# Module two Questions

1. Explain how girls are victims of torture when the source of collecting water is far and inconveniencing, from the dimension of cultural beliefs and practices

When sources of collecting water for domestic use is far and inconveniencing, girl child usually suffers as a victim cultural beliefs and practices. In India and most African countries, water collection is socially regarded a woman’s responsibility irrespective of her physique. She’ll have to endure illness, menstruation or any other suffering she undergoes because no assistance will be forthcoming from her male counterpart. The urban women and girls especially those living in city outskirts and in the slums are no different. This is because in instances where water is supplied in the middle of the night, these girls get deprived of their sleep to go fetch water as the other household members continue sleeping, yet it’s the girl child who has to wake up early again and prepare breakfast for the family before rushing to school (Graham, Hirai, & Kim, 2016).

Incidences of girls being denied education purely on the basis of staying behind to help collect water and assist in other household chores have been reported by Folifac, & Gaskin, (2011; Bekele, & Seyoum, (2016) and Koolwal & Van de Walle, (2013) among others. Such incidences deny girls their rights to education and an opportunity for them to fully experience their childhood in addition to the risks of being raped, getting attacked by wild animals or even developing psychological trauma from unnecessary harassment form the parents whenever they fail perform this tasks and or exhaustion from long distances travelled especially in rural areas (Ngomuo & Msoka, 2018). In Sub-Sahara Africa and Asia for instance, it takes about 33 minutes and 21 minutes in rural areas and 25 minutes and 19 minutes in urban centers to respectively access water roundtrip (UNICEF, 2016).

1. Why do we need an alternative source of water in rural and slum areas and what options are available?

The primary distinction between water supply in urban and rural areas is the existence of the much needed infrastructure in the former. Water supplies in many countries have customarily been in favour of urban population at the expense of the rural inhabitants.

Rural areas mostly rely on Surface water sources (lakes, reservoirs, streams, and rivers) which are generally of poor quality and often liable to seasonal failures. Extraction and supply from such conventional sources, are not cost effective, thus prompts the need to design and construct more reliable, consistent and low cost sources. Some of the alternative options include:

**Yard taps:** This method of supply is a compromise between in-house or single family connections and the community. It’s a public supply not only suitable for rural settlements, but also in unplanned and low income urban settlements. Possible water source for a yard tap can be urban or rural utility network whose supply can either be from the ground or surface. The advantages for this option are that it’s convenient, costs are shared and there’s minimal water contamination. Disadvantages on the other hand include possible use disputes, lack of cooperation by other households and high rate of water wastages. The responsibility of managing a yard tap depending on its location can be taken up by a provider, private entrepreneur, non-governmental organization or community.

**Stand posts:** Also referred as standpipe or communal water point, stand post is an appropriately reinforced water pipe that is linked with a water supply system that’s dispensed through a tap or spout accessible to the public who can then draw the water for their domestic and other uses. Whereas stand posts are at times installed as intermediate a head of connection to main water supply systems, this could as well be a decade long only feasible option for rural communities. That’s why public stand posts have remained significant mode of fast-tracking water delivery in rural and marginal areas of the urban slums. This has underscored a necessity for a well-designed and planned existence of stand posts in areas with low water connection, so as to minimizing outbreak of diseases associated with water contamination (Ngomuo & Msoka, 2018).

1. Explain the process of harvesting rain water in rural areas

Rainwater harvesting involves diversion, collecting, storage, usage, and management of rain runoff (Aroka, 2010). During rainy seasons, rainwater which would otherwise have been lost as surface runoff, can be harvested, stored and distributed to homesteads in rural areas facing scarcity. Some of the popular water harvesting techniques used in rural areas include subsurface dams, roof catchment and rock catchments.

For roof catchment, rainwater harvesting system comprises of three basic elements; collection or catchment area, conveyance system and storage facilities. The roof which is the collection area need be made of corrugated iron, tiles, slates, or asbestos sheets for effective employment of this technique. Conveyance system which directs the flow into storage facility is composed of gutters and faucets made of chemically inert materials such as plastic or aluminum. Storage facility on the other hand is where storage of collected water takes place. Storage facility just like conveyance system, must be made of recommended material like reinforced concrete, stainless steel, plastic or any other suitable inert material.

