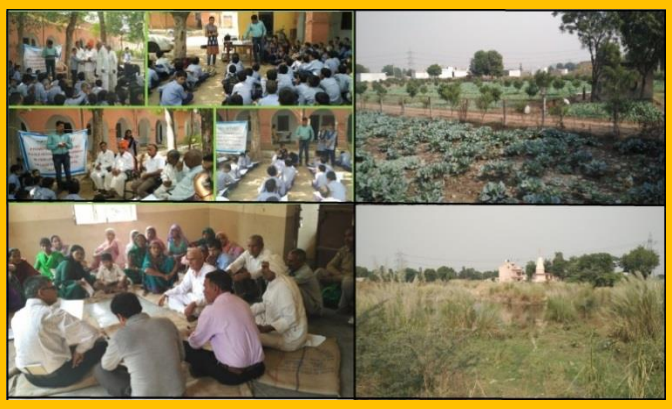
DETAILED PROJECT REPORT

INTEGRATED WATER RESOURCE MANAGEMENT

For

Village Garhi Harsaru, Gurgaon



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Contents

ABBREVIATIONS

BCM	Billion Cubic Meter
BSF	Bio Sand Filter
COI	Census of India
DPR	Detailed Project Report
DW	Drinking Water
Ft	Feet
Gal	Gallon
GPS	Global Positioning System
GP	Gram Panchayat
GWP	Global Water Partnership
GWT	Ground Water Table
HHs	Households
HQ	Head Quarters
IEC	Information Education and Communication
IWP	India Water Partnership
IWRM	Integrated Water Resource Management
L	Litre
Kms	Kilometers
mm	Millimeter
MCM	Million Cubic Meter
MDWS	Ministry of Drinking Water and Sanitation
NCR	National Capital Region
ODF	Open Defecation Free
O&M	Operations & Maintenance
PLA	Participatory Learning Action
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
PHC	Public Health Center
PHED	Public Health and Engineering Department
PRI	Panchayati Raj Institutions
PWS	Piped Water Supply
RRC	Resource Recovery Centre
SBM	Swachh Bharat Mission
SLWM	Solid and Liquid Waste Management
Sq. kms	Square Kilometers
SSF	Slow Sand Filter
Sq. kms	Square Kilometers
TDS	Total Dissolved Solids
VWSC	Village Water and Sanitation Committee
VLI	Village Level Institution

Section 1. INTRODUCTION

1. 1 Background

World's oceans cover about three fourth of the earth surface. Still, the fresh water constitutes only 2.7% of the Earth's total water, out of which 75.2% is locked up in glaciers and ice caps[1]. India is endowed with a rich and vast diversity of water resources. Only 4% of the world's fresh water share is present in India for supporting 16% of the world's population. India receives about 4000 km^3 of precipitation annually distributed over 100-120 days, but there exists stark temporal and spatial variability in this. 50 % of the precipitation happens in just 15 days and over 90 percent of rivers flow in just four months (www.india-reports.com). Despite having a network of irrigation channels, India's agriculture is still dependent on rainfall for irrigation. The other source of fresh water is ground water. It is the major source of drinking water in both urban and rural India and also an important source for irrigation. It accounts for about 80% of domestic water requirement and more that 45% of the total irrigation requirement in the country[2].

In view of the over-dependence on ground water, the water table is falling at an alarming rate, much beyond the capacity of the rainfall to recharge it. Additionally, the water resources are also getting contaminated due to malpractices and consequences of industrialization and urbanization and other anthropogenic factors, like improper waste disposal, chemical run-off from fertilisers and pesticides from farms, to list a few. Although water is an abundant resource, still it is not always available where and when it is needed, restricting its consumption. This has a negative impact on various aspects, like livelihoods, gender parity, education, etc., thereby affecting the social fabric of the society. This also often leads to law and order issues arising out of water wars. The situation is further aggravated with rising population, rising standards of living, changing land use, urbanization, increasing economic activity and climate change.

Improper waste disposal is one of the key reasons, responsible for water pollution. Adding to the problem, unavailability of adequate water results in unsanitary conditions, as it prompts people to go for open defecation. This in turn, results in contamination of our water resources. Consumption of unsafe drinking water, improper disposal of human excreta, improper environmental sanitation and lack of personal and food hygiene are the major causes of human diseases in developing countries such as India. It is an unending vicious cycle. This calls for the need of conserve this precious resource and use it judiciously. There is a need for integrated approach to manage the water resource.

Over the last few years, the concept of open defecation free, popularly known as ODF, has emerged as one of the first building blocks towards achieving Total Sanitation. This has led to dramatic changes in vision, goal, policies, programmes and even mindset of the governments and communities to focus on behaviour change approaches instead of construction driven approaches. Rural sanitation, particularly, is one of India's greatest challenges. Despite many fold increase in the national rural sanitation budget since 2001, more than 60% of the rural population continues to defecate in the open–more than half of the

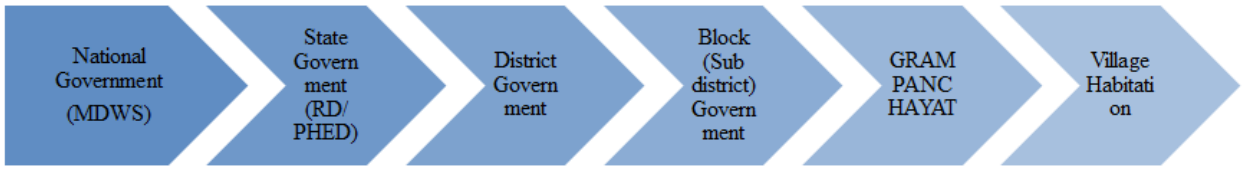
[1] http://wrmin.nic.in/

[2] http://www.iisc.ernet.in/currsci/sep102005/794.pdf.

World's total. The consequences can be computed in economic terms (a recent WSP study estimated the cost of inadequate sanitation in the country at US$ 54 billion) and in terms of human impact where preventable diseases like diarrhoea claim the lives of 1,000 children (under the age of 5) every day. Rural sanitation is managed as a sector programme by the Ministry of Drinking Water Supply and Sanitation. Swachh Bharat Abhiyan (Gramin) (SBA-G) (earlier Nirmal Bharat Abhiyan) was launched in October 2014 with an objective to bring about improvement in the cleanliness, hygiene and the general quality of life in rural areas. Therefore, the focus of SBA-G has been widened to include hitherto neglected aspects of total sanitation such as Solid and Liquid Waste Management (SLWM), that is one of the key components of the programme. Undoubtedly, it is also a critical element for Integrated Water Resource Management, that includes integration of all basic necessities that are fundamental to health, survival, growth and development.

SLWM is understood to be an integral part of rural sanitation and has been given increasing priority in the SBM strategy, with 25% of the State SBM budget allocated for this. In this mission, IEC activities were also focussed on Solid and Liquid Waste Management so as to create a felt need for these activities amongst the population and are taken up in project mode for each Gram Panchayat (GP) with financial assistance capped for a GP on number of household basis to enable all GPs to implement sustainable SLWM projects. The total assistance under SBM(G) for SLWM projects is worked out on the basis of total number of households in each GP, subject to a maximum of Rs.7 lakhs for a GP having up to 150 households, Rs.12 lakhs up to 300 households, Rs.15 lakhs up to 500 households and Rs.20 lakhs for GPs having more than 500 households. Funding for SLWM project under SBM(G) is provided by the Central and State Government in the ratio of 75:25. Any additional cost requirement is to be met with funds from the State/GP, and from other sources like Finance Commission funding, CSR, Swachh Bharat Khosh and through the PPP model[3].

Institutional Structure for SLWM Management in India[4]



However, progress in this area has been hampered in many States due to the lack of clear guidelines on taking it forward, and funding allocations, which are in some cases considered insufficient. A recent guideline on solid and liquid waste management produced by the Asian Development Bank for the Ministry of Drinking Water and Sanitation (MDWS) outlines the general steps recommended to be taken at State and local level, and this pilot is in line with that document. This 'action learning' pilot is thus proposed to respond to the felt need by the GOI for workable models of SLWM in rural areas as well as addressing the premise that continued support to communities after ODF (ODF +) will strengthen the sustainability of the ODF status.

[3] http://www.and.nic.in/archives/rdpri/downloads/guidelines_Swachh_Bharat_Mission_Gramin.pdf
[4] http://www.mdws.gov.in/sites/default/files/Handbook%20on%20SLWM%20WSP%20final%20May%202012.pdf

In this regard, we propose to demonstrate Integrated Water Resources Management system in peri-urban setting within participatory and partnership approaches.

1. 2 Project Rationale

Delhi NCR is a water scarce region, largely dependent on groundwater and surface water resources (located outside the region). It is estimated that on an average, NCR receives about 22542 MCM/year rainfall; about 75% of which is received during the monsoon season. The peri-urban areas in Delhi NCR face even bigger challenges as the situation there is grimmer, in terms of infrastructure and physical development. Water stress is one of the major problems faced in these areas. Rising population, increasing per capita water demands for domestic uses, environmental sanitation, increasing municipal & industrial uses of water, environmental management services, compounded by dwindling local sources of water and increasing inability of peri-urban water utilities, etc. all compound the problem.

BOX 1: Water Resource Situation

Water Resource Situation across the country:

- 17.4% households are slums
- 43.3% of households don't have drinking water source within the household premises

Water Situation across NCR of Delhi:

- 14.6% of urban households are slums (U)[5]
- Out of 27 Groundwater assessed units, 74% (20 in no.) are over exploited and 19 percent are semi-critical[6]

Integrated Water Resources Management (IWRM) is a solution to the water problems with improved water governance and management. IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM approach considers participatory and inclusive principles with knowledge frameworks which helps the development of the action research plan. A pilot initiative was launched in this regard implemented by TARU and supported by IWP/GWP with a 'hypothesis Integrated Water Resource Management is one of the best approaches to ensure safe and sustainable water in the village'. One of the methodologies used were action research which is used to solve an immediate problem to improve the way they address issues and solve problems. This project is the continuation of Action Research study (refer Box).

In the first phase, Village Garhi Harsaru was identified as one of the water stressed peri-urban area in Delhi NCR and chosen for the action research study. The village faced a lot of water stress issues which can be attributed to raising population, increasing per capita water demands for domestic uses, lack of awareness among residents, weak institutions, and so on. Besides the water related issues, the environmental sanitation issues, especially solid and liquid waste management, were some other aspects which required attention. Currently there is no system of reusing the wastewater in the village. Options of reusing the water after treatment, for gardening or agricultural purposes has neither been explored nor been encouraged in the village. Currently there is no system of water treatment in the village. Though the actual water wastage has not been quantified, it is estimated that around 30% unaccounted water in water

[5] COI, 2011
[6] http://wrmin.nic.in/

supply systems. Considering this, system of reuse and recycle should be explored, encouraged and implemented in the village. The peri-urban characteristic property of the village compounded by dwindling local sources of water and absence of peri-urban water utilities compound its water problem.

In the next phase, the project aims to is to provide a comprehensive framework for sustainable development and management of the water resources, as well as to highlight the main areas that the investment will be directed, in which an effective legal and institutional framework for its implementation will be put in place.

BOX 2: Action Research Study & its findings

Action research framework was developed by carrying out primary and secondary research which included consultations with different stakeholder; group discussions & triangulations; primary surveys with the household, school and Anganwadi surveys. These discussions and surveys clearly indicated the requirement to focus on water related issues in terms of coverage, safety and conservation. The village was heavily dependent on groundwater resources in the absence of any alternate source of water supply and water reuse. Safe and reliable water supplies are essential to public health, social and economic growth.

