Impact Assessment of Village Life Improvement Projects in Punjab

Marshy land turned into a village square with watch tower

By

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PUNJAB DEVELOPMENT SOCIETY (Regd.)
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Executive Summary

Remarkable achievement of Punjab in modernization of its rural economy during latter part of the 20th century notwithstanding, quality of life in its rural areas failed to keep pace with rising aspirations of people. The inadequate access to quality civic amenities in rural Punjab is a matter of serious concern. Government has been following a piecemeal approach and well-to-do households are making their own arrangements for drinking water and sanitation facilities. Consequently, the health of people suffered. In spite of being a high income state with comparatively better infrastructure, Punjab emerged as the second highest disease risk state in India. Realizing the gravity of situation, the Village Life Improvement Foundation undertook the mission of integrated sustainable development of modern civic amenities in rural Punjab. Modernization of village Kharoudi in Hoshiarpur district by two NRIs, Dr. Basi and Dr. Gill became a role model for many others. The VLIF is currently replicating the Kharoudi model in many other villages in the state.

Development of underground water supply and sewerage system, and their universal access to every household, modern sewerage treatment plant, cement-concreting and solar lighting of streets, and computer education to school children are core activities of the VLIF in the chosen villages. For all these, the VLIF mobilises resources from Punjabi diaspora, local village community, international funding agencies (CIDA), international NGOs and the state Government. The unique feature of the projects is involvement of the whole village community and other stakeholders right from planning to implementation and completion. Ownership is ultimately passed on to them for its future operation, maintenance and further (if any) expansion. Following the case-control methodology and based on the information from primary survey of the households from project and non-project villages, the present study assessed how the VLIF projects impacted the health, social, economic, and environmental aspects of the population in project villages.

The findings of the study indicate that the VLIF brought remarkable change in living conditions in the project villages. The projects works were implemented very quickly, hassle-free and to the entire satisfaction of the stakeholders following bottom-up approach. The VLIF implemented the projects in most cost-effective manner as the costs of VLIF works were found to be 30 per cent or more cheaper than incurred by the public

agencies for similar works. The projects are not specific to particular situation (villages) but are replicable in other villages of Punjab as well. Unlike the Government water supply and sanitation programmes, universal connectivity to water supply and sewage facilities is the unique and the most commendable feature of the VLIF projects. The projects are implicitly pro-poor, pro-weaker social groups and are gender-biased towards females. Consequently, the projects are most inclusive, equitable and resources seem to be pareto-optimally utilised.

The study suggests that there have been significant improvements in health status, economy, and overall living environment through various linkages. The most significant finding is reduction of diarrhoeal morbidity by about 70 per cent. The residents appreciate underground water supply and sewerage facilities and cementing and solar lighting of streets. The reduction in flies, mosquitoes, and foul smell is universally recognised. The residents affirm that the completion of projects has led to better community relations by eliminating the causes of petty disputes arising from dumping of garbage, overflow of waste water channels, household waste, and stagnant water potholes etc.

The findings of the study also bring out many useful policy implications. First lesson to be learnt is that rather than thinly spreading the sources on piecemeal (individual) schemes, better results can be achieved in integrated provisioning of all (water supply, sanitation and hygiene) civic amenities. Therefore, preference must be given to integrated development of civic amenities in the villages to harness the full potential of their benefits on quality of life in villages. Second, in all such future projects, the issue of sustainability must be addressed at the time of their planning. There must be provision for an adequate corpus/reserve for each project to meet future operation and maintenance costs and also to finance future expansion plans. Third and an important missing component in the VLIF projects is that though a commendable job is done in provision of water and sanitation to the target population but the hygiene part is somehow missing from the projects. A substantial body of empirical literature conclusively established that the appropriate knowledge, attitude and practices (KAP) of good hygiene is as important as provision of safe water supply and sanitation services. In all the future projects the VLIF must involve officials of established local institutions and NGOs to create awareness regarding the potential benefits of better water and hygiene practices in the project villages. Fourth, though VLIF projects provide universal connectivity to water supply and sanitation facilities, but many chronically poor households are unable to make best use of these owing to their inability to making their supplementary investment for

construction of on premises latrines. VLIF before implementing the projects must combine the on going Government welfare programme like provision for assistance for construction of household latrines under 'Total Sanitation Campaign' and other schemes with project works. The foundation must convince the Government agencies to adopt project villages on priority basis for implementation of such programmes. Fifth, the VLIF must design strategy to deal with safe disposal of bio-wastes that due to inadequate facilities is dumped in outskirts/periphery of villages. The bio-waste so dumped near residential areas not only gives dirty outlook but also becomes a fertile ground for disease vectors, and leading to environmental degradation. The same is more or less true of stinking village ponds that lost their traditional role with development of better alternative sources of drinking and bathing source of water for animals and washing of laundry in the villages. Again Kharoudi shows the way how the filthy ponds can be converted into beautiful parks, playgrounds, and tanks-serving outlet for sewerage treatment plant. The other project villages must emulate Kharoudi to get rid of the problem.

Acronyms

CDN$	Canadian Dollar
CIDA	Canadian International Development Agency
GOI	Government of India
GOP	Government of Punjab
KAP	Knowledge, Attitude and Practice
NGO	Non Governmental Organisation
NRI	Non Resident Indian
NSSO	National Sample Survey Organisation
O&M	Operation and Maintenance
Panchayat	Elected Democratic Body at Village Level in India.
PC	Personal Computer
Sarpanch	Head of the Village Assembly
TSC	Total Sanitation Campaign
VLIF	Village Life Improvement Foundation
VLIB	Village Lifestyle Improvement Board
WSS	Water Supply and Sanitation
WSH	Water, Sanitation and Hygiene

Impact Assessment of Village Life Improvement Projects in Punjab

Rural Punjab recorded remarkable achievement in modernisation of its rural economy following active government intervention and investment in socio-economic infrastructure, rural institutions and production technology. High growth and development brought unprecedented prosperity in rural areas. But the quality of life in rural Punjab failed to keep pace with the rising aspiration for better living conditions aroused by rising incomes and visible high quality of life in the urban towns. Furthermore, revolutionary penetration of information technology and mass media in rural Punjab further fuelled the aspiration for rural Punjabis' for similar facilities in their villages. However the stark reality is that villages in Punjab continue to lag much behind the urban centres in provisioning of basic civic amenities like quality educational, both public and private health facilities, and availability of safe drinking water, sanitation and hygiene (Dhesi, 2007). Open drains, accumulated water in potholes and near the water sources, stinking village ponds, heaps of garbage and human excreta in periphery of villages is general scenario in rural Punjab. Moreover, open defecation not only leads to a sense of indignity, specifically among the females, but also poses serious environment and health hazards. The poor environment provides the most fertile ground for growth of flies, mosquitoes and vector diseases. Unreached by the public sector services, many well-to-do and health conscious households in villages make their own inadequate arrangements. Even the public provision of the basic amenities like water supply, sanitation and hygiene infrastructure, whenever and wherever provided, follows a piecemeal approach. It is now well accepted that there is a critical threshold level of coverage of water, sanitation and hygiene that has to be crossed before the intended impact is felt (Wan, 1997). This is also borne by the fact that in spite of being the high income state with comparatively better infrastructure, Punjab is the second highest morbidity incidence state in India (GOI, 2004). Inadequate civic amenities might be responsible for such a high incidence of illness in otherwise rich state. In fact well established empirical evidence suggests that inadequate water, sanitation and hygiene are among the 10 top contributors to overall worldwide burden of diseases (Murray and Lopez, 1997). Realizing the gravity of situation and exposed to the high quality civic amenities in the Western World, a number of Punjabi NRIs undertook the mission of integrated sustainable development of modern civic amenities in their ancestral villages. Modernization of village Kharoudi in Hoshiarpur district by two NRIs, Dr. Basi and Dr.

Gill, begin to be cited as a role model for many others. The initial efforts of the two NRIs led to institutionalisation of village life improvement programme and establishment of the Village Life Improvement Foundation (VLIF). The VLIF is currently replicating the Kharoudi model in many other villages in the state.

The success story of VLIF experiment has been widely acclaimed but there is no scientific study quantifying the changes in quality of life and environment brought by the projects in villages. This study proposes to fill the gap and undertake the impact assessment of the village modernisation programme on the quality of life and environment in the project villages. More specifically the **main objectives** of proposed study are to:

(i) examine the health impact of water supply, sanitation and hygiene components of the VLIF projects;
(ii) study the socio-economic impact of VLIF projects; and
(iii) identify key areas and approaches to make such future projects more effective in meeting the aspiration of villagers for modern quality of life facilities on sustainable basis.

The study is organised as follows. The following section provides the status and issues in access to water supply and sanitation in rural Punjab. The section examines the justification for intervention in this sector. Section 3 provides a theoretical and empirical review of available evidence on expected heath improvement and socio-economic benefits from the water supply and sanitation improvement. The methodology followed in the study to explore the objectives of the study in context of health and socio-economic impacts is detailed in section 4. Section 5 provides detail of the procedure followed in sampling and survey of the households from the project and non-project villages. Empirical evidence on impact of projects on health, socio-economic and environmental aspects of the population in project villages is presented in section 6. The section also deals with other related aspects like choice of technology, replicability, sustainability; cost-effectiveness, and perception of the individuals and households' regarding the projects. And summary and suggestions based on the earlier sections are presented in the concluding section 7.

2. Water Supply and Sanitation Scenario in Punjab: Status and Issues. Is There Any Rationale for Interventions?

2.1 Status and Issues

(A) Water Supply

(i) Accessibility

Unlike most other states, accessibility to water is not a major problem in Punjab. Plenty of water, both surface and underground, is available in the state. The 2003 habitation survey revealed that 27.8 per cent of the 13,724 rural habitations in Punjab were fully covered in the sense that they had water supply level of 40 liters per capita per day (lpcd). Another 39.7 per cent on the habitations were partly covered with supply of 20-40 lpcd. Owing to the concentrated expansionary efforts by the state government under "Rajiv Gandhi National Drinking Water Mission", proportion of the fully covered habitations under public sector rural water supply 93 per cent as on April 1, 2006 (GOI, 2007). Only about 7 per cent of the habitations are yet to be reached in the state under the rural water supply mission.

Besides coverage another important issue with the existing rural water supply system is the lack of its universal coverage. Due to low paying capacity of the villagers, and inadequate supply capacity or poor distribution management of the system, only 25 per cent of the households in these covered villages draw water from the system whereas rest rely on alternative (and probably) unsafe water sources.

(ii) Quality of Water:

Accessibility apart, major concern of rural water supply lies in the quality of available shallow ground water in the state. Majority of the rural households still exploits it through their own hand /power operated pumps. Estimates reveal that 54 per cent on the rural villages in the state have serious water quality problems due to presence of physical, biological and chemical contaminants (GOP, 2006). Even the habitation survey of 2003 indicates that 76 per cent of the not covered and 1 per cent of the partially covered villages under the (public) water supply schemes are affected by at least one of these contaminants. Of these problematic rural habitations, 53 per cent suffer due to physical and biological contamination whereas 47 per cent due to presence of some chemical like iron, arsenic, fluoride, nitrate, salinity, and sulphate beyond the safe limits accepted internationally. Presence of contaminants in majority of the villages, still not covered fully under the safe water supply, poses serious health hazards to the population.

Therefore, availability of adequate water in these problematic villages notwithstanding, there is urgent need for provision of alternative safe drinking water source either by the Governmental (investment) or by encouraging the philanthropic organizations like 'Village Life Improvement Foundation' in this context.

Table -1 Water Supply and Sanitation Scenario: Status in Rural Punjab

Sr No	Type	Habitations	Number	% of Total
1	**Water Supply** [Habitation survey-2004]	Fully covered Partially covered Not covered Total	3813 5450 4461 13724	27.8 39.7 32.5 100.0
2	**Water Quality Problem** [Habitation survey-2004]	Partially covered Not covered Quality problem Habitations	50 3390 3440	0.9 76.0 34.7
3	**Source Quality Problem** [Habitation survey-2004]	Type of contaminant Physical & Biological Chemical All	 1813 1627 3440	 52.7 47.3
4	**Sanitation** [Census of India, 2001]	**Type of Latrine within the house** • Pit latrine • Water closet • Other latrine • No latrine	**%age of rural households** 26.4 6.4 8.2 59.1	
5	**Drainage Connectivity** for waste water outlet [Census of India, 2001]	• Closed drainage • Open drainage • No drainage	4.2 73.8 21.9	

B. Sanitation

(i) Inadequate Defecation Facilities:

According to NSSO 2002 survey, about half of the rural households in Punjab have no sanitation facility. Consequently, almost half of the rural population defecates in open leading to degraded sanitation environment. The practice not only poses serious health hazard to defecators themselves but even to others having their own in-house latrine. The decaying human excreta in village periphery paves way for rapid multiplication of disease vectors and contamination of water sources. The situation becomes serious during the rainy season when it gets dissolved in rain water and enters village streets, drinking water sources, water channels and village ponds. Even the underground water gets contaminated with bacteria and nitrate with the run-off that seeps into shallow aquifer.

