Environmental Research Journal
MEDWELL PUBLICATIONS

The Feasibility Study in Development of the Kha-Kang Creek Muang District, Maha Sarakham Province

[1]Prayoon Wongchantra, [2]Kuantean Wongchantra, [1]Uraiwan Praimee, [1]Likhit Junkaew, [1]Kannika Sookngam, [1]Suparat Ongon and [1]Surasak Kaeongam
[1]*Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham, Thailand*
[2]*Srimahasarakham Nursing College, Mahasarakham, Thailand*

Key words: Feasibility study, development of the Kha-Kang creek, Maha Sarakham province

Corresponding Author:
Prayoon Wongchantra
Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham, Thailand

Page No.: 9-18
Volume: 14, Issue 01, 2020
ISSN: 1994-5396
Environmental Research Journal

Absract: The Kha-Kang creek was originated from the Kok-Hin-Lad forest, Muang district, Maha Sarakham province and has total length of 60.82 km. A creek that are important to the public by utilization in agriculture and production of water supply. The objective of this research was to study the feasibility study in development of the Kha-Kang creek Muang district, Maha Sarakham province by divided into 3 phases: upstream, midstream and downstream. The scope of the study had 4 aspects of space and situation Kha-Kang creek; technical development of water resources Kha-Kang creek, economics, management Kha-Kang creek and public hearing. The research found that space and situation Kha-Kang creek. Kha-Kang creek flows through 8 sub-district including Khok-ko sub-district, Nong No sub-district, Thalad sub-district, Kaeng Loeng Jan sub-district, Lat Phatthana sub-district, Koeng sub-district, Khwao sub-district and Tha Tum sub-district, Maha Sarakham Province. The Kha-Kang creek was mainly used in agriculture and livestock. The technical development of water resources Kha-Kang creek example dredging, building a reservoir, build a dam, make a canal, economics irrigation project with a total budget of 25.3 million.baht. Which is cost-effectiveness and appropriateness of implementation. The management including the reconstruction of the canal, integrated water management and the public hearing. Most of the participants were able to participate and agree on the development of the development of Kha-Kang creek was appropriate for the area.

INTRODUCTION

At present, the problem of degradation of water resources has intensified all the time. One of the important reasons is the accelerated economic development regardless of the impact and the ability to recover natural resources. Thailand also has a lack of integrated water resources management. This is a key achievement

(DWR., 2003, 2012). In addition, the management of land use in watersheds that do not comply with the watershed management principles has changed the composition of ecosystems in the watershed. The impact on the environment and natural resources in the watershed. Watershed management, the past was often not achieved because of the focus on watershed management, the extent of the area and management policies are too broad difficulties in achieving a budget goal. The community in the watershed is not responsible. If the communities in the area do not know or do not respond to the spirit in good way. It is difficult for the operation to succeed (Kudtalang *et al*., 2016).

Kha-Kang creek is a sub-basin area of Chi river which has a total area of 546 km^2. The total length is about 60.28 km. There are upstream at Ban Nong Bua-Non Mee, Bua Kho sub-district, Muang district. Kha-Kang creek flows through 8 sub-district, including Khok-ko sub-district, Nong No sub-district, Thalad sub-district, Kaeng Loeng Jan sub-district, Lat Phatthana sub-district, Koeng sub-district, Khwao sub-district and Tha Tum sub-district, Maha Sarakham province. Then flow to the Chi river at Ban Tum, Tha-Tum sub-district, Mueang district, Maha Sarakham province.

For this reason, Kha-Kang creek is a stream that feeds the life of the Maha Sarakham. It is a source of fish to make a living. Water resources in agriculture. The source of raw water used to plant water. The Kha-Kang creek is a source of water that has been a major factor in the establishment of Maha Sarakham, since, 1865. The factors that make Maha Chai (The first governor) with Thao Bua-Tong to select this area was the city of Maha Sarakham to expand the city (MPOCICS., 2018). Now a days, Kha-Kang creek do not qualify for such activities. Because of the impact of the growth of urban society relentless. The drainage of the municipality and the discharge of waste water into the creek. Water is contaminated with sewage, disease and chemicals, so, it can not be used for consumption. In addition, agriculture by planting monoculture in the upstream area. The watershed forest which has over 8,000 km^2 has been degraded. The use of chemicals severely impacted on water quality, erosion of the soil as a result, the shallow branch of the creek (Rojwirat, 2006).