The action research exercise was built on the hypothesis that integrated water resource management is one of the best approaches to ensure safe and sustainable water in the village. The study recommends the following to address the water issues for the village within this framework:

- Augmenting Groundwater by Constructing Rooftop Rainwater harvesting structures, Recharging of Groundwater, Reuse of Water
- Improving Water Quality through filtration and disinfection at HH level.
- Improving Service Delivery by extending the coverage and increasing the efficiency to two times a day and aiming for 24x7 in the future. Meters should be installed at the consumer end for effective monitoring of amount of water used which shall help plug water wastage.
- Awareness campaigns should be conducted regularly to highlight the importance of water conservation and reducing water wastage.
- Integrated plan for solid and liquid waste management to be developed: Zero-waste SWM Model and Zero-runoff Model should be used to address the solid and liquid waste problems in the village as part of the integrated solution.
- In order to ensure that the recommendations are implemented, a well-defined institutional structure is required with clear roles and responsibilities to lead the processes in a sustainable. Formulating a Water and Sanitation Committee to address the water and sanitation related issues, etc.
- For sustainable development, building partnerships with different stakeholders is essential. One of the key stakeholders to be involved is the community. Awareness campaigns should be conducted regularly to highlight the importance of water conservation, reducing wastage. These can be done at the community level, school level, HH level using different mediums such as shows, street plays, competitions, consultations etc. Importance of segregation of the solid waste at source needs to be highlighted at the community and HH level through awareness campaigns, street plays etc.

Competition for water use continues to increase and drinking water supply can no longer be separated from agricultural and industrial use. Integrated water resource management needs to address the water issues in entirety. Hence, there is a need for integrated water resource management for the identified village.
In the next phase, the project aims to is to provide a comprehensive framework for sustainable development and management of the water resources, as well as to highlight the main areas that the investment will be directed, in which an effective legal and institutional framework for its implementation will be put in place.

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1. 3 Aims & Objectives

The ***aim*** of the study is to develop an Integrated Water Resources Management proposal (in form of a Detailed Project Report) to be implemented in village Garhi Harsaru in Gurgaon.

The ***overall objectives*** of the study are, firstly, to pilot effective management of water resources and integration with SLWM activities in a Gram Panchayat Garhi Harsaru in Haryana state, testing the hypothesis that ODF+ activities increase the sustainability of ODF status; secondly, developing an integrated model which could be scaled up by the government under the funding framework of the SBM.

Working closely with local government partners and community members on the ground, ***some specific objectives*** of this pilot project are:

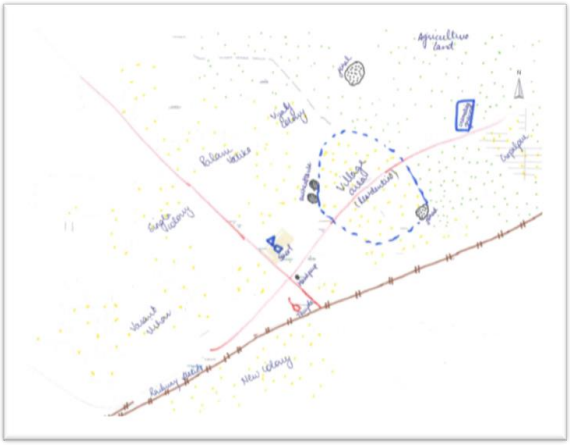
- To develop an integrated model of drinking water supply and solid & liquid waste management facilities in selected Gram Panchayat that is affordable, scalable and can be effectively managed at the GP level.
- To transform Village Garhi Harsaru in to a Zero Run-off Village
- To provide improved, sustainable drinking water services in the entire area

1. 4 Methodology

To develop the integrated DPR, following methodology was adopted:

Phase 1- Action research

- Transect Walk was carried out to gain insights of the ground situation in the village. The walks covered location and distribution of resources, features, landscape and main land uses along a given transect. It also involved participatory observation for



Resource mapping with Community & transects Walks

establishing a rapport within a community and learning to act in such a way as to blend into the community so that its members will act naturally.

	Activities	Stakeholders	Tasks
Phase 1 Action Research	**Transact Walk**	GP officials, villagers (volunteers/ motivators)	▶ A quick walk around the village to understand existing systems and Identify problem areas
	Consultations with Key Stakeholders	GP officials, select motivators	▶ Project Introduction ▶ Discussion on future plans & stakeholders support ▶ Preparation of village/resource map in discussion with villagers
	Baseline Survey	Villagers (Sample: 607 households; 8 school and 7 Anganwadis)	▶ Local villagers identified as volunteers for conducting surveys ▶ A structured questionnaire was formed ▶ Survey was conducted
	Participatory Rural Appraisal & Village Mapping	GP officials and Villagers	▶ Discussion on existing condition and aspirations
Phase 2 Developing DPR	**Consultations with Key Stakeholders**	GP officials, select motivators	▶ Introduction to Phase 2 ▶ Discussed existing systems ▶ Discussed past and current plans/ programmes, financial condition etc.
	Consultations with Key Experts	IGS/SMS	▶ Discussed Need based on Action research ▶ Proposed Models
	Developing DPR		▶ Exploring Better technologies ▶ Integrating Water & SLWM systems

- Consultations with Key Stakeholders: Consultation meetings in the village were organized with the panchayat members and School Principal and Teachers to understand the water related issues. A drawing competition cum awareness program was organized in the

Senior Secondary Government School with students from class 6th to 8th. Approximately 160 students participated in the competition.

- Baseline Survey: In addition to the surveys, information on community water sources, availability and services was gathered through Key Stakeholder Interviews at various levels.
    - GP level: One interview with Panchayat Pradhan and other PRI members
    - Key interviews with govt. officials
    - Group Discussions and Triangulations: In order to triangulate the findings of the sample survey, interviews, and focus group discussions were conducted at village level.
    - Focused Group Discussions with Community members
    - Focused Group Discussions with Farmers
    - Household, school and anganwadi surveys: Pre-coded questionnaires capturing the proxy indicators for measuring water availability, demand and supply components were administered.

- Participatory Rural Appraisal & Village Mapping: After the baseline survey, consultantions were organized with different stakeholders that included community, panchayat members, school teachers etc. It was done to propose an integrated solution mapping based on the problems identified. The solutions for an integrated approach were a combination of conventional knowledge as well as modernized technical expertise.

Phase 2: Developing DPR

It shall involve:

- Consultations with Key Stakeholders: All the key stakeholders were consulted again before developing the DPR, discussing the priorities in the village.

- Consultations with Key Experts: Many consultations were held with key experts from IGS & SM Seghal Foundation to develop the DPR.

- Developing DPR

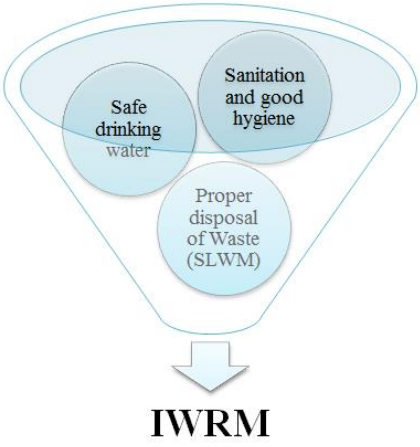
For developing the DPR, first and foremost, detailed surveys shall be carried out for the entire village. The village shall be mapped for its existing infrastructure, on basis of which the proposed components shall be placed. These shall include:

To achieve the objective of the study, detailed mapping of the area will be carried out. Mapping will include the following:

- Contour mapping
- Drainage mapping
- Storm water drainage
- Domestic waste water drainage
- Resource mapping: water sources, structures, potential locations, common lands
- Catchment areas segmentation
- Public water supply mapping
- Mapping of DW Supply Line
- Analysing the unserved population and demands; and potential source locations and managing un-served areas
- Mapping Distribution Line flaws (low pressure, leakages, defective control systems etc.
- Rainwater potential analysis
- Water demand analysis
- Analysis of Amount & Nature of Waste Generation

Section 2. CONCEPT OF IWRM

As has been highlighted in the previous section, an IWRM approach has the following facets:



1. Safe Drinking Water
2. Proper disposal of waste (both solid and liquid)
3. Sanitation and good hygiene practices

1. Safe drinking water:

Safe drinking water is key to good health. In addition to this, having a sustained source of water supply is also critical. IWRM explores means through which use of existing water resources (including waste water) can be optimized, to address the needs of the community for which it is designed (both in short-term and long term).

There are mainly five Strategic Objectives (Enable Participatory Planning and Source Sustainability; Water Quality Management; Sustainable Service Delivery (O&M), Strengthening Decentralised Governance, and Building Professional Capacity) to achieve its overall objective of providing improved, sustainable drinking water services in the entire area.

1. Enable Participatory Planning and Implementation of Schemes and Source Sustainability
   i. Participatory Integrated Water Resource Management at village, district and State levels including conjunctive use of rainwater, groundwater and surface water and provision of bulk water supply, as needed
   ii. Water security planning and implementation by ensuring cost-effective, optimal scheme design to reduce O&M requirements
   iii. Water source sustainability measures including sustainability plans implemented at block, watershed and village level including water harvesting and groundwater recharge measures

2. Water quality Management
   i. Source protection with Water Safety Plan implemented at village level to prevent contamination before it happens
   ii. Monitoring, surveillance and testing through Water Quality Testing including field test kits and district and sub-divisional water quality testing laboratories
   iii. Treatment of water from contaminated sources with cost-effective, appropriate technologies, safe distribution and household hygiene
   iv. Legal, institutional and regulatory measures to make water quality standards mandatory and enforceable in a phased manner

3. Sustainable Service Delivery (Operation and maintenance)
   i. Operation and Maintenance (O&M) measures implemented at village level to ensure skills and finance for O&M, replacement, expansion and modernisation.
   ii. Incentivize States to take measures for decentralising functions, funds, functionaries using a

Management Devolution Index

iii. Focus on metering, bulk and individual, to reduce unaccounted-forwater
iv. Service agreements for hand pump mechanics and piped water supply operators

4. Strengthen Decentralised Governance
   i. Institutional roles and responsibilities to support water security planning and implementation (source sustainability, water quality and O&M)
   ii. Convergence of different development programmes
   iii. Results-based financing of drinking water security plans
   iv. Oversight and regulation, including value for money and monitoring of progress and performance

5. Build Professional Capacity
   i. Training to capacitate new roles and responsibilities
   ii. Technical support
   iii. Outsourcing, including hand pump mechanics and piped water supply operators

2. Proper disposal of waste (both solid and liquid):

Proper disposal of waste is necessary to prevent contamination of water resources. This includes the solid wastes and the liquid wastes. The liquid wastes comprise of waste water from toilets, kitchens & baths, and the rain water. To address this, the concept of solid and liquid waste management is followed. These follow the principle of safe disposal of waste, once it is generated (zero waste management). There is no mechanism to reduce waste generation or further, to re-use waste as a resource for some other process.

In response to this, we evolved the concept of Solid and Liquid Resource Management instead. (discussed in the proposal part). This process considers waste as a resource and tries to extract and re-use waste to the extent possible, thereby reducing the amount of waste that goes to the landfill. Similarly, the liquid waste generated shall be treated locally using low-cost techniques, and the consequent partially treated water shall be used to recharge ground water or for irrigation purposes.

Ideally, domestic waste should be collected within 12 hours' intervals every day. If kept beyond 24 hours, it generates unpleasant odours and attracts flies. Beyond 24 hours, foul smell generates and further beyond 48 hours ends up in bad odour and begins to stink and after 72 hours along with the bad odour formation of maggots take place which is the prime reason for nuisance of domestic flies in and outside homes. Thus to achieve 100% ZWM, collecting garbage every 12 hours is strongly suggested to all concerned. The primary system as key point to zero waste is immediate collection of any domestic waste and segregation at source.

3. Sanitation and good hygiene practices

This subject covers habits and behavioural context of human aspect in day-to-day life. This includes, hand washing, not wasting water, not littering around, making judicious use of resources available, and many other habits. For this, information, communication and training of the stakeholders (including the community and the governance mechanisms) regarding good practices is critical for the conservation and sustainability of the resources.

Managing water resources

Moving to a higher level of sanctity of sources, rather than mere protection, should be a guiding principle, both to keep the sources sustainable in quantity as well as save the water from being contaminated beyond usability. This would involve participatory integrated water resource management, conjunctive use of water and source sustainability measures. It may also involve suitable legislative or regulatory measures including defining water source protection zones or water sanctuaries.

