MINISTRY OF AGRICULTURE AND FORESTRY
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

JANUARY 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

INTEM CONSULTING, INC.

AZUSA SEKKEI CO., LTD.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the Project for Strengthening Research and Development on Fisheries and Aquaculture in the Lao People's Democratic Republic and entrust the survey to the consortium of INTEM Consulting, Inc. and Azusa Sekkei Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Laos and conducted field investigations from March to October 2014. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the implementation of the Project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Laos for their close cooperation extended to the survey team.

January 2015

Mr. Makoto KITANAKA
Director General
Rural Development Department
Japan International Cooperation Agency

Summary

Lao People's Democratic Republic: An Overview

The Lao Peoples' Democratic Republic (hereinafter referred to as "Laos") is situated in the center of the Indochina Peninsula, sharing borders with Thailand, Cambodia, Vietnam, China and Myanmar. It is approx. 1,000km long from north to south, covering an area of 236,800km^2. The Mekong River runs for an approximate distance of 1,800km along the border with Thailand. Most of the national land is mountainous areas of the Annamite Chain as well as Bolaven Plateau and the Plain of Jars, covering 87.7% of the national land with arable land accounting for 4% of it.

Laos is hot and humid and has a savanna climate under Koppen climate classification with wet and dry seasons. The nation is very hot with an annual average temperature exceeding 20 degrees centigrade. The annual rainfalls exceed 2,000mm and concentrate in the wet season from May to October.

The people of Laos are mild-mannered in general with the majority of low-land Laos that accounts for approx. 60 percent of the population being Buddhists. The country is divided into some regions due to underdeveloped infrastructure. Ethnic minorities in mountainous areas maintain their own culture, language and customs, forming an extremely diverse society.

As for the national economy, GDP is 9.1 billion USD and per capita GDP is 1,349 USD, with the GDP growth rate at 8.2 percent (according to the basic data by country released by the Ministry of Foreign Affairs).

Although Laos is an inland nation surrounded by five countries, fisheries, mainly freshwater fishing, has been a main sector as it has the Mekong River and many lakes. Approx. 70% of the working population is farmers and they have been engaged in fishing for self-consumption in the Mekong River and its tributaries, natural lakes, dams, manmade lakes for irrigation and rice paddies. However, since the 1990s, industry and service sectors have grown significantly (export increase by the private sector, in particular) and the ratio of electricity and minerals are forecast to increase rapidly.

Background of the Project

Freshwater fish has long been the most important animal protein source in Laos and fisheries is one of the key sectors for the nation. However, traditional fishing is quantitatively limited because of resource and expectations for aquaculture have grown recently and it has developed significantly. However, aquaculture in the country faces such serious challenges as insufficient technical capacity and seed shortage. Against the backdrop, the Government of Laos established Namxouang Aquaculture Development Center (NADC) and Living Aquatic

Resources Research Center (LARReC) and other implementing agencies in the field for research and development of aquaculture techniques, spread of developed techniques, and fish seed production by public entities and distribution to aquaculture farmers. The two organizations also have received technical assistance from Japan and other donors to solve the problems. As a result of their efforts, the aquaculture production volume accounts for 74% of total fish production including fishing.

However, because there are very few fish seed producers in Laos, fish farmers have no other choice but to procure seeds from Thailand and other neighboring countries and the seed production system is expected to be strengthened. Laos has a problem of absence of producers of all-male tilapia seeds that have had much demand as aquaculture fish culture in recent years. Against the background, there is an urgent need for the establishment of techniques to produce such all-male tilapia seeds in the country.

NADC which is a target organization of the Project is an important entity responsible for policy formulation and execution to solve the problems. However, due to ageing of the facility and equipment, they are not necessarily active enough. It is also found out that the facility of LARReC that is supposed to support NADC activities in the field of basic research for the technical development is also ageing and research equipment is insufficient. Although the facility was rebuilt funded by the national government, they were unable to improve the equipment and thus it cannot conduct research activities sufficiently due to the shortage of research equipment.

Against the backdrop, the Government of Laos requested for assistance to improve the functionality of NADC and LARReC.

Survey Results and Project Contents

In response to the request described above, Japan International Cooperation Agency (JICA) dispatched a contact survey team from March 30 to April 9 and the secondary survey team from April 20 to May 16, 2014, to Laos to consult with officials of NADC, LARReC and the Ministry of Agriculture and Forestry and other relevant organizations and the survey team conducted site survey based on the requested contents.

After the survey, the survey team conducted analysis in Japan based on the field survey results and, as a preparatory survey report (draft), compiled an outline design of facility construction and equipment improvement, which were determined to be prioritized among the requested contents and necessary for the organizations to conduct their activities and visited Laos from October 19 to 25, 2014, to give briefing to relevant members of Laos before compiling the preparatory survey report.

An outline of the Project produced based on discussions with the recipient country is given below.

(1) Scope of Cooperation, Components and Scale of Cooperation

NADC is not capable of supplying the amount of seed production requested by the Government of Laos. It is mainly because the water leakage of existing broodstock and nursery ponds made it impossible to conduct activities sufficiently. In spite of the increased needs for quality and safety inspections of fisheries products to be distributed before the ASEAN Free Trade Agreement comes into effect in 2015, no inspection system is established. The Government of Laos intends to improve the functions of NADC for solving such problems.

However, the ageing of existing facilities and equipment are apparent and there is an urgent need to improve them for establishing the system and the Government of Laos requested Japan for a grant aid project.

However, it is difficult for Japan to undertake all of the projects Laos is planning and thus it decided to formulate a project plan of minimum necessary requirements for self-sustaining development of the country in the future. Based on the position, it was decided that Japan would improve the broodstock and nursery ponds, rebuild the office building, training facility and dormitory and improve equipment of NADC and Laos would be responsible for renovation of laboratories room and other existing facilities.

The target scale of the Project is 10 million seeds although Laos plans 20 million seeds as the production amount. Sales of seeds of increased production as a result of the Project implementation will enable Laos to improve the facilities and equipment independently to produce 20 million individuals as the final target. The scale of the facilities was also decided based on the current number of staff and past training sessions.

As for LARReC, it has built a new office building on its own effort and thus it was decided that the Project is to procure necessary equipment limiting to basic minimum necessary equipment for basic research works.

(2) Facility Plan (NADC only)

The survey team decided the basic policy of the facility plan as described below based on the above basic policy.

① Construction of 12 concrete broodstock and nursery tanks rather than renovation of existing ponds

② The new office/ training building is planned to secure the capacity of 28 staff which is the maximum approved number by the Ministry of Agriculture and Forestry. The main

training room is planned to secure the capacity of 40 people along with the exhibition room for the spread activity, and the library serving also as the study room for trainees for the purpose of strengthening the function of training section.

③ The existing dormitories of NADC are far from comfortable living conditions. Therefore, not renovation of the existing dormitories but construction of a new dormitory is planned at NADC which has the capacity of 40 trainees at most and 16 students in addition to the room for 3 staffs in night duty including the NADC director and deputy directors.

The facility plan is summarized in the table below.

Facility name	Functions	Rooms
New Office/ Training Building	Office	Reception, Office Rooms, Conference Room (S)(L), Director's Office, Deputy Director's Offices and etc.
	Training	Exhibition, Library, Training Room and etc.
	Common Area	Entrance Hall, Pantry, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
New Dormitory Building	Trainee's Dorm	Trainee's Room (20 x 2-bed room to hold 40 people), Dayroom, Kitchen and etc.
	Student's Dorm	Student's Room (8 x 2-bed room to hold 16 people), Dayroom, Kitchen and etc.
	Officer's Dorm	Staff's Room (3 x 1-bed room to hold 3 people), Dayroom, Kitchen and etc.
	Common Area	Entrance Hall, Lounge, Laundry, Shower Room, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
Elevated Water Tank		Elevated Water Tank for Office/Training Building and Dormitory Building, Pump room and etc.
New Hatchery	Hatchery	Spawning Room, Multiple Incubation Room, Tilapia Incubation Room and etc.
Moina Culture Tank	Moina Culture	Moina Culture Tank (w/ roof and blackout curtain), water supply system, aeration system
Tilapia Larval Rearing Tank	Larval Rearing	Tilapia Larval Rearing Tank (w/ blackout curtain), water supply system, aeration system
Brood Stock/ Nursery Pond	Brood Stock/ Nursery	Brood Stock/ Nursery Pond (water supply system)
Sedimentation Pond	Sedimentation Pond	Sedimentation Pond for Brood Stock/ Nursery Pond
Sedimentation Pond for Hatchery	Sedimentation Pond	Sedimentation Pond for Moina Culture Tank, Tilapia Larval Rearing Tank, Hatchery and existing tanks

(3) Equipment Plan (NADC and LARReC)

The survey team evaluated the requested equipment based on the following criteria to formulate a plan:

① Consistency with activities of the target facilities
② Consistency with personnel makeup of the target facilities
③ Consistency with operational budget of the target facilities
④ Redundancy with other equipment
⑤ Consistency with maintenance and management systems of the target facilities
⑥ Possibility of use for other purposes
⑦ Consistency with the location and storage place of the target facilities

Main equipment is listed in the table below.

No.	Equipment	Quantity
18	Mixer	1 set
19	Pellet machine	1 set
22	Recirculating Aquaculture System for tilapia egg incubation	1 set
23	Egg incubation system for tilapia egg	1 set
24	Egg incubation system for buoyant egg	1 set
25	Spawning unit	1 set
26	Water Supply System	3 sets
38	Tag reader	1 set
40	Tractor	1 set
41	Truck	1 set
45	Mini bus	1 set
61	Crude Lipid analysis system	2 sets
63	Crude Protein Tester	2 sets
84	Fiber Analyzing Equipment Set	1 set
105	Water pump	3 sets

Project Schedule and Project Cost Estimation

The Project implementation is estimated to require a total of 19 months when the construction scale and climate as well as local construction conditions are taken into consideration—4 months for detailed design, 3 months for tender, and 12 months for facility construction and equipment procurement. The Project is estimated to require 23 months to be

completed because the soft component is implemented after the delivery of facility and equipment.

The initial cost to be borne by the Government of Laos is estimated as 9.5 million Japanese Yen.

Project Evaluation

(1) Relevance

The Project is relevant as a Japan's Grant Aid project for the reasons listed below.

1) Project beneficiaries

The target organizations of the Project are NADC and LARReC and 68 staffs in total of both organizations will be the direct beneficiaries. Because the seeds produced by NADC are distributed to fish farmers across the nation, farmers in the country are also direct beneficiaries. The marine products produced by the fish farmers also benefit all the people of Laos. Thus, the Project is highly relevant.

2) Perspective of human security

Human security is a concept of promoting sustainable independence of individuals and community development through protection and capacity building, looking at each and every person, protecting them from broad and serious threats against survival, livelihood and dignity in order to realize their full potential.

From the perspective that the Project will help stable supply of fresh and safe fish, it is consistent with the perspective of human security and thus is relevant.

3) Contribution to achievement of mid- to long-term development goals of the target country

The 7th National Development Plan includes food security and production increase and value addition of commercial crops as focal goals in agriculture and forestry. The plan also promotes expansion of public seed production facilities and increased production of seeds to be distributed to growers against the backdrop of importance of aquaculture. The Project includes elements to realize the goal. From the perspective, the Project is consistent with the relevant mid- to long-term development goals of Laos and thus is relevant.

4) Consistency with Japan's Grant Aid policy

In the country assistance policy (April 2012) for Laos of the Ministry of Foreign Affairs of Japan, agricultural development and forest conservation are main pillars (mid-level goal) and it says that Japan intends to provide assistance for the improvement of farmers' income

and productivity and promotion of commercial crop cultivation. Aquaculture development and higher productivity as a result of the improvement of related techniques when the Project is implemented is expected to increase farmers' (fishermen's) income. Thus, the Project is also highly relevant.

(2) Effectiveness

The Project is estimated to have the following numerical effects:

1) Quantitative effects

Indicator	Baseline (actual figures in 2013)	Target (2019) (3 years after project completion)
Number of fish species whose juveniles are produced by NADC	5	8
Juvenile production by NADC (1 million inds.)	3.8	10
Trainees' dormitory occupation rate (%)	18.1	27.4
Number of research projects of LARReC	10	12

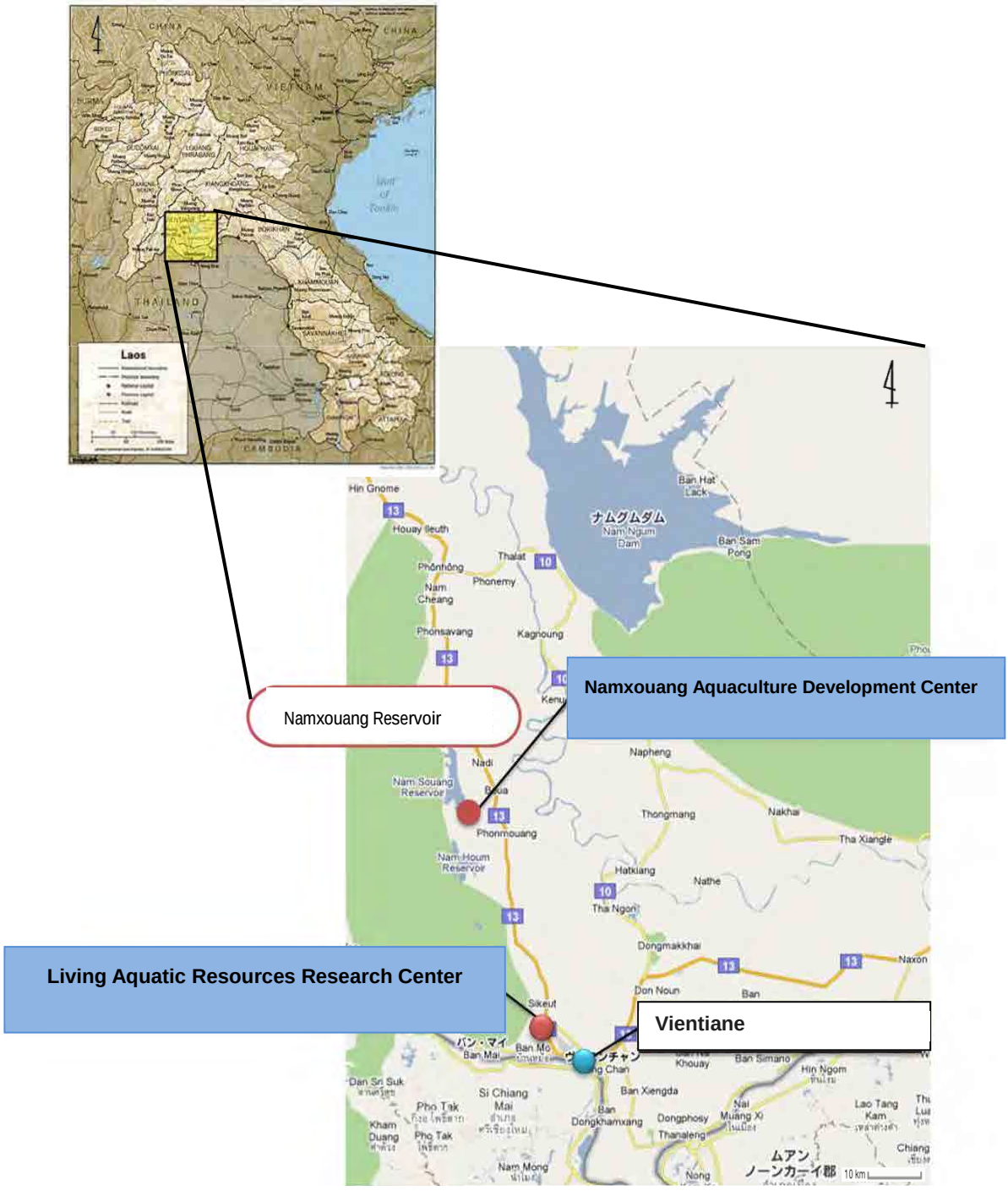
2) Qualitative effects

The Project will help enhance the aquaculture technique promotion structure for farmers and aquaculture operators.

Thus, the Project as a Japan's Grant Aid project is highly relevant and effective.

Contents

[Appendices]



Location Map

Perspective (NADC panoramic landscape)

Perspective (NADC New Office/Training Building and New Dormitory Building)

List of Figures & Tables

Abbreviations

Abbreviation	English
AIT	Asian Institute of Technology
AQIP	Aquaculture Improvement Extension Project
ASEAN	Association of South - East Asian Nations
AusAID	Australian Aid or Australian Agency for International Development
DANIDA	Danish International Development Assistance
DLF	Department of Livestock and Fisheries
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Aquaculture Practice
GDP	Gross Domestic Product
GTZ	German Technical Assistance Agency
IRDC	International Development Research Center
ISSN	International Standard Serial Number
JICA	Japan International Cooperation Agency
JIRCAS	Japan International Research Center for Agricultural Sciences
LARReC	Living Aquatic Resources Research Center
LDC	Lesser Developed Country
LIPS	Livelihood Improvement Project for Southern Mountainous and Plateau Areas
MAF	Ministry of Agriculture and Forestry
MDGs	Millennium Development Goals
MONRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
NADC	Namxouang Aquaculture Development Center
NaFDeC	National Fisheries Development Center
NAFRI	National Agriculture and Forestry Research Institute
PAS	Provincial Aquaculture Station
Save Children	Save the Children
SEAFDEC	Southeast Asian Fisheries Development Center
SURE	Sustainable. Utilization of Rice-field Ecosystem
TICA	Thailand International Development Cooperation Agency
UNDP	United Nations Development Programme

Chapter 1 Background of the Project

1-1 Background of the Project

Freshwater fish has long been the most important animal protein source in Laos and fisheries is one of the key sectors for the nation. However, traditional fishing is quantitatively limited because of resource and expectations for aquaculture have grown recently and it has developed significantly. However, aquaculture in the country faces such serious challenges as insufficient technical capacity and seed shortage. Against the backdrop, the Government of Laos established NADC and LARReC and other implementing agencies in the field for research and development of aquaculture techniques, spread of developed techniques, and fish seed production by public entities and distribution to aquaculture farmers. The two organizations also have received technical assistance from Japan and other donors to solve problems. As a result of their efforts, the aquaculture production volume accounts for 74% of marine product production including fishing.

However, because there are very few seed producers of aquaculture in Laos, fish farmers have no other choice but to procure seeds from Thailand and other neighboring countries and the seed production system is expected to be strengthened. Laos has a problem of absence of producers of all-male tilapia seeds that have had much demand as aquaculture fish in recent years. Against the background, there is an urgent need for the establishment of techniques to produce such tilapia seeds in the country.

NADC which is a target organization of the Project is an important entity responsible for policy formulation and execution to solve the problems. However, due to ageing of the facility and equipment, they are not necessarily active enough. It is also found out that the facility of LARReC that is supposed to support NADC activities in the field of basic research for the technical development is also ageing and research equipment is insufficient. Although the facility was rebuilt funded by the national government, they were unable to improve the equipment and thus it cannot conduct research activities sufficiently due to the shortage of research equipment.

Against the backdrop, the Government of Laos requested for assistance to improve the functionality of NADC and LARReC.

1-2 Natural Conditions

(1) Climate

The climate data of Vientiane is shown in Table 1-1. Laos has a savanna climate (Aw) under Koppen climate classification with wet and dry seasons. The nation is very hot with an annual average temperature exceeding 20 degrees Centigrade. The annual rainfalls exceed 2,000mm (2011) and concentrate in the wet season from May to October. Insulation needs to be taken into full consideration and natural ventilation needs to be also secured to prevent room temperature rise in the facility plan. It is also necessary to pay attention to prevention of rain from entering the facility by installing long eaves, for example.

Table 1-1 Climate of Vientiane

(Monthly average in 2011 and annual average from 2009 to 2011)

	2011													2010	2009
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual		
Average temperature (℃)	21.3	24.7	24.3	28.3	28.2	28.1	27.8	27.2	27.4	26.9	25.8	22.2	26.0	27.2	26.7
Average maximum temperature (℃)	27.3	30.9	29.2	33.6	32.9	31.7	31.5	31.2	31.3	30.9	31.4	28.1	30.8	32.2	31.9
Average minimum temperature (℃)	16.3	19.9	20.3	24.2	25	25.5	25.3	24.9	24.8	23.8	21.2	17.4	22.4	22.9	22.4
Average humidity (%)	70	68	67	69	79	83	84	85	85	79	72	68	76	74	75
Average maximum humidity (%)	88	88	84	85	93	94	95	95	95	91	91	85	90	90	90
Average minimum humidity (%)	51	45	50	50	61	67	68	71	68	62	50	48	58	55	55
Precipitation (mm)	1.6	2.2	88.6	23.9	282.1	328.3	464.4	382.2	466.8	156.9	5.4	0	2,202.4	1,794.2	1,482.8

Source: Agriculture Statistics 2011 (MAF, June 2012)

(2) Natural Disasters

① Earthquake

Although there is no record of earthquake occurrence in Vientiane, seismic resistance needs to be taken into consideration with Japanese structural standards as reference.

② Flood

Because NADC is situated on the ground higher than its surrounding areas, heavy rains in the wet season are not likely to flood the building.

③ Power outage and lightning

Power outage occurs about twice a week in Vientiane. However, it is only for a short period mostly less than for 10 minutes.

Because lightning strikes occur frequently in the wet season, lightning protection systems need to be installed.

1-3 Environmental and Social Considerations

1-3-1 Environmental Impact Assessment

1-3-1-1 Project Components that Have Environmental and Social Impacts: An Overview

The Government of Laos requested for facility renovation and equipment procurement for NADC and equipment procurement for LARReC. Because it contains facility renovation, it was decided that its review of Environmental and Social Considerations need to be examined. There was concern over the conflict with local water use as it would increase the water distribution to the seed

production facility after the expansion and renovation work there and the Project was screened to fall in Category B under JICA Guidelines for Environmental and Social Considerations.

The Project components subject to the EIA are listed in Table 1-2 below.

Table 1-2 Main Project Components Subject to EIA

Facility name	Functions	Rooms
New Office/ Training Building	Office	Reception, Office Rooms, Conference Room (S)(L), Director's Office, Deputy Director's Offices and etc.
	Training	Exhibition, Library, Training Room and etc.
	Common Area	Entrance Hall, Pantry, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
New Dormitory Building	Trainee's Dorm	Trainee's Room (20 x 2-bed room to hold 40 people), Dayroom, Kitchen and etc.
	Student's Dorm	Student's Room (8 x 2-bed room to hold 16 people), Dayroom, Kitchen and etc.
	Officer's Dorm	Staff's Room (3 x 1-bed room to hold 3 people), Dayroom, Kitchen and etc.
	Common Area	Entrance Hall, Lounge, Laundry, Shower Room, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
Elevated Water Tank		Elevated Water Tank for Office/ Training Building and Dormitory Building, Pump room and etc.
New Hatchery	Hatchery	Spawning Room, Multiple Incubation Room, Tilapia Incubation Room and etc.
Moina Culture Tank	Moina Culture	Moina Culture Tank (w/ roof and blackout curtain), water supply system, aeration system
Tilapia Larval Rearing Tank	Larval Rearing	Tilapia Larval Rearing Tank (w/ blackout curtain), water supply system, aeration system
Brood Stock/ Nursery Pond	Brood Stock/ Nursery	Brood Stock/ Nursery Pond (water supply system)
Sedimentation Pond	Sedimentation Pond	Sedimentation Pond for Brood Stock/ Nursery Pond
Sedimentation Pond for Hatchery	Sedimentation Pond	Sedimentation Pond for Moina Culture Tank, Tilapia Larval Rearing Tank, Hatchery and existing tanks

1-3-1-2 Baseline Environmental and Social Conditions

Five environmental problems listed below are pointed out as main problems in Laos. The Project needs to consider biodiversity at the bottom of the list for its protection. Other environmental problems the Project needs to examine are the right to use agricultural water, leakage of chemicals in the environment, and noise and vibration during construction work.

- Environmental pollution caused by mining development
- Unexploded bombs dropped in the Vietnam War
- Illegal logging

- Burn agriculture
- Decrease in biodiversity

1-3-1-3 Environmental and Social Considerations and Organizations of the Recipient Country

(1) Agency responsible for environmental administration

The Ministry of Natural Resources and Environment (MONRE) is responsible for environmental administration in Laos and the Department of Environmental and Social Impact Assessment performs the Environmental Impact Assessment.

(2) Laotian institutions and organizations related to environmental

Major environmental laws and regulations in Laos are listed in the table below.

The Environment Protection Law (EPL) in Laos that serves as the basic environmental law was promulgated in 1999 and the latest version was revised on December 18, 2012, between it was revised repeatedly. The Article 8 in the EPL stipulates the environmental impact assessment and the environmental impact assessment ordinance was issued in 2010. Because the latest version of the EPL was officially announced in 2012, the ordinance was revised on December 17, 2013. The ordinance consists of two sections—regulations on the initial environmental examination (IEE) and regulations on the environmental and social impact assessment (ESIA).

Table 1-3 Environmental Laws and Regulations in Laos

No.	Name of law	Year
General		
1	The National Constitution	2003
2	Environment Protection Law (EPL) of 1999	2012
3	Environment Impacts Assessment	2010
Pollution and Conservation		
1	Regulation on Industrial Waste Discharge	1994
Food and Consumer Protection		
1	Law on Food	2004
2	Law on Livestock Production and Veterinary Matters	2008
3	Technical Regulation on Livestock Management and Animal Production	2003
Land Use, Administration and Management		
1	Land law	2003
2	Decree on the Implementation of the Land Law	1999

Water Resources		
1	Law on Water and Water Resources	1996
Fishery		
1	Fisheries Law	2009

Source: Profile on Environmental and Social Consideration in Lao P.D.R. December, 2013 by JICA

1-3-1-4 Comparison with Alternative Plans

The important project scope in terms of environmental and social considerations is Broodstock/nursery tanks and alternative plans including zero option were examined.

(1) Alternative plan 1

No construction of new tanks. Take measures to prevent leakage of seven tanks with much leakage among existing 10 storage tanks and use all of the 10 tanks as Broodstock/nursery tanks.

(2) Alternative plan 2

No construction of new tanks. Use 12 existing storage tanks on the south side of NADC premises as Broodstock/nursery tanks.

As shown in the table below in the comparison with zero option and Alternative plans 1 and 2, the Project is relevant and effective. Thus, challenges of environmental and social considerations of the Project are examined below.

Table 1-4 Comparison of Alternative Plans and the Project

Evaluation Item	Zero Option	Alternative Plan 1	Alternative Plan 2	Project
Number of usable tanks	3 in the north 12 in the south	10 in the north (renovation of 7 tanks in the north) No use of tanks in the south	12 in the south No use of tanks in the north	16 in the north (construction of new 12 tanks)
Renovation /construction cost	0	128 million yen for renovation	Pump repair	15 million yen for construction of 12 tanks
Safety management	No change	No change	High risk of cultured being stolen	No change
Pump repair or new installation	Not needed	Installation of new pump for new construction of elevated water tank	Repair of pump or installation of new on the south side of premises	Installation of new pump for new construction of elevated water tank

Water leakage	Water leakage continues in 7 tanks.	Water leakage problem is solved.	Water leakage continues.	Water leakage problem is solved.
Transfer to Nursery ponds	Easy	Easy	Difficult	Easy
Overall evaluation	Because only 3 tanks can be used effectively and water leakage continues, major problems related to production and water resource use remain unsolved.	It cost more than new construction and only 10 tanks are secured.	There are major problems of cultured fish being stolen and transfer of seeds.	It meets the requested scheme and 16 tanks are secured in the north. Seed production increases, consistent with national policy.

1-3-1-5 Scoping

The Project was screened as a Category B project under the JICA Guidelines for Environmental and Social Considerations in the preparatory stage in Japan mainly because it is likely to increase water intake from waterways as it includes fish seed production increase. The survey team conducted scoping which included other concerns and produced the below scoping matrix (Table 1-5).

Category-B impacts are forecast to be caused in the following nine categories: "Misdistribution of benefits and damages", "Water usage, water right or right of common", "Groundwater" "Flora, fauna and biodiversity", "Air pollution", "Water pollution", "Waste", "Noise and vibration", and "Accident."

Table 1-5 Possible impacts on 9 items and its reasons

Category	No.	Item	Assessment		Reasons
			Before and Construction Phase	Operation Phase	
Social environment	7	Misdistribution of benefits and damages		B-	Operation Phase: Because the facilities are for fish farmers, other local residents receive no benefit.
	10	Water usage, water right or communal ownership		B-	Operation Phase: Water intake is likely to increase for pond repair and addition for seed production increase.

Natural environment	15	Groundwater		B-	Operation Phase: Currently, groundwater is also used. Its use will also increase due to the expansion of facilities.
	18	Flora, fauna and biodiversity		B-	Operation Phase: Because farm fish is exotic species, its spread in the ecosystem will affect biodiversity. Steroid hormones are administered for male tilapia production and its discharge outside the system will affect the ecosystem.
Anti-pollution measures	22	Air pollution	B-		Construction Phase: Construction vehicles and machines will emit flue gas.
	23	Water pollution	B-	B-	Construction Phase: Construction vehicles and machines are likely to cause waste oil leakage. After Operation: dead fish, excess feed and excreta and other biological wastewater will deteriorate irrigation water quality.
	25	Waste	B-	B-	Construction Phase: Material waste will be generated. Operation Phase: A variety of office waste and raw garbage for dead creature treatment will be generated.
	26	Noise and vibrations	B-		Construction Phase: Construction vehicles and machines will cause noise and vibration.
Others	30	Accidents	B-		Construction Phase: Accidents will be caused in operation of construction vehicles and machines.

Impact classification:
A+/- : Significant positive/negative impact is expected.
B+/- : Positive/negative impact is expected to some extent.
C+/- : Extent of positive/negative impact is unknown. (A further examination in needed, and the impact could be clarified as the study progresses.)
D : No impact is expected.

1-3-1-6 TOR of Environmental and Social Consideration Survey

TOR of environmental and social consideration survey is formulated as in

Table 1-6 based on the above scoping results.

Table 1-6 TOR of Environmental and Social Consideration Survey

No.	Impact Item	Survey Item	Survey Approach
N/A	Examination of alternative plans	Accurate contents requested by Laos Examination of specific items of the Project Examination of construction methods	Information gathering on existing facility Interview survey on request with NADC
7	Misdistribution of benefits and damages	Stakeholder analysis Stakeholders' intention	Interview survey
10	Water usage, water right or right of common	Required water amount Size of water intake pit	Face-to-face survey with NADC Field survey
15	Groundwater	Current water use volume Pump performance	Face-to-face survey with NADC Field survey
18	Flora, fauna and biodiversity	Species of released seed Steroid hormone behaviors	Face-to-face survey with NADC Field survey
22	Air pollution	Scale of construction Laotian environmental standards	Estimation of scale of construction Gathering of environmental standards
23	Water pollution	Scale of construction Laotian environmental standards Function of drainage facility	Estimation of scale of construction Gathering of environmental standards Field survey
25	Waste	Scale of construction Laotian environmental standards Waste treatment methods	Face-to-face survey with NADC Estimation of scale of construction Gathering of environmental standards Field survey
26	Noise and vibrations	Scale of construction Laotian environmental standards	Estimation of scale of construction Gathering of environmental standards
30	Accidents	Scale of construction Laotian safety and sanitation	Estimation of scale of

		standards	construction
N/A	Stakeholder meeting	Residents' intention Project known to the public or not	Interview survey Holding stakeholder meeting

1-3-1-7 Survey results

The table below summarizes the field survey results on the impact items based on Environmental and Social Consideration survey TOR.

Table 1-7 Survey results of Environmental and Social Considerations

No.	Impact item	Survey and result
1	Misdistribution of benefits and damages	In the interview with 20 residents who are not fishermen, most responded that local development benefits all residents. Although it is not quantitative result, the Project is unlikely to cause misdistribution of social benefits and damages.
2	Water usage, water right or right of common	It was revealed that water use will decrease. Water is taken naturally from northern and southern intakes (each 1m x 1m ($1m^2$)). NADC allocation is 2,740 tons/day according to the AQIP-1 report. Although there is no flowmeter, the monthly water volume that naturally flows in from the two pits is estimated to be 2,740 tons. Currently, 30 to 40 percent of the water is used for seed production of 3.87 million fish. Although water use of facilities for the targeted 10 million seed increases in volume, it is within the range of upper limit agreed on with the irrigation authority and thus there is no need for additional water exceeding the limit. As repair or no use of ponds with significant water leakage is planned and introduction of Recirculating Aquaculture System is examined, it is extremely unlikely that the water demand will exceed the upper limit. We contacted Namxouang Irrigation Center to confirm the volume of 2,740 tons and they responded that there is an agreement on water use between DLF and the Irrigation Center. Water currently flows in from two 1m x 1m pits naturally and it is unlikely that there is competition with other water

		use.
3	Groundwater	Groundwater is used only for tap water in everyday life and toilet drainage. Significant increase of groundwater use is extremely unlikely.
4	Flora, fauna and biodiversity	The Namxouang dam is restocked only with indigenous species of silver barb. Meanwhile, exotic fish culture is popular in the Mekong river water system and realistic reaction to the biodiversity is to sort out between the mainstream and influents. Steroid hormones are administrated with the feed for all-male tilapia seed production. Although the steroid hormones differ from endocrine-disrupting compound, which is so called environment hormone, its flow outside the water system needs to be prevented as much as possible. Tilapia larval rearing tanks will be constructed independently from other tanks. Steroid hormone has low water solubility and absorbed in sand and silt and become deposited.
5	Air pollution	The Project includes new construction of 12 concrete ponds. It is relatively small-scale construction. Instructions are given to the contractors to compile an air pollution control manual and comply with it. Air monitoring is also instructed during construction.
6	Water pollution	Although waste oil leakage is likely to be caused by construction vehicles and machines during construction, its scale is small enough to manage the leakage. Instructions are given to the contractors to compile a water quality control manual and comply with it. After starting the operation, NADC will drain water into the sedimentation pond and discharge stocked water after the examination of water quality. The additional construction of the northern sedimentation pond is included in the Project. Although items of water quality tests are water temperature, pH, chlorine, turbidity, dissolved oxygen, and BOD/COD, other items may be added when necessary. Rainwater is discharged from the outlet of the open ditch as it has been. Human sewage is released separately from

		it into the biological wastewater from concrete tanks and ponds. Sewage water from newly constructed toilets is stored in the septic tank.
7	Waste	Instructions are given to contractors to be responsible for waste treatment. They are also instructed to compile a waste management manual and comply with it. NADC does not have clear rules on plastic garbage treatment. We persuaded them to request a garbage treatment service operator to perform the work for 60,000Kip/ month and it agreed. Dead creatures are buried as organic matters as raw garbage. We talked to NADC to have chemicals in the laboratory treated by the supplier and it agreed.
8	Noise and vibrations	The construction is in a very small scale. The site is approx. 500 meters away from residential areas. Instructions are given to the contractors to compile a noise and vibration control manual and comply with it. Noise and vibration will be monitored by it daily.
9	Accidents	The construction is in a very small scale. Instructions are given to the contractors to compile a safety control manual and comply with it. Instructions will be given to NADC and LARReC to compile a safety control manual after the delivery of the Project and a written agreement will be obtained.
10	Stakeholder meeting	The interview was conducted with 20 stakeholders and 10 fish farmers. No interviewee expressed objection against the Project or concern over the impacts on natural or social environment. Representatives of 10 villages in the Phongthong group where NADC is situated, with a total population of approx. 70,000, participated in the stakeholder meeting. No participant expressed objection against the Project or concern over the impacts on natural or social environment.

1-3-1-8 Impact assessment

The proposed scoping and field survey results are compared in the table

below. The Project is likely to have Category-B impacts on items of air pollution, water pollution, waste, noise/ vibration and accidents during construction and water pollution after the start of operation and thus it is relevant to conclude that it has Category-B impacts of comprehensive environmental assessment.

Table 1-8 Comparison of Proposed Scoping and Field Survey Results

Category	No.	Impact item	Impact assessment of provisional scoping		Impact assessment based on the survey results		Description
			Before and Construction Phase	Operation Phase	Before and Construction Phase	Operation Phase	
Social environment	7	Misdistribution of benefits and damages		B		D	Local residents who are not fish farmers also think that they are also beneficiaries of the Project.
	10	Water usage, water right or right of common		B-		D	The water use is unlikely to increase.
	15	Groundwater		B-		D	Groundwater use will not change.
Natural environment	18	Flora, fauna and biodiversity		B-		D	There is little possibility of spread of foreign species.
Anti-pollution measures	22	Air pollution	B-		B-		Construction of 13 ponds includes drilling of 1.5 m in depth and construction scale is small. However, it does not mean that the Project has no impact.
	23	Water pollution	B-	B-	B-	B-	After the start of operation, waste water is put in the sedimentation pond for hatchery and discharged after water inspection. However, it will still have some impact.
	25	Waste	B-	B-	B-	D	The construction is in a small scale and contractors are responsible for waste treatment. Waste is properly managed after the start of operation.
	26	Noise and vibrations	B-		B-		The construction is in a small scale and the site and

							residential areas are far apart. However, still, it will still have some impact.
Other	30	Accidents	B-		B-		The construction is in a small scale and contractors are responsible for accident management. All accidents are reported to NADC and improvement measures and preventive measures are taken repeatedly. However, it will still have some impact.

Impact classification:
A+/- : Significant positive/negative impact is expected.
B+/- : Positive/negative impact is expected to some extent.
C+/- : Extent of positive/negative impact is unknown. (A further examination in needed, and the impact could be clarified as the study progresses.)
D : No impact is expected.

1-3-1-9 Environmental management and monitoring plans

A monitoring plan during construction and after the beginning of the use of the facilities is formulated to be carried out in the procedures (main items) below.

During Construction

- Air: PM10, SOx, NOx, etc., to be measured once a month around the construction site
- Water: oil content to be measured once a week at the drain outlet
- Waste: waste treatment to be checked once a day
- Noise/ Vibration: to be measured around the construction site with a portable measuring instruments three times a day

In Operation

- Complaints/ requests from neighboring residents: accepted anytime
- Water: temperature, pH, chlorine, turbidity, etc., to be measured once a week at the wastewater tank
- Waste: waste to be checked once a week

1-3-1-10 Consultation with stakeholders

(1) Interview survey with stakeholders

We interviewed 20 stakeholders in the field survey in order to find out their intention and no one expressed any particular objection to the Project. The findings of the interview are described below.

① Although farmers who also culture fish are most benefited, beneficiaries are not limited to them because it promotes economic development of the village. (no view of uneven distribution of benefits)

② It is not likely to cause any negative impact on natural and social environments. (no comment on negative impact)

③ We support the Project and we expect similar assistance from Japan. (likely to have positive outcomes of AQIP-1 and 2)

④ Technical assistance and equipment procurement for NADC will spread to fish farmers and to the entire village through training programs organized by NADC. (Most interviewees mentioned such domino effects.)

⑤ It also contributes to solution of food shortage of the village as fish production increase leads to increase in protein supply. (Many interviewees expressed their expectation for seed production increase and increase in fish supply as food.)

(2) Stakeholder meeting

We held a stakeholder meeting after the interview with them. There were 34 participants, which include 18 farmers who also culture fish in all 10 villages in the Phonthong group.

In the meeting, representatives of each village gave comments that the Project would not have any negative impact on natural and social environment and that it assists the fish farmers more than other people and it would help improve their livelihood.

Each representative requested NADC to supply a larger amount of seeds of more species, offer training courses more frequently, and inspect irrigation water quality periodically in the future.

Mr. Chantalangsy of the Namxouang Irrigation Center said that the irrigation water volume to be used by NADC is agreed between it and DLF and it does not cause any problem under the present circumstances.

As a conclusion, stakeholders have high expectations for the Project and no one expressed concern over negative impacts on natural and social environments.

1-3-2 Land Acquisition and Relocation of Residents

1-3-2-1 Needs for land acquisition and relocation of residents

The land for the Project is owned by DLF and it is confirmed that it has permitted NADC to use it. Documents that show the land ownership of the Project site are attached in Appendix 6 at the end of the report. Because the Project is construction of nursery tanks on the Project site on NADC premises, it involved no relocation of local residents.

