

Research article

# Latest Local Check Dams for 2012 in Thailand

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## Abstract

Local check dam were developed year by year such as Asia, Europe and Africa particularly in Thailand which having 3 seasons per year. They were developed local check dam around 10 models successfully. In 2011 they further developed for making low-cost check dams for natural water preservation in Eastern Region of Thailand. The project was set the objective as following 1) Screening for advantage and disadvantage of ten former check dam in Thailand. 2) Making the proper check dam for low cost with local material utilization. 3) Collected the concerned data on preserving water. By the three groups of concern person from Rambhai Barni Rajabhat University, Local administrator and local farmer to come together to the field and make a final conclusions among a groups in each step by step at Tambol Huay-Rang Amphoe Muang, Trad Province, Thailand for making pilot model of check dam for preserve the natural water from rainy season up to dry season with the cheap and local material utilization.

The step of making low cost check dam with local material utilization can divided into 6 step as following 1) Select the location 2) Making enforcement structure by polar wood 3) Re-enforcement structure by bunch of connecting bamboo 4) A bunch of connecting bamboo to place nearby the polar wood. 5) To seal bunch of connecting bamboo with inner plastic bag of fertilizer. 6) The completed low-cost check dam with local material utilization, without any polluted material for the coming rainy season.

The researchers can get achievement with 5 low-cost check dams at Trad Province. The cost of investment near about 5,000 baht (approximately 170 US\$) the quantity of the water preservations range from 2,500 -5,000 m<sup>3</sup> benefited area was covered from 175 – 375 Acers. The low-cost check dam was adopted in Thailand and other countries from 2012 later on.

**Keywords:** Latest Local Check Dams for 2012, low-cost check dam, water preservation, water management for dry season and Eastern region of Thailand

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## 1. Introduction

Water is precious material for human beings with different uses such as for domestic use, industrial use and agricultural production is increasing. Not only in plants but in animal activities, they need water in whole cycle especially in plant before to get flower or fruits they have the critical period for water utilization before to harvest the production, otherwise the whole year can get only leave and stem without any fruits. On other countries such as India, China, and so on including Thailand have abundance of water in rainy season but lack of the water in dry season. (Saranrom, 2011)



**Picture 1:** The diagram for water utilization as water for life in Thailand.

Most of the said countries try to preserve the natural water from rainy season up to dry season by 3 levels of natural water preservation.

1).The first level of water preservation quite adopted as permanently structure or dam (biggest preservation). Although dams provide a variety of economic goods and services, including electric power, flood control, water supply, reservoir recreation, and navigational services, they also have detrimental effects on riverine ecosystems (Petts, 1984, Aini, 2007 and Shieh, et.al., 2007)



**Picture 2.**The sample of Top Three highest dam in the worlds as 2.1).Rogun Dam (Tajikstan) 2.2).Nurek Dam (Tajikistan) 2.3).Grand Dixence (Switzerland) **Source:** A Short Encyclopedia, 2010.



**Picture 3.** The sample of Top Three Largest dam in the worlds as 3.1). Three Gorges (China) 3.2). Syncrude Tailings (Canada) 3.3). Aswan Dam (Egypt) **Source:** Quality Junkyard, 2009.

2). The second levels of the natural water preservation also named as dam but smaller size the structure are semi-permanently building.



**Picture 4.** The sample of semi-permanently dam make from 4.1). Rock 4.2). Earth and 4.3). Rubber **Source:** Small Dam Gallery, 2011, Newton Consultants, Inc., 2011 and U.S. Geological Survey, 2011.

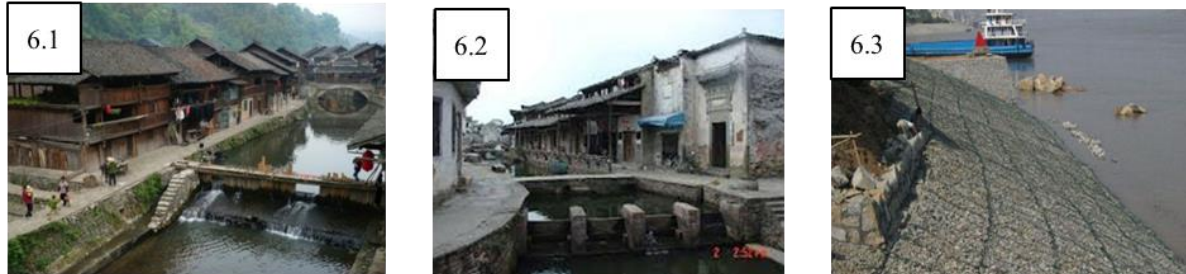
3). The third levels of the natural water preservation known as check dam or smallest dam or temporary dam and so on,



**Picture 5.** The sample of smallest dams or temporary dams in Europe (Pennsylvania) as 5.1). A 3 ft. in Lancaster County 5.2). A 5 ft. in York County 5.3). A 10 ft. in Carbon County **Source:** Small Dam Gallery, 2011 and Ecological Effects of Small Dams, 2012.



