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Preface

This story telling document is about how needy villagers of Eastern Ghat of Visakhapatnam suffered for lack of water facilities in their villages. Their struggle over years has been captured via the eyes of VJNNS. We have tried in this book to illustrate the conditions before the construction of the system and after the construction of the system. This book will be ideal guide for anyone who wants to construct Gravity Fed Water Supply system in hilly terrain. These mechanisms will work 100 % if demographics are matched equally.

This is a collection of our experiences gathered over a period and put in practice in successfully running the water projects. This book provides complete information on the planning, designing, implementing and maintenance of the water system. The material requirements might differ depending on the dynamics of the region and water demand. We had tried to justify it based on the constructions that we had executed so far.

We are very grateful to our donor agencies for supporting us in fulfilling the vision that we have. Two of our major contributors are Arygham, Bengaluru based organization and FrankWater, UK based organization. With their support we were able to construct more tanks to the needy villages.

This book can be used as a reference to those who all are intended to replicate the mechanism in similar regions. However, the findings and executing of plan can be deviated as per best suit. Innovative ideas and incremental processes will be developed over the years and same can even replace the current approach.

Village Identification & Feasibility Study

This is the very first step in setting up the Gravity Fed Water Supply System (GFWSS) in any village. Our surveyor goes out in search of villages and understands the current situation or problem that the villagers are facing due to scarcity of water system and based on this demand he further investigates on the feasibility of building GFWSS in the village. The surveyor conducts geographic and topographic surveys and determines the viability of the system. Another important aspect that needs to be looked upon is the mind-set of people for such a construction.

The surveyor talks to the villagers and understands their mind-set on having such a project for them at the village. It is very important to understand the attitude and villager's motivational level for having such system in place. These analysis provides a better outlook for building a sustainable water system. The ability to judge the motivational level of villagers at an early stage is very difficult and that's why it is very important to conduct workshops and awareness programs in order to make the villagers understand the importance of the system. Moreover, this will help to provide the long term maintenance required to keep the tank in working condition.

The surveyor studies the spring source and determines the yield of it. This is very important in considering the size of distribution tank. Based on the flow of spring and demand of water in villages, the technical team decides on the capacity of the distribution tank. It is designed in such a way that the villages get enough water during peak summer time. Note that during rain, the yield will be more and water would be overflowing the tank, this water is redirected to kitchen garden to water the trees.

The Village profile document needs to be created during the initial feasibility study. The information is collected for each of following headings: -

1. Village Information
2. Population Details
3. Land Details
4. Existing water bodies
5. Agriculture Details
6. Livestock Details
7. Sanitation Infrastructure
8. Transport Infrastructure
9. Village Educational Infrastructure
10. Health Details
11. Basic Amenities
12. Welfare Schemes
13. Income Details

Village Information: - Details regarding Village name, Latitude, Longitude, Mandal & District

Population Details: - Total Population, No. of Males & Females, No. of children (male & female), no. of households, religion/caste info

Land Details: - Type of land (dry, wet etc), rocks & soil types

Existing water bodies: - Any nearby lakes, flowing stream, depth of the river/stream, nearby dam, nearby canal, existing borewell, wells, handpumps, springs count etc

Agriculture Details: - Vegetation details, crops info, water demand for agriculture

Livestock Details: - No. of cows, bullock, goat, poultry etc

Sanitation Infrastructure: - Toilets/Latrines availability, sanitation awareness, toilets availability in schools

Transport Infrastructure: - Any roads connecting to village, distance to nearest bus stop, distance to Govt offices, police station, post office and banks

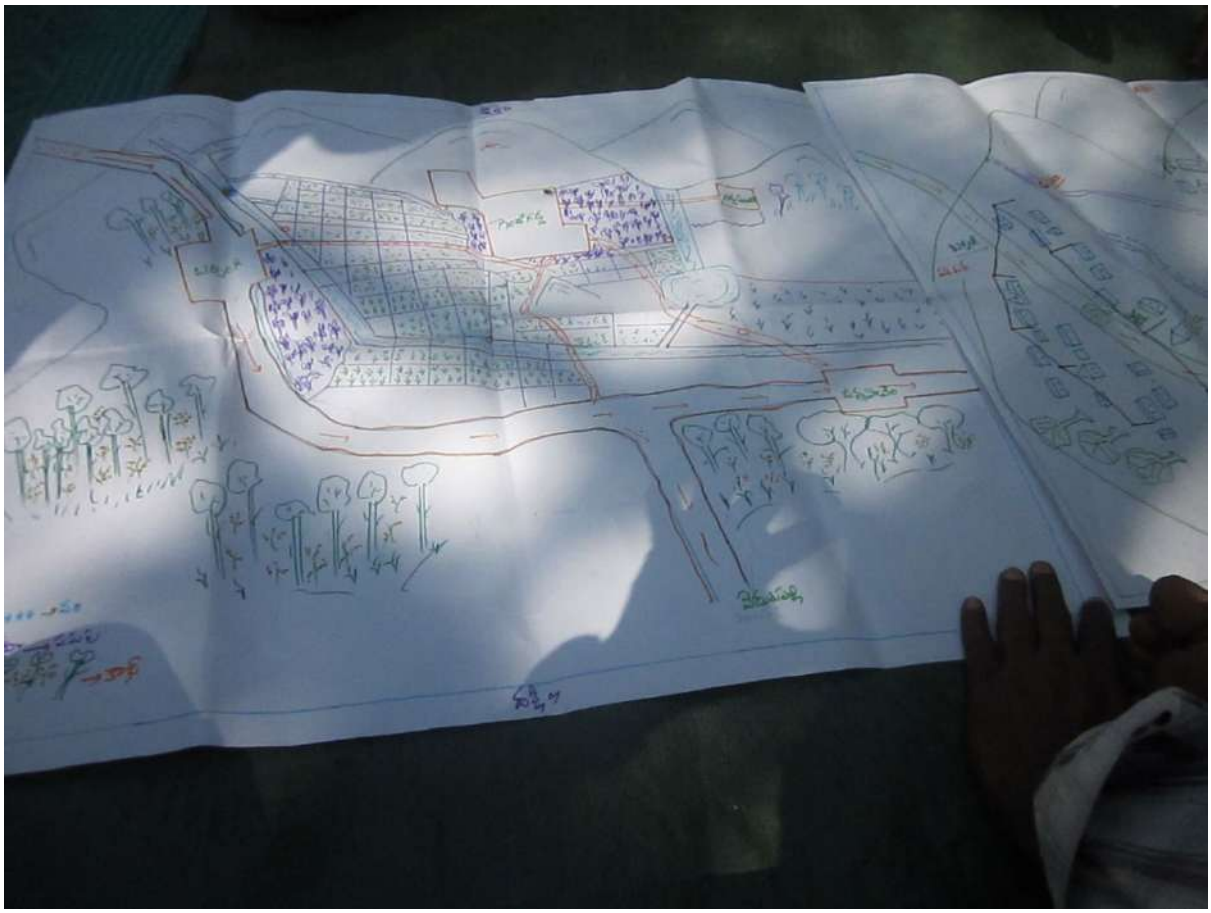
Village Educational Infrastructure: - No of schools, Anganwadi (Montessori), no. of children, no. of teachers, educational qualification of teachers, drinking water availability, toilets/latrines facilities in school, distance of school from village, supporting staff in school

