

**PEOPLE'S PARTICIPATION IN WATER POLLUTION PREVENTION :  
A CASE STUDY OF TAMBOL KAENGKHOI MUNICIPALITY  
SARABURI PROVINCE**



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SARABURI PROVINCE

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The objectives of this research were to study the level of people's participation in water pollution prevention and the necessity of the construction of a wastewater treatment system. Effects of independent variables on people's participation were analyzed. Problems were investigated and recommendations were also made to motivate people's participation in Tambol Kaengkhoei municipality. Methodology used in this study was survey research. A set of interview schedules which consisted of 357 family leaders or housewives who lived in Tambol Kaengkhoei municipality were used for data collection. Data were analyzed by the computer, using the Statistical Packages for the Social Sciences (SPSS for Windows), by using percentage, mode, arithmetic mean, standard deviation, t-test and one way analysis of variance.

The results of analysis indicated that most of the respondents had an immediate level of participation in water pollution prevention. However, they desired a large role of participation in the construction project of a wastewater treatment system. Comparisons were made to test the effects of individual factors on participation level, they indicated that people's participation in prevention and solution of wastewater at the household level were a function of people's opinions and knowledge at a significant level of 0.05. However, levels of such participations were not a function of gender, age, occupation, education, residence rights, type of residence and access to information about water pollution. Variables effecting level of participation in a construction project of a wastewater treatment system, at a significant level of 0.05, included an access to information of water pollution and knowledge of water pollution. Gender, age, occupation, education, residence rights, type of residence and people's opinions, however, did not effect level of participation in the construction of a wastewater treatment system. Obstructions to people's participation level were the lack of convenient time and economic problems.

On the basics of the above results, it is therefore proposed that the government should increasingly implement a public relations approaches to educate people on the water pollution problems. In addition, the government should emphasize the importance of promoting people's participation in solving wastewater problems at the household level and in the construction of wastewater treatment systems.

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การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาระดับของการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำและระดับความต้องการมีส่วนร่วมในโครงการก่อสร้างระบบบำบัดน้ำเสีย และเปรียบเทียบความแตกต่างของการมีส่วนร่วมตามตัวแปร พร้อมทั้งศึกษาปัญหา อุปสรรคและข้อเสนอแนะของการมีส่วนร่วมของประชาชนในเขตเทศบาลตำบลแก่งคอย เป็นการวิจัยเชิงสำรวจ เครื่องมือที่ใช้เก็บข้อมูลคือแบบสัมภาษณ์ โดยสัมภาษณ์จากหัวหน้าครัวเรือนหรือภรรยาที่พักในเขตเทศบาลตำบลแก่งคอยจำนวน 357 คน วิเคราะห์ข้อมูลโดยใช้โปรแกรมสำเร็จรูป SPSS for WINDOWS ค่าสถิติที่ใช้ ได้แก่ ร้อยละ ฐานนิยม ค่าเฉลี่ยเลขคณิต ส่วนเบี่ยงเบนมาตรฐาน การทดสอบค่าที และการวิเคราะห์ความแปรปรวนทางเดียว

ผลการวิจัยพบว่า กลุ่มตัวอย่างส่วนใหญ่มีส่วนร่วมในการป้องกันและแก้ไขมลพิษทางน้ำอยู่ในระดับปานกลาง และมีความต้องการมีส่วนร่วมในโครงการก่อสร้างระบบบำบัดน้ำเสียอยู่ในระดับสูง เมื่อทดสอบเปรียบเทียบความแตกต่างของการมีส่วนร่วมกับตัวแปรต่างๆพบว่า การมีส่วนร่วมในการป้องกันและแก้ไขมลพิษทางน้ำระดับครัวเรือน มีความแตกต่างกันตามตัวแปร ความคิดเห็นและความรู้ อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 แต่ไม่แตกต่างตามตัวแปร เพศ อายุ อาชีพ ระดับการศึกษา กรรมสิทธิ์ถือครองที่อยู่อาศัยและการได้รับข่าวสาร สำหรับความต้องการมีส่วนร่วมในโครงการก่อสร้างระบบบำบัดน้ำเสีย มีความแตกต่างกันตามตัวแปรการได้รับข่าวสารและความรู้ อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 แต่ไม่แตกต่างตามตัวแปร เพศ อายุ อาชีพ ระดับการศึกษา กรรมสิทธิ์ถือครองที่อยู่อาศัยและความคิดเห็น ส่วนปัญหาอุปสรรคที่พบส่วนใหญ่คือ ปัญหาด้านเวลาและปัญหาเศรษฐกิจ

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## Chapter I

### Introduction

#### 1.1 Rationale and justification

Water is one of the fundamental resources for livings. It has been directly consumed by human and by agricultural, industrial and transportation sectors. It could be said that water has been very important resource for human.

Water from human's activities could have altered properties that could be impossible to restore its quality. In the past when population was small, the country's economy was in the agricultural sector. Industrial technology had not been well developed. Volume of wastewater disposed to natural water sources, e.g. rivers, was relatively less. Therefore, a natural water source could restore its condition. (Sreewattana, R.,1988:65) A growth in population, which results in the expanded communities, in combination with economy expansion, has altered human livings as well as way of life. Ability of natural water source to recover itself, which used to be adequate for handling small amount of wastewater in the past, is no longer adequate. Volume of wastewater disposed to water sources is a function of population size. Therefore, population growth, economy changes, community expansions and need for water have caused the deterioration of natural water sources. In addition, lack of awareness to society and improper perception to environment have been considered as causes for the deterioration as well.

Pasak river is one of major natural surface rivers in central plain of Thailand. The origin of the river is in Petchaboon mountain range in Dan Sai district, south of Leoi province and ends at Chao Praya River.

Communities along the river path have utilized water and have disposed wastewater back to the river. The exposure of wastewater is also found in several public areas. Wastewater has not been properly treated prior to disposing. Therefore, water quality of Pasak River has decreased which could be noticed from quality survey conducted by Environmental Quality Standard Division, the National Environmental Broad. The survey has indicated that quality of water in Pasak river is at level 3-4. In addition, some parts of the river could be classified as Type 5, which could only be used for transportation, in dry season. (Team Consulting Engineer Co., Ltd., 1995: 3-370 - 3-372)

Apart from the above survey, Saraburi Official Province (1998:8) had collected information from quality survey of water of Pasak river in Saraburi section during 1988-1995. It had been found that Total Coliform Bacteria (TCB) values varied from 30.0 to 475,000 MPN/100 ml. In 1995, TCB value of 2,300 – 475,000 MPN/100 ml. was found in area around the main bridge in Maung district. In addition, it had been found that Fecal Coliform Bacteria (FCB) values varied from 20 to 85,550 MPN/100 ml. FCB in area around Wat Kaengkhoi, Kaengkhoi district had been found as high as 800 to 85,550 MPN/100 ml.

There had been another survey by Water Quality Division, Department of Pollution Control done to Pasak river during 1996-1997. The survey had focused in area around Adireksarn bridge in Kaengkhoi municipality in April 1996, November 1996 and March 1997. From this survey, it had been found total coliform bacteria value greater than 240,000 MPN/100 ml. This figure revealed that water in this area was heavily contaminated. Table 1 contains results of this survey.

**Table 1** Water quality survey of Pasak river at Adireksarn bridge, Kaengkhoi municipality, Saraburi province during 1996-1997

No.	Date	DO	BOD	Total Coliform Bacteria (MPN/100 ml)	Standard of water quality type 3
1/39	22 April 1996	6.2	1.2	> 240,000	DO $\neq$ 4.0
2/39	22 July 1996	6.5	2.3	< 20,000	BOD $\neq$ 2.0
3/39	26 Nov 1996	6.1	1.1	> 240,000	TCB $\neq$ 20,000
1/40	3 March 1997	7.7	1.5	> 240,000	MPN/100 ml.
2/40	9 June 1997	6.7	0.8	79,000	FCB $\neq$ 4,000 MPN/100 ml.

Source : Water Quality Division, Department of Pollution Control (1998)

Remarks: Standard of water quality type 3 came from announce of the National Environmental Broad edition 8(1994)

It shows that the wastewater from the communities have been major cause to degrade water quality in canals and rivers as well as other type of water sources in the communities. Most of these activities had been done without realizing the contamination consequence of the disposed water. Thailand Development Research Institute (TDRI) surveys, performed in 1988, shows that 75% of wastewater to Chao Praya River was from the community. Community in that report excluded only factories. Ninety five percent of wastewater was from activities in households and restaurants. (Chindakul, D& Klaysangoun, W.,1994:29) This survey corresponded to that of Prunsawast, T., et al.(1989)which the latter work studied about wastewater from community and water pollution in Bangkok and its suburban area. From this survey,it was found that the most polluted water disposed to Chao Praya River and canals in Bangkok was from households. The second large source was restaurant (Khaikest, B.,1991:1). Similarly, community section of Pasak River had low water quality. Sources of the wastewater were from households that didn't have proper treatment or had only partial treatment. Such untreated wastewater had degraded

quality of Pasak's water to the level that could not be autonomously restored. Evidence could be seen from the survey of water quality survey in Kaengkhoi municipality, Saraburi province section of the river.

Kaengkhoi municipality, Saraburi province has population of 14,108. Total area is 4.05 square kilometer, which 2,000 meter of the area in the northern part are along with Pasak River. The most crowded area is in the central part of the town which is commercial and market areas. This includes the eastern bank of the river. Currently, Pasak River is the major area for disposing waste of the municipality. Wastewater disposal system consists of 4 points of disposal. Total disposed wastewater is more than 2,300 cubic meter per day. A study had been performed by PPK Associated Consultants Co., Ltd. (1998 : 6-1 to 6-5). The study included environmental impact assessment and measuring quality of water in Pasak River of two sections, i.e. before entering and after exiting the municipality. The purpose of this study was to estimate the difference of the water quality obtained from the two aforementioned points. The assumption made was difference of water quality from two points was a seasonal function of volume of disposed water from the municipality. Its results showed that water collected from August to March had shown high level of organic contamination (measured as BOD : Biological Oxygen Demand). BOD at the entering point was high and increasing along the river path through the community. This could be the cause that degraded water quality of Pasak River passing through a community which disposed wastewater to it.

PKK Associated Consultants Co., Ltd. (1997 : 6-6 to 6-7) had a field survey and had collected information of water usage from Water Supply Division, Kaengkhoi Municipality during 1995. It had been found that total water usage was 2,843 cubic

meter per day. In addition, industry in this area had been expanded rapidly since Kaengkhoi had been promoted by a government as an industrial zone. Therefore, need for water usage had increasing along with community expansion. As a result, water quality degradation problem had been more critical. The degraded water quality had an impact on quality of raw water for the water work for the community.

From these information, it had been found that water pollution problem in Kaengkhoi municipality was mainly the result of disposing untreated wastewater from households in the community to Pasak River. In addition, current wastewater disposal system did not include a subsystem to collect wastewater. On the other hand, flowing of wastewater was still under natural flow condition. Therefore, there were many depositions of wastewater, especially in crowded areas and markets. The system could not handle large amount of water, for example when there was heavy rain, therefore water would be overflowed. Depositing wastewater was a source of germination and smell. The last problem of existing wastewater disposal system was obstructed by earth materials, such as conglomerate, vulgar, sands, and rubbish. This incorporated with non-systematic inclination of the piping system had caused the inundation. (PPK Associated Consultants Co., Ltd.;1998 : 6-1) Combination of the problems, as a result, leaded to severe water pollution. Kaengkhoi municipality, who was directly responsible for wastewater, then had urgently searched for guideline, measure and procedure to resolve the problem. Currently, the municipality has asked for a budget for construction of wastewater collection and treatment system. However, the project hasn't been started yet because of lack of budget and land.

An attempt to solve the problem by the concerned government agents with the deviations of the problem sources may result in the inability of problem solution. In addition, it could be considered as poor usage of existing resources. All above, solving the problem is not solely a function of government agents but also of all parties concerned since there are number of parties involving as causes of problem. Finally, the community is affected. Therefore, an open communication of changes, causes and situations of the problems to community in combination with a chance to participate in decision making of concerned situation as well as participation in prevention and solving the problem will ultimately change behavior of community to alleviate the problem. Individual who has this opportunity tends to adapt themselves not be a part of problem creation.(Benjasiri, R.,1997:30-33) An effective environmental administration system requires cooperation from the entire community. Individual in a society needs to be involved in proposing the policy, administration measurement, and also share the cost to handle the environmental issues. (Khowsa-ad, M.,1995:1) Similarly, prevention and solving water pollution problem in Kaengkhoi municipality require cooperation from all parties. The cooperation results in reaching the goal and avoid major conflict between each party.

In order to promote cooperation among individual in society could be done by supporting of government. Government agents should change their attitudes as well as increase their ability in supporting and assisting local people. This could be achieved by use of public communications, developing information distribution system concerning natural resources and environment. Apart from information distribution, local people should have a chance to participate in planning, decision making and following government projects which may have impacted on natural resources and

environment. Government parties involving in a project should have continuous public communications. The communications should be done through several steps as project progresses, i.e. decision making, preparation, and implementation of the project. Cooperation from the local people, such as public hearing, implementation, cost sharing, donation either capital or tangible material, being committee and assessment of the project is the major issue. Without cooperation from society, the problem may not be solved within limited time. Another important benefit from having society involved in the government project is to increase social awareness of the importance of participation in prevention, protection and finding solution of water pollution problem. All of these actions to environment problem will ultimately improve quality of life of people who will be a fundamental for developing the country. (Sutipanwihan, S.,1996:5)

As all of above situation mentioned has led the researcher to consider that the cooperation of local people to prevent and solve water pollution in Kaengkhoi municipality is an important topic. The study includes surveys of level of cooperation. In addition, it covers problems and obstacles that prevent the cooperation. The latter topics will be used as guidelines to establish policy and measure to encourage the cooperation of the population and concerned government parties.

## **1.2 Objectives of the study**

This research focuses on the following items.

1. Study the cooperation of local people to prevent and to solve water pollution in Kaengkhoi municipality. This includes the need of local people for the wastewater treatment system in the municipality.

2. Study factors that impact on the cooperation of local people to prevent and solve water pollution and on the need for the wastewater treatment system in Kaengkhoi municipality. The factors include gender, age, occupation, education, residential rights, type of residence, access to information of water pollution, knowledge and attitude of water pollution.

3. Study problems and obstacles to the cooperation of local people to prevent and solve water pollution and need to be involved in a construction project of the wastewater treatment system in Kaengkhoi municipality.

### **1.3 Research questions**

1. What level is local people in Kaengkhoi municipality involved in preventing and solving water pollution? Do they need to get involve in a construction project of the wastewater treatment system?

2. Are the cooperation of the local people to prevent and solve water pollution and the need to be involved in the wastewater treatment project functions of gender, age, occupation, education, residential rights, type of accommodations, access to information of water pollution, knowledge and attitude of water pollution?

3. What are the problems and threats of the cooperation of local people to prevent and solve water pollution and of the participation in the wastewater treatment system project?

### **1.4 Hypothesis**

There has been surveys on the relevant researches. Information obtained from those surveys have been used for establishing assumptions for this research. Therefore, the result from this research will confirm the assumptions that involvement of local people in preventing and solving water pollution and in the wastewater

treatment system are functions of gender, age, occupation, education, residential rights, type of residence, access to information of water pollution, knowledge and attitude of water pollution.

### **1.5 Scope of the study**

This research was conducted within the following scopes.

1. Target area is Kaengkhroi municipality, Saraburi province.
2. To study of involvement of local people on preventing and solving water pollution was focused on the cooperation of the household in the target area. The cooperation refers to activities that lower contamination as well as quantity of wastewater from the community. Such activities are as follows.
  - Separation of food or grease from the kitchen ware before washing. This will prevent the contamination by grease to wastewater.
  - Use of chemicals, either basic or acid base, to clean bathroom as well as hard surface areas.
  - Effective use of water, e.g. fully close the tap opened while not using, reuse the water such as washing cars or feeding the plants.
  - Household wastewater treatment such as water from bathroom, toilet, cloth washing.
  - Waste treatment for toilet.
3. To conduct a study covering the need of involvement in the wastewater treatment system of the municipality in 5 levels as follows.
  - Proposals or comments on the construction and operations.
  - Donation of either capital or related items to the project.
  - Sharing operating and maintenance costs.

- Being a committee in planning and operating processes.
- Assessment in construction and operation phases.

### **1.6 Definition of operational terms**

1. Local people refers to household owner, or a legally marriage couple representing the owner, who lives in Kaengkhroi municipality.

2. Involvement of the local people refers to reaction of the local people, in any kind, to any activity or circumstance. This reaction should finally lead to changes to preventing and solving water pollution in Kaengkhroi municipality.

3. Involvement of local people to prevent and solve water pollution in household level refers to the cooperation of the household in the target area. The cooperation refers to activities that lower contamination as well as quantity of wastewater from the community. Such activities are separation of food or grease from the kitchen ware before washing which will prevent the contamination by grease to wastewater, use of chemicals, either basic or acid base, to clean bathroom as well as hard surface areas, safe and effective use of water, e.g. fully close the tap opened while not using, reuse the water such as washing cars or feeding the plants, household wastewater treatment such as water from bathroom, toilet, cloth washing and waste treatment for restroom, etc.

4. The need of involvement of local people in municipality level includes proposing comments, donation of either capital or related items, sharing costs, being a committee, assessment. This involvement limits to only the wastewater disposal and wastewater treatment systems only.

5. Proposing comments refers to involvement of local people in proposing comments to construction of the wastewater treatment project.

6. Donation of either capital or related items refers to involvement of local people in donating capital or related items to the wastewater treatment project.

7. Sharing costs refers to involvement of local people to pay for costs to treat wastewater. Costs incorporate both operating and maintenance costs of the disposal and treatment systems. Concerned agents which are responsible for the treatment and the disposal will be paid by local people in order to maintain disposed water quality.

8. Being a committee refers to the participation of local people in proposing the plan and following the construction of the wastewater treatment system.

9. Assessment refers to the participation of local people in evaluating, following and auditing the construction of the wastewater treatment system.

10. Water pollution refers water which has lower physical properties than usual as a result of contamination. This covers only when its properties are low to the level that could not be utilized for human living or could be harmful to natural livings or could have an impact to environment.

11. Access to information of water pollution refers to frequency to get information of local water pollution from newspaper, magazine, radio, television, discussion and seminar.

12. Knowledge of water pollution refers to ability of individual to understand the sources of water pollution and impact of water pollution and solution of local water pollution.

13. Attitude to water pollution refer to reaction of individual to consider fact or evaluate impact of local water pollution, such as source of the pollution, its impact and solution to the local water pollution.

### **1.7 Contribution of the study**

1. Understand the level of local people involvement in preventing and solving water pollution in Kaengkhoi municipality. This includes understanding the need of local people to the participation in construction of local wastewater treatment.

2. Ability to classify level of local people involvement in preventing and solving water pollution in Kaengkhoi municipality and the need of local people to the participation in construction of local wastewater treatment. The criteria are gender, age, occupation, education, residential rights, type of accommodations, access to information of water pollution, knowledge and attitude of water pollution.

3. Understand problems and threats to the participation of local people to prevent and solve water pollution and understand the need to the participation of local people in a construction project of the wastewater treatment system in Kaengkhoi municipality.

### **1.8 Variables used in this research**

1. Independent variables : gender, age, occupation, education, residential rights, type of residence, access to information of water pollution, knowledge and attitude of water pollution.

2. Dependent variables : involvement of local people to prevent and to solve water pollution which could be classified into two levels as follows.

2.1. Involvement of local people to prevent and solve water pollution in household level refers to the cooperation of the household in the target area. The cooperation refers to activities that lower contamination as well as quantity of wastewater from the community. Such activities are separation of food or grease from the kitchen ware before washing which will prevent the contamination by grease to

wastewater, use of chemicals, either basic or acid base, to clean bathroom as well as hard surface areas, safe and effective use of water, e.g. fully close the tap opened while not using, reuse the water such as washing cars or feeding the plants, household wastewater treatment such as water from bathroom, toilet, cloth washing and waste treatment for restroom, etc.

2.2. The need of involvement of local people in municipality level includes proposing comments, donation of either capital or related items, sharing costs, being a committee, assessment. This involvement limits to only the wastewater disposal and wastewater treatment systems only.

### **1.9 Conceptual framework of the research**

Definitions and studies, on the participation of population, incorporating with literature surveys lead to the conclusion that involvement to prevent and to solve water pollution means involvement in making decision, in operation, in benefits and in assessment of the project. In the decision making step, government agent plans and makes decision without having population involved. In this study, term involvement of local people in Kaengkhroi municipality could be classified into 2 levels as follows.

1. Household level is an individual activity to prevent and to solve water pollution. This mainly relies on individual knowledge, understanding and realization. Water pollution could be prevented or solved if all members of the society have this household involvement, such as having household treatment prior to disposing wastewater to natural water sources. Therefore, member who has knowledge, understanding and realization could be involved in all steps, from decision making, operation, gaining benefit and assessment, for example, separation of food or grease from the kitchen ware before washing which will prevent the contamination by grease

to wastewater, use of chemicals, either basic or acid base, to clean bathroom as well as hard surface areas, safe and effective use of water, e.g. fully close the tap opened while not using, reuse the water such as washing cars or feeding the plants, household wastewater treatment such as water from bathroom, toilet, cloth washing and waste treatment for restroom, etc.

2. Municipality level is a complex process. This requires knowledge, technology and high investment. This type of projects is initiated from an organization or the government. The problem is above the solution ability of each member of the society. Scope of solution to water pollution in Kaengkhoi municipality is very wide and requires a number of concerned government parties. Operation is a cooperation from several government parties, is similar to other projects in term of limiting the participation of local people. Therefore, the section of the participation of local people in municipality level in this research represents only the interview of the need of the participation of local people in the construction of the wastewater treatment system in 5 levels.

This research, therefore, focuses on the attitude on the participation of local people under the following diagram.

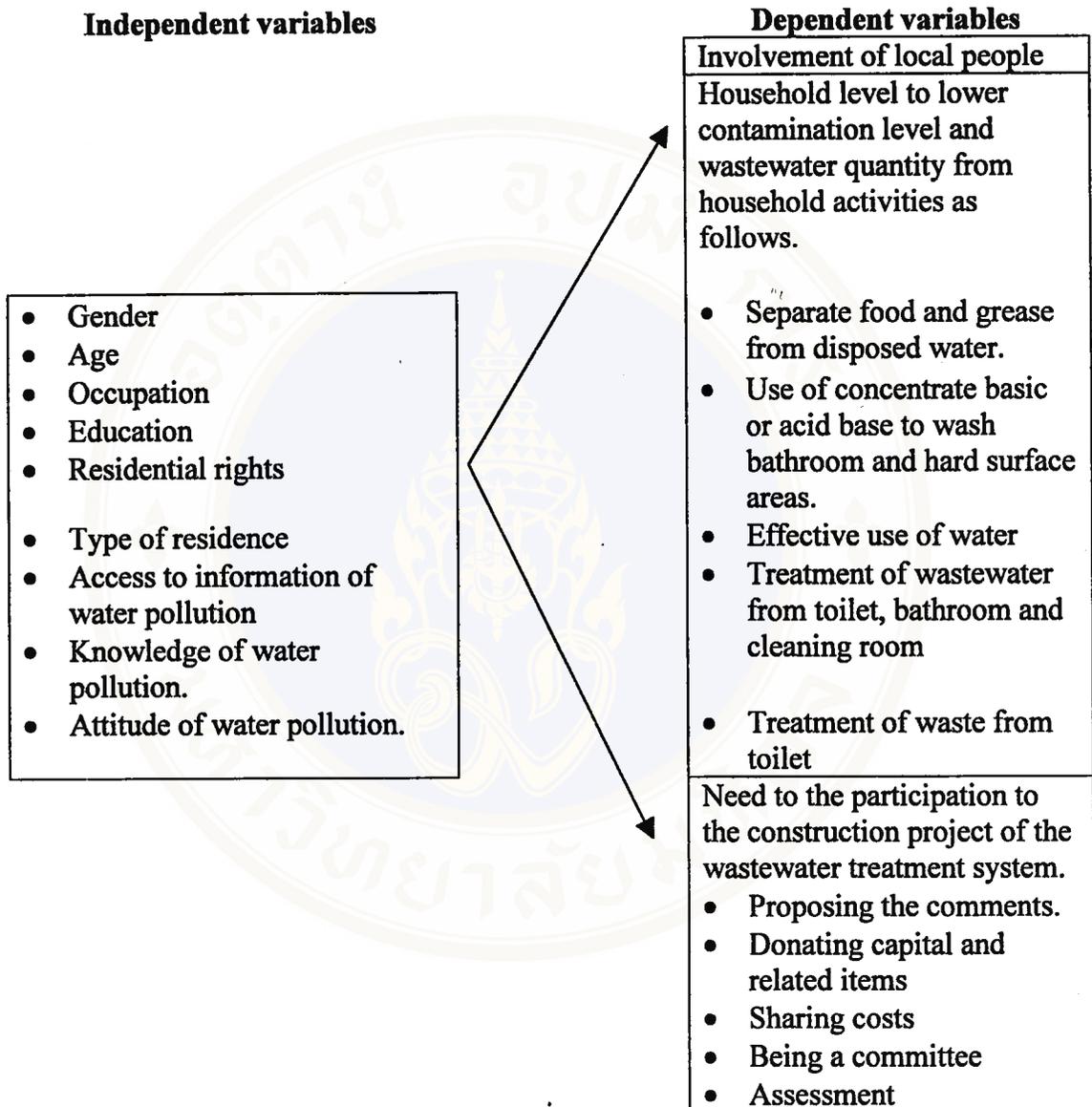


Diagram 1 : Conceptual framework used in this research

## **Chapter II**

### **Literature Reviews**

This research focuses on the participation of local population in Kaengkhoi municipality, Saraburi province, to prevent and to solve water pollution. A number of literatures has been surveys in term of paradigm, theories and their research results. Information from literature surveys have been used as a foundation and guidelines for this research and could be summarized in this chapter in the following sections.

- Concepts and theory of the participation
- Knowledge of local water pollution
- General information of Kaengkhoi municipality, Saraburi province
- Relevant researches and studies

#### **2.1 Concepts and theory of the participation**

##### **2.1.1 Definition of the participation**

It has been found, from the surveys, that there is not a unique definition of the participation. This term has been defined differently based on the situation when it occurred. Each definition has been supported by different form, procedure, activity and objective. However, it could be classified as follows.

International Labour Office (1971:7) had defined term the participation as a cooperation to accomplish a certain task. This definition covered responsibility.

United Nation (1975:4) had defined it as a process of the activity and involved the population in the following levels.

- Decision making level – involving decision on objectives of the society and allocation of natural resources

- Self autonomous response to activity and project

Reader (1974:39) mentioned that the participation referred to the participation in social activities, including individual and group participation.

Erwin (1976:138) had given a guideline for the definition of the participation. The guideline stated that the participation was a process that the population had taken parts in the operating process, sharing thoughts, making decision, solving self problem, sharing creative thinking, knowledge and expertise, combined with use of right technology and supporting tasks of concerned parties and their officers.

Cohen & Uphoff (1977:7-9) mentioned that the participation generally referred to the participation in making decision. But that did not limit to decision making process only. It incorporated the decision making with the implementation of the development activity. Therefore, the decision making almost directly involved the operational process. It also involved the benefit and the assessment. The benefit was a result from the operation and the benefit defined need of the assessment. Both the benefit and the assessment were the results of decision being made. In addition, feedback from the assessment and the operation could be used for the decision making too.

Jongwuttivest, N., (1984:183-186) had defined the cooperation as the mental and emotional involvement of individual in group situation. The result of the participation is a stimulus to individual to contribution toward group objectives. Also, it creates the group responsibility among members. In addition, he had mentioned that the cooperation had been the results of at least three factors as follows.

1. People are free to be cooperative.
2. People are able to be cooperative.

### 3. People are willing to be cooperative.

Wuthimethee, Y.,(1983:20) mentioned that cooperation of people meant that giving opportunities to people to share initiation, decision making, operation and responsibility in the issues that effect them. The leader must perceive community philosophy that everybody wants to live happily with others, fairly treated and being accepted by others as well as willing to contribute to social activities. The perception helps to convey people to be involved in solving community problems and finally improve living quality of the members. Meanwhile, it should be understood that people tends to adapt if proper instruction and opportunity have been provided.

Boonrutsuntorn, J.,(1987:20) explained that the principle of appropriate development was cooperation from members of the community. This was because only the people knew their needs, understood their abilities. These realizations leded them to properly implement appropriate developing methods to fulfill their needs.

Prachayapruth,T.,(1988:622) mentioned that cooperation referred to any activity of individual which required involvement in any type of activity.

Even definitions of the participation vary among the authors as mentioned, conclusion could be made that the participation of people means the cooperation or support of people to any environmental development related activity of the community, proceed in any kind to accomplish the purpose.

#### **2.1.2 People participation theory**

People participation to solve water pollution from the community is another objective of this research. The researcher has used the following theories as guidelines.

### **(1) The theory of social action**

Webber (Adiwattanasithi, J ,1980:60-63) had studied human action and had defined action as both human disclose and hidden behavior. The acting person has made it as individual behavior. According to Max Webber, understanding the meaningful system is the result of 2 causes.

- Individual perspective could be understood from directly observing individual behavior.
- Understand the stimuli. People can express the feeling by using rational activities that is the purpose of being the leader. If a person performs any irrational activity, one can understand attitude which controls the activity by participating and sympathizing with that particular person. The observer doesn't need to fully agree with the theory or ultimate goal or leader esteem. However, the observer understands the circumstance and concerned activities.

