TRADITIONAL RAINWATER SYSTEM TO MODERN USAGE: A PRACTICAL APPROACH

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ABSTRACT: Malaysia has a very high rainfall average through out the year. It is endowed with far more rainfall than the amount of water demand. Rainwater harvesting has been carried out for generations in many rural areas. Our rural communities have the traditional ways to collect rainwater. This paper describes our traditional harvesting system and how their system influences modern practice of rainwater harvesting. Thus our traditional harvesting is made compulsory as an essential knowledge when move forward to implement the modern rainwater harvesting. For a practical approach, rainwater harvesting system nowadays includes the catchments area, conveyance system, filtering, distribution system, and storage facility. Whereas, the traditional rainwater harvesting is simple, namely from the rooftop catchments and directly goes to cistern storage. But, with the advantage of city public water supply nowadays, people were forgotten about rainwater harvesting. Even in houses where gutter and down pipes are already fixed, rainwater is left to flow wastefully into the drainage system. Subsequent to the 1998 April drought, The Ministry of Housing and Local Government have expressed the Government's interest for buildings to be designed to include rainwater harvesting system. The traditional practice of collecting rainwater where it falls has been revived to provide inexpensive water source for thousands of people. With the installation of rainwater harvesting system, it is yet to be hoped that in the near future; water users will not fully depending on public water supply.

Keywords: rainwater harvesting, rainwater system, rural area

1.0 INTRODUCTION

Water is natural resources which we can obtain easily from rivers, seas, ponds and rainfall. But sadly nowadays, it seems like the population is not appreciating to our nature. The natural resources destroyed from day to day with pollution and wasteful, which are the results of human-made activities.

This paper discussed about rainwater harvesting. Rainwater harvesting is the best way to avoid the waste of rainwater. Rainwater is valued for its purity and softness. It has a nearly neutral pH, and is free from disinfection by-products, salts, minerals, and other natural contaminants. In a residential or small-scale application, rainwater harvesting can be as simple as channeling rain running off a roof to a storage tank (Krishna, 2005). Most of residential schemes in our country already fixed with the gutter

and rainwater down pipes. But the function of gutter and down pipes is to let the rainwater flow wastefully into drainage system. We pay water bill for water supply, at the same time we let the free water flow wastefully.

Figure 1: A child collect the rainwater from tent roof for drinking purpose (*Utusan Malaysia, 2008*)

Figure 1 shows a child whose suffer the Cyclone Nargis at Myanmar; collect the rainwater from tent roof for drinking purpose. Because of less of fresh water, people are forced to use rainwater. Actually rainwater harvesting is a traditional practice that dates back hundreds of years, is relatively cheap and easily to implement. Traditionally rainwater harvesting has been practiced in arid and semi-arid areas, and has provided drinking water, domestic water, water for livestock, water for small irrigation and a way to replenish ground water levels. Nowadays we are only remembering to the rainwater during water crisis.

2.0 BENEFITS OF RAINWATER HARVESTING

Rainwater harvesting is a part of sustainable architecture and it is bring a lot of advantages for our environment. Water should never be wasted and allowed to flow out of any village or community facing a shortage of drinking water. This is also can reduce the occurrence of flash floods. Beside that, costs are less to collect rainwater than to exploit groundwater (Sanjit, ND).

Planning Department, Manpower and Employment Unit, New Dehli (2006) states that most of the traditional water harvesting systems in the cities have been neglected and have turned into disuse, as a result worsening the urban water scenario. One of the solutions to the urban water crisis is Rainwater Harvesting by capturing the runoff and promoting the water conservation in a bigger perspective.

Rainwater harvesting is an ancient technique enjoying a revival in popularity due to the inherent quality of rainwater and interest in reducing consumption of treated water (Krishna, 2005). The advantages and benefits of rainwater harvesting are numerous.

Rainwater should never be wasted. Water resource is natural components which we can obtain easily because ¾ of our earth surface is consisting of water. But 97% of water resource is sea water, 2% is glacier at Arctic and Antarctic, and 1 more percent is the only fresh water which we can use for daily purpose. Rainwater is a part of the 1% fresh water; therefore we should never waste that (Graham *et al.*, 2008). Our ancestor collected rainwater as an important water supply.

