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Study on Opportunity Cost of Unclean Water with regard to Health in Himachal Pradesh

WASH

Indo-German Bilateral Project
Strengthening Local Administration for Rural Water Supply and Minor Irrigation in Himachal Pradesh

Government of Himachal Pradesh
Irrigation and Public Health Department

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Study on Opportunity Cost of Unclean Water with regard to Health in Himachal Pradesh

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"STRENGTHENING LOCAL ADMINISTRATION FOR RURAL WATER SUPPLY AND
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CONTENTS

ABBREVIATIONS

ARWSP	Accelerated Rural Water Supply Programme
BCC	Behaviour Change Communication
BMO	Block Medical Officer
BOD	Burden of Disease
DALY	Disability Adjusted Life Years
DBP	Disinfection by-products
DoHFW	Department of Health and Family Welfare
EC-SIP	European Commission – Sector Investment Programme
FAO	Food and Agriculture Organisation
FGD	Focus Group Discussion
GoHP	Government of Himachal Pradesh
HACCP	Hazard Analysis and Critical Control Points
HP	Himachal Pradesh
IPD	In-Patient Department
IPH	Department of Irrigation and Public Health
KAP	Knowledge Attitude Practices
NC	Not Covered
NFHS	National Family Health Survey
NGO	Non Government Organisation
OPD	Out Patient Department
O&M	Organisation and Management
PC	Partially Covered
PHC	Primary Health Centre
PMGY	Pradhan Mantri Gramodaya Yojna (Prime Minister's Village upliftment programme)
PPS	Probability Proportional to Population Sampling
PRI	Panchayati Raj Institutions
RCH	Reproductive and Child Health programme
RGNDWM	Rajiv Gandhi National Drinking Water Mission
SHG	Self Help Group
SRS	State Routine Statistics
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America
WHO	World Health Organisation
WSP	Water Safety Plans
WUA	Water Users' Association

EXECUTIVE SUMMARY

Good quality water supply to the target population has a direct bearing on the health of the population, especially in terms of the incidence of waterborne diseases. Contaminated drinking water is a major health hazard in developing countries and diarrhoea is the most common disease associated with it. The World Health Organisation (WHO, 2002) estimates 1.7 million deaths and 54.2 million disability adjusted life years (DALYs) lost worldwide per year due to unsafe water, hygiene and sanitation. Almost all of theses deaths are in developing countries and nine out of ten deaths occur in children. In India alone, more than 80% diseases are water related including typhoid, hepatitis cholera etc. and over 4 lakh children die per year due to unsafe water.

As per the report on Burden of Disease Report of Himachal Pradesh, waterborne diseases are among top five of diseases even in the state of Himachal Pradesh (HP), across all age groups. This is due to mainly due to the topography, where water sources carry the disease causing agents from upstream and infects people in the downstream area, especially in the monsoons. The responsibility of managing any outbreak of waterborne disease/ gastroenteritis lies mainly with the Irrigation and Public Health (IPH) Department, which is responsible for ensuring supply of potable water and maintaining the water bodies in the State and the Department of Health and Family Welfare (DoHFW), Government of Himachal Pradesh (GoHP).

Although Himachal Pradesh has a fairly high coverage with regard to water supply schemes, the delivery of sufficient water (in terms of quantity and quality throughout the year) is not always satisfactory. The main reason for this is the often inadequate operation and maintenance of the schemes. This has been recognised by the central and state governments, and efforts are being made to improve service delivery towards a demand-driven and participatory approach by involving Panchayati Raj Institutions (PRIs) and Water Users Associations (WUAs) in operation and maintenance of the rural water supply schemes through the centrally sponsored *Swajaldhara* scheme. This will lead to new roles and responsibilities for both the Irrigation and Public Health department (IPH) and the PRIs.

The Indo-German WASH Project has been designed with this in mind, and the project's objective is: Water Users, Panchayati Raj Institutions and other stakeholders are enabled and empowered to plan, implement and manage safe drinking water and minor irrigation systems in a sustainable manner.

As the supply of clean drinking water has a cost and the community receiving the clean water need to have a role in sharing that cost, it was proposed by the Indo-German WASH Project that a study be undertaken to estimate the monetary value that the community can identify with for getting good quality water, in terms of the broad opportunity cost of water vis-à-vis expenditures on water and waterborne diseases. This is to be done by collecting evidence regarding the extent of the problem of waterborne diseases in the state of HP and determine the underlying causes, so as to develop a holistic strategy to tackle the problem through an inter-sectoral approach, and presenting to the community the "real" i.e. full economic cost of failing to obtain and maintain good quality water. The specific objectives of the study are as follows:

- Determine the prevalence and spread of waterborne diseases in the study area
- Determine the out of pocket expenditures incurred (average household expenditure) on not being able to prevent water borne diseases
- Determine the Knowledge, Attitude and Practices (KAP) of the community vis-à-vis the use of water and sanitation practices
- Assess the knowledge among the community about waterborne diseases
- Find the willingness to pay by the community for good quality water supply

The prevalence of the disease (diarrhoea/gastroenteritis and other waterborne diseases) was determined through secondary data, to be obtained from the health department at the block level (from the BMO). A statistically significant sample was identified and randomly selected at each

block. A household survey was then conducted to determine whether any family members have been sick and whether opportunity costs have arisen. The household survey was complemented with Focused Group Discussions (FGD) and In-Depth Interviews of community leaders and panchayat members for triangulation of finding. Furthermore, the current water quality of IPH water as well as of traditional sources was also determined through water testing. The quantitative study covered a total of 781 households in Mandi district (which was taken as representative of the state); and the qualitative survey covered six FGDs in the interior villages in the district, apart from interviews with IPH officials at state and district level.

The study findings based on quantitative survey and complemented by the qualitative survey, focussing on the issues of sources of water, use of water, hygiene and sanitation practices, incidence of water borne diseases and associated cost of treatment, and community's willingness in owning the supply and management of water supply, leads us to the following conclusions:

- Most of the households had multiple accesses to water, i.e. using water from different sources, but there is gross irregularity in IPH water supply and in few places water is supplied with gaps of up to 15 days. The richest (top 25%) households are eight per cent more likely to use IPH source as compared to the poorest (lowest 25%) households, which means richer households do have greater probability to use IPH (piped water) source as compared to the poorer households. Also, the poorer households are definitely disadvantaged in terms of access to water (distance travelled for accessing water).
- Although people take some precautions, they do not take the safe handling of water very seriously. Although almost all the households regularly washed/scrubbed the vessel used for storing water, an overwhelming number of the households were not treating the water domestically before drinking. An overwhelming majority of the households use IPH/piped water for bathing and washing clothes, which leads to wastage of a precious resource, which if saved, could have been made available to those who do not have access to clean drinking water. On the personal hygiene front, people do practice washing hands before eating, but in some places people prefer using soil instead of soap for washing hands. As far as sanitation facilities and practices are concerned, accessibility is a major problem as almost 40 per cent of the households do not have sanitary toilets in their homes. A major source of concern is the domestic waste disposal practice followed by the households where people are very careless in this aspect with less than 10 per cent of the households throwing domestic waste in dustbins or having it carried away by waste disposal agency. Over half of the households just throw the waste in the open.
- The study reveals that the awareness of waterborne diseases (those that have heard of the diseases) is quite high. Going by the level of awareness, it seems that the most prevalent waterborne disease is Diarrhoea followed by Gastroenteritis and Typhoid. Dysentery and Jaundice also seem to be on top of the mind of many people. As far as knowledge of Diarrhoea/gastroenteritis goes, most of the people associate the diseases to contaminated drinking water although very few people knew it could be caused by uncovered road-side food and by not washing hands properly before eating. This also corroborates with the general lack of hygiene practices revealed in the earlier discussion. Regarding home remedies, most of the respondents were aware of Oral Rehydration Solution (ORS), but quite a few also believed that anti-diarrhoeal drugs are necessary in addition to home remedies. This practice of self medication using anti-diarrhoeal drugs might be an important cause of high health expenditure.
- The prevalence of waterborne diseases (diarrhoea/gastroenteritis) is high in the region (about 19% of the households reported occurrence of the disease in previous six months, which is about 22% more than the reported cases from government hospitals of Mandi District). The increase was expected as many cases go unreported being treated either at home by conventional remedies or at private health facilities. No particular socio-economic group is any more vulnerable than others to waterborne diseases, although households without IPH supply of water are marginally more likely to be affected by such diseases. Most of the cases of waterborne disease get cured at the level of first point of contact, which shows that very few complications arise in such cases.

- For an average case of waterborne disease being taken to first point of contact, the expenses are expected to be around Rs. 1500 per episode of illness, which can be saved if clean water is maintained and safe hygiene practices are followed. This can be a case for convincing the community to follow safe and hygienic practices and also contributing monetarily to safe and good quality water. Even looking at expenses on medicine in home remedies (Rs. 45), this is comparable to average monthly water charges for IPH connection at home.
- It was found that an overwhelming majority of the respondents (74%) were willing to pay for water provided regularity in supply and safe/quality of water is ensured. Respondents who were not willing to pay for water cited affordability as the major reason.

Some concrete suggestions that emerge from the study findings are as follows:

- As household expenditure is highest on medical and health related expenses, there seems to be an opportunity of reducing the medical expenses on the households, at least those related to waterborne diseases (like diarrhoea, gastroenteritis, etc.), by making them pay marginally more on good quality and safe water and by undertaking intensive Behaviour Change Communication (BCC) campaign.
- There is a need to undertake intensive BCC campaign among the households on the following issues, which will also call for practical demonstration and monitoring of community practices on an ongoing basis:
    - Safe handling of water and domestic water treatment
    - Domestic waste disposal practices
    - Personal sanitation and hygiene practises
    - Causes of diarrhoea/gastroenteritis related to hygiene practices, do's and dont's during home remedy and all the danger signs, which should prompt household members to take the patient immediately to qualified healthcare provider/facility
- Proper attention should be given to the possibility of contamination of ground water by soak-pit type toilets.
- There is a need to educate the masses on appropriate use of water from different sources and evolving innovative ways of restricting the wastage of drinking water.
- User charges for can be introduced, taking into consideration that presently they are paying around Rs. 25-40 per month and they can also be convinced on the lines of saving treatment cost of waterborne diseases which are Rs. 45 to Rs. 1500 per episode. But introduction of user charges has to go hand-in-hand with a guarantee of uninterrupted water supply, which for the community means at least once every day and in quantity according to norm.
- Communities feel ready to be passed on the responsibility of management and maintenance of water supply at the community level through creation of regular formal bodies. Members of these bodies need to be trained and provided with technical support on a continuous basis.

Further, the results of the water testing also indicate that the IPH Department needs to further strengthen its monitoring mechanism to ensure proper chlorination of the filtered water before supplying it to the consumers, in terms of quantity of chlorine added and time period, for which chlorine has been applied to inactivate micro organism.

This study is also expected to provide a set of evidences to the policy makers and managers in IPH and Health department at the state and district level, and also to point out concrete questions and issues to be probed further through scientific enquiry as well as community participation.

Section 1
INTRODUCTION

1.1 Background of the Study

Contaminated drinking water is a major health hazard in developing countries and diarrhoea is the most common disease associated with it. The World Health Organisation (WHO, 2002) estimates 1.7 million deaths and 54.2 million disability adjusted life years (DALYs) lost worldwide per year due to unsafe water, hygiene and sanitation. Almost all of theses deaths are in developing countries and nine out of ten deaths occur in children.

The report of the year 2006[1] elaborates on the Indian Scenario as under:

- *As per GOI 10th 5-year plan (2002-07), more than 80% diseases in India are water-related, including typhoid, cholera etc.*
- *Over 4 lakh children die in India every year due to unsafe drinking water*
- *Water borne diseases are the largest killer of children*
- *Unsafe water makes one in 5 babies ill every fortnight*
- *It has been estimated by the World Bank that a loss of Rs.19995 crore annually accrues to India on account of water pollution alone*

Interventions to improve drinking water quality and minimise exposure to health risks from ingestion of contaminated water include provision of quality regulated piped water supply to all households. According to a WHO (2002) estimate, if universal piped and regulated water supply were achieved, 7.6 billion diarrhoea cases could be averted annually worldwide.

Although Himachal Pradesh has a fairly high coverage with regard to water supply schemes, the delivery of sufficient water (in terms of quantity and quality throughout the year) is not always satisfactory. The main reason for this is the often inadequate operation and maintenance of the schemes. This has been recognised by the central and state governments, and efforts are being made to improve service delivery towards a demand-driven and participatory approach by involving Panchayati Raj Institutions (PRIs) and Water Users' Associations (WUAs) in operation and maintenance of the rural water supply schemes through the centrally sponsored *Swajaldhara* scheme. This will lead to new roles and responsibilities for both the Irrigation and Public Health department (IPH) and the PRIs.

The Indo-German WASH Project has been designed with this in mind, and the project's objective is:

> *Water Users, Panchayati Raj Institutions and other stakeholders are enabled and empowered to plan, implement and manage safe drinking water and minor irrigation systems in a sustainable manner.*

The main services of the project are:

- Awareness and orientation of key stakeholders, at various levels, about water sector reform, new roles of various stakeholders and supporting process of creating enabling environment in the state for operationalisation of reform initiative.

- Capacity building and training of the key staff of IPH as trainers and facilitators of the processes of planning, implementation, management of community-based, demand-driven water sector projects. Training and capacity building of selected PRI functionaries

[1] *"Problems and Realistic Estimates of Water Related Diseases"*; V.P. Sharma, Centre for Rural Development and Technology, IIT, New Delhi

and WUA for planning, implementing, maintaining and managing the water service delivery.

- Providing technical assistance to IPH for the implementation of the water sector reform approaches by developing guidelines, manuals and technical tools for participatory technical planning, developing strategy and plan for PRI based O&M systems and handing over of existing schemes.
- Documentation and information sharing of the best practices, development of training material, communication material, case studies etc. and sharing the information amongst various stakeholders.
- Pilot schemes to identify and demonstrate best practices for planning, implementation of demand-led schemes in the new framework and using them as learning nodes for all the stakeholders in other programs.
- Policy support to IPH department, Agriculture department, Panchayati Raj & Rural Development department of GoHP for the development of necessary legal and institutional framework for reform. Based on the experience and analysis of various issues information products will be presented (workshops, seminars, conferences) to the relevant state institutions.

Good quality water supply to the target population has a direct bearing on the health of the population, especially in terms of the incidence of waterborne diseases. According to the study on Burden of Disease (EC-SIP, Dept. of Health, 2000), waterborne diseases are among the top five diseases even in the state of Himachal Pradesh (HP), across all age groups. This is mainly due to the topography, where water sources carry the disease causing agents from upstream and infect people in the downstream area, especially in the monsoon. The responsibility of managing any outbreak of waterborne disease/ gastroenteritis lies mainly with the Department of Health & Family Welfare (DoHFW), Government of Himachal Pradesh (GoHP) and the Irrigation & Public Health (IPH) Department, which is responsible for ensuring supply of potable water and maintaining the water bodies in the State.

In light of the above, the Indo- German WASH Project entrusted INTRASOLUTIONS with the responsibility of conducting a study styled “Opportunity Cost of Unclean Water with regard to Health in Himachal Pradesh”. The specific objective of the study was to determine the prevalence and spread of waterborne diseases, identify the underlying causes of the same and determine the average household expenditure incurred on treatment in wake of occurrence of water borne diseases. The findings of the study would help to develop a holistic strategy to tackle the problem through an inter-sectoral approach.

1.2 Water Supply & Waterborne Diseases: Experience in India and around the World

Regarding the condition of drinking water supply and availability in India, it has been found that major efforts to improve access to drinking water across India have not been matched by proportionate declines in deaths and illnesses from waterborne diseases, which remain grossly underestimated.

> *As per a report in the year 2003[2], 85% of India’s population is covered by water infrastructure, said the report, from India’s planning commission, a top policy making body. Between 400,000 and 500,000 children aged under five years die each year from diarrhoea, the report said, citing a failure to improve personal and home hygiene as a factor. The report also cautioned that failure in epidemiological surveillance is leading public health authorities to record only a small fraction of cases of waterborne diseases.*
>
> *Reported data indicate that the incidence of viral hepatitis is 12 cases per 100 000 people. But at least two studies in urban communities studies have shown that the incidence might be around 100 per 100,000. The report also said that only a small proportion of diarrhoeal diseases are picked up through surveillance. The report, which*

[2] “India’s burden of waterborne diseases is underestimated” New Delhi; Ganapati Mudur; BMJ 2003;326:1284 (14 June)

> *was sponsored by the World Health Organization and UNICEF, said that improvements in hygiene behaviour are not likely unless sanitation coverage improves dramatically. Without an adequate water supply, children cannot wash often enough and so contract eye infections and skin conditions such as scabies.*
>
> *The report said that poor water quality and the lack of adequate disposal of human, animal, and household wastes are contributing to waterborne diseases. Just 30% of wastewater from India's cities is treated before disposal. The rest flows into rivers, lakes, and groundwater, it said. Public health experts also say that the actual quality of water varies widely. "Quality assurance checks are lacking in cities and rural areas. What's passed off as drinking water often leaves much to be desired," said Dr Chandrakant Pandav, a specialist in community medicine at the All India Institute of Medical Sciences.*

Figures from India's Central Bureau of Health Intelligence show that the incidence of diarrhoea, enteric fever, viral hepatitis, and cholera has stayed at the same level over the past decade. Fluoride contamination of fresh water also affects large parts of rural India. More than 25 million people across 17 states have to drink water with fluoride concentrations higher than the maximum permissible limit of 1.5 parts per million, it said. Excess fluoride can cause a condition called skeletal fluorosis.

The problem of disease breakout because of water contamination is not unique only to third world countries like India, but also occur in more advanced countries.

