

# Making Portable Small Check Dams for Water Preservation from Rainy Season up to Dry Season in Eastern Region of Thailand

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**Abstract**—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 portable type. 3) Collected the concerned data on preserving water from rainy season up to dry Season. The procedure was done by the three groups of researchers from Rambhai Barni Rajabhat University, Local administrator and local farmer to come together in the field and make a final conclusions among the groups in each step by step at Tambol Huay-Rang, Amphoe Maung, Trad province. For making pilot model was divided into 6 step as following 1) Take a consideration to former check dam in Thailand 2) Making inforcement structure by comparative studies for 5 kinds of local materials 3) Making reinforcement structure by comparative studies for 4 kinds of local materials 4) Sealing for the water control both of sealing and level of water by comparative studies for 4 kinds of local materials 5) Making proper reservoir. 6) The completed portable small check dams for water preservation from rainy season up to dry season in Trad Province getting the achievement. The researchers can get achievement with 5 Portable Small Check Dams.

**Index Terms**— Portable small check dams; Low cost; local material utilization; Water preservation from rainy season up to dry Season.

## I. INTRODUCTION

Water is essential natural resources for human life. It start from inside and outside the human body up to domestic use for example industrial use, transportation use, sport use, recreation use and also influence to human habitats, environments and ecosystem including the way of living such as sustainable agriculture, sufficiently economic system [1], [2], [3]. 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 example in the critical period of Durian.

On other countries such as India, China, Afghanistan and so on including Thailand have abundance of water in rainy season but lack of the water in dry season. 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. 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 [1], [2], [3].

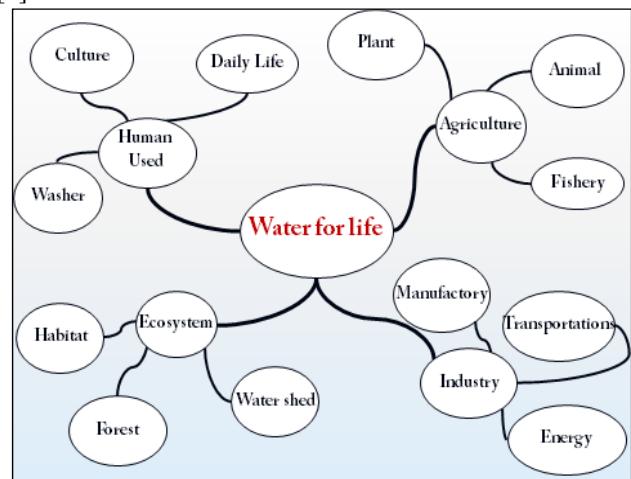


Fig. 1. Water is essential natural resources for human life, industrial use, transportation use, sport use recreation use and also influence to human habitats, environments and ecosystem

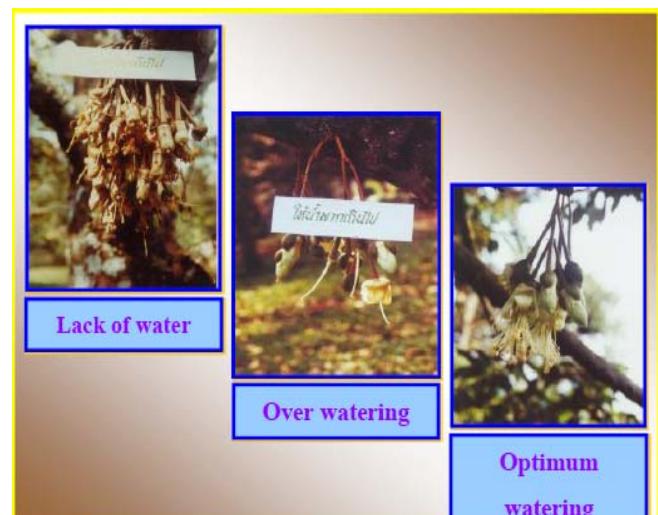


Fig. 2. Critical period for optimum water management during flowering of Durian.



Fig. 3. The sample of Top Three highest dam in the worlds as 1).Rogun Dam (Tajikstan) 2).Nurek Dam (Tajikistan) 3). Grand Dixence (Switzerland)

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Fig. 4. The sample of Top Three Largest dam in the worlds as 1). Three Gorges (China) 2). Syncrude Tailings (Canada) 3). Aswan Dam (Egypt)

Second levels of the natural water preservation also named as dam but smaller size the structure are semi-permanently building and the third levels of the natural water preservation known as check dam or smallest dam or temporary dam and so on.



