

# [資 料]

1. 調査団員・氏名	-----App 1 - 1
2. 調査行程	-----App 2 - 1
3. 関係者（面会者）リスト	-----App 3 - 1
4. 討議議事録（M/D）	-----App 4 - 1
5. ソフトコンポーネント計画書	-----App 5 - 1
6. 参考資料（収集資料リスト）	-----App 6 - 1
7. その他の資料・情報	
7-1 既存施設の劣化診断結果	-----App 7 - 1
7-2 概略設計図	----- App 7 - 20
7-3 アンケート調査結果	----- App 7 - 48
7-4 環境社会配慮（チェックリスト、モニタリングフォーム案、 ステークホルダー協議議事録）	----- App 7 - 51
7-6 配水管網の水理計算書	----- App 7 - 72

1. 調査団員・氏名

**官団員**

1. 総括：沖浦 文彦  
**Leader: Mr. Fumihiko OKIURA**  
JICA 地球環境部 水資源・防災グループ 水資源第一課 課長  
**Director, Water Resources Management Division 1, Water Resources and Disaster Management Group, Global and Environment Department, JICA**
2. 米山 芳春  
**Mr. Yoshiharu YONEYAMA**  
JICA ラオス現地事務所 次長  
Sinior Representative, JICA Laos Office
3. 協力企画：濱野 聡  
**Cooperation Planning: Mr. Satoshi HAMONA**  
JICA 地球環境部 水資源・防災グループ 水資源第一課 副調査役  
Deputy Assistant Director, Water Resources Management Division 1, Water Resources and Disaster Management Group, Global and Environment Department, JICA

**コンサルタント団員**

4. 業務主任／上水道計画：間宮 健匡  
**Chief Consultant/ Water Supply Planning Specialist: Mr. Takemasa MAMIYA**  
株式会社日水コン・海外事業部 事業部長  
*Nihon Suido Consultants, Director, Overseas Services Department*
5. 副業務主任：星野 孝  
Deputy Chief Consultant: Mr. Takashi HOSHINO  
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*Nihon Suido Consultants, Overseas Services Department*
6. 施設設計 1：男鹿 剛彦  
Water Supply Facilities Designer 1: Mr. Takehiko Oga  
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*Nihon Suido Consultants, Overseas Services Department*
7. 施設設計 2：菊池 秀治  
Water Supply Facilities Designer 2: Mr. Hideharu KIKUCHI  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*
8. 水道事業運営：岩田 大三  
Waterworks Management Specialist: Mr. Daizo IWATA  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*
9. 環境社会配慮：木村 光志  
Environmental & Social Considerations Specialist: Mr. Koji KIMURA  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*

10. 機械・電気設備：溝下 眞  
*Mechanical and Electrical Equipment Specialist: Mr. Makoto MIZOSHITA*  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*
11. 機材・調達計画／施工計画／積算：小原 幸三  
*Procurement / Construction Plan / Cost Estimation Specialist: Mr. Kozo Obara*  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*
12. 自然条件調査／業務調整：中田 貴大  
*Coordinator / Natural Condition Investigation Assistant: Mr. Takahiro Nakata*  
株式会社日水コン・海外事業部・技術部  
*Nihon Suido Consultants, Overseas Services Department*

## 2. 調査行程

### 現地調査スケジュール（その1）

日順	日付		官団員	コンサルタント団員						
			総括：沖浦文彦 協力企画：濱野聡	業務主任/ 上水道計画	副業務 主任	施設 設計 2	機械・ 電気設備	環境 社会配慮	水道 事業運営	
				間宮健匡	星野 孝	菊池秀治	溝下 眞	木村光志	岩田大三	
1	1月16日	月	NRT→BKK→VTE							
2	1月17日	火	JICA 事務所、 MPWT 協議	NRT→BKK→VTE						
3	1月18日	水	JICA ラオス事務所表敬、MPWT 協議							
4	1月19日	木	ミニッツ署名	ミニッツ署名、VTE→TKK						
5	1月20日	金	VTE→BKK	NPKMN 協議						
6	1月21日	土	BKK→NRT	現地調査、NPKM 協議						
7	1月22日	日								
8	1月23日	月		現地調査、NPKM 協議						
9	1月24日	火		現地調査、NPKM 協議						
10	1月25日	水		TKK→VTE		NRT→BKK →VTE	PNN→ VTE			
11	1月26日	木		団内協議	団内協議、VTE→TKK					
12	1月27日	金		VTE→BKK	現地調査、関係機関と協議、資料収集					
13	1月28日	土		→NRT	現地調査、関係機関と協議、資料収集					
14	1月29日	日								
15	1月30日	月			現地調査、関係機関と協議、資料収集					
16	1月31日	火			現地調査、関係機関と協議、資料収集		NRT→BKK→VTE			
17	2月1日	水			現地調査、関係機関と協議、資料収集		VTE→TKK			
18	2月2日	木			現地調査、関係機関と協議、資料収集					
19	2月3日	金			現地調査、関係機関と協議、資料収集					BKK→VTE→TKK
20	2月4日	土			現地調査、関係機関と協議、資料収集					
21	2月5日	日								
22	2月6日	月			現地調査、関係機関と協議、資料収集					
23	2月7日	火			現地調査、 関係機関 と協議、 資料収集	TKK→VTE→ BKK→NRT	現地調査、関係機関と協議、資料収集			
24	2月8日	水					現地調査、関係機関と協議、資料収集			
25	2月9日	木					現地調査、関係機関と協議、資料収集			
26	2月10日	金					現地調査、関係機関と協議、資料収集			
27	2月11日	土					現地調査、関係機関と協議、資料収集			
28	2月12日	日					TKK→VTE			
29	2月13日	月			現地調査、 関係機関 と協議、 資料収集	VTE → BKK →NRT	TKK→VTE	資料収集		
30	2月14日	火					VTE→BKK→JKT	資料収集		
31	2月15日	水							TKK→VTE	
32	2月16日	木							VTE → BKK →NRT	
33	2月17日	金								
34	2月18日	土								
35	2月19日	日								
36	2月20日	月			TKK→VTE					
37	2月21日	火			市場調査					
38	2月22日	水			JICA 報告					
39	2月23日	木			大使館報告					
40	2月24日	金			VTE→BKK→NRT					

現地調査スケジュール (その2)

日順	日付		官団員		コンサルタント団員								
			協力企画： 濱野聡		業務主任 ／上水道 計画	副業務 主任	施設 設計 1	施設 設計 2	機械・ 電気設備	環境 社会配慮	水道 事業運営	機材調達 ／施工計 画／積算	自然条件 調査／業 務調整
			間宮 健匡	星 野 孝	男 鹿 剛彦	菊 池 秀治	溝 下 真	木 村 光志	岩 田 大三	小原 幸三	中田貴 大		
1	4月1日	日	NRT→BKK→VNT										
2	4月2日	月	MPWT と協議、VNT→TKK										
3	4月3日	火	現地調査、NPKM 協議										
4	4月4日	水	TKK→VNT		現地調査、関係 機関と協議、資 料収集								
5	4月5日	木	MPWT とミッツ協議										
6	4月6日	金	ミニッツ 署名、VNT →BKK	ミニ ッツ 署名									
7	4月7日	土	BKK→NRT	VNT→ TKK									
8	4月8日	日											
9	4月9日	月	現地調査、NPKM 協議										
10	4月10日	火	TKK→VNT										
11	4月11日	水		VNT→ BKK	VNT→ TKK								
12	4月12日	木		BKK→ NRT									
13	4月13日	金											
14	4月14日	土											
15	4月15日	日											
16	4月16日	月											
17	4月17日	火			現地調 査	VNT→ TKK		VNT→ TKK					
18	4月18日	水			現地調査			現地 調査					
19	4月19日	木											
20	4月20日	金											
21	4月21日	土											
22	4月22日	日											
23	4月23日	月			現地調査	NRT→ VNT							NRT→ VNT
24	4月24日	火					現地 調査	現地 調査					現地調 査
25	4月25日	水									NRT→ VNT		
26	4月26日	木					VNT→ TKK						VNT→TKK
27	4月27日	金	現地調査									現地調査	
28	4月28日	土											
29	4月29日	日											
30	4月30日	月			現地調査								現地調査
31	5月1日	火					NRT→ VNT						
32	5月2日	水					VNT→ TKK						
33	5月3日	木	現地調査、関係機関と協議、資料収集										
34	5月4日	金	現地調査、関係機関と協議、資料収集										

35	5月5日	土																	
36	5月6日	日																	
37	5月7日	月					現地調査					現地調査							
38	5月8日	火			現地調査	TKK→ VNT→ BKK	現地調査		NRT→ VNT	現地調査									
39	5月9日	水			現地調査	BKK→ NRT			VNT→ TKK										
40	5月10日	木							現地調査										
41	5月11日	金																	
42	5月12日	土																	
43	5月13日	日						TKK→ VNT											
44	5月14日	月			現地調査		現地調査	VNT→ BKK	現地調査										
45	5月15日	火			現地調査			BKK→ NRT											
46	5月16日	水																	
47	5月17日	木																	
48	5月18日	金			ステークホルダー協議		ステークホルダー協議			ステークホルダー協議									
49	5月19日	土																	
50	5月20日	日																	
51	5月21日	月			現地調査		現地調査			現地調査									
52	5月22日	火			DPWT協議		DPWT協議			DPWT協議									
53	5月23日	水			現地調査		現地調査			現地調査									
54	5月24日	木																	
55	5月25日	金			NPKM協議		NPKM協議			NPKM協議									
56	5月26日	土					TKK→ VNT			TKK→VNT									
57	5月27日	日					VNT→ BKK			VNT→ BKK									
58	5月28日	月			TKK→ VNT		BKK→ NRT			BKK→ NRT		TKK→ VNT							
59	5月29日	火			MPWT協議				VNT→ BKK		VNT→ BKK	MPWT協議							
60	5月30日	水							BKK→ NRT		BKK→ NRT								
61	5月31日	木			JICA、大使館報告、VNT→BKK							JICA、大使館報告、VNT→BKK							
62	6月1日	金			BKK→NRT							BKK→NRT							

現地 DFR スケジュール

日順	日付		官団員	コンサルタント団員		
			協力企画	業務主任/ 上水道計画	施設 設計 1	水道 事業運営
			濱野聡	間宮健匡	男鹿剛彦	岩田大三
1	11月6日	火	NRT→BKK→VTE			
2	11月7日	水	JICA 事務所、MPWT 協議			
3	11月8日	木	MPWT 協議			
4	11月9日	金	ミニッツ署名、VTE→BKK			
5	11月10日	土	BKK→NRT			

### 3. 関係者（面会者）リスト

#### Ministry of Public Works and Transport (MPWT)

##### Department of Housing and Urban Planning (DHUP)

- Mr. Thamthavy THAIPHACHANH Director General
- Mr. Noupheuak VIRABOUTTH Deputy Director General in Charge of Water Supply Affairs, Urban Development & International Relations
- Mr. Khanthone VORACHIITH Director of Water Supply Division
- Mrs. Malychanh SANANIKHOM Deputy of Division, Budget and External Cooperation, Planning and Budget Division
- Dr. Xayphaxa LIENGSONE Sewer Staff of WSD

##### Khammouane Province

- Mr. Chanh BOUPHALIVANH Director General, Department of Public Works and Transport (DPWT)
- Mr. Daidanvong KIENMANY Vice Director, Department of Public Works and Transport (DPWT)
- Mr. Xaisomvang LIENTHISONE Deputy, Housing and Urban Planning

#### Ministry of Natural Resources and Environment (MNRE)

##### Department of Natural Resources and Environment, Khammouane Province (DNRE)

- Mr. Khamphai PHENGPHAENGMEUNG Director General
- Mr. Sinnasone SENGCHATHAVONG Deputy Director
- Mr. Dethsada Somphousy Head of Section, Environment Section

#### Khammouane Water Supply State Enterprise (NPKM)

- Mr. Khangeun SENGIEM General Director
- Mr. Phouthone SOULINHONG Deputy Director
- Mr. Khamveuy TAYAVONG Deputy Manager
- Mr. Khampasith SITHEPHAVON Chief, Technical Section
- Mr. Saykham VONGPHADY Engineer, Technical Section
- Mr. Amphaivanh DOUANGKHAMCHANH Vice Chief, Technical Section
- Mr. Phasouk XAYAONTA Chief, Water Treatment Plant
- Mr. Khamphouvieng SOUVANNASAO Engineer, Groundwater Facility
- Mr. Inthavong SOULAPHONE Engineer, Groundwater Facility
- Mr. Somsanith KHOTSOUVANH Chief, Financial Section
- Ms Outhid MANNOLINH Chief, Commercial Section
- Mr. Ounkham SOULINHONG Engineer, Electrical and Mechanical Facility
- Mr. Bounmee PHONMANY Engineer, Electrical and Mechanical Facility
- Mr. Soulaphong PHABOUDDY Chief, Administration Section
- Ms. Naphaphone NANTHAVILAI Staff, Administration Section
- Ms. Vannida PHENGTHALANGSY Staff, Financial Section
- Ms. Viphavanh SENGSAVANG Staff, Secretary
- Mr. Somiphasouk TAILIYA Staff, Technical Section



4. 討議議事録 (M/D)

MINUTES OF DISCUSSIONS  
ON THE PREPARATORY SURVEY  
ON PROJECT FOR  
THAKHEK WATER SUPPLY DEVELOPMENT IN KHAMMOUANE PROVINCE,  
LAO PDR

In response to the request from the Government of the Lao People's Democratic Republic (hereinafter referred to as "Lao PDR"), the Government of Japan decided to conduct a Preparatory Survey on Project for Thakhek Water Supply Development in Khammouane Province (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Lao PDR the Preparatory Survey Team ( hereinafter referred to as "the Team" ), which is headed by Mr. Fumihiko Okiura, Director, Water Resources Management Division 1, Water Resources and Disaster Management Group, Global Environment Department, JICA, and is scheduled to stay in the country from January 16 to 20, 2012.

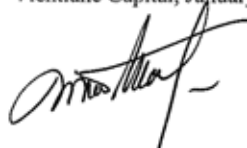
The Team held discussions with the officials concerned of the Government of Lao PDR.

In the course of discussions, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Outline Design Study Report.

Vientiane Capital, January 19, 2012

沖浦 文彦

Fumihiko OKIURA  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



Khamthavy THAIPHACHANH  
Director General  
Department of Housing and Urban Planning  
Ministry of Public Works and Transport  
Lao People's Democratic Republic



Chanh BOUPHALIVANH  
Director General  
Department of Public Works and Transport  
Khammouane Province  
Lao People's Democratic Republic

## ATTACHMENT

### **1. Objective of the Project (Request)**

The objective of the Project is to improve the water supply services in urban area of Thakhek district in Khammouane province in order to supply safe water and sufficient water for the residents.

### **2. Project site (Request)**

The site of the Project is as shown in **Annex-1**.

### **3. Responsible and Implementing Agency**

3-1. The Responsible Agency is Department of Housing and Urban Planning (hereinafter referred to as "DHUP") of Ministry of Public Works and Transport (hereinafter referred to as "MPWT").

3-2. The Implementing Agencies are the Khammouane Provincial Water Supply State Enterprise (hereinafter referred to as "PNP Kammouane") under supervision of Department of Public Works and Transport of Kammouane Province.

### **4. Items originally requested by the Government of Lao PDR**

The items originally requested by the Lao side are described in **Annex-2**.

The both sides confirmed that the appropriateness of the request would be examined in accordance with the further studies and analysis, and the final components of the Project would be decided by the Japanese side.

### **5. Japan's Grant Aid Scheme**

5-1 The Lao side understood the Japan's Grant Aid Scheme explained by the Team, as described in **Annex-3**.

5-2 The Lao side will take the necessary measures, as described in **Annex-4**, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

### **6. Schedule of the Survey**

6-1 The consultant members of the Team will proceed to further studies in Lao PDR until June, 2012. The studies include 2 field surveys that 1st field survey has started since January until late February 2012 and 2nd field survey will conduct from April to June 2012.

6-2 JICA will prepare the draft outline design report in English and dispatch a mission in order to explain its contents to the Lao side around October 2012.

6-3 In case that the contents of the report are accepted in principle by the Lao side, JICA will finalize the report and send it to the Lao side around December 2012.

6-4 The Lao side understood that execution of the Preparatory Survey (hereinafter referred to as "the Survey") does not necessarily imply the Japanese Government's commitment of the project implementation.

## 7. Other relevant issues

The following issues were discussed and confirmed by both sides.

### 7-1. Phasing of Field Survey

The Team explained that the field survey in Lao PDR will be divided into following two phases in order to share the basic policy for design including location, future of existing Water Treatment Plant (hereinafter referred to as "WTP"), covered area, intake type and the capacity of WTP with both side before starting the design.