(ii) Unsafe Disposal of Waste Water:

Even in the households having sanitary latrines, effluent overflowing the septic tanks finds its way into waste water drains constructed in the village lanes and by-lanes. Waste water generated in the households' kitchen, bathrooms, and cattle sheds also flows into the water drains. Unlike the urban settlements, there is no formal drain cleaning system in the villages. Consequently, waste water and effluent overflows into pot holes in lanes and by lanes, seeps into hand pumps and underground water. The stagnated water often clogged in open surface drains also becomes a fertile ground for flies, mosquitoes, and other disease vectors. As per 2001 census, only 4.2 per cent of the rural households in Punjab have closed drainage connectivity whereas 73.8 per cent continue to dispose of waste water into open drains. The continuous running water from community water supply connections (most of which are without any tap) further complicates the situation. The open drain system in villages poses a serious health hazard and contributes to poor living environment. The situation is really worse in the case of 21.9 per cent households having no drainage connectivity. The accumulated waste water discharged by them in open space in or around their premises exposes them to big health risk.

(iii) Stinking Village Ponds:

The village ponds that traditionally served a good source of water for animals and washing of clothes lost its importance with development of piped water supply and installation of individual household hand pumps. Presently, untreated waste water and sullage, overflow of effluent from septic tanks, run-off from cattle dung and bio-waste from dumps (*rudis*) ends in these ponds. The highly polluted stinking stagnant water and growth of unwanted aquatic plants in these ponds contributes to growth of vector diseases, poses serious health hazard, and poor living environment. The village ponds need to be rehabilitated not because besides being a source of water, they also contribute towards the maintenance of ecological balance by acting as natural drainage, ground water recharger, providing habitation to the local flora and fauna.

(iv) Bio-waste:

The solid household waste, agriculture bio-waste and animal dung is dumped traditionally in open space/pits (known as *rudis*) which almost makes a garland around the village. Though waste is good fertilizer source for agriculture purposes, but its nearness to habitations, unscientific storage and poor management, foul smell and a source for multiplication of disease vectors, poses serious environment and health hazard to the villagers. The problem needs solution on priority basis.

2.2 Rationale for Intervention

The inadequate arrangement for safe water supply, poor sanitation owing to lack of proper households and community arrangements for defecation, disposal of waste water and bio-wastes, poor condition of lanes and by-lanes, unscientific management of animal dung and other wastes prevailing in villages cry for the need of an holistic integrated sustainable development of basic civic amenities in villages to lay foundation of human resource development in Punjab.

The provision of improved civic amenities to rural population, though, continues to be an integral part of the Indian planning right from the country's First Five Year Plan (1951-56). But the coverage of sanitation remained astoundingly low at 1 per cent for rural India on the eve at launching of the International Drinking Water and Sanitation Decade in 1981 (GOI, 2003). Even with launching of this International Decade and sensitization of the policy makers, the situation continues to be alarming in that 78 per cent of the rural peoples even in 2002 still continue to defecate in open and contribute to health hazard and transmission of diseases (2003). The progrmme gained strength with declaration of 'Total Sanitation Campaign (TSC) in 1999, but rapid progress has been achieved during the 10^{th} Plan period with coverage increasing to 36 per cent in 2006 from 22 per cent in 2002 (GOI, 2006). The unique feature of the VLIF projects in rural Punjab is that contrary to the piece meal approach of provision of safe water and sanitation latrines, it adopted an integrated approach of universal provisioning of all basic civic amenities to all households in their adopted villages in a single go. Empirical evidence shows that there is a minimum threshold level in access to safe water and sanitation to realize their intended benefits (Wan, 1997).

What types of benefits are expected to flow from the improvements in quality of life brought about by the modernisation of villages by the VLIF, are discussed in the following section.

3. VLIF Projects: Kharoudi Model of Village Modernisation

3.1. How it Started?

A substantial number of expatriates from the *Doaba* region of Punjab is well settled in many parts of the Europe and North America. Majority of them maintains strong ties with their land of origin and contributes substantially to its social and economic development. Many continue to send remittances, drastically transforming the

lives of their family members back home, others invest in palatial houses, and many others contribute to religious charity (Dhesi, 2007 and Thandi, 2007). However, Dr. R.S.Basi, a retired Professor of Economics of International Development and Provost, Alaska Pacific University, Alaska, had something different in his mind. Appalled at the squalor and filth around his native village, ground littered with animal dung, muddy streets with no light and overflowing drains and waste piling up ankle deep, stinking village pounds, and abundance population of flies, mosquitoes and other disease vectors in the village, Dr. Basi thought of starting a process of integrated sustainable development. The idea was to initiate a holistic bottom-up process of integrated sustainable development with focus on the betterment of the "left behind" village people. The process so conceived, was thought to begin with building up basic infrastructure facilities centred around water supply, sanitation, hygiene and computer education.

Box 1: Before Project Village Lane

Armed with a vision and urge to contribute something unique to the village of his forefathers, Dr. Basi visited the village in 1999. He discussed his ideas first with village leaders and later on with whole village by calling a village assembly. With overenthusiastic and unanimous response, it was resolved to construct underground water supply and sewerage system, cementing village streets, and make arrangement for improvement of education in the village primary school. Aware of the many bureaucratic roadblocks one encounters, Dr. Basi consulted Dr. Shamsher Singh Babra of the World Bank, who arranged his meeting with S.Parkash Singh Badal, the then Chief Minister of Punjab. Impressed by the proposed programme, he promised a dollar-for-dollar assistance from the Government (Basi, 2007).

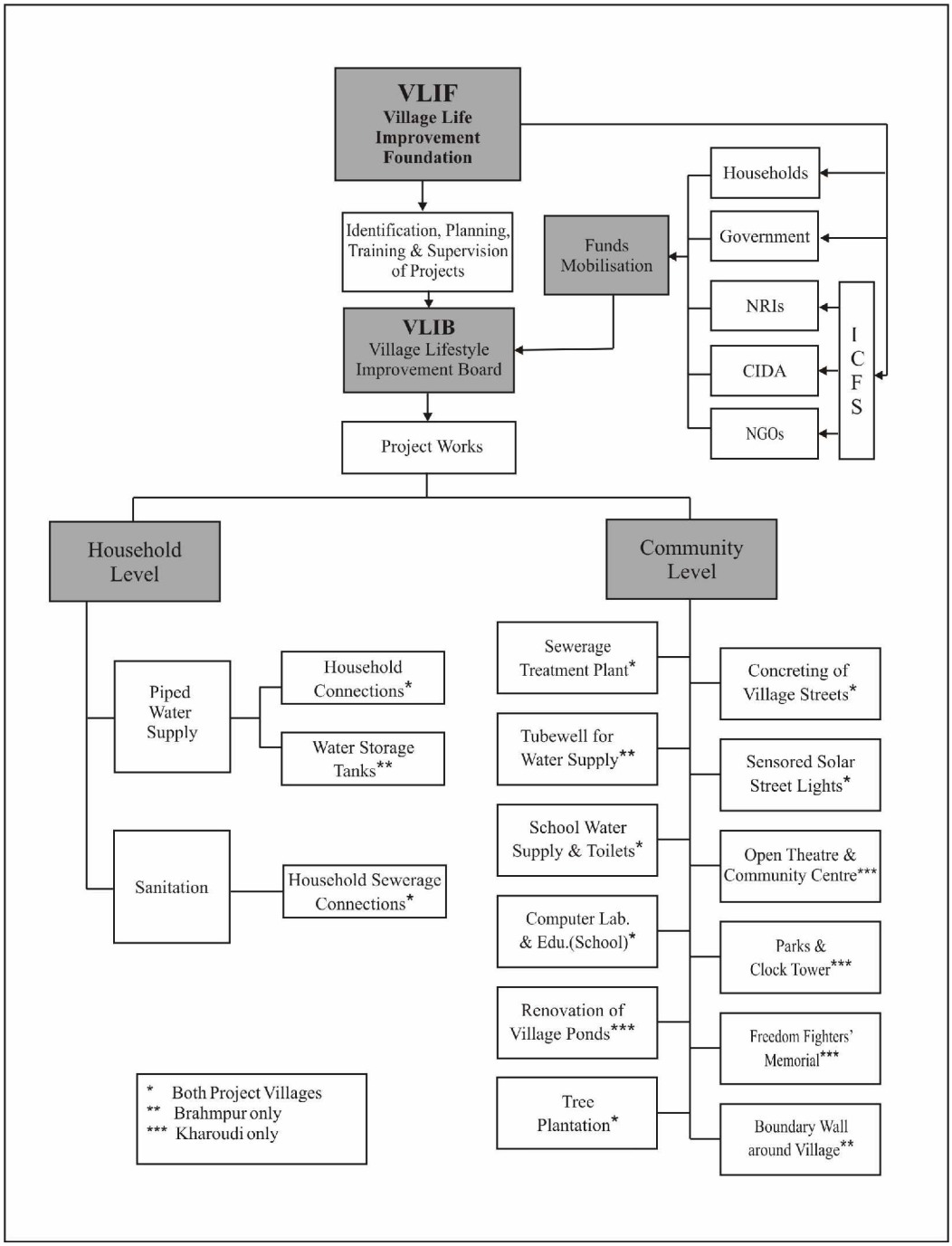
With commitments in hand, Dr. Basi consulted Dr Gurdev S. Gill, a retired Physician from Vancouver Canada and a compatriot from his native village Kharoudi. Dr. Gill was working to enhance mutual understanding between Indo-Canadians and Canadians at large and to provide community services as needed through the "India Canadian Friendship Society of British Columbia"(ICFS)- of which he has been the

founder President. Dr. Gill not only agreed enthusiastically to become partner of such venture but also to provide leadership in the proposed rural development work. Both immediately agreed and set up "Village Lifestyle Improvement Board (VLIB)", Kharoudi in December 1999 to handle the development work.

With formal institution (VLIB) and roadmap in hand, Drs Basi and Gill started with most difficult task of mobilization of resources for execution of their plans. The idea of these two social entrepreneurs begins taking definite shape with overwhelming support from the fellow NRI's abroad (from village Kharoudi). Dr. Gill used the good offices and established reputation of ICFS and prevailed upon the Canadian International Development Agency (CIDA) and other NRIs for funding of their proposed project. Soon they were able to mobilize enough resources for their dream project. Besides monetary contribution, the ICFS provided all technology to VLIF and Dr. Gill imparted technical know-how and training to the VLIF contractor and practically handled everything in the field. With enough money and active involvement of all stakeholders, these two visionaries soon developed modern civic amenities in their village, which soon became a role model and a *Mecca* for all those concerned with provision for modern civic amenities in the rural areas.

Today village Kharoudi has cemented concrete roads with solar street lights, underground piped water supply, underground sanitation opening into sewerage treatment plant, underground telephone lines, three parks, and with almost universal provision of water supply and sewer connection to every household. With household flies and mosquitoes almost disappeared, not a drop of water being visible in any village lane/by-lane, and a village square with watch tower- a fair combination of tradition with modernity, puts the village at par with any other modern village in the Western world and any modern city in India so far as the availability of civic amenities are concerned. Besides this, VLIB also established three parks in the village, and constructed crematorium away from the village community centre; a new room in the school for solar operated computer education centre (equipped with 5 PCs and a paid computer teacher) and; a community centre with guest house facilities, a specially created stone sculpture memorial adorned with inscription of "In Honour of the Gaddarites (freedom fighters from the village)", and trees around the village. When asked to express the change in a single sentence, Ram Das-ex sarpanch (head) of the village panchayat (assembly) remarked that "the village is beyond recognition" and is "a dream come true".

Figure : 1 VLIF Projects



The modernization has been widely acclaimed and the village attracted the attention of Dr. A.P.J. Abdul Kalam, Honourable President of India, who paid a personal visit to the village and commended the contribution of VLIF.

3.2. How the Kharoudi Bug Stung Others?

Impressed by the remarkable change in village Kharoudi, many other resourceful NRI's from other villages of Punjab, also approached the VLIF to replicate the Kharoudi model in their ancestral villages. Brahmpur was the second such village adopted by the VLIF. The initiative here mainly came from Mr. Anant Pal Singh, a Canadian citizen and NRI from the village who alone contributed CDN$ 58,000 for modernization of Brahmpur. With matching grants of CDN$ 58,000 from CIDA, CDN$ 60,000 from the Government of Punjab, CDN$ 50,000 by the villagers in kind and cash and CDN$ 15,000 by eau2 System Works (Canadian NGO) in kind, total amount invested in village Brahmpur amounts to CDN$ 231,000. It includes the installation of a deep tubewell for piped supply of safe drinking water, construction of water storage facility in each household, beautification of village lanes by plantation of ornamental trees in the village streets, painting all walls facing streets, and construction of about six feet high wall around the village to cover the unpleasant scene created by dumps of garbage's and also to block the intrusion of disease vector originating from animal dung and bio-waste. The VLIB employed two sweepers to clean village streets every morning.