> *As per a report in 1997[3], in the United States, more than half of reported waterborne disease outbreaks are caused by inadequate or no disinfection. According to the this report infectious diseases typically transmitted by water have far-reaching socioeconomic implications in both industrialized and developing countries. The effect can be especially severe for the very young, the aged, the nutritionally deficient, and those whose immune systems are compromised by disease or therapeutic agents. Nevertheless, there still seems to be an imbalance between real and perceived health risks associated with disinfection.*

The problem of contaminated in water supply is also prevalent in Europe, as is evident from the following study[4]:

> *In Europe, Finland known as a country with thousands of natural water sources, the treatment processes applied in the drinking-water industry are quite simple. These kinds of water supplies are vulnerable for accidental pollution, leading to twenty-four reported waterborne epidemics outbreaks in Finland in 1980-1992 The largest of these outbreaks affected some 5,000 people. About 40 per cent of these outbreaks were due to contaminated water from community drinking-water supplies. Contaminated groundwater was a more common cause than surface water. In most outbreaks, leakage and blockage of a sewage pipe in the vicinity of a groundwater well resulted in the contamination of drinking water. The etiologic agents in these epidemics were most probably viruses; faecal indicator bacteria and enteric viruses were detected in water samples during the epidemics. Inadequate disinfection of surface water was the reason for three outbreaks. The raw water source for this supply was of quite a high quality, for which reason the treatment consisted only of rapid sand filtration and chlorination. For fear of the chlorinated organic compounds formed (some of which considered bad for health) during disinfection, the amount of chlorine in water treatment was reduced to a level where disinfection was inadequate, and some hundred people became ill.*

Use of appropriate technology for disinfection of water poses the challenge of addressing the competing risks of disinfection versus disinfection by-products (DBP). Not until the past two decades have public health authorities had to grapple with controlling a drinking water

[3] "Disinfection in Americas: A Necessity" Horst Otterstetter and Gunther Craun; AWWA Journal, September 1997.

[4] "Causes of waterborne outbreaks in community water systems in Finland: 1980-1992" K. Lahti and L. Hiisvirta; Water Science and Technology Vol 31 No 5-6 pp 33–36.

contaminant associated with a widely used water treatment practice that is generally accepted as beneficial. This dilemma has caused some bewilderment among government officials and the public. There is no doubt that competing risks must be balanced, but this requires a quantitative risk assessment, which is not yet available.

Comparing benefits and risks will be difficult even with appropriate information. Alternatively, we can consider the cost-effectiveness of preventing waterborne infectious disease. Municipal water systems designed to prevent waterborne infectious disease have proved to be one of the most effective investments society can make. Improved sanitation practices, sewage collection and treatment, increased protection of source water quality, effective filtration of surface water sources, disinfection, and adequate water distribution systems are all important to reduce the risk of infectious waterborne diseases.

Although filtration is required to remove many waterborne pathogens such as protozoan cysts and oocysts, **disinfection, especially with chlorine,** will continue to play a major role in helping to prevent waterborne disease. The health risks reported to be associated with long-term consumption of water disinfected by chlorine or other disinfectants are extremely small and uncertain. These risks pale in comparison with the real, immediate, and potentially grave health risks posed by the contamination of drinking water sources with microbial pathogens in both developing and highly industrialized countries.

However, **for chlorination to be effective, water needs to be treated with an adequate quantity of chlorine and it should be applied for a minimum required time period** so as to inactivate the micro organisms.

A recent study of the cost of water treatment for five significant pathogens found that chlorination alone or chlorination with conventional treatment is extremely cost-effective for preventing waterborne transmission. Chlorination has generally been found to be effective against almost 90% – 95% of disease causing pathogens, though a common type of oocyst named “cryptosporidium” is totally resistant to chlorination.

Apart from technology, education and awareness also plays a great role in tackling the issue of checking water contamination and waterborne diseases.

> *A study in Gurgaon near Delhi[5] found that private purification methods were not very effective in reducing contamination rates - 55 percent of home-purified drinking water tested “dirty”. This was put down partly to the need to store purified water, under which circumstances it could become easily contaminated. The most striking finding of the survey was that information about water quality did prompt action. Households that had been told that their water was “dirty” - and which were initially not doing any home water purification - were found to be 11 percent more likely to have begun purifying their water (seven weeks later when the researchers returned) than households that had not been informed of their test result.*

From the above study it is apparent that even one-time targeted information on water quality can have a considerable impact on health awareness and led to prompt practical disease prevention action. Whether such awareness will ultimately lead to a significant decline in the incidence of waterborne disease is a question for further research, however, it is probable that this will be the case.

For policy makers and those involved in public health promotion, it is clear that regular water testing linked to public information campaigns about water safety can help improve the way in which people treat their water, and that such campaigns can improve people’s chances of avoiding waterborne illnesses.

[5] South Asian Network for Development and Environment Economics (SANDEE), Policy Brief, No.8-25, Aug 2005

It is also likely that such measures will increase both demand, and political pressure, for improvements in water supply quality in addition to raising the amount that people are willing to pay for such improvements. More generally, this research also shows that more studies and research is needed in this area for increasing the database of evidences to help develop effective and alternative strategies to inform the public.

Public health is intimately linked with adequate water supply and quality and with adequate sanitation.

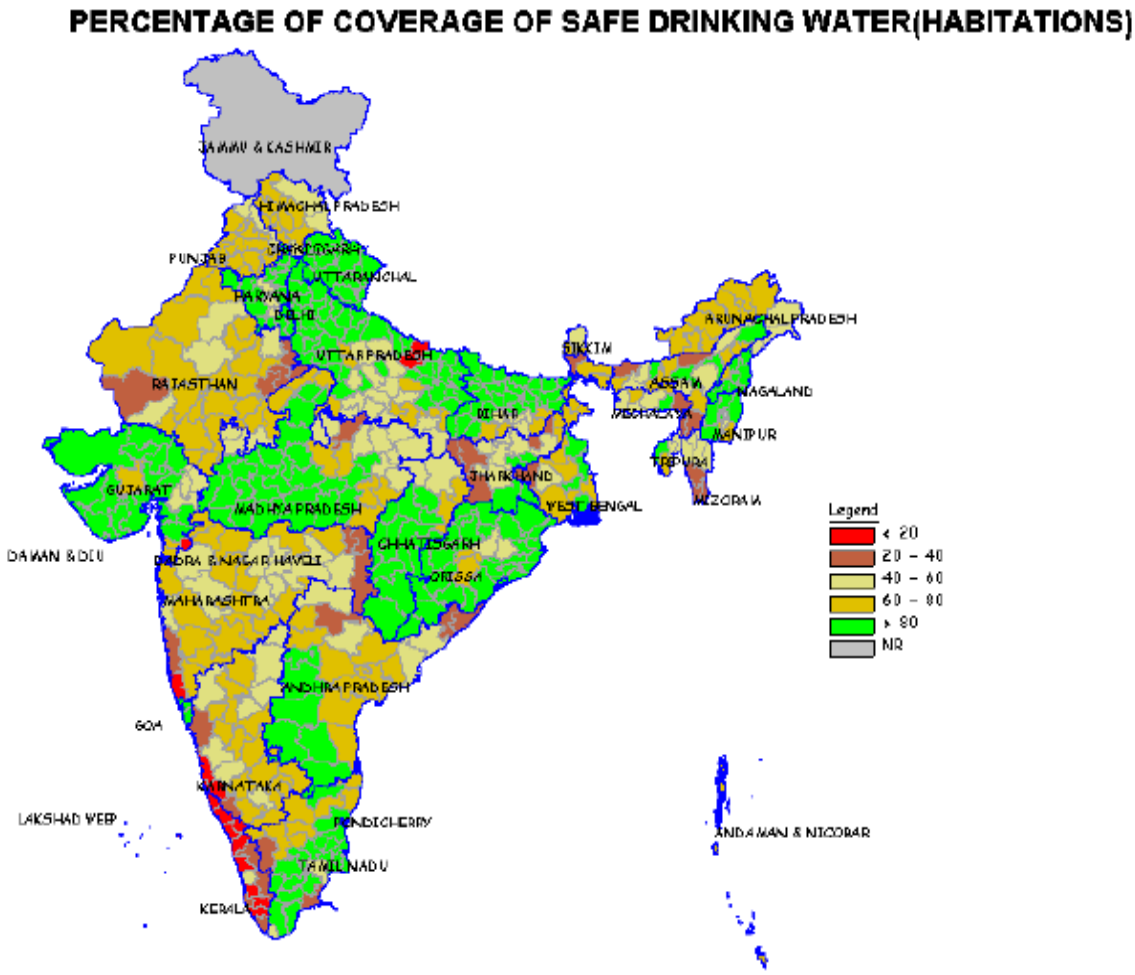
> *According to a World Bank Report in 1994, of eight major diseases or disease groups found in developing countries, four are linked to water supply and sanitation or to vectors that breed in water. Many water projects alter the environment so as to either increase the number of vectors or increase the amount of contact with disease-causing organisms. Attaining a certain standard of public health is often a government objective, and improved public health may be the outcome of government programmes that are not directly linked with water, such as general education programmes, particularly for women.*

Of course, many government health programmes concern water directly, such as programmes that are aimed at improving personal hygiene. Public health policy should be addressed by a team of professionals including members from the IPH, Sanitation and Rural Development, Health, PRIs and NGOs. The assessment should include estimation of the levels of incidence of water-related diseases, their dynamics and some identification of the existing capacity to overcome them. It is extremely difficult to make reasonable projections of the economic benefits of improved public health, and the strategy formulation exercise should keep this in perspective.

Water-related diseases in developing countries fall into two major categories: those arising from the ingestion of food or water contaminated by excrete, and vector-borne diseases. Malaria is by far the most important water-related, vector-borne disease, in terms both of numbers of sufferers and of directly attributable deaths. Control programmes for vector-borne diseases in many countries emphasize preventive or curative measures, to the neglect of environmental management and community-based preventive measures, so these should also be taken into account in an integrated plan.

1.3 Safe Drinking Water: Issues

Water is essential to life; a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking water can result in tangible benefits to health. Every effort should be made to achieve a drinking-water quality as safe as practicable. Safe drinking water, as meant here, does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.



The above map[6] denotes a graphic representation of the percentage of habitations covered by safe drinking water across India.

As can be seen from the above map, Himachal Pradesh has reasonable access to safe drinking water, varying from as low as 40% in some pockets to as high as 80% in others. On a comparative scale, with respect to the rest of India, H.P. is in an average position.

In the provision of safe drinking water, changes in water quality and hydrology, due to management and other human impacts, may have physical, biological and social consequences - consequences which need to be understood for environmentally sound and sustainable water resources management.

Some of the environmental and health impacts of use of different sources of water, which may be considered in water strategy options are mentioned below:

6 Source: National Commission on Population (http://populationcommission.nic.in)

- A variety of chemicals can contribute to groundwater contamination. Salts, fertilisers and agrochemicals such as insecticides, herbicides and fungicides used in agriculture may be leached to groundwater. Other sources of contamination include surface disposal of liquid wastes, septic tanks, leaking sewers and underground storage tanks, industrial wastes and oil field brine disposed of through injection wells, as well as mining wastes.
- Agriculture and forestry alter soil cover and affect the rate of runoff and percolation in a catchment.
- Groundwater pumping can induce the inward migration of poor quality waters from adjacent areas. Over-extraction could cause permanent decline in groundwater levels.
- Variation in stream flow affects the amount and concentration of organic and inorganic matter and the rate and location of its deposition. Variation in stream flow also affects oxygenation through surface aeration.
- Partially or untreated urban wastewater entering surface waters and groundwater can spread diarrhoea, cholera or other waterborne diseases. Such public health hazards can be exacerbated under low-flow conditions, when wastes become more concentrated, prolonging the survival and growth of pathogens.
- Industrial effluent can affect water in many ways, from changing the temperature (thereby altering sensitive biochemical processes) to harming and even destroying aquatic ecosystems by direct effects of toxicity or by raising biological oxygen demand.
- Water pollution and over-allocation of water resources are the two principal causes of conflict among competing users of water. Over-allocation of water is often a result of poor planning, poor management decisions or undue influence of vested interests.

It is well known that all natural water bodies have the capacity to assimilate some level of waste without apparent damage. This is due to physical and biochemical processes that break down waste into harmless substances, but negative impacts become significant once the threshold is exceeded. Pollution from point and non-point sources affects all beneficial uses. Controlling waste discharges from point and non-point sources should be a priority objective for protecting surface water and groundwater quality. This would first require identifying major point and non-point sources and loads, then reviewing and using the various instruments (standards, permits or incentives) for controlling waste discharges and, finally, monitoring changes in pollutant loads to enforce compliance and determine the effectiveness of the controls to meet the water quality objectives adopted for surface water bodies and underground aquifers.

Provision and Management of Safe Drinking Water: An Operational Framework

Figure 1.3.1 Framework for Safe Drinking Water

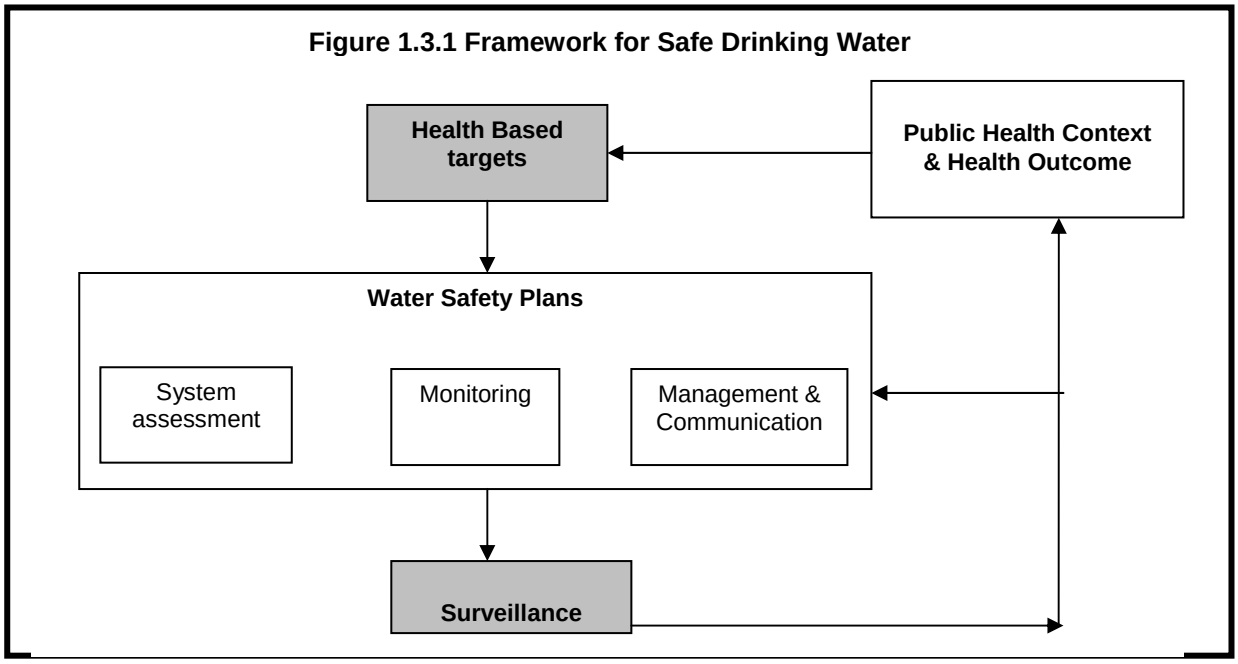


Figure 1.3.1 provides an overview of the interrelationship among various factors in ensuring drinking water safety, from an operational perspective.

The quality of drinking water may be controlled through a combination of protection of water sources, control of treatment processes and management of the distribution and handling of the water.

Further, the framework for provision and management of safe drinking water requires supporting information, including microbial aspects, chemical aspects, radiological aspects and acceptability aspects. There is a wide range of microbial and chemical constituents of drinking water that can cause adverse human health effects. The detection of these constituents in both raw water and water delivered to consumers is often slow, complex and costly, which limits early warning capability and affordability. Reliance on water quality determination alone is insufficient to protect public health. As it is neither physically nor economically feasible to test for all drinking water quality parameters, the use of monitoring effort and resources should be carefully planed and directed at significant or key characteristics.

Some characteristics not related to health, such as those with significant impacts on acceptability of water, may also be of importance. Where water has unacceptable aesthetic characteristics (e.g., appearance, taste, and odor), further investigation may be required to determine whether there are problems with significance of health.

The control of the microbial and chemical quality of drinking water requires the development of management plans, which, when implemented, provide the basis for system protection and process control to ensure that numbers of pathogens and concentrations of chemicals present a negligible risk to public health and that water is acceptable to consumers. The management plans developed by water suppliers are best termed “water safety plans” (WSPs). A WSP comprises system assessment and design, operational monitoring and management plans, including documentation and communication. The elements of a WSP build on the multiple-barrier principle, the principles of hazard analysis and critical control points (HACCP) and other systematic management approaches. The plans should address all aspects of the drinking water supply and focus on the control of abstraction, treatment and delivery of drinking water.

Many drinking water supplies provide adequate safe drinking water in the absence of formalized WSPs. Major benefits of developing and implementing a WSP for these supplies include the systematic and detailed assessment and prioritisation of hazards and the operational monitoring of barriers or control measures. In addition, WSP provides for an organised and structured system to minimise the chance of failure through oversight or lapse of management and for the contingency plans to respond to system failures or unforeseen hazardous events.

1.4 Rural Water Supply Schemes in Himachal Pradesh

The department of Irrigation and Public Health (IPH), Government of Himachal Pradesh (GoHP) is responsible for ensuring quality and accessibility to good quality water for the people of Himachal Pradesh. Towards meeting this end, the department is implementing various water supply schemes/programmes in the rural areas of the state, some of which are mentioned below.

ACCELERATED RURAL WATER SUPPLY PROGRAMME (ARWSP)

According to the census 1981, there were 16,807 villages in the state. All of them have been provided with drinking water facilities. As per the latest validated survey of 1993, the position of water supply to Rural Habitations in the State is given below:-

Status as on	(Not Covered)	(Partially covered)	(Fully covered)	Total
01.09.2006	0	3464	41903	45367

WASH

The Government in its endeavour to provide drinking water to all habitations in the State has formulated an action plan. Efforts to arrange financial assistance from Government of India under ARWSP/PMGY programmes are being made to achieve the target to ensure supply of 40 lpcd to all PC habitations by March 2007. All former NC habitations have been covered already.

There are 7506 Water Supply Schemes in the State. Out of these 1232 are lift, 181 tube wells and 6093 are gravity schemes.

During 1991-93, the Rajiv Gandhi National Drinking Water Mission, Govt. of India conducted a status survey of Rural Water Supply in the State and the focus shifted from providing water facilities not just to census villages, but further to habitations.

As per the survey so conducted, 45,367 habitations were identified in the State. The habitations were further divided into three main categories i.e. Not Covered (NC), Partially Covered (PC) and Fully Covered (FC), as per RGNDWM's guidelines.

The Govt. of India under ARWSP has accorded top priority to provide water supply to NC/PC (0-10 LPCD) habitations and while preparing its shelf of projects, the Govt. of H.P. accords similar priorities.

