No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF RESEARCH FACILITIES FOR BIODIVERSITY CONSERVATION AND UTILIZATION
IN
THE REPUBLIC OF INDONESIA

NOVEMBER, 2003

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
KUME SEKKEI CO., LTD.
INTEM CONSULTING, INC.

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Research Facilities for Biodiversity Conservation and Utilization and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia two study teams from April 13 to May 13, 2003 and from August 3 to August 7, 2003.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the teams.

November, 2003

Kunimitsu Yoshinaga
Vice-President
Japan International Cooperation Agency

November, 2003

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Research Facilities for Biodiversity Conservation and Utilization in the Republic of Indonesia.

This study was conducted by the joint venture between Kume Sekkei Co., Ltd. and Intem consulting, Inc., under a contract to JICA, during the period from April 2003 to November 2003. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

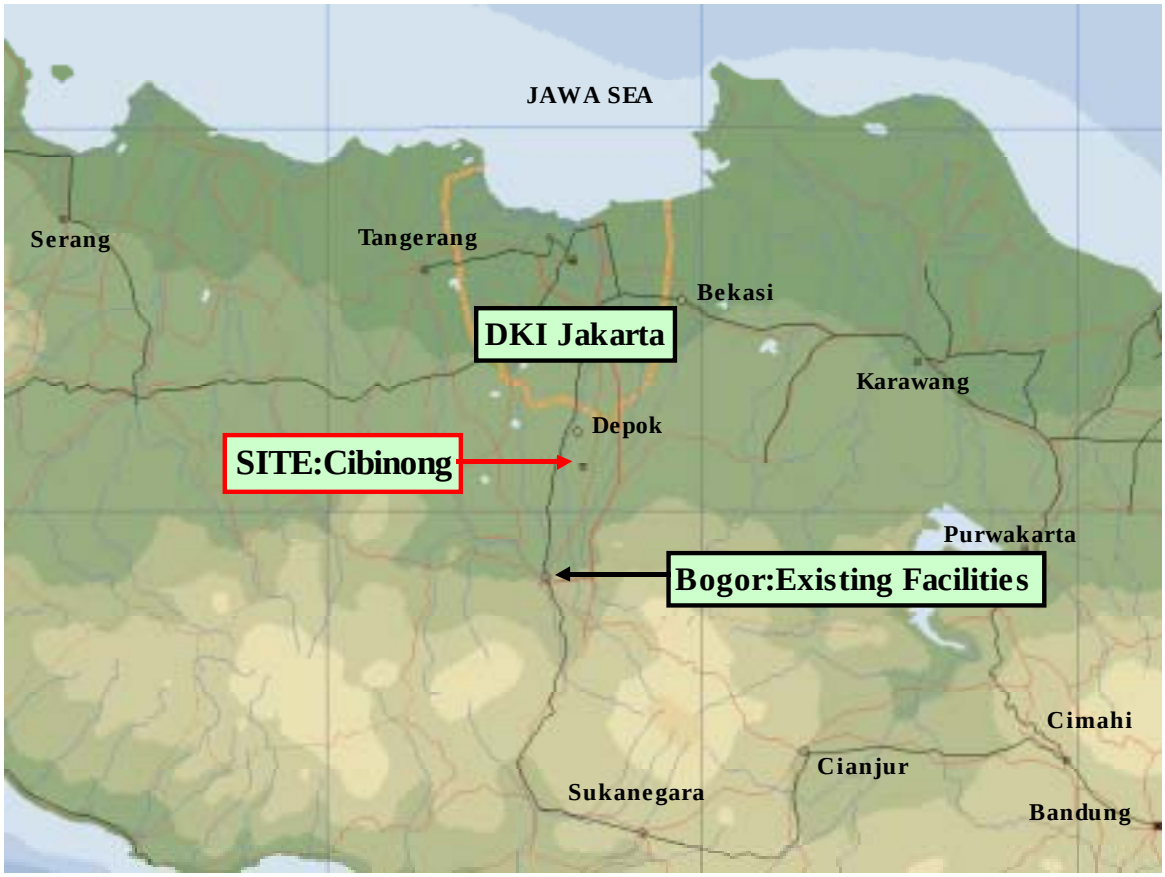
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Shigeru Yasumatsu
Project Manager,
Basic Design Study Team on
The Project for Improvement of Research Facilities
for Biodiversity Conservation and Utilization
The Joint Venture between Kume Sekkei Co., Ltd.
and Intem Consulting, Inc.

■ Project Location Map

■ Jakarta and Project Site



The Project for Improvement of Research Facilities for Biodiversity Conservation and Utilization in the Republic of Indonesia

PERSPECTIVE DRAWING -1

The Project for Improvement of Research Facilities for Biodiversity Conservation and Utilization in the Republic of Indonesia

PERSPECTIVE DRAWING -2

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List of Abbreviations

Abbreviations	Full Words
AAS	Atomic Absorption Spectrophotometer
BAPI	Biodiversity Action Plan for Indonesia
BAPPENAS	The State Ministry of National Development Planning/National Development Planning Agency
BIC	Biodiversity Information Center
BOD	Biochemical Oxygen Demand
CIFOR	Center for International Forestry Research
CSC	Cibinong Life Science Center
DNA	Deoxyribonucleic asid
FT-IR	Fourier Transform Infrared Spectrophotometer
GC-MS/MS	Gas-chromatograph Mass-spectrophotometer
GDP	Gross Domestic Product
GEF	Global Environment Facilities
HPLC	High Performance Liquid Chromatogarph
IBSAP	Indonesia Biodiversity Strategy Action Plan
IUCN	International Union of Nature Conservation
KEW	The Royal Botanic Gardens, Kew
LAN	Local Area Network
LIPI	Indonesia Institute of Sciences
LPG	Liquefied Petroleum Gas
NCIC	Nature Conservation Information Center
RCB	Research Center for Biology
PHPK	Forest Protection and Nature Conservation, Ministry of Forestry
PLN	PT. PLN(Persero)Unit Bisin UPJ Bogor
VAT	Value Add Tax

Summary

SUMMARY

The Republic of Indonesia (hereinafter referred to as "Indonesia") boasts some of the most prominent biodiversity among the world's countries because of the existence of forests of various types, thousands of large and small islands and zoologeographical zones and is particularly important for the conservation of global biodiversity and as a repository of potential biological resources.

Some 325,000 wild animal and plant species, i.e. equivalent to 20% of all species in the world, inhabit Indonesia, the land area of which accounts for 1.3% of the global land area. In the case of plants, 29,375 flowering plants, i.e. 10% of all species of this kind in the world, are found in Indonesia, 60% of which are believed to be indigenous species found only in Indonesia. The number of animal species found in Indonesia is also large and the proportion of indigenous species is very high. In the case of *Mammalia*, out of 457 species recorded, 49% are indigenous species, making Indonesia the country with the largest number of indigenous mammals. The number of species and the proportion of indigenous species in Indonesia among other higher animals are 1,530 species and 27% for *Ares* (birds), 514 species and 59% for *Reptilia* and 285 species and 40% for *Amphibia*.

According to increasing population, land development, deforestation and forest fire etc., the rainforests and marshland etc., which are contained rich biodiversity are losing annually. And some wild animal and plant species are faced a crisis of extermination duo to reckless using.

More than 6,000 wild or cultivated botanical and zoological species are used by the people of Indonesia while some 7,000 sea and freshwater fish species constitute an important source of protein. Many wild plants and animals are also domestically as well as commercially used as food, for handicrafts, for medicinal purposes, as fuel and/or as construction materials. Agriculture, forestry and fisheries are still leading industries in Indonesia, employing 40 million people or some 19% of the total population, the livelihood of which directly depends on biodiversity. In fact, biodiversity is the largest natural resource of Indonesia. As many economic sectors in the country directly or indirectly depend on the diversity of the natural ecosystem as well as the semi-natural ecosystem, the conservation and utilization of biodiversity is essential to enable the sustainable development.

In its National Development Plan (PROPENAS 2000 – 2004), the Government of Indonesia has adopted "strengthening of the infrastructure for sustainable and fair development based on the facilitation of economic reconstruction and the national economic system" as one of its five principal goals and calls for the implementation of "the programme for the natural resources and environment sector" to achieve this goal. This programme emphasises the critical importance of research on and evaluation of the potential benefits of biodiversity, the sustainable use of biodiversity, people's participation in the conservation of biodiversity and education and publicity of the environment.

As the basic policy for the conservation of biodiversity in Indonesia, the Government of Indonesia formulated the Biodiversity Action Plan for Indonesia (BAPI) in 1994 following accession to the Biodiversity Treaty at the UN Conference on the Environment and Development held in 1992. This plan covers a period of 25 years and it's the national goals are "to conserve as much as possible of the biodiversity on which the livelihood and prosperity of Indonesia depends".

In 1990, the Government of Indonesia appointed the Indonesia Institute of Sciences (hereinafter referred to as "LIPI"), which is directly controlled by the President, as the organization responsible for scientific research on the conservation of biodiversity, and as this project implementing body. The Research Center for Biology (hereinafter referred to as "RCB") is the section of the LIPI which is responsible for research on the conservation of biodiversity, and as this project managing and operating body. The RCB has three research divisions, i.e. Botany Division, Microbiology Division and Zoology Division, each of which conducts a wide range of basic research work relating to the conservation and utilization of biodiversity. The Botany Division of the RCB is managing and operating the Herbarium Bogoriense which is one of the world's leading herbariums.

The results of the research conducted by the RCB's Botany Division and Microbiology Division are actively used for the following of the national economic development.

① Restoration of forests and cultivation of agricultural products in areas of lost forests
② Recovery of agricultural productivity through restoration of the soil fertility at waste land
③ Increase of agricultural productivity in arid areas
④ Development of new species to increase agricultural productivity
⑤ Development of new drugs
⑥ Development of new foodstuffs

Despite the extending field of these types of research to whole of biology and the growing need for the research to be interdisciplinary, i.e. joint research by zoological, botanical and microbiological specialists, in recent years, the research facilities in Indonesia are scattered. To be more precise, the Zoology Division of the RCB is based at Cibinong while the Botany and Microbiology Divisions are based at Bogor, hindering the desirable interdisciplinary research work. To make matters worse, all of the research facilities use buildings which are designed as hospital or office, and are not designed to serve the intended research work. Along with the old equipment, the present situation of the research environment is far from ideal.

The Herbarium Bogoriense stores some 1.3 million dry botanical specimens accumulated since the early 19th Century and is renowned as an important center for precious biodiversity resources in the world. However, the storage conditions of many of these specimens are poor, making the proper restoration and improvement of the storage conditions an urgent task. Under these circumstances, the Global Environment Facilities (GEF) Project which commenced in 1994 has restored 265,000 specimens, leaving 976,000 specimens still in need of restoration.

Many government bodies, including the LIPI, are aware of the importance of environmental education on biodiversity under the BAPI and the National Development Plan and are conducting education on the conservation of biodiversity. Neither the Botany Division nor the Microbiology Division has any facilities to organize an environmental education.

In order to improve the present situation, the Government of Indonesia has formulated a project for Improvement of Research Facilities for Biodiversity Conservation and Utilization (hereinafter referred to as "the Center") at Cibinong in a suburb of Jakarta and has made a request to the Government of Japan for grant aid for the construction of the center buildings and the provision of the necessary equipment.

The Project aims at contributing to "development in the natural resources and environment sector" under the National Development Plan and to "the expansion of data and information on domestic biodiversity and promotion of the utilization of biological resources by policy planners and the people" under the BAPI. The Project also aims at providing facilities and equipment for basic research designed to contribute to the conservation of diverse biological resources and their use by the people and to provide environmental education for the people on the conservation of diverse biological resources.

In response to this request, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team to Indonesia for the period from 13th April to 13th May, 2003. The Study Team studied the planned activities at the Center, the existing facilities and the storage conditions of the specimens among other things, collected relevant information and held discussions with government officials in Indonesia on such issues as the selection of the center site, specimen restoration plan, operation and maintenance plan and the desirable contents of the facilities and equipment. In addition, the Study Team conducted a natural conditions survey, including the topography and geology, at the proposed construction site. On its return to Japan, the Study Team concluded that an additional field survey was required in regard to the restoration and transfer plan for the botanical specimens, the specimen storage method and site selection. Accordingly, the Basic Design Study Team was dispatched again to Indonesia to discuss the above issues with the Indonesian side.

On its return from Indonesia, the Study Team analysed the planned activities and the operation and maintenance cost, etc. based on the findings of the two field surveys together with examination of the optimal scale and contents of the facilities and equipment, estimation of the project cost and formulation of the implementation plan and prepared the Basic Design Study Report (Draft Final). JICA subsequently sent the Basic Design Study Report (Draft Final) Explanation Team to Indonesia for the period from 19th to 25th October, 2003. This Team jointly examined and discussed the Summary with the Indonesian side and also conducted an additional field survey.

For the planning of the Project, the priority items for analysis were ① the findings of the study on the activity plan and existing facilities, ② the restoration, transfer and storage methods for the botanical specimens and ③ the appropriate project scale based on the feasible operation and maintenance budget to be provided by the Indonesian side. Proper consideration was also given to the natural and social conditions, the local situation regarding construction and procurement work, the ability of the project implementing body regarding the operation and management of the new Center and the propriety of the construction period determined by Japan's grant aid scheme.

The original Indonesian request involved a floor area of some 20,500 m^2 of facility and 773 items of equipment. These were subsequently judged to be excessive in view of the present situation of activities and existing facilities as well as equipment and past records of the operation and maintenance budget and, therefore, a more appropriate scale and contents to reflect the real situation were examined. The examined appropriate floor area of facility and equipment were accepted by the Government of Indonesia.

The Project involves the construction of botanical and microbiological research facilities at Cibinong in a suburb of Jakarta for the transfer of the functions currently performed at the existing facilities in Bogor for the purposes of ① concentrating the research functions of the Botany Division and the Microbiology Division at Cibinong where the Zoology Division is

based to improve the research environment, ② strengthening of the specimen storage function to contribute to research activities and ③ adding to the environmental education function to intensify the environmental education and awareness of enhancement activities for the public. The concrete contents of the grant aid are the construction of the Center and the procurement of the equipment required for research, restoration and storage of specimens and environmental education.

< Facilities >

Center building (1); annex (1); greenhouse (4)

Center building	:	Administrative and research sections: two storeys Herbarium: three storeys RC with prestressed RC in parts Floor area: approximately 11,550 m^2
Annex	:	Single storey, RC, approximately 402 m^2 of floor area
Greenhouse	:	Single storey, approximately 378 m^2 of floor area in total

The main rooms are outlined below.

Room	Description
Staff and Technician Rooms	Accommodating 76 research staff members and 29 technicians of the Botany Division and 44 research staff members and 8 technicians of the Microbiology Division
Laboratories	24 rooms for 6 research groups of the Botany Division and 14 rooms for 4 research groups of the Microbiology Division
Herbarium	Storage of some 1,280,000 dry botanical specimens, some 51,600 spirit specimens and carpology and seed specimens, etc.
Processing and Maintenance Rooms	Processing room, drying room, labelling room, mounting room, freezer room, fumigation room and database room, etc.
Administration, Common and Information Service Rooms	Division head rooms, administration office, meeting rooms, library, repairing workshop, canteen, information center and others

< Equipment >

The equipment categories and main equipment are listed below.

Category	Main Equipment
Laboratory Equipment for Botany Division	Freeze-dryer, HPLC, FT-IR3, atomic absorption spectro photometer, GC-MS/MS, clean bench, draft chamber, laboratory tables and others
Laboratory Equipment for Microbiology Division	Inverted microscope, freeze-dryer, DNA/protein/enzyme analyser, total organic carbon/nitrogen analyser, clean bench, draft chamber, laboratory tables and others
Herbarium Equipment	Specimen cabinets, pre-fab walk in freezer, dryer and others
Information Center	Television, video deck, computer and others
Meeting Room	LCD projector, screen, audio system and others

The LIPI will act as the project implementing body and will be responsible for the design, tender and construction of the Center. The RCB, which will use the Center upon its completion, will be responsible for the general coordination of the work during the project implementation period as the front organization for project implementation.

In the case of the Project's implementation with grant aid provided by the Government of Japan, the project implementation period is estimated to be eight months for the detailed

design, followed by 14.5 months for construction and procurement. The estimated project cost is approximately ¥2,415 million (some ¥2,173 million to be borne by the Japanese side and some ¥242 million to be borne by the Indonesian side to cover the cost of site clearance, planting, construction of gates, gate house and fence, obtaining of any necessary permits for building work, infrastructure connection work, bank payment charge and restoration/transfer of specimens, etc.) This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant, and also it does not mean a grant amount of the Exchange of Notes of the Project.

The construction of the Center is expected to have the following direct effects.

① The number of joint research involving the Ministry of Agriculture, the provincial government and/or private enterprises featuring the conservation or utilization of biodiversity will increase to contribute to the development of the national economy; such research work will be led by the Botany Division and the number will increase from 15 in 2002 to more than 20 in 2010.

② Dry botanical, spirit and microbiological specimens will be stored in accordance with storage methods of an international standard.

- The number of properly stored dry botanical specimens will increase from 20,000 in 2003 to some 707,000 in 2007.
- The number of properly stored spirit botanical specimens will increase from 8,194 in 2003 to some 50,000 in 2007.
- The number of properly stored microbiological specimens will increase from 864 in 2003 to 37,800 in 2007.

In addition, the Project is expected to have the following indirect effects.

① The number of academic research papers published by the Botany and Microbiology Divisions is expected to increase from 119 in 2002 to some 160 in 2010.

② The number of groups of student visitors from high schools and universities to receive environmental education is expected to increase from 1,054 in 2002 to approximately 1,300 in 2010.

The relevance of the Project for the grant aid scheme of the Government of Japan is confirmed because of not only the positive effects described above but also because of its contribution to the promotion of the development of the national economy through (i) environmental education for people on the importance of the conservation of biodiversity and (ii) the utilization of the research achievements for the use of diverse biological resources. In regard to the construction work, repair/transfer of specimens and operation/management of the Center, the Indonesian side has pledged to secure the necessary funding.

In connection with the implementation of the Project, the Indonesian side has some problems which must be solved in an appropriate manner.

(1) Restoration of dry and spirit specimens which cannot withstand transfer prior to their transfer

Many of the specimens held by the Herbarium Bogoriense are precious specimens which are used not only for basic research for the conservation and utilization of biodiversity in Indonesia but also for research by research institutes and individual researchers worldwide.

For this reason, the remounting of some 450,000 dry specimens and the rebottling of some 40,000 spirit specimens, the current storage conditions of which are not good enough to withstand the hustle of transfer, prior to the completion of the new Center are necessary in view of their safe transportation.

As the project implementing body, the LIPI must secure the necessary restoration budget for FY 2004 through FY 2006 to complete this restoration work and this money must be made available without delay. Moreover, the preparation of a reliable transfer plan is necessary by means of studying precedences in other countries and also examining the desirability of receiving supervisors from related major research organizations in view of the completion of the safe transfer of the specimens.

(2) Guarantee of operation and maintenance budget

The operation and maintenance cost for the Center is to be borne by the LIPI and it has been confirmed that the LIPI will duly prepare the necessary budget to meet the estimated operation and maintenance cost. As the project implementing body, the LIPI should complete the necessary procedure without delay so that the government budget to cover the operation and maintenance cost is secured every year.

(3) Establishment of interdisciplinary research system

The location of the Center next to the Zoology Division at Cibinong is designed to facilitate interdisciplinary biological research which is one of the objectives of the Center. While this location of the Center will undoubtedly improve the geographical conditions for such research, actual collaboration involving the three divisions of the RCB and their research staff will be critical for the progress of interdisciplinary research. For this reason, senior staff of the LIPI and the RCB should provide continuous guidance to facilitate interdisciplinary research involving the three divisions.

CONTENTS

CHAPTER 1 BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1.1 Background of the Request

(1) Background

The Government of the Republic of Indonesia (hereinafter referred to as "Indonesia) has formulated a plan to construct a research facilities for Biodiversity Conservation and Utilization (hereinafter referred to as "the Center") at the LIPI Life Science Center (hereinafter referred to as "CSC") in Cibinong to solve the problems faced by the Botanical Division and the Microbiological Division of the RCB in terms of their facilities and equipment. The problems are (i) the research facilities are scattered, hindering the desirable interdisciplinary research work, (ii) the storage conditions of many specimens are poor and (iii) there is no facilities for the public as an environmental education activity.

The Center aims at owning the facilities and equipment required for (i) basic research for the conservation and utilisation of biodiversity, in turn contributing to the development of the national economy, (ii) the preservation of botanical specimens complying with the relevant international standards and (iii) environmental education. As the Center can greatly contribute to "development in the natural resources and environment sector" under the National Development Plan (PROPENAS 2000 – 2004) and to "to conserve as much as possible of the biodiversity on which the livelihood and prosperity of Indonesia depends" which is the national goals of the BAPI, the need for the Center is exceptionally high.

(2) Request

The Government of Indonesia has made a request to the Government of Japan for the provision of grant aid for such components of the Project for Improvement of Research Facilities for Biodiversity Conservation and Utilization as the construction of the Center and the procurement of equipment. The contents of the original request are outlined below.

1) Date of Request : December, 2001

2) Requested Amount : US$ 18,000,000 (approximately ¥2,160 million)

3) Contents of the Request

Division	Outline of Facilities		Outline of Equipment
	Rooms	Floor Area (m^2)	
Botanical Division	Administration room, library, staff rooms, laboratories, herbarium, others	15,530	Electrophoresis, DNA sequencer, atomic absorption spectro photometer, GC-MS/MS, specimen cabinets, others
Microbiological Division	Administration room, library, staff rooms, laboratories, others	3,970	Electrophoresis, HPLC, freeze dryer; others
Natural History Museum	Exhibition rooms, auditorium, information room, storage room, library, others	Rehabilitation of the existing herbarium	Exhibition equipment; audio-visual equipment; storage equipment; others
Sub-Total		19,500	Total 780 items
Total (including corridors and staircases, etc.)		27,300	

In August, 2002, the Indonesian side changed the contents of the request, including withdrawal of the Natural History Museum and reduction of the floor area of the Botanical and Microbiological Divisions to approximately 20,500 m^2 while adding the construction of an information Center during the field survey period as an information service base with a view to strengthening environmental education.

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Higher Plan and Project Goal

(1) Higher Plan and Project Goal

The Project will contribute to "development in the natural resources and environment sector" under the National Development Plan (PROPENAS 2000 – 2004)" and to "to conserve as much as possible of the biodiversity on which the livelihood and prosperity of Indonesia depends" which is the national goals of the BAPI and will provide facilities for (i) basic research on the conservation of biodiversity and its utilization by the people of Indonesia and (ii) environmental education for the people on the conservation of biodiversity.

The goal of the Project is to facilitate the following activities through the construction of new buildings for the Botany Division and the Microbiology Division of the RCB at Cibinong in a suburb of Jakarta and the transfer of the existing facilities and functions at Bogor.

① Concentration of the research functions of the Botany and Microbiology Divisions of the RCB at Cibinong where the Zoology Division is already located in order to improve the interdisciplinary research environment
② Strengthening of the specimen storage (preservation) function to contribute to the basic research described above
③ Addition of an environmental education function to strengthen the environmental education and public awareness activities, targeting the people of Indonesia

(2) Outline of the Project

Under the Project, a new modern research center contributing to the conservation and utilization of biodiversity will be established through the construction of research facilities for the Botany and Microbiology Divisions, storage facilities for botanical specimens and an information center to conduct environmental education. The establishment of such a center is expected to facilitate interdisciplinary research as well as basic research on the conservation and utilization of biodiversity, to preserve botanical specimens in good condition for many years to come and to provide environmental education and public awareness activities. The resulting conservation and utilization of biodiversity with sustainability should contribute to the development of the national economy.

The scope of the grant aid is the construction of research facilities for the Botany and Microbiology Divisions, storage facilities for botanical specimens and an information center and the procurement of the equipment required for research work.

2.1.2 Outline of Activity Plans for Botany and Microbiology Division

The planned activities of the RCB Botany Division and Microbiology Division consist of (i) research contributing to biodiversity, (ii) collection, storage, preservation and management of specimens and (iii) implementation of environmental education as described in more detail below.

(1) Activity Plan for Botany Division

1) Research Activities

(a) Research Themes

The Botany Division is composed of six research groups which conduct basic research on the conservation and utilization of biodiversity to contribute to national development and also basic research relating to commercial-based development utilizing biodiversity.

① Phytochemistry Group
② Plant Physiology Group
③ Anatomy and Morphogenetic Group
④ Taxonomy Group
⑤ Ecology Group
⑥ Ethnobotany Group

The research themes of each group are listed in the table below.

Table 2-1 Research Themes of Research Group of Botany Division

Group	Research Theme	Research Target	Anticipated Outcome
Phytochemistry	Extraction of medicinal substances from plants	Use for the development of medicine	Pharmaceutical development
	Interaction between plants and soil microbes, such as mycorrhiza	Use for the improvement of production techniques relating to plantation of useful timber species	Forestry development
Plant Physiology	Interaction between environmental stress and plant growth/physiological processes	Use for the development of production techniques serving agriculture and forestry	Agricultural and forestry development
	Propagation of rare species by means of tissue culture, etc.	Technological development for the conservation of biological diversity, including artificial propagation techniques and the preservation of *ex situ* stock	Diversity conservation; agricultural development
Anatomy and Morphogenetic	Improvement of diversity through investigation of the pollination process and the artificial pollination of rare species	• Use for the improvement of the productivity of useful species together with research on farming fields • Development of artificial propagation techniques for rare species	Agricultural development Diversity conservation
	Morphology and propagation of parasitic plants	Use for the habitat management of rare species and also for diversity conservation	Diversity conservation
	Improvement of the genetic qualities (diversity) of rare plants	Use for conservation at the population level	Diversity conservation
Taxonomy	Systematic research of plants in the Malesian Region based on morphology, anatomy, chemotaxonomy, molecular, cytology	Understanding of the diversity of plant species in the geohistorical context	Understanding of botanical diversity
	Systematic research of a useful species using DNA (a Dipterocarp species: lauan)	Understanding of the genetic relationship within a species (genetic diversity) and the development of useful varieties	Forestry development
	Clarification of flora forming ecosystems in protected areas and small islands which are important in terms of conservation	Understanding of the environmental factors and area size required for the conservation of plant diversity based on various species' life histories for the protected area management	Diversity conservation
	Establishment of a DNA bank of rare species	Collection and preservation of the genetic information and specimens of endangered species and the *ex situ* conservation of these species with a view to the reintroduction of such species	Diversity conservation

	Systematic research on rare species and useful species at the population level	• Understanding of the genetic diversity among local population and the use of this knowledge for conservation measures • Establishment of wild gene resources of useful species	Diversity conservation Agricultural development
Ecology	Dynamics of the ecosystem in protected areas and small islands which are important in terms of conservation (structure; inter-relationships)	Foundations for effective biological diversity conservation measures	Diversity conservation
	Monitoring of typical forest ecosystems (analysis of the growth and regeneration system at Mt. Halimun, etc.)	• Basic reference materials for botanical diversity conservation • Guidelines for application methods for economic development	Diversity conservation Economic development
	Research on important species at population level (mechanism for the enlargement of distribution and other topics)	Use for the establishment of protected areas for rare species	Diversity conservation
	Forest restoration process from forest fire, etc.	• Protection and restoration methods for biological diversity from fire damage • Guidelines for the sustainable use of forest resources	Diversity conservation Forestry development
	Dynamics of seed bank	Guidelines for the restoration of a degraded forest ecosystem and forest resources	Diversity conservation; forestry development
	Mapping of ecosystems in protected areas, etc.	Basic reference materials for effective biological diversity conservation measures in protected areas	Diversity conservation
	Nutrient cycles in the ecosystems (nitrogen, etc.)	Basic reference materials to make decisions in regard to the size and location of protected areas	Diversity conservation
Ethnobotany	Accumulation and analysis of indigenous knowledge on the traditional use of plants for medicinal and dying purposes, etc. by locality and ethnic group	• Development of new materials • Application of traditional methods of use for economic development and securing royalties for local people	Development of pharmaceuticals and dyes

(b) Joint Research

The Botany Division led joint research involving the Ministry of Agriculture, the provincial government and/or private enterprises featuring the conservation or utilization of biodiversity, and the output of the research was contributed to the development of agriculture, forestry, food and medicine. The Botany Division plans to continue the joint research, and the number expects to increase from 15 in 2002 to more than 20 in 2010 by improving facility and equipment.

Table 2-2 Number of Joint Research of Botany Division

	Year 2002	Expecting in Year 2010
Joint Research	15	20

2) Collection and Management of Specimens

(a) Number of Specimens

The Botany Division keeps a large number of botanical specimens, said to total approximately 1.5 million (according to the Management Policy of the Herbarium Bogoriense published in 2002), at the Herbarium Bogoriense and the Taxonomy Group is mainly responsible for their collection and management.

The Herbarium was established in 1851 and currently stores some 1.4 million dry specimens, some 50,000 specimens in spirit, 7,800 carpology and seed specimens and 1,000 xylarium specimens in addition to drawing specimens. These specimens are restricted to those of cryptogamae, ferns, gymnospermae and dicotyledonae in the Flora Malesiana Region. Of these, more than 20,000 are type specimens (type specimen: a specimen subject to obligatory preservation as evidence for academic names and taxonomical reference when a plant species is given an academic name). Because of such a vast collection, it is said that the wide-ranging study of histobotany in the Flora Malesiana Region is impossible without the specimens held by the Herbarium Bogoriense.

Table 2-3 Specimens Collection in the Herbarium Bogoriense

Type of Specimens	Number of Specimen
1. Dry Specimen	1,405,229
(1) Cryptogamae	63,949
(2) Ordinary Dry Specimen	1,241,280
1) Fern	96,000
2) Gymnospermae	19,200
3) Monocot	282,240
4) Dicotyledonae	843,840
(3) Loan Specimen	100,000
2. Spirit Collection	49,614
3. Carpology & Seed Specimen	7,800
4. Xylarium Specimen	58,414
Total	1,463,643

All of the specimens are classified by taxonomy. Within each taxonomy, they are alphabetically stored under the categories of family, genus and species. Type specimens are stored in an air-conditioned independent room as they are very important specimens. Other types of specimens stored include those of the voucher collection, reference collection and drawing collection.

Table 2-4 Other Types of Specimens

Type Specimen	The type specimens are used for identification of collected specimens as a base of family, genus and species, and the type specimens shall be stored permanently.
Voucher Collection	The specimens in the collection are used to indicate the date and place, etc. of their collection and are kept until the research achievements using the plants in question are clearly established.
Reference Collection	The specimens in this collection are displayed for visitors in the Herbarium and unmounted dry specimens are stored in files.
Drawing Collection	The specimens in this collection are illustrations of plants.

The number of specimens collection has been steadily increasing each year through the collection work of researchers working for the Botany Division and the exchange of specimens with the Herbarium of Leiden University (Rijksherbarium Leiden) in the Netherlands and the Royal Botanical Gardens, Kew in the UK. The average annual rate of increase by type of specimen is shown below.

Table 2-5 Expecting Annual Averaged Increasing Specimen

Type of Specimen	Annual Averaged Increasing Specimen
Cryptogamae	1,000
Ordinary Dry Specimen	4,000
Spirit Collection	200
Carpology & Seed Specimen	100
Voucher Collection	4,000
Reference Collection	1,000

(b) Dry Specimen Preservation Method

Dry specimens used to be dried after dipping in a mercury chloride solution and then mounted on an acid mounting board for storage in a naturally ventilated Herbarium. In recent years, however, the mounting boards are showing much damage, partly due to the adverse impacts of the mercury chloride. A new preservation method has been employed since 1994 under the Global Environment Facilities (GEF) Project in line with the current international standards. With this method, the specimens are mounted on acid free mounting boards for storage at a room temperature of between 18°C and 23°C after insects are killed in a freezer. The employment of this method not only aims at the storage of specimens in good condition but also implies a change of practice from the conventional storage method using mercury chloride which poses a health hazard for researchers and prevention of the destruction of plant DNA by mercury chloride as the extraction of DNA is an essential requirement for the latest botanical research.

This new preservation method is the most appropriate method to protect the specimens from insect damage for a long period of time. Its suitability vis-à-vis the meteorological conditions in Indonesia is assumed by the second basic design study team.

Table 2-6 Changing Preservation of Dry Specimen

Period	Method	Fumigation (Insect Treatment)	Preservation	Problem and Remarks
1841 to 1994	- Using mercury chloride, paradichloro benzene and naphthalene ball - Mounted acid board	- To fumigate using methyl bromide	- To maintain with rich ventilation	- Damaged mount board - Dangerous substance to researcher's health(*) - To destroy DNA of specimen
After 1994 (GEF Project)	- To insert freezer - To mount on acid free board	- To insert freezer - To fumigate using chemical (Magtoxin) approved by MOH	- To maintain with 18-23 degree by air conditioning as international standard	- To be restricted using poisonous chemicals for fumigation - To maintain type specimen only with air conditioning

(*): KEW does not recommend to use mercury chloride that is a very dangerous substance to handle.

Remounting, mainly of type specimens, was conducted under the GEF Project. In fact, remounting has been continuing since the end of this project in 2001 and 265,000 specimens out of a total of 1,241,280 ordinary dry specimens have so far been remounted. Remounting of the remaining 976,280 specimens in also planned.

Table 2-7 Condition of Dry Specimen at Bogor Herbarium

Type of Specimen	Total Number	Completed Remounting	Necessary remounting
Storing in Herbarium	1,241,280	265,000	976,280
Loan to Outer	100,000		
Total	1,341,280	265,000	976,280

(c) Spirit Collection Preservation Method

Bottles with a paraffin-sealed glass plate lid have conventionally been used for specimens in spirit. Many of the bottles have, therefore, suffered from the leakage of ethanol. In order to improve this situation, rebottling in standard bottles with a plastic screw cap in line with the international standards has been decided. 8,194 specimens were rebottled under the GEF Project and the rebottling of the remaining 41,420 specimens in the spirit collection is planned.

The spirit collection is currently kept in a naturally ventilated room. Given the fact that there is still minor leakage of ethanol from the standard bottles with a plastic screw cap, it has now been decided to store them in a temperature controlled room with less prospect of ethanol leakage as recommended by Leiden University and Kew. The assessment results of the second basic design study team in this regard are that storage in a naturally ventilated room may have to be accepted if sufficient funds to cover the maintenance cost are unavailable even though storage in a temperature controlled room is desirable. Both cases are found in Japan. For example, Kyoto University uses a temperature controlled room for its spirit collection while Tokyo University uses a naturally ventilated room. In the face of such assessment by the second basic design study team, the RCB has promised to secure funding for the running and maintenance cost without fail and, therefore, it has been decided to adopt the storage method using a temperature controlled room.

(d) Scope of Use of Specimens

In the 20th Century, botanical science has developed rather differently, with a great expansion of molecular, cell and physiological studies, which have displaced taxonomy from its former primary position. This has led to a view among many scientists that taxonomy is an out-dated, minor discipline of little importance in the modern world. In our own time, this opinion has been shown to be a serious error of judgement. The drastic degradation of the environment which is apparent throughout the world today has demonstrated how little we know about the plant diversity which is so fundamental to successful human existence. To a very large extent, plants are our environment. Regions where plants are abundant tend to be places where man can succeed, and where they are absent man has little hope of survival. Knowledge of plant diversity is essential in the present struggle to reclaim deserts and degraded landscapes, breed pest resistant into our crops, and find new sources of energy, food, medicines and useful materials. Many scientific disciplines are involved in this work, including ecology, conservation, physiology, plant breeding, pharmacology, biochemistry, ethnobotany, materials technology, agronomy, plant pathology and many others. Constantly, and with increasing urgency, questions such as the following, which only the taxonomist can answer are being asked about plants: how can they be recognised? (identification), what should they be called in order that information about them can be freely exchanged without ambiguity? (nomenclature), what are their closest relatives? Are there any other plants likely to have similar properties or compatible genetic systems? (classification), where do they grow? (distribution), in what kind of habitat do they grow? (ecology) and have they any useful properties? (uses) (cited from the Herbarium Handbook published by Kew).

At the Herbarium Bogoriense, the specimens are used to serve three purposes relevant to Indonesia, i.e. (i) research on botanical diversity, (ii) use for the conservation of diversity and (iii) research on the use of diversity. The Herbarium is expected to play the following three functions.

① Supply of specimens representing the botanical diversity in Indonesia
② Supply of useful specimens, including data such as collected place etc. for researchers throughout the world
③ Supply of information regarding the conservation of botanical diversity through publications, lectures and other educational activities

In order to satisfactorily perform these functions, researchers, including students, have access to almost all specimens. In addition, specimens may be loaned to botanical research institutions around the world. These include precious type specimens although some restrictions are attached. The sampling of specimens for DNA extraction or chemical research on proteins is also possible provided that it is approved by the Herbarium.

Researchers of the Botany Division conduct research using stored botanical specimens in addition to the collection of research subjects from fields as well as greenhouses.

(e) Insect Control and Prevention of Chemical Damage

Insect control is important to prevent damage to the specimens and careful attention is paid to insect control. Daily insect control includes the use of traps to check for the presence of insects. When a specimen is infected by insects, it is placed in the freezer to kill the insects. When the insect damage is severe, the entire Herbarium is fumigated. In the future, the specimens will be stored in a temperature controlled room where the possibility of an insect outbreak is minimal. In the case of the observation of an insect outbreak, the specimens will be placed in the freezer to kill the insects. Alternatively, fumigation of the infected specimen cabinet(s) will be conducted. Fumigation of the entire Herbarium will also be an option depending on the damage situation.

As mercury chloride and harmful insecticides and fumigating agents are still used, careful attention is paid to the prevention of any harm to researchers by the chemicals in the following ways. These methods of controlling insects and preventing chemical damage are expected to continue as the remounting of the existing dry specimens will not eliminate the mercury chloride adhering to such specimens.

① When severe insect damage is discovered in the Herbarium, fumigation is conducted using a chemical authorised by the Indonesian Ministry of Health.
② Staff members undergo a blood test and urine test every year.
③ Rubber gloves are used to handle the chemicals to prevent any direct contact with them.
④ A mask and laboratory clothing are worn when handling specimens to prevent any contact with residual mercury chloride, naphthalene and/or insecticide on the specimens.
⑤ Hand washing is always conducted after handling specimens.

⑥ The use of mercury chloride and insecticide spray will be terminated from now onwards.

(f) Database

The work to create a botanical specimen database commenced under the GEF Project and is still in progress. As of the end of July, 2003, data input was completed for 279,973 specimens. This work has been conducted by a team of 6 members with average data input of 75 specimens a day. The addition of 2 more persons to the team in 2004 is planned to create a team of 8 members.

This work is conducted at the Data Input Room affiliated to the Biosystematic Laboratory and the data is fed to the host computer in the Database Room. The same method of data input is planned for the new facilities to be constructed under the Project to continue with the work to create a complete database.

(2) Activity Plan for Microbiology Division

1) Research Activities

The Microbiology Division consists of four research groups and conducts basic research for the conservation of biodiversity to contribute to national development and also basic research leading to commercial-based development using biodiversity.

① Ecology and Physiology Group
② Applied Microbiology and Developmental Group
③ Biosystematics and Genetics Group
④ Microbial Biochemistry Group

The research themes of each group are listed in the table below.

Table 2-8 Research Themes of Research Group of Microbiology Division

Group	Research Theme	Research Target	Anticipated Outcome
Ecology and Physiology	Relationship between the diversity of soil microbes and the ecosystem (species diversity ; ecological and genetic characteristics)	Understanding of species and genetic diversity in each ecosystem	Understanding of diversity
	Relationships between functions of soil microbes and ecosystems (soil microbes and nutrient cycle; symbiosis with plants)	Development of a conservation method for diversity in protected areas by clarifying the relationship between the material flow and groups of microbes in the ecosystem; nurturing of commercial plants in each locality	Conservation Development of commercial plants
	Application of microbial functions (fertilisation of soil and waste water treatment, etc.)	• Restoration of a degraded soil ecosystem • Use of microbes for waste water treatment	Agricultural and forestry development Development of a waste water treatment technology

Applied Microbiology and Development	Extraction of useful substances from traditional fermented foods (extraction of medicinal constituents and isolation of ferment bacilli, etc.)	Use for the development of pharmaceuticals and foods	Development of pharmaceuticals and foods
	Development of agricultural production materials (refinement of fungi and the composting process of litters, etc.)	Use for the widening of income sources for farmers and to promote sustainable and cyclical agriculture which does not rely on chemical fertilisers	Agricultural development
Biosystematics and Genetics	Understanding of the diversity of microbes (identification of nitrogen fixing bacteria, identification of yeast in protected areas and understanding of their genetic characteristics, etc.)	Understanding of the diversity of local microbes (diversity in terms of species and genetics)	Understanding of diversity
	Understanding of the application potential of microbial functions (resistance to true fungi as a measure to prevent crop diseases; anti-active oxygen enzymes of yeast fungi)	• Use for the reduction of pesticide and other inputs to agriculture • Use for the manufacture of anti-active oxygen enzymes of yeast	Agricultural development Pharmaceutical development
	Development of cultured specimens	Improvement of the effective references for identification	Understanding of diversity
Microbial Biochemistry	Clarification and improvement of the traditional fermentation process (identification of yeast for soy beans and their genetic characteristics; biological extraction of palm oil)	• Identification of efficient yeast variety for their use for improvement of the production efficiency • Use for the development of safe foods	Food development
	Application of microbes to biosynthesis (living activated glycoside and proteolytic enzymes, etc.)	Use for pharmaceutical and feed development	Pharmaceutical and agricultural development

2) Preservation and Management of Specimens

Four types of preservation methods are available for microbial specimens, i.e. sub-culture, frozen-dried, frozen and liquid nitrogen. The most appropriate method is selected depending on the intended period of storage. The frozen-dried method offers the longest storage period and is commonly used for the long-term storage of specimens as national reference specimens which be used for identification of microbial.

Table 2-9 Preservation Methods for Microbial Specimens

Method	Characteristics
Sub-Culture	The original microbe is cultured in a medium and is stored in a refrigerator or freezer. The expected storage period is as short as approximately one month in a refrigerator and several years in a freezer.
Frozen-Dried	After suspending the microbe in a solution containing a protective agent, the microbe is placed in a glass ampoule and the ampoule is then sealed with heat after vacuum drying. The specimen produced can be stored for a long period of time.
Frozen	DNA is stored at a temperature of –80°C.
Liquid Nitrogen	A cultured microbial specimen is stored in liquid nitrogen. This method is suitable for a microbe of which the immediate use is planned.

At present, the Biosystematics and Genetics Group stores and manages some 1,400 specimens, including frozen-dried and sub-culture specimens of bacteria, yeast and mold (fungi). However, the lack of facilities to store specimens in liquid nitrogen means that

the storage of the culture collection in liquid nitrogen is entrusted to the Biotechnology Centre of the LIPI Life Science Centre (CSC). Meanwhile, individual researchers of the Microbiology Division personally store more than 200 specimens because of the poor frozen-dried storage facilities of the division.

The development of national reference specimens with 37,800 specimens, including those personally owned, is planned at the end of 2005. The planned ratios of these national reference specimens are some 79% for frozen-dried specimens, some 20% for frozen specimens and 1% for specimens in liquid nitrogen.

Table 2-10 Preservation Plan for Microbial Specimens

Taxa	Present Number					At end of 2005				
	Sub-Culture	Frozen-Dried	Frozen	Liquid Nitrogen	Total	Sub-Culture	Frozen-Dried	Frozen	Liquid Nitrogen	Total
Bacteria	150	124			274	0	10,000	2,500	100	12,600
Yeast	200		120		320	0	10,000	2,500	100	12,600
Mold (fungi)	200	620			820	0	10,000	2,500	100	12,600
Total	550	744	120	(*)	1,414	0	30,000	7,500	300	37,800

(*): Storing at Biotechnology Center in CSC

3) Database

The design of a microbial specimen database has been completed by the Biosystematics and Genetics Group and input work is planned to commence in early 2004 by 2 operators.

(3) Environmental Education

At the LIPI, environmental education on the conservation of biodiversity is mainly conducted by the RCB, the Centre for Plant Conservation of the Bogor Botanical Garden and the Research Centre for Oceanography. The main environmental education activities conducted by the RCB are the acceptance of group visits by students to its facilities, an annual open house event when the research facilities of the RCB are open to the public, management of the museum and visiting lectures at universities, etc.

