

4-2 テクニカルノート (2011 年 3 月 7 日)

Technical Notes  
on  
The Second Preparatory Survey on Mangrove Rehabilitation Plan  
for Enhancement of Disaster Prevention in The Ayeyawady Area  
in  
the Union of Myanmar

In response to the request from the Government of the Union of Myanmar (hereinafter referred to as "Myanmar"), the Government of Japan decided to conduct the Second Preparatory Survey (hereinafter referred to as "the Second Survey") on the Mangrove Rehabilitation Plan for Enhancement of Disaster Prevention in the Ayeyawady Delta (hereinafter referred to as "the Project"), and entrusted the implementation of the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA dispatched the Second Preparatory Survey Team (hereinafter referred to as "the Team") to Myanmar.

The Team has held series of discussions with the relevant officials of the Myanmar side, and conducted a first field survey in the Project area.

As the result of the discussions and the first field survey, both side confirmed the main technical items described on the attached sheets.

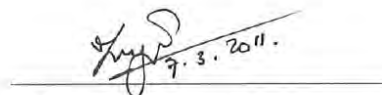
The signing of this note does not imply the commitment of the Japan side for the implementation and components of the Project.

The Team will proceed to further works and prepare the interim report.

Nay Pyi Taw, 7 March 2011



Hideto YAMAZAKI  
Chief Consultant  
Chief Consultant  
The Second Preparatory Survey Team  
Kokusai Kogyo Co., Ltd.  
Japan



On behalf of Director General  
ZAW WIN  
Director  
Plantation and Statistics Division  
Forest Department  
the Union of Myanmar

Attachment

1. Mangrove Plantation

(1) Project Area for Mangrove Plantation

1) Policy for the Confirmation of the Project area

Policy 1: Existing cultivated areas shall be excluding in accordance with the Minutes of Discussion signed on 20 January, 2011.

Policy 2: The existing forest areas which canopy ratio are more than 50% shall be excluding, because natural generation is expected.

Policy 3: The low land areas and the bank of rivers and creeks shall be excluding, because the areas are narrow and there are existing forests.

Policy 4: The areas which are not covered by vegetation shall be excluding, because the soil potentials for plantation are not expected.

2) Project Area

During the field survey, Myanmar side declared to cancel the plantation for Pyinalan RF. Because the original request is following Myanmar side's rehabilitation plan which is based on the map of 2008-2009 dry season. The land use in Pyinalan RF has been changed rapidly during these 2 years.

Myanmar side request approximately 2,300 ha for Kadonkani RF and approximately 1,100 ha Kyakankwinpauk RF, in total 3,400 ha, in finally.

The Team has been confirmed the potential for mangrove plantation in Kadonkani RF and Kyakankwinpauk RF as following table.

Table-1 The final request from Myanmar side and its potential

Reserved Forest	Final Requested Are	Potential
Kadonkani RF	approximately 2,300 ha	Confirmed
Kyakankwinpauk RF	approximately 1,100 ha	Confirmed
Total	3,400 ha	

(2) Candidate Species for the project

The candidate species mentioned in the following tables are suggested by the Team and agreed by both parties.

Table-2 Candidate Species for Kadonkani RF

Species
Sonneratia caseolaris (LAMU)
Heritiera fomes (KANASO-YAY)

Table-3 Candidate Species for Kyakankwinpauk RF

Species
Sonneratia apetala (KANTPALAR)
Avicennia officinalis (THAMAE GYI)

Note: There is possibility to change the candidate species by the further analysis.

### (3) Necessary Components for Mangrove Plantation

The both parties confirmed followings necessary component for Mangrove plantation

- 1) Preparation work
- 2) Seed collecting work
- 3) Germination work (depend on species)
- 4) Potting work
- 5) Nursery work
- 6) Land preparation work (Cutting grass and Brush)
- 7) Staking work
- 8) Planting work (Including seed transportation)
- 9) Weeding work
- 10) Survival counting work
- 11) Fire protection work
- 12) Necessary temporary work for above works

### 2. Procurement of Equipment

#### (1) Vehicles (3 Units)

Myanmar side will submit further information including operation plan and maintenance plan are required for the confirmation of the necessity of vehicles by 10 April 2011 to JICA Myanmar office.

#### (2) Passenger Boat (3 Units)

Myanmar side will submit further information including operation plan and maintenance plan are required for the confirmation of the necessity of Passenger Boat by 10 April 2011 to JICA Myanmar office.

### 3. Construction of Cyclone Shelters (2 units)

The requested Cyclone shelter in compartment No.55, Kadonkani RF, has been confirmed by the Team. Myanmar side will submit further information for another Cyclone Shelter by 10 April 2011 to JICA Myanmar office.

### 4. Soft Component

The both parties confirmed the components of Soft Component activities as follows.

#### (1) Establishing CF in Kyakankwinpauk RF

Both parties confirmed the establishment of CF in Kyakankwinpauk RF is necessary to protect the rehabilitated forest, establishing a CF which is to serve as a fuel wood forest for the village.

##### 1) The components for the establishment of CF

- Target area: 90 ha of bordering areas of Kwinthonesint village in Compartment 27
- Proposed activities: Planting of trees to be completed by the project
- Consultation with the community for deciding locations.
- Workshops to secure participation of majority of community in CFUG.
- Formulation of CF Management plan in a participatory manner, in line with existing CFL.
- Continuous participatory monitoring of the CF woodlot prior to the hand over

#### (2) Promotion of Improved (energy-saving) cooking stove

Improved cooking stove was introduced to the area before the Cyclone Nargis devastated the area. The villagers still acknowledge its efficiency. Since the fuel wood is currently the sole energy source for household chores in the project area, and no other alternative energy source is easily available (financially and physically), reduction of consumption is essential to protect

- Introducing Energy-saving stoves to villages near the project plantation area in Kyakankwinpauk RF.
- Monitor changes in consumption of fuel woods in these villages
- Develop an awareness tools for possible expansion to other villages.

#### (3) Fish inventory as tools of monitoring the impact on the bio-diversity and awareness creation

Inventory survey for fish and other aquatic creatures characteristic to the mangrove forests will be conducted in the project area, to measure the impact of the mangrove forest rehabilitation on the bio-diversity. Participatory survey will also be conducted as a part of the survey where the villages exist, so that the community people will become more conscious of their environment and the beneficial functions of mangrove forests.



## 5. Project Term

Project term shall be divided into 5 terms. The activities for each term are shown in following table.

Table-4 Activities for the Term

TERM	Activities
TERM 1	Preparation work, Construction of cyclone shelter. Procurement of equipment, Temporary works, Soft-component
TERM 2	Plantation, Temporary works, Soft-component
TERM 3	Plantation, Weeding and Fire protection works for term 2 plantation, Temporary Works, Soft-component
TERM 4	Plantation, Weeding and Fire protection works for term 3 plantation, Temporary Works, Soft-component
TERM 5	Weeding and Fire protection works for term 4 plantation, Temporary works, Soft-component





4-3 テクニカルノート (2011年7月8日)

Technical Notes  
on  
The Second Preparatory Survey on Mangrove Rehabilitation Plan  
for Enhancement of Disaster Prevention in the Ayeyawady Area  
in  
The Republic of the Union of Myanmar

In response to the request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar"), the Government of Japan decided to conduct the Second Preparatory Survey (hereinafter referred to as "the Second Survey") on the Mangrove Rehabilitation Plan for Enhancement of Disaster Prevention in the Ayeyawady Delta (hereinafter referred to as "the Project"), and entrusted the implementation of the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA dispatched the Second Preparatory Survey Team (hereinafter referred to as "the Team") to Myanmar.

The Team has held series of discussions with the relevant officials of the Myanmar side, and conducted a field survey in the Project area.

As a result of the discussions and the field survey, both sides confirmed the main technical items described on the attached sheets.

The signing of this note does not imply the commitment of the Japan side for the implementation and components of the Project.

The Team will proceed with further works and prepare the Preparatory Survey Report.

Nay Pyi Taw, 8 July 2011



Hideto YAMAZAKI  
Chief Consultant  
The Second Preparatory Survey Team  
Kokusai Kogyo Co., Ltd.  
Japan



On behalf of Director General  
Maung Maung Kyaw  
Director  
Planning & Statistics Division  
Forest Department  
Ministry of Forestry  
The Republic of the Union of Myanmar

Attachment

**1. Mangrove Plantation**

(1) Project Area for Mangrove Plantation

Both parties confirmed the plantation areas for the Project shown in the following table.

Table.1 The Plantation area for the Project

Reserved Forest	Area (ha)	Area (ac.)
Kadonkani RF	2,137	5,278
Kyakankwinpauk RF	1,236	3,052
Total	3,373	8,330

1 hectare (ha) = 2.47 acres (ac.)

