3) Exterior Plan

As described in (1) Overall Site Plan in 4-3-1 of this chapter, there should be no floor level differential. As the project site and the areas surrounding it slope eastward, the ground level on the western side of the buildings will be higher than the floor level. For this reason, side ditches with adequate widths should be provided around the buildings and in each place which requires such ditches so that they may prevent rainwater from coming into the buildings from the western part of the site. Since the proposed buildings will be equipped with sophisticated equipment which are prone to damage from dust and dirt, gravel should be spread around each building to protect it against sandy dust.

4-3-3 Structural Plan

(1) Outline of the Facilities

The facilities of this project are for geological investigation, and include a laboratory building, a sample preparation and storage building, a study and administration building and ancillary buildings. These buildings are to be connected with each other by connecting passageways. While the study and administration building is to be two-storeyed (partially single-storeyed), all the other buildings will be single storeyed. In principle, the height of both ground and first floor levels will be 3.8 meters. The length of each building will be approximately 50 meters, and considering the effects of extension, shrinking and irregular shifting, expansion joints will be used to connect parts of the buildings.

(2) Outline of the Structure

1) Structural Form of the Building

For the study and administration building, earthquake-proof walls will be used in the direction of the gable to minimise the load on the frame, and rigid frame structure will be used for the portions of the building in the direction of the beams. All the other buildings will have rigid frame construction. The external walls will be made of reinforced concrete to protect against rainwater, and the internal walls will be made of bricks which are commonly used in Pakistan to minimise the period of works, as well as the construction costs.

2) Form of the Foundation

As stated in (4) of "3-3-4 Outline of the Project Site" of Chapter 3, the ground of the project site includes a relatively hard silty layer with an N value of 10 to 15, which exists approximately 2 meters below the earth's surface. As the facilities to be constructed for the project are mostly single-storeyed, it is advisable to design the foundation of each building as a direct foundation in which the above-mentioned layer will serve as the supporting layer. The ground floors should be suspended instead of a slab-on-grade due to the lack of bearing pressure on the earth's surface.

(3) Structural Materials

Concrete	:	Ordinary concrete (28-day compression strength)	Fc=180kg/cm^2
Reinforcing bars	:	16mm or less	SD30, Fy=3,000kg/cm^2
		19mm or more	SD35, Fy=3,500kg/cm^2

(4) Design Load and External Force

1) Dead Load

The dead load value shall be calculated in accordance with the actural weight of the structural and finishing materials.

2) Live Load

The live load shall be calculated in accordance with the provisions of the Building Standards Act of Japan. Shown below are typical values of live load.

	Slab/beam	Column/girder	Earthquake-proof structure
Scientist rooms · office rooms	300 kg/m^2	180 kg/cm^2	80 kg/m^2
Laboratory	400	320	180
Roofs	100	60	0
Stack room	800	700	700
Sample Storage	300	270	160

3) Seismic Force

Islamabad, where the project site is located, is in the Eurasian Earthquake Zone. Historical records indicate that the city has been hit by earthquakes with a magnitude up to 6 on the Richter scale once or twice a year. Therefore, the proposed facilities should be a seismatic structure. The value of seismic force can be calculated based on standard design seismic intensity of 0.10.

$$K=\alpha\cdot\beta\cdot\gamma\cdot K_0$$

K : Design seismic intensity
K_0 : Standard design seismic intensity (0.10)
α : Zone coefficient (1.0)
β : Soil condition coefficient (silty clay 1.5)
γ : Coefficient of usage (1.0)

Thus the design of seismic intensity (K) is calculated as follows.

$$K=\alpha\cdot\beta\cdot\gamma\cdot K0=1.0\times1.5\times1.0\times0.10=0.15$$

4) Allowable Bearing Capacity of Soil

The value of allowable bearing capacity of soil (Ra) should be 10.0 t/m^2 on the basis of the geological data on the project site obtained from the Geological Survey of Pakistan.

4-3-4 Utility Plan

(1) Electric Facility Plan

1) Power Supply System

The proposed facilities are to receive 11kV electric power from the Water and Power Development Authority (WAPDA). The power is transformed to low voltage electric power (400V-230V) at the substation by a transformer of about 500kVA, and then distributed to each building.

The works of the 11kV overhead power line up to the power receiving point (at the western corner of the project site), and service meters of electricity such as KWH and MDI are included in the works by the Government of Pakistan. After the power receiving point, the works within the project site are those of the Government of Japan.

- Power receiving electric system:
  3-phase, 3-wire, 50Hz, 11kV
- Low voltage power electric system:
  3-phase, 4-wire, 50Hz, 400V-230V

Some of the laboratory equipment will require special voltage other than the above-mentioned voltage, high-stable power sources, etc. Special power source equipment such as transformers, automatic voltage

regulators, etc. will be provided as part of the laboratory equipment work.

A power generator will be installed as an emergency source in case of power failure. Things which require emergency power include emergency lights, fire hydrant pumps, neutralisation tank and laboratory equipment (electron probe micro analyser, X-ray diffractormeter, X-ray fluorescence spectrometer, atomic absorption spectrometer, etc.).
The required capacity of the power generator will be approximately 100kVA. Fig.4-4 shows the outline of the power supply system and demarcation of works.

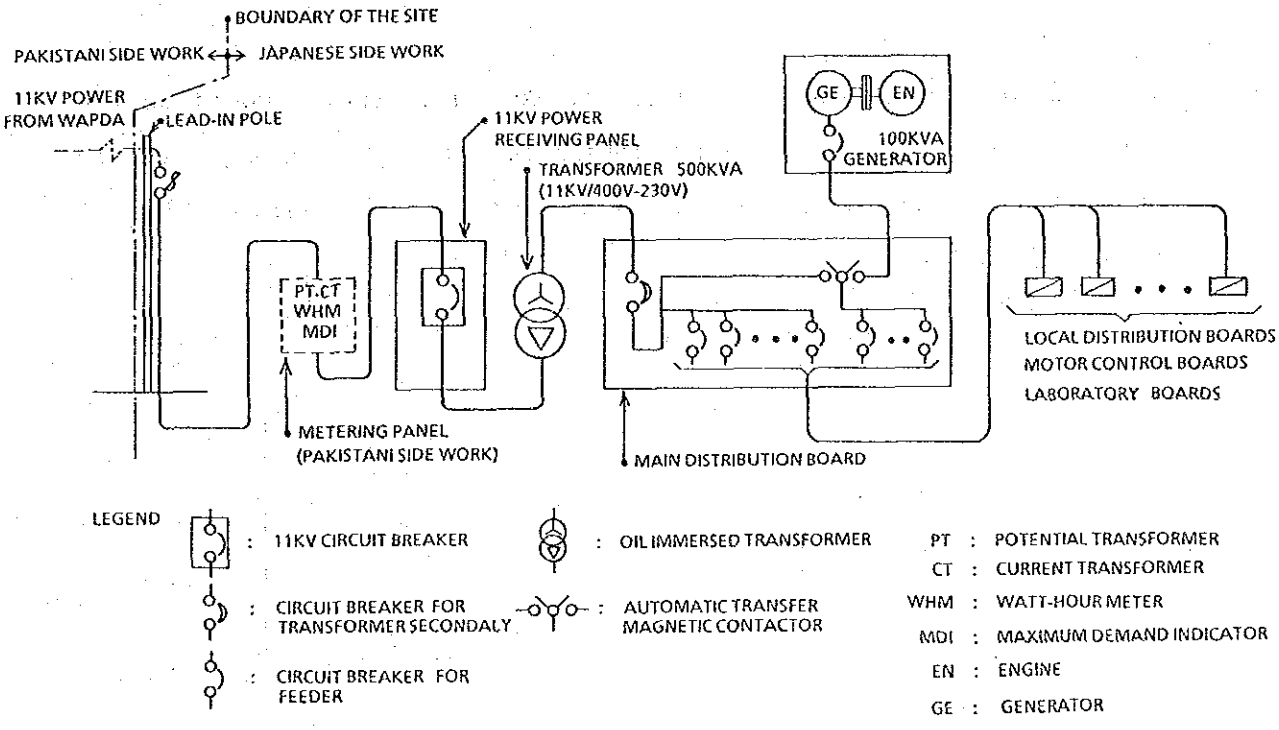


Fig. 4-4 Power Supply System and Demarcation of Works

3) Socket outlets

Socket outlets will be installed at necessary locatons in the buildings as power supply sources for small electric apparatuses and laboratory equipment. All these socket outlets will be 15A, 3-pole type (one pole for earthing). A distribution board will be installed in each laboratory to facilitate control of power sources.

4) Lighting System

In principle, lighting fixtures will be equipped with fluorescent lamps. Suspended lighting fixtures will be installed in office rooms, scientist rooms, etc. and the recessed-mounting type will be installed in laboratories. In rooms like the crushing room which will generate dust the lighting fixtures will be surface-mounted to facilitate their cleaning.

Illumination level values shown in the following table should be the target values. The illumination levels for scientist rooms, lecturer rooms and office rooms are set relatively low in consideration of natural lighting.

Table 4-1 Target Illumination Level

Rooms	Design target illumination level (lux)
Laboratory rooms	300~500
Crushing and polishing rooms	300~400
Scientist rooms and lecturer rooms	250~350
Office rooms	250~350
Canteen	100~200
Sample storage	50~100

5) Telephone

It is expected that 10 service lines (central office line (COL)) from PTTD (Pakistan Telephone and Telegraph Department) will be required in

total including future lines for telex, facsimile, etc.
The works of the service line up to MDF (main distribution frame which is installed in PABX room on the ground floor) and telex, facsimile etc. are included in the works by the Government of Pakistan.
An electronic PABX capable of covering 10 COL and about 60 extensions will be installed.
Extension telephones will be installed in the scientist rooms, the lecturer rooms, the laboratory rooms, the library, the canteen and the director room.

6) Public Address System

A public address system will be provided for general and emergency announcements in the buidlings. Its main units (amplifier and microphone) will be installed in the clerks' office on the ground floor, from where announcements will be broadcasted to each building.

7) Fire Alarm System

Early fire detection is of vital importance. Therefore, an automatic fire alarm system will be installed. As Pakistan has no official regulations on installation of fire alarm equipment, the system will be installed in accordance with the provisions of the Fire Services Act of Japan. Like the main units of the public address system, the fire alarm main control panel will be installed in the clerks' office on the ground floor to facilitate emergency notice when a fire breaks out.

8) Lightning Protection System

A lightning protection system will be provided at the study and administration block and elevated tank tower to prevent damage due to lightning.

(2) Air Conditioning Facility Plan

An air conditioning system which is easy to maintain and operate will be employed to minimise the maintenance and operation costs.

1) Design Conditions

a. Outdoor Design Conditions

Outdoor design air conditions are set as follows, in consideration of those typically existing in Islamabad and according to ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers) standard.

- Summer

  Dry-bulb temperature : 42°C (108°F)

  Wet-bulb temperature : 27°C (80°F)

- Winter

  Dry-bulb temperature : 2°C (35°F)

  Wet-bulb temperature : -1°C (30°F)

b. Indoor Design Conditions (target values)

In order to minimise the operation cost, no indoor humidity control will be available. Indoor design air temperature will be set only in places which require such control to maintain the performance of the analysing equipment.

- Summer

  Dry-bulb temperature : 24°C (75°F)

- Winter

  Dry-bulb temperature : 22°C (72°F)

2) Air Conditioning System

The number of rooms to be air conditioned should be limited to minimise the running cost of air conditioners. The air conditioning system should use individual air conditioners, to ensure ease of maintenance and quick repair. A direct heating system using natural gas should be used to minimise running costs. Heat pump-type individual air conditioners should be employed to control room temperature to maintain performance of analysing equipment in winter. In consideration of the rainy season in Islamabad, dehumidifiers will be used in rooms where analysing equipment is installed.

3) Ventilating System

Each room will be ventilated by a ceiling fan. Exhaust fans will be installed in toilets, pantries and laboratories.

(3) Sanitary and Plumbing Facility Plan

1) Water Supply System

At present, the Capital Development Authority (CDA) has no plan to supply city water to the project site. It is necessary, therefore, to establish a water supply system which uses a well within the project site. A deep well (12 inches in diameter and 350 feet in depth) will be dug within the project site. The water pumped up from the well will be stored in an underground concrete water tank (capacity: 15,000 gallons) after going through a sand removing unit and a filter. Then the water will be pumped up to an elevated water tank (FRP tank with a capacity of 1,300 gallons), which will distribute the stored water to all the facilities. Galvanised steel pipes should be used for the direct pressure portions and polyvinyl chloride pipes should be used for other portions.