Table 2-11 RCB's Approach to Education on Biodiversity and the Environment

Main Environmental Education Activities
1. Group visits by students to the RCB's facilities
2. Sponsoring of an annual open house event
3. Museum management
4. Species identification service
5. Visiting lectures at universities, etc.
6. Publication of reference books compiling research achievements
7. Sponsoring of seminars, workshops and training courses

The Sub-Division of Cooperation and Services of the Division of Administration of RCB has been responsible for the management of the Bogor Zoological Museum and the Indonesian Ethnobotany Museum since 2001. The Botany Division and the Microbiology Division are engaged in the activities listed above except for museum management. The RCB is planning to establish an information centre in the near future to provide information on biodiversity and the activities of the RCB directly for students and the public with a view to strengthening the RCB's environmental education activities.

Table 2-12 Activity Plan for Information Center

Room Required	Planned Activities
Information Centre	- Information service regarding biodiversity and the RCB's activities - Provision of information in the form of the small display of specimens, books, video tapes and Internet webpages - Teaching on how to create specimens
Use of Large Meeting Room	- Use of this room for briefing large groups, such as groups of students visiting the RCB's facilities

The environmental education activities conducted by the Botany Division and the Microbiology Division are explained in more detail below and these activities are planned to continue.

1) Group Visits by Students to the RCB's Facilities

The RCB accepts group visits of high school and university students to its facilities, and plans to allocate a permanent staff at the planned information center to increase environmental education activity, and expects to increase visiting student from 1,054 in 2002 to approximately 1,300 in 2010.

Table 2-13 Expecting Increasing Number of Visiting Students

Division Name	Year 2002 (Total Students Number)	Year 2010 (Total Students number)
Botany Division	894	1,100
Microbiology Division	160	200
Total	1,054	1,300

2) Annual Open House Event (Lasting 2 – 3 Days)

An annual open house event is held in November before Ramadan to allow public access to the facilities of the three divisions (Botany, Microbiology and Zoology).

3) Species Identification Service

The RCB provides a species identification service. The users of this service include teachers and students of high schools and universities, consultancy firms, specimen traders (for application for an export licence; particularly for the identification of zoological species), the CIFOR (Centre for International Forest Research) and other international organizations and NGOs (particularly for the identification of botanical species) and biotechnology companies (particularly for the identification of microbial species). The service fees and number of samples received for identification are shown in the table below.

Table 2-14 Service Fees and Number of Samples for Identification

Division	Service Fees	Annual Received Samples	Remarks
Botany	- Rp. 5,000/ sample for student - Rp. 10,000 sample for others	3,000-4,000	Up to species level identification
Microbiology	Family level - Rp. 25,000/ sample for student - Rp. 50,000/ sample for Official - Rp. 100,000/ sample for Private	About 400	Family level identification only duo to lack of equipment

4) Lecture Visits to Universities

More than half of the research staff of the Botany Division and the Microbiology Division teach or provide tutorial guidance for students at the Bogor Agricultural Institute and the University of Indonesia, etc.

5) Academic Research Papers

The number of academic research papers published by the Botany and Microbiology Divisions is 119 in 2002, and expected to increase to some 160 in 2010 duo to improvement of facility and equipment.

Table 2-15 Number of Academic Research Papers

Division	Year 2002	Year 2010 (Expecting)
Botany Division	83	100
Microbiology Division	36	60
Total	119	160

6) Publication of Reference Books Compiling Research Achievements

In addition to the publication of individual research papers, both the Botany Division and the Microbiology Division publish a number of reference books for the public as part of their efforts to spread basic knowledge on biodiversity. In recent years, these publications have often been sponsored by the JICA, the GEF and others. The number of published reference books is shown in the table below.

Table 2-16 Number of Publications (Sponsor Category)

Division	JICA (1999-2003)	GEF (1992-2001)	RCB-LIPI (1975-2000)
Botany	2	4	29
Microbiology	1	-	1

7) Sponsoring of Seminars, Workshops and Training Courses

The number of seminars, workshops and training courses sponsored by the RCB increased from three in 2001 to 14 in 2002. Five workshops featuring the classification of animals and plant conservation, etc. are planned in 2003 in response to the requirements of the Washington Convention (regarding the international trade of endangered wild animal and plant species) and others. The RCB plans to continuously organize and sponsor various seminars, workshops and training courses in the coming years.

2.1.3 Restoration and Transfer Plan

As the planned facilities under the Project will be constructed at Cibinong, it will be necessary to safely transport the existing botanical species without causing any damage. Given the poor storage conditions of some of the dry specimens and the spirit collection, their restoration will be necessary prior to transportation. The regeneration and ampouling microbial collections will also be necessary prior to transportation. The RCB has, in fact, formulated a restoration and transfer plan to ensure the transportation of specimens in good condition. The contents of this plan are described next.

(1) Botanical Specimen Restoration and Transfer Plan

1) Number of Specimens to be Restored

① Botanical Dry Specimens

The storage situation of 1,241,280 ordinary dry specimens is classified into the following three categories.

- 265,000 specimens of which the storage conditions are excellent as they have been remounted in line with the international standard preservation method.

- The 976,280 species requiring remounting consist of those which can withstand transportation and those which cannot withstand transportation. According to the calculations of the RCB based on a sampling survey on the specimen preservation conditions, 533,568 specimens can withstand transportation and 442,712 specimens cannot withstand transportation.

When the adoption of the international standard storage method was decided, the remounting of all 1,241,280 ordinary dry specimens on acid free mounting boards was necessary. Because of restrictions in terms of the remounting cost, place for the restoration work and management requirements, the RCB plans to remount 442,712 specimens which cannot withstand transportation at the Herbarium Bogoriense prior to their transportation and to remount 533,568 specimens which can withstand transportation at the new facilities after their transportation to the new facilities.

Table 2-17 Number of Dry Specimens and Requiring Remounting Specimens

Type of Dry Specimen	Total No. of Specimens	No. of Specimens Already Remounted	No. of Specimens Requiring Remounting (A)	No. of Specimens to be Remounted Prior to Transfer (B)	B/A (%)
(1) Cryptogamae					
Fungi	22,403				
Lichens	9,220				
Hepaticae	15,329				
Musci	14,582				
Algae	2,415				
(1) Total	63,949				
(2) Ordinary Dry Specimens					
Fern	96,000	0	96,000	96,000	100%
Gymnospermae	19,200	183,400	118,040	118,040	100%
Monocot	282,240				
Dicotyledonae-I	247,680	59,520	188,160	56,448	30%
Dicotyledonae-II	596,160	22,080	574,080	172,224	30%
Sub-Total	1,241,280	265,000	976,280	442,712	45%
Specimens on Loan	100,000				
(2) Total	1,341,280				

Total Number of Dry Specimens: 1,405,229

Note: Fungi and lichens species are contained in small bags.

② Spirit Collection

The spirit collection is suffering from ethanol leakage from the bottles due to deterioration of the seals, making the rebottling of 41,420 specimens necessary prior

to transfer which excludes the 8,194 specimens already rebottled under the GEF Project.

Table 2-18 Number of Spirit Collection and Requiring Rebottling Collection

Type of Collection	Total No. of Collection	No. of Collection Already Rebottled	No. of Collection to be Rebottled Prior to Transfer
Spirit Collection	49,614	8,194	41,420

③ The storage conditions of the carpology and seed collection and of the xylarium collection are good enough for transfer without restoration.

2) Restoration Methods

① Remounting of Dry Specimens

The work involves the remounting of specimens from the acid mounting boards to acid free mounting boards.

② Rebottling of Spirit Collection

The work involves the transfer of specimens to standard bottles with a plastic screw cap, refilling with fresh ethanol and sealing of the cap.

3) Restoration Schedule

① Remounting of Dry Specimens

8,258 specimens was remounted from January to July 2003. 16 mounters from August and 30 mounters from September was employed, 8,087 specimens was remounted from August to October 15, 2003. It will be expected to remount some 30,000 specimens from August to end of December 2003. From 2004, the number of mounters will be increased to 40 and the remounting of 442,712 specimens is scheduled to be completed in June, 2006. Following the transfer of the specimens to the new facilities, some 8 mounters will be used to remount the remaining specimens.

② Rebottling of Spirit Collection

4 workers are planned for the rebottling work which will commence at the beginning of 2005 and will be completed in June, 2006.

Table 2-19 Restoration Schedule

Type of Specimens	Number	2003		2004				2005				2006			
		3	4	1	2	3	4	1	2	3	4	1	2	3	4
Dry Specimen															
Fern	32,000														
Fern	64,000														
Gymno/Monocot	118,040														
Dicotyledonae	228,672														
Total	442,712														
Spirit collection	41,420														

1. In 2004 and thereafter, 40 mounters will be conducting remounting work.
2. The spirit collection will be rebottled by four workers.

4) Transfer Schedule

The transfer of the botanical species to the new facilities at Cibinong will commence with the packing of carpology specimens in July, 2006 after the completion of the construction of the new facilities under the Project and will take some 8 months to complete until the completion of the storage of the dicotyledonae specimens in the designated cabinets in early March, 2007.

Table 2-20 Transfer Schedule of Botanical Specimen

	2006																								2007											
	July				Augu.				Sept.				Oct.				Nov.				Dec.				Jan.				Feb.				March			
Schedule	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Herbarium collection																																				
Type specimens																																				
Cryptogamae																																				
Fern																																				
Gymnospermae																																				
Monocotyledonae																																				
Dicotyledonae																																				
Carpology																																				
Spirit collection																																				
Voucher specimens																																				
Backlog																																				
Loan																																				
Reference collection																																				
Mounting, Drying, Freezer																																				
Laboratory																																				
Personal belonging																																				
Library																																				
Photography & drawing																																				
Database																																				
Administration office																																				
Storage rooms																																				
MBA ref. Collection																																				
Notes:	: packing								: transferring								: unpacking & rearrangement																			

5) Transfer Cycle

① Killing of Insects

One crucial point for the successful transfer of the dry specimens is how to kill insects for some 1.24 million ordinary dry specimens prior to the commencement of their storage at the planned new facilities. There are two standard methods to kill insects, i.e. (i) specimen storage in a freezer at –30°C for 4 – 5 days and (ii) fumigation of the storage room after the delivery of the specimens to the room. The former requires a large freezer, incurs a very high electricity cost and lengthens the overall transfer period. However, a fumigant, the use of which requires careful attention to prevent any adverse impacts on human health, is unnecessary. In contrast, the use of a fumigant means a shorter transfer period and a lower cost although careful attention is required.

The RCB originally considered using a freezer to kill insects but eventually opted for the use of a fumigant in the storage room because of the shorter transfer period and lower cost. Magnesium phosphide (Magtoxin), i.e. the planned fumigant, is registered with the Indonesian Ministry of Health and is scheduled for registration

in Japan as an agrochemical in the near future for the fumigation of grains and leaf tobacco, etc.

② Transfer Cycle

The planned transfer cycle is packing → transportation → unpacking → storage → fumigation of the storage room. This cycle will be repeated to complete the transfer operation. Transfer of the specimen cabinets will be conducted as part of this transfer operation in view of the fact that the specimen cabinets introduced under the GEF Project will be used at the new facilities. When the cabinets to be provided under the present Project are fully occupied, it will be necessary to transfer the GEF cabinets.

③ Supervision of Transfer Operation

When the zoological specimens were transferred, the transfer operation was supervised in detail by supervisors appointed under the GEF Project. The similar appointment of supervisors is believed by the RCB to be necessary for the transfer of the botanical specimens under the Project while studying previous cases of transfer involving other herbaria (those at Leiden, Tokyo, Kyoto and Tsukuba Universities).

6) Formation of Working Teams

The RCB has formed two working teams to ensure the proper implementation of the restoration and transfer activities. These are the Planning Team to prepare the restoration and transfer guidelines and the Moving Team to be responsible for the actual transfer operation. The members of these teams are assigned from the Botany Division, Microbiology Division and Administration Division. The Planning Team is currently conducting a detailed examination of the restoration and transfer plans.

7) Preparation of Protocol

The Planning Team prepared a protocol as the restoration and transfer guidelines, referred to the attached Minutes of Discussions. The Team will review the protocol to complete it as the final.

8) Notification of Related Leading Research Institutions and Scientists

The Botany Division has formulated a plan to send a protocol to related leading research institutions for the purposes of (i) informing of the planned relocation to Cibinong and (ii) obtaining their advice and recommendations and has sent this protocol to Kew, Leiden University, the University of Missouri, Tokyo University and nine scientists (at Kew, the National Herbarium of the Netherlands, the Australian National Herbarium, the Philippine Museum, the Forest Herbarium, the Herbarium of Malaysia and the Herbarium of Singapore). Kew, Leiden University and Australian National Herbarium have already expressed their support for the planned relocation and have offered advice on the spirit collection preservation and transfer method, etc. The University of Missouri has also expressed its support for the relocation. It is planned to send further protocols in the same way as soon as they have been finalised.

9) Sampling Survey on Dry Botanical Specimens

A sampling survey was jointly conducted with the Collection Manager of the Botany Division to investigate the preservation conditions of the dry botanical specimens and also to estimate the number of specimens which can withstand transportation and the number of those which cannot withstand transportation. This survey was conducted by classifying the preservation conditions into three categories.

Table 2-21 Preservation Condition Categories

Category	Preservation Conditions
A	Specimens which have been mounted or remounted to acid free mounting boards since the introduction of the GEF Project
B	Specimens which require remounting due to their mounting on acid mounting boards but which are strong enough to withstand transportation
C	Specimens which urgently require remounting because they will not withstand transportation due to damage to the labelling and/or mounting board

The results of this sampling survey are shown in the table below. The safe estimate of the ratio of specimens which will not withstand transportation and which require remounting prior to transfer is believed to be less than 30%. The Collection Manager of the Botany Division agrees with the survey results and the estimate.

Table 2-22 Preservation Condition and Damaged Ratio of Ordinary Dry Specimens

Taxa	Surveyed Nos. of Ph	No. of Specimens Already Remounted (A)	No. of Specimens to be Remounted after Transfer (B)	No. of Specimens to be Remounted Prior to Transfer (C)	Can Transfer (A+B)	Remounted Prior to Transfer (C)	Standard Deviation	Standard Error
Fern	10	9%	65%	26%	74%	26%	20%	6%
Gym/Monocot	7	38%	46%	16%	84%	16%	22%	8%
Dicot.	43	24%	66%	10%	90%	10%	16%	2%

(2) Microbial Collection Regeneration and Transfer Plan

1) Number of Specimens to be Transferred

Some 31,000 frozen-dried collections planned as national reference at the end of 2005 and 100 existing wet collections will be transferred to the new Center.

Table 2-23 Number of Microbial Collection to be Transferred

Group	Collection Number	Type of Collection
Bacteria	10,000	Frozen-Dried
Yeast	10,000	Frozen-Dried
Mold	10,000	Frozen-Dried
Actinomycetes	1,000	Frozen-Dried
Azolla	100	Wet Collection

2) Regeneration and Ampouling

Regeneration and ampouling of frozen-dried collections is planned prior to transfer.

Table 2-24 Regeneration and Ampouling Schedule

Type of Specimen	Number	2004				2005				2006			
		1	2	3	4	1	2	3	4	1	2	3	4
Bacteria	10,000												
Yeast	10,000												
Mold	10,000												
Actinomycetes	1,000												
Total	31,000												

3) Transfer Schedule

The transfer of the microbial frozen-dried collections to the new facilities at Cibinong will commence in August, 2006 after the completion of the construction of the new facilities and will take some 3 months to complete.

Table 2-25 Transfer Schedule of Microbial Collection

Type of Specimen	2006																							
	July				Aug.				Sept.				Oct.				Nov.				Dec.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Bacteria																								
Yeast																								
Mold																								
Actinomycetes																								

Note: : Packing : Transferring : Unpacking & rearrangement

4) Preparation of Protocol

The Planning Team prepared a protocol as the restoration and transfer guidelines. The Team will review the protocol to complete it as the final.

(3) Budget Plan

The RCB has estimated the cost of operation and maintenance of facilities and equipment, matters related construction work and specimen restoration and transfer as Table 2-26. The Indonesian side has pledged its proper funding to meet its share of the construction cost, the specimen restoration and transfer cost and the operation and maintenance cost of the new Center on the Minute of Discussions of Explanation on the Draft Final Report.

Table 2-26 Estimated Necessary Cost by RCB

Unit: 1,000 RP

Item	2004	2005	2006	2007	2008	Total
1. Operating Cost for Facilities and Equipment			1,705,195	1,996,174	2,348,125	6,049,494
(1) Electricity Cost	-	-	945,472	1,134,567	1,361,480	3,441,519
(2) Telephone Cost	-	-	64,800	97,200	145,800	307,800
(3) LPG Gas Cost	-	-	6,480	7,120	7,830	21,430
(4) Equipment Consumables	-	-	688,443	757,287	833,015	2,278,745
2. Maintenance Cost			522,000	626,400	751,680	1,900,080
(1) Facilities	-	-	270,000	324,000	388,800	982,800
(2) Utilities	-	-	240,000	288,000	345,600	873,600
(3) Lift	-	-	12,000	14,400	17,280	43,680
1+2 Total			2,227,195	2,622,574	3,099,805	7,949,574
3. Construction Cost by Indonesian Side	635,000	452,695	1,670,500	0	0	2,758,195
4. Restoration and Transfer Cost (Botany)	4,382,418	4,382,418	1,732,274	4,581,511		15,078,621
(1) Personnel Cost	467,974	467,974	214,274	214,274	-	1,364,496
(2) Equipment and Supplies Cost	3,914,444	3,914,444	-	3,355,237	-	11,184,125
(3) Transfer Cost	-	-	1,518,000	1,012,000	-	2,530,000
5. Restoration and Transfer Cost (microbiology)	209,000	486,500	1,956,650	0	0	2,652,150
(1) Personnel Cost	24,000	24,000	24,000	-	-	72,000
(2) Equipment and Supplies Cost	185,000	462,500	92,650	-	-	740,150
(3) Transfer Cost	-	-	1,840,000	-	-	1,840,000
4+5 Total	4,591,418	4,868,918	3,688,924	4,581,511	0	17,730,771
Total	5,226,418	5,321,613	7,586,619	7,204,085	3,099,805	28,438,540

1) Restoration Cost

Fiscal 2003

As already half of the fiscal year has passed, it is difficult to obtain new budgetary allocation. The necessary funding will, therefore, be made from the current budget of the RCB. At present, the RCB has a stock of 44,000 mounting boards. However, the procurement of mounting tape and genus covers is still necessary.

2) Transfer Cost

For reference, some Rp 1,290,000,000 was secured from the central government budget in Indonesia to cover the entire transfer cost, including the personnel cost, when the zoological specimens were transferred.

2.2 Basic Design of Requested Japanese Assistance

2.2.1 Design Policies

2.2.1.1 Opposition to Relocation to Cibinong

Some researchers of RCB and in overseas have oppositions to relocation to Cibinong, and the opposition consists of three major reasons.

(1) The Herbarium Bogoriense and the Bogor Botanical Garden are located closely, it is very convenient for research activity, because comparison of actual plants and specimens is easy.

(2) If the maintenance budget is enough, the specimens stored in rooms with air-conditioning is best. However, the Indonesian Government will not allocate enough budget, and the air-conditioning of the rooms will be stopped due to shortage of maintenance budget, and the specimens will be damaged. Therefore, the existing preservation method is appropriate in Indonesia.

(3) The transportation to Cibinong could damage many specimens which cannot withstand transportation.

The above opposition was appeared at the basic design study, and the second basic design study team was dispatched to evaluate the above oppositions in academic and technical aspect. The second basic design study team member is referred to Appendix 1.

The following basic design policies are formulated with the result of the second basic design study.

2.2.1.2 Basic Design Policies

(1) Policy Regarding Scope of Assistance

While the RCB has the obligation to conduct basic research for the conservation and utilization of biodiversity as a scientific research organization for conservation of the biodiversity in Indonesia, the research facilities of its RCB are insufficient and are dispersed at two sites of Bogor and Cibinong. The integration of these facilities at one site together with the Zoology Division and modernisation of the facilities to promote the required interdisciplinary biological research is essential.

Three types of facilities have been requested for the Botany and Microbiology Divisions, i.e. research facilities, storage facilities for botanical specimens to support research and facilities for environmental education. These three facilities have strong necessity to execute RCB's task for (1) interdisciplinary biological research by three Divisions, (2) basic research on the conservation and utilization of biodiversity, (3) a long period preservation in an environment of an international standard and (4) strengthening the environmental education and public awareness activities, targeting the people of Indonesia, and have also urgency to support promotion of "development in the natural resources and environment sector" under the National Development Plan (PROPENAS 2000 – 2004)".

Based on the above, the policy for the scope of assistance is to include ① research facilities with functions capable of conducting the necessary basic research, ② botanical specimen storage facilities capable of storing such specimens in good condition in an environment of an international standard and ③ the minimum facilities for environmental education while examining the scale of these facilities which can be maintained by Indonesia without external assistance.

(2) Policy for Site Selection

The site proposed by Indonesia is situated on the premises of the LIPI Life Science Centre (CSC) at Cibinong and there is a consensus regarding the selection of this site within the LIPI and the RCB. As a number of research advantages associated with this planned relocation have been appraised by the second basic design study team, this site will be examined as the site for the new facilities to be constructed under the Project.

The reasons for the site's selection given by the LIPI, the appraisal by the second basic design study team and the formation of the consensus are further described below.

1) Reasons for Site Selection Given by LIPI

① The site is in line with the plan decided by the Government of Indonesia in the early 1960's to concentrate research facilities at the CSC premises.

② It is practically impossible to rehabilitate the Herbarium Bogoriense and the Treub Laboratory to meet future research requirements because of the lack of building drawings and structural restriction for building rehabilitation work.

③ As the Bogor Botanical Garden is a place for the planting of herbs and trees, etc., the construction of new buildings will have adverse impacts on plants in the surrounding area. The construction of such facilities at the site of the Garden should also be avoided in security reason because of the presence of many visitors.

④ The LIPI lacks sufficient funds to purchase new land in Bogor.

2) Positive Effects of Transfer as Conceived by RCB

① The facilities of the Botany Division and the Microbiology Division are located at two different sites, making the implementation of joint research by the divisions difficult. The centralised location of these divisions as well as the Zoology Division will make it possible to the divisions to conduct collaborated biological research.

② As researchers have access to the Botanical Garden when necessary, there is no special need for the new facilities to be adjacent to the Botanical Garden. It is planned to create botanical gardens in Cibinong for research purposes and no difficulties are anticipated in regard to the creation of such gardens.

③ Even if the Herbarium is relocated to Cibinong, its herbarium abbreviation "BO" will remain unchanged.

④ The concentration of all research facilities at a single site will enable the joint use of research equipment.

⑤ The specimens will be stored in international standard conditions at the new facilities.

⑥ As Cibinong is not far from Bogor, the new site at Cibinong will not hinder collaboration research with external research organizations.

⑦ The Microbiology Division is currently situated some distance from the Biotechnology Centre which is an inconvenience for the research by both institutions. Its relocation to the CSC premises will facilitate collaboration research.

⑧ The relationship with other research organizations in Bogor, including the Bogor Agricultural Institute, will not be adversely affected by the relocation as all organizations require one another regardless of the geographical distance. The Bogor Agricultural Institute is planned to relocate to the suburbs of Bogor.

3) Approval of Selected Site by the Second Basic Design Study Team

In view of the recent trends and forms of botanical research, the separation of the herbarium and research facilities from the botanical garden will have few disadvantages. In fact, there are many advantages in terms of facilitating academic research by concentrating botanical, microbiological and zoological research facilities which are very closely related from the viewpoint of ecology. Moreover, the concentration of the said facilities is significant for the future implementation of educational facilities by the LIPI regarding the conservation of biodiversity.

4) Consensus for Relocation

A number of meetings were held by the Botany Division and the Microbiology Division to achieve a consensus for the relocation to Cibinong. Even there concern regarding possible damage to the specimens due to their transportation and shortage of maintenance cost were expressed by some staff members, such concern subsided in the process of the discussions to achieve a consensus. Moreover, a draft of basic design was displayed and explained to staff member of both divisions around the explanation on the draft final report. The RCB believes that it is necessary to continually and widely publicise the planned relocation at home and abroad, including universities in Indonesia, and is considering the use of a poster in English and Indonesian to publicise the relocation in addition to a website.

(3) Policies for Facilities

1) Enhancement of Collaboration with the Zoology Division Building

The new facilities of the Botany Division and the Microbiology Division will be planned as near as possible to the Zoology Division Building to enable interdisciplinary basic research on the conservation and utilization of biodiversity, which is a duty of the RCB, by these three research divisions of the RCB.

2) Integration of Facilities of Botany and Microbiology Division in Single Building and Shared Use of Facilities

If the facilities of the Botany Division and the Microbiology Division are planned separately, duplications will occur. To avoid such duplications to achieve the minimum but sufficient scale of the facilities, the facilities of these two divisions will be accommodated in a single building so that the entrance hall, meeting rooms, library, canteen and workshop can be shared.

3) Scale of Facilities Conforming to Research Activity Plan

The scale of the planned facilities will be the minimum but sufficient scale based on analysis of the current research activities and the feasibility of planned activities in the future by the Botany Division and the Microbiology Division so that the new facilities are not excessively large, resulting in a low usage rate.

4) Minimisation of Insect Damage in Herbarium

As the life span of a specimen is determined by the level of insect damage, the herbarium will be designed so as to prevent the entry, of insects, including those attached to the clothes and shoes of researchers, as much as possible.

5) Scale and Contents of Facilities for Which Operation and Maintenance Budget Can be Secured

① Natural ventilation will be effectively used while the areas subject to air-conditioning will be restricted to reduce the running and maintenance cost so that the necessary operation and maintenance can be secured for a long period of time.

② A separate air-conditioning unit will be installed in those rooms which require air-conditioning so that air-conditioning is only operated in those rooms which require air-conditioning at a given time.

③ The dry and spirit collection rooms where continuous air-conditioning is required for the storage of specimens in an environment of an international standard will have the minimum room volume together with the adoption of measures to reduce the adverse impacts of solar radiation in order to minimise the cost of air-conditioning.

6) Appropriate Facility Layout

The planned facilities can be classified into three types, i.e. administration and information service facilities which are busy with visitors, research facilities where an environment to be concentrated easily on research work is required and collection rooms where the minimum contact with people for protection of insect damage must be maintained. Accordingly, all of the facilities will be positioned to achieve these objectives while smoothly performing their respective functions.

(4) Policy on Equipment Planning

1） The priority list of requested equipment, which will be used for equipment plan, shall be prepared.

The priority list of equipment including additional request presented at the time of discussion among both parties shall be prepared by Indonesian side and used for equipment plan.

2) The relation between RCB's level such as the research themes and the capacity and level of the research groups and researchers, and the requested equipment shall be aligned for equipment plan.

The research themes and results in each research group and researcher shall be assessed and the relation between their operation and maintenance capacity and level, and the contents of equipment shall be studied.

3) The existing equipment shall be included in the design for the economical plan.

The equipment to be transferred from the existing facilities shall be studied on the point of contents and conditions and the usable equipment will be included in the design.

4) The equipment which needs the high cost on consumables and operation shall be studied in the relation with the budget and capacity of Indonesian side.

The past expenditure in RCB will be assessed and the current and future budget will be studied. The increasing budget after the implementation of this project will be compared with the scheduled budget by Indonesian side.

5) The chemicals, consumables and spare parts basically will be excluded.

The procurement of the chemicals, consumables and spare parts should be continued every year so the necessary budge shall be prepared by Indonesian side.

6) High grade analytical equipment and the equipment which needs the high technology and high level maintenance will be studied based on the operation and maintenance capacity, necessity and budget of Indonesian side.

High cost and high performance analytical equipment basically will be excluded unless the necessity will be studied well and the possibility of substitution by other equipment will be considered. At the same time the solvency of the Indonesian side will be assessed.

7) The quantity of each equipment will be kept at a minimum depending on the necessity.

The number of researchers in each laboratory, the utilization method and frequency of equipment will be studied and used for design of minimum quantity.

8) The equipment which can be used commonly will be adjusted on quantity in terms of common use.

The quantity of equipment used commonly will be basically 1(one) and the utilization method will be studied to avoid the trouble among laboratories.

9) The contents and quantities of equipment will be studied as to its conformity on facility plan.

The facility space is not unlimited so the equipment scale will be designed within the available space.

10) The equipment to be considered shall be consistent with the available utilities.

The necessary electric capacity will be studied with the utilization method of equipment to avoid the overestimation.

2.2.1.3 Planned Components of Facilities

Based on the activity plan formulated by the Indonesian side, the confirmed contents of the requested facilities and the results of the survey on the existing facilities, the facilities required to implement the activity plan, except for such common spaces as the entrance hall, corridors, staircases, toilets, general storages, machine room and electrical room, consist of facilities which are shared by the two divisions, such as the meeting room and library, administration and research facilities of the Botany and Microbiology Divisions, educational facilities and such external facilities as greenhouses.

The required floor area of each facility is in the table below. The required floor area shown in the table below may well change depending on the actual span of the columns to be adopted for the floor planning for the new facilities.

Table 2-27 Required Facility/Room and Floor Area

Facility/Room	Required Floor Area (m^2)
1. Common Use Rooms for Both Divisions	1,080
2. Facilities for Botany Division	
① Administration Section	60
② Research Section	5,672
a. Staff and Technician Rooms	864
b. Phytochemistry	132
c. Plant Physiology	336
d. Anatomy and Morphogenerics	156
e. Taxonomy (including Herbarium)	3,980
f. Ecology	96
g. Ethnobotany	36
h. Common Equipment Room	72
③ Others	110
④ Annex	215
Botany Division Total	6,057
3. Facilities for Microbiology Division	
① Administration Section	60
② Research Section	1,044
a. Staff and Technician Rooms	444
b. Ecology and Physiology	144
c. Applied Microbiology and Developmental	84
d. Biosystematics and Generics	168
e. Microbial Biochemistry	96
f. Common Equipment Room	108
Microbiology Division Total	1,104
4. Environmental Education Facilities	150
Grand Total	8,391

Required Facilities: External Greenhouses

Division	Required Floor Area (m^2)
Botany Division	185
Microbiology Division	200
Total	385

(1) Required Facilities and Their Purpose of Use

The planned purpose of use, contents and floor area of each facility (room) are described in more detail next.

1) Common Use Rooms

The originally requested use rooms for the Botany Division and the Microbiology Division will become common use rooms where possible to ensure the planning of facilities of a suitable scale and also to reduce the maintenance cost.

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
C-1	Large Meeting Room	1	200	100 staff accommodation. For the botany division meeting (103 staff、once per month) and the microbiology division meeting (48staff、once per month), seminar, Study Tour and open house, etc. Dividing 2 rooms by movable petition. New tables, chairs and movable audio visual equipment equips.
C-2	Meeting Room-1	1	80	40 staff accommodation. The botany research group can accommodate (40 staff). For meeting of research group of both division. New tables and chairs equips.
C-3	Meeting Room-2	1	40	20 staff accommodation. For meeting of research group of both division and reception of guest. New tables and chairs equips
C-4	Pray Room	2	Total 50	Pray for Muslims' staff. 25 ㎡ x 2 rooms (for men and women)
C-5	Canteen	1	200	There is no restaurant in CSC. A staff canteen is planned same as the zoology division building that is daily used by staff. 80 staff accommodation for two cycle of 161 staff of both division. New simple kitchen and equipment, table and chairs equips.
C-6	Library	1	480	Common use by both division.
	Book Storage	(1)	(360)	Layout of the existing compactors (book shelf) for books of both division (botany 18,200 and microbiology 8,400 books) and book shelf (7,200 books). New compactors for Kuswata collection of 15,500 books equips. The existing map drawers are planned to transfer.
	Reading Room	(1)	(120)	Layout of the existing reading desks and chairs for 20 persons, the existing 7 librarian desks and chairs and copy machine, etc. are planned to transfer.
C-7	Repairing Workshop	1	30	Simple repairing instrument and making support material for research. The existing equipment and furniture are planned to transfer.
	Total		1,080	

2) Botany Division Facility

① Administration Section

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
BA-1	Division Head Room	1	30	Same room size as head of the zoology division building. The existing furniture is planned to transfer.
BA-2	Administrative Office	1	30	3 staff accommodation.10 ㎡ for one person including cabinet space. The existing furniture is planned to transfer.
	Total		60	

② Research Section

a. Staff and Technician Rooms

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
BS-1	Staff Room	76	(each 9) Total 684	Separate staff room and laboratory for safety of research staff and possible to concentrate study. Private staff room is planned as same size as the zoology division building and requested by the Indonesian side. The staff rooms are positioned near laboratories for convenient research. 76 rooms is planned for 1 guest researchers＋74 present division staff＋1 new recruit. New desks and chairs equip.

BS-2	Technician Room	1	180	Common use type rooms for 29 technicians. Technician supports research for preparation and assistant of researcher. The room is positioned near by each research group laboratory. New desks and chairs equip. some 6 ㎡ for one person.
	Total		864	

b. Phytochemistry Group

- Research Themes
- Extraction of medicinal substances from plants
- Interaction between plants and soil microbes, such as mycorrhiza

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
B1-1	Laboratory Ⅰ (Natural Product)	1	48	Extraction of medicinal substances from plants. Interaction between plants and soil microbes, such as mychorrhizal fungi
B1-2	Laboratory Ⅱ (Bio-Organic Science)	1	48	
B1-3	LaboratoryⅢ(Bio-Assay)	1	36	
	Total		132	

c. Plant Physiology Group

This group is further divided into the Plant Cell and Tissue Culture Sub-Group and the Stress Physiology and Macro Propagation Sub-Group to pursue the following research themes.

- Research Themes
- Plant Cell and Tissue Culture Sub-Group:
  Propagation of rare species by means of tissue culture, etc.
- Stress Physiology and Macro Propagation Sub-Group:
  Interaction between environmental stress and plant growth/physiological processes

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
Plant Cell & Tissue Culture				
B2-1	Cryo-Room	1	24	Culture in liquid nitrogen
B2-2	Wet Processing Room	1	24	Preparation of media, and storing instrument, glass ware, etc. Installation of washing sinks.
B2-3	Plant Cell & Tissue Culture laboratory	1	48	Inoculation of plant tissue using clean bench. Media stores in cabinet. Preparation of media, and storing instrument, glass ware, etc.
B2-4	Common Optics Room	1	36	Installation of common use Microscope
B2-5	Culture Room (high temp)	1	36	Culture in high temperature (25-32℃)
B2-6	Culture Room (low temp)	1	36	Culture in low temperature(18-23℃)
	Sub-Total		204	
Stress Physiology & Macro Propagation				
B3-1	Stress Physiology Laboratory	1	48	Research of growth of plant with environmental stress such as water and weather, etc.
B3-2	Macro Propagation Laboratory	1	48	Research of Macro Propagation of seeds
B3-3	Preparation Room	1	36	Installation of common use equipment
	Sub-Total		132	
	Total		336	

d. Anatomy and Morphogenetic Group

This group is further divided into the Plant Genetic Sub-Group, Plant Morphology Sub-Group and Anatomy and Cytology Sub-Group to pursue the following research themes.

- Research Themes
- An anatomical and cytological studies of plant to support taxonomical study and phylogenetic analysis.
- Anatomy and morphological study of parasitic plants.
- Genetic improvement of rare, endangered and important plants.
- Pollination process study and artificial pollination of rare plants to improve the genetic diversity of the rare plants.

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
Plant Genetic				
B4-1	Plant Genetic Laboratory	1	48	Research of biodiversity of plant genetic
B4-2	Culture and Equipment Room	1	36	Culture room and installation of Precision Instrument
	Sub-Total		84	
Plant Morphology, Anatomy & Cytology				
B5-1	Plant Morphology, Anatomy & Cytology Laboratory	1	72	Research on morphology and propagation of parasitic plants Preparation of media, and storing instrument, glass ware, etc.
	Sub-Total		72	
Total			156	

e. Taxonomy Group

This group is engaged in research on biosystematics, chemotaxonomy, molecular systematics and cryptogamae and also manages the herbarium.

- Research Themes
- Systematic and phylogenetic study of plants (Lauraceae, Bambusoideae, Sapotaceae, Annonaceae, Balsaminaceae, Begoniaceae, Rutaceae, Arecaceae, Orchidaceae, Dipterocarpaceae, Araliaceae, Rafflesiaceae, Fabaceae, Myrtaceae, Burseraceae, Myrsinaceae, Cucurbitaceae, Bryophytes, Fern, Lichens, Ecto mycorrhiza, Endo mycorrhiza) in the Malesian region based on morphology, anatomy, chemotaxonomy, molecular, cytology.
- Genetic diversity study and biogeography study on Dipterocarpaceae, Fagaceae, Bambusoideae, Cucurbitaceae, Araliaceae using DNA.
- Floristic study in the protected areas and small islands to fill the ecosystem study.

- Necessary Rooms

  Necessary rooms is planned in accordance with specimen processing and maintenance flow.

- Dry specimen processing flow:
  collecting → drying → identification → labelling → mounting → freezing → thawing → registration (data input) → storage in collection
- Dry specimen maintenance flow:
  collection storage → killing insect (freezing/fumigation) → storage in collection

- Spirit collection processing flow:
  collecting → identification → labelling → bottling → sealing → registration (data input) → storage in collection

- Increasing number of specimens:
  The number of specimens has been increasing each year and the scale of the new facilities will be large enough to accommodate new specimens for the next 10 years as in the case of the Zoology Division building.

Table 2-28 Annual Averaged and Total of Increasing Specimens

Type of Specimens	Averaged Annual Increasing Specimens	Total Number of Increasing in 10 years
Ordinary Dry Specimen	4,000	40,000
Reference Collection	1,000	10,000
Voucher Collection	4,000	40,000
Cyrptobamae Collection	1,000	10,000
Carpology & Seed Collection	100	1,000
Spirit Collection	200	2,000

Herbarium

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
Dry Specimens				
H-1	Processing Room	1	30	Unpacking collected plants and keeping it for next process. To dry plant with suction paper
H-2	Drying Room	1	30	After drying with suction paper, insert plant in dryer.
H-3	Labelling Room	1	25	Making label of specimen using personal computer, and sealing label. Label cutter is installed.
H-4	Identification Storage	1	50	Keeping specimen before identification.
H-5	Mounting Room	1	80	Mounting specimen on mounting board, and insert folder. 8 mountors will work. 10 ㎡ for one person including cabinet space.
H-6	Freezing Room	1	15	Killing insect of dry specimen in －30℃ freezer for 4-5 days.
H-7	Thawing Room	1	15	Thawing after freezing with low humidity by air-con. and dehumidifier.
H-8	Fumigation Room	1	15	A specimen cabinet or some volume of specimens at insect found will be fumigate for killing insect. This method is cheaper running cost than freezer.
H-9	Packing & Unpacking Room	1	90	Temporary keeping of specimens from outer researches, and packing and unpacking loan and exchanged specimens.
H-10	LIFT	1		Carrying specimens from freezer to collection storage after killing insect, and carrying specimens and cabinet from collection storage to freezer and fumigation room for killing insect. The lift is for specimen carrying exclusive.
H-11	Biosystematic Laboratory	2	(each 60) 120	Identifying specimen using microscope and the existing specimens, etc. by 10-12 researchers.
H-12	Date Base / In-put Room	1	36+36	Preparation of database of botany using 7-8 computers.
	Sub-Total		542	
H-13	Cyrptogamae Collection	1	120	Storing several kind of dry specimens. Dry specimens are increasing 4,000 annually, and space for increasing specimens for 10 years is planned. Layout of the existing GEF cabinets, and some numbers of new cabinets. Air- conditioning equips. New tables and chairs are planned for studying in collection storage.
H-14	Fern/Gymnospermae Collection	1	270	
H-15	Monocot Collection	1	510	
H-16	Dicotyledonae Ⅰ	1	750	
H-17	Dicotyledonae Ⅱ	1	750	
H-18	Type Collection	1	150	Type specimens is most important specimens and store in GEF cabinets. Air- conditioning equips. New one set of table and

				chair is planned for studying.
H-19	Unprocessed Room (Back Log)	1	120	Storing unprocessed specimens such as un-identify and un-mounting. 100,000 specimens will be stored as backlog.
	Sub-Total		2,670	
Spirit Collection				
H-20	Spirit Processing Room	1	30	Bottling specimens with ethanol, and sealing of cap with paraffin. Using burner for sealing.
H-21	Spirit Biosystematic Laboratory	1	30	Identifying specimen using microscope and the existing specimens, etc.
H-22	Data In-put Room	1	15	Input the specimens data using two computers.
H-23	Spirit Collection	1	220	Storing several kind of spirit collection in compactor. Space for increasing 2,000 collections for next 10 years is planned. Air-conditioning system equips.
	Sub-Total		295	
Carpology, Seed and Xylarium Collection				
H-24	Carpology Biosystematic Laboratory	1	30	Identifying specimen using microscope and the existing specimens, etc.
H-25	Carpology & Seed, Xylarium Collection	1	140	Storing several specimens in cabinets. Space for the existing Carpology & Seed 7,800 and increasing 1,000 specimens for next 10 years is planned. Storing existing Xylarium 1,000 specimens in Racks. New specimens is not planned. Air-conditioning system equips.
	Sub-Total		170	
Voucher Collection				
H-26	Ecology Collection	1	35	Specimens for research evidence of collected date, place and data. It will keep for Max. 5 years (research output awareness) in cabinet. Increasing specimens and destruction in every year, the existing number 30,000 storing without increasing. Air-conditioning system equips.
H-27	Ethnobotany Collection	1	35	
	Sub-Total		70	
Reference Collection				
H-28	Reference Collection	1	30	Visitor study specimens as un-mounting condition and installed in file as book. The existing 5,000 plus increasing 10,000 for next 10 years is planned. The existing study chair is planned to transfer.
	Sub-Total		30	
Drawing Collection and Others				
H-29	Drawing Room	1	30	Two illustrators draw specimen's illustrations.
H-30	Slide/Drawing Collection	1	45	Installation of existing 1 slide cabinet, 2 illustration drawers, 50 catalogue specimen cabinets
H-31	Video Processing Room	1	20	Processing video tape for specimen information and environmental education information
	Sub-Total		95	
Other Laboratory				
B8-1	Chemotaxonomy Laboratory	1	-	Researching plant Chemotaxonomy Only equipment is planned in Laboratory BI-2.
B9-1	Molecular Systematics Laboratory	1	72	Researching plant Molecular Systematics. Including dark laboratory.
B10-1	Cryptogamae Laboratory	1	36	Researching Cryptogamae
	Sub-Total		108	
Total			3,980	

f. Ecology Group

- Research Themes

- Dynamics of ecosystems in protected areas and small islands which are important in terms of conservation (structure, inter-relationships)
- Monitoring of typical forest ecosystems (analysis of the growth and regeneration system at Mt. Halimun, etc.)

- Research in important species at population level (mechanism for the enlargement of distribution and other topics)
- Forest restoration process from forest fire, etc.
- Dynamics of seed bank
- Mapping of ecosystems in protected areas, etc.
- Nutrient cycles in the ecosystems (nitrogen, etc.)

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
B12-1	Soil & Plant Litter Laboratory	1	36	Researching Dynamics of buried seeds
B12-2	Plant Ecology Laboratory	1	60	Researching material cycle in the ecosystem
	Total		96	

g. Ethnobotany Group

- Research Themes
- Accumulation and analysis of indigenous knowledge on the traditional use of plants for medicines and dying purposes, etc. by locality and ethnic group

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
B13-1	Ethnobotany Laboratory	1	36	Research and analysis of knowledge on the traditional methods of use of plants as medicines and dyes
	Total		36	

h. Common Equipment Room

High grade analytical equipment will be planned as common use of Botany Division.

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
B14-1	Common Instrument Room 1	1	36	Installation of common use equipment such as freeze dryer, HPLC, AAS, GC-MS/MS, analytical balance etc.
B15-2	Common Instrument Room 2	1	36	
	Total		36	

③ Others

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
BO-1	Specimen Material Storage	1	50	Storing mounting boards and folders for dry specimens
BO-2	Glass Bottle Storage	1	20	Storing bottles for spirit collection
BO-3	Field Equipment Storage	1	20	Storing field equipment
BO-4	Office Equipment Storage	1	20	Storing office consumables and equipment
	Total		110	

④ External Facility

a. Annex

Rooms where are used soil and etc. is planned as an annex separately to protect contamination of laboratories at research facility.