On the other hand, human action is caused by external stimuli. Understanding the stimuli explains the actual time which the action has been carried out. That is because stimuli is hidden in human thought. For the observer, stimuli is an appropriate foundation for studying the behavior. In addition, Webber had classified social action into 4 steps as follows.

1. Rational activity is an appropriate activity to achieve reasonable objectives. The particular activity has focused on politics, economy and society.
2. Value oriented activity is another appropriate activity which has focused to achieve ultimate goal in order to have perfect life. This type of activity has focused on moral, religious and religious precepts to sustain society order.

3. Traditional activity is a time independent type of activity. The activity has followed tradition without considering the reason.

4. Affective activity is an activity which considers emotion and mental relationship with the target object. Person who does this type of activity does not consider other reasons except personal interest.

Therefore, people participation is a result of a group intention to participate in a certain activity for accomplishing group objective or to achieve appropriate social order. This is similar to Parsons and Shill's work. (Parsons & Shills cited by Yamchuenpong, U.,1994:15) Both had established Theory of Social Action which explained action of human which could be adapted to be general theory of action. The theory had mentioned that any human activity was dependent on the following factors.

- Individual personality
- Social system to which that particular individual belonged
- Culture of the society in which that particular was. This culture identified thoughts, idea of believes, primary of interest, and system of value orientation.

Given the above mentioned theories, one can conclude that stimulating an individual or a group to participate in social activity in a participation form with willingness requires understanding of human lifestyle, value, tradition, and perception of people in the society. As all factors have been understood, one could identify proper stimuli for a developing activity.

Human behavior was affected by several factors. This theory coincided with that of Reeder (Reeder, 1951:39-53). Reeder mentioned that social actions were not results of only one factor but of several factors. He explained that the reason that

made individual act was affected by believes or disbelieves. In addition, he stated that a human action was influenced by the following factors. (Reeder, 1983:39-53)

1. Goal
2. Believes Orientation
3. Standard Values
4. Habit and Custom
5. Expectation
6. Commitments
7. Reinforcement
8. Opportunity
9. Ability
10. Support

From the aforementioned factors, Reeder also explained the causes that effected social action as follows.

1. In a certain situation, social action was involved in social behavior. Each individual had personal reason for doing such an activity.

2. An Individual person or an organization made decision or acted based on a combination of reasons. A person or an organization could identify whether such a reason related to a problem or circumstance.

3. Some reasons might support the decision while the others might oppose the decision.

4. The person who made decision weighted each reason with different scale. The selection of reasons or factors had influenced the decision making process.

5. The reason for making decision was not solely from one particular reason.

6. The decision made on a group of reasons which related to a certain circumstance would impact on all following decision making.

7. A group of factors and reasons that had an impact on social action had changed.

8. For a certain circumstance under social action, usually there were two or three alternatives to that circumstance.

9. The person who acted or made decision could choose any alternative.

10. Reasons for making such a decision could be seen from the chosen alternative.

11. An individual person and an association usually acted when they found that they had reasonable supports for doing an activity.

From this theory, it could be concluded that stimulating the society for a social activity in order to have social member participate needs understandings of social values, habit and customs, tradition, individual attitude. It requires appropriate stimulus to achieve the goal that the social members have participated in social activity in a form of participation and self autonomous.

## **(2) The theory of social psychology**

Maslow (1954:90) had done a research on motivation of human action. He had explained on human behavior relating to basic needs which were the result of self satisfaction. Basic needs had been ordered from the lowest to the highest levels. When the need has not been satisfied, the need still exists and becomes an efficient mechanism to drive human perform an activity to satisfy such a need. Maslow (1954:4) had given an explanation that basic needs that drove human to act could be divided into 5 levels as follows.

1. Physiological needs, the fundamental level
2. Safety needs
3. Love or belonging needs
4. Esteem needs
5. Self-Actualization needs

Maslow's theory could be summarized that basic need that was from satisfaction was the major drive for human to participate in any social activity.

### **(3) Communication theory**

Roger (1973:45-49) had pointed out the relationship between the new exposure and the communication. He had mentioned that the new exposure was a function of communication which was composed of communication channel and individual profile. The explanations of those terms are as follows.

1. Personal profile includes age, social status, economic status which includes income, land ownership, and personal expertise and education.
2. Communication channel includes communication skills which includes source, channel and target.

Communication channel which is the mean that the source transmits information to the target could be classified into two categories as follows.

1. Mass media channel is a mean to transmit information involving the community. This channel is, for example, newspaper, magazine, periodic, or other channels such as television, film and radio programs.
2. Interpersonal channel is an interpersonal reaction to exchange information between source and target.

Roger also mentioned that mass media had an important role to increase knowledge, to expand information. In addition, mass media could change personal attitude. However, interpersonal activity had more influence to change personal attitude.

⊗ It could be concluded that communication had an impact to increase knowledge, an impact to change personal attitude. Therefore, it could help to increase an understanding and realization of a person. This led to high level of participation in social activity. As a result, this research would focus on an influence of the level of exposure to information on the level of participation to solve water pollution problem of the population in the society. On the other hand, people with different information exposure should have different level of participation to solve water pollution problem. ✕

### 2.1.3 Factors and criteria for participation

Cohen & Uphoff (1977:17-19) had proposed that a study of participation should include the surrounding factors, which were very complicate, as follows.

1. Physical and biological factors
2. Economic factors
3. Political factors
4. Social factors
5. Cultural factors
6. Historical factors

In addition, Cohen & Uphoff (1977:59-78) had proposed that there were four major parties which contributed to participation to rural environmental development. The parties included local population, local leaders, government officers and the

outsiders. There were a number of factors involved in people participation such as factors listed below.

1. Age and gender
2. Status in the family
3. Education
4. Social status
5. Occupation
6. Income and asset
7. Period of stay in the society
8. Land ownership and working environment

The aforementioned factors, incorporating with cultural factors, could be similar to Bertrand's theory (Bertrand,A., 1958:147-157). His theory covered cultural factors which related to participation. The factors included:

1. Age
2. Gender
3. Social status
4. Occupation
5. Education
6. Residence
7. Period of stay in the society and period of participation
8. Other factors, e.g. Urban or suburb residential, value, attitude

The above factors were comparable to Koufman's works (Koufman, 1949:528). Koufman had studied the factors that had an impact on society development. He found

that age, gender, education, family size, occupation, income and period of stay in the society affected the level of people participation.

In addition to the aforementioned factors, there was a number of factors which had a result on people participation. Jongwuttivest, N(1984:183-186) had pointed out the factors for participation as follows.

1. Individual faith in famous persons and religious had persuaded people to participate in social activity such as common activities.
2. Respect to honored persons or to position which people had persuaded people to participate although they didn't have willingness to participation.
3. People who had power to force people to participation.

He had also mentioned the three conditions that made people participate as the followings.

1. Freedom to participation
2. Ability to participation
3. Willingness to participation

Keys factors to the success of participation included.

1. People must have adequate time for participation. On the other hand, participation wasn't appropriate for emergency situation.

2. People didn't need to spend much money for participation exceeding their expected return.

3. People were interested in the participation.

4. People must be able to mutually communicate.

5. Participation would not have an impact on existing occupation, or social order of the people.

The study of theory of the participation, factors and conditions for participation had led to the conclusion that participation of people in the society involved the basic needs of people to improve living. Therefore, there were several parameters involved, i.e. population, economy and society. All these parameters had effects on the participation. In this study, a conclusion could be drawn that participation of people was a function of gender, age, education, occupation, ownership in land, type of accommodation, access to information, knowledge and opinion on water pollution.

#### **2.1.4 Type and step of participation**

A number of organizations and specialists, both local and international, had proposed a number of participation types and steps which could be explained as follows.

World Health Organization (WHO) had proposed that the actual participation should include the following four steps as:

1. **Planning** : People had to participate in stage of problem analysis, prioritization, goal setting, resource allocation, monitoring process, evaluation and the, important step, decision making.
2. **Implementation** : People had to participate and administrate the use of resources. They had to take responsibility on allocation, financial control and service control.
3. **Utilization** : People needed to have ability to adapt the activity for further utilization. This would improve level of self dependency and social order.
4. **Obtaining benefits** : People had to get benefit from the society on the equal basis. The benefit could be individual benefit in either social or material form.

Type of participation mentioned above was similar to theory of participation for decision making, implementation or conduct social activity and benefit sharing which Cohen and Uphoff (1980 : 213-218) had pointed out that the participation included four step, similar to that of Yadav (1979:3) which could be detailed as follows.

1. Participation in decision making consists of 3 steps as initiation, decision making and implementation.
2. Participation in implementation consists of 3 steps as resource support, administration and coordination.
3. Participation in benefit either material, social benefit or individual benefit.
4. Participation in evaluation of the developing activities.

Participation types according to criteria set by WHO could be considered as similar to the criteria which Fenaroff had proposed (Fenaroff, 1980:104). His proposal was that the participation consists of 4 steps as follows.

1. Planing
2. Action
3. Use of the project
4. Participation in gaining benefit

Bunyaruttapun, P.,(cited by Sutipanwihan, S,1996:15) has proposed form of social participation which was partially similar to that of Fenaroff. He had mentioned that social participation had been continously with the society. It included the planing process, contribution to labor force, finance, raw material or resource available within the society. Also, he summarized the activities indicating social activity as follows.

1. Attendance at meeting
2. Financial contribution

3. Membership on committees
4. Position of leadership
5. Interviewer
6. Solicitor
7. Customers
8. Entrepreneurs
9. Employees
10. Material contribution

However, participation form mentioned above were similar to concept proposed by Pintong J.,(1984:10) who had summarized that social participation included 4 processes as follows.

1. Participation in problem searching and addressing its sources.
2. Participation in planning.
3. Participation in investing and implementation.
4. Participation in monitoring and evaluation.

Theory and research relating to participation could lead to an observation that type and process of participation were generally not quite different. It could be different in detail such as participation in searching for problem, planning, decision making, evaluating could be appropriate for social leaders, local administrator committees. These personnel have roles in participation as mentioned earlier. In addition, participation could be found in a project which had been well planned and had clear implementation plan such as participation of people in a water bank project, participation of people in developing small water reservoirs, etc.. In this research which studies participation of people living in Kaengkhroi municipality, participation

of people living in Kaengkhoi municipality, as pollution sources, in sharing cost to treat and rehabilitate the environment is studied. In addition, people living in Kaengkhoi municipality are individualism. Therefore, this research follows process proposed by Prachayapruth, T(1998:622). He had mentioned that participation was an activity of an individual to participation in a certain activity which aimed to a certain target. As a result, participation of people to prevent and resolve the water pollution according to this research covered process or individual actions in any kind to a certain activity in order to lead to prevent or to solve water pollution.

#### **2.1.5 Level of participation**

Kasperson & Brietbat (1985:36) had proposed participation measurement as 3 points as follows.

1. Individual action was not a group action. This might lead to misinterpretation or incorrect conclusions. Individual action in social participation reflected believes, learning and behavior of an individual. It could be mentioned that an action which could be considered as participation was an action which had a direct effect to individual activity.

2. Density of actions could be represented by frequent participation. Such participation had long activity time. Motivation was a drive for this type of participation

3. Quality of participation could be visualized by the result of action and an impact from the primary action such as responsibility, decision making, an acceptance to competency and other considerations. This included an evaluation of the activity.

Apart from the measurement of the participation mentioned earlier, Suksumrith, P (1988:25-28) had mentioned that people's participation in any project or activity had to cover the followings.

1. People had participated in the benefit from the development projects.
2. People had participated in the implementation of the development project.
3. People had participated in decision making throughout the development project.

He had identified seven levels of participation as follows.

Level 1 : Forced – This level referred to no participation.

Level 2 : Induce – This level referred to mild participation.

Level 3 : Persuade – This level referred to slight participation.

Level 4 : Interview to wanted – This level referred to moderated participation.

Level 5 : Opportunity to opinion -- This level referred to moderated participation.

Level 6 : Opportunity to present project -- This level referred to moderated participation.

Level 7 : Opportunity to make himself decision -- This level referred to idealism participation.

#### **2.1.6 Strategy to promote participation**

Promotion of people's participation in improving environment included the strategy which comprised the following plans.

1. Continued to distribute correct and precise information to improve people's perception of future dangers if no prevention and control had been implemented. Improving people realization might be done by either regular or irregular education. This covered an education using mass media such as newspaper, radio and television broadcasting and an education through social institutes such as a family, a school and

a temple. It must be stressed that environment issue could be solved and controlled by real participation. Without real participation, social would be impacted by environment problems such as polluted water, deforestation. These problems required urgent solutions. Distribution of information was an important subject since the information was the major factor to lead the people to realize problems and solutions to them.

2. Widely promoted and supported the establishment of people organization. Use of information as a tool to change people's thoughts was the beginning of the process to stimulate people to realize environmental impact and its harmfulness to living, health and environment. However, only perceiving the problems did not eliminate all problems. Therefore, a people organization helped to widely spread the information. In addition, such an organization incorporated finding of problems and solutions.

3. Although receiving information was the major factor to promote people's participation in improving people realization of environmental problem, lack of implementation impacted long term improvement of that realization. Therefore, action participation was an approach to convert the realization to actions. Action participation could be divided into 2 levels as follows.

(1) *Usual situation* – Under this situation, people organizations in Thai society, especially the established ones, would be accepted as organizations that would provide knowledge and understandings to people in the society. The organizations would also coordinate to solve the existing problems as well as control, watch and follow the use of equipment and instrument for preventing pollution.

(2) *Unusual situation* – This term referred to a severe situation that could be expanded. The people organizations were not able to control or solve the problem.



The widely spread of information could not be avoided. In such a situation, local people who faced with the problem would establish an organization to conserve environment. The specific of this type of organizations was to demand for solution of the existing problems, for example a case of a tantalum factory in Phuket. "Phuket Environment Assembly" was formed. Another example was the deforestation in "Pa Dong Yai" Buriram province which "Pa Dong Yai" was arrested. In the latter case, a group called "Pa Dong Yai Conservation Group" was established. It could be noticed that promoting people realization was sensitive to people perspective. In general, it should begin from normal living. That meant incorporating environmental problem to daily life would ease a participation of people in several ways. If the promotion was successful, and people widely realized, developing participation in solving and preventing environment problem would finally happen. However, such an approach took relatively long time since Thais had long history of living close to nature. Therefore, Thais would not be able to adapt thinking process and ways of life to understand an impact from environmental problems. Such problems were the results of new economics environment and deeply related to behavior and believes. Although preventive administration and necessary technology were used, the problems could not be solved without understanding the problems.

As mentioned above, it was clearly seen that there was not a fixed solution for establishing people organization. In addition, promoting the support of people in conserving natural resources. These two activities were based on nature of the problems which was very complicated. However, it should be realized that the activities should be in line with culture and society where people lived.

### 2.1.7 Limitation of promoting people's participation

In general, people responded to environment, which resulted in the negative impact to individual life. Riordon (Cited by Thammachart, S.,1997:21-22)

1. *Unaware group* : It referred to an individual/a group of individuals who did not pay attention to environmental concerns. Although they had received an impact from environmental changes, they would not want to participate. It could be found that the members of this group were mostly over 60 years old.

2. *Un-affected group* : It referred to an individual/a group of individuals who realized the existence of the environmental impacts. However, people in this group could be about to withstand those impacts, by making physical and mental substitutions. Most of people in this group lived in industrial society and believed that the factories which were the pollution's sources did not deteriorate environments but the factories were the working places for living.

3. *Fatalist group* : It referred to a group who believed in superstitious. They believed that nobody had controlled any situation. It was found that people of this group resisted to democratic participation.

4. *Active Participant group* : This group usually expressed their opinions with the believes that their opinions helped to solve the problems. However, there were not many persons who really showed their comments. There were two subgroups of this active participant group as follows.

4.1 *Express group* : This group protested some situations to prevent any damage or loss on which they were focusing. Forms of this group of people were usually a society or an association, for example a society of wild lovers, or an association of cliff hangers. Correct information was distributed to members.

4.2 *Instrumental group* : The purpose of forming this group was to distribute information and promote people's conscious of environment. This would help them to become ownership of the environment. This group had longer plan than that of the express group.

Apart from the differences mentioned above, Riordon had also pointed at the limitations of promoting people's participation. He mentioned that in general, people tended to showed their opinions which might deviate from the reality because of the following reasons.

1. In general, people tended not to participate by expressing their opinions.
2. People tended not to help each other unless there was a situation which everybody was effected.
3. People were able to adapt themselves by using defensive mechanism. This resulted in the acceptance or the avoidance of the impacts.
4. Most of people usually delegated authority for decision making of complicate issues to government or specialists.
5. In case that time was a constraint for expressing opinions, the emotion would be more effecting the opinion than would the practical reasons. It was recommended that there should be enough time for people to consider the problem. In addition, people participation by showing their opinion was time consuming, costly, utilizing manpower. Furthermore, only an appropriate group would be representing total population. Although limitation on people participation existed, careful planning and implementation and adequate resource helped to lower those limitations. Since the people participation was necessary for long term planning, this technique had been widely used, especially in developed countries.

## **2.2 Knowledge of water pollution**

### **2.2.1 Definition of water pollution**

In this research, the major cause of water pollution of Kaengkhoi municipality was wastewater from the society. Therefore, the definition of wastewater was as follows (Menasawet, P.,1993: 120)

Sanitary wastewater was the wastewater from household. It was the water from bathroom, restroom, kitchen and from washing.

Domestic wastewater was the wastewater from the society including household, market and hospital.

Municipal wastewater was the wastewater in the gutter of the municipality. In general, there was only domestic wastewater. However, some municipality allowed factories to drain industrial wastewater in gutter of domestic wastewater. Therefore, wastewater of the latter case was dirtier. Generally, wastewater in gutter in some countries, such as United States, included industrial wastewater at the approximated level of 20%.

Combined wastewater was the combination of domestic wastewater, industrial wastewater from small factories and storm water runoff. Wastewater in Bangkok's gutter was the example of combined wastewater.

The definition of section 4 of the nation of legislation in environmental promotion and preservation in 1992(1992:2) provides for the term of wastewater that is the waste which is liquid and pollutant contaminating in this one. On the other hand, sewage is liquid which is mixed up by excrement.

In this research, term "Water pollution" was defined as unwanted water or drained used water. Its color and odor differed from natural beings. Water pollution

could be underground water, ground water or rain which had contamination from activities, accommodations, business, factories and other institutes. Wastewater harmed living organisms and effected environment.

### **2.2.2 Source of polluted water**

There were several sources of pollution to water. Pollutants could be categorized according to their origins as follows.

1. Domestic Wastewater
2. Industrial Wastewater
3. Agricultural Wastewater

It could be concluded from the research documentation on sources of polluted water (Worasayun, M.1992:114 ) as mentioned below.

1. Domestic wastewater included wastewater from household, buildings, shops, markets, entertainment places, hotels etc. It was wastewater from daily activities of people, e.g. bathing, cloth washing, cooking, and excretion. Pollutants in this type of wastewater usually were organic substances such as food, detergent, soap, excrement. Domestic wastewater could be divided into two groups as wastewater from restroom which included excrement and wastewater from other activities such as cooking, bathing and washing. If wastewater to natural water source had been contaminated by detergent which had undegradable substance, the polluted water would last long. In addition, if that particular wastewater percolated to underground water sources, underground water pollution would occur in wide area since the constitution of detergent would be able to move with water at longer distance.(Sakulprahm, P.,1982:164) In general, properties of used water were altered according to its usage, for example, water from washing usually contained organic substance, toxic or heavy

metal compound. If water was not appropriately drained, it could accumulate in certain places and might be a source to culture pathogenic germ and could be bad odour. It could be called "Sewage"

Rapid expansion of society due to growth in economic environment had caused water pollution in rivers and canals of the country. Cause of the problem was partially due to lack of appropriate management. The problem became more severe and it reached the point that a prompt solution was required. Some of the solution had concerned government agents participating in the studies. That resulted in appropriate design and construction of water irrigation system and wastewater treatment system. During the time of this research, some systems had been implemented, such as municipality of Khon Kean, Nakorn Pathom and Pattaya. Some were being constructed such as Nonthaburi, Patumthani, Ayudhaya, Samutprakarn and Karnchanaburi. The design and construction of such proper systems would continue. Required information for the study and the design of domestic wastewater treatment system included quantity and properties of wastewater. This information was used to determine size and capabilities of the proper and low cost system. In the past, this type of information didn't exist in Thailand. Therefore, information from developed countries, such as United States of America or England, was used in design stage. Since information used was from societies which had higher economic, social and living standard higher than those of Thai society, parameters and variables used were far above requirement for Thai society. As a result, systems were too large which implied to very high construction cost and very high operating expenses. At the time of this research, research institutes, consultancy firms and educational institutes on this field had

surveyed and collected more data in this area, resulting in more reliable information for designing proper system for Thai society.

2. Industrial wastewater from factories included treated and untreated wastewater. Since most of factories used water for their processes and for cleaning, large amount of water was drained to ground water sources. Properties of drained water varied according to major process of the factories, such as paper, canned food, sugar. Wastewater from these factories included organic substances and toxic substances. Organic substance was digested by aerobic bacteria. Such digestion lowered oxygen content in water which finally changed water to "Wastewater" and effected fish and other aquatic animals. Fish died when dissolved oxygen (DO) was lower than 2 milligram per litre. Indirect measurement of DO was measuring biological oxygen demand (BOD). BOD was the volume of oxygen which was required by bacteria to digest organic substances. BOD indicated level of water dirty. Toxic substances in industrial wastewater included heavy metal such as mercury, cadmium, lead. It was difficult to analyze these substances. Large among of these substances could accumulate in aquatic animals such as shell, crab, fish and shrimp. Hence, toxic substances could accumulate in human body when eating these aquatic animals. These toxic substances could be harmful to human once their levels in human body exceeded a certain limit. Examples of disease from toxic substances included Minamata disease (mercury) and Itai-Itai disease (cadmium) which were found in Japan.

3. Agricultural wastewater included utilized water from agriculture. Cultivation and animal farming required irrigation or canals, pond or water reservoirs. Those activities also required proper water allocations. Utilized water from agriculture had

altered properties. Mineral dissolved in water increased because surface minerals were rinsed. It resulted in brackish water. Examples of these mineral included calcium, magnesium, sodium, carbonate compound, sulphate compound and chloride compound. Brackish water then could not be further used in agriculture. In addition, utilized water was dirtier because of bacteria in water. Also, the utilized water cause several water pollution. This could be explained as once water was more brackish, water treatment before consuming water, by either household or industry, was required. Not only the dirty of water, solid particles in water from sediments should increase. Solid particles also effected color, odour and taste of water. If fertilizers or pesticides were used, these chemicals became contaminants. Nitrogen and phosphorous compound in fertilizers acted as catalysts to accelerate growth of aquatic plants.

### **2.2.3 Factors accelerating water pollution**

Factors that changed water which could be consumed without additional germ treatment to become wastewater are as the followings. (Chindakul, D& Klaysangoun, W.,1994:28)

The first factor was the rapid increase of the population due to the industrial development and the misplaced population policy. The increase of the population and very populated society resulted in a number of activities including normal life, industrial production, merchandising and transportation. These activities affected the water and disposal of waste to water sources. For example, Bangkok residents had increased almost ten times in the past 30 years resulting in the severe problem in wastewater.

The second factor was the result of incomplete wastewater treatment from the society and the factories and also there was garbage in the environment. A few waste treatment could not lower the problem.

The third factor was the decreasing flow of water in rivers and canals due to the construction of dam in the upstream of water sources. Dams had lowered volume of water flowed in Chao Phraya river, shallown the canals. The problem of decreasing in water flow was reinforced by garbage, road, building and house constructions and over the existing rivers.

The fourth factor was the result of the carelessness of people living nearby the river as well as travelers along the river. Those usually littered garbage to river and canal, and some had disposed wastewater directly to rivers and canals though there had been a numbers of campaign to promote the care to water sources in the past years.

As long as the government had not taken serious action to solve wastewater problem and people did not participate, the problem and its impact, relating to environment and human would continue. Therefore, urgent solutions and prevention should be released.

#### **2.2.4 Properties and characteristics of wastewater**

To consider the wastewater problem in term of severity or the need of having wastewater treatment system, the factors to be assessed were quantity and characteristics of wastewater. In term of quantity, volume of wastewater should be considered. For the properties, level of uncleanness, foreign material in water. Properties of wastewater in one aspect typically related to another aspect. Highly unclean water might have equivalent total waste loading to that of high volume of low unclean water. (Lorpensri, H.,1997:33)

There were three characteristics of wastewater to be considered as follows:

1. Physical Characteristics
2. Chemical Characteristics
3. Biological Characteristics

Water quality index (characteristics) which should be measured included the following properties.

1. Temperature
2. pH
3. Biological Oxygen Dissolved : BOD
4. Chemical Oxygen Dissolved : COD
5. Solid Content
6. Color and turbidity
7. Nutrient : nitrogen and phosphorus compound
8. Microorganism, e.g. E. Coli or fecal coliform bacteria
9. Toxic substances
10. Metal and heavy metal

**Table 2** Typical characteristics of wastewater

Content	Concentration		
	Low	Medium	High
<b>1. Physical</b>			
Color	Gray	Gray	Gray
Odor	Smell	Bad	Hydrogen sulfide
Total Solid (mg./l.)	450	800	1,200
Total Volatile Solids (mg./l.)	250	425	800
Suspended Solids (mg./l.)	100	200	375
Volatile Suspended Solids (mg./l.)	75	130	200
Settleable Solids (cc./l.)	2	5	7

**Table 2** Typical characteristics of wastewater(continued)

Content	Concentration		
	Low	Medium	High
<b>2..Chemical</b>			
pH	6.5	7.5	8.0
Total Nitrogen (mg./l.)	15	40	60
Organic Nitrogen (mg./l.)	10	25	40
Ammonium Nitrogen (mg./l.)	-	0.5	1.0
Nitrate Nitrogen (mg./l.)	-	0.5	1.0
Total Phosphate (mg./l.)	5	15	30
<b>3.Biological</b>			
Total Bacteria(Counis/100 ml)	1*10 <sup>8</sup>	30*10 <sup>8</sup>	100*10 <sup>8</sup>
Total Coliform(MPN/100 ml)	1*10 <sup>8</sup>	30*10 <sup>8</sup>	100*10 <sup>8</sup>
Biochemical Oxygen Demand (mg./l.) (BOD at 5 days 20 °C)	100	200	450

Source: Atkins (1986)

In addition to this, there were a number of pollutants in the water which could result in the water pollution. Those pollutants were as follows:

1. Organic matters : Aerobic bacteria in water digested organic matters which then lowered amount of dissolving oxygen and impacted fishes and other livings. Generally, fishes could not live in water which had dissolving oxygen lower than 2 milligram per litre. When total dissolving oxygen had been totally consumed, anaerobic bacteria digested organic matters which resulted in certain gases, e.g. hydrogen sulfide, and prevented the use of that particular water.

2. Inorganic matters : Inorganic matters from factories was another factor that caused hard water which could not be used, either for industry and agriculture. For example, hard water was the source of calces in water boiler tube which might cause the blockage and potential burst. As a result, some certain factories, e.g. fabric dying factorioes, beverage factories and canned-food factories could not use hard water. In addition, nitrogen and phophorus, inorganic matters, could accerelate the grow of

water plants which could increase the uncleanness of water once the plants died and being digested.

3. Acid or basic substances : Acid or basic disposal to river, for example sulfuric acid, harmed human and water livings, corroded boat and bridge structure and ports. Acid or basic substances were typically from fabric dyeing factories, soap and detergent factories and impacted some certain industry, for example canned-food factory.

4. Suspended solids : Some types of Suspended solids could be chemically disintegrated resulting in odor or reduce quality of dissolving oxygen. Suspended solids which spread over the water surface, e.g. fat or oil, also prevents the sun light from going through water. This was an obstacle for the growth of water plants. Some chemicals were toxic to certain kinds of fish and were an obstacle for some manufacturing since water could not be used.

5. Hot water : Hot water was defined as cool water used in the cooling system of machines in the factories and being disposed to water source. Disposed hot water causes layering of water since hot water is lighter. Quantity of dissolving water in hot water is lower than that of normal water. As a result, water livings tended to move to normal temperature water. In addition, when waste was dispose to water, bacteria in the hot water environment digests organic matter more rapidly than those in the normal temperature water. Therefore, small amount of dissolving oxygen in hot water would be used more quickly and then resulting in water pollution.

6. Color : Generally, the source of colored wastewater was fabric dyeing factories. Colored water sources was not only visual pollution, but also prevented the travelling of light in water which was the major component of the photo synthesis. Some color

could not be able to eradicate and was toxic to water plants and animals. People or manufacturers at the downstream of the water source could not use this colored water.

7. Toxic and radioactive substances : Toxic chemicals generally were from insecticides and weed killers or from factories. When water from the agricultural areas had moved to water sources or when it rained, these substances were carried to the sources. If these substances were highly concentrated, they were harmful to people and also microorganism in water, for example the source of minamata disease in Japan was from mercury disposal to water source. Disposal of these substances caused the accumulation and the expanded result of the toxic along with the food chain known as biological magnification.

8. Microorganism : Two types of microorganism could be found. First was the digesting organic matter type and the second was the microorganism which caused disease. The second type of microorganism propagate from the household or hospital waste. The propagation caused people who used water from the disposed water source to suffer from microorganism which caused disease. The diseases found from this propagation included asiatic cholera, dysentery, typhoid. One of the bacteria used for indexing water quality was coliform bacteria. Generally, this bacteria lived in humans and animals' intestines without causing any disease. If this bacteria was found in a water source, that particular water source was risk to have some types of bacteria that caused disease.