Health Details: - Distance to nearest medical centre, medical illness history

Basic Amenities: - Is there a Community building, whether village is having electricity facility, nearest telephone facility

Welfare Schemes: - no of widows with pension, no. of differently abled in the village, non-ration card members, land title deeds, any special welfare schemes available to villagers

Income Details: - small scale industries (handicraft, pottery etc), savings by family, Village Development Fund programme, agricultural income, livestock income etc



Population Survey

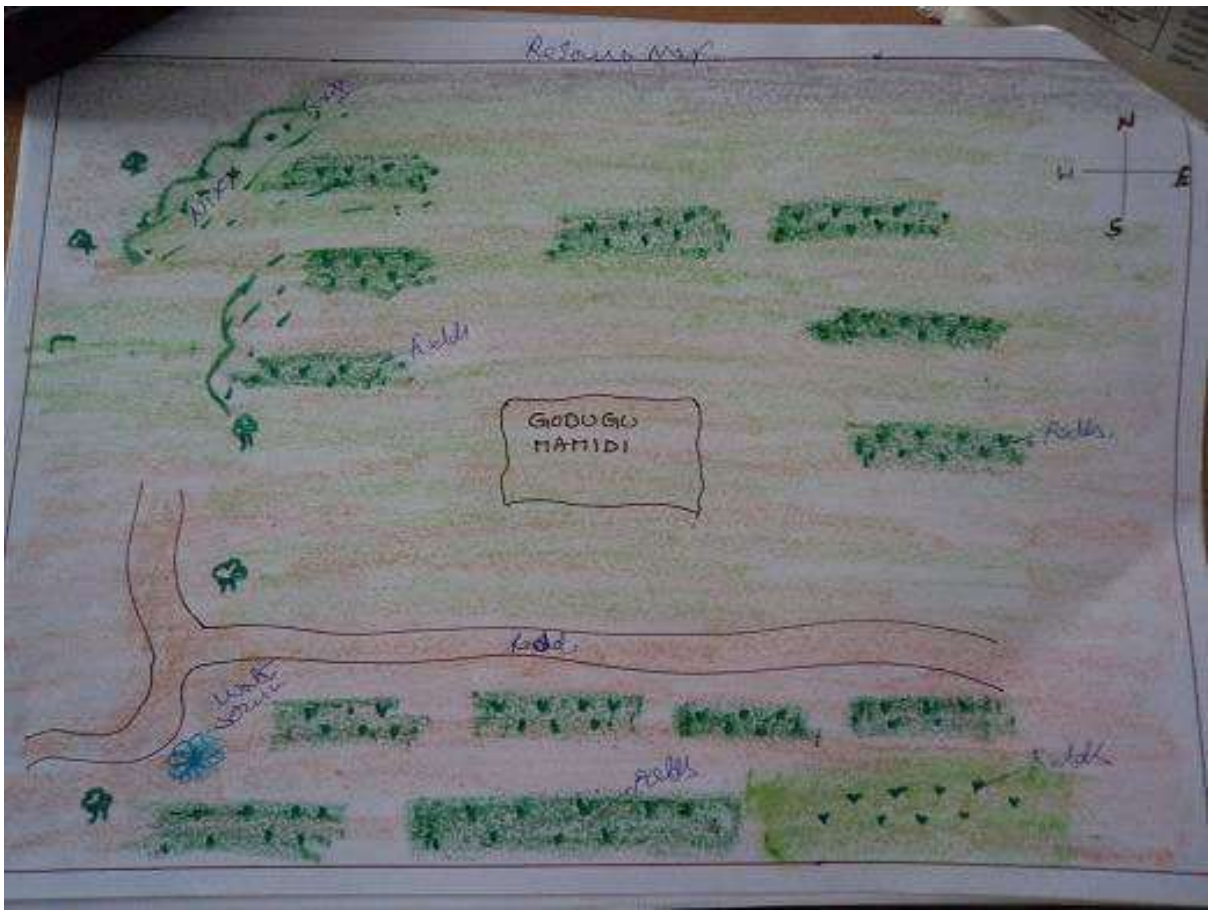
The estimate of water requirements are totally depended on the population of the village. Villagers tend to roughly estimate the population, but it is recommended that surveyor investigates it in greater detail by visiting each household and conducting the social mapping. The total number of males, females, children, elderly members all are counted. Age wise categorization is also done in order to under the water consumption levels for the family.

Motivation & Enthusiasm Level

It is very important to understand the willingness of the villagers in implementing the GFWSS. It is best for us to know their motivational level, cooperative ability among villagers, religious and political viewpoints and passionate towards development. By having a high motivational level, it will be helpful in maintenance for a longer duration.