- 1) Field Survey I (from January to late February, 2012)
  - Confirmation of the necessity and appropriateness of the project requested by the Lao side
  - Collection and analysis of the necessary information and data
  - Examination of the existing WTP and appropriate scale of the project as a grant aid project
- 2) Homework in Japan (March, 2012)
  - Discussion of the outline policy for design by Government of Japan
- 3) Field Survey II (from beginning of April to June, 2012)
  - Explanation of the outline policy for design to Lao side
  - Implementation of the survey necessary for the design of priority project

### 7-2. Future of the existing water treatment plant

The Team explained that the usage of existing water treatment plant should be reasonably considered. Therefore, the team will study various aspects including as follow:

- 1) Structure
- 2) Function of mechanical and electrical equipment
- 3) Treatment performance
- 4) Future operation and maintenance
- 5) Financial viability

### 7-3. Installation of service pipes and water meters

As for individual house connections, both side agreed that necessity of provision of the materials such as water meters and pipes will be considered in the survey in order to assist the expansion of water supply to poor communities. Both sides also confirmed that Lao side will bear the cost for installation works.

### 7-4. Social and Environmental Considerations

- 1) Lao side explained that the Environmental Impact Assessment (EIA) is not needed but Initial Environmental Examination (IEE) is needed for the project under the laws and regulations of Lao PDR.
- 2) The Team explained that the environmental and social considerations studies would be

conducted according to JICA's Guidelines for Environmental and Social Considerations in order to examine the mitigation measures of impacts and monitoring plan during/after the implementation.

7-5. Tax exemption

The taxes including Value Added Tax (VAT), custom duty, and any other taxes and levies in Lao PDR which is to be arisen from the Project activities will be exempted by Lao side. DHUP will take any procedures necessary for the tax exemption with the Ministry of Finance of Lao PDR at its responsibility.

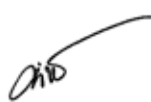
7-6. Overlapping with other projects

Both side confirmed that the on-going / proposed projects in Thakhek district supported by other donor agencies, NGO, and Lao official organization(s) should be carefully investigated to avoid overlapping with the Project. Lao side agreed to provide necessary information on related projects.

7-7. Items requested by Japan Preparatory Survey Team

The Lao side agreed to undertake the actions requested by the Team, as described in **Annex-5**.

Annex-1	Project Sites Map
Annex-2	Items Requested by the Lao Side
Annex-3	Japan's Grant Aid Scheme
Annex-4	Major Undertakings to be taken by Each Government
Annex-5	ITEMS REQUESTED BY JPST



Annex-1: Project Sites Map



Annex-2: Items Requested by the Lao Side

A) Construction of Water Treatment Plant with production capacity of 10,000m<sup>3</sup>/day

Water Intake Facilities	- 3 Intake Pumps - Installation of Water Transmission Pipe : dia.350mm - Construction of Intake
Mixing Basin	- 1 Mixer
Flocculation Basin	- 4 Flocculators - 4 Flocculation Basins
Sedimentation Basin	- 2 Sedimentation Basins
Rapid Filtration Basin	- Installation of Filter Sand Bed - 4 Rapid Sand Filters
Clear & Backwash Reservoir	- 1 Reservoir (1,500m <sup>3</sup> )
Elevated Tank	- 1Elevated Tank (1,000m <sup>3</sup> )
Transmission Pipeline	- Installation of Transmission Pipe: dia. 400mm
Transmission Pump	- 3 Transmission Pumps
Distribution Main Pipeline	- Extension of Distribution Pipes: dia. 350-100mm
Electrical Equipment	- Substation Equipment - Installation of Switchgear and Panels - Installation of 1 Diesel Generator
Chemical Equipment	- Installation of Chemical Tank Equipment - Chemical Feeding System
Administration Building	- Construction of Administration Building

B) Supply of Equipment

Water Meter Dia. 13mm	- 2,000 pcs
Maintenance Machineries	- 1 Pick-up Truck (2,500 cc) - 2 Motor Bike (100 cc)

### Annex-3: JAPAN'S GRANT AID SCHEME

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as part of this realignment, JICA was reborn on October 1, 2008. Based on the law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Project, for Fisheries and for Cultural Cooperation, etc.

Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

#### 1. Grant Aid Procedures (Attachment 1)

Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey conducted by JICA
- Appraisal & Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation by Exchange of Notes (hereinafter referred to as "the E/N")
  - The Notes exchanged between the GOJ and a Government of recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

#### 2. Preparatory Survey

##### (1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its

self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the E/N will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Attachment 1.

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(6) Proper Use

The Government of recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) Export and Re-export

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA environmental and social considerations guideline.

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contractor	Others
Application	<p>Request (D/R : Terms of Reference)</p> <p>Screening of Project → Evaluation of T/R → Project Identification Survey</p>	✓					
Project Formulation & Preparation	<p>Preparatory Survey → Field Survey Home Office Work Reporting</p> <p>Preparatory Survey 2 (Outline Design) → Selection &amp; Contracting of Consultant by Proposal → Field Survey Home Office Work Reporting</p> <p>Explanation of Draft Final Report → Final Report</p>	✓	✓	✓			
		✓	✓	✓	✓		
		✓	✓	✓	✓		
Appraisal & Approval	<p>Appraisal of Project</p> <p>Inter Ministerial Consultation</p> <p>Presentation of Draft Notes</p> <p>Approval by the Cabinet</p>		✓				
		✓	✓				
			✓				
Implementation	<p>E/N &amp; G/A (E/N : Exchange of Notes, G/A : Grant Agreement)</p> <p>Banking Arrangement</p> <p>Consultant Contract → Verification → Issuance of A/P</p> <p>Detailed Design &amp; Tender Documents → Approval by Recipient Government → Preparation for Tendering</p> <p>Tendering &amp; Evaluation</p> <p>Procurement / Construction Contract → Verification → A/P</p> <p>Construction → Completion Certificate by Recipient Government → A/P</p> <p>Operation → Post Evaluation Study (A/P : Authorization to Pay)</p>	✓	✓	✓			
		✓					✓
		✓		✓	✓		
		✓		✓	✓	✓	
		✓		✓	✓	✓	
		✓		✓	✓	✓	
		✓		✓	✓	✓	
		✓		✓			
Evaluation & Follow up	<p>Ex-post Evaluation → Follow up</p>	✓		✓			

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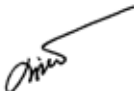
Annex-4: Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land		•
2	To clear, level and reclaim the site when needed		•
3	To construct gates and fences in and around the site		•
4	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
5	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	(•)	(•)
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
7	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
8	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
9	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

(B/A: Banking Arrangement, A/P: Authorization to Pay)

Annex-5: ITEMS REQUESTED BY JPST

- (1) Provide JPST with available relevant data, information and materials necessary for the execution of the Survey including items in the attached questionnaire;
- (2) Carry out IEE and hold stakeholder meetings, as required with assistance from JPST;
- (3) Provide written approvals/confirmations, issued by the Ministry of Public Works and Transport (MPWT) or organizations concerned, for additional raw water intake from the Mekong River, land use for planned water supply facilities, pipe installation on the right of way, power supply for the planned water supply facilities, no further requirement for EIA, securing space for temporary stock yard, contractor/consultant offices, and disposal for excavated soil, and other related requirements;
- (4) Assign full-time counterparts to the JPST team during their stay in Lao PDR, on the following:
  - Making appointments, setting up meetings with authorities, departments, relevant institutions, and organizations JPST requires to visit;
  - Accompanying JPST onsite surveys and other visits and making the necessary arrangements for accommodation, transportation, and obtaining permissions if required; and
  - Assisting and advising JPST on collection of data and information as much as possible;
- (5) Secure the permission to photograph and enter into private properties and restricted areas as required;
- (6) Inform JPST members of any dangers and/or risks expected in the survey areas, and take the necessary measures to ensure the safety of the members of JPST;
- (7) Make arrangements to allow JPST to bring back to Japan any necessary data, maps and materials, related to the study, subject to approval by the GOL, in order to prepare the reports; and
- (8) Supply office space in Thakhek for JPST. The required space would be about 100 m2 with basic furniture, at least 8 desks and chairs. Electricity and telephone line connections would be also required. The telephone charge would be borne by JPST.



MINUTES OF DISCUSSIONS  
ON THE PREPARATORY SURVEY (FIELD SURVEY II)  
ON PROJECT FOR  
THAKHEK WATER SUPPLY DEVELOPMENT IN KHAMMOUANE PROVINCE,  
LAO PDR

Japan International Cooperation Agency (hereinafter referred to as "JICA") sent Lao People's Democratic Republic (hereinafter referred to as "Lao PDR") to the Preparatory Survey Team ( hereinafter referred to as "the Team") for the Field Survey II of the Project for Thakhek Water Supply Development in Khammouane Province (hereinafter referred to as "the Project") , which is headed by Mr. Yoshiharu Yoneyama, Senior Representative, JICA Laos Office, and the Survey II is scheduled from the beginning of April to the end of May, 2012.

The Team held discussions with the officials concerned of the Government of Lao PDR.

In the course of discussions, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Outline Design Study Report.

Vientiane Capital, April 6, 2012

米山 芳春

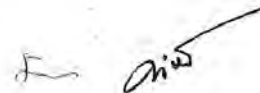
Mr. Yoshiharu YONEYAMA  
Senior Representative  
Laos Office  
Japan International Cooperation Agency  
Japan



Mr. Khamthavy THAIPHACHANH  
Director General  
Department of Housing and Urban Planning  
Ministry of Public Works and Transport  
Lao People's Democratic Republic



Mr. Chanh BOUPHALIVANH  
Director General  
Department of Public Works and Transport  
Khammouane Province  
Lao People's Democratic Republic



## ATTACHMENT

The following items were confirmed by both sides.

### 1. Framework of the Outline Design

#### 1-1. Target Year of the Supply Capacity

In line with the Lao PDR's long term goal of the water supply sector that is to provide 24-hours per day access to safe drinking water for 80% of the urban population, the target year for outline design shall be 2020.

#### 1-2. Abandonment of the Existing Plant in the Future Water Supply System

Through the field survey I and study in Japan, the Team deliberated about the usage of the existing water treatment plant in Thakhek. According to the cost analysis comparison between utilizing of the existing plant or not, both sides confirmed the new planned water supply system without existing plant would be reasonable compared to with existing plant.

#### 1-3. Project Scope for New Planned Water Supply System

As a consequence of the discussions described in 1-1 and 1-2 above, both sides confirmed the project scope described as Case 3-2 of APPENDIX I is the most appropriate option of this project. The Team will prepare the outline design based on the scope in the field survey II.

### 2. Installation of the Pipe by Lao side

Both sides confirmed that after completion of the project, Lao side would have responsibility to install the distribution and service pipes between main distribution pipes installed by the project and houses in service area to enable 80% of the urban population to have the stable access to drink safety water in Thakhek district up to 2020, as described in 1-1 above.

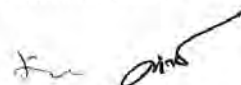
### 3. Social and Environmental Considerations

Both sides reconfirmed that the Environmental Impact Assessment (EIA) is not needed but Initial Environmental Examination (IEE) is needed for the project, according to the Government of Lao PDR's regulation: "Decision on Approval and Promulgation of the List of Projects that shall Undertake IEE and EIA", No.697/PMO, WREA 2010 (Item 3.52 of the list on Page 6), as both sides had agreed in the minutes of discussion on the inception report meeting signed on January 19, 2012.

### 4. Field Survey II in Lao PDR

The following activities will be carried out in the field survey II:

- 1) Explanation and discussion of results of the First Study in Japan;
- 2) Formulation of Project components and plans;
- 3) Environmental and social considerations (2) (consideration of environmental management plan, checklist preparation, assistance to stakeholder meetings conducted by the GOL, etc.);
- 4) Investigation of natural conditions of the candidate site (topographical survey, soil exploration, etc.);
- 5) Investigation of social considerations related to the candidate site (questionnaire survey, etc.);
- 6) Formulation of operation and management (O&M) plan for the Project and considerations of



technical assistance.

Major study/survey points

- Project scoping
- Facility design (outline design)
- Operation and maintenance arrangements
- Financial study
- Environment/social considerations
- Preliminary costing
- Implementation schedule, procurement plan
- Necessity of Soft component

**5. The Schedule of the Project**

- Field Survey II (the beginning of April to the end of May, 2012)
- Design and cost estimation work in Japan (June to September, 2012)
- Explanation of the Draft Final Report (October, 2012)
- Submission of the Final Report (December, 2012)

**APPENDIX I      Case Study for WTP and for Alternative Target Years**



2



Preparatory Survey on Project for Thankhek Water Supply Development in Khammouane Province in Lao People's Democratic Republic  
**Case Study for WTP and for Alternative Target Years**

Blue color implies less costly than the other case.

Target Year	Water Demand (Daily Max) m <sup>3</sup> /day (Required Capas.)	Case	Supply Capacity (m <sup>3</sup> /day)			Preliminary Project Cost (Million Yen)	O&M Cost (Electrical Power Cost) (Ratio) *	Sustainability	Required Nos. of Operators in WTPs		Service Ratio in Urban Area (%)	Population Served	Population in Urban Area
			Existing Wells	Existing WTP	New WTP				Total	Exisl. WTP			
<b>Case 1</b>													
2015	12,000	Case 1-1	2,000	2,500	7,500	12,000	1.00	Life-time is unknown. Requiring periodical repair work. Life-time is generally 40 to 50 years for concrete structures.	6	9	15	36,000	55,900
		Case 1-2	2,000	Abandon	10,000	12,000	0.95		non	9	9		
<b>Case 2</b>													
2018	15,500	Case 2-1	2,000	2,500	11,000	15,500	1.29	Life-time is unknown. Requiring periodical repair work. Life-time is generally 40 to 50 years for concrete structures.	6	9	15	46,000	59,700
		Case 2-2	2,000	Abandon	13,500	15,500	1.25		non	9	9		
<b>Case 3</b>													
2020	17,000	Case 3-1	2,000	2,500	12,500	17,000	1.41	Life-time is unknown. Requiring periodical repair work. Life-time is generally 40 to 50 years for concrete structures.	6	9	15	50,000	62,300
		Case 3-2	2,000	Abandon	15,000	17,000	1.39		non	9	9		

非公表

**Water Demand Projection**

Items / Year	2010	2015	2018	2020
Domestic Demand (m <sup>3</sup> /day)	3,754	5,604	7,255	7,980
Per Capita Consumption (L/capita/day)	150	155	157	160
Non Domestic Demand (m <sup>3</sup> /day)	1,609	2,402	3,109	3,420
Total Demand (m <sup>3</sup> /day)	5,313	8,161	10,321	11,660
NRW (%)	25%	20%	20%	20%
Daily Average Demand (m <sup>3</sup> /day)	7,151	10,098	12,955	14,250
Peak Factor	1.2	1.2	1.2	1.2
Daily Maximum Demand (m <sup>3</sup> /day)	8,600	12,000	15,500	17,100

**Tentative Cost Breakdown**

Case / Items	Rehabil. of Exisl. WTP	New WTPs <sup>2</sup>	New Trans. & Distrib. System <sup>3</sup>	Procurement of Equipment	Consultant Cost	Total <sup>4</sup>
Case 1-1						非公表
Case 1-2						
Case 2-1						
Case 2-2						
Case 3-1						

非公表

\*1: The above costs were estimated roughly from the past similar projects, but not estimated from the exact drawings and quantities.

In the final Survey Report, the Team will estimate based on the exact drawings and quantities.

\*2: Cost of "New WTP" includes costs for intake facilities, clar & backwash reservoirs, etc.

\*3: Cost of "New Trans. & Distrib. System" includes costs for transmission mains, distribution mains, and elevated tank.



**THE MINUTES OF DISCUSSIONS**  
**ON**  
**THE MISSION FOR THE PREPARATORY SURVEY**  
**ON**  
**THAKHEK WATER SUPPLY DEVELOPMENT PROJECT**  
**IN**  
**LAO PDR**  
**(EXPLANATION OF DRAFT REPORT)**

In April 2012, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the 2<sup>nd</sup> Preparatory Survey Team on Thakhek Water Supply Development Project in Khammouane Province (hereinafter referred to as "the Project") to the Lao People's Democratic Republic (hereinafter referred to as "Lao PDR") and through discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the survey.

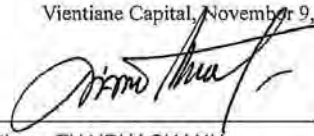
In order to explain and to consult the officials concerned of the Government of Lao PDR on the components of the draft report, JICA dispatched the Preparatory Survey Mission (hereinafter referred to as "the Mission") to Lao PDR, which was headed by Mr. Masato TOGAWA, Chief Representative of JICA Laos office, from November 6<sup>th</sup> to 9<sup>th</sup>, 2012.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Vientiane Capital, November 9, 2012



Mr. Masato TOGAWA  
Chief Representative  
Laos Office  
Japan International Cooperation Agency  
Japan



Mr. Khamthavy THAIPHACHANH  
Director General  
Department of Housing and Urban Planning  
Ministry of Public Works and Transport  
Lao People's Democratic Republic



Mr. Chanh BOUPHALIVANH  
Director General  
Department of Public Works and Transport  
Khammouane Province  
Lao People's Democratic Republic

## ATTACHMENT

### 1. Components of the Draft Report

Lao side agreed and accepted in principle the components of the draft report as explained by the Mission. The project site map and components of the project are shown respectively in Annex-1 and Annex-2.

### 2. Japan's Grant Aid Scheme

Lao side understood the scheme of Japan's Grant Aid and would take the necessary measures and allocate necessary budget properly for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented. The Grant Aid Scheme and necessary measures were described in Annex-3.

