

1. 合同評価報告書 (Joint Evaluation Report)

JOINT EVALUATION REPORT  
ON  
THE JAPANESE TECHNICAL COOPERATION  
FOR THE PROJECT  
ON THE INDUSTRIAL WATER TECHNOLOGY INSTITUTE  
IN THE KINGDOM OF THAILAND


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

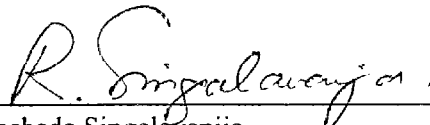
MINISTRY OF INDUSTRY  
DEPARTMENT OF INDUSTRIAL WORKS  
THE KINGDOM OF THAILAND

JANUARY 14, 2000  
BANGKOK, THE KINGDOM OF THAILAND

MUTUALLY ATTESTED AND SUBMITTED  
TO ALL CONCERNED

JANUARY 14, 2000  
BANGKOK, THE KINGDOM OF THAILAND

  
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Japanese Evaluation Team  
Japan International Cooperation Agency  
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## I. INTRODUCTION

### 1. The Evaluation Teams

The Japanese Evaluation Team (hereinafter referred to as “the Japanese Team”) organized by Japan International Cooperation Agency (hereinafter referred to as “JICA”) and headed by Mr. Yoshifusa Shikama, visited the Kingdom of Thailand from January 5 to 14, 2000 for the purpose of evaluating jointly with the Thai Evaluation Team (hereinafter referred to as “the Thai Team”) the achievement of the Japanese technical cooperation for the Project on the Industrial Water Technology Institute in the Kingdom of Thailand (hereinafter referred to as “the Project”) on the basis of the Record of Discussions signed on April 9, 1998 (hereinafter referred to as “R/D”).

Both Teams reviewed together the progress of the Project and evaluated jointly achievement, effectiveness, impact, efficiency, relevance and sustainability of the Project implemented at the Industrial Water Technology Institute (hereinafter referred to as “IWTI”) in Bangkok, the Kingdom of Thailand.

Through careful studies and discussions, both sides summarized their findings and observations as described in this document.

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## 2. Schedule of Joint Evaluation

(January 5-14, 2000)

<u>Date</u>	<u>Schedule</u>
January 5, 2000	(Member in charge of evaluation analysis) Arrive in Bangkok
January 6, 2000	Meeting with the Japanese experts Interview with Thailand Environment Institute Interview with IWTI staff Interview with the Japanese experts
January 7, 2000	Interview with IWTI staff
January 8, 2000	Data analysis
January 9, 2000	Data analysis
January 10, 2000	Workshop with IWTI staff Interview with Environmental Engineers Association of Thailand (Japanese Evaluation Team) Arrive in Bangkok
January 11, 2000	Meeting with the Japanese experts Meeting with the JICA Thailand Office Courtesy call to DIW Courtesy call to DTEC Meeting with JETRO
January 12, 2000	Interview with IWTI staff Preparation of the draft Joint Evaluation Report
January 13, 2000	(Both Evaluation Teams) Joint Evaluation Committee at DIW Preparation of the Joint Evaluation Report
January 14, 2000	(Both Evaluation Teams) Signing ceremony of the Joint Evaluation Report at DIW

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### 3. Members of Evaluation Team

#### 3-1. Japanese Evaluation Team

Mr. Yoshifusa Shikama	Leader
Mr. Akio Kobayashi	Technical Cooperation Planning
Dr. Totaro Goto	Technical Transfer Planning
Ms. Yukari Saito	Evaluation Planning/Project Cooperation Planning
Mr. Naoya Azegami	Evaluation Analysis

#### 3-2. Thai Evaluation Team

Mr. Rachada Singalavanija	Deputy Director General, Department of Industrial Works (Leader)
Dr. Pitsamai Eamsakulrat	Project Manager, Institute of Industrial Environment, Federation of Thai Industries
Dr. Varatus Vongsurakrai	Executive Director, Cho Heng Rice Vermicelli Ft. Co., Ltd.
Ms Duanghathai Chenchaiivitha	Program Officer, Monitoring & Evaluation Sub-Division, DTEC

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## II. METHODOLOGY OF EVALUATION

### I. Method of Evaluation

Both teams used the Project Design Matrix (PDM) as the basis of evaluation and evaluated activities using the Evaluation Grid.

### 2. Aspects for Evaluation

Both teams reviewed all the activities and achievement and evaluated the Project based on the following five aspects.

Effectiveness

Impact

Efficiency

Relevance

Sustainability

These aspects represent the most important points to be taken into consideration in connection with decisions on development projects.

### 3. Information for Evaluation

In order to evaluate the past performance, the following materials were used:

1. Record of Discussions (R/D), Tentative Schedule of Implementation (TSI), Technical Cooperation (TCP), Annual Plan of Operations (APO), Minutes of Discussions, and other documents agreed to or accepted in the course of implementation of the Project.
2. Project Design Matrix
3. Data of input to and output from the Project
4. Result of series of interviews and questionnaires



### III. BACKGROUND AND SUMMARY OF THE PROJECT

#### 1. Outline of Project's Background

With the industrial development in the past, Thailand has come to recognize the serious problems due to over extraction of groundwater and water pollution caused by industrial effluent discharges. Though the government of Thailand has been making efforts to cope with these problems, the problem has yet to be solved.

Under such condition, the government of Thailand planned to establish the Industrial Water Technology Institute within the Department of Industrial Works, the Ministry of Industry as the implementing agency to accomplish the task and submitted to the Japanese government a request for a project type cooperation.

In response to the above request, the Japanese government dispatched the Preliminary Study Team and the Supplementary Study Team in 1997, the Implementation Study Team in 1998. The Project started on June 1, 1998 with two-year cooperation period.

#### 2. Chronological Review of the Project

The chronological review of the Project is shown in Annex 2.

#### 3. Objective of the Project

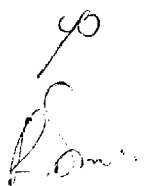
The objectives of the Project are integrated and compiled into "Overall goal" and "Project purpose" by a logical consequence in PDM as follows.

##### "Overall goal"

IWTI will be able to provide Thai industries with technical guidance on industrial water supply, rational use of water and wastewater treatment and re-use.

##### "Project purpose"

Engineers who have a basic technology relating to industrial water will be fostered systematically in IWTI.





#### 4. Tentative Schedule of Implementation

The Tentative Schedule of Implementation (TSI) is shown in Annex 3.

#### 5. Technical Cooperation Program

The Technical Cooperation Program (TCP) is shown in Annex 4.