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
A-1	Plant Preparation Room	1	50	Preparation of planting to green houses and germination room. Common use by both division and planned at outside.
A-2	Germination Room	1	15	Germination for cutting plant. Room condition shall be same as outer. Wall and windows are planned.
A-3	Animal Room /Simplisia Starage	1	40	Animal room for Phytochemistry research. Several animals in gauges on shelf. Anti-smell measurement is necessary. Storing about 200 collected leaves, trunks, roots for research.
A-4	Dry Chemical Storage	1	30	Storing dry chemicals for laboratory
A-5	Wet Chemical Storage	1	30	Storing wet chemicals for laboratory
A-6	Fertiliser Storage	1	30	Storing fertiliser for planting in green house
A-7	Waste Goods Storage	3	Total 20	Three temporary storage for toxic liquid and bio-waste and ordinary waste from laboratory. Toxic liquid and bio-waste will treated by outer agents.
	Total		215	

b. Green House

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
G-1	Plant Genetics	1	60	For planting with glass roof, wall mesh and concrete planting table.
G-2	Stress Physiology & Macro Propagation	2	(each 30) 60	For planting with glass roof, wall mesh and concrete planting table under natural climate.
G-3	Plant Cell & Tissue Culture	1	30	For planting with glass roof, wall mesh and concrete planting table.
G-4	Plant Ecology	1	20	For planting seeds in collected soil under natural climate. Double wall net, water outlets, concrete table equips.
G-5	Cryptogamae	1	15	Glass roof, double wall net, water outlets, concrete table equips.
	Total		185	

c. Others

No.	Room Name	Room Nos.	Required Floor Area (m^2)	Planned Purpose of Use and Contents
O-1	Drying Floor	1	20	For drying plants for research under natural climate
O-2	Concrete Bench	2	(each 20) 40	Mist control instrument is not planned because of difficulty of maintenance. Mist control equips by Indonesian side. For cutting plant growth.
	Total		60	

2) Microbiology Division

① Administration Section

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
MA-1	Division Head Room	1	30	Same room size as head of the zoology division building. The existing furniture is planned to transfer.
MA-2	Administrative Office	1	30	3 staff accommodation.10 ㎡ for one person including cabinet space. The existing furniture is planned to transfer.
	Total		60	

② Research Section

a. Staff and Technician Rooms

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
MS-1	Staff Room	44	(each 9) 396	Separate staff room and laboratory for safety of staff and possible to concentrate study. Private staff room is planned as same size as the zoology division building and requested by the Indonesian side. The staff rooms are positioned near laboratories for convenient research. 44 rooms is planned for 3 guest researchers＋40 present division staff＋1 new recruit. New tables and chairs equip.
MS-2	Technician Room	1	48	Common use type room for 8 technicians. Technician supports research for preparation and assistant of researcher. The room is positioned near by each research group laboratory. New tables and chairs equip. 6 ㎡ for one person.
	Total		444	

b. Ecology and Physiology Group

- Research Themes

- Relationship between the diversity of soil microbes and the ecosystem (species diversity; ecological and genetic characteristics)
- Relationships between functions of soil microbes and ecosystems (soil microbes and nutrient cycle; symbiosis with plants)
- Application of microbial functions (fertilisation of soil and weste water treatment. etc.)

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
M1-1	Ecology Laboratory	1	48	Researching functions and ecosystem of soil microbes
M1-2	Physiology Laboratory	1	48	Researching physiology of microbes and application of microbial functions
M1-3	Ecology / Physiology Preparation Room	1	48	Researching resolution capability for waste water by bacteria, etc. Preparation of media, and storing instrument, glass ware, etc.
	Total		144	

c. Applied Microbiology and Developmental Group

- Research Themes

- Extraction of useful substances from traditional fermented foods (extraction of medicinal constituents and isolation of ferment bacilli, etc.)

- Development of agricultural production materials (refinement of fungi and the composting process of litters, etc.)

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
M2-1	Applied Microbiology Laboratory	1	48	Extraction of useful substances from traditional fermented foods. Development of materials for agricultural production such as mushroom.
M2-2	Distillation /Fermentation	1	36	
	Total		84	

d. Biosystematics and Generics Group

- Research Themes
- Understanding of the diversity of microbes (identification of nitrogen fixing bacteria, identification of yeast in protected areas and understanding of their genetic characteristics, etc.)
- Understanding of the application potential of microbes functions (resistance to true fungi as a measure to prevent crop diseases; anti-active oxygen enzymes of yeast fungi)
- Development of cultured specimens

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
M3-1	Genetic Laboratory	1	48	Researching the prospect of the applied use of microbes genetics
M3-2	Genetic Instrument Room	1	36	Installation of precision equipment as common use
M3-3	Isolation/Preservation Room	1	36	Three isolation rooms for bacteria, yeast, mold. Ante room is necessary for buffer.
M3-4	Processing Room	1	48	Data base for culture collections. Genetics group developed data base for collection. Installation of equipment for frozen-dries collections. LPG gas using to insert dried collection in ampoules.
	Total		168	

e. Microbial Biochemistry Group

- Research Themes
- Clarification and improvement of the traditional fermentation process (identification of yeast for soy beans and their genetic characteristics; biological extraction of palm oil)
- Application of microbes to biosynthesis (living activated glycoside and proteolytic enzymes, etc.)

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
M4-1	Bio-processing Room	1	48	Researching production process. Testing production samples. Preparation of media.
M4-2	Inoculation / Cool Working Room	1	48	Inoculation of plant tissue using clean bench. Ante room is necessary for buffer. Working in Cold Room 4-9℃.
	Total		96	

f. Common Equipment Room

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
M5-1	Common Room (Analytical Equipment 1)	1	48	Installation of common use equipment for microbiology division.
M5-2	Common Room (Analytical Equipment 2)	1	24	Installation of common use equipment for microbiology division.
M5-3	Common Equipment Room	1	36	Installation of common use equipment for microbiology division.
	Total		108	

② External Facility

a. Annex (Indonesian side work)

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
Applied	Mushroom House	1	9	For sample mushroom product. Restriction of sunlight, room temperature 28-30℃, humidity 80-90% is required. Transfer the existing room as the Indonesian side work, because it is difficult to secure the required conditions.

b. Green House

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
G-6	Ecology and Physiology	2	(each 100) 200	Researching plant that was inserted microbes. Dividing two houses for growth and anti-pest. Installation plant pots on concrete bench.
	Total		200	

3) Environmental Education

RCB plans to appoint a staff of sub-division of Cooperation and Services, Division of Administration to station at the Center as permanent staff. RCB also established a committee to support activity of the Center, which is consisted of representatives of each research division.

No.	Room Name	Room Nos.	Required Floor Area (㎡)	Planned Purpose of Use and Contents
I-1	Information Center	1	150	Providing information of biodiversity and RCB's activities with specimens display, books, video, internet, etc. Including specimen trial making and meeting space.
	Total		150	

2.2.1.4 Planned Component of Equipment

The equipment components are as follows;

(1) Botany Division

①	Phytochemistry research of Phytochemistry group Equipment for Natural product laboratory, Bio-Organic Science laboratory and Bio Assay laboratory
②	Plant Cell & Tissue Culture research of Plant Physiology group Equipment for Plant cell & tissue culture laboratory, Common optics room, Two(2) Culture rooms of high and low temperature, Wet processing room, Cryo storage room)
③	Stress Physiology research of Plant Physiology group Equipment for Stress physiology laboratory, Macro Propagation laboratory and Preparation room
④	Plant Genetic research of Anatomy and Morphogenetic group Equipment for Plant genetic laboratory, Culture/Equipment room
⑤	Plant Morphology, Anatomy and Cytology laboratory of Anatomy and Morphogenetic group 1) Equipment for Cytology research 2) Equipment for Plant Morphology and Anatomy research
⑥	Biosystematics research of Taxonomy group Equipment for Biosystematics laboratory I, II
⑦	Chemotaxonomy research of Taxonomy group (installed into Plant Cell & Tissue Culture laboratory, Plant Physiology group) Equipment for Chemotaxonomy research
⑧	Molecular Systematics research of Taxonomy group Equipment for Molecular Systematics laboratory
⑨	Cryptogamae research of Taxonomy group Equipment for Cryptogamae laboratory
⑩	Plant Ecology research of Ecology group Equipment for Soil and Plant Litter laboratory
⑪	Ethnolobotany research of Ethnobotany group Equipment for Ethnolobotany laboratory
⑫	Herbarium Equipment for restoration of plant dry and wet specimens
⑬	Field Equipment Equipment for field survey
⑯	Video Processing room
⑰	Drawing room
⑱	Common Equipment room Equipment for Analytical equipment room I & II

(2) Microbiology Division

①	Ecology and Physiology group Equipment for Ecology laboratory, Physiology laboratory and Ecology/Physiology preparation room
②	Applied Microbiology & Development group Equipment for Applied Microbiology laboratory, Distillation/Fermentation room
③	Biosystematics & Genetics group Equipment for Genetic laboratory, Genetic Instrument room, Isolation/Preservation room and Processing room
④	Microbial Biochemistry group Equipment for Microbial Biochemistry laboratory and Inoculation/Cool working room

⑤ Common Equipment room Equipment for Analytical equipment room I, II and Common equipment room

(3) Meeting room, experimental tables and etc.,

① Meeting room Audio visual equipment for meeting room
② Library Equipment for Library
③ Information Center Equipment for Information Center
④ Experimental tables, etc., Experimental tables and etc., for laboratories

2.2.1.5 Policies Regarding Natural Conditions

(1) Temperature and Solar Radiation

According to meteorological data from 1997 to 2002, the mean annual, maximum and minimum temperatures at Cibinong are 26.6°C, 27.1°C (September) and 25.8°C (January) respectively, indicating high temperatures throughout the year. The mean annual wind velocity is 2.1 m. The findings of the interview survey at the Zoology Division building suggest that the natural ventilation in the research staff rooms, etc. where no air-conditioning system is installed is quite sufficient. In view of this fact, natural ventilation will be adopted for all of the facilities except the herbarium, laboratories and library, etc. which require air-conditioning to fully perform their functions. Given the strong solar radiation, cavity wall construction with shielding louvres and long eaves will be adopted as in the case of the zoology division building to ensure effective natural ventilation or air-conditioning.

(2) Rainfall

According to the same meteorological data cited above, the annual rainfall at Cibinong is 2,684 mm, of which 63% falls in the rainy season from October to March. The planned site is slightly above or level to the adjacent roads and has drainage facilities to the north, south and west. Accordingly, it is unlikely that rainwater invades the site from outside.

Within the site, the southeastern part facing the road to the east is the highest and the ground dips towards the northwestern corner from there. Using this natural inclination, it is planned to collect rainwater in the drainage ditches to the north, south and west for its drainage to a pond in the northwestern corner. It will be necessary to drain rainwater from around the building away from the building and, therefore, the first floor level of the building will be planned 30 cm higher than the present ground level to ensure the smooth drainage of rainwater around the building.

(3) Lightning

Lightning frequently occurs in the area where the site is located and, therefore, an arrester or similar will be installed to prevent damage to the facilities. In addition, a measure to prevent stray current will be planned in order to prevent damage to electronic equipment by stray current associated with lightning.

(4) Earthquakes

As 11 earthquakes have been observed in Bogor in a period of 29 years up to 2003, an aseismatic design is planned in line with the structural design standards in Indonesia.

(5) Ground Subsidence

The geological survey at the site found that the permissible bearing strength of the clay layer containing silt, which is situated 2 – 3 m below the ground surface and which is at the bottom of the building foundation, is small at approximately 3 tons/m^2. Accordingly, this layer is unsuitable to support the planned 2 – 3 storey building. The clay layer containing silt at a depth of between 3 m and 14 m below the ground cannot be said to have completed uniform consolidation. Uneven subsidence of the building is expected to occur if this layer is

used as the supporting layer for the planned building. Therefore, this layer is unsuitable as the supporting layer. The current plan for the foundations to support the building is the use of pile foundations supported by a consolidated sand layer at a depth of 14 – 20 m from the ground surface to prevent any subsidence of the building.

2.2.1.6 Policies Regarding Social Conditions

(1) Creation of Appropriate Scenery for Research Facilities on CSC Premises

The CSC consists of a concentration of many research facilities. All of the research facilities on the premises of the CSC have a modern and calm appearance and facilities with an Indonesian appearance are Main Gate, Mosque and Biotechnology Guest House only. For this reason, it is planned that the new building will have a modern and calm appearance.

(2) Necessary Considerations for the Herbarium

The life of a dry botanical specimen is said to be eternal provided that it is not infected by insects. As some specimens are of those species which are believed to be extinct, insect control and fire control measures pose the most important tasks for the herbarium where the specimens are stored. The specimen management policies and following measures implemented by Kew and other research organizations will, therefore, be adopted for the planned herbarium.

1) Plants which attract insects will not be planted nearby.

2) The herbarium shall have appropriate fire resistance, water resistance and earthquake resistance.

3) The use of tropical timber will be avoided in view of its possible infestation by termites.

4) The use of honeycomb wall materials will be avoided in view of their possible infestation by cockroaches.

5) The facilities to receive specimens and to kill insects will be kept at a distance from the herbarium to prevent insect infestation.

6) The herbarium for ordinary dry specimens will be located on the second floor upwards and not on the first floor which is in contact with the ground to reduce termite damage and humidity.

7) The temperature and humidity of the dry collection room will be constantly controlled at 18-23°C and 40-60% respectively to prevent the hatching of insect eggs.

8) The collection rooms where fumigation to kill insects is conducted after specimens transfer will have a ventilation system for ventilation of the rooms after fumigation.

9) The spirit collection room will be provided with an excellent ventilation system in the case of any ethanol leakage from the bottles.

10) To prevent the unwanted incursion of insects, the doors of the collection rooms will be steel doors in view of their tight fit, termite damage resistance and good fire resistance. An insect control net will be used for each door to prevent the entry of any insect along with a person.

11) Such loose materials as carpet will be avoided and a material of which the surface can be easily kept clean will be used as the floor material for the collection rooms.

12) As dry specimens will be routinely transported from the collection rooms to the freezer or fumigation room, the introduction of an exclusive lift will be planned to ensure the safe transportation of many precious specimens without damage and to prevent insect infestation.

13) Indoor fire hydrants will be installed in the collection rooms or nearby and a fire alarm system will be installed in each collection room to prevent loss of the specimens due to fire.

14) The doors of the specimen cabinets will be tight fitting to prevent the incursion of insects.

(3) Feedback From Existing Zoology Division Building

Any experience in operation of facility and equipment of the existing Zoology Division building since its completion must be fed back to the Project.

(4) Reduction of Operation and Maintenance Costs

The introduction of the following measures is planned to make it easier to secure the necessary operation and maintenance budget over a long period of time and to achieve savings in terms of resources and energy.

① The air-conditioning and electrical systems will be compartmented so that staff members can operate the systems to cover only the areas requiring such systems.

② The procurement priority will be given to locally popular and simple equipment and systems so that they can be maintained with the current technical skill level of the maintenance staff.

③ The ceiling height of such rooms as the dry botanical specimen storage rooms where continuous air-conditioning is required for 24 hours a day will be set at the minimum required height to reduce the air volume, i.e. room volume, subject to air-conditioning. Direct sunlight into these rooms will be avoided because of its adverse impacts on air-conditioning.

(5) Consideration of Religion

90% of Indonesia's population are said to be Muslims and most staff members of the Botany Division and the Microbiology Division of the RCB are Muslims. This means that most of the staff members need to pray at their place of work or visit the pray room even during working hours. In view of this, the introduction of pray rooms are planned under the Project.

2.2.1.7 Policies Regarding Local Construction Industry

(1) Building Regulations and Laws

Even though there are no building height restrictions at the site or any restrictions posed by the existence of a road along the eastern perimeter of the site, the entrance to the planned building will be at a sufficient distance from the east road to ensure smooth access on this large site.

The planned building will conform to the Building Standards Law and the Fire Service Law, etc. in Indonesia.

(2) Environmental Regulations and Environmental Impacts Assessment

No obligation to conduct an environmental impacts assessment is attached to the construction of the planned building. Even though there are no regulations demand the treatment of laboratory effluent which could have adverse impacts on the environment, the introduction of a neutralisation tank is planned. This tank will be as simple as that currently used by the zoology division building and will be easy to maintain.

(3) Use of Locally Procurable Equipment and Materials

Except for lift and power failure control device for air-conditioning unit, most construction materials are produced in Indonesia. Durable equipment and materials which pose few maintenance problems will, therefore, be selected from among locally procurable equipment and materials.

(4) Use of Local Construction Method and Local Workers

The standard local construction method involves RC columns, beams and floors, concrete block or brick masonry walls with a mortar and paint finish and a tiled pitched roof or a flat roof and this method will be used for the Project. The construction of the new building using only local workers is planned by the adoption of the local construction method with which local workers are familiar.

2.2.1.8 Policy Regarding Use of Local Construction Company

Construction companies in Indonesia have sufficient technical capability for the domestic market and can act as local subcontractors for the Japanese contractor for the Project provided that the standard local construction method is used. For this reason, the local construction method with which local construction companies are familiar will be given priority in the planning process.

2.2.1.9 Policies Responding to Operation and Maintenance Capability of Implementation Body

(1) Easy to Operate Equipment and Systems

The planned building service equipment and systems for the new building will be the same as or similar to those currently used and maintained by the RCB's Zoology Division building. As the maintenance of the existing air-conditioning system is found to be inadequate, maintenance guidance will be provided by the Japanese contractor for the Project at the time of the handing over of the building to ensure strict maintenance of the system. In the case of equipment, that currently used by research staffs and technicians of the Botany Division and the Microbiology Division or similar will be given procurement priority.

(2) Inspectable and Repairable Building Service Equipment, Systems and Machinery

The daily maintenance of the existing building service equipment, systems and machinery of the Botany Division and the Microbiology Division is currently conducted by staff members of the Division of Facilities & Collection Management of RCB. Service and repair work is entrusted to external service providers in Bogor or Jakarta. For this reason, the procurement priority will be given to that equipment and systems which can be serviced and repaired in Bogor or Jakarta.

2.2.1.10 Policies Regarding Grades of Facilities and Equipment

The main purpose of the new facilities is the implementation of basic research for the conservation and utilization of biodiversity and the grades of the facilities and equipment will be sufficient to conduct such basic research.

As the Zoology Division building constructed with Japanese grant aid is situated on the adjacent site, the procurement priority will be given to locally procurable construction materials as in the case of the Zoology Division building to achieve a similar grade of facilities.

Meanwhile, the equipment grades will be determined with reference to the grades of existing equipment and researching staff.

2.2.1.11 Policies Regarding Construction and Procurement Methods and Construction Schedule

In view of the anticipated scale of the new facilities, the construction work can be completed in approximately 14.5 months if locally procurable materials and the standard local construction method are adopted with the Project being financed by bonds issued by the Government of Japan. It is also judged that the equipment procurement and installation will be equally completed within the same period.

2.2.2 Basic Plan

The contents of the request consist of research facilities for the Botany Division and the Microbiology Division, Botanical specimen storage facilities to assist research work and environmental education facilities which were additionally requested during the field survey. The necessary equipment for these facilities was also requested. The facilities and equipment envisaged under the cooperation project are the same as those requested, i.e. research facilities for the Botany Division and the Microbiology Division, botanical specimen storage facilities, environmental education facilities and equipment to support the activities of such facilities, all of which are essential to implement the activity plans of the Botany Division and the Microbiology Division.

Type of Facilities	Necessity
Research facilities for the Botany Division	These are necessary for research activities on the conservation and utilization of biodiversity.
Botanical specimen storage facilities	These are necessary for the storage of precious specimens which assist research activities in an excellent environment of an international standard in long period.
Research facilities for Microbiology Division	These are necessary for research activities on the conservation and utilization of biodiversity.
Environmental education facilities	These facilities are necessary to provide education on and to publicise the necessity for the conservation of biodiversity.

However, the requested scale of the facilities and equipment has required adjustment to meet the minimum requirements for implementation of the activity plans and to ensure a realistic prospect of their operation and maintenance as they include ① those which do not reflect the reality of the current activities and ② an excessive scale when compared to the scale of the existing facilities and equipment and are, therefore, beyond the existing operation and maintenance capability. Meanwhile, as the dry collection and spirit collection managed by the Botany Division are globally precious and essential for botanical research, it has been decided that the equipment and materials required for the restoration of these precious specimens prior to their transfer to ensure their safe transfer will be included in the scope of the Project.

In the case of the meeting rooms, library, canteen and repairing workshop, etc. which were originally separately requested by the Botany Division and the Microbiology Division, it has been decided that these will be common use facilities of the minimum required size by the two divisions in order to reduce the maintenance cost. Moreover, research equipment and the equipment room have also been designated for common use.

The resulting facilities subject to cooperation are outlined in the table below. In short, they consist of such facilities as common use facilities, administration rooms, staff and technician rooms, research facilities (laboratory) for six groups of the Botany Division, research facilities (laboratory) for four groups of the Microbiology Division, botanical specimen storage facilities (dry collection and spirit collection room, etc.), information center, machine and electrical buildings, outdoor car parking, etc., the necessary equipment for these facilities and materials for the restoration of specimens.

Table 2-30 Outline of Facility Envisaged under Cooperation

Original Request		Scope of the Project	
(1) Common Use Facilities		(1) Common Use Facilities	
1) Meeting Rooms	300 seat room x 1 50 seat room x 1 20 seat room x 4	1) Meeting Room	100 seat room x 1 40 seat room x 1 20 seat room x 1
2) Library	33,800 books + 15,500 unstacked books serving the 2 divisions; 20 reading seats	2) Library	As requested (existing compactors and reading table, plus new compactor for 15,500books)
3) Pray Rooms	4 serving the two divisions	3) Pray Rooms	2 (1 for men and 1 for women) serving the 2 divisions
4) Canteen	200 seats for the Botany Division and 50 seats for the Microbiology Division	4) Canteen	80 seats serving meals in 2 shifts including furniture and kitchen equipment
5) Repairing Workshop	1 for each division	5) Repairing Workshop	Total 1 room
(2) Botany Division		(2) Botany Division	
1) Administration Section	Administration office and division head room (total: 120 m^2)	1) Administration Section	Administration office and division head room (total: 60 m^2)
2) Research Section	9,161 m^2	2) Research Section	5,672 m^2
a. Staff and Technician Rooms	96 single rooms for staff and technicians	a. Staff and Technician Rooms	76 single rooms for staff and large rooms for (29) technicians including furniture
b. Phytochemistry	8 rooms (total: 482 m^2)	b. Phytochemistry	3 rooms (total: 132 m^2)
c. Plant Physiology	14 rooms (total: 560 m^2)	c. Plant Physiology	9 rooms (total: 336 m^2)
d. Anatomy and Morphogenetic	5 rooms (total: 240 m^2)	d. Anatomy and Morphogenetic	3 rooms (total: 156 m^2)
e. Taxonomy	5,329 m^2, including 2,880 m^2 for the dry collection, 360 m^2 for the spirit collection and 180 m^2 for the carpology, seed and xylarium collection	e. Taxonomy	3,980 m^2, including 2,670 m^2 for the dry collection, 220 m^2 for the spirit collection and 140 m^2 for the carpology, seed and xylarium collection; all the collection rooms will be air conditioned
f. Ecology	2 rooms (total: 120 m^2)	f. Ecology	2 rooms (total: 96 m^2)
g. Ethnobotany	1 room (30 m^2)	g. Ethnobotany	1 room (36 m^2)
		h. Common Equipment Room	2 rooms (total: 72 m^2)
4) Others	200 m^2, including specimen material storage	4) Others	110 m^2, including specimen material storage
5) Annex	320 m^2, including plant preparation room and chemical storage's	5) Annex	215m^2, including plant preparation room and chemical storage's
6) Greenhouses	5 (total: 260 m^2)	6) Greenhouses	Total 185 m^2
7) Others	Drying floor; concrete benches	7) Others	Drying floor and concrete benches
(2) Total	10,081 m^2		6,242 m^2
(3) Microbiology Division		(3) Microbiology Division	
1) Administration Section	Administration office and division head room (total: 120 m^2)	1) Administration Section	Administration office and division head room (total: 60 m^2)
2) Research Section	1,925 m^2	2) Research Section	1,008 m^2
a. Staff and Technician Rooms	80 single rooms for staff and technicians	a. Staff and Technician Rooms	44 single rooms for staff and one large room for 8 technicians including furniture
b. Ecology and Physiology	5 rooms (total: 292 m^2)	b. Ecology and Physiology	3 rooms (total: 144 m^2)
c. Applied Microbiology and Developmental	5 rooms (total: 200 m^2)	c. Applied Microbiology and Developmental	2 rooms (total: 84 m^2); the existing mushroom house to be transferred by the Indonesian side

d. Biosystematics and Genetics	9 rooms (total: 454 m^2)	d. Biosystematics and Generics	4 rooms (total: 168 m^2)
e. Microbial Biochemistry	5 rooms (total: 265 m^2)	e. Microbial Biochemistry	3 rooms (total: 96 m^2)
		f. Common Equipment Room	2 rooms (total: 108 m^2)
3) Greenhouses	4 greenhouses (total: 400 m^2)	3) Greenhouses	Total 200 m^2
(3) Total	2,971 m^2	(3) Total	1,304 m^2
(4) Environmental Education		(4) Environmental Education	
1) Information Centre	1 room to provided displays and information on documents, etc.	1) Information Centre	1 room to provide displays and information on documents, etc. and also to be used for meetings and the preparation of specimens, etc.
2) Workshop	1 room for the experience specimens making and other purposes	2) Workshop	To be included in the Information Centre
Grand Total	15,142 m^2	Grand Total	9,120 m^2
(5) Others		(5) Others	
1) Machine and Electrical Buildings	None	1) Machine and Electrical Buildings	Including a water tank, an elevated water tank and a electrical room
2) Connection of Infrastructure	To be conducted by the Indonesian side	2) Connection of Infrastructure	To be conducted by the Indonesian side
3) Exterior Work		3) Exterior Work	
a. Planting	To be planted by the Indonesian side	a. Planting	To be planted by the Indonesian side
b. Fence, Gate, Gate House	To be conducted by the Indonesian side	b. Fence, Gate, gate House	To be conducted by the Indonesian side
c. Others	None	c. Others	Roads on the premises, septic tank, neutralisation tank and drainage ditches, etc.
4) Furniture	None	4) Furniture	• The related to the laboratories • The existing general furniture to be transferred by the Indonesian side

2.2.2.1 Planning Policies for Site and Facility Layout

(1) Location and Characteristics of the Site

1) Location of the Site

The CSC is located some 3 km west of the Cibinong Exit of the Bogor-Jakarta Expressway and is situated in the Cibinong District. The CSC premises have an area of 190 ha, including a gently sloping area. There is a pond in the central lowland to which rainwater as well as waste water from the CSC is discharged. The zoology division building constructed with Japanese grant aid is located some 500 m south of this pond or some 1 km from the main gate. The planned site for the new facilities under the Project is adjacent to this zoology division building to the north.

2) Area Around the Site

The planned construction site faces a trunk road running from the main gate area to the north and faces another road which is gently curving and lined with tall trees to the east. This road provides access to the zoology division building. The site is adjacent to

the zoology division building to the south across an unpaved road which faces a small water channel leading to the pond.

By eliminating the unpaved road to the south to create an integral site with the zoology division building, it will be possible to locate the facilities of the three research divisions of the RCB, i.e. Zoology Division, Botany Division and Microbiology Division, on the same site, facilitating the mutual access and security of the facilities. For these reasons, a request has been made to the RCB for the closure of the unpaved road and the relocation of the aerial power cables along the road. The closure of the road will not cause any traffic problems as there is another route to the area at the end of the road in question. For this request, LIPI decided to close the road for integration of two sites.

3) Access to the Site

At present, the planned construction site can be accessed from two directions. One is via the main gate of the CSC after leaving the Cibinong Exit of the Bogor-Jakarta Expressway. This route is wider and well-paved but requires some 15 minutes from the Cibinong Exit. Instead, the narrow unpaved road to the northeast entrance of the CSC is more frequently used because the travelling time is reduced by almost half.

The CSC has only one official entrance via the main gate in view of tight security, leaving the road to the northeast entrance unpaved. Most visitors from the Jakarta direction use this unpaved road and a request has been made to the RCB to pave this road. However, there is little chance that this request will be met because it means paving work for a road outside the premises of the CSC.

4) Topography

The planned site is almost rectangular, stretching some 300 m in the north-south direction and some 150 m in the east-west direction with a total area of 45,793 m^2. There are no existing structures on the site which require to be dismantled and removed. The southeast section facing the eastern road has the highest elevation of 100 m where a flat area of 100 m wide and 150 m long is located. This flat area is suitable for the locationing of the new building. The site gently slopes from this flat site to the west and the north, reaching an elevation of 97.5 m in the southwestern corner, 99.2 m in the northeastern corner and 93.5 m in the northwestern corner. The ground level of the neighbouring zoology division building site is around an elevation of 100 m which is the same as that of the southeastern section of the planned site. The site is sufficiently large to set up temporary facilities required for the construction work. There are no obvious obstacles for the transportation of construction materials or site access by work vehicles. The adverse impacts of the work on local residents or the existing facilities will be minimal.

5) Hydrology and Hydraulics

While no records regarding flooding of the CSC premises are maintained, the Biotechnology Centre on the CSC premises has confirmed that no flooding has taken place since 1989 when it was relocated to the CSC up to the present, presumably because the CSC premises are located on higher land than the surrounding area. When there is a high rainfall level in a short period of time, stormwater overflows onto the roads from

the drainage channels to the pond located in the central lowland area of the CSC premises. Therefore, there is a little effect on access to the planned site when there is a high rainfall level in a short period of time.

As the planned site is situated at a higher elevation than the Biotechnology Centre site, there is little concern in regard to flooding.

(2) Evaluation Results of the Site and Other Conditions

1) The size of the land is sufficiently large. Within the planned construction site, the southeast section has the highest elevation with large flat land suitable for building construction. The other sections are sloping and would require major banking work and rainwater drainage facilities around the planned building. These sections are, therefore, unsuitable for the locationing of the planned building.

2) The planned site faces the trunk roads on the CSC premises to the north and east which provide access to the site. It will be advantageous for the new building to face one of these roads.

3) The construction of an administration building for the RCB at the planned site is planned in the future.

4) The Project aims at the concentration of the research facilities of the Botany Division, Microbiology Division and Zoology Division of the RCB at one site to improve interdisciplinary biological research.

5) By eliminating the unpaved road to the south of the planned site to create an integral site with the zoology division building, the three research divisions of the RCB will be located on a single site, facilitating mutual access and security.

(3) Policies for Site Layout

1) Building Location

There are three options for the location of the planned building, i.e. ① facing the north road, ② facing the east road and in the northern section of the site and ③ facing the east road and in the southern section of the site, as compared in the following figure and table. The third option is selected in view of the facts that ① it can realise the project concept of “achieving linkage with the existing zoology division building” and ② it has fewer shortcomings than the other options.

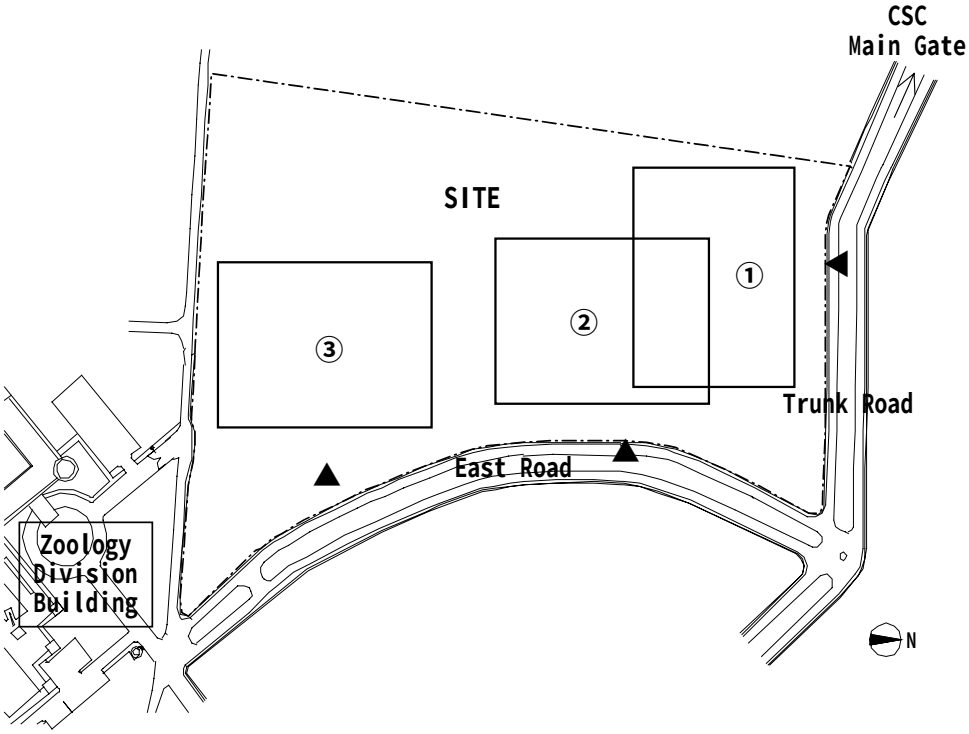


Figure 2-1 Layout Options

Table 2-31 Examination of Layout Options

	Item for Comparison	Option ①		Option ②		Option ③	
1	Integration and harmonious with the zoology building	The longest distance from the zoology building, the harmonious with the zoology building is low.	▲	Between ① and ③	○	The shortest distance from the zoology building, the integration and harmonious with the zoology building is low.	◎
2	Prospect of future extension	Can be extended at the south and west side	○	Can be extended at the south and west side	○	Can be extended at the north and west side	○
3	Drainage of rainwater	Rainwater within the site is gathered to the building, a large drainage system is required.	▲	Between ① and ③	○	The building is located highest level of the site, the drainage is easy.	◎
4	Land preparation cost	The building is located sloped area, the scale of the banking work is large.	▲	Between ① and ③	○	The building is located flat level of the site, the scale of the banking is small.	◎
5	Approach from outside	The shortest approach from CSC main gate, the longest approach from unpaved road in the northeast.	◎	Between ① and ③	○	The longest approach from CSC main gate, the shortest approach from unpaved road in the northeast.	△
6	Easy on-site entry	It is difficult to enter the site, because of sloped front road.	△	It is easy to enter the site, because of flat front road.	○	It is easy to enter the site, because of flat front road.	○
7	Visibility of building from outside	Good visibility from trunk road continuing from CSC's gate.	◎	Only back of building can be seen from trunk road. Good visibility from the front road in east.	△	Only back of building can be seen from trunk road. Good visibility from the front road in east.	△

2) Positioning Plan

① Position of Facilities

- The sloping lowland to the west is unsuitable for the positioning of a building. The housing of the new facilities in a single building is planned to minimum the use of the available flat land in order to leave as much flat land space for the construction of additional buildings in the future.

- The planned building will be positioned adjacent to the zoology division building and the front of the planned building will face the east road.
- The herbarium is planned far from the new building (laboratory) separately to reduce insect and dust carrying into the herbarium.
- Such outdoor facilities as greenhouses and annex required for research will be positioned to the north and south of the new building for easy access.
- The future extension of the herbarium is planned in the eastern and/or western section of the site and the future construction of an administration building is planned in the northern section of the site.

② Access
- In view of creating a sense of integrity with the zoology division building and easy access between the buildings, approach to the site will be from the east road near the zoology division building before entering the new building via its entrance.
- Connection of the roads on the zoology division building and the new building site is planned in the site.
- A service road to herbarium is planned to the northern side of the herbarium in order to avoid any problems due to the overlapping of access to the herbarium and other area of the new building.

③ Car Parks
- One car park for visitors and staff vehicles, is planned in convenient locations.

④ Security
- As in the case of the zoology division building, the site will be surrounded by perimeter fencing (to be constructed by the Indonesian side) to prevent the easy access of burglars to the planned facilities.
- At each entry point to the site, a guard house (to be constructed by the Indonesian side) will be introduced as in the case of other facilities on the CSC premises to ensure security.

⑤ Planting (to be planted by the Indonesian side)

No trees which attract insects will be planned around the herbarium, including the courtyard, to reduce the insect damage potential to the herbarium.

2.2.2.2 Building Plan

(1) Floor Plan

① The machine building and greenhouses, etc. will be constructed as separate buildings in view of their nature.

② The library, meeting rooms and canteen, etc. will be set up as common use facilities to serve both the Botany Division and the Microbiology Division in order to reduce the construction cost and the maintenance cost.

③ The facilities will be planned in three blocks, i.e. (i) administration section and such common use facilities as the library and meeting rooms, (ii) botanical and

microbiological research facilities (laboratory) and (iii) specimen storage and related facilities (herbarium).

④ A courtyard will be introduced near the common use facilities and research facilities to create a bright space with good ventilation.

⑤ The information center to provide information on biodiversity and the activities of the RCB for visitors will be planned near the entrance to ensure easy access by visitors.

⑥ The research staff rooms and laboratories of the Botany Division and the Microbiology Division will be positioned closely together along the middle corridor to enhance the research efficiency.

⑦ In regard to the specimen storage rooms, functional path lines for acceptance, treatment, insect killing and preservation will be emphasised. The entry points to these facilities will be restricted as the prevention of insect damage to the specimens is the highest priority.

The original Indonesian request involved a floor area of some 20,500 m^2. This was subsequently judged to be excessive in view of the present situation of activities and existing facilities and past records of the operation and maintenance budget and, therefore, a more appropriate scale and contents to reflect the real situation were examined. As a result, the appropriate floor area was found to be some 12,330 m^2.

Table 2-32 Floor Area of Planned Rooms

Section/Room Name	Planned Floor Area(m^2)	Purpose/Remarks
1. Center Building	11,551.03	
(1) Research Section	4,302.16	
1) Botany Division	1,832.94	
・Staff Room	726.71	Private staff rooms for 76 researchers x 9 m^2, 1st FL: 40 rooms, 2nd FL: 36 rooms
・Technician Room	145.20	Common use type rooms for 29 technicians x 6 m^2, 1st FL: 1 room 97.2 m^2、 2nd FL: 1 room 48 m^2
・Laboratory	961.03	24 laboratories for 6 research groups: Phytochemistry, Plant Physiology, Anatomy and Morphogenetic, Taxonomy, Ecology, Ethnobotany
2) Microbiology Division	1,073.08	
・Staff Room	421.48	Private staff rooms for 44 researchers x 9 m^2, 1st FL 22 rooms, 2nd FL 22 rooms
・Technician Room	48.00	Common use type room for 8 technicians x 6 m^2, 1st FL: 1 room 48 m^2
・Laboratory	603.60	14 laboratories for 4 research groups: Ecology and Physiology, Applied Microbiology and Development, Biosystematics and Genetics, Microbial biochemistry
3) Repairing Workshop	25.20	Common use for both divisions
4) Common Space	1,370.94	Corridor, stair, toilet, storage etc.
(2) Herbarium	4,979.91	
1) Dry Specimen Collection	3,354.99	Dry specimen collection storage (2,612.28 m^2 including type specimen storage), processing room, drying room, labeling room, mounting room, freezing room, thawing room, fumigation room, biosystematic laboratory (2 rooms total 132 m^2), data base room etc.

2) Spirit Collection	308.70	Spirit collection storage (220.05 ㎡), processing room, spirit biosystematic laboratory, data input room
3) Other Collection	325.23	Carpology, seed and xylarium collection storag (143.88 ㎡), carpology biosystematic laboratory, voucher collection storage (Ecology, Ethnobotany), Drawing room etc.
4) Others	34.74	Field equipment storage, glass bottle storage
5) Common Space	956.25	Working space, unloading space, Corridor, stair, toilet, storage etc.
(3) Admin. Common Use, Information Section	2,268.96	
1) Admin. Section	152.08	2 head rooms, 2 administration offices etc.
2) Common Use	1,017.49	Large meeting room (for 100 persons x 1), meeting rooms (for 40 persons x 1, for 20 persons x 1), canteen (for 80 persons x 2 shift, including kitchen), library (for 49,300 books, 20 reading table) etc.
3) Information Section	179.52	Information center (including specimen trial making and meeting space), reference collection storage (for 15,500 specimens), video processing room
4) Common Space	919.87	Corridor, stair, toilet, storage etc.
2. Annex	402.56	Animal room, plant preparation room, germination room, chemical storage, pump room, electrical room etc.
3. Green House	378.00	For botany division (126 ㎡ x 1、 60 ㎡ x 1), for microbiology (96 ㎡ x 2), total 4 houses
Total	12,331.59	

(2) Sectional Plan

① The building appearance will be harmonious and will have a sense of integrity with the zoology division building.

② The common and research facility sections will have two storeys while the specimen storage sections will have three storeys to ensure effective use of the land, the freedom of building positioning and a low construction cost.

③ The floor level of the first floor will be approximately 30 cm above the road surface at the front of the building so that the higher level of the first floor than the surrounding area will prevent the invasion of rainwater and will ensure the smooth drainage of rainwater as well as waste water from the building.

④ The cross-section will minimise differences in levels to make the building friendly for the disabled and to ensure easy wheelchair access to the building.

⑤ The roof will be a flat roof as in the case of the zoology division building. A cavity roof structure will be adopted to reduce the adverse impacts of direct sunlight on the rooms below and the upper roof will be sloping in view of rainwater drainage.

⑥ Cavity walls with sun-shading louvres and wide eaves will be introduced to avoid strong solar radiation as this design which is adopted by the zoology division building is commonly adopted locally.

⑦ The ordinary dry botanical collection storages will be planned on the second or a higher floor to avoid damage by termites and/or humidity.

⑧ The dry and spirit collection storages where the temperature will be controlled by an air-conditioning system will have the minimum required ceiling height as 2.8 m to reduce the air volume, i.e. room volume, to reduce the air-conditioning cost.

⑨ Dry specimens will be routinely transported to the freezer or fumigation room to kill any insects and then returned to their respective storages. An exclusive lift to serve such operation is planned to prevent the destruction of specimens and/or the attachment of insects to the specimens during such operation.

(3) Structural Plan

1) Design Policies

The design of the building will conform to the Load Regulations and the Structural Design Standards in Indonesia. The standards of the Architectural Institute of Japan (Steel Structure Design Standards and others) will be used to supplement the local standards.

- Building Load Regulations NI18–1983 (Peraturan Pembebanan Indonesia Untuk Gedung 1983)
- RC Structural Design Standard NI2-1971 (Peratural Beton Bertulang Indonesia 1971)

2) Ground Conditions and Foundation Plan

As already described in the Policies Regarding Natural Conditions, uneven subsidence is likely to occur if spread foundations are employed. Pile foundations using the highly compacted sand layer (N value: 35 – 60) at 14 – 20 m below the ground surface will, therefore, be employed to prevent any subsidence of the new building. The percussion method will be employed using prestressed concrete piles which are locally produced and economical and which offer a large bearing capacity.

The floor of the first floor will be made of structural slabs so that any subsidence due to banking or backfilling soil to adjust a difference in level at the site does not affect the building.

3) Skeleton Plan

The main skeleton will have a rigid frame using the common method in Indonesia and different types of structures will be adopted for different parts of the building as listed below.

- Main structure frame: RC concrete and prestressed RC concrete beam (some part)
- Flat roof: RC concrete
- Internal and external walls: concrete block masonry
- Entrance roof: RC concrete

4) Design Load

① Live Load

A realistic live load will be adopted for each room in view of its prospective use based on the Building Load Regulations NI18-1983 and the actual live load conditions. The resulting live loads for the main rooms are listed below.

- Dry collection storage : 7,800 N/m^2
- Spirit collection storage : 11,800 N/m^2
- Laboratory : 3,900 N/m^2
- Meeting room : 2,900 N/m^2
- Research staff room : 2,900 N/m^2
- Flat roof : 1,000 N/m^2

② Wind Load

The following wind load is adopted in accordance with the Building Load Regulations NI18-1983.

- Reference wind load : 250 N/m2

③ Seismic Force

The planned construction site is located in Zone 3 of the Structural Design Standards of Indonesia and the following seismic coefficient will be adopted.

- Seismic coefficient: 0.07 (0.2 for Japan)

5) Construction Materials

The following materials which can be procured in Indonesia will be used.