Box 2 : After Project Lane Village Brahmpur

The **VLIF** aims to extend its domain by enabling Punjabi diaspora all over the globe to pool resources for modernization of their ancestral villages back home (Gill, 2007). Whosoever approaches them, the organization helps them in getting a village development proposal prepared, work out least cost estimates, contacting village NRIs abroad, providing names of experienced and approved (for funding) contractors, overseeing progress of work, contacting Government Officials in Punjab to obtain

matching funds, and establishing local NGO/VLIB and helping to overcome other hurdles in the implementation of their village development project.

4. Water Supply and Sanitation Projects: Probable Outcomes

A number of investigative reports written by committed individuals, reformers and physicians in early nineteenth century brought the plight of poor in France and England with regard to their accessibility to safe drinking water and sanitation to public and government attention. These reports not only outlined the potential impacts of poor water and sanitary conditions on diseases and public health but also brought out their wider social, economic and political ramifications (see for detail, Bryer, 2006). The most famous among these was Edwin Chadwick's 1842 *Report on the Sanitary Condition of the Labouring Population of Great Britain*. Besides directly focussing on disease, the report had linked poor sanitary conditions to such questions as illegitimacy, crime, labour unions, and sedition and family values. Many other reformers, "saw the need for universal sanitary provision more in terms of disciplining of the 'labouring and dangerous classes' than in terms of their dignity and liberty" (Bryer, 2006). Notwithstanding the motives, such reports are credited of bringing the water supply and sanitation to the centre stage and laying strong emphasis on the responsibility of central government and local authorities in providing these basic amenities to its population in general and to poor in particular.

A considerable volume of both theoretical and empirical studies convincingly brings out strong linkages between improved water supply and sanitation and health benefits. Available studies besides quantifying the health impact in terms of reduced morbidity and mortality, also measured the economic, social and overall developmental impacts of water supply and sanitation (WSS) projects[Esray et al., (1990) and (1991); Fewtrell et al. (2004); Klees et al (1999);UNDP (2006); and WB (1993)]. On the basis of existing literature we propose to review the selected studies in this section to examine the potential health, economic, social and developmental outcomes of WSS projects.

4.1 Health Impact

There are a number of diseases related with poor water, sanitation and hygiene conditions. These can be broadly divided in two groups: those related with poor water supply and those with poor sanitation conditions.

(i) Water related diseases: A number of diseases have their roots in poor quality and inadequate quantity of water consumed by people. Depending upon their transmission route, David Bradley (Cairncross and Valdman, 2006) classified these in the following groups:

- *Water-borne*: diseases transmitted through indigestion of pathogens in drinking water. These include diarrheas, dysenteries, cholera, Hepatitis A, typhoid fever.
- *Water-washed or Water-scarce*: diseases favoured by inadequate hygiene conditions and practices. These include skin and eye infection, Louse borne typhus and louse-borne relapsing fever.
- *Water-based*: diseases transmitted via aquatic intermediate host. These include schistosomiasis, guinea worm, clonorchiasis.
- *Water-related insect vector*: diseases transmitted by insect which breed in water or bite near water. These include malaria, dengue, trypanosomiasis.

(ii) Sanitation related diseases: Sanitation here means the safe disposal of human excreta. Poor or inadequate sanitation related diseases can be classified into following groups:

- *Excreta-related helminthes*: diseases transmitted through soil contaminated by helminthes due to open defecation. These include roundworm, hookworm and whipworm.
- *Excreta-related vectors*: diseases transmitted by flies and cockroaches that breed on excreta. These include diarrhoea, dysentery and trachoma.

The impact of improved water supply and sanitation on incidence of mortality and morbidity due to these diseases however conditional to many factors. These include access to, and use of services, type and /or quality of services, seasonality, environment, and knowledge, attitude and practices of health hygiene of the targeted population (Hunt, 2006). Therefore, studies on impact evaluation of projects may differ considerably in their effectiveness in reduction of water and sanitation related diseases due to heterogeneous conditions and environments under which improvements were made. Quantification of health benefits of water and sanitation projects therefore are likely to vary over a wider range. Therefore, evidence generated on the basis of meta-analysis of rigorous studies would provide better insight into the impact of these projects on health of the targeted population. Esrey et al (1991), Fewtrell et al (2004) and Gundry et al (2004) are such studies that have drawn conclusions based on extensive review of empirical literature. Moreover most of the empirical analysis of impact is in term of reduction in prevalence of

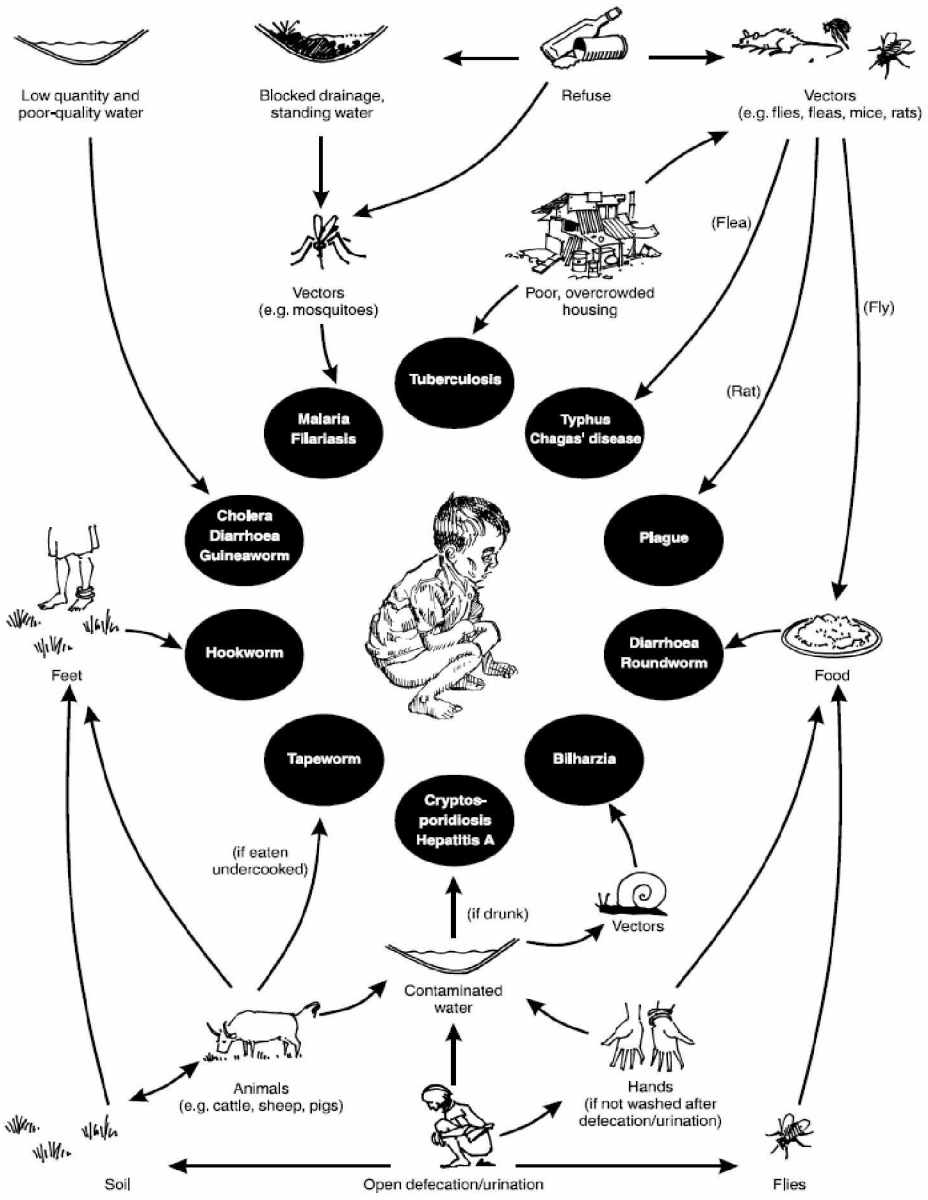


Figure 2: Causes and transmission routes of environmental-related illness

Source: http://www.lboro.ac.uk/well/resources/technical-briefs/51-water-sanitation-and-hygiene -understanding. pdf

The transmission pathways and the causes of water supply and sanitation related illness is shown in the Figure-2.

diarrhoeal diseases, even though many other diseases have transmission mechanism through water and sanitation media (Figure-2). Among the available review of studies, Esrey et al.(1991) is considered to be more authoritative and widely referred. The authors applying the criteria of epidemiological rigor estimated expected median reduction in diarrhoeal morbidity from different components of water supply and sanitation interventions. As can be seen from conclusion drawn by Esrey et al. (1991) and reported in Table-2a, sanitation improvement is the single most effective intervention in median reduction in diarrhoeal morbidity by 36 per cent. Sanitary is closely followed by hygiene promotion as it is expected to reduce diarrhoeal morbidity by 33 per cent. The improvement in both water and sanitation together expected to reduce diarrhoeal morbidity by 30 per cent morbidity. The provision of improved quality and quantity of water expected to reduce diarrhoeal morbidity by 20 per cent and 15 per cent respectively whereas provision of both together reduces illness by 17 per cent. Esrey et al. (1991) study also reveals that the impact on incidence of mortality reduction (65 per cent) due water supply and hygiene improvements is much higher compared with reduction (22 per cent) in morbidity (Cairncross and Valdmanis, 2004). Besides reduction in diarrhoeal morbidity and mortality, the study also brings out that water supply and sanitation improvements leads to 78 per cent reduction in Dracunculiasis, 77 per cent reduction in Schistosomiasis, and 27 per cent reduction in trachoma incidence of morbidity in targeted population.

Table-2a Reduction in Diarrhoeal Morbidity from Improvement in Water Supply or/ and Sanitation Components

Intervention (objective of improvement)	Number of rigorous studies used/reviewed	Median (%) reduction in diarrhoeal morbidity
Water quality only	4	15
Water quantity only	5	20
Water Quality and Quantity both	2	17
Sanitation only	5	36
Water and sanitation	2	30
Hygiene promotion only	6	33

Source: Esrey et al. (1991)

Table- 2b Reduction in Morbidity (other than Diarrhoea) Associated with Improved Water Supply and Sanitation

Disease	Number of better studies used/reviewed	Median (%) reduction in morbidity
Dracunculiasis	2	78
Schistosomiasis	3	77
Trachoma	7	27

Source: Esrey et al. (1990)

4.2 Economic Impact

Economic impact of the water supply and sanitation projects can be classified into three main groups: (1) direct economic benefits of avoiding WSS related diseases; (2) indirect economic benefits related to health improvements; and (3) non-health benefits following implementation of WSS projects. Each of these includes benefits to individual as patient and consumer, health sector, and agriculture and other sectors of the economy (Table 3).

Table-3 Potential Economic Benefits of Water Supply and Sanitation Improvement Projects

	Direct Economic Benefits	**Indirect Economic Benefits**	**Non-Health Benefits**
Individuals as Patients	• Less expenditure on medical treatment due to low morbidity • Less Expenditure on transportation to seek medical treatment • Time saving due to low morbidity	• Value of time saved due to reduced morbidity • Value of time saved of attendants of patients • Value of avoided death loss	• More efficiently managed water resources and effect of bionomics
Individuals as consumers			• Time saving related to water collection or accessing sanitary facilities /defecation • Labour saving devices in household • Switch away from more expensive water source • Property value rise
Health Sector	• Less expenditure on treatment of water supply and sanitation related diseases	• Value of reduced risk of health sector workers falling sick with water and sanitation diseases	• More efficiently managed water resources and effect on vector bionomics
Agriculture and Other Sectors	• Less expenditure on treatment of employees with water & sanitation related diseases • Savings on less medical costs induces productive investment	• Less impact on productivity of ill-health of workers. • Reduced morbidity and mortality leading to higher economic growth	• Benefits to agriculture and other sectors from more efficiently managed water resources

Source: Hutton Guy and Laurence Haller (2004), **Evaluation of the Costs and Benefits of Water Supply and Sanitation Improvements at the Global Level**, Geneva, World Health Organisation.

