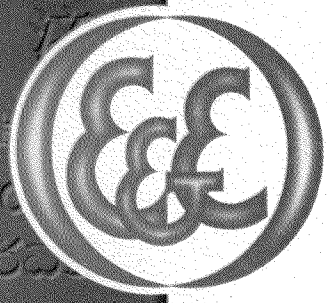

ECONOMY AND ENVIRONMENT PROGRAM FOR SOUTHEAST ASIA

Water Quality Improvements: A Contingent Valuation Study of the Chao Phraya River

Churai Tapvong and Jittapatr Kruavan

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Churai Tapvong and Jittapatr Kruavan*

December 1999

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EXECUTIVE SUMMARY

This study considers models of willingness to pay for central wastewater treatment facilities in Bangkok, based on dichotomous choice contingent valuation method using survey data of 1,100 households.

The questionnaire design was constructed from a variety of methods: the Delphi technique, focus group discussions and pre-tests. Results showed that more than two-thirds of the respondents were willing to pay for the service, should it be available, to improve water quality at levels that enables fish to live (water quality 1) or allows for swimming (water quality 2). The logistic regression indicates that the factors governing the respondents' willingness to pay for wastewater treatment were education, knowledge and importance of the project, living near a river or canal, and referendum fees. On the quantitative side, the mean values of the treatment fee for water quality 1 and 2 were found to be 100.81 and 115.03 baht/month, respectively. The use of Ordinary Least Square (OLS) models also showed that the amount of fees the respondents were willing to pay depended a great deal on referendum fee, income, education, existing quality of water and being near a river or canal. Finally, the referendum fee in the OLS application may have led to a starting point bias in the respondents' answers in determining the stated fee. The means of the corresponding stated fees tended to go in the same direction as the referendum fees. It was found that majority of those unwilling to pay for service were either protesting the bid or too poor to pay. This implies that if they were more aware of the project and understood its importance, they might be more willing to support it and even to pay the necessary fee to keep it operational.

Institutional arrangements are a big challenge to the central wastewater treatment project implementation. This study indicates that the best option for billing and collection of wastewater charges is through metered water consumption with a joint billing for water and wastewater bills. The Metropolitan Waterworks Authority (MWA) should be responsible for wastewater tariff collection. Bangkok residents are willing to pay for the improvement of the water quality of the Chao Phraya River. It is now up to the government to effectively respond to this need in a timely and efficient manner.

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WATER QUALITY IMPROVEMENTS: A CONTINGENT VALUATION STUDY OF THE CHAO PHRAYA RIVER

Churai Tapvong and Jittapatr Kruavan

1.0 INTRODUCTION

1.1 Project Rationale and Background

In recent years, environmental degradation has become an increasing concern in Thailand. Of the environmental problems and challenges facing the Kingdom, water pollution is one of the most serious. Among the rivers in Thailand, the Chao Phraya River is the most contaminated. Recently, the Pollution Control Department (1997) reported that the levels of dissolved oxygen in the lower reaches of the Chao Phraya River have been close to zero since 1990, and that by the year 2000, the "King's River" may well be "dead". The finality of this observation is not just an academic hyperbole: so reduced is the level of dissolved oxygen in the lower reaches of the Chao Phraya River that most aquatic life find it impossible to survive.

Water, once a "free good", is becoming increasingly scarce and therefore, valuable. But because water is still regarded and used as a free good, there are distortions in the pricing of environmental quality - so-called "market failures".[1] The general failure to price water and maintenance of water quality - or at least to price it accurately - has led to widespread problems of water pollution in the Chao Phraya River.

Once, Bangkok used to enchant people all over the world that they called it the "Venice of the East". Now, this seems a distant memory. However, the chronic problem of wastewater disposal throughout Bangkok is at least being tackled. Uncontrolled urban sewage discharge is considered to be the major cause of water pollution in the Chao Phraya River. Many studies have indicated that the major source of water pollution in Bangkok is the residential sector. The wastewater is discharged to the storm sewer, flow into canals or "klongs" and finally to the Chao Phraya River. Thus, treating water in Bangkok klongs is, of course, treating the ailing Chao Phraya River. However, due to capital constraints, households and medium- and small-scale industries can not build their own on-site pollution control facilities, hence, the government defined their use of pollution control facilities.

Over 30 years ago, there had been attempts to plan for wastewater collection, treatment and disposal systems, in order to provide effective solutions to problems of increasing water quality deterioration which were perceived at that time. Bangkok has a long history of attempts to install a proper sewerage system.[2] The first study, completed in 1960 by Litchfield Whiting Browne and Associate, foresaw Bangkok in 1990 as a city with a modern drainage and sewerage system. Thirty years later, Bangkok is still struggling to get a sewerage project off the ground. While Bangkok residents generally feel that the almost catastrophic delay in building comprehensive

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[1] For more detailed discussion, see Bromley 1991; Panayotou 1993; Freeman III 1993; Barde 1994; Olewiler and Hartwick 1998; Pearce and Warford 1996; and OECD 1995

[2] For instance, Tholin 1962; and JICA 1994a, b, 1996a, b

sewage treatment works were due to government wrangling, indecision and engineering logistics caused by the rapid sprawling of the city's population, the Bangkok Metropolitan Administration (BMA) had actually considered and given the sewerage system a green light as early as 1968. That year, a master plan was drawn and followed up by the Japan International Cooperation Agency (JICA).

But even after the need was determined in 1984, the real kickstart to the project occurred only in 1987 when His Majesty the King highlighted the urgent need to clean up the city. After His Majesty implemented clean water experiments in the Makkasan Swamp and at the Rama IX Pond, the entire sewage treatment scheme seemed to take on more meaning. Money, or rather the lack of it, is often heard as the reason for officials' inability to initiate action on public work projects. Thus the question must be raised - where does the money come from? Inevitably, the central government must be a major player in the scheme. In the end, however, everyone in the city - households and businesses alike - have to bear the cost of constructing, operating, and maintaining the system, since all stand to gain in terms of better water quality. In carrying out a massive public works project such as this, the people who pay must be convinced that the end result is worth the expense.

This raises the question: are Bangkok residents willing to pay extra money in order to increase the water quality of klongs and eventually the Chao Phraya River?

1.2 Research Objectives

The specific research objectives are:

1) to estimate the willingness of Bangkok residents to pay for improved water quality by conducting a contingent valuation survey, and

2) to suggest economic instruments to encourage this willingness to pay, such as user fees, property taxes, and other measures.

The study offers several variants of the contingent valuation method survey. In one variant, households are presented two possible water quality scenarios. They are simply asked how much they are willing to pay for wastewater treatment charges for the following scenarios:

Scenario 1: Improve the water quality from 'boatable' to a level where fishing could take place, and

Scenario 2: Further improve water quality from 'boatable' to a level where swimming is possible.

1.3 Wastewater Treatment Studies in Thailand

Many studies have been conducted on technical solutions to water quality improvements of the Chao Phraya River.[3] But there have been very limited studies on the application of economic instruments that apply to water quality management in Thailand (see O' Conner 1994; Kaosa-ard and Kositrat 1994; TEI 1994 a, b). Thus far, the Royal Thai Government (RTG) has applied economic instruments such as

[3] See Pansawat et al. 1987; TDRI 1988; PCD 1997; and Binnie & Partners, et al. 1997

subsidies through the Environment Fund (EF), managed by the Ministry of Science, Technology, and Environment and the Ministry of Finance. This is the first top level recognition by the RTG that special attention must be given to financing wastewater treatment projects in Thailand.

It must be emphasized, however, that very little recovery of wastewater collection and treatment costs is undertaken in Thailand. Pattaya and Phuket (Patong Beach Area) have instituted flat rate charges based on land use, which are directed primarily at the tourist trade. These charges are set at levels which do not fully recover recurrent costs. In Pattaya, the revenues derived in 1993 from these charges amounted to 7 million baht which covered only about 70% of the operating budget of 10 million baht. TDRI (1995) conducted an in-depth study on full-cost water and wastewater pricing in the case of Phuket. The result of the study indicated that Phuket residents are willing to pay additional money for the improvement of water quality. In addition, majority of the people (78%) are willing to pay wastewater charges on top of the cost of pipe water, at an average rate of 2.08 baht/m^3. In Bangkok, there is currently no charge for wastewater disposal yet. However, the experiences of developed countries in wastewater collection may be useful to Thailand. OECD (1994) presents a comprehensive study on user charges for sewerage and sewage treatment in many countries. Households and firms pay user charges for sewerage and sewage treatment, usually on the basis of water usage. This charge is usually included in water bills.

1.4 The Study Area

The study area is the Bangkok Metropolitan Area. Bangkok is not only the capital city, but is also the center of commerce, service, industry, national and international transportation, and the center of government administration. Bangkok covers an area of 1,568.753 km^2 with an average height above mean sea level of 1.5 m. The area is called the lower Chao Phraya River basin or the Chao Phraya delta plains.

The population in Bangkok as of 31 December 1996 is 7.5 million. The number and distribution of the population in the community directly impact on wastewater quantity. Based on the 1980 and 1990 population censuses, the population projection is estimated to increase from 7.5 million in 1996 to 11.1 million in 2017. Even more striking is the projection for wastewater from the residential sector to increase from 575.85 million m^3/year in 1996 to 1,044.93 million m^3/year in 2017.[4] Bangkok will continue to strive for higher quality levels of urbanization and will continue to pay a higher "price" for environmental degradation due to water pollution, unless adequate investments in pollution control facilities are instituted for effective wastewater management.

1.5 Scope of the Project

The research project covers seven priority areas in Bangkok that have central wastewater treatment facilities. At present, there are six central wastewater treatment facilities in Bangkok. These include: (1) SiPhraya, (2) Rattanakosin, (3) Central Wastewater Treatment Phase 1, (4) Yannawa, (5.1) Nongkham-Pasricharean, (5.2) Ratburana, and (6) Central Wastewater Treatment Phase 4.