The problem with Kha-Kang creek was likely to be intensified in order and to improve water quality for maximum efficiency. Therefore, the researcher has realized the importance of studying the feasibility study in development of the Kha-Kang creek, Muang district, Maha Sarakham province by studying the feasibility of the area and the water situation, the feasibility technical development of water resources, the feasibility of economics, the feasibility of management of creek and public hearing to manage water resources.

MATERIALS AND METHODS

The study the feasibility in developing of the Kha-Kang creek, Muang district, Maha Sarakham province is divided into 3 phases: upstream, medium and downstream and analyze the feasibility of the area, situation of water resources, the feasibility technical, the feasibility of economics and the feasibility of management of creek using primary data and qualitative research, the study documents, the concepts and theories involved in comparing the feasibility of developing and managing the water in Kha-Kang creek (Chunkeaw, 2002).

Data collection: In this research, the data were collected from the actual situation by recording and primary data and analyze information from documents, books, media and other documents related to Kha-Kang creek project in feasibility analysis of the area, the feasibility technical, the feasibility of economics and the feasibility of water management.

Data analysis: In analyzing the study data, the feasibility of development of the Kha-Kang creek Muang district, Maha Sarakham province. There are issues.

The feasibility of the area and situation of Kha-Kang creek: Assessing the initial area to evaluate the appropriateness of the development of Kha-Kang creek, secondary data collection or statistical data and the water situation to set up guidelines for water resources development.

The feasibility of the technical development the Kha-Kang creek: Study on techniques for water source development to plan the management of Kha-Kang creek, suitable for conservation and rehabilitation, improvement of water quality, the water management system that can support enough water and shallow water protection.

The feasibility of the economics: Considering cost analysis of the project, the cost of machinery, operating expenses for the choice of decisions and information to the agency responsible for development projects. This will lead to efficient operation and the most rewarding return.

The feasibility of management Kha-Kang creek: Study on the conservation and rehabilitation of the Kha-Kang creek including water management, water management, good governance in water management, integrated water resources management and the composition of water resources management.

Public hearing: Studies with the participation of the people in the project area is divided into 3 phases: upstream, midstream and downstream.

RESULTS AND DISCUSSION

A feasibility study on the development of Kha-Kang creek, Mueang district, Maha Sarakham province can be divided into the possibility of the area and the situation of Kha-Kang creek, technical development of the water resources, economics and the management of water resources of the Kha-Kang creek.

The feasibility of the area and situation of Kha-Kang creek: In the study, the area of the Kha-Kang creek is in the Muang district, Maha Sarakham province was divided into 3 phases; the first, upstream is covered the Khok Ko and Nong No sub-district, the second, the midstream is covered the Talad and Kaeng Lueang Jan sub-district. And the third, the downstream is covered the Keng, Khao and Tha Tum sub-district (Fig. 1).

A feasibility study of the area and the situation of Kha-Kang creek can be described the results as follows. The upstream is covered the distance about 26.2 km. The retention of water in the upstream is about 126.4 million/N^3. In the both riverside area of Kha-Kang creek is the main area for agricultural. And some of them is used for resting place for now a days. That there are a lot of people to take advantage on it. As a result, the water in the upstream of Kha-Kang creek is lower quality than before. The canal has been shallow. That in the drought season the water in Kha-Kang creek is insufficient for the use of people in the area (Fig. 2).

