

**REPORT ON BASIC DESIGN SURVEY FOR
THE CONSTRUCTION PROJECT OF PETROLOGICAL,
MINERALOGICAL AND GEO-CHRONOLOGICAL SERVICES
LABORATORY IN THE REPUBLIC OF THE PHILIPPINES**

June, 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

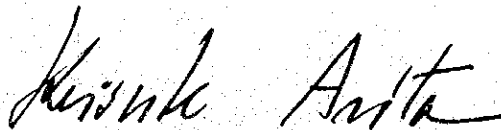
In response to a request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a survey on the Basic Design for Petrological, Mineralogical and Geo-chronological Services Laboratory Project and entrusted the Japan International Cooperation Agency to conduct the survey. The JICA sent to the Philippines a survey team headed by Masayoshi Enomoto from March 2nd to March 22nd, 1981.

The team had discussions with the officials concerned of the Government of the Philippines and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

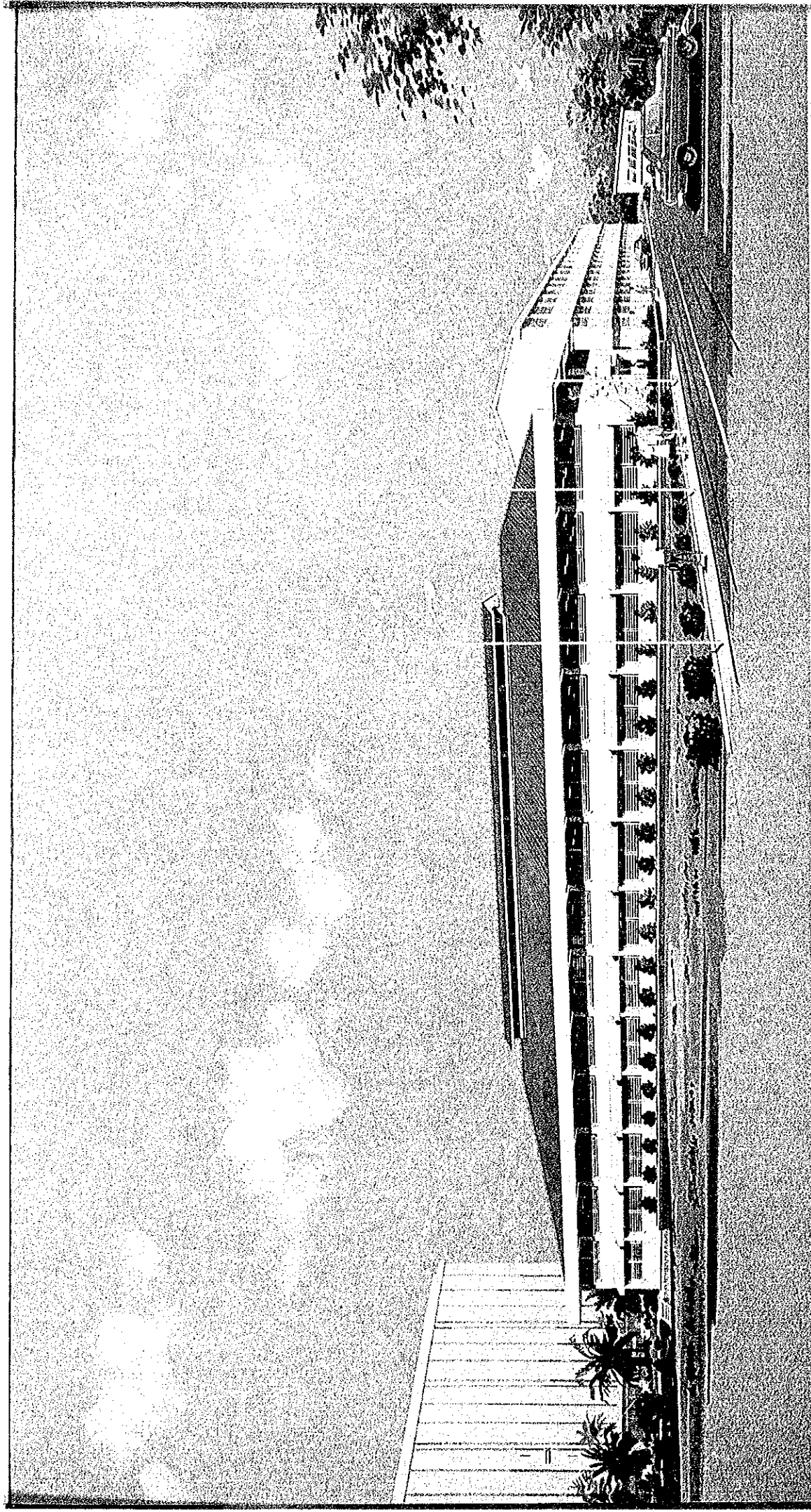
June, 1981



Keisuke Arita,

President,

Japan International Cooperation Agency



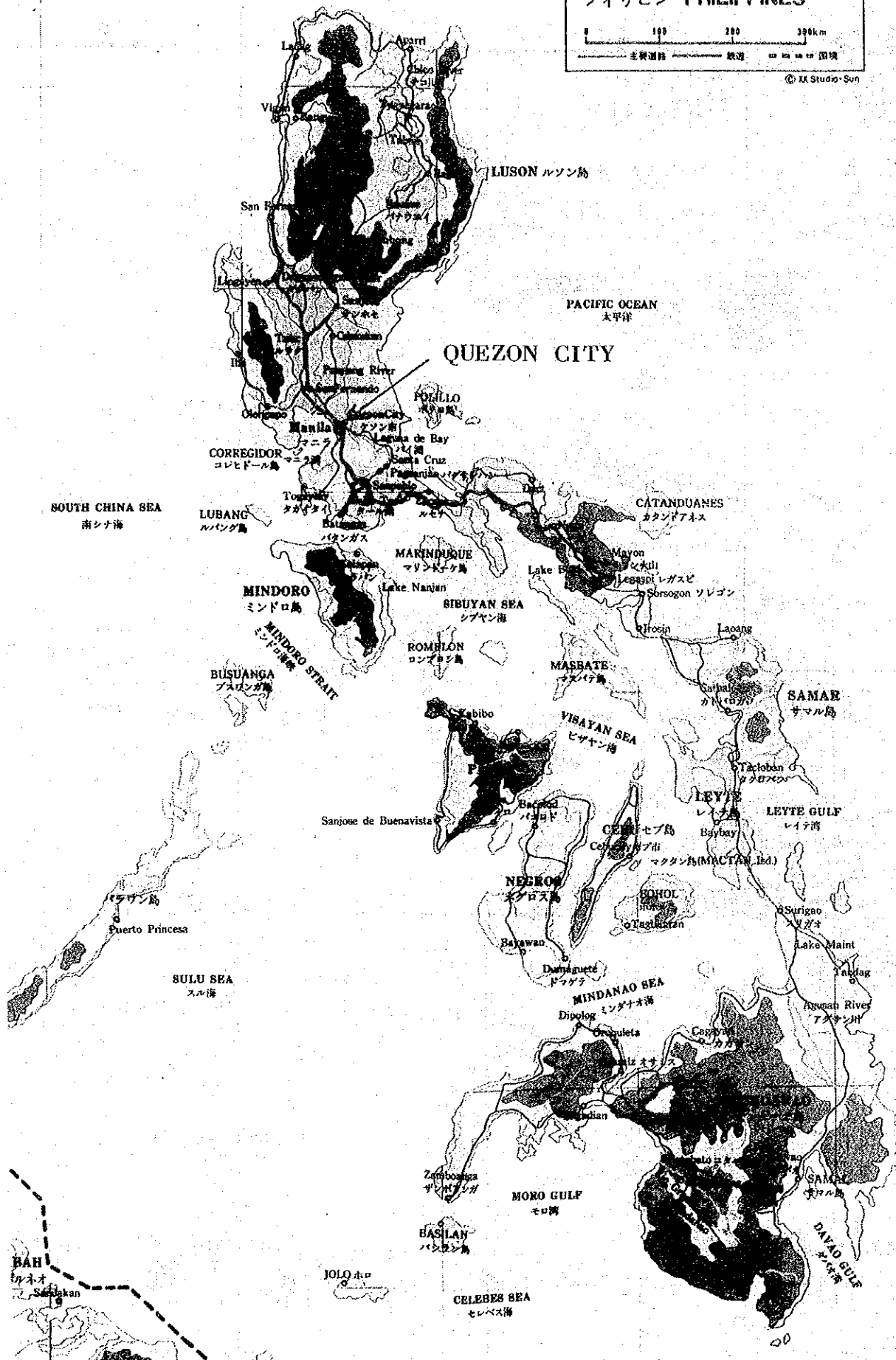
EXTERIOR PERSPECTIVE

フィリピン PHILIPPINES

0 100 200 300km

主要道路 鉄道 国境

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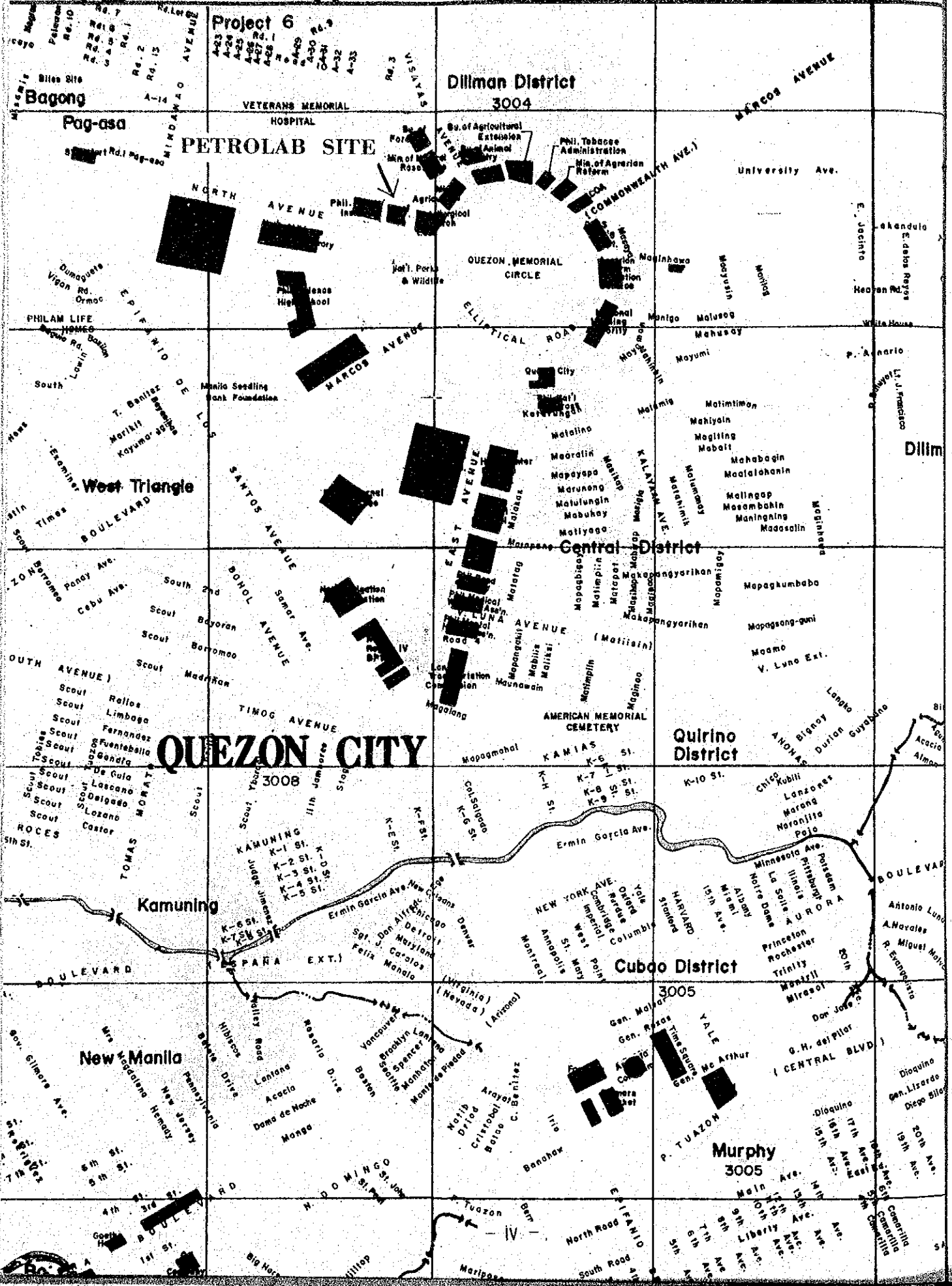


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SUMMARY

1. The Philippines has ample mineral resources, such as copper, gold and chromium. Great expectation is placed on the mining sector utilizing these mineral resources as a major industry in the Philippines. However, a fully equipped central service laboratory to provide aid in the exploration of mineral resources, analysis of explored rocks and minerals and judgement of economic benefits has not been established yet. The Petrological, Mineralogical and Geochronological Services Laboratory (hereinafter called PETROLAB) requested in 1980 by Bureau of Mines and Geosciences (hereinafter called BMG) of the Ministry of Natural Resources is to satisfy a broad demand from the government and private enterprises with regard to geophysical, petrological, mineralogical, geochemical and geochronological study and analysis.

The basic design survey has analyzed the substance of the request, and planned the best suitable basic design based on appropriateness, the social and economical effect of the project within the limit of Grant Aid of the government of Japan for the construction project of PETROLAB.

2. The site will be located on the grounds of BMG in the central part of Quezon City, a part of the metropolitan Manila.

The proposed yard for PETROLAB has been mostly subgraded except for a partial area which will require filling of the existing pond. The bedrock of the proposed building is the rigid adobe deposit, which lies on 0.5 meter or 0.7 meter depth below the surface. Service pipings and wirings for electricity, telephone and water supply has already led into the site.

Considering the above conditions, the proposed area can be said to provide a very good condition for the construction of PETROLAB.

3. Main Building

The main building is to consist of the research and analysis division and the administration and service division.

