

The results of examination of the equipment request are as follows.

(1) Equipment for the Multipurpose Lecture Theater

The equipment requested is separable into the following two categories

- a) Equipment for stage lighting: spotlights, power and dimmer rack, control system, etc.
- b) Equipment for presentations and lectures: interactive whiteboard; 3D object projector

The purposes for which the multipurpose lecture theater will be used include orientation meetings, graduation exercises, instruction in the expressive arts, lectures for 100 or more persons, academic or other seminars and meetings, educational events, cultural events, and so on, as indicated below. The room will be frequently used for school-wide events and academic or scholarly meetings, as well as community services (including events sponsored by religious institutions), and it is expected that it will be used perhaps three times a week for joint lectures or for performances by students working in the area of the expressive arts.

Table 2-6 Intended Uses of the Multipurpose Lecture Theater

Purpose	Use/Curriculum	Frequency
University Events	Orientation Graduation ceremony Others	Occasionally
Joint Lecture	HLIS001 Life skills EPG320 Introduction to Guidance & Counsel GED421 Measurement & Evaluation	Weekly
Performances	HEXA011, 012, 111, 112 Expressive Arts I, II, III, IV GEA301, 302 Expressive Arts II, III GEA321, 322 Music Major GEA331,332 Dance & Drama, Others	Once in a semester
Conference /Seminar	Academic conferences and seminars (international, domestic)	Occasionally
Community Service	Regular church services, etc.	Week ends
Cultural Service	Performance, concerts, show, etc.	Occasionally

The multipurpose theater at present is equipped with audio equipment and stage lighting, and it is considered to be adequate for the expected uses of the room. However, the number of spotlights is not adequate for teaching the use of lighting as part of the expressive arts program. In addition, a multimedia projector and other AV equipment are deemed necessary in order to enhance the effects of presentations when the room is used for lectures and seminars.

a) Equipment for stage lighting

Stage lighting equipment such as installed in conventional theater has been requested. In particular, ceiling-mounted stage lights have been planned in addition to which the major equipment comprises various spotlights as a set, a power and dimmer rack, and a control board. As it is thought that equipment suspended over the stage is to be considered as special equipment used in commercial theaters, it cannot be assigned high priority from the viewpoint of educational objectives. It would be unavoidable to enlist the cooperation of the building designer and contractor to determine if a weight of 300 to 600kg could be suspended from the ceiling. It is also thought that there would be an issue of potential liability in the case of installation and operation of such equipment. Therefore it is judged that it would not be proper to include such equipment in the plan. Nevertheless, as spotlights are essential for stage performances, spotlights of the type that can be manually moved are planned for inclusion in the equipment to be supplied. Further, because there is some duplication of equipment at the old lecture theater (as discussed below), in terms of performance and quantity, equipment suitable for joint use is included in the item for equipment for the old theater.

b) Equipment for presentations and lectures

The Multipurpose Lecture Theatre would not be constantly used only for lectures. Therefore, considering its function as a facility for university-wide activities, it is assumed that when necessary the equipment provided in the AV section will be used and will not be treated as equipment dedicated to use in this room.

(2) Library equipment

Library equipment has four categories.

- a) Furniture (Book stacks, reading tables and chairs, office desks and chairs)
- b) Computers (For library data management, loan data, search and office work)
- c) AV equipment (For library AV room)
- d) Others (Security gate system)

a) Furniture

Shelving for library books, and reading tables for students using the library are of high necessity and are suitably considered to be educational equipment. The New Library acquisition plan is summarized in the table below. The stacks can accommodate the entire holdings of the old Library (about 140,000 volumes) but the project plans take into account library plans for expansion in 4-5 years' time. With regard to reading desks and chairs enrollment at the university at present is in excess of 900, but it has been judged as proper to plan on reading desks and chairs as would be needed in 4-5 years when enrollment has risen to about 1,000. Desks and chairs for offices, however, are not deemed as directly related to education, and those that are presently in use can continue to be used; desks and chairs for offices therefore are not included.

Table 2-7 Library Expansion Plan (Number of Books)

Classification \ Year	2003	2004	2005	2006	2007	2008
General Collection	70,000	71,000	72,000	73,000	-	-
Reference Collection	4,230	4,280	4,280	4,300	-	-
Research Collection	10,000	10,500	10,700	10,900	-	-
Special Reserve Collection	6,000	6,200	6,200	6,300	-	-
Periodicals Collection	31,000	31,040	31,080	31,120	-	-
Fiction Collection	20,000	20,500	21,000	21,500	-	-
Disertations Collection	135	155	175	195	-	-
Total	141,365	143,675	145,435	147,315	150,315	152,315

b) Computers

At present computers are being used for library data management, loan data management, and book searching. The requested equipment would be for replacing the existing system with a new one on the occasion of the relocation of the library and its expansion, whereby the present seven terminals used to search the catalog would be increased to ten. Regarding the computer system for the New Library, however, AusAID had planned to increase the number of terminals through the PASTEP Project, but consultation with PNG officials led to the disclosure that this plan is not to be implemented. Regarding computers for office use, despite their being necessary, as they will not be directly used by the students, and inasmuch as the existing equipment can continue to be used, these are not included in this project. Request was also made for computers that students could use for study, but this is taken as an alternative to using the open computer laboratories, so computers for this purpose were not included.

c) AV equipment

In connection with the relocation of the library, plans call for creation of a lounge where students can use the library's videotapes (about 2,000) and other visual media materials (about 100 CD-ROMs), and equipment was requested for that purpose. Use of the lounge, however, will be on a random and irregular basis and at any given time there will be a continually varying number of users. This pattern of expected usage is such that the requested equipment for the lounge is not in compliance with the concept of "educational equipment" and hence provision of equipment is not suitable. As requested by each department, however, the AV Lecture Room (a room for lectures where AV equipment is used) is to be provided in the New Library, for joint use by students in all departments.

d) Others

A security gate system is in operation in the existing library at this time. If a new system was to be introduced when the books are moved to the New Library, there would be the issue of the formidable task of changing the antitheft tags on all of the books. Moreover, a new system would not provide an improved function and is not likely to prevent a high theft rate. This system therefore was not included in the project.

(3) AV Section equipment

The requested equipment is classified as follows.

- a) Video cameras for student practice, and editing machines, for use in educating students in educational technology
- b) Video cameras, editing machines, editing machine attachments for use by the AV section
- c) Equipment and tools for maintenance and repair
- d) AV equipment for joint use
- e) Satellite broadcast equipment

a) Video cameras and editing machines for Educational Technology

The Educational Technology subject (ETE-001) is required for all students, and in this subject students learn the use of AV equipment and the methods for actual application of the equipment in education. The thinking with regard to the intended objective of use of the equipment is that the students would use the equipment themselves in the context of their studies and learn the material being studied at the same time as they learn how to use the equipment. But because at the present time there is no faculty member who is in charge of videotaping and editing it is believed that it would be difficult to expect educational effects of such use of the AV equipment. It would be technically appropriate, however, to provide a videotaping-and-editing training opportunity to a technician in the AV section who has some experience at this work, so that that person could make videotapes of model teaching sessions. Therefore, the plan calls for education on the method of use of this equipment is to be done by borrowing AV section equipment, and for the AV section to manage the equipment for the use of all departments.

b) Video cameras and editing machines for use by the AV Section

The AV Section is under the Academic Services Division, which provides facilities for university-wide use. When requested by a department, the Section will videotape a lecture or other activity, and edit the tape. The requested equipment thus would be used for services on the school grounds, in addition to which the AV Section would cooperate in establishing the teaching methods for instruction using AV media and because both taping and editing instruction would be provided, the equipment needed for that is included in the plan.

c) Equipment and tools for maintenance and repair

The AV Section at present undertakes replacement of parts and repair of single-function parts and also undertakes replacement of functional parts as part of the maintenance work it does on campus, but the measuring devices and tools for such work now available are insufficient. In view of the University's geographic location, at least to an extent there would be need for making repairs *in situ*. Therefore the plan concentrates on tools needed for repair of AV equipment.

d) AV equipment for common use

Joint use of AV equipment for lectures is effective in that it raises the degree of utilization of the equipment, but it is necessary either concentrate such lectures in a room where TV monitors and other equipment cannot be easily removed, or to use a room that enables easy transport of equipment up and back. Because each department has submitted its own AV equipment request, a study was made of specifications and quantities for the university as a whole, assuming joint use of the equipment. The basic thinking was to group the equipment into (a) fixed equipment, or equipment fixed in place (TV-video monitors, projectors, etc.) and (b) mobile equipment that can be loaned to users one at a time (projectors, screens, computers). Maintenance and management of both types of equipment would be by the AV Section. The plan is provided below in "Equipment for other lecture theatres and classroom."

e) Satellite broadcast equipment

The objective behind the request was for reception of news and scientific programs broadcast by satellite, and distribution of the programs throughout the campus. As information service for teaching of students, news programs are not to be expected to provide strong educational effects, so the plan provides only for equipment for scientific educational programs.

(4) Printery Section equipment

Request was made for plate making, printing and binding equipment, but as a result of a review of the role of the Printing Section it was confirmed that there was need for equipment for use prior to plate making. The Printing Section is now using its old-type printing machines at capacity and since expansion of the University will increase demand for printing, there is strong need for high-performance printing processes. The past record for the University's production of textbooks, and forecast of requirements, are as follows.

Table 2-8 Textbook Printing, Record and Forecast

(Unit: one book)

2001 results	2002 results	2003 estimate	2004 forecast	2005 forecast
14,991	16,404	17,000	18,000	20,000

The average number of pages per book is 100. The printing machinery now in use was acquired in 1992, and considering the normal usable lifetime of a printing machine as 10-15 years, as well as the difficulty in obtaining replacement parts, it is judged that it is time to replace the machinery. It is considered that, in terms of functioning of the printing machines, a printing speed equal to that used at present will be adequate. Whereas the present Printery Section technical staff is believed to possess adequate knowledge and experience in the field of printing technology, a certain amount of training will be needed because the new processes will be somewhat more advanced than those now in use.

(5) Equipment for Language and Linguistics classes

Because of a wide disparity in the students' language (English) ability, a course, Communication Skills (HCOS 002) has been provided in order to raise the level of all students to a certain minimum or higher. The Language and Literature department, moreover, wishes to acquire equipment it can make available for student use for practice and skill improvement (in hearing, speaking, reading and writing) from each student's starting level, and equipment was requested on that basis. Accordingly, as it was determined that the most suitable equipment would be computer based that used educational CDs so that each student could work at his or her own level, and this was included in the plan. Since there is no security measure taken in this room, it is necessary to fix iron grills in all the windows and padlocks on the entrance door. Besides, it is planned to include a storage cabinet to safe keep the planned equipment. Also, because it is recommended that language instruction make use of overhead projectors more often, OHPs are included in the plan. Other AV equipment is planned as separately reported, for joint use.

(6) Equipment for Educational Technology classes

The requested equipment includes TVs, video cameras, OHPs, and cassette players, at the ratio of one per 4 or 5 students, and is for teaching that will improve student skills in the use and care of the equipment. Almost all equipment items are controlled by a one-chip computer, and because there are few items for which the technology has been disclosed so that the operating principles can be known, resulting in weak learning effects if study is confined to equipment from a single manufacturer, the plan calls for the minimum needed for instructor use. The planned equipment will be located in the AV Section.

(7) Equipment for Computer Laboratories

The requested equipment comprises

- a) New Computer Lab: Computers, server, UPS, AVR, security system, projector
- b) Department of Mathematics & Computing Teaching Lab: AVR, security system, air conditioner
- c) Male Open Computer Lab: AVR, security system, air conditioner
- d) Female Open Computer Lab: AVR, security system, air conditioner
- e) IT Room (Section): Cable testers, UPS, air conditioner, server software

Concerning locations of the computer laboratories, the existing Male Open Computer Lab and Female Open Computer Lab are to be merged for use by male students, and a new computer room will be furnished for female student use.

a) New Computer Lab

At present about 18 students share a personal computer and computer usage is only once in 4 or 5 days and for 2 hours at a time, so the standard for planning was one use every 2 days; concerning UPS, a unit with AVR capability is to be provided, and a plan for a security system as antitheft device was also made. As the

existing computer room functions well enough without an air conditioner, the need for this type of equipment was judged to be low and it was excluded. This computer lab is solely for use of female students and, in consideration of the gender balance, two other open computer labs - currently one for male and the other for female - will be made for use of male students.

- b) Department of Mathematics & Computing Teaching Lab, c) Male Open Computer Lab and d) Female Open Computer Lab

No plans are made for installation of AVRs and security systems in these existing computer labs because the equipment to be protected by these items are already existing and therefore it is not suitable to provide these items alone in consideration of demarcation of responsibility. The Mathematics & Computing department requested a projector, but this is not provided as joint use of a projector at the AV Section will be possible.

- e) IT Room (IT Section)

Because the IT Room comprises the computer center for the University, plans have been made to provide them with equipment enabling a network management function and improving stability.

(8) Equipment for Expressive Arts education (Music Section)

Requests were made for musical instruments, equipment for composition, and AV devices. The necessity and suitability of the requested musical instruments and composition equipment was considered high in view of the objective of use and courses where they will be used, and therefore are included in the Equipment Plan. The existing building, however, is now over 30 years old and signs of wear are evident in the interior; repairs and improvements are needed. No AV equipment is to be provided here as joint use of equipment at the AV Section will be possible.

(9) Equipment for agricultural education

Concerning education in the Agriculture Section of the Department of Science, Agriculture and Health at present there is a diploma course in agriculture education and plans call for institution of a degree course in 2004. Details of the program for each course, as to the practice and experiments performed from Level 3 upward are available, and at present, since no classrooms, experimental devices, tools and so forth are available in the department, for the sake of convenience, those of the adjacent biology and chemistry labs are used for classes. The equipment requested comprised experiment materials, AV equipment for classroom use, and practice equipment such as used on farms.

- a) Experiment materials

As a result of efforts to confirm appropriateness of intended use and the curriculum for which the equipment would be used, as well as confirm the necessity and suitability of requested equipment, some

equipment was assigned low priority according to the equipment selection criteria or was taken to be outside the project scope because it was judged that the nature of the equipment showed it was intended for research use, or (as in the case of atomic absorption spectrometer and auto analyzer) either would present a problem concerning after-service, would be expensive to operate, or difficult to maintain and manage. Other equipment (especially relatively expensive equipment for which more than one had been requested, such as flame spectrometer, dissecting microscopes, and environmental monitoring station, adjustments were made in terms of quantity or other aspects, on the basis of suitability and appropriateness.

The laboratory glassware, chemicals, reagents, and consumables that will be needed are numerous and in great variety, and it would be particularly difficult to include everything that is needed within the scope of this project. Consideration was given to supplying those glassware items, chemicals and reagents that are needed for operation of the planned equipment, and all other materials (including replenishments of project-supplied materials) are assumed to be procured by the University through by means of its own fund.

Regarding the labs where the equipment is to be installed, a part of the old Library is to be renovated for use as an agricultural lab, but as long as an adequate budget is provided, no problems are expected in connection with this conversion of use.

b) AV equipment for lectures and practical

The departments are assumed to share all AV equipment and no equipment is to be provided specifically as AV equipment for classroom or lecture use in this department.

c) Model Farm Equipment

The equipment requested included a tractor, tractor attachments, a pig unit, poultry house, nursery house, irrigation equipment and so on. For such facilities as the pig unit, poultry house, nursery house and others, as these are not commonly within the scope of projects such as this one it has been assumed that the University would acquire them at its own initiative. It was thought that the supply of irrigation equipment was possible after confirming that the water source and the irrigation area could be secured. For the tractor and attachments, construction of a roofed shelter is needed, and for the other equipment a warehouse is needed. It is assumed that the University will furnish these structures.

(10) Equipment for Science, Agriculture and Health

The Science Section in the Department of Science, Agriculture and Health has well established faculty responsible for the curriculum development, planning of experiments, planning management of equipment, and so forth. Because the requested equipment will be used in labs in this section of the Department, they are divisible into two groups, namely chemistry and biology (including some related to agriculture) lab equipment, and AV equipment and computers for shared use.

a) Lab equipment

At present the labs comprise two chemistry labs, one biology lab and one research lab. Each of the four is adequate in terms of area, water supply and drainage systems, and so on. But much of the equipment for practice and experiments is broken or out of date, so that at present the results obtained from experiments are less than is desired.

The request for equipment was duly examined whereby particularly sophisticated equipment, research equipment that was deemed difficult to operate, maintain and manage, or presented problems related to maintenance and after-service (for example, inverted microscope, and tissue culture set) were eliminated as not satisfying the predetermined selection criteria. At the same time, equipment which could be shared with agricultural education was designated for joint use. In the case of equipment for which requests had been made for more than one of the same kind (such as high-speed centrifuges, dissecting microscopes, etc.) the number was reduced on the basis of consideration of the appropriateness relative to the curriculum, and the suitability of the scientific or technical level of the equipment. Moreover, additions to the Equipment Plan were made. At the time of the basic design field study an additional request was made for a microtome and attachments. Also, a clean cabinet was not originally requested, but is indispensable in view of the condition and environment of the labs. These were added on the basis of their necessity and suitability both being high.

The varieties and types of laboratory glassware, chemicals and reagents, and consumables requested for use in experiments, were quite numerous, and it would be difficult to include all of them within the scope of the project, so it was assumed that except for those needed in connection with the use of the equipment to be provided, the University would procure them through its own arrangements.

b) Shared equipment

AV equipment and computers had been requested. Because it was judged that the computers would be used in the Computer Labs there was little need for this Section to have its own computers. It is assumed that the AV equipment to be supplied will be for sharing by all departments, and no provision is made in the Equipment Plan for AV equipment solely for this Section.

(11) Equipment for other lecture theatres and classrooms

Requests were made for the following.

- a) Equipment for new lecture room (in the Old Library): AV equipment
- b) Equipment for the Old Lecture Theatre: AV equipment spotlights, audio system
- c) Classroom equipment: AV equipment
- d) Equipment for the Life Skills Center: AV equipment

a) Equipment for new lecture room (in the Old Library)

A room with AV equipment for joint use will be in the New Library and the new lecture room in the Old Library. The departments that wish to use the equipment will reserve a date and time, and use of the equipment will be confined to these two rooms, whereby the number of pieces of equipment will be kept at a minimum.

b) Equipment for the Old Lecture Theatre

Spotlights and an audio system are planned. The spotlight will be a portable one, so that it can be used also in the new Multipurpose Lecture Theatre. AV equipment had been requested, but this equipment will be available from the AV Section and there are no plans to supply equipment specifically for the old Lecture Theatre.

c) Classroom equipment

Requests were received from the departments of (a) Education Foundation, (b) Science, Agriculture and Health (Home Economics Section), (c) Mathematics & Computing. (d) Social Science and Commerce. Plans are for a TV and video player, with a cabinet for same, to be provided one each for specified classrooms in each department. The AV Section will be in charge of maintenance of this equipment.

d) Equipment for the Life Skills Center

There is strong need for equipment for educational use at the Life Skills Center where instruction is given in pedagogical theory and other subjects. One TV and one video player and a cabinet for them are to be provided. Maintenance of this equipment is to be by the AV Section.