Spring Study

The technical team along with villagers identifies the spring source, and discuss with the senior members from the village regarding the yield of the spring. This is just a partial information, but will be accurate as over years the spring is monitored by the senior folks.



Moreover, technical team also test the flow of water and calculate the yield of the spring. There are several methods used in determining the flow of water, we generally use these:

1. Bucket Method
2. V-notch Weirs
3. Velocity Area Method

Bucket Method: -

This is the most commonly used and simplest approach in determining the flow of a stream. In this method, a bucket of known capacity and a stopwatch is required. The time required for the water to fill in the bucket is considered and based on that the volume of flow is measured. The simple formula is

Q = V/t where Q = Volumetric Flow Rate

V = Volume of bucket

t = average time

To get the best results it is advisable to repeat this method couple of times before finalizing. The bucket is easily available in the village and one member can check on the bucket filling while other individual can keep an eye on the stop watch.

V-notch Weirs: -

This method is used for large and small springs. A V-shaped notch is built and water is allowed to pass it over it. The V shaped notch is wide enough and water falls through the gap. The distance that water travels before touching ground at the other end of notch decides the flow rate of water. More the distance, more the flow. While using this method, we should make sure that no obstacles like dry leaves, weeds, and plants are struck at the notch angle.

Velocity Area Method: -

This method is used less compared to the previous ones. In this method, a small wooden or light weight floating object is placed at one end of the stream and is recorded to reach to other end of the stream. The time taken for the object to reach from one place to another is calculated and based on this the flow rate is determined.

We advise that first two methods to be used to get an accurate reading. These spring studies have to be conducted during the peak summer time so that we would be able to judge the scarcity of water. These studies are revisited again when the actual GFWSS construction is about to begin. During the spring study, the technical team also analyses the soil type, plantations around the spring, wildlife accessibility, types of rocks and geological structure surrounding the spring source. One thought that comes across during this is that we humans are tapping the springs then how would the wildlife be able to drink water; to this we happens is that, we keep certain springs open for wildlife and farmers to fetch water for their purposes. While spring study, we keep in mind the life cycle for *Flora* and *Fauna*. Plantation around the springs are very important as these will help in sustaining the source

for longer periods. Last year we had some plantation of silver oak saplings which will provide shades to these springs thus protecting them from evaporation.

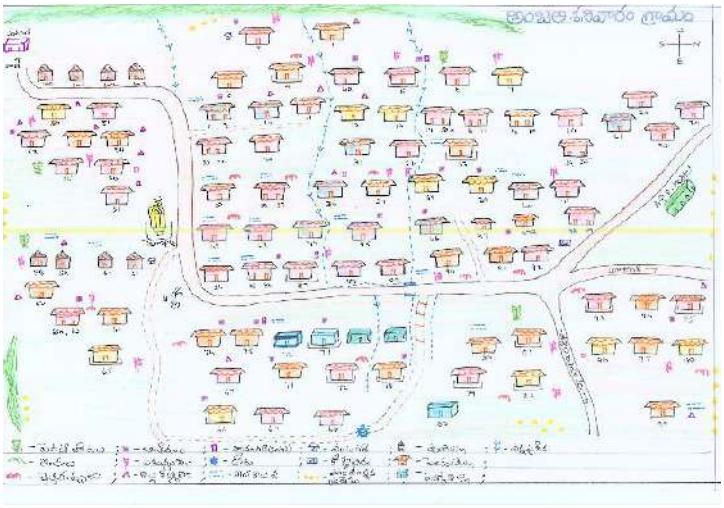
There is possibility of having more than one spring near to a village, in that case, we build pipeline system from both the springs and connect it to the distribution tank. This is done when one of spring source have low yield and the demand for water needs are met by combining both springs. However, water from other springs are made available for wildlife and for agriculture purposes.

Micro Level Planning (MLP) Preparations

This is the very first step toward having a Gravity Fed Water supply system (GFWSS), the MLP includes collection of raw data of a particular village and covering the complete scope of the current scenario. This MLP helps Govt. bodies and Donor agencies in evaluating the current situation of a village and all the required info in building a GFWS system.

VJNNS prepares a list of villages which are in great need of water facilities and then conducts a detailed micro level planning along with villagers. We involve the villagers in such activities so that we can educate and advise them on having such a planned approach towards building such system.

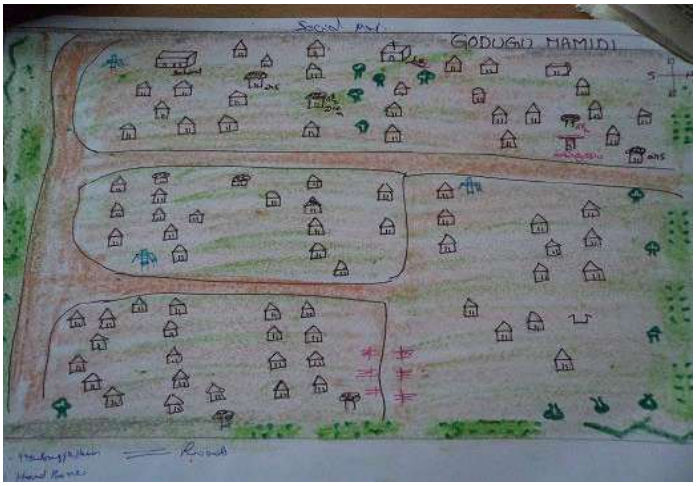
This kind of collective approach helps in developing the overall knowledge of the villagers and put them through a disciplined activity. During the MLP preparation, data is collected and put through analysis in determining the actual scenario.



A village map is drawn along with all the houses layout and identifying the water source. It is very important for everyone to understand the distance between source of water and the village. This information is important as this will decide where should be the distribution tank to be situated. It should be placed at strategically better position in order to produce better efficiency. We should calculate the elevations of the water source and elevations at which the villagers' houses are. A decent amount of increment in the positions will help us in creating the supply system.

These spring sources are generally very rich in mineral contents and are safe in drinking. These springs are naturally filtered and are available at these source points. After geographically locating the source and the houses, we decide on the position where stand post needs to be build. Stand post is the point

which is built at different places in the village so that all the villagers are able to fetch water regularly for daily needs.