(2) Plantation Species for the project

Both parties confirmed the plantation species for the Project shown in the following table.

Table.2 Plantation Species for Kadonkani RF

Species
<i>Sonneratia caseolaris</i> (LAMU)
<i>Avicennia officinalis</i> (THAMAE GYI)

Table.3 Plantation Species for Kyakankwinpauk RF

Species
<i>Sonneratia apetala</i> (KANTPALAR)
<i>Avicennia officinalis</i> (THAMAE GYI)

(3) Necessary Components for Mangrove Plantation

Both parties confirmed the following necessary components for mangrove plantation.

- 1) Preparation work
- 2) Seed collecting work
- 3) Germination work
- 4) Potting work
- 5) Nursery work
- 6) Land preparation work (cutting grass and bushes)



- 7) Staking work
- 8) Planting work (including seed transportation)
- 9) Weeding work
- 10) Fire protection work
- 11) Survival counting work
- 12) Necessary temporary tasks for the above works

(4) Weeding after plantation work

Myanmar side requested that weeding after planting shall be executed by Japanese side until the end of the Project term according to the following schedule.

Table.4 Weeding schedule

Year	First	Second	Third	Fourth	Fifth
Works	Preparation	Planting	Weeding	Weeding	Weeding
		Preparation	Planting	Weeding	Weeding
			Preparation	Planting	Weeding

Myanmar side explained that the weeding work is necessary at least 5 years after plantation. However during the Project period it may be difficult to assign enough staffs and to procure enough skilled workers, because they will take care for the Project activities.

Myanmar side understands the maintenance work including weeding work for the Project should be executed by Myanmar side after handing over the Project.

## 2. Procurement of Equipment

### (1) Vehicles (3 Units)

Myanmar side has submitted the Draft Operation and Maintenance Plan for the Project and the final Draft Operation and Maintenance Plan will be submitted by 16 July, 2011.

The study by the Team found that two cars were not appropriate for the Project and that one car might be appropriate, as shown in the following table.

Table.5 Vehicle procurement

Car for:	Appropriate
1. Bogalay Township (Kadonkani RF)	Yes
2. Laputta Township (Kyakankwinpauk RF)	No
3. FD Headquarters	No

(2) Passenger Boat (2 Units)

Myanmar side has submitted the Draft Operation and Maintenance Plan for the Project and the final Draft Operation and Maintenance Plan will be submitted by 16 July, 2011.

The study by the Team found that two passenger boats were appropriate for the Project.

Table.6 Passenger Boat procurement

Passenger Boat for:	Appropriate
1. Bogalay Township (Kadonkani RF)	Yes
2. Laputta Township (Kyakankwinpauk RF)	Yes

**3. Construction of Cyclone Shelters with Forest Watch Towers (2 units)**

Myanmar side requested Cyclone shelters in compartment No.55, Kadonkani RF and No.27, Kyakankwinpauk RF.

The team confirmed the necessity of Cyclone Shelter with Forest Watch Tower in compartment 55, Kadonkani RF. However, the team confirmed that there is an existing Cyclone Shelter in No.27, Kyakankwinpauk RF.

Both sides confirmed that the Project shall establish one Cyclone Shelter in compartment 55, Kadonkani RF.

Table.7 Cyclone Shelter construction

Cyclone Shelter with Forest Watch Tower for:	Construction as the project
1. Kadonkani RF	Yes (1 unit)
2. Kyakankwinpauk RF	No

**4. Soft Component**

Both parties confirmed the components of Soft Component activities with participation as follows.

- (1) Extension activities (Community Forestry) for only in Kyakankwinpauk RF
- (2) Extension activities of importance of mangrove forest
- (3) Promotion of improved (energy-saving) cooking stove
- (3) Establishment of fish inventory
- (4) Training of evacuation from natural disasters




### 5. Project Term

The Project shall be divided into 5 terms. The activities for each term are shown in the following table.

Table.8 Activities for the Term

TERM	Activities
TERM 1	Preparation work, Construction of cyclone shelter, Procurement of equipment, Temporary works, Soft-component
TERM 2	Plantation, Temporary works, Soft-component, Construction of cyclone shelter
TERM 3	Plantation, Weeding work for term 2 plantation, Temporary Works, Soft-component
TERM 4	Plantation, Weeding work for term 2 and term 3 plantation, Temporary Works, Soft-component
TERM 5	Weeding work for term 2, term 3 and term 4 plantation, Temporary works, Soft-component

### 6. Priority for the Project

Both parties confirmed the priority for the Project shown in the following table.

Table.9 Priority for the Project

Site	Priority
Kadonkani RF	1
Kyakankwinpauk RF	2

Both parties confirmed that in case of difficulties because of budget limitations etc., Kadonkani RF is priority and Plantation, Soft-component and procurements of equipment for Kyakankwinpauk RF shall be excluded from the Project.

Both parties confirmed that also the area for Kadonkani RF and the Project term may be reduced by the same reasons.



## 4-4 討議議事録 (M/D) (2011 年 10 月 27 日)

MINUTES OF DISCUSSIONS  
ON THE SECOND PREPARATORY SURVEY  
ON MANGROVE REHABILITATION PLAN FOR ENHANCEMENT  
OF DISASTER PREVENTION IN THE AYEYAWADY DELTA  
IN THE REPUBLIC OF THE UNION OF MYANMAR

(EXPLANATION OF DRAFT OUTLINE DESIGN REPORT)

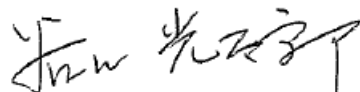
In response to a request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "GOM"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct the Second Preparatory Survey (hereinafter referred to as "the Second Survey") on the Mangrove Rehabilitation Plan for Enhancement of Disaster Prevention in the Ayeyawady Delta (hereinafter referred to as "the Project"), and entrusted the implementation of the Second Survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA dispatched the Second Survey Team to the Republic of the Union of Myanmar from January to July 2011, and through discussion, field survey and technical examination of the results in Japan, JICA prepared a draft outline design report of the Second Survey.

In order to explain and consult with the concerned officials of the GOM on the components of the report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Kotaro TANIGUCHI, Deputy Director of Forestry and Nature Conservation Division 1, Global Environment Department, JICA, from 23 to 28 October 2011.

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

Nay Pyi Taw, 27 October 2011



Mr. Kotaro TANIGUCHI  
Leader  
Draft Report Explanation Team  
Japan International Cooperation Agency



U Aye Myint Maung  
Director General  
Forest Department  
Ministry of Environmental Conservation  
and Forestry  
The Republic of the Union of Myanmar

## ATTACHMENT

### 1. Components of the Draft Report

The Myanmar side agreed and accepted in principle the components of the Draft Outline Design Report explained by the Team. The components of the Project are shown in Annex-1.

### 2. Japan's Grant Aid Scheme

The Myanmar side understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the GOM as explained by the Team and described in Annex-7 of the Minutes of Discussions signed by both sides on 20 January 2011 (hereinafter referred to as "the Previous M/D").

### 3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the GOM by the beginning of February 2012.

### 4. Tentative Schedule of the Project

The Myanmar side understood the tentative time schedule of implementation stage of the Project as shown in Annex-2. The Myanmar side also understood the time schedule is subject to change, depending on the date of Exchange of Notes (hereinafter referred to as "E/N") and Grant Agreement (hereinafter referred to as "G/A").

### 5. Confidentiality of the Project

#### (1) Detailed Specifications

Both sides confirmed all the information related to the Project including detailed specifications of plantation, construction, equipment and other technical information shall not be released to any other party/parties before the signing of all contract(s) for the Project.

#### (2) Current Project Cost Estimation

The Team explained to the Myanmar side the current estimated Project cost to be borne by the GOJ and by the GOM. The Myanmar side agreed to allocate necessary budget in order to bear requested undertakings as shown in Annex-3. The Team also explained that these costs estimations are subject to change since they are provisional and would be examined further by the GOJ for its final approval.

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Both sides also agreed that the Project cost estimation should never be duplicated in any form nor disclosed to any third party/parties before signing of contract(s) for the Project because this confidentiality of the Project cost estimation is essential to ensure fairness of the tender procedure.

#### 6. Other Relevant Issues

##### (1) Contribution to Climate Change

Both sides recognized the Project is expected to contribute to mitigation of and adaptation to climate change.