(12) Equipment for Design and Technology Section

Metalworking and woodworking equipment had been requested. Many pieces of the existing equipment are older than their planned usable life, but are still in use; the precision of the work that can be done with them is not good. Further, almost all of the equipment is now incapable of sustaining the loads that were possible in the past. Therefore, the equipment need to replace or supplement the existing equipment is planned to be provided. The buildings having workshops are either of recent construction or were recently renovated and no technical problem will be encountered in receiving the planned equipment.

(13) Equipment for Home Economics Section

The requested equipment included among others sewing machines and pressing machines for practice in Clothing Lab, a refrigerator, freezer, microwave oven, and educational videotapes (on food poisoning, food spoilage, fermentation, etc.) for practice in Food Lab. Because there is a high level of need for these, and they would be frequently used, they are included in the plan. Educational video tapes will be stored in the Library together with other video materials. One TV and one video player and a cabinet as planned in

above (11) will be located in this section. It is considered justifiable that, in view of the necessity in lab works, computers and a steam compressor to be included in the plan though these were not requested originally.

(14) Equipment for Technical Vocational Section

This section offers workshop practical called as Independent Workshop Project in various trades for a class of students who are divided into small groups of 1-8 students depending on the area of trade. Equipment requested primarily includes the basic tools for lathe, milling, piping, welding, and auto repair (electrical; mechanical). Basically, one set each was requested but three or four sets were requested for the piping (plumbing) and carpenter class use in view of the number of students. There is already sufficient number of tools and machinery in this section though some items of tools are lacking. It is thought that one set per two or three students is suitable. Because supply of these tools would be to augment what is now in use there would not be a problem in terms of management or technical matters and so they are to be provided.

(15) Office equipment

Requested office equipment included scanners, copiers, computers, digital cameras, etc. Investigation of prevailing conditions at the University revealed, however, while finding that use of copiers was high, that this equipment is not used directly for education of students and has been left off of the list.

(16) Others (Backup power source)

At Goroka University there is on average one power outage every month (the frequency varies according to the season), for about 2 hours on average. The overall capacity of the University is 858A (158kVA equivalent for the educational buildings; 48kVA for lodgings and dormitories, totaling 206kVA), and the main need for a backup power source is at the education buildings where it is important for data management of computers and lighting. Including computers to be provided through this project the University would have about 170 computers for use by students; estimating that each uses 500VA for a total of about 85kVA; with 40 classes of 25 persons the lighting draw of classrooms is 1kVA per classroom and a total of about 40kVA, making in all 125kVA as the requirement. Power demand therefore may be considered to be 125kVA. This corresponds to about 60% of total University demand and can be said to be appropriate for planning purposes. A backup power source with this capacity therefore was planned. The distribution cable from the power source to the university facilities is to be provided by the University.

The major items of equipment selected from the above are as shown on the following page (Table 2-9).

Table 2-9 List of Planned Equipment

Code	Description	Q'ty	Unit	Main Specifications	Location
B. Equipment for the New Library					
1.1.1	Book Stacks	40	unit	500(L) x 50(W) x 181(H) cm, stacks in both side, wooden made	Reading Room (GF)
1.1.2	Reading Table	21	unit	360(L) x 120(W) x 71(H) cm, wooden made	Reading Room (GF)
1.1.3	Reading Chair	126	unit	420(L) x 500(W) x 500(H), back rest: 790 (H) cm, wooden made	Reading Room (GF)
1.2.1	Book Stacks	30	unit	500(L) x 50(W) x 181(H) cm, stacks in both side, wooden made	Reading Room (FF)
1.2.2	Reading Table	17	unit	360(L) x 120(W) x 71(H) cm, wooden made	Reading Room (FF)
1.2.3	Reading Chair	102	unit	420(L) x 500(W) x 500(H), back rest: 790 (H) cm, wooden made	Reading Room (FF)
2.1	Maps Cabinet	1	unit	1000(L) x 700 (H) x 85(W), with 7 drawers	Reading Room (FF)
3.2	Computer	5	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), CD-ROM drive, WINDOWS XP, keyboard, mouse, 15" monitor	Reading Room, Librarian's Room, Secretary Room (FF)
5.1	Multimedia Projector	1	unit	3LCD panel, 2400ANSI lumen or more, multi system compatible, resolution: 500 TV lines (video), RGB : 1024 x 768 dots or better	AV Lecture Room (GF)
5.2	Computer	1	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), CD-ROM drive, WINDOWS XP, keyboard, mouse, 15" monitor	AV Lecture Room (GF)
5.3	VHS Video player	1	unit	Multi system compatible	AV Lecture Room (GF)
5.4	CD/DVD Player	1	unit	Playable formats: DVD/VCD/CD,	AV Lecture Room (GF)
5.5	Cabinet	1	unit	Lockable storage cabinet 600x600x1820mm	AV Lecture Room (GF)
5.7	Projector Screen	1	unit	Ceiling mounted, 100" screen	AV Lecture Room (GF)
C. Equipment for AV Section					
3.1	Digital Video Camera with accessories	2	unit	Image device: 1/3" CCD, 450000 pixels or more, Horizontal resolution: 500TV lines, with battery, charger, cover, tripod, carrying case	Store (Shooting)
4.1	Computer	2	set	P4, 2GHz, cache 256KB, memory 256MB, HDD 80GB (IDE), CD-ROM drive, video memory: 8MB, video capture card: IEEE1394 and composite, WINDOWS XP, keyboard, mouse, 17" monitor	Store (Editing)
4.2	Software	2	set	Video processing application software	Store (Editing)
4.3	Video Monitor	2	unit	CRT 20" or more, resolution: 600TV lines, color system: PAL/NTSC, input: composite, GGB: component	Store (Editing)
4.4	Digital Video Recorder/player	1	unit	Video system: composite/S-video, audio: phono 1/phono1	Store (Editing)
4.6	VHS Recorder/player	1	unit	Format: VHS standard (multi system),	Store (Editing)
4.8	CD/DVD player	1	unit	Playable formats: DVD/VCD/CD, color system PAL/NTSC, horizontal resolution: 500 lines	Store (Editing)
4.10	Portable Cassette Tape Recorder/player	1	unit	Track format: 4-track, 4-channel, frequency response: approx. 40Hz-16kHz	Store (Editing)
4.11	Scanner	1	unit	Flat bed type, resolution: 2400dpi or better, max scan size: A4	Store (Editing)
4.12	Laser Printer	1	unit	Laser beam printing, mono-color, A4 size, resolution:1200dpi or better	Store (Editing)
4.14	UPS	2	unit	Output: 300W or more, 500VA, back-up time: 15 min., with AVR function, surge filter, power on-off signal	Store (Editing)
4.15	Photocopier	1	unit	Max sheet size: A3, mono-color, 16 pcm or more, zoom: 50-200%	Store (Editing)
4.18	Steel Cabinet	1	lot	1800(H) x 900(W) x400(D) mm, 2 doors, 4 stacks	Store (Editing)
5.1	Cathode Ray Oscilloscope	1	unit	Frequency bandwidth: DC up to 50MHz, 2 channel	Maintenance Shop
5.2	Digital Multimeter	2	unit	Measuring: AC/DC voltage, AC/DC current, resistance, capacitance	Maintenance Shop
5.3	Digital LCR meter	1	unit	Measuring range: 4mH-40H C:4nF-4uF R:400-40MΩ	Maintenance Shop
5.4	Color Picture Tube Rejuvenator	1	unit	Measuring: cathode/anode characteristics	Maintenance Shop
5.5	High Wattage Soldering Station	2	unit	Temperature range: approx. 200-480°C, power: 50W	Maintenance Shop
5.6	Isolation Transformer	1	unit	2 AMP, 240V-240V, isolator type	Maintenance Shop
5.7	High Voltage Probe	1	unit	Max. DCV 30kV, ratio 1000:1	Maintenance Shop
5.8	Color TV Pattern Generator	1	unit	Color system: NTSC, PAL, SECAM, output: crosshatch, convergence,	Maintenance Shop
5.9	L.O.P.T. Tester	1	unit	Input resistance: approx. 1000M, max. voltage: 40kV	Maintenance Shop
5.10	Degaussing Wand	2	unit	Degaussing function, power source 240V	Maintenance Shop
5.11	Video Service Tool Kit	2	unit	Pliers, screw drivers, circrip remover, etc.	Maintenance Shop
5.13	Video Head Tester	1	unit	Bridge circuit, for VHS	Maintenance Shop
5.15	Monitor Function Generator	1	unit	Pattern chart: color bars 1000/100/0, red, green, blue, scale of grays: crosshatch, multiburst, white, output frequency: 0.5-5MHz	Maintenance Shop
5.17	Cabinet for Tool & Instruments	1	lot	Size: approx. 900(W) x 400(D) x 1800(H)mm, hinged double doors, 4 shelves	Maintenance Shop
5.18	Work Bench	1	lot	Size: approx. 3000(W) x 670(D) x 1400(H)mm, surface insulated	Maintenance Shop
6.1	Computer	2	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 30GB (IDE), CD/DVD-ROM drive, WINDOWS XP, keyboard, mouse, 15" monitor	Store (for Lending)
6.2	Multimedia Projector	2	unit	3LCD panel, 2400ANSI lumen or more, multi system compatible, resolution: 500 TV lines (video), RGB : 1024 x 768 dots or better	Store (for Lending)
6.4	Digital Camera	2	unit	Digital SLR camera, pixels: 6mil. or more	Store (for Lending)
6.5	CD/DVD Player	2	unit	Playable formats: DVD/VCD/CD, color system PAL/NTSC, horizontal resolution: 500 lines	Store (for Lending)
6.8	Extension power reel	2	unit	Length: 10m	Store (for Lending)
6.10	VHS Video player	2	unit	Multi system compatible	Store (for Lending)
6.11	Screen	2	unit	Screen size: 100 inch, tripod stand	Store (for Lending)
7.1	Satellite TV Dish	1	set	Dia. 10 feet, with decoder, cable	Store (for Lending)
7.3	S-VHS Video Recorder/Player	1	unit	Multi system compatible	Store (for Lending)
D. Equipment for Printery Section					
1	Offset press, A3 single-color	1	unit	A3 size, mono-color, printing speed:4000-12000sph	New Printery Shop
2	Dark room camera (Graphic camera)	1	unit	Sheet size: 620 x440mm, Magnification: 200%-50%	New Printery Shop
3	Plate Maker (Exposure system)	1	unit	Effective area: 800 x 650mm, densitometer, sink & vat	New Printery Shop
4	Electric Guillotine	1	unit	Cutting size 820 x 820 mm	New Printery Shop
5	Electric Stapler	1	unit	Max. thickness: 20mm, wire size: 0.8-0.41mm	New Printery Shop
6	Thermal Book Binder	1	unit	Speed: 300 books/hr, max. thickness: 30mm, max.	New Printery Shop
7	Paper Folder	1	unit	Speed: 10000sph, two-fold, three-fold	New Printery Shop
8	Paper Sorter	1	unit	Speed: 3500sph, setting height: 50mm, section:1	New Printery Shop
9	Digital Stencil Duplicator	1	unit	Paper size: 297 x 432, storage capacity: 1500 sheets, color	New Printery Shop
10	Photocopier, heavy duty	1	unit	A3 size, mono-color, 18pcs/min or more, zoom: 50-200%	New Printery Shop
11	Light Table	1	lot	800 x 700mm, light table	New Printery Shop
13	Computer	1	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), CD-R/RW drive, WINDOWS XP, keyboard, mouse, 17" monitor, with scanner, printer	New Printery Shop
E. Equipment for Language Laboratory, Dept. of Language & Linguistic					
1	Students' Self-learning system for tutorial class	30	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), CD/DVD-ROM drive, WINDOWS XP, keyboard, mouse, 17" monitor, headphone, language	Language Lab
6	OHP	3	unit	Halogen lamp: 300W, magnification: x3.0 - x10 or more	Language Lab
7	Projector Screen, Movable	3	unit	Screen size: 100 inch, tripod stand	Language Lab
8	Cassette Tape Player, Portable	3	unit	Track format: 4-track, 4-channel, frequency response: approx. 40Hz-16kHz	Language Lab

Code	Description	Qty	Unit	Main Specifications	Location
G. Equipment for Computer Laboratories					
1.1	Computer with monitor	60	set	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), FDD, CD-ROM drive. WINDOWS XP, keyboard, mouse, 15" monitor	New Open Computer Lab
1.1.1	Computer for server	1	set	P4, 2GHz, cache 256KB, memory 256MB, HDD 40GB (IDE) x 2, FDD, CD-R/RW drive. Windows XP, keyboard, mouse, 15" monitor	New Open Computer Lab
1.3	Equipment/Materials for Network system	1	lot	Network cable, hubs, plugs and jacks, UPS	New Open Computer Lab
1.4	Laser Printer	2	unit	Laser beam printing, mono-color, A4 size, resolution:1200dpi or better	New Open Computer Lab
1.5	Scanner	1	unit	Flat bed type, resolution: 2400dpi or better, max scan size: A4	New Open Computer Lab
1.6	UPS	60	unit	Output: 300W or more, 500VA, back-up time: 15 min., with AVR function, surge filter, power on-off signal	New Open Computer Lab
1.9	Security system	1	set	Self alarming type, display keeper	New Open Computer Lab
5.1	UTP Cable(CAT5) Tester	1	unit	For UTP LAN cable (category 5), with remote terminator	IT Room (IT Section)
5.2	Fiber Optic Cable Tester	1	unit	Wave length: 635nm, laser class:3, spectra width: 10nm or more	IT Room (IT Section)
5.3	UPS for Data servers	3	unit	Output: 2100W or more, 3000VA, back-up time: 24 min. or more, with AVR function, surge filter, power on-off signal	IT Room (IT Section)
5.5	Switch (HUB) - 16 port	4	unit	Switching port: 16	IT Room (IT Section)
5.6	Operating System for server	1	unit	Windows 2003	IT Room (IT Section)
H. Equipment for Expressive Arts Education (Music Section)					
1.1	Trombone	1	unit	Bell: gold brass 200-230mm, bore: 12-15mm, key: B b/ F	Music (Instruments)
1.2	Trumpet	3	unit	Key: B b, heavy weight, bell: gold brass 110-130mm, bore: 10-15mm	Music (Instruments)
1.3	Cornet	2	unit	Key: B b, bell: 100-150mm, bore: 10-15mm	Music (Instruments)
1.4	Alto sax	4	unit	Key: high F#, front-F mechanism, adjustable thumb hook, gold lacquer	Music (Instruments)
1.5	Tenor sax	4	unit	Key: high F#, front-F mechanism, adjustable thumb hook, gold lacquer	Music (Instruments)
1.6	Clarinet	3	unit	Key: B b, granadilla body, silver-plated parts	Music (Instruments)
1.7	Flute	4	unit	Silver head joint, nickel-silver body, with split E-mechanism	Music (Instruments)
1.8	Violin	2	unit	Face plate: high quality spruce, back/side plate: high quality maple	Music (Instruments)
1.9	Electric Guitar	1	unit	Scale length: max 700mm, pickups: single coil x 2, amplifier: 100W	Music (Instruments)
1.10	Bass Guitar	1	unit	Scale length: max 900mm, pickups: hum bucker x 2, amplifier: 100W	Music (Instruments)
1.13	Drum Kit	1	set	Bass drum 20", floor tom 14", tom tom, snare drum, cymbal, etc.	Music (Instruments)
1.14	Music Stand	20	unit	Steel made, height: approx. 600-1200mm	Music (Instruments)
1.15	Digital Piano with stand for classroom (student use)	12	unit	Keys: 76 piano-sized, speakers: stereo 2-way	Music (Instruments)
1.16	Piano Seat-Padded regular	13	unit	300mm x 500mm x 500mm, adjustable height	Music (Instruments)
1.17	Digital Piano with stand- Portable type for classroom (teacher use) & live application	1	unit	Keys: 88 or more, tone generator: AWM or equivalent	Music (Instruments)
1.18	Electronic Synthesizer for live application (a)	1	unit	Keys: 88 or more, sound: piano, organ, etc.	Music (Instruments)
1.19	Electronic Synthesizer for live application (b)	1	unit	Keys: 61 or more, sound: orchestra	Music (Instruments)
1.20	Power Amplifier	1	unit	Power rating: approx.300W (max. 600W)	Music (Instruments)
1.21	16 Channel Mixer	1	unit	Output: 300W + 300W, EQ: 60Hz-16kHz, THD: 0.5% or less	Music (Instruments)
2.3	Computer for Music composition	4	unit	P4, 2GHz, cache 256KB, memory 256MB, HDD 80GB (IDE), CD/DVD-ROM drive, Windows XP, keyboard, mouse, 15" monitor, with electric keyboard (60 keys), recorder tool	Music (Composition)
2.7	Laser Printer	1	unit	Laser beam printing, mono-color, A4 size, resolution:1200dpi or better	Music (Composition)
2.9	Compact Stereo System (CD, DVD, Tape)	1	set	Playback: DVD, CD, MD, cassette tape, FM/AM tuner	Music (Composition)
2.10	UPS	4	unit	Output: 300-350W, 500VA, back-up time: 15 min., with AVR function, surge filter, power on-off signal	Music (Composition)
I. Equipment for Agriculture Education (Agriculture Section)					
1.1	Analytical Lab Balance	2	unit	Capacity: 400-420g, sensibility: 0.001g, table top type	Agr Lab (Common)
1.2	Distilled Water/ Deionised Water Machine	1	unit	Capacity: approx. 1.8 liter/h, tank: 20 liter or more, with stand	Agr Lab (Common)
1.3	Lab Drying Oven	1	unit	Capacity: 90L or more, temperature range: 40-270°C, with timer	Agr Lab (Common)
1.4	Ammonia Distillation Apparatus	1	set	Heater: 6 pcs, flask: 500mL x 6 pcs, surface temperature: approx. 55°C	Agr Lab (Common)
1.5	Lab Incubator	1	unit	Temperature range: -10-50°C, capacity: 130L or more	Agr Lab (Common)
1.6	Digital Lab pH Meter	2	unit	Digital, measuring range: 0-4 pH, ± 1999mV, 0-100°C, with carrying case	Agr Lab (Common)
1.7	Desiccators	1	lot	Desiccator (3 pcs) & dessicator with hook (2 pcs): Φ240mm x 320(H)mm	Agr Lab (Common)
1.8	Table top Centrifuge with Tubes	1	unit	6000rpm or more, swing rotor, tubes: 15mL x 32, 50mL x 8, 50mL Polyethylene tube (with cap) x 2dz, 50mL(without cap) x 2dz	Agr Lab (Common)
1.9	Spectrophotometer	2	unit	Wavelength: 340-950nm, bandwidth: 5nm, display: 4LCDs (%T, Abs, Conc. 1, Conc. 2)	Agr Lab (Common)
1.10	Vacuum Pressure Pump	1	unit	Ultimate pressure: 26kPa or more, pumping speed: 12L/min. or more	Agr Lab (Common)
1.11	Mortar & Pestle	5	set	5 types (Φ90, 150, 180, 240, 300mm)	Agr Lab (Common)
1.12	Aluminum Heating Block	1	set	Setting temperature: 30-200°C, accuracy: ±1°C, tube setting: 25 pcs or more	Agr Lab (Common)
1.15	Conductivity Meter	4	unit	Measuring: conductivity (0-199.9mS/cm), impedance (0-19.99k/cm), temperature (0-100°C)	Agr Lab (Common)
1.17	Maniles	1	unit	Max. temperature: 450°C or more, flask: 100, 200, 300, 500, 1000, 2000mL	Agr Lab (Common)
1.18	Kjehdahl apparatus	1	unit	Flask: 100 or 150mL x 6 pcs, heater: 200W x 6 pcs	Agr Lab (Common)
1.19	Liquid Dispenser	1	set	Micro dispenser (2 pcs): 0.5- 5mL, dispenser with amber bottle (3 pcs): 2-	Agr Lab (Common)
1.20	Calorimeter	5	unit	Max. capacity: 1000g, readability: 1g/0-500g, 2g/500-1000g	Agr Lab (Common)
1.21	Peristaltic Pump	1	unit	Tube: 2 pcs, flow range: 10-1000mL/h or more, accuracy: within ±1%	Agr Lab (Common)
1.22	Lab Water Bath	1	unit	Temperature range: 5-80°C, temperature regulation: PID control or equivalent	Agr Lab (Common)
1.23	Electronic Microscope	20	unit	Head: binocular 45°, magnification: 40x-1000x with illumination Lamp	Agr Lab (Common)
1.24	Dissecting/Stereo Microscope	10	unit	Head: binocular 45°, magnification: 20x, 40x, illumination lamp	Agr Lab (Common)
1.25	Hand lenses	20	pc	Magnification: 10x or more, metal frame	Agr Lab (Common)
1.26	Electric Cork Borer	1	unit	Revolution: 0-2300rpm, bit: 6 pcs (4-12mm)	Agr Lab (Common)
1.27	Laboratory Blender with Timer	1	unit	Capacity: 1.9L or more, revolution: approx. 18000rpm, with timer	Agr Lab (Common)
1.28	Laboratory sample storage refrigerator	1	unit	Capacity: 340L or more, temperature range: 2 - 14°C	Agr Lab (Common)
1.29	Laboratory Deep freezer for sample storage	1	unit	Capacity: 400L or more, temperature range: -20 ~ -35°C	Agr Lab (Common)
2.1	Soil Bulk Density Corers - stainless	20	pc	Sample capacity: 100mL, sampling depth: 25cm, material: steel & aluminum alloy, with hammer, knife, carrying case	Agr Lab (Soil/Plant)
2.2	Rotary Shaker	2	unit	Applicable flask: more than 50mL, capacity: more than 2 pcs, frequency: approx. 30rpm	Agr Lab (Soil/Plant)
2.3	Reciprocating shaker	2	unit	Applicable flask: 300 ~ 500mL, capacity: 12 - 20 pcs, frequency: approx. 20-	Agr Lab (Soil/Plant)
2.4	Refractometer	5	unit	Scale range: Brix 0.0-10.0% or more, min. scale: 0.1 - 0.2%	Agr Lab (Soil/Plant)
2.5	Tullgren Funnel	1	pc	Number of funnel : 6pcs, Soil container: approx. Φ14 x 5cm, with net plate, with Lamp bulb	Agr Lab (Soil/Plant)
2.6	Salt & Hollick Soil Washing Apparatus	1	unit	Shaking analyzer: approx. 450(W) x 620(D) x 1320(H)mm, mesh sieve: Φ150 x 45(H)mm, 4 sets of 5 sieves	Agr Lab (Soil/Plant)
2.7	Lab Bench Shaker	2	unit	Shaking method: reciprocate/rotate, shaking speed: 20-250 times/min., Amplitude : 25mm, temperature range: 4-50°C or more	Agr Lab (Soil/Plant)