1-3-2-2 Legal framework related to land acquisition and relocation of residents

N/A

1-3-2-3 Scale and scope of land acquisition and relocation of residents

N/A

1-3-2-4 Specific guarantee and support measures (including requirements for recipients and calculation of guarantee)

N/A

1-3-2-5 Complaint handling mechanism

N/A

1-3-2-6 Execution system

N/A

1-3-2-7 Execution schedule

N/A

1-3-2-8 Costs and financial sources

N/A

1-3-2-9 Monitoring structure and form by executing agency

N/A

1-3-2-10 Consultation with residents

N/A

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

The Project is, in order to improve of facilities and equipment necessary for production increase of seeds with equipment for fish disease diagnosis, feed analysis, and for basic study of the fishery sector at the objected organizations, for both organizations to increase the productivity of hatchery and to improve equipment of the fundamental research for aquaculture, fish disease and feed analysis.

The summary for the facilities and equipment in the plan is as follows.

(1) Facilities

The facilities to be constructed in the site of NADC: approx. 2,100m^2 (excluding the water tanks, nursery pond and sedimentation ponds)

Table 2-1 Summary of the Project (facilities)

Facility name	Functions	Rooms
New Office/ Training Building	Office	Reception, Admin. Unit Office, Conference Room (S)(L), Director's Office, Deputy Director's Offices and etc.
	Training	Exhibition, Library, Training Room and etc.
	Common Area	Entrance Hall, Pantry, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
New Dormitory Building	Trainee's Dorm	Trainee's Room (20 x 2-bed room to hold 40 people), Dayroom, Kitchen and etc.
	Student's Dorm	Student's Room (8 x 2-bed room to hold 16 people), Dayroom, Kitchen and etc.
	Officer's Dorm	Staff's Room (3 x 1-bed room to hold 3 people), Dayroom, Kitchen and etc.
	Common Area	Entrance Hall, Lounge, Laundry, Shower Room, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
Elevated Water Tank		Elevated Water Tank for Office/ Training Building and Dormitory Building, Pump room and etc.
New Hatchery	Hatchery	Spawning Room, Multiple Incubation Room, Tilapia Incubation Room and etc.
Moina Culture Tank	Moina Culture	Moina Culture Tank (w/ roof and shading curtain), water supply system, aeration system
Tilapia Larval Rearing Tank	Larval Rearing	Tilapia Larval Rearing Tank (w/ shading curtain), water supply system, aeration system
Brood Stock/ Nursery Pond	Brood Stock/ Nursery	Brood Stock/ Nursery tank (water supply system)
Sedimentation Pond	Sedimentation Pond	Sedimentation tank for Brood Stock/ Nursery tank
Sedimentation Pond for Hatchery	Sedimentation Pond	Sedimentation Pond for Moina culture Tank, Tilapia Larval Rearing Tank, Hatchery and existing tanks

(2) Equipment

All 111 items (number of items accounting the same equipment) including the following equipment:

[NADC]

- Equipment for administration office: 5 items- copy machines, PCs, scanners, etc.
- Equipment for dormitory: 3 items- bed, locker, and desk/table set
- Equipment for work shop: 11 items- small generator, drilling machine, electric saw, etc.
- Equipment for aquaculture section: 26 items- grinder for materials, Pellet machine, freezer, etc.
- Equipment for fishing section: 5 items- PC, GPS, ultrasound depth sounder, portable type balance, etc.
- Equipment for research laboratory: 12 items- PC, micro bath, LCD projector, etc.
- Equipment for library: 4 items- copy machine, PC, library furniture, etc.
- Equipment for examination room: 30 items- instrument set for dissection, autoclave, etc.

[LARReC]

- Equipment for research section of aquaculture techniques: 32 items- PC, water supply/ filtration system, instrument set for dissection, etc.
- Equipment for research section of fishing techniques: 28 items- PC, GPS, DO mete, etc.

(3) Soft Component

The Project plans the soft component as bellow

1) Initial technical guidance for the seed production of all-male tilapia
2) Support for the improvement of laboratory at NADC and technical guidance on feed/ food analysis
3) Technical guidance on diagnosis of fish diseases
4) Guidance for the improvement of system for management/maintenance of equipment

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

It is assumed that the circumstances in Laos for agriculture, stockbreeding, and marine products will greatly change along with the ASEAN Free Trade Agreement. Accordingly, the strengthening of the system of administration and techniques is an urgent matter in the fisheries sector including aquaculture techniques which Laotian government requests in The Project.

The facility design and Equipment for contribution to the above purpose is planned under this Grant Aid of Japan based on the following policy.

2-2-1-1 Basic Policy

Basic policy regarding to overall project is as follow.

(1) Basic plan to subsidiary the strengthening of administrative and technical ability of DLF

Due to the lack of human resources, actually DLF's basic data for fishery such as about distribution of indigenous fish species and ecology of each fish species are not well organized. In such circumstance, MAF plans to add basic fishery study function to the NADC. This plan represents one of the most important measures to resolve fishery problems Laos encounters today. Under such prospect, the project aims improvement of facilities and equipment required for this newly-organized unit.

(2) Basic plan to subsidiary the strengthening of seed productivity in NADC

At present Laos, the number of organizations for fish seed production is very limited. In addition, there are very few producers of all-male tilapia seed. In this condition, fish farmers request to the public seed production facilities including NADC to supply more seeds in better quality. The Project aims also to improve such situation. On the other hand, while the Laotian side plans to produce 20,000,000 seeds as a final goal, the Project sets up its target volume for only 10,000,000 seeds and requests to the Laotian side to make their self-efforts to increase the productivity. Technical assistance, as soft component, is also planned to establish seed production technique for all-male tilapia in the Project.

(3) Basic plan to subsidiary the strengthening of examination system in NADC

At present, laboratory in the existing facility of NADC does not function at all due to a lack of human resource. However, after taking effect of the ASEAN Free Trade Agreement, it is very important to improve examination system of fisheries product to ensure the quality of fish seed and to take measures against fish diseases. It is certain also a broad examination system will be necessary for the food security. Taking these backgrounds into consideration, NADC plans to establish an examination system and dispatched 2 laboratories engineers to Thailand for the training. These 2 staffs will come back at the end of the year and thus their ability for examination will be reinforced. Tough there are problems of aging and a lack of equipment, so it is necessary to improve also hardware aspect such as equipment of examination system. Therefore, The Project plans to supply necessary equipment for current important examinations so far. The existing laboratory will be used and necessary improvement of facilities will be done by Laotian side. However, as it is necessary that a specialist on laboratory layout assists facility and equipment arrangement plan, a technical assistance is planned and included in the component of The Project.

(4) Basic plan to subsidiary the strengthening of training system in NADC

Training is one of the roles required for NADC. Today, trainings for fish

farmers, seed producer, and students studying fishery are implemented, but their accommodation conditions are extremely inadequate and training facilities are old to the extent that it is difficult to carry out effective training. With the influence of ASEAN Free Trade Agreement, it is obvious that the trainings for people related to fishery and aquaculture will become important more than ever. Therefore, to assist the restoration of their training function by the Project is very appropriate.

(5) Basic plan to enhance research capacity for aquaculture and fishery of LARReC

Today, LARReC has few existing equipment. This can be explained by the fact that most of their research activities were with other donor organizations and there were no need to possess their own equipment. However, as new facility was constructed and laboratory was prepared by their self-efforts, The Project plans to supply minimum basic equipment to enhance their research capacity.

2-2-1-2 Policy for Natural Environment Conditions

The climate in Laos is that of a tropical monsoon with high temperature and high humidity. There are 2 seasons- rainy (May to October) and dry (November to April). The rainy season has strong wind and heavy rain with thunder. The large roof with overhanging deep eaves and the exterior wall finish with waterproof materials will prevent mold on the wall. The building orientation, structure and finish materials for the buildings are considered to intake the sunlight and ventilation into the rooms, especially without air conditionings, against high temperature/humidity.

(1) There is no report of Flood/Typhoon damages in Laos, the landlocked country. However, the floor level for office/training building and dormitory is designed approx. 500mm high from the ground level following other existing buildings to prevent damage by flood due to the heavy rain.

(2) The construction materials to be used for the new building shall be selected under considerations of the waterproofing, heat insulation, durability, and also maintenance easiness.

(3) The large roof is designed to prevent sunshine, stain on the exterior wall and water leakage as well as use of natural ventilation.

(4) Considering the high temperature of more than 40°C under direct sunlight in dry season, the insulation of roof shall be applied. Louvers are also installed for sufficient ventilation of attic.

(5) Most of the existing buildings have double sliding glass windows with aluminum frames for natural ventilation. The windows with aluminum frames are also designed in The Project following the existing buildings.

(6) A lightning rod is planned for the prevention of lightning strikes frequently occurring in the rainy season.

2-2-1-3 Policy for Social Economic Conditions

The special characteristics for construction of the private houses are, raised wooden floors and roofs with a steep slope. This style fits the natural conditions in Laos for the natural ventilation and the prevention of flood. The architectural style of temples is also unique with its multi-layered roofs. The old temples are built with a mixture of wood and bricks. The newer temples are built mainly and basically with reinforced concrete and the complex roofs are built with light weight steel.

The new buildings to be constructed under the Project will have reinforced concrete frame with brick wall, which is the same as the popular construction method in Laos. The rooms using natural ventilation are installed with perforated concrete blocks and aluminum louvers. The exterior wall is painted on mortar trowel, following the local construction method considering the durability. The roof is planned to be covered with cement tile roofing and with a steep slope in order to secure enough space; air volume in the attic for heat insulation.

2-2-1-4 Policy for Construction/Procurement Circumstances

(1) Facilities

There have been very few construction projects of large scale, both in Vientiane and in local cities, which results in a lack of skilled workers, especially in local cities. The Project needs skilled workers although the construction methods are not especially difficult. The instruction for supervision of construction by Japanese is essential. It is necessary to avoid complex designs and adopt simple and rigid shapes for easier construction. Most construction materials are procured from local suppliers. Therefore, the process control is important for their quality control and confirmation of their stock. The building standards law in Laos has not yet been enforced but the application for a building permit is required. The architectural, structural, electrical and mechanical drawings shall be attached to the application form. It takes about 30 days for permission. The fire code came into effect in December 2007 in Laos but the detailed standards have not yet been determined. The code determines the necessary equipment to prevent from fire for each purpose of buildings. Accordingly fire alarms are set at the office/ training buildings and dormitories.

(2) Equipment

There are some distributors dealing with aquaculture equipment for many aquaculture farmers. However, it is not a wise choice to procure aquaculture

equipment from such small scale shops. There are very few distributors who keep the stock for the constant sale of equipment excluding the distributors who are dealing with the office machines such as PCs and copy machines or furniture. Accordingly the equipment expect PCs, office machines and furniture is procured from Japan.

2-2-1-5 Policy for Use of Local Companies

(1) Facilities

There are many local construction companies in Laos and several Japanese construction companies expanded business in Vientiane until a few years ago. Many projects under Japan's Grant Aid have been executed in Laos.

The major construction companies in Laos have experience of working with these projects. However, these construction companies do not have as much ability as the Japanese contractors for the general management as there is less consciousness of quality control and safety control so that it is essential to instruct the Japanese style of construction management since local skilled workers are not enough, it is important Japanese contractor lead them as well as use the local companies as efficiently as possible.

(2) Equipment

The equipment and materials are basically procured from Japan. Regarding analytical or precision equipment, it shall be considered that there is a local agent which can offer consumables and provide maintenance service for damaged equipment.

2-2-1-6 Policy for Operation and Maintenance

The worker especially in charge of the maintenance for the facilities and equipment is not posted at both of LARReC and NADC. The staff in charge of operation of aquaculture performs the easy work tasks like switching the pump on and off and cleaning the filter. The repair of facilities and equipment is ordered and outsourced to specialist for maintenance but it is very limited case because of the insufficient budget.

The facilities are designed that the present maintenance staff can technically apply for the maintenance. The facilities are designed for the low cost of maintenance and decreased running cost.

Concerning the equipment maintenance, by implementation of the soft component, training for periodic maintenance and control methods are planned for local engineers to support the establishment of their equipment management system.

2-2-1-7 Policy for Suitability on the Grade of Facilities and Equipment

(1) Facilities

The balance of function and design of the facilities with the existing ones shall be considered in the plan as followed with the policy mentioned below.

1) The existing production facilities for fingerlings are spread within the premises. The new facilities are built to be adjoined with the related facilities considering the flow of the staff using the facilities.
2) The balance of design with the existing facilities is considered.
3) The grade and scale of facilities should not be excessively burdensome for operation and maintenance.

(2) Equipment

There are not many important subjects because most of the planned equipment is the replacement of old equipment. The specifications of new equipment are basically the same level as with the existing equipment.

2-2-1-8 Policy for Construction Method, Procurement and Scheduling

(1) Facilities

Most of the construction equipment and materials, such as structural materials and finishing materials including the equipment for facilities can be procured in Laos. However they are often imported, thus, the construction method is selected that the local staff is able to handle with their skill considering future maintenance. The plans for material procurement shall be well prepared considering the temporary works plan, labor plan, importation and transportation plan and construction schedule. The construction period with sufficient allowance of curing time is considered especially during the rainy season when the finishing process for construction still continues. Early procurement is necessary for the sands and aggregates during the concrete pouring works. The construction materials and equipment are planned to prevent the quick deterioration of facilities from mold and rust. They are basically procured in Laos but the construction period is affected because the procured materials in Laos are mostly imported from Japan or other third countries. It is planned to avoid a stock shortage delaying the construction period by daily checking the quantity of materials to be procured and the present stock.

(2) Equipment

The equipment is basically procured in Japan or Laos. The installation of equipment to be delivered as single items begins at the time when the equipment can be installed in time during the finishing stage. In regard to some equipment which is assembled at the site, the installation begins at the

appropriate time to be discussed for the detailed schedule with the staff of facilities considering the scramble of the materials among the staff of facilities. The installation and assembly are executed by the distributors but under the instructions and management of the consultant for soft component.

2-2-2 Basic Plan (Construction Plan/Equipment Plan)

2-2-2-1 Plan for Facilities

(1) Basic Policy

1) The seed production number to be released into the river, which is targeted to NADC by the government, has not been achieved (3.5 million fingerlings out of the assigned amount of 5million) because of water leaks in the existing ponds (7 ponds out of 10 ponds). Twelve new ponds made of concrete tanks are planned, in order to produce 10 million seeds in total, 5 million fingerlings for releasing into the river and another 5 million contributing to the increase in self-production rate in Laos. The existing ponds are reserved for future expansion in case that NADC will achieve by their own effort the target of 20 million fingerlings in future. As the auxiliary facilities, hatchery, Moina culture tank, Tilapia (*Oreochromis niloticus*) larval rearing tank and sedimentation ponds are planned.

2) Laotian government requested to repair the existing administration office building due to the rainwater leakage. However, after the survey conducted at the site, the result of structural strength was showed as mentioned below.

According to Japanese standards (earthquake resistance evaluation standards for existing reinforced concrete buildings, Japan Building Disaster Prevention Association), when the average compressive strength of drilled concrete cores is below 13.5N/mm2 and below 75% of the basic design strength, the building is considered to have problems in materials and construction. In such cases, it needs to be examined comprehensively including the possibility of rebuilding, in consideration of questions about the reliability of earthquake resistance test and reinforcement calculation and effects of reinforcement. The average compressive strength test result of drilled concrete cores was 12.68 N/mm^2 in the field survey and its reliability is questionable even the reinforcement calculation and reinforcement work are performed, and if it is used for a long time, building safety cannot be guaranteed. Thus, the existing office building is decided to be rebuilt instead of

renovation under the assistance of Japan.

Table 2-2 Test Result of Durability of Concrete Structures by Schmidt Hammer

Test Locations	Average of 10 Rebound Test Locations	Correction Factor	Compressive Strength Converted to Cylinder 150φ×300(N/mm^2)	Result (Design Strength 21N/mm^2)
H1	28.00	27.41	20.85	×
H1-1	22.40	21.93	14.14	×
H2	25.60	25.06	17.77	×
H3	27.20	26.63	19.83	×

Table 2-3 Compressive Strength Test Result of the Drilled Concrete Core

Test Locations	Core Size (mm)		Core L/D Ratio	Compressive Test Value (N/mm^2)	Corrected Compressive Strength (N/mm^2)	Result (Design Strength 21N/mm^2)
	Length	Diameter				
C1	143.7	71.9	1.999	14.93	14.93	×
C2	134.2	71.8	1.869	10.93	10.81	×
C3	132.0	71.8	1.838	12.47	12.31	×

3) The new office/ training building is planned to secure the capacity of 28 staffs which is the maximum approved number by the Ministry of Agriculture and Forestry. The main training room is planned to secure the capacity of 40 people along with the exhibition room for the spread activity, and the library serving also as the study room for trainees for the purpose of strengthening the function of training section.

4) The existing dormitories of NADC are far from comfortable living conditions and the damage by termites in the construction structure is found. Therefore, a new dormitory is planned at NADC which has the capacity of 40 trainees at most and 16 students in addition to the room for 3 staffs in night duty including the NADC director and deputy directors. The above capacities are determined by the past training experiences at NADC.

(2) Plan for site and arrangement

The Project site for NADC facilities is located at 35 km north from Vientiane and covers approx. 13.93 ha. A mild slope continues downward from the entrance of NADC. The difference in altitude is about 5 meters.

The site is surrounded by the canal flowed from Namxouang dam. The careful study of the plan for water supply and drainage is required considering the difference in altitude.

The facilities related to aquaculture which has been supported by the

Projects for more than 10 years since 2001 for the Aquaculture Improvement and Extension Project (AQIP-1 and AQIP-2) are dotted in the site. The office/ training building, dormitory and auxiliary facilities (elevated water tank, ground water tank and septic tank) are built in the vacant lot near the entrance of NADC where the new facilities are seen as a new face of NADC. The facilities related to aquaculture such as hatchery, Moina culture tank and tilapia larval rearing tank are to be located among the facilities related aquaculture considering the functional relations with the existing buildings.

The new broodstock/ nursery ponds are planned at the lowland area located at the edge of northern part of the site considering the difference in altitude, as the existing ponds are not functioning due to water leaks.

The basic plan is to construct the new facilities in the vacant lot. For this reason the demolition and removal of existing buildings, cutting down of trees and leveling of ground to be executed by Laotian side are considered to be a minimum burden.

The construction site is on the premises of NADC and the survey team received a copy of registration that proves NADC has its ownership for confirmation. Thus, there is no impact on the construction.

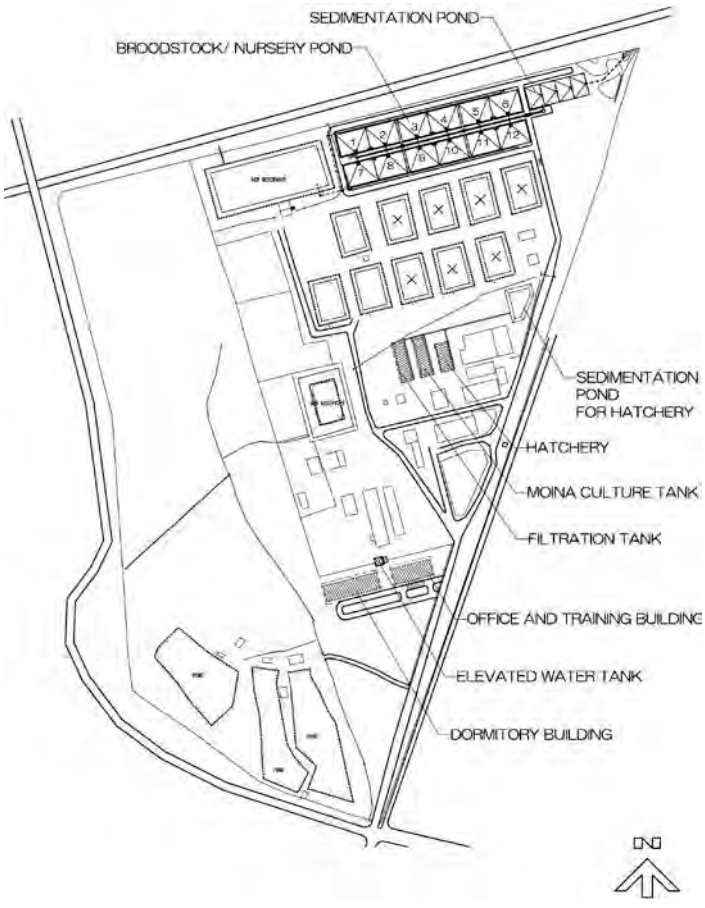


Figure 2-1 Site Plan

(3) Construction Plan

1) Floor Plan

i) Contents of each facility

Main facilities based on the discussion with Laotian side at the time of site survey are as follows.

Table 2-4 Main rooms for each facility

Facility name	Functions	Rooms
New Office/ Training Building	Office	Reception, Office Rooms, Conference Room (S)(L), Director's Office, Deputy Director's Offices and etc.
	Training	Exhibition, Library, Training Room and etc.
	Common Area	Entrance Hall, Pantry, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
New Dormitory Building	Trainee's Dorm	Trainee's Room (20 x 2-bed room to hold 40 people), Dayroom, Kitchen and etc.
	Student's Dorm	Student's Room (8 x 2-bed room to hold 16 people), Dayroom, Kitchen and etc.
	Officer's Dorm	Staff's Room (3 x 1-bed room to hold 3 people), Dayroom, Kitchen and etc.
	Common Area	Entrance Hall, Lounge, Laundry, Shower Room, Toilet, Storage, Stairs, Corridor, Water Receiving Tank, Septic Tank and etc.
Elevated Water Tank		Elevated Water Tank for Office/Training Building and Dormitory Building, Pump room and etc.
New Hatchery	Hatchery	Spawning Room, Multiple Incubation Room, Tilapia Incubation Room and etc.
Moina Culture Tank	Moina Culture	Moina Culture Tank (w/ roof and blackout curtain), water supply system, aeration system
Tilapia Larval Rearing Tank	Larval Rearing	Tilapia Larval Rearing Tank (w/ blackout curtain), water supply system, aeration system
Broodstocktock/ Nursery Pond	Brood Stock/ Nursery	Broodstock/ Nursery Pond (water supply system)
Sedimentation Pond	Sedimentation Pond	Sedimentation Pond for Brood Stock/ Nursery Pond
Sedimentation Pond for Hatchery	Sedimentation Pond	Sedimentation Pond for Moina Culture Tank, Tilapia Larval Rearing Tank, Hatchery and existing tanks

ii) Floor Plan

[Office/ training building]

a. Administration section

- NADC consists of 3 units—the administration unit, technical unit and fish disease and water quality inspection unit. The administration and technical units will be moved to the new office/ training building to be constructed under the Project. The existing office building will be renovated into the office and laboratory of the fish disease and water quality inspection unit.

- The current workforce is 22 including the director, although 28 is approved by the Ministry of Agriculture and Forestry. The office to be constructed in the Project will have a capacity for 25 personnel, excluding a room for 1 director and 2 rooms for deputy directors. Laos has a future plan to divide the technical unit into aquaculture, fishing and training units and increase the workforce.
- The large and small conference rooms are planned for various kinds of conference and reception of guests. The small conference room is located at the ground floor mainly for the administration section and the large conference room at the first floor mainly for training section. The room space of facility is considered to be reduced by common use of the conference rooms between 2 sections.
- The private rooms are located at the first floor for the director and deputy directors for their reception of guests.
- The pantry, storage and reception counter are also planned as the auxiliary rooms.

b. Training section

- The training section is an indispensable function for NADC which was established for the purpose of development and spread of aquaculture. Various kinds of training are held even for the general aquaculture farmers. Since 40 trainees have been accepted at most, the training room is planned for 40 trainees considering the continuous activities for the spread of aquaculture.
- The library is planned for service of study for the trainee and student.
- The exhibition room combined with the entrance hall is set to introduce the activities to the visitors.
- The pantry and storage are also planned for common use with the administration section.

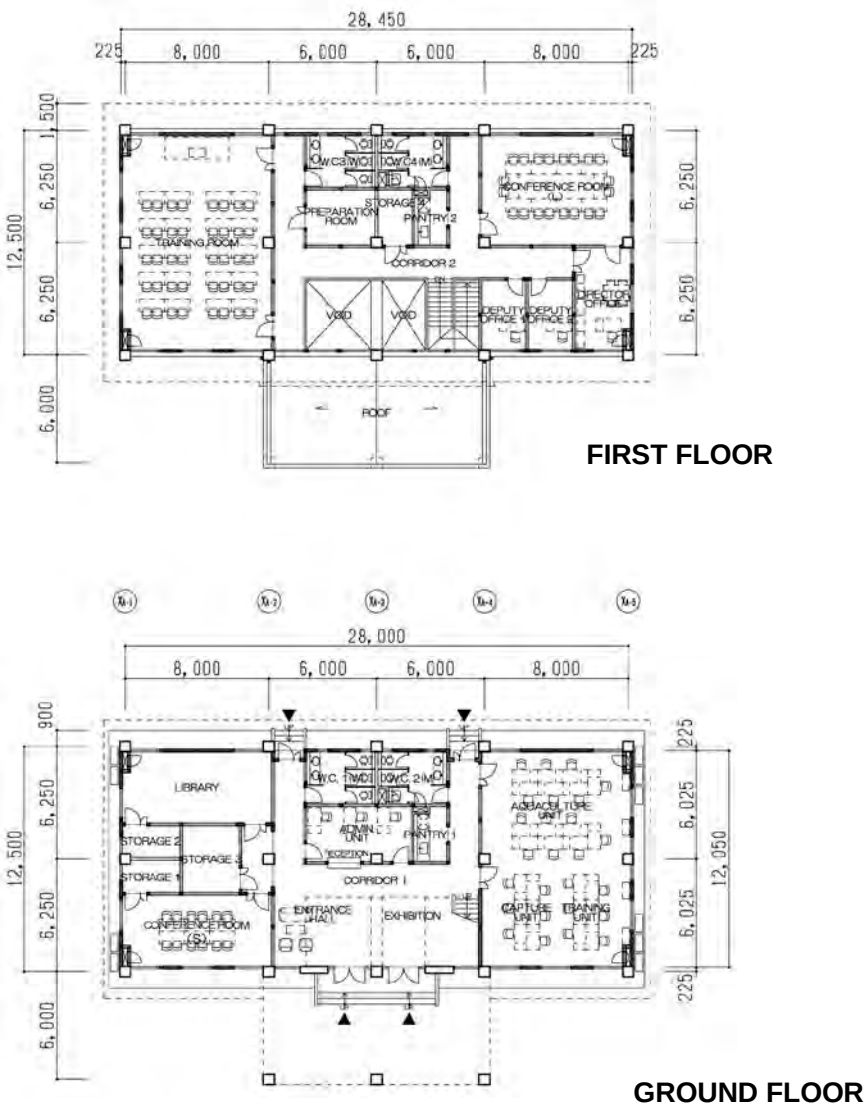
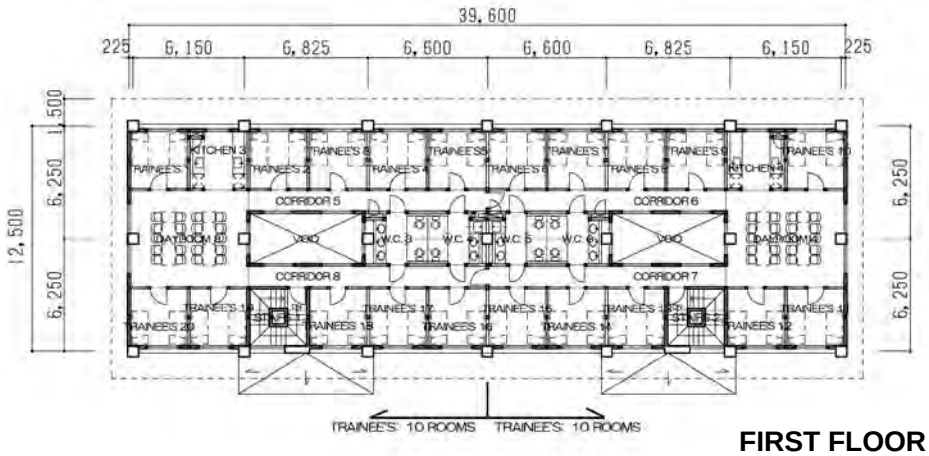


Figure 2-2 New Office/ Training Building Floor Plans

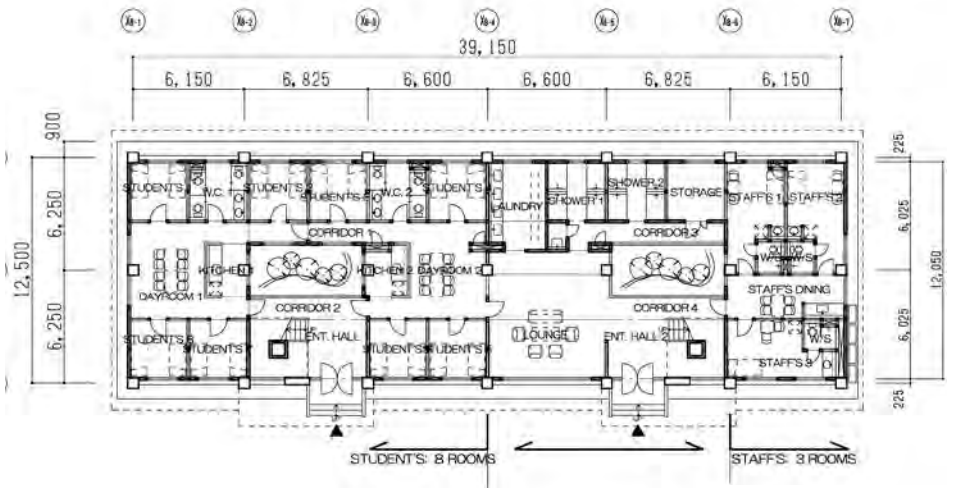
[Dormitory]

- Though initially the dormitory was planned as a building having office/training function in the ground floor and dormitory function in the first floor, as NADC requested making the dormitory separate from the office/ training building to avoid noise from dormitory and smells from kitchen, dormitory function is planned to be in an independent building for trainee, student and the staff in night duty.
- The accommodation capacity is planned for 40 trainees (2 persons for one room x 20 rooms) at most and 16 students (2 persons for one room x 8 rooms) and 3 staff in night duty including the chief and assistant chief based on the past experience.
- The dormitory is planned to be divided into 2 large units so that men and women can stay separately in the rooms for the trainees and students respectively.

- The space for each room is as same as the existing dormitory rooms.
- The building has a high roof for the natural ventilation and 2 courtyards for the ventilation and lighting. The rooms for staff will be air-conditioned.
- The ceiling fan is set at each room for the trainees and students, as is the case in the existing dormitories.



FIRST FLOOR



GROUND FLOOR

Figure 2-3 Dormitory Floor Plans

[Hatchery]

The hatchery is planned to have a spawning room, a multi-purpose incubation room, a tilapia incubation room and their scale is calculated based on the grounds described below.

[Spawning room]

In Laos and Cambodia, Capacity of 4m^3 spawning tank is commonly used. However, such large tank is not recommended for NADC from the view point of its work efficiency. The larger spawning tank is recommended for large scale

hatcheries with the seed production volume of more than 10 million per fish species. On the contrary, NADC plan to produce several fish species seed with small-quantity. As NADC also plans to produce seed from big spawner (such as silver carp and bighead carp), the tank size of $2m^2$ is secured. Because the production concentrates from May to August, two tanks will be installed for better efficiency of artificial spawning with multiple fish species and spawning inducement work.

[Multi-purpose incubation room]

The necessary incubation tank capacity—the tank capacity and number of tanks—is calculated based on the number of eggs for production of 2.5 million silver barb juveniles, which requires most intensive work (below table).

Table 2-5 Incubation Tank Capacity Required for Production

Production No. of Silver barb	Hatching rate (%)	Required egg No.	Spawning frequency	Required egg No./operation	Stocking density (egg/m^3)		Required volume (m3)	
					Circular tank	Incubation tank	Circular tank	Incubation tank
2,500,000	80%	3,125,000	3	1,041,667	100,000	200,000	3.76 ($1.88m^3$ x 2)	4.0 ($0.5\ m^3$ x 8)

[Tilapia hatching jar]

As shown in the table below, 12 hatching jars are needed for the production of 2.5 million all-male tilapia in six months.

Table2-6 Calculation of Necessary Tilapia Hatching Jars

Monthly required egg No.	Operation (/month)	Required egg No./operation	Egg stocking density (eggs/jar)	No. of hatching jar required
474,000	10	47,400	4,000	12

- The spawning room, multi-purpose incubation room and tilapia incubation room are separately arranged because of the different operating procedures to limit the movement of the workers for strengthening the disease prevention measures and reduce the stress to the broodstock and eggs as well as newly hatched larvae.
- 2 sets of spawning tanks are set in Spawning room. In order to improve the egg quality and to minimize the work effort, each of tank adjuncts egg collecting tank.
- In the multi-purpose incubation room, eight small tanks and two sets of 2

m^3 tanks are set. This makes it possible to control egg incubation according to the amount of eggs as well as to carry out incubation and larval rearing experiments.

- To minimize water use and to supply stabilized water, Recirculating Aquaculture System (RAS) is set in the tilapia incubation room.
- The round shaped tank is set in the spawning and multi-purpose incubation rooms in the hatchery. The deterioration of hatching rate due to the sedimentation and accumulation of eggs on the tank bed is prevented by creating the calm and steady water current in the tank.
- Hatchery has a high roof and basic exhausting fans and ceiling fans which require the easy maintenance in order to easily control the thermal environment of the rooms.

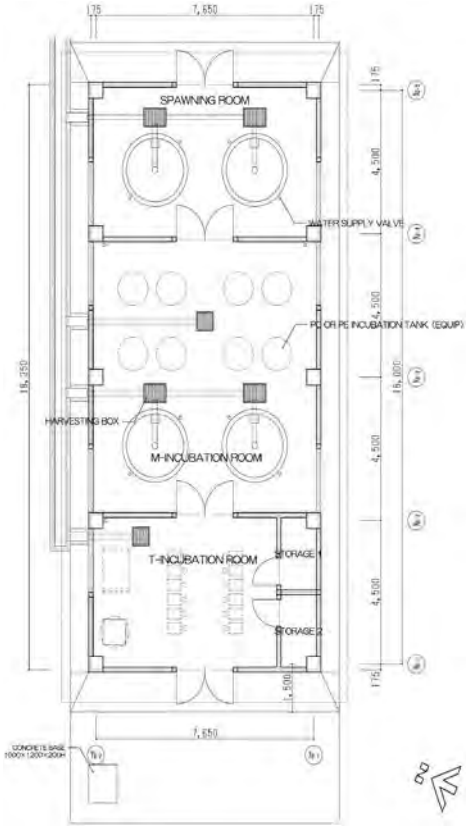


Figure 2-4 Hatchery Floor Plan

[Moina culture tank]

- 6 Moina culture tanks are set for fish species like African cat fish, which requires zooplankton at early larval stage.

  As Moina requires for seven days from inoculation to harvest, seven culture tanks are needed when the batch culture method is applied. African catfish usually begins eating feed from the third day after hatching. However, because 3- to 4-day-old larvae eat a little amount, Moina is

partially harvested from a culture tank. As the amount increases with 5- to 9-day old larvae, all Moina is taken from the culture tank with batch culture method. In this method, six tanks are needed. The production volume of Moina is controlled based on the water depth between 20 and 70cm.

- The concrete tank covered with the transparent roof is set for preventing the sudden decline of water temperature due to heavy rain. It is also covered with the shading curtain which can control the light intensity for preventing the over blooming of phytoplankton and increasing of water temperature.
- The shape of Moina culture tank is a possible structure for conducting rearing trials during the off season.

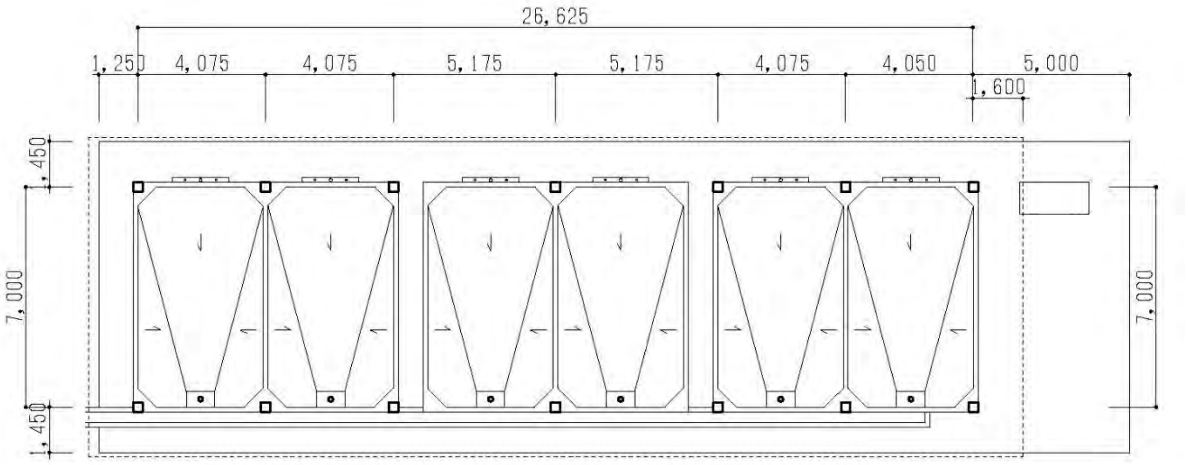


Figure 2-5 Moina Culture Tank Plan

[Tilapia larval rearing tank]

- 6 tilapia larval rearing tanks are set to produce all-male tilapia and installed next to Moina culture tank.

  This is the number of the tanks necessary for producing 2 million all-male tilapia, the NADC's annual target number, in six months and the grounds for the calculation are shown in the below table.

Table 2-7 Calculation of Tilapia Larvae Rearing Tanks

Production Target	No. of operation month	Monthly juvenile production No.	Survival rate (DAH3-)	Required larval No. (DAH 3)	Larval stocking density (inds./m^3)	Required volume (m^3)	Required tank No.
2,000,000	6	333,333	74%	450,000	3,500	129	6 (22.4m^3/tank)

- On the rearing tank, plastic shade is set to control light intensity, in order to prevent over blooming of phytoplankton as well as to prevent increasing of water temperature.
- The steroid hormone is drained into earthen pond to prevent spilled out of the steroid.

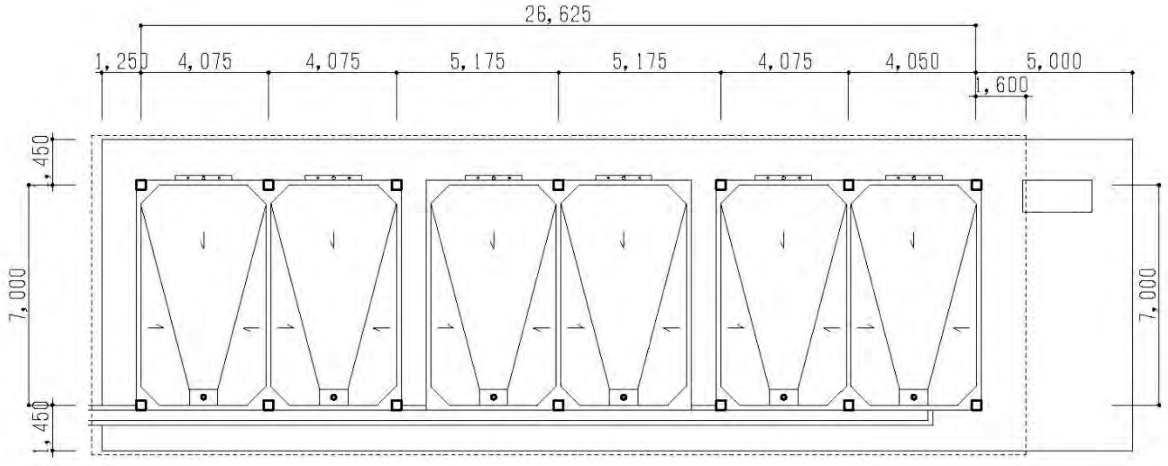


Figure 2-6 Tilapia Larval Rearing Tank Floor Plan

[Broodstock/ Nursery ponds and sedimentation pond]

The production target shown in the table below is decided through the discussions with NADC staffs.

