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Course : Certificate in wash

Course unit : Module one questions

Date of Submission : 29th November 2018

# 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
2. Why do we need an alternative source of water in rural and slum areas and what options are available?
3. Explain the process of harvesting rain water in rural areas
4. Explain how community water catchment areas are protected in rural areas from extinction and from contamination
5. Briefly discuss why it is unwise for drinking water to be in contact with sewerage
6. Briefly discuss the types of sewerage system discussed and their applicability
7. What are the considerations that one has to bear in mind before choosing a particular sewerage system? Briefly explain your choice of answer
8. Explain how the water distribution system can be a source of diseases to the water cycle and how it can be reversed.
9. Explain how the distribution system of water in an urban center should take care of hydrants
10. Explain in great detail the uses of storage tank

**Answers to question one.**

Women and girls are disproportionately affected by the water crisis, as they are often responsible for collecting water. This takes time away from work, school and caring for family. The lack of water and sanitation locks women in a cycle of poverty.

Empowering women is critical to solving the water crisis. When women have access to safe water at home, they can pursue more beyond water collection and their traditional roles. They have time to work and add to their household income.

The traditional and cultural practices in most developing counties in Africa associates the sole responsibility of fetching water to women and girls, they walk long distances to remote and dangerous places to look for water and this water when collected is carried in buckets and Grecians which are heavy hence affecting the health of both women and girls

### Children’s and education crisis; Children (Girls) are often responsible for collecting water for their families. This takes time away from school and play. They spend hours in queues waiting to collect water as result they end up not going to school and limited to enjoy the right to Education.

Time spent gathering water or seeking safe sanitation accounts for billions in lost economic opportunities. Access to safe water and sanitation at home turns time spent into time saved, giving families more time to pursue education and work opportunities that will help them break the cycle of poverty.

Women and girls are at high risk being affected with diseases such as Malaria due to the long hours spent at the water source exposing them to mosquito bites and other water bones diseases that arise due to contact with contaminated water such as cholera and spread of other infectious disease leading mortality and maternal death rates.

**Answers to question two.**

Alternative water systems have been used in rural areas for decades. They obviously are an option in new urban areas where no central infrastructures pre-exist, and in extra- urban areas.

In addition, alternative water systems might be considered in city centers with decaying water infrastructures or with infrastructures meeting diseconomies of scale or capacity constraints, and in projects of urban renewal. They are more competitive in unstable contexts, where flexibility, resilience and adaptation are valuable (i.e. a context created by climate change in many places).

They are even more relevant where property developers operate the buildings they invest in. In any case, the most appropriate infrastructure may very much depending on policy orientations, as no single system’s performance is systematically superior for, e.g., water conservation, recycling nutrients, and keeping construction costs low. One size does not fit all the different functions of urban water services (e.g. supplying potable water, non-potable water uses, rain water management, sanitation) and the most appropriate scales for each function have to be combined and articulated.

**Question three**

Rainwater harvesting consist of capturing the rain where it falls or capturing and storing the runoff in farms, villages and towns. Measures should also be taken to keep the water clean. This technique was widely used for the provision of drinking water in Europe and Asia particularly in rural areas.

Where piped water supplies have been provided, the importance of rainwater has a source has diminished. On some tropical islands rainwater continues to be the only source of domestic water supply. Rainwater harvesting should be considered as a source of domestic water in countries where rain comes in storms of considerable intensity. It is used in many different ways: in some parts of the world only a small storage capacity is required, in arid areas a sufficient large collection surface area and storage capacity will be required to provide enough water.

Rainwater harvesting can consist of a collection surface, a storage tank, and guttering or channels to transport the water from one to the other. Sometimes it includes a first-flush system to divert the initial dirty water that contains roof debris built up during prolonged dry periods, filtration equipment’s and settling chambers. A wide variety of systems are available for treating water before, during and after storage.

The level of sophistication also varies from extremely high-tech to very simple techniques. Filters are often use for filtering water entering a tank and use sand, stone, gravel or charcoal or a combination of these as filter material.

The storage tank is usually the biggest capital investment element of a rainwater harvesting system for domestic water, it therefore require the most careful design to provide the best capacity with the lowest cost as possible. For larger storage volumes, tanks or cisterns constructed of brick or stone masonry are used most.

**Answers to question four**

A catchment is an area where water is collected by the natural land scape. The outside edge of a catchment is always the highest point. Gravity causes all rain and run-off in the catchment to run downhill where it naturally collects in creeks, rivers, lakes or oceans.

