



Low-cost plastic-lined water harvesting pond (Thinley Penjor Dorji)

Low-Cost Plastic-Lined Water Harvesting Pond ()

Chhusho Laglen Thabtey Zowai Chhu Sakni Zing (མུ་ཤོག་ལག་ལེན་འཐབ་སྡེ་བཟོ་བའི་མུ་བསག་ནིའི་རྩིང་།)

Low-cost plastic-lined water harvesting ponds collect and store rain and overland flow water for agricultural and domestic purposes in the dry season. They are both economic and efficient.

Low-cost plastic-lined water harvesting ponds are used to collect and store rain or overland flow water for agricultural purposes in the dry season. They are economic and efficient. These ponds are required in the context of irrigation water shortages. Although rainfall has been projected to be increasing (NCHM, 2017), irrigation water shortage was - and continues to be - one of the major constraints in crop production (IHPP, 2017).

Water from precipitation and surface water sources is lost due to inadequate collection and storage. Villages at the top of the hills, in particular, suffer from acute irrigation as well as drinking water shortages. To tap and collect wastewater, rainwater, and water from other perennial and non-perennial sources, low-cost plastic lined water harvesting ponds are proposed. This water can be used during the dry or "lean" season for agricultural as well as household purposes.

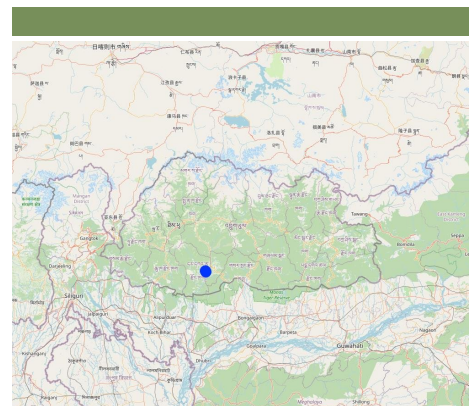
The proposed model pond (plastic sheet size; 9m * 7m) costs less than Nu. 25, 000 (USD 315) for construction but can hold more than 27, 000 litre of water. The same dimension of pond if constructed using concrete, would cost more than Nu. 1, 19, 000 (USD 1500). Furthermore a 10, 000 litre synthetic tank available on the market costs more than Nu.35, 000.

Irrigation water shortage results in fallow lands. It is reported that 6,400 acres (2,600 ha) of irrigable land was left fallow in 2016 and 26 % of the total households surveyed were affected by irrigation water shortages (DoA, 2016). By reducing fallow land and increasing crop production, this technology could be a stepping stone towards food self-sufficiency - as well as providing water for consumption by people and livestock.

Though a similar technology is said to have introduced in the country many years ago, the present form of the technology was introduced to Barshong gewog in Tsiwang Dzongkhag by the 'Himalica' pilot project in 2014. However, the proposed technology has been modified and improved to suit to the topography and needs of farmers in Bhutan. The proposed pond design is a reverse truncated square pyramid shape unlike the cuboid shape ponds of ICIMOD's. The pond is designed in such way as to increase pond stability and ease of construction.

Concrete tanks require specific construction methods and faults can develop with ice freezing and expanding in cracks in tank walls during the winter (Slater, 2011). Plastic (silpaulin) sheet lined ponds are leak-proof and primarily depend on the longevity of the plastic sheet unlike concrete tanks. Concrete water tanks, (especially elevated tanks) are also prone to damage due seismic activities (Housner, 1963).

The low-cost plastic lined water harvesting pond adopted is cheap, environmentally friendly, and has positive social impacts. It reduces irrigation water constraints, addresses fallow land problems, and supplements water for domestic purposes. The technology is a tool for reducing poverty, expanding cultivated land and increasing food self-sufficiency resulting in a healthier and happier society.



: Pangserpo Chiwog, Drujeygang Gewog, Dagana Dzongkhag,

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Water harvesting pond (Thinley Penjor Dorji)

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Site selection for pond construction:

Choose a site for the pond at the top of the farm for easy flow/use of water to the agricultural fields. Select the site only at the stable soils to avoid collapse, and bursting of the pond. Water sources for the pond may be perennial water sources, rainwater gutter systems, water from tap stand, and waste water from farm house or a combination of the different sources.

Materials required: The materials required for making the pond are:

1. Plastic sheet of desired length and breadth
 - a. 250-300 GSM (gram per square meter)]
 - b. UV stabilized
2. Measuring tape (30m)
3. Shovel, spade, and crowbar
4. Mosquito net or similar ones
5. HDPE pipes, gates valves
6. Fencing materials (bamboo poles, wooden poles, barbed wire, nails, wire mesh, binding wire)

Procedure to dig the pond:

