NO.

MID-TERM EVALUATION REPORT

ON

THE PROJECT

FOR

IMPROVEMENT OF SEWAGE TREATMENT PLANT MANAGEMENT IN THAILAND

March 2006

Japan International Cooperation Agency (JICA)

Thailand Office

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06-005

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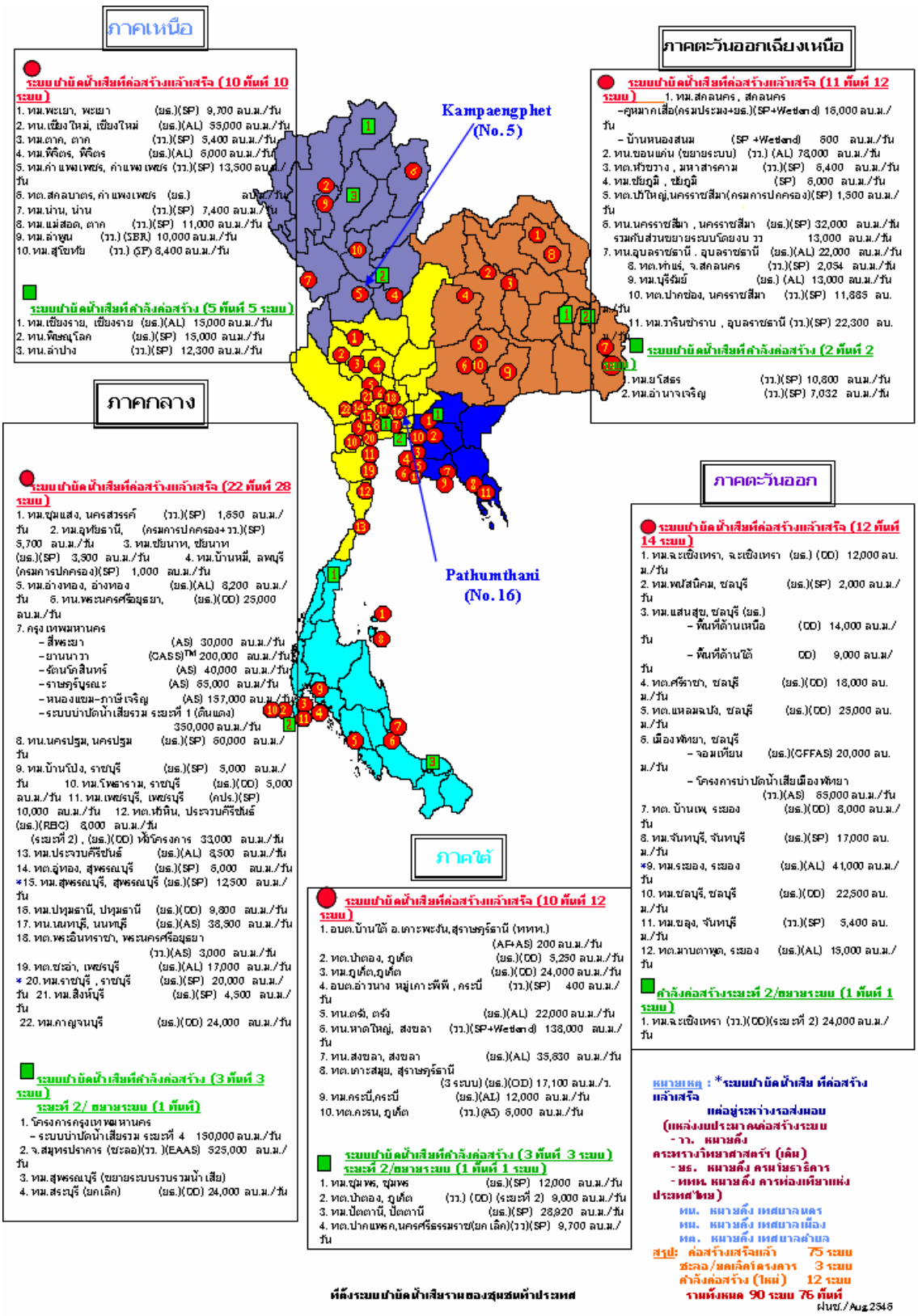

Photos of Activities

The STP in Kampaengphet Town Municipality

1. Kampaengphet STP (Stabilization Pond)

2. Inspection of check valve conditions

3. Manual racked screen (before improvement)

4. Manual racked screen (after improvement)

The STP in Pathumthani Town Municipality

5. Pathumthani STP (Oxidation Ditch) (Before rehabilitation)

6. Pathumthani STP (After rehabilitation)

Note: More pictures are shown in the **ANNEX VIII**.

Abbreviations

AL	Aerated Lagoon
AS	Activated Sludge
BOD	Biochemical Oxygen Demand
CPs	Counterparts
JICA	Japan International Cooperation Agency
LAs	Local Authorities
MONRE	Ministry of Natural Resources and Environment
OD	Oxidation Ditch
O&M	Operation and Maintenance
PCD	Pollution Control Department
PDM	Project Design Matrix
PLC	Programmable Logistic Controller
PS	Pumping Station
R/D	Record of Discussion
SP	Stabilization Pond
STP	Sewage Treatment Plant
TCSW (project)	Training Center for Sewage Works (project)
WMA	Wastewater Management Authority

Executive Summary

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<tr><td colspan="2">Issue / Sector: Sewerage</td><td>Cooperation scheme:
Project-type Technical Cooperation</td></tr>
<tr><td colspan="2">Division in charge: JICA Thailand Office</td><td>Total cost: 120,282 thousands Japanese yen</td></tr>
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November 25, 2007</td><td>Partner Country's Implementing Organization:
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1. Background of the Project

Thailand has faced various environmental problems due to the rapid economic growth and urbanization. The former Ministry of Science, Technology and Environment and the Public Works Department actively promoted the development of sewage treatment facilities in all over Thailand in the 1990s in order to respond to the problems of water pollution. Since Thailand faced shortages in technical personnel who could operate and maintain those newly built facilities appropriately, the Training Center for Sewage Works (TCSW) Project was implemented from August 1995 to July 2000 in order to meet the urgent demands to foster technical personnel. Through the TCSW project, about 1,000 technical officers underwent training sessions. However, it became clear that inappropriate designing and insufficient operation and maintenance of sewage treatment plants (STPs) were root causes of malfunction of many STPs. Under these circumstances, the Project for Improvement of Sewage Treatment Plant Management in Thailand, which targets improvement of STPs efficiently, started in May 2004 for the period of three and a half years.

2. Project Overview

The Project aims to rehabilitate a few malfunctioning STPs, improve the method of operation and maintenance of those STPs, and then disseminate knowledge and experiences obtained through those activities in order to improve efficiency of many existing STPs.

(1) Super Goal

The water quality of public water bodies is improved.

(2) Overall Goal

Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.

(3) Project Purpose

Efficient and effective operation method of STPs is established.

(4) Outputs

Output 1: Function of focused STPs is recovered.

Output 2: Reference materials for improvement of sewage treatment plant management are developed.

Output 3: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.
Output 4: Information system is established to disseminate reference materials and to collect O&M data.

(5) Inputs (as of this mid-term evaluation)

Japanese side:

- Long term expert 4 persons ・Equipment supply 6,823 thousand yen
- Short term expert 4 persons ・Local cost 26,929 thousand yen
- Number of trainees received in Japan 4 persons

Thai side:

- Counterparts 20 persons ・Facilities and part of local cost

II. Evaluation Team

Members of Evaluation Team	Team Leader:	Mr. Shoichi Okumura, Deputy Resident Representative, Thailand Office, JICA
	Evaluation Planning:	Mr. Hirofumi Kinugasa, Assistant Resident Representative, Thailand Office, JICA
	Wastewater Operational Management:	Mr. Haruki Takahashi, Japan Sewage Works Agency
	Wastewater Planning Management:	Ms. Hiroko Kamata, Senior Advisor, Institute of International Cooperation, JICA
	Evaluation Analysis:	Ms. Misa Oishi, Consultant, IC Net Limited

Period of Evaluation: February 20, 2006 - March 8, 2006

Type of Evaluation: Mid-term Evaluation

III. Results of Evaluation

1. Summary of Evaluation Results

In general, the Project received planned inputs from both the Japanese and Thai sides as scheduled and thus there are no serious problems. As for output levels of the Project, although the output 2 “Reference materials for improvement of sewage treatment plant management are developed” is slightly behind the schedule, the Project is likely to produce enough outputs and achieve the project purpose during the Project period.

(1) Relevance

In Thailand, *The National Policy and Plan for Environmental Quality Promotion and Conservation B.E. 2540-2559 (A.D. 1997-2016)* formulated by the Office of Environmental Policy and Planning and ordained by the National Environment Board covers various environmental issues over the 20 year period from 1997. Water quality improvement and wastewater treatment are considered important issues in this policy. On the other hand, environmental issues are considered as one of the priority areas in development assistance according to the initiatives by the Ministry of Foreign Affairs of Japan. Thus the Project, directly contributing to improvement of wastewater treatment system and prevention of water pollution, complies with both the priorities set by the environmental policy of Thailand and Japanese aid policy.

WMA, a state-owned enterprise, provides support to local authorities for sound operation of STPs.

Since the revision of the Royal Decree in 2005, the responsibilities and opportunities of WMA as an authorized agency have been expanded. Under these circumstances, fostering of skilled technical personnel of WMA is urgently needed. Thus it is relevant to promote transfer of technology towards WMA counterparts.

In Japan, there is an organization called Japan Sewage Works Agency, which functions like WMA. This organization has contributed greatly to developing the wastewater treatment facilities and improving wastewater treatment technologies. Thus the Project is relevant in terms of advantages of Japanese technology.

(2) Effectiveness

Although the output 2 is slightly behind the schedule, a number of activities have been accumulated for each output. Thus it can be said that the project purpose will probably be achieved. The accumulated knowledge and experiences through a number of rehabilitation activities carried out in the two focused STPs have greatly contributed to formulation of reference materials which contextualize situations in Thailand. It is worth keeping in mind that the reference materials are major means to disseminate technical knowledge and information accumulated through all activities. Thus it is important to monitor the level of dissemination as a factor which will significantly affect the effectiveness of the Project.

(3) Efficiency

Due to the delay in approval of amendment to the R/D, the long-term expert on electric and machinery engineering and the project coordinator were dispatched later than originally scheduled. This had a negative impact on the progress at the beginning of the Project. However, since then, the Project has received planned inputs from both the Japanese and Thai sides as scheduled. Given the present level of outputs and many activities carried out by now, efficiency of the Project can be judged as sufficient at this stage. As for the counterparts' assignment, it is true that counterparts are busy with routine WMA work, but it became clear that counterparts were doing their best and actively participating in Project activities to produce outputs. For instance, each output is assigned to the specified counterpart, and he/she closely works with the Project team on the matter. The Japanese experts confirm that they are assigned in an efficient manner to produce outputs.

(4) Impact

At this moment, it is too early to assess the overall impact of the Project since it requires more time and inputs beyond the Project framework to achieve the overall goal. The positive development which affects impact is the revision of the Royal Decree in 2005, which placed more responsibilities and opportunities to WMA. In addition, it became clear that the overall wastewater collection system and the capacity of each local authority will definitely affect the achievement level of the overall goal, and therefore it is important to monitor any development in this regard. The overall conditions of the wastewater collection system in particular are acknowledged as an important assumption.

(5) Sustainability

The five-day training for the officers in charge of wastewater management was successfully organized. The involvement of WMA senior technical officers as lecturers in the training session gave them

experiences as lecturers, and this helps WMA staff members to organize the training sessions by themselves later on. In addition, it is currently under consideration to make one of the forthcoming reference materials a guideline. If this materializes, it also secures sustainability of the Project.

After the revision of the Royal Decree in 2005, the responsibilities and opportunities of WMA have expanded. In order to meet increasing responsibilities and opportunities, WMA is now hiring more employees. As for the financial aspect of WMA, the figures related to the result of operation have been in an upward trend. Those factors secure the Project sustainability of WMA as the implementing organization.

2. Factors that promoted realization of effects

(1) Factors concerning the Planning

In the Project, Japanese experts have been working closely with counterparts in order to rehabilitate the two focused STPs. Working closely with counterparts in the focused sites enables the transfer of technology to be most effective. It also contributes to fostering rapport between Japanese experts and counterparts. The knowledge and experiences obtained at the focused sites have been well utilized to organize the practical training. Likewise, the reference materials are to be practical and suitable to the Thai situation by employing the knowledge and experiences at the focused sites.

(2) Factors concerning the Implementation Process

The regular monthly team meeting, in which both counterparts and Japanese experts take part, functions adequately as a formal means of communication to monitor the progress of the Project and share technical information. It also facilitates smooth communication among the project members. In addition, each output is assigned to the specified counterpart, and he/she works closely with the Project team on the matter. This helps affirm the commitment of counterparts.

3. Factors that inhibited realization of effects

(1) Factors concerning the Planning

Now WMA supports only 10 STPs. Thus it became apparent that a mechanism to enhance the collaboration with the Pollution Control Department, a regulator of wastewater treatment systems, is necessary in order to magnify effects of the Project beyond 10 STPs under the supervision of WMA.

Issues concerning the indicators of the output 1 were raised during the course of the mid-term evaluation. Presently, two indicators, namely (i) Unit cost (Baht/m^3) is reduced by 20% at the focused STPs and (ii) Treated wastewater is increased by 30% at the focused STPs, are not considered as suitable for measuring discernable effects of the Project. Thus, the discussion was done to define the first two indicators more clearly, as seen in the recommendation part, without changing indicators themselves.

(2) Factors concerning the Implementation Process

Counterparts are indeed busy with routine WMA work and business trips. Thus some of the activities had to be initiated by Japanese experts. Although the major activities have been carried out almost always with counterparts, the progress of the Project is inevitably affected when the counterparts have

to give priority to work other than the Project.

It is highly beneficial that Japanese experts along with counterparts have carried out many activities. However, no comprehensive reports or public relations documents on those activities have been formulated and distributed. Thus relevant organizations and the general public are unaware of the contributions of the Project.

4. Conclusion

Although the progress of outputs in uneven, given the present status of implementation, the project purpose is expected to be achieved by the end of the Project.

5. Recommendations

■ Enhancing the collaboration with the Pollution Control Department (PCD)

As previously noted, besides WMA, there is another important organization called PCD. PCD functions as a regulating agency and monitors all STPs in Thailand while WMA is an implementing agency working for the limited numbers of STPs. Thus it is essential to encourage PCD to take part in the Project in order to disseminate the Project's outputs to STPs beyond STPs supervised by WMA.

■ Redefining conditions for the objectively verifiable indicators of output 1

In order to measure output 1 more precisely, the Team recommends the Project to redefine conditions to use objectively verifiable indicators as follows:

- Indicator 1-1: Base data measurement for decrease of the unit operation cost

  Base data should be data obtained before employing the cost-reduction suggestions by JICA experts. For STP in Pathumthani, the base data for the unit cost should be 10.4 baht/m^3 of May 2005. For STP in Kampaengphet, the base data for unit cost should be the average unit cost of January and February of 2006. Additionally, cost reduction effects by elements such as electricity expense and personnel expense should be also considered.
- Indicator 1-2: Base data measurement for increase of treated wastewater

  Base data should be accurate and limited to only sanitary wastewater excluding storm water. Thus they should be the average figure of flow rates in dry season only after the reliable flow rate measurement is secured. In concrete terms, the volume of influent wastewater of December 2005, January 2006 and February 2006 on average should be applied as base data. At the time of terminal evaluation, the base month for base data can also be reviewed.

■ Complementing the indicator 1-2 of output 1

For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, the technical suggestions and proposals related to improvement of wastewater collection system, etc, should be made to increase efficiency of the focused STPs. At the instance of terminal evaluation, the evaluation team should study the likelihood of realizing those suggestions and proposals. In this regard, the Team recommends that the Project encourage local authorities of the focused STPs to take part in the Joint Coordinating Committee and make them aware of the importance of the wastewater system, especially improvement of the wastewater collection system.

■ Developing reference materials which can serve many users

The Team recommends the Project to reconsider the contents of reference materials and concentrate on materials with higher priorities, if necessary, based on the discussion within the project team. Reference materials could be in various forms such as guidelines, training materials and manuals / check sheets for O&M, but should be highly useful.

■ Continuing the training activities

According to the PDM, the training activities target the personnel in the focused STPs only. However, the tailor-made intensive training sessions, which the Project organized once in January 2006, could be one of the most effective ways to disseminate knowledge that the Project is trying to disseminate through the reference materials. In order to assure the achievement of the project purpose, continuation of training sessions by using reference materials is highly recommended. During the training sessions, the water quality measurement equipment of the Training Center for Sewage Works (TCSW) Project transferred from the Public Works Department can be also utilized.

■ Enhancing the public relations activities

Unfortunately, a number of accumulated activities and knowledge are not compiled in a written form. It became clear, only by interviewing experts individually, that a large number of activities have been carried out by each expert. The Team recommends documenting the progress of the Project, by preparing newsletters and booklets, and publicizing what the Project has done, not individually but as the Project. These documents also help the Project to show its presence to the general public.

6. Lessons Learned

No lessons learned were extracted as of this mid-term evaluation.

1. Outline of the Evaluation Study

1.1 Background of the Evaluation Study

The Japanese Mid-term Evaluation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (JICA), headed by Mr. Shoichi Okumura, conducted an study from February 20th to March 8th, 2006, for the mid-term evaluation of the Project for Improvement of Sewage Treatment Plant Management in Thailand (hereinafter referred to as "the Project").

1.2 Objectives of the Evaluation Study

The main objectives of the evaluation study are as follows.

i. To confirm the process and outcomes of the Project and evaluate its achievement from the viewpoints of relevance, effectiveness, efficiency, impact and sustainability
ii. To extract recommendations and lessons learned to improve the future activities of the Project and JICA's future planning and management of similar projects
iii. To enhance the knowledge of WMA on JICA's evaluation through joint evaluation process
iv. To meet accountability to the Japanese taxpayers by producing an evaluation report

1.3 Members of the Evaluation Team

The Team carried out the study in order to monitor and assess the project achievement from the commencement of the Project up to February 2006, from the perspectives of relevance, effectiveness, efficiency, impact and sustainability, and to come up with recommendations for better project management for the rest of the cooperation period.

Team Leader:
Mr. Shoichi Okumura, Deputy Resident Representative, Thailand Office, JICA

Evaluation Planning:
Mr. Hirofumi Kinugasa, Assistant Resident Representative, Thailand Office, JICA

Wastewater Operational Management:
Mr. Haruki Takahashi, Director, Research and Technology Development Department, Japan Sewage Works Agency

Wastewater Planning Management:
Ms. Hiroko Kamata, Senior Advisor, Institute of International Cooperation, JICA

Evaluation Analysis:
Ms. Misa Oishi, Consultant, IC Net Limited

1.4 Schedule of the Evaluation Study

Date		Activities
Feb. 20	Mon.	Meeting with JICA experts and Thai counterparts at WMA
Feb. 21	Tue.	Attending at the monthly team meeting to explain the process of the mid-term evaluation Interview with Mr. Akanit Ampawasiri and Mr. Sombat Paneiam at WMA
Feb. 22	Wed.	Interview with Mr. Supparat Ittipol, Mr. Thanawat Nakornchai, Ms. Hatarirat Likitanupak and Mr. Phanthat Chuncharoensook at WMA
Feb. 23	Thu.	Interview with Mr. Chusup Saisang at Kamphaengphet municipality and Ms. Anchalee at the Kamphaengphet Sewage Treatment Plant
Feb. 24	Fri.	TV meeting at JICA office
Feb. 25	Sat.	Preparation of evaluation summary
Feb. 26	Sun.	Preparation of evaluation summary
Feb. 27	Mon.	Interview with Dr. Chaiyo Juisiri at PCD Interview with Mr. Atirak Bupachanto at WMA
Feb. 28	Tue.	Interview with Mr. Carsten Hollaender Laugesen of DANIDA
Mar. 1	Wed.	Interview with Mr. Anirut Aree at Pathumthani municipality, and interview with Mr. Atapol Kanokrattana at Pathumthani Sewage Treatment Plant
Mar. 2	Thu.	Submission of the draft report / evaluation grid Arrival of two members (Mr. Takahashi and Ms. Kamata) of the Team from Tokyo Briefing of the draft report / evaluation grid
Mar. 3	Fri.	Meeting on the draft report / evaluation grid at WMA
Mar. 4	Sat.	Site visit to STP in Pathumthani
Mar. 5	Sun.	Preparation of Minutes of Meetings
Mar. 6	Mon.	Meeting with Thai CPs on the results of the evaluation and Minutes of Meetings
Mar. 7	Tue.	Meeting with Thai CPs on the results of the evaluation and Minutes of Meetings
Mar. 8	Wed.	Joint Coordinating Committee Meeting and Discussion of the Minutes of Meetings Report to JICA Thailand Office

2 Outline of the Project

2.1 Background of the Project

The sewerage management is indispensable not only for living environment improvement but also for water pollution reduction in public water bodies. The first modern sewage treatment plant (STP) with the capacity of 2,400 cubic meters per day was constructed in 1971 to serve a housing complex in Bangkok. In the areas outside Bangkok, modern STPs were first constructed in Khon Kaen and Patong in Phuket in 1985. The former Ministry of Science, Technology and Environment and the Public Works Department actively promoted the development of sewage treatment facilities in all over Thailand in the 1990s in order to address the problems of water pollution. As of 2003, in the regions except Bangkok, 14 STPs were under construction, 51 in operation and 12 dormant[1]. The

[1] These figures have changed since the inauguration of the rehabilitation plan, which was prepared by the Pollution Control Department (PCD). For example, according to the hearings from PCD, nine out of 14 STPs that were planned to be constructed were completed. Other latest figures were not disclosed.

total design capacity with all 87 STPs in Thailand is to be about 1.3 million cubic meters per day. Since Thailand faced acute shortages in technical personnel who could operate and maintain those newly built facilities appropriately, the Training Center for Sewage Works (TCSW) Project had implemented training sessions from August 1995 to July 2000 in order to meet the urgent demands to foster technical personnel. Through the TCSW project, about 1,000 technical officers underwent training sessions.

