the field, in order to provide some statistical information which can be used for mapping the village drinking water situation. I acquired these data during the semi-structured interviews and afterwards extracted and edited them in such a way that they could be presented in this thesis. The quantity and quality of the data is not sufficient for carrying out a full statistical analysis, but I used them as an additional source of information and to support other research findings.

1.4.4 Population and sampling

In total, I conducted 75 interviews with water users, all members of different households, which amounts to a research population of 75 households. The village of Sultanpur has 5000 inhabitants and consists of 800 households, according to village records. Hence, a sample of 75 households attributes to almost 10% of the village population. I tried to achieve an equal balance of male and female perspectives in my research, in order to get both perspectives on the water situation and to get insight in the role of gender in water access and gender-specific experiences. The division of the gender of the interviewees in figure 1.1

Figure 1.1: Division of gender in sample

MIXED
7%

TOTAL MALE
45%

TOTAL FEMALE
48%
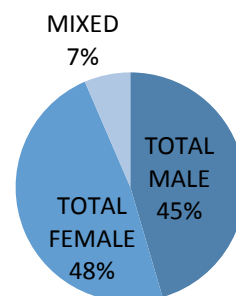
shows that an equal balance was indeed achieved. Sometimes, more than one person was present during the interviews, but in general, who was the main interviewee was very clear. In 5 cases, an interview was conducted with both a man and a woman (mainly married couples), which is indicated as 'mixed' in the chart. The households interviewed had an average size of 8 people and the range of household sizes was quite wide, varying from elderly couples to large joint families with up to 20 members.

As explained above, caste is an important factor in Indian social life and relations. It determines social status and influences power relations; hence it has in impact on water access as well. Therefore it is an important factor to include in the research. I made efforts to include all castes present in the village in the research sample, so that a representative stratified sample was achieved. In this, I did not succeed entirely, as two castes are not represented at all. However, 10 of 12 castes were included in the sample, so a relatively significant sample was taken. In table 1.1, an overview of the sample in relation to the village population can be seen. It is visible that most interviewees (39) belong to the predominant (higher) Rajput caste. I specifically targeted to include lower castes (Harijan, Balmik, Bawaria), in order to understand the consequences of their social position for drinking water access.

A complete list of all interviews with gender and caste of the main interviewee can be found in appendix 1. The four tables of interviewees show the difference between focus groups, key persons, experts and inhabitants of Sultanpur interviewed. Out of privacy considerations, interviewed persons are made anonymous. Names used in this thesis are aliases I made up, except for the experts I interviewed on behalf of their organization.

Table 1.1 Overview of caste included in sample

Caste	Interviewed	Total in village
RAJPUT	39	600
HARIJAN	9	40
BALMIK	5	12
BAWARIA	4	6
PANDIT	4	25
YADAV	2	50
NAAI	3	20
SAINI	3	20
KHATI	1	4
KUMHAAR	1	2
BHAT	0	15
BANIYA	0	5
CASTE UNKNOWN	6	0
	77	**799**

1.5 Structure of the thesis

In this first chapter I have introduced the contents and set-up of my research. The guiding problem statement and research questions have been introduced and the methodology of the research has been explained. Also, I have provided a literature overview of relevant theories and concepts. Based on the theoretical ideas of political ecology and with use of the concepts I described above, I now set out to further analyse social organization of drinking water access in peri-urban areas. The remainder of this thesis is structured as follows:

In the next chapter, I will provide a broad regional and policy background, by discussing urbanization processes in India and specifically for the city of Gurgaon. I will also shortly discuss water issues, debates and policies that are relevant for this region and my research.

Chapter 3 will give a description of the village of Sultanpur, where I conducted my fieldwork. It will give insight in some important spatial, demographic and political characteristics of the village. Also, I will describe the main environmental and hydrological features of the village and its environment, in order to understand the 'hydrological part' of the hydrosocial cycle. There will be specific attention for the peri-urban nature of this village and how this is experienced by its inhabitants.

The fourth chapter will further go into the 'water picture' of the village, discussing water needs and the available water resources. I elaborate on people's choices for using different water resources (supplied water and groundwater) for different purposes and show the narratives, beliefs and traditions involved in this. This chapter will give a broad overview of how access to drinking water is distributed in the village and will also go into the available technologies for obtaining water access.

In chapter 5 and 6 I will try to provide insight in the *why* of the distribution of water access. Which groups are excluded and along which lines? I will focus on the daily interactions villagers have with water and with each other about water. In these interactions, I show, some groups and individuals experience (subtle forms of) exclusion. This has everything to do with relations of power and dependency, in which I will also provide more insight. I will also discuss the role of village politics and institutions for organizing water access in processes of inclusion and exclusion. In chapter 5 I will analyse the workings of the water supply, and in chapter 6 I will go into groundwater practices. As clearly different dynamics and processes can be distinguished in people's interactions with these two resources, I choose to discuss this in two separate chapters.

Finally, chapter 7 forms the conclusion to the research. Here, I will revisit the main research question and discuss the research findings in relation to the literature. I will explain how inequitable water access are reproduced through institutions and interactions and how these are determined by power relations. I will argue that inequities and water access mutually constitute each other and that water cannot be seen apart from the (hydro)social context it is located in.

2 Regional background

In this chapter I will explain more about the background of my study. I will discuss the regional background of Sultanpur village, which is located near the city of Gurgaon, in the state of Haryana. Also I will shortly introduce the country of India, to provide some insight in its population and economy. Central to this regional background are processes of urbanization as well as water issues and policies in India, Haryana and Gurgaon. As India is experiencing increasing urbanization, peri-urban areas are becoming more significant. Gurgaon provides a clear example of rapid urbanization and the accompanying population, land and water pressures. Inadequate water provision proves to be a problem in this city. Groundwater depletion also forms an issue in this region. Hence, it forms an interesting area to research.

2.1 India, an urbanizing country

With a population of 1.2 billion, India is the second-most populous country in the world. It is home to a mixture of ethnicities and religions, of which Hinduism and the Islam are the most prevalent. The socialist state it formed after independence from the United Kingdom in 1947, was often regarded as a developing country, due to slow economic growth and the presence of large-scale poverty. In the past decades, this image has been changing. Due to market reforms and the opening up of the economy for foreign investments in the 1990s, the Indian economy has experienced fast growth. Even though economic data indicate a recent slow-down, the Indian economy currently finds itself in the top 10 countries in terms of nominal GDP and is part of the BRICS[4] (CIA 2012). These economic success stories do not mean that the country does not face challenges. A large part of its enormous population still lives in very poor circumstances and there are big disparities between rich and poor. India ranks 134th out of 187 countries in the UNDP Human Development Index (UNDP 2011), which shows that developmental issues remain. Social differences between castes and gender inequity are widespread in Indian society and the differences in income, lifestyles and opportunities vary widely between rural and urban areas. As explained in the literature overview, Indian society is structured and controlled by the caste system. Though officially abolished, the system still is 'in people's minds' and social status is still largely determined by birth.

Though many Indians regard their country as a rural place and an agriculture-based economy, this vision is changing. Urbanization is happening on a large scale, as is the case in many countries in the global South. Many rural dwellers are attracted to the city by the prospects of more opportunities and prosperity. According to national census (Government of India 2011), in 2001 28,5% of India's population was living in cities. In 2011, this number had grown to 31,2%. It is expected to grow further in the coming decades, with estimations going up to over 40% in 2030. With these numbers, India is still below global urbanization averages. However, due to the size of its population and the rate of urban growth, Indian cities are facing large challenges. Uncontrolled urban growth leads to typically urban issues of the global South, such as illegal (slum) settlements and problems in urban service provision, such as water supply. As I have explained in the literature overview, urbanization also leads to challenges for peri-urban areas, which experience significant environmental, institutional and social changes.

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[4] BRICS is an often-used acronym for indicating the leading emerging economies of this moment: Brazil, Russia, India, China and South-Africa.

2.2 Indian drinking water policy and issues

In India, the (federal) states are responsible for making water policy. That does not mean that the country's central government is not involved in this. They make policy-guidelines for the states, to which states can make their own adjustments. In the national policy, a prioritization of water allocation is included. Different uses of water are ranked in order of importance, which broadly boils down to drinking, agriculture and industrial purposes (Ministry of Water Resources 2002). Hence: *"Who needs the water most is decided top-down in a national guideline."*[5] The current policy was made in 2002, but a new national water policy is in the making. A draft of this has already been released and it is expected to become presented and adapted soon. The new policy is a hot topic of debate. Firstly, it proposes a shift of tasks and responsibilities between government actors, thereby giving the central state more control. This leads to opposition of the federal states who are unwilling to give up power to the nation state (Indian Water Review 2012). Secondly, water is labelled as a finite and scarce resource in the new policy. Thus, the focus is on recharging and saving water. Perceptions of water as a scarce resource also form the motivation for regarding water as an economic good. There is a focus on water pricing and water is seen as an input variable in the economy, which can be used for generating profits (Ministry of Water Resources 2012). This is controversial in a country where over 50% of the population is dependent upon agriculture for a living (CIA 2012). As industries are able to generate more profits with the same water input as agriculture, the move might lead to a shift in priorities away from agriculture. According to Matthew Gandy (2008: 118) *"Water politics in India is inextricably linked with the […] widening polarities in wealth between urban and rural areas."* And with on-going economic growth, more industrial demands on water can be expected. Now that the proposed new policy seems to benefit industry over agriculture, this might have large consequences for India's farmers (CSE 2012b).

The proposed new national water policy opens with the statement *"India has more than 17% of the world's population, but has only 4% of world's renewable water resources*."(Ministry of Water Resources 2012). India is struggling to manage its water resources in a sustainable way. Some areas of the vast country have to deal with yearly flooding, whereas other regions are suffering from drought. Characteristic of India's hydrology is its episodic nature, in which the yearly monsoons account for most of the precipitation (Gandy 2008: 126). Depletion of groundwater sources proves to be a nationwide issue and, as the proposed policy shows, there is fear of future water scarcity.

Drinking water provision is a problematic issue in all cities in India, according to a water expert of the Centre for Science and Environment I interviewed.[6] Though in most Indian cities a piped water supply network is in place, service is generally unreliable with water coming infrequently. Poor water infrastructure leads to leakage and contamination of the water. As cities are rapidly expanding, many peripheral areas are not (yet) connected to the public network. This causes inequities in supply. Though there are attempts to abolish this practice, groundwater extraction is (still) occurring on a large scale in many Indian cities (CSE 2012a). The insufficient workings of the public network are a major reason for on-going extraction of the resource. Large-scale Investments in India's water supply networks are needed for improvements. Sanitation and sewage disposal also forms a major challenge for India, where most of the sewage is released untreated into its surface waters, thereby forming a risk of contamination of these (ibid.).

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[5] Interview deputy programme manager water management, CSE New Delhi 05/07/12
[6] Ibid.

Table 2.1 provides an overview of the drinking water situation in India and Haryana and the differences between urban and rural areas. The table shows that most households in India have access to an improved water resource (i.e. protected from outside contamination). Significant improvements have been made in the past decades. According to UNICEF (2012), who use other data, 88% of the population had access to drinking water from improved sources in 2008, as compared to 68% in 1990. Haryana is doing relatively well, with access to improved drinking water sources well above national average. Still, the role of public taps and stand pipes should not be overseen. In Haryana, there is a clear difference between urban and rural areas; only 8,9% of urban households depend on such public water resources, in comparison with 27% of rural households. Many Indian households are not serviced by a piped water supply; only 50,7% of urban and 11,8% of rural households receive this. However, many more households have water access on their premises (respectively 70,5% and 42,15%), which points towards the role of groundwater. These households are likely to have access to groundwater on their premises, via a pump or well. This shows how groundwater still plays an important role in Indian drinking water provision, as 21,3% of urban and 53,2% of rural households are dependent upon tubewells or boreholes for drinking water. Also in Haryana, groundwater is a significant source of drinking water (with 27,6% and 36,9%).

Table 2.1: Drinking water data for India and Haryana (NFHS 2006)

	India		Haryana	
Source of drinking water	*Urban*	*Rural*	*Urban*	*Rural*
Improved sources:	95%	84,5%	98,6%	94,2%
- **Piped water into dwelling/yard**	50,7%	11,8%	62,1%	29,7%
- **Public tap / stand pipe**	20,3%	16,1%	8,9%	27,0%
- **Tubewell / borehole**	21,3%	53,2%	27,6%	36,9%
Non-improved sources	4,8%	15,4%	1,4%	5,8%
Time to obtain water (round trip)				
Water on premises	70,5%	42,1%	85,8%	50,8%
Less than 30 minutes	22,4%	43,3%	11,1%	27,0%
30 minutes or longer	6,9%	14,4%	3,1%	22,1%
Water treatment prior to drinking				
Boil	16%	7,7%	6,4%	1,1%
Strain through cloth	19,1%	15,4%	2,3%	2,0%
Ceramic, sand or other filter	13,4%	3,3%	7,0%	0,4%
Other treatment	0,5%	0,9%	5,6%	3,5%
No treatment	51%	72,7%	80,2%	93,1%
Person who usually collects water				
Adult female 15+	74,2%	82,7%	*	*
Adult male 15+	20,3%	10,7%	*	*
Female child -15	3,3%	4,7%	*	*
Male child -15	1,2%	1,1%	*	*

The numbers in table 2.1 also exemplify the role of women in drinking water provision in India. Women and girls are responsible for collecting water in 77,5% of urban households (which do not have a water source on their premises, as that would remove the burden of fetching water). This number is even higher in rural areas (87,4%) where the likelihood of having to fetch water from outside the house premises is greater. Hence, the burden of fetching drinking water lies on the shoulders of women. A final, striking, issue that the table presents, is the low occurrence of water treatment. Certainly in the state of Haryana, there is little habit of boiling or filtering the water obtained. This is interesting, as groundwater and tap-water are not automatically to be trusted. Other data confirm this, stating that 67% of Indian households do not treat their drinking water, even though it could be chemically or bacterially contaminated (UNICEF 2012).

2.3 Haryana and Gurgaon

Gurgaon provides an interesting example of urbanization in India. It has experienced rapid growth in the past decades in terms of size, population, industries and economics. Gurgaon is a city located in the North of India and belongs to the state of Haryana. It is situated 30 kilometres southwest of national capital New Delhi and belongs to the National Capital Region (NCR) that consists of New Delhi and four satellite cities.

Only a peasant village until the 1960s, economic development and population growth started after Gurgaon had been labelled one of Delhi's satellite cities in the Delhi master plan in 1962. This led to land speculation in the 1980s, with the government allowing private companies to purchase land. These companies started buying up vast amounts of land for developing residential projects. Economic growth took off with the liberalisation of the Indian economy in the 1990s. The Haryana state loosened control on the area's development and installed favourable tax policies, enabling the development of special economic zones (SEZs). This – and the favourable location near Delhi and the international airport – has attracted many foreign companies, which started opening outsourcing offices here. Now, Gurgaon is one of India's main outsourcing hubs. Characterized by

Figure 2.1: Haryana (red) and Gurgaon district (black) *(Source: Wikimedia 2012)*

modern high rise commercial and residential buildings, the city is often called India's 'Millennium City' (Sustainable Cities Collective 2011; Narain 2009).

The city has experienced heavy population growth. The 2011 census showed an increase of the population of Gurgaon district with 73.9% compared to 2001. The district now has over 1.5 million inhabitants with a population density of 1.241 people per square kilometre. With this number, Gurgaon accounts for almost 6% of Haryana's total population. Gurgaon district also comprises rural areas, in fact 31% of its population is rural (Government of India 2011). 291 villages, among which Sultanpur, are located in the district of Gurgaon. For all of the district, the city functions as main administrative and fiscal unit (Government of Haryana 2012a). Factors causing the city's rapid population growth are labour migration, attracted by Gurgaon's economic opportunities, and migration from Delhi, attracted by Gurgaon's housing possibilities. It is one of the richest cities in India, with the third highest per capita income of Indian cities (Business Today 2009).

The physical, economic and population growth of Gurgaon appeared to be ceaseless. In 2011, an article on India's Millennium City stated: *"The recently released Gurgaon 2021 Master Plan is in essence a template for further facilitating endless urban growth, for the benefit of those who can pay for it."* (Sustainable Cities Collective 2011). The 2012 Master Plan is depicted in figure 2.2. This plan included a large expansion towards the west of Gurgaon, around the highway to Jaipur and in the direction of Sultanpur village (which is marked with the black arrow on the map). Marked in pink on

the map is a new SEZ, where industrial and commercial development was planned. Reliance, a large private developer, bought 1384 acres (560 hectares) of land in the area around Sultanpur in 2007 with the aim of developing the SEZ (Times of India 2012b). However, no construction has taken place here so far. Recently, the Gurgaon Master Plan for 2031 has been released, and the SEZ is no longer included in this. The area is now partly designated for residential space and partly for agricultural land. In august 2012, the Times of India reported that the Haryana government has taken back the land purchased by Reliance, as it has failed to implement the proposed projects, due to financial troubles (Times of India 2012a). With this new plan, it seems that the urbanization ambitions of Gurgaon might be adjusted a bit. It will be interesting to see what types of development will actually take place in the area towards Sultanpur, as *"many lands have been sold to Reliance some years ago, they are now just lying there."*[7]
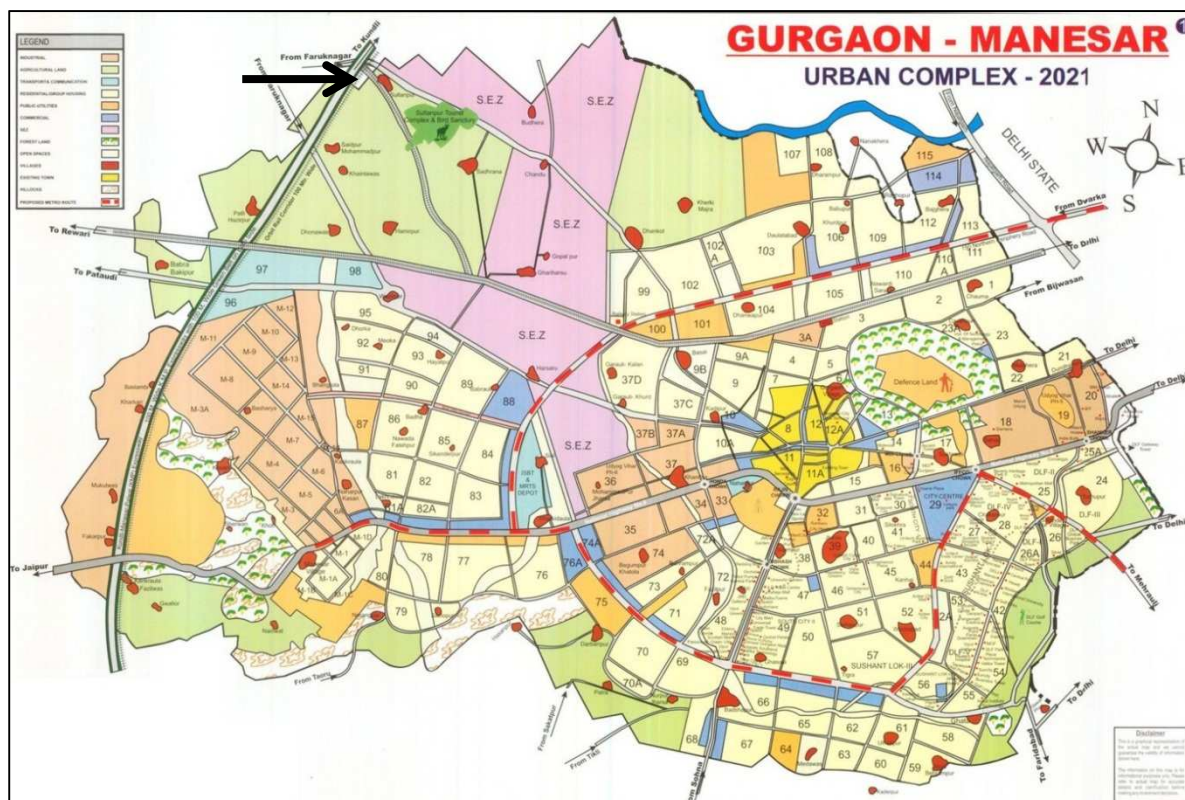
 Figure 2.2: Map of Gurgaon Masterplan 2021   *(Source: Gharshoppe 2012)*

Gurgaon's explosive growth over the past decades has not been without problems. The Millennium City's development happened in an uncontrolled manner. The many privately developed residential colonies are well developed up to the gates. The public areas however, are lagging behind. Public services like roads, local transport, electricity, sewage disposal and also water supply are not functioning well. The municipal government is struggling to keep up with rapid urbanization and to control private developments. During the time I stayed in Gurgaon, I noticed the city's growth problems in the form of bad roads and undeveloped public services. The occurrence of power cuts and problems with water supply increased during the summer. With its glitzy malls and high-rise office buildings, the city appears modern at first glance. A second look shows that there is much to be improved; basic service provision is lagging behind and city planning is struggling to keep up with

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[7] Interview 70 (27/06/12)

the pressures and challenges created by a growing population. A lack of city planning and the large role of private developers can be seen as causes, and Gurgaon's governance structure may also have contributed to this. The city belongs to and is governed by the state of Haryana, but is simultaneously part of the NCR. Due to its location on the fringes, in the south of Haryana, it is not considered a centre of the state, even though it is its largest city. A complaint I heard several times was that the state income is earned in Gurgaon, but spent in the state capital Chandigarh. Locally, the municipality of Gurgaon has jurisdiction over the old city and its surroundings, whereas the new settlements are governed by HUDA (the Haryana Urban Development Authority), who also govern other urban centres of Haryana.