Surveys & Testing

A detailed technical survey is taken place at the time of feasibility study. The technical team along with village members go to source of spring, the spring sources are generally deep in the forest or very remote hilly region. It is required by the village people to clear all the bushes, and make path for everyone to reach the spring area. The water available in the spring is tested to check its levels. The various readings that are taken into consideration are: pH Value, turbidity, dissolved oxygen, total solids (TDS), salinity, fecal coliform, electrical conductivity (EC), temperature and flow rate. The device which we uses for water testing is Tracer, this instrument gives readings for pH, temp, TDS and EC.

During the spring survey, the flow rate of the spring needs to be calculated using the bucket method or V-notch weirs or velocity areas methods. Generally, the tech team implements two methods to arrive at an average value. By the help from villagers the V-notch is built at the spring. Once the source is finalized then spring protection activities are planned for future days. Saplings are cultivated near the spring so that shade will be provided to the spring and it is protected from animals contaminating the water. The tech team builds up a concrete surrounding at the spring and cover it with a concrete slab. Pipelines are connected to the spring tank and other ends to the distribution tank.

After getting the water through the filtration system, the water is tested again for pH, Temp, EC and TDS. The slow sand filtration clears off most of the impurities in the water.

Materials Specification

Distributed tank is having RCC concrete walls with ____ thickness and the length varies from ___ to ____ depending on the population of the village and demand for water needs. The distribution tank that we construct is a 3 layer tank. First two layers of the tank is the filter media system where the water gets distilled and stored in the third layer from where the pipes are connected to the stand posts. Dimension of the tank is

Length – 4.5 meters; Width – 2 meters; Height – 2.7 meters

Description	Quantity	Units	Sand Cum*	Stone Cum	40MM cum	20MM cum	Iron in K.Gs	Cement
C.C. 1:4:8	9.35	Cum	5	-	9	-	-	20 Bags
R.R.Masonary	13.82	Cum	4	13.82	-	-	-	25 Bags
C.C.Tank	1.68	Cum	1	-		1.60	-	10 Bags
R.C.C.Tank	13.03	Cum	7	-		13.00	450	70 Bags
Plastering	117	Sq. mt	5	-			-	40 Bags
			22	**13.82**	**9**	**14.60**	**450**	**165 Bags**

*cum = length*width*height

R.C.C stands for Reinforced Cement Concrete which comprises of mixture of concrete and steel which provides better strength to the structure. Concrete is good in resisting compression and steel is good in resisting tension due to this the structure gets better strength. To overcome the drawback of concrete, reinforced steel bars are used along with concrete.

On an average 450 Kgs of Iron rods will be required in constructing the RCC wall frames.

These rods give better strength to the complete structure.

Spring Box

The spring box is actually a small transmission box, which is built around the source of the spring. This is basically built to have protection of the spring from getting contaminated from animals and human intervention. This box tank is built around the hilly terrain and have a concrete top cover. This top cover is removable for the team to have maintenance work and water flow testing. All round the year, the team is supposed to collect the water flow and have the data under observations.

The source tank latitude and longitude are calculated using the GPS device and noted for mapping and elevation calculations.

Stand Posts

Before the project planning, the team visits the entire village and draws a village map along with villagers and identify the need for stand post. They need to calculate the number of inhabitants and the water demand and based on that the decision of stand post position is determined. Ideally a stand post will be distributed among 4 to 5 families.

The stand posts are built into 3 different sections.

1. Water collection area
2. Cleaning area
3. Soak pit

Water Collection Area: - This is the place where the tap stand is placed and villagers are supposed to collect the water from this area.

Cleaning Area: - This is the place where villagers are supposed to use the water for cleaning activities. Washing clothes and utensils are the cleaning activities by the villagers.

Soak Pit: - This is the place where the waste water is collected and this waste water is redirected to kitchen garden. This will help the plants to have water and it's again back to ground.

Pre-Construction

During this phase, VJNNS facilitates complete training to the village members about the complete process. As the population of village is more, only a few selected influential members are called upon to act as Community Action Group (CAG). This CAG members are mostly responsible for the complete village development. They also form the Village Development Committee (VDC). VJNNS conducts a full day programme for the pre-construction training where the CAG members are made understood the complete process of GFWSS construction. These CAG members will be responsible for community mobilization and the construction timeline. VJNNS gets the CAG members to plan the work plan and come up the timeline estimates for the complete work. The CAG members are called upon the previous and stay at VJNNS premises as the travel time required is 4 to 5 hours from villages, so in order to begin the training early morning, members come down the one day early and stay.

The training begins with first discussing on the current issues that the villager are facing and the desirable solutions that the committee and VJNNS can come forward. Most of these issues will be pertaining to drinking water systems, so we would explain them more about the Gravity Fed Water system and their functioning. A video featuring the importance of Gravity system and how a village benefitted out of this is viewed to the members. Once the motivational level are set, we start off with process of how the construction starts beginning with foundation layout, digging, stone collecting, digging, loading and unloading of raw materials. The technical details for the size of the distribution tank, the foundation specifications, and the length, depth and height of the tank are explained to the members. During all these training session, we try to keep it very interactive so that more and more topics are discussed and CAG members understand the complete process deeply. Once the concept for distribution tank is explained we move ahead with pipeline layout, channel width to be digged, minimal joints plans etc are discussed. Based on the village map, the stand post positions are explained. In the same training programme, the importance of having a village development committee is detailed out and the committee is formed with these CAG members. There is formally

an agreement exchange between the CAG members and VJNNS which details out the action plan to be executed by the village members and VJNNS. This agreement also stands as an obligation for the villagers towards the project.

We encourage and have a muster roll (attendance sheet) for the shramdaan that villagers give. This way CAG and VJNNS will be able to keep track of the task which are executed and pending line items. All this construction have a timeline which we get the commitment from CAG members which in turn will be communicated to the villagers.

