CHAPTER 4 OUTLINE OF THE PROJECT SITE

CHAPTER 4 OUTLINE OF THE PROJECT SITE

4-1 Location of the Site and Surrounding Environment

Quezon City is located at about 14°39 N latitude and 121°03' E longitude, and about 10 km northeast of the center of Manila. The site is located in the center of Ateneo de Manila University campus on the east side of Katipunan Road, about 2.5 km southeast of Quezon Memorial Circle.

The area is called Loyola Heights, a little higher than the surrounding land, which is on the east edge of the plateau of Quezon City running down to a flat area. The east side of the site has a steep slope with a level difference of 50 meters compared with the flat area, while the west side has a gentle slope to a valley and continues to the next hills.

The Ateneo de Manila University campus has an area of about 1350 thousand square meters and over 30 buildings, which are arranged with wide spaces in between and stand among much shrubbery including acasia trees and others. The environment is suitable for the location of a new laboratory. Katipunan Road, which is about 55 meters wide with its sidewalks, runs along the west side of the campus, about 250 meters from the project building. There are three (3) gates on the road and the second and the third gates are usually open. The third gate is nearest to the project site. The campus is separated from the road by a wire fence two (2) meters high. The south side of the campus has a gentle downward slope facing a substation, house, and factories under construction and is separated from the road by a wire fence two (2) meters high. The east side continues to the Marikana River beyond the steep slope mentioned above. It is a tributary of the Pasig River that flows through Manila. The border of the campus is the concrete wall running in the middle of the slope. Half of the north border faces a girls' school and the rest faces a road under construction. No campus roads or gates lead to this road

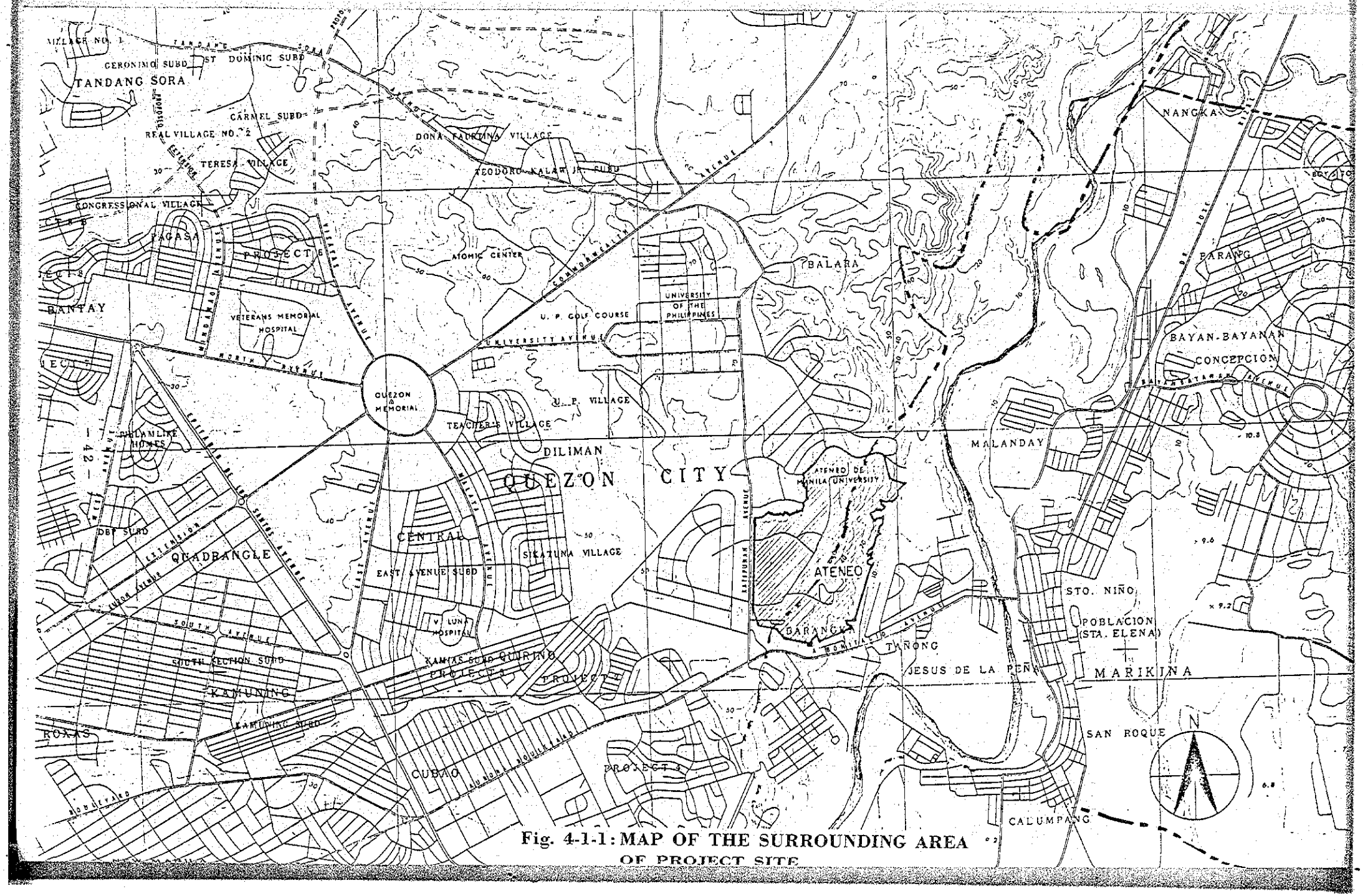


Fig. 4-1-1: MAP OF THE SURROUNDING AREA OF PROJECT SITE

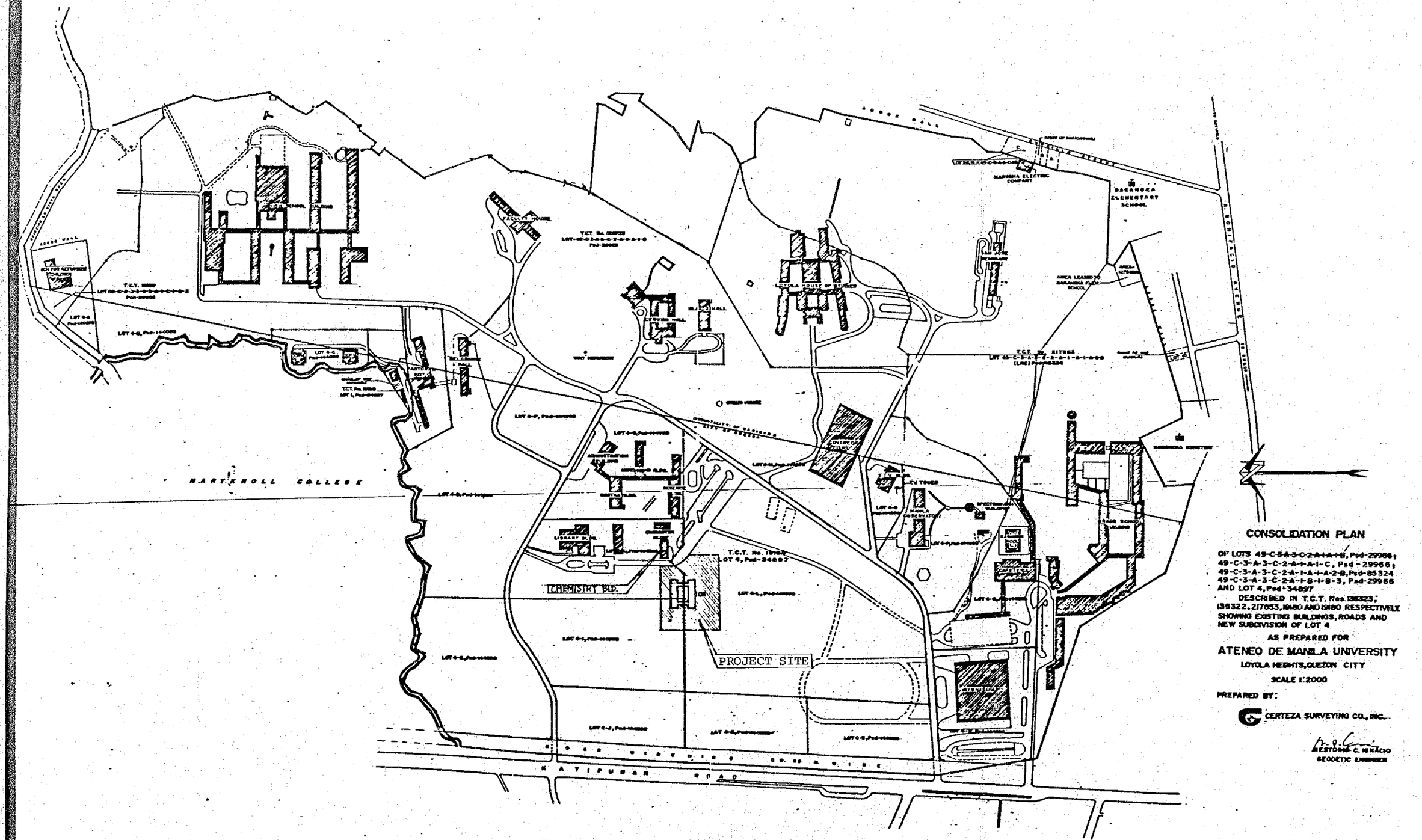
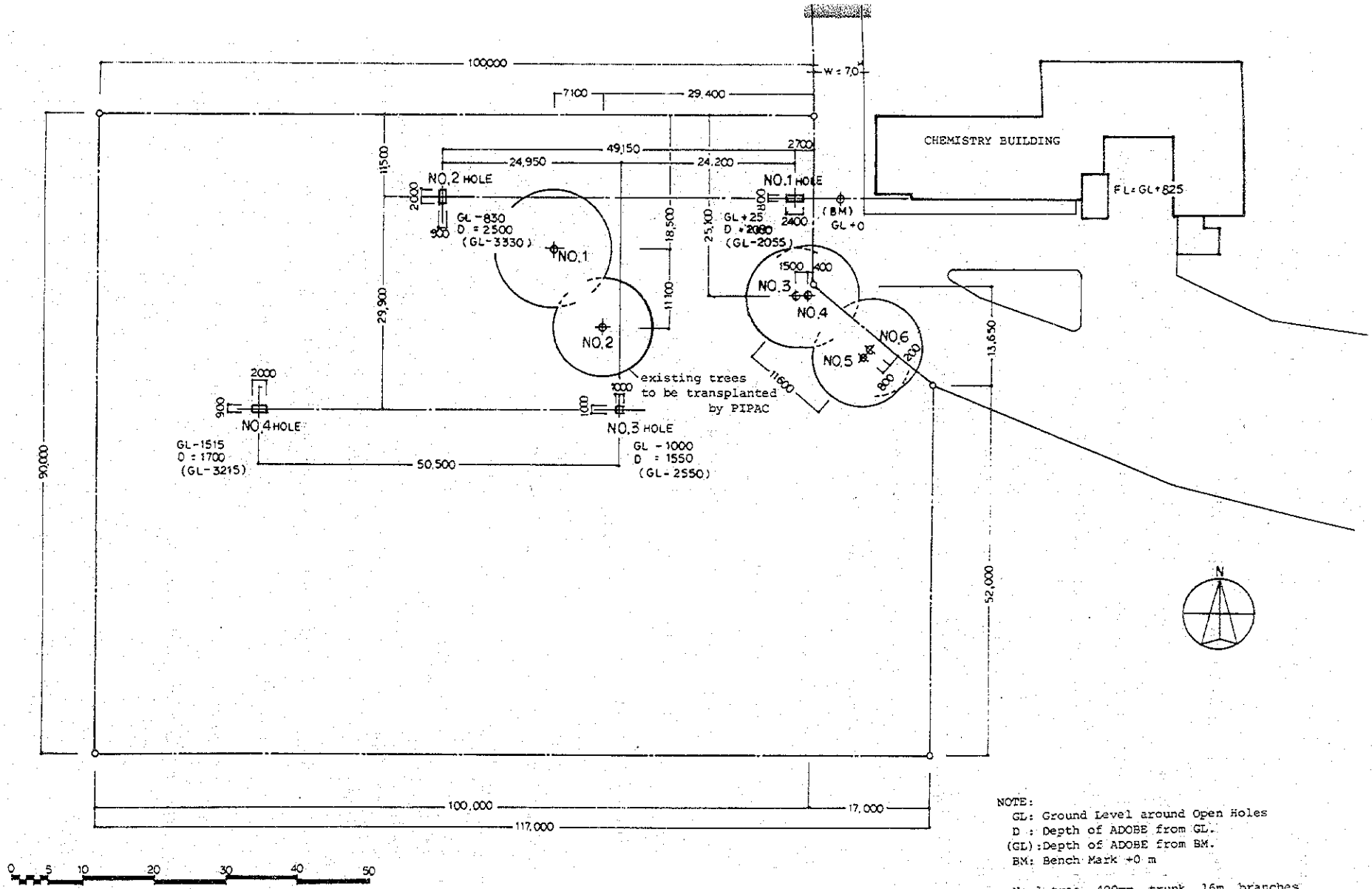


Fig. 4-1-2: PROJECT SITE IN ATENEO DE MANILA UNIVERSITY



NOTE:
GL: Ground Level around Open Holes
D : Depth of ADOBE from GL.
(GL):Depth of ADOBE from BM.
BM: Bench Mark +0 m

No.1 tree: 400mm trunk, 16m branches
No.2 " : " " , 14m "
No.3 NO.6: "

Fig. 4-1-3: PRESENT CONDITION OF PROJECT SITE

at present.

4-2 Present Situation of the Project Site

The chemistry building used by PIPAC at present is located on the west of the main street in the campus, which runs through the center from north to south. A grass field occupies about 300 meters between the building and Katipunan Road.

The project site is planned in this grass field west of the chemistry building across a 7-meter wide campus road. The area is planned to be 10,000 square meters with the condition that the shape of the project site is allowed to be optimal to the building design. This place is, as stated before, a gentle slope down from the campus main street westward, with about 1/50 average gradient. The place is also a gentle slope both from north and south, and constitutes a small valley. Therefore, drainage of the buildings west of the campus main street such as the chemistry building, Students Union, canteen and library runs off to Katipunan Road in an open cahnnel through this valley. The storm water drainage of the vast grass field north and south of the valley including the ground is also concentrated into this open channel. As a result, the lowest area around the end of the open channel near Katipunan Road functions as a retarding basin in the rainy season and is always damp.