[4] The details can be obtained from the BMA

The Bangkok sewerage master plan which was completed in 1981 with the assistance of the Japanese Government divided the project areas into 10 zones. The six wastewater treatment facilities are located in seven priority zones of 10 zones. This study was conducted in 20 districts consisting PhraNakron, Dusit, Bangrak, PraTumWan, Yannawa, PomprabSattruphai, Sampanthawong, Phrayathai, HuaiKwang, Pasricharean, NongKham, Ratburana, DingDaeng, Sathorn, BangZue, Jatujuk, BangKawleam, Ratchathewee, BangKae, and ThungKu. Currently the SiPhraya centralized wastewater treatment plant is in operation while other facilities are under construction. These six central wastewater treatment facilities cover catchment areas of 191.7 km^2 with wastewater treatment capacity of about 992,000 m^3/day. Details are as follows:

1.5.1 SiPhraya Wastewater Treatment Project

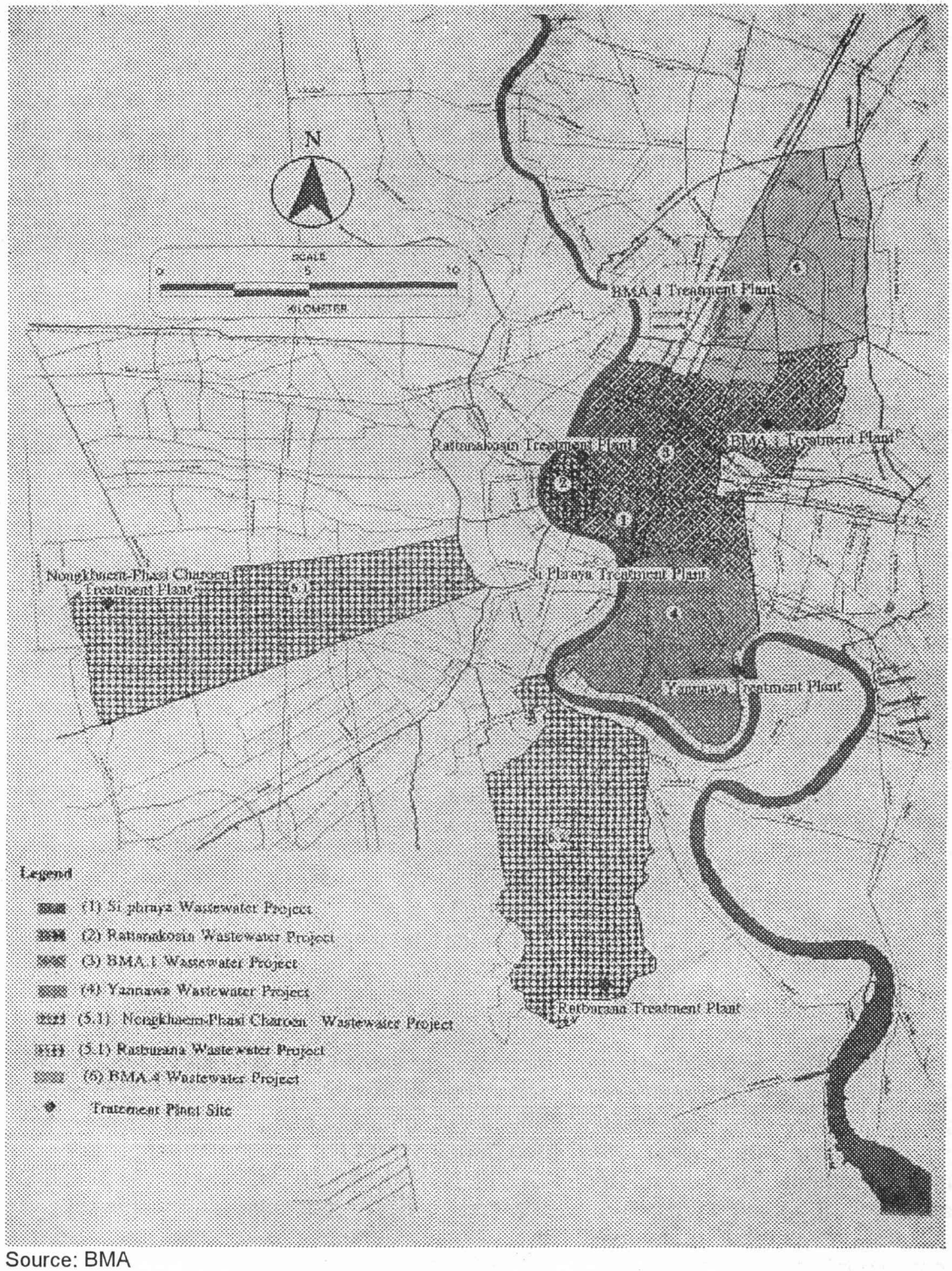
The catchment area is about 2.7 km^2 consisting of PomprabSattruphai, Sumpanthawong, and Bangrak district. The capacity of the plant is 30,000 m^3/day. The plant was completed on 23 December 1993 by Hydro Tech Co. and S.T. Kranchang Co. The construction cost was about 450.4 million baht. The plant has been operating since January 1995.

1.5.2 Rattanakosin Wastewater Treatment Project

The catchment area is about 4.1 km^2 consisting of PhraNakhon district. The capacity of the plant is 40,000 m^3/day. The total length of sewers is about 16.5 km and the pine diameter varies from 0.25 to 1.5 m. The plant is located in BanPhanThom area near Klong BangLumPhu. This project is now being constructed by the Siam Syntech Construction Co. and Federal Engineering Co. Construction will be completed in 2000. The construction cost is about 883 million baht and the consulting services is 15.2 million baht.

1.5.3 Bangkok Wastewater Project Stage 1

The catchment area is about 37 km^2 consisting of Pomprabsattruphai, Sumpanthawong, PraTumWan, Ratchathawee, and some parts of PhraNakron, Dusit, Phayathai, and DingDaeng district. The capacity of the plant is 350,000 m^3/day. This project is a turn-key project which includes construction and operation works. It was conducted by NOSS Consortium. The construction cost for the initial plan was 6,382 million baht. The consultant was Dorsch Consult and Associates, with a consulting service cost of 199,998,500 baht. The contract was signed on November 1, 1993 and construction will be completed in 2002.



Source: BMA

Figure 1.1 Central wastewater treatment facilities in BMA

1.5.4 Yannawa Wastewater Treatment Project

The catchment area is about 28.5 km^2 consisting of Bangrak, Yannawa, Sathorn, and BangKawleam district. The capacity of the plant is 200,000 m^3/day. This project is a turn-key project which includes construction and operation works. It is being conducted by a Sumsung-Lotte-CEC joint venture. The construction cost of this project is 4,552 million baht. The consultant is Metcalf & Eddy International Co., Ltd., with a consulting service cost of 155 million baht. The contract was signed on July 24, 1995. The plant has been operational since December 1999.

1.5.5 NongKham-Phasricharean-Ratburana Wastewater Treatment Project

There are two treatment plants for this project, NongKham-Pasricharean treatment plant and Ratburana treatment plant. The catchment area of the first one is about 44 km^2 consisting of NongKham and Phasricharean district and the latter one is about 42 km^2 consisting of Ratburana district. The capacity of these two plants is 222,000 m^3/day. This project is a turn-key project which includes construction and operation works. The construction cost for this project is about 4,799,999,105 baht, awarded to the Premier Enterprise PCL. The consultant is CH2M Hill Engineering Inc. and Epsilon, with a consulting service cost of 210,648 million baht. The contract was signed on September 19, 1996 and the project will be completed in the year 2001.

1.5.6 Bangkok Wastewater Project Stage 4

The catchment area is about 33.4 km^2 consisting of some parts of Dusit, Phrayathai, HuaiKwang and Jatujak district. The capacity of the plant is 150,000 m^3/day. The government has approved a budget of 4,025 million baht for this project which includes construction and operation works. The project is in the process of contract negotiation.

2.0 METHODOLOGY

2.1 The Application of CVM

Over the past two decades, the use of the contingent valuation method (CVM) in policy analysis and academic research has grown rapidly.[5] CVM is used to elicit people's preference, expressed in terms of willingness to pay (WTP). It basically asks people what they are willing to pay for a benefit. CVM has two important features: (1) it will frequently be the only technique of benefit estimation; and (2) it should be applicable to most contexts of environmental policy. A contingent market is taken to include not just the good itself, for instance, better water quality, but also the institutional context in which it would be financed.

[5] Arrow et al. 1993; Alberini et al. 1997; Bergstorm et al. 1989; Barrens et al. 1997; Bishop and Heberlein 1990; Boyle et al. 1997; Carson 1997; Cooper 1993; Cameron 1988; Cameron and Englin 1997; Carson et al. 1997; Carson and Mitchell 1993; Cummings et al. 1994; Hanemann 1994; Harrison 1992; Kahneman and Knetsch 1992; Kanninen 1995; Loomis et al. 1996; Loomis et al. 1993; McFadden 1994; Mansfield 1998; Nickerson 1993; Portney 1994; Randall 1997; and Smith 1996, 1997 offer comprehensive assessments of the contingent valuation methods

The use of CVM for measuring WTP for social projects is well accepted and widely used in many different circumstances in developing countries. However, there is a very large part of the literature in CVM which discusses the "accuracy" of CVM.[6] At the 1994 Annual Meeting of the American Economics Association, during a panel discussion about the findings of the NOAA, a leading expert in CVM, Professor Kenneth Arrow, remarked that "CV studies are fine when the results are accurate and reliable, and the results will be reversed if this is not the case".[7]

There are various ways of classifying the nature of the biases that may be presented in the CVM. These include strategic bias (see Prince et al. 1992; Brookshire et al. 1976; Rowe et al. 1980; Hoehn and Randall 1987; Milon 1989; Bergstorm et al. 1989; Mitchell and Carson 1989; Evans and Harris 1982), design bias (see Boyle et al. 1986), vehicle bias (see OECD 1995), information bias (see Schulz 1985; Hoehn and Randall 1976; Boyle 1989; Bergstorm et al. 1989; Whitehead and Blomquist 1991; Hanley and Munro 1994), hypothetical bias (see Bishop et al. 1983; Thayer 1981), starting point bias (see Boyle 1985; Randall et al. 1983), and operating bias (see Cummings et al. 1986).

Obviously, it is possible that some biases may exist when using the CVM. These biases are due to the hypothetical nature of the approach. Nevertheless, careful survey design is necessary to control these sources of bias.[8] The study here attempted to control certain biases.

The first step was to set up a hypothetical for water quality improvements of the Chao Phraya River through central wastewater treatment facilities in Bangkok. Respondents were told that the BMA is implementing six central wastewater treatment facilities located around Bangkok. The wastewater to be treated will be transported via an existing sewer system, which has already connected most of the households in the treatment area.[9] The survey described what these sanitary facilities consisted of and their affects, and explained that the operation could go ahead if sufficient funds were generated. Then reasons were given for payment of services,

[6] The evidence on the accuracy of CVM in developing countries is much more limited, nevertheless, the few available studies suggest that CV surveys can be successfully implemented (see Briscoe et al. 1990; Singh et al. 1993; and Whittington 1990a, b, 1991, 1992, 1993)

[7] Cited from Whittington 1996

[8] The reliability of contingent values has also been assessed by employing test-retest procedure'where a sample of individuals is asked to respond to the same valuation question at two distinct periods of time. Estimated values are considered to be reliable if they do not demonstrate statistically significant difference over time. Of course, the "true value" must be unchanged, and sample characteristics, such as income, must be held constant during the test-retest period (see Loomis 1989, 1990; Teisl 1995; and Reiling 1990). Along this line, Whittington et al. (1992) examined whether the time given people to think about their responses to CVM questions influenced their answers. He found that respondents who were allowed time to evaluate the proposed water system in Anamber State, Nigeria, bid significantly less than those who did not have that time. Therefore, the authors argue that the estimates based on bids from respondents who had time to think are probably better measures on the value of improved water services. However, test-retest will not apply in this study.