PRIME MINISTER'S GRAMODAYA YOJNA (PMGY) – RURAL DRINKING WATER PROGRAMME.

In order to achieve the objective of sustainable human development at the village level, the Govt. of India started the Prime Minister's Gramodaya Yojna (PMGY) from the year 2000-01.

SWAJALDHARA PROGRAMME

Sirmour District was covered under the pilot project under this programme. The basic features of the Programme, as per the guidelines issued in June 2003, are as under:

Swajaldhara streams

Swajaldhara-I to have Gram Panchayat as the lowest unit.

Swajaldhara-II with District as the unit.

Main Basic Principles

- Demand–driven, participatory approach.
- Village Panchayat/community will be given powers to plan, implement & manage.
- Integrated approach to water, sanitation & hygiene, Ground Water Conservation and rain water harvesting.
- Capacity development of the community to plan, implement and manage the Rural Water Supply Schemes of their own choice.
- Government playing the role of a facilitator instead of provider.

1.5 Waterborne Diseases in Himachal Pradesh

The Burden of Disease estimates study was undertaken in the state of Himachal Pradesh in the year 2001-02. The first estimates of Burden of Disease (BOD) was made on the basis of secondary data available on mortality and morbidity. The morbidity data for the state has been compiled from the morbidity report of the state for the year 1999. The source of mortality data is the annual statistical report prepared by Government of Himachal Pradesh for the year 2000.The total population of the state has been taken from primary census abstract for 2001.The age and sex composition of the state is based on the average of the annual SRS report of the past five years (1993-1998).The summary of estimation for BOD for year 2001 is given below.

1. The total "Disability Adjusted Life Year "(DALYs) lost in Himachal Pradesh was 23,05,295; 55.8% (1288461) were lost in males and 44.1 % (10,16,834) in females.
2. The total DALYs lost per 1000 population in Himachal Pradesh were 379, which was slightly higher than India (344 per 1000 population) and lower (537 per 1000 population) as compared to rural Andhra Pradesh. The estimates of Himachal Pradesh are comparable to Nepal (349 per 1000 population).
3. Premature mortality and disability (YLL:YLD) ratio is higher among males as compared to females. **Among the children (0-4 years), diarrhoeal diseases**, low birth weight and lower respiratory infections are **still the leading causes of disease burden**.
4. Among the reproductive age group (15-45 years), road accidents, other unintentional injuries, iron deficiency anaemia, tuberculosis, chronic obstructed pulmonary diseases and upper respiratory infection are the leading causes of disease burden.
5. Among the elderly (more than 60 years), the main causes of disease burden are chronic obstructed pulmonary disease, ischemic heart disease, tuberculosis, asthma, other infectious diseases and other unintentional injuries.
6. The overall leading causes of disease burden in both sexes are chronic obstructed pulmonary disease, asthma iron deficiency anaemia, dental caries, other unintentional injuries and diarrhoeal diseases.
7. The common **leading causes of premature mortality (YLL) in males and females** are road accidents, **diarrhoeal and other infectious diseases**, ischemic heart disease, selfinflicted and unintentional injuries, tuberculosis and chronic obstructed pulmonary disease.
8. The common **leading causes of disability (YLD) in both sexes** are chronic obstructed pulmonary disease, ischaemic heart disease, **diarrhoeal diseases**, and other unintentional injuries.

The top ten causes of diseases burden in different age group in males and for females are shown in table 1.5.1 and 1.5.2.

Table 1.5.1 Top ten causes of burden of diseases among Males of Himachal Pradesh

Rank	0-4 yrs	5-14 yrs	15-44 yrs	45-59 yrs	60 +yrs
1	**Diarrhoeal diseases**	Iron-deficiency anaemia	Other unintentional injuries	Chronic Obstructive Diseases	Chronic Obstructive Pulmonary Disease
2.	Low birth weight	Other unintentional injuries	Road accident	Other unintentional injuries	Other unintentional injuries
3.	Lower Respiratory Infectious	Asthma	Iron – deficiency anaemia	Ischaemic heart disease	Other unintentional injuries
4.	Other infectious diseases	Other infectious diseases	Chronic Obstructive Pulmonary	Tuberculosis	Ischaemic heart disease

Rank	0-4 yrs	5-14 yrs	15-44 yrs	45-59 yrs	60 +yrs
			Diseases		
5.	Iron deficiency anaemia	**Diarrhoeal diseases**	Self-inflicted injury	Road accident	Tuberculosis
6.	Dental caries	Otitis Media	Tuberculosis	Other infectious diseases	Road accident
7	Upper Respiratory Infections	Dental caries	Asthma	Peptic ulcer	Iron-deficiency anaemia
8.	Asthma	Upper Respiratory Infections	Other infectious diseases	Iron deficiency anaemia	Cataracts
9.	Otitis Media	Lower Respiratory Infections	Upper Respiratory Infections	Asthma	Asthma
10	Other unintentional injuries	Vitamin A Deficiency	Dental carrier	Dental carrier	Dental carrier

Table 1.5.2 Top ten causes of burden of diseases among Females of Himachal Pradesh

Rank	0-4 yrs	5-14 yrs	15-44 yrs	45-59 yrs	60 +yrs
1	**Diarrhoeal diseases**	Iron-deficiency anaemia	Iron-deficiency anaemia	Chronic Obstructive Pulmonary Disease	Chronic Obstructive Pulmonary Disease
2.	Low birth weight	**Diarrhoeal diseases**	Other unintentional injuries	Iron-deficiency anaemia	Other infectious diseases
3.	Other infectious diseases	Other infectious diseases	Chronic Obstructive Pulmonary Disease	Other unintentional injuries	Other unintentional injuries
4.	Lower Respiratory Infectious	Other unintentional injuries	Self-inflicted injury	Other infectious diseases	Rheumatic heart disease
5.	Iron deficiency anaemia	Otitis Media	Tuberculosis	Tuberculosis	Ischaemic heart disease
6.	Dental caries	Asthma	Road accidents	Ischaemic heart disease	Iron-deficiency anaemia
7	Upper Respiratory Infections	Dental caries	Peptic Ulcer	Dental caries	Dental caries
8.	Otitis Media	Road accident	Dental caries	Asthma	**Diarrhoeal diseases**
9.	Other unintentional injuries	Upper Respiratory Infections	Lower Respiratory Infections	Road accident	Tuberculoses
10	Other digestive injuries	Lower Respiratory Infections	Other infectious diseases	Cataracts	Asthma

1.6 Study Area: Mandi District

The study area is chosen as Mandi district. Originally it was proposed to undertake the study in three districts, namely Mandi, Shimla and Kangra. But later, in light of time and cost considerations, it was decided to focus only on one district and so Mandi was chosen as it has lower as well as high altitude areas, thus representation of the whole state. Although the situation in lower districts like Una and high altitude areas in Shimla, Kullu and tribal districts might vary considerably with the topography, climate and watersheds, it was felt that Mandi presented the opportunity to study the situation and practices both upstream and downstream, in both densely populated semi-urban and sparsely populated farflung villages. The statistical profile of Mandi district, as compared to the state of Himachal Pradesh, is shown in table 1.6.1 below.

Table 1.6.1 Statistical Profile of Mandi and Himachal Pradesh

Sl.No.	INDICATOR	Reference Year	NUMBER	NUMBER
			Mandi	**H.P.**
1	Area (In Sq.Kms.)	Census –2001	3950	55673
2	*Population*			
	Total	Census –2001	901344	6077900
	Males	Census –2001	447872	3087940
	Females	Census –2001	453472	2989960
	Rural	Census –2001	840362	5482319
	Urban	Census –2001	60982	595581
	POPULATION (0-6 Years)			
	Total	2001 Census	119949	793137
	Males	2001 Census	62535	418426
	Females	2001 Census	57414	374711
3	Percentage of Rural Population	Census –2001	93.23	90.20
4	Percentage of Urban Population	Census –2001	6.77	9.80
5	Percentage of State Population	Census –2001	14.83	
6	Decennial Growth Rate (1991-2001)	Census –2001	+ 16.10	+ 17.54
7	Sex – Ratio (Females per 1000 Males)	Census –2001	1014	968
8	Density of Population (Pop.per Sq.Km)	Census –2001	228	109
9	Literacy Rate (Percentage)			
	Combined	Census –2001	75.2	76.5
	Males	Census –2001	85.9	85.3
	Females	Census –2001	64.8	67.4
10	Number of Towns	Census –2001	5	57
11	Number of CD Blocks	Census –2001	10	75
12	Number of Inhabited villages	Census –2001	2833	17495
13	Number of Medical Institutions	30-6-2005		
	General Hospitals		6	50
	Community Health Centres Total		9	66
	Primary Health Centres Total		59	439
	Civil Dispensaries		0	13
	Sub- Centres		311	2068
	Number of Beds Sanctioned		1110	8832

The statistics related to waterborne diseases in Mandi district, blockwise detail is given in table 1.6.2 below.

Table 1.6.2 Reported cases of waterborne diseases in Mandi district, by Blocks

Name of the Block: Medical	Popu lation	Number of cases Registered in last one year (April 2005 to March 2006)													
		Diarrhoea			Gastroenteritis			Typhoid			Hepatitis			TOTAL	Inci-dence
		OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total		
Ratti	160024	5973	524	6497	1679	519	2198	331	346	677	98	36	134	9506	5.94%
Riwalsar	78584	3738	180	3918	176	52	228	367	78	445	18	14	32	4623	5.88%
Drang (Paddhar)	87831	5099	525	5624	1012	500	1512	357	177	534	72	6	78	7748	8.82%
Chauntra	72742	2476	33	2509	41	30	71	140	31	171	1	0	1	2752	3.78%
Chakhiot (Bagsaid)	65836	2194	224	2418	160	104	264	31	1	32	0	0	0	2714	4.12%
Seraj	82125	4806	265	5071	541	103	644	6	0	6	0	0	0	5721	6.97%
Dharampur	95816	3419	199	3618	514	73	587	597	2	599	0	0	0	4804	5.01%
Gopalpur	98845	4809	416	5225	558	118	676	1323	454	1777	49	3	52	7730	7.82%
Rohand (Sundernagar)	126081	4158	179	4337	704	204	908	962	185	1147	0	0	0	6392	5.07%
Karsog	102686	5241	301	5542	728	125	853	897	136	1033	93	0	93	7521	7.32%
TOTAL	**970570**			**44759**			**7941**			**6421**			**390**	**59511**	**6.13%**

Overall, the incidence of waterborne diseases, as reported by the health department, is 6% of the population. So for a target sample of approximately 3900 persons (780 households) we expected to get a minimum of 239 cases on a yearly basis or about 120 cases on a halfyearly basis. The survey reported in all 146 incidences of waterborne diseases on a half-yearly basis, which is approximately 22% more than the reported cases. This increase of 22% might look like a big variation, but it is not so as this is more on account of the cases that are not reported. These unreported cases are either treated at home with conventional remedies or get treatment at private health facilities.

The salient findings of epidemiological investigation in the year 2002[7], of an outbreak of jaundice at Mandi District, Himachal Pradesh are as follows:

- *Analysis of records showed total number of cases reported at various hospitals of Mandi Town from 01.02.2002 to 31.03.2002 to be 456.*
- *A total population of 4575 was surveyed (at 9 different locations representing the whole Mandi town), out of total town population of 35000.*
- *Attack rate was 1.137% amongst the surveyed population.*
- *Over all relative risk of jaundice cases among the population who were consuming tap water supply was 2.8 as compared to those who were consuming water from other sources like Bauri, well etc.*
- *Relative risk among the population living in the area with water supply from Motipur water treatment plant was infinitive as compared to those who were consuming water from other sources.*
- *On checking residual chlorine levels in running piped water, it was found that nil residual chlorine was detected in the two samples out of the total nine tested on 24.03.2002.*
- *Team visited Motipur water treatment plant and found some of the deficiencies namely infrequent mixing of alum at rapid sand filtration unit, inadequate chlorination and use of defective chloroscopes. The same was communicated to the concerned authorities.*

[7] *Findings of epidemiological investigation of outbreak of jaundice in district Mandi by National Institute of Communicable Diseases*

- *City waste disposal/ dumping site was located at the riverbank, 3 kilometres upstream of the place from where Motipur water treatment plant draws water. Team observed presence of a stream passing through the dumping site and carrying the polluted water to the river Beas.*
- *Eight out of nine blood samples tested positive for IgM HEV antibody.*
- *Clinical, epidemiological and laboratory findings indicate that this outbreak of jaundice was due to Hepatitis E virus infection.*
- *Irrigation and Public Health department should ensure mixing of alum in pre-treatment tank in adequate quantity so as to coagulate and sediment all the dissolved organic material and microorganisms.*
- *IPH department need to ensure proper chlorination of the filtered water before supplying the same to the town in terms of quantity of chlorine added and time period, for which chlorine has been applied to inactivate micro organisms and its regular monitoring at source and consumer points.*
- *There is a need to repair / replace leaking water pipes.*
- *Periodic IEC- activities to be carried out to prevent water borne disease outbreaks.*
- *There is an urgent need to improve the disease surveillance system in the district. As it is difficult to receive disease surveillance data from the various difficult/ distant areas of district, it is advisable to use modern means of communications for an effective surveillance.*

Though the above findings/recommendations were very specific to the jaundince outbreak in the year 2002, they do bring to the knowledge of all concerned various issues like need for IEC activities, proper disinfection, waste disposal etc., which also corroborate with the findings of this study.

Outcome of Interviews with State and District IPH Officials

In light of the above background information, in-depth interviews were conducted with the IPH officials at state and district level. This was required primarily to triangulate the findings of the quantitative study. The outcome of the discussions as well as the perspective of the department is enumerated below:

- District Mandi is fully covered with regard to IPH supply. According to the official records, in all 7218 villages are fully covered while 140 villages are partially covered.
- The IPH Schemes in District Mandi broadly fall into two categories, namely gravity schemes and lift schemes. Of the total of 235 schemes, only 18 are lift schemes and the rest are gravity schemes, i.e. spring sources.
- Water supplied in most places is adequate, safe and conforms to laiddown norms/parameters.
- Weekly testing of water samples is done both for rural and urban supply. Testing takes place both at the distribution point i.e. at the tail end and also at the intake point. During rainy seasons, testing is done on a daily basis. The results according to the officials have been generally within prescribed parameters.
- Regular monitoring and reporting system is in place and there is proper record management.
- According to the department, 90% of the water-borne diseases are generally not caused due to contaminated piped drinking water supply, but are a result of unsafe personal hygienic practices, improper storing and handling of water and use of water from traditional sources. “Dhams” were mentioned specifically for Mandi.
- In rare cases, contamination of IPH water may take place due to leakage, mixing of sewerage and water pipe at certain point. Intermittent supply also increases chances of contamination.
- For improving performance, need for training/capacity building at all levels focusing mainly on new techniques and general management (monitoring and supervision) was voiced.
- Need of awareness building amongst communities on various issues (IPH schemes, catchments protection, use of sanitary latrines, scientific disposal of waste, storage and

conservation of water, right treatment procedures, personal hygiene etc.) was highly emphasised.

- Communities need to come forward and take on the onus of regular maintenance and upkeep of the IPH Schemes. In a phased manner, the Department has decided to hand over the operation and maintenance of 10% of the Schemes to the Panchayats. The required technical support will be provided by the Department.
- According to the Department, there are water and sanitation committees at village, block as well as district level. However, FGDs at village level showed that they are either not existing or are practically defunct. At District level in Mandi, the existence of a Drought Committee under the chairmanship of the DC was mentioned. As the name indicates, it generally meets during drought, which is once every year before summer, to chalk out a combined Action Plan to regulate the water supply during summers.
- According to a new plan, School Laboratories at plus 2 level will be equipped with the requisite water testing equipment, so that not only the water can be tested independently, but also community participation can be strengthened. A pilot introduction has been done in two schools each of blocks Dharampur and Darang.

Section 2
METHODOLOGY

2.1 Problem Definition

Today, in most countries, pressure has increased not only to modify investment allocations but also to recognize and accommodate new demands for water. The direct implications for water managers include fewer capital investments in new water projects, the reduction or elimination of irrigation subsidies, increased efforts to recover true costs, and more emphasis on demand management to improve the efficiency of existing supplies.

In the context of economics of water supply, a few issues and concepts are important to understand for ensuring efficiency, some of which are discussed below.

Economic efficiency and the value of water

Economic efficiency is an important development objective in most countries and this implies that economic incentives are needed to encourage efficient allocation of scarce water resources to those uses that provide the greatest socio-economic benefits for society.

Opportunity cost and pricing

The task of valuing water to determine price is particularly complex. The existence of alternative uses for water reinforces the case for charging at least an economically justified price for water consumption. Here, it is useful to distinguish between *valuation* principles - which attempt to rank and prioritise the economic value of usage - and *pricing* principles - which have to be applied in practice. There are only two effective pricing principles: based on the cost of provision of water, and market pricing in an open competitive market. However, pricing policy is subservient to more general economic and social policy, and governments can decide on the level and focus of subsidies applied in either case.

Where there is a concern about providing water to the poor at a low cost, block or graduated prices can be used. A zero or low charge can be set for the volume or block of water that is needed to meet a minimum basic health requirement. For the next volume or block of water a higher price may be charged. Also, different prices can be charged for office and industrial uses. One can thus introduce an element of cross-subsidisation between users. When it is not possible to charge users a price based on the economic (or even cost) value per unit of water consumed, then quantity restrictions can be used to improve water allocation and use. Although quantity restrictions are less efficient allocation methods than water prices per volume of water used, they do create an implicit price for water. The implicit price forces consumers to use water more efficiently than if there were no restrictions on quantity, since consumers would like to have more water than they receive at the existing charges.

Other economic incentives

Governments might want to use economic incentives to encourage the adoption of water saving and re-use technology, and the use of water-saving crops. This can be done by direct subsidies, tax credits for the purchase of certain technology or credit subsidies to purchase water-saving technologies. The amount of subsidies or tax credits should not exceed the economic value of the water saved.

Economic incentives may also be needed to achieve the desired level of pumping and conservation of groundwater. Where there is overexploitation of groundwater resources, fuel taxes and electricity charges may offer a way of achieving the desired level of extraction. The alternatives for managing groundwater are either some form of control by the community of users,

or measures imposed by the state. Apart from informal agreements, which are only feasible in small homogeneous communities, the choice of measures is between:

- Prices and charges (e.g., volumetric charges based on metering or pumping rates, taxes and price adjustments for fuel or electricity)
- Quantity-based controls (permits for new wells, taxes on pumps, specifications for pumps, pumping quotas)
- Transferable pumping entitlements (quotas that can be bought and sold within a group of users)
- Subsidies to adopt water-saving technologies.

