3-3 Construction Situation

3-3-1 General

Almost all of the buildings in the old town of Kathmandu are three to four stories high and mainly used as shops and residences. The structure is of brick masonry with wooden beam, concrete slab and roofed with clay tiles over wooden truss. As openings are supported by wooden framework, the width of a unit opening is only around 80 cm to 120 cm so that the inside of buildings is generally dark. The buildings which line the streets of the old town are uniformly of sedate brick masonry.

The construction method of most recent buildings adopts the use of reinforced concrete for columns, beams and slabs and the use of brick for walls. The level of construction techniques and accuracy are considered to be low even by comparison to other Southeast Asian countries.

3-3-2 Laws and Standards

Laws concerning buildings have not been fully established yet except for the few rules that pertain to group control on wall surface line, etc. in the city of Kathmandu. Technical regulations especially are nil; only some of the standard criteria of India (former British Commonwealth of Nations) serve as reference in designing. Also, specifications and standards of various countries are being used with lack of order.

3-3-3 Construction Materials

Nepal depends on imports for most of its construction materials, particularly from India. The materials which are locally produced in Nepal are sand, gravel, brick, precast terrazzo, wooden fittings, wooden furnitures, etc. Although cement and reinforcing bars are produced in small quantities, those are not quite reliable in both quality and quantity. Available lumber is mostly the hard wood called

"sal wood" which is used as structural members, fixture material and mold material. However, the wood has many problems: it is extremely hard and difficult to work with, and tends to become twisted when dried.

3-3-4 Labor Situation

Although the absolute number of workers is large, there are few skilled workers. Daily wages range from 25 Rs (about ¥330) for labor to 45 Rs (about ¥620) for electrician, which are only about two-thirds of the wages in Thailand. The skilled technicians are mostly Indians who are efficient but higher paid. Working hours are from 10 a.m. to 5 p.m. with a 30 minutes break. Every Saturday is a holiday, and in addition, there are about 30 national holidays in a year.

CHAPTER 4

CONTENTS OF THE PROJECT

CHAPTER 4 CONTENTS OF THE PROJECT

4-1 Purpose of the Project

The purpose of this Project is to construct the Horticultural Development Center within the compound of the Horticulture Research Station of the Ministry of Agriculture located at Kirtipur in the suburbs of Kathmandu City for the purpose of selecting varieties of fruit trees suitable to the hilly and mountainous regions of Nepal, developing pomiculture techniques and training pomiculture technicians.

The Government of Nepal has mapped out an extensive horticulture development program which includes the expansion of production of not only junar, suntala, grape, chestnut, pear, peach, plum and apricot and other fruits and various vegetables produced in the Kathmandu Valley, the improvement and expansion of Sarlahi Horticulture Research Station, the establishment of the New Kirtipur Horticultural Development Center and horticulture service centers, the development of marketing facilities and the establishment of processing plants, etc.

This Project constitutes a part of the foregoing program and its object is the pursuit of technological development and training of technicians of mostly citrus, grape and chestnuts as the object fruit trees. By this, it attempts to diversify farming operation in the mountainous and hilly regions and contribute to the increase of farmer's income and improvement of the nutrition of Nepalese people.

4-2 Relationship Between the Horticultural Development Center and Other Research and Training Institutions

This Horticultural Development Center will function as the center of developmental research and training in temperate fruit trees of Nepal as a part of the development of agriculture, and will cooperate with existing research institutions in the following manner:

Horticulture Research Station (Kirtipur): Although it will have some functional relationship with this Center, the Center will communicate its research results on temperate fruit trees and offer advisory suggestions and guidance on culturing techniques for grape, chestnut and citrus fruits.

National Citrus Development Program Horticulture Research Station (Dhankuta): Its citrus fruit cultivation training program and development plan of teaching materials will be drafted with the advice of the Fruits Development Division and Horticulture Research Station (Kirtipur), and the Center will offer counsel and cooperation in the drafting of this training program.

Central Food Research Institute: Although it has no relationship with the Center, the cooperation of this Institute would be necessary for training in fruit processing, etc.

Agricultural Extension and Training Division: The Center, in drafting its training program, would need to consult this division for details.

The following would require each cooperation of the foregoing institutions; Development of Training Equipment: It would be desirable to include representatives from each of the foregoing institutions as members of the working committee of this Center, and to obtain their cooperation in developing the training program and teaching materials.

Lecturers for Training Course: The Center will secure its own research staff, but for the training course it will be necessary to invite experienced specialists of the foregoing institutions as lecturers.

The Horticulture Research Station (Kirtipur) is scheduling its pomiculture technique training program for leading fruit growers, JTs and JTAs for 1985-86 as shown in Table 4-1. After the establishment of the Horticultural Development Center, the Station will carry out this

program by utilizing the facilities of the Center only during the periods that do not interfere with the Center's own training program. The curriculum will include training in the cultivation of citrus fruits, grape and chestnut grown on the orchard of the Center as well as peach, pear, persimmon and other fruit trees planted in the orchard of the Horticulture Research Station.

Table 4-1 Schedule of Training Programme in Horticultural Research Station Kirtipur, for 1985–86

No.	Nature of Training	Training Period	No. of Participants
1.	Pre-service training for horticulture officer	One week	
2.	Pre-service training for junior technicians	One week	
3.	Pre-service training for junior technical assistants	One week	
4.	In-service training for junior technicians	One week	35
5.	In-service training for junior technical assistants	One week	35
6.	Training for nurserymen (Deciduous)	One week	35
7.	Training for fruit growers (Deciduous)	One week	35
8.	Training cum workshop for Hort. Officers, Farm Managers (Officer)	One week	70

4-3 Activities of the Center

To attain the foregoing objectives, the Center will perform the below described activities in the fields of pomiculture technology development and training/public relations.

4-3-1 Pomiculture Technology Development

The technical level of Nepal with respect to pomiculture lags behind that of the advanced countries, and soil improvement, fertilizer administration and irrigation are hardly practiced in Nepal.

In order to diffuse and penetrate fruit gardening in the mountainous and hilly regions, pomiculture technology suitable to Nepal must be developed and established.

1) Object Fruit Trees for Technological Development

The fruit trees being considered in the horticulture development program for the mountainous and hilly regions of Nepal are, junar, suntala, grape, chestnut, pear, peach, plum and apricot. Apple is also produced in the northwestern mountainous regions, but it is not one of the object fruits of this Project. If the techniques are to be developed and diffused at an early date, number of object fruit trees would be limited and efforts would be concentrated on those trees. The criteria for selecting the object fruit trees are:

- They must be suited to the geology, terrain and climate, and promise a large yield.
- They must be highly marketable.
- They must have large potential demand.
- They must not be easily perishable or damageable by handling and transport. They must be easy to retain freshness and withstand transport to the consuming market.

As fruit trees that satisfy these conditions, citrus such as junar and suntala, grape and chestnut were selected as the object fruit trees of this Center.

2) Object Fields of Technological Development

It goes without saying that the pomiculture technology should desirably be developed in all aspects, but it was decided that this Center would confine itself to the development of production process

techniques necessary in the initial period and, as a result, the subjects of storage, processing, distribution, etc. of harvested fruits were excluded from its coverage. Thus, the scope of its coverage in the development of pomiculture technology is as follows:

(1) Introduction of fruit trees and selection of suitable varieties

There are numerous fruit trees in the mountainous and hilly regions of Nepal, but the ones that are evaluated as industry are only citrus such as junar and suntala and apple. The rest are still close to primary or wild types and have a little value as merchandise.

It is important to consider the diversity of Nepal's terrain and climate and to induce the fruit trees that are most suited to the soils and climate of each area, and to breed these into selected varieties that would have large economic effects.

(2) Seedling propagation technology

The Government of Nepal hopes for a drastic increase in fruit production. For this, superb seedlings must be produced in large quantities which require improvement in techniques of cutting, grafting and nursery bed preparation, nursing and management of seedlings and construction and management of the glass house.

(3) Pomiculture techniques

In pomiculture, techniques of fertilizer administration, irrigation, drainage, pruning, fruit thinning and judging of harvesting time are important, which greatly affect yield depending on the way they are executed. In Nepal where the fruit trees are not being given any of these cares, the need for development and diffusion of pomiculture technology is high.

(4) Disease and insect control technology

Unlike grains and vegetables, fruit trees once planted are not renewed for over ten years. Adequate care, therefore, must be paid to prevent plant death due to disease and insect damage.

(5) Soils and fertilizer

Soils are the very foundation for the growth of living organisms. Basic study of the soil is indispensable not only for selecting suitable varieties but for the study of breeding, culturing, damage by disease and other subject.

The technological development in each of the foregoing five fields are inter-related. And, if developed in collateral relation to each other, the synergistic effects would be expected to be large.

4-3-2 Training and Public Relations

Training is conducted in order to implant basic knowledge of pomiculture and the technical knowhow developed for it among the growers so as to increase the production quantity of fruits.

1) Candidate Trainees

The agricultural extension workers (JTs and JTAs) and leading growers are considered as the candidates for training.

There are altogether 75 agricultural extension offices in Nepal, where about 7,000 agricultural extension workers are engaged in the work of extending agricultural techniques.

The utilization of the foregoing network of agricultural extension offices is judged to be effective for extension of pomiculture techniques. It was therefore planned that the agricultural extension workers should be given the knowledge and technical knowhow in the growing of fruit trees and that they should be assigned to the villages planned as the producing areas of fruits to instruct the farmers on how to grow fruit trees. In addition, it was planned that aspiring leader farmers who were already engaged in pomiculture or who were about to do so should be selected as the targets for training, who would be instrumental in picking up specific problems of the production area and in creating and increasing opportunities to study countermeasures for them.

2) Training Plan

The annual training program of the new Center is as follows. (Refer to Table 4-2).

a. Long Term Training

A year of consecutive training will be given to the newly recruited JTs and JTAs in order to foster specialists in pomiculture technology. Those who have completed the course will be dispatched as pomicultural specialists to the extension stations which, among the agricultural extension offices in each of the 75 districts throughout the country, are located in the areas planned for fruit production.

The number of trainees is planned to be ten at a time, which is judged to be the required minimum for the development of Nepalese horticulture, considering that the number of newly recruited JTs and JTAs each year ranges between 100 to 120 and that the total number of agricultural extension workers is 7,000 throughout Nepal. The contents of the training program are designed to let the trainees acquire overall knowledge and the techniques necessary for year-round culturing, and includes actual practice on the orchard, and during the off-seasons, studies of basic subjects and theories and other broader subjects that any leader should know.

b. Short Term Training

Short term training will be offered to the JTs/JTAs and leading growers already active in pomiculture so as to improve their techniques and thus increase fruit production in Nepal. Those who have completed this training will return to their original posts or production area and provide technical guidance to the farmers or utilize their newly acquired techniques in their own horticultural operation in order to contribute to upgrading the overall technical level of the area.

The short term training program will offer three courses: on citrus, grape and chestnut, and ten trainees will be admitted to each course. The term of each course, as a rule, will be one month and offered about five or six times a year by attuning the timing of each course to the working process of each tree.

As the candidates for training are active JTs and JTAs and leading growers, it was feared that any extended training might interfere with their own work. A training period of three months or so is actually desirable for the trainees to become somewhat versed in the techniques and knowledge, but because of the foregoing reason, the permissible training period was judged to be within one month, during which time, it was planned that intensive training of a particular technique such as pruning, or fruit thinning would be offered. Accordingly, training will be mainly centered on actual practice on the field and supplemented by lectures in the classroom. Also, on some specific fruit trees, greater emphasis will be placed on practical training by making short trips to the producing areas for a grasp of the actual situation there and to acquire the techniques suited to each situation.

c. Travelling Guidance

As the problems and the countermeasures for even the same type tree are presumed to be just as diverse as the terrain and the climate in Nepal depending on each particular locality, it is conceivable that training on the orchard of Kirtipur or on the desk alone will not lead to any practical solution.

So, to supplement in a way what have been taught at Kirtipur, visits to the producing areas will be made to offer practical guidance to the growers.

As for the places to be visited, mostly Sindhuri, where a sub-center is planned to be set up for citrus, Nakhtaj and Nepalgunj for grape, and Kakani for chestnut are considered appropriate.

The travelling guidance program will not only publicize horticulture, but will offer technical guidance and counsel on the problems in each producing area.

3) Public Relations

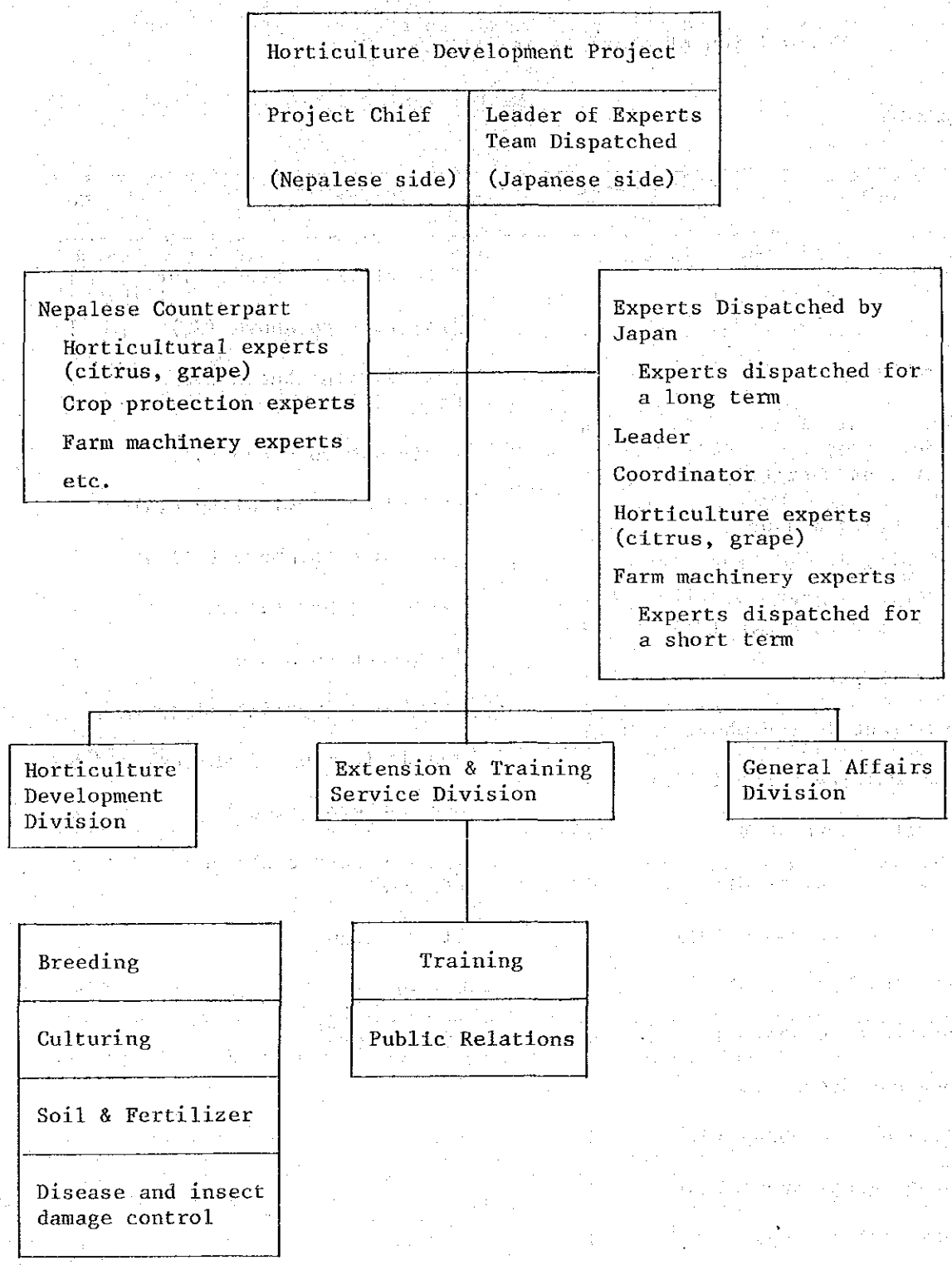
In Nepal, horticulture, particularly pomiculture, is not popular yet, but for the development of its mountainous and hilly regions, Nepal places hope on the development of fruit gardening. Improvement in culturing techniques is of course necessary for this purpose, but it is also necessary to let the farmers throughout the country know about the economic advantages of pomiculture and its necessity and to provoke their willingness to try. Also, pamphlets and the like will be used to transmit information and introduce techniques to the remote places that are hard to reach. Public relations is an indispensable function of the Center.

Table 4-2 Training Plan

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Citrus	plant Growth	Ripening Season / Dormant		Flowering Time			Shoot Growth					Repening Season / Dormant	
	Field Work	Harvesting; Winter Pruning (Propagation); Grafting (Topworking); A.C.Spray; Weed Control	Apply of Fertilizer	Spring Shoot Pruning	A.C.Spray	Fruit Thinning; Summer Management of Shoot	Bud Grafting (Topgrafting for Renewal of Variet or Strain); A.C.Spray	Weed Control	A.C.Spray	Apply of Fertilizer		Harvesting	Winter Pruning; Grafting (Propagation, (Topworking)
Grape	Plant Growth	Dormant		Flowering Time			Shoot Growth	Ripening Season				Dormant	
	Field Work	A.C.Spray; Weed Control; Apply of Fertilizer	GA Treatment; A.C.Spray	Cutting (Propagation); A.C.Spray	Thinning of Bunch and Fruitlet; Mist Cutting; A.C.Spray	Summer Management of Shoot; A.C.Spray	A.C.Spray; Weed Control	Weed Control	Harvesting		A.C.Spray; Apply of Fertilizer	Winter Pruning; Cutting (Propagation)	
Chestnut	Plant Growth	Dormant		Flowering Time			Shoot Growth	Ripening Season				Dormant	
	Field Work	Grafting; Weed Control	A.C.Spray	A.C.Spray	Summer Management of Shoot; A.C.Spray		A.C.Spray; Weed Control	Weed Control	Harvesting	Apply of Fertilizer		Pruning; Grafting	

Long Term Training (General)	10 person
Short Training (Citrus)	10 person
Short Training (Grape)	10 person
Short Training (Chestnut)	10 person
Total	40 person

Fig. 4-1 Organization Chart



4-4 Organization Structure and Manning Plan

The Center is planned to be operated under the following organizational structure.