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Attached:

Annex-1: Components of the Project

Annex-2: Tentative Time Schedule

Annex-3: Current Project Cost Estimation

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Annex-1: Components of the Project

Component	Contents	Major Specifications and Quantity
1. Plantation	Kadonkani Reserve Forest	<ul style="list-style-type: none"> <li>● 1,154 ha (2,850 acre) in Compartments No. 38, 39, 43, and 44</li> <li>● Species: <i>Sonneratia caseolaris</i> (LAMU) and <i>Avicennia officinalis</i> (THAMAE GYT)</li> </ul>
2. Construction	A cyclone shelter with a forest watch tower	<ul style="list-style-type: none"> <li>● 1 Unit in Kadonkani Reserve Forest in Compartment No. 55</li> <li>● Capacity: 150 persons, total floor area 300m<sup>2</sup></li> </ul>
3. Equipment	Two Vehicles for management	<ul style="list-style-type: none"> <li>● 1 in Bogalay Township</li> <li>● 1 in Forest Department Headquarters in Yangon</li> </ul>
	A boat for management	<ul style="list-style-type: none"> <li>● 1 in Bogalay Township</li> </ul>
4. Detailed design and supervision		
5. Soft component	Participatory management plan of mangrove	
	Participatory evacuation plan from disaster	
	Establishment of fish inventory	

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Annex-2: Tentative Time Schedule

Year Japanese Fiscal Year	2011			2012			2013			2014			2015			2016														
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
I. Detail Design																														
Approval by the Japanese Cabinet																														
Exchange of News (E/N) between the GOJ and the GOM																														
Grant Agreement (G/A) between JICA and the GOM																														
Agreement for consultix services																														
Site survey and study in Myanmar																														
Design study in Japan																														
Preparation of tender documents																														
Approval of tender documents																														
Pre-Qualification notice																														
Tender announcement & preparation																														
Tenders																														
Tender evaluation																														
Contract signix																														
II. Implementation of the Project																														
A. Manureve Plantation																														
Preparatory work																														
Seed collection																														
Seed selection/Seed aniretment																														
Germination																														
Plants																														
Nursery																														
Transportation																														
Land preparation (Cultire, etc.)																														
Land preparation (Staking)																														
Planting																														
Nurture: Survival countix																														
Nurture: Patching																														
Nurture: Weedix for Term 2 ablation																														
Nurture: Weedix for Term 3 ablation																														
Inspection and handix over																														
B. Construction of the Cyclone Shelter																														
Preparatory work																														
Foundation work																														
Building work																														
Finishing work																														
Inspection and handix over																														
C. Procurement																														
Manufacture and procurement																														
Transportation																														

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## Annex-3: Current Project Cost Estimation

CONFIDENTIAL

Total Current Project Cost Estimation (including cost borne by the Japanese side and the Myanmar side)

Approx. 625,432,000 Japanese Yen

## (1) Obligation of the Japanese Side

Items		Project Cost (Japanese Yen)	
Plantation	Mangrove Plantation 1,154 ha in Kadonkani Reserve Forest	404,500,000	433,500,000
Construction	A cyclone shelter with forest watch tower in Kadonkani Reserve Forest	22,500,000	
Equipment	2 vehicles and 1 boat for management	6,500,000	
Detailed design and supervision			172,200,000
Soft component			15,000,000
Total			<b>620,700,000</b>

Note:

1. The cost estimates in the above table are provisional and will be further examined by the GOJ for its final approval.
2. The Project cost was calculated using the average exchange rate in six (6) months from 1 January to 30 June, 2011 as follows:

1 US \$=83.0 Japanese Yen

## (2) Obligation of the Myanmar Side

Items	Cost (Myanmar Kyat)
Staff salary related to mangrove operation and management during the Project	15,375,000
Commission for Banking Arrangement (B/A)	9,878,000
Tax for import vehicles	20,000,000
Total	<b>45,613,000</b>

Note:

The Project cost was calculated using the following exchange rate:

1 US \$=800 Myanmar Kyat

## 資料5 ソフトコンポーネント計画書

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## 資料5 ソフトコンポーネント計画書

### (1) ソフトコンポーネントを計画する背景

本プロジェクトは、サイクロンの襲来に対して防災機能が実証されたマングローブ林の早期復旧のため、約 1,000ha におよぶマングローブ植林を実施するものである。

対象地域一帯は、保全林区として 20 世紀初頭から管理されてきているが、域内には漁業、農業を営む村落が点在し、生活のために必要な薪炭材や木材、その他の林産物を保全林内から日常的に収集しており、それが森林破壊の大きな要因ともなっている。マングローブ林は、地域住民にとって生活のために必要な資源となる一方、その破壊は防災効果の低下を招き、住民の不利益に繋がることは地域住民に十分に理解されていない。

本プロジェクトで植林されるマングローブ林は原則的に森林局が管理することとなり、森林局が、自らが主体となるマングローブ林管理計画を策定する。計画策定に当たり、地域住民にもマングローブ林の植林の目的（防災のため）を理解してもらう必要があり、地域住民も参画してマングローブ林管理計画を策定する。なお、技プロ「エーヤーワディ・デルタ住民参加型マングローブ総合管理計画プロジェクト」と連携し、技プロにおいて開発してきた環境保全・環境保全・林業省職員向けの「植林標準手順書」を実用的に運用できるようにする。また、環境保全・環境保全・林業省の研修機関と連携して実施する同標準手順書に基づく研修にも森林局職員を参加させ、技プロと連携した森林局職員による住民参加型のマングローブ林の管理を行う。

また、同時に対象村落において、既存サイクロン避難施設等を活用した防災訓練を実施する。住民参画のマングローブ林管理計画策定や防災訓練を通して、周辺村落住民へのマングローブ林の防災機能の理解と防災意識の向上、マングローブ林保全への意識と関心を高めること、そして、策定されたマングローブ林管理計画に従うことにより、植林されたマングローブ林の持続的な保全を目指すこととなる。

### (2) ソフトコンポーネントの目標

「住民参加を通してマングローブ林管理計画が策定され、マングローブ林の持続的な保全に対する活動が開始されるとともに、住民のマングローブ林の機能について理解が深まる」

ソフトコンポーネントでは、森林局と地域住民と一緒に協議、検討し、マングローブ林管理計画を策定することを通して、周辺住民のマングローブ林保全への理解を深めるとともに、策定された管理計画を実行し、本プロジェクトで植林されたマングローブ林の持続的な保全を目指す。

**(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3点である。

**成果 1. 植林されたマングローブ林の管理計画が住民の参画を得て森林局を主体として策定される**

住民参加を通して、森林局職員主体による、本プロジェクトで植林されたマングローブ林に対する管理計画が策定される。

**成果 2. 住民の防災意識が向上する**

本プロジェクトサイト付近の村落住民を対象に既存サイクロン避難施設を活用した防災訓練を主に実施し、住民の防災意識の向上が図られる。

**成果 3. 住民のマングローブ林の機能に関する理解が深まる**

本プロジェクト付近の水生生物の調査を実施し、マングローブ植林による水生生物に対する影響（効果）を把握するとともに、薪炭材の利用状況等の把握を含め、こららの活動を通して、マングローブ林の機能に対する住民の理解が深められる。

**(4) 成果達成度の確認方法**

表 1 成果と達成度の確認方法

成果	達成度の確認項目	達成度の確認方法（案）
1.植林されたマングローブ林の管理計画が住民の参画を得て森林局を主体として策定される。	1.森林局職員によりマングローブ林の管理計画が策定されたか？ 2.住民が当該地域のマングローブ林管理計画について内容を理解しているか？	1.マングローブ林の管理計画 2.策定に参加した住民へのヒアリング
2.住民の防災意識が向上する。	1.サイクロン襲来時における避難方法を住民が理解しているか？ 2.当該地域の森林局職員がサイクロン避難施設の位置と現状を理解しているか？ 3.住民がマングローブ林が有する防災効果について理解しているか？	1-1.住民へのヒアリング 1-2.現存の防災マップの普及状況の把握 2.森林局職員へのヒアリング 3.住民へのヒアリング
3.住民のマングローブ林の機能に関する理解が深まる。	1.住民がマングローブ林の有する機能について理解しているか？ 2.住民のマングローブ林への生活に関する依存度	1.住民へのヒアリング 2.住民の薪炭材の利用状況の調査 3.水生生物インベントリー調査