In view of the problems with monitoring and enforcement, quantity-based approaches may be superior to pumping charges, and can yield economically efficient solutions. The application of *pollution charges* proportional to the volume and quality of effluent is rare, but has shown to be effective in reducing water intake as well as discharge.

The economic value of water

Estimating the value of water is not easy because its value varies with quality, use, location and time. During dry periods of the year or during drought years, water values will be much higher than in other periods. Moreover, certain seasons or times of the year may also be important (high water values) because of critical water demands for crop growth, heating, cooling, industrial production or shipping.

There are four principal methods of valuing water:

1. Costs of providing the water service to the point of consumption
2. Establishing the marginal benefits in terms of its contribution to output
3. Calculation of some aggregate opportunity cost
4. Market prices, where water transactions occur

The value of water to domestic consumers can be estimated based on willingness-to-pay surveys of potential water users that are then aggregated to measure the demand. The problem is to construct a survey that elicits actual consumer willingness to pay.

Cost recovery

Another important aspect of the economics of water resource strategies involves the financing of water investments and operations. With the rising costs of water investments and the increased competition for public funds, greater attention will have to be paid to just how investments are to be financed and sustained, with adequate funding for Operations and Management (O&M). Aside from finding funds to improve the system, innovative ways must be found to break the old cycle of poor service, low willingness to pay user fees, and inadequate funds for O&M. Current strategies to break this cycle involve turning over the O&M (and in some cases, ownership) of water projects to financially autonomous entities, either public or private and to Water Users Associations (WUA). WUA are generally in a better position to monitor compliance and to use social pressure to collect water fees from their members.

Looking at the magnitude of the problem associated with quality of water and its effect on health, especially in the context of Himachal Pradesh, as established by the Burden of Disease study conducted by the Department of Health, Government of HP, and the inherent issue of the economics of water supply discussed earlier, it becomes important to know the economic cost of providing safe water, especially to rural population, from the provider as well as from the beneficiaries point of view. Along with that, it is also important to map the KAP (Knowledge, Attitude and Practices) of the community with respect to water use and management. Also, from the point of view of cost recovery, it is important to educate the community regarding the value of water and also to know their willingness to contribute. Keeping the above in mind it was proposed that a study be undertaken to “Assess the Opportunity Cost of Unclean Water with Regard to Health”. The findings of the study will help develop a holistic strategy to tackle the problem

through an inter-sectoral approach. The objectives and methodology of the proposed study is enumerated below.

2.2 Objectives & Research Questions

The study aims at making an estimate of the monetary value that the community can identify with for getting good quality water, in terms of the broad opportunity cost of water vis-avis expenditures on water and waterborne diseases. This is to be done by collecting evidence regarding the extent of the problem of waterborne diseases in the state of HP and determines the underlying causes, so as to develop a holistic strategy to tackle the problem through an inter-sectoral approach, and presenting to the community the "real" i.e. full economic cost of failing to obtain and maintain good quality water.

The specific objectives of the study are as follows:

- Determine the Knowledge, Attitude and Practices (KAP) of the community vis-à-vis the use of water and sanitation practices.
- Assess the knowledge among the community about waterborne diseases.
- Determine the prevalence and spread of waterborne diseases in the study area.
- Determine the out-of-pocket expenditures incurred (average household expenditure) on not being able to prevent water borne diseases.
- Find the willingness to pay by the community for good quality water supply.

The specific questions to be answered by the proposed study are as follows:

- What are the sources of water for the community in the rural areas in terms of type of source, quality of water, use, distance, mode of transporting the water, potential sources of contamination, etc.?
- What is the prevalent sanitation practice followed by the community? What, if any, are the potential risks within the existing practices that may be the cause of waterborne diseases?
- What is the level of community awareness regarding the waterborne diseases, in terms of ability in identifying symptoms, knowledge of prevention and home remedies, etc.?
- What is the prevalence of waterborne diseases (diarrhoea/gastroenteritis) in the region? Which population group/sub-group is most vulnerable to the diseases?
- What is the average out-of-pocket expenditure (which includes travel, stay and food of attendants, amount of wages lost for days not worked, expenditure on private diagnostic and medicines etc.) incurred by any household on treatment of water borne diseases?
- Given the risk of contracting waterborne diseases incurring expenditure on its treatment, is the community willing to pay for good quality water? Are there any associated conditions for payment by the community for water?

2.3 Study Design

The prevalence of the disease (diarrhoea/gastroenteritis and other water-borne diseases) was determined through secondary data, to be obtained from the health department at the block level (from the BMO). A statistically significant sample was identified and randomly selected at each block. A household survey was then conducted by trained field investigators to determine whether any family members have been sick and whether opportunity costs have arisen. The household survey was complemented with Focused Group Discussions (FGD) and In-Depth Interviews of community leaders and panchayat members for triangulation of finding. Furthermore the current water quality of IPH water as well as of traditional sources was also determined through water testing.

Also, the awareness level of the community, KAP for water use and sanitation, apart from background (socio-economic and demographic) characteristics, was determined through a rapid household survey employing a structured schedule for each sample household.

2.4 Data Collection

The study is mainly based on household level data regarding KAP, WTP (Willingness to Pay), and other socio-economic characteristics. This is done through quantitative survey using structured schedule. The findings are triangulated by qualitative data collected mainly through FGDs at the community level.

A. Quantitative Survey

The study is mainly based on household survey, using a quantitative survey approach. The detailed sampling and data collection plan adopted for the quantitative survey is described below.

(a) Sample Size:

Sample size for the study is determined using the following formula:

$n = Z^2_{1-x2} (1-P) \varepsilon^2 P$ [table showing the desired sample size for different values of population proportion and accuracy, at 95% level of confidence is attached in the Annex VII]

where, n = desired sample size
Z = "Z' value based on ±standard deviation (depicting confidence level)
P = Expected proportion of the studied characteristic in the population
ε = measure of desired accuracy

For the study
Confidence level = 95%
Accuracy = 90%
Incidence of waterborne diseases = 10% of the population (as per health department data)

Thus the desired Sample Size = 3457 population (individuals)
Or, = **3500** (approximately)

Assuming household size of 5 members per household;
Desired sample of households = **700 households**

(b) Sampling Technique

A 2-stage Random Cluster Sampling based on PPS (Probability proportionate to Population Sampling) is used for the survey. This technique is the commonly used methodology for household health surveys used by World Bank (RCH and NFHS surveys), WHO (District Health

Surveys) and UNICEF (Border District Cluster surveys for Immunisation coverage). Whereas RCH household surveys use the 50-cluster method (50 villages/wards in a district), WHO and UNICEF use the 30-cluster method (30 villages/wards in the district).

For this study we used Stratified Random 50-Cluster Sampling Approach for the 1st stage as Simple Random Cluster Sampling would have resulted in surveying less than 5 households in many of the sample villages where population is less then district average, which being statistically insignificant for drawing conclusions, is not recommended, i.e. for the results to be statistically significant, the number of households studied per cluster (village) should be more than 5. Also in Simple Random Cluster Sampling, geographically all the areas are not represented.

It may be noted that 50-clusters mean 50 social units, and in our case it denotes 50 villages or wards in the district. It may be further noted that this type of sampling will give us the results for the entire district and not at the block/sub-district level. Further, by villages we mean Revenue Villages, as they are distinct legal/administrative entities, clearly demarcated in land-revenue records and census maps/records. As the sampling is based on the population of the studied villages, Revenue Village is the lowest unit for which official population figures are available.

Stage I: selecting villages

We first allocate the total sample of households (700) to each of the Tehsil in proportion to its population. Similarly, we allocate the total villages/wards to be covered (50) to each of the Tehsil in proportion to the population of the selected Tehsil.

For selection of villages, all the villages (Revenue Villages) of the Tehsil/Town district were then arranged in increasing order of their respective population (official/census figures), alongside the cumulative population. Sample interval was calculated by dividing the total population of the Tehsil by the number of villages to be covered in that particular Tehsil. The villages at equal sample interval were then selected.

As explained above, the technique used for selection of villages is PPS (Probability proportionate to Population Sampling), which means villages with more population have higher probability of being selected. It does not mean that villages with less population will not be selected. It simply means there will be fewer villages with low population and more villages with greater population. This may seem to be biased against lesser population villages, but any health related intervention has to cater to the health problem faced by the maximum number of population, which is mainly based on economic sense. This is precisely the reason for having hospitals in greater population clusters (towns or big villages), as having a hospital in each faraway village does not make economic sense and is not practical.

Stage II: selecting households

For selection of households, first we converted the population in the selected villages into the expected number of households by dividing the population by five (assuming average family size of 5). Then we allocated the total sample of households to be covered in a particular Tehsil/ward into the selected villages in proportion of the number of households in the selected villages.

The survey team got an idea of the selected village upon reaching it, especially the different clusters/hamlets, with the help of village elders, panchayats, Anganwadi worker, teacher, etc. The investigators then divided the total (given) sample size of the village among the clusters proportional to the number of households per cluster. In each cluster the chosen households were spread-out i.e. they were instructed not to group the nearby households. The respondent was any adult male/female member of the household, preferably avoiding older people.

B. Qualitative Survey

A qualitative survey was used to primarily triangulate the findings of the qualitative study. The tools adopted for data collection for the qualitative survey are described below.

(a) Focus Group Discussion (FGD)

FGD was conducted in some villages. An effort was made to select villages (among villages selected in the sample), which were far from the tehsil headquarter or in the interiors, or not having a motorable road.

It was tried as far as possible to ensure participation of panchayat members in the FGD. The group was heterogeneous with participation from various segments of population groups in the village like youth group, mahila mandal, SHG, NGO active in the village. Participation of government officials in the FGD was avoided, as that would have influenced the group interaction.

Checklist for the FGD:

- What is the situation regarding waterborne diseases (diarrhoea, cholera, gastroenteritis, jaundice, typhoid, etc.)? Do these diseases occur in the village because of contaminated water, or because of unhygienic food (at home or from roadside vendors)?
- How costly is it to get treatment for patents affected by various waterborne diseases (range of cost incurred)? Do the villagers depend on home remedies and local practitioners (qualified, unqualified or traditional) for such treatment? Is it preferable to bear the cost of clean drinking water over bearing the cost of treatment of waterborne diseases?
- What are the sources of water for drinking and other purposes for the residents of the village? What are the practices followed for treating the water and ensuring the water is not contaminated? Is there any cost incurred by the households to get water for their homes? If yes, what is the cost (range)?
- Do the villagers follow proper hygiene practices? What are the problems (behavioural, customs) in ensuring good hygiene practices?
- Are there systems in the village for managing water resources (like water and sanitation committees)? What type of system is preferred by the villagers for community management (including managing cost and user charges) for safe water in the village?

The surveyors probed for any hint of out-of-pocket expenditure related to getting water by the households, expenditure on treatment of waterborne diseases. They also probed the willingness (along with conditions, if any, for the willingness) to pay for clean water.

(b) In-Depth Interview

In-depth interviews were conducted mainly with the state/district level officials of the IPH department to get the providers perspective.

Collection of Data:

The tools for collecting both qualitative and quantitative data were developed and finalised after detailed discussions with the WASH Representatives. Pre-testing was done before finalisation of the schedule. Survey was conducted by a team of trained field supervisors and field investigators.

2.5 Data Analysis & Interpretation

The filled-in household schedules were edited in the field as well as before data entry, checking for consistency and validity. Ten per cent of the schedules were also cross-checked in the field, for checking the reliability. The filled-in schedules were entered in an Access-2000 based data entry programme, which also had in-built checks, based on field values and relationship between various fields/variables.

The quantitative analysis is based on simple frequency tables and bivariate analysis using cross-tabulation. As most of the key variables under consideration are categorical variables, testing dependency relationships using correlation or regression[8] is ruled out.

The results of the quantitative analysis were triangulated with findings of the qualitative survey, mainly the Focus Group Discussions conducted with the community.

[8] Correlation and Regression can be applied to continuous variables only, as covariance among categorical variables is inherently very high, thus falsely establishing a significant relationship.

Section 3
STUDY FINDINGS

3.1 Background Characteristics of the Population

The study was conducted in Mandi District of Himachal Pradesh, covering a total of 781 households, of which 93 per cent were rural households (in villages) and seven per cent were urban households (in municipal wards).

As far as occupation is concerned, the majority of the households had the earning members/head of the household engaged in agriculture and private service (31% each). 10 per cent were engaged in government service and 17 per cent had their own business (see table 3.1.1 below).

3.1.1 Occupation profile of sample households

Occupation groups	Number	Percentage
Agriculture	241	31%
Crafts	29	4%
Business	135	17%
Government service	76	10%
Private service	242	31%
Others	58	7%
Total (households)	**781**	**100%**

The socio-economic profile of the sample households was based on the estimation of a socio-economic index, which was based on household assets, type and ownership of house and source of kitchen fire. Based on the index, the households were divided into wealth groups. Households falling in the first group (lowest 25%) were identified as Very Poor. Households falling under the second group (between 25 and 50%, as per the socio-economic index) were termed as Poor. Households in the third group (between 50 and 75%, as per the socio-economic index) were termed as Middle Class, and the households falling in the fourth group (highest 25%) were categorised as the Affluent Class.

3.1.2 Socio-economic profile

Socio-economic category	Number	Percentage
First wealth group	282	36%
Second wealth group	198	25%
Third wealth group	164	21%
Fourth wealth group	137	18%

As can be seen from table 3.1.2 above, more than 60% of the households were poor (including Poor and Very Poor), and more than one-third of the households (36%) were very poor. Only one-fifth of the households fell into either the Middle Class or the Affluent category (21% and 18% respectively).

Thus it can safely be interpreted that the majority of the population is poor (comparatively), mostly engaged in the so-called unorganised sector.

If we look at the non-essential expenditure (table 3.1.3) incurred by the households (expenditure other than food) we find that the households do spend substantial amounts on other necessities

as well as some luxuries. Here, expenditure on water is considered non-essential, assuming people have access to other "free" sources of water.

3.1.3 Household expenditure profile for some key expenditure heads

Expenditure head	Average monthly expenditure (Rs.)
Electricity	199
Telephone	157
Water	14
Transportation	258
Medical	425
TV (cable)	27
Mobile	100

The above table reveals that the households are spending around Rs. 200 on electricity, between Rs. 100 – 150 on telecommunication (phone and mobile) and around Rs. 250 on transportation per month, but are spending only Rs. 14 per month on water. On the other hand, it was found that the household expenditure is highest on medical and health related expenses (Rs. 425 per month). The FGDs with the community also revealed that most of the households having IPH water connection in their homes pay around Rs. 25 per month, and the average expenditure on treatment for diseases are around Rs. 300-400.

Thus, there seems to be an opportunity of reducing the medical expenses on the households, at least those related to waterborne diseases (like diarrhoea, gastroenteritis, etc.), by making them pay marginally more on good quality and safe water. Although there might be factors other than clean water (like personal and environmental hygiene practices, prevalence of vector-borne diseases, etc.), which might be responsible for such high health expenditure by the households.

A further analysis of the expenditure on water alone (table 3.1.4) reveals that the rural households are spending on an average Rs. 4 per month as compared to the urban households who are spending Rs. 68 per month on water.

3.1.4 Household expenditure profile on water

	Total No. of households	Total monthly expenditure on water (Rs.)	Average monthly expenditure (Rs.)
Rural	729	2460	4
Urban	52	3558	68
Total	781	1098	14.06

3.2 Water & Sanitation: Facilities and Practices

It was found that most of the households had multiple access to water, i.e. using water from different sources. As can be seen from table 3.2.1 below, more than ninety per cent of the households had access to piped water, whether at home or outside and half of them had to access the piped water from outside, i.e. they do not have access to piped water at their home. The qualitative survey (FGDs) also reveals that most of the households in the community have access to IPH water, but the FGDs revealed that there is gross irregularity in water supply and in many places water is supplied with gaps of up to 15 days.

3.2.1 Sources of drinking water

Source of drinking water	Number	Percentage
Hand	93	12%
Well	87	11%
Tube well	3	0 %
Piped water supply outside home	398	51%
Piped Water at Home	330	42%
Pond	1	0
Stream	12	2%
Others	40	5%

It is also revealed by the above table that almost a quarter of the households (23%) are accessing local ground water (hand pump and well), but only four per cent of the households were found to be exclusively depend on groundwater sources.

As far as access/use of non-IPH versus IPH source of water across the socio-economic groups is concerned, it is normally believed that the poor use the traditional sources and the affluent have greater access to piped water supply, showing their "power" (of getting IPH connection) and affordability (towards cost of water meter, and charges). But, as can be seen from table 3.2.2 below, there is no marginal increase use of IPH source (piped water) as one moves across the socio-economic groups from poor to affluent. On the other hand, if we compare within the socio-economic groups, we find that 12 per cent of the Very Poor are using non-IPH sources and 88 per cent are using IPH sources, whereas only four per cent of the Affluent are using non-IPH sources as against 96 per cent who are using IPH sources.

3.2.2 Source of drinking water by socio-economic groups

Socio-economic groups	Source of drinking water			
	Non-IPH source		IPH source	
	Number	%	*Number*	%
1. Very Poor (282)	35	45%	247	35%
2. Poor (198)	25	33%	173	24%
3. Middle class (164)	12	16%	152	22%
4. Affluent (137)	5	6%	132	19%
Total	**77**	**100%**	**704**	**100%**

The above analysis reveals that the group of affluent class are eight per cent more likely to use IPH source as compared to the group of the very poor households, which means richer households do have greater probability to use IPH (piped water) source as compared to the poorer households.

If we look at the difficulty in accessing water by the households, represented by the distance travelled for accessing water, we find that the situation is not really grim in general as only 10 per cent of the households have to travel more than a kilometre and as many as 42 per cent have access within their homes (see table 3.2.3 below).

3.2.3 Accessibility to source of water

Distance to the source of water	Number (of households)	Percentage
In the household	326	42%
Within plot/less than 1 km	378	48%
1-5 km	73	9%
More than 5 km	4	1%
Total	**781**	**100%**

The analysis of accessibility (in distance) to water sources across the socio-economic groups does reveal a bias towards the richer households. As can be seen from table 3.2.4 below, 14 per cent of the Very Poor households have to travel more than a kilometre to access water, of which two per cent have to travel more than five kilometres. On the other hand, only four per cent of the Affluent households have to travel beyond one kilometre to access water, but none of them have to travel more than five kilometres.