2) Hot Water Supply System

Hot water will be supplied by water heaters which use natural gas as heat source. The piping should be of deoxidised copper.

3) Drainage and Vent Piping System

For sewerage not to remain on and around the project site, soil and waste water must be treated in septic tanks and a plain oxidisation bed, to let it penetrate into the soil. Rainwater will be collected at a lower part of the site, then discharged. The vent piping system will be the circuit and stack type. The piping should be of polyvinyl chloride.

4) Neutralisation System

The acid or alkaline waste water discharged from the laboratories should be neutralised. The piping should be of polyvinyl chloride.

5) Sanitary Fixtures

Sanitary fixtures which conform to the local social customs will be installed.

6) Gas Supply System

Pipes for supplying natural gas will be laid in pertinent places.
The piping should be of galvanised steel.

7) Fire Extinguishing System

Fire hydrants and other fire extinguishing devices which comply with the provisions of the Fire Services Act of Japan should be installed in accordance with instructions of the local fire defense authorities.

Supply (minimum: 15,000 gallons) of sufficient water for use with the fire extinguishing units should be secured.

8) Kitchen Equipment

Kitchen equipment which conforms to the local dietary habits will be installed.

9) Incinerator

An incinerator for burning garbage and trash will be installed at the project site.

4-3-5 Material Plan

Selection of building materials should consider the required functions, the current construction situation, the planned construction period and construction costs, and management and operation of the facilities. As it is expected that the use of locally procured materials should facilitate the prospective management and maintenance of the facilities, such materials should be selected if there are no supply or performance problems.

(1) Structural Materials

The main structural materials should be of reinforced concrete commonly used in Pakistan. There is no difficult problem with the prices, quality and quantity of locally manufactured cement, aggregate and concrete blocks.

However, there are wide variations in the quality of the locally manufactured reinforcing bars. Moreover, 12-meter-long reinforcing bars are usually transported bent in two, which causes deterioration of the bent portion. For this reason, reinforcing bars should be imported from Japan.

(2) External Finishing Materials

1) Roofs

Each uppermost storey should have a reinforced concrete flat roof. The waterproofing asphalt will be covered with insulation, on which concrete will be laid. In addition, a brick insulating layer will be laid on the concrete to ensure enough heat insulation. The brick insulating layer is one of the methods of insulation used in Pakistan.

2) External Walls

External walls should be finished with chipped marble which is commonly used in Pakistan. This finishing material is highly durable and can be quickly repaired. The finishing method of applying paint to the troweled mortar is also commonly practiced in Pakistan. But external walls finished in this way are generally not sufficiently weatherproof and require frequent repainting, making them costly in the long term.

3) Doors and Windows

Aluminium fitting should be used as exterior fittings because it is not necessary to re-paint them, and they are easy to maintain compared with steel fittings. Unlike wooden fittings, they can not be damaged by termites. As sophisticated equipment is to be installed in the facilities, Japanese-made aluminium fittings which excel in airtightness should be used to protect against sand and dust. Grilles will be applied to the exterior windows on the ground floors for the purposes of preventing thefts and other crimes. In addition, screens should be attached to the windows to prevent flies and mosquitoes from flying into the rooms. In principle, the doors will be locally manufactured wooden flush doors. But aluminium or steel doors will be

used as exterior doors, which are required to be weatherproof and durable.

(3) Interior Finishing Materials

1) Floors

The floors of the facilities for common use such as the scientist rooms, office rooms and the corridor should be covered with terrazzo tiles, which are widely used in Pakistan. On the other hand, the floors of the laboratories where scientist are to work for many hours will be covered with plastic tiles which are more elastic than terrazzo tiles. The floors of the chemical analysis room, the crushing room and the like should be finished with epoxy resin.

2) Interior Walls

Reinforced concrete walls, columns, beams and brick walls should be finished with troweled mortar and paint. The interior walls of the lavatories should be covered with ceramic tiles.

3) Ceilings

In accordance with local customs, scientist rooms, office rooms, other general rooms and the rooms of the sample preparation and storage building will not be equipped with suspended ceilings. However, the interior sides of the roofs should be reinforced concrete and finished with colored perlite mortar. The air conditioned portions of the laboratory building will have ceilings covered with mineral acoustic tiles to enhance the air conditioning effect.

4-3-6 Equipment Plan

The following criteria are considered in determining the types, specifications and grades of equipment for the project.

(1) Equipment to contribute to the enhancement of the geological investigation

Investigation activities on mineral resources can be broadly divided into field works and laboratory works. At present the Geological Survey of Pakistan is suffering a shortage of experimental equipment. The primary objective of the equipment plan is, therefore, to obtain precise data by concentrating equipment necessary for laboratory works in the proposed facilities, and effectively and efficiently maintaining and operating the equipment installed.

(2) Equipment which is easy to maintain

Some of the equipment to be installed in the proposed facilities is rather sophisticated, and therefore the availability of maintenance systems for such equipment in Pakistan is an important factor in selection. Also, consideration should be given to the relative difficulty and cost in procuring consumables and spare parts locally. In selecting equipment, careful attention should also be paid to the technical difficulty in maintaining and operating it.

(3) Equipment to be consistent with the contents of the scheduled project-type technical cooperation by the Japanese government.

It is essential to select equipment which conforms to the requirements of the scheduled project-type technical cooperation by the Japanese government. The equipment selected must also be of such a type as will facilitate transfer of technology as well as the training of Pakistani scientists.

The outline of the equipment proposed for each laboratory and section is as follows.

(1) Paleomagnetic Geochronology Laboratory

A remanent magnetisation measurement unit, demagnetisers for obtaining information on the thermal and electrical histories of rock magnetism and a device for identifying magnetic minerals and other instruments will be installed.

(2) Petrology and Mineralogy Laboratory

Optical instruments to identify mineral constituents of rocks and minerals and observe their textures, instruments utilising X-ray to observe crystallography and details of constructions of mineral constituents and analyse distribution of elements within fine particles of minerals, a thermal analysis instrument to identify minerals by determining their thermal properties and measuring phase transition temperatures, and other instruments will be installed.

(3) Analytical Chemistry Laboratory

Absorption spectrometers and a fluorescence X-ray spectrometer for analysing various types of samples and other instruments will be installed. These instruments will be effective in determining contents, and major and trace elements in various types of samples.

(4) Geochemical Exploration Section

The main activities of this section are to conduct statistical analysis of data based on chemical analysis of rock and mineral samples and to prepare geochemical maps on the basis of the statistical analysis. For this purpose, computer units for processing data and equipment for giving graphic representations of the processed data will be installed.

(5) Isotope Geochronology Section

This section requires a mass analysis instrument for determining isotopic compositions of rocks and minerals. However, this instrument requires highly developed technical skills. A lot of problems are expected to be faced in the maintenance and operation of this type of instrument. For these reasons, its use is very limited, even in Japan. It would be difficult to train Pakistani scientists in the maintenance and operation of this instrument in the proposed project-type technical cooperation by the Government of Japan. Therefore, only a mineral separating unit will be installed in this project, and the separated, pretreated minerals will be sent to Japan and other foreign countries for isotopic analysis.

(6) Geology Section

The main activities of this section are to conduct comprehensive analysis of the results obtained by the above-mentioned five sections and the results of field observations and to prepare geological and other maps, diagrams and presentations of other forms incorporating the comprehensive interpretation and related reports. Thus this section requires computer units for analysis of various types of information and a drafting instrument for illustrating the results of the computer-aided analyses.

(7) Sample Preparation Section

It is necessary in conducting the above-mentioned laboratory works to pretreat samples in various forms suitable for various uses. Activities of this section will be divided into 1) crushing and processing the rocks and minerals collected and 2) preparing thin, polished and thin polished samples of rocks and minerals and refining them for detailed measurement. The main instruments to be installed in the facilities of this section are crushers, pulverisers, rock cutters, lapping machines and polishing machines. A storage for storing rock samples should be included in this section's facilities.

4-3-7 Equipment List

No.	Item	Q'ty
A－1	AC Demagnetiser (Main Body, Controller, Amplifier)	1 Set
A－2	Thermal Demagnetiser (Main Body, Controller)	1 Set
A－3	Magnetic Susceptibility Meter (Range: 1~9999×10-6 C.G.S.)	1 No.
A－4	Magnetic Balance (Main Body, Max. 5000 oe, Amplifier, Recorder, Vacuum Pump)	1 Set
A－5	Spinner Magnetometer (Main Body, Controller, Amplifier, Computer System)	1 Set
A－6	Fluxgate Magnetometer (Laboratory-Use, Sensitivity : 0.01%)	1 No.
A－7	Shielded Case for Sample Stocks (4-fold shield)	2No .
B－1	Electron Probe Micro Analyser (Main Body, Display, Computer Systems, X-ray Detection Unit, Disc Rack, Pump Box, Table, Cooling Water Circulation Unit)	1 Set
B－2	Vacuum Evaporator (for EPMA and Microscope, Au and C)	1 No.
B－3	X-ray Diffractometer (X-ray Generator, Data Processing Unit, X-Y Plotter, Cooling Water Circulating Unit, JCPDS Data File)	1 Set
B－4	Differential Thermal Analyser and Thermal Gravimeter (Main Body, Data Processing Unit, Cooling Water Circulating Unit)	1 No.
B－5－1	Polarising Microscope (with Microphoto Unit)	3 Nos.
B－5－2	Polarising Microscope (for Transmitting and Reflecting Lights, Trinocular)	1 No.
B－5－3	Polarising Microscope (for Transmitting Light, Single Ocular)	1 No.
B－5－4	Ore Microscope (with Microphoto Unit, for Reflecting Light, Trinocular)	1 No.
B－5－5	Gem Microscope (Trinocular, with Microphoto Unit)	1 No.
B－5－6	Stereographic Polarising Microscope (with Microphoto Unit, Zoom Objective Lens, Polarising Filter, Trinocular)	1 No.
B－5－7	Stereographic Polarising Microscope (with Zoom Objective Lens, Polarising Filter, Binocular Coaxial Episcopic Illuminator)	1 No.
B－5－8	Metallurgical Microscope (with Microphoto Unit, for Reflecting Light, Trinocular)	1 No.
B－5－9	Stereographic Polarising Microscope (Zoom Objective Lens)	1 No.
B－6	Refractometer (with Digital Thermometer)	1 No.
B－7	Micro Hardness Tester (Vicker's Hardness Tester)	1 No.
B－8	Point Counter (Mechanical Stage, Automatic Recorder, Polarising Projector)	1 No.

No.	Item	Q'ty
B-9	Dryer (with Stand, for Drying Photos)	1 No.
B-10	Universal Stage (4 Axes Type)	1 No.
B-11	Specific Gravity Meter (Measuring Range: 0.700~1.850, with Thermometer, 19 tubes-set)	1 Set
B-12	Specimen Press for Polished Section	2 No.
B-13	Polishing Plate for Polished Section (Made of Deer Hide)	2 Nos.
B-14	Cases for Microscopes	11 Nos.
B-15	Micrometer Gauge	1 No.
B-16	Graphite Electrode Sharpener	1 No.
B-17	Grinder (Manual Operation)	1 No.
B-18	Automatic Particle Size Distribution Analyser (Gravitational, Centrifugal)	1 No.
B-19	Heating-Cooling Stage (Long Focusing Objective Lenses, Quenching Unit)	1 No.
C-1	X-ray Fluorescence Spectrometer (Spectrometer, Printer, Display, Cooling Water Circulating Unit, Rotary Pump, Sample Changer)	1 Set
C-2	Beads Sampler (High Frequency Induction Furnace, with 3 Platinum Crucibles)	1 No.
C-3-1	Touch Mixer	1 No.
C-3-2	Vibrating Spatula	2 Nos.
C-4	Hand Bricket Press (Maximum Pressure: 50t)	1 No.
C-5	Flame Atomic Absorption Spectrometer (Double Beam Optical System)	1 No.
C-6	Flameless Atomic Absorption Spectrometer (Double Beam Optical System)	1 No.
C-7	Ultraviolet-Visible Spectrometer (Double Beam Optical System, Wave Length Range : 190~1100nm)	1 No.
C-8	Automatic Titrator (Potentiometric Titration, Built-in Micro-Computer with Autosampler)	1 No.
C-9-1	Electronic Analytical Balance (Weight Read-out 0~205g, Graded at 0.1mg)	3 Nos.
C-9-2	Top-Loading Electronic Balance (Weight Read-out: 0~4,100g/0~600g, Graded at 0.1g(0.01g))	6 Nos.
C-10-1	High Temperature Muffule Furnace (Temperature Range: 100~1,150°C, Inner Volume: Approx.8ℓ)	2 Nos.
C-10-2	High Temperature Muffle Furnace (Floor set, Maximum Temperature: 1,500°C, Inner Volume: Approx. 7.5ℓ)	1 No.