### 3. Responsible and Implementing Agency

Both sides reconfirmed the responsible and implementing agencies as follows:

- 1) The Responsible Organization is the Department of Housing and Urban Planning, Ministry of Public Works and Transport (hereinafter referred to as "DHUP").
- 2) The Implementing Agencies are the Department of Public Works and Transport, Khammouane Province (hereinafter referred to as "DPWT") and Khammouane water supply state-owned enterprise (hereinafter referred to as "NPKM").

### 4. Schedule of the Survey

JICA will finalize the report and send it to the Government of Lao PDR around December 2012.

### 5. Other Relevant Issues

#### 5-1 Project Cost Estimate and Budgetary Arrangement

The Mission explained to Lao side the estimated project cost as attached in Annex-5. Both sides confirmed that this cost estimate was provisional and would be examined further by the Government of Japan for its final approval. Furthermore, both sides confirmed that this project cost estimate is confidential, and should never be duplicated in any forms or released to any other parties until the relevant contracts are awarded by Government of Lao PDR, in order to secure fairness of tender procedure.

#### 5-2 Necessary Budget to be covered by Lao Side

Japanese side explained necessary project cost to be covered by Lao side and necessary operation and maintenance cost as attached in Annex-5. DPWT agreed to secure necessary budget as attached in Annex-5.



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### 5-3 Service Area of the Project covered by Japan side

The Mission explained distribution area covered by Japan side was changed as shown in Annex-1 after 2<sup>nd</sup> field survey due to budget limitation. Lao side agreed the service areas, the locations of principal facilities, and the routes of transmission and distribution pipelines as shown in Annex-1 and Annex-2.

### 5-4 Soft components

Both sides confirmed that Lao side requested soft component for "Operation and Maintenance of WTP" and "Distribution Control" to the Mission in order to operate properly new water supply system introduced by the Project, and the Mission agreed it. NPKM shall assign proper staff for these soft components.

### 5-5 Environmental and Social considerations

Both sides confirmed Environmental and Social considerations issues as follows:

#### 1) Monitoring for Environmental and Social considerations

Monitoring for Environmental and Social considerations will be conducted by DPWT/NPKM in accordance with the Monitoring Plan for the Project described in the Preparatory Study Report. The results of monitoring will be provided to JICA on a quarterly basis until 1 year after the completion of the project and by filling in the Monitoring Form attached as Annex-7 as part of progress reports.

#### 2) Disclosure of Monitoring Result

JICA may disclose the part of the monitoring results as shown in Annex-7 conducted by DPWT/NPKM. JICA explained that JICA will disclose further information, when third parties request, subject to approval of DPWT/NPKM.

#### 3) Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 6.

### 5-6 Other undertakings of Lao side

The Mission explained to Lao side its undertakings as listed in Annex 4 and Lao side understood and promised to execute them. The following items are to be emphasized:

#### 1) Exemption of financial duties

Both sides reconfirmed DHUP shall take necessary measures to facilitate project implementation, such as exemption of Value Added Tax, customs duties, and any other taxes and fiscal levy charges in Lao PDR arisen from the Project activities, collaborating with the signer of the Grant Agreement of the recipient side.



**2) Installation of distribution and service pipe by 2020**

Both sides reconfirmed Lao side shall install necessary distribution and service pipes up to 2020, in accordance with Lao PDR's policy that aims to cover 80% people of urban area with piped water in 2020.

**3) Demolishing of Existing Intake facility and Water Treatment Plant**

Both sides confirmed Lao side shall remove existing intake facility and Water Treatment Plant (WTP) after completion of the project components by Japanese grant aid, because they will not be used after constructions of new intake facility and WTP.

**4) Power and Telephone Lines to the Project Sites**

Both sides confirmed Lao side shall install the power and telephone line to the project site, and Japan side will install substation equipment in the premises of new intake facility and WTP.

Annex 1 Project Site Map

Annex 2 Components of the Project

Annex 3 JAPAN'S GRANT AID SCHEME

Annex 4 Major Undertakings to be taken by Each Government

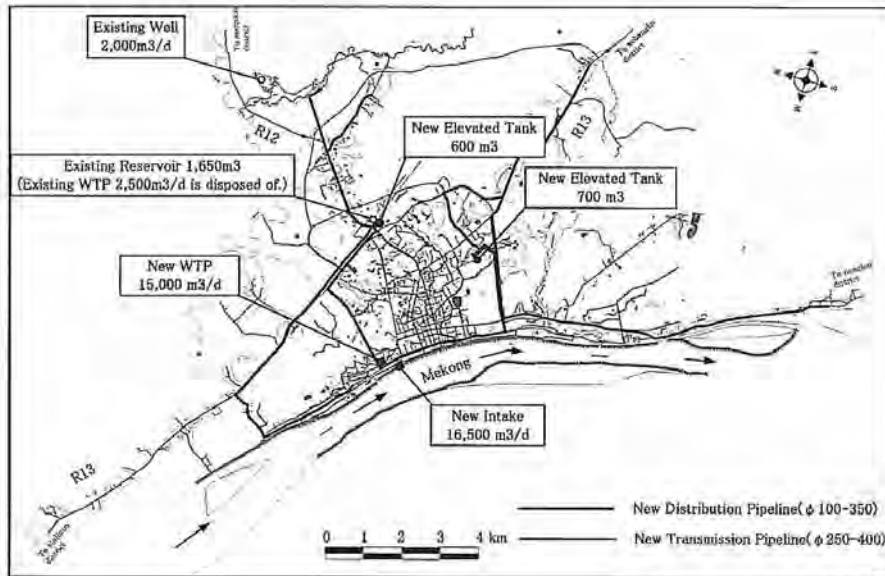
Annex 5 Cost Estimation

Annex 6 Check List (Environmental and Social Considerations)

Annex 7 Monitoring Form for Environmental and Social Considerations



Annex-1: Project Site Map



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Annex-2: Components of the Project

Project Summary

	By Japan Grant Aid	By Lao Government
<b>1. Constructions</b>		
(1) Water Intake Facilities	- Intake Facility - 3 intake submergible pumps	- Electricity Supply Line (150 kVA)
(2) Raw Water Transmission Pipeline	- Intake to WTP (DIP $\Phi$ 450 mm, L $\approx$ 550m)	
(3) Water Treatment Plant	- Plant Capacity: 15,000 m <sup>3</sup> /day - Mixing Basin - Flocculation Basin - Sedimentation Basin - Rapid Filtration Basin - Clear & Backwash Reservoir - Transmission Pump - Electrical Equipment - Chemical Equipment - Administration Building	- Electricity Supply Line (500 kVA)
(4) Treated Water Transmission Pipeline	- WTP to Pakdong ET (DIP $\Phi$ 250-300 L $\approx$ 6,100m) - WTP to KM4 Reservoir (DIP $\Phi$ 350-400 L $\approx$ 4,800m)	
(5) Elevated Tank	- Pakdong ET (V=700 m <sup>3</sup> ) - KM4 ET (V=600 m <sup>3</sup> ) - Modify of the Existing KM4 ground reservoir	
(6) Distribution Main Pipeline	- ETs to Expansion Areas (L $\approx$ 40km) (DIP $\Phi$ 350 L=578m) (HDPE $\Phi$ 300 L=2,318m) (HDPE $\Phi$ 250 L=9,992m) (HDPE $\Phi$ 200 L=5,795m) (HDPE $\Phi$ 150 L=8,998m) (HDPE $\Phi$ 100 L=12,051m)	- Extension of Distribution Main Pipelines (L $\approx$ 10km) (HDPE $\Phi$ 150 L=5,780m) (HDPE $\Phi$ 100 L=4,220m)
(7) Distribution Sub Main Pipeline		- Branches from Distribution Main Pipelines (L $\approx$ 33km) (HDPE $\Phi$ 80 L=7,530m) (HDPE $\Phi$ 65 L=6,260m) (HDPE $\Phi$ 55 L=5,180m) (HDPE $\Phi$ 40 L=4,690m) (HDPE $\Phi$ 30 L=4,790m) (HDPE $\Phi$ 25 L=4,550m)
(8) Service Connections		- House Connection (3,800 households)
<b>2. Procurements</b>		
(1) Procurement of the Equipment	- Water quality analysis equipment at laboratory in administration building of WTP	- Water meter (2000 pc),
(2) Removal of Existing Facility		- Existing Water Treatment Plant - Existing Intake Pumping Station
<b>3. Soft Components</b>		
(1) Technical Assistance	- Operation and Maintenance of WTP - Distribution Control	

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### Annex-3: JAPAN'S GRANT AID SCHEME

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as part of this realignment, JICA was reborn on October 1, 2008. Based on the law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Project, for Fisheries and for Cultural Cooperation, etc.

Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

#### 1. Grant Aid Procedures (Attachment 1)

Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey conducted by JICA
- Appraisal & Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation by Exchange of Notes (hereinafter referred to as "the E/N")
  - The Notes exchanged between the GOJ and a Government of recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

#### 2. Preparatory Survey

##### (1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.



(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the E/N will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Attachment 1.

(6) Proper Use

The Government of recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) Export and Re-export

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the





obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA environmental and social considerations guideline.



Attachment for Annex-3 FLOW CHART OF JAPAN'S GRANT AID PROCEDURES

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contractor	Others
Application	Request (T/R : Terms of Reference)	✓					
	Screening of Project → Evaluation of T/R → Project Identification Survey		✓	✓			
Project Formulation & Preparation	Preparatory Survey → Field Survey Home Office Work Reporting	✓	✓	✓			
	Preparatory Survey 2 (Outline Design) → Selection & Contracting of Consultant by Proposal → Field Survey Home Office Work Reporting	✓	✓	✓	✓		
	Explanation of Draft Final Report → Final Report	✓	✓	✓	✓		
Appraisal & Approval	Appraisal of Project		✓				
	Inter Ministerial Consultation		✓				
	Presentation of Draft Notes	✓	✓				
	Approval by the Cabinet		✓				
Implementation	E/N & G/A (E/N : Exchange of Notes, G/A : Grant Agreement)	✓	✓	✓			
	Banking Arrangement	✓					✓
	Consultant Contract → Verification → Issuance of A/P	✓		✓	✓		
	Detailed Design & Tender Documents → Approval by Recipient Government → Preparation for Tendering	✓		✓	✓		
	Tendering & Evaluation	✓		✓	✓	✓	
	Procurement/Construction Contract → Verification → A/P	✓		✓	✓	✓	
	Construction → Completion Certificate by Recipient Government → A/P	✓		✓	✓	✓	
	Operation → Post Evaluation Study (A/P : Authorization to Pay)	✓		✓			
Evaluation & Follow up	Ex-post Evaluation → Follow up	✓		✓			

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Annex-4: Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient
1	To secure land, construct gates and fences in and around the site		•
2	To clear, level and reclaim the site when needed		•
3	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
4	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	(•)	(•)
5	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
6	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
7	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
8	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•
9	To give due environmental and social consideration in the implementation of the project and provide the results of monitoring with format attached as Annex-7		•
10	To remove existing WTP and intake facility after completion of the Project		•
11	To install transmission, distribution, and service pipes (Details are shown in Annex-2).	•	•
12	To install power and telephone lines to the project sites		•

(B/A: Banking Arrangement, A/P: Authorization to Pay)

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## Cost Estimations

## 1. Project Components by Japan Grant Aid

非公表

## 2. Project Components by Lao Government

Total Project Cost borne by Lao Government: approximately 1,640,500 USD (13.2 Billion Kip).

## (1) Electricity Supply Cost to Intake Facility and Water Treatment Plant

	Capacity	Estimated amount, USD (billion Kip)
Intake Facility	150 kVA	6,200 (0.05)
Water Treatment Plant	500 kVA	12,400 (0.10)
Total		18,600 (0.15)

\*Estimated amount is based on EDL's quotation via NPKM

## (2) Distribution Main Pipeline

	Pipe Size (mm)	Total Length (km)	Estimated amount, USD (billion Kip)
Installation of Distribution Main Pipeline (Lao side portion)	150	5.78	166,400 (1.34)
	100	4.22	104,300 (0.84)
Total		10.00	270,700 (2.18)

\*Estimated amount is based on installation by local contractor.

## (3) Sub-main Pipeline

	Pipe Size (mm)	Total Length (km)	Estimated amount, USD (billion Kip)
Installation of Distribution Sub-main Pipeline for existing distribution network	80	0.22	5,000 (0.04)
	65	0.71	14,900 (0.12)
Installation of Distribution Sub-main Pipeline from new main pipeline	80	7.31	167,700 (1.35)
	65	5.55	115,500 (0.93)
	55	5.18	90,700 (0.73)
	40	4.69	73,300 (0.59)
	30	4.79	65,800 (0.53)

	25	4.55	48,400	(0.39)
Total		33.00	581,300	(4.68)

\*Estimated amount is based on installation by local contractor.

(4) Service Connection Cost except Water Meter (paid by Customers)

	Number of household	Estimated amount, USD (billion Kip)
Service Connection	3,800	534,000 (4.30)

\*Estimated amount is based on a quotation via NPKM

(5) Water Meter Cost (paid by Customers)

	Quantity	Estimated amount, USD (billion Kip)
Water Meter	3,800	86,900 (0.70)

(6) Removal of Existing Water Treatment Plant

	Description	Estimated amount, USD (billion Kip)
Existing Water Treatment Plant	2,500m <sup>3</sup> /day, Constructed of Steel Plate and RC	145,300 (1.17)
Existing Intake Pumping Station	Horizontal Pump 4 sets, Submersible Pump 2 sets and a Barge	3,700 (0.03)
Total		149,000 (1.20)

**3. Operation and Maintenance**

**Annual O&M Cost Estimation of Water Supply Facilities in Thakhek District from the year 2020**

(Unit: million Kip)

No.		Estimated Amount
1	Electricity cost	2,071.23
2	Chemical cost	908.89
3	Personal cost	592.20
4	Fuel cost	88.48
5	Others	5.40
6	Maintenance cost	154.17
7	Depreciation cost *	2,040.00
8	Total costs (per annum)	5,860.37

Note: \*: Depreciation cost estimates only for mechanical equipment which shall be replaced by NPKM, excluding that for the other facilities.

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Check List (Environmental and Social Considerations)

Environmental Social Consideration Check List

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) N (d) Y	(a)(b) The IEE report was prepared and was approved (c) No conditions added (d) The approval of usage of Mekong River for the intake tower was completed
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed the project basically. (b) Comments were stated and requests were submitted from the stakeholders and countermeasures will be disclosed.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations? (b) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (c) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) Y (b) N (c) Y	(a) Alternative plans are partially explained in the stakeholder meeting and fully described in the report. (b) Low concentration chlorine (e.g. 2%) is planned to be used for good working condition and prevention of air pollution. (c) By using low concentration chlorine and installing ventilators, the safety standard (3mg/m <sup>3</sup> ) will be complied with.
2 Pollution Control	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) Y	(a) Except SS, even raw water can comply with the standards already. SS is going to be removed in a sludge pond and only purified supernatant will be discharged.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) The country's regulation allows to discharge sludge directly but a sludge pond will separate sludge and it will be dried, transferred and dumped in a designated site, according to the current design.

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Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) The intake pump will be installed under water and little noise can be produced. The transmission pump will be installed in the WTP site being covered with RC walls and noise will not reach the boundary of the site.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence? (a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N/A	(a) No groundwater will be exploited.
3 Natural Environment	(1) Protected Areas	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?(b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?(d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N/A (d) N	(a) The project sites are all outside of protected areas. No adverse impacts are expected by the project.
	(2) Ecosystem	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N	(a) The sites are all within developed lands.(b) As above(c) As above(d) Even in a significant dry season, the intake will affect only 0.01% of Mekong River water flow.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) Even in a significant dry season, the intake will affect only 0.01% of Mekong River water flow.