3.2.4 Accessibility to drinking water by socio-economic category

Socio-economic group	Distance to the source of drinking water					
	More than 5 km		1-5 km		Less than 1 km	
	Number	%	Number	%	Number	%
1. Very Poor	5	2%	33	12%	244	86%
2. Poor	0	0%	20	10%	178	90%
3. Middle class	0	0%	15	9%	149	91%
4. Affluent	0	0%	5	4%	132	96%

The above analysis reveals that the poorer households are definitely disadvantaged in terms of access to water.

Looking at the practices regarding how water is handled in the households, it seems that although people take some precautions, they do not take the safe handling of water very seriously. As can be seen in table 3.2.5 below, only around half the households (52%) used long-handled scoops which avoid inserting fingers in water. Although almost all the households (99%) regularly washed/scrubbed the vessel used for storing water, an overwhelming number of the households (78%) were not treating the water domestically before drinking. Even a simple method of straining drinking water with at least eight folds of cloth, for which the household would not incur any cost, is not adopted. This is known to provide significant protection against cholera though most freefloating bacteria would still pass through the mesh (Colwell et. al., 2003)

3.2.5 Water handling practices

	Number (of households)	Percentage
Handling of vessels		
▪ Inserting hand/fingers in the water contained in the vessel	324	42%
▪ Scoops with long handle, not necessitating insertion of hand/fingers in the water	409	52%
▪ Others	48	6%
Is the vessel containing/storing drinking water regularly washed/ scrubbed?		

▪ Yes	774	99%
▪ No	7	1%
Household water treatment practices		
▪ Boil at least for 10 minutes	64	8%
▪ Use chlorine tablets	22	3%
▪ Use of ordinary water filters	83	11%
▪ Use of electric filters	15	2%
▪ Do not treat water before drinking	609	78%
▪ Other Methods	10	1%

The above table highlights the importance of undertaking intensive Behaviour Change Communication (BCC) campaign among the households on the issue of safe handling of water and domestic water treatment.

Another important finding of the study is the use of piped water, meant for drinking water, for other purposes. As can be seen from table 3.2.6 below, more than 80 per cent of the households use IPH/piped water for bathing and washing clothes, whereas eight per cent of the households do not have access to IPH supplied water.

3.2.6 Use of IPH water for other purposes

Use of IPH water (other than drinking purposes)	Number (of households)	Percentage
IPH Supply not available	**60**	**8%**
Wash clothes	650	83%
Bathing	695	89%
Irrigation/kitchen garden	62	8%
Wash cattle	94	12%
Others	25	3%

The use of water meant for drinking water for other purposes leads to wastage of a precious recourse, which if saved, could have been made available to those who do not have access to clean drinking water. Thus there is also the need to educate the consumers on appropriate use of water from different sources and innovative ways of restricting the wastage of drinking water.

On the personal hygiene front, the community seems to be adequately aware with all the households reporting washing hands before eating, and a majority of them (64%) using soap to wash hands. Now, this being a response from the respondent to the interviewer, this may be a case of "politically correct" response and the actual behaviour/practice may not correspond to the reported behaviour. The FGDs with the community also reveal that people do practice washing hands before eating, but in some places people prefer using soil instead of soap for washing hands.

3.2.7 Hygiene practices

	Number	Percentage
Do the household members routinely wash hands before eating?		
▪ Yes	781	100%
▪ No	0	0%
Hands washed with		
▪ Water only	263	32%
▪ Soap	485	64%
▪ Mud	14	2%
▪ Ash	19	2%
▪ Others	0	0%

As far as sanitation facilities and practices are concerned, accessibility is a major problem, as is revealed by table 3.2.8 below, which shows that as many as almost 40 per cent of the households do not have sanitary toilets at their homes. But those who have use them quite regularly (99%) and do wash hands after defecation (almost 100%) and that too with soap (81%).

3.2.8 Sanitation practices

	Number	Percentage
Households with toilet/sanitation facility		
▪ Have toilets	474	61%
▪ Do not have toilets	307	39%
Type of toilet		
▪ Soak-pit	402	85%
▪ Connected with sewer line/septic tank	71	15%
▪ Others	1	0
Do the household members regularly use the above toilet?		
▪ Yes	469	99%
▪ No	5	1%
Do the members of the household wash hand after defecation?		
▪ Yes	779	100%
▪ No	2	0%
Hands washed with		
▪ Water only	9	1%
▪ Soap	633	81%
▪ Mud	113	15%
▪ Ash	25	3%
▪ Others	0	0%

The only potential source of risk is the overwhelming majority of soak-pit type toilets, which if near underground sources of water, might lead to water contamination. But this probability is low and as was seen earlier, only four per cent of the households are exclusively dependent on groundwater sources. But, nevertheless, proper attention should be given to the possibility of contamination of groundwater by soakpit toilets.

A major source of concern is the domestic waste disposal practice followed by the households. The survey reveals that people are very careless in this aspect. As can be seen from table 3.2.9 below, less than 10 per cent of the households throw domestic waste in dustbins or have it carried away by waste disposal agency. Over half of the households (53%) just throw the waste in the open and 35 per cent throw it in a nearby pit (not a dustbin). The study also revealed poor quality of solid waste management services in the District especially in the rural areas.

3.2.9 Household waste disposal practices

Household waste disposal practice	Number	Percentage
Thrown in the open nearby	415	53%
In a pit	272	35%
In a dustbin nearby, which is not regularly cleared	32	4%
In a dustbin nearby, which is regularly cleared	16	2%
Taken away by waste disposal agency	45	6%
Others	9	0%

The above analysis again highlights the need for intensive BCC campaign aimed at proper domestic waste disposal practices. It further highlights on the responsibility that lies with the local administration to provide waste disposal collection services and a regular basis especially in habitations where there is certain number of population residing.

3.3 Waterborne Diseases: Incidence and Cost of Treatment

The study reveals that the awareness of waterborne diseases (those that have heard of the diseases) is quite high, as can be seen from table 3.3.1 below. Going by the level of awareness, it seems that the most prevalent waterborne disease is Diarrhoea (70% awareness) followed by Gastroenteritis (49%) and Typhoid (32%). Dysentery and Jaundice also seem to be on top of the mind of many people (awareness of 19% each).

3.3.1 Awareness of Waterborne diseases

Diseases that occur due to infected water	Number	Percentage
Diarrhoea	549	70%
Gastroenteritis	384	49%
Dysentery	145	19%
Cholera	68	9%
Jaundice	145	19%
Typhoid	250	32%
Others	185	24%
Don't know	5	1%

As far as knowledge of Diarrhoea/gastroenteritis goes, most of the people associate the diseases to infected drinking water (85%) although only 20 per cent knew it could be caused due to uncovered road-side food and only 12 per cent knew it could be caused by not washing hands properly before eating. This also corroborates with the general lack of hygiene practices revealed in the earlier discussion.

Regarding home remedies, most of the respondents were aware of Oral Rehydration Solution (ORS), but quite a few (26%) also believed that anti-diarrhoeal drugs are necessary even for home remedies. The practice of self-medication using anti-diarrhoeal drugs might be an important cause of high health expenditure, revealed in earlier discussion in section 3.1 above.

As far as danger signs are concerned, quite a few respondents (61%) were aware that severe dehydration should lead to immediate visit to doctor/hospital, but less than 20 per cent were aware that blood in stool and dry mouth and tongue should also lead to immediate hospitalisation. The non-awareness of all the danger signs could also be a reason for high treatment costs as patients are taken to medical care only when the case becomes serious.

3.3.2 Awareness of Diarrhoea/gastroenteritis

	Number	Percentage
Causes of Diarrhoea/gastroenteritis (731)		
▪ Infected source of drinking water	667	85%
▪ Uncovered food from roadside vendors	158	20%
▪ Improper washing of hands before meals	93	12%
▪ Polluted air	30	4%
▪ Curse by god	2	0%
Home remedy for diarrhoea		
▪ ORS	474	61%
▪ Breast milk (for infants)	9	1%
▪ Fresh fruit juice	110	14%
▪ Light tea with little sugar	21	3%
▪ Rice/Dal water	62	8%
▪ Anti-diarrhoeal drugs	201	26%
▪ Multi-vitamins	0	0%
▪ Others	238	30%
Danger Signs of diarrhoea		
• Slight Dehydration	207	27%
• Blood in Stool	145	19%

	Number	Percentage
• Severe Dehydration	476	61%
• Patient stops drinking liquid	43	6%
• Dry mouth and tongue	91	12%
• Others	43	6%

The above analysis shows that there is a need for health education among the community regarding all the causes of diarrhoea/gastroenteritis related to hygiene practices, do's and dont's during home remedy and all the danger signs, which should prompt the household members to take the patient immediately to qualified healthcare provider/facility.

As far as the incidence[9] of waterborne diseases is concerned, it was found that almost 17 per cent of the households reported one or more cases of waterborne diseases in their household in the previous one year. Looking at the incidences of waterborne diseases across the socio-economic group (see table 3.3.3), it seems that the probability of exposure to water-borne diseases does not vary with socio-economic status and all groups are equally prone to these diseases.

3.3.3 Water borne diseases by socio-economic groups

Socio economic groups	Waterborne disease reported from the household (in last 6 months)	
	Yes	No
1. Very Poor	48 (17%)	234 (83%)
2. Poor	30 (15%)	168 (85%)
3. Middle class	29 (18%)	135 (82%)
4. Affluent	23 (17%)	114 (83%)

Looking at the incidence of waterborne diseases by type of water available to the households (IPH/non-IPH) reporting the occurrence of the disease (see table 3.3.4), we find that households having IPH supply are marginally (4%) less likely to contract waterborne diseases as compared to households not having IPH supply.

3.3.4 Water borne diseases by chief source of drinking water

Chief source of drinking water	Waterborne disease reported from the household (in last 6 months)	
	Yes	No
Non-IPH	17 (22%)	61 (78%)
IPH	129 (18%)	590 (82%)

The above analysis reveals that socio-economic profile (standard of living) is not a determinant of waterborne diseases in the study area, but type of water (IPH/non-IPH) is a determinant, although not a very significant determinant of waterborne diseases. Thus there are bound to be other factors like unsafe handling of water, improper hygienic practices, food contamination, etc., which might be major causes of waterborne diseases in this area.

Looking at the cost of treatment, we find that, on average, home remedies for waterborne diseases cost Rs. 74 per illness episode, taking the patient for treatment to a health provider (first point of contact) costs Rs. 1565 per episode, and if the case is serious which needs taking it to referral hospital, it costs around Rs. 1975 per illness episode (see table 3.3.5). Looking at the break-up of the treatment costs, it seems that the highest expenditure is on medicines, followed by transportation and wage loss; although, for hospitalisation cases, diagnostic tests and food expenses also take a major share of the total treatment cost.

[9] Incidence is the number of new cases reported over a period of time (here, one year), whereas Prevalence is the total number of cases (old or new) at a given point of time.

3.3.5 Expenditure on treatment for waterborne diseases

Expenditure heads	Average Expenditure (in Rupees)		
	Home remedy (n^{10}=36)	First point of contact (n=134)	Referral centre (n=8)
Faith healers	29 (39%)	---	---
Transportation	---	204 (13%)	401 (20%)
Boarding/lodging	---	39 (2%)	138 (7%)
Food	---	40 (3%)	248 (13%)
Hospital expenses (fee)	---	33 (2%)	15 (1%)
Test etc.	---	137 (9%)	238 (12%)
Medicines	45 (61%)	751 (48%)	586 (30%)
Lost wage	---	360 (23%)	250 (13%)
Others	---	---	---
Total	**74 (100%)**	**1565 (100%)**	**1975 (100%)**

From the above table, we can interpret that, assuming an average case of waterborne disease being taken to first point of contact, the expenses will be around Rs. 1500 per episode of illness, which can be saved if clean water is maintained and safe hygiene practices are followed. This can be a case for convincing the community on following safe and hygienic practices and also contributing monetarily to safe and good-quality water. Even looking at expenses on medicine in home remedies (Rs. 45), this is comparable to average monthly water charges for IPH connection at home.

Analysing the treatment cost by socio-economic group (table 3.3.6), we do not see any significant trend across the groups, although the Middle Class seem to be paying more than other classes on treatment for waterborne diseases.

3.3.6 Total expenditure on treatment for waterborne diseases by socio-economic groups

Socio-economic groups	Average total expenditure* on treatment of waterborne diseases in Rupees **(n=178)**
1. Very Poor	1461
2. Poor	1389
3. Middle class	1917
4. Affluent	1588

Thus it seems that the cost of treatment is determined more by clinical and personal conditions of the patient suffering from waterborne disease and not dependent of standard of living. This also corroborates with the earlier discussion, which showed that standard of living is not a determinant of waterborne diseases in the study area.

[10] number of patients who went for a specific treatment option

3.4 Community Involvement in Management of Water Supply

The study also looked into the aspect of community perception regarding getting involved in the operations, management and ownership of safe drinking water supply and taking up the responsibility thereof.

It was found that an overwhelming majority of the respondents (74%) were willing to pay for water, which is also corroborated by the FGDs where people expressed willingness to pay provided regularity in supply and purity/clean of water is ensured. The concern about regularity of supply and clean water is also seen in table 3.4.3 where 52% respondents had it as a precondition to pay for water.

3.4.1 Expectations from government, if willing to pay

	Number	Percentage
Adequate regular and clean water	303	52%
Clean/Pure Water	190	33%
Regular and adequate/more water	69	12%
No Response	12	2%
If individual supply is provided	5	1%
Others	2	0%

Respondents who were not willing to pay for water (26% of the respondents), cited affordability as the major reason (56%), as seen in table 3.4.2 below.

3.4.2 Reasons for not willing to pay

	Number	Percentage
Cannot Afford to Pay	112	56 %
No Response	17	8 %
Less Usage of IPH Water	5	2
Are Using Other Sources of Water (well, hand-pump, etc.)	23	12 %
Will arrange water from somewhere else	9	5 %
Regular/Adequate/clean water is not available	27	13 %
Responsibility of Govt. to supply water for free	5	3 %
Water connection is personal	2	1 %

The qualitative study findings (FGDs with the community: Annex-III) reveal that there are no regular community level water management bodies functional in the area, although the community is willing to take on the responsibility if provided with adequate training and continuous guidance by technical experts.

The *Swajaldhara* project, started by the state government to ensure quality water at the community level through greater community participation and ownership, has been launched in the districts. But the study revealed that only a quarter of the respondents had heard about *Swajaldhara* project (see table 3.4.3). People who have heard of the project have a confusion regarding the implementing agency, with 24 per cent thinking it is through IPH department, 37% think it is through Panchayats, and 36 per cent believe it is through other agencies.

3.4.3 Awareness of Swajaldhara programme

	Number	Percentage
Aware of Swajaldhara programme		
▪ Yes	196	25%
▪ No	585	75%
Who is supposed to implement Swajaldhara?		
▪ IPH	47	24%
▪ Panchayats	72	37%
▪ Rural Development	6	3%
▪ Others	70	36%

So there seems to be ample scope for community involvement in the management of water supply and also regarding communities willingness for monetary contribution towards safe and regular supply of water.

Section 4
CONCLUSION

4.1 Conclusions

The study findings based on the quantitative survey and complemented by the qualitative survey, focussing on the issues of sources of water, use of water, hygiene and sanitation practices, incidence of water borne diseases and associated cost of treatment, and community's willingness in owning the supply and management of water supply, leads us to the following conclusions:

- Most of the households had multiple accesses to water, i.e. using water from different sources, but there is gross irregularity in water supply and in many places water is supplied with gaps of up to 15 days. The richest households are eight per cent more likely to use IPH sources as compared to the very poor households, which means richer households do have greater probability to use IPH (piped water) sources as compared to the poorer households. Also, the poorer households are definitely disadvantaged in terms of access to water (distance travelled for accessing water).
- Although people take some precautions, they do not take the safe handling of water very seriously. Although almost all the households regularly washed/scrubbed the vessel used for storing water, an overwhelming number of the households (78%) were not treating the water domestically before drinking. An overwhelming majority of the households use IPH/piped water for bathing and washing clothes, which leads to wastage of a precious recourse, which if saved, could be made available to those who still do not have access to clean drinking water. On the personal hygiene front, people do practice washing hands before eating, but in some places people prefer using soil instead of soap for washing hands. As far as sanitation facilities and practices are concerned, accessibility is a major problem as almost 40 per cent of the households do not have sanitary toilets in their homes. A major source of concern is the domestic waste disposal practice followed by the households. People are very careless in this aspect, with less than 10 per cent of the households throwing domestic waste into dustbins or having it carried away by waste disposal agency. Over half of the households just throw the waste in the open. The study also revealed poor quality of solid waste management services available in the District, especially in the rural areas.
- The study reveals that the awareness of waterborne diseases (those that have heard of the diseases) is quite high. Going by the level of awareness, it seems that the most prevalent waterborne disease is Diarrhoea followed by Gastroenteritis and Typhoid. Dysentery and Jaundice also seem to be on top of the mind of many people. As far as knowledge of Diarrhoea/gastroenteritis goes, most of the people associate the diseases to infected drinking water although very few people knew that they could be caused by uncovered road-side food and by not washing hands properly before eating. This also corroborate with the general lack of hygiene practices revealed in the earlier discussion. Regarding home remedies, most of the respondents were aware of Oral Rehydration Solution (ORS), but quite a few also believed that anti-diarrhoeal drugs are necessary even for home remedies. This practice of self medication using anti-diarrhoeal drugs might be an important cause of high health expenditure.
- The prevalence of waterborne diseases (diarrhoea/gastroenteritis) is not too low in the region (about 19% of the households reported occurrence of such diseases in the previous six months which is about 22% more than the reported cases from government hospitals of Mandi District). The increase was expected as many cases go unreported being treated either at home by conventional remedies or at private health facilities. No particular socio-economic group is any more vulnerable than others to waterborne diseases, although households without IPH supply of water are marginally more likely to

be affected by such disease. Most of the cases of waterborne disease get cured at the level of first point of contact, which shows that very few complications arise in such cases.

- For an average case of waterborne disease being taken to first point of contact, the expenses are expected to be around Rs. 1500 per episode of illness, which can be saved if clean water is maintained and safe hygiene practices are followed. This can be a case for convincing the community on following safe and hygienic practices and also contributing monetarily to safe and good quality water. Even looking at expenses on medicine in home remedies (Rs. 45), this is comparable to average monthly water charges for IPH connection at home.
- It was found that an overwhelming majority of the respondents were willing to pay for water provided regularity in supply is ensured. Respondents who were not willing to pay for water cited affordability as the major reason.