No.	Item	Q'ty
C－10－3	Constant Temperature Drying Oven (Operating Temperature: 40~250°C, Inner Volume: Approx. 100ℓ)	4 Nos.
C－11	Pure Water Production System (Permeated Water Quantity: Approx. 0.5m³/h、with Tank Pump and Water Softening Apparatus)	1 No.
C－12	Water Still (Distilled Water Collection Rate: Approx. 6ℓ/h)	1 No.
C－13	Centrifuge (Max. Speed: 4,000r.p.m., Capacity: 100ml×4/50ml×4, Floor set)	1 No.
C－14	PH Meter with Ion Meter(Digital Display, with Printer, Measuring Range PH: 0.0~14.00, mv: 0~±1,999mv, Temp. Range: 0~100°C)	1 No.
C－15	Electric Conductivity Meter (Digital Display, with Printer, Measuring Range 0.100~1.999Ω, 0~199.9MΩ, with Range Exchanger)	1 No.
C－16	Shaker (Vertical Vibrating Type (2-sides), Maximum Number of Racks: 1,000ml×3(Separatory Fannels))	1 No.
C－17	Karl-Fisher Titrator (Coulometric, Digital Display, Concentration Read-out: 10ppm~100%, Water Content Read-out: 0.1~1,000mg)	1 No.
C－18－1	Magnetic Stirrer (Max. Heat Plate Temperature: 300°C, with Temperature Control)	3 Nos.
C－18－2	Interlocked Multi Type Magnetic Stirrer (Stirring Capacity: 50~2,000ml, Revolving Speed : 0~1,200 r.p.m.)	2 Nos.
C－19	Water Bath (Operating Temp. : Room Temp. ~ Boiling Temp., Inner Capacity: 6 Holes)	2 Nos.
C－20	Sand Bath (Max. Temp. : 400°C, Hot Plate : Casting Iron.Make)	5 Nos.
C－21－1	Vacuum Desiccator (Glass, with 150mm∅ inner plate)	2 Nos.
C－21－2	Vacuum Desiccator (Glass, with 200mm∅ inner plate)	2 Nos.
C－21－3	Vacuum Desiccator (Glass, with 250mm∅ inner plate)	2 Nos.
C－21－4	Vacuum Desiccator (Glass, with 300mm∅ inner plate)	2 Nos.
C－21－5	Vacuum Desiccator (Glass , with 350mm∅ inner plate)	2 Nos.
C－22－1	Standard Fume Hood (Steel, Corrosion-Proof Paint, Air Volume : Approx. 30m³/min)	2 Nos.
C－22－2	Perchloric Fume Hood (Steel, Corrosion Proof Paint, Baking Painted Asbestos Inside Wall, Air Volume: Approx. 30m³/min.)	1 No.
C－23	Scrubber (Air Volume : 60m³/min、Pump Outlet : 250ℓ/min)	1 No.
C－24－1	Trolley (900(W)×450(D)×750(H) mm)	5 Nos.
C－24－2	Trolley for Cylinder Exchange (For 7m³)	1 No.
C－25－1	Cylinder Stand (for 7m³ Cylinder)	9 Nos.

No.	Item	Q'ty
C－25－2	Cylinder Stand (for 1.5m^3 Cylinder)	1 No.
C－26	Glassware, Plasticware, Metalware (Beakers, Flasks, Vinyl Tubes, Filters, etc.)	1 Set
C－27	Chemicals and Reagents (HCℓ, HNO_3, H_2SO_4, HCℓO, etc.)	1 Set
C－28	Crucibles (Pt, Zr, Ni, Aℓ, etc.)	1 Set
D－1	Personal Computer (Main Body, Key Board, Expanding Interface, Printer)	3 Sets
D－2－1	Plotter (A-1, Memory (1MB))	1 No.
D－2－2	Plotter (A-3, Memory (512KB))	1 No.
D－3	Digitiser (A-2)	1 No.
D－4	Hard Disc (40MB)	1 No.
D－5	Book Rest (For A-4 size)	2 Nos.
D－6	Floppy Disc Case	2 Nos.
D－7	Floppy Disc (5 inch)	100 Nos.
E－1	Isodynamic Separator	1 No.
E－2	Hot Plate (Operating Temperature Range: 40~370°C, Aluminium Make)	7 Nos.
E－3	Auto-Desiccator (with Hygrometer, Inner Volume : Approx. 40ℓ)	5 Nos.
F－1	Overhead Projector	2 Nos.
F－2	Slide Projector	2 Nos.
F－3	Screen	2 Nos.
F－4	Drafting Table(Size: 1,050×750mm、With 36mm Thick Plate, with Drafting Light and Plaider)	1 No.
F－5－1	Tracing Table (Standing Type: 1,056(W)×750(D)×790~1,065(H)mm, With 5mm Thick Transparent Glass Plate, Plated with 1mm Thick Milky White Plastic Film, Drafting Light, Drafting Area:895(W)×590(D) mm)	2 Nos.
F－5－2	Tracing Table (1,500(W)×1,200(D)×800(H) mm)	1 No.
F－5－3	Tracing Table (Table-Top Type, with 4mm Thick Acryle Plate, 637×450×90 (Front)137(Rear) mm	3 Nos.
F－6－1	Map Locker (for A-0 size)	6 Nos.
F－6－2	Map Suspender (for A-0 size, with 6 Hangers 615(W)×275(D)×1,270 (H) mm)	2 Nos.
F－7	Electronic Lettering Set	1 Set

No.	Item	Q'ty
F－8	Cabinet (1,800(W)×400(D)×900(H) mm)	1 No.
F－9－1	Map Case (for A-0 Size, 1,375(W)×989(D)×415(H) mm, 3 shelves)	2 Sets
F－9－2	Map Case (for A-2 Size, 730(W)×565(D)×415(H) mm, 3 shelves)	1 Set
F－10	Portable Magnetic Susceptibility Meter (Sensitivity : $<1\times10^{-6}$ C.G.S.)	2 Nos.
F－11	Field Survey Vehicles (4-Wheel Drive, Diesel Fuel Use)	4 Nos.
F－12	Field Survey Equipment (Portable Generator, Altimeter, Compass etc.)	2 Sets
F－13	Books and Documents (Hand-Books, Manuals and Other Publications Necessary for Research)	1 Set
F－14	Portable Core-Picker (Electric, Diamond Bit : Inner Diameter 25mmØ)	1 No.
G－1－1	Jaw Crusher (Crushed Size: 5mm or Less, Feed Size: Approx. 70mm, Jaws: High Manganese Steel)	1 No.
G－1－2	Jaw Crusher (Crushed Size: 5mm or Less, Feed Size: Approx. 25mm, Jaws: Stainless Steel)	1 No.
G－2	Brown Crusher (Crushed Size: 0.25mm or Less, Feed Size 5mm)	1 No.
G－3－1	Sieve Shaker (Electric, Sieve Rack: Up to 7 Sieves)	1 No.
G－3－2	Sieve Shaker (Table-Top Type)	1 No.
G－4	Rock Trimmer (Manual)	1 No.
G－5－1	Vibrating Mill (Container Volume : 250ml, Speed Reduction Gear for Agate Container, Grinding Containers ; Chrome Steel, Tungsten Carbide, Agate (100ml))	1 No.
G－5－2	Vibrating Mill (Container Volume : 100ml, Grinding Container : Chrome Steel, Tungsten Carbide, with Timer)	1 No.
G－6	Pot Mill (2 Pots of 2ℓ Volume)	1 No.
G－7	Automatic Agate Mortar (with Single Pestle)	2 Nos.
G－8	Divider (No. 6, 10, 20)	1 Set
G－9	Air Compressor (Discharged Air Flow Rate: 750ℓ/min, Air Receiver Capacity: 280ℓ)	1 No.
G－10	Dust Collector (Air Flow Rate : 50m³/min)	1 No.
G－11－1	Agate Mortar (Inner Diameter : 90mmØ, with Pestle)	5 Nos.
G－11－2	Agate Mortar (Inner Diameter : 150mmØ, with Pestle)	1 No.
G－11－3	Agate Mortar (Inner Diameter : 45mmØ, with Pestle)	3 Nos.
G－12－1	Iron Mortar (Inner Diameter : Approx. 90mmØ, with Pestle)	1 No.

No.	Item	Q'ty
G－12－2	Iron Mortar (Inner Diameter: Approx. 150mmØ, with Pestle)	1 No.
G－13－1	Stainless Mortar (Inner Diameter: 90mmØ, with Pestle)	1 No.
G－13－2	Stainless Mortar (Inner Diameter: 150mmØ, with Pestle)	1 No.
G－14	Anvil	2 Nos.
G－15	Vacuum Cleaner	3 Nos.
G－16－1	Rock Cutter (Diamond Cutting Blade: 300mmØ, Water Cooling, with Water Trap)	1 No.
G－16－2	Ore Cutter (Diamond Cutting Blade: 150mmØ)	1 No.
G－17	Lapping Machine (Single Disc)	1 No.
G－18	Lapping Machine (Double Discs)	1 No.
G－19	Polishing Machine (Disc diameter: 8 inches, Revolution: Continuous Rotation Speed Change)	1 No.
G－20	Thin Section Preparation Machine (Lapping Disc with Diamond Paste, for Top and Bottom Lapping, with Automatic Thickness Adjustment Device)	1 No.
G－21	Secondary Thin Section Cutter (Diamond Cutting Blade: 200mmØ, Thickness Adjustment: 0.2mm or less)	1 No.
G－22	Specimen Press (Hydraulic, with Heater)	1 No.
G－23	Vacuum Drying Oven (Operating Temperature Range: 40~240°C, Operating Vacuum Range: 760~1Torr, Inner Capacity: Approx. 10ℓ)	1 No.
G－24	Impregnation Apparatus (for Porous Materials, with Steel Container, Vacuum Gauge)	1 No.
G－25	Ultrasonic Cleaner (Stainless Steel, Capacity: 5ℓ)	3 Nos.
G－26	Low Pressure Bonding Device (Operating Pressure: 2.0 atoms, with Safety Valve)	1 No.
G－27	Core Picker (Electric, Diamond Bit: Inner Diameter 25mmØ)	1 No.
G－28－1	Sieve (Stainless Steel, Inner Diameter: 150mm)	1 Set
G－28－2	Sieve (Stainless Steel, Inner Diameter: 75mm, Depth: 20mm)	1 Set
G－28－3	Sieve (Stainless Steel, Inner Diameter: 200mm)	1 Set
G－29	Safety Equipment (Safety Eye Glasses, Earplugs, Dust-Proof Masks, etc.)	6 Sets
G－30	Cleaning Equipment (Cleaning Brush, etc.)	1 Set
G－31	Vacuum Pump	1 No.
H－1	Photocopy Machine	3 Nos.

No.	Item	Q'ty
H－2	Typewriter (Electric)	2 Nos.
H－3	Word Processor	1 No.
H－4	Blueprint Machine (Width : A-0)	1 No.
I－1	Photo Enlarging Apparatus	1 No.
I－2	Dryer for Printing Paper	1 No.
I－3	Camera (Single-lens Reflex, Lenses: Macro, Micro, 50mm, with Flash Light)	1 No.
I－4	Camera Stand (with Caster)	1 No.
I－5	Camera Stand for Close-Up Photography (with Arms)	1 No.
I－6	Slide Mount (with Light Box)	1 No.
I－7	Light Stand (with Light Bulbs)	2 Nos.
I－8	Desiccator (Inner Diameter: 250mm)	1 No.
I－9	Refrigerator (Inner Capacity: 270ℓ)	1 No.
I－10	Table for Camera Container (900(W)×500(D)×70(H) mm)	1 No.
I－11	Developing Solution Tank (Plastic)	1 No.
I－12	Photography Equipment (Dark Room Lamps, Trays, Timer for Enlarging)	1 Set
I－13	Photography Chemicals (Developing Solution, Fixing Solution, etc.)	1 Set
I－14	Laboratory Side Table for Dark Room (2,400(W)×1,000(D)×800(H) mm)	1 No.
I－15－1	Work Bench for Dark Room (2,400(W)×1,000(D)×800(H) mm)	1 No.
I－15－2	Work Bench for Dark Room (1,200(W)×750(D)×800(H) mm)	1 No.
I－16	Sink Unit for Dark Room (1,200(W)×750(D)×910(H) mm)	1 No.
I－17	Hanging Storage Cabinet (1,500(W)×300(D)×1,000(H)mm)	1 No.
I－18	Stool	1 No.
I－19	Storage Cabinet (1,200(W)×400(D)×800(H) mm)	2 Nos.
I－20	Background Board for Photography (1,800(W)×1,200(H) mm)	1 No.
I－21	Cutter	1 No.
J－1－1	Laboratory Centre Table (with Sink Unit on Both Ends, 3,600(W)×1,500(D)×800(H) mm)	1 No.
J－1－2	Laboratory Centre Table (2,400(W)×1,500(D)×800(H) mm)	1 No.