Fig. 1: Map showing the flow of Kha-Kang creek upstream, midstream and downstream

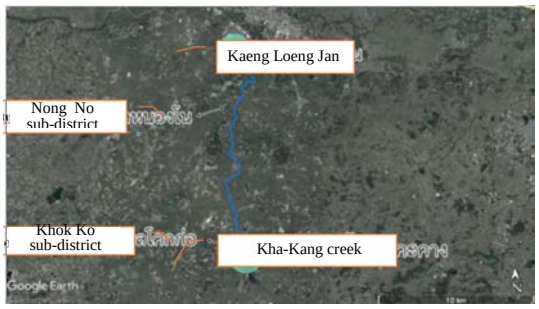

Fig. 2: Map showing the flow of Kha-Kang creek upstream

A feasibility study of the area and the situation of Kha-Kang creek can be described the results as follows. In the midstream is covered the area of the distance about 5.18 km. In the both river side of these area is for residence or urban area. Within there are some of commercial buildings and some agricultural areas. Where the wastewater is discharged into the canal of Kha-Kang creek. That affects to the agricultural area. For this reason, it is necessary to develop Kha-Kang creek for better utilization and quality (Fig. 3-5).

A feasibility study of the area and the situation of Kha-Kang creek can be described the results as follows. In the downstream is covered the area from Mahasarakram University (Urban Campus) to Tha Tum

Fig. 3: Kha-Kang creek

Fig. 4: Floodgate of Khok-Ko reservoir

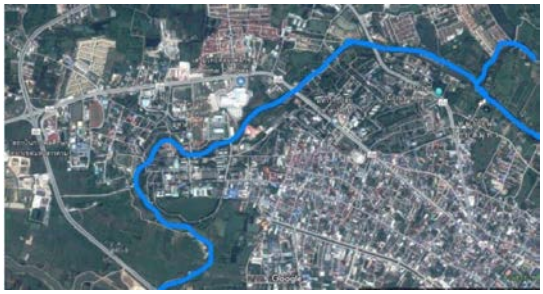

Fig. 5: Map showing the flow of Kha-Kang creek midstream

Fig. 6: Kha-Kang creek (Maha Sarakham University)

Fig. 7: Situation of Kha-Kang creek

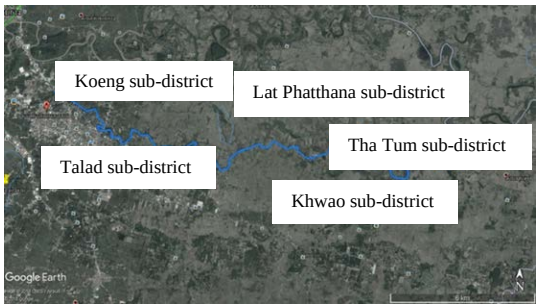

Fig. 8: Map showing the flow of Kha-Kang creek downstream

Fig. 9: Kha-Kang creek

Fig. 10: Kha-Kang creek with Chi river, Tha Tum, Mueang, Maha Sarakham province

Fig. 11: Kha-Kang creek

sub-district and the distance along the canal is about 28.9 km. In the both riverside area is used for agriculture mainly. In their area has enough water in all seasons. The rainy season will be partially flooded. And some of water is released from consumption. That have an affect on the water quality in the canal lower (Fig. 6-8).

The feasibility of the technical development the Kha-Kang creek: The development of water resources for cultivation or irrigation is the main important and useful for the people around that area. Which the Kha-Kang creek water resources development project can provide benefits to farmers in both short and long term. This project can be summarized as follows (Fig. 9 and 10):

Dredging of water resource: For the dredging of water resource must be considered the type of soil, the amount of soil to be dredged, duration of the dredging project, meteorological conditions, oceanographic conditions, geography, the defined depth, density of soil to be dredged, dust problems caused by dredging, dump location and the safety during dredging.

The building of the reservoir: General, the reservoir has 3 main components. The first component is the reservoir,

Table 1: Budget schedule of irrigation Huai Kha-Kang creek project in 2018

			Budget (Baht)	
Dredging project	Begin	End	Total	End total
Dredging Huai Kha-Kang creek canals by Department of Irrigation Mahasarakham	2018	2018	4,000,000	4,000,000
Repair the left main water distribution system. Huai Kha-Kang creek by Department of Irrigation Mahasarakham	2018	2018	800,000	800,000
Improved reservoir retention system. Huai Kha-Kang creek	2018	2018	20,000,000	20,000,000
Repair stone stool for Spillway Huai Kha-Kang creek Tambon Khokkrung, Muang, Mahasarakham	2018	2018	500,000	500,000
Sum				25,300,000