The planning of the project site shape will be mentioned in Sec. 5-2. Arrangement of the Building: there are four (4) acasia trees with a trunk dia. of 40 cm and about 13 m branch dia. along the east site road and two (2) acasia trees of 40 cm trunk dia. and 14 m and 16 m branch diameters at the middle of the projected building site. These two trees will have to be removed prior to the project construction.

4-3 Existing Infrastructure

4-3-1 Water Supply

The Metropolitan Water Works and Sewerage System manages and controls the water supply. A water main of 250 mm (10 in.) caliber is embedded across from the Ateneo de Manila University campus from which a branch pipe of 100 mm (4 in.) caliber directly supplies water to the 3-storeys chemistry building through a hydrant meter. Hydropressure on the second floor of the chemistry building is about 1.5 kg/cm^2. To the buildings in the highest area in the campus, water is supplied by a pressure tank system because of low hydrant pressure.

4-3-2 Drainage

Though the Metropolitan Water Works and Sewerage System also manages and controls drainage system, no drains are installed around the university. The drainage system is planned for 10 years hence. The present drainage system around the district is by open channels along the streets.

From the chemistry building, sanitary sewage and chemical laboratory waste water are drained separately to the embedded channel through the septic tank and the laboratory waste holding tank, across under the east site road of the project site to the open channel. They flow westward collecting storm water from the surrounding area and are discharged into the open channel along Katipunan Road. The area between the project site and the Katipunan Road open channel is a grass field that acts as a retarding basin for the university campus during the rainy season.

The septic tank and laboratory waste water are regulated by the National Pollution Control Commission and Laguna Lake Development Authority. The figure below shows a rough sectional view of the whole campus.

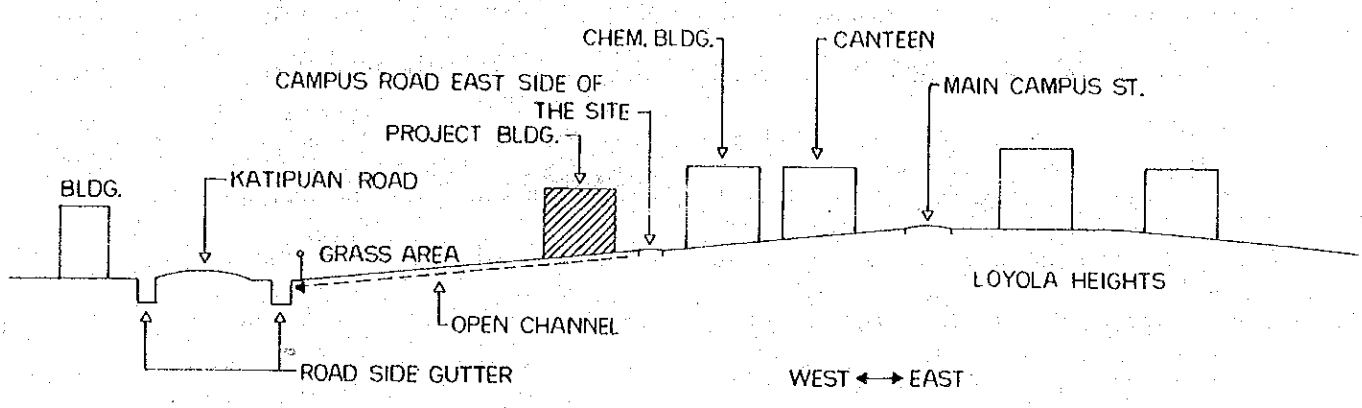


Fig. 4-3-2: STORM WATER DRAINAGE

4-3-3 Electric Power

The electric power supply is managed and controled by MERALCO-Manila Electric Company; however, Ateneo de Manila University is responsible for management and control of the power supply within the campus outside the transformer and the main meter. Electric power of 2,400 V, 3 phase, 3 wire, 60 Hz is supplied to the campus from which each building takes 200 V power through a transformer and meter.

4-3-4 Telephone System

The Philippine Long Distance Telephone Company provides management and control of the telephone system. At present 20 circuits lead to the university and are connected to each building via an exchange system. Another circuit for the exclusive use of PIPAC is also directly connected to the Chemistry Building.

4-4 Soil Conditions

A tuff layer called adobe which is similar to Oya stones but more solid is widespread in the plateau area of Metropolitan Manila. This adobe layer is 2 to 3 meters thick with a 50 to 70 t/m^2 bearing capacity and is generally used as the building foundation bed. Four (4) open test holes were dug in the project site to investigate the presence, depth and weathering condition of the adobe layer as the project building is to utilize this layer as the foundation bed. The open holes were arranged at four (4) places as is shown in fig. 4 -4 so that the distribution of the adobe layer in the entire project site could be judged. The results showed that the adobe layer lies 2.08 m deep from the ground level at No. 1 hole, 1.5 m deep at No. 3 hole and 1.7 m at No. 4 hole. At No. 2 hole, there is an extremely hard clay layer 2.5 m deep which generally lied right above the adobe layer and prevented further digging.

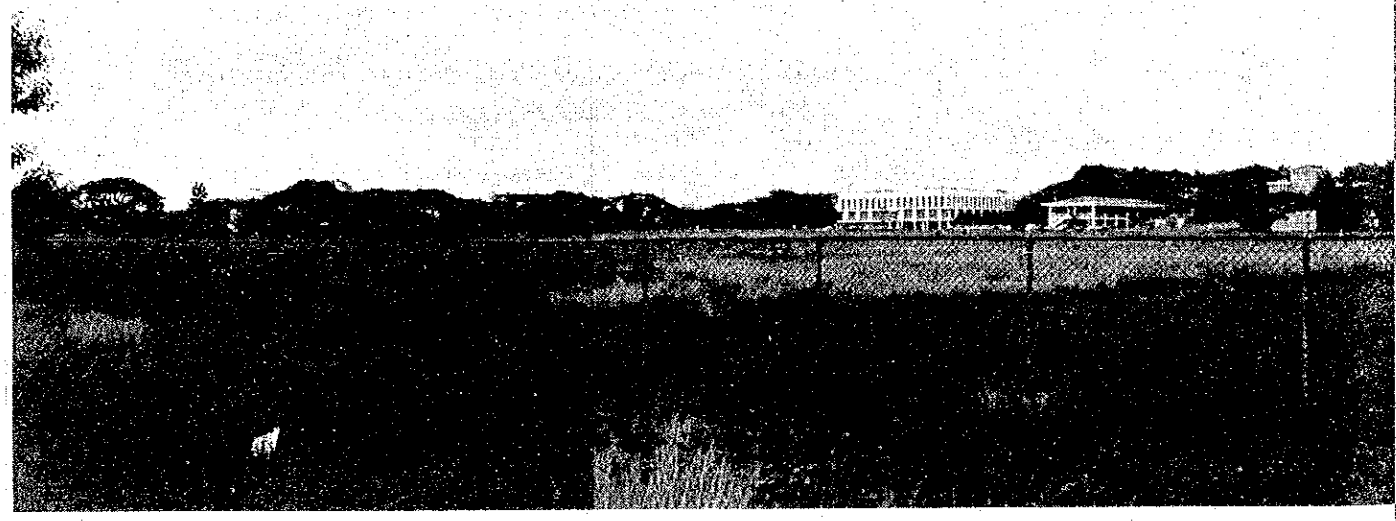
The test results are summarized as follows:

(1) The top soil of the adobe layer is considerably weathered. It is desirable to remove it to a level at least 30 cm deep to set the building foundation bottom.

(2) The adobe layer is considered to lie deeper toward the low area of the open channel.

(3) As is indicated by the No. 2 hole test, the depth and thickness of the adobe layer might vary somewhat. Therefore, it may be necessary to confirm the adobe layer for each foundation area at the time of foundation work.

Project Site from North Side



Project Site from Katipunan Road

CHAPTER 5 BASIC DESIGN

CHAPTER 5 BASIC DESIGN

5-1 Basic Principles

The project building is to be a 3-storey reinforced concrete construction building. The basic policies in designing the project are as follows:

(1) to design the building to ensure a free air flow through each room suitable for Philippines' local weather conditions, which are hot and humid,

(2) to keep the construction cost low and to attain a maximum effective floor area within the budget,

(3) to plan the simplest design to minimize the running and maintenance cost for the building and facilities after completion of construction,

(4) to respect local construction methods utilizing domestic Philippine products and materials as far as practicable,

(5) to consider the low and damp ground conditions of the project site and to design the laboratory not to adversely affect the building, equipment and the staff's health,

(6) to harmonize with the environment of the surrounding area, especially with the other buildings in Ateneo de Manila University as the project building is planned to be located in the university campus,

(7) to limit the air-cooling system and the capacity of generator system only to the laboratory equipment and to the area that functionally requires cooling, and

(8) to respect the desire of the Philippine authorities in the selection of laboratory equipment and to consider the simplest system for their easy operation and maintenance.

5-2 Arrangement of Building

The main access to the project site is a campus road diverging from the campus main street to the east side of the chemistry building and reaching the library building. With this access to the project building, the project building has to be located not on a line with the chemistry building but to the south of the chemistry building's front side so that the new building will not be shaded by the chemistry building. Fig. 4-4 project site shows 10,000 square meters of the area based on this consideration. The project site faces the campus road on the east side and faces the drainage open channel mentioned in sec. 3-2 on the north side. The project building is planned to be away from this open channel more than 10 meters to the shouth. Still the area is so damp in the rainy season that all the surplus soil from the foundation digging shall be used for filling around the building. Care will be taken in planning the storm water drainage system.

As the project building is expected to have many visitors, such as clients commissioning chemical analyses or people attending seminars and training programs, the building as a whole as well as the main entrance will need to be high conspicuous. For people coming by the south gate, toward Manila (most visitors are expected from Manila), going north along the campus main street and turning off to the chemistry building (here a subgate is located) to the project site, the south side is the most conspicuous. Therefore the project building shall have its main entrance on the south side. The entrance to the project site is planned to lie between four (4) acacia trees, two (2) on the right and two (2) to the left on the edge of the chemistry building front yard. From this entrance, vehicles keep to the right according to the Philippine traffic system to reach the canopy of the main entrance. A parking lot with sufficient area is planned for the front yard. A service access is to run around the

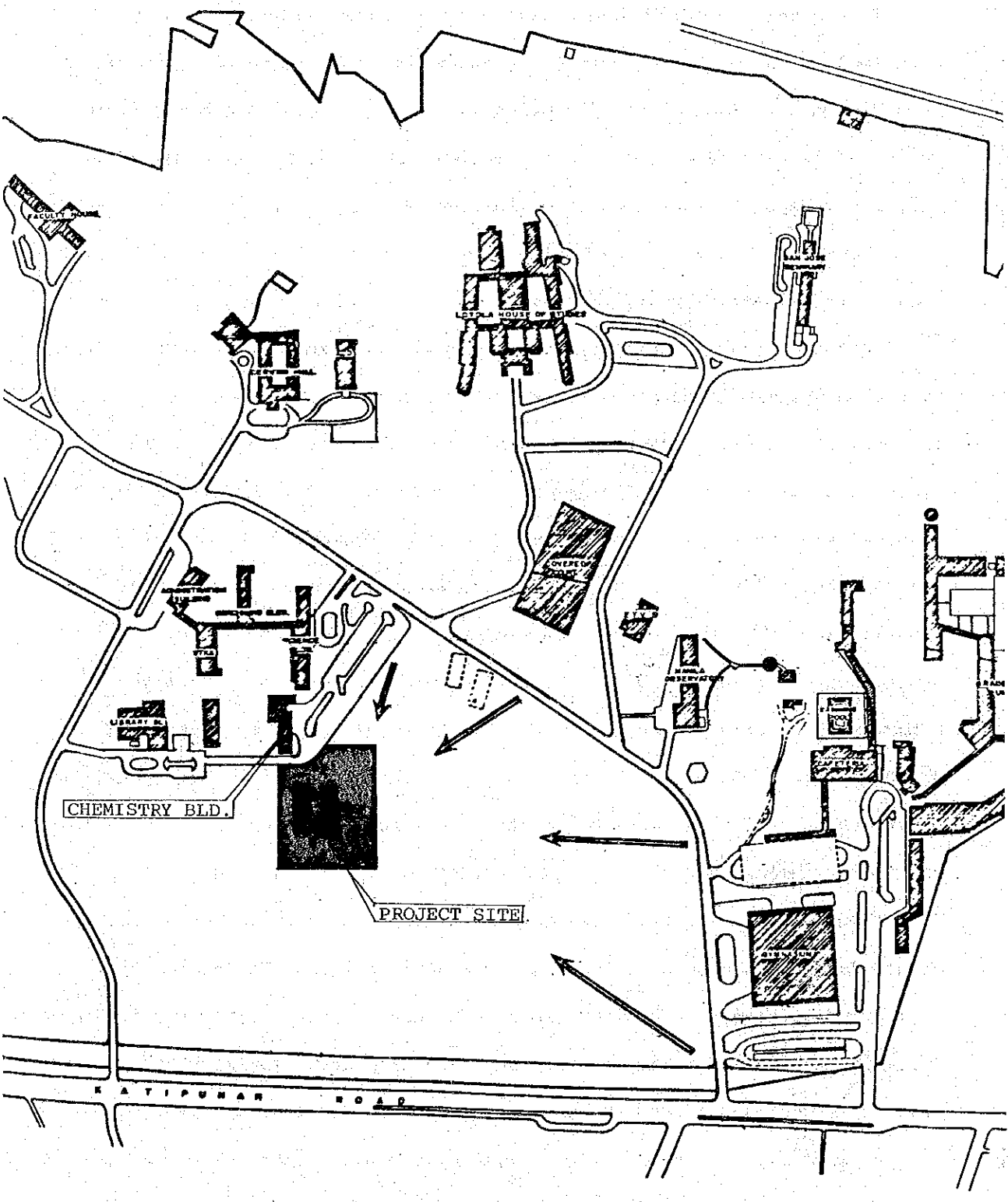


Fig. 5-2: VIEW LINE FROM ACCESS ROAD

building from north to west, to connect to the stairway hall on the west side, where a service dumbwaiter is to be installed. The service access is to go around the west side and then to the front parking lot.

The project building as a whole is planned for the east of the project site to keep the west area for future expansion. Since the distance of about 200 meters from the project site to Katipunan Road is a grass field which is also highly visible, consideration shall also be given in designing this side of the building to be monumental.