Rain falling outside the edge of one catchment is falling on a different catchment, and will flow into other creeks and rivers. Some water also seeps below ground where it is stored in the soil or in the space between rocks. This is called groundwater.

Water [catchment management](https://www.waternsw.com.au/water-quality/catchment/manage) activities involve a combination of science and research, enforcing laws, providing grants and incentives, education and training, and land improvement work.

Major catchment management activities to be conducted to protect water quality include:

* Dairy waste disposal - support for dairy farmers to better collect and treat waste from dairy sheds and feed pads for re-use as fertilizers.
* Land improvements - grants and other support for catchment landholders and farmers to use practices that manage stock access, increase vegetation and reduce erosion near creeks.
* Training - on-farm training to catchment grazers on using sustainable practices, such as increasing pasture cover, to improve water quality.
* Rural and urban development - support and tools for councils and developers to ensure new housing and industry developments have a minimal impact on water quality.
* Pest and weed control - on Water NSW land and in the Special Areas, in partnership with the National Parks and Wildlife Service.
* Mines - support to remove, remediate and control contaminants from derelict mines sites.

### ****Living and working in the catchments****

People living and working in the drinking water catchments can do simple things to help keep the environment our water comes from healthy:

* Trees and shrubs - plant or retain native trees and shrubs to help prevent soil erosion.
* Riverbanks - protect plants on the banks of streams and rivers to provide a buffer against pollution.
* Weeds and pests - use organic herbicides and pesticides for control.
* Sewage systems - do regular maintenance on on-site sewage systems to prevent overflow or leaks.
* Oil and grease - don't pour down the sink, instead put in a container and then in a bin.
* Chemicals - use carefully and dispose of any leftovers responsibly at household chemical collections days.
* Report spills - immediately report spills of dangerous liquids such as petrol, oil or chemicals.

and don't allow pets to wander in the bush, and clean up after your dog with a pooper-scooper or plastic bag.

* Get involved - join a local Land care or Stream watch group, or apply for a community grant.

### ****Visiting the catchments****

People visiting towns or bushland in the catchments can also do simple things to help keep the environment our water comes from healthy:

* Camping - take your rubbish away with you, and make sure fires are completely extinguished.
* Bushwalking - keep to marked trails, take only photographs and leave only footprints.
* Warning signs - obey signs in parks, and leave parks in a better state than when you found them.
* Fires - help prevent bushfires by knowing the fire danger level, and obey fire warning signs.
* Pets - don't allow pets to wander in the bush, and clean up after your dog with a pooper-scooper or plastic bag.
* Rubbish - pick up rubbish, even if it's not yours.
* Report spills - immediately report spills of dangerous liquids such as petrol, oil or chemicals.

**Answers to question five.**

More than 2 million people die each year from diseases such as cholera, typhoid, and dysentery that are spread by contaminated water or by a lack of water for hygiene. These illnesses have largely been eradicated in developed nations, although outbreaks can still occur. In 1993 and infestation of cryptosporidium, a protozoan that causes gastrointestinal illness, killed 110 people and sickened an estimated 400,000 in Milwaukee, Wisconsin. The city's water treatment system was in compliance with federal and state regulations at the time, but after the outbreak federal regulators increased testing requirements for turbidity (cloudiness) in drinking water, an indicator of possible contamination. Water-related illnesses fall into four major categories:

Waterborne diseases, including cholera, typhoid, and dysentery, are caused by drinking water containing infectious viruses or bacteria, which often come from human or animal waste.

Water-washed diseases, such as skin and eye infections, are caused by lack of clean water for washing.

Water-based diseases, such as schistosomiasis, are spread by organisms that develop in water and then become human parasites. They are spread by contaminated water and by eating insufficiently cooked fish.

Water-related insect vectors, such as mosquitoes, breed in or near water and spread diseases, including dengue and malaria. This category is not directly related to water supply

**Answers to question six**

**Sewerage system** refers to a network of pipes, pumps, and force mains for the collection of wastewater, or sewage, from a [community](https://www.merriam-webster.com/dictionary/community). Modern sewerage systems fall under two categories: domestic and industrial sewers and storm sewers. Sometimes a combined system provides only one network of pipes, mains, and outfall sewers for all types of sewage and runoff. The preferred system, however, provides one network of sewers for domestic and industrial waste, which is generally treated before discharge, and a separate network for storm runoff, which may be diverted to temporary detention basins

Combined Sewers are large networks of underground pipes that convey domestic sewage, industrial wastewater and storm water runoff in the same pipe to a centralized treatment facility mostly found in urban areas do not require on-site pre-treatment or storage of the wastewater Transport all their wastewater to a WWTP where it is treated and discharged to a water body

Combined system applicability.

