

BASIC DESIGN STUDY
ON
THE CONSTRUCTION PROJECT
OF
CENTRAL FOREST RESEARCH LABORATORY AND TRAINING CENTER
IN
THE KINGDOM OF THAILAND

FEBRUARY, 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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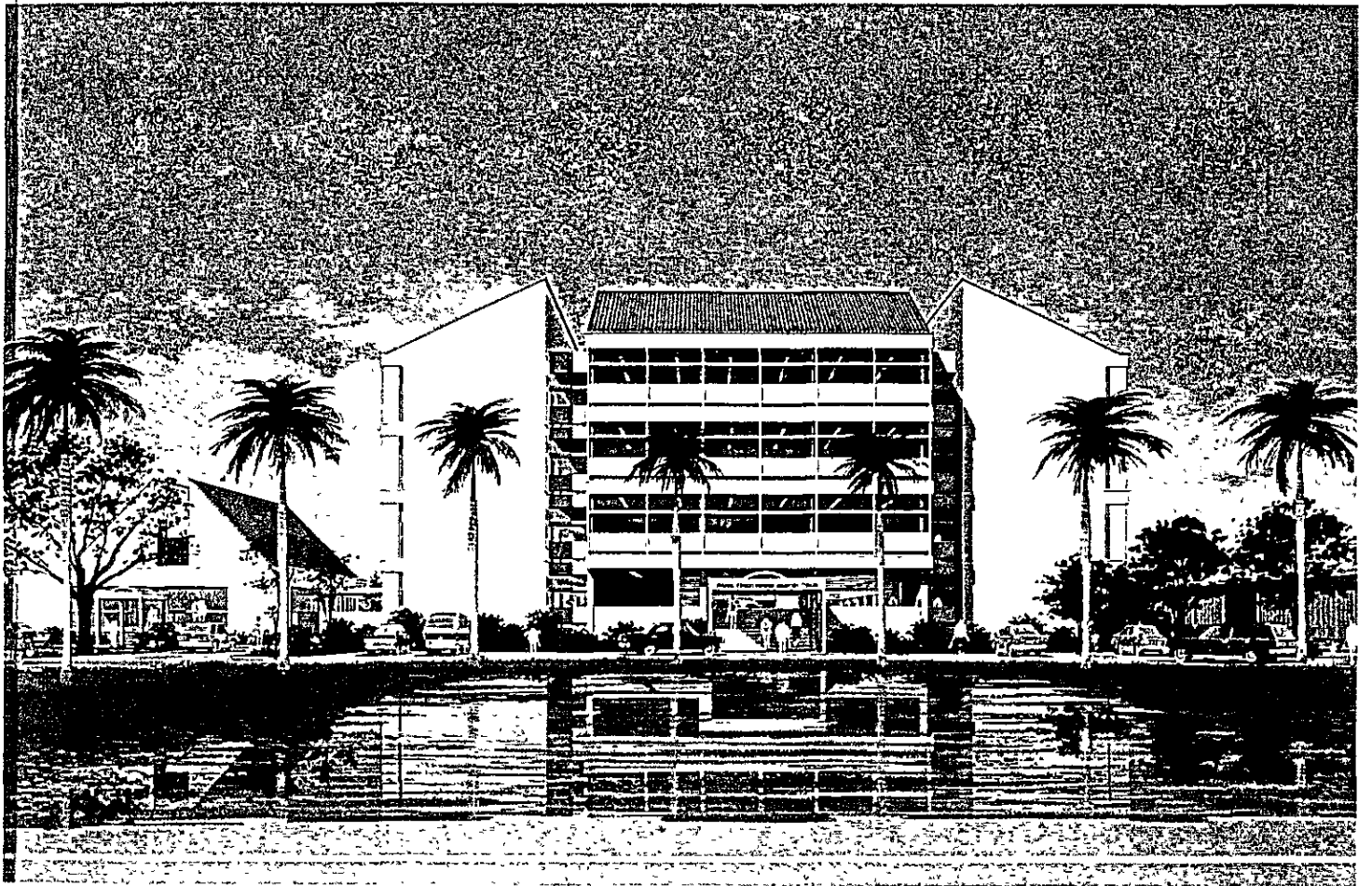


Bangkok Center
Central Forest Research Laboratory and Training Center

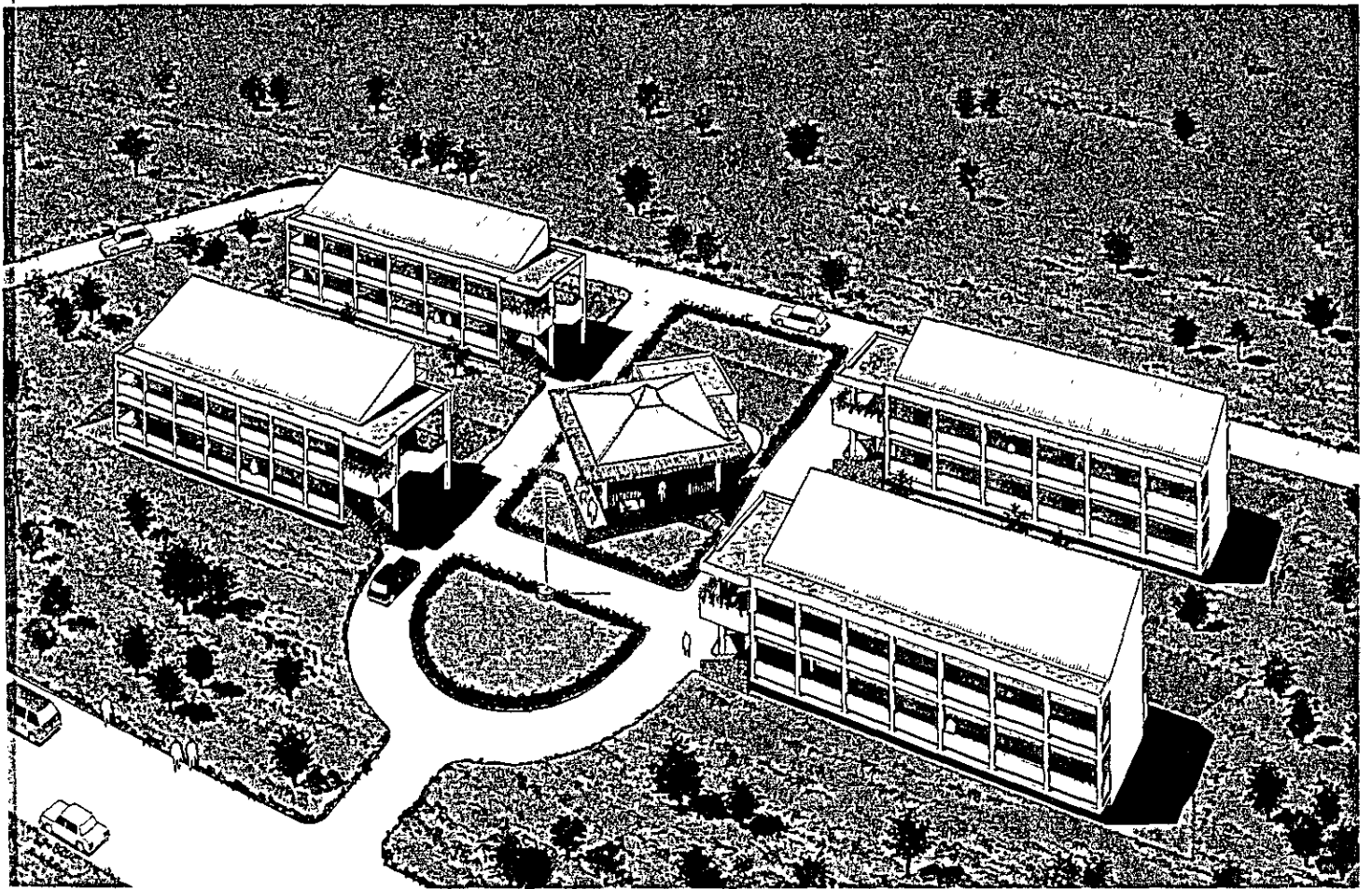
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Bangkok Center
Central Forest Research Laboratory and Training Center



Sakaerat Field Station
Central Forest Research Laboratory and Training Center

P R E F A C E

In response to the request of the Government of the Kingdom of Thailand, the Japanese Government decided to conduct a Basic Design Study on the construction project of Central Forest Research Laboratory and Training Center and entrusted the survey to the Japan International Cooperation Agency. The J.I.C.A. sent to Thailand a survey team headed by Mr. Shigeru KONDO, Special Technical Adviser to the President of JICA, from 26 October to 14 November, 1981.

The team exchanged views with the officials concerned of the Government of Thailand and conducted a field survey in the Project Area. After the team returned to Japan, further studies were made and the present report has been prepared.

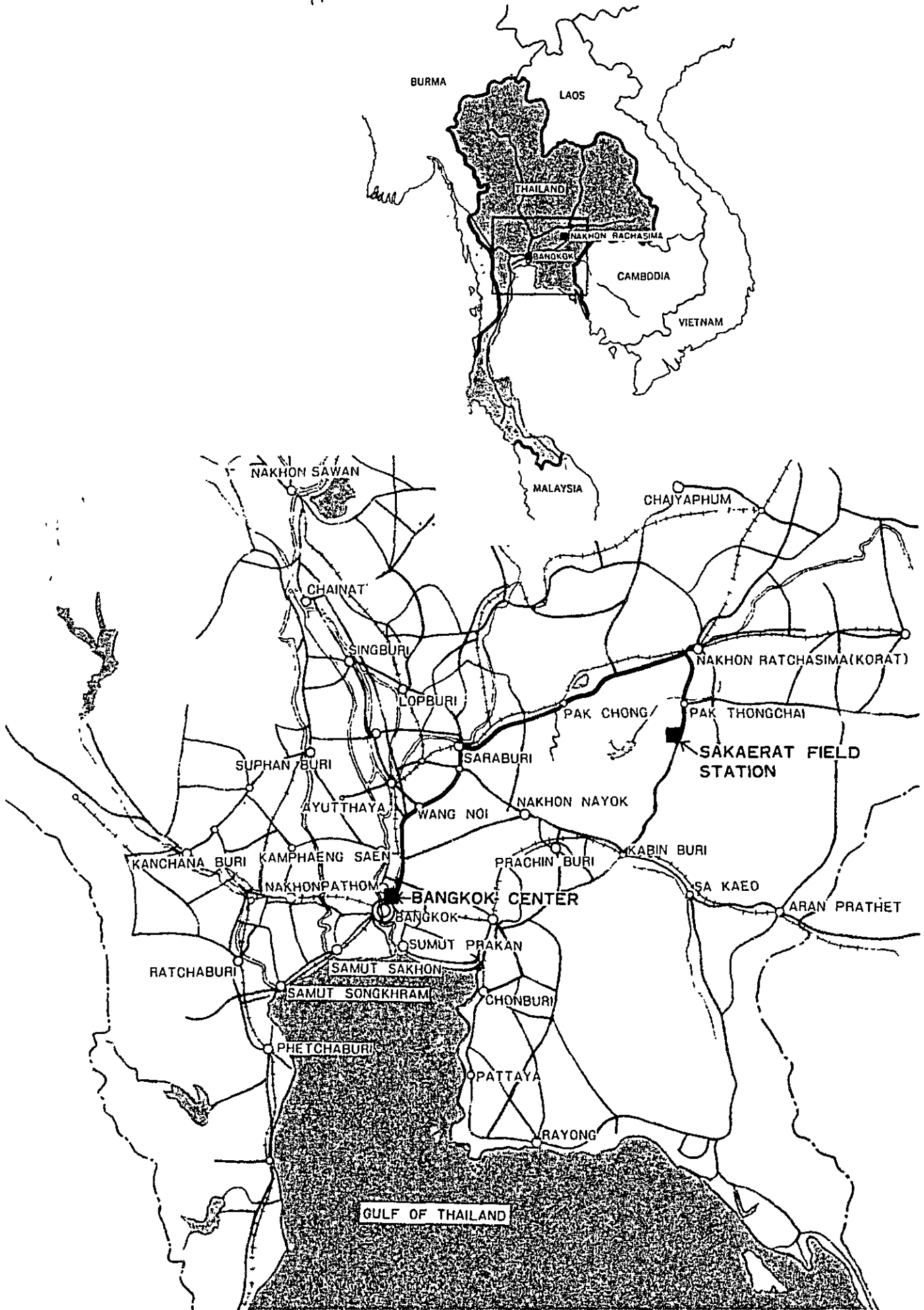
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Thailand for their close cooperation extended to the team.

February, 1982



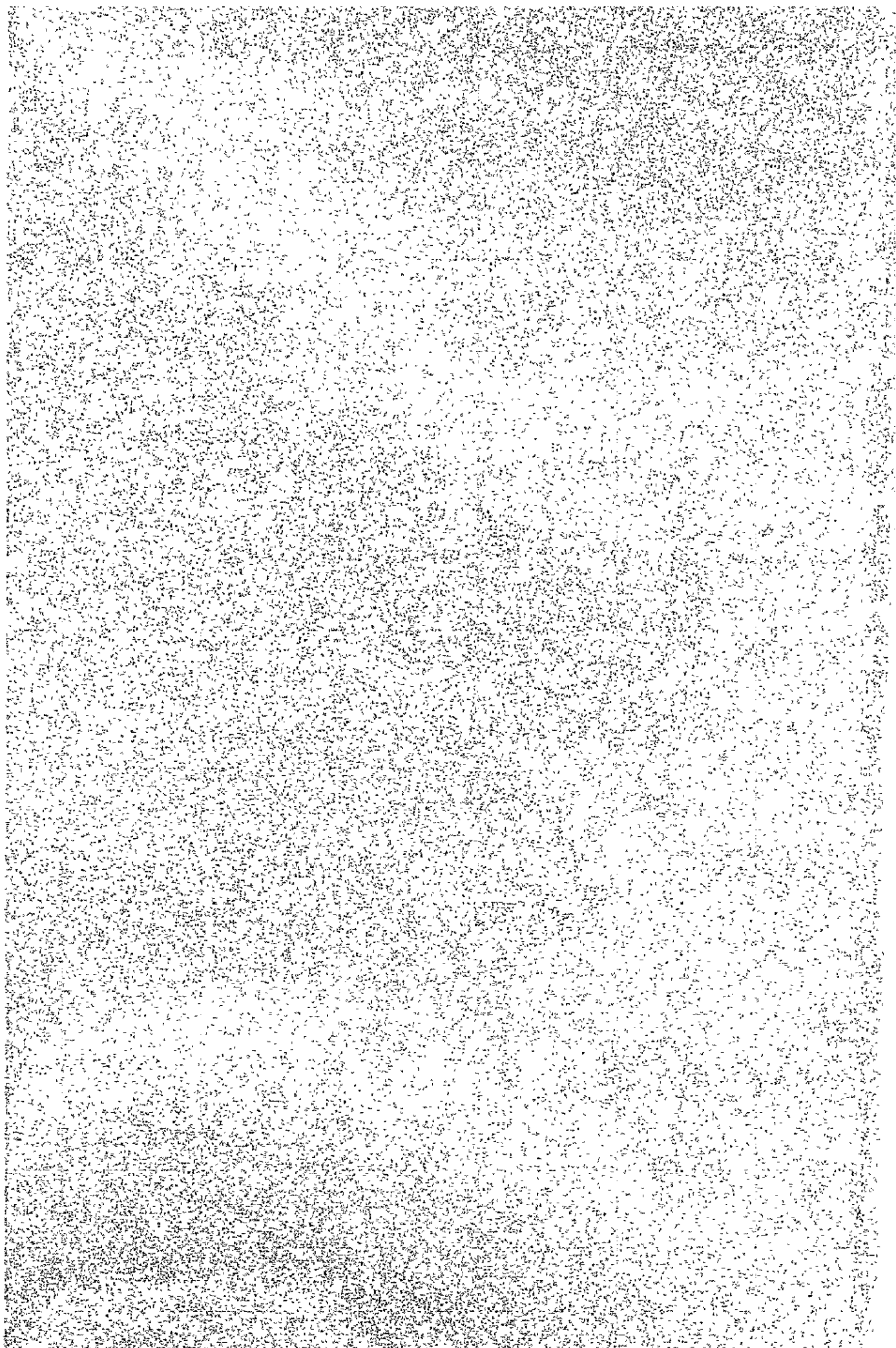
Keisuke Arita
President
Japan International Cooperation Agency



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SUMMARY



S U M M A R Y

1. Basic Design Survey

The Thai Government now makes efforts to promote the silviculture technology and increase the forestry acreage under the National Social and Economic Development Plan whereby maintaining the sound forestry resources and preserving the national domain. In such background, the Thai Government has requested the Japanese Government to grant the aid for establishing the Central Forest Research Laboratory and Training Center of which aim is to effect the research and practical training of silviculture technology.