The direct economic benefits include value of reduced direct and indirect (on transportation, food, drinks etc.) medical expenditures borne by individuals, government, employees or others (like insurance companies) due to avoided illness on implementation

of WSS projects. The indirect benefits mainly follow through productivity effect. These include gains related to reduced morbidity and mortality. The indirect economic benefits are mainly measured in terms of the value (opportunity cost) of gained productive days of patients and their care-takers and health-workers, and also value (of time) of the averted deaths. The non-health related benefits related to WSS projects time savings are associated with improved project services, and benefits of switching over to more expensive WSS sources.

Monetization of all these economic benefits is not always possible. Calculation of benefits over the life cycle of the projects involves number of assumptions on various aspect like number of potential beneficiaries, wages, demand, costs of treatment etc. There is broader consensus in empirical literature (for example, Hutton and Hailer, 2004) that the total societal benefits of such projects include: (1) health sector benefit of avoided illness; (2) averted patient expenses on illness treatment; (3) value of averted deaths; (4) value of time savings on shifting to better water and sanitation facilities; (5) value of time gained (both of patients and care-takers) due to with avoided illness; (6) value of increased school attendance due to averted morbidity among school age children.

Measurement of economic benefits by itself is incomplete economic analysis unless costs incurred in provision of benefits are not taken into consideration. The cost-benefit analysis (CBA) or cost-effective analysis (CEA) is used for the purpose. In economy analysis, projects benefits are weighed against the costs and economic justification of project requires the former to exceed the later. Though the CBA is widely evaluated for its use and misuse in project analysis due to numerous assumptions employed in estimating the costs and benefits, yet the approach is found useful in selecting among the competing technologies and investment projects involving externalities, specifically in developing countries where limited resources compete for alternative uses (WHO, 2000).

Hutton and Haller (2004) evaluated the cost-benefit of water supply and sanitation projects under five alternative scenarios and for different regions in the world. In all the regions and under all five scenarios, all water and sanitation interventions found to be cost-beneficial as the cost benefit ratio (CBR) significantly exceeds 1. Based on rigorous empirical analysis, the authors conclude that when all benefits are included, CBR fall in the 5-11 range for most of the regions in the developing world. This implies that for most of the water supply and sanitation interventions, $1 invested generate $5 - $11worth of economic benefits.

4.3 Social Impact

Like health and economic benefits, a number of potential social benefits follow water supply and sanitation projects. However unlike the health and economic benefits, less direct evidence exists on this account (Hunt, 2006). Most of the social benefits of water supply in general and sanitation in particular feature in the mind of users who invest in or demand sanitation facilities. Sanitation raises social status, empower women, bestow self-respect, dignity and privacy to households, emancipate women from imprisonment of daylight as they wait for darkness to defecate, and provide them safety of sex assault and harassment of going out in dark on their way to and from the site of defecation. In-household sanitation improvement generates externalities particularly by improving overall community sanitation and better living environment in the project villages (Table-4).

Table-4 Potential Social and Environmental Benefits of Water Supply and Sanitation Improvement Projects

Social Benefits to Households	Social Benefits to Community	Environmental sustainability
• Raised social status to be modern • Convenience and comfort of in-household flush latrines • Higher school attendance of girl child's. • Women empowerment-reduction of drudgery of work and participation in project activities • Enhanced self-respect, dignity, and privacy-particularly of females • Safety from danger of sex assault and harassment of females due to going out in dark for defecation • Lesser urinary track infection , chronic constipation and undue stress of compulsion to wait until dark for defecation • Better and cleaner environment • Investment on in house water and sanitary facilities-a financial legacy for next generation • Reduced flies, misquotes, cockroaches etc and bad odor	• Establishment of village level inclusive and accountable institution(s) • Improve Effectiveness of panchayat Raj and other participatory institutions • Reduced incidence of communicable water supply and sanitation related morbidity • Reduced flies, misquotes, cockroaches etc and bad odor. • School sanitation and hygiene practices produce generation of sanitation champions who carry message of clean sanitation and hygiene back to homes and community.	• Adequate treatment and disposal of excreta and wastewater contributes to better ecosystem management and less pressure on freshwater resources. • Improved sanitation reduces flows of human excreta into waterways, helping to protect human and environmental health.

Sources: Caroline (2006).

In spite of strong social reasons, not much empirical work on this count is available in the literature. In a widely referred empirical study of latrine adoption behaviour of 320 households from 6 villages in rural Benin, the ten most commonly perceived advantages identified by Jenkins (1999) in descending order are to: (i) to avoid

discomforts of the bush, (2) to gain prestige from visitors, (3) to avoid dangers at night, (4) to avoid snakes, (5) to reduce flies in my compound, (6) to avoid risk of seeing/smelling faeces in the bush, (7) to protect my faeces from enemies, (8) to have more privacy to defecate, (9) to keep my house/property clean, and (10) to feel safer (Table-5). The study also found that females also have greater preference for latrines and more negative attitudes toward open defecation than men.

Table-5 Benefits of Latrine Ownership as Perceived by 320 Households in Rural Benin

Benefit	(Average importance rating, scale 1–4)*
Avoid discomforts of the bush	3.98
Gain prestige from visitors	3.96
Avoid dangers at night	3.86
Avoid snakes	3.85
Reduce flies in compound	3.81
Avoid risk of smelling or seeing faeces in bush	3.78
Protect my faeces from enemies	3.71
Have more privacy to defecate	3.67
Keep my house or property clean	3.59
Feel safer	3.56
Save time	3.53
Make my house more comfortable	3.50
Reduce my family's health care expenses	**3.32**
Leave a legacy for my children	3.16
Have more privacy for household affairs	3.00
Make my life more modern	2.97
Feel royal	2.75
Make it easier to defecate because of age or sickness	2.62
Be able to increase my tenants' rent	1.17
For health (spontaneous mention)	**1.27**

Note: * On a scale of 1=not important to 4=very important.
Source: Jenkins 1999; Page- 239.

4.4 Impact on Economic Development

Investment in water supply and sanitation improvement projects by reducing the prevalence of diseases and health improvement contributes substantially to overall economic development through various pathways (Figure-3). In fact good population health is not an end in itself for well-being of households but is a crucial input into poverty reduction, economic growth and long run economic development. The breakthroughs in public health and control of diseases supported the economic take-offs

in the history of Britain, United States, Japan and many other developed countries (WHO, 2001). Empirical studies established a strong relationship between health status and economic development. Estimates suggest that 10 per cent improvement in life expectancy at birth, ceteris paribus, is associated with at least 0.3 to 0.4 per cent per year rise in economic growth(WHO, 2001).

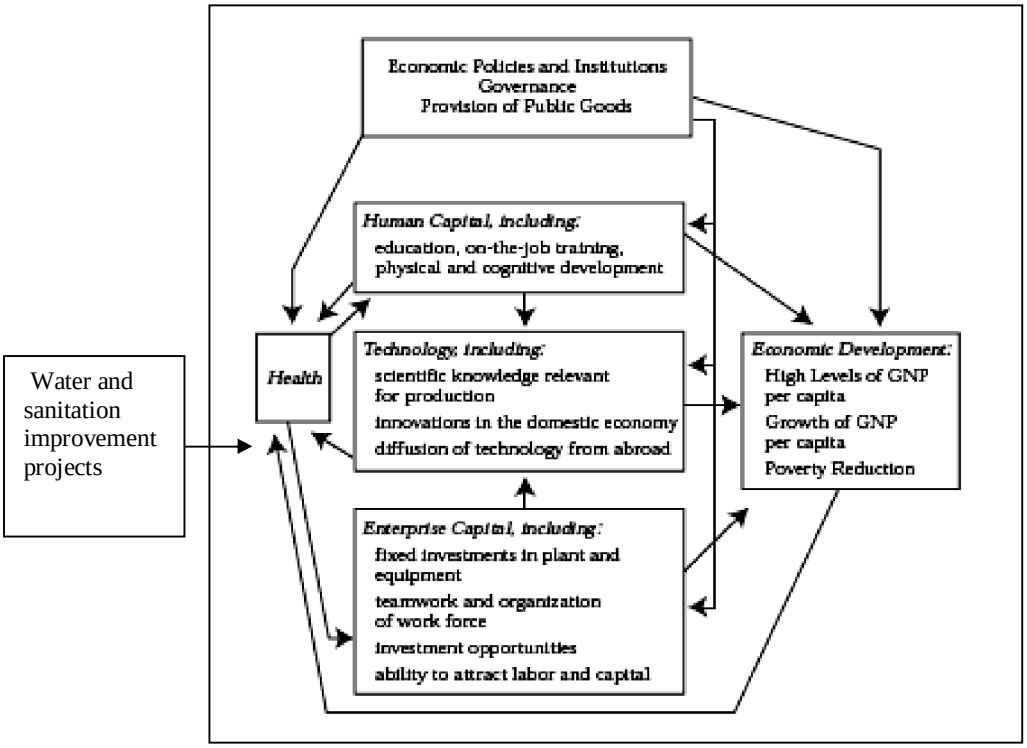


Figure-3 Water Supply and Sanitation Related Health Improvement Inputs into Economic Development

Source: Adapted from WHO (2001)

5. Methodology and Data

5.1 Methodology:

Many different assessment methods have been used to estimate impacts of water supply and sanitation projects. Following all methods is neither feasible nor desirable. Choice varies as per objectives of the project, policy implications, availability and quality of data and constraints on time and other resources. The present study follows traditional descriptive methods or modelling methods. These involve the collection and analysis of ex-post information of water supply and sanitation projects. The information so collected

is compared with the ex-ante (base line) information from the same respondents or without project information collected from some control group of villages/respondents. The approach tries to build a plausible explanation as how the observed changes are accounted for by the project intervention. Quantification of benefits so generated yield data easily understood by politicians and policymakers and other stakeholders. However, user must be aware of the implicit problems that can distort the conclusions following from before/after or case/control comparison of quantitative information. These are: changes that would have occurred without the new project in temporal studies and finding a control group identical to the group affected by the project intervention in the case-control group in spatial analysis.

For the project villages in the study, no such ex-ante (before project) information was collected. Therefore, we followed the case-control approach for impact assessment approach to study the impact of VLIF projects. Following the empirical literature, we also opted to study the impact of VLIF projects by estimating the changes brought by projects on health, socio-economic and environmental aspects of the targeted population. Furthermore, barring a few, most of the empirical studies draw conclusions regarding health impact by estimating the reduction in the incidence of diarrhoeal morbidity among the population targeted of the WSS projects. In the present study we have also evaluated the health impact of VLIF projects by studying the reduction in prevalence of diarrhoeal morbidity in the project villages.

Besides quantification of benefits following project implementation, the study also employs the limited dependent variable econometric model to study the impact of project on health of the households in the project villages. These models not only help to overcome the many problems on quantitative comparison of before/after or case/control information but also help to build linkages between the policy changes and its impact on the policy goals. Modelling methods allow specific hypothetical policy intervention on the targeted indicator(s) to be tested empirically. The specific advantage of modelling is that the impact of many other household and environment specific characteristics affecting outcome of the target indicator get controlled and the parameter capture the real impact of the policy intervention. Moreover, the chain linkages are explicitly spelt out and results following the model built on carefully collected information from representative sample data are amenable to generalization and forecasting. However, reliability of the model outcomes of econometric models depends upon the availability and accuracy of the desired information and fulfillment of the underlying assumptions.

Subject to the problem under consideration and availability of information, we employ the Logit Model to study the impact of water supply and sanitation on health status of the households in the project villages. We hypothesize that both the household specific and environmental characters of individuals play crucial role as determinants of their health status. Specifically, piped water supply, provision of sewerage facilities, treatment of sewerage, building concrete streets and better animal and solid waste management lead to better human health through numerous direct and indirect linkages. Consequently, ceteris paribus, incidence of many diseases following inadequate water, sanitation and hygiene facilities get considerably reduced in the project villages. The parameters of the Logit Model will enable us to test the hypothesis whether or not the probability of a household suffering from WSS borne diseases has been reduced considerably on provision of WSS facilities in the project villages. Besides testing hypothesis, estimates of the model facilitates quantification of the reduction in incidence of WSS related morbidity in the project villages.

The study makes use of the following form of the Logit Model to examine the impact of VLIF projects on health of the population:

$$P_i = \frac{1}{1+e^{-(\alpha+\sum\beta X_i+\sum\delta_i D_i+\varepsilon_i)}}$$

$$\text{Or} \quad Log\left[\frac{P_i}{1-P_i}\right] = \alpha + \sum\beta X_i + \sum\delta_j D_j + \varepsilon_i$$

Where P_i- is the probability of i-th suffering from diarrhoea

X_i – is the set of household characteristics of the i-th individual

D_j – is dummy variable (=1 for project villages and 0 for others)

α, β_i and δ_j are parameters of the model to be estimated.