#### 6. Annual Plan of Operations

Annual Plan of Operations (APO) is shown in Annex 5.



## IV. RESULTS OF EVALUATION

### 1. Summary

#### Effectiveness

The Project Purpose is likely to be achieved by the end of the Project. The IWTI staff have gained basic technology through lectures, factory practice, seminars and other activities. The Outputs are also likely to be produced as planned. IWTI is being operated with the resources necessary in general. Equipment for basic measurement and analysis is maintained properly. The IWTI staff have gained knowledge and skill regarding industrial water through various activities. They also could understand the current situation facing the factories and gain practical experience by the factory practice. The middle- and long-term plan was formulated by IWTI.

#### Impact

Due to the nature of the project as a preparatory phase, it did not produce a significant impact on the industry water of the Thai industry. In spite of the limited scale of the activities, the expectation to the IWTI of the Thai industry and the organizations concerned seems increasing through seminars and factory practice. The Project also seemed to have increased the recognition on the significance of industrial water technology of the DIW through the preparation of the operation plan, as DIW has shifted a policy direction from command and control to service provision.

#### Efficiency

The quantity, quality and timing of the Inputs were appropriate in most aspects and the Inputs were turned into the Outputs efficiently. Collaborative work were also facilitated with other projects and related organizations, which contributed to the efficiency of the Project.

#### Relevance

Overall Goal is regarded as appropriate, as the problems of over extraction of groundwater and inappropriate treatment of wastewater are negatively affecting the environment and the factories have the need for efficient use of water due to the price increase of groundwater and the prohibition of its use. Project Purpose is properly defined to realize Overall Goal since the project is the first phase to become a public service institution for the Thai industry. The function of IWTI comply with a shift in the policy direction of DIW from "command & control" on industrial sector to "service provision".

### Sustainability

IWTI is expected to play more important role as a technical service provider under the industrial policy framework. IWTI has established cooperation relationship with other related organizations, though on a limited scale. IWTI staff has gained some experience in managing activities, though there remains the room for strengthening its organizational capability for the expansion of the services in the future. DIW is also expected to provide financial support to assist IWTI in expanding the services to the Thai industry. IWTI staff have gained basic knowledge, which enables them to learn more advanced technology in industrial water.

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## 2. Details

### 2-1 Achievement of the Plan

Narrative summary	Verifiable Indicator	Result	Reference
(Overall Goal) IWTI will be able to provide Thai industries with technical guidance on industrial water supply, rational use of water and wastewater treatment and re-use.	1. Actual result of technical guidance to factories	Actual technical guidance is expected to start during the Phase II project.	
(Project Purpose) Engineers who have a basic technology relating to industrial water will be fostered systematically in IWTI.	1. Number of counterparts who have basic knowledge 2. Technical level of counterparts	1. Full-time counterparts are 10 including 1 director. 2. There is a certain range of technical level. The counterparts seem to gain basic technology by the end of the project. Reports of factory practice will be prepared after January by the counterparts.	Annex 12
(Outputs) 0. The organization of the project will be institutionalized and be operated efficiently. 1. Equipment for basic measurement and analysis in the factory practice will be installed and maintained properly. 2. The technology relating to industrial water will be acquired by IWTI counterparts. 3. The present situation on industrial water use in the factories will be understood by IWTI counterparts. 4. A middle and long-term operation plan of IWTI will be formulated.	0. Staff, budget and settlement of accounts of IWTI 1. Situation of maintenance and usage of equipment 2. Actual result of technology transfer/contents of curriculum and educational materials 3. Actual result of factory practice/number of and content of report 4. Middle and long term operation plan of IWTI	0. 10 counterparts and 4 administrative staff. Achievement of local cost by Thai side is 3.5 million Baht for 1998 and 2.7 million Baht for 1999.) 1. Most equipment is used properly. The counterparts take note of maintenance and usage record. Equipment is maintained well though there were small problems such as consumables shortage. 2. Technology transfer is conducted as was originally planned. Curriculum is appropriate in general. However textbooks for lectures were regarded as insufficient. 3. Factory investigations at the five factories were conducted. Report will be produced in 2000. 4. The plan was formulated by IWTI and approved by DIW in November 1999.	Annex 12 Annex 14  Annex 10

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(Activities)	Input		Reference
	R/D	Achievement	
0-1. Allocate staff as planned.			
0-2. Make operation plan of the project.			
0-3. Make and implement budget plan properly.			
0-4. Establish and operate joint coordinating committee.			
1-1. Provide and purchase the equipment for basic measurement and analysis in the factory practice.	Long-term Experts <3 persons × 24 months> -Chief Advisor and Wastewater Treatment and Re-use -Coordinator -Rational Use of Water and Industrial Water Supply	Long-term experts (3 persons × 24 months) 1. Chief Advisor/Wastewater treatment and re-use 2. Coordinator 3. Rational use of water and industrial water supply	Annex 11 Annex 7
1-2. Make operation and maintenance plan of the equipment.			
1-3. Operate the equipment constantly and inspect it periodically.	Short-term Experts	Short-term experts 1998: 4 (actual) 1999: 5 (planned)	Annex 7
2-1. Understand technical level of the counterparts through OJT.	Equipment for basic measurement and analysis	Equipment for basic measurement and analysis	Annex 10
2-2. Make plan of technical transfer to the counterparts.	Counterpart Training in Japan <2 persons>	Water analysis equipment Computer and peripheral device Others	
2-3. Make curriculum of technical transfer to the counterparts.			
2-4. Make educational materials for technical transfer to the counterparts.			
2-5. Implement technical transfer to the counterparts by lectures.	Support for Operational Cost of the Project	Counterpart training in Japan 1998: 2 (JICA), 4 (AOTS) 1999: 2 (JICA)	Annex 9
2-6. Make manuals and standard forms.			
3-1. Make Questionnaire to the factories.			
3-2. Select model factories and make plan of factory practice.		Support for operational cost of the project 1998: approx. 918,500 baht 1999: approx. 976,500 baht	
3-3. Implement technical transfer to the counterparts by factory practice.			
3-4. Make report on the results of factory practice			
3-5. Arrange engineering data from factory practice.	Inputs (Thai side)	Inputs (Thai side)	
3-6. Make examples of recommendation plans for factories.	Allocation of necessary budget for operation of IWTI	Allocation of necessary budget for operation of IWTI 3.5 Million Baht (1998) 2.7 million Baht (1999)	Annex 14
3-7. Hold seminars.	Long-term assignment of Project Manager and 10 full-time technical counterpart personnel	Long-term assignment of Project Manager and 10 full-time technical counterpart personnel	Annex 12
	Allocation of administrative personnel	1 Project Manager 9 full-time technical counterparts	
	Building and Facilities	2 part-time counterparts 1 trainee from TISTR	
	Equipment and Materials		
		Allocation of administrative personnel	Annex 12
		4 administrative personnel	
		Building and Facilities	Annex 13
		Office space of IWT with 4 rooms for Japanese experts Laboratory room	
		Equipment and Materials	Annex 13