At the village level, water security planning should start with knowledge of water resources management in the village, aquifer or watershed. A water budgeting exercise should consist of understanding water resources available, and methods of appropriate utilisation of available water resources, for meeting water requirements of different sectors like drinking water, livestock, agriculture, industry and commerce. Monitoring of ground water levels and rainfall with rain gauges will lead to knowledge of availability of water resources. Understanding of water conservation and recharge should lead to planning of water harvesting and groundwater recharge structures, which maximise recharge and minimise evaporation losses. Demand management of water by the irrigation sector would focus on use of less water intensive crops, efficient irrigation methods like drip and sprinkler, reuse and recycling of water, and regulation of groundwater over-abstraction. The water budgeting exercise should culminate in arriving at a shared Village Water Vision on managing this resource and equitable allocation for landless villagers and land holding agriculturists, while protecting the domestic requirements. This collective approach requires considerable work, by trained persons with the villagers. The Village Water Vision should deal with the impacts of declining ground water tables, increasing competing demands and vagaries caused by climate change.

Another major work is to move from a project mode which focuses on creating infrastructure, to a programme mode which focuses on providing, improving and sustaining high standards of drinking water supply services. Decentralisation puts planning, implementation, operation and maintenance in the hands of beneficiaries. This creates ownership and commitment to action.

In terms of water resources regulation, critical work is the sector concern inter-sectoral distribution, bulk water tariffs and water resource management. Availability of water at every house (In suburbs) in a network chain is again very important. A network distribution network chain should be designed in a way that it reaches to every house hold without any or much of pressure drop. This can be achieved by proper mapping of complete village which would include GPS, slope & terrain identification, pressure drop points, road crossings & other aspects. There should be a provision to boost the pipeline water from low pressure point, so that it further travel to those points which are some distant & on high elevation.

Section 3. ASSESSMENT OF EXISTING SCENARIO

This section highlights describes the site identified for the study and assesses the existing scenario in the village, terms of water supply, solid waste management, liquid waste management and rain water management.

3.1 About Village Garhi Harsu

Garhi Harsaru village is in Gurgaon Tehsil in Gurgaon district of Haryana state in India. The village is mainly dominated by Yadav and Rajputs community. According to the Census of India 2011, the village comprises of 598 households with 3140 population. But according to the National Rural Drinking Water Programme, total number of households was reported to be 1253 with 5334 populationas on 1st April 2014. The area has also been reported to have large amount of unauthorized settlements by the PRI members of the village.

Key Indicators of Garhi Harsaru Gram panchayat

Total population: 8000 approx. (Baseline Survey) **Villages: 1 (Garhi Harsaru)** **Distance from Gurgaon Block HQ: 12 kms**	Distance from State Capital (Chandigarh): 318 Kms Distance from Delhi: 50 Kms

Following is the demographic status of the village.

		Population							
		HHs	**Total Population**	**Male Population**	**Female Population**	**SC**	**Literate Population**	**Total working population**	**Involved in Agriculture and cultivation**
Harsaru Village	Rural	598	3140	1724	1416	604	2295	976	90

Source: Census of India 2011

Following is an assessment of existing water supply and waste management scenario in village.

3.2 Existing Water Supply System

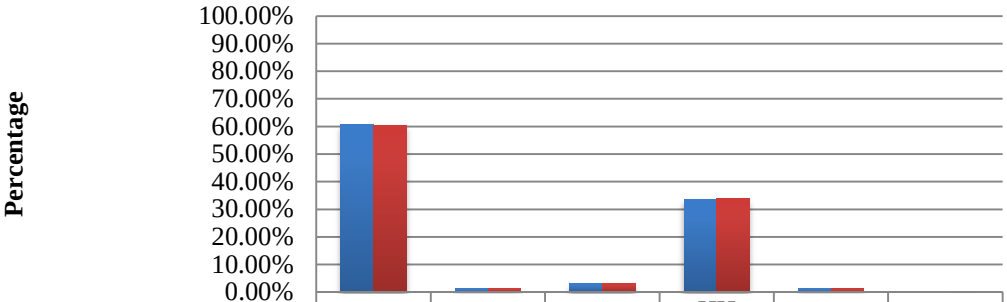
Field visits and primary research indicated that the village is heavily dependent on groundwater, though there exist surface water sources also**.** It is the single major source for meeting all the water demands of the village, both domestic as well as agricultural. Majority of the population is using it for drinking purposes. Although, there are three ponds in the village, two of these are on the verge of extinction as a consequence of encroachment on inflow channel and the pond by the inhabitants. Even the third pond is in a pathetic condition, as waste water from the village flows into it, contaminating the water; thereby, defeating the purpose of a village pond.

According to the Ministry of Water Resources, there are total 18 tubewells; 10 owned by group of farmers while 8 by individual farmers. The main source of drinking water in the village is tapwater from treated source. According to the National Rural Drinking Water Programme as on 1st April 2014, there are 13

existing source/delivery point/stand point and 10 safe sources/delivery point/stand point which covers 5002 population.

The below displayed graph, portrays the water supply scenario in the village.

Main Source of Drinking Water for HHs (N = 607)



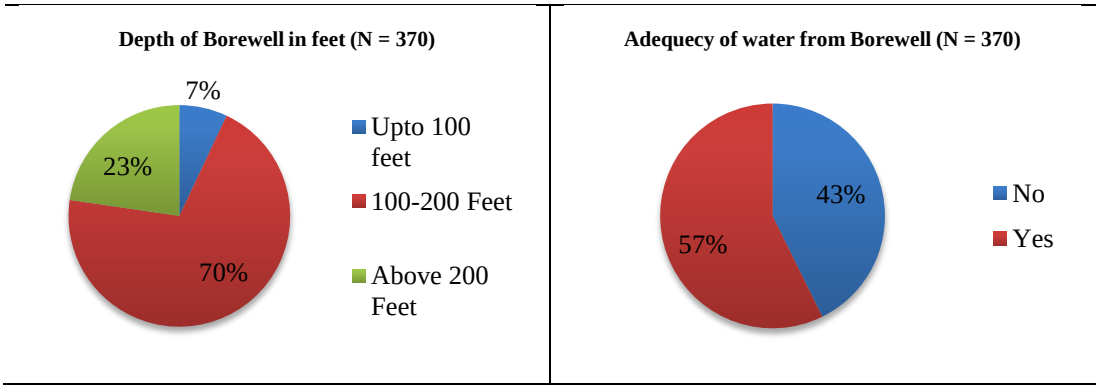
	Borewell	Handpump	Other Sources	HH Piped Water Supply	Tubewell	Tanker
Drinking Water	60.79%	1.32%	3.13%	33.44%	1.32%	0.00%
Other Domestic Purposes	60.46%	1.32%	3.13%	33.77%	1.15%	0.16%

On the basis of above figure, type of water supply can be categorized into:

1. ***Borewells:*** Individual borewells form the backbone of water supply in the village. In the survey, it came to fore that almost sixty-one percent (61%) HH are dependent on the borewells for their water needs. Of these, twenty-three percent (23%) HH have borewell with depth above 200 feet; seventy percent (70%) households have borewell with depth measuring between 100 feet and 200 feet; while only seven percent (7%) households have a borewell with depth less than 100 feet.

   Almost half (43 %) of the HHs (refer figure below) informed that despite individual borewells, the water from borewell is not adequate for them.

Depth of Borewell and Adequacy of water from Borewell (N = 370)



2. ***Public Water Supply (PWS):*** PWS is available only in limited areas of the village i.e. only about thirty-three percent (33%) HH (around 206 HH) have access to it. Moreover, supply of water to PWS system also happens through borewells, which are at a depth of 250 feet. Supply of water happens only for a few hours in a day. Due to the non-availability of the continuous water supply, storage structures have been constructed at the household level which not only increases the individual's expenditure but also incurs huge loss of water. Although the community perception towards the quality of water is good, but the water quality analysis depicts the presence of faecal contamination.

3. ***Hand pumps:*** Less than two percent (1.32 %) residents are dependent on hand pumps for water supply.

4. ***Tube wells:*** A little above one percent (1.32 %) residents are dependent on tube well for water supply.

5. ***Tankers:*** A negligible portion of residents, sources it water through water tankers.

3.3 Existing Solid Waste Management

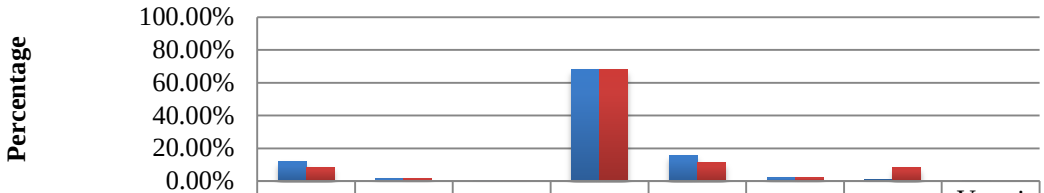
At present, there is no waste collection and disposal mechanism. The Garhi Harsaru Gram Panchayat does not have any infrastructure to collect and transport the waste and there is no specified location for the waste disposal. The figure below shows the current waste generation and the present methods used for disposal of the waste.

Waste Generation	Collection and Transportation	Disposal
Total estimated Solid Waste Generated: • 1.5 – 2 tonnes per day (based on estimate of 250g/person/day) **Types of Solid Waste:** • Biodegradable: Animal waste, vegetable waste • Non-Biodegradable: Plastic bags, papers, glass **Solid Waste Sources:** • HH, Weekly markets, • Schools/Anganwadis, Shops, etc.	✓Currently there is no scientific system to daily collect and/or transport the solid waste generated ✓Once in 2 to 3 months, waste is collected from the roads/drains and transported to an open area outside the village. ✓This process is contracted out by the GP	**Current Disposal methods** • **Vegetables & Food Waste:** Given to livestock, reused in field • **Plastics:** Thrown outside in the open area, fields, drains or burnt

In the Action Research Study, it came to fore that majority of the respondents dump their biodegradable waste (68.04%) and non-biodegradable (67.71%) waste in dustbins, which is ultimately thrown in the open fields. A very less proportion of households (1.48%) dispose bio-degradable waste in a safe manner. Safe disposal of bio-degradable waste includes disposing solid waste in an identified place; composting, burying, re-using in the garden and having the GP collect the waste and feeding it to the cattle.

Solid Waste Management Facility within the HHs (N = 607)

Percentage wise type of waste management facility in the HHs (N = 607)



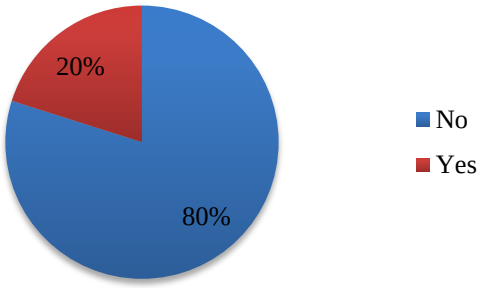
	Burn	Compost	Don't Know	Dustbin	Dumping Area	No facility	Others	Vermi-compost
Biodegradable	11.86%	1.48%	0.16%	68.04%	15.65%	1.98%	0.66%	0.16%
Non-Biodegradable	8.57%	1.81%	0.16%	67.71%	11.20%	2.31%	8.24%	0.00%

The awareness level of waste segregation at home is very less in the village. Only 20 percent mentioned that they segregate waste at home.

As far as the volume of waste generated is concerned, there is no specific measured data that is available. The national waste generation average (250 gram/capita/day) can be taken as a basis for designing a management solution for solid waste disposed from the area. Thus, it is estimated that the village generates around 1.5-2 tonnes of waste every day.