Code	Description	Q'ty	Unit	Main Specifications	Location
2.8	pH Meter	2	unit	Measuring range: 0.00-14.00pH, -1999mV ~ +1999mV, temperature: 0-100°C, resolution: 0.01pH, handy type	Agr Lab (Soil/Plant)
2.9	Ion Analyzer	1	unit	Measuring method: ion chromatograph, measuring item: PO4, F, Cl, NO2, Br, NO3, SO4, Li, Na, NH4, K, Mg, Ca, with dot matrix printer	Agr Lab (Soil/Plant)
2.10	Soil Sieve Set	1	unit	Material of sieve: stainless, dia.: approx. 200mm, depth: approx. 45mm, mesh: 4.0, 2.0, 1.0, 0.5, 0.25mm	Agr Lab (Soil/Plant)
2.11	Standard Test Sieve Shaker	1	unit	Frequency: 720-3,000 times/min. (variable), amplitude: 0.1-2.5mm, with timer	Agr Lab (Soil/Plant)
2.12	Water quality Analyzer	2	unit	Measuring system: absorption spectrophotometry, wavelength: 365-880nm or better, resolution: ±1nm at 400 to 700nm	Agr Lab (Soil/Plant)
2.13	Hygrothermograph	2	unit	Temperature range: -15 ~ +40°C, humidity range: 0-100%, with recorder	Agr Lab (Soil/Plant)
2.14	Thermograph	2	unit	Temperature range: -15 ~ +50°C, accuracy: ±0.5°C, with recorder	Agr Lab (Soil/Plant)
2.15	Soil Density Hydrometer	5	unit	Measuring range: 0.995-1.050, min. value: 0.001, length: approx. 280mm	Agr Lab (Soil/Plant)
2.16	Soil Thermometers	10	unit	Measuring range: -20 ~ +50°C, min. value: 0.5 °C, length: approx. 1000mm	Agr Lab (Soil/Plant)
2.17	Fruit gauge	5	pc	Measuring range: 0-15cm, min. value: 0.5mm, material: wood	Agr Lab (Soil/Plant)
2.18	Electronic Dendrometer	5	unit	Measuring range: 1-300m, min. value: 1cm, display: LCD, with carrying case	Agr Lab (Soil/Plant)
2.19	Chlorophyll Meter	5	unit	Measuring method: 2-wave length optical concentration difference, accuracy: ±1.0 % SPAD, measuring area: 2 x 3mm, leaf thickness: max. 1.2mm	Agr Lab (Soil/Plant)
2.20	Permeameter	5	unit	Guelph type, depth range: 15-75cm, max. capacity: 3L or more, with stand, case, auger, brush, hand pump	Agr Lab (Soil/Plant)
2.24	Soil Infiltrometer	5	unit	Tube: acrylic or equivalent, disk: plastic or equivalent, suction: 0.5cm, 2cm	Agr Lab (Soil/Plant)
2.25	Soil Tensiometer	5	unit	Measuring range: 0-250cmH2O resolution: 10cmH2O, tubes: 150, 300, 500,mm 3 kinds/set	Agr Lab (Soil/Plant)
2.26	Capacitance Probe	5	unit	Measuring response time ; less than .5sec. Probe output ; conductivity 0 to 300mS _c , temperature ; -5°C to +50°C, Volumetric soil moisture ; 1 to 100%, with carrying case	Agr Lab (Soil/Plant)
2.27	Time Domain Relectometry System	5	unit	Measuring range: 0-40% or better, resolution: 0.5% or better, accuracy: ±6% or less, measuring interval: approx. 60min., LCD 4-digit display	Agr Lab (Soil/Plant)
2.28	Cone Penetrometer	5	unit	Max. 100kg, measuring depth: approx. 100cm, cone bearing capacity: 0-15kg/cm ² (6.45cm ²), 0-30kg/cm ² (3.23cm ²)	Agr Lab (Soil/Plant)
2.29	Pressure Extractor	1	set	Measuring range: approx. 100-1500kPa or more, sample chamber dimension: approx. Φ300 x 100 ~ 200(D)mm, with Pressure Control : 0 ~ Sensor range: approx.0 ~ -30MPa or more, resolution: ±0.05MPa or better, accuracy: ±0.5MPa or better	Agr Lab (Soil/Plant)
2.30	Soil temperature and water potentiometer	5	unit	Measuring range: approx.0 ~ -30MPa or more, resolution: ±0.05MPa or better, accuracy: ±0.5MPa or better	Agr Lab (Soil/Plant)
2.31	Munsell Soil Color Chart	30	unit	Size: B6, loose leaf type, 300 color or more, with vinyl cover English Version	Agr Lab (Soil/Plant)
2.32	Wind speed anemometer	2	unit	3-cup type, measuring range: 1.0-40m/s or more, accuracy: ±0.5m/s at velocity within 10m/s	Agr Lab (Soil/Plant)
2.33	Soil Core Sampler	5	unit	Standard kit, auger: approx. 50φ x 50mm., Sampler capacity ; 100mL, Sampling Depth approx.250mm with core sampler.	Agr Lab (Soil/Plant)
2.34	Soil Sampling auger	5	unit	Auger: 5 types, 50.75mm, Mud and Sand type ; 75mm, Handle with detachable grip: 60cm or more	Agr Lab (Soil/Plant)
2.35	Environmental Monitoring Equipment	1	unit	Measuring range- temperature: -20 ~ +50°C or better, humidity: 0-95%, air pressure: 930-1050hPa or more, wind speed: 2-50m/s, rain gauge.	Agr Lab (Soil/Plant)
6.1	Tractor with PTO & Attachments	1	unit	Engine: 90HP or more, 4WD drive system.	New Model Farm
6.1.1	Trailer	1	unit	Attached by 3-point hitch, applicable tractor HP: 80 or more	New Model Farm
6.1.2	Disc plough	1	unit	Attached by 3-point hitch, applicable tractor HP: 80 or more	New Model Farm
6.1.3	Disc harrow	1	unit	Attached by 3-point hitch, applicable tractor HP: 80 or more	New Model Farm
6.1.4	Mould board plough	1	unit	Attached by 3-point hitch, applicable tractor HP: 80 or more	New Model Farm
6.1.5	Rotary disk mower	1	unit	Attached by 3-point hitch, applicable tractor HP: 80 or more	New Model Farm
6.2	Generator Skva - diesel	1	unit	Engine type: diesel, rated output: approx. 5kVA	New Model Farm
6.3	Portable lawn mower	1	unit	Cutting width: 40cm	New Model Farm
6.4	Water pump - diesel	1	unit	Engine: diesel, pump: 200L/min., with sprinklers, hose	New Model Farm
6.10	Storage refrigerator - standard	1	unit	Capacity: 340L or more, temperature range: 2 ~ -14°C	New Model Farm
6.11	Storage freezer - standard	1	unit	Capacity: 400L or more, temperature range: -2 ~ -35°C	New Model Farm
6.12	Tools kit for maintenance of farm machinery	1	unit	Pliers, drivers, wrenches, etc.	New Model Farm
6.14	Rice milling machine	2	unit	Capacity: max. 3g, screen: 0.5mm, 10mm, frequency: 12000rpm or more	New Model Farm
6.15	Hanging scale	2	unit	Weighing capacity: max. 50kg	New Model Farm
6.16	Weighing scale for animals	2	unit	Portable type, weighing capacity: 200kg, gradation: 200g, platform size: 1300 x 500mm, for middle sized animals	New Model Farm
6.17	Hammer mill	1	unit	Capacity: 5kg/h, screen: 0.5mm, 10mm, frequency: 10000rpm or more	New Model Farm
6.18	Animal Feed mill / grinder	1	unit	Capacity: 5kg/h, screen: 0.5mm, 10mm, frequency: 10000rpm or more	New Model Farm
6.19	Feed pelletter	1	unit	Capacity: 20kg/h or more, pellet size: between Φ3-10mm	New Model Farm
6.20	Feeding bins	10	unit	Capacity: 20L	New Model Farm
6.21	Feeding bucket	10	unit	Capacity: 10L	New Model Farm
6.22	Ear tag applicator	2	unit	Tugs, applicator, marking pen	New Model Farm
6.23	Metal cages	5	unit	Size: 500 x 500 x 1000mm or equivalent	New Model Farm
6.24	Emasculator	2	unit	Length: 170mm, for middle sized animals	New Model Farm
6.25	Tape measure	2	unit	5m, 30m, 100m	New Model Farm
J. Science Section					
1.1	Electronic Balance	2	set	LCD digital type, 3 types of capacity/readability - a) 400-500g/0.01g, b) 200-300g/0.01g, c) 100-120g/0.1mg	Lab (Common)
1.4	pH meter - Bench	4	unit	Digital, measuring rage: 0-14 pH, ± 1999mV, 0-100°C, resolution: 0.01pH, battery operated	Lab (Common)
1.8	Conductivity Meter	1	unit	Measuring: conductivity (0-199.9mS/cm), impedance (0-1999kcm), Concentration ; (0 to 199.9 %), temperature (0-100°C)	Lab (Common)
1.9	Digital Hygro-Thermometer	2	unit	Measuring range: -10 ~ +70°C, 5 ~ 98%RH, accuracy: ±0.1°C, ±0.1%RH	Lab (Common)
1.10	Thermometer, Mercury	10	set	Mercury (white): measuring range: -5 ~ 105°C, mercury (yellow):measuring range: 0 ~ 150°C, both for stirring use	Lab (Common)
1.12	Automatic Pipette	6	set	Pipette size: 1 - 10 µl, 10- 100 µl, 100- 1000 µl, 1mL- 5mL, variable volume, digital display	Lab (Common)
2.1	Spectrophotometers	4	unit	Wavelength range: 340-950nm, measuring range: 0-2Abs, 0-100%T, analog	Lab (Common)
2.2	UV-VIS Spectrophotometer	1	unit	Wavelength range: 190-1100nm, accuracy: ±1.0nm, repeatability: ±0.3nm,	Lab (Common)
3.1	Paper Chromatography	4	unit	Cylinder type (glass: Φ100 x 450mm), with filter paper fixer, sprayer	Lab (Common)
3.2	Thin Layer Chromatography	1	unit	Storage box, gel coating applicator, sprayer, micro pipette (0.05, 0.01mL)	Lab (Common)
3.3	Electrophoresis apparatus	1	set	Gel tank 10 samples, power supply unit: 10-300V, 4-200mA, with timer	Lab (Common)
4.1	Bunsen Burner	25	unit	For natural gas, nozzle dia. 0.6mm or more	Lab (Common)
4.2	Auto Vortex Variable speed mixer	2	unit	Revolution: 350-2500rpm, head dia. 80mm or more	Lab (Common)
4.3	Blender	2	unit	Revolution: 12,000 or 16,000rpm, capacity: approx.1.9L	Lab (Common)
4.4	Homogeniser	2	unit	Revolution: 18,000rpm or better, homogeniser Cup : 5 types	Lab (Common)