9. Foam : Foam in water were generally from textile manufacturers, pulp and paper factories, chemical and detergent manufacturers. When the detergent reacted with water, foam formed and reduced water to air contact area which finally prevented the dissolution of oxygen to water. This caused severe problem during 1960-1970.

Therefore, the industry had changed to use LAS (Linear Alkyl Sulfonate) detergents (Srisupan, W.,1983 :117-118) . However, some substances could not be disintegrated by bacteria and some were harmful to microorganism depending on the source materials.

### **2.2.5 Water pollution from community**

Mostly, water pollution from a community was caused by lack of proper wastewater treatment, knowledge and technology to treat water pollution. Environmental Quality Standard Division ( Cited by Sutipanwihan, S.,1996:33-35) had summarized the problems as follows.

#### *1. Wastewater treatment*

1.1 Communities in both municipality and sanitation were still not able to handle polluted water from the activities in the community. There was not proper system to drain for polluted water to the treatment system. Currently, polluted water from most of the activities is drained to water sources directly resulting in the unclean water source and becoming refuse water. Therefore, there should be a proper plan for draining system in urban area and a proper location for wastewater treatment facility. This included the immediate plan and long term plan.

1.2 Most of municipality and sanitation had inadequate financial supports for treating polluted water since the cost was very expensive especially construction cost and land prices which were highly over the financial capability of the local government to find location and financial sources for the project. Inability of the local government caused the central government to allocate country wide budget to local government. The process therefore delayed the proceed of the local wastewater

treatment facility and resulted in inadequate system which could not accommodate the rapid growth of the problem.

1.3 Personnel of the municipality and sanitation who understood the mechanism of the treatment of polluted water and knew the control of wastewater facility were not enough. If the facility was simple to operate, the serious problem should not occur. On the other hand, if the facility had many mechanisms which required a number of equipment and machines, the operators should be competent to perform the works in order to effectively run the system.

1.4 In principle, party who disposed polluted water should pay fee to treat the disposed water, known as “Polluter Pays Principle” or PPP. This principle was to lower the expenditure of the municipality to operate and maintain the water treatment facility. Settlement of fee for collecting and treat polluted water required consideration of other component of each community in term of affordability. This included construction and maintenance costs which were used to determine appropriate fee for each community.

1.5 Municipality and sanitation had regulation which could be enforced legally since there had not been particular law to control disposal of polluted water from household and hospital. Therefore, combination of The National Environmental Broad with current law, such as building control, could control that the disposal of wastewater from buildings must conform with the standard before disposing to natural water sources. However, with the fact that municipality and sanitation are under the interior ministry, the ministry should identify the relevant policy or ministeral regulations then the municipality and sanitation should follow effectively.

## *2. Technology concerning wastewater treatment*

Currently, a number of wastewater treatment exists, covering from a large scale of wastewater treatment facility which could handle large amount of wastewater to a small system for household. Most of developed countries had central wastewater treatment system to service and treat wastewater in the community. The central wastewater treatment facility was very expensive. Since the financial capability of the society for constructing the facility was inadequate for central system, stand alone wastewater treatments should be used in order to lower the uncleanness from the source. A number of stand alone wastewater treatment system exists such as cesspit and permeated pit ,wastewater treatment tank and fat trap well. Details of wastewater treatment were as follows.

Majority of households and buildings in municipality and sanitation used cesspit and permeated pit as wastewater treatment system and treated only excretion from toilet. Polluted water from other activities, e.g. rest room, shower room, washing room, which has high uncleanness level was drained directly to water sources. In addition, most of the makers of cesspit and permeated pit did not follow the required specification. As a result, the system could not effectively lower uncleanness of the polluted water. Therefore, even the treated polluted water was still dirty.

In addition to the above problem, some areas were low land, and soil was not able to absorb water but people choose to use cesspit and permeated pit. Such property of soil prevented the absorption of initial treated wastewater by soil and caused the filling problem of cesspit and permeated pit . As a result, the building owners then connect the conduit directly to polluted water draining system of the municipality. Doing this had resulted in the more severe problem to natural water sources. Further

problem included the household owner did not have proper maintenance program and the life of the system was shortened.

2.1. Municipality and sanitation had not controlled and transferred basic knowledge for wastewater treatment to the community, for example technology of sedimentation tank and oil & grease removal before draining polluted water to the public wastewater draining system. If the sediment and garbage had been taken out, uncleanness level of water would be reduced by 50% of the initial uncleanness.

2.2. There had not been a feasibility study of polluted water collection and treatment system in order to choose the proper system to the community. Each community had different population density and distribution also different quantity and quality of the wastewater. As a result, wastewater problem in each area was different from one to another. Selection of proper system and proper location were necessary to reduce the operating and to give long term benefit. A proper wastewater treatment should handle wastewater for at least 15-20 years.

### 3. *Characteristics of wastewater from community*

Wastewater from community was neutral and had pH of approximately 7. Pollutant in water included organic and inorganic matters in both solid and solution forms. In addition, there could be germ and parasite. However, the most uncleanness matters was inorganic matters which could be digested by microorganism. This amount was regularly measured as BOD (biochemical oxygen demand) which was a measurement of oxygen that the aerobic microorganism required for digesting soluble and insoluble organic matters in water or the uncleanness which had been reported as oxygen amount required to digest organic matters in water. Generally BOD of the

community varied from 10 milligram per litre or lower to 1,000 milligram per litre depending on the following factors.

1. *Type of the community* : If people in the community had limited amount of water to use, the uncleanness level of water was higher than that of the community without limit on amount of water to use.

2. *Draining system* : If there was a wastewater draining system separate from that for the overflow water, concentration and contamination of water would not vary. If the draining system was municipal wastewater and combined wastewater, water drained would have variable concentration and contamination. If water leaked or there was external water coming to the main stream, the concentration of wastewater changed. The length of the conduit was also important. The very long conduit could cause the rottenness of water and caused decay and smell.

3. *Flow rate in the conduit* : Each day, flow rate in the pipe varied. This could cause the change of wastewater concentration.

In addition to the above factors, BOD of the wastewater also depended on the activities that used water. For example, wastewater from market and restaurant had BOD higher than that of other areas. This was illustrated in table showing the results from a measurement done in Kaengkhroi municipality on Sunday 14 July 1996 (PPK Associated Consultants Co., Ltd.,1998 : Appendix 7-2)

**Table 3** Analysis of wastewater in Kaengkhoi Municipality

Index	Unit	Location of the municipality wastewater system					
		Main pipe at Sud buntud road	Market (Behind railroad station)	Main pipe at Tinnaluk road	Infront of flat	Main pipe at Liab suntisuk road	Main pipe at Wat Kaeng khoi
PH	-	7.36	6.70	7.22	7.29	7.14	7.22
BOD	mg/l	6.12	146.10	18.42	22.50	65.85	17.82
Suspended Solids	mg/l	17.00	77.00	23.00	20.00	35.00	19.00
Settleable Solids	mg/l	0.02	0.50	0.40	0.50	0.20	0.40

Souce : Laboratory , United Analyst and Engineering Consultant Co.,Ltd.

#### 4. Impact of water pollution

Impact of wastewater was different depending on volume and concentration pollutant in wastewater. The impact could be minimal such as lower visualization pleasant to as severe as damaging the balance of the ecological system. The most important impact was the degradation of natural water source to the level that unable to use which further resulted in the lack of raw water for the city water supply or for other uses. Although in some cases, water from natural water sources which had been effected from wastewater could be used, the water treatment was required to pretreat the water. In some cases, it needed to find new water sources. In both cases, however, cost to use water would increase.

In addition to the above impact, Chindakul, D& Klaysangoun, W(1994:34) had concluded the impact of polluted water to people and environment as follows.

1. Impact to plants and animals : For example, mercury from chemicals and disposed to sea at Minamata bay, Japan, lead from the disposed water from paint factories, batteries factories, from petroluem plants, cadmium from metallic coating,

tannery and other toxic material. If these material dissolved in water in high concentration, water livings could not live. Some chemical compounds such as nitrogen or phosphorus when dissolved in water hasten the growth of water plants such as water weed, water hyacinth which use oxygen in water and caused deoxygen condition for other water livings and water plants.

2. Effect to people health : Wastewater was the major cause that effected human health and was the carrier of disease to human. Coliform bacteria caused diseases such as dysentery, cholera, typhoid. There could be viruses which caused skin disease. Wastewater could be the source of mircoorganism propogation or might caused mutation due to redioactive materials.

3. Impact to natural places and environment : Wastewater caused bad odor and had black color, had toxic gases and was visual unpleasent. These characteristic caused the tourism place non-suitable for visit. In addition, wastewater could have an impact to the visual effect of the water source since wastewater which had high amount colloid from the community might change the color of natural water source and might cause bad odor to irritate the people living nearby the water source and lower visual effect of that particular water source. Table 4 summarizes the impact of wastewater to environment.

**Table 4** Pollution of wastewater and its impact to environment

Type of pollutant	Measurement variable	Impact to environment
Digestable organic matters	1. BOD : Biochemical Oxygen Demand 2. COD : Chemical Oxygen Demand	Lowered amount of oxygen in water and caused small
Suspended solids	1. TSS: Total Suspended Solids 2. VSS : Volatile Suspended Solids	Cause turbidity and sediment in river and canal
Microorganism that caused diseases	Fecal Coliform	Unsafe to drink or use for recreation
Ammonia	Ammonium Nitrogen : $\text{NH}_4^+$ - N	Lowered oxygen content in water, toxic to water livings and might cause rapid growth of water weed
Phosphorus	Orthophosphate – P : $\text{PO}_4^{3-}$ - P	might cause rapid growth of water weed
Inorganic salt	TDS : Total Dissolved Solids	Limited the use of water for industries and certain argicultures, might migrate to underground water
Toxic materials	Depend on type	Harmful to water living and might further effect to other livings through food chains and might migrate to underground water
Heat	Temperature	Lower soluability of oxygen in water and hasten the growth of water livings
Acid and basic condition	PH	Harmful to water livings

Source : Metcall and Eddy (Cited by Ruttanachai, C,1996:202)

### 5. Treatment of wastewater from the community

The purpose to treat wastewater from the community was to lower the uncleanness level or the lower the dirty level from wastewater before disposing to natural water sources. The treatment had the following purposes.

1. To lower the uncleanness measured in BOD (Biochemical Oxygen Demand) from.
2. To lower amount of suspended solids (SS) in water.
3. To lower amount of coliform bacteria.

Wastewater which had primarily treated had lowered 50% of the coliform bacteria originally in the water, lowered suspended solids by 35-65% and BOD had been reduced by 25-40% of its original values.

The water which had the secondary treatment had lowered coliform bacteria by 70-95%, suspended solid by 70-90% and BOD by 65-95%.

After the tertiary treatment, these pollutant would be reduced by almost 100% (Atkins cited by Menasawet, P,1993:124).

In the treatment process, Uyasatean,U(Cited by Sutipanwihan, S.,1996: 40-41 ) had concluded as the followings items.

1. There were four steps for treating wastewater from the community as follows.
  - 1.1. Preliminary treatment, such as screens, grit chamber to remove insoluble suspended solids and insoluble big pollutant.
  - 1.2. Primary treatment, such as primary sedimentation, was used for remove light sediment and could lower BOD by 25-40%.
  - 1.3. Secondary treatment, such as activated sludge, trickling filter, was used for removing organic matters and could lower BOD by 75-95%.
  - 1.4. Tertiary treatment used chemical reactions or physical actions such as sedimentation phosphate compound by using lime, removal of remaining organic matters by using carbon absorption, and to remove metal pollutant by using ion exchange process.

It was not necessary to include all the four steps in all the wastewater treatment system. In some system, such as oxidation ponds and aerated lagoon had combined the primary and the secondary treatments.

2. There were four processes to treat wastewater from the community as follows.

2.1. Physical processes such as screening, skimming, flotation, sedimentation, centrifugation and filtration were used to remove insoluble solids.

2.2. Chemical processes was used to remove compound pollutant, which typically the inorganic material. The processes included neutralization, precipitation, oxidation and reduction and also chlorination.

2.3. Biological processes were used to remove organic matters which could not be digested by mircoorganism. This type of process had two subtypes as follows.

2.3.1. Aerobic processes included oxidation pond, areated lagoon, activated sludge, trickling filter and rotating biological contractor.

2.3.2. Anaerobic processes included anaerobic lagoon, anaerobic digestion and anaerobic filter.

2.4. Physical-Chemical processes were used to remove organic and inorganic which were solvable in water. These processes included carbon absorption, ion exchange and reserves osmosis.

#### *6. Prevention and solution of the wastewater from the community*

To prevent and to solve the wastewater from the community, all of the concerned parties must corporate. The concerned parties included people, government and private sectors. Each party had different role as follows.

### **People and private**

1. Stopped disposing wastewater, garbage and excretion to natural water sources.
2. Lowered water usage in household by changing behavior
3. Recycled or reused water
4. Changed equipment which was relating to the use of water to increase usage efficiency.

### **Government**

1. Identify policies and measures to prevent and solve water pollution problems and also controlled the concerned organization to follow the regulations by using measures and activities to support the specified policies.
2. Urged the construction of the central draining and treatment system for the community especially for the one which had severe problem.
3. Allocate annual budget to operate or to support the researches on the methodology to effectively prevent and solve the water pollution problem. The results of the researches could be used in the strategic planning level.
4. Used economical tools such as "Polluter Pays Principle" or PPP which allocate cost of protecting environment to both the producers and the consumers for solving water pollution problem. The tools might include tax scheme, fee or subsidy.
5. Used public relation tools to promote the understanding of prevention and solution of water pollution in order to aware the people of water pollution solution.

### **Municipality and sanitation**

Municipality and sanitation were the local organizations which could proceed the solution of wastewater from the community by the following means.

1. Policies and action plans to lower and eradicate pollution in the municipality and sanitation areas. The policies and the action plan must conform with The National Legislation in Environmental Promotion and Preservation in 1992. The municipality and the sanitation might request corporation from the concerned organizations, including Policy and Environmental Plan office, Department of Pollution Control, Department of Environmental Promotion, Department of Public Works and Department of Public Health.

2. Finding lands for constructing central wastewater treatment system by considering location and the system. The system must be geographically appropriate for underground water, water tide, existing pipeline, other infrastructure (road, inundation prevention system, and draining system), volume of wastewater in the area, piping route of the main and supplement draining system, piping route to drain treated water to water source as well as cost of the construction.

3. Appointed the local organization to be responsible for the water pollution treatment and the facility used for the community. A transparent scheme to collect treatment fee as well as its goal must be clarified. The treatment fee could be divided into three levels as follows.

3.1 Do not collect any fee to compensate the investment

3.2 Collect fee for only operating and maintaining expenditure

3.3 Collect fee for investment to use for operating and maintaining the system.

Form of the organization could be either government or business organization. If it was chosen to be government organization type, responsibility should belong to the municipality and sanitation. On the other hand, if the business type was chosen, private organization should be responsible under supervision of the local government, which should also be expertise in wastewater treatment system in order to effectively, operate the facility.

4. Allocation of local budget to support the construction of the collecting and treatment system as well as to support the maintenance of the two systems. Modification of the existing piping system to collect wastewater from household required the direction of the pipeline to the designated area for the treatment facility. Local government could proceed this by using local budget.

The budget for constructing wastewater collection system and treatment facility which had been used included wastewater treatment in Pattaya phase I in 1984 at 27.51 million baht. The facility could handle maximum volume of wastewater of 4,000 cubic meter per day. There was a supplement budget of 69.784 million baht for further construction during 1989 to 1991. Total treatment capacity was 13,000 cubic meter per day. The second project was the wastewater treatment in Nakhon Rachasima municipality which the construction had been completed in 1989 using the budget of 88.5 million baht and capable of treating wastewater of 32,000 cubic meter per day.

5. Joint investment between the government organization and the private sector should promote the investment from the private sector and the operation should be responsible of the private sector under the condition that the proper fee would be collected. The municipality and sanitation should take supervision role in this joint

investment. The alternative to this approach was to raise a loan with low interest rate and long term payment from Environmental Fund to construct the treatment facility.

6. The local organization should reinforce the standard of disposed water from buildings by combining this particular standard set by The National Environmental Broad with the existing regulations such as building controls, municipality law. Also, there should be a follow up action to reinforce the use of the standard which finally should lower the uncleanness from the sources such as office buildings, schools, hospitals, hotels and large buildings which traditionally disposed wastewater to natural water sources.

7. There should be a measure to promote the use of stand alone wastewater treatment system such as cesspit and permeated pit ,wastewater treatment tank and fat trap well for small and medium buildings. This could be used as a pool facility for several small units before disposing wastewater to natural water sources. The use of stand alone facility should be highly promoted in the populated areas in municipality or sanitation and also in the area out of the municipality and sanitation coverage. The stand alone facility would help to decrease the uncleanness of the disposed wastewater to natural water sources. In addition to promoting the use of stand alone wastewater treatment facility, the use of public relation tools to increase knowledge of wastewater treatment technology such as the technology of the household treatment facility, the use of primary wastewater treatment facility such as sedimenting and removing garbage in water before disposing to natural water sources. This public relation could be handled by local organization with the cooperation with the concerned organizations such as cesspit and permeated pit ,wastewater treatment tank and fat trap well Policy and Environmental Plan office, Department of Pollution Control,

Department of Environmental Promotion, Department of Public Works and Department of Public Health.

### **2.3 Information on the studied area**

#### **2.3.1 General information of Kaengkhoi municipality**

##### *(1) Geographic*

Location and boundary : Kaengkhoi municipality is 4.05 square kilometers and is located 12 kilometers to the northeastern of Saraburi province. The municipality is located 188 kilometers of Bangkok along the north eastern railroad and 121 kilometers along main road. The boundaries of the municipality include the followings.

North : To Pasak river, Tambon Songkorn, Kaengkhoi District

South : To Tambon Tal Dieo, Kaengkhoi District

East : To Tambon Bann Pa, Kaengkhoi District

West : To Tambon Tal Dieo, Kaengkhoi District

Geographically, Kaengkhoi municipality locates on the bank of Pasak river. The north western part of the municipality is closed to the river. The eastern part is the river plain. The southern part is the plateau. The highest point of the river plain is in the north eastern part. Outer part of the municipality is the hill with the average height of 241.5 meters above mean sea level. The hill has a slope downward toward the north western where the municipality locates. In the municipality area, the average height is about 20.0 meters above mean sea level. The plain has a gentle slope from the east to the south.

##### *(2) Climate*

General temperature is high in summer and quite low in winter. The climate is controlled by the north eastern monsoon which carries the coldness and dryness and

the south western which brings the humidity and rains. From this information, it could be concluded that there are three seasons as follows.

Summer season from mid of February to mid of May

Raining season from mid of May to mid of October

Winter season from November to mid of February

### *(3) Natural water sources*

The most important of ground natural resources in Kaengkhoi municipality is Pasak river which is also the main river of the province. The origin of the river is in Petchaboon mountain range in the southern part of Loei province. The path of the river has passed Lopburi province to Saraburi province from Muaklek district to Kaengkhoi, Maung, and Sao Hai district prior to joining Chao Praya river in Pranakorn Sri Ayudthaya. The river has passed the municipality in the northern part. People in the municipality has used the river for consumption, agricultural and fishry. Water from the river has been used as water source for the water supply in the municipality which is serviced to people living in Kaengkhoi municipality.

### *(4) Political areas of the municipality*

Kaengkhoi municipality has 9 communities as follows.

1. Sahapattana community covers the area from Nuan Ta road along the railroad to the east until the railway station at Liab Santisuk road. The other direction is bounded by Pra Pa Yap road (Mong apparel shop) and Nuan Ta road.

2. Liab Santisuk community covers the area from Sud Bann Tad intersection with the Liab Santisuk road from the grocery store (Tia Sim Tai) along the Liab Santisuk to the railway station. On the other edge is from the Tia Sim Tai along the Sud Bann Tad road on the eastern side to the boundary of the municipality.

3. Santisuk community covers the area from Adireksarn bridge along Liab Santisuk road to the only traffic light. The other direction covers the area from the Liab Santisuk road along Sud Ban Tad road on the western side to the boundary of the municipality (covering Kaengkhoi temple area).

4. Tes Wi Wat community is bounded by the beginning of Tes Wi Wat road which is intersecting with Pra Pa Yap Road on the same side of the military and police houses. The area covers the eastern side of Tes Wi Wat road through Sud Bann Tad road, passes Ta Win Wattana road and ends at the Tep Prasit rice mill. From the rice mill corner, the boundary of the community continues along Pasak river to the east and ends at Liab Santisuk road. On this edge, the other end is at the intersection of Liab Santisuk and Pra Pa Yap roads which located the food shop called Nam Long.

5. Pra Pa Yap community covers the area from beginning of the Pra Pa Yap road from Saha Chokawat Co., Ltd along the east side of the road which located the Bank of Agricultural and Cooperatives and Bangkok Bank to Tes Wi Wat road at the front of motorcycle shop (Pan Toon). On the other side is Urai Ratn road from the intersection with Sud Bann Tad road along the Sud Bann Tad road covering Kaengkhoi school, public park and ends at Tes Wi Wat road where located the drink shop (Eak Ocha)

6. Ta Chao Wong community covers the area from Sud Bann Tad Soi 5 (Soi Sawasdee) along Sud Bann Tad road through Ta Win Wattana and Tin Na Luk roads. The area locate Saeng Wittaya school, Bank of Ayudthaya and through Wora Sawas road and ends at Tes Wi Wat road where locates the rice shop (Du Hua Heng) and covers Ta Chao Wong area to Tep Prasit rice mill.



7. Ta Win Wattana covers Bann Muang area along the east side of Pasak river to the end at Bann Muang school. The other edge is from Bann Muang temple along the municipality southern border line and ends at Sud Bann Tad road. The area covers to the eastern part to Sud Bann Tad soi 7.

8. Urai Ratn covers the western part of Mittabharp road as a linear boundary. This edge covers Urai Ratn soi 5 and ends at Sud Bann Tad road. The other edge is from the beginning of Sud Bann Tad road and cover Sud Bann Tad soi 11, 12 and 13 and ends at Urai Ratn road at the T-Junction. Another edge is a linear border passing through Urai Ratn soi 7 and ends at the beginning of Pra Pa Yap road covering municipality area, Kaengkhoi hospital, Kaengkhoi district administrative office, Kaengkhoi police station, Tesaban Pattana School and Urai Ratn soi 1, 2, 3 and 4.

9. Ruam Pattana community covers the area from the eastern part of Mittabharp road to the north through Sahasan Textile and ends at the rail road covering rail road area.

*(5) Social and economic environment*

1. Economy : Most of people income in the municipality area were from merchant or private own business. Majority of the merchants which were small were in the raw food market. The second source of income were from employment from the companies or the factories located in the district. There was a number of both small and large factories in the municipality and surrounding areas. In addition, there was a number of general workers and government officers.

2. Social services

2.1. Education : There were 7 schools in the municipality. One of those which was under the Elementary Education Department had was higher secondary school.

Two of the seven belonged to the municipality and were primary school. Another municipality school was mainly the primary school with the extension to the lower secondary school. Three were the private schools. There was one center for non-ordinary education.

2.2. Religion : About 99% of the population were buddist. There were three tamples in the municipality, i.e. Kaengkhoi, Bann Maung and Rasd Pattana.

2.3. Public health services : There were one office for controlling malaria epidemics, one municipality's health center and 6 office for primary health centers.

2.4. Government offices, public utilities offices included municipality office, Kaengkhoi administrative office, provincial police station, post office, telephone office, office of department of lands, water supply office, argicultural cooperative, office of department of argiculture, pawn shop, Saving Bank, Bank of argiculture and cooperative, Sri Ayudthaya Bank, Bangkok Bank, Siam Commercial Bank, Bangkok Metropolitan Bank, and Saha Bank.

3. Residences : The residences in the municipality included merchandise-houses which were concrete and wooden built. Services found in these houses included car repairs, metal works, rice mill, machine shops, ice shops, photo shops, pharmacies, service and entertainment houses, food shop, beauty shop and housing.

#### 4. Utilization and condition of lands in Kaengkhoi Municipality

Total area of Kaengkhoi municipality was 18,802 rais. 78.02% of the lands or 14,670 rais were used for argiculture, unoccupied and empty space. Industrial area covered the land of 1,308 rais or 6.96% of total area. Residential areas were in 1,147 rais or 6.10%. Government offices occupied 129 rais. Warehouses area were 75 rais. Religious institutions occupied area of 186 rais. Lands for rest and recreations were

16 rais. Schools and education institution were 87 rais. Lands for animal farming were 166 rais. Apart from this, the river and canals were 696 rais and the road and sub road were 265 rais.

The use of lands in the municipality was the centralized which had the business and residential centers in the middle of the municipality located to the north of the rail way station where was surrounded by the residences. Government offices were crowdedly located near the middle of the municipality. Industrial area was to the western part of the municipality and had a trend of growing and more crowded. Most of the factories were considered large and had high investment, for example, โรงงานกระดาษ , sanitary ware factories and factory for building material such as tile and conduit. The municipality had highly growth into the manufacturing side since the area had a potential for industrial investment. Also, there was natural resources to feed the heavy industry. The infrastructure was another factor that supported the growth of the industrial sector. The municipality had the basic and required infrastructure for the manufacturers and located not far from Bangkok which was the biggest market. In term of the energy supply, there was a natural gas pipeline laying through Nong Khae, Maung, Kaengkhoi and Bann Mor districts. Gas could be fed directly to the factories. This area was supported by the investment agency. The use of lands for industries had been in very high level. From the aforementioned reasons, Kaengkhoi municipality had the industrial sector as a foundation in the economy and had increased number of industrial workers.

The survey conducted by PPK Associated Consultants Co., Ltd (1997 : 2-4-2-5) had reported that the direction of the areal expansion had been from the middle of the municipality in front of the railway station to the western, the northern and the

southern parts of the municipality. The major expansion was to the western part since there was a rail road as an obstacle to prevent the expansion to the eastern and southern parts. Pasak river was the obstacle to the expansion to the northern part and there was only one bridge, Adireksarn bridge, that crossed the river. In the area of 4.05 square kilometers, the utilizations of the lands were as follows.

1. Western part had a relatively high expansion along the Tawin Wattana and Sud Bann Tad roads compared to that of other areas. There were a number of houses, condominium, commercial building and merchant shops along these two roads.

2. Northern part along Liab Santisuk, Tes Wi Wa, Poke Supat and Pra Pa Yap roads was crowded with merchant buildings, shops and residential areas.

3. Southern part along Urai Ratn and Mittrabhap roads had the high expansion of merchant buildings and crowded residences.

4. Forecast of future lands utilization

The utilization of lands in the past to present was considerably high. At present, there is almost full utilization of land in the municipality, land prices is quite high and population is very crowded. Therefore, the future of land utilization (during 1997 to 2006) could be expected that the first expansion would be to the western part of Sud Bann Tad and Ta Win Wattana roads and the area connected to Tumbon Tal Dieo which will be highly expanded compared to other areas since there are a number of housing projects such as Maruay, Faung Fa, merchant buildings and shops. The second expansion will be along the Urai Ratn and Mittabharp roads which is the southern part of the municipality. This area has a moderate expansion potential, e.g. a number of housing projects, townhouses, merchant buildings. There is only slight change in the northern part, i.e. Maek Mai housing. During 2007 to 2016, the

expansion would still be to the western part which will be more crowded especially the housing areas and commercial areas mostly along the border line with Tambon Tal Dieo. In addition, the southern part of the municipality along Urai Ratn and Mittabharp roads, especially inbound direction of the Mittabharp road, would have more houses and merchant buildings continually.

#### 5. Population and changes in population

Currently, Kaengkhoi district consists of 13 tambols and 1 municipality. Area with the highest population is Kaengkhoi municipality which has a population of 14,108 or 18.04% of total population. The second high population is Tambol Tab Kwang which has 15.21% of the district's population. The least population is in Tambon Tao Poon which has 2.01% of total population in the district. If consider the change of the population, it is found that the number of population increases in both the period of 1988 to 1990 and 1990 to 1995. The increasing rates were 2.68% and 1.56% per annum respectively. Tambon which had the highest population growth rate is Tal Dieo which had 1.33% and 5.40% in the period of 1988-1990 and 1990-1995 respectively. These trends indicate that the total district, covering Kaengkhoi municipality, part of Tambon Song Korn, Tambon Baan Pa, Tambon Tao Poon and Tambon Tal Dieo has a tendency of increasing of population.

In term of population per unit area, it is found that the municipality is the most crowded area of the district. The population density in the municipality is 3,483 persons per square kilometer. The second crowded area is Tambon Bann Pa which has the density of 186 persons per square kilometer. In term of working age, people in Kaengkhoi municipality have the age for effective working at the age between 25 to 49 years old or 40.5%. People start working at the age of 15 to 24 years old which is

account for 22.1% of the total population in Kaengkhoi municipality. The structure of ages and gender of population has shown that there are more people in the lower ages.

#### 6. Forecast of population

There is a forecast of population in the Kaengkhoi municipality, both registered and unregistered ones, during 1997 to 2016 by using information in 1995 from Department of Provincial Administration, Ministry of the Interior and the compound growth rate equation which could be described as follows.

$$POP_t = POP_0 (1+r)^t$$

where

$POP_t$  = population at year t

$POP_0$  = population at base year

r = population growth rate

t = forecasting period

By using 1995 as a base year, with it could be estimated that the population growth rate is about 1.44 according to the historical changes. Hidden population which is from the social and economical survey done by PPK Associated Consultant Co., Ltd (1997:3-11 – 3-12) has been the employees of the factories surrounding the municipality who have rent houses in the municipality. This hidden population has the growth rate of 8.1. For the non permanent residence such as government officers, teachers, students who live outside the municipality but come to do their activities in the municipality has an increasing rate of 4.80%.