## (5) 活動（投入計画）

実施年次	活動内容概略	対象者	活動場所	実施リソース
成果1: 植林されたマングローブ林の管理計画が住民の参画を得て森林局を主体として策定される に対する活動				
第1年次	1.1 既存のマングローブ林管理計画について確認する 1.2 本プロジェクトの植林地域におけるマングローブ林の管理計画の策定方針について検討する。 1.3 住民が参画する村落の選定方針を検討し選定する 1.4 今後の管理計画策定実施工程について検討、決定する	森林局職員 本プロジェクト植林サイト付近の村落住民	ボガレタウンシップ森林局事務所 カドンカニ森林区及び近辺地域の村落	森林局職員 邦人コンサルタント ローカルコンサルタント
第2年次	1.5 作成したマングローブ林管理計画策定方針に基づき、村落住民とのワークショップを実施し、マングローブ林管理計画案について説明、住民の意見を聞く 1.6 ワークショップでの意見等を踏まえたマングローブ林管理計画案を検討する			
第3年次	1.7 マングローブ林管理計画案をもとに、村落住民と協議するワークショップを開催する。 1.8 上記のワークショップの結果を踏まえ、マングローブ林管理計画案を見直す。			
第4年次	1.9 見直されたマングローブ林管理計画を住民に説明し、策定されたことと内容の周知を図る。			
成果2: 住民の防災意識が向上する に対する活動				
第1年次	2.1 当該地域の既存サイクロン避難施設の活用状況について確認する 2.2 上記1.3と合わせて、防災訓練を実施する本プロジェクト付近の村落について確認、選定する。 2.3 防災訓練の実施方針について検討、決定する 2.4 本プロジェクト地域の防災マップ等の既存資料を確認する 2.5 本プロジェクトで整備する避難施設の災害時の避難方法について検討する	森林局職員 本プロジェクト植林サイト付近の村落住民	ボガレタウンシップ森林局事務所 カドンカニ森林区及び近辺地域の村落	森林局職員 邦人コンサルタント ローカルコンサルタント
第2年次	2.6 防災訓練実施のための、対象村落住民とのワークショップを実施する 2.7 ワークショップの結果を踏まえ、既存避難施設を活用した防災訓練を実施する。			
第3年次	2.8 対象村落において防災訓練を実施する。 2.9 防災訓練結果を検討する			
第4年次	2.10 防災訓練実施における結果について、対象村落住民とワークショップを開き、防災に関する意識調査を行う			

実施年次	活動内容概略	対象者	活動場所	実施リソース
成果3:住民のマングローブ林の機能に関する理解が深まる に対する活動				
第1年次	3.1 住民参加型の水生生物インベントリー調査の実施案を検討、決定する 3.2 上記1.3及び2.2と合わせて、水生生物インベントリー調査を実施する場所及び村落を選定する。	森林局職員 本プロジェクト植林サイト付近の村落住民	ボガレタウン シップ森林局事務所 カドンカニ森林区及び近辺地域の村落	森林局職員 邦人コンサルタント ローカルコンサルタント
第2年次	3.3 住民参加型の水生生物インベントリー調査とマングローブが有する機能の説明のため、対象村落住民とのワークショップを開催する。 3.4 水生生物インベントリー調査を実施する 3.5 現在の薪炭材の利用状況を調査する			
第4年次	3.6水生生物インベントリー調査を実施する。 3.7水生生物インベントリー調査結果をまとめ、参加住民とともに確認する 3.8 薪炭材の調査結果をまとめ、参加住民とともに確認する 3.9 マングローブ林の機能について、過去の活動を振り返り、その機能について話合う。			

ソフトコンポーネント活動は、現地コンサルタントを活用し、邦人コンサルタントはコンサルタント側の全体の取りまとめ役、全体方針決定の総括者としてスポット派遣とする。本活動は、4タームに区分されて実施される植林工事に合わせて、各年度の乾季を中心に、各活動を実施する。本活動の実施時期は大きく4回に区分され、各回において邦人コンサルタントがスポットで4回（計4.5ヶ月）活動する。また、ローカルコンサルタントの活動期間は2人を配置し、それぞれ15ヶ月活動する。

表2 各年度の活動期間

	第1年度	第2年度	第3年度	第4年度	合計
邦人コンサルタント	1.5ヶ月	1.0ヶ月	1.0ヶ月	1.0ヶ月	4.5ヶ月
ローカル コンサルタント1	4.0ヶ月	4.0ヶ月	2.0ヶ月	4.0ヶ月	14.0ヶ月
ローカル コンサルタント2	4.0ヶ月	4.0ヶ月	2.0ヶ月	4.0ヶ月	14.0ヶ月



**(6) ソフトコンポーネントの実施リソースの調達方法**

ソフトコンポーネントでの投入計画は、本邦コンサルタント（スポット）が各タームにて活動の初期段階でローカルコンサルタントと共に活動を開始し、ローカルコンサルタントと活動の意図と方向性を確認しつつ実施する。

ローカルコンサルタントとしては、以下の組織を考慮している。

- ・Suntac Technologies Co., Ltd.
- ・Royal Tree Services Company Limited

**(7) 成果品**

ソフトコンポーネント活動における成果品（案）は各年度の活動毎に以下の通り設定する。

**表3 ソフトコンポーネント活動における成果品（案）**

	成果1を目的とする活動	成果2を目的とする活動	成果3を目的とする活動
第1年次	・マングローブ林管理計画策定方針案	・防災訓練実施方針案 ・本プロジェクト中のサイクロン襲来時における避難方針	・水生生物インベントリー調査実施案
第2年次	・ワークショップ結果とマングローブ林管理計画案（第2年次）	・ワークショップ結果 ・防災訓練実施結果（第2年次）	・ワークショップ結果 ・水生生物インベントリー調査実施結果（第2年次） ・薪炭材活用状況調査結果（第2年次）
第3年次	・ワークショップ結果とマングローブ林管理計画案（見直し案）	・ワークショップ結果 ・防災訓練実施結果（第3年次）	なし
第4年次	マングローブ林の管理計画（最終）	・ワークショップ結果と防災訓練のまとめ	・水生生物インベントリー調査及びまとめ ・薪炭材活用状況調査のまとめ

なお、上記の活動に対する結果を評価・検討し、ソフトコンポーネントを実施中と完了後には以下の報告書を提出するものとする。

1. ソフトコンポーネント実施状況報告書
2. ソフトコンポーネント完了報告書

**(8) 概算事業費**

概算事業費総額：14,996千円

**(9) 相手国政府の責務**

**1) ソフトコンポーネント実施中の責務**

- 本ソフトコンポーネント計画実施のカウンターパートであるボガレタウンシップ森林局事務所の本プロジェクトサイト対象地区担当フォーレスター、レンジャー等職員の積極的な参画と協力
- 本ソフトコンポーネント計画実施にあたる邦人コンサルタント及びローカルコンサルタントなどに対する「ミ」国内移動及び活動許可
- 活動に必要となるフィールドオフィスとなる事務所の提供
- 関連省庁への協力依頼及び活動許可

**2) ソフトコンポーネント終了後の責務**

- マングローブ林の管理計画の推進
- 本ソフトコンポーネント活動で得た経験、知識の普及、積極的活用

## 資料 6 参考資料

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## 資料6 参考資料

相手国政府の運営維持管理計画

The Republic of the Union of Myanmar

Ministry of Forestry

Forest Department

Operation and Maintenance Plan (Draft)

for

The Project for Mangrove Rehabilitation Plan for Enhancement of

Disaster Prevention in the Ayeyawady Area

in the Republic of the Union of Myanmar

(DRAFT)