HHs segregating waste at home (N = 607)

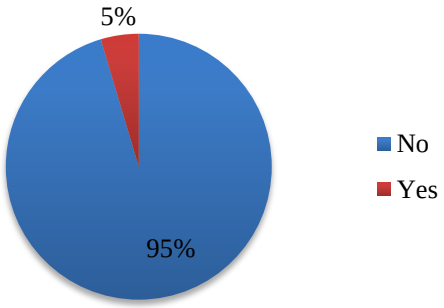
HHs segregating waste at home (N = 607)



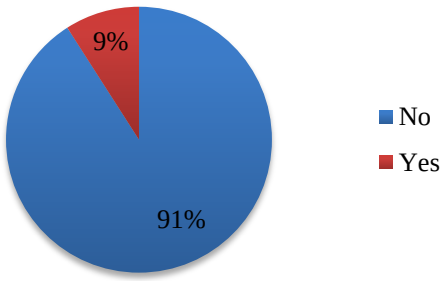
Only 5 percent of the respondents mentioned that they are willing to participate in waste management program and amongst that only 9 percent out of them are willing to pay for waste management program. On an average, people are willing to pay Rs. 100 ranging from Rs. 50 to Rs. 300.

Waste Management program (N = 607)

HHs willing to participate in waste management program (N = 607)

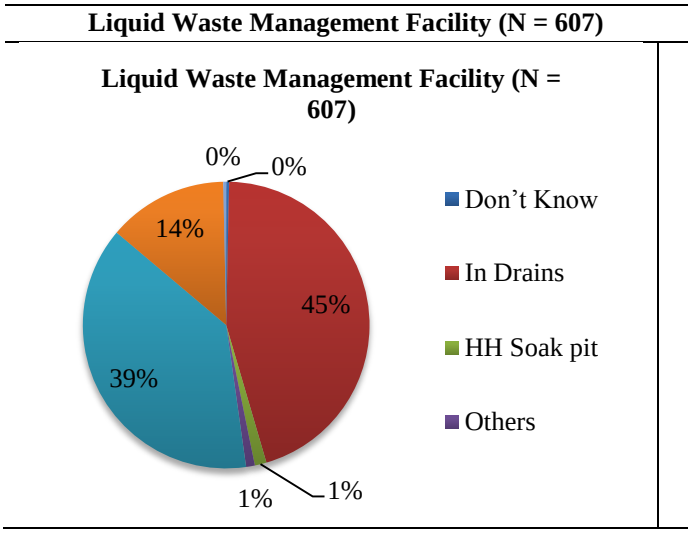


HHs willing to pay for waste management program (N = 607)



3.4 Existing Liquid Waste Management

This includes waste water from kitchen/bathing area/toilets. The research gathered information on the type of disposal systems that the sample households had access to for managing liquid waste. As far as liquid waste (waste water from either the kitchen or bathing area) is concerned, 45 percent of the households reported safe disposal of liquid waste[7] while 14 percent mentioned that the liquid waste goes on the streets causing serious health issues as well as bad odour and environment. Water stagnation on streets creates breeding ground for flies and mosquitoes leading to water and vector borne diseases.



Individual households have septic tanks and/or soak pits for disposal of toilet waste. The septic tanks are emptied on regular basis using suction devices.

3.5 Existing Rain Water Harvesting Mechanism

Currently, there is no formal mechanism for rain water harvesting. Following the natural drainage patterns, the rain water escapes to the fields, the village pond and partly gets percolated. Some rain water stagnates in the puddles, created in depressions in land. At the time of the survey, there existed no appropriate network of rain water drainage channels.

3.6 Conclusions

Based on the site assessment and stakeholder discussions, following conclusions were derived:

- Groundwater table is lowering. Lowering water table implies water has to be pumped farther to reach the surface, using more energy, and hence, cost prohibitive in the long run, making it an unsustainable or unviable option.

- Lowering of groundwater table has affected the quality of water. Excessive pumping causes saltwater to move inland and upward and has resulted in saltwater contamination of the water supply. As a result, tube well, hand pumps and borewells have started yielding saline water. Even the Piped Water Supply system witnesses saline water supply.

[7] Safe disposal of liquid waste includes disposal in to a soak pit, drain or kitchen garden

- The water supply through the public water system is intermittent and when provided, the supply is for just an hour, in the morning and in some cases in the morning and evening. Inadequate and inefficient systems Piped Water Supply (PWS) has forced people to depend on individual borewells.

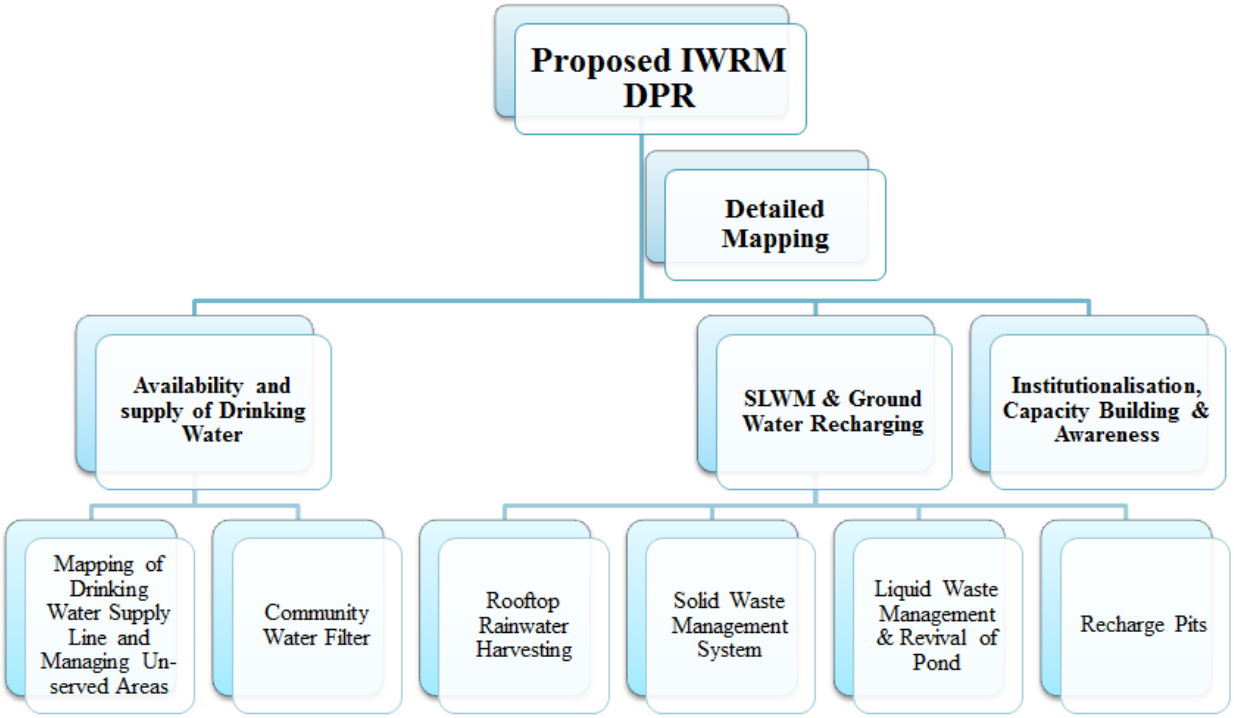
- There is no focus on surface or rainwater management, currently. With climatic change looming large, there is severe threat to ground water resources if the increasing population continues to extract groundwater in unregulated manner. Although, people do accept this overly dependence on groundwater resources and the resulting falling ground water table, but they are yet to embrace any harvesting measures.

- The village lacks proper Solid & Liquid Waste Management, which is contaminating village water resources.

Looking at the current situation in the village, Integrated Water Resources DPR has been prepared incorporating the solutions that were also mapped in consultations with the community, to be implemented in the second phase.

Section 4. PROPOSAL FOR INTEGRATED WATER RESOURCES MANAGEMENT

This section lists down the solutions that have been proposed based on the inputs given by the Gram Panchayat and the baseline survey findings and existing situation assessment.



4.1 Proposed Drinking Water Supply System

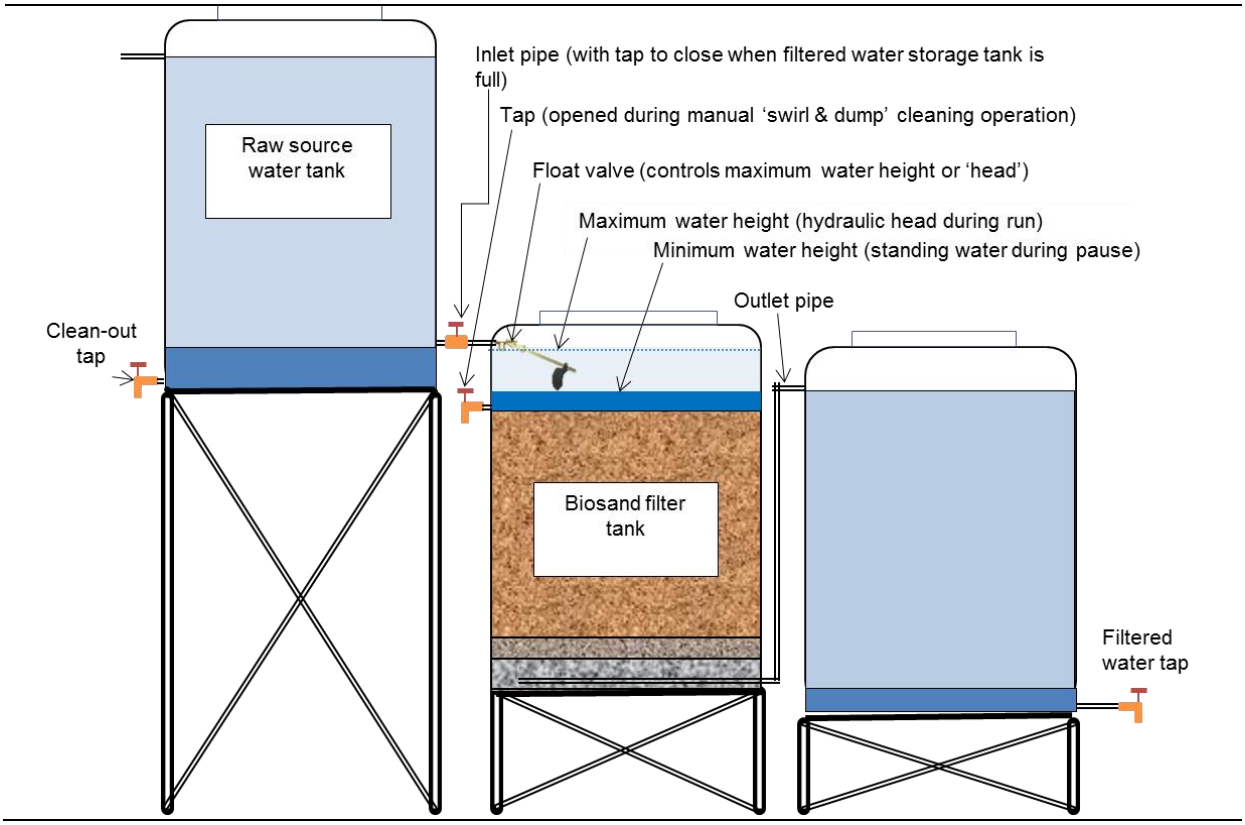
To address the issue of sustained drinking water supply to the village households, the concept of **COMMUNITY WATER FILTER** has been proposed.

Concept:

This concept is an affordable large-size bio-sand filter sized for schools or small communities. The water tank bio-sand filter uses a float valve to maintain a constant hydraulic head of water above the sand. This arrangement provides a means to feed the water from the raw source water inlet pipe into the bio-sand filter tank at a rate that matches the filtration rate in the filter. This scheme allows much more water to be filtered through a single bio-sand filter by operating over a longer period of time; such as overnight or over the school weekend. The filtration rate is controlled by the hydraulic head (height of water above the standing water), which in turn is controlled by the float valve at the inlet to the filter tank. This allows the maximum filtration rate to be maintained at a lower rate compared to conventional bio-sand filters which improves the filtered water quality.

The function of the tank float valve is to allow raw source water to run into the bio-sand filter tank and be capable of shutting off the incoming water when the selected water level is reached. Basically, the mechanism works just like the float valve in the toilet tank. The water flows in by gravity. Once the water reaches the height of the inlet, the float valve will maintain the water level at a constant height.