ε_i - is the stochastic error term

5.2. Selection of Villages and Collection of Data

To carry out valuation of project outcomes on health and socio-economic status of population, we conducted primary survey of the households in two project villages, Kharoudi in Hoshiarpur and Brahmpur in Ludhiana district of Punjab. The VLIF began modernization works in 1999 and 2002 in Kharoudi and Brahmpur respectively. WSS facilities were developed within a year time in both villages. To analyze the health and socio-economic impact of the projects, three other villages, namely Digrian, Jian and

Langeri were also selected as the control villages. These villages were also selected purposively. The VLIF has proposed to modernize these villages on the similar lines as the modernization of the project villages in the study. Therefore, the data collected in the present study on various aspects on the sampled household's from these villages would serve as base line or before project information for any future longitudinal evaluation of the project benefits in these villages.

A sample of 360 households was selected from project and non-project villages. Information on sources water supply, disposal of waste /grey water and related problems, garbage / bio-waste disposal, methods and hygiene practices followed in feces disposal of the children, method of defecation and type of latrines, if any, and problems therefore, and provision of water supply and sanitation facilities to school going children's was collected with a pre-tested structured questionnaire. Information on health status of each member in the selected households was also collected. Information on nature, duration, treatment, all direct and indirect medical expenditure incurred and losses suffered on ailment of any member from the household on this account were collected for the 15 days preceding the date of survey. Similar ailment wise information on nature, medical expenditure, and other all direct and indirect costs incurred by the members of sampled households was also collected for members admitted to any public or private hospital during the last 365 days preceding the date of survey. Besides this common information for both case-control households, additional information on the perception of the households on various aspects of the projects benefits was also collected from the respondents in the project villages (A copy of the Survey Schedule is appended – Appendix-1).

To carry out the survey, first of all a comprehensive listing of all the households in each selected village was prepared. From the list of households of each village, every third household was selected for interview. For canvassing of pre-tested schedule on these selected households, eight well informed and educated persons were selected and imparted practical training to interview the respondents. To maintain quality of the data so collected, survey schedules were randomly selected and authors of the study along with interviewers re-visited the households personally to check for the accuracy of the information compiled by the surveyors.

Apart from the household information, additional information regarding access of the households to other socio-economic infrastructural and civic amenities was also collected for all the selected villages.

6. Impact Assessment:

6.1 Characteristics of Project and Non-Project Villages:

6.1.1 Socio-economic Profile of Sampled Households

The role of socio-economic characteristics of the households as determinant of health status and well-being of households is well accepted. Therefore before comparing the households in project and non-project villages for impact assessment, it would be imperative to compare them on account of their background socio-economic characteristics. Such a comparison would provide us some information regarding justification for comparability of the two set of households. Though in case of small sampling, as only five villages in present study, it is very difficult to find homogenous group of households on every socio-economic characteristic, but the comparison has no justification in case the compounding determinants of an event varies considerably across the compared groups.

Information on various household background characteristics of the sampled households/population is detailed in Table-6. Comparison shows that the project and non-project villages are similar in many characteristics whereas different in some others. However the differences between two groups is not much except for the lower sex ratio, higher proportion of secondary and above level of education, higher proportion of the scheduled caste and other backward caste households, and higher proportion of households owing means of information and communication (Television and telephone) in the non-project villages in comparison to households in the project villages. However empirical evidence suggests that these variables are expected to have differential impact on the health status of households. For instance households with higher education and higher ownership of means of communication tend to better placed on health aspect as well, other things being the same. On the other hand, low sex ratio, low caste status, employment in low paying and dirty jobs tend to be associated with low health status and a higher incidence of morbidity. It is quite possible that the incremental impact association of positive and negative impact of some variables may mutually cancel resulting in comparability of the sample households in the two groups.

Table-6 Characteristics of the Project and the Non-project Villages

Sr No	Characteristics	Project villages	Non-project villages
1	Number of Sampled Households	138	222
2	Sex Ratio (Females per 1000 males)	969	899
3	Age (% of population in age group)		
	0 – 4	5.1	4.6
	5-14	17.8	13.2
	15 -59	63.6	70.9
	60+	13.5	11.3
4	Level of Education (%)		
	• Illiterate [never to school]	19.9	20.7
	• Below Primary	8.0	4.6
	• Primary	16.7	16.3
	• Middle	42.0	37.6
	• Secondary	10.5	13.7
	• Graduate &above	2.9	7.1
5	Caste (% of households)		
	Scheduled Castes	31.2	38.3
	Backward Castes	3.6	19.4
	Others	65.2	42.3
6	Employment Pattern of Workers (%)		
	Cultivators	44.9	37.1
	Self Employed in Non-Agr	10.0	11.4
	Labour	25.6	30.4
	Service	19.5	21.1
7	Type of Dwelling (% households)		
	Pucca	61.6	68.0
	Semi-pucca	8.0	6.1
	Katcha	30.4	28.3
8	Source of Energy (% using)		
	Electricity for Lighting	100.0	99.5
	LPG for Cooking	30.4	57.7
9	Motored Mean of Transport (%hhd)		
	Car/Jeep	6.5	8.1
	Scooter/Motor cycle	60.1	44.1
10	% age of households owning		
	Television	88.4	95.5
	Telephone	44.9	62.6

6.1.2. Water Supply and Sanitation

Though the households have universal access to sources of drinking water, but 92.8 per cent of the households in project villages have piped water supply on their premises (Table-7). Another 3.6 per cent of the households in this set use hand pump as main source of drinking water. Only 3.6 per cent of the households have to fetch water from sources outside their premises. Compared to it, only 20.7 per cent of the households have piped water supply into their premises whereas 32 per cent have to fetch it from some outside premises source. It may not be out of context that VLIBs provided universal

access to piped water in project villages. The non-piped cases are from Kharoudi village as every household in Brahmpur village has piped water supply. The difference is basically because of the fact that the VLIB in Brahmpur has to install its own tubewell as public sector water work was dysfunctional. Therefore every household was provided running water piped connection free of charges. Besides connection, VLIB Brahmpur also constructed a water storage tanks on premises of every household. On the contrary, VLIB in Kharoudi though also provided piped connection to each and every household but for supply of water each household has to get connection from public water supply system by depositing security and connection charges. On inquiry, it was found that most of the households lacking piped water connection opted out not to have it due to their inadequate paying capacity to the public sector water supply system. Many households from Kharoudi also complained of inadequate 24X1 (once in 24 hours) water supply from public works. These may also be dispelling factors for some household to opt out of getting piped water supply into their premises.

Table- 7 Water Supply and Sanitation Facilities: Project and Non-project Villages

Sr No	Characteristics	Project villages	Non-project villages
1	Main Source of Drinking Water (%hhd)		
	• Piped water in house	92.8	20.7
	• Handpump in household	3.6	47.3
	• Pipe / handpump outside Household premises	3.6	32.0
2	Disposal of Gray Water into (%hhd)		
	• Sewerage	99.3	0.0
	• Street water channel	0.0	91.9
	• Open space	0.7	8.1
3	Toilet Facilities (% households)		
	• Flush into sewer	90.6	0.0
	• Pour/Flush into pit	0.0	48.2
	• Open defecation	9.4	51.8

The most important impact of the project is almost universal usage of the sewerage system for disposal of grey /waste water from their premises. In fact only one of sampled household not availing this facility was constructed dwelling recently and planning to lay sewer pipes up to the nearest sewerage line. In non-project villages, waste water from household premises is discharged in the street channels that end into either into village pound or marshy common land. Even 8.1 per cent of households lack access

to street water channels and discharge their waste/grey water into open space in or outside their premises.

Besides the disposal of grey water, sewerage system made a major impact in mode of defecation in the project villages. Laying sewerage system facilitated 90.6 per cent of the households in the project villages to construct flush latrines on their premises. Compared to this, almost a half of the households in non-project villages use their flush/pit latrines whereas the remaining half defecate in open fields /crops / garbage pits in periphery of the villages. The irony of the matter is that 9.4 per cent of the households in project villages still defecate in open though almost everyone has sewerage connection. Our inquiry revealed that most of them were from weaker segments of the village and they lack resources to construct flush toilets on their premises. In our visits to the some poor households it was found that some of them constructed their latrines very recently after getting financial assistance from the central Government under 'Total Sanitation Campaign' (TSC). This suggests that mere provisioning of WSS facilities does not always guarantee their use by the targeted population. Much depends upon their capacity to pay user charges and to make complimentary investment to make use of the facility.

6.2 Technology Used: Is it the Most Cost-Effective?

Before analysing the impact assessment of the VLIF projects, the most crucial questions are: Whether or not the technology adopted was most appropriate so far as the cost and suitability are concerned. Whether or not the Kharoudi model of development can be replicated elsewhere? Whether or not the stake holders were involved at each and every stage of the project implementation? Though these questions were outside the purview of the study, yet it would of interest to examine these issues with the available empirical evidence. In fact the first two issues were posed by His Excellency, Dr. A.P.J.Abdul Kalam, President of India to the Ministry of Rural Development, Government of India. A comparative study conducted by Saxena (2005) for the Government of India to analyse the Kharoudi/Brahmpur technology vis-à-vis the technology adopted by the Government of Punjab in provision of sanitation facilities in Ulana village reveals that per capita cost of Brahmpur/Kharoudi technology is cheaper by about 30 per cent than that of Ulana technology (Table-8). Therefore VLIF seems to have selected the most cost-effective sewer collection and treatment technology in its projects.

Table-8 Brahmpur /(Kharoudi Model) Project vis-a-vis the Ulana System.

Sr.No.	Description	Ulana Details	Brahmpura Details
1.	Projected Design Population	2478	3500
2.	Waste Generated/ Capita	80 litres	80 litres
3.	Treatment Scheme Provided	Aerobic followed by floculative lagoon	Anaerobic, followed by recirculation filter and then lagoon
4.	Green House Gases	Let out at 210 different places	Let out at one place and can be harnessed as biogas.
5.	Per Capita Cost of Sewage collection System including manholes etc.	**Rs. 1455/-** (High due to 210 individual septic tanks)	**Rs.700/-** (24,50,000/3500)
6.	Per Capita Cost of Treatment Plant	**Rs. 638/-**	**Rs. 641/-** (21,45000/3500)
7.	Total Per Capita cost before pucca streets	**Rs. 2093/-**	**Rs. 1341/-**
Thus the per capita cost of Brahmpur/Kharaudi technology is actually less by nearly 30%			
8.	Total per capita Sanitation cost including street concreting	Not done	Rs. 2468

Source: Saxena Shipra (2005)

6.3 Is the Experience Replicable?

Many of the success stories involving implemented projects under specific situation may have limited utility elsewhere, specifically in case ground realities differ considerably. The Kharoudi and Brahmpur model of modernising the quality of life in rural areas seems to fall in this category. The model can be successfully replicated in villages having NRI(s) or locals willing to contribute adequate resources for modernisation of their ancestral villages. However high cost involved in provision of modern sewerage system and up-gradation of other services in villages may be beyond the capacity of village community, specifically in highly fragmented village communities. There is substantial number of the Punjabi NRIs settled abroad from four districts, namely Jalandhar, Nawan Sahar, Hoshiarpur and Kapurthala, of Punjab. So, the Kharoudi model seems to have substantial scope of replicability in many villages of these four districts. Already, VLIF has adopted a number of villages from these districts for replication of the Kharoudi model. However, due to lack of similar NRI support, the model seems to have limited application in rest of districts in Punjab. The VLIF is already aware of this problem. Replication of the Kharoudi model has no problem, according to the VLIF, as fund is not the problem but what is most crucial is willingness from the villagers (Basi, 2007). The foundation is willing to facilitate the process in mobilisation of resources and

actual implementation of the projects (Saxena, 2005 and Basi, 2007). The task can only be accomplished provided the VLIF successfully rope in international development agencies and donors from the developed world.

6.4 Stakeholders Participation?

The modus operandi of the VLIF is to involve every stake holders at all stages of the project. To begin with, as discussed earlier also, VLIF discusses the proposed project first of all in the village assembly. The second stage starts only if everybody agrees/convinced and pass resolution in favour of the project. In the second stage the foundation employs the services of the technicians / engineers to survey the village and based on the ground realities in the village, prepare a detailed report on design of the water supply and sanitation project and the also work out the estimated cost of the project including the sewerage treatment plant. The project report is consequently taken to all stakeholders, village assembly, state Government, and other agencies, for approval and mobilisation of resources for the approved project. Once required resources are mobilised, Village Life Improvement Board (VLIB) is constituted at the village level with wider representation to the village community. The task of actual execution the project is than assigned to the local VLIB under overall guidance and supervision of the VLIF. On completion, the project is handed over to the local VLIB for its running, repair and maintenance, and management. Therefore, unlike the top-down approach of rural development followed in most of the Government projects, Kharoudi model is bottom-up approach implemented involving every stakeholder. The projects are ultimately owned, operated and used by the villagers.