July 2011

## Contents

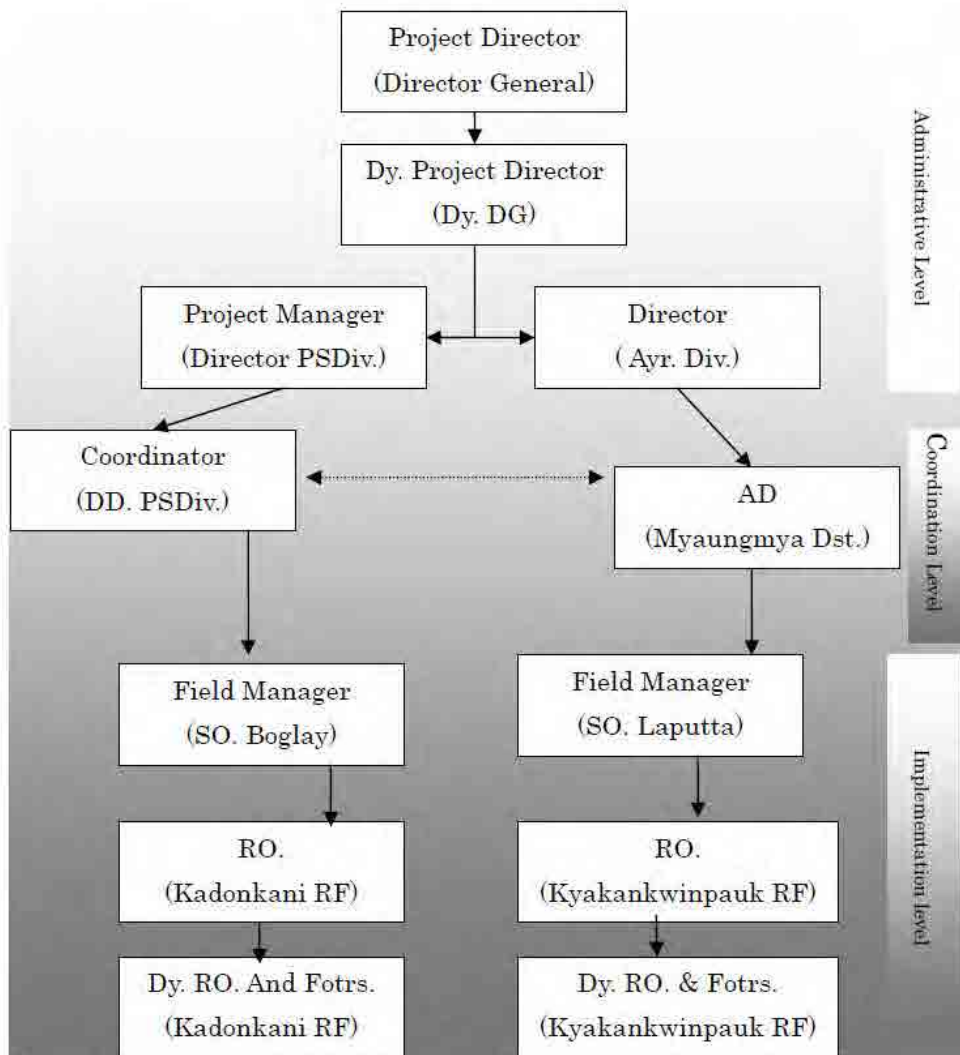
1. Purpose
2. Organization
3. Mangrove Plantation
4. Facilities
5. Equipment
6. Record and Report
7. Operation and Maintenance Cost

**1. Purpose**

The purpose of this plan is to keep good condition of Mangrove Plantation, Facilities and Equipment which will established by the Project for Mangrove Rehabilitation Plan for Enhancement of Disaster Prevention in the Ayeyawady Area in the Republic of the Union of Myanmar (the Project). Ministry of Forestry, Forest Department (FD) shall operate and maintain in accordance with this plan.

**2. Organization**

- a. FD shall establish the following operation and maintenance structure for the Project.



DD= Deputy Director, AD= Assistant Director, SO= Staff Officer

RO= Range Officer

Fotrs= Foresters

RF= Reserved Forest

## b. Staff Plan

FD shall assign the following staff for the Project

## 1. Planting, construction and procurement stage (including detail design stage)

Position for the Project	Number	Position
Administrative Level		
Project Director	1	Director General
Deputy Project Director	1	Deputy Director General
Project Manager	1	Director of Planning Division
Project Coordinator	1	Deputy Director of Planning Division
Implementation Level		
Field manager for Kyakankwinpauk RF	1	Staff Officer of Laputta township
Field manager for Kadonkani RF	1	Staff Officer of Bogalay township
Field staff for Kyakankwinpauk RF	2	Range Officer of Laputta township
Field staff for Kadonkani RF	2	Range Officer of Bogalay township

## c. Operation and Maintenance stage (after handing over the Project)

1. The staff for the central government level shall be same as a. planting, construction and procurement stage.

Position for the Project	Number	Position
Kyakankwinpauk RF		
Field manager	1	Staff Officer
Field staff	1	Range Officer
Field staff assistant	1	Dy. Range Officer
Forest guard	2	Forester
Driver	1	
Boat operator	1	
Kadonkani RF		
Field manager	1	Staff Officer
Field staff	1	Range Officer
Field staff assistant	2	Dy. Range Officer
Forest guard	3	Forester
Driver	1	
Boat operator	1	

## 3. Mangrove Plantation

a. Operation Plan (Planting, construction and procurement stage (including detail design stage))



### 1. Inspection work

Inspection work shall be executed with the Japanese Consultant (the Consultant) in accordance with the agreement between FD and the Consultant. The inspection shall be executed following schedule.

Inspection	Participant
Daily Inspection	Field Staff
Weekly Inspection	Field Manager
Monthly Inspection	Project Manager and/or Project Coordinator
Quarterly Inspection	Project Manager
Annual Inspection	Project Director

### b. Meeting with Report

Monthly meeting with report shall be held at FD headquarter, Nay Pyi Taw. The participants for the monthly meeting shall be as followed.

Roles	Participant
Chairman	Project Director
Vice Chairman	Deputy Project Manager
Project Report	Project Manager
Site Report	Field Manager
Progress Report	The Consultant

### c. Maintenance Plan

After handing over the Project FD shall execute following maintenance works for the Mangrove Plantation. The schedule of maintenance is shown in following figure.

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Fire protection		■	■	■	■							
Weeding						■	■	■	■	■		
Supplemental Plant						■	■	■				
Forest Guard	■	■	■	■	■	■	■	■	■	■	■	■

\*Supplemental Plant or patching: If it will be necessary.

#### 1. Fire protection work

Before the high dry season, from February to May, the grass on the fire protection line established by the Project shall be cut and cleaned by FD.

#### 2. Weeding work

During rainy season, from June to October, the grass which will grow around the planted tree shall be cut by FD. The method for the weeding shall be the standard method of FD.

#### 3. Patching

If there are large damage in the plantation area. FD shall consider the replanting or patching.

4.Forest Guard

FD shall appoint the forest guards for the preservation of the plantation area. The forest guard shall patrol to protect the forest fire and illegal logging every day.

5.Survival Counting

FD shall execute the survival counting once a year. The method of survival counting shall be the standard method of FD.

**4. Facilities**

**a. Cyclone Shelter with Forest Watch Tower)**

1.location of the facilities

Facility No.	Location
No.1	Compartment No.27 of Kyakankwinpauk RF, Laputta Township
No.2	Center of Kadonkani RF, Bogalay Township

2.Operation Plan

Forest Watch Tower shall be used for the fire outbreak observation by the Forest Guard. An Operation Plan for Cyclone Shelter, the fleeing plan, shall be established by the soft-component activity which will be executed by the Project.

3.Maintenance Plan

Daily cleaning shall be done by the Forest Guard and Dy. Range Officer. Basically the facility is very simple design but the roof shall be coated by waterproof paint every ten years. Some renovation work shall be done whenever necessary.

**5. Equipment**

**a. Vehicles (4WD Pickup, double cabin)**

1.Locations of the Equipment

Stations where the vehicles will be allocated are as follows.

Vehicle No.	Place
No.1	Bogalay Township
No.2	Laputta Township
No.3	FD Headquarter

2.Operation Plan of the vehicles for the Project

Vehicle No.	Operation Plan	Operation days/year
No. 1	1.During the project term	
	1) Inspection work by the field staff: The bridge of Bogalay River and the	150 days

	bridge of Kyainchaung Gyi village will be constructed by the end of 2012. In consideration for the safety and saving the fuel consumption and time the field staff shall move to Kyainchaungyi village which is the entrance of the Project site after the construction of these bridges. The field staff shall be sent to the site on Monday and return to Bogalay on Friday.	
	2) Inspection work by the Field manager: The Field manager shall inspect the Project site once a week.	100 days
	3) Meeting: Field Manager shall attend the monthly meeting held in FD headquarter in Nay Pyi Taw.	48 days
	Total	298 days
	2. Maintenance work for the Project	
	1) Fire Protection Work: During this operation the Field staff shall go to the site on Monday and return to Bogalay on Friday. The additional tools and/or shall carry to the site once a week.	66 days
	2) Weeding Work: During this operation the Field staff shall go to the site on Monday and return to Bogalay on Friday. The additional tools and/or shall carry to the site once a week.	66 days
	3) Supplemental Plant: Included in above	Included in above
	4) Forest Guard: The Forest Guard shall return to Bogalay every 2 weeks.	24 days
	5) Report: Field Manager shall report the condition of the project site once a month. And food and consumable goods shall bring to the site once a week.	96 days
	Total	252 days

Vehicle No.	Operation Plan	Operation days/year
No. 2	1. During the project term	
	1) Meeting: Field Manager shall attend the monthly meeting held in FD headquarter in Nay Pyi Taw.	48 days
	Total	48 days
	2. Maintenance work for the Project	
	1) Report: Field Manager shall report the condition of the project site once a month.	48 days
	Total	48 days



Vehicle No.	Operation Plan	Operation days/year
No. 1	1. During the project term	
	1) Inspection work by Project Manager: Project Manager shall inspect the Project site once a month.	60 days
	2) Inspection work by Project Director: Project Director shall inspect the Project site once in three months.	20 days
	Total	80 days
	2. Maintenance work for the Project	
	1) Inspection work by Project Manager: Project Manager shall inspect the Project site once a month.	60 days
	2) Inspection work by Project Director: Project Director shall inspect the Project site once a three months.	20 days
	Total	80 days

b. Boats (10 passengers)

1. Stations where the Boats will be allocated are as follows.

Boat No.	Place
No.1	Bogalay Township
No.2	Laputta Township

Both boats shall use for the daily inspection and supply equipment and consumable goods every day during the project term. And also both boat shall use for the daily patrol and supply equipment and consumable goods every day.

c. Maintenance Plan for vehicles

1. Vehicles (4WD Pickup, double cabin)
2. Daily Maintenance: The driver shall check the vehicles every day.
3. Periodic maintenance: The vehicles shall be inspected and maintained at the official workshop once a half year.