Typical Design of Community Water Tank Bio-sand Filter



Merits and Limitations:

Using a plastic water tank (instead of the traditional cylinder) as the filter body increases the surface area of the filtration sand and could produce over 2000 litres (500 gal) of filtered water per day which is more than the household sized bio-sand filters. This quantity of water could be produced at a filtration rate (hydraulic loading rate) of 0.2 m^3/m^2/hour, which is one-half of the target maximum filtration rates of the household filters.

The improved water quality and quantity are possible because the water tank bio-sand filter design is a hybrid of the slow sand filter (constant filtration at constant hydraulic head) and the bio-sand filter (intermittent filtration at variable hydraulic head) technologies. The float valve in the water tank BSF maintains the constant head that is a feature of the slow sand filter technology. The pause period height of water is a feature of the bio-sand filter technology - slow sand filters do not allow for any significant stopping of flow. The location of the outlet pipe is determined so that when there is no water to flow through the filter, the level of water remaining in the filter tank will be 5 cm (2 inches) above the sand – same as the bio-sand filter. This standing water height of 5 cm allows oxygen to reach the bio-layer at the

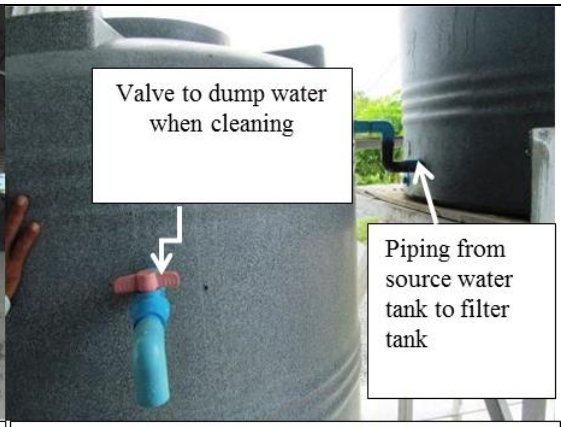
top of the filtration sand bed which keeps the bio-layer healthy and growing during the pause period and prevents the filter system from becoming anaerobic.

By locating the float valve approximately 15 cm (6 inches) above the sand and with adjustment to the float arm, the filtration rate target of the water tank filter could be held constant at 0.2 m3/m2/hour (about 1.5 litre per minute for a 0.75 m diameter tank) until the available source water is filtered or the filtered water storage tanks become full. This rate is within the range that is normally maintained in slow sand filters (SSF). This lower rate is expected to improve the effectiveness of the water tank bio-sand filter versus conventional bio-sand filters which filter water intermittently with filtration rates varying from 0.4 m^3/m^2/hour down to zero during each run.

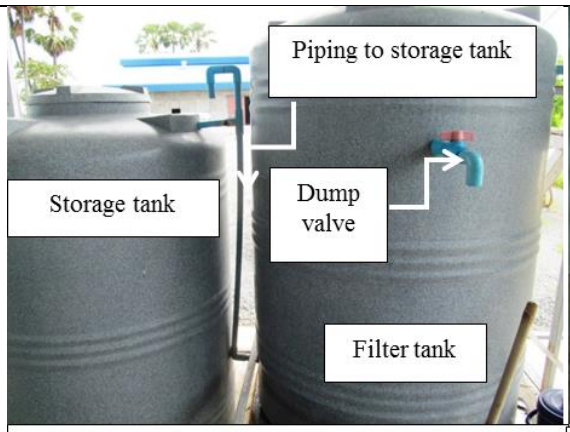
In the following pictures, note that the dump valve is positioned at the top of the sand inside the filter tank. The design of the community bio-sand filter can be customized/developed based on the daily drinking water demand.

Community Water Tank Biosand Filter

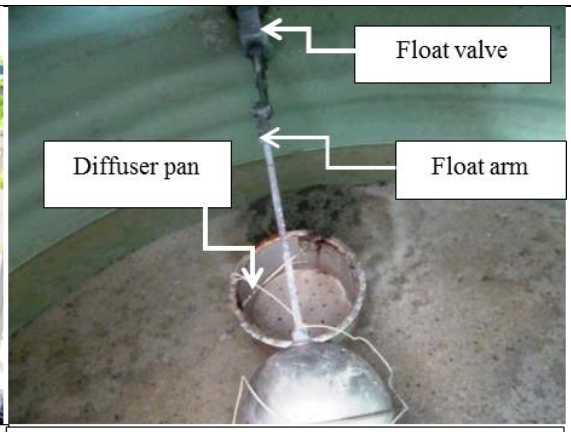
Water tank biosand filter system



Piping – 'dump valve' and inlet pipe



Piping from filter tank to storage tank



Float valve and diffuser pan inside filter tank

Plastic water tanks are available in most of the cities. They are light to transport, when empty, and generally last for 7 – 10 years. They are inexpensive relative to other container materials and simple to fit

with pipes and valves (using compression fittings around the holes through the tank walls to prevent leakage). The size is determined by the diameter of the tank and the access at the top that will allow manual 'swirl & dump' cleaning (reaching the entire sand surface to stir up the particles clogging the sand). Generally, 750 L (200 gal) water tanks with a diameter of 0.75 m and a height of 1.0 metres or greater are considered ideal for this concept. Smaller cylindrical shapes, such as the 55 gal (200 L) blue plastic drum, may also work if a suitably sized float valve can be found.

Float valves are also commonly available especially where water tanks are used. Apparently the brass ones last much longer and work better. The remainder of the plumbing could use ½" (13 mm) PVC piping. The compression fittings are rubber type gaskets compressed with washers on a threaded pipe nipple.

The heights of the tanks are important for the proper function of the water tank BSF system. The dimensions of the water tanks must be known before the recommended heights of tanks, underdrain, separating layer and filtration sand layers can be developed.

4.2 Proposed Rainwater Harvesting

Rainwater harvesting includes rooftop rain water harvesting and surface runoff rain water harvesting. In this sub-section, the focus shall be on using rooftops of public buildings for rain water harvesting. The runoff from rooftops of houses and surface runoff from ground shall be dealt as part of the liquid waste management. Details of these have been indicated below:

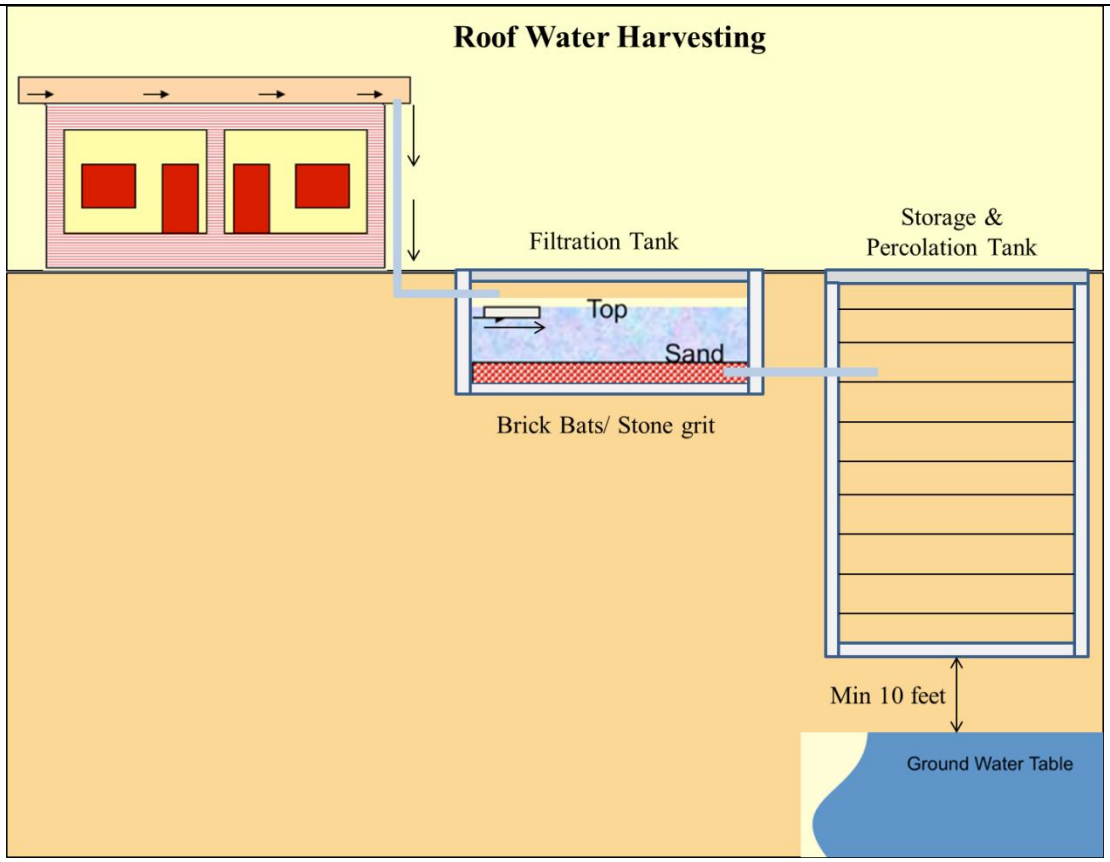
A). Rooftop rain water harvesting (for public buildings)

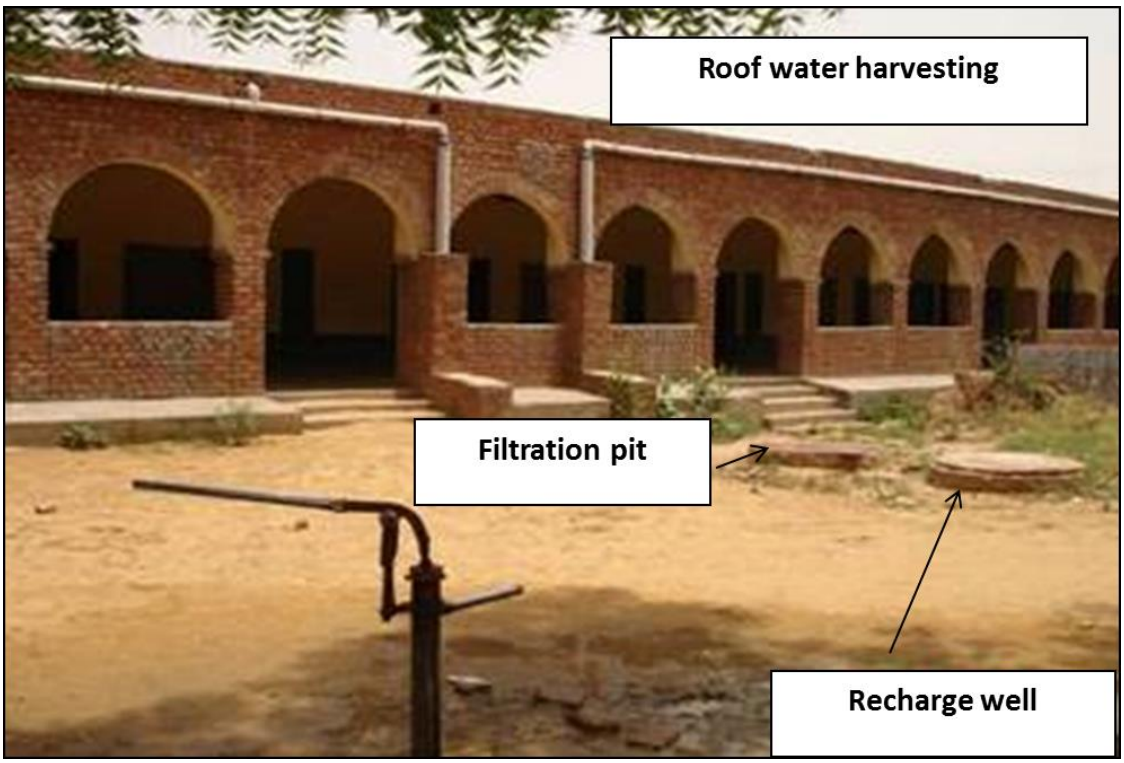
Roof Water Harvesting is the process of collecting and storing rainwater from the roof area for future productive use and for recharging the aquifer. The proposal is to use rooftops of public buildings in the village to harvest the rain water for its internal use and also ground water recharge. The water from rooftops of private houses shall be allowed to flow to the road/ground and shall form part of the surface rain water harvesting mechanism.