5-3 Arcitectural Planning

In the general planning of laboratories, there are two (2) types of plans, on the middle corridor system with laboratories on both sides and the other the side corridor system with laboratories on one side only. As the laboratories on both sides utilize one corridor in the middle corridor system, this system is more space efficient, making the building size smaller and requiring a smaller site area as a result. Most new laboratories in Japan are designed with the middle corridor system. This system has other advantages. The corridor is shorter, communication between laboratories is more convenient, the total length of piping, ducts and the wiring system are shorter, leading to a low facility cost and the construction costs can also be lowered as the total area of the exterior walls are smaller.

Though the side corridor system is inferior in these respects, the middle corridor system has a crucial drawback, environmental discomfort. Full air-conditioning cannot be provided because of the initial and running costs in the hot and humid weather in the Philippines. Therefore this project is designed to use the side corridor system with a courtyard to improve comfort and avoid a long flow line.

To keep the total length of the corridor under a certain limit and also to be able to use the building without elevators, the total floor area is planned at 3,000 m^2 in 3-storeys with 1,000 m^2 on each floor. Buildings of more than 4-storeys are not suitable because they require a longer construction period that leads to higher costs.

In general, natural science research centers with laboratories in Japan have 30 m^2 to 40 m^2 floor area per laboratory staff member though the area varies according to the purpose of the center and equipment accomodated. The area of 3,000 m^2, even subtracting 250 m^2 for the training center, is enough space for a laboratory staff of 70 to 90. This figure includes a reserve space for 5 to 20 personnel when compared to the planned 65 personnel in the end of PIPAC's five-year program shown in sec. 7-2, plan for Disposition of Personnel. If PIPAC is assumed to continue favorably and keep increasing the number of staff by half of the projected number of staff increase even after the five-year program, the space still is sufficient for two (2) to six (6) years.

5-3-1 Planning

The project building is to consist of two (2) wards parallel arranged north and south at 10 meters distance. The wards will be of 10-meter spans, 45 meters in length. The interval is to be connected at the east and west ends where the stair-cases are to be located. The inner space will be left as a courtyard. The connecting portions are planned to be withdrawn, one (1) span each from the east and west ends, to reduce the length of the corridor. This way, the total corridor length is to be reduced by 20 meters and in addition, four (4) large rooms can be arranged at the ends of each ward. The building shape is symmetric both east to west and north to south. Symetric design presents a neat, attractive appearance, well-balanced form from the structural point of view, and a

simplicity of form which leads to low construction costs. The main entrance is designed to be arranged at the center of the south ward for the reason stated in sec. 5-2 Arrangement of the Building. Next to the entrance hall, rooms for administration and reception departments will be located. The first floor of the north ward is to be used mainly for various storerooms and rooms for building facilities. A dumbwaiter is planned to be provided on the west connecting portions for carrying gas cylinders for laboratory use.

On the second floor, training seminar rooms and the library will be arranged in the south ward, and the research laboratory and stock rooms for chemical reagents and materials in the north ward. Visitors will be allowed to enter as far as the south ward. Research laboratories and analytical laboratories which visitors are prohibited to enter will be arranged on the third floor. The research laboratories will belong to the research and development department and the analytical laboratories will belong to the analytical services department. Each laboratory is to have a laboratory office attached and an instrument room.

On the top of the east and west connecting portions, there will be an exhaust fan for the draft chamber, a cooling tower for the air-conditioner and an open space for weather proofing and exposing tests.

PURPOSE OF THE VARIOUS ROOMS IN THE PROJECT BUILDING

Room No.

FIRST FLOOR

106 1) The Entrance Hall is a reception area for clients who bring samples or pick up results or wish to consult with PIPAC personnel.

2) The Main Office Complex contains:

103 a. the Director's office,

102 b. the computer room which will house the office microcomputer and its storage disks, as well as the building's microcomputer network equipment,

Room No. FIRST FLOOR

104 c. the secretarial office for the typing of reports and other official business of PIPAC,
d. an information window for clients,
105 e. a sample receiving area including a small conference area, and,
101 f. a records room for the storage of non-current PIPAC files and reports.

118 3) The Cold Storage room will house refrigerators and freezers for the storage of certain samples and chemicals. It will also have a dark room for loading and developing film for the spectrograph.

119 4) The Pilot Plant is for chemical reactions on a larger-than-bench scale. These chemical reactions and processes will be required in connection with PIPAC R & D work on process development and trouble-shooting.

120 5) The room for Storage of Dangerous Materials will provide proper isolation and safe-keeping of samples and chemicals that provide special danger.

121 6) The Gas Cylinder room will contain the building's supply of LPG and other gases (H_2, N_2, etc.) in cylinders as back-up storage for the various laboratories.

122 7) The Transformer room will provide the main electrical source for the building.

123 8) The Standby Generator room will house the emergency generator which will keep essential instruments functional during the many blackouts that are common in Manila.

124 9) The Machine room will house the machines, pump and receiving tank for building facilities.

125 10) Sample Preparation room will be where any needed grinding or pulverizing of samples will be done.

126 11) The storage room is needed for back-up supplies of chemicals and laboratory equipment and supplies, 95 percent of which must be imported.

127 12) The Night room is for carrying out, in a safe environment, of chemical reactions that must be continued overnight or for other long period without the necessity of a person watching it.

112 13) The Staff Lounge is where the staff may take their lunch or rest.

107 14) The Locker room is for storage of raincoats, umbrellas and other similar items for the staff.

Room No.

SECOND FLOOR

201 1) The Library is a reference room with journals and monographs of importance to the work of PIPAC.

2) The Training Complex contains:

202 & 203 a) Two Seminar rooms with audio-visual equipment for the lectures/discussions which are a part of all PIPAC training programs.

204 b) The Training Laboratory is where the trainees receive hands-on experience in running GC, IR, UV-Visible and other analyses.

209-211 216-218 3) The Staff Rooms 1 and 2 provide office space for Visiting Staff and for the more senior members of the PIPAC staff.

223 4) The Stock room is a storage and dispensing area for small amounts of chemicals and ordinary laboratory apparatus such as glassware. It also will house the water still and apparatus for the recovery/recycling of solvents.

222 5) Conference room is for staff meetings and also for meetings with outside scientists and clients.

6) Research Laboratory Complex No. 1 contains:

220 a) Office of the team leader of a major research project,

221 b) Instrument room containing priority equipment (connected to the emergency generator) such as the NMR instrument, the research IR instrument, the pulse polarograph and other electrochemical instrument, two balances and a microcomputer,

219 c) Research Laboratory, an area which can be used in a flexible manner for carrying out most of the non-instrumental work connected with a major research project.

THIRD FLOOR

1) Research Complex No. 3 contains:

302 a. Office of the Supervising Scientist for Research and Development.

303 b. Instrument room containing two liquid chromatograph, two balances, small mass spectrometer, and a microcomputer.

301 c. Research Laboratory where the non-instrumental aspects of various research projects can be carried out.

2) Research Complex No. 2 contains:

304 a. Office of the team leader for biochemical research.

305 b. Instrument room containing two balances, refrigerated centrifuge, extractor, fermentor and other equipment for biochemical research, and a microcomputer.

Room No. THIRD FLOOR

306 c. Research laboratory for carrying out the non-instrumental aspects of biochemical research.

311 3) Instrumentation Laboratory is for the spectrograph, for a planned (non-JICA grant) Gas Chromatograph-Mass Spectrometer and other instruments, and a microcomputer.

4) Analytical Laboratory Complex contains:

319 a. Office of the Supervising Scientist for Analytical Services,
320 b. Small Instrument room (attached to the emergency generator) containing two ordinary balances, a micro balance, a planned (non-JICA grant) UV-Visible spectrophotometry, and space for moving in, for a limited time, equipment that must be on the emergency generator, and a microcomputer.
317 c. Large Instrument room for two AA instruments, three gas chromatographs and a microcomputer.
318 d. Analytical Laboratory No. 1 is a sample preparation area for classical and instrumental techniques that are relatively clean. An area is also provided for report writing.
321 e. Analytical Laboratory No. 2 is a sample preparation and analysis area where the work is more likely to produce fumes or excessive heat. A special hood is provided for perchloric acid digestions.

316 5) Electronics shop is for the repair and maintenance of various instruments or PIPAC, with the additional plan of extending this service to PIPAC clients.

5-3-2 Sectional Planning

The most important points in designing the project building for weather conditions in the Philippines is to design the building to withstand the strong rays of the sun in the dry season and the high temperatures and humidity and showers in the rainy season. Manila is located at 14°37' N latitude with a southing solar height of 42° S at the winter solstice and a northing solar height of 81° N at the summer solstice. Therefore windows are planned not to be placed on the east and west sides as far as practicable in order to receive the minimum solar heat but to be spaciously open on the north and south sides with large canopies to eliminate the sun's rays and leaking in heavy rains.

The roof is to be tiled and of a steep pitch in order to prevent water leakage in rain showers as well as to utilize the spacious attic as a heat

insulating zone. The hot air absorbed through the roof will be ventilated by a natural ventilator which is to be designed under the roof. For rooms with no air-conditioning, fresh air is to be taken through the exterior windows, flow to the corridor by the transom windows above the door or the vents on the bottom of skirtings and leave through the corridor windows on the courtyard side.

The project site is damp because storm waters of the surrounding area flow through the site ground in the rainy season. Therefore, the first floor level is designed to rise from the ground level to attain free air-flow under the floor to keep the floor dry and the ground level is to be raised using the surplus soil. This design will give the building a longer life and is favorable for the laboratory staff's health and maintenance of the equipment. The following chart shows a section of the building and the air flow.

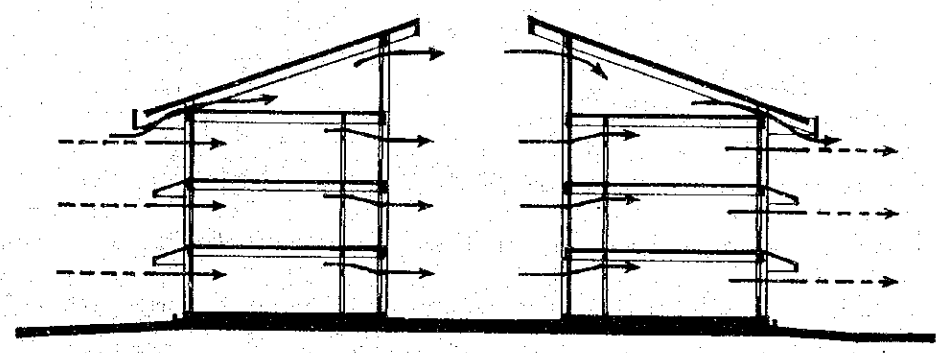


Fig. 5-3-2: BUILDING SECTION

5-3-3 Module

Architecture is called the "science of dimension", which means that architecture interprets every tool and device in human life into dimensions to form a comfortable ecological environment. The basic module value of the basic laboratory plan is to be 750 mm, which is the greatest common measure of the laboratory equipment, facilities, furniture and human activities as is shown in the following figure. Based on the dimension of 750 mm, a module table has been estimated as follows. This table covers the dimensions of ready made construction materials or their combination. Each room's dimensions will be principally based on this table.

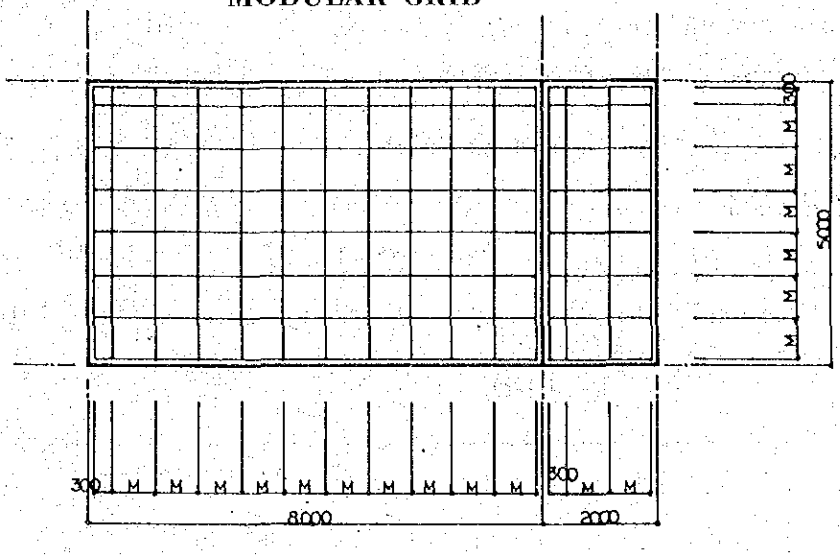
MODULE TABLE

25	[5]	1	2	4	[8]	16	32	64
(75)	15	3	6	12	24	48	96	
	45	9	18	36	72			
		27	54					

75 stands for the basic module, 5 and 8 mean the spans of the Standard Laboratory Room Unit. From the basic module, double numbers or half numbers are listed to the right and left, and triple or one-third numbers downward or upward.

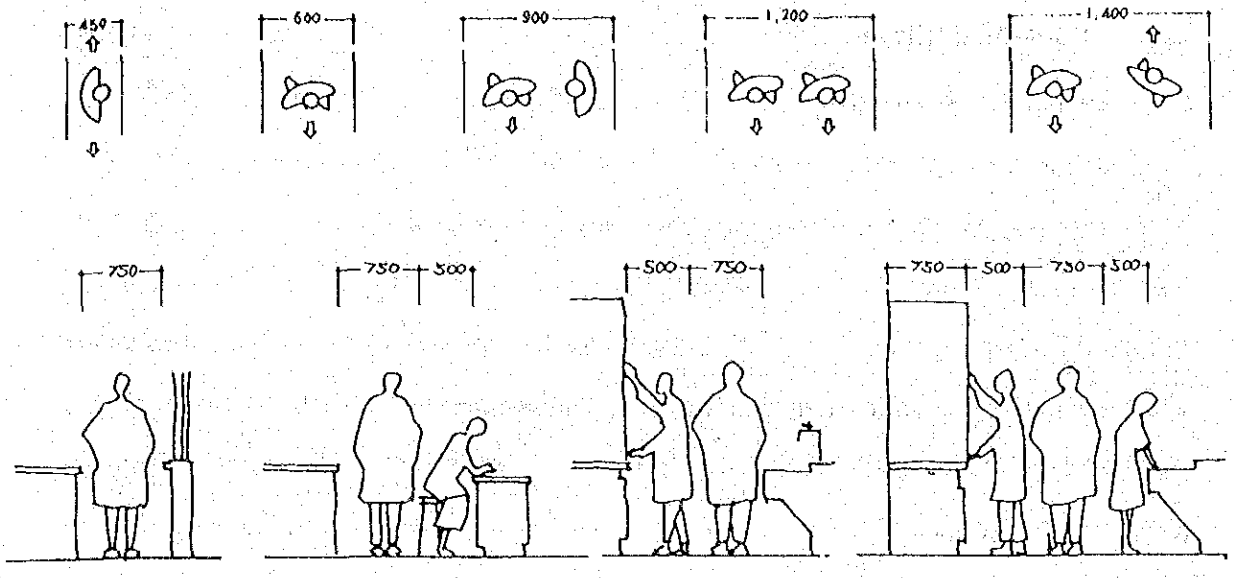
The following figure indicates modular grids in the laboratory standard spans. This method is useful for working designs in that it creates no useless space while keeping enough space for human activities when working tables, shelves, tables, passages and the like are designed based on this grid as well as creating a neat interior appearance.