2-2 Analysis on Evaluation Issue

2-2-1 Effectiveness

	Level of Achievement and Obstacles in Achieving the Initial Plan	Reference
Output Level	(Output 0) The organization of the project is institutionalized and operated efficiently.	
	IWTI was established on September 1997 based on DIW Order No. 212/2540. IWTI is one of the divisions of the Bureau of Industrial Environment Technology (BIET), while it used to be under Director General of DIW.	Annex 6
	The ten full-time technical staff were assigned to the project as originally planned. At present, the IWTI has ten full-time technical staff including the IWTI Director, two part-time counterparts from Water Pollution Division and one trainee from TISTR and four administrative staff.	Annex 12
	The Thai side provided the budget for the project, totaling to 3.34 million bahts in 1998 and 2.57 million bahts in 1999. The budget could generally cover the operation. The counterparts also could visit the factories in major industry sectors relevant to industrial water, though the project was forced to reduce the number of factory visit due to the limited budget.	Annex 14
	Regular weekly meeting has been held to discuss the project activities, attended by Japanese experts and Thai counterparts, which led to a closer communication between them and reflection of the need of the counterpart.	
	Preparation activities for the seminars gave the counterparts the experience of managing activities.	
	(Output 1) Equipment for basic measurement and analysis in the factory practice is installed and maintained properly.	
Equipment for basic measurement and analysis was provided by JICA and has been generally maintained in good condition, though minor problems occurred due to a shortage of the consumables and insufficient operation instruction from the manufacturers. The counterpart staff are divided into two groups and each group was responsible for the maintenance. It also produced a master file of the record of equipment list, operation and maintenance.	Annex 10	
The equipment procured was used well in the project activities as planned. Some of the counterparts suggested some other equipment be procured. The equipment for the measurement of BOD and SS was, for example, suggested, as the project had to measure and analyze these data in the factory practice.		
(Output 2) The technology relating to industrial water is acquired by IWTI counterparts.		
Technology of industrial water was transferred through lectures, factory practice and other activities. While the level of knowledge and skill of the counterparts varies depending on educational attainment and		

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	<p>experience in the past and some of the counterparts feel they need more knowledge and skill to do their tasks, basic technology was successfully transferred to the counterparts.</p> <p>The curriculum was originally prepared by the experts. It was, however, revised to reflect the needs felt by the counterparts, based on the discussion in regular weekly meetings.</p> <p>The textbooks provided and used in lectures were regarded as insufficient in terms of number and volume by the counterparts, resulting from the unavailability of ready made textbooks in the field. The need is felt for the compilation of well-organized reference books.</p> <p>(Output 3) The present situation on industrial water use in the factories is understood by IWTI counterparts.</p> <p>The factory practice has been conducted at the five factories since January 1999. Although the report writing has not finished yet and the difference of the attainment in knowledge and skill is observed among them, many of the counterparts seem to have gained basic knowledge and skill essential to plan and conduct factory investigation. Both counterparts and experts regard as satisfactory the presentation on the findings of factory practice made in March and December 1999. Report writing is expected to deepen the knowledge and skill of the counterparts.</p> <p>(Output 4) A middle and long-term operation plan of IWTI is formulated.</p> <p>Draft middle- and long-term operation plans were produced and revised several times based on the discussion of those concerned, including the DIW high rank officers as well as IWTI counterparts. It was approved in November 1999 by DIW.</p> <p>The formulation of the plan provided the counterparts the chance to discuss the objectives and activities in the future and recognize the current situation of industrial water. The formulation of detailed plan is desirable with more efforts to (1) understand the needs of the Thai industry and reflect them into the services and (2) facilitate the communication and cooperation with other related organizations.</p>	
<p>Factors Affected to Achievement of the Outputs</p>	<p>Output 0 The project encountered minor problems regarding Output 0. Two counterparts started to attend the lectures in three months after the commencement of the project, though they caught up by attending additional lectures of the experts. In addition, JICA has to procure a new OHP, as the one provided by the Thai side did not show a satisfactory performance. Furthermore, the budget of the IWTI had been adversely influenced by the government policy on curtailing the budget as a whole. Nevertheless, they did not have a critical negative impact on Output 0.</p> <p>Output 1 The IWTI had to request TISTR to assist in analyzing BOD and SS, since the equipment of measurement and analysis was unavailable at the IWTI. The limited local budget delayed the procurement of the consumables for the equipment. Although it requested IWTI to finance</p>	<p>Annex 12</p>

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	<p>it, JICA provided financial assistance for them as the delay was causing a operational problem.</p> <p>Output 2 Varying knowledge and skill level of the counterparts made it difficult for the experts to adjust the level of technical transfer appropriate to the counterparts. Added to that, ready-made textbooks, especially in the field of effective use of water were not always available.</p> <p>Output 3 Although the factories cooperated with the practice in general, some factories declined to disclose the relevant data as confidential and other factories were unable to provide the information, as they were not sure about the actual condition, which resulted in extra work for collecting data.</p>	
Project Purpose Level	<p>(Project Purpose) Engineers who have a basic technology relating to industrial water are fostered systematically.</p> <p>Project Purpose is likely to be realized at satisfactory level at the end of the project. The counterparts gained basic technology through lectures and factory practice, though a varying level of knowledge and skill gained is observed among the counterparts.</p>	
Factors Affected to Achievement of Project Purpose on the Basis of the Outputs	<p>There have not occurred changes in Important Assumptions, which would significantly influence the realization of Project Purpose.</p>	



2-2-2 Impact

	Content of Impact
Positive and Negative Impacts	Due to the nature of the project as a preparatory phase, it did not produce a significant impact on the industry water of the Thai industry, except for the investigation of five factories and the seminars.
Expected and Unexpected Impacts	<p>In spite of the limited scale of the activities, the expectation to the IWTI of the Thai industry and the organizations concerned seems increasing through seminars, site visits and factory practice. Indeed, the expectation of a representative from FTI was expressed on the role of IWTI to give other divisions of Ministry of Industry the technical advice and the information adapted to the context of Thailand.</p> <p>The project also seemed to have increased the recognition on the significance of industrial water technology of the DIW through the preparation of the operation plan.</p> <p>The project could contribute to the promotion of clean technology through the activities, which was made possible by Miyazawa fund.</p>