In Asia have much more complicate natural water preservation more than hundred year ago especially in big countries like China and India.



**Picture 6.** The sample check dams or temporary dam in China as 6.1).Zhaoxing Dam 6.2).Village Tangmo, Huang Shan 6.3).Gabion baskets Dam

**Source:** Zhaoxing, 2008, Huangshan Tangmo Scenic Spot, 2012 and Rock filled gabion basket, 2012.



**Picture 7.** The sample check dams or temporary dam in India as 7.1).The check dams were constructed from vehicle tires, sand, stones, cement, bamboos and plastic micro concrete. 7.2).Vanrai Dam 7.3).Tabelagummi Dam

**Source:** Check Dam at Anandwan, 2012, Pragatipratishthan, 2012 and Association for India's Development, 2007.

A check dam is the construction that lay across the stream in the area of the origin of the stream. A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. (California Stormwater, 2003). It can slow down the movement of the water when it has a heavy rain in the rainy season or when the storm is coming. A check dam can prevent or slow down the movement of a mud too. It can conserve a soil in the forest also. The main purpose of a check dam or small barriers across the direction of water flow or shallow river and stream for the purpose of water harvesting. (Balooni, et.al., 2008)

The check dam serves mainly 5 purpose such as 1) To provide direct irrigation 2) To prevent rain water from flowing always into the sea 3) Reduce or mitigate the speed of the water stream 4) Reduce soil erosion and trap sediments 5)Facilitate the recharging of surrounding wells through percolation of water. (Zhou, et.al., 2004, Lin, et.al., 2008, Zeng, et.al., 2008 and Hassanli, et.al., 2009.) The suitable application for check dams may be appropriate in the following situations: 1) To promote sedimentation behind the dam 2) To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.3) In small open channels that drain 10 acres or less.4) In steep channels where storm water runoff velocities exceed 5 ft./s. 5) During the establishment of grass linings in drainage ditches or channels. 6) In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings. The limitations of check dams were briefly as

following 1) Not to be used in live streams or in channels with extended base flows. 2) Not appropriate in channels that drain areas greater than 10 acres. 3) Not appropriate in channels that are already grass-lined unless erosion is expected, as installation may damage vegetation. 4) Require extensive maintenance following high velocity flows. 5) Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam. The implementation of check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Reduced slopes reduce the velocity of storm water flows, thus reducing erosion of the swale or ditch and promoting sedimentation. (California Stormwater, 2003).

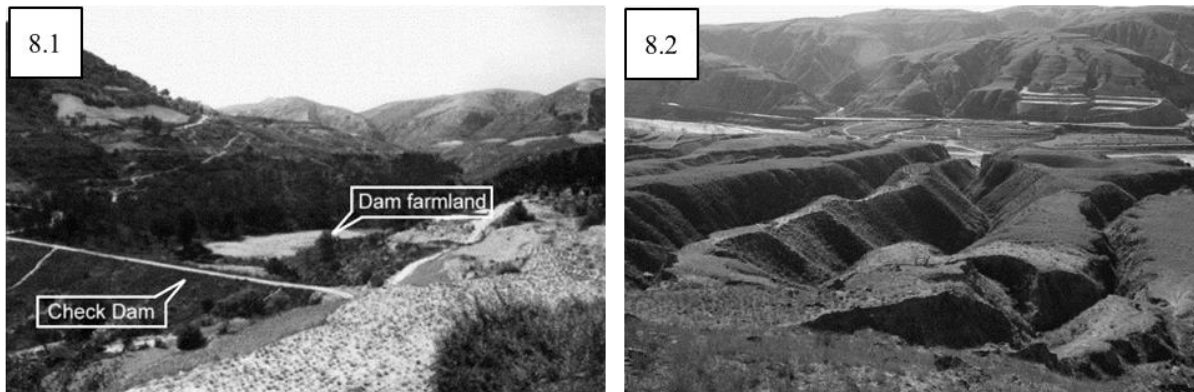
### **The check dam in China**

As China is the highest population in the world with larger area, they developed quite a lot for water conservation and utilization but mostly done by government or local authority investments. Check-dams are the most widespread structures for conserving soil and water in China especially in gullies on the Loess Plateau. By making use of the local geography and climate, the people of the Loess Plateau of China skillfully invented the check-dam system in gullies several centuries ago, to retain sediments and to form farmland. Check-dams at the Kanghe Gou watershed of the Fen-xi County, built in the Ming Dynasty 400 years ago, are still in good condition. As one of the primary measures to conserve water and soil, the check-dam project has been given great emphasis ever since the founding of the People's Republic of China.