Item	Time
Engine oil	Every 5,000km and/or every 6 month
Engine oil filter	Every 2 time of engine oil changing
Air filter or fuel filter	The cleaning shall be every month. The replacement shall be every year.
Engine Plug	Every 50,000 km
Others	Following the maintenance manual

d. Maintenance Plan for Boats (10 passengers)

1. Daily Maintenance: The operator shall check the boats every day.

2. Periodic maintenance: The boats shall be maintained by the qualified engineer once a half year.

3. Replacement of consumable parts and oil

Item	Time
Engine oil	Every 3 month
Engine oil filter	Every 2 time of engine oil changing
Air filter or fuel filter	The cleaning shall be every month. The replacement shall be every year.
Engine Plug	Every year
Others	Following the maintenance manual

## 6. Record and Reports

### a. Mangrove Plantation (Planting stage)

1. Operation records

2. Inspection records: Inspection are prepared by the Consultant and confirmed by FD.

### b. Meeting :

1. Meeting record shall be prepared by the Consultant and confirmed by FD.

2. Progress report and final report: Progress and final report shall be prepared by the Consultant and approved by FD.

3. Maintenance record: FD shall keep the maintenance records.

### c. Facilities (Cyclone Shelter with Forest Watch Tower)

1. Operation record: FD shall keep the operation records.

2. Maintenance record: FD shall keep the Maintenance record.

### d. Equipment

1. Vehicles (4WD pickup, double cabin)

1. Operation record: FD shall keep the daily operation records.

2. Maintenance record: FD shall keep the maintenance records.

2. Boats (10 passengers)

1. Operation record: FD shall keep the daily operation records.

2. Maintenance record: FD shall keep the maintenance records.

### e. Summary Report

1. The summary report of the operation and maintenance for the Project shall be prepared by Project Manager FD every year and submitted to FD Head Office and JICA Myanmar office.

## 7. Operation and Maintenance Cost

The Operation and Maintenance costs shall be allocated from FD headquarter directly. And salary for the staff shall be allocated from ordinary budget. The estimated Operation and Maintenance Cost are

attached.

**JICA Grant Aid Project**  
**The Project for Mangrove Rehabilitation Plan for Enhancement of Disaster**  
**Prevention in the Ayeyawady Delta**

Maintenance Costs for Mangrove Plantations and Operation and Maintenance Costs for Vehicles, Boats and Cyclone Shelter

■ Initial Costs for the project

1 US \$ = 750 MM Kyats

1 US \$ = 81 Japanese Yen

Item	No.	Unit	Unit cost in MM Kyat	Amount in MM Kyat	Amount in US\$	Amount in Japan Yen
<b>1. Tax</b>						
Vehicle	3		10,000,000	30,000,000	40,000	3,240,000
<b>2. Banking Arrangement</b>						
AP charge	1	set	9,259,259	9,259,259	12,346	1,000,000
Documentation	6	set	55,556	333,333	444	36,000
<b>Total</b>				<b>39,592,592</b>	<b>52,790</b>	<b>4,276,000</b>

■ Maintenance Costs for Plantation in Kadonkani RF

Item	No.	Unit	Unit cost in ( MM Kyat)	Amount in ( MM Kyat)	Amount in (US\$)	Amount in (Japan Yen)
Fire Protection	2,136	ha	2,965	25332960	33777.28	2735959.68
Weeding	2,136	ha	19,768	168897792	225197	18240957
Supplemental Planting	2,136	ha	2,965	25332960	33777.28	2735959.68
Forest Guard (3persons)	48	Month	41,000	1968000	2624	212544
Survival Counting	2,136	ha	2,224	19001856	2535.8	2052200.45
<b>Four Years Total</b>				<b>240533568</b>	<b>297911.4</b>	<b>25977621</b>

■ Maintenance Costs for Plantation in Kyakankwinpauk RF

Item	No.	Unit	Unit cost in (MM Kyat)	Amount in (MM Kyat)	Amount in (US\$)	Amount in (Japan Yen)
Fire Protection	1,236	ha	2,965	14658960	19545.3	1583167.68
Weeding	1,236	ha	19,768	37732992	130310.66	10555163.14
Supplimental Plant	1,236	ha	2,965	14658960	19545.28	1583167.68
Forest Guard (3persons)	48	Month	41,000	7872000	10496	850176
Sarvival Counting	1,236	ha	2,224	10995456	14660.6	1187509.25
<b>Four Years Total</b>				<b>85918368</b>	<b>194557.8</b>	<b>15759184</b>

Remark: Fire Protection will be conducted until the plantation is at 5 year age.

■ Operation and Maintenance Costs for Vehicle, Boats and Cyclone Shelter for Kadonkani  
RF

1 US \$ = 750 MM Kyats

1 US \$ = 81 Japanese Yen

Item	No.	Unit	Unit cost in (MM Kyat)	Amount in (MM Kyat)	Amount in (US\$)	Amount in (Japan Yen)
<b>(1) Salary</b>						
Driver	48	Month	41,000	1968000	2624	212544
Boat Operator	48	Month	41,000	1968000	2624	212544
<b>(2) Fuel</b>						
Vehicle	2400	gal.	3,500	8,400,000	11200	907200
Boat	3000	gal.	3,500	10,500,000	14000	1134000
<b>(3)Facilities</b>	4	time	100,000	400,000	533.3	43199.9
<b>(4)Vehicle</b>						
Engine Oil	8	time	50,000	400,000	533.3	43199.9
Oil Filter	4	time	30,000	120,000	168	13608
Air Filter	4	time	20,000	80,000	106.6	8634.6
Engine Plug	4	time	100,000	400,000	533.3	43199.9
Others	4	set	100,000	400,000	533.3	43199.9
<b>(5) Boat</b>						
Engine Oil	4	time	50,000	200,000	267	21,600
Oil Filter	8	time	30,000	240,000	80	6,480
Air Filter	4	time	20,000	80,000	27	2,160
Engine Plug	4	time	100,000	400,000	533.3	43199.9
Others	4	set	100,000	400,000	533.3	43199.9
<b>6) Others</b>						
Miscellaneous	48	Month	100,000	400,000	533.3	43199.9
<b>4 Years Total</b>				<b>26,356,000</b>	<b>24,289.7</b>	<b>2,821,170</b>



■ Operation and Management Costs for Vehicle, Boats and Cyclone Shelter for  
Kyakankwinpauk RF

1 US \$ = 750 MM Kyats

1 US \$ = 81 Japanese Yen

Item	No.	Unit	Unit cost in (MM Kyat)	Amount in (MM Kyat)	Amount in (US\$)	Amount in (Japan Yen)
<b>(1) Salary</b>						
Driver	48	Month	41,000	1968000	2624	212544
Boat Operator	48	Month	41,000	1968000	2624	212544
<b>(2) Fuel</b>						
Vehicle	2400	gal.	3,500	8,400,000	11200	907200
Boat	3000	gal.	3,500	10,500,000	14000	1134000
<b>(3) Facilities</b>	4	time	100,000	400,000	533.3	43199.9
<b>(4) Vehicle</b>						
Engine Oil	8	time	50,000	400,000	533.3	43199.9
Oil Filter	4	time	30,000	120,000	168	13608
Air Filter	4	time	20,000	80,000	106.6	8634.6
Engine Plug	4	time	100,000	400,000	533.3	43199.9
Others	4	set	100,000	400,000	533.3	43199.9
<b>(5) Boat</b>						
Engine Oil	4	time	50,000	200,000	267	21,600
Oil Filter	8	time	30,000	240,000	80	6,480
Air Filter	4	time	20,000	80,000	27	2,160
Engine Plug	4	time	100,000	400,000	533.3	43199.9
Others	4	set	100,000	400,000	533.3	43199.9
<b>6) Others</b>						
Miscellaneous	48	Month	100,000	400,000	533.3	43199.9
<b>4 Years Total</b>				<b>26,356,000</b>	<b>24,289.7</b>	<b>2,821,170</b>