• Concrete	:	normal concrete K-225 prestressed concrete K-350		
• Reinforcing bars	:	deformed bars	D10-D16	BJTD30
			D19-D25	BJTD35
			D29	BJTD40

(4) Mechanical Work Plan

1) Design Policies

A number of unit air-conditioners will be installed in the dry botanical collection storages and the spirit collection storages where continuous air-conditioning for 24 hours a day is required so that the breakdown of a single unit does not affect the preservation of the required temperature for insect control.

In the case of laboratories where air-conditioning is required at the time of their use, a separate air-conditioning system for each laboratory is planned to reduce the operating cost. The system to be introduced will be easy to operate and maintain. Research staff rooms and technician rooms, etc. will use natural ventilation with no mechanical air-conditioning equipment being installed.

2) Air-Conditioning System

Air-cooled package air-conditioning units will be independently installed as these units can meet the above-mentioned design policies while minimising the zone affected by the breaking down of equipment.

The following indoor and outdoor temperature and humidity conditions will be adopted.

- Dry and spirit collection storages
  - Outdoor : temperature of 34.5°C; humidity of 50%
  - Indoor : temperature of 18 – 23°C; humidity of 40 – 60%

- Laboratories and others
  - Outdoor : temperature of 34.5°C; humidity of 50%
  - Indoor : temperature of 26°C

① Air-Conditioning System

The actual model of the air-cooled package air-conditioning units will be selected based on the room size and mode of operation. In the case of the dry and spirit collection storages, a number of floor-mounted direct air-blow type package units will be introduced to ensure effective and efficient air-conditioning because of the large floor area. This package units have a lower initial and operational cost than others, because of good heat exchange efficiency. The power failure control device for air-conditioning units which is automatically switch on the air-conditioning units when the power supply return after power cut will be equipped for herbarium to protect insect damage.

In regard to other rooms, wall-mounted air-conditioning units will be introduced because of their easier maintenance with a shorter piping length for the coolant and drain. The number of units will depend on the size of each room.

② Ventilation System

A mechanical ventilation system will be installed in the following rooms.

- Spirit processing room: discharge of ethanol
- Collection storage (dry and spirit) and fumigation room: discharge of fumigating gas
- Drying room: discharge of hot air
- Laboratory and preparation room: discharge of hot air and odour produced during experiments
- Meeting room: ventilation
- Toilets, storages and kitchen, etc: ventilation

③ Fumigation Concentration Gauge

Fumigation of collection storage's rarely occurs, instrument such as concentration gauge of entrusted outside fumigation contractor should be used. A narrow fumigation room regularly uses, therefore concentration gauge will be planned.

④ Dehumidifier

After killing of insect of dry specimen in freezer, the frizzed specimen will be thawed with dehumidifier and air-conditioning unit in order to no damage to specimen, therefore dehumidifier will be planned in thawing room.

3) Plumbing and Sanitary Work

The plumbing materials and sanitary fixtures to be procured will be made in Indonesia to facilitate their post-Project maintenance.

① Water Supply System

A deep well to be drilled under the Project will be used as the water supply source. Water will be pumped to a concrete water reservoir tank (100 m^3) to be placed under the machine building. It will then be further pumped to an elevated FRP water tank (10 m^3) for gravity water supply to various rooms and facilities. The quality of the groundwater is good as it meets the drinking water criteria set by the Indonesian Ministry of Health. However, as it contains microbes which may form fur inside the distribution pipes, a strainer to remove such microbes and a simple sterilisation unit which is easy to maintain will be installed.

② Drainage System

- Miscellaneous Waste Water

  Sewage and miscellaneous waste water will be separately drained indoors for mixing outside the building. This mixed waste water will be discharged to an open ditch on the west side of the site after purification at a septic tank to the regulated value (BOD: 20 ppm) or lower.

- Laboratory Waste Water

  Waste water from the laboratories will be discharged to an open ditch in the western part of the site after neutralisation to the level of pH 6 – 8 as required by the West Java Provincial Regulations, in a neutralisation tank. A manual operating system is planned for this tank in view of easy maintenance.

- Harmful Waste Water

  Harmful waste water discharged from the laboratories will be stored in the laboratories in containers and its treatment and disposal will be entrusted to an outside contractor.

③ Sanitary Fixtures

- Closets : all closets will be Western type closets; hand shower facilities will be introduced at the side of the closets in accordance with the local custom
- Urinals : wall-mounted stall type
- Washbasins : single faucet type without hot water supply

④ Fire Extinguishing System

In accordance with the local Fire Services Law, indoor fire hydrants and fire extinguishers will be installed throughout the building, including the herbarium. However, indoor fire hydrants will not be installed inside the herbarium but around it to prevent water damage to the specimens. Water will be fed to the indoor fire hydrants by a fire pump installed in the machine building. The fire extinguishers will be the form type which are commonly used in Indonesia.

⑤ Kitchen Equipment

A range of kitchen equipment, including gas ranges, sinks and fridge-freezers, will be installed to serve some 160 people with 2 shifts per day.

⑥ Gas Equipment

LPG gas cylinder will be used for the cooking equipment in the kitchen. Connection to the city gas (methane gas) supplied to the CSC premises will not be done because the connection is costly for leading the long distance, and the leakage gas may occur.

⑦ Laboratory Shower

As a measure to deal with laboratory accidents involving the splashing of chemical agents, an emergency shower will be installed near the laboratory entrance. This shower will release a large quantity of water by pulling a chain. The laboratory tables will be equipped with an eye rinsing shower, the installation work of which will fall under the equipment work rather than the building work.

⑧ Special Laboratory Gas

Special gas cylinders such as helium, etc. will be carried into laboratory by RCB for research that is same as the existing condition.

(5) Electrical Work Plan

1) Power Receiving and Transforming Equipment

Power will be supplied to the electrical room on the site through an aerial cable from the high voltage aerial cable (20 kV, 50 Hz) along the unpaved road between the site and the zoology division building. After stepping down by a transformer, low voltage supply (380/220 V) will be made to each room. Service extension to the switchgear in the power room will be conducted by the Indonesian side (PLN, a local electricity company) while

the installation of the switchgear and the work beyond will be conducted as part of the Project. Receiving power capacity with 1,250kVA is planned.

Given the little voltage fluctuation of the power supplied, an AVR (automatic voltage regulator) will not be installed. Power cuts rarely occur as the emergency generator installed at the zoology division building has only been used for a total of 730 hours in the period of 5 years and 8 months since early September, 1997 to the end of April, 2003 (approximately five days a year). Therefore, emergency generator with a capacity of whole demand of the new building will not be installed, because the operating cost is high. A emergency generator with capacity of 12.5kVA will be installed to supply electricity to deep freezer, refrigerator, thermal cycler and shaker etc. which are require absolute continuity as an essential condition.

2) Trunk Power System

Power will be distributed from the distribution panel in the electrical room to the lighting panels and power control panels in the building. The distribution trunk lines and power lines will use a cable rack and conduit pipe. A warning for each power equipment will be displayed on a warning panel installed in the administration office.

The power system for the main branch lines will be as follows.

- Trunk lighting and power lines : 3 phase, 4 wire, 380/220 V
- Branch power line : 3 phase, 3 wire, 380 V
- Branch lighting line : single phase, 2 wire, 220 V

3) Cabling for Lighting

It will be possible to switch on and off each zone designated on the lighting panel to reduce the running cost.

In addition to general plug sockets (receptacles), exclusive plug sockets will be introduced to serve the laboratory equipment, laboratory tables, OA equipment in the administration office and AV equipment in the meeting rooms. The number of these plug outlets will be determined based on the equipment layout and capacity.

4) Lighting Equipment

Fluorescent lamps of locally procurable sizes will be the main sources of lighting to reduce the running cost. Fluorescent lamps at herbarium will be installed between and along specimen cabinet lines. As a measure to deal with power cuts, emergency lights and evacuation guide lights with a built-in battery will be installed in the herbarium and at strategic places along the evacuation routes. The planned illuminance is as follows.

- Database room : 500 lux
- Herbarium (collection storage) : 250 lux
- Laboratory : 400 lux
- Administration office; staff room; library : 350 lux
- Entrance : 150 lux
- Corridor : 150 lux

5) Telephone System

There is a digital aerial telephone cable (100 lines) along the unpaved road between the site and the zoology division building. 10 lines will be aerially extended to the service pole on the site from where further extension will be made through an underground conduit. The telephone lines will then be extended to outlets in certain rooms via the main terminal board and the relay terminal board. Service connection to the main terminal board will be the responsibility of the Indonesian side while equipment installation and wiring after the main terminal board will be included in the scope of the Project.

A telephone switchboard will be installed in the administration office while telephones will be installed in the rooms requiring them. The system will allow both internal communication and external telephone communication.

6) Fire Alarm System

A fire alarm system will be installed for the early detection of fires and swift initial fire-fighting. Push buttons to inform of the outbreak of a fire will be installed in strategic places. A fire signal will be displayed on the display panel in the administration office and an alarm bell will sound to prompt swift evacuation. A fire detector will be installed in the herbarium (collection storage) as a fire prevention measure to protect the specimens in accordance with the herbarium management policies of the Botany Division.

7) Lightning Arresters

Lightning often occurs near the site. The installation of lightning arresters is planned to prevent damage to the facilities and equipment. In regard to the zoology division building, a stray current caused by lightning in a nearby area has run reverse through the underground grounding, damaging the PABX (private automatic branch exchange), etc. three times in the past. For this reason, a lightning arrester will be installed to the power line and the communication line of the planned building to protect electronic equipment from an ordinary voltage surge caused by lightning.

8) Lift

As routine insect control is essential to protect dry specimens from insect damage, specimens and specimen cabinets containing specimens will be regularly transported between the herbarium on the second and third floors and the freezer and/or fumigation room on the first floor. Particularly important will be insect control during the transportation of dry specimens and specimen cabinets treated in the freezer and/or fumigation room. For the purpose of such transportation, one lift will be planned between the herbarium and the freezer/fumigation room. This lift will be a hydraulic cargo lift. The maximum live load will be 750 kg and the dimensions will be 1,300 mm (W) x 2,300 mm (D) x 2,500 mm (H) to enable the lift to carry a specimen cabinet (870 mm (W) x 545 mm (D) x 2,300 mm (H)) and a staff member(s) at the same time. The lift will stop on the first, second and third floors.

The hydraulic lift installed at the neighbouring zoology division building has a maximum live load of 2,500 kg to carry zoological specimens which are generally heavier than botanical specimens. Its dimensions are 2,400 mm (W) x 2,900 mm (D) x 2,500 mm (H). This lift has been properly maintained by a local maintenance company.

9) LAN System

Wiring for LAN system will be planned between computers for database in herbarium and taxonomy group laboratories. There are no LAN system plan for the new building, therefore only wiring for LAN system between staff rooms and relay terminal board of each floor will be planned. Wiring route for LAN system will be secured to complete the system of the new building, when LAN system plan is developed.

(6) Building Materials Plan

The basic policy for the selection of building materials is the selection of commonly used materials and finishing methods in Indonesia which are suitable for the local climate in view of the construction of facilities which can be easily maintained. It is also planned to make on-site repair and maintenance easier by procuring local construction materials as much as possible. From the viewpoint of insect control, wooden finishing materials, window frames and doors will be eliminated from the planning contents as much as possible to ensure good specimen storage conditions.

Table 2-33 Comparison of Construction Method

	Local Method	Applied Method	Reason for Apply
Exterior: Roof	Pitched roof: cement roof tile, metal roofing Flat roof: asphalt or urethane waterproof + adiabatic block	Flat roof: urethane waterproof + adiabatic block and cement sheet roofing for Herbarium	Well weather proof, commonly used in local. For heat insulation for Herbarium, double roof with cement sheet roofing has high efficiency.
Wall	Brick or concrete block + mortar trowel + paint. Ceramic tile wall finish is popular in CSC	Concrete block + mortar trowel + ceramic tile, brick tile, screen concrete block and spray paint and GRC louver	Popular in CSC, and similar materials with the zoology division building.
Fixture	Aluminum window Wooden door (inside)	Aluminum window Steel door and wooden door (inside)	Well durability, commonly used in local. Termites is popular in CSC, Steel door use at Herbarium for anti-termites, wooden door use for other.
Interior: Floor	Stone, ceramic tile, carpet tile, terrazzo, PVC tile	Ceramic tile, vinyl sheet for Herbarium	Commonly used in local. Easy for clean and not loose material (Herbarium)
Wall	Mortar trowel + paint, wood, stone	Mortar trowel + paint, wood, stone	Commonly used in local. Wood as minimum use as possible for anti-termites
Ceiling	Rock wool acoustic board (T-Bar), gypsum board + paint(T-Bar)	Rock wool acoustic board (with and without T-Bar), gypsum board + paint (T-Bar)	Rock wool acoustic board has sound absorption capacity, commonly used in local.

The interior finishing of the main rooms is described in the table below.

Table 2-34 Main Finishing Materials

Room Name	Floor	Wall	Ceiling	Reason for Apply
Laboratory	Ceramic Tile, Vinyl Sheet	Mortar trowel + paint	Rock wool acoustic board (T-bar)	Anti-chemical, easy for clean
Dry Collection storage	Vinyl Sheet	Gypsum board + paint	Gypsum board + paint	Thermal capacity, easy for clean
Spirit Collection storage	Vinyl Sheet	Gypsum board + paint	Rock wool acoustic board (T-bar)	Economical, easy for clean
Other Collection Storage	Vinyl Sheet	Gypsum board + paint	Rock wool acoustic board (T-bar)	Economical, easy for clean
Mounting Room	Vinyl Sheet	Mortar trowel + paint	Rock wool acoustic board (T-bar)	Economical, easy for clean
Staff Room	Ceramic Tile	Mortar trowel + paint	Rock wool acoustic board	Economical, sound absorption
Admin. Office	Ceramic Tile	Mortar trowel + paint	Rock wool acoustic board	Economical, sound absorption
Head of Division	Tile Carpet	Mortar trowel + paint	Rock wool acoustic board (T-bar)	Economical, sound absorption
Meeting Room	Ceramic Tile	Mortar trowel + paint	Rock wool acoustic board (T-bar)	Economical, sound absorption
Library	Ceramic Tile	Mortar trowel + paint	Rock wool acoustic board	Economical, sound absorption
Canteen	Ceramic Tile	Mortar trowel + paint	Gypsum board + paint	Economical, easy for clean
Toilet	Ceramic Tile	Ceramic Tile	Gypsum board + paint	Durability, easy for clean
Storage	PVC Tile	Mortar trowel + paint	Gypsum board + paint	Economical

2.2.2.3 Equipment Plan

(1) Equipment Plan

1) Based on the equipment list which combined the originally requested equipment and the additionally requested equipment, the priority with 3 grade-systems set up by the Indonesian side and the requested quantity were justified by the comparison and assessment of necessary equipment and quantity in the research activities and research themes. Through these procedures, the necessary equipment were selected and the quantities were determined.

2) The research fields of each researcher in each laboratory and the past results were assessed in connection with the requested equipment.

3) Consumables such as chemicals and spare parts basically were excluded, however the consumables such as mounting boards and wet collections etc., necessary for the restoration of specimens, which was an important objective on this project, were to be included depending on the budget situation of Indonesian side.

4) The usable existing equipment were included in the adjusted contents and quantities of equipment

5) Some high grade analytical equipment, high cost multipurpose equipment, equipment which needs the high technology and high level maintenance and the equipment which needs the high operation cost were included. These equipment were studied well based on the necessity and the solvency of budget and manpower by Indonesian side.

6) The plan of high performance analytical equipment and high cost multipurpose equipment, considered not only the common use among laboratories in each division but also the common use between two divisions.

7) The quantities of equipment were determined based on the requested and existing equipment. The quantity in each laboratory was be 1 (one) or 2 (two). The quantities of equipment for the field survey were based on the number of group of surveyors which was 3 (three).

8) As for high performance analytical equipment, common equipment room were prepared for the convenient utilization by each laboratory

9) On the layout plan, the following points were considered.

   ① The layout plan of laboratories, preparation rooms and equipment rooms prepared by Indonesian side and the existing equipment which will be transferred from the existing facility were considered during the layout plan.
   ② The general equipment which are used daily, were to be installed in each laboratory and the high performance analytical equipment were to be set up for proper common use. However some common equipment were allocated to the laboratory which would use very frequently.

③ The layout of central experimental table, side table and working table were designed after assessment of manner of equipment utilization and the methodology of experiment and analysis.

(2) Equipment Design

The researchers of RCG will be within a constant level from their background.

Table 2-35 Background of Researcher

Name of Group	Doctor	Master	Bachelor
Botany Dept.,	21	7	46
Microbiology Dept.,	8	5	27

As for the equipment of research facility, there is no standard in Japan. However "Facility standard for the experiment of students in the division of engineering in the University" were prepared through the discussion of technical education council settled in the Ministry of Education in Japan in 1953 and 1961. Considering this standard, the design of equipment was prepared.

The original request was 542 items in the division of Biology, 231 items in the division of Microbiology and 773 items in total.

Table 2-36 Original Request of Research Laboratory Group

Botany Division

Code No.	Name of group in Botany Division	Items
B-7/8/9/10	Taxonomy	83
B-14/15/19/20	Herbarium	125
B-12	Ecology	36
B-13	Ethnobotany	34
B-4/5/6	Anatomy and Morphogenetic	92
B-2/3	Plant Physiology	118
B-1	Phytochemistry	54
Total		542

Microbiology Division

Code No.	Name of group in Microbiology Division	Items
M-1	Ecology and Physiology	73
M-2	Applied Microbiology & Developmental	55
M-3	Biosystematics & Generics	48
M-4	Microbial Biochemistry	55
Total		231

The equipment list, presented by divisions and by research groups, was finalized through the discussion among two parties. The followings are details discussed among two parties and the final request by Indonesian side.

1) Both Division

In some of the research laboratories, both of the draft chamber and the clean bench were requested. As the utilization of both equipment in the same laboratory is not recommended, the number of draft chamber was adjusted to avoid the duplication of these equipment in each laboratory in each division. The common use of draft chamber in each laboratory group was also taken into consideration.

In many of the research laboratories, the analytical balances were requested. However special flooring and anti-vibration balance table are needed for utilization. Thus, 2 (two) kind of analytical balances were designed for common use in common equipment room of both divisions.

Any item, which was produced by a mono-manufacturer, was substituted with other item which plural manufacturers produce. When the plural manufacturers did not exist, such items were excluded.

① Phytochemistry research of Phytochemistry group (Natural product laboratory, Bio-Organic Science laboratory, Bio Assay laboratory)

The main themes of Phytochemistry group are "Isolation, extraction, antibacterial and antioxidant test of biologically active components" and "Study on interaction between soil microbes and the plant". The equipment necessary for these researches were requested. High performance analytical equipment such as Middle pressure chromatography, Chromato-tron, High resolution mass spectrometry, Nuclear Magnetic Resonance Spectrometer (NMR) etc., were excluded due to their high cost and the difficulty of maintenance. The Spectrofluorometer, Supercritical Fluid Extraction and Amino acid analyzer were also excluded due to the limited necessity. The Freeze drier, UV-VIS Spectrometer, FT-IR Spectrophotometer, and DNA Sequencer were included and classified under common use, as they have a wide application in other fields also. The DNA Sequencer was to be installed in the Genetic laboratory of Biosystematics & Genetics group from the frequency of use. The requested Packed column type distillation apparatus was for plant scale and could not be installed in the laboratory, so it was substituted by the laboratory level distillation unit. The extractor was also substituted by the Soxhlet abstractor due to same reason.

○=included, ×=excluded, △=specification adjustment

Item	Equipment	R'est	Q'ty	Priority	Judge
B-1-1	Clean bench(Vertical air current type)	2	2	A	○
B-1-2-1	Rotary evaporator 2 L	8	1	A	○
B-1-2-2	Rotary evaporator 10 L	2	1	A	○
B-1-6	Test tube mixer	2	2	A	○
B-1-7	Laboratory jacks	2	1	B	○
B-1-8	Benchrack lattice	2	2	B	○
B-1-9	Syringe cleaners	2	2	A	×
B-1-11	Water bath 29 L	2	1	A	○
B-1-12-1	Ultrasonic cleaner	1	1	A	○
B-1-12-2	Ultrasonic pipette cleaner	1	1	A	○
B-1-13	Autoclave 46 L	2	2	A	○
B-1-14-2	CO2 Incubator	1	1	A	○
B-1-15	Chiller/cooling aspirator	4	4	A	○
B-1-16-1	High speed microcentrifuge	1	1	A	○
B-1-16-2	High speed refrigerated centrifuge	1	1	A	○
B-1-17-1	Freezer	1	1	A	○
B-1-17-2	Deep freezer	1	1	A	○
B-1-18	Refractometer	1	1	B	○
B-1-19	Freeze drier	2	0	B	Common
B-1-20	Draft chamber	3	1	A	○
B-1-21-1	Packed column type distillation unit 20 L	2	1	A	Changed to 2 L
B-1-21-2	Packed column type distillation unit 200 L	2	0	A	
B-1-23-1	Drying oven for instruments	1	1	A	○
B-1-23-2	Incubator	1	1	A	○
B-1-24	Sample mill	1	1	A	○

B-1-25	Extractor	2	1	A	△
B-1-26	Middle pressure chromatography(flash chrome)	1	0	A	×
B-1-27	Chromato-tron Chromatograph	1	0	A	×
B-1-28	Gradient HPLC	1	0	A	Common
B-1-29	Recycling HPLC	1	1	A	○
B-1-30	UV-VIS Spectrometer	1	0	A	Common
B-1-31	Fourier transform infrared spectrophotometer (FTIR)	1	0	A	Common
B-1-32	High resolution mass spectrometry	1	0	A	×
B-1-33	Glassware + rubber filler etc.	1	0		×
B-1-34	Nuclear magnetic resonance spectrometer(NMR)	1	0	A	×
B-1-35	DNA Sequencer	1	0	A	Common
B-1-36	Fermenter	1	1	A	○
B-1-37-1	Electrophoresis（horizontal type w/densitometer）	1	1	B	○
B-1-37-2	Electrophoresis（vertical）	1	1	B	○
B-1-38	Thermal cycler for PCR	1	1	B	○
B-1-39	Supercritical Fluid extraction	1	0	A	×
B-1-40	Amino acid analyzer	1	0		×
B-1-41	Spray drier	1	1	B	Common
B-1-44	Animal cage（rat）	20	20	A	○
B-1-45	Animal cage（mouse）	20	20	A	○
B-1-46	Animal cage (rabbit)	10	10	A	○

② Plant Cell & Tissue Culture research of Plant Physiology group (Plant cell & tissue culture laboratory, Common optic room, Two(2) culture rooms of high and low temperature, Wet processing room and Cryo storage room)

The research theme of the plant cell & tissue culture laboratory is “generative and vegetative propagation of rare and economically important plant species”. The requested equipment will be used for the tissue culture. Out of 5 kinds of microscope requested, the inverted microscope and stereomicroscope were selected in consideration of the existing equipment.

Item	Equipment	R’est	Q’ty	Priority	Judge
B-2-1	Clean bench(Laminar air flow)	4	3	A	○
B-2-2	Desk top centrifuge	1	1	A	○
B-2-5-1	Cart	2	1	B	○
B-2-5-2	Cart（folding type）	1	1	A	○
B-2-6	Inverted microscope with camera	1	1	A	○
B-2-7	Stereo microscope	1	1	B	○
B-2-8	Stereoscopic microscope with digital camera	0	0	A	×
B-2-9	Stereoscopic microscope	1	1	A	×
B-2-10	Microscope for dissecting	2	1	A	×
B-2-11	Fiber optic bifurcated illuminator	1	1	A	○
B-2-12	Shaker	4	2	2A/B/C	○
B-2-13	Culture shelf	20	20	B	○
B-2-14	Computer	2	2	1A/1C	○
B-2-20	Film scanner	1	1	B	○
B-2-21	Flatbed scanner	1	1	B	○
B-2-25	Laser printer	1	1	C	○
B-2-26	Refrigerator	4	2	2A/2C	○
B-2-27～33	Micropipette set	4	2	A	○
B-2-34	Test tube mixer	2	2	C	○
B-2-36	Autoclave large	2	1	A	○
B-2-38	Drying oven	1	1	B	○
B-2-39	Sterilizer, dry heat with glass bead	6	2	A	○
B-2-40	Magnetic stirrer with hot plate	4	2	B	○
B-2-41	Electronic balance、600g、0.01g	2	1	C	○
B-2-42	Analytical balance 300g、0.1mg	1	1	C	Common
B-2-43	Top loading balance 3000g、0.01g	1	1	C	○

B-2-47～49	Spatulas （6 1/2, 9, 8 in.）	12	1	C	○
B-2-50	pH meter (desk top type)	2	2	C	○
B-2-51	Freezing container	8	1	A	○
B-2-52～57	Flask dewar （2、10、20、34、35 l）	2/3	1	A	○
B-2-71-1	Water bath	1	1	A	○
B-2-71-2	Culture flasks and tubes	1	1	C	×
B-2-72	Culture flasks, long neck:125mL	240	1	C	○
B-2-73	Culture flasks, long neck:250mL	240	1	C	○
B-2-74	Culture tubes	2400	1	C	○
B-2-75	Culture tube rack	200	1	C	○
B-2-76	Closures for tubes	1000	2	C	×
B-2-77	Water purifier	1	1	A	○
B-2-78	Touch-o-matic gas burner	6	2	A	○
B-2-80	Liquid nitrogen producer	1	1	A	○
B-2-81	Medium dispenser	1	1	B	×

③ Stress Physiology research of Plant Physiology group (Stress physiology laboratory, Macro Propagation laboratory and Preparation room)

In the Stress physiology laboratory, research equipment to be used for “Impact under the environmental stress such as water and weather” are required. Several kinds of equipment related to the photosynthesis and transpiration were requested, so a component into which assembled their duplicated functions was included instead of them.

The AAS was included as common use in the common equipment rooms.

Item	Equipment	R’est	Q’ty	Priority	Judge
B-3-1	Portable photosynthesis and transpiration measurement system	2	1	A	○
B-3-2	Image analysis system	2	1	A	×
B-3-3	Porometer	2	2	A	○
B-3-4	Tube net radiometers	2	2	B	○
B-3-5	Sunfleck ceptometer type CEP	2	1	B	○
B-3-6	Weather station	2	1	B	○
B-3-7	Data logger	2	1	A	To B-3-6
B-3-8	Plant colony analyzer	2	2	B	×
B-3-9	Soil hygrometer/psychrometer	2	2	A	○
B-3-10	Leaf hygrometer / psychrometer	2	2	A	○
B-3-11	Sample chamber	2	1	C	×
B-3-12	Psychrometer switchbox	2	1	C	×
B-3-13	Respirometer	1	1	A	△
B-3-14	Germinator chamber	2	2	A	○
B-3-15	Incubator	3	2	A	○
B-3-16-1	Analytical balance 0-1200g, 0.1mg	1	1	A	Common
B-3-16-2	Electronic balance 0-1200g, 0.1g	1	1	A	○
B-3-17-1	Drying chamber 106 L	1	1	A	○
B-3-17-2	Drying chamber 144 L	1	1	A	○
B-3-19	Seed counter	1	1	C	○
B-3-21	Refrigerator	2	1	A	○
B-3-22	Freezer	1	1	B	○
B-3-23	Digital camera	1	1		○
B-3-25	Atomic Absorption Spectrophotometer	1	0	A	Common
B-3-26	Infrared moisture meter	1	1	A	○
B-3-27	Stereoscopic microscope	1	1	A	○
B-3-28-1	pH meter(Portable)	1	1	A	○
B-3-28-2	pH meter (Desktop)	1	1	A	○
B-3-29	Colorimeter	1	1	B	○
B-3-30	Computer set (plus printer and scanner)	1	1	A	○
B-3-31	Desk top centrifuge	1	1	B	○

④ Plant Genetic research of Anatomy and Morphogenetic group (Plant genetic laboratory, Culture/equipment room)

Plant genetic laboratory's research theme is "genetic improvement and inducing genetic variability of endangered or economically important species". The spectrophotometer and the DNA Sequencer are transferred to the common use. The microscopes were excluded as there was enough number in the existing facility.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-4-1-1	Water bath	1	1	A	5 L
B-4-1-2	Water bath	1	1	A	10 L
B-4-2	Thermal cycler for PCR	1	1	A	○
B-4-3	Autoclave（Horizontal)	1	1	A	○
B-4-4	Drying oven	1	1	A	○
B-4-5	Refrigerated centrifuge	1	1	A	○
B-4-6	Rotor (for microcentrifuge)	1	-	A	To B-4-5
B-4-7	Refrigerator	1	0	A	×
B-4-8	Freezer	1	0	A	×
B-4-9	UV-VIS Spectrometer (DNA quantitation)	1	0	A	Common
B-4-10	Power supply	1	-	A	×
B-4-11	Power supply	1	-	A	×
B-4-12	Electrophoresis](horizontal type)	2	1	A	○
B-4-13	Electrophoresis(horizontal, large)	2	1	A	○
B-4-14	Electrophoresis(vertical type)	2	1	A	○
B-4-15	Comb bridges	2	-	A	To accessory
B-4-16	Combs	4	-	A	To accessory
B-4-17	UV-transparent trays	3	-	A	×
B-4-18	Dewar flasks（4 L）	2	2	A	○
B-4-19	Gel air drier	1	1	A	○
B-4-20	Vacuum centrifugal concentrator	1	1	A	○
B-4-21	UV transilluminator	1	1	A	○
B-4-22	UV blocking eye glasses	2	1	A	○
B-4-23	Gel documentation system	1	2	A	○
B-4-24	Red filter	1	1	A	×
B-4-25	Micropipette set	2	2	A	△
B-4-26	Carousel racks for pipettes	2	0	A	×
B-4-27	Rack for microcentrifuge tubes	4	-	A	×
B-4-29	Glass reagent bottles	1	1	A	○
B-4-30	Laboratory cooler	2	2	A	○
B-4-31	Draft chamber	1	1	A	○
B-4-32	Extractor for ethidium bromide decontamination	2	2	A	○
B-4-33-1	Biohazard waste container	2	2		○
B-4-36	pH meter (Desktop)	1	1	A	○
B-4-37	Magnetic stirrer with hot plate	2	2	A	○
B-4-38	Test tube mixer	2	2	A	○
B-4-39	Analytical balance 300g、0.1mg	1	1	A	Common
B-4-40	Top loading balance 1200g、0.1g	1	1	A	○
B-4-42-1	Staining box	2	2	A	×
B-4-42-2	Staining box (with groove)	2	2	A	×
B-4-43	Steel cupboards	1	0		×
B-4-44	Water purifier	1	1	A	○
B-4-45	DNA sequencer	1	0	A	Common
B-4-46	Clean bench(Lamina flow type)	2	2	A	○
B-4-47	Inverted Microscope	1	0	A	×
B-4-48	Light transmission microscope	1	0	A	×
B-4-49	Dissecting microscope	2	0	A	×
B-4-50	Flow cytometer	1	0	A	×
B-4-51	Computer	1	1	A	○
B-4-52	Clean bench(Laminar air flow type)	1	0	A	×
B-4-53	Deep freezer	1	1	A	○

⑤ Plant Morphology, Anatomy and Cytology laboratory of Anatomy and Morphogenetic group

1) Cytology research

The Cytology research, which themes is “biological morph and reproduction of parasitic plant”, mainly study the interrelationship between host and parasitic plant. The requested ultra microtome is very expensive and is normally used for preparation of the specimen of electron microscope or infrared spectrophotometer. Thus this changed to the precision microtome available up to 0.5μ. The stereoscopic microscope was excluded due to the low frequency of utilization in this research.

Item	Equipment	R’est	Q’ty	Priority	Judge
B-5-1	Ultra microtome with glass breaker	1	1	A	△
B-5-2	Transmission light microscope	1	1	A	○
B-5-3	Stereoscopic microscope	1	0	A	×

2) Plant Morphology and Anatomy research

The research theme in anatomy and cytology research is “flower biology, autogamy, fruiting induction and artificial crossing of endangered and medicinal plant”. The equipment unnecessary for the research were excluded and the inverted microscope and CCTV stereoscopic microscope were excluded due to the existing microscopes.

Item	Equipment	R’est	Q’ty	Priority	Judge
B-6-1	Vacuum pump	1	1	A	○
B-6-2	Digital stereoscopic micrometer	1	1	A	○
B-6-3	Software for B-6-2	1	1	A	×
B-6-4	Precision rotary microtome	1	1	B	○
B-6-5	Razor blade holder	2	0	B	×
B-6-6	Specimen heating stage	1	1	B	○
B-6-8	Microtome knife sharper	1	0	B	×
B-6-9	CCD Microscope	1	1	B	○
B-6-10	Staining jar	24	12	C	○
B-6-13	Increment borers	2	2	B	○
B-6-14	CCTV Stereoscopic microscope	1	0	A	×
B-6-16	Draft chamber	1	1	A	×
B-6-17	Magnetic stirrer with hot plate	2	2	B	○
B-6-18	Vacuum desiccator	12	2	B	○
B-6-19	Inverted microscope	3	0	A	×
B-6-22	Water bath	1	1	C	○
B-6-23	Computer	1	1	A	○
B-6-25	Microscope	1	0	A	×
B-6-28	Universal testing machine (UTM)	1	0	B	×
B-6-30	Incubator	1	1	B	○
B-6-31	Water purification	1	1	B	○
B-6-32	Vacuum oven	1	0	B	×
B-6-33	Chemical cabinet	1	1	A	○

⑥ Biosystematics research of Taxonomy group (Biosystematics laboratory I、II）

In the Biosystematics laboratory, “biosystematics study based on the morphological characters” is conducted. The microscope with slide observation attachment and dissecting microscope with micrometer were included.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-7-1	Microscope with slide observation attachment	4	2	A	○
B-7-2	Dissecting microscope with micrometer	8	2	A	○
B-7-3	Micrometer	8	-	A	×
B-7-4	Microscope with camera	4	2	A	○
B-7-5	Forceps microdissecting	12	12	B	○
B-7-6	Sharp pointed forceps	12	0	B	×
B-7-7	Hand lens	6	6	B	○
B-7-9	Glass fibre light conductors	10	0	B	×
B-7-10	Microwave oven	4	0	A	×
B-7-11	Computer（Mac）	2	1	A	○
B-7-15	Computer	5	1	A	○
B-7-16	Printer	5	1	A	○
B-7-17	Scanner	2	1	A	○
B-7-18	Tally counters	1	3	A	○
B-7-20	Water proof torch	5	3	A	○

⑦ Chemotaxonomy research of Taxonomy group (installed into Plant Cell & Tissue Culture laboratory, Plant Physiology group)

The equipment necessary for the isolation and analysis at molecular level were included.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-8-1	Horizontal gel electrophoresis units MP-1015 multipurpose biomex	1	1	A	○
B-8-2	Power supply for electrophoresis + line cord	1	1	A	To B-8-1
B-8-3	Gel drier	1	1	A	○
B-8-4	Staining box	6	6	A	○
B-8-6	Draft chamber	1	1	A	×

⑧ Molecular Systematics research of Taxonomy group (Molecular systematics laboratory)

The equipment necessary for the isolation and analysis at molecular and DNA level were included.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-9-5	Genetic analyzer	1	0	A	Common
B-9-8	Fluorometer	1	1	B	○
B-9-9	Deep freezer	1	1	A	○
B-9-10	Ice maker	1	1	A	○
B-9-11	Laboratory coolers	5	5	B	○
B-9-13	DNA tray (staining tray)	4	2	C	○
B-9-14	Ultra water purifier	4	1	B	○
B-9-16	Microcentrifuge	1	0	C	×
B-9-18	Freezer drying	1	0	C	Common
B-9-19	Draft chamber	2	1	A	○
B-9-21	Magnetic stirrer with hot plate	2	2	B	○
B-9-23	Computer（Mac）	1	1	B	○
B-9-24	Freezer	1	0	A	×
B-9-25	Thermal cycler for automated PCR	1	1	A	○
B-9-26	Liquid nitrogen transfer vessel	1	0	C	×
B-9-27	Slab gel electrophoresis	1	1	B	○
B-9-28	Cryogenic vial and box	1	1	A	○
B-9-29	Liquid nitrogen monitor	1	0	C	×
B-9-30	Ultrasonic washing machine	1	1	A	○
B-9-31	Regent bottles	1	1	B	○

B-9-32	Biohazard deposit bucket small	4	4	A	○
B-9-33	Biohazard deposit bucket large	4	4	A	○
B-9-34	Sample storage container medium	5	5	B	○
B-9-35	Sample storage container large	5	5	B	○
B-9-36	Draft chamber	1	0	C	×
B-9-37	Shaker	1	0	C	×

⑨ Cryptogamae research of Taxonomy group (Cryptogamae laboratory)

The equipment necessary for biosystematics of cryptogams, were included. The equipment for isolation and analysis at molecular and DNA level were available at Molecular systematics laboratory.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-10-1	Inverted microscope with CCTV system	2	0	B	×
B-10-2	Vacuum desiccator	12	1	C	○
B-10-3	Equipment cabinet	2	0		×
B-10-4	Growth chamber	1	0	C	×
B-10-8	Sharp pointed forceps	12	6	C	○
B-10-9	Biological microscope + camera lucida	1	1	A	○
B-10-10	Stereoscopic microscope + Teaching tube for 2	1	1	A	○
B-10-11	Water bath	1	1	A	○
B-10-12	Refrigerator	1	1	B	○
B-10-13	Hot plate stirrer	1	1	C	○
B-10-14	Chemical cabinet	1	1	B	○
B-10-15	Autoclaves small	1	1	B	○
B-10-16	Clean bench(Vertical air current type)	1	1	A	○
B-10-17	Hot plate	1	0	C	×
B-10-18	Stereoscopic microscope	2	1	A	×
B-10-20	Computer	1	1	C	○

⑩ Plant Ecology research of Ecology group (Soil and Plant Litter, Plant Ecology laboratory)

The equipment for forestry ecology research were mainly included. Atomic Absorption Spectrometer (AAS) and UV-VIS Spectrometer were included in the common equipment rooms.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-12-1	MVSP program	1	1	A	×
B-12-2	Relascope	2	2	B	○
B-12-3	Lux meter	3	3	A	○
B-12-4	Leaf area meter	2	1	A	×
B-12-5	Haglof VERTEX hypsometer	3	3	A	×
B-12-6	Densitometer for canopy	3	3	B	×
B-12-7	Computer	2	2	A	○
B-12-8-1	Laser printer	1	1	A	○
B-12-8-2	Ink jet printer	1	1	A	○
B-12-9	Scanner	1	1	A	○
B-12-10	pH meter(Portable)	3	1	A	×
B-12-11	pH meter(Portable)	1	0	B	×
B-12-12	Microscope	1	0	B	×
B-12-13	Stereoscopic microscope	1	0	A	×
B-12-14-1	Drying oven L	1	0	A	×
B-12-14-2	Drying oven M	1	1	A	○
B-12-15	Electronic balance 6100g、0.1g	1	1	A	○
B-12-16-1	Field digital scale、1000g	2	2	B	○
B-12-16-2	Field digital scale、100g	2	2	B	○
B-12-17	Theodolite	1	1	B	○
B-12-18	Photosynthetic portable	1	1	A	○
B-12-19	Soil tester	2	2	A	○

B-12-20	Thermohygrometer	3	3	A	○
B-12-23	Tape measure	10	5		○
B-12-25	Atomic absorption spectrophotometer	1	0	A	Common
B-12-26	Mercury analyzer	1	1	A	○
B-12-27	UV-VIS spectrometer	1	0	A	Common
B-12-28	CN analyzer	1	1	A	○
B-12-29	Soil CO2 meter	1	1	A	×
B-12-30	Muffle's furnace	1	1	A	○
B-12-31	Incubator	1	1	A	○
B-12-32	Light meter	1	1	A	○
B-12-33	Chlorophyll meter	1	1	A	○

⑪ Ethnolobotany research of Ethnobotany group (Ethnobotany laboratory)

The Ethnobotany laboratory is used to "studying the traditional knowledge of local ethnic communities on plant community, such as knowledge for natural resources conservation, plants for traditional medicine, plant for daily life including ritual, ceremonial purposes and traditional farming". Many of the equipment were duplicated with the field equipment so the duplicated items were deleted. The furniture for laboratory were excluded as they are built-in in the design of the facility.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-13-1	Electronic labelmaker	2	2	A	○
B-13-2	Barcode maker	2	0	B	×
B-13-10	Audio set	1	0	A	×
B-13-11	Computer	2	1		○
B-13-15-1	Laser printer	1	1	A	○
B-13-15-2	Ink jet printer	1	1	A	○
B-13-17	Scanner	1	1	B	○
B-13-19	Fire proof archive cabinet	4	0	B	×
B-13-26	Drying oven	1	-	B	×
B-13-27	Taper measure	2	-	B	×

⑫ Herbarium

The indispensable materials for the restoration for plant dry and wet specimens, were included as follows;

Item	Equipment	R'est	Q'ty	Priority	Judge
B-14-1	Cart(mechanical)	2	2	A	○
B-14-2	Cart（folding type）	2	2	A	○
B-14-3	Cart(carriage)	6	3	A	○
B-14-4	Cart(utility)	4	0	A	×
B-14-5	Freezer	1	0	A	×
B-14-6	Plastic bag 10x8cm with zipper	100,000	-	A	36,000
	Plastic bag 15x11cm with zipper	50,000		A	14,000
	Plastic bag 44x55cm with zipper	500,000		A	34,600
B-14-7	Samson paper	100,000	0		×
B-14-8-1	Danish bottles, 450cc	5,000	-	A	4,400
B-14-8-2	Danish bottles, 850cc	2,500	-	A	4,400
B-14-9-1	Us bottles, 2000cc	1,000	-	A	4,400
B-14-9-2	Us bottles, 4000cc	1,000	-	A	4,400
B-14-9-3	Us bottles, 250cc	5,000	-	A	13,000
B-14-9-4	Us bottles, 125cc	7,500	-	A	13,000
B-14-10	Carpology collection cabinet	80	-	A	521
B-14-12	Specimen cabinet	1,000	-	A	3
B-14-13	Slide pollen, anatomy, mycology collection cabinet	5	-	A	×
B-14-18	Species cover/species folders	1,000,000	-	A	102,455
B-14-19	Genus covers	1,000,000	-	A	20,491
B-14-20	Mounting papers/mounting board	1,000,000	-	A	307,365

B-14-23	Herbarium mounting tape for dry collection				553
B-14-24	Iron heater for herbarium				40
B-14-26	Alcohol meter	1	1	A	○
B-14-27	Box for wet collection 31.5x40x13cm	2,400	-	A	288
B-14-28-1	Box for carpology 8x76x48cm	1,500	-	A	To B-14-27
B-14-28-2	Box for carpology	500	0		To B-14-27
B-14-29-1	Box for fungi 49x16.5x8cm	3,500	-	A	To B-14-27
B-14-29-2	Box for fungi 49x35x8cm	200	0		To B-14-27
B-14-29-3	Box for fungi 16x8x5cm	500	-	A	To B-14-27
B-14-29-4	Box for fungi 8x8x2.5cm	200	-	A	To B-14-27
B-14-30	Seed collection cabinet	5	-	A	×
B-14-36	Walk in freezer（prefabricated type）	1	1	A	○
B-14-38	Drying oven	1	1	A	○

⑬ Field Equipment

Item	Equipment	R'est	Q'ty	Priority	Judge
B-15-1	Altimeter	8	4	A	○
B-15-2	Portable trace light tables	2	1	A	○
B-15-3	Caliper	8	4	A	○
B-15-4	Sokkia small mirror stereoscope	4	4	A	○
B-15-5	Tree grippers (panjat pohon)	4	2	A	○
B-15-6	Tree pruner head	4	4	A	○
B-15-7	Binocular	4	4	A	○
B-15-10	Seccateur	4	4	B	○
B-15-11	Hand pruners	2	2	A	○
B-15-12	GPS（with antenna）	4	2	A	○
B-15-13	GPS（Handy type）	2	2	A	○
B-15-14	Compass（with hook）	4	4	A	×
B-15-15	Compass(precision type)	4	0	B	×
B-15-16	Compass with clinometer	4	4	A	○
B-13-3	Tape recorder	4	4	A	○
B-13-4	Counter	3	3	B	○
B-13-6	Diameter tape	5	5	B	○
B-13-7	Soil profiler(sampler)	2	2	A	○
B-13-8	Soil pH and moisture meter	2	2	A	○
B-13-9	Digital caliper	4	4	A	○
B-13-29	Relascope	1	1	B	○
B-13-30	Digital Video Camera	3	3	A	○
B-13-31	Digital Camera	3	3	A	○

⑭ Video processing room

Item	Equipment	R'est	Q'ty	Priority	Judge
B-19-1	Slide & photograph cabinet	5	1		×
B-19-2	Camera	1	1		○
B-19-3	Camera flash	1	1		○
B-19-4	Tripod	1	1		○
B-19-5	Macro hand	1	0		×
B-19-6	Copy stand	1	0		×
B-19-7	Camera case	1	1		○
B-19-8	Camera filter 58mm	1	1		○
B-19-9	Slide viewer	1	1		○
B-19-10	Stepping ring	1	1		○
B-19-11	Treshine foto konbata plus sutando	1	1		○
B-19-12	Video camera	1	1		○
B-19-13	Video DC light	1	1		○
B-19-14	Home video light	1	1		○
B-19-15	Video player cassette VHS	1	1		○
B-19-16	TV 25"	1	1		○
B-19-17	Video title	1	1		○

B-19-18	Digital handycam	3	0		×
B-19-19	Video walkman player	1	0		×
B-19-20	Tripod	3	0		×
B-19-21	Digital camera	3	0		×
B-19-22	Camera autofocus	2	0		×
B-19-23	Macro lens autofocus	2	0		×
B-19-24	Camera cine handycam	1	0		×
B-19-25	Ring flash	1	0		×
B-19-26	Camera flash	2	0		×
B-19-27	Slide duplicator	1	1		○
B-19-28	Photo camera	2	0		×
B-19-29	Telezoom camera	1	0		×
B-19-30	Video camera	2	0		×
B-19-31	Tripod	3	0		×
B-19-32	Digital camera	3	0		×
B-19-33	Slide scanner	1	1		○
B-19-34	Video capture program	1	0		×
B-19-35	Cable from video player VHS to computer	1	-		×
B-19-36	Plotter for environmental education	1	1	A	×

⑮ Drawing room

The necessary equipment will be transferred from the existing facility. So finally all equipment in drawing room were deleted.