The village has institutions (both, government and private) that include 7 Anganwadis and 8 schools. 8 schools include 5 primary schools, a secondary school and 2 senior secondary schools. 3 schools have individual borewells while 5 are connected to the government PWS. Many schools presently do not have a reliable source of water for drinking and other use.
The school rooftop rainwater harvesting system seeks to provide a source of water for all purposes such as toilet flushing, cooking, washing hands and feet before eating and after toilet use, hygiene. If the rainwater is treated well it can be considered for use for drinking purpose as well. The harvested rain water can also be considered for the aquifer recharging.

The quantity of rain water to be harvested depends on the rooftop area and the rainfall at that place. For example, in a place where it rains 500 mm and the roof area is 100 square meters, the rainwater falling on the roof is 50,000 liters. Some amount of it will be absorbed by the roof and some amount will be lost in the collection and conveyance process. If we assume 80% can be collected, then 40,000 liters of rainwater is available for collection and recharge.

Typical Design of Roof Water Harvesting





The components of the rooftop rain water harvesting mechanism are:

- ROOF – The existing roof is made use of to collect rainwater. Since rainwater is pure as it falls from the sky it is necessary that the roof be kept clean for it to remain pure when it is collected. This means the roof will need to be swept and cleaned before the rainy season in the district. This should be carefully done by an adult (never by children unless it is accessible and safe) equipped with the necessary implements such as a ladder, broom and a brush if necessary. However, leaves falling from the roof will cause blockage in the gutters and pipes. The leaves can also color the water and cause it to decompose and smell. Therefore, roofs should invariably be completely cleaned of all leaves, dust, bird droppings etc. using a broom. Water should only be used if necessary as most times a dry sweeping with a broom will be enough.

- PVC GUTTERS: The gutters of PVC collect the rainwater from the roof and transfer it to the filter. PVC gutters can pick up leaves, dust, small twigs and other organic matter. The gutters need to be cleaned regularly at least weekly once. During the rainy season the PVC gutters should be inspected and cleaned daily. The gutters are fixed to the roof or to the walls with clamps. The clamps hold the gutter or pipes to the wall or to the roof firmly and allow a small slope in the system to enable water to flow in one direction. The clamps sometimes may come off due to various reasons. The clamps should be fixed immediately whenever it is seen to be loose or when it has come off. At all times, the PVC gutters or pipes should slope in the direction of the filter system/recharge well/ tank and not away from it.

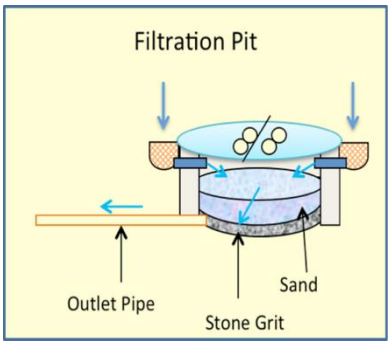
- DOWNPIPES: PVC down pipes brings the water from the rainwater gutters or pipes vertically down. They should invariably be clamped firmly to the wall and should never be loosely fixed. Always check that the down pipe is firmly fixed and if necessary replace or tighten the clamp whenever necessary.

- FIRST RAIN SEPARATOR: The first rain separator or a washout pipe as it is called, has a valve or an end cap to allow the first little amount of rainwater to be collected separately. This has most of the dust and dirt in it. The first rain separator also is used when the roof is being cleaned or when rainwater is NOT to be collected. It is important to ensure that the first rain separator is always kept in the closed position and never left open. After every rain it should be opened carefully and the collected water allowed flowing out. The pipe should then be cleaned and the valve or the end cap closed. Sometimes the first rain separator can get jammed due to the dirt or dust in it. In such a situation the valve or the end cap should be carefully replaced by a good plumber.

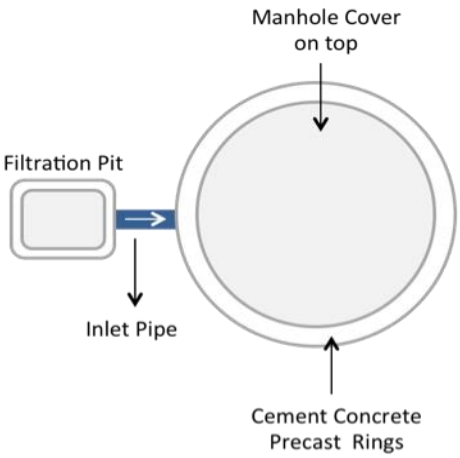
- LEAF TRAP: The roof of a school has lots of leaves falling from trees a conical leaf trap can be placed in the vertical down pipe. This has a mesh on top. The mesh prevents small leaves, twigs and other material from entering the pipe and blocking it or choking the filter. The material collected on the leaf trap if any must be removed at regular intervals and daily during the rainy season.

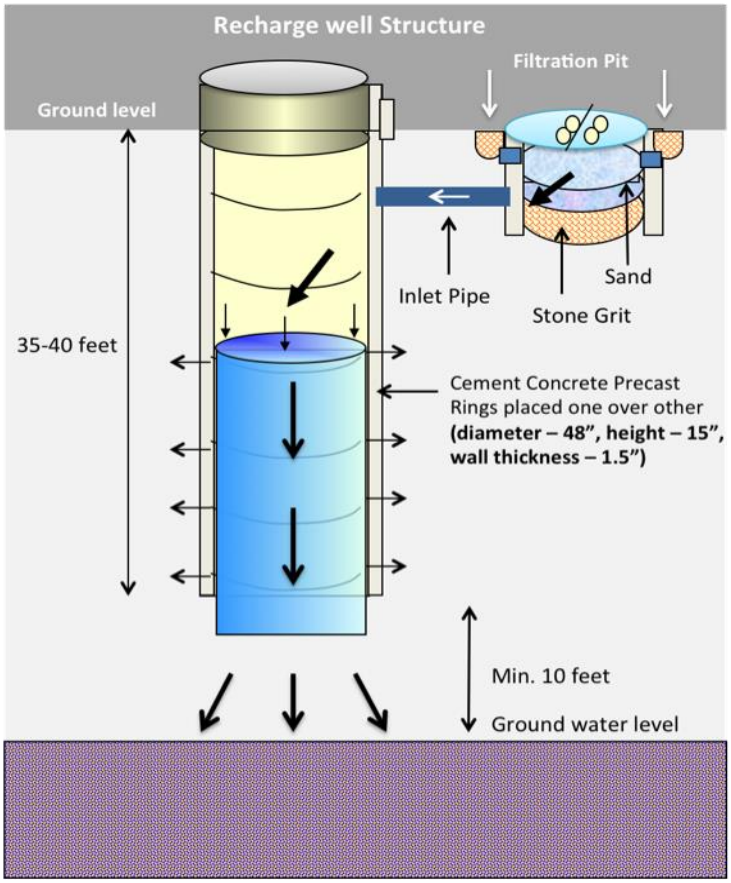
- FILTER: A gravel, sand and ‘netlon’ mesh filter is designed and placed before the recharge well or storage tank. This filter is very important to remove silt etc. coming with the water. It removes silt,

dust, leaves and other organic matter from entering the recharge well/storage tank. The top surface of filter media should be cleaned daily after every rainfall event. Clogged filters prevent rainwater passing through it. The sand or gravel media should be taken out and washed before it is replaced in the filter.



- RECHARGE WELL: The recharge well collects, store for a while and recharges all the filtered rainwater into the ground. In order to avoid contamination ten feet is considered as safe depth of infiltration. Thus the recharge well is made below the ground to the depth where sandy layer is stricken. But it should be taken to a depth leaving minimum ten feet above the ground water table to avoid contaminations leaching into ground water. It is made by placing the precast cement concrete rings of about four feet diameter. The top of the recharge well is kept about two feet above the ground and also will be sealed from the top either with stone slabs or concrete slabs. It must be ensured that the top cover is permanent and always fully covered. This will prevent the growth of algae or bacteria in the well. In no case should it be opened. If there are small cracks in the joints they should be sealed with cement mortar immediately.





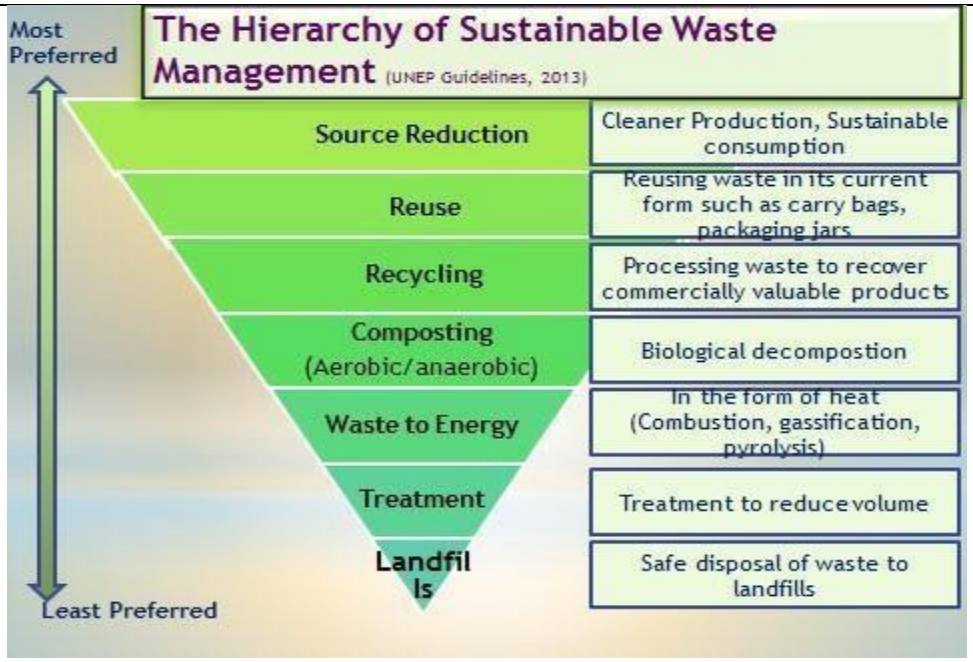
B). Rooftop rain water harvesting (for private buildings) & ground surface runoff harvesting:

These components shall be dealt as part of the liquid waste management system.

4.3 Proposed Solid Waste Management System

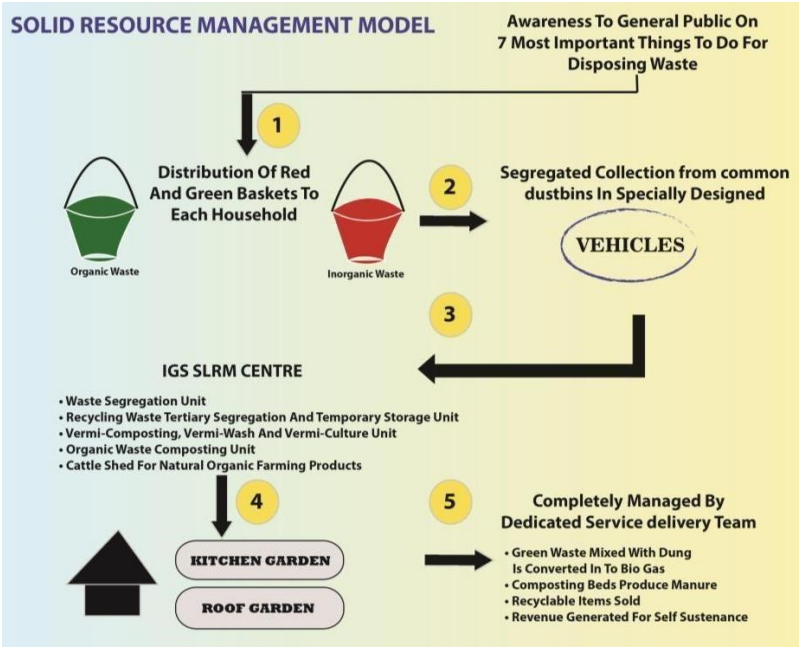
The Solid Waste Management Model is based on the sustainable hierarchy of waste management which lays more focus on Reduction to Recycling based on decentralized concepts.