Fig. 5. The sample of semi-permanently dam make from 1). Rock 2). Earth and 3). rubber



Fig. 6. The sample of smallest dams or temporary dams in Europe (Pennsylvania) as 1). A 3 ft in Lancaster County. 2). A deteriorated 5 ft in York County 3). A 10 ft in Carbon County

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



Fig. 7. The check dams or temporary dam in China as 1). Zhaoxing Dam 2).village Tangmo, Huang Shan 3).Gabion baskets Dam



Fig. 8. The check dams or temporary dam in India as 1). The first check dams are constructed from vehicle tires, sand, stones, cement, bamboos and plastic microconcrete. 2). Vanrai Dam 3). Tabelagummi Dam

The people try to utilization it with carefully system, especially try to preserve it from rainy season until dry season by so many technology concerned for example pond, dam, check dam and so on. A Check dam is the construction or small barrier that lay across the stream of water flow, constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a cannel, small river, constructed swale or drainage ditch for the purpose of water harvesting [4], [5]. 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 [6], [7], [8], [9]. 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 are 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 [5].

#### *The check dam in Thailand*

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 rather 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. They were looking for private natural water preservation making by them. Because of 10 of the former local check dam quite expensive and consumed heavy work for them. 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 up to dry season with the lowest cost on their own investment. Most of Check dams in Thailand have typical dam or small dam up from the past up to 12 can divided into 10 typical models

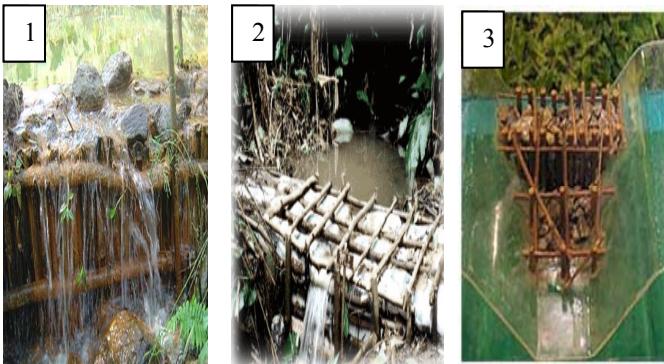


Fig. 9. The check dam in Thailand is constructed using local material following as 1) Rock framed with wood 2) Sand bags framed with wood 3) Soil pig-pen fill with rock

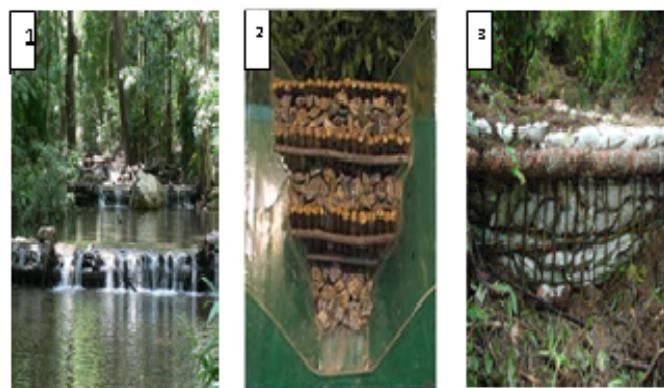


Fig. 10. The check dam in Thailand is constructed using local material following as (Continued) 1) Arrangement with rock 2) Pig-pen filled with rock 3) Pig-pen filled with sand bags



Fig. 11. The check dam in Thailand is constructed using local material following as 1) Concrete framed fill with rock 2) Sand bag arrangement

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 they looking for private natural water preservation making by themselves. The two main ideas for making private portable small check dam, first one is a low cost investment and the second for local material utilization without complicated procedures [10], [11]. 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.



Fig. 12. The check dam in Thailand is constructed using local material following as (Continued) 1) Soil ridge 2). Modified Bamboo

## II. OBJECTIVE

A. 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 portable small check dams for water Preservation from Rainy Season up to Dry Season in Eastern Region of Thailand 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 (Inforcement structure)
    - 2.2.2) Sub-structure for implement against the stream of water (Reinforcement Structure).
    - 2.2.3) 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.

## III. METHODOLOGY

Three 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.