As mentioned above, it became clear that Thailand had many sewerage facilities but most of them were not utilized in an effective manner. According to the project document issued in September 2004, the following problems were common.

- Inadequate operation and maintenance
- Unwillingness to implement sewerage tariff
- Low financial capability of municipalities
- Insufficient skills and knowledge of operators

Therefore, it was urgently required to restore the primary function of constructed sewerage facilities and make them do what they were supposed to do for the welfare of the people.

The Project for Improvement of Sewage Treatment Plant Management in Thailand was formulated from this background to solve the above-mentioned problems and to restore STPs' primary function. The project document clearly states that, although it will be ideal to solve all these problems concurrently, problems related to the collection system and administrative and financial matters are impossible to solve in a rather short period of five to ten years. Thus the Project focused on solving the technical problems.

The Project has been implemented in accordance with the Record of Discussion (R/D) signed on May 25, 2004, between JICA and the Wastewater Management Authority (WMA). Due to the necessity for modification of the project design matrix (PDM), the project strategy was reviewed after the signing of the R/D. Based on the review and subsequent discussions, the amendment to the R/D was signed on March 8, 2005. The Project, which started officially on May 26, 2004, was then fully able to undertake its activities.

2.2 Summary of the Project

According to the newly revised PDM as seen in the **ANNEX II**, the overall goal, purpose and outputs of the Project are as follows.

Super Goal:
The water quality of public water bodies is improved.

Overall Goal:
Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.

Project Purpose:
Efficient and effective operation method of STPs is established.

Project Outputs:

1) Function of focused STPs is recovered.
2) Reference materials for improvement of sewage treatment plant management are developed.
3) Skilled personnel are assigned to operate and maintain the focused STPs appropriately.
4) Information system is established to disseminate reference materials and to collect O&M data.

Project Activities:

1. Function of focused STPs is recovered.

1-1. Review rehabilitation plan of focused STPs
1-2. Support implementation of rehabilitation focused STPs.
1-3. Inspect rehabilitation works
1-4. Operate and maintain rehabilitated STPs.

2. Reference materials for improvement of sewage treatment management are developed.

2-1. List necessary reference materials.
2-2. Examine methodology to develop reference materials.
2-3. Conduct research works for development of reference materials.
2-4. Develop reference materials.

3. Skilled personnel are assigned to operate and maintain the focused STPs appropriately.

3-1. Decide areas of necessary knowledge and skills for officers in charge.
3-2. Prepare training materials.
3-3. Execute training.

4. Information system is established to disseminate reference materials and to collect O&M data.

4-1. Prepare reference materials for dissemination.
4-2. Collect operation and maintenance data report (daily, weekly, monthly, yearly report).
4-3 Collect completion document (construction drawings, plans and specifications, As-build drawings).
4-4. Investigate existing information systems.
4-5. Develop information system modifying existing ones.

3 Evaluation Process

3.1 Methodology of the Evaluation Study

The original project design matrix (refer to **ANNEX I**), which was attached to the Record of Discussions (R/D) signed between JICA and WMA, is utilized as a basis of the evaluation. However, while the evaluation was under way, some of the indicators turned out to be not necessarily appropriate for measuring the achievement. Thus, in addition to the original indicators, other indicators are used to evaluate some of the outputs.

The Team conducted an extensive review of documents and other materials produced by the Project and the other sources to assess achievement of the Project quantitatively. The Team also conducted a qualitative assessment through questionnaire surveys (refer to **ANNEX X**), interviews and field observations (refer to **ANNEX VIII**). The results of these exercises were presented and reviewed in the Joint Coordinating Committee meeting on March 8, 2006, and finalized as attached in the minutes.

Achievement of the Project has been evaluated by the following five criteria through discussion between the two sides.

a. Relevance

Relevance of the project plan is reviewed by the validity of the project purpose and the overall goal in connection with the development policy of the Governments of the member countries and the needs of the beneficiaries as well as the logical consistency of the project plan.

b. Effectiveness

Effectiveness is assessed by evaluating to what extent the Project has achieved its purpose and clarifying the relationship between the purpose and outputs.

c. Efficiency

Efficiency of the project implementation is analyzed with an emphasis on the relationships between inputs and outputs in terms of timing, quality and quantity.

d. Impact

Impacts of the Project are assessed by either positive or negative influences caused by the Project.

e. Sustainability

Sustainability of the Project is assessed in managerial, financial and organizational aspects by examining the extent to which the achievement of the Project will be sustained and expanded after the completion of the Project.

3.2 Review of the Evaluation Basis

3.2.1 Revisions of PDM

The following revisions of the original PDM were discussed and approved in the Joint Coordinating Committee meeting on March 8, 2006, as seen in the **ANNEX II**.

(1) Revision regarding to output 3

Output 3

Original: Qualified personnel are assigned to operate and maintain STPs appropriately.

Revision: <u>Skilled</u> personnel are assigned to operate and maintain <u>the focused</u> STPs appropriately.

Objectively verifiable indicator 3-1

Original: Evaluation of personnel assigned for the focused STPs based on the Qualification standard.

Revision: <u>Personnel assigned for the focused STPs undergo trainings organized by the Project.</u>

Objectively verifiable indicator 3-2

Original: All of the focused STPs are managed by qualified personnel.

Revision: All of the focused STPs are managed by skilled personnel.

Activity 3-1

Original: Establish qualification standards.

Revision: Decide areas of necessary knowledge and skills for officers in charge.

(2) Addition of an important assumption from the project purpose to the overall goal

- The problems relating to the wastewater collection system are solved.

(3) Deletion of a means of verification 1-1

This was a means of verification of the PDM of the planning stage, and thus this should be deleted from the present PDM.

3.2.2 Other Discussions on PDM

The Team intensively discussed the objectively verifiable indicators of output 1 during the course of the mid-term evaluation. The output 1, "Function of focused STPs is recovered", is measured by the following indicators.

1. Unit cost (Bath/m3) is reduced by 20% at the focused STPs.
2. Treated wastewater is increased by 30% at the focused STPs.
3. Effluent water quality meets the standard at the focused STPs.

Among the three, the first two were under thorough examination by the Team.

In fact, in order to achieve the output 1, the Project has proposed many ways and ideas from the viewpoints of unit cost reduction and treated wastewater increase for the focused STPs. For example, major proposed ideas are as follows:

1. STP in the Kampaengphet Town Municipality
   1-1 Unit cost reduction
      ・Improvement of check valve conditions
   1-2 Treated wastewater increase
      ・Expansion of the service area including a facility near the PS
2. STP in the Pathumthani Town Municipality
   2-1 Unit cost reduction
      ・Intermittent operation of aerators in oxidation ditch
      ・Single-train operation of oxidation ditch
   2-2 Treated wastewater increase
      ・Increase of pump operation time at pumping stations

Many other proposals and suggestions by the Project are detailed in the "Activities for output 1" section under the Efficiency part of the Evaluation Grid (refer to **ANNEX V**).

However, it became clear that the first two indicators, unit cost and treated wastewater volume, were

unsuitable for measure discernable effects of the Project at this stage of implementation due to the following reasons:

- Although the Project proposed many ways of cost reduction and some of them have been already employed, there are some other suggested methods which have not yet been employed.
- The major suggestions for treated wastewater increase would be employed in later in the project period and thus the effects would be brought about later.
- Prior to the Project, there was no accurate base data on treated wastewater volume in the dry season in both of the focused STPs and electricity of STP in Kampaengphet, which should be compared with data at the end of the Project.

The unit cost and influent wastewater of the focused STPs are shown in the following two tables. Those of STP in Kampaengphet became more accurate after an electric magnetic flow meter had been installed in October 2005 and a watt-hour was measured every day from January 2006. Those of STP in Pathumthani would be compared before and after an electric magnetic flow meter was set up by the Project in June 2005.

Table 3-1: Operational costs of Kampaengphet STP

Items	**unit**	**Nov-05**	**Dec-05**	**Jan-06**
Personnel expense	baht	109,650	109,650	109,650
Maintenance expense	baht	11,500	10,000	15,000
Electricity expense	baht	25,000	26,500	26,500
Chemicals and analysis expense	baht	12,000	12,000	13,000
Other	baht	15,000	13,000	13,000
Total expense	baht	173,150	171,150	177,150
Monthly influent	m^3	269,816	114,725	95,463
Unit cost	baht/ m^3	0.6	1.5	1.9
Unit electricity expense	baht/ m^3	0.1	0.2	0.3

Table 3-2: Operational costs of Pathumthani STP

Items	**unit**	**May-05**	**Jun-05**	**Jul-05**	**Aug-05**	**Sep-05**	**Oct-05**	**Nov-05**	**Dec-05**
Personnel expense	baht	260,000	270,000	280,000	290,000	310,000	240,000	250,000	250,000
Expense for repairing machinery	baht			30,000	30,000	30,000	10,000	30,000	30,000
Electricity expense	baht	170,000	151,064	76,480	69,800	66,435	58,756	52,492	66,085
Water expense	baht	10,500	12,481	9,197	3,528	3,897	8,052	6,798	7,797
Telephone expense	baht	5,000	5,500	6,000	6,000	6,000	4,593	3,836	2,328
Chemical expense	baht	36,000	40,000	25,000	20,000	28,906	20,000	22,000	20,000
Fuel expense	baht			20,000	34,000	34,000	15,000	20,000	15,000
Water quality analysis expense	baht	4,500	3,500	8,000	8,000	12,000	8,000	15,000	15,000
Other	baht	71,000	75,000	70,000	80,000	80,000	12,353	15,600	12,000
Total expense	baht								

		557,000	557,545	524,677	541,328	571,238	376,754	415,726	418,210
Monthly influent	m^3	53,510	19,277	49,445	15,875	53,188	41,123	45,957	31,016
Unit cost	baht/m^3	10.4	28.9	10.6	34.1	10.7	9.2	9.0	13.5
Unit electricity expense	baht/m^3	3.2	7.8	1.5	4.4	1.2	1.4	1.1	2.1

Under these circumstances, in order to measure output 1 more precisely, redefinition of conditions to use objectively verifiable indicators is recommended as follows:

- Indicator 1-1: Base data measurement for decrease of the unit operation cost

  Base data should be data obtained before employing the cost-reduction suggestions by JICA experts. For STP in Pathumthani, the base data for unit cost should be 10.4 baht/m^3 of May 2005. For STP in Kampaengphet, the base data for unit cost should be the average unit cost of January and February of 2006. Additionally, cost reduction effects by elements such as electricity expense and personnel expense should be considered.
- Indicator 1-2: Base data measurement for increase of treated wastewater

  Base data should be accurate and limited to only sanitary wastewater excluding storm water. Thus it should be the average figure of flow rate in the dry season only after the reliable flow rate measurement is secured. In concrete terms, the volume of influent wastewater of December 2005, January 2006 and February 2006 on average should be applied as base data. At the time of the terminal evaluation, the base month for base data can also be reviewed.

Regarding the possibility of achieving the targets of the above indicators, counterparts (CPs) expressed a concern that the target of the indicator 1-1 is likely to be achieved, but the target of the indicator 1-2 might not be achieved. The reason is that WMA itself is incapable of implementing most of the activities to increase the wastewater volume such as expansion of wastewater collection area and connecting specified major facilities including hospitals, schools and large office buildings. Instead, local authorities (LAs) are in charge of them. Then the following is recommended for indicator 1-2.

- For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, the technical suggestions and proposals for improvement of wastewater collection system, etc, should be made to increase efficiency of the focused STPs. In the terminal evaluation, the evaluation team should study the likelihood putting into practice those suggestions and proposals. Thus the Team recommends that the Project encourage LAs of the focused STPs to take part in the Joint Coordinating Committee and make them aware of importance of the wastewater system, especially the improvement of the wastewater collection system.

4 Achievement and Implementation Process

4.1 Inputs

4.1.1 Inputs from Japanese side

The Project has had the following inputs from the Japanese side since its commencement. (Refer to **ANNEX III**, **ANNEX IV**)

(1) Assignment of long-term experts

	Name of Expert	Period of Assignment		Title
		From	Until	
1	Mr. Shuji TANAKA	May 26, 04	Mar. 31, 06	Chief Advisor
2	Mr. Matsuo TANAKA	May 26, 04	May 26, 06	Design/Planning/Construction on Sewage
3	Mr. Nagahide NAKAMURA	July 04, 05	July 04, 06	Electric and Machinery Engineering
4	Mr. Tetsuro USUI	May 25, 05	May 24, 07	Project Coordinator

(2) Assignment of short-term experts

	Name of Expert	Period of Assignment		Title
		From	Until	
1	Mr. Nobuyuki MATSUMOTO	Nov. 23, 04	Jan. 21, 05	O&M Electric Engineering
2	Mr. Akito KURAMOCHI	June 02, 05	July 31, 05	O&M Electric Engineering
3	Ms. Yuko FUJII	Oct. 31, 05	Dec. 29, 05	Training
4	Mr. Kazuhisa SAKAGUCHI	Nov. 21, 05	Jan. 14, 06	O&M Mechanical Engineering

(3) Financial figures

In total, the Japanese side has allocated and appropriated a necessary budget for the project activities and management as shown in the following table.

Unit: Thousand yen

Japanese Fiscal Year	JFY2004	JFY 2005 (Plan)
Total Cost for Project Implementation	**40,077**	**80,205**

(4) Counterpart training in Japan

	Name of Counterparts	Period of Training		Theme of Training
		From	Until	
1	Mr. Akanit AMPAWASIRI	Nov. 23, 04	Jan. 21, 05	Management
2	Mr. Supparat ITTIPOL	June 02, 05	July 31, 05	Management
3	Mr. Atilak BUPACHANTO	Oct. 31, 05	Dec. 29, 05	Wastewater Engineering
4	Mr. Phanthat CHUNCHAROENSOOK	Nov. 21, 05	Jan. 14, 06	Wastewater Engineering

4.1.2 Inputs from Thai side

The following inputs have been provided by the Thai side.

(1) Assignment of personnel

Enough counterparts have been assigned as seen in the **ANNEX III**, although not on a full time basis.

(2) Provision of project office
Office space is provided at WMA.

(3) Allocation of recurrent costs for project operation
The Thai side has allocated a budget for utility and administrative costs of the Project, including personnel costs. The budget allocated for 2004 and 2005 were approximately Thai Baht 45,858 and 282,943, respectively[2].

4.2 Achievement of the Project

4.2.1 Outputs

The following are summaries of the achievement of each output.

Output 1. "Function of focused STPs is recovered."
Originally, this output was to be measured by the following indicators.

i. Unit cost (Baht/m^3) is reduced by 20% at the focused STPs;
ii. Treated wastewater is increased by 30% at the focused STPs; and
iii. Effluent water quality meets the standard at the focused STPs.

However, as noted previously, the above mentioned indicators are unsuitable for measuring discernable effects of the Project due to the following reasons:

- As for the reduction of unit costs, though the Project proposed many ways of cost reduction and some of them have been already employed, there are some other suggested methods which have not been employed.
- As for the increase of treated wastewater, the major suggestions would be employed later in the project period. Thus effects would be brought about later.

Given the reasons above, the Team suggests that the first two indicators be defined clearly as seen in the recommendation part of this document.

As for the effluent water quality, the two focused STPs met the Industrial Effluent Standard in Thailand as seen in the following table.

Table 4-1: Comparison of effluent water quality

Item	Unit	Kampaengphet		Pathumthani		Industrial Effluent Standard
		27-28 April 2005 (wet season)	27-28 July 2005 (dry season)	24-25 May 2005 (wet season)	10 August 2005 (dry season)***	
BOD	mg/l	8.1	18	7.5	-	20-60
SS	mg/l	18.5	40	8	-	50-150
DO*		7.6	1.9	7	-	-

[2] Figures are the amounts of total allowance from the Thailand International Cooperation Agency. As for 2006, the expense of WMA for the training sessions is added.

DO**		4.6	4.0	6.1	-	-

*, ** Spot sampling was carried twice during the survey period. Other data were figured out by composite sampling.
*** Due to the renovation work of STP, the sampling was unable.
(Source) Final report "Chemical Analysis of Sewage Influent and Final Effluent, Sludge and Sediments in Sewage System in Nine STPs" (IST-JICA, October 2005)

Output 2. "Reference materials for improvement of sewage treatment plant management are developed."

At the time of the mid-term review, no reference material has been distributed, although according to the schedule, five materials, namely *Analysis of Existing Wastewater Treatment System and Direction for Improvement, Guide for Wastewater Collection to Sewer, Pumping Station Designing and O&M, Wastewater Treatment System O&M* and *Safety Manual for Construction and O&M*, were supposed to be developed by the end of May 2006. In order to produce those reference materials, intensive surveys have been carried out by a local consulting firm. *Analysis of Existing Wastewater Treatment System and Direction for Improvement* is now compiled and to be distributed soon after approval by the committee in the Project. Presently, the project team, especially the committee on reference materials, discusses reducing the number of reference materials from 13 to about 10.

Output 3. "Skilled personnel are assigned to operate and maintain the focused STPs appropriately."

Since the qualification standards of sewerage management officers are not and will not be established anytime soon in Thailand, the project team, consisting of both CPs and Japanese experts, discusses and decides the areas of necessary knowledge and skills for the officers in charge. Then the Project provides training sessions accordingly. Under these circumstances, the description of output 3 in PDM was revised as seen in the **ANNEX II**.

The first five-day training, which targeted the officers in charge of STPs with OD system, was carried out from 30 January to 3 February 2006. Thirty officers of local authorities and contractors, including WMA officers, took part in the training and 24 completed it[3]. Unfortunately, officers working at Pathumthani STP, who were supposed to attend the training, were unable to do so. Supplementary training sessions for them are under consideration. Now the training committee in the Project plans to organize the second training for officers in charge of STPs with SP and AL.

Output 4. "Information system is established to disseminate reference materials and to collect O&M data."

As previously noted, reference materials are in preparation. As for the development of an information system, the Project placed an order and the ordered hardware equipment is to be delivered by the end of March 2006. Five persons took the intensive training on programming languages and now three of them are actively participating in the Project.

4.2.2 Project Purpose

"Efficient and effective operation method of STPs is established."

[3] Since the training course lasted five days, 6 out of 30 officers managed to attend the course only partially.

The project purpose is expected to be achieved through the project activities. Though the reference materials have not been formulated yet, the accumulated knowledge and experiences on the focused STPs are sufficient to make them practical and suitable in STPs in Thailand. Once the materials are formed, through direct distribution and the Internet, information on the efficient and effective operation method will be distributed.