Composition of staff is as follows:

Table 4-3

Staff	No.	Staff	No.
Manager	1	Entomological Specialist	1
		Assistant to above (JT)	1
Farm Manager	1	Soil & Plant Nutrition Specialist	1
General Affairs (incl. typist, wireless operator)	4	Assistant to above (JT)	1
		Agrometeorological Specialist	1
Accounting & Supply	3	Assistant to above (JT)	1
Citrus Expert	1	Extension Specialist	1
Assistant to above (JT)	2	Assistant to above	1
Grape Expert	1	Dormitory Superintendent	1
Assistant to the above (JT)	2	Guards (2 men x 3 shifts)	6
Farm Machinery Specialist	1	Odd-Jobbers (Peons)	6
Assistants to above	2	Kitchen worker/Cleaner (female)	2
Public Relations Officer	1	Electrician	1
Assistant to above (JT)	1	Driver	5
Breeding Specialist	1	Farm Laborer	6
Assistant to above (JT)	1		
Chestnut Specialist	1		
Assistant to above (JT)	1		
Pathological Specialist	1		
Assistant to above (JT)	1		
Total		61 persons	

4-5 Necessary Facilities and Equipment

Based on the activities plan and manning table of the Center, the necessary facilities and equipment were planned as follows:

1) Technological Development Division

Necessary Facilities	Necessary Equipment (major items)
Pomiculture & Breeding Laboratory	Growth cabinet, microscope, leaf area meter, pure water collection, autoclave, refrigerator, center table, etc.
Biochemistry Laboratory	Microscope, pure water collection, paper chromatography, refrigerator, center table, etc.
Entomology Laboratory	Microscope, sprayer, anatomy set, insects growing chamber, balance, center table, etc.
Soil and Plant Nutrition Laboratory	Oven, shaker, incubator, sieve, balance, microscope, center table, etc.
Plant Pathology Laboratory	Clean bench, incubator, autoclave, sprayer, microscope, balance, center tabel ect.

Laboratory Staff Room
(Office room for 10 Nepalese specialists and 13 assistants as well as 10 experts from Japan under technical assistance agreement.)

2) Training Division

Necessary Facilities:

The facilities for the training division will be designed to accommodate long term training and short term training programs. It will also be used for the one-week training programs which have been offered at the Kirtipur Horticulture Research Station heretofore, but only at times that the space for it is available.

According to the training plan, the maximum simultaneous number of trainees is altogether 40 persons for four courses. As a part of the training, such as actual practice out on the fields and apprentice in the workshop, do not require the use of classrooms, they will be planned to accommodate 75% of the maximum number of trainees, that is, three rooms that can accommodate 10 persons to a room.

Lectures on subjects common to all courses will be offered in the form of joint lectures for which the used of the lecture hall will be planned. The lecture hall will be planned with a seating capacity of 100 to allow room for other uses, such as for lecture meetings for the neighboring farmers and annual report meetings on fruits produced in Nepal.

Necessary Equipment:

Overhead projector, slide projector, tape recorder, video set, blackout curtain

3) Administrative Division

Necessary Facilities:

. Administrative office (9 persons)
. Printing room

. Health clinic
. Manager's room (1 person)
. Senior staff room (2 persons)

Also, a wireless radio room will be provided in which to install a wireless telephone set for communication with the sub-center(s).

. Meeting room (for 20 persons)
. Library (for 10 readers and to house 10,000 books)

Necessary Equipment:

Typewriter, printer, word processor, copying machine, book binding machine, camera, developing machine, enlarging machine, wireless radio set

4) Dormitory

Since the trainees will come from every part of the country, and discussions and exchange of information will most likely take place at night time to enhance the training effect, dormitory will be provided. According to the Nepalese custom, the wings for male and female will be clearly separated.

Necessary Facilities:

. Bedrooms (10 four-person rooms)
. Dining hall (16 males, 8 females), kitchen, food storage
. Dormitory keeper's room, store room
. Lavatory, shower, laundry room
. Dormitory superintendent quarter

5) Workshop, Garage, etc.

A workshop will be built for maintenance and repair of farm machinery.

As for vehicles, four-wheel driven small passenger cars for travelling guidance, a micro-bus for inspection of surrounding farms, a small truck for work on the fields and demonstration farm are mainly planned.

Necessary Facilities:

- Workshop
- Garage (2 jeep-type passenger cars, 1 micro-bus, 1 four-ton truck, 1 pickup truck)
- Space for repair work training
- Drivers' room (5 persons)
- Electrical room

Necessary Equipment:

- Equipment for workshop
- Vehicles (2 jeep-type passenger cars, 1 micro-bus, 1 four-ton truck, 1 pickup truck)

6) Farm Management Division

A farm is necessary for actual practice of horticulture training. The field shall be 0.8 ha for citrus, 1.6 ha for grape, 0.35 ha for chestnut, 0.5 ha for nursery of seedlings. A grapevine trellis is needed for the grape field and it must be built before planting of the seedlings. For culturing seedlings, glass houses and vinyl house will be planned.

Necessary Facilities:

- Orchard irrigation facilities
- Farm House (cold storage of harvested crops, agricultural material storage, workroom, etc.)
- Farm machinery yard
- Glass house 8.1 x 18 m (with a cooling facility)
- Glass house 8.1 x 18 m

. Vinyl house 7.2 x 21 m

. Grapevine trellis 0.7 ha

Necessary Equipment:

Tractor (with accessories), trencher, tiller, sprayer, reaper, sprinkler

4-6 Relevance to Technical Cooperation

The HMG of Nepal has requested the Government of Japan for technical cooperation and grant aid for the implementation of its mountain horticulture development program. The Government of Japan, in compliance with this request, has conducted a preliminary survey for project-type technical cooperation in June, 1984, and it is now in the process of studying the contents of its technical cooperation which is based on the premise that the Project Center will be constructed as its grant aid. The details of the facilities of this Center and the contents of Japanese technical cooperation, therefore, are quite closely related and important.

As for the technical cooperation, a leader of experts team, horticulture experts and other experts will be dispatched from Japan. At the same time, equipment will be supplied to the Horticulture Development Project and trainees from the Kingdom of Nepal will be invited to Japan for their training.

For the activities of the technical cooperation, the Horticultural Development Center will play the role of a center facility for various activities such as transferring of technique for technical development and offering of advisory suggestions and guidance on the training programme. Furthermore, sub-center(s) and demonstration farms will be established for as to offer the travelling guidance programme services.

Citrus, grape and chestnut are selected as the object fruits trees, and the pomiculture technological development and public relations activities will be performed for these fruits trees.

CHAPTER 5

BASIC DESIGN

CHAPTER 5 BASIC DESIGN

5-1 Facility Design

5-1-1 Basic Design

In developing the basic design for this Center, the following basic policies were adopted.

1) The Center shall be designed with full understanding and appropriation to the climate, natural features, habitual customs and other special characteristics of Nepal and also of Kathmandu where the construction site is earmarked.

2) Efforts shall be made to reduce maintenance, repair and operating costs by positively utilizing natural ventilation and lighting as well as sunshine.

3) With due consideration to Nepal's construction technology and labor situation, the Center shall be designed to achieve easy construction and economy. In consideration of the aspects of maintenance and repairs after its completion, the same materials being used locally shall be positively utilized for the construction.

5-1-2 Layout Plan

Zoning

For the Layout Plan, the facilities of the Center can be classified into below metioned zones by each function.

a. Administraion Dept. & Publicity Dept.:
Administration and publicity zone

b. Training Dept.:

Classroom, lecture hall - Seated training zone

Workshop - Mechanical training zone

Farm work house - Orchard training zone

c. Technological development Dept.:

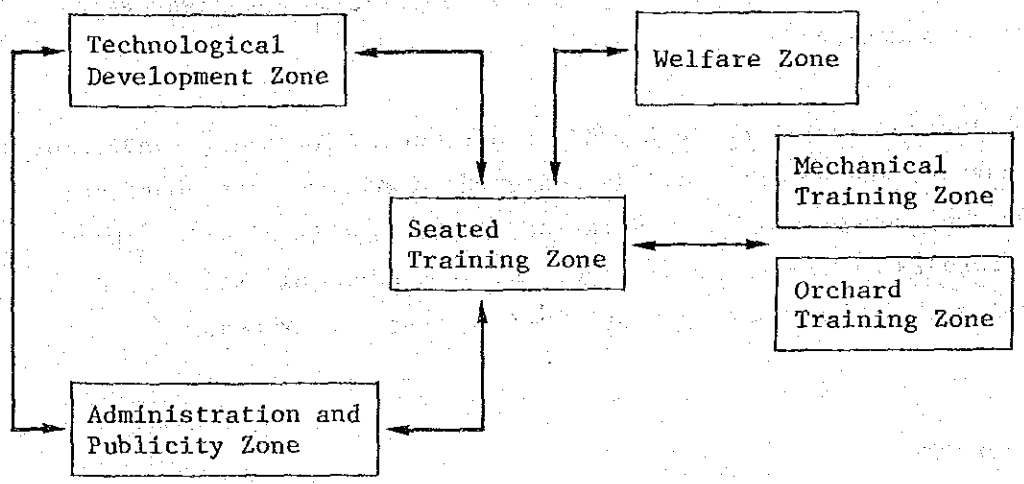
Laboratory and laboratory - Technological development staff room zone

d. Welfare Dept.:

Bedrooms, dining hall - Welfare zone

The functional relationship among these zones are illustrated in Fig. 5-1.

Fig. 5-1



Layout Plan

1) Since the administration and publicity zone must function administratively during daytime to facilitate technological development and research, and training and public relations activities, it must be placed at a position where it can maintain close relationship with the technological development zone and training zone.

2) The technological development zone must maintain close relationship with the training zone for guidance on the training. At the same time, its communication with the administration zone is also indispensable.

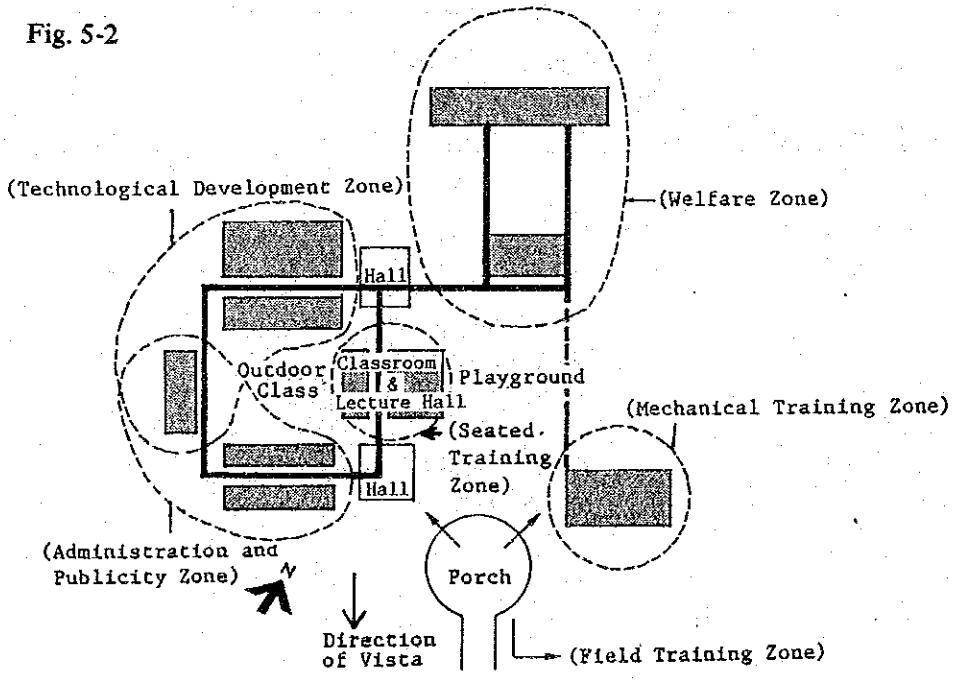
3) The seated training zone is the zone where systematic and theoretical education in pomiculture techniques is comprehensively carried out, and it is a zone that should have integral relationship with both the technological development zone where the instructors stay and the administration and publicity zone where the administration office is located. The workshop in the mechanical training zone concurrently serves as a repair shop of vehicles so that it must be placed at a position easily accessible to vehicles and close to the garage where the vehicles are to be housed.

The field training zone must be adjacent to both the orchard where actual practice is carried out and the stockyard for farm machinery.

4) The welfare zone is the zone for lodging and boarding of trainees and is mainly used at night. It must, therefore, be placed in the rear part of the site where it is quiet.

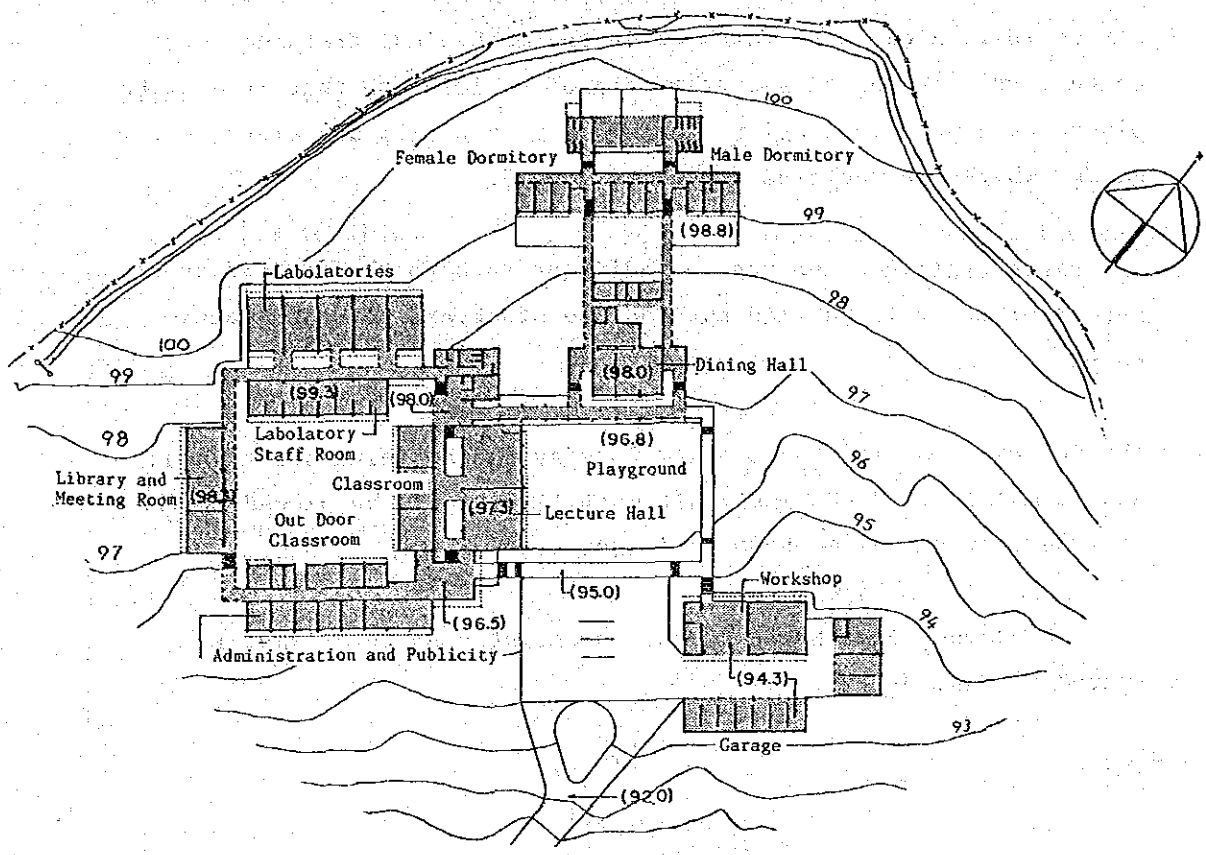
The layout plan based on the foregoing considerations is illustrated in Fig. 5-2.

Fig. 5-2



The Center was designed to achieve easy construction and economy by arranging the buildings along the contour lines in tiers. At the same time, the layout was arranged to afford an open vista, natural ventilation and sunshine. (Refer to Fig. 5-3)

Fig. 5-3 Layout Plan



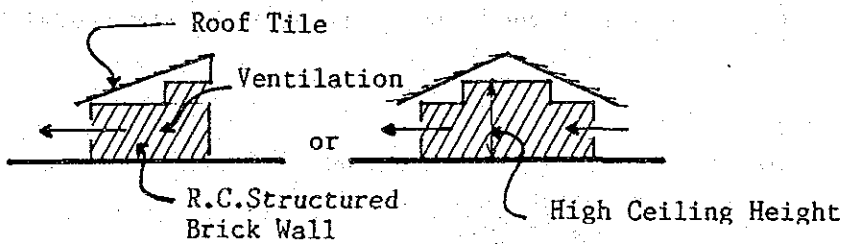
5-2 Architectural Plan

5-2-1 Structural Method

The Center will be single storied so that it allows easy construction, a short construction period and easy use, and mainly constructed by the brick wall structural method with reinforced concrete frame normally seen in Kathmandu today. The grades of structural method were demarcated as follows in consideration of the usage of each room and cost economy.