The table is the list of the target production volume, spawning season, rainfall, and water temperature for respective fish species.

Table 2-8 Targeted Seed Production Volume and Spawning Season by Fish Species

Species		No.	Spawing season (Month)											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Silver barb	5,000,000												
2	Common carp	1,000,000												
3	Tilapia (Mono-sex)	2,000,000												
4	Grass carp	500,000												
5	Catla	500,000												
6	African catfish	500,000												
7	Sliver carp + Bighead carp	500,000												
Total		10,000,000												
Rain fall (mm, World Metrological Organiza			7.5	13.0	33.7	84.9	245.8	279.8	272.3	334.6	297.3	78.0	11.1	2.5
Min. Water Temp.(°C, NADC 2002-2003)			21.3	22.4	23.5	27.2	26.7	26.6	27.5	27.4	27.4	26.3	25.0	22.3
Max. Water Temp.(°C, NADC 2002-2003)			24.7	28.7	29.3	30.9	30.6	30.0	32.1	30.0	29.9	30.3	28.7	28.1

6 ponds are needed to achieve the above target as shown below.

Table 2-9 Required broodstock tanks to produce targeted seed number

	Species	Target production number (A)	Survival rate (%) (B)	Production No. (Juvenile/kg spawner) (C=A*B)	Annual spawning frecuency (D)	Required weight of broodstock (kg) (E=C/D*1.5)[1]	Stock density (kg/m^3) (F)	Required pond volume (m^3) (G=E/F)			Description of broodstock pond (500m^3/pond) (H=G/500)
			Target	Target				Active	Subsequent generation[2]	Total	
1	Silver barb	150,000	30	45,000	1	256	0.75	342	342	684	2
2	Common carp	1,200	70	840	18	305	0.75	407	407	814	2
3	Tilapia	100,000	35	35,000	2	33	0.25	132	132	264	2 [3]
4	Grass carp	200,000	30	60,000	1	19	0.25	77	77	154	
5	Catla	300,000	20	60,000	1	19	0.25	77	77	154	
6	African catfish	200,000	30	60,000	2	19	0.25	77	77	154	
7	Sliver carp + Big head carp	60,000	30	18,000	1	32	5.0	6	6	13	Existing pond
	Total pond number										6

[1] Required weight of broodstock =Required weight of male and female broodstock
Required weight of male broodstock= Required weight of female broodstock x 0.5
[2] As subsequent generation are to be selected when necessary, the same volume of active broodstock is planned for "Subsequent generation".
[3] Poly-culture

In Laos, July 13th is designated to be the "Day of Releasing" and the public seed producers are required to provide seeds for releasing into the irrigation dams and rivers for free by the Government. NADC plans to provide 5 million of silver barb, which is indigenous species. The releasing of seeds are carried out within one month before and after "Day of Releasing", the nursery tanks will be occupied by silver barb production for three months from early May to late July (below table). This is an essential condition for deciding the necessary nursery ponds number.

Table 2-10 Nursery Tank Operation Plan

	Species	No.	Nursery Pond Operation (Month)											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Silver barb	5,000,000					1	1	1					
2	Common carp	1,000,000		1	1	1								
3	Tilapia (Mono-sex)	2,000,000			1	1				0.5	0.5	0.5	0.5	1	1	
4	Grass carp	500,000								1	1			
5	Catla	500,000								1	1			
7	Sliver carp + Bighead carp	500,000								1	1			
6	African catfish	500,000			1	1				0.5	0.5	0.5	0.5	1	1	
	Total	10,000,000												

Silver barb requires 1.5 months for nursing, which allows two productions for the three months from May to July. Thus, 2.5 million seeds need to be produced per production. The production volume per unit capacity

of the concrete tank is estimated to be 1,000 seed/ m^3 and thus 2,500m^3 water volumes are required regularly. The capacity of a concrete tank is 500 m^3 as requested by NADC, 5 tanks (2,500m^3) are needed (below table). On the other hand, many target fishes start their spawning season in late April and early August, 1 backup pond will be constructed and thus a total of 6 nursery tanks will be newly constructed.

Table 2-11 New Nursery Tanks Required Achieving the Targeted Seed Production Volume

No.	Species	Production target (A)	No. of juvenile (45 Days old) at harvest/m3 (B)	Required volume (m3) (C=A/B)	Operation No.	Required tank No. (500m^3/tank) (E=C/D)	Main month of operation
1	Silver barb	5,000,000	1000	5,000	2	5	May-July
2	Common carp	1,000,000	1000	1,000	2	1	Feb.-April
3	Tilapia	2,000,000	1000	2,000	18	(1-4)[1]	Mar.-April, Aug.-Nov.
4	Grass carp	500,000	1000	500	1	1	Aug.-Sep.
5	Catla	500,000	1000	500	1	1	Aug.-Sep.
6	African catfish	500,000	1000	500	2	1	Aug.-Sep.
7	Sliver carp + Big head carp	500,000	1000	500		(1-2)[1]	Mar.-April, Aug.-Nov.
8	Back up tank					1	April-Aug.
	Total	10,000,000					
	Required No. of pond for busy season					6	

- The necessary pond volume is designed based on the fish rearing density in accordance with the amount for target seed production number.
- 12 tanks (approx. 500m^3/tank) are designed considering the request from NADC staffs from workability.
- The Sedimentation tank is planned with 4 small inner tanks to make the suspended solid (SS) to be settled.

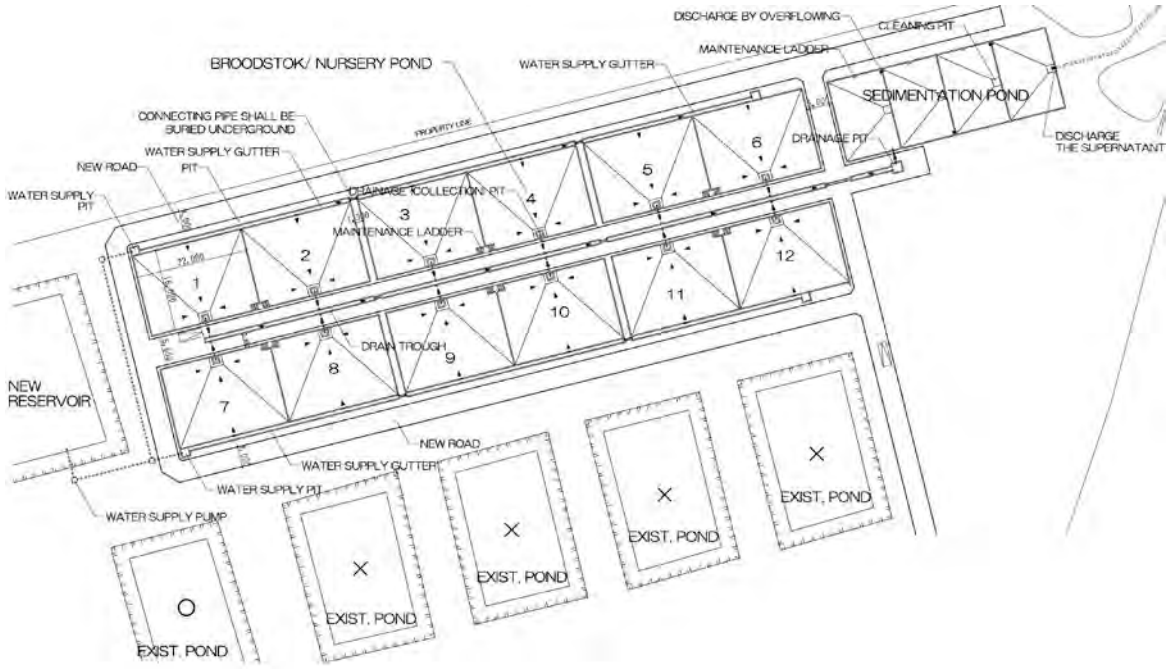


Figure 2-7 Broodstock/ Nursery Pond Floor Plan

[Auxiliary facilities]

- The elevated water tank, water receiving tank and septic tank attached to the office/ training building and dormitory are planned.
- The Sedimentation pond of excavation without timbering is planned for the drainage of wastewater covering the existing facilities for aquaculture. The function of Sedimentation tank is strengthened by reconstructing the existing Sedimentation tank by excavation and leveling.

iii) Table of planned floor area

Table 2-12 Floor area of main facilities

Building	Department	Room	No. of Rooms	Area per Room(m^2)	Total Area (m^2)
New Office/ Training	Office	Office	1	101.82	101.82
		Conference Room (L)	1	52.81	52.81
		Conference Room (S)	1	34.64	34.64
		Director's Room	1	18.85	18.85
		Deputy Director's Room	2	10.40	20.80
		Reception	1	19.26	19.26
	Training	Training Room	1	101.82	101.82
		Library	1	34.64	34.64
		Exhibition	1	11.10	11.10
		Preparation Room	1	12.81	12.81
	Common Area	Entrance Hall	1	23.10	23.10
		Pantry	2	6.28	12.56
		Toilet	4	12.02	48.08
		Storage	4	-	32.13
		Corridor	-	-	134.28
				Total	**658.70**
New Dormitory	Student Dormitory	Dormitory	8	10.89	87.12
		Toilet	2	10.89	21.78
		Kitchen/Day Room	2	35.97	71.94
		Corridor	1	8.25	8.25
	Trainee Dormitory	Dormitory	20	10.89	217.80
		Kitchen	2	10.89	21.78
		Day Room	2	35.97	71.94
		Toilet	2	20.13	40.26
		Corridor	4	16.50	66.00
	Officer Dormitory	Dormitory	3	-	63.03
		Dining/ Kitchen	1	16.50	16.50
	Common Area	Lounge	1	48.45	48.45
		Entrance Hall	2	29.00	58.00
		Laundry	1	16.33	16.33
		Shower	2	10.89	21.78
		Storage	1	10.89	10.89
		Corridor	-	-	37.31
				Sub Total	**879.16**

Hatchery		Spawning Room	1	38.80	38.80
		M-Incubation Room	1	69.20	69.20
		T-Incubation Room	1	32.01	32.01
		Storage	2	-	6.79
				Sub Total	**146.80**
Moina Culture Tank (w/ roof)		Tank	6	29.67	**178.02**
Elevated Water Tank		Elevated Water Tank	4		**64.33**
				Total 1	**1,927.01**
Tilapia Larval Rearing Tank (w/o roof)		Tank	6	29.67	**178.02**
Broodstock/ Nursery Pond		Tank	12	359.64	**4,315.68**
Sedimentation Pond		Tank	1	719.28	**719.28**
				Total 2	**5,212.98**

2) Cross Section Plan

- The appearance of main buildings of the office/ training building and dormitory are specially designed for the roof with inclination following the Laostradition. The standard cross section figure is as follows.
- The ground floor of the office/ training building and dormitory is 500 mm high from the ground level to prevent the flood by the heavy rain. The porch including the outside stairs to be covered with the large roof is set at each entrance.
- The rooms with natural ventilation have a high roof to secure air volume in the room. The office/ training building is basically air conditioned and the dormitory is by the natural ventilation.
- The height of story for each building is determined by the following ceiling height.
  - The ceiling height of the air conditioned rooms is 3 m or 2.7 m.
  - The ceiling height of roof is 2.7 m at the dormitory accounting the space for setting of ceiling fan.
  - The ceiling height of corridor is 3 m considering the natural ventilation (transom above the door at the rooms for dormitory is set with louver to take the outside air through the non-air conditioned rooms).
- The administration and training office building and the dormitory are located in parallel. It is planned that 2 facilities are unified in the cross section structure and highlighted with entire facilities.
- The background of roof is made of fiber cement board instead of ply wood to reduce the heat of sunshine to the attic and to avoid termite damage. Louver is also set at attic for sufficient ventilation.

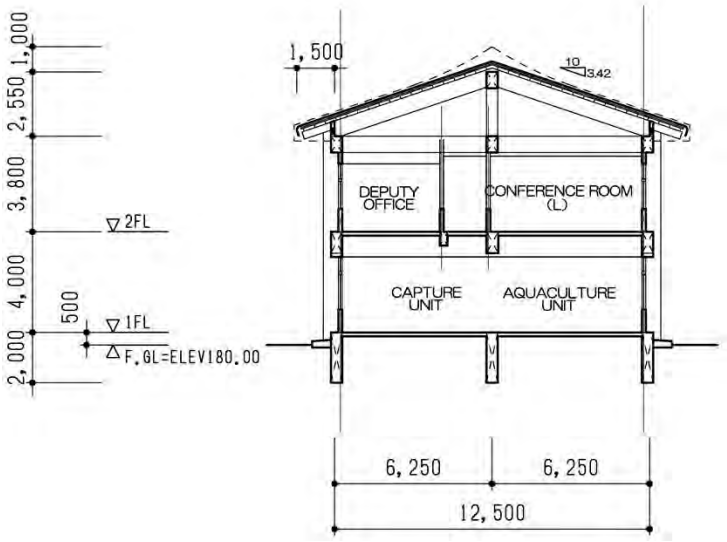


Figure 2-8 Section (Standard)

3) Structural plan

i) Structural planning conditions

- Earthquake: Laos is located far from the circum-Pacific earthquake belt. No report on the damage by earthquake is found.
- Typhoon: No report on the damage by typhoon is found but it has a heavy rain with strong wind in the rainy season.
- Soil condition: The ground in the site is currently sloping north-ward from the southern part. 7-8m of sandy clay 1 m or so down from the surface is found at the site from southern part to central part according to 4 points of boring survey. N value varies from 5 to 22.
- The water level at the site from southern part to central part is GL-4.5-4.6m but the ground water level is higher of GL-0.14-1.8 m at the northern part of site.

ii) Structural plans

- Type of structure: The main construction is reinforced concrete considering the easy procurement of materials in Laos, costs and experiences. However, the roofing frame covering the Moina culture tank is steel structure.
- Structural frame : Because of no earthquake in Laos reinforced concrete frame is basically planned without any concrete shear wall.

iii) Foundation plans

- The buildings are planned for two-story, one-story and water tank. Since axial force to the column is not so large accounting the building scale, direct foundation is planned.
- Ground water level: water level of the bore hole measured during the boring survey is GL-4.5 - 4.6m near the building. No affection of ground water is considered during the construction and after the completion.

- Water level of the bore hole is higher value of GL-0.14～1.8m at the lowest ground level where the broodstock, nursery and Sedimentation ponds are planned. The ground water is assumed as the leaked water from the existing ponds. So, the excavation work may start after emptying the water at existing ponds.
- The N-value of the construction site for broodstock, nursery and Sedimentation tanks on the northern side of the premises is around 2 to 3 at the foundation level. It is low and fragile as supporting soil. Thus, ground improvement work is performed up to 2 meters below the fragile foundation level.

iv) Design load

- Earthquake load: No report of past earthquake is found. Main structural frame, excluding the brick wall, is designed against the middle and small scale of earthquake following Japanese Building Code. The base shear factor is set 0.05 (1/4 of design seismic force in Japan) considering horizontal seismic factor of 0.02 recommended by the Ministry of Agriculture and Forestry.
- Wind load: Although no typhoon damage record is found, the main structural frame, excluding the brick wall, is designed in accordance with the Japanese Building Code. The V0 is 30m and terrain flatness is categorized to be II.
- Construction load: the load is mentioned in the table below referring to the Japan Building Code and its regulation.

Table 2-13 Major Live Loads

Room	Live Load (N/m^2)			Remarks
	For Slab	For Frame	For Earthquake	
Office, Conference Room	2900	1800	800	
Dormitory	1800	1300	600	
Storage	7800	6900	4900	
Hatchery	4900	3900	2500	

Source: Japan's Building Standards Act, etc.

v) Construction materials

- Concrete: The procurement of ready mixed concrete is possible near the site. The concrete batching plant need not be planned.
- Reinforcing bar: deformed bar SD295A of JIS for D10-D16 and SD390 of JIS for D20-D25 are used because of possible procurement in Laos.
- Iron flame: SS400 of JIS for iron flame possible for procurement in Laos is used.

4) Electrical and Mechanical Facilities Plan

4)-1 Plan for electrical facilities

i) Lead of electric power

- 22KV power distribution line of the power company is available at the eastern part of the road. The transformer is set on the pole with the nearest line and to lower the power to 380V/ 220V to lead it to the administration/training office building.
- The Laotian side leads the power to the first electric pole in the site and after that Japan side bears other works including the set of transformer.
- The power leads to only the buildings newly constructed excluding the existing buildings.

ii) Emergency power generator facilities

- Because power outage occurs frequently in the target site, a 50kVA emergency power generator is planned to be installed to enable continued seed production operation even under power outage.

iii) Main power line and power facilities

- The power of 380V/ 220V is distributed to the necessary power points from the office/ training building through the power distribution panel

iv) Lighting and outlet facilities

- The illuminance for each room is planned to be set based on the minimum standard of JIS. The fluorescent light is used for easier change at low costs.
- The power outlet is set at the appropriate places
- The emergency lights and guide lights are set mainly at corridor and the door way in the office/ training building and dormitory.

v) Communications facilities

- The phone facilities are equipped in the office/training building and the receivers are mainly set at each office room.
- The outlet and piping for LAN for future run is equipped mainly in the office rooms in office/ training building.
- The communication facilities are equipped only in the new buildings excluding the existing buildings.

vi) Fire prevention facilities

- The emergency alarm is equipped as the minimum equipment following the standard set in the fire code in Laos which came into effect in 2007.

vii) Lightening prevention facilities

- The lightning is very often in Laos and the lightning rod is set on the building of the elevated water tank to prevent the lightning.

4)-2 Plan for mechanical facilities

i) Water supply facilities

- The water is supplied from the new digging wells. 2 wells dug for comparison of water quality and the well with better water quality is used.
- The water is pumped up from the water receiving tank to the elevated tank and is distributed to the necessary places at the office/training building and dormitory by gravity.
- The water receiving tank in concrete made is constructed instead of using FRP made because of the difficult procurement. The elevated water tank of stainless made which is popular in Laos is used coupling two tanks.
- The water is supplied to the new hatchery, Moina culture tank and tilapia larval raring tank from the existing water supply piping system.
- The supply of water in The Project is only to the new buildings and not to the existing buildings.

ii) Sewage and drainage facilities

- The sewage water and other waste water born at the office/training building and dormitory is merged to first pit outside the building and sloped to the septic tank.
- The rain water is left to be penetrated naturally.
- The drainage is only for new buildings and not for existing buildings.

iii) Hot water facilities

- The facilities for hot water service are not planned.

iv) Toilet facilities

- The lavatory is equipped with the sanitary goods such as toilet pan, basin and sink.
- The toilet pan is planned a hand shower.
- The toilet pan is Asian style. The washing of toilet pan is low tank type.

v) Fire protection facilities

- The fire code does not state any concrete standards for installation of fire protection equipment but the fire extinguishers are equipped in this project for easier maintenance at the site as minimum fire extinction. The installation standard of Japan Fire Code is applied.
- These facilities are set only in the new buildings under the Project.

vi) Septic Tank

- The septic tank is set to deal with the domestic waste water. The capacity is for 46 persons. The facilities are planned following the Japan standard for septic tank.
- The sewage is once kept at balance tank and pumped up to follow into settlement and separation tank. The sewage passes through contact aeration tank and disinfection tank for treatment.
- Treated water is eventually discharged into a drainage on the west side of the dormitory building.

vii) Air conditioning facilities

- The air cooling packaged air conditioner is set at the office rooms and conference rooms for air conditioning.

viii) Ventilation facilities

- The ventilation facilities are set at toilets, shower rooms, storage, and machine room and etc. .
- The ventilation is basically natural intake and machine exhaust type.
- The ceiling fan is set at the rooms not air conditioned.

5) Plan for construction materials

The main construction materials are generally used in Laos for future maintenance by themselves. The following are the exterior and interior finishing.

Table 2-14 Exterior Finish

Part	Finish
Roof	Reinforced Concrete Gable Beam, Steel Purlin (Frame), Fiber Cement Board, Asphalt Roofing, Cement Roof Tiles
Exterior Wall	Mortar Trowel finish, Synthetic Resin Emulsion Paint (G-EP)
Exterior Doors & Windows	Colored aluminum sash

Table 2-15 Interior Finish

Type of Rooms	Finish			
	Floor	Baseboard	Wall	Ceiling
Entrance Hall	Non-slip Porcelain Tile	Porcelain Tile	Emulsion Paint	Emulsion Paint
Office, Conference, etc.	Same as above	Same as above	Same as above	T-bar Rockwool Acoustic Board
Dormitory, Day Room, etc.	Same as above	Same as above	Same as above	Emulsion Paint
Shower Room	Same as above	Same as above	Same as above	Emulsion Paint
Corridor, Stairs	Same as above	Same as above	Same as above	Emulsion Paint
Hatchery: each room	Concrete; mortar trowel finish	―	Same as above	Exposed
Elevated Water Tank	Same as above	Same as above	Same as above	Exposed
Concrete Tanks (Moina Culture Tank, Tilapia Larval Rearing Tank)	Same as above	―	Concrete; mortar trowel finish	―

2-2-2-2 Plan for Equipment

(1) Basic policy for Equipment plan

The final requested equipment after the site survey is evaluated on the

following criteria in the domestic analysis.

i) Consistency with the activities of objected organization
   It is evaluate if the requested equipment is really needed at the objected organization.
ii) Consistency with the personnel at the objected organization
   It is evaluated if the personnel to use the requested equipment are posted appropriately at the objected organization.
iii) Consistency with the budget for management at the objected organizations
   It is evaluated if the budget for management the requested equipment is secured at the objected organizations.
iv) Overlap with other equipment
   It is evaluated whether the requested equipment is overlapped or not.
v) Consistency with the management and maintenance system at the objected organization
   It is evaluated if the personnel posted for the management and maintenance of requested equipment and its personnel system are arranged.
vi) Possibility of conversion to other purposes
   It is evaluated if the requested equipment is possible to be converted to any purposes other than original purposes.
vii) Consistency with the installation places and storing places
   It is evaluated if there are any proper places for installation and storing the requested equipment.

The above subjects are evaluated in 3 grades.

[Evaluation standard]

A: no problem

B: appropriate but some fears exist

C: many points for fear exist

The overall evaluation result is rated “C” when there is one or more “C” or more than two “B”s out of seven criteria.

The overall evaluation result is rated “B” when there are two “B”s out of seven criteria.

The overall evaluation result is rated “A” when there is one or no “B” and no “C” out of seven criteria.

The equipment evaluated as “A” and “B” is included in the plan and “C” is excluded from the plan. The evaluation results for each piece of equipment are as follows.

Table 2-16 Evaluation results for each requested equipment

No.	Equipment	Q'ty	Unit	Evaluation items								Planed Equipment No.
				①	②	③	④	⑤	⑥	⑦	Overall	
1-1	Copy Machine	2	Units	A	A	A	B	A	A	A	A	1
1-2	Desktop PC	10	Units	A	A	A	A	A	A	A	A	2
1-3	Scanner	1	Unit	A	A	A	A	A	A	A	A	3
1-4	Lap Top PC	6	Units	A	A	A	A	A	A	A	A	4
1-5	Printer	8	Units	A	A	A	B	A	A	A	A	5
2-1	Bed	1	Set	A	A	A	A	A	A	A	A	107
2-2	Locker	1	Set	A	A	A	A	A	A	A	A	108
2-3	Desk & Chair	1	Set	A	A	A	A	A	A	A	A	109
3-1	Bed	1	Set	A	A	A	A	A	A	A	A	107
3-2	Locker	1	Set	A	A	A	A	A	A	A	A	108
3-3	Desk & Chair	1	Set	A	A	A	A	A	A	A	A	109
4-1	Bed	1	Set	A	A	A	A	A	A	A	A	107
4-2	Locker	1	Set	A	A	A	A	A	A	A	A	108
4-3	Desk & Chair	1	Set	A	A	A	A	A	A	A	A	109
5-1	Generator	1	Unit	A	A	A	A	A	A	A	A	6
5-2	Codeless Drill	1	Unit	A	A	A	A	A	A	A	A	7
5-3	Electric Drill	1	Unit	A	A	A	A	A	A	A	A	8
5-4	Electric Saw	1	Unit	A	A	A	A	A	A	A	A	9
5-5	Air Steprer/w Air Compressor	1	Unit	A	A	A	A	A	A	A	A	10
5-6	Submergeble Pump	1	Unit	A	A	A	A	A	A	A	A	11
5-7	High Pressure (jet) Washer	1	Unit	A	A	A	A	A	A	A	A	12
5-8	Sawing Machine	1	Unit	A	A	A	A	A	A	A	A	13
5-9	Tool Set	1	Unit	A	A	A	A	A	A	A	A	14
5-10	Moving Machine	2	Units	A	A	A	A	A	A	A	A	15
5-11	Disk Cutter	1	Unit	A	A	A	A	A	A	A	A	16
6-1	Mill	1	Unit	A	A	A	A	A	A	A	A	17
6-2	Mixer	1	Unit	A	A	A	A	A	A	A	A	18
6-3	Pellet Mill	1	Unit	A	A	A	A	A	A	A	A	19
6-4	Freezer	1	Unit	A	A	A	A	A	A	A	A	20
6-5	Scale	1	Unit	A	A	A	A	A	A	A	A	21
7-1	Aquaculture Recirculating Syatem for Egg Incubation	1	Set	A	A	A	A	A	A	A	A	22
7-2	Egg incubation system 1	1	Set	A	A	A	A	A	A	A	A	23
7-3	Egg incubation system 2	1	Set	A	A	A	A	A	A	A	A	24
7-4	Spawning Unit	1	Set	A	A	A	A	A	A	A	A	25
7-5	Water Supply System	1	Set	A	A	A	A	A	A	A	A	26
7-6	Aeration System	1	Set	A	A	A	A	A	A	A	A	27
7-7	Generator	1	Unit	A	A	A	A	A	A	A	A	-
7-8	Engine Pump (disel)	1	Unit	A	A	A	A	A	A	A	A	28
7-9	Plankton Net for zooplankton sampling	30	m	A	A	A	A	A	A	A	A	29
7-10	Plankton Net for Egg Collection in Pond	50	m	A	A	A	A	A	A	A	A	30
7-11	Nyron Net	1	Rool	A	A	A	A	A	A	A	A	31
7-12	Nyron Net	1	Roll	A	A	A	A	A	A	A	A	32
7-13	Material for Mosquito Net	1	Roll	A	A	A	A	A	A	A	A	33
7-14	Syringe/w needle	3	Box	A	A	A	A	A	A	A	A	34
7-15	Dissection Tool Set	1	Set	A	A	A	A	A	A	A	A	35
8-1	Live Fish Tank for Transportation	1	Unit	A	A	A	A	A	A	A	A	36
8-2	Scien Net	1	Pc.	A	A	A	A	A	A	A	A	37
8-3	Tag Reader	1	Unit	A	A	A	A	A	A	A	A	38
8-3	O2 Cylinder/w Regulator	1	Set	A	A	B	A	B	A	A	A	39
9-1	Scien Net	1	Pc.	A	A	A	A	A	A	A	A	37

10-1	Four Wheel Car for Field Survey	1	Unit	A	A	A	C	A	B	A	C	×
10-2	Tractor/w Moving Cutter	1	Unit	A	A	A	A	A	A	A	A	40
10-3	Truck	1	Unit	A	A	A	A	A	A	A	A	41
11-1	GPS	1	Unit	A	A	A	A	A	A	A	A	42
11-2	Echo Sounder	1	Unit	A	A	A	A	A	A	A	A	43
11-3	Balance	1	Unit	A	A	A	A	A	A	A	A	44
11-4	PC	1	Unit	A	A	A	A	A	A	A	A	2
11-5	Printer	1	Unit	A	A	A	A	A	A	A	A	5
12-1	Mini Bus	1	Unit	A	A	A	A	A	A	A	A	45
12-2	LCD Projector	1	Unit	A	A	A	A	A	A	A	A	46
12-3	DVD/VCD Player	1	Unit	A	A	A	A	A	A	A	A	47
12-4	Library Furniture	1	Set	A	A	A	A	A	A	A	A	48
12-5	E/library System	1	Set	A	A	A	A	A	A	A	A	49 etc.
12-6	Server	1	Unit	A	A	A	A	A	A	A	A	49
12-7	Lap Top PC	1	Unit	A	A	A	A	A	A	A	A	4
12-8	PC Set	1	Set	A	A	A	A	A	A	A	A	2
13-1	Autoclave	1	Unit	A	A	A	A	A	A	A	A	50
13-2	Pipette Washer	1	Unit	A	A	A	A	A	A	A	A	51
13-3	Table Top Centrifuge	1	Unit	A	A	A	A	A	A	A	A	79
13-4	Incubator	1	Unit	A	A	A	A	A	A	A	A	52
13-5	DO Meter	1	Unit	A	A	A	A	A	A	A	A	53
13-6	pH Meter	1	Unit	A	A	A	A	A	A	A	A	54
13-7	Electric Balance	1	Unit	A	A	A	A	A	A	A	A	55
13-8	Thermometer	1	Pc.	A	A	A	A	A	A	A	A	56
13-9	Water Distillation Apparatus	1	Unit	A	A	A	A	A	A	A	A	57
13-10	Scale	1	Unit	A	A	A	A	A	A	A	A	21
13-11	Precision Balance	1	Unit	A	A	A	A	A	A	A	A	58
13-12	Heat Cutter Set	1	Unit	A	A	A	A	A	A	A	A	59
13-14	Micro crucible	1	Set	A	A	A	A	A	A	A	A	60
13-15	Crude Lipid analsis system	1	Set	A	A	A	A	A	A	A	A	61
13-16	Freezer	1	Unit	A	A	A	A	A	A	A	A	62
13-17	Crude Protein Tester	1	Set	A	A	A	A	A	A	A	A	63
13-18	Hazard Residue Tester	1	Set	A	A	A	A	A	A	A	A	64
14-1	Dissection Tool Set	2	Sets	A	A	A	A	A	A	A	A	35
14-2	Microscope/w Camera	1	Unit	A	A	A	A	A	A	A	A	65
15-1	Ammonium Test Kit	1	Set	A	A	A	A	A	A	A	A	66
15-2	Nitrous Acid Test Kit	1	Set	A	A	A	A	A	A	A	A	67
15-3	Nitrate Test Kit	1	Set	A	A	A	A	A	A	A	A	68
15-4	Alkalinity Test Kit	1	Set	A	A	A	A	A	A	A	A	69
15-5	Trbidimeter	1	Unit	A	A	A	A	A	A	A	A	70
15-6	Digital Balance	1	Unit	A	A	A	A	A	A	A	A	71
15-7	Zooplankton Counting Chamber with Iron Frame	1	Pc.	A	A	A	A	A	A	A	A	82
15-8	DO Test Kit	5	Sets	A	A	A	A	A	A	A	A	72
15-9	pH Meter	1	Unit	A	A	A	A	A	A	A	A	54
15-10	Portable pH Meter	2	Units	A	A	A	A	A	A	A	A	73
15-11	DO Meter	1	Unit	A	A	A	A	A	A	A	A	53
15-12	BOD Meter	1	Unit	A	A	A	A	A	A	A	A	97
15-13	COD Meter	1	Unit	A	A	A	A	A	A	A	A	96
16-1	Shelves for Specimen Stock	1	Set	A	A	A	A	A	A	A	A	74
16-2	Specimen Bottles	1	Set	A	A	A	A	A	A	A	A	75
16-3	Microscope/w Camera	1	Unit	A	A	A	A	A	A	A	A	65
LA-1	DO meter	3	Units	A	A	A	A	A	A	A	A	53
LA-2	DO test kit	12	Sets	A	A	B	A	A	A	A	A	72

LA-3	Handy pH meter	3	Units	A	A	A	A	A	A	A	A	76
LA-4	Thermometer	5	Pcs.	A	A	A	A	A	A	A	A	56
LA-5	Ammonium test kit	12	Sets	A	A	B	A	A	A	A	A	67
LA-6	Nitrous acid test kit	12	Sets	A	A	B	A	A	A	A	A	68
LA-7	Nitrate test kit	12	Sets	A	A	B	A	A	A	A	A	66
LA-8	Alkalinity test kit	12	Sets	A	A	B	A	A	A	A	A	69
LA-9	Saline meter	2	Units	A	A	A	A	A	A	A	A	77
LA-10	Water Sampling Bottle	50	Pcs.	A	A	A	A	A	A	A	A	78
LA-11	Digital balance	1	Unit	A	A	A	A	A	A	A	A	55
LA-12	Centrifuge	1	Unit	A	A	A	A	A	A	A	A	79
LA-13	Plankton net	2	Sets	A	A	A	A	A	A	A	A	80
LA-14	Hemocytometer	2	Pcs.	A	A	A	A	A	A	A	A	81
LA-15	Zooplankton counting chamber	2	Pcs.	A	A	A	A	A	A	A	A	82
LA-16	Komagome pipette with silicon nipple	60	Pcs.	A	A	A	A	A	A	A	A	83
LA-17	Kjeldahl distillation unit	1	Set	A	B	B	A	A	A	A	A	63
LA-18	Soxhlet extractor	1	Set	A	B	B	A	A	A	A	A	61
LA-19	Fiber Analyzing Equipment Set	1	Set	A	B	B	A	A	A	A	A	84
LA-20	Ash Analyzing Equipment Set	1	Set	A	B	A	A	A	A	A	A	85
LA-21	Recirculating aspirator	1	Unit	A	A	A	A	A	A	A	A	86
LA-22	Dissection tools	2	Sets	A	A	A	A	A	A	A	A	35
LA-23	Digital camera with ring type speed light	1	Unit	A	A	A	A	A	A	A	A	100
LA-24	Notebook type PC	1	Unit	A	A	A	A	A	A	A	A	4
LA-25	Desktop PC	1	Unit	A	A	A	A	A	A	A	A	2
LA-26	DNA PCR analyzer	1	Set	B	B	B	A	B	A	A	C	×
LA-27	Filter System	2	Sets	A	A	A	A	A	A	A	A	26
LA-28	Electric Balance	2	Units	A	A	A	A	A	A	A	A	58
LA-29	Freezing Bottle for Sperm Stock	1	Set	A	A	A	A	A	A	A	A	87
LA-30	Water Mill	5	Units	A	A	A	A	A	A	A	A	88
LA-31	Compacter	2	Units	A	A	A	A	A	A	A	A	89
LA-32	Scien Net	3	Pcs.	A	A	A	A	A	A	A	A	37
LA-33	Aquarium	54	Pcs.	A	A	A	A	A	A	A	A	90
LF-01	Biological microscope	1	Unit	A	A	A	A	A	A	A	A	91
LF-02	Stereoscopic microscope	1	Unit	A	A	A	A	A	A	A	A	92
LF-03	TV Camera for Microscope	1	Unit	A	A	A	A	A	A	A	A	93
LF-04	Hemocytometer	2	Pcs.	A	A	A	A	A	A	A	A	81
LF-05	Zooplankton counting chamber	2	Pcs.	A	A	A	A	A	A	A	A	82
LF-06	Komagome pipette with silicon nipple	60	Pcs.	A	A	A	A	A	A	A	A	83
LF-07	Plankton net	1	Pc.	A	A	A	A	A	A	A	A	80
LF-08	Dissection tools	1	Set	A	A	A	A	A	A	A	A	35
LF-09	Sechi disk	1	Pc.	A	A	A	A	A	A	A	A	103
LF-10	Stop watch	1	Unit	A	A	A	A	A	A	A	A	94
LF-11	Flow meter	1	Unit	A	A	A	A	A	A	A	A	95

LF-12	GPS	1	Unit	A	A	A	A	A	A	A	A	42
LF-13	Thermometer	5	Pcs.	A	A	A	A	A	A	A	A	56
LF-14	Handy pH meter	2	Units	A	A	A	A	A	A	A	A	54
LF-15	Portable DO meter	1	Unit	A	A	A	A	A	A	A	A	53
LF-16	COD analyzer	1	Unit	A	A	A	A	A	A	A	A	96
LF-17	BOD analyzer	1	Unit	A	A	A	A	A	A	A	A	97
LF-18	Ammonium test kit	12	Sets	A	A	B	A	A	A	A	A	66
LF-19	Phosphorus meter	1	Unit	A	A	A	A	A	A	A	A	98
LF-20	Nitrogen test meter	1	Unit	A	A	A	A	A	A	A	A	98
LF-21	Digital balance	1	Unit	A	A	A	A	A	A	A	A	55
LF-22	Centrifuge	1	Unit	A	A	A	A	A	A	A	A	79
LF-23	Notebook PC	1	Unit	A	A	A	A	A	A	A	A	4
LF-24	Ekman-Birge grab	1	Unit	A	A	A	A	A	A	A	A	99
LF-25	Digital camera with ring speed light	1	Unit	A	A	A	A	A	A	A	A	100
LF-26	Desktop PC	1	Unit	A	A	A	A	A	A	A	A	2
LF-27	Sieves Set	1	Set	A	A	A	A	A	A	A	A	101
LF-28	Sample Bottle	20	Pcs.	A	A	A	A	A	A	A	A	102

As explained in the above table, the requested equipment is evaluated as appropriate but the following 2 items are evaluated “C” of overall evaluation result. The reasons of those two items are as follows:

[Equipment to be excluded in the Project]

i) Request No. 10-1 four-wheel drive car

NADC has currently several four-wheel drive cars supplied by Japan. It is not so necessary to include this item in the project.

ii) Request No. LA-26 PCR

This equipment has no records in the past at LARReC. The high technique is required for its operation but no personnel are posted for possible operation. The action plan showing its necessity is not presented. Since the proper use of this equipment is not secured, it is not evaluated as appropriate.

(2) Equipment in the Project

The equipment is selected in the Project based on the above evaluation result. The generators are planned as the equipment for facilities considering the scramble among the facilities.

The requested equipment is put together at each section but the same equipment requested separately from each section is unified and arranged as the list of equipment in the Project.

The main equipment in the Project is as follows.

Table2-17 Main Equipment

No.	Equipment	Major Specification and Composition	Unit	Intended Purpose
18	Mixer	Capacity: 250L or more Speed：40rpm or more Motor power：Approx. 0.75kW	1	To stir aquaculture feed materials
19	Pellet Machine	Capacity: 80kg/h or more Size of Pellet: 4~6mm(φ) or wider Power source : Approx. 4kW	1	To granulate aquaculture feed materials
22	Recirculating Aquaculture System for tilapia egg incubation	Composition: Honeycomb filiter, Biological filter, Rapid filter, Flow meter	1	To remove suspended matters from water for Tilapia egg incubation
23	Egg incubation system for tilapia egg	Hatching jar, Tilapia larval stock tank, Trestle table, Transparent plastic hose Air stone, PVC materials	1	To efficiently conduct Tilapia egg incubation
24	Egg incubation system for buoyant egg	Composition: Polycarbonate incubation tank,Polyethylene incubation tank, Filter materials for incubation tanks, FRP incubation tank	1	To efficiently conduct buoyant egg incubation
25	Spawning Unit	Composition: Egg collection Net, Frame for Egg collection net, Filter Net for drain	1	To improve conditions of the spawning room
26	Water Supply System	Capacity: 5m3/h or more Material of outer: Resistance to climatic conditions of outside Filter element: Anthracite or sand Valve manipulation: Manual Stainless pipe: 10m or longer Switch panel: Earth Leakage Circuit Breaker, Alarm for no water supply	3	To filter crude water for egg generation
38	Tag Reader	Type: Water proof handy type Operational Frequency: Approx. 130kHz Max. Read distance: 10mm or more Display: LCD or equivalent Power Source: Battery	1	To individually mark and manage each spawner
40	Tractor	Power：15 kW or more Engine:Liquid cooled 3 cylinder Displacement：1,300cc or more Capacity of Tank:28 litter or more Fuel：Diesel Max. Speed：18 km/h	1	To fix the pond and transfer spawners and juveniles within NADC territory
41	Truck	Lording Capacity：1500 kg or more Engine type：Diesel 4 Cycle 4 cylinder in-line Displacement：Approx. 4000cc Type of drive：5-speed Manual Max. output：110 kW or more Transmission：4 speed or more Steering：Recirculating ball with hydraulic booster Wheels and Tires：6 with 1 spare tire Fuel tank：100 litter or more Handle：Left Air conditioner：Equipped	1	To transfer eggs and equipments
45	Mini Bus	No. of seat：30 or more Engine：4 cycle or more Displacement：4,000 cc or more Max. output：90 kW or more Rear drive：Rear-wheel drive Type of driving：4-speed Automatic Steering：Power steering Capacity of tank：100 litter or more Fuel：Gasoline	1	To transfer staffs and interns
61	Crude Lipid analsis system	Composition: Soxhlet extractor for crude lipid analysis, Draft chamber, Dry heat sterilizer, Desiccator	2	To analyze feed components
63	Crude Protein Tester	Composition: Kjeldahl block digesters, Kjeldahl distillation system, Auto bullet for manual titration, Bottle top dispenser	2	To analyze feed components
84	Fiber Analyzing Equipment Set	Analytical method: Filter bag method or equivalent Analytical range: 0-100% Analytical accuracy: 0.1% or less Capacity of sample: 3g or less Capability of treating: 6samples/time or more	1	To analyze feed components
105	Water Pump	Bore：125 ~ 150 mm Capacity：Max. 3.5 m3/min. or more Head：Max. 42 m Power：11 kW or more	3	To supply water for concrete aquarium

All planned equipment is shown in the following Table.