[9] Most of the households under the survey are already connected to the sewer system and their wastewater will be treated at one of the six facilities. Only a very small percentage of households, mostly those located near the river, are unable to access the sewerage system. Nevertheless, the questionnaire does not specifically ask whether a respondent has a flush toilet or, if he/she has it, whether it connects to the sewer system. In addition, there are no private water connections for households.

where no direct payment was currently exacted. How funds will be raised also needed to be described: the bid vehicle was decided upon, for instance, the utility bill. The questionnaire used "focus" groups, which were assembled to discuss their reactions to the hypothetical market, following the pre-test prior to conducting the main survey.[10]

More specifically, this study used the dichotomous choice contingent valuation method (DC CVM).[11] Basically, the DC CVM procedure asks whether respondents would be willing to pay for the service or accept the charge of a specified amount (a yes/no or DC CVM question). The willingness to pay question begins with a single-bounded format. Following questions are asked in the double-bounded format. This approach asks respondents whether they are willing to pay a pre-chosen randomly-assigned amount. If the answer is yes, the respondents are asked whether they are willing to pay a pre-chosen higher amount. If the answer is no, the respondents are asked whether they are willing to pay a pre-chosen lower amount. Four different bids were offered in the main survey questionnaire to measure the respondent's willingness to pay, but different amounts were used in these two questions.

2.2 Questionnaire Design[12]

Procedures for questionnaire design were based on the Delphi technique, focus group discussions and pre-tests.

2.2.1 Delphi technique

The Delphi technique is applied to benefit the research project and makes it practical. In the research process, opportunities are provided for related agencies to get involved such as the BMA and PCD.

The application of the Delphi technique involved the following steps:

1) The objectives of the research project were explained to the related agencies so they will clearly understand the project. The research team spoke of the cooperation needed by the research project from the related agencies and the benefits that the agencies in turn would receive from the research project, and

2) Opinions were solicited from related agencies, BMA Staff, PCD experts, and EEPSEA resource persons through the questionnaires as inputs in the recommendations.

[10] Increased use of focus groups, of the de-briefing of CVM respondents to see how well they understood the survey, and why they gave the particular answers recorded, and further analysis of the human valuation process for environmental resources all seem likely to improve reliability. (For more detail discussion, see Schkade and Payne 1994 and Blamey 1997)

[11] See Alberini 1995; Barrens et al. 1997; Boyle et al. 1996; Carson et al. 1997; Cameron 1998; Cameron and Quiggin 1994; Ready et al. 1996; Cooper 1993; Loomis 1989; Cameron 1991; Carson 1996; Duffield and Patterson 1991; Hanemann 1984; Kanninen 1993; Kanninen and Kristrom 1993; McConnell 1990; Park et al. 1991 and Poe et al. 1997

[12] The survey questionnaire is presented in Appendix 1

2.2.2 Focus group discussions

The focus group discussions were used to develop the questionnaire so that the items in the questionnaire were practical and easy to understand. The research team requested cooperation from eight districts to arrange eight focus groups, which included two groups for each category: residential (far away from canal/the Chao Phraya River), residential and commercial (far away from canal/the Chao Phraya River), canal houses, and informal settlements. Ten participants were selected from each community from the eight districts. The director of the district offices helped the research team in selecting the heads of the community in each subdistrict. Then a list of participants with a brief personal history were sent to the research team in advance so that the research team would know their background and be able to select participants to the focus group discussions.

These steps were followed in conducting the focus group discussions:

1. The most convenient meeting place was arranged for the participants to meet for three-hour sessions.
2. The project leader clearly explained the objectives and procedures to the participants. Each member was allowed to freely express his/her opinions regarding the discussion topic without any interference from other members. This approach was adopted to provide everyone with an opportunity to freely express their opinions.
3. The project staff and participants determined the main discussion items for the meeting, consistent and arranged according to priority.
4. The project leader conducted the discussions in an orderly fashion and created a relaxing atmosphere so that the participants did not feel uncomfortable and could be themselves.
5. The research assistant recorded information and discussion results, operated the sound recording system during the meeting, and reminded the project leader of the topics that needed to be discussed.

Discussion topics in focus group basically concentrated on the following items:

- Details/information on central wastewater treatment facilities
- Benefits from water quality improvements
- Level of water quality improvements
- Payment methods
- Willingness to pay for central wastewater treatment facilities
- Starting bid point
- Range of bid
- Suitable method for wastewater collection
- Criteria for collection fee
- Organization for wastewater collection fee

6. At the end of the meeting, the project leader expressed her gratitude and gave small mementos to each participant.

7. The final step consisted of gathering the minutes of the meeting from the research assistant and checking the information for correctness, and finally, making adjustments, and corrections on questionnaire items for a clearer understanding among the research team and the questionnaire respondents.

Since central wastewater treatment facilities are so new to Bangkok residents, the study provided complete information to the respondents in multimedia (photographs, cards, and site area maps) during the focus group discussions, pre-tests and the main survey.

2.2.3 Sample design

The sample size of this household survey was 1,100 households. A two-stage stratified random sampling procedure was used to select households from the BMA population where central wastewater treatment facilities existed. In the first stage, the study drew 20 districts. Then, for each district, the study identified the number of street blocks and randomly drew a sample out of appropriate street blocks. For every street block chosen, the study interviewed every fifth household until 8-10 households were interviewed. However, if a chosen street block had less than 10 households, the study randomly drew a sample for that particular block for every second household until five households were interviewed. Respondents must be household heads (male or female) aged 20-60 years old. The sample size of 1,100 was divided into four versions A, B, C, and D. Each version contained 275 households with a distribution proportionate to the population of each district.[13] Households were classified in four categories: residential, residential and commercial, canal houses, and informal settlements.

2.2.4 Survey pre-test and administration

The survey instrument was extensively pre-tested using experienced interviewers to conduct interviews of 100 households in 14 districts. The pre-test showed the need to modify some parts of the questionnaire which flowed badly, to change some of the redundancies, and to provide additional cards containing response choices for some questions. A number of language changes were made to make it more understandable. Then the second pre-test was carried out for 50 households in 10 districts. Interviewer screening and training techniques developed for the pre-test were developed further as a result of the pre-test experience.

In our administrative survey, well trained professional interviewers were required. Interviewers received extensive training by attending full-day sessions that emphasized the use of visual aids, the need for neutrality, and the nature of the questionnaire. The survey instrument took an average of 30 minutes to complete. Moreover, in the field survey, a supervisor was appointed for each group to facilitate, check and recheck, and to assure the quality of the questionnaire. After finishing interviews for each day, the research team held a meeting to summarize the results and problems.

[13] The structure of *willingness to pay questionnaire* is presented in Appendix 2

In April and May 1998, 1,100 household interviews were conducted in 20 districts in Bangkok. Of these interviews, 1,020 provided sufficiently complete responses to permit empirical analysis. There were a number of reasons which accounted for such a high response.

First, the project staff provided good public announcements about the survey in advance. Second, schools in the designated districts were asked to make announcements about the survey and to ask their students to convey the message to their parents. Third, the letter requesting cooperation was sent to heads of the communities in advance. Fourth, a day before the survey in the designated area, each district office helped the project staff make announcements and requested cooperation in answering the questionnaires. Lastly, in the field survey, the team leader met with heads of the communities and made the announcement using the community microphone to ask for cooperation from the respondents.

Nevertheless, some problems occurred in the field survey.

First, the sample size of the study was too large encompassing 1,100 households and covering 20 districts. Each district had distinctly different problems. For instance, most people who live in the Sampanthawong district are Chinese. They live together as a big family with the same budget. When asked about water bill expenses, they were confused as to which house should give the answer.

Second, the poor people who live in informal settlements share one water meter with others. Each respondent had a tendency to give the total water bill which is actually more than their actual payment.

Third, the areas in some districts were so large and the population more scattered (e.g., Jatujak district) that there were difficulties in survey management.

Finally, it was difficult to interview the wealthier people in the district because they do not entertain interviewers. This is typical in Bangkok. We solved this problem by first, sending them a letter introducing ourselves and the project, then following these up by phone and making appointments; and second by approaching the Rotary Association to introduce the survey to their members who were mostly from the high and middle income classes.

The first version of empirical results from the survey were presented on 31 August 1998 at a public hearing in the form of a seminar entitled "Public Participation on Central Wastewater Treatment Facilities in Bangkok".

3.0 ANALYSIS AND RESULTS

The survey showed that the respondents' major problem was traffic, followed by air pollution, water quality, garbage and others. Water quality was the focus of this study. A total of 60.4% of the respondents rated the existing water quality in Bangkok as 'very poor' while 21.1% rated it as 'poor'. This indicated that many people were aware of the problem and may also be willing to do something to improve the situation. The survey shows that most of the respondents would like to have a water quality high enough so that they are able to fish and swim.

The analysis was divided into two parts. The first explored the respondents' willingness and ability to pay for the wastewater treatment. The second part formulated econometric models to estimate the respondents' WTP.

3.1 Willingness and Ability to Pay

The respondents' willingness and ability to pay for wastewater treatment provides useful information not only in understanding the basic characteristics of the respondents but also in properly distinguishing them when formulating WTP estimates.

Table 3.1 shows that majority of the respondents (78.4%) are both able and willing to pay for the service. However, 13% are able but unwilling to pay.

The rest of the respondents indicated that they are either willing but unable to pay (3.3%) or both unwilling and unable to pay (4.5%). Those who are unwilling to pay have quiet diverse reasons. For example, they said they have already paid taxes, such a treatment should be the responsibility of the BMA, or because most of the wastewater come from the industrial sector, the latter should be the one to pay. The detailed responses or reasons are given in Table A3.6 in Appendix 3.

Table 3.1 Willingness and ability to pay for wastewater treatment

Opinion	Percent
Willing and able to pay	78.4
Willing but unable to pay	3.3
Able but unwilling to pay	13.0
Unable and unwilling to pay	4.5
Others	0.8
Total	100.0

3.2 Willingness to Pay Estimates

The analysis on WTP estimates involved three parts. The first part, a qualitative approach, attempted to explore the factors governing the decision whether a person was willing to pay for the wastewater treatment service. The second part, a quantitative approach, tried to explore the roles of major factors determining the amount of the service fees for different water quality. The last part involves a starting point bias. Appropriate econometrics models were employed in each of these parts.

3.2.1 Willingness to pay: qualitative approach

The exploration of whether a person is willing to pay for the wastewater treatment was done using a logit model.[14] The model was chosen because of its ability to deal with a dichotomous dependent variable and a well-established theoretical background.[15] Consider :

[14] There might be distinction in the application of probit and logit models in dealing with qualitative variable cases. Probit is thought to better suit the experimental data while logit might be more appropriate for survey data.