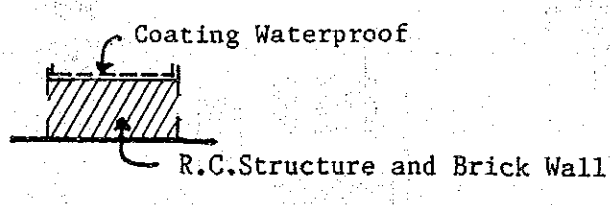
1) Structure of Major Activity Rooms

It will be made of reinforced concrete frame with brick wall mounted with roof of clay tile over wooden frame so as to match the scenery of Kathmandu and also to assure improved insulation and heat retaining performance during summer and winter seasons respectively.



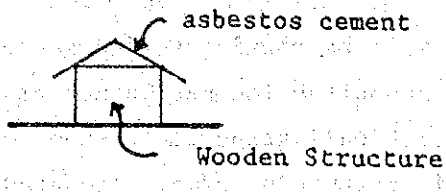
2) Structure of Other Rooms Such as Lavatory, Garage and Corridor

Coating waterproofing on the structure of reinforced concrete frame with brick wall.



3) Light Structures Such as Laundry Room and Covered Walkway

Wooden structure roofed with corrugated asbestos cement sheet.



4) Structure of Farm House

Steel structure roofed with corrugated asbestos cement sheet.

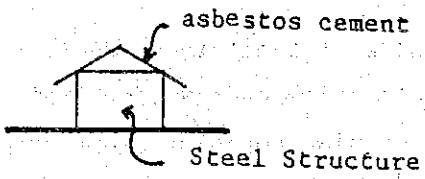
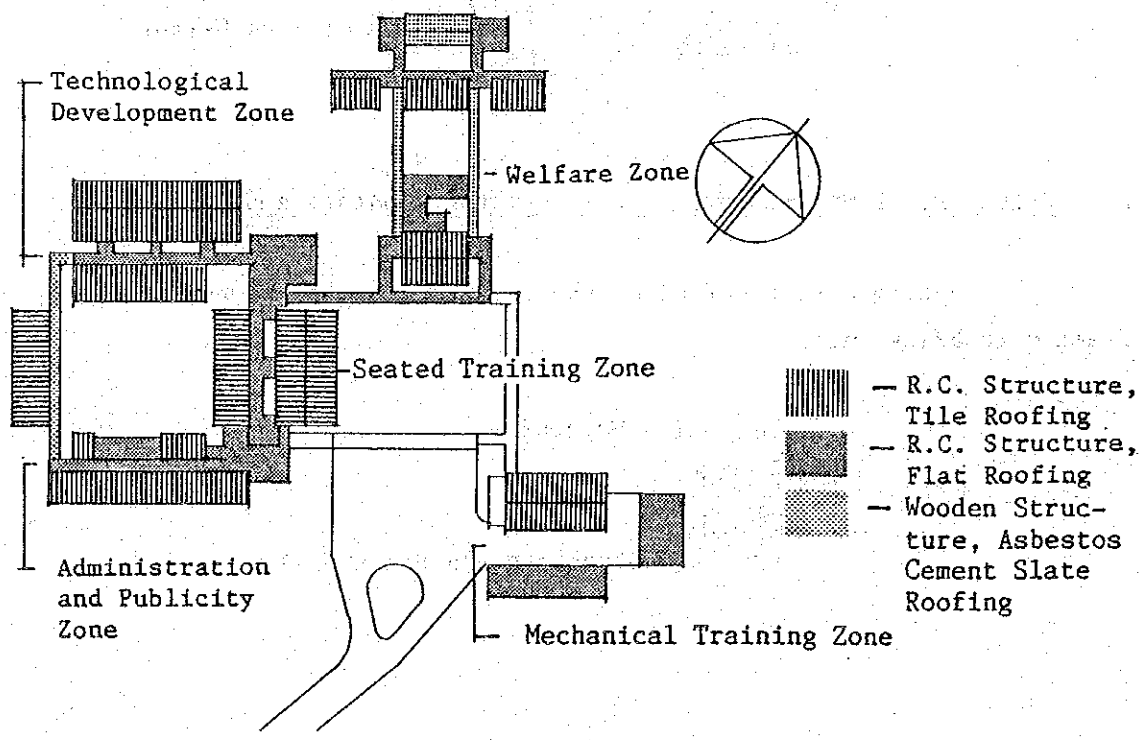


Fig. 5-4 is the layout plan classified by structural methods.

Fig. 5-4



The major activity rooms were designed to afford an unbroken vista (90° each to the right and left in the direction of view that spreads from northeast to south to southwest) to the maximum extent possible, and to shut out the sun in summer and to let the sun in the winter by the protruding pent roof for amenity and to save on maintenance cost. Of the tile roofing, the shed roof is for the office rooms and bedrooms with short room depth, and the high window provided on the other side of the room allows natural light to be taken in from both sides. In overall, it is designed to provide good ventilation and the rooms usable even during power failure which occurs frequently in Kathmandu.

The gable roof will be used for the lecture hall, laboratory, dining hall and other rooms with a large depth. By the use of space under the gable roof, a high ceiling height will be obtained. The rooms on the side of the corridor are designed to face the outdoor lighting yard so that natural light can be taken in from both sides and for the sake of ventilation.

5-2-2 Finishing

As for finishing, 1) the number of types of finishing will be minimized by unifying the type of finish by the function of each room, 2) locally available finishing materials (aggregate, brick, roof tile, asbestos sheet, wood, precast terrazzo, ceramic tile) will be used as much as possible, 3) if materials are not locally available or inferior in quality, Japanese materials (steel and aluminium sash, waterproof material, spraying material) will be used, and 4) the grade of finishing will be as practical as possible to conform with the local situation.

External finish:

Roof - clay tile, coating waterproofing, corrugated asbestos cement sheet

Wall upper than picture rail - corrugated asbestos cement sheet

Wall - brick masonry

Column, beam, slab - fairface concrete with spray coating

Sash - aluminium and steel sash

External floor - brick

Ordinary rooms:

Floor - terrazzo tile

Skirting - mortar with paint

Exterior wall and corridor wall - brick masonry

Partitioning wall - brick masonry, plaster with paint

Column, beam, slab - fairface concrete with spray coating

Water using rooms:

Floor - ceramic tile

Wainscot - porcelian tile

Wall - brick masonry, plaster with paint

Column, beam, slab - fairface concrete with spray coating

5-2-3 Floor Area

Table 5-1

Room	Area (m^2)	Remark
1. Laboratory & Lecture Block:		
Classroom	105	Three rooms, each to accommodate 10 students
Lecture hall	210	Seating capacity for 100 persons
Laboratory	270	Five rooms (pomiculture & breeding, plant physiology & biochemistry, soil science & fertilizer, entomology, plant pathology)
Laboratory staff room	144	33 persons (pomiculture & breeding, soil science & fertilizer, entomology, plant pathology, citrus, grape, chestnut, farm machinery, agrometeorology, extension)
Administrative office	60	9 persons (general affairs, accounting & supply, public relations)
Farm manager's office	20	1 person

Room	Area (m^2)	Remark
Manager's room	20	1 person
Senior staff room	20	2 persons
Health clinic	20	
Reception room	20	Seating capacity for 10 persons
Wireless communications room	16	
Printing room	16	
Meeting room	42	Seating capacity for 20 persons
Library	84	10 readers, 10,000 books
Store room	16	
Peons' room	21	5 persons
Lavatory, kettle room	88	
Corridor, hall	348	
Covered walkway	58	
Laboratory & Lecture Block, Sub-total	1,578	
2. Dormitory Block:		
Bedroom	150	10 rooms with 4 persons to a room
Superintendent quarter	59	
Dining hall	96	16 males, 8 females
Kitchen	42	
Cocker's room	12	
Dormitory keeper's office	12	1 person
Store room	12	
Footwear room	32	
Lavatory & shower	60	
Corridor	79	

Room	Area (m^2)	Remark
Laundry room	42	
Covered walkway	99	
Dormitory Block, Sub-total	695	
3. Covered Walkway:		
Covered walkway	98	
Covered Walkway, Sub-total	98	
4. Workshop Block:		
Workshop	90	
Space for repair work training	72	
Driver's room	27	5 persons
Garage	182	
Electrical room	48	
Workshop Block, Sub-total	419	
5. Farm Management Block:		
Farm machinery garage	168	
Agricultural material room	48	
Fruit storage	24	
Work room	48	
Cold storage, control room	40	
Farm Management Block, Sub-total	328	
Total	3,118	

5-2-4 Design Criteria for Each Structure

1) The lecture hall will be the one which can be converted into two classrooms by means of sliding wall, each to accommodate 50 trainees and to be used as audio visual room. In this case, if the two small rooms are of proper aspect ratio for classroom use, the length of the room would become too long when the two small rooms are connected to be used as one large hall; one room therefore will be designed to have a slope internal structure in tiers for lecture use.

2) The courtyard will be designed in brick-laid tiers to serve as a pleasant outdoor classroom on fine days particularly in the winter time which would be a saving on heating and lighting expenses. It would be desirable to set up a grapevine trellis to shade the sun in the summer and to use the planted grape for the course in actual training practice.

3) According to the local custom, the dining hall and the dormitories will be separated for male and female, but in case of the dining hall, it will be partitioned by a sliding wall so that it can also be used as one room for multiple purposes. The central wing of the dormitory will be designed to have partitioning doors at two places on the corridor so that these doors can be opened or closed by a key to adjust the size of either dormitory according to the ratio of male and female. (28 males : 12 females or 24 males : 16 females)

   By adopting the system of wearing indoor slippers inside the dining hall and the dormitories, cleaning of these rooms would be made easier. As an accompaniment to this system, a footwear room will be provided.

4) Except in the administration and publicity block and dormitory block where traffic is heavy, the corridors will be outdoor passageways with a roof which are often seen locally.

5) The health clinic in the administration and publicity zone will also serve as temporary bedroom for an instructor.

6) Laboratories, wireless radio room, health clinic and printing room which become exposed to the westering sun will be shaded by a wall of trees planted in wooden frames.

7) The plaza in front of the dining hall will be made a playground to be used for physical exercises and recreation of instructors and trainees. A lawn is desirable.

8) A small garden separated from the outside according to local custom by brick walls will be provided in front of the dormitory. From the viewpoint of maintenance, landscaping shall be avoided. The garden of a lawn or a brick-laid yard is desirable therefore.

5-3 Structural Design

5-3-1 Outline

The Center will be single storied, and to make it earthquake resistant, the major structures will be of reinforced concrete rigid frame structure with brick walls which is common in this locality.

The foundation will be the direct foundation type to be laid on the clayey soil stratum about 1 m deep from the current ground level. The reasonable design soil bearing capacity is considered to be about 8.0 ton/m^2 based on the field survey, but this will be determined after boring and loading test on the spot. The length of each building will be around 40 m at the most, and if it becomes any longer, an expansion joint will be provided to prepare for temperature changes and uneven sinking of ground.

5-3-2 Standards

Since Nepal does not have any structural calculation standards, structural calculations will be based on the various structural calculation standards of the Building Society of Japan and Indian Standards by assuming the following external force and load.

a. Seismic force (Indian Standards)

$F = \alpha.h.w.$ $\alpha.h = \alpha o.I.\beta$

in which:

αo : Zonal coefficient (Zone V) 0.08

I : Degree of importance factor (school) 1.5

β : Coefficient of soil reaction 1.2

b. Wind load (Indian Standards)

$P = C.q$

in which:

P : Wind pressure (kg/cm^2)

C : Wind pressure coefficient 1.0

q : Velocity pressure 150 kg/m^2 ($H \leq 30$ m)

c. Life load

To be in accordance with the Building Standard Law of Japan and Indian Standards.

5-3-3 Materials

The major materials to be used shall be as follows:

Concrete : Fc = 210 kg/cm^2 (strength after four consective weeks)
However, cement used shall be either Japanese cement or imported cement of equal quality.

Steel bar : SD30 (D10 - D25)

Steel frame : SS41

5-4 Plumbing Design

5-4-1 Air Conditioning and Ventilation Facilities

1) Air Conditioning Facilities

Upon examining the meteorological conditions and other factors on the site, it was decided that cooling system will not be used. Heating, however, will be necessary in December and January. It will be of localized heating type using electric heater or kerosene stove, and the necessary apparatus for it will be installed by the Nepalese side.

2) Most Rooms will be Naturally Ventilated, and Ventilating Fans and Ceiling Fans will be Installed Only at Necessary Places

The rooms in which ventilating fan or ceiling fan will be installed are:

- Rooms provided with ventilating fan:
  kitchen, soil and fertilizer laboratory
- Rooms provided with ceiling fan:
  laboratories, laboratory staff room, library, meeting room, classrooms, lecture hall, dining hall, various administration offices

5-4-2 Water Supplying Facilities

1) Water Supplying Facilities

In this project, water will be supplied by two systems, one for potable water and another for miscellaneous water to be used for the lavatory, in consideration of the water situation in the area.

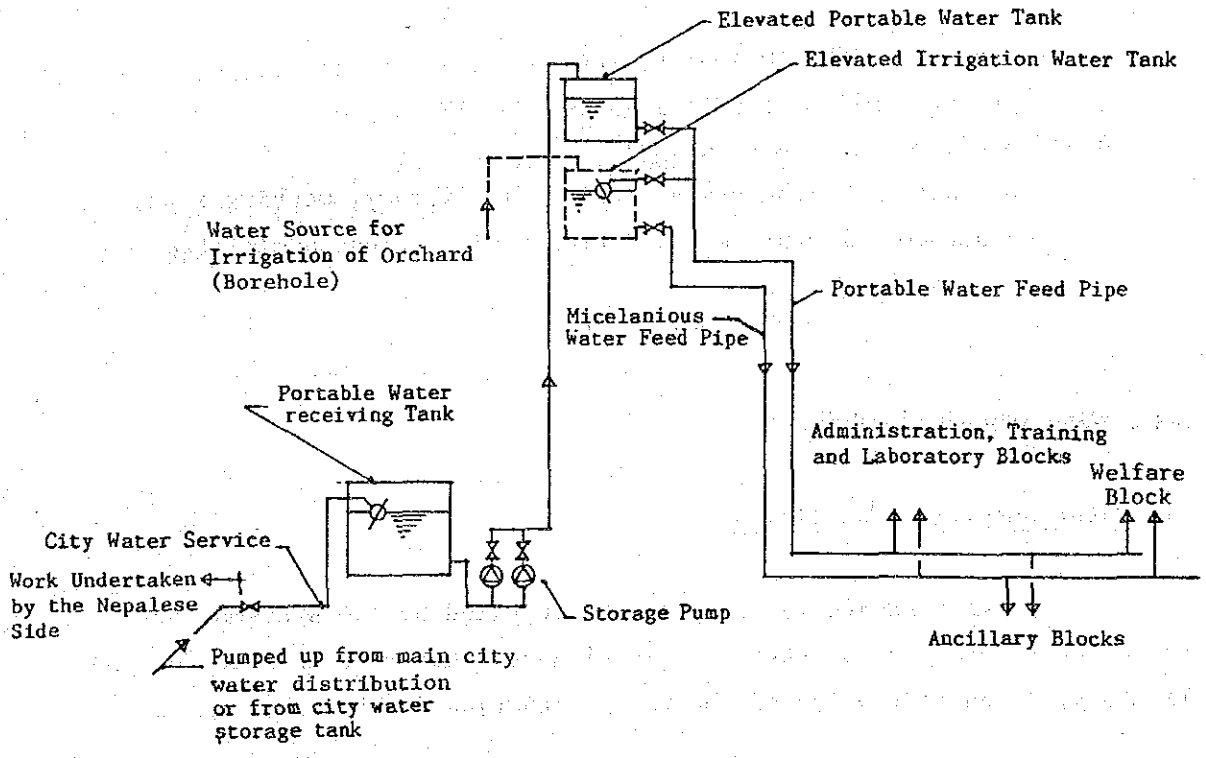
As for potable water, a water receiving tank for exclusive use by the buildings under this project will be set up on the project site to which city water will be drawn in and pumped up to an elevated water

tank for distribution to the necessary buildings by gravity feed. The water receiving tank will be designed to hold one-day supply of water and the elevated tank, one-hour supply of water.

The city water service pipeline laying work from the city water main pipe to the boundary of the site for this project will be undertaken by the Nepalese side, but a survey of the city water supply situation revealed that it would be better to take in the city water directly from the adjacent purification plant rather than from the currently used city water line.

As for miscellaneous water, piping will be branched off from the elevated water tank set up for irrigation of the orchard and fed to the necessary places of the lavatories..

Fig. 5-5 Schematic Diagram of Water Supply System



2) Hot Water Supply System

To save the building maintenance cost, a hot water apparatus using solar energy will be installed on the roof of the welfare block to supply hot water for the shower. The usage rate of the shower was assumed to be 60%. As for hot water supply to the kitchen, LPG water heater will be used for the exclusive use in the kitchen instead of a solar energy hot water system which requires an excessively large initial cost as a large quantity of hot water is used in the kitchen including the time of morning.