Upon request of the Thai Government, the Japanese Government made the basic design survey in October/November, 1981 through the Japan International Cooperation Agency. The survey team had discussions with the concerned Thai Government officials and conducted investigations necessary for the preparation of the basic design.

The findings and discussions held between the team and the Thai Government officials were summarized in the form of the Minutes of Discussions on November 5, 1981.

In succession, the basic design confirmation survey was made in Thailand in December, 1981, and the draft final report on the basic design submitted by the survey team was confirmed by the Thai Government in the Minutes of Discussions dated December 24, 1981.

2. Establishment of the Central Forest Research Laboratory and Training Center

The research activities in Silviculture Division are dispersed at present, most of the researchers doing their work at such fields as provincial or district forest offices and nurseries because of

the lack of central research facilities. However, as needs to promote preservation and development of forest resources have increased and researches have gone to a higher level, researchers have come to encounter more problems which can not be solved merely by research studies conducted at the fields. In view of this situation, the Central Forest Research Laboratory and Training Center has been projected.

The objectives of the Center are to provide a place for conducting basic researches and their project studies with high efficiency in an integrated manner on problems which arise out of field activities now dispersed in various districts and to provide a place for systematizing and extending training activities through the basic research and on-the-job practice. The Center is also intended to serve as research facilities which can be utilized commonly by visiting researchers, cultivate rich human resources in the field of forestry research through the effective use of the facilities and thus help develop and disseminate useful forestation technology.

The concept of the proposed project is to establish the Central Forest Research Laboratory and Training Center which consists of the Bangkok Center and the Sakaerat Field Station, each to be constructed in the Compound of the Royal Forest Department (R.F.D.) in Bangkok and the site of the Sakaerat Re-afforestation Project respectively for the fundamental research on silviculture and on-field training.

3. Basic Design

The Bangkok Center is composed of the four-storied Center Building, Auditorium and two Glasshouses. The Center Building includes the departments of research, training, information and administration, and comprises the entrance hall, machine room, garage and administration office on the first floor; the information, training and administration space on the second floor; and research space on the

third and fourth floors. The research floors are devoted to five branches of fundamental silvicultural studies, namely, forest soil, soil microbiology, tree seed, forest tree biochemistry and forest ecology. The research activities for these subjects are supported by the facilities, such as, analytical instruments, microtechniques, growth chamber, plant specimen, and sample processing and storage of subject materials. As a separate building, the Auditorium is provided for lecture and conference, with the seating for 200 audience. Two glasshouses are also provided for nursery and cutting at nursery area.

The Sakaerat Field Station is encompassed by the site for the Research and Training in Re-afforestation Project now undertaken by the Thai Governmental authorities. The Field Station consists of the Administration and Training Building, Laboratory, Dormitories, Cafeteria, Workshop, Garage, Mechanical House and Glasshouse. These facilities are planned to suit the use with the technical cooperation separately extended by the Japanese Government.

4. Project Implementation

The construction of the Center is now scheduled to be implemented with the aid of the Japanese Government's grant following the procedures established thereby. In parallel with this, some work portions related to the construction by the grant must be implemented at the responsibilities of the Thai side. Coverable works by the Japanese grant are the construction of the facilities of the Bangkok Center and the Sakaerat Field Station, while by the Thai side are the filling and grading of the two sites, service connections of the public utility lines, and cooperation with the Japanese side in the procedural matters. Currently scheduled construction period is 17 months for the Bangkok Center and 9 months for the Sakaerat Field Station. Upon the project completion, the Thai side will be required to take thorough care of the operation and maintenance of the Center in line with the initial objectives.

5. Project Appraisal

The Center is planned to provide the facilities for research and training activities in silviculture technology to secure the growing wood stock and to increase the forest acreage in Thailand. Upon the establishment, the Center will contribute to the development of research activities through the substantial and effective studies on fundamental silviculture technology and to the promotion of afforestation through practical training of those engaged in silviculture industry. Beside this, when this Center project is implemented in parallel with the Japanese technical cooperation, the effects of either project will be heightened and the achievements thus made will greatly contribute to the amity between Thailand and Japan.

As to the management of this Center, the Thai side is to undertake great managerial responsibility for satisfactory operation, and take constant care in organization, administration and budget for operation and maintenance of the facilities.

6. Outline of Project

Project title : Construction of the Central Forest Research Laboratory and Training Center

Implementing agency : Royal Forest Department, Ministry of Agriculture and Cooperatives, the Government of Thailand

Project implementation: To be implemented under the grand aid by the Japanese Government

Location : R.F.D. Compound, Bangkhen, Bangkok (Bangkok Center) and Sakaerat Re-afforestation Project site, Nakhonratchashima Province (Sakaerat Field Station)

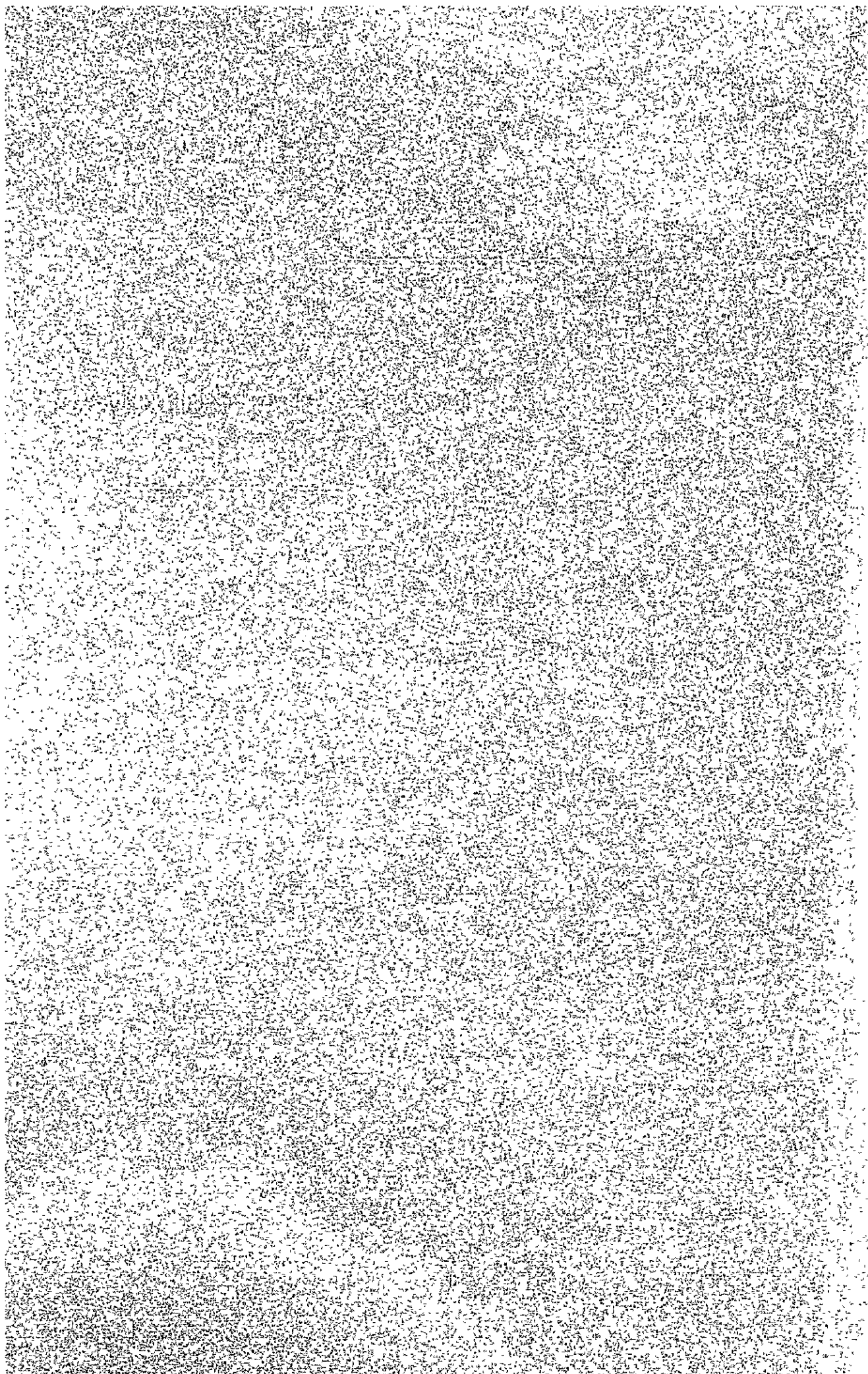
Facilities : Bangkok Center

Center building	Floor Area	5,724 m ²
Auditorium		512
Glasshouses		144
Outside facilities		
Laboratory equipment		
	Total	6,380 m ²

Sakaerat Field Station

Administration and training building	Floor Area	384 m ²
Laboratory		384
Dormitories		638
Cafeteria		91
Workshop		179
Garage		144
Mechanical house		108
Glasshouse		90
Laboratory tables		
	Total	2,018 m ²
	Grand Total	8,398 m ²

CHAPTER 1: BASIC DESIGN SURVEY



CHAPTER 1: BASIC DESIGN SURVEY

1-1 OBJECTIVE AND BACKGROUND

In Thailand, the acreage of forest is now considerably on the decrease. This may be ascribable to increasing demand of timber, illegitimate deforestation, unlawful settlement of inhabitants, burning for agriculture, etc. In order to cope with such status, the Thai Government has made efforts to promote the silvicultural technology for promoting sound preservation and development of forest resources and to increase the forest area under the National Social and Economic Development Plan.

In a hope to promote the development of silviculture technology, the Thai Government has requested the Japanese Government to extend a grant aid for establishing the Central Forest Research Laboratory and Training Center as will serve for research and educational training activities. The scope of the aid as is requested is to mainly build the forest research laboratory and training center in Bangkok (Bangkok Center) with an aim to make the fundamental research of silviculture and the Field Station in Sakaerat to carry out the study and on-the-job training. In parallel with the physical facilities, a technical cooperation program on the Research and Training in Re-forestation Project is separately implemented by the Japanese Government.

1-2 BASIC DESIGN SURVEY MISSION

In compliance with the request of the Government of Thailand, the Government of Japan through the Japan International Cooperation Agency (JICA) dispatched a survey mission headed by Mr. Shigeru Kondo, Special Technical Adviser to the President of JICA to Thailand from October 27 to November 14, 1981. The survey mission conducted various investigations necessary for the preparation of the basic design, conferring with the concerned Thai government officials. What were investigated and discussed include, among others, the following:

- 1) Discussion to clarify the request of the Government of Thailand
- 2) Field investigations to ascertain the site conditions of the Bangkok Center and the Sakaerat Field Station
- 3) Discussion on establishment of the Bangkok Center and the Sakaerat Field Station
- 4) Discussion on function, intended purpose, and planning of facilities and installations to be provided at each site
- 5) Explanation of the typical procedure of the Japanese grant aids and discussions on the scope of the work by each government including the budgetary provision to be made by the Thai side, and the maintenance requirements for facilities and installations
- 6) Observations and investigations of similar facilities existing in Thailand

The findings and discussions held between the survey mission and the Thai government officials were summarized in the form of the Minutes of Discussions on November 5, 1981. Based on the Minutes, further technical discussions were made and confirmed in the Memorandum on November 13, 1981.

1-2-1 Confirmation of Request

The survey mission had a series of discussions with the Royal Forest Department (R.F.D.) on the implementation of the project. At the outset, the mission submitted the Inception Report, giving supplemental explanation to affirm the conceptual scheme evolved by the Thai side. With regard to the Bangkok Center, the project requirements were made clear for its status, function, role, organization and operation, and the plans of utilization and activities in each department of research, training, information and administration were discussed in detail. In the course of the discussions, the Thai side requested to include the forest ecology section in the research department. The Thai side also requested to include the dormitories for trainees in the Sakaerat Field Station in the present grant aid to allow more effective achievement of the technical cooperation program by the Japanese Government.

1-2-2 Proposed Sites and Block Layout

For the site for the Bangkok Center, since the acreage was considerably small as compared with that initially proposed by the Thai side and a roadway ran into the site, the site plan, block layout and number of stories had to be re-studied. As a result of discussions, the Thai side proposed that in view that all the facilities are not necessarily located within the site, two of glasshouses be located at Bangkok and shifted to the nursery to the west of the existing Herbarium and the remaining one be moved to the Sakaerat Field Station. The survey mission requested the Thai Side to conduct the boring test at the Bangkok site as soon as possible because of the unfavorable soil condition.

For the site for the Sakaerat Field Station, the survey mission, after the site exploration, requested to conduct the detailed leveling survey and discussed with the Thai side the block layout on the basis of the land utilization plan prepared by the Thai side.