Table2-18 Planned Equipment

Code No.	Equipment	Allocation									Q'ty	Unit
		NADC							LARReC			
		New Office/Training Building Office Rooms	New Dormitory Building	Existing Building	New Office/Training Building Storage	New Office/Training Building Training Room	New Office/Training Building Library	Existing Laboratory	Aquaculture Research Unit Laboratory	Fishery Research Unit Laboratory		
1	Copy Machine	2					1				3	sets
2	Desk Top Computer Set	11				1	3		1	1	17	sets
3	Image scanner	1									1	set
4	Notebook computer	6				1			1	1	9	sets
5	Printer	9									9	sets
6	Generator			1							1	set
7	Codeless Drill			1							1	set
8	Drilling machine			1							1	set
9	Electric Saw			1							1	set
10	Air Steprer			1							1	set
11	Submersible pump			1							1	set
12	High Pressure (jet) Washer			1							1	set
13	Sawing Machine			1							1	set
14	Tool Set			1							1	set
15	Moving Machine			2							2	sets
16	Disk Cutter			1							1	set
17	Mill			1							1	set
18	Mixer			1							1	set
19	Pellet Machine			1							1	set
20	Freezer			1							1	set
21	Scale			1				1			2	sets
22	Recirculating Aquaculture System for tilapia egg incubation			1							1	set
23	Egg incubation system for tilapia egg			1							1	set
24	Egg incubation system for buoyant egg			1							1	set
25	Spawning Unit			1							1	set
26	Water Supply System			1					2		3	sets
27	Air Blowing System			1							1	set
28	Engine Pump			1							1	set
29	Plankton Net			1							1	set
30	Plankton Net for Egg Collection in Pond			1							1	set
31	Polyester net for spawner and juvenile			1							1	set
32	Polyester net for prevention of insect, for scoop net preparation			1							1	set
33	Mosquito net			1							1	set
34	Syringe/w needle			3							3	sets
35	Dissection Tool Set			1				2	2	1	6	sets
36	Live Fish Tank for Transportation			1							1	set
37	Scien Net			2					3		5	sets
38	Tag Reader			1							1	set
39	O2 Cylinder/w Regulator			1							1	set
40	Tractor			1							1	set
41	Truck			1							1	set
42	GPS				1					1	2	sets
43	Echo Sounder				1						1	set
44	Balance				1						1	set
45	Mini Bus					1					1	set
46	LCD Projector					1					1	set

Code No.	Equipment	Allocation									Q'ty	Unit
		NADC							LARReC			
		New Office/Training Building Office Rooms	New Dormitory Building	Existing Building	New Office/Training Building Storage	New Office/Training Building Training Room	New Office/Training Building Library	Existing Laboratory	Aquaculture Research Unit Laboratory	Fishery Research Unit Laboratory		
47	DVD/VCD Player					1					1	set
48	Library Furniture						1				1	set
49	Server					1	1				2	sets
50	Autoclave							1			1	set
51	Pipette Washer							1			1	set
52	Incubator							1			1	set
53	DO Meter							2	3	1	6	sets
54	pH Meter							2		2	4	sets
55	Electric Balance							1	1	1	3	sets
56	Thermometer							1	5	5	11	sets
57	Water Distillation Apparatus							1			1	set
58	Precision Balance							1	2		3	sets
59	Heat Cutter							1			1	set
60	Micro crucible							1			1	set
61	Crude Lipid analsis system							1	1		2	sets
62	Freezer (S)							1			1	set
63	Crude Protein Tester							1	1		2	sets
64	Hazard Residue Tester							1			1	set
65	Microscope/w Camera					1		1			2	sets
66	Ammonium Test Kit							○	○	○	1	set
67	Nitrous Acid Test Kit							○	○		1	set
68	Nitrate Test Kit							○	○		1	set
69	Alkalinity Test Kit							○	○		1	set
70	Trbidimeter							1			1	set
71	Digital Balance							1			1	set
72	DO Test Kit							○	○		1	set
73	Portable pH Meter							2			2	sets
74	Shelves for Specimen Stock					1					1	set
75	Specimen Bottles					1					1	set
76	Handy pH meter								3		3	sets
77	Saline meter								2		2	sets
78	Water Sampling Bottle								50		50	sets
79	Centrifuge							1	1	1	3	sets
80	Plankton net								2	1	3	sets
81	Hemocytometer								2	2	4	sets
82	Zooplankton counting chamber							1	2	2	5	sets
83	Komagome pipette with silicon nipple								60	60	120	set
84	Fiber Analyzing Equipment Set								1		1	set
85	Ach Analyzing Equipment Set								1		1	set
86	Recirculating aspirator								1		1	set
87	Freezing Bottle for Sperm Stock								1		1	set
88	Water Mill								5		5	sets
89	Compacter								2		2	sets
90	Aquarium								54		54	sets
91	Biological microscope									1	1	set
92	Stereoscopic microscope									1	1	set
93	TV Camera for Microscope									1	1	set
94	Stop watch									1	1	set

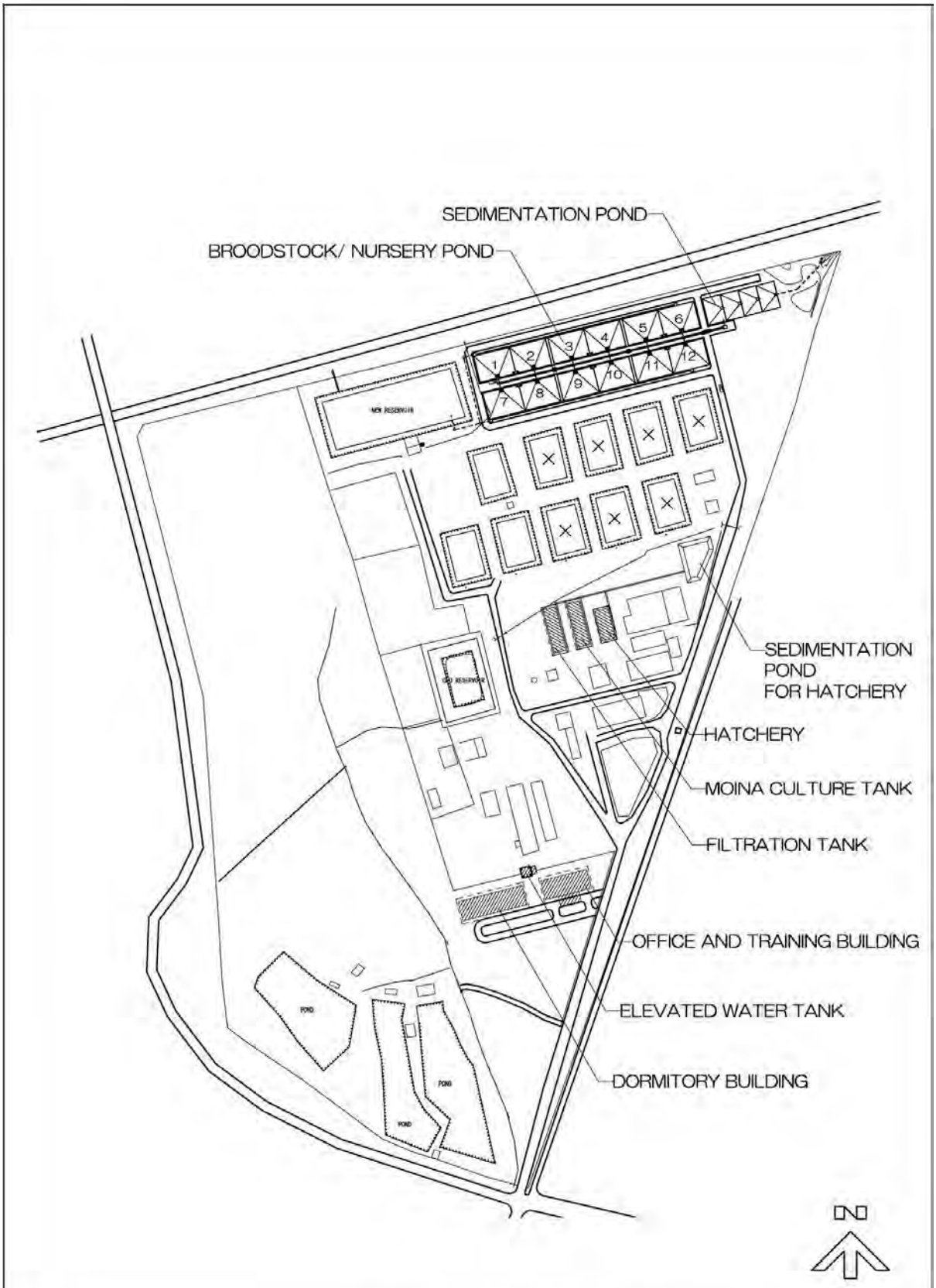
Code No.	Equipment	Allocation									Q'ty	Unit
		NADC							LARReC			
		New Office/Training Building Office Rooms	New Dormitory Building	Existing Building	New Office/Training Building Storage	New Office/Training Building Training Room	New Office/Training Building Library	Existing Laboratory	Aquaculture Research Unit Laboratory	Fishery Research Unit Laboratory		
95	Flow meter									1	1	set
96	COD analyzer							1		1	2	sets
97	BOD analyzer							1		1	2	sets
98	Phosphorus Nitrogen Test meter									1	1	set
99	Ekman-Birge grab									1	1	set
100	Digital camera with ring speed light								1	1	2	sets
101	Sieves Set									1	1	set
102	Sample Bottle									20	20	sets
103	Sechi disk									1	1	set
104	Video Camera									1	1	set
105	Water Pump			3							3	sets
106	Projector screen					1					1	set
107	Bed		59								59	sets
108	Locker		3								3	sets
109	Desk & Chair for Dormitory		35								35	sets
110	Desk for Training Room					20					20	sets
111	Chair for Training Room					40					40	sets

○: The layout place of component of "1 set"

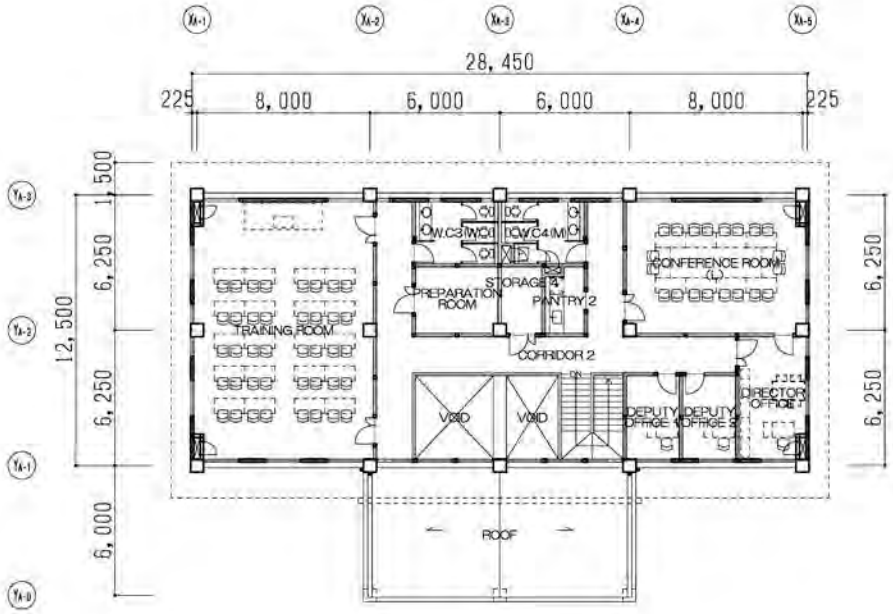
2-2-3 Outline Design Drawings

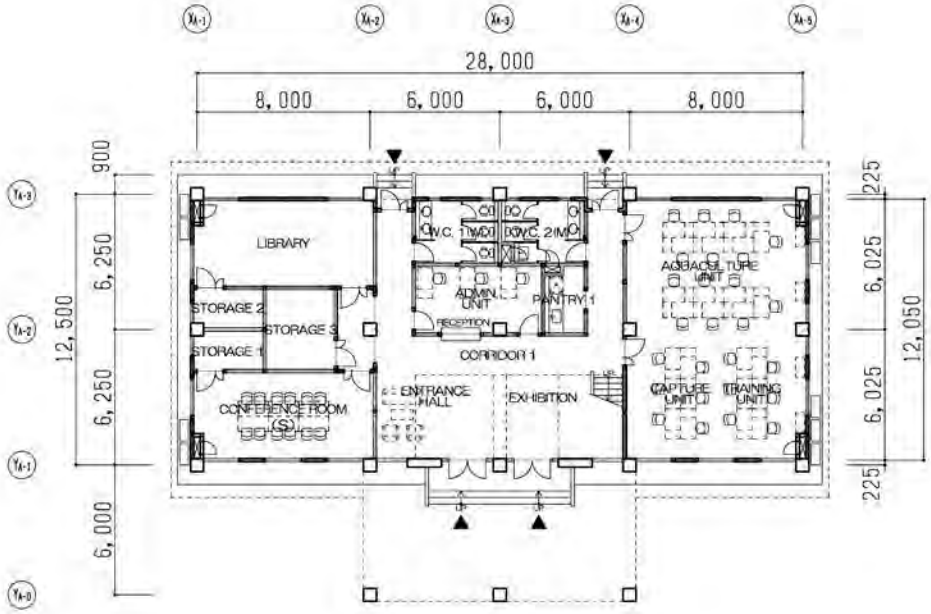
List of drawings

A1-01		Overall Site Plan	1/3000
A1-02	Office/ Training Building	Floor Plans	1/300
A1-03		Elevations	1/300
A1-04		Sections	1/300
A1-05	Dormitory	Floor Plans	1/300
A1-06		Elevations	1/300
A1-07		Sections	1/300
A1-08	Hatchery	Floor Plan	1/100
A1-09		Elevation & Section	1/100
A1-10	Moina Culture Tank	Floor Plan & Section	1/200
A1-11	Tilapia Larval Rearing Tank	Floor Plan & Section	1/200
A1-12	Broodstock/ Nursery Pond	Floor Plan	1/600
A1-13	Elevated Water Tank	Floor Plan & Section	1/150
A1-14	Septic Tank	Floor Plans & Sections	1/100
A1-15	Sedimentation Pond for Hatchery	Floor Plan & Section	1/150,1/300



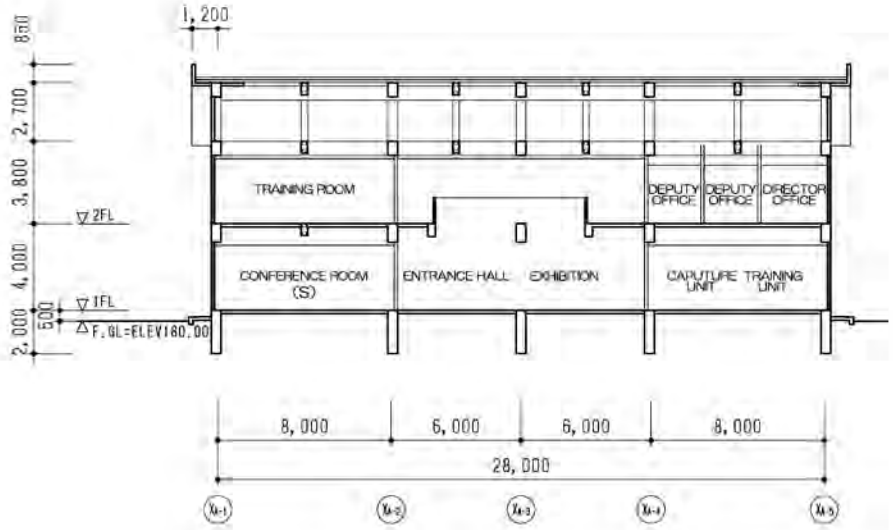
PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	OVERALL SITE PLAN				
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/3000	DATE DEC 2014	PROJECT No.	DRG No. A1 — 01	

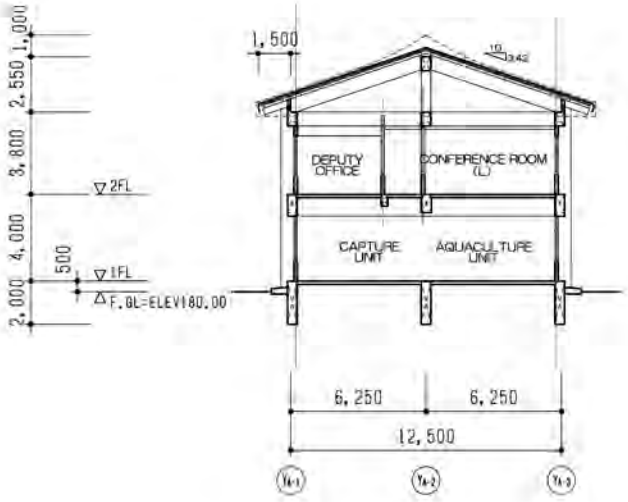




PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	OFFICE/ TRAINING BUILDING FLOOR PLANS				
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/300	DATE DEC 2014	PROJECT No.	DWG No. A1 – 02	

PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	OFFICE/TRAINING BUILDING ELEVATIONS			
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/300	DATE DEC 2014	PROJECT No.	DWG No. A1 — 03





PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	OFFICE/ TRAINING BUILDING SECTIONS			
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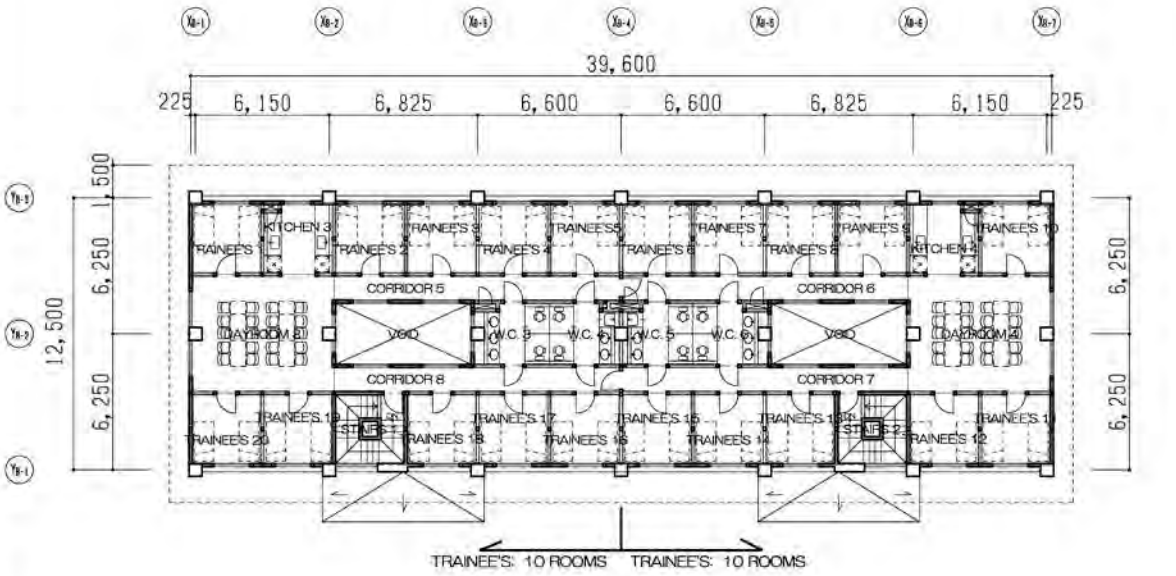

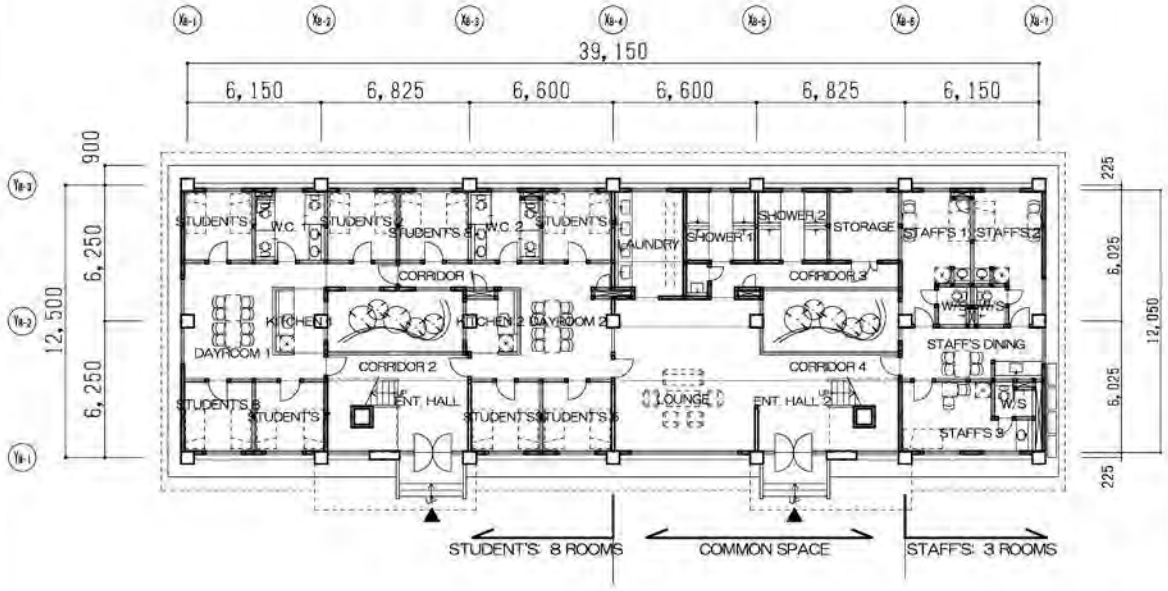

PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	DORMITORY FLOOR PLANS				
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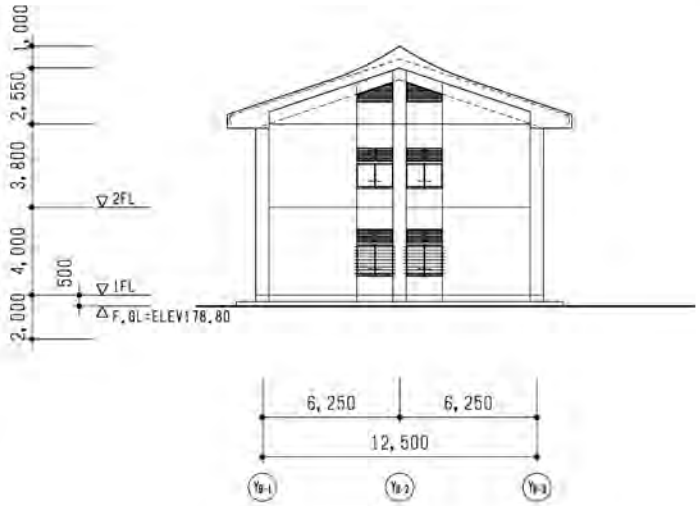
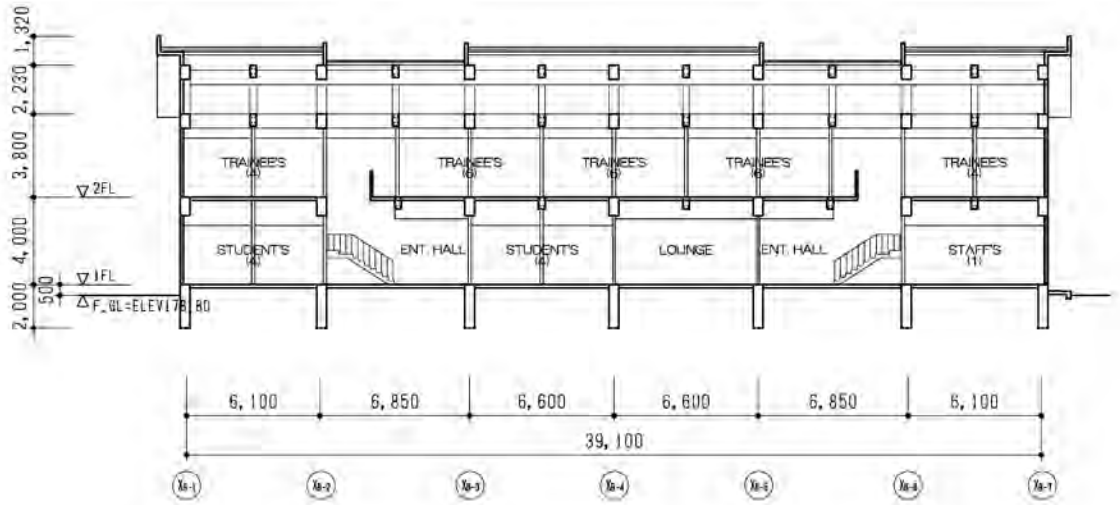
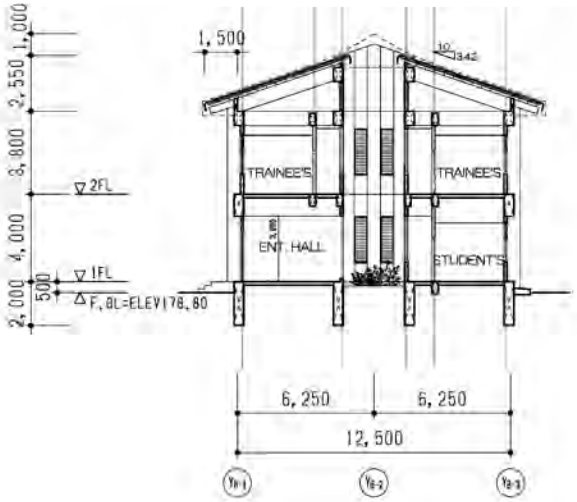
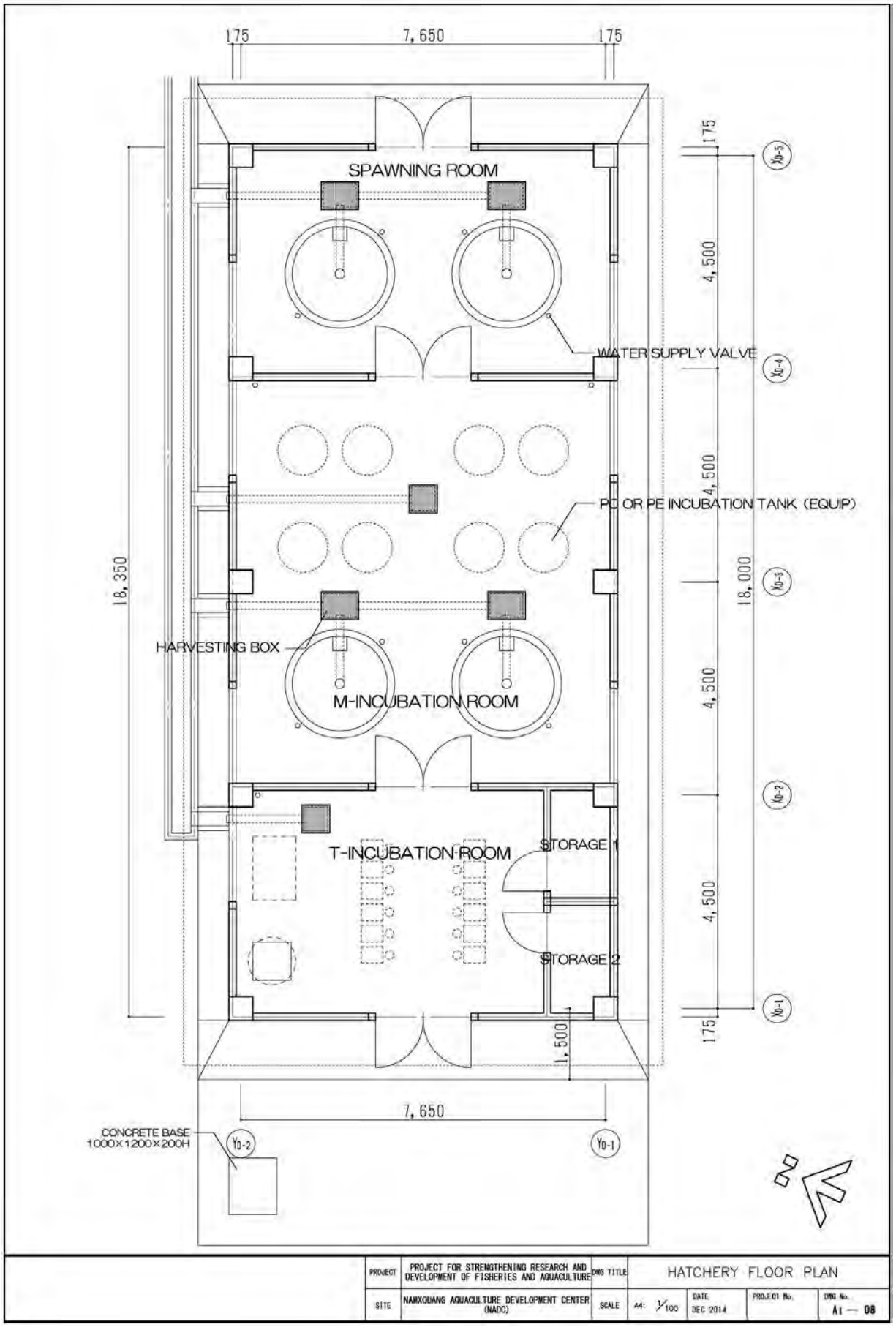


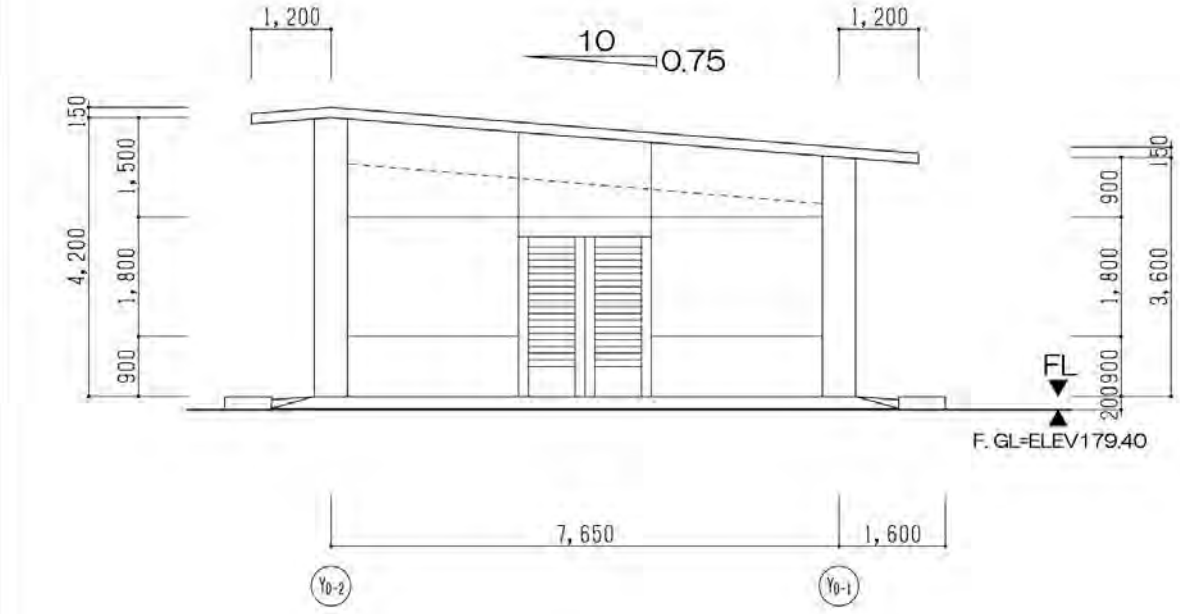
PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	DORMITORY ELEVATIONS			
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/300	DATE DEC 2014	PROJECT No.	DWG No. A1 — 06

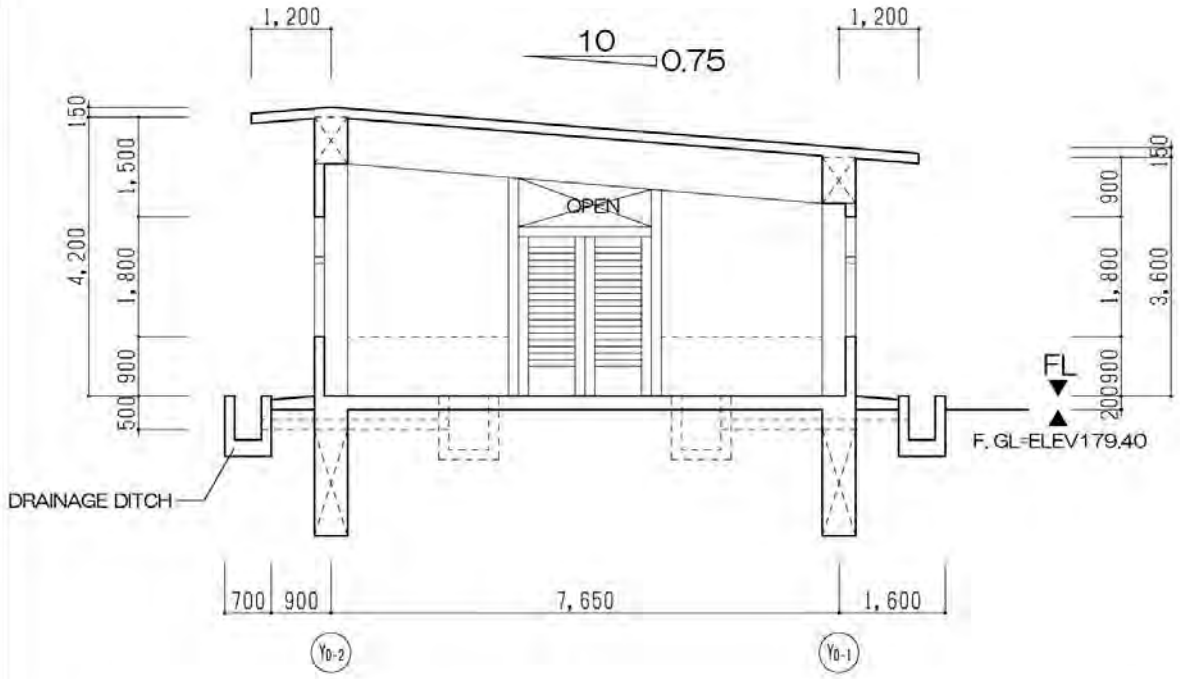




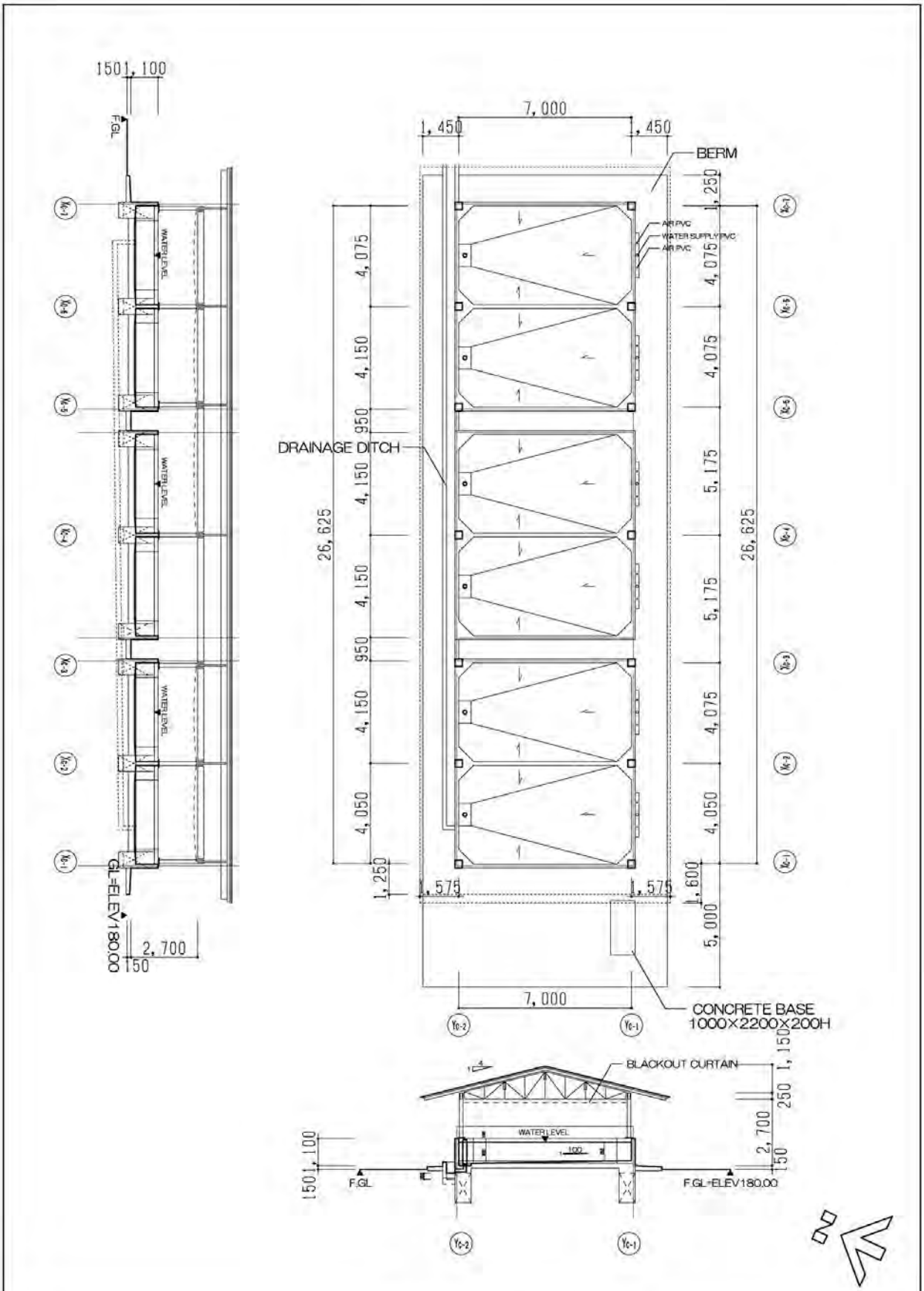
PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE	DWG TITLE	DORMITORY SECTIONS			
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/300	DATE DEC 2014	PROJECT No.	DWG No. A1 — 07


175
7,650
175
SPAWNING ROOM
WATER SUPPLY VALVE
PC OR PE INCUBATION TANK (EQUIP)
HARVESTING BOX
M-INCUBATION ROOM
T-INCUBATION ROOM
STORAGE 1
STORAGE 2
18,350
4,500
4,500
4,500
4,500
18,000
175
175
1,500
7,650
CONCRETE BASE
1000×1200×200H
Y0-5
Y0-4
Y0-3
Y0-2
Y0-1
PROJECT
PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE
DWG TITLE
HATCHERY FLOOR PLAN
SITE
NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)
SCALE
A4: 1/100
DATE
DEC '2014
PROJECT No.
DWG No.
A1 — 08