3) Drainage and Ventilation Facilities

As for sanitary sewage, a septic tank type sanitation facility instead of a mechanical one will be installed in the proposed site from where the treated sewage water will be discharged into the existing reservoir for irrigation within the site for use as irrigation water.

As for the waste water from the kitchen, it will be discharged only after the oily substances are separated by a grease trap. The gasoline trap for the workshop will be omitted because of the difficulty of maintenance.

Sewage from the stool will be individually discharged to an outdoor catch basin by a separate pipe in order to avoid any clogging by foreign matters.

4) Sanitary Ware and Utensils

In accordance with the local custom, the stools will be eastern style and a water cock will be provided in each booth. As for the lavatory of foreigners western style stools will be provided.

5) Kitchen Ware and Utensils

In consideration of local cooking practice, only the basic appliances such as cooking stand, sink, gas range, refrigerator, etc. will be installed.

6) Gas Facilities

In Nepal, firewood is generally used as heat source for kitchen, but in consideration of the depletion of forest resources and an accompanying rise in the price of firewood, it was decided, upon consulting with the local side, that LPG would be used for this project. LPG cylinders will also be installed in the laboratory block and piped to each laboratory for experiment use.

5-5 Electrical Facilities Plan

5-5-1 Facilities to Receive and Step Down Electricity Supply

A line will be connected to the separately built electrical room at the northern part of the Center's site from the 11 kV overhead distribution line.

The electrical room will house a transformer with capacity of 150 kVA inside a simple cubicle and the incoming power will be stepped down the voltage to 400 V - 230 V in 3 phases with 4 wires. Also, in view of the fact that the local power situation is considerably unstable, an automatic voltage regulator will be installed.

The work of the power line connection into the electrical room and installation of the integrated watt-hour meter will be undertaken by the Nepalese side.

5-5-2 Electric Power Generator

A generator of around 30 kVA will be installed in the electrical room to secure the minimum required power supply to the cold storage cabinet, refrigerator, incubator, laboratory equipment, illumination of corridors and lavatory, water pump for water storage tank, etc. in times of power failure.

- Type: Package type (mounted with control panel and oil tank)
- Cooling system: Water cooling system by a radiator
- Capacity: 3 phases, 3 wires, 400 V (1 phase, 2 wires, 230 V), approx. 30 kVA
- Service tank: About 500 liters and serve as main tank
- Operation: Automatic start up, manual stop

5-5-3 Main Line System

Wiring is necessary to supply power from the low voltage switchgear to the distribution and power panel.

- Supply voltage:

  light, power; 3 phases, 4 wires, 400 V/230 V, 50 Hz

  motor power; 3 phases, 3 wires, 400 V, 50 Hz

- Distribution System:

  Outdoor; trough + cable buried underground

  Indoor; wiring by piping of conduit

Fig. 5-6 Power Receiving and Stepping Down System Diagram

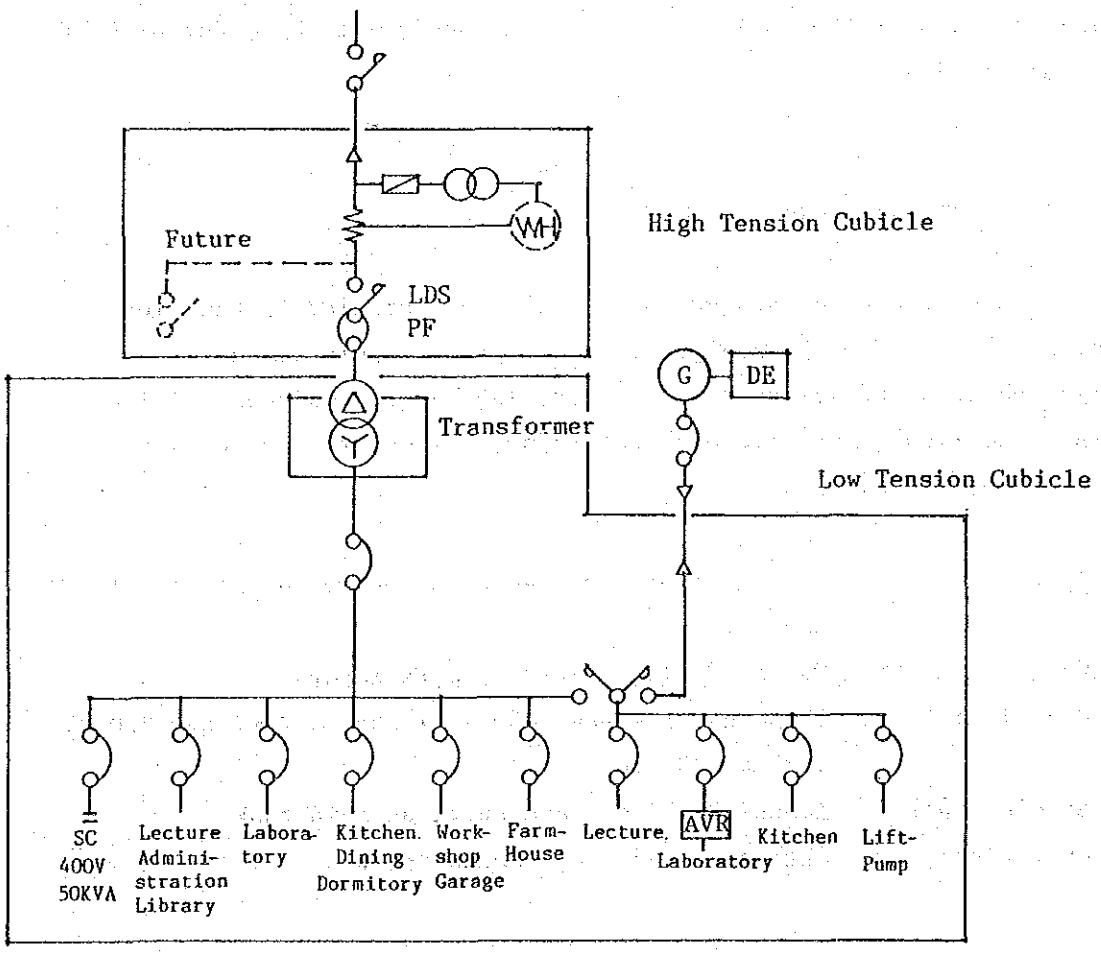
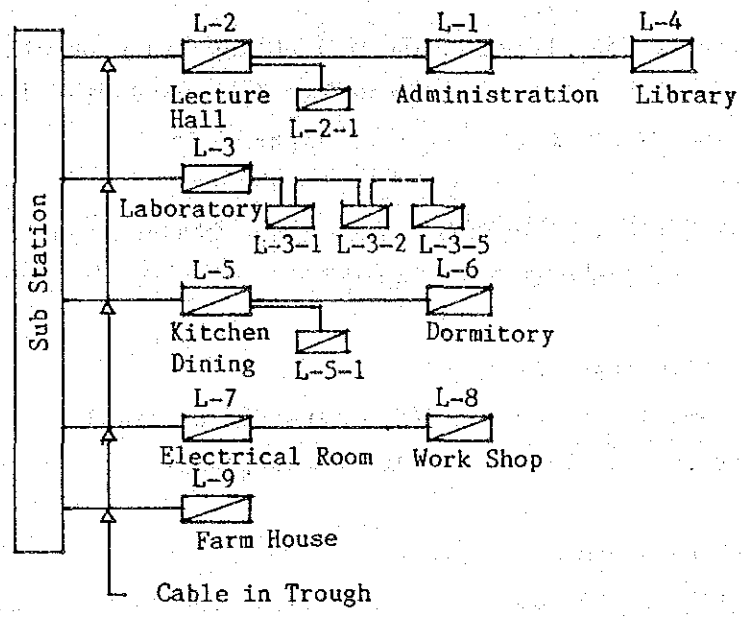


Fig. 5-7 Distribution System Diagram



5-5-4 Power System

A power unit and a controlling device will be provided to drive the pump for water storage tank.

- *Service voltage:* *3 phases, 3 wires, 400 V, 50 Hz*
- Control system: Normally run two pumps reciprocally. However, at a time of emergency, the pumps are run together. The system is actuated by an water level sensor.
- Wiring method: Cable + piping (vinyl pipe)

5-5-5 Lighting and Outlet Receptacles System

A panel board will be installed in each block from where wiring will be connected to light switches, receptacles, fans and other fixtures.

1) Lighting System

The intensity of illumination of lighting fixtures will be set at a low level as the facilities are to be mainly used during daytime and also as the rooms will utilize natural light.

- Light source: Mainly fluorescent lamp (pipe pendant type or fitted with raceway)

- Intensity of illumination:
  Major rooms 100 - 200 lux (40 W fluorescent lamp)
  Corridor 20 - 50 lux (20 W fluorescent lamp)

- Power failure countermeasure:
  1/2 to 1/3 of the lamps in the corridor and lavatory will be lit by the generator.

- Switch: Those made in Japan in accordance with JIS Standards will be used.

2) Receptacles

Receptacles will be provided where necessary. The specifications of the receptacle shall be BS Standards (Square Pin Type).

3) Wiring Method

The conduit pipe method of wiring, which houses the vinyl pipe in the structural body, shall be employed in principle.

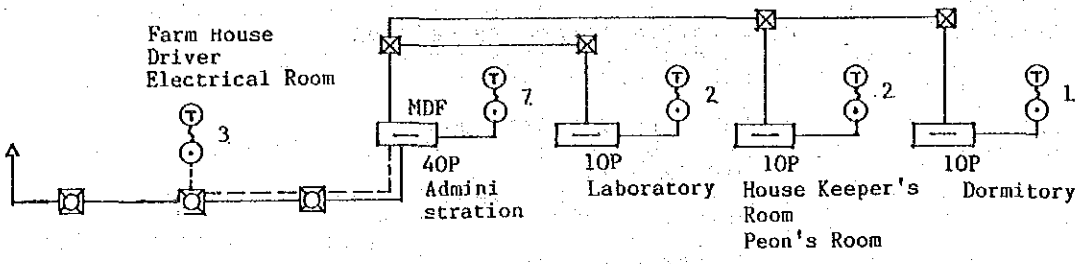
5-5-6 Power System for Laboratory Use

Each laboratory room will be equipped with a power panel to which receptacles, etc. will be fitted so that it can be used as power source. The electrical work will terminate with the fitting of the power panel. All subsequent secondary wiring shall be done as a part of the equipment installation work.

5-5-7 Telephone System

An electronic push button telephone system will be installed for external and internal communications. An underground conduit will be laid from a place close to the existing building (the work to be undertaken by the Japanese side) to connect the city line at the terminal board of MDF in Administration Office (this work to be undertaken by the Nepalese side) via the manhole in the electrical room.

Fig. 5-8



City line:	About 3 lines
Main system:	Built-in battery type
Push button telephone set:	*Electronic system (3 office lines, 24 extension lines)*
No. of telephone sets:	About 15 sets

Administrative office:	2 sets
Manager's room:	1 set
Farm Manager's office:	1 set
Senior staff room:	1 set
Wireless communication room:	1 set
Laboratory staff room:	2 sets
Peons' room:	1 set (secondary set)
Dormitory keeper's office:	1 set (night time switch-over)
Dormitory:	1 set (secondary set)
Driver's room:	1 set (")
Electrical room:	1 set (")
Farm management block:	1 set (")

5-5-8 Public Address System

An amplifier will be installed in the Administration Office to allow announcements to be aired to all of the buildings. The laboratories, a dining hall, a workshop building, and other independent buildings will be provided with a speaker in each room. Also, pipe pendant type speakers fixed to the ceiling will be installed in the corridors.

- Amplifier: 60 W table use type with microphone

- Speaker: Directory attached to ceiling
  - Laboratory: 5 rooms
  - Laboratory staff room
  - Dining hall
  - Driver's room
  - Electrical room

  Pipe pendant type facing two ways: each corridor
  Horn shaped waterproof type: for outdoors, orchard

- Conduit wiring: IV wire + vinyl pipe (housed in the structural body)
  CV cable + vinyl pipe (outdoor)

Another amplifier and speaker will be installed in the lecture hall.

5-6 Orchard Preparation Plan

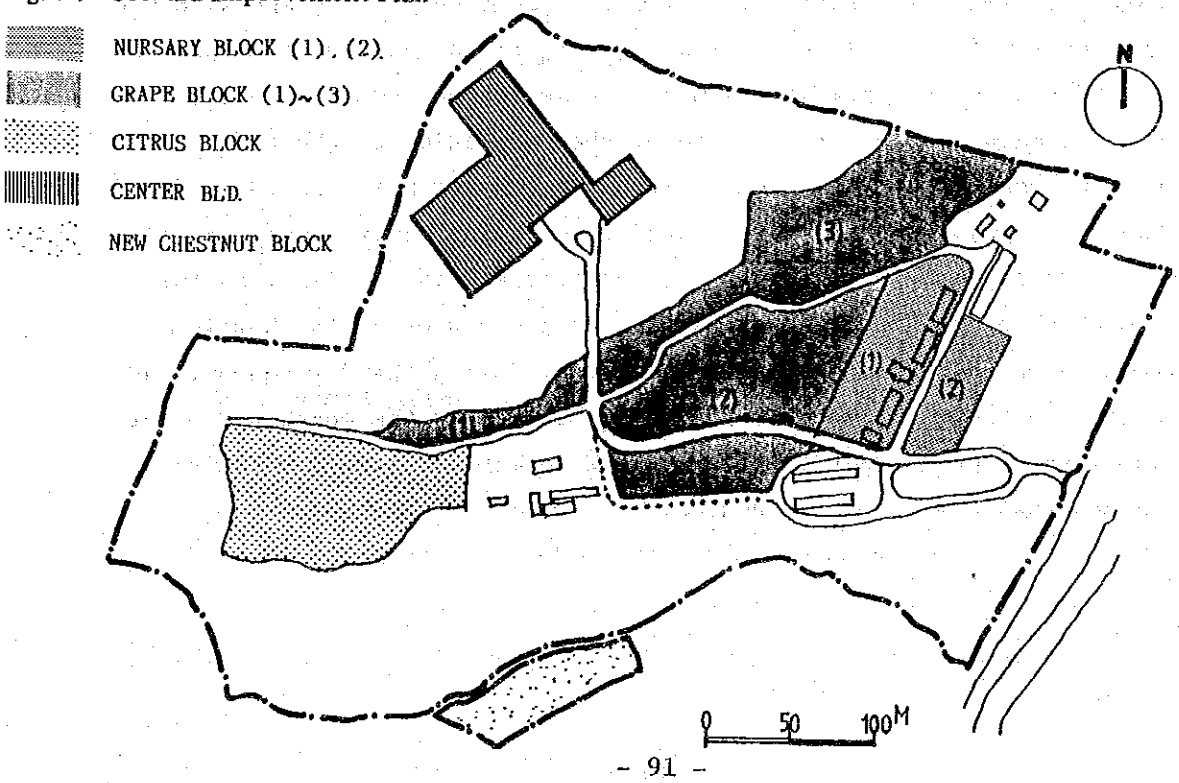
Of the Horticulture Research Station's compound of 20 ha, 8 ha will be used for the Horticultural Development Center. Of this, about 2.75 ha is planned for use as orchard and 0.5 ha is planned for nursery of seedlings.

5-6-1 Composition and Layout Plan of Orchard

Upon considering the contents of research and the need for training to culture citrus fruits, grape and chestnut, the respective blocks to be used for developmental reesarch were decided to be 0.8 ha for citrus fruits, 1.6 ha for grape and 0.35 ha for chestnut.

The layout of the orchard was determined in consideration of topography and soil conditions, and each field was located where it would not be an inconvenience for research and experiment. In other words, as topographic conditions, the drainage conditions were considered, and the ground where mechanized work could be easily performed was selected as the orchard even if it happened to be comparatively inclined. (Refer to Fig. 5-9)

Fig. 5-9 Orchard Improvement Plan



5-6-2 Outline of Facilities on the Orchard

The experimental orchard will be altogether 3.25 ha, consisting of 0.8 ha for citrus fruits, 1.6 ha for grape, 0.35 ha for chestnut and 0.5 ha for nursery of seedlings, and the blocks of the orchard will be planned so that they will harmonize with the use of the existing orchard of the Horticulture Research Station. For instance:

- As for farm road and drainage for irrigation, the existing ones will be utilized. In the grape field block, a grapevine trellis will be installed.

- Glass houses will be built for production of seedlings and to promote the extension and distribution of seedlings.

5-6-3 Required Amount of Water and Water Source

The Bagmati River which flows on the east of this project site has abundant discharge and never dries up even during the dry season. It is therefore a desirable water source, but the idea of pumping water from this river was foregone under this project because the Horticulture Research Station built such a system more than twenty years ago with the aid of India which had sought its water for irrigation from the Bagmati River and had built a pump station soon came to face numerous difficulties in maintenance - for instance, the foundation of the pump station became unstable due to the river bed having been eroded by flood during the rainy season, and the foundation of the water conveyance pipe corroded badly - so that it had to be dismantled since. Also, as the stream which flows through the lowlands in the center of the Horticulture Research Station frequently dries up during the dry season, and also because the Kathmandu Waterworks is scheduling the construction of an auxiliary storage reservoir in the upstream, this stream was also given up as a possible water source.

Fortunately, a borehole which was test drilled near the front porch of the Horticulture Research Station is spontaneously welling up so that the use of this borehole is being considered by installing a pump. If the pumping out test proves the pumping rate to be inadequate, another borehole will be drilled beside it.