4.2.3 Overall Goal

"Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand."
Since the Project has been carried out only for about two years, it is too early to measure the achievement of the overall goal. However, the Project is obviously promoting an efficient and effective operation method of STPs. Although the direction of the overall goal is agreed upon in the beginning of the Project, there is a certain gap between the project purpose and the overall goal. Many important assumptions affect the overall goal. Even if a few of reference materials can be set as guidelines, they contribute tremendously to the overall goal. However, it is good to review the overall goal to make it more closely linked to the project purpose and achievable within several years of project completion.

4.2.4 Implementation Process

The Project has been implemented smoothly and encountered no major obstacles in its implementation process. It has the mechanisms to facilitate implementation such as the monthly team meeting. It is true that counterparts are busy with routine WMA work and business trips, and therefore some of the activities had to be initiated by the Japanese experts. But the major activities have been carried out almost always with counterparts. The regular monthly team meeting, in which both the counterparts and the Japanese experts take part, functions adequately to fill gaps between them, serves as a formal means of communication to monitor the progress of the Project, and share technical information. It also facilitates smooth communication among the project members. In addition, each output is assigned to the specified counterpart, and he/she closely works with the project team on the matter. This helps affirm the commitment of counterparts.

5 Results of Evaluation

5.1 Five Criteria

5.1.1 Relevance

The relevance is assessed from different viewpoints such as priority and necessity of the Project. In general, the Project bears sufficient relevance. The details are as follows.

The Project, directly contributing to improvement of wastewater treatment system and prevention of water pollution, complies with both the priorities set by the environmental policy of Thailand and Japanese aid policy. In Thailand, *The National Policy and Plan for Environmental Quality Promotion and Conservation B.E. 2540-2559 (A.D. 1997-2016)*, formulated by the Office of Environmental Policy and Planning and ordained by the National Environment Board, covers various environmental issues over the 20 year period from 1997. Water quality improvement and

wastewater treatment are considered important issues in this policy. On the other hand, in Japan, based on *the Environmental Conservation Initiative for Sustainable Development* formulated by the Ministry of Foreign Affairs of Japan in 1997, the government has promoted actions in the following four priority areas, namely (1) Efforts to Address Global Warming, (2) Pollution Control including water pollution, (3) Fresh Water Issues and (4) Conservation of the Natural Environment.

WMA, a state-owned enterprise, provides supports LAs for the sound operation of STPs. After the revision of the Royal Decree in 2005, the service area of WMA was expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can expand the Wastewater Management Area itself by proposing to the Cabinet. In addition, *the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand* also recommends LAs with difficulties in sewage management to contact with WMA. Under these circumstances, it is urgently needed to foster skilled technical personnel of WMA. Thus it is relevant to choose and support WMA as a CP agency.

In terms of suitability as means, the project approach "the experiences of rehabilitation and O&M in the focused STPs are disseminated mainly through reference materials" is understood both by Japanese experts and Thai CPs to be relevant in order to achieve the project purpose. Now the discussion is on whether the Project should start working in the 3rd STP.

It is worth noting at this point that there is another important government agency called the Pollution Control Department (PCD). PCD monitors and controls the functions of STPs in Thailand and wastewater quality in general. Thus it is relevant that PCD is a member of the Joint Coordinating Committee.

In Japan, there is an organization called the Japan Sewage Works Agency, which functions like WMA. This organization has contributed greatly to developing the wastewater treatment facilities and improving wastewater treatment technologies in Japan. Thus it is also fair to say that the Project is relevant in terms of advantages of Japanese technology.

5.1.2 Effectiveness

Given the present situation of each output mentioned below, it can be said that the project purpose will probably be achieved and the effectiveness of the Project is likely to be secured, only if the Project could produce sufficiently practical reference materials in time.

The progress of the four outputs that contribute to achieving the project purpose can be summarized as follows. As for output 1, the function of the focused STPs in Kampaengphet and Pathumthani is recovering. During the course of rehabilitation activities, practical knowledge and experiences have been accumulated in the Project. As for output 2, the progress is delayed and no reference material is produced as of February 2006 except the reference material No.1 in a draft form. However, for the production of the reference material, technical papers by Japanese experts have been already accumulated. In addition, several comprehensive studies to collect basic data were conducted by the Project. As for output 3, a five-day training session on the OD system was carried out in January

2006 and the other training sessions are to be held in May 2006 for the officers in charge of other STP systems. Output 4 will be soon started once the server arrives in March 2006. The reference materials will be publicized once the system is established.

Although the reference materials have not been formulated yet, given the present status of outputs and activities accumulated in order to produce those outputs, it is fair to say that the Project could produce sufficiently practical materials that take situations in Thailand into account. Once they are formulated and distributed in various ways, technical information in the reference materials will be widespread. However, it is worth keeping in mind that, according to the PDM, the reference materials are the only major means to disseminate technical information accumulated through all the activities of the Project.

5.1.3 Efficiency

In general, the Project has been implemented efficiently. The details are as follows.

In view of output levels and activities, the Project is now being implemented efficiently. Although a delay in preparation of reference materials is a major concern, a number of activities have been carried out diligently as previously noted under the effectiveness criterion. The accumulated activities are contributing effectively to producing the present levels of outputs.

As for the situation of inputs and outputs, the delay in dispatch of two project members should be mentioned. Due to the delay in approval of an amendment to the R/D, the long-term expert on electric and machinery engineering and the project coordinator were dispatched later than originally scheduled. The project coordinator was dispatched six months later and the expert on mechanical / electrical equipment was dispatched one month later than originally scheduled, respectively. This delay had a negative impact on the progress in the beginning of the Project. Due to the delay, the schedule and plan of the Project were revised and have been implemented accordingly. But despite the delay, efficiency of the Project can be judged as sufficient at this stage given the present level of outputs and many activities carried out by now.

As for the CPs' assignment, twelve staff members of WMA including the acting director general are to be assigned in the year 2006. CPs are certainly busy with routine WMA work, but it became clear that CPs are doing their best and actively taking part in the Project to produce outputs. An example of such efforts is that each output is assigned to the specified CP, and he/she closely works with the project team on the matter. Japanese experts confirm that they are assigned in an efficient manner to produce outputs.

5.1.4 Impact

At this moment, it is too early to assess the overall impact of the Project since it requires more time and inputs beyond the project framework to achieve the overall goal, "Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand". In addition, the important assumptions considerably affect the overall goal. If the project purpose is achieved, the reference materials will contribute to promoting an efficient and effective operation method in Thailand. As seen in the section on effectiveness, reference materials play a major role in this regard. If only a few reference

materials can be set as guidelines, they will contribute tremendously to the overall goal.

The revision of the Royal Decree in 2005 has had a positive impact on the Project. As described in "3.1. Relevance", the revision along with the rehabilitation plan of PCD placed more responsibilities and opportunities to WMA. By seizing these opportunities, WMA could disseminate what it has gained during the course of the Project directly to more LAs.

During the first half of the project period, the situations of the overall sewage system, which were not well known in the stage of project planning, became clear, such as poor sewer conditions and low connection rates to the municipal sewage system. These situations definitely affect achievement of the overall goal. Although the Project targets only STPs and not the sewer system, the Project should keep watch on those situations as one of the important assumptions as described in the revised PDM.

In addition, during the course of the mid-term evaluation, it became clear that the future organizational restructuring of WMA, if any, and the capacity of each LA may affect the overall goal substantially. Thus the Project should keep an eye on any developments in those issues although they are not incorporated in the revised PDM.

5.1.5 Sustainability

(1) Policies and organizational/ financial aspects

As noted above, after the revision of the Royal Decree in 2005, the service area of WMA has been expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can re-define and expand the Wastewater Management Area itself by proposing to the Cabinet. This creates great opportunities for WMA to work with LAs all over Thailand and thus strengthen the business base of WMA.

As for the organizational aspect, WMA is now expanding in terms of the number of employees, especially for 2005 and 2006 (plan), in order to play a major role in the field of municipal wastewater management. The increment of technical employees can be interpreted as WMA's commitment in this field. As for the financial aspect of WMA, the figures related to the result of operation are in an upward trend from 2001 to 2004, according to the annual reports of WMA.

Given those factors mentioned above, the environment that secures sustainability is being put into place.

(2) Technological aspects

As noted in the Impact section, it is currently under consideration to make *the Standards for quality control of construction works on wastewater systems* (one of the forthcoming reference materials) a guideline. If this materializes, it also secures sustainability. Likewise, CPs are willing to utilize reference materials. Depending on the contents, they are to endeavor to make them more formalized, possibly as guidelines.

The five-day training in January 2006 was well appreciated by both the Project and the participants. WMA is considering continuing training even after the Project. The involvement of WMA senior technical officers as lecturers in the training session gave them experiences as lecturers, and this helps WMA to organize the training sessions on its own later. In addition to factors related to the policies and organizational/ financial aspects mentioned above, the Project itself made efforts to internalize mechanisms to secure sustainability.

5.2 Factors that promoted realization of effects

5.2.1 Factors concerning the Planning

In the Project, Japanese experts have been working closely with counterparts in order to rehabilitate the two focused STPs. Working closely with counterparts in the focused sites has made the transfer of technology most effective. It also has contributed to fostering rapport between Japanese experts and counterparts. The knowledge and experiences obtained at the focused sites have been well utilized to organize the practical training. Likewise, the reference materials are to be practical and suitable to the Thai situation by employing those knowledge and experiences at the focused sites.

5.2.2 Factors concerning the Implementation Process

The regular monthly team meeting, in which both counterparts and Japanese experts take part, functions adequately as a formal means of communication to monitor the progress of the Project and share technical information. It also facilitates smooth communication among the project members. In addition, each output is assigned to the specified counterpart, and he/she closely works with the project team on the matter. This helps affirm the commitment of counterparts.

5.3 Factors that inhibited realization of effects

5.3.1 Factors concerning the Planning

Presently, WMA supports only 10 STPs. Thus it became apparent that a mechanism to enhance the collaboration with the Pollution Control Department, a regulator of wastewater treatment systems, is necessary in order to magnify effects of the Project beyond 10 STPs under the supervision of WMA.

Issues concerning the indicators of the output 1 were raised during the course of the mid-term evaluation. Now, two indicators, namely (i) Unit cost (Baht/m^3) is reduced by 20% at the focused STPs and (ii) Treated wastewater is increased by 30% at the focused STPs, are considered unsuitable for measuring discernable effects of the Project. Thus, the Team along with Japanese experts and Thai counterparts has discussed defining the first two indicators more clearly, as seen in the recommendation part, without changing indicators themselves.

5.3.2 Factors concerning to the Implementation Process

Counterparts are indeed busy with routine WMA work and business trips. Thus some of the activities were initiated by Japanese experts. The major project activities have been carried out almost always with counterparts. But the progress of the Project is inevitably affected when the counterparts have to give priority to work other than the Project.

It is highly beneficial that Japanese experts along with counterparts have carried out a large number of activities. However, neither comprehensive reports and nor public relations documents on those activities have been formulated or distributed. Thus relevant organizations and the general public are unaware of the contributions of the Project.

5.4 Conclusion

Although the progress of outputs is uneven, the project purpose is expected to be achieved by the end of the Project in light of the present status of project implementation.

6 Recommendations and Lessons Learned

6.1 Recommendations

(1) Enhancing the collaboration with PCD

As previously noted, besides WMA, there is another important organization called PCD. PCD functions as a regulating agency and monitors all STPs in Thailand while WMA is an implementing agency working for a limited number of STPs. Thus it is essential to encourage PCD to take part in the Project to disseminate the Project's outputs to STPs beyond STPs supervised by WMA.

(2) Redefining conditions for the objectively verifiable indicators of output 1

In order to measure output 1 more precisely, the Team recommends the Project to redefine conditions to use objectively verifiable indicators as follows:

- Indicator 1-1: Base data measurement for decrease of the unit operation cost

  Base data should be data obtained before employing the cost-reduction suggestions by JICA experts. For STP in Pathumthani, the base data for the unit cost should be 10.4 baht/m^3 of May 2005. For STP in Kampaengphet, the base data for the unit cost should be the average unit cost of January and February 2006. Additionally, cost reduction effects by such elements as electricity expense and personnel expense should be also considered.
- Indicator 1-2: Base data measurement for increase of treated wastewater

  Base data should be accurate and limited to only sanitary wastewater excluding storm water, thus should be the average figure of flow rate in the dry season only after the reliable flow rate measurement is secured. In concrete terms, the volume of influent wastewater of December 2005, January 2006 and February 2006 on average should be applied as base data. At the time of the terminal evaluation, the base month for base data can also be reviewed.

(3) Complementing the indicator 1-2 of output 1

For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, the technical suggestions and proposals related to improvement of wastewater collection system, etc., should be made to increase efficiency of the focused STPs. In the terminal evaluation, the evaluation team should study the likelihood of realizing those suggestions and proposals. In this regard, the Team recommends that the Project encourage LAs of the focused STPs to take part in the Joint Coordinating Committee and make them aware of the importance of the wastewater system, especially the improvement of the wastewater collection system.

(4) Developing reference materials which can serve many users
The Team recommends the Project to reconsider the contents of reference materials and concentrate on materials with higher priorities, if necessary, based on the discussion within the project team. Reference materials could be in various forms such as guidelines, training materials and manuals / check sheets for O&M, but must be highly useful in any case.

(5) Continuing the training activities
According to the PDM, the training activities target personnel in the focused STPs only. However, the tailor-made intensive training sessions, which the Project organized once in January 2006, could be one of the most effective ways to disseminate knowledge that the Project is trying to spread through the reference materials. In order to assure the materialization of the project purpose, continuation of training sessions by using reference materials is highly recommended. During the training sessions, the water quality measurement equipment of the Training Center for Sewage Works (TCSW) Project transferred from the Public Works Department can be also utilized.

(6) Enhancing the public relations activities
Unfortunately, a number of accumulated activities and knowledge are not compiled in a written form. It became clear, only by interviewing experts individually, that a large numbers of activities have been carried out by each expert. The Team recommends documenting the progress of the Project, by preparing newsletters and booklets, and publicizing what the Project has done not as individuals but as the Project. These documents also help the Project to show its presence to wider public.

6.2 Lessons Learned

No lessons learned were extracted as of this mid-term evaluation.

ANNEX I

Project Design Matrix (PDM)

Project Name: The Project for Improvement of Sewage Treatment Plant Management in Thailand Duration: May 26, 2004 to November 25, 2007

Target Area: STPs under WMA management. Target Group: Central and local government officials for wastewater plant management

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal The water quality of public water bodies is improved. **Overall Goal** Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.	1. Operation and maintenance for STPs is executed appropriately. 2. Quality of effluent from STPs meets the effluent standard in Thailand.	Post evaluation study report.	● New wastewater system construction plan for overall Thailand is formulated.
Project Purpose Efficient and effective operation method of STPs is established.	1-1. STPs under WMA adopt the reference materials for their operation. 1-2. Effluent from STPs under WMA meets the water quality standard in Thailand.	Questionnaire survey (before and after) Project report	● People are willing to pay the sewage charge.
Outputs 1. Function of focused STPs is recovered.	1-1. Unit cost (Baht/m3) is reduced by 20% at focused STPs. 1-2. Treated wastewater is increased by 30% at focused STPs. 1-3. Effluent water quality meets the standard at focused STPs.	1-1. Project report,site survey 1-2. Operation report of each STP 1-3. Operation report of each STP 1-4. Report of effluent water quality	● Sufficient budget for O&M is allocated. ● Both central and local governments practically refer the outputs of the project.
2. Reference materials for improvement of sewage treatment plant management are developed.	2-1. All of the listed necessary reference materials (Activity2-1) is formulated.	2-1. The number of reference materials	
3. Qualified personnel are assigned to operate and maintain STPs appropriately.	3-1. Evaluation of personnel assigned for the focused STPs based on the Qualification standards. 3-2. All of the focused STPs are managed by qualified personnel	3-1. Questionnaire survey 3-2. Site survey	
4. Information system is established to disseminate reference materials and to collect O&M data.	4-1. Reference materials are available through information system on WMA managing STPs. 4-2.O&M data of all of the focused STPs is collected with using information system. (Focused STPs shall be decided after the project started. The number of focused STPs is supposed to three at the initial stage.)	4-1. Questionnaire survey, site survey 4-2. Data printing.	

Activities	**Inputs**	
1. Function of focused STPs is recovered. 1-1. Review rehabilitation plan of focused STPs 1-2. Support implementation of rehabilitation focused STPs. 1-3. Inspect rehabilitation works 1-4. Operate and maintain rehabilitated STPs. 2. Reference materials for improvement of sewage treatment management are developed. 2-1. List necessary reference materials. 2-2. Examine methodology to develop reference materials. 2-3. Conduct research works for development of reference materials. 2-4. Develop reference materials. 3. Qualified personnel are assigned to operate and maintain STPs appropriately 3-1. Establish qualification standards. 3-2. Prepare training materials. 3-3. Execute training. 4 Information system is established to disseminate reference materials and to collect O&M data. 4-1. Prepare reference materials for dissemination. 4-2. Collect operation and maintenance data report (daily, weekly, monthly, yearly report) . 4-3. Collect completion document (construction drawings, plans and specifications, As-build drawings) . 4-4. Investigate existing information systems. 4-5. Develop information system modifying existing ones.	Japanese Side Dispatch of Experts: Long-term experts: Chief Advisor/ Sanitary Engineering, Planning/ Design/ Construction, Mechanical/ Electrical Engineering, Coordinator/ Training Short-term experts: STP operation and maintenance, inspections and others Provision of Equipment: Mobile water quality analyzer, flow meter, computer server,etc Training: Counterpart training in Japan Thai Side Personnel: Full time counterpart staff for all the field of activities Part-time counterpart from STPs and local governments Facilities Office for Japanese experts Equipment for STPs Cost: Necessary budget for rehabilitation of STPs Necessary budget for training Necessary budget for O&M of STPs	● Trained personnel continue working for O&M.

ANNEX II

Project Design Matrix (PDM) Version: 2 Date of revision: March 8, 2006

Project Name: The Project for Improvement of Sewage Treatment Plant Management in Thailand Duration: May 26, 2004 to November 25, 2007

Target Area: STPs under WMA management. Target Group: Central and local government officials for wastewater plant management

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal The water quality of public water bodies is improved. **Overall Goal** Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand.	1. Operation and maintenance for STPs is executed appropriately. 2. Quality of effluent from STPs meets the effluent standard in Thailand.	Post evaluation study report.	● New wastewater system construction plan for overall Thailand is formulated.
Project Purpose Efficient and effective operation method of STPs is established.	1-1. STPs under WMA adopt the reference materials for their operation. 1-2. Effluent from STPs under WMA meets the water quality standard in Thailand.	Questionnaire survey (before and after) Project report	● People are willing to pay the sewage charge. ● The problems relating to the wastewater collection system are solved.
Outputs 1. Function of focused STPs is recovered.	1-1. Unit cost (Baht/m3) is reduced by 20% at focused STPs. 1-2. Treated wastewater is increased by 30% at focused STPs. 1-3. Effluent water quality meets the standard at focused STPs.	1-1. Operation report of each STP 1-2. Operation report of each STP 1-3. Report of effluent water quality	● Sufficient budget for O&M is allocated. ● Both central and local governments practically refer the outputs of the project.
2. Reference materials for improvement of sewage treatment plant management are developed.	2-1. All of the listed necessary reference materials (Activity2-1) is formulated.	2-1. The number of reference materials	
3. Skilled personnel are assigned to operate and maintain the focused STPs appropriately.	3-1. Personnel assigned for the focused STPs undergo trainings organized by the project. 3-2. All of the focused STPs are managed by skilled personnel.	3-1. Questionnaire survey 3-2. Site survey	
4. Information system is established to disseminate reference materials and to collect O&M data.	4-1. Reference materials are available through information system on WMA managing STPs. 4-2.O&M data of all of the focused STPs is collected with using information system. (Focused STPs shall be decided after the project started. The number of focused STPs is supposed to three at the initial stage.)	4-1. Questionnaire survey, site survey 4-2. Data printing.	