In research and analysis division, petrological and mineralogical units are to conduct mineral components analysis by X-ray spectrometry and diffractometry, wet and dry chemical analyses, chemical analysis of small amount, classification and appraisal of rocks and minerals including precious stones. Geochronological units are to conduct analyses such as judging the ages of rocks older than 10^5 years by the mass spectrometer (gas) based on the half life of 1.25 times 10^9 years of the isotope ^{40}K change to ^{40}Ar . or the ages of rocks not older than 4×10^4 years by the C14 analyzer based on the half life of C14 of 5,730 years. A rock mineral, and fossil standards library and a book reference library will also be located. The administration and service division will include manager room, office, conference room, lecture hall and cafeteria, etc.

The main building is to be planned as a 2-story reinforced concrete building by reason that a multi-story building which would expand the vibration through the structure is not suitable for the proper operation of the laboratory equipment which requires a state of extremely minimal vibration.

The total floor area is expected to cover 2,340 square meters.

Sample Preparation Building

This building is to accommodate the sample preparation unit which is to prepare samples for research and analysis. The sample preparation unit is preferably to be located as far away as possible from the main building to ensure the normal operation of the laboratory equipment. This building shall be of single story construction as the laboratory equipment which generates vibration is to be located. The total floor area is expected to be 160 square meters.

4. In addition to the general sanitary and plumbing system and the electric system, an air conditioning system for the laboratory equipment which needs temperature and humidity control for proper operation is necessary. An emergency generator system on 24-hour continuous standby for some of the major laboratory equipment, and a fire alarm system for fire protection are considered necessary.

5. The laboratory equipment which is to be needed in PETROLAB is mostly highly technical, precise equipment and they require minimal vibration, noise and dust. On the other hand, the laboratorians who will be appointed to serve analysis and research with the equipment are rather young and may not have much experience. Therefore, simplicity and utility of the equipment, exclusion of easily damaged system, accessibility for usual maintenance and minimal maintenance cost has been considered in selecting the laboratory equipment.

6. It is expected that after the change of notes, it will take four (4) months for furnishing the detailed design and three (3) months for the construction contract, altogether, seven (7) months before the commencement of the work.

The construction is expected to take about 14 months, including one (1) month for the adjustment of the building facilities and the laboratory equipment. Therefore, the plan requires about 21 months from the exchange of notes to the date of completion and handover.