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2-2-3 Efficiency

	Content	Reference
Timing, Quality and Quantity of Inputs	<p>&lt;Experts&gt; The number of the long-term experts and the period of the assignment term are regarded as appropriate. Depending on the level of the lecture, the period of the dispatch of some short-term experts should have been extended for better understanding on the content of the counterparts.</p>	Annex 7
	<p>&lt;Training in Japan&gt; Four counterparts attended the training program in Japan under JICA counterpart training scheme, while other four did the AOTS training program. Those who attended are satisfied with the duration and content of the programs.</p>	Annex 9
	<p>&lt;Equipment&gt; The majority of the equipment procured by JICA was effectively used and properly maintained by the counterparts except for minor problems. The procurement and installation of the equipment were also completed in appropriate time.</p>	Annex 10
	<p>&lt;Local cost borne by the Japanese side&gt; In addition to the project budget from JICA, the funding of the Special Assistance for Asian Economic Crisis was made available to the project. The latter was spent to fund the activities of the project such as seminars.</p>	Annex 11
	<p>&lt;Counterpart staff&gt; The counterparts were assigned to the project in enough number as planned, though two of them attended a few months after the project's commencement.</p>	Annex 12
	<p>&lt;Facility and equipment&gt; Appropriate project office and equipment were provided by the Thai side under the severe financial condition of the government and they were effectively utilized by the project staff.</p>	Annex 13
	<p>&lt;Local cost borne by the Thai side&gt; The project was forced to reduce the factory visits due to the budget constraint. The disbursement of the budget was delayed in some cases because of administrative procedure.</p>	Annex 14
Level of Outputs Compared with Quantity and Quality of Inputs	Inputs were efficiently and effectively utilized to produce the planned outputs in general. The project could dispatch more counterparts than originally planned to the training programs in Japan by the cooperation with JETRO and AOTS.	
Supporting system for the Project	The Joint Coordinating Committee was established to assist in the operation of the project. Members are from a variety of the organizations concerned, including FTI, EEAT, TISTR and TEI as well as DIW and JICA. The first meeting was held in May 1999 so far due to a relatively short period of the project. As such, the meeting mainly focused on introducing the project to the attendants.	
Linkage with Other Cooperation Projects	<p>&lt;NEDO&gt; The project sent the staff to the NEDO demonstration plant to let them study plant design and construction. The counterparts could gain useful knowledge through site visits, lectures and discussion with NEDO engineers.</p>	

	<p>&lt;JETRO&gt; Coordination with JETRO made it possible for the project to send four counterparts to the training program as AOTS trainees. Some of the project members also participated in the steering committee, which was established by DIW and JETRO, regarding the strengthening of pollution control supervisor and operator system. The counterparts could recognize the possibility of the cooperation for curriculum development by IWTI.</p> <p>&lt;Other JICA projects&gt; The experts and several counterparts visited the JICA project in Thailand and the Project on Risk Management of Hazardous Chemical Substance of SIRIM Berhad in Malaysia to learn lessons of operation and management of the institute through JICA technical exchange program.</p> <p>&lt;Universities&gt; The experts and some counterparts visited Environmental Engineering Department of both Chulalongkorn University and Kasetsart University to exchange opinions and establish a close cooperation relationship. As a result, one lecturer of Chulalongkorn University was invited to the seminar as a guest speaker.</p> <p>&lt;Others&gt; Clean technology project by Miyazawa plan gave the counterparts the opportunity to visit factories and the practical skill in clean technology.</p>	
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2-2-4 Relevance

	Content
Relevance of the Overall Goal	The project staff as a whole regard Overall Goal as still appropriate, as the problems of over extraction of groundwater and inappropriate treatment of wastewater are negatively affecting the environment and the factories have the need for efficient use of water due to the price hike of groundwater. The Thai industry still has the need of technical guidance from the governmental organizations concerned.
Relevance of the Project Purpose	Project Purpose is properly defined to realize Overall Goal since the project is the first phase to become a public service institution for the Thai industry. The function of IWTI comply with a shift in the policy direction of DIW from "command & control" on industrial sector to "service provision".
Rational of Project Planning	The project is designed properly in that it is the first phase for the IWTI to become a service institution to the Thai industry and concentrated on gaining basic technology, which will become the basis for the provision of the service. The project also prepared the operation plan as one of the Outputs, which is essential to function as a service institution in the future.
Factors Affected	There has been no significant change in important assumptions, which would affect the relevance of the Project.

## 2-2-5 Sustainability

<p>Institutional Aspects</p>	<p>&lt;Policy framework&gt;          Though there is not a comprehensive policy framework of industrial water, Clean Technology Unit of BIET is currently formulating a master plan of clean technology, which industrial water is a part of, and Water Pollution Division is making a plan for the reduction of industrial waster water pollution. IWTI is expected to play a major role as the technical center, especially in training, under these policy frameworks.</p> <p>&lt;Human resource&gt;          DIW is planning to reallocate the staff of inspection to other divisions in the future. There may be a possibility that more staff will be allocated to IWTI. The majority of the counterparts are motivated to continue to work for the IWTI, though some expressed a concern that the future status is not finalized yet.</p> <p>&lt;Cooperation with related organizations&gt;          The IWTI has established a limited cooperation with other organizations concerned through the Joint Coordinating Committee and the activities, though the measures are not made clear yet on how IWTI can extend and strengthen the relationship.</p> <p>&lt;Management capability of IWTI&gt;          The counterparts gained experience and know how of operation and management of the IWTI through the activities to some extent. Especially, the formulation of the operation plan gave a good chance for the counterparts to seriously consider the future of the IWTI and build planning capability. Considering the expansion of the services in the future, more efforts should be required to strengthen organizational capability.</p>
<p>Financial Aspects</p>	<p>Although it has made best effort to finance the project sufficiently so far, DIW is expected to provide more financial assistance for the expansion of the services.</p> <p>Although the IWTI is expected to raise money through the provision of the services to the Thai industry, the prospect is not clear, because governmental organizations are normally not allowed to charge fees for the services and it depends on the quality and competitiveness of the service even if possible.</p>
<p>Technical Aspects</p>	<p>The counterparts successfully gained basic technology of industrial water, which enables them to gain more advanced technology and provide the services in the future, though the majority of them recognize they need more assistance from outside before they start to provide the services.</p> <p>The counterparts learned how to operate and maintain the equipment and are able to apply it to that of more sophisticated equipment.</p>

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## V. CONCLUSION

In conclusion, the Project is likely to produce the Outputs and achieve the Project Purpose by the end of the Project period. In addition, the five conditions, which are specified by the Japanese Implementation Study Team, are also likely to be met as follows. Based on these achievements, the Japanese and the Thai sides discuss the second phase of the Project.