Successful harvesting occurs when water from the catchment area (roof) is directed to flow through gutter arrangements that’s evenly slopping in the direction of a downpipe to avoid stagnation. The downpipe then leads the flow into a storage facility which can be underground or free standing above the ground surface. In order to maintain quality of water collected, it’s recommended that the first flush from roof collection at the onset of every rainy season be diverted as it would have accumulated dust and other filths like bird droppings, leaves, etc. As much as regular cleaning of all the systems is deemed appropriate, a mesh wire placed between the gutter and downpipe would help sieve off some of the debris and prevent them from ending up into the storage system.

As much as Liang & van Dijk, (2011) finds rainwater harvesting to have positive effects in the society, challenges such as affordability, poor roofing materials, lack of suitable harvesting facilities and housing occupancy status are some of the factors still hindering advancement of this noble technology (Opare, 2012)

1. Explain how community water catchment areas are protected in rural areas from extinction and from contamination

Before functioning of a new water source, comprehensive site investigation ought to be undertaken to establish the quantity and the quality of its water to avoid use of possibly contaminated water. If it’s of acceptable quality, the water oozing point is subsequently located by excavating around the source and down through into the impervious layer. The process of securing the catchment can thereafter take place as follows:

* Construct a concrete waterproof protection box over the water source to prevent possible contamination.
* A withholding barrier that is also waterproof is then raised in front of the protection box so as to ensure water flows to a delivery pipe. Where flow keeps fluctuating, a collection box may be built to stock more water.
* Intake and overflow faucets must be screened to keep away rodents and insects from accessing the water. Both the spring and the collection box if any, should also not allow any leakages. Depending on the intended location of supply, water can either flow by gravity or get pumped. Inspection hole must equally be tightly enclosed and ensured it remains under key and lock at all times.

Further protection for rural sources like springs can be achieved by digging a channel all round to divert surface runoffs from contaminating it. The ditch ought to be deep enough to handle runoffs from a heavy downpour. The perimeter of the water source should also be fenced or hedged to prevent unauthorized entries and trees or shrubs planted within to trap dust and any other materials carried by the wind.

1. Briefly discuss why it is unwise for drinking water to be in contact with sewerage

Drinking water must never get mixed with drinking water because of the following reasons:

1. Sewage or wastewater contain disease causing pathogens like bacteria, amoeba, viruses as well as eggs and larvae of parasitic worms. Diarrhea, dysentery, cholera and typhoid are some of the deadly diseases linked to untreated sewage.
2. Sewage have foul smell that make water undrinkable
3. Sewage sludge from industries and hospitals for example may contain harmful heavy metals and elements of antibiotics, X-ray contrast agents, disinfectants and pharmaceuticals (Gros et al., 2014)
4. Briefly discuss the types of sewerage system discussed and their applicability

**Combined system:**

This type of sewer is designed in a manner that it collects water from rain runoffs and wastewater in the same pipe and channels them into a sewage treatment plant where it’s treated before it gets discharged. The system is also designed such that whenever there’s a high volume of surface runoffs emanating from a heavy rainfall to the extent that it surpasses sewer capacity, the system allows an overflow of both rain water and untreated sewer into stream and rivers close by.

***Applicability:***Combined sewer system is appropriate where there’s convenience of a centralized and large capacity treatment facility.

*Advantages*

* No need for flushing in areas with high rainfall. It self-cleanse with surface runoffs
* Only one plumbing pipe is required
* Easy to layout especially in congested areas

*Disadvantages*

* High cost of operation at the treatment plant due to high inflow volumes
* Not suitable in areas experiencing minimal rainfall
* Causes pollution when there’s an overflow
* Uneconomical if pumping is required

**Separate System:**

Unlike the combined system, a separate system just as the name suggests have separate conduits for surface runoff and sewage. Storm water pipe directs it to nearby water bodies. Sewage conduit on the other hand, is first directed to a sewage treatment plant for appropriate disinfection before being discharge.