4.2 Policy Implications

Major efforts to improve access to drinking water by the GoHP have not been matched by proportionate declines in deaths and illnesses from waterborne diseases, which remain grossly underestimated. Failure in epidemiological surveillance is leading public health authorities to record only a small fraction of cases of waterborne diseases. Poor water quality and the lack of adequate disposal of human, animal, and household wastes are contributing to waterborne diseases.

A recent study of the cost of water treatment for five significant pathogens found that chlorination alone or chlorination with conventional treatment is extremely cost-effective for preventing their waterborne transmission. Following strategies are suggested to ensure that drinking water is microbiologically safe:

- Disinfection should never, under any circumstance, be abandoned or compromised.
- Because the cost of disinfection, especially chlorination, is so low and the health benefit is so great, disinfection should be practiced universally. IPH department need to ensure proper chlorination of the filtered water before supplying the same to the consumers in terms of quantity of chlorine added and time period for which chlorine has been applied to inactivate microorganisms. Also, adequate disinfectant residual should be maintained throughout the distribution network and residential pipelines.
- Regular monitoring of disinfection at source and consumer points is required.
- Because adequate technologies for disinfection are generally available for all communities, the technology selected should be the most suitable in terms of cost-effectiveness and level of complexity. Disinfection must be adapted to local conditions and available skills to assure sustained operation and maintenance. Although the use of ozone followed by chlorination may be technologically and economically feasible in wealthy and scientifically advanced communities, this treatment scheme would not be affordable and sustainable in the rural areas of Himachal Pradesh.
- As an interim solution -- while people await microbiologically safe community water systems -- the Government should promote and facilitate disinfection, safe storage, and safe handling of water at the household level. As of now, even the method of “straining” of drinking water with a cloth folded over at least eight times, wherein households do not incur any cost, is not practised in the study area.
- Integrated Disease Surveillance Programme should also be established to help improve reporting and detecting water-borne diseases.

Apart from technology, education and awareness also plays a great role in tackling the issue of checking water contamination and waterborne diseases. Targeted information on water quality can have a considerable impact on health awareness and will also prompt practical disease prevention action. Whether such awareness will ultimately lead to a significant decline in the

incidence of waterborne disease is a question for further research. However, it is probable that this will be the case. If the issue of information provision is not taken into account when measuring the demand for environmental quality, then there is likely to be a significant underestimate of that demand. This means that provision and dissemination of information must be considered in any policy analysis relating to environmental quality and that it must also be considered as a central plank in any policy relating to environmental and welfare improvements. More studies and research in this area are clearly needed for increasing the database of evidences and effectiveness of alternative strategies.

Some concrete suggestions that emerge from the study findings are as follows:

- As household expenditure is highest on medical and health related expenses, there seem to be an opportunity for reducing the medical expenses of the households, at least those related to waterborne diseases (like diarrhoea, gastroenteritis, etc.), by making them pay higher fees marginally for good quality and safe water.
- There is a need to undertake intensive Behaviour Change Communication (BCC) campaigns on the following issues, which will also call for practical demonstration and monitoring of community practices:
    - Safe handling of water and domestic water treatment
    - Domestic waste disposal practices
    - Safe sanitation and hygiene practises
    - Causes of diarrhoea/gastroenteritis related to hygiene practices, do's and dont's during home remedy and all the danger signs, which should prompt the household members to take the patient immediately to qualified healthcare provider/facility.
- Proper attention should be given to the possibility of contamination of ground water by soak-pit type toilets.
- There is a need to educate the masses on appropriate use of water from different sources and evolving innovative ways of restricting the wastage of drinking water.
- User charges for better water quality can be introduced, taking into consideration that presently they are paying around Rs. 25-40 per month and they can also be convinced on the lines of saving treatment cost of waterborne diseases, which are Rs. 45 to Rs. 1500 per episode. But introduction of user charges has to go hand-in-hand with a guarantee of uninterrupted water supply, which for the community means at least once every day.
- The community is ready and can be given the responsibility of management and maintenance of water supply at the community level through creation of regular formal bodies. Members of these bodies need to be trained and provided with technical support on a continuous basis.

EPILOGUE: QUALITY OF WATER

If a drinking water supply, such as a stream or a shallow well, becomes polluted with human wastes (faeces, night-soil, sewage, even some sewage effluents), it may serve as a vehicle of transmission of such waterborne diseases as typhoid, cholera and dysentery or of other water-based diseases. This argument assumes that the waste contains the organisms which cause these diseases. The very high incidence of intestinal diseases and parasitic infestations in hot climates means that there is a high chance of the presence of disease-causing organisms in human wastes. Water supplies which become contaminated with human wastes are therefore always regarded as real health hazards.

The number of disease-causing organisms that have been isolated from polluted waters is very large indeed. It is simply not possible to examine a water sample for the presence or absence of all of these organisms. Moreover, they may often be only irregularly present in a water sample, even though the water is being polluted continuously. Therefore we look for the presence or absence of a special bacterium which is always present in faeces and whose normal habitat is the intestine of man and higher mammals - a bacterium which is therefore an indicator of faecal pollution. One such bacterium is *Escherichia coli (E. coli),* which is itself normally harmless to man (though there are very rare strains that are harmful).

If a water sample is shown to contain *E. coli,* we know that the body of water from which it was obtained has been polluted with human or animal wastes. The water may therefore contain disease-causing organisms. An attempt should therefore be made to protect the water from further contamination or to develop an alternative source of supply.

Presence of coliforms in drinking water is consistently associated with organisms that produce hydrogen sulfide (H2S). Furthermore, enteric bacteria such as *Salmonella, Proteus, Citrobacter,* and some strains of *Klebsiella* also produce H2S. This is a very simple method for assessment of contamination in drinking water based on the detection of H2S-producing organisms.

Keeping the above background information in mind, a total of 78 samples were collected from different types of water sources from 44 separate locations in Mandi District. The samples were tested for H2S producing organism. The table below details the results of the test conducted:

RESULT OF WATER SAMPLE TESTING FOR H2S PRODUCING ORGANISMS				
S. No.	**Type of Water Source**	**No. of Samples**	**Result Status**	
			Black (%)	**Yellow (%)**
1.	IPH	43	36 (74%)	7 (16%)
2.	Well	9	6 (67%)	3 (33%)
3.	Hand pump	9	2 (22%)	7 (78%)
4.	MC Supply	2	2 (100%)	0 (0%)
5.	Bauri	10	8 (80%)	2 (20%)
6.	Spring	3	3 (100%)	0 (0%)
7.	BBM Supply	1	0 (0%)	1 (100%)
8.	Canal	1	1 (100%)	0 (0%)
	TOTAL	**78**	**58 (74%)**	**20 (26%)**

Of the total of 78 samples tested, 74% turned black indicating presence of coliforms i.e disease causing organisms. Hand-pump water was found much more pure than IPH supply with 78% of

hand-pump water samples showing no signs of presence of coliform as compared to only 16% of IPH water supply samples.

Remedial Action:

If faecal contamination is present, boil the water for at least 10 minutes (once it starts boiling) and cool it for drinking, or use chlorine tablets available in the market. Both these methods will kill the harmful bacteria.

The above results also clearly indicates that the IPH department needs to ensure and monitor proper chlorination of the filtered water before supplying the same to the town in terms of quantity of chlorine added and time period for which chlorine has been applied to inactivate micro-organism.

Annex I

Terms of Reference

WASH

22.6.06

TERMS OF REFERENCE

Assessing the Opportunity Costs of Water with Regard to Health

Introduction

Although Himachal Pradesh has a fairly high coverage with regard to water supply schemes, the delivery of sufficient water (in terms of quantity and quality throughout the year) is not always satisfactory. The main reason for this is the often inadequate operation and maintenance of the schemes. This has been recognized by the central and state governments, and efforts are being made to improve service delivery towards a demand driven and participatory approach by involving Panchayati Raj Institutions (PRIs) and Water Users' Associations (WUAs) in operation and maintenance of the rural water supply schemes through the centrally sponsored *Swajaldhara* scheme. This will lead to new roles and responsibilities for both, the Irrigation and Public Health department (IPH) and the PRIs.

The Indo-German WASH Project has been designed with this in mind, and the project's objective is:

> **Water Users, Panchayati Raj Institutions and other stakeholders are enabled and empowered to plan, implement and manage safe drinking water and minor irrigation systems in a sustainable manner.**

The main services of the project are:

- Awareness and orientation of key stakeholders, at various levels, about water sector reform, new roles of various stakeholders and supporting process of creating enabling environment in the state for operationalization of reform initiative.
- Capacity building and training of the key staff of IPH as trainers and facilitators of the processes of planning, implementation, management of community-based,

demand-driven water sector projects. Training and capacity building of selected PRI functionaries and WUA for planning, implementing, maintaining and managing the water service delivery.

- Providing technical assistance to IPH for the implementation of the water sector reform approaches by developing guidelines, manuals and technical tools for participatory technical planning, developing strategy and plan for PRI based O&M systems and handing over of existing schemes.
- Documentation and information sharing of the best practices, development of training material, communication material, case studies etc. and sharing the information amongst various stakeholders.
- Pilot schemes to identify and demonstrate best practices for planning, implementation of demand-led schemes in the new framework and using them as learning nodes for all the stakeholders in other programs.
- Policy support to IPH department, Agriculture department, Panchayati Raj & Rural Development department of GoHP for the development of necessary legal and institutional framework for reform. Based on the experience and analysis of various issues information products will be presented (workshops, seminars, conferences) to the relevant state institutions.

Background

As per the Burden of Disease (EC-SIP, Dept. of Health, 2000), waterborne diseases are among top five of diseases in the state of Himachal Pradesh (HP), across all age groups. This is mainly due to the topography, where water sources carry the disease causing agents from upstream and infects people in the downstream area, especially in the monsoons.The responsibility of managing any outbreak of waterborne disease/ gastroenteritis lies mainly with the Department of Health & Family Welfare (DoHFW), Government of Himachal Pradesh (GoHP) and the Irrigation & Public Health (IPH) Department, which is responsible for ensuring supply of potable water and maintaining the water bodies in the State.

In light of the above, it is proposed that a study be undertaken to map the existing problem of waterborne diseases, identify the underlying causes of the same and determine the average household expenditure incurred on treatment in wake of occurrence of water borne diseases. The findings of the study will help develop a holistic strategy to tackle the problem through an inter-sectoral approach. The objectives and methodology of the proposed study is enumerated below.

Aims & Objectives of the Study

The study aims at collecting evidence regarding the extent of the problem of waterborne diseases in the state of HP and determines the underlying causes, so as to develop a holistic strategy to tackle the problem through an inter-sectoral approach.

The specific objectives of the study are as follows:

- Determine the prevalence and spread of waterborne diseases in the study area.
- Determine the out of pocket expenditures incurred (average household expenditure) on not being able to prevent water borne diseases.
- Assess the knowledge among the community about waterborne diseases.
- Determine the Knowledge, Attitude and Practices (KAP) of the community vis-à-vis the use of water and sanitation practices.

- Determine the current water quality of IPH water and water from traditional sources in the study area.

The specific questions to be answered by the proposed study are as follows:

- What is the prevalence of waterborne diseases (diarrhea/gastroenteritis and others) in the region? Which population group/sub-group is most vulnerable to the disease? In what condition (in terms of degree of severity) do cases of waterborne diseases/ gastroenteritis and other waterborne diseases reach the health facilities?
- What is the average out of pocket expenditure (which includes travel, stay and food of attendants, amount of wages lost for days not worked, expenditure on private diagnostic and medicines etc.) incurred by any household on treatment of water borne diseases?
- What is the level of community awareness regarding the waterborne diseases, in terms of ability in identifying symptoms, knowledge of prevention and home remedies, etc.?
- What are the sources of water for the community in the rural areas in terms of type of source, quality of water, use, distance, mode of transporting the water, potential sources of contamination, etc.?
- What is the prevalent sanitation practice followed by the community? What, if any, are the potential risks within the existing practices that may be the cause of waterborne diseases?

Methodology

It is proposed that the study be focused in District Mandi.

The prevalence of the disease (diarrhea/gastroenteritis and other water borne diseases) will be determined through secondary data, to be obtained from the health department at the block level (from the BMO). A statistically significant sample will be identified and randomly selected at each block. A household survey will then be conducted to determine whether any family members have been sick and whether opportunity costs have arisen. The household survey will be complemented with Focused Group Discussions (FGD) and In-Depth Interviews of community leaders and members for triangulation of finding. Furthermore the current water quality of IPH water as well as of traditional sources will be determined.

Also, the awareness level of the community, KAP for water use and sanitation, apart from background (socio-economic and demographic) characteristics, will be determined through a rapid household survey employing structured schedule for each sample household.

After compilation and analysis of related data, a dissemination workshop will be organised, where all stakeholders will be represented. After obtaining their feedback, the final report will be submitted.

Tasks

The major tasks involved in the study are as follows:

- Secondary data analysis from respective departments (IPH, Health etc.) for the three project districts.
- Identification of statistically significant and randomly selected households

- Quantitative study involving a household survey
- Qualitative study involving stakeholder consultation with both the beneficiaries and the service providers (IPH, Department of Health etc.)
- Water Quality Testing of IPH water and water from traditional sources in the survey area
- Data compilation and analysis
- Dissemination workshop with stakeholders at the state level
- Submission of final report

Time Line

The estimated timeline for undertaking the study is 2 months, with the following time-schedule:

1. Start-up and initial consultation:	1 week
2. Finalisation of data collection tools and training of field investigators:	1 week
3. Data collection (quantitative & qualitative):	2 weeks
4. Data analysis & draft report:	2 weeks
5. Workshop & final report	1 weeks
Total:	8 weeks

Deliverables (Output of the Study)

The proposed study on waterborne diseases will come up with the following deliverables:

- Status report of prevalence and distribution of waterborne diseases.
- Average out of pocket expenditure incurred by any household on treatment of water borne diseases as well as opportunity costs by the households.
- Current water quality situation on the study area.
- Integrated strategy for addressing the issue of waterborne diseases in the state.

Human Resources:

It is proposed to assign:

- Ms. Anjali Jain, project officer of the GTZ supported Basic Health Project in Shimla, HP. – 53 days.
- Furthermore for the field investigations expected costs will be approx. 165000.- INR, which includes the proper field investigations as well as the evaluation of the data collected.

Support to be provided by WASH Team:

- Water Quality Testing in the Study Area

Support to be provided by IPH:

- Provide all available data and information relevant to this study;
- Assist in identifying contacts with key sector institutions and facilitate consultation with institutions/agencies, potential stakeholders and others.
- Depute staff to attend workshops and meetings.

Annex II

Training Schedule

STUDY ON OPPORTUNITY COST OF WATER WITH REGARD TO HEALTH

Training of Field Investigators for Data Collection

Venue: Ekant Vatika, Theog

Workshop Schedule

Day 1: 7th September 2006		
Time	Content	Resource Person
10:30 – 11:00 11:00 – 11:30 11:30 – 1:30	• Inauguration and Introduction to workshop agenda • Introduction about WASH Project • Brief about Swajaldhara Programme • Training on Testing of Water Quality	Ms. Anjali Jain Ms. Kasturi Basu (WASH) Ms. Kasturi Basu (WASH) Jitender
1:30 – 2:30	Lunch	
2:30 – 4:00	About Water Borne Diseases 1. What is Potable Water and how to prevent water pollution 2. Different methods of purifying water 3. Different diseases caused by polluted water and their Symptoms Home Remedies to be used and the preventive aspect	Dr. Ramesh (CHC Thoeg) Dr. Pawan Sharma (CHC Theog)
Day 2: 8th September 2006		
10:30 – 1:30	Understanding the Services offered by different Govt. Health Institutions and the referral system Introduction to the study: • Objectives, Scope and Methodology	Ms. Anjali jain
1:30 – 2:30	Lunch	
2:30 – 5:00	• Questionnaire	Ms. Anjali jain

Day 3: 9th September 2006		
10:30 – 1:00	• Practice Mock Interviews • How to conduct Group meetings • Instructions for the field investigators	Ms. Anjali jain Mr. C.R Azad
1:30 – 2:30	Lunch	
2:30 – 5:00	• Practice and Field Testing of the Questionnaire	
Day 4: 10th September		
10:30 – 1:30	• Practice and Field Testing of the Questionnaire	Ms. Anjali jain
1:30 – 2:30	Lunch	
2:30 – 5:00	• Checking and Feedback to the Questionnaire • Logistics for the data collection	Ms. Anjali jain Mr. C.R Azad
	END	

Annex III

Sample Villages (List & Map)

S.No.	Name of the Viilage	Name of the Tehsil	Population	Households
1	Padar	Padhar	247	40
2	Mulsu	Padhar	499	86
3	Katipri	Padhar	799	229
4	Kaunsal	Jogindernagar	312	67
5	Khalai	Jogindernagar	538	98
6	Sagnehr	Jogindernagar	832	196
7	Garoru	Jogindernagar	1735	383
8	Bhardaon	Bhardaon	346	89
9	Ghanala	Sandhol (S.T.)	978	231
10	Phihar	Dharmpur (S.T.)	441	81
11	Chauki	Dharmpur (S.T.)	1010	184
12	Gharaun	Kotli (S.T.)	639	139
13	Gadyara	Sarkaghat	229	47
14	Bag	Sarkaghat	331	68
15	Mohin	Sarkaghat	458	113
16	Kothi	Sarkaghat	778	166
17	Kaihri	Baldwara	334	77
18	Manwana	Baldwara	718	172
19	Nalag	Sundernagar	355	43
20	Bina	Sundernagar	730	142
21	Sai	Sundernagar	1294	247
22	Mahadev	Sundernagar	2607	506
23	Bag	Mandi	262	65
24	Lehra	Mandi	350	81
25	Brahal	Mandi	444	88
26	Tili	Mandi	533	115
27	Sihan	Mandi	672	130
28	Tikar Kalan	Mandi	787	145
29	Bijan	Mandi	1044	207
30	Pandoh	Mandi	1295	245
31	Kumi	Mandi	3525	657
32	Sozha	Aut (S.T.)	964	163
33	Nagwain	Aut (S.T.)	1903	384
34	Thata	Bali Chowki	544	96
35	Somgad	Bali Chowki	1115	182
36	Bakhalwar	Thunag	342	60
37	Chhatri	Thunag	698	142
38	Fagnyar	Chachyot	362	72
39	Tikkari	Chachyot	658	124
40	Parwana	Chachyot	1251	241
41	Chiral	Nihri (S.T.)	283	45
42	Kinder	Nihri (S.T.)	701	124
43	Bahal	Karsog	165	26
44	Kot	Karsog	275	58
45	JAe	Karsog	444	69
46	Banthal	Karsog	756	168
47	Karsog	Karsog	2280	596
48	Sundernagar-Ward No. 2	Sundernagar	1583	336
49	Sundernagar-Ward No. 9	Sundernagar	2168	477
50	Mandi-Ward No. 3	Mandi	2665	644