*The team develops monitoring and reporting systems performance and budget expenditures (2013:online)

Table 2: Development budget table and dredging Kha-Kang creek (upstream)

Projects	Budget (Baht)	Period time
Water resources restoration and management	1,000,000	Started in 2018
Check and maintain	-	-
Signs not to dump waste into water	-	-
Huai Kha-Kang creek water management project	1,000,000	Started in 2018
Development of Huai Huai	-	-
Kha-Kang creek (upstream)	-	-
Establish a volunteer group		
Dredging of Huai Kha-Kang creek project	5,000,000	Started in 2018
Water resources control and management program	300,000	Started in 2018
Drainage of dredging	-	-
Maintain the source of water	-	-
Plan for understanding acceptance and participation in the management of the Huai Kha-Kang creek	-	Started in 2018
Publish and promote	-	-
Sum		7,300,000 baht

Table 3: Budget schedule for irrigation project (midstream)

Program	Irrigation system (baht)	Sum of project cost (Baht)
Project preparation	30,000	30,000
Civil project	100,000	100,000
Hydraulic equipment	500,000	500,000
Electrical system	500,000	50,000
Reserve funds	300,000	300,000
Management fee and processing	2,000,000	2,000,000
Engineer consultant	150,000	150,000
VAT		
Prevent, fix and monitor environmental impact	600,000	600,000
Sum of the project (Excluding VAT)	4,180,000	4,180,000

second is the overflow drainage and the third is water tower. The reservoir will be used to store water. This will depend on the capacity of the reservoir. It will vary according to the nature of meteorology, hydrology, physical of river basin and the water demand or the purpose of the reservoir. The overflow drainage is the building that functions to drain excess water capacity from the normal containment level. The water tower is the building serves to regulate the discharge of water from the reservoir into the irrigation system. That to be used for various purposes (Fig. 11).

Table 4: Budget schedule for canal construction project (downstream)

Program	Sum of project cost (Baht)
Project preparation	4,000,000
Mower equipment	200,000
Truck	800,000
Multi purpose loaders	1,000,000
Tools for civil work	700,000
Color tools	300,000
Machine tools or other necessary equipment	1,000,000
Reserve funds	1,100,000
Management fee and processing	1,000,000
Prevent, fix and monitor environmental impact	1,300,000
Sum	7,400,000 (Baht)

The irrigation: The irrigation is the development of water resources for agriculture. There are irrigation systems that can be either canal or water pipelines. It is very useful during the dry season that there is very little rain fall. As a result, there is not enough water for cultivation. Therefore, it is necessary to have water sources for irrigation.

The feasibility of the economics: The Kha-Kang creek water resources development project is a medium-sized irrigation project. This project will be consisting of water supply and distribution system. The reservoir is an Earth fill dam. The benefit of the dam is to keep water. The water will be collected during the raining season and released for agricultural and consumerism during a shortage of water (Table 1-4).

In Table 1, the budget of irrigation project, Kha-Kang creek in 2018 was consistented with the project of dredging Kha-Kang creek canals by Department of Irrigation Mahasarakham. This project is started and ended in the year 2018 and costed with the budget of 4,000,000 baht. For the repair the left main water distribution system of Kha-Kang creek project is started and ended in the year 2018 with the budget of 800,000 baht. The improved reservoir retention system of Kha-Kang creek project is started and ended in the year 2018 with the budget of 20,000,000 baht. And the project to repaired stone stool for spillway is started and ended in the year 2018 with the budget of 500,000 baht. Consequently, the sum of the budget for Kha-Kang creek project in the year 2018 is 25,300,000 baht. For economics analysis, the budget of each phase in 3 projects

are the development and dredging Kha-Kang creek for the area of upstream with the budget of 7,300,000 baht. Table 2 the irrigation project for the area of midstream with the budget of 4,180,000 baht. Table 3 and the anal construction project for the area of downstream with the budget of 7,400,000 baht. Table 4 the overall budget for upstream, midstream and downstream is 18,880,000 baht. For the comparison with the irrigation budget for Kha-Kang creek project, the effectiveness cost is about 6,420,000 baht. So, there is a possibility. The Kha-Kang creek project has a cost-effective for the agriculture.