The rainfall is free and so does with the consumption of rainwater. What is needed, just to install a rainwater harvesting system. There is no need to pay for the rainwater for a long term. At the same time, it is very lucky to receive the treated water supply from the authority. Even the cost now can be considered as cheaper, we have to realize that it will be increased from time to time. As our country is endowed with plenty of rainfall, we can harvest it as to reduce the very much dependency to the public water supply.

3.0 TRADITIONAL RAINWATER SYSTEM COMPONENTS

Generally most of the rural areas in Malaysia already get connected with the public water supply from the authorities. Interestingly, traditional rainwater harvesting still can be found at certain village, but the villagers are not fully depend to this rainwater. They are still using rainwater only for certain purposes such as washing and gardening.

Rainwater collection is the simplest way to obtain the water resources. The system is more easily to work and cheaper than groundwater exploitation because the user only need to install the collection tank. The simplest traditional rainwater harvesting system is putting the container like barrels at open space and it will catch the water during rainfall. Most of users are catching the rainwater from roof made of zinc sheet and store it using the containers as in Figure 2.

Figure 2: Example of traditional rainwater harvesting in Pendang, Kedah, Malaysia

3.1 Kampong Pampang, Sandakan

Kampong Pampang at Sandakan is one of the village which still using the traditional rainwater harvesting system as shown in Figure 3. Most houses are installing a large zinc container at front of house. The rainwater is collect from zinc roof and flow into the container. The rainwater is use for washing and gardening only.

Figure 3: Traditional rainwater harvesting at Kampung Pampang, Sabah

Nowadays people already used the poly tank as rainwater harvesting system in their house. The poly tank has been provided by local government. Rooftop rainwater is collected by the gutter and discharge to poly tank located above-ground through rainwater down pipe. The above-ground storage tank is using gravity system for water flow, therefore pump system is unnecessary. Traditional rainwater harvesting system is without of distribution system, there are uses rainwater directly from storage system.

3.2 Changkat Jering, Perak

In Changkat Jering, there is 2-storey house still utilizes the rainwater by using a simple collection system. They don't bother about how much rainwater can be collected. It is just depend on the weather, so long with the usage. Rainwater just becomes additional sources since the house receives water supply from the authority.

The use of rainwater is limited for cleaning the outdoor area. The occupants just collect the rainwater; store it and use when necessary. Originally it has 2 catchment areas, namely at the back and one-side of the house as in Figure 4. But nowadays only the collection at the back is functional; while the side is abandon.

Figure 4: The back (left) and side (right) catchment of rainwater (side catchment is abandon)

The roof is the catchments component and the rainwater collected by the gutter and flow directly to storage system without down pipes. For the storage system, the house owner only use a large barrel as the storage tank for purpose to retain the rainwater. No need to bother how much the rainwater was falls, the rainwater will overflow if the barrel is full.

3.3 Traditional Rainwater System Components

Figure 5 shows the diagram of traditional rainwater harvesting system. There is very simple system; the components for the traditional rainwater harvesting are the catchment area and storage system. Normally the rainwater will flow to storage system via gutter and down pipes, but that is not necessary in traditional system.

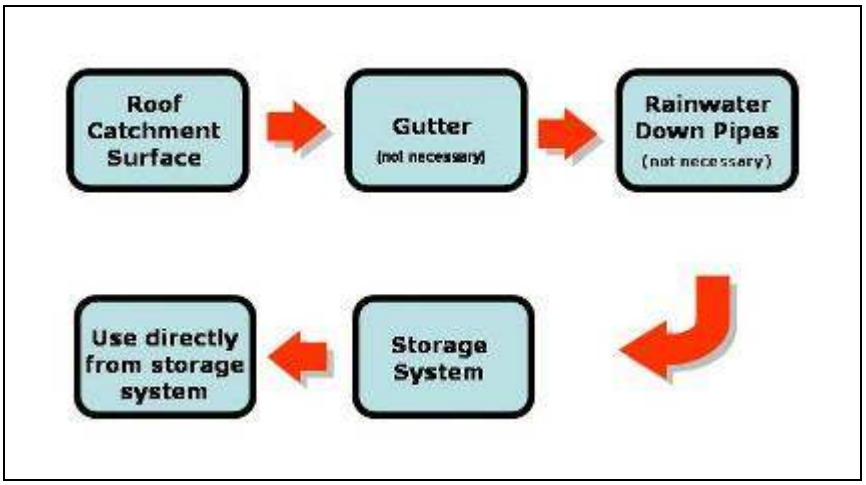


Figure 5: Conceptual diagram for traditional rainwater harvesting system

4.0 MODERN USAGE OF RAINWATER SYSTEM

Rainwater harvesting in urban areas can have manifold reasons. To provide supplemental water for the city's requirement, to increase soil moisture levels for urban greenery, to increase the ground water table through artificial recharge, to mitigate urban flooding and to improve the quality of groundwater are some of the reasons why rainwater harvesting can be adopted in cities. In urban areas of the developed world, at a household level, harvested rainwater can be used for flushing toilets and washing laundry. It can also be used for showering or bathing. It may require treatment prior to use for drinking.