Code	Description	Q'ty	Unit	Main Specifications	Location
4.5	Magnetic Stirrer with Hotplate	1	set	a) with hot plate (1 set, temperature: 250°C or more, revolution: approx. 100-1,200, plate size: ϕ 150mm or larger), b) without hot plate (2 sets)	Lab (Common)
4.7	Stirred Water bath	2	unit	Water temperature control: 30-80°C, with safety device, Bath Capacity ; approx. 9 Litter	Lab (Common)
4.8	Centrifuge - Bench Top	2	unit	Max. speed: 5000rpm or more, max. RCF: 4600xg or more, swing rotor: 15mL x 32 pcs or more	Lab (Common)
4.9	Universal refrigerated centrifuge	1	unit	Max. speed: 8000rpm or more, max. RCF: 8500xg or more, Angle rotor: 15mL x 26 pcs, 50mL x 8 pcs or more	Lab (Common)
4.10	Distilled water/ Deionised Water Machine	2	unit	Distilling capacity: 1.5-2.0L/h or more, deionized water capacity: 0.5-1.0L/min., tank (with stand) capacity: 20L	Lab (Common)
4.11	Freeze-Dryer	1	unit	Dehumidifying: approx. 1L, cooling temperature: -45°C	Lab (Common)
4.12	Heating mantles, Fire Resistant	2	set	100mL type x 1 set, 500mL type x 1 set, max. temperature: 400°C or higher	Lab (Common)
4.13	Incubator	2	unit	Temperature range: 10-50°C or better, chamber capacity: 120L or more	Lab (Common)
4.14	Laboratory Furnace	1	unit	Temperature range: 100-1150°C or better, chamber capacity: 5L or more, temperature control: PID	Lab (Common)
4.15	Oven	1	unit	Max. temperature: 260°C or more, chamber capacity: 90L or more, with Timer	Lab (Common)
4.16	Refrigerator	2	unit	Capacity: 340L or more, temperature range: 2 ~ -14°C	Lab (Common)
4.17	Deep Freezer	1	unit	Capacity: 420litters or more, temperature range: -2 ~ -35°C	Lab (Common)
4.18	Microtome	1	unit	Rotary type, sectioning range: 1-30 μ m or more, with disposable blades (500 Paraffin tank, warmer tank, hot plate (60-75°C), forceps warmer (80°C) with standard accessories, paraffin 10kg	Lab (Common)
4.19	Microtome Equipment	1	unit	Paraffin tank, warmer tank, hot plate (60-75°C), forceps warmer (80°C) with standard accessories, paraffin 10kg	Lab (Common)
5.1	Disposable Dust Mask	300	pc	Three dimensional molding type	Lab (Common)
5.2	Face shield	20	pc	Shield: acrylic, size: approx. 200 x 200mm	Lab (Common)
5.3	Safety Spectacles	60	pc	Frame: cellulose acetate plastic, lens: resin	Lab (Common)
5.4	Lab. Coat	60	pc	Color: white, material: polyester/cotton	Lab (Common)
5.5	Gloves, Disposable	300	pair	Material: nitrile rubber or equivalent, size: M/L	Lab (Common)
5.6	Gloves, Leather	20	pair	Material: leather, size: M/L	Lab (Common)
5.7	Gloves, Rubber	20	pair	Material: rubber or chemical rubber, size: M/L	Lab (Common)
5.8	Laboratory First-Aid Chart for teaching purpose	3	pc	Paper chart (laminated) for first-aid in the Laboratory English version	Lab (Common)
6.1	Flame Spectrometry	1	unit	Natural gas type, measuring range: Na, K, Li (2 ~ 200ppm), Ca (10 ~ 200ppm), wavelength: Na 580, K 766, Li 470, Ca 622 \pm 3nm, with printer	Chem/Agr Lab
6.2	Gas Chromatography	1	unit	Dual Column, Dual Flow type, temperature range: ambient ~ 400°C or more, detector: TCD, with accessories	Chem/Agr Lab
7.1	Dissecting Instrument Set	1	set	a) dissecting set-60, b) dissecting table-60, c) dissecting knife-60, d) dissecting scissors-10, e) surgical scissors-10, f) stalization operation knife-10, g) forceps-10, h) suture needle set-10	Biology/Agr Lab
8.1	Microscope	25	unit	Binocular type, magnification: 40x ~ 1000x, with illumination	Biology/Agr Lab
8.2	Dissecting microscope	7	unit	Binocular type, magnification: 20x, 40x, with illumination	Biology/Agr Lab
8.3	Hand lense	50	pc	Magnification: 10x or more, metal frame	Biology/Agr Lab
8.5	Microscope, phase contrast with TV system	1	set	Magnification: 40x ~ 1000x, illumination: halogen lamp, digital CCD camera attachment, color video monitor	Biology/Agr Lab
8.6	Dry Cabinet for Microscopes	2	unit	Capacity: for 20 ~ 25 sets of Microscope, humidity control: 50% RH or less,	Biology/Agr Lab
9.1	Autoclave	1	unit	Capacity: approx. 50L, max. pressure: 2.4kgf/cm ² , sterilization temperature: 105 ~ 135°C, floor type (vertical)	Biology Lab
9.3	UV Fluorescent tube for Room Sterilization	1	set	Tube: 2 x 15W, wavelength: 254nm	Biology Lab
9.4	UV lamp	1	unit	Tube: 1 x 15W, wavelength: 254nm	Biology Lab
9.5	Ultrasonic Disintegrator	1	unit	Output: 50W or more, frequency: 20KHz or more, with probe, timer	Biology Lab
9.6	Laminar Flow Workstation	1	unit	Type: class 100, main filter: HEPA, collecting efficiency: 99.99% at 0.3 μ m, with illumination, table top type	Biology Lab
10.1	Educational media set	1	set	a) Educational slides (botany, ecology, zoology), b) video films (animal behavior, botany, ecology, environmental science, evolution), c) microscope slides set (botany, plant collection, plant cryology, histochemistry, cell division, genetics, histology, etc.), d) poster (kingdoms of life, plant/animal cell, electrophoresis techniques), e) chart set (cell structure & cell division, botany & zoology, periodic table & atomic data, human system)	Biology/Agr Lab
11.1	Teaching model set (Biology)	1	set	a) DNA molecular models, b) organic structure models, c) protein synthesis, d) plant & animal cells, system, organs	Biology Lab
12.1	Teaching model set (Chemistry)	1	set	Molecular models of a) sodium chloride, b) diamond, c) graphite, d) scale atoms kit	Chemistry Lab
K: Equipment for Other Lecture Theaters & Classrooms					
1.1	TV Monitor	1	unit	29", multi color system	New Lecture Room (Old Library)
1.2	VHS Video player	1	unit	Format: VHS standard (multi system)	New Lecture Room (Old Library)
1.3	CD/DVD Player	1	unit	Playable formats: DVD/VCDD/CD, color system PAL/NTSC, horizontal resolution: 500 lines	New Lecture Room (Old Library)
1.4	Steel Cabinet for the above TV, VTR, CD/DVD player	1	unit	600x600x1280mm	New Lecture Room (Old Library)
1.5	OHP	1	unit	Projection lamp: halogen, 300W, projection lens: f=300-338mm variable	New Lecture Room (Old Library)
1.6	Projector Screen	1	unit	Image size: approx. 2000(W) x 1500(H)mm, with tripod	New Lecture Room (Old Library)
1.7	Extension power reel	1	unit	Length: 10m	New Lecture Room (Old Library)
1.8	Multimedia Projector	1	unit	3LCD panel, 2400ANSI lumen or more, multi system compatible, resolution: 500 TV lines (video), RGB : 1024 x 768 dots or better, with carrying bag	New Lecture Room (Old Library)
1.9	Computer	1	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), FDD, CD/DVD-ROM drive, WINDOWS XP, keyboard, mouse, 15" monitor	New Lecture Room (Old Library)
2.6	Pin Spotlight, Follow	3	set	Lens: Plano-Convex lens D=177, D=152, lamp: 1000W, with color changer,	Old Lecture Theater
2.7	Stage Spotlight, Plano-convex	6	unit	Lens: 8" spherical Plano-Convex lens, lamp: 1000W, with filter, stand	Old Lecture Theater
2.8	Stage Spotlight, Fresnel	10	unit	Lens: 8" fresnel lens, lamp: 1000W, with filter, stand	Old Lecture Theater
2.9	Cable Terminal Box	1	set	Dimmer capacity: 240V, 15A/20A x 24 circuits, plug-in type dimmer block, with lighting control board	Old Lecture Theater
2.10	Lighting Control Board	1	unit	Channel: 24, chase memory: 11 patterns, 24 steps	Old Lecture Theater
2.12	Audio System	1	set	Mixer, equalizer, speakers, tape recorder, CD player	Old Lecture Theater
3.1	TV System	4	set	29" multi color system TV monitor, VHS video player, steel cabinet with 3	Classrooms (EF, HE, MC, SSC)
4.2	TV Monitor	1	unit	29", multi color system	Life Skills Center
4.3	VHS Video player	1	unit	Format: VHS standard (multi system)	Life Skills Center
L: Equipment for Design & Technology Section					
1.1	Metal Lathe	2	unit	Swing over bed: 300mm or more, spindle bore: 54mm or more, spindle speed: 200-1500/200-1200 or better	Metal Workshop
1.2	Power Hacksaw	4	unit	Max. cutting range: round Φ 210mm or more, square 190 x 190mm or more, blade length: 350mm or more, stroke: 108mm or more	Metal Workshop
1.3	Welder	2	unit	CO ₂ welding, rated current: 40-500A or more	Metal Workshop

Code	Description	Qty	Unit	Main Specifications	Location
1.4	Spot Welder	1	unit	Rated current: 5000A or more, rated power: 2.4kVA or more	Metal Workshop
1.5	Compressor	1	unit	Receiving tank capacity: 30L or more, operating pressure: 0.54 - 0.69MPa or more	Metal Workshop
1.6	Tube Bender	1	unit	Capacity: 3/4"-2", angle: 0-90°, manual hydraulic pump, with shoe	Metal Workshop
1.7	Industrial Vacuum Cleaner	1	unit	Collecting capacity: 45L or more, vacuum capacity: 17kPa or more	Metal Workshop
2.1	Woodworking Lathe	2	unit	Swing over bed: 460mm or more, distance between centers: 1150mm or more	Wood Workshop
2.2	Dust Extractor	3	unit	Air flow: 1900CFM, blower wheel: approx.350mm or more	Wood Workshop
M: Equipment for Home Economics Section					
1.1	Electric Sewing Machine	10	unit	Stitch: 15 stitches or more, buttonhole, drop feed, free arm	Clothing Lab
2.1	Refrigerator	1	unit	Capacity: 320L or more, temperature range: 3 - 7°C	Food Lab
2.2	Freezer	1	unit	Capacity: 300L or more, temperature range: -30°C, upright type	Food Lab
2.3	Household Electric Stove	4	unit	Number of stove: 4, with electric oven	Food Lab
2.5	Educational Video programs	1	set	Food related disease/microorganism, food contamination/spoilage, food	Food Lab
2.6	Computer	1	unit	P4, 2GHz, cache 256KB, memory 128MB, HDD 40GB (IDE), CD/DVD-ROM drive, WINDOWS XP, keyboard, mouse, 15" monitor	Teachers Room (Common)
2.7	UPS	1	unit	Output: 300W or more, 500VA, back-up time: 15 min., with AVR function, surge filter, power on-off signal	Teachers Room (Common)
2.8	Steam Presser	1	unit	Electric iron, vacuum table (size: 1000 x 600mm), steam boiler	Clothing Lab
N: Equipment for Technical/Vocational Section					
1.1.1	Vernier Caliper	2	pc	Measuring range: 150mm, min. gradation: 0.05mm	Lathe & Milling Workshop
1.1.2	Micro Meter	2	pc	Measuring range: 0-25mm/25-50mm/50-75mm/75-100mm, min. gradation:	Lathe & Milling Workshop
1.2	Surface Gauge	2	unit	Size: 200mm, gradation: 0.1mm	Lathe & Milling Workshop
1.3	Vernier Height Gauge	2	unit	Measuring range: 300mm	Lathe & Milling Workshop
1.4	Dial Indicator gauge	2	pc	Measuring range: 0.01-10mm	Lathe & Milling Workshop
1.5	Marking out table	2	pc	Size: 350 x 400mm, with tool box	Lathe & Milling Workshop
2.1	Blow lamp, medium	3	unit	Gasoline type, capacity: 1L or more	Plumbing Workshop
2.2	Pipe cutter, 3"	3	set	Cutting pipe size: 40mm or more	Plumbing Workshop
2.3	Tube bender	2	set	Capacity: 3/4"-2", angle: 0-90°, manual hydraulic pump, with shoe	Plumbing Workshop
2.4	Tinsnips (straight)	4	pc	Length: 240mm	Plumbing Workshop
2.5	Rivet gun	3	pc	Battery operated, rivet size: Φ2.4, 3.2 4.0, 4.8mm, with rivets	Plumbing Workshop
2.6	Silicon gun	3	pc	Manually operated, effective length: 300mm or more	Plumbing Workshop
2.7	Tinsnips (right hand)	4	pc	Blade: bore shape, approx.210mm	Plumbing Workshop
2.9	Stilson	3	pc	Length: 250mm or more	Plumbing Workshop
2.10	Gulltone, Manual	2	unit	Cutting length: 1-1000mm or more	Plumbing Workshop
2.11	Bender, Galvanize bender	2	unit	Bending capacity: 0.8mm or more, bending length: 1000mm	Plumbing Workshop
2.12	Scriber (metal)	3	pc	Length: 190mm or more	Plumbing Workshop
2.13	Hacksaw	3	pc	Made of pipe, length: 300mm or more	Plumbing Workshop
2.14	Claw Hammer	8	pc	Length: approx. 260mm	Plumbing Workshop
2.15	Plunger 4"	5	pc	4", 100mm or more	Plumbing Workshop
2.16	Flaring tool	2	set	Pipe dia.: 4, 6, 8, 10, 12, 14, 16mm, with tool box	Plumbing Workshop
2.17	Extractor	2	set	Fan dia. 285mm, air volume: 52m ³ /60min.	Plumbing Workshop
3.1	Combination Square (adjustable)	4	pc	Length: 400mm or more	Carpentry Workshop
3.2	Tape Measure set	4	set	Measuring length: 2m, 3.5m, 5.5m	Carpentry Workshop
3.3	Claw hammer set	4	pc	Length: approx. 380mm	Carpentry Workshop
3.4	Chisels set	4	set	Size: 3, 6, 9, 12, 15, 18, 24, 30, 36, 42mm	Carpentry Workshop
3.5	Screw Driver set	4	set	8 size each of plus and minus driver	Carpentry Workshop
3.6.1	Handsaw, 26 inches- Saw set	4	set	Short cut saw, cross cut handsaw, back/mitre saw, coping saw, high tension	Carpentry Workshop
3.7.1	Hand Plane, Medium- Smoothing plane	2	set	Smooth plane, block plane, smooth bottom jack plane	Carpentry Workshop
3.8	Ratchet screw driver	3	pc	Length: approx. 300mm	Carpentry Workshop
3.9	Screw driver bit set	2	set	A set of 13 pcs. or more	Carpentry Workshop
3.10	Hand Brake Drill	4	pc	Chuck size: approx. 6.5mm, with bearings	Carpentry Workshop
3.11	Spiral Brace	4	pc	Rotating dia. 250mm, with click handle	Carpentry Workshop
3.12	Power Drill (Portable)	3	unit	Capacity: 10mm (metal), 15mm (wood), revolution: 1400rpm	Carpentry Workshop
3.13	Battery Operated Drill (Portable)	1	unit	Battery operated, max. torque: 230kgf·cm or more, chuck: Φ13mm or more	Carpentry Workshop
3.14	Disc Grinder (Portable)	2	unit	Disk size: Φ100mm or more, revolution: 12000rpm	Carpentry Workshop
3.15	Electric Jig saw (Portable)	1	unit	Capacity: 65mm (wood), 6mm (soft steel) or more, stroke: 2700-3200/min. or	Carpentry Workshop
3.16.1	Electric Sander - Vibrating Type	1	unit	Paper size: 90 x 220mm or more, revolution: 10000rpm	Carpentry Workshop
3.16.2	Electric Sander - Belt Sander Type	1	unit	Belt size: 75 x 530mm or more, speed: 360m/min. or more	Carpentry Workshop
3.17	Electric Portable Router	1	unit	Chuck dia. 8mm, revolution: 27000rpm or more	Carpentry Workshop
3.18	Sliding Bevel	4	pc	Dia. 210mm, rod length: 500mm	Carpentry Workshop
3.19	Marking knife	4	pc	Blade length: 18mm or more, with case	Carpentry Workshop
3.20	Nail pincher	4	pc	Length: approx. 165mm	Carpentry Workshop
3.21	Extension drill bit set	4	set	15-6.5mm x 0.5, 3.2mm, 4.8mm	Carpentry Workshop
3.22	Triangular file	4	set	Length: 200mm or more, mesh: fine -coarse (4 sets), with handle	Carpentry Workshop
3.23	Saw set	4	pc	Blade length: 300mm or more	Carpentry Workshop
3.24	Sledge hammer	2	pc	Weight: 450g or more	Carpentry Workshop
3.25	Dumpy level set	1	pc	Material: aluminum, length: 450mm or more	Carpentry Workshop
3.26	Wrench Spanner, 200mm long	2	pc	Length: approx. 200mm	Carpentry Workshop
3.27	Wrench Spanner, 150mm long	1	pc	Length: approx. 150mm	Carpentry Workshop
3.28	Open end spanner set	1	set	A set of 6 sizes	Carpentry Workshop
3.29	Ring spanner set	2	set	A set of 6 sizes	Carpentry Workshop
3.30	Folding ruler	2	pc	Length: 1m, six-fold type	Carpentry Workshop
3.31	Fix square/try square	2	pc	Brass made, length: 200mm or more	Carpentry Workshop
4.1	Welder	1	set	Output: 50-150A, welding rod: 2.0-4.0Φ	Metal Fab/Welding Workshop
4.2	Easy/Portable welder	1	set	Output: 40-110A, welding rod: 1.4-3.2Φ	Metal Fab/Welding Workshop
4.3	Power Hacksaw Machine	1	set	Max. cutting dia. 200mm or more, stroke: 120-90mm or more	Metal Fab/Welding Workshop
4.4	Metal Cutter	1	set	Blade dia. 185mm or more, max. cutting depth: 65mm (90°)-43mm (45°) or more, revolution: 4700rpm or more	Metal Fab/Welding Workshop
4.5	Pipe Bender	1	set	Capacity: 3/4"-2", angle: 0-90°, manual hydraulic pump, with shoe	Metal Fab/Welding Workshop
4.6	Electrode hot warmer	1	set	Bench type, max. temperature: 250°C or more	Metal Fab/Welding Workshop
4.9	Steel rule	5	set	Measuring range: 150mm, 600mm, 1000mm	Metal Fab/Welding Workshop
5.1.1	Multi Tester - Digital	2	pc	Display: digital, measuring: DCV/ACV/DCA/Ω/CONT	Automotive (Elec) Workshop
5.1.2	Multi Tester - Analog	2	pc	Display: analog, measuring: DCV/ACV/DCA/Ω	Automotive (Elec) Workshop
5.2.1	Battery Charger - Booster	1	unit	For rapid charging, DC output: 6-12V, 30A or more	Automotive (Elec) Workshop
5.2.2	Battery Charger - Trickle	1	unit	For normal charging, DC output: 6-12V, 30A or more	Automotive (Elec) Workshop
5.3	Ammeter	1	pc	Measuring range: DCA/50mA-500mA-5A, ACA/100mA-1A-10A, analog type	Automotive (Elec) Workshop
5.4	Voltmeter	1	pc	Measuring range: DCV/3V-15V-300V, ACV/15V-150V	Automotive (Elec) Workshop
5.5	Capacitance Meter	1	pc	Applicable battery: 12V, 18-200AH, voltage: 0-16V	Automotive (Elec) Workshop
5.6.1	Soldering iron - Small/Medium	1	set	a) output:30W, top dia. approx. 4mm, b) output: 60W, top dia. approx.6mm	Automotive (Elec) Workshop
5.6.2	Soldering iron - Large	1	unit	Output: 100W, top dia. approx.8mm	Automotive (Elec) Workshop
5.7	Hydrometer	1	set	a) for heavy liquid- temperature: 0-70°C, b) for light liquid- temperature: 10-	Automotive (Elec) Workshop

Code	Description	Q'ty	Unit	Main Specifications	Location
5.8	Luxmeter	2	pc	Measuring range: 200-200000LUX, with sensor	Automotive (Elec) Workshop
5.9	Lug Crimpier	1	pc	Length: approx. 200mm, with screw cutter	Automotive (Elec) Workshop
5.10	Wire cutter	1	pc	Length: approx. 150mm	Automotive (Elec) Workshop
5.11	Electrical Tool	2	set	Standard tool set for electrician	Automotive (Elec) Workshop
5.12	OHM Meter	2	pc	Measuring range: 20-200M Ω , resolution: 1m/20 Ω	Automotive (Elec) Workshop
5.13	Test Bench	1	unit	Size: approx. 1200(W) x 800(D) x 700(H)mm, equipped with a vice, 4	Automotive (Elec) Workshop
6.1	Screw Driver set	1	set	Standard set of screw drivers (minus/plus), with tool box	Motor Mechanic Workshop
6.2	Diagonal/side cutter plier	1	pc	Length: 150mm or more	Motor Mechanic Workshop
6.3	Combination Plier	1	pc	Length: 150mm or more	Motor Mechanic Workshop
6.4	Long Nose/pointer	1	pc	Length: 125mm or more	Motor Mechanic Workshop
6.5	Circclip plier (internal)	1	set	Standard set of convertible circclip pliers	Motor Mechanic Workshop
6.6	Circclip Plier (external)	1	set	Standard set of convertible circclip pliers	Motor Mechanic Workshop
6.7	Vice Gripping plier	1	pc	Length: 180mm or more	Motor Mechanic Workshop
6.8	Torque Wrench - 1/2 inch Drive	1	pc	Range: 300-1800kgf-cm, square drive: 12.7mm	Motor Mechanic Workshop
6.9	Torque Wrench - 3/4 inch Drive	1	pc	Range: 1000-5600kgf-cm, square drive: 19.05mm	Motor Mechanic Workshop
6.10	Adjustable Wrench	1	pc	Length: approx. 300mm	Motor Mechanic Workshop
6.11	File (Meta)	1	set	A set of plane-pilfsaw-round-square-triangle, length: 200mm or more, with	Motor Mechanic Workshop
6.12	Chain Block	1	unit	Max. load: 2 tons or more, standard lift: 3m or more, with chains	Motor Mechanic Workshop
6.13.1	Combination Spanners	1	set	Size: 5.5/7/8/10/12mm or more	Motor Mechanic Workshop
6.16	Multi-meter	2	pc	Display: digital, measuring: DCV/ACV/DCA/VACA/V Ω /CONT	Motor Mechanic Workshop
6.17	Air Pressure Gauge (reading)	1	pc	Type: bar, capacity: 15kgf/cm ² or more	Motor Mechanic Workshop
6.18	Floor Jack	1	unit	Capacity: 2 tons or more, minimum height: 130mm or less	Motor Mechanic Workshop
6.19	Safety stand	4	unit	Capacity: 7.5 tons or more, max. height 630mm or more, ratchet type	Motor Mechanic Workshop
P	P. Other				Common Facility
1	Standby Generator	1	unit	Rated output: 125kVA, 50Hz, 3-phase 4-wire, engine: 7L, fuel:diesel	Generator Shed

* Specifications are for reference only.