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Category	Environmental Item	Main Check Items	Yes/ Y No/ N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	<p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?</p> <p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Is the compensations going to be paid prior to the resettlement?</p> <p>(e) Is the compensation policies prepared in document?</p> <p>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p>	<p>(a) N</p> <p>(b) N/A</p> <p>(c) N/A</p> <p>(d) N/A</p> <p>(e) N/A</p> <p>(f) N/A</p> <p>(g) N/A</p> <p>(h) N/A</p> <p>(i) N/A</p> <p>(j) N/A</p>	<p>(a) No resettlement occurs</p> <p>(b) As above</p> <p>(c) As above</p> <p>(d) As above</p> <p>(e) As above</p> <p>(f) As above</p> <p>(g) As above</p> <p>(h) As above</p> <p>(i) As above</p> <p>(j) As above</p>
	(2) Living and Livelihood	<p>(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?</p>	<p>(a) Y</p> <p>(b) N</p>	<p>(a) Construction activities can cause inconvenience to inhabitants but the countermeasures for impact minimization were agreed in the stakeholder meeting. (b) Positive impact such as prevention of ground water exploitation is possible, instead.</p>
	(3) Heritage	<p>(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?</p>	<p>(a) N</p>	<p>(a) The sites are all within developed lands and no heritage exists there.</p>



Category	Environmental Item	Main Check Items	Yes <sup>1</sup> /Y No <sup>2</sup> /N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?(b) What are the items, methods and frequencies of the monitoring program?(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities? (a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan was prepared according to the EMP.(b) The monitoring contents were decided by consultation between the proponent and authorities.(c) The monitoring plan includes such components.(d) As above
6 Note	Reference to Checklist of Other Sectors Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) No dams are included as project components and the impact to Mekong River is very little.  (a) The project does not have possibility of significant adverse impacts on environment.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Monitoring Form (Environmental and Social Considerations)

Monitoring Results of Thakhek Water Supply Development Project (Before and During the Construction Phases)

1. Monitoring Results of Noise Pollution

Table M-1-1 Results Unit: dB(A)

No.	Date	Measured Value															Item: Noise	Unit: dB(A)
		St.1	St.2	St.3	St.4	St.5	St.6	St.7	St.8	St.9	St.10	St.11	St.12	St.13	St.14	St.15		
Pre-Construction Phase (Baseline)																		
1																		
2																		
Construction Phase																		
1																		
2																		
3																		
4																		
5																		

Table M-1-2 Station

Measured Station	Adopted Standard*)	Detailed location
St.1		
St.2		
St.3		
St.4		
St.5		
St.6		
St.7		
St.8		
St.9		
St.10		
St.11		
St.12		
St.13		
St.14		
St.15		

\*) Refer to Table M-1-3

Table M-1-3 National Standard values (Lao PDR)

Type of Area	Standard Value in dB(A)		
	6:00-18:00	18:00-22:00	22:00-6:00
Quiet areas: hospitals, libraries, treatment places, kindergarten and schools	50	45	40
Residential areas: hotels and houses	55	55	45
Commercial and service areas	70	70	50
Small industrial factories located in residential areas	70	70	50

Table M-1-4 Other Standard values

Country	Industrial Area	Commercial Area	Residential Area	Silence Zone
U.S(E.P.A)	70	60	55	45
W.H.O	65	55	55 / 45 (day / night)	45 / 35 (day / night)
E.C	65	55	55 / 45 (day / night)	45 / 35 (day / night)

2. Monitoring Results of Dust Pollution

Table M-2-1 Results

No.	Date	Measured Value														Item: Dust	Mark: "✓"			
		St.1	St.2	St.3	St.4	St.5	St.6	St.7	St.8	St.9	St.10	St.11	St.12	St.13	St.14			St.15		
Construction Phase - 1 <sup>st</sup> Year																				
1																				
2																				
3																				
4																				
5																				
6																				
Construction Phase - 2 <sup>nd</sup> Year																				
1																				
2																				
3																				
4																				
5																				
6																				

Construction Phase - 3 <sup>rd</sup> Year														
1														
2														
3														

Table M-2-2 Station

Observed Station	Detailed location	Remark
St.1		
St.2		
St.3		
St.4		
St.5		
St.6		
St.7		
St.8		
St.9		
St.10		
St.11		
St.12		
St.13		
St.14		
St.15		

Table M-2-3 Standard values Item: Dust (as PM10) Unit:  $\mu\text{g}/\text{m}^3$

Country	Annual mean	Daily mean
Lao PDR	-	-
U.S(E.P.A)	50	150
W.H.O	20	50
E.C	40	50

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3. Monitoring Results of Waste Management

Table M-3 Result as of (Date: \_\_\_\_\_) Item: Waste Management Mark: "✓" if management is good

Station	Location	Kind of Waste	Whole amount (m <sup>3</sup> )	Receiving Dumping Site	Situation of General Waste Management/Remark
Construction Phase - <input type="checkbox"/> 1 <sup>st</sup> Year / <input type="checkbox"/> 2 <sup>nd</sup> Year / <input type="checkbox"/> 3 <sup>rd</sup> Year					
No. (1/2)					
St. 01					
St. 02					
St. 03					
St. 04					
St. 05					
St. 06					
St. 07					
St. 08					
St. 09					
St. 10					
St. 11					
St. 12					
St. 13					
St. 14					
St. 15					
St. 16					
St. 17					
St. 18					
St. 19					
St. 20					

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4. Monitoring Results of Safety Management

Table M-4 Result as of (Date: \_\_\_\_\_) Item: Safety Management Mark: "✓" if management is good

Station	Location	Description of Incident (Injury, Accident and so on)	Situation of Fencing and Other Safety Management/Remark
Construction Phase - <input type="checkbox"/> 1 <sup>st</sup> Year / <input type="checkbox"/> 2 <sup>nd</sup> Year / <input type="checkbox"/> 3 <sup>rd</sup> Year			
No. (1/2)			
St. 01			
St. 02			
St. 03			
St. 04			

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St. 05			
St. 06			
St. 07			
St. 08			
St. 09			
St. 10			
St. 11			
St. 12			
St. 13			
St. 14			
St. 15			

**5. Monitoring Results of Sanitary Management**

**Table M-5-1** Result as of (Date: \_\_\_\_\_) Item: Sanitary Management Mark: "✓" if the item is well conducted

Interviewee	Items indicated by Sanitary Program				Remark
	i)	ii)	iii)	iv)	
Construction Phase - <input type="checkbox"/> 1 <sup>st</sup> Year / <input type="checkbox"/> 2 <sup>nd</sup> Year / <input type="checkbox"/> 3 <sup>rd</sup> Year					
No. (1/2)					
In and around the Labour Camps					
LC-01					
LC-02					
LC-03					
LC-04					
LC-05					
LC-06					
LC-07					
LC-08					
LC-09					
LC-10					
LC-11					
LC-12					
LC-13					
LC-14					
LC-15					
In and around the Construction Sites					
St.1-1					
St.1-2					
St.1-3					
St.2-1					
St.2-2					

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Monitoring Results of Thakhek Water Supply Development Project (Operation Phase)

Monitoring Results of Total Suspended Solids

Table 1 Concentration Values of Total Suspended Solids (TSS) Unit: mg/L Country's Standard: 40 mg/L (EC: 35 mg/L, WB: 50mg/L)

Y / M	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015												
2016												

Table 2 Detail of Measurement

Year	Month	Day	TSS Value (mg/L)	Measurer	Certifier	Remark
2015	1					
	2					
	3					



## 5. ソフトコンポーネント計画書

### 5-1 ソフトコンポーネントを計画する背景

本プロジェクトにより整備される水道施設は、取水施設、導水管、浄水場、送水ポンプ、送水管、高架水槽、配水管等からなっている。この上水道施設整備により、新たに 15,000m<sup>3</sup>/日の水道水をタケク郡に給水できるようになる。これらの水道施設を永続的に運転維持管理していくためには、カムアン県水道公社（NPKM）のタケク郡の運転維持管理（O&M）職員が、それぞれの担当部署の業務を十分に遂行しうる技術力を運転開始までに持っている必要がある。

本プロジェクトでは、次の2つの分野に対するソフトコンポーネントの実施を提案する。

1. 浄水場運転維持管理
2. 配水量管理

#### 1) 浄水場運転維持管理

現在タケク郡にある浄水場からは、濁度の高い処理水が生産されており、適正な浄水処理が行われていない。その原因としては、計画処理能力を超える過負荷運転を行っていること、薬品注入量が適切に調節されておらず、フロックの形成が十分ではないこと、傾斜パイプ（沈澱池）とろ過池で、十分な濁質の除去が行われていないことが挙げられる。他方で、最適な浄水処理を継続的に行うために必要な、薬品注入量や逆洗、浄水場内流量等の実績データの全体的かつ整然とした整備が行われておらず、常時適正な運転を行なえる体制とはなっていない。本プロジェクトによる能力増強と他地域への移動により、新しい職員も補充・増員されて新浄水場の運転維持管理を行うことになった場合に、特別な訓練をせずにスムーズに十分な浄水処理が行われるようになるとは考えられない。そこで、新浄水場の処理能力を発揮して十分に処理された安全・清潔な浄水を生産するためには、全体的な浄水場の運転維持管理に関する訓練が必要である。

ポンプやバルブ等の個々の機器の操作については、施設建設を担当するコントラクターが施設の引渡しをする際に説明を行う。しかし、取水施設の流量調整バルブによる浄水場内の流量調節や薬品注入量の調節等、浄水処理システムとして各操作の組み合わせによって適切な浄水処理を行う浄水場全体の操作指導については、コントラクターの業務の範囲外であり、浄水場を設計したコンサルタントが指導しなければならない。そこで、本件のソフトコンポーネントとして、十分な浄水処理を可能とする浄水場の運転維持管理の訓練を行う。さらに、定期的なデータの取得と記録・保管の方法について指導し、その後の運転

維持管理に活用できるようにする。最終的には浄水場運転維持管理マニュアルを作成して、継続的に浄水場の処理能力を発現できるようにする。なお、水質分析・管理については、ラオス国側で事前にトレーニングを行うことを前提としており、本ソフトコンポーネントには含まず、マニュアルにも含まない前提で投入計画を作成している。

## 2) 配水量管理

本プロジェクトの送配水施設では、新浄水場からの送水管が2系統に分かれ、1系統は新規高架水槽に接続し、他の1系統は既存浄水場敷地内でさらに既存配水池と新規高架水槽の2系統に分かれる。すなわち、全体では1つの浄水場から送配水システムが3系統に分かれる構造になっている。送水ポンプ施設は新規浄水場に設置される。それぞれ標高が異なるこれら3系統の配水池・高架水槽の水位を適正に保つためには、これらの水位をチェックしながら、流量調整バルブの開閉や新規浄水場の送水ポンプの運転・停止を適時適切に行わなければならない。すなわち、配水池と2つの高架水槽の水位を見つつ、3系統に必要な水量を適正に配分するための送水ポンプ・流量調整バルブの組み合わせ操作、ならびに水位データ等の蓄積・保管・活用を適正に行うための技術が新たに必要になる。

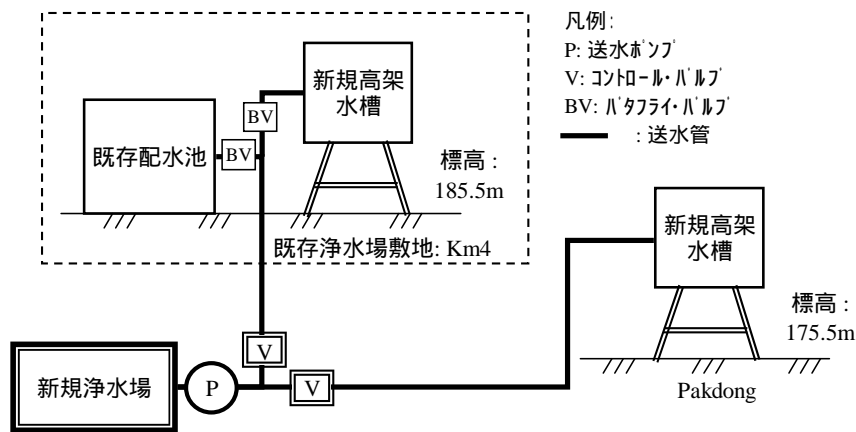


図 3.2.4.8-1 配水量管理の関連施設イメージ

送水ポンプや流量調整バルブ等の個々の機器の操作については、コントラクターの引渡し時に説明がなされるが、送配水システムとして流量調整バルブと送水ポンプの組み合わせの操作・記録管理については、これまで行われなかった特別な技術が必要となる。そこで、配水量管理に関わるこれらの技術についてはソフトコンポーネントで指導を行う。

なお、JICA は本プロジェクトと並行して、2012年8月から2017年8月にかけてカムアン県水道公社を含むラオス国内3カ所の水道公社を対象に、事業管理能力向上のための技術協力プロジェクトを実施する。したがって、本ソフトコンポーネントでは投入量を最低限にし、本ソフトコンポーネントにて今回作成されるアウトプットであるマニュアル等を活用した施設の運用維持管理状況を技術協力プロジェクトでモニタリング・サポートしていく予定である。

## 5-2 ソフトコンポーネントの目標

本プロジェクトにおけるソフトコンポーネントの目標は、「NPKM タケク郡の職員が、データを整備しデータに基づき適切に処理された安全な浄水を生産できるようになること、ならびに適切に流量調整バルブと送水ポンプを操作し送水量を適切に管理できるようになる」ことである。

## 5-3 ソフトコンポーネントの成果

本ソフトコンポーネントの成果は以下の通りである。

### 1) 浄水場運転維持管理

NPKM 浄水施設課 (Treatment Plant Section) の職員が、本プロジェクトの浄水システムを理解し、データに基づき適切に処理された安全な浄水を生産できるようになる。

### 2) 配水量管理

NPKM 給水課 (House Connection Section) 職員、および関係する浄水施設課の職員が、本プロジェクトの送配水システムを理解し、送水ポンプと流量調整バルブ等の適切な操作方法を習得して、配水池および高架水槽 (2 箇所) への適切な送水ができるようになる。

## 5-4 成果達成度の確認方法

本ソフトコンポーネントの、各分野・成果ごとの達成度の確認方法を表 5.4- 1 に示す。

表 5.4-1 ソフトコンポーネント各分野・成果ごとの達成度の確認方法

分野	成果	達成度の確認項目	確認方法
浄水場運転維持管理	NPKM 浄水施設課 (Treatment Plant Section) の職員が、本プロジェクトの浄水システムを理解し、データに基づき適切に処理された安全な浄水を生産できるようになる。	<ol style="list-style-type: none"> <li>1. 水量 (取水、送水)、薬品注入量、逆流洗浄、ポンプ運転台数・稼働時間等の浄水場運転記録を毎日記録できる。</li> <li>2. 水質管理で決定された適正薬品注入量に基づいて、適切に薬品が注入される。</li> </ol>	<ol style="list-style-type: none"> <li>1. 水量、薬品注入量、ポンプ運転台数・稼働時間等の記録の有無</li> <li>2. 薬品注入量の記録の結果</li> <li>3. 上記全体に関する、マニュアルの有無</li> </ol>
配水量管理	NPKM 給水課 (House Connection Section) および浄水施設課の職員が本プロジェクトの送配水システム	<ol style="list-style-type: none"> <li>1. 高架水槽および配水池の水位を毎日記録できる。</li> <li>2. 配水管網結果による最低圧力地点の水圧の時間毎の記録を毎日記録できる。</li> </ol>	<ol style="list-style-type: none"> <li>1. 水位記録の有無</li> <li>2. 最低圧力地点の水圧記録の有無</li> <li>3. 当該記録と関係マニュアルの有無</li> </ol>

	を理解し、送水ポンプと流量調整バルブ等の適切な操作方法を習得して、配水池および高架水槽（2棟）への適切な送水ができるようになる。	3. 送水系および配水系の流量、水圧、水質、ポンプの消費電力をモニターしながら、最適かつ省電力の送水ポンプ・流量調整バルブの操作が行えるようになる。	
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### 5-5 ソフトコンポーネントの活動（投入計画）

本ソフトコンポーネントの活動（投入計画）の詳細を表 5.5-1 に示す。なお、通訳/支援の現地スタッフを1名当り 1.90M/M で合計2名としている。「7. ソフトコンポーネントの実施工程」で述べるとおり、2名の本邦専門家の現地業務をそれぞれ2回に分け、その間に NPKM 職員が自分達で実地訓練を行う。その際に通訳/支援の現地スタッフが、必要に応じて職員への指導やサポート、各専門家への報告等を行うため、各専門家の現地業務期間よりもそれぞれ 0.30M/M ずつ多く配置している。

表 5.5-1 ソフトコンポーネントの活動（投入計画）

分野	成果	活動	必要な投入量
浄水場運転維持管理	NPKM 浄水施設課（Treatment Plant Section）の職員が、本プロジェクトの浄水システムを理解し、データに基づき適切に処理された安全な浄水を生産できるようになる。	<ol style="list-style-type: none"> <li>1. 浄水場全体システムに関する講義（資料作成と講義）</li> <li>2. 現在の浄水場関連記録の確認</li> <li>3. 情報伝達フローを考慮しつつ、水量（取水、送水）、薬品注入量、逆流洗浄、ポンプ運転台数・稼動時間等の浄水場運転記録フォーマットの作成</li> <li>4. 上記フォーマットの記載方法指導</li> <li>5. 浄水場運転管理マニュアルの作成</li> <li>6. 上記マニュアルの講義・実地指導</li> </ol>	浄水場運転維持管理専門家（本邦コンサルタント）： 1名×1.6M/M （乾季・雨季の2回に分けて派遣）  通訳・支援（現地スタッフ）： 1名×1.9M/M
配水量管理	NPKM 給水課（House Connection Section）および浄水施設課の職員が本プロジェクトの送配水システムを理解し、送水ポンプと流量調整バルブ等の適切な操作方法を習得して、配水池および高架水槽（2棟）への適切な送水ができるようになる。	<ol style="list-style-type: none"> <li>1. 送配水システム全体に関する講義（資料作成と講義）</li> <li>2. 現在の送配水関係記録の確認</li> <li>3. 高架水槽・配水池の水位記録、最低圧力地点の水圧等の記録フォーマットの作成</li> <li>4. 上記フォーマットの記載方法指導</li> <li>5. 送配水システム運転維持管理マニュアル（ポンプ・バルブ類操作手順、送水ポンプ運転スケジュール及び維持管理含む、無収水対策は除く）の作成</li> <li>6. 上記マニュアルの講義・実地指導</li> </ol>	配水量管理専門家（本邦コンサルタント）： 1名×1.6M/M （乾季・雨季の2回に分けて派遣）  通訳・支援（現地スタッフ）： 1名×1.9M/M