Suitable for urban areas with resources to implement, operate and maintain the system Appropriate when a centralized treatment facility is available Planning, construction, operation and maintenance require expert knowledge Infiltration may hamper the performance combined sewers

Separate Sewers Separate sewer systems are designed to convey wastewater and storm water in separate pipes Sanitary sewer systems collect and transport wastewater Storm sewer systems collect and transport storm water runoff Sanitary sewer systems may also collect wet weather flow via illicit connections from house drains or storm sewers, as well as through defects in the pipes and manholes

Separate Sewers – Applicability The same applicability as combined sewer Suitable for urban areas with resources to implement, operate and maintain the system Appropriate when a centralized treatment facility is available Especially suitable in areas where irregular, heavy rainfall is expected to avoid frequent combined sewer overflows

Simplified and Condominal Sewers describe a sewer system that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than conventional sewers Allows for a more flexible design associated with lower costs and a higher number of connected households Because the sewers are more communal, they are often referred to as condominal sewers

Simplified sewer – Applicability Where the ground is rocky or the groundwater table is high They can be installed in almost all types of settlements and are especially appropriate for dense urban settlements It is recommended that the scum from greywater, heavy solids and garbage be removed from the wastewater prior to entering the sewer to avoid frequent clogging

Solids-free Sewers These are similar to conventional sewer systems, except that the wastewater is pre-settled and solids removed before entering the system As solids are removed, sewer diameter can be much smaller and they can be constructed using less conservative design criteria (lower gradients, fewer pumps, less pipe depth, etc.) resulting in significantly lower investment costs Due to the simplified design, solids-free sewers can be built cheaper

Solids-free sewer – Applicability They are well suited for areas where soak pits are inappropriate due to sensitive groundwater or lack of space for on-site infiltration discharge of non-pre-settled wastewater into the sewers should be prevented require a constant supply of water, although less water is needed compared to conventional sewers

Pressurized Sewerage system differ from conventional gravity collection systems, because they use pumps instead of gravity to transport wastewater The primary effluent is delivered to the collection tank by gravity where it is grinded (pressed) before being transported into the pressurized a system by pumps The system can be built with only shallow trenches and relatively small-diameter pipe. It is an effective solution where conventional systems are impractical such as in rocky, hilly or densely populated areas or areas with a high groundwater table

Pressurized Sewers – Applicability Flat topography: gravity systems demand installation at great depths to maintain adequate flow ( and require pumping) Rock layers, running o sand or a high groundwater table make deep excavation difficult Densely populated areas

**Answers to question seven.**

The following are the consideration to be taken into account before choosing a particular sewage system.

The number of conduits, you will require two conduits in case of separate sewage system whereas in combined system, only one bigger size is required.

The intensity of street congestion, where streets are congested, it’s very difficult to use separate system that requires the use of two conduits and in this case a combined system should be considered.

Treatment plant, where there is large quantity of waste water, there is need for treatment plant where the waste is treated before its being discharged in case of combined system hence large Capacity treatment plant is required.

In combined system, sewers are liable for silting during non-monsoon season hence they are required to be laid at steeper gradients. The steeper gradients require more number of plumping stations especially for flat terrains thus making it costly.

In separate system, sewage is only treated before discharged into natural water body or used for irrigation. No treatment is generally given to the rainwater collected before it is discharge in natural water body.

If you intend to consider separate system, pumping is required only for sewage and it can be avoided for storm waterlines as they are not very deep and normally laid along the natural slopes.

The capacity of the pumping station; where a person has chosen the combined system, large capacity of pumping station is required to safely handle the flow that is likely to be generated during highest design storm considered. Based on site conditions the economy of the system needs to be evaluated and selection is mad accordingly.

**Answers to question eight.**

Rapidly growing populations and migration to urban areas in developing countries has resulted in a vital need for the establishment of centralized water systems to disseminate potable water to residents. Protected water source and modern well-maintained drinking water treatment plants can provide water adequate for human consumption. However, ageing, stressed or poorly maintained distribution systems can cause the quality of piped drinking water to deteriorate below acceptable levels and pose serious health risks.