A check-dam in the Loess Plateau. By 2002, about 113,500 check-dams had been built, creating 3200 km<sup>2</sup> of farmlands with high productivity, and intercepting a total of 700 million m<sup>3</sup> of sediments that pour into the Yellow River. Thus, the check-dam system is the most important and well-known project in China to conserve soil and water. Generally, a check-dam is composed of three parts: the embankment, the spillway, and the outlet. Sometimes some simple check-dams are constructed without spillways or outlets.

Check-dam system design has to fulfill several purposes:

1. To prevent flooding i.e. to ensure the check-dam system can withstand rainstorms.
2. To guarantee harvest from the dam farmland i.e. to reduce the loss of crops due to rainstorms.
3. To conserve floodwater and sediment by impounding.
4. To ensure that increase in height and repair of the dams after prolonged use are unnecessary. (Fang, 1995, Zhou, et.al., 2004)



**Picture 8.** The sample of check dams in China at the Loess Mesa Ravine Region and the Loess Hill Ravine Region as  
8.1).A check-dam in ZiFangGou, Shannxi Province (photo: Zhang Ouyang). 8.2).A sight of loess ridges and mounds in the Loess Plateau (photo: Xu Xiangzhou).  
**Source:** Zhou, et.al., 2004



**Picture 9.**The lower check dam is an earthen wall some 2 meters high; it is collecting the silt released from the higher flood mitigation dam.  
9.1). At Shanxi, Mizhi, Yulingou gully (China) 9.2 and 9.3). Fenxi county, Shanxi (China)  
**Source:** Planting Water, 2012



**Picture 10.** The sample of rock dams and concrete check dams in southwestern China. (Shengou Creek, Jiangjia Ravine and Xiaobaini Ravine)  
**Source:** Yu, et.al., 2012

### The check dam in India

India is one of long historical for typical irrigation. They are a lot of project concern to local check dam which a lot of water conservation and utilization for example check dam cum bridge built by the people of Bhaliadihi village,



Keonjhar, Odisha under GOONJ's "Cloth for work" initiative. The bridge has reduced the travel distance significantly, benefiting hundreds of people by connecting 5 villages- guth, ambadhara, balipati, suakathi and linthu. The bridge is also serving the purpose of check dam to store water for irrigation and for daily usage and the larger impact is the recommendation of administration (BDO) to the higher authority to make a permanent over bridge on the river. They are made by rock and sand bag structured.



**Picture 11.** The peoples of India were making local check dam at the same time of bridge by rock structure at Bhaliadihi village, Keonjhar, Odisha  
**Source:** Goonj, 2012



**Picture 12.** The peoples of India were making local check dam at the same time of bridge by sand bag structure at Telkoi Block of Keonjhar, Odisha  
**Source:** Goonj, 2012



**Picture 13.** The sample of check dams which Mr. Anil Joshi, an Ayurveda doctor in Fatehgarh village in Madhya Pradesh- collected one rupee each from one lakh people and constructed a check dam across a local seasonal river called Somli, and still going on to repeat it across eleven locations, he is now a full-time water conservationist, with a dream to build 100 such check dams in nearby villages.

Source: Kavita Kanan Chandra, 2012



**Picture 14.** The sample of concrete check dams in India as constructed to slow the water flow of natural rivulets and streams. 14.1 and 14.2). At Gujarat 14.3). At Pachmarhi Hill Station

Source: National Innovation Foundation, 2012, Julia Jones, 2008 and Jagdishchandra, 2011.

### The check dam in Africa

A check dam (also called gully plug) is a small, temporary or permanent dam constructed across a drainage ditch, swale, or channel to lower the speed of concentrated flows for a certain design range of storm events. A check dam can be built from wood logs, stone, pea gravel-filled sandbags or bricks and cement (Ruffino, 2009). Reduced runoff speed reduces erosion and gully erosion in the channel and allows sediments and other pollutants to settle out. Check dams are inexpensive and easy to install. They may be permanent if designed properly and can be used where it is not possible to otherwise divert flow and stabilize the channel (Polytechnic n.y., 2012). Furthermore, they allow groundwater recharge (Ruffino, 2009). While gully plugs are able to retain soil moisture, to harvest runoff water, sand dams (which are similar in appearance) might be the better solution.

This method allows farmers to protect themselves against soil loss problems from runoff. It slows down the runoff velocity on sloped land, helps to settle out sediments, and helps to retain soil moisture (learn more about soil moisture conservation here). Some expert knowledge is required to adapt the correct check dam (depending on topography, precipitation, material).