本ソフトコンポーネントの要員配置計画を図 5.5-1 に示す。

図 5.5-1 ソフトコンポーネントの要員配置計画

	担 当	氏名	月数	1	2	3	4	5	人/月			
									小計		計	
									現地	国内	現地	国内
本邦技術者	浄水場 運営維持管理 専門家			0.8 ■				0.8 ■	1.60	0.00	1.60	0.00
	配水量管理 専門家			0.8 ■				0.8 ■	1.60	0.00	1.60	0.00
									3.20	0.00	3.20	0.00
現地スタッフ	通訳/支援1 (浄水場)			0.8 ■	0.1 ■	0.1 ■	0.1 ■	0.8 ■	1.90	0.00	1.90	0.00
	通訳/支援2 (配水量管理)			0.8 ■	0.1 ■	0.1 ■	0.1 ■	0.8 ■	1.90	0.00	1.90	0.00
									3.80	0.00	3.80	0.00
	報告書			実施状況 報告書		完了報告 書						

凡例： ■ 本邦専門家及び現地スタッフ ■ 現地スタッフのみ

### 5-6 ソフトコンポーネントの実施リソースの調達方法

本ソフトコンポーネントでは、以下の2名の技術者を現地に派遣する。ソフトコンポーネントの目標が、季節による水質変化に対応し適切に処理された安全な浄水を生産できるようになること、ならびに適切に流量調整バルブと送水ポンプを操作し送水量を適切に管理できるようになることであり、現状の運転維持管理状況から判断してローカルリソースでは対応が困難であることから、本邦コンサルタントの活用が望ましい。そこで、本ソフトコンポーネントは、本邦コンサルタント直接支援型とする。

#### 1) 浄水場運転維持管理専門家

浄水場の運転管理全般に精通している本邦コンサルタントを1名派遣する。個々の機械・電気設備の運転方法の指導（コントラクターが実施）ではなく、浄水処理を効果的に行うべく、浄水処理システムとしての浄水場内流量調節や薬品注入量の連携操作を適切に行うための指導およびマニュアル作成、関係記録の蓄積・活用等ができるようにするための支援である。

#### 2) 配水量管理専門家

送配水システムの運転管理に精通している本邦コンサルタントを1名派遣する。個々の機

械・電気設備の運転方法の指導（コントラクターが実施）ではなく、システムとして配水池と高架水槽からの配水量・水圧を適正に保つために、把握すべき情報の理解、それら情報に基づく送水ポンプと流量調整バルブの連携操作、また関係記録の蓄積・活用等ができるようにするための支援である。

#### **5-7 ソフトコンポーネントの実施工程**

実施工程計画を図 5.7-1 に示す。参考までにプロジェクトの全体実施工程表(案)を示す。

全体実施工程表(案)

月数	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	
閣議承認	▲																																						
交換公文調印 (E/N)		▲																																					
コンサルタント契約			▲																																				
実施設計																																							
PQ公示																																							
業者入札																																							
業者契約																																							
準備工																																							
取水場工事																																							
浄水場工事																																							
配水池工事																																							
導水管敷設工事																																							
送水管敷設工事																																							
配水本管敷設工事																																							
機材調達																																							
ソフトコンポーネント																																							
試運転・引渡し																																							

図 5.7-1 実施工程計画

No.	活動	月数	1					2					3					4					5				
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1.	浄水場運転維持管理		■										■														
1)	浄水場全体システムに関する講義(資料作成と講義)		■																								
2)	現在の浄水場関連記録の確認			■																							
3)	情報伝達フローを考慮しつつ、水量(取水、配水)、薬品注入量、逆流洗浄、ポンプ運転台数・稼働時間等の浄水場運転記録フォーマットの作成			■																							
4)	浄水場運転記録フォーマットの記載方法指導(専門家不在時はローカル補助員)				■				■		■																
5)	浄水場運転管理マニュアルの作成																		■								
6)	上記マニュアルの講義・実地指導																									■	
2.	配水量管理		■										■														
1)	送配水システム全体に関する講義(資料作成と講義)		■																								
2)	現在の送配水関係記録の確認			■																							
3)	高架水槽・配水池の水位記録、最低圧力地点の水圧等の記録フォーマットの作成			■																							
4)	上記フォーマットの記載方法指導(専門家不在時はローカル補助員)				■				■		■																
5)	送水ポンプ・流量調整バルブの操作マニュアル(ポンプ・バルブ類操作手順、送水ポンプ運転スケジュール及び維持管理)の作成																		■								
6)	上記操作マニュアルの講義・実地指導																									■	
	ソフトコンポ-ネット実施状況報告書の提出																										
	ソフトコンポ-ネット完了報告書の提出																										

App 5 - 8

凡例： ■ 本邦専門家及び現地スタッフ ■ 現地スタッフのみ



各専門家の現地派遣を2回に分け、現地1回目の最後にNPKM職員に宿題を課す。各現地作業の間には、既存水道施設を用いて、各種フォーマットの記載等、職員に宿題を行わせる。2回目の専門家の現地作業開始時にフォーマット記載状況のフォローアップと追加指導を行うことを想定している。

本ソフトコンポーネントは、完成施設の運用を適正に行えることを目的としているので、最後の現地指導は新規浄水場や送配水施設の建設工事が完了する時期を目処に行う。

## 5-8 ソフトコンポーネントの成果品

ソフトコンポーネントの成果品は以下の通りである。

- 浄水場運転維持管理  
講義資料、各種記録フォーマット、浄水場運転維持管理マニュアル（水質分析・管理を除く）
- 配水量管理  
講義資料、各種記録フォーマット、送配水システム運転維持管理マニュアル（無収水対策を除く）

なお、報告書としては下記の成果品がある。

- ソフトコンポーネント実施状況報告書
- ソフトコンポーネント完了報告書

これらの報告書の記載要領は独立行政法人国際協力機構「ソフトコンポーネント・ガイドライン（第3版）」（2010年10月）に準じるものとする。

## 5-9 ソフトコンポーネントの概算事業費

本ソフトコンポーネントの投入は、浄水場運転維持管理専門家の本邦コンサルタント1.60M/M及び、配水量管理専門家の本邦コンサルタント1.60M/Mおよび通訳/支援の現地スタッフ2名合計3.80M/Mであり、概算事業費は表9-1に示すように約10.5百万円である。

表 5.9-1 ソフトコンポーネントの概算事業費 (百万円)

直接人件費	2.5
直接経費	4.8
間接費	3.2
ソフトコンポーネント計	10.5

#### 5-10 相手国側の責務

本ソフトコンポーネントのターゲットである浄水場施設課と給水課の適正人数の職員配置が必要である。その人員確保・配置はラオス国側で実施されるべき事項である。これら、ソフトコンポーネントのターゲット・グループの人材配置は、新入職員に対する NPKM での基礎的な職員教育等を含めて、ソフトコンポーネント実施前までに完了している必要がある。

なお、浄水場運転維持管理の指導には、水質管理の知見を有する NPKM 職員がいることが必要不可欠である。薬品注入量を決定する上で不可欠な凝集試験（ジャーテスト）や水質試験に関するノウハウを、本ソフトコンポーネントの実施までに職員が習得していなければ、浄水場運転維持管理の成果を前述の投入・期間で出すことは困難である。ラオス国側は、NPNL のトレーニングセンター等を活用して、本ソフトコンポーネント実施前までに、NPKM の水質担当職員に水質・凝集試験などの水質管理に関する訓練を行い、水質・凝集試験の技術を習得させておかなければならない。

6. 参考資料（収集資料リスト）

調査名：ラオス国タケク上水道拡張整備計画準備調査

番号	名称	形態 図書・ビデオ 地図・写真等	オリジナル ・コピー	発行機関	発行年
G1	タケク郡デジタルマップ	CD (CAD)	コピー	Department of Map, Vientiane	2012
G2	タケク郡地形図 (1/100,000)	地図	オリジナル	Department of Map, Vientiane	1987
G3	タケク郡地形図 (1/10,000)	地図	オリジナル	Department of Map, Vientiane	2012
W1	Lower Mekong Hydrologic Year Book 2001-2002	CD	コピー	Mekong River Commission	2004
W2	Lower Mekong Hydrologic Year Book 2003-2004	CD	コピー	Mekong River Commission	2004
W3	Mekong River (Gage Height in Mater at Thekhek) 1968-2001	データ	コピー	Mekong River Commission	2012
W4	Mekong River (Gage Height in Mater at Thekhek) 2002-2011	データ	コピー	Department of Meteorology	2012
W5	Xebanfai Water Supply Project	レポート	コピー	NPNL	2010
W6	Water Production Summary 2010	レポート	コピー	NPKMN	2010
W7	Water Production Summary 2011	レポート	コピー	NPKMN	2011
W8	Water Supply Construction Agreement (既存浄水場の建設にかかる契約図書)	図書	コピー	NPKMN	2000
W9	Report of Thakhek Urban Improvement Project, Khammouane Province	CD	コピー	DPWT	2009
W10	Summary Information Regarding Nampapa Work for 3 Districts; Thkhek, Nongbok, Mahaxai 2009	レポート	コピー	NPKMN	2009
W11	Summary Information Regarding Nampapa Work for 3 Districts; Thakhek, Nongbok, Mahaxai 2010	レポート	コピー	NPKMN	2010

番号	名称	形態 図書・ビデオ 地図・写真等	オリジナル ・コピー	発行機関	発行年
W12	Regulation of Nampapa	図書	コピー	NPKMN	2011
W13	Regulation on Water Supply Operation in Lao PDR	図書	コピー	WASA	2008
W14	Urban Water Supply and Sanitation in Lao PDR	レポート	コピー	NPKMN	2012
W15	Khounekham Project Water Treatment Plant (900m3/day)	レポート	コピー	DM Construction-Trading LTd	2011
W16	Study Report of Design for Bualapha District (900m3/day)	レポート	コピー	NPNL	2007
W17	Memorandum of Understanding between Neighboring Countries Economic Development Cooperation Agency and Provincial Waterworks Authority of Thailand and Department of Housing and Urban Planning, Ministry of Public Works and Transport of Lao PDR	レポート	コピー	NEDA	2011
W18	Population of Thakhek (Water Supply & Expansion Area) 2010	データ	コピー	NPKMN	2010
W19	Population of Thakhek District 2009-2012	データ	コピー	NPKMN	2012
W20	Regulation of LPCD	データ	コピー	NPKMN	2012
W21	Summary of Water Production, Water Sold and Loss (Yearly 1999-2011, Monthly 2011, Daily 2010-2011 Data)	データ	コピー	NPKMN	2011
W22	Summary of Water Distribution and Sold in 2010 and 2011	データ	コピー	NPKMN	2011
W23	Record of Water Meter from Well 2012	データ	コピー	NPKMN	2012
W24	Record of Water Meter from Mekong 2012	データ	コピー	NPKMN	2012
W25	Drinking Water Standards, Guide Line and Recommended Value	データ	コピー	NPNL	
W26	Drainage Outlet Location	地図	コピー	NPKMN	2012
W27	Phoukhyo Specific Economic Zone	パンフレット	コピー	SV Group	2012
W28	Tender Documents Lot 2 (Well and Reservoir Construction)	図書	コピー	Nampapa Lao (NPL)	1995

番号	名称	形態 図書・ビデオ 地図・写真等	オリジナル ・コピー	発行機関	発行年
W29	Feasibility Study of Project Development on Thakhek Specific economic Zone	書面	コピー	DPWT-KM	2012
W30	Feasibility Study of Project Development on Phu Khyo Na Khonh Project	書面	コピー	DPWT-KM	2010
W31	Thakhek Water Supply Project Lot1:Supply of Plant and Equipment, Drilling and Equipping of Wells Final Implementation Report	書面	コピー	NPKMN	1996
W32	Management and technical Guidelines Water Supply	書面	コピー	NPKMN	2009
W33	As Built Drawing Nam Theun 2 Hydropower Project (Lao PDR) Public Road Zone A1	書面	コピー	DPWT-KM	2010
W34	From The Entrance of Hinboun Road-Juntion Mittaphap/Friendship Bridge no.03-Juntion Road no.12-Nabouap	書面	コピー	DPWT-KM	2011
W35	Thakhek Water Supply System Feasibility Study and Detailed Design	書面	コピー	NPKMN	2011
W36	The Project for the Construction of New Water Supply Pipeline System In Expansion Circle Road Area, Km2 to PamSokxai	書面	コピー	NPKMN	2011
E1	Decree on the Implementation of the Environmental Protect Low	図書	コピー	STEA, UNDP, NORAD	2002
E2	Communicable Disease in Khammauane Provine 2010-2011	データ	コピー	Khammauane Province	2011
E3	Precipitation and temperature (monthly average / 2007-2011 / Thakhek)	書面	オリジナル	Khammauane Province	2012

番号	名称	形態 図書・ビデオ 地図・写真等	オリジナル ・コピー	発行機関	発行年
E4	Mekong River flow rate (2002-2011)	データ	コピー	Department of Meteorology	2012
E5	Land use allocation in Khammouane province	データ	コピー	DNRE	2012
E6	Population in planned service areas	書面	オリジナル	Thakhek district office	2012
E7	Breakdown of Agricultural products	書面	オリジナル	Department of Agriculture	2012
E8	Land use of Thakhek	データ	コピー	DNRE	2012
E9	Environmental Protection Law (1999)	データ	コピー	DNRE	1999
E10	Decree on Environmental Assessment	データ	コピー	DNRE	2010
E11	Type and Size 697 PM WREA	データ	コピー	DNRE	2010
E12	Lao National Environment Standard	データ	コピー	DNRE	2009
E13	Approved Resettlement Guideline	データ	コピー	DNRE	2010
E14	DECREE 192_Compensation&Resettlement	データ	コピー	DNRE	2005
E15	Khammouane Environmental Strategy to the years 2020 and Action Plan for the years 2006-2010	図書	オリジナル	STEO, LENS	2007
E16	Laos People's Democratic Republic Peace Independence Democracy Unity and Prosperity	書面	コピー	Prime Minister Office Water Resource and Environment Authority	2010
M1	Customer Number of Thakhek, Mahaxay, Nongbok 2010-2011	データ	コピー	NPKMN	2012
M2	Organization Chart of Khommouane Water Supply Enterprise in 2011	データ	コピー	NPKMN	2012
M3	Summary of Water Meter Installation	データ	コピー	NPKMN	2012
M4	Water Leakage Detection Instruments provided by JICA Partnership Program	データ	コピー	NPKMN	2012

## 7. その他の資料・情報

### 7-1 既存施設の機能劣化診断結果

- 既存取水場、浄水場の機能劣化診断結果（構造物編）
- 劣化度調査対象施設位置図
- 調査結果
  - 取水場
  - 浄水場
- 既設の扱い
- 既存取水場、浄水場の機能劣化診断結果表（機械・電気編）

## 巻末資料1－既存取水場、浄水場の機能劣化診断結果(構造物編)

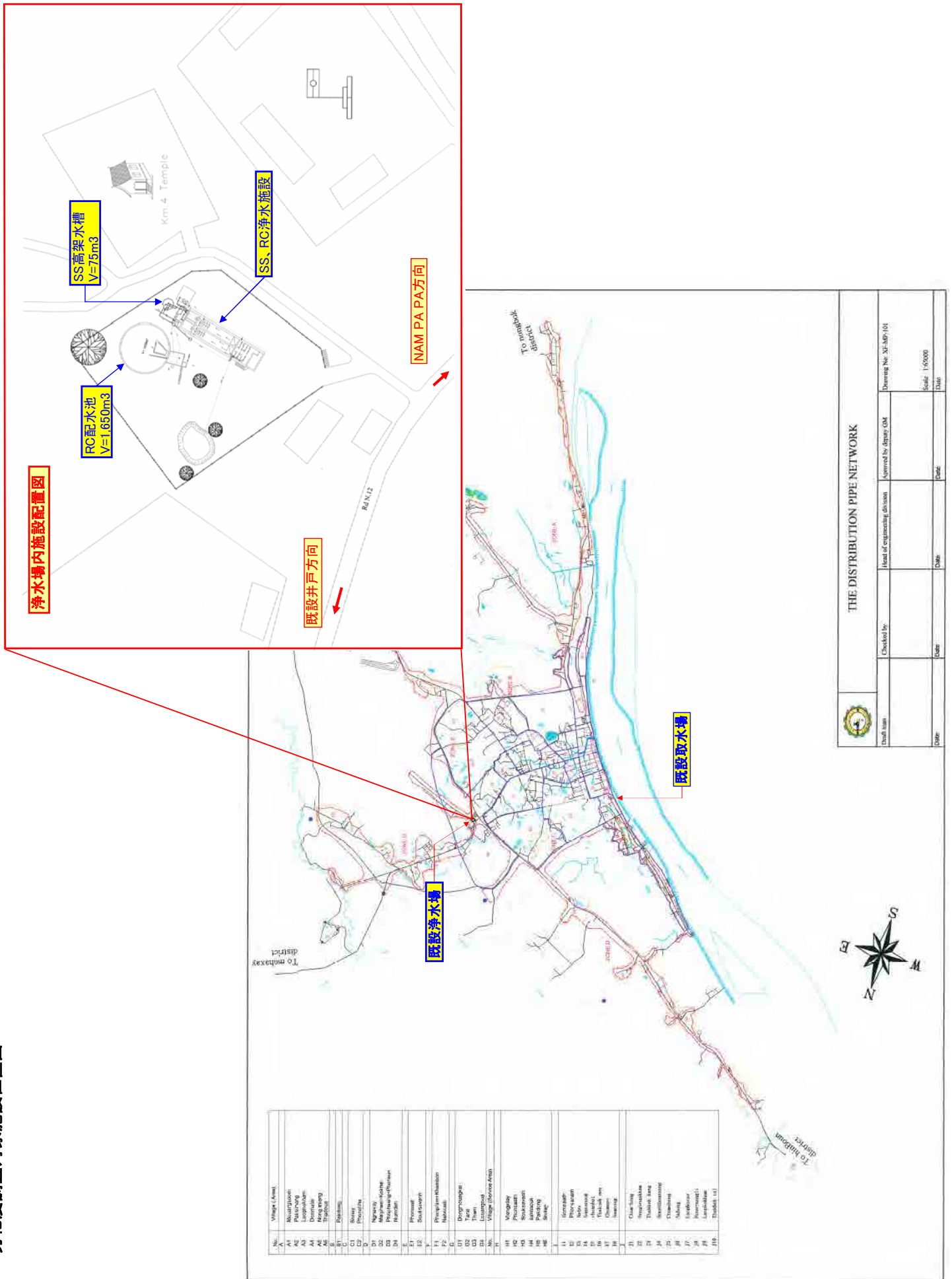
- 1.劣化度調査対象施設  
劣化度調査対象施設及びその構造は以下のとおりである。
  - 1.1取水場
    - ・露出配管受台(無筋コンクリート構造)
    - ・露出配管支持材(鋼構造)
  - 1.2浄水場
    - (1)浄水施設
      - ・着水井、フロック形成池、沈澱池(鋼構造)
      - ・同上基礎(鉄筋コンクリート構造)
      - ・薬品溶解槽架台(鋼構造、鉄筋コンクリート構造)
      - ・急速ろ過池(鉄筋コンクリート構造)
    - (2)高架水槽
      - ・基礎(鉄筋コンクリート構造)
      - ・水槽及び脚部(鋼構造)
    - (3)配水池(鉄筋コンクリート構造)