Distribution system inadequacies; a number of failures in the distribution system, namely loss of adequate disinfectant residual, low water pressure, intermittent service and ageing of infrastructure can result in the declining quality of the water supply (WHO & UNICEF 2000). Pathogen intrusion may occur under these E. J. Lee and K. J. Schwab) Drinking water distribution systems in developing countries Journal of Water and Health.

Circumstances if poor sanitary conditions exist because of improper wastewater collection and leakages in the network. Consequently, these various deficiencies can result in the cross-contamination of a clean water supply which, in some cases, has led to outbreaks of waterborne and water related diseases.

Inadequate disinfection residual; The use of a disinfectant in the treatment of a water supply has proved to be crucial to ensuring public health (Gadgil 1998; Ford 1999). There are numerous reasons why water supplies are not disinfected, including the intentional absence of disinfection due to consumer resistance to the taste of disinfected water (Diergaardt & Lemmer 1995), or avoidance of disinfectant by-product formation in the water (van DijkLooijaard & van Genderen 2000).

Owing to its effectiveness and relatively low cost, chlorine is the most commonly used disinfectant globally (Baxter 1995). However, its odor, taste and reactivity (defined as the potential for disinfection by-product formation) may negatively influence the choice of chlorine as a disinfectant (Besner et al. 2002). Failure to disinfect the water supply may also occur inadvertently, for example when the supply of treatment chemicals dwindles and cannot be replaced, or from mechanical or human failure during the treatment process (Diergaardt & Lemmer 1995).

The failure to disinfect water has clear public health consequences: resulting disease outbreaks have been well documented in both the developing and the developed world (Ca´ rdenas et al. 1993; Rab et al. 1997; Craun et al. 2002). Despite the importance of disinfection, approximately 20–40% of urban water systems in the developing world do not disinfect their water supplies (WHO & UNICEF 2000). Population coverage for disinfected water supplies varies widely between countries, ranging from the lowest to the highest.

Not only is treatment necessary at the water treatment plant, but the maintenance of a detectable concentration of the disinfectant (called a residual) in the water distribution systems is also crucial. There are many purposes for maintaining a disinfectant residual; the primary goal is preservation of water quality during transit by preventing regrowth of pathogens, as well as inactivation of pathogens that may later be introduced into the system (Trussell 1998). Both chlorine and chloramines are used widely for this purpose; the latter have a greater ability to persist in the distribution system (Egorov et al. 2002).

In addition, the lack of residual in the system is a warning sign that organics, including potential pollutants, have entered the system and has been used as an indicator of contamination (Trussell 1998; Haas 1998). This is usually supported by increasing bacterial counts as residual concentrations decrease. In Trinidad, it was observed that, as the chlorine residual decreased from 4.6 ppm at the plant to 0.2 ppm at the household, there was a statistically significant increase in total and thermos tolerant coliforms (Agard et al. 2002). Presence of a disinfectant residual is especially important in developing countries because of poor sanitary conditions and the high risk of recontamination during distribution. This is especially true if the water must travel great distances to reach the end consumer, since generally, residual chlorine levels decline as the distances from the plant increase (Egorov et al. 2002).

In addition to distance travelled, other factors that affect the rate of depletion of a residual are: water flow velocity, residence time, age and material of pipes, and water pressure (Egorov et al. 2002). However, a disinfectant residual can guard against only a small amount of reintroduced pathogens. The greater the risk of contamination in the pipelines, the higher the residual concentration that must be maintained.

The World Health Organization recommends maintenance of a disinfectant residual of 0.2 to 0.5 mg l21 in a distribution system under normal operating conditions (WHO 1997); in general, developing countries maintain higher concentrations of residual than the estimated 0.2 mg l21 maintained by developed countries’ water supplies (Geldreich 1996).

**Answers to question nine.**

Besides providing drinking water, a major function of most distribution systems is to provide adequate stand by fire flow, the standards for which are governed by the National Fire Protection Association (NFPA, 1986).

Fire-flow requirements for a single family house vary from 750 to 1,500 gpm (2,839–5,678 Lpm); for multi-family structures the values range from 2,000 to 5,000 gpm (7,570–18,927 Lpm); for commercial structures the values range from 2,000 to 10,000 gpm (7,570–37,854 Lpm), and for industrial structures the values range from 3,000 to over 10,000 gpm (11,356–37,854 Lpm) (AWWA, 1998). The duration for which these fire flows must be sustained normally ranges from three to eight hours

In order to satisfy this need for adequate standby capacity and pressure, most distribution systems use standpipes, elevated tanks, and large storage reservoirs.