The feasibility of management Kha-Kang creek: Kha-Kang creek management is the management to develop water resources to be fully utilizedinto 3 phases: upstream, midstream and downstream. It requires the cooperation of all people in the area both public and private. The details are as follows.

The feasibility of management Kha-Kang creek upstream: Integrated management of Kha-Kang creek an effective water management process. This is generally, related to the supply and development. This is generally, related to the supply and development. Use for conservation and restoration of water resources. Including the problem solving of water resources both quantity and quality (Fig. 12 and 13).

The feasibility of management Kha-Kang creek midstream: It is important for the development of water resources. To make the villagers use clean water. Villagers in the nearby area used to be consumed and agriculture. Government agencies, private sectors and communities in the watershed should be jointly reviewed and improved water management processes are appropriate to the present. With the concept of policy based on reality and can be practiced by the knowledge and wisdom of all parties involved in the source of the problem.

The feasibility of management Kha-Kang creek downstream: The royal irrigation department, Maha Sarakham province were agency responsible for supervision and manage the water system in downstream. There should be measures to prevent and solve environmental problems in the Kha-Kang creek as follows:

Provide staff to maintain the equipment and wastewater treatment system to work effectively. Establishment of public relations staff for cooperation in water conservation. Do not leave the garbage, sewage or chemicals to the water. Tracking and monitoring performance always. Preparation of EIA Report and plans to protect the environment.

The reported results of the implementation of the plan to reduce and always eliminate pollution. Compliance with preventive measures and environmental impact and measures to monitor the environmental impact. To cooperate in linking the results of continuous environmental quality measurement to the environmental monitoring and control center.

Public hearing: The study of public hearing in the project is divided into 3 phases: upstream, midstream and downstream. The details were as follows.

Upstream phases: The results on the problems of water resources in the water showed that the water was not enough for agriculture, 98 households or 54.44%. The lack of water resources for consumption was 28 households, or 15.56%. Flood of 24 households or 13.33%. Drought in 18 households or 10% and water quality is not standard 12 households or 6.67%.

Midstream phases: In analyzing the data, a survey of the community in the midstream, Thalad sub-district, Kaeng Loeng Jan sub-district, Muang district, Maha Sarakham province that live near the Kha-Kang creek. Based on interviews and questionnaires with residents of 100 people by convenience sampling. The results of the survey revealed that most respondents agreed with the development of Kha-Kang creek 89%, unsure 9% and disagreed 2%.

Fig. 12: Contact the Khok-Ko

Fig. 13: To the questionnaire sub-district administration organization

Downstream phases: A survey of people in downstream areas Koeng sub-district, Khwao sub-district and Tha Tum sub-district, Muang district, Maha Sarakham province that live near the Kha-Kang creek. Based on interviews and questionnaires with residents of 260 people by convenience sampling. The results of the survey revealed that water is not enough for agriculture, 89 households or 38.25%. Floods are 20 households or 7.69%. Drought is 31 households or 11.92%. Water quality was not standardized 19 households or 7.31%.

Summarize the feasibility study of the public hearing to ensure that the selected project is practical. There is a benefit to the value of the investment and can be used effectively without affecting the environment and society. Both public and private sharing solution integrated to keep water resources in balance with increasing water demand (Fig. 13-15).