これら施設の位置関係を次ページ「劣化度調査対象施設位置図」に示す。

- 2.調査項目  
劣化位置及びその度合いは目視により確認する。また、断面欠損についてはその度合いを計測する。
  - 2.1鉄筋コンクリート構造
    - ・ひび割れの有無
    - ・ひび割れの規模
    - ・エフロレッセンス(白華現象)の有無
  - 2.2鋼構造
    - ・錆の発生程度
    - ・腐植の度合い(断面欠損の有無)
    - ・部材の撓み



劣化度調査対象施設位置図



No.	Village (Area)
A	Moulmein
A1	Langphabum
A2	Langphabum
A3	Langphabum
A4	Langphabum
A5	Langphabum
A6	Langphabum
A7	Langphabum
A8	Langphabum
A9	Langphabum
A10	Langphabum
B	Phongsavan
C	Phongsavan
C1	Phongsavan
C2	Phongsavan
C3	Phongsavan
D	Phongsavan
D1	Phongsavan
D2	Phongsavan
D3	Phongsavan
D4	Phongsavan
E	Phongsavan
E1	Phongsavan
E2	Phongsavan
F	Phongsavan
F1	Phongsavan
F2	Phongsavan
G	Phongsavan
G1	Phongsavan
G2	Phongsavan
H	Phongsavan
H1	Phongsavan
H2	Phongsavan
I	Phongsavan
I1	Phongsavan
I2	Phongsavan
J	Phongsavan
J1	Phongsavan
J2	Phongsavan
K	Phongsavan
K1	Phongsavan
K2	Phongsavan
L	Phongsavan
L1	Phongsavan
L2	Phongsavan
M	Phongsavan
M1	Phongsavan
M2	Phongsavan
N	Phongsavan
N1	Phongsavan
N2	Phongsavan
O	Phongsavan
O1	Phongsavan
O2	Phongsavan
P	Phongsavan
P1	Phongsavan
P2	Phongsavan
Q	Phongsavan
Q1	Phongsavan
Q2	Phongsavan
R	Phongsavan
R1	Phongsavan
R2	Phongsavan
S	Phongsavan
S1	Phongsavan
S2	Phongsavan
T	Phongsavan
T1	Phongsavan
T2	Phongsavan
U	Phongsavan
U1	Phongsavan
U2	Phongsavan
V	Phongsavan
V1	Phongsavan
V2	Phongsavan
W	Phongsavan
W1	Phongsavan
W2	Phongsavan
X	Phongsavan
X1	Phongsavan
X2	Phongsavan
Y	Phongsavan
Y1	Phongsavan
Y2	Phongsavan
Z	Phongsavan
Z1	Phongsavan
Z2	Phongsavan



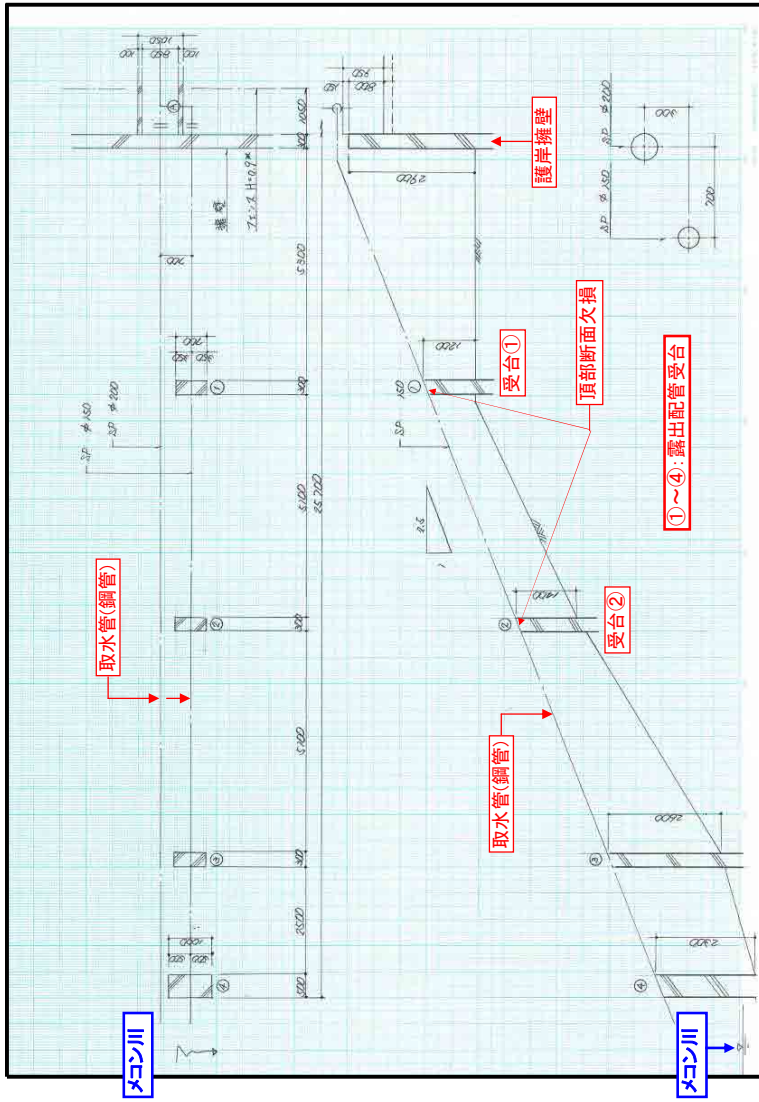
**THE DISTRIBUTION PIPE NETWORK**

	Checked by: _____	Approved by: _____	Drawing No. 30-AP-01
Drawn by: _____	Head of engineering division: _____	Scale: 1:5000	Date: _____
Date: _____	Date: _____	Date: _____	Date: _____

### 3.調查 結果

### 3.1 取水場

(1) 調査対象構造概要図



#### (2) 調査結果

- 1) 受台: 無筋コンクリート構造
  - ・受台①及び②の頂部に管設置に伴う人為的なコンクリートのはつりが見られる。
  - ・受台①～④のすべてで部分的なコンクリートの剥離が見られる。但し、その度合いは極小規模である。
- 2) 管支持材: 鋼構造
  - ・支持材は受桁が等辺山形鋼、支柱が鋼管で構成されている。
  - ・受桁の一部に固定が不十分で不安定な箇所が見られる。
  - ・管固定バンド(SSプレート、B.N)に緩みが見られる。
  - ・全体に錆の発生が見られる。

【受台①頂部コンクリート欠損状況】



はつりによる  
断面欠損

【受台②頂部コンクリート欠損状況】



等辺山形鋼  
不安定

【管支持材状況】



支柱: 鋼管

受桁: 等辺山形鋼

支柱: 鋼管

受台②

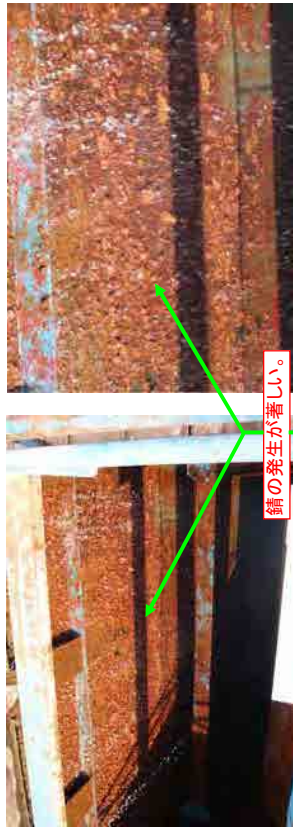
受桁: 等辺山形鋼

### 3.2 浄水場

(1) 着水井、フロック形成池、沈蔵池：鋼構造

1) 内面

内面の調査は着水井、フロック形成池共に1系列であり空水にすることが不可能なことから、2系列である沈蔵池のみについて行った。【沈蔵池壁面状況】

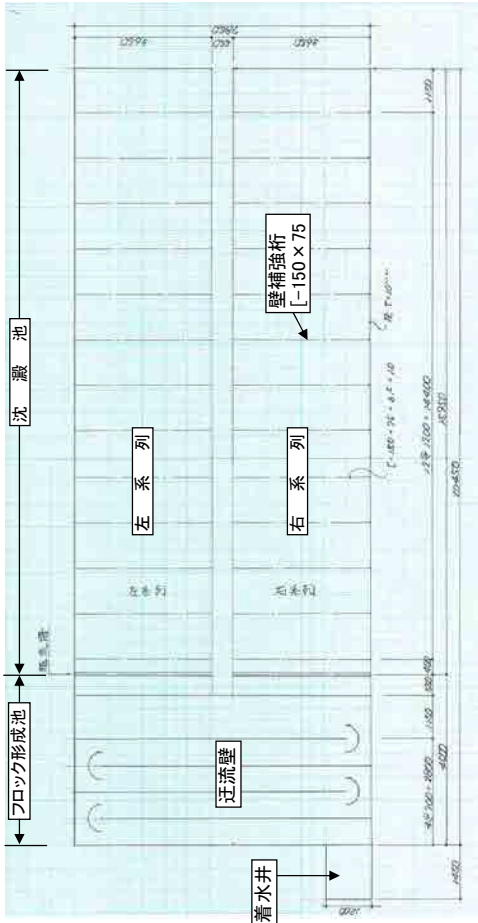


錆の発生が著しい。

【沈蔵池壁補強桁状況】



錆の発生が著しい。



【フロック形成池迂流壁状況】



壁板に錆みが見られる。

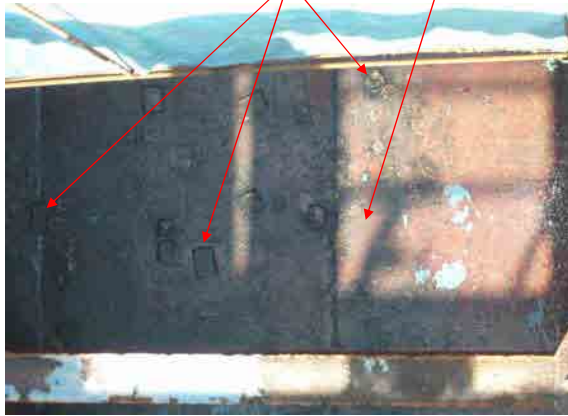


錆の発生が見られる。

液相部全体に発生付着物有り。

壁板に錆みが見られる。

【沈蔵池底面状況】

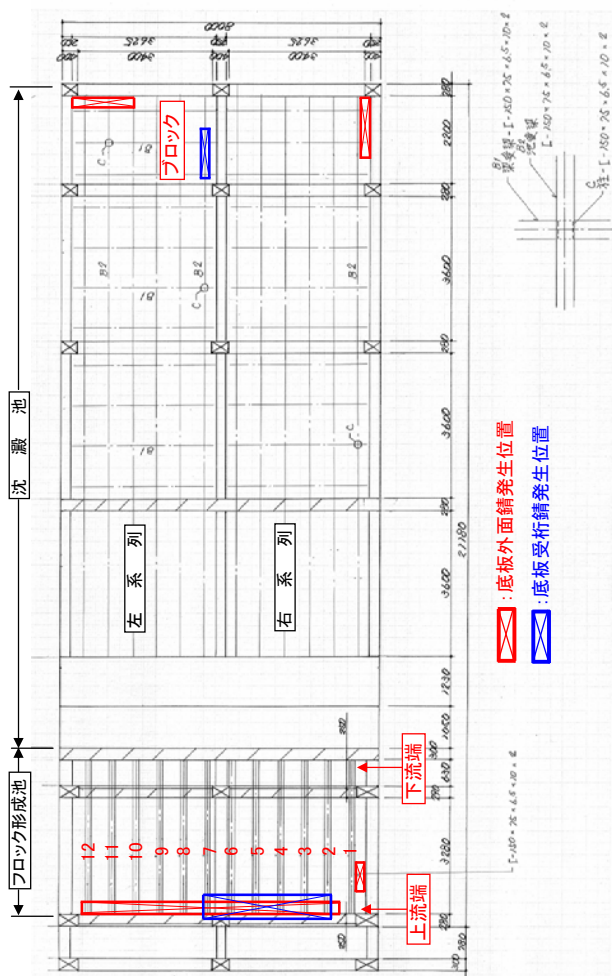


当金溶接による補修跡が見られる。  
右系列補修箇所：58箇所  
左系列補修箇所：35箇所

塗料の剥離が全面に亘っている。

右系列底面状況写真

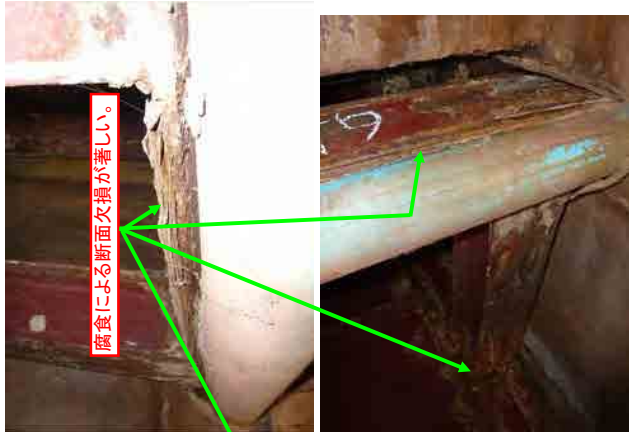
2)外面



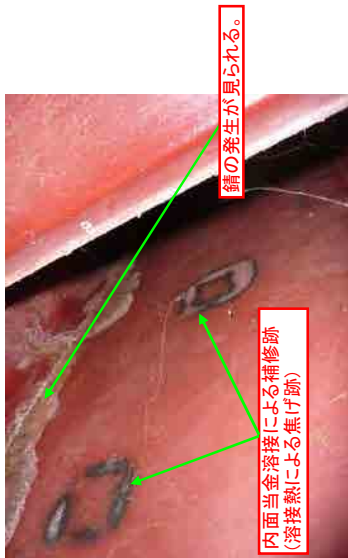
【ブロック形成池底板、受桁状況】



受桁5上流端及び底板状況写真



【沈蔵池底板、受桁状況】



【沈蔵池柱下部状況(ブロック1)】



ブロック1内のすべての柱(18本)にこの状況が見られる。

【ブロック形成池、沈澱池壁外面状況】



ブロック形成池上流部外面状況写真

3)調査結果

【内 面】

- ・注流壁に構みが見られる。
- ・壁に錆の発生が見られる。水中部分は沈澱池と同様に錆の発生が著しいものと考えられる。
- ・沈澱池底面に孔食(と考えられる)の補修跡(当金溶接による補修)が多数見られる。
- 右系列: 58箇所 左系列: 35箇所
- ・沈澱池底面は全面に亘り上塗り塗料の剥離が見られる。
- ・沈澱池壁面及び同補強桁部分の錆発生が著しい。