7. Effects of the Project

The basic design survey was carried out to study the present situation in the Philippine geosciences and mining industry, the demand and necessity for the establishment of PETROLAB, and to make a basic design for the laboratory based on these factors. For the realization of the project, the cooperation by the government of the Philippines and a well-planned training program after the completion of the laboratory will be necessary. The Philippines will have a well equipped service laboratory for geosciences with the completion of this laboratory project.

The establishment of PETROLAB is expected to enable to exploit a mining method of deposits which used to be considered difficult to mine economically and technologically; to increase the possibility of a systematic exploration of mines judging the ages of

strata based on the geochronological analyses; to discover new mineral resources; to accomplish geologic mapping based on the geoscientific analyses; to develop a more efficient mining technology for existing mines; to promote the fundamental and practical educational training, and to develop the level of the geoscientific study of the Philippines.

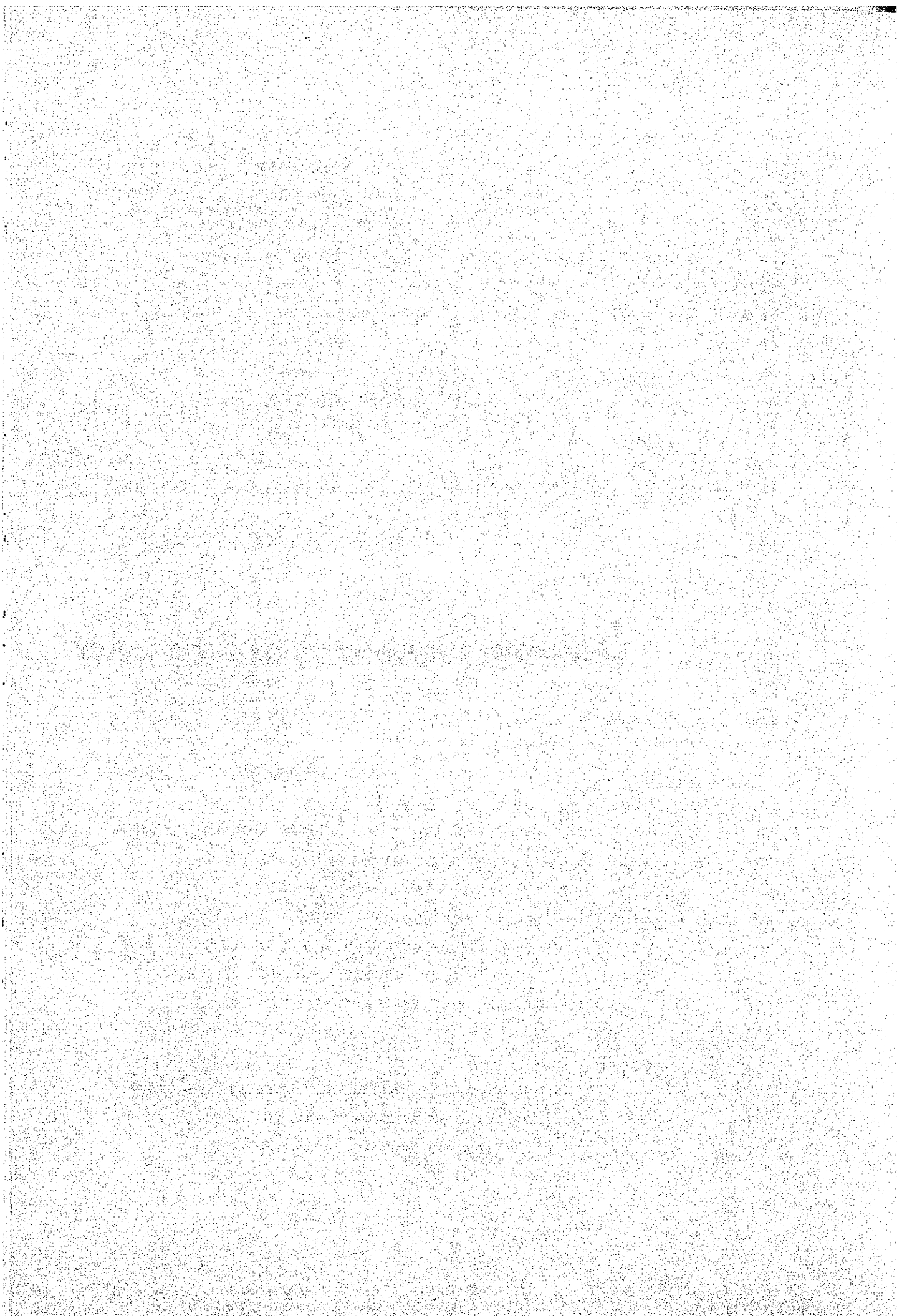
The benefits of PETROLAB are assumed not to be limited to the development of the mining sector but to include environmental conservation and disaster prevention as well as landscaping, hydraulic control and public works.

CONTENTS

PREFACE.	i
PERSPECTIVE VIEW OF PETROLAB	ii
LOCATION MAP	iii
SUMMARY.	v
CHAPTER 1 OBJECTIVES OF THE PROJECT.	1
CHAPTER 2 BACKGROUND OF THE PROJECT.	2
2 - 1 Mining Industry in the Philippines and the Role of PETROLAB.	2
2 - 2 Present Situation of Philippine Geology and Mineralogy.	3
2 - 3 Present Situation of Research Units of BMG.	4
2 - 4 Manpower Training Program by BMG.	6
2 - 5 Organization of Geological Survey Division of BMG.	7
CHAPTER 3 SITE CONDITIONS.	8
3 - 1 Location of the Site.	8
3 - 2 Surrounding Area at the Site.	8
3 - 3 Present Situation of the Site	8
3 - 4 Existing Infrastructure	9
3 - 5 Soil Conditions	11
CHAPTER 4 BASIC PLANNING	16
4 - 1 Basic Principles.	16
4 - 2 Arrangement of Buildings.	16
4 - 3 Architectural Planning.	18
4 - 4 Structural Planning	27
4 - 5 Building Facilities	33
4 - 6 Laboratory Equipment Planning	35

CHAPTER 5	BASIC DRAWINGS	
5 - 1	Location Map	38
5 - 2	Topographic Plan	39
5 - 3	Site Plan	40
5 - 4	Ground Floor Plan	41
5 - 5	Second Floor Plan	42
5 - 6	Elevation	43
5 - 7	Section	44
5 - 8	Sectional Detail	45
5 - 9	Sample Preparation Building	46
CHAPTER 6	PLAN FOR DISPOSITION OF PERSONNEL	47
CHAPTER 7	MAINTENANCE COST	50
CHAPTER 8	REQUEST TO THE GOVERNMENT OF THE PHILIPPINES	51
CHAPTER 9	TENTATIVE DESIGN AND CONSTRUCTION SCHEDULE	53
CHAPTER 10	PROJECT EVALUATION	54
CHAPTER 11	RECOMMENDATIONS	57
ANNEX I	REFERENCES	58
I - 1	Basic Design Survey Team	58
I - 2	Minutes of Discussions	64
I - 3	A Project Proposal for Japanese Grant Aid by BMG	76
I - 4	PETROLAB Building Proposed by BMG	95
I - 5	Manpower Program of BMG	100
I - 6	Geological Survey Division Organization Chart	103
I - 7	Boring Log	104
ANNEX II	CONSTRUCTION CONDITIONS	106
II - 1	Present Construction Situation	106
II - 2	Construction Cost Conditions	113

CHAPTER 1 OBJECTIVES OF THE PROJECT



CHAPTER 1 OBJECTIVES OF THE PROJECT

A request was made by the government of the Republic of the Philippines in 1980 for the assistance in the establishment of PETROLAB (Petrological, Mineralogical and Geochronological Service Laboratory) under BMG (Bureau of Mines and Geosciences) which belongs to the Ministry of Natural Resources as a project proposal for Japanese Grant Aid.

The proposal aims at the establishment of a service laboratory which will serve for general requirements regarding to rocks and minerals of Philippine underground resources.