The feasibility of the area and situation of Kha-Kang creek: From our study, we have found out that the area where Kha-Kang creek originates, measures 26.2 km altogether. Whereby, the upstream lies at Kha-Kang reservoir Khok Ko sub-district, Muang district, Maha Sarakham province. The midstream is the one and only creek flowing through the city in Muang Municipality, Talad and Kaeng Lerng Jan sub-district with the length of 5.18 km. And the downstream is a river that flows through Goeng, Kwao and Ta Toom sub-district which measures 28.9 km. It is feasible and possible to do a water resource development project. The surrounding environment is to a great extent supportive for developing. Currently, dredging has been done to widen the reservoir, so that, water is sufficient for agricultures and consumption which complies to the policy to manage water resources in the Chi-region of DWR. (2003) which mentioned water supply shortage and specified that the cause of the drought was mainly the unseasonal and irregular rainfall, the growing communities and economic activities and together with agricultural expansion, both inside and outside of irrigation systems. All this calls for water shortage in summer whereby, the water resources potential is limited. Existing reservoir could not contain enough water to meet the need. Rivers and creek become shoal, cannot contain water to its full capacity which will affect the wellbeing and ways of living of the inhabitants. This conforms to the study of Boonlai and Sripokangkul (2017) which studied developing of water resources management system for sustainable agricultures, case study: Tha Khra Seam sub-district, Nam Phong district, Khon Kaen province. The water distribution system of Nam Phong was project operation and maintenance Nong Wai. The responsibility of the Regional Irrigation Office 6 (Khon Kaen) is divided into. The right main canal system, mainly for industrial purposes and for plumbing. For left main canal. The main objective for agriculture only. Irrigation area: 194,023 rai for rainwater plantation 262 million/m^3. And sent to the drought crop 410 milioln.m^3 (Planted area dependent on water cost) total annual water transport 672 million/m^3. This is consistent with the research (Wongchantra *et al*., 2017a-c) found that the project feasibility study of solid waste transfer station of Pluakdaeng Subdistrict Administrative Organization, Pluakdaeng district, Rayong of Thailand. Feasibility of project area the project area of the solid waste transfer station has a total area of 7 rai. The criteria for selection design of community solid waste transfer station. The use of space in the community solid waste transfer station using the appropriate scale. For areas with an average of 50-100 tons of waste per day, the appropriate size for the establishment of loading stations is not <5 rai. Therefore, the area used for the study is suitable for the criteria. Similaly, Wongchantra *et al*. (2017a-c) studied the project feasibility analysis of a waste-electric power plant of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province. Feasibility analysis of the availability of the power plant waste. The project area is located at the Kamalasai sub-district, Kamalasai district, Kalasin province about the 13 Rai 66 m^2 considering the project compared to the Interior Ministry. The project area is considered suitable for the establishment of power plant waste.

The feasibility of the technical development the Kha-Kang creek: Upstream of Kha-Kang creek there is a high possibility. Due to dredging, the water in Kha-Kang creek has more space for water storage. Moreover, the water resources are managed better. There is a possibility of developing the Kha-Kang creek with the way to build a reservoir. To build a dam, dredging and irrigation. Consistent with the concept of community water resources management by HAII. (2017), discusses community water resources management in drought and flood areas. It is important to develop water sources for water storage. It is a source of water for use in the dry season. Can be done in several ways such as dredging, creating a reservoir, Kaem Ling project and waterways. Consistent with Naivinit *et al*. (2015) studied the learning process together to develop water user groups to effectively manage irrigation water pipeline system. The study was conducted with farmers in the irrigation system. Bung Malang sub-district, Sawang Wirawong district, Ubon Ratchathani. The research found that. Irrigation pipe system is a form of small water source development to increase the potential of agriculture. It is a system that has little water loss during transportation to agricultural plots. This is consistent with the research Sisomporn and Brikshavana (2013) studied feasibility study on technical and financial of small hydropower project at Hauykapor

canal, Laongarm district, Saravan province, Lao PDR. The canal has the total water volume of 52.58×106 m^3/year and electricity generation use of 42.064×106 m^3/year. The turbine type is pelton with two 2.5 MW generators with total installed capacity of 5 MW which can produce annual energy of 21.325 GWh/year.

The feasibility of the economics: The investment in the development of Kha-Kang creek irrigation dredging projects were cost effectived. Due to the implementation of irrigation canals. Assists in the management and development of water resources and other resources. For stability economic, social, ecological sustainability and the development of sustainable agriculture. This conforms to the study of Songsrirote (2016) which studied the economic feasibility of the groundwater resources revelopment project. A case study of Ban Aor Kham, Kranuan sub-district, Sam Sung district, Khon Kaen province. The findimg of this research found that the cost of capital investment.