[15] For more detailed discussion, see Alberini et al. 1997; Alberini 1995; Boyle and Bishop 1988; Hanemann 1984 and Kanninen 1995.

$$P_i = E(Y = 1 \mid Xi) = \frac{1}{1+e^{-(\beta_1 + \beta_2 Xi)}} \qquad (3\text{-}1)$$

where Pi is a probability that Yi = 1, Xi is a set of independent variables while β_1 and β_2 are an intercept and a set of coefficients to be estimated corresponding to a logistic distribution. Taking a natural logarithm of an equation (3-1) above, we obtain

$$L_i = \ln\left(\frac{Pi}{1-Pi}\right) = \beta_1 + \beta_2 X_i \qquad (3\text{-}2)$$

where L_i, which is called Logit, is the log of the odd ratios and is linear in both independent variable and parameter. The estimation method is maximum likelihood estimator (MLE) and the coefficients obtained are consistent.

The actual estimation in this section involved three logit models. The first one tried to formulate a model capturing a simple yes/no answer on whether a respondent was going to pay for the wastewater treatment. All the data were employed at this stage in order to understand a broad perspective of the factors underlying a respondent's decision. The second and third models, representing water quality 1 and 2 respectively, were formulated to closely correspond to a WTP concept. This was done by (1) excluding the data representing the cases of protest bid[16] and (2) including a referendum price each respondent had encountered as one of the independent variables. This was done in order to identify the true underlying factors determining the WTP for each water quality. Variables employed and the estimation results are given in Table 3.2 and 3.3.

The result of whether a respondent is going to pay for the wastewater treatment (PAYYN equation) indicates quite clearly that the respondents' education, the importance and knowledge of the project as well as living near river or canal are important factors. Since the coefficients of these variables are all positive, it implies that a respondent who has a higher education, knows about the project and understands its importance and who lives near a river or canal has a higher probability of paying for the treatment. Note that the coefficient of the income variable is not only negative but also insignificant. The explanation seems to show a high correlation between income and education variables in the model.[17]

The estimation results of the WTPYN1 and WTPYN2 equations indicate that education and the importance of the project still play a major role in determining the WTP for wastewater treatment. Income, similar to the PAYYN equation, is neither able nor has significant effect in determining the WTP for both water qualities.[18]

[16] Protest bid is classified as those who are able but unwilling to pay for the wastewater treatment. A comparison of major characteristics of those who are under 'protest bid' and who are not is given in Table A3.7 in Appendix 3.

[17] See Table A3.8 in Appendix 3

[18] Some of the explanations are (1) wealthier respondents have their own wastewater treatment system so they do not see the importance of the proposed 'centralized' wastewater treatment system; (2) wealthier respondents not need to travel by boat in the canal or the Chao Phraya River every day and (3) they do not need to use water from the canal or river

These findings are somewhat similar to that of the first equation. Three additional points should also be noted. The first is that even if a referendum price does play a significant role in discouraging a WTP for water quality 1, it does not seem to have such a similar effect for that of water quality 2. The second point is that a 'knowledge' variable is excluded from the estimation since it seems to wreak havoc to other coefficients in the model. The final point is that type of living environment, particularly AHT3, does not display such a strong effect in determining the WTP, which is contradictory to that in the PAYYN equation.

Table 3.2. Definition of variables

Variable Name	Description
Dependent variables:	
PAYYN	Yes and No response to whether a respondent will pay for the water treatment; 1 = pay, 0 = no pay
WTPYN1	Willingness to pay for treatment to achieve water quality 1; 1= willing to pay, 0 = unwilling to pay
WTPYN2	Willingness to pay for treatment to achieve water quality 2; 1 = willing to pay, 0 = unwilling to pay
Independent variables:	
Income	Income per month of the respondent; baht/month
Education	Education level of the respondent; 1= not finish school, 2 = primary school, 3 = secondary school, 4 = professional training, 5 = university graduate, 6 = otherwise
Importance	A respondent's opinion on how important the project is; 1 = important, 0 = not important
Knowledge	Whether a respondent knows about the project; 1 = already know, 0 = don't know
AHT2	Type of living environment 2: for commercial purposes
AHT3	Type of living environment 3: near river or canal
AHT4	Type of living environment 4: densely populated area
REF1	Referendum fee as stated in the questionnaire for water quality 1 treatment; 70, 85, 100 and 120
REF2	Referendum fee as stated in the questionnaire for water quality 2 treatment; 80, 100, 120 and 130

3.2.2 Willingness to pay: quantitative approach

A linear model is employed in order to determine the factors governing the amount of fee an individual is willing to pay for the treatment for each water quality. A model for determining the maximum fee for wastewater treatment needs some explanation. Since the respondent is asked to specify his/her maximum fee, the figures are available and they are, at this stage, considered to be continuous in nature. Following this line, it might be possible and correct to directly formulate a linear regression model using Ordinary Least Squares (OLS) method using maximum WTP figures as a dependent variable. Similar to those of WTPYN1 and WTPYN2, the data employed also exclude that of protest bid. In addition, outliers[19] are also

[19] Outlier here is defined as an observation whose error term is greater than 3 standard error from the estimated mean value

identified and excluded from the estimation process. The second activity is done in order to prevent certain data points from dominating the outcome of the whole equation. Definitions of additional variables and the outcomes of the OLS models are given in Tables 3.4 and 3.5.

Table 3.3 Estimation results of logit models

Dependent variable:	PAYYN	WTPYN1	WTPYN2
Independent variables:			
Intercept	-1.2865 (5.1325)*	0.2237 (5.4224)*	2.0060 (0.6179)
Income	-7.4E-06 (1.0226)	1.44E-06 (0.0031)	-1.5E-05 (0.4221)
Education	0.1461 (3.2929)*	0.7610 (5.4224)*	0.5014 (2.5155)
Importance	1.6398 (10.4460)*	2.0400 (3.0379)*	2.0339 (2.8646)*
Knowledge	0.5853 (10.4713)*		
AHT2	0.1803 (0.7069)	0.6138 (0.7607)	0.4028 (0.2995)
AHT3	0.5846 (5.5004)*	1.6927 (2.5190)	8.6400 (0.0510)
AHT4	0.4105 (2.4891)	8.0246 (0.0941)	8.6674 (0.0398)
REF1		-0.0093 (3.0379)*	
REF2			-0.0140 (0.6225)
-2 Log L % of correct prediction, total	874.414 77.83	111.725 98.05	89.531 98.50

Note: values in parentheses are Wald-statistics
* 10% significant level

Table 3.4 Additional definition of variables for linear models

Variable Name	Description
Dependent variables:	
WTP1	Fee to be paid as stated by the respondent for water quality 1 treatment; baht/month
WTP2	Fee to be paid as stated by the respondent for water quality 2 treatment; baht/month
Independent variables:	
Sex	Sex of a respondent, 1=male, 0=female
WQN	Perceived condition of an existing water quality. 1=very good, 2=moderate, 3=poor, 4=extremely poor

Table 3.5 Estimation results of linear models

Dependent variable:	WTP1	WTP2
Independent variables:		
Intercept	-38.805 (2.2007)**	-26.055 (1.227)
REF1	0.556 (5.918)**	
REF2		0.492 (5.077)**
Income	7.0E-04 (4.427)**	6.1E-04 (3.461)**
Education	4.124 (2.494)**	4.255 (2.359)**
Importance	32.326 (2.159)**	31.743 (1.969)**
WQN	5.585 (2.616)**	6.083 (2.623)**
Sex	5.568 (1.576)	3.621 (0.943)
AHT2	7.454 (1.618)	0.326 (0.065)
AHT3	13.261 (2.790)**	12.075 (2.336)**
AHT4	-3.259 (0.623)	-2.804 (0.494)
R-squared	0.139	0.108

Note: Numbers in parentheses are t-statistics
** indicates 5% significant level

The outcomes of both linear models are mostly as expected, not only in terms of variables that affect the fees but also their signs and levels of significance. For the WTP1, coefficients of referendum fee, level of education, income, importance of the project, severity of existing water quality and whether a respondent is living near a river or canal are observed to be significant. Their positive relationships are also consistent with what we have predicted. It should be noted that sex does not seem to play a significant role in determining WTP in this equation. However, a relatively low R-squared is a bit of concern. The explanation might lie on the fact that the actual fee (values of WTP1) that respondents are willing to sacrifice have a very wide dispersion and their increments are very small, making it difficult for a model to precisely determine each individual figure. For WTP2, the observed outcomes are rather similar. Major variables possess correct signs and most are statistically significant. Furthermore, small R-squared value and insignificant coefficient of a sex variable has also been observed. Upon close inspection of the above results, it can be concluded that most of the coefficients in the above models are quite similar, with the exception of those of constant and AHT2. In particular, a constant in WTP1 equation possesses a smaller coefficient than that of WTP2, indicating that, everything else being the same, a respondent is willing to pay more to obtain water quality 2. This finding indicates that a respondent seems to follow the same logic and consistency in determining the amount of fee he/she is willing to pay for the treatment of wastewater at different qualities.

3.2.3 Starting point bias

As the WTP models have been estimated, there has been a doubt on the existence of a starting point bias. This can be observed by comparing a correspondent's stated fee and the respective referendum fee (Table 3.6).

Table 3.6 Relationship between referendum and stated fees

Referendum Fees	Stated Fees (baht/month)		
	Mean	Mode	Median
Water Quality 1			
70	101.45	100	100
85	116.56	100	100
100	146.09	120	100
120	155.56	140	150
Water Quality 2			
80	114.50	100	100
100	140.85	120	100
120	181.55	150	150
130	168.90	150	150

Source: Questionnaire

Results indicate a significant positive relationship between the referendum fee and stated fees. In the case of water quality 1, as the referendum fee rose from 70 to 120 baht/month, the mean value of the stated fee also increased from 101.45 to 155.56 baht/month. On the average, such a mean value of the stated fee is about 30-40 baht above the referendum fee. A rise in a referendum fee increases mode and median from 100 to 140 baht/month and from 100 to 150 baht/month, respectively. A similar outcome was found in the case of water quality 2, except for one case: a 130 baht/month referendum fee corresponded with a stated fee of only 169.80 baht/month, which is below that observed at a referendum fee of 120 baht/month. In addition, stated fees for water quality 2 are relatively higher than those of water quality 1, which is consistent to what is expected.

The existence of a starting point bias as indicated above is rather worrisome. This is because it might have been used as a clue or an indicator for the respondents in stating the fees they were willing to pay instead of what they might have had in mind. On the other hand, if we try to eliminate such a problem by not specifying a referendum fee, stated fees from the respondents may be so widespread so as to make data analysis much more difficult. However, the analysis of the (actual) stated figures indicate that the ranges[20] of these fees are relatively wide while the distribution, although not considered to be normal, centered toward the mean figures as they should.