1-2-3 Outline of the Facilities

Based on the foregoing discussions, the survey mission prepared the sketches of block layout, plans and installations, and research equipment list and presented to the Thai side for detailed discussions. As the consequence, the Bangkok Center building will be four-storied and of such a size as to provide the space where research and training can be done with convenience. The research equipment was mainly selected on the basis of the themes of research which are to be taken up as soon as the Center has been commissioned in operation. In addition, as for the appurtenant facilities, instead of Greenhouses (air-conditioned) in the project proposal, the glasshouses not air-conditioned were taken into consideration. The training facilities will be used mainly for lecture; therefore, consideration to be given were concentrated on securing adequate space provided with some projection equipment.

1-2-4 Implementation of the Project

For the implementation of the project, the survey mission gave to the Thai side an account of the typical procedure of Japanese grant aids and the construction schedule, clarifying the scope of works by both sides. Also the operation/maintenance, administrative organization and running costs in the post-construction stage were discussed to assure the Thai side's recognition of the project implementing arrangement and budgetary provision.

1-3 BASIC DESIGN CONFIRMATION SURVEY MISSION

After working out the basic design on the basis of the survey results and compiling it in the "Basic Design Survey Report on the Central Forest Research Laboratory and Training Center in the Kingdom of Thailand (Draft)," the Government of Japan made a basic design confirmation survey in Thailand through the Japan International Cooperation Agency from December 20 to 26, 1981. The survey mission, headed by Mr. Shigeru Kondo, submitted and explained to the Thai Government officials concerned the Report and conducted further investigations necessary for finalizing the basic design. The discussions and investigations carried out include the following:

- 1) Confirmation of the contents described in the Report
- 2) Confirmation of the items pending the basic design survey
- 3) Confirmation of the preparatory arrangements made by the Thai side
- 4) Explanation of the demarcation for research equipment to be covered by the grant aid and the technical cooperation program
- 5) Observations of similar facilities

The survey mission and the Thai Government officials concerned agreed in principle to all matters described in the Report and exchanged the Minutes of Discussions on December 24, 1981.

1-3-1 Confirmation of the Basic Design Survey Report (Draft)

The survey mission made a presentation of the Basic Design Report (Draft) and explained that the forest ecology section in the Bangkok Center and the dormitories in the Sakaerat Field Station which were

the items pending the basic design survey have been included in the project as described in the Report. The survey mission proposed that the workshop/garage be divided into two buildings to secure a working space in front of the facilities. The Thai side agreed to the proposal.

From the Thai side, it was proposed that a training office be provided on the second floor of the Bangkok Center and that a shower set be provided in one women's toilet on each floor of the Bangkok Center. The survey mission agreed with the Thai side.

1-3-2 Preparatory Arrangements by the Thai Side

In R.F.D., the implementation team for the establishment of the Center was organized on December 14, 1981 as described in Annex I-6 and was launching into a preparatory arrangements for the implementation of the Project including the studies on tentative schedule and budgeting the works to be done by the Thai side.

As for the Bangkok Center, the boring tests started at the site, the result being made ready by the end of January, 1982. The Thai side had investigated the existing conditions of such utility service lines as electricity, water and telephone within the R.F.D. Compound and presented the data to the survey mission. Based on the data obtained, the required extensions of the service lines were discussed. The Thai side also made necessary arrangements for staffing of research sections upon the establishment of the Center.

As for the Sakaerat Field Station, the level surveying had been carried out at the site. The survey mission and the Thai side discussed and determined the layout of the facilities on the basis of the surveying results. The Thai side also made a preparation for construction of access and approach roads, site leveling and provisions of electricity and water supply systems which start in January, 1982.

1-3-3 Research Equipment

The survey mission made a presentation of the overall research equipment plan to the Thai side and explained that the technical cooperation program will cover some of research equipment at the Bangkok Center and all the equipment except laboratory benches at the Sakaerat Field Station. The Thai side agreed with the survey mission.

1-4 SITE SURVEY

For the basic design of the Central Forest Research Laboratory and Training Center, the survey mission conducted the local investigations into the site conditions. The sites both for the Bangkok Center and the Sakaerat Field Station are already acquired by the Thai Government.

a. Bangkok Center Site

(1) Location

The construction site for the Bangkok Center is at the Compound of the Royal Forest Department (R.F.D.), an agency of Ministry of Agriculture and Cooperatives. The R.F.D. Compound is located in Bangkok Metropolitan Area about 20 minutes' drive from the center of Bangkok. The R.F.D. Compound bounds on the Bangkok Campus of Kasetsart University and is served with a bus station at the front gate, thus being favored by the traffic convenience. From an operational viewpoint too, the completed center will be very favorably located to nearby Kasetsart University and agencies of Ministry of Agriculture and Cooperatives.

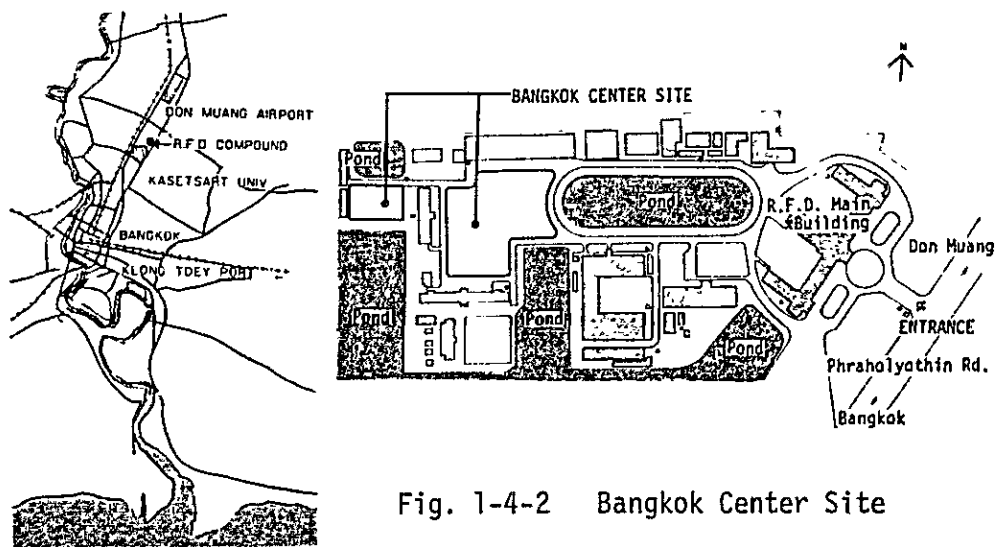


Fig. 1-4-1 Bangkok Map

Fig. 1-4-2 Bangkok Center Site

The site for the Bangkok Center is encircled by the existing concrete-paved roadway, with the inside left as basin-like swamp. In the east of the site is that shed for abandoned cars of which removal the Thai side agreed to undertake. The site area available for construction is about 5,200 m², becoming considerably small as compared with that initially proposed by the Thai side. To worsen the condition, since a roadway runs into the northwest corner of the site, it must be relocated to let the area usable for construction.

Along the peripheral roadway, there are casuarina trees lined up within the site. Some of them may be removed where they interfere with the construction.

The site faces the pond, National Park Div. Building, Herbarium and workshop in the east, south, west and north directions, respectively.

Although the glasshouses had been planned to be located within the site in the proposal by the Thai Government, it was shifted to the nursery (area 1,300 m²) to the west of the existing Herbarium.



Bangkok Center Site

(2) Geological Conditions

Bangkok, the capital of Kingdom of Thailand, is about 20 km north of the southern end of the Plains of Chaophraya which consists of the delta formed around the Chaophraya River, a large river flowing in the central area of Thailand.

The Plains of Chaophraya is in the basin, which extends for about 300 km from the north-west highland to the Bight of Bangkok, being surrounded by the range of Tanowsri Mountains in the west, hilly highland in the north and Khorat Plateau in the west. The ground of Chaophraya Plains, including Bangkok, is classified as alluvial deposit which has been formed by repeated accumulation of water-borne soil and sand originating from the upper-stream. Thus, the subsoil of Bangkok area is, for its most part, composed of alluvial strata developed from deposit delta of the Chaophraya River. Geographically, Bangkok and vicinities are lowland generally 1.5 m above the sea level.

Around Bangkok area, the alluvial soil is composed of layers of soft sand, sandy clay, clay and silt, and the water table is high. Regarding its properties, the subsoil down to 15 m below the ground is formed by soft loose strata with N-value of zero, for which reason the ground settlement due to consolidation is noticeable, partially settlement over 10 cm having been recorded.

Then, the Bangkok Center Building must be supported on piled foundations. The subsoil stratum on which piles rest will be determined from the data having been clarified by boring tests. In this connection, the local practice is that the piles are usually supported by a fine sand stratum which is usually encountered at more than 20 m below the ground and has N-value of not less than 40. In this project too, the piles will be 20 m or so long.

(3) Earthquakes

It is known that most of earthquakes take place on two major seismic belts which are Circum-Pacific belt and Alps-Himalaya belt. Since Thailand lies outside those belts, seismic activity in this country is very low. Local records indicate no actual damage due to earthquakes in the past. Although there have been some earthquakes sensible to human senses in recent years, it will not be necessary to take earthquakes into account in structural design.

(4) Climatic Conditions

The meteorological data obtained in R.F.D. Compound and in Bangkok area are as shown in Table 1-4-3 and Appendix II-1-2, respectively. The climatic conditions on the site may be summarized as follows:

- i. Temperature is more than 32°C in monthly average and is very high during a year
- ii. Humidity is considerably high
- iii. Rainfall difference in dry season and wet season is considerable

From Oct. 1979 - Sept., 1980

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)												
Mean	33.8	34.9	36.4	36.3	35.6	33.0	33.1	33.9	31.6	33.1	32.1	32.1
Mean max.	35.0	37.0	37.9	41.0	41.0	37.0	37.0	36.0	36.0	35.0	35.0	34.0
Mean min.	33.0	32.0	35.0	30.0	30.9	30.8	27.0	29.0	26.0	32.0	28.0	30.0
Relative Humidity (%)												
Mean	53.3	54.3	57.1	68.6	68.3	69.8	69.4	67.4	74.8	60.9	58.5	58.4
Mean max.	69.0	63.0	66.0	90.0	53.0	57.0	60.0	60.0	60.0	74.0	61.0	63.0
Mean min.	44.0	41.0	49.0	59.0	18.8	18.7	17.2	17.2	18.7	52.0	52.0	52.0
Rainfall (mm)												
Total rainfall (m.m.)	-	0.8	35.8	130.8	579.0	216.5	166.8	207.6	484.9	188.7	93.9	-
Greatest in 24 hr. (m.m.)	-	0.6	27.2	60.1	96.0	40.3	44.3	80.7	80.3	78.7	42.4	-
No. of rainy days (Days)	-	2	2	4	15	12	9	14	15	11	4	-

Table 1-4-3 Meteorological data in R.F.D. Compound

(5) Utilities

i) Electricity

The existing power distribution line around the proposed site is as shown in Appendix II-1-5. There run super high tension power cables (12KV) along the front road of R.F.D. Compound. From these cables, branch cables are led overhead inside the Compound, being received at transformers provided on a few poles. By these transformers, power is stepped down into 3 phase 380 volts and single phase 220 volts at 50 Hz in frequency and distributed into the buildings in the Compound. For the proposed Center, new super high tension power cables will be provided to new transformers near the electrical room in the Center Building.

ii) Telephone

There are 300 telephone trunk lines along the front road of R.F.D. Compound. Out of them, about 10 lines are laid into the R.F.D. Main Building. The overhead lines are distributed to each building at the Compound, using the same poles that are provided for power distribution. There also exist about 60 direct lines to the buildings in the Compound as shown in Appendix II-1-5.

iii) City water

Along the front road of R.F.D. Compound, there runs underground main city water pipe of 50 cm in diameter, from which 10 cm dia. and 7.5 cm dia. branch pipes are led into the Compound. The details of water line in the Compound are shown in Appendix II-1-5. The quality of city water in R.F.D. is as shown in Appendix II-1-3.

iv) Sewage and waste

For the existing R.F.D. facilities, sewage and waste are disposed of by soakaways after primary treatment as is generally done in Thailand.

There are no laws and regulations related to the sewage and waste disposal except those applied to manufacturing factories.

v) Gas

There is no city gas supply around R.F.D. Compound. Cylinder gas of propane and butane mix is available in Bangkok. The characteristics of the gas are as follows:

Contents: C H and C H
Calorie : 11,900 kcal/hr

vi) TV and Radio

There are 4 channels in TV net-work and FM/AM radio broadcasting in Bangkok area.

vii) Garbage Disposal

There is a garbage collection area at the corner of the R.F.D. Main Building. The garbage from the existing building at R.F.D. Compound is carried away by city trucks every other day.

b. Sakaerat Field Station

(1) Location

Sakaerat is about 300 km distant in the northwest direction from Bangkok along National Highway Route 304. Nearby towns include Nakhonratchasima and Pak Thong Chai. The site is under the control by the Sakaerat Environmental Research Station (SERS). Near the site, there are also the plantation for practical study owned by Kasetsart University and the National Park to serve as very favorable determinants in the site selection.

The site for the Sakaerat Field Station is about 45 ha in area at an elevation of about 400 m above the sea level and on 5° - 10° sloped stretch of land. The site is encompassed in the area allotted for the entire scheme of the Re-afforestation Project which is at present almost prepared for nursery arrangements by cutting shrubbery, cassava, etc.

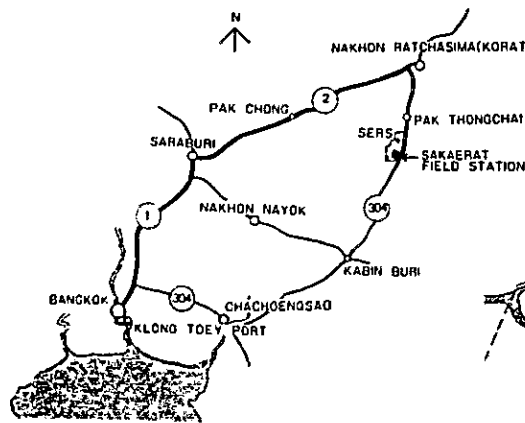


Fig. 1-4-4 Map of Sakaerat

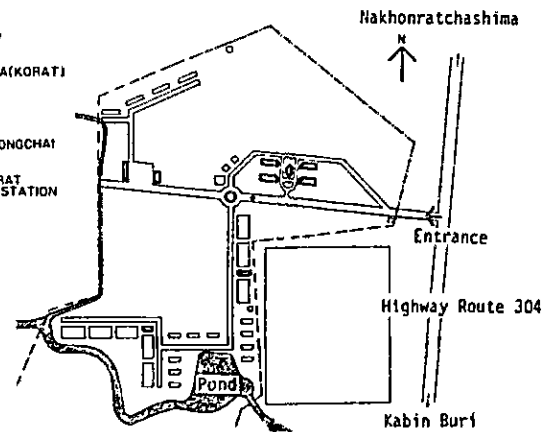


Fig. 1-4-5 Sakaerat Field Station Site

(2) Geological Conditions

Sakaerat and its vicinity are in a mountaineous region. Geologically, the subsoil, belonging to Khorat Group, consists of: bed rock formed by sandstone and shale; the next upper stratum of sandy loam and sandy clay deposits; and the top soil of alluvial deposit. That top soil classified as Red-Yellow Podzolic Group and is comparatively dense sandy soil. Since the projected buildings are single- or two-storied, small ones, they will be supported on such foundations as will directly rest on the ground in reliance of the sufficient bearing capacity of soil.