1) Required Amount of Water

Assuming that the deep well will serve as the water source for the entire area, the required amount of water was estimated as follows:

$$Vs = \frac{Do \times 10{,}000 \times Au}{1{,}000\ E} = 249\ m^3/day$$

in which:

Do = required water depth, 6 mm/day
(In Japan Standard, water consumption rate for fruit trees is assumed to be 4.8 mm/day. However, it was assumed to be 6 mm/day for Nepal since evaporation rate is higher during the dry season)

Au : planned area, 2.9 ha
(except the block for chestnut)

E : irrigation efficiency, 0.7

Thus, the capacity of the pump shall be:

$$Qp = \frac{K\ Vs}{60\ t} = \frac{K\ Do\ Au}{6\ t\ E} = 0.380\ m^3/min$$

in which:

t = daily water supply hours (12 hr)

K : conveyance loss compensation factor, 1.1

Miscellaneous water:

The miscellaneous water is used in the daytime, which gives the rate of 25 liter/day/person. As the trainees use such water all day long, the rate is assumed to be 50 liter/day/person.

55 staff x 25 liter/day = 1,375 liter/day

41 trainees x 50 liter/day = 2,050 liter/day

Total: 3,425 liter/day

Qp2 = 0.0048 m^3/min

Grand Total: Qp1 + Qp2 = 0.380 + 0.0048 = 0.38 m^3/min

Determination of the required capacity of the water pump:

Determination of the required capacity

(1) Water Power $W = \frac{rQH}{60 \times 102}$ kW $= \frac{1{,}000 \text{ kg/m}^3 \times 0.4 \text{ m}^3/\text{min} \times 120 \text{ m}}{60 \times 102}$

$$= \frac{48{,}000}{6{,}120} = 7.8 \text{ kW}$$

in which:

w : Water Power (kg/s)

r : Specific Gravity of Water (kg/m^3)

Qp : Pumping Volume (0.4 m^3/min)

H : Total Pumping Height (120 m)

1 kW : 102 kg/s

(2) Axle Power $S = \frac{W}{n}$ kW $= \frac{7.8}{0.7} = 11.2$ kW

in which:

s : Axle Power (KW)

n : Pump Efficiency Factor (0.7)

(3) Required Motor Capacity

$$R = \frac{S\ (1 + k)}{nt} = \frac{11.2 \times 1.1}{1} = 12.3 \text{ kW}$$

in which:

R : Required Motor Capacity

k : Allowance Coefficient 0.1

nt : Conveyance Efficiency Factor 1

(4) Revolution Rate of Pump

$$N = \frac{120f\ (1 - p)}{z}\ \text{rpm} = \frac{5,880}{2} = 2,950\ \text{rpm}$$

in which:

f : Electricity Frequency 50 Hz

p : Slipping Factor 0.02

z : Electric Pole Number 2

2) Plan for Deep Borehole

Based on the current condition of the test borehole, the borehole diameter shall be 300 mm and the depth of 120 m. Principal particulars of the borehole shall be as follows:

Table 5-2

	Diameter	Depth	Pump Caliber	Output	Revolution rpm	Pumping Rate
No.1	300 mm	120 m	80 mm	15 kW	2,940	400 liter/min
Stand by	100 mm	120 m	65 mm	15 kW	2,940	400 liter/min

3) Plan for the Regulating Reservoir

A. Capacity of the Regulating Reservoir

While water conveyance at a constant rate is desirable, considerations are necessary to cope with fluctuations in water demand at the terminal end of the distributing system in the following cases.

(1) To align the timing of irrigation at the terminal end with that of trunk line water conveyance.

(2) To alleviate the heavy concentration of demand for irrigation water during a particular time.

(3) For smooth operation control of the pumping facility and the diversion facility.

(4) For smooth control of water conveyance.

(5) The event of breakdown of irrigation facility.

(6) Curtailment to cope with demand for irrigation water at the terminal end.

(7) Risk of failing to the seedling growing particularly in the glass houses in the event the water supply is cut off.

(8) When spraying becomes necessary for prevention of frost damage: On a windless night when the air strata are stable, there is danger of frost damage because heat transport by the turbulent current is small and the temperature close to the ground surface drops by the transfer action of infrared ray radiation. To prevent frost damage, spraying is necessary.

In view of the foregoing, regulating reservoirs are desirable. Accordingly, the existing regulating reservoir will be utilized after necessary repairs. The storage capacity of this reservoir is 108 m^3. As this will store 40% of the necessary quantity of irrigation water, it will adequately cope with every one of the aforementioned situation.

For the same reasons, a new regulating reservoir of 25 m^3 in capacity to store about half of the required 48 m^3 of necessary irrigation water will be constructed for the citrus block.

B. Determination of the Elevated Water Tank Capacity

As the grape block (2) is located above the height of the regulating reservoir, 1/4-day supply of irrigation water plus one-day supply of water for miscellaneous use of 3,400 liters, or a total of 16 m^3 was decided as the capacity of the elevated water tank. The principal particulars of the regulating reservoirs and the elevated water tank shall be as follows.

Table 5-3

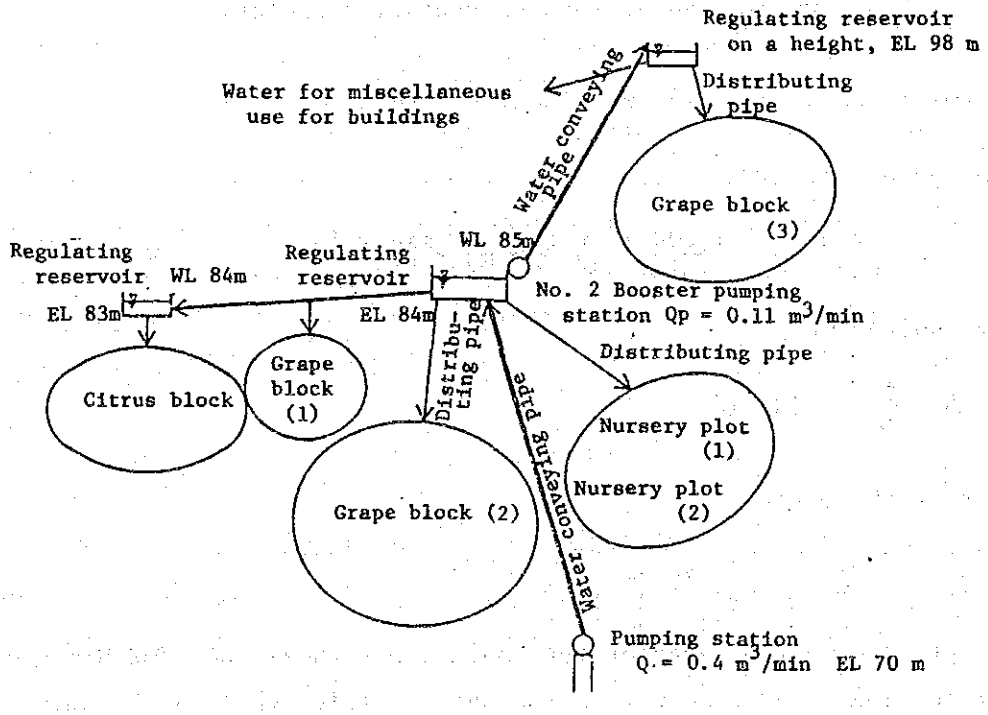
Water Tank	Storage Capacity	Dimensions
Regulating reservoir	108 m^3	10 m x 10 m x 1.0 m
Second regulating reservoir	25 m^3	5 m x 5 m x 1.0 m
Elevated water tank	16 m^3	2 m x 2 m x 4 m

4) Form of Water Channel and Water Conveyance System

The closed type pipe water channel will be adopted in consideration of the location of water sources, irrigation method, topography and farming conditions.

As for the conveyance and distribution system, because there is a height difference between the water tank and the orchard, closed type water receiving channel will be adopted to minimize the water pipe control loss, and the water will be distributed by the gravity flow method to save on maintenance and control expenses.

Fig. 5-10 Layout of Orchard Irrigation Facilities



5) Booster Pumping Equipment for Grape Block (3) and Water for Miscellaneous Use

(2) Required Quantity of Water

Irrigation water

$$Vs1 = \frac{Do \times 10{,}000 \times Au}{1{,}000\ E} = 68.6\ m^3/day$$

in which;

Do : 6 mm/day

Au : 0.8 ha

E : irrigation efficiency, 0.7

Water for miscellaneous use $Vs2 = 3.4\ m^3/day$

Required quantity of water $Vs = Vs1 + Vs2 = 72\ m^3/day$

Pumping rate

$$Qp = \frac{K\ Vs}{60\ t} = \frac{79.2}{720} = 0.11\ m^3/min$$

in which;

t = No. of hours water is supplied per day (12 hours)

K : Water channel loss compensating factor, 1.1

(2) Determination of the Required Power of the Motor

Water power

$$W = \frac{rQH}{60 \times 120} = \frac{1{,}000\ m^3 \times 0.11\ m^2/min \times 15}{60 \times 102} = 0.27\ kW$$

Shaft horsepower

$$S = \frac{W}{n} = 0.385\ kW$$

Power of the motor

$$R = \frac{S(1 + k)}{nt} = 0.46\ kW$$

From the performance of the small centrifugal pump (50 Hz) and its specifications, the diameter of the suction inlet shall be 50 mm.

(3) Determination of Pump Capacity

Total head 15 m, diameter 50 mm, pumping rate 0.11 m^3/min, output 0.75 kW.

5-6-4 Orchard Irrigation Plan

In order to irrigate whole area of the orchard (citrus and grape blocks) uniformly with sprinkler, the sprinklers must be arranged with appropriate spacing between sprinkling laterals.

1) Sprinkling Irrigating System

The irrigation water pumped up from the well and stored in the regulating reservoir will be directly distributed to grape blocks (1) and (2) and nursery plots by underground piping. Water to the citrus block will be conveyed from the regulating reservoir to the second regulating reservoir and then distributed. Since grape block (3) is located at a higher elevation than the regulating reservoir, the water must be pumped up to the elevated water tank for distribution. For sprinkling laterals, polyethylene pipe will be used. The laterals will be set stationary on the ground for the duration of the cropping period but removed during tilling. At the terminal end, small sprinklers with a small flow rate will be arranged at narrow intervals to be used for maltiple purposes, for instance for disease and insect control, fertilizer application, etc. Especially for the grape blocks and citrus blocks which are steeply sloped and where the nursery plots, which need to be irrigated with great frequency, are located, the stationary ground surface sprinkling system (the system between the portable and the stationary) will be adopted.

2) Orchard Plan

To save water consumption, the irrigation block consisting of an area 20 m wide and 100 m long will be irrigated by an intermediate pressure sprinkler of 20 m to 30 m in sprinkling diameter.

3) Irrigation System at the Terminal End

As the sprinklers on each terminal sprinkling lateral operate simultaneously, all blocks within the area controlled by them will be organized to compose rotation blocks so that each block will be given its turn to be irrigated once in a specific number of days.

4) Sprinkling Intensity

As the blocks of this orchard are of clayey soil and are located on a slope (on about 15°), the irrigation intensity shall be controlled to the maximum of 7 mm/hour to prevent soil erosion.

Fig. 5-11 Sprinkler System

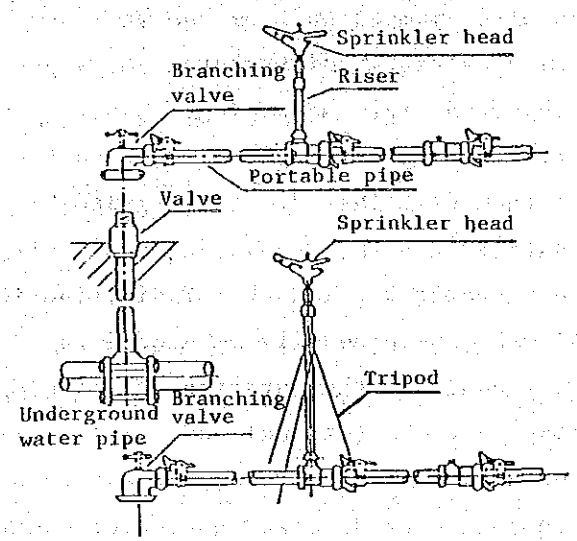
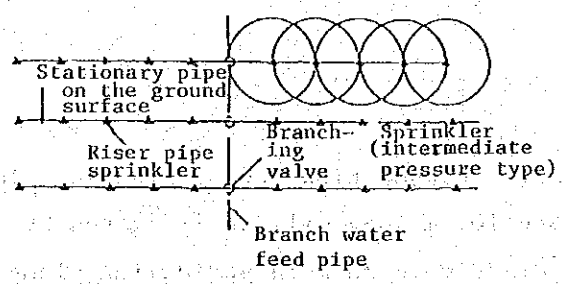


Fig. 5-12 Stationary, Ground Surface-Type Sprinkler Laterals



5) Mist System within Glass House

As a measure to constrain high temperature inside the glass house, a mist sprayer will be installed to hold the temperature within 5°C above external atmosphere. As the mist sprayer sprays fine droplets of water (of about 50 microns) against the air that comes into the hot house to cool it by evaporation, waterdrops tend to run into the hot house. In order to prevent this, an eliminator will also be installed.

Glass House (with Cooling System) and Glass House Plan

Selection of Member Parts

As the glass house is always hot and humid inside and has the danger of being eroded by chemicals, the frame of the hot house will be built of shaped and processed products of special galvanized, light weight, shaped white-LG steel. All other parts will be aluminium member parts.

Glass House Standard Specifications

1) Design Criteria

- Design wind velocity: 55 m/sec
- Seismic force: Horizontal seismic coefficient 0.2

However, the localized wind pressure on the surface of roof shall be calculated on the assumption that the negative wind force factor is 1.5 for the corner area of the roof within 1/10 of the length from each of eave, verge, and ridge.

2) Outline of Structure

- Foundation: independent foundation made of reinforced concrete, with strip footing made of concrete block

- Framework: light weight steel frame, Rahmen rigid frame structure for the span, braced structure for girder

However, the length of span in the direction of beam spacing to be 9.0 m x 2 and frame pitch in the direction of girder depth to be 3.1 m.

- Eave height: 2,110 m (including strip footing of 300 m)
- Ridge height: 4,405 m (")
- Covering material: Glass Normally 3 mm
  Locally 5 mm
- Pitch of roof: 5/10

3) Performance

- Allowable resistance against wind force 55 m/sec per "Preliminary Standard" of the Safe Structure Standard of Horticulture Structures.
- Water tightness: 20 kg/m^2 per JIS A4706 test method
- Air tightness: 15 m^2/hrm

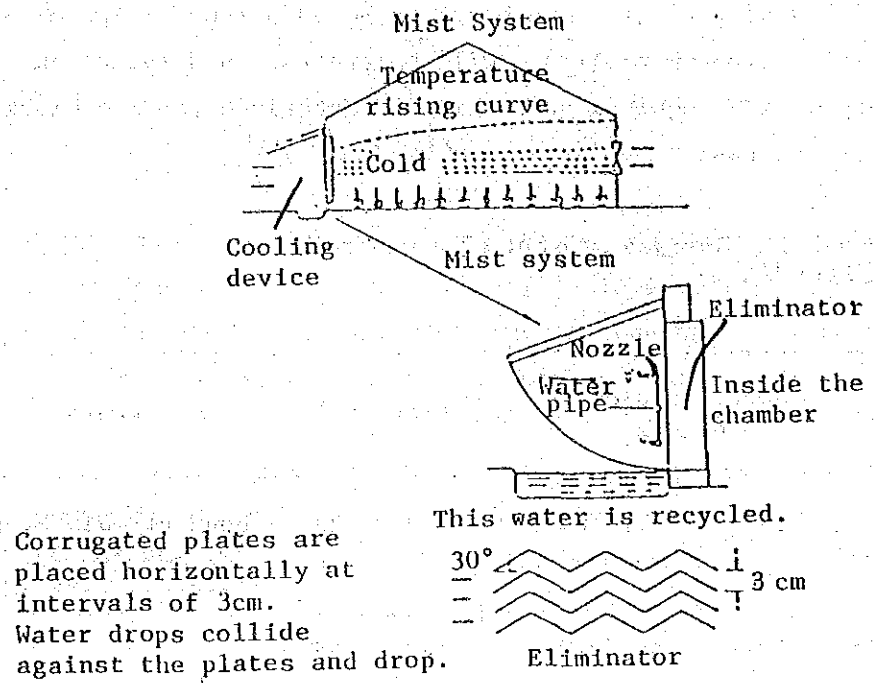
4) Other Specifications

- Toplight: one single pane (on both roof)
  . Opening and closing angle:
  5° to 10° in angle of elevation from horizontal angle.
  manual operation

- Girder window: four cross sliding windows (aluminum fittings)

- Doorway: twin cross sliding doors with external lock (made of aluminium)

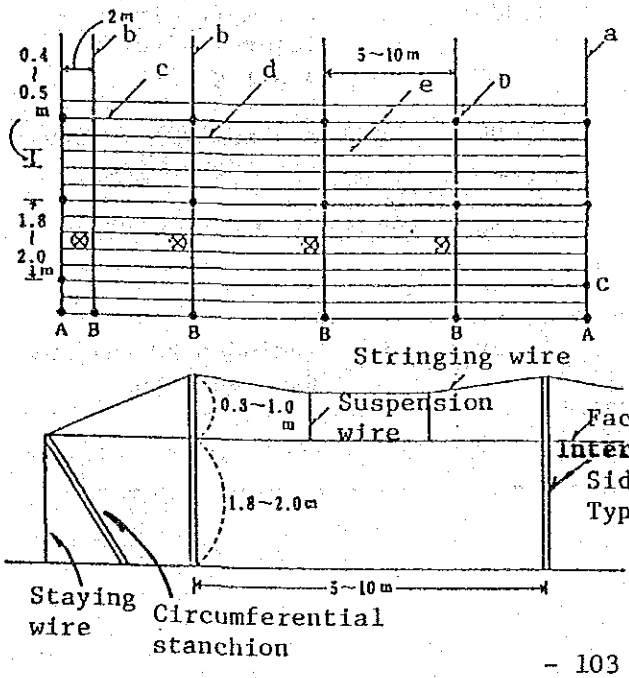
Fig. 5-13 Mist System for Cooling Glass House



5-6-5 Erection of Grapevine Trellis

For culturing of Neo-Muscot, Berry-A, Pione and Kyoho which are varieties that bear the largest number and size (weight) of fruit bunch to the number of leaves, the types of trellis were decided to be the stringing type short treetop trellis and the all-back trellis.