1. Clear the vegetation and level the ground to construct the harvesting pond.
2. Measure the base length (l), and the base breadth (b) on the leveled ground. These length and breadth will be the length and breadth of the pond floor. Dig out the soil till 1.2 m height (h) to construct a cuboidal pond.
3. From the top edges of the cuboidal pond, measure distance 'g' in all four sides. Make slanting cuts from the top to the base on all four sides. Scrap off soils on all sides to obtain slope of 700. The gradient is made for slope stabilization and convenience to lay out plastic sheet.
4. Make the cut surfaces including the floor smooth by using mud and cow dung paste or mud paste in order to avoid damages to the plastic sheet while laying out and when filled with water. The pit ready to lay out plastic sheets should have the dimensions.
5. Carefully lay out the plastic sheet over the pit. Keep an anchor length (overlap) of 0.5m on all sides of the pit. Fix wooden or bamboo pegs or iron rod through the eyelets of the plastic sheet and or cover the overlapping plastic edges by at least 10cm of mud or soil to strongly anchor the plastic sheet.
6. Construct a drain with 30cm width and 30cm depth around the edges of the plastic sheet which was covered with soil or mud. The drainage should slope towards a suitable drain out area.
7. Fence the pond using wire mesh/bamboo/wooden poles/timber to prevent mishaps or accidents. Fill the pond with water only after fencing. Galvanized wire mesh is preferable.

Using water:

Water from the pond can be used in the following ways:

- Directly siphoning off with a pipe
 - Pumping up with a small motor pump
 - Taking out with suitable containers
 - Inserting a drain out pipe at one of the base corners.
- The insertion of the drain out pipe should be done during the construction of the pond.

Note: The stone wall may be required in specific situations if built in a slope like this one but not generally needed. Technical drawing of the water harvesting pond without the cement structure is available at <http://rcbajo.gov.bt/leaflet/> also shared under section 7 of this document.

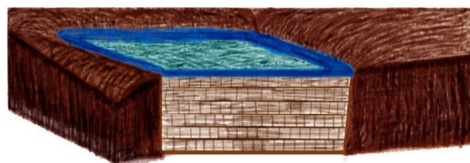


Figure 1: Plastic lined water harvesting pond

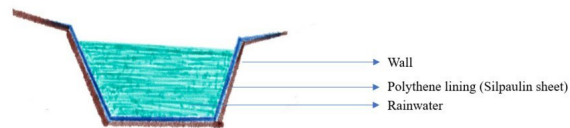


Figure 2 : Cross section Plastic lined water harvesting pond

Author: Ongpo Lepcha

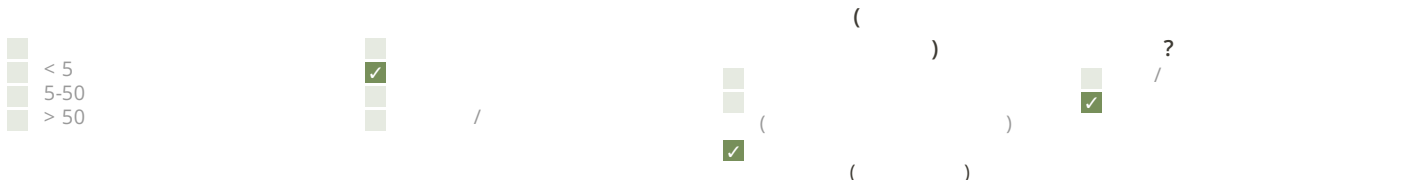
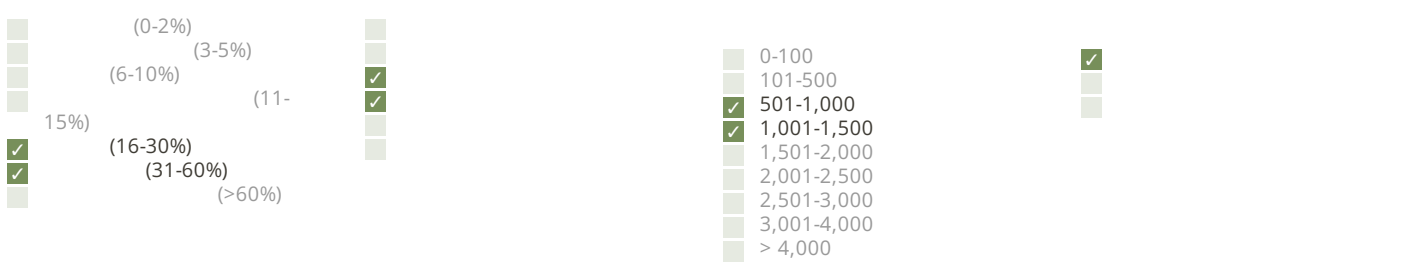
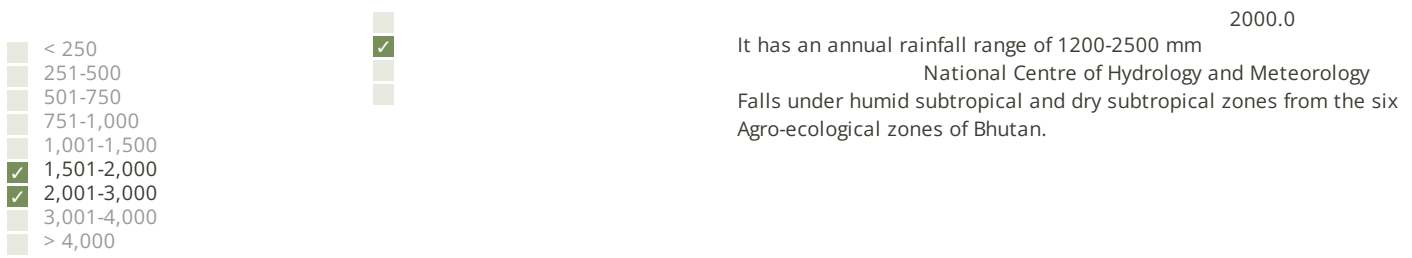
<ul style="list-style-type: none"> • harvesting pond volume, length: 41.6 cubic metre • Ngultrum (Nu.) • () 1 USD = 80.0 • Ngultrum (Nu.) • Ngultrum 350 	<p>water</p> <p>The most important factors that affect the cost are the construction materials and labour. In this particular situation, cement wall is also one of the major factors affecting the cost although it is not usually required.</p>
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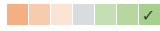
1. Surveying and site selection (/ : Anytime)
2. Procuring materials (/ : Anytime after surveying)
3. Construction of pond (/ : Dry season)
4. Fencing (/ : After completion of water harvesting pond)
5. Monitor (/ : Checking water level, infestation of mosquitoes and checking safety measures like fencing and leakages)