*Applicability:* The design is suitable in larger cities where expertise and resources are available to implement, operate and maintain (Mannina & Viviani, 2009). It’s also applicable in areas with low rainfall since storm water can be harvested separately, stored and used when there’s shortage.

*Advantages of separate system*

* Load on treatment plant is easy due to separation
* Storm water is not contaminated since there’s no mixture with sewage
* Economical when pumping is required

*Disadvantages of separate system*

* Small size makes cleaning of sewage Difficult
* Storm sewage operates only during rainy seasons
* High cost of maintenance
* No self-cleansing, hence flushing may be required
* Difficult to install in congested areas

***Partially separate system:***

This system is an intermediate of combined and separate sewage system. It helps reduce the load of the combined system and the lag of the separate system using trenchless technology that enables creation of additional sewerage system with limited disturbance of the original network.

The working mechanism of this system is that partial storm water, say from roofs and paved yards is admitted in the sewage line. Any other surface runoff is collected separately and directed to an exclusive water conduit that discharges into a water body.

**Advantages**

* Combines advantages of both combined and separate systems
* Storm water minimizes chances of choking
* Its moderate size makes cleaning easier
* Drainage of roof and pavement runoffs is simplified

**Disadvantages**

* Rain water may increase load on treatment plants
* Low self-cleansing velocity during dry seasons
* Cost of pumping maybe higher compared to separate system.

1. What are the considerations that one has to bear in mind before choosing a particular sewerage system? Briefly explain your choice of answer

The following are the guiding considerations when selecting a suitable sewage system:

1. *Topography:* combined system sewers are liable to silting during non-monsoon season, hence they are required to be laid at steeper gradients.
2. *Capacity of treatment plant:* Large quantity of wastewater is required to be treated before discharge in case of combined system. Large capacity treatment plant is therefore required.
3. *Construction Costs:* Consider your available budget. Some systems are more costly to construct than others
4. *Availability of space:* some systems require larger construction spaces. This may not be appropriate in congested streets, small or premium properties where space isn’t readily available.
5. *Ease of Operation*: All systems require maintenance at some point. Availability of maintenance experts and associated costs should be considered since it varies from system to system.
6. *Reliability***:** Some systems have a greater failure rate than others.
7. *Aesthetics***:** Some systems are lower to the ground than others hence aesthetically appealing.
8. Explain how the water distribution system can be a source of diseases to the water cycle and how it can be reversed.

Storage tanks and reservoirs can be the source of disease to the water cycle in that when left for prolonged period, it attracts certain oduor that makes water unsuitable for use. Laxity in security at the reservoirs can also result in deliberate contamination of distribution systems.

The above threats can be averted by improving security and restricting access of unauthorized persons to the reservoirs. Additionally, water shouldn’t be stored over long periods before use.

1. Explain how the distribution system of water in an urban center should take care of hydrants

Hydrants are mainly part of firefighting aspect of water system. Their design, spacing and maintenance should be in such a way that the flow meets firefighting requirements. The equipment should be exercised and tested annually to meet and satisfy ISO 1980 certification. The location of the hydrants must be free from pedestrians and other vehicles for easy accessing of firefighting engines and personnel during emergency situations.

1. Explain in great detail the uses of storage tanks

The primary functions of storage tanks include:

* Provide water storage capacity and make it available whenever fluctuation in demand is experienced
* It’s a water reserve supply for firefighting and other emergencies
* Help in stabilization of pressures in the distribution system
* Blending of different water sources can take place in storage tanks/reservoirs.
* Storage tanks reserve of treated water that will minimize interruptions of supply due to failures of mains, pumps, or other plant equipment;
* Acts as a relief valve on a system of mains supplied by pumping;
* permit a reduction in the size of distribution mains below that which would be required in the absence of a reservoir;
* Allow pumping at the average rather than peak flow rate.

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