No.	Item	Q'ty
J－2－1	Laboratory Table (3,000(W)×750(D)×800(H) mm)	2 Nos.
J－2－2	Laboratory Table (2,400(W)×750(D)×800(H) mm)	7Nos.
J－2－3	Laboratory Table (1,800(W)×750(D)×800(H) mm)	5Nos.
J－2－4	Laboratory Table (1,500(W)×750(D)×800(H) mm)	3Nos.
J－2－5	Laboratory Table (1,200(W)×750(D)×800(H) mm)	6Nos.
J－2－6	Laboratory Table (900(W)×750(D)×800(H) mm)	3Nos.
J－2－7	Laboratory Table (600(W)×750(D)×800(H) mm)	1 No.
J－2－8	Laboratory Table (2,400(W)×1,000(D)×800(H) mm)	1 No.
J－2－9	Laboratory Table (1,000(W)×1,000(D)×800(H) mm)	1 No.
J－3－1	Laboratory Table (3,000(W)×750(D)×800(H) mm)	3Nos.
J－3－2	Laboratory Table (3,000(W)×750(D)×650(H) mm)	4Nos.
J－3－3	Laboratory Table (1,800(W)×750(D)×800(H) mm)	3Nos.
J－3－4	Laboratory Table (1,500(W)×750(D)×800(H) mm)	1 No.
J－3－5	Laboratory Table (1,200(W)×750(D)×800(H) mm)	4Nos.
J－3－6	Laboratory Table (900(W)×750(D)×800(H) mm)	1 No.
J－3－7	Laboratory Table (2,400(W)×900(D)×800(H) mm)	1 No.
J－3－8	Laboratory Table (2,000(W)×750(D)×800(H) mm)	1 No.
J－4－1	Laboratory Table (1,800(W)×900(D)×800(H) mm)	1 No.
J－4－2	Laboratory Table (1,000(W)×1,000(D)×800(H) mm)	1 No.
J－5－1	Laboratory Work Bench (1,800(W)×900(D)×800(H) mm)	5Nos.
J－5－2	Laboratory Work Bench (1,500(W)×900(D)×800(H) mm)	5Nos.
J－6－1	Laboratory Work Bench (1,800(W)×750(D)×800(H) mm)	5Nos.
J－6－2	Laboratory Work Bench (1,500(W)×750(D)×800(H) mm)	5Nos.
J－6－3	Laboratory Work Bench (1,500(W)×1,200(D)×800(H) mm)	5Nos.
J－6－4	Laboratory Work Bench (with Sink Unit, 1,800(W)×750(D)×800(H) mm)	1 No.
J－6－5	Laboratory Work Bench (1,200(W)×750(D)×800(H) mm)	2 Nos.
J－6－6	Laboratory Work Bench (900(W)×750(D)×800(H) mm)	3 Nos.
J－6－7	Laboratory Work Bench (2,000(W)×750(D)×800(H) mm)	1 No.
J－7－1	Sink Unit (1,800(W)×750(D)×800(H) mm)	1 No.

No.	Item	Q'ty
J－7－2	Sink Unit (1,200(W)×750(D)×800(H) mm)	8 Nos.
J－7－3	Sink Unit (900(W)×750(D)×800(H) mm)	6 Nos.
J－7－4	Sink Unit (400(W)×750(D)×800(H) mm)	1 No.
J－8	Clean Hood	2 Nos.
J－9	Fusion Table (2,400(W)×750(D)×800(H) mm)	1 No.
J－10	Microscope Table (1,500(W)×750(D)×800(H) mm)	6 Nos.
J－11	Arranger Cabinet (3,000(W)×500(D)×800(H) mm)	3 Nos.
J－12	Counter Table (1,200(W)×450(D)×900(H) mm)	3 Nos.
J－13－1	Cabinet (1,800(W)×400(D)×1,800(H) mm)	9 Nos.
J－13－2	Cabinet (900(W)×400(D)×1,800(H) mm)	1 No.
J－13－3	Cabinet (1,200(W)×400(D)×1,800(H) mm)	1 No.
J－14－1	Unit Shelf (1,800(W)×500(D)×1,800(H) mm)	3 Nos.
J－14－2	Unit Shelf (900(W)×500(D)×1,800(H) mm)	1 No.
J－15	Book Shelf (880(W)×515(D)×1,066(H) mm)	4 Nos.
J－16－1	Storage Shelf (1,800(W)×400(D)×1,800(H) mm)	6 Nos.
J－16－2	Storage Shelf (1,500(W)×400(D)×1,800(H) mm)	2 Nos.
J－17	Reagent Shelf (1,200(W)×400(D)×1,800(H) mm)	1 No.
J－18	Storage Cabinet for Standard Samples (900(W)×400(D)×1,800(H) mm)	6 Nos.
J－19	Map Locker (900(W)×400(D)×1,000(H) mm)	1 No.
J－20	Vibration Proof Stand	2 Nos.
J－21	Storage Rack (1,200(W)×500(D)×1,800(H) mm)	2 Nos.
J－22	Work Desk (1,060(W)×730(D)×740(H) mm)	6 Nos.
J－23－1	Chair (for Office Work)	16 Nos.
J－23－2	Stool (for Balance)	7 Nos.
J－23－3	Chair (for Microscope)	13 Nos.
J－23－4	Chair (for Computer)	5 Nos.
J－23－5	Chair (for Drafting)	4 Nos.
J－24－1	White Board (900(W)×600(H) mm)	4 Nos.
J－24－2	White Board (1,860(W)×556(D)×1,770(H) mm)	1 No.

No.	Item	Q'ty
J－25	Fluorescent Light Stand	1 No.
J－26－1	Large Size Tools	1 Set
J－26－2	Standard Tools	4 Sets
J－27	Step-ladder (590(H) mm)	3 Nos.
J－28	Rock Sample Rack (1,800(W)×500(D)×1,800(H) mm)	63 Nos.
J－29	Rock Sample Cabinet	1 Set
K－1	Desk with Double Side Drawers (1,500(W)×900(D)×750(H) mm)	10 Nos.
K－2	Desk with Single Side Drawers (1,200(W)×900(D)×750(H) mm)	33 Nos.
K－3	Armchair	10 Nos.
K－4	Armchair	31 Nos.
K－5	Chair	19 Nos.
K－6	Chair	52 Nos.
K－7	Chair with Table	30 Nos.
K－8	File Storage (900(W)×500(D)×1,900(H) mm)	33 Nos.
K－9	Dining Table (1,200Ø×750(H) mm)	6 Nos.
K－10	Work Desk (1,800(W)×1,200(D)×750(H) mm)	6 Nos.
K－11	Library Desk (1,500(W)×1,200(D)×750(H) mm)	2 Nos.
K－12	Locker (1)(900(W)×455(D)×1,800(H) mm)	1 No.
K－13	Locker (2)(300(W)×455(D)×1,800(H) mm)	2 Nos.
K－14	Open Book Shelf (900(W)×300(D)×1,200(H) mm)	6 Nos.
K－15	Closed Book Shelf (900(W)×300(D)×2,500(H) mm)	58 Nos.
K－16	Library Card Storage (1,050(W)×625(D)×1,275(H) mm)	2 Nos.
K－17	Step-ladder	2 Nos.
K－18	Bed (1,950(W)×850(D)×300(H) mm)	2 Nos.
K－19	Food Cabinet (900(W)×600(D)×1,950(H) mm)	5 Nos.
K－20	Dining Chair	24 Nos.
K－21	Library Counter Table	1 No.
K－22	Rock Sample Shelf (900(W)×450(D)×1,950(H) mm)	20 Nos.

4-3-8 Area of Facilities

Based on the result of 4-3-2, areas of each department are shown in the table below.

Table 4-2 Area Schedules

Building	Ground floor area	1st floor area	Total
Laboratory Building	809	–	809
Sample Preparation and Storage Building	636	–	636
Study and Administration Building	1,127	666	1,793
Canteen	158	–	153
Mechanical Building	142	–	142
Guard House, Garage, Power Receiving House, Neutralisation Tank, Elevated Tank	126	–	126
Total	2,998	666	3,664 m^2