Annex IV

Household Schedule

Serial No. ☐ ☐☐ ☐☐

IDENTIFICATION igpku	
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mÙkjnkrk (Respondent) dk uke _____	vk;q% fyax% i:"k ..... 1 efgyk 2
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Q. No.	Question	Options/ Response	Instruction
109	ifjokj dh vk; dk eq[; lk/ku D;k gS \ What is the chief source of income for the household?	[ksrh ckMh.....1 nLrdkjh@f'kYi.....2 0;kikj .....3 futh ukSdjh .....4 ljdkjh ukSdjh .....5 vU; ¼Li"V djsa½ .....6 _____	
110	edku fdl izdkj dk gS \ What is the type of house?	dPpk (Mud house)..... 1 vk/kk iDdk (Brick wall, thatched roof) ..... 2 iDdk (Brick with cement & mortar)..... 3	nwljk vUnkt k yxk,a
111	fuokl viuk gS ;k fdjk, ij \ Is the residence rented or owned by the household?	fdjk, ij ..... 1 viuk edku..... 2	
112	D;k edku esa fctyh gS \ Is there electricity connection to the house?	gk ..... 1 ugh 2	nwljk vUnkt k yxk,a
113	jlkbZ esa bZa/ku dk D;k lk/ku gS \ What is the source of kitchen fire?	ydMh .....1 feêh dk rsy..... 2 xSl (LPG) ..... 3 vU; ¼Li"V djsa½ ..... 8 _____	
114	?kj esa bues lsa dku&lh ?kjsyw oLrq,a miyC/k gS \ What household assets do the household posses/own?	TV (dsbcy jfgr) ..... a TV (dsbcy lfgr) ..... b VsyhQku (land line) ..... c eksckbZy Qku ..... d pkj ifg;k okgu¼dkj o vU;½ .. e bues lsa dkbZ Hkh ugh.....f	,d lsa vf/kd mÙkj lHko
115	ifjokj dh dqy ekfld vk; fdruh gS \ What is the average monthly income of the household?	Rs.	
116	fuEu enksa ij ifjokj dk vkSlr ekfld 0;; ¼[kp½ fdruk gksrk gS\ What is the average monthly household expenditure on the following?	fctyh VsyhQku ikuh fpfdRlk TV (dsbcy) eksckbZy Qku Fuel	

Q. No.	Question	Options/ Response	Instruction
2. Water & Sanitation (Facilities & Practices)			
201	vki ihus dk ikuh dgk ls ikIr djrs gS \ Where do you get your drinking water from?	gSMiEi ……..a dqvk.....b V;wc o;y …….....…….....c ukfy;ksa }kjk ?kj dk ckgj tykifr..d ?kj dk vUnj ikuh dk duD'ku.....e rkykc ……..…….....….....f >juk ……..…..…. .....g vU; ¼Li"V djsa½……..…….....h	,d ls vf/kd mÙkj lHko (;fn mÙkj e gk rk i'u 203 ij tk,a)
202	ty L=kr ?kj ls fdruk nj gS \ How far is the source of water from the house?	fudV (within Plot) ….....….....1 vf/kd nj ugh (within 1 km)...….....2 cgr nj (More than 1 km).…….....3	
203	vki i;;ty dk cjru dk dSls bLrseky djrs gS \ How do you handle the vessel containing drinking water?	cjru esa gkFk@mxyh Mkydj …..1 ycs gSMy oky cjru dk bLrseky rkfd mxfy;k@gkFk ikuh esa u tk,.....2 vU; ¼Li"V djsa½…….....8	Cgrj gksxk dh ihus dk ikuh exok dj nsa[kk tk,
204	D;k ihus ds ty dk j[kus okyk cjru dh fu;fer :i ls lQkbZ dh tkrh gS \ a) Is the vessel containing/storing drinking water regularly washed/scrubbed? b) ;fn gk rk ekg esa fdruh ckj	gk …….…….. 1 ugh ……. 2	
205	D;k vki ihus ls igys ikuh dk fdlh rjhds ls 'k) djrs gS Do you treat water in any way before drinking?	de ls de 10 feuV rd mckyk.....a Dykfju dh xksfy;ksa dk bLrseky ....b lk/kkj.k fQYVj.....c fctyh okyk fQYVj ….....….d fcuk fdlh 'k)hdj.k ds ihrs gS.....e vU; ¼Li"V djsa½.....h	,d ls vf/kd mÙkj lHko
206	D;k ifjokj ds lnL; Hkkstu ls iwoZ fu;fer :i ls gkFk /kksrs gS \ Do the household members wash hands before eating?	gk …….…….....1 ugh …….....….....2	208 ij tk,a
207	gkFk fdlls /kksrs gS \ What do they wash the hands with?	dsoy ty ……..……1 lkcqu o ikuh ……..….....2 feêh ……3	

Q. No.	Question	Options/ Response	Instruction
		jk[k .....4 vU; ¼Li"V dj½ .....8 _____	
208	D;k edku e‡ 'kkpky; dh lfo/kk g\ \ Does the house has toilet/sanitation facility within the house	gk .....1 ugh .....2 →	211 ij tk,¡
209	;g fdl izdkj dk 'kkpky; g\ \ What type of toilet is it?	lk[ku okyk xMMk ¼Soak pit).....1 Sewer line l‡ tqMk gqvk .....2 vU; ¼Li"V dj½ .....8 _____	
210	D;k ifjokj fu;fer :i l‡ mDr 'kkpky; dk i;kx djr‡ g\ \ Does the household regularly use the above toilet?	gk .....1 ugh 2	
211	D;k ifjokj d‡ lnL; 'kkp d‡ ckn gkFk /kkr‡ g\ \ Do the members of the household wash hand after defecation?	gk .....1 ugh .....2 →	213 ij tk,¡
212	o‡ gkFk fdl l‡ /kkr‡ g\ \ What do they wash the hands with?	dsoy ty .....1 lkcqu o ikuh .....2 feêh .....3 jk[k .....4 vU; ¼Li"V dj½ .....8 _____	
213	?kj d‡ dpj‡ dh fudklh d‡l‡ dh tkrh g\ \ How is the household waste disposed off?	ikl gh [kyk e‡ Qsdk tkrk g\ .....1 xMM‡ e‡ Mkyr‡ g\ .....2 ikl d‡ dM‡nku e‡ ftl‡ fu;fer :i l‡ lkQ ugh fd;k tkrk g\ .....3 ikl d‡ dM‡nku e‡ ftl‡ fu;fer :i l‡ lkQ fd;k tkrk g\ .....4 dpjk ic‡/ku vfHkdj.k (Agency) }kjk y‡ tk;k tkrk g\ .....5 vU; ¼Li"V dj½ 8	
214	ihu‡ d‡ vykok fl¡pkbZ o tuLokLF; ty vU; fdl&fdl mi;kx e‡ yk;k tkrk g\ \ For what other purpose do you use IPH Water except drinking?	vkbZ-ih-,p ty miyC/k ugh .....a diM‡ /kkr‡ g\ .....b ugkuk .....c fl¡pkbZ .....d eof'k;‡ dk ugykuk .....e vU; ¼Li"V dj½ .....h	,d l‡ vf/kd mÙkj lHko

Q. No.	Question	Options/ Response	Instruction
3. Awareness about Waterborne Diseases (Diarrhoea/ Gastroenteritis)			
301	o dku lh fcekfj;k gS tks nf"kr ty ds dkj.k gks ldrh gS \ Which are the diseases which can occur due to infected water?	nLr.....a vk='kk/k.....b iSph'k (Dysentry).....c dkyk jk.....d ihfy;k.....e Vk;QkbM.....f vU; ¼Li"V djsa½ .....h _____ →	;fn mÙkj "a" ;k "b" gks rks iz'u 303 ij tk,a ,d lh vf/kd mÙkj lHko
302	D;k vkius nLr@vk='kk/k ds ckjs esa lquk gS \ Have you heard of Diarrhoea/ Gastroenteritis?	gk¡ ..... 1 ugh ..... .2 →	401a ij tk,a
303	vkids fopkj ls nLr@vk='kk/k ds lHkkfor dkj.k dkSu& dkSu ls gSa \ What, in your opinion are the possible causes of Diarrhoea/ Gastro?	nf"kr ty dk ihdj..... a lMd ds fdukjs fcuk <dk gq;k Hkkstu Hkkpu okyk..... b Hkkstu ls igys vPNh rjg gkFk u /kksuk ..... c izn"kr gok..... d nosk dk dkbi..... e vU; ¼Li"V djsa½..... h _____	,d lh vf/kd mÙkj lHko
304	nLr ls ihfM+r 0;fDr dks D;k fn;k tkuk pkfg;s What should be given to a person suffering from Diarrhoea?	thou j{kd ?kksy ¼ORS)..... a ek dk n/k ¼f'k'kq½ ..... b rkt Qy dk jl..... c gYdh ehBh pk; ..... d pkoy@nky dk ikuh..... e nLr jksdh nok,a ..... f cgq&foVkehu ..... .g vU; ¼Li"V djsa½..... h _____	,d lh vf/kd mÙkj lHko
305	nLr@vk='kk/k ds dkSu ls [krjukd lpd ¼y{k.k½ gSa] tc ejht@jksxh dk rRdky fpfdRld ds ikl ys tkuk pkfg, \ What are the danger signs in Diarhoea / Gastro, when the patient should be immediately taken to a doctor?	gYdk futyhdj.k ..... a 'kkp esa jDr vkuk ..... b vR;f/kd futyhdj.k ..... c tc ejht ekf[kd izou ys jgk.....d egq o thHk dk l[kuk.....e vU; ¼Li"V djsa½..... h _____	,d lh vf/kd mÙkj lHko
4. Health Seeking Behaviour & Health Expenditure			
401a	D;k ?kj dk dksbZ lnL; fiNys N% eghuksa esa ty ikf"kr fcekfj;ksa ls ihfM+r jgk gS \ Has any member of the household suffered from any WBD in last 6 mnths?	gk¡ ..... 1 ugh ..... .2 →	501 ij tk,a
401b	How many people have suffered?	_____	

vc e mu ykxk d ckj e dN tkudkjh ikIr djuk pkgxk tk fiNy 6 eghuk e vkid ?kj e ikuh l tfUer fcekfj;k l xLr g, g

NO.	fcekj 0;fDr dk uke i'u 402	fcekjh dh vof/k i'u 403		fyx i'u 404	me i'u 405	?kjy mipkj i'u 406	?kjy mipkj ij [kpk i'u 407		ikFkfed mipkj i'u 408	lok pu tku dk dkj.k i'u 409
	Ni;k e>s mu ykxk d uke cuk, tk fiNy 6 eghuk e vkid ?kj e ikuh l tfUer fcekfj;k l xLr g, g	fdruk fnuk rd 0;fDr fcekj jgk \ ¼fnuk e½ Days Month		i:"k --- 1 efgyk..-2	(1 lky l uhp@ de me d fy, *00*½	fdl rjg dk ?kjy mipkj 0;fDr dk fn;k x;k \ (;fn mÙkj "f" gk rk i'u 408 ij tk,)	fuEu ij fdruk [kp vk;k \ 1- nokb;k ¼futh ndkuk l½ 2- >kM Qd dj (Faith Healer) 3- ikfjJkfed dk ?kkVk 6- vU; ¼Li"V dj½		0;fDr dk ikFkfed mipkj gr dgk y tk;k x;k (;fn mÙkj 9 gk rk i'u 501 ij tk,)	lok nu oky dk pu tku dk dkj.k D;k Fkk \
01							1. _____ 2. _____	3. _____ 6. _____		
02							1. _____ 2. _____	3. _____ 6. _____		
03							1. _____ 2. _____	3. _____ 6. _____		
04							1. _____ 2. _____	3. _____ 6. _____		
05							1. _____ 2. _____	3. _____ 6. _____		

Codes: Q 406:
ued o ikuh dk ?kky.....a
thou j{kd ?kky.....b
tMh&cVh lhc/kh mipkj.....c
>kM Qd dj(Faith Healer).....d
vU; ¼Li"V dj½.....e
dN ugh fd;k.....f

Codes Q 408:
ljdkjh ¼mi LokLF; dsUn½.....1
ljdkjh ¼ikFkfed LokLF; dsUn½.....2
ljdkjh vLirky ¼CHC and above½.....3
futh fpfdRld@fpfdRlky;.....4
futh vLirky.....5
ljdkjh vk;qosZfnd fpfdRlky;.....6
futh vk;qosZfnd fpfdRlky;.....7
nokb dh ndku.....8
dkbZ mipkj ugh fd;k.....9

Codes Q 409:
?kj d fudV.....1
de [kpk.....2
lok nu oky d lkFk futh lhc/k.....3
vPNk :rc okyk inkrk.....4
vPNh lfo/kk.....5
vU; ¼Li"V dj½.....8

NO.		EXPENSES AT FIRST POINT OF CONTACT Q410		REFERRAL Q411	Q412	EXPENSES AT REFERRED FACILITY Q413	
	fcekj 0;fDr dk Code i:'u 402	fuEu ij fdruk [kpZ vk;k \ 1- ifjogu 5. VLV o vU; 2- jgu@lgu 6- nokbZ;k 3. [kkuk 7- ikfjJkfed ?kkVk 4- vLirky dk [kpk ¼Qhl) 8- vU; ¼Li"V djsa½		D;k jksxh dks ikFkfed inkrk }kjk fdlh vU; lqfo/kk dsUnz ij Hkstk x;k (Referral)	jksxh dks bykt ds fy, dgk ys tk;k tk, \	fuEu ij fdruk [kpZ vk;k \ 1- ifjogu 5. VLV o vU; 2- jgu@lgu 6- nokbZ;k 3. [kkuk 7- ikfjJkfed ?kkVk 4- vLirky dk [kpk ¼Qhl) 8- vU; ¼Li"V djsa½	
01		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____		gk¡ ---------..... 1 ugha -----.....- 2 (;fn mÙkj 2 gk¡ rks i:'u 501 ij tk,a)		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____	
02		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____		gk¡ ---------..... 1 ugha -----.....- 2 (;fn mÙkj 2 gk¡ rks i:'u 501 ij tk,a)		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____	
03		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____		gk¡ ---------..... 1 ugha -----.....- 2 (;fn mÙkj 2 gk¡ rks i:'u 501 ij tk,a)		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____	
04		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____		gk¡ ---------..... 1 ugha -----.....- 2 (;fn mÙkj 2 gk¡ rks i:'u 501 ij tk,a)		1. _____ 5. _____ 2. _____ 6. _____ 3. _____ 7. _____ 4._____ 8._____	

Codes Q 412:

ljdkjh ¼mi LokLF; dsUnz½.....1 ljdkjh vLirky ¼CHC and above½.....3 ljdkjh vk;qfoZnd fpfdRlky;.....6 futh vk;qfoZnd fpfdRlky;.....7
ljdkjh ¼ikFkfed LokLF; dsUnz½.....2 futh fpfdRld@fpfdRlky;.....4 futh vLirky.....5 nokbZ dh nqdku.....8

Q. No.	Question	Options/ Response	Instruction
5. Awareness about Swajaldhara Scheme			
501	D;k vkiu Loty/kkjk dk;Øe d ckj e lquk g \ Have you heard about the Swajaldhara Programme?	gk ..... 1 ugh ..... .2 →	601 ij tk,
502	Loty/kkjk dk;Øe dk ykx fdl djuk pkfg, \ Who is supposed to implement Swajaldhara?	vkb-ih-,p- foHkkx ¼IPH).....1 ipk;r.....2 xkeh.k fodkl foHkkx.....3 vU; ¼Li"V dj½.....4 ---	
6. Willingness of people to pay			
601	;fn ljdkj ty d cny 'kYd y@c<k, rk D;k vki ilk nu dk r;kj g \ Would you be willing to pay in case the Govt. charges/ increases charges for supply of water?	gk ..... 1 → ugh 2	603 ij tk,
602	;fn ugh] rk D;k ugh \ If no, why not?		lekIr
603	;fn gk] rk ml Hkxrku d cny e vki ljdkj l D;k vk'kk djr g\ If yes, what would be your expectation from the Govt. in return for the payment?		lekIr
THANK YOU **(End the Interview)**			

Annex V

Focus Group Discussions (FGD) with Community

District: Mandi, Himachal Pradesh

FGD-1

Name of the village: Parwara **Name of the Block: Chachiot (Gohar)**

A team of investigators led by Mr. Satish Tegta visited Parwara village of the Parwara Panchayat of Chachiot Block. The team arranged an FGD in the village in which more than 25 people participated including panchayat member representing Parwara ward.

Keypoints/Findings of the Focused Group Discussion:

- Frequency of the waterborne diseases is average
- Perceived cause of these diseases is unhygienic food and unhygienic practices
- Average cost of the treatment of these diseases is Rs. 200 per HH per month
- Home remedies are preferred over any other treatment as there are no Private Providers (RMPs etc.)
- The villagers were willing to pay for water provided the water supplied is clean and safe
- In addition to the IPH supply there is a hand pump and a stream nearby which is used for water for drinking and other purposes
- No payments are made by the villagers in lieu of water supplied
- Though the villagers claim to practise proper hygiene but there are behavioural problems as they wash their hands with soil after excretion
- There is no functioning committee/body at village level for the management of water resources and improving sanitation

It was observed that villagers are managing the water of the stream for the purpose of irrigation by mutual understanding.

FGD-2

Name of the village: Jae
Name of the Panchayat: Teban **Name of the Block: Karsog**

On 19th of September 2006 a FGD was conducted in village Jae, Block Karsog of Mandi district. The discussion was joined among others by persons who represented the ward Jae in the Panchayat of Teban. There were 17 villagers who actively participated in the discussion.