Fig. 5-14



Plan of all-back trellis
A: Corner stanchion
B: Lateral line stanchion
C: Circumferential stanchion
D: Intermediate stanchion
a: Circumferential wire
b: Lateral wire
c: Main wire
d: Auxiliary wire
e: Secondary wire
⊗: Tree

Two blocks of trellis - one block to be 50 a (50 m x 100 m) of stringing type short treetop trellis - will be erected in Grape Block (2) on flat ground. The required quantities of materials for one block of trellis are as follows:

Table 5-4 Input Materials for Stringing Type Short Treetop Trellis (50 a : 50 m x 100 m)

Input Material	Specifications/ Dimensions	Quantity	Unit	Remark
Steel pipe corner stanchion	89.1x2.8x2,750mm	4	ea	Span of main branch 2m, spacing between lateral wires 10m
Steel pipe circumferential stanchion	42.7x2.3x2,300mm	58	ea	
Steel pipe intermediate stanchions	42.7x2.3x2,330mm	100	ea	
Circumferential wire	#14x7wires (22sq. twisted wire)	310	m	
Stringing wire/ staying wire	#13x3wires (twisted wire)	1,800	m	Staying wire used only for corner stanchions
Semi-steel wire	#12 (2.6mm)	2,300	m	For main wire, lateral wire, staying wire
Semi-steel wire	#14 (2.0mm)	11,000	m	For auxiliary wire, secondary wire
Receptacle stone		158	ea	
Anchor	Large sized	4	ea	
Anchor	Medium sized	78	ea	Includes 20 pulling down anchors
Wire clip		80	ea	

5-7 Equipment Plan

The necessary equipment for this Center were selected with due attention to the following points.

1) Regarding research and experiment equipment for technological development, only those which are indispensable for basic research were selected. Duplication of any of the same equipment needed by each laboratory was avoided as much as possible.

2) The experimental equipment and materials for training will be of such contents and level as to be enhance the educational effects in consideration of the fact that the objective of the training is to improve the quality of the pomiculture technical workers in Nepal.

3) The introduction of modern farm machinery was avoided as much as possible. Instead, equipment which are easy to be maintained by periodical checkups and for which spare parts are easily replaceable were selected. Also, maintenance parts and tools for repairs were selected.

4) Equipment with low running cost and which are easy to maintain and operate were mostly selected.

5) The quantities were determined in consideration of the training program of the Center, the number of operating staff, etc.

6) Equipment for preparing information service media with which to promote the extension of technology among as many of the farmers as possible was selected.

In order to retain the various equipment in proper condition to be used for their intended purposes, it is necessary to offer guidance to the local technicians on maintenance and operation for each equipment and, after completion of the Center, to follow up to

see how they are being maintained. For this purpose, it will be necessary on the part of Japan to be prepared to receive the Nepalese technicians to systematically carry out guidance on operation and to replenish the necessary spare parts by maintaining close coordination with the project-type technical cooperation of Japan in Nepal.

EQUIPMENT LIST FOR THE HORTICULTURE DEVELOPMENT CENTER

EQUIPMENT

1. Pomiculture and Breeding Laboratory
2. Plant Physiology and Biochemistry Laboratory
3. Soil Science and Fertilizer Laboratory
4. Entomology Laboratory
5. Plant Pathology Laboratory
6. Meteorological Observatory Station
7. Wireless Radio Unit
8. Vehicles
9. Office Equipment
10. Audio Visual Equipment and Teaching Aid
11. Farm Machinery and Work Shop

1. POMICULTURE AND BREEDING LABORATORY

No.	Item	Qty.
1.	Growth Cabinet	1
2.	Incubator	2
3.	Stereoscopic Microscope	1
4.	Student Microscope	2
5.	Microscope Photograph Equipment	1
6.	Microtome	1
7.	Micro Analytical Balance	1
8.	Balance with Top Pan(5.0kg)	2
9.	Balance Table	3
10.	Platform Scale (100kg)	2
11.	Automatic Leaf Area Meter	1
12.	Automatic Dyeing Instrument	1
13.	Auto Forming Embedding Instrument	1
14.	Pure Water Collection	1
15.	Homogenizer	1
16.	Refractometer	1
17.	Drying Oven	1
18.	Magness Taylor Hardness Tester	2
19.	Universal Hardness Tester	2
20.	Auto Fruit Juice Analyzer	1
21.	Juicer	1
22.	Autoclave	1
23.	Lux Meter	1
24.	Magnetic Stirrer	3
25.	Caliper (0.2) 30cm, 60cm, 100cm	1 set
26.	PH Meter	2
27.	Titrated Acidity Tester	3
28.	Clean Bench	1
29.	Cold Storage Cabinet (Freezer)	1
30.	Refrigerator	1
31.	Laboratory Center Table	1
32.	Ice Maker	1
33.	Dark Room	1

34.	Photograph Development, Print and Enlargement	1 lot
35.	Camera	1
36.	Calculator	1
37.	Others	

2. PLANT PHYSIOLOGY AND BIOCHEMISTRY LABORATORY

No.	Item	Qty.
1.	Micro Analytical Balance	1
2.	Semi Micro Analytical Balance with Top Pan	1
3.	Balance Table	2
4.	Water Bath	1
5.	Evaporator	2 set
6.	PH Meter	1
7.	Refrigerator	1
8.	Incubator	1
9.	Pure Water Collector	1 set
10.	Paper Chromatography Assembly	1 set
11.	Electric Chromatograph Assembly	1 set
12.	Laboratory Center Table	2
13.	Others	

3. SOIL SCIENCE AND FERTILIZER LABORATORY

No.	Item	Qty.
1.	Soil Crusher	1
2.	Drying Oven	1
3.	Shaking Machine	1
4.	Electric Furnace	1
5.	Hot Plate	1
6.	Incubator	2
7.	Electric Heater	1
8.	Soil Standard Sieves	1 lot
10.	PH Meter	1

11.	N Analysis Apparatus	1 lot
12.	Water Bath	1
13.	Evaporator	1 set
14.	Penetration Apparatus	1
15.	Soil Sampler	1
16.	Soil Auger	1
17.	Soil Sample Preparation Apparatus	1
18.	Soil Sedimentation Analysis Apparatus	1
19.	Soil Drying Shelves	3
20.	Electric Vacuum Cleaner	1
21.	Ion Meter	1
22.	Soil Actual Volumenometer	1
23.	Draft Chamber	1
24.	Magnetic Stirrer	3
25.	Titrate Apparatus	5
26.	Sucking Machine	1
27.	Conductivity Meter	2
28.	Colorimeter	1
29.	Micro Analytical Balance	1
30.	Semi Micro Analytical Balance	1
31.	Platform Scale	1
32.	Balance Table	2
33.	Laboratory Center Table	1
34.	Calculator	3
35.	Others	

4. ENTOMOLOGY LABORATORY

No.	Item	Qty.
1.	Analytical Microscope	1
2.	Student Microscope	5
3.	Desiccators	2 set
4.	Anatomy Set	10
5.	Insect Collection Box	60
6.	Cabinet for Insect Boxes	4

7.	Epidiascope	1
8.	Pesticide Handling Kits	5
9.	Power Sprayer	1
10.	Portable Electric Sprayer	1
11.	Analystic Balance	1
12.	Macro Analystic Balance	1
13.	Balance Table	2
14.	Laboratory Center Table	1
15.	Insects Growing Chamber	2
16.	Others	

5. PLANT PATHOLOGY LABORATORY

No.	Item	Qty.
1.	Clean Bench	1
2.	Gas Heater	1
4.	Refrigerator	1
5.	Deep Freezer	1
6.	Incubator	2
7.	Micro Analytical Balance	1
8.	Balance Table	1
9.	Drying Oven	1
9.	Water Bath	1
10.	Microscope	1
11.	Anatomy Microscope	1
12.	Sterillizer	1
13.	Autoclave	1
14.	Paraffin Spreading Warmer	1
15.	Paraffine Embedding Oven	1
16.	Paraffine Embeding Mould Brass	1
17.	Sample Dyeing Apparatus	1 set
18.	Koch Sterillizer	1
19.	Microtome	1
20.	Power Sprayer	1
21.	Hand Sprayer	1

22.	Knap Sack Sprayer	1
23.	Pathogen Stock Chamber	1
24.	Laboratory Center Table	1
25.	Balance Table	1
26.	PH Meter	1
27.	Others	

6. METEOLOGICAL OBSERVATORY STATION

No.	Item	Qty.
1.	Max. and Min. Thermometer	1
2.	Dry and Wet Bulb	1
3.	Rain Gauge	1
4.	Wind Anemometer and Anemoscope	1
5.	Barometer	1
6.	Sunshine Recorder	1
7.	Evaporation Pan	1
8.	Soil Thermometer	1
9.	Instrument Screen	1
10.	Evaporimeter	1
11.	Actinograph	1

7. WIRELESS RADIO UNIT

No.	Item	Qty.
1.	Wireless Radio Unit	1 set
2.	Solar Generator	2

8. VEHICLES

No.	Item	Qty.
1.	Passenger Vehicles	2
2.	Micro-bus	1
3.	Truck	1
4.	Pick Up	1

9. OFFICE EQUIPMENT

No.	Item	Qty.
1.	Word Processor	1
2.	Electric Type Writer (English)	1
3.	Type Writer (English)	1
4.	Type Writer (Nepalese)	2
5.	Mimeograph 550	1
6.	Punching and Binding Equipment	2
7.	Book Binding Machine	1
8.	Electric Calculator	3
9.	Calculator (Portable)	5
10.	Photo-copy	1
11.	Camera	2
12.	Others	

10. AUDIO VISUAL EQUIPMENT AND TEACHING AID

No.	Item	Qty.
1.	Audio Visual Set Amplifier, Tuner, Turn Table, Cassette Deck, Mixing Console, Speakers, Mic w/Stand	1
2.	Overhead Projector	1
3.	Slide Projector	1
4.	Portable Tape Recorder	1
5.	Video Camera	1
6.	Movie Projector 16mm	1
7.	VTR 1/2 VHS	1
8.	Monitor 26"	1
9.	Editing Machine for VTR	1
10.	Color Video Projection System	1

11. FARM MACHINARY AND FOR WORKSHOP

No.	Item	Qty.
1.	Tractor	1
2.	Disc Harrow	1
3.	Disc Plough	1
4.	Rotary Cutter	1
5.	Trailer for Tractor	1
6.	Hole Digger	1 set
7.	Trencher	1
8.	Speed Sprayer	1
9.	Portable Reaper	5
10.	Power Tiller	1
11.	Trailer for Tiller	1
12.	Knap Sack Sprayer	2
13.	Power Sprayer	2
14.	Baby Mower	2
15.	Rotary Mower Surrounding Trunk	1
16.	Battery Quick Charger	1
17.	Oil Charger	1
18.	Parts Washer	1

19.	Bench Grinder	1
20.	Motor Garage Jack	1
21.	Electric Drill 10mm	1
22.	Disc Sander	1
23.	Tool Stand	1
24.	High Speed Cut Off	1
25.	Grease Pump	1
26.	Electric Welder	1
27.	Drilling Machine	1
28.	House Jack	1
29.	Test Meter	1
30.	Boldering Heating Torch	1
31.	Lath Machine	1
32.	Electric Hock Saw	1
33.	Oxyacetylene Welder	1
34.	Repairing Tool	2 set
35.	Tool Cabinet	2
36.	Work Table	2
37.	Cold Storage	1

5-8 Basic Design Drawings

LIST OF BASIC DESIGN DRAWINGS

01 SITE PLAN

02 LAYOUT PLAN

03 RABOLATORY AND LECTURE BLOCK PLAN

04 DORMITORY BLOCK PLAN

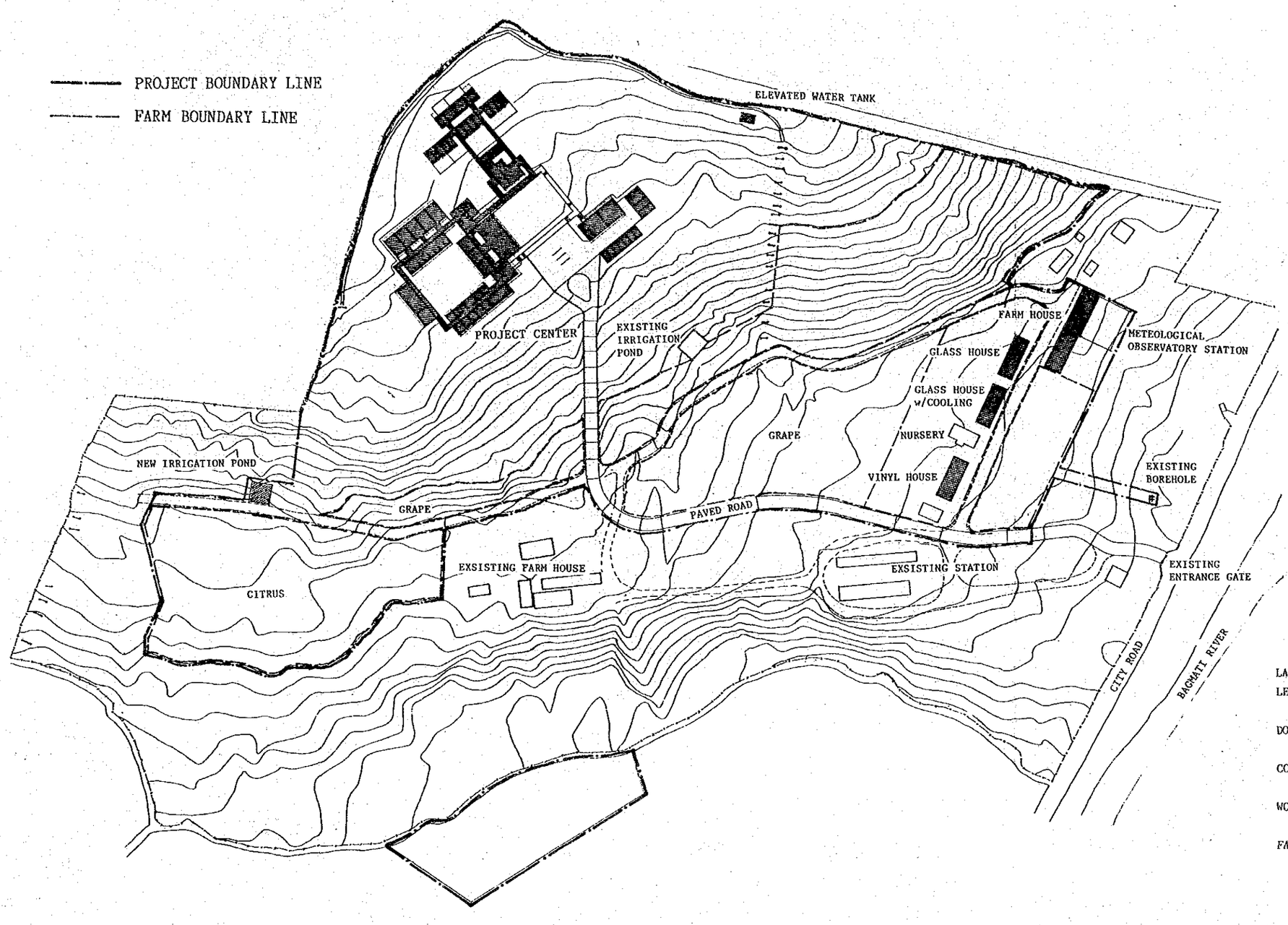
05 ELEVATION

06 ELEVATION AND SECTION

07 WORKSHOP BLOCK AND FARM HOUSE

08 ORCHARD IMPROVEMENT PLAN

09 FURNITURE LAYOUT PLAN



FLOOR AREA TABLATION

LABORATORY AND LECTURE BLOCK	1,578 sqm
DORMITORY BLOCK	695 sqm
COVERD WALKWAY	98 sqm
WORKSHOP BLOCK	419 sqm
FARM HOUSE	328 sqm
TOTAL	3,118 sqm

SITE PLAN S1:2,000 01

DORMITORY BLOCK

ELEVATED WATER TANK

BM(100.0)