Hierarchy of Sustainable Solid Waste Management



This hierarchy can only be achieved by way of DECENTRALISATION of Waste management. The proposed model is a culmination of awareness to systemized and scientific management. Fool proof monitoring and effective documentation are key pillars which will take us to the objective of ZERO WASTE.

As shown in the image, dustbins (2 nos.) will be distributed to HHs to ensure source segregation, and segregation will further be ensured by compartmentalized community dustbins and transportation vehicles. The HHs will dump their waste in the community dustbins which will be collected by service delivery team from these community dustbins and will be disposed-off to resource recovery centre. Image below outlines detailed specifications of resource recovery centre.



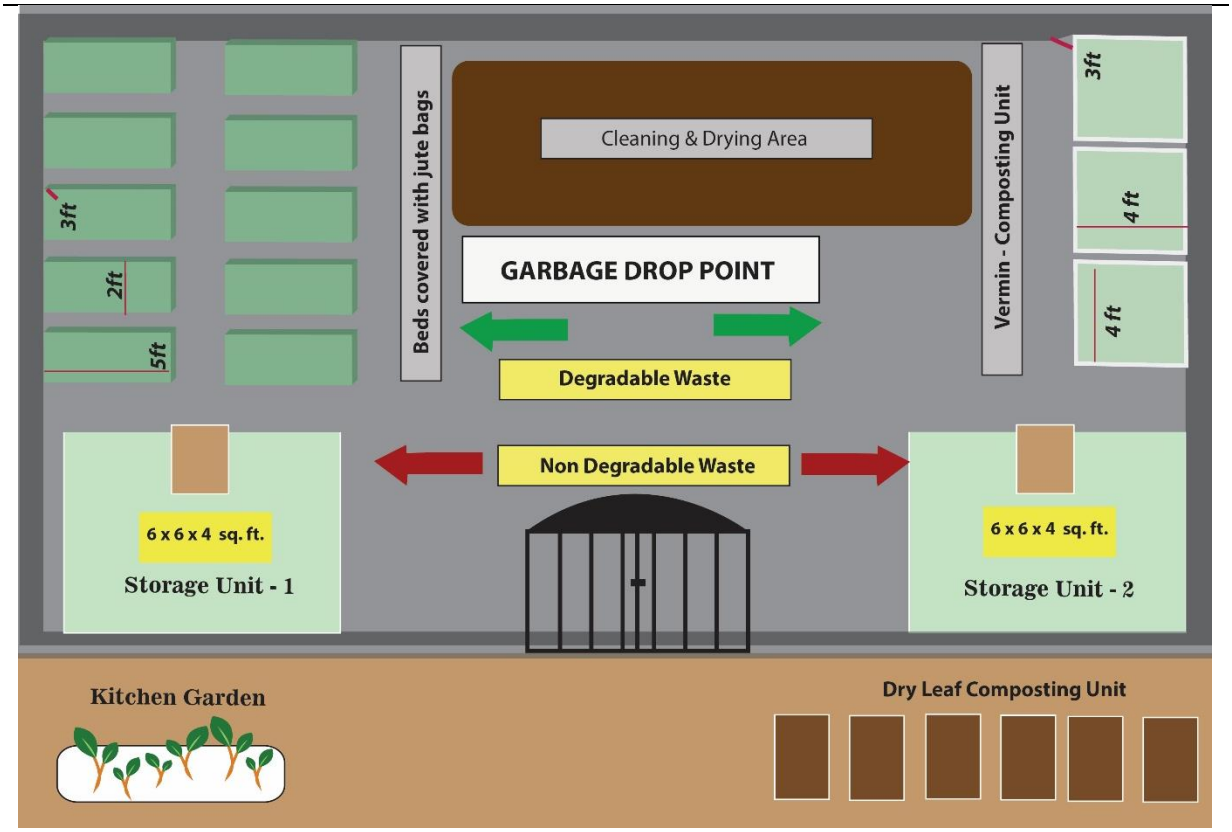
Proposed SWM system for the village

Note: Just basic representation of concept

Key specifications of the Resource Recovery Center

Description	Volume	Description	Volume
Total Building Area	2000 square feet	Flooring	Cement Flooring
Height Of The Building	15 Ft	Side Walls	4ft Brick Walls On All Sides*
Vermi Compost Tanks Inside The Centre	Tanks of capacity 54 cu. Ft (4x3x4.5 Ft)	Iron Mesh	9 Ft
Waste Handling Capacity	4000 kgs /day	Roof	GI-Sheet Welded with Side Mesh
Gate	Iron Gate 4 Ft Height		

Schematic drawing of Resource Recovery Centre at Garhi Harsaru



4.4 Proposed Liquid Waste Management System

This shall include managing waste water from kitchens and bathrooms, surface runoff of rain water & from private rooftops. It has been divided into 2 components: revival of the village pond (johad); and, recharge pits at different locations in the village.

A). Revival of Village Pond (Johad):

A johad is a pond like structure that collects and stores water throughout the year. The water stored can be used for different purposes like, domestic uses, animals and agricultural purposes. Additionally, these johads can also be used for harvesting rainwater and groundwater recharging. In dry season, the johad can

be filled using a nearby canal. A johad is present in the village near the Lal Dora area. Storm water drains laid in the village are connected to this johad. Also, the waste water from kitchens and bathrooms shall flow to the jihad through these drains.

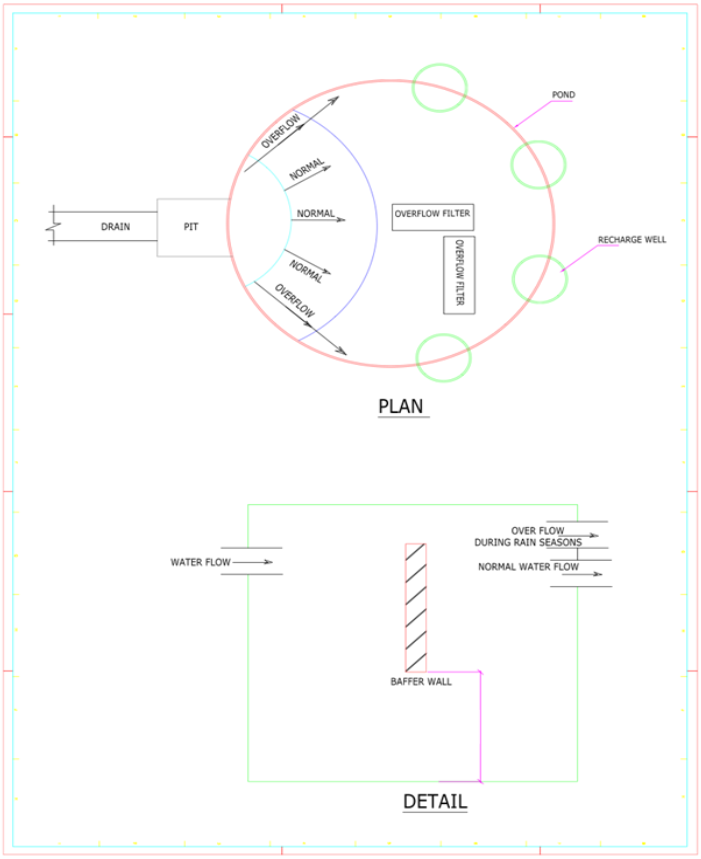
In order to manage the surface water runoff, measures for the restoration of Johad would be required to be undertaken. One of the suggested measures include, having an open chamber at the final discharge point, where the drain gets connected to Johad. The size of open chamber shall be kept 6x8 or 8x10 (all dimensions are in feet). There would be a Baffle wall with in this chamber, and the bottom of baffle wall be 750 mm high from the bottom of chamber. The depth of the chamber will depend on the inverted level of the inflow, where we have already considered 750 mm additional depth (clear cover to baffle wall) for the functioning of baffle wall.

So the depth of chamber can be kept as = Inverted level of Inflow + 750 mm

The given baffle wall will prevent all type of solid waste mainly plastic & clothes), which is coming along with inflow, to remain in chamber. This can be cleaned periodically and will also regulate the flow of water during monsoon.

In the normal season, the water which will pass through the bottom of baffle wall, will go into the 1st section of pond (marked in given lay out, outflow mentioned as NORMAL) through the first outlet point named as Normal Water Flow. , When the inflow would increase during the monsoon, the additional water will pass through the second outlet point named as OVER FLOW and will lead to the second portion of pond. The over flow will be handled by the pipe network which will direct the out flow water to get discharged in second portion of pond.

After this, the additional water of second portion of pond will lead to recharge wells (which would be developed in the periphery of Pond) through the OVERFLOW filters & via pipe network. The Overflow filter will direct the additional water to travel through pipe network, so that it can lead to recharge wells.



Typical Design of Recharge Well for Johad

B). Recharge Pits at Different locations across the village

For additional water, which will not be part of runoff reaching the Johad, recharge pits will be constructed. One recharge pit will be constructed for approximately 5000 square meter of area. Recharge Pit will be similar to filtration pit mention in above sections.

4.5 Proposal for Institutionalization and Awareness

This sub-section proposes measures for Institutionalization & Awareness, so as to sustain the entire eco-system of the proposed interventions. The capacity building measures shall be incorporated as part of this.

A). Village Level Institution (VLI) Building

Institution building is a major concern for the project. It implies graduating grassroots level initiatives and peoples' collectives into a proper participation in the project implementation and overall village development process. A comprehensive support need to be extended in the form of need assessment, capacity development and strategic development planning. This will ultimately contribute in developing ownership and sustainability of development oriented interventions. Identifying leaders and improving the quality of the leadership will be the integral part of the process. It would need to groom leaders who are part of the village organisation. These representatives will be giving rural communities a greater voice in their development, not only representing stakeholders' concerns to the local government, but they actively work in implementation. They also use their social network to bring best practices into wider use and raise awareness of other issues, such as water resource management, water quality and health.

It is imperative to develop a sense of ownership of the project in the community. For sustainability of project, we propose to undertake the following steps:

a. *Sharing plans with the community and attaining a buy-in:*
To involve the community in this project and garner support, the implementation plan shall be shared with the villagers. Applicable and feasible suggestions from the community through VLI will be sewn into the plans, making this project inclusive. Community will also be encouraged to contribute in the project. These efforts will help develop a sense of ownership of the project in the community, aiding other sustainability efforts.

b. *Preparing the community on operation and maintenance of the new infrastructure:*
Community's commitment is imperative for operation and maintenance of the infrastructure created. The contribution collected from the community will provide the required financial support. However, these funds need to be managed. The site will also require supervision for its sustenance. For this, a committee comprising responsible and key villagers will take charge of the project site post the close of the project. A bank account will be opened in the committee's name and all contribution shall be deposited there. This account will be jointly operated by the committee members to take care of maintenance after completion.