Keypoints/Findings of the Focused Group Discussion:

Situation regarding waterborne diseases: There are more than average cases of water borne diseases in the village, jaundice in particular and people perceive contaminated water to be the major cause of these diseases and opine that the government has done little to solve the problem. In the absence of any other health provider in the vicinity the villagers depend upon home remedies and faith healer for the treatment of the waterborne diseases. They generally pay Rs. 200 to 300 to treat a patient. Villagers are willing to pay for water provided ample and regular supply is assured.

Sources of water: The IPH water supply is available but the villagers seldom get water through it as water is supplied once in a fortnight or so. There is distant stream and a pond of water which is the heavily crowded source of water.

Hygiene Practices: People in this area are accustomed to wash their hands with soap after excretion. Yet a few still use soil considering it more appropriate for cleaning their hands. People bath mostly twice a week. Drinking water is kept in the plastic buckets and changed daily. There is a negligible number of households having toilets built. Those who have do not use this facility as there is not adequate supply of water for the purpose.

Sources of drinking water: Other than the IPH supply there is no other water source nearby which can be considered worth drinking by the villagers. For the purpose of washing cloths and feeding their livestock they go to the Bawri in the neighbouring village.

System of water management: At present there is no system for water management but there used to be a committee that was responsible to assure supply of water regularly and pursue the government to redress the problem of the villagers but the aforesaid committee could not function given to the factional differences in the committee.

As of today the villagers want technical and financial assistance to assure the proper and regularspply of water in the village and are ready to pay the cost incurred.

FGD-3

Name of the village: Mulsu **Name of the Block: Padhar**

The team of investigators was at Mulsu village in the Development Block Padhar where it conducted An FGD on the opportunity cost of water in the village. The meeting was attended by more than ten villagers. They discussed the problems related to water and sanitation in the village.

Keypoints/Findings of the Focused Group Discussion:

- The cases of water borne diseases are seldom.
- On occurrence of these diseases preference is given to home remedies as there is little cost incurred on the treatment. In case of no recovery through these remedies patient is taken to CHC Padhar and average cost incurred is Rs. 300.
- Though there is IPH water supply but water comes rarely and the villagers depend upon Hand Pumps and stream of water coming down from the village Gawali. The situation in the area where majority of residents is Scheduled Castes is even worse.
- People have healthy hygiene and good traditions and economic well being is responsible for this, but the case with the economically weaker section is otherwise.
- There is no formal committee for management of water in the villagers as yet.

FGD-4

Village: Chhattri **Name of the Block: Thunag**

The interaction with the people at the village Chhattri was done by the team of investigators comprising Mr. Satish Tegta , Neelam Gamalta, Kuldeep Rajta, Ms. Dolma Thakur and Mrs. Uma Shandil. They conducted discussion with the people probing the status of water borne diseases and sanitation and the hygiene habits and practices as well.

Keypoints/Findings of the Focused Group Discussion:

Prevalence of water borne diseases: According to the villagers there is a high prevalence of diseases water borne diseases i.e. dysentery, diarrhea, cholera, jaundice and typhoid etc. They also agreed to the fact that these diseases are also in vogue because of unhygienic practices. It was found that expenditure incurred on medication is paid by the head of the family. On an average Rs. 500/- is the cost of treatment per patient suffering from common water borne disease including transportation, boarding and lodging of the patient.

Source of water: The only source of water is IPH supply supplemented by a seasonal stream. In rainy season water is available in plenty but in summers things are other way around. Water is supplied on the simultaneous days. IPH people do not pay heed to the upkeep and maintenance of the resources and assuring proper supply of water.

On being asked that if the villagers were ready and have the capacity to maintain and ensure supply of safe water in a better way than the government their response was “we will need technical and financial support from the government and then we can manage it”.

Cost of water and willingness to pay for water: The villagers generally do not pay any cost for the water that they get through the IPH supply as there are public taps in the village, yet those who have got their indoor water connection pay not more than 22 Rupees monthly. They however

showed their willingness to pay in lieu of safe water if the supply is regular and they get enough water to meet out their daily needs.

Village Level Committee: At present there is committee or body to manage the water resources of the village though not very active.

Hygiene practices: Toilets are far and between and traditionally people go out in the jungle for excretion. Hands are washed with soap after excretion. House waste and garbage is either thrown in open or burnt by the individually as there is no agency to pick and manage it. Drinking water is kept in the buckets of plastic which are cleared and washed daily on regular basis.

FGD-5

Name of the village: Kumi **Name of the Block: Mandi**

At a distance of 23 Kms from Mandi the village of Kumi is situated. Accessible by single lane *semi pucca* road the village can be arrived in any bus going from Mandi to Sundernagar via Gaggal. Agrarian economy of the village is evident from the all aspects of life there. Houses are well built but mud houses or of baked bricks and thatched roofs of stones with stray appearances of *pucca* houses. An FGD with the villagers was conducted in order to collect information for the supplementing the study on the opportunity cost of water and know the public opinion as well. ore than thirty persons including 9 women and ward member of the Kumi ward took part:

Keypoints/Findings of the Focused Group Discussion:

- There are instances of water borne diseases like jaundice and diarrhoea though people perceive cold and weather changes as the main cause of these diseases in addition to unhygienic food.
- Cost incurred on the treatment of these diseases ranges between Rs.150 and Rs.700 though most of them preferred treatment is home based remedies like faith healing in case of jaundice and typhoid and salt sugar solution for dehydration. Patient is taken to any service provider only after these remedies have failed and there are no signs of recovery.

Hygiene practices and traditions:
It was delighting to know that there is greater awareness among the residents of the village being exceptionally more than any other in the district. Though there were no well built toilets but the pits covered from all sides with jute bags knitted together which can accommodate on person at a time. Though these proto – toilets are too close to the houses yet they are well kept.

- Though there is IPH supply through the public taps but people drink the water from the wells or hand pumps which so ever is in the vicinity of the house.
- People do not wish to pay any thing in lieu of water and to our surprise they will prefer to get water from other sources than the IPH supply, if asked to make any payments in lieu of water as there is no problem of water. You can find water after digging a few feet in the ground and a well can easily be dug.
- Sources of water include hand pumps, 4 or 5 wells in addition to the IPH supply.
- There is no village level committee for looking into the managerial aspect of water sanitation so far as there has been no problem like this.
- Plastic bucket is the commonly used utensil for storing drinking water and is cleaned daily.

FGD-6

Name of the village: Manwana
Panchayat: Manwana **Name of the Block: Sarkaghat**

Manwana is a village in Sub – Tehsil Baldwara of Sarkaghat block in Mandi district. A team under the supervision of Mr. C R Azad conducted an F G D at the village in which a total of 26 villagers took part.

Keypoints/Findings of the Focused Group Discussion:

Prevalence of waterborne diseases: To the surprise of the investigating team the prevalence of the water borne diseases in the village is negligible except stray instances of diarrhea and dysentery. These too are attributed to reasons other than contaminated water by the villagers such as bad digestion and unhygienic food etc.

Cost of treatment: Since the CH Sundernagar is near to the village cost incurred on the treatment of the waterborne diseases and other ailments is minimal, yet people prefer home remedies to treat the water borne diseases and these diseases are considered as no serious problem. Only after the patient is on the death bed and there remains no alternative the patient is taken to the Hospital. Average cost of treatment ranges between Rs.150 and 500.

Sanitation: Traditionally people don't have any idea of proper sanitation. The drain lines are open. There are no toilets in the houses in general. Garbage is thrown in open and there is no agency for the upkeep of the sanitation and cleanliness of the village.

Sources of water: Source of water in the village is only the IPH supply. There a hand pump but its water is used only during the summer when the water supply of IPH is inadequate.

Willingness to pay for water: No cost of water is paid by the people except a few who had indoor water connection and pay amount of Rs. 40 per month. People are willing to pay any amount if the water is supplied regularly and in adequate quantity.

Annex VI

In-depth Interviews with Key IPH Officials

Shimla

Name of the Officials Interviewed:
Mr. Sumam Vikarant (Executive Engineer)
Mr. Rajinder (SDO)

Water Quality:
According to the IPH officials the department takes all possible measures and follows proper treatment guidelines to ensure supply of safe potable water. Type of treatment depends upon the quality and type of raw water. Spring sources for e.g. are relatively pure and requires less treatment procedures.

Monitoring of Water Quality:
Weekly testing of water is done both for rural and urban supply. During rainy seasons testing is done on a daily basis. Samples are tested at the District Level laboratory and are regularly sent to laboratories at Kandaghat and Chandigarh for cross checking. Every circle has a nodal officer who regularly monitors and sends reports to the Liaison officer at the Head Quarter which thereafter sent to the Engineer in Chief. Proper records/registers are maintained with regard to the same. Testing takes place both at the distribution point i.e. at the tail end and also at the intake point. Testing at tail end is done at household level and samples are taken randomly from different household every week preferably the farthest household of the selected area. Testing is also done before and after treatment of water.

Possible Causes of Water Borne Diseases:
The IPH Department does not agree that the cause of Water Borne Diseases is in any way poor quality of drinking water being supplied by the department. According to the Department Water Borne Diseases are generally not caused due to contaminated drinking water but are a result of unsafe personal hygienic practices and due to improper storing and handling of water which may result in contamination at the end user level.

Though the Department agrees that despite of all measures taken, no system is fool proof and it is possible that about 10-15% cases of Water Borne Diseases may be due to contaminated IPH supply. Sometimes contamination of IPH water may be due to leakage or mixing of sewerage and water pipe at certain point which is corrected as soon as it is reported. Intermittent supply also increases chances of contamination.

Importance of IEC:
There is also lack of awareness amongst the people with regard to use of safe potable water. Furthermore despite access to IPH supply, people because of various psychological reasons/beliefs, generally tend to use water from traditional sources like bauris etc. These sources are generally not well maintained and the water is generally contaminated. Sometimes river based/khad based water sources are adjoining cremation ground as such due to psychological reasons people do not use IPH Water.

Community needs to be made aware on the following:

- Various IPH Schemes
- Catchments Protection
- Use of Sanitary Latrines
- Scientific disposal of waste
- Storage and conservation of water
- Right treatment procedures

Active Community Participation is required to further help in dealing with this problem. Communities need to come forward and take on the onus of regular maintenance and upkeep the IPH Schemes. Communities have an important role to play in protection and upkeep of the Catchment area and water sources as well.

In a phased manner the Department has decided to hand over the operation and maintenance of 10% of the Schemes to the Panchayats. In the year 2001 such an attempt was made but the decision was taken back due to the lack of an enabling environment. The communities were not prepared and lacked the necessary capacity to take up the responsibility. Learning from past, the department has taken care of all these issues to ensure successful implementation. The required technical support will be provided by the Department.

Mandi

Name of the Officials Interviewed:
Mr. S. K. Dhiman (Executive Engineer)
Mr. M. K. Thakur

According to the official records IPH schemes covers the whole of District Mandi. All the villages in the District are covered wherein 7218 villages are fully covered while 140 villages are partially covered. There are few places where the supply of water is erratic but otherwise the Department has a full reach in the District. The schemes in District Mandi broadly fall into two categories namely the gravity schemes and the lift schemes. There are about 235 Schemes in all in District Mandi. Similar to the whole of Himachal the majority of the water supply consist of the gravity schemes i.e. the spring sources.

A storage tank is built near the springs and the supply is done from the tanks.

A labor person called beldar is entrusted with the task of chlorination of this water. The person maintains a record of all the activities performed in context of the supply and maintenance of the scheme.

The storage tanks are regularly cleaned on a monthly basis. This is generally done on the wage distribution day as the people are able to verify the physical cleaning of the water storage tank.

The register maintained by the labor person is cross checked by the Panchayat Members.

Supervisors or Foremen are next in the hierarchy who are entrusted the task of cross checking the supply and maintenance services.

The next in line are junior engineers who supervise the maintenance work and collect samples form the end user. They are equipped with chloroscope to conduct an on the spot assessment of the chlorination of the water.

The samples on a monthly basis are sent to the field laboratory in Mandi and on a quarterly basis to the state Laboratory in Kandaghat and Hamirpur to cross check the field report. According to the IPH officials the results are generally within the prescribed parameters.

Sewerage and water supply pipes are being laid separately so that the risk of contamination is reduced due to seepage and or leakage.

For more effective and improving performance at all levels training is required/imparted in new techniques and monitoring at the supervisory level.

There is an IEC CSCU Drought Committee under the chairmanship of the DC which as the name indicates generally meets during a drought and also meets at least once every year before summer to chalk out a combined Action Plan involving the other line departments like health and rural development to regulate the water supply during summer and the same is monitored by the DC/SDM.

A new plan has been introduced wherein School Laboratories at plus 2 level will be equipped with the requisite water testing equipment so that not only the water can be tested independently but also to increase the community participation. It will also help in building up a community knowledge base at the school level. A pilot Introduction has already been done in 2 blocks Dharampur and Darang at two schools.

Another pilot programme is being introduced wherein the regulation and maintenance of 10-15 Schemes are being devolved to the PRI. The duties of the beldar are being given to a person at the village level. An incentive of Rs.750 per month will be given to that person. This will help in the generating employment, increasing community participation and also the beldar can be used more effectively for other work.

According to the Department Water Borne Diseases are generally not caused due to contaminated drinking water but are a result of unsafe personal hygienic practices and due to improper storing and handling of water which may result in contamination at the end user level. “Dhams” was specifically mentioned for Mandi District after which outbreaks of diarrhoeal cases are sometimes reported.

Annex VII

Table 2. Estimating a population proportion with specified relative precision

$$n = z^2_{1-\alpha/2}(1-P)\,\varepsilon^2 P$$

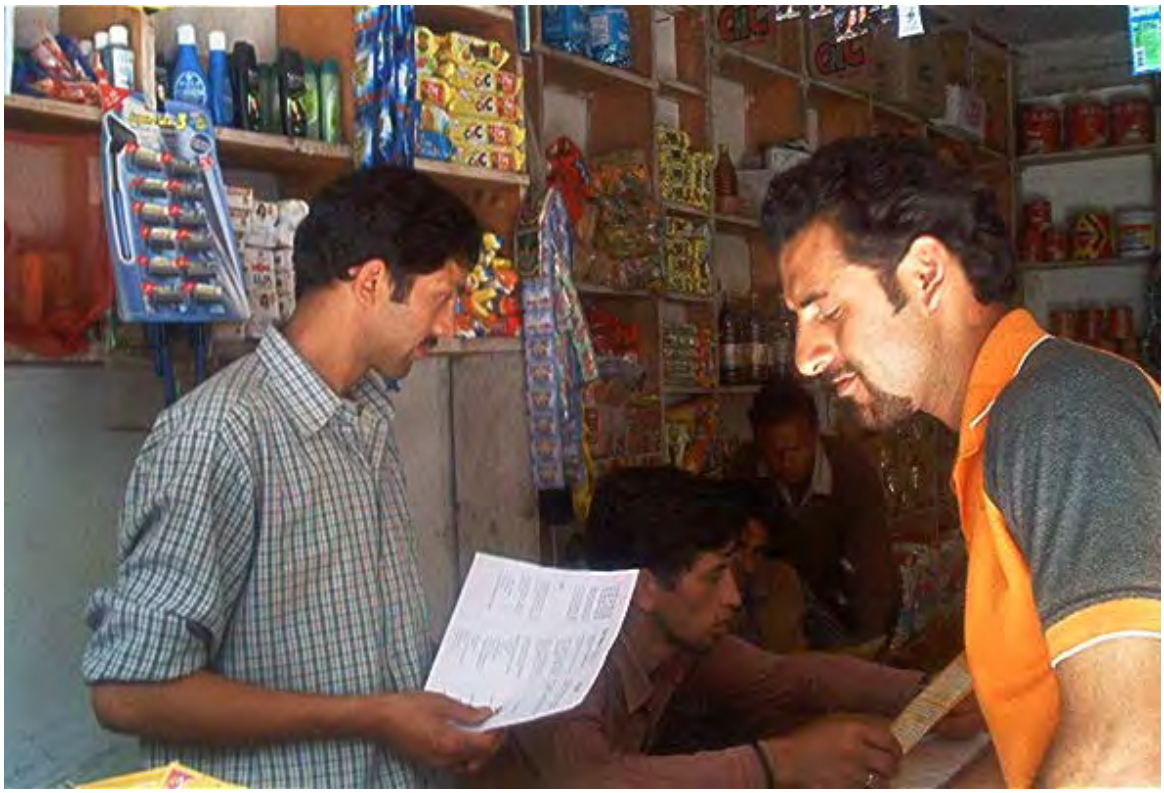
(a) Confidence level 95%

ε \ P	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
0.01	729904	345744	217691	153664	115248	89637	71344	57624	46953	38416	31431	25611	20686	16464	12805	9604	6779	4268	2022
0.02	182476	86436	54423	38416	28812	22409	17836	14406	11738	9604	7858	6403	5171	4116	3201	2401	1695	1067	505
0.03	81100	38416	24188	17074	12805	9960	7927	6403	5217	4268	3492	2846	2298	1829	1423	1067	753	474	225
0.04	45619	21609	13606	9604	7203	5602	4459	3602	2935	2401	1964	1601	1293	1029	800	600	424	267	126
0.05	29196	13830	8708	6147	4610	3585	2854	2305	1878	1537	1257	1024	827	659	512	384	271	171	81
0.06	20275	9604	6047	4268	3201	2490	1982	1601	1304	1067	873	711	575	457	356	267	188	119	56
0.07	14896	7056	4443	3136	2352	1829	1456	1176	958	784	641	523	422	336	261	196	138	87	41
0.08	11405	5402	3401	2401	1801	1401	1115	900	734	600	491	400	323	257	200	150	106	67	32
0.09	9011	4268	2688	1897	1423	1107	881	711	580	474	388	316	255	203	158	119	84	53	25
0.10	7299	3457	2177	1537	1152	896	713	576	470	384	314	256	207	165	128	96	68	43	20
0.15	3244	1537	968	683	512	398	317	256	209	171	140	114	92	73	57	43	30	19	9
0.20	1825	864	544	384	288	224	178	144	117	96	79	64	52	41	32	24	17	*1	5
0.25	1168	553	348	246	184	143	114	92	75	61	50	41	33	26	20	15	11	7	*
0.30	811	384	242	171	128	100	79	64	52	43	35	28	23	18	14	11	8	5	*
0.35	596	282	178	125	94	73	58	47	38	31	26	21	17	13	10	8	6	*	*
0.40	456	216	136	96	72	56	45	36	29	24	20	16	13	10	8	6	*	*	*
0.50	292	138	87	61	46	36	29	23	19	15	13	10	8	7	5	*	*	*	*

*Sample size less than 5.

Annex VIII

Photographs



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