WORKSHOP BLOCK

LABORATORY AND
LECTURE BLOCK

GLASS HOUSE

FARM HOUSE

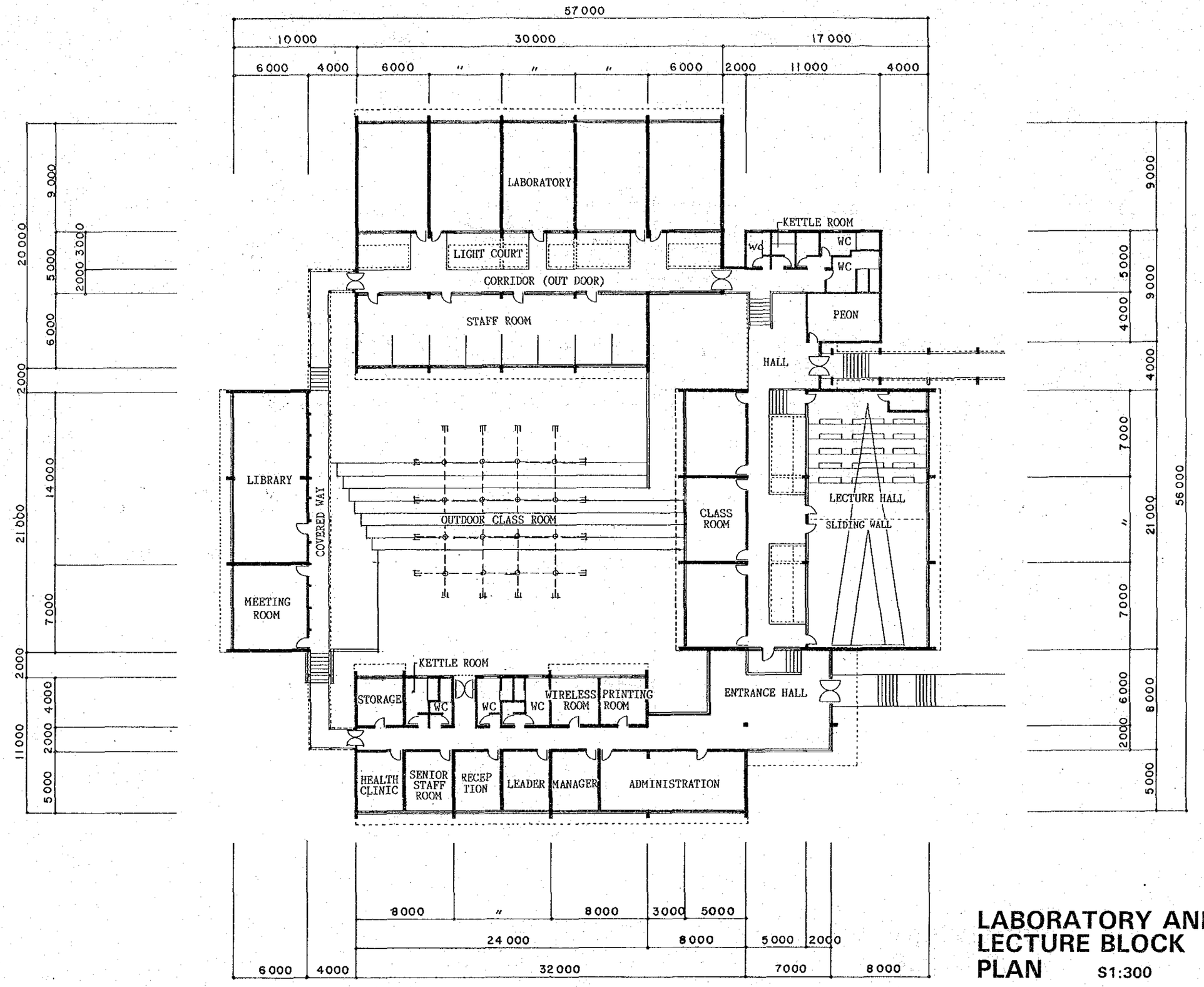
GLASS HOUSE
w/COOLING

VINYL HOUSE

PAVED ROAD

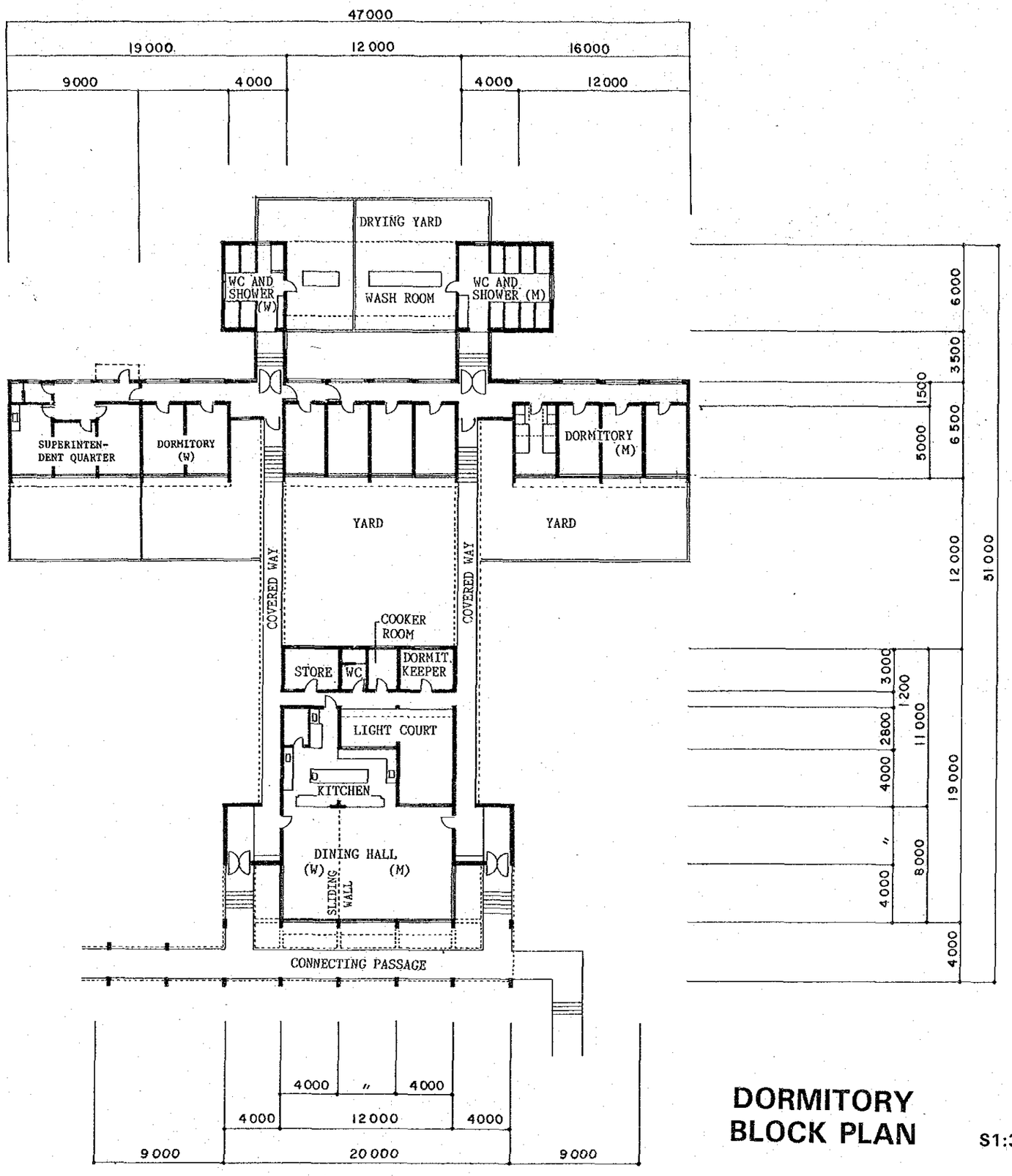
LAYOUT PLAN S1:1,000

02



LABORATORY AND LECTURE BLOCK PLAN 03

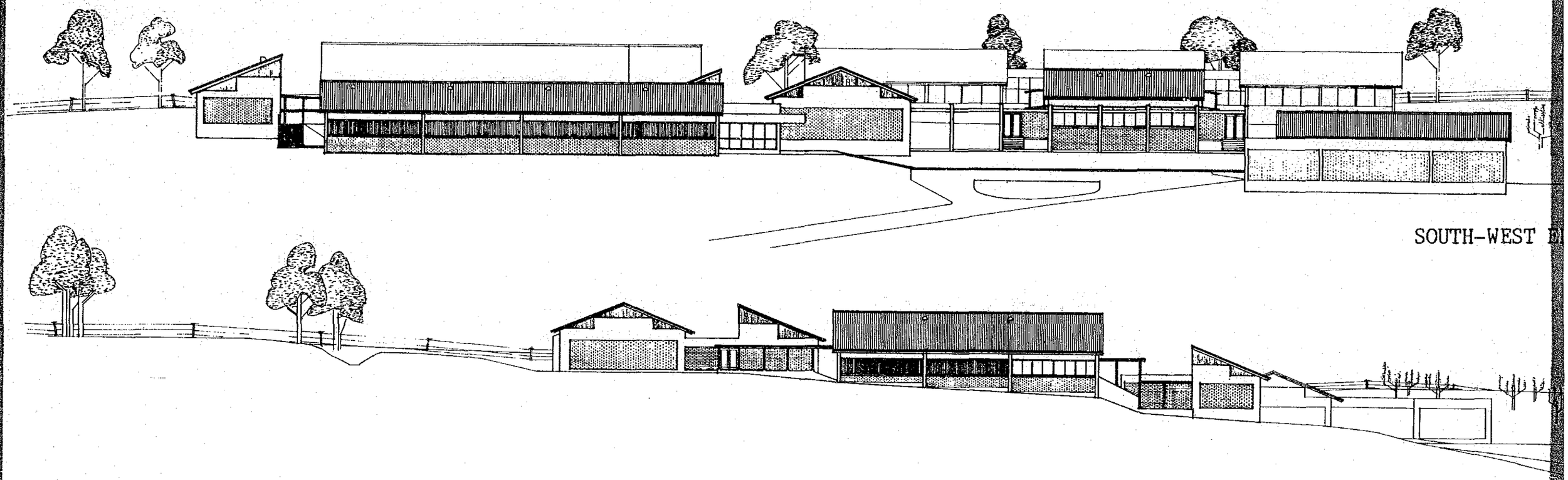
S1:300



DORMITORY BLOCK PLAN

S1:300

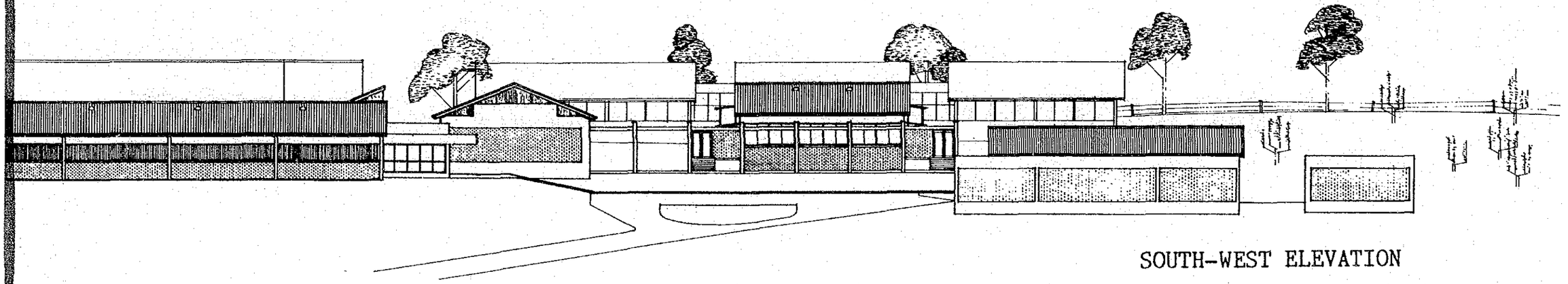
04



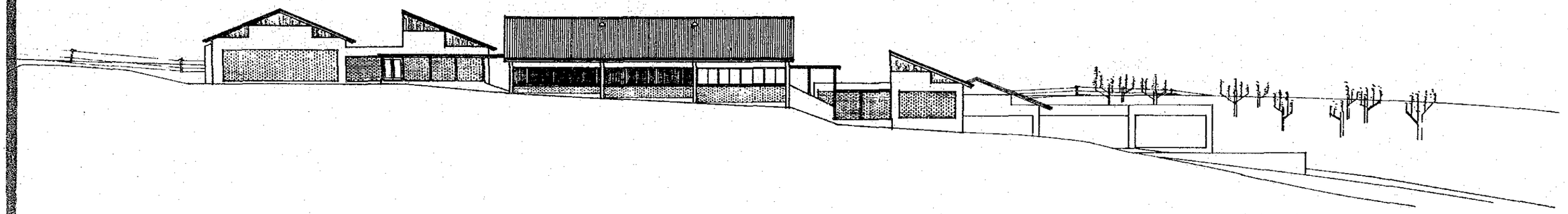
SOUTH-WEST E

SOUTH-EAST E

ELEVATION

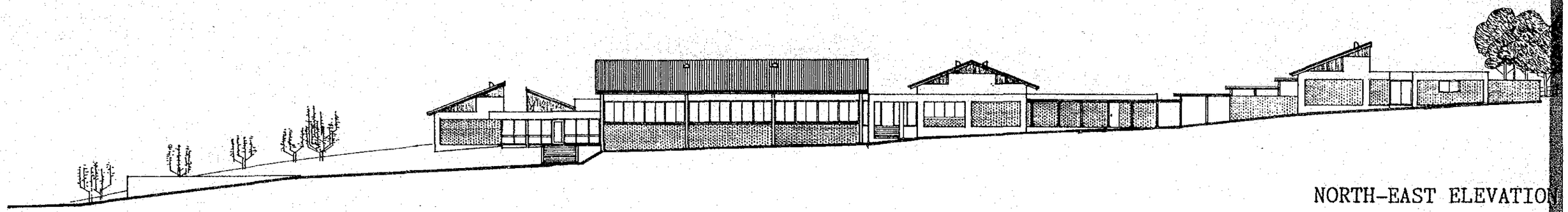


SOUTH-WEST ELEVATION

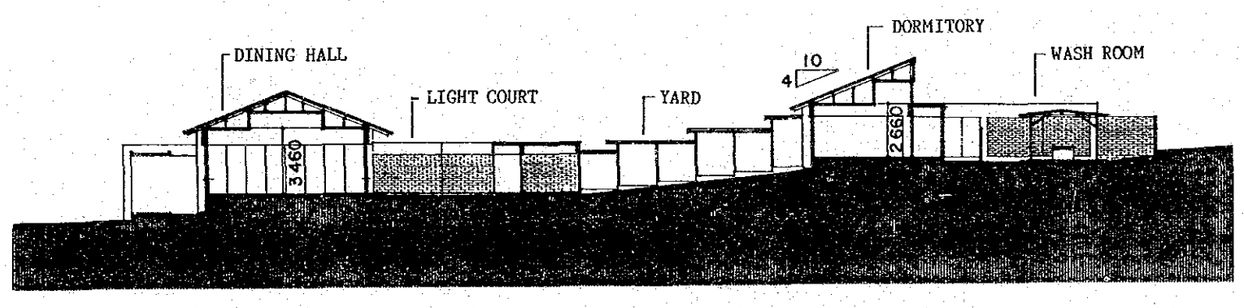


SOUTH-EAST ELEVATION

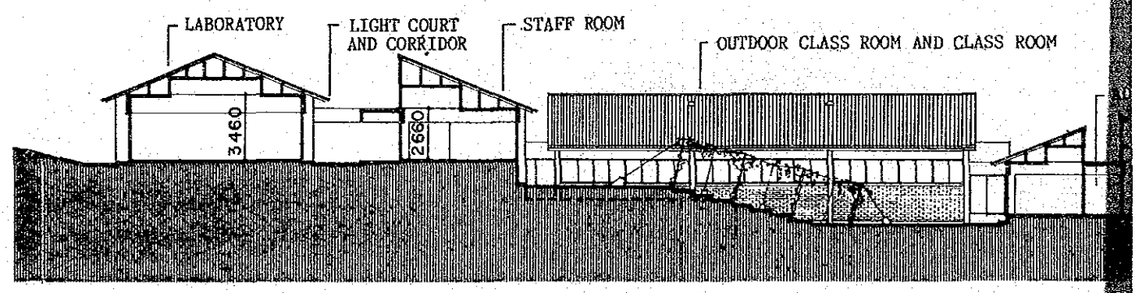
ELEVATION S1:300 **05**



NORTH-EAST ELEVATION