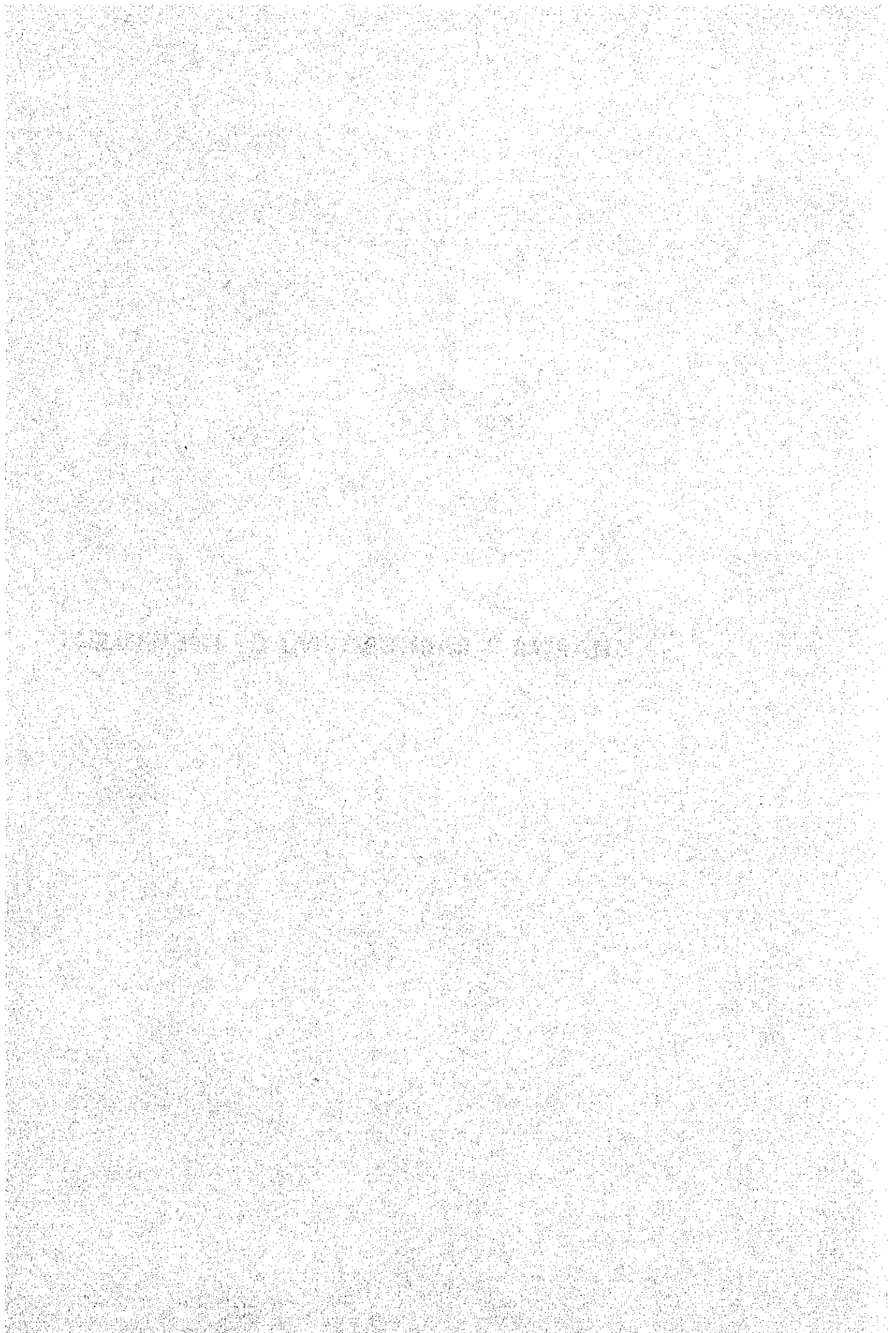
It is a great expectation that the mining sector of the Philippines with its ample underground resources will be one of the main stays for the modernization of the Philippine industry and PETROLAB is expected to take the role as the principal research and analysis laboratory and to serve for a large amount of need by the government and private enterprises in the field.

The government of Japan dispatched a basic design survey team through the Japan International Cooperation Agency (hereinafter called JICA) headed by Mr. Masayoshi Enomoto, Grant Aid Div., Grant Aid and Procurement Dept., JICA, to the Philippines in March 1981 to confirm the request of the Philippines and to undertake an investigation of local conditions.

The objectives of the basic design survey is to analyze the substance of the request and to plan the best suitable basic design based on appropriateness, the social and economical effect of the project within the limit of Grant Aid of the government of Japan for the construction project of PETROLAB.

❖ The Yokogawa Architects and Engineers Inc. was commissioned by JICA to participate in the basic design survey team.

CHAPTER 2 BACKGROUND OF THE PROJECT



CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Mining Industry in the Philippines and the Role of PETROLAB

From the onset of the Second Four Year Philippine Development Plan started in 1972 with "Constitutional Authoritarianism", a doctrine declared by the president Marcos, to the current Five Year Philippine Development Plan (FYDP, 1978 to 1982), the Philippine agricultural sector has achieved self-sufficiency in food and now is producing more food for export, while the industrial section has been increasing its share in the NDP (National Domestic Products) from 25 percent in 1971 to 27.7 percent in 1975, gaining more importance in the drive for a self-sufficient economy. With the Philippines' ample mineral resources, the mining sector is expected to be one of the main stays in industrialization. Ministry of Natural Resources has planned the Mineral Resources Development Program based on the FYDP as well as the Ten Year Development Plan (TYDP; 1978 to 1987).

The Mineral Resources Development Program is aimed to:

- (1) provide direction for an integrated and coordinated approach in the development and conservation of mineral resources,
- (2) intensify mineral investigation surveys; exploration and development of the country's mineral resources,
- (3) encourage the development and exploitation of non-traditional minerals which could be mined economically,
- (4) explore the industry's contribution in the development of the rural communities and in pursuit of balanced regional development,
- (5) increase the mining output and to encourage the further processing of mineral commodities,
- (6) develop viable systems, technologies and procedures to minimize or eliminate problems regarding environmental pollution due to mining operations,
- (7) provide for the development of adaptive technology taking into account local resources and manpower,
- (8) provide direction and incentives for a rapid exploration and development of strategic minerals vital to industrial growth and national security, and
- (9) maximize the contribution of the mining industry in foreign exchange earnings.

This PETROLAB (Petrological, Mineralogical and Geochronological Service Laboratory) which is requested as a project proposal for Japanese Grant Aid by BMG (Bureau of Mines and Geosciences), the authority in charge of mineral resources under the Ministry of Natural Resources will have responsibility for every item mentioned above concerning research and analysis in the field. That is, PETROLAB is to provide services to satisfy general demand such as intensifying mineral investigation surveys, development and exploration as well as study of non-metallic mineral resources, judgement of deposit order based on geochronological study, geological mapping based on geoscientific surveys, joining environmental conservation programs based on this knowledge and requesting analysis and study of mineral resources by mining industries. This PETROLAB shall serve as a practical laboratory regarding rocks, minerals and geochronology as the best equipped laboratory in the Philippines. It is expected that PETROLAB will greatly contribute to the development of Philippine mineral resources as well as the industrialization of the Philippines.

2-2 Present Situation of Philippine Geology and Mineralogy

The University of the Philippines (UP) and BMG are the centers for geology and mineralogy as well as research and the study of mineral resources in the Philippines. A few private colleges offer courses relating to mineralogy but they are rather new. UP plays a leading part with its historical background. The department of geology of UP is composed of three (3) courses; petrology, mineralogy and paleontology. Other related courses are mining engineering and geosciences. The professors of each course, listed below, are all graduates of UP who have studied and qualified in countries like the United States and Japan.

Paleontology	two (2) professors
Mineralogy	three (3) professors
Petrology	two (2) professors

The total number of students in the department of geology is over 200, producing 20 to 25 graduates each year.

Graduates of the department of geology take the national examination. Those who pass the exam are enrolled in the Geological Society of the Philippines. Each year around 30 students and graduates

of UP take the exam and 26 or 27 of them are said to pass. As for the private colleges which have geological study courses, like Mapua Institute of Technology and Adamson University, the rate of the successful candidates from these colleges is said to be about 10 percent. The president of the Geological Society of the Philippines is Mr. J.C. Fernandez, the director of BMG, and Dr. G.R. Balce from BMG is a member of the board of directors.