### Advantages

- Water speed is slowed, which reduces erosion and prevents unwanted gully formation during a flood
- No trench design required, just uses existing gully drainage pattern
- Can assist recharge of shallow wells
- Can reduce salinity in groundwater
- Allows groundwater recharge and sediment to settle out (reduces sediment transport)
- Cost effective – these dams can use locally available materials

### Disadvantages

- They can silt up and will need maintenance
- Levels of infiltration can be slow due to silt build-up
- Unclear land tenure can result in ownership of the structure
- If designed incorrectly, may block fish passage
- When only focusing on gully plug construction, the main cause of gully development is missed.(Stauffer, 2012)





**Picture 15.** The sample of smallest dams or sand dams in Kenya

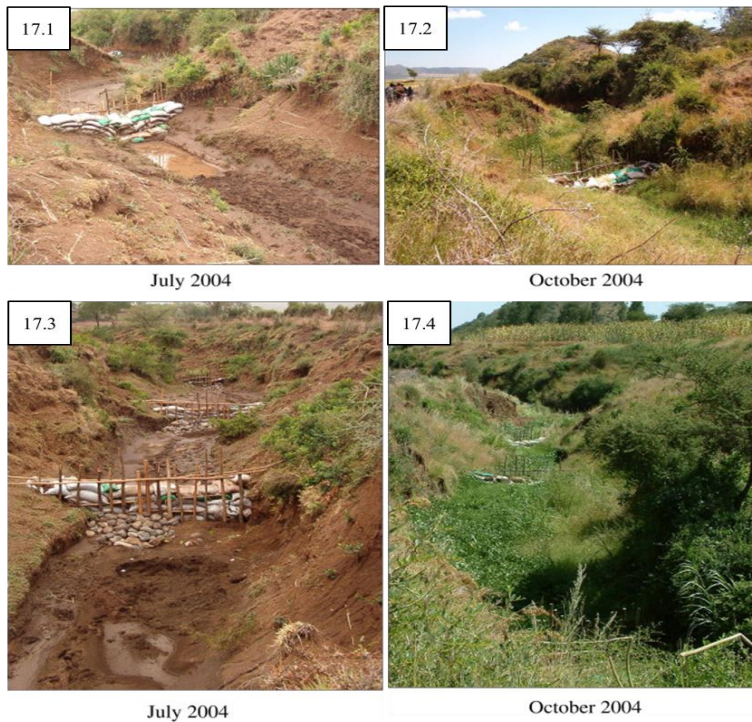
**Source:** The water project, 2012, A Layman's Guide to Clean Water, 2010 and Agfax, 2012.



**Picture 16.** The sample of smallest dams or temporary dams in Ethiopia as

16.1). Rehabilitated gully in AdagaLemne watershed, Axum, Tigray Province. Photo: Johan Rockstrom. 16.2). Relief Society of Tigray 16.3). Check dam construction in Silti to control erosion, Ethiopia 2009

**Source:** Akvopedia (Editor), 2012, U.S. Agency for International Development, 2012 and Flickr, 2009.





**Picture 17.** The sample of case study in Amhara, Ethiopia. Sandbag check dams constructed in main gullies of Kolo Kobo catchment: (17.1 and 17.3) shortly after installation of check dams and (17.2 and 17.4) three months later showing good vegetation cover and gully stabilization.

**Source:** Liu, et.al., 2008.

### The check dam in Europe

Europe each one of the continent which developed a lot of water utilization and environment conservation from the past up to present.



**Picture 18.** The sample of check dams in Europe.

**Source:** J. John, 2011 and Vincenzo D'Agostino, 2012.

### The check dam in America

America each one of the country which developed a lot of water and environment conservation from the past up to present.



**Picture 19.** The sample of smallest dams or temporary dams in America (in past).

19.1). A Beaver Dam, Tolland, Colorado. 19.2 and 19.3). Silt Collected Above a Check Dam, California.

**Source:** The Library of Congress, 2011.



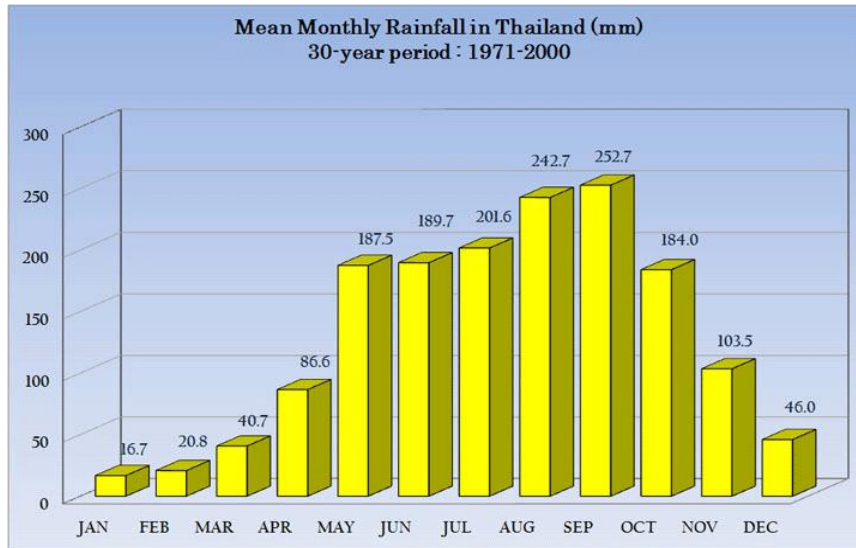
**Picture 20.** The sample of smallest dams or temporary dams in America (Modern)