Construction

During construction phase, the CAG members gets the villagers and assigns the task as per the timeline that is decided during pre-construction phase. First will be the mapping activity, where the technical team decides on the location of distribution tank. This distribution tank is strategically placed from source tank to the villagers centre area. The elevation of source and distribution tank is taken into consideration and noted down. The mapping of distribution tank is done and then villagers start digging the pit. Once the pit is dig, they lay the concrete as the base layer. This is done so that water doesn't leak out to the soil below.

Once the concrete base layer is done, we add iron rods to the structure. This adds more strength to the concrete structure. This iron mesh is laid internally across the complete structure and then one more layer of concrete is added. The distribution tank is built in 3 layer of concrete wall, each of them consisting of 2 feet height (this varies based on total distribution tank height). After the first layer is built, we keep adding wet gunny bags to the structure so that water is retained and concrete becomes solid. This process is carried out for a period of 3 days as each day one layer is constructed. After the complete structure is built, plastering happens. This takes a day or two to completely dry up. Regular water is given to the structure.

As soon as the base work is completed, the engineers divides the tank into the required chambers (ideally 3), first two chambers will have filtration system while the third chamber is only for storing water. Once the plastering work is completed, the filter media work is initiated.

During the construction phase, VJNNS takes up the training programme pertaining to sanitation and best hygiene practices. This training is taken place at village level including all the members so that everyone understand the importance of hygiene practices. A lot of emphasis is given to this training as this is most difficult part as the community tends to follow bad practices after couple of months' time.

Plumbing work is carried out during the construction related to distribution tank. The inlet pipe which gets into the first chamber below filter media, the outlet valve for first two chambers, the overflow pipe at third chamber and the outlet valve of the third chamber connected to stand posts. At the distribution tank we have water meters installed in order to have a track of total amount of water that is utilized by the village via Distribution tank. The inlet pipe have a meter which measure the amount

of water that goes into the distribution tank and at the outlet valve connecting to stand post we have another water meter.

Filter Media Chamber

The water that comes to the distribution tank is filter twice before passing it to the stand posts. This filtration system is a combination of slow sand filter and reverse slow sand filter. The filtration system is made using a concrete slab with holes, large number of pebbles and fine grain sand.

Concrete Slab

This concrete slab is made up to 5cms thickness and have 1 – 2 cm diameter holes. The basic purpose of having such slab is to prevent dry leaves, plastic materials and other unwanted floating particles from entering the system.

First Filter (Reverse Sand Filter)

In the first filter tank the water inlet pipe is given below the concrete slab and as water is flow into the tank the water rises upwards and will have a reverse filtration. It first crosses the concrete slab and through the holes water is slowly risen upwards and passed through sand and pebbles.

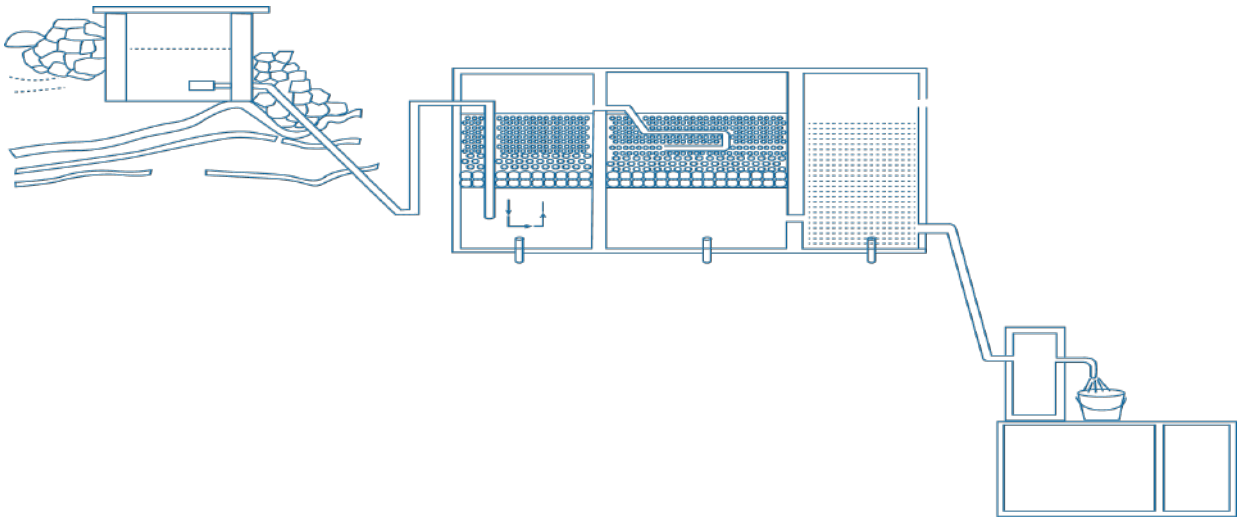
Second Filter

Once the water is risen above the pebbles it falls into second chamber where it again passes pebbles and gets filtered by sand. This clean water is collected to the third chamber from where the water is distributed to stand posts. All these outlets have valve to control the water flow.

The water passes through the sand medium and traps suspended solids that contribute to high turbidity. The discharge from these filters is usually clear. The sand medium should be changed every

three or four weeks to remove solids and prevent biological growth. The removed sand can be washed, dried and reused. This kind of filtration system is most inexpensive and natural way to get clean water.

The third collection chamber have an outlet at top of the chamber for overflow. This water is passed on to the kitchen garden to water the plants. Each of these chambers will have an output valve in order to clean the tank during the maintenance.



Pipeline Digging

The villagers help in loading and unloading the pipes that comes to the village and stores it nearby village. During the mapping phase, the stand post position are determined and the pipeline layout is drawn. Based on the mapping, villagers dig 2 feet of depth pipeline channels and lay the pipes. Once the pipes are laid it is covered and this protects the pipe from any damage. The major reason of digging 2 feet is to protect the pipes from the animals that walk over and also from erosion of soil

during rainy season. Channel digging are sometimes very difficult work and requires complete work load from the villagers. As soon as the channel are dug, laying of pipes should not be delayed as that might cause further problems. The idea is to close the channel as early as possible to avoid any harm to anyone. All the instructions and procedure for digging the channel at steady depth is explained to the community in the training sessions. It is observed that in hilly terrain if on the way there is rock formation then villagers will not be able to dig up to 2 feet during this time, whatever depth is possible is dug and the pipe is surrounded by small stones, so that pipes are not damaged. All the digging tools like shovel, rock-picks, hammer etc are available with the villagers, as most of the members will be farmers so they do have materials required for digging purposes.