2-2-3 Basic Design Drawings

The project site is the campus of the University of Goroka. The layout plan of the campus is shown as Fig. 2-1. The locations for the planned equipment are shown in Figs. 2-2 through 2-11 on the following pages.

- ① Main Quadrangle
- ② Science, Agriculture, Health
- ③ Old Library
- ④ Old Theater
- ⑤ New Library
- ⑥ New Multipurpose Theater
- ⑦ Music House
- ⑧ Home Economics
- ⑨ Technical & Vocational Education
- ⑩ Design & Technology
- ⑪ New Printery Section
- ⑫ New Model Farm

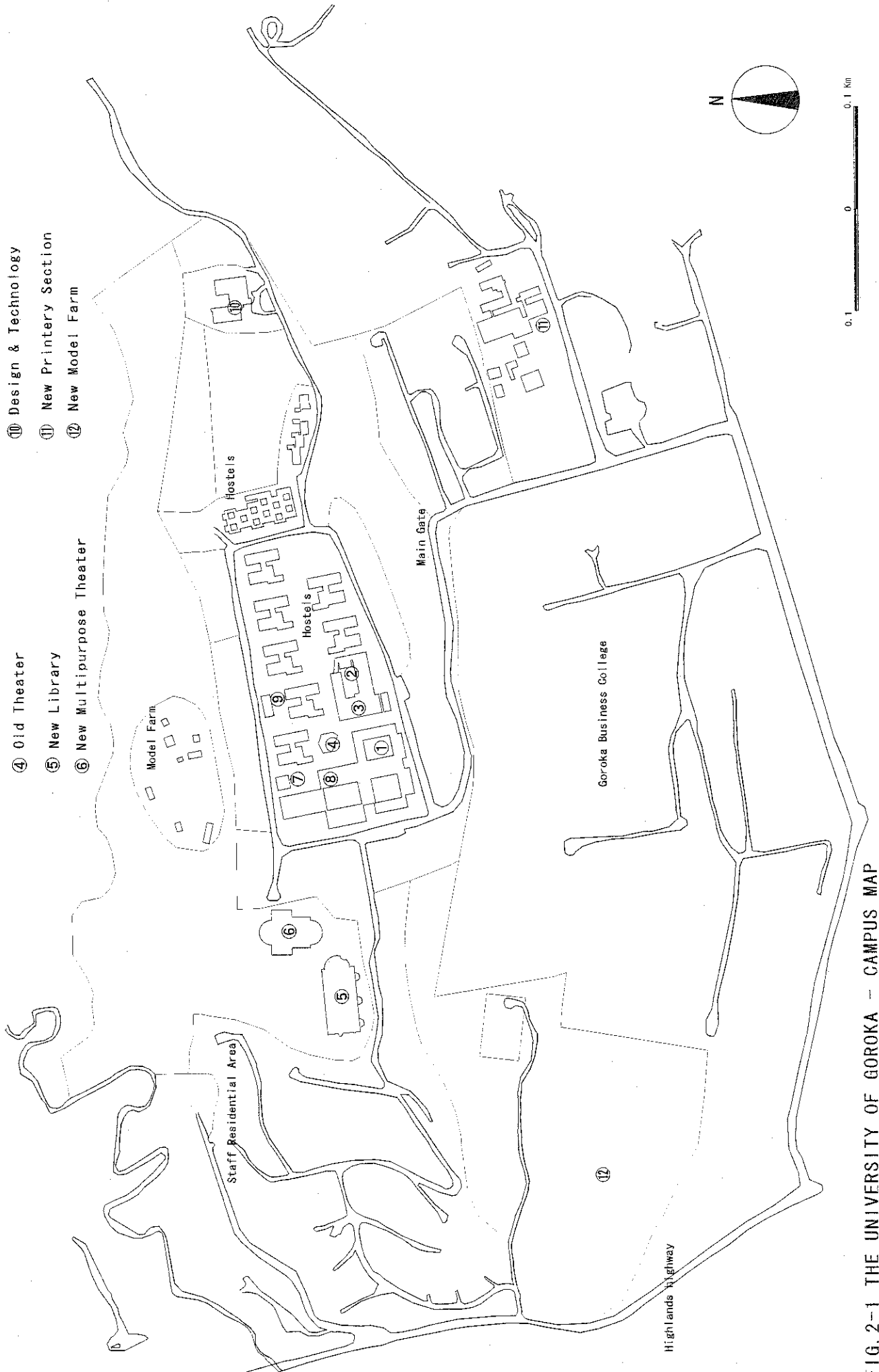


FIG. 2-1 THE UNIVERSITY OF GOROKA - CAMPUS MAP

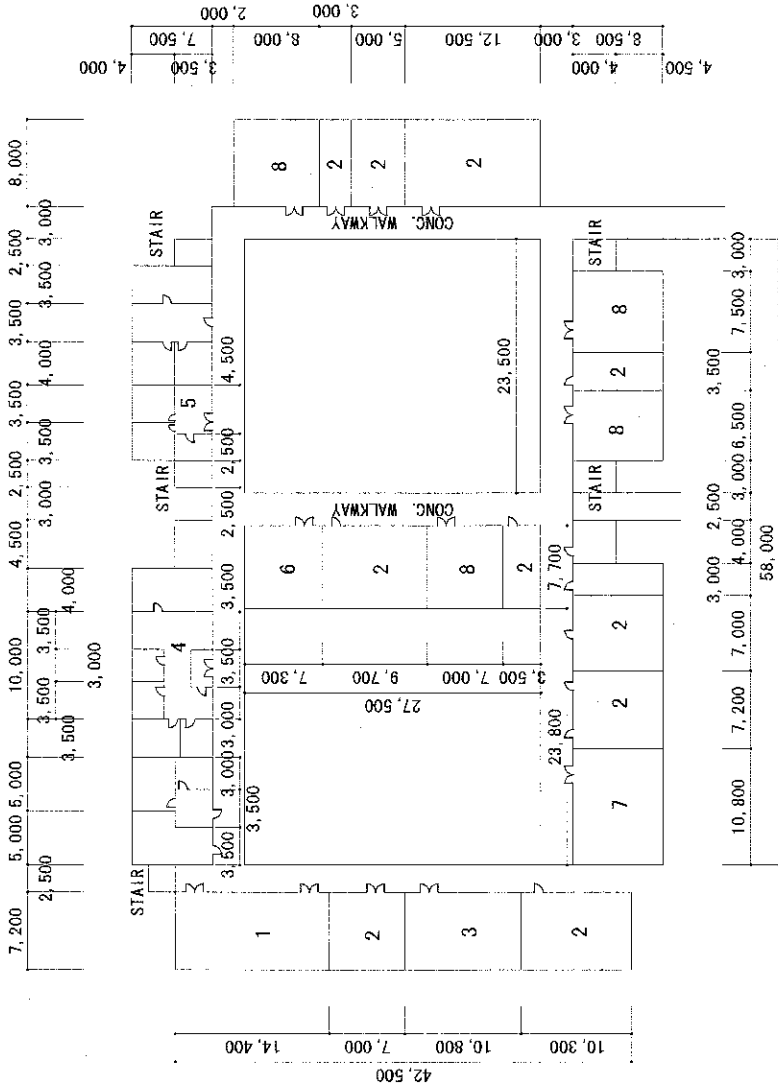
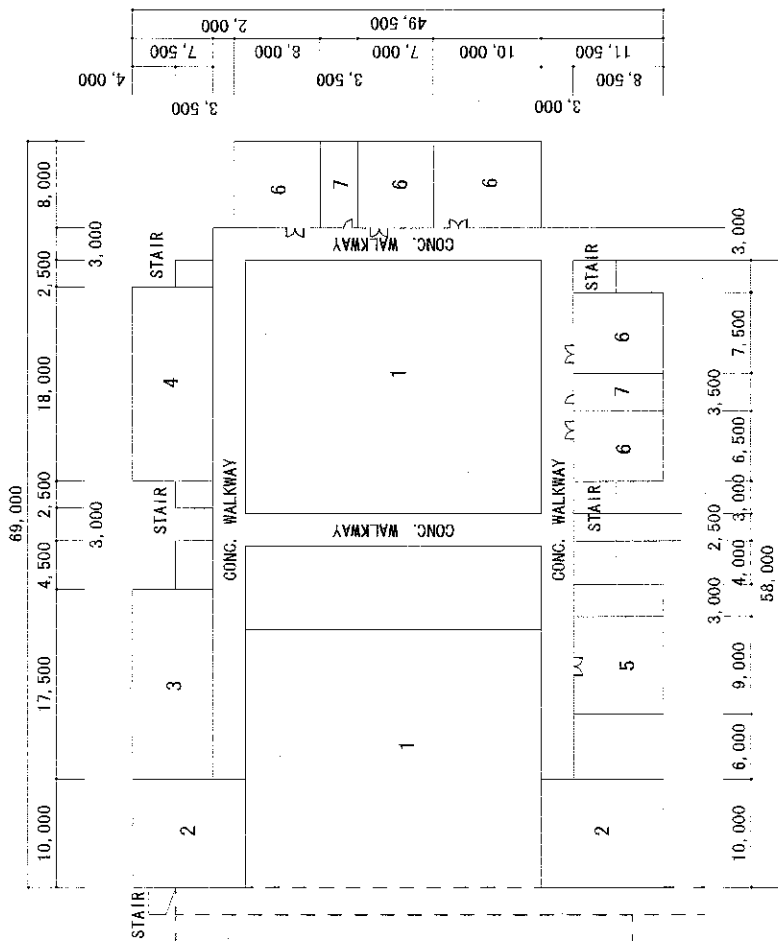


FIG. 2-2 MAIN QUADRANGLE





- 1 OFFICE
- 2 FEMALE COMP. LAB. (EXISTING)
- 3 CLASSROOM
- 4 HEALTH BUILDING
- 5 GEOLOGY LAB.
- 6 STORE
- 7 PHYSICS LAB

- 1 LECTURE ROOM (NEW)
- 2 AV STORE (NEW)
- 3 AGRICULTURE LAB. (NEW)
- 4 SCIENCE LAB.
- 5 OFFICE
- 6 CLASSROOM
- 7 SCIENCE LAB. (INSTRUMENTATION)
- 8 HEALTH BUILDING
- 9 BIOLOGY LAB.
- 10 CHEMISTRY LAB-1
- 11 CHEMISTRY LAB-2
- 12 BIOLOGY STORE
- 13 CHEMICAL STORE
- 14 GLASSWARE STORAGE



FIG. 2-3 SCIENCE, AGRICULTURE, HEALTH & OLD LIBRARY

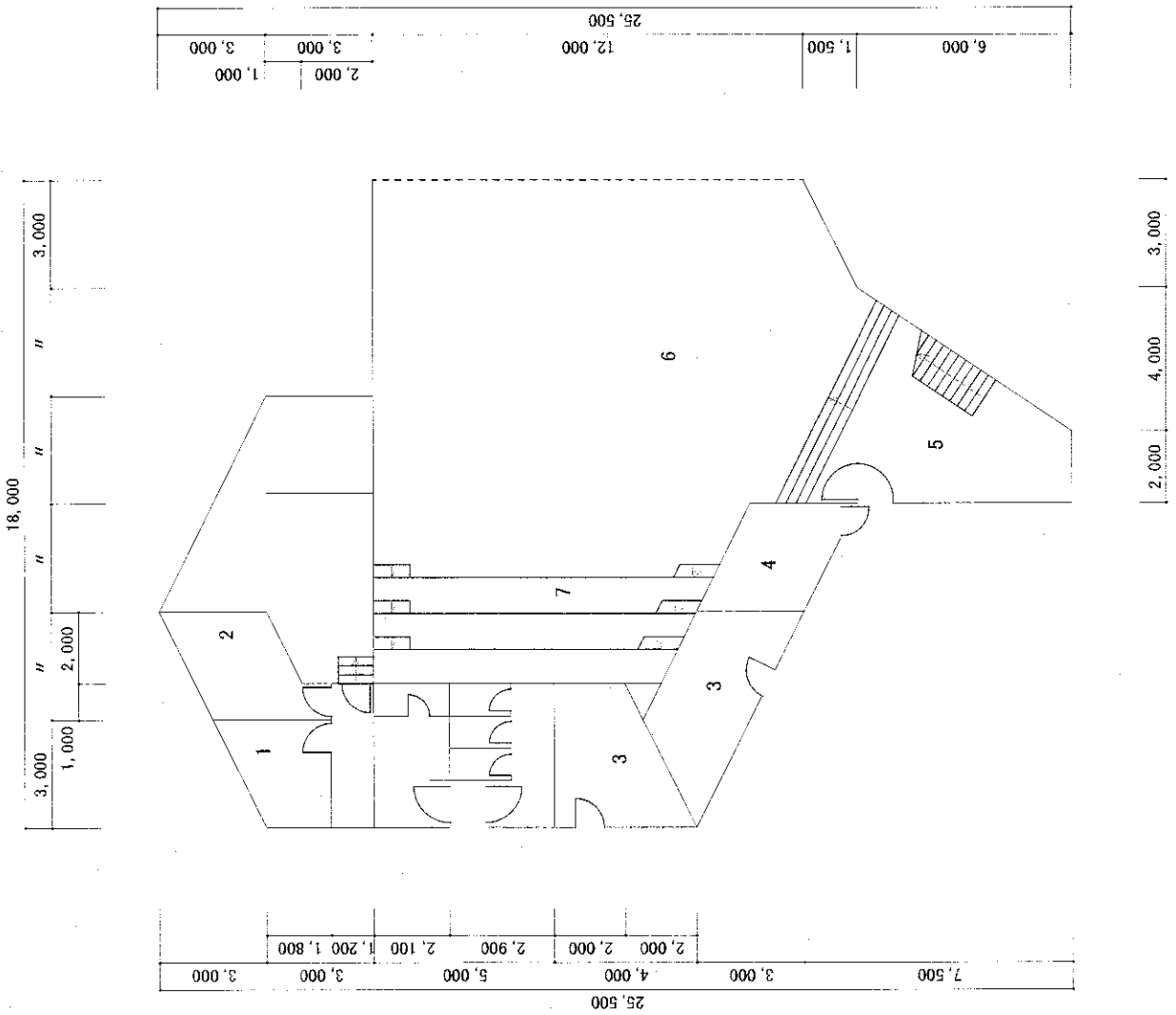
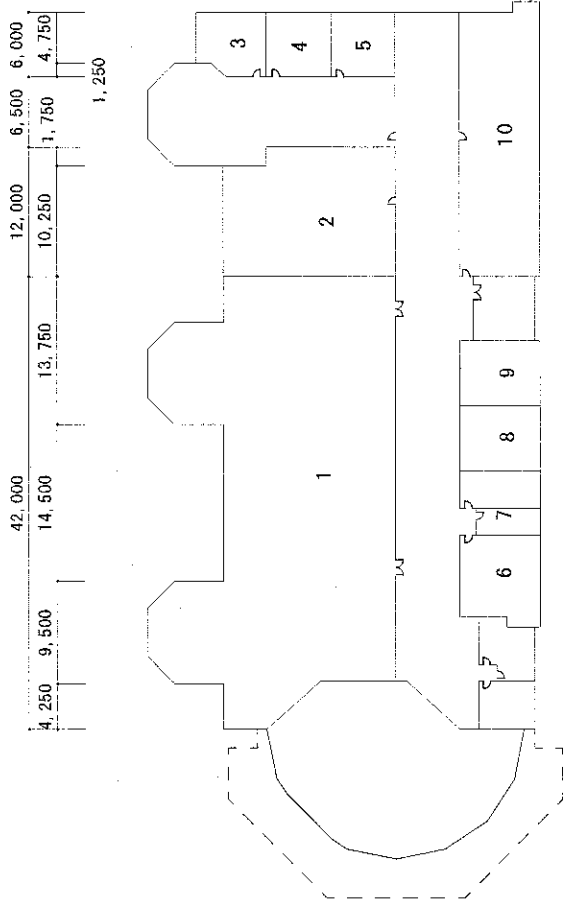
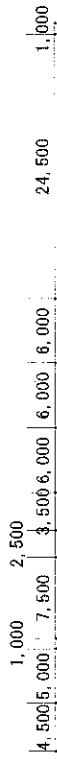


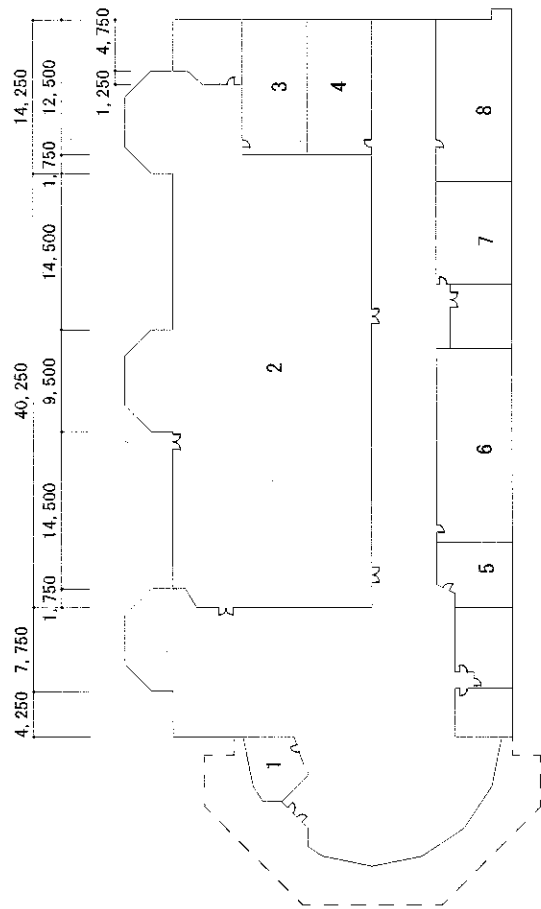
FIG. 2-4 LECTURE THEATER (OLD)