1. Middle- and long-term operation plan has been formulated by IWTI, though the detailed plan is necessary to put it into practice.
2. IWTI staff have gained basic technology relating industrial water.
3. The current ten staff are likely to continue to work for IWTI.
4. It will be discussed in the preliminary study for the Phase 2 project whether the budget necessary for the operation of IWTI is ensured.
5. Enough office space was secured for the activities of IWTI.

## VI. RECOMMENDATION

IWTI is expected to play a more important role in the provision of services to the Thai industry in line with a shift in the policy of DIW from "command & control" to "service provision". Following recommendations are made for IWTI to achieve the mission in an efficient and effective manner.

1. The detailed plan should describe the measures to put into practice the middle- and long-term operation plan, with emphasis on the promotion of the cooperation with the organizations concerned and the incorporation of the needs of the Thai industry into the services.
2. More communication and cooperation with other divisions of Ministry of Industry should be promoted.
3. Efforts should be made to secure the enough number of the qualified personnel.
4. Efforts should be also made to secure the budget necessary for the activities of IWTI.
5. The budget should be disbursed in a timely manner to guarantee the efficient operation.
6. Organizational capability should be strengthened necessary to provide the services on a larger scale.

## VII. LESSONS LEARNED

The Project was implemented as a preparatory phase, which made it possible that those concerned carefully monitor and evaluate the Project at particular times, revise the plan and take corrective actions for the better operation of IWTI in the next phase.

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Annex 1 Project Design Matrix (PDM)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>(Overall Goal) IWTI is able to provide Thai industries with technical guidance on industrial water supply, rational use of water and wastewater treatment and re-use.</p>	<p>1. Actual result of technical guidance to factories</p>	<p>1. Record of technical guidance to factories 2. Interview to factories</p>	<p>a. Thai Government will continue its policy on industrial wastewater treatment. b. Thai economy is not getting worse rapidly. c. Thai industries accept technical guidance of IWTI. d. Thai industries invest for installation of wastewater treatment facilities.</p>
<p>(Project Purpose) Engineers who have a basic technology relating to industrial water are fostered systematically in IWTI.</p>	<p>1. Number of counterparts who have a basic knowledge. 2. Technical level of counterparts</p>	<p>1. List of counterparts 2. Interview to counterparts and Japanese experts 3. Report of factory practice 4. Performance of seminars (Questionnaire to the participants)</p>	<p>a. Thai industries recognized the roles of IWTI and supports IWTI. b. Counterparts continue to work at IWTI and gain experience. c. DIW supports activities of IWTI.</p>
<p>(Outputs) 0. The organization of the project is institutionalized and operated efficiently. 1. Equipment for basic measurement and analysis in the factory practice is installed and maintained properly. 2. The technology relating to industrial water is acquired by IWTI counterparts. 3. The present situation on industrial water use in the factories is understood by IWTI counterparts. 4. A middle and long-term operation plan of IWTI is formulated.</p>	<p>0. Staffs, budget and settlement of accounts of IWTI 1. Situation of maintenance and usage of equipment 2. Actual result of technology transfer / Contents of curriculum and educational materials 3. Actual result of factory practice / Number and content of report 4. Middle and long term operation plan of IWTI</p>	<p>0. List of staffs, budget and settlement of accounts 1. List of equipment / Record of maintenance and usage 2. Record of technology transfer / curriculum and educational materials 3. Record of factory practice / Report of factory practice 4. Middle and long term operation plan of IWTI</p>	<p>a. Counterparts continue to work at IWTI. b. DIW approves middle and long term operation plan of IWTI. c. Factories cooperate continuously to factory practice.</p>



Narrative Summary	Inputs		Important Assumptions
	Thai Side	Japanese Side	
(Activities) 0-1. Allocate staffs as planned. 0-2. Make operation plan of the project. 0-3. Make and implement budget plan properly. 0-4. Establish and operate joint coordinating committee. 1-1. Provide and purchase the equipment for basic measurement and analysis in the factory practice. 1-2. Make operation and maintenance plan of the equipment. 1-3. Operate the equipment constantly and inspect it periodically. 2-1. Understand technical level of the counterparts through OJT. 2-2. Make plan of technical transfer to the counterparts. 2-3. Make curriculum of technical transfer to the counterparts. 2-4. Make educational materials for technical transfer to the counterparts. 2-5. Implement technical transfer to the counterparts by lectures. 2-6. Make manuals and standard forms. 3-1. Make questionnaire to the factories. 3-2. Select model factories and make plan of factory practice. 3-3. Implement technical transfer to the counterparts by factory practice. 3-4. Make report on the results of factory practice. 3-5. Arrange engineering data from factory practice. 3-6. Make examples of recommendation plans for factories. 3-7. Hold seminars. 4-1. Select targeted industries, scale of the factories and technical fields 4-2. Make a middle and long-term operation plan of IWTL. 4-3. Make a middle and long-term consolidation plan of facilities and equipment in IWTL. 4-4. Make a middle and long-term budget plan of IWTL.	Allocation of necessary budget for operation of IWTL  Long-term assignment of Project Manager and 10 full-time technical counterpart personnel  Allocation of administrative personnel  Building and Facilities  Equipment and Materials	Long-term Experts <3 persons ×24 months> Chief Advisor and Wastewater Treatment and Re-use Coordinator Rational Use of Water and Industrial Water Supply  Short-term Experts  Equipment for basic measurement and analysis  Counterpart Training in Japan <2 persons>  Support for Operational Cost of the Project	a. Equipment for basic measurement and analysis in the factory practice are procured smoothly. b. Factories cooperate continuously to factory practice.  (Pre-conditions) a. IWTL is established formally under DIW. b. Building and facilities of IWTL are prepared. c. Factories cooperate to factory practice. d. Related information and data in DIW are available.