4-3-9 Basic Design Drawings

(1) List of Drawings

01 Site Plan

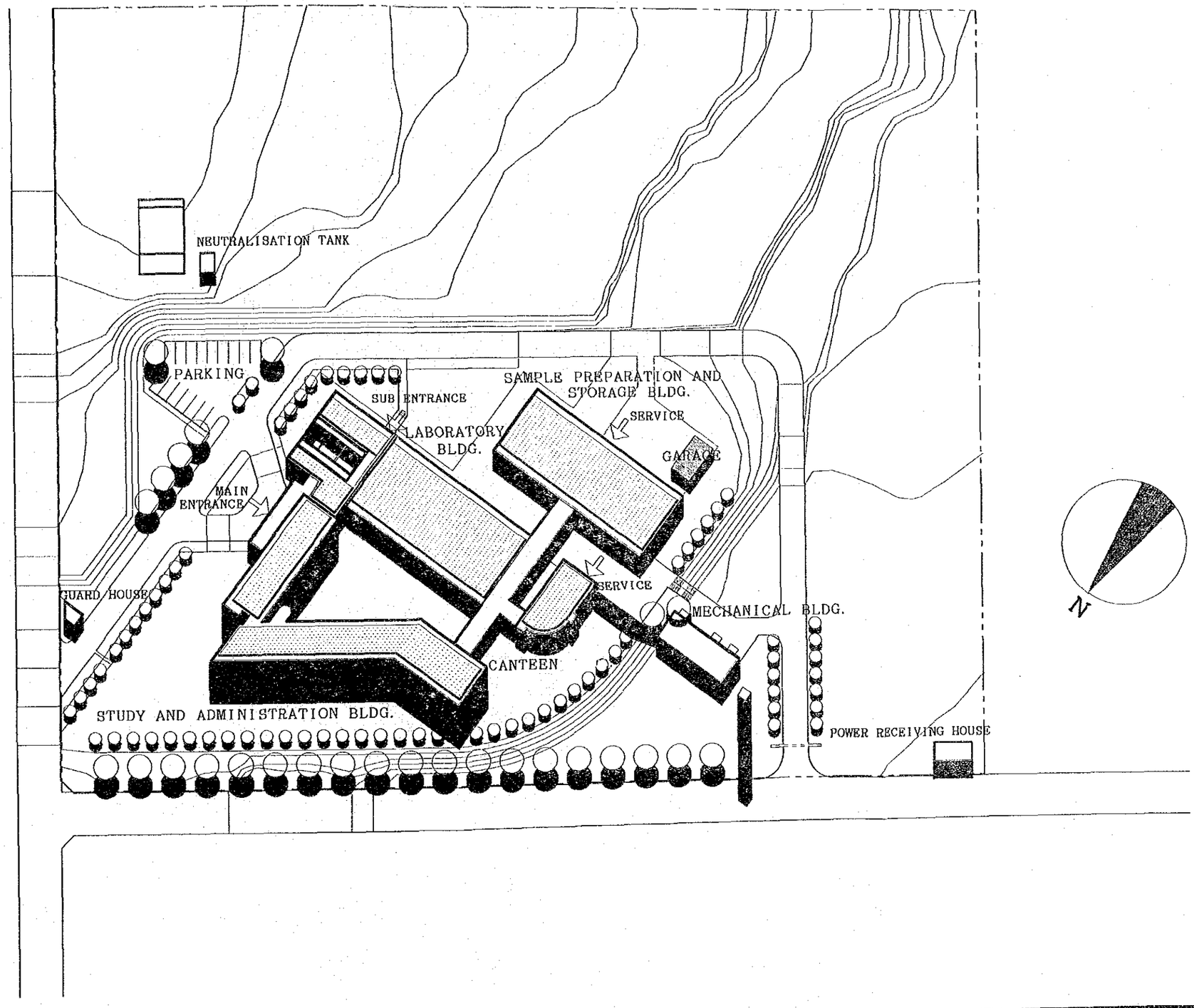
02 Ground Floor Plan

03 First Floor Plan

04 Elevation and Section

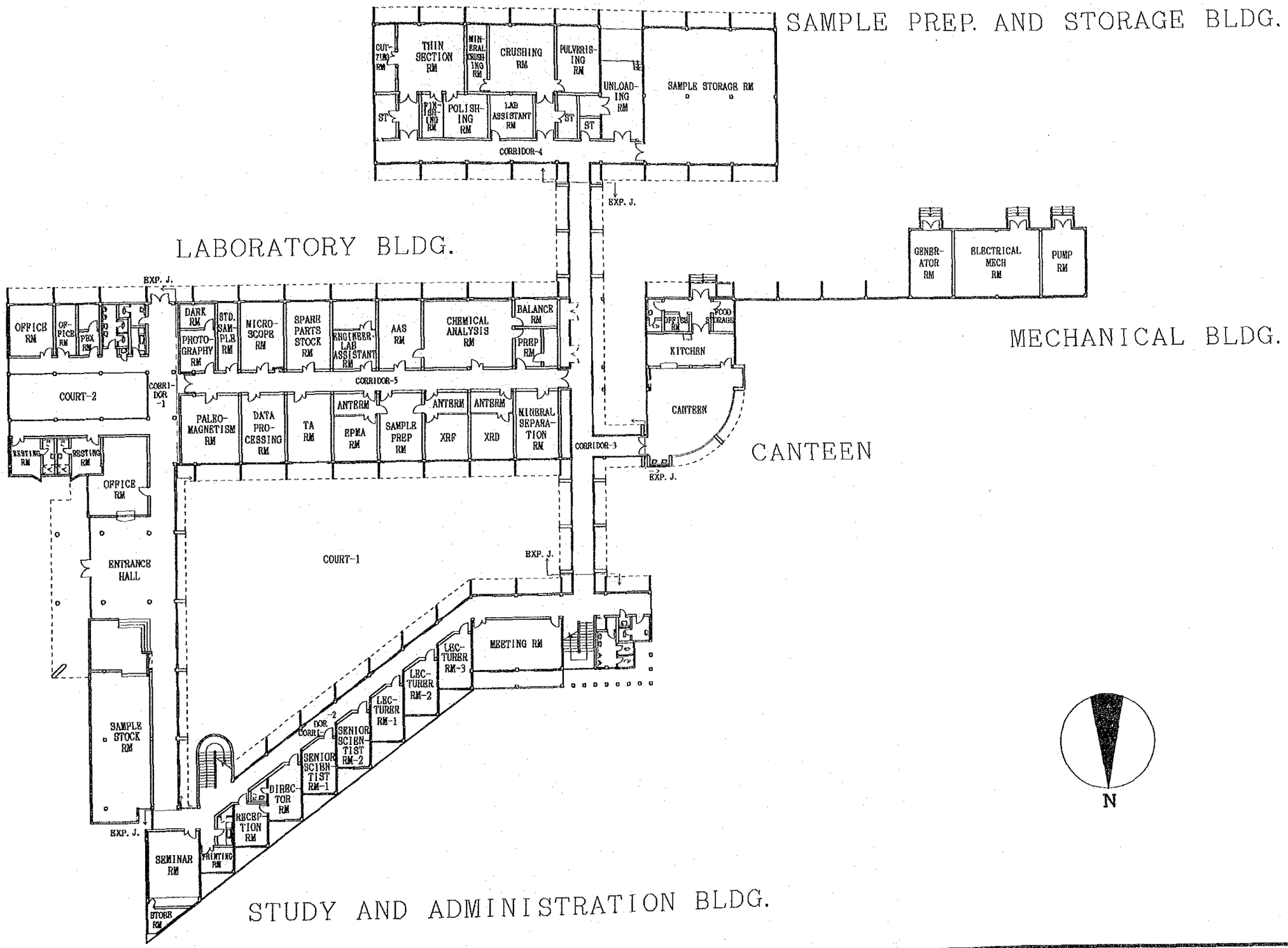
05 Elevation and Section

06 Layout 1~11



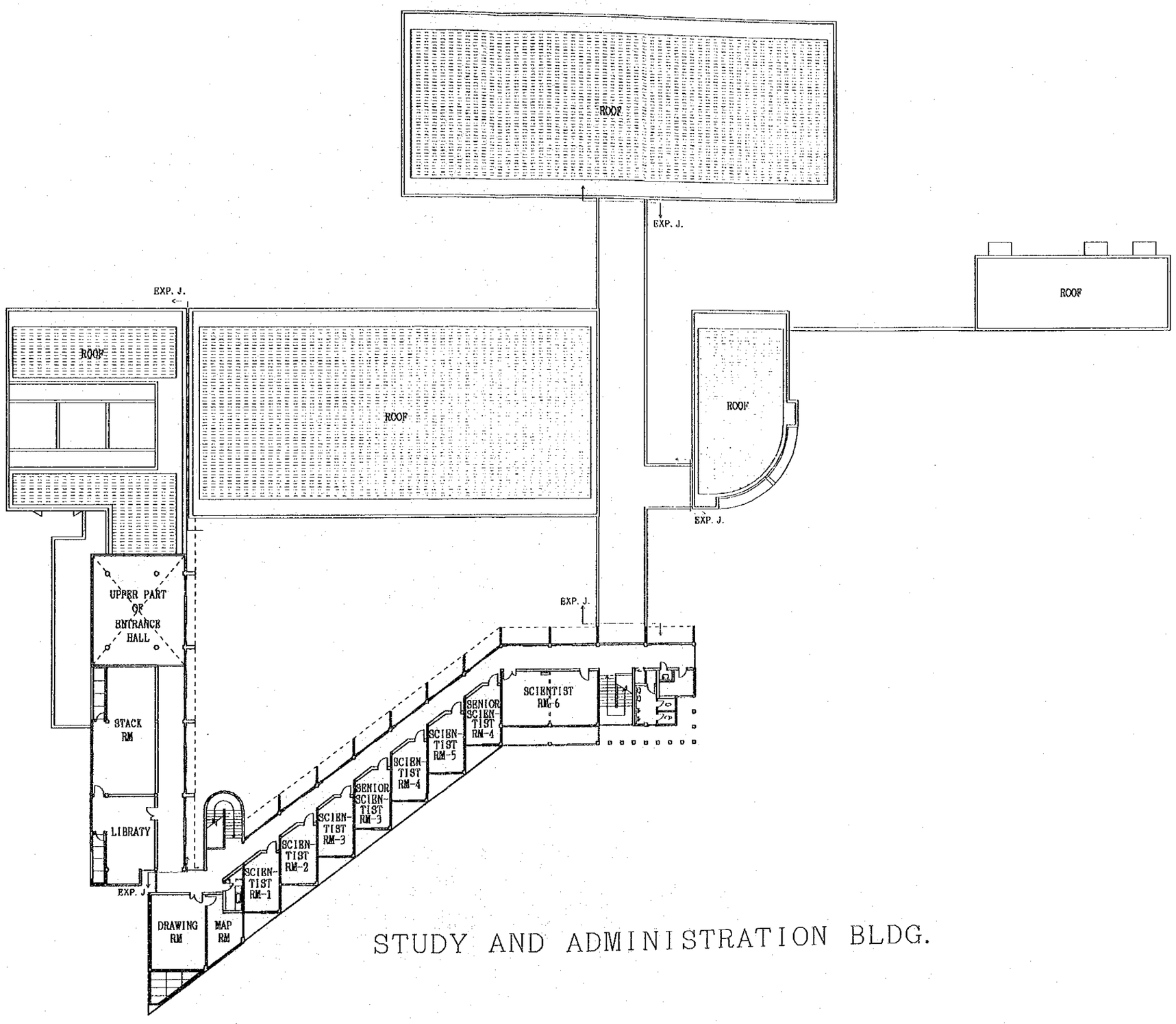
GEOSCIENCE LABORATORY

SITE PLAN 1/1000 01



GEOSCIENCE LABORATORY

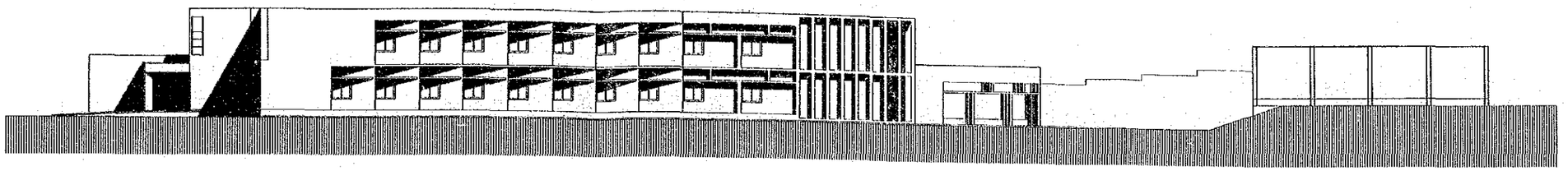
GROUND FLOOR PLAN 1/400 02



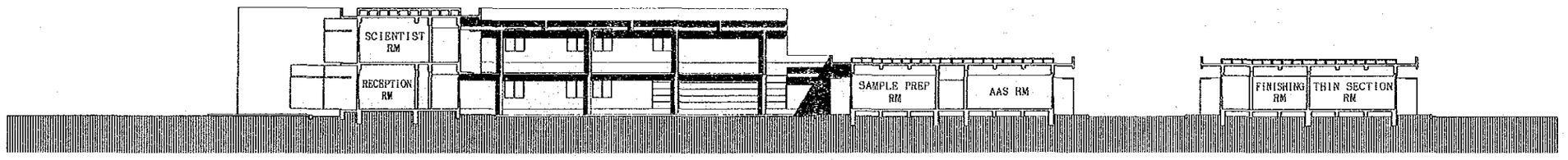
STUDY AND ADMINISTRATION BLDG.