FIRST FLOOR PLAN



- 1 MAIN LIBRARY HALL
- 2 COMPUTER LAB.
- 3 CONFERENCE ROOM
- 4 PVC (ADMINISTRATION)
- 5 PVC (ACADEMIC)
- 6 STAFF ROOM
- 7 OFFICE
- 8 LIBRIAN
- 9 ASSISTANT LIBRIAN
- 10 UNIGOR OFFICE



GROUND FLOOR PLAN



- 1 CLOAK ROOM
- 2 MAIN LIBRARY HALL
- 3 SPECIAL COLLECTION
- 4 AV ROOM
- 5 IT ROOM
- 6 CAT&ACCESSION
- 7 COUNCIL SEC.
- 8 PLANNING

FIG. 2-5 NEW LIBRARY

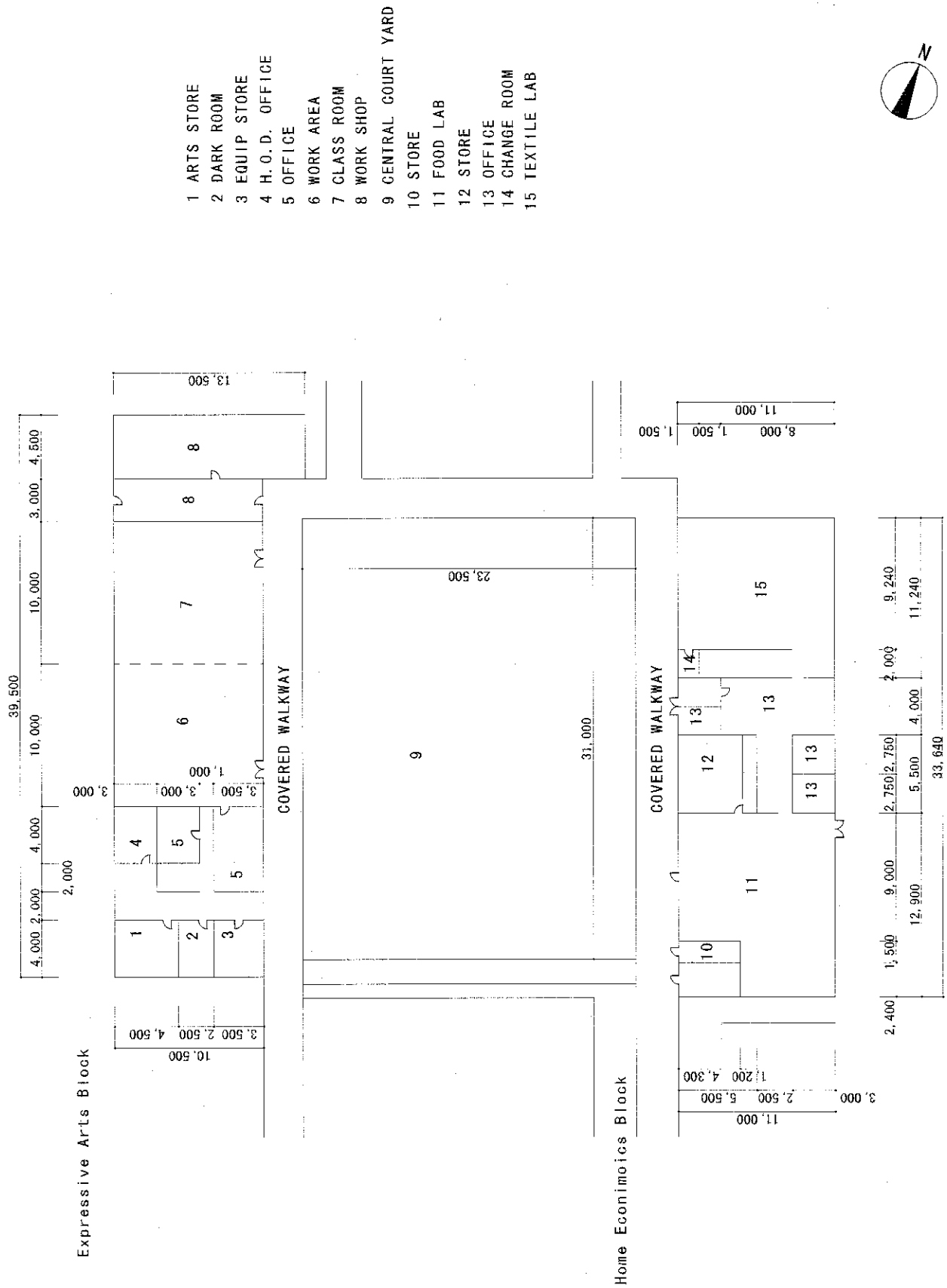
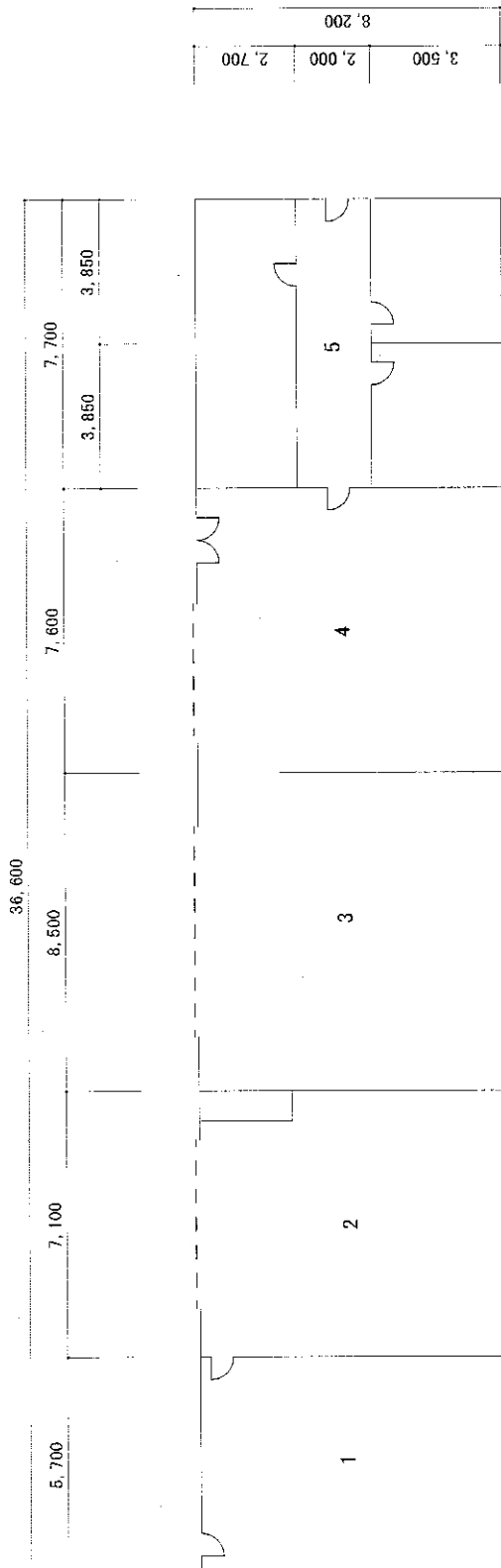


FIG. 2-6 EXPRESSIVE ARTS & HOME ECONOMICS



- 1 COMPUTER ROOM
- 2 MECHANICAL WORKSHOP
- 3 WELDING SHOP
- 4 CARPENTRY SHOP
- 5 OFFICE

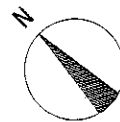


FIG. 2-7 TVE WORKSHOP

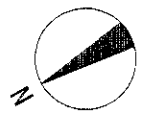
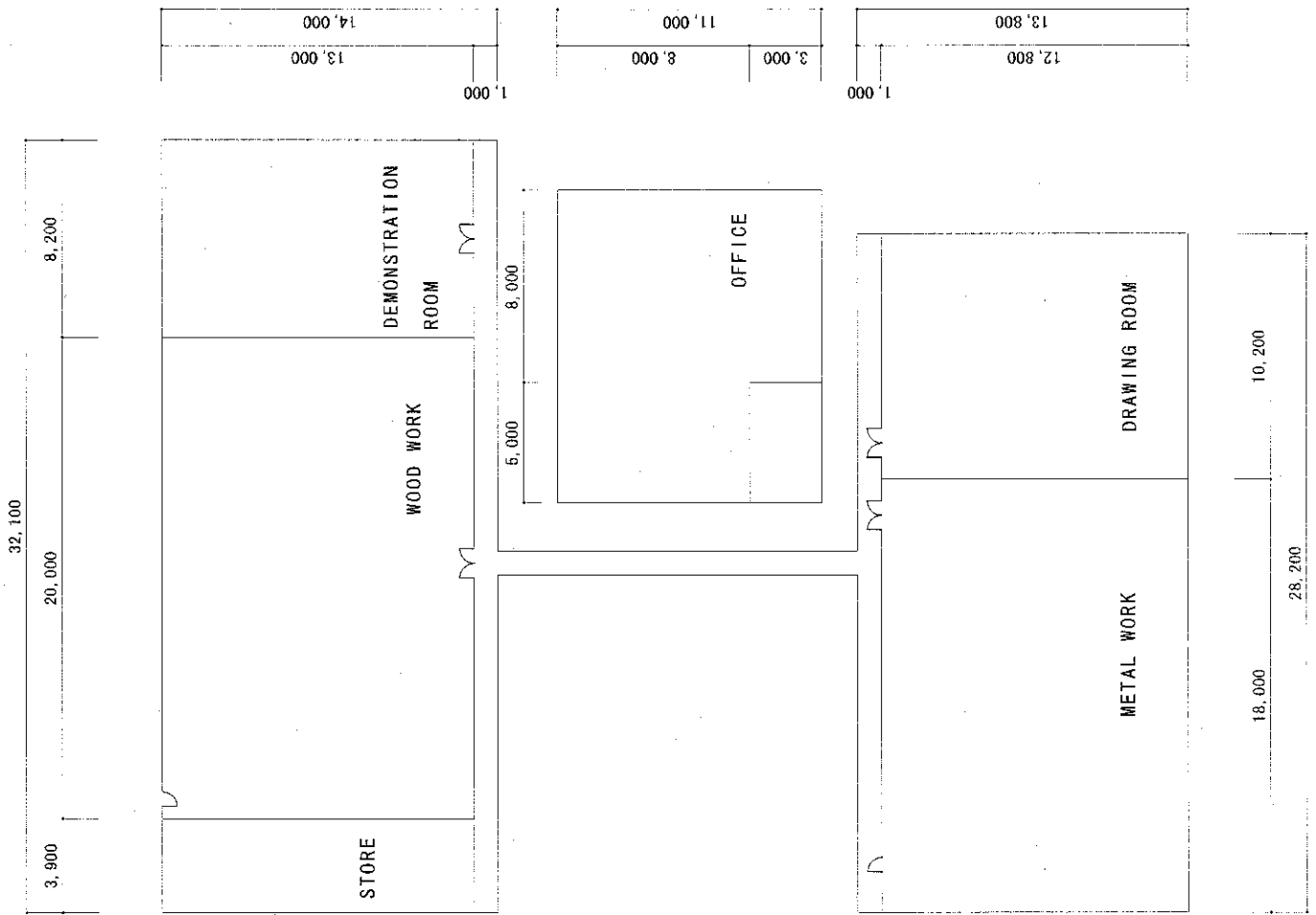
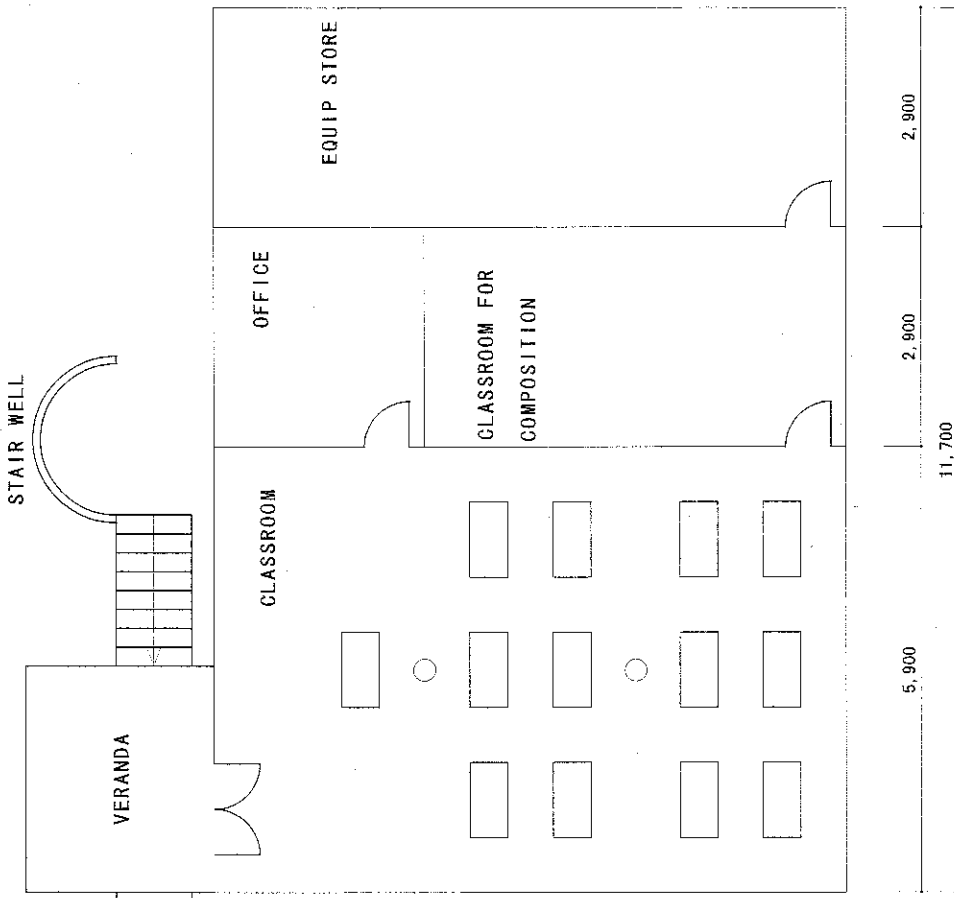
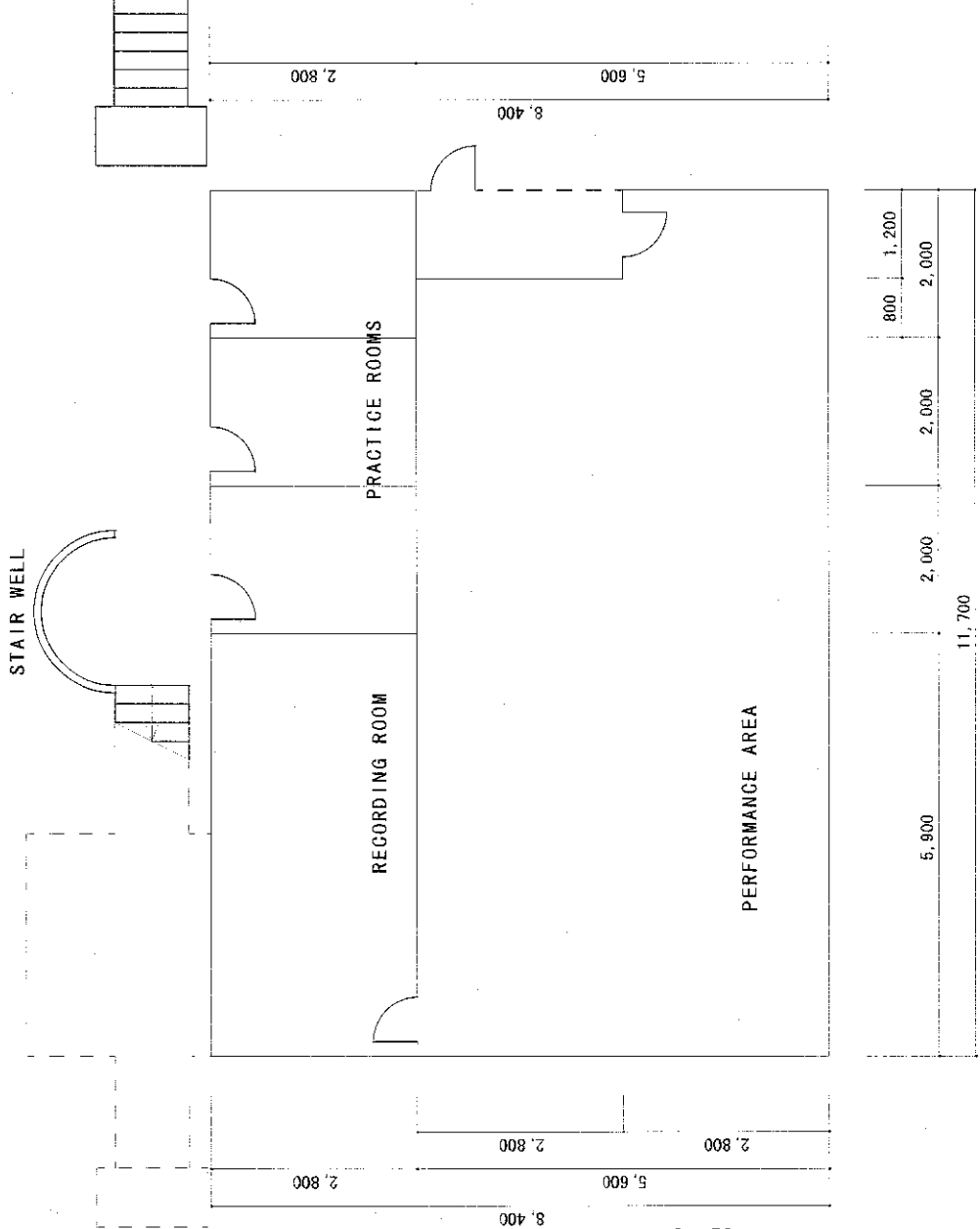