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## Annex 2 Chronological Review of the Project

Year	Month / Date	Item
1995	July	Submission of the request for a project-type technical cooperation from the Government of the Kingdom of Thailand to the Government of Japan
1997	June 23 - July 3	Dispatch of the Preliminary Study Team
	Nov. 30 - Dec. 20	Dispatch of the Supplementary Study Team
1998	April 2 - 11	Dispatch of the Implementation Study Team
	April 9	Signing of the Record of Discussions (R/D)
	June 1	Dispatch of the Japanese long-term experts (Chief advisor/Wastewater treatment and reuse, Industrial water supply/Effective use of water, Coordinator)
	June 8	Start of the lectures by the Japanese long-term experts
	Sep. 3 - 4	Factory visit to Ayutthaya Province
	Sep. 24	Delivery of the photocopy machine donated by JICA
	Sep. 28 - Oct. 10	Dispatch of the Japanese short-term expert (Operation and management of institutes)
	Oct. 20 - Nov. 14	C/P training in Japan (Operation and management of institutes: 2 persons)
	Oct. 26 - Nov. 7	Dispatch of the Japanese short-term expert (Effective use of water)
	Nov. 11	Delivery of the water analysis equipment donated by JICA (first batch)
	Nov. 16 - 28	Dispatch of the Japanese short-term expert (Wastewater treatment)
	Nov. 28 - Dec. 19	AOTS group training in Japan (Environmental protection of textile factory: 4 persons)
	Dec. 1	Delivery of the computers donated by JICA
	Dec. 2	Delivery of the water analysis equipment donated by JICA (second batch)
1999	Jan. 11	Start of the factory practice by the Japanese long-term experts
	Jan. 22	Delivery of the water analysis equipment donated by JICA (third batch)
	Jan. 27	Seminar on effective use of water and industrial wastewater treatment
	Jan. 28 - 30	Factory visit to Kanchanaburi Province
	March 1 - 12	Dispatch of the Japanese short-term expert (Information and data management)
	March 25	Seminar on the results of factory practice in the field of industrial water supply
	March	Submission of the request for the Phase II project from the Government of the Kingdom of Thailand to the Government of Japan

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## Annex 2 Chronological Review of the Project

Year	Month / Date	Item
	May 9 - 14	Dispatch of the Management Consultation Team from JICA
	May 17 - 29	Dispatch of the Japanese short-term expert (Quality control of industrial water)
	June 7 - 18	Dispatch of the Japanese short-term expert (Industrial Wastewater Pollution Management)
	July 12 - 22	Dispatch of the Japanese short-term expert (Operation and management of institutes)
	Aug. 23 - Sep. 1	Dispatch of the Japanese short-term expert (Principles and practices of anaerobic biological treatment)
	Sep. 20 - 24	Technical exchange with the Project on Hazardous Chemical Substances and the SIRIM Berhad in Malaysia
	Sep. 20 - Oct. 9	C/P training in Japan (Industrial water supply, effective use of water, wastewater treatment and reuse: 2 persons)
	Dec. 23	Seminar on cost reduction techniques of industrial water
2000	Jan. 5 - 15	Dispatch of the Japanese Evaluation Team from JICA

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### Annex 3 Tentative Schedule of Implementation (TSI)

Calendar Year	1997				1998				1999				2000
Japanese Fiscal Year	1997				1998				1999				00
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I
Term of Technical Cooperation													
<u>Japanese Side</u>													
I. Dispatch of Mission													
(1)Preliminary Study	-												
(2)Supplementary Study			-										
(3)Implementation Study				-									
(4)Evaluation											-		
II. Dispatch of Long-Term Experts													
(1)Chief Advisor / Wastewater Treatment and Re-use													
(2)Coordinator													
(3)Rational Use of Water and Industrial Water Supply													
III. Dispatch of Short-Term Experts					(Short-term experts in specific fields will be dispatched, if necessary)								
IV. Training of C/P Personnel in Japan					(Two C/P Personnel will be accepted in Japan)								
V. Provision of Machinery and Equipment													
<u>Thai Side</u>													
I. Buildings and Facilities													
II. Machinery and Equipment													
III. Allocation of C/P Personnel and Administrative Personnel													
IV. Budgetary Allocation													

NOTE: The Japanese fiscal year starts in April and ends in March.

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# Annex 4 Technical Cooperation Program (TCP)

Calendar Year	1998				1999				2000	Remarks
Japanese Fiscal Year	1998				1999				2000	
	I	II	III	IV	I	II	III	IV	I	
Term of Technical Cooperation	●-----●									
1. Industrial Water Supply										
(1) Lecture	●-----●									
• Basic Technology										
• Factory Investigation Program										
• Process Design Method										
• Operation and Maintenance										
(2) Preparation of Factory Practice	●-----●									
(3) Factory Practice	●-----●									
• Investigation of Actual Conditions										
2. Rational Use of Water										
(1) Lecture	●-----●									
• Outline of Production Process										
• Implementation Procedure										
(2) Preparation of Factory Practice	●-----●									
(3) Factory Practice	●-----●									
• Investigation of Actual Conditions	●-----●									
• Recommendation for Improvement	●-----●									
3. Wastewater Treatment and Re-use										
(1) Lecture	●-----●									
• Basic Technology										
• Wastewater Treatment Program										
• Factory Investigation Program										
• Process Design Method										
• Procedure of Economic Estimation										
• Operation and Maintenance										
(2) Preparation of Factory Practice	●-----●									
(3) Factory Practice	●-----●									
• Investigation of Actual Conditions	●-----●									
• Recommendation for Improvement	●-----●									
• Site Visit of Demonstration Plant (NEDO)	●-----●									
4. Report on Factory Practice	●-----●									

(Notes) • Factories ; ① Cho Heng Rice ② Teijin Polyester ③ Griffith Lab. ④ Charter Print ⑤ Theppadungporn Coconut

• Factories can be changed.

• The Japanese fiscal year starts in April and ends in March.

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Annex 5 Annual Plan of Operations (APO)

Activities	Target	Schedule (2 years)																								Responsible Person		Input	Remarks		
		Japanese Fiscal Year 1998												Japanese Fiscal Year 1999																2000	
		1			2			3			4			1			2			3			4		1	2					
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			Japan	Thai
3-2 Select model factories and make plan of factory practice.																												L/E	D/I		
3-2-1 Select the process for practice of selected factories.																															
3-2-2 Make detailed plan of factory practice.																															
3-3 Implement technical transfer to the counterparts by factory practice.																												L/E	D/I		
3-3-1 Investigate actual conditions of each technology field.																															
3-3-2 Analyze actual conditions and arrange engineering																															
3-4 Make report on the results of factory practice.																															
3-4-1 Make presentations on the results of factory investigation.																															
3-4-2 Make presentations on recommendation plans for industries.																															
3-5 Arrange engineering data from factory practice.																															
3-6 Make examples of recommendation plans for factories.																															
3-7 Hold seminars.																															