Leading people in Philippine geology and mineralogy have an excellent knowledge of the field. Dr. Datuin, and geoscience's Dr. Sonido, professors at UP are well-known to the world. The Philippines, rich in mineral resources, has been encouraging education in these fields. This is shown in the number of 52 enrollments in the Geological Society of the Philippines this year compared with the number of former members, 300 and some. It is apparent that this encouragement was begun recently.

There is, however, a lack of those who fill the gap between the top-level scholars and the young technicians who have just finished or are at school in. Technological assistance from foreign countries will help to fill this blank.

It is considered better to prepare a technical electronics expert for the control and maintenance of equipment installed in PETROLAB. Although the survey team did not have time to study the Ministry of Energy or National Power Corporation, these institutes possess excellent geological and mineralogical experts, too.

2-3 Present Situation of Research Units of BMG

Test, analysis, research and study units of BMG are located in Manila and Quezon City. The existing BMG office building in Manila has two (2) chemical analysis labs and one (1) petrological and mineralogical office and lab equipped with two (2) microscopes. One of the chemical analysis labs carries out analysis requested by the outer agencies while the other lab carries out basic analysis relating to researches. Basic analyzing instruments like atomic absorption analyzers, calorie meters, furnaces analytical balances, etc. are installed. They say that they are able to analyze major metallic components of ores such as silicon, aluminum, iron, copper, manganese, chromite, nickel, cobalt, lead, zinc, alkali, etc., but are not able to analyze gold, silver or other components of small quantity. They usually employ the wet analysis

method. Samples are prepared with two (2) old jaw crushers, one (1) brown mill and one (1) ro-top type sieve shaker. These instruments for sample preparation has become old. The chemical analysis lab staff numbers over twenty. Most of them are female except a few male staff working in sample preparation. The BMG office building also has a thin section and a polished section preparation room which prepare samples for microscopic testing with three (3) old portable type cutting machines, two (2) grinding tables, one (1) drying oven. The instruments are not in very good condition and insufficient in number. The BMG branch office in Manila has laboratories relating to paleontology where seven (7) or eight (8) female staff are working with eight (8) stereoscopic microscopes and two (2) binocular microscopes for paleontology. It is equipped with basic instruments.

The laboratory of the selection and metallurgy unit which was opened in the new BMG grounds in Quezon City is well equipped. The laboratory equipment includes:

Jaw Crusher (various portable types)	6
Roll Crusher	1
Ball Mills	2
Spiral Heavy Media Separator	1
Cyclone	1
Flotators	3
Agitators (installed type)	3
Dram Washer	1
Wilfler Table (portable type)	1
Rotary Kiln (5 meters)	1
Rotary Kiln (50 centimeters)	1
Ovens (big and small)	4
Atomic Absorption, Varian	1
X-ray Diffractometer, Rigaku Model 2013	1
Marble Cutter (60 centimeters)	1
Analytical Balances	4
Flotation Units	2

And newly purchased equipment consists of

Draft Chambers	2
Screen (500 x 2,000 mm)	1
Table Mills	3
Cutter	1
Agate Motors	2
Jaw Crushers	2

Equipment for metallurgical laboratory use is rather sparse. Several female staff members are working in the selection and metallurgy unit, too. The petrology and rock mechanics building is also

located in the BMG site in Quezon City. The building contains some microscopes which were purchased under this year's budget and an X-ray microanalyzer (XMA):

Microscopes	10
XMA	1

The laboratory equipment possessed by BMG at present are enough for selecting minerals at the selection and metallurgy unit, though they are insufficient in number, old and in poor condition for geological and mineralogical research. BMG is planning annual programs to buy new machines.

The reason for this insufficiency of laboratory equipment is that many were destroyed by fire in 1976. BMG lost most of its laboratory equipment for the geological and mineralogical research unit and its rock, mineral and fossil specimens.

Some of the physical testing and measuring instruments owned by the Ceramic Research and Development Center at Bisutan, where technical assistance by the government of Japan is being carried out are similar to those proposed for the PETROLAB project. The laboratory equipment of the Ceramic Research and Development Center is, however, to be used for testing those clayey minerals which are ceramic materials. They are considered to have different specifications from those of PETROLAB.

Though UP takes a leading role concerning geoscientific study as well as BMG, most of the laboratory equipment at the department of geology is antiquated. For example, X-ray diffractometer at the mineralogy section is about twenty years old and is out of order.

2-4 Manpower Training Program by BMG

The government of the Philippines has encouraged the training of engineers who deal with development of Philippine natural resources. The government also encourages sending students abroad. BMG has been sending one or two students abroad every year since 1977. The following persons are now studying outside the country in the geochronology department.

	<u>Major</u>	<u>Place</u>	<u>Degree</u>	<u>Completion</u>
A	Paleontology	Tsukuba Univ. Japan	Ph.D	1982
B	Paleomagnetism	Akita Univ. Japan	M.Sc.	1980

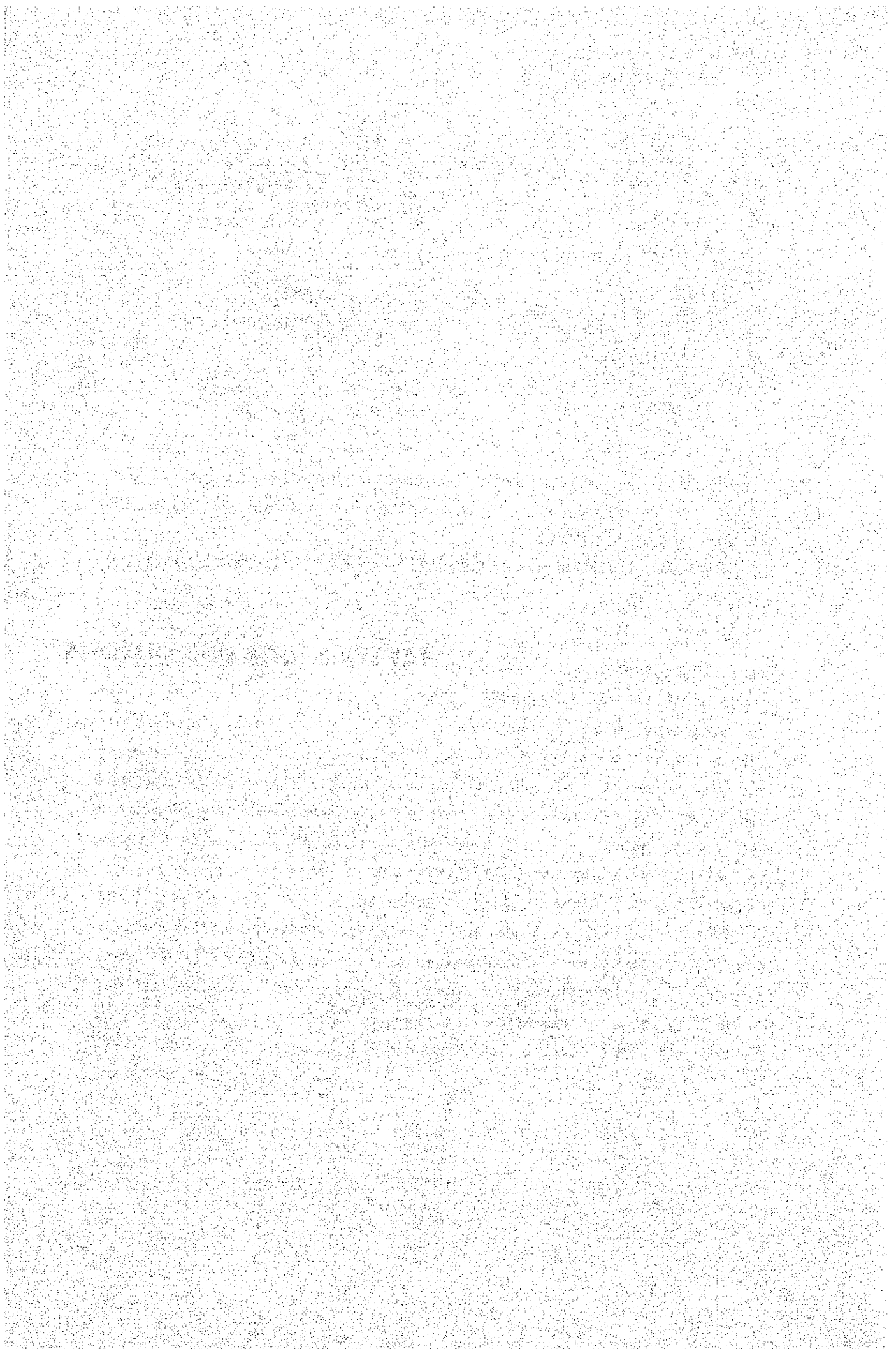
C	Petrology and Geochemistry	Univ. of New South Wales Australia	M. Sc.	1982
D	Isotope dating	"	"	1982
E	"	Seoul Nat. Univ. Korea	Post-grad.	1980
F	Isotope dating and Petrology	Training in West Germany	"	1981
G	"	"	"	1982
H	Fusulina datings	Training in Thailand	"	1980

As these persons are scheduled to be back home by 1982 and to participate in the geochronological studies, PETROLAB will have sufficient capability for geochronological research and study.