20.1). A modern check dam. Photo courtesy of Washington State Department of Transportation. 20.2 and 20.3). In the Sierra foothills

**Source:** Grahame, et.al., 2002 and Y. Magarik, 2013.

## The check dam in Thailand

Thailand can best be described as tropical and humid for the majority of the country during most of the year which having 3 seasons as summer, rainy and winter.



**Picture 21.** Mean Monthly Rainfall in Thailand (mm) 30 year.

**Source:** Thai Meteorological Department. 2012

That why a lot of project for water conservation and utilization both of government and private sectors as following,

- 1) The big project of the natural water preservation will be handle by royal irrigation department, Ministry of Agriculture and cooperation.
- 2) For the secondary or moderately project will be handle by royal irrigation department and natural water resources department.
- 3) The next level will be handle by natural water resources department, Land development department and local administrative office even though local society. Check dam project will have a lowest cost by construct it with natural resources in this area such as stones that cover it with a nest to block a stream and a small river in the length.

**Picture 22.** His Majesty the King searched for sustainable, simple, and cost-saving methods to increase the size of





the country's first area by supporting the natural cycle of the forest, by build check dams across water channels or steams at intervals to retain some water and silt. The water seeps into the earth and spreads out, turning both banks into a wet forest, which can prevent forest fires.

**Source:** The Chaipattana Foundation, 2012

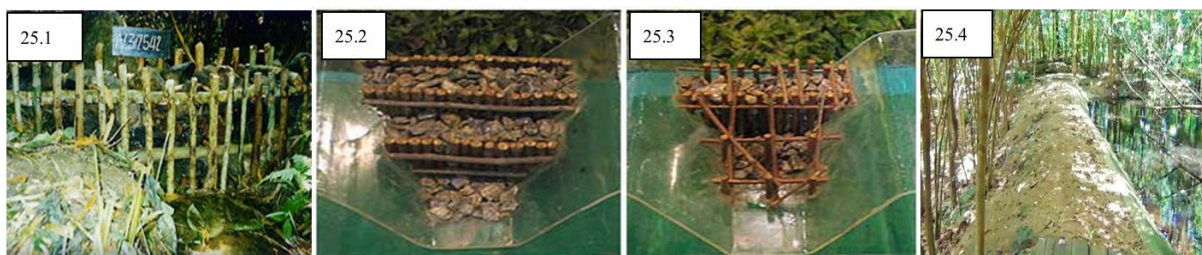
Most of Check dams in Thailand have typical dam or small dam up from the past up to 2012 can divided into 10 typical models as Picture 23, 24 and 25



**Picture 23.**The check dam in Thailand is constructed using local material following as 23.1).Arrangement with rock 23.2).Rock framed with wood 25.1).Concrete framed fill with rock  
**Source:** The Office of Public Relations Region 2, 2011, Matchon online, 2008 and Parichat, 2012.



**Picture 24.**The check dam in Thailand is constructed using local material following as (Continued) 24.1).Sand bag arrangement 24.2).Pig-pen filled with sand bags 24.3).Sand bags framed with wood  
**Source:** Royal Irrigation Department, 2013, Hydro and Agro Informatics Institute, 2012 and Department of National Parks, Wildlife and Plant Conservation, 2012.



**Picture 25.**The check dam in Thailand is constructed using local material following as (Continued) 25.1). Modified Bamboo 25.2) Pig-pen filled with rock 25.3).Soil pig-pen fill with rock 25.4).Soil ridge  
**Source:** Department of National Parks, Wildlife and Plant Conservation, 2012, Hydro and Agro Informatics Institute, 2012 and Oknation.net. 2011.

The typical local check dam in Thailand were developed about 10 typical local check dams as mentioned, however Thailand still develop more type of local check dam which different location, purpose and variation best on suitable material for each local check dam.

Some of the project in Thailand so wonderful targets. The local check-dams aim to preserve

and slow down the stream in the forest, providing drinking water and bathing areas for wild elephants. Volunteers divided into many groups. Some helped to dig the big rocks from the ground while other help to pass the rocks for filling into the check dam until full. With the cooperation of over 140 volunteers, we can finished 71 check dams along the stream within 4 hrs.