GEOSCIENCE LABORATORY

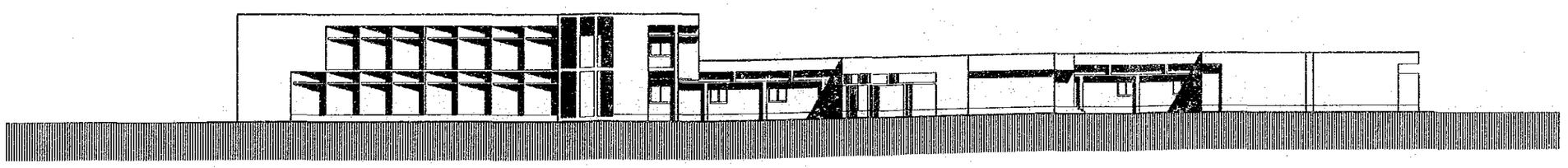
FIRST FLOOR PLAN 1/400 03



NORTH ELEVATION



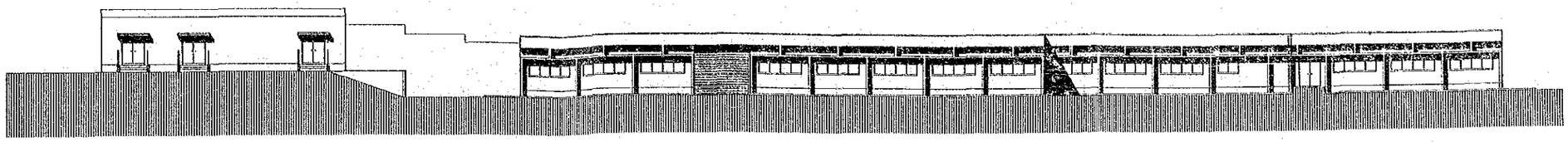
A-A SECTION



WEST ELEVATION

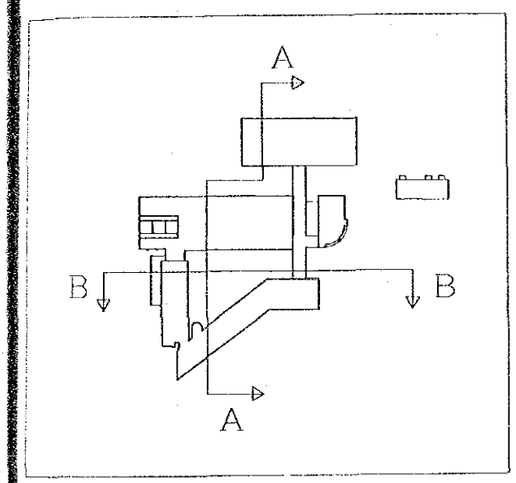
GEOSCIENCE LABORATORY

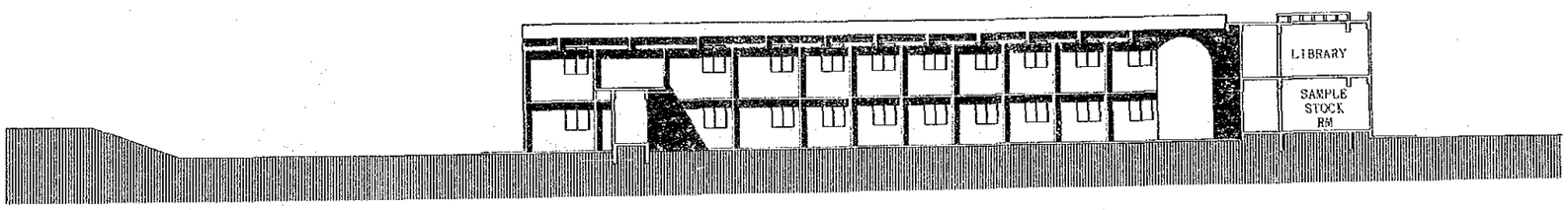
ELEVATION/SECTION 1/400 04



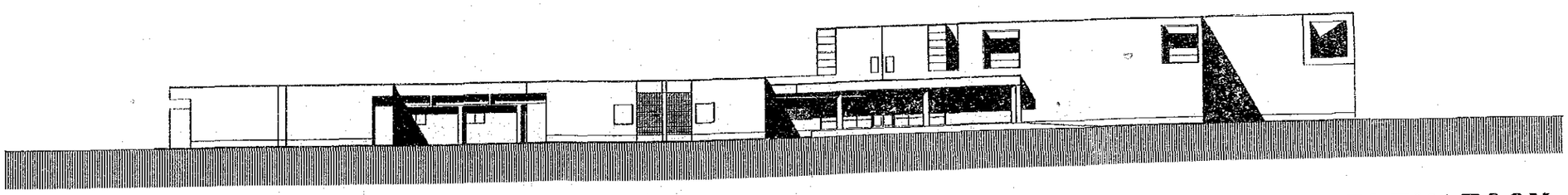
SOUTH ELEVATION

KEY TO SECTION





B-B SECTION

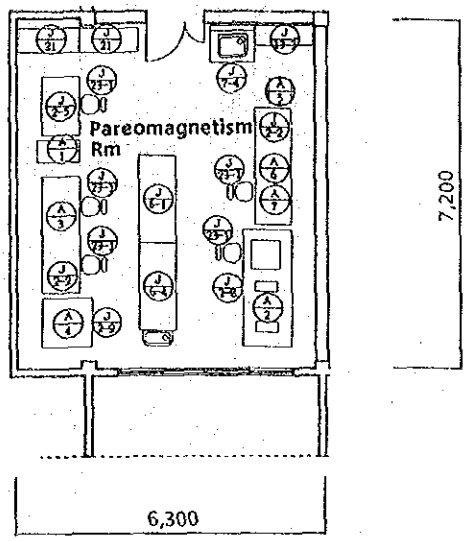


EAST ELEVATION

GEOSCIENCE LABORATORY

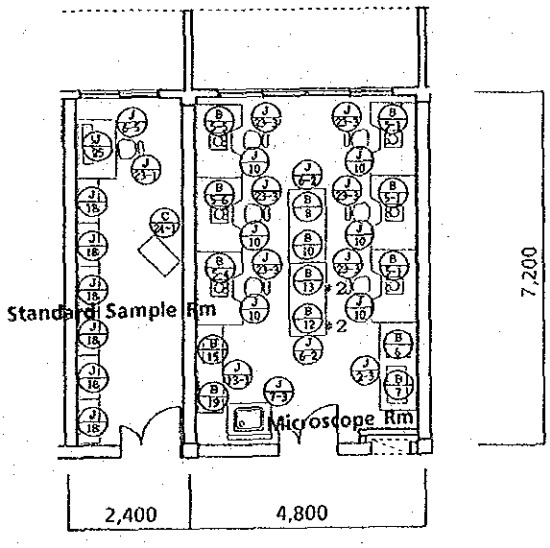
ELEVATION/SECTION 1/400 05

Paleomagnetism Rm (46m²) LAYOUT 1



No.	Item	Q'ty
A-1	AC Demagnetiser	1Set
A-2	Thermal Demagnetiser	1Set
A-3	Magnetic Susceptibility Meter	1 No.
A-4	Magnetic Balance	1Set
A-5	Spinner Magnetometer	1Set
A-6	Fluxgate Magnetometer	1No.
A-7	Shielded Case for Sample Stocks	2Nos
J-2-2	Laboratory Table	2Nos
J-2-5	Laboratory Table	1No.
J-2-8	Laboratory Table	1No.
J-2-9	Laboratory Table	1No.
J-6-1	Laboratory Work Bench	1No.
J-6-4	Laboratory Work Bench	1No.
J-7-4	Sink Unit	1No.
J-13-3	Cabinet	1No.
J-21	Storage Rack	2Nos
J-23-1	Chair	5Nos

Microscope Rm (35m²) Standard Sample Rm (18m²) LAYOUT 2



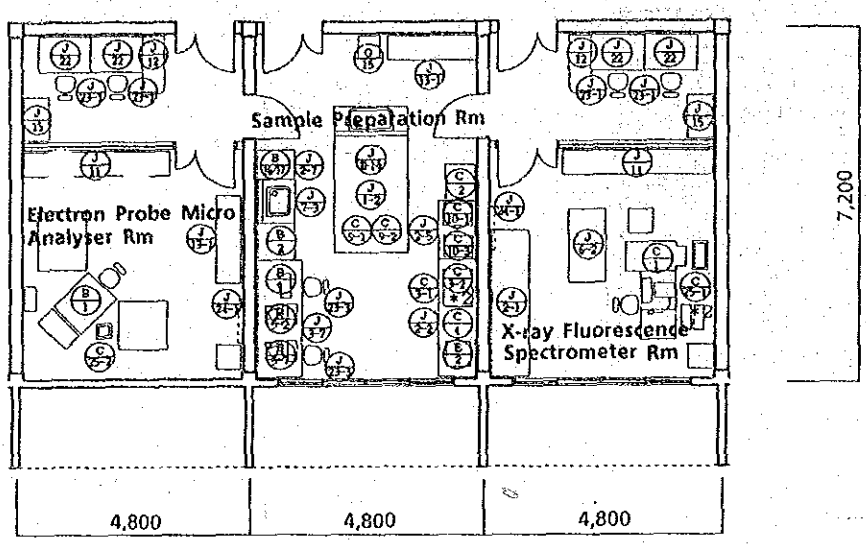
Standard Sample Rm

No.	Item	Q'ty
C-24-1	Wagon	1No.
J-6-5	Laboratory Work Bench	1No.
J-18	Storage Cabinet for Standard Samples	6Nos
J-23-1	Chair	1No.
J-25	Fluorescent Light Stand	1No.

Microscope Rm

No.	Item	Q'ty
B-5-1	Polarising Microscope	3Nos
B-5-4	Ore Microscope	1No.
B-5-5	Gem Microscope	1No.
B-5-6	Stereographic Polarising Microscope	1No.
B-6	Refractometer	1No.
B-7	Micro Hardness Tester	1No.
B-8	Point Counter	1No.
B-10	Universal Stage	1No.
B-12	Specimen Press for Polished Section	2Nos
B-13	Polishing Plate for Polished Section	2Nos
B-14	Cases for Microscopes	11Nos
B-15	Micrometer Gauge	1No.
B-19	Heating-Cooling Stage	1No.
J-2-3	Laboratory Table	1No.
J-6-2	Laboratory Work Bench	2Nos
J-7-3	Sink Unit	1No.
J-10	Microscope Table	6Nos
J-13-1	Cabinet	1No.
J-23-3	Chair	6Nos

Electron Probe Micro Analyser Rm (35m²) Sample Preparation Rm (35m²) LAYOUT 3
X-ray Fluorescence Spectrometer Rm (35m²)



Electron Probe Micro Analyser Rm

No.	Item	Q'ty
B – 1	Electron Probe Micro Analyser	1Set
C – 25 – 2	Cylinder Stand	1No.
J – 11	Arranger Cabinet	1No.
J – 12	Counter Table	1No.
J – 13 – 1	Cabinet	1No.
J – 15	Book Shelf	1No.
J – 22	Work Desk	2Nos
J – 23 – 1	Chair	2Nos
J – 24 – 1	White Board	1No.

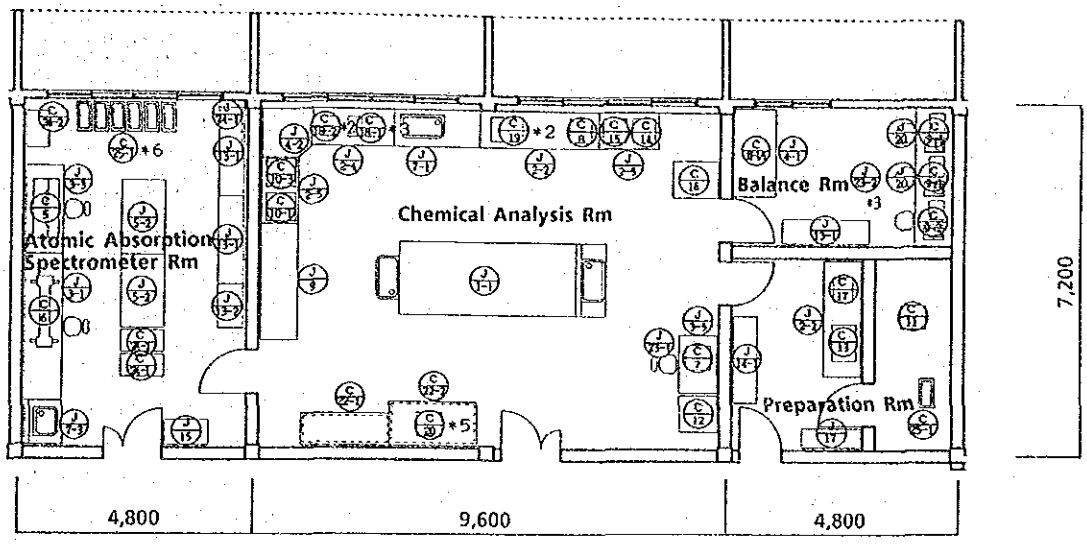
Sample Preparation Rm

No.	Item	Q'ty
B – 2	Vacuum Evaporator	1No.
B – 5 – 2	Polarising Microscope	1No.
B – 5 – 7	Stereographic Polarising Microscope	1No.
B – 9	Dryer	1No.
B – 16	Graphite Electrode Sharpener	1No.
B – 17	Grinder	1No.
C – 2	Beads Sampler	1No.
C – 3 – 1	Touch Mixer	1No.
C – 3 – 2	Vibrating Spatula	2Nos
C – 4	Hand Bricket Press	1No.
C – 9 – 1	Electronic Analytical Balance	1No.
C – 9 – 2	Top-Loading Electronic Balance	1No.
C – 10 – 1	High Temperature Muffule Furnace	1No.
C – 10 – 3	Constant Temperature Drying Oven	1No.
C – 21 – 1 ~5	Vacuum Desiccator	5Sets
E – 2	Hot Plate	1No.
G – 15	Vaccum Cleaner	1No.
J – 1 – 2	Laboratory Centre Table	1No.
J – 2 – 2	Laboratory Table	1No.
J – 2 – 5	Laboratory Table	1No.
J – 2 – 7	Laboratory Table	1No.
J – 3 – 7	Laboratory Table	1No.
J – 7 – 3	Sink Unit	1No.
J – 13 – 1	Cabinet	1No.
J – 23 – 3	Chair	2Nos

X-ray Fluorescence Spectrometer Rm

No.	Item	Q'ty
C – 1	X-ray Fluorescence Spectrometer	1Set
C – 25 – 1	Cylinder Stand	2Nos
J – 2 – 1	Laboratory Table	1No.
J – 6 – 2	Laboratory Work Bench	1No.
J – 11	Arranger Cabinet	1No.
J – 12	Counter Table	1No.
J – 15	Book Shelf	1No.
J – 22	Work Desk	2Nos
J – 23 – 1	Chair	2Nos
J – 24 – 1	White Board	1No.