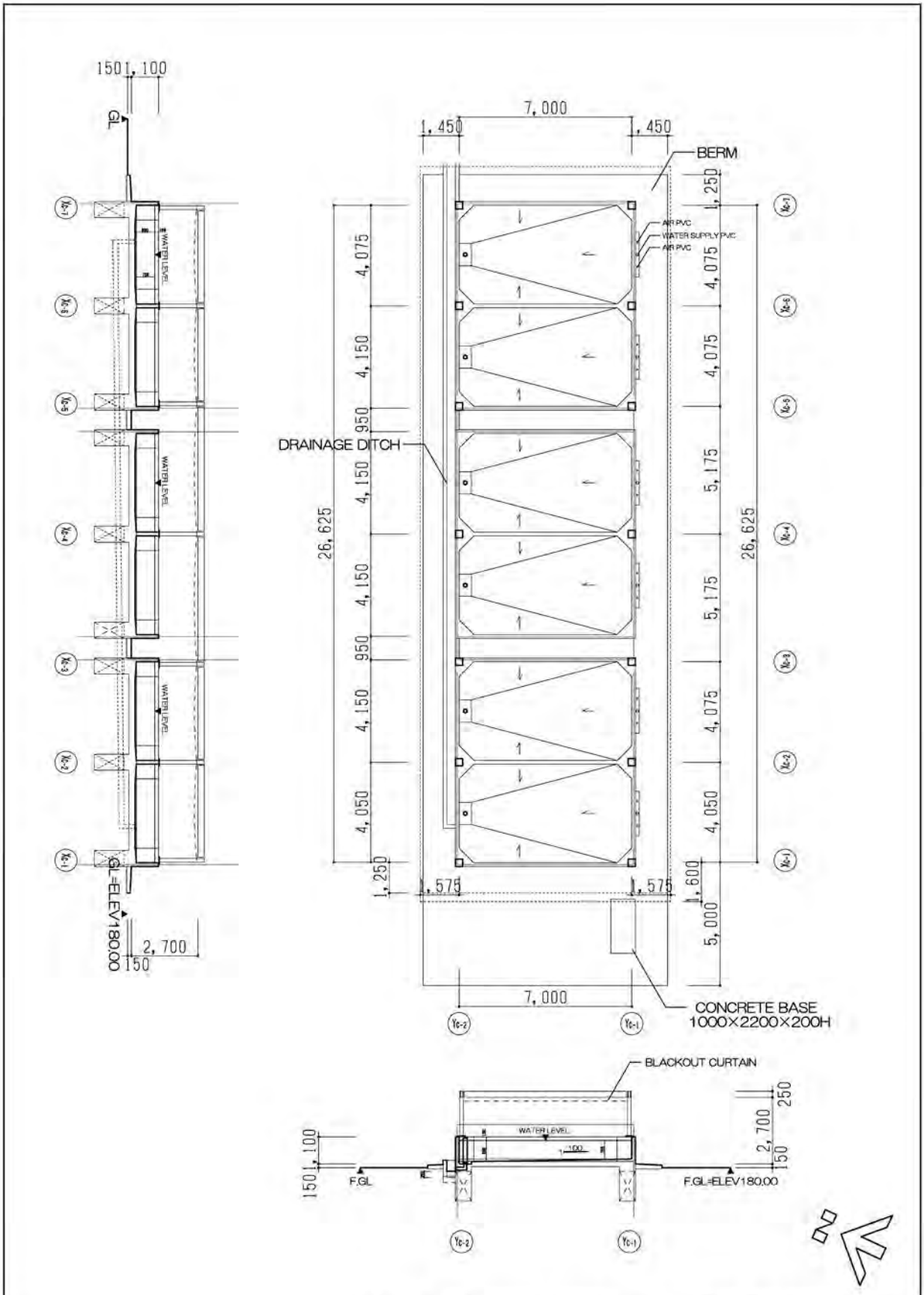




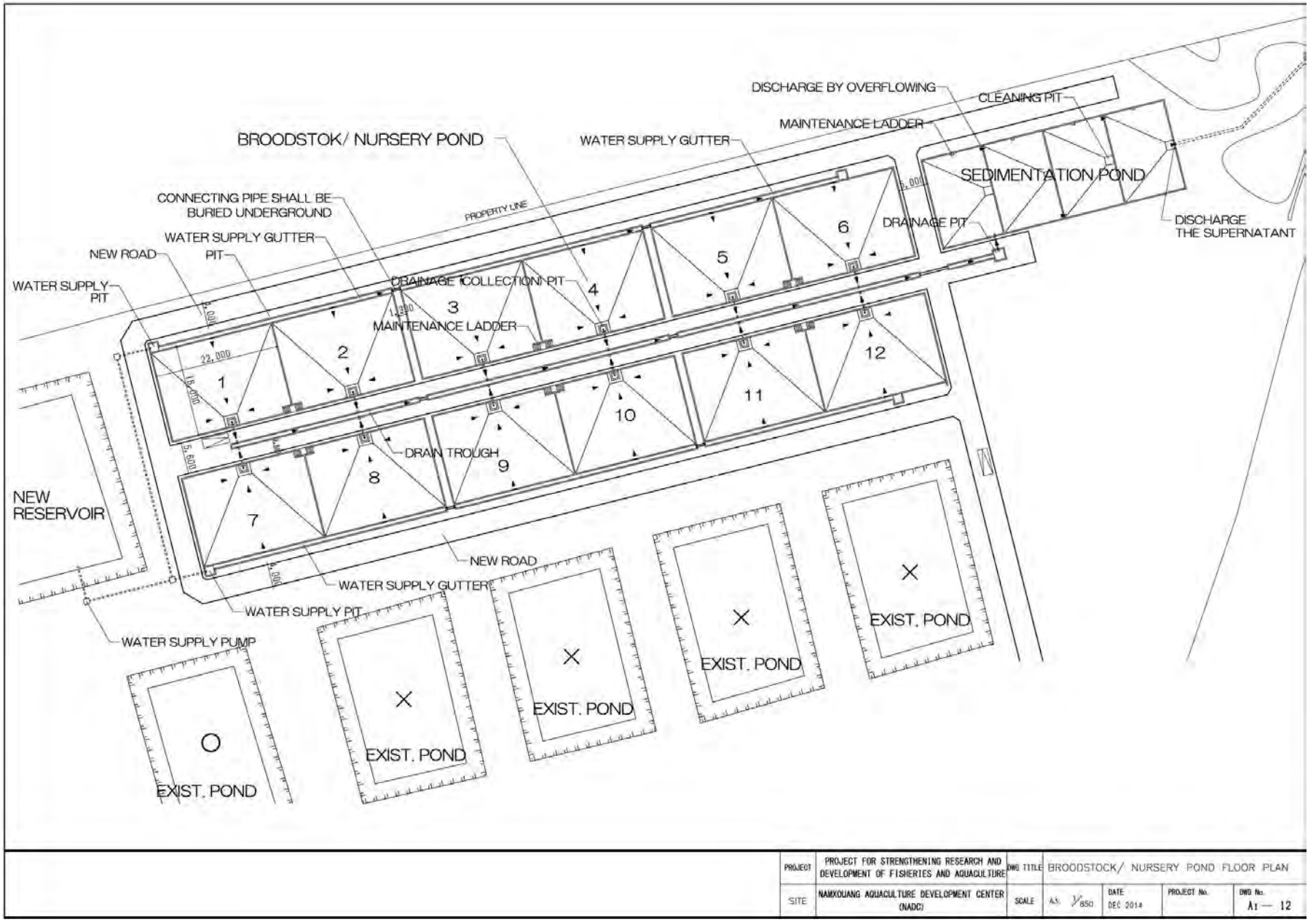
PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	HATCHERY ELEVATION & SECTION				
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/100	DATE: DEC 2014	PROJECT No.	DWG No. A1 — 09	



PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	MOINA CULTURE TANK FLOOR PLAN & SECTION				
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/200	DATE DEC 2014	PROJECT No.	DWG No. A1 — 10	



	PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	TILAPIA LARVAL REARING TANK FLOOR PLAN & SECTION			
	SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4; 1/200	DATE DEC 2014	PROJECT No.	DWG No. A1 — 11



PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	BROODSTOCK/ NURSERY POND FLOOR PLAN				
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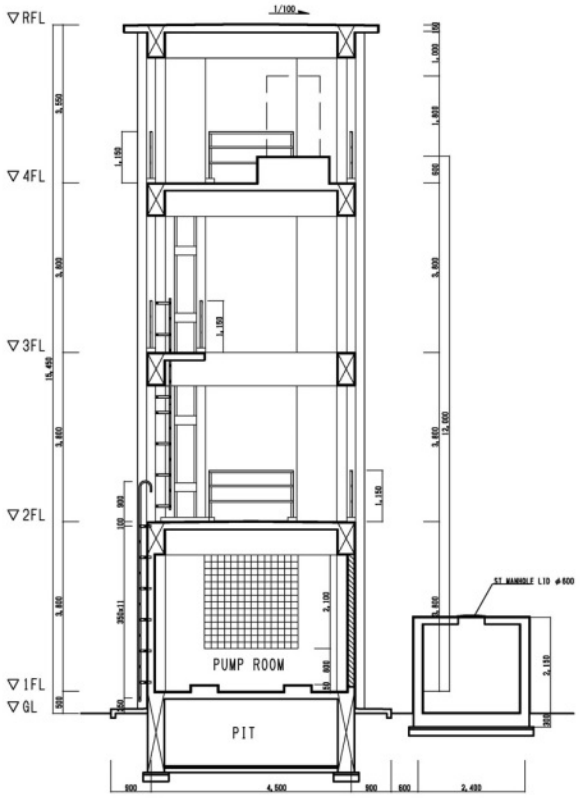
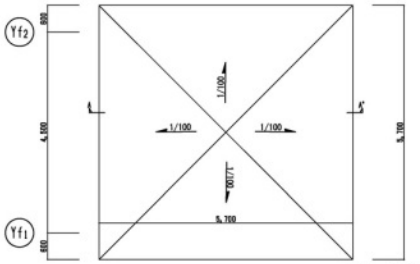
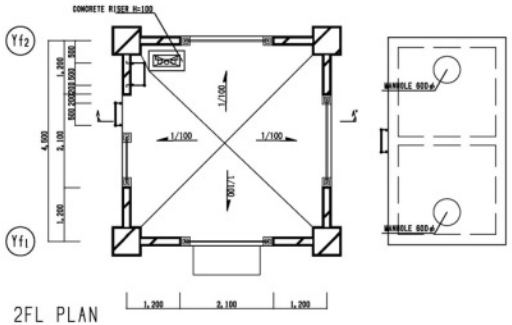


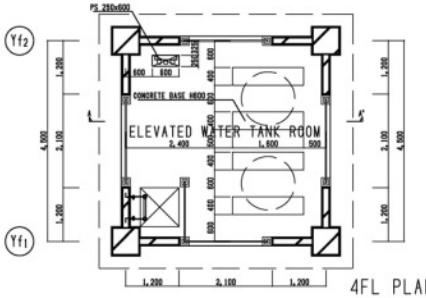
A-A' SECTION



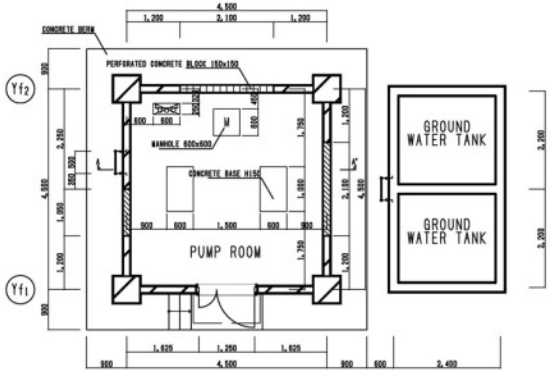
RFL PLAN



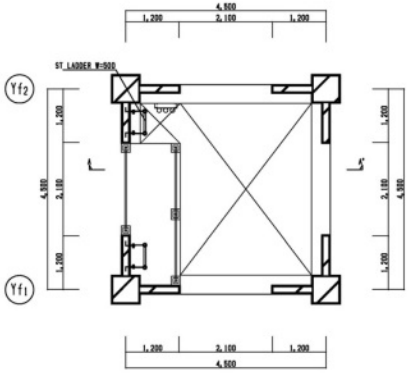
2FL PLAN



4FL PLAN

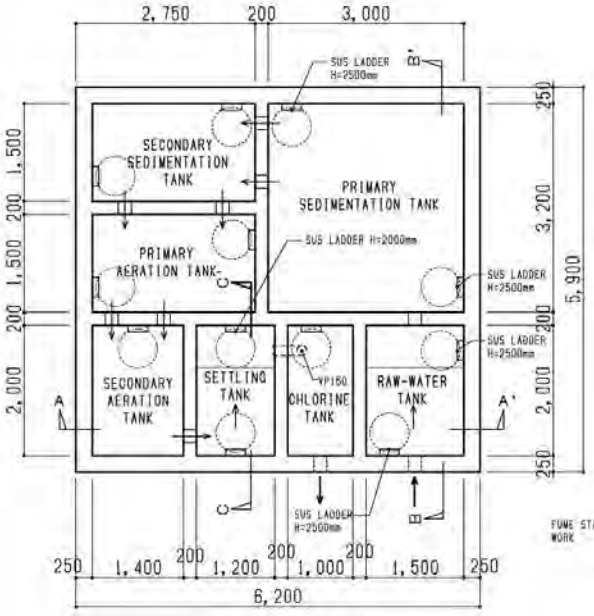


1FL PLAN

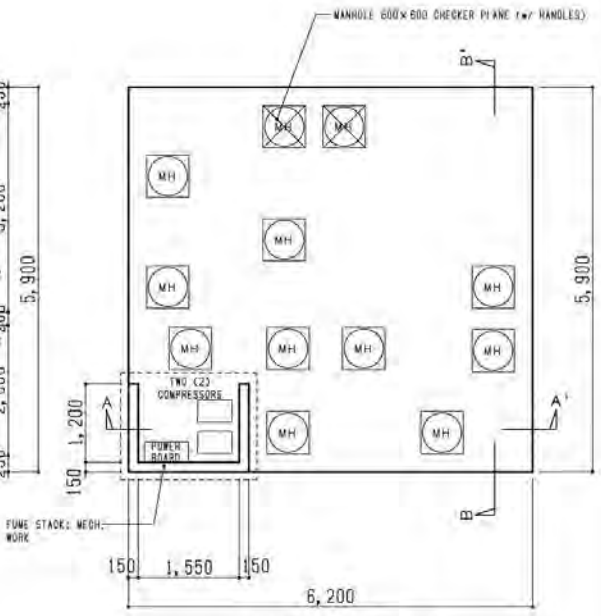


3FL PLAN

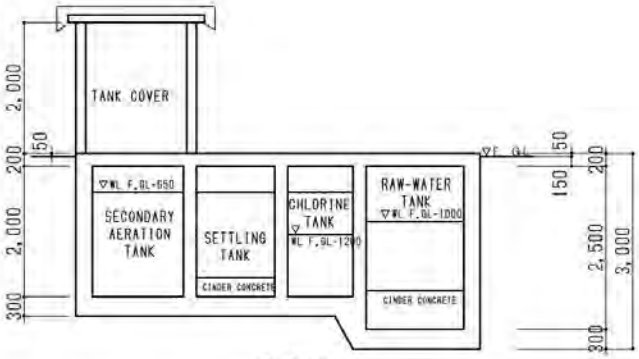
PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	ELEVATED WATER TANK FLOOR PLAN & SECTION			
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/150	DATE DEC 2014	PROJECT No.	DWG No. A1 — 13



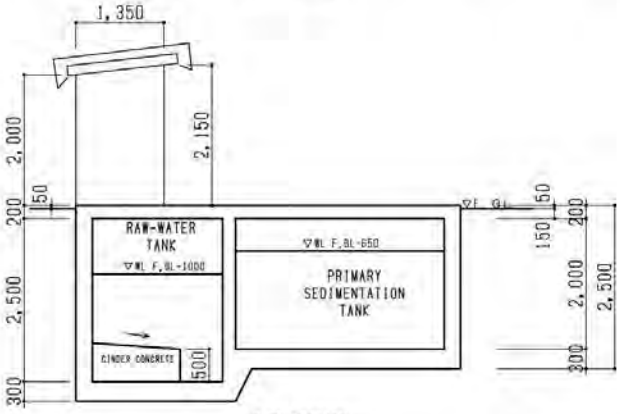
WATER TANK FLOOR PLAN



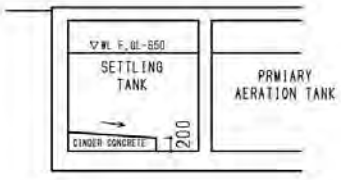
GROUND LEVEL FLOOR PLAN



A-A' SECTION

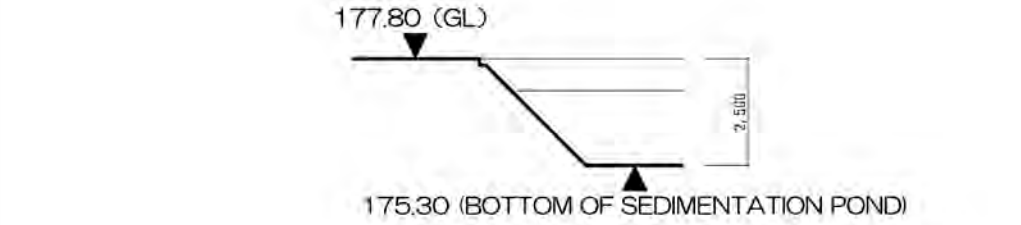


B-B' SECTION

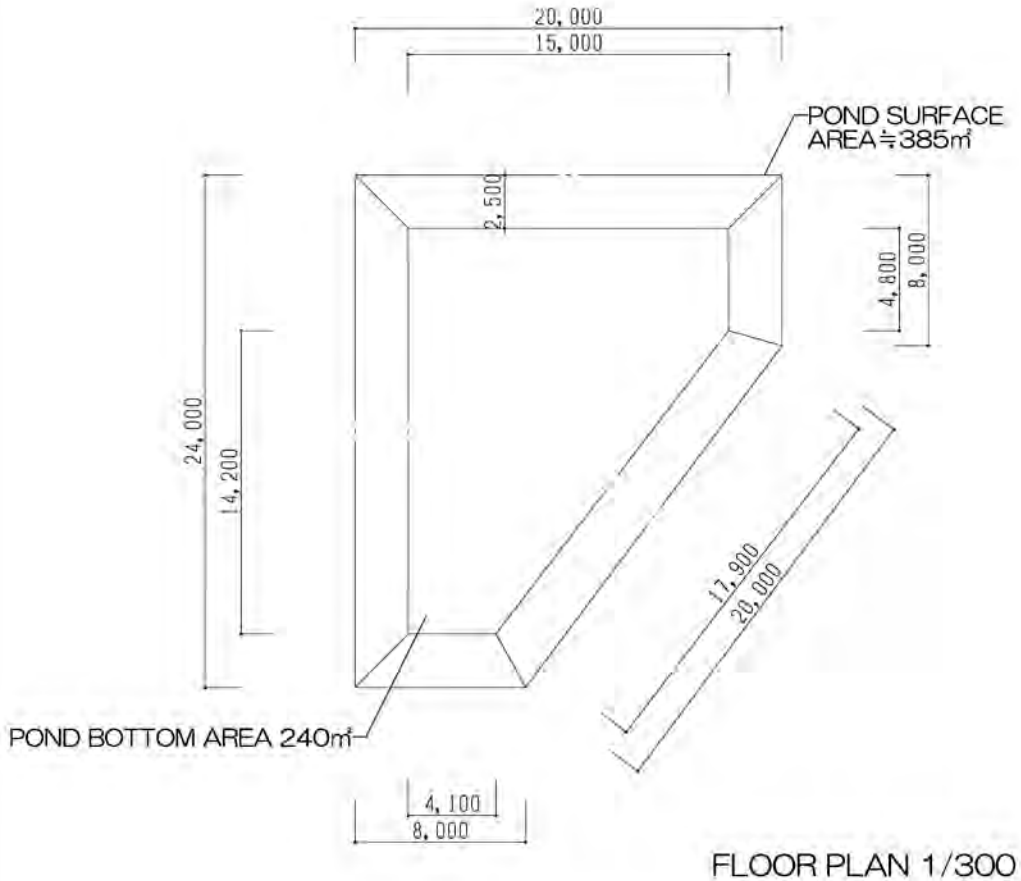


C-C' SECTION

PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	SEPTIC TANK FLOOR PLANS AND SECTIONS			
SITE	NAMXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/100	DATE DEC 2014	PROJECT No.	DWG No. A1 — 14



SECTION 1/150



FLOOR PLAN 1/300

	PROJECT	PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT OF FISHERIES AND AQUACULTURE	DWG TITLE	SEDIMENTATION POND FOR HATCHERY			
	SITE	NANXOUANG AQUACULTURE DEVELOPMENT CENTER (NADC)	SCALE	A4: 1/300	DATE DEC 2014	PROJECT No.	DWG No. A1 — 15

2-2-4 Implementation Plan

2-2-4-1 Implementation policy

The elements of The Project include facility construction work, supply and installation of equipment, and the scope of cooperation regarding to the Project undertaken by the Japanese side will be implemented according to the framework of Japan's Grant Aid. Implementation of The Project will be officially implemented after the signing of the Exchange of Notes (E/N) between the Governments of Japan and Laos, and Grant Agreement (G/A) between JICA and the Government of Laos. Immediately after signing of the E/N and the G/A, the Government of Laos will sign a contract with the consultant in Japan and then start the detailed design. When the detailed design is completed, a contractors and equipment supplier in Japan participate in the tender for their works. The successful tenderers for construction of facilities and procurement and installation of equipment proceed to their works. The basic principles and items to be proposed for implementation of The Project are described as below.

(1) Implementing Organization on the Laotian side

The implementing Organization on the Laotian side of this Project is Ministry of Agriculture and Forestry in Laos. While LARReC and NADC are responsible for the operation and maintenance of facilities and equipment constructed and procured by Japan.

(2) Consultant

After signing of the E/N and the G/A, the Japanese consultant and the Laotian implementing organization enter a consultant agreement according to the formal procedure for Japan's Grant Aid system. This consultant firm executes the following activities under the agreement.

1) Detailed design: To prepare the detailed design documents (specifications and technical materials for the facilities and equipment in the project)
2) Tender: To cooperate with implementing agency in conducting the tender for selection of the contractor(s) and supplier(s) through the tender and in transaction of procedures required under the contract.
3) Supervision: To supervise the construction of the facilities and procurement, installation and instruction of the equipment.

In the detailed detail design stage, the consultant determines the construction plan and the equipment supply plan in detail based on the Preparatory Survey of the Project, and prepares the tender documents which include specifications of the plans, tender terms and conditions, and draft of the contract documents regarding construction work and equipment procurement work.

The consultant assistance to implementing agency at tender stage is as follows:

1) to observe the tender to be conducted by the implementing agency for the selection of contractors and suppliers
2) to help the implementing agency to transact the formal procedures required for execution of their contracts
3) to report the results to the Japanese government.

The supervision is to supervise whether or not the contractor and the supplier implement their works as specified in their contracts to make sure that the contents of their contracts are implemented appropriately. In addition, to promote smooth implementation of the Project, the consultant shall, in the neutral position, provide related parties with advice and guidance and serve as a coordinator among them. Listed below are major items in the scope of the construction supervision work.

1) Procedures required for verification and approval of the work implementation plan, implementation drawings, equipment specifications and other documents submitted by the contractor(s) and supplier(s).
2) Inspection and approval prior to shipment of qualities and performances of the construction materials and equipment to be supplied.
3) Checking and approval of construction materials.
4) Monitoring and reporting the progress of construction and procurement.
5) Observation of the handover of completed facilities and equipment.

The consultant reports to the related authorities of Japanese organization about the progress of construction, payment schedule, etc.

(3) Contractor(s) and Supplier(s)

The contractor(s) and the supplier(s) shall be selected through the open tender for the Japanese corporations that are qualified to the specific requirements. In principle, contracts will be made between the MAF and the contractor(s) and the supplier(s) that proposed the lowest price and succeed in the subsequent negotiations.

The contractor(s) and supplier(s) execute the construction of facilities and the procurement, installation and instruction of the necessary equipment. The contractor and the supplier are responsible to serve free repairing during the warranty period.

(4) JICA

JICA shall give due advice to the consultant so that the Project is implemented in conformity with the Grant Aid system. Also, it shall hold

consultations with the implementing agency of The Project as necessary for smooth implementation of the Project.

(5) Coordination among Stakeholders

The representatives of the implementing organization of the Laotian side and the consultant shall review the implementation plan during the detail design period. They shall make clear the scopes of the construction work of which Japanese and Laotian sides take charge, confirm through consultations the starting time and the method of each work and discuss so that all the works will be carried out smoothly according to the implementation schedule in this report.

2-2-4-2 Implementation Conditions

Described below are those items to be noted for implementation of the Project. They should be fully taken into consideration when making the implementation plan.

(1) Management of implementation schedule

Since the Project site is in a region where it rains frequently and heavily during the rainy season from May to September, sufficient time should be allocated to excavation and groundwork if those works are scheduled to be executed in rainy season. Also, allocating enough curing time for each finishing task will ensure finish quality of the buildings. Therefore, the Project will fully take the above construction schedule into consideration.

(2) Dispatch of engineers for the installation of equipment

It is extremely important to impart knowledge and skills regarding appropriate operation and maintenance of the equipment so as to contribute to activities of each organization through continuous proper operation of the procured equipment after implementation of the Project. That being the case, technicians who are thoroughly familiar with the operation of the each piece of equipment will be selected as the equipment installation technicians, and sufficient time will be allotted for them to explain operation thereof (operation techniques, simple repair techniques, inspection methods, etc.) and to make sure that those concerned on the receiving side acquire sufficient understanding concerning its operation and maintenance.

(3) Safety control

The plan is to procure the equipment and construct the facilities in the premises of NADC under operation. The great attention shall be paid to safety control including complete separating of NADC users/ cars and construction workers/vehicles. The temporary fence and the guards shall also be set to avoid the affection by the noise and dust.

2-2-4-3 Scope of Works

The plan is executed by the mutual cooperation between Laos and Japan. If The Project is implemented under the Japan's Grant Aid, the scopes of works undertaken by the governments of both countries shall be as described below.

(1) Obligations of Japanese government

The Japanese government bears the cost to undertake consultation of The Project and the works related to construction of the facilities, procurement and installation of equipment as described below.

1) Consultations
   - i) To prepare detailed design documents for the facilities and equipment subject for The Project and their tender documents
   - ii) To cooperate in selecting the contractor(s) and supplier(s) as well as executing contracts for the Project
   - iii) To supervise the instructions for the construction of the facilities and procurement, installation and instruction of the equipment.
   - iv) To conduct soft component (technical assistance) for effective use, management and maintenance

2) Construction of facilities and procurement/installation of equipment
   - i) To construct facilities subject to The Project.
   - ii) To procure construction materials and equipment subject to The Project, transport and deliver them to the site.
   - iii) To instruct installation of the equipment subject to The Project, conduct a trial run and make adjustments
   - iv) To explain and instruct operation and maintenance methods for the equipment subject to The Project.

(2) Obligations of Laos government

Laotian government bears the cost and implements the following tasks concerning land development of the construction site, piping/wiring and equipment installation to draw utilities into the construction site, procedures for tax exemption, etc.

1) Preparation of construction site
   - i) To secure and prepare the land for the construction and the temporal works
   - ii) To remove trees and other obstacles in the planned construction site
   - iii) To level the ground of the planned construction site

2) External works
   - i) Construction of roads inside the premises
   - ii) Planting

3) To procure or relocate the equipment, furniture and furnishings to be

prepared on Laotian side.

4) To exempt custom duties, internal taxes and other fiscal levies which may be imposed in Laos with respect to the supply of the products, services and equipment necessary for the Project.
5) To ensure prompt unloading and customs clearance at the points of disembarkation and internal transportation for the equipment and materials to be exported from Japan and other foreign countries according to the approved contracts
6) To provide arrangements necessary for entrance and stay to those Japanese who enter and stay in Laos to carry out their roles for the Project
7) To issue approvals and permissions required for implementation of The Project
8) To pay all the necessary expenses other than those borne by the government of Japan.

2-2-4-4 Consultant Supervision

(1) Policy for supervising the construction

Under Japan's Grant Aid policy, the consultant forms, based on the concept of the outline design, a team that is consistently responsible to execute the Project including preparation of the detail design to achieve smooth and successful implementation. The construction supervision policy for The Project is outlined below.

1) To keep close contact with those who are in charge of the Project representing related organizations of both countries so that construction of the facilities and installation of equipment will be completed without delay.
2) To provide quick and appropriate advice and suggestions from the neutral standpoint to the contractor(s), supplier(s) and others concerned.
3) To provide appropriate guidance and suggestions regarding suitable equipment layout and adjustment of tie-in with facilities as well as operation and management after handing over. And to confirm that construction has been completed and terms of each contract are fulfilled, to observe handing over the facilities and equipment and obtain an approval of receipt from the Laotian side.

(2) Plan for supervising construction

As the types of construction works involved in The Project are versatile, a resident supervisor (in charge of construction) is appointed and the following engineers are dispatched from time to time, keeping step with the progress of the construction works.

1) Manager of general affairs (Overall coordination, process control)
2) Engineer in charge of construction (Confirmation of construction methods, design concept, construction drawings, specifications of materials, etc.)
3) Engineer in charge of structure (Confirmation of the ground conditions, foundation work, framework)
4) Engineer in charge of electrical installation (Power supply and distribution equipment, power receiving and transforming equipment, etc.)
5) Engineer in charge of mechanical installation (Utility supply and processing system, air conditioning, water supply, drainage and hygiene system, etc.)
6) Engineer in charge of equipment (Supervision of equipment installation, adjustment with the facility, confirmation of operation instructions, etc.)

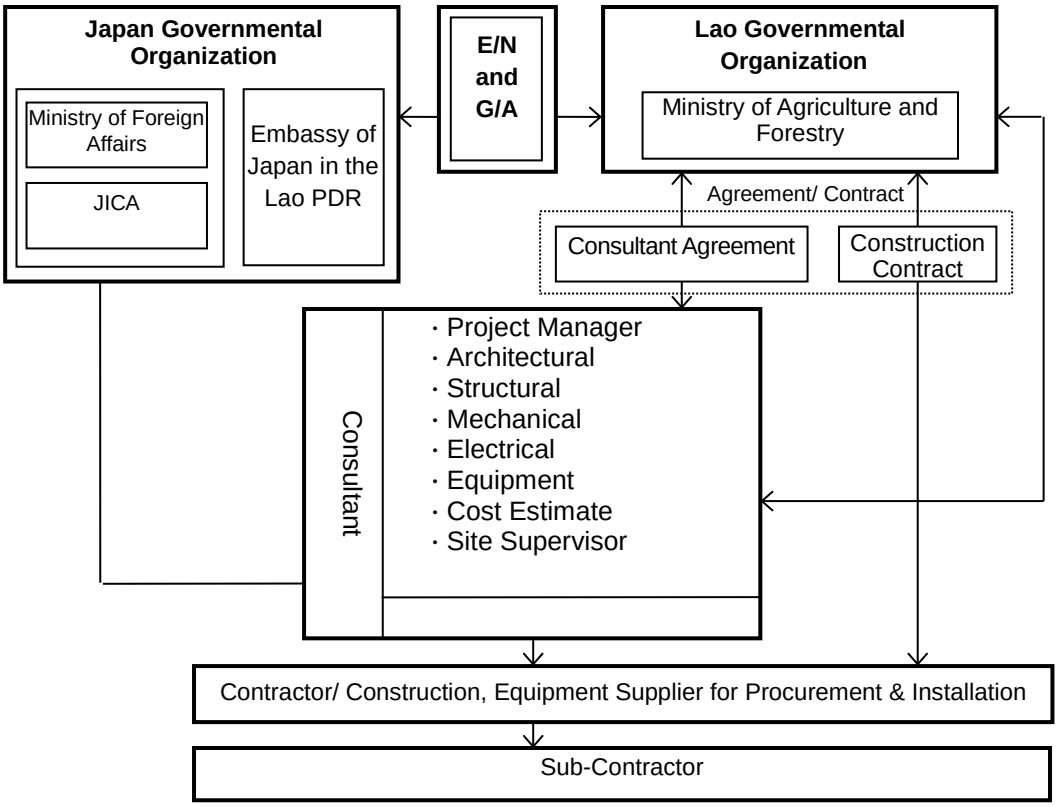


Figure 2-9 Construction Supervision System

2-2-4-5 Quality Control Plan

(1) Quality control plan for facilities

The Contractor(s) will submit the documents of construction plans in advance to the consultant according to the construction contract (drawings, specifications, etc.). The consultant will, prior to the commencement of

construction, verify the adequacy of the construction plan by specifically setting inspection items and frequency to secure high level of quality control. Major items to supervise are listed below.

1) Materials

On-site resident supervisor will implement the inspection of receiving construction materials.

i) Reinforcing mill sheets, results of tension strength tests and manufacturers names

ii) Analysis tables of cement material identification, tables of test results and manufacturers names

iii) Analysis of salt components in sands/gravels, size distributions, specific gravities and percentages of absorption

iv) Reinforced concrete

iv-1) Verification of Mixing Plans

Confirmation and determination of the sands/gravels quantity, slump, cement-water ratio, air quantity and salt components through test mixings

iv-2) Compression Tests

Determination of the standard control values from analysis of result tables

iv-3) Control of material quantity measures and complete control of material storage

iv-4) Prior submittals of concrete casting plans

2) Standards of control

The consultant will carry out the construction supervision with certain standards of control based on the approved construction schedule plans. The standards of control will be basically governed by the standards of Japan.

3) Soil bearing capacity

Confirmation of the soil bearing capacity will be carried out with the presence of on-site resident supervisor on the site by implementing plane table loading tests.

(2) Quality control plan for equipment

Ready-made equipment to be procured for The Project will be selected from the equipment that complies with JIS, UL, IEC, ISO and other international standards. The consistencies between the equipment to be procured and the contents of the contract will be confirmed at the inspections carried out before shipment together with the inspections carried out by the third agencies for the components of shipment and containers.

2-2-4-6 Procurement Plan

(1) Construction materials

The purchase of construction materials surrounds of Namxoung is not easy. The site of NADC planned for construction of facilities is located at 35km north-ward from the towns in Vientiane (less than one hour by car). Aggregates such as sand and gravel together with other materials are purchased in Vientiane. For selection of materials, it is essential to comprehensively discuss usage purpose, durability, economic efficiency, etc., and conduct detail planning with full consideration for maintenance of not only primary structures but also finishing and facility equipment. For this reason, the Project should procure as many materials capable of local maintenance as possible.

Taking into account that Namxouang has only few Laosengineers and skilled labors need to be dispatched from Vientiane, the labor situation is not good. It is therefore essential to dispatch Japanese staff to supervise the site in accordance with the progress of the Project.

Table 2-19 Procurement of Major Construction Materials

Item	Country of procurement			
	Laos	Japan	Other	Remarks
Cement	○			
Aggregate	○			
Plywood	○			
Concrete block	○			
Reinforcing bar	○			
Steel	○			
Wood	○			
Roofing tiles	○			
Floor/ wall tiles	○			
Paint	○			
Insulation material	○			
Aluminum doors& windows	○			
Steel fixtures	○			
Glasses	○			
Doors & windows Hardware	○			
Wooden furniture	○			
Distribution panel	○			
Lighting fixtures	○			
Electric wire & conduit	○			
Wiring devices	○			
Power distribution panel	○			
Transformer	○			
Low-voltage equipment	○			
PVC pipe	○			
Plumbing fixtures	○			
Pump	○			
Ground water tank	○			

(2) Equipment

To address procurement prices and availability of equipment with appropriate specifications, the planned equipment will be basically procured from Japan or Laos.

2-2-4-7 Operational Guidance Plan

The planned equipment is basic one applying to the activities of facilities concerned. Most of staff of the facilities concerned is used to operating of equipment. The instructions for initial operation and use are for the specific equipment. Also, since equipment will be procured, in principle, from manufacturers that have distributors in Laos, technicians of these distributors will provide installation/initial usage/operational guidance.

2-2-4-8 Soft Component (Technical Assistance) Plan

The Project is aimed to improve the function of 2 organizations of NADC responsible for the technical development and extension of aquaculture and LARReC responsible for the basic research of inland fisheries biological resources. 2 organizations have been engaged in their routine works and they are well experienced in the operation and use of equipment.

However, it is newly planned at NADC to start the seed production of all-male tilapia in addition to the present activities and the equipment necessary for such activity are procured in The Project. Although such activity is technically in extension of a straight line with the present activities, it is preferable to introduce the basic instructions on the field at the beginning stage by the specialist as it includes the process for seed production with hormone administration.

NADC also has the plan for fish pathology and analysis of food/feed for fish. The staffs to be engaged in The Project are now receiving the training at Israel and Thailand. The reconstruction of the existing facilities is not planned in The Project and the use of existing laboratory is planned. However, the existing laboratory is one big room which is not a suitable structure for disease diagnosis of fish and analysis of food/feed for fish and the partial renovation is required. The renovation of the laboratory is executed by Laotian side but the support of specialist in this field is favorable for preparing the plans for room layout and layout for utilities and required equipment.

The current circumstance for storage and management of equipment at both NADC and LARReC are not good. Even the equipment maintenance book is not prepared. There is a fear in the circumstance that the procured equipment will deteriorate over time.

From the above points of view the following soft component is planned to begin the activities without delay and fail after finishing the Project.

(1) Initial technical guidance for the seed production of all-male tilapia
(2) Support for the improvement of laboratory at NADC and technical guidance on feed/food analysis
(3) Technical guidance on diagnosis of fish diseases
(4) Guidance for the improvement of system for management/maintenance of equipment

2-2-4-9 Implementation Schedule

1) Schedule for the execution of duties

Following the tendering and contract signing concerning construction and equipment procurement after the exchange of notes (E/N) and the grant agreement (G/A), which were signed between the two countries for implementation of the Project under Japan's Grant Aid system, facility construction, equipment procurement and installation will be implemented within a single fiscal year. The following Table 2-19 shows approximate time needed for detail design, tendering and construction/ procurement/ installation:

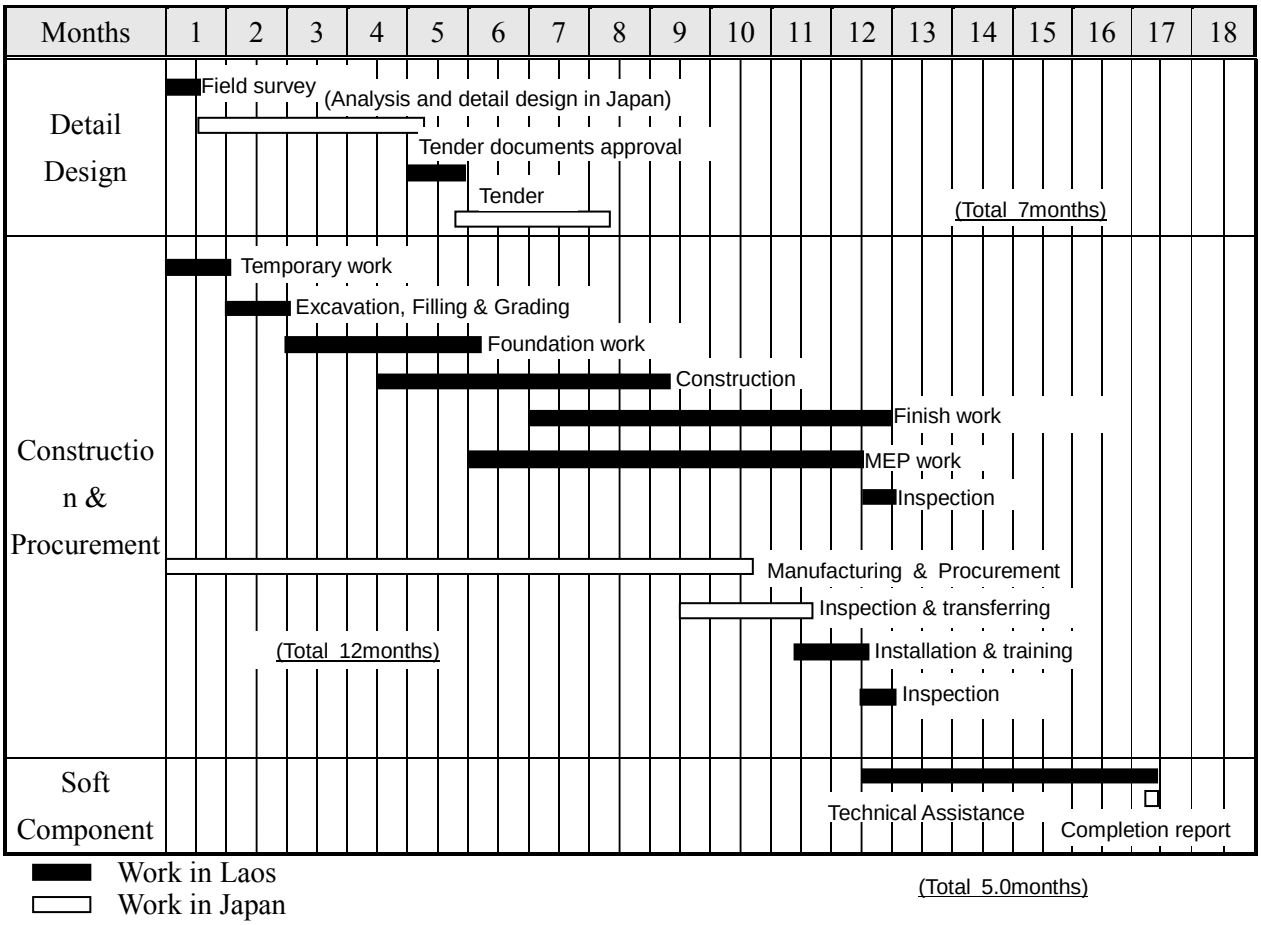
Table 2-20 Schedules for the execution of duties

Work		Period	
Detailed design	Detailed design (including field survey)	4.0 months	19.0 months
	Tender preparation	3.0 months	
Construction and procurement	Construction and procurement	12.0 months	
Soft component		5.0 months	5.0 months

2) Process for the execution of duties

The process for the execution of duties is shown as next table.