FIG. 2-8 DESIGN & TECHNOLOGY WORKSHOPS



FIRST FLOOR



GROUND FLOOR

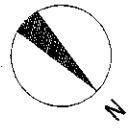


FIG. 2-9 MUSIC HOUSE

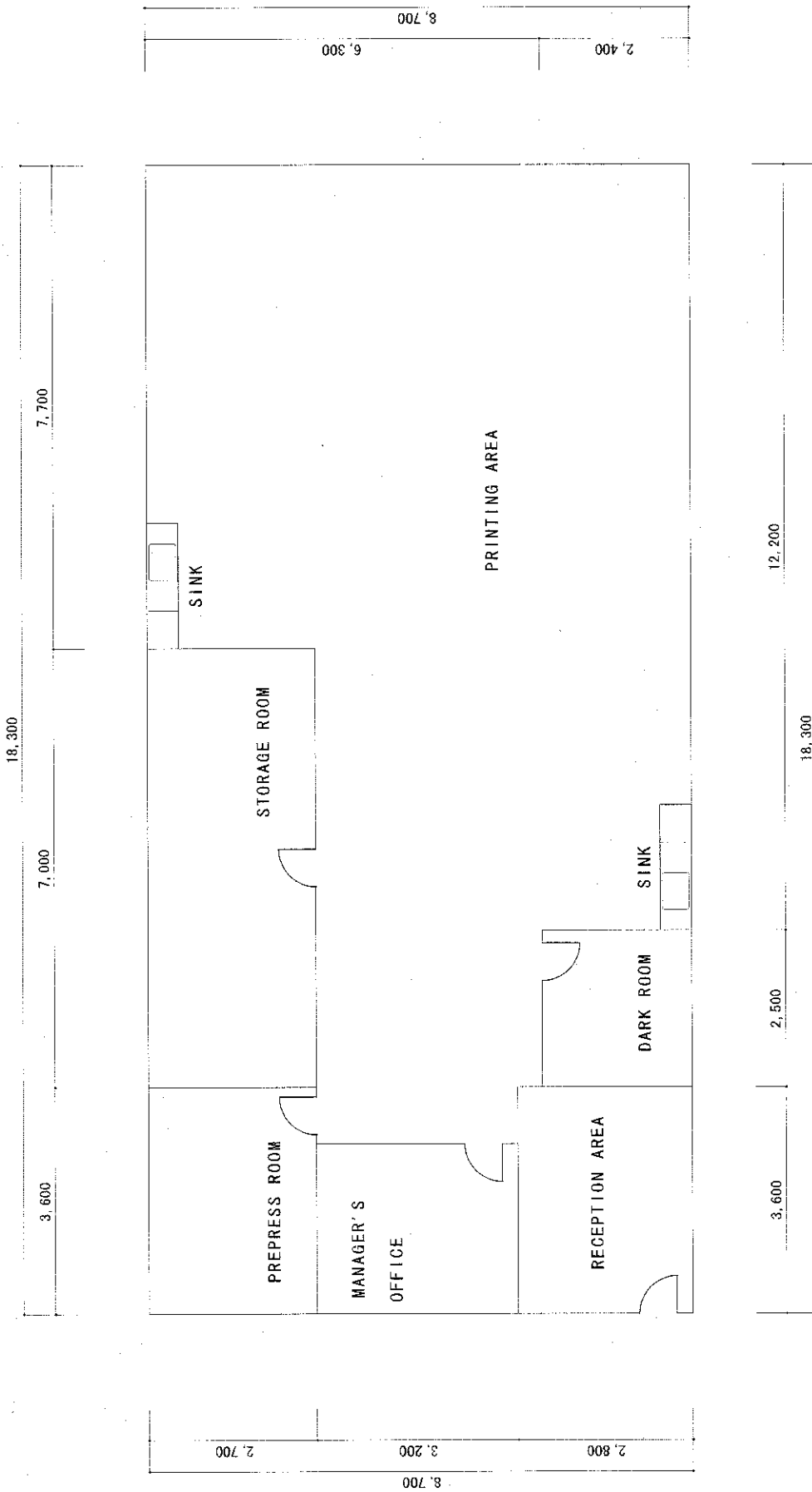
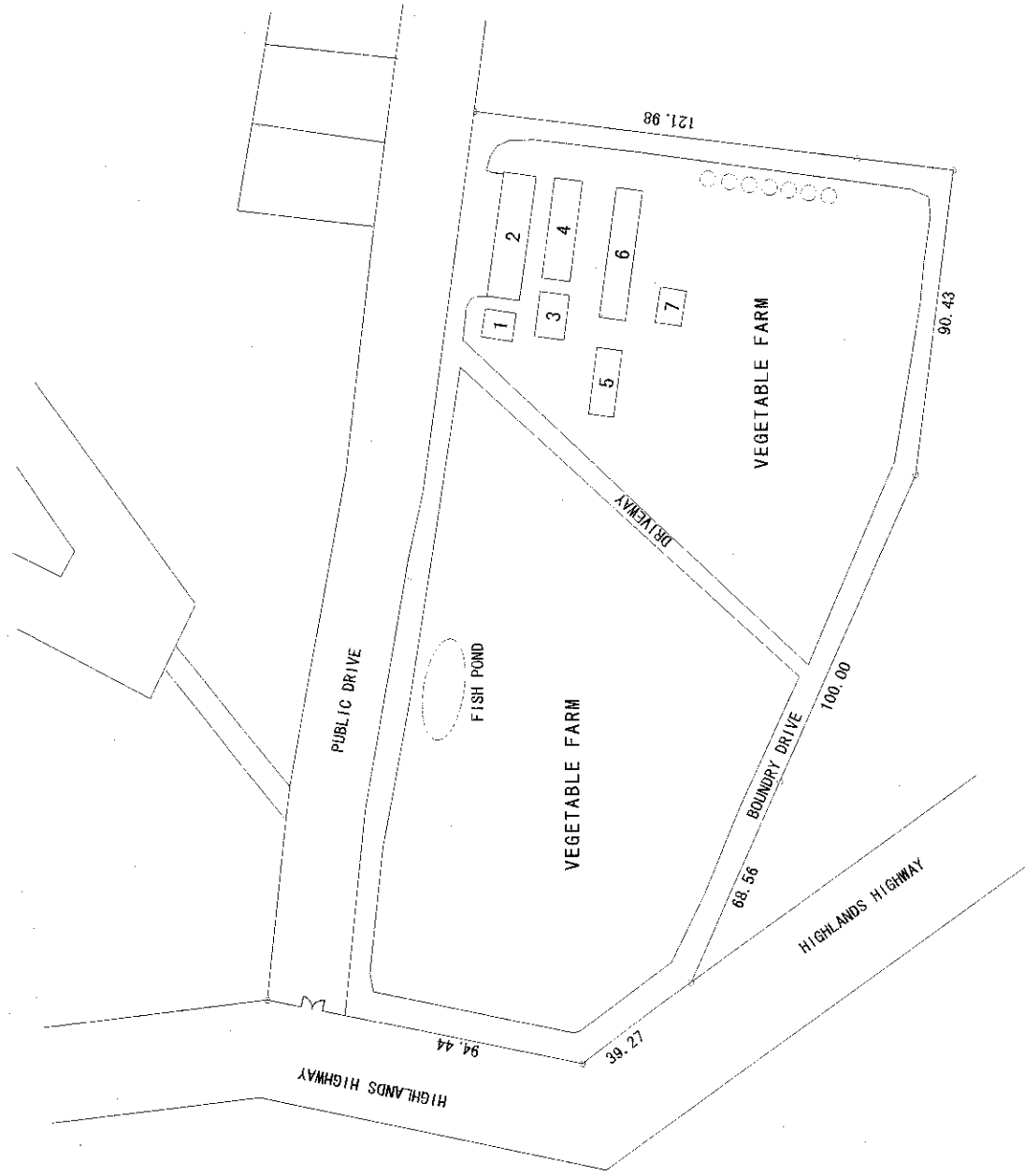


FIG. 2-10 NEW PRINTERY SECTION



- 1 TOOL SHADE
- 2 DEMONSTRATION CLASSROOM
- 3 TOOL SHADE
- 4 POULTRY
- 5 NURSERY
- 6 PIGGERY
- 7 WEATHER STATION

FIG. 2-11 NEW TRAINING FARM

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The following orientation or policies are desirable in view of the framework of implementing this project as an example of grant assistance by the government of Japan.

- ① After the Exchange of Notes (E/N) is concluded, a project implementation schedule and a staffing plan are to be formulated so that all phases of work can be carried out effectively and efficiently within a predetermined time, enabling completion of work starting from the detail design through the installation of equipment and inspection for purposes of acceptance.
- ② There is to be a full and open exchange of opinions and information among the PNG government agency such as the Department of National Planning and Rural Development, the University of Goroka, the consultant, and the supplier (or suppliers), so that there is smooth communication and smooth realization of plans.

After both governments have approved the project and there has been an exchange of notes to that effect, a Japanese consulting company is to provide the required services from the stage of implementation planning to supervision of procurement, on the basis of an agreement signed with the agency so designated by the government of PNG. Further, on the basis of the exchange of notes, Japanese supplier(s) will be selected through a competitive tender and will perform the procurement and installation of the equipment. For this project, the implementing agency, the consultant, and the supplier(s) are to be as follows.

(1) Implementing agency

The responsible organization of the PNG government that is in charge of this project is the Department of National Planning and Rural Development. This Department will coordinate the contracting matters on behalf of the PNG government. The University of Goroka is the project implementing organization that is to be in charge of project-related tasks such as assigning proper personnel to receive the equipment during installation, trial operation and inspection of the equipment. The Department and the University shall also cooperate with the supplier(s) in the process of customs clearance and inland transport of the equipment.

(2) The consultant

After the exchange of notes, the PNG authority so designated by the government will sign an agreement with a Japanese consulting firm for implementation planning and supervision of procurements services. This agreement will become effective after it is verified by the Japanese government. The consultant is to perform the following under this contract.

1) Implementation planning phase

Tasks required for final confirmation of the content of the project; review and study of the specifications for equipment, preparation of tender documents; conducting the tender; evaluation of bids, and related work.

2) Procurement phase

Required tasks for guidance, advising and adjusting the work of the supplier(s) during procurement stage; attending pre-shipment inspection of the equipment; conducting the soft component services, attending installation and trial operation of the equipment; conducting inspection of the equipment; other supervisory tasks.

(3) Supplier(s)

On the basis of the Exchange of Notes, the PNG authority so designated by the government will sign a contract for supply of equipment with a Japanese firm, in compliance with the Guidelines of the Japanese Grant Aid for General Projects and for Fisheries. This contract becomes effective when it is verified by the Japanese government. The work of the supplier(s) as set forth in this contract is:

- ① Procurement, transport and delivery of the equipment
- ② Installation of the equipment, technical guidance concerning operation and maintenance of the equipment

2-2-4-2 Implementation Conditions

It will be important to work to maintain good communications with the supplier(s) during the entire period of project implementation so that the purchasing, ocean transport, forwarding, and installation work progresses efficiently and swiftly. For the same reason PNG side needs to establish a sound system for project management. Particularly concerning the new Printery Section and Model Farm, the University will carry out renovation of facilities or site preparation and construction of structures, so that it will be important that such work be closely monitored in order to prevent any delay that could interfere with the procurement process.

2-2-4-3 Scope of Works

The division of responsibility between the Japanese and PNG governments for this project shall be as follows.

Japanese side

- Procurement of equipment
- Transportation of procured equipment to the University
- Delivery, installation and trial operation of the equipment

- Guidance in equipment operation and maintenance
- Consulting services related to implementation planning, preparation of tender documents, supervision of the tender, and supervision of project implementation, inclusive of the soft component services

PNG side

- Provision of site access (site preparation, construction of buildings, removal of existing equipment, etc.)
- Renovation of existing buildings (interior work, flooring, ceilings, partitions, etc.)
- Security measures (metal fence/grid, padlocks, etc.)
- Electrical work (wiring, interior lighting etc.)
- Water supply and drainage
- Ventilation and air conditioning work
- Telecommunications work (telephones, data points, ISP access)
- Furnishings, accessories, office supplies, reagents, consumables etc.

2-2-4-4 Consultant Supervision

In accordance with the Japanese government policy for grant aid cooperation, a Japanese consulting firm is to provide guidance and advice, and make adjustments on a fair and impartial basis through all phases from project planning through supervision of implementation, so as to ensure smooth realization of the project. The consultant is to work for smooth implementation of the project by first reviewing the detailed technical specifications of the equipment that is to be procured, preparing the tender documents, holding the tender meeting on behalf of the implementing agency, as well as providing technical assistance to the PNG side on the occasion first in the phase of procurement management, of confirmation of the work of the supplier(s) and discussions with the supplier(s), and second at the time of approval of design drawings of the equipment. Moreover the consultant would be present at the time of pre-shipment inspection of equipment. All these services of the consultant are intended to ensure the smooth procurement of the equipment. The consultant would supervise at the University installation work of the supplier(s) and attend acceptance inspection of completed work and delivered equipment. The services of the consultant end when the PNG side, after completion of the installation and delivery, confirms that all contracted services have been provided and gives their approval.

(1) Guidelines for procurement management

- 1) Efforts are to be made to ensure close contact by the competent officials of both governments in order to complete the supply of equipment without delay.
- 2) The supplier(s) is to be given swift and suitable instructions and advice.
- 3) There is to be suitable guidance and advice in connection with the operation and maintenance of the equipment after acceptance.

(2) Consultants assignment

The consultant team shall comprise of the following members.

- 1) Project Manager (1 person)
Performs overall management and provides guidance for the work of the consultant.
- 2) Equipment planner A (1 person)
Confirms the contents of the project and reviews the procurement specifications.
Prepares tender documents, undertakes work related to the tender and bid evaluation; supervises installation.
- 3) Equipment planner B (1 person)
Prepares tender documents, undertakes work related to the tender and bid evaluation; supervises installation.
- 4) Procurement planner (1 person)
Confirms the contents of the project, prepares tender documents, confirms calculations and quantities
- 5) Soft component consultant (2 persons)
Support services for the soft component

2-2-4-5 Procurement Plan

(1) Points of caution concerning equipment procurement

It is essential that there be a representative or an agent in PNG or in a nearby country for services for equipment requiring periodic maintenance, spot checks and replacement of parts, or a stable supply of consumable materials. From the viewpoints of ease of maintenance after acceptance, and a system for the supply of replacement parts and consumables, as well as establishing a system for periodic maintenance of the equipment, procurement can be of locally-available equipment, or equipment from a third country, in addition to procurement from Japan, provided that the equipment in question meets required levels of quality and performance. Although there are almost no instances of Japanese firms' having dealers or agents in PNG, both Australian firms and Japanese firms operating in Australia cover the PNG market. Several of these companies do business with retailers in PNG and in addition to having wide distribution networks, supply replacement parts and consumables as part of their business. For parts and consumables that are not

in stock in PNG, import orders may be placed through these local distributors (one week to two weeks would be needed for delivery). Also, although the parts may be imported, there are some products which are assembled in PNG and sold under local brand names.

Chinese products are available in the PNG market, but the quality makes them undesirable for this project. There would also be a maintenance problem if Chinese-made products were to be used, so these products are not to be purchased for this project.

The following gives the major items that are expected to be acquired locally (including imported items) or from a third country

Local procurement

Book stacks, reading tables, reading chairs, maps cabinet, satellite TV dish, generator, etc.

Third-country procurement

UPS, CRT rejuvenator, high wattage soldering station, isolation transformer, permeameter, woodworking lathe, etc.

(2) Inland transportation route

It is believed that inland transportation would be from PNG's second largest city, Lae, where equipment would be offloaded in the port, overland by truck to the University of Goroka.

There are several places on the road from Lae to the University where the road is not paved, and because the container yard whereby arriving container would be kept until it clears customs is unpaved, there is the matter of windblown dust. In view of the need to protect the procured equipment from dust and the high ambient temperature, special precautions need to be taken by packing the equipment in hermetically sealed wooden crates. This will also serve to protect the equipment from damage during transit.

(3) Plans for dispatch of technical personnel

Workers needed for the installation of the equipment will be available from the local market including the University. There are some pieces of equipment that are to be procured which will require the services of a specialist for installation and to give instruction on the method of operation, but in principle local workers will transport and install the equipment under the supervision of and with guidance by a technical specialist from Japan. Full measures shall be taken so that there is a transfer of technique or know-how to the competent person in each department of the University, through the trial operation and adjustment of the equipment. A work plan shall be made to accomplish this without interfering with the teaching obligations of faculty.

A unification of maintenance and management of equipment in the University campus is being studied.

In order to improve the abilities of staff to maintain and control the equipment, it will be necessary to secure a suitably long period for the trial operation and instruction to be provided by the equipment supplier, in addition to which for major pieces of equipment there will need to be guidance provided by the technical staff from the equipment manufacturer or its representative, as well as education and practical training regarding the principles of the equipment, the basic functions or performance of the equipment, and the method of handling and working with the equipment. On the basis of such knowledge, a centralized maintenance system that is appropriate to the University is to be prepared. Use of this system will serve to reduce breakdowns and prevent damage to the equipment, and it is for this that support must be provided for as the soft component mentioned below.

2-2-4-6 Soft Component

(1) Background

Maintenance management of the equipment held by each department, section, or workshop is handled by each organization respectively (Table 2-10), where the present allocation of responsibility for equipment maintenance at the University of Goroka is shown, demonstrates that there is a broad separation into the responsibility held by the AV Section and the collective responsibilities held by the technical staff of the other departments and sections. As a result of this, equipment maintenance in overall terms is greatly affected by the wide variation of capability and characteristics of persons in charge of the equipment maintenance. Differences in the maintenance and use of equipment among the constituent organizations also arise when the persons in charge of equipment maintenance are transferred or leave their job; these differences are undesirable from the viewpoint of maintenance of the University's equipment.

Table 2-10 Present Conditions of Equipment Maintenance

Teaching Facilities

Faculty	Dept.	Section	Lab/Subject	In-charge Maintenance	
				AV Section	Dept/Lab
Education	Curriculum & Teaching	Curriculum & Teaching	Educational Technology	-	o
	Educational Foundations	Educational Foundations	Educational Foundations	-	o
Humanities	Expressive Arts & Religious Education	Expressive Arts	Drama	o	-
			Music	-	o
			Arts	-	-
	Language & Literature	Religious Education	Religious Education	-	-
		Language & Literature	Language & Literature	o	-
	Social Science & Commerce	Social Science	Social Science	o	-
Commerce		Commerce			
Science	Science, Agriculture & Health	Science	Chemistry Lab	-	o
			Biology Lab	-	o
			Physics Lab	-	o
		Agriculture	Agriculture	-	o
			Model Farm	-	o
		Health	Health	-	-
	Home Economics & Design and Technology	Home Economics	Clothing Lab	-	o
		Design & Technology	Food Lab	-	o
			Metal Workshop	-	o
			Wood Workshop	-	o
	Mathematics & Computing	Mathematics & Computing	Technology	-	o
			Commerce	-	-
	Mathematics & Computing	Mathematics & Computing	Computer Lab	-	o
Physical Education	Physical Education	Physical Education	-	-	

Common Service Facilities

Title	Facility/Section	In-charge Maintenance	
		AV Section	Dept/Lab
Common Facilities	Multipurpose Theater (New)	o	-
	New Library	o	-
	AV Section	o	-
	Printery Section	o	-
	New Open Computer Lab	-	o
	Open Computer Labs	-	o
	New Lecture Room (Old Library)	-	o
	Multipurpose Theater (Old)	o	-
	Life Skills Center	o	-
	PNG Journal	-	-
	Stand-by Generator	-	o

Against this background, the University of Goroka has studied centralization of the management of equipment maintenance, but because the University does not have sufficient know-how in this field, it would be difficult for it to construct such a system. It is therefore necessary as part of the implementation of this project to construct the optimum system by assisting the University to centralize equipment maintenance, providing this assistance within the framework of the grant aid project. The following soft component has been planned against that background.