[20] The range of stated fee for water quality 1 is 5 to 1,000 baht/month while that of water quality 2 is 2 to 1,000 baht/month

4.0 INSTITUTIONAL ARRANGEMENTS AND FEE COLLECTION METHODS

4.1 Institutional Arrangements

Institutional arrangement is an essential element for implementing the central wastewater treatment project. The possible organizations that may collect wastewater treatment fees are the BMA and Metropolitan Waterworks Authority (MWA). Four cases are proposed as follows:

Case 1: The BMA collects wastewater treatment fees on its own.

The BMA must:

- set up a staff for a Wastewater Fee Collection Department
- examine manpower within the BMA and allocate staff to the new department or recruit new employees.
- prepare the budget for new employees.

This case is possible but is costly.

Case 2: The BMA hires a private company to collect wastewater treatment fees. The total expense in this case is lower than case 1. However, the implementation process, cooperation, tariff planning, reporting, monitoring, and penalties may be problematic. This case is not a good alternative.

Case 3: The BMA seeks a joint venture with a private company for wastewater fee collection. The problem is similar to case 2 and cost recovery may result in losses. Thus, it is difficult to find a joint venture.

Case 4: The BMA asks MWA to collect wastewater fees.
In fact, the MWA is responsible for water tariff collection. This case is possible and more efficient than other cases.

4.2 Fee Collection Methods

Selection of the most suitable model is one of the most important decisions to be made in project implementation. There has been an institutional controversy about fee collection methods. As a practical matter, the range of choices are proposed as follows:

4.2.1 Wastewater surcharge on metered water consumption

Under such a structure, wastewater charges are set as a function of metered water consumption. The most common approach is to establish a wastewater surcharge on the water bill. Billing can be undertaken jointly for water and wastewater under an arrangement whereby the BMA and MWA provide billing and collection services to entity or entities operating the wastewater system. Alternatively, a separate billing and collection system can be established for the wastewater system on the basis of water consumption data provided by a cooperation between the BMA and MWA.

One of the most important advantages of the wastewater surcharge would be realized if a cross-delinquency provision is incorporated into the customers' service agreement for both water and wastewater. Under such a provision, customers not paying the wastewater charge would have their water supply services terminated. This provision would provide an effective incentive for customers to pay for wastewater service. The system is also generally perceived to be an equitable and transparent mechanism for assessing charges and allows consumers to have some control over their wastewater charge by adjusting water consumption.

4.2.2 Uniform flat fee

The most simple approach is to apply a fee that is the same for all customers in each customer group. Therefore, all domestic customers would pay the same monthly charge regardless of their actual contribution of wastewater into the system. The major advantages of a uniform flat fee is that it is simple both to establish and operate. As a result, the cost of operating and maintaining such a system is also low relative to other systems and the requirement for highly skilled personnel is limited. Additional advantages include the simplicity of the uniform flat fee and the opportunity for abuse and corruption in the assignment of customers to various groups is limited.

The major disadvantages of the uniform flat fee structure are that it is inconsistent with the polluter pays principle; it may create equity concerns which can reduce willingness to pay; the establishment of effective mechanisms for the enforcement of collection is typically difficult; and is generally only applicable in cases where the average revenue requirement per customer is relatively low. Since the same charge is applied to all customers in each group, the charge needs to be set at a level low enough to be affordable by all customers in each group. Therefore, the revenue generation potential of the uniform flat fee is inherently constrained by structures such as wastewater surcharge.

4.2.3 Variable flat fee

Under a variable flat fee structure, customers are set on the basis of the number of taps, number of floors of dwelling, number of residents in the household, and number of toilets.[21] Like the uniform flat fee, there is no incentive to reduce wastewater generation. Depending on the complexity of the structure, the costs of establishing and operating the system can be significantly greater than that for the uniform flat fee. An initial database would need to be established through a comprehensive survey of all customer premises and regularly updated. The need to update the database would be particularly necessary in Bangkok where there is rapid economic growth which results in a significant amount of property upgrading and redevelopment. The need for a survey of premises also creates opportunities for abuse and corruption which can undermine the credibility of the system and, as a result, reduce willingness to pay. An additional disadvantage is that the application of the charge can be problematic since the classification of customers into the various groups can be subject to interpretation and, therefore, may lead to disputes and a resistance to pay. Therefore, collection may be even more of a problem for the uniform flat fee.

[21] The two municipalities in Thailand (Pattaya and Patong) which currently levy wastewater charges both employ variable flat fees

4.2.4 Surcharge on property tax

In many developing and developed countries, the capital and recurrent costs of wastewater systems are covered through charges which are assessed on the value of property. The charge can be applied as a surcharge on the property tax or as a direct separate tax which is based on the assessed value of the property.

The major advantages of this system are the relatively low cost of implementation and the assessment of charges which at least indirectly reflect differences in wastewater generation and ability to pay. However, the experience in applying a property tax surcharge for wastewater has been unsatisfactory in many developing countries. The ability of the wastewater operating entity to generate sufficient revenues depends on the accuracy and credibility of an external database.

The property tax structure in Thailand has been established under central government legislation but is applied by local governments and all revenues collected are retained by local governments. The property tax actually consists of two separate taxes which are both levied on the registered owner of the property. The first is a land tax which is applied on privately owned properties above a specified minimum lot size. The minimum lot size subject to taxation varies between provinces but generally ranges between 0.25 rai and 0.50 rai.[22] All land within each province is categorized as being either high value or low value and assigned an estimated value which is reassessed every four years. However, due to a reluctance by provincial and local governments in increasing the land tax, re-evaluations in most areas of Bangkok have lagged well behind actual changes in the market value of property. A charge is then set for each type of local authority for land category. The second tax, which is referred to as the property tax, is a tax on properties used for income-generating purposes. This would include all industrial and commercial properties.

There are presently a number of factors inherent in both the structure and application of Thailand's land and property tax system which significantly limit the viability of a wastewater surcharge on these taxes. These factors include:

- the minimum lot size exemption would exclude a significant proportion of the domestic customer base from the payment of the wastewater surcharge;
- the average revenue generated through the land tax is so low that the wastewater surcharge would need to be set at a level significantly higher than the land tax;
- provincial and local governments are reluctant to revalue properties at levels consistent with actual market values which has limited the rate of increase in tax revenues;
- enforcement mechanisms are problematic; and
- there are major differences in the collection rates between local authorities due to differing levels of efforts devoted to tax collection.

As a result, a surcharge on property taxes is not a good alternative method.

[22] Traditional Thai unit area; 1 rai = 0.16 ha

4.2.5 Pollution charge

Under such structures, fees are set on the basis of the pollutant loading of wastewater. Therefore, the pollution charge is fully consistent with the polluter pays principle in that fees are directly linked to the cost of treatment. As a result, the system provides an incentive to reduce the total environmental impact associated with wastewater generation rather than simply the volume of wastewater generated.

The major disadvantage of the pollution charge is the cost complexity associated with establishing and operating such a structure. The system requires a survey of all major wastewater generators in order to establish an initial database for the application of charges. The database must then be supplemented through a comprehensive and ongoing monitoring programme. Therefore, the establishment of pollution charges may be very complicated.

4.3 Empirical Findings

This study also explored the administrative and fee collection aspects of the project. The results are valuable as guidelines for further policy investigation and in generating further debates on the issue. Major results concerning such administrative parts include: (1) how should the fee be collected; (2) on what basis should the fee be based upon; and (c) what organization should collect such a fee.

Results showed that half of the respondents preferred a separate bill for wastewater treatment while a fourth of them wanted it included it in the tap water's bill. The other answers included billing it with the garbage collection fee (10%) or with property tax (10%). The basis of the wastewater treatment fee were found to be in accordance with the respondents' preferences (30%), amount of tap water used (25%), fixed rate (21%), types of house (12%), amount of wastewater (10%) and family size (2%).

The more controversial issue, at least in Bangkok, is what organization should be responsible in collecting a wastewater treatment fee. The answer is overwhelmingly the BMA (62%) followed by the MWA (33%).[23]

5.0 CONCLUSIONS AND RECOMMENDATIONS

This study successfully implemented contingent valuation studies for measuring the WTP for central wastewater treatment facilities in Bangkok that adhere to many aspects of modern contingent valuation designs.

The outcomes of the study have made it quite clear that deteriorating water quality in Bangkok is one of the major problems and the treatment might be inevitable. In addition, more than two-thirds of the respondents under the survey indicated their willingness to pay for the water treatment service should it be available, whether to improve quality to enable fishes to live in it or to allow for swimming.

[23] See related Table A3.9 - A3.11 in Appendix 3

The use of logistic regression to study the WTP for the wastewater treatment service indicates that the factors governing the respondents' behavior whether to pay for the service are education, knowledge and importance of the project, living near a river or canal, and referendum fees. On the quantitative side, the mean values of the fee for the treatment of water quality 1 and 2 are found to be 100.81 and 115.03 baht/month respectively. The use of OLS models also concludes that the amount of fees the respondents are willing to pay depend a great deal on referendum fee, income, education, quality of existing water and being near a river or canal. Finally, the significance of the referendum fee in determining the stated fee in OLS application also leads to the discovery of a starting point bias as referendum and means of the corresponding stated fees tend to go in the same direction. Majority of those unwilling to pay for the service have been found to be either protesting the bid or too poor to pay. The implication of this finding is that if they are more aware of the project and understand its importance, they might be more willing to support and even to pay the necessary fee to keep the project operational.

Institutional arrangements are essential for central wastewater treatment project implementation and the most controversial issue is what organization should be responsible for collecting a wastewater treatment fee. The selection of the most appropriate fee collection method is at least partially dependent upon customers and could be enforced through the existing wastewater operating entity. For example, should constraints on ability or willingness to pay necessitate that tariffs be initially set at relatively low levels, the most appropriate fee collection method is likely to be a simple and inexpensive system such as a flat rate. Based on the results of the household survey, it is likely that while initial charges will be constrained somewhat by willingness to pay, they could be set at levels which support the wastewater surcharge, particularly if separate billing with the MWA can be arranged.

As far as the issues of equity, efficiency, and practicality are concerned, the wastewater surcharge on metered water consumption with a joint billing arrangement in which the water and wastewater bills are combined, seems to represent the best option for billing and collection of wastewater charges.

Should joint billing not be possible, a separate wastewater billing system based on metered water consumption provided by the BMA and MWA should be considered as potentially feasible. Other issues must be raised. For instance, the MWA has been reluctant to accept the billing responsibility for wastewater treatment fee, because of the perception that customers will object and that collection of water bills will be adversely affected. Moreover, the MWA is increasing its water tariffs and perhaps justifiably feels that added burden of a wastewater treatment fee in its bill would hinder its ability to implementing the needed water tariff adjustment. Therefore, discussions with the BMA and MWA should be pursued in order to address the concerns of these agencies regarding billing, collection method, and benefit.