The study has shown that total population in 1997 will be 19,446. The number of population will increase to 21,227, 22,298, 26,600 and 29,890 in year 2001, 2006, 2011 and 2016 respectively. It indicates that the total population will increase drastically since the municipality is a very populated area with the population density

of 3,400 persons per square kilometer. The municipality is also the center of merchants and services. In addition, when the Pasak dam has been built, there will be an expansion of the investment, agriculture, construction and industry in the surrounding areas and nearby tambol which will create the employment for both in and out of the municipality and out of the district. Therefore, there will be more people coming to work in the number of factories surrounding the municipality and the number of rented houses in the municipality will increase. There will also be a number of land development projects and private housing construction projects. Workers of the construction projects will be living in the municipality and then result in an increasing of the retail stores, food shops and grocery stores.

#### 7. Situation of water pollution in Tambol Kaengkhoi municipality

The most important of ground natural resources in Kaengkhoi municipality is Pasak river which is also the main river of the province. The origin of the river is in Petchaboon mountain range in the southern part of Loei province. The path of the river has passed Lopburi province to Saraburi province from Muaklek district to Kaengkhoi, Maung, and Sao Hai district prior to joining Chao Praya river in Pranakorn Sri Ayudthaya. The river has passed the municipality in the northern part. People in the municipality has used the river for consumption, agricultural and fishery. Water from the river has been used as water source for the water supply in the municipality which is serviced to people living in Kaengkhoi municipality.

A study conducted by PPK Associated Consultants Co., Ltd (1997 : 6-3 –6-5) has concluded the water quality in Pasak river by using the analysis from the environment impact assessment of the Pasak dam of the Department of Irrigation in Saraburi and Lopburi provinces in 1993. The study has identified the points to collect

water sample for analysing water quality during August 1992 to March 1993. There were two sampling points in upstream and downstream of Kaengkhoi district, e.g. upstream point at Ta Sa La temple and the downstream at Adireksarn bridge. The detail of water quality is as follows.

1. In rainy season (14-16 August 1992), average temperature of the water varied between 30-30 C. The water was slightly basic, with the pH of 7.7 to 8.0 and the basic constituent in form of calcium carbonate ( $\text{CaCO}_3$ ) was about 78 to 118 milligram per litre which was considered moderate level. This value increased along the river and was considered as a result of solution of calcium salt from the river plain to the river. DO of the water was at the same amount along the river at 4.4 to 5.0 milligram per litre. BOD varied between 0.4 to 4.1 milligram per litre which was higher than the quality of type 4 water according to announce of The National Environmental Broad edition 8<sup>th</sup> (1994) which has set at 4.0 milligram per litre.

2. In winter (13-15 November 1992) water in the river during this period of time had temperature varied between 25.5 to 27.0 C which was slightly lower than that of the rainy season. Water typically was slightly basic and had higher DO than water in rainy season. DO throughout the river was similar while the BOD of the downstream section was higher than that of the rainy season, i.e. varied between 1.4 to 4.4 milligram per litre. The increasing of BOD indicated that water became rotten at the downstream which had very low flow.

3. In summer (19-21 March 1993) water in the river was still lightly basic. Dissolving oxygen in water in the district area was higher than the saturated point, at the level of 10.0 to 11.9 milligram per litre. The highest dissolving oxygen was the result of the photo synthesis of plankton. BOD of the upstream part was higher than

that of the winter (2.3 milligram per litre) while the BOD in the downstream part was 4.3 milligram per litre which was higher than that of type 4 water which legislation of pollution control in 1994 had set the highest BOD of 4.0 milligram per litre.

In conclusion, water in Pasak river in Kaengkhroi district during August to March had contaminant in form of BOD which was high from the upstream of the river (in the district part) and the BOD gradually increased along the river to the downstream section. The increasing in BOD indicated more rottenness from the community in the municipality which had disposed wastewater to the river. The municipality did not have the proper wastewater treatment system, therefore there was a direct draining of wastewater from household, office building, accommodation (some of them did not have wastewater treatment system) to the river.

## **2.4 Relevant studies**

There have been a number of researches on the participation of people to solve the water pollution from the community. Those research could be referenced for consideration of the past researches and also could be reference in the relevant parts. The past relevant researches could be categorized to draining of the disposed water, people opinions, people participation and the research relating to variables as follows.

### **2.4.1 Draining and treating polluted water from the community**

The studies of the draining the disposed water from household by several concerned organizations had concluded that most of people had drained disposed water to land or water sources directly and had not disposed water to the draining system of the local government such as municipality and sanitation. Such actions had caused the water pollution problem to the water sources. The exception to draining disposed water was found in Bangkok where there was draining of disposed water to

draining system of Bangkok. However, people who living nearby the canals of Bangkok was still disposing water directly to the canal (Benjasiri, R.,1997: 37). This behavior was corresponding to that of the people who lived in Maung Suphanburi municipality in 1990 where 59% of the people disposed used water to the empty space in the house or to the pond while only 29.5% of people who disposed water to the draining system of the municipality. This was also corresponding to people living in the Khao Pra municipality where 59.0% and 71.1% respectively (The Thailand Institute for Sciences and Technology Research cited in Sutipanwihan, S,1996: 63)

#### **2.4.2 Opinions to cause of water pollution problems**

People had a variety of opinions to the causes of water pollution problem. The variation of opinions was dependent on the activity in the areas they lived. Sutipanwihan, S.,(1996 : 65) had interviewed samples in Maung Phuket municipality and the results had shown that 62.4% of people believed that the major sources of water pollution were hotel, restaurant, food shops and household while 33.6% considered that the factories were the major source. This was also corresponding to the study from the people living in Samchook sanitation which 76.9% of people thought that the disposed water from household was the main source for water pollution problem in Ta Chin river (The Thailand Institute for Sciences and Technology Research cited in Sutipanwihan, S,1996: 64)

#### **2.4.3 Opinions on the impact of water pollution problem**

A number of studies conducted by several concerned parties had concluded that there were a number of impacts of water pollution from the community, such as water became rotten, quality of water had reduced, environment was degraded. In addition, there were other indirect impacts such as the sources of diseases, lower visualize

pleasant and the economic recession. 36% of people in Pathum Thani province thought that the major impact from water pollution was to health while 38.8% of people in Pranakorn Sri Ayudthaya believed that the water pollution caused the growth of germs. (Sutipanwihan, S,1996 : 66)

#### **2.4.4 Opinion on solution of water pollution**

Most of people in many areas of study had agreed that the most effective approach was to let the people in the community participate in prevention and solution of the water pollution problem. The second most effective approach was the use of law to fine and imprison the offender. It should emphasize on teaching the people for preventing the problem. In addition, some had thought that the parties who potentially produced wastewater should treat the wastewater prior to disposing to public draining system or to natural water sources and the municipality should expedite the construction of central water treatment to handle the problem (Sutipanwihan, 1996: 66)

More than 90% of people in most of the studied areas agreed that there should immediately have wastewater piping system in their local areas, for example Muang Ayudthaya municipality, Muang Suphanburi municipality and Muang Patumthani municipality.

#### **2.4.5 Participation on the water pollution from the community**

##### **(1) Participation by action**

It is found in the study of participation of people by action that 57.2% of people in Suphan Buri province would not litter to natural water source, 16.3% would keep the natural water source clean, the rest would not dispose wastewater (The Thailand Institute for Sciences and Technology Research cited by Sutipanwihan, S,1996 : 66 )

For the participation of people in Muang Phuket municipality, it is found from the study by Sutipanwihan, S., (1996: 132) that people participated in separating food particles, littering in the bin and saving use of water by 95.2%, 92.3% and 85.7% respectively. For cleaning of the water sources, 73.8% of people did not participate.

### (2) Participation in donation of cash and equipment

It was found that 35.3% of people in Maung Pranakorn Sri Ayudthaya municipality thought that people should share the cost and expense with the municipality. Fifty four point two percent of people in Pathum Thani were willing to donate for the construction cost (Envitech Consultant Co.Ltd., cited in Sutipanwihan, S., 1996: 65-66 )

Participation by donating material from the study of South East Asia Technology Co.Ltd., indicated that if the government organization asked for participation to develop the water sources, 89.2% of people in Nakorn Chiang Mai municipality were willing to participate which 40% would donate material and labor force.

### (3) Participation to pay the fee for treating polluted water

Most of people were willing to pay fee for treating the polluted water while not many people were unwilling to pay fare for operating and maintenance of wastewater treatment. Most of people in Phuket (78.6%) answered that they wanted to pay (Sutipanwihan, S., 1996: 70). Range of fare that most people would like to pay was 81 to 100 baht per month which 26.3% of people were willing to pay at this range and the average fee was 72 baht per month. This conclusion was corresponding to that of The Thailand Institute for Sciences and Technology Research which concluded that proportion of people in the community in the southern part of Prem

Pracha Korn canal, Khao Pra and Sam Chook sanitations who were willing to pay were 60.6%, 81.0% and 86.2% respectively. The rate that people in these three areas were willing to pay were 58, 10 and 25 baht per month per household respectively. The study by Benjasiri, R(1997 : 37) also had similar conclusion that people who lived along the canal in Bangkok were willing to pay the fare to treat or to solve water pollution problem at the rate of 73 baht per month. This was different from people who lived in Suphan Buri province which 61.4% were not willing to pay the fare. (The Thailand Institute for Sciences and Technology Research cited in Sutipanwihan, S,1996:65 )

#### **2.4.6 Variable relevant to the research**

(1) Gender : Chances that male and female would participate in social activity were different especially Thai society which the leader of public activity were mostly male. As a result, factor of gender should have effect on the participation of people to solve water pollution problem.

Daosuwan, W(1990 : 95) had studied the Local people's participation on the conservation of environment at Bung-khunthalae and found that gender had effect on the participation to preserve the environment of Bung-khunthalae .

Khongtong, S(1993:110) had studied the participation of people to preserve the forest at the estuary in Sikao district, Trang province and found that gender had effect on the participation to preserve the forest.

Yamchuenpong,U(1994:176) had studied The Participation of Tambol Council association in the conservation of the Thacheen river: a case study of the area in amphoe Nakornchaisri, Nakornpathom province and found that gender had no effect on the participation level to preserve the river.

Sutipanwihan, S.(1996: 136) had studied the participation of people to the water pollution problem from the community in Muang Phuket as a case study and found that gender had effect on the participation of people on every activities which relating to water pollution problem.

Thammachart, S(1997:107)had studied The Participation of the local people toward coastal resources conservation : a case study of Langu district,Satun province and found that gender had relationship to participation of local people to preserve natural resources nearby sea shore. It could be found from the relevant studies and research that male and female were naturally different, ways of treating, culture and role in the community. Therefore, different genders should have different level of participation.

2. Age : People with different ages had different experience and had different competencies. In Thai society, especially, believed that the older should have more experiences, more skills and were listened by the younger. Therefore, the older people were accepted and had more chances to participate social activities such as the following research results.

Dee-in, P., (1988:119), had studied participation of Tambol and village headman in forest resources conservation in the Northern part of Thailand and found that age does not effect the participation of the Head of Tambol and the head of village in forest conservation.

Ratana, P(1993:75)had studied the People Participation in Environmental Development Programme of the Community Development Department : A Case Study of Ubonratchathani Province and had found that age was one factor that related to the participation of people to preserve forest natural resources.

Daosuwan, W(1990:95) had studied local people's participation on the conservation of environment at Bung-khunthalaе and had found that age was the one factor that related to the participation of people to preserve natural resources in Bung-khunthalaе .

Aungkuldee, P(1996:69)had studied Women Leaders'Participation in Promotion and Conservation of Environment in Changwat Ratchaburi and had found that age was one factor that related to the participation or most of the older female leaders had more participated in promoting and preserving the environment than had the younger female leaders.

Sutipanwihan, S(1996:96) had studied People's participation in Domestic Wastewater Management : a case study of the Phuket Municipality had found that age was relating to participation in every activities. People at different ages had participated differently.

Thammachart, S(1997: 110) had studied the participation of the local people to preserve natural resources along the shore in La Ngoo district, SaTool province and had found that the participation of people to preserve natural resource along the sea shore was a function of the age.

From the relevant studies it could be found that age had impact on the experience and roles in the community. Thai society had respected to the senior people. Therefore, age could possibly be a factor that makes the different participation of people to prevent and to solve water pollution problem.

6.1. Occupation : Occupation of people depended on the natural resources both directly and indirectly. People who had occupations relating to natural resources directly might have different participation from those who had occupations relating

indirectly to natural resources. As a result, occupation might be one factor that had impact on the participation on the social activities such as :

Kaufman(1949 : 528) had studied and had found that occupation had related to the participation of the people.

Tuntichart, S (1988:48) had studied the participation of Tambol Council in small scale water resource and development in Kalasin province and had found that Tambol Council who had been on agriculturers had more participated in small water source developments more than those who were having more professions.

Khongtong, S(1993: 112) had studied the participation of people to preserve the forest at the estuary in Sikao district, Trang province and found that occupation had effect on the participation to preserve the forest.

Ratana, P(1993:75)had studied the People Participation in Environmental Development Programme of the Community Development Department : A Case Study of Ubonratchathani Province and had found that occupation was not the factor that effected the participation.

Sutipanwihan, S (2539:96) had studied the participation of people to water pollution from community in Muang Phuket municipality as a case study and had found that occupation was relating to participation in every activities. People at different occupations had participated differently.

From the relevant studies, it was found that occupation of people that related to the natural resources both directly and indirectly would cause an understanding of the importance of the natural resources and the importance to preserve natural resources. As a result, different occupation might be one factor that had impact on the participation on the social activities

2.5 Education : Education had increased people's knowledge, thoughts and understanding of the social activities which had benefit to community and individual. Most of people in Thai community had respected people who had high education since the education had increase experience and abilities to applied knowledge to solve the problems such as:

Vudhikamruksa, C(1994:114-115) had studied the social and economical factors that effected the participation of people to the project for job employment in the rural areas which focused on the rewarded project at Tambol Khum Payorm, Bann Pong district, Ratchaburi province and had found that the higher educated people had more participated that had the lower educated people.

Issareemet, A(1993:114) had studied the factors which effected the awareness of the Tambol council to solve water pollution in Chao Praya river in Maung Pathum Thani as a study case and had found that the different in education level had caused the different in the awareness to solve water pollution problem in Chao Praya river.

Daosuwan, W(1990:95) found that Education does not effect to local people participation in environmental conservation at The Bung-Khunthalaе. As same as result of Sanchai Sutipanwihan (1996:142) in topic "people's participation in Domestic Wastewater management : a case study of The Phuket municipality", which indicated that educational level is not related to people participation in any level and any willing to participation in any steps of process.

Thapunya, S(1996:72). had studied the Factors affecting environmental conservation of archaeological site : a case study of people participation at the nearby archaeological site, Chiang-Mai province and had found that education level was one factor that effected the participation of people to preserve the ancient places.

From the relevant studies and documentation, it was found that education had caused the people to think and could change the behavior of people to change social problem. As a result, different education might be one factor that had impact on the participation of people to prevent and solve water pollution problem.

2.5. Access to information : Access to information was the necessity to daily life since the development in communication technology had effected to decision making process of people to the social activities (Chumnong, W,1990 : 3 ) which could be seen from:

Iddhipongse,S.,(1993 :163) had studied the participation of the member of Tambol council to preserve the forest at the estuary of Ta Mai district and Nai Arm subdistrict, Chan Ta Buri province as a case study and had found that access to the information was one of the factor that effected the preservation of the forest at the estuary.

Vivatthanavanich,C(1994:101)had studied the factors that effected the participation of people to preserves natural resources and environment in Pla and Payoon villages, Bann Chang district, Rayong province and had found that the access to information of the preservation effected the participation to preserve natural resources and environment.

Sutipanwihan, S(1996:96) had studied the participation of people to water pollution from community in Muang Phuket municipality as a case study and had found that people who had more access to information had more participated in the activities more than those who had less access to the information.

From the relevant studies and documentation, it was found that level of the access to information might be one factor that had impact on the participation of people to prevent and solve water pollution problem.

6.7 Knowledge: This item included the fact and truth which had been concluded from experiences (Good, 1973:325). Knowledge was then the important factor which made understanding and ability to proceed the action. Thammaraksa, K.,(1984:64) had mentioned that if people had knowledge in any topic, it led to related activity. As a result, knowledge was the major factor for understanding and motivation to participate and caused the ability to perform the activity such as:

Horatan ,W.,(1992 : 161) had studied the opinion about the treating water litter of people who lived along Klong Bangkok Noi and Klong Chak Pra, Ta Ling Chan district, Bangkok and had found that people along Klong Bangkok Noi had different knowledge about the service which then caused the different opinion to such a service.

Issareeyamet, A.,(1993 : 114) had studied the Awareness of Tambol Council on resolution Chao Phraya river pollution problem : a case study at Amphoe Muang, Pratumthanee province and had found that the member who had different knowledge about water pollution had the different awareness to solve water pollution problem in Chao Praya river.

Aunguldee,P.,(1996 : 69) had studied the participation of the female leaders to promote and preserves environment in Ratchburi province and had found that knowledge about the problem was the factor that effected the promotion and solution the environment problem.

From the relevant studies and documentation, it was found that knowledge was the major factor that controlled activities. Therefore, different knowledge of the water pollution problem from the community would cause different level of participation of people to prevent and solve water pollution problem.

6.8 Opinion:Opinion was not based on the fact and truth but the individual thought and believe (Webster dictionary, 1970 : 296).Opinion was not proved if it was true or false (Education dictionary, 1973 : 296 ).And from the reinforcement theory of Hofland & Delly(1953:6-10) , opinion was caused by the learning and was dependent on the interest, understanding, satisfaction.Therefore, if a person had good experience, it had a high chance to had good opinion on that subject and could accept such particular subject. The examples could be noticed from the following studies.

Khemcharoen, S.,( 1988 : 214 ) had studied the participation of people to preserve forest resources in Sa -Iab, Song district, Prea province and had found that the opinion relating to the preservation of forest was one factor that related to participation of people to preserve forest natural resources.

Yeekhun,S.,(1991:149)had studied the participation of people to manage community forest in Srilago, Chackkarat district, Nakornratchasima province as a case study and had found that different opinion to community's forest had caused different participation to manage community forest.

Triwongyoy, P.,(1995:93-101) had studied the participation of local people in community forest management: a case study of Banpalan, Tambol Pongnoi, Maechan district,Chiangrai province and had found that opinion and awareness of the ownership of the forest,the group which had score of opinion and awareness of the

ownership of the forest in medium and high level had the statistical significant level of 0.01.

Thammachart, S(1997 : 110) had studied the Participation of the local people toward coastal resources conservation : a case study of Langu district, Satun province and had found that the opinion to preserve natural resources along the sea shore and the participation of people to preserve natural resource along the sea shore had highly related at the statistical significant of 0.000.

From the relevant studies and documentation, it was found that people opinion had effected on people activities. Therefore, the different opinion of people might effected the participation of people to prevent and solve water pollution problem at different level.

## **Chapter III**

### **Methodology**

A study of “ People ’ s participation in water pollution prevention: a case study of Tambol Kaengkhoi Municipality, Saraburi province” uses a survey research approach to explain the participation level of population in Tambol Kaengkhoi Municipality, Saraburi province in the prevention and solution water pollution problems. The study also includes the comparison of the people participation in prevention and solving of water pollution, and the different of independent variables. In addition, suggestions to prevention and solving water pollution by people in Tambol Kaengkhoi Municipality are also included. The details of the study are as follows.

#### **3.1 Population and samples used in the study**

##### **3.1.1 Population**

Population in this study includes the followings.

(1) One persons who is the family leaders or spouse who represents the whole family. The family must live in Tambol Kaengkhoi Municipality, Saraburi province which has total number of 3,323 families as detailed in table 5.

(2) Representatives from the government organization which relating to the solution water pollution problem in Tambol Kaengkhoi Municipality, e.g. head of public health and environment, Tambol Kaengkhoi Municipality administrative office.

**Table 5** Number of household in Tambol Kaengkhoi municipality, Saraburi province, categorised by area

No	Community	Soi/Road/Area	Number of households
1	Saha Pattana	Liab Santisuk Road, Poke Supat Road Soi Pra Pa Yap 10, 11 and 12 Area behind Sa Nguan Shop	263
2	Liab Santisuk	Raw food market along Liab Santisuk Road Behind the rail road association	339
3	Santisuk	Soi Liab Santisuk 1, 2 and 3 Soi Rong Soob Kaengkhoi Tample	382
4	Tes Wi Wat	Soi Tes Wi Wat 1, 3 Saha Pattana	349
5	Pra Pa Yap	Soi Pra Pa Yap 1,2,3,4 and 5 Pra Pa Yap road	312
6	Ta Chao Wong	Soi Ta Win Wattana 1, 3 Sud Bann Tad road 5 and 6	432
7	Ta Win Wattana	Soi Ta Win Wattana 5, 7 and 9 Soi Sud Bann Tad 7, 8 and 9 Feung Fa village	535
8	Urai Ratn	Soi Urai Ratn 1,2,3,4 and 5 Sud Bann Tad road 11, 12 and 13	362
9	Ruam Pattana	Soi Pracha Uthit 1,2 Pracha Uthit road	349
<b>Total</b>			<b>3,332</b>

Source : Tambol Kaengkhoi Municipality administrative office, Saraburi province (2538)

### 3.1.2 Size of the sample

(1) From the total population which has the exact size. From the survey of the water supply fare from water supply division, Tambol Kaengkhoi Municipality administrative office, Saraburi province. The formulation used to determine the size of the sample is Yamane. (cited by Kijpredaborisuthi, B(1997:71) which could be described as follows.

$$n = \frac{N}{1+Ne^2}$$

where n = number of sample required  
 N = number of household in the municipality  
 e = Confident level of 95.0 % or = 0.05

Substitute the parameters in the equation

$$\begin{aligned}
 N &= 3,323 \\
 e &= 0.05 \\
 n &= \frac{3,323}{1+3,323(0.05)^2}
 \end{aligned}$$

Therefore, the require sample size equals 357 and the practical size of sample is 357.

(2) Sample size is categorized by the service areas of Tambol Kaengkhoi Municipality. Table 5 had shown that the municipality has been divided into 9 sub communities. In order to study covering all the communities, the study of each community has been done. This is done by stratified sampling the sample size obtained from the previous step. The stratification is based on services area given to the municipality. The number of the sample of each community is determined by using the ratio of the population of each community according to the following equation.

$$n_h = \frac{N_h \times n_0}{N}$$

Where  $n_h$  = size of sample from each community  
 $N_h$  = number of household in each community  
 $N$  = total number of household in the municipality  
 $n_0$  = size of the total samples

The above equation has given the result as shown in table 6.

**Table 6** Number of households and size of the samples categorized by services area in Tambol Kaengkhoi municipality, Saraburi province

No	Community	Number of household	Size of the sample
1	Saha Pattana	263	28
2	Liab Santisuk	339	36
3	Santisuk	382	41
4	Tes Wi Wat	349	38
5	Pra Pa Yap	312	34
6	Ta Chao Wong	432	46
7	Ta Win Wattana	535	57
8	Urai Ratn	362	39
9	Ruam Pattana	349	38
	<b>Total</b>	<b>3,332</b>	<b>357</b>

Therefore, the number of samples is 357 persons.

(3) Sampling technique used is an accidental sampling which has no exact principle to sample. When the family according to the service area of Tambol Kaengkhoi municipality has been found, the data is collected. This process repeats until the number of required samples has been met. (Taweerut, P.,1997:84)

### **3.2 Instrument and instrument development**

In this study, the researcher had collected information by using questionnaires. The questionnaires are based on thoughts, theories, thesises and research reports relevant to this study. The structure of questions in the questionnaire could be divided into 7 sections as follows.

**Part 1** is personal information such as gender, age, occupation, education, right to own residence and the utilization of houses or buildings. The questions are both multiple choices type and open end type.

**Part 2** relating to the utilization and consumption of water, and the disposal of waste water and excretion, including source of utilized and consumed water and type of waste water disposal. The questions are both multiple choices type and open end type.

**Part 3** is related to the knowledge of water pollution. The 20 questions have two select choice as true or false. There are both positive and negative questions covering the following items.

1. Sources and factors of water pollution
2. Impact of water pollution
3. Measures to prevent and solve water pollution

#### **Criteria for scoring.**

Positive question      1 score for true answer

	0 score for false answer
Negative question	0 score for true answer
	1 score for false answer

The classification of people's knowledge on the water pollution from the community has three levels based on the following criteria as follows.

Knowledge Level	Scores
Low	0-6
Medium	7-13
High	14-20

**Part 4** is the testing of people's opinions to water pollution problems in the following items.

1. Source and factors causing water pollution
2. Impact from water pollution
3. Measure to prevent and solve water pollution

Each of the 20 questions have three different choices as agree/unsure/disagree.

The question could be both positive and negative senses.

#### **Criteria for scoring.**

Positive question	3 score for "agree"
	2 score for "uncertain"
	1 score for "disagree"
Negative question	1 score for "agree"
	2 score for "uncertain"
	3 score for "disagree"

Rating scale for this type of part has 3 different levels based on the following criteria.

Level of Opinion	Scores
Disagree	20-33

Uncertain	34-47
Agree	48-60

**Part 5** concerns the access to information about water pollution through communication means. There are seven questions in this part.

**Criteria for scoring.**

Frequency	Scores
Always	3
Usually	2
Often	1
Never	0

Meaning of the frequency to access to the information via several information sources.

Always means to access information on daily basis

Usually means to access information 2-3 times per week.

Often means to access information once a week

Never means no access to information

Classification of the access to the information has three level based on the following scores.

Level of access to information	Scores
Low	0-6
Medium	7-13
High	14-20

**Part 6** covers the participation level and needs of people to participate in prevention and solution water pollution problem. Questions in this part are divided into two types as

1. Participation and obstacles for participation, in household level, to lower uncleanness and volume of waste water from the household. There are five activities in this category as follows.

1.1. Separate food particles from disposed water

1.2. Avoid using concentrated acid and basic to clean rest room and hard surface

1.3. Effectively use water

1.4. Waste water treatment in household level

1.5. Treatment excretion from toilet

The questions indicate the participation level of people in the household level.

Rating scale has 4 scales as follows.

Non- participate means have not done any of the action given above.

Participation means doing any of the above action occasionally or once or twice per week.

Criteria for scoring the answers has 2 ranges as follows.

Level	Scores
Non- participate	0
Participation	1

To find participation level of the people in the household level, answer of each question will be counted and the mode will be determined.

2. Want to participate and obstacle of people for the construction of waste water treatment system. The needs could be categorized into 5 levels as follows.

1. Participate by giving comments

2. Participate by donate cash and equipment

3. Participate by paying fare for the treatment

4. Participate by being a committee

5. Participate by assessing the project

The questions measure the needs of people to participate in a particular step. The questions are closed-end questions which people could choose whether need or not need to participate.

In the categories of paying the fare for treating the wastewater, there is a question on the amount of fare that people can afford in addition to the willingness to pay for the fare. In case that the response is not willing to pay, there is a section for the response to explain the reason for not paying the fare.

Part 7 covers the comments and suggestions for the participation of people to prevent and to solve water pollution problem. The question is an opened end type.

### **3.3 Validity of the instruments**

1. Verify the content validity by 3 of the experts in this area of study to validate the context and the content of the questionnaires. The suggestions and comments are used as guidelines for revisions and modifications.

2. Once the questionnaires have been revised and modified according to comments and suggestions from the experts and the thesis committees, the questionnaires were tried-out with 34 people in Tambol Kaengkhoi Municipality who are not in the sample set earlier. Responses are used to determine the quality of the Instrument.

3. Questionnaire for the opinion is a rating scale which has 3 level. The technique used is 25% of the high and low response. It tests the different opinion of the positive and negative minded people by using t-test. After this, the question which

has t-value of greater than 2.0 will be used since it effectively represents the answer of the responses.

Analysis for the confident level by using alpha coefficient of Cronbach with the following equation. (cited by Taweerut, P,1997:125-126)

$$\alpha = \frac{n}{n-1} \left[ 1 - \frac{\sum S_i^2}{S_t^2} \right]$$

where  $\alpha$  = coefficient of the confident  
 $n$  = number of questions in the questionnaire  
 $\sum S_i^2$  = summation of the variance of each question  
 $S_t^2$  = total variance of all questions

3. Questionnaire to test the knowledge of the response will be analyzed to find the ease and difficulty and power factor by each question. The technique used is 25% of the high and low groups by the following equation (Kijpredaborisuthi, B.,1997 : 158)

$$P = \frac{P_H + P_L}{2n}$$

$$r = \frac{P_H - P_L}{n}$$

where  $P$  = difficulty level  
 $r$  = power factor to separate response  
 $n$  = number of response in the both high and low groups  
 $P_H$  = number of correct response in the high group  
 $P_L$  = number of correct response in the low group

After that select the question which has the difficult index from 0.2 to 0.8. For the separation power, choose only the question which has the factor of 0.2 or above for the confident level analysis. The confident level analysis uses internal constant factor method by using equation number 20 of Kuder-Richardson method as follows. (cited by Kijpredaborisuthi, B.,1997:211)

$$r_{tt} = \frac{k}{k-1} \left[ 1 - \frac{\sum p_i q_i}{S_t^2} \right]$$



- where
- $r_{tt}$  = confident level
  - $k$  = number of the questions
  - $S^2_t$  = variance of the total questionnaire
  - $p$  = proportion of the repossess that has the correct answer
  - $q$  = proportion of the response that have the incorrect answer = 1- p

Valid instrument should have the confident level of greater than 0.7 (Kijpredaborisuthi, B.,1997:177)

5. Questionnaire to test the access to information and the participation could be analyzed by using the alpha coefficient of Cronbach.