(2) Expected results

The following are the results anticipated from assisting in the construction of an equipment maintenance system.

- ① Current situation of equipment maintenance would be regularly monitored.
- ② When there has been an equipment breakdown the time before it is remedied will be reduced.
- ③ Abilities of equipment maintenance personnel will be improved.
- ④ It will support the work of creating an equipment maintenance management manual.
- ⑤ It will be possible to transfer the technology embodied in the system to schools to which teachers are assigned (a ripple effect)

(3) Form of implementation

Engineering support

(4) Activities

With regard to support for the establishment of an equipment maintenance management system, cooperation is to be provided in five stages, namely 1) ascertaining the objectives and major features of the system components, 2) analysis, 3) design, 4) production, and 5) implementation. Within this, however, implementation will be only by means of simulation, and actual realization of system operation and use will be undertaken by the University at its own initiative. At each stage, an expert dispatched by the consultant will provide guidance in assisting the University personnel.

1) Objective and major features

Activities : Lectures and meetings. At the same time as awareness on the University side is modified by explaining the objective of building a system (the maintenance management system for newly supplied equipment), its major features, methods of analysis, methods of tabulating and ordering data, procedures, etc., the overall University equipment maintenance management system will be defined.

Duration : One week (by 1 person)

Results : Clarification of the organization chart, objectives of management, and system features.

2) Analysis

Activities : Analysis and adjustment of the system. Determination of the essential components of equipment maintenance and analysis of their content. The components are as given below but because there is great variety among them it is necessary to structure the analysis according to the type of equipment.

The persons who are actually in charge of work are to be assembled in groups based on the type of equipment and the content of equipment maintenance is to be determined as follows.

- Control of equipment (person responsible, budget, control method - code control, wear and tear control)
- Location of equipment (person responsible, normal place of storage/use)
- Functions of equipment (performance test procedures)
- Use of equipment (time, frequency, lending out and return)
- Breakdowns (locus and frequency)
- Repairs (locus, frequency, cost, required time)
- Component of equipment (attachments, consumables)
- Cost of operating equipment (consumables, power source -electricity, gasoline, gas, water, other)
- Other relevant matters

Duration : One week (by 2 persons each)

Results : Clarification of management elements and system objectives; feedback to work defining major features.

3) Design

Activities : Design of a system by integration of control elements. Construction of a management system on the basis of analysis of control content. Working with the persons in charge of maintenance, defining the organization of management and lines of authority and ordering of responsibilities; defining the system for repair work; planning budget procedures (maintenance management, repairs); designing the work tasks of maintenance management (record-keeping of equipment repair; management charts, etc.).

Duration : One week (by 2 persons each)

Results : Design of the materials making up the system (organization, budget, control charts).

4) Production

Activities : Drafting of the organization chart, control charts, checklist manuals. Working with the persons responsible, defining the major features (authority and responsibilities) of the equipment maintenance, the organization for this work, control charts to be used, and checklist manuals. Computerize control chart work to the extent possible.

Duration : 1.5 weeks (by 2 persons each)

Results : Production of the materials making up the system (organization, budget, control charts).

5) Implementation

Activities : Case studies and simulation work. To the extent possible, coding of the equipment and readily actionable procedures are to be begun, but the University is to do this at its own initiative, under the guidance of the consultant.

Duration : One week (by 1 person)

Results : Smooth functioning of the new system.

(5) Method of implementing services

Total requirement for the soft component services by the consultant is 9 weeks by a team of 2 specialists, and will be implemented in 2 stages as follows.

- a) In the first stage, lectures and meetings will be conducted by a leading specialist of the soft component team, and detailed implementation plan will be identified through discussions with concerned parties of the University. University staff together with a consultant shall summarize the feature of maintenance system specific to the University, including organization and objectives of management. After the task, the specialist of consultant return home leaving some time for the University staff to work on the plan of operation.
- b) With more than 1 month interval, 2 specialists visit the University and start supporting the staff to conduct “analysis”, “design” and “production.” Throughout this stage, University staff will participate in analysis and adjustment of specific management system, design of the system, production of the materials for system set up continuously. Services for this stage can be conducted during the installation work of the planned equipment. In the next step, one of the specialist remain at the University and support the activities primarily to be undertaken by the University staff. The

specialist shall assist and monitor the activities of University staff such as case studies and simulation of implementation of the maintenance system.

Table 2-11 Schedule of Services for the Soft Component

Stage	2004			2005		
	10	11	12	1	2	3
1. Objective & Major Features		■				
2. Analysis				■		
3. Design					■	
4. Production					■	
5. Implementation						■
Reporting						△

(6) Method of procuring services

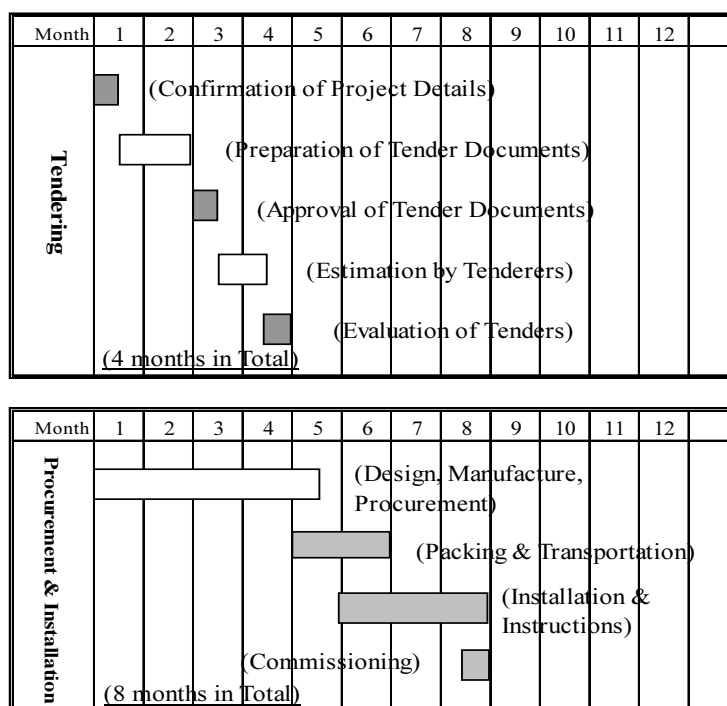
The objective of this soft component is to enable the University of Goroka to grasp the present situation concerning management of its equipment maintenance, and to create a centralized control system for the maintenance based on the particular conditions of the University. The consultant team that possesses understanding and knowledge of the present situation and of maintenance management systems of the University shall be assigned to this task. From this point, the consultant team engaged in the basic design study for the project will be able to provide direct support.

2-2-4-7 Implementation Schedule

In the event that this project is implemented as a grant aid project of the Japanese government, there is to be study of the equipment specifications by the consultant and a tender for supply of the equipment, after which the selected supplier(s) will procure and deliver the equipment.

The process of realization of this project would be as shown in Table 2-12.

Table 2-12 Project Implementation Schedule



2-3 Obligations of the Recipient Country

The PNG side would have the following tasks and responsibilities in the event that this project is implemented as a grant aid project of the Japanese government.

- 1) Supply documents and information as are required for implementation of the project.
- 2) Move or relocate existing equipment and facilities, and complete architectural work, prior to the start of installation of procured equipment.
- 3) Furnish facilities for the necessary electricity, water, drainage, telephone service etc.
- 4) For the sake of suitable and effective operation and maintenance of equipment procured for this project, to make the necessary budgetary provisions and assignment of human resources.
- 5) Pay the necessary fees or commissions to the Japanese bank for services under the Banking Arrangement.
- 6) Exemption of taxes and duties on equipment procured for the project, and guarantee of swift passage through Customs and inland transportation.
- 7) To exempt Japanese companies or individuals employed in the supply of goods and services under a verified contract of customs and domestic duties and taxes.
- 8) To provide to Japanese persons who are to provide services related to the goods and services supplied under verified contract with courtesies regarding entry to PNG and during their stay in the country.
- 9) To obtain the necessary approvals, licenses etc. for implementation of the project.

- 10) To ensure responsibility of the PNG side for the care and appropriate, effective utilization of the facilities and equipment procured under this project.
- 11) To bear all costs required for the project but not included in the grant aid provided by Japan.

2-4 Project Operation Plan

After installation of the equipment, the University of Goroka must adopt and use the following methods of maintenance management as the implementing agency for this project.

- ① A manual for all of the University's major equipment must be prepared, giving in this manual the rules for equipment use by faculty, technical personnel and administrative staff, and students, in a handy edition, and use this for instruction in safety and treatment and use of the equipment in such a manner that prevents damage.
- ② Persons in charge of and responsible for the equipment are to be identified, measures are to be adopted to prevent theft, and awareness of the importance of prevention of theft or damage must be fully and properly instilled.
- ③ Twice a year an inspection of all equipment including attachments is to be made, with the persons responsible for the equipment in question present.
- ④ Records must be maintained including notes of the results of periodic inspections and any problems identified at such times. Damage or breakdowns must be remedied swiftly.
- ⑤ Small-size equipment must be stored together in a suitable cabinet or locker, room, etc. and may not be removed without the approval of the person responsible for the equipment.
- ⑥ An annual budget for maintenance including repair is to be secured.

Concerning AV equipment, since this equipment is to be used by the entire student body, in order to assure that the management and maintenance system for this equipment is as it should be, there will be need to increase the number of technical personnel to be assigned to this work, and the University is in the process to hire such persons.

2-5 Estimated Project Cost

2-5-1 Project Cost

The estimated total cost of implementing this project as a grant assistance undertaking by the Japanese government is about 368 million Japanese yen, and the division of costs based on the allocation of responsibility of the Japanese and PNG sides as stated above is as follows, given the conditions as below.

(1) Japanese expenses

Table 2-13 Project Cost (Estimation)
Approximately 279 million yen

Items		Cost Estimation (million yen)
Equipment	New Library	10
	AV Section	8
	Printery Section	48
	Language Laboratory	11
	Computer Laboratory	18
	Expressive Arts Education (Music Section)	10
	Agriculture Education (Agriculture Section)	62
	Science Section	26
	Other Lecture Theaters & Classrooms	16
	Design & Technology Section	17
	Home Economics Section	6
	Technical Vocational Section	5
	Other	6
Detail Design/Implementation/Soft Component		36

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

(2) PNG expenses

The expense to be borne by the University of Goroka would be as follows

Table 2-14 PNG Expenses (Estimation)

Cost Item	Amount
Building renovation, site preparation, etc.	K 2,756,500
Electrical work	K 16,000
Piping work	K 18,000
Air conditioning, ventilation work	K 8,000
Security, fire prevention work	K 20,000
Purchase of goods and other services	K 44,000
Miscellaneous works	K18,000
Total	K 2,880,500 (About ¥ 89mil.)

Note: Conversions at K1 = ¥31.06

(3) Conditions for estimation

- 1) Time of estimation: January 2004
- 2) Exchange rates: US\$1 = ¥116.05; K1 = ¥31.06
- 3) Implementation period: See Table 11.
- 4) Others: This project is to be implemented in accordance with the established system of the Japanese government for grant aid projects.

2-5-2 Operating and Maintenance Cost

Annual operation and maintenance cost would increase, according to the work of the study team, and assuming all equipment planned herein is acquired, as shown in Table 2-15. Including utility service, spare parts and consumables, the total is estimated to be on the order of ¥6.34 million. This corresponds to 2.1% of the K9,665,200 budget to be allocated to the University of Goroka in fiscal 2004. The increase in costs would become an obligation from fiscal 2005 (after acquisition and the start of use of the equipment) and in the initial year is estimated as about 15% of the above amount.

Table 2-15 Cost increase by implementation of the Project

Organization	Electricity			Consumable		Repair		Total
	Consumption/year	Unit rate (K)	Amount (yen)	Consumption/year	Amount (yen)	Consumption/year	Amount (yen)	
B. New Library	920 kWh	0.4075	12	1 lot	5	1 lot	63	80
C. AV Section (New)	667 kWh	0.4075	8	1 lot	126	1 lot	90	224
D. Printery Section (New)	7,480 kWh	0.4075	95	1 lot	2,264	1 lot	458	2,817
E. Language Laboratory	5,520 kWh	0.4075	70	1 lot	12	1 lot	79	161
G. Computer Labs	10,460 kWh	0.4075	132	1 lot	20	1 lot	157	309
H. Music Section	540 kWh	0.4075	7	1 lot	10	1 lot	112	129
I. Agriculture Lab	9,432 kWh	0.4075	119	1 lot	68	1 lot	850	1,037
J. Science Labs (Chemistry/Biology)	5,832 kWh	0.4075	74	1 lot	73	1 lot	332	479
K. Lecture Rooms/Classrooms	6,593 kWh	0.4075	83	1 lot	190	1 lot	144	417
L. Design & Technology Section	4,965 kWh	0.4075	63	1 lot	37	1 lot	156	256
M. Home Economics Section	7,500 kWh	0.4075	95	1 lot	5	1 lot	67	167
N. TVE Section	3,024 kWh	0.4075	38	1 lot	32	1 lot	52	122
P. Stand-by Generator	0 kWh	0.4075	0	1 lot	50	1 lot	96	146
Total	62,932 kWh	-	796	-	2,892	-	2,656	6,344

- 1) Valid only for the equipment to be provided under the Project.
- 2) Based on the assumptions of operation hours at 5-10 hours per week, for 2 semesters.
- 3) Electricity unit rate of Kina 0.4075/kWh is converted by Kina 1 = J. yen 31.06.
- 4) Based on those equipment that need consumable.
- 5) Equivalent to 1% of equipment costs.

CHAPTER 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

The following are the results that are expected from realization of this project that is intended to improve the educational equipment used at the University of Goroka as it endeavors to educate and prepare secondary school teachers in compliance with the PNG government's Medium-Term Development Strategy and the education sector's National Education Plan.

(1) Direct Effects

- Through the effects of improvement of the equipment used for practice in specialized courses of pedagogy program at the University of Goroka it will be possible for all students of the university (about 1,000) to engage in hands-on experiments, contributing to the deepening of their education.
- By improving the equipment that is used to prepare teachers for instructing upper secondary-school classes (grades 11 and 12), it will be possible to elevate the level and improve the content of education for the benefit of both faculty and students (total, about 1,500 persons).
- Through giving priority to improvement of equipment used in the Home Economics section where female students dominate, and by newly equipping a computer laboratory dedicated to use by the women, two changes intended to improve the gender balance, the environment for the education of women will be improved.
- Improvement of equipment for the production of educational aids in various media (print, audio, images) will mean substantial improvement in terms of educational technology, and make it possible for the faculty and students to use latest instruction methods that utilize new technology.

(2) Indirect Effects

- When the University of Goroka uses the new equipment to produce educational aids in various media, it will become possible to provide up-to-date materials in a timely way to the secondary schools, vocational schools and technical colleges countrywide, where the teaching staff (about 4,400 persons in total) will be better able to implement and benefit from the new curricula.
- Improvement of the information technology (IT) equipment, including computers, at the University of Goroka will enable those teachers who graduate from the university after having received instruction in teaching methods using information technology to provide improved

instruction at all of the secondary schools or equivalent where they are employed, throughout the nation.

· When teachers who have attended refresher and updating programs at the university return to their positions, they will be able to transfer at least part of what they have learned to their co-workers, providing a multiplier effect.

Measures of the above direct effects that can be employed include the increase in the number of high school (grades 11 and 12) teachers in PNG secondary schools, and the increase in the hours spent at hands-on training at the university, using the new, improved equipment and facilities. Measurement of indicators of the results of implementation of this project would be by means of statistics collected by the university and the Department of Education.

3-2 Issues and Recommendations

(1) Assuring Budgetary Provisions, and Monitoring

The University of Goroka must apply to the Department of Finance during the previous year for a budget allocation each year that will cover the costs of maintaining and managing any equipment supplied under this project. The allocation that is subsequently approved by the Finance Department is provided to the university as a subsidy. It will be necessary, moreover, to include in the budget request the incremental costs of maintenance and management (including operation) as well as related personnel costs, at the time of acceptance and the start of use of the equipment. It is a major assumption behind planning of this project that these budgetary measures will be taken, so as to ensure the proper maintenance and management of the equipment over the long term. To make certain that this is in fact the case, it will be necessary for the PNG government to report to Japan on a regular basis the conditions regarding allocation of budgets to the university.

(2) Improvement of the System for Operating and Maintaining Equipment

In the event that this project is implemented as planned, the existing staff at the university charged with operation and maintenance as well as management of educational equipment will be required to extend their work to include the newer, larger and more diversified assortment of equipment. It will be unavoidable for the number of persons in charge of maintenance and management of audio-visual equipment to be increased, as the new equipment will involve new technology. The Printing Section, moreover, will acquire equipment for processes new to the section, meaning that the vendor will have to provide the section's technical staff with training on the use and care of the equipment immediately after it is delivered and installed. It is expected that cooperation will be provided to the university as services in the soft component in regard to constructing a unified maintenance and management system for all of the

educational equipment of the university, but for this to be done the university must select the persons responsible, and make whatever preparations are necessary, prior to the start of the service. If cooperation is provided as described here, the university will be capable of preparing its own manuals for use of the equipment, make use of a system for carrying out routine inspections and checks of the equipment and recording the results thereof, make use of an improved system for the storage of equipment, and prepare reliable annual budget allocation requests, all measures that will further ensure that the equipment is more effectively used and generates maximum benefits.

(3) Linkage to Technical Cooperation

The content of this project provides for performance of training and guidance in the operation and maintenance of major pieces of equipment, by technical personnel dispatched by the supplier of the equipment after the equipment has been installed, for the benefit of teachers and technical personnel of the university who are to use, maintain and manage the equipment. This will ensure that the equipment is properly used and usable over a long period of time. The university desires to receive technical cooperation in the area of high technology from Japan in direct and indirect connection to this project. In particular, the Japan Overseas Cooperation Volunteers, having provided cooperation to the university in the field of IT, is highly evaluated, but the volunteer who had been at the university, having concluded his assignment, has returned to Japan, and the university wishes that another person be dispatched to continue his work. Including what has been requested, the university will have more than 300 computers, and significant benefits are expected if Japan provides cooperation in connection with management of these as a network. If this sort of hands-on cooperation, implemented *in situ*, is provided, it would generate a multiplier effect in combination with this project, so that this ODA from Japan would have augmented value.

(4) Linkage to Assistance by International Agencies and Other Donors

As stated above, a number of projects are being implemented by the PNG government in the area of education and with assistance by various donors. These involve development of curricula in compliance with the new educational system being created under the National Education Plan, or development of new methods of instruction, development of educational materials, or improvement of educational equipment. It is expected that implementation of this project as grant aid from Japan would enhance and supplement these efforts, through the use of the improved, increased equipment, and the improved and new abilities related to use of the equipment, as well as the improvement of ability to maintain and management equipment.