As discussed earlier, the traditional system can be termed as simple and practical. They just have the temporary storage and rainwater is collected manually from the container whenever they want to use it. They don't much thinking of about the capacity of rainwater that can be harvested as well as the water quality. Even though

not to the extent of drinking purposes, they do use the rainwater for body contract i.e. washing hand and leg.

One important approach of the traditional and modern rainwater harvesting is that the building which harvested the rainwater. Nowadays the Malaysian Government (except in Sandakan) encourages non-residential building to be rainwater harvested, and this is in contrast where the residential type is widely used rainwater during the early days. With the different type of building, the concept of traditional system is fully used and adopted in our modern building, with the adjustment of detailing and additional components as to suit with the big scale of building. This is described with the case study as illustrated below.

4.1 Taman Utama, Sandakan, Sabah

In Sandakan, rooftop rainwater harvesting is being practiced for use for domestic purposes. Rainwater collected from roofs as a source of water beside public supply for all household activities. In year 1984, the local authorities of Sandakan has been planned a policy guideline to encourage the housing developer to provide a rainwater storage tank for new residential building especially type of bungalow, semi-detached, and terrace houses. The capacity of each storage tank is 400 gallons. There is the pushing factor in Sandakan, namely the residents experience the scarcity of public water supply (cut-off about twice times per week).

Taman Utama is a good rainwater harvesting example in housing development. Residents of Taman Utama is using rainwater for flushing toilet, watering garden, washing car, laundry, and cleaning drainage. Basically, there are three types of rainwater harvesting system in Taman Utama; namely the backyard system (Figure 6), frontage system and underground system. This system known as ‘collection system only’ because of there is no distribution system, except for the outlet tap at the bottom of the tank. This system is very cheap and easy to install compare to other systems which come with plumbing system.

The installation of exposed storage tank gets a very good support from housing developers and owners because of low cost and easy to install. In addition, the setback

for Sandakan housing is 15 feet and this is makes rainwater tank can easily be installed without worrying it will be demolished for future house renovation.

There is also terrace houses that install reinforce concrete tank at the front of house. Actually, the system is same with the above-ground backyard system. However, in this case, poly tank has been replace with reinforce concrete tank. Besides, reinforce concrete tank is more endurance than poly tank. Underground tank with pump also constructed at Taman Utama, Fasa 4 as in Figure 6. This is a new system in Sandakan. However, this system still does not have filtration and just only have simple distribution system (water tap at car porch).

Figure 6: Backyard elevated rainwatertank (left), Frontage reinforce concrete tank (middle), and underground tank (right)

4.2 Solar Hydrogen Eco-House, Universiti Kebangsaan Malaysia

Solar Hydrogen Eco-house at UKM is the first in the world that is fully self-sustainable and runs entirely on hydrogen, which is combining the low energy architectural features such as sun shading, day lighting and passive air movements with a solar hydrogen production system. It also has a rainwater harvesting system that is powered by solar energy. The cost of rainwater harvesting system is about RM 8,500.00 except for roof, gutter, and downpipes, which are under building cost.

For Solar Hydrogen Eco-house, the roof surface is the only catchment area. The rainwater is collected by gutter and flow to storage tank via down pipes. The storage tank capacity is 700 gallons and located below parking area. Before entering storage tank, the rainwater is filtered at filtration chamber. From the underground tank, the rainwater will be pump up directly to the gardening tap. The diagram as in Figure 7.