Item	Equipment	R'est	Q'ty	Priority	Judge
B-20-1-1	Drawing desk	2	2		×
B-20-1-2	Backlight table	1	1		×
B-20-2	Drawing	2	0		×
B-20-3	Radiograph	1	0		×
B-20-4	Rottoring combination drawing set	1	0		×
B-20-5	Drawing cabinet	2	1		×
B-20-6	Tool cabinet	2	0		×
B-20-7	Drawing cabinet	1	0		×
B-20-8	Drawing projector	1	1		×

⑯ Common equipment rooms (Analytical equipment room I & II)

Item	Equipment	R'est	Q'ty	Priority	Judge
B-1-19/B-9-18 (B-21-1)	Freeze Drier	1	1		Common
B-1-28(B-21-2)	High performance liquid chromatograph	1	1		Common
B-1-30/B-12-27 (B-21-3)	UV-VIS Spectrometer	1	1		Common
B-1-31(B-21-4)	Fourier transform infrared spectrometer (FTIR)	1	1		Common
B-1-41(B-21-5)	Spray drier	1	1		Common
B-3-25/B-12-25 (B-21-6)	Atomic absorption spectrophotometer (AAS)	1	1		Common
B-4-9(B-21-7)	Spectrophotometer（ＤＮＡ quantitation）	1	1		Common
M-4-51(B-21-8)	Gas chromatograph tandem mass spectrometer (GC-MS/MS)	1	1		Common in both dept.,

2) Microbiology Division

① Ecology and Physiology group (Ecology laboratory, Physiology laboratory and Ecology/Physiology preparation room)

"The ecology, nutritive circulation, paragenesis, heredity and function of soil microbe" are researched in this group and the necessary equipment for this research were included. High performance analytical equipment and high cost multipurpose equipment such as AAS, DNA/Protein/Enzyme analyzer, Ion Chromatography and Total Organic Carbon and Nitrogen analyzer were included as common use in the common equipment rooms.

Item	Equipment	R'est	Q'ty	Priority	Judge
M-1-1	AAS	1	0	A	Common
M-1-2	DNA/Protein/Enzyme analyzer	1	0	A	Common
M-1-3	Gas analyzer	1	0	B	×
M-1-4	Ion Chromatographs	1	0	A	Common
M-1-5	Electronic balance 600g、0.01 g	1	1	A	○
M-1-6	Incubate shaker	1	1	A	○
M-1-7	Clean bench(Vertical air current type)	1	1	A	○
M-1-8-1	Autoclaves small	1	1	A	○
M-1-8-2	Autoclaves large	1	1	A	○
M-1-9	Thermohygrometer	2	2	A	○
M-1-10	Automatic Potentiometeric Titrator and Multi Sample Changer	1	1	A	○
M-1-11-1	Refrigerated centrifuge	1	1	A	○
M-1-11-2	Refrigerated centrifuge	1	0	A	×
M-1-12	Micropipette set	1	1	A	△
M-1-13	Refrigerator cabinet	2	1	A	○
M-1-14	Magnetic stirrer with hot plate	1	1	A	○
M-1-15	Digital microscope	1	0	A	×
M-1-17	Total Organic Carbon & Nitrogen Analyzer	1	0	A	Common
M-1-19	Water quality analyzer system	1	1	A	○
M-1-20-1	Multi pipette set（0.5-10μ）	1	1	A	×
M-1-20-2	Multi pipette set（5-50μ）	1	1	A	×
M-1-22	Portable MLSS meter	1	1	A	○
M-1-23	COD meter	1	1	A	○
M-1-24	Crucible Furnace	1	1	A	○
M-1-28	BOD analyzer	1	1	A	○
M-1-29	Turbidity/temperature meter	1	1	A	○
M-1-31	Ultra precise DO meter	1	1	A	○
M-1-32	Salinometer	1	1	A	○
M-1-34	Compass	-	3	A	○
M-1-35	Altimeter	3	3	A	○
M-1-36	Soil core	3	3	A	○
M-1-37	Mud auger	3	3	A	○
M-1-38	Sand auger	3	3	A	○
M-1-40	Soil tester	3	3	A	○
M-1-41	Hygrometer	3	3	A	○
M-1-42	Thermometer	5	3	A	○
M-1-43	Binocular	1	3	A	○
M-1-44	Lux meter	5	3	A	○
M-1-45	Tape measure	4	3	A	○
M-1-46	Clinometer	4	3	A	○
M-1-47	Dry box	4	3	A	○
M-1-48	Interval timer	4	3	A	○
M-1-50	GPS	3	3	A	○
M-1-52	Drying oven	1	1	A	○
M-1-53	Magnetic stirrer with hot plate	2	2	A	○
M-1-55	Hot plate	2	2	A	○
M-1-56-1	Analytical balance、80g、0.01mg	1	1	A	Common
M-1-56-2	Analytical balance、300g、0.1mg	1	1	A	Common
M-1-57	Drying oven	1	1	A	○
M-1-58	Test tube mixer	2	2	A	○
M-1-59	pH meter (Desktop)	1	1	A	○
M-1-60	Freezer	1	1	A	○
M-1-62	Shaker	1	1	A	○
M-1-63	Computer	1	1	A	○

M-1-65	Fermenter	1	1	A	○
M-1-66	Denaturing Gradient Gel Electrophoresis	1	1	A	○
M-1-67	Draft chamber	1	1	A	○
M-1-68	Washing Machine	1	0	A	Common
M-1-69	Thermal cycler for PCR	1	1	A	○

② Applied Microbiology & Development group (Applied Microbiology laboratory, Distillation/Fermentation room)

The Applied Microbiology and Development group, which main themes are "isolation and analysis of the component of traditional fermentation food and the fermentation fungi" and "the development of agricultural production material".

Item	Equipment	R'est	Q'ty	Priority	Judge
M-2-1	Rotary Vacuum Evaporator	1	1	A	○
M-2-2	Fermenter	1	1	A	○
M-2-3	Homogenizer	1	1	A	○
M-2-4	Spray drier	1	0	B	Common
M-2-5	Crude fiber digestion	1	0	B	×
M-2-6	Autoclave	1	1	A	○
M-2-7	Electronic balance	1	1	A	○
M-2-8	Refrigerator cabinet	1	1	A	○
M-2-9	Water distillatory apparatus	1	0	A	Common
M-2-11	Shaker	1	1	A	○
M-2-12	Blender	1	0	B	×
M-2-14	Shaker incubator	1	1	A	○
M-2-15	Freezer	1	1	A	○
M-2-16	Ultrasonic Homogenizer	1	1	A	○
M-2-17	Alcohol Distiller	-	0	A	×
M-2-19	Microwave oven	1	1	A	○
M-2-21	Incubator	1	1	A	○
M-2-22	Test tube mixer	1	1	B	○
M-2-23	Clean bench(Vertical air current type)	1	1	A	○
M-2-25	Thermometer	1	1	B	○
M-2-26	Computer set	1	1	A	○
M-2-27	Oil bath	1	1	A	○
M-2-28	Top loading balance 3000g, 0.01g	1	1	A	○
M-2-32	Altimeter	5	0	B	×
M-2-33-1	Barometer	5	1	B	○
M-2-33-2	Thermo-hygrometer	1	1	A	○
M-2-34	Oven	1	1	A	○
M-2-54	Washing Machine	1	0	A	Common

③ Biosystematics & Genetics group (Genetic laboratory, Genetic Instrument room, Isolation/Preservation room and Processing room)

In the biosystematics & genetic group is conducting "the operation of the analysis of diversity, applied function and cultured specimens of microbe". High performance analytical equipment and high cost multipurpose equipment were included as common use in the common equipment rooms.

Item	Equipment	R'est	Q'ty	Priority	Judge
M-3-1	Clean bench(Vertical air current type)	3	3	A	○
M-3-2	Anaerobic laminar air flow cabinet	1	1	A	○
M-3-3	Water batch shaking incubator	1	1	A	○
M-3-4-1	Incubator	2	1	A	×
M-3-4-2	Incubator	1	1	A	×
M-3-5	Deep freezer	1	1	B	○
M-3-6	Refrigerator cabinet	1	1	A	○
M-3-7	Desk top refrigerated centrifuge	1	1	A	○
M-3-8	Microcentrifuge	1	1	A	○
M-3-9	Ice maker	1	0	A	Common

M-3-10	Water purifier	1	0	A	Common
M-3-11	Autoclave	1	1	A	○
M-3-12	Analytical balance 300g、0.1mg	1	1	A	Common
M-3-13	Binocular microscope	2	0	A	Common
M-3-14	Microscope and Camera system	1	0	A	Common
M-3-15	Test tube mixer	3	2	B	○
M-3-16	Magnetic stirrer with hot plate	2	1	B	○
M-3-17	UV-VIS spectrometer	1	0	A	Common
M-3-18	Freeze drier system	1	0	A	Common
M-3-19	Thermal cycler for PCR	2	1	A	○
M-3-20	DNA gel electrophoresis apparatus	1	1	A	○
M-3-21	Protein gel electrophoresis apparatus	1	1	A	○
M-3-22	Pulse field gel electrophoresis	1	1	A	○
M-3-23-1	Micropipette set	3	2	A	△
M-3-23-2	Multi pipette, 12channel,30-300μL	1	1	A	○
M-3-24	DNA Sequencer	1	0	A	Common
M-3-25	UV photo gel documentation system	1	1	A	○
M-3-28	Biology microstation	1	0	A	×
M-3-29	Ribo printing system	1	0	A	×
M-3-30	Vacuum pump	1	0	B	×
M-3-31	pH meter (Desktop)	1	1	A	○
M-3-33	Fermenter	1	1	A	○
M-3-35	Sonicator	1	1	A	○
M-3-36	Ultra filtration	1	1	A	○
M-3-37	Microwave oven	1	0	B	×
M-3-38	Computer	1	1	A	○
M-3-39	Laser printer	1	1		○
M-3-40	Scanner	1	1	A	○
M-3-41	Drying oven	1	0	B	×
M-3-42	Washing Machine	1	0	A	Common
M-3-44	Denaturing Gradient Gel Electrophoresis	1	0	A	×
M-3-45	Drying oven	1	0	A	×
M-3-46	Dissecting microscope	1	0	A	×

④ Microbial Biochemistry group (Microbial Biochemistry laboratory and Inoculation/Cool working room)

"The characterization and genetic identification of traditional fermentation fungi" and "applied microbiology such as the bioactive glycoside and the protein breakdown enzyme" are main themes in microbial biochemistry laboratory, which is requesting the equipment related to the isolation and analysis. The high performance analytical equipment were included as common use in the common equipment rooms.

Item	Equipment	R'est	Q'ty	Priority	Judge
M-4-1	Analytical balance 300g、0.01mg	1	1	A	Common
M-4-2	Spectrophotometer	1	0	A	Common
M-4-3	Protein electrophoresis mini.	1	0	A	×
M-4-4	Protein electrophoresis midi.	1	1	B	○
M-4-5	HPLC Digital signal	1	0	A	Common
M-4-6	Autoclaves small	1	1	A	○
M-4-7	Fast protein liquid chromatograph(FPLC)	1	0	A	×
M-4-8	Incubate shaker	1	1	A	○
M-4-9	Refrigerated Centrifuge	2	1	A	○
M-4-10	Fermenter	1	1	A	○
M-4-11	Shaker	1	1	A	○
M-4-12	Ice maker	1	0	A	×
M-4-13	Ultra filtration	1	1	A	○
M-4-14	Freeze drier	1	0	A	Common
M-4-15	Clean bench(Vertical air current type)	2	2	A	○
M-4-16-1	Magnetic stirrer with hot plate	1	1	A	○
M-4-16-2	Magnetic stirrer (6stirrer)	1	1	B	○
M-4-17	Peristaltic pump	1	1	A	○
M-4-18	Gas Chromatograph	1	0	A	×
M-4-19	UV Hand Lamp	1	1	A	○
M-4-20	Cool working room	1	1	A	○

M-4-21	Crude fiber digestion	1	1	A	×
M-4-22	Muffle's furnace	1	1	A	○
M-4-23	Fat determination system	1	1	A	○
M-4-24	Auto Kjeldahl unit	1	1	A	○
M-4-25	Thermometer	1	1	B	○
M-4-26	Vacuum Oven	1	1	A	○
M-4-27	Washing machine	1	0	A	Common
M-4-28	Sonicator	1	1	A	○
M-4-30	Rotary vacuum evaporator	1	1	A	○
M-4-31	Water purifier	1	0	A	Common
M-4-32	Concentrator	1	1	A	○
M-4-33	Fraction Collector	1	1		×
M-4-35	Micropipette set	2	2	A	△
M-4-36	Test tube mixer	2	2	B	○
M-4-37	Computer	1	1	A	○
M-4-38	Microscope	1	0	A	Common
M-4-39	Refrigerator cabinet	1	1	A	○
M-4-40	Refrigerated Centrifuge	1	1	A	○
M-4-41	pH meter (Desktop)	1	1	A	○
M-4-42	Microwave oven	1	1	B	○
M-4-43	Incubator	1	1	A	○
M-4-45	Freezer	1	0	A	×
M-4-47	Amino acid analyzer	1	0	A	×
M-4-48	Water distilling apparatus	1	0	A	Common
M-4-49	Drying oven	1	1	A	○
M-4-50	Thin layer chromatography	1	1	A	△
M-4-51	GC-MS	1	0	A	Common
M-4-52	Spectropolarimeter	1	0	A	Common
M-4-53	Fluorescence Spectrophotometer	1	0	A	Common
M-4-54	Sterring Mixer	1	1	A	○

⑤ Common equipment room (Analytical equipment room I, II and Common equipment room)

Item	Equipment	R'est	Q'ty	Priority	Judge
M-1-15	Digital microscope	1	0	A	×
M-3-13	Binocular microscope	2	0	A	×
M-3-14 (M-5-1)	Microscope and camera system	1	1	A	○
M-3-46 (M-5-2)	Inverted microscope with Micromanipulator	1	1	A	○
M-4-38	Microscope	1	0	A	×
M-3-24	DNA sequencer	1	1	A	Common in both division

Item	Equipment	R'est	Q'ty	Priority	Judge
M-1-68/M-2-54/M-3-42/ M-4-27(M-5-3)	Washing machine	4	2	A	1F & 2F ○
M-2-4(M-5-4)	Spray drier	1	1	A	○
M-3-9(M-5-5)	Ice maker	1	1	A	○
M-2-9, M-4-48	Water distillation apparatus	2	1	A	×
M-3-10/M-4-31 (M-5-6/7)	Water purifier	2	1	A	1 unit into ultra purifier
M-3-18(M-5-8)	Freeze drier	1	1	A	○
M-4-14	Freeze drier	1	0	A	×

Item	Equipment	R'est	Q'ty	Priority	Judge
M-1-1(M-5-9)	Atomic absorption spectrophotometer （AAS）	1	1	A	Common in both division
M-1-2(M-5-10)	DNA/Protein/Enzyme analyzer	1	1	A	○
M-1-4(M-5-11)	Ion chromatography	1	1	A	○
M-1-17M-5-12)	Total Organic Carbon & Nitrogen Analyzer	1	1	A	○
MM-3-17(M-5-13)	UV-VIS Spectrometer	1	1	A	○
M-4-2(M-5-14)	Spectrophotometer	1	1	A	○

M-4-5(M-5-15)	High performance liquid chromatography （HPLC）	1	1	A	○
M-4-52(M-5-16)	Spectropolarimeter	1	1	A	○
M-4-53(M-5-17)	Fluorescence Spectrophotometer	1	1	A	○

3） Meeting Room and etc.,

① Meeting room

Item	Equipment	R'est	Q'ty	Priority	Judge
Meeting room（100 capacity）					
A-1	Screen	1	1	A	○
A-2	Projector 1	1	1	A	○
A-3	Slide projector	1	1	A	○
A-4	Visual presenter	1	1	A	○
A-5	OHP	1	1	A	○
A-6	Laser pointer	1	1	A	○
A-7	Audio system	1	1	A	○
A-7-1	Speaker（wall type）	1	1	A	○
A-7-2	Amplifier	1	1	A	○
A-7-3	Mixer	1	1	A	○
A-7-4	CD deck	1	1	A	○
A-7-5	Video deck	1	1	A	○
A-7-6	Cassette deck	1	1	A	○
A-7-7	Monitor	1	1	A	○
A-7-8	Microphone	1	1	A	○
A-7-9	Tuner	1	1	A	○
Meeting room（50 capacity）					
A-8	Slide projector	1	1	A	×
A-9	OHP	1	1	A	×
A-10	Projector 2	1	1	A	×
A-11	Movable screen	1	1	A	△
A-12	Television	1	1	A	×
A-13	Video deck	1	1	A	×
A-14	Tape recorder	1	1	A	○

② Library

Item	Equipment	R'est	Q'ty	Priority	Judge
L-1	Book shelf, movable	20			To facility
L-2	Computer	2	1		○
L-3	Computer	1			×
L-4	Copying machine	1	1		○
L-5	Filing cabinet	2			To facility
L-6	Typewriter	1	1		○
L-7	Cutter	1	1		○
L-8	Stapler, big	3	0		×
L-9	Boring machine	3	0		×
L-10	Cart	2	2		○
L-11	Ladder with step	2	0		×
L-12	Vacuum cleaner	2	0		×
L-13	Table & chair	7	0		×
L-14	Cupboard	7	0		×

③ Information center

The display television, computer and television set necessary for Information center were included.

④ Experimental tables etc.,

Item	Equipment	R'est	Q'ty	Priority	Judge
Botany					
T-B-1	Central experimental table	*	11		○
T-B-2	Sink table	*	22		○
T-B-3	Side experimental table	*	101		○
T-B-4	Working table	*	5		○
T-B-5	Cabinet for laboratory	*	36		○
Microbiology					
T-M-1	Central experimental table	*	7		○
T-M-2	Sink table	*	11		○
T-M-3	Side experimental table	*	81		○
T-M-4	Working table	*	1		○
T-M-5	Cabinet for laboratory	*	20		○

Remark: depending on the facility design

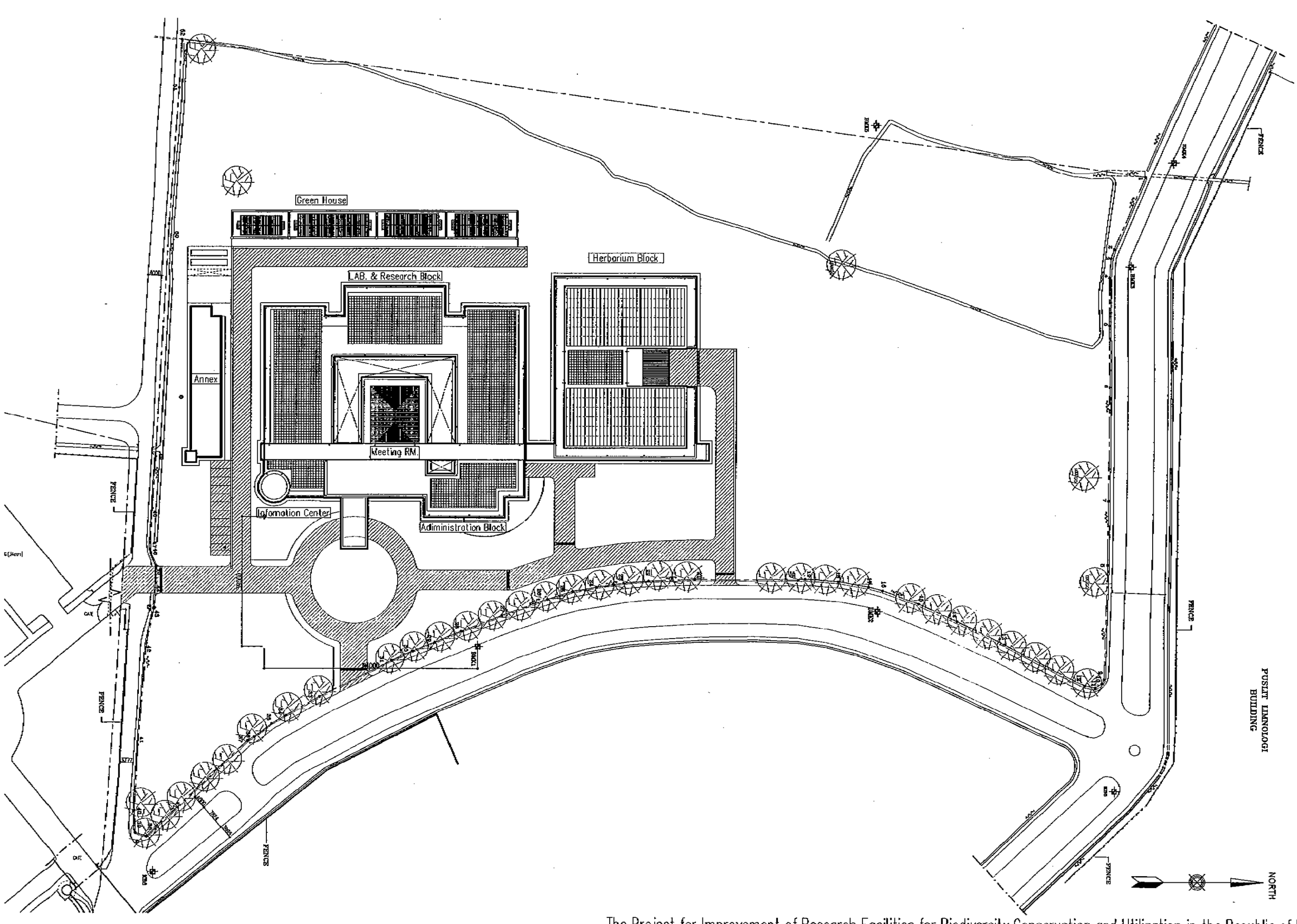
4) Relation with the existing equipment

The existing equipment which are still in working condition are to be transferred to the new facility and they were included in the design.

2.2.3 Basic Design Drawing

2.2.3.1 Facilities Drawing

1. Site Plan
2. First Floor Plan
3. Second Floor Plan
4. Third Floor Plan
5. Elevation
6. Section
7. Annex Plan/Section
8. Annex Elevation
9. Green House
10. Infrastructure Connection Site Plan



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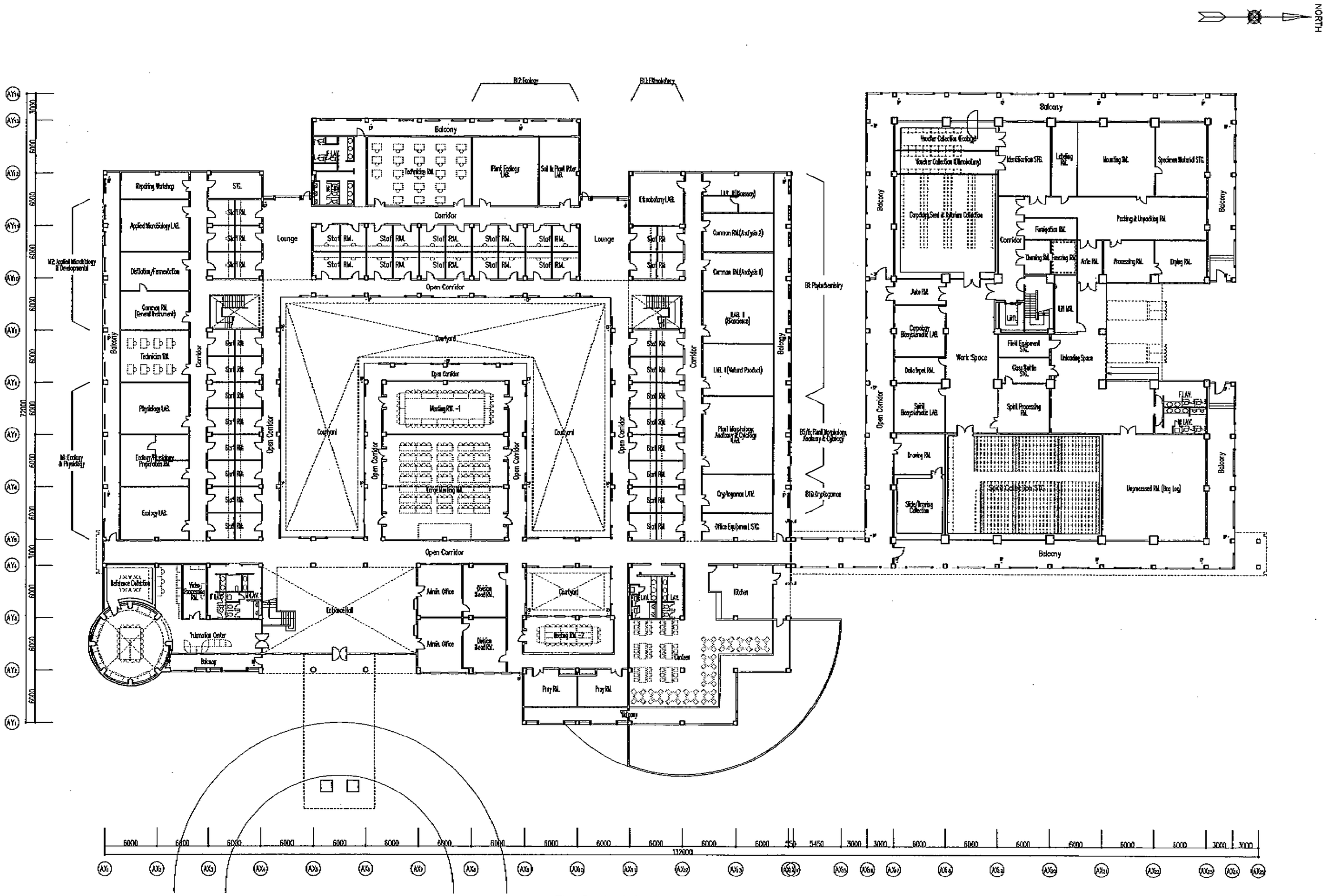
Site Plan 1:1000



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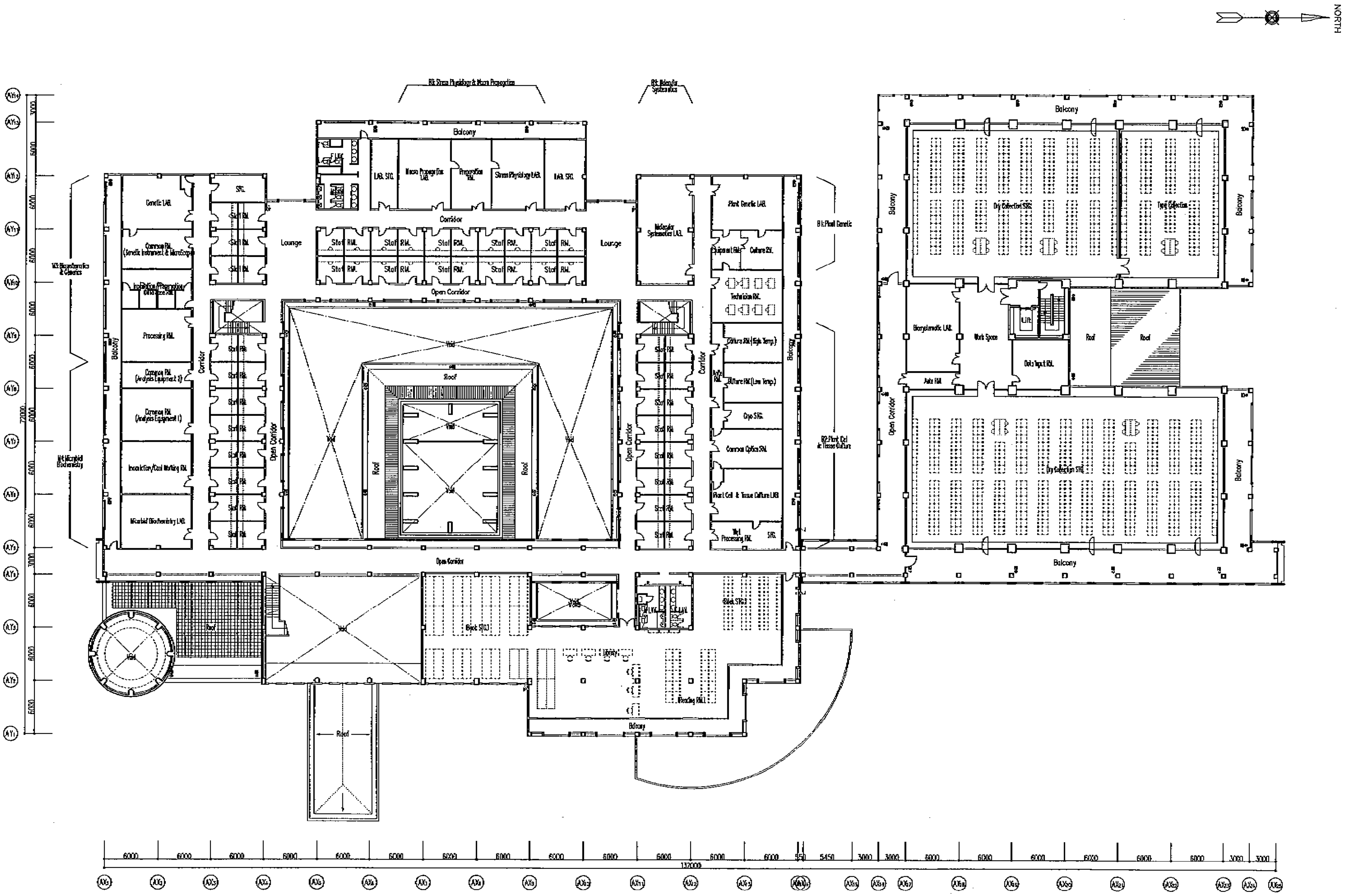
1st Floor Plan 1:400



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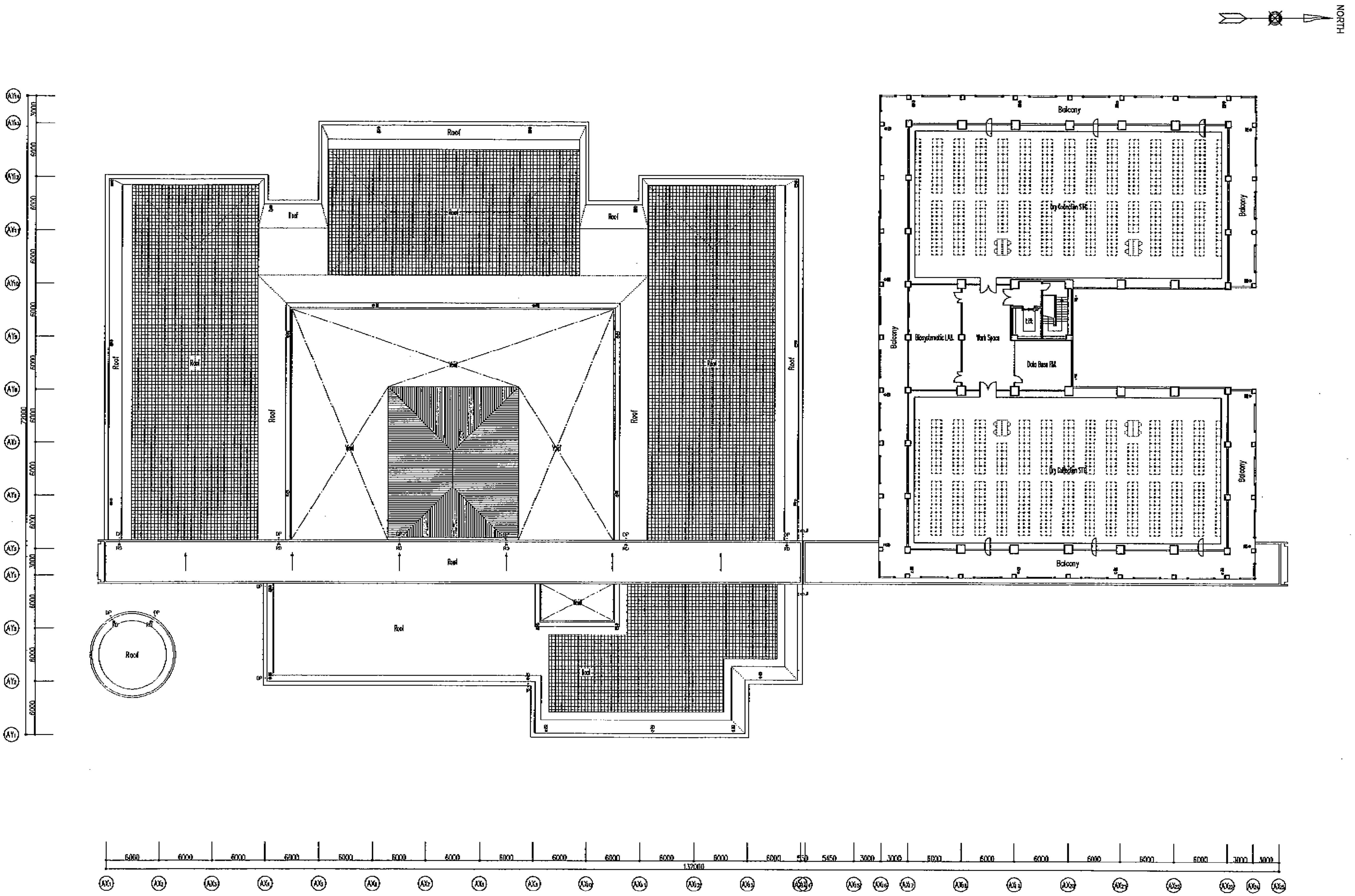
2nd Floor Plan 1:400



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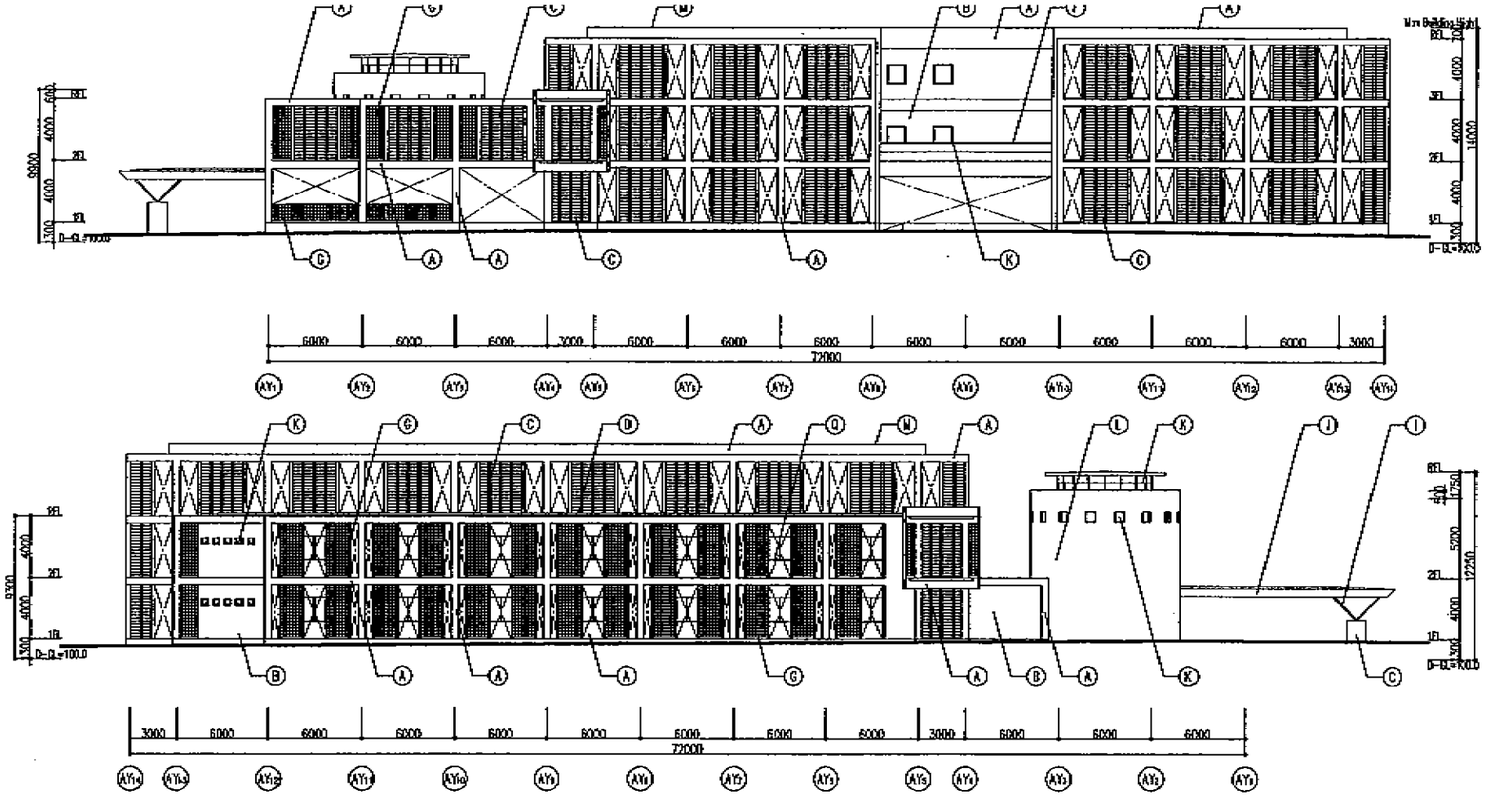
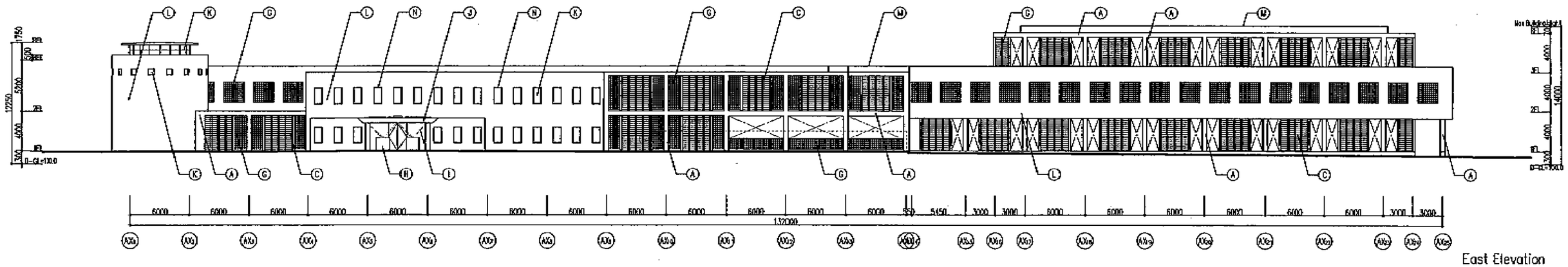
3rd Floor Plan 1:400

LEGEND			
A	SPLIT TILE	K	GLASS
B	FAIR-FACED BRICK TILE	L	CERAMIC TILE HOLLOW
C	GRC LOUVER FLIP	M	ALM. COPING
D	CONC. ROOF BRICK	N	ALM. WINDOW
E	COLOR ALM SHEET	O	FAIR FACED CONC. FLIP
F	ALM. RIBBED ROOF DECK	P	ALM LOUVER B-FLIE
G	BOLLOW BLOCK 200X200 FLIP	Q	PC HANDRAIL FLIP
H	STONE	R	CERAMIC ROOF TILE
I	SI FLIP	S	FIBER CEMENT ROOF DECK
J	ALM. PANEL B-FLIE		