The urbanization of Gurgaon area is also putting great pressures on water and land resources in the region. Some argue that Gurgaon had a chance to become a sustainable city, but failed to do so. The city is often regarded as a dusty concrete jungle that is dependent upon resources from outside and many of its water bodies and green areas have disappeared. Urbanization is disturbing the natural water cycle. Plots that were used for agriculture or nature, are subject to urban expansion. This is disturbing the renewal of water and declining groundwater levels (Narain 2010a: 5).

Picture 2.1 & 2.2: Skyline of Gurgaon

Gurgaon's public water supply is co-managed by HUDA and the Public Health Engineering Department (PHED). The PHED is responsible for the old town and its surroundings, the HUDA arranges for the new settlements and colonies. HUDA is responsible for all water treatment and provides bulk transfers of water to the PHED for their supply (CSE 2012a). Like most Indian cities, the water supply consists of surface water, which is filtered at one of the three treatment plants. The water comes from Yamuna river, north of Gurgaon, and is transported through a 60 kilometre long canal (ibid.). From there, a piped network distributes it to the different sectors. As the city's current water demand far exceeds its supply, there is a new plan to deliver more water to the city through a new NCR canal, from even further away (70 kilometres). According to municipal government estimates, the total amount of water required in the Gurgaon district is 184 million litres a day, while only 107 million litres is daily supplied, and this gap might be even larger in reality (ibid.). To currently meet the demand for water, groundwater is being extracted in Gurgaon at an alarming speed. Residential areas developed by large private investors, industrial areas, construction sites and shopping malls are largely dependent upon groundwater, and use this both legally and illegally. There are no data available on the amount of groundwater extracted illegally, but this is estimated to account for a large part of overall groundwater extraction (ibid.). Except from extracting

groundwater in the city, I observed another adaptation strategy to water scarcity: the use of water tankers bringing in groundwater from outside the city. These can easily be ordered by individuals and are a popular emergency solution to the shortcomings of the supply network. A final water-related issue in Gurgaon concerns poor sewage disposal and treatment, which causes pollution of water resources around the city.

Haryana is a dry state with an arid climate. Except during monsoon in July and August, precipitation is low. Monsoon provides the most important rainfall for agriculture and for recharge of water bodies. Gurgaon district has average annual rainfall figures of 596mm without much variation in the past decades. Climate studies have shown that extreme climatic events occur more often in the past two decades in Gurgaon (Singh et al. 2008, cited in Narain 2010a). Such extremes can lead to a decline in agricultural yields. This might have to do with the influence of urban expansion on local (micro)climatic conditions. Due to overall low precipitation, groundwater has always been an important source of water for drinking and irrigation in this region. The range of groundwater level varies widely across Haryana: from less than 1 metre below ground level up to over 68 metres below ground level. However, groundwater levels are declining all over the state. The soil has a relatively high level of salinity and there is a risk of fluoride in the groundwater, which can form a risk for contamination of groundwater (CGWB 2012). According to India's Central Groundwater Board, there is a relatively high level of overexploitation – average groundwater levels in the Gurgaon region vary from 10-40 metres below ground level (ibid. 2012). In the city of Gurgaon, these levels [of groundwater] are dropping even deeper and at a faster rate. A report of Haryana's Groundwater Cell has shown that groundwater levels have fallen by 36 metre to 60 metre between 2000 and 2010 in Gurgaon (Department of Agriculture Haryana 2010). This has led to attempts to further register and restrict groundwater extraction.

2.4 Conclusion: Gurgaon and its water footprint

This chapter has provided the geographical context of the research area of this study. For India, Haryana and Gurgaon, I have given a background and described the relevant water-related policies and issues. Economic growth and urbanization trends have caused the city of Gurgaon to grow tremendously over the last decades. Located in the state of Haryana and part of India's national capital region, Gurgaon can be considered an important economic centre and outsourcing hub. Gurgaon's rapid urbanization has created a large ecological footprint of the city, also in terms of water usage and pollution. For its public water supply, the city is using surface water from areas far away. This supply is insufficient to fulfil Gurgaon's water needs. Therefore, groundwater extraction is occurring on a large scale and groundwater from the region around the city is imported with water tankers. Due to extraction at large scale and high speed, groundwater levels are dropping quickly. Moreover, lack of a properly functioning sewage system is causing pollution of the city's water bodies. This unsustainable way of managing resources is bound to have its consequences in the future. Specifically the declining groundwater levels are affecting the possibilities for agriculture in the area around the city. Not only does groundwater become increasingly difficult to access, it is also at risk of becoming saline and thus unusable. These processes are threatening for drinking water resources in the region which, as this chapter has indicated, still consist for a significant part of groundwater.

The chapter has also provided more insight in drinking water access in India and Haryana. It appears that certainly in rural areas, many households do not have private water access (within the premises of the house). Hence, for many people, fetching drinking water is a daily reality. Overwhelmingly women are responsible for this task, which is important to take into account in thinking about drinking water access and social identity. Sultanpur village is located in the peri-urban zone around Gurgaon and is affected by its rapid development. The city does not appear to grow in the direction of the village as fast as was expected, due to the cancellation of the SEZ on this side. Because of this, there is still some physical (rural) space between the village and the city. However, Gurgaon's thirst for water and pollution of resources certainly have effects for the area around the village. It is interesting to see how, in the context of such developments, drinking water access is distributed and organized in the village of Sultanpur. This is what I set out to research in the next chapters of this thesis.

3 Sultanpur village

This chapter contains a description of the village of Sultanpur, the place where the case-study was conducted. It will provide an overview of the main spatial, demographic and political-organizational characteristics of the village. In this chapter I will also go into the environmental and hydrological features of Sultanpur, and the peri-urban characteristics of the village will be discussed.

3.1 Picture of the village

Located in the state of Haryana, Sultanpur is situated 15 kilometres southwest of Gurgaon. The village is situated directly on the highway towards the small town Farukh Nagar, 5 kilometres to the west of Sultanpur. It is surrounded by several other villages, like Jhanjrola Khera, Kaliawas and Iqbalpur. Historically, these other villages are all situated on the lands that originally belonged to Sultanpur, but they are independent settlements nowadays.[8] Adjacent to the village is the *Sultanpur Bird Sanctuary*, a small national park and popular bird-watching site. There is a railway line running through the village area, to which Sultanpur is also connected with a train station. On the map in figure 3.1 below, Sultanpur and the national park can be seen in relation to their location to Gurgaon. As explained in chapter 2, the city is likely to expand further in the direction of the village.
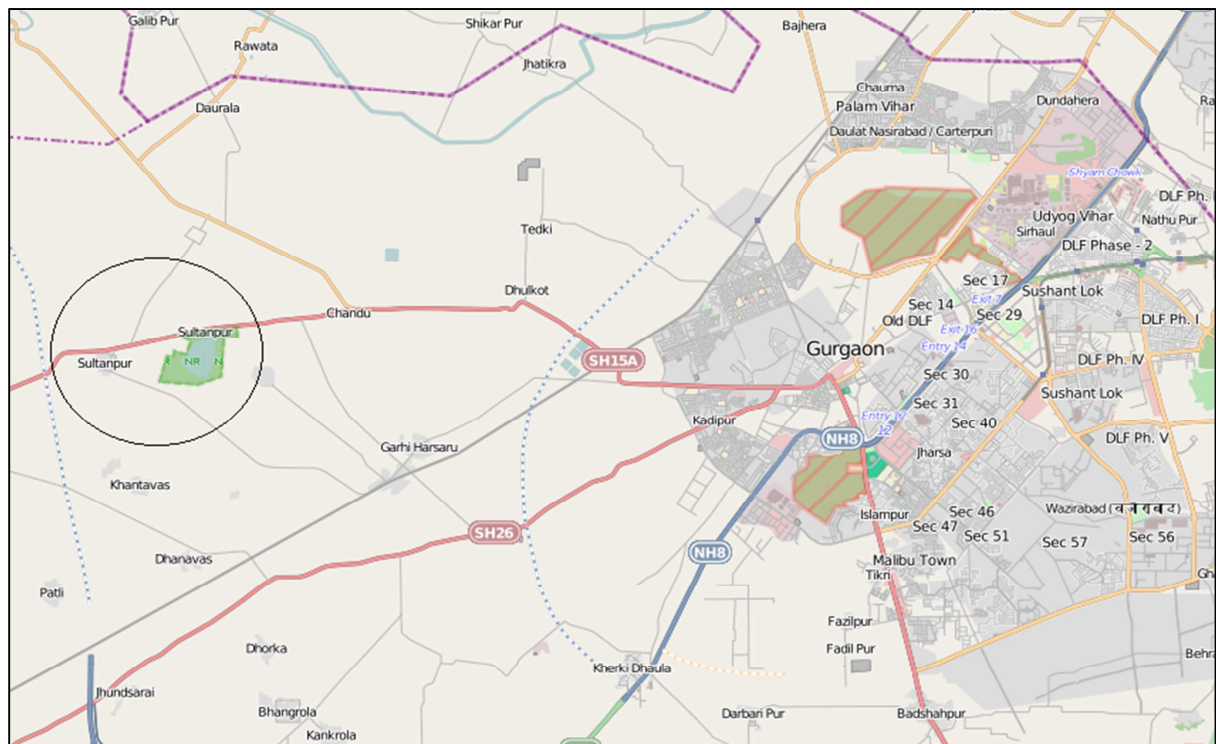
Figure 3.1: Sultanpur and the national park in relation to Gurgaon *(Source: OpenStreetMap 2012)*
On the satellite view in figure 3.2 (next page), one can see that Sultanpur has a more or less square form. The outside roads function as village boundaries. The northern highway and the southern railway line are important spatial characteristics. The main settlement area is located between the railway line and the highway. Most local shops and businesses can also be found at the entrance of the village from the highway. There is also some settlement towards the south of the railway line, which officially belongs to the village territory as well. The total size of village lands is 1775 hectares, of which 1623 is cultivable and 152 is non-cultivable (Ranjan & Narain 2012:2).

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[8] Personal note P. Ranjan, April 2012.

Figure 3.2: Satellite view of Sultanpur village *(Source: Google Maps 2012)*

Much of this terrain is sloping, the village itself is located on one of the higher hills. Several parts of the village are so-called 'panchayat-lands': communal lands owned by the village council.[9] Public services, such as hand pumps, old wells and a site for public meetings can often be found on such lands. Also most low-caste communities are settled here. They do not have landownership and have been appointed these lands to live on by the village council. This holds that they are allowed to build houses and live on these village grounds, but cannot own (and thus sell) these lands. These areas are mainly found on the outskirts of the village, the largest one is situated south of the railway line. As the lower caste groups are generally less well-off than other village inhabitants, these are quite poor and untidy areas. When walking through them, I noticed for instance that there was more dirt and sewage on the streets and the houses were smaller and of lesser quality.

According to village records[10], Sultanpur has about 5000 residents and 800 households (often consisting of large joint families). A variety of castes can be found in the village, of which table 3.1 (next page) gives an overview. Of the castes mentioned in the table, Harijan, Balmik and Bawaria are lower or scheduled castes. They traditionally have occupations as land labourer, in service of higher caste landlords, or menial jobs such as collecting sewage or swiping the streets. Rajput, Saini, Bhat and Pandit can be defined as higher castes. Of these, the Rajput are the most predominant group, consisting of 600 households. They are mostly landlords and have long been the rulers of the village (all Rajput I spoke to were land owners, though there was a large internal variety in size of land holdings in this group); this is why Sultanpur is often typified as a 'Rajput village'. The Pandit and Bhat belong to the Brahmin caste, traditionally the spiritual leaders and priests, but are also land

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[9] Interview sarpanch (30/05/12)
[10] Village records were accessed through contacts with SaciWATERs.

owners and working in other jobs now. Other groups have a social status somewhere in between and traditional professions like artisans, farmers or merchants.

Traditional divisions of labour are not so strongly visible anymore, members of all castes can be found working in jobs in the city for instance. Differences in social status and landownership do persist however. And though caste status does not determine personal wealth, higher caste members and landlords are generally better off than lower caste members without any land. All castes live closely together in the village, though some spatial segretation is visible. Several lower-caste areas can be distinguished: many Harijans live on the east-side within the village; the Bawaria reside on a hill in the west; and the village settlement south of the railway line also is a lower-caste area, where many Balmik and Harijan households live.

Table 3.1: Caste composition of Sultanpur

Caste	Number of households
Rajput	600
Yadav	50
Harijan	40
Pandit	20-25
Saini	20
Naai	20
Bhat	10-15
Balmik	10-12
Bawaria	6
Baniya	4-5
Khati	4
Kumhaar	2

In terms of employment, there are no village records available that give a comprehensive overview of this. My impression was inhabitants of the village are active in the agricultural sector, either as landowner, farmer or labourer. Another source of employment is owning or working in one of the village shops. Waged jobs, which are most often located in the city, are also an imported source of income. Having multiple sources of employment or income is not uncommon. Farming (or renting out land) is often combined with a job in the village or the city. Unfortunately, also no numbers on people's income or socioeconomic status of the village inhabitants are available. What I did see was a number of households *below poverty line* (BPL), this was marked on their houses. This means that they have an income below the BPL benchmark decided by the national government and they are entitled to food and fuel rations.

In the areas surrounding the village, I saw a lot of agriculture being conducted. Crops that are typically cultivated in this region are leafy vegetables, flowers, mustard and grains like wheat and barley. Depending on their affluence, landowners' family members work the land themselves or they have employ labourers. Land rights are mainly held by high castes and are passed on from father to son (daughters are excluded from this after they marry into another family), or can be attributed through purchasing land. Most landowners and labourers live in the village and work on their lands during the day. However, 200 households are situated in the farmlands surrounding the village, in so-called *dhaanis* (Ranjan & Narain 2012: 2). These are settlements of only a couple of households outside the village. Reasons to move here are availability of more space and water, or securing land, cattle and harvests. Cattle raising is also conducted, several farmers hold cows for dairy production. And almost every household that can afford it has one or several cows or buffaloes, used for dairy and agricultural work.

Picture 3.1: View over the village rooftops

3.2 Politics and organization

Like all Indian villages, Sultanpur is governed by the *Gram Panchayat*, or shortly: panchayat. This is an elected village council headed by the village headman or *Sarpanch.* Of all 5000 inhabitants of the village, 2200 are eligible to cast votes, according to village records. Historically, Sultanpur was divided in three *muhallas* (colonies) of 200 – 400 households. A more recent division of the village is into eleven wards, a division which mainly serves electoral purposes. Each ward has around 200 voting members (Ranjan & Narain 2012: 2). From each ward, a *panch* (representative) is elected. The sarpanch is elected separately, though in the same elections which are held once in five years. Together with and led by the sarpanch, the eleven panches form the panchayat. The current sarpanch is a male member of one of the Rajput clans. There are several female panches, but the majority of the panchayat are men. The panchayat is the primary unit of local government in the Indian administration, which is responsible for local administration and welfare. Providing local water supply and proper sanitation also fall under these responsibilities, as local health is a panchayat duty. The sarpanch has most executive and budgeting power, his actions should be controlled by the other panches (Ministry of Panchayati Raj 2012). Together with 291 other villages, Sultanpur falls in the district of Gurgaon which also functions as the main administrative and fiscal unit (Government of Haryana 2012a).

The service provider of public water provision to Sultanpur is the Public Health Engineering Department (PHED). This government department is located in Gurgaon and responsible for public water provision in the old city and the surrounding rural area with 60-70 villages located in this (the old municipal boundaries). The PHED is a state (i.e. Haryana, not India) government service provider (Government of Haryana 2012b). Together with the panchayat, it organizes public water provision in Sultanpur. The panchayat can make plans and requests to the PHED, which is the body to approve and carry out these.

As explained in chapter 2, HUDA is responsible for water provision in the newer (and larger) part of Gurgaon. This governing body is headed by the superintending engineer. HUDA is also responsible for managing the main water supply and treatment plants, where surface water is filtered to become drinking water. The PHED is dependent upon HUDA water supply for servicing their areas (CSE 2012a). Currently, there is only one water treatment plant in Gurgaon (the Basai treatment plant), a second one is being planned at Chandu Budhera village (CSE 2012a). The working district of the old-Gurgaon PHED office, headed by the executive engineer, is divided in several sub-districts, which are administered by the subdivisional engineers. The work in the field is carried out by the junior engineers, who each have their own responsibilities and working area. Apart from water supply, the PHED is also responsible for sanitation and sewage management (Government of Haryana 2012b). The PHED is not responsible for groundwater issues, which is the terrain of the soil department, who work on e.g. groundwater recharging projects, restoring wells and ponds and soil desalinization projects (Government of Haryana 2012b).

3.3 Water resources and infrastructure

3.3.1 PHED water supply

The PHED provides a public water supply to Sultanpur through a piped network since approximately eight years. Before this, all village dwellers were dependent on local (ground)water resources for drinking water. The PHED water is supplied to the village through two large reservoirs, located just outside of the village (on the northern side of the highway), with a capacity of 20.000 and 160.000 litres. These tanks are filled up from the Iqbalpur (a nearby village) water plant, which distributes water from the Gurgaon Water Supply Canal, which is supplied through one major underground (cement) pipeline. This is the same water as supplied in Gurgaon, consisting of treated surface water coming from the Yamuna river.

For supplying this water through the village, a piped network is in place. This consists of cement pipes, which are laid through the main streets of the village. From these pipes, households can be connected to the network by boring a hole in the pipe and sticking in a small plastic pipe leading to their home. When the network was constructed, this connecting was done by the PHED, but it can easily be done by people themselves, which now also occurs. I observed that none of the connections can be closed with a tap. The water supply is pumped through the village with use of an electric booster pump. It is supplied in alternate turns to different parts of the village, using a system of pipes and valves which divide the piped network in 7 different zones. This system is co-managed by the PHED & the panchayat. One inhabitant of the village is appointed by the panchayat for carrying out the daily task of opening and closing all the valves in turn, this operator reports to the sarpanch. The panchayat (and most often the sarpanch) functions as intermediary between the people in the village and the PHED, who are responsible for maintenance to the network . As per official government guidelines, village residents should receive 75 litres of water per head per day, according to PHED subdivisional engineer (vis-à-vis 135 litres per head per day for urban residents, and 50 litres per head per day for rural areas with tubewell based supply). In principle, the supply should run to each part of the village every other day for at least half an hour, according to the PHED officials and the sarpanch. The water cannot be supplied through the whole village every day, as the main supply to the village is not sufficient for this: water from the treatment plant usually comes only once in two days and is then in turns diverted to the different zones. The operator has to ensure that when not enough water is available for all of the village, the remaining zones will be the first to receive water supply when the tank has filled up again.

The quantity of water that Sultanpur receives is related to the total amount of water available for the Gurgaon district. As I have explained in chapter 2, this is not enough to fulfil all needs, let alone provide everyone with a constant supply. Hence, the village also feels the effects of this water supply shortage and has to manage with the however much is distributed to them. The fact that the urban authorities decide how much water is distributed to the village means that there is a dependency relation. It is the question which area is prioritized in times of water scarcity: the urban centre or the peri-urban fringes. To me, it did not appear that there were significant differences in the quality and quantity of water supply between the city and the village, as service was – in my view – quite poor in both areas. As the pumping of water to and through the village is done with use of an electric booster pump, power outages have their influence on the water supply. Electricity is also available on alternate days only, and thus limits the days that water can be distributed through the village. Not the whole of the village is served by the PHED supply: the settlement south of the railway line is

not served by the PHED supply, as there is no pipeline constructed under the railway. Also households outside the official village boundaries are not served by the supply, as they are located in area designated for agriculture and not for residential settlement, according to the sarpanch. The causes and effects of the exclusion from the water supply will be further discussed in chapter 5.

3.3.2 Groundwater resources

The other main water resource in Sultanpur is groundwater. This is the traditional drinking water resource and still much used for this purpose. In the past, groundwater for household purposes and drinking used to be extracted via (public) wells. Though these were still used a decade ago, they have all gone dry. The only way to access groundwater now is through boreholes in the ground, with use of motorized or hand pumps.