MODULAR GRID

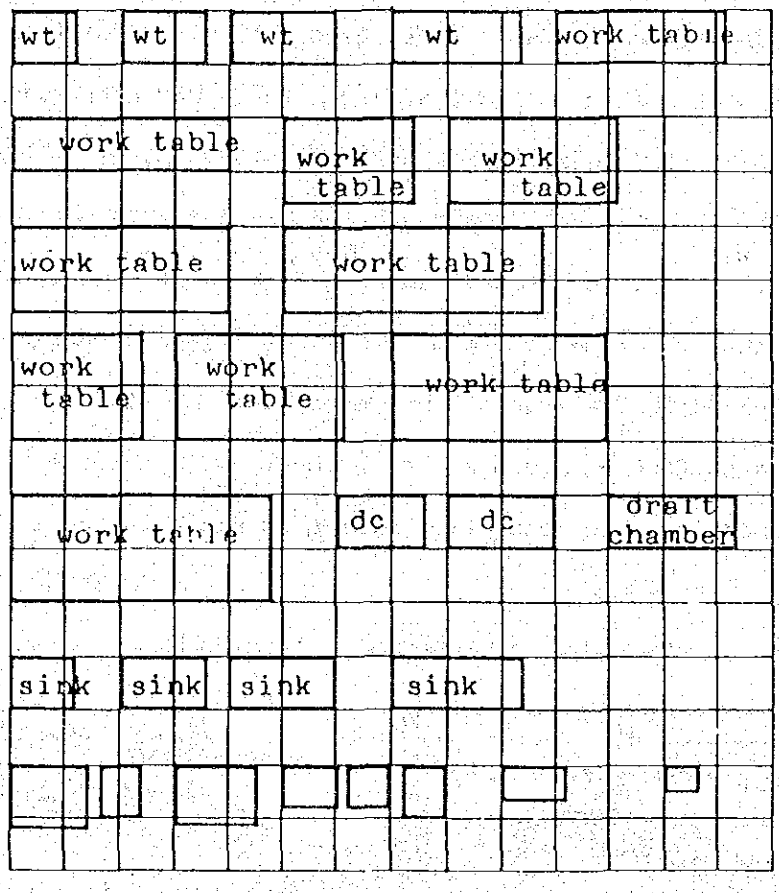


M stands for the standard dimension of 750 mm.

The 300 mm width is for shelf spaces.



WIDTH OF PASSAGE



LABORATORY EQUIPMENT IN MODULAR GRID
(750mm × 750mm)

5-4 Structural Planning

Earthquake force and wind force must be taken into consideration because the Philippines is a part of the Pacific Ocean Seismic Zone and is a breeding ground for the typhoons which strike Japan. However, Quezon City (Metropolitan Manila), where the project site is located, is in a category where earthquake force is high moderate and wind force is moderate. Their horizontal force is smaller than that in Japan.

5-4-1 Foundation

As is mentioned in sec.3-4, the depth of the adobe layer as the bed rock varied from place to place, from -1,550 m to -2,500 m and the average depth -1,950 m from the surface of the ground; and -2,055m, -3,330m, -2,790 m measured from each mark. (See fig. 5-4) Based on these data, the standard foundation bottom level is set at B. M. -2,500 m, close to the average depth of the adobe layer, and where the adobe layer lied deeper, the weathered surface soil is scraped and an artificial foundation bed is to be made with lean concrete to the B. M. -2,500 m level, on which foundations are to be set. The foundation system is to be of the reinforced concrete isolated footing style since the bearing capacity of the adobe layer is dependable. The foundation system is shown in the following chart.

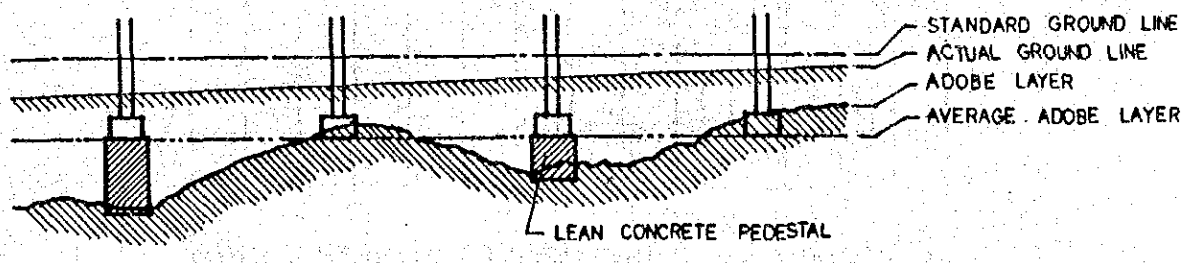


Fig. 5-4-1: FOUNDATION SYSTEM

5-4-2 Framing

The project building is to be a 3-storey reinforced concrete structure with rigid framing, and the roof is to be of steel truss construction. Both gable walls of the north and south wards are to be designed as earthquake resisting walls in order to lower the construction cost of framing. For the other exterior walls, except those facing the courtyard, reinforced concrete walls are to be designed to prevent water leakage in strong wind. Concrete blocks that are commonly used in the Philippines will not be used in these parts. However, since the rain and wind effect is expected to be less on the walls of the courtyard, it is considered to be safe to use concrete blocks in these parts. Partition walls are to be of concrete blocks so that they can be removed with a partition design change with usage change in the future.

The first floor is planned to be a reinforced concrete floor slab separate from the ground surface. Considering that the north and south span of 10 meters is rather wide for a reinforced concrete construction framing, the post-tensioning prestress method is to be applied to prevent the beam depth and the amount of the reinforcing bar from increasing for reasons of economy.

5-4-3 Design Standards

The structural design of this project is to be based on the present construction regulations in the Philippines. The following standards and regulations are to be applied:

National Structural Code of the Philippines (NSCP)

Uniform Building Code (UBC)

Building Code Requirements for Reinforced Concrete (ACI Code)

Timber Design Specification

5-4-4 External Forces and Loads

(1) Dead Load

Dead load will include the weights of all the structural materials, partitions and finishing materials, etc.

(2) Live Load

Live load of each room will be as follows, calculated in compliance with NSCP and UBC.

Room	Live Load kg/m^2
Office	300
Laboratory	300
(This figure may be increased if necessary to accomodate heavy equipment)	
Library	615
Lecture Hall	300
Lavatory	250
Cafeteria	300
Corridors & Stairs	490

3) Earthquake Force

The base shear assumed to act on the structure and distribution of earthquake force to each room will be determined in accordance with NSCP.

$V = ZIKCSW$

where

V: base shear

Z: coefficient depending upon the zone (See fig. 5-4-1)
Zone No. 3, therefore Z = 3/4

I: occupancy importance factor
(See Table 5-4-1) I = 1.0

K: horizontal force factor

(See table 5-4-2) K = 1.0 or 0.8

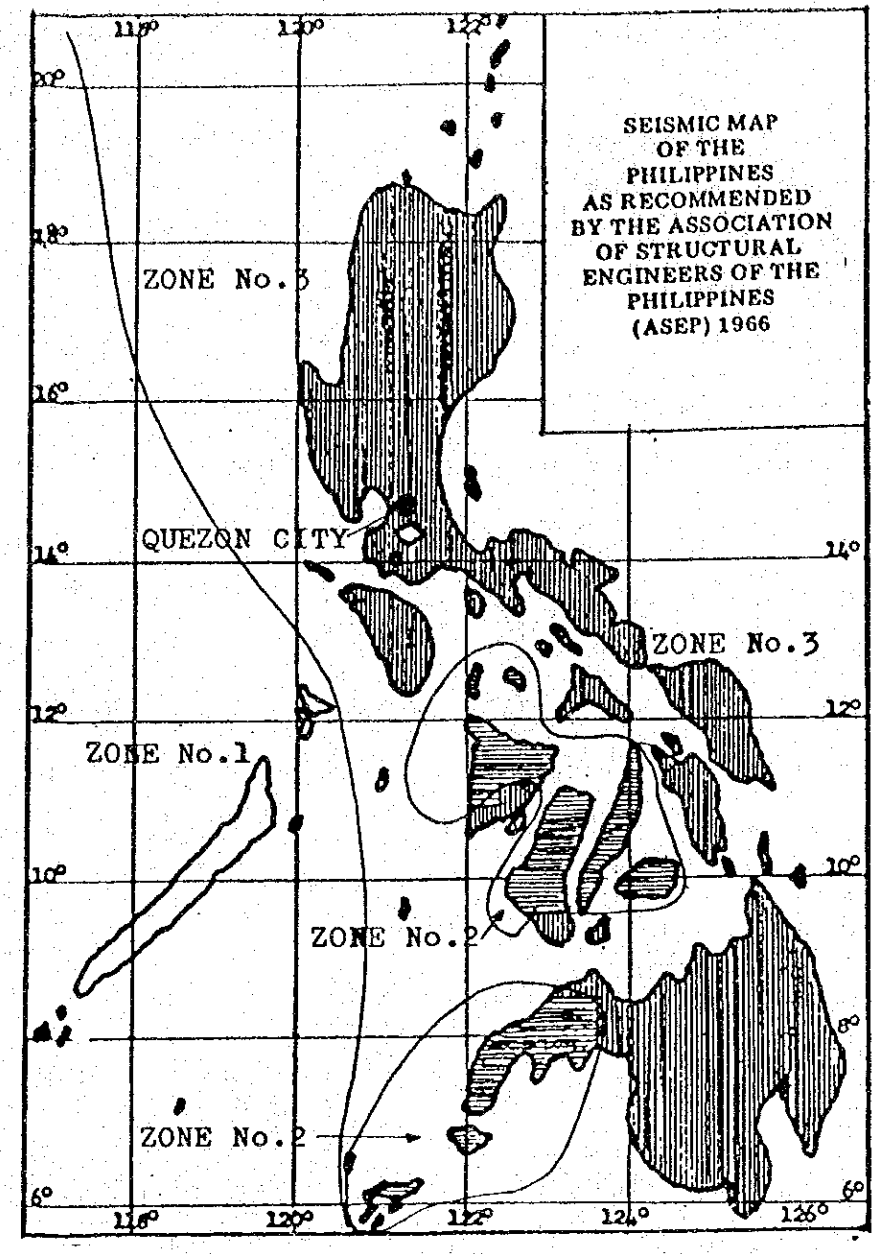
C: coeffecient determined by natural frequency of the structure; must be less than 0.12

$$C = \frac{1}{15\sqrt{T}} \qquad T = \frac{0.05\ hn}{\sqrt{D}}$$

S: coefficient for site-structure resonance

S = 1.5 (as per UBC 2312 (d))

W: total load for calculation of earthquake force



	ZONE No.1	ZONE No.2	ZONE No.3
Z	3/16	3/8	3/4

Fig. 5-4-41: SEISMIC MAP OF THE PHILIPPINES

Table 5-4-41: VALUES FOR OCCUPANCY IMPORTANCE FACTOR "I"

TYPE OF OCCUPANCY	I
Essential Facilities[1]	1.5
Any building where the primary occupancy is for assembly use for more than 300 persons (in one room)	1.25
All others	1.0

[1]See Section 2312 (k) for definition and additional requirements for essential facilities.

Table 5-4-42: HORIZONTAL FORCE FACTOR "K" FOR BUILDINGS OR OTHER STRUCTURES

TYPE OR ARRANGEMENT OF RESISTING ELEMENTS	VALUE[1] OF K
1. All building framing systems except as hereinafter classified	1.00
2. Buildings with a box system as specified in Section 2312 (b)	1.33
3. Buildings with a dual bracing system consisting of a ductile moment resisting space frame and shear walls or braced frames using the following design criteria: a. The frames and shear walls shall resist the total lateral force in accordance with their relative rigidities considering the interaction of the shear walls and frames b. The shear walls acting independently of the ductile moment resisting portions of the space frame shall resist the total required lateral forces c. The ductile moment resisting space frame shall have the capacity to resist not less than 25 percent of the required lateral force	0.80
4. Buildings with a ductile moment resisting space frame designed in accordance with the following criteria: The ductile moment resisting space frame shall have the capacity to resist the total required lateral force	0.67
5. Elevated tanks plus fill contents, on four or more cross-braced legs and not supported by a building	2.5[4]
6. Structures other than buildings and other than those set forth in Table No. 23-J	2.00

[1]Where wind load as specified in Section 2311 would produce higher stresses, this load shall be used in lieu of the loads resulting from earthquake forces.

[2]See Figure Nos. 1, 2 and 3 this chapter and definition of "Z" as specified in Section 2312 (c).

[3]The minimum value of *"KC"* shall be 0.12 and the maximum value of *"KC"* need not exceed 0.25.

[4]The tower shall be designed for an accidental torsion of five percent as specified in Section 2312 (e) 5. Elevated tanks which are supported by buildings or do not conform to type or arrangement of supporting elements as described above shall be designed in accordance with Section 2312 (g) using *"C_p"* = .2.