### 3.4 Collection and analysis of the information

1. A letter from Faculty of Social Sciences and Humanities to mayor of Tambol Kaengkhoei Municipality to explain about the research and to coordinate with different parties for easing the collection of information.

2. Meeting with the research assistance to agree on the principle and methodology in order to effectively collects information.

3. Collect information from 357 samples in Tambol Kaengkhoei Municipality during 17 May 1999 to 20 June 1999.

4. After the information has been collected, the researcher codes the questionnaire and compiles the results by using SPSS (Statistical Package for the Social Science) for Windows.

### 3.5 Statistics used in the study

Once the information from the sample has been collected, the researcher validates all the responses and codes before compiling with the SPSS for Windows commercial package. Statistics used for the analysis consists of the followings

1. Demographic, economic and social information will be analyzed by using percentage, mode, standard deviation, minimum and maximum values.

2. Analyze the participation level by using percentage, mode, standard deviation, minimum and maximum values.

3. Comparison of the difference between mean values of the independent variables to participation to prevent and to solve water pollution problem uses the following statistics..

3.1. T-test is used to determine the difference of means of the two groups of the independent variable on the participation of people to solve water pollution from the community. T-test is the following formula. (cited by Taweerut, P,1997: 131-132)

$$t = \frac{(\bar{X}_{high} - \bar{X}_{low})}{\sqrt{\frac{S^2_{low}}{n_{high}} + \frac{S^2_{high}}{n_{low}}}}$$

where t = t- value  
 $\frac{n}{n}$  = number of sample in each group which has to be equal  
 $\bar{X}_{high}$  = mean value of the high group  
 $\bar{X}_{low}$  = mean value of the low group  
 $S^2_{high}$  = variance of the high group  
 $S^2_{low}$  = variance of the low group

3.2. One Way Analysis of Variance or ANOVA will be used to determine the difference of means of more than two groups of independent variables.

3.3. If it is found that there is a significant difference, multiple comparison will be used to test if there is any subgroup, which is different from others. The technique used is Scheffe' test (cited by Kijpredaborisuthi, B.,1997: 145-146)

## **Chapter 4**

### **Results**

The analysis of people's participation in water pollution prevention: A case study of Tambol Kaengkoi municipality, Saraburi province, was collected by using questionnaire. The research's sample is families' leader or housewife of each household as 100 percent. The analysis has the following details:

- 4.1 General Information of the Sample
- 4.2 Water Usage and Sewage Disposal
- 4.3 Knowledge and Its Level about Water Pollution
- 4.4 Opinion and Its Level about Water Pollution
- 4.5 Receiving Information and Its Level about Water Pollution
- 4.6 Participation of People
- 4.7 Analysis of People's Participation and Independent Variables
- 4.8 Problems, Obstacles and Suggestions in People's Participation

#### **4.1 General information of the sample**

The results about gender, age, marital status, education, number of family member, occupation, type of residence, right on residence and residence usage are

##### **Gender**

From 357 persons in the sample, they are female 64.4 percent and male 35.6 percent.

##### **Age**

The range of the sample's age is 18 to 76 year-old. Most of them are between 18 to 30 year-old as 33.9 percent of the sample. 31 to 40 year-old have 32.5 percent. 41 to year-old have 24.4 percent. More than 50 year-old have 9.2 percent.

**Marital status**

Majority of the sample or 61.3 percent of them was married. Those who are single are 31.1 percent. The widow/divorce/separated are 7.6 percent.

**Education**

Most of the sample graduated from secondary school/vocational as 28.9 percent of the sample. The rest graduated from primary school, bachelor degree or up and diploma as 26.6, 23.2 and 20.7 percent respectively.

**Number of family member**

By average the sample's family has 4 members. 53.8 percent of the sample has 4 to 6 members. 33.0 percent has 1 to 3 members. The rest 13.2 percent has 7 members or more.

**Occupation**

Most of the sample, 30.3 percent of the sample, is an employee in private enterprise. Second is commerce with 21.3 percent. Government officer is 19.6 percent. General employee is 17.6 percent. And the least is others (agriculture, housewife and unemployed) with only 11.2 percent.

**Right on residence**

60.5 percent of the sample who live in this municipality has right on their residence. 39.5 percent left does not have it.

**Type of residence**

Up to 62.4 percent of the sample lives in single house. The rest are apartment, townhouse and commercial building as 18.5, 9.0 and 8.1 percent respectively.

### Residence usage

According to the data most of the sample use their residence for only living, 77.0 percent. Solely 23.0 percent use it as living place and doing business.

### Type of business in residence

Almost half of the sample or 41.5 percent of them also use their residence as glossary. 23.2 percent sell food. 15.9 percent is defined as others business. Lastly, 9.7 percent is beauty salon, which is equal to fixing engine shop.

**Table 7** General information of the sample

General Information	Number	Percentage
<b>Number of All Sample</b>	357	100.0
<b>Gender</b>		
Male	127	35.6
Female	230	64.4
<b>Age</b>		
18-30 year-old	121	33.9
31-40 year-old	116	32.5
41-50 year-old	87	24.4
More than 50 year-old	33	9.2
Max = 76, Min = 18, Mean = 36.93, S.D. = 10.99		
<b>Marital Status</b>		
Single	111	31.1
Married	219	61.3
Widow/Divorce/Separated	27	7.6
<b>Education</b>		
Primary school	95	26.6
Secondary school	103	28.9
Diploma	74	20.7
Bachelor degree and up	83	23.2
No education	2	0.6
<b>Number of Family Member</b>		
1-3 members	118	33.0
4-6 members	192	53.8
7 members and more	47	13.2
<b>Occupation</b>		
Employee in private enterprise	108	30.3
Commerce/ Own Business	76	21.3
Government officer/State enterprise	70	19.6
General employee	63	17.6
Others (Agriculture, Housewife, Unemployed)	40	11.2

**Table 7** General information of the sample (Continued)

General Information	Number	Percentage
Number of All Sample	357	100.0
<b>Right on Residence</b>		
Have right	216	60.5
Do not have right	141	39.5
<b>Type of Residence</b>		
Single house	223	62.4
Apartment	66	18.5
Townhouse	32	9.0
Commercial building	29	8.1
Others	7	2.0
<b>Residence Usage</b>		
Only living	275	77.0
Living and doing business	82	23.0
Glossary	34	41.5
Selling food	19	23.7
Beauty salon/Hair cut	8	9.7
Fixing engine	8	9.7
Others	13	15.9

#### 4.2 Water usage and sewage disposal

The results of water usage and sewage and rubbish draining are described in table 8.

##### Source of consumed water

From all 357 persons of the sample 66.4 percent uses completed bottle water for drinking and cooking. Secondary sources are hydrant water, rain and underground water use by 43.7, 30.5 and 7.0 percent of the sample respectively. Water for bath and wash is mainly from hydrant water. 89.1 percent of the sample uses it. The proportion of the sample who was using rain, underground water and shallow well for these purposes is 16.8, 7.0 and 2.5 percent respectively.

### **Average monthly expense for hydrant water**

The highest average expense of the sample is 900 baht per month. The lowest is 20 baht. Total average is 175.0 baht a month. Considering as the range showed that up to 30.3 percent of sample pay, by average, for hydrant water 51 to 100 baht per month. The share of the sample which has average monthly expense for hydrant water at 101 to 150 baht, more than 200 baht and 151 to 200 baht are 20.2, 19.6 and 19.3 percent respectively. At the same time, average payment at 20 to 50 baht per month is the least fraction or only 10.6 percent of the sample.

### **Reaping benefit from Pasak river**

86.8 percent of the sample uses Pasak River as consumed water from municipal water supply. 36.7 percent uses it as recreation ground. 7.0 percent uses it for agriculture. 6.7 percent uses it for fishery. 5.3 percent uses it as place to drain sewage. 2.0 percent was communicating through this river. Finally, 1.1 percent left trash into it.

### **Problems in reaping benefit from Pasak river**

The major problem faced by the sample is translucent water (78.7 percent). Secondary problems are inadequate water, bad sight, wasted water source and shallow source as 38.7, 21.8, 21.3 and 14.3 percent respectively.

### **Wastewater treatment system in household**

Most of the sample's household up to 98.3 percent does not have this kind of system. Only 1.7 percent of the sample's household has this treatment system, which are fat trap well and installation type of wastewater treatment tank.

### **Leaving of meal separation and method to separate fat and leaving of meal from sewage**

69.2 percent as the majority of the sample separate leaving of meal from sewage. In this number, they do it by hand about 38.7 percent. The rest use sieve and stored pit as 27.2 and 3.3 percent respectively.

### **Draining method of sewage**

The following are the draining method of the sample. 55.7 percent of them connect to the municipal drainage ditch. 20.7 percent put it to stored pit/soil pit and let it permeate by itself. 16.0 percent releases it to the space inside their residences' area while 6.2 percent do it outside. The least, 1.4 percent, let it directly off to the river.

### **Type of lavatory**

Most of the sample up to 85.2 percent uses cesspool. 8.4 percent uses flush toilet. The rest 6.4 percent use both.

### **Riddance of wastewater from lavatory**

The results indicate that majority or 51.0 percent of the sample rid it off by using cesspit and permeated pit. 31.7 percent uses only cesspit. 16.5 percent discharges it directly to the municipal drainage ditch (without passing cesspit). Only 0.8 percent let it off directly to the river (without passing cesspit).

### **Overflow water from cesspit/permeated pit draining method**

78.1 percent of the sample hires the lavatory suction service. The others pass to municipal drainage ditch and river 13.2 and 1.1 percent respectively.

**Riddance of rubbish from lavatory**

Hiring lavatory suction service is mostly used up to 85.7 percent. Draining to municipal drainage pipe is employed by 7.8 percent of the sample. 3.1 percent bury them. And, 1.4 percent depletes it to water source.

**Table 8** Water usage and sewage disposal

<b>Information</b>	<b>Number (N=357)</b>	<b>Percentage</b>	<b>Remark</b>
<b>Source of drinking and cooking water</b>			
Completed bottle water	237	66.4	can answer
Hydrant water	156	43.7	more than one
Rain	109	30.5	choice
Underground water	25	7.0	
<b>Source of bath and wash water</b>			
Hydrant water	318	89.1	can answer
Rain	60	16.8	more than one
Underground water	25	7.0	choice
Shallow well water	9	2.5	
<b>Average monthly expense for hydrant water</b>			
1-50 baht per month	38	10.6	
51-100 baht per month	108	30.3	
101-150 baht per month	72	20.2	
151-200 baht per month	69	19.3	
More than 200 baht per month	70	19.6	
Max = 900, Min = 20, Mean = 175.0, Mode = 100, S.D. = 148.8			
<b>Reaping benefit from Pasak river</b>			
Consuming from municipal hydrant water	310	86.8	can answer
Recreation ground			more than one
Agriculture	131	36.7	choice
Fishery for consuming or selling	25	7.0	
Draining sewage place	24	6.7	
Communicating route	19	5.3	
Leaving trash	7	2.0	
<b>Problems in reaping benefit from Pasak river</b>	4	1.1	
Translucent water			
Inadequate water	281	78.7	can answer
Bad sight	138	38.7	more than one
Wastewater	78	21.8	choice
Shallow water source	76	21.3	
	51	14.3	

**Table 8** Water usage and sewage disposal (Continued)

<b>Information</b>	<b>Number (N=357)</b>	<b>Percentage</b>	<b>Remark</b>
<b>Wastewater treatment system in household</b>			
Have it	351	98.3	
Do not have it	6	1.7	
<b>Leaving of meal separation and method to separate fat and leaving of meal from sewage</b>			
Do not separate	110	30.8	
Separate by	247	69.2	
Hand	138	55.9	
Sieve	97	39.2	
Stored pit	12	4.9	
<b>Draining method of sewage from lavatory, kitchen and wash</b>			
Connect to municipal drainage ditch	199	55.7	
Connect to soil pit/stored pit and permeate itself	74	20.7	
Release to space inside residence area	57	16.0	
Release to space outside residence area	22	6.2	
Release to river	5	1.4	
<b>Type of lavatory</b>			
Cesspool	304	85.2	
Flush toilet	30	8.4	
Both	23	6.4	
<b>Riddance of wastewater from lavatory</b>			
Cesspit and permeated pit	182	51.0	
Only cesspit	113	31.7	
Drain directly to municipal drainage ditch (without passing cesspit)	59	16.5	
Drain directly to river (without passing cesspit)	3	0.8	
<b>Draining method of overflow water from cesspit/permeated pit</b>			
Hire lavatory suction service	279	78.1	
Pass to municipal pipe	47	13.2	
Pass to river	4	1.1	
Never overflow	27	7.6	
<b>Riddance of rubbish</b>			
Hire lavatory suction service	306	85.7	
Pass to municipal pipe	28	7.8	
Bury	11	3.1	
Pass to river	5	1.4	
Never full	7	2.0	

### **4.3. Knowledge and its level about water pollution**

#### **4.3.1 Knowledge about water pollution**

##### **A. Knowledge about origin and factor of water pollution**

The items 1, 3, 7, 12 and 17 in table 9 are used to analyze this topic. The sample gets average score 4.26 out of maximum score 5 and minimum 0. This average is counted to be 85.2 percent of the full score. It indicates that the sample has good knowledge and understanding about origin and factor of water pollution. The detail of each question about this knowledge is described as follow.

Water pollution means the source of water that is getting worse. This is because it is accepted any substances from human activities until it cannot be normally used. Most of the sample or 92.2 percent of them answer it right. Only 7.8 percent do it wrong. According to the question that people's residences cause water pollution in densely inhabited localities, 81.2 percent of the sample answers it right. The rest 18.8 percent is wrong. Next increasing of population in town, which causes more routine then wastewater quantity is main basis of water pollution, 82.9 percent answer right while 17.1 percent choose wrong. Most of the sample around 85.2 percent answers that it is correct that releasing wastewater from industry is a factor to pollute Pasak river. 14.8 percent left does not think so. Lastly economic expansion and larger community is a factor of water pollution. 84.6 percent of the sample agree but 15.4 percent does not.

##### **B. Knowledge about effect of water pollution**

According to the items 2, 9 and 13 of table 9, the sample has 3 scores as maximum and 0 as minimum. The sample shows that they have high standard in this

topic. It is expressed by the average score 2.67 which is 89.0 percent of the full score. The detail of this analysis is below.

First of all, 91.3 percent of the sample perceive that water pollution causes economic and social impact is right. The rest 8.7 percent does not think so. In health aspect, water pollution causes gastrointestinal infection such as dysentery, cholera or typhoid. 85.4 percent of the sample chooses to answer right while 14.6 percent chooses wrong. Finally, the question is that does water pollution leads the water to get stale and have terrible smell. Aquatic animal dies. That place turns to be source of infection. Then lacking resource to produce hydrant water. 90.2 percent as majority of the sample answers that it is right. Only 9.8 percent choose to answer wrong.

### **C. Knowledge about water pollution prevention and solution**

From the item 4, 5, 6, 8, 10, 11, 14, 15, 16, 18, 19 and 20 of table 9 about this topic found that the sample got the average score 8.87 from maximum 12 and minimum 1. This is 73.91 percent of the full score. It indicates that the sample has knowledge about water pollution prevention and solution in moderate level. The detail of each question is following.

Separating the leaving of meal and trapping fat out of the utensils before wash reduces dirt in wastewater. 95.8 percent think that it is correct. The rest 4.2 percent think it is wrong. For the question that sewage drain system planning and controlling direction of sewage in sewer decrease wastewater, 72.5 percent choose right while 27.5 percent choose wrong. Next water usage equipment and toilet appliance inspection regularly help to save water and lessen wastewater. 82.1 percent of the sample answer right but 17.9 percent answer wrong. Furthermore 92.7 percent of the sample agree that water pollution prevention and solution relates to all sectors; people,

government and private sector, together. The rest 7.8 percent does not agree. To the question about choosing detergent, 78.4 percent of the sample perceive that it is correct to use detergent, which naturally dissolve for partly diminishing of water pollution. The 21.6 percent left do not think so. Then, releasing sewage or used water to elephant grass or circle reed garden is a sewage treatment possibly done in household. Toward this question 58.5 percent of the sample pick the right choice contrary to the 41.5 percent which pick wrong. Continuously, the last water from washing cloth without soften solution can be reused in, for example, washing mob or rag. 85.4 percent answer right while 14.6 percent answer wrong. Ceaselessly, 63.3 percent agree that brushing teeth and washing face directly from faucet in stead of using basin or glass save water. But the rest 36.4 percent do not agreed. Keeping further that dishwashing water cannot water a plant because existing solution will kill it. 83.2 percent of the sample make response that it is right while 16.8 percent reply wrong. To the question that using rubber tube for cleaning car is saver than using buck, 70.0 percent answer choose right contrary to the rest 30.0 percent which choose wrong. Asking about the fee, 56.6 percent think that paying fee for wastewater treatment by every household is right. But 43.4 percent think it is wrong. The last question, dropping bits and pieces or leaving of the meal into cesspool is an appropriate riddance of trash. 85.6 percent of the sample reply right. The rest 24.4 percent choose to reply wrong.

According to the analysis of evaluating knowledge about water pollution by frequency distribution, item 4 has highest percentage of sample that choose to answer right. 95.8 percent of them choose to reply right in this item. The item with least percentage of the sample that makes response as right is item 19. Only 43.4 percent

choose right in this item. This maybe because the sample thought that government should response and bear burden for the fee.

**Table 9** Number and percentage of the sample about knowledge in water pollution classified by item

Question	Number	Percentage	Mode
Number of All Sample	357	100.0	
1. Water pollution means the source of water that is getting worse because it is accepted any substances from human activities until it cannot be normally used.			
Answer Right	329	92.2	Answer
Answer Wrong	28	7.8	Right
2. Water pollution causes economic and social effect.			
Answer Right	326	91.3	Answer
Answer Wrong	31	8.7	Right
3. People's residences cause water pollution in densely inhabited localities			
Answer Right	290	81.2	Answer
Answer Wrong	67	18.8	Right
4. Separating the leaving of meal and trapping fat out of the utensils before wash reduces dirt in wastewater.			
Answer Right	342	95.8	Answer
Answer Wrong	15	4.2	Right
5. Sewage drain system planning and controlling direction of sewage in sewer decrease wastewater			
Answer Right	259	72.5	Answer
Answer Wrong	98	27.5	Right
6. Water usage equipment and toilet appliance inspection regularly help to save water and lessen wastewater.			
Answer Right	293	82.1	Answer
Answer Wrong	64	17.9	Right
7. Increasing of population in town, which causes more routine then wastewater quantity is main basis of water pollution.			
Answer Right	296	82.9	Answer
Answer Wrong	61	17.1	Right

**Table 9** Number and percentage of the sample about knowledge in water pollution classified by item (Continued)

Question	Number	Percentage	Mode
Number of All Sample	357	100.0	
8. Water pollution prevention and solution relates to all sectors; people, government and private sector, together.			
Answer Right	329	92.2	Answer
Answer Wrong	28	7.8	Right
9. Water pollution is a factor of gastrointestinal infection such as dysentery, cholera or typhoid.			
Answer Right	305	85.4	Answer
Answer Wrong	52	14.6	Right
10. Using detergent that naturally dissolve can partly diminish water pollution.			
Answer Right	280	78.4	Answer
Answer Wrong	77	21.6	Right
11. Releasing sewage or used water to elephant grass or circle reed garden is a sewage treatment possibly done in household.			
Answer Right	209	58.5	Answer
Answer Wrong	148	41.5	Right
12. The cause that Pasak river in Tambol Kaengkhoi municipality gets stale because The industries release water into it.			
Answer Right	304	85.2	Answer
Answer Wrong	53	14.8	Right
13. Water pollution leads the water to get stale and have terrible smell, aquatic animal dies, that place turns to be source of infection, then lacking resource to produce hydrant water.			
Answer Right	322	90.2	Answer
Answer Wrong	35	9.8	Right
14. The last water from washing cloth without soften solution can be reused in, for example, washing mob or rag.			
Answer Right	305	85.4	Answer
Answer Wrong	52	14.6	Right

**Table 9** Number and Percentage of the Sample about Knowledge in Water Pollution Classified by Item (Continued)

Question	Number	Percentage	Mode
Number of All Sample	357	100.0	
*15. We can save water by brushing teeth and washing face directly from faucet in stead of using basin or glass.			
Answer Right	227	63.6	Answer
Answer Wrong	130	36.4	Right
*16. We cannot use dishwashing water to water a plant because existing solution will kill it.			
Answer Right	297	83.2	Answer
Answer Wrong	60	16.8	Right
17. Expansion and larger community is a factor of water pollution.			
Answer Right	302	84.6	Answer
Answer Wrong	55	15.4	Right
*18. Using rubber tube for cleaning car is saver than using buck.			
Answer Right	250	70.0	Answer
Answer Wrong	107	30.0	Right
19. Paying fee for wastewater treatment is duty of every household is right			
Answer Right	202	66.6	Answer
Answer Wrong	155	33.4	Right
*20. Dropping bits and pieces or leaving of the meal into cesspool is an appropriate riddance of trash.			
Answer Right	270	85.6	Answer
Answer Wrong	87	24.4	Right

**Remarks:** \* is negative statement.

Max = 20, Min = 6, Mean = 15.80, Mode = 17, S.D. = 2.89, Full score = 20

#### 4.3.2 Knowledge Level about Water Pollution

After classifying the score of the analysis about water pollution by using questionnaire with 20 full score according to the setting rules imply that most of the sample or 81.3 percent of them has knowledge in high level. The rest 17.9 percent has it in moderate level. Only 0.8 percent has been in low level as the detail in table 10.

**Table 10** Number and Percentage of the Sample Classified by Knowledge Level about Water Pollution

<b>Knowledge Level</b>	<b>Number</b>	<b>Percentage</b>
Number of All Sample	357	100.0
<b>Knowledge Level about Water Pollution</b>		
Low level (0-6 scores)	3	0.8
Moderate level (7-13 scores)	64	17.9
High level (14-20 scores)	290	81.3

#### **4.4 Opinion and Its Level about the Water Pollution**

##### **4.4.1 Opinion about the Water Pollution**

###### **A. Opinion about Origin and Factor of Water Pollution**

According to items 3, 5 and 20 in the table 11, the samples' opinion about the origin and factor of water pollution can be described in detail as follow.

Most of sample (92.2 percent) accept that human unawareness is main factor of water pollution while 5.3 percent and 2.5 percent are uncertain and disagree respectively. In addition, the statement that low quality of water in the river caused from the community drop garbage and wastewater prior to improve its quality to it. Majority of the sample; 46.5 percent, concedes that water pollution is critically caused by the community located riverside when 28.6 percent is not sure and 24.9 percent are disagree.

###### **B. Opinion about the Effect of Water Pollution**

Items 12, 14 and 15 in the table 11 given the opinion of the sample about the effect of water pollution. 85.4 percent of the sample agrees that water pollution prevention and solution will help to protect gastrointestinal infection such as typhoid, dysentery and cholera while 11.2 percent is uncertain and 3.4 percent is disagree. In addition, the majority or 77.6 percent of the sample accepts that water pollution will

lead to the lack of source for hydrant water production. But 20.2 percent and 2.2 percent are uncertain and disagree respectively. Toward the statement that large quantity of dirt in water relates to high water treatment cost, 73.4 percent of the sample agrees with it while 19.0 percent is uncertain and 7.6 percent does not agree.

### **C. Opinion about Direction of Water Pollution Prevention and Solution**

According to the analysis result represented by the items 1, 2, 4, 6, 7, 8, 9, 10, 11, 13, 16, 17, 18 and 19 in table 11 the description of the sample's opinion about the direction of water pollution prevention and solution is following.

The premise that saving water by only you yourself cannot protect and solve water pollution, so you do not need to do it is rejected by 75.9 percent of the sample. Only 15.4 percent and 8.7 percent, which accept and is uncertain respectively. The awareness to save water should be started at home. 95.2 percent of the sample agrees while 3.7 percent of them is not sure and 1.1 percent does not agree. Most of the sample or 94.4 percent of them accepts that it is time for everybody to cooperate in preventing and solving water pollution. Only 4.2 percent is uncertain and 1.4 percent does not think so. To the statement that you should save water today before no water to use, 92.4 percent of the sample agrees. 5.9 percent is not sure and 1.7 percent deny it. Using appropriate toilet appliance is a way to save water. The majority or 76.8 percent of the sample agrees. 17.4 percent is uncertain while 5.8 percent disagrees with this statement. The water pollution solution is responsibility of solely the government sector. 67.8 of the sample disagrees while 18.5 and 13.7 percent agrees and uncertain respectively. Toward the statement that the industry and restaurant cause more dirt in sewage than the household's, therefore it is not duty of household to response for the wastewater treatment before releasing it to water source, most of the

sample (44.8 percent) disagrees. Only 37.5 and 17.5 percent agrees and uncertain. The used water should be reused like water the plant by vegetable washing water. Up to 89.4 percent of the sample agrees to this premise while 6.7 percent is uncertain and 3.9 percent disagrees with it. Next statement is that water usage equipment and toilet appliance should be regularly checked. Most of the sample or 93.8 percent accepts it. Only 4.2 percent is not sure and 2.0 percent does not agree. Using detergent that naturally dissolved can partly diminish water pollution. Toward this premise 74.2 percent of the sample agrees with it while 19.6 percent is uncertain and the rest 6.2 percent disagree. Moreover the sewage can be discharged to the natural water source because it can recover itself. 58.0 percent disagree with it. 23.2 percent is not sure and 18.8 percent agree. To the premise that many water source still exist, so it is no need to care about water pollution, 69.5 percent of the sample disagree. Only 18.2 percent of them agree with it while 12.3 percent is not sure. Next statement is that should not leave the faucet open while brushing teeth or using water utensil instead. Up to 88.0 percent of the sample agree while 7.8 percent does not and 4.2 percent is uncertain. Lastly washing the dish one by one and leaving the faucet open along that period save time and water. 88.0 percent of the sample disagree with it but only 7.8 percent agree and 4.2 percent is uncertain.

**Table 11** Number and Percentage of the Sample about Opinion in Water Pollution Classified by Item

Statement	Agree	Uncertain	Disagree	Mode
	Amount (Percent)	Amount (Percent)	Amount (Percent)	
Number of samples = 357				
*1. Saving water by only you yourself cannot protect and solve water pollution, so you do not need to do it.	55 (15.40)	31 (8.7)	271 (75.9)	Disagree

**Table 11** Number and Percentage of the Sample about Opinion in Water Pollution Classified by Item (Continued)

Statement	Agree	Uncertain	Disagree	Mode
	Amount (Percent)	Amount (Percent)	Amount (Percent)	
Number of samples = 357				
2. The awareness to save water should be started at home.	340 (95.2)	13 (3.7)	4 (1.1)	Agree
3. Human unawareness is main factor of water pollution.	329 (92.2)	19 (5.3)	9 (2.5)	Agree
4. It is time for everybody to cooperate in preventing and solving water pollution.	337 (94.4)	15 (4.2)	5 (1.4)	Agree
5. Low quality of water in the river Caused from the community drop garbage and wastewater prior to improve its quality into it.	298 (83.4)	42 (11.8)	17 (4.8)	Agree
6. You should save water today before no water to use.	330 (92.4)	21 (5.9)	6 (1.7)	Agree
7. Using appropriate toilet appliance is a way to save water.	274 (76.8)	62 (17.4)	21 (5.8)	Agree
*8. The water pollution solution is responsibility of solely the government sector.	66 (18.5)	49 (13.7)	242 (67.8)	Disagree
*9. The industry and restaurant cause more dirt in sewage than the household's, therefore it is not duty of household to response for the wastewater treatment before releasing it to water source.	134 (37.5)	63 (17.5)	160 (44.8)	Disagree
10. The used water should be reused like water the plant by vegetable washing water.	319 (89.4)	24 (6.7)	14 (3.9)	Agree
11. Water usage equipment and toilet appliance should be regularly checked.	335 (93.8)	15 (4.2)	7 (2.0)	Agree
12. Water pollution prevention and solution will help to protect gastrointestinal infection such as dysentery or cholera.	305 (85.4)	40 (11.2)	12 (3.4)	Agree
13. Using detergent that naturally dissolved can partly diminish water pollution.	265 (74.2)	70 (19.6)	22 (6.2)	Agree
14. Water pollution will lead to the lack of source for hydrant water production.	277 (77.6)	72 (20.2)	8 (2.2)	Agree

**Table 11** Number and Percentage of the Sample about Opinion in Water Pollution Classified by Item (Continued)

Statement	Agree	Uncertain	Disagree	Mode
	Amount (Percent)	Amount (Percent)	Amount (Percent)	
Number of samples = 357				
15. Large quantity of dirt in water relates to high water treatment cost	262 (73.4)	68 (19.0)	27 (7.6)	Agree
*16. The sewage can be discharged to the natural water source because it can recover itself.	67 (18.8)	83 (23.2)	207 (58.0)	Disagree
*17. Many water source still exist, so it is no need to care about water pollution.	65 (18.2)	44 (12.3)	248 (69.5)	Disagree
18. Should not leave the faucet open while brushing teeth or using water utensil instead.	314 (88.0)	15 (4.2)	28 (7.8)	Agree
*19. Washing the dish one by one and leaving the faucet open along that period save time and water.	43 (7.8)	25 (4.2)	289 (88.0)	Disagree
20. Water pollution is critically caused by the community located riverside	166 (46.5)	102 (28.6)	89 (24.9)	Agree

Remarks: \* is negative statement.