Salinity of the soil and groundwater is an important geological feature of the village. Many people told me that the British used to conduct salt mining in Sultanpur, in colonial times. For this purpose, the railway line was also constructed in the 19th century. Though this practice has long been abandoned and moved to other (cheaper) places, the salinity of the soil has not changed and is an important influence on the quality of groundwater. As explained in chapter 2, throughout the region, groundwater tables are falling. According to the PHED executive engineer, the groundwater used to be at a depth of 18-20 metres below ground level in 1985, but is in some places down to more than 35 metres bgl, and declining with 1,5 metre every year. Local overexploitation and a decline in rainfall are seen as the causes of this process. The massive exploitation of groundwater in Gurgaon city poses a threat to the village, as this accelerates the decline of its levels in the region. Groundwater is used for different purposes: for drinking and household chores, but also for agriculture and construction work. Increasing salinity causes problems: saline water is not potable and affects other purposes as well. Flowers and leafy vegetables require ample irrigation and cannot be cultivated with saline water. Other crops, such as mustard, wheat and barley can also be grown on dryer lands and with slightly saline water. For construction, sweet water is needed for mixing the cement, which corrodes if saline water is used.

Groundwater is publicly accessible through hand pumps installed by the panchayat, of which there are 12 in Sultanpur. These are accessible for everyone and free of charge. The pumps are owned, managed and maintained by the panchayat, not the PHED. These hand pumps are placed on public lands, where the public wells used to be in the past. Not all of these hand pumps provide sweet water. For drinking water, 6 or 7 hand pumps in the village are most often used, as they provide the sweetest water. Privately, groundwater can be accessed as well, as landowners have the right to extract water from their land under Indian law. However, for installing a private well or pump, registration is needed nowadays. This regulation has been put in place for agricultural and industrial tubewells and might soon be applied to domestic groundwater access too, in order to control groundwater extraction, in line with new Indian water policies. It is difficult to check to what extent people actually do this and how this is being controlled by the authorities. At least it seems that it is necessary for getting an electricity connection installed, hence electric pumps are generally registered. Differences between public and private groundwater access and how this is distributed between households and groups will be further discussed in chapters 4 and 6 below.

3.4 A peri-urban environment

The village of Sultanpur is not a standalone island. It is located in and interacts with a wider environment. As explained in chapter 2, Gurgaon has seen enormous urban growth in the past decades, becoming one of India's main outsourcing hubs. This growth has also influenced Sultanpur village and its surrounding. Plans for further city expansion in the western direction will mean that the village will be located even closer to the city borders in the near future.

Currently, the first border of the encroaching city is located at 12 kilometres, which takes about 15 minutes to drive. However, close to the village the influences of urbanization are also visible: the relatively new and good-quality highway from Gurgaon to Farukh-Nagar is a clear sign of this. Also the expanding number of schools, institutes and hospitals mark the proximity of the city. Not a lot of industry can be found in this area yet, though this might change in the future. Plots of land are offered for sale and purchased for farmhouses (rural holiday homes for rich urbanites) of urban dwellers or large construction projects of developing companies and by the government. Many signs on the side of the road and advertisements in newspapers mark the activity of real estate agents in the area. Villagers told me that land prices have been rising in Sultanpur and its surroundings because of these projects. Several years ago, the company Reliance bought land around Sultanpur for the development of the SEZ, which caused a rise in land prices. However, no construction has happened here and the project has been cancelled (see chapter 2). It seems that urbanization might not reach this place as soon as expected, as the government of Haryana has purchased the lands back and designated them for residential and agricultural purposes.

In the 1970s, the Indian national government purchased 350 acres (142 ha) of land near Sultanpur for establishing a bird sanctuary. This place, where bird watchers come to spot a wide range of (migratory) bird species, was upgraded to national park status in 1989. The park is owned and managed by the government of Haryana, who also exploit it for tourism. The area has a size of 140 hectares and is surrounded by a wall and fences. It borders parts of Sultanpur's agricultural lands and is located at a distance of 1 kilometre from the village (Birding in India 2012). The bird sanctuary was established here because it was such a water rich place. This situation has changed: with the general decline of groundwater tables and increasing salinization of the soil, the land is less fertile and dryer than before. For extra irrigation of the national park, water used to be extracted from bore wells. However, since levels of fluoride were encountered in the soil and the water, groundwater is no longer used for this nowadays. In order to prevent the park's lake, which attracts the bird population, from drying up, the national park is currently irrigated with water from the PHED household water supply, the subdivisional engineer of the PHED explained. This is the same water as is delivered to Sultanpur. In fact, the smaller of the two village water tanks is designated for supply to the national park. Due to the decline of water levels the park is going dry and attracting less birds. The future viability of a national park dependent on outside water supply is unclear. The presence of the park does affect the terrains around it though: there are building restrictions to protect the environment of this area. These hold that within a radius of 3 kilometres no new construction is allowed and within 10 kilometres, no (polluting) industries are allowed. Because of this, the national park might form an obstacle for building projects and further urbanization.

Agriculture is one of the main income generating activities in Sultanpur. It used to be a 'typically rural' village where most people were working as farmer or land labourer. This has changed with increasing levels of education and more and more people working in the city. People from Sultanpur

are working both in Delhi and Gurgaon; this has already been happening for a long time, also when Gurgaon was not yet a significant city. However, many people still rely on agriculture for income and food generation. The changes in groundwater quality have their effect on agricultural practices: the increasing salinity limits farmers in the options of crops they can grow. Instead of preferred and more profitable cultivation of leafy vegetables and flowers, they have to switch to growing grains and mustard. If salinity further increases, it will be impossible to grow these crops as well. These developments have consequences for land use. Land prices of plots with sweet water access are higher, both outside and within the village. Some farmers are selling (or considering to sell) their land and moving to live in the village. One farmer I asked about this told me: *"We could use the money well, farming is no more a lucrative business, it is difficult to make a living out of it. We will sell when we really need the money"*.[11] It seems that agriculture is losing popularity, as many farmers do not see a sustainable future in their occupation.

The growth of Gurgaon is by many villagers seen as an opportunity, as it creates jobs and business opportunities, and it might lead to development of the village. The rise in land prices creates opportunities for landowners, by selling their lands they can make large profits. However, for land labourers this poses threats, as they are dependent for their income upon agriculture. With the option of selling land, peri-urbanization creates new inequities: *"Landlords around here have money, because they have land. They own so much that if they sell only one piece, they can feed many generations with that. My family does not have any land, so we can't make such money",* a member of the Naai community complained to me.[12] The effects of land sales are visible in the village: several landlords are able to afford large *pucca* houses and drive around in big cars. An elderly couple living in a traditional house told me: *"The village has grown quite a lot around here. Earlier, everyone used to have houses like ours, made of mud and straw, but now many more have concrete houses, as they got money from selling land or getting retired. We haven't got land or government jobs, so we cannot build things like this."*[13] Some general improvements to the village have been made in the past years: parts of the main roads have been paved and the water supply network has been installed. Many villagers have hopes that when large-scale private development will start happening near Sultanpur, local infrastructure for water provision and electricity will be further improved. It seemed like this would happen with the construction of the Reliance SEZ, but now that this is cancelled, the future plans for the area remain unclear. The presence of the bird sanctuary might prove to be an obstacle in this, as it poses restrictions to the type of development possible.

Though these are examples of urban influences, inhabitants regard their village still as a rural place. The land around Sultanpur is still largely agricultural, and selling off land to private investors is not happening on a large scale. 'Village life' is regarded by many as better than urban life: it is perceived as more natural, cleaner and healthier. Urbanization might form a threat to this, with air and water pollution as possible problems. Another change that I heard many elderly villagers complain about is the erosion of traditions. An elderly (Saini) lady told me that people are becoming more individualistic, and that the feeling of community, which used to provide a sort of social security is disappearing.[14] The youth wants to live like the 'city folk' and has no respect for traditions anymore.

[11] Interview 62 (08/06/12)
[12] Interview 50 (30/05/12)
[13] Interview 33 (16/05/12)
[14] Interview 37 (18/05/12)

3.5 Conclusion: between rural and urban

In this chapter I have described the research area of my case study, Sultanpur village, by providing an overview of its main spatial, demographic, political and environmental characteristics. It has become clear that Sultanpur is a peri-urban village: though it is currently still regarded as a rural place by most of its inhabitants, interactions with and influences of the city are clearly visible.

Gurgaon's growth has consequences for water access in the village. As mentioned before, for its public water supply, Sultanpur is dependent upon Gurgaon (authorities), which might lead to competition with the city when water scarcity increases. However, Sultanpur can also benefit from its relation with the PHED, which is a governing body from Gurgaon. After all, the public supply that is in place now was installed 8 years ago, and new projects can lead to further improvements. Declining groundwater levels and accompanying salinization of resources are a serious issue in the region, affecting both household water access and agriculture. This decline is not only caused by Gurgaon's massive extraction of groundwater – local extraction practices also play a role in this –, but it does contribute to the declining levels. If groundwater extraction in the region is not reduced soon, many water resources are under serious threat for the near future.

In general, changes in land use and work opportunities in the city are likely to have mixed effects: not everyone will be able to benefit from these, and (social and economic) differences within the village might increase. Those who have assets such as money or land will be able to benefit from new opportunities and are able to cope with threats posed by urbanization. But less well-off people might face more difficulties in the future, as coping with (water) problems might become a costly matter. This can lead to new inequities, also in water access. With an expanding and encroaching city and its continuing need for resources, Sultanpur is bound to feel the effects of urbanization to a larger extent in the future, though it is difficult to predict how. As one villager put it: *"Currently this is a peaceful rural area, but it is changing quickly, maybe it will turn into a city in 20 years or so."*[15]

Picture 3.2 - 3.4: Spatial features of Sultanpur village – the railway line, the highway and the fields

[15] Interview 5(25/04/12)

4 The water picture: drinking water needs, resources and technologies

In this chapter, I will show how drinking water access is distributed in Sultanpur. First, I will provide insight in the water needs in the village, the water resources available and the purposes these are used for. After that, I will elaborate on perceived quality and quantity of the main water resources: supplied water and groundwater. Also, I will discuss the use of technology for accessing both of these resources, hereby showing the different stages involved in obtaining water access. With this, I aim to provide a coherent picture of the current water situation in the village and the complexities involved in obtaining water access. Also, I will demonstrate how water users make motivated choices when it comes to drinking water access, as not just any resource is considered suitable for drinking.

4.1 Water needs and resources

4.1.1 Water needs

Water needs differ per household and largely depend on household size. The size of households in Sultanpur varies widely, from couples forming a household of two people, to joint families with up to twenty members. On average, the interviewed households consisted of eight members. When I asked how much drinking water they needed on a daily basis, the average of all household estimates was three *matkas*. Matkas are the large earthen pots traditionally used to store water in. Generally, they contain 15 to 20 litres of water. This means that the daily drinking water need of an average household in Sultanpur amounts to 45-50 litres per day. Smaller households get by on only one matka (15 litres) a day, large families can need up to 90 litres a day. This is the need for potable water only, which is not used for household chores and other activities. The amount of potable water used might seem higher than what is to be expected of water used for drinking only. The water is used for drinking, but also for cooking and making tea. Water gets wasted in processes of fetching, carrying and storing water; and I observed that after a certain conservation time, usually a day, the water is considered 'old' and thrown away. Most people fetch water twice a day, in order to always have relatively fresh water.

When I asked for the needs for all water used in the household, taking other purposes than only drinking into account as well, I found that much more water is needed. Though I did not research this systematically, I can provide some examples: a man with a household of 6 members and 2 buffalos for instance, estimated the total water use at 200-400 litres per day. A similar sized household, also with some cattle, estimated their water use at 20 pots a day, which amounts to 300 litres in total. This water is used for drinking and cooking, but also for bathing, household chores and for the cattle. Apart from the household size, the number of cattle and physical size of the house influence the total amount of water needed per household. Water used for non-household purposes, such as agriculture, industry and construction work is not central to this research, but I did take these water uses into account whenever I found them to be of influence on drinking water access. The distinction between drinking and other water is clearly made by the water users. This has a lot to do with the available sources of water in the village, and their (perceived) quality. Some sources are deemed clean enough for drinking, whereas others are only used for other purposes, such as cleaning and bathing. Personal taste also influences the decision of which water is suitable for drinking. On matters of water quality, I will elaborate further below.

4.1.2 Water sources

As I explained in chapter 3, the main drinking water sources in Sultanpur are groundwater and the water that is distributed through the village by a piped network, organized by the PHED government department. Not every household in the village is connected to the PHED supply. Table 4.1 shows that of the households interviewed; almost 30% are not connected to the piped network. Reasons for this are that those households are located on places where the network does not reach, e.g. beyond village boundaries or out in the fields. In some places, a connection to the network should technically be possible, but it was stated that the water did not reach those places, for instance because of elevated terrains. The total number of households in the village that is not connected to the network is probably below 30%. These households are slightly overrepresented in the research sample because I focused specifically on these areas in my research. I found these interesting areas to examine, because the fact households here are not connected to the formal supply network causes that they have to look for alternative ways of finding water access.

Table 4.1: Number of households connected to piped public water supply (PHED supply)

	Number	Percentage
Connected	54 households	70,1%
Not connected	23 households	29,9%
Total	77 households	100,0%

The fact that 70% of the household sample has a connection to the piped network, does not mean that the water supplied is also the main source of drinking water for them. As can be seen in table 4.2, the picture is in reality quite different. Most households (74%) depend on groundwater for their drinking water needs. Only 14% of households rely on only the supplied water and 10,4% use a mix of both. Looking at these numbers, it becomes clear that many inhabitants of Sultanpur prefer groundwater over the supplied water for drinking. This is interesting, because even if households have a water supply coming to their house – which is very easily accessible, they opt for dinking groundwater, which has to be obtained separately. Of all 54 households connected to the supply, only 11 (20,8%) use it as their main drinking water source, and another 8 (14,8%) use it mixed with groundwater. This amounts to a total of 19 people, or 35,2% of the connected households. The reasons for this can be found in the quality and quantity of the supplied water. Only one household indicated to use another source for their regular drinking water supply: ordering water tankers.[16] It concerned an affluent and large joint family, which was able to pay 500 INR for a tanker to fill up their underground tank on a regular basis. This option is too costly for most other households.

Table 4.2: Main drinking water source per household

Main drinking water source	Number	Percentage
Supplied water	11 households	14,3%
Groundwater	57 households	74,0%
Both supplied & groundwater	8 households	10,4%
Tanker	1 household	1,3%
Total	77 households	100,0%

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[16] Interview 24 (07/05/12)

4.2 Supplied water

4.2.1 Perceptions of quality

When it comes to drinking water, quality is very important. In Sultanpur, I found the awareness of water quality is very high: only water that is perceived clean and healthy is used for drinking. There are large differences between households in perceptions of water quality. This was also visible in the numbers presented in tables 4.1 and 4.2 above: though 70% of households is connected to water supply, only 24% chooses to use this water for drinking. Most households indicated to prefer groundwater for drinking, as they do not trust the quality of the water supply. When I asked people why they do not trust the supplied water's quality, I found that it is generally considered to be not clean enough for drinking. Many people stated that they often find dirt and mud in the water. Also it was mentioned several times that if the water is left still for a while, larvae or worms start to develop (although I have never actually seen this). The general opinion about the quality of the water supply is well reflected in this quote of a landlord I spoke to: *"We do not trust to drink the water supply, it comes from an open river, people defecate in it, throw dead bodies and waste in it. Whatever we do, it will not get clean, it won't get out of our mind. The groundwater is much more to be trusted."*[17] I found that different ideas exist on what causes insufficient water quality:

- The water is not filtered well: it is filtered only through gravel (natural process) and no chemicals are added to kill all germs and diseases in the water.
- The source of the water supply is surface water, it comes from a river which is polluted with garbage and sewage, and which is used as a cremation site.
- Breakages in the cement pipes that supply the water cause dirt and sewage to seep in.

Many people are afraid that they will get sick of the water, and will not drink it even after boiling it. An elderly man stated: "*The water is very unhealthy; I get boils on my body from drinking it.*"[18] A mother of four told me that her children used to get diarrhoea often, until her doctor advised against drinking the supplied water.[19] I found that the people of Sultanpur are traditionally used to drinking groundwater, and therefore many prefer to fetch their own drinking water from a hand pump than to drink from the supply which they do not fully trust.

Nonetheless, according to PHED officials the water quality should be sufficient for drinking. They argue that has been tested and certified at the water plant from which it is provided. The responsible subdivisional engineer of the PHED also stated that chlorine and other chemicals are added to the water.[20] This contradicts the many stories of an improper filtration process which are being told in the village. I was not able to find official information or documents on the PHED's filtering system and water treatment to confirm or discard these contradicting stories. An expert on water policy and provision in Gurgaon and Delhi also held the opinion that the water supplied is in principle of reasonable quality. He considered the poor quality of the piped network to be the cause of contaminations, because dirt and sewage can seep in through breakages in the cement pipes of the supply network.[21] The PHED officials agreed with this, they believed that the only possible cause

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[17] Interview 32 (16/05/12)
[18] Focus group 3 (11/06/12)
[19] Interview 12 (30/04/12)
[20] Interview subdivisional engineer PHED (31/05/12)
[21] Interview deputy programme manager water management, CSE New Delhi (05/07/12)

of water contamination was to be found in the transport of water to and within the village.[22] No official public water testing has ever been conducted in Sultanpur, in order to establish more objective knowledge. The lack of information causes many different stories to be told about the supplied water quality.

Despite the widespread mistrust of water quality, 24% of the people I interviewed chooses to use the water for drinking (either as primary source or mixed with groundwater, see table 4.2). A member of the village government stated that he drinks the water without filtering and can uses it easily for 10 days in a row. In his view, local beliefs on water quality are not true: "*The water is fine, people here are just superstitious*"[23] And even for the people who depend on groundwater for drinking, the supplied water is important as a household water source. Many people indicated that having a water supply in their house is valuable for doing household chores, bathing and for keeping cattle. It alleviates the use of groundwater and, for those who do not have private groundwater access, reduces the amount of physical labour involved in water fetching. A lot of people also indicated that they would very much like to see the water quality improved so that they are be able to drink it, and are less dependent on groundwater.

The situation illustrated in this paragraph shows how influential the role of perceptions and narratives is in the choices made on which water resource to use for which purpose. Certainly when it comes to drinking water, people are cautious and aware of quality issues, because of the relation to their health and body. They take care in selecting water for this and take into account the stories told. The wide-spread mistrust of supplied water quality is constantly reproduced and confirmed by the stories told in the village and the ensuing water practices. Significant is the difference with the official narratives of the government and experts, that the water is of sufficient quality for drinking. The discrepancy between these official stories and water users' practices in reality, shows how personal perceptions and local discourses are more influential on deciding upon which water source to use. does not matter. The quotes used in this paragraph show how 'what is in people's minds' is more important in determining people's behaviour than what is the 'truth' about water quality.

4.2.2 Quantity of water supplied
As stated before, the average amount of drinking water used is 45 litres per household per day (with an average household size of 8 members). Much more water is needed to fulfil all household needs, and most of the supplied water is used for doing household chores. This makes the supplied water an important water source, and therefore water quantity is another vital issue. There are many complaints about the water supply being insufficient. In principle, it comes on alternate days and serves the different parts of the village separately. Because of this situation, every household has to fill up pots, drums or tanks and store the water for some days. In principle the supply should come for half an hour to each part of the village. In practice, this varies from 15 to 45 minutes; to most households it comes for about 20-30 minutes at a time. Many people told me that this amount is not sufficient to fulfil all household needs. It is difficult to establish how much water is supplied to the houses in the village. Some households are able to fill up a tank of 200 litres in one time; others can hardly fill up a 70 litre drum at a time. There is a lot of variety between households, and the amount supplied can differ from one time to the next.

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[22] Interview subdivisional engineer PHED (31/05/12)
[23] Interview 2 (25/04/12)

This variety in quantity of water received has several causes; one being that the division of the supply within the village is manually operated by an operator who has to do this in between his other jobs. As the whole system is dependent upon his work, this makes it vulnerable to human errors and manipulation. Another cause is that the supply is dependent upon electricity (for pumping it through the village). As electricity is very erratic this affects the supply too, especially in summers there are frequent power outages. Because electricity comes to the village on alternate days, supplying water is also possible on alternate days only. Moreover, the village is dependent upon the amount of water the PHED lets into the main tank. In times of scarcity or when technical problems occur, this might be less than normal. This actually happened when one main pump was broken at the water plant, leading to a smaller amount of water being supplied to the village than usual. Many people in the village complained that they receive less water than usual throughout the summer. According to the PHED subdivisional engineer this was not the case, the PHED let the same quantity of water as usual to the village. However, he stated, because of the summer, the water usage increases dramatically.[24] This makes that there is less water to share amongst each other and people perceive more scarcity. The man who operates the valves stated that the PHED often does not supply enough water to the main tank for supplying all 7 zones, he can only supply 4 or 5 on some days.[25] Ideally, many people said, the water should come every day for at least half an hour.