【外 面】

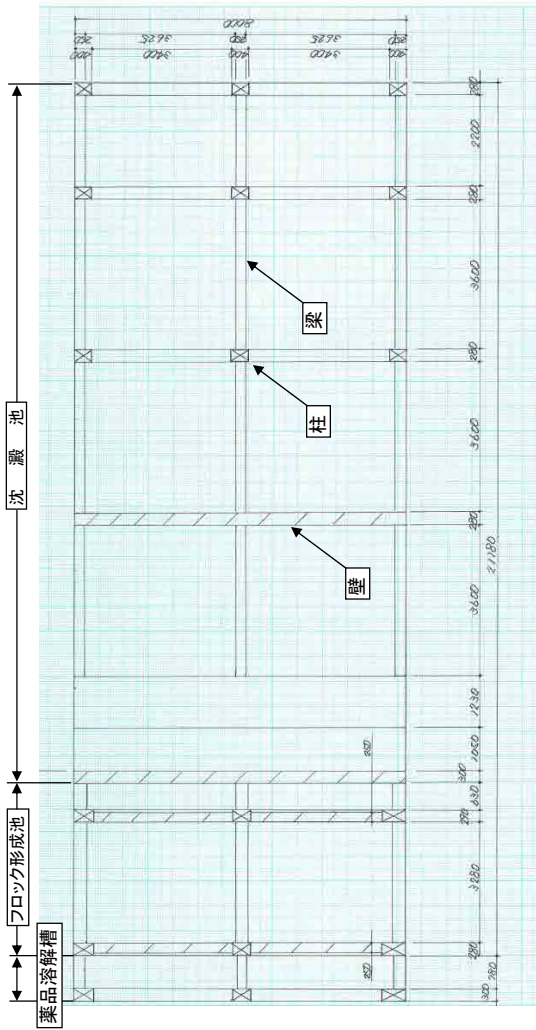
- ・左右壁については上塗り塗料の劣化(色あせ)が全面に見られる。また、上塗り塗料の剥離が部分的に見られる。
- ・ブロック形成池上流部壁については、異常は見留められない。
- ・ブロック形成池下部補強梁2~7の上流端に著しい腐蝕が見られ、最も腐蝕の激しい梁6部分においては部材厚が1/2(5mm/10mm)に減少している。
- ・上記梁上の柱及び梁も同様に腐蝕が著しい。また、これに接する底板も錆の発生が著しい。
- ・沈澱池底面ブロック1部分の柱下部(土と接する部分)で腐蝕による断面欠損が見られる。

ブロック形成池～沈澱池右外面状況写真

ブロック形成池～沈澱池左外面状況写真

(2) 着水井、フロック形成池、沈澱池基礎・鉄筋コンクリート構造

1) 調査位置構造概要図



【フロック形成池、沈澱池基礎状況】



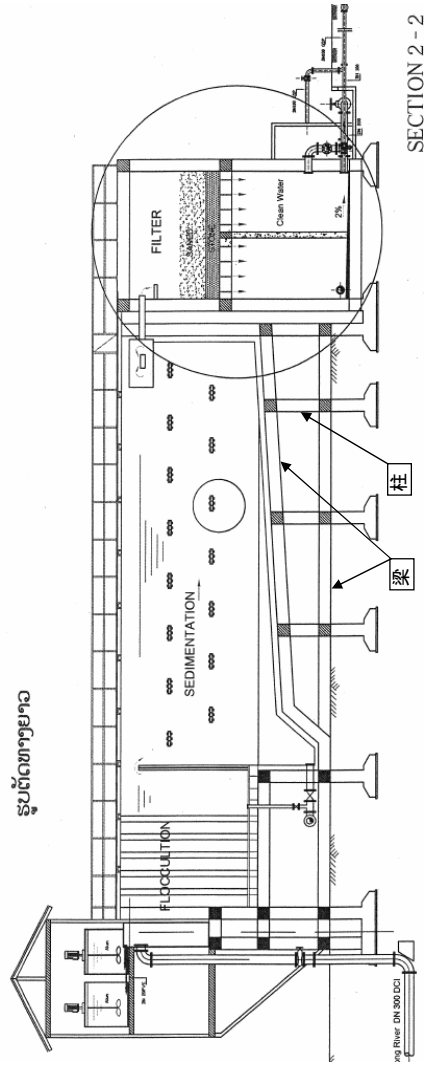
端部梁、柱状況写真(1)



端部梁、柱状況写真(2)



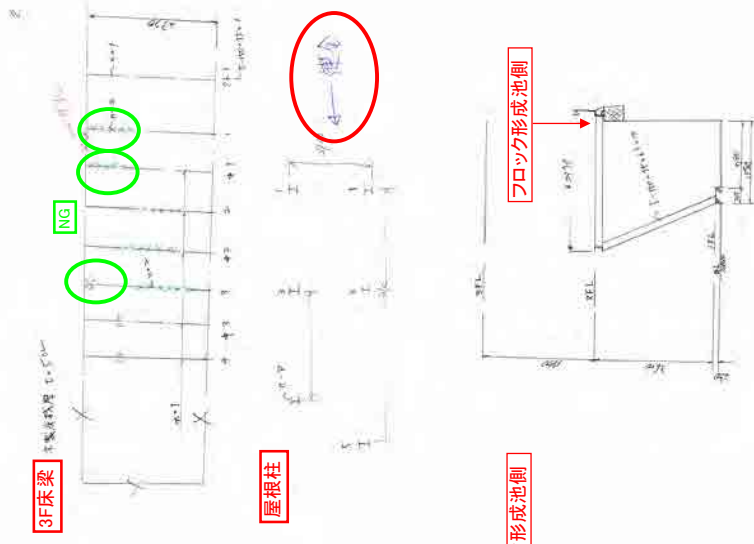
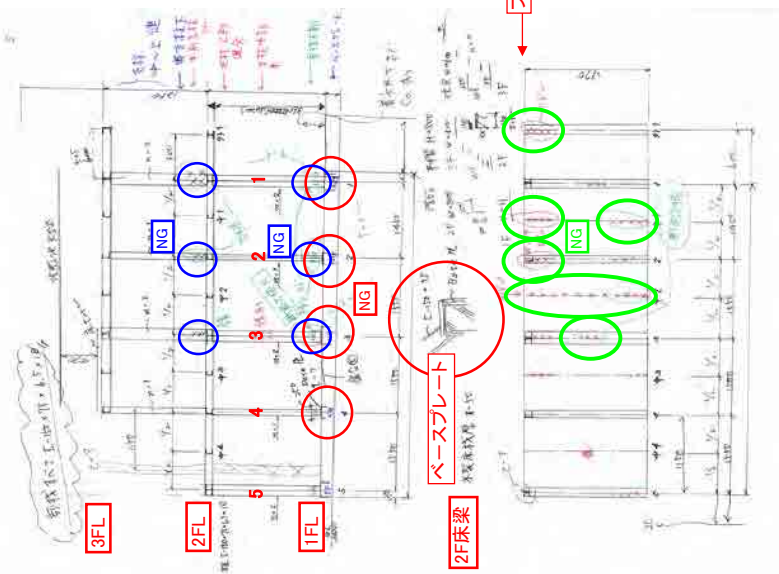
池底部梁、柱状況写真



2) 調査結果  
当該部分の鉄筋コンクリートにはひび割れ、エプロレッセンスともに見留められない。

(3)薬品溶解槽架台：鋼構造  
1)調査位置構造概要図

桁、柱部材：すべて薄形鋼 [一]150×75×6.5×10



【薬品溶解槽架台全景】

【ベースプレート腐食状況】



【1F~2F柱下部腐食状況】

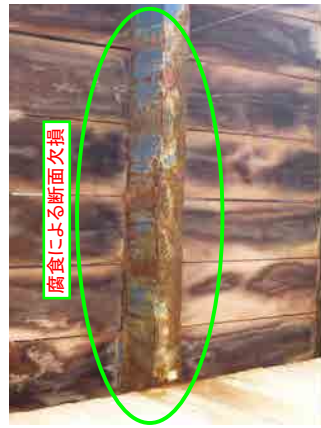




【2F～3Fフロック形成池側柱下部腐食状況】



【2F床梁腐食状況】



【3F床梁腐食状況】



【着水井壁外面腐食状況】



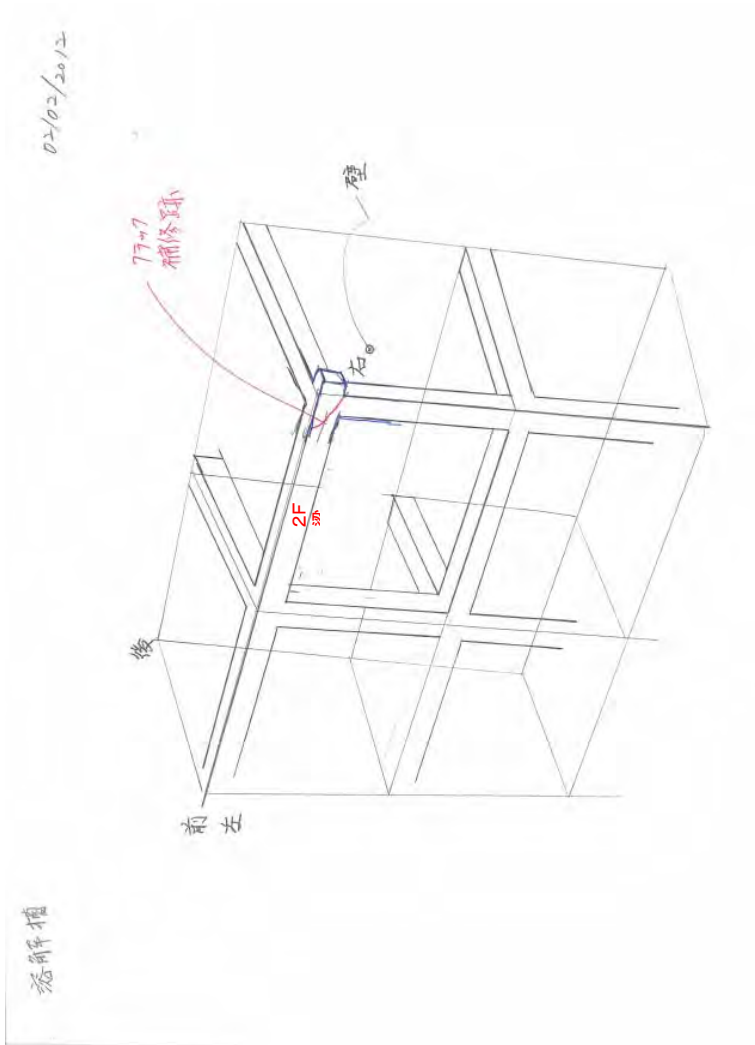
2)調査結果

腐食が著しく、断面欠損を来している部位は以下のとおりである。

- ・柱1、2、3、4下部ベースプレート
- ・柱1、2、3の1F～2F下部(土に接する部分)
- ・柱1、2、3の2F～3F下部(フロック形成池側の2F床と接する部分)
- ・2F及び3F床梁
- ・着水井壁外面

- (図及び写真中の○印部分)
- (図及び写真中の○印部分)
- (図及び写真中の○印部分)
- (図及び写真中の○印部分)
- (写真中の○印部分)

(4)薬品溶解槽架台:鉄筋コンクリート構造  
1)調査位置構造概要図

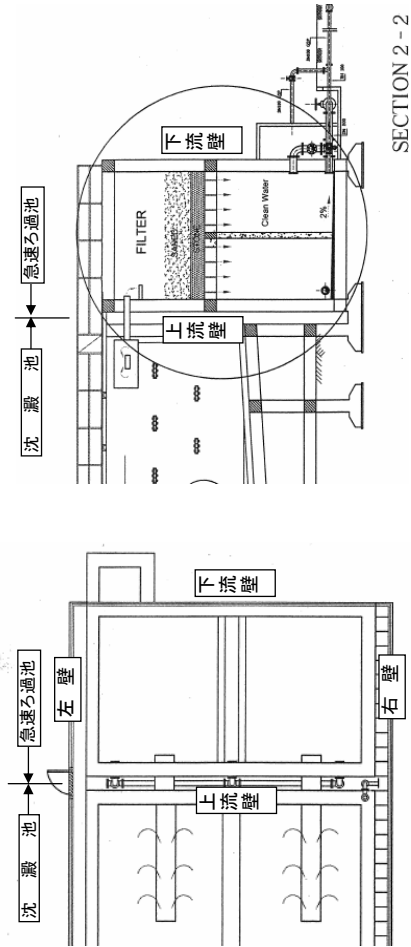


【薬品溶解槽架台状況】

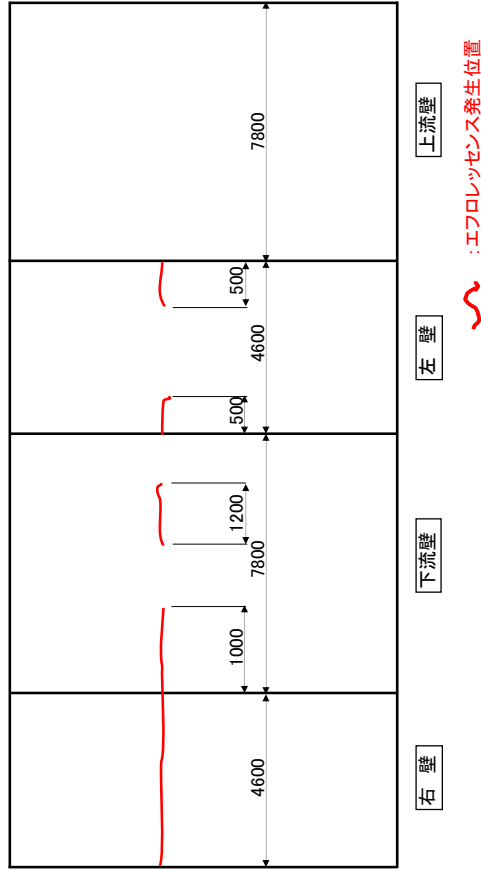


2)調査結果  
2F 梁右端にひび割れ補修跡が見られる。その他の部分の鉄筋コンクリートにはひび割れ、エフロレッセンスともに見留められない。

(5)急速ろ過池:鉄筋コンクリート構造  
1)調査位置構造概要図



【壁外面展開図】



：エフロレッセンス発生位置

2)調査結果

- ・上流壁を除く池外面のコンクリート面については、展開図に示す位置にエフロレッセンスが見られる。
- ・池内面のコンクリート面については、異常は見留められない。

【急速ろ過池外面状況】



右側壁エフロレッセンス状況写真



下流壁エフロレッセンス状況写真

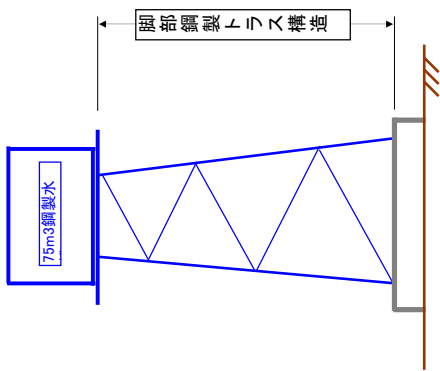


左壁エフロレッセンス状況写真

【急速ろ過池内面状況】

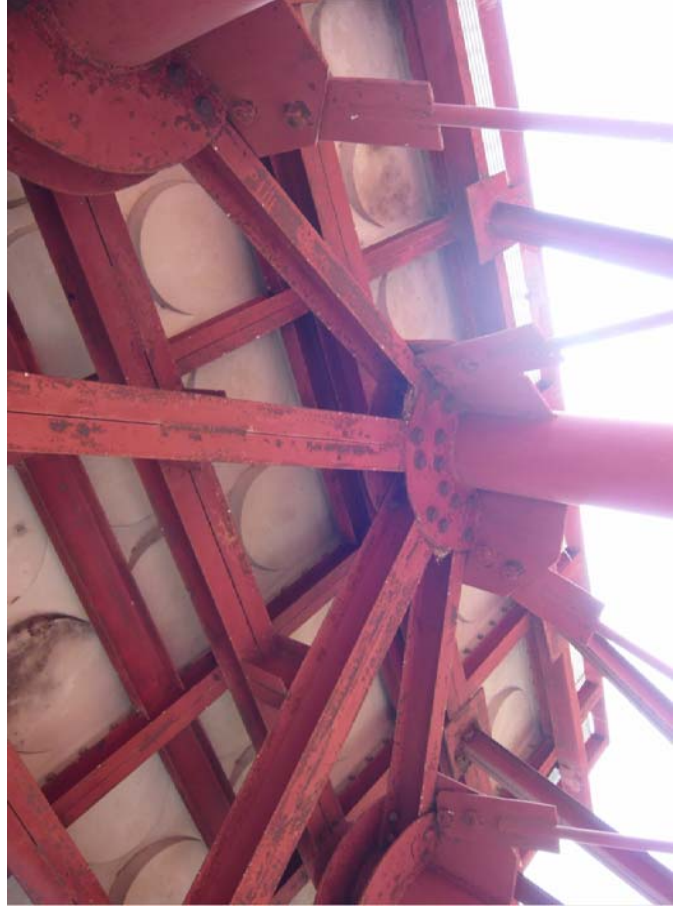


(6)高架水槽、基礎 鉄筋コンクリート構造、水槽及び脚部 鋼製  
1)調査位置構造概念図

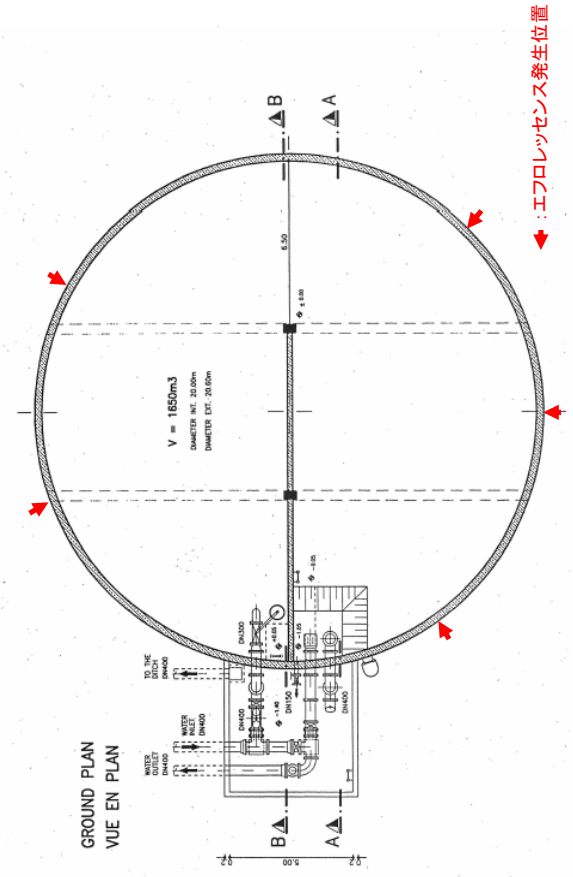


- 2)調査結果
- ・基礎部鉄筋コンクリートについては、異常は見留められない。
  - ・脚部鋼製トラスについては、面的に錆が浮いている。
  - ・鋼製水槽については、異常は見留められない。