Atomic Absorption Spectrometer Rm (35m²) Chemical Analysis Rm (70m²) LAYOUT 4
Balance Rm (15m²) Preparation Rm (20m²)



Atomic Absorption Spectrometer Rm

No.	Item	Q'ty
C-5	Flame Atomic Absorption Spectrometer	1No.
C-6	Flameless Atomic Absorption Spectrometer	1No.
C-24-1	Trolley	2Nos
C-24-2	Trolley for Cylinder Exchange	1No.
C-25-1	Cylinder Stand	6Nos
J-3-1	Laboratory Table	1No.
J-3-3	Laboratory Table	1No.
J-5-2	Laboratory Work Bench	2Nos
J-7-3	Sink Unit	1No.
J-13-1	Cabinet	2Nos
J-13-2	Cabinet	1No.
J-15	Book Shelf	1No.
J-24-1	White Board	1No.

Chemical Analysis Rm

No.	Item	Q'ty
C-7	Ultra Violet-Visible Spectrometer	1No.
C-8	Automatic Titrator	1No.
C-10-1	High Temperature Muffule Furnace	1No.
C-10-3	Constant Temperature Drying Oven	1No.
C-12	Water Still	1No.
C-14	PH Meter with Ion Meter	1No.
C-15	Electric Conductivity Meter	1No.
C-16	Shaker	1No.
C-18-1	Magnetic Stirrer	3Nos
C-18-2	Interlocked Multi Type Magnetic Stirrer	2Nos
C-19	Water Bath	2Nos
C-20	Sand Bath	5Nos
C-22-1	Standard Fume Hood	1No.
C-22-2	Perchloric Fume Hood	1No.
C-26	Glassware, Plastic-ware, Metalware	1Set
C-27	Chemicals and Reagents	1Set
C-28	Crucibles	1Set
J-1-1	Laboratory Table	1No.
J-2-2	Laboratory Table	1No.
J-2-4	Laboratory Table	1No.
J-2-5	Laboratory Table	2Nos
J-3-5	Laboratory Table	1No.
J-4-2	Laboratory Table	1No.
J-7-1	Sink Unit	1No.
J-9	Fusion Table	1No.
J-23-1	Chair	1No.

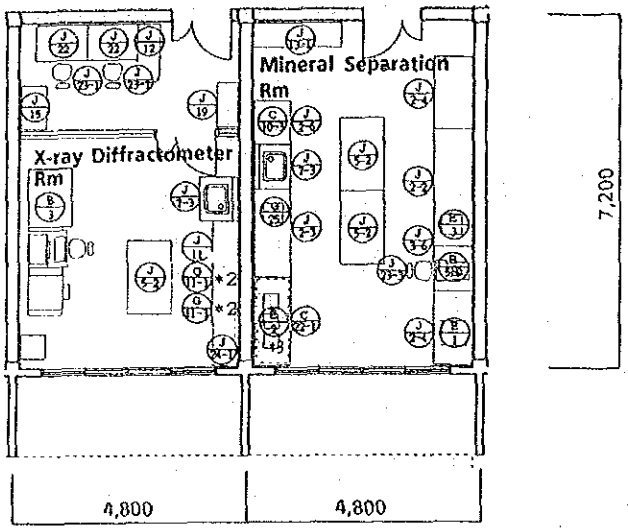
Balance Rm

No.	Item	Q'ty
C-9-1	Electronic Analytical Balance	2Nos
C-9-2	Top-Loading Electronic Balance	1No.
C-21-1 ~5	Vacuum Desiccator	5Sets
J-4-1	Laboratory Table	1No.
J-13-1	Cabinet	1No.
J-20	Vibration-Proof Stand	2Nos
J-23-2	Stool	3Nos

Preparation Rm

No.	Item	Q'ty
C-11	Pure Water Production System	1No.
C-13	Centrifuge	1No.
C-17	Karl-Fisher Titrator	1No.
C-25-1	Cylinder Stand	1No.
J-2-2	Laboratory Table	1No.
J-14-1	Unit Shelf	1No.
J-17	Reagent Shelf	1No.

X-ray Diffractometer Rm (35m²) Mineral Separation Rm (35m²) LAYOUT 5



Mineral Separation Rm

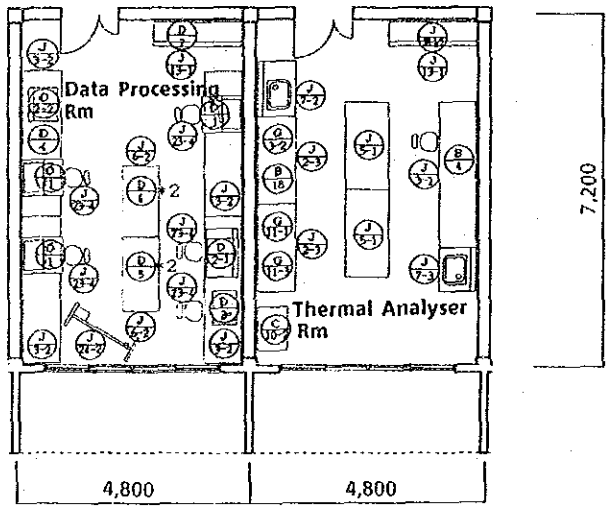
No.	Item	Q'ty
B – 5 – 9	Stereographic Polarising Microscope	1No.
C – 10 – 3	Constant Temperature Drying Over	1No.
C – 22 – 1	Standard Fume Hood	1No.
E – 1	Isodynamic Separator	1No.
E – 2	Hot Plate	3Nos
E – 3	Auto-desiccator	1No.
G – 25	Ultrasonic Cleaner	1No.
J – 2 – 2	Laboratory Table	1No.
J – 2 – 3	Laboratory Table	1No.
J – 2 – 4	Laboratory Table	2Nos
J – 2 – 6	Laboratory Table	1No.
J – 3 – 6	Laboratory Table	1No.
J – 5 – 2	Laboratory Work Bench	2Nos
J – 7 – 3	Sink Unit	1No.
J – 13 – 1	Cabinet	1No.
J – 23 – 3	Chair	1No.

X-ray Diffractometer Rm

No.	Item	Q'ty
B – 3	X-ray Diffractometer	1Set
G – 11 – 1	Agate Mortar	2Nos
G – 11 – 3	Agate Mortar	2Nos
J – 5 – 2	Laboratory Work Bench	1No.
J – 7 – 3	Sink Unit	1No.

J – 11	Arranger Cabinet	1No.
J – 12	Counter Table	1No.
J – 15	Book Shelf	1No.
J – 19	Map Locker	1No.
J – 22	Work Desk	2Nos
J – 23 – 1	Chair	2Nos
J – 24 – 1	White Board	1No.

Data Processing Rm (35m²) Thermal Analyser Rm (35m²) LAYOUT 6



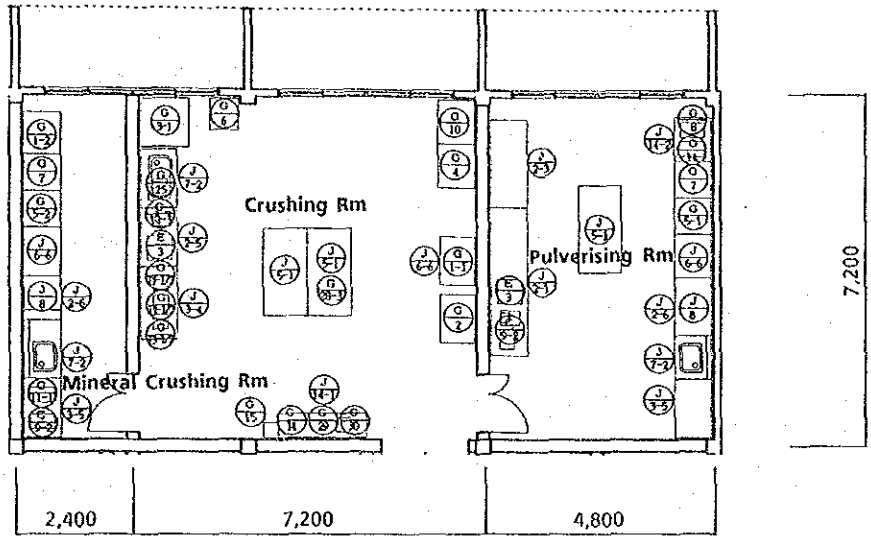
Data Processing Rm

No.	Item	Q'ty
D – 1	Personal Computer	3Set
D – 2 – 1	Plotter	1No.
D – 2 – 2	Plotter	1No.
D – 3	Digitiser	1No.
D – 4	Hard Disc	1No.
D – 5	Book Rest	2Nos
D – 6	Floppy Disc Case	2Nos
D – 7	Floppy Disc	100Nos
J – 3 – 2	Laboratory Table	4Nos
J – 6 – 2	Laboratory Work Bench	2Nos
J – 13 – 1	Cabinet	1No.
J – 23 – 4	Chair	5Nos
J – 24 – 2	White Board	1No.

Thermal Analyser Rm

No.	Item	Q'ty
B – 4	Differential Thermal Analyser and Thermal Gravimeter	1No.
B – 18	Automatic Particle Size Distribution Analyser	1No.
C – 10 – 2	High Temperature Muffle Furnace	1No.
G – 3 – 2	Sieve Shaker	1No.
G – 11 – 1	Agate Mortar	1No.
G – 11 – 3	Agate Mortar	1No.

G – 28 – 1	Sieve	1No.
G – 28 – 2	Sieve	1No.
J – 2 – 3	Laboratory Table	2Nos
J – 3 – 1	Laboratory Table	1No.
J – 5 – 1	Laboratory Work Bench	2Nos
J – 7 – 2	Sink Unit	1No.
J – 7 – 3	Sink Unit	1No.
J – 13 – 1	Cabinet	1No.



Mineral Crushing Rm

No.	Item	Q'ty
C – 9 – 2	Top Loading Electronic Balance	1No.
G – 1 – 2	Jaw Crusher	1No.
G – 5 – 2	Vibrating Mill	1No.
G – 7	Automatic Agate Mortar	1No.
G – 11 – 1	Agate Mortar	1No.
J – 2 – 6	Laboratory Table	1No.
J – 3 – 5	Laboratory Table	1No.
J – 6 – 6	Laboratory Work Bench	1No.
J – 7 – 2	Sink Unit	1No.
J – 8	Clean Hood	1No.

Crushing Rm

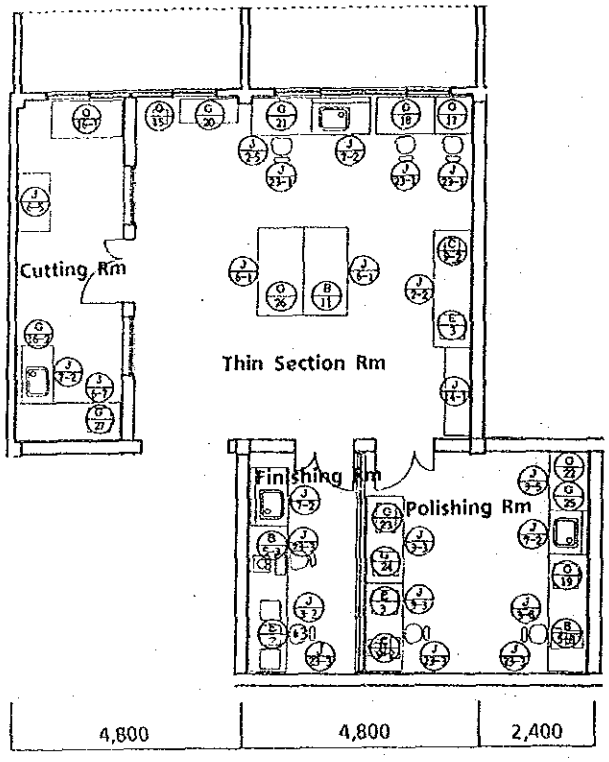
No.	Item	Q'ty
C – 10 – 3	Constant Temperature Drying Oven	1No.
E – 3	Auto-Desiccator	1No.
G – 1 – 1	Jaw Crusher	1No.
G – 2	Brown Crusher	1No.
G – 3 – 1	Sieve Shaker	1No.
G – 4	Rock Trimmer	1No.
G – 6	Pot Mill	1No.
G – 10	Dust Collector	1No.
G – 11 – 1	Agate Mortar	1No.
G – 11 – 2	Agate Mortar	1No.
G – 12 – 1	Iron Mortar	1No.
G – 12 – 2	Iron Mortar	1No.
G – 13 – 1	Stainless Mortar	1No.
G – 13 – 2	Stainless Mortar	1No.
G – 14	Anvil	1No.
G – 15	Vacuum Cleaner	1No.
G – 25	Ultrasonic Cleaner	1No.
G – 28 – 3	Sieve	1No.
G – 29	Safety Equipment	6Nos
G – 30	Cleaning Equipment	1Set
J – 2 – 5	Laboratory Table	1No.
J – 3 – 4	Laboratory Table	1No.
J – 5 – 1	Laboratory Work Bench	2Nos
J – 6 – 6	Laboratory Work Bench	1No.
J – 7 – 2	Sink Unit	1No.
J – 14 – 1	Unit Shelf	1No.