**Picture 26.** Check dam making aiming to slow down the stream and trap the sediment. The main structure of the check dams made by bamboo as a cage with 50 cm. high, a crossing the stream at every 5 - 10 meter apart from each other. Providing drinking water and bathing areas for wild elephants.

**Source:** Bring the Elephant Home, 2012 and Department of National Parks, Wildlife and Plant Conservation, 2012.



**Picture 27.** The sample of Solar Generation volunteers constructs a check dam in rural area.

**Source:** S. Charoenpipatpimpa, 2008

Solar Generation constructs a check dam by digging, cutting grass to adjust the area, carrying bricks for the dam in Occupational Patient Rights Network. The activity is part of Global Day of Action aiming to send message "get serious about climate change" to governments around the world gather at the Conference of Parties under UNFCCC and Meeting of the Parties under Kyoto Protocol in Poznan, Poland where negotiations are ongoing on a range of measures to curb greenhouse gas emissions to stop the dire impacts predicted to result from climate change. Mae Moh coal plant is one of the largest lignite-fired electricity generating facilities in Southeast Asia. Every hour the plant pour approximately 7 tons of sulphur dioxide into the local environment. Every year, Mae Moh coal plant emits over 7 million tons of climate change-inducing carbon dioxide.

The monk's initial development projects constructed a long network of check dams able to retain natural water resources in a series of small reservoirs. The construction of the check dam system involved local community members, military personnel, and government officials. The collaboration between both local and external organizations (Government, Military and NGOs) is a key pillar in Wat Doi Pha Som's sustainable development scheme. Twelve months after the check dams' construction, the moisture content and growth potential of the local soil steadily increased. Currently there are over 100 check dams of different sizes [0.25m-2m] in the Hoi Bong watershed.

All of the natural water preservation project in Thailand classifieds as big, medium and small level depend on amount of investment by financial budge of government for every year with the big amount but the Thailand people still not enough for their demand. The farmer or the land holder in local area cannot wait for the governmental



budget them looking for private natural water preservation making by themselves. The two main ideas for making private check dam, first one is a low cost investment and the second for local material utilization without complicated procedures. The researcher want to make the pilot model of check dam for enhance the farmer or land holder which having dry or empty small cannel to preserve the rainy season water with the lowest cost on their own investment.



**Picture 28.** The sample of various local check dam which initiate by monk.

**Source:** Phra S.Thanapanyo, 2011

Reforestation efforts during the first year of development complemented the check dam network by supporting the soil's ability to retain natural water resources. Plants from the 'sufficiency economy' three categories of resourceful plants (Food, Usage, and Economic) were planted.

"Check dams" helps to retain moisture content and enables growth potential of the local soil.

## 2. Objective

The researcher tries to soft the problem by aiming to

- 1) Screening for advantage and disadvantage of ten former check dam in Thailand.
- 2) Making the proper check dam for low cost with local material utilization.
  - 2.1) Consideration for select location
  - 2.2) Step of making check dam
    - 2.2.1) Main structure for against the stream of water (Enforcement Structure)
    - 2.2.2) Sub-structure for implement against the stream of water (Re-enforcement Structure)
    - 2.2.3) To seal for the water control both of sealing and level of water
    - 2.2.4) Making proper reservoir not to damage to any point of view
- 3) Collected the concerned data on preserving water.

## 3. Methodology

Groups of the researchers from university, local administrators and local farmers come to the field and brainstorming in each step with final conclusion before tried out in each step and collect the data by group consideration with final satisfaction

## 4. Results

- 1) Screening for advantage and disadvantage of ten former check dam in Thailand.



**Table 1:** Screening for advantage and disadvantage of ten former check dam in Thailand

Type of Dam	Advantage	Disadvantage
1. Rock framed with wood	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair and 4) High invest
2. Sand bags framed with wood	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) high invest
3. Soil pig-pen soil with rock	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
4. Arrangement with rock	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
5. Pig-pen filled with rock	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
6. Pig-pen filled with sand bags	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
7. Concrete framed fill with rock	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
8. Sand bag arrangement	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest
9. Soil ridge	low durability	1) A lot of worker 2) Dirty work 3) Difficult to repair 4) High invest
10. Modified Bamboo	high durability can be paste with cement	1) A lot of worker 2) Heavy work 3) Difficult to repair 4) High invest

2) Making the proper check dam for low cost with local material utilization.

2.1) Consideration for select check dam location.