6.5. Health Impact of Projects

Diarrhoeal Morbidity: As mentioned earlier the core objective of the project investment was improvement in quality of life by providing modern water supply and sanitation facilities in villages. The projects successfully realised the core objectives is well accepted. The ultimate gain to the target population however is reflected though improvement in health status, economy, and overall living environment in the villages through various linkages discussed earlier. The available evidence suggests that improvement in water supply and sanitation make significant reduction in many water borne diseases. However, empirical literature is mainly focused on measurement of reduction in prevalence of diarrhoeal diseases in the target population. Our estimates

reveal that on the whole 4.5 percent of the sample population was found to be suffering from diarrhoea during the 15 days preceding the date of visit to a sample household. The incidence is on the higher side compared to 0.9 percent diarrhoeal morbidity incidence in rural Punjab found in a recent survey conducted by the National Sample Survey Organisation (NSSO, 2004). Departure of our result from the well accepted field survey of NSSO may be due to the fact that we conducted the survey during the month of May-June when the prevalence of the disease on its peak. On the other side the NSSO survey was undertaken during Jan-July period.

Separate estimates of diarrhoea in project and non-project villages show a much higher incidence in the non project villages. Compared with 7.1 percent incidence in non project villages, the incidence was just 0.8 percent in the project villages. Assuming other compounding determinants of diarrhoeal morbidly being same in the project and non project villages, the project intervention seems to have reduced the incidence of diarrhoeal morbidity by 90 percent among the project village population. As pointed out earlier, the homogeneity assumption of the compounding determinants of diarrhoeal morbidity seems to be too strong. Therefore, the reduction of diarrhoeal morbidity may not be entirely due to project intervention. To estimate the real impact of project intervention on the diarrhoeal reduction among the target population, we estimated the logistic regression on the unit level data collected during the survey.

The estimates of the logistic regression of the impact of various compounding factors of diarrhoeal morbidity is detailed in Table-9. It may be seen that age of the person, caste background, availability of the toilet facilities, project non project status of the village, type of dwelling unit are the variables that effect significantly the occurrence of diarrhoeal morbidity in the sample villages. The other variables namely, sex status of an individual, source of drinking water, economic status of the household and ownership of television included in the regression does not have much effect on the prevalence of diarrhoeal diseases in the sample population. Our results reveal that the children of age 0-4 are most susceptible to the risk of diarrhoeal diseases. These are followed by children in the age group of 5-14 years. Results also reveals that persons with the low caste background (Scheduled Castes) are more prone to diarrhoeal morbidity compared with others. Availability of toilet facility within premises considerably reduce the risk of diarrhoeal diseases. The prevalence of diarrhoea is significantly related with structure of the dwelling unit. Persons living in *katcha* or semi *pucca* houses are more prone to risk of suffering from diarrhoeal diseases. All these significant determinants of diarrhoeal

morbidity remaining the same, development of water supply, sanitary facilities and improved environment, as carried out in project villages, significantly reduce the risk of diarrhoeal morbidity.

The log odds ratio of the dummy variable for the project villages indicate that, other things being same, the provision of water supply and sanitary facilities by the VLIB has reduced diarrhoeal morbidity by about 70 percent in the project villages – Kharoudi and Brahmpur. This validates our earlier hunch that the difference of 90 percent diarrhoral morbidity between the project and non project villages may be due to non homogeneous population in the two set of villages. Our results shows that provision of facilities in the project villages led to 70 percent improvement in health status of the population so far as the prevalence of diarrhoeal diseases are concerned.

Table-9 Logistic Regression on Prevalence of Diarrhoea in Rural Punjab.

S.No.	Variable	Regression Coefficient	Percent Change in Odds Ratio	Level of significance
1.	Age Dummy1 (=1 for 0-4 yrs., 0 otherwise)	3.592 (0.358)	3630.9	0.000
2.	Age Dummy2 (=1 for 5-14 yrs., 0 otherwise)	1.398 (0.321)	39.47	0.000
3.	Sex Dummy (=1 for males, 0 otherwise)	-0.363 (0.273)	30.5	0.184
4.	Caste Dummy (=1 for Scheduled Caste, 0 otherwise)	0.963 (0.338)	162.1	0.004
5.	Water Dummy (=1 for Piped water connection, 0 otherwise)	0.353 (0.367)	42.4	0.335
6.	Water Dummy (=1 for own Handpump, 0 otherwise)	-0.216 (0.323)	-19.4	0.504
7.	Toilet Dummy (=1 for on premises toilet facility, 0 otherwise)	-2.904 (0.947)	-94.5	0.002
8.	Status Dummy (=1 for high income group, 0 otherwise)	-0.637 (0.384)	-47.1	0.097
9.	Dwelling Dummy (=1 for pucca structure, 0 otherwise)	-1.129 (0.311)	-67.7	0.000
10.	Television Dummy (=1 for own television, 0 otherwise)	-0.289 (0.575)	-25.1	0.615
11.	Project Dummy (=1 if person from project village, 0 otherwise)	-1.189 (0.637)	-69.6	0.062
	Constant	-2.370 (0.696)		0.001
	-2 Log likelihood	439.75		
	Nagelkerke R square	0.35		
	No. of Observations	1729		

As discussed earlier, findings of empirical studies undertaken in different environments and following varied methodology are not strictly comparable. However

the most of the empirical evidence on water supply and sanitation projects is focused on individual components (Esrey el.al., 1990). The impact of developing water supply, sanitation and hygiene individually leads to 15-36 per cent reduction in diarrhoeal morbidity. The studies examining the impact of multiple interventions in developing countries are few and complex. Moreover most of the available studies targeted young children with the exception of Hoque et al. (1996). A comprehensive review and meta-analysis of these studies by Fawtrell and Colford (2004) reveals that the multiple interventions lead to 67 per cent reduction diarrhoea. The 95 per cent confidence interval varies from 59.2 to 75.7 per cent. Our finding of 69.6 per cent reduction in diarrhoea in the VLIF projects is quite in line with this international evidence. Similarly higher incidence of diarrhoea among younger age children is also in line with the available evidence. The evidence of higher risk of diarrhoea among the scheduled castes may be due to their location in congested localities with poor in- and out-house sanitation facilities.

6.6 Social Impact:

In a state like Punjab, where access to water is not a major problem, social factors are high on the mind of stakeholders in choice of investment in water supply and sanitation projects. Enhanced social status, greater convenience, privacy and safety for women are some of such social factors. Therefore, besides health and economic impact, it becomes imperative to evaluate the social impact of the water supply and sanitation projects. The issue involved in evaluation of the social impact of such projects includes: (i) inclusion, (ii) equity, (iii) ownership, accountability, and transparency, (iv) capacity building, and (v) changes in hygiene behaviour of the targeted population (WB, 2001, and also section 3.3). Here we examine the (i) and (ii), whereas the other issues are briefly touched upon in this section as these are dealt elsewhere in the study. Both these issues are examined from the point of view of benefits flowing to the weaker segment households and females.

In a heterogeneous social set up, based on strong traditional caste and class relations, it is generally alleged that most of gains from rural development strategy and allied policies and programmes are cornered by the high caste and rich peasant households (Bardhan, 1984). Therefore it is imperative to evaluate how the gains of VLIF projects are shared among the rural households in the project villages. To examine the issue, we estimated the access to water supply, and sanitation facilities in the project

villages among different caste group of the households. The sample households are divided into three social groups: Scheduled Castes (dalits), backward castes and others (upper castes). Information by the source of water supply and sanitation and castes group in project and non-project villages is detailed in Table-10.

6.6.1 Are VLIF Projects Inclusive and Equitable?

(a) Water Supply: There are considerable differences in the access to the source of drinking water in the project and non-project villages (Table-10). The projects led to four-fold increase in access to the piped water supply-a source considered to be the most convenient, adequate and safest(quality wise). The weaker sections (Scheduled castes and other backwards caste households) seem to have benefited as much as the others (upper caste). However, there is considerable difference in access to the piped water supply across the caste groups in project villages. Compared to almost a universal (98.9 per cent) access to piped water connections to upper caste households, only about 80 per cent of the households in low caste groups have this facility. Does the evidence suggest exclusion of many weaker section households in the VLIF projects in provisioning of piped water supply? Ground realities do not support the argument. In fact the VLIF laid down underground water supply lines in both the villages. There was a provision for individual connection to every household in the village from the underground mainlines. In village Brahmpur, the public sector water supply with huge overhead storage water tank was dysfunctional at the time of project implementation. So, the VLIB installed its own tubewell for water supply to each household and constructed individual small water storage tank within the premises of every household in the village. The construction and operation of piped water supply in Brahmpur is entirely under the control of local VLIB. The local VLIB provided universal access to piped water supply in this village, irrespective of payment of the user charges by the villagers. Contrary to this village, the public sector water supply scheme was functional at time of executing the project in village Kharoudi. The local VLIB though made provision of piped water connection to every household but many households opted not to have the functional water supply due to their incapacity to pay security and water charges to the Government Water Supply Department. Proportion of such non-piped connection households is obviously higher among the weaker segments of the households owing to their low paying capacity. However they meet their safe water supply requirement either by having their own hand pumps or draw water from the common community public taps.

Table-10 Access to Water Supply and Toilet Facilities by Types of Households in Project and Non-Project Villages

A. Water Supply

Household Social Group	Main Source of Drinking Water	%age of Households	
		Project Villages	Non-Project Villages
Scheduled Caste	• Piped Water Supply connection in household • Handpump in household • Pipe / handpump outside Household premises	81.4 9.3 9.3	20.0 44.7 35.3
Other Backward Castes	• Piped Water Supply connection in household • Handpump in household • Pipe / handpump outside Household premises	80.0 0.0 20.0	16.3 62.8 20.9
Others	• Piped Water Supply connection in household • Handpump in household • Pipe / handpump outside Household premises	98.9 1.1 0.0	23.4 42.6 34.0

B. Toilets Facilities

Household Social Group	Toilet Facility	%age of Households	
		Project Villages	Non-Project Villages
Scheduled Caste	Sewerage connection Some Facility No Facility (open defecation)	74.4 0.0 25.6	0.0 28.2 71.8
Other Backward Castes	Sewerage connection Some Facility No Facility (open defecation)	80.0 0.0 20.0	0.0 48.8 51.2
Others	Sewerage connection Some Facility No Facility (open defecation)	98.9 0.0 1.1	0.0 66.0 34.0
All Households	Sewerage connection Some Facility No Facility (open defecation)	90.6 0.0 9.4	0.0 48.2 51.8

(b) Sanitation-Toilet facilities: Like the Water supply, information detailed in Table-10 indicates a remarkable improvement brought by the project in access to the sanitary facilities in the project villages. All social groups benefited from the underground sewerage facility and universal connections to sewerage were provided by the VLIB in project villages. Compared with more than a half of the households in non-project villages, the proportion of the households having no-toilet facilities and defecating in open is just 9.4 per cent in the project villages. This implies that provision of sewerage connection to every household by the VLIB encouraged the peoples in project village to construct flush latrines on their premises. The most remarkable improvement in sanitation facilities has been achieved by the weaker section households. Compared with 71.8 per

cent of the scheduled castes households having no toilets facilities in the non-project villages, the proportion of such households is just 25.6 per cent in the project villages.

Comparatively, the other (upper caste) households benefited more from provision of sewerage facilities. Almost every household from these upper castes have sewage connected toilet facilities. However, the proportion of sewage connected toilet is 74.4 and 80.0 per cent respectively among the Scheduled Castes and Backward Caste households. The differences are mainly due to low capacity of the weaker segment households to construct latrines on their premises. The VLIB provided sewerage connections to every household free of cost but not invested in construction of private latrines. However, on our re-visit to Brahmpur villages, we found that the village panchayat extending assistance to weaker section households for construction of individual on premises toilet facilities under the Total Sanitation Campaign (TSC)- a Government of India Scheme for improvement of sanitation facilities in the country. Consequently, the weaker segment households would benefit more from the VLIF projects as their deprivation of access to toilet facilities was much more than the upper caste households before the project investment.

The evidence on access to safe water and sanitation facilities suggests that the VLIF projects are both inclusive and equitable. Contrary to most of government projects, the VLIF projects have implicit built-in bias towards weaker segments of the society.

6.6.2 Are VLIF Projects Gender Biased?

The benefits of the projects also have an inbuilt gender bias towards the females. In fact, it is well accepted that the women and children bear the main brunt of lack of adequate access to the water supply and sanitation facilities. Arrangements for better water supply and better sanitation tend to provide greater convenience, privacy, relief and safety for women and children Therefore household females and children are the main beneficiaries of improvement of water supply and sanitation facilities.