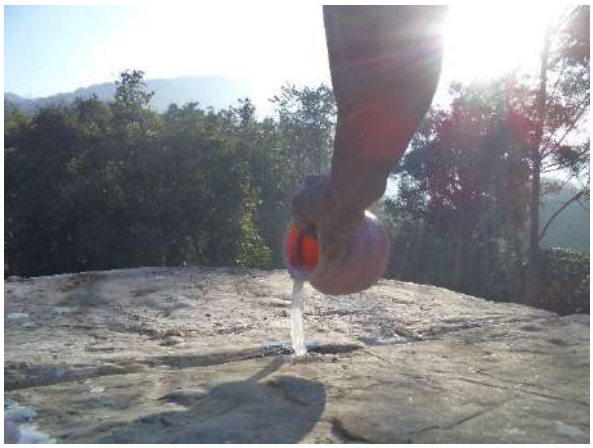
All the shramdaan are recorded in the muster roll. It is necessary to keep a track of equal contribution from each household.

After the Pre-construction training to the CAG members, they go back to the village and conducts same training at village level, during this time one training coordinator from VJNNS also accompany in case there is any confusion or doubt. During this village level training it is made clear to them that it's in their best interest that the project is going on so that motivation level are maintained and they are committed to the work fully. Complete planning is discussed with the villagers so that everyone knows what needs to done.

Post – Construction

Once the distribution tank is constructed, then community and VJNNS decides on a particular date for Post Construction Training. This is led forward by the CAG members as they explain to VJNNS about the complete construction process. This is specially done for post work analysis so that villagers can review all the activities and improve further in the future days for any collaborative work. The timeline which will be prepared during pre-construction training will be analysed as whether community was able to keep up with the timelines. Any delays will be discussed thoroughly to understand root cause issues. This training session also empowers the presentation & communication skills of CAG members as in future it would be these people who go to Govt. official and present other development activities. This also strengthens the bonding between members and cooperative ability.

Once the first part of the training is over, VJNNS explains alternative ways in which community can raise funds for Village Development Fund (VDF). Every family has to contribute Rs. 10 towards this fund and if there is any special occasion in the family and they require more water then, that family might have to contribute more during the time. Some of the farmers would ask for extra water for their agriculture demand and in that case also community allows the draw water with some extra



charges toward this. Community sole responsibility will be to protect the water system and finds ways in generating revenue for maintenance purposes. VJNNS using its past experience also educates the community on the type of pipeline repair work that might come in future and ways to solve these problems. Distribution tank requires to de-slit the water from time to time and VJNNS explains the process of doing so. The chambers are required to be cleaned at regular intervals. Villagers are also advised to use chlorine mix in chamber.

VJNNS also trains the community members on ways to clean the filter media and how to replace the sand and pebbles at regular intervals. After the construction is over, the first time the water is not used by the village people for drinking purpose, as the water might have some taste difference due to new construction. This time the water is passed on to the garden area. Couple of times after this process is repeated and then water becomes drinkable. After changing the filter media also the first time water is redirected to garden area. The dual filtration system makes the water drinkable, but we again test the water from stand post and make sure all the checks are intact.

As the training programme continues, another important topic that's key to the discussion is about sanitation and best hygiene practices. This discussion happens during the post construction at community level with CAG members and also at village level with the coordination from CAG members. These hygiene practices are about washing hands, keeping drinking water area clean,

fetching water with a different vessel than the drinking glass etc. Hygiene practices are generally taken place at village level and made sure that all children are part of this awareness programme. We believe that if such best practices are taught at early age it remains in their mind forever and would lead for a better lifestyle.

Operations & Maintenance

After the construction is completed and water is available at the stand post, then formally a handover process is followed wherein VJNNS hand over the complete operation of GFWSS to the village community. In this phase, the CAG group monitors the system and do time to time repair work if any. It is during this phase itself when VJNNS explains the group about how to protect the spring source by making sure that a spring box is constructed around the surrounding and plantation are made in order to cover it properly and provides shade to the source. This plantation helps a lot in having less evaporation during peak summer time. It is also advisable to plant these tress in order to prevent animals contaminating the water. VJNNS team also inspect each village post construction and ensure that the system is working fine. Any sort of technical help is always provided from VJNNS side. Minute repair works are handled by the CAG using the VDF. VJNNS team decides on having the catchment protection area and advises the community on plantation of saplings in the surrounding areas. The spring source is protected by constructing a spring box with a concrete slab as a cover to close it. This protects the source from animal intervention. The distribution tank is also protected by building a surrounding boundary wall of sticks. This way the outlet and inlet valves are protected from animals.

Shramdaan (hard work donation)

This is the major contribution by the villagers in getting the GFWSS system live in the village. They will the engineering team in digging, loading & unloading of materials, pipeline laying, and plastering etc. The water committee decides on the shramdaan requirement and helps the team in construction. Daily wages for plumbing work, masonry etc are taken care by VJNNS, as these require skilled workforce and are hired from outside the community.

Water Plus activities

VJNNS also conducts various training programmes which is not the part of GFWSS construction but toward community overall development. This kind of programmes are included as Water Plus Activities. This programme can be conducted at two different levels; one at village level and other at community level.

The village development members will be the part of community level training programmes while the whole village will be included during village level programmes. The complete process of how we dealt with the water problems is discussed and how village people along with VJNNS solved the water problem by having GFWSS. After the complete process is analysed and discussed, we advise them on the importance of collaborative efforts to achieve success. Due to their commitment towards the problem and hard work paid off with solving the issue at the earliest. Same concept and process can be utilized to other key areas for development. Various processes were introduced to the villagers

during the GFWSS process and same can be replicated in clearing out other issues in the village. The complete process of GFWSS construction makes the villagers understand the importance of hard work, self-motivation, cooperative attitude, team work and willingness to gain something. We guide them in taking up other issues that the village is facing like lack of toilets, schools, job schemes etc.