### Annex 5 Annual Plan of Operations (APO)

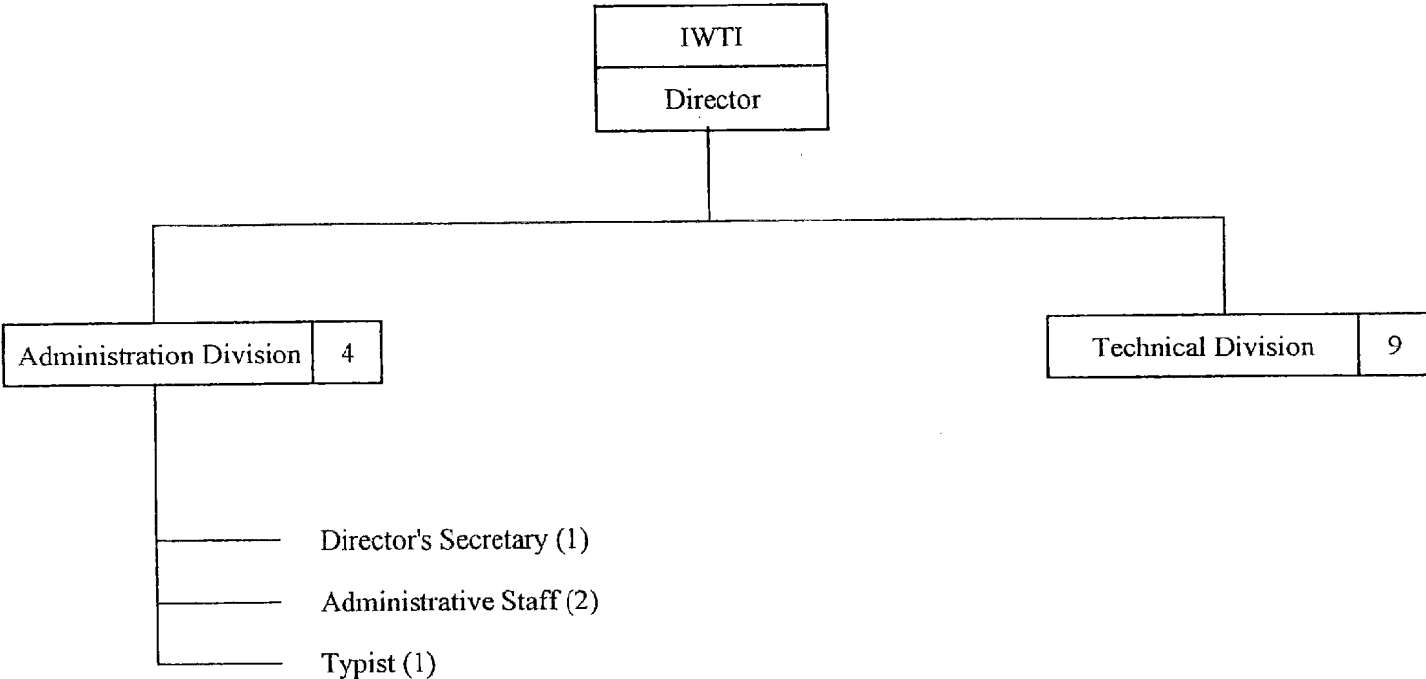
Activities	Target	Schedule (2 years)																								Responsible Person		Input	Remarks		
		Japanese Fiscal Year 1998												Japanese Fiscal Year 1999												2000					
		1			2			3			4			1			2			3			4			Japan	Thai				
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May				
4-1 Select target industries, scale of the factories and technical fields.																												L/E	D/I		
4-1-1 Collect and analyze existing data of industrial sectors concerned.						•						••																			
4-1-2 Select target industries, scale of the factories and technical fields.																															
4-2 Make the middle and long-term operation plan of IWTL.			•																											D/I	
4-2-1 Make a plan of operation fields of IWTL.			•																												
4-2-2 Make a plan of organization of IWTL.			•																												
4-2-3 Make a plan of allocation of staff.			•																												
4-2-4 Make a plan of facilities.			•																												
4-3 Make the middle and long-term consolidation plan facilities and equipment in IWTL.			•																											D/I	
4-4 Make the middle and long-term budget plan of IWTL.			•																											D/I	

(Notes) L/E: Long term expert D/I: Director of IWTL C/P: Counterpart

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Annex 6 Organization Chart of IWTI



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## Annex 7 Japanese Experts Dispatched by JICA

Year Month	1998												1999												2000											
	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						
<b>Long-term Expert</b>																																				
1) Chief Advisor/Industrial Wastewater Treatment and Re-use	●-----● Mr. Osamu OBA [June 1, 1998 - May 31, 2000]																																			
2) Industrial Water Supply/Effective Use of Water	●-----● Mr. Sueo NAGASAWA [June 1, 1998 - May 31, 2000]																																			
3) Coordinator	●-----● Mr. Shigeyuki MATSUMOTO [June 1, 1998 - May 31, 2000]																																			
<b>Short-term Expert</b>																																				
1) Operation and Management of Institutes	●●----- Dr. Totaro GOTO [Sep. 28, 1998 - Oct. 10, 1998]																																			
2) Effective Use of Water	●●----- Mr. Naoto HASHIMOTO [Oct. 26, 1998 - Nov. 7, 1998]																																			
3) Wastewater Treatment	●●----- Mr. Yoshihiro TANAKA [Nov. 16, 1998 - Nov. 28, 1998]																																			
4) Information and Data Management	●●----- Mr. Shin KURITA [March 1, 1999 - March 12, 1999]																																			
5) Quality Control of Industrial Water	●●----- Mr. Takashi SUZUKI [May 17, 1999 - May 29, 1999]																																			
6) Industrial Wastewater Pollution Management	●●----- Mr. Katsuya TSURUSAKI [June 7, 1999 - June 18, 1999]																																			
7) Operation and Management of Institutes	●●----- Dr. Totaro GOTO [July 12, 1999 - July 22, 1999]																																			
8) Principles and Practices of Anaerobic Biological Treatment	●●----- Dr. Hideki HARADA [Aug. 23, 1999 - Sep. 1, 1999]																																			

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## Annex 8 Japanese Survey Team Dispatched by JICA