**Table 2:** Consideration for select check dam location.

<b>1) Place of check dam</b>	A. Should be narrow or not to be wider area
	B. Both side of the canal in this area should be rigid or stability and easily to places for the wooden polar
	C. If they have the big tree in this area should be modify for supporter
<b>2) Reservoir of water</b>	A. Should be more wider, larger and deeper
	B. Should not flooding to any crop or orchard
	C. Should not damage or harmful to building or animal
	D. The bank of reservoir should alright stability

- 2.2) Step of making check dam consist of four main step as following
- 2.2.1) Main structure for against the stream of water (Enforcement Structure)
  - 2.2.2) Sub-structure for implement against the stream of water (Re-enforcement Structure)
  - 2.2.3) To seal for the water control both of sealing and level of water
  - 2.2.4) Making proper reservoir not to damage to any point of view



**Picture 29.** Step of making low cost check dam material utilization following

- 29.1). Select the location
- 29.2). Making Enforcement structure by polar wood
- 29.3). Re-enforcement structure by bunch of connecting bamboo
- 29.4). A bunch of connecting bamboo to place nearby the polar wood.
- 29.5). To seal bunch of connecting bamboo with inner plastic bag of fertilizer, without any polluted any material for the coming rainy season.
- 29.6). The completed low-cost check dam with local material utilization

**Source:** Saranrom, 2011

- 2.2.1) Main structure for against the stream of water (Enforcement Structure)

Main structure for against the stream of water (Enforcement Structure) can be applied with so many type of local material utilization. The groups of the researcher tried to searching and comparing among them

**Table3.**Comparisons of four type of local material for making main structure for against the stream of water (Enforcement Structure)

Local Material	Advantage	Disadvantage
1.Factory Wooden Polar	1. High Quantity of water preservation 2. Marketable supply 3. Strong Structure 4. Easily to work	1. Expensive
2. Bamboo Polar	1. High Quantity of water preservation 2. So abundant 3. Moderately strong structure 4. Easily to work 5. Some area free of charge	1. Inferior than factory wooden polar or steel pipe
3. Wooden Tree Polar	1. High Quantity of water preservation 2. So abundant 3. Moderately strong structure 4. Easily to work 5. Some area free of charge	1. More heavier than bamboo polar 2. Sensitive to deforestation
4. Pepper climbing pole	1. Strong structure 2. Marketable supply	1. Limited length for 4 meter only 2. Heavy weights and clumsy
5. Steel pipe	1. Highest strong 2. Compactness structure 3. Not limited on length 4. The farmer can get reused material for cheaper	1. Expensive

2.2.2) Sub-structure for implement against the stream of water (Re-enforcement Structure)

**Table4.**Comparisons of four type of local material for making splint for sub-structure for against the stream of water (Re-enforcement Structure)

Local Material	Advantage	Disadvantage
1. Stem of red grass, Giant reed, Great reed ( <i>Arundodonax</i> L.)	1) Local availability 2) So abundance 3) Cheap or some area free of charge 4) Compactness structure	1) Lowest reinforcement 2) Easily to broke 3) Shorts period durability
2. Stem of bambam, ( <i>Donaxgrandis</i> (Marantaceae)),	1) Local availability 2) So abundance 3) Cheap or some area free of charge 4) Compactness structure	1) Low reinforcement 2) Moderated to broke 3) Should be made for basket or other utilization 4) Sensitive to deforestation
3. Grinding Bamboo	1) Local availability 2) So abundance 3) Cheap or some area free of charge 4) Compactness structure 5) No limitation for length	Consume the time for grinding
4. Factory wooden twig	1) Compactness structure 2) Easily to work 3) Strongest structure	Expensive



2.2.3) To seal for the water control both of sealing and level of water

**Table5.**Comparisons of four type of local material for the water control both of sealing and level of water

Local Material	Advantage	Disadvantage
1.Tinplate	<ol style="list-style-type: none"> <li>1. High Quantity of water preservation</li> <li>2. Marketable supply</li> <li>3. Stronger structure</li> <li>4. Corrugation Structure increase reinforcement</li> </ol>	<ol style="list-style-type: none"> <li>1. Clumsy for setting</li> <li>2. Consumed the time</li> <li>3. Difficult for removal</li> <li>4. Risky on work</li> <li>5. Difficult for bending</li> <li>6. Fixed level of water for one level only cannot be adjust</li> </ol>
2. linoleum	<ol style="list-style-type: none"> <li>1. High Quantity of water preservation</li> <li>2. Marketable supply</li> </ol>	<ol style="list-style-type: none"> <li>1. Clumsy for setting</li> <li>2. Difficult to bending compare to plastic sheets</li> <li>3. Consumed the time</li> <li>4. Should be complete linoleum without hole</li> </ol>
3. Plastic sheet or vinyl sheet	<ol style="list-style-type: none"> <li>1. Cheap</li> <li>2. Can get reused material</li> <li>3. Public participation</li> <li>4. No residual effect</li> <li>5. Can adjust the level of water preservation</li> <li>6. Easily for making and repair</li> <li>7. Low worker</li> </ol>	<ol style="list-style-type: none"> <li>1. Low technology</li> <li>2. Moderately effective</li> <li>3. Sensitive maintenance</li> </ol>
4. Inner side of fertilizer plastic bag	<ol style="list-style-type: none"> <li>1. Cheapest or free of charge</li> <li>2. Using waste material</li> <li>3. Easily to adjust or control level of water</li> <li>4. Compactness structure</li> <li>5. Lowest worker</li> <li>6. Easily to repair or removal</li> </ol>	Frequently maintenance

2.2.4) Making proper reservoir not to damage to any point of view

After finished the making procedure, the farmer should made a survey in the water reservoir area and made a proper phenomenal not to be damage to the environments.