## IV. RESULTS

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

TABLE I: 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 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 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 II: CONSIDERATION FOR SELECT CHECK DAM

Place of check dam	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
Reservoir of water	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 portable small check dam consist of four main steps as following

- 2.2.1) Main structure for against the stream of water (Inforcement Structure)
- 2.2.2) Sub-structure for implement against the stream of water (Reinforcement 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



Fig. 13. Step of making low cost check dam material utilization following

- 1). Select the location
- 2). Making inforcement structure by polar wood
- 3). Reinforcement structure by bunch of connecting bamboo
- 4). A bunch of connecting bamboo to place nearby the polar wood.
- 5). Seal bunch of connecting bamboo with inner plastic bag of fertilizer, without any polluted any material for the coming rainy season.
- 6). Complete with portable small check dam

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

TABLE III: COMPARISONS OF FOUR TYPE OF LOCAL MATERIAL FOR MAKING MAIN STRUCTURE FOR AGAINST THE STREAM OF WATER (INFORCEMENT 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 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

#### 2.2.1) Sub-structure for implement against the stream of water (Reinforcement Structure)

TABLE IV. COMPARISONS OF FOUR TYPE OF LOCAL MATERIAL FOR MAKING SPLINT FOR SUB-STRUCTURE FOR AGAINST THE STREAM OF WATER (REINFORCEMENT STRUCTURE)

Local Material	Advantage	Disadvantage
1. Stem of red grass, Giant reed, Great reed ( <i>Arundo donax</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 bembam, ( <i>Donax grandis</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

TABLE V: COMPARISONS OF FOUR TYPE OF LOCAL MATERIAL FOR THE WATER CONTROL BOTH OF SEALING AND LEVEL OF WATER

Local Material	Advantage	Disadvantage
1.Tinplate	1. High Quantity of water preservation 2. Marketable supply 3. Stronger structure 4. Corrugation Structure increase reinforcement	1. Clumsy for setting 2. Consumed the time 3. Difficult for removal 4. Risky on work 5. Difficult for bending 6. Fixed level of water for one level only cannot be adjust
2. linoleum	1. High Quantity of water preservation 2. Marketable supply	1. Clumsy for setting 2. Difficult to bending compare to plastic sheets 3. Consumed the time 4. Should be complete linoleum without hole
3. Plastic sheet or vinyl sheet	1. Cheap 2. Can get reused material 3. Public participation 4. No residual effect 5. Can adjust the level of water preservation 6. Easily for making and repair 7. Low worker	1. Low technology 2. Moderately effective 3. Sensitive maintenance
4. Inner side of fertilizer plastic bag	1. Cheapest or free of charge 2. Using waste material 3. Easily to adjust or control level of water 4. Compactness structure 5. Lowest worker 6. Easily to repair or removal	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.



Fig.14. Showing the status of some canal in 1) rainy season 2) dry season and 3) After preservation (Water reservoir area) in Eastern region of Thailand

3) Collected the concerned data on preserving water.

TABLE VI. 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 DISTRICT, AMPHOE MUANG, TRAD PROVINCE).

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.**
P1	Across under the bridge	3 X 1.2	3,500	4,300	143.57	120	300
P2	Across under the bridge	3 x 1.2	2,500	4,500	150.25	70	175
P3	Across the canal	5 x 1.2	3,000	5,000	166.95	100	250
P4	Across the canal	4 x 1.2	2,500	4,700	156.93	140	350
P5	Across the canal	5 x 1.2	5,000	5,250	175.30	150	375

\* 1 US\$. Approximately 30 baht

\*\* 1 Acre equal to 2.5 Rais.

P1; Ban Klong-Peed, Moo 10, Amphor Muang, Trad Province  
P2; Ban Klong-Peed, Moo 10, Amphor Muang, Trad Province  
P3; Ban Klong-Peed, Moo 10, Amphor Muang, Trad Province  
P4; Ban Koh-Kwang, Moo 1, Amphor Muang, Trad Province  
P5; Ban Chang-klua, Moo 6, Amphor Muang, Trad Province

## V. 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, Malaysia, Ceylon 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 inforcement 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 canal.

### 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 VI

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 [13], [14], [15].

TABLE VII. THE THEORETICAL CHECK DAM IN THAILAND CAN BE CLASSIFIED BY THE VALUE OF EXPENDITURE.

Type of water preservation project	Responsibility Sector	Approximately Investment	
		Baht	US\$*
Big (Permanently)	Royal Irrigations Depart.	More than 5,000,000	More than 166950.0
Medium (Semi-Permanentl y)	1. Royal Irrigations Depart. 2. Natural water resources depart.	500,000 5,000,000	16695.00 166950.00
Small (Temporary)	1. Natural water resources depart. 2. Land Development 3. Local Administrator	50,000 — 500,000	1669.50 — 16695.00
Local wisdom	1. Local Administrator 2. Local Society	5,000 50,000	166.95 —
Desirable local check dam	Researcher	Less than 5,000	Less than 166.95

\*1 US\$ approximately 30 baht

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