M7-ALIRAN GRAVITASI

The component a gravity-flow water system
- An elevated source of water: spring, clean river, or river. Where disinfection is necessary, simple methods should be used
- A sedimentation tank (if necessary)
- The main pipeline
- District reservoir
- Network of smaller pipes
- Standpipes
- Washout valves

Advantage
- Requires no energy to operate as the water is propelled by gravity alone
- Water is delivered when required, close to the user’s home
- Can be built by the village people
- System of different sizes can be built for different numbers of people

Disadvantages
- Depends on the quality of water source. Additional treatment facilities may have to be built if clean water is not available
- Water may not provide adequate amounts of water throughout the year
- Water rights cause problems in some area
- The systems require regular maintenance, especially the care of the taps

Design Procedure
1. Locate the reliable, clean source
2. Determine the consumption of water
3. Choose the pipe alignment
4. Calculate the reservoir and sedimentation tank
5. Locate air release valves, washouts, and break-pressure tanks
6. Establish the locations of the reservoirs
7. Determine flow per tap
8. Locate valves

Locate the reliable, clean source
- The cleanest source possible, even if it is not the closest one to the village
- The intake for the water has to be carefully built
- If the source is a stream the location must be chosen to be as free of contamination as possible
- If the water is contaminated, a water treatment system may be installed
- The flow rate must be determined
Determine Consumption of water

- The amount of water required by one person
- An estimated used:
  - Drinking
  - Cooking
  - Washing
  - Additional uses such as livestock watering
- Vary from region to region as it depends on local custom, the availability of water and the uses for piped water
- Typical value: 15-50L/day

Establish the locations of the standpipes

- Should be done with the advice of users through the Community Committee
- Can be located in common areas to serve a large number of households or in yards to serve a few households
- The precise number of people per tapstand depends on the number of hours of used
- For high density areas large standpipes with many taps may be built
- The location should set out on a plan and checked in the field
- Taps should be kept away from streams and rivers

Choose the pipe alignment

- A steady gradient should be maintained wherever possible
- The length of pipeline should be kept to a minimum
- Avoid pipeline alignments which will require constant maintenance:
  - Hillsides
  - Numerous stream crossings
  - etc

Determine Flow per Tap

- The present population
- Appropriate increase per year
- The lifetime of the project
  - 15 years is suggested
  - The maximum 25 years
- Water usage for: school, health centre, other institutions

Design the main Pipeline

- PVC is fairly low-cost and is usually easy to obtain
- High Density polyethylene (HDP)
- Asbestos Cement (AC)
- Galvanized Iron (GI)
Head loss

- Placed high enough to give adequate pressure
- Needed if the source cannot supply all of the water needed in working day
- May also be installed to save money. A study should be undertaken to determine whether it is cheaper to
  - Put in a large pipe
  - Put in a reservoir to cope the peak demands

Reservoir & Sedimentation tank

- Allow solids to settle out

Sedimentation tank
Reservoir

Locate air release Valves, Washouts and Break Pressure Tank

- Air release valves: located at high points on the pipeline to prevent “air locks”
- Washouts are located at low points
- Break pressure tanks

Locate Valves

- Located at the inlet for every tank

Organization of a Gravity-Flow Water Project

Community Request

- The community needs the technology
- The technology is appropriate to the abilities and the social and cultural patterns of the community
- There is sufficient demand for technology

Preliminary Feasibility Survey

Technic
- Visit all potential water resources
- Assess the quantity (flow) and quality
- Attempt to estimate lowest dry season flow
- Examine potential pipeline routes

Social
- Discuss project with community leader
- Estimate population to be served
- Assess potential of community participation
- If possible, examine condition of past community participation projects
Detailed Community Survey

**Technical**
- Water resource survey
- Topographical and Subsoil Surveys
- Local Building Techniques and Supplies

**Social**
- Population
- Water Use Practices
- Leadership Patterns
- Community Participation

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**Construction**

<table>
<thead>
<tr>
<th>Project Engineer</th>
<th>Field Supervisor</th>
<th>Field Technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepares Project Schedule</td>
<td>Assists the community committee</td>
<td>Maintains and completion of all tasks</td>
</tr>
<tr>
<td>Arranges Material Delivery</td>
<td>Monitors Field Technicians</td>
<td>Distributes labour and artisans</td>
</tr>
<tr>
<td>Supervises Field Work</td>
<td>Provides support and supervision</td>
<td>Supervises self-help labour</td>
</tr>
<tr>
<td>Ensures Community Participation</td>
<td>Maintains stores of materials and equipment</td>
<td>Manages communication</td>
</tr>
<tr>
<td>Supervises Artisans</td>
<td>Orchestrate the allocation and use of project</td>
<td>Oversees specific technical operations</td>
</tr>
<tr>
<td>Inspects Final Project</td>
<td>Interprets simple construction plans</td>
<td>Oversees site, stores and equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reports to site supervisor</td>
</tr>
</tbody>
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**Construction...2**
- **Artisans**: have specific job tasks for which they must be qualified
- **Labourers**: have general tasks to perform although they may be trained for more specific jobs

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**Divide community into work forces**

**Preliminary work such as clearing the site**

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**Standpipe...1**

**Standpipe should be**
- Strong
- Have a large platform area
- Good drainage
- Social acceptability

**The platform should be**
- Constructed of stone slabs or concrete
- The edge should be raised to contain splashing water

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**Construction...**
Standpipe...2

Splash water can be drained away to a soakway or used to irrigate a small vegetable garden.

The drain must have a good gradient, either an open channel or a buried plastic pipe stretching at least 3m away from the standpipe.

Operation and maintenance Functions
- Maintenance Assistant
- Maintenance schedule
- Carrying out of all repairs and preventive maintenance work
- Headworks Watchman
- Community Maintenance Responsibilities

Regular maintenance
- Cleaning of screens at the intake
- Routine cleaning of tanks
- The occasional adjustment of valves

Other common maintenance
- Preventing erosion damage
- Mending pipe burst
- Repairing standpipe

Maintenance should be regularly

Water resource survey
- Select water sources with the best potential
- Measure minimum rate of flow
- Measure quality of the water
- Evaluate desirability
  - Potential for contamination
  - Potential for future expansion
  - Ease of contraction
  - How difficult it will be to protect the intake works against erosion, floods and contamination
- Ensure that community has water rights to the source

Topographical and Subsoil Surveys
- Potential pipeline
- Survey subsoil depth
- Location for sedimentation and reservoir
- Shortest route

Local Building Techniques and Supplies
- Local building methods
- Sources of building materials
- Assess the skills of local
- Evaluate the labour requirements
- Sketch a system layout