Table 2-21 Processes for execution of duties



2-3 Obligations of Recipient Country

The duties of the Ministry of Agriculture and Forestry are elaborated hereafter while the demarcation of the duties between the government of Laos and the government of Japan are shown in the section 2-4-3.

(1) Government Clearance

1) Land Acquisition

The Project site is planned to be located in the government owned land under the Ministry of Agriculture and Forestry of Laos.

2) Tax exemption

The Ministry of Agriculture and Forestry should coordinate with other government department to ensure that customs duties, internal taxes, and other fiscal levies which may be imposed in Laos with respect to the purchase of the products and the services under the Project be exempted.

3) Custom clearance and inland traffic

The Ministry of Agriculture and Forestry should ensure the prompt customs clearance of the products under the Project and to assist internal transportation of the products in Laos.

4) Land use clearance

In Laos, it is necessary to obtain building permission before construction starts. Application shall be made through submitting necessary documents including architectural, electrical and mechanical drawings to the Vientiane Municipality. For this particular project, the Ministry of Agriculture and Forestry shall make necessary procedures for building construction.

5) Banking Arrangement and Authorization to pay

The Ministry of Agriculture and Forestry should do the necessary arrangement with relevant banks for the smooth issuance of Banking Arrangement and Authorization to pay for Japanese consultant and contractor.

(2) Obligations of the Ministry of Agriculture and Forestry

To implement the Project, the Ministry of Agriculture and Forestry should do the following obligations:

1) Removal of obstacles and ground leveling at the Project site

It is required to cut off existing trees in the construction site. The construction site is mostly flat but is sloped down mildly from southern part to northern part. The Laotian side should cut off of trees and level the ground before the construction starts.

These tasks do not require high costs or special techniques, thus can be done by the Laotian side.

2) Connection to electricity, water and sewerage infrastructure

ii) Electricity

22KV power line is available under the road on the eastern side of site. The electricity of the new building will be lead from the power line. The Ministry of Agriculture and Forestry should facilitate that the electricity company will newly install the power distribution panel and lead the electricity to the primary transit point. Other works including the setting of transformer will be done by Japanese contractor.

iii) Water supply

The domestic use water will be supplied from the tube wells and the water for aquaculture will be supplied from the river. The wells for new buildings, office and dormitory, will be constructed by Japanese contractors. The water for aquaculture will be supplied from the existing facilities, thus does not require additional construction work.

iv) Drainage

The dirty water and other waste water will be discharged to the drainage ditch placed in the site through the septic tank. The public sewage is not available near the site.

3) Perimeter of the buildings

The Ministry of Agriculture and Forestry should arrange a nice perimeter of the newly constructed building by planting trees around the entrance or surrounding of the buildings

after the completion of the construction. This will improve working environment.

4) Relocation of existing equipment and furniture

The Ministry of Agriculture and Forestry is responsible for relocation of existing equipment and furniture from the existing facilities to the new facilities. This task can be done by existing office staff and there is no need for specific skill, thus can be done without budgetary expenses.

Timing of the relocation will be determined in accordance with the progress of the construction, but it will take place soon after the construction is complete.

2-4 Project Operation Plan

(1) Operation and Maintenance Structure

[NADC]

NADC has currently not established the maintenance system. The technical staff is applying to repair the minor damage of facilities and equipment when required. In case the staff can not apply, the repair is out sourced under the responsibility of the director. No routine inspection and cleaning of facilities and equipment make the delay in finding and applying to the damage. The improvement of maintenance system is required.

[LARReC]

LARReC has not also established the preservation system. The repair of facilities and equipment is outsourced at the time of requirement. The technical instructions by the use of soft component are given to the staff that can basically preserve the equipment by themselves.

(2) Operation and Maintenance method

1) Facilities

The plan is designed to exclude the system in high degree and complex specification for easier maintenance. The routine cleaning and inspection is required to immediately apply to the damages caused by wear, breakage and aging.

- Routine cleaning: the periodical cleaning is executed by regular staff following the cleaning schedule for frequency of every day, every week and every quarter.
- Periodical repair of facilities: the inspection and repair of doors and windows (once a year), touch up painting (once for 3 years) and repaint (once for 10 to 15 years) are required for application to the damages by wear, breakage and aging.
- Maintenance of electrical and mechanical facilities: the routine “preventive maintenance” is important for electrical and mechanical facilities prior to the repair of damage and exchange of parts. The life of machinery is surely prolonged by the normal operation, routine inspection, supply of oil, adjustment, cleaning and repair and not only by operating period.
- Establishment of maintenance system: The responsible person in charge for organizing the team for maintenance accelerates the exercise of above measures without fail. The scheduled maintenance is executed by the preparation of an annual plan for maintenance activities and the preparation of maintenance records. The system and activity of the team for maintenance of equipment are summarized as the following chart.

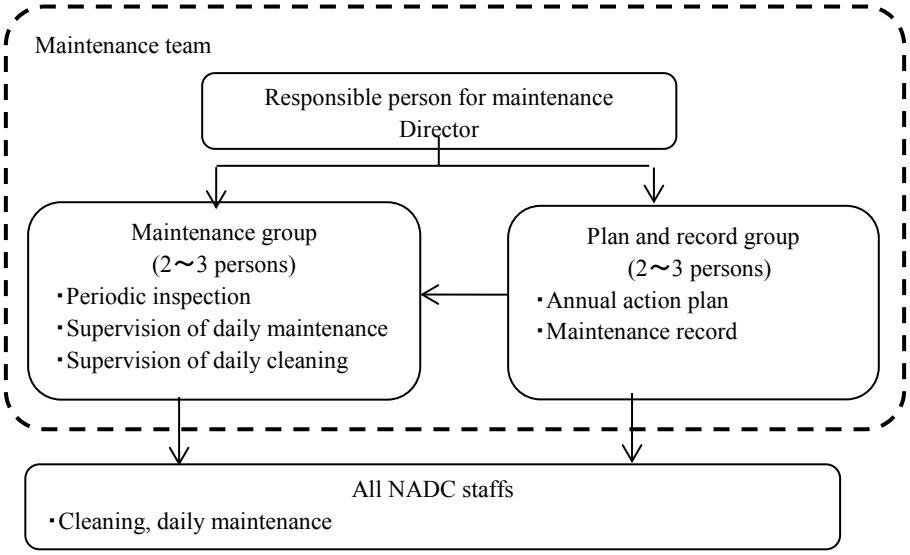


Figure 2-10 Maintenance system

2) Equipment

Both NADC and LARReC have not prepared the management ledger of possessed equipment, nor have the systematic management of the equipment manual. Therefore, under implementation of The Project, the operation and maintenance are instructed by the soft component. The support is to improve the system for periodic inspection and maintenance of equipment and management of consumables and spare parts, and preparation of equipment ledger and its management report.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Details of the estimated expenses to be borne on the Laotian side are as follows based on the conditions for calculating the amount shown in (2), when the Project is implemented through Japan's Grant Aid.

(1) Cost borne by Laos

Table 2-22 Cost borne by Laos

Total Project Cost Approx.9.5 million yen

Item	Approx. Cost (USD 1,000)	(million yen)
[1] Banking Arrangement	4.6	0.5
[2] Construction site preparation	31.1	3.2
[3] Renovation of existing office building and laboratory	48.8	5.0
[4] Planting work	8.0	0.8
Total	92.5	9.5

(2) Cost estimation condition

1) Cost estimation time: October 2014
2) Exchange rate: ¥103.89 per US$1.00
3) Procurement and construction period: As shown in the "implementation schedule"
4) Other: Cost estimation shall be calculated following the Japan's Grant Aid system

2-5-2 Operation and Maintenance Cost

(1) Budget for operation and maintenance for target organizations

Cost for operation and maintenance for target organizations

[NADC]

The annual budget stated in the annual report of NADC has been well increased to approx. 573 million kip for 2012/2013. The operation and maintenance cost is not mentioned independently but it is included in the technical activity cost. However, the item for the technical activity cost in the table below is blank form which the details cannot be studied. The estimated operation and maintenance cost based on the past results is presumed to be approx. 250 million kip.

Table 2-23 Annual balance of NADC (2008/09～2012/13)

(Unit：1000 Kip)

	Year				
	2008/09	2009/10	2010/11	2011/12	2012/13
Revenue					
Surplus carried forward from precedent year	3,625.5	2,551.5	-15,823.5	0.5	0.5
Budgetary allocation from Ministry of Agriculture and Forestry	50,000.0	0.0	295,191.0	336,307.8	573,081.0
Income from technical activities	33,314.0	63,910.0	10,529.0		
Income from other activities			9,248.0		
DLF loan			30,000.0		
Total	86,939.5	66,461.5	329,144.5	336,308.3	573,081.5
Expenditure					
Expenditure from budget of Ministry of Agriculture and Forestry	50,000.0				
Personal expenses	Unknown	Unknown	95,191.0	136,307.3	273,081.0
Technical activity cost	34,388.0	82,285.0	30,557.7	Unknown	Unknown
Administrative cost	Unknown	Unknown	3,395.3	Unknown	Unknown
Public investment			200,000.0	200,000.0	300,000.0
Total	84,388.0	82,285.0	329,144.0	336,307.3	573,081.0
Balance	2,551.5	-15,823.5	0.5	1.0	0.5

Source：Annual report / Annual action plan of NADC（2008～2012）

[LARReC]

The budget for operation of LARReC is shown below. Approx. 150 million kip is the budget for activities.

Table 2-24 Budget of LARReC (2008/09～2012/13)

(Million kip)

Item	Fiscal Year				
	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
Operation	60	60	65	70	70
Activities	50	100	150	280	150
Facilities	84	90	90	100	108
Equipment	8	10	9	12	13
Equipment maintenance	5	10	15	28	15
Total	207	270	329	490	356

(2) Operation and Maintenance Cost

[NADC]

1) O/M cost for facilities

i) Electricity costs

The electric charge is billed directly to the Ministry of Agriculture and Forestry and this expenditure is not appropriated with NADC. The

electric charge for the existing facilities for 2013 obtained from the Ministry of Agriculture and Forestry is stated below. 42.239 million Kip for one year and 3.52 million kip for average of one month. The electric charge is increased especially during the rainy season with high temperature. The total floor space of existing air conditioned buildings of administration and training office building and the dormitory for specialist and trainee is 1,090m2 (312+254+104+420). The total floor space using pump such as brood stock tanks, incubation tanks and hatchery is 1,276m2 (76+311+233+170+486). All the space is totaled and the electric charge per space is calculated and shown in the following table.

Table 2-25 NADC Electricity Bill in 2013

(Unit: 1,000 Kip)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total	Avg.
Electricity Bill	3,076	2,684	3,624	3,869	4,273	4,147	5,345	4,568	3,639	2,058	2,189	2,767	42,239	3,520
Per m^2	1.30	1.13	1.53	1.64	1.81	1.75	2.26	1.93	1.54	0.87	0.93	1.17	17.86	1.49

The total floor space of newly constructed facilities equipped with air conditioners or pumps is 659m2 for administration and training office building, 880m2 for dormitory, 147m2 for new hatchery and 178m2 for each Moina culture tank and tilapia larval rearing tank. The electric charge for facilities is estimated to 3.042 million kip/month. However, the proportion of rooms equipped with air conditioners is larger than the existing buildings; it is supposed to be 3.65 million kip/month with 20% additional increase. Therefore, the electricity bill is almost equivalent to the same electric charge for the existing buildings and Ministry can afford without big burden.

ii) Facility Maintenance Cost

The supposed cost for maintenance of facilities is 10 million Kip per year. The items and costs are shown below.

Table 2-26 Estimation of Annual Building Maintenance Cost

Type	Item	Content/ Estimates	Frequency	Total Cost(Kip)
Consumables	Lighting fixtures	Replacing 20% of fluorescent lamp annually	As needed	360,000 Kip/year
	Liquid chlorine	Estimated based on the amount of replenishment/ water supply	1 time/year	160,000 Kip/year
	Filter	Estimated based on the number of filter replacement	1 time/year	540,000 Kip/year
	Subtotal			1,060,000 Kip/year
Maintenance	Substation	Inspection by staff	1 time/year	
	Generator set	Accounted for only inspection and replacement by staff	1 time/year	3,5701,000 Kip/year
	Ground water tank cleaning	Cleaning by staff	1 time/year	
	Elevated water tank cleaning	Cleaning by staff	1 time/year	
	Septic tank	Inspection by staff	3 times/year	
	Septic tank sludge removal	Work done by specialist	3 times/year	4,400,000 Kip/year
	Subtotal			7,970,000 Kip/year
Total				10,090,000 Kip/year

As shown in Table 2-22, the average expenditure of NADC for 3 years (2020/11-2012/2013) is 423 million kip. The cost for maintenance of facilities is 10 million kip which is equivalent to approx. 2.4% of total expenditure of NADC and is possible to bear.

2) Equipment

The expenditure for the operation and maintenance of equipment borne by the Laotian side after delivery is supposed to be approx. 900 thousand yen (75 million Kip) per year as shown in the table 2-27. The supposed yearly budget of 250 million kip at present is not enough for the activity of NADC. However, NADC budget shall be increased through the increase in production amount for seed because this sales amount shall be returned from the state as the activity budget for the next year (approx. 4.7 billion kip when calculated with the final targeted production amount). Also, considering the fact that the Minister showed informal consent to the arrangement of the additional personnel and budget for the action plan of strengthening NADC structure, it is considered to be enough feasible for the operation of NADC.

The sales forecast by increased seed production is shown in the table 2-28.

Table 2-27 Cost Estimation of Consumables of NADC

(Unit: Yen)

No.	Equipment	Expendables・Spare Parts	Q'ty		Unit Price	Total
38	Tag Reader	PIT Tag	1,000	unit	100	100,000
53	DO Meter	Dissolved Oxygen Probe	1	unit	20,000	20,000
		Diaphragm Set	6	sets	1,000	6,000
		Electrolyte(30ml)	2	units	2,000	4,000
54	pH Meter	Extra Electrode(1 unit)	1	unit	20,000	20,000
		Ph Standard Solution pH4, pH7, pH9	1	set	8,000	8,000
57	Water Distillation Apparatus	Replacement Heater(3 units)	1	unit	20,000	20,000
61	Crude Lipid analsis system	Extraction Thimble	1	unit	5,000	5,000
		Petroleum Ether (18 Lt)	2	sets	10,000	20,000
		Silica Gel Blue (500g)	3	units	1,000	3,000
63	Crude Protein Tester	0.1 Hydrochloric Acid (500ml)	8	units	1,000	8,000
		Hydrogen Peroxide Solution(500ml)	8	units	1,000	8,000
		Sulphuric Acid (500ml × 8 units)	8	units	1,000	8,000
		Methyl Red (25g)	1	unit	3,000	3,000
		Bromocresol Green Solution (500ml)	12	units	10,000	120,000
		Boric Acid (500g)	2	sets	1,000	2,000
		Ethanol (18 lt)	1	unit	10,000	10,000
		Sodium Hydroxide(500g)	4	units	1,000	4,000
64	Hazard Residue Tester	for 30 times	1	set	50,000	50,000
65	Microscope/w Camera	Immersion Oil	1	unit	3,000	3,000
66	Ammonium Test Kit	for 100 times	1	set	7,000	7,000
67	Nitrous Acid Test Kit	for 100 times	1	set	9,000	9,000
68	Nitrate Test Kit	for 100 times	1	set	5,000	5,000
69	Alkalinity Test Kit	for 100 times	1	set	2,000	2,000
72	DO Test Kit	for 30 times	1	set	10,000	10,000
73	Portable pH Meter	Extra Electrode(1 unit)	1	set	20,000	20,000
		Standard Solution	1	unit	5,000	5,000
76	Handy pH meter	Replacement Sensor	1	unit	10,000	10,000
		Standard Solution	1	unit	7,000	7,000
84	Fiber Analyzing Equipment Set	Exclusive Filter Bag	1	unit	300,000	300,000
		Acetone-resistant Pen	5	pcs	2,000	10,000
		Consentrated Sulphuric Acid(500ml)	20	units	500	10,000
		Sodium Hydroxide(500g)	4	units	1,000	4,000
		Acetone(500ml)	20	units	500	10,000
91	Biological microscope	Immersion Oil	1	unit	3,000	3,000
98	Phosphorus Nitrogen Test meter	Total Nitrogen Reagent Set	1	set	18,000	18,000
		Total Phosphorus Reagent Set	1	set	10,000	10,000
		Total				862,000

Table 2-28 Sales forecast of seed production

(Unit: Kip)

	Species	Seed production	Unit price	Total sales amount
1	Puntius	5,000,000	150	750,000,000
2	Common carp	1,500,000	150	225,000,000
3	Tilapia (mixed-sex)	2,000,000	150	300,000,000
4	Tilapia (All-male)	3,000,000	500	1,500,000,000
5	Grass carp	1,500,000	200	300,000,000
6	Catla	2,500,000	250	625,000,000
7	African catfish	2,000,000	300	600,000,000
8	Sliver carp + Bighead carp	2,500,000	150	375,000,000
	Total	20,000,000		4,675,000,000

[LARReC]

The major consumables to be required for equipment procured in The Project are shown in the table 2-29. Approx. 700 thousand yen (58.4 million Kip) is supposed for required expenditure but the current budget for operation is not enough. However, as the current budget is based on the very few existing equipment at present and it is supposed to be increased in accordance with the induction of new equipment. Therefore, it is assumed to be enough feasible in operation and maintenance of equipment after delivery.

Table 2-29 Cost Estimation of Consumables of LARReC

(Unit: Yen)

No.	Equipment	Expendables・Spare Parts	Q'ty		Unit Price	Total
53	DO Meter	Dissolved Oxygen Probe	1	unit	20,000	20,000
		Diaphragm Set	6	sets	1,000	6,000
		Electrolyte(30ml)	2	units	2,000	4,000
54	pH Meter	Extra Electrode(1 unit)	1	unit	20,000	20,000
		Ph Standard Solution pH4, pH7, pH9	1	set	8,000	8,000
61	Crude Lipid analsis system	Extraction Thimble	1	unit	5,000	5,000
		Petroleum Ether (18 Lt)	2	sets	10,000	20,000
		Silica Gel Blue (500g)	3	units	1,000	3,000
63	Crude Protein Tester	0.1 Hydrochloric Acid (500ml)	8	units	1,000	8,000
		Hydrogen Peroxide Solution(500ml)	8	units	1,000	8,000
		Sulphuric Acid (500ml × 8 units)	8	units	1,000	8,000
		Methyl Red (25g)	1	unit	3,000	3,000
		Bromocresol Green Solution (500ml)	12	units	10,000	120,000
		Boric Acid (500g)	2	sets	1,000	2,000
		Ethanol (18 lt)	1	unit	10,000	10,000
		Sodium Hydroxide(500g)	4	units	1,000	4,000
65	Microscope/w Camera	Immersion Oil	1	Unit	3,000	3,000
66	Ammonium Test Kit	for 100 times	1	Set	7,000	7,000
67	Nitrous Acid Test Kit	for 100 times	1	Set	9,000	9,000
68	Nitrate Test Kit	for 100 times	1	Set	5,000	5,000
69	Alkalinity Test Kit	for 100 times	1	Set	2,000	2,000
72	DO Test Kit	for 30 times	1	Set	10,000	10,000
76	Handy pH meter	Replacement Sensor	1	unit	10,000	10,000
		Standard Solution	1	unit	7,000	7,000
84	Fiber Analyzing Equipment Set	Exclusive Filter Bag	1	unit	300,000	300,000
		Acetone-resistant Pen	5	pcs	2,000	10,000
		Consentrated Sulphuric Acid(500ml)	20	units	500	10,000
		Sodium Hydroxide(500g)	4	units	1,000	4,000
		Acetone(500ml)	20	units	500	10,000
91	Biological microscope	Immersion Oil	1	Unit	3,000	3,000
98	Phosphorus Nitrogen Test meter	Total Nitrogen Reagent Set	1	set	18,000	18,000
		Total Phosphorus Reagent Set	1	set	10,000	10,000
Total						667,000

Chapter 3 Project Evaluation

3-1 Preconditions

The Project consists of construction of new facilities on a vacant lot of the premises of existing NADC facility and improvement of equipment for the facility and existing facility and improvement of equipment for existing LARReC facility. Thus, there is no precondition for land acquisition. However, the construction of new facility requires construction permit and tax exemption procedures and what the recipient country is in charge of needs to be completed without delay for the smooth implementation of the Project.

3-2 Necessary Inputs by Recipient Country

The listed items as bellow are needed to be performed or prepared properly by Laos for the achievement of the entire Project.

- Items Laos is in charge of described in Chapter 2
- Securing human resources and budget necessary for specifications and maintenance of the equipment to be procured and facility to be constructed
- Securing space and utility to install the equipment in the existing building

3-3 Important Assumptions

The Project consists of construction of seed production facility and training facility, etc., improvement of equipment, and soft components that include tilapia seed production techniques and inspection techniques necessary for NADC operation and improvement of equipment necessary for work operation for LARReC. It is important that the facilities and equipment will be fully utilized and that they will continue operation for which the Project is implemented. Particularly, training activities carried out by NADC benefit the entire Laos and the success or failure of the Project largely depends on the formulation and implementation of efficient and effective training plans. Thus, it is desired that planned training programs be carried out actively and continuingly.

3-4 Project Evaluation

The Project is relevant as a Japan's Grant Aid project for reasons listed below.

3-4-1 Relevance

(1) Project beneficiaries

The target organizations of the Project are NADC and LARReC and there will be 68 direct beneficiaries. Because the seeds produced by NADC are distributed to fish farmers across the nation, it is farmers in the country are also direct beneficiaries. The marine products produced by the fish farmers also benefit all the people of Laos. Thus, the Project is highly relevant.

(2) Perspective of human security

Human security is a concept of promoting sustainable independence of individuals and community development through protection and capacity building, looking at each and every person, protecting them from broad and serious threats against survival, livelihood and dignity in order to realize their full potential.

From the perspective that the Project will help stable supply of fresh and safe fish, it is consistent with the perspective of human security and thus is relevant.

(3) Contribution to achievement of mid- to long-term development goals of the target country.

The 7th National Development Plan includes food security and production increase and value addition of commercial crops as focal goals in agriculture and forestry. The plan also promotes expansion of public seed production facilities and increased production of seeds to be distributed to growers against the backdrop of importance of aquaculture. The Project includes elements to realize the goal. From the perspective, the Project is consistent with the relevant mid- to long-term development goals of Laos and thus is relevant.

(4) Consistency with Japan's Grant Aid policy

In the country assistance policy (April 2012) for Laos of the Ministry of Foreign Affairs of Japan, agricultural development and forest conservation are main pillars (mid-level goal) and it says that Japan intends to provide assistance for the improvement of farmers' income and productivity and promotion of commercial crop cultivation. Aquaculture development and higher productivity as a result of the improvement of related techniques when the Project is implemented is expected to increase farmers' (fishermen's) income. Thus, the Project is also highly relevant.

3-4-2 Effectiveness

The Project is estimated to have the following numerical effects:

(1) Quantitative effects

Indicator	Baseline (actual figures in 2013)	Target (2019) [3 years after project completion]
Number of fish species whose juveniles are produced by NADC	5	8
Juvenile production by NADC (1 million inds.)	3.8	10
Trainees' dormitory occupation rate (%)	18.1	27.4
Number of research projects of LARReC	10	12

(2) Qualitative effects

The Project will help enhance the aquaculture technique promotion structure for farmers and aquaculture operators.

1. Member List of the Study Team

1-1. Preparatory Survey 1

Position		Name	Organisation	Schedule
1	Cooperation Planning	Mr. Toshinobu MIKI	Paddy Field Based Farming Area Division 1 Rural Development Department, JICA	3/30～4/5
2	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Mr. Yasumichi DOI	INTEM Consulting, Inc.	3/30～4/9
3	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Mr. Yasuhiro MATSUMOTO	AZUSA SEKKEI CO., LTD.	3/30～4/9
4	Fresh aquaculture planning/ Operation and Management planning	Mr. Goro NEZAKI	INTEM Consulting, Inc.	3/30～4/9
5	Construction plan 2/Cost Estimation2	Mr. Yosuke OTA	AZUSA SEKKEI CO., LTD.	3/30～4/9

1-2. Preparatory Survey2

Position		Name	Organisation	Schedule
1	Mission Leader	Mr. Satoshi CHIKAMI	JICA Senior Adviser	4/21～4/25
2	Cooperation Planning	Mr. Toshinobu MIKI	Paddy Field Based Farming Area Division 1 Rural Development Department, JICA	4/20～4/25
3	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Mr. Yasumichi DOI	INTEM Consulting, Inc.	4/20～5/10
4	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Mr. Yasuhiro MATSUMOTO	AZUSA SEKKEI CO., LTD.	4/29～5/10
5	Fresh aquaculture planning/ Operation and Management planning	Mr. Goro NEZAKI	INTEM Consulting, Inc.	4/20～5/10
6	Environmental and Social Considerations/ Baseline Survey	Dr. Hajime ISHIHARA	INTEM Consulting, Inc.	4/20～5/16

1-3. Explanation of Draft Report

Position		Name	Organisation	Schedule
1	Mission Leader	Mr. Satoshi CHIKAMI	JICA Senior Adviser	10/19～10/25
2	Fisheries Policy	Mr. Isao KOYA	Rural Development Department, JICA	10/19～10/25
3	Cooperation Planning	Mr. Hiroaki IMAI	Rural Development Department, JICA	10/19～10/25
4	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Mr. Yasumichi DOI	INTEM Consulting, Inc.	10/19～10/25
5	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Mr. Yasuhiro MATSUMOTO	AZUSA SEKKEI CO., LTD.	10/19～10/25
6	Fresh aquaculture planning/ Operation and Management planning	Mr. Goro NEZAKI	INTEM Consulting, Inc.	10/19～10/25

2. Study Schedule

2-1. Preparatory Survey 1

Date			Mission Leader	Cooperation Planning	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Fresh aquaculture planning/ Operation and Management planning	Construction plan 2/Cost Estimation2
			Mr. Chikami	Mr. Miki	Mr. Doi	Mr. Matsumoto	Mr. Nezaki	Mr. Ota
3/30	Sun.	AM	-	Tokyo→Vientiane				
3/31	Mon.	AM	-	Discussion with JICA				
		PM	-	Discussion with DOP Discussion with DLF				
4/1	Tue.	AM	-	Discussion with DLF, LARReC				
		PM	-	Survey at NADC				
4/2	Wed.	whole days	-	Survey at LARReC, NADC and Discussion				
4/3	Thu.	whole days	-	Survey at NADC and Discussion				
4/4	Fri.	AM	-	Discussion with NADC				
		PM	-	Report to JICA		Discussion with Construction Company	Discussion with LARReC	Same as Mr. Matsumoto
			-	Vientiane→Tokyo	Discussion with LARReC			
4/5	Sat.	whole days	-		Survey at Market			
4/6	Sun.	whole days	-		Data Filing			
4/7	Mon.	AM	-		Discussion with DLF Data Collecting			
		PM	-		Discussion with LARReC			
4/8	Tue.	AM	-		Discussion with NADC			
		PM	-		Vientiane→			
4/9	Wed.	whole days	-		→Tokyo			

2-2. Preparatory Survey 2

Date			Mission Leader	Cooperation Planning	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Fresh aquaculture planning/ Operation and Management planning	Environmental and Social Considerations/ Baseline Survey
			Mr. Chikami	Mr. Miki	Mr. Doi	Mr. Matsumoto	Mr. Nezaki	Dr. Ishihara
4/20	Sun.	AM	-	Tokyo→Vientiane			Same as PM	
4/21	Mon.	AM	Courtesy Call on JICA, EOJ				Same as PM	
		PM	Discussion with DLF, NAFRI				Same as PM	
4/22	Tue.	AM	Internal Meeting				Same as PM	
		PM	Courtesy Call on MOF, Discussion with DOP				Same as PM	
4/23	Wed.	AM	Discussion with DLF				Same as PM	
		PM	Discussion with LAREREC, NAFRI Discussion with DLF				Same as PM	
4/24	Thu.	whole days	Internal Meeting, Data Filing				Same as PM	
4/25	Fri.	AM	Report to JICA				Same as PM	
		PM	-	Vientiane→Tokyo	Data Filing		Same as PM	
4/26	Sat.	whole days			Data Filing		Same as PM	
4/27	Sun.	whole days			Data Filing		Same as PM	
4/28	Mon.	AM			Discussion with NADC		Same as PM	
		PM					Same as PM	
4/29	Tue.	AM			Survey and Discussion at NADC		Same as PM	Survey at NADC
		PM				Tokyo→Vientiane	Same as PM	
4/30	Wed.	AM			Discussion with LARReC	Discussion with Survey Company		Discussion with MOE
		PM			Survey at Market	Survey at Market		Preparation of Document
5/1	Thu.	AM						Survey at NADC
		PM						
5/2	Fri.	AM						Stakeholder Meeting
		PM						
5/3	Sat.	AM						Data Filing
		PM						
5/4	Sun.	AM			Data Filing			
		PM						
5/5	Mon.	AM			Survey at NADC	Discussion with Survey Company	Same as PM	Survey at NADC
		PM			Discussion with LARReC	Discussion with NADC	Same as PM	Survey at LARReC
5/6	Tue.	AM			Discussion with NADC	Discussion with DLF, NADC	Same as PM	Survey at NADC
		PM			Survey at Market	Survey at Market	Same as PM	
5/7	Wed.	AM			Survey at Market	Survey at Market	Same as PM	Survey at NADC
		PM			Discussion with DLF, NADC			
5/8	Thu.	AM			Discussion with NADC, LARReC			Stakeholder Meeting
		PM			Report to EOJ			
5/9	Fri.	AM			Report to JICA			Data Filing
		PM			Vientiane→			
5/10	Sat.	AM			→Tokyo			Data Filing
		PM						
5/11	Sun.	AM						Data Filing
		PM						
5/12	Mon.	AM						Survey at NADC
		PM						Discussion with DLF
5/13	Tue.	AM						Report to MOE
		PM						
5/14	Wed.	AM						Survey at NADC
		PM						
5/15	Thu.	AM						Survey at NADC
		PM						Vientiane→
5/16	Fri.	AM						→Tokyo
		PM						

2-3. Explanation of Draft Report

Date			Mission Leader	Fisheries Policy	Cooperation Planning	PM/Equipment and Maintenance planning/ Procurement and Cost Estimation1	Sub-PM/Architectural and Facility Design/Natural conditions survey / Construction plan 1/Cost Estimation1 / Maintenance Planning 2	Fresh aquaculture planning/ Operation and Management planning
			Mr. Chikami	Mr. Koya	Mr. Imai	Mr. Doi	Mr. Matsumoto	Mr. Nezaki
10/19	Sun.	AM	-	Tokyo→Vientiane				
10/20	Mon.	AM	Report to Embassy, Discussion with DLF					
		PM	Discussion with NAFI, DOPC, Report to JICA					
10/21	Tue.	AM	Discussion with NADC					
		PM	Discussion with LARReC					
10/22	Wed.	AM	Discussion with DOP, DLF, NAFRI for M/M					
		PM	Data Filing					
10/23	Thu.	AM	Discussion with DOP, DLF, NAFRI for M/M					
		PM	Data Filing					
10/24	Fri.	AM	Sighing of M/M, Report to JICA					
		PM	Report to Embassy					
			-	-		Vientiane→		
10/25	Sat.	whole days	-	Tokyo→Vientiane		→Tokyo		→Cotonou

3. List of Parties Concerned in the Recipient Country

Organization	Position	Name
Ministry of Agriculture and Forestry (MAF)		
	Vice Minister	Dr. Phet Phomphiphak
Department of Planning & Cooperation	Director General	Mr. Xaypladeth Choulamany
Department of Livestock & Fisheries (DLF)	Director General	Dr. Bounkhouangkhambounheuang
	Deputy Director General	Mr. Bounthong Saphakdy
	Deputy Director General	Dr. Sithong Phiphakhavong
	Director, Division of Fisheries	Mr. Sommano Phounsavath
	Deputy Director, Division of Fisheries	Mr. Viengsombark Bouasavath
	Deputy Chief of Fishery Management Section, Division of Fisheries	Mr. Bounthanom Chamsinhg
Namxouang Aquaculture Development Center (NADC)	Director	Mr. Thougkhoun Khonglaliane
	Deputy Director	Mr. Vannaphar Tammajedy
	Deputy Director	Mrs. Khonsavanh
National Agriculture and Forestry Research Institute (NAFRI)	Director	Mr. Lieng Khamsivilay
	Deputy Director	Mr. Douangkham Singhanouvong
	Head of Aquaculture Unit	Mr. Bounsong
Living Aquatic Resources Research Center (LARReC)	Head of Capture Fisheries Research Unit	Mrs. Khamphong Homesombath
SMP Design & Construction Sole Co., Ltd.	Managing Director	Mr. Phoukhaokham Vannha
	Deputy Director (Architect)	Mr. Virathoun Phounsavath
	Site Manager	Mr. Phaisavath Nilaxay
Visouda Construction Co., Ltd.	Director	Mr. Khamhou Saysana
Embassy of Japan	Counselor	Mr. Hideyuki OHNISHI
JICA Lao's Office	Director	Mr. Koichi TAKEI
	Deputy director	Ms. Machiko KAMIYA
		Mr. Syuhei TERADA

4. Minutes of Discussions（M/D）

4-1 Preparatory Survey

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR THE CONSTRUCTION OF THE NATIONAL AQUACULTURE AND FISHERIES RESEARCH AND DEVELOPMENT CENTER
IN
LAO PEOPLE'S DEMOCRATIC REPUBLIC

In response to a request from the Government of Lao People's Democratic Republic (hereinafter referred to as "GOL"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct the Preparatory Survey on the Project for the Construction of the National Aquaculture and Fisheries Research and Development Center (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 People's Democratic Republic (hereinafter referred to as "Lao PDR") the Preparatory Survey Team (hereinafter referred to as "the Team") headed by Dr. Satoshi Chikami, Senior Advisor, JICA and is scheduled to stay in the country from 30 March to 15 May, 2014.

The Team held discussions with the officials concerned of GOL and conducted a field survey at the survey area.

As a result of discussions and field survey, the both sides confirmed the main points described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Vientiane, April 25, 2014

Dr. Satoshi Chikami
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. Xaypladeth Choulamany
Director General
Department of Planning and Cooperation
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

Witnessed by:

Dr. Bounkhouang Khambounheuang
Director General
Department of Livestock and Fisheries
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

for Dr. Bounthong Bouahom
Director General
National Agriculture and Forestry Research Institute
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

ATTACHMENT

1. Inception Report

The Team explained the objective of the Project and procedure of the Survey to be conducted in accordance with the Inception Report. After a series of discussions, the Team and GOL side (hereinafter referred to as "the both sides") agreed on the contents of the Inception Report in principle.

2. Objective of the Project

The objective of the Project is to improve facilities and equipment for fisheries and aquaculture research and development in Lao PDR.

3. Project Site

The site of the Project is in Namxouang and Nongteng. A map of the site is attached as Annex 1.

4. Executive and Implementing Agency

4-1. The executive agency is Department of Planning and Cooperation (DOPC), Ministry of Agriculture and Forestry, Government of the Lao People's Democratic Republic.

4-2. The implementing agency is Department of Livestock and Fisheries (DLF) and National Agriculture and Forestry Research Institute (NAFRI), Ministry of Agriculture and Forestry, the Government of the Lao People's Democratic Republic

4-3. The implementation structure for the Project is agreed by the both sides as shown in Annex 2. Steering Committee will be organized among DOPC, DLF and NAFRI under the chairmanship of Vice Minister for better communication and implementation of the Project. Steering Committee is the body to share the information and monitor/evaluate the progress of the Project, and make necessary decision when the issues arise with regard to the Project.

4-4. The organization chart of the Ministry of Agriculture and Forestry is confirmed by the both sides as described in Annex 3.

5. Building, Facilities and Equipment requested by GOL

5-1. After discussions between the both sides, the building, facilities and equipment contents requested by GOL were revised with priority and finally requested as described in Annex 4.

5-2. However, the priority of building, facilities and equipment marked by asterisk (*) in relation to establishment of new function (such as Capture Fisheries Unit, Pathology Lab, Taxonomic Lab, etc) under DLF is subject to further examination.

5-3. Therefore, the Team requested DLF to submit concrete supporting documents and Action Plan prepared in English to the Team, which is endorsed by higher authority

of GOL. The both side confirmed that the deadline of submission is set **on or before 7th May, 2014**. These documents must include operational plan for at least five (5) years with human resource and budget allocation as well as concrete analytical activities at laboratories among others. The Team will analyze documents so as to evaluate feasibility of the plan and determine project components. Otherwise, it would be difficult to consider items mentioned in above 5-2.

6. Japan's Grant Aid Scheme

6-1. GOL side understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex 5.

6-2. The Team explained major undertakings to be taken by each government as described in Annex 6, for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented. The both sides agreed that liabilities of taxes, duties and levies with respect to the Project will remain further discussion.

7. Environmental and Social Considerations

7-1. GOL side agreed to take necessary procedures for due environmental and social conditions for the implementation of the Project. Detailed procedures (items, responsible agencies, deadlines) will be clarified through the Preparatory Survey.

7-2. The Team explained that Initial Environmental Examination (IEE) needs to be done since the Project is classified into category B according to the JICA Guidelines for Environmental and Social Consideration (April, 2010). The both sides confirmed that IEE would be conducted according to Lao PDR's law and regulation, and JICA's guideline above.

7-3. The both side confirmed that land registration of Namxouang project site as presented in Annex 7 certifies exclusive land use and occupation by the Ministry of Agriculture and Forestry and the land plot is secured for the Project.

8. Schedule of the Preparatory Survey

8-1. The Team will proceed to further surveys in Lao PDR until 15th May, 2014.

8-2. JICA will prepare the Draft Final Report in English and dispatch a mission in order to explain its contents in October, 2014 at the earliest.