Apart from the supply coming too shortly, there are also complaints about its flow. Due to power outages, the flow can be erratic. Moreover, it reaches places which are farther away from the main tank or located on or behind a slope with less flow. The supply does not come with sufficient force to reach these places. Because of this, some households in the village have placed a motor or manual pump, to pull the supply up to their houses. This widespread practice affects those who do not use extra methods for pulling up water: less water comes to their houses, with even lower pressure. The fact that no one in the village has installed a tap on their supply also contributes to the fact that water does not reach the more remote places. Because of this, the water keeps on flowing through all connections at the same time when the supply comes. If people would be able to close the supply after having filled their storages, the remaining water would be able to reach farther. Not only can this help in distributing the water more evenly, it can also be a way to combat wastage according to PHED engineers.[26] As the supply does not come on fixed timings, it occurs that people are not there to notice the water coming and it flows away. To avoid this, many have their supply leading directly into a tank. Others make sure that someone is always at home to watch the water when they expect it to come. Many people indicated that they find it bothersome that there are no fixed timings: it keeps them waiting until they can fill up their tanks and carry out their chores.

Very few people in the village are satisfied with the quantity of the supplied water. A lady explained me the difficulty of the situation: "*We don't even have water for bathing sometimes, because there is no water for 6-7 days. This happens often, not only when there is no electricity. Sometimes we just put the clothes in water and soap and then wait some days till there is water to rinse them.*"[27] Issues of water quantity are even more salient for large households, as they have to share a similar amount of water with even more people. A mother of five children told me about her struggles to manage

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[24] Interview subdivisional engineer PHED (04/07/12)
[25] Interview 73 (29/06/12)
[26] Interview executive engineer PHED (31/05/12)
[27] Interview 36 (18/05/12)

the household with the available water: "*We get the PHED supply, but it is very erratic and not enough. There is very little water that comes, only when there is a surplus it is that we can all bathe and was utensils etcetera.*"[28] The village headman admitted that the supply is not sufficient for fulfilling all household needs, and said that the use of tubewells remains necessary.[29] Hence, dependency on groundwater is still high in Sultanpur.

4.2.3 Technology used

Several types of technology are included in obtaining water from the supply network. In order to get an understanding of the different technologies used and their specific role, I will provide a short overview of this. A distinction can be made between the technologies of the network (supplied by the PHED) and the household technologies used to improve individual quality or quantity of water access. Everyone who wants to take a connection to the water supply has to place a pipe for leading it from the main pipeline to the home, which are generally made of plastic. As explained before, the water supply does not reach many places in the village with equal force. In order to improve the quantity of water reaching the home, several methods are used by villagers:

- At least 10 of the interviewed households use *motors* for pulling water supply to their house. Otherwise, they told me, the water does not reach their house at all. Most of these are electric motors, some are powered by fuel; both of these inputs bring additional costs.
- Some households use *tool pumps,* a manual device for pulling the water up, which works like a hand pump and can be placed on the pipes from which the supply is taken. This method also works when there is no electricity and is often used as a back-up for motors.

Picture 4.1: Tool pump used for pulling water

Picture 4.2: Plastic pipe used for connecting to water supply

Picture 4.3: Motor used for pulling water

As there is a large mistrust of the quality of the supplied water, many people employ filtration methods before drinking it or using it for other purposes. I encountered several methods used for this, of which some were also used for filtering groundwater.

- The traditional and cheapest method of filtration is to strain the water through cloth. While this does filter sand and dirt out of the water, bacteria cannot be removed with this. Boiling water before drinking is safer, but I did not see this method employed in the village. What most people do is leave the water still for a while, so that sand and dirt settle at the bottom.

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[28] Interview 59 (06/06/12)
[29] Interview sarpanch (23/04/12)

- A newer, safer, but more costly method is *reverse osmosis* (RO). With this membrane-technology filtration method, dirty water can be cleaned and made potable. This is an expensive technology (purchasing costs of 15.000 – 20.000 INR, and regular maintenance is needed), and therefore only available for the most well-off households. Estimates are that about 10% of households in Sultanpur have invested an RO system. ROs can also be used for getting the salinity out of groundwater. This does happen in the village, but not on a large scale, as this also requires more maintenance of filter.

Picture 4.4: Boy filtering water from the supply through a muslin cloth

Due to the erratic nature of the water supply, all users have to store the water they receive. There is variety in the means used for this, from large drums and special water tanks with a tap, to overhead and underground storages built in the house. The size and quality of storages people choose depends on the cost and the purpose for the water stored.

It is important to realize that all of these technologies come at a cost, and are therefore not affordable for everyone. Poor households are not able to invest in motors or RO filters, also because such technologies require additional costs of electricity, fuel and maintenance. But even more basic technologies such as tool pumps or overhead tanks are simply too expensive for the poorest households. Hence, this limits their options of improving or obtaining drinking water access.

Picture 4.5: Overhead water tank on house rooftop

Picture 4.6: Variety of one household's water storage utensils

4.3 Groundwater

4.3.1 Quality issues: salinity

As many people do not trust the PHED supplied water, groundwater is the most important drinking water source for almost 75% of the households (see table 4.2). I observed that groundwater is widely perceived as being clean and pure. There is, for instance, much less fear of contamination of groundwater via the open sewage disposal of the village than for the water supply. I think that this is related to tradition, using groundwater is more embedded in traditional practices and ideas, and might therefore be considered as more trustworthy than the water supply coming from surface water. However, groundwater quality is not impeccable either. There are many complaints in the village of groundwater sources becoming saline over the past 30 years. This has to do with salinity of the soil and falling groundwater tables, as I explained in chapter 3; declining groundwater tables directly affect drinking water access too.

There are different levels of salinity in the village groundwater resources, varying from place to place. Some people have become accustomed to drinking slightly saline water, or use this for cooking their meals. Even though not all saline water is unusable for drinking, there are drawbacks. An important disadvantage of saline water, often mentioned by the villagers, is that it is unsuitable for making *chai*[30] because of splitting milk. They also complained that the water is not only saline, but also very hard: soap does not mix well with the water, which makes some groundwater resources unsuitable for washing clothes. This is also a problem for bathing: the more saline the water becomes, the less enjoyable taking a bath with it is. House owners who use saline groundwater for doing their chores showed the salt marks on the floors, left there by the water. They stated that it damages their houses and causes corrosion of the iron pipes of water pumps.

The exact depth of the water and the moment where it turns saline varies from place to place. Over the years, more and more groundwater resources have turned saline, with negative consequences for drinking water access. Among water users, I noted, there is much awareness of the changing water quality of different water resources. There seems to be a common base of knowledge about which resources provide adequate drinking water and which are changing in quality. This translates directly into people's actions: households which are fully dependent upon groundwater for all their needs, distinguish between water sources for different purposes, even if this means going to other hand pumps for different chores. For instance, I observed a lady of a lower caste household bathing her son at the hand pump closest to her house, and afterwards walking a longer distance to another hand pump to fetch drinking water. Also, some hand pumps appeared seem to be used for cattle-related purposes only.

The on-going process of declining groundwater levels and salinization are a source of concern in the village. The process is causing new vulnerabilities for those dependent on groundwater, and as all people in Sultanpur are using groundwater in one way or another, the effects of this process are not to be underestimated. Awareness about the issue of salinity is present, as one woman stated *"If all water goes saline, we will have to drink the supplied water,"*[31] she indicated that this is not a favourable option, because of the perceived lesser quality of the supplied water. Ordering water

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[30] Preparation of *chai,* Indian tea, is done by boiling the tea leaves in water and milk. If saline water is added to the milk, it will not only affect the taste but also cause the milk to split, making it undrinkable.
[31] Interview 31 (14/05/12)

tankers can be an alternative, but this is quite costly and not affordable for everyone. Filtering saline water with an RO is a way of making it potable, though this does require more maintenance of the RO membrane than filtering sweet water. It is not an often used technique, because there are still non-saline sources available and ROs are expensive.

4.3.2 Availability and accessibility of groundwater

Groundwater is extracted from the soil with submersibles or hand pumps, and accessed both publicly and privately in the village. Table 4.3 shows how access to groundwater is distributed in the village. The majority of the population (69,2%) is dependent upon public or semi-public resources for their drinking water. However, quite a large number of households (30,8%) has access to a private groundwater source that is suitable for drinking. I found that there are more households in the village that have some form of private groundwater access to a source that is not suitable for drinking, but which can be used for other activities (such as washing and cleaning). These people have to rely on one of the other resources for their drinking water. I observed that It is not customary in the village to let people pay for using these public or semi-public water resources.

Table 4.3: Private or public access to groundwater

Type of groundwater source	Number	Percentage
Private source	20 households	30,8%
(Semi-)public source	45 households	69,2%
Total[32]	65 households	100,0%

Groundwater can be extracted from a privately owned plot of land, as the owner of the land also has the right to use or extract its groundwater. In principle, the public sources are located on public land (owned by the panchayat). They are put in place by the village government and accessible for everyone. Semi-public sources are accessible for everyone as well, but located on private land. Most of these are placed and managed privately, however I encountered one disputed case where a panchayat hand pump was placed on land claimed as someone's private property. An implication of this is that the distinction between public and private is not always clear and what can be regarded as a public source by one person: *"It was placed here by the panchayat for the whole village to use."*[33] can be seen as private by another: *"It is located on my land, the panchayat put it here without even consulting me! I allow the people to use it, but if the water gets*

Picture 4.7: Queue at the hand pump

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[32] This total is not the total population of 77, but the part of the total population that relies (completely or partly) on groundwater for drinking. As can be seen in table 4.2, this amounts to (57+8) 65 households.
[33] Interview 21 (07/05/12)

spoilt, I will close the pump or put a fence around it."[34] This can cause disputing claims, which I will further discuss in chapter 6.

4.3.3 Groundwater technology

For accessing groundwater resources, a whole range of technologies is deployed. Two main types of technology can be distinguished: pumps to physically access the groundwater reservoirs and other means and technologies to carry and store the water obtained. A short overview is provided below. For drawing up groundwater, both manual and motorized pumps are available, which come at different costs. For all ways of accessing groundwater in the village, it is necessary to bore deep holes in the ground in order to reach the groundwater reservoirs. This involves costs, effort and additional technology.

- With a *hand pump,* groundwater can be extracted by use of physical labour. This is a traditional and comparatively cheap technology. However, there are some limits to the depth it can reach, compared to motorized pumps. Public groundwater points of access are all hand pumps, there are 12 of these in the village, of which 6 or 7 provide sweet water.[35] 11 interviewed households have a private hand pump.

- The most popular method to access private groundwater resources is by use of a *submersible pump*. These motorized devices run on electricity or fuel and can pump up water without any physical effort needed. This type of pump consists of a small motor which is put below the ground in a pipe for accessing the groundwater and draws the water up from there. They can easily draw up groundwater from a depth of 100 feet. These technologies are more costly, and the dependency on electricity or fuel does bring extra costs as well. They are also often used by farmers for irrigating their fields. 26 of the interviewed households have a submersible pump in their homes of their fields.

- Another technology some households use holds the middle between a hand pump and a submersible: the *jet pump*. Whereas a submersible motor is placed underground to bring up the water, this pump has a motor above the ground and functions like a motorized hand pump. This is cheaper than a submersible pump, but cannot reach the same depths.

Picture 4.8: Private submersible pump

Picture 4.9: Government-placed hand pump

Picture 4.10: Woman using a public hand pump

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[34] Interview 32 (16/05/12)
[35] Interview sarpanch (23/04/12)

With motorized technology, there is a dependency on electricity or fuel (diesel or kerosene). Electricity supply to Sultanpur is of poor quality, it comes to alternate days and the village experiences many power cuts. Hence, electric technologies are not always reliable. This can be improved with use of *inverters,* which provide an electric back-up for some hours. This involves extra costs, just as well as the use of fuel (I heard many complaints about the rising fuel prices), which have to be taken into account when thinking about technology and water access. For the poorer households, it is not feasible to afford all of these things, which makes these options for accessing groundwater out or reach for them.

For storing groundwater, several different technologies are used as well. When it is privately accessed, large tanks and storages can be used, to pump it in directly. If drinking water is fetched from a hand pump it is stored and carried in pots or small tanks. The earthen *matka* is the traditional way of carrying and storing drinking water, the pot keeps the water cool and people like the taste it gives. Though these are not costly technologies, I heard complaints about the prices of the matkas going up recently, "*we used to get them for only 40 rupees in the village, now the price has gone up to 80 or 100 rupees*"[36] one woman complained to me. She is a member of a poor, lower caste household and dependent upon public hand pumps for drinking water. This shows that for such households, changes in price of even the most basic technology can have serious consequences.

Picture 4.11: The *matkas* used for transporting and storing drinking water

Finally, means of transport matter for groundwater access, as many people in Sultanpur fetch drinking water from outside the home. The customary way to do this, is to go by foot. All hand pumps in the village are best accessible by foot and for most people within walking distance of maximum 1 kilometre. However, I observed some alternative means for transport being used. Tractors are used for transporting large quantities of water from long distances. This mostly done by farmers who own (or can use someone else's) a tractor and who have access to groundwater in their fields. Motorbikes are used for transporting smaller quantities of water within the village, generally the distances which can be covered by foot too. This can only be done by those who can afford a motorcycle and fuel. Fetching water with use of such a means of transport seems quite luxurious and might even function as a status symbol. Strikingly, these means of transport are typically only used by men. Women fetching water have to walk the distances. I have not seen women conducting vehicles and assume that this is not considered a women's task. Hence, this excludes them from using these means of technology.

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[36] Interview 43 (25/05/12)

4.4 Conclusion: a diverse picture

Sultanpur presents a diverse 'water picture', in terms of resources, purposes and technologies. Groundwater and water from the public PHED supply form the two most important household water resources. Though both are used for drinking, groundwater is selected most often for this purpose. There is a lot of mistrust of the quality of the water supplied by the PHED and many stories are told about why this water is not suitable for drinking. By most villagers it is perceived as dirty and contaminated. Hence, most water users prefer groundwater for drinking, which they perceive as cleaner and more appropriate for drinking. This shows that personal choices and local beliefs play an important role in selecting water for different purposes. These choices and beliefs have to be taken into account in thinking about drinking water access: it is not just about which sources are physically and technologically accessible, rather, it is about which water people trust to drink and find appropriate for this.

For water access, the quantity of water available also matters. Above, I have described how there are many complaints about the PHED supply coming too shortly and erratically, and thereby not supplying enough water for the households connected to it. As summer intensified, water needs went up, and it was widely perceived that less water was distributed through the network, causing an experience of water scarcity. The quantity of groundwater available is also limited. Declining groundwater levels are causing that some sources are no longer accessible and others are going saline, making the water undrinkable. These developments are a source of concern for the villagers, also for the future availability of groundwater.

In this chapter, I have shown how both for supplied water and groundwater technology is an important factor to take into account. Through pipes, pumps and pots, all drinking water access is mediated by technology. A wide variety of technologies are used by households in Sultanpur for increasing or improving drinking water access. The overview of technology per water resource provided in this chapter shows the complexities, stages and layers involved in the process of accessing drinking water. Affordability matters for technology: those who can afford it have many more options of obtaining (or improving) drinking water through diverse and advanced technologies, whereas the options of poorer households are limited.

There is a significant difference between having access to a private water resource, such as a submersible pump or a connection to the supply, or being dependent upon public water resources (hand pumps). Having a private water access means more security of access, less effort involved and more alternatives available (as the public resources can be used as well). Households without a private groundwater access and excluded from the public water supply are in a less fortunate position. Both situations can be found in the village.

This paragraph has provided an introduction in the social reality and complexities of drinking water access in Sultanpur. Based on the distinction between groundwater and supplied water used here, I will further elaborate on inequities in access to these resources and the causes of this in chapter 5 and 6. This will be done by discussing social identities, spatial characteristics and power relations that were found to play a role. I will show how these lead to interdependencies between water users and exclusion of access for some groups and individuals.

5 The workings of the water supply

In this chapter, I will further analyse the social and political characteristics of the PHED water supply network. After having explained its main features in chapter 4, I will now study more in-depth how this water supply is accessed. This I will do by providing insight in the institutions and interactions involved. Hereby, I can show who is excluded from the network and why, who controls this and how social relations play a role in sharing the water supply with its many users. First, attention will be paid to physical exclusion from the network, then, the relations and interdependencies involved in sharing the water supply will be discussed. After that, I will go deeper into village politics, and which role these play in determining where to the water flows. Finally, I will elaborate on the recent initiative of panchayat and PHED to start a billing cycle for the water supply.

5.1 Exclusion from the network

Access to the water supply is closely related to location of the household. As explained in the previous chapter, not all households are connected to the PHED network (only 70% of the research sample). The map in figure 5.1 illustrates which areas are serviced by the network. Households outside of the official village boundaries (the outside roads) are not able to take a connection to the water supply, as the piped network does not extend to these places. Moreover, the settlement beyond the railway line (though part of the village) is not served. According to the PHED and sarpanch, this is caused by restrictions of the railway department, who do not allow water pipes to be constructed underneath the railway, as this would destabilize the railway line. Hence, people residing in this area are physically excluded from accessing the public supply network.

Figure 5.1: Map of the areas in- and excluded from the PHED water supply
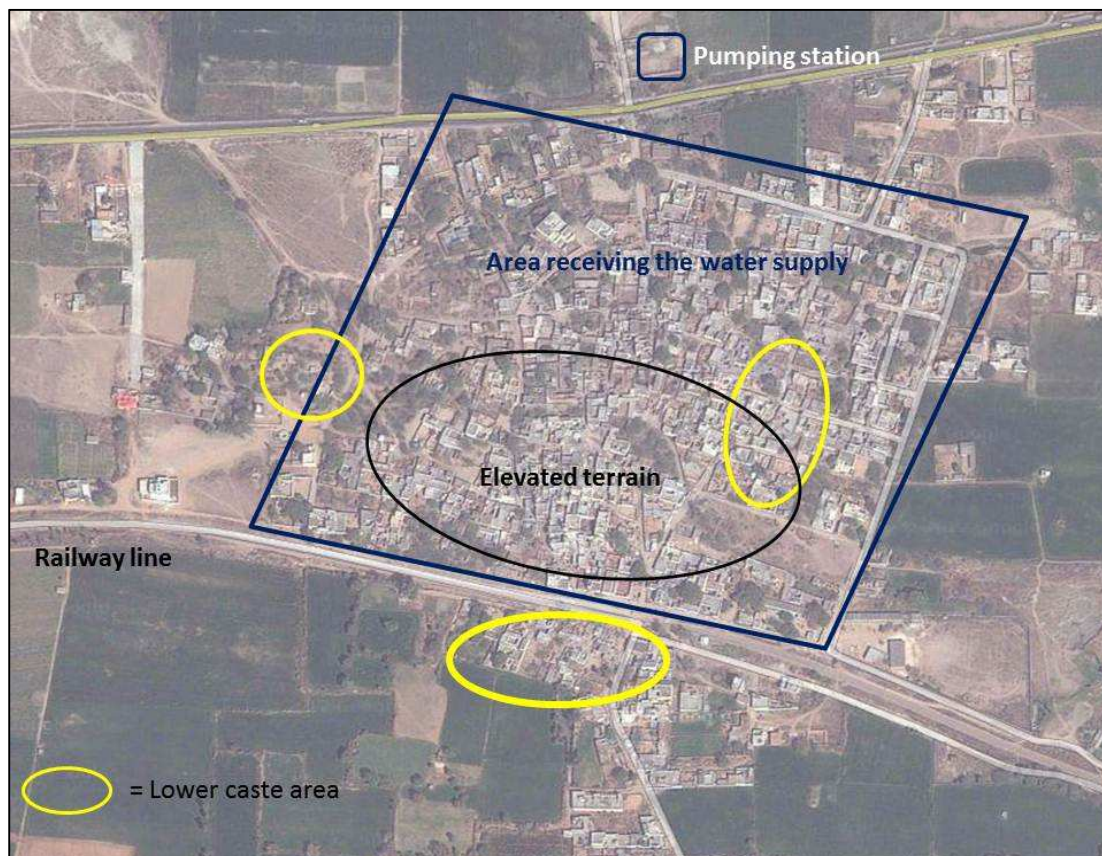
Specifically for the area south of the railway line this exclusion is interesting to examine, as this contains one of the largest lower caste settlements of the village. Though the official discourse is that the railway department is to blame for the water network not reaching here, there might be a relation to the social status of the Balmik and Harijan inhabitants living here. The low social status of these people makes connecting the area to the supply network a less pressing political issue. No one of the policy makers actually made such statements, but perceptions of the low castes being unclean and dirty were present in the village. This might make them less suitable and deserving for being connected to the water supply. However, the settlement south of the railway line is not only a place where low caste members live. Several Rajput landlords also have moved to this area, because of the presence of sweet groundwater on this side of the village. The availability of potable groundwater is higher here than in other places in the village, which makes it a popular area to settle, despite the lack of PHED water supply. This availability of sweet groundwater makes the political necessity of bringing the supply there even less pressing, as richer and higher caste households residing there, are easily able to afford submersible pumps for accessing the groundwater. Lower caste households are not able to afford these technologies.