Activities 1. Function of focused STPs is recovered. 1-1. Review rehabilitation plan of focused STPs 1-2. Support implementation of rehabilitation focused STPs. 1-3. Inspect rehabilitation works 1-4. Operate and maintain rehabilitated STPs. 2. Reference materials for improvement of sewage treatment management are developed. 2-1. List necessary reference materials. 2-2. Examine methodology to develop reference materials. 2-3. Conduct research works for development of reference materials. 2-4. Develop reference materials. 3. Skilled personnel are assigned to operate and maintain the focused STPs appropriately 3-1. Decide areas of necessary knowledge and skills for officers in charge. 3-2. Prepare training materials. 3-3. Execute training. 4 Information system is established to disseminate reference materials and to collect O&M data. 4-1. Prepare reference materials for dissemination. 4-2. Collect operation and maintenance data report (daily, weekly, monthly, yearly report) . 4-3. Collect completion document (construction drawings, plans and specifications, As-build drawings) . 4-4. Investigate existing information systems. 4-5. Develop information system modifying existing ones.	**Inputs** Japanese Side Dispatch of Experts: Long-term experts: Chief Advisor/ Sanitary Engineering, Planning/ Design/ Construction, Mechanical/ Electrical Engineering, Coordinator/ Training Short-term experts: STP operation and maintenance, inspections and others Provision of Equipment: Mobile water quality analyzer, flow meter, computer server,etc Training: Counterpart training in Japan Thai Side Personnel: Full time counterpart staff for all the field of activities Part-time counterpart from STPs and local governments Facilities Office for Japanese experts Equipment for STPs Cost: Necessary budget for rehabilitation of STPs Necessary budget for training Necessary budget for O&M of STPs	● Trained personnel continue working for O&M.

ANNEX III
List of Japanese Experts

Japanese Fiscal Year		TITLE	NAME	2004	2005	2006	2007	
				4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3
JICA EXPERT DISPATCH	LONG TERM	1) Chief Advisor	Mr. Tanaka Shuji	04/05/26		06/03/31		
		2) Design/Planning/Construction on Sewage	Mr. Tanaka Matsuo	04/05/26		06/05/26		
		3) Electric & Machinery Engineering	Mr. Nakamura Nagahide		05/07/04	06/07/04		
		4) Project Coordinator	Mr. Usui Tetsuro		05/05/25		07/05/24	
	SHORT TERM	1) O&M Electric Engineering	Mr. Matsumoto Nobuyuki	04/11/23-05/01/21				
		2) O&M Electric Engineering	Mr. Kuramochi Akito		05/06/02-07/31			
		3) Training	Ms. Fujii Yuko		05/10/31-12/29			
		4) O&M Mechanical Engineering	Mr. Sakaguchi Kazuhisa		05/11/21-06/01/14			

ANNEX III
Counterpart Distribution

	No	Name	Year	2004					2005					2006					2007					C/P Training in Japan
			Month	4	7	10	1	3	4	7	10	1	3	4	7	10	1	3	4	7	10	1	3	
Counterpart Member	1	Mr. Akanit Ampawasiri																						May 2 - May 31, 2005
	2	Mr. Suchai Janepojanat																						
	3	Mr. Sarawut Srisakuna																						
	4	Mr. Kitti Teerasoradech																						
	5	Mr. Suppamit Yuvatana																						
	6	Mr. Sombat Paneiam																						
	7	Mr. Kitti Uyakul																						
	8	Mr. Supparat Ittipol																						May 2 - May 31, 2005
	9	Ms. Hatarirat Likitanupak																						
	10	Mr. Norasigh Karnjanaprakorn																						
	11	Ms. Rattana Chunsano																						
	12	Mr.Chira Wongburana																						
	13	Mr. Thanawat Nakornchai																						
	14	Mr. Akrawat Wettayavatin																						
	15	Mr. Atirak Bupachanto																						August 30 - December 10, 2005
	16	Ms. Valailak Komolrit																						
	17	Ms. Areewan Paopiamsub																						
	18	Mr. Phanthat Chuncharoensook																						August 30 - December 10, 2005
	19	Mr. Phanithan Meechaiyo																						
	20	Mr. Kampanart Thanasetkorn																						

ANNEX IV: List of Equipment

No	Item	Product	Date	Quantity	Amount	Location	Purchase	Disposal	Exist	Usage	Maintenance	Management
1	Desktop Computer	HP Pa 718	04/07/12	1	B31,993	Project	Local	0	1	A	A	A
2	Notebook Computer	IBM Thinkpad R50e	04/07/20	2	B162,857	Project	Japan	0	1	A	A	A
3	Laser Printer	Canon LBP 3800	04/07/20	1	B63,571	Project	Japan	0	1	A	A	A
4	Flow Meter	ISCO 4210	04/08/17	1	B465,357	Project	Japan	0	1	A	A	A
5	Portable Dissolved Oxygen Meter	SENSIO N6	04/09/16	1	B80,357	Project	Japan	0	1	A	A	A
6	COD Reactor	HACH DRB 300	04/09/16	1	B77,857	Project	Japan	0	1	A	A	A
7	Portable Spectrophoto Meter	HACH DRB 2400	04/09/16	1	B311,429	Project	Japan	0	1	A	A	A
8	Desktop Computer	HP Pa 718	04/09/30	1	B31,993	Project	Local	0	1	A	A	A
9	Printer	Brother HL5170DN	04/12/23	1	B19,940	Project	Local	0	1	A	A	A
10	Desktop Computer	HP Pav a1052L	05/06/01	1	B36,166	Project	Local	0	1	A	A	A
11	Printer	HP Lase Jet 1020	05/06/01	1	B7,090	Project	Local	0	1	A	A	A
12	FAX	HP Lase Jet 3030	05/07/19	1	B19,790	Project	Local	0	1	A	A	A
13	Digital Video	SONY DVD653	05/12/23	1	B29,990	Project	Local	0	1	A	A	A
14	Digital Camera	SONY Cybershot n1	05/12/23	1	B21,990	Project	Local	0	1	A	A	A
15	VDO signal capture	Pinnacle Studio plus10	05/12/23	1	B11,200	Project	Local	0	1	A	A	A
16	KVM switch	IOGEA 8	05/12/27	1	B17,013	Project	Local	0	1	A	A	A
17	Proxy Server	HP Compaq ML350G4P	06/03/15	1	B283,500	Project	Local					
18	Wireless Network	CISCO Air-Ap1121G-E-K9	06/03/15	1	B64,000	Project	Local					
19	Notebook Computer	HP Compaq Presario B1809TU	06/03/15	1	B62,500	Project	Local					
20	Laser Printer	HP Compaq 2420dn	06/03/15	1	B38,400	Project	Local					
21	Scanner	RICHO Africo IS330DC	06/03/15	1	B176,000	Project	Local					
22	24 Ports Switching	3COM Super Stack3, 4228G	06/03/15	1	B14,500	Project	Local					
23	Color Laser Printer	HP Compaq 5550dn	06/03/15	1	B135,000	Project	Local					
24	UPS	SOCOMEC EGYS-SE2000	06/03/15	1	B18,500	Project	Local					

ANNEX V

Evaluation Grid: The Project for Improvement of Sewage Treatment Plant Management in Thailand

1. Relevance			
Evaluation Item	Survey Item	Means of Verification	Result
1. Relevance in terms of priority: Consistency with the national policies of Thailand and the cooperation policy of Japan	- National policy of Thailand - Cooperation policy of Japan	- Project Document - Website of the Ministry of Foreign Affairs of Japan	**[National Policy of Thailand]** The *National Policy and Plan for Environmental Quality Promotion and Conservation B.E. 2540-2559 (A.D. 1997-2016)*, formulated by the Office of Environmental Policy and Planning and ordained by National Environment Board, covers various environmental issues over the 20-year period from 1997. Water quality improvement and wastewater treatment are considered as important issues in this policy. In addition, PCD under MONRE formulated the *Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand* (hereinafter referred to as the *Rehabilitation Plan*) in 2003. Currently, rehabilitation works are in progress according to this plan. **[National Policy of Japan]** Based on *the Environmental Conservation Initiative for Sustainable Development* formulated by the Ministry of Foreign Affairs of Japan in 1997, the government has promoted actions in the following four priority areas, namely (1) Efforts to Address Global Warming, (2) Pollution Control including water pollution, (3) Fresh Water Issues and (4) Conservation of Natural Environment. The Project, directly contributing to improving the wastewater treatment system and thus preventing water pollution, complies with both the priorities set by the environmental policy of Thailand and Japanese aid policy.
2. Relevance in terms of necessity: Consistency with the needs of the target group	- Needs of CP organizations - Needs of LAs - Needs of contractors	- Interviews with/ questionnaire survey of CPs - Interviews with/ questionnaire survey of LAs - Interviews with/ questionnaire survey of contractors - Interview with PCD - Interviews with Japanese experts - Annual report of WMA	**[Needs of CP organization]** In Thailand, the national law stipulates the LAs as organizations responsible for construction and management of the wastewater treatment plants. According to the *Rehabilitation Plan*, 77 STPs are to be targeted for the year 2004-2009*. Due to the constraints that many LAs face, WMA, a state-owned enterprise established under the Ministry of Science, Technology and Environment, by Royal Decree on 20th July 1995 and announced in the Royal Gazette on August 14th 1995, provides support to LAs by filling the gap. At present, WMA is under MONRE according to the Ministry Act of 1995. WMA was originally responsible for promoting wastewater management and organizing other activities in the Wastewater Management Area comprising Bangkok metropolis and surrounding provinces (Prathum Thani, Nonthaburi, Nakhon Prathom, Samut Prakam and Samut Sakhon) and the other areas approved by the cabinet. After the revision of the Royal Decree in 2005, the service area of WMA was expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can expand the Wastewater Management Area itself by

proposing to the Cabinet. As of February 2006, WMA supports wastewater management of 10 STPs **. The *Rehabilitation Plan* also recommends LAs with difficulties in sewage management to contact WMA.

Besides LAs, two organizations under MONRE, namely WMA and PCD, are other leading organizations in the field of wastewater management. PCD functions as a regulating agency and WMA is an implementing agency. WMA is a young organization with 10 years since establishment, and according to the interview with the acting DG, it became clear that fostering skilled technical personnel within WMA is urgently needed.

* PCD focused more on rehabilitation of 11 sites categorized as low performance. In addition, 9 were constructed out of 14 plants which were to be constructed. (Hearing from PCD officials on 27th February)

** Table1-1: List of 10 STPs under supervision of WMA

	Location	System	System Capacity (m3/d)
1	Chumsaeng Town Municipality	SP	1,650
2	Kampaengphet Town Municipality	SP	13,500
3	Pathumthani Town Municipality	AS	11,000
4	Petchaburi Town Municipality	SP	10,000
5	Sakonnakorn Town Municipality	SP	16,000
6	Tombon Tarea Municipality	SP	2,054
7	Sri Racha Town Municipality	AS	18,000
8	Tambon Ban Pae Municipality	AS	8,000
9	Bantai Koh Pangan Tambon Admin Org, Surat Thani	Biofilter	200
10	Tambon Hua Kwang Municipality, Mahasara-kam	SP	1,500

Source: Handouts at the monthly team meeting of the Project held at 21 February 2006

[Needs of LAs and Private Contractors]

According to the questionnaire and interview survey in the two focused STPs, all the officers in charge of LAs and private contractors (four out of four) answered that the technical expertise and suggestions received from WMA and Japanese experts meet their needs well. (Summary of the interviews will be annexed in the final evaluation report.)

Given that (i) WMA is an implementing agency which closely collaborates with LAs, (ii) the responsibilities of WMA is expected to expand and (iii) an urgent need in fostering technical expertise further within WMA, it is relevant to choose WMA as a CP agency.

<table>
<tr><td></td><td></td><td></td><td>However, it is necessary to encourage PCD to take part in the Project in order to disseminate the Project's outcomes to STPs beyond STPs supervised by WMA.</td></tr>
<tr><td>3. Relevance in terms of suitability as a means</td><td>- Appropriateness of the project approach
- Appropriateness of the target group (the focused STPs)
- Advantages of Japanese technology</td><td>- Project document
- Project report
- Interviews with/ questionnaire survey of CPs
- Interviews with/ questionnaire survey of LAs
- Interviews with/ questionnaire survey of contractors
- Interviews with Japanese experts
- Interviews with other donors</td><td>[Appropriateness of the project approach]
The Project approach is understood as "the experiences of rehabilitation and O&M in the focused STPs are disseminated through reference materials". Japanese experts reiterate the importance of experiences in the focused STPs in order to produce practical reference materials contextualizing Thai situation well. So Japanese experts consider that the approach to gather the experiences in the field and compile technical suggestions which suit Thai situation is appropriate. This same approach is also widely accepted by CPs.

[Appropriateness of the target group and the focused STPs]
Given the target area and the target group written in PDM, it is fair to say that the immediate target group is WMA officials and local government officials in STPs under WMA. Although, as mentioned earlier, WMA supports wastewater management of 10 STPs as of February 2006, its responsibilities are likely to expand according to the Rehabilitation Plan. In addition, WMA is the only agency that works closely with LAs with the exception of private contractors.

Presently, the following two are the focused STPs in the Project among 10 STPs under WMA.

Table1-2: the Focused STPs
<table>
<tr><th></th><th>STPs</th><th>Population Size</th><th>Type</th><th>System capacity (m3/d)</th><th>Construction cost (m. Baht)</th></tr>
<tr><td>1</td><td>STP in the Kampaengphet Town Municipality</td><td>31,000 (2002)</td><td>SP</td><td>13,500</td><td>230.00</td></tr>
<tr><td>2</td><td>STP in Pathumthani Town Municipality</td><td>19,772 (2003)</td><td>AS</td><td>11,000</td><td>340.00</td></tr>
</table>
Source: Purchase order with specification of WMA; Basic Study for IST-JICA vol.1: Final report "Reviewing Sewage Works Planning at Pathumthani Municipality; Survey of sewer connecting ratio and pollution sources" (IST-JICA, October 2005)

According to the survey of CPs, most of them thought that the focused sites were appropriate since those STPs represent two most common types of treatment system which now WMA was handling. However, all of CPs interviewed recommend increasing the number of the focused STPs from two to three under the following conditions.
• First priority should be given to STP which uses AL system in order to cover all three systems.
• If not, two is sufficient. Otherwise, the clear selection criteria should be set to choose the third STP.</td></tr>
</table>

			[Advantages of Japanese technology] In Japan, there is an organization called Japan Sewage Works Agency that functions like WMA. This organization has contributed greatly to developing the wastewater treatment facilities and improving wastewater treatment technologies. In addition, major local authorities such as Yokohama city have accumulated a wide range of knowledge and experience in municipal wastewater management, and knowledge of major local authorities has been disseminated through relevant associations. Likewise, Japan has acquired theoretical and practical knowledge on wastewater management.
2. Effectiveness (Prospects)			
1. Prospects for achievement of the Project Purpose		- Interviews with/ questionnaire survey of CPs - Interviews with Japanese experts - National Plans	According to the interviews with CPs, six out of six assume that the Project purpose will be achieved within the Project period if the reference materials are disseminated through the information system soon enough*. As for output 1, function of the focused STPs in Kampaengphet and Pathumthani is recovering. Now the discussion over the third STP is going on. As for output 2, the progress is delayed and no reference material is produced as of February 2006 except the reference material No.1 in a draft form. As for output 3, one five-day training on the OD system was carried out in January 2006 and the other training sessions are to be held soon for the officers in charge of other STP system. Output 4 will soon start once the server arrives in March 2006. The reference materials will be publicized once the system is established. *Seven CPs in WMA were interviewed. However, one CP's answers are confined to only relevant questions since he is a specialist on IT.
2. Sufficiency of outputs for achieving the Project Purpose		- Interviews with/ questionnaire survey of CPs - Interviews with Japanese experts - National Plans	The same interview reveals that some CPs (two out of six) reiterates that improvement of managerial capacity of LAs is essential for establishing "efficient and effective operation method". In fact, support from WMA in this regard is and will be in high demand from LAs.
3. Important assumptions from outputs to Project Purpose		- Interviews with/ questionnaire survey of CPs -Interview with PCD -Interviews with LAs - Budgetary document of LAs	**[Sufficient budget for O&M is allocated]** This remains an important assumption and the Project needs to keep an eye on the financial situation of LAs. Since the Project purpose is to establish efficient and effective operation "method" of STPs and tryouts are basically carried out at the two focused STPs, for the time being it is sufficient to monitor the financial situations of LAs where only the focused STPs are located. However, to achieve the overall goal, it is important to pay attention to any developments in programs and policies which affects LAs' financial conditions.

Table 2-1: Budgetary Information of Kampaengphet Municipality Unit: Baht

No.	Item	2002	2003	2004	2005	2006
A	**Total budget**	**82,985,772**	**87,216,110**	**99,999,900**	**116,355,221**	**120,000,000**
B	**Total budget of Technical Sanitary Section**	**3,681,420**	**3,530,760**	**5,848,040**	**6,069,370**	**11,556,380**
1	Fixed cost	3,620,120	3,093,260	3,678,040	4,989,370	4,056,380
1.1	*Salary*	*1,007,880*	*970,920*	*1,196,400*	*1,749,750*	*1,240,940*
1.2	*Temporary wages*	*405,840*	*405,840*	*405,840*	*0*	*598,840*
1.3	*Fringe benefit, maintenance, equipment*	*1,950,400*	*1,361,500*	*1,720,800*	*2,920,120*	*2,186,600*
1.4	*Utility, Subsidy*	*256,000*	*355,000*	*355,000*	*319,500*	*30,000*
2	Investment	61,300	437,500	2,170,000	1,080,000	7,500,000
2.1	*Land and construction*	*61,300*	*437,500*	*2,170,000*	*1,080,000*	*7,500,000*
	B/A (%)	**4.44**	**4.05**	**5.85**	**5.22**	**9.63**

Source: Annual budgetary reports from 2002 to 2006, Kampaengphet Town Municipality

Table 2-2: Budgetary Information of Pathumthani Municipality Unit: Baht

No.	Item	2003	2004	2005	2006
A	**Total budget**	**78,065,940**	**84,053,100**	**106,224,500**	**108,429,500**
B	**Total budget of Sanitary and Environment Division**	**4,525,490**	**6,323,540**	**6,611,440**	**6,252,540**
1	Fixed cost	4,110,490	5,163,540	6,611,440	6,252,540
1.1	*Salary*	*125,250*	*138,180*	*244,320*	*255,420*
1.2	*Temporary wages*	*520,800*	*1,534,400*	*1,113,120*	*1,029,120*
1.3	*Fringe benefit, maintenance, equipment*	*3,334,440*	*3,270,960*	*4,924,000*	*4,638,000*
1.4	*Utility, Subsidy*	*130,000*	*220,000*	*330,000*	*330,000*
2	Others	415,000	1,160,000	0	0
2.1	*Land and construction*	*415,000*	*0*	*0*	*0*
2.2	*Design of solid waste system*	*0*	*1,160,000*	*0*	*0*
	B/A (%)	**5.80**	**7.52**	**6.22**	**5.77**

Source: Annual budgetary reports from 2003 to 2006, Pathumthani Town Municipality

<table>
<tr><td></td><td></td><td></td><td>[Both central and local governments practically refer the outputs of the Project]
The interviews with CPs revealed that some* think of making the Standards for quality control of construction works on wastewater systems (one of the reference materials) a guideline. For that purpose, establishing a committee with personnel from PCD and Environmental Engineering Association of Thailand is under consideration.
*: Some are the acting DG and the CP in charge of reference materials.</td></tr>
<tr><td colspan="4">3. Efficiency</td></tr>
<tr><td>1. Achievement level of outputs</td><td>Achievement level of output 1</td><td>- Interviews with Japanese experts
- Interviews with CPs
- Project reports
- Operation reports of STPs</td><td>[Unit cost (Baht/m3) is reduced by 20% at the focused STPs.]
[Treated wastewater is increased by 30% at the focused STPs.]

Presently, the above mentioned indicators are unable to measure discernable effects of the Project due to the following reasons:
• As for the reduction of unit costs, although the Project proposed many ways of cost reduction and some of them are already employed, there are some other suggested methods which are taking more time to employ.
• As for the increase of treated wastewater, the major suggestions would be employed at a later stage in the project period. Thus effects would appear later if at all.

[Effluent water quality meets the standard at the focused STPs.]
The effluent water quality of the two focused STPs met the Industrial Effluent Standard in Thailand as follows.