**Picture 30.**Showing the status of some cannel in 30.1).rainy season 30.2).dry season and 30.3).After preservation (Water reservoir area) in Eastern region of Thailand

Source: Saranrom, 2011

3) Collected the concerned data on preserving water.

**Table 6.** The data on place, type of location, size of check dam, quantity of water preservation, cost of investment and benefited area of making check dam in Eastern region of Thailand (Huay Rang Distric, Amphoe Muang, Trad Province).

No.	Place.	Type of location	Size of check dam (m <sup>2</sup> )	Quantity of Water Preservation. (m <sup>3</sup> )	Cost of Investment		Benefited area	
					Bahts	US\$*	Rais.	Acres.**
1.	Ban Klong-Peed, Moo 10	Across under the bridge	3 * 1.2	3,500	4,300	143.57	120	300
2.	Ban Klong-Peed, Moo 10	Across under the bridge	3 * 1.2	2,500	4,500	150.25	70	175
3.	Ban Klong-Peed, Moo 10	Across the cannel	5 * 1.2	3,000	5,000	166.95	100	250
4.	Ban Koh-Kwang, Moo 1	Across the cannel	4 * 1.2	2,500	4,700	156.93	140	350
5.	Ban Chang-klua, Moo 6	Across the cannel	5 * 1.2	5,000	5,250	175.30	150	375

\* 1 US\$. approximately 30 baht

\*\* 1 Acre equal to 2.5 Rais.

## 5. Discussion

From the results

### 1). Discussion on screening for advantage and disadvantage of ten former check dam in Thailand.

All of the 10 typical check dam in Thailand quiet adopted to the Thai citizenship because they want to follow up the King Bhumiphol's idea, who was the first declared that "Water is life" and a lot of the local society tried to made some of the 10 check dam in the rural area for donate to the king. However the said project quiet consume a lot of worker and implement with heavy work (difficult to carry the rock and the sand bags, it should be strongman or the soldier). The new pilot model of the check dam made the stream of breakthrough by local portable check dam with cheap and local material utilization.

### 2) Discussion on making the proper check dam for low cost with local material utilization.

The making check dam for this location just only suitable for eastern region of Thailand in the other path of Thailand can be applied the other local material to suited for the specific of check dam. Especially in some of the area the local material can be free of charge. In the other country just like China, India, Cambodian, Laos, Vietnam, Philippines and so on can be modified in the said matter.

After making the low cost check dam some of the farmer can made the infrastructures just like enforcement to made with the cement material for convenient or reuse for every year or every rainy season. The quantity of water preservation can be various by the wide length and deep of the cannel.

**3) Discussion on the value of low cost check dam.**

In Thailand all of the water preservation project can be dividing into 4-5 type as table number 7.

**Table 7.** The theoretical check dam in Thailand can be classified by the value of expenditure

No.	Type of water preservation project	Responsibility Sector	Approximately Investment	
			Baht	US\$*
1.	Big (Permanently)	Royal Irrigations Department	More than 5,000,000	More than 166950.0
2.	Medium (Semi-Permanently)	1. Royal Irrigations Department	500,000	16695.00
		2. Natural water resource department	– 5,000,000	– 166950.00
3.	Small (Temporary)	1. Natural water resource department	50,000	1669.50
		2. Land Development	–	–
		3. Local Administrator	500,000	16695.00
4.	Local wisdom	1. Local Administrator	5,000	166.95
		2. Local Society	– 50,000	– 1669.50
5.	Desirable local check dam	Researcher	Less than 5,000	Less than 166.95

\*1 US\$ approximately 30 baht

Follow this model of check dam the farmer or the land owner should not wait for the governmental budget any more. They should stand it up by themselves with the low cost check dam and applied for the most suitable in their area. The making check dam also directing to preserve environments, human habitat and sustainable agricultural development so on. (Lenzi, 2002, Boix-Fayos, et.al., 2007, Rajabu, 2005 and Khlifi, et.al., 2010)



**Picture 31.** The sample of the river which suitable to make the local check dam.

**Source:** Mirror Wild Nature Advance Photographic, 2012, Thai Art Studio, 2012and Saranrom, 2011.

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