In applying CVM to water quality improvements of the Chao Phraya River, Bangkok residents are aware of the water pollution problem and the study showed that they are willing to sacrifice their resources to improve their standards of living. It is now up to the government to appropriately respond to this demand in a timely, efficient and effective way.

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APPENDICES

APPENDIX 1

Questionnaire to Assess Water Quality Improvements: A Contingent Valuation Study of the Chao Phraya River

Study #.....
District #.....
Supervisor's Name # .....

Respondent's
Name: Mr. Mrs. Miss: .....
Address: .....
.....
Date of Interview: ..... Time: .....A.M. or P.M.
Length of Interview: ..... minutes

There are three parts to this questionnaire:
Part 1: Environmental attitudes and concerns
Part 2: Willingness to pay a wastewater treatment fee
Part 3: Socioeconomic characteristics and household characteristics

Introduction
Notice: Respondent must be the head of the household (male or female) age 20-60 years old.
Good Morning/Afternoon/Evening: Suhkothai Thammathirat Open University and Chulalongkron University have undertaken a field survey about "Willingness to Pay the BMA Central Wastewater Treatment Fee". I am with Chulalongkron University. We are talking with Bangkok residents about the necessity for water quality improvements of canals and the Chao Phraya River, and how much central wastewater treatment facilities are worth to them. Your views will be used to help policy makers, especially the BMA, make informed decisions. Most of the questions have to do with your attitudes and opinions, and there are no right or wrong answers. Your opinion is essential for the study to enable us to know Bangkok residents' attitudes and involvement. Thank you very much for your kind cooperation.

Part 1: Questionnaire to Assess Environmental Attitudes and Concerns

1. In your opinion, which problem is the most urgent environmental problem in Bangkok that you would like immediately addressed (or solved)?
(insert order of priority, 1 implies highest order of priority, the answer can be more than one).

For interviewer: Let respondent give an oral response first.

_____1. Water pollution
_____2. Air pollution
_____3. Solid wastes
_____4. Traffic congestion
_____5. Others (please specify).....

For interviewer: Before asking the next questions, slowly read the information from Card 1, Card 2, and show photographs 1, and 2. Allow the respondent sufficient time to think. Please read Card 1

Card 1
The Chao Phraya River is Thailand's principal river, draining from a large part of the Central Plain - the rice bowl of the Kingdom - and running through the heart of Bangkok. The water quality of the lower Chao Phraya River is continuously getting worse. For the past several years, the lower section of the Chao Phraya River from Rama VI bridge to the estuary, especially at low tide, has become polluted and foul smelling from dead canals throughout Bangkok. The Chao Phraya River is suffocating. By the year 2000, the "King's River" may well be dead.

For interviewer: Please show photograph 1, and then read Card 2

Card 2

The canals run in all directions throughout Bangkok with high density, about 1 km/km2.
There are approximately 1,145 canals in Bangkok, most of which are in critical condition. Presently, the water in most canals in Bangkok is dark in color and foul smelling. The water quality in all these canals is suitable for water transportation only.

For interviewer: Please show photograph 2

Then ask the next questions

2. How do you rate the quality of surface water in Bangkok canals/the Chao Phraya River?
(check one only)

_____ 1. Excellent (water is clear during the wet and dry season)
_____ 2. Acceptable (water occasionally turns black in the dry season)
_____ 3. Not acceptable (water is always black during the dry season)
_____ 4. Severely polluted (water is black and emitting odor)

3. Do you think that water pollution in canals/the Chao Phraya River can cause?
(insert order of priority, 1 implies highest order of priority, the answer can include the same priority more than once)

_____1. Health problems
_____2. Decline in fishing
_____3. Unable to swimming
_____4. Severe pollution, emitting odor
_____5. Decline in quality of water supply
_____6. Others (please specify)

4. What are your the major uses of canals/the Chao Phraya River?
(enter as appropriate, there can be more than one answer)

_____1. Primary water purposes include swimming, washing and bathing
_____2. Secondary water purpose is water transportation
_____3. Fishing
_____4. Drinking
_____5. None
_____6. Others (please specify).....

5. Suppose you fall into a canal, how would you feel?
(check one only)

_____1. Afraid of becoming wet
_____2. Afraid of disease
_____3 Do not have any worry
_____4 Others (please specify).....

6. Suppose someone said that discharge of wastewater into canals/the Chao Phraya River is illegal. What do you think?
(check one only)

_____1. Believe to be true
_____2. Do not believe it
_____3. Do not care
_____4. Do not know
_____5. No answer

7. In your opinion, which sector is the major source of wastewater discharges?
(insert order of priority, 1 implies highest order of priority, there can be more than one answer).
_____1. Residential
_____2. Commercial
_____3. Industrial
_____4. Institutional
_____5. Others (please specify).....

8. Do you know where your household's wastewater is being discharged to?
(check one only)
_____1. Drains into a canal via the sewer
_____2. Drains into canals/the Chao Phraya River
_____3. Seeps into the ground near the house
_____4. Others (please specify).....

9. In your opinion, which is the best way to improve water quality of canals/the Chao Phraya River?
(insert order of priority, 1 implies highest order of priority, there can be more than one answer)
_____1. BMA should build a central wastewater treatment system
_____2. Households should built their own wastewater treatment plants
_____3. Encourage Bangkok residents to be aware of and participate in water quality improvement programs
_____4. Enforce the law and fine people who discharge raw wastewater directly into canals/the Chao Phraya River
_____5. Others (please specify).....

Part 2: Questionnaire to Assess Willingness to Pay a Wastewater Treatment Fee

Section 1: Central Wastewater Treatment Information

1. Have you ever heard about centralized wastewater treatment plants?

_____ 1.Yes (Continue Q. 2 and Q. 3)
_____ 2. No (go to Q. 3)

2. From (the answer can be more than one)

_____ 1. Newspaper
_____ 2. Radio
_____ 3. T.V.
_____ 4. Bangkok Metropolitan Authority's pamphlet
_____ 5. Relatives and friends
_____ 6. Others (please specify).....

3. How do you rate the importance of central wastewater treatment plants?
(check one only)

_____1. Important because .....
_____ 1.1 wastewater pollution is an urgent problem that needs to be addressed immediately
_____ 1.2 central wastewater treatment plants can improve water quality
_____ 2. Not important because.....
_____ 2.1 Wastewater does not directly affect my household
_____ 2.2 Do not believe that central wastewater treatment facilities can improve water quality
_____ 2.3 Others (please specify).....

Section 2: Benefits from Water Quality Improvements

For interviewer: Before asking the next questions, please give the respondent a copy of the BMA central wastewater treatment booklet.

- Explain details about 6 central wastewater treatment facilities by using information from the BMA booklet
- Show photographs 3, 4, and 5, and site areas map of 6 central wastewater treatment facilities
- Make sure the respondent understand very well the information on the central wastewater treatment facilities.

Then read Card 3

Card 3

The benefits of central wastewater treatment facilities will have both environmental and economic benefits. It will lead to improved water quality of canals/the Chao Phraya River. In economic terms, the benefits may include increased income from improved community health, improved productivity in fishing and agriculture, improved efficiency in water transportation and reduced costs of industrial water.

1. How do you rate the benefits to your household from water quality improvement of canals/the Chao Phraya River, which may benefit you directly or indirectly?
   (the answer can be more than one)

For interviewer: Be aware that once an item is marked "Have Benefit", it cannot be marked "No Benefit". Wait and see what the respondent says first.

Benefits of Water Quality	Have Benefit	No Benefit
1) Improved health		
2) Increase in fish population		
3) Able to swim, wash, and bath in the canal/the Chao Phraya River		
4) Improved quality of water supply		
5) Improved living condition		
6) Improved productivity of agriculture		
7) Cost savings for industrial water users		
8) Improved water transportation		
9) Increase in tourism activities		
10) Increase in price of housing and land, which are located near canal/the Chao Phraya River		
11) Watering Plants/Trees		

Section 3: Desired Water Quality Objectives

For Interviewer: Please read Card 4

Card 4

This section is about the different levels of water quality in Bangkok canals and the Chao Phraya River, and about how much the different levels of water quality in these water bodies are worth to you.

Level C is boatable.
Level B is fishable.
Level A is swimmable.

In these questions, I will not be talking about drinking water. One way of thinking about different levels of water quality is to use a ladder like the one shown in Card 5.

For interviewer: Please show Card 5

Card 5
Water Quality Ladder

Level C: "Boatable"
Level B: "Fishable"
Level A: "Swimmable"

1. What level of water quality would you like to see in the canals/ the Chao Phraya River? (There can be more than one answer)

_____1. Swimmable
_____2. Fishable
_____3. Boatable
_____4. Others (please specify).....

Section 4: Willingness to Pay

For interviewer: Please read Card 6

Card 6
Currently the SiPhraya centralized wastewater treatment plant is in operation while other facilities are under construction and will be completed by the year 2000. The wastewater treatment system consists of two parts: sewers and wastewater treatment plants. Sewers can usually be located along the side of the street. Wastewater is drained into sewers, which transmit the flow to the treatment plant. Wastewater treatment plants are usually located near the community in order to lower the collection system construction costs. After wastewater is treated, the quality of treated water should comply with the effluent standard set by the Ministry of Science, Technology, and Environment. You are not required to pay for connecting the sanitation facilities in your house to a sewer, because the BMA uses the existing public sewer system to carry wastewater to the treatment facilities.
However, the financial structure and sources of financing are crucial to implementing the BMA central wastewater treatment facilities. Thus your answer will be very important to assess policy decisions for the tariff system.

Section A

1. Would you be willing to pay the service fee for wastewater treatment facilities?

_____1. Yes, willing to pay fee (go to Section B)
_____2. No. (please give your reason why you would not pay the service fee)
_____2.1 Industry should be responsible for the problem, not the people
_____2.2 The public already pay taxes to the government, therefore, the government should be responsible for the problem
_____ 2.3 BMA should be responsible for the problem, it is not the Bangkok residents' responsibility
_____ 2.4 Need to know others' opinions about the service fee
_____ 2.5 Others (please specify).....

2. Which of these best describes your household decision?
(check one only)

_____1. Willing to pay, but not able
_____2. Able, but not willing to pay
_____3. Not able, not willing to pay
_____4. Others (please specify).....

Section B

Interviewer: Before asking the next question read card 7. Allow the respondent sufficient time to think

Card 7

In case, there are central wastewater treatment facilities, then the water quality improvement can be divided into two stages:

Stage 1: Raising the water quality from boatable to a level where fish could survive
Stage 2: Raising the water quality from boatable to a level where individuals can use canals/the Chao Phraya River for swimming.

In this section of the questionnaire, I am going to ask you how much it is worth to you to pay a central wastewater treatment fee for these two different water quality scenarios.