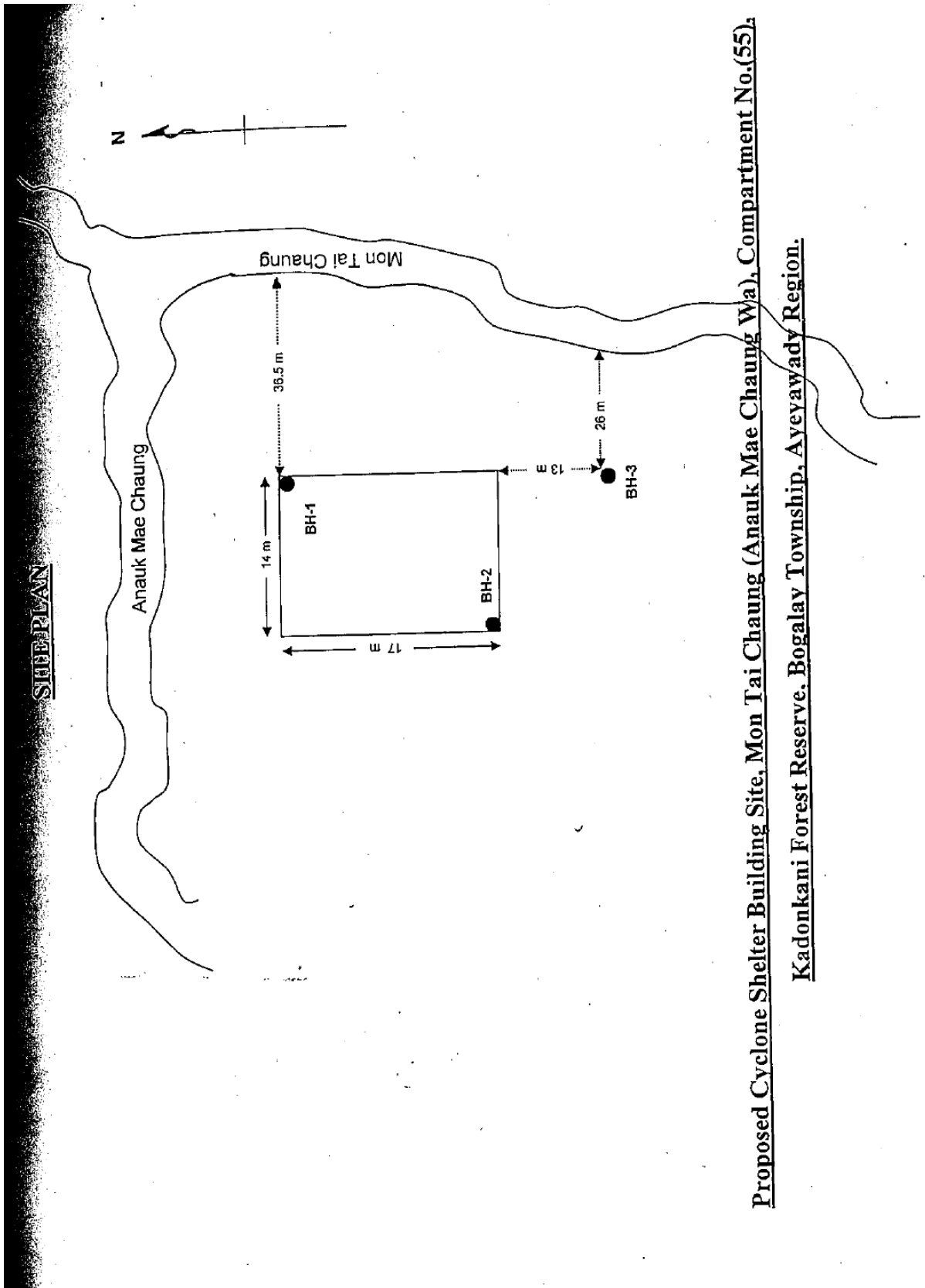
## 資料 7 その他の資料・情報

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# 資料7 その他の資料・情報

サイクロン避難施設建設予定地地質調査結果



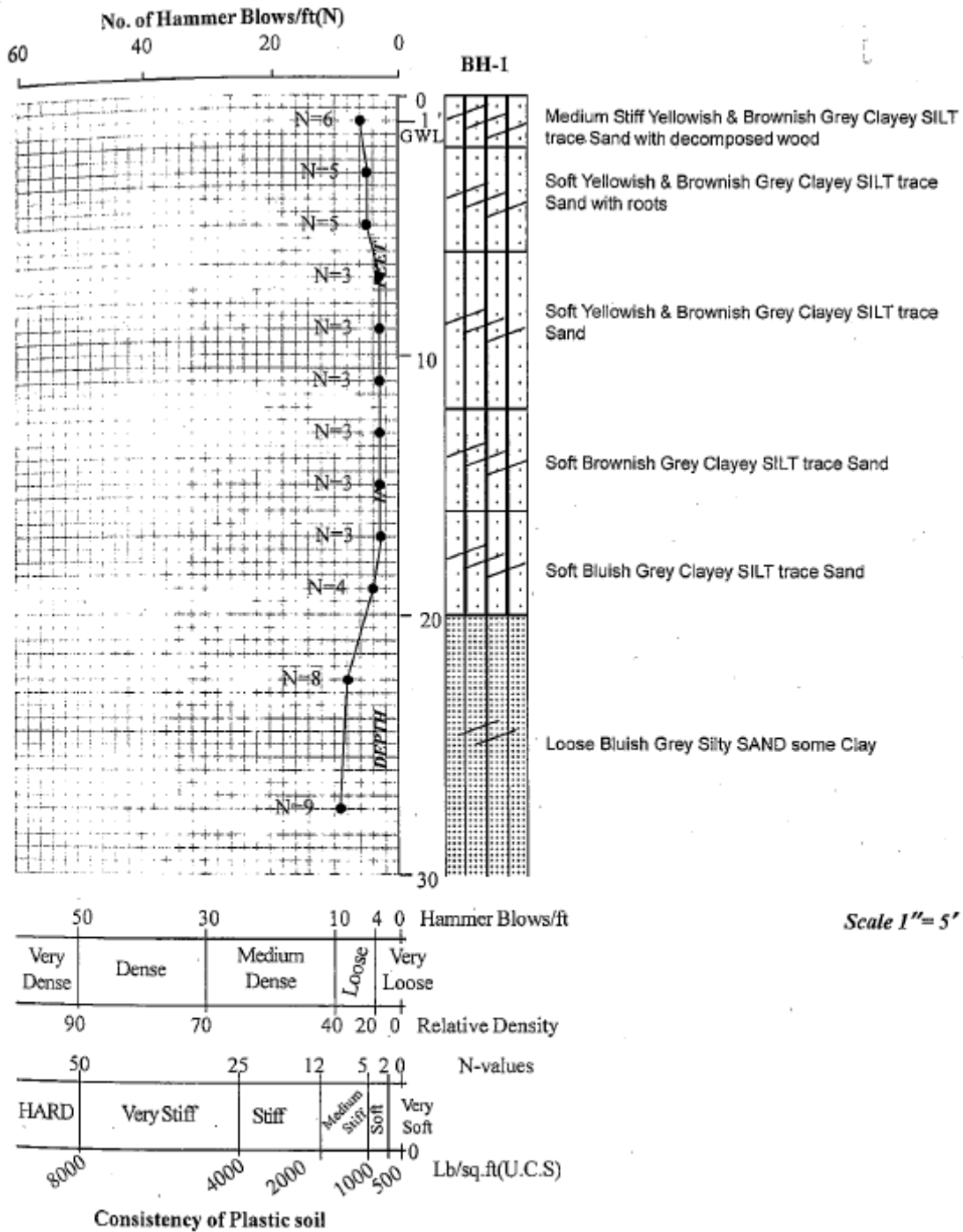
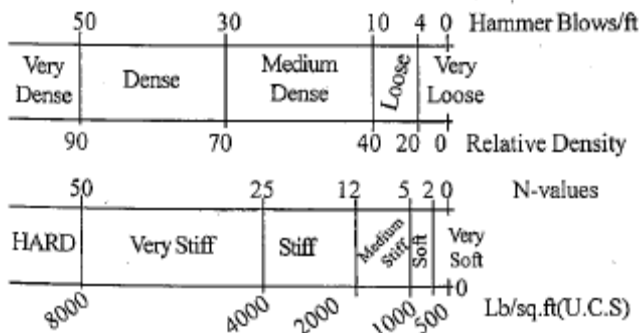
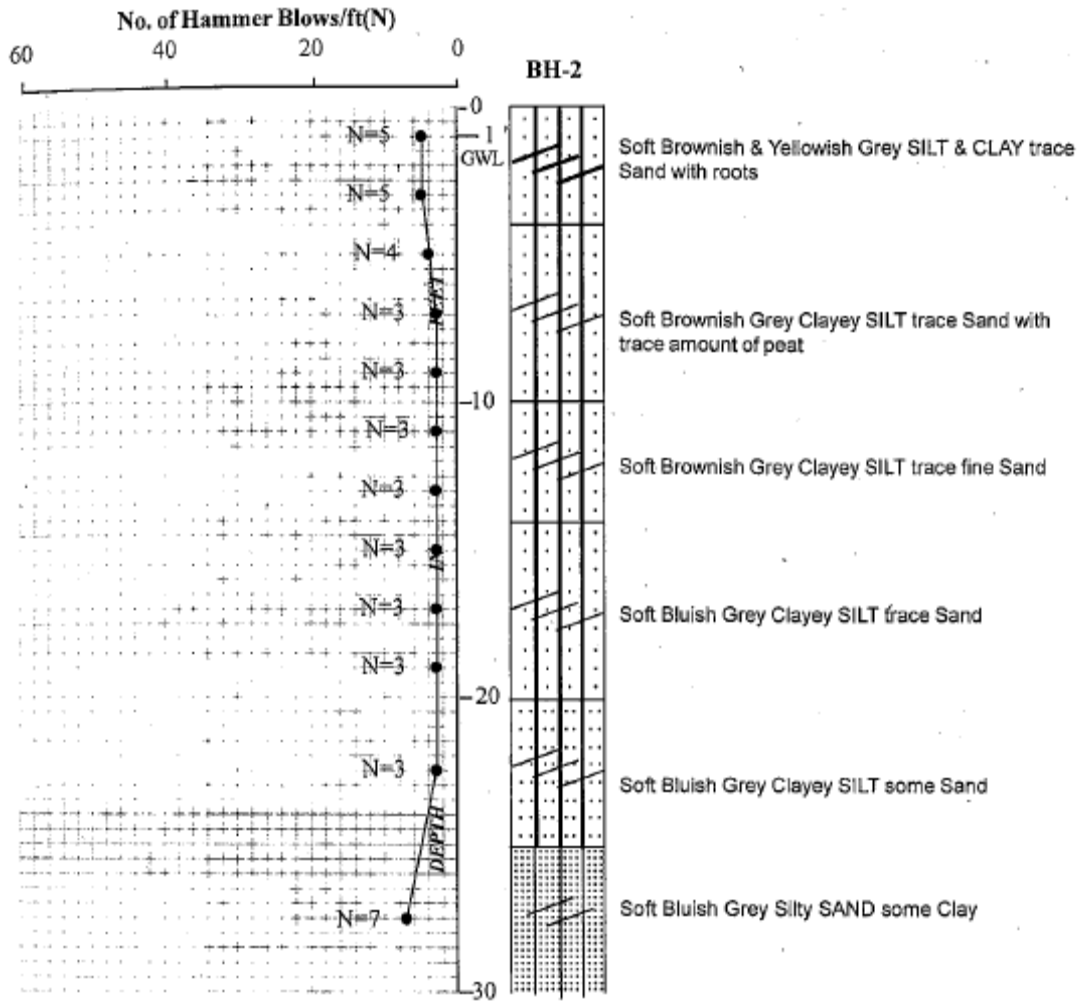
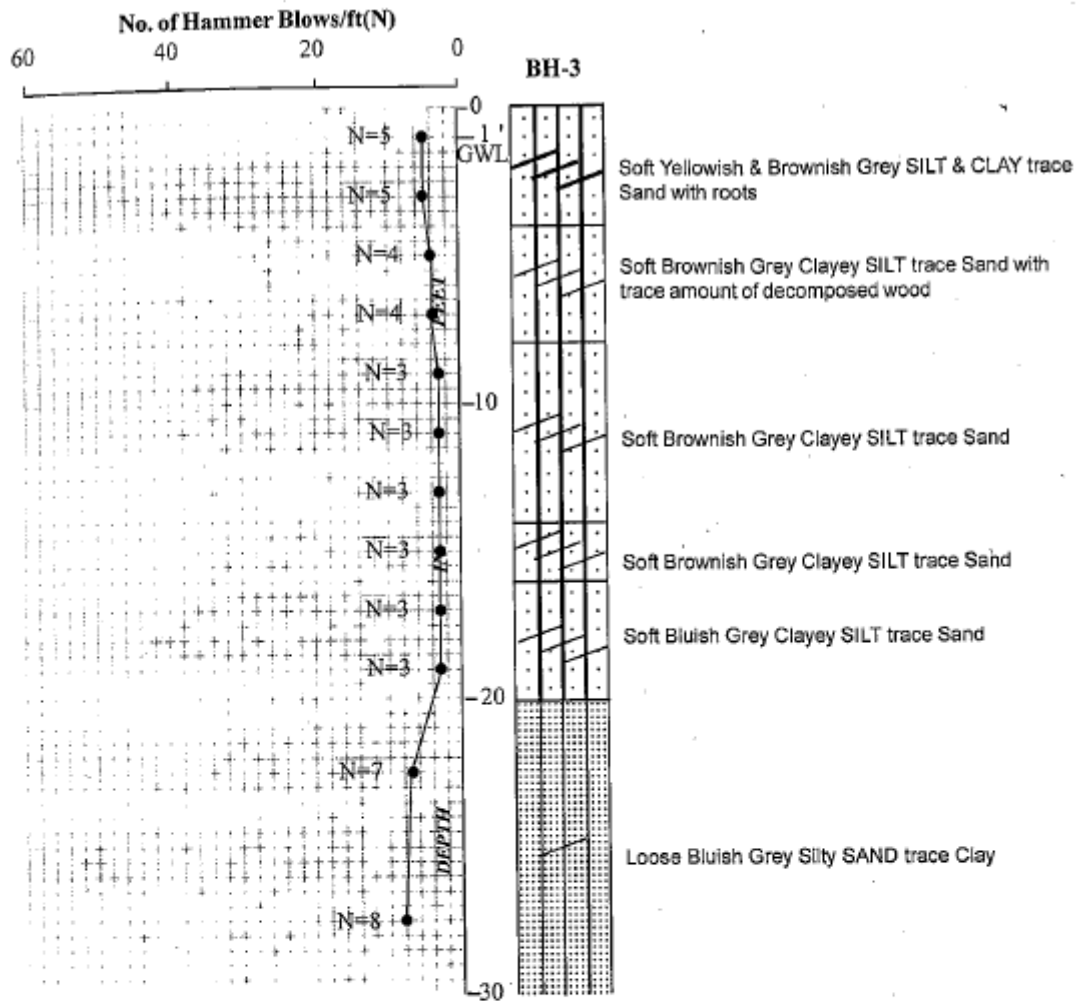


Figure 2.1 **SOIL PROFILE OF BORE HOLE NO.(1)**  
**PROPOSED CYCLONE SHELTER BUILDING SITE, MON TAI CHAUNG (ANAU MAE CHAUNG WA), COMPARTMENT 55, KADONKANI FOREST RESERVE, BOGALAY TOWNSHIP, AYEYARWADDY REGION.**



Scale 1" = 5'

Figure 2.2 **SOIL PROFILE OF BORE HOLE NO.(2)**  
**PROPOSED CYCLONE SHELTER BUILDING SITE, MONTAI CHAUNG (ANAU MAE CHAUNG WA), COMPARTMENT 55, KADONKANI FOREST RESERVE, BOGALAY TOWNSHIP, AYEYARWADDY REGION.**



50	30	10	4	0	Hammer Blows/ft
Very Dense	Dense	Medium Dense	Loose	Very Loose	
90	70	40	20	0	Relative Density
50	25	12	5	2	N-values
HARD	Very Stiff	Stiff	Medium Stiff	Soft	Very Soft
8000	4000	2000	1000	500	Lb/sq.ft(U.C.S)

Scale 1"= 5'

Consistency of Plastic soil

Figure 2.3 **SOIL PROFILE OF BORE HOLE NO.(3)**  
**PROPOSED CYCLONE SHELTER BUILDING SITE, MON TAI CHAUNG (ANAU MAE CHAUNG WA), COMPARTMENT 55, KADONKANI FOREST RESERVE, BOGALAY TOWNSHIP, AYEYARWADDY REGION.**