Sakaerat Field Station Site

(3) Climatic Conditions

The meteorological data obtained in the SERS and in Nakhonratchashima Province are as shown in Table 1-4-6 and Appendix II-2-2, respectively. The climatic conditions on the site may be summarized as follows:

- i. Temperature is 22° - 28°C in monthly average and is quite high during a year.
- ii. Humidity is considerably high.
- iii. Rainfall difference in dry season and wet season is considerable.

From 1969 - 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)												
Mean	22.67	25.81	27.99	28.48	27.60	27.74	27.16	26.80	26.38	25.10	22.75	21.74
Mean max.	29.56	32.17	34.10	34.52	33.35	32.66	31.95	31.24	31.12	29.70	27.61	27.60
Mean min.	15.82	18.65	21.56	22.64	22.83	22.88	22.42	22.26	21.63	20.51	17.92	15.81
Relative Humidity (%)												
Mean	69.2	63.4	62.7	69.7	74.9	77.4	78.2	78.4	84.1	84.4	79.4	75.4
Mean max.	89.7	84.3	81.7	83.3	87.0	86.6	87.5	87.5	93.2	95.2	92.7	91.9
Mean min.	48.8	46.2	49.2	56.1	68.5	68.2	69.0	69.0	75.1	73.6	66.5	59.0
Rainfall (mm)												
Total rainfall (m.m.)	12.23	17.91	86.13	178.02	177.65	126.83	121.49	119.56	277.66	210.03	68.78	12.84
Greatest in 24 hr. (m.m.)	12.23	10.2	38.1	58.4	19.8	25.4	29.5	17.8	17.1	21.5	24.8	12.84
No. of rainy days (Days)	1	3	7	7	13	15	19	22	19	11	2	1

Table 1-4-6 Meteorological data in SERS

(4) Utilities

i) Electricity

There are no electric supply facilities near the site.

At present electric power lines are laid from Nakhon-ratchashima City to the point about 20 km from the site. The lines will be extended to the SERS by the end of 1982. So no power supply from public source can be expected at the site until that time.

ii) Telephone

There is no telephone line around the site.

iii) Water Supply

There is no city water supply around the site. At the SERS, water is taken from a dam provided in the site, being reserved at a water reservoir and pumped up to the elevated water tank made of concrete for distribution to each building by gravity. For the Sakaerat Field Station the same method will be adopted. The quality of water available from the stream in the SERS is shown in Appendix II-2-3.

iv) Sewege

There is no sewege around the site. In the SERS, existing habitations dispose of soil water by soakaways without any primary treatment.

v) Gas

There is no city gas supply around the site.

vi) TV and Radio

TV and AM/FM radio broadcasting reception is possible around the site.

1-5 OTHER ITEMS SURVEYED

1-5-1 Similar Facilities

The survey mission observed and studied similar facilities in Thailand to obtain the required information. The survey items covered the data and information on buildings, utilities and equipment especially with regard to the implementation of construction program, operation/maintenance of the completed institutions, and their costs for the construction and maintenance.

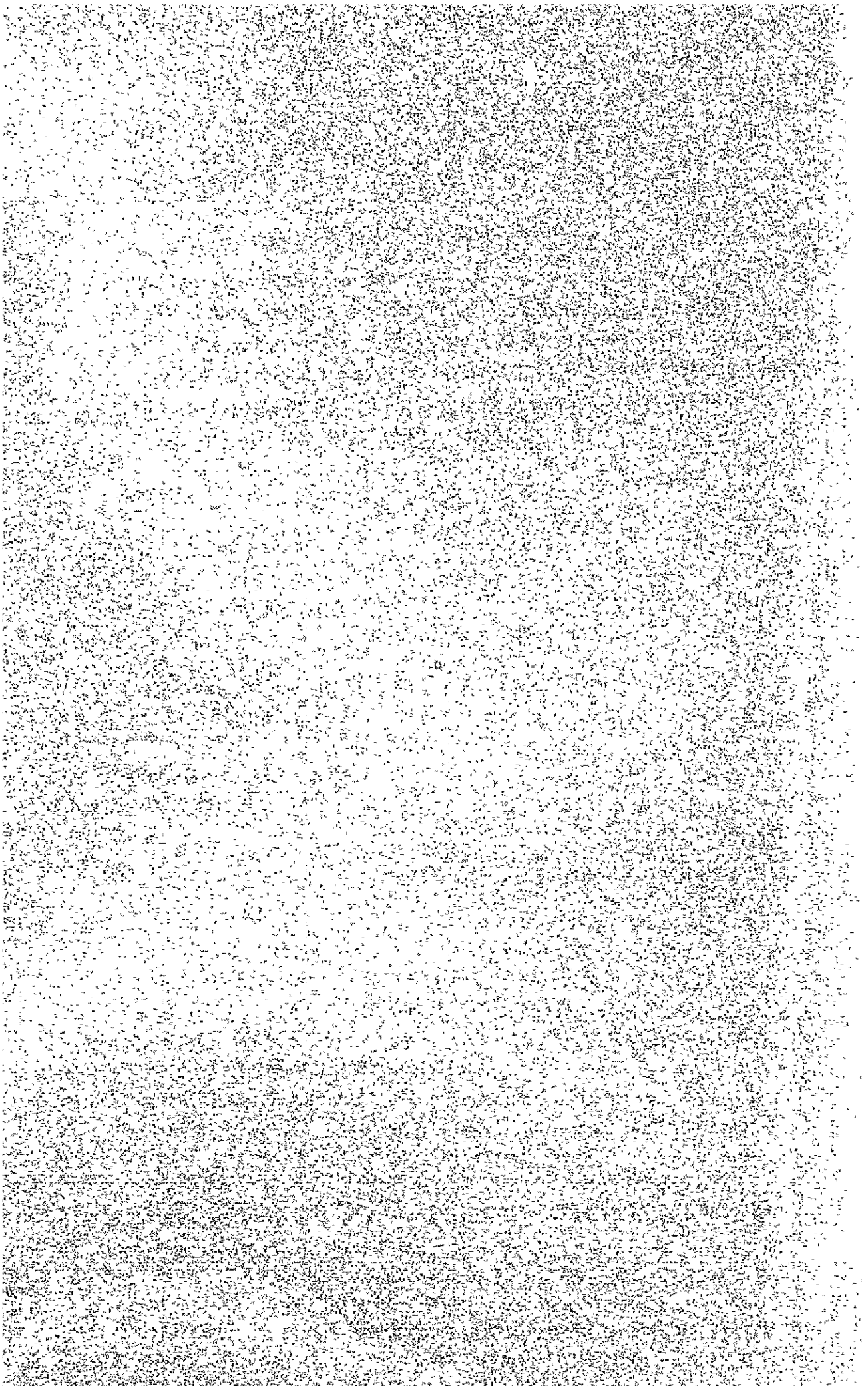
- ASEAN-CANADA FOREST TREE SEED CENTER, MUAG LEK
- SAKAERAT ENVIRONMENTAL RESEARCH STATION
- KASETSART UNIVERSITY, KAM PHAENG SAEN CAMPUS
- KASETSART UNIVERSITY, BANGKHEN CAMPUS
- FACILITIES IN R.F.D. COMPOUND
- NATIONAL INLAND FRESHWATER INSTITUTE
- YOUTH WELFARE CENTER

1-5-2 Construction Conditions

In order to substantiate the construction conditions for the project, the survey mission studied and collected the data and information on the following construction items and related ramifications.

- Materials and equipment, available in the locale
- Construction costs and material costs
- Availability and adequacy of labor force and labor costs
- Transportation and procedures
- Standard practice in construction
- Relevant laws and regulations

CHAPTER 2: ESTABLISHMENT OF THE CENTRAL FOREST
RESEARCH LABORATORY AND TRAINING CENTER



CHAPTER 2: ESTABLISHMENT OF THE CENTRAL FOREST RESEARCH LABORATORY AND TRAINING CENTER

2-1 STATE OF FORESTS AND FORESTRY IN THAILAND

Although the forest area in Thailand is said to be about 27-million ha, the actual forest area as estimated on the basis of the photos taken in 1977 by Landsat is taken as about a half the foregoing figure, or 13-million ha approximately. The latter figure clearly indicates the immense loss of the forestry area and equally immense increase of weeded area which has resulted in its consequence. The decreasing trend of forestry area is predicted to continue for years to come as "The Earth in the Year 2000" published by the U.S. Government warns that the aggregated forest area in developing countries will decline to about 60% of the area in 1978 at the turn of the century.

It is believed that this decrease in the forest area is primarily attributable to the increase in the demand of timber due to the population growth, indiscreet deforestation, unlawful occupancy of forests for dwelling purpose, and increase in the area of shift cultivation, etc.

In Thailand, the annual target of forestation is set at 80,000 ha under the 5-year Social and Economic Development Plan now in force; however, actual rate of forestation is no more than a little over 30,000 ha per annum. On the other hand, the decrease in the forestation area is estimated at 150,000 to 200,000 ha per year. This serious imbalance provides more than enough grounds on which to base the assertion that the increase in the forest area is the urgent necessity. Because of this, it is required that primary stress in silviculture research should be placed on the development of new renovation techniques and the reduction of forestation costs by the use of such techniques. Further, remarkable sterilization and

densification of soils are observed in weeded areas which have grown in consequence of shifting cultivation. Because of the climatic condition which is characterized by the long dry season, there are a number of problems which cannot be solved by mere introduction of technical and research achievements available in the systems of technology existent in the developed nations advanced in forestation. These problems apparently require the exploitation of new research and technology system based on the integration of the fundamental research and field experiment.

2-2 PRESENT STATE OF SILVICULTURE RESEARCH AND TRAINING ACTIVITIES

In Thailand, the research and education in forestry are mainly conducted at Faculty of Forestry of Kasetsart University, the Royal Forest Department (R.F.D.), and a junior college under the jurisdiction of R.F.D. The research and training activities at R.F.D., particularly those related with forestation, are as described below.

2-2-1 Research Activities

Researches at R.F.D.'s facilities in Bangkok are mainly done by Forest Products Research Division, Silviculture Research Sub-Division and Forest Botany Sub-Division of Silviculture Division, and Watershed Management Division. In addition to these, researches are also done by the researchers assigned to Teak Breeding Center, Pine Breeding Center, and Provincial and District Forest Offices. As for Silviculture Research Sub-Division of Silviculture Division which is most deeply involved in the present Project, the Sub-division is presently engaged in the following branches of research.

- 1) Plus tree selection
- 2) Progeny and clonal testing
- 3) Establishment of seed orchard and seed production area
- 4) Establishment of gene conservation area
- 5) Species and provenance testing
- 6) Vegetative propagation
- 7) Seed collection, testing, and handling
- 8) Agroforestry and mixed-cultivation
- 9) Silvicultural research

The foregoing research works are being done by 42 researchers of Silviculture Research Sub-Division.

In Silviculture Division, a total of 60 staff researchers are engaged in research studies. Because facilities and equipment essential

for basic research are virtually absent, almost all the researches now being done at R.F.D. are accounted for by research works at nurseries and forests.

2-2-2 Training Activities

R.F.D. has in its jurisdiction Prae Forestry Junior College for training of forestry officials and Tark Forestry School for giving education to government personnel and people in private sector.

In addition, R.F.D. provides yearly short (1 to 4 weeks) training courses for its staff members and hired workers. These courses are to comprise: (1) Officer Course (2 - 3 times/year), (2) Technician Course (4 - 6 times/year) and Laborer Course (4 - 6 times/year), and each course is attended by about 30 persons at a time. Lecture is given on such subjects as silviculture technology, forestry conservation, land utilization, forestation equipment, etc. mainly at the buildings in R.F.D. Compound. However, the place for this sort of training activities is often unavailable, and the courses cannot be held so often and at such dates as desired. This naturally makes it difficult to implement training on a pre-planned basis.

2-3 SCHEME TO ESTABLISH THE CENTRAL FOREST RESEARCH LABORATORY AND TRAINING CENTER

2-3-1 Objectives

Because of the lack of central research facilities, the activities of the researchers assigned to Silviculture Research Sub-Division of Silviculture Division are dispersed, most of the researchers doing their work at provincial or district forest offices and nurseries. As researches have gone to a higher level, however, researchers have come to encounter more problems which cannot be solved merely by research studies conducted at the field. In view of this situation, the Central Forest Research Laboratory and Training Center has been projected. The objectives of the Project are as summarized below.

- 1) To provide a place that can meet the demand for basic researches on problems which arise out of field tests and researches.
- 2) To provide a place for basic researches required for project research studies.
- 3) To provide a place for reorganizing, and extending, through on-the-job training and fundamental research, training activities which are not systematic at present.
- 4) To promote efficiency of research by concentrating in one place the researchers who are at present dispersed in various districts and also to provide research facilities which can be utilized commonly by visiting researchers.
- 5) To cultivate rich human resources in the field of forestry research through the effective use of the facilities as described above and thereby to help develop and disseminate useful forestation technology.

To achieve the foregoing objectives, the projected Center will be planned as a research and training center which can accommodate about 40 researchers of Silviculture Research Sub-Division. During the period of the project implementation, the facilities will be placed under the direct command of Silviculture Division; however, in future a new organization will be established for administration of the Center.

According to R.F.D.'s concept which is now seriously studied a research and training committee composed of the heads of research-oriented divisions and sub-divisions in R.F.D. will be organized and placed under the command of Director General of R.F.D. This proposed committee will, at its responsibility, integrate all the existing research facilities into National Forestry Research Institute and the facilities planned under the present Project will be principal facilities of such national institute.

In the background of the above-mentioned organization plan, there exist a desire to place all R.F.D. research facilities under a single command to keep the interrelations between various research sections well coordinated and also a desire to unify the research-oriented budget to help promote the efficiency of research activities. This organization plan, therefore, does in no way lead to change in research functions included in the initial concept of the Center Project. Fig. 2-3-1 shows the organization of the Center now under consideration.