Furthermore, the sizing of water mains is partly based on fire protection requirements set by the Insurance Services Office (AWWA, 1986; Von Huben, 1999).

The minimum flow that the water system can sustain for a specific period of time governs its fire protection rating, which then is used to set the fire insurance rates for the communities that are served by the system. As a conseBottom of Formquence, fire-flow governs much of the design of a distribution system, especially for smaller systems.

A study conducted by the American Water Works Association Research Foundation confirmed the impact of fire-flow capacity on the operation of, and the water quality in, drinking water networks (Snyder et al., 2002). It found that although the amount of water used for firefighting is generally a small percentage of the annual water consumed, the required rates of water delivery for firefighting have a significant and quantifiable impact on the size of water mains, tank storage volumes, water age, and operating and maintenance costs. Generally nearly 75 percent of the capacity of a typical drinking water distribution system is devoted to firefighting (Walski et al., 2001

The effect of designing and operating a system to maintain adequate fire flow and redundant capacity is that there are long transit times between the treatment plant and the consumer, which may be detrimental to meeting drinking water MCLs (Clark and Grayman, 1998; Brandt et al., 2004). Snyder et al. (2002) recommended that water systems evaluate existing storage tanks to determine if modification or elimination of the tanks was feasible.

Water efficient fire suppression technologies exist that use less water than conventional standards. In particular, the universal application of automatic sprinkler systems provides the most proven method for reducing loss of life and property due to fire, while at the same time providing faster response to the fire and requiring significantly less water than conventional fire-fighting techniques. Snyder et al. (2002) also recommended that the universal application of automatic fire sprinklers be adopted by local jurisdictions for homes as well as in other buildings

There is a growing recognition that embedded designs in most urban areas have resulted in distribution systems that have long water residence times due to the large amounts of storage required for firefighting capacity More than ten years ago, Clark and Grayman (1992) expressed concern that long residence times resulting from excess capacity for firefighting and other municipal uses would also provide optimum conditions for the formation of DBPs and the regrowth of microorganisms. They hypothesized that eventually the drinking water industry would be in conflict over protecting public health and protecting public safety

**Answers to question ten**

Water tanks are large containers that store water. This is great for people who need water for a variety of reasons and might live far away from a store. There are many uses for water tanks, some that you may or may not know about. Water tanks are kept outside, underground or above ground in your yard. Where you put them is related to where the pipes lay to transfer the water from the tank to your home or business. When you choose to purchase a water tank, there are many uses you should be aware of so you can better understand why you might need a water tank to run your home efficiently.

Watering Garden; having water tanks to hold water for your garden is highly important if you grow your own fruits, vegetables, or anything else. While most people don’t look at keeping their yard green as an immediate need for water, it is highly important for those that depend on water to keep their food growing properly. The size of the water tank will depend on how much water you use on a regular basis, and how much room you have to store the water tank.

Washing Clothes; washing clothes is a necessity. [Water tanks are highly useful for  storing water](https://www.rainbowtanks.co.za/)until you are ready to use it to wash your laundry. You can also use the water tank for washing outdoor items such as lawn equipment or porch furniture. To save yourself a fairly large amount of water, you can connect your washing machine directly to your tank. This eliminates any water getting stuck in the pipes and not being used.

Water to Flush the Toilet; Flushing the toilet is an absolute necessity. If you do not have water to flush the toilet, you can be exposed to bacteria that can make you very ill. Water tanks come in various sizes, and the size of your home and how many bathrooms you have will come into play. You will also want to use this water for taking a shower, bathing, and washing dishes on a regular basis, as well. On average, a toilet will use twelve liters every time you flush. This adds up to about 210 liters a week, depending. Having water in your tank to ensure that you can flush your toilet anytime you need to and this very important to most people.

Emergency Uses; Emergency use for water tanks includes putting out fires. You do not want to be without water if something goes up in flames. Water tanks are great for this purpose, and it’s highly recommended that you have a backup tank in case you run out in your main tank. Of course, for small fires, it is great to have a fire extinguisher, as well.

Water for Drinking, while it’s completely normal to drink bottled water, this is not always something that everyone has access to, especially if they live far from a store or area that where can get the water. Having a water tank will help greatly to ensure that you always have good drinking water whenever you need.

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