Despite the presence of sweet groundwater, the inhabitants are not satisfied with being excluded from the supply. They feel ignored by the local authorities: *"The government is neglecting this area. There is no supply coming and no sewage disposal. We have been asking for these things, but it is still not provided,"*[37] a higher-caste member living in this area told me. Though the supplied water is not considered potable by most villagers, it would be useful for doing household chores and alleviate the burden of fetching water for these. *"I now have to walk to the hand pump for every single task: doing the dishes, washing my clothes, taking a bath and washing the cattle. It would save us a lot of time and energy if they extend the water supply to this side,"*[38] a lady of a lower caste household explained. The situation is most pressing for households who do not have access to a private groundwater source on their premises. They have to depend on hand pumps for all their water needs. Typically, these are members of lower caste communities with low socioeconomic status. Hence, the lack of the public network holds that these groups, of which many members do not have private groundwater access, face large challenges. The availability of sweet groundwater could pose threats for the future. As the area becomes more popular for settlement, prices of land with sweet water access are rising. Lower castes have no entitlements to their lands and could be forced to move, without benefiting from rising prices.

The official discourse of *"The railway authorities don't let us dig below the railway tracks"*[39] is doubted by some. The former sarpanch, under whose rule the network was constructed, believes that convincing the railway department to have a pipeline constructed should be possible. He showed me a small drain constructed under the railway (picture 5.1), through which he was planning to get a pipeline constructed. *"I thought of a plan to make the water pipes through that drain. It should be possible and you can get permission for that, you just have to work for getting it done."*[40] He accuses the current headman of not putting enough effort into this, which the sarpanch denies, as he blames the railway authorities. Though most inhabitants of the area share the official

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[37] Interview 6 (27/04/12)
[38] Interview 48 (25/05/12)
[39] Interview sarpanch (23/04/12)
[40] Interview former sarpanch (22/06/12)

discourse of the railway department, some find it difficult to understand why the railway department and PHED, both government agencies cannot better cooperate. Despite the presence of

sweet groundwater at this moment, many people fear that this might become saline in the future as well. Because of this, they hope to get some form of public supply to their neighbourhood. An man living in this area expressed it like this: "*We would like to get the PHED supply. It will take some time to get this arranged, but we are sure that one day it will happen. We are hopeful for that. We need an alternate source, in case the groundwater goes bad [saline] here as well.*"[41] The lack of political pressure is an important reason in the exclusion of this area from the supply network.

For many higher-caste people it is their own choice to move to these areas outside of the PHED serviced zone. The main reason for this is the availability of more space compared to inside the village, which is appreciated over being connected to the water supply. The more well-off households that choose to live here, are able to establish a private source of drinking water access via submersibles. For poorer

Picture 5.1: Drain underneath the railway tracks

households in these areas, the situation is completely different. These are generally the lower caste groups who have to live on the lands assigned to them by the panchayat. These households are vulnerable in terms of water access: they are excluded from the PHED network by location, and they have little means to establish private groundwater access. Therefore, these groups are dependent upon (semi-)public groundwater resources. Hence, though both higher and lower caste groups live in areas excluded from the PHED supply, there is a difference between their reasons for this (free choice or not) and their ability to afford alternative forms of water access.

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[41] Interview 6 (27/04/12)

5.2 Sharing of the PHED supply

The total amount of water supplied through the piped network has to be shared by all users. Thus, if one household uses more water, this negatively affects the amount of water available for others. Also, certain ways of using the water connection can cause pollution of the supply for others. These interdependencies, the practices around the water supply and the consequences for other users will be discussed here.

People can take a connection by making a hole in the main cement lines and putting a plastic pipe to their house in that hole. This system was installed by the PHED under the rule of the former sarpanch. He explained me that everybody had the same type of connection installed, in terms of size and material. After a while, people started digging new holes and taking unsupervised connections. The former sarpanch maintains that this is currently not being controlled by the panchayat and someone else also mentioned that the PHED never checks the size of the holes.[42] Because of these practices, some households have more than one connection to the supply and others have made bigger holes than the standard size of 6mm. Thus, they can take more water from the supply than households that follow the guidelines for this.

Another way to receive more water is by pumping it to the house with use of motors. This is a much used method by households located on a slope or at the end of the supply lines, but not affordable for everyone. Hand pumps are also used for this, they are however much less effective. All these methods of taking more water from the supply negatively affect the other users, specifically the ones located at the end of the supply lines and those who are not able to afford additional technologies. Some of these methods also cause pollution of the water supply: dirt and sewage can seep in the holes from which the connections are taken, especially if these are not properly made or bigger than the pipe used for extracting the water. Moreover, the use of motors causes dirt to be pulled up as well, rather than that it settles at the bottom of the pipe, according to PHED engineers.[43] These interdependencies between all users of the network and their practices affect both quality and quantity of the supply.

For households connected to the supply, their location determines the force of the flow and hence the quantity of water supplied. Both at the end of supply lines and on or behind slopes, the quantity of water supplied is significantly less than on places closer to the main tank and in low lying areas. The capacity of the tank and the motors pumping the water through the village simply is not sufficient to reach those places. Thus, the way the piped network is laid down and the capacities of the pumping system determine who gets water supply and to which extent. It is interesting to see which areas this concerns. The part of the village located on the side of the highway, at the entrance of the village receives most water, due to its low lying location close to the main reservoir. The elevated areas and fringes of the village get the least water through the network, as they are difficult to reach and only receive what is left after other's use. The elevated areas of the village are roughly indicated in the map in figure 5.1 as well.

This differentiation in supply can to a certain extent be related to social stratification in the village. The Bawaria, a lower caste community, for instance, live at the end of a supply line. They live with six households on a small hill on the west side of the village (the small lower caste area in the west of

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[42] Interview former sarpanch (22/06/12) and interview 52 (04/06/12)

[43] Interview subdivisional engineer PHED (31/05/12)

the village indicated on the map in figure 5.1). Because the supply line does not run up to this hill, they share one connection at the bottom of it. They have to share the water this connection provides among all six households, whereas other houses on the line that all have their own connection. They stated that is not enough at all for their daily water use: "*If we would get more water from the supply, that would solve a lot. Now we have to walk to the hand pump for many chores, or even have to ask other people for water. With more water, we would be able to stay clean and hygienic*."[44] In the northeast of the village, some households are located who experience both the advantages and disadvantages of their low lying location. The Saini who reside here, are neither high nor low caste members, but rather somewhere in between. They do receive water from the supply and do not have to pull this with motors or hand pumps. However, close to their homes is also the ditch where all the village sewage flows to. This runs through their street, as all sewage drains in the village are open and above the ground, which causes unhygienic situations. The people living here expressed their concerns that the water reaching their house was getting contaminated from the sewage flow.[45] A completely different situation can be seen in the one area in the village which currently receives water through a metal pipeline. This is the line leading up to the area where the sarpanch and his family live. The sarpanch had this installed quite soon after he came in to power. This is a contested issue, as through metal pipes, water can be transported with more force and there is less risk of contamination. *"It is not fair that the headman's side of the village has a much better water supply, they get cleaner and more water, so he secured his own supply well*,"[46] a Rajput woman living in another area complained. These three examples show the differences in experience with the water supply between different areas in the village. They illustrate how people with higher social status, more means, and more power have better access to the water supply than others. However, this is not exclusively so, as physical conditions of the network and geographical factors also have influence.

'Illegal' connections are a source of concern for the PHED and panchayat. One of the PHED engineers stated that it forms a lot of trouble for them that *"Many people in the village take illegal or too big sized connections from the cement pipelines."*[47] No one in the village admitted to me that they have an illegal connection. It is the question whether they want to hide this, which is a realistic possibility, or if they simply do not regard it as such. Illegality was not often mentioned by villagers as a complaint about others, whereas overuse and pollution of the supply were. It seems to be mainly a PHED worry, who state that there is a lot of 'water theft'. The formalization of the connections was implemented recently, to enable a billing procedure. Many households still do not have the official files made that confirm the legality of their connection to the supply. Because this initiative is relatively new, not having a file made is not widely considered as illegal; only recently, this was the case for all connections. The PHED and sarpanch admit the difficulties in the start-up of the filing procedure, not everybody who has a connection did get a file made. According to the PHED executive engineer, the policy is in place, but implementation and control are needed, maybe even in the form of penalties.[48]

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[44] Interview 4 (25/04/12)
[45] Interview 52 (04/06/12)
[46] Interview 26 (11/05/12)
[47] Interview subdivisional engineer PHED (04/07/12)
[48] Interview executive engineer PHED (31/05/12)

In general, I found the people of the village to approach the PHED water supply as an individual entitlement, instead of a common-pool resource. Arranging household water access is regarded as an individual responsibility and this reflects in user's practices, with many households using strategies to extract more water from the supply. The consequences of these practices for other water users are not taken into account much. However, the accusations of others 'misusing' the supply by taking too much water or polluting it, show that there is awareness of the inter-linkages between water users through the network.

Box 5.1: What the PHED supply means for women

As women are responsible for the household chores, they are the main users of the PHED supply. With several women's groups, I discussed what the supply means for them, in relation to their household tasks. For the households connected to it, the supply greatly alleviates the workload of women, certainly compared to the past, as the following quote illustrates: "*Our mothers and elders say that we are very lucky to have the water supply coming to our house. They had to walk 2 or 3 kilometres every day to get water.*"[49] However, with the decreasing workload of fetching water, the ease with which water is used is also changing. The women told me that nowadays, their families expect all meals to be freshly made, instead of only cooking once a day, which means more work and more water needed. Many people now wash their clothes every day, because they can do this inside the premises of their own homes. And bathing practices have also changed: "*Earlier, everyone would take a bath once in two days, but now everyone does it twice a day. This takes a lot more water.*"[50]

One woman related the increasing water usage to the modern amenities: "*Life has been made very easy by the resources we now have, such as electricity and pumps. First we had to use our hands to get water, but now you can just press the button and water comes out. Because of this, people are becoming a little careless, so they waste water, for instance by leaving the tap open while doing dishes. The irony is that the easier these amenities are to use, the more ignorant the users become, because you don't have to put in the physical effort anymore.*"[51]

The supply is not sufficient for fulfilling all household needs, which is partly caused by increasing water usage. Hence, the task of fetching water remains for these women, also because the supplied water is not trusted for drinking and cooking. However, as they have the supply coming into their homes, elders say that they should not complain, the women told me.

Picture 5.2: Meeting of women's self-help group

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[49] Focus group 1 (11/05/12)
[50] Focus group 2 (11/05/12)
[51] Interview 22 (07/05/12)

5.3 Who controls? The role of village politics

By now, It has become clear that the network supply is not equally accessible for everyone. In this paragraph I will describe the role of village politics in controlling who gets access to the network. As explained in chapter 3, the panchayat – led by the sarpanch, and the PHED are together responsible for organizing the water provision in Sultanpur. The services provided are not equally available to everyone, hence many people are dissatisfied with the current situation. This leads to conflicts and political tensions in the village.

Different political constituencies are visible in the village, which are formed along lines of caste and kinship. There are two Rajput families in Sultanpur who have 'delivered' the sarpanch in the past decades. These families are located on different sides of the village and are in constant political competition with each other. In principle, anyone can run for becoming sarpanch in the elections. However, as political campaigning is quite costly, it are mainly richer families (landowners) who partake in this. The sarpanch is the central figure in the panchayat and has a lot of power in village decision making processes. This is why many complaints about politics are not so much about the panchayat, but specifically about the sarpanch. An elderly man explained to me that he thought that the panchayat has not been functioning properly in the past years: instead of controlling the plans and actions of the sarpanch, they just follow him.[52]

Many people attribute negative changes in the village to the sarpanch: e.g. the cancelling of certain ration cards or complaints about the sewage disposal. Not only are decisions criticized, there are also accusations of the sarpanch favouring his 'side' of the village, where many of his family and voters live. According to one lady, this is nothing new: *"Every person that becomes the headman takes care of only his side of the village."*[53] It is seen as a normal part of village politics, though this does not mean that people think this is fair or right. The metal pipeline leading to the sarpanch's house is generally regarded as proof of the sarpanch using his powers to the benefit of his own constituency. According to the sarpanch, this project is the start of a wider improvement project that will soon be carried out (see box 5.2 below) in which the whole village will be served by metal pipelines, but that is not how it is seen by others. Considering the consequences of protesting, people are reluctant about coming into action. A group of men discussed the issue: *"We are not very happy with the sarpanch, he is not concerned with the well-being of the village. He has made some improvements on his side, but other than that he has done little. But we can't push him too much, otherwise he might just get stubborn and not do anything anymore. The sarpanch's word is final, so we need to be careful and patient."*[54] This last remark indicates how the power of the sarpanch is perceived: people do not want to be on his bad side, as that might have negative consequences for themselves.

Related to this image and the metal pipeline to the sarpanch's area, are the many accusations that there is difference in the time that the water supply is left running to the different sides of the village. I heard many people in the eastern part of the village complain that they receive structurally less water, especially during the hottest days of summer when there was less water available for all of the village (because of water scarcity and problems with the supply in the whole region). This happens to be the area where the former sarpanch and his family live. Rumours and accusations of

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[52] Interview 74 (29/06/12)
[53] Interview 39 (23/05/12)
[54] Interview 41 (23/05/12)

differential supply are difficult to confirm, but they were very persistent. It shows that not only location affects the amount of water obtained (e.g. receiving less because of elevated terrain), but that also the other way around, the amount of water provided to different sides can be differentiated, due to village politics and power relations. This is physically controlled by the valve-operator. In carrying out his job, he can regulate how long and to which areas the water will flow. By many villagers, he is blamed if the water does not come long enough. The operator himself says that he carries out the orders that the sarpanch gives and that the water is equally divided. He has to do with the water the village receives from the PHED, and as this is amount too little for the whole village, everyone is always complaining to him.[55] In the eastern side of the village, a lot of people also told me that the former sarpanch had done his job much better. Under his rule, the water supply was introduced and many people assured me that the division of water between areas in the village was much more equal then. I am not in a position to make judgements about this; however, these stories and accusations show the role that politics play in daily life. It matters to which politically constituency one belongs and whom you voted for. A sarpanch is in a powerful position and opposing him is a risk, also for matters about the water supply.

Also in the working relation between the PHED and panchayat, village politics are of influence. *"Village politics are a major hassle for the PHED. Often after elections, ruling parties will try to benefit themselves. It is a lot of trouble and extra work for us to deal with."[56]* The subdivisional PHED engineer explained that they try to prevent getting involved projects that are more for the self-interest of a headman than for the betterment of the village. However, the sarpanch forms the main line of contact and source of information between the PHED and village, so this seems difficult to avoid. The existence of the one metal pipe supplying the sarpanch's area is an eminent example of this. For the village people, it is difficult to contact the PHED directly. The procedure they can follow is to contact the sarpanch with a complaint, and he can take it to the PHED. Villagers can go to the city and visit the PHED office personally, but the chances of succeeding here are low. According to the sarpanch, the PHED will only come to the village if they are contacted by him directly.[57]

In line with official government quota, there are several female panchayat members. I spoke to one of these ladies, and she explained the difficulties she had participating in this body: *"There are several female panches, but we are not much listened to. Sometimes there are meetings in Gurgaon, but I can never attend those, because I cannot just leave my house, kids and mother-in-law! I have to take care of the household, these are responsibilities that the men do not have to deal with."[58]* So even though women are nowadays included in the governing bodies of the village, they still larger obstacles than man in participating in the political processes and can therefore exert less power over these. Lower caste groups also face more difficulty in this. Though there are government quota for encouraging lower caste participation in politics, I did not hear of any Harijan or other lo caste panchayat members. A lower caste woman said that she feels that her social group is only used for votes: *"Politicians just come here to get our votes, after elections we never hear from them again."[59]* She expressed a feeling of being excluded and unrepresented in regional and village politics, and had therefore little conficence in the political process in general.

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[55] Interview 73 (29/06/12)
[56] Interview subdivisional engineer PHED (04/07/12)
[57] Interview sarpanch (30/05/12)
[58] Interview 75 (29/06/12)
[59] Interview 4 (25/04/12)

5.4 Paying for the water supply: the case of the pipeline project

A recent change in the service provision of the water supply is that the PHED and panchayat have started an initiative of introducing payment for this. When the current panchayat came into power, they started an initiative to officially register all connections to the PHED supply. On the basis of the files made, some people have started receiving bills, and others will get these soon. This holds that people who have a registered connection have to pay 20 INR per month for their water supply. Currently, only 10 of the interviewees stated that they receive bills, while many more (70%) are connected to the water supply. Of the 10 households receiving bills, 3 interviewees stated not to pay this as they find the quality and quantity of water delivered insufficient. A mother of a small, middle-class household stated *"We have received some bills, but we don't pay them. The water doesn't even reach here! No one around here pays their bills."*[60] Not everyone is unwilling to pay though, another woman explained: *"I have never received a bill. I would not mind to pay though, if the water would come properly and conveniently"*[61] This shows that these people might be willing to pay for the services, but along with that come higher expectations in terms of water quality and quantity, and the services have to be accountable. In many people's views, the current services provided do not live up to standards, and thus they are not willing to suddenly start paying for this now, especially since the services provided have not improved.

According to the PHED officials*, "people will have to get in the routine of paying bills, realize that complaining won't help the situation."*[62] This is an interesting remark, as payments are in theory also seen as a means to improve the accountability of the service, by creating a more customer-oriented attitude of the service provider. The villagers indeed expect an improvement in quality and quantity of the supply for their payments. The PHED officials however, rather seem to view it as a matter of disciplining water users in behaving 'properly', by formalizing connections, paying for water used, and avoiding wastage of water. These policies are implemented from above, and initiated by the state of Haryana.[63] The PHED officials see the introduction of paying for water services as having two objectives: on the one hand it is a return on investment on the provision of the network and any improvements that have to be made on this. On the other hand, there is a plan to put taps on all the connections and install meters in the near future, which makes paying upon actual use possible and is seen as a way to combat water wastage.

In general, water is seen as a free resource by the villagers. They are not used to paying for water and have in the past never had to do this. Water is perceived as a gift of the gods and not something you can sell. Other costs are involved though: time and effort invested in fetching water, and costs for technology to access groundwater have been common for ages. Recently, the idea of paying for water services seems to become more accepted in India, or at least in its water policies – as I explained in chapter 2. Also in Sultanpur, a shift can be identified. Instead of investing time and physical effort in accessing water, some people now are paying for water. There is for instance a habit of ordering water tankers when large quantities of sweet water are needed at once, which is the case for (wedding) ceremonies and construction work. The regular ways of supplying cannot fulfil this need, which makes people willing to pay about 500 INR for a tanker of 10.000-15.000 litres

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[60] Interview 31 (14/05/12)
[61] Interview 59 (06/06/12)
[62] Interview executive engineer PHED (04/07/12)
[63] Interview subdivisional engineer PHED (31/05/12)

of water. A move towards paying for water services can affect poorer households negatively, as they have to spend a relatively larger share of their budget on water. The current amount charged for the supply is quite low, almost everyone can afford this. The amounts charged for water tankers however, are much higher, and if the availability of good quality groundwater further deteriorates, the use of tankers might become a more common way of arranging water access. *"If the hand pumps don't work anymore, we might have to rely on water tankers for drinking water. This will be very difficult and expensive for us, as 4 pots of water will then cost us about 20 INR a da*y,"[64] a mother of a poor lower caste household explained. Hence, those households that do not have access to the PHED supply are more vulnerable to changes in the availability of sweet groundwater. If no other options are found, there is a risk that water access will become more costly for them in the future. The billing cycle was introduced simultaneously with the project explained in box 5.2 below.

Box 5.2: The metal pipeline project

Throughout my fieldwork period, there was talk of a new project to be undertaken by PHED and panchayat: the cement pipelines would be replaced with new metal pipes. Hereby, both quality and quantity of the water supply should be improved. As metal pipes do not break as easily as cement pipes, less leakages will occur. This reduces the chances of contamination with soil or sewage of the water in the pipes. It should also improve the water pressure within the village network, and thus improve the overall water supply, especially for households located at the end of the supply lines. However, villagers perspectives on these improvements were more critical *"It will not make the water any cleaner, it is still the same water,"*[65] referring to narratives about the dirty (river) water source and insufficient filtration. Another opponent of the project stated *"It will not make much difference, as long as the time for which the water is left running will remain the same*."[66] Two months after the metal pipes had been delivered, they were still lying near the entrance of the village. Seasonal labour shortage had delayed the project; according to the PHED officials no contractor could be found to do the job in the heat of summer. During my last field visit, the PHED engineer told me that a contractor had been found and they would make the plan for the network that same week. I do not know if this has actually happened, as that was the time I left the village. This project has wider implications than just improvement of water pressure and quality. According to the PHED engineers: *"With the new metal pipes it will no longer be possible to take illegal connections or make bigger holes. There will be a standard size of 6mm for each connection. This will improve the situation, the water will be cleaner and there will be less trouble for the PHED."*[67] People cannot simply make holes in the main pipe anymore and take their own connection (illegally). Now, a formal file will be needed to get a supply to the metal pipeline, and people should pay their bills to get this. Hereby, the supply will become more formalized and with this move, it will become easier to check and control the billing and (if necessary) close the supply, according to the sarpanch and PHED. A group of village men also saw this as a positive development: *"This will be an improvement, people will not be able to multiple connections anymore, so it will reach more places."*[68] Not everyone seemed aware of these implications though; many villagers did not even know about the metal pipeline project and very few mentioned the relation to having a file made and paying bills.