Version A

For interviewer: Please read Card 8

Card 8

Now, I would like to ask how much your household is willing to pay for wastewater treatment so that the BMA can improve water quality from boatable to fishable?

For interviewer: Use Card 5, which points to the levels from boatable to fishable.
Then ask the next questions

Stage 1

1. If your household would have to pay 70 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to fishable, would you be willing to pay the fee?
_____ 1.Yes (go to Q. 2)
_____ 2. No (go to Q. 3)

2. Suppose your household would have to pay 85 baht per month for the wastewater treatment fee, would you be willing to pay?
_____ 1. Yes (go to Q. 4)
_____ 2. No (go to Q.4)

3. Suppose your household would have to pay 50 baht per month for the wastewater treatment fee, would you be willing to pay?
_____ 1. Yes (go to Q.4)
_____ 2. No (go to Q.4)

4. What is the maximum that you are willing to pay for the wastewater treatment?

Maximum fee is ..... baht per month.

Stage 2

For interviewer: Please read Card 9

Card 9

Suppose, the BMA can improve water quality from boatable to swimmable. (See the levels from boatable to swimmable on Card 5).
This means higher level of treatment, at a higher cost. I am going to ask you if you are willing to pay a little bit more extra money for this alternative?

Then ask the next questions

5. If your household would have to pay 80 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to swimmable. Would you be willing to pay the fee?
   _____1. Yes (go to Q. 6)
   _____ 2. No (go to Q. 7)

6. Suppose your household would have to pay 100 baht per month for the wastewater treatment fee, would you be willing to pay?
   _____ 1. Yes (go to Q. 8)
   _____ 2. No (go to Q. 8)

7. Suppose your household would have to pay 65 baht per month for the wastewater treatment fee, would you be willing to pay?
   _____ 1. Yes (go to Q. 8)
   _____ 2. No (go to Q. 8)

8. What is the maximum that you are willing to pay for the wastewater treatment?

   Maximum fee is.....baht per month.

Version B

Stage 1

For interviewer: Please read Card 8

Card 8

Now, I would like to ask how much your household is willing to pay for wastewater treatment so that the BMA can improve water quality from boatable to fishable?

For interviewer: Use Card 5, which points to the levels from boatable to fishable.
Then ask the next questions

9. If your household would have to pay 85 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to fishable, would you be willing to pay the fee?

   _____ 1. Yes (go to Q. 10)
   _____ 2. No (go to Q. 11)

10. Suppose your household would have to pay 100 baht per month for the wastewater treatment fee, would you be willing to pay?

    _____ 1. Yes (go to Q. 12)
    _____ 2. No (go to Q. 12)

11. Suppose your household would have to pay 70 baht per month for the wastewater treatment fee, would you be willing to pay?

_____ 1. Yes (go to Q. 12)
_____ 2. No (go to Q. 12)

12. What is the maximum that you are willing to pay for the wastewater treatment?

Maximum fee is.....baht per month.

Stage 2

For interviewer: Please read Card 9

Card 9

Suppose, the BMA can improve water quality from boatable to swimmable. (See the levels from boatable to swimmable on Card 5).
This means higher level of treatment, at a higher cost. I am going to ask you if you are willing to pay a little bit more extra money for this alternative?

Then ask the next questions

13. If your household would have to pay 100 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to swimmable. Would you be willing to pay the fee?

_____1. Yes (go to Q. 14)
_____ 2. No (go to Q. 15)

14. Suppose your household would have to pay 120 baht per month for the wastewater treatment fee, would you be willing to pay?

_____1. Yes (go to Q. 16)
_____ 2. No (go to Q. 16)

15. Suppose your household would have to pay 80 baht per month for the wastewater treatment fee, would you be willing to pay?

_____1. Yes (go to Q. 16)
_____ 2. No (go to Q. 16)

16. What is the maximum that you are willing to pay for wastewater treatment?

Maximum fee is.....baht per month.

Version C

Stage 1

For interviewer: Please read Card 8

Card 8

Now, I would like to ask how much your household is willing to pay for wastewater treatment so that the BMA can improve water quality from boatable to fishable?

For interviewer: Use Card 5, which points to the levels from boatable to fishable.
Then ask the next questions

17. If your household would have to pay 100 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to fishable, would you be willing to pay the fee?

_____ 1. Yes (go to Q. 18)
_____ 2. No (go to Q. 19)

18. Suppose your household would have to pay 120 baht per month for the wastewater treatment fee, would you be willing to pay?

_____ 1. Yes (go to Q. 20)
_____ 2. No (go to Q. 20)

19. Suppose your household would have to pay 85 baht per month for the wastewater treatment fee, would you be willing to pay?

_____ 1. Yes (go to Q.20)
_____ 2. No (go to Q.20)

20. What is the maximum that you are willing to pay for the watewater treatment
Maximum fee is .....baht per month.

Stage 2

For interviewer: Please read Card 9

Card 9

Suppose, the BMA can improve water quality from boatable to swimmable. (See the levels from boatable to swimmable on Card 5).
This means higher level of treatment, at a higher cost. I am going to ask you that if you are willing to pay a little bit more extra money for this alternative?

Then ask the next questions

21. If your household would have to pay 120 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to swimmable. Would you be willing to pay the fee?

_____1. Yes (go to Q. 22)
_____ 2. No (go to Q. 23)

22. Suppose your household would have to pay 130 baht per month for the wastewater treatment fee, would you be willing to pay?

_____1. Yes (go to Q. 24)
_____ 2. No (go to Q. 24)

23. Suppose your household would have to pay100 baht per month for the wastewater treatment fee, would you be willing to pay?

_____1. Yes (go to Q. 24)
_____ 2. No (go to Q. 24)

24. What is the maximum that you are willing to pay for the wastewater treatment?

Maximum fee is.....baht per month.

Version D

Stage 1

For interviewer: Please read Card 8

Card 8

Now, I would like to ask how much your household is willing to pay for wastewater treatment so that the BMA can improve water quality from boatable to fishable?

For interviewer: Use Card 5, which points to the levels from boatable to fishable.
Then ask the next questions

25. If your household would have to pay 120 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to fishable. Would you be willing to pay the fee?

_____ 1. Yes (go to Q. 26)
_____ 2. No (go to Q.27)

26. Suppose your household would have to pay 130 baht per month for the wastewater treatment fee, would you be willing to pay?

_____ 1. Yes (go to Q. 28)
_____ 2. No (go to Q. 28)

27. Suppose your household would have to pay100 baht per month for the wastewater treatment fee, would you be willing to pay?

_____ 1. Yes (go to Q. 28)
_____ 2. No (go to Q. 28)

28. What is the maximum that you are willing to pay for the wastewater treatment
Maximum fee is .....baht per month.

Stage 2

For interviewer: Please read Card 9

Card 9

Suppose, the BMA can improve water quality from boatable to swimmable. (See the levels from boatable to swimmable on Card 5).
This means higher level of treatment, at a higher cost. I am going to ask you if you are willing to pay a little bit more extra money for this alternative?

Then ask the next questions

29. If your household would have to pay 130 baht per month for the wastewater treatment fee so that the BMA can improve water quality from boatable to swimmable. Would you be willing to pay the fee?
_____1. Yes (go to Q. 30)
_____2. No (go to Q. 31)

30. Suppose your household would have to pay 140 baht per month for the wastewater treatment fee, would you be willing to pay?

_____1. Yes (go to Q. 32)
_____2. No (go to Q. 32)

31. Suppose your household would have to pay 120 baht per month for the wastewater treatment fee, would you be willing to pay?

    _____1. Yes (go to Q. 32)
    _____2. No (go to Q. 32)

32. What is the maximum that you are willing to pay for the wastewater treatment?

    Maximum fee is.....baht per month.

Section 4: Questionnaire to Assess Institutional Arrangements

1. Which do you think is the most suitable method of the wastewater fee collection? (check only one)
   _____1. Recover through property tax
   _____2. Surcharge on water bill
   _____3. Surcharge on electricity bill
   _____4. Surcharge on its own wastewater treatment fee
   _____5. Other means (please specify).....

2. What do you think is the most suitable way to determine the charge per household. Should it be based on? (check one only)
   _____1. Volume of water use
   _____2. Number of members in the household
   _____3. Type of house (single one-story house, single two-story house,townhouse,apartment/flat/mansion/condo, commercial row house, or row house)
   _____4. Wastewater volume
   _____5. Fixed rate
   _____6. Other (please specify).....

3. Which organization should be responsible for the wastewater fee collection? (check one only)
   _____1. Metropolitan Waterworks Authority
   _____2. Metropolitan Electricity Authority
   _____3. Bangkok Metropolitan Administration
   _____4. Others (please specify).....

Part 3: Questionnaire to Assess Socio-Economic and Housing Characteristics

1. Gender
   _____1. Male
   _____2. Female

2. Age ..... years

3. Marital Status
   _____1 Single
   _____2. Married
   _____3. Windowed/Divorced/Separated

4. Education
   _____1. None
   _____2. Primary
   _____3. Secondary
   _____4.Technical,Diploma
   _____5. Bachelor
   _____6. Higher than Bachelor Degree
   _____7.Others (please specify).....

5. Occupation
   _____1. Government/State enterprise employee
   _____2. Private employee e.g. company officer
   _____3. Business (company owner)
   _____4. Merchant
   _____5. Labor (daily)
   _____6. Driver
   _____7. Unemployed and looking for work
   _____8. Others (please specify) .....

6. Total monthly income of household? .....baht/ month

For interviewer: In case the respondent has difficulty to answer this question use Card 10 then asks at what level for household income.

Card 10

Total Income Household

1. Uncertain (0 - < 4,000 baht)
2. 4,001 - 8,000 baht
3. 8001 - 12,000 baht
4. 12,001 - 16,000 baht
5. 16,001 - 20,000 baht
6. 20,001 - 24,000 baht
7. 24,001 - 28,000 baht
8. 28,001 - 32,000 baht
9. 32,001 - 36,000 baht
10. 36,001 - 40,000 baht
11. 40,001 - 44,000 baht
12. 44,001 - 48,000 baht
13. 48,001 - 70,000 baht
14. 70,001 - 90,000 baht
15. More than 90,000

For interviewer: If possible, may ask to see the bills in Q.7 and Q. 8 from the respondent.