Table 3-1: Comparison of effluent water quality
<table>
<tr><td rowspan="2">Item</td><td rowspan="2">Unit</td><td colspan="2">Kampaengphet</td><td colspan="2">Pathumthani</td><td rowspan="2">Industrial Effluent Standard</td></tr>
<tr><td>27-28 April 2005 (wet season)</td><td>27-28 July 2005 (dry season)</td><td>24-25 May 2005 (wet season)</td><td>10 August 2005 (dry season)***</td></tr>
<tr><td>BOD</td><td>mg/l</td><td>8.1</td><td>18</td><td>7.5</td><td>-</td><td>20-60</td></tr>
<tr><td>SS</td><td>mg/l</td><td>18.5</td><td>40</td><td>8</td><td>-</td><td>50-150</td></tr>
<tr><td>DO*</td><td></td><td>7.6</td><td>1.9</td><td>7</td><td>-</td><td>-</td></tr>
<tr><td>DO**</td><td></td><td>4.6</td><td>4.0</td><td>6.1</td><td>-</td><td>-</td></tr>
</table>
*, ** Spot sampling was carried twice during the survey period. Other data were figured out by composite sampling.
*** Due to the renovation work of STP, sampling was not possible.
Source: Final report “Chemical Analysis of Sewage Influent and Final Effluent, Sludge and Sediments in Sewage System in Nine STPs” (IST-JICA, October 2005)</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Achievement level of output 2</td><td>- Interviews with Japanese experts
- Interviews with CPs
- Project reports</td><td>[All the listed necessary materials are formulated.]

At the time of the mid-term review, no reference material has been distributed. But according to the schedule, five materials, namely Analysis of Existing Wastewater Treatment System and Direction for Improvement, Guide for Wastewater Collection to Sewer, Pumping Station Designing and O&M, Wastewater Treatment System O&M and Safety Manual for Construction and O&M, were planned to be developed by the end of May 2006. To develop these materials, the intensive surveys are in progress by a local consulting firm under the close supervision of Japanese experts. The first reference material, Analysis of Existing Wastewater Treatment System and Direction for Improvement, is now compiled and to be distributed soon after approval by the committee in the Project.

Now the Project team, especially the committee on reference materials, contemplates reducing the number of reference materials from 13 to about 10. The title and the contents will be revised based on discussion with CPs.

Table 3-2: List of (originally planned) reference materials
<table><tr><td>No</td><td>Title of reference materials</td></tr><tr><td>1</td><td>Analysis of Existing Wastewater Treatment System and Direction for Improvement</td></tr><tr><td>2</td><td>Appropriate wastewater treatment system for Thailand</td></tr><tr><td>3</td><td>Guide for Wastewater Collection to Sewer</td></tr><tr><td>4</td><td>Standard for Quality Control of Construction Works on Wastewater System</td></tr><tr><td>5</td><td>Pumping station designing and O&M</td></tr><tr><td>6</td><td>Wastewater treatment system O&M</td></tr><tr><td>7</td><td>Anticorrosion guide for sewerage systems</td></tr><tr><td>8</td><td>Troubleshooting example book on O&M for wastewater systems</td></tr><tr><td>9</td><td>Energy saving plan and operation for wastewater systems</td></tr><tr><td>10</td><td>Safety guideline for recycle of treated wastewater and disposal of sludge</td></tr><tr><td>11</td><td>Cost control for O&M of STPs</td></tr><tr><td>12</td><td>Cost estimation for O&M and rehabilitation works</td></tr><tr><td>13</td><td>Safety manual for construction and O&M</td></tr></table>
According to the interviews with CPs, LAs and private contractors, many believe that this output is tremendously important and urgently needed. CPs could bring the materials along when they visit STPs. They could be distributed to LA officials and contractors in charge, too, to carry them around. The contractor said, “if all the advice and technical suggestions are compiled as a book, it is easier for us to access, since we cannot always access the internal reports of WMA.”</td></tr>
</table>

	Achievement level of output 3 Original: Qualified personnel are assigned to operate and maintain STPs appropriately. Revision: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.	- Interviews with Japanese experts - Interviews with CPs	**Original: [Evaluation of personnel assigned for the focused STPs based on the qualification standards]** **Revision: [Personnel assigned for the focused STPs undergo trainings organized by the Project.]** Since the qualification standards of sewerage management officers are not established, and not to be established soon, the Project team, consisting of both CPs and Japanese experts, discusses and decides the areas of necessary knowledge and skills for the officers in charge. Then the Project provides training sessions accordingly. The first five-day training, which targeted the officers in charge of STPs with OD system, was carried out from 30 January to 3 February 2006. Thirty officers of LAs and contractors, including officers of WMA, participated and 24 completed the training course*. Unfortunately, officers at Pathumthani STP who were supposed to participate in the training, were unable to participate. Supplementary training sessions for them are under consideration. Now the training committee in the Project is planning to organize the second training sessions for officers in charge of STPs with SP and AL. *Since the training course is five-day long, 6 (out of 30) officers were unable to attend the course for the whole five days consecutively.
	Achievement level of output 4	- Interviews with Japanese experts - Interviews with CPs	**[Reference materials are available through information system on WMA managing STPs.]** **[O&M data for all of the focused STPs is collected with using information system.]** As previously noted, reference materials are in preparation. As for the development of an information system, the Project placed an order and the ordered hardware equipment is to be delivered by the end of March 2006. Five persons have undergone the intensive training on programming languages and now three of them are actively participating in the Project.
2. Contribution from each activity		-Interviews with Japanese experts -Interviews with CPs -Project document (questionnaire survey of the participants)	**[Activities for output 1]** Many activities have been carried out in relation to output 1. (i) Major technical suggestions by the Japanese experts are as follows. Some are already implemented; others, especially those that require a considerable amount of money, are now awaiting the budgetary allocation. a. For Kampaengphet STP • Designing in detail manual raked screens for PS2 • Ground fault protection setting for electrical systems • Improvement of setting of level switch • Improvement of check valve conditions • Improvement of printing systems for pumped-up volume

			• Improvement of combined over flow structures and flap valves • Improvement of pumping rooms (drying in low level area) • Proposal of operation for auto-screen and damage prevention • Valve operation proposal for storm water reservoir • Indication of malfunction of controller for power factor and proposal of improvement • Improvement of pumping operation systems • Upgrade and repair of electrical boards seals • Installation of a discharge flow meter at the end of chlorination chamber • Improvement of working hour timer for main pump • Improvement of the method of the check for the repairing works b. For Pathumthani STP • Setting of timer board for controlling the aerator instead of restoring of PLCs: setting PLCs for controlling aerators so far are over-designing for using simple controlling of the systems. • Improvement of power factor for reduction of electricity charge • Improvement of setting height and place of terminal box and wiring • Proposal for aerator operation interval • Proposal for single-train operation of the systems • Proposal for relocation of electric board in PS2 • Energy saving operational method • Maintenance works for electricity board and demonstration • H-Q curve testing for pumps which have lost documented-specification of HQ • Estimation of wastewater volume that is generated in the service area (ii) Other major activities by the Japanese experts are as follows. a. Numbers of visits to Kampaengphet STP (man-times) : 1 (2004), 15 (2005), 2 (2006) b. Numbers of visits to Pathumthani STP (man-times) : 7 (2004), 44 (2005), 4 (2006) c. Numbers of visits to other STPs (man-times) : 18 (2004), 40 (2005), 5 (2006) d. Numbers of technical reports / handouts: 46 e. Numbers of technical presentations : 11 The survey of CPs and officers in LAs and contractors reveals that many (10 out of 10) thought those major technical suggestions were practical, appropriate and new to them. Because (i) CPs who usually visit the focused STPs with the Japanese experts supervise more than two STPs, and (ii) the Japanese experts visit STPs other than the focused STPs, it can be said that the technical expertise and suggestions go beyond the focused STPs. **[Activities for output 2]** Although reference materials are not yet formulated, in order to collect basic data for them, the

			comprehensive studies were conducted by using the local consulting firms under the close supervision of Japanese experts. • The Basic Study for IST-JICA vol.1: Final report "Reviewing Sewage Works Planning at Pathumthani Municipality; Survey of sewer connecting ratio and pollution sources" (IST-JICA, October 2005) • The Basic Study for IST-JICA vol.2: Final report "Chemical Analysis of Sewage Influent and Final Effluent, Sludge and Sediments in Sewage System in Nine STPs" (IST-JICA, October 2005) • The Basic Study for IST-JICA vol.3: Draft report "Pump Station Design Review, Rubbish Screening and Effective Wastewater Catchments and Pump Operation" (IST-JICA, February 2006) • The Basic Study for IST-JICA vol.4: Draft report "The Study for Improvement of Sewage Treatment System Operational Improvement for Oxidation Ditch System and Pump Equipment" (IST-JICA, February 2006) **[Activities for output 3]** The five-day training was well planned and prepared. The uniqueness lies in two features of the training course, namely the involvement of WMA senior technical officers as lecturers and the one-day practical on-site training. In addition to as many as five WMA officers, a variety of lecturers such as an officer from BMA and personnel from the private company were invited and delivered the lectures. The posteriori questionnaire survey on the training reveals the following results. • As many as 31.82% and 54.54% of participants rated the knowledge level and performance of lecturer as very satisfactory and satisfactory, respectively. This means that about 86% of the participants found the lecturers more than satisfactory. • As many as 23.81% and 66.67% of participants rated the practicability of the training as very satisfactory and satisfactory, respectively. This means that about 90% of the participants were satisfied with the practicability of the training. **[Activities for output 4]** No activity is under way now except the IT training sessions in which CPs in charge are taking part.
3. Adequacy of quantity, quality and timing of inputs	- Experts, equipment, C/P, C/P training, budget allocation	- Project document - Interview with C/P - Interviews with experts	**[Dispatch of experts]** Due to the delay in approval of amendment to the R/D, the long-term expert on electric and machinery engineering and the Project coordinator were dispatched later than originally scheduled. The project coordinator was dispatched six months later than scheduled and the expert on mechanical / electrical equipment was dispatched one month later than scheduled. **[Assignment of counterpart staff]** Twelve staff members of WMA are to be assigned in the year 2006. Now seven of them, including the

			acting DG, are actively involved in the Project. Each output is assigned to the particular CP, and he/she closely works with the Project team on the matter. **[Counterpart training in Japan]** Four counterparts were dispatched to Japan as planned for counterpart training in 2005. **[Provision of equipment]** Equipment was procured and provided as planned except a server for the IT system due to the revision of specifications was requested from the JICA side. However, at the same time, IT staff members in WMA have undergone training. Once the IT server is procured by mid-March, the system can be developed soon enough to catch up with the schedule. All equipment is kept in good condition. **[Others]** JICA's procurement procedures were stymied by Tsunami and the earthquake in Pakistan. Thus two basic studies for IST-JICA, which are important activities of output 2, were delayed.
4. Important assumptions from activities to outputs		- Project documents - Interview with C/P - Interviews with experts	**[Trained personnel continue working for O&M.]** This remains an important assumption. Since personnel from the focused STPs have not received training yet, the supplementary training should be given first. Then the Project should monitor if the trained personnel continue working for the focused STPs.
4. Impact (Prospects)			
1. Achievement forecast for the overall goal		- Interviews with CPs - Interviews with Japanese experts - Interview with PCD	According to the interviews with CPs, five out of six* assume that the overall goal can be achieved, but the following concerns were presented during the interviews. • Achievement of the overall goal depends highly on capacity of each local municipality in terms of technical expertise, human resources and finance, all of which are out of WMA's control. • Many municipalities still do not know much about WMA. Thus access to the reference materials might become limited. The positive development is the revision of the Royal Decree. After the revision of the Royal Decree in 2005, the service area of WMA was expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can expand the Wastewater Management Area itself by proposing to the Cabinet. In addition, the *Rehabilitation Plan* of PDC also recommends LAs with difficulties in sewage management to contact WMA. * One CP said it was just too difficult to predict future developments.
2. Important		- Interviews with CPs	**[People are willing to pay the sewage charge.]**

<table>
<tr>
<td>assumptions from project purpose to overall goal</td>
<td></td>
<td>- Interviews with Japanese experts</td>
<td>
This still remains an important assumption. The Basic Study for IST-JICA vol.1: Final report "Reviewing Sewage Works Planning at Pathumhtani Municipality; Survey of sewer connecting ratio and pollution sources" (IST-JICA, October 2005) included the survey regarding willingness to pay. For example, the following table shows the opinion on expenses of the wastewater collection and treatment to be shared by service user. The table indicates that people's awareness on the wastewater issues is reasonably high. However, it is important to keep in mind that people's "willingness to pay" does not directly link to the introduction of sewage charges. Introduction of the sewage charge is a highly political issue. In fact, the officer of Pathumthani Municipality said it takes time (a few years at least) to introduce the sewage charge. He said it is more important now to expand the sewage treatment area first. On the other, as for Kampaengphet Municipality, WMA is now calculating number of households and the suitable rate on behalf of the municipality. However, the officer said it is difficult to predict if there is a political will to introduce the sewage charge.

Table 4-1: Views on expenses of the wastewater collection and treatment to be shared by service user
<table>
<tr><td></td><td></td><td colspan="2">Yes</td><td colspan="2">No</td><td colspan="2">Total</td></tr>
<tr><td></td><td></td><td>Number</td><td>%</td><td>Number</td><td>%</td><td>Number</td><td>%</td></tr>
<tr><td></td><td>Group A1</td><td>145</td><td>58</td><td>98</td><td>39</td><td>243</td><td>98</td></tr>
<tr><td></td><td>Group A2</td><td>29</td><td>50</td><td>27</td><td>47</td><td>56</td><td>97</td></tr>
<tr><td></td><td>Group A3</td><td>54</td><td>53</td><td>42</td><td>42</td><td>96</td><td>95</td></tr>
<tr><td></td><td>Group B</td><td>23</td><td>68</td><td>11</td><td>32</td><td>34</td><td>100</td></tr>
</table>
Group A1: Residential users connected to the sewer system
Group A2: Residential users not connected to the sewer system
Group A3: Household located in non-sewer area
Group B: Non-domestic users located in sewer area

Addition: [The problems relating to the wastewater collection system are solved.]
In the first half of the project period, the situations of overall sewage system, which were not known at the stage of project planning, became clear, such as poor sewer conditions and low connection rates to the municipal sewage system. These situations definitely affect achievement of the overall goal. However, since the project targets only STPs but not the sewer system, there is a view that another important assumption "Problems on the wastewater collection system are solved" should be added to PDM.

[Others]
The future direction of WMA as an organization should be closely monitored, though it may not so necessary to include as another important assumption. Although no conclusion has been reached, many discussions on such matters as the expansion of WMA's responsibilities to solid waste management are now going on. In addition, the Cabinet may be shuffled soon.
</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>In addition, the capacity of each LA is to be a crucial factor, though this may not necessarily be another important assumption. Thus this point should be monitored.</td></tr>
<tr><td>3. Ripple effects</td><td></td><td>- Interviews with CPs
- Interviews with Japanese experts</td><td>In order to make the Standards for quality control of construction works on wastewater systems a guideline, some CPs have a valuable idea of organizing a committee which consists of WMA staff members, officers from PCD and engineers from Environmental Engineering Association of Thailand. If this materializes and the document becomes a guideline, there will definitely be a positive impact.</td></tr>
<tr><td colspan="4">5. Sustainability (Prospects)</td></tr>
<tr><td>1. Policies and organizational/ financial aspects</td><td></td><td>- Interviews with CPs
- Interviews with Japanese experts</td><td>As previously noted, after the revision of the Royal Decree in 2005, the service area of WMA was expanded to the whole country with regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can re-define and expand the Wastewater Management Area itself by proposing to the Cabinet. In addition, the Rehabilitation Plan by PCD recommends LAs with difficulties in sewage management to contact WMA.

As for the organizational aspect, WMA is now expanding in terms of the number of employees in order to play a major role in the field of municipal wastewater management. The total numbers of employees of WMA from 2004 to 2006 (planned) are 88, 92 and 104 respectively. As for technical personnel, the numbers of employees* are as follows;
• Engineering department: 2 (2004), 4 (2005)
• Wastewater management department: 7 (2004), 12 (2005)
• Statistical and data development division: 0 (2004), 3 (2005)
The increment of technical personnel can be interpreted as WMA’s commitment in this field.

As for the financial aspect of WMA, the revenue and expenditure figures have been in an upward trend from 2001 to 2004 according to the annual plans.

Table 5-1: Financial Status of WMA Unit: baht
<table>
<tr><th colspan="2">Item</th><th>2001</th><th>2002</th><th>2003</th><th>2004</th></tr>
<tr><td rowspan="4">Revenue</td><td>Government budget fund</td><td>58,337,739.49</td><td>68,395,911.95</td><td>81,456,677.91</td><td>96,128,135.05</td></tr>
<tr><td>Income from the operation</td><td>-</td><td>831,361.32</td><td>4,635,408.60</td><td>4,194,859.89</td></tr>
<tr><td>Income from bank nterest</td><td>375,008.38</td><td>91,314.37</td><td>85,384.54</td><td>101,823.91</td></tr>
<tr><td>Other income</td><td>231,899.42</td><td>347,288.35</td><td>401,396.25</td><td>678,730.07</td></tr>
</table>
</td></tr>
</table>

	Total income	**58,944,647.29**	**69,665,875.99**	**86,578,867.30**	**101,103,548.92**
Expense	Administrative expense	44,179,192.62	49,055,491.39	73,445,473.05	55,492,311.62
	Depreciation	1,801,605.16	1,311,768.69	711,042.67	1,382,497.84
	Saensuk project expense	13,038,787.29	15,931,991.16	9,134,071.96	36,207,703.35
	Loss sharing in associated companies	-	6,105.94	60,831.27	-
	Other expense	-	-	-	345,000.00
	Total expense	**59,019,585.07**	**66,305,357.18**	**83,351,418.95**	**93,427,512.81**
Income - Expense		**-74,937.78**	**3,360,518.81**	**3,227,448.35**	**7,676,036.11**

*The gap is the actual increment of personnel.

2. Technology		- Interviews with CPs - Interviews with Japanese experts	As noted in the section, presently there is an idea of making *the Standards for quality control of construction works on wastewater systems* (one of the forthcoming reference materials) as a guideline. If it is materialized, it secures sustainability. Likewise, CPs are willing to utilize reference materials, and depending on the contents, they are to endeavor to make them formalized, possibly as guidelines and WMA publications. The five-day training was well appreciated. WMA is considering continuing training even after the Project. The involvement of WMA senior technical officers as lecturers in the training session in January gave them experiences as lecturers, and this helps WMA to organize the trainings themselves later on. In addition, water quality measurement equipment of the TCSW project was transferred from PWD to WMA. Presently WMA starts analyzing water quality of STPs under supervision of WMA. This contributes the sustainability of TCSW project.
6. Verification of Implementation Process			
1. Progress of activities		- Interviews with CPs - Interviews with Japanese experts	Details are as noted in 2. Contribution from each activity of Effectiveness. Although there are some delays in certain outputs, the activities for all outputs are diligently being accumulated.
2. Project management		- Interviews with CPs - Interviews with Japanese experts	The monthly team meeting participated by both CPs and Japanese experts is functioning regularly and well as a formal means of communication. In fact, according to the survey, five out of six CPs* said the same meeting functions adequately to monitor the progress of the Project and share its information. In addition, six out of six said that they communicate well each other not only through the monthly team meetings but through informal discussions and site visits.

			However, no comprehensive reports and public relations documents on the Project have been formulated or distributed within WMA, or to LAs and other relevant organizations. It is highly recommended to prepare such documents and actively distribute them. For example, the officer in Kampaengphet requested the Project to give him a success story of STP with pictures. If there is such a document, he could easily explain what has been accomplished to the high-ranking officials in the municipality. Comprehensive reports could meet this kind of demand. *One person became CP quite recently and could not evaluate the function of the monthly team meeting.
3. Ownership		- Interviews with CPs - Interviews with Japanese experts	The accumulated experiences on STPs together with CPs are assets of the Project. Through these working experiences on the ground, it seems that the Project earned the trust of CPs and established a rapport. The survey reveals that the technical knowledge and suggestions were very well shared. These sharing experiences are supposed to enhance a sense of ownership. In addition, each output has a responsible CP to actively facilitate each output. This mechanism seems to help foster ownership, too.