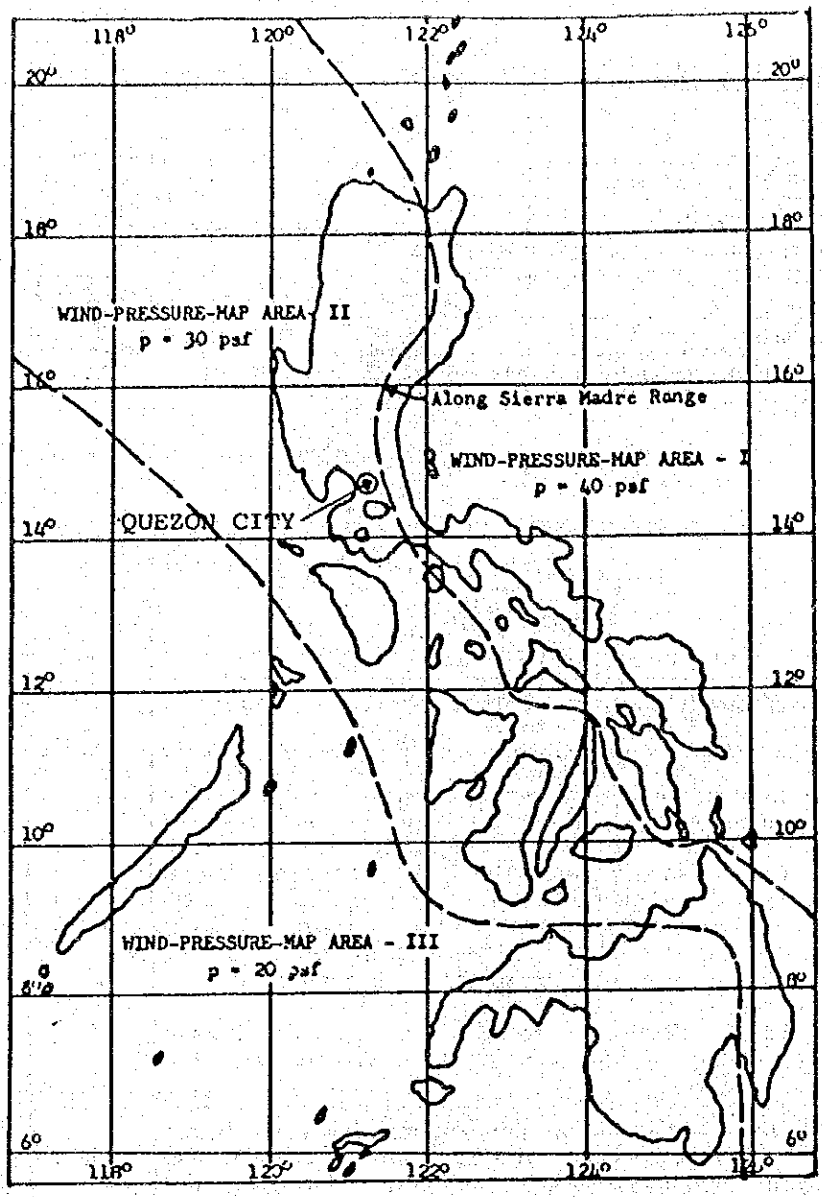


Fig. 5-4-42: WIND-PRESSURE-MAP AREAS FOR THE PHILIPPINES

Table 5-4-43
BASIC WIND PRESSURES FOR DIFFERENT HEIGHTS ZONES ABOVE GROUND FOLLOWING UNIFORM BUILDING CODE HEIGHT ZONES AND PRESSURE VARIATIONS (AUTHOR'S RECOMMENDATION)

HEIGHT ZONE IN FEET	WIND-PRESSURE-MAP AREA		
	AREA - I	AREA - II	AREA - III
Less than 30	30 psf	20 psf	10 psf
30 to 50	40 psf	30 psf	20 psf
50 to 100	50 psf	35 psf	25 psf
100 to 500	60 psf	40 psf	30 psf
500 to 1200	70 psf	45 psf	35 psf
over 1200	80 psf	50 psf	40 psf

(4) Wind Force

The wind force effecting the structure will be determined in accordance with NSCP. Quezon City belongs in AREA II, (fig. 5-4-2), therefore the column of AREA II in table 5-4-3 will be applied. As for the pressure coeffecients, recommended values prescribled by NSCP will be applied.

5-5 Building Facilities

5-5-1 Water Supply System

Water supply pipes of 100 mm (4 in) caliber are installed in the chemistry building and a standby pipe of the same caliber is embedded under the campus road east of the project site, which leads into the project site. The project plans to utilize this embedded piping by installing a new water supply pipe of 40 mm (1-1/2 in) caliber to be connected to this 100 mm (4 in) dia. pipe.

Since the water supply is suspended three or four times a month on the average, a receiving tank will be necessary for water storage. It will have sufficient capacity for about 24 hours consumption considering the purpose of the chemical laboratory. The plan is for water to be distributed by a pressure-pump system to each necessary discharge point.

Future changes, and new directions for the equipment piping system have to be expected along with changes in the laboratory equipment. For this purpose, a pipe system embedded in concrete is to be avoided as far as possible and an exposed piping system is planned. The main piping for each floor is to be mounted on the surface of the corridor ceiling, with water to be supplied to each room through valves.

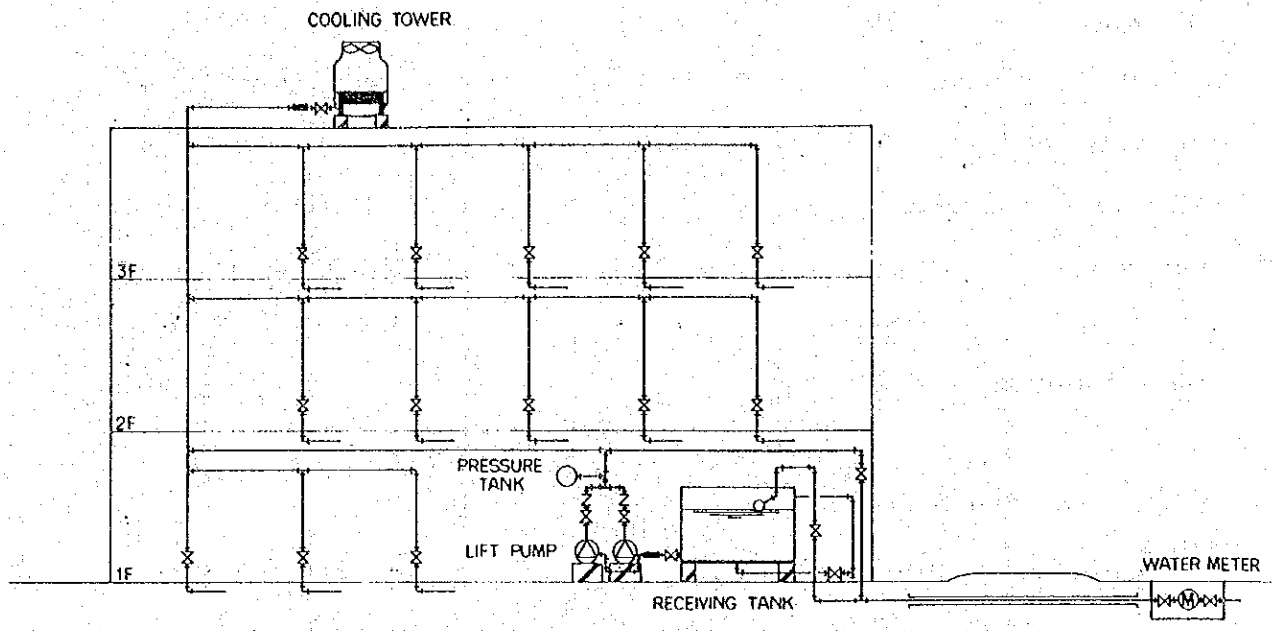


Fig. 5-5-1: WATER SUPPLY SYSTEM

5-5-2 Drainage System

The drainage system is planned to be separated into drainage systems for sewage water, sanitary water, laboratory waste water and storm water. Sanitary water is to be discharged via a septic tank, and laboratory waste water via a laboratory waste holding tank. They will be combined with sewage water and storm water to be disposed off into the open channel in the site. Laboratory waste water may not be specially treated according to the Laguna Lake Development Authority, however, at least a sedimentation tank must be provided to eliminate heavy metals in laboratory waste water.

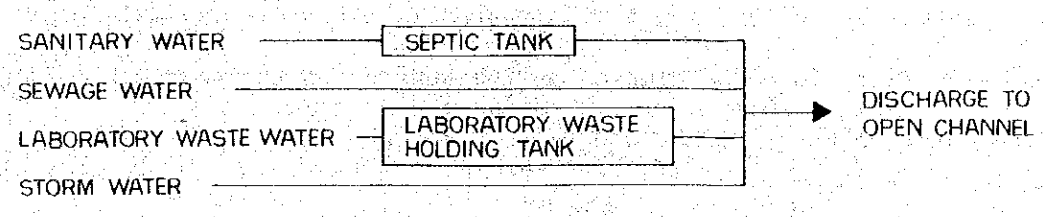


Fig. 5-5-2: DRAINAGE SYSTEM

5-5-3 Gas System

A propane gas central distribution system is to be provided to supply gas to necessary places. Propane gas is supplied by the Manila Gas Company. The gas calorific value is about 20,000 BTU/P. Gas piping will be of the exposed system. Gas will be distributed through the main piping installed on the corridor ceilings of each floor and supplied to each room via valves. Gas other than propane gas for laboratory use is to be supplied by gas cylinders provided at necessary places.

5-5-4 Air-conditioning and Ventilation System

An air-conditioning system for cooling only is to be provided for the common rooms (minimum area) and the laboratory equipment. The existing air-cooling system in Ateneo University is the water-cooled package type which distributes cool air by ducts. The same system is to be applied for maintenance, etc.

Ventilation will be principally of the natural ventilation system except that ventilation of the chemical laboratory draft chamber is to be a mechanical system on the top of the building.

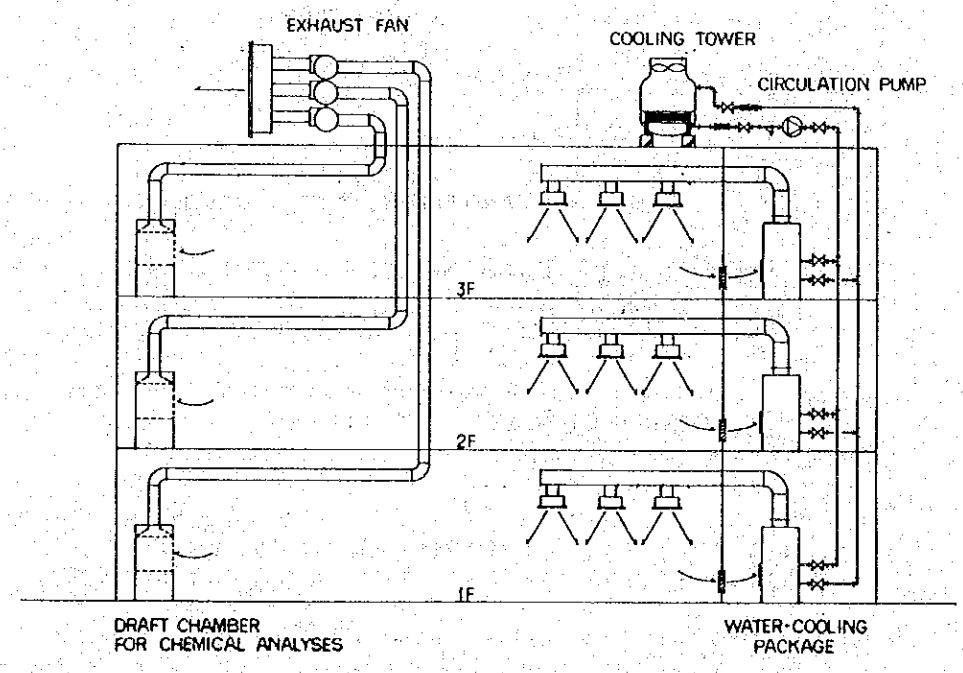


Fig. 5-5-4: AIR CONDITIONING AND VENTILATION

5-5-5 Fire Protection System

For fire protection, a siamese connection is to be provided outside, water-flow connections and hoses are to be provided on the second and third floors. These are to be connected by a piping system.

5-6 Electric System

5-6-1 Electric Power Supply

From a power line of 2,400 V, 3 phase, 3 wire, 60 Hz to the chemistry building, an incoming line is planned. It is to be embedded leading to the project building and a new transformer of about 300 KVA capacity is to be provided.

Apart from the common receiving system, an air-cooled type generator system with minimal capacity is to be provided for power failures. This generator system is for emergency lighting, fire alarm, an interphone system and laboratory equipment which must not stop in a power failure.

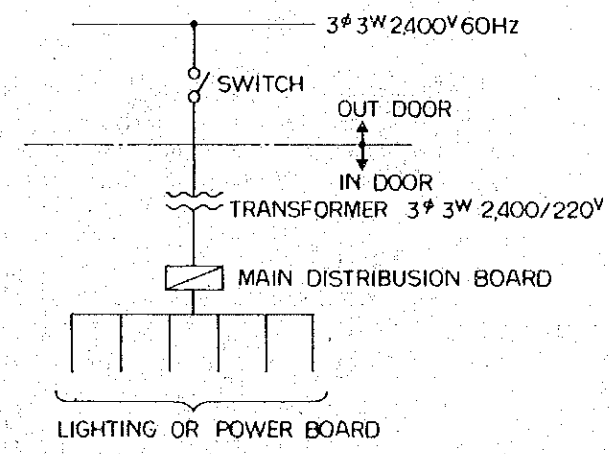


Fig. 5-6-1: ELECTRIC POWER SUPPLY

5-6-2 Main Line Facilities

A power line of reduced voltage is to be led from the new transformer through the main distribution board, and to the power board for air-conditioning and the plumbing system, to the distribution boards for lighting and the laboratory equipment.

5-6-3 Lighting Fixtures

Flourescent lamps will be used in principle to ensure sufficient illumination. Exit lighting fixtures are to be installed at the emergency exits.

5-6-4 Receptacle Outlets

1 ø 220 V or 110 V receptacle outlets are to be provided at necessary places in each room.

5-6-5 Weak Current Electric System

(1) Telephone System

One (1) circuit on a direct line for PIPAC's exclusive use leads into the chemistry building. It is to be moved into the project building. Interphones are to be provided in the main rooms for internal intercommunications.

(2) Fire Alarm System

A thermal detection type fire alarm system is to be installed in most parts, while a smoke detection type system is to be installed in fire escape passages like stairs and corridors.

5-7 Construction Materials and Building Facilities

In principle Philippine domestic materials and machinery are to be used as far as practicable except that product not produced in the Philip-

pines, imports from Japan that are cheaper than domestic products even considering the transportation costs or that are preferable in quality consiering maintenance costs after completion of the work, and those made in the Philippines involving difficulties in supply and/or delivery schedules may revert to imports from Japan. Due consideration shall be given to planning transportation schedules when Japanese products are used considering that it will take 14 days for shipping to Manila and 5 days for customs clearance.