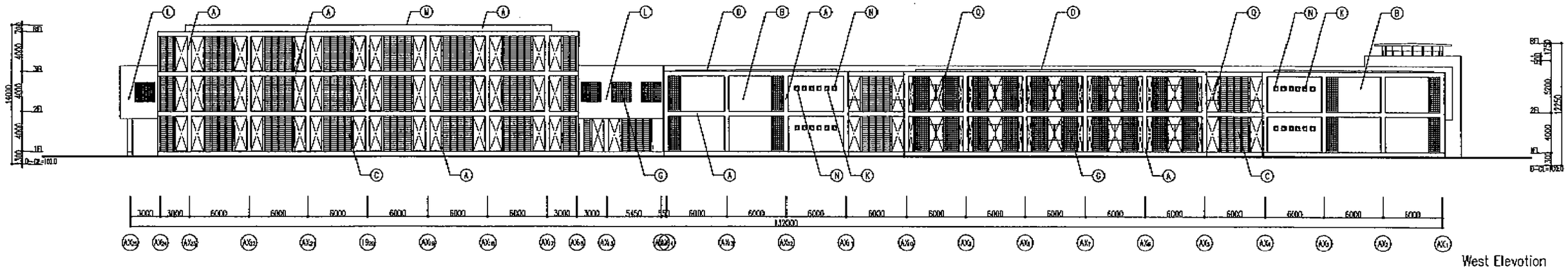


North Elevation

South Elevation



East Elevation



West Elevation

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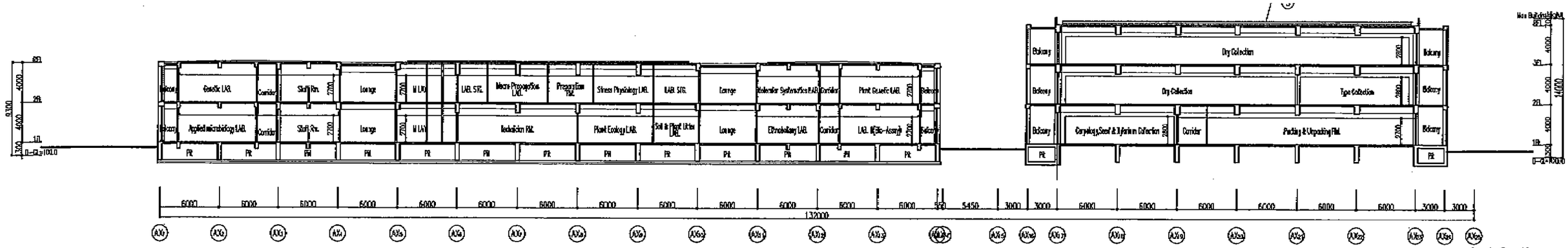
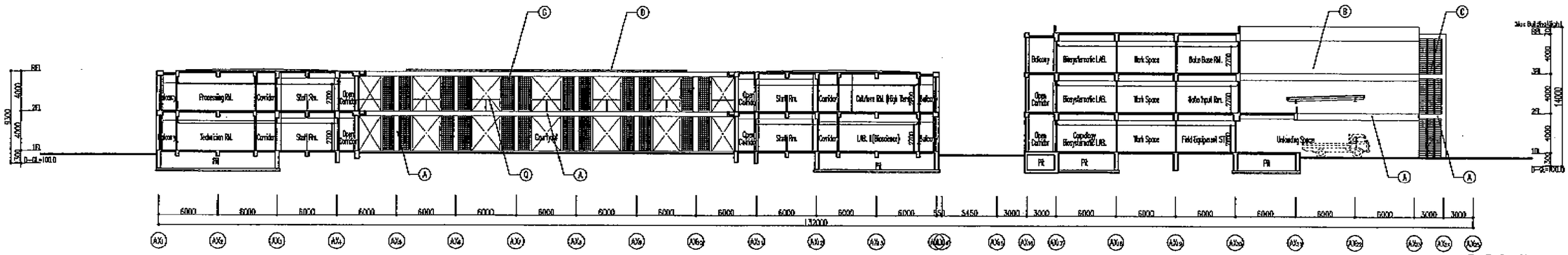
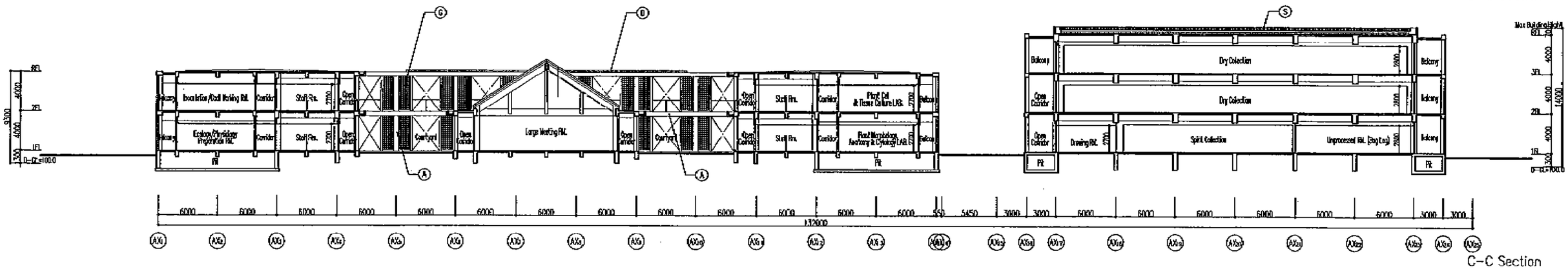
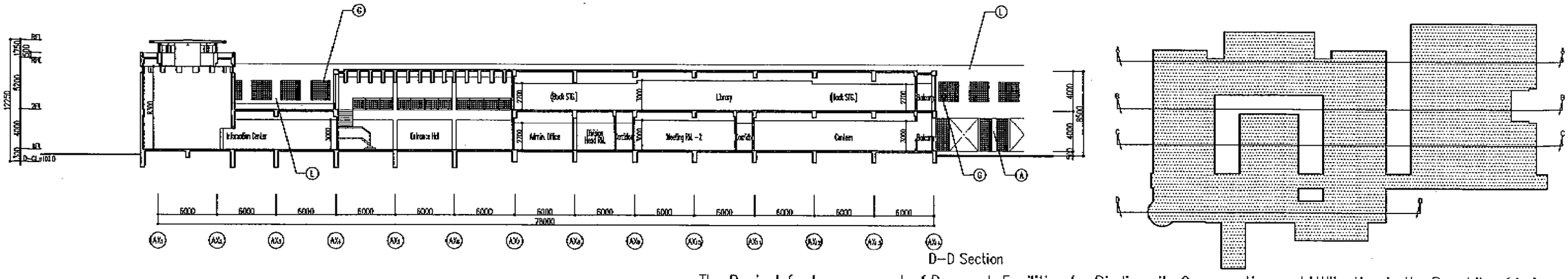
Elevation 1:400









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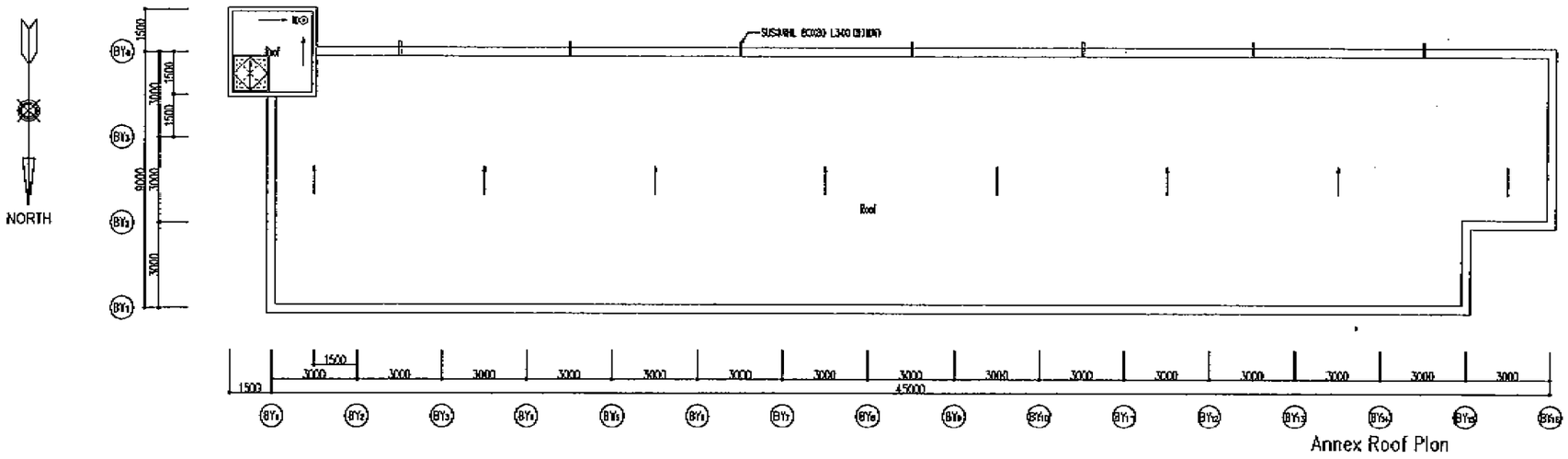
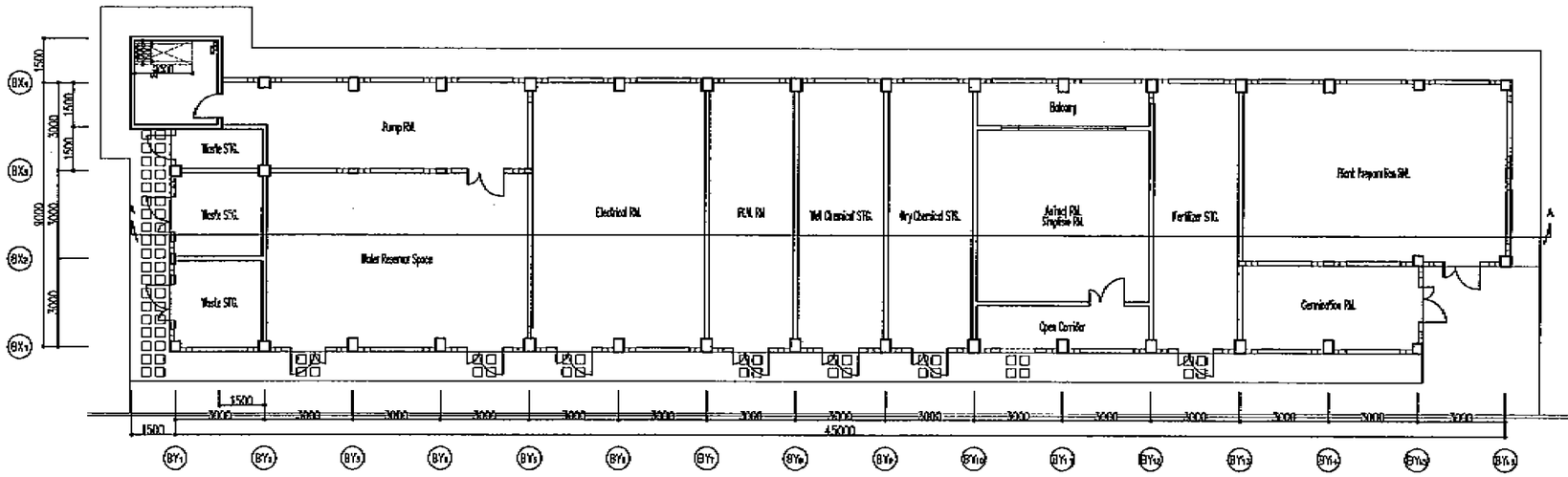
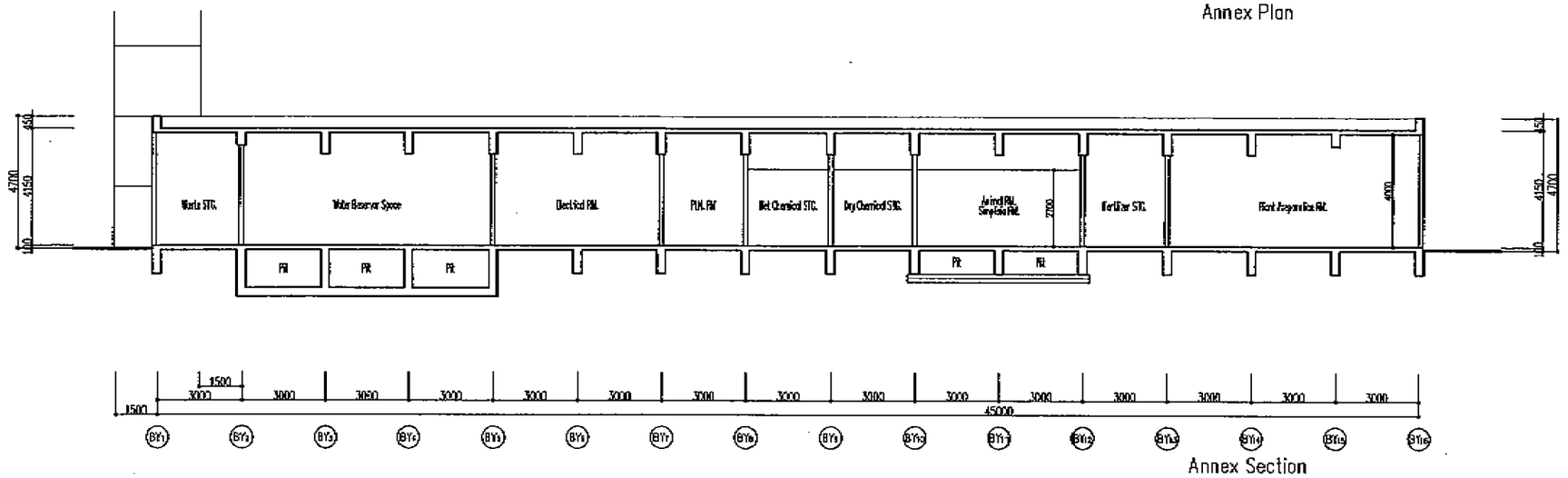
Section 1:400







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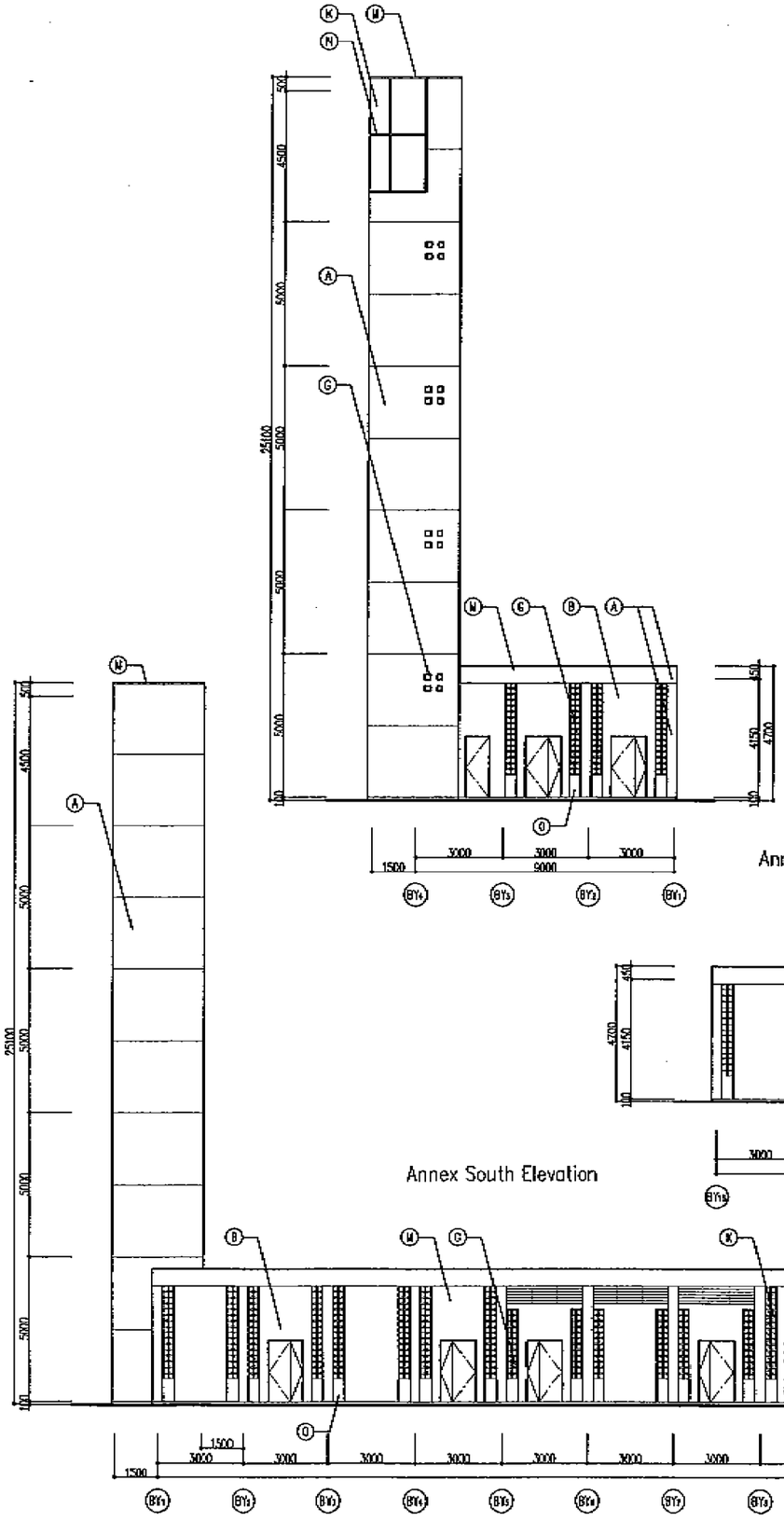
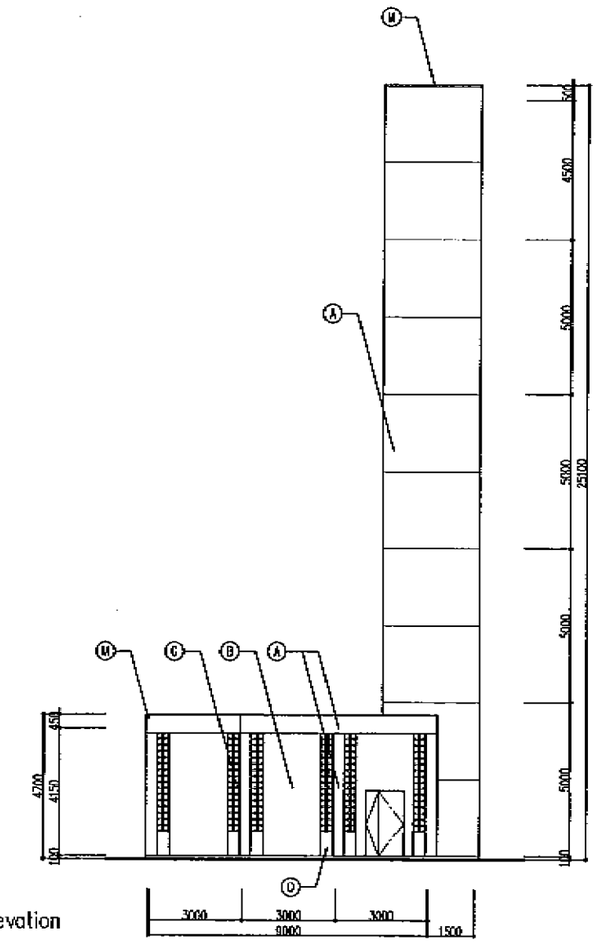
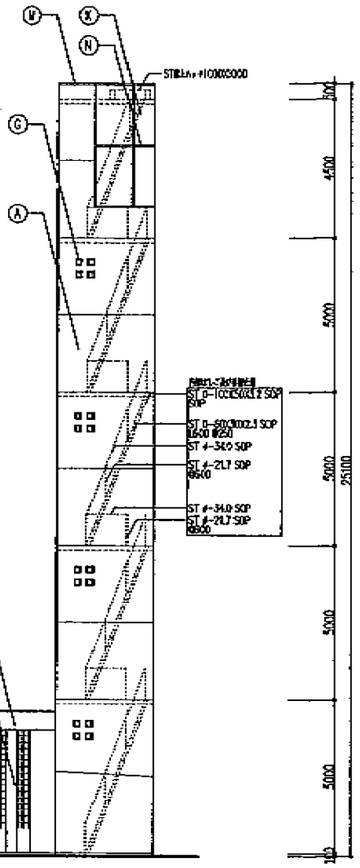
Annex Plan/Section 1:100



Annex East Elevation



Annex West Elevation



Annex South Elevation

Annex North Elevation

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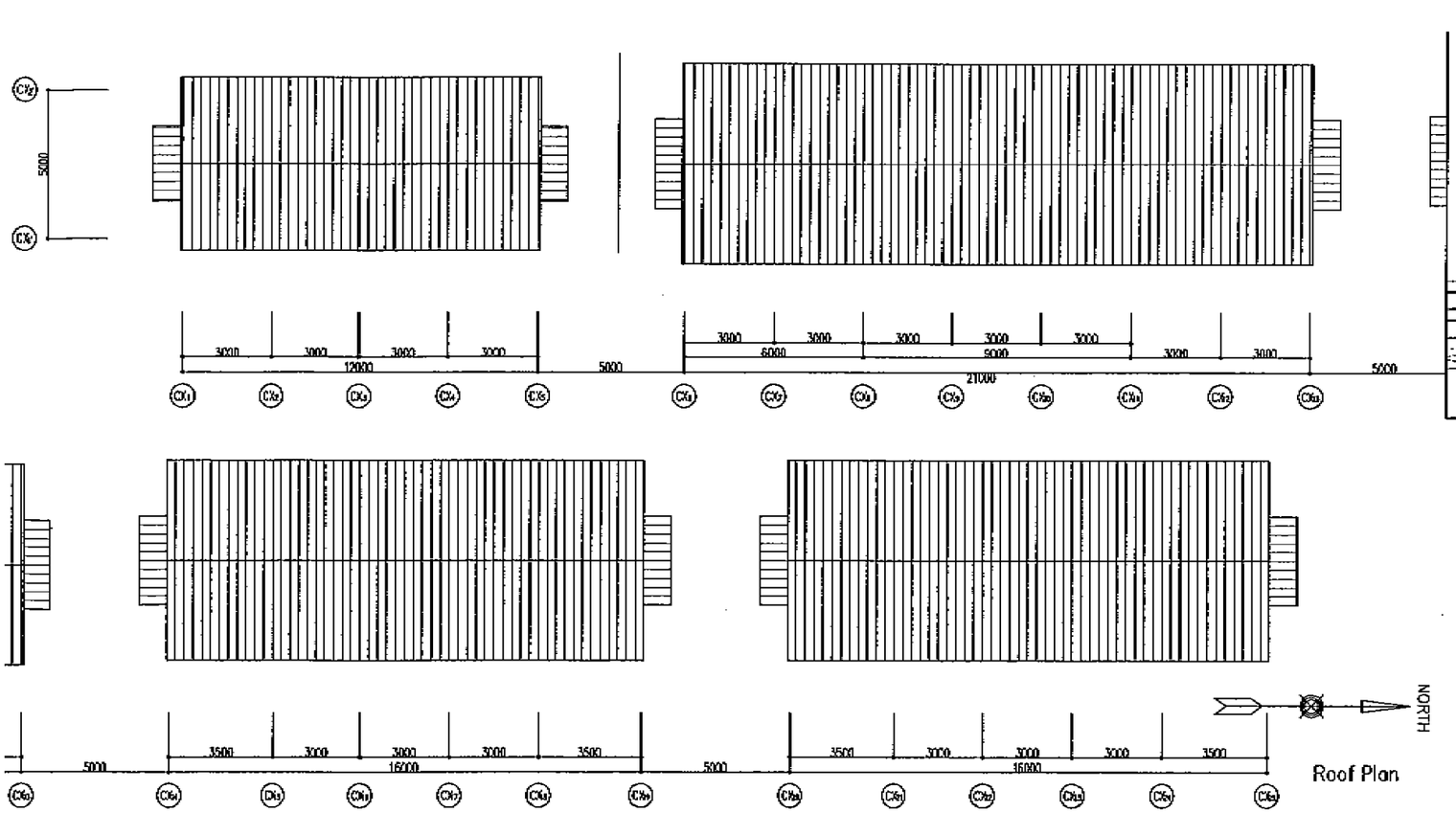
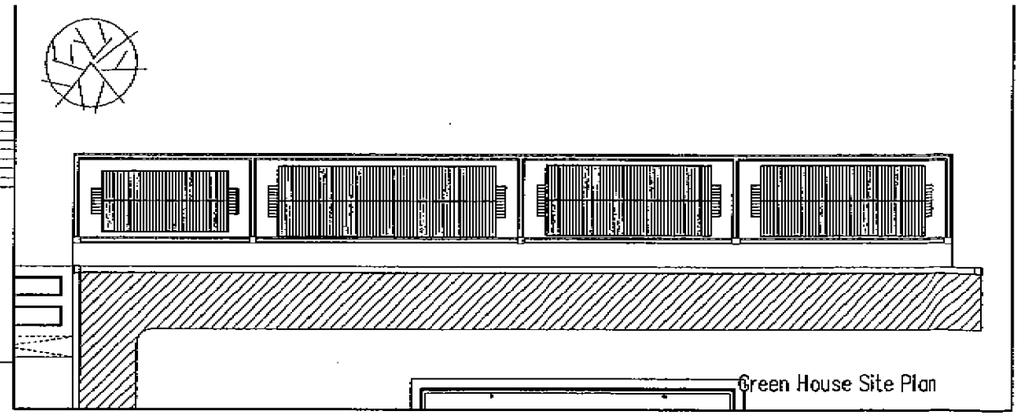
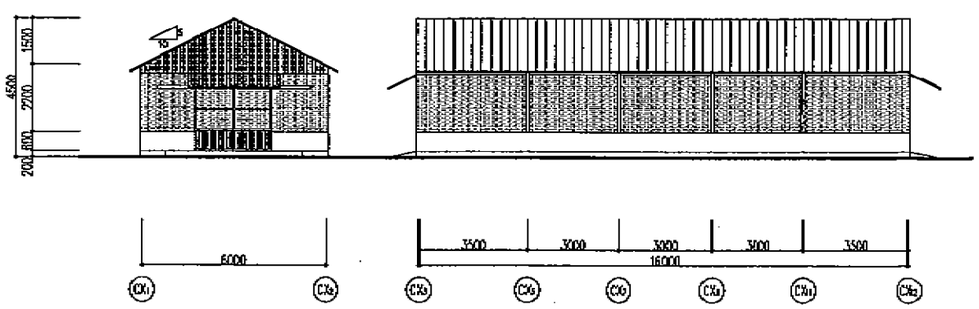
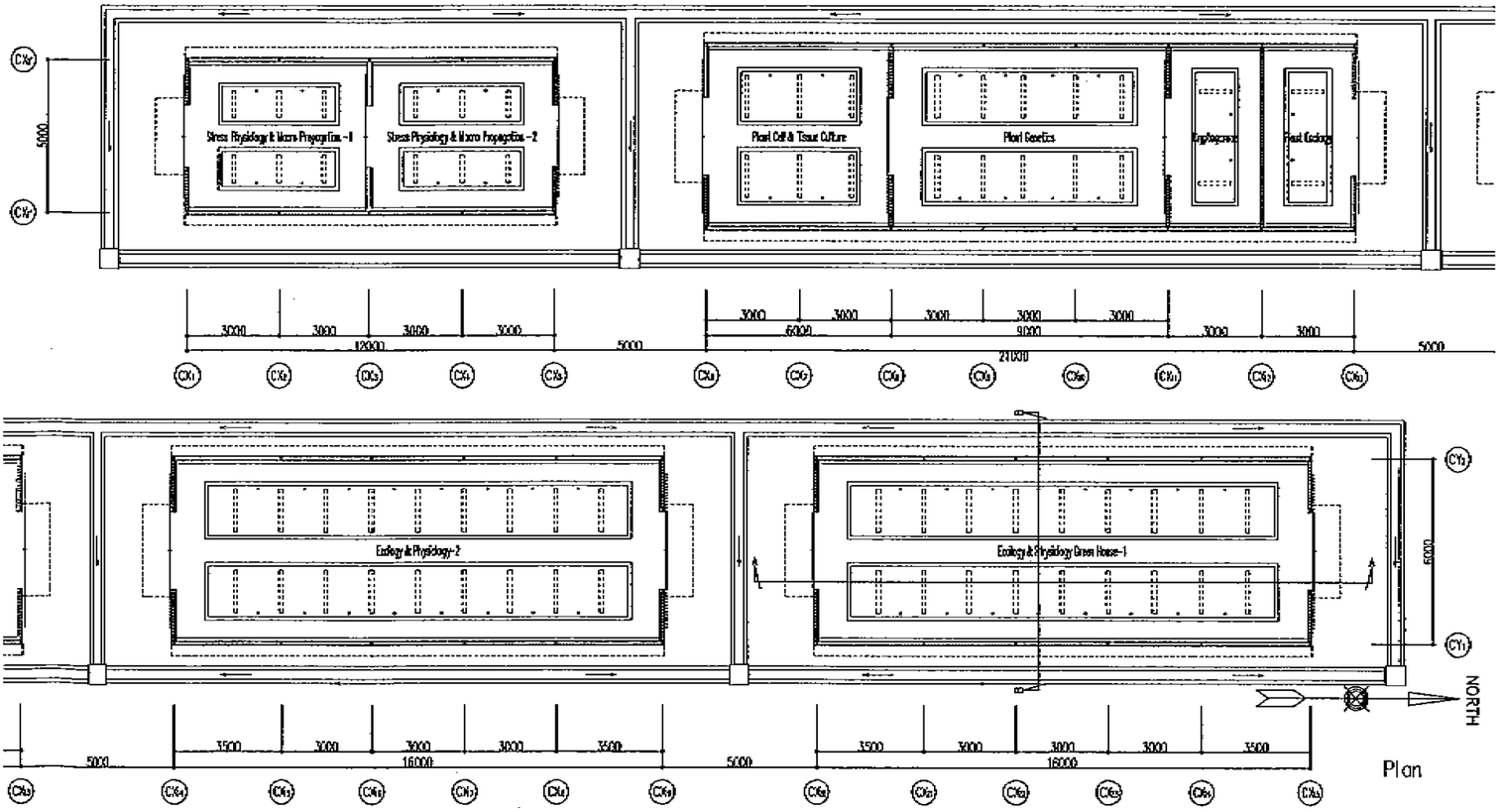
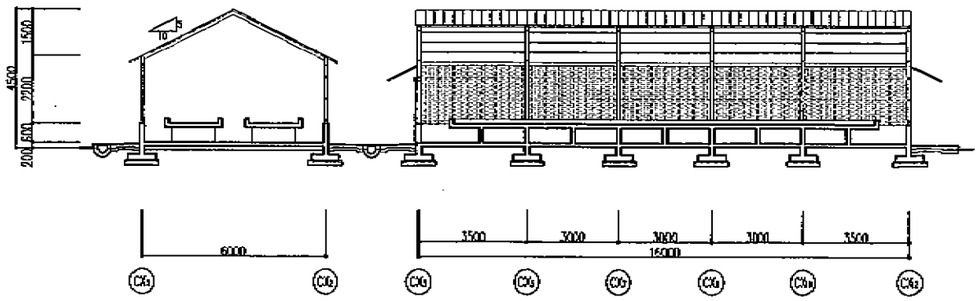
Annex Elevation 1:200











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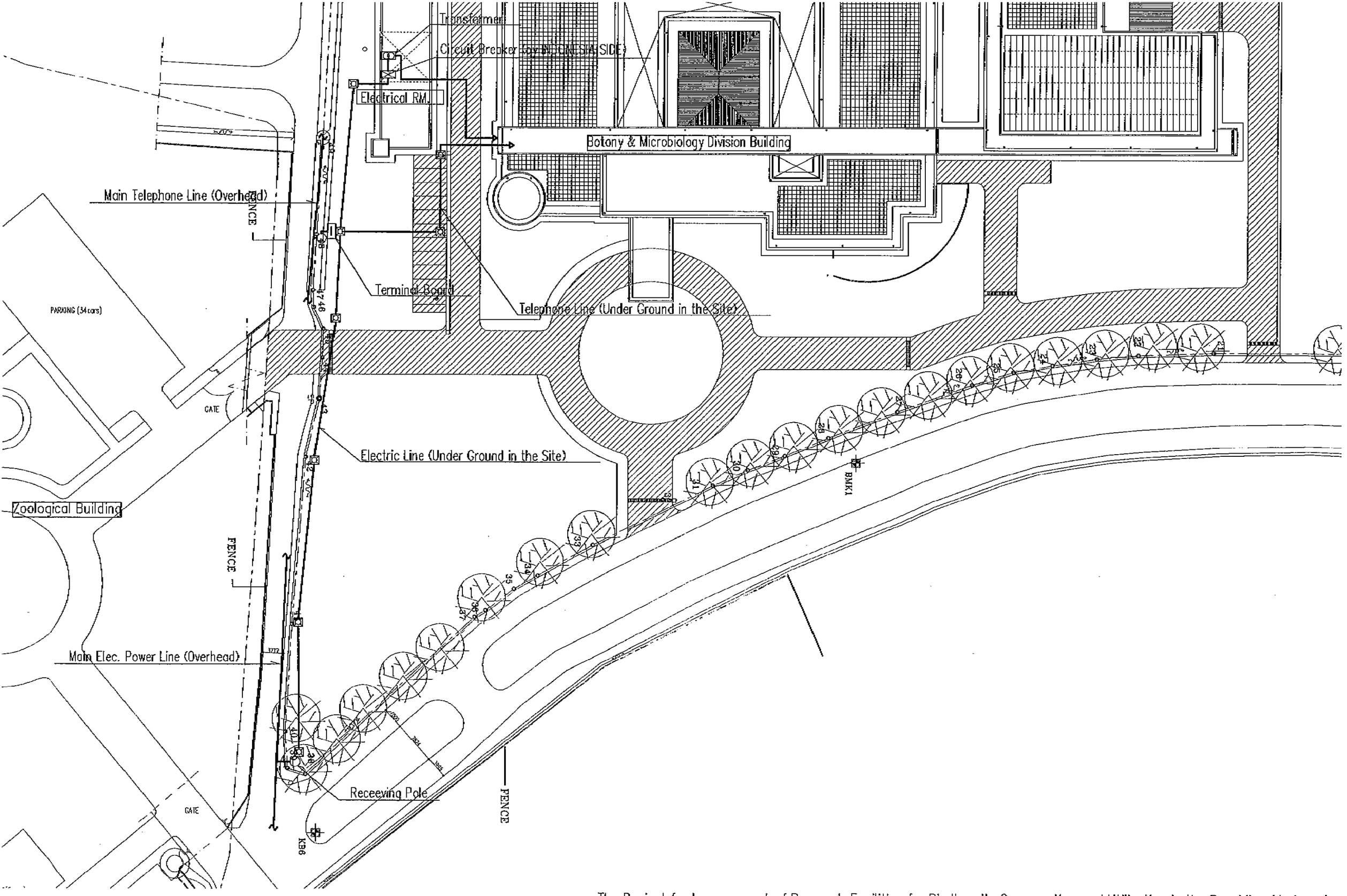
Green House Plan/Elevation/Section 1: 200



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Infrastructure Connection Site Plan 1:600

2.2.3.2 Basic Design of Equipment

(1) Contents of equipment

1) Botany Division

Item	Equipment	Q'ty	Item	Equipment	Q'ty
①Phytochemistry research of Phytochemistry group (Natural product laboratory, Bio-Organic Science laboratory and Bio Assay laboratory)					
B-1-1	Clean bench (Vertical air current type)	2	B-1-20	Draft chamber	1
B-1-2-1	Rotary evaporator 2 L	1	B-1-21-1	Packed column type distillation unit 2 L	1
B-1-2-2	Rotary evaporator 10 L	1	B-1-23-1	Drying oven for instruments	1
B-1-6	Test tube mixer	2	B-1-23-2	Incubator	1
B-1-11	Water bath 29 L	1	B-1-24	Sample mill	1
B-1-12-1	Ultrasonic cleaner	1	B-1-25	Extractor(Soxlet)	1
B-1-12-2	Ultrasonic pipette cleaner	1	B-1-29	Recycling HPLC	1
B-1-13	Autoclave 46 L	2	B-1-36	Fermenter	1
B-1-14-2	CO2 Incubator	1	B-1-37-1	Electrophoresis（horizontal type with densitometer）	1
B-1-15	Chiller/cooling aspirator	4	B-1-37-2	Electrophoresis（vertical type）	1
B-1-16-1	High speed microcentrifuge	1	B-1-38	Thermal Cycler for PCR	1
B-1-16-2	High speed refrigerated centrifuge	1	B-1-44	Rat cage	20
B-1-17-1	Freezer	1	B-1-45	Mouse cage	20
B-1-17-2	Deep freezer	1	B-1-46	Rabbit cage	10
B-1-18	Refractometer	1	B-1-47	Experimental equipment	1
②Plant Cell & Tissue Caulture research of Plant Physiology group (Plant cell & tissue culture laboratory, Common optics room, Two(2) Culture rooms of high and low temperature, Wet processing room, Cryo storage room)					
B-2-1	Clean bench (Horizontal air current type)	3	B-2-34	Test tube mixer	2
B-2-2	Desk top centrifuge	1	B-2-36	Autoclave, large	1
B-2-5-1	Cart	1	B-2-38	Drying oven	1
B-2-5-2	Cart（folding type）	1	B-2-39	Sterilizer, dry heat with glass bead	2
B-2-6	Inverted microscope with camera	1	B-2-40	Magnetic stirrer with hot plate	2
B-2-7	Stereoscopic microscope	1	B-2-41	Electronic balance、600g、0.01g	1
B-2-11	Fiber optic illuminator	1	B-2-43	Electronic balance, top loading 3000g, 0.01g	1
B-2-12	Shaker	2	B-2-50	pH meter (desk top type)	2
B-2-13	Culture shelf	20	B-2-51	Nitrogen freezing container	1
B-2-14	Computer	2	B-2-71-1	Water bath	1
B-2-20	Film scanner	1	B-2-77	Water purifier	1
B-2-21	Flatbed scanner	1	B-2-78	Micro gas burner	2
B-2-25	Laser printer	1	B-2-80	Liquid nitrogen producer	1
B-2-26	Refrigerator	2	B-2-81	Experimental equipment and glassware	1
B-2-27	Micropipette set	2			
③Stress Physiology research of Plant Physiology group (Stress physiology laboratory, Macro Propagation laboratory and Preparation room)					
B-3-1	Portable photosynthesis and transpiration measurement system	1	B-3-22	Freezer	1
B-3-3	Data logger with scanner	2	B-3-23	Digital camera	1
B-3-6	Weather station with recorder	1	B-3-26	Infrared moisture meter	1
B-3-9	Soil hygrometer /psychrometer	2	B-3-27	Stereoscopic microscope	1
B-3-14	Germinator chamber	2	B-3-28-1	pH meter(Portable)	1
B-3-15	Incubator	2	B-3-28-2	pH meter (Desktop)	1
B-3-16	Electronic balance, 0-1200g, 0.1g	1	B-3-29	Colorimeter	1
B-3-17-1	Drying oven, 106 L	1	B-3-30-1	Computer	1
B-3-17-2	Drying oven 144 L	1	B-3-30-2	Printer	1
B-3-19	Seed counter	1	B-3-30-3	Scanner	1

B-3-21	Refrigerator	1	B-3-31	Desk top centrifuge	1
④Plant Genetic research of Anatomy and Morphogenetic group (Plant genetic laboratory, Culture/Equipment room)					
B-4-1-1	Water bath　5 L	1	B-4-25	Micropipette set	2
B-4-1-2	Water bath　10 L	1	B-4-31	Draft chamber	1
B-4-2	Thermal cycler for PCR	1	B-4-32	Extractor for ethidium bromide decontamination	2
B-4-3	Autoclave （Horizontal)	1	B-4-33-1	Biohazard waste container	2
B-4-4	Drying oven	1	B-4-36	pH meter (Desktop)	1
B-4-5	Refrigerated centrifuge	1	B-4-37	Magnetic stirrer with hot plate	2
B-4-12	Electrophoresis(horizontal type)	1	B-4-38	Test tube mixer	2
B-4-13	Electrophoresis（horizontal type, large)	1	B-4-40	Electronic balance, top loading 1200g,0.1g	1
B-4-14	Electrophoresis (vertical type)	1	B-4-44	Water purifier	1
B-4-19	Gel Air Drier	1	B-4-46	Clean bench(Laminar flow type)	2
B-4-20	Vacuum Centrifugal concentrator	1	B-4-51-1	Computer	1
B-4-21	UV transilluminator	1	B-4-51-2	Laser printer	1
B-4-22	UV blocking eye glasses	1	B-4-53	Deep freezer	1
B-4-23	Gel documentation system	2	B-4-52	Experimental equipment and glasswares	1
⑤Plant Morphology, Anatomy and Cytology laboratory of Anatomy and Morphogenetic group 1) Cytology research					
B-5-1	Precision microtome（0.5μ)	1	B-5-2	Biological microscope	1
2) Plant Morphology and Anatomy research					
B-6-1	Vacuum pump	1	B-6-17	Magnetic stirrer with hot plate	2
B-6-2	Biological microscope with digital video camera	1	B-6-18	Vacuum desiccator	2
B-6-4	Precision rotary microtome	1	B-6-22	Water bath	1
B-6-6	Specimen heating stage	1	B-6-23	Computer	1
B-6-9	CCD Microscope	1	B-6-30	Incubator	1
B-6-10	Staining jar	12	B-6-31	Water purifier	1
B-6-13	Increment borers	2	B-6-33	Chemical cabinet	1
⑥Biosystematics research of Taxonomy group (Biosystematics laboratory I & II)					
B-7-1	Microscope with slide observation attachment	2	B-7-16	Printer	1
B-7-2	Dissecting microscope with micrometer	2	B-7-17	Scanner	1
B-7-4	Microscope with camera	2	B-7-18	Tally counters	3
B-7-11	Computer（Mac)	1	B-7-20	Water proof torch	3
B-7-15	Computer	1	B-7-21	Experimental equipment	1
⑦Chemotaxonomy research of Taxonomy group (installed into Plant Cell & Tissue Culture laboratory, Plant Physiology group)					
B-8-1	Electrophoresis (horizontal type with densitometer	1	B-8-4	Staining box	6
B-8-3	Gel drier	1			
⑧Molecular Systematics research of Taxonomy group (Molechular systematics laboratory)					
B-9-8	Fluorometer	1	B-9-25	Thermal cycler for automated PCR	1
B-9-9	Deep freezer	1	B-9-27	Electrophoresis(slab gel type)	1
B-9-10	Ice maker	1	B-9-30	Ultrasonic washing machine	1
B-9-14	Water purifier	1	B-9-32	Biohazard deposit bucket small	4
B-9-19	Draft chamber	1	B-9-33	Biohazard deposit bucket large	4
B-9-21	Magnetic stirrer with hot plate	2	B-9-36	Experimental equipment and glass wares	1
B-9-23	Computer（Mac)	1			
⑨Cryptogamae research of Taxonomy group (Cryptogamae laboratory)					
B-10-2	Vacuum desiccator	1	B-10-13	Magnetic stirrer with hot plate	1
B-10-8	Sharp pointed forceps	6	B-10-14	Chemical cabinet	1
B-10-9	Biological microscope with camera	1	B-10-15	Autoclave, small	1
B-10-10	Stereoscopic microscope	1	B-10-16	Clean bench(Vertical air current type)	1
B-10-11	Water bath	1	B-10-20	Computer	1
B-10-12	Refrigerator	1			
⑩Plant Ecology research of Ecology group (Soil and Plant Litter laboratory)					
B-12-2	Relascope	2	B-12-17	Theodolite	1
B-12-3	Lux meter	3	B-12-18	Portable photosynthetic	1
B-12-7	Computer	2	B-12-19	Soil tester	2
B-12-8-1	Laser printer	1	B-12-20	Thermohygrometer	3
B-12-8-2	Ink jet printer	1	B-12-23	Tape measure	5

B-12-9	Scanner	1	B-12-26	Mercury analyzer	1
B-12-10	pH meter(Portable)	1	B-12-28	CN analyzer	1
B-12-14-2	Drying oven M	1	B-12-30	Muffle's furnace	1
B-12-15	Electronic balance 6100g、0.1g	1	B-12-31	Incubator	1
B-12-16-1	Field balance 1000g	2	B-12-32	Light meter	1
B-12-16-2	Field balance 100g	2	B-12-33	Chlorophyll meter	1
⑪Ethnobotany research of Ethnobotany group (Ethnobotany laboratory)					
B-13-1	Electronic labelmaker	2	B-13-15-2	Ink jet printer	1
B-13-11	Computer	1	B-13-17	Scanner	1
B-13-15-1	Laser printer	1			
⑫Herbarium					
B-14-1	Trolley(for wet collection)	2	B-14-18	Species folders	102,455
B-14-2	Folding handle platform trolley	2	B-14-19	Genus cover	20,491
B-14-3	Trolley(for dry collection)	4	B-14-20	Mounting board	307,365
B-14-4	Pencil type pH meter	6	B-14-23	Herbarium mounting tape for dry collection	553
B-14-5	Forceps, for herbarium	8	B-14-24	Iron heater for herbarium	40
B-14-6	Plastic bag for herbarium	1	B-14-26	Alcohol meter	1
B-14-7	Wet collection bottles	1	B-14-27	Mobile rack for wet collection with container	1
B-14-9	Special bottle for wet collection	1	B-14-36	Walk in freezer（prefabricated type）	1
B-14-10	Carpology collection cabinet	521	B-14-38	Drying oven	1
B-14-12	Specimen cabinet	3			
⑬Field equipment					
B-15-1	Altimeter	4	B-15-14	Compass with clinometer	4
B-15-2	Tracing tables	1	B-13-3	Tape recorder	4
B-15-3	Caliper	4	B-13-4	Talley counter	3
B-15-4	Mirror stereoscope	4	B-13-6	Diameter tape	5
B-15-5	Tree grippers	2	B-13-7	Soil profiler	2
B-15-6	Tree pruner	4	B-13-8	Soil pH and moisture meter	2
B-15-7	Binocular	4	B-13-9	Digital caliper	4
B-15-10	Pruning Secateur	4	B-13-29	Relascope	1
B-15-11	Hand pruners	2	B-13-30	Digital Video Camera	3
B-15-12	GPS with antenna	2	B-13-31	Digital Camera	3
B-15-13	Portable GPS	2			
⑭Video processing room					
B-19-2	Camera set	1	B-19-14	Home video light	1
B-19-4	Tripod	1	B-19-15	Video player cassette VHS	1
B-19-9	Slide viewer	1	B-19-16	Television	1
B-19-11	Slide maker	1	B-19-17	Video editor	1
B-19-12	Video camera	1	B-19-27	Slide duplicator	1
B-19-13	Video DC light	1	B-19-33	Film scanner	1
⑮Common equipment room (Analytical equipment room I & II)					
B-21-1	Freeze Drier	1	B-21-6	Atomic absorption spectrophotometer	1
B-21-2	High performance liquid chromatograph (HPLC)	1	B-21-7	Spectrophotometer	1
B-21-3	UV-VIS Spectrometer	1	B-21-8	Gas chromatograph tandem mass spectrometer (GC-MS/MS)	1
B-21-4	Fourier transform infrared spectrophotometer (FTIR)	1	B-21-9	Analytical balance 0.1mg, 1200g w/table	1
B-21-5	Spray drier	1	B-21-10	Analytical balance 0.01mg、1200g w/ table	1