Max = 60, Min = 39, Mean = 53.65, Mode = 56, S.D. = 4.62, Full score = 60

#### 4.4.2 Opinion Level about Water Pollution

According to table 12 after classifying the score of the analysis about water pollution by using questionnaire with 60 full score along the setting rules indicates that most of the sample or 89.6 percent of them has opinion in agree group. The rest 10.4 percent is in uncertain group.

**Table 12** Number and Percentage of the Sample Classified by Opinion Level about Water Pollution

Opinion Level	Number	Percentage
Number of All Sample	357	100.0
Opinion Level about Water Pollution		
Disagree level (20-33 scores)	0	0.0
Uncertain level (34-47 scores)	37	10.4
Agree level (48-60 scores)	320	89.6

## **4.5 Receiving Information and Its Level about Water Pollution**

### **4.5.1 Receiving Information and Source of Information about Water Pollution**

According to analysis in table 13 the sample has maximum score 16 and minimum 0. They get 7.24 as average score out of full score 18. It is 40.22 percent of the full score. This is arranged in low rank. It indicates that the sample receive information in low level. Considering to the source of information the detail is below.

Reflect on the newspaper, 37.3 percent of the sample rarely get information from this source. 32.5 percent often get it. 16.8 percent never get it and 13.4 percent always get it.

Obtaining information about water pollution from journal/magazine, 46.5 percent of the sample never receive it via this source. 36.1 percent seldom accept it. 16.0 percent get it frequently. The rest 1.4 percent always receive it.

Most of the sample (30.3 percent) hears the information about water pollution from the radio once in a great while. Those who never hear it, frequently hear it, and hear it all the time are 29.4, 26.6 and 13.7 percent respectively.

Looking at television as the source of this information, 37.8 percent as majority of the sample usually receive it via this source. The rest often obtain it, occasionally obtain it and never obtain it are 35.6, 19.9 and 6.7 percent respectively.

Another source is cabled sound. Majority of the sample or 46.5 percent never gets it via this source. 26.6, 14.8 and 12.1 percent of them uncommonly, often and always receive it.

Conversations with others, for example, neighbor or government agency is final source concerned. 41.5 percent of the sample never has it. The rest hardly ever, frequently and always have it as 36.7, 14.8 and 7.0 percent respectively.

In conclusion most of the sample receive information about water pollution from television all the time. They get information from newspaper and radio once in a while. Finally they rarely obtain information about water pollution from cabled sound, journal/magazine and other persons like neighbor or government agency.

**Table 13** Number and Percentage of samples in water pollution information received according to sources of information

Sources of information	Never	Once in a while	Often	Regular	Amount (Percentage)	Mode
1. Newspaper	60 (16.8)	133 (37.3)	116 (32.5)	48 (13.4)	357 (100)	Once in a while
2. Journals	166 (46.5)	129 (36.1)	57 (16.0)	5 1.4	357 (100)	Never
3. Radio	105 (29.4)	108 (30.3)	95 (26.6)	49 13.7	357 (100)	Once in a while
4. Television	24 (6.7)	71 (19.9)	127 (35.6)	135 37.8	357 (100)	Regular
5. Local radio	166 (46.5)	95 (26.6)	53 (14.8)	43 12.1	357 (100)	Never
6. Talk with others such as friend, government officials	148 (41.5)	131 (36.7)	53 (14.8)	25 7.0	357 (100)	Never

#### 4.5.2 The water-pollution information receiving level

Table 14 was shown that 18 full-points in the questionnaire about water-pollution information receiving level. After grouping the data, found that 47.1% in the low level, 46.2% median level, 6.7 high level.

**Table 14** Number and Percentage of samples according to the water-pollution information receiving level

Information receiving level	Number	Percentage
Number of all sample	357	100.0
Water-pollution information receiving level		
Low level ( 0 - 6 scores)	168	47.1
Medium level ( 7-13 scores)	165	46.2
High level (14-21 scores)	27	6.7

#### 4.6 People participation and people participation level

This topic will be studied into 2 levels, which are:

1. People participation in water pollution prevention in household level
  2. Demand for people participation in wastewater treatment system construction
- 1. People participation in water pollution prevention in household level**

People participation in water pollution prevention in household level can be divided into 5 activities are fat separating, cleaning chemicals, efficient water use, household wastewater treatment, toilet waste treatment. The detail as follows:

##### 1.1 Activities of people participation can be analyze as follow:

**(1) Fat and food separating.** 83.3% anticipate in separating fat and food before dish washing, and only 16.7% which not anticipate in the action.

**(2) Use of cleaning chemicals to wash the restroom.** 19.0% use cleaning chemicals increase the PH value, then effect to the severity of water pollution. And 81.0% do not use the chemicals or only 1-2 times per week.

**(3) Efficient water use** 81.0% are in the anticipation process such as not use, not open water or re-use the used water.

**(4) Household wastewater treatment** Household wastewater are from bathing, toilet, cloths washing in the household. We found that 95.8% have never treated the wastewater before release. Only 4.2% have treated wastewater.

**(5) Toilet waste treatment** Most of people (77.6%) does not participate in toilet waste treatment and 22.4% are do treat the toilet waste.

By comparing participation in each activity, found that the most participated is fat and food separating as shown in table 15. Secondly, the chemicals use in cleaning bathing room and efficient water use. Thirdly, toilet waste treatment and lastly, the least participated is efficient water use.

### 1.2 People participation in every activities

The data, as in table 15, show that maximum and minimum score are 5 points and 0 point. Average at 2.72 points, Mode equals 3 points, from total score equals 5 points.

We can conclude that most of people participate in every activity in medium level, low level, and high level as 51.8%, 32.6%, and 15.6%, respectively.

**Table 15** Number Percentage and level of people participation in water pollution prevention in household level

Activities	Amount number	Percentage	Mode
Total samples	357	100.0	
1. Food and fat separating			
Participation	299	83.3	Participated
Non-participation	58		
2. Intensive chemicals use			
Participation	289	81.0	Participated
Non-participation	68	19.0	
3. Efficient water use			
Participation	289	81.0	Participated
Non-participation	68	19.0	
4. Household water treatment			
Participation	15	4.2	Non –
Non-participation	342	95.8	participated
5. Toilet waste treatment			
Participation	80	22.4	Non –
Non-participation	277	77.6	participated
People participation in ever activity			
Low level (1-2 scores)	115	32.6	
Medium level (3 scores)	183	51.8	
High level (4-5 scores)	55	15.6	

### **1.2.1 Demand for people participation in wastewater treatment construction project**

The result of Demand for people participation in wastewater treatment construction project at Kaengkhoi municipality can be divided into 5 stages. Which are idea sharing stage, money and materials donation stage, wastewater treatment fee collection stage, being the committee of project operation stage, and lastly, evaluation and inspection stage.

**Demand for people participation in wastewater treatment construction project can be classified by activities as follows (Table 16):**

**(1) Idea sharing stage**

78.7% of samples would like to join in the idea sharing stage and 21.3% don't want to participate.

**(2) Money and materials donation stage**

67.7% of samples would like to donate the money and materials and 37.3% don't want to participate.

**(3) Wastewater treatment fee collection stage**

52.1% willing to pay for wastewater treatment fee and 48.2% don't want to participate.

**(4) Being the committee of project operation stage**

51.8% would like to participate in committee of the project and 48.2% don't want to participate.

**(5) Conclusion, evaluation and inspection stage**

59.7% would like to participate and 40.3% don't want to participate.

The Most wanted stage to participate is idea sharing. Secondly, the money and materials donation stage and evaluation and inspection stage. Lastly, people would like to

pay for wastewater treatment fee , being the committee of project operation as shown in table 16.

**Demand for participation in every stage of the project**

The result shows the maximum and the minimum score at 5 points and 0 point, respectively. Average equals 3.05, mode equals 5 points from the full score equals 5 points. From the result we can conclude that most of the samples (50%) highly desire to participate in wastewater treatment construction. 26.1% is in the low level of desire, and 23.9% would like to participate in the medium level as Table 16.

**Table 16** Number Percentage and level of demand for people participation in wastewater treatment construction

Activities	Amount number	Percentage	Mode
Total samples	357	100.0	
1. Idea sharing stage			
Participation	281	78.7	Would like to Participate
Non-participation	76	21.3	
2. Money and material donation			
Participation	224	67.7	Would like to Participate
Non-participation	133	37.3	
3. Willing to pay wastewater treatment fee			
Participation	186	52.1	Would like to Participate
Non-participation	171	47.9	
4. Joining the committee of the project			
Participation	213	51.8	Would like to Participate
Non-participation	172	48.2	
5.Evaluation and inspection stage			
Participation	213	59.7	Would like to Participate
Non-participation	144	40.3	
People participation in ever activity			
Low level (1-2 scores)	84	26.1	
Medium level ( 3 scores )	77	23.9	
High level (4-5 scores)	161	50.0	

### Wastewater treatment fee payment

After compared the desire to participate in fee paying found that there are more people who willing to pay for wastewater treatment fee(52.1%) than who don't want to pay(47.9%) just a little.

For who willing to pay for wastewater treatment fee, on average willing to pay at 59.09 Baht per month. 29.6% of sample would like to pay at 10-20 baht per month, 26.3% would like to pay in range of 41-60 baht,18.3% would like to pay in range of 81-100 baht, 15.6% willing to pay at 21-40 baht, 6.4% willing to pay at 101-300 baht and 3.8 willing to pay at 61-80 baht per month.

For one who don't want to pay(47.9%), 40.9% of them didn't give any reasons but 26.9% because of inadequate income,23.4% think this is government responsibility, 3.5% is municipality's responsibility, 2.9% is responsibility of riverside residence and plants, and 2.4% want to know more information. As show in table 17.

**Table 17** Desire for participating in paying wastewater treatment fee and reasons

Characteristics of data	Amount	Percentage
Total sample	357	100.0
Would like to pay	186	52.1
Don't want to pay	171	47.9
Amount willing to pay		
10-20 Baht per month	55	29.6
21-40 Baht per month	29	15.6
41-60 Baht per month	49	26.3
61-80 Baht per month	7	3.8
81-100 Baht per month	34	18.3
101-300 Baht per month	12	6.4
Max=300, Min=10, Mean=59.09, Mode=50,S.D.54.10		
Total samples	357	100.0
Reasons for not willing to pay		
Inadequate income	46	26.9
Government's responsibility	40	23.4
Municipality	6	3.5
Riverside resident's responsibility	5	2.9
Advance information needed	4	2.4
No answer	70	40.9

#### 4.7 Analysis of people participation in water pollution prevention and variables

##### 4.7.1 People participation in household level analysis

###### A. t-test analysis

To analyze people participation in water pollution prevention in household level can be analyzed by t-test analysis and specify variables as gender, residential rights holding, residence use, water pollution idea.

(1) **People participation in water pollution prevention in household level according to gender.** According to table 18, female has participation more than male as 2.74 and 2.69, respectively.

The results of t-test analysis show that male and female are not significantly different in water pollution prevention at statistic significant level equals 0.05. Which do not follow hypothesis “female and male are different in participating the water pollution prevention.”

**Table 18** Means, S.D., and T-value of people participation in water pollution prevention in household level according to gender

Gender	Amount	Mean	S.D.	t	P
Female	230	2.74	0.88	-0.598	0.550 <sup>NS</sup>
Male	127	2.69	0.90		

<sup>NS</sup>P>0.05

(2) **People participation in water pollution prevention in household level according residential rights holding.** From table 19 Means of people who hold the residential rights equals 2.75 and who don't have equals 2.67, therefore the point of people who hold the rights is more than who don't have just a little.

From t-test analysis, found there are not different participation between people who having residential rights and who doesn't have any at statistical significant level equals

0.05. Therefore, the hypothesis “the residential rights holding or not holding effects the people participation in water pollution prevention” is rejected.

**Table 19** Means, S.D., and T-value of people participation in water pollution prevention in household level according residential rights holding

Type of rights holding	Amount	Mean	S.D.	t	P
Holding	216	2.75	0.90	0.846	0.398 <sup>NS</sup>
Not holding	141	2.67	0.85		

<sup>NS</sup>P>0.05

**(3) People participation in water pollution prevention in household level according residence use.** Table 20 show that participating score of samples who use residence for residence only higher than who use residence as residence and business building, 2.76 and 2.61, respectively.

The t-test analysis found that the purpose of using residence is not significantly difference in water pollution prevention at statistically significant level equals 0.05. Which is not correspondent with hypothesis of “the purpose of using residence effect to different water pollution participation”.

**Table 20** Means, S.D., and T-value of people participation in water pollution prevention in household level according residence use

Type of residence use	Amount	Mean	S.D.	t	P
Residential only	275	2.76	0.88	1.321	0.187
Residential and business	82	2.61	0.89		

<sup>NS</sup>P>0.05

**(4) People participation in water pollution prevention in household level according water pollution idea.** Table 21 shows that people who agree with has participating score equals 2.79 and who are not sure equals 2.11. From t-test analysis found that the water pollution information level does not significantly effect water pollution prevention at statistically significant level equals 0.05. Or we can say that the hypothesis “the

information level effect to people participation level in water pollution prevention” is rejected.

**Table 21** Means, S.D., and T-value of people participation in water pollution prevention in household level according water pollution idea

Type of idea	Amount	Mean	S.D.	T	P
Agree	320	2.79	0.85	-4.597	0.000 <sup>NS</sup>
Not sure	37	2.11	0.91		

<sup>NS</sup>P>0.05

**B. One way Anova (Analysis of variance)**

To analyze people participation in water pollution prevention in household level can be analyzed by one way Anova analysis and specify variables as age, occupation, information received, water pollution knowledge by one way Anova analysis in order to test the hypothesis. If the variables effect the results significantly, then statistical comparison by Scheffe multiple comparison method.

(1) Comparison of average score of people participation in water pollution prevention in household level according to age. We found that the maximum of sample group is group of more than 50 years olds people and minimum is in 31-40 years old group, 2.88 and 2.63, respectively. One way Anova method found that the age interval does not significantly effect the people participation in water pollution prevention in household level at 0.05 as show in table 22 and 23 which made the hypothesis “The different age, different participation level” rejected.

**Table 22** Comparison minimum, maximum, means, S.D. of people participation in water pollution prevention in household level according to age

Age (years)	Amount	Min	Max	Mean	S.D.
18-30	121	0	5	2.76	0.88
31-40	116	1	5	2.63	0.88
41-50	87	0	4	2.74	0.92
more than 50	33	1	4	2.88	0.82
Total	357	0	5	2.72	0.88

**Table 23** Variation analysis of the people participation in water pollution prevention in household according age group

Sources of variation	Df	SS	MS	F	P
Between group	3	2.002	0.667	0.855	0.465
Within group	353	275.545	0.781		
Total	356	332.930			

P&gt;0.05

(2) Comparison of average score of people participation in water pollution prevention in household level according to occupation. We found that group of people who in agricultural sector, housemate is the highest score group (2.59) and the minimum score is 2.59 in a group of private business. When use one way Anova found that each career group does not make any significant difference in water pollution prevention at statistical significance equals 0.05 as shown in table 24 and 25 which reject the hypothesis of “different occupation then different level of people participation in water pollution prevention”.

**Table 24** Comparison minimum, maximum, means, S.D. of people participation in water pollution prevention in household level according to occupational group

Occupational group	Amount	Min	Max	Mean	S.D.
Government/public enterprise's officer	70	1	4	2.60	0.82
Private business	76	0	5	2.59	1.04
Business's employee	108	1	5	2.82	0.84
General employee	63	1	4	2.70	0.85
Others(housemate, farmer)	40	1	5	2.95	0.78
Total	357	0	5	2.72	0.88

**Table 25** Variation analysis of the people participation in water pollution prevention in household according age group

Sources of variation	Df	SS	MS	F	P
Between group	4	5.564	1.391	1.800	0.128
Within group	352	271.983	0.773		
Total	356	227.546			

P&gt;0.05

**(3) Comparison of average score of people participation in water pollution prevention in household level according to education level.** We found that group of people who finish diploma is the highest score group (2.80) and the minimum score is 2.57 in a group of high school graduate and occupational school. When use one way Anova found that each educational group does not make any significant difference in water pollution prevention at statistical significance equals 0.05 as shown in table 26 and 27 which reject the hypothesis of “different educational level then different level of people participation in water pollution prevention”.

**Table 26** Comparison minimum, maximum, means, S.D. of people participation in water pollution prevention in household level according to educational level

Educational level	Amount	Min	Max	Mean	S.D.
Primary school	95	1	4	2.75	0.90
High school/occupational	103	0	4	2.57	0.90
Diploma	157	0	5	2.80	0.86
Total	355	0	5	2.72	0.89

**Table 27** Variation analysis of the people participation in water pollution prevention in household according educational level

Sources of variation	Df	SS	MS	F	P
Between group	2	3.372	1.686	2.166	0.116
Within group	352	274.020	0.778		
Total	354	277.778			

P>0.05

**(4) Comparison of people participation in water pollution prevention in household level according to water pollution knowledge.** We found that group of high knowledge level the highest score group (2.78) and the minimum score is 2.00 in a group of low knowledge level. When use one way Anova found that the level of water pollution knowledge does make significant difference in water pollution prevention at statistical significance equals 0.05. After Scheffe comparison test found that group of high knowledge will participate more than the medium one as shown in table 28,29 and table

30. Which correspond to the hypothesis of “different knowledge level then different level of people participation in water pollution prevention”.

**Table 28** Comparison minimum, maximum, means, S.D. of people participation in water pollution prevention in household level according to water pollution knowledge

Water pollution knowledge	Amount	Min	Max	Mean	S.D.
Low level	3	1	3	2.00	1.00
Medium level	64	1	4	2.48	0.84
High level	290	0	5	2.78	0.88
Total	357	0	5	2.70	0.88

**Table 29** Variation analysis of the people participation in water pollution prevention in household according to water pollution knowledge

Sources of variation	Df	SS	MS	F	P
Between group	2	6.248	3.124	4.076	0.05
Within group	354	271.298	0.766		
Total	356	277.546			

\*P>0.05

**Table 30** Difference among the people group with different knowledge level by Scheffe method

Variable level	Mean	2.00	2.48	2.78
Low level	2.00			
Medium level	2.48			*
High level	2.78			

\*P>0.05

(5) Comparison people participation in water pollution prevention in household level according to water pollution information received. We found that people who get high level of information is highest scores group (3.04) and the minimum score is 2.68 in a group of lower information received. When use one way Anova found that each information received level does not make any significant difference in water pollution prevention at statistical significance equals 0.05 as shown in table 31 and 32 which reject the hypothesis of “different received information level then different level of people participation in water pollution prevention”.

**Table 31** Comparison minimum, maximum, means, S.D. of people participation in water pollution prevention in household level according to water pollution information received

Water pollution information received	Amount	Min	Max	Mean	S.D.
Low level	168	0	5	2.63	0.91
Medium level	165	0	5	2.78	0.84
High level	24	1	5	3.04	0.86
Total	357	0	5	2.72	0.88

**Table 32** Variation analysis of the people participation in water pollution prevention in household according to water pollution information received

Sources of variation	Df	SS	MS	F	P
Between group	2	4.510	2.255	2.924	0.055
Within group	354	273.036	0.771		
Total	356	277.546			

P>0.05

#### 4.7.2 Analysis of people participation in wastewater treatment construction

##### A. t-test analysis

To analyze people participation in wastewater treatment construction can be analyzed by t-test analysis and specify variables as gender, residential rights holding, residence use, water pollution idea.

**(1) People participation in wastewater treatment construction according to gender.** According to table 33, male has participation more than female as 3.25 and 2.93, respectively.

The results of t-test analysis show that male and female are not significantly different in water pollution prevention at statistic significant level equals 0.05. Which do not follow hypothesis “female and male are different in participating in wastewater treatment construction”.

**Table 33** Means, S.D., and t-value of people participation in wastewater treatment construction according to gender

Gender	Amount	Mean	S.D.	t	P
Female	230	2.93	1.62	1.807	0.072 <sup>NS</sup>
Male	127	3.25	1.63		

<sup>NS</sup>P>0.05

### (2) Willing to participate in wastewater treatment construction according to the residential rights holding

According to table34, willing to participate in the project 's score of sample who have right equals 3.07 which is more than average of people who don't have right (score equals 3.01).

T-test analysis found that the holding of residential rights or not does not significantly effect the willing to participate in wastewater treatment construction at statistically significant level equals 0.05.

From the result, the hypothesis of "holding of residential rights effect to willing to differently participate in wastewater treatment construction" will be rejected.

**Table 34** Means, S.D., and t-value of people participation in wastewater treatment construction according to residential rights holding

Residential rights holding	Amount	Means	S.D.	t	P
Having rights	216	3.07	1.63	0.338	0.735 <sup>NS</sup>
No having rights	141	3.01	1.63		

<sup>NS</sup>P>0.05

### (3) Willing to participate in wastewater treatment construction according to residence use

According to table35, willing to participate in the project 's score of sample who use residence as only residence equals 2.98 which is more than average of people who use as residence and business (score equals 3.25).

T-test analysis found that different way to use the residence does not significantly effect the willing to participate in wastewater treatment construction at statistically significant level equals 0.05. From the result, the hypothesis of “different way to use residence effect to differently willing to participate in wastewater treatment construction” will be rejected.

**Table 35** Means, S.D., and t-value of people participation in wastewater treatment construction according to residence use

Residence use	Amount	Means	S.D.	t	P
Residence only	275	2.98	1.60	-1.301	0.194 <sup>NS</sup>
Residence and business	82	3.25	1.72		

<sup>NS</sup>P>0.05

**(4) Willing to participate in wastewater treatment construction according to water pollution idea**

According to table36, willing to participate in the project ’s score of sample who agree with water pollution equals 3.10 which is more than average of people not sure about water pollution (score equals 2.62).

T-test analysis found that idea level does not significantly effect the willing to participate in wastewater treatment construction at statistically significant level equals 0.05. From the result, the hypothesis of “different water pollution ideas effect to differently willing to participate in wastewater treatment construction” will be rejected.

**Table 36** Means, S.D., and t-value of people participation in wastewater treatment construction according to water pollution idea

Water pollution idea	Amount	Means	S.D.	t	P
Agree	320	3.10	1.60	-1.692	0.092 <sup>NS</sup>
Not sure	37	2.62	1.81		

<sup>NS</sup>P>0.05

### B. One way Anova (Analysis of variation)

To analyze people participation in wastewater treatment construction can be analyzed by one way Anova analysis and specify variables as age, occupation, information received, water pollution knowledge by one way Anova analysis in order to test the hypothesis. If the variables effect the results significantly, then statistical comparison by Scheffe multiple comparison method.

(1) **Comparison of average score of people participation in wastewater treatment construction according to age.** We found that the maximum of sample group is group of more than 50 years olds person group and minimum is in 41-50 years old group, 3.21 and 2.95, respectively. One way Anova method found that the age interval does not significantly effect the people participation in wastewater treatment construction at 0.05 as show in table 37 and 38 which made the hypothesis "The different age, different participation level" rejected.

**Table 37** Comparison minimum, maximum, means, S.D. of people participation in wastewater treatment construction according to age

Age (years)	Amount	Min	Max	Mean	S.D.
18-30	121	0	5	3.15	1.57
31-40	116	0	5	2.96	1.59
41-50	87	0	5	2.95	1.72
more than 50	33	0	5	3.21	1.74
Total	357	0	5	3.05	1.63

**Table 38** Variation analysis of the people participation in wastewater treatment construction according age group

Sources of variation	Df	SS	MS	F	P
Between group	3	3.883	1.294	0.483	0.694
Within group	353	945.210	2.678		
Total	356	949.092			

P>0.05

**(2) Comparison of average score of people participation in wastewater treatment construction according to occupation.** We found that the maximum score is from the general employee group and minimum is other occupation (farmer, housemate), 3.09 and 3.02, respectively. One way Anova method found that the occupation does not significantly effect the people participation in wastewater treatment construction at 0.05 as show in table 39 and 40 which made the hypothesis “The different occupation, different participation level” rejected.

**Table 39** Comparison minimum, maximum, means, S.D. of people participation in wastewater treatment construction according to occupational group

Occupational group	Amount	Min	Max	Mean	S.D.
Government/public enterprise’s officer	70	0	5	3.05	1.63
Private business	76	0	5	3.05	1.71
Business’s employee	108	0	5	3.03	1.63
General employee	63	0	5	3.09	1.57
Others(housemate, farmer)	40	0	5	3.02	1.64
Total	357	0	5	3.05	1.63

**Table 40** Variation analysis of the people participation in wastewater treatment construction according age group

Sources of variation	Df	SS	MS	F	P
Between group	4	0.211	5.282	0.020	0.999
Within group	352	948.881	2.696		
Total	356	949.092			

P>0.05

**(3) Comparison of average score of people participation in wastewater treatment construction according to educational level.** We found that the maximum score is in diploma level and minimum is high school graduated, 3.13 and 2.89, respectively. One way Anova method found that the educational level does not significantly effect the people participation in wastewater treatment construction at 0.05 as show in table 41 and 42 which made the hypothesis “The different education level, different participation level” rejected.

**Table 41** Comparison minimum, maximum, means, S.D. of people participation in wastewater treatment construction according to educational level

Educational level	Amount	Min	Max	Mean	S.D.
Primary school	95	0	5	3.05	1.75
High school/occupational	103	0	5	2.89	1.61
Diploma	157	0	5	3.31	1.57
Total	355	0	5	3.04	1.63

**Table 42** Variation analysis of the people participation in wastewater treatment construction according educational level

Sources of variation	Df	SS	MS	F	P
Between group	2	3.613	1.807	0.676	0.509
Within group	352	940.753	2.673		
Total	354	944.366			

P>0.05

(4) **Comparison of average score of people participation in wastewater treatment construction according to received information level.** We found that the participating score of people who receive information in high level is 3.60, more than, 2.77 of people who get low level of information. One way Anova shows that the different level of information received make willing to participating in wastewater treatment construction at statistically significant level equals 0.05. Scheffe comparison method found that there are different people participation between low information level and medium level. Medium information level is higher information level than low level as show in table 43, 44,45 corresponding to hypothesis of “Different received information level, different participating level in wastewater treatment construction”.

**Table 43** Comparison minimum, maximum, means, S.D. of people participation in wastewater treatment construction according to water pollution information received

Water pollution information received	Amount	Min	Max	Mean	S.D.
Low level	168	0	5	2.77	1.71
Medium level	165	0	5	3.25	1.50
High level	24	0	5	3.60	1.58
Total	357	0	5	2.72	1.63



**Table 44** Variation analysis of the people participation in wastewater treatment construction according to water pollution information received

Sources of variation	Df	SS	MS	F	P
Between group	2	26.938	13.469	5.1704	0.011*
Within group	354	922.155	2.6051		
Total	356	949.092			

\*P>0.05

**Table 45** Difference received water pollution information level among the people group by Scheffe method

Variable level	Mean	2.77	3.25	3.60
Low level	2.77		*	
Medium level	3.25			
High level	3.60			

\*P>0.05

**(5) Comparison of people participation in wastewater treatment construction according to water pollution knowledge.** We found that high knowledge level group have maximal point, 3.22, which is higher than low knowledge group, 1.33. One way Anova found that different knowledge level effect to participating level in wastewater treatment construction at statistically significant level equals 0.05. By using Scheffe comparison method, we found that there are different participating level between medium knowledge level and high level. High knowledge level has higher participating score than medium level as shown in table 46, 47, 48 corresponding to hypothesis of “different water pollution knowledge effect people participation in wastewater treatment construction”.

**Table 46** Comparison minimum, maximum, means, S.D. of people participation in wastewater treatment construction according to water pollution knowledge

water pollution knowledge	Amount	Min	Max	Mean	S.D.
Low level	3	0	3	1.33	1.52
Medium level	64	0	5	2.34	1.53
High level	290	0	5	3.22	1.60
Total	357	0	5	3.05	1.63

**Table 47** Variation analysis of the people participation in wastewater treatment construction according to water pollution knowledge

Sources of variation	Df	SS	MS	F	P
Between group	2	49.557	24.779	9.751	0.000*
Within group	354	899.535	2.541		
Total	356	949.092			

\*P&gt;0.05

**Table 48** Difference among the people group with different knowledge level by Scheffe method

Variable level	Mean	1.33	2.34	3.22
Low level	1.33			
Medium level	2.34			*
High level	3.22			

\*P&gt;0.05

#### 4.8 Problems, obstacles, and suggestion in people participation

**8.1.1 Problems and obstacles of people participation in water pollution prevention,** can be considered into 2 criteria.

**Problems and obstacles of people participation in household level** can be divided into 5 activities and can be explain as following:

**Food and fat separating.** Most of samples(83.8%) gave answer as no problems and 16.2% said there were some times constraints to separate sometimes they couldn't separate at all.

**Bathroom cleaning by chemical (acid-base).** Most of samples said there has not any obstacles in avoiding chemicals (78.4%), and 21.6% the obstacles resulting from the dirty in bathroom. Chemicals help them to save time and energy.

**Efficient water use.** We found that 89.9% said there were no problem to save the water and use it efficiently. But 10.1% said there were some time constraints and uncomfortable to reuse that water.

Household wastewater treatment. 81.2% stated that wastewater from bath taking, washing, kitchen can be treated with no problems. 18.8% said there were some economic reasons because fat separating pit and wastewater treatment construction are expensive.

Toilet waste treatment. 85.7% said there were no problems and 14.3% thought there were some economic constraints because toilet septic tank improvement construction is costly.

In conclusion, even there were some economic and time constraints, in general there were not obstacles for people participation in 5 activities above in household level though.