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[64] Interview 43 (25/05/12)
[65] Focus group 3 11/06/12
[66] Interview 69 (22/06/12)
[67] Interview subdivisional engineer PHED (04/07/12)
[68] Focus group 3 (11/06/12)

The way it is carried out, this project will not improve anything for those who are currently not connected to the network; they will remain excluded. Also, it could have negative consequences for those people who do not have 'a file made', i.e. a formalized connection. Hence, the project can also be seen as a move towards formalization and increased control over the network by the panchayat and PHED. Yet, the presentations of the project being an improvement of water pressure and quality will not be completely false. What struck me, however is that those people who are currently in the most vulnerable position – the poor and lower caste households who are excluded from the PHED supply – are not in any way benefiting from this project. They will remain dependent upon (semi-) public groundwater resources and are very vulnerable to any changes in the quality of accessibility in this. Hence, the project is about replacing and improving what is there, not about including more people to benefit from the supply. Rather than working towards alternatives and involving the people currently excluded from the network, the project simply reinforces the existing situation and benefits the people who are already included in and benefitting from the network.

Picture 5.3: The metal pipelines lying in the village

The new metal pipeline grid will be designed by the PHED engineers in cooperation with the panchayat. In practice, this comes down to the sarpanch and one of the junior engineers. The plan was that they would take a short survey by walking through the village together and deciding upon how and where the pipes would be laid down.[69] One man expressed the fear that the iron pipeline project would benefit the sarpanch's votebanks more than other areas, as this was what happened with the earlier pipeline he installed as well.[70] In any way, the sarpanch, but also PHED have a lot of power and control over who is in- and excluded from the network. And ith the metal pipeline project, they will further consolidate this control, through the formalization and barring 'illegal' connections.

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[69] Interview sarpanch (30/05/12)
[70] Interview 1 (25/04/12)

5.5 Conclusion: where the water flows to

In this chapter, I have analysed the workings of water supply network in Sultanpur and shown how these lead to inequitable access to the water that is distributed through it. By the way the grid is constructed, parts of the village are excluded from accessing this water supply. Some households choose to live in an area which is not reached by the water supply, because they can afford the alternatives for accessing sweet groundwater. But lower caste and poor households residing in such areas, do not have this choice. By their location, they are excluded from the network. And they are in a vulnerable position because they are unable to afford alternative solutions of privately accessing groundwater. Hence, they have to depend on public groundwater resources.

The PHED and panchayat are together responsible for deciding where and how the network is constructed. Hence, they determine who is included and who is excluded. The way the grid is constructed is the outcome of a political process. In the analysis, I have shown that the sarpanch has a powerful role in decisions about the construction of the grid. The part of the supply network that is constructed with metal pipelines, is supplying water to the area where the headman and his clan live. Also, many stories are told in the village about internal differences in quantity of the supply between different areas. Persistent are the allegations that the area where the former headman and his constituency live, is structurally receiving less water. These differences in supply are contested and disputed. This is not to say that everything can be attributed to the PHED and sarpanch: geographical conditions are of influence (e.g. sloping terrain), and other governance actors such as the railway department also play a role. User practices are also of influence on the water supplied through the network. Use of technology and households making more or bigger holes in the supply lines are practices which negatively affect other users. The use of motors, for pulling more water, is an important element of these practices, as these cause inequitable distribution of water through the network and pollution of the pipes, affecting the water quality. Moreover, such technologies are not affordable for everyone. Hence, on the individual level, wealth plays an important role in ensuring access to the water supply. In Sultanpur, the water flows (with more force) towards the people who have money and power.

Interesting is the recent initiative to register and charge all households connected to the piped network, and the simultaneous replacement of the cement pipes with metal ones. One the one hand, this is a way of improving the supply and the users' conduct by discouraging 'illegal' practices which negatively affect other users. On the other hand, however, this initiative can also be seen as a sign of further consolidation of control by the authorities. By many villagers, connecting to the network without a registration is currently not seen as an illegal practice. Rather, it can be regarded as an informal way of accessing water. By formalizing the connections to the network and possibly closing off of these unregistered connections, the PHED and panchayat make clear that they want to ban these informal or 'illegal' practices.

The findings in this chapter can be linked to Anands (2011) argument on making pressure. Those who are currently excluded from the supply network, are not able to present themselves as a deserving political group for getting connected to the water network (and overcoming the obstacles posed by the railway department). I believe that this is caused by the low social status of the lower caste settlement south of the railway line. In line with Bakker's (2010) argument of being connected to the formal water supply as an emblem of citizenship, this group is not regarded as being worthy citizens for receiving such privileges. As for the higher castes members living here, they consciously

moved here because of sweet groundwater access. They do not need to make pressure for getting connected to the supply, as they can afford (and even prefer) alternative ways of water access. This makes the issue of bringing supply to this side of the village politically less pressing. Thus, it has become clear that the grid is designed in such a way that it benefits those with money and power more than those with less means and influence. Hereby I have shown that "*the myth of the orderly grid*" (Coelho 2006: 508) - the technical but false representation of the orderly and equitable distribution of water through the network – is indeed a myth in Sultanpur. Internal differentiation, exclusion of part of the village and individual user practices, cause inequitable access to this water resource. The flow of the water through the network is determined by power and politics, and hence, political and contested.

6 Groundwater practices

This final chapter of the analysis will discuss groundwater practices and interactions. This resource is not equally accessible for everyone and tied to the ownership of land. This will be discussed in the first paragraph, for both public and private groundwater access. After that, I will go into sharing practices and interdependencies between owners and users of groundwater. After that, I will elaborate on the role that caste relations play in groundwater access, which I found to play an important role. Finally, I will take a closer look at the fetching practices and experiences of the individual, with a focus on the role of gender and age in this.

6.1 Groundwater access and location

There is a lot of variation in levels of salinity in the groundwater sources of Sultanpur. Different locations have access to different qualities of groundwater. It depends on the location of the household (and the land belonging to it) whether the groundwater is potable. Households which own land outside of the village, have access to more groundwater sources than households who do not own additional land. The price of land with sweet groundwater access is up to 15% higher than that of land with saline water.[71] As mentioned in chapter 5, south of the railway line are more sweet groundwater resources. I noticed that some richer families in the village have bought small plots of land here, for keeping their cattle, but also to secure access to the good quality groundwater there.

Quality of groundwater access is not static, water levels and salinity have been changing over the past decades. A consequence of this is that settlement patterns in the village are changing in line with the changing availability and quality of groundwater. I found several instances of people who stated that they have moved out of the village to a plot of land with groundwater access. For them, this alleviates the burden of fetching water for each and every chore. A farmer living outside the village in his fields (though he used to own a property there), explained his reasons for staying there to me by relating it to water access: *"Water became such a hassle when we were living in the village; we had to fetch water for our buffaloes all day long. Now, that we live with our cattle outside in the fields [where we have a tube well] we don't have that problem anymore."*[72] Since the PHED water supply network has been laid down in the village, this might not happen as often as it used to, as that also alleviated the burden of fetching water for the household. However, due to (perceived) poor quality and quantity of the PHED supply, many prefer to use private groundwater over this.

I also spoke to farmers who have moved back into the village, because the water in their fields has gone saline. This obstructs farming activities and drinking water access, and is therefore a motivation for moving back to the village. One of these farmers expressed: *"We had to move back because of the saline water. In some places, it is so bad that the animals won't even drink it anymore. We farmers now have to sell our land, because of the water situation. This is something we don't want to happen; it is a loss for us. We would like to continue farming, but it is not possible to do this anymore."*[73] With selling a part of his land, he was able to construct a large house on the outskirt of the village, in the area beyond the railway line. He explained that he moved here because this has the sweetest and best groundwater resources of the village. This is also the reason why this is still a popular area to settle, despite lack of PHED water supply. But considerable groundwater extraction

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[71] Focus group 6 (04/07/12)
[72] Interview 70 (27/06/12)
[73] Interview 6 (27/04/12)

is causing changes in quality and availability here as well. Some people told me that this water is now going saline too, due to the presence of many private submersibles.

The examples discussed here show that the changes and fluctuations in groundwater quality are influencing settlement patterns. Households who have the option of relocating, move to places which have access to sweet groundwater. Interesting is that simultaneous movements towards and out of the village can be seen. As long as the availability and quality of the groundwater keeps changing, settlement patterns will too. However, the presence of the public water network in the village since 8 years has to be considered too. As the supply provides an additional water resource for many households, it mediates groundwater-related moving patterns.

Poorer households living in areas with good quality groundwater might be negatively affected by these moving patterns. If their land becomes more in demand, these households might be pushed to move from this. For lower caste household this would have serious consequences: as they do not hold land rights, they can easily be driven of their land (which is owned by the panchayat). Hence, they are rendered at the hands of village politics. However, it did not appear to me that this formed a big threat for the lower caste settlement south of the railway line. Richer households are apprehensive of buying land in a lower caste area, which they perceive as filthy. Also, the sweet water resources rather seemed to be close to the lower caste settlement south of the railway line, than actually within it. Buying (additional) land and moving is not affordable for everyone. Hence, access to groundwater is to a large extent an effect of wealth, also in terms of being able to afford the technologies for extracting groundwater. This is why it is generally the rich, high caste households who have access to good quality private groundwater resources.

Figure 6.1 : Location of hand pumps in the village
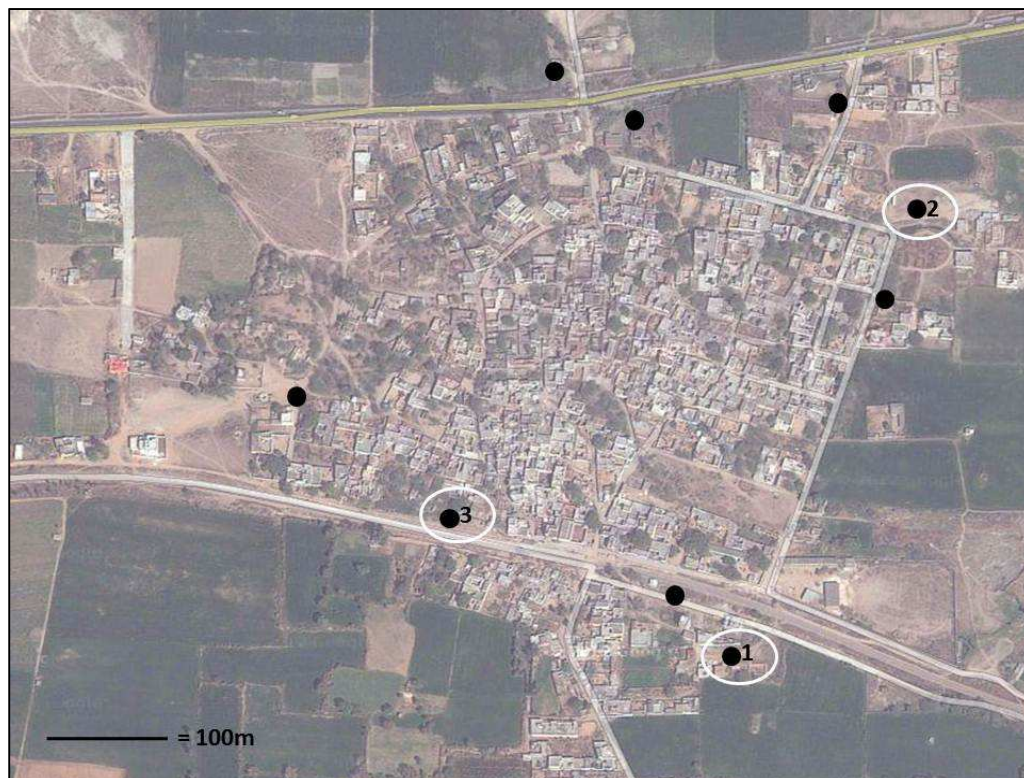
In terms of the relation between groundwater and location, the distance to a hand pump also matters. This determines the time and effort that people have to invest in fetching water. Most public hand pumps are located on the fringes of the village. This is visible in the map in figure 6.1, on which I marked the most popular public and semi-public hand pumps. The location of the public hand pumps is determined by the panchayat, depending on which public property has access to good groundwater.[74] Some of these pumps provide saline water as well, and are therefore not much used, which is why some semi-public hand pumps are more popular. As can be seen on the map, there are several hand pumps on different locations in the village, for most people reachable within a walk of several hundred meters. This walk can form quite a physical effort with a 20 litre pot of water on the head. (I personally could not even lift the *matka* above my shoulders!) Most hand pumps are located on the fringes of the village, which holds that the people living in the centre have to walk the furthest. For me, it was difficult to establish with certainty whether hand pumps were public or semi-public, though I know that most hand pumps indicated on the map are public (placed by the panchayat). Three hand pumps are highlighted: number 1 is the most popular pump south of the railway line, many people come here for fetching drinking water, as it provides 'the best' quality water. This pump is in fact privately owned and made available for the village by the owner, it will come back in the cases in box 6.1 and 6.2. Number 2 is also a semi-public hand pump, about which more will be explained in box 6.3. Number 3 refers to a popular public hand pump, which is mainly used by higher castes, though it is located close to the lower caste settlement on the railway line. These three pumps are, in my view, the most used pumps in the village, and therefore I focused on these during my fieldwork. They are important water resources, but, as I will show, not uncontested.

Walking to a hand pump and carrying a pot of water is the traditional way of water fetching. The effort that has to be invested in this is perceived as quite normal. One woman for instance told me that "*My mother-in-law says I should not protest, she comes from another village and had to walk 2 or 3 kilometres every day to get water.*"[75] Due to the coming of the PHED supply and the modern technologies available, the burden of fetching water has been much alleviated compared to the past. However, for the household members who are in charge of fetching water every day, the burden should not be underestimated. Throughout the day, one can see people walking around with pots, bottles and small tanks to fetch water. In mornings and evenings it gets most busy at the hand pumps, as the temperatures are more pleasant. Members of those households that do not have a private groundwater resource or a connection to the PHED supply have to do the most work: they have to walk to the common hand pumps for every chore they do. For households with water supply or a private groundwater resource the situation is different and the necessity of fetching water is less. However, many people still choose to do so for drinking water, as the (perceived) better quality of the water is apparently worth the effort of fetching it from the public hand pumps.

Picture 6.1: The most popular semi-public hand pump south of the railway line (*number 1 on the map*)

[74] Interview sarpanch (23/04/12)
[75] Interview 54 (04/06/12)

6.2 Sharing of groundwater and interdependencies

The nature of the common flow resource that water is, is that it is always shared among its users. It is difficult to establish which water belongs to whom, even if there are formal provisions (such as land rights or a formalized connection to the supply). This can lead to conflict about how much and in which ways the water should be used. The groundwater resources in the village have to be shared, and there are multiple ways for accessing these. Some households have more ways and means for this than others. In times of scarcity, when there is less water available or when means of access are blocked, more practices of sharing water can be observed in the village. An example of this is elaborated in box 6.1, on the breaking down of one of the main hand pumps.

Box 6.1: **The case of the broken hand pump**

When we arrived in the village on the 20th of June, we noticed there were a lot of water worries in the settlement south of the railway line. The main hand pump on this side was broken (a semi-public pump, located at someone's plot). The removal of this important water resource uncovered the vulnerabilities and the coping strategies in this side of the village, where the water supply does not reach. Members of lower caste groups living here expressed their concerns and, as they do not have access to private groundwater resources, were diligently looking for alternatives.

The first man we spoke to explained their current dependency on other people's water resources: *"The situation is very difficult. We have to ask for water, we are begging for it everywhere. Sometimes they let us fill, but sometimes they don't. We are walking long distances to get water now, all the way to other side of the village. It depends on people's mood if they let us fill or not. Sometimes they even close their fences when they see us coming. It is very difficult on this side, we also don't have water supply coming here, now what do we do?"*

Another lady shared this experience: *"We are getting water from other people, we have to go and ask for it, though we are reluctant to keep begging for it. We only go to people on this side [of the railway line], it is far to walk to the other side and the people there won't allow us in anyway."*

Though she did not state it directly, when I enquired whether this might have something to do with caste perceptions and prejudices, she hesitantly confirmed this. The importance of this one, semi-public hand pump for this part of the village slowly became clear: *"This hand pump is our main source of water for the past 15 years, for everyone around here. The situation is very troublesome now; some people are even drinking saline water these days."*

This hand pump, however, is not the only place on this side of the village with sweet groundwater access. Owners of other plots in this area with groundwater access now opened these more frequently for other people to use. Many people were now going to these places to fetch water. One of these owners, an elderly Rajput lady, was watching her cattle at one of these plots and told us: *"Whenever we are here, the gate is open and people can come and take water. Usually, it doesn't happen too much, but now that the hand pump is broken, more people are coming. If there is electricity, they can fill up from the submersible; otherwise, they can use the hand pump. All communities come here, even the Harijans. I don't discriminate; everyone is welcome for fetching water."*[76] This plot was only opened during the parts of the day that the lady was present. In most other, similar, plots too, the fences remained closed when the owners were not around.

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[76] All observations and interviews of field visit 21

In this case, water sharing occurred on a larger scale than usual, which provided me with insight in this practice. The people most affected by the broken hand pump were lower caste and poor households. Few of these have access to a private groundwater resource, because they cannot afford the technologies needed for this. As I showed in chapter 4, only 30% of groundwater users I interviewed has private access to potable groundwater[77], whereas 70% has to depend on public sources. As the event described above occurred in the area south of the railway line, it concerned people without access to the PHED supply. Hence, they had only few options to choose from: drink saline water, walk longer distances to other hand pumps, or ask people with a private water resource for access to this. This last option occurred on a larger scale than normal. Asking for water is considered a lower caste practice. But even in these groups, it is not very commonly practices, as most people I spoke to indicated that they do not like to 'beg' for water. It is an option that can be resorted to in times of need. Then they prefer to ask people they know: preferably family or caste members – but these often are in the same situation of scarcity. Other options are asking neighbours, landlords or parents of their children's friends and classmates. In sum, people asking for water rely on their social relations and go to people where they expect to succeed (and not get chased away). This practice is possible because of a religious tradition where giving water to the thirsty is considered a good deed. Hence, this collective pattern of behaviour can be seen as a village institution for water provision to those in need. Though this institution is acknowledged to exist by all villagers I spoke to, it does not provide a certain flow of water. Asking for water is a practice that costs a lot of time and energy, is only resorted to in time of scarcity and is not seen or used as a regular way of securing water access. People asking for water constantly have to negotiate access to other people's private resources. Though I did not actually see that favours were asked in return for this, it is not unimaginable that it does create a kind of social 'debt', which can create new relations of dependency with the owners. The panchayat also did not get involved in the issue described above, as the hand pump concerned is not an official public hand pump. This left the people depending on it to take care of themselves, and they relied on the traditional institutions for asking and giving water. It shows that households who do not have a secure private supply, remain in a vulnerable position concerning water access.

This case shows the dependency relationship between owners and users of water sources. People asking for access to someone's private resource have to adapt to the conditions of use that the owners of the groundwater resources decide, meaning that they sometimes are excluded from resources and find gates closed. This relates to caste prejudices that still exist (consider for instance the fact that '*even*' the Harijans are allowed on to the lady's premises). Traditions and rules-in-use play a role here, also as a motivation for people to share water with others. Giving water is done because it is considered 'good conduct'. An owner told me: *"I could put up a fence around it and use it only for myself. But that is not good to other people, so I don't."*[78] It appeared that otherwise these higher caste members might not even want to give out their water to the lower with all the prejudices they hold. But their beliefs say that giving water to the thirsty is one of the best deeds possible and good for one's karma. Thus, members of a higher caste can mobilize two discourses of religion and tradition for justifying a choice whether to give water or not: lower castes are unclean or it is a good deed to provide them with water. This causes uncertainty for lower caste members who are depending on these resources.