2) Microbiology Division

Item	Equipment	Q'ty	Item	Equipment	Q'ty
①Ecology and Physiology group (Ecology laboratory, Physiology laboratory and Ecology/Physiology preparation room)					
M-1-5	Electronic balance 600g、0.01g	1	M-1-41	Hygrometer	3
M-1-6	Shaking incubator	1	M-1-42	Digital thermometer	3
M-1-7	Clean bench(Vertical air current type)	1	M-1-43	Binocular	3

M-1-8-1	Autoclave, small	1	M-1-44	Lux meter	3
M-1-8-2	Autoclave, large	1	M-1-45	Diameter measure	3
M-1-9	Thermohygrometer	2	M-1-46	Clinometer	3
M-1-10	Automatic Potentiometeric Titrator	1	M-1-47	Dry box	3
M-1-11-1	Refrigerated centrifuge	1	M-1-48	Interval timer	3
M-1-12	Multi pipette set	3	M-1-50	Hand type GPS	3
M-1-13	Refrigerator	1	M-1-52	Drying oven	1
M-1-14	Magnetic stirrer with hot plate, 6 plates	1	M-1-53	Magnetic stirrer with hot plate	2
M-1-19	Water quality meter	1	M-1-55	Hot plate	2
M-1-22	Portable MLSS meter	1	M-1-57	Drying oven	1
M-1-23	Portable COD meter	1	M-1-58	Test tube mixer	2
M-1-24	Crucible Furnace	1	M-1-59	pH meter (Desktop)	1
M-1-28	BOD analyzer	1	M-1-60	Freezer	1
M-1-29	Turbidity/temperature meter	1	M-1-62	Shaker	1
M-1-31	DO meter	1	M-1-63	Computer	1
M-1-32	Salinometer	1	M-1-65	Fermenter	1
M-1-34	Compass	3	M-1-66	Universal mutation detection system	1
M-1-35	Altimeter	3	M-1-67	Draft chamber	1
M-1-36	Auger sets(core, mud, sand, soil)	3	M-1-69	Thermal cycler for PCR	1
M-1-40	Soil tester	3			
②Applied Microbiology & Development group (Applied Microbiology laboratory, Distillation/Fermentation room)					
M-2-1	Rotary Vacuum Evaporator	1	M-2-21	Incubator	1
M-2-2	Fermenter	1	M-2-22	Test tube mixer	1
M-2-3	Homogenizer	1	M-2-23	Clean bench(Vertical air current type)	1
M-2-6	Autoclave	1	M-2-25	Digital thermometer	1
M-2-7	Electronic balance 300g、0.001g	1	M-2-26	Computer	1
M-2-8	Refrigerator	1	M-2-27	Oil bath	1
M-2-11	Shaker	1	M-2-28	Electronic balance 3000g, 0.01g	1
M-2-14	Shaking incubator	1	M-2-33-1	Barometer	1
M-2-15	Freezer	1	M-2-33-2	Thermo-hygrometer	1
M-2-16	Ultrasonic Homogenizer	1	M-2-34	Drying Oven	1
M-2-19	Microwave oven	1			
③Biosystematics & Genetics group (Genetic laboratory, Genetic Instrument room, Isolation/Preservation room and Processing room)					
M-3-1	Clean bench(Vertical air current type)	3	M-3-21	Protein electrophoresis middle	1
M-3-2	Anaerobic laminar air flow cabinet	1	M-3-22	Pulse field gel electrophoresis	1
M-3-3	Water bath shaking incubator	1	M-3-23-1	Micropipette set	2
M-3-4-1	Incubator 10 L	1	M-3-23-2	Multi micro pipette, 12 channel	1
M-3-4-2	Incubator 120 L	1	M-3-24	DNA Sequencer （Common equipment）	1
M-3-5	Deep freezer	1	M-3-25	Gel documentation system	1
M-3-6	Refrigerator	1	M-3-31	pH meter (Desktop)	1
M-3-7	High speed refrigerated centrifuge	1	M-3-33	Fermenter	1
M-3-8	Microcentrifuge	1	M-3-35	Sonicator	1
M-3-11	Autoclave	1	M-3-36	Ultra filtration	1
M-3-15	Test tube mixer	2	M-3-38	Computer	1
M-3-16	Magnetic stirrer with hot plate	1	M-3-39	Laser printer	1
M-3-19	Thermal cycler for PCR	1	M-3-40	Scanner	1
M-3-20	Horizontal electrophoresis apparatus	1			
④Microbial Biochemistry group (Microbial Biochemistry laboratory and Inoculation/Cool working room)					
M-4-4	Protein electrophoresis middle	1	M-4-25	Digital thermometer	1
M-4-6	Autoclave, small	1	M-4-26	Vacuum Oven	1
M-4-8	Shaking incubator	1	M-4-28	Sonicator	1
M-4-9	Refrigerated Centrifuge	1	M-4-30	Rotary vacuum evaporator	1
M-4-10	Fermenter	1	M-4-32	Concentrator	1
M-4-11	Shaker	1	M-4-35	Micropipette set	2
M-4-13	Ultra filtration	1	M-4-36	Test tube mixer	2
M-4-15	Clean bench(Vertical air current type)	2	M-4-37	Computer	1
M-4-16-1	Magnetic stirrer with hot plate	1	M-4-39	Refrigerator	1
M-4-16-2	Magnetic stirrer (6 stirrer）	1	M-4-40	Refrigerated Centrifuge	1
M-4-17	Peristaltic pump	1	M-4-41	pH meter (Desktop)	1

M-4-19	UV Hand Lamp	1	M-4-42	Microwave oven	1
M-4-20	Cold room	1	M-4-43	Incubator	1
M-4-22	Muffle's furnace	1	M-4-49	Drying oven	1
M-4-23	Fat determination system	1	M-4-50	Chromatography scanning system	1
M-4-24	Auto Kjeldahl unit	1	M-4-54	Stirrer	1
⑤Common equipment room (Analytical equipment I, II and Common equipment room)					
M-5-1	Microscope with digital camera system	1	M-5-11	Ion chromatography	1
M-5-2	Inverted microscope with Micromanipulator	1	M-5-12	Total Organic Carbon & Nitrogen Analyzer	1
M-5-3	Washing machine	2	M-5-13	UV-VIS Spectrometer	1
M-5-4	Spray drier	1	M-5-14	Spectrophotometer	1
M-5-5	Ice maker	1	M-5-15	High performance liquid chromatograph (HPLC)	1
M-5-6	Water purifier	1	M-5-16	Spectropolarimeter	1
M-5-7	Ultra water purifier	1	M-5-17	Fluorescence Spectrophotometer	1
M-5-8	Freeze drier	1	M-5-18	Analytical balance 100g, 0.01mg, w/table	1
M-5-10	DNA/Protein/Enzyme analyzer	1	M-5-20	Analytical balance 300g, 0.1mg、w/table	1

3) Meeting rooms, experimental tables and etc.,

Item	Equipment	Q'ty	Item	Equipment	Q'ty
①Meeting room					
A-1	Portable screen	1	A-7-3	Mixer	1
A-2	LCD Projector	1	A-7-4	CD deck	1
A-3	Slide projector	1	A-7-5	VTR	1
A-4	Visual presenter	1	A-7-6	Cassette deck	1
A-5	OHP	1	A-7-7	Monitor	1
A-6	Pointer	1	A-7-8	Microphone	1
A-7	PR system/sound system	1	A-7-9	Stereo synthesizer tuner	1
A-7-1	Speaker（wall type）	1	A-8	Roll-in screen	1
A-7-2	Amplifier	1	A-9	Tape recorder	1
②Library					
L-2	Computer	1	L-7	Cutter	1
L-4	Copying machine	1	L-10	Cart	2
L-6	Typewriter	1			
③Information Center					
I-1	Display television	1	I-3	Television set	1
I-2	Computer for internet with T/C	5	I-4	VHS	1
④Experimental Table					
Dept., of Botany					
TB-1	Central experimental table	11	T-B-4	Work table	5
TB-2	Sink	22	T-B-5	Cabinet for laboratory	36
TB-3	Side experimental table	101			
Dept., of Microbiology					
TM-1	Central experimental table	7	T-M-4	Work table	1
TM-2	Sink	11	T-M-5	Cabinet for laboratory	20
TM-3	Side experimental table	81			

(2) Purpose of use of main equipment

Equipment		Specification and Application	Q'ty
1	Shaking incubator	Spec: floor type 10～70 L, flask （200ml x 24,500ml x 12） Use: culture under the constant temp., and vibration.	3
2	Clean bench (Vertical air current type)	Spec: 1300x900 x 1800mm approx., vertical air current type Use: laboratory device for operation under germ free condition.	10
3	Clean bench (Horizontal air current type)	Spec: 1300x900 x 1800mm approx., horizontal air current type Use: laboratory device for operation under germ free condition.	5
4	Automatic Potentiometeric Titrator	Spec: full set of potentiometric titration, multiple sample changer (12) etc., Use: automatic titration of multiple sample.	1
5	Fermenter	Spec: for 5 L、automatic control operation Use: culture and fermentation of plant and microbe.	5
6	Universal mutation detection system	Spec: electrophoresis, amplifier, gel producer, circulation pump, gel drier etc., Use: detection of mutated DNA.	1
7	Draft Chamber	Spec:1200x750 x 2200mm approx., Use: chamber for laboratory operation involving toxic and corrosive gas.	4
8	High speed refrigerated centrifuge	Spec: revolution 100,000rpm Use: separation of cell such as nucleus etc., of microbe.	1
9	DNA Sequencer	Spec: more than 24 capillary type Use: reading of DNA base sequence (common use of both divisions)	1
10	Cold Room	Spec:4～10 L, 15m3 approx., Use: experiment under the low temp., condition	1
11	Refrigerated Centrifuge	Spec: revolution 20,000rpm, rotor etc., Use: separation of sample such as enzyme etc., in microbiology.	1
12	Fat Determination System	Spec: automatic type with control unit, max. temp. 300 degrees C, size 500 x250x650mm Use: extraction of nonvolatile component in solid	
13	Chromatography Scanning System	Spec: scanning type Use: analysis of DNA quantum and chain length, protein molecular mass etc.,	1
14	Inverted Microscope	Spec: microscope with manipulator Use: observation of microbe	1
15	Washing Machine	Spec: main body with 2 tiers rack and test tube rack etc., Use: cleaning of experimental equipment etc.,	2
16	DNA/Protein/Enzyme analyzer	Spec: double beam system, 190～1100nm Use: quantum and measuring of DNA, RNA and protein.	1
17	Ion chromatography	Spec: all in one unit of liquid feeding, injection and detection Use: separation and analysis of ionic species.	1
18	Total Organic Carbon & Nitrogen Analyzer	Spec: for detection of C and N Use: analysis of elements in sample	2
19	UV-VIS Spectrometer	Spec: single beam system, 200～1100nm Use: identification of sample component by spectral measuring.	2
20	Spectropolarimeter	Spec: circular dicroism (±10, 200, 2000mdg) Use: analysis of protein structure of optically active molecular.	1
21	Fluorescence Spectrophotometer	Spec:220～750nm Use: quantitative and qualitative analysis of ultra minute sample	1
22	Rotary Evaporator	Spec: capacity of 10 L Use: distillation and concentration of plant chemical products	1
23	High speed refrigerated centrifuge	Spec: revolution 20,000rpm approx., rotor etc., Use: separation of plant sample	1
24	High Performance Liquid Chromatograph（HPLC）	Spec: for minute amino acid detection including pump, auto sampler, column, UV/VIS detector set Use: amino acid analysis, separation and quantum of ionic compound and high polymer etc.,	2
25	Packed column type distillation unit	Spec: capacity 2 L Use: distillation of plant oil	1

26	Recycle HPLC	Spec: recycle type, for large volume Use: analysis of plant chemical products	1
27	Liquid nitrogen producer	Spec: production capacity of 25 L/day Use: production of liquid nitrogen for plant specimen preservation	1
28	Portable photosynthesis and transpiration measurement system	Spec: portable type, open type photosynthesis measuring system Use: measuring of photosynthesis and transpiration in the field.	2
29	Data Logger with Sensors	Spec: data logger for CO2/H2O and sensors, and leaf meter Use: measuring by sensors in the field	2
30	Soil Hygrometer	Spec: reading meter, sample changer, switch box etc., Use: measuring of moisture potential	2
31	Precision Microtome	Spec: hand wheel cutting method, cutting thickness .5μm Use: making of cutting segment of plant minute cell	1
32	Microscope with camera	Spec: with camera Use: observation of plant sample	1
33	Mercury analyzer	Spec: reducing vaporization method, open blast Use: detection and measuring of mercury in sample	1
34	ＦＴ-ＩＲ spectrophotometer	Spec: wavelength（7800～350cm-1） Use: analysis of food additive, water and air pollution	1
35	Atomic Absorption Spectrophotometer	Spec: furnace type, auto sampler, various detection lamps Use: detection of minute metal and impurities in food, soil, water quality etc.,	1
36	Spectrophotometer for DNA	Spec:190～1100nm　Use: analysis of protein and DNA	1
37	Gas Chromatograph Tandem Mass Chromatography	Spec: ion trap type, GC-MS/MS Use: mass analysis in the field of food and environment	1
38	Plastic bag for Herbarium	Spec:3 kinds　Use: preservation of herbarium dry collection	1
39	Wet Collection Bottles	Spec: glass wide mouth bottles Use: preservation of wet collection	1
40	Special Bottles for Wet Collection	Spec: glass or plastic big bottles Use: preservation of wet collection	1
41	Mobile rack for Wet Collection with container	Spec: mobile rack type Use: shelves for preservation of wet collection	1
42	Walk in Freezer (prefabricated type)	Spec:-30 degrees C, 20m3 approx., Use: pest control and sterilization of dry collection	1
43	Carpology Collection Cabinet	Spec:860(W) x 540(D) x 2300(H)mm, steel Use: preservation of dry collection	521
44	Culture Shelf	Spec:1520(W) x 460(D) x 1830(H)mm, steel Use: tissue culture	20
45	Anaerobic laminar air flow cabinet	Spec:800(W)x600(D)x 650(H)mm, vacuum 3.3Pa approx., with fluorescent lamp Use: chamber for handling unstable obstacle in the air.	1
46	Thermal Cycler for PCR	Spec: gradient type, 96 samples, temp. control range of 4-99 L Use: duplication and amplification of DNA.	5
47	Refrigerator	Spec300L approx.,－60～-85 degrees C　Use: storage of sample	2
48	Refrigerator, cabinet type	Spec:340L approx., 2-14 degrees C　Use: storage of samples	4
49	Deep Freezer (Vertical)	Spec:700L approx., -85 degrees C　Use: storage of sample	1
50	Spray Drier	Spec: moisture evaporation volume:1.5 L/h, nozzle 2fluid, minimum sample volume 20ml Use: drying device to change liquid into powder	2
51	Gel Documentation System	Spec:3 million pixels, max gel size 30 x 20cm approx., full set of filters Use: taking a picture of electrophoresis gel	3
52	Autoclave	Spec: capacity of 15 L, 20 L, 45 L, 80 L or more Use: sterilization of experimental equipment	10

53	Incubator	Spec:1）550 L,+5～80 L, 2) 300 L, natural convection, 3) 10 L,+5～40 L, forced convection, 4) 120 L, natural convection, 5) 47 L forced convection, etc., Use: culture of plant and microbe under constant temperature.	9
54	Computer	Spec: more than Intel P4 processor (2.4G), HDD 40G, RAM 256MB Use: experimental data processing	16
55	Specimen Rehabilitation Equipment	Component: mounting board, species folder, genus cover, forceps for herbarium etc.,	-
56	Central Experimental Table	Component: central experimental table, cabinet for laboratory, side experimental table, work table and sink	-
57	Others	pH meter, test tube mixer, thermometer, DO meter, magnetic stirrer with hot plate, electronic balance, audio visual equipment etc.,	

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy (Construction and Procurement)

The Project consists of (i) the construction of the planned facilities and (ii) the procurement and installation of equipment, and will be implemented in accordance with the framework of the grant aid scheme of the Government of Japan after the signing of the Exchange of Notes (E/N) by the Government of the Republic of Indonesia (hereinafter referred to as "Indonesia") following a cabinet approval by the Government of Japan. After the signing of the E/N, the Government of Indonesia will conclude a consultant services agreement with a Japanese consultant to proceed to the detailed design stage of the facilities and equipment. After the completion of the detailed design drawings and tender documents, a Japanese contractor and a Japanese equipment supplier, both of which are selected by tender, will conduct the construction work and the equipment procurement/installation respectively.

The contracts with the consultant, contractor and equipment supplier will only become valid after their verification by the Government of Japan. A construction supervision organization will be established by the project implementation agency on the Indonesian side, the consultant, the contractor and the equipment supplier under the control of the project related government organizations in Japan and Indonesia.

(1) Project Implementation Agency

The responsible and implementation agency of the Project on the Indonesian side will be the Indonesia Institute of Science (LIPI). It is anticipated that the LIPI will be a party to the project-related contracts. The RCB will also be responsible for the general coordination of the work.

(2) Consultant

After the signing of the E/N, the project implementation agency (LIPI) will conclude a consultant services agreement for the detailed design and supervision with the Japanese Consultant in accordance with the set procedure of Japan's grant aid scheme and this contract must be verified by the Government of Japan. After verification of the agreement, the Consultant will prepare the detailed design drawings and tender documents in accordance with the present Basic Design Study Report and in consultation with RCB and will have them approved by the Government of Indonesia.

At the tender and construction stages, the Consultant will conduct the work to assist the tender and construction supervision based on these drawings and documents. The Consultant will also conduct supervisory service for the procurement and installation of the equipment from the equipment tender stage to the installation, test operation and handing over of the equipment.

1) Detailed Design

The detailed design means the decision on the details of the facilities plan and review of the equipment plan based on the findings of the present Basic Design Study and also the preparation of tender documents consisting of design drawings, specifications, general tender conditions and draft contracts for the construction work and equipment

procurement/installation. It also includes estimates of the construction cost and equipment procurement/installation cost.

2) Assistance for Tender

This means that the Consultant witnesses the selection of the contractor and equipment supplier by the project implementation agency by means of tender and provides assistance for the administrative procedure required for the concluding of contracts, reporting to the Government of Japan and other necessary work to proceed with the Project.

3) Supervision

This means that the Consultant checks the compliance of the work by the contractor and equipment supplier with the relevant contracts in order to verify the proper execution of the contracts. It also involves the provision of advice and guidance for the project-related bodies and the coordination of such bodies in a fair manner to facilitate the implementation of the Project. The types of work expected of the Consultant in this regard are listed below.

① Checking and approval of the construction plan, work drawings, equipment specifications and other documents submitted by the contractor and the equipment supplier
② Pre-shipment inspection and approval of the quality and performance of the construction materials and equipment to be delivered to the site
③ Confirmation of the delivery, installation and proper explanation of use of the building service equipment and other equipment
④ Assessment of and reporting on the work progress
⑤ Witnessing of the handing over of the completed facilities and installed equipment, etc.

In addition to the above types of work, the Consultant will report on the progress of the Project, payment procedure and handing over on completion, etc. to the project-related government organizations in Japan.

(3) Contractor and Equipment Supplier

The Contractor and the Equipment Supplier for the Project will be selected from among Japanese companies with certain qualifications through an open tender. In principle, the tenderer with the lowest tender price will be declared the successful tenderer and will conclude a construction (or equipment supply and installation) contract with the project implementation agency on the Indonesian side. The Contractor and Equipment Supplier awarded the respective contract will conduct the construction of the facilities and the procurement, transport and installation of the equipment in accordance with the respective contract. They will also provide technical guidance on the operation and maintenance of the building service systems and equipment. After the handing over of such systems and equipment, they will provide support together with the equipment manufacturers and local agents so that the RCB can receive a supply of spare parts and consumables for the major equipment and technical guidance at cost.

(4) Japan International Cooperation Agency (JICA)

JICA will provide the necessary action to promote proper implementation of the Project in accordance with the grant aid scheme of the Government of Japan.

(5) Preparation of Construction Plan

The project implementation agency on the Indonesian side and the Consultant will discuss the construction plan during the detailed design period. It will be necessary for the scope of work for the Japanese side and the Indonesian side to be clearly determined and the timing and method to conduct the work assigned to each side must be confirmed so that the work in question can be smoothly conducted in accordance with the implementation schedule specified in the Basic Design Study Report. For the Project, it will be necessary for the Indonesian side to stop the cultivation at the site and clearance of cultivated plants and cutting grass at the site prior to the commencement of the construction work.

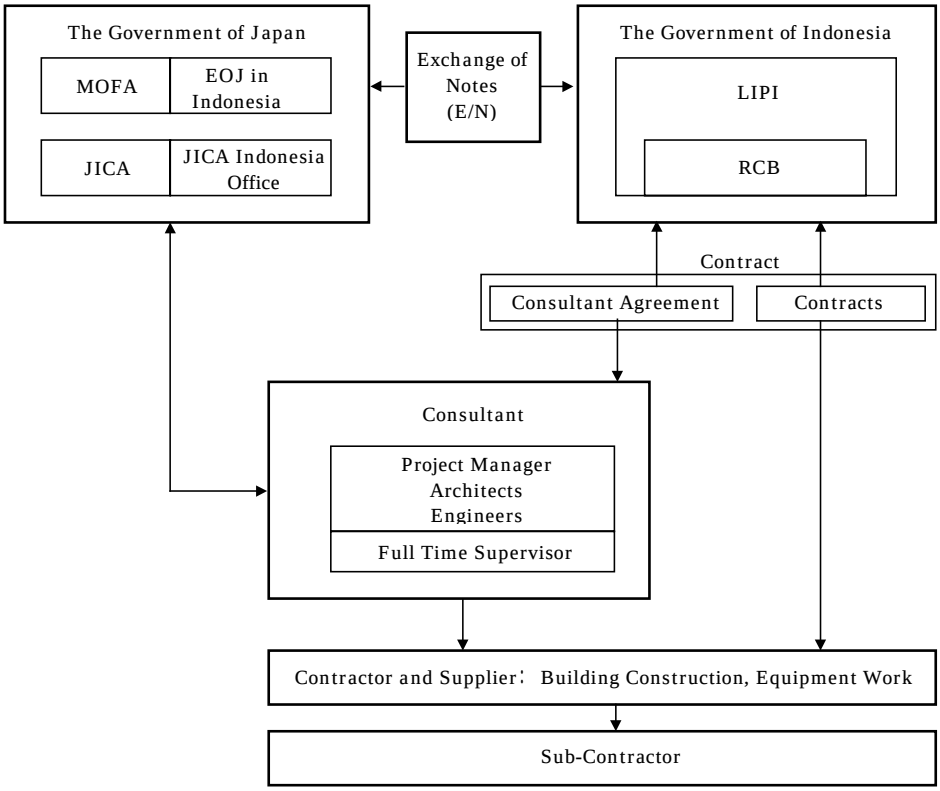


Figure 2-2 Construction Supervision Organization

2.2.4.2 Implementation Conditions

(1) Situation of Local Construction Industry

The situation of the local construction industry around Jakarta, including Cibinong, is outlined below.

① Construction companies in Indonesia have sufficient techniques to serve the domestic market.
② Most construction materials are produced in Indonesia and can be procured locally.
③ Based on the average work efficiency of joiners, plasterers, bar workers and finishing workers, the manpower requirement will be 2.5 – 3 times higher than that in Japan.
④ Skilled workers are available in all fields.
⑤ For the construction of the planned facilities, 2 copies each of the detailed design documents (detailing the building structure and services) and the structural computation documents, both signed by a locally registered architect and engineer, must be submitted to the Building Department of the Cibinong Municipal Council for examination and approval. As this examination requires 1 – 2 months to complete, application must be made immediately after the completion of the detailed design. In addition, it will be necessary for the LIPI to submit the latest CSC development drawings to the BAPPEDA (the development bureau of the kabupaten) for confirmation of the development plan contents. Building permit obtaining is a work to be done by the Indonesian side.

(2) Important Issues relating to Construction Work

1) Schedule Control

The rainy season in Cibinong lasts from October until March and 63% of the annual rainfall is concentrated in this period. In order to complete the Project on schedule, it will be essential to ensure the efficient drainage of rainwater from the short but strong rain during the rainy season to prevent any delay of the construction work. Regular meetings on schedule control between the implementation body in Indonesia, the Consultant and the Contractor for the Project will, therefore, be necessary.

2) Safety Control

The planned site is sufficiently large and some distance from other existing buildings, including staff housing, on the CSC premises. Nevertheless, construction materials will be delivered to the site via the trunk road on the premises from the main gate, making it necessary to ensure the safety of people working and/or living on the CSC premises. Proper coordination between the implementation body, the Consultant and the Contractor for the Project will be required in regard to the access control of work vehicles to the CSC premises and safety control for pedestrians.

(3) Important Issues Relating to Equipment Procurement

Some of the equipment to be delivered and installed at the planned facilities require complicated installation arrangements during the construction period. Their procurement and installation schedule must, therefore, be properly arranged through close liaisoning between the Consultant and the Contractor. The equipment requiring such arrangements are listed below.

- Prefabricated cool working room, Laboratory table, Draft chamber, Audio visual equipment, Screen, AAS, etc.

(4) Construction Management Engineers

In order to complete the construction of the facilities in line with the design documents, the Contractor must be capable of smoothly arranging the joint work with the local sub-contractor, providing appropriate technical guidance and controlling the schedule. The appointment of full-time engineers who are familiar with the local conditions will be necessary to achieve high quality facilities based on a proper understanding of the character of the planned facilities.

Given the contents and scale of the planned facilities, the following full-time on-site engineers are believed to be necessary.

- Site manager (1) : general construction management
- Architectural engineer (1) : guidance on building work, schedule control, quality control
- Shop drawing engineer (1) : guidance on shop drawing preparing
- Mechanical and : schedule control, equipment installation and test operation, technical guidance
- Administrator (1) : administrative work, personnel control, import procedures

(5) Equipment Procurement

- In addition to the procurement, installation, test operation and quantity checking of the equipment, the operation and maintenance requirements of each equipment must be properly explained together with the provision of technical guidance.

- At the time of the handing over of the equipment, a list of parts, etc. which are liable to break down must be prepared and submitted to the Indonesian side.

2.2.4.3 Scope of Works

The Project will be implemented through cooperation by Japan and Indonesia. In the case of the Project's implementation with grant aid scheme provided by the Government of Japan, it is appropriate to decide the following scope of work for each side.

(1) Work to be Undertaken by the Government of Japan

The Government of Japan will be responsible for the following relating to the consultant services for the Project, the construction of facilities and the procurement/installation of equipment.

1) Consultant Services

① Preparation of the detailed design documents and general conditions for the tender for the planned facilities and equipment of the Project
② Cooperation for the selection of the Contractor and the Equipment Supplier (procurement and installation) for the Project and also for the signing of the contracts with them

③ Supervision of the facility construction work and the delivery, installation and guidance on the operation and maintenance of the equipment

2) Construction of Facilities and Procurement/Installation of Equipment

① Construction of the planned facilities for grant aid
② Procurement of the construction materials and equipment/systems for the planned facilities for grant aid and their transportation and delivery to the planned facilities
③ Procurement, transportation, installation, test operation and adjustment of the planned equipment/systems for grant aid
④ Explanation of and guidance on the operation and maintenance methods for the planned equipment/systems for grant aid

(2) Work to be Undertaken by Government of Indonesia

At its own expense, the Government of Indonesia will undertake the clearance at the site, planting work at the site, gate, gate house and fencing work, infrastructure (utility) connection work, the procurement of furniture and fixtures which are not included in the scope of the Japanese grant aid and work related to tax exemption measures and others as described below.

1) Clearance at the Site
Clearance of cultivated plants and cutting grass at the site

2) Planting Work at the Site
Whole of planting work of the site (including planting for termite prevention to collection storage)

3) Gate, Gate House and Fencing Work
Construction of 2 gates, gate house and a fence along the boundaries

4) Obtaining Building Permit

5) Infrastructure (Utility) Connection Work
① Service connection for power
② Service connection for telephone

6) Procurement
Procurement of the general furniture and fixtures which are not included in the scope of the Japanese grant aid (Transfer of the existing general furniture and fixtures are planned.)

7) Tax Exemption
Exemption of Japanese nationals (persons and companies) from domestic taxes, including VAT, and financial levies imposed in Indonesia for the procurement of goods and the provision of services based on the verified contracts for the Project

8) Customs Clearance, etc.
Provision of all conveniences for (i) the speedy customs clearance of equipment and materials imported from Japan and/or the third countries for the purpose of the Project

based on the verified contracts and (ii) the inland transportation of such equipment and materials

9) Visas, etc.
Provision of all conveniences for the entry to and stay in Indonesia of Japanese nationals who enter and stay in Indonesia to conduct their assigned work for the implementation of the Project

10) Issue of Permits, etc.
Prompt issue of the various permits and authorisations which are required for the implementation of the Project

11) Payment
Payment of all necessary expenses which are not covered by the Japanese grant aid

12) Operation and Maintenance
Appropriate as well as effective operation and maintenance of the facilities construction and equipment procured with the grant aid

13) Restoration and Transfer of Specimens
① Restoration of fragile dry specimens and spirit collection prior to transfer to the planned facilities in accordance with the restoration plan prepared by the Indonesian side
② Transfer of the existing specimens, laboratory equipment and furniture, etc. in accordance with the transfer plan prepared by the Indonesian side

2.2.4.4 Consultant Supervision

(1) Construction Supervision Policy

In accordance with Japan's grant aid scheme, the Consultant will establish a project team, which will be consistently involved in the detailed design and construction supervision stages to ensure the smooth progress of all of the work, taking the purport of the basic design into consideration. The policy for the construction supervision for the Project are described below.

1) To aim at completing the construction of the facilities and the procurement and installation of the equipment/systems without delay through close liaisoning with the people responsible for the Project in the two countries

2) To provide prompt and appropriate guidance and advice for the Contractor, Equipment Supplier and people related to them from an impartial standpoint

3) To provide appropriate guidance and advice on the operation and management of the facilities as well as the installed equipment/systems and to witness the handing over of the facilities and equipment/systems following confirmation of the completion of both the construction work and the equipment/system installation work meeting the contract conditions with a view to completing the consulting work by obtaining approval of the handed over facilities and equipment/systems by the Indonesian side

(2) Supervision Plan

As the Project has many work items, one on-site work supervisor (in charge of construction work) will be appointed on a full-time basis with the dispatch of the following engineers in line with the progress of the work.

- Project manager : general coordination and guidance on schedule control
- Architect : confirmation of design intentions, work drawings and material specifications
- Structural engineer : confirmation of bearing strength for piles, foundation work, structural work and steel structure work
- Mechanical engineer : plumbing and air-conditioning system, etc.
- Electrical engineer : conduit work, wiring and power receiving transforming equipment, etc.
- Equipment supervisor : guidance on equipment installation, coordination with building service work and confirmation of appropriate explanation of equipment handling, etc.

2.2.4.5 Quality Control Plan

Given the high temperature, high humidity, strong solar radiation and concentrated rainfall during the rainy season from October to March, proper quality control is required in regard to the construction work. According to past local meteorological data, the annual averaged temperature is 26.6°C and the temperature may reach more than 30°C around September, necessitating measures to deal with a possible concrete temperature of more than 30°C. In view of such a likelihood, the ambient temperature at the time of concrete placing and the concrete temperature will be measured to ensure the correct concrete quality.

There are batcher plants some 10 – 15 minutes away from the site by car and fresh concrete will be transported from these plants. For this purpose, the quality control system of the batcher plants will be checked. If the earth work is to be conducted during the rainy season, a work plan describing the retaining work and unwatering work, etc. will be prepared as part of the quality control exercise.

The quality control plan for the main work is described in the table below.

Table 2-37 Quality Control Plan

Work	Work Type	Control Item	Method	Remarks
Structural Work	Concrete work	Fresh concrete	Slump, air volume, temperature	Strength test at public test institution
		Concrete strength	Comprehensive strength test	
	Reinforcing work	Reinforcing bar	Tensile test, mill sheet check	
		Arrangement	Bar arrangement check	
	Pile work	Material, bearing capacity	Factory inspection sheet check Bearing capacity check	

Finishing Work	Roof work	Workmanship, leakage	Visual inspection, water spray or filling test	
	Tile work	Workmanship	Visual inspection	
	Plastering work	Workmanship	Visual inspection	
	Door & window work	Products	Factory inspection sheet check	
		Installation accuracy	Visual inspection, dimension check	
		Workmanship	Visual inspection	
	Painting work	Products, workmanship	Visual inspection	
Electrical Work	Power Receiving & Transforming	Performance, operation installation check	Factory inspection sheet check; withstand voltage, megar, operation, Visual inspection	
	Conduit Work	Bending, support check	Visual inspection, dimension	
	Wiring and cable Work	Sheath damage, loose connection check	Performance sheet check, cleaning before laying, marking after bolt fixing	
	Lightning Work	Resistance, conductor support pitch check	Resistance measuring, visual inspection, dimension	
	Lighting Work	Performance, operation, installation check	Performance sheet check, illumination measurement, visual	
Mechanical Work	Water Piping Work	Support pitch, leakage	Visual inspection, leakage, water pressure test	
	Drainage Piping	Slope, support pitch, leakage	Visual inspection, leakage, water flow test	
	Pump Installation	Performance, operation, installation check	Performance sheet check, flow rate test	
	Air-Con. Work	Performance, operation, installation check	Performance sheet check, temperature measurement	
	Water Tank	Leakage	Water filling test	
	Sanitary Fixture	Operation, installation, leakage check	Visual inspection, flow test	

2.2.4.6 Procurement Plan

(1) Construction Materials

1) Procurement Policy

Most construction materials are produced in Indonesia, they will, in principle, be procured in Indonesia. It is also planned to make on-site repair and maintenance easier by procuring local construction materials as much as possible. The materials and equipment of which the procurement in Indonesia is difficult and which are necessary to secure the intended functions of the planned facilities will be procured from Japan.

2) Procurement Plan

① Structural Work

The main materials for the structural work, such as prestressed concrete pile, fresh concrete, reinforcing bar and plywood for forms, etc., can be procured locally. Concrete block and brick for partitioning wall, etc., can also be procured locally.

② Facilities Exterior and Interior Work

Steel door, timber, tiles, roof tiles, paint and glass used for the exterior and interior of facilities can be procured locally.

③ Air-conditioning and Plumbing Work

Air-conditioning equipment, exhaust fan, pumps, various apparatus and sanitary-fixture, and fire hydrant as custom-order products, etc. can be procured locally. In principle, those products is procured in Indonesia in view of easy repair and maintenance. Power failure control device for air-conditioning unit is not produced in Indonesia, it will be import from Japan.

④ Electrical Work

Lighting fixture, switches, lamps, electrical wires and cables, conduits and others can be procured locally. In principle, those products is procured in Indonesia in view of easy repair and maintenance.

⑤ Lift Work

The planned lift is not ready made because of 2.5m height of door is required, this type as custom-order products is not produced in Indonesia, it will be import from Japan.

Table 2-38 Major Materials Procurement Plan

Architectural Work

Work type	Materials	Local Market		Procurement Plan	
		Condition*	Import	Indonesia	Japan
Concrete work	Portland cement	◎		○	
	Sand, aggregate	◎		○	
	Reinforcing bar	◎		○	
	Form (plywood)	◎		○	
Pile work	Prestressed Concrete pile	◎		○	
Masonry work	Concrete block, Brick	◎		○	
Waterproof work	Urethane waterproofing	◎		○	
Tile work	Ceramic tile	◎		○	
Wooden work	Wood	◎		○	
Roof work	Corrugated cement board	◎		○	
Metal window and door work	Aluminum window	◎		○	
	Steel door	◎		○	
Wooden door work	Wooden door	◎		○	
Ironmonger	Door handle, lock	◎		○	
Glass work	Plane glass	◎		○	
Paint work	Paint	◎		○	
Interior finishing work	Rockwool acoustic board (T-bar)	◎		○	
	Vinyl sheet	◎		○	
	Gypsum board for wall, ceiling	◎		○	
	Carpet tile	◎		○	
	PVC tile	◎		○	
Lift work	Lift	×	Japan		○

* ◎ Procure in the Indonesian market ○ Procurement country

× Difficult to procure in Indonesia

Mechanical and Electrical Work

Work type	Materials	Local Market		Procurement Plan	
		Condition*	Import	Indonesia	Japan
Air-conditioning work	Air conditioner	◎		○	
	Power failure control device for air-con	×	Japan		○
	Exhaust fan	◎		○	
Plumbing work	Pump	◎		○	
	Fire hydrant	◎		○	
	Sanitary fixture	◎		○	
	Pipe	◎		○	
	FRP tank	◎		○	
Electrical work	Lighting fixture	◎		○	
	Panel	◎		○	
	Wire, cable	◎		○	
	Conduit	◎		○	
	Telephone system	◎		○	
	Fire alarm system	◎		○	

(2) Equipment

1) Procurement Policy

Each equipment will be selected with a cheapest price through comparison of specification and price of products in Indonesia, third country and Japan. The procurement will be decided in consideration with repairing and after sales services condition in Indonesia.

2) Procurement Plan

① Procurement in Indonesia

The copy machine and computer etc. which require regular maintenance after procurement, will be procured from local agents. The Experimental table will be examined to procure in Indonesia with economical price

② Procurement from Japan

The Japanese products of bio-equipment has an advantage in capability and price, and they will be procured from Japan. There are many local agent of these equipment in Indonesia, it seems that maintenance of equipment is not so difficult.

③ Procurement from third Country

The third Country products in specimen cabinet and furniture, etc. has an advantage in price, and they will be procured from the third Country.

(3) Transportation Plan

In principle, transportation of the construction materials from Japan will use wooden crates or container shipment because of the small quantity involved while the equipment will be transported in a container by sea. The main disembarkation point for maritime cargo to Indonesia is Port Jakarta. There are frequent mixed consignment services from Japan to Port Jakarta. It will be taken customs clearance at a bonded warehouse in Port Jakarta. Following customs clearance, it will be delivered to the site by trailer. There are no obstruction for transportation between the port to the site, because road for trailer is equipped.

	Sea		Land	
Japan	→	Port Jakarta	→	Site

It will take about 1.5 months from shipping in Japan to the site. In principle, transportation of equipment from the third countries will be transported in a container by sea.

2.2.4.7 Implementation Schedule

In the case of the Project's implementation with grant aid scheme provided by the Government of Japan, the following processes will be followed up to the commencement of the construction work.

① Signing of the E/N by the Government of Japan and the Government of Indonesia
② Recommendation of a Japanese consultant by JICA
③ Signing of the consultant services agreement by LIPI on the detailed design and supervisory of the planned facilities and equipment and the recommended consultant
④ Preparation of the detailed design documents and tender documents, tender in Japan and signing of the construction and equipment contracts with (a) Japanese companies, leading to the commencement of the construction work.

Following the signing of the E/N, the LIPI will become responsible and implementation agency on the Indonesian side.

(1) Detailed Design

The detailed design drawings and tender documents will be prepared based on the basic design. These will consist of the detailed design drawings, specifications, calculation sheets, budget statement and tender outline, etc. The Consultant will conduct detailed consultations with the project-related organizations of the Government of Indonesia at the beginning and end of the detailed design. The detailed design work of the Consultant will be completed when the final products submitted to the Government of Indonesia are approved.

(2) Tender and Contract

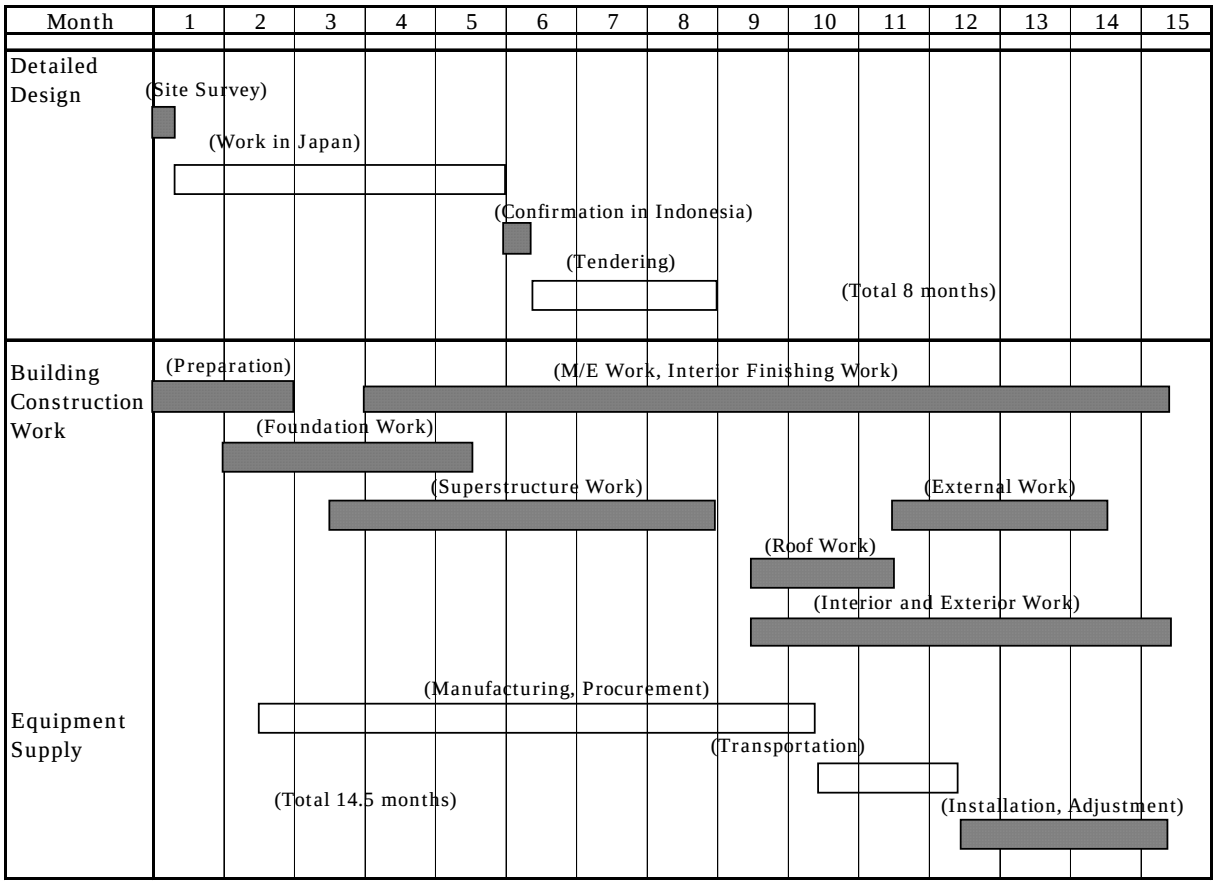
Following the completion of the detailed design, the prequalification for tender will be announced in Japan. Based on the prequalification results, the LIPI (project implementation agency) will invite construction companies and equipment suppliers which have expressed a willingness to participate in the tender. The tender will then be held and will be witnessed by the related parties. The tenderer with the lowest tender price will be declared the successful tenderer provided that the contents of tender are judged to be appropriate. The successful tenderer will conclude a construction contract or an equipment supply contract with the LIPI.

(3) Construction Work and Equipment Procurement

Following the signing of the contract, the Contractor and the Equipment Supplier will commence their respective work. Judging from the scale of the planned facilities and the local situation of construction workers, it is judged that the Project will take some 14.5 months to complete including equipment procurement and installation. The completion of the Project in

this period assumes the steady procurement of the equipment and materials, the quick clearance of the various procedures and reviews, etc. by related organizations in Indonesia and the smooth implementation of the work to be undertaken by the Indonesian side.

Table 2-39 Implementation Schedule



2.3 Obligations of Recipient Country

2.3.1 Obligations of Recipient Country

It will be necessary for the Government of the Indonesia to undertake the following matters for the implementation of the Project with grant aid provided by the Government of Japan.