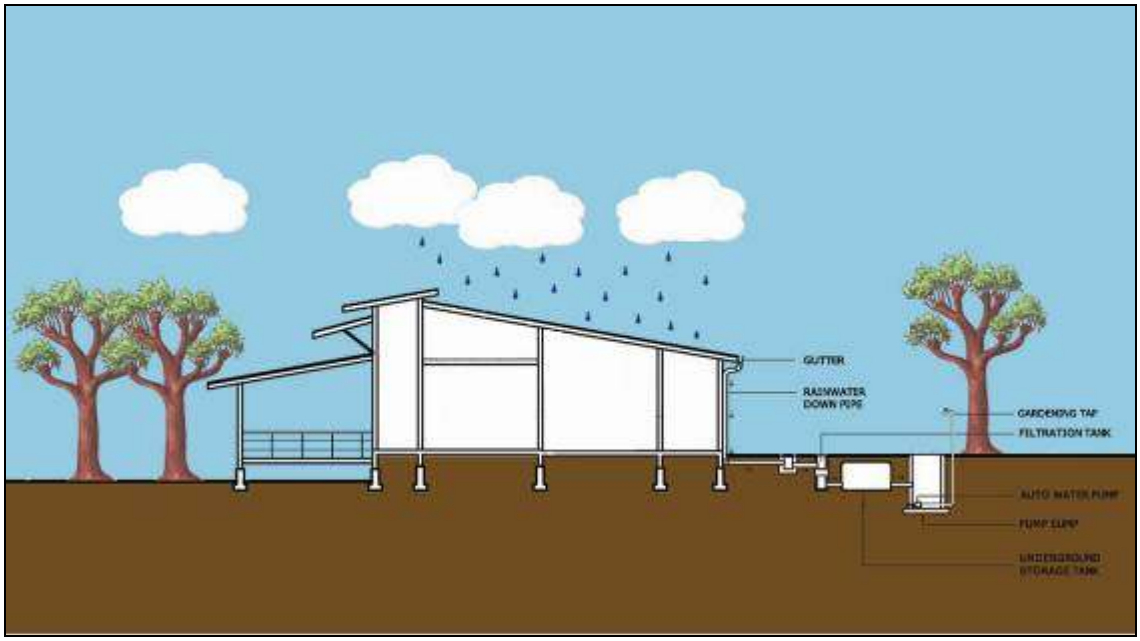
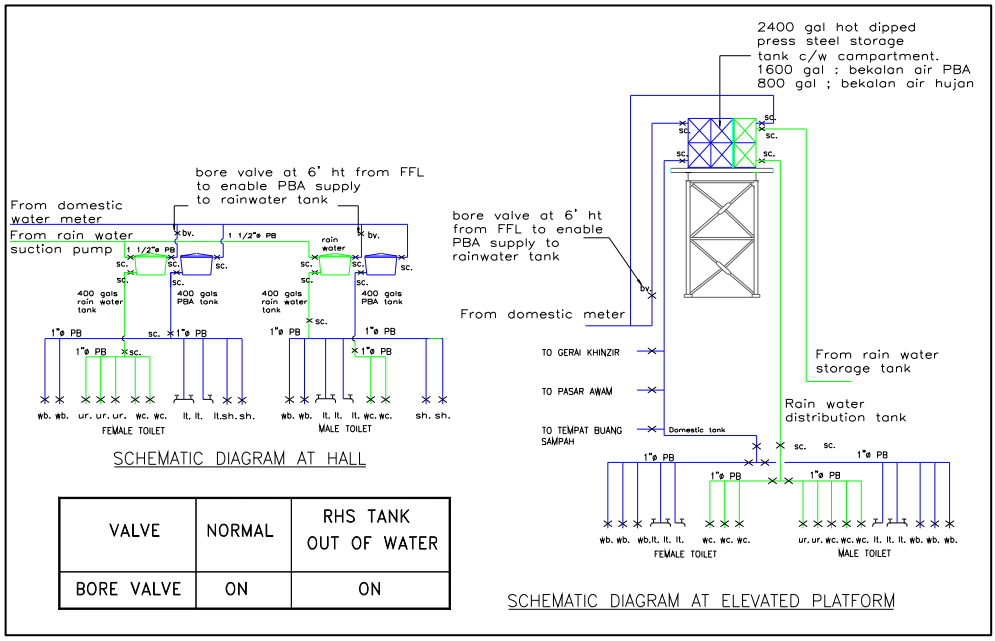


Figure 7: Diagramatic Sectional Detail

4.3 Multi Purpose Hall and Market Complex, Kota Permai, Pulau Pinang

The Multi Purpose Hall and Market Complex at Kota Permai, Bukit Mertajam is also applying the rainwater harvesting system. The complex's cost is RM 4,697,000.00 and was completed on 13 October 2002. The cost of rainwater harvesting is about RM 180,000.00.