It also cost the economy and creates income for farmers in the area as well. This is consistent with the research Wongchantra *et al*. (2017a-c) studied the project feasibility study of solid waste transfer station of Maha Sarakham, Thailand. Feasibility of economics management in the field of project management, solid waste transfer station has an estimated cost of personnel to carry out the construction project and assessing personnel costs for the operation of the transfer station include: Chiang Yuen transfer station the project management budget for the construction of the project is 10,000,000 baht and the operating budget of the waste disposal station is 5,616,000 baht/year. Similarly, Wongchantra *et al*. (2017a-c) studied the project feasibility study of solid waste management in Kalasin Local Governance Organization to produce Refuse Derived Fuel (RDF). The economics of waste management to RDF, the financial return of the investment project of 177,489,006.14 Baht will have an IRR of 26.4% and a net cash flow of NPV 624,349, 487.31 million. The payback period of the project is 2 years 3 months. It shows that the RDF-5 waste incineration plant is feasible to invest in. It is a fast-paced and cost-effective RDF-5 project.

The feasibility of management Kha-Kang creek: The feasibility of management Kha-Kang creek need to be planned to use integrated watershed management. Coupled with the planning policy to be effective. Therefore, it was necessary to cooperated with all sectors in the development of Kha-Kang creek watershed. To have a water management system and measures to prevent and mitigate environmental impacts. This is consistent with the research by Talaluxmana (2014), studied on integrating water management in Phetchaburi watershed. Found that the ways to reduce the risk of water shortages caused by the allocation of water between different water use sectors. This will help reduce conflicts and the results can be used as a decision-making tool in water resources management planning. In addition, the study also found that water management under the operating reservoir characteristics constant. To make inefficient use of water. Therefore, the criteria should be adjusted to suit current water use and rainfall conditions. Similarly, Kositsakulchai (2010) studied on participatory planning for water security in Samutsakhon using web geographic information system. The finding of this research found that the water management Samutsakhon planning used a clarification mechanism, tried to understand and invited relevant agencies to participate. It enables the integration of a mission of each agency.

Public hearing: A study of the feasibility of the public hearing project. To ensure that the selected project is practical. There are benefits and returns that are worth the investment and can be used efficiently. It does not affect the environment and society later and can be achieved objectives. To solve the water resources problem. It was a factor in driving economic and social development and the people who lived in areas of water Kha-Kang creek has worked well together. Well find out how integrated solutions and water resources management is balanced with increasing water demand. Consistent with the concept of the social research Institute which discusses environmental management through an administrative process independently. But environmental issues are spatial and need to integrate clustered capacity. So, adjusting working patterns, including the spatial budget and indicators that will serve as a common goal will increase the efficiency and effectiveness of the system. This is consistent with the research of Polpetch (2004) studied on right to freedom and human dignity. Discusses the power to manage natural resources and the environment that the state monopolizes. To cause natural resources and environment deteriorate dramatically. Therefore, the need to modify the power of the community and public participation in the management of natural resources and the environment. Similarly, Tangtham (1987) discussed the problem of watershed management. Most of the government policies. However, there must be people in the community to participate in the implementation of the watershed management. The problem of land use conflict is reduced. It is a direct

response to basic needs of the community. This is consistent with the research of Sachchaveta (2002) studied on participation in the utilization of water resources of farmers from irrigation projects case study: Huai Aeng reservoir project, Roi ed provinct. The results revealed that the farmers in irrigation project reservoir basins are involved in the use of water in the medium.

CONCLUSION

To study the feasibility in development of the Kha-Kang creek Muang district, Maha Sarakham province. It is divided into 3 phases: upstream, medium and downstream.

RECOMMENDATIONS

The recommendations of this research were: government departments must provide farmers took part in irrigation projects and to support the activities of water users seriously. Including the need to make agricultural knowledge to farmers. Farmers should have a collective consciousness. Guidelines for conservation of Kha-Kang creek. The public offer to manage leachate problems and community wastewater problems.

ACKNOWLEDGEMENT

The research team would like to thank the staff of Khok-Ko, Nong No, Thalad, Kaeng Loeng Jan, Lat Phatthana, Koeng, Khwao and Tha Tum subdistrict Administration Organization to support for information. And thank the villagers in the area to answer the questionnaire cause to the research was completed successfully.