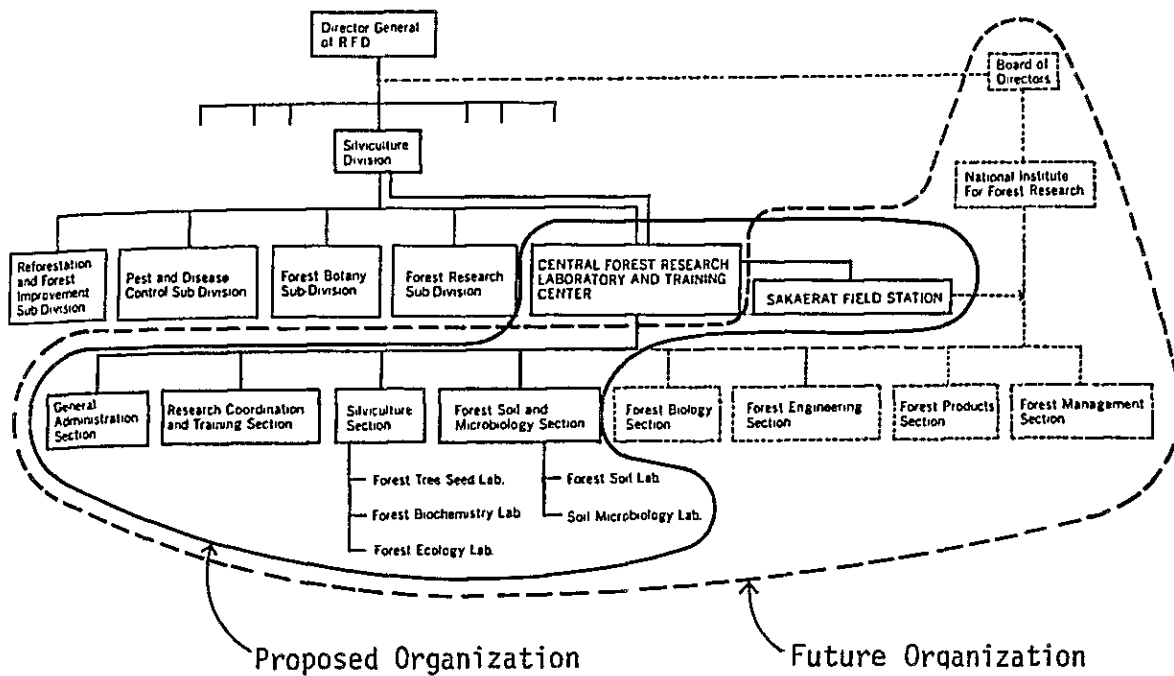


Fig. 2-3-1 Organization of Central Forest Research Laboratory and Training Center

2-3-2 Research and Training Programs at Bangkok Center

There will be established in the Center five branches which will be concerned with tree seed, forest tree biochemistry (including physiology and genetics), forest ecology, forest soil and soil microbiology, each research branch being occupied by three researchers and three assistant researchers. Forest ecology was not in the initial requirements prepared by the Thai side.

Forest ecology, however, is an indispensable branch of forestry research, and a research worker belonging to Silviculture Research Sub-Division is at present engaged in forest ecology research in the forest centering about Sakaerat Environmental Research Station (SERS). The studies at this time have clearly indicated that forest ecology research, though is mostly done outdoors, is closely related with research on forest soil, forest microbiology and tree physiology and, therefore, that this branch is really indispensable for the Center. The research branches organized as above will cover almost all basic forestry research and also enable researchers to do some high level researches. According to the schedule made by the Thai side, these branches are supposed to take up such research schemes as listed below.

Tree Seed

- 1) Effects of light and temperature on seed germination
- 2) Seed pretreatment
- 3) Seed storage
- 4) Seed development

Forest Tree Biochemistry

- 1) Genetic variation of isozymes in some important tree species
- 2) Flowering induction
- 3) Identification of C3 and C4 forest tree species
- 4) Hormonal control of differentiation processes in tissue culture
- 5) Study on net assimilation rate of some fast-growing tree species

Forest Ecology

- 1) Biomass productivity of some fast-growing species
- 2) Light conditions and natural regeneration in tropical forest

- 3) Structure and dynamics of various types of forest in Thailand
- 4) Relation between rhizosphere and root biomass
- 5) Plant succession

Forest Soil

- 1) Soil nutrients and fertilization
- 2) Mulching effects on soil chemistry and structure
- 3) Relationship between soil properties and soil microbes
- 4) Forest soil classification

Soil Microbiology

- 1) Identification, culture and inoculation of mycorrhizal fungi
- 2) Identification, culture and inoculation of rhizobium strains

In reviewing the foregoing themes of research, it is noticed that some of the research subjects contemplated in certain branches (e.g. forest tree biochemistry) require by far high level of the substance and techniques. It is also noticed that more research subjects are contemplated in some branches than can be properly dealt with by three researchers. Therefore, it is considered appropriate that the research themes as described below, which are required to be taken up right after the Center comes into operation, be undertaken immediately and then augmented by the aforementioned research themes as the operation and research activities of the Center are enriched along its long range development plan. For establishing the Center, it is essential for its sound operation and maintenance that the facilities and research equipment be minimized to serve the short and medium range operation.

Tree Seed:

Research on coordination, germination and storage of seeds

Forest Tree Biochemistry:

Mainly research on tissue culture and photosynthesis. Research related to isozyme will be an additional theme.

Forest Ecology:

Research on drying and light measurement

Forest Soil:

Research on chemical and physical properties on soil

Soil Microbiology:

Research on separation, culture and inoculation

For these research branches, each laboratory will be provided. And, in addition, there will be a number of research-supporting facilities which will comprise: Microtechnique Lab, Analytical Instrument Lab, Growth Chamber Lab, Plant Specimen Room, Sample Processing and Storage Room, Cold Storage, Tissue Culture Room, Data Processing Room, Dark Room and Glasshouses. Each facility will be staffed as shown on Table 2-3-2. The director, deputy directors and other staff members in administration, information and training departments will be about 40 in number.

As for the man power resources for the Center, there are at present 42 researchers in Silviculture Sub-Division which include 11 researchers who were selected among nation-wide staff members in R.F.D. in November, 1981. Almost all of these researchers will be assigned to the Center activities. In addition, R.F.D. is requesting to the Thai Government a budget for recruiting more staff in the fiscal year of 1982. In view that the researchers are said to be in a high level in ASEAN countries, the sound research activities in the Center are considered to be realistic enough. Moreover, the technical cooperation program on the Re-forestation Project in Sakaerat is expected to expand its cooperation to both Bangkok and Sakaerat, thus up-grade the qualitative level of the research staff.

		<u>Permanent</u>	<u>Visitor</u>
		(Researcher : Assistant)	
Laboratory	Tree Seed	6 (<u>3</u> : <u>3</u>)	2
	Forest Tree Biochemistry	6 (<u>3</u> : <u>3</u>)	2
	Forest Ecology	6 (<u>3</u> : <u>3</u>)	2
	Forest Soil	6 (<u>3</u> : <u>3</u>)	2
	Soil Microbiology	6 (<u>3</u> : <u>3</u>)	2
Sub-total		30 (<u>15</u> : <u>15</u>)	10
(Qualified : Skilled)			
Supporting Facilities	Microtechnique	4 (<u>4</u>)	2
	Analytical Instrument	3 (<u>3</u>)	2
	Plant Specimen	2 (2)	
	Sample Processing	2 (2)	2
	Cold Storage	-	
	Tissue Culture	2 (<u>1</u> : 1)	
	Growth Chamber	4 (<u>2</u> : 2)	
	Workshop	9 (3 : 6)	
	Dark Room	3 (<u>1</u> : 2)	
	Data Processing	2 (<u>1</u> : 1)	
Sub-total		31 (15 : 16)	6
TOTAL		61	16
GRAND TOTAL			77

Note: The underlined indicates the staff specialized in forest.

Table 2-3-2 Staff of the Center

The training is to be conducted according to the established plan as shown below; therefore, Auditorium, Conference Room, Seminar Room, comparatively simple Audio-Visual Room, etc. which can also serve the research functions will be required.

Training Program in the Bangkok Center

(1) Lecture

- 1) Statistics
- 2) Tree improvement
- 3) Silviculture
- 4) Conservation of natural resources
- 5) Land use planning

(2) On-the-job training

(3) Type of training with number of trainees

- | | | |
|----------------------|------------------|-------------------|
| 1) Manager course | 2 - 3 times/year | total 90 trainees |
| 2) Technician course | 4 - 6 times/year | " 180 trainees |
| 3) Worker course | 4 - 6 times/year | " 180 trainees |

2-3-3 Sakaerat Field Station

In this Project, Sakaerat Field Station is planned to be adjunct to the research and training facilities located in Bangkok.

The Field Station is required as a proving ground which enables researchers to see how the results of basic research can be applied in the field and how the problems encountered in the field can be reflected on the research to be done at the central research facilities. The Field Station is also indispensable as a place for field training. This Project will be closely coordinated with the Research and Training in Re-forestation Project which is implemented under the technical cooperation for development, research and training related with forestation technology through the development of the exhibit forest and nursery in Sakaerat area. To meet these purposes, necessary facilities are required.

Training Program in the Sakaerat Field Station

- (1) Lecture
- (2) On-the-job training

- Nursery practice
- Plantation practice
- Soil survey
- Machanization
- Plus tree selection

A tentative training program of the Research and Training in Re-forestation Project is shown in Appendix I-6.

2-4 TECHNICAL COOPERATION PROGRAM

Prior to the grant request for the Project, the Thai Government made a request, in April 1980, for the technical cooperation to assist the promotion of mechanized reforestation. This emerged in the backdrop that since the Thai Government had been seriously concerned about the recent, rapid destruction of forest area and associated problems as caused by indiscriminate cutting of forest resources, it had arrived at a decision to promote mechanized reforestation for enlarging the forest area as well as to look for the new usage of local trees and immigrate foreign trees, all these development and research being undertaken by R.F.D.

In reply to that request; the Japanese side conducted the preliminary survey in July 1980 and the long-term one in January to February, 1981, making the confirmation of the request, investigation of scheduled project site and preparatory analysis of projected achievement. Subsequently in July 1981, the implementation survey and discussions were made and both governments agreed in the Record of Discussions to start the five-year-technical cooperation program.

The cooperation program plans to make advice and recommendation on the research development and training to be performed by R.F.D., establishing a Project Office in the R.F.D. Main Building, Bangkok and to work out the demonstration plantation for silvicultural tests, research development and training, establishing a Field Office in Sakaerat. By those activities at two stations, the transfer of technology and investigatory studies in the field of silvicultural research development and training are expected.

The scope of cooperation is scheduled to include the following.

- (1) Nursery techniques
- (2) Techniques for site classification and species selection
- (3) Planting and tending techniques

- (4) Mechanization techniques related to re-afforestation activities
- (5) Systematization of various techniques included in re-afforestation
- (6) Techniques for counter-measures against fire, insects, diseases and other natural damages
- (7) Agroforestry

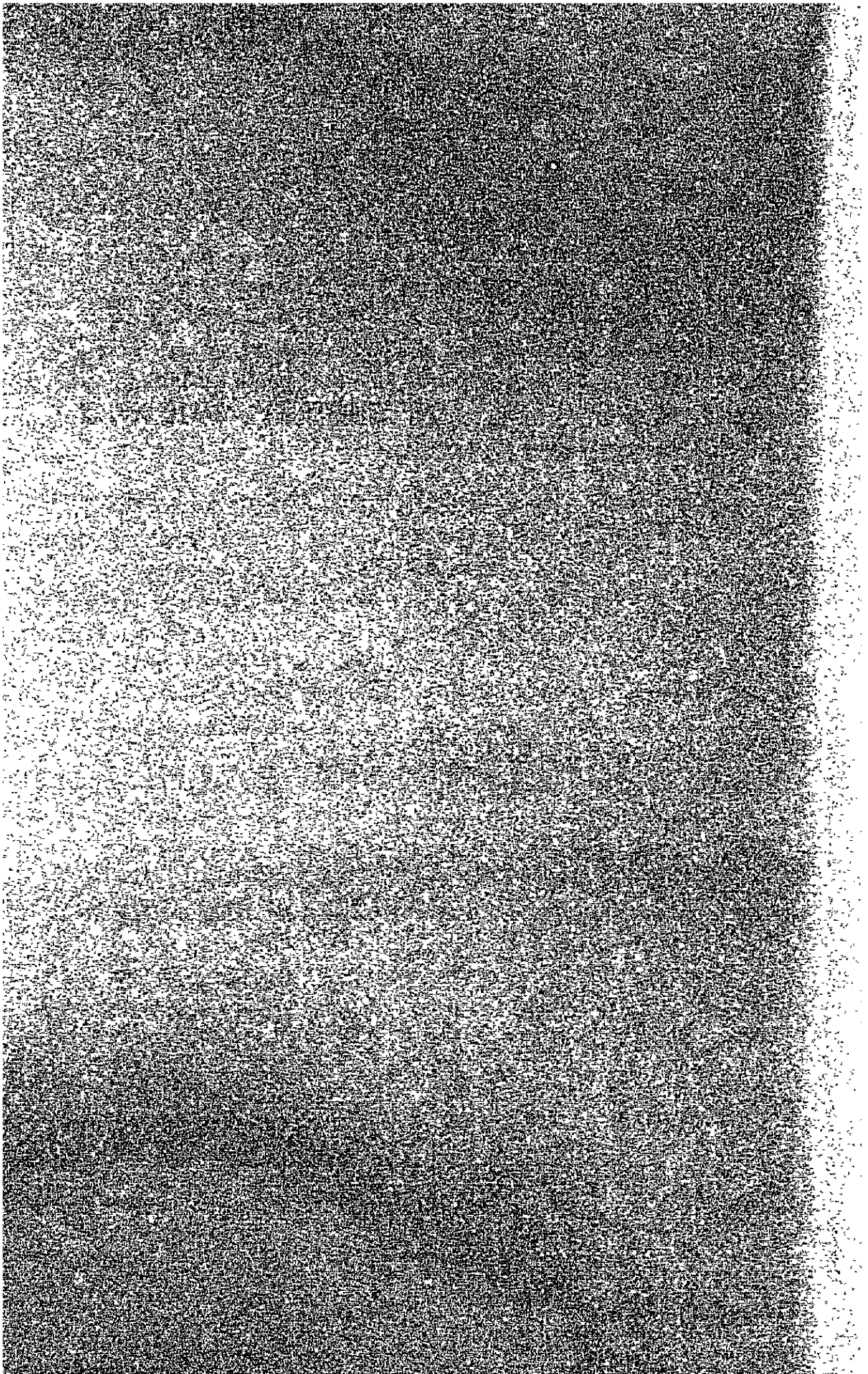
To implement the technical cooperation program, the Japanese side is to send the experts, invite the trainees and supply the equipment, while the Thai side is to select and station the counterpart staff and researchers as well as undertake the construction of the field station and the management cost of the program.