The specialty of this project is regarding the storage system. This building used 10 nos 600mm diameter and 12m length HDPE Pipe below the parking area besides hall building. The pipe is function as storage tank with capacity of 6000 gallons for rainwater. From the storage pipe, rainwater is pump to the distribution tank with a submersible pump. The capacity of distribution tank is 800 gallons.



VALVE	NORMAL	RHS TANK OUT OF WATER
BORE VALVE	ON	ON

Figure 8: Schematic Diagram at Hall (Left) and Elevated Platform (Right) (*MPSP, 2008*)

4.4 Modern Rainwater System Components

From the discussion, it can be noted that modern usage of rainwater system components is complete with the catchment surface, conveyance system, filtration chamber, storage tank, and distribution system. Normally, the roof surface will act as the catchment area for a rainwater harvesting system. Water quality from different roof catchments is of the effect of different type of roof finishing and the surrounding environment. Metal roof have a smooth surface, because of the smooth roof texture, the quality of collected rainwater is much than the clay or concrete roof.

The conveyance system includes the gutter and rainwater down pipes. Gutter is installed to capture rainwater running off the eaves of a building. Gutter should be installed with slope towards the downspout; also the outside face of the gutter should be lower than the inside face to encourage drainage away from the building wall.

Storage tank could be the most expensive and biggest component for rainwater harvesting. The size and type of tank is varied and depend on necessity, normally tank size is depending on rainfall amount. Basically, the storage tank must be covered and vents screened to discourage mosquito breeding. Besides, tanks should be located as close to supply and demand points as possible to reduce the distance water is

conveyed. Storage tank should be protected from direct sunlight, if possible. Nowadays the underground tank is become more popular for the new building project. The conceptual diagram of modern rainwater harvesting is depicted in Figure 9.

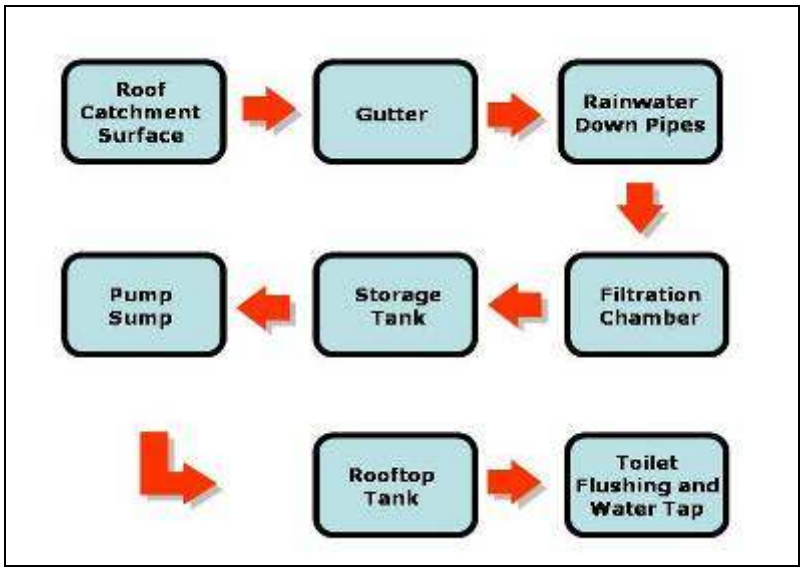


Figure 9: Conceptual diagram for modern rainwater harvesting system

5.0 CONCLUSION

Rainwater had become the most potential source of water supply since our country has a very high volume of rainfall throughout the year. In addition, rainwater harvesting is not a new approach in our country, especially in rural area. Since ancient times, the only sources of natural water that are recognized as safe to drink are the rain water and water from deep wells.

Our rural communities have the traditional skills and technique to collect rainwater. Therefore our traditional rainwater harvesting is made compulsory as an essential knowledge when move forward to implement the rainwater harvesting. Even the concept of traditional system is simple, but with high technology nowadays the rainwater harvesting system can be installed for all types of building. Besides, the mosquito breeding problems also can be solved with the modern rainwater system. Successful implementation of rainwater harvesting system at Sandakan, UKM and Pulau Pinang is a great contribution for future rainwater harvesting development.

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