(1) Matters Related to Construction Work

① Clearance at the site
② Whole of planting work at the site (including planting for termite prevention to collection storage)
③ Construction of gate, gate house and fencing
④ Obtaining building permit
⑤ Extension and services connection work for power to the site and extension and service connection work for the telephone line to the planned facilities

(2) Matters Related to Maintenance

① Procurement of general office furniture, fixtures and utensils (Transfer of the existing general office furniture, fixtures and utensils is planned.)
② Arrangement of consumables and spare parts which will be required for the maintenance of the facilities and equipment
③ Appropriate as well as effective use and maintenance of the facilities and equipment procured with the grant aid

(3) Matters Related to Implementation Process

① Banking arrangements and payment charge of contracts amount
② Issue of authorization to pays (A/P) and amendment of A/Ps and charge for issue
③ Clearance of the procedure for the application of building permits and payment of various fees
④ Tax exemption and customs clearance of the equipment and materials imported within the scope of the grant aid and their swift inland transportation
⑤ Exemption of Japanese companies and Japanese persons working for the Project from customs duty, domestic taxes including VAT and any other financial levies imposed in Indonesia
⑥ Provision of all conveniences for the entry to and stay in Indonesia for Japanese persons for the execution of Project-related work
⑦ Issue of various permits and authorisation required for the implementation of the Project
⑧ Payment of all costs which are not included in the grant aid but which are necessary for the implementation of the Project

(4) Restoration and Transfer of Specimens

① Restoration of fragile botanical dry specimens and spirit collection prior to transfer to the planned facilities
② Transfer of the existing specimens, laboratory equipment and furniture, etc. to the planned facilities

2.3.2 Cost Estimation

Currency Exchange Rate: 1 US$ = 9,099.30 Rp = 116.79 J-Yen

(1) Matters Related to Construction Work
  1) Clearance at the Site: 93,070,000 Rp
  2) Whole of Planting Work at the Site
     (The cost of planting work will be estimated by the Indonesian side after the designing.)
  3) Construction of Gate, Gate House and Fencing: 282,430,000 Rp
  4) Obtaining Building Permit 202,965,000 Rp
(2) Infrastructure Connection
  1) Power Connection: 355,250,000 Rp
  2) Telephone Line Connection: 8,500,000 Rp
(3) Payment Charge (Contract Amount x 0.1%): 183,638,000 Rp
(4) Authorization to Pay (A/P) Charge for issue and amendment of A/P: 6,233,000 Rp
(5) Procurement General Furniture: 0 Rp
     (Transfer of the existing general furniture, etc. is planned.)
(6) Restoration and Transfer of Specimens 17,730,771,000 Rp

Grand Total 18,862,857,000 Rp

The RCB has estimated the cost of operation and maintenance of facilities and equipment, matters related construction work and specimen restoration and transfer as Table 2-26. The Indonesian side has pledged its proper funding to meet its share of the construction cost, the specimen restoration and transfer cost and the operation and maintenance cost of the new Center on the Minute of Discussions of Explanation on the Draft Final Report.

2.3.3 Project Cost

The project cost for the planned facilities and equipment including consultant services by the Government of Japan is estimated as below, for the implementation of the Project with the Grant.

Rough Total Project Cost about 2,173 Million Yen

Main Building and Annex (Total Floor Area: about 12,330 ㎡)

Item		Total Project Estimated Cost (Million Yen)	
Facilities	Main Building, Annex Building, Green House, External Work	1,441	2,002
Equipment	Botany and Microbiology Division Equipment, Meeting Room Equipment, Experimental Table, Specimen Restoration Equipment	561	
Consultant Services Fee			171

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Condition of Estimation:
1) As of November 2003
2) Currency Exchange Rate: 1 US$ = 9,099.30 Rp = 116.79 J-Yen

2.4 Project Operation Plan

2.4.1 Operation and Maintenance System

The Division of Facilities and Collection Management will be responsible for the maintenance of the new facilities and equipment together with maintenance of the library and information system in line with the current organizational structure of the RCB. This division has three sub-divisions, each responsible for the Botany Division, the Microbiology Division and the Zoology Division, in addition to the general facilities and collection management sub-division. A total of four technicians provide a facility and equipment maintenance service together with the procurement and supply of materials, equipment and consumables.

Table 2-40 Staff Composition of Division of Facilities and Collection Management

Sub-Division	Total No. of Staff Members	Technical Staff		
		Technician	Librarian	Information System
Facilities and Collection Management	5	1	2	1
Facilities and Collection Management for Botany Division	8	1	4	1
Facilities and Collection Management for Microbiology Division	8	0	3	2
Facilities and Collection Management for Zoology Division	8	2	4	1
Total	29	4	13	5

Technical issues of the Microbiology Division are handled by technicians of the Facilities and Collection Management Sub-Division and the Facilities and Collection Management Sub-Division for the Botany Division.

In regard to the maintenance, inspection and repair of facilities, technicians of the Facilities and Collection Management Division conduct daily maintenance and inspection for the zoology division building which resembles the planned facilities under the Project and also for the existing facilities of the Botany Division and the Microbiology Division while an external service company conducts periodical maintenance and repair. The same system will be adopted for the planned facilities. For this reason, the mechanical and electrical systems for the planned facilities are planned to be equivalent to those of the zoology division building with emphasis placed on simplicity.

The specifications and supply sources of the equipment are planned in a manner to allow equipment requiring special maintenance to be maintained by a local agent in order to ensure continual maintenance.

2.4.2 Maintenance Plan

(1) Facilities

There are three key issues for the maintenance of the facilities, i.e. (i) daily cleaning, (ii) repairs in the face of wear, damage or aging and (iii) security to ensure safety and crime prevention.

The rigorous implementation of daily cleaning gives a good impression of the facilities to visitors/users and prompts people to use the facilities and equipment gently. It is also important to maintain the proper functioning of the equipment, leading to the early detection and repair of any damage or break down and prolonging the life of the building service equipment.

The main components of the repair work will be the repair or replacement of exterior and interior materials protecting the facilities structure. Renewal to maintain the serviceability of the facilities is assumed to be required every 10～15 years based on examples in Japan.

The details of the regular inspection and repair which determine the life of the facilities will be submitted in the form of "a maintenance manual" by the Contractor when the facilities are handed over to the Indonesian side together with an explanation of the inspection and regular cleaning methods. The required inspections are outlined below.

Table 2-41 Outline of Regular Inspection for Facility

	Type of Maintenance Work	Frequency
Exterior	• Repair and repainting of external walls	Repair: every 5 years Repaint: every 15 years
	• Inspection and repair of roofing materials	Inspection: every year Repair: every 5 years
	• Regular cleaning of gutters and drainage system	Monthly
	• Inspection and repair of sealing of external windows and doors	Every year
	• Regular inspection and cleaning of ditches and manholes	Every year
Interior	• Renewal of interior finishing	As required
	• Repair and repainting of partition walls	As required
	• Renewal of ceiling materials	As required
	• Adjustment of window and door fitting	Every year
	• Replacement of hardware	As required
Lift	• Regular maintenance under maintenance services contract by manufacturer or agent	Monthly

(2) Building Service Equipment

What is important for the building service equipment is regular preventive maintenance before the equipment suffers from a break down which requires repair or the replacement of a part(s). The life of the building service equipment can certainly be extended by proper operation and regular inspection, lubrication, adjustment, cleaning and repair. Such regular inspection can prevent break downs and accidents and prevent the spread of accidents. With regular inspection, the replacement of worn parts and the cleaning/replacement of filters are conducted in accordance with the maintenance manual.

It is essential to establish a proper maintenance organization involving the rigorous implementation of regular inspection and maintenance by maintenance personnel and the subcontracting of regular inspection to manufacturers' agents if necessary. The general life expectancy of the main equipment is shown below.

Table 2-42 Life Expectancy of Building Services Equipment

	Type of Building Service Equipment	Life Expectancy
Electrical System	• Distribution panels • Fluorescent lamps • Incandescent lamps	20 – 30 years 5,000 – 10,000 hours 1,000 – 1,500 hours
Water Supply and Drainage Systems	• Pumps, pipes and valves • Tanks • Sanitary fixture	15 years 20 years 25 – 30years
Air-Conditioning System	• Pipes • Exhaust fans • Air-conditioning units	15 years 20 years 15 year

(3) Equipment

It is very important for efficient equipment using to manage the using and maintain with washing and cleaning after equipment using, and also very important to read the manual through to become familiar with the operation and maintenance requirements to protect miss operation.

2.4.3 Operation and Management Cost

The operation and maintenance cost when the full-scale operation of the planned new Center will commence following the completion of the Project is estimated. The operation and maintenance cost is divided into the operating cost for the facilities and equipment (electricity cost, deep well pumping cost, telephone cost, LPG cost and equipment consumables cost) and the maintenance cost (facilities, utilities, equipment and).

Table: 2-43 Estimated Operation and Maintenance Cost

Operation and Maintenance Cost	Rp
(1) Operating Cost for Facilities and Equipment	1,458,810,706
① Electricity Cost including Deep Well Pumping Cost	727,973,306
② Telephone Cost	48,000,000
③ LPG Gas Cost	3,494,400
(①~③ Total)	(779,467,706)
④ Equipment Consumables	679,343,000
(2) Maintenance Cost	129,075,000
① Facilities	45,700,000
② Utilities	74,795,000
③ Lift	8,580,000
Total	1,587,885,706

- The inflation of prices is not considered.
  (Exchange rate: 1US$=9,099.30Rp=116.79J-Yen)

Breakdown of Estimation

(1) Operating Cost for Facilities and Equipment

① to ③ : Electricity, Telephone and LPG Gas cost

The annual averaged operation cost (2001-2002), such as electricity cost, deep well pumping cost, telephone cost, LPG cost, of the Zoology Division Building that has many large collection rooms with air-conditioning was a total of 365,076,000 Rp as the Table: 2-44, and the estimated annual operation cost of the planned new Center is about 780,000,000 Rp as

the Table: 2-43. The estimated annual operation cost of the RCB's three research divisions is about 1,145,000,000 Rp, and it is increased about 470,000,000 Rp than the existing cost of the RCB.

Table: 2-44 RCB's Electricity, Telephone and LPG Gas Cost in Year 2001 & 2002

Facility Name	Year 2001 (Rp)	Year 2002 (Rp)	Average (Rp)
Zoology Division Building	379,500,000	350,652,000	365,076,000
The Planned Facilities	296,800,000	332,506,000	314,653,000
Total	676,300,000	683,158,000	679,729,000

The budget for electricity, telephone and LPG gas cost is increased in last 5 years as the Table: 2-45. The budget for these items is expecting to increase about 820,000,000 Rp in 2007, calculating with averaged increasing ratio of the last 5 years. However the estimated annual operation cost of RCB's three divisions is more 325,000,000 Rp than the expecting budget in 2007, the balance is not so much. The Indonesian side has pledged its proper funding to meet the operation and maintenance cost of the new Center on the Minute of Discussions of Explanation on the Draft Final Report.

Table: 2-45 Breakdown of Routine Budget of RCB in Last 5 Years (Unit: 1,000Rp)

Item	Budgetary Year				
	1999/2000	2000	2001	2002	2003
1. Human Resources	3,824,767	3,778,817	4,391,533	5,171,689	5,218,973
2. Operation Cost	961,382	743,278	981,027	1,215,956	1,391,449
(1) Daily Consumables	144,000	122,397	164,800	274,200	349,320
(2) Equipment & Supply	41,350	27,183	28,900	24,400	19,540
(3) Electricity, Telephone and LPG Gas (Increased Ratio)	491,825 (100%)	368,869 (75%)	498,000 (101%)	575,796 (117%)	634,989 (129%)
(4) Others	284,207	224,829	289,327	341,560	387,600
3. Maintenance Cost	567,574	537,807	692,964	965,823	1,095,715
(1) Building, Landscape	343,224	334,927	446,020	628,073	657,895
(2) Car	38,725	35,250	47,750	51,400	58,000
(3) Others(including Equipment)	185,625	167,630	199,194	286,350	379,820
4. Travel Expense	19,490	16,875	20,000	22,740	22,740
Total	5,373,213	5,076,777	6,085,526	7,376,208	7,728,877

Detailed Breakdown of the Estimation

Table 2-46 Electricity, Telephone and LPG Gas cost

Electricity Coat*1													
A	1,653,439	kWh/Year	×	371	Rp/kWh						=	613,425,869	Rp/Year
B	220,538	kWh/Year	×	519.4	Rp/kWh						=	114,547,437	Rp/Year
Telephon *2													
	10	lines	×	400,000	Rp/line	×	12	month			=	48,000,000	Rp/Year
LPG Gas													
	4	kg/h	×	2	h/day	×	0.8	×	260	day/Year × 2,100	Rp/kg		
											=	3,494,400	Rp/Year
Total												779,467,706	Rp/Year

*1: Referred to the attached electricity consumption calculation

*2: Including basic charge

④ Equipment Consumables Cost

The expected maintenance cost for the consumables of the main machinery in this project is shown as below.

It is very difficult to decide the contents and quantities of the consumables in the research center since they depend on the subjects of the research in each year. However, researchers gain the research funds from the corporations by conducting joint research and contract research with them, so that it seems that the consumables are partly filled up for the funds. The RCB procures consumables depending on the annual budget other than these consumables. Also, when RCB needs the analysis using the analytical equipment which it presently dose not have, such analysis are commissioned to the outside research institute. Thus, if the RCB can analyze by own analytical equipment, it can minimize the cost. Therefore, it is considered that the newly additional expenses for the consumables are not so big through this project.

Table 2-47 Estimated Quantities, Cost of Consumables for the Equipment

Equipment name	Q'ty	Expected consumable items	Unit	Unit price 1000Rp	Q'ty /year	T Amount 1000Rp	T Amount \1000Yen
Water purifier	6	Cartridges		4,000.00	12	48,000.00	633.60
AAS	1	Total		56,000.00	1	56,000.00	739.20
GC-MS/MS	1	Carrier gases (He, Ar, etc.)		2,000.00	2	4,000.00	52.80
COD meter（Portable）	1	Titration reagent Ⅰ	Bottles(100ml)	2,000.00	2	4,000.00	52.80
		Titration reagent II	Bottles(100ml)	2,000.00	2	4,000.00	52.80
		KCL solution	Bottles(100ml)	250.00	1	250.00	3.30
BOD tester	1	Reagent（CO_2 remover）	500mg	500.00	2	1,000.00	13.20
		Buffer regent	500mg	500.00	2	1,000.00	13.20
DO meter	1	Exchange membrane	piece	1,000.00	2	2,000.00	26.40
		Electrolysis solution	Bottles(100ml)	400.00	2	800.00	10.56
pH meter	8	Standard solution powder	bottles	4,500.00	1	4,500.00	59.40
		KCL solution	100ml	280.00	2	560.00	7.39
DNA sequencer	1	Buffer, polymer, capillaries	set	2,081.00	3	6,243.00	82.41
Ion chromatography	1	Proof regent	Bottles(100ml)	4,000.00	2	8,000.00	105.60
		Eluant	Bottles(500ml)	500.00	2	1,000.00	13.20
C/N analyzer	1	Tubes	Bottle	50.00	50	2,500.00	33.00
		Catalytic agents	Bottle(500ml)	2,000.00	2	4,000.00	52.80
		Cooling coil	piece	2,000.00	1	2,000.00	26.40
		CO_2 absorbent	Bottle(500g)	2,000.00	2	4,000.00	52.80
		Dry chemicals	Bottle(500g)	1,000.00	2	2,000.00	26.40
Microcentrifuge	2	Tubes	1pack(500tubes)	225.00	24	5,400.00	71.28
Refrigerated high speed centrifuge	2	Tubes	250ml	500.00	16	8,000.00	105.60
			50ml	400.00	24	9,600.00	126.72
Electrophoresis	11	Buffer reagent	12l	850.00	132	112,200.00	1,481.04
		agarose gel	500g	5,500.00	11	60,500.00	798.60
		acrylamide	500g	4,000.00	11	44,000.00	580.80
Thermal cycler	5	Reagent	set	157,000.00	1	157,000.00	2,072.40
		Tubes, etc.	set	23,800.00	1	23,800.00	314.16
Precision Rotary Microtome （0.5μm）	1	Disposable blade 50pcs/pack	pack	650.00	50	32,500.00	429.00
		Staining jars with glass cover	pack of 6	1,140.00	1	1,140.00	15.05
Laser printer	5	Toner cartridge	unit cartridge	1,500.00	10	15,000.00	198.00
		copying paper	rim	30.00	120	3,600.00	47.52
Printer（Ink jet）	1	Ink	cartridge	400.00	8	3,200.00	42.24
		copying paper	pack of 10	10.00	400	4,000.00	52.80
Water quality analyzer	1	Standard solution	Bottle(100ml)	3,000.00	2	6,000.00	79.20
Fat determination system	1	Paper filter	pack(100pieces)	146.20	250	36,550.00	482.46
		Acidic detergent reagent kit		1,000.00	1	1,000.00	13.20
Total						679,343.00	8,967.33

(2) Maintenance Cost for Facilities

① Facilities Maintenance Cost

Even though the facilities maintenance cost considerably changes with the aging process, the necessity for major repair, etc. does not usually emerge for some 30 years after facilities completion. Actual examples of the maintenance cost for similar facilities suggest that the average annual repair cost is approximately 0.07% of the direct construction cost.

Direct Construction Cost 838,000,000 J-Yen × 0.07% = 586,600 J-Yen/year
586,600 J-Yen (about 45,700,000 Rp)

② Utilities Maintenance Cost

The amount of this type of maintenance cost will remain small for some five years after completion but will begin to increase thereafter because of the need for the replacement of parts and the replacement of equipment due to aging. The average annual repair cost over a 10 year span is estimated to be approximately 0.2% of the direct cost of utilities work.

Direct Cost 480,000,000 J-Yen × 0.2% = 960,000 J-Yen/year
960,000 J-Yen (about 74,795,000 Rp)

③ Lift Maintenance Cost

The all amount of maintenance cost is a regular maintenance services cost by manufacture or his agent under a services contract.

Annual Regular Maintenance Services Cost: 8,580,000 Rp/year

Estimation of Electricity Cost

① Lighting, Air-conditioning Load

Estimated Load
Lighting 20 VA/㎡
Receptacle 40 VA/㎡
Air-con 80 VA/㎡

Estimated Condition
Open 9:00-16:30 (including one hour lunch time)
Max. of room running is 6.5 hours per day. Specimen collection storage is 24 hours.
Annual runing days are 260 days.

		ROOM NAME	Floor (㎡)	Lighting (kVA)	Demand	Load (kVA) A	Receptacle (kVA)	Load	Total Load (kVA) B	Air-con (kVA)	Demand	Total Load (kVA) C	Total Load (kVA) A+B+C	Running houe/day a.	b.	Running day/Y	Running day/year a.	b.	Total Annual Load (kWh/year) a.	b.
Common Use Room																				
		Large Meeting RM.	173.75	3.475	100%	3.475	6.95	50%	3.475	13.9	70%	9.73	16.68	1.3		260	338	0	5,638	0
		Meeting RM. -1	87.94	1.7588	100%	1.7588	3.5176	50%	1.7588	7.0352	70%	4.92464	8.44224	3.25		260	845	0	7,134	0
		Meeting RM. -2	44.29	0.8858	100%	0.8858	1.7716	50%	0.8858	3.5432	70%	2.48024	4.25184	3.25		260	845	0	3,593	0
		Pray RM.	49.10	0.982	100%	0.982	1.964	20%	0.3928				1.3748	3		260	780	0	1,072	0
		Canteen	149.11	2.9822	80%	2.38576	5.9644	20%	1.19288				3.57864	1.5		260	390	0	1,396	0
		Canteen	42.52	0.8504	100%	0.8504	1.7008	80%	1.36064				2.21104	3		260	780	0	1,725	0
		Library	467.63	9.3526	80%	7.48208	18.7052	20%	3.74104	37.4104	60%	22.44624	33.66936	6.5		260	1,690	0	56,901	0
		Corridor	3268.75	65.375	50%	32.6875	130.75	5%	6.5375				39.225	6.5		260	1,690	0	66,290	0
		Open Corridor																0		
		Lavatory																0		
		Storage																0		
		Repairing Workshop	24.00	0.48	80%	0.384	0.96	20%	0.192				0.576	0.5		260	130	0	75	0
External Facility外部	Annex 1	Waste Storage	22.72	0.4544	10%	0.04544							0.04544	0.5		260	130	0	6	0
	Annex 1	Pump RM.	31.07	0.6214	10%	0.06214							0.06214	0.5		260	130	0	8	0
	Annex 1	Water Reservor Space	54.9	1.098	10%	0.1098							0.1098	0.5		260	130	0	14	0
	Annex 2	Electrical RM.	56.27	1.1254	10%	0.11254							0.11254	0.5		260	130	0	15	0
	Annex 2	PLN RM.	27.45	0.549	10%	0.0549							0.0549	0.5		260	130	0	7	0
Botany Division																				
Administration		Division Head RM.	31.23	0.6246	100%	0.6246	1.2492	50%	0.6246	2.4984	70%	1.74888	2.99808	6.5		260	1,690	0	5,067	0
		Administrative Office	33.23	0.6646	100%	0.6646	1.3292	50%	0.6646				1.3292	6.5		260	1,690	0	2,246	0
Research section	a. Staff/Technician Room																			
		Staff RM.	745.60	14.912	80%	11.9296	29.824	50%	14.912				26.8416	3.25		260	845	0	22,681	0
		Technician RM.	177.64	3.5528	80%	2.84224	7.1056	50%	3.5528				6.39504	3.25		260	845	0	5,404	0
	b. Phytochemistry																			
		LAB. I (natural Product)	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
		LAB.II (Bio-organic Science)	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
		LAB.III(Bio-Assay)	37.20	0.744	100%	0.744	10	50%	5	2.976	70%	2.0832	7.8272	3.25		260	845	0	6,614	0
		Common Instrument Room	60.00	1.2	100%	1.2	10	50%	5	4.8	70%	3.36	9.56	3.25		260	845	0	8,078	0
	Annex 1	Animal RM.	36.00	0.72	50%	0.36	1.44	20%	0.288				0.648	3.25		260	845	0	548	0
	c. Plant Physiology Plant Cell & Tissue Culture																			
		Plant Cell & Tissue Culture LAB.	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
		Cryo STG.	12.52	0.2504	50%	0.1252	0.5008	20%	0.10016	1.0016	70%	0.70112	0.92648	3.25		260	845	0	783	0
		Wet Processing RM.	12.68	0.2536	50%	0.1268	0.5072	20%	0.10144	1.0144	70%	0.71008	0.93832	3.25		260	845	0	793	0
		Commonn Optics RM.	24.00	0.48	100%	0.48	10	50%	5	1.92	70%	1.344	6.824	3.25		260	845	0	5,766	0
		Culture RM.	72.00	1.44	100%	1.44	10	50%	5	5.76	70%	4.032	10.472	3.25		260	845	0	8,849	0
	Stress Physiology & Macro Propagation																			
		Stress Physiology LAB.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Macro Propagation LAB.	37.20	0.744	100%	0.744	10	50%	5	2.976	70%	2.0832	7.8272	3.25		260	845	0	6,614	0
		Common Instrument RM.	24.00	0.48	100%	0.48	10	50%	5	1.92	70%	1.344	6.824	3.25		260	845	0	5,766	0
	d. Anatomy and Morphogenetic Plant Genetic																			
		Plant Genetic LAB.	49.20	0.984	100%	0.984	10	50%	5	3.936	70%	2.7552	8.7392	3.25		260	845	0	7,385	0
		Culture RM./Precision Instrument RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
	Plant Morphology, Anatomy & Cytology																			
		Common Instrument RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Plant Morphology, Anatomy & Cytology LAB.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0

		ROOM NAME	Floor (m^2)	Lighting (kVA)	Demand	Load (kVA) A	Receptacle (kVA)	Load	Total Load (kVA) B	Air-con (kVA)	Demand	Total Load (kVA) C	Total Load (kVA) A+B+C	Running houe/day a.	Running houe/day b.	Running day/Y	Running day/year a.	Running day/year b.	Total Annual Load (kWh/year) a.	Total Annual Load (kWh/year) b.
Research section	e. Taxonomy Herbarium																			
		Processing RM.	29.25	0.585	100%	0.585	1.17	20%	0.234				0.819	6.5		260	1,690	0	1,384	0
		Drying RM.	29.25	0.585	100%	0.585	1.2	100%	1.2				1.785	1.85		260	481	0	859	0
		Labeling RM.	21.25	0.425	100%	0.425	0.85	50%	0.425	1.7	70%	1.19	2.04	6.5		260	1,690	0	3,448	0
		Identification STG.	51.00	1.02	80%	0.816	2.04	20%	0.408	4.08	70%	2.856	4.08	6.5		260	1,690	0	6,895	0
		Mounting RM.	80.75	1.615	100%	1.615	3.23	20%	0.646	6.46	70%	4.522	6.783	6.5		260	1,690	0	11,463	0
		Freezing RM.	14.63	0.2926	50%	0.1463	1.91	100%	1.91				2.0563	3		260	780	0	1,604	0
		Fumigation RM.	15.00	0.3	50%	0.15	0.6	20%	0.12				0.27	1		260	260	0	70	0
		Packing & Unpacking RM.	105.00	2.1	100%	2.1	4.2	20%	0.84				2.94	6.5		260	1,690	0	4,969	0
		LIFT Machine RM.	15.90	0.318	50%	0.159							0.159	0.1		260	26	0	4	0
		Biosystematic RM.	72.00	1.44	100%	1.44	2.88	20%	0.576	5.76	70%	4.032	6.048	3.25		260	845	0	5,111	0
		Date Base RM.	36.00	0.72	100%	0.72	1.44	80%	1.152	2.88	70%	2.016	3.888	6.5		260	1,690	0	6,571	0
		Date input RM.	18.00	0.36	100%	0.36	0.72	80%	0.576	1.44	70%	1.008	1.944	6.5		260	1,690	0	3,285	0
		Cyrptogamae Collection	2613.78	52.2756	5%	2.61378				209.1024	60%	125.46144	128.07522	20	4	365	7,300	1,460	934,949	186,990
		Work Space	211.30	4.226	100%	4.226	8.452	20%	1.6904	16.904	70%	11.8328	17.7492	3.25		260	845	0	14,998	0
		Unprocessed Room(Bag Log)	144.00	2.88	5%	0.144							0.144	6.5		260	1,690	0	243	0
	Spirit Collection																			
		Spirit Processing RM.	36.00	0.72	100%	0.72	1.44	20%	0.288				1.008	3.25		260	845	0	852	0
		Work Space	105.78	2.1156	100%	2.1156	4.2312	20%	0.84624	8.4624	70%	5.92368	8.88552	3.25		260	845	0	7,508	0
		Spirit Biosystematic RM.	36.00	0.72	100%	0.72	1.44	20%	0.288	2.88	70%	2.016	3.024	3.25		260	845	0	2,555	0
		Data input RM.	18.00	0.36	100%	0.36	0.72	80%	0.576	1.44	70%	1.008	1.944	6.5		260	1,690	0	3,285	0
		Spirit Collection	216.00	4.32	5%	0.216				17.28	60%	10.368	10.584	20	4	365	7,300	1,460	77,263	15,453
	Carpology, Seed and Xylarium Collection																			
		Carpology Biosystematic RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Carpology & Seed Collection	143.88	2.8776	5%	0.14388				11.5104	60%	6.90624	7.05012	20	4	365	7,300	1,460	51,466	10,293
	Voucher Collection																			
		Ecology Collection	40.20	0.804	5%	0.0402				3.216	60%	1.9296	1.9698	20	4	365	7,300	1,460	14,380	2,876
		Ethnobotany Collection	31.80	0.636	5%	0.0318				2.544	60%	1.5264	1.5582	20	4	365	7,300	1,460	11,375	2,275
	Reference Collection																			
		Locality Collection	28.31	0.5662	5%	0.02831				2.2648	60%	1.35888	1.38719	6.5		365	2,373	0	3,291	0
	Drawing Collection and Others																			
		Drawing RM.	36.00	0.72	100%	0.72	1.44	20%	0.288	2.88	70%	2.016	3.024	6.5		260	1,690	0	5,111	0
		Slide/Drawing Collection	36.00	0.72	5%	0.036				2.88	60%	1.728	1.764	2.2		260	572	0	1,009	0
		Video Processing RM.	18.03	0.3606	100%	0.3606	0.7212	80%	0.57696	1.4424	70%	1.00968	1.94724	2.2		260	572	0	1,114	0
	Other Laboratory																			
		Chemotaxonomy LAB.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Molecular Systematics LAB.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Cryptogamae LAB.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
	f. Ecology																			
		Soil & Plant Litter LAB.	37.20	0.744	100%	0.744	10	50%	5	2.976	70%	2.0832	7.8272	3.25		260	845	0	6,614	0
		Plant Ecology Laboratory	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
	g. Ethnobotany																			
		Ethnobotany LAB.	37.20	0.744	100%	0.744	10	50%	5	2.976	70%	2.0832	7.8272	3.25		260	845	0	6,614	0
	h. Others																			
		Mounting Board STG.	51.00	1.02	10%	0.102				4.08	60%	2.448	2.55	20	4	260	5,200	1,040	13,260	2,652
		Glass Bottle STG.	18.00	0.36	10%	0.036							0.036	0.5		260	130	0	5	0
		Field Equipment STG.	15.90	0.318	10%	0.0318							0.0318	0.5		260	130	0	4	0
		Office Equipment STG.	25.20	0.504	10%	0.0504							0.0504	0.5		260	130	0	7	0
	Annex 1	Wet Chemical STG.	26.76	0.5352	10%	0.05352							0.05352	0.5		260	130	0	7	0
	i. External Facility																			
	Green House																			
		Plant Genetics	60														0	0	0	0
		Stress Physiology & Macro Propagation	60														0	0	0	0
		Plant Cell & Tissue Culture	30														0	0	0	0
		Plant Ecology	20														0	0	0	0
		Cryptogamae	15														0	0	0	0
	Others																			
		Drying Floor															0	0	0	0
		Concrete Bench															0	0	0	0
	Annex 1	Plant Preparation RM.	55.81	1.1162	10%	0.11162							0.11162	1.3		260	338	0	38	0
	Annex 1	Germination RM.	18.23	0.3646	10%	0.03646							0.03646	1.3		260	338	0	12	0

		ROOM NAME	Floor (m²)	Lighting (kVA)	Demand	Load (kVA) A	Receptacle (kVA)	Load	Total Load (kVA) B	Air-con (kVA)	Demand	Total Load (kVA) C	Total Load (kVA) A+B+C	Running houe/day a.	Running houe/day b.	Running day/Y	Running day/year a.	Running day/year b.	Total Annual Load (kWh/year) a.	Total Annual Load (kWh/year) b.
Microbiology Division																				
Administration		Division Head RM.	30.75	0.615	100%	0.615	1.23	50%	0.615	2.46	70%	1.722	2.952	6.5		260	1,690	0	4,989	0
		Administrative Office	31.67	0.6334	100%	0.6334	1.2668	50%	0.6334				1.2668	6.5		260	1,690	0	2,141	0
Research Section	a. Staff/Technician Room																			
		Staff RM.	421.46	8.4292	80%	6.74336	16.8584	50%	8.4292				15.17256	3.25		260	845	0	12,821	0
		Technician Room	48.00	0.96	80%	0.768	10	50%	5				5.768	3.25		260	845	0	4,874	0
	b. Ecology and Physiology																			
		Ecology LAB.	49.20	0.984	100%	0.984	10	50%	5	3.936	70%	2.7552	8.7392	3.25		260	845	0	7,385	0
		Ecology/Physiology Processing RM.	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
		Physiology LAB.	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
	c. Applied Microbiology & Developmental																			
		Applied Microbiology Laboratory	49.20	0.984	100%	0.984	10	50%	5	3.936	70%	2.7552	8.7392	3.25		260	845	0	7,385	0
		Common Instrument RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Distillation/Fermentation	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
	d. Biosystematics & Generics																			
		Genetic LAB.	49.20	0.984	100%	0.984	10	50%	5	3.936	70%	2.7552	8.7392	3.25		260	845	0	7,385	0
		Genetic Instrument RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Isolation/Preservation RM.	36.00	0.72	100%	0.72	10	50%	5	2.88	70%	2.016	7.736	3.25		260	845	0	6,537	0
		Processing RM.	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
	e. Microbial Biochemistry																			
		Micorobial Biochemistry LAB.	49.20	0.984	100%	0.984	10	50%	5	3.936	70%	2.7552	8.7392	3.25		260	845	0	7,385	0
		Inoculation/Cool Working Room	48.00	0.96	100%	0.96	12.24	100%	12.24				13.2	1.85		260	481	0	6,349	0
		Common Instrument RM.	48.00	0.96	100%	0.96	10	50%	5	3.84	70%	2.688	8.648	3.25		260	845	0	7,308	0
	f. External Facility																			
	Green House																			
		Ecology and Physiology	200														0	0	0	0
Enviromental Education																				
		Information Center	133.18	2.6636	100%	2.6636	5.3272	80%	4.26176	10.6544	60%	6.39264	13.318	6.5		260	1,690	0	22,507	0
Others																				
		(PS/AD, Others)																		
																			a.	b.
		Total	12,439			129.90783			248.60002			319.22536	697.73321						1,651,441	220,538

② Plumbing Load

Pump capacity		Elec. Load (kW)	Demand 20%	Annual Using hour of kitchen and toilet	Annual Consumpsion
Lift Pump	Capacity 3.7kW × 2 Nos.	7.4	1.48 kW		
Septic Pump	Capacity 3.7kW × 1 No.	3.7	0.74 kW		
	Total		2.22 kW	900 h/year	1,998 kWh/year

× 371.0 Rp/kWh

= 741,258 Rp/year−①

Electricity Charge

a. Using time 22:00 ～ 18:00 (20 hours) **371.0** (Rp/kWh)

b. Using time 18:00 ～ 22:00 (4 hours) **519.4** (Rp/kWh)

a. 1,651,441 kWh/year × 371.0 Rp/kWh

= 612,684,611 Rp/year

b. 220,538 kWh/year × 519.4 Rp/kWh

= 114,547,437 Rp/year

a. + b. = 727,232,048 Rp/year −②

Annual Consumpsion ① + ② = 727,973,306 Rp/year

2.4.4 Timing and Cost of Renewal

Building service equipment, paint finish and equipment, etc. can perform their functions for a long period of time if daily maintenance is conducted. However, each equipment has its own life and its function deteriorates once it reaches the end of its expected life, necessitating its renewal.

The renewal timing and cost of the main equipment, etc. planned under the Project are described below. It is necessary for the Indonesian side to secure the necessary budget to ensure the renewal of equipment, etc. in due course.

Conditions of schedule planning and cost estimation are as follows.

- Renewal is limited to item with a life time lower than 20 years.
- Excluding break under unusual use
- Renewal cost is based on current price without price escalation
- Exchange rate: 1 US$=9,099.30Rp=116.79 Japanese Yen

Table 2-48 Timing and Cost of renewal

Facilities: Architectural Work					
Part	Work Item	Life Time	Renewal Schedule	Unit	Renewal Cost
Exterior		(Year)		(㎡)	(Rp)
Roof	Asphalt Waterproofing	20～30	—	—	—
	Aluminum Roofing	20～30	—	—	—
Wall	Spray Paint	15～20	Re-spray within 15 years	8,000	334,800,000
	Ceramic Tile	30	—	—	—
Exterior	Paint on Steel	3	Re-paint within 3 years	180	3,760,000
	Paint on Board	5	Re-paint within 5 years	820	17,400,000
	Aluminum Window	40	—	—	—
	Steel Door	35	—	—	—
	Stainless Steel Window	40～60	—	—	—
Interior		(Year)			(Rp)
Floor	Porcelain Tile	30	—	—	—
	Ceramic Tile	30	—	—	—
	Carpet Tile	20	—	—	—
	Vinyl Sheet	30	—	—	—
	PVC Tile	30	—	—	—
Wall	Mortar Trowel＋Paint	5	Re-paint within 5 years	7,130	121,290,000
	Ceramic Tile	30	—	—	—
	Gypsum Board + Paint	5	Re-paint within 5 years		
Ceiling	Rockwool Accoustic Board	30	—	—	—
	Gypsum Board + Paint	5	Re-paint within 5 years	3,100	52,750,000
Others		(Year)			(Rp)
	Paint on Wooden Door	5	Re-paint within 5 years	80	4,900,000
	Paint on Steel Door	5	Re-paint within 5 years	1,830	30,990,000
	Paint on Steel	5	Re-paint within 5 years	70	796,000
	Wooden Door	30	—	—	—
	Steel Door	40	—	—	—
	Kitchen Sink	20	—	—	—
	Lift	30	—	—	—

Facilities: Mechanical and Electrical Work

		(Year)		(No.)	(Rp)
Part	Work Item	Life Time	Renewal Schedule		Renewal Cost
Air-Con.	Package Air-Conditioner	15	Re-place within 15 years	149	6,021,358,300
	Exhaust Fan	20	—	—	—
Plumbing	Lifting Pump	15	Re-place within 15 years	1	58,240,000
	Fire Hydrant Pump	27	—	—	—
	Elevated Water Tank(FRP)	20	—	—	—
	Fire Hydrant	20	—	—	—
	Vinyl Piping	25～30	—	—	—
	Sanitary Fixture	25～30	—	—	—
	Valve	20	—	—	—
	Gas Range	8	Re-place between 8 years	1	26,481,000
Electrical	Panel	30	—	—	—
	Lighting Fixture	30	—	—	—
	Telephone System	15～20	Re-place between 15～20 years	1	384,878,280
	Fire Alarm	20	—	—	—
	Switch, Receptacle	20	—	—	—

Equipment

The manufactures should supply parts for equipment for 7 years after equipment supply, and the equipment can be repair in this term. It is difficult to supply parts of equipment over 10 years, because there are many cases to change the model and discontinue the equipment. Some manufacturers of analytical equipment may supply parts over 10 years, but they may not supply consumables of equipment for the time. Therefore, it is impossible for equipment to specialise timing for renewal of equipment.

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

Chapter 3 Project Evaluation and Recommendations

3.1 Project Effect

Present Situation and Problems	Improvement Measures Under the Project (Grant Aid Project)	Project Effects and Degree of Improvement
• The scope of basic research on the conservation and utilization of biodiversity has expanded in recent years, making interdisciplinary research involving the Zoological, Botanical and Microbiological Divisions necessary. Such research by the RCB has been hampered because of the location of the research facility of the Zoological Division at Cibinong and the research facilities of the Botanical and Microbiological Divisions at Bogor. The equipment of Botanical and Microbiological Divisions are also insufficient for modernised research activity.	• Relocation of the research facilities of the Botanical and Microbiological Divisions to the next to the research facility of the Zoological Division at Cibinong CSC through the construction of the Biodiversity Research Facilities (the Center).	The construction of the Center is expected to achieve the following effects. ① Increase of joint research with the Ministry of Agriculture, provincial government and/or private enterprises for the purpose of conserving and utilizing biodiversity, in turn contributing to the development of the national economy. Such joint research will be based at the Botanical Division and the number is expected to increase from 15 in 2002 to more than 20 in 2010. ② The dry, spirit and microbiological specimens will be preserved using a method of an international standard. - The properly stored dry specimens will increase from 20,000 items in 2003 to some 707,000 items in 2007. - The properly stored spirit specimens will increase from 8,194 items in 2003 to some 50,000 items in 2007. - The properly stored microbiological specimens will increase from 864 items in 2003 to some 37,800 items in 2007.
• The current research facilities of the Botanical Division include the Herbarium Bogoriense housing some 1.3 million dry botanical specimens, boasting one of the leading collections in Asia. However, the condition of these specimens is deteriorating because of their storage under natural ventilation.	• Construction of specimens storing facilities which is capable of storing botanical specimens to the relevant international standards.	
• The Botanical and Microbiological Divisions currently conduct environmental education, and the expansion of environmental education on biodiversity is planned. However, an exclusive facility for environmental education is lacked.	• Construction of an exclusive facility for environmental education on biodiversity.	The number of research papers published by the two divisions is expected to increase from 119 in 2002 to some 160 in 2010. The number of students visiting the Center for environmental education is expected to increase from 1,054 in 2002 to 1,300 in 2010.

3.2 Recommendations

Although the implementation of the Project is expected to have the significant effects described above, such effects will be much greater with the swift improvement of the following points by the Indonesian side.

(1) Restoration and Transfer Plan of Dry and Spirit Specimens

The specimens kept by the Herbarium Bogoriense include type specimens of indigenous species in Indonesia which have been collected since the early 1800's. These specimens are very precious as they are used for not only basic research on the conservation and utilization of biodiversity in Indonesia but also for research conducted by research institutes and individual researchers world-wide. Therefore, the transfer of the existing specimens without damage is of critical importance.

For this reason, the remounting of some 450,000 dry specimens and the rebottling of some 40,000 spirit specimens which are considered to be unfit for transfer because of damage to the mounting board or specimen itself prior to the completion of the new Center are necessary, and the safe transfer of specimens after completion of the new Center is also necessary.

The availability of a restoration and transfer budget to be funded by the Indonesian side is, therefore, the most important requirement. As the project implementing body, the LIPI must secure the necessary restoration and transfer budget for FY 2004 through FY 2007 to complete the restoration and transfer work and these money must be made available without delay.

(2) Guarantee of Operation and Maintenance Budget

The operation and maintenance cost of the Center must be properly funded to ensure the implementation of the planned research, specimen storage and environmental education. Any shortage of such funding may cause damage to the specimens due to stoppage of the air-conditioning system and other reasons. Moreover, the inability to procure consumables for essential equipment for research will hamper the progress of research.

The operation and maintenance cost for the Center is to be borne by the LIPI and it has been confirmed on the minutes of discussions that the LIPI will duly prepare the necessary budget to meet the estimated operation and maintenance cost. As the project implementing body, the LIPI should complete the necessary procedure without delay so that the government budget to cover the operation and maintenance cost is secured every year.

(3) Establishment of Interdisciplinary Research System

The location of the Center next to the Zoological Division at Cibinong is intended to facilitate interdisciplinary biological research which is one of the objectives of the Center. While this location of the Center will undoubtedly improve the geographical conditions for such research from the present conditions, i.e. the locationing of the Zoological Division at Cibinong and that of the Botanical and Microbiological Divisions at Bogor.

The research staff of three research divisions of the RCB should discuss for cooperation of the research periodically to facilitate interdisciplinary research involving the three divisions.

(4) Preparation of Environmental Education Materials

A staff of the exclusive facility for environmental education will be stationed. The committee for preparation of environmental education materials has been organized by representatives of three research divisions of RCB. The committee should prepare necessary materials to support implementation of environmental education.

(5) Consensus for relocation

A number of meetings were held by the Botany Division and the Microbiology Division to make a consensus for the relocation to Cibinong. The LIPI promised on the minutes of discussions that the LIPI will continue this process for making further consensus for the relocation among researchers within and without RCB by disclosure of project plan, and the LIPI is requested to continue the process steadily.

(6) Necessity of Technical Cooperation

The following dispatching experts under the technical cooperation is required to implementation of the Project smoothly.

1) Supervision and Guidance of Restoration of Specimens

The Indonesia side has planned to complete the remounting of some 450,000 dry specimens and the rebottling of some 40,000 spirit specimens which are considered to be unfit for transfer prior to June 2006, when the new Center will be constructed. The RCB has experiences for restoration of botanical specimens under supervision of experts who were dispatched by the GEF Project. However, the numbers of restoration is quite large, and if it is not completed by the time, the project implementation will be hindered. Therefore, the Japanese Government is requested to examine a necessity of the dispatching short-term expert(s) for supervision and guidance of the restoration upon evaluating the progress.

2) Supervision and Guidance of Transfer of Specimens

On the previous similar occasion, i.e. the transfer of the zoological specimens to Cibinong from Bogor, a supervisor was dispatched periodically from the Smithsonian Museum under the GEF Project to provide detailed guidance. The RCB has desired of receiving such supervisors for this project and is seeking a donor support. If such request is submitted by the Indonesian Government, the Japanese Government is requested to dispatch short-term expert(s) for supervision and guidance of the packing, transfer and unpacking after examination of the request.

3) Guidance of Environmental Education Materials Making

RCB has some audio visual environmental education materials which has been made under the Japanese technical cooperation program of the biodiversity conservation project and etc. However, the number of audio visual environmental education materials is not enough for the expanding the environmental education by RCB. The RCB has requested to dispatch volunteer(s) to guide and support for audio visual material making

at the basic design study because of lack of know-how for audio visual materials making. Therefore, the dispatching of a volunteer for guidance and support of the teaching materials making is requested.

The expecting dispatching: 2 years from July 2006 when construction of the new Center is completed