【脚部状況】



(7)配水池：鉄筋コンクリート構造  
1)調査位置概要図



2)調査結果  
化粧目地と思われる縦目地部分5箇所にエプロレットセシンスが見られる。

【配水池全体状況】



【配水池エプロレットセシンス発生状況】



## 4. 既設の扱い

以下に、既設取水場及び浄水場を継続供用した場合に必要な補修(更新)の内容を、また補修(更新)工事に当たった時の問題点を示す。

### 4.1 取水場

取水場の既存施設を継続供用するためには

- ① 受台コンクリートの断面修復を行う。
- ② 管支持材の更新し、受台コンクリートへの固定を行う。  
の2作業が必要となる。

この作業は、取水管(φ150、φ200)を仮受することで比較的容易に行えるものと判断する。

### 4.2 浄水場

継続供用にあたって、補修を必要とする施設に関し以下に示す。(高架水槽、鉄筋コンクリート構造施設の

一部に見られるエフロセシスは構造体の強度低下を来すものではないため)については供用にあたって補修は不要と判断する。)

- (1) 着水井、フロック形成池、沈澱池・鋼構造

#### 1) 内面補修

ケレンを行い、再塗装することで十分に機能は回復する。

#### 2) 外面補修

- ① 着水井、フロック形成池、沈澱池壁外面

ケレンを行い、再塗装することで機能は回復する。

- ② フロック形成池

底板受桁、柱の腐蝕が進み断面欠損している部材の交換が必要となる。

底板の腐食部分の切断除去及び同位置の断面修復が必要となる。

- ③ 沈殿池

底板及び同受桁についてはケレンを行い、再塗装することで機能は回復する。

同上部材を支える柱のうち、フロック1部分についてはすべて部材の交換が必要となる。また、交換に際しては根入れ部分に重防食塗装を施す必要がある。

### 3) 問題点

- ① 各補修は作業期間を長期に亘り必要とし、その間浄水場の運転は停止しなければならない。

したがって、補修作業は

・新設浄水場の供用開始後に水需要を見極め実施する。

・現行と同機能の代替え浄水施設を建設し実施する。

のいずれかを選択することで初めて可能となる。

- ② なお、鋼構造であるが故に、補修後数年で再度機能維持を目的としたケレン、塗装を行う必要が生じる。

- ③ 「②」については供用期間中、常に繰り返される作業であり、今後水需要が伸びた場合には困難が伴う作業となる。

- (2) 薬品溶解槽架台：鋼製

#### 1) 補修

腐蝕により断面欠損している部材の交換が必要となる。

### 2) 問題点

薬品溶解槽を現位置のままに部材の交換作業を実施することは非常に困難である。

したがって、作業に際しては「フロック形成池上部に仮架台を設置し、仮置きする」等の措置を施す必要がある。

### 4.3 既設の扱い

#### (1) 取水場

取水管受台及び管支持材の部分的な補修は比較的容易に行える。

しかし、フローティング方式による取水施設は現在ワイヤロープ2条のみで係留されており、メコン川の水位、流速の変動の影響を十分に受けている。

係留ワイヤの破断時には施設が流下する危険性がある。よって、取水施設については既設を廃止し、新設取水施設と統合することが望ましいものと判断する。

#### (2) 浄水場

既設浄水場の補修は、

・新設浄水場の供用開始後に水需要を見極め実施する。

・現行と同機能の代替え浄水施設を建設し実施する。

を選択し行えば可能であるが、鋼構造の補修では今後継続供用する上で維持管理上問題が多い。

よって、以下の2方法のいずれかを選択実施することが望ましいものと判断する。

方法1：現浄水場の鋼構造部分を鉄筋コンクリート構造に変更する。

方法2：新設浄水場を水需要に合わせて増設する。(既設浄水場は高架水槽及び配水池を存続させ、浄水施設は廃止とする)

既存取水場、浄水場の機能劣化診断結果表(機械・電気編)

タケク既設浄水施設機器リスト(機械設備)

番号	整理番号	設備名	機器名称	方式・形式	仕様	製造者	設置年度	設置場所	現状	補修工事
001	TM1001	取水設備	取水ポンプNo1	陸上片吸込みポンプ	2.0m3/min	IN-LINE MOTOR	2001	取水施設	稼働中	故障時修理
002	TM1002	"	ポンプ電動機No1	かご型誘導電動機	55kw		2001	"	稼働中	故障時修理
003	TM1003	"	サクション管		150mm		2001	"	異常無	現状使用可
004	TM1004	"	デリバリー管		100mm		2001	"	"	現状使用可
005	TM1005	"	逆止弁		100mm		2001	"	"	現状使用可
006	TM1006	"	制水弁		100mm		2001	"	"	現状使用可
007	TM1007	"	取水ポンプNo2	陸上片吸込みポンプ	2.0m3/min	KR MOTOR	2001	"	稼働中	故障時修理
008	TM1008	"	ポンプ電動機No2	かご型誘導電動機	55kw		2001	"	稼働中	故障時修理
009	TM1009	"	サクション管		150mm		2001	"	異常無	現状使用可
010	TM1010	"	デリバリー管		100mm		2001	"	"	現状使用可
011	TM1011	"	逆止弁		100mm		2001	"	"	現状使用可
012	TM1012	"	制水弁		100mm		2001	"	"	現状使用可
013	TM1013	"	取水ポンプNo3	陸上片吸込みポンプ	2.0m3/min	KR MOTOR	2001	"	稼働中	故障時修理
014	TM1014	"	ポンプ電動機No3	かご型誘導電動機	55kw		2001	"	稼働中	故障時修理
015	TM1015	"	サクション管		150mm		2001	"	異常無	現状使用可
016	TM1016	"	デリバリー管		100mm		2001	"	"	現状使用可
017	TM1017	"	逆止弁		100mm		2001	"	"	現状使用可
018	TM1018	"	制水弁		100mm		2001	"	"	現状使用可
019	TM1019	"	取水ポンプNo4	陸上片吸込みポンプ	2.0m3/min	KR MOTOR	2001	"	稼働中	故障時修理
020	TM1020	"	ポンプ電動機No4	かご型誘導電動機	55kw		2001	"	稼働中	故障時修理
021	TM1021	"	サクション管		150mm		2001	"	異常無	現状使用可
022	TM1022	"	デリバリー管		100mm		2001	"	"	現状使用可
023	TM1023	"	逆止弁		100mm		2001	"	"	現状使用可
024	TM1024	"	制水弁		100mm		2001	"	"	現状使用可
025	TM1025	"	ヘッド管		150mm		2001	"	"	現状使用可
026	TM1026	"	制水弁		150mm		2001	"	"	現状使用可
027	TM1027	"	可とう導水管	河川水位に対応	150mm		2001	"	"	現状使用可
028	TM1028	"	可とう管		150mm		2001	"	"	現状使用可
029	TM1029	"	Y分岐管 No1		150mm		2001	"	"	現状使用可
030	TM1030	"	Y分岐管 No2		150mm		2001	"	"	現状使用可
031	TM1031	"	Y分岐管 No3		150mm		2001	"	"	現状使用可
032	TM1032	"	Y分岐管 No4		150mm		2001	"	"	現状使用可
033	TM1033	"	制水弁		200mm		2001	"	"	現状使用可
034	TM1034	"	制水弁		80mm		2001	"	"	現状使用可
035	TM1035	"	取水ポンプNo5	水中ポンプ	3.3m3/min	山東顔山原並	2005	"	故障中	修理中
036	TM1036	"	水中ポンプモーター		150kw		2005	"	異常無	故障時修理
037	TM1037	"	デリバリー管		150mm		2005	"	"	現状使用可
038	TM1038	"	逆止弁		150mm		2005	"	"	現状使用可
039	TM1039	"	バタフライ弁		150mm		2005	"	"	現状使用可
040	TM1040	"	取水ポンプNo6	水中ポンプ	3.3m3/min	山東顔山原並	2005	"	稼働中	故障時修理
041	TM1041	"	水中ポンプモーター		150kw		2005	"	異常無	故障時修理

番号	整理番号	設備名	機器名称	方式・形式	仕様	製造者	設置年度	設置場所	現状	補修工事
042	TMI042		デリバリー管		150mm		2005	"	"	現状使用可
043	TMI043		逆止弁		150mm		2005	"	"	現状使用可
044	TMI044		バタフライ弁		150mm		2005	"	"	現状使用可
045	TMI045		可とう導水管	河川水位に対応	200mm		2005	"	"	現状使用可
046	TMI046		可とう管		200mm		2005	"	"	現状使用可
047	TMI047		Y分岐管 No1		200mm		2005	"	"	現状使用可
048	TMI048		Y分岐管 No2		200mm		2005	"	"	現状使用可
049	TMI049		Y分岐管 No3		200mm		2005	"	"	現状使用可
050	TMI050		Y分岐管 No4		200mm		2005	"	"	現状使用可
051	TMI051		制水弁		200mm		2005	"	"	現状使用可
052	TMT001	送水設備	送水管	取水場～浄水場	300mm		2001	道路埋設	"	現状使用可
053	TMT002		制水弁	原水制御用	300mm		2001	浄水場	"	現状使用可
054	TMT003		制水弁	バイパス配水用	200mm		2001	"	"	現状使用可
055	TMT001	浄水設備	急速攪拌機No1	凝集剤攪拌用	2.2kw		2001	"	破損	要新規取り換え
056	TMT002		急速攪拌機No2	凝集剤攪拌用	2.2kw		2001	"	稼働中	故障時修理
057	TMT003		急速攪拌機No3	凝集剤攪拌用	2.2kw		2001	"	稼働中	故障時修理
058	TMT004		沈澱池排泥弁No1		100mm		2001	"	異常無	現状使用可
059	TMT005		沈澱池排泥弁No2		100mm		2001	"	"	現状使用可
060	TMT006	ろ過池設備	処理水弁No1		300mm		2001	"	"	現状使用可
061	TMT007		処理水弁No2		300mm		2001	"	"	現状使用可
062	TMT008		処理水制御弁		300mm		2001	"	"	現状使用可
063	TMT009		ろ過水排水弁No1		100mm		2001	"	"	現状使用可
064	TMT010		ろ過水排水弁No2		100mm		2001	"	"	現状使用可
065	TMT011		逆洗水弁No1		100mm		2001	"	"	現状使用可
066	TMT012		逆洗水弁No2		100mm		2001	"	"	現状使用可
067	TMT013		逆洗空気弁No1		100mm		2001	"	"	現状使用可
068	TMT014		逆洗空気弁No2		100mm		2001	"	"	現状使用可
069	TMT015		処理水量積算計		300mm		2001	"	"	現状使用可
070	TMT016		逆洗ブローア	ルーツタイプ	11kw	LNG TECH	2001	"	"	現状使用可
071	TMT017		吸込みサイレンサー				2001	"	"	現状使用可
072	TMT018		吐き出しサイレンサー				2001	"	"	現状使用可
073	TMT019	高架水槽	高架水槽配水元弁		100mm		2009	"	"	現状使用可
074	TMT020		揚水ポンプNo1		18.5kw		2009	"	稼働中	故障時修理
075	TMT021		逆止弁		100mm		2009	"	異常無	現状使用可
076	TMT022		仕切弁		100mm		2009	"	"	現状使用可
077	TMT023		揚水ポンプNo2		5.5kw		2009	"	破損	要新規取り換え
078	TMT024		逆止弁		100mm		2009	"	異常無	現状使用可
079	TMT025		仕切弁		100mm		2009	"	"	現状使用可
080	TMT026	薬品設備	攪拌槽No1	現在水槽で使用	1500L		2001	"	"	現状使用可
081	TMT027		攪拌槽No2	現在水槽で使用	1500L		2001	"	"	現状使用可
082	TMT028		攪拌機No1		1.5kw		2001	"	稼働中	故障時修理
083	TMT029		攪拌機No2	破損使用不可	-		2001	"	破損	要新規取り換え
084	TMT030		塩素水タンクNo1	PVC	50L		2001	"	異常無	現状使用可



番号	整理番号	設備名	機器名称	方式・形式	仕様	製造者	設置年度	設置場所	現状	補修工事
085	TMT031	”	塩素水タンクNo2	PVC	50L	”	2001	”	”	現状使用可
086	TMT032	”	塩素水注入ポンプNo1	”	”	”	2001	”	稼働中	故障時修理
087	TMT033	”	塩素水注入ポンプNo2	破損使用不可	-	グランドフォス	2001	”	破損	要新規取り換え
088	TMT034	配水池設備	流量計(井戸系)	”	”	”	2001	”	破損	要新規取り換え
089	TMT035	”	空気弁(井戸系)	”	100mm	”	2001	”	異常無	現状使用可
090	TMT036	”	流入弁(井戸系)	”	400mm	”	2001	”	”	現状使用可
091	TMT037	”	排水弁	配水池排水用	150mm	”	2001	”	”	現状使用可
092	TMT038	”	圧力水位計	0~10m	”	”	2001	”	稼働中	現状使用可
095	TMT039	”	制水弁	流出用	400mm	”	2001	”	異常無	現状使用可
096	TMT040	”	ろ過水流計	ろ過水流計	400mm	”	2001	”	異常無	故障時修理
097	TMT041	”	積算流量計	流出用(不良)	400mm	”	2001	”	破損	要新規取り換え
098	TMT042	”	空気弁	流出用	100mm	”	2001	”	異常無	現状使用可
タケク既設浄水施設機器リスト(電気設備)										
001	TEI001	取水設備	変圧器	柱上設置	22kv/380v 250kva	UNION THIA	2001	取水場内	EDL	現状使用可
002	TEI002	”	低圧配電盤	柱上自立型	”	ラオス製	2001	取水場変圧器柱	EDL	現状使用可
003	TEI003	”	No1ポンプ起動盤	屋内自立型	”	フランス製	2001	取水場電気室	稼働中	故障時修理
004	TEI004	”	No2ポンプ起動盤	屋内自立型	”	フランス製	2001	取水場電気室	稼働中	故障時修理
005	TEI005	”	No3.No4ポンプ操作盤	屋内自立型	”	ラオス製	2001	取水場ポンプ船	稼働中	故障時修理
006	TEI006	”	No3.No5ポンプ起動盤	屋内自立型	”	ラオス製	2001	取水場ポンプ船	稼働中	故障時修理
007	TEI007	”	No5ポンプ起動盤	壁掛型	”	中国製	2005	取水場電気室	稼働中	故障時修理
008	TEI008	”	No6ポンプ起動盤	壁掛型	”	中国製	2005	取水場電気室	稼働中	故障時修理
009	TEI009	”	操作盤	P1,P2,P5用	”	ラオス製	2001	取水場電気室	稼働中	故障時修理
010	TEI010	”	操作盤	P6用	”	ラオス製	2001	取水場電気室	稼働中	故障時修理
011	TEI011	”	現場操作盤	P1,P2用	”	ラオス製	2001	取水場ポンプ船	稼働中	故障時修理
012	TEI012	”	現場操作盤	P5,P6用	”	ラオス製	2001	取水場ポンプ船	稼働中	故障時修理
013	TEI013	”	エア-コデションナ-	壁設置型	9000BTU	タイ製	2001	取水場電気室	稼働中	故障時修理
014	TEI001	浄水施設	凝集攪拌機制御盤	3台共通盤	”	ラオス製	2001	浄水場攪拌タンク横	稼働中	故障時修理
015	TEI002	”	浄水機器制御盤	各種共通	”	ラオス製	2001	浄水場制御室	稼働中	故障時修理
016	TEI003	”	照明機器	”	”	ラオス製	2001	浄水場場内	稼働中	故障時修理
017	TEI004	”	変圧器	柱上設置 外部共用	22kv/380v 250kva	タイ製	2001	外部	EDL	現状使用可
018	TEI005	”	低圧配電盤	”	”	ラオス製	2001	電柱部	稼働中	故障時修理