ANNEX VI: Plan of Operation (Progress & Revision)

Schedule of Activities

Upper row: original plan Under row: progress & revision plan Note: (*)Jun. including from 25 to 31 May 04.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	(*)Jun. 04	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 05	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 06	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 07	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	24 Nov. 07
1. Function of focused STPs is recovered.																																									
1-1. Review rehabilitation plan of existing STPs.																																									
1-2. Support implementation of rehabilitation focused STPs.																																									
1-3. Inspect rehabilitation works.																																									
1-4. Operate and maintain rehabilitated STPs.																																									
2. Reference materials for improvement of sewerage treatment plant																																									
2-1 List necessary reference materials.																																									
2-2 Examine methodology to develop reference materials.																																									
2-3 Conduct research works for development of reference materials.																																									
2-4 Develop reference materials.																																									
3. Qualified personnel are assigned to operate and maintain STPs																																									
3-1 Establish qualification standards.																																									
3-2 Prepare training materials.																																									
3-3 Execute training.																				OD											AD											
4. Information system is established to disseminate reference materials.																																									
4-1 Prepare reference materials for dissemination.																																									
4-2 Collect operation and maintenance data report.																																									
4-3 Collect completion document (construction drawings, etc.)																																									
4-4 Investigate existing information systems.																																									
4-5 Develop information system modifying existing ones.																																									
Midterm and Final evaluation																	M																				F					

Schedule of Personnel

Personnel/Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	Total
Long-Term Experts																																											
Chief Advisor/sanitary engineering																																										42MM
																																										42MM
Advisor for planning/designing/construction																																										36MM
																																										36MM
Advisor for mechanical/electrical equipment																																										30MM
																																										29MM
Coordinator/training																																										36MM
																																										30MM
Short-Term Experts																																										
Expert in charge of mechanical/electrical equipment																																										2 MM
																																										2MM
Expert in charge of O&M																																										7 MM
																																										8MM
Expert in charge of management for construction works and inspection																																										6 MM
																																										4MM
Expert in charge of training																			2	2				2																			6 MM
																																											8MM

ANNEX VII:

MINUTES OF MEETING
BETWEEN
THE JAPANESE MID-TERM EVALUATION TEAM
AND
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THAILAND
ON
THE JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR IMPROVEMENT OF
SEWAGE TREATMENT PLANT MANAGEMENT IN THAILAND

The Japanese Mid-term Evaluation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Shoichi Okumura conducted an evaluation study from February 20th to March 8th, for the purpose of the joint mid-term evaluation of the project for improvement of sewage treatment plant management in Thailand (hereinafter referred to as "the Project").

During their stay in Thailand, the Team had a series of discussion with the Thai authorities concerned, jointly evaluated the achievements of the Project, and exchanged views of the Project.

As a result of the study and discussions, both sides agreed to report to their respective Governments the matters referred to in the document attached hereto.

Bangkok, March , 2006

Mr. Shoichi Okumura	Mr. Akanit Ampawasiri
Leader	Acting Director General
Japanese Mid-Term Evaluation Team,	Wastewater Management Authority
Japan International Cooperation Agency,	Ministry of Natural Resources and Environment
Japan	Kingdom of Thailand

CONTENTS

ANNEXES

List of Abbreviations and Acronyms

General Terms

AL	Aerated Lagoon
AS	Activated Sludge
CPs	Counterparts
JICA	Japan International Cooperation Agency
LAs	Local Authorities
MONRE	Ministry of Natural Resources and Environment
OD	Oxidation Ditch
O&M	Operation and Maintenance
PCD	Pollution Control Department
PDM	Project Design Matrix
PLC	Programmable Logistic Controller
PS	Pumping Station
R/D	Record of Discussion
SP	Stabilization Pond
STP	Sewage Treatment Plant
TCSW (project)	Training Center for Sewage Works (project)
WMA	Wastewater Management Authority

ATTACHED DOCUMENT

1. Introduction

1.1. Background

The sewerage management is indispensable not only for living environment improvement but also for water pollution abatement in public water bodies. The first modern sewage treatment plant (STP) with the capacity of 2,400 cubic meters per day was constructed in 1971 to serve a housing complex in Bangkok. In the areas outside Bangkok, modern STPs were first constructed in Khon Kaen and Patong in Phuket in 1985. As of 2003, in the regions except for Bangkok, 14 STPs were under construction, 51 in operation and 12 with no operation at all[1]. The total design capacity with all 87 STPs in Thailand is to be about 1.3 million cubic meters per day.

As mentioned above, Thai has possessed lots of sewerage facilities but most of them have not been utilized in an effective manner. According to the project document issued in September 2004, the following problems were observed commonly.

- Inadequate operation and maintenance
- Unwillingness to implement sewerage tariff
- Low financial capability of municipalities
- Insufficient skill and knowledge of operators

Therefore, it was urgently required to restore primary function of constructed sewerage facilities and to make them play their role.

"The Project for Improvement of Sewage Treatment Plant Management in Thailand" (hereinafter referred to as "the Project") was formulated from this background to solve the above-mentioned problems and to restore STPs' primary function. The project document clearly states that though it is ideal that all these problems are concurrently solved, problems related to collection system and administrative/financial matters are impossible to solve in rather short period of five to ten years. So the Project focused on solving the technical side of the problems.

The Project has been implemented in accordance with the Record of Discussion (R/D) signed on May 25, 2004, between the Japan International Cooperation Agency (JICA) and the Wastewater Management Authority (WMA). Due to the necessity for modification of the project design matrix (PDM), the Project strategy was reviewed after the signing of the R/D in May 2004. Based on the review and the following discussions, the amendment to the R/D was finally signed on March 8, 2005. The Project, which started officially from May 26, 2004, could undertake its activities with the utmost operation.

1.2. Objectives of the Evaluation

The main objectives of the evaluation study are as follows:

i. To confirm the process and outcomes of the Project and evaluate its achievement from the viewpoints of relevance, effectiveness, efficiency, impact and sustainability
ii. To extract lessons-learned and recommendations to improve the future activities of the Project and future JICA's planning and management of similar projects

[1] These figures have been changed since the inauguration of rehabilitation plan was prepared by Pollution Control Department (PCD). For example, according to the hearings from PCD, nine out of 14 STPs that were planed to be constructed were completed their constructions. Other latest figures were not disclosed.

iii. To enhance the knowledge of WMA on the JICA's evaluation through joint evaluation process
iv. To meet accountability to the Japanese tax payers by producing an evaluation report

1.3. Evaluation Team

The Mid-term Evaluation Team (hereinafter referred to as "the Team") carried out the study in order to monitor and assess the project achievement from the commencement of the Project up to February 2006, from the perspectives of relevance, effectiveness, efficiency, impact and sustainability, and to come up with recommendations for the better project management for the rest of the cooperation period.

Team Leader:
Mr. Shoichi Okumura, Deputy Resident Representative, Thailand Office, JICA

Evaluation Planning:
Mr. Hirofumi Kinugasa, Assistant Resident Representative, Thailand Office, JICA

Wastewater Operational Management:
Mr. Haruki Takahashi, Director, Research and Technology Development Department, Japan Sewage Works Agency

Wastewater Planning Management:
Ms. Hiroko Kamata, Senior Advisor, Institute of International Cooperation, JICA

Evaluation Analysis:
Ms. Misa Oishi, Consultant, IC Net, Ltd.

1.4. Major Activities of the Team

Date		Activities
Feb. 20	Mon.	Meeting with JICA experts and Thai counter parts at WMA
Feb. 21	Tue.	Attending at the monthly team meeting to explain the process of the mid-term evaluation Interview with Mr. Akanit Ampawasiri and Mr. Sombat Paneiam at WMA
Feb. 22	Wed.	Interview with Mr. Supparat Ittipol, Mr. Thanawat Nakornchai, Ms. Hatarirat Likitanupak and Mr. Phanthat Chuncharoensook at WMA
Feb. 23	Thu.	Interview with Mr. Chusup Saisang at the Kamphaengphet Municipality and Ms. Anchalee at the Kamphaengphet Sewage Treatment Plant
Feb. 24	Fri.	TV meeting at JICA office
Feb. 25	Sat.	Preparation of evaluation summary
Feb. 26	Sun.	Preparation of evaluation summary
Feb. 27	Mon.	Interview with Dr. Chaiyo Juisiri at PCD Interview with Mr. Atirak Bupachanto at WMA
Feb. 28	Tue.	Interview with Mr. Carsten Hollaender Laugesen of DANIDA
Mar. 1	Wed.	Interview with Mr. Anirut Aree at Pathumthani municipality, and interview with Mr. Atapol Kanokrattana at Pathumthani Sewage Treatment Plant
Mar. 2	Thu.	Submission of the draft report / evaluation grid Arrival of two members (Mr. Takahashi and Ms. Kamata) of the Team from Tokyo Briefing of the draft report / evaluation grid
Mar. 3	Fri.	Meeting on the draft report / evaluation grid at WMA
Mar. 4	Sat.	Site visit to STP in Pathumthani

Mar. 5	Sun.	Preparation of Minutes of Meetings
Mar. 6	Mon.	Meeting with Thai CPs on the results of the evaluation and Minutes of Meetings
Mar. 7	Tue.	Meeting with Thai CPs on the results of the evaluation and Minutes of Meetings
Mar. 8	Wed.	Joint Coordinating Committee Meeting and Discussion of the Minutes of Meetings Report to JICA Thailand Office

1.5. Methodology of Evaluation

1.5.1. Methodology

The original Project Design Matrix (PDM, **refer to ANNEX I**), which was attached to the Record of Discussions (R/D) signed between JICA and WMA, is utilized as a basis of the evaluation. However, during the course of implementation, it became clearer some of the indicators are not most appropriate to measure the achievement. Thus, in addition to the original indicators, other indicators are used to evaluate some of the outputs.

The Team conducted extensive review of documents and other materials produced by the Project and the other sources to assess achievement of the Project quantitatively. The Team also conducted qualitative assessment through questionnaire surveys, interviews and field observations. The results of these exercises were presented and reviewed in the Joint Coordinating Committee meeting held on March 8, 2006, and finalized as attached in the minutes.

Achievement of the Project has been evaluated by the following five criteria through discussion between both sides.

a. Relevance

Relevance of the Project plan is reviewed by the validity of the Project purpose and the overall goal in connection with the development policy of the Governments of member countries and the needs of the beneficiaries as well as the logical consistency of the Project plan.

b. Effectiveness

Effectiveness is assessed by evaluating to what extent the Project has achieved its purpose and clarifying the relationship between the purpose and outputs.

c. Efficiency

Efficiency of the Project implementation is analyzed with an emphasis on the relationships between inputs and outputs in terms of timing, quality and quantity.

d. Impact

Impacts of the Project are assessed by either positive or negative influences caused by the Project.

e. Sustainability

Sustainability of the Project is assessed in managerial, financial and organizational aspects by examining the extent to which the achievement of the Project will be sustained and expanded after the completion of the Project.

1.5.2. Review of PDM

The following revision of the original PDM were discussed and approved in the Joint Coordinating Committee meeting on March 8, 2006, as seen in the **ANNEX II**.

(1) Revision regarding to output 3

- **Output 3**

  Original: Qualified personnel are assigned to operate and maintain STPs appropriately.

  Revision: Skilled personnel are assigned to operate and maintain the focused STPs appropriately.

- **Objectively verifiable indicator 3-1**

  Original: Evaluation of personnel assigned for the focused STPs based on the Qualification standard.

  Revision: Personnel assigned for the focused STPs undergo trainings organized by the Project.

- **Objectively verifiable indicator 3-2**

  Original: All of the focused STPs are managed by qualified personnel.

  Revision: All of the focused STPs are managed by skilled personnel.

- **Activity 3-1**

  Original: Establish qualification standards.

  Revision: Decide areas of necessary knowledge and skills for officers in charge.

(2) Addition of an important assumption from the project purpose to the overall goal

- The problems relating to the wastewater collection system are solved.

(3) Deletion of a means of verification 1-1

This was a means of verification of the PDM of the planning stage, and thus this should be deleted from the present PDM.

2. Project Achievement

2.1. Inputs

2.1.1. Inputs from Japanese side

In total, the Japanese side has allocated and appropriated necessary budget for the project activities and management as shown in the following table.

Unit: Thousand yen

Japanese Fiscal Year	JFY2004	JFY 2005(Plan)
Total Cost for Project Implementation	**40,077**	**80,205**

As for the assignment of personnel, enough Japanese experts have been assigned as seen in the **ANNEX III**. As for equipment, see the **ANNEX IV.**

2.1.2. Inputs from the Thai Side

The following inputs have been provided by the Thai side.

(1) Assignment of personnel

Enough counterparts (CPs) have been assigned as seen in the **ANNEX III**, although not in a full time condition.

(2) Provision of project office
Office space is provided at WMA.

(3) Allocation of recurrent costs for project operation
The Thai side has allocated budget for utility and administrative costs of the Project, including personnel costs. The budget allocated for 2004 and 2005 were approximately Thai Baht 45,858 and 282,943 respectively[2].

2.2. Outputs
To summarize, the achievement of each output is discussed as follows.

Output 1. "Function of focused STPs is recovered."
Originally this output was to be measured by the following indicators.

i. Unit cost (Baht/m^3) is reduced by 20% at the focused STPs;
ii. Treated wastewater is increased by 30% at the focused STPs; and
iii. Effluent water quality meets the standard at the focused STPs.

However, presently the above mentioned indicators are unable to measure discernable effects of the Project due to the following reasons:

- As for the reduction of unit costs, though the Project proposed many ways of cost reduction and some of them have been already employed, there are some other suggested methods which have not been employed.
- As for the increase of treated wastewater, the major suggestions would be employed in the later of the project period and thus effects would be brought about later.

By considering the above situations, the Team would like to suggest defining the first two indicators clearly as seen in the recommendation part of this document.

As for the effluent water quality, the two focused STPs met the Industrial Effluent Standard in Thailand. Details are seen in the **ANNEX V**.

Output 2. "Reference materials for improvement of sewage treatment plant management are developed."
At the instant of the mid-term review, no reference material has been distributed, though according to the schedule, five materials, namely *Analysis of Existing Wastewater Treatment System and Direction for Improvement*, *Guide for Wastewater Collection to Sewer, Pumping Station Designing and O&M*, *Wastewater Treatment System O&M* and *Safety Manual for Construction and O&M*, were planned to be developed by the end of May 2006. In order to do so, the intensive surveys are in progress by a local consulting firm. *Analysis of Existing Wastewater Treatment System and Direction for Improvement* is now compiled and to be distributed soon after approved by the committee in the Project. Presently the Project team, especially the committee on reference materials, discusses reducing the number of reference materials from 13 to about 10.

Output 3. "Qualified personnel are assigned to operate and maintain STPs appropriately."

[2] Figures are the amounts of total allowance from the Thailand International Cooperation Agency. As for 2006, the expense of WMA for the trainings is added.

Since the qualification standards of sewerage management officers are not established in Thailand, and not to be established soon, the Project team, consisting of both CPs and Japanese experts, discusses and decides the areas of necessary knowledge and skills for the officers in charge. Then the Project provides trainings accordingly. Under these circumstances, the description of output 3 in PDM was revised as seen in the **ANNEX II**.

The first five-day training, which targeted the officers in charge of STPs with OD system, was carried out from 30 January to 3 February 2006. Thirty, including officers of WMA, officers of local authorities (LAs) and contractors, have participated in and 24 have completed the training course[3]. Very unfortunately, officers working at Pathumthani STP, who were supposed to attend, was unable to participate in the training. Supplementary trainings for them are under consideration. Presently the training committee in the Project is planning to organize the second training for officers in charge of STPs with SP and AL.

Output 4. "Information system is established to disseminate reference materials and to collect O&M data."

As previously noted, reference materials are in preparation. As for the development of information system, the Project placed an order and the ordered hardware equipment is to be delivered by the end of March 2006. Five persons have undergone the intensive training on programming languages and now three of them are actively participating in the Project.

2.3. Project Purpose

"Efficient and effective operation method of STPs is established."

The project purpose is expected to be achieved through the activities conducted by the Project. Though the reference materials have not been formulated yet, the accumulated knowledge and experiences on the focused STPs are considered sufficient to make them practical and suitable in STPs in Thailand. Once they are formed, through direct distributions and internet, information on the efficient and effective operation method will be distributed.

2.4. Overall Goal

"Sewage Treatments Plants (STPs) are operated efficiently and effectively in Thailand."

Since the Project has carried out only for about two years, it is too early to measure the achievement of the overall goal; however, the Project is obviously promoting efficient and effective operation method of STPs. Although the direction of the overall goal is agreed in the beginning of the Project, there is a certain gap between project purpose and overall goal. Quite many important assumptions affect the overall goal. Even if only a few of reference materials can be set as guidelines, it contributes tremendously to the overall goal. However, it is good to review the overall goal to be more closely linked to project purpose in logics and to be possible to achieve within several years after project completion.

3. Evaluation by Five Criteria

3.1. Relevance

The relevance is assessed from the different viewpoints such as priority and necessity of the Project. In general, the Project bears sufficient relevance. The details are explained as follows.

[3] Since the training course is five-day long, 6 (out of 30) officers were unable to attend for the whole 5 days consecutively.

The Project directly contributing to improvement of wastewater treatment system and prevention of water pollution complies with both the priorities set by the environmental policy of Thailand and Japanese aid policy. In Thailand, *The National Policy and Plan for Environmental Quality Promotion and Conservation B.E. 2540-2559 (A.D. 1997-2016)* formulated by Office of Environmental Policy and Planning and ordained by National Environment Board covers various environmental issues over the 20 year period from 1997. Water quality improvement and wastewater treatment are considered as important issues in this policy. On the other, in Japan, based on *the Environmental Conservation Initiative for Sustainable Development* formulated by the Ministry of Foreign Affairs of Japan in 1997, the government has promoted actions in the following four priority areas, namely (1) Efforts to Address Global Warming, (2) Pollution Control including water pollution, (3) Fresh Water Issues and (4) Conservation of Natural Environment.

WMA, a state-owned enterprise provides supports LAs for the sound operation of STPs. After the revision of the Royal Decree in 2005 the service area of WMA was expanded to the whole country in regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can expand the Wastewater Management Area itself by proposing to the Cabinet. In addition, *the Rehabilitation and Improvement Plan for Municipal Wastewater Collection and Wastewater Treatment System for Overall Thailand* also recommends LAs with difficulties in sewage management to contact with WMA. Under these circumstances, the fostering skilled technical personnel of WMA is in urgent need. Thus it is relevant to choose and support WMA as a CP agency.

In terms of suitability as means, the project approach “the experiences of rehabilitation and O&M in the focused STPs are disseminated mainly through reference materials” is understood both by Japanese experts and Thai CPs to be relevant in order to achieve the project purpose. Now the discussion is whether the Project should start working in the 3rd STP.

It is worth noting at this point that there is another important government agency called Pollution Control Department (PCD). PCD monitors and controls the functions of STPs in Thailand and wastewater quality in general. Thus it is relevant that PCD is a member of the Joint Coordinating Committee.

In Japan, there is an organization called Japan Sewage Works Agency, which functions like WMA. It is known that this organization has contributed greatly to developing the wastewater treatment facilities and improving wastewater treatment technologies. Thus it also can be said that the Project is relevant in terms of advantages of Japanese technology.

3.2. Effectiveness (Prospects)

Looking at the present situation of each output mentioned below, it can be said that most probably the project purpose will be achieved, and thus the effectiveness of the Project is likely to be secured, only if the Project could produce sufficiently practical reference materials in time.

The progresses of four outputs which contribute to achieving the project purpose can be summarized as follows. As for output 1, function of the focused STPs in Kampaengphet and Pathumthani is in recovering. During the course of rehabilitation activities, practical knowledge and experiences have

been accumulated in the Project. As for output 2, the progress is in delay and no reference material is produced as of February 2006 except the reference material No.1 in a draft form. However, in order to do so, technical papers by Japanese experts have been already accumulated. In addition, several comprehensive studies to collect basic data were conducted by the Project. As for output 3, one five-day training on the OD system was carried out in January 2006 and the other trainings are to be held in May 2006 for the officers in charge of other STP system. Output 4 will be soon started once the server is arrived in March 2006. The reference materials will be publicized once the system is established.

Though the reference materials have not been formulated yet, by considering the present status of outputs and activities accumulated in order to produce those outputs, it can be easily assumed that the Project could produce sufficiently practical materials which contextualize situations in Thailand. Once they are formulated and distributed in various ways, technical information explained in the reference materials will be well spread. However, it is worth keeping in mind that, according to the PDM, the reference materials are the only major means to disseminate technical information accumulated through all activities of the Project.

3.3. Efficiency

In general, the Project has been implemented efficiently. The details are explained as follows.

By looking at output levels and activities, the Project is being implemented efficiently at present. Although a delay in preparation of reference materials is a great concern of the Team, a number of activities have been carried out diligently meanwhile as previously noted under the effectiveness criterion. The accumulated activities are contributing effectively to producing the present levels of outputs.