Another important programmes that comes along with these are better awareness programmes on sanitation and better hygiene practices. These programmes are conducted at village level with all members. Separate sessions are taken for children and ladies. Washing hands before and after food is something which is very important and kids do remember the same and promote the same among elders of the family. A lot time is saved due to the water availability near the house which gives more time to the villagers in engaging in other activities. Also now women do not have to spend a lot of time in fetching water for household needs and this time saved here is utilized in generating revenue for family by doing small scale business.

Community Formation

This is an important activity that we insist in having in place for the village. The village would have Sarpanch and some senior folks for taking key decisions, however, we insist in forming a Water Committee. The representatives for the committee are selected among the villagers and the roles and responsibility of the committee is decided.

The water committee plays key role during the construction, before the construction and after the construction.

Pre – Construction

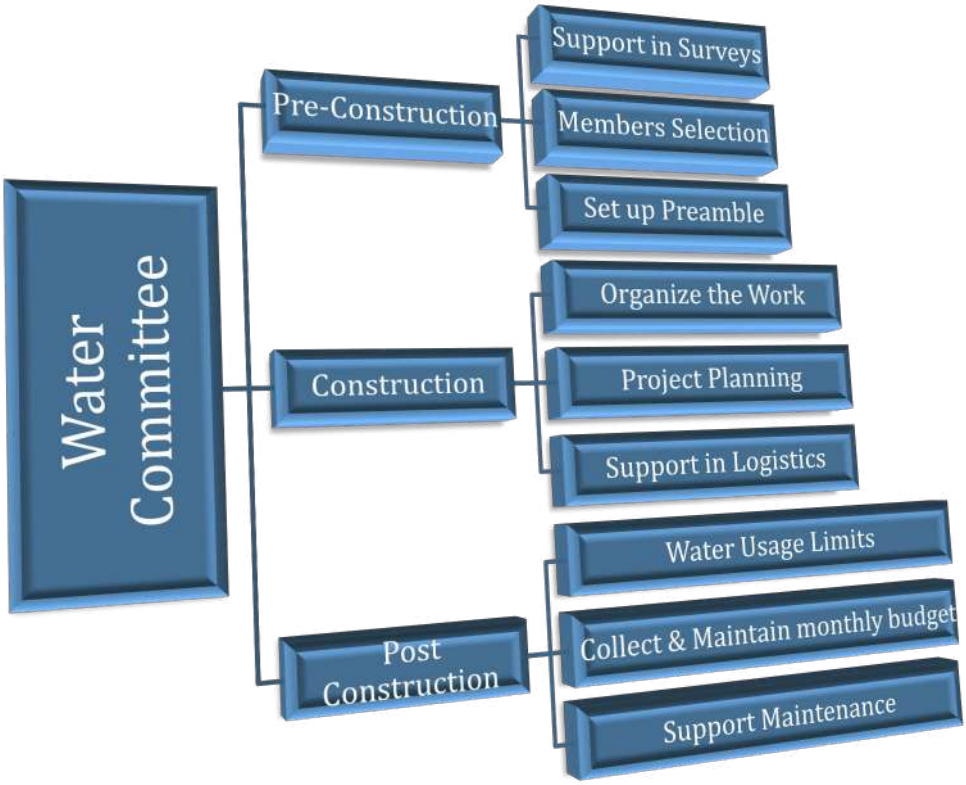
- The committee members helps the surveyor in going door to door and conducting the surveys
- Along with Sarpanch and senior folks in the village, the members for the committee are finalized
- The roles and responsibility of the body is discussed and finalized

Construction

- Coordinate with the team and organize the work
- Villagers are the most knowledgeable people about village surroundings, so they help in building up the project plan
- Support the team in transportation of construction materials, loading & unloading of materials and storing the materials

Post – Construction

- Plan and finalize on the water usage rules
- Collect and maintain the budgets collected from each household for the maintenance work
- Coordinate the team in support and maintenance activities



Lessons Learnt

Over the years, VJNNS has several experiences which has made us to understand and learn various improvements. One of the key lessons is that it is very necessary to strengthen the local community. The village community should be united and must have same understanding toward implementing of GFWSS. As mentioned earlier, VJNNS use to make sure that the morale of the community is always positive and they should help each other. More the villagers take this unit construction as their responsibility more advantageous it will be in a long run.

It's very difficult to have construction done during the rainy season as rain water fills in the construction pit and causes problems for the villagers to carry on with the work. We observed that during 2 months of rainfall, we better engage in community education and awareness programmes and continue construction only after the rain.

While approaching villagers from the tribal belt, one important aspect becomes communication. As tribal villagers have a different dialect of the language and it becomes difficult for the team to discuss and make them understand. During these villages we tend to extend the timeline as it takes time to make them understand during Shramadaan.

The construction of distribution tank happens near to the habitation of villagers and sometimes we face a challenge in terms of having the land given by the villager for construction of GFWSS. Lot of farmers are afraid of handling the land for the construction due to obvious reasons. We had to

convince them and explain about the complete process. This becomes difficult if unity among the villagers is not so great, but we have observed that over a period of time, as and when awareness and training programmes are attended by these villagers they tend to see the overall picture of the complete project. If cooperation among villagers are not strong then it's also a challenge as lot of difference will delay the construction process.

The spring source always needs to be protected by animals and other unwanted interference and this was mainly done by making plantation surrounding the source tank. We use to approach the NREGS department and use to get saplings to plant around the source tank. This provides protection and also shade to the source resulting in less evaporation process during summer time. Plantation was also another support activities that we use to undertake to protect the environment from pollution.