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[77] Groundwater users are the 74% of households interviewed who use groundwater for drinking.
[78] Interview 32 (16/05/12)

In the case of the broken hand pump, several other plot owners in the same area were now found to leave their plots with private hand pumps and submersibles open to others to fetch water. This is also a way in which water resources were shared in times of scarcity. Dependencies between user and owner became very clear: many of these plots were irregularly opened and closed, causing uncertainty for those wanting to use it. In fact, the very hand pump that was broken -one of the most important water points for the area behind the railway line-, is semi-public as well. It is a hand pump located on land owned by a large Rajput family of which several members have been panch or sarpanch. The previous sarpanch also belongs to this family. In an interview he told me that his father has made the pump available to the public, as it is provides the best and sweetest water of Sultanpur. He and his family will make sure that there will always be a hand pump for everyone to use at that site, as they want to take care of the village.[79] I think political motivations might also play a role here, as keeping this hand pump available can be important for the owners family in order to get votes from this area of the village. It functions as a votebank, where water provision is arranged via this pump in exchange for votes for the former sarpanch's family. Currently, the plot it belongs to a son of the former sarpanch, and in the week it was broken, he was doing construction work there. The box below shows how this lead to rumours and accusations.

Box 6.2: The owner of the broken hand pump

The owner of this plot of land is Ankit. He is constructing a work place or small factory at this place and says that the hand pump happens to be broken, coincidentally in the same week that he is doing construction work. He will repair the pump soon, because the people in the village really need it for drinking water. They are accusing him, Ankit explains, of breaking the hand pump on purpose, in order to do his construction work. But he denies this: the village needs the water and his family is also depending on it for drinking water.

His sister, whom we meet later that day, tells us that he did not break the hand pump on purpose, she says it breaks because people keep stealing items from that pump to use for themselves. It is a hassle for their family to keep it functioning: *"We've been doing this for years: providing water to the village from our own grounds. We do it because it is a good deed to do so. People have been using our water. Now they are blaming us for these problems, which is not right. They are making a political issue out of it, saying that we only did this because of the sarpanch elections. They think we've closed it because our family has lost. But we need this water ourselves too. We too are now drinking saline water, we have the same problems as everyone. And we've said that we will put another source of water if we do something with that plot. But the people don't believe us, while they have been using our water for years."*

A couple of ladies who normally use this hand pump for fetching water, indeed express these fears. They think it unlikely that the pump will be repaired, because it seems like the owners of the plot are going to build something. The panchayat cannot do anything about this, as it is private property. They suspect that the pump might have been broken deliberately, as to not get disturbed during the construction work. *"Who knows what will come here and if they will put the hand pump back?"*

Despite these fears and rumours, the hand pump was repaired within a couple of days and kept on working afterwards. However, the construction work did not seem finished yet, and no one seemed entirely sure about the exact plans of the owner with this plot and the water resources.[80]

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[79] Interview former sarpanch (22/06/12)
[80] All observations and quotes from visit 21 (20/06/12)

Thus, the people who make their private groundwater resources available are crucial for some people's drinking water access. They have a powerful position: they can close their resources to others and exclude those who depend on it. This creates relations of dependency, and causes uncertainty for the users. The unclear status of the semi-public hand pumps does not help: though some of these are currently regarded as public water access points, the owners do have the power to close them to the public, which then has to look for alternatives. If groundwater scarcity further increases, this risk might increase as well.

Picture 6.2: People using the hand pump after it was repaired
(the text on the wall reads 'watch out for snakes')

6.3 Caste interactions with groundwater

In chapter 2 and 3, I have provided some information on the workings of the caste system in India and which different castes live in the village of Sultanpur. In my research, I paid specific attention to the relation between caste groups and their access to water. In this paragraph, I will describe some relations and dependencies between different caste groups, which are relevant to water access.

During the research I could see that caste is not a label that is all determining, as differences exist within castes as well. For instance, I interviewed one quite poor Rajput households, who had to live off one piece of land and 2 cattle to support a family with several children. Also, some Harijan households had fathers and sons going to work in the cities and children getting an education. It seems that caste relations and perceptions, though slowly, are changing in the village. This was also acknowledged by a couple of Harijan ladies we spoke to; they indicated that caste discrimination is not something they experience while fetching water. *"The Harijans used to get troubled by other [higher] caste members at the hand pump, but that is not anymore right now."* As they put it: *"Everybody in the village is equal in practice, not in thought however",* indicating that even though practical and physical restrictions have been removed, some higher castes still hold prejudices against them.[81] Another lady could also see the differences between different members of higher castes: "*In general, the situation has been improving, it is only a few people who are egoistic and behave like that."[82]* These thoughts are mainly shared by lower caste members. Members of higher castes are less concerned with caste differences and discrimination, as they are less affected by it. As one member of the Yadav community stated: "*Everyone lives happily together in the village, there are no caste problems*."[83]

The public hand pumps are places where many villagers come together for fetching water. It is a site for social interaction, particularly in the end of the afternoon. This is the time that it gets busy, when the heat of the sun decreases. This is also a place where different castes interact, even if they normally live quite segregated lives. In Indian culture, caste perceptions are linked to ideas of cleanliness and purity. Harijans are perceived as unclean and untouchable. This is important in thinking about caste interactions and water, as water also has a lot to do with perceptions and rituals about cleanliness in Hindu beliefs. When I was observing the go-abouts at the hand pumps during several afternoons, I noticed some caste-specific (inter)actions. I saw that some higher caste women clean the hand pump before filling up their pots, if it had been used by a member of a lower caste before them. They take quite a bit of time and water for performing this cleansing ritual. With this they indirectly indicate the status differences and perceptions of Harijans being 'unclean'. Through performing these rituals, caste relations and perceptions are being reproduced. Lower caste women also complain that the higher caste women cut lines and make them and their children wait longer at the hand pumps. If they say something about this, they get scolded off.[84] When it gets busy, this means that the lower caste women have to wait longer to fill up their pots. One of the women explained that it was not normal to confront the higher caste ladies about this and start an argument. Rather, they would wait for their turn, and avoid arguments by going to places where there are less chances of such conflict happening. This has the consequence that some hand pumps

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[81] interview 36 (18/05/12)
[82] Interview 43 (25/05/12)
[83] Interview 70 (27/06/12)
[84] Interview 43 and 46 (25/05/12)

are more used by higher castes (e.g. the one at the railway line, which is placed in a Rajput area, though bordering the lower caste area south of the railway line) and some more by the lower caste groups. Some lower caste members might therefore have to walk longer distances than necessary to go to a hand pump where they can fetch their water hassle-free. Hence , through daily interactions at hand pumps and the way people adapt their behaviour accordingly, status differences and power relations are constantly expressed and reproduced.

From higher caste members, I often heard the complaints that lower caste members do not know how to use the water properly. As many lower caste members are dependent upon the public hand pumps for more purposes than only drinking water, they often do their dishes and laundry right at the spot, which some higher caste members find inappropriate. They themselves however, have more often the option of doing this at home, using a private water supply, which many lower caste members do not have access to. This also is reflected in the case described in the box below, which provides insight in caste interactions and perceptions in the village.

Box 6.3: Caste-interactions at a semi-public hand pump

Suresh is the owner of a large plot of land close to the entrance of the village. He has built a *pucca*[85] house here, in which he lives with his family of seven members. They are Rajputs and own lands outside of the village, which he rents out to other people to work on. Close to their house, the panchayat has installed a public hand pump. According to Suresh, this is located on his premises. The panchayat however states that this is public land. During our talk, it is busy at the hand pump; many people are coming to fetch water or washing their clothes and cattle here. Because it is summer, Suresh says, people need a lot of water and they keep coming all day long. They can easily access the pump, as there is no fence around this plot. His household also uses this hand pump for several purposes, also because the piped water supply does not suffice for all their needs.

During the interview, Suresh's wife is washing clothes at the hand pump. As she is perceived as one of the owners, another lady makes room for her to go first, while she was already doing her own laundry there. It turns out this is a lower caste woman. Another man, Ankur, who is also a Rajput, takes his turn fetching water as well before she can continue. Ankur and Suresh scold at her, saying that she is wasting drinking water by using it for laundry and washing it in the wrong place (right at the pump, so that it seeps into the groundwater again). Suresh's wife, in the meantime, is doing her laundry just a couple of meters away from the pump. They are not mad at her, however.

Suresh says that the lady belongs to a low caste group and: *"They don't understand anything. The government has made them equal and all, which we understand. But they should also look at the other side, that these people do not have any common sense. They don't listen to us, they don't understand. We can keep fighting with them all day, they just won't listen, you can't do anything about it, it's how their community is. These communities have been taking advantage of the changes in politics. I preferred the way it was before, when us Rajput did not let them on our lands."* During this conversation, the lower caste woman was still present, though kept her distance. She stopped washing her clothes after she got scolded at. As soon as Ankur left the premises however, she continued her activity.[86]

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[85] *Pucca* is the Hindi word for concrete, and has a connotation of 'nice' or 'beautiful'. A pucca house is a symbol of status and affluence.
[86] Interview 32 (16/05/12)

The case presented above shows a difference in status between the owner of the plot with the pump (and his family) and the lower caste woman who is using it. Though Suresh's wife is practically doing the same as the Harijan woman, their actions are perceived differently because of their caste differences. Because of her Harijan-ness, one women's actions are perceived as 'inappropriate' and 'not right'. In other interviews and observations, I also found that higher caste members often describe 'them' (lower castes) as ignorant people who do not know how to behave properly. These prejudices are expressed in interactions the groups have with each other. Though the Harijan woman was not prohibited from using the pump (the owner stated he could not do so because it was a panchayat installed pump, so open for everyone), she was discriminated when she used it. As she left before we finished the interview, I was not able to speak to this woman personally.

Picture 6.3: Mother and daughter washing themselves at public hand pump

As was illustrated by the case of the broken hand pump in the previous paragraph, many lower caste people seem to prefer to stay in their own area when they are fetching water. This was specifically found for the lower caste community south of the railway line, who seldom go to the pump right across the railway. This has to do with the distance to walk, but also with the fact that *"Some people there scold at us and shoo our children away. They say that we don't know how to use the water properly. We rather go to another pump, where there is less hassle."*[87] Though officially abolished, it is clear that caste prejudices are still present in social relations and daily interactions between the villagers and in their dealing with (ground)water resources. Caste labels are difficult to escape from, as they are fixed through someone's lineage. Lower caste members have to deal with discrimination and prejudices. This influences their water access and limits their options in looking for alternatives. However, the caste label is not all-determining, socioeconomic status and location of the household also influences their options for accessing water. Poor higher caste households also struggle with issues of water access, whereas relatively well-off lower caste households might be able to afford technology which alleviates their situation.

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[87] Interview 46 (25/05/12)

6.4 Fetching practices: on gender and age

Apart from caste, gender and age are interesting social characteristics to look at, as these also play a role in access to water and people's experiences in this process. Differences in gender and age exist within households, so experiences can differ on an individual level, between household members. Caste perceptions and dimensions relate to this as well, it will become clear below.

In the definition I provided in the introduction to this thesis, 'gender' is viewed as the social and cultural meaning attributed to the (biological) differences between men and women. This makes gender a useful concept for studying social relations and divisions of labour between the sexes. In the organization of (household) water access in Sultanpur, I also discovered gendered divisions of labour. Though I initially observed both men and women fetching water in the village, I later found that gender does indeed play a role in the organization of household drinking water access. Women are the household members who are responsible for many water related tasks, they are generally the ones who do the cleaning, washing and cooking. During (part of) the day, many men are away to work on the fields or in the city, while the women stay at home to do the household work. This does not mean that they are automatically also the ones who have to fetch the water for this too. For many women, tradition dictates that they stay inside the house (premises) and do not leave this by themselves. This tradition of *purdah* which is part of the lifestyle of the higher castes (i.e. Rajput, Pandit, Bhat), also means that they cannot go the public hand pumps for fetching water. As the majority of the village belongs to the Rajput community, many village women stay inside during the day. In these groups, water is fetched by the men or children; and this is therefore mostly done before or after school and work times. Sometimes, elderly women in the family are also responsible for water fetching, as mainly younger women are kept in purdah (some stated: from marriage 15 years onwards). In the lower caste groups, purdah is not practiced, and the women are typically the ones fetching water. In these households role pattern are less defined; 'whoever can carry a pot fetches the water.' The fact that in these groups women do not practice purdah (often out of practical reasons, there is simply too much work to do), makes lower caste women less 'woman-like' and reflects negatively on their social status. The tradition of purdah makes very clear how gender and caste identities intersect and how such identities are given meaning through water practices.

Gendered task divisions and traditions are not fixed, in the village I encountered examples of women going out of the house for school or work, and not all families apply purdah as strictly. Purdah traditions are changing too: now that more village men go away to work in the city, they are not always able to fetch sufficient water for the women to use all day. This is forcing some higher caste women to go out for water, showing how modern developments change gender relations and traditional role patterns. New technologies and services can make it more easy to keep purdah: for those who have the PHED water supply coming to their house, this is very convenient. Access to a private groundwater source within the premises also alleviates the burden of going out for water. And some families indicated that this tradition also was a reason for installing an RO system (to filter the supplied water or saline groundwater). A Rajput mother of three children told me for instance that her father-in-law had an RO installed *"So that the children don't have to carry so much water around, which affects their growth. We woman can't go out, so often my kids fetch the water."*[88] Such options are not available for everyone though, as these technologies come at a cost. Therefore,

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[88] Interviews 25-27 (07/05/12)

the ability of practicing purdah is becoming even more a privilege and a symbol of social status, as these technologies are only available for the more affluent.

As many people are still depending on the sweet groundwater provided by some public hand pumps for drinking water, the physical burden of fetching water should not be underestimated. This was something that many women who do the fetching themselves complained about. *"I am losing my head from filling water all these years"* an elderly lady stated during one of the women's meetings held. The women complained that during summers the burden gets really heavy, because more water is used. Especially when relatives come to stay with them for a while, there is extra pressure, as guests have to be treated 'like gods' in Indian culture: *"Then we can spend the whole day getting water."*[89] The burden of carrying the water can cause frictions within households as well, especially when the people who fetch it are not the people who use it. As one lady stated: *"Our daughters in law don't have to carry the water, but they have no trouble wasting it!"*[90]

I observed that there was a slight form in gender segregation in choice of hand pumps. Higher caste men fetching the water opt for different places to go than lower caste women. This of course, also relates to walking distances and settlement area. Therefore I did not observe a lot of hand pump interactions between these two groups. I also noticed some other differences in practice, whereas all women carry the *matkas* on their heads, man carry them on their shoulder. Also, men more often go for water fetching in the morning (before work) and women in the afternoon. Afternoons are the time when the hand pumps get the busiest, fetching water then becomes a social activity as well. Finally, the women I saw were always walking with the water pots. As mentioned in chapter 4, men sometimes also have the option of using motor cycles, making the burden of fetching water considerably less for them. In all castes, children too are involved in fetching water. However, most parents will only send their children for water as soon as they are big enough to carry the pots around, saying that it is too heavy a job for young children, hurting their backs and shoulders.

Picture 6.4 & 6.5: Men and women fetching water at different hand pumps

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[89] Focus group 5 (11/06/12)
[90] Interview 57 (06/06/12)

Apart from these practices, it is interesting to look at the different perceptions of water issues between men and women. Women more often mentioned concerns about drinking water quality in relation to their children's health. *"Because of the bad quality of the water, children are sick in every household, there is typhoid, there is diarrhoea..."*[91] Also, they seemed more worried about scarcity of household water, as they are the ones directly working with it. For instance, the increasing salinity of groundwater means for them that cleaning and washing with this becomes more difficult. Men also often discussed this issue, but more often in relation to agriculture and construction work becoming more difficult because of this issue. Both on household and village level (as explained above in paragraph 5.3), men have more influence on decision making. In a meeting with a group of women, they explained that they do not have a forum for expressing their concerns: *"We discuss it among each other, the difficulties we experience. We complain to our husbands, but they are tired when they come from work, and the water is there, because we take care of that. So they do not feel these issues enough to do something about it."*[92] Thus, drinking and household water supply seem to be less of a priority for men, because they do not experience these difficulties directly. Both within the household and within the village context, women have less power and influence over the (water-related) decisions that are made. As they are the ones who have to deal with obtaining household water directly, they have to do a lot of the hard work. And, in the view of the women, precisely because they take care of the issues, household water matters do not seem pressing enough for the village men to take care of. Hence, they feel that this burden is resting largely on their own shoulders.

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[91] Focus group 2 (11/05/12)
[92] Focus group 2 (11/05/12)

6.5 Conclusion: groundwater access and social identity

This final chapter of the analysis of water access and inequities in Sultanpur has described how groundwater is accessed in Sultanpur and to which extent this resource is accessible for different social groups. The accessibility and quality of groundwater access varies between different locations and it has become clear that the ability to access these is largely determined by wealth. More affluent households are able to purchase land with access to good quality groundwater and to pay for the technologies needed for extracting this. Poorer households are not able to afford this, and are therefore largely dependent upon public groundwater resources. Therefore, poor households which are not connected to the PHED supply network find themselves in a vulnerable position.

In cases described in this chapter, I have shown how the lower caste community south of the railway line had to look for alternatives when the water resource they depend on became inaccessible. All strategies involved investing more effort in fetching water, be it through walking longer distances or asking owners of private resources for water. This last practice gave light to the dependency relations between owners and users of private groundwater resources. The owners are able to decide whether to open up their resource to others or not, hence they have a powerful position. People asking for (temporary) access to such a resource are in an uncertain position whether they will obtain this or not. Mobilizing social relations is a way to increase the likelihood of getting access.

Social identity are essential in understanding groundwater access in Sultanpur. The role of caste perceptions and practices should not be underestimated. Lower caste members face more difficulties in accessing groundwater, as they are largely dependent upon public groundwater resources. Moreover, the perceived 'uncleanliness' of lower castes is a label which forms an obstacle in accessing certain water resources. Some higher caste members do not allow these groups access to their private groundwater resources because of this idea. Others who do permit access, draw upon discourses that consider giving water to others as a good deed. At public hand pumps, lower castes experience discrimination and exclusion: they have to wait longer, are sometimes chased away and are accused of misusing the water. Through these daily interactions and experiences, caste relations are constantly reproduced, and cause inequitable social positions. Other types of social identity matter as well in issues of groundwater access: gender is important to take into account. Within the household, women are mainly responsible for water-related household tasks and hence for water fetching. Despite this responsibility, women indicated that they can exert little influence of water-related decision making. Nevertheless, women cannot be considered to be a homogeneous group, as there are large differences between them in terms of wealth and work-load. The tradition of purdah provides a good example. The ability to keep women inside, sometimes enabled by technology, provides the higher caste members who practice this with a high social status.

This chapter has provided examples of how differences between gender and caste are constructed and reproduced through daily practices and interactions with water. Through these experiences, symbolic ideas on social identities materialize and result in inequities in access (Nightingale 2011; O'Reilly 2006). Identities of caste and gender are given meaning through water practices. In interactions with water resources, social differences are expressed and reaffirmed and inequities reproduced. I have demonstrated how identities such as gender and caste cannot be seen apart from each other, for example in practices of purdah. Hence, I endorse Nightingale's (2011) argument on how intersectionality matters and is made material in interaction with natural resources.

7 Conclusion and discussion

This thesis has presented a case study of the hydrosocial cycle in peri-urban Sultanpur, focused on drinking water access, inequity, power relations and social identity. I have tried to unravel the complex and diffuse processes of drinking water access, located in a peri-urban context. In this final, concluding chapter, I will discuss the research results and provide an answer to the main research question:

How is drinking water access distributed in the peri-urban village of Sultanpur and how can inequities in this be explained?

In Sultanpur, access to drinking water takes a variety of forms, due to varying hydrological conditions and different technologies available. The village presents a diverse water picture where water from a piped supply network and groundwater both play a role in drinking water provision. These water resources are accessed in different ways and are used for different purposes. Throughout the study, it has become clear that household drinking water access is not equitably distributed in the village. Large differences exist in terms of type, quality, quantity and security of drinking water access. Some areas in the village are excluded from connecting to the piped supply network, which only serves a part of the village, and within the water network, differential quantities of water are supplied to different areas in the village. Groundwater can be obtained from public hand pumps or via private means of access, but establishing private groundwater access is expensive for many people. And though public groundwater resources are in principle accessible for everyone, some groups of villagers face discrimination in using these. Hence, the case of Sultanpur presents a range of types and degrees of access. In this conclusion I will discuss my research findings in relation to the literature presented the introduction. With use of the concepts of identity, institutions, politics, power and citizenship I provide insight in the workings of the hydrosocial cycle of Sultanpur and explain *how* the inequities in drinking water access are created and reproduced.

Identity and inequities

Social identity plays an important role in explaining inequities in drinking water access, as these inequities occur for an important part along lines of identity. In this study, I specifically found caste and gender to be of importance in constituting drinking water access. The relation between identity and access is two-way: identity is constituting of access, water access is also constituting of identity.