5-7-1 Framework

It is planned to use ready mixed concrete manufactured by a local ready mixed concrete company. Care shall be given to cement supply conditions and the selection of a producing district of concrete aggregates and especially sand to obtain strong aggregates. Investigation is necessary regarding the concrete plant for the storage of aggregates and presence of concrete strength testing facilities. It is suggested that steels made in Japan be used due to quality problems. High tension steels of good quality for prestressing use are available in Manila. Though basic steel beams like L-shaped and I-shaped ones are locally available, assembling factories shall be selected with care if truss structure is applied which requires a high-level technique for assembling.

5-7-2 Finishing Work

Local products are to be used such as tiles for roofing materials, ceramic tiles for lavatories, terrazzo blocks and mortar. Vinyl tiles for floors of common offices, etc. are better imported from Japan considering their quality. All the partition walls are to be of concrete blocks except for the earthquake resisting walls of the gables; exterior windows will have steel sashes; glasswool insulation will be used for the third

floor ceiling; steel doors for exit doors and those in fire protection area; and wooden doors for the other areas. Locally produced materials are to be used for them.

5-7-3 Building Facilities

Building fires occur frequently in Manila compared with big cities in Japan. Razed buildings can be seen in various places. One reason is the use of flammable materials for building construction such as wooden partition walls, plywood ceiling panels on wooden subceilings and flammable curtains. Electricity leakage frequently becomes a cause of fires. Therefore Japanese products may need to be used for most of the electric wires, conduit tubes and lighting fixtures as well as boards, generators for emergency use and weak current facilities. Some of the package unit and cooling tower for air-conditioning, etc. may also require Japanese products. Well established manufacturers capable of maintenance and supply for spare parts and repairs shall be selected for the facilities requiring a power source.

5-8 Analytical Equipment Planning

5-8-1 Basic Principles

Analytical equipment to be supplied by Japanese Grant is selected according to the following principles:

(1) to be indispensable in the realization of the future prospects of PIPAC

(2) to contribute effectively to the development purpose of small and medium scale industries through PIPAC's activities

(3) to be easy for maintenance

In accordance with the rapid progress in technology of analytical equipment, some of the equipment have become exceedingly complicated but with low accuracy and poor reproducibility of analytical results. These types of equipment are not suitable for PIPAC.

Attachments and accessories of major analytical equipment shall be supplied sufficiently in order to provide more flexibility and increase the capacity of use of the analytical equipment.

Minor analytical equipment such as glassware, porcelainware, stirrers is also very important to promote PIPAC's function, because of the large number of analytical samples which are treated by hand analysis, that means volumetric and gravimetric analysis. In order to accelerate PIPAC's contribution for the small and medium scale industries of the Philippines, supply of these minor equipment shall be taken into consideration.

In order to avoid the idle time of the analytical equipment caused by the lack of maintenance, a reliable manufacturer shall be selected who offers a periodical technical service and reliable maintenance service and also supply of spare parts through agents or dealers in the Philippines. The operation rate of analytical equipment installed in the Philippine laboratories is not seemed to be very high due to an insufficient supply of spare parts. Therefore, easily broken parts especially those used in the position of high temperature and friction shall be also supplied for the smooth operation of PIPAC.

Furthermore it is very important for PIPAC's staff to gain the knowledge and experience in use of advanced analytical equipment, its attachments and accessories and to master the method of adjustment, control and maintenance through the specialists sent by the manufacturer during the installation and testrun of the analytical equipment in the standpoint of smooth technology transfer.

5-8-2 List of Major Analytical Equipment

The short specifications of the major analytical equipment and these analytical purposes are described in table 5-8-2 as the listed formula. A brief explanation of each analytical equipment is:

(1) High Performance Liquid Chromatograph

Generally, it is extremely difficult to analyze and define each compound of a mixture of organic compounds. This equipment is very effective to separate the mixture into the pure component by the application of the charactersitcs of each substance such as surface tension, adsorption and diffusion in capillary. After separateion into pure components, the analysis becomes very easy using the detector of UV-VIS spectrometer or infrared spectrophotometer. Therefore this equipment must be widely used for the various analysis of odor substances, edible oils, medicines, chemical dyes and so forth.

(2) Infrared Spectrophotometer (for Research)

An organic compound gives rise to characteristic peaks in its adsorption spectrum according to the nature of the molecular binding energy and structure. By the application of this principle, this equipment is very effective to analyze and define the pure substances and also widely useful for pesticides, vegetable oils, paints, plastics, food and etcetera.

Data memory, as an accessory, is also supplied to interpret analytical results promptly compared with property of adsorption patterns of infrared spectrum.

(3) Infrared Spectrophotometer (for Training)

Infrared spectrophotometer for training or exercise has a simpler system than the research grade one but trainees are able to learn the principle of infrared adsorption and the techniques with respect to the followings;

* Sample preparation procedure prior to analysis

* Handling procedure of solid and gaseous samples
* Operation method of infrared spectrophotometer
* Reading procedure of spectrum

Also this infrared spectrophotometer is expected to take a part of analytical services.

(4) Atomic Absorption Spectrophotometer (for Training)

Atomic absorption spectrometry is remarkably effective for analysis of metals like mercury and cadmium and, therefore, is powerful in the pollution monitoring analysis for mining industries, agriculture and marine products which are mainly exporting materials from the Philippines.

Although the operation procedure of this equipment looks rather difficult, it is capable of measuring a microchemical quantity. In addition, this equipment is useful not only for training but also for analysis on PIPAC's activities in future.

(5) Gas Chromatograph (for Training)

Gas chromatograph is very common equipment for the qualitative and quantitative analysis of volatile materials based on the principle of the adsorption property of gas on the porous surface of solid. This equipment has the wide range of usage and the highest operation rate in the analytical services done by PIPAC. Recently the gas chromatograph is progressing to analyze a micro quantity of gas such as odor substance in accordance with the development of accessories.

(6) UV-VIS Colorimeter (for Training)

This equipment is very effective to analyze organic compounds, metals, soils and miscellaneous substances by the measurement of wave length and its strength in the range of visible and ultraviolet rediation.

This equipment is very simple and analytical period is short but the techniques of coloring by special reagent or masking of disturvance substances

shall be attended prior to analysis.

The training type equipment is available for the research and analysis purpose in order to promote PIPAC's activities.

(7) Elemental Analyzer

Elemental analyzer is capable of defining the quantities of carbon, hydrogen and nitrogen which are three major elements of organic substances such as oils, fuels, proteins, amino acids, fertilizers and so forth. Based on the analytical results, the combustion heat value is able to estimate and the structure of organic compounds is also presumed.

This equipment is expected to contribute to the research and development plan of PIPAC.

(8) Microcomputer System

Microcomputer system with the calculating capacity, memory function and speedy printer is considerably necessary for the management of analytical information, data banking and the delivery of analytical results for PIPAC's clients.

Hand input system shall be applied to the microcomputer since the automatic pickup system may make cause of troubles.

(9) Spectrodensitometer for Thin Layer Chromatography

This equipment is useful to analyze quantitatively unsaturated oils, aromatic compounds in fruits, oxidized substances, medicines and food contamination among others by the intensities of reflected light and also is considered to be effective for consulting and advisory services to small and medium scale industries of the Philippines.

(10) Laboratory Scale Fermenter

This equipment is taking an important role of biomass development as well as alcohol production by the fermentation of waste of agricultural

products, to utilize alcohol as local or public energy source.

(11) Refrigerated Centrifuge

This equipment is necessary to make the precipitation of the essence of agricultural and marine products in a short time and also is very powerful to separate the yeast or enzyme under the low temperature condition, which have very sensitive activity in the slightly high temperature.

(12) Freeze Drier

This equipment is utilized to make a freeze-dried substances such as enzymes or heat sensitive materials under the vacuum and refrigerated condition.

(13) Droplet Countercurrent Extractor

This equipment is to extract the essence very effectively from foods, oils, medicines, etcetera in the countercurrent solvent stream, using the different solubility of essence to two kinds of solvents. This is a kind of separation and purification apparatus.

(14) Equipment for Maintenance

Tools and maintenance equipment are absolutely necessary for the laboratory in which are installed a lot of analytical equipment and electronics instrument and furthermore maintenance equipment is expected to be utilized in the electronics and instrument group assigned in PIPAC's future plan.

(15) Differential Thermal Analyzer

This equipment is useful to trace the thermal change process of volatilization, oxidation, decomposition and carbonization of foods, drugs, plastics and so forth although this equipment has a slight problem in the reproducibility.

Table 5-8-2: LIST OF MAJOR SCIENTIFIC LABORATORY EQUIPMENT

Priority	Description : Specification	Quantity	Purpose	Notes
1	High Performance Liquid Chromatograph with recorder: liquid supply system- double plunger type flow rate stability- within 1%	1	Food - food colors - flavoring agents - preservatives-benzoic and other acids - aflatoxins - anti-oxidants in fat	
	1-1) Accessories			
	blunt-needle LC syringe,10 ul	2	Textiles - dye formulations - dyes in effluents	
	blunt-needleLLC syringe, 5 ul	2		
	blunt-needle LC syringe, 1 ul	1		
	Prepacked analytical column for Ion Exchange HPLC, micro-particle, 4.5 mm I.D. x 2.5 cm.			
	a) (strongly basic) exchanger - for biological samples like nucleotides and pharmaceuticals	1	Soaps and detergents - perfume loss and retention - fatty acid characterization	
	b) cation exchanger - for vitamins	1	Pharmaceuticals - analgesics like aspirin,phenacetin - ephedrine and related compounds -phenyl butazone and other anti-inflammatory drugs - diazepan and other tranquilizers	
	Prepacked columns of spherical microporous packing material= 5 um:			
	a) Silica, 25 cm x 4.6 mm	1		
	b) Silica with bonded nitrile group,15 cm x 4.6mm	1		
	c) Silica with bonded amine group, 25 cm x 4.6 mm	1		
	d) Alumina, 25 cm x 4.6 mm	1		
	Prepacked columns (Reversed-phase), 5 um, 15 cm x 4.6mm			
	a) Silica modified with hexyl group (C_6)	1		
	b) Silica modified with octyl group (C_8)	1		
	c) Silica modified with octadecyl group (C_{18})	1		
	Toyo pearls HW for protein and dextran molecular size determination	250 ml		
	Deae Toyo pearls: semi-rigid gel from hydrophilic vinyl polymer containing many hydroxyl groups, super fine, 25-44um.	250 ml		
	1-2) Data Processor connectable chromato - graph- 6 no of processable peaks 10^0 10^0	1		

Priority	Description : Specification	Quantity	Purpose	Notes
2	Infrared Research Spectrophotometer: Wavelength range: 4000-400 cm^{-1} Scan time: 3 min.-64 hr. standard: 6 min.	1	Pesticides - polychlorinated benzene and related compounds - organic phosphates and carbamates Natural Products (Structure Elucidation) - essential oils from oil producing plants - toxins from marine invertebrates - natural insect repellants from native plants Paints - alkyl and other resins - naphthanates and related drying compounds Plastics - polymer composition of plastic products - plasticizer formulations Food - lacquer coatings in tin cans - food colors, flavors and other additives	
	2-1) Accessories			
	agate mortar and pestle	1		
	beam attenuator	1		
	demountable liquid KBr cell	2		
	demountable cell holder with teflon plugs	2		
	gas cell with Kbr window	1		
	KBr die	1 set		
	KBr die holder	1		
	light source	1		
	Attenuated Total Reflectance Attachment	1		
	KBr powder	500 g		
	polishing kit	1		
	hydraulic press	1		
	2-2) Data memory	1	Makes comparison of Infrared Spectra fast and accurate and can be used for analysis of spectra of multiple components.	
3	Training Infrared Spectrophotometer: wavelength range: 4000-600 cm^{-1}	2	Training Program Fundamental source of Infrared absorption spectra Principles of the Infrared spectrophotometer - light source, monochromator, detectors - optical feedback principle Preparation of Sample materials - KBr method, liquid solutions, mulls - gas samples - Attenuated Total Reflectance (ATR) method Identification of substances by Infrared spectra - use of Infrared libraries	Revision: 1-set Supply
	3-1) Accessories			
	agate mortar and pestle	2		
	beam attenuator	2		
	demountable liquid KBr cell	4		
	demountable cell holder with teflon plugs	4		
	gas cell with KBr window	1		
	KBr die	2 sets		
	KBr die holder	2		
	light source	1		
	Attenuated Total Reflectance Attachment	2		
	KBr powder	500 g		

Priority	Description : Specification	Quantity	Purpose	Notes
4	Training Atomic Absorption Spectrophotometers : wavelength: 1900-9000 Å	3	Training program Fundamental source of emission and absorption spectra Parts and Operation Of the Atomic Absorption Spectophotometer (AAS) - the hollow cathode lamp, monochromator, aspirators and burners, detectors - choppers and phase sensitive detection - fuel and oxidant combinations Basic Atomic Absorption Spectrophotometer analysis - sample preparation, standards and calibration - releasing agents and ionization suppressors - choice of analytical wavelength Electrodeless Discharge Lamp, Flameless methods and other advanced topis Maintenance and trouble shooting	
	4-1) Accessories			
	air compressor, small, portable	3		
	gas regulator, two stage for acetylene	3		
	hollow cathode lamp (13)			
	Calcium/Magnesium combination	2		
	Chromium/Iron/Nickel/Copper/Manganese/ Nickle, Multielement	2		
	Zinc	2		
	Sodium/Potassium combination	2		
	Lead	2		
	Cadmium	2		
	Hydrogen continium	1		
	nebulizer	3		
	spare additionally 2			
5	Training Gas Chromatograph : dual column type temperature programming	3	Training Program Fundamental Principles of Chromatographic separations Parts of the gas chromatograph - Injector, flow controllers, columns, ovens and temperature controllers and programmers - Detectors and their principle of operation Thermal Conductivity Detector(TCD) Flame Ionization Detector (FID) Electron Capture Detector(ECD) Flame Photometric Detector (FPD) Performing Gas Chromatograph analyses - Column packings and how to choose them - Optimizing Gas Chromatography performance - Temperature programming - Sample Trapping Maintenance and Trouble shooting	
	5-1) Accessories			
	empty glass columns for research Gas Chromatograph, 1/4 inch O.D.			
	3 feet	4		
	6 feet	6		
	12 feet	4		
	stainless steel tubing for columns			
	1/4 inch O.D.	50 ft.		
	1/8 inch O.D.	200 ft.		
	syringes			
	gas-tight, 1000 ml	2		
	for liquids, 10 ul, ordinary plunger	6		
	for liquids, 10 ul, reinforced plunger-	6		
	column caps			
	1/4 inch	50		
	1/8 inch	100		
	septa			
	high temperature	100		
	ordinary	500		