8-3. In case the contents of the report are accepted in principle by GOL side, JICA will finalize it as Final Report and send it to GOL.

9. Other Relevant Issues

9-1. Title of the Project

The both sides confirmed that the title of the Project should be changed to "the Project for Strengthening Research and Development on Fisheries and Aquaculture" instead of "the Project for the Construction of the National Aquaculture and Fisheries

Research and Development Center."

9-2. Support for the Team

The Team explained the importance of security for persons concerned with the Project in order to implement the Preparatory Survey and the Project. GOL side understood that and expressed to take necessary measures for the subsequent surveys.

9-3. Permissions necessary for the Project

GOL side agreed to issue or to arrange permissions from the organizations concerned necessary for the Project implementation prior to the construction of the proposed facilities.

9-4. Coordination with local authorities and others concerned

GOL side agreed that, with thorough understanding on the Project, activities and information of the Team would be appropriately informed to the local authorities and communities concerned, and meetings with stakeholders would be organized as required.

9-5. Maintenance of Building, Facilities and Equipment

GOL side understood that operation and maintenance cost would have to be borne by GOL along with other responsibilities explained by the Team, if construction of building and facilities and procurement of equipment would be implemented under the Project. GOL committed to secure budget and personnel for proper maintenance of building, facilities and equipment, if they would be proposed as a result of Preparatory Survey.

9-6. Soft Component

The both sides also confirmed technical service as a soft component would be necessary for initial operation and maintenance of facilities and equipment to be procured under the Project. The Team would convey the request to the GOJ and GOL side agreed to make efforts for providing their staff for necessary arrangements, if the soft component would be proposed.

9-7. Approval of the Project

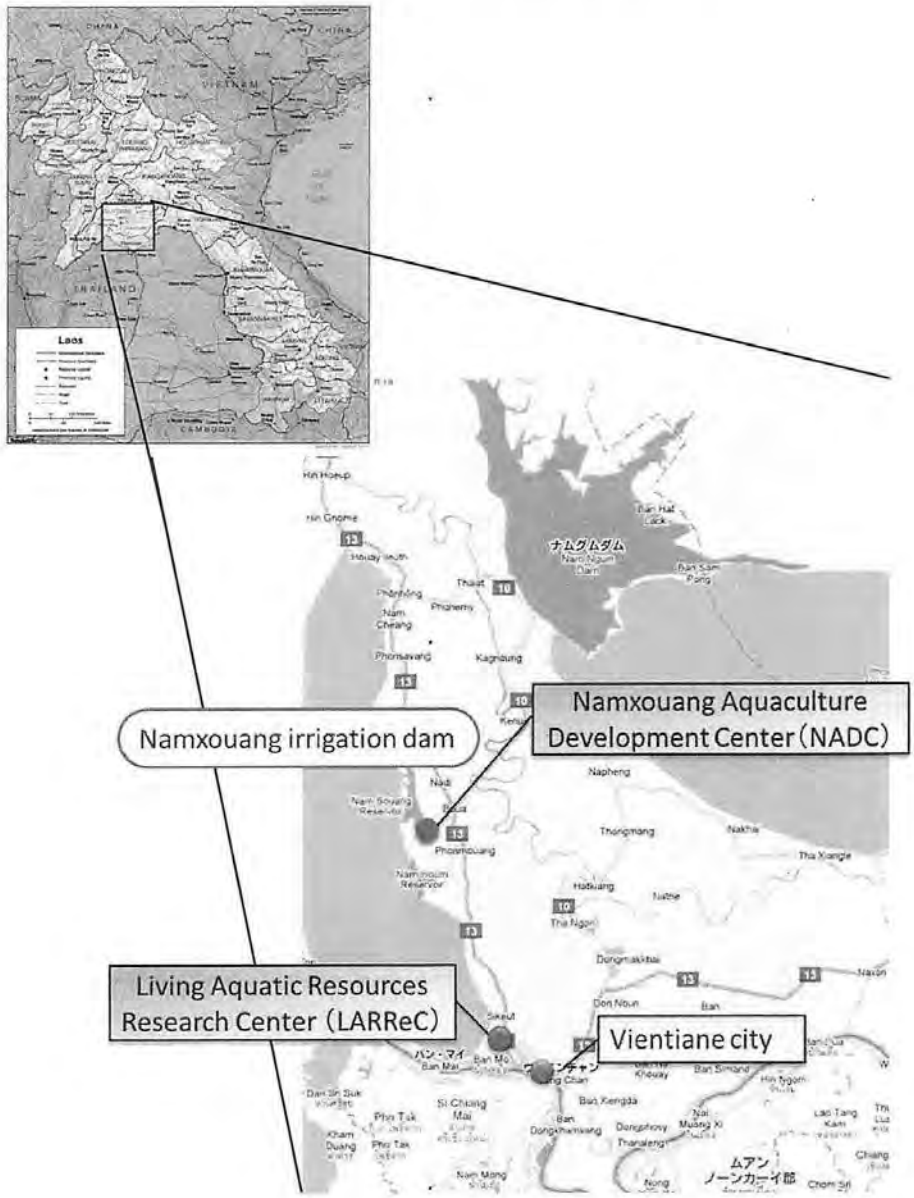
The both sides confirmed that the approval of the Project would be depended on the decision by the GoJ.

END

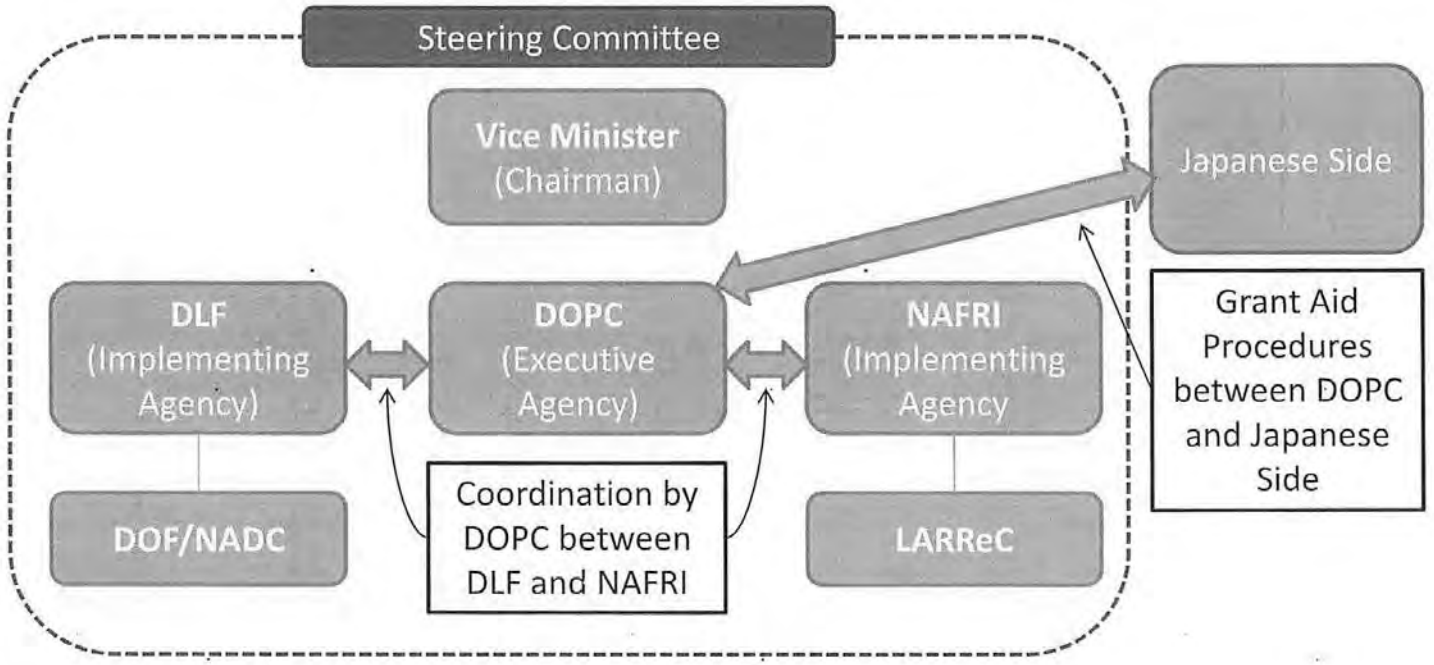
Annex 1 Map of Lao People's Democratic Republic and Project Sites

Annex 2	Implementation Structure for the Project
Annex 3	Organization Chart of the Ministry of Agriculture and Forestry
Annex 4	Revised Contents Requested by GOL
Annex 5	Flow Chart of Japan's Grant Aid Procedures
Annex 6	Major Undertakings to be taken by each Government
Annex 7	Land Registration Certificate of Project Site in Namxouang

Annex 1: Map of Lao People's Democratic Republic and Project Sites

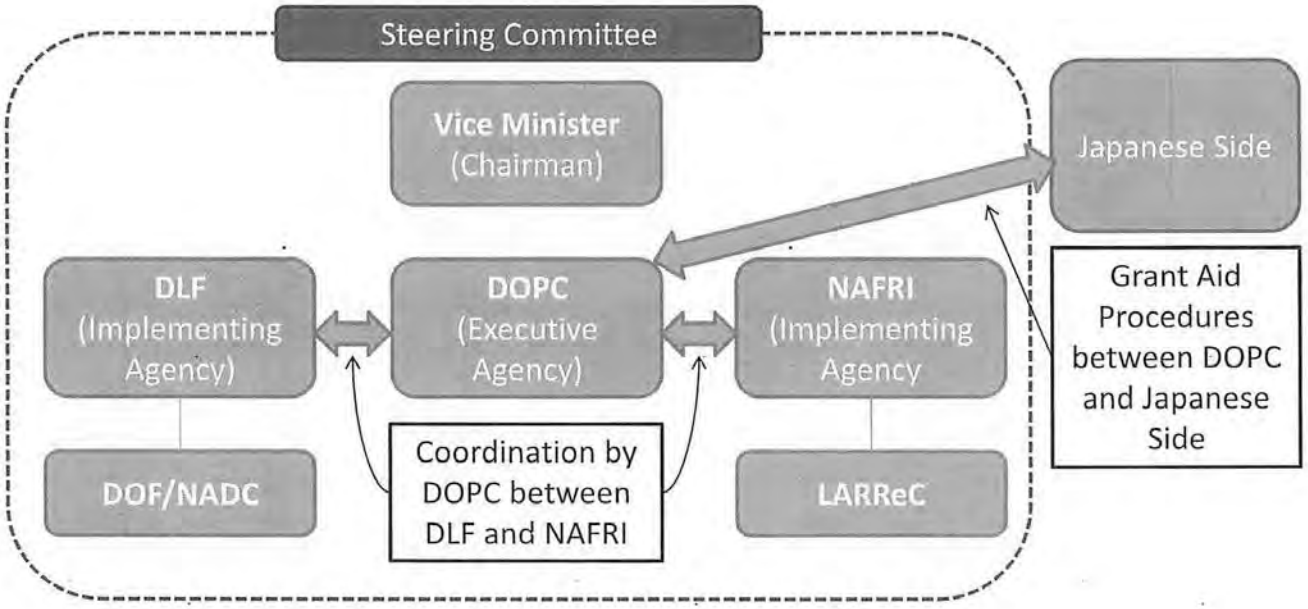


Annex 2: Implementation Structure for the Project



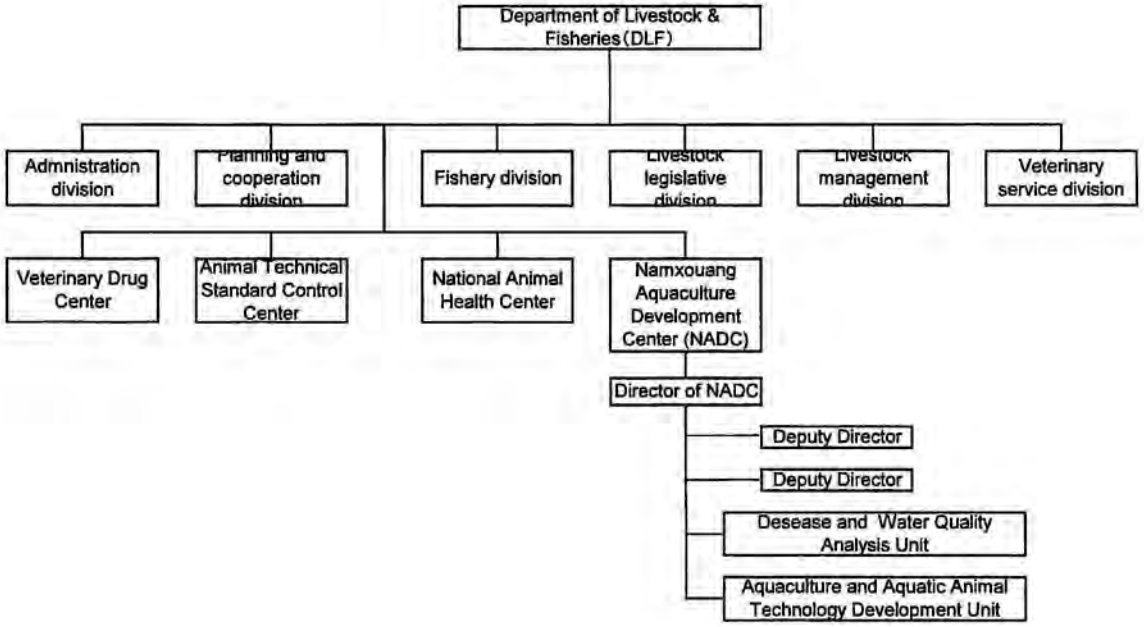
DOF: Division of Fisheries

Annex 2: Implementation Structure for the Project

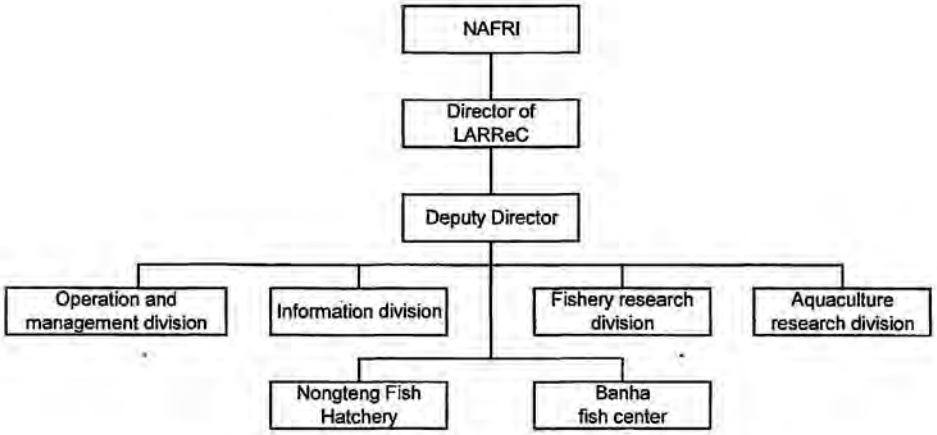


DOF: Division of Fisheries

Annex 3-2: Organization Chart of Departmenf of Livestock and Fisheries and NADC



Annex 3-3: Organization Chart of LARReC



Annex 4: Revised Contents Requested by GOL

I NADC

1 Outside Facilities

Items	Priority
(1) Hatchery	A
(2) Broodstock Ponds	A
(3) Nursery Ponds	A
(4) Cement Tanks for Moina Culture	A
(5) Cement Tanks for Tilapia Broodstock	C
(6) Elevated tank	A
(7) Water Reservoir	C
(8) Water Supply Piping System	B

2 Building

	(1) Main Office	-
	1) Director Room	B
	2) Deputy Director Room	B
	3) Room for Heads of Units	C
*	4) Technical Unit Office (Aquaculture, Fishery, Disease Analysis, Training)	B
	5) Administration Office	B
	6) Meeting Room (L)	B
	7) Meeting Room (S)	B
	8) Store Room	B
	(2) Trainee Dormitory	-
	1) Dormitory	A
	2) Male Toilet & Shower Room	A
	3) Day Room	A
	(3) Student Dormitory	-
	1) Dormitory	A
	2) Male Toilet & Shower Room	A
	3) Female Toilet & Shower Room	A
	4) Kitchen	A
	5) Day Room	A
	(4) Officer Dormitory	-
	1) Dormitory	A
	2) Toilet & Shower Room	A

(5) Storage	-
1) Equipment Store	C
2) Workshop & Equipment House	C
3) Fish Feed Storage	B
(6) Rooms for Training and Information	-
1) Library	B
2) Training Room	A
3) Preparation Room	A
(7) Laboratory	-
1) Wet Lab	B
2) Chemical Storage	B
* 3) Pathology Lab	B
* 4) Taxonomic Lab	B
5) Specimen Room	B
6) Experimental & Demonstration Room	B
(8) Hatchery House	-
1) Larval Rearing Room	B
2) Spawning Room	B
3) Incubation Room	B
4) Storage Room	B
(9) Others	-
1) Dormitory for Lecturers	B
2) Machine House	B
3) Generator House	A
4) Garage	C

3 Equipment

(1) Equipment for Administration Division	B
(2) Equipment for Trainee Dormitory	B
(3) Equipment for Student Dormitory	B
(4) Equipment for Officer Dormitory	B
(5) Workshop Equipment	B
(6) Equipment for Feed Preparation	B
(7) Equipment for Hatcheries	B
(8) Equipment for Brood Fish Rearing	B
(9) Equipment for Fingerling Rearing	B

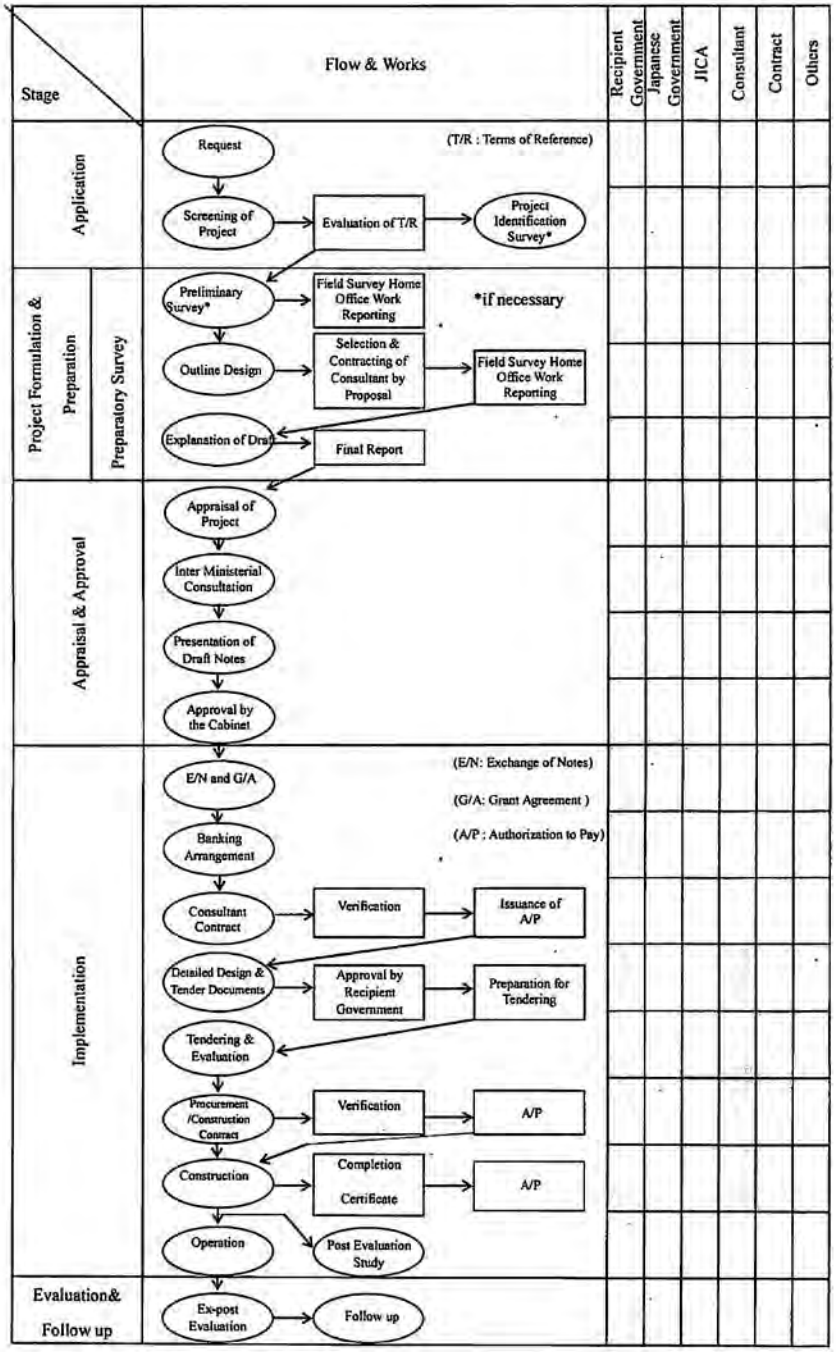
	(10) Equipment for Fisheries Unit	-
*	1) Four Wheel Car for Field Survey	B
	2) Tractor	B
	3) Truck	B
*	4) GPS	B
*	5) Echo Sounder	B
	6) Speed Boat	C
	7) Four Wheel Car	C
	8) Others	B
	(11) Equipment for Training and Information Unit	-
	1) Mini Bus	B
	2) LCD Projector	B
	3) DVD/VCD Player	B
	4) Library Furniture	B
	5) E/library System	B
	6) Information System (Server, PCs, etc.)	B
	(12) Equipment for Laboratories	-
	1) Equipment for Water Quality Analysis	A
	2) Equipment for Feed Quality Analysis	B
	3) Microscope	B
	4) Digital Balance	B
	5) Refrigerator	B
	6) Freezer	B
	7) Shelves for Specimen	B
	8) Specimen Bottles	B
	9) Fish Passage Models	C
	10) Others	B

II LARReC

(1) Equipment set for Fish DNA Checking	B
(2) Equipment set for Fish Sperm Keeping	B
(3) Equipment set for Water Quality Analysis	B
(4) Bottle for Keep Water in the Field	B
(5) Equipment set for Protein, Fiber, Fat, Ash Analysis	B
(6) Aquarium for use experiment in Lab.	B
(7) Circulation Aspirator	B
(8) Electric Balances	B
(9) Centrifuge	B

(10) Plankton Nets	B
(11) Ekman Dredge for Benthos Collection	B
(12) Microscopes and a Image Analyzer	B
(13) Dissection Tools	B
(14) Equipment set for Field Survey	B
(15) Equipment for Plankton Observation	B
(16) Notebook Computers	B
(17) Digital Cameras	B
(18) Automatic Voltage Regulators	B
(19) Equipment for Water Filtration	B
(20) Other Necessary Equipment	B

Annex 5: Flow Chart of Japan's Gant Aid Procedures



Annex 6: 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 lots of land necessary for the implementation of the Project and to clear the sites;		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites.		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt customs clearance of the products and to assist internal transportation of the products in the recipient country.		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Internal transportation from the port of disembarkation to the project site	(●)	(●)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted.		●
6	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

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

Annex 7: Land Registration Certificate of Project Site in Namxouang

ກະຊວງການເງິນ

ແຜນທີ່ດິນລັດ

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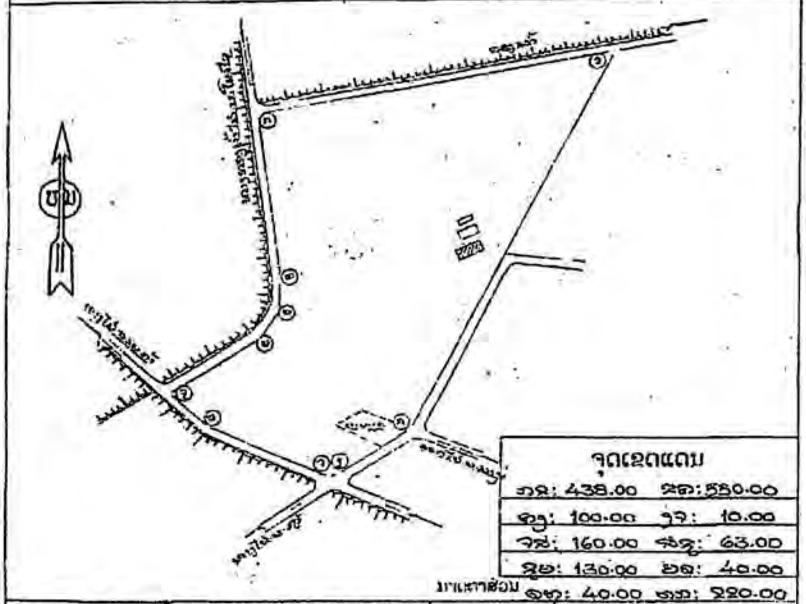


ຈຸດເຂດແດນ

[illegible]	438.00	[illegible]	550.00
[illegible]	100.00	[illegible]	10.00
[illegible]	160.00	[illegible]	63.00
[illegible]	130.00	[illegible]	40.00
[illegible]	40.00	[illegible]	220.00

20/12/2001

1/.5000

4-2 Explanation of Draft Report

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR STRENGTHENING RESEARCH AND DEVELOPMENT ON FISHERIES AND AQUACULTURE IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC
(EXPLANATION OF DRAFT REPORT)

In April, 2014, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on the Project for Strengthening Research and Development on Fisheries and Aquaculture 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 the draft report of the survey.

In order to explain and to discuss with the concerned officials of the Government of Lao PDR (hereinafter referred to as "GOL") on the components of the draft report, JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team"), from October 20th to October 22th, 2014 headed by Mr. Satoshi Chikami, Senior Advisor of JICA to Lao PDR.

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

Vientiane, October 22, 2014

Mr. Satoshi Chikami
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Mr. Xaypladeth Choulamany
Director General
Department of Planning and Cooperation
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

Mr. Bounthong Saphakdy
Deputy Director General
Department of Livestock and Fisheries
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

Dr. Bounthong Bouahom
Director General
National Agriculture and Forestry Research Institute
Ministry of Agriculture and Forestry
Lao People's Democratic Republic

ATTACHMENT

1. Components of the draft report

1-1. The GOL side agreed and accepted in principle the components of the draft report explained by the Team including obligations of the recipient country which are mentioned in the Chapter 3 of the draft report.

1-2. The GOL understood that the further modification request of the Project components shall not be considered; however, the components of the Project are still subject to change depending upon the result of the tender for contractor.

2. Japan's Grant Aid Scheme

The GOL side reconfirmed its understanding of the Japan's Grant Aid scheme and major undertaking of each Government as described in the Annex 5 and 6 of the Minutes of Discussions signed on 25th April, 2014.

3. Schedule of the Survey

JICA will complete the final report in accordance with the confirmed items and send it to GOL by the end of January 2015.

4. Cost Estimation

4-1. The Team explained the cost estimation of the Project as described in Annex-I.

4-2. The GOL sides affirmed that the estimated cost of the Project, together with other project related information such as facility design drawings and specifications of equipment shall not be released to any outside parties before conclusion of all the contract(s) for the Project.

5. Other Relevant Issues

5-1. Soft component

Both side discussed the terms of reference of technical assistance to be implemented as part of soft component and agreed on its outline.

5-2. Operation and Maintenance cost of both the Facilities and the Equipment to be procured under the Japan's Grand Aid

The GOL side agreed to allocate necessary budget for operation and maintenance of the facilities and the equipment as described in Annex-II in order to conduct the Research, Technical Development and Training activities in Namxouang Aquaculture Development Center and Living Aquatic Resources Research Center in a sustainable manner.

5-3. Assignment of Personnel

Both sides confirmed that the GOL side assigns necessary number of researchers, technical staff, administrative staff, operation and maintenance staff, drivers and other support staff and so on, to fully utilize the facilities and the equipment for the educational, research and dissemination activities of the Project.

ANNEXES:

Annex-I	Project Cost Estimation
Annex-II	Operation and Maintenance Cost to be borne by the GOL

Annex-I-1

Estimated Project Cost to be borne by Japan's Grant Aid

This Part is closed due to the confidentiality.

Annex-I-2

Project Cost to be borne by the GOL side

Total Project Cost Approx.9.5 million yen

Item	Approx. Cost (USD 1,000)	(million yen)
[1] Banking Arrangement	4.6	0.5
[2] Construction site preparation and earth filling	31.1	3.2
[3] Renovation of existing office building and laboratory	48.8	5.0
[4] Planting work	8.0	0.8
Total	92.5	9.5

Note: Conditions of Estimation

a. Date of estimation : May, 2014
b. Foreign exchange rates : US$ 1 = 103.33 yen
: 1 LAK = 0.012 yen
c. Construction/procurement period: Period of detailed design, construction work and procurement of equipment as shown in the execution schedule
d. Miscellaneous: The estimation shall be carried out in accordance with the rules of the Grant Aid Cooperation Scheme of the Government of Japan.

Annex-II

Operation and Maintenance cost of both the Facilities and the Equipment to be procured under the Japan's Grand Aid

Facilities	53,800,000 Kip/year (43,800,000 Kip/year for electricity) (10,000,000 Kip/year for facility)
Equipment (NADC)	75,000,000 Kip/year (900,000 JPY/year)
Equipment (LARReC)	58,400,000 Kip/year (700,000 JPY/year)

Note:

1. Foreign exchange rates : 1 LAK = 0.012 yen
2. For details, see the final report of the survey
3. Actual operation and maintenance cost may exceed the estimation. Nevertheless, GoL will adhere to the clause 5-2 of this Minutes of Discussion.

The Project for Strengthening Research and Development of Fisheries and Aquaculture In Laos PDR

Soft Component Plan

August 2014

INTEM Consulting, Inc.

Azusa Sekkei Co., Ltd.

Consortium

Contents

1. Background of the Soft Component Plan

The Project for the Construction of the National Aquaculture and Fisheries Research and Development Center (herein after called "the Project") in Lao People's Democratic Republic ("Lao PDR") targets the two institute: Namxouang Aquaculture Development Center (NADC) that conducts aquaculture-related technical development and technical extension activities for fish farmers; and the Living Aquatic Resources Research Centre (LARReC) that conducts research on living aquatic resources. The Project will improve the facilities and equipment of NADC and the research equipment of LARReC.

It is expected that, after the free trade agreement takes effect in 2015, a large amount of fisheries products including processed ones will be imported to Lao PDR. However, the nation faces the difficulties listed below and the Project is regarded as inputs to tackle them.

[Aquaculture-related Challenges Lao PDR faces]

・Because of low fish seed production capacity, a large quantity of seeds are imported from neighboring countries.

・As for tilapia culture, which accounts for 25% of the total fish production volume in LAO PDR, there is no mono-sex all-male seed production which is in great demand, and this inhibits competitiveness with neighboring countries.

・Seeds with unknown background are being imported from neighboring countries.

・Quality inspection of imported products (processed fisheries products and feed for aquaculture) is not being performed and thus the product quality or food safety is not guaranteed.

・No established of management or distribution system of superior broodstock.

The Lao PDR Ministry of Agriculture and Forestry set up a fisheries unit within NADC to collect and sort out basic information on the nation's fisheries sector and planned improvement of seed production capacity, starting of all-male tilapia seed production, improvement of training plans, and strengthening of examination systems of NADC and LARReC. The Project aims to assist these plans.

Lao PDR also increased manpower in line with the Project implementation and is making such efforts as sending NADC laboratory technicians to Thailand to study and acquire examination techniques, and renovating the LARReC laboratory and other facilities with its own budget.

However, new technology introduction including starting of all-male tilapia seed production is planned in the Project and it is desired that technical assistance for the initial launch listed below be provided in line with the introduction and Lao PDR also requested Japan for the provision of the soft component.

(1) Initial technical guidance on all-male tilapia seed production techniques

NADC has produced mixed-tilapia. However, demand for all-male tilapia seed production that is expected to enable increased yield has been on the rise in recent tilapia farming. Although all-male tilapia seed production was once conducted by the private sector in Lao PDR, it withdrew from it because of low all-male ratio of domestically produced seeds and price gap with juveniles imported from Thailand. As a result, no all-male tilapia seed production is conducted in the country. From this backdrop, it was decided that NADC, which is the only public aquaculture technical development

institution in the country, would work on all-male tilapia seed production. Although the Project includes the production facility development, NADC has no experience of such production and initial guidance needs to be provided by knowledgeable experts in the field together with the Project for early production outcomes.

(2) Assistance for NADC laboratory improvement and guidance on feed analysis techniques

Equipment for feed analysis and pathological equipment to be introduced to NADC are planned to be installed in the existing facility. However, the current laboratory is a large room and there is concern over contamination in the examination when fish disease diagnosis and feed analysis are carried out in the same space, and thus it is inappropriate to carry out such activities in the same space. NADC also has a plan to perform food safety analysis after the Project implementation and the existing laboratory needs to be renovated and improved. Although the renovation and improvement of the laboratory is to be carried out by Lao PDR, the inspection technicians are currently studying in Thailand and plan to return to the country at the end of December 2014. However, no specific plan is yet to be made. The technical staffs will have no technical problem in performing examination as they acquire the techniques in Thailand. However, it is hard to say that they are very familiar with laboratory layout planning equipment layout and technical assistance for proper laboratory layout planning, etc., is effective to have outcomes after the Project implementation. Therefore, experts will assist formulation of proper laboratory layout plan and the equipment layout plan in the laboratories together with the technicians after the confirmation of equipment to be procured while estimating the cost for the renovation, etc., and requesting the Lao side to allocate the budget and perform the work before temporary return to Japan. They will visit the country again when the equipment is installed and instruct the installation in the improved laboratory, as well as provide guidance about the feed analysis techniques using the newly introduced equipment. If the laboratory improvement is not completed due to delayed budget allocation when the experts visit the country, they will instruct the best equipment layout they can in the laboratory under the circumstances and give advice on relocation after the completion.

(3) Guidance on fish disease diagnosis techniques at NADC

As disease is one of the impediments to production efficiency, it is important to properly diagnose fish disease caused to spawners and seeds to improve the seed production efficiency. However, NADC does not perform diagnosis due to the absence of technician staff and equipment shortage. Laboratory staffs are currently studying in Thailand and expected to acquire basic diagnostic techniques when they come back to NADC. However, they do not have sufficient experience to diagnose such diseases on a daily basis. Thus, it is important to provide technical assistance in the initial stage by the Experts in the field to guarantee the outcomes of the Project.

(4) Guidance on maintenance techniques of equipment including those procured in the Project

The target facilities were observed to check the conditions of existing equipment during the field survey.

Because there was no equipment record book at neither institution (NADC nor LARReC), it was impossible to grasp the current equipment conditions and their repair record. Equipment was not sufficiently organized and they do not inspect it at the beginning or end of their use. Thus, technical guidance on the creation of an equipment record book, its neat organization in storage and routine maintenance and inspection is effective to guarantee the outcomes of the Project so the equipment to be procured in it will be properly used continuingly.

(5) Technical guidance management

The soft component is equivalent to technical assistance although it is in a small scale and it is important for personnel familiar with the Project contents and Japanese assistance scheme to manage the work including careful schedule coordination with the client, detailed meetings and reporting to the client. Although technical consultation on budget formulation and renovation for the laboratory renovation is necessary for the Project implementation, the expert in laboratory improvement assistance is not very familiar with the price survey for renovation or consultation with contractors. Thus, a manager who will perform the work jointly with the expert in laboratory improvement assistance is needed. Implementation of the soft component also involves management of the implementation budget, including payments of interpreter fees and vehicle rental fees. Commissioning external personnel to perform such work with responsibilities causes concern over possible the occurrence of problems and the delay of work. Therefore, a Japanese person will be allocated to assist the guidance performed by the above four experts and coordinate various duties.

2. Soft Component Goals

The soft component execution is expected to achieve the goals listed below.

Ⅰ. All-male tilapia seed production is launched at NADC.

Ⅱ. NADC laboratories are improved properly and feed analysis is performed there.

Ⅲ. Basic fish disease diagnosis is performed at NADC.

Ⅳ. Proper equipment maintenance systems are established at NADC and LARReC.

3. Soft Component Outcomes

The outcomes listed below are expected to be achieved at soft component completion.

Ⅰ All-male tilapia seed production techniques are established at NADC.

Technical transfer of broodstock management and egg collection, all-male treatment after hatching to NADC seed production technical staffs will enable achievement of the following:

I-① NADC employees are capable of operation of all-male treatment facility.

I-② An all-male tilapia seed production manual at NADC facility is compiled.

Ⅱ NADC laboratories are improved properly and feed analysis techniques are established.

Technical assistance for renovation and improvement of NADC laboratories in the existing building for the newly planned inspections will enable achievement of the following:

Ⅱ-① A proper laboratory layout plan is formulated.

Ⅱ-② Equipment layout plans of the laboratories are formulated.

Ⅱ-③ Laboratories are improved based on the above plans and a feed analysis structure is established receiving guidance on feed analysis techniques.

Ⅲ Basic fish disease diagnosis techniques are established at NADC.

Basic fish disease diagnosis techniques are enhanced, functions which laboratories are supposed to be equipped with to perform the diagnosis, including the inspections which NADC plans to perform in the future, are explained, and the fish disease diagnosis laboratory layout plan formulation is assisted.

This will enable achievement of the following:

Ⅲ-① A basic fish disease diagnosis manual (draft) is formulated.

Ⅲ-② Facility and equipment improvement plans for each laboratory are formulated.

Ⅲ-③ Proper conductive wire plans and laboratory improvement plans are formulated.

Ⅲ-④ Inspection device to be possessed at the fish disease diagnosis laboratory is properly allocated.

IV Equipment maintenance techniques are established at target institutions.

Guidance on equipment maintenance, neat organization and inspections at the beginning and end of the day at target institutions will enable achievement of the following:

Ⅲ-① Equipment is properly maintained and managed at NADC and LARReC.

Ⅲ-② Proper maintenance at the institutions enables long use of the equipment.

Ⅲ-③ An equipment operation manual is compiled.

4. How to Check Outcome Achievement

The soft component outcomes and their checking methods are shown in the table below.

Outcome		Checking Method
Ⅰ Guidance on all-male tilapia seed production techniques	Production of all-male seed production manual (draft)	Visual check of items below notated in manual -Facility operation and management -Broodstock management -Sex revisal techniques with hormone administration -Male rate determination method -Seed taking method
Ⅱ Assistance for laboratory improvement and guidance on feed analysis	① Formulation of laboratory layout plan ② Formulation of equipment layout plans of each laboratory ③ Formulation of feed analysis manual (draft)	Visual check of outcomes of items below -Laboratory layout plan -Equipment layout plans -Feed analysis manual

Ⅲ Guidance on fish disease diagnosis techniques	① Formulation of basic fish disease diagnosis manual (draft) ② Fish disease diagnosis room development plan	① Visual check of items below notated in manual − Equipment operation method − Description of record − Autopsy − Basic parasite inspection method − Basic bacterial checking method ② Visual check of formulated layout and equipment layout plans List of equipment planned to be introduced
IV Guidance on equipment maintenance techniques	① Formulation of operation manual ② Neat organization of equipment ③ Equipment inspection at the beginning and end of the day	① Visual check of formulated manual ② Visual check of equipment organization after technical guidance ③ Visual check of or through interview on equipment inspection at the beginning and end of the day after technical guidance

5. Soft Component activities (Input Plan)

Activities (input plan) to achieve the outcomes are summarized in the table below.