In the course of discussion of the technical cooperation program, a grant aid for establishing the Central Forest Research Laboratory and Training Center was requested by the Thai side, and then, was studied by both Governments from the viewpoint of the relevance to the technical cooperation. As a consequence, it was agreed that to include the Sakaerat Field Station in the grant was favorable for the grant as well as the technical cooperation and that the Thai side made a supplementary request.

The reason may be given as follows. Firstly, by incorporating the field office adjunct to the Bangkok Center, it will be made possible to assure the functional combination of the field tests and training with the central research and training and establish the efficient research system for promoting the forest expansion program, thereby making the construction program itself more significant. Secondly, to construct the Sakaerat Field Station under the Japanese grant will allow more effective achievement of the technical cooperation program, and to provide the assistance both for the Bangkok Center and for its supplemental field office will make the research and development more effectual.

As seen from the above, the present construction program, when correlated to the technical cooperation program, will enable both the programs to be enhanced through mutual effects of one on the other.

CHAPTER 3: BASIC DESIGN



CHAPTER 3: BASIC DESIGN

3-1 GENERAL

- 1) The basic design of the Central Forest Research Laboratory and Training Center has been prepared on the basis of the basic principles agreed upon by R.F.D. and the Japanese survey missions through the basic design survey conducted in October/November 1981 and the Basic Design Confirmation Survey conducted in December 1981.
- 2) R.F.D. and the survey missions made extensive joint investigations and studies as to the buildings, utility services and research equipment and constructional approach to be adopted for this Project, and also had in-depth discussions on these matters. The results of these endeavors and those of the investigations severally conducted by the Japanese survey missions have been coordinated from an overall point of view and incorporated into this basic design.
- 3) The projected Center is intended to serve as a place for fundamental afforestation research and also as a place for training in practice. The facilities for research, training, information and administration will be provided in the Bangkok Center to be constructed in the R.F.D. Compound in Bangkok, while the Field Station will be located in Sakaerat where the Research and Training in Re-afforestation Project is to be implemented by the Japanese Government.

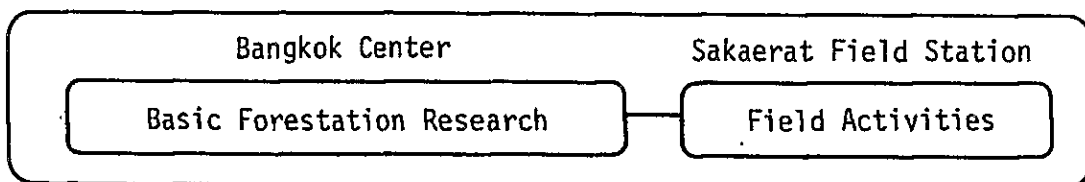


Fig. 3-1-1 Central Forest Research Laboratory and Training Center

3-2 OUTLINE OF FACILITIES

3-2-1 Bangkok Center

(1) Site

The Compound of Royal Forest Department, Bangkok, Bangkok

(2) Facilities

a. Buildings

Center Building: 4-storied reinforced concrete

Auditorium : 2-storied reinforced concrete

Glasshouse x 2 : Single-storied steel frames

b. Outdoor facilities

In-site road, service yard, parking lot

Sewage treatment tank, oil tank

Gas cylinder storage, garbage stock, washing area

c. Research equipment

3-2-2 Sakaerat Field Station

(1) Site

Re-afforestation Project Site in Pak Thong Chai, Nakhon-rachashima Province

(2) Facilities

a. Buildings

Administration and Training Building	:	2-storied reinforced concrete
Laboratory	:	"
Dormitory x 2	:	"
Cafeteria	:	single-storied reinforced concrete
Workshop	:	"
Garage	:	"
Mechanical House	:	"
Glasshouse	:	single-storied steel frames

b. Laboratory tables

3-2-3 Floor Area

Bangkok Center

Center Building	5,724 m ²
Auditorium	512
Glasshouse -1	90
Glasshouse -2	54
Sub-total	6,380 m ²

Sakaerat Field Station

Administration and Training Building	384 m ²
Laboratory	384
Dormitory -1	319
Dormitory -2	319
Cafeteria	91
Workshop	179
Garage	144
Mechanical House	108
Glasshouse	90
Sub-total	2,018 m ²
Grand-total	8,398 m ²

3-3 DESIGN PRINCIPLES

The basic design has been governed by the following design principles:

- 1) Facilities should be such that the requirements of the users are fully reflected on their design.
- 2) Environmental conditions, both natural and man-made, should be fully considered in designing.
- 3) The design should be compatible with local climatic conditions characterized by high temperature and humidity and concentrated rain during the wet season, and also with local customs and mode of life.
- 4) To be compatible with local conditions, the buildings as designed should be easy to use and maintain and should involve as little maintenance cost as possible. For this purpose, natural ventilation and lighting should be utilized to a maximum extent and the need to rely on mechanical systems should be minimized.
- 5) Design should be such as will enable construction to be performed at a minimum cost without undue difficulty. To achieve this end, due consideration should be given to utilization of local construction techniques, materials and practice.
- 6) The design will basically conform to the relevant laws and regulations now in force in Thailand; however, the regulations and standards in Japan will be referred if relevant ones are not established in Thailand.

3-4 BLOCK LAYOUT

3-4-1 Bangkok Center

The layout and composition of the Bangkok Center have been established in the manner as described below.

- (1) The Bangkok Center is composed of Center Building, Auditorium and two Glasshouses which are intended to have different functions and serve different purposes.
- (2) The site (Area: 5,200 m²), facing the existing R.F.D. Main Building across the pond in the R.F.D. Compound, accommodates the Center Building and Auditorium. An additional parcel of land being used as nursery at present will be used for the construction of two Glasshouses.

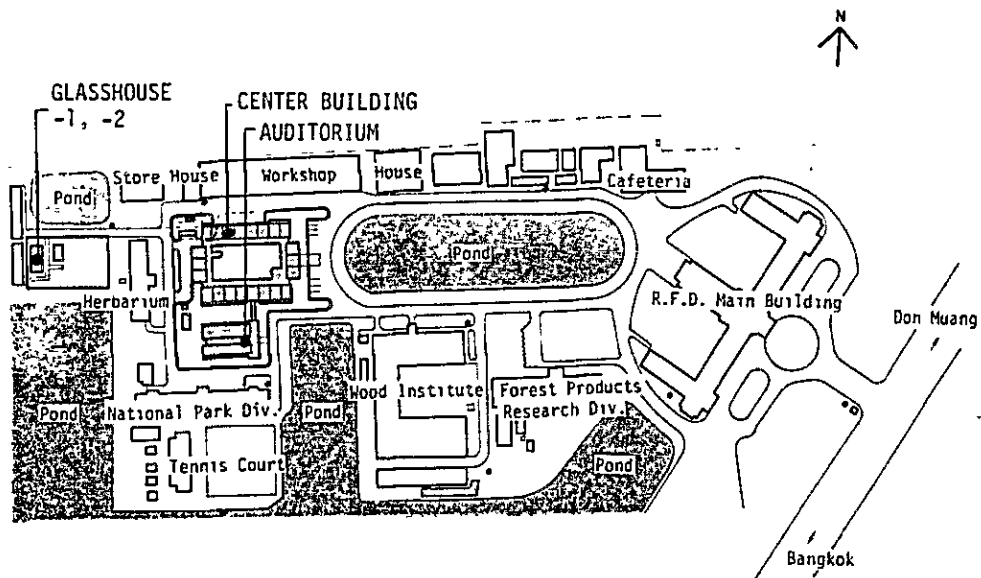


Fig. 3-4-1 Royal Forest Department Site Plan

- (3) The Center Building will be located in front of the pond in such a way that the main axis of the building will coincide with that of the pond. The building will be four-storied in order to utilize the small site effectively. The layout of the outside facilities involves some difficulties because the site is small and moreover is surrounded by the existing facilities on all the sides except the east side which confronts the pond. In the present layout plan, the main entrance and parking lots are located on the east side, a maintenance service yard on the north side adjacent to the existing workshop, and the road leading to the garage on the first floor of the Center Building and the service yard for delivery on the west side.
- (4) The Auditorium will occupy the southern part of the site, being connected with the Center Building by a covered corridor. The Auditorium will also have its independent access.

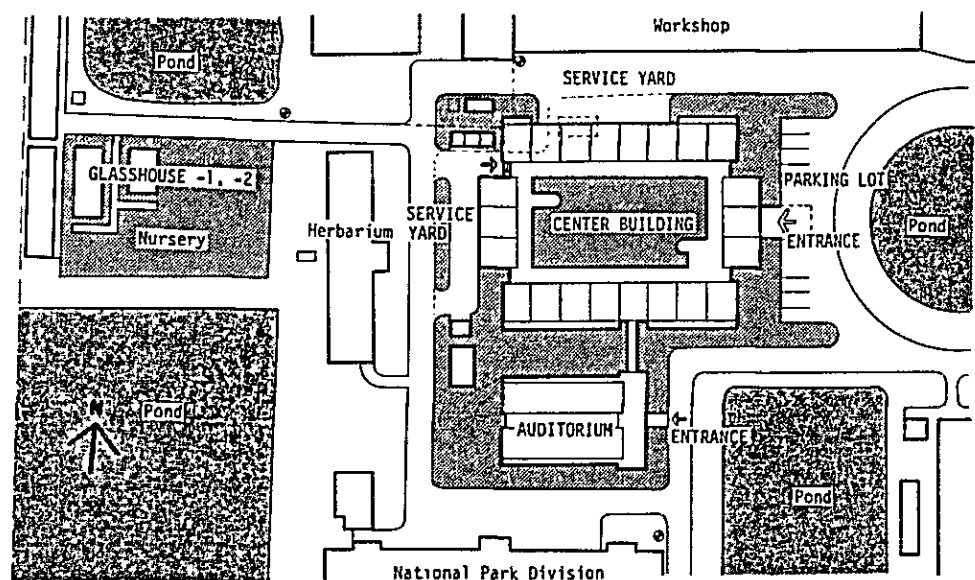


Fig. 3-4-2 Bangkok Center Site Plan

(5) Two Glasshouses are located approximately at the center of the detached site, with their main axes in the north-to-south direction.

(6) Site Preparation

The Thai side will prepare the site and make it ready for construction. The work required for this will include:

- i) Expansion of the site at the northwestern corner and replacement of the road
- ii) Removal of the garage shed, underground oil tank and other obstacles existent within the site
- iii) Providing a 50 - 80 cm fill over the whole area of the Center Building site which is presently lower than the surrounding roads and is therefore liable to ponding in the wet season
- iv) Removal of shade houses, nursery beds, and other obstacles from the site of Glasshouses
- v) Providing a 50 cm fill over the nursery area
- vi) Providing temporary facilities space for construction



Bangkok Center Site



Nursery for Glasshouses Site

3-4-2 Sakaerat Field Station

The layout and composition of the Sakaerat Field Station have been established in the manner as described below.

- (1) The Thai side has its own land utilization plan and facility layout plan for the site as a whole; therefore, the facilities covered by the present Project are to be incorporated into the respective pre-planned zones.
- (2) The site is about 400 m in elevation and has a slope of 5° to 10° . In the present plan, the facilities are so laid out as will require minimum change to the existing slope terrain.

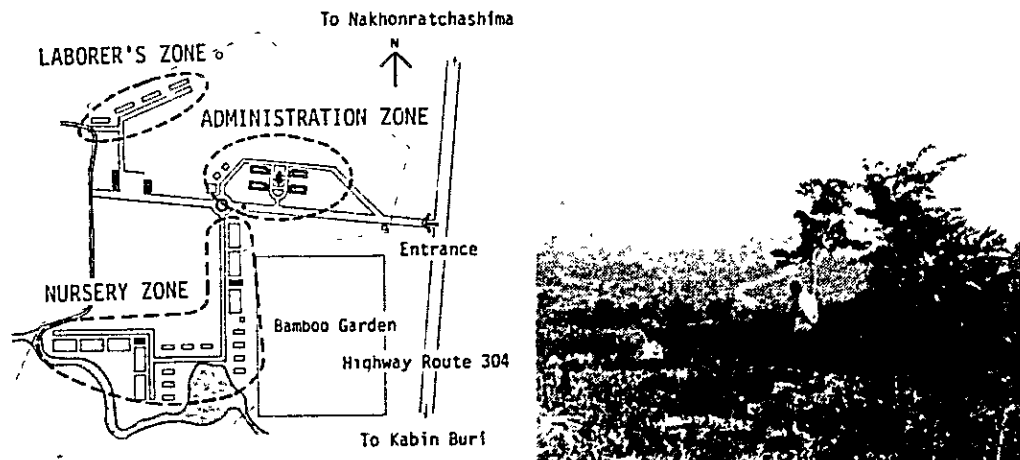


Fig. 3-4-3 Sakaerat Field Station Site Land Utilization Plan

- (3) The key facilities of the Station such as Administration and Training Building, Laboratory, Dormitories and Cafeteria are grouped in the zone near the entrance to the site from Highway 304 so as to facilitate the management of the Station and to minimize the utility services network.

(4) The site will be made ready for construction by the Thai side.
The work required for this will comprise the following:

- i) Construction of the access road to the site and of the approach roads to each facility within the site
- ii) Cutting, filling, etc. as required at the proposed locations of respective facilities

3-5 ARCHITECTURAL PLANNING

3-5-1 Bangkok Center

(1) Center Building

- a. Center Building will consist of four 4-storied blocks each having semi-open corridor on one side, surrounding the courtyard as shown below.

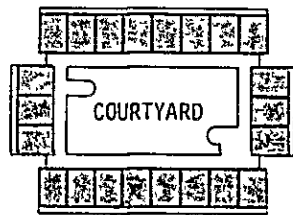


Fig. 3-5-1 4 Blocks and Courtyard

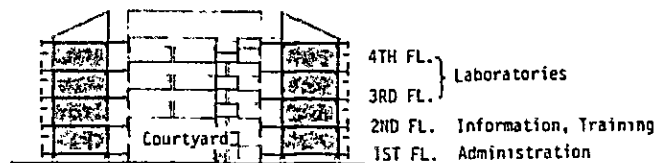


Fig. 3-5-2 Utilization of Each Floor

- b. Four divisions, i.e., laboratories, training, information and administration will be located on different floors. Thus, the first floor will comprise the entrance hall, mechanical room for utility service systems, garage and administration office; the second floor, the facility for training and information and the directors office; and the third and fourth floors, laboratories. It is the primary requirement that the laboratories should be properly interrelated. By concentrating the laboratories on the third and fourth floors, this requirement will be well satisfied and the duplication of supporting facilities for research activities can also be avoided. Further, considerable planning advantages may be expected in respect with the utility service systems by locating the laboratories which require special service systems on the upper stories of the building.
- c. To cope with the local climatic conditions, the four blocks are detached from each other at the corners, and such stilted space as entrance and garage is provided on the first floor of the east and west blocks respectively. By this, the movement of air between the courtyard and the external space can be maintained and, in visual aspect, the vista of the outside space is opened.

d. Formation Plan of Laboratory

For laboratory, a key point in formation planning is the pattern in which the experiment rooms and research offices are laid out.