Priority	Description : Specification	Quantity	Purpose	Notes
5	Training Gas Chromatograph (continued)			
	swagelok or equivalent gas pressure fittings			
	front ferrules, 1/4 inch	50		
	back ferrules, 1/4 inch	50		
	nuts, 1/4 inch	50		
	front ferrules, 1/8 inch	100		
	back ferrules, 1/8 inch	100		
	nuts, 1/8 inch	100		
	column supports; Chromsorb or the equivalent,120/140 mesh			
	Chromsorb W, non-acid washed	900 g		
	Chromsorb W, high performance	100 g		
	Chromsorb P	300 g		
	stationary phases			
	OV-101	20 g		
	OV-210	20 g		
	OV-275	10 g		
	Carbowax 20, M	50 g		
	Diethylene glycol	20 g		
	Poropak Q 100/120 mesh	75 cc		
	Silicone O-rings for glass columns, 1/4 inch	200		
	gas pressure regulator, two stage for Nitrogen	3		
	gas pressure regulator, two stage for Air	3		
	gas pressure regulator, two stage for Hydrogen	3		
	gas purifiers (molecular seives)	6		
	tool for gas chromatograph	1		
	trapping equipment	3		
	5-2) Recorder	3		
	Recorder Chart Paper	24 rolls		
6	Training Colorimeter (UV-VIS) : wavelength : 200-1000nm single beam digital	3	Training Program Fundamentals of Ultraviolet and Visible light absorption spectra Electronic energy levels, the Beer-Lambert Law Monochromators, light sources and detector Single and Double beams operations Performing UV VIS Spectrograhic Analysis Choice of solvents, wavelength, sample cells Colorimeter reagents Analysis of simple components Optimization of analytical parameter	Revision: 2-sets Supply
	6-1) Accessories			
	quartz cell, 1 cm	8		
	quartz cell, 10 cm	2		
	glass cell, 1 cm	8		
	Hydrogen or deuterium lamps	2		
	Tungsten lamps	2		

Priority	Description : Specification	Quantity	Purpose	Notes
7	Spectrographic System- Spectrograph : wavelength range: 1200Å" 1200 lines/mm grating	1	Metals Industry - identification,of aluminum, copper and ferrous alloys - determination of trace components Mo,Zn, Mn, etc. - detection of heavy metal waste contamination in plating industry Ni, Cr, Cd, Zn Minerals - survey for economically important ores of Cu, Fe, Mn and Cr. - identification of minerals Food - rapid detection of heavy metal contamination: Zn,Cd, Pb, Cu Pollution - rapid detection of heavy metal pollution in water and soil: Cu, Zn, Pb, Cd, Ni, Cr, Mn, Ag	Revision: Canceled
	7-1) Accessories			
	camera : 102 x 254 mm photographic plate	1		
	Excitation sources : low voltage DC Arc and high voltage AC spark	1		
	7-2) Microdensitometer	1		
8	Elemental analyzer- Carbon, Hydrogen, Nitorgen : sample: 1-3 mg analytical speed: 9-15 mm/ sec absolute error: ± 0.3%	1 set	Energy and Fuel - characterization of local sources of coal and charcoals - characterization of oil from various oil producing plants like the Euphorbia species Natural Products - elemental analysis before structure elucidation by Infrared, Nuclear Magnetic Resonance and Mass Spectrometer analyses of natural pesticides, pheromones, medicinal extracts, oils, toxins and others	
	8-1) Accessories			
	Kjehdahl Set-up	2 sets		
	Kjehldahl flask,750 ml	20		
9	Microcomputer system : 16 terminals as pick-up	1 set	Data processing and preparation of analytical results for clients.	Revision: Hand-Input 2 sets requested
	9-1) Accessories			
	Printer	1 set		
	Printing paper	24 rolls		

Priority	Description : Specification	Quantity	Purpose	Notes
10	Spectrodensitometer for Thin Layer Chromatography : wavelength range: 200-800 nm Dual wavelength	1	Used for scanning Thin Layer Chromatography plates for quantitation of spots on the plates for the following: Foods - aflatoxin and other contamination - colors and related additives - flavorroids in fruit extracts - polyunsaturated fats and oils Pharmaceuticals - caffeine in Aspirin-Phenacetin Caffeine (ACP) tablets - penicillin and its derivatives - analgesics- phennacetin, antipyrine - diazepan and related drugs	
	10-1) Accessories			
	Thin Layer Chromatography Plates Silica gel GF 254 : precoated on glass layer thickness 0.25 mm, 20 x 20 cm	100 plates		
11	Laboratory Scale Fermentor : iNside volume: 50 l	1	Used for exploration of production by biotechniques of such materials as: Alcohol - development of varieties of yeast for specific substrates like palm sap, sweet sorghum, etc. Sugars - development of enzyme systems for the saccharification of cellulosics and starchy materials like cassava and related rootcrops Antibiotics - development of possible new antibiotics by biotech modifications like the penicillins.	
12	Refrigerated Centrifuge : Power: 200V x 50/60 Hz x 30 A	1	Separation of components in natural products preparation and in biotech research. Examples are: Yeast - separation of yeasts from the medium for possible use in animal feeds	
	12-1) Accessories			
	Rotor : Nominal Tube Capacity:	1		

Priority	Description : Specification	Quantity	Purpose	Notes
12	Refrigerated Centrifuge (continued)		Enzymes – Separation of bacterial cells from the medium for possible extraction of cellular or extra-cellular enzymes. Most important now are the cellulases and the various saccharifying enzymes.	
	Rotor — Nominal tube capacity: 7 ml x 18 tubes	1		
	Test tubes	2 sets		
13	Freeze Dryer — W 650 x D 550 x H 700 up to 0 - 50°C Power: 400 watts	1	Drying of heat sensitive materials like enzyme preparations	
	13-1) Accessory			
	FD-A sample flask	20 pcs.		
14	Droplet Countercurrent Extractor	1 set	Natural Products - oils from oil bearing plants - steroidal materials - medicinal extracts	
15	Equipment for instrument maintenance and trouble shooting			
	a) Dual Trace Oscilloscope — 50 M Hz, delayed sweep and single trace capabilities	1		
	b) Digital Multimeters	2		
	c) Frequency Counters — 250 M Hz	1		
	d) Function and Pulse generator	1		
16	Thermal Analysis System — 1) Differential Scanning Calorimeter 2) Differential Thermal Analysis 3) Thermal Gravimetric Analysis	1 set	Minerals – identification or characterization of economic minerals – phosphates – potassium minerals – clays and refractories Plastics – characterization of different plastic formulations like polyethylenes, polystyrenes, polybutylenes, etc. Pharmaceuticals – characterization of antibiotics, analgesics, antidiabetics	Revision: Canceled

5-8-3 List of Auxiliary Equipment

Auxiliary equipment is commonly needed for the analytical laboratory and is listed up in table 5-8-3.

PIPAC borrows the minor analytical equipment from Ateneo de Manila University which shall be remained in the university at the time of the completion of new facilities.

The glassware and procelainware used in hand analysis, of which the number of samples reaches to about 50 percent of PIPAC's analytical services, are supplied to gain the reliable analytical results. Taking care of damage or breakage of these minor equipment, glassware is properly stored in the locked drawers of the laboratory tables. In order to minimize the breakage of these minor equipment, the surface of laboratory table is preferable to be made of wood instead of tile and concrete.

Chemical reagents are supplied in account of annual consumption, in which standard solutions, indicating reagents, acids and alkalis, but no poisosn are included.

These minor equipment and chemical reagents shall be taken care of in the packing and transportation due to the fragile apparatus and dangerous chemicals.

Table 5-3-3: LIST OF AUXILIARY EQUIPMENT

Priority	Description	specification	Quantity	Purpose	Notes
1	Standby Generator	capacity:	1		
2	Automatic Analytical Balance	160 g/.0001 sensitivity	8		Revision: 6-sets Supply
3	Micro Balance	Capacity: 20 g/10.001 mg	1		
4	Rough Balance	Top loading Type with dual range- 0.01g and 0.1 g Capacity: 1200g/ 10 mg	8		Revision: 4-sets Supply
5-1	Drying Oven	250°C inside volume: 60 cm x 50 cm x 50 cm	8		Revision: 6-sets Supply
5-2	Drying Oven	500°C inside volume: 45 cm x 40 cm x 40 cm	2		
6	Muffle Furnace	1200°C inside volume: 20cm. x 30 cm x 12.5 cm	4		Revision: 2-sets Supply
7	Automatic Water Still	Distillation capacity: 4 liters/ hr. distillation unit ion-exchange unit	2		
8	Cold Storage Equipment	-20°C to +60°C inside volume: 40 cm x 30 cm x 40 cm power: AC 100 volt x 6A	1		
9	Metal and Woodworking tools				
	Metal Cutting lathe with bits	8 in	1		
	Drill press	3/4 inch capacity	1		
	Milling Machines	horizontal	1		
	Band Saw		1		
	Circular Saw	10 inches	1		

Priority	Description	Specification	Quantity	Purpose	Notes
	Power Hack Saw		1		
	Adjustable wrench	crescent	5 pcs.		
	Screw Driver		1 set		
	Screw Driver (Phillips)		1 set		
	Ball Hammer		1 pc.		
	Hammer	small and big	1 pc.		
	Pipe Wrench	1 pc.	1 pc.		
	Long Nose plier		1 pc.		
	Tin Snips (scissors for metal sheets)		1 pair		
	Rasp or file for glasswork	6 inches long, rectangular	10 pcs.		
	Rasp or file for glasswork	6 inches long, round	5 pcs.		
	Allen Wrench		1 set		
	C-Clamps	max, distance between jaws 150 mm	2 pcs.		
	Soldering gun	150 watts	1 pc.		
	Portable Power Workshop set		1 set		
10	Audiovisual Equipment				
	a) Overhead projector		2		
	b) Slide Projector	Automatic Slide Exchanger -spare slide cartridge	2 1		
	c) Movie Projector		1		
	d) Screen	1.5m. x 1.5 m Daylite type	2		

Priority	Description	Specification	Quantity	Purpose	Notes
11	Laboratory Glassware, porcelainware and other minor laboratory equipment and supplies	Refer to attachment "A"			Revision: A little change on Quantities
12	Chemical Reagents and Standards	Refer to attachment "B"			

Attachment - A

MINOR LABORATORY EQUIPMENT AND SUPPLIES

Basis for the estimate of the Amount Requested

1. Five laboratories with three analysts each total of 15 analysts
2. a) For frequently used equipment - 40 units/analyst
   b) For moderately used equipment - present units x 10
   c) For seldomly used equipment - present units x 5
3. Breakage factor: 1 to 3 units / month / analyst

In the present set-up, PIPAC borrows most of the minor laboratory equipment from the Ateneo Chemistry Department.

I T E M S	UNITS
Aneroid barometer with thermometer, accuracy: ± 0.5 mm Hg (Japan Meteorological Agency)	1 pc.
Asbestos paper, roll of 6 meters	5 rolls
Autotransformer, Variable, .0 to 140v, powerstat for use on 120v, 60 Hz, min. 7.5 amps to 10 amps max	10 pcs.
Beaker, low form, 10 ml	100 pcs.
Beaker, heavy duty, 25 ml	300 pcs.
Beaker, heavy duty, 50 ml	500 pcs.
Beaker, heavy duty, 100 ml	500 pcs.
Beaker, heavy duty, 150 ml	500 pcs.
Beaker, heavy duty, 250 ml	600 pcs.
Beaker, heavy duty, 400 ml	600 pcs.
Beaker, heavy duty, 600 ml	100 pcs.
Beaker, heavy duty,1000 ml	100 pcs.
Beaker, low form, polypropylene, 250 ml	50 pcs.
Beaker, low form, teflon, 250 ml	50 pcs.
Buchner funnel, all glass w/ sintered disc, 3.8 cm. dia.	10 pcs.
Buchner funnel, all glass w/ sintered disc, 6.8 cm. dia.	10 pcs.
Buret, teflon stopcock, 10 ml	5 pcs.
Buret, teflon stopcock, 50 ml	50 pcs.
Beaker safety tongs	10 pcs.
Burner, bunsen, LPG	90 pcs.
Burner, Meker, high temperature	50 pcs.
Bottle, washing plastic, 500 ml	50 pcs.
Bottle, weighing, tall form (30 x 50 mm)	30 pcs.
Crucible, gooch, porcelain, 25 ml capacity	500 pcs.
Crucible porcelain with cover, 15 ml, case of 72	2 cases
Crucible porcelain with cover, 30 ml, case of 36	1 case
Crucible porcelain with cover, 50 ml, case of 24	2 cases
Crucible, platinum with cover, 25 ml capacity	6 pcs.
Crucible, platinum with cover, 50 ml capacity	6 pcs.
Crucible tongs, 18 in.	3 pcs.
Crucible tongs with platinum tip	1 pc.
Crucible, filter glass, 30 ml	30 pcs.

Caps, plastic, screw type with Vinylute Liners, (size no. equivalent to the inside diameter of the cap in millimeters at the screw thread root)	
No. 18 (ctn. of 144)	10 ctns.
No. 20	20 ctns.
No. 22	5 ctns.
No. 24	5 ctns.
No. 28	10 ctns.
Teflon cap liners	
No. 18	10 ctns.
No. 20	20 ctns.
No. 22	6 ctns.
No. 24	5 ctns.
No. 28	10 ctns.
Centrifuge tubes, heavy duty, 50 ml, pk of 12	5 pks.
Centrifuge tubes, heavy duty, 15 ml, pk of 12	2 pks.
Clamps, iron	300 pcs.
Clamp holders	300 pcs.
Condenser, Allihn w/ S joints, 400 mm length S joints 24/40	40 pcs.
Condenser, Allihn w/ S joints, 400 mm length S joints 29/40	10 pcs.
Cork borer, hard polished brass with wing handles	5 sets
Cork borer sharpener	5 pcs.
Dish tongs, for handling hot evaporating dish	2 pcs.
Dessicator, for general purpose, inside dia. 250 mm	30 pcs.
Dessicator, for general purpose, inside dia. 160 mm	30 pcs.
Dessicator, vacuum type, inside dia. 160 mm	10 pcs.
Dessicator, vacuum type, inside dia. 250 mm	10 pcs.
Distilling head, Claisen w/ S joints 24/40 (good for 100-500 ml distilling flask)	20 pcs.
Distilling head, Claisen w/ S joints 29/40 (good for 1000-2000 ml distilling flask)	10 pcs.
Erlenmeyer flask, 25 ml	100 pcs.
Erlenmeyer flask, 50 ml	150 pcs.