			(Ngultrum (Nu.))	(Ngultrum (Nu.))	%
Construction of pond	Person-days	8,0	500,0	4000,0	100,0
HDPE pipe	Metre	100,0	40,0	4000,0	100,0
Wire mesh	Pieces	2,0	3500,0	7000,0	
Silpaulin plastic sheet	Pieces	1,0	7500,0	7500,0	
Wooden post	Pieces	14,0	60,0	840,0	100,0
				23'340.0	
				291.75	

1. Construction of concrete wall (/ : Dry season)
2. Monitor (/ : Throughout the year)
3. Maintenance of fence (/ : Annually)

			(Ngultrum (Nu.))	(Ngultrum (Nu.))	%
Reconstruction of pond	Person-days	15,0	500,0	7500,0	
Cement (50 kg per bag)	Bag	10,0	400,0	4000,0	
				11'500.0	
				143.75	





Trapping the rainwater prevents the utilization of scarce spring water. Therefore, reducing the demand for irrigation from the spring water source.

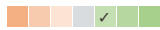


Irrigation plays a significant role in crop cultivation. Therefore, with adequate irrigation water crop production and productivity increase leading to increased farm income.

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With sustainable sources of irrigation, land users produce enough food for self-consumption increasing food security. Further, the land users sell the produce and generate income with which they can purchase nutritious foods that are not available on the farm.



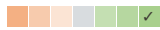
Water is important to keep the surroundings clean. Therefore, the technology improves the health of the farm household and livestock.



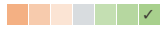
Using drinking water for irrigation leads to social conflict. However, the issue is resolved with the low-cost plastic-lined water harvesting technology.

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The amount of water available for farm activities is increased as the technology traps overflow and rainwater preventing water wastage.



The rainwater and overflow water are harvested efficiently preventing runoff and surface erosion.

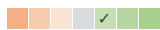


Water harvesting pond acts as a suitable habitat for mosquitoes therefore increasing the risk of malaria.

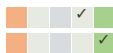
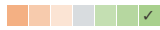
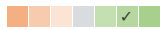


The impact of drought on agricultural activity is significantly reduced as the tank increases water availability.

(-springs)



Reduced spring water requirement in the field is diverted to water availability for other farming communities and wildlife.



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11-50%
51-90%
91-100%

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The location of the water harvesting technology on slopes presents a risk of potential landslides caused due to climate change effects such as heavy rainfall. Therefore, the structure of the technology was modified to address this issue by providing support using the cemented wall. The modification is suitable for the steep slopes and is not required on the plain areas.

- Increased crop production. The technology enables land users to cultivate crops during dry seasons.
- Increased water availability. The water harvesting pond provides adequate water for livestock rearing, household use and agricultural purposes.
- It is cost-effective compared to a cemented tank.
- The water harvesting tank constructed using high-quality plastic is durable providing economical benefits.

- Risk of accidents leading to the drowning of small children and domestic animals such as dogs. Constructing a fence around the pond and creating awareness.
- The technology acts as a habitat for mosquitoes leading to increased malaria infection in the household. Regular cleaning and removal of sediments, vegetation, algal and plankton growth (serves as a food source for mosquitoes).

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https://qcat.wocat.net/km/wocat/technologies/view/technologies_6821/

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Approaches: Climate-Smart Village Approach https://qcat.wocat.net/km/wocat/approaches/view/approaches_6852/

- National Soil Services Centre, Department of Agriculture, Ministry of Agriculture & Livestock (NSSC) -
- Strengthening national-level institutional and professional capacities of country Parties towards enhanced UNCCD monitoring and reporting - GEF 7 EA Umbrella II (GEF 7 UNCCD Enabling Activities_Umbrella II)

- Low cost plastic lined water harvesting pond: <http://rcbajo.gov.bt/leaflet/>

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