REFERENCES

Boonlai, S. and S. Sripokangkul, 2017. Guidelines for the development of water management systems for sustainable agriculture case study: Tha Kraso sub-district, Nam Phong District, Khon Kaen Province. J. Soc. Sci. Arts, 10: 1771-1784.

Chunkeaw, K., 2002. Integrated Environmental Management. Kasetsart University, Bangkok, ISBN: 974-537-034-7, pp: 77-101.

DWR., 2003. Water management of Thailand. Department of Water Resource, Ministry of Natural Resources and Environment, Bangkok, Thailand.

DWR., 2012. The study Integrated Water Management (IWRM) and pushing the country into action: Case study of Mae Klong watershed. Department of Water Resource, Ministry of Natural Resources and Environment, Bangkok, Thailand.

HAII., 2017. Community Water Resources Management. Ministry of Science and Technology Thailand, Thailand.

Kositsakulchai, A., 2010. Participatory planning for water security in SamutSakhon Province area using web-based geographic information system. The Thailand Research Fund, Thiland.

Kudtalang, N., V. Yaowares, C. Nueasri, S. Patsako and P. Mokamun *et al*., 2016. [A study of ecology and land use around the Huay Khak-Hang watershed in Maha Sarakham Province through public participation for sustainable watershed management]. MSc Thesis, Rajabhat Mahasarakham University, Thailand. (In Thai)

MPOCICS., 2018. History of Maha Sarakham City. Mahasarakham Provincial Operation Center, Information and Communication Section, Thiland. http://www.mahasarakham.go.th/mkweb/new-data/294

Naivinit, W., W. Suwanna, S. Sena and D. Nareenuch, 2015. Co-learning process to institutionalize an organization of water users for better piping irrigation management in Bungmalang Sub-District, Sawangweerawong District, Ubon Ratchathani Province. Area Based Dev. Res. J., 7: 4-18.

Polpetch, P., 2004. Right to freedom and human dignity. The Thailand Research Fund, Bangkok, Thiland.

Rojwirat, K., 2006. Opinions on sustainable water resources policy and management in Kha-Kang creek Mahasarakham province of water users. Master Thesis, Mahasarakrm University, Thailand.

Sachchaveta, P., 2002. The participation in water resources utilization of farmers from irrigation project case study: HuaiAeng project Roi-Et province. Master Thesis, Mahidol University, Thiland.

Sisomporn, B. and D. Brikshavana, 2013. Feasibility study on technical and financial of small hydropower project. Kasetsart Eng. J., 84: 91-110.

Songsrirote, N., 2016. An economic feasibility analysis of spring groundwater resource development project in Ban O Kham, Kranuan sub-district, Sam Sung district, Khonkaen province. Nida Dev. J., 56: 108-137.

Talaluxmana, Y., 2014. Integrated water management in Phetchaburi River Basin. Thai Soc. Agric. Eng. J., 20: 15-23.

Tangtham, N., 1987. Rural community watershed: Another approach in watershed management for Thailand. Thai J. For., 6: 188-196.

Wongchantra, P., K. Wongchantra, G. Savatsomboon, L. Junkaew and K. Sookngam *et al*., 2017c. The project feasibility study of solid waste transfer station of pluakdaeng subdistrict administrative organization, Pluakdaeng district, Rayong of Thailand. Intl. J. Agric. Technol., 13: 2143-2160.

Wongchantra, P., K. Wongchantra, K. Sookngam, L. Junkaew and S. Ongon *et al*., 2017b. The project feasibility study of solid waste management in Kalasin local governance organization to produce Refuse Derived Fuel (RDF). Intl. J. Agric. Technol., 13: 1791-1803.

Wongchantra, P., K. Wongchantra, S. Kaeongam, L. Junkaew and K. Sookngam *et al*., 2017a. The project feasibility analysis of a waste-electric power plant of Kamalasai Sub-district Municipality, Kamalasai district, Kalasin province. Intl. J. Agric. Technol., 13: 1773-1789.