2-5 Organization of the Geological Survey Division of BMG

BMG, as the name shows, consists of a mining division and a geological survey division. PETROLAB will be part of the latter. The geological survey division is divided further into a geological sciences branch and a mineral resources branch. The geological sciences branch includes a geology section; a geological mapping and photogeology section; a paleontology section; a geochemistry, petrology and mineralogy section and an international geology section. This branch mainly carries out geological scientific surveys including geochronology. The mineral resources branch mainly carries out mineralogical surveys, with a metallic mineral deposits section, a non-metallic mineral deposits section and a special services section. PETROLAB is an organization directly attached to the geological survey division, independent from the other section. PETROLAB is to study and analyze the data of the surveys made by these ten (10) sections and to provide them with necessary data. It is also responsible for fulfilling requests for study and analysis from the mining and other industries as the exclusive service laboratory in this field in the Philippines.

CHAPTER 3 SITE CONDITIONS



CHAPTER 3 SITE CONDITIONS

3-1 Location of the Site

Quezon City is located at about $14^{\circ}37'$ N latitude and $121^{\circ}16'$ E longitude. The site is located on the north side of North Avenue, about 250 m west of Quezon Memorial Circle about 10 km northeast of the center of Manila. The site is 10 km inland east of the Manila Bay. It is on the plain about 60 km from the ocean both to the east and west.

3-2 Surrounding Area at the Site

Quezon City is a planned city on which construction was started in 1940 by President Quezon in order to make a new capital for the Philippines and was instated formally as the capital of the Philippines in July 1948 with an interruption of construction during World War II. Buildings of various governmental agencies as well as public offices have been constructed with ample clearances between buildings centering Quezon Memorial Circle. Wide roads and modern style buildings give an impression of cleanness.

The site of PETROLAB is located within the grounds of BMG near Memorial Circle. There are no high buildings around the grounds of BMG other than the adjoining 7-storey PILSUCOM building on the west side, and the green of street plants and trees planted around each compound stand out. North Avenue, on the south side of the site is 30 m wide, however, the paved part is only 6 m, wide enough for just two (2) lanes. An open canal without timbering and covered with wild grasses runs north of the avenue. The volume of traffic is not heavy.

3-3 Present Situation of the Site

The BMG grounds are about 88 meters wide and about 211 meters in depth. The north half of the grounds in back of the road is occupied with the operating metallurgical lab., geological assay lab. which is under construction, mining equipment storage bldg., and tennis courts. The construction of the BMG administration bldg. is

planned for the south part of the grounds. The PETROLAB site stretches east-west between two (2) existing laboratories and the administration building mentioned above. The site has a slope from east to west with a level difference of about 1.5 m from east to west. A pond about 2.5 m in depth lies in the west end of the site, which was once dug to explore for adobe as a material for building walls. There are a mango tree and a few bamboo trees on the east side of the pond. About 35 meters of a stone wall about 1.3 m high bordering the pond to the south of the existing laboratory will have to be removed for the construction of PETROLAB.

3-4 Existing Infrastructure

3-4-1 Electric Power

Electric power will be supplied from a power line of the MERALCO MANILA Electric Company which runs overhead along North Avenue on the south side of the site. At present a 230 V, 3 phase, 3 wire, 100 KVA line leads into the site, the capacity of which can be increased to 300 KVA.

3-4-2 Water Supply

Metropolitan Water Works and Sewage System manages and controls the water supply. Water mains of 300 m/m (12 inches) caliber and 600 m/m (24 inches) caliber are embedded under North Avenue, on the south side of the site.

3-4-3 Drainage

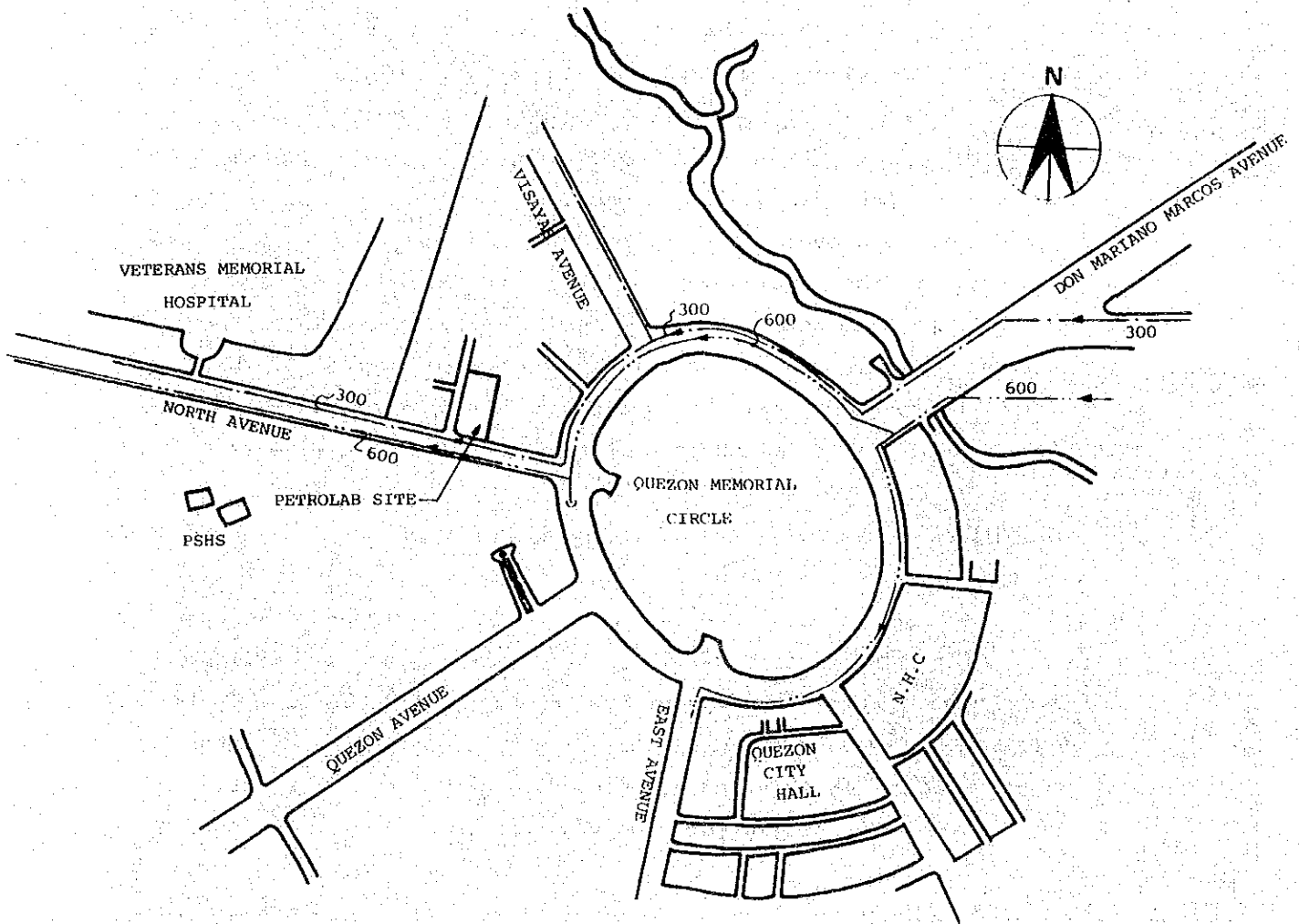
There is no direct sewage system. There is an open canal along North Avenue, south of the site to which the site's drainage system is connected. The Highway District Engineer's Office provides management and control. Sanitary water will be drained through a septic tank, which complies with the U.S. code standards, the reference of which is Pollution Control Agency.