(1)Activity Plan

Outcome		Activity Plan	
		Instructor	Guidance Outline
I Guidance on all-male tilapia seed production techniques	Formulation of all-male seed production manual (draft)	Expert in teaching all-male seed production techniques	• Give instructions on facility operation and maintenance. • Instruction on repair of spawner tank (existing facility) flaws. • Explain about all-male seed production theory in lectures and design transfer production techniques in practice. • Instruct NADC employees on how to formulate a manual based on the knowledge obtained through the above activities.
II Assistance for laboratory improvement and guidance on feed analysis techniques	① Laboratory layout draft ② Equipment layout draft	Expert in assistance for laboratory improvement and guidance on feed analysis	• Sort out proper laboratories to be suitable to inspection items that the recipient is planning and propose proper layout plan. • Sort out equipment necessary for inspection items and propose equipment layout plans for each laboratory. • Give instructions on feed analysis techniques.
Ⅲ Guidance on fish disease diagnosis techniques	① Formulation of basic fish disease diagnosis manual (draft) ② Fish disease diagnosis room development plan	Expert in guidance on fish disease diagnosis techniques	• Give instructions on basic fish disease diagnosis techniques. • Explain about the theory and proper layout plans related to inspections and specifications necessary for laboratories, and support the recipient formulating the plan suitable to the inspection it intends to perform. • Explain about the operation methods and

			points of note for the operation of equipment necessary for inspections, and support the formulation of equipment introduction plan, and layout plan.
IV Guidance on equipment maintenance techniques	① Formulation of operation manual	Expert in guidance on equipment maintenance techniques	Together with the recipient, formulate a maintenance manual for each piece of equipment.
	② Neat organization of equipment		Give instructions on specific ways of organizing equipment.
	③ Equipment inspection at the beginning and end of the day		Give instructions on how to inspect equipment at the beginning and end of the day.

(2)Instructors

1) Expert in teaching all-male tilapia seed production techniques: 1 Japanese
2) Expert in assistance for laboratory improvement and guidance on feed analysis: 1 Japanese
3) Expert in guidance on fish disease diagnosis techniques: 1 Japanese
4) Expert in guidance on equipment maintenance techniques: 1 Japanese
5) Expert in technical guidance management: 1 Japanese

The experts will make technical guidance plans, consult with the Ministry of Fisheries, target institutions and concerned organizations (a certain level of expert knowledge is required as it involves overall coordination of training contents), arrange the venue and means of travel and make the schedule for efficiently organizing the training sessions.

(3) Activities (draft)

Ⅰ. Guidance on All-Male Tilapia Seed Production Techniques

No. of Days	Week	Activity	Training Style
Dispatch 1			
30 days	1	• Travel (Japan to Laos) • Discussion and agreement on inception report • Introduction to all-male tilapia seed production techniques • Preparation of the reinforcement plan for existing broodstock tanks • Material procurement • Reinforcement of existing broodstock tank	• Discussion • Lecture • Consultation • Practice • Practice
	2	• Material procurement • Reinforcement of existing broodstock tanks • Computer lesson for manual-preparation※1	• Practice • Practice • Lecture/Practice
	3	• Reinforcement of existing broodstock tanks • Water quality analysis • Sex determination of broodstock • Data management method※2 • Guidance on manual-preparation (facility)	• Practice • Lecture/Practice • Lecture • Lecture/Practice • Lecture/Practice
	4	• Theory on broodstock management • Male-female sorting of broodstock • Guidance on manual-preparation (broodstock management)	• Lecture • Lecture/Practice • Lecture/Practice
	5	• Separate rearing of male and female broodstock • Guidance on manual preparation (spawner management) • Travel (Laos to Japan)	• Practice • Lecture/Practice
Dispatch II			
60 days	1	• Travel (Japan to Laos) • Guidance on larvae and juvenile rearing tool making • Material procurement • Water quality measurement • Broodstock coupling techniques • Hatching facility adjustment • Guidance on manual-preparation (facility, coupling, tools)	• Practice • Practice • Lecture/Practice • Lecture/Practice • Practice • Lecture/Practice

	2	• Hatching facility adjustment • Egg collection/incubation techniques • Introduction of water recirculation system • Water quality measurement • Guidance on manual-preparation (hatching facility management)	• Lecture/Practice • Lecture/Practice • Lecture/Practice • Practice • Lecture/Practice
	3	• Incubation facility adjustment • Egg collection/incubation techniques • Hormone feed adjustment • Guidance on manual-preparation (Incubation management)	• Lecture/Practice • Lecture/Practice • Lecture/Practice • Lecture/Practice
	4	• Computer data use • Mono-sex seed production with hormone administration • Guidance on manual-preparation (broodstock management/hormone feed preparation)	• Lecture/Practice • Lecture/Practice • Lecture/Practice
	5	• Guidance on incubation techniques • Sex revisal of larvae using hormone feed • Guidance on manual-preparation (larvae rearing)	• Practice • Lecture/Practice • Lecture/Practice
	6	• Late larval rearing techniques • Juvenile rearing techniques • Sex rate determination techniques of juvenile • Collection and observation of zooplankton and phytoplankton	• Lecture/Practice • Lecture/Practice • Lecture • Lecture/Practice
	7	• Sorting techniques of newly hatched larvae using sieve • Sex rate determination techniques of juvenile • Guidance on manual-preparation (seed production plan, male rate determination techniques)	• Lecture/Practice • Practice • Lecture/Practice
	8	• Rearing techniques in large nursery tank • Observation of zooplankton and phytoplankton • Guidance using prepared manual	• Lecture/Practice • Lecture/Practice • Lecture/Practice
	9	• Guidance using prepared manual • Travel (Laos to Japan)	• Lecture/Practice

※1 : Guidance on use of MS-Word and MS-Excel and image processing techniques necessary for manual-preparation.

※2 : Although NADC measures water quality, it does not organize obtained data and information is not shared sufficiently with personnel in charge of production. Mono-sex tilapia seed production requires that personnel fully understand the factors that affect productivity (water temperature,

dissolved oxygen, fish weight, and condition factor of broodstock) as well as sufficiently understanding their individual impacts on productivity. In the lecture, it is planned that MS-Excel, with which NADC employees have little familiarity, will be used to instruct C/Ps on how to input obtained data, make diagrams from it, and make correlation diagrams of each factor and number of eggs/seed production count.

The main contents of the guidance are planned to be the following:

1. Give instructions on how to input each indicators (water quality, dissolved oxygen, fish weight, and body-mass index) and calculation methods using Excel.
2. How to prepare correlation diagrams of number of eggs and each indicator using MS-Excel.
3. How to make presentation materials using MS-PowerPoint

Ⅱ. Assistance for Laboratory Improvement and Guidance on Feed Analysis Techniques

No. of Days	Week	Activity	Teaching Style
Dispatch I			
20 days	1	• Travel (Japan to Laos) • Kick-off meeting • Consideration of necessary laboratories • Consideration of laboratory layout plan	• Consultation • Training /Consultation
	2	• Consideration of necessary equipment • Confirmation of existing equipment • Consideration of equipment layout plans	• Consultation • Collaborative work • Consultation
	3	• Consideration of laboratory improvement details • Estimation of laboratory improvement budget • Formulation of laboratory improvement plan (draft) • Travel (Laos-Japan)	• Consultation • Consultation
Dispatch II			
30 days	1	• Travel (Japan to Laos) • Confirmation of laboratories • Consideration of challenges and improvement plans • Guidance on equipment layout	• Collaborative consulting • Practice
	2	• Guidance on how to use equipment • Reagent adjustment • Moisture content analysis	• Lecture/Lecture/Practice • Lecture/Training Lecture/Training

		• Crude protein content analysis and crude fat content analysis • Crude fiber content analysis • Ash content analysis • Guidance on manual-preparation (crude fiber) • Procurement of raw materials for home-made feed	• Lecture/Training • Lecture/Training • Training
	3	• Analysis of home-made feed • Guidance on manual-preparation (ash content) • Production of home-prepared formula feed • Guidance on manual-preparation (home-prepared formula feed)	• Lecture/Training • Lecture/Training • Training • Lecture/Training
	4	• Guidance on equipment maintenance • Guidance on use of various manuals	• Lecture/Training • Lecture/Training
	5	• Travel (Laos to Japan)	

Ⅲ. Guidance on Fish Disease Diagnosis Techniques

No. of Days	Week	Activity	Teaching Style
35 days	1	• Travel (Japan to Laos) • Consultation and agreement on inception report • Introduction to fish disease diagnosis and basic fish health protection • Introduction to theory on inspections and necessary laboratory specifications • Support for making proper layout plans • Material procurement	• Consultation • Lecture • Lecture • Consultation • Practice
	2	• Support for equipment layout • Guidance on equipment list-making • Guidance on how to use equipment	• Practice • Lecture/Practice • Lecture/Practice
	3	• Guidance on fish disease diagnosis (how to keep records) • Guidance on fish disease diagnosis (external and internal diagnosis) • Guidance on fish disease diagnosis (gross parasitic disease diagnosis) • Guidance on fish disease diagnosis (gross germ disease diagnosis)	• Lecture/Practice • Lecture/Practice • Lecture/Practice • Lecture/Practice

	4	• Guidance on fish disease diagnosis manual-preparation • Guidance on fish disease diagnosis room development planning	• Lecture/Practice • Lecture/Practice
	5	• Guidance on use of various manuals • Travel (Laos to Japan)	• Lecture/Practice

Ⅳ. Guidance on Equipment Maintenance Techniques

No. of Days	Week	Activity	Teaching Style
13 days	1	• Travel (Japan to Laos) • Kick-off meeting • Making equipment record book • Formulation of equipment management manual • Guidance on equipment maintenance techniques	• Consultation • Collaborative work • Collaborative work • Practice
	2	• Guidance on equipment maintenance techniques • Wrap-up meeting • Travel (Laos to Japan)	• Practice • Consultation

Ⅴ. Technical Guidance Management

No. of Days	Week	Activity	Teaching Style
Dispatch I			
15 days	1	• Travel (Japan to Laos) • Kick-off meeting • Consideration of technical guidance guidelines • Technical guidance schedule-making	• Consultation • Consultation • Consultation
	2	• Preparation for technical guidance • Support for technical guidance • Wrap-up meeting	• Collaborative work • Collaborative work • Consultation
	3	• Travel (Laos to Japan)	
Dispatch II			
15 days	1	• Travel (Japan to Laos) • Consideration of technical guidance guidelines • Technical guidance schedule-making	• Consultation • Consultation

		• Preparation for technical guidance	• Collaborative work
	2	• Support for technical guidance • Wrap-up meeting	• Collaborative work • Consultation
	3	• Travel (Laos to Japan)	
Dispatch III			
15 days	1	• Travel (Japan to Laos) • Consideration of technical guidance guidelines • Technical guidance schedule-making • Preparation for technical guidance	 • Consultation • Consultation • Collaborative work
	2	• Support for technical guidance • Wrap-up meeting	• Collaborative work • Consultation
	3	• Travel (Laos to Japan)	

6. Procurement of Soft Component Resources

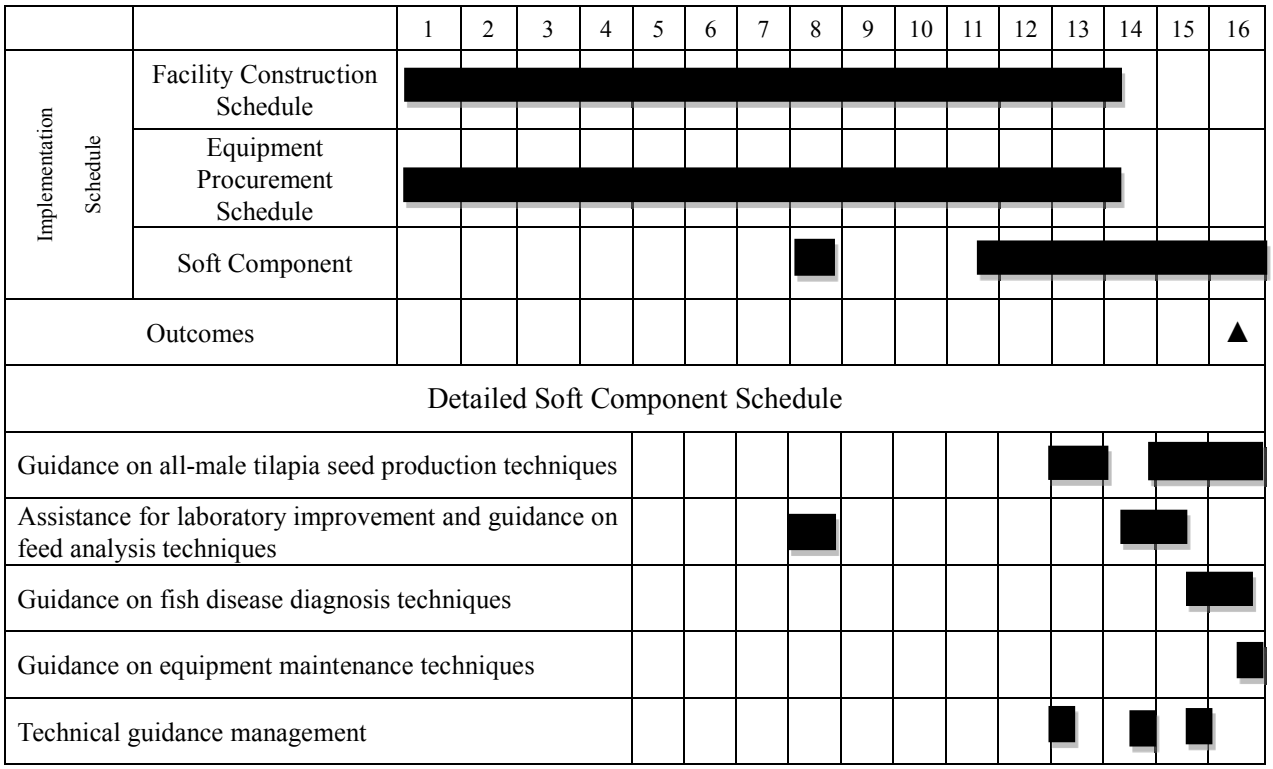
Knowledgeable Japanese consultants in each expertise field are in charge of the soft component.

The expert in charge of technical guidance management will consult with concerned parties of the recipient prior to the soft component implementation to confirm the contents of the technical guidance and overall schedule.

7. Soft Component Implementation Schedule

The soft component implementation schedule (draft) is shown below. It will be finalized based on request from Lao PDR and consideration by plan coordination expert and each expert.

The soft component is implemented at NADC and LARReC that are target institutions of the Project.



Overall Schedule (draft)

8. Soft Component Outcomes

The following is expected as soft component outcomes in addition to the completion report to be submitted to the client and Japanese side:

① Training teaching materials

② Various reports

9. Responsibilities of Implementing Agencies of the Recipient Country

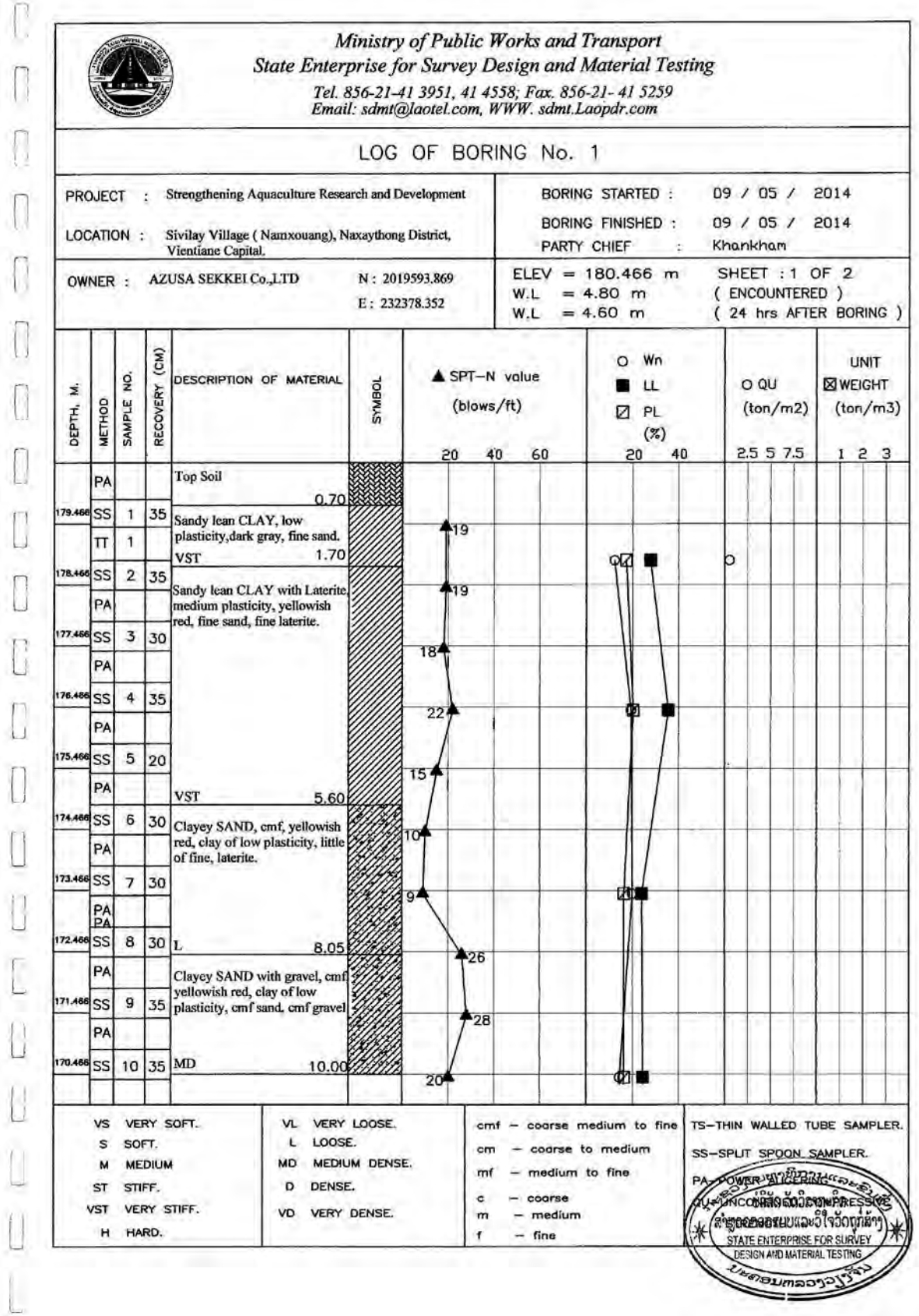
Parties involved in the Project, which include NADC, LARReC, Department of Livestock and Fishery of the Ministry of Agriculture and Forestry, and National Agriculture and Forestry Research Institute, are required to coordinate the schedule and provide the venue for the technical guidance, select target trainees and have them participate. The Department of Livestock and Fishery that oversees NADC is required to promptly take action that includes budget allocation and procurement necessary for the implementation in accordance with the layout plan, equipment plan, and equipment layout plan which are outcomes of the soft component for developing the inspection system.

6. Other Relevant Data

No.	Name of Document	Type	Originar/Copy	Isuued by	Date
1	Agriculture Statistics 2011, Meteorology Statistics	Book	Copy	Department of Planning, Ministry of Agriculture and Forestry	2012
2	Lao Census of Agriculture 2010/2011	Book	Copy	Department of Planning, Ministry of Agriculture and Forestry	2012
3	Administration Boundary of Lao PDR	Book	Copy	Lao Department of Statistics / National Geographic Department	2011
4	Fisheries Survey Luangprabang Province Lao PDR	Book	Copy	LARReC	2000
5	A Report on Cage Culture in Lao PDR	Book	Copy	LARReC	2001
6	Fish marketing study in Attapeu Province	Book	Copy	LARReC	2006
7	Livelihood Opportunities for Upland Aquaculture	Book	Copy	LARReC	不明
8	An Institutional Analysis of LARReC on Economic and Market-Related Research	Book	Copy	LARReC	2005
9	LARReC Budget 2009 to 2014	Book	Copy	LARReC	2014
10	List of LARReC Research	Book	Copy	LARReC	2014
11	Seed price in LARReC	Book	Copy	LARReC	2013
12	List of LARReC Technical Reports	Book	Copy	LARReC	2014
13	The Impacts of Introductions and Stocking of Exotic Species in the Mekong Basin and Policies for Their Control	Book	Copy	MRC	2003
14	メコン河委員会による水資源管理の課題と展望	Book	Copy	政策科学	2012
15	Steering Committee for the Agricultural Census Agricultural Census Office	Book	Copy	統計局	2012
16	Decision of the Director General Regarding the Organization and Activities of the NADC	Book	Copy	DLF	2012
17	The National Strategy for Fisheries from the present to 2020 Action Plan for 2006 to 2010	Book	Copy	DLF	2010
18	Annual Report of NADC 2008	Book	Copy	NADC	2009
19	Annual Report of NADC 2009	Book	Copy	NADC	2010

7. References

7-1 Data of Natural condition investigation



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Email: sdmt@laotel.com, WWW. sdmt.Laopdr.com

LOG OF BORING No. 1

PROJECT : Strengthening Aquaculture Research and Development
LOCATION : Sivilay Village (Namxouang), Naxaythong District, Vientiane Capital.
BORING STARTED : 09 / 05 / 2014
BORING FINISHED : 09 / 05 / 2014
PARTY CHIEF : Khankham
OWNER : AZUSA SEKKEI Co.,LTD
N : 2019593.869
E : 232378.352
ELEV = 180.466 m
W.L = 4.80 m
W.L = 4.60 m
SHEET : 1 OF 2
(ENCOUNTERED)
(24 hrs AFTER BORING)

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL
	PA			Top Soil 0.70	
179.466	SS	1	35	Sandy lean CLAY, low plasticity,dark gray, fine sand.	
	TT	1		VST 1.70	
178.466	SS	2	35	Sandy lean CLAY with Laterite, medium plasticity, yellowish red, fine sand, fine laterite.	
	PA				
177.466	SS	3	30		
	PA				
176.466	SS	4	35		
	PA				
175.466	SS	5	20		
	PA			VST 5.60	
174.466	SS	6	30	Clayey SAND, cmf, yellowish red, clay of low plasticity, little of fine, laterite.	
	PA				
173.466	SS	7	30		
	PA PA				
172.466	SS	8	30	L 8.05	
	PA			Clayey SAND with gravel, cmf yellowish red, clay of low plasticity, cmf sand, cmf gravel	
171.466	SS	9	35		
	PA				
170.466	SS	10	35	MD 10.00	

VS VERY SOFT.
S SOFT.
M MEDIUM
ST STIFF.
VST VERY STIFF.
H HARD.

VL VERY LOOSE.
L LOOSE.
MD MEDIUM DENSE.
D DENSE.
VD VERY DENSE.

cmf – coarse medium to fine
cm – coarse to medium
mf – medium to fine
c – coarse
m – medium
f – fine

TS–THIN WALLED TUBE SAMPLER.
SS–SPLIT SPOON SAMPLER.
PA–POWER AUGERING
QU–UNCONFINED COMPRESSIVE

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PROJECT : Strengthening Aquaculture Research and Development
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OWNER : AZUSA SEKKEI Co.,LTD N : 2019593.869 E : 232378.352

BORING STARTED : 09 / 05 / 2014
BORING FINISHED : 09 / 05 / 2014
PARTY CHIEF : Khankham

ELEV = 180.466 m
W.L = 4.80 m (ENCOUNTERED)
W.L = 4.60 m (24 hrs AFTER BORING)
SHEET : 2 OF 2

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL
	PA			Clayey SAND with gravel, cmf yellowish red, clay of low plasticity, cmf sand, cmf gravel	
169.466	SS	11	35		
	PA				
168.466	SS	12	25		
	PA			VD 12.60	
167.466	SS		0	Elastic SILT, high plasticity, yellowish red.	
	PA				
166.466	SS	13	18	H 14.05	
				End of Boring Drilling	

▲ SPT–N value (blows/ft): 20 40 60 — 51, 57, 70, 70
O Wn ■ LL ☑ PL (%): 20 40
O QU (ton/m2): 2.5 5 7.5
UNIT ☒ WEIGHT (ton/m3): 1 2 3

15 16 17 18 19 20

VS VERY SOFT. S SOFT. M MEDIUM ST STIFF. VST VERY STIFF. H HARD.

VL VERY LOOSE. L LOOSE. MD MEDIUM DENSE. D DENSE. VD VERY DENSE.

cmf – coarse medium to fine
cm – coarse to medium
mf – medium to fine
c – coarse
m – medium
f – fine

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LOG OF BORING No. 2

PROJECT : Strengthening Aquaculture Research and Development

LOCATION : Sivilay Village (Namxouang), Naxaythong District, Vientiane Capital.

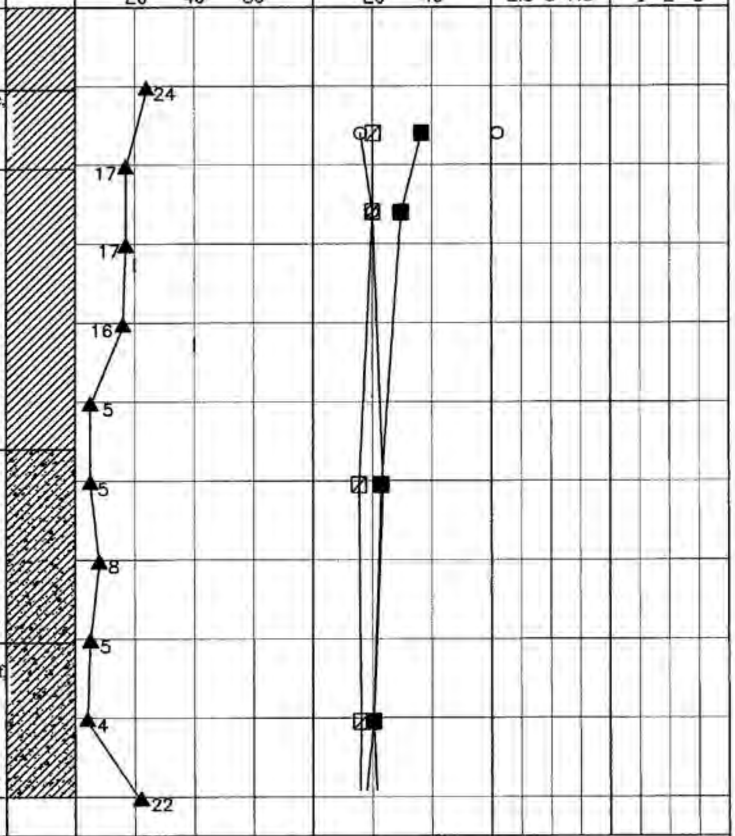
BORING STARTED : 07 / 05 / 2014
BORING FINISHED : 08 / 05 / 2014
PARTY CHIEF : Khankham

OWNER : AZUSA SEKKEI Co.,LTD N : 2019749.546 E : 232391.971

ELEV = 180.127 m
W.L = 4.70 m (ENCOUNTERED)
W.L = 4.50 m (24 hrs AFTER BORING)
SHEET : 1 OF 2

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL
	PA			Top Soil
179.127	SS	1	18	1.05
	TT	1		Sandy lean CLAY with Laterite, medium plasticity,dark gray, fine sand, fine laterite.
178.127	SS	2	21	VST 2.05
	TT	2		Sandy lean CLAY, low plasticity, yellowish red, cmf sand, little of fine laterite.
177.127	SS	3	27	
	PA			
176.127	SS	4	21	
	PA			
175.127	SS	5	26	
	PA			VST-M 5.60
174.127	SS	6	30	Clayey SAND, fine, yellowish red, clay of low plasticity.
	PA			
173.127	SS	7	30	
	PA			
172.127	SS		0	L 8.05
	PA			Clayey SAND with gravel, cmf yellowish red, cmf gravel.
171.127	SS	8	15	
	PA			
170.127	SS	9	10	L 10.00

SYMBOL | ▲ SPT–N value (blows/ft) 20 40 60 | O Wn ■ LL ▨ PL (%) 20 40 | O QU (ton/m2) 2.5 5 7.5 | UNIT ☒ WEIGHT (ton/m3) 1 2 3



VS VERY SOFT.	VL VERY LOOSE.	cmf – coarse medium to fine	TS–THIN WALLED TUBE SAMPLER.
S SOFT.	L LOOSE.	cm – coarse to medium	SS–SPLIT SPOON SAMPLER.
M MEDIUM	MD MEDIUM DENSE.	mf – medium to fine	PA–POWER AUGERING
ST STIFF.	D DENSE.	c – coarse	UC–UNCONFINED COMPRESSIVE
VST VERY STIFF.	VD VERY DENSE.	m – medium	
H HARD.		f – fine	

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LOG OF BORING No. 2

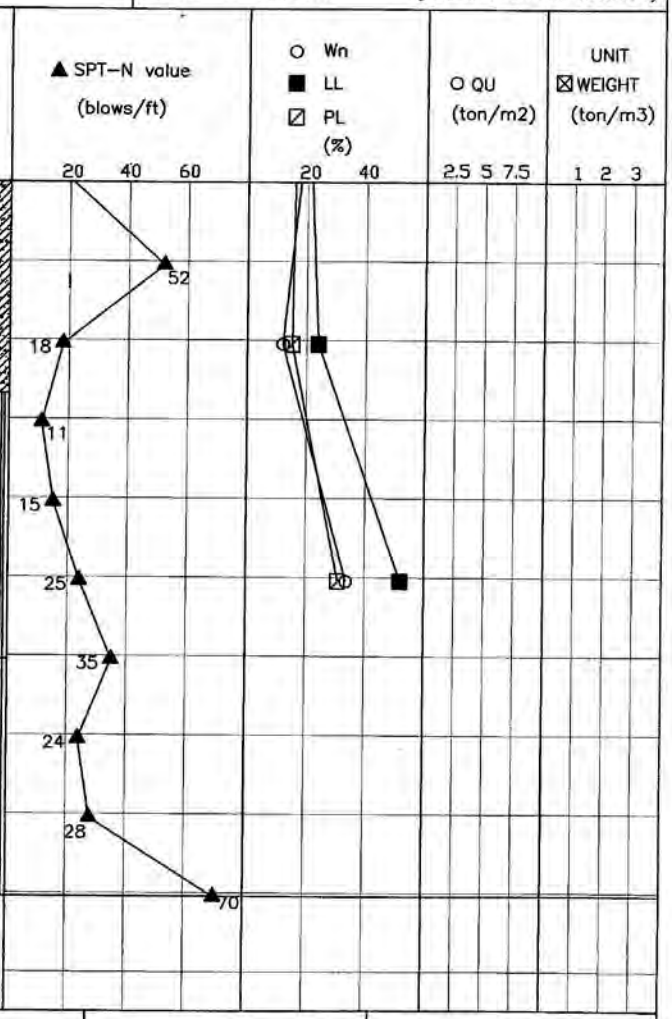
PROJECT : Strengthening Aquaculture Research and Development
LOCATION : Sivilay Village (Namxouang), Naxaythong District, Vientiane Capital.
OWNER : AZUSA SEKKEI Co.,LTD N : 2019749.546 E : 232391.971

BORING STARTED : 07 / 05 / 2014
BORING FINISHED : 08 / 05 / 2014
PARTY CHIEF : Khankham

ELEV = 180.127 m
W.L = 4.70 m
W.L = 4.50 m

SHEET : 2 OF 2
(ENCOUNTERED)
(24 hrs AFTER BORING)

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL
	PA			Clayey SAND with gravel, cmf yellowish red, cmf gravel.	
169.127	SS	10	17		
	PA				
168.127	SS	11	17		
	PA			VD-MD 12.68	
167.127	SS	12	30	Elastic SILT, high plasticity, reddish brown.	
	PA				
166.127	SS	13	30		
	PA				
165.127	SS	14	28		
	PA				
164.127	SS	15	30	ST-VST	
	PA			As above, pinkish gray.	
163.127	SS	16	30		
	PA				
162.127	SS	17	25		
	PA				
161.127	SS		0	VST-H 19.05	
20				End of Boring Drilling	



VS VERY SOFT.
S SOFT.
M MEDIUM
ST STIFF.
VST VERY STIFF.
H HARD.

VL VERY LOOSE.
L LOOSE.
MD MEDIUM DENSE.
D DENSE.
VD VERY DENSE.

cmf – coarse medium to fine
cm – coarse to medium
mf – medium to fine
c – coarse
m – medium
f – fine

TS–THIN WALLED TUBE SAMPLER.
SS–SPLIT SPOON SAMPLER.
PA–POWER AUGERING
UC–UNCONFINED COMPRESSION

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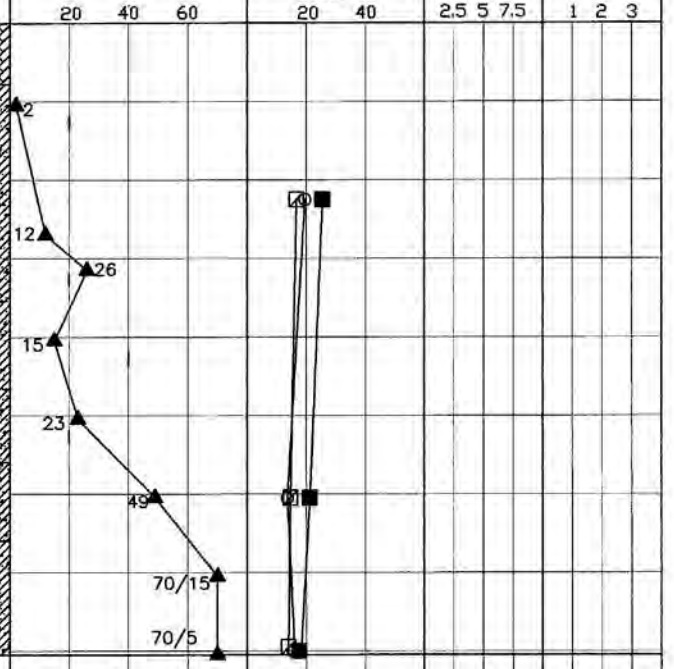
LOG OF BORING No. 3

PROJECT : Strengthening Aquaculture Research and Development
LOCATION : Sivilay Village (Namxouang), Naxaythong District, Vientiane Capital.
OWNER : AZUSA SEKKEI Co.,LTD N : 2019916.131 E : 232357.341

BORING STARTED : 06 / 05 / 2014
BORING FINISHED : 06 / 05 / 2014
PARTY CHIEF : Khankham

ELEV = 175.578 m SHEET : 1 OF 1
W.L = 0.20 m (ENCOUNTERED)
W.L = 0.14 m (24 hrs AFTER BORING)

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL
	PA			Top Soil 0.78	
174.578	SS		0		
	PA			Silty Clayey SAND with Laterite, fine, light yellowish brown, clay of low plasticity, cmf laterite.	
173.578	TT	1			
	SS	1	10		
172.578	SS	2	10		
	PA				
171.578	SS	3	5		
	PA				
170.578	SS		0		
	PA			MD 5.60	
169.578	SS	4	25	Clayey SAND with gravel +laterite, cmf, light yellowish brown, clay of low plasticity, cmf gravel+laterite. D 6.60	
	PA				
168.578	SS	5	22	Clayey SAND, cmf, dark gray little of fine gravel+laterite	
	PA				
167.578	SS	6	20	VD 8.05	
				End of Boring Drilling	



VS VERY SOFT.	VL VERY LOOSE.	cmf – coarse medium to fine	TS–THIN WALLED TUBE SAMPLER.
S SOFT.	L LOOSE.	cm – coarse to medium	SS–SPLIT SPOON SAMPLER.
M MEDIUM	MD MEDIUM DENSE.	mf – medium to fine	PA–POWER AUGERING
ST STIFF.	D DENSE.	c – coarse	UNCONFINED COMPRESSION
VST VERY STIFF.	VD VERY DENSE.	m – medium	
H HARD.		f – fine	

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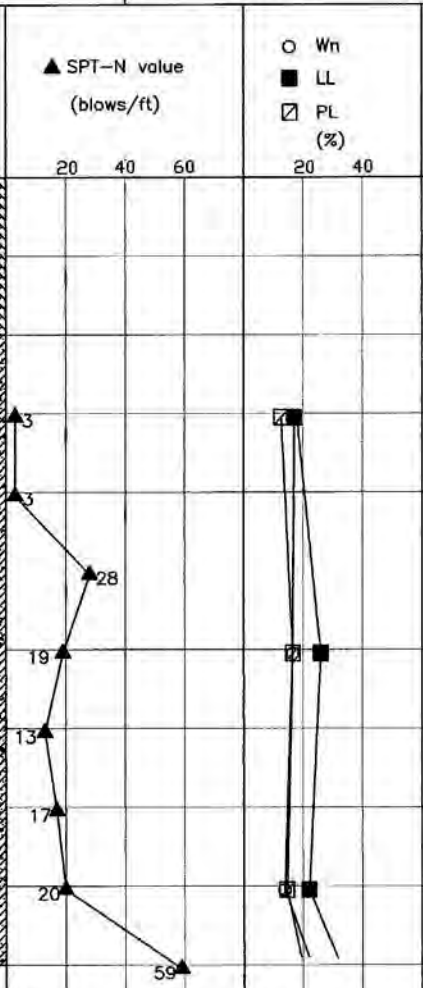
LOG OF BORING No. 4

PROJECT : Strengthening Aquaculture Research and Development
LOCATION : Sivilay Village (Namxouang), Naxaythong District, Vientiane Capital.
OWNER : AZUSA SEKKEI Co.,LTD N : 2019886.004 E : 232362.156

BORING STARTED : 10 / 05 / 2014
BORING FINISHED : 10 / 05 / 2014
PARTY CHIEF : Khankham

ELEV = 177.326 m
W.L = 1.90 m (ENCOUNTERED)
W.L = 1.80 m (24 hrs AFTER BORING)
SHEET : 1 OF 2

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL
176.326				Top Soil	
175.326				2.00	
	PA			Silty Clayey SAND with laterite,fine, light yellowish brown, clay of low plasticity, fine laterite.	
174.326	SS	1	10		
	TT	0			
173.326	SS	2	35		
	TT	0			
172.326	SS	3	15		
	PA			VL-MD 5.60	
171.326	SS	4	23	Clayey SAND with gravel, cmf, yeloowish brown, clay of low plasticity, cmf gravel.	
	PA				
170.326	SS		0		
	PA				
169.326	SS	5	13		
	PA				
168.326	SS	6	12		
	PA				
167.326	SS	7	20	MD 10.00	



VS VERY SOFT.	VL VERY LOOSE.	cmf – coarse medium to fine	TS–THIN WALLED TUBE SAMPLER.
S SOFT.	L LOOSE.	cm – coarse to medium	SS–SPLIT SPOON SAMPLER.
M MEDIUM	MD MEDIUM DENSE.	mf – medium to fine	PA–POWER AUGERING
ST STIFF.	D DENSE.	c – coarse	QU–UNCONFINED COMPRESSIVE
VST VERY STIFF.	VD VERY DENSE.	m – medium	
H HARD.		f – fine	

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LOG OF BORING No. 4

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BORING STARTED : 10 / 05 / 2014
BORING FINISHED : 10 / 05 / 2014
PARTY CHIEF : Khankham

ELEV = 177.326 m
W.L = 1.90 m (ENCOUNTERED)
W.L = 1.80 m (24 hrs AFTER BORING)
SHEET : 2 OF 2

DEPTH, M.	METHOD	SAMPLE NO.	RECOVERY (CM)	DESCRIPTION OF MATERIAL	SYMBOL	▲ SPT–N value (blows/ft) 20 40 60	O Wn ■ LL ☑ PL (%) 20 40	O QU (ton/m2) 2.5 5 7.5	UNIT ☒ WEIGHT (ton/m3) 1 2 3
	PA			Clayey SAND with gravel, cmf, yeloowish brown, clay of low plasticity, cmf gravel.					
166.326	SS	8	4	VD-L 11.30		5			
	PA								
165.326	SS	9	30	Elastic SILT, high plasticity, yellowish red.		9			
	PA								
164.326	SS	10	27			7			
	PA								
163.326	SS	11	25			12			
	PA								
162.326	SS		0			13			
	PA								
161.326	SS		0			20			
	PA								
160.326	SS		0	ST-H 17.05		70			
				End of Boring Drilling					
18									
19									
20									

VS VERY SOFT.
S SOFT.
M MEDIUM
ST STIFF.
VST VERY STIFF.
H HARD.

VL VERY LOOSE.
L LOOSE.
MD MEDIUM DENSE.
D DENSE.
VD VERY DENSE.

cmf – coarse medium to fine
cm – coarse to medium
mf – medium to fine
c – coarse
m – medium
f – fine

TS–THIN WALLED TUBE SAMPLER.
SS–SPLIT SPOON SAMPLER.
PA–POWER AUGERING
QU–UNCONFINED COMPRESSIVE

STATE ENTERPRISE FOR SURVEY DESIGN AND MATERIAL TESTING