Erlenmeyer flask, 100 ml	400 pcs.
Erlenmeyer flask, 250 ml	800 pcs.
Erlenmeyer flask, 500 ml	150 pcs.
Erlenmeyer flask, B24/40, 250 ml	100 pcs.
Erlenmeyer flask, B24/40, 500 ml	50 pcs.
Erlenmeyer flask safety tongs	10 pcs.
Evaporating dish, porcelain, 150 ml	100 pcs.
Evaporating dish, porcelain, 350 ml	50 pcs.
Face shield	15 pcs.
Fluorescent lamps, 12v, 6w, battery-operated	15 pcs.
Filter paper, Qualitative, 4.25 cm dia. pk of 100	10 pks.
Filter paper, Qualitative 11 cm dia. pk of 100	25 pks.
Filter paper, Qualitative 9 cm dia..pk of 100	10 pks.
Filter paper, Quantitative, ashless, course ppt, 11 cm. pk of 100	20 pks.
Filter paper, Quantitative, ashless, fine ppt, 11 cm, pk of 100	10 pks.
Filter paper, Quantitative, ashless, very fine ppt. 11 cm, pk of 100	20 pks.
Filter paper, Quantitative, ashless, for silica, ceramics, 11 cm, pk of 100	40 pks.
Funnel, glass, short stem, 65 mm dia. case of 12	20 cases
Funnel, powder w/ beaded rim and short, large bore stem, 65 mm	10 pcs.
Funnel, separatory, 250 ml, short stem	50 pcs.
Funnel, separatory, 1000 ml, short stem	10 pcs.
Gas-washing bottle, 100 ml	20 pcs.
Gas-washing bottle, 250 ml	30 pcs.
Gas-washing bottle, 500 ml	20 pcs.
Ground glass joints-cone B14/23	20 pcs.
Ground glass joints-cone B19/26	50 pcs.
Ground glass joints-cone NS24/29	60 pcs.
Ground glass joints-cone NS29/32	20 pcs.
Ground glass joint-socket NS14/23	20 pcs.
Ground glass joint-socket NS19/26	50 pcs.
Ground glass joint-socket NS24/29	60 pcs.

Ground glass stopper, NS29/32	50 pcs.
Ground glass stopper, NS24/29	100 pcs.
Ground glass stopper, NS19/26	30 pcs.
Gloves, Asbestos	5 pairs
Gloves, polyethylene, disposable, medium, case of 1000	1 case
Hydrometer set (for specific gravity measurement)	1 set
Heating tapes, 1 in. wide, 6 ft. long/reel	2 reels
Heating mantle, electrothermal w/ fabric bottom covering, 50 ml	5 pcs.
Heating mantle, electrothermal w/ fabric bottom covering, 100 ml	5 pcs.
Heating mantle, electrothermal w/ fabric bottom covering, 250 ml	5 pcs.
Heating mantle, electrothermal w/ fabric bottom covering, 500 ml	5 pcs.
Heating mantle, electrothermal in self-standing metal case, 1000 ml	10 pcs.
Heating mantle, electrothermal in self-standing metal case, 2000 ml	20 pcs.
Hot plate, 5 x 7, 600 watts, 120v, porcelain top	20 pcs.
Hot plate with stirrer, 5 x 7, 600 watts, 120v, porcelain top	10 pcs.
Hot air dryer, hand portable, blower type for thin layer chromatography	5 pcs.
Iodine flasks, w/ stoppers, 500 ml	30 pcs.
Iron rings with screw clamp, 2½ in. dia. pk of 5	30 pks.
Iron rings with screw clamp, 3½ in. dia. pk of 5	10 pks.
Magnetic stirrers	10 pcs.
Measuring cylinder, polypropylene, 10 ml	100 pcs.
Measuring cylinder, polypropylene, 100 ml	200 pcs.
Measuring cylinder, glass, 10 ml	50 pcs.
Measuring cylinder, glass, 25 ml	50 pcs.
Measuring cylinder, glass, 100 ml	100 pcs.
Measuring cylinder, glass,1000 ml	5 pcs.
Mercury germicidal lamp	10 pcs.

Microscope, polarizing	1 pc.
Mixing cylinder, 25 ml w/ glass stopper	300 pcs.
Mixing cylinder, 50 ml w/ glass stopper	400 pcs.
Mixing cylinder, 250 ml w/ glass or plastic stopper	200 pcs.
Mixing cylinder, 100 ml w/ glass or plastic stopper	500 pcs.
Mortar & Pestle, porcelain, capacity 275 ml	20 pcs.
Mortar & Pestle, porcelain, capacity 400 ml	10 pcs.
Motor Driven Mill or Grinder, with accessories, Laboratory size (for reduction of analytical sample like plants and grains)	1 set
Petri dish w/ cover, 100 x 15 mm glass	100 pcs.
Pipet measuring, 1 ml	300 pcs.
Pipet measuring, 2 ml	300 pcs.
Pipet measuring, 5 ml	600 pcs.
Pipet measuring, 10 ml	600 pcs.
Pipet measuring, 25 ml	500 pcs.
Pipet, volumetric, 1 ml	300 pcs.
Pipet, volumetric, 2 ml	300 pcs.
Pipet, volumetric, 5 ml	800 pcs.
Pipet, volumetric, 10 ml	600 pcs.
Pipet, volumetric, 20 ml	600 pcs.
Pipet, volumetric, 25 ml	600 pcs.
Pipet, volumetric, 50 ml	300 pcs.
Pipet, volumetric, 100 ml	200 pcs.
Pipet filler, large	75 pcs.
Pipet filler, small	30 pcs.
pH test paper, general purpose covering pH 0-13 w/ distinct color change per pH unit	10 pcs.
pH /specific ion meter w/ digital display	5 sets
Fluoride electrode	1 pc.
Round bottom flask, w/ ℧ mouth, 1 neck, 50 ml, B19/38	10 pcs.
Round bottom flask, w/ ℧ mouth, 1 neck, 100 ml, B24/40	5 pcs.
Round bottom flask, w/ ℧ mouth, 1 neck, 250 ml, B24/40	5 pcs.
Round bottom flask, w/ ℧ mouth, 1 neck, 500 ml, B24/40	5 pcs.
Round bottom flask, w/ ℧ mouth, 1 neck, 1000 ml, B24/40	10 pcs.

Round bottom flask, w/ ℔ mouth, 1 neck, 2000 ml, B24/40	5 pcs.
Round bottom flask, 3 neck, ℔ 24/40, 1000 ml	20 pcs.
Round bottom flask, 3 neck, ℔ 24/40, 2000 ml	20 pcs.
Rotary evaporator w/ support jacks for water bath and accessories	3 sets
Rotary evaporator flask, pear shaped, 100 ml	10 pcs.
Rotary evaporator flask, pear shaped, 250 ml	10 pcs.
Rubber gasket for suction flasks, conical sizes 22-89	5 sets
Rubber bulb, cylindrical shape of Neoprene for droppers, 2 mls which will fit 7-9 mm pipets, 144/carton	2 ctns.
Rubber tubing, general purpose w/ excellent durability, thick wall, bore x wall thickness in inches = 1/2 x 3/32, 50 ft. per reel	5 reels
Ring support, 4 in. dia. w/out holder	50 pcs.
Spatula, metal (trough shaped, tapered at one end, width 13 mm, depth 16 mm, length 178 mm)	150 pcs.
Spatula, micro, spoon, teflon coated, stainless steel	50 pcs.
Spatula, flexible stainless steel blade w/ wooden handle	30 pcs.
Spatula, vibrating stainless steel, teflon coated	1 pc.
Suction flask, 500 ml	100 pcs.
Suction flask, 1000 ml	5 pcs.
Stop watches, Utility Grade with Time-out provision, longest time, 30 min.	15 pcs.
Stirring rod, teflon coat, 8 in.	5 pcs.
Spin bars, magnetic, tefon coated, 12 mm	100 pcs.
Spin bars, magnetic, teflon coated, 20 mm	100 pcs.
Spin bars, magnetic, teflon coated, 25 mm	50 pcs.
Stopcock, 3 way, 1.6 mm bore	10 pcs.
Spin bar retriever, magnetic	5 pcs.
Shaker, reciprocating with High Torque Box	1 set
Test Sieve No. 10, 9-mesh	2 pcs.
Test Sieve No. 20, 20-mesh	2 pcs.
Test Sieve No. 100, 100-mesh	1 pc.
Test tube brush, small	200 pcs.

Test tube brush, large	200 pcs.
Triangles, pipe stem covered, 2 in.	100 pcs.
Triangles, nickel	100 pcs.
Thermometer, Celsius, Yellow back, graduated stem, mercury, 76 mm, immersion:	
-35 to 50°C x 1°	10 pcs.
-20 to 150°C x 1°	20 pcs.
- 5 to 250°C x 1°	50 pcs.
Thermometer, Drying oven	
- 5 to 200°C	20 pcs.
- 5 to 300°C	10 pcs.
Volumetric flask, ground joint, 5 ml	100 pcs.
Volumetric flask, ground joint, 10 ml	300 pcs.
Volumetric flask, ground joint, 25 ml	300 pcs.
Volumetric flask, ground joint, 50 ml	500 pcs.
Volumetric flask, ground joint, 100 ml	500 pcs.
Volumetric flask, ground joint, 250 ml	300 pcs.
Volumetric flask, ground joint, 500 ml	100 pcs.
Volumetric flask, ground joint, 1000 ml	100 pcs.
Volumetric flask without ground joint, 25 ml	500 pcs.
Volumetric flask, without ground joint, 50 ml	900 pcs.
Volumetric flask, without ground joint, 100 ml	800 pcs.
Universal Timer, Laboratory Model w/ alarm (for 1 hr)	5 pcs.
Watch glass (speedy vap) w/ 3 ribs on lower surface: 4½ in. dia. pks. of 12 (or will fit on 600 ml beakers)	10 pks.
Watch glass (speedy vap) w/ 3 ribs on lower surface: 3½ in. dia. pks. of 12 (or will fit on 250 ml beakers)	20 pks.
Watch glass, ordinary, 60 mm or for 150 ml beakers	200 pcs.
Watch glass, ordinary, 75 mm or for 250 ml beakers	200 pcs.
Water Bath, constant temperature, electric (removable top with at least 4 openings)	1 pc.
Wire Gauze, square, iron, asbestos center	200 pcs.

Attachment - B

CHEMICAL SUPPLY FOR ONE (1) YEAR

I T E M S	GRADE	Q U A N T I T Y		
		Unit	Number	Total
Acetic acid anhydride, 97.5%	analytical	1 L	2	2 L
Acetic acid glacial, min. 99.8%	analytical	1 L	2	2 L
Acetone, 99%	analytical	22 Kg	1	22 Kg
Ammonia solution, min. 25%	analytical	500 ml	5	2.5 L
Barium chloride 2 H_2O, granular 20 mesh	analytical	250 g	4	1 Kg
Boron trifluoride-methanol complex (20% in methanol) for synthesis	special analytical grade	500 ml	4	2 L
Brucine (dihydrate), min 99%	special analytical grade	5 g	1	5 g
Buffer solutions, concentrated volumetric solution in special ampoule				
pH 4	analytical	ampoule	10	10 ampoules
5	analytical	ampoule	5	5 ampoules
6	analytical	ampoule	5	5 ampoules
7	analytical	ampoule	10	10 ampoules
8	analytical	ampoule	5	5 ampoules
Bromothymol blue indicator	pure	25 g	1	25 g
Calcium chloride, dehydrated coarse/granular	pure	1 Kg	6	6 Kg
Chloroform, stabilized with ethanol, 99.0-99.4%	analytical	2.5 L	2	5 L
Diethyl ether (max. 0.2% water)	analytical	1 L	3	3 L
Ethanol, 99-100%	analytical	2.5 L	4	10 L

ITEMS	GRADE	QUANTITY Unit	Number	Total
Ethyl methyl ketone	analytical	2.5 L	2	5 L
Hydrochloric acid, min. 32%	analytical	2.5 L	8	20 L
Hydrofluoric acid, min. 48%	analytical	500 ml	4	2 L
Hydrogen peroxide, 30% for synthesis	analytical	1 L	4	4 L
Hydroxyl ammonium chloride min. 99%	analytical	250 g	8	2 Kg
n - Hexane	UV grade	500 ml	2	1 L
Iron (II) sulfide, small lumps for producing hydrogen sulfide	pure	1 Kg	2	2 Kg
Methanol, min. 99.5%	UV grade	2.5 L	2	5 L
Methyl orange indicator	pure	25 g	1	25 g
Nitric Acid, min. 65% for mercury analysis	analytical	500 ml	50	25 L
Perchloric acid, 60%	analytical	1 L	2	2 L
Phosphorus pentoxide drying agent, granulated	pure	1 Kg	1	1 Kg
Potassium hydrogen phthalate, volumetric standard	standard grade	100 g	2	200 g
Potassium chloride, 99.5%	analytical	1 Kg	2	2 Kg
Potassium permanganate for mercury analysis	analytical	1 Kg	1	1 Kg
Phenolphthalein indicator	pure	25 g	2	50 g
Silver nitrate solution, 0.1N	standard	ampoule	2	2ampoules
Sodium borohydride (powder) for synthesis	analytical	500 g	6	3 Kg

ITEMS	GRADE	QUANTITY		
		Unit	Number	Total
Sodium bicarbonate, min. 99.5%	analytical	500 g	2	1 Kg
Sodium carbonate anhydrous, 99.5%	analytical	1 Kg	1	1 Kg
Sodium chloride, 99.5%	analytical	1 Kg	2	2 Kg
Sodium hydroxide pellets, min. 99%	analytical	1 Kg	1	1 Kg
Sodium acetate 3 H_2O, 95%	analytical	1 Kg	2	2 Kg
Silicon anti-foaming agent	pure	100 g	3	300 g
Silver diethyl dithiocarbamate (reagent for arsenic & mercury)	analytical	5 g	1	5 g
Sulfuric acid, 95 - 97% (for Mercury analysis)	analytical	500 ml	50	25 L
Tin (II) chloride 2 H_2O, 98% (for Mercury analysis)	analytical	1 Kg	2	2 Kg
Zinc granules, 20 mesh (for arsenic)	analytical	1 Kg	3	3 Kg