A typical layout of experiment rooms and research offices with center corridor is indicated in Fig. 3-5-3. For the Center building, the corridor will be laid out on one side.

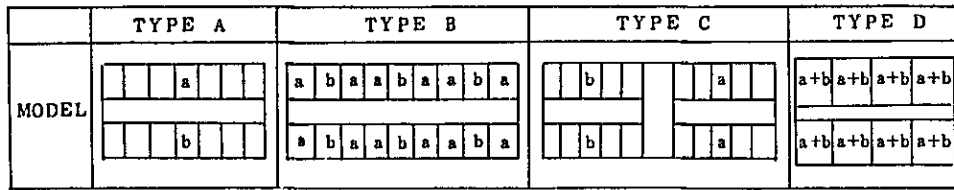


Fig. 3-5-3 Layout of Experiment Room and Research Office

a : EXPERIMENT ROOM
b : RESEARCH OFFICE

Based on the discussion with the Thai side, research office and experiment room are independently grouped as in Type B for each research division with a preparation room. In establishing size of each room, a basic planning unit is taken as 6m x 7.5m (45 m²). Each research division is composed of experiment room of two units, research office of one unit and preparation room of one unit, totaling four units.

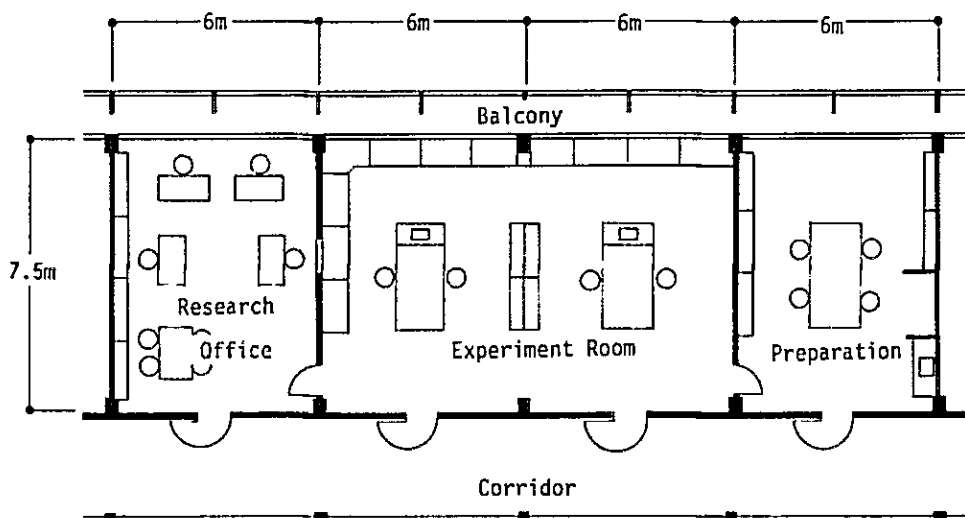


Fig. 3-5-4 Composition of Laboratory

e. Sections

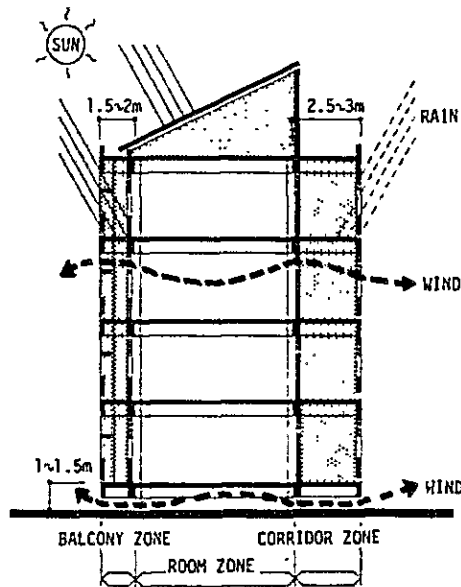


Fig. 3-5-5 Section

i. Roof

An additional roof will be provided above the topmost slab over each room zone in order to provide for rain and also to minimize the heat load which would be excessive in the uppermost room zone if the topmost slab were subjected to direct sun radiation.

ii. Corridor and Balcony

A corridor zone and a balcony zone will be provided on the courtyard side and the external side, respectively, of each block so that protection against rain and direct sun radiation can be provided by these zones. Overhangs and louvers will be used extensively where they are believed to serve the purpose of sun control and rain protection.

iii. Exterior Walls

Since rain and direct sun radiation will be dealt with by the zones on both sides of the room zone, the required function of walls in the room zone will be to ensure ventilation and air movement in the zone.

iv. First Floor Level

The first floor will be raised more than one meter off ground to cope with heavy rains in the wet season and to effect air movement under the floor.

(2) Auditorium

Auditorium will be intended for multiple purposes including, primarily, lecture and conference, and will have a capacity for 200 persons. It will have fixed seats mounted on a sloped floor, a fixed stage and be provided with audio-visual aids. Auditorium, though provided with air conditioning system, will be so designed as to be usable with natural ventilation and daylighting.

(3) Glasshouses

Two glasshouses, one for cutting and the other for nursery, will be provided. These glasshouses will have roofs which are raintight but allow sun beam to pass, and exterior walls made of wire netting which permits ventilation. They will be provided with the mist spray system.

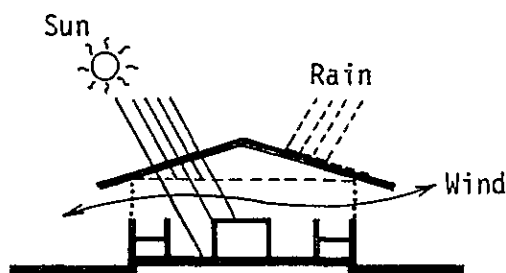


Fig. 3-5-6 Section

(4) Floor Area in Departments

The floor area in each department for the Bangkok Center was studied as shown in Fig. 3-5-7.

	<u>Rooms</u>	<u>Floor Area (m²)</u>	<u>Location</u>
1. Research Area			
(1) Laboratory	Forest Tree Seed	180	3rd FL.
	Forest Soil	180	3rd FL.
	Forest Ecology	135	3rd FL.
	Biochemistry	180	4th FL.
	Soil Microbiology	180	4th FL.
	Sub-total	855	
(2) Supporting Facilities	Plant Specimen	135	2nd FL.
	Guest Researcher & Sec. Rm.	67.5	2nd FL.
	Data Processing & Storage	135	2nd FL.
	Audio-Visual Room	135	3rd FL.
	Analytical Instrument	90	3rd FL.
	Sample Processing & Storage	90	3rd FL.
	Cold Room	22.5	3rd FL.
	Storage	180	3rd & 4th FL.
	Microtechniques	112.5	4th FL.
	Tissue Culture	45	4th FL.
	Bioassay	22.5	4th FL.
	Growth Chamber	112.5	4th FL.
	Dark Room	22.5	4th FL.
Sub-total	1,170	Total 2,025 m ²	
2. Training & Information Area			
	Conference Room	112.5	2nd FL.
	Training Office	90	2nd FL.
	Library	180	2nd FL.
	Seminar Room	112.5	4th FL.
Sub-total	495		
	Auditorium	512	Annex Total 1,007 m ²
3. Administration			
	Administrative Office	207	1st FL.
	Storage	90	1st FL.
	Machine Room	180	1st FL.
	Workshop	135	1st FL.
	Director's Office	135	2nd FL.
	Meeting Room	45	2nd FL.
Total		792 m ²	
4. Common Area			
	Toilet, Shower	360	1st-4th FL.
	Corridor, Elev., Garage, Staircase & Ent. Hall	2,052	1st-RF Total 2,412 m ²
5. Appurtenant Facilities			
	Glasshouse -1	90	Annex
	Glasshouse -2	54	Annex
Total		144 m ²	
GRAND TOTAL			6,380 m²

Fig. 3-5-7 Breakdown of Floor Area for Bangkok Center

3-5-2 Sakaerat Field Station

(1) Administration and Training Building

This will be a two-storied building having a corridor on one side. A lecture room to accommodate 30 to 40 persons will be located on the first floor, and the administration office, the field manager's office, a conference room, etc. will occupy the second floor.

(2) Laboratory

This will also be a two-storied building having a corridor on one side. Three laboratories of forest soil, sample preparation and instrumentation, and four research offices for forest soil, mechanization, silviculture plantation and silviculture nursery will be located on the first floor and the second floor respectively.

(3) Two Dormitories

Two dormitories each with 10 twin-bed rooms, or with a total of 20 twin-bed rooms, will be provided to accommodate 40 trainees.

Each will also be a two-storied building having a corridor on one side.

(4) Cafeteria

This will have a capacity for 30 to 40 persons. The building will be in a semi-outdoor fashion, being roofed but devoid of walls. The kitchen will be sized to provide meals for 60 persons, but the dining space will be used in shifts.

(5) Workshop

Workshop will be so designed as to service mainly the tractors, bulldozers, etc to be used for the Re-afforestation Project and to secure a space where lectures may be given in a small group on mechanics of vehicles and methods of driving and repairing. Workshop will be a single-storied, high roofed building with a hoist crane on the ceiling.

(6) Garage

This will be a single-storied building to accommodate seven heavy-duty vehicles and be provided with a tool storage.

(7) Mechanical House

Mechanical House will be a one-storied shed housing power generators for the Sakaerat Field Station. The shed will have a storage space.

(8) Glasshouse

A glasshouse, similar to that for cutting in Bangkok Center, will be provided. The glasshouse will not be provided with a mist spray system but a watering system.

3-6 STRUCTURAL DESIGN

3-6-1 Design Principles

- (1) Structural system should be suitable to the size, layout and mode of use of the building facilities, all as related to the physical and social conditions in Thailand.
- (2) Structural system should be adaptable to the locally available materials and their quality and construction techniques, preference in selection of them being given to the local products and methods unless involving any especial problems.
- (3) Structural system should be economical yet durable.

3-6-2 Design of Structures

- (1) As a rule, reinforced concrete rigid frame system will be adopted which is the most prevailing one in Thailand. Walls will be built of bricks and concrete blocks piled in the frames.
- (2) Foundations
 - a. Because the Bangkok Center site is quite unfavorable in subsoil conditions, the building foundations will be supported by piles. Their length and bearing capacities will be determined upon clarification of the boring data and the dead weights of buildings as established in the detail design.
 - b. In case of the Sakaerat Field Station, because the projected buildings are single- or two-storied, small ones and, in addition, the subsoil composed of sandy loam is in such comparatively favorable strata as will develop bearing capacity, the foundation will be placed without pile support.

- c. The structural computation will be made by way of the working stress design method generally following the applicable design standards established by the Architectural Institute of Japan. The allowable stresses of structural members will be taken at practical values by referring to the design standards adopted in Thailand and Japan while giving due allowance to the workmanship and irregularity in quality of products.

3-6-3 Design Loads

The design loads will comply with the Bangkok Municipal Ordinance "By-laws of the Bangkok Metropolis, Re; Control of the Construction of Building, 1979."

(1) Dead Loads

- | | |
|--|-----------------------|
| a. Reinforced concrete | 2.4 t/m ³ |
| b. Structural steel | 7.85 t/m ³ |
| c. Bricks and concrete blocks | 1.9 t/m ³ |
| d. Dead weights of other materials and finishing materials will be evaluated in the stage of detail design | |

(2) Live Loads

- | | |
|--|-----------------------|
| a. Roof (general) | 50 kg/m ² |
| b. Roof (concrete overhang) | 100 kg/m ² |
| c. Toilet | 150 kg/m ² |
| d. Dormitory | 200 kg/m ² |
| e. Office, meeting room, corridor, staircase | 300 kg/m ² |
| f. Auditorium, laboratory | 400 kg/m ² |

- g. Library, storage, machine room, workshop 500 kg/m²
- h. Portions carrying heavy loads, such as, water tank and especial machine room floor will be separately determined

(3) Wind Loads

For wind loads, those values adopted in the said Bangkok Ordinance will be used.

<u>Height</u>	<u>Wind Pressure</u>
Less than 10 m	50 kg/m ²
10 m to 20 m	80 kg/m ²
20 m to 40 m	120 kg/m ²

Note: These wind loads are one third times as small as the Japanese values so that in substance they may be disregarded for this Center.

(4) Seismic Load

In view that Thailand has not been subjected to considerable magnitudes of earthquakes, no seismic consideration will be paid in the design.

3-6-4 Structural Materials

Major construction materials will be designated as follows.

- (1) Reinforcing bars: Deformed bar, SD 30 (TIS)

- (2) Concrete : $F_c = 210 \text{ kg/cm}^2$
(Cylinder test for 4-week-strength)
- (3) Cement : Normal Portland cement (ASTM)
- (4) Structural steel: SS41 (JIS) or equivalent
- (5) Pile : Precast concrete product

3-7 UTILITY DESIGN

3-7-1 Design Principles

- (1) Simple operation, easy maintenance and economical running cost should be primary considerations in designing the electrical and mechanical systems for this Center because they should meet not only local climatic conditions but also living habits and customs in Thailand.
- (2) Wherever possible, standardized equipment and fixtures should be considered to facilitate the future replacement and exchange.
- (3) The design of electrical and mechanical systems should be in accordance with codes and regulations in Thailand. When these are not available, Japanese standards should be referred to.
- (4) Equipment and materials to be imported from Japan should comply with JIS (Japanese Industrial Standard) and those to be purchased in Thailand should generally comply with TIS (Thai Industrial Standard).

3-7-2 Electrical System

(1) Bangkok Center

a. Power Supply System

Power will be received at the mains intake panel in the Electrical Room to be located on the first floor from the overhead transformers to be provided by the Thai Government north near the Electrical Room. The supply voltage will be 3 phase 380 V and single phase 220 V. The frequency will be 50 Hz.