7. What was your last monthly water supply bill?
   Amount paid last month .....baht per month.

8. What was your last monthly electricity bill?
   Amount paid last month .....baht per month.

9. Number of members in the household
   1. Number of adults .....persons
   2. Children .....persons(below 15 years old)

10. Ownership of the house
    _____1. Owned house
    _____2. Rented

11. How many years have you been living in this house? .....years.

12. Indicate the distance from your house to the nearest canal or the Chao Phraya River

    _____1. About ..... meters
    _____2. Do not know
    _____3. No answer

End of the questionnaire

Enumerator

1. Type of house

   _____1. Residential only (far away from canal/Chao Phraya River)
   _____2. Residential and commercial (far away from canal/Chao Phraya River)
   _____3. Canal houses (include residential and commercial)
   _____4. Informal settlements

2. Purpose of housing
   _____1. Residential only

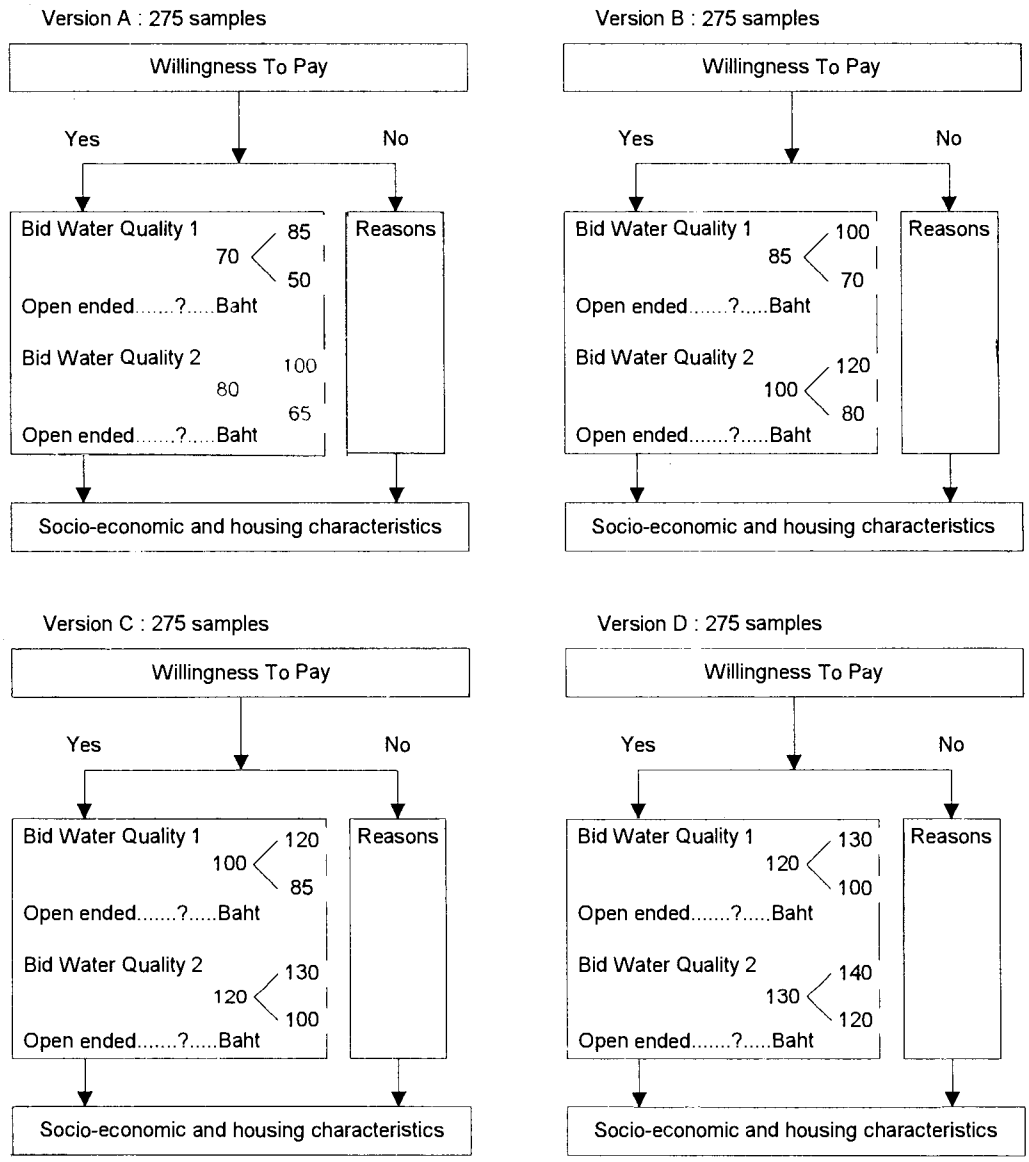
   Residential and commercial
   _____2. Small restaurant
   _____3. Grocery (retail)
   _____4. Laundry service
   _____5. Wholesaler
   _____6. Small-scale factory
   _____7. Others (please specify).....

3. Quality of interview (data)
   _____1. Excellent
   _____2. Okay
   _____3. Poor

4. Are there any other persons present during the interview?
   _____1. No
   _____2. Yes, but only listening
   _____3. Yes, and participating in the interviewing session

Appendix 2

Willingness to Pay Questionnaire Structure



In practice versions A, B, C and D were randomly selected and given to the respondents.

APPENDIX 3

Related Table Contingent Valuation Surveys

Table A3.1 Respondents' perception on the existing water quality

Water Quality	Frequency	Percent
Good	9	0.9
Fair	174	17.1
Poor	215	21.1
Very Poor	616	60.4
Others	6	0.4
Total	1,020	100.0

Table A3.2 Water quality that respondents would like it to be

Water quality desired	% of Response
Able to swim	83
Fish able to live	15
Others	2
Total	100%

Table A3.3 Effects of existing water quality

Effects of existing water quality	% of Response
Health related effects	41
Bad smell	32
Effect to raw water sources	7
Fish unable to live	6
Unable to swim	3
Others	11
Total	100%

Table A3.4 How important is this project?

Important of project	% of Response
Important	98
Not important	2
Total	100%

Table A3.5 Amount of payment (fee) per month for water treatment service

Water Quality level	Mean	Median	Mode	S.D.**
Level 1: Able for fish to survive	100.81	100.00	100.00	68.51
Level 2: Able to swim	115.03	100.00	100.00	77.41

S. D. ** = Standard Deviation.

Table A3.6 Reasons not to pay for the water treatment service

Reason not to Pay	Percent
Most of the waste water comes from the industrial sector	5.3
We already pay taxes, government should provide such services	62.6
BMA should take care of it, not the citizens	21.1
Wait to see whether others will pay	6.8
Others	4.2
Total	100.0

Table A3.7Major characteristics of those who belong to a group of 'protest bid' and who are not

	'Protest bid'	Not 'Protest bid'
Income (baht per month, mean)	18,173	14,261
Education level (mode)	primary school	primary school
Age (mean)	43.8	42.4
Sex (% female)	52.7	52.8
Knowledge of the project (% yes)	67.3	74.7
Importance of the project (% yes)	95.5	98.4
Living in a resident/commercial quarter (%)	27.3	21.4
Living near canal or rives (%)	10.0	19.8
Living in densely populated area (%)	10.0	15.7

Note that significant differences in characteristics of those 'protest bid' and the rest of the samples are observed in income and living conditions. In terms of income, the above table indicates that those who are in the 'protest bid' group do have higher average income. This might indicate that those who have higher income are expecting more from the society or that they are able to get access to clean water and the treatment is unnecessary for them. This latter point might be emphasized when looking at the data concerning living conditions. It has been clear that only 10% of those 'protest bid' are living near a river or canal while 19.8% of those who are not 'protest bid' are living near such water sources. In addition, those in the group of 'protest bid' seem to be living in a better environment since 27.3% are living in a resident/commercial quarter and only 10% are living in a densely populated area. Comparative figures for those who are willing to pay for the treatment (not 'protest bid) are 21.4% and 15.7% respectively. The other characteristics that distinguish these groups of respondents include age, whether they are aware of the project (knowledge) and a perception on the importance the project. It should be noted that sex and education do not play a very important role in determining whether a respondent belongs to a group of 'protest bid' or not.

Table A3.8 Correlation coefficients (Spearman's rho) of variables employed

	AHT2	AHT3	AHT4	EDU	INCOM	PAYYN	PI	PK	REF1	REF2	WQN	SEX
AHT2	1.000	-0.254	-0.224	0.048	0.117	0.006	0.025	0.029	0.051	0.046	-0.054	-0.015
AHT3	-0.254	1.000	-0.200	-0.098	-0.054	0.006	-0.018	-0.012	0.020	0.016	0.024	-0.061
AHT4	-0.224	-0.200	1.000	-0.107	-0.163	0.026	0.013	-0.050	-0.016	-0.015	-0.014	0.014
EDU	0.048	-0.098	-0.107	1.000	0.407	0.059	0.009	0.087	0.060	0.054	0.006	0.149
INCOM	0.117	-0.054	-0.163	0.407	1.000	0.046	0.037	0.095	0.002	0.002	0.011	0.076
PAYYN	0.006	0.066	0.026	0.059	0.046	1.000	0.105	0.124	-0.129	-0.125	0.012	0.012
PI	-0.025	-0.018	0.013	0.009	0.037	0.105	1.000	0.029	-0.055	-0.056	0.080	-0.033
PK	0.029	-0.012	-0.050	0.087	0.095	0.124	0.029	1.000	-0.052	-0.050	-0.040	0.017
REF1	-0.051	0.020	-0.016	0.060	0.002	-0.129	-0.055	-0.052	1.000	0.984	-0.016	0.004
REF2	-0.046	0.016	-0.015	0.054	0.002	-0.125	-0.056	-0.050	0.984	1.000	-0.017	0.001
WQN	-0.054	0.024	-0.014	0.006	0.011	0.012	0.080	-0.040	-0.016	-0.017	1.000	0.096
SEX	-0.015	-0.061	0.014	0.149	0.076	0.012	-0.033	0.017	0.004	0.001	0.096	1.000

Table A3.9 How the fee should be based?

Fee determination basis	% of Response
Quantity of (tap) water use	30
Fixed rate	25
Types of house	21
Quantity of wastewater	12
Family size	10
Others	2
Total	100%

Table A3.10 How the fee should be collected?

Fee collecting method	% of Response
Separately billed	48
With tap water bill	28
With garbage collection bill	12
With housing tax	10
Others	2
Total	100%

Table A3.11 Organization that should be responsible for collecting wastewater treatment fee

Organization	% of Response
Bangkok Metropolitan Administration	66
Metropolitan Waterworks Authority	33
Others	1
Total	100%

APPENDIX 4

Basic Information about the Samples		
1. Number of respondents:	1,020	
2. Income:	Mean Mode Standard Deviation	16,200 Baht (US$440)/month 6,000 Baht (US$164)/month 1,800 Baht (US$50)/month
3. Sex:	Female Male	52.9% 47.1%
4. Age:	Mean Mode Standard Deviation	42 years 40 years 11 years
5. Education:	Not finish school Primary school Secondary school Others	4.6% 41.7% 23.4% 30.3%
6. Occupation:	Trading Daily employee Employee Ownership Government Officer Others	33.9% 15.7% 12.5% 13.0% 9.6% 15.3%
7. Knowledge about the project:	Know Don't know	73.7% 26.3%
8. Importance of the project:	Important Not important	98.0% 2.0%

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