6.6.3 Ownership, Participation and Capacity Building?

As discussed earlier, though need for provisioning quality of life infrastructure in the project villages was conceived by the VLIF but it was ultimately deliberated and approved unanimously in the village assembly. The projects were implemented by VLIF with active participation of the residents. On completion, the ownership of the projects was passed on to the local board with functionaries representing all social segments of villagers including member of weaker sections and functionaries of village level elected

bodies (Panchayat). For instance, Sh. Ram Das, Vice-President of VLIB, Kharoudi, belongs to the Scheduled Caste (weaker section) community. In our interaction with him and other community leaders, we found him to be most actively involved in planning, implementation, ownership, operation and maintenance of the all components of the VLIF project in village Kharoudi. Virtually he attends all the outside visitors to village. He is well-informed and takes keen interest in present functioning and future plans. There are many others like Ram Das in the project villages.

Besides household water supply and sanitation connections, the members of weaker section communities in project villages benefited proportionally more than upper caste households on two other counts. During the survey it was found that most of the well-to-do households in the project villages either send their school going age children's to renowned English medium high quality education schools. So majority of the children left in the village schools are either from weaker caste or economically deprived households. They are therefore the main beneficiaries from provision of piped water supply and sewer connected flush latrines in village school. The provision of these facilities in school not only reduces the risk of water and sanitation borne diseases but also improves school attendance, particularly of girl students (Kelly, 2004). Consequently, it would lead to augmentation of their human capital formation. Similarly building of computer labs with 5 PCs to each village school along with payment to computer teacher further augments the capacity building in the project villages. Same is more or less applicable so for as development of 3 parks and donation of sewing machines and provision of space in the community centre development under the project, and community centre in village Kharoudi has significant capacity building potential in the village in the long run.

6.7 Environmental impact

As discussed earlier, the sorry state of village environment was the main motivating factor that coerced Dr.'s Basi and Gill to do something for improvement of appalling environmental condition in their ancestral village-Kharoudi. Drastic improvement in the project villages has been highly appreciated both in official and non-official circles and attracted the attention of policy makers from other areas/states. Cement concrete streets with underground water supply and sewer facilities, solar lights, and construction of boundary wall around village Brahmpur put these villages at par with ultra modern villages elsewhere in the world. Findings of the rapid rural appraisal survey

in project villages, discussed in the following sub-section, brings out what residents in the project villages themselves perceive of these changes.

6.8 What Peoples Think of the Projects?: PRA and Perception of the Households

Besides canvassing a household questionnaire, some searching questions were put to groups of people and also to selected individuals in the project villages for their perception regarding the potential impact of the development of water supply, sanitation and overall environment in the villagers. Surprisingly response from group discussions and individual households were same. Information in this context detailed in Table-11. Everybody in the project villages was appreciative of the water supply, sewerage, cementing and solar lighting of streets. Similarly reduction of flies, mosquitoes, and foul smell was universally recognised by the residents in the project villages whether asked in group or individually. Similar views were echoed unanimously regarding better living environment. Everybody affirmed that the project led to better community relations as it eliminated petty disputes arising from dumping of sullage from waste water channels or household waste, and stagnant water in the potholes.

Box-3 Voices From the Project Villages.

Modernisation of village is dream come true. The NRIs have transformed our village beyond recognition. Having enjoyed a high quality of living environment in the village, we are scarce of visiting/staying with our friends and relatives in other villages where foul smell from open water channels and stagnant water, hoards of flies and mosquitoes welcome us.

Ram Das-Ex-Sarpanch of village Kharoudi

Our seven generations will not be in position to repay debt to Mr. Anant Pal Singh for his generiuosity and creating wonderful facilities for us. Project enhanced social capital and harmony among neighbours by eliminating petty disputes on account of blocked waste water channels or arising due to dumping of filth on the streets.

Krishan Chand –shopkeeper from village Brahmpur

Incidence of Diarrhea and Malaria has been drastically reduced in the village since modernization. Villagers benefited but it adversely affected our practice.

Davinder Singh- a RMP Doctor from village Brahmpur

Mr. Anatpal Singh, created a heaven on earth for us that we never imagined in our life time. He would be remembered by our future generations.

A group of elderly sitting in village *Chappaul* (common place) *of Brahmpur*

Life is now easy. We have been emancipated of prisoner of day light for defecation in the dark.

An anonymous woman from village Kharoudi

Table-11 Project Benefits: Perceptions of Sampled Households

Sr No		% of households responding	
		Yes	No/can't say
1.	**Are You Satisfied with Provisioning of**:		
	• Water Supply	100.0	0.0
	• Sewerage	100.0	0.0
	• Better Streets and Solar Lights	100.0	0.0
2	**Do you thing that the Project has Reduced**		
	• House Flies	100.0	0.0
	• Mosquitoes	100.0	0.0
	• Foul Smell	100.0	0.0
3	Do you thing that the Project Created Better Living Environment	100.0	0.0
4	Do you thing that the Project Reduced Faces and Filth around the Village	90.6	9.4
5	Do you thing that the Project Improved Community Relation	100.0	0.0
6	**Do you thing that the Project has Reduced the Prevalence of**		
	• Malaria	97.1	2.9
	• Fever	97.1	2.9
	• Diarrhoea	94.2	5.8

Except for a miniscule proportion of rural households, the rest were unanimous of the view that the project successfully reduced faeces and filth around the village and led to substantial reduction in incidence of malaria, fever and diarrhoea. To further explore into the reason of their departure from unanimity, we re-visited these households and inquired of the reason for same. We found that most of these households were located in out-skirts of the project villages. Because of prevalence of open dumping of animal dung and household wastes practice in periphery of the villages, for which nothing has been done by the VLIB so far. However the VLIB Brahampur village came out with a noble solution and constructing about 6 feet high wall with provision of entry gates to ward off foul smell, and the intrusion of disease vectors from open dumps of garbage and animal dung. However, same is missing in village Kharoudi. Mr. Ram Das, *ex-sarpanch* and functionary of VLIB Kharoudi informed us that they are planning to find a suitable place to shift the garbage dumping ground away from the residential area.

7. Summary and Some Suggestions

7.1 Summary

The VLIF successfully achieved its objective of modernization of civic amenities in the selected project villages. Universal connectivity to piped water supply and sewerage to every household without any charges is the unique and unparallel feature of the VLIF projects. Similarly, cement concentrating of village streets with sensor operated solar streets lights, development of parks, sewerage treatment plants, computer education to school children, and community centre with guest house facilities are unthinkable in villages of developing countries like India. The VLIF put the project villages at par with any other model village in the western world and any other town in India. Another specific feature of the project is its bottom-up approach with active involvement of all stakeholders at almost every stage of the project implementation. On completion, the ownership has been passed on to the users and they are currently operating and maintaining these projects. For villagers it was dream that come true.

Findings of the study suggests that VLIF implemented the projects at much cheaper costs (30 per cent less) than those borne by the Government departments on similar projects. The successful modernization of other villages on lines of the Kharoudi villages indicates that the model is not confined to specific situation; rather suitable for almost every village in the state provided people demand and are willing to cooperate. In fact Kharoudi model shows the way to both Government agencies and other development organizations that how the down-up approach with active participation of the users and other stakeholders at every stage is more cost effective and successful than the top-down approach.

The projects brought remarkable change in the quality of life of peoples in these villages. Improved assess to water supply and sanitation not only improved the living environment in the project villages but also brought substantial improvement in the health status of population by bringing a perceptible decline in disease vectors like flies, mosquitoes, and cockroaches, and foul smell. The study found that the incidence of diarrhoeal morbidity in the project villagers has been in reduced by 70 per cent. The same is likely to be true in many other water supply and sanitation related diseases. In the long run the projects are likely to enhance longtivity by making significant dent on water and sanitation borne morbidity and malnutrition.

Besides health, the projects made a significant contribution to social benefits. It strengthened social capital by eliminating petty disputes arising over dumping of garbage or filth in streets or due to accumulation of overflow of water and grey water from streets channels. Universal access to piped water supply and sewerage connectivity not only empowered the women, provided them dignity, and saved their time but also emancipated them of the slavery of day light to defecate in open in dark hours. In fact universal access to project facilities and users' participation made these projects most inclusive, equitable, pro-poor and pro-female - the features generally missing in many similar projects.

Participatory rural appraisal suggests almost universal satisfaction with project works among the residents of project villages. With improved health status, enhanced social capital and capacity, and economic benefits, the VLIF projects would lead to better human resource development and hence boost economic growth and development in rural areas.

7.2 Some Policy Suggestions

1 **Modernization of Civic Amenities in Punjab Villages:** Findings of the study suggests the need to modernize basic civic amenities in the villages of Punjab in general and improvement in water supply and sanitation in particular. Provision of these facilities leads to substantial improvement in health by reducing the incidence of diahhroeal, dracunculiasis, schistosomiasis, trachoma, ascariasis and trachoma morbidity and mortality. A high benefit-cost ratio provides strong economic rationale for investing in these projects.

2 **Bottom-up Model of Village Modernisation**: The pro-poor bottom-up approach followed by the VLIF in village modernization in general and water supply and sanitation in particular is more cost-effective, both from initial investment, and operation and maintenance angles. By following this approach, rather than top-down followed currently in most of the government sponsored programmes, almost double the number of villages can be modernized with same resources. Government should restrict its role to facilitator than actor itself. Findings of the study suggest that the matching grant policy of Government being adopted in the case of VLIF project seems to be the most suitable, cost-effective and sustainable model of development for rural Punjab.

3 **Integrated Water Supply, Sanitation and Hygiene Projects:** By now it is well accepted that to harness the full potential of health benefits to communities will only

be achieved if the provision of water is accompanied by hygiene promotion and sanitation. Unlike the VLIF projects, provision of safe drinking water and sanitation services are provided by the public sector in piece meal approach. The novelty of the VLIF projects lies in its universal coverage and integrated provision of piped water, sewer system, and construction of concrete cement lanes. Provision of solar street lights, treatment of the sewer and conversion of village ponds and marshy lands into beautiful parks with re-creational facilities for children creates environment worth living in the villages. The lesson to be learnt from findings of the study is that rather than thinly spreading the resources, better results can be achieved in integrated provisioning of all facilities in the selected villages.

4 **Building Adequate Corpus-A Pre-Requisite for Financial Sustainability**: Sustainability is the basic issue in community owned projects. Realizing it, the VLIB in Kharoudi is planning to build a corpus fund to ensure 100% coverage of the future operation and maintenance costs. But no such planning by VLIB in other project villages. Though in village Brahmpur, Mr. Anant Pal Singh is still contributing to the O&M costs as the user charge paid by the beneficiaries are too meagre to cover the monthly wages of the pump operator of sewer system, and 2 sweepers employed to sweep village streets, and the electricity charges of the pump used to supply of drinking water supply and other minor repairs etc. Rather than an individual bearing the deficit every month, it is suggested that VLIB must build its own corpus. Besides contribution from the villagers, the VLIF should approach the state government for one time endowment grant to each modernized village for O&M purposes. The other donors can also be approached for this purpose. The corpus must be enough so that the interest accruals from it would be enough to cover present and future running costs and expansion plans. It may not be out of context that in an integrated approach of water supply and sanitation facilities under the 'Rural Health and Environment Programme' mission operating in 211 villages of Orissa state by *Gram Vikas*-an NGO successfully maintaining a corpus of Rs. 20.1 million in addition to mobilising Rs. 200 millions for developmental works. With universal coverage of all households, every body from the project villages contributes to the corpus in accordance with their paying capacity (Madiath and Chattopadhyay, 2005).

5 **Hygiene Awareness Campaign:** A substantial proportion of the households from project villages have inadequate knowledge of hygiene practices. As mentioned earlier, available empirical evidence suggests that the appropriate knowledge, attitude

and practices (KAP) of good hygiene is as important as provision of safe water supply and sanitation services in reduction of water and sanitation borne diseases. However, the hygiene component found missing from the VLIF modernization projects. Once the modules are developed, the marginal cost in disseminating information (through posters, pamphlets, stickers, booklets, flip charts) would go a long way to sensitize the peoples of KAP hygiene, maximize the project benefits and also to create a society informed and aware of better water and hygiene practices.

6 **Ensure Universal Coverage:** Survey found a few households still defecating in open. Though they are provided piped water supply and sewer connections, but some are so poor to construct the flush latrines on their premises. Since the VLIF works in close tandem with the administration, it must either itself construct flush latrines for such poor households or approach the state/district administration to release funds for poor households in the project villages on priority basis under the 'Total Sanitation Campaign' currently under operation and funded by the Centre and state Governments. The impact of the water supply and sanitation would be more effective under universal provisioning of these services, specifically in reduction of communicable diarrhoeal diseases.