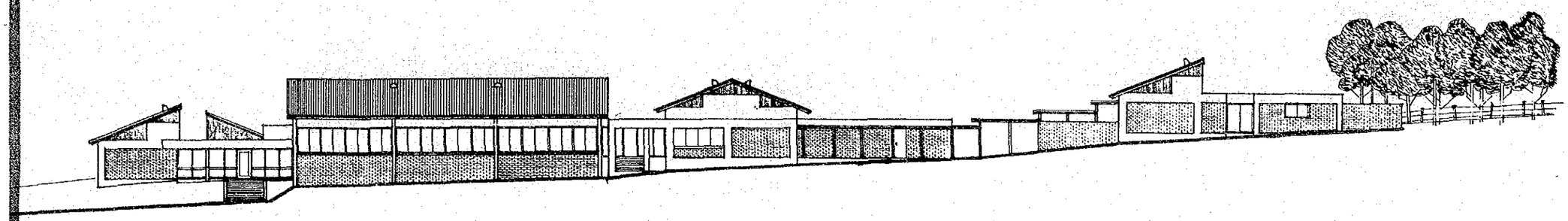


SECTION THROUGH DINING HALL - DORMITORY

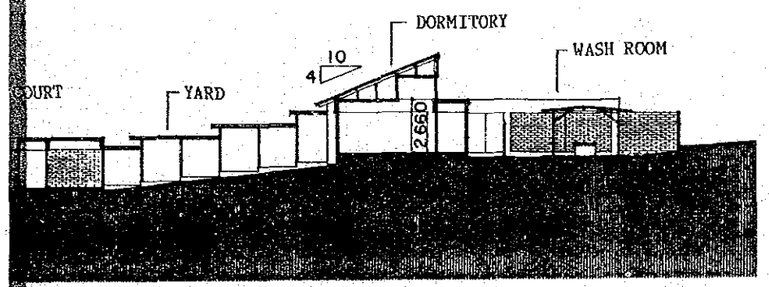


SECTION THROUGH LABORATORY - A

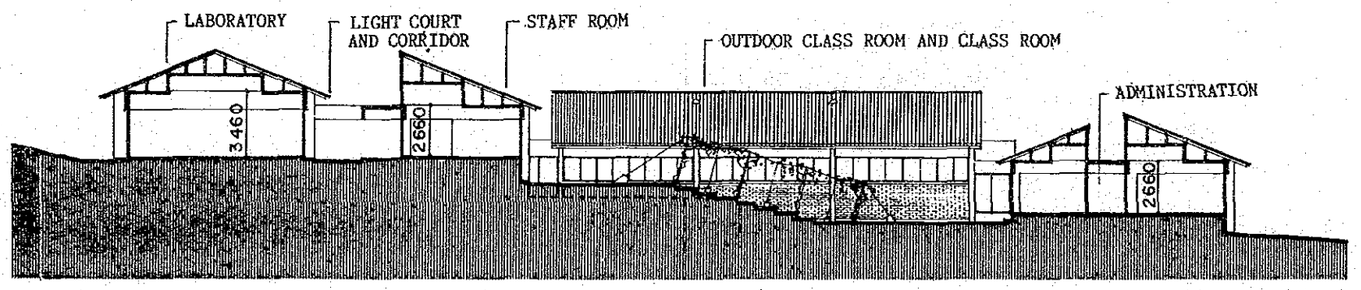
ELEVATION AND SECTION



NORTH-EAST ELEVATION

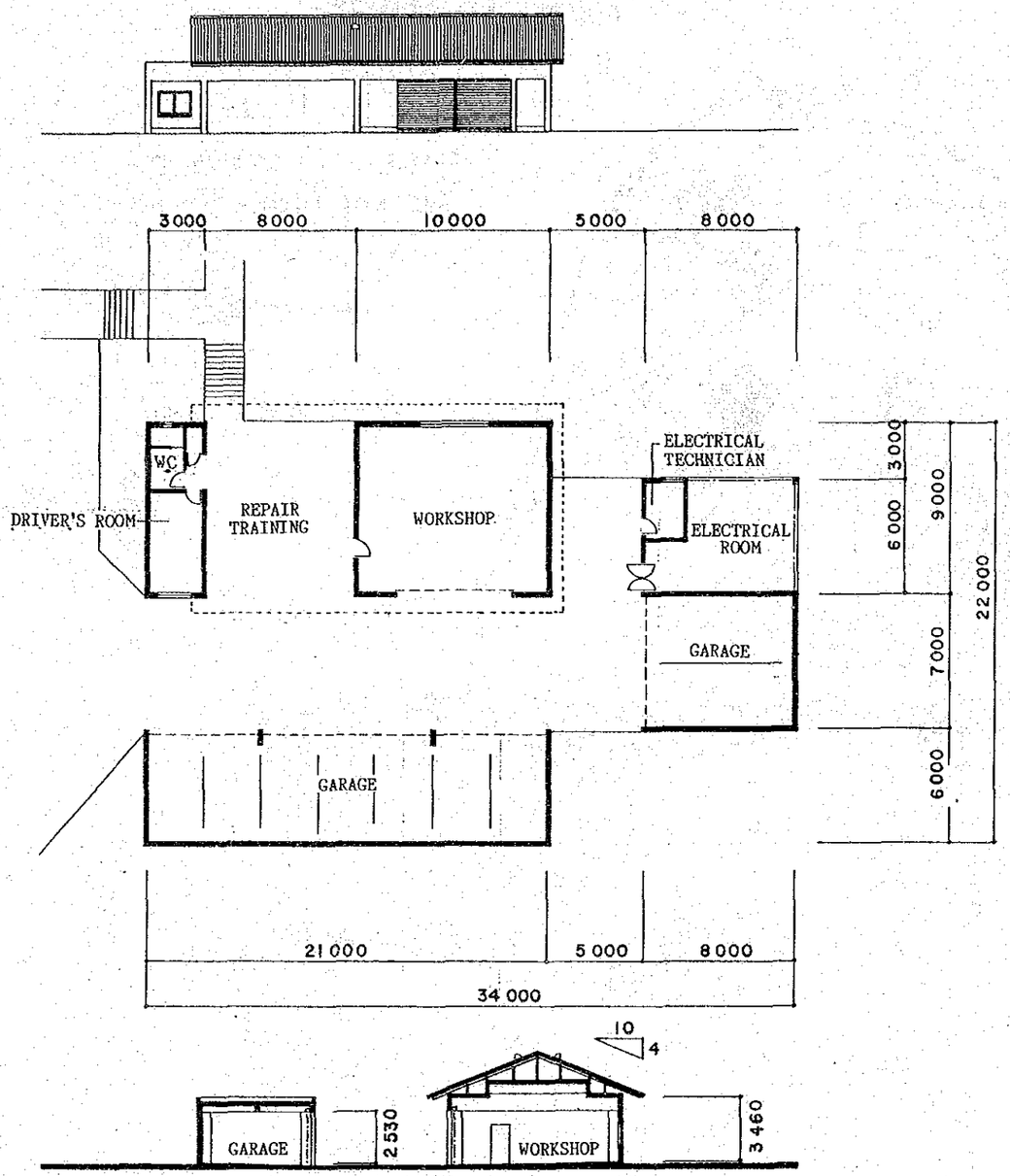


ECTION THROUGH DINING HALL - DORMITORY

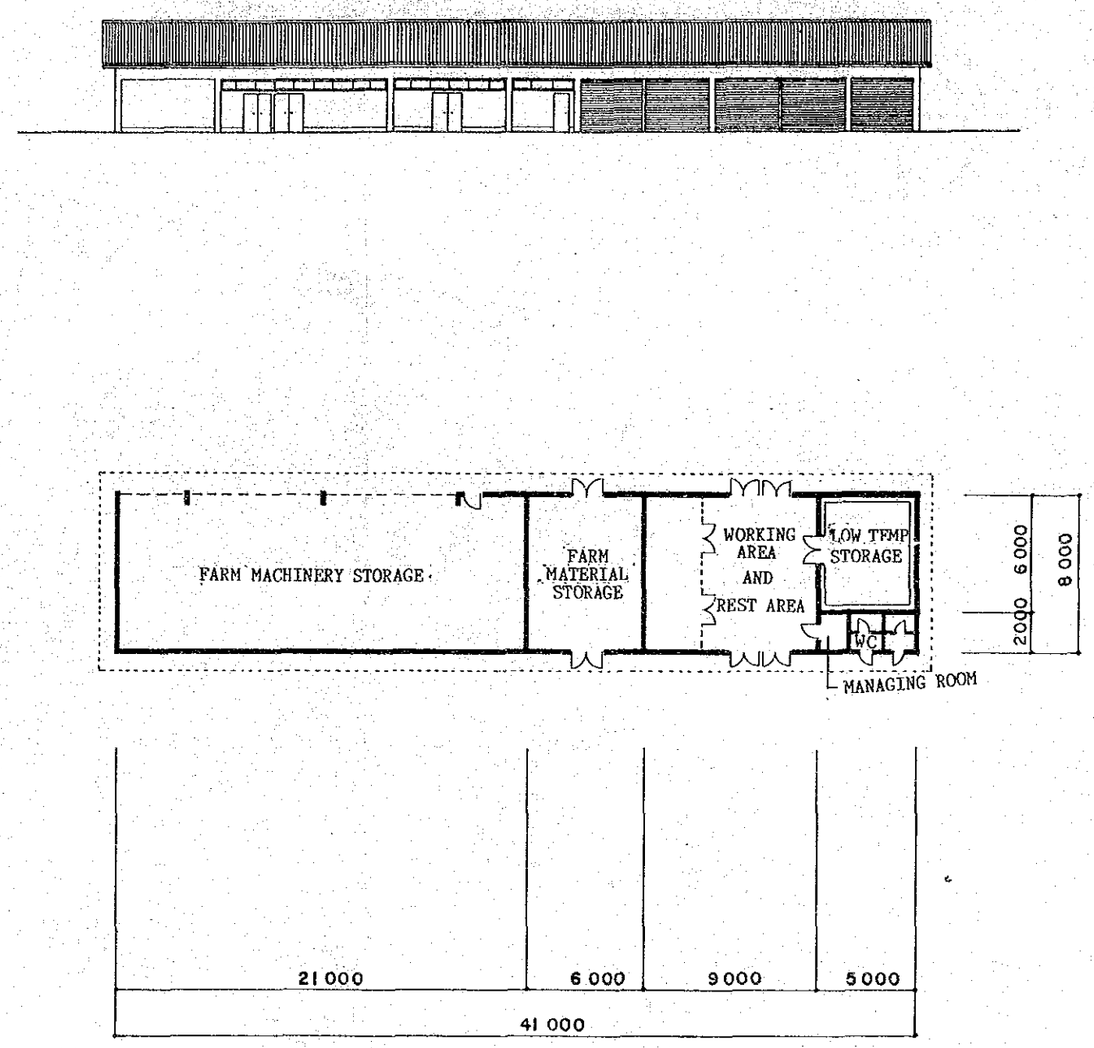


SECTION THROUGH LABORATORY - ADMINISTRATION

ELEVATION AND SECTION S1:300 **06**



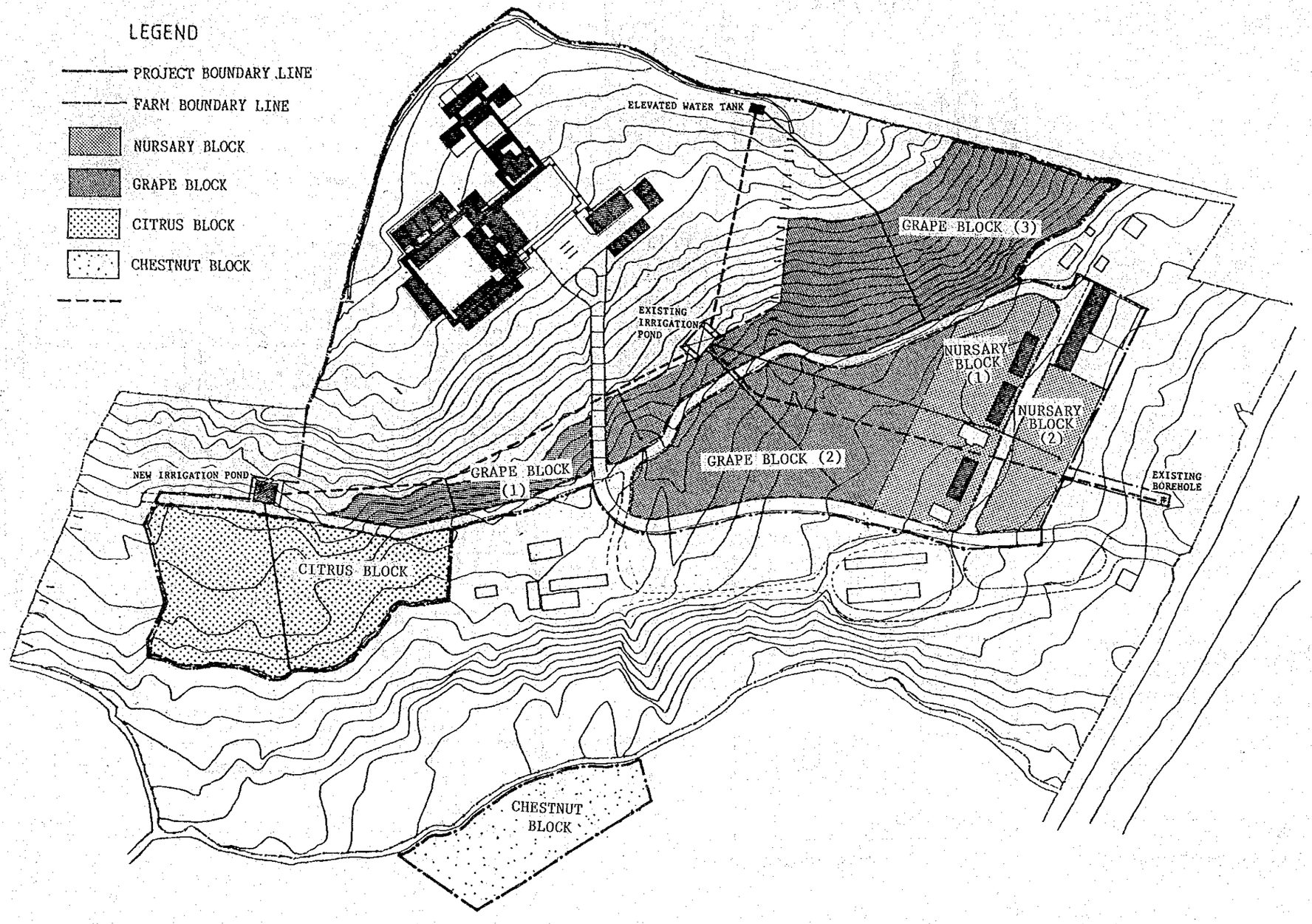
WORKSHOP BLOCK



FARM HOUSE

WORKSHOP BLOCK AND FARM HOUSE S1:300

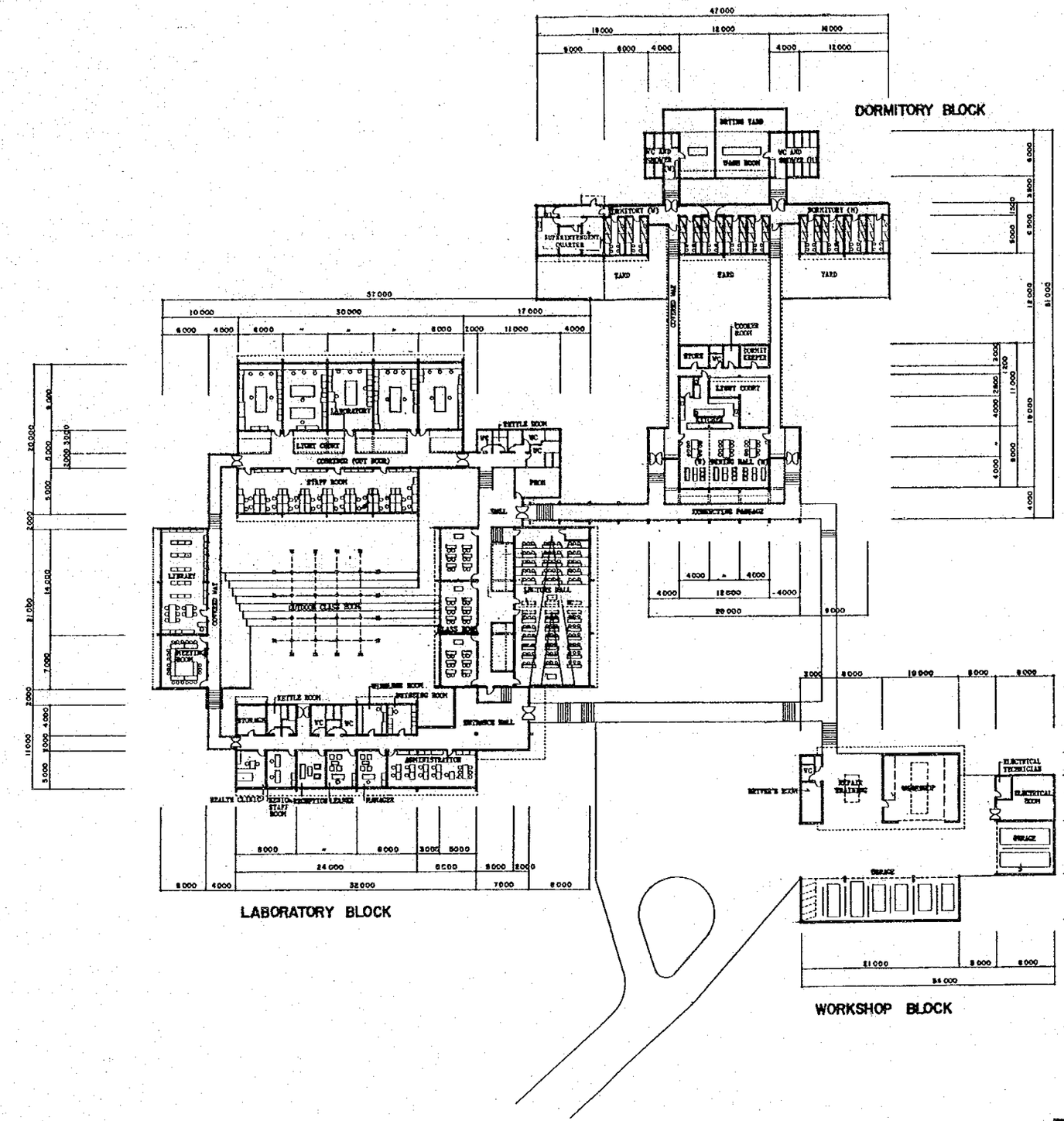
07



ORCHARD IMPROVEMENT PLAN

S1:2,000

08



FURNITURE LAYOUT PLAN 09