As for input-output situation, the delay in dispatch of two personnel should be mentioned. Due to the delay in approval of amendment to the R/D, the long-term expert on electric and machinery engineering and the project coordinator were dispatched later than originally scheduled. The project coordinator was dispatched six month later than the scheduled and the expert on mechanical / electrical equipment was dispatched one month later than the originally scheduled. This unfortunately affected negatively the progress in the beginning of the Project. Under these unavoidable circumstances, the schedule and plan of the Project were revised and has been implemented accordingly. Despite the delay in dispatch of two personnel in the beginning, by considering the present level of outputs and many activities carried out by now, efficiency of the project can be judged as sufficient at this stage.

As for the CPs' assignment, twelve staffs of WMA including the acting director general are to be assigned in the year 2006. It is true that CPs are busy with routine WMA works, but it became clear that maximum efforts and active participation were made by CPs to produce outputs. An example of these efforts is that each output is assigned to the specified CP, and he/she closely works with the Project team on the matter. Japanese experts confirm that they are assigned in the efficient manner to produce outputs.

3.4. Impact (Prospects)

At this moment, it is too early to assess the overall impact of the Project since it requires more time and inputs beyond the Project framework to achieve the overall goal, "Sewage Treatment Plants (STPs) are

operated efficiently and effectively in Thailand". In addition, the important assumptions considerably affect the overall goal. If the project purpose is achieved, the reference materials will contribute to promoting efficient and effective operation method in Thailand. Like as seen in the section of effectiveness, reference materials play a major role in this regard, too. If only a few reference materials can be set as guidelines, it tremendously contributes to the overall goal.

The positive development which affects impact is the revision of the Royal Decree in 2005. As described in 3.1. Relevance, this revision of the Royal Decree along with the rehabilitation plan of PCD placed more responsibilities and opportunities to WMA. By seizing these opportunities, WMA could disseminate what WMA has gained during the course of the Project directly to more LAs.

During the first half of the project period, the situations of overall sewage system, which were not well known in the stage of project planning, has become clear, such as poor sewer conditions and low connection rates to the municipal sewage system. These situations definitely affect an achievement of overall goal. Although the project targets only STPs and not sewer system, the Project should keep watch on those situations as one of the important assumptions as described in the revised PDM.

In addition, during the course of the mid-term evaluation it became clear that the future organizational restructuring of WMA, if any, and the capacity of each LA may affect the overall goal substantially, thus though those issues are not incorporated in the revised PDM, the Project should keep an eye on any developments in this regard.

3.5. Sustainability

(1) Policies and organizational/ financial aspects

As just noted above, after the revision of the Royal Decree in 2005, the service area of WMA has been expanded to the whole country in regard to O&M and sewage charge collection. As for the construction of new plants, the service area is still limited to the Wastewater Management Area, but now WMA can re-define and expand the Wastewater Management Area itself by proposing to the Cabinet. This creates the great opportunities for WMA to work with LAs all over Thailand and thus strengthen the business base of WMA.

As for the organizational aspect, WMA is now expanding in terms of numbers of employees, especially for 2005 and 2006 (plan), in order to play a major role in the field of municipal wastewater management. The increment of technical employees can be interpreted as WMA's commitment in this field. As for the financial aspect of WMA, the figures relating to the result of operation has been in upward trend from 2001 to 2004 according to the annual reports of WMA.

By looking at those factors mentioned above, the environment which secures sustainability is being put into place.

(2) Technological aspects

As noted in the Impact's section, presently there is an idea of making *the Standards for quality control of construction works on wastewater systems* (one of the forthcoming reference materials) as a guideline. If it is materialized, it secures sustainability too. Likewise, CPs are willing to utilize reference materials, and depending on the contents, they are to endeavor to make them more formalized, possibly as guidelines.

The five-day training in January in 2006 was well appreciated by both the Project and participants. WMA is considering continuing training even after the Project. The involvement of WMA senior technical officers as lecturers in the training session gave them experiences as lecturers, and this helps WMA to organize the trainings by themselves later on. In addition to factors relating the policies and organizational/ financial aspects mentioned above, the Project itself made efforts to internalize mechanisms which secure the sustainability.

4. Conclusion and Recommendations

During the course of the study, it became clear that the Project has made great efforts and has accumulated tremendous knowledge and experiences on the sewage treatment system in Thailand. The technical cooperation backed by expertise and understanding of local context is highly appreciated by CPs. However, the Team dares to recommend the followings in order to improve the Project.

Recommendations

(1) Enhancing the collaboration with PCD
As previously noted, besides WMA, there is another important organization called PCD. PCD functions as a regulating agency and monitors all STPs in Thailand while WMA is an implementing agency working for the limited numbers of STPs. Thus it is essential to encourage PCD to take a part in the Project in order to disseminate the Project's outputs to STPs beyond STPs supervised by WMA.

(2) Redefining conditions for the objectively verifiable indicators of output 1
In order to measure output 1 more precisely, the Team recommends the Project to redefine conditions to use objectively verifiable indicators as follows;

- Indicator 1-1: Base data measurement for decrease of unit operation cost
  Base data should be data obtained before employing the cost-reduction suggestions by JICA experts. For STP in Pathumthani, the base data for unit cost should be 10.4 baht/m^3 of May 2005. For STP in Kampaengphet, the base data for unit cost should be the average unit cost of January and February of 2006. Additionally, cost reduction effects by element such as electricity expense and personnel expense should be also considered.
- Indicator 1-2: Base data measurement for increase of treated wastewater
  Base data should be accurate and limited to only sanitary wastewater excluding storm water, thus should be the average figure of flow rate in dry season only after the reliable flow rate measurement is secured. In concrete term, the volume of influent wastewater of December 2005, January 2006 and February 2006 in average should be applied as a base data. At the instance of terminal evaluation, the base month for base data can also be reviewed.

(3) Complementing the indicator 1-2 of output 1
For the focused STPs where there is limited room to increase 30% of the volume of treated wastewater by O&M, the technical suggestions and proposals related to improvement of wastewater collection system, etc, should be made to increase efficiency of the focused STPs. At the instance of terminal evaluation, the evaluation team should study the likelihood of realizing those suggestions and proposals. In this regard, the Team recommends that the Project encourages LAs of the focused STPs to take part in the Joint Coordinating Committee and make them aware of importance of the

wastewater system, especially the improvement of wastewater collection system.

(4) Developing reference materials which can serve many users

The Team recommends the Project to reconsider the contents of reference materials and concentrate on materials with higher priorities, if necessary, based on the discussion within the Project team. Reference materials could be various forms such as guidelines, training materials and manuals / check sheets for O&M, but should be highly useful.

(5) Continuing the training activities

According to the PDM, the training activities target at personnel in the focused STPs only. However, the tailor-made intensive trainings, which the Project organized once in January 2006, could be one of the most effective ways to disseminate knowledge that the Project is trying to disseminate through the reference materials. In order to assure the materialization of the project purpose, continuation of trainings, by using reference materials, is highly recommended. During the trainings, the water quality measurement equipment of the Training Center for Sewage Works (TCSW) Project transferred from the Public Works Department can be also utilized.

(6) Enhancing the public relations activities

Unfortunately, a number of accumulated activities and knowledge are not compiled in a written form. It became clear, only by interviewing experts individually, that a large numbers of activities have been carried out by each expert. The Team recommends documenting the progress of the Project, by preparing newsletters and booklets, and appealing what the Project has done, not individually but as the Project. These documents also help the Project to show its presence to wider public.

ANNEX VIII: Field Observation Report

1. Date: 3rd in May, 2006 AM 7:30 – PM 1:00

2. Participants: Mr.Haruki Takahashi, Ms.Hiroko Kamata, Mr.Shuji Tanaka, Mr. Matsuo Tanaka

3. Target Facilities

3.1 Pathumthani Sewerage Facilities (treatment plant, two relay pumping stations)

3.1.1 Sewerage System in Pathumthani

Pathumthani Municipality is located about 10 km north from Bangkok, North West from Don Muang International Airport, along the Chao Phraya River. It is the capital and commercial city of Pathumthani Province, with the population of less than 20,000.

Based on the feasibility study conducted in 1993, the sewerage system was constructed financed by PWD in 1997. The two relay pumping stations were constructed until 2000. The present service area is about 7.1 sq.km, which equals to 43% of the municipal area,16.5 sq.km. The treatment process is Oxidation Ditch and the actual inflow in June and July in 2005 was 1,400 m^3/day with BOD of 60 – 80 mg/l, while the design capacity of the sewage treatment plant is 11,000 m^3/day.

The treatment plant had been operated for almost one year by the contractor which built these sewerage facilities. However, unfortunately, these facilities were almost closed due to the lack of budget for electricity charges and other expenditure for O&M.

3.1.2 Rehabilitation Plan

According to the report of "the rehabilitation and improvement plan for municipal wastewater collection and wastewater treatment system for overall Thailand" prepared by PCD in 2003, the Pathumthani sewage treatment plant was listed as one of the worst condition that needs immediate improvement implementation. In response to such situation, The Project was decided to work at Pathumthani Municipality as one of the focused sites after the Joint Coordination Committee in October, 2004. Rehabilitation of Pathumthani treatment plant and pumping station are currently executed by the private contractor called EEI and supervised by the WMA team including Japanese experts to accomplish after the first step of action plan of this rehabilitation plan.

When the rehabilitation works started in November 2004, the treatment facilities which had been left for few years were in miserable condition. Some of the treatment facilities were covered with woods and grasses. Some electrical wires were bitted by rats. The rubbish was found at pumping stations. Due to the effort of WMA and the Japanese experts, the treatment plant successfully started operation since May 2005. The major activities and suggestions are as follows; (1) operation of the reduced numbers of jet aerators based on the actual BOD loads, (2) setting of timer board for controlling the aerator instead of restoring of Programmable Logistic Controller (PCL) board, (3) setting height/place of terminal box and wiring (4) single-train operation of oxidation ditch, (5) suggestions on Improvement of power factor and (6) suggestion on relocation of electric board in PS2 and so on. These improvements, which were proposed by Japanese experts, contributed to saving the energy, resulting in the reduction of O&M cost.

To be more firmly for energy saving operation, introduction of the timer controlling board was executed with JICA in the 1st in March 2006.

3.1.3 Field Observation

Since it was Saturday when the member of the evaluation team visited the treatment plant, there was little staff in the private company which was entrusted the O&M works from the Municipality. There was no inflow of the wastewater regrettably because the inflow into the treatment plant depends on the intermittent operation of the pumping station. Also, the automatic rake and aerated grit chamber were not operated. The number of Jet aerator in operation was two out of eight to save energy cost. While the excess sludge was planned to be dewatered by mechanical dewatering process, it might be over specification because mechanical dewatering requires a huge investment and O&M cost in comparison to the drying bed. It is said that this machines has never worked till now as no excess sludge has generated in the Oxidation Ditch.

Since there was no effluent from the sedimentation tank due to no inflow from the pumping station, we could not check the effluent quality. However, it was found that the capacity of the staff in charge of the O&M works has been improved comprehensively due to the effort of the Japanese experts.

With regard to two pumping stations, one pumping station did not work, resulting in the very high water level in the reservoir. While the Japanese experts tried to start the pump manually, he could not succeed in starting operating it again. It was impossible to guess the reason why the pumping station stopped and from when it stopped, while it is said the pumping station was struck by thunder before. Since no operation of pumping station causes the water pollution because the wastewater is discharged into water body without any treatment, the quick measure should be taken. The Japanese experts promised to ask WMA to solve this problem, not directly to the entrusted company by WMA.

3.1.4 Comments

Due to the activity by the Japanese experts and WMA, the function of the sewerage facilities has been recovered to some extent. On the other hand, the collaboration and involvement of the Pathumthani Municipality is indispensable to achieve the output 1, namely “the function of focused STPs is recovered.”, which is measured by the indicator of the increase of the treated wastewater by 30 %.

While the improvement of the wastewater collection system is out of scope of this project, the efficiency of STP depends strongly on the performance of the sewer system. The major measurement to increase the treated wastewater is as follows;

(1) Recovery of the pumping station which lifts the wastewater into the treatment plant

According to the survey, it was found that two pumping stations were not in operation since the clogging of garbage and damage of control equipment due to insufficient maintenance.

(2) Increase of the connection rate to the sewage pipe, while it is said that the connection rate is assumed to be 25 %, 1000m3/day divided by 4000m3/day. (Observed inflow rate at dry season was divided by the estimated wastewater generation.)

(3) Extension of the sewage pipe

(4) Prevention of the leakage of the wastewater

(5) Recovery of the flow capacity of the pipe through the retrieval of the sedimentation/debris in the pipe

Among the five measurements mentioned above, four measures except (1) cannot be solved without the assistance of the Municipality. The problem of (1) also is partially caused by the clogging of garbage which shall be prevented through the public awareness.

It means that the increase of the treated wastewater shall be achieved only by the cooperation and the involvement by the Municipality. Therefore, the action to be expected by Municipality is shown below.

(1) to publicize the necessity of the sewerage system for environmental improvement to life quality and tourism of the neighbors

(2) to prevent to throw the garbage into the canal and sewer pipe

(3) to obtain the construction budget from the central and local government by taking priority action as shown below.

① Main sewer for community located along the main road

② Secondary sewer for community located along soi and canal

(4) to secure the O&M budget of clean up the pipe and to repair the leakage periodically in the own budget

While the budget of the municipality is limited and it might not be enough to spare for the sewerage improvement system, the Project has to make the every effort to let the City Mayor to understand the importance of the sewerage system. The reference material such as “Guide for Wastewater Collection to Sewer” might be very helpful to the Municipality. Furthermore, the Project should invite the Mayor to Joint Coordinating Committee. It is also useful to visit the Mayor if possible when the Japanese experts visit the sewerage facilities.

The fundamental solution is to acquire the budget for improving the sewerage system. Since the sewerage budget is distributed from the Ministry of Interior through ONEPP in the Ministry of Natural Resources and Environment, the Project has to work on the relevant organization to secure the budget for the focused Municipality.

Anyway, the Project has to take any chance to increase the treated wastewater conducted by the Municipality.

Single-train operation of OD

Newly Introduced timer board

3.2 Laboratory in Technical Center for Sewerage Works (TCSW) Project

3.2.1 Outline of TCSW Project

TCSW project is the output of the predecessor the Project, conducted from 1995 to 2000. Its objectives are to enhance the capacity of the staff in charge of the O&M of the sewage treatment plant in the Local Agency all over Thailand. Some textbook and training materials were prepared in Thai and English language and at the same time, the various kind of water quality measurement equipments were put into Thai side for training the staff in LAs.

However due to the reorganization of the central government organization in 2002, the jurisdiction of municipality's sewerage system was mandated from the department of Public Works (PWD) in the Ministry of Interior to the Pollution Control Department (PCD) in the Ministry of Natural Resources and Environment. Since the counter part of TCSW project was the staff in PWD and the laboratory and lecture room belonged to the building of Ministry of Interior, the result of TCSW project for five years were not used in PCD after the reorganization and abandoned till the commencement of the Project. Various materials and debris miserably occupied the laboratory. Some equipment did not work due to the invasion of small animals such as rats and gecko and so on.

3.2.2 Repair of Equipment

Total expense for all equipment including water analysis equipment was 190 million Japanese yen. So, Japanese experts had suggested WMA to reuse of the sleeping equipment such as for negotiation with the owner of the TCSW, DTP. Finally the water quality analysis equipment was handed over from DTP to WMA. The Japanese experts checked all the water quality analysis equipment to confirm the workability and based on this survey, some of the equipments were adjusted. Unfortunately, it was found that a lot of expense will be required to repair the rest such as the atomic absorption photometer, gas chromatography, water purification machine and high performance liquid chromatograph. So, it might be difficult to recover all the equipments in the laboratory.

With regard to the training materials such as textbooks, they were scattered on the floor. The WMA and Japanese experts scrambled them and checked whether which textbook was missing. Fortunately, almost all the textbook were collected. It is said that the content of textbook will be installed in the IT system to disseminate the result overall the Thailand.

These equipments will be used in analyzing the wastewater and training the staff in the staff of WMA and STPs. To achieve this work, WMA hired one staff for arranging the textbooks and equipments recently in order to prepare the training described above.

3.3.3 Field Observation

The laboratory has two parts; one part is equipped with the water quality measurement, and the other with a pump performance test plant and some tool for actual experimental training. It is said that only the former equipments were handed over from PWD to WMA.

Due to the devoted effort of the Japanese experts, the laboratory was clean and some equipment were adjusted and repaired again. But it is a great pity that the equipments provided by JICA had been used only for a short time and after that abandoned.

3.3.4 Comments

It is very pleased that that some of these equipments will be used again according the suggestion from Japanese experts.

Thai side, not Japanese side, had the title to these equipments and the reorganization of the central government triggered a miserable condition that the equipment provided by JICA was not used effectively and adequately. The abandonment of equipment for three years might not be the fault of Japanese Side. However this fact must be noted and JICA, including the regional office and the procurement division, has to learn a lesson from this, share it with JICA staff and never repeat such a mistake again.

Equipment and textbooks were transferred to WMA.

ANNEX IX: List of Interviewees

No.	Persons to interview	Organization & Designation	Date
1	Mr. Akanit Ampawasiri	WMA, Deputy Director for Administration; Acting Director of the WMA	21 Feb. 2006
2	Mr. Sombat Paneiam	WMA, Project Director; Director General Secretary	21 Feb. 2006
3	Mr. Supparat Ittipol	WMA, Office Director for Wastewater Treatment	22 Feb. 2006
4	Mr. Thanawat Nakornchai	WMA, Head of Information System	22 Feb. 2006
5	Mrs. Hatarirat Likitanupark	WMA, Office Director for Project Development and Planning	22 Feb. 2006
6	Mr. Phanthat Chuncharoensook	WMA, Drawing Technician	22 Feb. 2006
7	Mr. Chusup Saisang	Kamphaengphet Municipality, Director of Sanitary and Environment	23 Feb. 2006
8	Ms. Anchalee	Wastewater Operate & Maintenance Company, Contractor	23 Feb. 2006
9	Dr. Chaiyo Juisiri	Pollution Control Department, Engineer	27 Feb. 2006
10	Mr. Somchai Songprakob	Pollution Control Department, Environmental Officer	27 Feb. 2006
11	Mr. Athirak Bupachanto	WMA, Engineer	27 Feb. 2006
12	Mr. Carsten Hollaender Laugesen	DANIDA, Chief technical advisor CD-WMA	28 Feb. 2006
13	Mr. Anirut Aree	Pathumtani Municipality, Director of Sanitary and Environment	1 Mar. 2006
14	Mr. Atapol Kanokrattana	Environmental and Energy International Co., Ltd., Contractor	1 Mr. 2006

ANNEX X:

The Project for Improvement of Sewage Treatment Plant Management in Thailand

Mid-term Evaluation: 2006 February

Summary of the Interview

About implementation process

Q Does the Joint Coordinating Committee work adequately to support the Project in terms of frequency and the contents of discussion? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- No opinion since he had participated only once, and could not comment.
- Adequate. For my understanding, JCC is established as a formality. The JCC does not get involved much in the project's implementation. But sometimes the JCC suggests good advice to the project.
- Adequate. JCC is established as a formality. They could help by giving us suggestion but they won't contribute in action.
- No opinion. Since I haven't attended.
- No opinion. I am not involved in JCC.
- No opinion. As I have attended only once, and could not comment.

Q Does the monthly team meeting function adequately to monitor the progress of the Project and share its information in terms of frequency and the contents of discussion? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate since though I do not attend usually, I have heard from subordinates that the monthly team meetings are held regularly.
- Adequate for monitoring the progress and updating the information.
- Adequate. The monthly team meeting monitors every development on the project well. Japanese experts make technical presentations at this meeting. As for the technical presentation, I think it is better to do so to wider audience.
- No opinion. Since I have attended once in December 2005 after I came back from the training in Japan (31 Aug – 10 Dec).
- Adequate. I think we always have a discussion not only in the meeting but also outside the meeting as an informal discussion.
- Adequate. In addition, the emergency meeting could be applied for any urgent cases.

Q Do C/Ps and Japanese experts communicate adequately enough to implement the Project efficiently and effectively? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate. My technical staffs work very closely with Japanese experts. They visit site together. They are working very well together.
- Adequate. We communicate well with Japanese experts both formally (through the monthly team meeting) and informally (through site visits together.)
- Adequate. Not only the focused sites, but others such as visiting Phayao Town Municipality for survey and visiting the tsunami affected areas, we obtained help from Japanese experts.
- Adequate. I suppose we communicate very well informally, but we should communicate more formally, too. It is better to formalize handouts and reports by Japanese experts, like the recent study on Pathumthani Municipality.
- Adequate. In addition, it is highly recommended to compile all the information or knowledge presented by Japanese experts as a book.
- Adequate. The workplace of Japanese experts and Thai counterparts is quite close to each other. So, it is quite easy to have a discussion with Japanese experts.