FAQs

1. How is the demand for GFWSS from the community estimated?
    - During our initial survey, VJNNS surveyor visits each and every household and collects the details. A review will be done on the population estimates to make sure the information is accurate. As per UNICEF guidelines each person will consume 55 litres (including drinking, household activities, washing etc) + 20 litres for their livestock (Cows, sheep, goat etc) After this each household the minimum water needs are estimated based on whether they need 55 or 75 litres. This way complete village water demand is estimated.

2. What Parameters and Approaches were adopted to identify a reliable spring source?

    - VJNNS takes requisition from the community, and based on this request we go ahead and conduct the Micro Level Plans (MLP), during these MLP preparation, we consult with senior members from the village about the spring source. Since these senior folks will be observing the behaviour that info would help us better. Adding to that, the tech team also conducts various spring study methods to find the stream velocity, recharge and discharge flow rates and calculate the spring yield.

3. How is the community engaged in the design and planning phase? Are they involved or VJNNS engineers take a collective decision?
    - VJNNS team comes down to village and discuss with villagers about their problems and then list down all the problems. Based on further discussion, with the help of community, VJNNS breaks down these problems to main cause and prioritize them. "Water" seems to be the most crucial topic and decides to implement GFWSS. Initially planning is taken place with the help of community. During design phase, there are 2 phases, social mapping of the village and technical design of the system. Social mapping is done with the help of villagers but technical design decisions are taken by engineers from VJNNS.

4. What methods were adopted to ensure ownership of a GFWSS of the community?
        - VJNNS involves the community from initial phase of planning and make training programmes and create awareness among villagers. The construction of GFWSS

takes place with Shramadaan (donation of hard work) from villagers which creates a sense of responsibility among them toward the construction. We also help the villagers to form a Committee for the overall development of the village. This committee is responsible for collecting monthly budget and deposit in bank accounts for any repair work.

5. For what demand is the system designed? Capacity building?
    - The system is designed keeping in mind the water demand of the villagers. Initial survey helps the technical team to determine the water requirements and based on that the system is designed. Let's say the water demand is x litres then keeping an eye on the future increment in the demand the tank is constructed with capacity of (x + y) litres. This decision is taken solely by VJNNS team based on past year experience.

6. How many years can the system serve the community without any additional capital investment.
    - The system is designed in such a way that the water supply is there for a lifetime. This is no maintenance project, which only requires some pipeline repair in case of damage. Every 3 to 6 months' time, villagers are advised to cleanse the filter media for any impurities.

7. What is the per capita water consumption assumed while building the system?
    - 55 litres per day per human being + 20 litres for any livestock.

8. What is the peak flow factors considered?
    - During summer, the yield from the spring source reduces due to evaporation and during such time, the village committee follow the water usage rules which are set up post construction period.
    - During rainy season, the yield will be more and water overflows from the distribution tank, this water is redirected to the nearby kitchen garden.

9. What measures were taken to ascertain source protection?
    - Spring protection is taken place by planting saplings around the source so that it will be covered and shade will be provided. This will help in reducing the evaporation rate. Also these plantation helps from animals contaminating the spring. Saplings are provided by the Forest Department & NREGS of AP Govt.

10. What was the size of the distribution tank arrived at?
    - The size of distribution tank is arrived by the water need of a village. The size varies from village to village based on the population.

11. What is the filtering mechanism adopted to make it fit for potable use?
    - The filtration mechanism that is used in Gravity Fed Water Supply System is Slow Sand reverse filter. It is a three chambered tank in which first two tanks will have sand and pebbles layer and third one stores the water. First tank is reverse sand & stone filter

and second tank is normal sand & stone filter system. Filtering material used are: sand, pebbles and screen plates.

12. What is the material used for pipeline construction?
    - High density polyethylene pipe used for pipelining.

13. What is the period of reliability of tanks and pipeline?
    - The reliability of the tanks is 55 years and pipelines is 25 years.

14. What is the role and contribution of the community in the construction process?
    - Before constructing the GFWSS, the VJNNS has given trainings to community i.e pre – construction training. In those training the team of VJNNS has explained to community, what VJNNS can do for GFWSS & what community can do for GFWSS.
    - Community has contributed to shramadhan.
    - VDC collect rs.10 for each house hold for GFWSS maintenance.

15. What are the total materials required for complete construction?

No.	Material Particulars	Quantity
1	Cement	150 bags*
2	Steel/Iron	1500 Kg*
3	HDPE (High Density Polyethylene) Pipes	2850 Meters*
4	Sand	6 tractors/trucks*
5	Metal/Chips	1 truck
6	Bricks	600 Numbers*
7	Transport vehicles	1 or 2
8	Plastering tools	As required
9	Plumbing tools	As required
10	Pipes Cutting/welding tools	As required
11	Social Audit Boards	1

***NOTE: - These values are totally depended on the water demand and size of the distribution tank**

16. What is the contribution from the village?
    - Shramdaan (donation of hard work)

17. What mechanism is adopted to fund the O & M expenses?
    - As soon as the construction is over, the village committee sets up a Village Development Fund (VDF) at a bank and collects monthly a small fee to contribute to the account. This VDF is used for any Operational and Maintenance expenses such as pipeline repair, any replacement of filter media etc

18. Who oversees the O & M issues? And how?
    - VJNNS has appointed a project coordinator who looks over all the O & M work for any village. Minor issues are rectified by the community and project coordinator and if any major issues occurs then technical team is called upon.

19. How is the expenditure for O & M issues met?
    - O & M issues amount will be met from Gramnidhi (Village fund), which was developed by VDC (Village Development Committee).

20. What was the process adopted to get the community to participate?
    - VJNNS get commitment from villagers to do Shramdaan for completion of GFWSS construction. All the village members are given trainings before the construction work in order to understand the grave importance having such system in place.

21. What are the direct and indirect benefits that have accrued since the commissioning of the system?
    - The first and foremost important aspect is that water is available for these villagers throughout the year without any interruption.
    - Its free maintenance project.
    - Its community owned project.
    - Villagers are better aware of importance of water and uses carefully.
    - Economic development of village as women are able to help generate some revenue for the family.
    - Better awareness due to the training programmes on Water, Sanitation and Hygiene (WASH) practices.