In general, I found lower caste groups to face the most difficulties in obtaining drinking water access. These groups are largely dependent upon public water resources. Most of them have no means for establishing private water access and a large part of this community is excluded from the supply network. Higher caste members generally have more options for accessing water, as they more often possess the private resources for doing this. These inequities cannot only be attributed to caste; they also have to do with wealth, something that higher caste households generally have more of (though by no means all high caste households can be considered wealthy!). Affluent households are able to afford technologies for accessing water and to move to locations within the village with better water access. Poorer lower caste households have less options for doing so. This also clearly indicates that economic status and location of the household matter for water access.

Caste inequities are not limited to physical differences in water access, perceptions of the other and discrimination are also important to take into account. I found different ideas on caste

discrimination to exist in in the village. Several higher caste members denied that discrimination happens at all, referring to the official abolishment of the caste system. Other people acknowledged that caste relations are changing in the village. They mentioned that physical barriers of exclusion for lower castes had been removed, but that people are not yet 'equal in thought'. But discriminatory practices still exist: lower caste members explained which troubles they face in fetching water at public hand pumps. At these sites, low caste members face longer waiting times and have to deal with getting scolded at. Perceived misconduct of low caste members is often used by higher caste members as an excuse for discriminating against them. Though caste relations are changing, the labels and stratification of the caste system are persistent and difficult to escape from. This causes prejudice towards low caste members and practices of discrimination to still be present in Sultanpur.

In the case study it has become clear that different water-related work patterns exist for men and women and that obtaining water for the household is generally considered to be a women's task, as she is responsible for the household domain. However, the tradition of practicing purdah in higher caste households, creates differentiation in this. The ability to do so (often enabled by technology) gives these ladies a more feminine status in comparison to women who have to go out and fetch water themselves. Being able to (afford to) practice purdah also has consequences for the work-load and status of men. However, with more men working in the city nowadays, some women can no longer practice purdah, as they are forced to go out for water. This shows how multiple identities intersect, how new inequities are created and how economic status and technology play a role in this. It also shows how 'women' cannot simply be considered to be a homogeneous group.

Sultana and Nightingale (both 2011) argue that gendered resource interactions reinforce inequities between the sexes and confirm symbolic ideas about this. The same can be said for caste differences: symbolic ideas on difference between castes are made material through the daily differentiated interactions and experiences different caste members have with water, for instance at a public hand pump. Such experiences are related to wider discourses on social differences (Truelove 2011: 151). In thinking about caste and water, it is important to recognize the ideas of purity and impurity that are entrenched within the caste system and the role of water as a polluting or cleansing medium in this. Because of these ideas, daily interactions with water are important constituants of caste and gender identities. To fully grasp the relation between social identity and inequitable access, simply explaining inequities between groups does not suffice. Practices of water access are themselves constitutive of social identity. Rich higher caste households, for example, are able to afford expensive private technologies, thereby strengthening their high social status. And through subtle forms of exclusion and discrimination at public water pumps, lower caste members' low social status is constantly being reaffirmed. The differential water work-load for men and women reaffirms beliefs about differences between the sexes. Hence, the type and form of water access someone has, is tightly intertwined with their social identity. Through daily interactions with water and with other water users, these identities are reproduced and consolidated.

All of this shows that the village community of Sultanpur is not a homogeneous entity. Like Moretto (2006) argues: it is home to internal struggles and conflict, power disparities and social inequities. Different types of inequity in water access occur and coexist, such as those distinguished by Pahansalkar (2007): social inequity between (caste) groups, gendered inequities in practices of water access and spatial inequity between areas in the village.

Institutions, politics and citizenship

Institutions for organizing and distributing water also play a role in constituting inequitable drinking water access. As these are by their design created to reproduce inequitable (power) relations, they are not targeting the groups who face the most difficulties in accessing drinking water. Village level institutions for organizing water access proved to be sites of contestation and inherently political.

I observed both informal, traditional institutions for water access in Sultanpur, as well as more formalized bodies for organizing water access. In both of these, power relations and politics matter. The traditional institution of asking for water which I saw in the village, reproduce existing inequities by creating dependencies between owners and users of water resources. Owners are in the position to draw upon multiple discourses (e.g. religious beliefs, perceptions of caste, formal ownership) with which they can motivate choices of allowing someone to use their resource or not. The unequal power relations between these actors create insecurity for people asking to access to someone else's private resource, which places them in a vulnerable position when asking for access. On the other hand, they confirm the higher social status of the owners of such resources. These unequal power relations are sustained and accentuated through the institution of asking for water.

For the piped supply network, power relations matter as well. There is a lot of contestation about the quality and quantity of water supplied by the PHED and there are many stories told about internal differentiation in the network, benefitting some areas over others. Moreover, the area south of the railway line is excluded from using the supply. Thus, the workings of the water supply are subject to processes of power and politics. Instead of the orderly grid that water supply networks are often presented to be (Coelho 2006), the network is differential and exclusive in its workings. As argued before, water governance is inherently political and ideological, and not about neutral and technical interventions. This is also illustrated by the metal pipeline project in Sultanpur. The choice to 'improve' the current supply network with metal pipelines, instead of extending it to the areas currently excluded, can be viewed as an ideological move by the governing actors towards more control over the network and its users. The new project might reduce inequitable supply within the network, but it does not address the problems in the areas excluded from it. And by a move towards formalization and billing of all connections to the supply, households with unregistered connections, are labelled as 'illegal'. This might lead to new practices of exclusion from the network. Hence, the water supply network is a subject of politics and contestation. Within the network, practices of water users for getting more water, negatively affect the amount of water available for others. The wealthy have more options to afford technology for this, and those with good relations to village politics might be able to create more room for manoeuvre. Also groundwater resources, are more easily accessed by those with wealth and power. Once again, the role of economic status and power relations in determining water access becomes clear.

These daily struggles over water are what Mollinga (2001) labels the daily politics of water use. This shows that water can be seen as a political good. Institutions are not consciously crafted, rather they are, as Cleaver (2002) argues, the outcomes of disorganized processes of *bricolage.* However, they are inherently political as they tend to reproduce existing power relations and inequities. As the people who are in power also control the institutions, institutions will benefit their interests and constituencies, instead of those who are currently excluded. This holds true for both for the more intangible traditional institutions as well as the more formalized organizations of the PHED and panchayat. Both are political and contribute to producing inequitable conditions of water access.

When distribution of access is political, water access can be seen as an emblem of citizenship. This term, coined by Bakker (2010), holds that the inclusion of groups or areas in a water supply network, can be viewed as an acknowledgement of their citizenship. More authors (e.g. Truelove 2011; Anand 2011) argue along such lines, specifically for urban areas in the global South, where new settlements are often left unconnected to the water supply. Sultanpur is a small village without large new settlements, so this is a different situation. However, I argue that the argument can be extended to areas like these, because the underlying principles are the same: if institutions for water provision reinforce power relations and social differences, the linking up of excluded groups and areas to the network can be seen as politically including them. Hence, the area not connected to the water supply network has to present itself as a politically interesting and deserving group (Anand 2011), in order to overcome the obstacles for extending the water supply to their area. It is clear that identity also plays a role in the situation for the area south of the railway line, as this is predominantly a lower caste settlement. The inhabitants of the area are not properly represented in village politics. And the political necessity of extending supply here is viewed as less pressing, also because there is sweet groundwater present. However, accessing this is not affordable for the poor low caste population living here. If this group finds a way of making political pressure for bringing the network to this side, they might be able to achieve a more equitable water access. In that sense, establishing citizenship can provide a way to a more inclusive and equitable situation.

Access and agency

In this thesis, I have made clear that drinking water access takes a variety of forms and is deeply rooted in its social context. Access is achieved through a variety of institutions, in formal and more informal ways, also in manners that can be viewed as 'illegal'. The notion of legal pluralism has allowed me to keep an open view for this plurality in ways of access. Social relations matter in achieving access. Certainly in attempts to get access other people's private water resources through traditional institutions for water sharing, I found people to rely on their relations of kinship and acquaintance. This endorses Truelove's (2011: 146) argument that access is often achieved via social positions and relations, instead of direct interaction with the resource. Hence, my findings are in line with Ribot and Peluso's (2003) definition of access, showing how it is about a much broader range of social relations than only the formally acknowledged relations of property. The people of Sultanpur actively mobilize the relations, tools and means they have for obtaining and maintaining access to drinking water. Maintaining access is a burden that has to be constantly renegotiated. Ribot and Peluso argue that people can draw on bundles of powers for achieving access. I would like to emphasize that agency also matter. Accessing drinking water is both about people's abilities and the choices they make in the process. Water users make motivated choices about which resource to access for which purpose, based on perceptions of accessibility and beliefs about water quality and quantity. Singh et al.'s (2005) notion of social acceptability of access is useful in this. It points to the cultural discourses and beliefs of 'appropriate' drinking water access, e.g. the beliefs about uncleanliness of the PHED water supply and the relation between caste, water and purity. Hence, drinking water access has a cultural component, which influences the choices people make.

The hydrosocial cycle in Sultanpur

This research has presented a case study of the hydrosocial cycle in Sultanpur. By relating drinking water access to identity, institutions and politics, I have made clear that drinking water access is deeply rooted in its social context. In this analysis, the hydrosocial cycle has provided a tool to study how water flows through this social context and is determined by power relations. With use of this

concept, I have explained the processes that create *"inequitable socio-hydrological conditions"* (Swyngedouw 2009a: 57) and the meanings that are attributed to this by the villagers. It has become clear that 'the social' is very important in determining access to drinking water in the form of identity, power and relations. However, the role of natural conditions cannot be ignored, this also matters in determining how water flows and who can access it.

The hydrosocial cycle is a concept that originates from political ecology, the theoretical approach which I applied in my study. According to political ecologists, power relations are crucial in determining how access to resources is distributed. In Sultanpur, I found the people who face most difficulties in obtaining water access have little influence in institutions and village politics. As explained above, existing power relations and inequities are reproduced through these institutions and political processes. Hence, power relations can be said to determine water access. Moreover, by deploying their own agency, people use their own powers to access drinking water. Infrastructure and technologies are also important in determining the physical flow of water. As they are designed and created by people, these can also be regarded as social constructs. According to Frances Cleaver (2000), technologies are embodiments of beliefs and practices and always have to be seen in their social context. This ideological and political component of infrastructure has become clear from the discussion of the PHED supply network. Moreover, by being able to afford the most advanced private technologies, the wealthiest villagers can obtain the best water access.

Apart from this social side of drinking water access, the natural side should not be overseen. Geographical and environmental conditions, such as groundwater depth, location and quality, as well as the sloping terrains of the village, also influence water access. These create differential hydrological conditions in the village, which has its spatial consequences. There are clear moving patterns to areas with good, sweet groundwater access. Hence the land prices in these areas rise. For the PHED supply, geography also matters, the sloping terrains of the village have their consequences for the reach of the water pumped through the system. This in turn can be alleviated by the use of private pumping technologies. Hence, there is an interplay between social and environmental conditions in creating differential water access in the village of Sultanpur.

In reflecting on my research, it has shown that there is merit in adopting an approach that sees the natural and the social as co-constituted. They should be seen as two parts of a collective that are constantly mutually constituting each other. I argue that water cannot be seen apart from its social context. Water is permeated with cultural beliefs, power relations and social practices. It is physically located in spaces that are structured and given meaning by human beings. In turn, these geographical conditions shape institutions, identity and relations. Hence, I have shown how social identity constitutes drinking water access, but also how access is constituting of social status and identity. The hydrosocial cycle has attested to be a good analytical tool to study the way that water flows through its social context. I want to emphasize that water cannot be seen apart from this social context. Within this cycle, the 'social' and 'natural' elements should not be seen as separate, but as joint parts of a collective.

Concluding remarks

Returning to the main research question, I think that I have by now well-described how drinking water access is distributed and which inequities occur in the village of Sultanpur. Moreover, I have explained how such inequities are created and reproduced, with use of the concepts identity, power

and institutions. By focusing on the daily experiences of water users in the village, I have shown how social difference is made material through water practices and interactions. It is interesting to see how the interaction between identities, economic status, technology and spatial-hydrological characteristics plays out in reality, and how this presents Sultanpur's diverse water picture. It should be acknowledged that social and natural elements are co-determining and cannot be seen apart from each other. In my view, that is the essence of a study on the hydrosocial cycle.

Communities, institutions and water practices are deeply rooted in their social, cultural and geographical context. Hence, the peri-urban context that this research is located in should not be overseen. Because of the growth of Gurgaon, Sultanpur is experiencing both environmental changes and changes in social structures, institutions beliefs and traditions. All of these have consequences for drinking water access in the village. The changing situation can create new opportunities, by for instance challenging tradition beliefs about caste, but also poses threats. In the light of on-going processes of urbanization, it is relevant to gain insight in the consequences of these processes for peri-urban areas. With declining groundwater levels, drinking water is likely to become an even more contested resource. In my view, the rich and powerful inhabitants of Sultanpur are more likely to benefit from peri-urban change, whereas the poor and lower caste villagers might face even greater struggles and uncertainty in the future. Hence, it is important to understand the processes that underlie these issues of inequity, to which the findings of this research can contribute.

In this thesis I have provided an in-depth analysis of hydrosocial cycle in the peri-urban context of Sultanpur. Hereby, I contribute to a greater understanding of inequitable drinking water access. This understanding of how inequities occur and what they mean for people can also be of value for policy making. In my study, I have made clear that approaches which see water provision as a neutral and technical matter do not 'hold water': institutions and technology for water access constitute and reproduce social inequities. They are not neutral but ideological and political, designed to reproduce existing power relations. The complexities of social reality need to be taken into account in thinking about achieving more inclusive forms of water access. It has to be acknowledged that drinking water access is a complex social issue, which is deeply embedded in its cultural and geographic context. When reasoning from a political ecology view, it is not possible to prevent inequities in the future, as human interventions in the hydrosocial cycle are always political and create new kinds of inequities (Swyngedouw 2009a). If everything is political, a pathway to more equitable and inclusive ways of distribution of drinking water access might be found in the argument of citizenship argument described above. This requires excluded and underrepresented groups to make political pressure, they can force policy makers to listen to their needs, in order to achieve more equitable access to drinking water resources.

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Figure 2.1: Haryana State in India
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Figure 3.1: Sultanpur and the national park in relation to Gurgaon
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Figure 3.2: Satellite view of Sultanpur village
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Figure 5.1 and 6.1: *These are based on the satellite view of figure 3.2, and edited by the author.*

Pictures: *All pictures are the author's photographic material.*

Graphs: *All graphs are made by the author on the basis of the collected data.*

Appendix

1) **List of interviews and focus groups**

2) **Topic lists used for field research**

Appendix 1: list of interviews and focus groups

List of interviewed persons in Sultanpur[93]

Visit	Date	Interview number	Household size	Gender[94]	Caste
3	25-04-12	1	5	M	UNKOWN
		2	*	M	RAJPUT
		3	*	M	RAJPUT
		4	17	F	BAWARIA
		5	11	M	RAJPUT
4	27-04-12	6	27	M	RAJPUT
		7	5	M	HARIJAN
		8	6	F	BAWARIA
		9	5	M	NAAI
		10	4	F	HARIJAN
		11	5	M	RAJPUT
5	30-04-12	12	7	F	RAJPUT
		13	5	F	BAWARIA
		14	6	M	RAJPUT
		15	8	F	RAJPUT
		16	*	M	UNKOWN
		17	*	F	UNKOWN
6	4-05-12	18	10	M	YADAV
		19	7	M	RAJPUT
		20	5	F	BALMIK
7	7-05-12	21	*	F	UNKOWN
		22	8	F	RAJPUT
		23	11	M and F	RAJPUT
		24	20	F	RAJPUT
		25	5	F	RAJPUT
		26	20	F	RAJPUT
		27	13	M	RAJPUT
8	11-05-12	26	9	F	RAJPUT
		27	5	M	HARIJAN
9	14-05-12	28	10	M and F	RAJPUT
		29	10	F	RAJPUT
		30	11	M	UNKOWN
		31	4	F	KHATI
10	16-05-12	32	7	M	RAJPUT
		33	6	F and M	KUMHAAR

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[93] Visit 1(16/04/12) and 20 (13/06/12) consisted only of observation; visit 2 (23/04/12) and 15 (31/05/12) consisted only of interviewing key informants; and visit 25 (4/07/12) consisted of interviewing key informants and a focus group. During these visits no household / individual water users interviews were held.
[94] M:Male, F:Female

		34	*	M	PANDIT
11	18-05-12	35	5	F	HARIJAN
		36	5	F	HARIJAN
		37	6	F	SAINI
		38	*	M	SAINI
12	23-05-12	39	8	F	RAJPUT
		40	6	M	RAJPUT
		41	*	M	RAJPUT
		42	6	M	RAJPUT
13	25-05-12	43	5	F	BALMIK
		44	4	F	BALMIK
		45	2	F	BALMIK
		46	12	F	BALMIK
		47	*	M	UNKOWN
		48	5	F	HARIJAN
14	30-05-12	49	4	M	RAJPUT
		50	14	M	NAAI
		51	12	M	PANDIT
16	4-06-12	52	20	M	SAINI
		53	5	F	RAJPUT
		54	6	F	RAJPUT
		55	6	M	RAJPUT
17	6-06-12	56	6	M	RAJPUT
		57	7	F	PANDIT
		58	7	F	RAJPUT
		59	7	F	RAJPUT
		60	4	M and F	HARIJAN
18	8-06-12	61	6	M and F	BAWARIA
		62	20	M	RAJPUT
19	11-06-12	63	5	M	NAAI
		64	15	M	RAJPUT
21	20-06-12	65	6	F	RAJPUT
		66	3	F	HARIJAN
		67	5	F	RAJPUT
		68	6	F	RAJPUT
22	22-06-12	69	3	M	HARIJAN
23	27-06-12	70	5	M	YADAV
		71	8	F	RAJPUT
		72	3	F	RAJPUT
24	29-06-12	73	5	M	RAJPUT
24		74	15	M	PANDIT
		75	7	F	RAJPUT

List of focus groups

Visit	Date	Number	Consisting of
8	11-05-12	*Focus group 1*	*Meeting women's self-help group (SHG) meeting at Anganwadi (day-care centre) Sultanpur*
		Focus group 2	*SHG meeting (2) Anganwadi*
19	11-06-12	*Focus group 3*	*Elderly men at beginning village*
		Focus group 4	*SHG meeting (3) Anganwadi*
		Focus group 5	*SHG meeting (4) Anganwadi*
25	4-07-12	*Focus group 6*	*Panchayat men*

List of key persons

Visit	Date	Key informant
2	23-04-12	*Executive engineer PHED Old Gurgaon*
		Subdivisional engineer PHED Old Gurgaon
		Village headman Sultanpur
14	30-05-12	*Village headman Sultanpur*
15	31-05-12	*Executive engineer PHED Old Gurgaon*
		Subdivisional engineer PHED Old Gurgaon
22	22-06-12	*Former village headman Sultanpur*
24	29-06-12	*Valve operator Sultanpur*
25	4-07-12	*Subdivisional engineer PHED Old Gurgaon*

List of experts interviewed

Date	Name	Organization
24-05-12	Hans van Vliet - First Counsellor / Head of Development Co-operation Section	Delegation of the European Union to India – Development Cooperation Section, New Delhi
5-07-12	Barat Lal Seth – Deputy Programme Manager Water Management	Centre for Science and Environment (CSE) India, New Delhi

Appendix 2: topic lists used for field research

First topic list:

- Where do you get your drinking water from? (one or several sources?)
- How do you find the quality of this water?
- Is there sufficient clean water available?
- Why do you choose to take it from this source?
- Do you have other options to get water from?
- Why do you not use those?

- How much drinking water do you need per day for your household? (estimate)
- Do you use this water for other purposes as well? (e.g. cooking / cleaning)
- If other water is used for other purposes: from which source? Why that one?

- Technology: which objects are used for obtaining water?
- Is any technology used for cleaning the water?

- How are responsibilities towards obtaining / cleaning drinking water spread within the household? Who is responsible for this? (men / women / children)
- Do you work together with other people (family / friends) to obtain drinking water?
- Are there any dependencies on other people for your access to water?
- Is there any type of village organisation involved in this?
- Who is responsible for (maintaining) the water source? Who is paying for this?

- How much time is spend per day on obtaining the water?
- How does this compare to the rest or the tasks and chores around the house?
- Are any financial costs involved? For what and how much?

- Peri-urban changes?
- Basic information households: income, caste, occupation, size, education

Revised topic list:

Water access:

- Sources
- Purposes
- Preferences
- Quality
- Quantity
- Time / costs

Household:

- Members
- Caste
- Income
- Cattle
- Land
- Education

Technology:

- For fetching water
- For storing water
- For filtering water
- Electricity needed
- PHED supply

Organization:

- Role of Panchayat
- Role of PHED
- Social networks
- Role of women & children
- Village initiatives
- Water wastage

Peri-urban:

- Environmental changes
- Climate change
- Influence of the city
- Land use
- Influence on water access / water scarcity
- Future perspectives