#### **Problems and obstacles of people participation in wastewater treatment construction**

From 357 samples, most of people (56.0% ) stated that there were not any problems in participating the construction. 44.0% said there were some obstacles, which were 35.6% time constraints, 14.8% said limited knowledge, 6.4% economic constraints, 2.8% resulting from government operation. Reasons as following:

- Time constraints because have to work
- Inadequate knowledge about the project lead to absent
- Much of household expenditure
- Municipality does not allow people to participate in the project

#### **4.8.2 Suggestion for people participation in water pollution prevention**

**A. Suggestion for people participation in water pollution prevention in household level.** The study found that 226 person from 357 samples or 63.4% didn't answer this question and 131 person or 36.6% suggested. The answers of question can be

categorized into 2 issues are toward government and toward people or household. As following:

**Issues 1: Suggestion for government**

- 61.5% suggested that government should conduct public announce, promote about environment conservation and understand the water pollution treatment in household level.

- 25.3% suggested government should strictly control related enterprises, factories, restaurants, communities, riverside residences which releases wastewater to natural water source.

- 6.0% suggested government should accommodate adequate bins to avoid the misplaced trash to public space such as river.

- 3.6% suggested government should improve the quality of water supply and accommodate adequate water supply which will decrease the underground water.

- 3.6% suggested government should sincerely operate in water pollution control

**Issues2: Suggestion for people and household**

- 45% suggested people and household should have public consciousness in environmental conservation and coordinate with government in water pollution prevention.

- 32.3% suggested people should trash in the suitable place not in river.

- 8.4% suggested that people or household should decrease water using or use it more efficient to reduce the wastewater quantity.

- 7.1% suggested that people or household should have fat separating pool in order to treat household and community wastewater.

- 7.1% suggested that people or household should separate food and fat, and use only chemicals which can be naturally destroyed.

## **B. Suggestion for people participation in wastewater treatment construction**

### **Suggestion for people participation in wastewater treatment construction**

The study found that 246 person from 357 samples or 70.0% didn't answer this question and 111 person or 31.0% suggested. The answers of question can be categorized into 2 issues are toward government and toward people or household. As following:

#### **Issue 1: Suggestions for government**

- 54.8% suggested that government should public announce about the wastewater treatment construction to people and allow people to participate in any steps of the project including information disclosure.

- 21.6% suggested that government should be transparent, sincere, honest, not corruption.

- 19.3% suggested that government should allocate adequate budget and accelerate to build the wastewater treatment system

- 4.3% suggested responsible officer should be honest and strictly implement on the policy of controlling and inspection

#### **Issues2: Suggestions for people and household**

- 60.0% suggested that people or household should participate in wastewater treatment construction project such as idea brainstorming and government inspection.

- 25.0% suggested that people, household, and community should treat their wastewater before release

## **Chapter V**

### **Discussion**

From the study of people's participation in water pollution prevention at Tambol Kaengkhoi municipality. 357 people are the samples for this research in many criteria such as general information about the population, water use and eradication, pollution knowledge level, people participation in protecting and solving water pollution, problems and obstacles of people's participation in the water pollution prevention, willing for participating in wastewater treatment project at Tambol Kaengkhoi municipality, suggestion for people participation in water pollution prevention, and lastly suggestion for people participation in wastewater treatment system project. The result of the study can be explained as below.

#### **5.1 Result**

##### **5.1.1 General**

The population (357person) complies with female 64.4% and male 35.6%. 33.9% in 18-30 years-old, 61.3% married, mostly graduated from high school 28%, 26.3% having 4 person each household, 30.3% work as employee in private enterprise, 60.5% having residential right, 62.5% living in single house, 77% using house only as residence, 41.5% using house as residence and business(convenience store).

##### **5.1.2 Water use and wastewater eradication**

The 66.4% of population have brought drinking water in bottle for drinking and cooking, 89.1% of population use the water from pipe (water supply) for cleaning and

bathing. The water supply expenses average about 175 Baht per month and found that 30.3% of population pay for water supply 51-100 Baht per month.

The 86.8% indirectly receive the benefit from Pasak River via water supply, but 78.7% claim that the water supply is too turbid. 98.3% of people does not have any wastewater treatment system and 69.2% separate garbage from the wastewater and 55.9% by hand. 55.7% having the pipe connected to the sub-district wastewater eradication pipe. 85.2% are using lavatory with septic tanks, 51.0% using septic tanks.

### **5.1.3 The knowledge level, idea level, water pollution information level.**

The study found that 81.3% in high level of the water pollution knowledge and 89.6% agree with the water pollution. But the frequency of receiving water pollution information is still in the low level, and 47.1% are getting message from TV.

### **5.1.4 People participation**

The study found that people participation in the water pollution prevention in separating the garbage from the wastewater in household level 83.3%, and using the acid-base in cleaning bathroom 81.0%, in economically using water 81.0%. In wastewater treatment practice, 95.8% of household do not have the wastewater treatment system. The 77.6% of household has no toilet-waste treatment. By comparing, the food and fat separating is the most frequent behavior, 51.8%.

The study of people participation in wastewater treatment system establishment project show that 78.7% of people would like to give some idea about it, and 67.7% would like to give some money and materials for this project. While 51.8% want to be a committee in the project, and 59.7% want to engage in inspection process.

This study considered the wastewater treatment system establishment project into steps, and found that the brainstorming is the most popular steps that people

would like to participate in. And 50.0% willing to join in wastewater treatment system establishment project. For willing to pay for wastewater treatment, study found that there is not much different percentage of people who prefer to pay and do not, and the most preferable rate is 59.09 Baht per month. By the way, most of them (29.6%) prefer to pay in range of 10-20 Baht per month. 26.9% of people do not prefer to pay any fee said they can not afford for this fee.

#### **5.1.5 Comparison between people participation in water pollution prevention and variables.**

Comparison between people participation in protecting and solving water pollution in household level

According t-test analysis, people participation in protecting and solving water pollution in household level are significantly varied by water pollution idea level at 0.05. But people participation is not significantly different with different gender, different residential right, and different use of residences at 0.05.

By using one-way Anova, the people participation in protecting and solving water pollution in household level are significantly varied by water-pollution knowledge level at 0.05 but people participation is not significantly different with the different gender, different residential right, and different use of residences at 0.05.

#### **Comparison the people's willing in participating wastewater treatment system establishment project**

According to t-test analysis, the people's willing in participating wastewater treatment system establishment project is not significantly varied by gender, residential rights, uses of residences, and water-pollution idea level at 0.05.

By using one-way Anova, the people's willing in participating wastewater treatment system establishment project can be significantly different at statistic value equals 0.05 by information receiving levels and water-pollution knowledge levels. And found that people participation in protecting and solving water pollution in household level is not significantly varied by the ages, occupations, educational level at 0.05.

#### **5.1.6 Problems, obstacles, and suggestions for people participation**

People participation in protecting and solving water pollution in household level has some problems and obstacles in five activities. Two main causes of problems are timing and economic constraints.

The biggest problems and obstacles of people's willing in participating wastewater treatment system establishment project are timing, knowledge level, economic reason, and government operation, respectively.

This study provides 2 critical suggestions for people participation in protecting and solving water pollution in household level. First for the government agency, and second for people or household. The government should promote to people to more concern about the environment and strictly implement policies with the wastewater releasing source. Also government should accommodate adequate bins and water supply, and improve the quality of water supply. Lastly, government should sincerely concentrate on and solve the water pollution. People and household should conserve the environment, should have civic consciousness in the community and family level. Also people should cooperate with government, trash and eradicate the waste in proper place, save the water, separate the waste, food, garbage, and using the chemical things

which can be naturally destroyed. Lastly, crowded community should have the wastewater treatment pool to treat wastewater from community.

Public suggestions for wastewater treatment system establishment project can be divided into 2 criteria. For government. Government should provide people more information and allow people to participate in any process. Government should sincerely operate the project, no corruption, stimulate to run the project with suitable budget. In addition, government should be transparent, and strictly operate the policy avoiding the exception. For the people, every household should cooperate with the project, and being information eagerness. Every community should have their own wastewater improvement.

## **5.2 Study Discussion**

A study of people participation in protecting and solving water pollution in case of Tambol Kaengkhoi municipality, Saraburi province, can be discussed as following:

### **5.2.1 The people's participation in water pollution prevention in household level**

The people participation in protecting and solving water pollution in household level of Kaengkhoi municipality is in the medium level because most of the people take into 3 activities from 5 activities. By most of people (83.3%) are practice of separating the food garbage, 81.0% are using water economically as same as the proportion of using chemical in cleaning. The least participation activity is household wastewater treatment about 4.2% and toilet-waste treatment 22.4% which is corresponding to the survey found that 98.3% of household do not have any wastewater treatment system. Even most are single house with the property rights, there are not having the water treatment pool because it's costly. Also the sample of

study specify the expenses and inadequate income as the crucial factor effects the medium level of people participation. This result corresponds the research of Sutipanwihan,S(1996:132), he studied on people's participation in Domestic Wastewater Management : a case study of the Phuket Municipality and found that people participation toward water pollution from community case study of Phuket district is in the medium level. And Thammachart, S (1997:112) found that the local people participation in coastal resources conservation:case study of La-ngoo district, Satoon province is also in the medium level.

### **5.2.1 Willing to participating in wastewater treatment system establishment project**

Willing to participating in wastewater treatment system establishment project in Tambol Kaengkhoi municipality is in high level. The 50% of people want to participate in every steps of project's operation. If we consider into steps, the idea brainstorming is the most wanted (78.7%), then money and material donation (67.7%) And the less wanted is about 51.8% that is to participate as the committee of the project.

Since the government allow people to participate more, people alert to give idea in project especially in project that close to their daily life. If this project is success, the problem will be alleviated. The easiest step of process is the idea brainstorming and money and material donation which related to the work of Khaingsang, A(1992: 95) specified that most of people would like to participate in term of brainstorming and donation, in high level.

In case of wastewater treatment fee, people who willing to pay that such fee is more than people who do not want to pay. The preferable rate is approximately 59.09

Baht/ household/ month. This phenomena show that most of people realize themselves as the cause of water pollution so that they would like to compensate and to pay for improving the quality of water Sutipanwihan, S (1996:140)said in his study that people willing to pay on average 72 Baht/household/month. A TDRI study specified people willing to pay on average at 79 Baht/household/month.

### **5.2.2 The people's willing in participating wastewater treatment system establishment project**

According to the assumption: people participation in protecting and solving the water pollution and willing to participating in wastewater treatment system establishment project are varied with many variables such as gender, age, occupation, educational level, residential right, residence, water-pollution information receiving, water pollution knowledge, water pollution idea. The results are concluded as below:

#### **(1) Gender variable**

The study's results reject the assumption. Different gender does not make any different participation in protecting and solving water pollution and in willing to participate in wastewater treatment establishment project with statistic value equals 0.05. This result is the same as study of Yamchuenpong,U (1994: 176) ,which shows participation of municipality (Tambol) parliament's members in The Tha Jean River conservation. That study found that difference of gender make no different participation as same as Theeratakul, B.,(quoted in Khaisang ,A.,1992:47) indicated gender is not significant in political participation.

#### **(2) Age**

This study rejects the assumption. The age level does not make any different participation in protecting and solving water pollution and in willing to

participate in wastewater treatment establishment project with statistic value equals 0.05. This result is corresponding to Dee-in, P., (1988:119), he studied participation of Tambol and village headman in forest resources conservation in the Northern part of Thailand and found that age does not effect the participation of the Head of Tambol and the head of village in forest conservation. As same as the result of Ratana, P., (1993:74) indicated that people participation in environmental development programme of the Community Development Department: A case study of Ubonratchatani province, found that age is non-related to any people participation.

### **(3) Occupation**

This study rejects the assumption. Different occupation group does not make any different participation in protecting and solving water pollution and in willing to participate in wastewater treatment establishment project with statistic value equals 0.05. Because way of life in municipality has a similar environment and it does not differential social condition. So occupation does not effect the participation. This result is corresponding to the result of Ratana, P., (1993:75) had studied the People Participation in Environmental Development Programme of the Community Development Department : A Case Study of Ubonratchathani Province and had found that occupation was not the factor that effected the participation. As same as result of Prakobsap, K (1997:110). The Participation in Thacheen river Coservation by the Committees of Tambol Council in Suphanburi province and had found that occupation of committees of Tambol Council was not the factor that effected the participation.

### **(4) Education**

This study rejects the assumption. Different educational level does not make any different participation in protecting and solving water pollution and in willing to

participate in wastewater treatment establishment project with statistic value equals 0.05. This result is corresponding to the result of Daosuwan, W., (1990: 95) found that Education does not effect to local people participation in environmental conservation at The Bung-Khunthalae. As same as result of Sutipanwihan, S., (1996:142) in topic "people's participation in Domestic Wastewater management : a case study of The Phuket municipality", which indicated that educational level is not related to people participation in any level and any willing to participation in any steps of process.

#### **(5) Residential rights**

This study rejects the assumption. Having residential rights or not does not make any different participation in protecting and solving water pollution and in willing to participate in wastewater treatment establishment project with statistic value equals 0.05. This result is corresponding the study, did by Sutipanwihan, S., (1996: 143), found that the having residential rights has no relation with people participation in any level and any willing to participation in any steps of process.

#### **(6) The use of residence**

This study rejects the assumption. Different purposes of using residences do not make any different participation in protecting and solving water pollution and in willing to participate in wastewater treatment establishment project with statistic value equals 0.05. This result is corresponding to the result of a study " The feasibility of collection wastewater treatment fee: case study of Si Phra ya wastewater treatment plant, did by Lorpensri, H., (1997:121), and found that the type of residence does not effect the willing to pay wastewater treatment fee.

### **(7) Water pollution knowledge**

This study accepts the assumption. The water pollution knowledge is divided into 3 levels : high, medium, low. The different levels significantly effect participation level of people in protecting and solving the water pollution in household level and in willing to participate in wastewater treatment establishment project with statistic value equals 0.05. The study found that people who has higher knowledge will be different from one who has medium. Because knowledge is important factor to increase understanding and capability in practice. If people have knowledge about anything, they will tend to do properly. Therefore, knowledge is the important factor in creating understanding, and motivating to doing, and resulting in capability in practice (Thammaraksa,K.,1984:64), which does not related to the education level. Because most of the knowledge of people is come from the non systematic education so that the education level is not much significant on participation level. The high knowledge level resulting in high understanding level and absolutely can implement and solve the problem properly.This conclusion is related with the Issareemet's work(1993: 90), studied the factors effect awareness of Tambol council on resolution Chao Phraya river pollution problems:a case study of Amphoe Muang, Pratumthani province. He found that the different level of knowledge lead to different concerning level,as same as, Angkuldee,P.,(1996:69)studied about the Women leader participation in environmental promotion and conservation in Ratchaburi and she found that knowledge is a factor important to environmental supporting and conservation.

### **(8) Water-pollution idea**

This study accepts the assumption. The different idea will lead to different approach in protecting and solving water pollution in household level at statistic value

equals 0.05 because idea is the belief which is not based on the truth but idea is just the private viewpoint of each person (Webster, 1970:296). Moreover, Hofland and Delly's supporting theory say that idea created by the supporting learning process and depends on the interest, understanding, and preference. Therefore, when a person get good experience, he will have good attitude toward that such things, leads to acceptance which related to the results of Khemchareon's work (1988: 173), Yeekun, S., (1991:149), Triwongyoi, P., (1995:93-101) and Thongthammasat, S., (1998:119), studied about the local people participation in coast resource conservation: A study of La-ngoo district in Satoon province and found that the idea about coast conservation does relate to coast conservation in practice at statistic value equals 0.000.

However, this study shows that the different of idea toward water pollution do not make any significantly different willing to participate in wastewater treatment system establishment project at 0.05. Because 89.6% of people agree with the idea of water pollution, and most of them high prefer to join in the wastewater treatment project so that they are not much different idea on the same project. Lopensri, H., (1997:126) studied the feasibility of collection wastewater treatment fee: case study of Si Phra ya wastewater treatment plant and found that attitude toward wastewater problem and community wastewater system do not effect on the willing to pay for wastewater treatment.

#### **(9) Water pollution information receiving**

This study rejects the assumption. Different information receiving level does not make any different participation in protecting and solving water pollution with statistic value equals 0.05. But different information receiving level does different level of willing to participate in wastewater treatment establishment project with

statistic value equals 0.05. The people who receive medium level of information will have different joining project desire level from one who get less because a person who get more information will have more knowledge ,more understanding about the water pollution and wastewater treatment system establishment project that one who get information less. The information is very important, the communication has been crucial in social decision making.(Chumnong, W.,1990:3) This result relates to Sutipanwihan,S.,(1996:139) studied the people participation in water pollution from community: A case study of The Phuket district and found that information receiving level does not relate to any activities but relate to willing to join in wastewater treatment system establishment project, as well as, Khamnurak's work (1995:66) found that people who get more information about rural development will cooperate in the project more than people who didn't get any informations.

## Chapter VI

### Conclusion and Recommendations

Water is a crucial infrastructure. After used, water will become the wastewater and cannot use as the same purpose anymore. In the past, not much water-destroying rate, the water source can revive itself. Because of increased population, changed economic policy and community expansion increase quantity willing for water and also highly water polluting. This reflects the unconsciously water use and lack of environmental responsibility. Even government has many projects to resolute the wastewater, increasing of water pollution shows the ineffectiveness of government policy in resolving the water pollution and inefficiency of resource using. To effectively and efficiently resolve the water pollution, there is necessary to have cooperation from the stakeholders - people. By providing the opportunity to know the changes, problem and its causes, also the space for people in decision making process. Also the people power can help in case of preventing and avoiding the problem occurring. The people participation or civic engagement is the new trend of effective environmental management in policy planning, managing, inspecting and environmental cost responsibility.

From above, researcher studies the people's participation in water pollution prevention : A case study of Tambol Kaengkhoi municipality , Saraburi province in order stimulate the people to recognize the importance of people participation in solving water pollution problem, and it can reduce the burden of government. Therefore, this study has objectives as following:

1. To study the people participation in solving and protecting water pollution in Tambol Kaengkhoi municipality and willing for participation in waste water treatment system establishment project.

2. To compare people participation in protecting and solving the waste water pollution and willing for people participation toward the waste water treatment system establishment project in Tambol Kaengkhoi municipality according to gender, age, occupation, educational level, residential right, residence, water pollution information, knowledge, and idea about water pollution.

3. To study the problem, barriers, and suggestion about people participation in protecting and solving the water pollution and the willing to people participation toward the waste water treatment system establishment project in Tambol Kaengkhoi municipality.

This study is a survey research which collecting data by interviewing questionnaire. Questionnaires are designed by researcher and 3 thesis advisors, and 2 other respects. The questionnaire consists of 7 parts as following:

Part 1 General data about population 10 questions

Part 2 Water consumption, waste water eradication 6 questions

Part 3 Knowledge test about water pollution 20 questions

Part 4 Idea and suggestion about wastewater pollution 20 questions

Part 5 Waste water pollution information perception 7 questions

Part 6 People participation, problems in protecting and solving water pollution, and willing to participating in waste water treatment system establishment project 11 questions

**Part 7 Suggestion for people participation in protecting and solving the water pollution and willing to participate in the waste water treatment system establishment project 2 questions**

Before using the questionnaire to collect data with sample group, researcher had tested the questionnaire with 34 people in Tambol Tandiew, Kaengkhoi district. According to the 25% of top-bottom technique to test the classified value and difficulty and 20<sup>th</sup> Formula of Kuder-Richardson for questionnaire reliability, found that the reliability value equals 0.71. Part 4, idea and suggestion about wastewater pollution will be categorized into 3 rating scale which can be analyzed the classified value by 25% of top-bottom technique. The reliability can be referred in term of Alpha coefficient by Cronbach, from the study found that the questionnaire have reliability value equals 0.78.

After that researcher asked for cooperation from Tambol Kaengkhoi municipality in collecting data between May 17-June 20, 1999. The result of collecting data, we can get 100% of sample (357 person).

After tested and inspected the questionnaire, coding, data recording, then analyzing the data with SPSS for window: Statistical Package for the Social Sciences. The criteria such as sampling group data, water use, waste water eradication, participation level will be analyzed percentage, mode, Standard deviation, Minimum, Maximum. To compare the difference between means of exogenous variable toward waste water protecting and solving participation use t-test tests Mean of 2 groups and One way ANOVA compares Means which more than 2 groups, if find that they are different significantly will continuously do Multiple comparison to compare which group are different by Scheffe' test. Part 6 and 7 problems, obstacles, and suggestion

will use frequency distribution statistics called "Percentage". The results can be concluded as following.

## **6.1 Conclusion**

### **6.1.1 General**

Most of the sample is female more than male. About 18-30 years-old. Married, high school graduated, work as the private enterprise's employee. Most family have 4 person per family. The single house is the most popular residence used as the residential place only. For who use residence as home and economic work, most are the convenient store. For water use and waste water eradication, the most use the bottle water to drink and cook For cleaning and bathing use the water supply. The average of water supply payment approximately 175 Baht per month. The water from Pasak river is heavily used by the Water supply department, people don't use directly because water in Pasak river is turbid. Waste water from household has not treatment system at all, to separate the rubbish from waste water by hand. For household waste water eradication, they have pipes connect with the public pipes. The toilet almost is the lavatory with septic tank and clean with water.

The knowledge level of people about the water pollution is high. Also agree upon the idea of water pollution but the frequency to get information is low and TV is the best media.

### **6.1.2 People participation level in protecting and solving the water pollution.**

The participation in household level is in medium level, and highly willing for participate in the waste water treatment project.

**6.1.3 Comparison between the people participation level in protecting and solving the water pollution and the willing for people participation toward the waste water treatment system establishment project according to gender, age, occupation, educational level, residential right, residence, water pollution information, knowledge, and idea about water pollution.**

(1) To compare the People participation level in protecting and solving the water pollution. From the t-test, the idea of water pollution is significantly different. The participation in protecting and solving the water pollution is also significantly different at 0.05. From one way ANOVA, the knowledge level about water pollution is also significantly different at 0.05.

(2) To compare the willing for people participation toward the waste water treatment system establishment project. One way ANOVA shows different level of information received and knowledge lead significantly different willing for people participation toward the waste water treatment system establishment project at 0.05.

#### **6.1.4 Problems, obstacles, and suggestion in people participation**

(1) In household level, "time" and "economic criteria" are important obstacles for people participation in protecting and solving the water pollution. Also "time", "knowledge", "economic", "government operation" are important barriers, respectively, for people participation in joining the waste water treatment system establishment project.

(2) Suggestion for building people participation. First, suggestion for government, government should do public relations to provide the knowledge and information about the water pollution. Government should sincerely strict on the policies to inspect the waste water eradication, waste water treatment before fall it to

water source. Also should supply adequate garbage bin and improve the quality of water supply. Second, suggestion for people or household, people should have civic consciousness and keep the environment together. Also people should cooperate with government in protecting and solving the water pollution by separating the garbage and waste water, water save. Every community should have the waste water treatment pool to treat waste water from community. Suggestion for the waste water treatment system establishment project, government should announce to the public and sincerely open for people participation, no corruption, allocate adequate budget, and stimulate to build the system. The inspector should be very responsible, faithful, and strict on the inspection's principle. For the household, in conclusion, people and every household should cooperate with the project and treating waste water before fall to the river, also should interest in any information about water pollution.

## **6.2 Recommendations**

### **6.2.1 Recommendation from research results**

(1) Public relations. The research found that there are still not much water pollution information dispersity. Less than 40% of samples frequently receive the information. If government interest in public relation more, the people will know how to do about the waste water treatment in household level more. Government should have the natural water source conservation project to incentive the people recognition. In addition, the nature of message should not too long, but should stress on information given.

(2) Local government, municipality government should provide and support the knowledge to people to understand and recognize the importance of household waste water from many activity such as cooking, cleaning and bathing. From the

research found that only 4.2% of people are who participate in waste water treatment. Local government should do public relations and support the community to build the waste water treatment pool in community in order to decrease the toxic of waste water before fall to other natural water source, pursue the water pollution as a whole.

(3) Local government should support people participation. From the result show that many people would like to join in the project so that if government open for people, the project will be developed continuously and successfully. For example, to make a public listening about the project.

(4) Results show that the lack of time is the biggest obstacle for people participation. Secondly, economic reason. Therefore to raise the people participation, government should design the suitable time range, and making the good policy such as tax reduction policy for household which have waste water treatment.

### **6.2.2 Recommendation for further research**

To complete the next research in order to increase the benefit, the researcher suggest as following:

(1) Should study relations between other exogenous variables, different from this 9 variables, such as indebtedness, social role, group member status, etc., to study more about the relationship between those variables with people participation, willing to participation, and what type.

(2) Should expand the study area where have the same criteria of water pollution to compare the different data for finding various way to solve problems.

(3) Should emphasize on environmental studies for public relations. In order to stimulate people to recognize and perceive the problem status, also realize the importance of people participation which help government to decrease the expenses.

(4) Should do some qualitative research to get deeper information and analyze the most suitable form of project that people can participate and cooperate with government.



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**Direction : Please check / into  or give your real matters on the blank.**

### Section 1 Population Data

1) Gender

1.Male

2. Female

2) Where do you live?

1.Sahapattana Community

6.Tachouwongse Community

2.Liabsuntisuk Community

7.Tawinwattana Community

3.Suntisuk Community

8.Urirat Community

4.Testwiwat Community

9.Roumpattana Community

5.Prapayap Community

3) How old are you?.....years.

4) Marital status

1.Single

2.Married

3.Widowed/Divorced/Separated

5) What is your highest education attainment?

1.Literacy

2.Primary school

3.Secondary school

4.Diploma

5.Bachelor degree

6.higher than bachelor degree

6) How many people live in your household?.....(numbers)

7) What is your major occupation?

1.Government/State Enterprise

2.Commerce/Own Business

3.Employee in private company

4.General employee

5.Agriculturist

6.Other.....

8) Which form of your house do you live?

- 1.Single house
- 2.Apartment
- 3.Townhouse
- 4.Commercial building
- 5.Other.....

9) Are you the ownership of household?

- 1.Yes
- 2.No

10) How do you purpose of house?

- 1.Only living.
- 2.Living and doing business

Which type of your business?

- 1.Selling food
- 2.Hair cut/Beauty salon
- 3.Fixing engine
- 4.Glossary
- 5.other.....

**Section 2 Water use practices for Consume , draining sewage and lavatory.**

1) What kind of water do you use for drinking and cooking in your household? (You can answer more than 1 choice)

- 1.Hydrant water
- 2.Rain
- 3.Completed bottle water
- 4.Underground water
- 5.Other.....

2) What kind of water do you use to wash and bath?. (You can answer more than 1 choice)

- 1. Hydrant water
- 2. Rain
- 3. Underground water
- 4.Shallow well water
- 5.Other.....

3) What is an average monthly expenses for tap water?

Amount paid.....baht/month

4) What kind of benefit from Pasak river does your household reap for? (You can answer more than 1 choice)

- 1. Consuming from municipal hydrant water.
- 2. Agriculture
- 3. fishery for consuming or selling
- 4. Recreation ground
- 5. Communicating route
- 6. Draining sewage
- 7. Leaving trash

5) What is your problem to reap benefit Pasak river? (You can answer more than 1 choice)

- 1. Inadequate water
- 2. Translucent water
- 3. Wastewater
- 4. Shallow water source
- 5. Bad sight
- 6. Other.....

6) Draining wastewater and sewage treatment.

6.1 Do you have wastewater treatment system in the household?

- 1. Yes (specify).....
- 2. No

6.2 Do you separate remains of a meal from sewage?

- 1. Yes (specify)
  - 1. Stored Pit
  - 2. Sieve
  - 3. Hand
- 2. Do not separate

6.3 What method do you drain sewage (bathroom, kitchen and laundry)?

- 1. Connect to municipal drainage ditch
- 2. Connect to soil pit/stored pit and permeate itself
- 3. Release to space inside residence area
- 4. Release to space outside residence area
- 5. Release to river
- 6. Others.....

6.4 Type of lavatory

1) Type and amount of lavatory

- 1. No
- 2. Cesspool.....
- 3. Flush toilet.....
- 4. Both.....

2) What method do you treatment sewage from lavatory?

- 1. Only cesspit
- 2. Cesspit and permeated pit
- 3. Drain directly to municipal drainage ditch (without passing cesspit)
- 4. Drain directly to river (without passing cesspit)
- 5. Other.....

3) What method do you drain overflow water from cesspit/permeated pit?

- 1. Hire lavatory suction service
- 2. Pass to municipal pipe
- 3. Pass to river
- 4. Never overflow
- 5. Other.....

4) What method do you riddance Rubbish

- 1. Hire lavatory suction service
- 2. Pass to municipal pipe
- 3. Bury
- 4. Pass to river
- 5. Never full
- 6. Other.....

**Section 3 Knowledge about Water Pollution**

Question	Right	Wrong
1. Water pollution means the source of water that is getting worse because it is accepted any substances from human activities until it cannot be normally used.		
2. Water pollution causes economic and social effect.		
3. People's residences cause water pollution in densely inhabited localities		
4. Separating the leaving of meal and trapping fat out of the utensils before wash reduces dirt in wastewater		
5. Sewage drain system planning and controlling direction of sewage in sewer decrease wastewater		
6. Water usage equipment and toilet appliance inspection regularly help to save water and lessen wastewater.		
7. Increasing of population in town, which causes more routine then wastewater quantity is main basis of water pollution.		
8. Water pollution prevention and solution relates to all sectors; people, government and private sector, together.		
9. Water pollution is a factor of gastrointestinal infection such as dysentery, cholera or typhoid.		
10. Using detergent that naturally dissolve can partly diminish water pollution.		
11. Releasing sewage or used water to elephant grass or circle reed garden is a sewage treatment possibly done in household.		
12. The cause that Pasak River in Tambol Kaengkhoi municipality gets stale because the industries release water into it.		
13. Water pollution leads the water to get stale and have terrible smell, aquatic animal dies, that place turns to be source of infection, then lacking resource to produce hydrant water.		
14. The last water from washing cloth without soften solution can be reused in, for example, washing mob or rag.		
15. We can save water by brushing teeth and washing face directly from faucet in stead of using basin or glass.		
16. We cannot use dishwashing water to water a plant because existing solution will kill it.		
17. Expansion and larger community is a factor of water pollution.		
18. Using rubber tube for cleaning car is saver than using buck		
19. Paying fee for wastewater treatment is duty of every household is right		
20. Dropping bits and pieces or leaving of the meal into cesspool is an appropriate riddance of trash.		