Name of the Mission	Members	Term
1) Preliminary Study Team	Mr. Kazuhiko Yoneda Mr. Fujihiko Yamada Mr. Shigeru Haseba Mr. Yoshio Hamao Mr. Yasuhiko Wada	June 23 - July 3, 1997
2) Supplementary Study Team	Mr. Masayoshi Watanabe Mr. Fujihiko Yamada Mr. Osamu Oba Mr. Sueo Nagasawa Mr. Yasuhiko Wada	Nov. 30 - Dec 20, 1997
3) Implementation Study Team	Mr. Takeshi Usami Mr. Hiroshi Abe Mr. Shigeru Haseba Mr. Osamu Oba Mr. Yasuhiko Wada Mr. Shigeyuki Matsumoto	April 2 - April 11, 1998
4) Management Consultation Team	Mr. Yoshiyuki Sugijura Dr. Totaro Goto Ms. Yukari Saito	May 9 - May 14, 1999
5) Japanese Evaluation Team	Mr. Yoshifusa Shikama Mr. Akiho Kobayashi Dr. Totaro Goto Ms. Yukari Saito Mr. Naoya Azegami	Jan. 5 - Jan. 15, 1999

## Annex 9 Counterpart Personnel Trained in Japan

Name	Position	Type of Training	Field of Training	Period of Training	
1) Mr. Chumpon Cheewaprapanunt	Director of IWTI	JICA C/P Training	Operation and Management of Institutes	Oct. 20, 1998 - Nov. 14, 1998	26 days
2) Mr. Pinyo Thammasiri		JICA C/P Training	Operation and Management of Institutes	Oct. 20, 1998 - Nov. 14, 1998	26 days
3) Ms. Sumalee Dachoponchai		AOTS Group Training	Environmental Protection of Textile Factory	Nov. 28, 1998 - Dec. 19, 1998	22 days
4) Mr. Mongkol Suthivathanakul		AOTS Group Training	Environmental Protection of Textile Factory	Nov. 28, 1998 - Dec. 19, 1998	22 days
5) Mr. Somchai Phiranpisut		AOTS Group Training	Environmental Protection of Textile Factory	Nov. 28, 1998 - Dec. 19, 1998	22 days
6) Mr. Sutthi Tantipisitkul		AOTS Group Training	Environmental Protection of Textile Factory	Nov. 28, 1998 - Dec. 19, 1998	22 days
7) Ms. Jaruwan Wirawongnusorn		JICA C/P Training	Industrial Water Supply, Effective Use of Water, Wastewater Treatment and Reuse	Sep. 20, 1999 - Oct. 9, 1999	20 days
8) Ms. Nataya Sinthurat		JICA C/P Training	Industrial Water Supply, Effective Use of Water, Wastewater Treatment and Reuse	Sep. 20, 1999 - Oct. 9, 1999	20 days

AOTS: Association for Overseas Technical Scholarship

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## Annex 10 Equipment Provided by JICA

Name of Equipment	Maker/Model	Amount	Date of Delivery	Fiscal Year	Unit Price	Room installed	Classification
COD meter	HACH DR/2010 and COD reactor	1	11-Nov-98	1998	B 160,000	Laboratory	A
Portable Residual Chlorine Meter	HACH Pocket Colorimeter	2	11-Nov-98	1998	B 22,500	Laboratory	A
Portable Turbidity Meter	HACH Model 2100P	2	11-Nov-98	1998	B 67,600	Laboratory	A
Ultrasonic Flow Meter	FUJI Electric Model Portaflow-X	2	1-Dec-98	1998	B 254,400	Laboratory	A
Benchtop pH/ORP/Temp.Meter	HACH EC30	1	2-Dec-98	1998	B 46,000	Laboratory	A
Portable pH/ORP/Temp.Meter	HACH EC10	2	2-Dec-98	1998	B 38,500	Laboratory	A
Portable DO Meter	HACH DO175	2	2-Dec-98	1998	B 62,500	Laboratory	A
Portable Conductivity Meter	HACH CO150	2	2-Dec-98	1998	B 44,000	Laboratory	A
Jar Tester	Phipps&Bird PB900	1	2-Dec-98	1998	B 160,000	Laboratory	A
Balance	CT1200	1	14-Jan-99	1998	B 21,240	Laboratory	C
Magnetic Stirrer with Hot Plate	SR350	1	14-Jan-99	1998	B 17,500	Laboratory	C
Automatic Sampler	ISCO Model6700	1	22-Jan-99	1998	B 350,000	Laboratory	A
Refrigerator	Mitsubishi MR-VE41B	2	22-Jan-99	1998	B 23,000	Laboratory	A
Photocopy machine	Fuji Xerox Vivace 450	1	24-Sep-98	1998	B 338,000	Copy room	A
Portable Printer	Canon BJC-50	1	24-Nov-98	1998	B 16,900	Computer room	C
Color Inkjet Printer	HP 1120C	1	24-Nov-98	1998	B 22,770	Computer room	C
Scanner	HP Scanjet 5100C	1	24-Nov-98	1998	B 12,210	Computer room	C
Desktop-type Personal Computer	IBM PC300L	2	1-Dec-98	1998	B 66,000	Computer room	A
Laptop-type Personal Computer	TOSHIBA Satellite 330CDT	2	1-Dec-98	1998	B 93,500	Computer room	A
Laser Printer	HP LaserJet 5000	1	1-Dec-98	1998	B 73,000	Computer room	A
CD Rewritable	HP 7200e	1	11-Jun-99	1999	B 13,375	Expert's room	C
Laptop-type Personal Computer	IBM315ED	3	29-Jul-98	1998	¥276,000	Expert's room	B

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# Annex 11 Expenses by the Japanese Side

Unit : Thousand Yen

Items	Japanese Fiscal Year			Amount
	1997	1998	1999	
Training of Thai counterparts in Japan	0	695	1,005	1,700
Dispatch of Japanese Experts	43	63,874	40,781	104,698
Dispatch of Japanese Study Teams	9,093	336	1,500	10,929
Provision of Equipment	0	12,981	436	13,417
Amount	9,136	77,886	43,722	130,744

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### Annex 13 Supply of Facilities and Equipment by the Thai Side

Name of Facility and Equipment	Amount
1) Office space of IWTI	1
2) Rooms for long-term experts and short-term experts with desk, chair and shelf	4
3) Sofa and table for experts	1
4) Laboratory space	1
5) Personal computer	3
6) Printer	3
7) Photocopy machine	1
8) Overhead projector	1
9) Transport vehicle (Light van)	1~2

### Annex 14 Budget Allocation for the Project by the Thai Side

Unit: Thousand Baht

Item	Thai Fiscal Year		
	1998	1999	2000
1) Personnel Fee	2,142	2,270	2,401
2) Building Modification Cost	1,200	-	-
3) Expense for Water, Electricity, Fuel, Telephone and Transportation	-	300	300
Total	3,342	2,570	2,701

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