3-4-4 Telephone and Telecommunications

The Philippine Long Distance Telephone Company will provide management and control of the telephone system. At present one circuit leads to the site and another circuit is planned to lead into the

building which is now under construction.

The maximum number of circuits is limited to five (5) in the site under current regulations.



Main Water Supply Pipe Lines

3-5 Soil Conditions

3-5-1 Subsoil Exploration

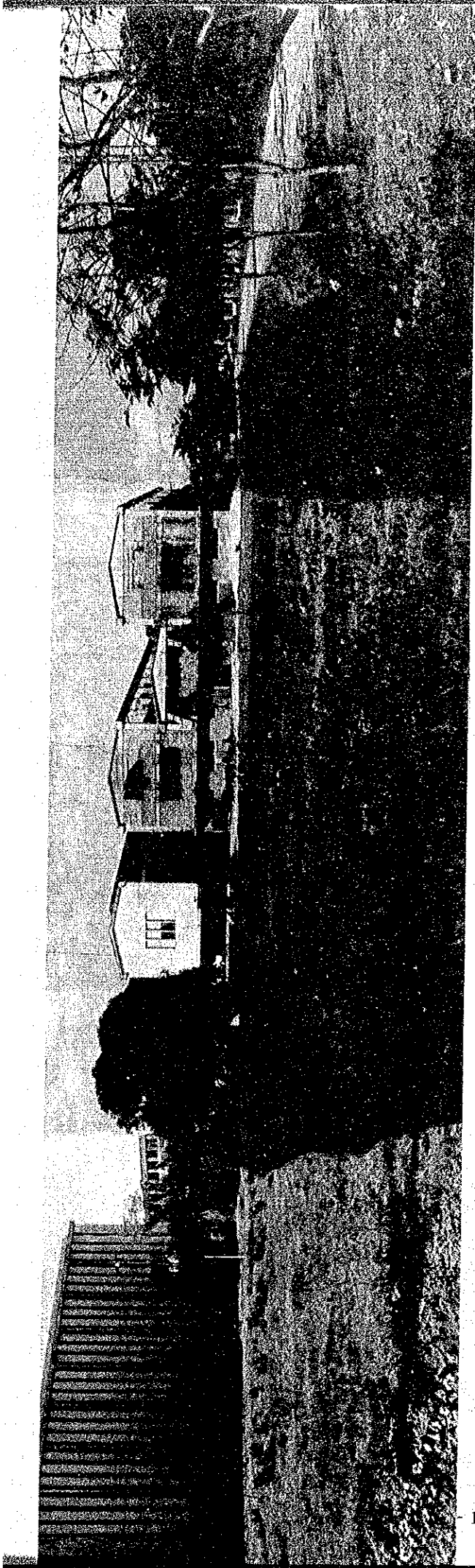
Two (2) boring core sampling tests were performed to a depth of 20 meters at the PETROLAB site by BMG for three (3) days, 11-13 March 1981. From the test at the No. 1 hole, it has been found that top soil (weathered soil) lies about 0.7 m in depth under the surface, then a solid tuffaceous sandstone layer 1.7 m deep, a hard clayed tuff layer a little less than 1.5 m in depth, below all of which lies a solid stone layer except for where another clayed tuff layer is, between 10 meters and 11.5 meters below the surface. From the test at the No. 2 hole, it has been found that top soil lies 0.5 m in depth, a tuffaceous sandstone layer about 2.3 m in depth, clayed tuff 0.9 m in depth, and a solid stone layer below them the same as No. 1 hole except for a clayed tuff layer at 9.8 m to 12.1 m below the surface.

What decides the soil bearing capacity of the site ground is the clayed tuff layer described above. This soil easily crumbles and goes to pieces when it is dry, but the samples were so hard with moisture that it was difficult to break them down with one's hand. Therefore, even if the clayed tuff becomes dry underground, it has no effect on the soil bearing capacity. The site ground has also shown good results regarding consolidation settlement. The only question is that the clayed tuff seems a little weaker than the other soils.

The bottom of the pond located in the west end of the Site is assumed, according to the result of the No.2 hole test, to be a clayed tuff layer. Therefore it will be necessary to test the bottom soil after draining the water. If necessary, the tuff layer below the clayed tuff will be made the excavation bottom by digging out the clayed tuff layer. It is also necessary to excavate the mango tree roots to a sufficient depth. The fill and backfill of the pond to be carried by BMG will be carried to the required grade with sufficient compaction after excluding the bottom mud deposit.

3-5-2 Test Pit

In order to confirm the depth of the topsoil, the test pits were dug in May at the same two points where the borings were carried out in March.