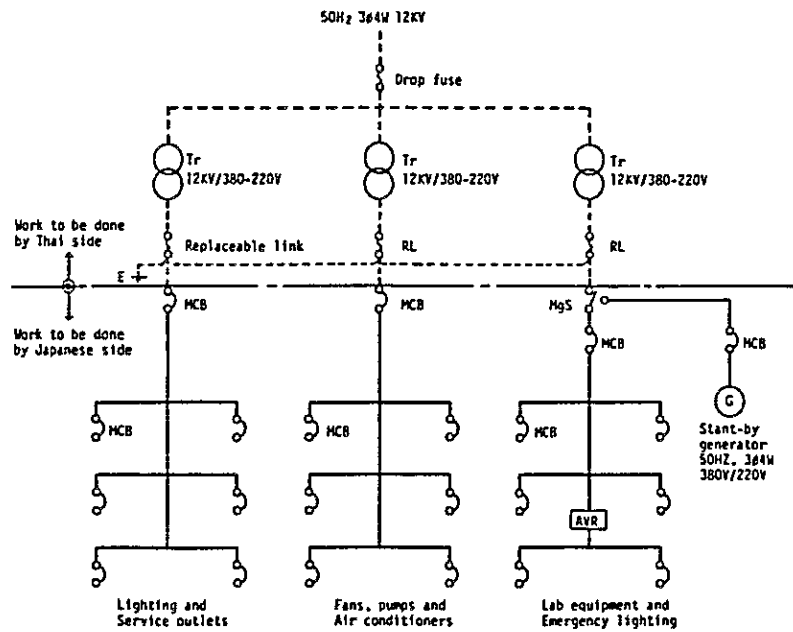


Fig. 3-7-1 Power Supply One Line Diagram

Estimated system design loads are as follows, totaling approximately 700 KVA.

Lighting, service outlets	200 KVA
Air conditioning, ventilation	200 KVA
Plumbing	100 KVA
Laboratory equipment	180 KVA
Elevator	20 KVA
Total:	700 KVA

b. Emergency Generator

A generator will be provided to supply power for emergency lighting, some laboratory equipment including refrigerators and incubators etc. in case of power interruption. A capacity of the generator is estimated as 150 KVA.

c. Power Mains

The power mains will be installed from the distribution panels in the Electrical Room as far as the power control panels and lighting panel boards. Wiring will be generally installed in metal ducts, racks or conduit pipes. The supply voltage will be 3 phase 380 volts for motors and single phase 220 volts for lighting and service outlets.

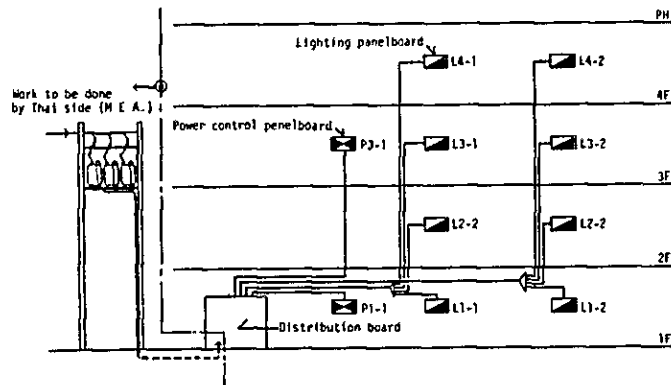


Fig. 3-7-2 Power Riser Diagram

d. Lighting and Service Outlets

- i. Natural light will be utilized as much as possible throughout the building. For electrical lighting, in most cases fluorescent lamps will be used while incandescent lamps will be used in some places. For Auditorium, fluorescent lamps will be mainly used while incandescent lamps will be used for the stage.
- ii. The average intensities of illumination in the main rooms will be as follows.

Office	300 lux
Laboratories	300 lux
Conference rooms	250 lux
Library	300 lux
Auditorium	250 lux
Toilets, corridors	70 lux

iii. Service outlets comprise general outlets, laboratory equipment power supply outlets, etc. Most outlets will be of single phase 220 volts in principle. Some of laboratory equipment power supply outlets will be with grounding.

e. Wiring and Conduiting to Motors

Wiring and conduiting from power control panels will be provided to supply power to air-conditioning units, ventilating fans, ceiling fans, pumps and elevator. The supply voltage will be in principle single phase 220 V for small motors and 3 phase 380 volts for other motors.

f. Telephone System

About five trunk lines from outside will be extended to the main terminal board in the Information Room by the Thai side. Compact exchanging system will be provided. About 25 extensions will be required in the building.

g. Public Address System

i. One amplifier set with a microphone will be installed in the Information Room and loud speakers will be installed at the corridors. This set will be used for paging covering the whole building.

ii. In the Auditorium independent audio system will be provided.

iii. In the Audio Visual Room necessary audio equipment will be installed.

h. TV and Radio Antenna System

TV and Radio antenna and necessary outlets will be provided in the Audio-Visual Room.

i. Fire Alarm System

Fire alarm bells will be provided at 2 spots on each floor. An indication panel for fire alarm signal will be located at the Information Room.

j. Lightning Protection System

A lightning protection system will be provided to prevent the properties in the building from being struck by lightning.

k. Elevator

An elevator as outlined below will be provided.

Type	: For passenger & cargo use
Capacity	: Load 750 kg or No. of passengers 11 persons
Speed	: 45 m/min
No. of stops	: 4

(2) Sakaerat Field Station

a. Generating System

One diesel engine generator for daily use will be provided for power supply to the facilities now under consideration because utility power service will not be available at the buildings by the time of the completion. The wiring from the generator to each building will be carried out by the Thai side.

Approximately the 50 KVA generator will be installed in the mechanical house in the site to distribute power to each building.

Change-over switches will be added to the generator panel so that utility power lines may be connected to the panel in mechanical house in future.

b. Lighting and Service Outlets

Lighting fixtures and service outlets will be provided in each building.

3-7-3 Ventilation and Air Conditioning System

(1) Bangkok Center

- a. The rooms to be provided with mechanical ventilation and air-conditioning system are, in principle, as shown in Fig. 3-7-3.
- b. For air conditioning, the design conditions are taken as follows:

Plant Specimen room:

Indoor temperature : $27 \pm 3^{\circ}\text{C}$ DB
(Outdoor temp. 35°C DB)

Indoor humidity : Not more than 60% RH

Air Conditioning system: Split type, air-cooled air conditioners and dehumidifier

Other air-conditioned rooms:

Indoor temperature : $27 \pm 3^{\circ}\text{C}$ DB
(Outdoor temp. 35°C DB)

Air Conditioning system: Split type, air-cooled air conditioners

(2) Sakaerat Field Station

Ceiling fans will be provided in offices, meeting rooms, lecture room, laboratories, etc.
Kitchen, etc. will be provided with ventilators.

		Mechanical Service			Remarks
	Room	Air Con.	Ceiling Fan	Vent. Fan	
1st Floor	Administration Office		0		
	Meeting Room		0		
	Information Room		0		
	Electrical Room			0	
	Generator Room			0	
	Workshop		0		
	Auditorium	0	0		
	Projection Room			0	
Control Room	0		0		
2nd Floor	Director Room	0	0		
	Deputy Directors Room	0	0		
	Secretary Room		0		
	Library		0		
	Data Processing Room & Office		0		
	Plant Specimen Room	0			
	Conference Room		0		
	Training Office		0		
	Guest Researcher Room	0	0		
Secretary Room		0			
3rd Floor	Analytical Instrument Lab	0	0	0	
	Forest Soil Lab	0	0	0	
	Forest Ecology Lab		0	0	
	Sample Processing & Storage		0	0	
	Forest Tree Seed Lab	0	0	0	
	Audio-Visual Room	0			
	Projection Room	0			
	Preparation Room		0		
4th Floor	Microtechniques Lab	0	0	0	
	Microscope Room	0			
	Dark Room	0		0	
	Forest Micro-biology Lab	0	0	0	
	Growth Chamber Lab		0	0	
	Biochemistry Lab	0	0	0	
	Tissue Culture Room	0		0	
	Bioassay Room	0		0	
Seminar Room		0			
Common Area	Laboratory Office		0		
	Laboratory Preparation Room		0	0	
	Toilet			0	
	Kitchenette			0	

Fig. 3-7-3 Room Provided with Mechanical Service

3-7-4 Water Supply and Plumbing System

(1) Bangkok Center

a. Water Supply System

- i. The Thai side will undertake to lead inside the service line up to the water reservoir from the existing water line. Then, the water will be lifted to the elevated water tank, subsequently being distributed by gravity to the demand points.

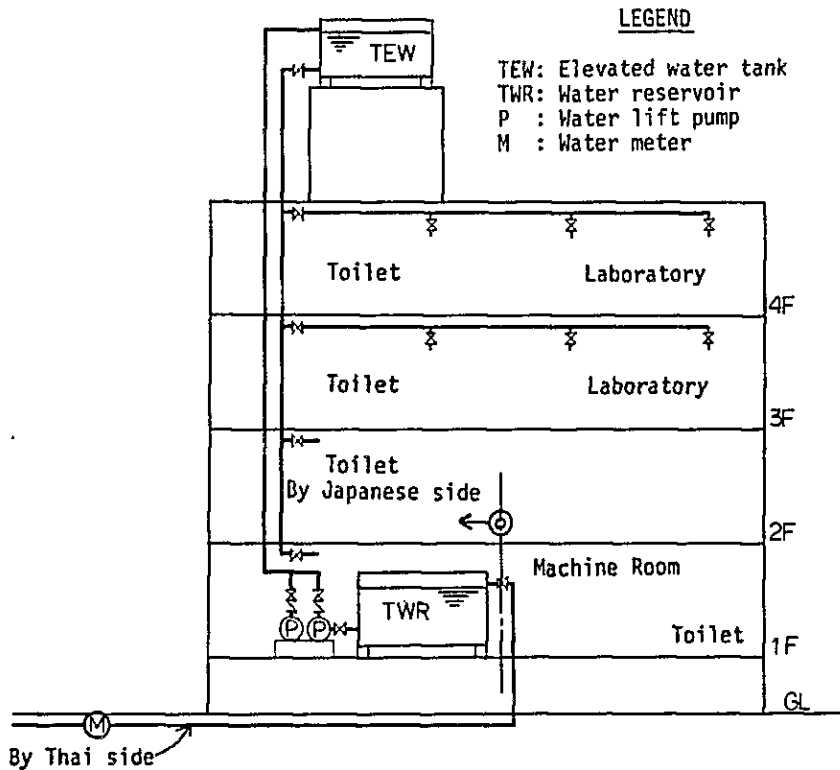


Fig: 3-7-4 Water Supply System Diagram

- ii. Water for experimental use will be provided at laboratory sections locally as directed by the demand.

iii. City water consumptions are roughly estimated as follows:

Researchers	40 persons	x 0.200m ³ /man.day	8.0m ³ /day
Assistants & Office workers	60	" x 0.120	" 7.2 "
Visitors	180	" x 0.025	" 4.5 "
Others (watering, etc.)			4.3 "
Total			24.0 m ³ /day

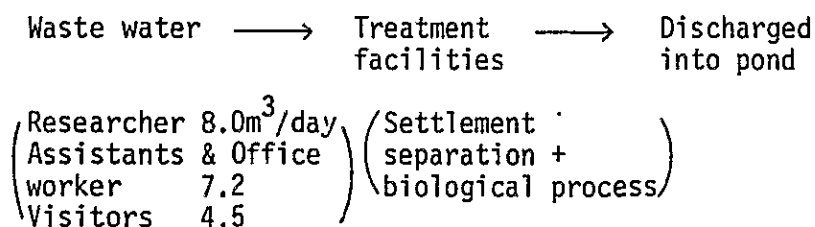
iv. Water reservoir and elevated water tank will be given the following capacity.

Water reservoir 20m³
Elevated water tank 10m³

b. Drainage System

The waste water from the building will be drained in three main lines, viz. Sanitary Sewage Line, Domestic Waste Line and Experiment Waste Line. All these will be joined at an appropriate point in the outdoor, be biologically treated to supplement the natural purification in a pond and then be discharged into the existing pond. Objectionable substance from the laboratories, for instance, harmful substance, radioactive substance, heavy metal, strong acid, strong alkali, solvent will be separately collected to avoid mixing with the said waste water.

The treatment capacity will be 20 m³/day, with the treatment standard taken at BOD 120 PPM.



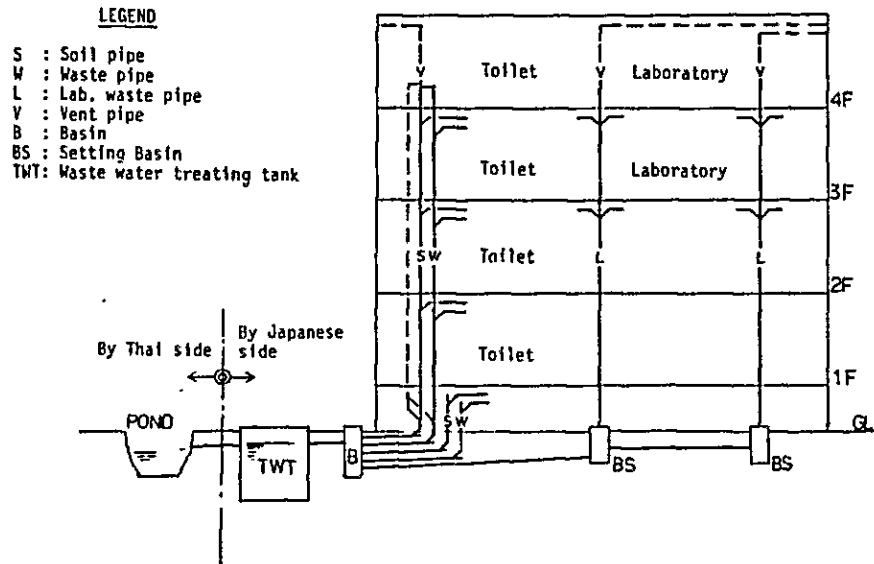


Fig. 3-7-5 Drainage System Diagram

c. Plumbing fixtures

The following will be provided.

Toilets: Water closets (western style), urinals, wash basins and service sinks

Showers: Shower heads

d. Kitchenette

Sinks, cooking heater tables and other provisions will be provided.

e. Gas

LP gas will be supplied to the laboratories and other demand points. The gas cylinders are stored in the exterior near the demand points.

f. Watering

Mist spray will be provided in glasshouses and watering system will be provided where required.

g. Fire Fighting System

Fire extinguishers will be provided, following the applicable standard in Thailand.

(2) Sakaerat Field Station

a. Water Supply

From the water supply installations (dam, elevated water tank, water supply pipe up to each building) to be constructed by the Thai side, water will be supplied to the demand points in the buildings.

b. Drainage System

Waste water will be discharged into the ground without any special treatment as adopted in SERS.

c. Plumbing Fixtures

The following plumbing fixtures will be provided:

Toilets: Thai-style water closets, urinals and wash basins

Showers: Shower heads

d. Kitchen Equipment

To be provided by the Thai side.

e. Fuel

Fuel will be such materials as to be locally available.
Where required, LP gas will be used.

f. Watering System

To be provided in glasshouse.

g. Fire Fighting System

Fire extinguishers will be provided.