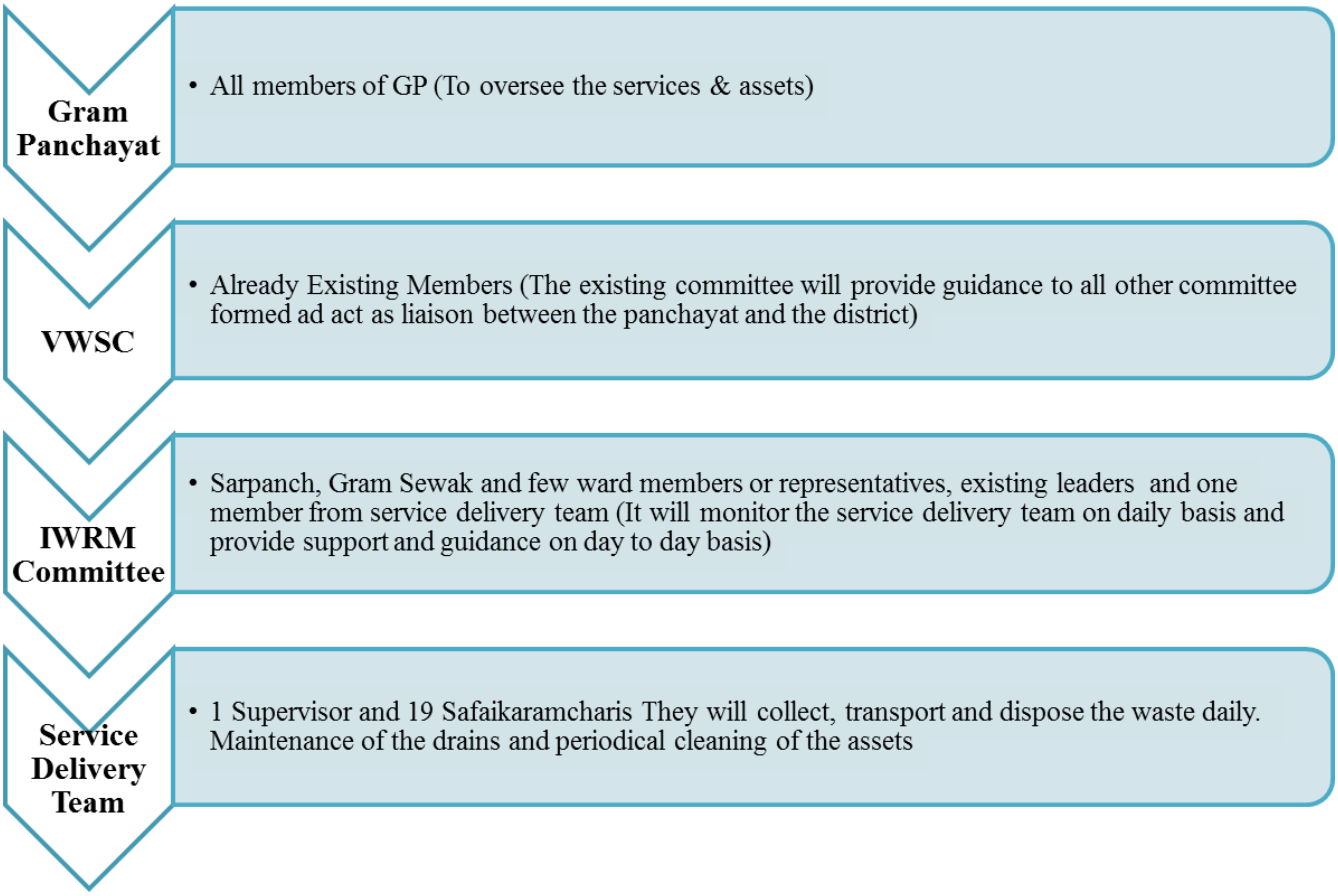
c. *Direct monitoring for one year to ensure a smooth transition of responsibility to the community:*
From the beginning of this project, emphasis will be laid on community involvement in and ownership of the project. The community will be made aware not only about the project but also about relevant government schemes and programs. We will also focus on creating government

linkages in order to access their support and funds. Over the period of one year, under direct supervision, the community will be trained to maintain the infrastructure created and resolve problems, if any.

d. *Supporting the community for two years, post transition of project:* Post the close of the project, it will be required to provide hand-holding support to VLI for two years, especially to the committee created, for operating and maintaining the infrastructure created under the project.

B). Proposed Institutional Structure

Accountability, Monitoring and sustainability of the initiatives are of extreme importance in order to sustain the activities initiated. Below figure outlines the proposed institutional structure for sustainability of the proposed system.



SLWM committee will be separately formed as there is no Nigrani Committee in the panchayat. They will play the role of monitoring the SLWM project as well as work towards sustaining ODF status of the gram panchayat.

Service Delivery Team is the most important part of the structure as it has to run the whole system on the daily basis. The team will be identified once the construction of the Resource Recovery Centre is completed. The service delivery team will have specific responsibilities. Few of those are:

- Every day collection of waste from the common dustbins and maintenance of the dustbins, transportation of the waste collected to the resource recovery centre and its maintenance;
- Daily segregation and packing of the non-degradable items and composting of the biodegradable items;
- Kitchen garden and eco-park maintenance;
- Maintenance of the drains and periodical cleaning of filter bed and chamber
- Maintenance of all accountability registers and reporting on a daily basis to the SLWM committee

Additionally, service delivery team will offer certain value added on call services. Few of them are:

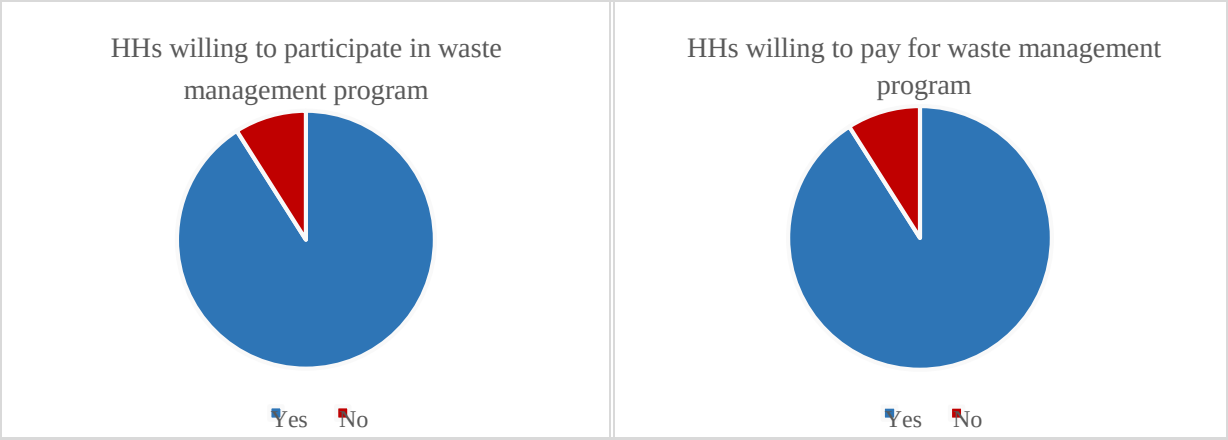
- Setting up Animal Waste compost beds (execution or training)
- Individual soak pit construction (where needed especially for black water)
- Sale of sanitation related products (6 months after the initiation of project based on demand)

Besides these responsibilities to maintain transparency, the attendance registers, collection registers, volume registers, sales registers and feedback/ suggestion register will be maintained.

C). Proposed Awareness Campaigns

In order to sensitize the villagers to encourage using these services, a series of awareness campaigns will be conducted covering; personal hygiene and sanitation, safeguarding water source, HH level segregation, cleanliness and maintenance of drains, open spaces etc.

The figure below shows that more effort has to be put in for the awareness campaigns in the area as a majority of the people do not wish to participate in the initiatives. This could be due to various factors. Hence a considerable amount of time has to be spent in making them understand the initiative and its importance.



Our current linear resource flow uses huge amounts of raw materials and generates huge amounts of waste. This will lead our society to resource depletion. SRM is about redesigning this resource flow so that most of what is generated as waste can be reused as raw material for further production. This

resource flow is more sustainable and will take us closer to goal of „zero waste". This requires focused actions before and after production.

Pre-production Actions

- Reducing Production (consumption): Producing and consuming only as much as needed.
- Redesigning Production processes: Producing using cleaner processes and packaging using less material.
- Production of safe and recyclable materials: Avoiding the use of toxic and nonrecyclable materials, so that maximum resource can be recovered with least harm to the environment.

Post-production Actions

- Reuse: What is produced should be reused as many times as possible. Eg. Bottles, containers, bags, etc.
- Recycle: Recycling those materials that cannot be reused. Eg. Organic waste into compost, PET bottles into polyester fibers, glass bottles into glass panes, cotton rags into paper, etc.
- These will be some of the key inputs in terms of awareness programs and advocacy initiatives. There will a scheduled and systematic awareness building initiatives.
- The awareness campaign and the entire initiative will follow the hierarchy of sustainable waste management. It is important for a larger group to understand the importance of having systems in place for waste management. This objective of ZERO WASTE cannot be obtained unless the hierarchy is understood.

Section 5. PROJECT IMPLEMENTATION

5.1 Implementation Plan

During implementation phase, the key responsibilities of the consultant team are to facilitate and support in;

i. the setting up of complete infrastructure facilities
ii. recruitment and training of the service delivery team and revival of other committees
iii. ensuring that the system and monitoring structure is in place

Furthermore, the key responsibilities of Panchayati Raj Department and the district administration shall include facilitation and support in

i. approval of DPRs,
ii. release of funds for the project implementation, if available
iii. Periodical visits at project site to provide feedback.

To ease the implementation of the entire system, the implementation is broken down into 4 phases. The phasing of implementation allows proper utilization of funds for the project.

Phases	Activities	Time Required
Phase 1	• Detailed mapping	3-4 Months
Phase 2	• Mapping of Drinking Water Supply Line and Managing Un-served Areas • Community Water Filter • Rooftop Rainwater Harvesting • Institution Building	6 Months
Phase 3	• Solid Waste Management • Institution Building	1 Year
Phase 4	• Liquid Waste Management & Revival of Pond • Recharge Pits • Institution Building	9 Months

5.2 Financial Planning

A). Fund Position of the Village

The discussions with the Gram Panchayat show that they will receive some funds which can be utilized for the implementation of the initiatives. However, utilization of other funds to compensate the remaining amount is a very critical point of discussion. This entire project is aimed at providing a long term and sustainable solution to the initiatives.

B). Costing & Finances

Financial for Integrated DPR- IWP Phase 2 are as follows:

Activities		Cost
	Detailed Mapping	3000000
Availability & Supply of Drinking Water	Community Water Filter Demonstration (4 in numbers)	600000
	Drinking Water Supply in uncovered Area	1000000
SLWM & Ground Water Recharging	Roof Top Rain Water Harvesting (For School)	350000
	Solid Waste Management System	24,00,810
	Liquid Waste Management & Revival of Pond	600000
	Recharge Pits (10 in numbers)	500000
	Grey Water Disposal & Drainage System	1,200,000
Building Village Level Institutions	Institution Building	200000
	Campaigns for promoting Water Conservations	100,000
Total		**7550000**

Section 6. PROJECT SUSTAINABILITY

The Integrated Water Resources project is envisaged to have both physical and financial sustainability. It is imperative to ensure that the behavioral modifications and new practices established are also sustained.

Physical Sustainability

- A set of rules and regulations with respect to usage of water, disposal of garbage and management of liquid waste inside the village will be laid down and every resident will be oriented about the same.
- The periodical awareness programs and information materials will be supplied so that the old and also the new residents are aware of the practices.
- A new monitoring committee will be set up which will constantly monitor the work of the implementation team as well as the compliance of the residents.
- Periodical documentation reports of the project and newsletters related to progress will be released to ensure that all the residents are aware of the progress of the project.

Financial Sustainability

By financial sustainability it is envisaged that the project will generate an income which breaks even the monthly recurring expenditure of the project. However the project itself is self-sustainable, but can generate revenue from Community Water Filter to meet a substantial part of the revenue expenditure after implementation.

The Revenue can be generated in many ways but the volume of revenue depends on various factors including the consistency and the nature of garbage generated.

- Sale of compost (organic markets, farmers and individuals – Direct and/or Online marketing)
- Sale of Recyclables (Plastics, papers, bottles and other items) – Directly to the factories will be profitable
- Other service fees for the service delivery team
- User fee collection (It is important to note that most of the residents at this stage are not in favour of this user fee – Source – Baseline survey data)
- Sale of filtered water

The Financial sustainability can be worked out only after a substantial period of implementation which will give a clear picture of the cooperation and the attitude of the villagers towards such a project.



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