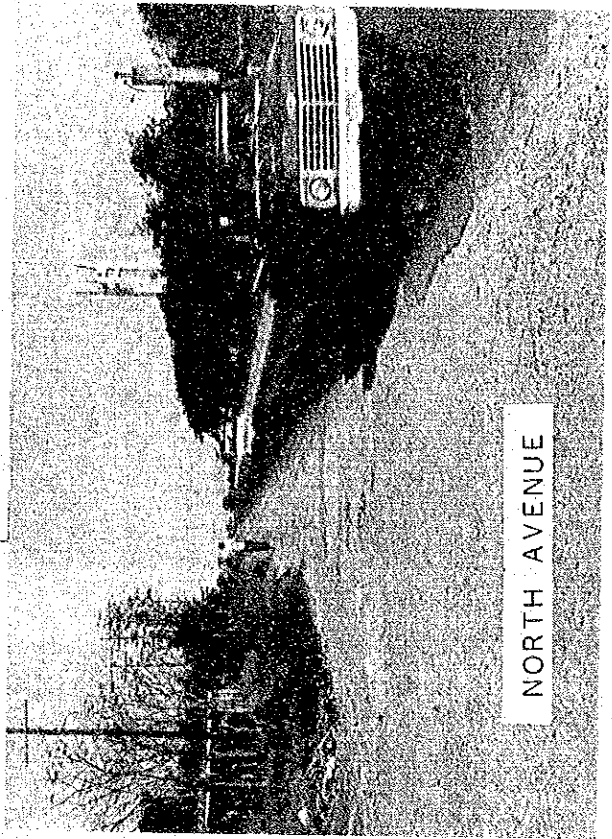


Site Area

North Avenue and Site

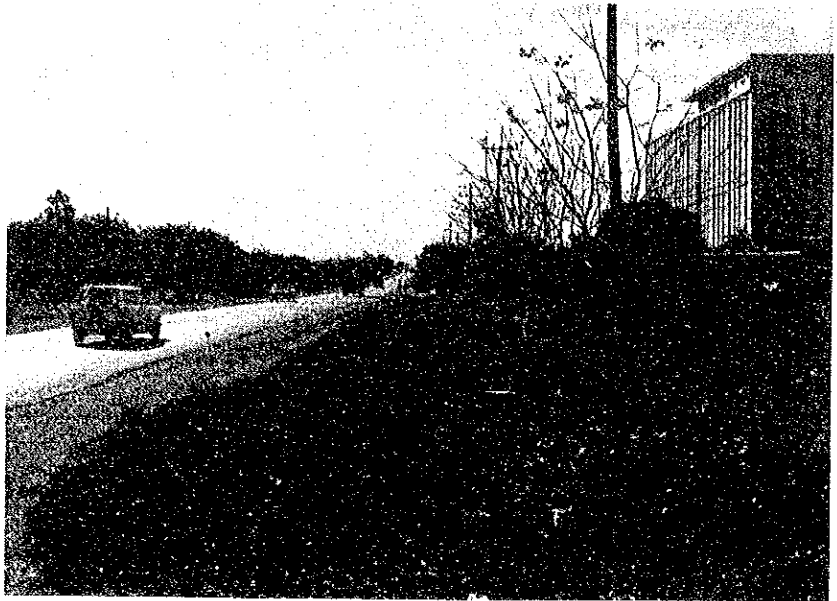


North Avenue

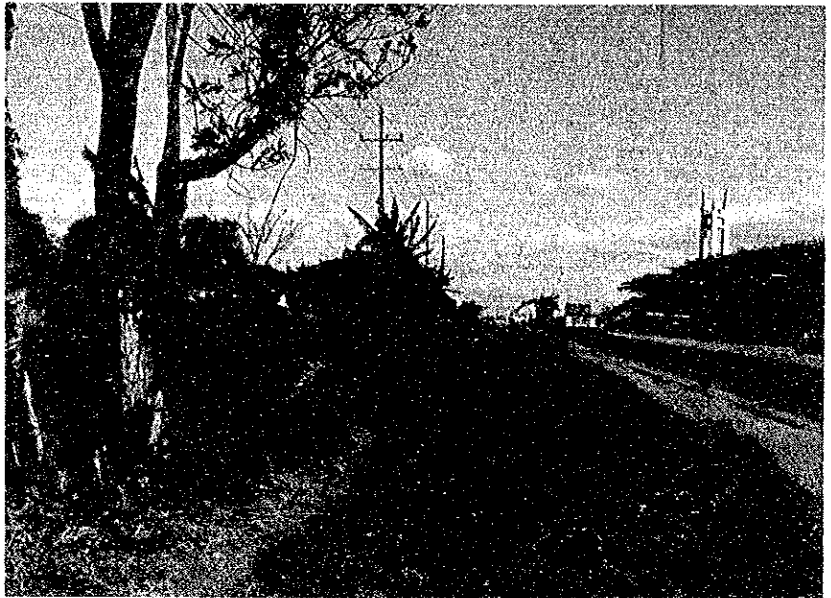


NORTH AVENUE

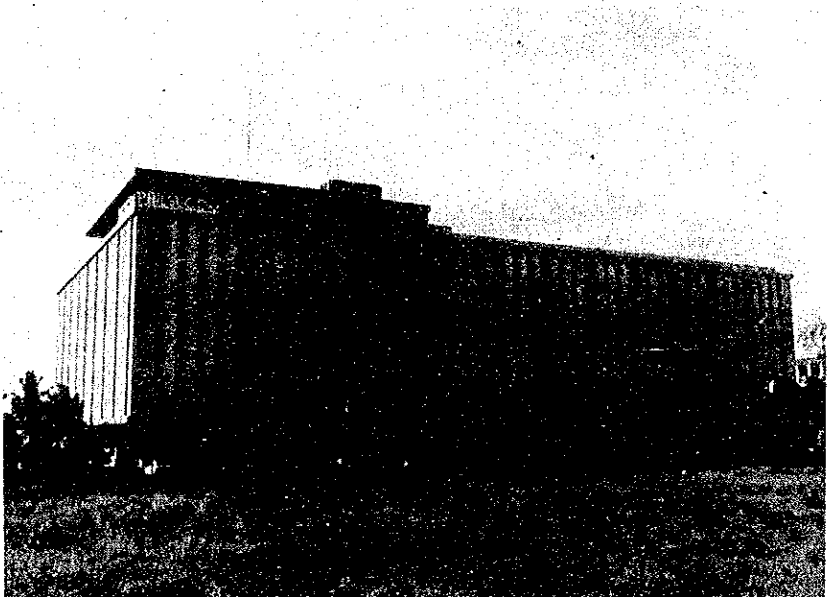
**West Side of
North Avenue**



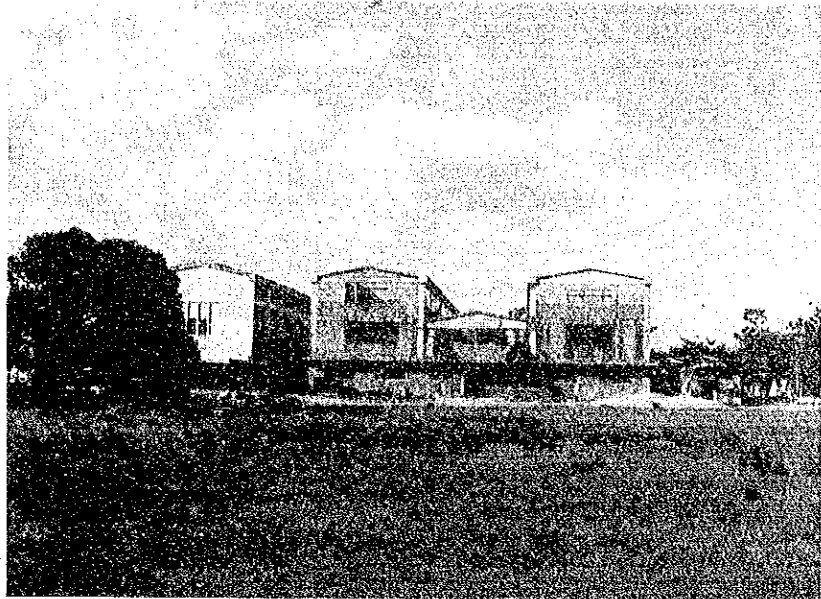
**East Side of
North Avenue**



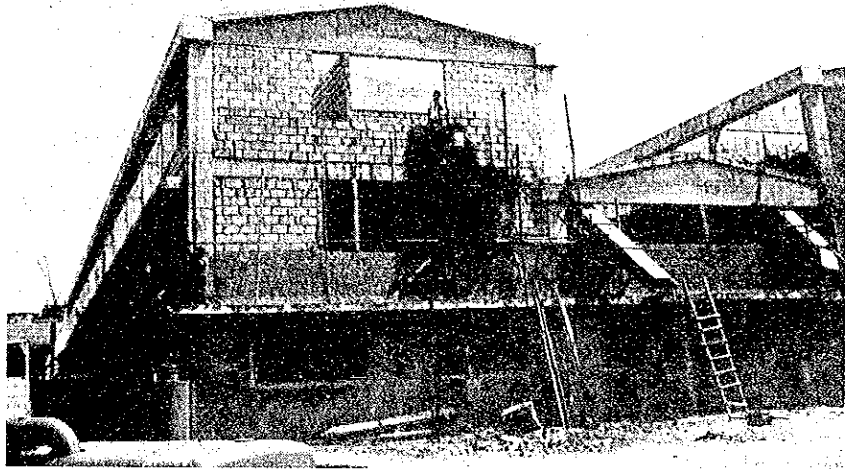
**PHILSUCOM Building
West of the Grounds**



**Existing Buildings
in the Grounds**



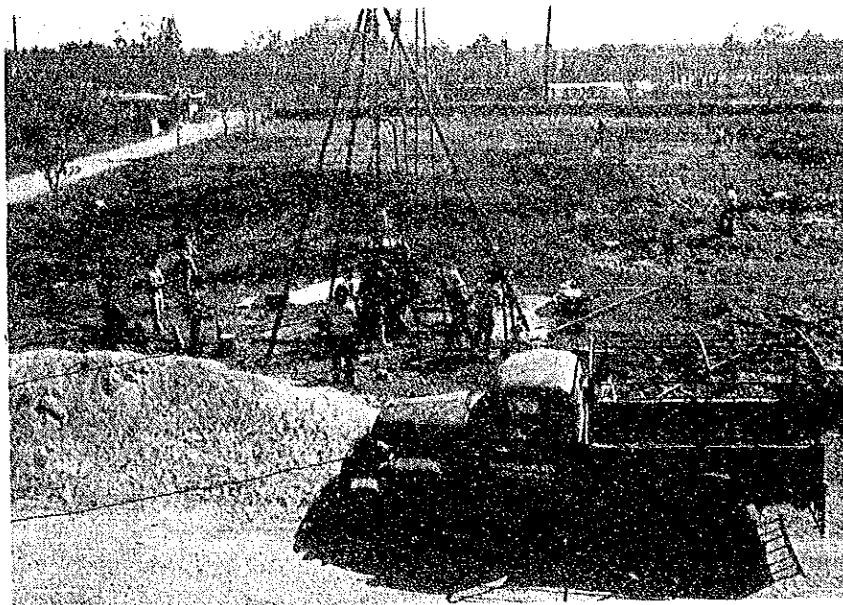
**Existing Building
under Construction**



**Interior View of
Existing Lab.**



Boring and Topographic Survey



Examination of the Boring Rod



Existing Pond in the Site