**Section 4 Opinion about the Water Pollution**

Statement	Agree	Uncertain	Disagree
1. Saving water by only you yourself cannot protect and solve water pollution, so you do not need to do it.			
2. The awareness to save water should be started at home.			
3. Human unawareness is main factor of water pollution.			
4. It is time for everybody to cooperate in Preventing and solving water pollution.			
5. Low quality of water in the river caused from the community drop garbage and wastewater prior to improve its quality into it.			
6. You should save water today before no water to use.			
7. Using appropriate toilet appliance is a way to save water.			
8. The water pollution solution is responsibility of solely the government sector.			
9. The industry and restaurant cause more dirt in sewage than the household's, therefore it is not duty of household to response for the wastewater treatment before releasing it to water source			
10. The used water should be reused like water the plant by vegetable washing water.			
11. Water usage equipment and toilet appliance should be regularly checked			
12. Water pollution prevention and solution will help to protect gastrointestinal infection such as dysentery or cholera.			
13. Using detergent that naturally dissolved can partly diminish water pollution.			
14. Water pollution will lead to the lack of source for hydrant water production.			
15. Large quantity of dirt in water relates to high water treatment cost			
16. The sewage can be discharged to the natural water source because it can recover itself.			
17. Many water source still exist, so it is no need to care about water pollution.			
18. Should not leave the faucet open while brushing teeth or using water utensil instead.			

Statement	Agree	Uncertain	Disagree
19. Washing the dish one by one and leaving the faucet open along that period save time and water.			
20. Water pollution is critically caused by the community located riverside			

**Section 5 Receiving Information and Source of Information about Water Pollution**

1. Have you ever been receiving information from following source?

Sources of information	never	ever		
		Once in a while	Often	Regular
1. Newspaper				
2. Journals				
3. Radio				
4. Television				
5. Local radio				
6. Talk with others such as friend, government officials				
7. Other.....				

**Section 6 People participation and people participation level**

1. People participation in water pollution prevention in household level , problems and obstacles of people participation in water pollution prevention.

1) Food and fat separating

Participation

Non-participation

2) Problems and obstacles of separating food and fat .

Have (continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Other.....

Have not

3) Intensive chemicals use

Participation

Non-participation

4) Problems and obstacles of using intensive chemicals.

Have(continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Other.....

Have not

5) Efficient water use

Participation

Non-participation

6) Problems and obstacles of using efficient water

Have(Continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Other.....

Have not

7) Household water treatment

Participation

Non-participation

8) Problems and obstacles of treatment household water

Have(continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Other.....

Have not

9) Toilet waste treatment

Participation

Non-participation

10) Problems and obstacles of treatment toilet waste

Have(continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Other.....

Have not

2. Demand for people participation in wastewater treatment construction project ,  
 problems and obstacles of people participation in wastewater treatment  
 construction project

1) Idea sharing stage

Would like to Participate

Would not like to Participate

2) Money and material donation

Would like to Participate

Would not like to Participate

3) Willing to pay wastewater treatment fee

Would like to Participate (continued)

Maximum willingness to pay for wastewater treatment fee  
 .....Baht/month

Would not like to Participate (reason).....

4) Joining the committee of the project

Would like to Participate

Would not like to Participate

5) Evaluation and inspection stage

Would like to Participate

Would not like to Participate

6) Problems and obstacles of people participation in wastewater treatment construction project

Have(continued)

1. Time(reason).....

2. Economy(reason).....

3. Knowledge(reason).....

4. Government operation(reason).....

5. Other.....

Have not

**Section 7 Suggestion for people participation in water pollution prevention**

1) Suggestion for people participation in water pollution prevention in household level.

Suggestion

For government.....  
.....

For people and household.....  
.....

No suggestion

2) Suggestion for people participation in wastewater treatment construction

Suggestion

For government.....  
.....

For people and household.....  
.....

No suggestion

## แบบสัมภาษณ์

## เรื่อง การมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ

: กรณีศึกษา เทศบาลตำบลแก่งคอย

## คำชี้แจง

1. โปรดทำเครื่องหมาย  ลงใน  หรือเติมข้อความลงในช่องที่ว่างไว้ให้ตรงกับความเป็นจริงหรือความคิดเห็นของท่านให้ครบทุกข้อ
2. แบบสัมภาษณ์นี้ เป็นส่วนหนึ่งของการศึกษาวิจัยด้านสิ่งแวดล้อมศึกษา โดยมีวัตถุประสงค์เพื่อศึกษาการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ ในเขตเทศบาลตำบลแก่งคอย จังหวัดสระบุรี แบบสัมภาษณ์ชุดนี้ประกอบด้วย 7 ส่วนดังนี้ คือ
  - ส่วนที่ 1 ข้อมูลด้านประชากร เศรษฐกิจ สังคม
  - ส่วนที่ 2 การใช้น้ำเพื่อการอุปโภคบริโภค และการกำจัดน้ำทิ้งและสิ่งปฏิกูล
  - ส่วนที่ 3 แบบวัดความรู้เกี่ยวกับมลพิษทางน้ำ
  - ส่วนที่ 4 แบบวัดความคิดเห็นของประชาชนเกี่ยวกับมลพิษทางน้ำ
  - ส่วนที่ 5 การรับรู้ข้อมูลข่าวสารด้านมลพิษทางน้ำ
  - ส่วนที่ 6 การมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ
    - 1) ระดับการมีส่วนร่วมและปัญหาอุปสรรคของการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ
    - 2) ความต้องการมีส่วนร่วมและปัญหาอุปสรรคของการมีส่วนร่วมของประชาชนในโครงการบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย
  - ส่วนที่ 7 ข้อเสนอแนะในการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ และข้อเสนอแนะในการมีส่วนร่วมของประชาชนในโครงการบำบัดน้ำเสียของเทศบาล

(นางสาวมณฑุา ศรีหินกอง)

นักศึกษาระดับปริญญาตรี สาขาสิ่งแวดล้อมศึกษา

คณะสังคมศาสตร์และมนุษยศาสตร์ มหาวิทยาลัยมหิดล



## 10) ลักษณะการใช้ประโยชน์บ้านเรือน

- 1.อยู่อาศัยอย่างเดียว
- 2.อยู่อาศัยและประกอบธุรกิจ(โปรดระบุประเภทกิจการ)
- 1) ร้านอาหาร  4) ร้านขายของชำ
- 2) ร้านเสริมสวย/ร้านตัดผม  5) อื่นๆ ระบุ.....
- 3) ซ่อมเครื่องจักร/ เครื่องยนต์

## ส่วนที่ 2 การใช้น้ำเพื่อการอุปโภคบริโภค และการกำจัดน้ำทิ้งและสิ่งปฏิกูล

## 1) น้ำที่ใช้สำหรับดื่มและประกอบอาหาร ของครัวเรือน/กิจการ (ตอบได้มากกว่า 1 ข้อ)

- 1.น้ำประปา  4.น้ำบาดาล
- 2.น้ำฝน  5.อื่น ๆ ระบุ.....
- 3.น้ำถัง/น้ำบรรจุขวดสำเร็จ

## 2) น้ำที่ใช้อาบและเช็ดล้างครัวเรือน/กิจการ (ตอบได้มากกว่า 1 ข้อ)

- 1.น้ำประปา  4.น้ำบ่อตื้น
- 2.น้ำฝน  5.อื่น ๆ ระบุ.....
- 3.น้ำบาดาล

## 3) บ้านของท่านจ่ายค่าน้ำประปาโดยเฉลี่ยเป็นเงิน..... บาท/เดือน

## 4) ปัจจุบันท่านใช้ประโยชน์จากแม่น้ำป่าสักในด้านใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

- 1.ใช้เป็นน้ำอุปโภคบริโภคจากน้ำประปาของเทศบาล  5.ใช้เป็นเส้นทางคมนาคม
- 2.ใช้ในการเกษตรกรรม  6.เป็นแหล่งระบายน้ำทิ้ง
- 3.จับสัตว์น้ำเพื่อบริโภคหรือจำหน่าย  7.เป็นที่ทิ้งขยะมูลฝอย
- 4.เป็นสถานที่สำหรับพักผ่อนหย่อนใจ  8.อื่นๆ ระบุ.....

## 5) ท่านประสบปัญหาในใช้ประโยชน์จากแม่น้ำป่าสักในข้อใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

- 1.ปริมาณน้ำไม่เพียงพอ  4.แหล่งน้ำตื้นเขิน
- 2.น้ำขุ่นมาก  5.ทัศนียภาพไม่ดี
- 3.น้ำเน่าเสีย  6.อื่นๆ.....

## 6) การระบายน้ำทิ้ง การกำจัดน้ำเสียและสิ่งปฏิกูล

## 6.1 ครัวเรือนของท่านมีระบบบำบัดน้ำเสีย หรือไม่

- 1.มี ระบุประเภท.....  2.ไม่มี

6.2 ท่านได้ทำการแยกไขมันและเศษอาหารออกจากน้ำทิ้งหรือไม่

- 1.แยก ระบุ..  1.ดักโดยใช้บ่อพัก
- 2.ใช้ตะแกรง
- 3.เก็บออกด้วยมือ
- 2.ไม่ได้แยก

6.3 ท่านระบายน้ำทิ้ง(จากห้องน้ำ ห้องครัว และห้องซักล้าง) โดยวิธีใด

- 1.ต่อลงบ่อดิน/บ่อพักให้ซึมหายไปเอง
- 2.ทิ้งลงพื้นที่ว่างในบริเวณบ้านให้ซึมหายไปเอง
- 3.ทิ้งลงพื้นที่ว่างนอกเขตบ้าน
- 4.ต่อลงท่อเชื่อมกับท่อระบายน้ำของเทศบาล
- 5.ปล่อยลงแม่น้ำลำคลองโดยตรง
- 6. อื่นๆ ระบุ.....

6.4 การระบายน้ำเสียจากสิ่งปฏิกูลและสิ่งปฏิกูล

1) ประเภทและจำนวนห้องส้วมในครัวเรือน

- 1.ไม่มีส้วม
- 2.ส้วมราดน้ำ.....ห้อง  3.ส้วมชักโครก.....ห้อง

2) ท่านมีวิธีกำจัดน้ำเสียจากส้วมอย่างไร

- 1.มีบ่อเกรอะอย่างเดียว
- 2.มีบ่อเกรอะและบ่อซึม
- 3.ระบายลงแม่น้ำลำคลองโดยตรง(ไม่ผ่านบ่อเกรอะ)
- 4.ระบายลงท่อเทศบาลโดยตรง(ไม่ผ่านบ่อเกรอะ)
- 5.อื่นๆระบุ.....

3) เมื่อมีน้ำล้นจากบ่อเกรอะหรือบ่อซึม มีการระบายน้ำที่ล้นอย่างไร

- 1.จ้างรถดูดส้วม  4.ไม่เคยล้น
- 2.ระบายลงท่อเทศบาล  5.อื่นๆ ระบุ.....
- 3.ระบายลงแม่น้ำลำคลองธรรมชาติ

4) เมื่อบ่อเกรอะเต็ม ท่านกำจัดกากปฏิกูลอย่างไร

- 1.จ้างรถดูดส้วม  4. ขุดหลุมฝัง
- 2. ระบายลงท่อเทศบาล  5. ไม่เคยเต็ม
- 3. ระบายลงแหล่งน้ำ  6. อื่น ๆ ระบุ.....

### ส่วนที่ 3 แบบวัดความรู้ ความเข้าใจ เกี่ยวกับมลพิษทางน้ำ

คำถาม	ถูก	ผิด
1. มลพิษทางน้ำ หมายถึง แหล่งน้ำที่มีการเปลี่ยนแปลงไปในทางที่เสื่อมลง เนื่องจากได้รับมลสารที่เกิดจากกิจกรรมของมนุษย์จนไม่สามารถนำไปใช้ได้ตามปกติ		
2. มลพิษทางน้ำ ก่อให้เกิดผลกระทบทางเศรษฐกิจและสังคม		
3. บ้านเรือนประชาชนเป็นแหล่งที่ทำให้เกิดปัญหามลพิษทางน้ำในเขตชุมชนเมือง		
4. การแยกเศษอาหารและไขมันออกจากถ้วยชาม ก่อนที่จะนำไปล้าง จะช่วยลดความสกปรกของน้ำเสียได้		
5. การวางแผนผังระบบระบายน้ำเสียและ การบังคับทิศทางกาลไหลของน้ำเสียในท่อระบายน้ำช่วยลดการเน่าเสียของน้ำเสียได้		
6. การหมั่นตรวจตราดูแลและซ่อมแซมอุปกรณ์การใช้น้ำและเครื่องสุขภัณฑ์ จะช่วยประหยัดน้ำได้ และลดปริมาณน้ำเสียได้		
7. การเพิ่มจำนวนประชากรในเขตชุมชน ทำให้เกิดกิจกรรมต่าง ๆ ในชีวิตประจำวันมากมาย ทำให้มีปริมาณน้ำเสียเพิ่มขึ้น และเป็นสาเหตุหลักของการเน่าเสียของแม่น้ำในปัจจุบัน		
8. การป้องกันปัญหามลพิษทางน้ำ เป็นเรื่องที่ทุกฝ่ายต้องเกี่ยวข้องทั้งประชาชน รัฐบาลและหน่วยงานเอกชน		
9. มลพิษทางน้ำ เป็นสาเหตุหนึ่งที่ทำให้เกิดการเจ็บป่วยของโรคติดต่อทางเดินอาหารเช่น บิด อหิวาต์ ไข้ไทฟอยด์		
10. การเลือกใช้ผงซักฟอกที่สามารถย่อยสลายได้ในธรรมชาติจะช่วยลดปัญหามลพิษทางน้ำได้ส่วนหนึ่ง		
11. การปล่อยน้ำทิ้ง หรือน้ำที่ผ่านการใช้ประโยชน์ลงสู่แปลงหญ้าแฝก หรือกกลมถือว่าเป็นการบำบัดน้ำทิ้งวิธีการหนึ่ง ที่สามารถทำได้ภายในครัวเรือน		
12. สาเหตุการเน่าเสียของแม่น้ำป่าสักในเขตเทศบาลตำบลแก่งคอย เกิดจากโรงงานอุตสาหกรรม ปล่อยน้ำเสียลงสู่แหล่งน้ำ		

คำถาม	ถูก	ผิด
13. ปัญหามลพิษทางน้ำ ทำให้น้ำเน่าเสียและส่งกลิ่นเหม็น สัตว์น้ำตาย เป็นแหล่งเพาะพันธุ์เชื้อโรค ทำให้เกิดทัศนียภาพไม่สวยงามของแหล่งน้ำ และขาดแคลนน้ำที่ใช้ผลิตน้ำประปา		
14. น้ำจากการซักผ้าครั้งสุดท้าย(ไม่ปนน้ำยาปรับผ้านุ่ม) สามารถนำไปใช้ในกิจกรรมอื่น ๆ ได้ เช่น ซักผ้าถูพื้นหรือผ้าจีวร		
15. เราไม่สามารถใช้น้ำล้างจานไปรดน้ำต้นไม้ได้ เพราะมีน้ำยาทำความสะอาด เจือปนอยู่ อาจทำให้ต้นไม้ตายได้		
16. เราสามารถประหยัดน้ำในชีวิตประจำวันได้โดยแปรงฟันและล้างหน้าจาก ก๊อกน้ำโดยตรง		
17. การขยายตัวทางเศรษฐกิจ และแหล่งชุมชนที่ขนาดใหญ่ขึ้น เป็นสาเหตุหนึ่งที่ทำให้เกิดมลพิษทางน้ำ		
18. การล้างรถด้วยสายยางจะช่วยประหยัดน้ำและให้ความสะดวกมากกว่าการ ล้างโดยใช้ถังน้ำ		
19. การจ่ายเงินค่าธรรมเนียมบำบัดน้ำเสียเป็นหน้าที่ของทุกคนรอบครัว		
20. การทิ้งเศษผง และเศษอาหารเล็กๆ น้อยๆ ลงใน โถส้วม เป็นการกำจัดขยะที่ เหมาะสมได้วิธีหนึ่ง		

#### ส่วนที่ 4 แบบวัดความคิดเห็นของประชาชนเกี่ยวกับมลพิษทางน้ำ

คำถาม	เห็น ด้วย	ไม่ เห็น	ไม่เห็น ด้วย
1. ท่านประหยัดน้ำเพียงคนเดียว ไม่สามารถป้องกันและแก้ไขมลพิษ ทางน้ำได้จึงไม่จำเป็นต้องประหยัดน้ำ			
2. การปลูกจิตสำนึกในการใช้น้ำอย่างประหยัด ควรเริ่มขึ้นที่บ้าน			
3. การกระทำที่ขาดจิตสำนึกของมนุษย์เป็นต้นเหตุสำคัญ ที่ทำให้เกิด ปัญหามลพิษทางน้ำ			
4. ถึงเวลาแล้วที่ทุกคน ควรจะร่วมมือ และช่วยกันป้องกันและแก้ไข ปัญหามลพิษทางน้ำ			

คำถาม	เห็นด้วย	ไม่เห็นใจ	ไม่เห็นด้วย
5. แม่น้ำลำคลองในปัจจุบันมีสภาพเสื่อมลง เนื่องจากการทิ้งขยะและการปล่อยน้ำเสียจากชุมชน โดยไม่ได้มีการปรับปรุงน้ำเสียก่อนระบายลงสู่แม่น้ำลำคลอง			
6. ควรประหยัดน้ำเสียตั้งแต่วันนี้ ก่อนที่จะไม่มีน้ำให้ใช้			
7. การเลือกใช้สุขภัณฑ์ที่เหมาะสม เป็นวิธีหนึ่งที่สามารถประหยัดน้ำได้			
8. การแก้ไขปัญหามลพิษทางน้ำ ควรเป็นเรื่องที่หน่วยงานรัฐเท่านั้นที่ต้องรับผิดชอบ			
9. โรงงานอุตสาหกรรม และร้านอาหาร ทำให้มีความสกปรกในน้ำทิ้งมากกว่าน้ำทิ้งจากบ้านเรือน จึงไม่ควรให้บ้านเรือนมารับผิดชอบการบำบัดน้ำเสียก่อนปล่อยลงแหล่งน้ำ			
10. ควรหมุนเวียนนำน้ำที่ใช้แล้วกลับมาใช้ใหม่ เช่น น้ำล้างผักผลไม้สามารถนำไปรดน้ำต้นไม้ได้			
11. เราควรหมั่นตรวจตราดูแลและซ่อมแซมอุปกรณ์กักน้ำและสุขภัณฑ์ที่ชำรุดเป็นประจำ			
12. การป้องกันและแก้ปัญหามลพิษทางน้ำจะช่วยป้องกันการเกิดโรคติดเชื้อจากทางเดินอาหาร เช่น บิด อหิวาต์ ไทฟอยด์ ได้			
13. การเลือกใช้ผงซักฟอกที่สามารถย่อยสลายได้ตามธรรมชาติ จะช่วยลดมลพิษทางน้ำได้บางส่วน			
14. ปัญหามลพิษทางน้ำจะทำให้เกิดการขาดแคลนน้ำดิบที่จะนำมาใช้ทำน้ำประปา			
15. เมื่อน้ำมีสิ่งสกปรกมาก จะทำให้เสียค่าใช้จ่ายในการบำบัดน้ำเสียมากด้วย			
16. ปัจจุบัน เราสามารถปล่อยน้ำทิ้ง ลงแหล่งน้ำตามธรรมชาติได้ เพราะแหล่งน้ำสามารถฟื้นฟูสภาพเดิมได้			
17. แหล่งน้ำตามธรรมชาติมีเป็นจำนวนมาก จึงยังไม่น่าเป็นห่วงเรื่องปัญหา มลพิษทางน้ำ			

คำถาม	เห็นด้วย	ไม่เห็นด้วย	ไม่เห็นด้วย
18. ขณะที่แปรงฟัน ไม่ควรเปิดก๊อกน้ำทิ้งไว้ หรือควรใช้ภาชนะสำหรับใส่น้ำ			
19. การล้างจานที่ละใบ ขณะที่ล้างจานเปิดให้น้ำไหลจะประหยัดเวลา และเป็นการประหยัดน้ำด้วย			
20. ปัญหามลพิษทางน้ำเกิดจากบ้านเรือนที่อยู่ริมแม่น้ำลำคลองเป็นส่วนใหญ่			

### ส่วนที่ 5 การได้รับข่าวสารด้านมลพิษทางน้ำ

1. ท่านเคยได้รับข่าวสารด้านมลพิษทางน้ำ จากแหล่งต่อไปนี้หรือไม่

แหล่งข่าวสาร	ไม่เคย	เคย		
		นานๆครั้ง (1 ครั้ง/สัปดาห์)	บ่อยครั้ง (2-3 ครั้ง/ สัปดาห์)	บ่อยมาก/ ประจำทุกวัน
1.หนังสือพิมพ์				
2.วารสาร/นิตยสาร				
3.วิทยุ				
4.โทรทัศน์				
5.เสียงตามสาย				
6.สนทนากับบุคคลอื่น เช่น เจ้าหน้าที่ของรัฐ เพื่อนบ้าน				
7.อื่นๆระบุ..... ..... .....				

## ส่วนที่ 6 การมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ

### 1. ระดับการมีส่วนร่วมและปัญหาอุปสรรคของการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ

1) การแยกเศษอาหารและไขมันออกจากภาชนะก่อนนำไปล้าง เพื่อไม่ให้ปะปนไปกับน้ำเสีย

- เคยปฏิบัติ  
 ไม่เคยปฏิบัติ

2) ท่านมีปัญหาลักษณะการแยกเศษอาหารและไขมันออกจากภาชนะก่อนนำไปล้าง หรือไม่ อย่างไร

มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)

- ด้านเวลา (ระบุและพร้อมเหตุผล).....  
 ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....  
 ด้านความรู้ (ระบุและพร้อมเหตุผล).....  
 ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....

ไม่มีอุปสรรค

3) การใช้สารเคมีที่เป็นกรด-ด่างเข้มข้นทำความสะอาดห้องน้ำและพื้นผิว

- เคยปฏิบัติ  
 ไม่เคยปฏิบัติ

4) ท่านมีปัญหาลักษณะที่ไม่ใช้สารเคมีที่เป็นกรด-ด่างเข้มข้นทำความสะอาดห้องน้ำและพื้นผิว หรือไม่ อย่างไร

มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)

- ด้านเวลา (ระบุและพร้อมเหตุผล).....  
 ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....  
 ด้านความรู้ (ระบุและพร้อมเหตุผล).....  
 ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....

ไม่มีอุปสรรค

- 5) การใช้น้ำอย่างประหยัดและมีประสิทธิภาพ ได้แก่ ไม่เปิดน้ำทิ้งไว้ขณะไม่ใช่ การนำน้ำที่ใช้แล้วกลับมาใช้ใหม่ เช่น นำไปรดน้ำต้นไม้ สานมหลุย้า หรือล้างรถยนต์ เป็นต้น
- เคยปฏิบัติ
  - ไม่เคยปฏิบัติ
- 6) ท่านมีปัญหาลุ่บสรรคในการใช้น้ำอย่างประหยัดและมีประสิทธิภาพ หรือไม่ อย่างไร
- มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)
    - ด้านเวลา (ระบุและพร้อมเหตุผล).....
    - ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....
    - ด้านความรู้ (ระบุและพร้อมเหตุผล).....
    - ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....
  - ไม่มีอุปสรรค
- 7) การกำจัดน้ำเสียดภายในครัวเรือน เช่น น้ำจากห้องน้ำ ห้องอาบน้ำ น้ำซักผ้า ก่อนปล่อยลงสู่ท่อระบายน้ำหรือแหล่งน้ำ
- เคยปฏิบัติ (ระบุวิธีการ) .....
  - ไม่เคยปฏิบัติ
- 8) ท่านมีปัญหาลุ่บสรรคในการกำจัดน้ำเสียดภายในครัวเรือนหรือไม่ อย่างไร
- มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)
    - ด้านเวลา (ระบุและพร้อมเหตุผล).....
    - ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....
    - ด้านความรู้ (ระบุและพร้อมเหตุผล).....
    - ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....
  - ไม่มีอุปสรรค
- 9) การบำบัดสิ่งปฏิกูลจากส้วมก่อนปล่อยลงสู่ท่อระบายน้ำหรือแหล่งน้ำ
- เคยปฏิบัติ (ระบุวิธีการ) .....
  - ไม่เคยปฏิบัติ

10) ท่านมีปัญหาอุปสรรคในการบำบัดสิ่งปฏิกูลจากส้วมก่อนปล่อยลงสู่ท่อระบายน้ำหรือแหล่งน้ำหรือไม่ อย่างไร

มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)

ด้านเวลา (ระบุและพร้อมเหตุผล).....

ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....

ด้านความรู้ (ระบุและพร้อมเหตุผล).....

ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....

ไม่มีอุปสรรค

2. ท่านต้องการมีส่วนร่วมในโครงการก่อสร้างระบบบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย ในขั้นตอนต่อไปหรือไม่

1) ขั้นตอนการร่วมแสดงความคิดเห็น หรือเสนอแนะต่อการก่อสร้างโครงการระบบบำบัดน้ำเสีย

ต้องการมีส่วนร่วม       ไม่ต้องการมีส่วนร่วม

2) ขั้นตอนการมีส่วนร่วมในการบริจาคเงินและวัสดุ อุปกรณ์ เพื่อสมทบทุนและใช้ในโครงการระบบบำบัดน้ำเสีย

ต้องการมีส่วนร่วม       ไม่ต้องการมีส่วนร่วม

3) ขั้นตอนการร่วมจ่ายเงินค่าธรรมเนียมบำบัดน้ำเสีย ซึ่งเป็นค่าใช้จ่ายในการดำเนินการและบำรุงรักษาระบบบำบัดน้ำเสีย

ต้องการจ่าย

ท่านยินดีจ่ายเงินค่าธรรมเนียมบำบัดน้ำเสีย

เป็นเงินสูงสุด.....บาท/เดือน

ไม่ต้องการจ่าย

ท่านมีเหตุผลอย่างไร โปรดอธิบาย

4) ขั้นตอนการร่วมเป็นกรรมการในการวางแผนและดำเนิน โครงการก่อสร้างระบบบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย

ต้องการมีส่วนร่วม       ไม่ต้องการมีส่วนร่วม

5) ขั้นตอนการร่วมสรุป ประเมินผล ติดตาม ตรวจสอบการดำเนินการ โครงการก่อสร้างระบบบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย

ต้องการมีส่วนร่วม       ไม่ต้องการมีส่วนร่วม

6) ปัญหาอุปสรรคของท่านในการที่จะเข้ามามีส่วนร่วมในโครงการบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย

มีอุปสรรค (ตอบได้มากกว่า 1 ข้อ)

ด้านเวลา (ระบุและพร้อมเหตุผล).....

ด้านเศรษฐกิจ(ระบุและพร้อมเหตุผล).....

ด้านความรู้ (ระบุและพร้อมเหตุผล).....

ด้านหน่วยงานของรัฐ(ระบุและพร้อมเหตุผล).....

ด้านอื่นๆ (ระบุและพร้อมเหตุผล).....

ไม่มีอุปสรรค

**ส่วนที่ 7 ข้อเสนอแนะการมีส่วนร่วมของประชาชนในการป้องกันและแก้ไขมลพิษทางน้ำ และข้อเสนอแนะการมีส่วนร่วมของประชาชนในโครงการบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย**

ท่านมีข้อเสนอแนะเพิ่มเติมอย่างไร ในการมีส่วนร่วมในการป้องกันและแก้ไขมลพิษทางน้ำ ในหัวข้อดังต่อไปนี้

1. การมีส่วนร่วมในการป้องกันและแก้ไขมลพิษทางน้ำภายในครัวเรือน

มีข้อเสนอแนะเพิ่มเติม ดังนี้

ต่อประชาชน.....

ต่อหน่วยงานของรัฐ.....

ไม่มีข้อเสนอแนะเพิ่มเติม

2. ข้อเสนอแนะเพิ่มเติมเกี่ยวกับการมีส่วนร่วมในโครงการก่อสร้างระบบบำบัดน้ำเสียของเทศบาลตำบลแก่งคอย

มีข้อเสนอแนะเพิ่มเติม ดังนี้

ต่อประชาชน.....

ต่อหน่วยงานของรัฐ.....

ไม่มีข้อเสนอแนะเพิ่มเติม

## BIOGRAPHY

NAME	Miss.Monnutha Srihinkong
DATE OF BIRTH	26 July,1966.
PLACE OF BIRTH	Saraburi, Thailand.
INSTITUTIONS ATTENDED	Saraburi Nursing Colledge,1985-1989 Diploma in Nursing and Midwifery (Equivalent to Bachelor in Nursing), Mahidol University, 1997-2000. (M.Ed. in Environmental Education)
POSITION & OFFICE	1989 - Present, Kaengkhoh Hospital, Amphur Kaengkhoh, Saraburi Province Registered Nurse 6