Q Do you and WMA team with Japanese experts communicate adequately enough to implement the Project efficiently and effectively?

- Normally we will communicate with the Japanese experts once a month when we visit one of the focused STPs. There is no problem so far.
- There is a monthly meeting in Bangkok and Kamphaengphet. The attendants are from WMA and WOMC. All of WMA's team and 3-5 staffs from Chumsang and Kamphaeng Phet will normally attend the meeting. The content of the meeting is mainly about the progress, performance, and problems.

Relevance: a criterion for considering the validity and necessity of the project

Q Does the Project adequately meet the needs of WMA? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate regarding the technical fields. Technically the Project is greatly contributing WMA personnel especially by influencing junior technical officers. Personally speaking, I would like to learn more about the experiences of Japan Sewage Works Agency in order to strength the WMA as a leading agency in the field of sewage treatment.
- Adequate. The project quite adequately meets the needs of WMA because the knowledge or technology provided by the project is necessary and useful to WMA to fulfill its mandate. (SI)
- Adequate. Since O&M is main activity of WMA. In addition, the equipment from TCSW helps to enhance the WMA's monitoring capacity of water quality.
- Adequate. Level of technological information is adequate but the point is how to transfer. For easier transfer, the formal documentation is very important.
- No opinion. I think this is much concern about WMA's policy. Anyway, the project itself is very useful to my routine work.
- Adequate. For IT section, data collection system is very important and though it is difficult to manage.

And now it is in the process of procurement of hardware equipment.

- Adequate. When JICA experts and WMA come, the problem or request will be reported or discussed through WMA.
- I would like to get more support on technical knowledge, electrical and environmental issues. Sometimes I know what the problem is but I cannot do or solve the problem because there is no budget.
- Adequate.

Q Is the Project's approach (experience of rehabilitating focused STPs will be disseminated through reference materials) appropriate? If appropriate, please describe why you consider it is appropriate. If inappropriate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate. We welcome more suggestions applicable to the situations in Thailand. (AA)
- Adequate. It seems to me this is the most effective way. For this approach, choosing WMA as a CP organization is right, since WMA is the only organization which has the actual activities with LAs.
- Adequate.
- Adequate.
- Adequate. Presently it is adequate. But in the future some other channels could be used such as the internet.
- Adequate. In the future there might be other ways such as through the internet. As the information is quite huge, only the guideline or content could be prepared in the internet. More details (reference materials) can be sent later as requested.

Q Are technical suggestions and technologies used in the rehabilitation and O&M appropriate? Please describe your opinion.

Appropriate Inappropriate No opinion

- Appropriate. I heard they are adequate. For example, the improvement regarding the electrical board/system is what I thought appropriate and new to us.
- Appropriate. Because Japanese experts have good expertise and up-dated knowledge of sewage management.
- Appropriate.
- Appropriate.
- Appropriate.
- Appropriate. For example, the suggestion to do the water screen before let it go into the sewage treatment system.
- The suggestion from WMA is quite ok. Sometimes it can help to improve the performance of the STP. There are three main organizations that organize the training; WMA, WOMC, and Ministry of Science and Technology.
- Appropriate. For example, at the Pathumthani STP, the Japanese experts suggested to use the Timer for the calculation on how many Jet Aerators should be operated and to check whether there is any leakage in the sewage treatment system, in order to save the energy.

Q Do you learn something new and useful from technical suggestions from Japanese experts? If so provide some examples.

- I have learned something new and useful such as the methodology for preparing pipes and energy saving implementation regarding aeration.
- Regarding the SP, covering from sun prevents faster grow of a certain substance.
- For example, evaluation of sewer pump's capacity.
- Yes. This is especially for the knowledge about new technology or method.
- The knowledge about the maintenance of sewage treatment system in Japan.
- Yes. But many times I also know the problem or what Japanese experts suggested.
- As far as I know thorough a series of good presentation by Japanese experts, it seems that the WMA has learned a lot from their experiences and expertise in facility improvement, for example, the incident of electrical board.
- Variety of knowledge in the field of mechanical and electrical engineering.
- The way to analyze and solve the problems itself is what we have learned. As for the concrete examples, deep analysis of O&M of pumping system was interesting.
- How to save the power of pumping system. Calculate the oxygen amounts necessary and suitable to the BOD level.
- Knowledge in the field of mechanical and electricity. For example, to use ground wire to protect the lightning.
- I used to attend the several of programming language classes such as Visual Basic, ASP, and PHP. (IT esperts)
- Maintenance system of equipment such as electric control box, auto screen, BOD, and wastewater pump.
- Suggestion in the field of maintenance and safety system.
- The technique to test or inspect the wastewater pump and its capacity. How to operate the Jet Aerator in a proper way.

Q Are selected STPs appropriate and enough in numbers? Please describe your opinion.

- Not enough. I would like to the IST project to cover a few more STPs under WMA.
- Two focused STPs are representing two most common types of treatment which now WMA is handling. So for the time being, two have been enough. Now the IST project is discussing to decide the third STP. For the 3rd STP, I think we should wait for the answer from Phichit municipality which has the third type of treatment (aerated lagoon) if they work with WMA. If there is a request from the Phichit Municipality, then I will propose for the 3rd STP. If there is no request, then only 2 STP should be enough. Otherwise, as I mentioned in the monthly team meeting, we need to justify why we choose a particular STP with the same method as a third focused site.
- Better to include the third STP which uses AL in order to cover all three types.
- All three types should be covered.
- As there are three types of sewage treatment system in Thailand. So, the project should cover to all of them.

Q Are there any organizations, regulations and programs which started recently to

improve the sewage system in Thailand? If so, how do you collaborate with those, or divide responsibilities?

- PCD is the only other organization which handles the wastewater treatment. PCD functions as like a police. On the other WMA functions as a implementing agency in the same field.
- PCD. As mentioned in the annual report of WMA, Department of Local Administration Promotion channel the funds to each LAs.
- Municipalities are responsible for wastewater treatment by our constitution. LAs are the main organization in this sense.
- As far as I know, the WMA is the leading organization.
- No idea.
- I think there are other two organizations; Pollution Control Department and National Environmental Office. They are concerning about the support of budget and inspection service. Nakornchum municipality is now requesting to use the sewage treatment system with Kamphaengpeth municipality.
- I think Bangkok has its own sewage treatment system. But Bangkok and WMA work separately to each other. The coordination or support will be provided as requested.

Effectiveness : a criterion for considering whether the implementation of project will benefit the intended beneficiaries

Q Looking at the present situation, is the project purpose "Efficient and effective operation method of STP is established" likely achieved? Please provide us the reason of your choice.

Likely Unlikely No opinion

- Likely. For my understanding, the IST project is contributing especially to the improvement of rehabilitation and O&M. However in order to achieve the project purpose, financial and administration side of operation of STP is also very important for the local governments.
- Likely. But for me, the indicators are not convincing to measure "efficient and effective operation".
- Likely. As for my understanding LAs lack three, namely technical expertise, personnel and budget. This approach is trying to affect first and second items.
- Likely.
- Likely. I think IT section will be ready and finished 100% at the end of the project.
- Likely. As our works are implemented according to the plan and we get good cooperation with the municipality.

Q Do four outputs contribute enough to achieve the project purpose? If enough, please describe why you consider it is enough. If not enough, how do you think it can be improved?

Enough Not enough No opinion

- Technically enough, but from the viewpoint of administrational operation, not enough. As mentioned above.
- I suppose it is enough, but difficult to say something concrete about the future. (SI)
- It is not enough, since the non-technical expertise in the field of wastewater treatment is also necessary.
- Enough.

- Enough.

Efficiency : a criterion for considering how economic resource / inputs are converted to results

Q How do you know / think about the present status of four outputs? (Note: Progress in rehabilitation of the two focused STPs; progress in preparation of the reference materials; progress in fostering technical personnel (O&M training); progress in developing the information system)

- I don't know in detail, but I heard the IST project is doing all right from the subordinates.
- I know well as a project director of the IST project. We discuss details in the monthly team meeting.
- I know well through the monthly team meeting.
- I know only about the progress of trainings since I recently joined the team. As for training, one 5-day session on OD system was carried out and now planning to organize the similar trainings for other two systems.
- I think the present status or progress of four outputs is fine so far.
- Regarding the progress of information system development, I have now about 70-80% of the knowledge to do it. I am waiting for the hardware. Once the hardware gets installed, the progress will be rapidly increased.
- As I know the training has already implemented, the suggestion of Japanese experts has been used such as to fix the check valve. But I don't know much in detail for the progress of IT and reference materials.

Q Have activities been sufficient to produce the outputs? Any activities that you would like to request the project to enhance?

- Same as the above. What I would like the IST project to do is training especially on the occupational safety and health.
- Two out of four outputs haven't been produced so far, which are reference materials and information system. Taking the present constraints on resources and time into consideration, what have produced so far is all right.
- Yes, but it becomes better if the project tries to benefit personnel in LAs. Shortage of skilled personnel in LAs is acute. The project's effect trickles down through WMA, but the way to more directly benefit them could be added such as trainings.
- So far the activities are sufficient
- Some activities should be enhanced. For example, the Japanese expert should visit other STPs more often but it might be difficult to visit some of them since they are located quite far from Bangkok.
- If possible, when WMA goes to STP sites, I would like the Japanese experts to come along with us. Because we always face new different problems. If Japanese experts come along with us, then we could get suggestions or advices at the sites during visit.

Q Are Japanese long-term experts and short-term experts dispatched adequately in terms of their expertise, numbers of experts, period and timing in order to carry out the planned activities? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate.
- Adequate.
- Adequate.
- Adequate. It is adequate for the long-term expert. But the short-term expert should be increased in term of number and duration.
- Adequate. It's adequate in term of the expertise. But the period of short-term expert should be extended a bit longer.
- Adequate. It's adequate in term of their expertise. In term of period, I think it's too short for both short-term and long-term experts. So far it's adequate for the number, but in the future the number of Japanese expert should be increased as we have to responsible more STPs.

Q Is provision of equipment adequate in terms of variety, quantity and timing? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate.
- Adequate.
- Adequate.
- Adequate.
- Adequate.
- No opinion.

＊Q (Only to those who participated in trainings in Japan) Was the training useful? If so, especially what was useful? If not so useful, how do you think the training can be improved?

Useful Not useful No opinion

- Useful, however it was too short to learn the details of the visited organization. I would like to learn about the administrational experience of Japan Sewage Works Agency.
- Useful. Learned especially the management side of wastewater treatment, including new technologies and management practices used in Japan. Not everything is applicable to Thailand immediately, but the introduction of wastewater tariff was a timely topic.
- Useful. I attended the training (Sewage Works Engineering and Stromwater Drainage Technology) in Japan during 31 Aug – 10 Dec, 2005. I think this training was useful because I learned the new technology and the way of solving the problem from the training. However, not all the new technology or knowledge can be applied to Thailand right now because of many limitations such as budget, technology, and participation of the people.
- Useful. I used to attend three month training (Sewage Works Engineering and Stromwater Drainage Technology). I think the training was very useful and I have learned a lot of things such as the technology of using CCTV in sewage treatment system, management of sludge, how to make use the sludge such as making the fertilizer, and knowledge of the reuse of wastewater.

Q Were Thai CPs allocated adequately in terms of their expertise and numbers in order to carry out the planned activities? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it can be improved?

Adequate Inadequate No opinion

- Adequate. Though I would like to allocate more personnel, this is the maximus that we can allocate under the limited resources of WMA. In addition, journior officers who are not directly involved in the IST project, communicate with the IST project team including Japanese experts and learn from them.
- Adequate. I believe it is adequate considering limited number of staffs and increasing task of WMA.
- Adequate. Not only assigned CPs but non-assighed junior officers also involved. For example, in the committee on reference material I include two junior officers.
- Inadequate. In term of the expertise, knowledge, or experience.
- Inadequate. I think more training should be applied to WMA's staffs. And number of the staffs should be also increased in the future.

Q Are there any other alternate approaches / methods to implement the Project more efficiently? If so describe your idea.

- Not really, but increasing the WMA coverage is an important factor even to the IST project. Personally WMA should target 30% coverage within the next decade.
- Not really.
- Not alternate, but the additional support is necessary especially to the laboratory which was relegated recently from the Public Work Department to WMA. We need one more chemist.
- The communication or coordination of Japanese expert, WMA, consultant company (WOMC and EEI), and other related, should be more formal. For example, the suggestions or techniques should be prepared as the reference material for future use.
- The reference materials should be well prepared. In addition, the brochure of the project should be prepared also to educate or promote to the public.
- I would like the Japanese experts to go to the STP sites more often with us in order to get the prompt suggestion or advice.

Impact : a criteria for considering the effect of the project with an eye on the longer term effects including direct or indirect, positive or negative, intended or unintended

Q Is the overall goal that the Project targeting "Sewage Treatment Plants (STPs) are operated efficiently and effectively in Thailand" likely to be achieved with the Project's contribution? If "(highly) likely to be achieved", please describe how do you think it can be achieved. If "(highly) unlikely to be achieved", please describe how do you think the project should be modified.

❑Likely to be achieved

❑Unlikely to be achieved

❑No opinion

- Likely to be achieved. Especially in the technical aspect.
- Likely to be achieved. In fact there is no guarantee if all LAs would follow the operation method that the

project proposes in the reference materials since we can not force them to follow. However, by common sense, if the method saves cost, many LAs would follow such methods.

- Difficult to say, since highly depends on LAs.
- Likely to be achieved.
- Likely to be achieved.
- Likely to be achieved. But I'm not sure for 3-5 years after the project because we have to manage everything by ourselves. I think it's quite difficult for us because WMA has been newly established and the municipality doesn't know much about our activities. So, it will be better if the project period will be extended a bit longer in order to make sure that WMA is strong enough to manage everything.

Q Are any impacts on the development strategy expected? For example, influence on the establishment of policies and on the preparation of laws, systems, standards, etc.

- Reference materials can be sold at, say, 200 Bhats. The other way is formulation of guidelines. I want to make *the Standards for quality control of construction works on wastewater systems* a guideline. We found that the most of the treatment plants are over designed without considering the on-site treatment by septic tanks, but no guideline has pointed out this. PCD prepared the code of practice, but it is not useful at all. (AA)
- Even after the project, I would like to review all the reference materials produced by the project, compile important points and submit to the higher authorities to make them regulations. (SI)
- I am thinking about organizing a committee which is also participated personnel from PCD and Environmental Engineering Association in order to make *the Standards for quality control of construction works on wastewater systems* a guideline next month. (HL)
- I think the policy or the operation guideline of the government concerning the wastewater treatment should be improved.

Q What is the present status of introduction of sewage charge?

- We do not even have the sewage law in this country, and it is difficult to implement the collection of sewage charges without clearly mentioning the PPP in the sewage law.
- Only small numbers of municipalities especially in the tourist places start collecting the sewage charges.
- WMA can help only for the calculating the suitable amount for each LAs if they request WMA to do so.
- It is quite difficult to apply the sewage charge system to the municipalities because it affects elections. The municipalities are afraid that if they apply this system, they might get the negative feedbacks from the people.
- It is now in the process of discussion with WMA. In addition the WMA has already made a survey for the sewage charge to the people who live in Kamphaengpeth municipality.
- WMA has the section that work with this issue. Mr. Monthon is the person in charge. Regarding the municipalities, they are not so willing to apply this system to people because local politicians are afraid to lose election. However, I think this system will be applied for KamphaengPhet during the project period since this STP is a model STP in the region.

Sustainability : a criteria for considering whether produced effects continue after the rumination of the project

Q Are the leanings and experiences from rehabilitation activities in the focused STPs shared and spread among other STPs under WMA at present? How would be when the Project end? How would be after 3 to 5 years of the Project?

Present Highly spread Spread A little spread Little spread Not at all spread

- Spread.
- Spread. Through site visits not only to two focused sites but also other STPs and through trainings.
- Spread.
- Little spread.
- Little spread.
- I got the request from the hospital to use the sewage treatment system of Kamphaengphet municipality. I think the hospital will be allowed to do so but the hospital has to meet the conditions such as the wastewater must not be such a kind of infected wastewater. It is now in the process of consideration. (Kamphaengphet municipality)
- At this moment I have not shared experience or knowledge with other but among WOMC's staffs. (private contractor)
- Spread. The information will be disseminated through the training. In addition, not only the STPs under WMA but also other STPs will be invited to join this training. We have finished two trainings so far (Khon Kaen and Chiaeng Rai province).

End of the Project Highly spread Spread A little spread Little spread Not at all spread

- Highly spread.
- Highly spread. Through reference materials. Though highly depends on the development of information system.
- Spread.
- Spread
- A little spread
- Spread. WMA will have the training for municipality to make sure that they can manage everything by themselves.

After 3-5 yrs of the Project Highly spread Spread A little spread Little spread Not at all spread.

- Highly spread.
- Highly spread.
- Spread.
- Highly spread.
- Spread. The WMA has the capacity to manage the training by themselves.
- Spread. I think WMA will continue to disseminate the information or knowledge after the end of the project.

Q Are the reference materials shared and spread among all STPs under WMA at present? How would be when the Project end? How would be after 3 to 5 years of the Project?

Present Highly spread Spread A little spread Little spread Not at all spread

- Not at all spread.
- Not at all spread.
- Not at all spread.
- Little spread.
- Not at all spread.

End of the Project Highly spread Spread A little spread Little spread Not at all spread

- Highly spread.
- Highly spread. Through the computer system, the WMA and the PCD.
- Spread.
- Spread.

After 3-5 yrs of the Project Highly spread Spread A little spread Little spread Not at all spread

- Highly spread.
- Highly spread.
- Spread.
- Highly spread.

Q What does the Project have to do to disseminate (i) the leanings and experiences from rehabilitation activities in the focused STPs and (ii) reference materials from now on and even after the completion of the Project?

- WMA holds the annual meeting participated by all WMA employees, officers in charge in each municipalities and so on. Both the leanings and experiences from rehabilitation activities in the focused STPs and reference materials can be shared and dissiminated at this annual meeting. In addition, we can send reference materials to all the relevant organizations. Using materials at the training session is another idea.
- The ICT project could organize more training to disseminate necessary information.
- I could think of three ways, namely through information system, by direct distribution and at the annual technical seminar.
- The information should be gathered or collected as a book, which will be distributed through training.
- It will be better if Japanese expert will make a VCD during their visit to the STP. It becomes easier to explain what WMA and Japanese experts suggested to other officers in the municipality. This information will be also disseminated to other STPs in the future.
- I would like to have the training to the technical staffs who really face the problems in the STPs. In addition, the reference materials should be also wildly disseminated.

Others

Q Is the overall project design adequate in terms of activities, outputs, indicators, scope of the Project, C/P organization and focused STPs? If somehow not adequate, why so?

Adequate Inadequate No opinion

- Adequate. We have already requested the extension of Mr. M. Tanaka and Mr. Nakamura. As far as I know, the extension up to four years is theoretically possible. I want them to stay longer.
- Adequate. Only thing that is not adequate is the involvement from our side. If we had more personnel, we could involve more and we could benefit more.
- Adequate. But what I think it is not appropriate is the indicator 1.2. Treated quantity of wastewater does not directly reflect the improvement of pumping station.
- Adequate.
- Inadequate. By considering the scope of the project, it should be covered all three systems of sewage treatment plant.

Q There was another foreign-aided project called "Capacity Development for the Wastewater Management Authority" by DANIDA. How do you evaluate the Danida project?

- It seems CPs in WMA could not learn much. We should have requested more specifically what we would like to learn in terms of capacity development. (AA)
- No opinion, since I am not involved in the CD-WMA. What I know is they work mainly in the wetland.
- It was all right. They focused more on public relations. I was a team leader to prepare management system in Sansouk municipality to obtain ISO standard. The contractor at the municipality is WOMC.
- I don't get involve much with DANIDA project.
- I have heard of DANIDA project but I have never involved to this project before.
- I used to get involve with DANIDA project. For example, the STP at Sakon Nakhon recently has been certified for ISO 9000 (February 2006). And this is the first STP of Thailand that passed the ISO standard. DANIDA supported for the cost of inspection of ISO system.