7 **Renovate Village Ponds-** Village water ponds that once served useful sources of drinking and bathing water for animals, recreation (swimming) activity of villagers, and laundering of clothes lost traditional importance with development of alternative affordable sources of water like handpumps, tubewells, and piped water supply through public works. Stinking village ponds these days have become a sullage collection centre and a source of disease vectors. VLIB Kharoudi dealt with problem successfully by converting one such pond into storage tank for treated water discharged from sewerage treatment plant. Villagers use its water for irrigation purposes as it is very rich in urea-an essential fertilizer (Nitrogen-nutrient) for plants. The other pond was converted into beautiful park for children. However, the village ponds in village Brahmpur are still a bolt on beauty of the village. Sharp factionalism among villagers and rampant corruption in execution of village schemes, blocked the intended conversion of village ponds into beautiful parks. Our PRA revealed that the VLIB was anxious to complete the task and was ready with funds to convert the two very big and dirty village ponds into beautiful parks by earth filling of these ponds. However factionalism ridden panchayat blocked the novel scheme. Therefore, in our

opinion renovation of village ponds or conversion of them for alternative purposes like parks must be made an integral part of the future projects.

8 **Safe and Scientific Bio-waste Management:** The future project plans must chalk out some strategy for safe disposal and management of bio-waste at a minimum safe distance from the residential area. The bio-waste constituting agriculture waste and animal dung is handled most un-scientifically and dumped in open space around most of the Punjab villages. This forms almost a garland around most villages and not only smell foul but also provides fertile ground for disease vectors and responsible for environmental degradation. VLIF must design strategy by motivating the people to shift the garbage disposal at safe distance from the village or create awareness among the peoples for its scientific management by digging pits and covering the waste with earth. Functionary of the VLIB Kharoudi apprised us that they have already conceived of the problem and trying to build consensus for alternative site for dumping of bio-waste.

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Appendix-1
Impact Assessment Survey of Village Life improvement Projects in Punjab
Base line Survey

Household Questionnaire

A. Household Identification

1. Name of Village	4. Date of Visit
2. Household Head	5. Contact Number
3. Name of Informant	

B. Household Characteristics

1. Principal Occupation	**7. Whether household own any land? Yes / No**
2. Subsidiary Occupation	**8. If yes than – Land owned (acres)**
3. Household social group	**Land cultivated (acres)**
4. Household Religion	**Land irrigated (acres)**
5. Type of Dwelling --- Pucca / kacha / semi-pucca	**9. Milch animals owned Number --------**
6. Primary Energy Source Cooking **Lighting**	**10 To which category the household belongs?** Low------ Middle-------- Upper-------

C. Household Durable Goods

What means of transport owned by the members of the household?	**Motor car/jeep**	**Source of entertainment /communication owned by the household?**	**Television**
	Motor cycle/Scooter		**Tape recorder**
	Bicycle		**Radio**
	None		**Telephone**

C. Demographic Characteristics

SR NO.	NAME	RELATION TO HEAD	SEX M/F	AGE (YEARS)	MARITAL STATUS	EDUCATION	USUAL ACTIVITY	SUBSIDIARY ACTIVITY	WHETHER HOSPIT- --ALISED DURING LAST 365 DAYS -Y/N	NUMBER OF TIMES HOSPITALISED	WHETHER ALIING ANY TIME DURING LAST 15 DAYS – Y/N	REMARKS

D. Water Source

1	What is the main source of drinking water for members of your household?	(i) Piped water ------- on premises /Public tap (ii) Hand pump------ on premises /public place (iii) Motor pump --------- on premises /public place (iv) Tubewell ------ on premises /public place (v) Dug Well ------ on premises /public place – covered/open
2	Information for on premises water source	Year of Instalment ---------- Approximate installation cost ---------- Repair Expd during past year ---------- User charges paid, if any ---------- Any other provision cost ----------
3	If water is not on premises, who usually collect water?	(i) Adult women (ii) School age female child (iii) School age male child (iv) Young pre-school age children (v) Other
4	What is the main source of water used by the household for hand washing?	(i) Piped water ------- on premises /Public tap (ii) Hand pump------ on premises /public place (iii) Motor pump --------- on premises /public place (iv) Tubewell ------ on premises /public place (v) Dug Well ------ on premises /public place (vi) Pond/Lake/standing water in the fields (vii) Other
5	What is the main source of drinking water for domesticated livestock?	
6	Are you satisfied with quality of water	Yes / No If no, than problem: Bad taste Polluted Contain excess iron Other
7	When source of water was installed?	
8	Do you treat water before use?	Yes / no
9	Initial investment?	Rs.
10	Repair and maintenance incurred on water source during the last one year.	Rs.
11	How much you are ready to pay for three times a day, regular and safe drinking piped water supply in your premises?	

E. Waste (Grey) Water Disposal

1	How do you dispose of water used for washing dishes, doing laundry, and bathing?		i. Piped into street water channels ii. Poured into street water channels iii. Piped/poured into empty space outside premises iv. Piped /poured into premises yard
2	Does the grey water disposed by your neighbour's cause any problem for you?		Yes No
3	If yes, than type of problem	Foul odour	
		Accumulate around your house	
		Breeding ground for flies/mosquitoes/other vectors	

F. Garbage /Bio-Waste Disposal

1	Animal Dung Management	NA/In house/outside house
2	Agriculture Bio-Waste	NA/In house/outside house

G. Excreta Disposal

1	What kind of toilet facility does this household use?	(i) Flush to septic system ----- located inside / outside premises (ii) Pour flush to pit ----- located inside / outside premises (iii) Pit latrine with floor/slab----located inside / outside premises (iv) No facility ---- Field / bush
2	If pit or septic system, how frequently is it emptied?	(i) At least once a year (ii) Every couple of years (iii) Never
3	Do children under 5 use this toilet facility?	Yes No
4	Toilet facility observation : superstructure	Has walls Has a roof Has door No superstructure
5	Toilet facility observation for pit latrine- Are the holes covered?	Yes No
6	Toilet facility observation: Is there any fecal matter present inside the facility on floor or walls?	Yes No
7	Toilet facility observation: Is there a place for hand washing in or near the toilet facility?	Yes No
8	Toilet facility observation: Are the following items present at the place for hand washing?	(i) Water from tap or container (ii) Soap or detergent (iii) Ash (iv) Towel or cloth (v) Basin or sink (vi) None of the above
9	Main problem with current toilet facilities	1. Smell 2. inadequate privacy 3. location inconvenience
10	How much per month you are willing to pay for sewerage connection in your premises?	Rs.
11	How much cost you are willing to share for construction of flush latrine and sewerage connection on your premises?	1. Full cost 2. Partial 3. Not willing

H. Feces Disposal

(For children less than 5 years age)

1	When is it important for a young child (>3 years) to wash his/her hands or have his/her mother wash them for him/her?	i. Before eating ii. After defecating iii. After eating iv. Other v. Don't know
2	Name of the child	
3	Where did the child passed stool last time	i. Used sanitary facility ii. Used potty iii. Used diaper- disposable / washable iv. Went in house/ yard v. Any other
4	Where did the feces disposed off last time?	i. Dropped into toilet facility ii. Rinsed/washed away iii. Disposed into solid waste/trash iv. Somewhere in yard v. Outside premises vi. Left it there

I. Morbidity and Medical Treatment

I Particulars of ailment &treatment received as inpatient of a hospital during the last 365 days

1	Name of the patient					
2	Type of hospital (Public / Private)					
3	Nature of ailment					
4	Duration of stay in hospital (days)					
5	For how long the patient was unable to work properly before hospitalisation?					
6	For how long the patient was unable to work properly after discharged from hospital?					
7	No of persons attending the patient: All time Part time					
8	**A. Medical services received (paid/ free)**					
	Surgery					
	Medicine					
	X-ray					
	Other test					
9	**B Medical expenditure for hospital treatment**					
	Doctor's fee					
	Medicine					
	Bed/room charges					
	Diagnostic charges					
	Any other charges (blood/services etc)					
10	**C. Other expenditure**					
	Transport					
	Boarding & Lodging charges of attendants					
	Any other					
11	**D. loss of household income due to hospital.**					

NATURE OF AILMENT

Gastro-intestinal
1 Diarrhoea /dysentery
2 Gastritis/gastric ulcer
3 Worm infection
4 Amoebiosis
5 Hepatitis/jaundice

6. Cardiovascular diseases
7. Respiratory / ENT ailments
8 tuberculosis
9. disorder of bones/joints
10 diseases of kidney /urinary system
11 Gynecological disorder
12 Neurological disorder
13 Psychiatric disorders
14 Eye ailments
15 Disease of skin
16 Diabetes mellitus
17 Anemia
18 STD

Febrile illness
19. Malaria
20. Mumps
21. Whooping cough
22. Fever of unknown origin
23. Filariasis

Disabilities
24. Visual
25. locomotion
26. speech
27. Hearing
28. Accident/injuries
29. teeth
30. cancer
31. Any other

J Particulars of ailment & treatment received by household members during the last 15 Days

1	Name of the patient						
2	Type of hospital (Public / Private) or clinic						
3	Nature of ailment						
4	**Number of days within the reference period**	ill					
		On restricted activity					
		Confined to bed					
5	For how long the patient was unable to work properly during ailment?						
6	For how long the patient was unable to work properly on recovery?						
7	No of persons attending the patient: All time Part time						
8	**A. Medical services received (paid/ free)**						
	Surgery						
	Medicine						
	X-ray						
	Other test						
9	**B Medical expenditure for hospital treatment**						
	Doctor's fee						
	Medicine						
	Bed/room charges						
	Diagnostic charges						
	Any other charges (blood/services etc)						
10	**C. Other expenditure**						
	Transport						
	Boarding & Lodging charges of attendants						
	Any other						
11	**D. loss of household income due to ailment.**						
12	Unidentified pain/illness/ace Whether getting treatment Self medication Effect on working efficiency, if any						

K. Particular of any household member died during last 365 days

Sr no	Name of the deceased	Sex M/F	Age at death (years)	Medical attention received before death (Y/N)	Whether hospitalized yes/no	If female, whether pregnant Y/N	Amount of expenditure on treatment, if any	Remarks

L. School Child Questionnaire
About School Water Supply, Sanitation and Hygiene

1.	Name of the school child	
2.	What grade are you in ?	
3	**Drinking water** Source of drinking water in your school	(i) Piped water ------- on premises /Public tap (ii) Hand pump------ on premises /public place (iii) Motor pump ------ on premises /public place (iv) Tubewell ------ on premises /public place (v) Dug Well ------ on premises /public place (vi) Water cooler (vii) Own water bottle (viii) No facility
4	Do you have to wait when using common water facility?	(i) always (ii) sometimes (iii) never
5	How do you take drinking water from the common source of water in school?	(i) With glass (ii) with hands
6	Is there proper drainage of excess water flowing from the common source of water?	Yes No
7	**Toilet facility** Does your school have toilet facility?	
8	If yes, are there separate toilet facilities for boys and girls?	
9	Do your friends use toilet facilities to defecate?	
10	If not, why not?	(i). Dirty (ii).Out of order (iii) smells bad (iv) Other
11	Do you have to wait when you want to use toilet facility in your school?	(i) always (ii) sometimes (iii) never
12	Who cleans the toilet?	(i) No body (ii) students by turn (iii) Cleaner (iv) never cleaned
13	Do your friends wash their hands after toilet?	Yes No Don't know
14	How often soap available near the toilet or source of water to wash hands?	(i) always (ii) sometimes (iii) never
15	Health and Hygiene in School curriculum Formal Informal	

M. Perception of the Beneficiaries

1. Are you Satisfied/Benefited from the improvement of :-

(a) Sewerage System in the village	Yes / No
(b) Water Supply	Yes / No
(c) Concreting Streets	Yes / No

2. Do you think that the project in your village led to:

(a) Reduction of Mosquitoes	Yes / No
(b) Reduction of House Flies	Yes / No
(c) Reduction of foul smell	Yes / No
(d) Reduction of Facets and filth around your village	Yes / No
(e) Better living environment	Yes / No
(f) Improved interpersonal/community relations	Yes / No
(g) Saving and better utilization of time	Yes / No

3. Do you think that the project implementation led to reduction of falling ailments:

(a) Diarrhoea	Yes / No
(b) Malaria	Yes / No
(c) Fever	Yes / No
(d) Any other	

4. Overall view of the Project.

Appendix-2

Data Collection Teams

	Village	Name
1.	Kharoudi	Sh. Malkiat Singh
2.	Brahmpur	Sh. Charanjit Singh, Sh. Balbir Singh
3.	Jian	Ms. Harbans Kaur Ms Rajdeep Kaur
4.	Langeri	Sh. O.P.Singh
5.	Digrian	Sh. Krishan Kumar Sh. Kanwaljeet Singh

A finished street in village Brahmpur