Pulverising Rm

No.	Item	Q'ty
C – 9 – 2	Top-Loading Electronic Balance	1No.
E – 3	Auto-Desiccator	1No.
G – 5 – 1	Vibrating Mill	1No.
G – 7	Automatic Agate Mortar	1No.
G – 8	Divider	1Set
G – 14	Anvil	1No.
J – 2 – 1	Laboratory Table	1No.
J – 2 – 3	Laboratory Table	1No.
J – 2 – 6	Laboratory Table	1No.
J – 3 – 5	Laboratory Table	1No.
J – 5 – 1	Laboratory Work Bench	1No.
J – 6 – 6	Laboratory Work Bench	1No.
J – 7 – 2	Sink Unit	1No.
J – 8	Clean Hood	1No.
J – 14 – 2	Unit Shelf	1No.

Cutting Rm (18m²) Thin Section Rm (52m²) Finishing Rm (12m²) Polishing Rm (24m²)

LAYOUT 8



Cutting Rm

No.	Item	Q'ty
G-16-1	Rock Cutter	1No.
G-16-2	Ore Cutter	1No.
G-27	Core Picker	1No.
J-6-5	Laboratory Work Bench	1No.
J-6-7	Laboratory Work Bench	1No.
J-7-2	Sink Unit	1No.

Finishing Rm

No.	Item	Q'ty
B-5-3	Polarising Microscope	1No.
E-2	Hot Plate	3Nos
J-3-1	Laboratory Table	1No.
J-7-2	Sink Unit	1No.
J-23-3	Chair	2Nos

Thin Section Rm

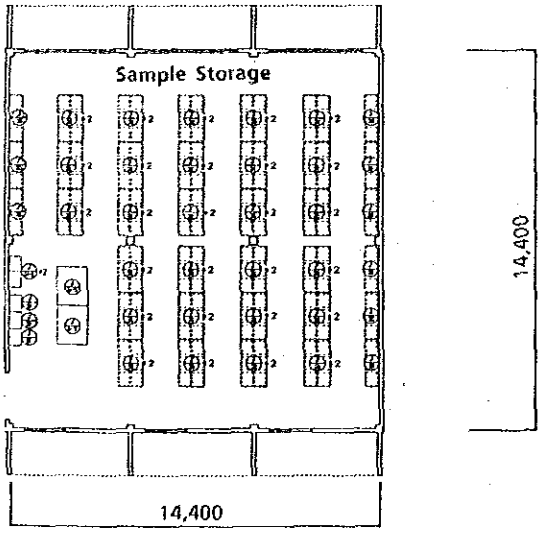
B-11	Specific Gravity Meter	1No.
C-9-2	Top-Loading Electronic Balance	1No.
E-3	Auto-Desiccator	1No.
G-15	Vacuum Cleaner	1No.
G-17	Lapping Machine	1No.
G-18	Lapping Machine	1No.
G-20	Thin Section Preparation Machine	1No.
G-21	Secondary Thin Seciton Cutter	1No.
G-26	Low Pressure Bonding Device	1No.
J-2-2	Laboratory Table	1No.
J-2-5	Laboratory Table	1No.
J-6-1	Laboratory Work Bench	2Nos
J-7-2	Sink Unit	1No.
J-14-1	Unit Shelf	1No.
J-23-1	Chair	3Nos

Polishing Rm

B-5-8	Metallurgical Microscope	1No.
C-9-2	Top Loading Electronic Balance	1No.
E-3	Auto-Desiccator	1No.
G-19	Polishing Machine	1No.
G-22	Specimen Press	1No.
G-23	Vacuum Drying Over	1No.
G-24	Impregnation Apparatus	1No.
G-25	Ultrasonic Cleaner	1No.
J-3-3	Laboratory Table	2Nos
J-3-5	Laboratory Table	1No.
J-3-8	Laboratory Table	1No.
J-7-2	Sink Unit	1No.
J-23-3	Chair	2Nos

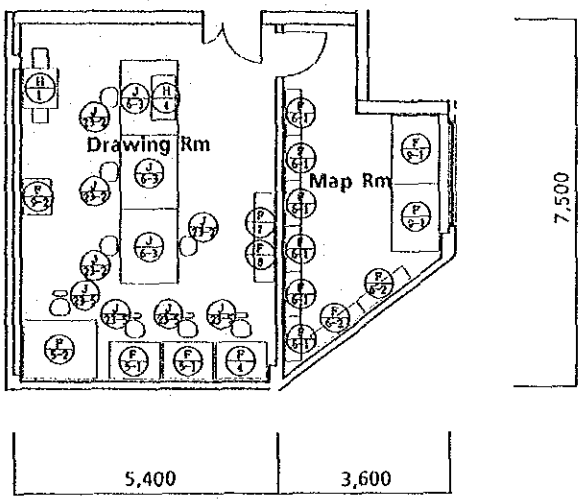
Sample Storage (212m²)

LAYOUT 9



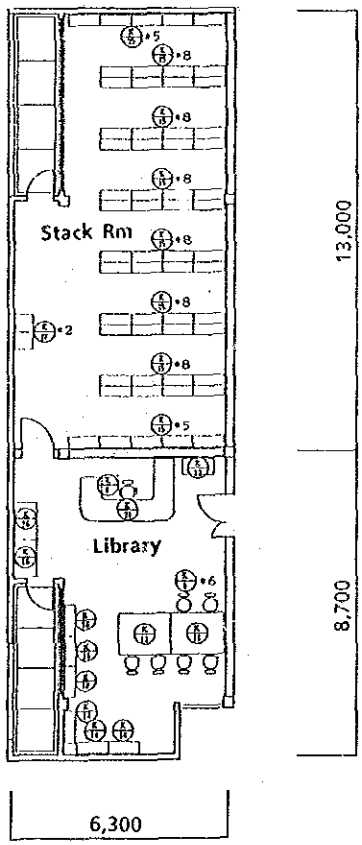
No.	Item	Q'ty
C-24-1	Trolley	2Nos
J-6-3	Laboratory Work Bench	2Nos
J-27	Step-ladder	3Nos
J-28	Rock Sample Rack	63Nos

Drawing Rm (41m²) Map Rm(16m²) LAYOUT 10



No.	Item	Q'ty
F-4	Drafting Table	1No.
F-5-1	Tracing Table	2Nos
F-5-2	Tracing Plate	1No.
F-6-1	Map Locker	6Nos
F-6-2	Map Suspender	2Nos
F-7	Electronic Lettering Set	1No.
F-8	Cabinet	1No.
F-9-1	Map Case	2Nos
F-9-2	Map Case	1No.
H-1	Photocopy Machine	1No.
H-4	Blueprint Machine	1No.
J-6-3	Laboratory Work Bench	3Nos
J-23-2	Stool	4Nos
J-23-5	Chair	4Nos

Library (45m²) Stack Rm (71m²) LAYOUT 11



No.	Item	Q'ty
K-4	Arm Chair	1No.
K-5	Chair	6Nos
K-11	Reading Table	2Nos
K-12	Locker (1)	1No.
K-14	Open Book Shelf	6Nos
K-15	Closed Book Shelf	58Nos
K-16	Library Card Storage	2Nos
K-17	Stepladder	2Nos
K-21	Library Counter Table	1No.

CHAPTER 5 PROJECT IMPLEMENTATION PLAN

PROJECT IMPLEMENTATION PLAN

5-1 Project Implementation System

This project will be implemented in accordance with the grant aid cooperation system of the Japanese government. The grant aid programme for this project will be started formally after cabinet approval by the Government of Japan and signing of the Exchange of Notes (E/N) between the Government of Pakistan and the Government of Japan. After the signing of the Exchange of Notes, the Pakistani agency responsible for implementation of this project will conclude a contract for consulting services regarding detail design and supervision of facilities and equipment with a Japanese consulting firm. Detail design work will be started after the verification of the contract by the Japanese government. A Japanese construction company for the building work and a Japanese contractor for equipment procurement and installation work will be selected by tenders. Transfer of the contract money will be conducted through a bank designated through the banking arrangement (B/A). The Government of Japan will implement this project in two phases. Phase 1 is to be started in Japanese fiscal year 1989; Phase 2 is to start in Japanese fiscal year 1990.

The Geological Survey of Pakistan is the executing agency for this project. The headquarters of the GSP are located at Quetta in Baluchistan province, about 600km from the project site at Islamabad. It will therefore be efficient in terms of both time and cost for the Pakistani government agencies concerned to carry out Pakistani works such as coordination with other organisations, project site infrastructure works, conclusion of the banking arrangement, acquisition of building permission, customs clearance formalities, etc. in Islamabad. For this reason, the Geological Survey of Pakistan will set up an office in Islamabad to carry

out Pakistani works related to the project, thereby facilitating its smooth implementation.

- Address of the Islamabad office for the project:
  53-Plaza, Blue Area, F-6, Islamabad
  Phone: (051) 824624

5-2 Scope of Works

The project is to be implemented with cooperation from both governments, and in accordance with the Japanese grant aid cooperation system. The scope of works of each side is as follows:

5-2-1 Scope of Works by the Government of Japan

(1) Facilities

- Construction of the buildings indicated in the Basic Design Study Report

(2) Equipment

- Procurement and installation of equipment given in the equipment list in the Basic Design Study Report

(3) Infrastructure

- Power supply, Water Supply, Drainage works within the project site
- Telephone : Installation of telephone facilities in the buildings

(4) Exterior Works

- Construction of roads, walkways, parking lots, courtyards and drainage facilities within the project site

(5) Transportation of Materials and Equipment

- Packing, loading, insurance, ocean freight, unloading and inland transportation of construction materials and equipment exported to Pakistan

5-2-2 Scope of Works by the Government of Pakistan

(1) Site

- Securing the project site

(2) Infrastructure

- Site preparation: Clearing, levelling and reclaiming the project site as needed
- Roads : Construction of roads to connect the project site to public roads
- Power supply : Installation of 11kV power lines up to the boundary of the project site
- Drainage : Connecting public drainage facilities to the project site
- Gas supply : Installation of the city gas main up to the boundary of the project site
- Telephone : Connecting telephone lines to the MDF (to be installed by the Japanese side)
- Others : Construction of an access road, provision of the area necessary for temporary offices, workshops and yards, and temporary supply of power, water and telephone services.

(3) Exterior Works

- Planting, construction of fences in and around the project site

(4) Utensils, Fittings and Furniture

- Provision of utensils, fittings, curtains, blinds and general furniture other than those to be provided by the Japanese side

(5) Applications and Expenses Necessary for the Project

- To conclude a banking arrangement (B/A) with an authorised Japanese foreign exchange bank and to bear the necessary commissions to the Japanese foreign exchange bank for the banking services based on the B/A as per the rules of the Government of Pakistan applicable when receiving grant aid from the Government of Japan

- To ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation in Pakistan, and prompt internal transportation of imported materials and equipment for the project. To pay customs, internal taxes and other fiscal levies for unloading, customs clearance, inland transportation, etc. of imported materials and equipment for the project as per the rules of the Government of Pakistan applicable when receiving grant aid from the Government of Japan

- To exempt Japanese nationals involved in the project from customs, internal taxes and other fiscal levies which may be imposed in Pakistan with respect to the supply of the products and services under verified contracts as per the rules of the Government of Pakistan applicable when receiving grant aid from the Government of Japan

- To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry

into Pakistan and stay therein for the performance of their work as per the rules of the Government of Pakistan applicable when receiving grant aid from the Government of Japan

- To obtain building permission and other necessary permissions for the project
- To maintain and properly use the facilities constructed and equipment provided under the grant

(6) Other Expenses

- To bear all the expenses, other than those to be borne by the Japanese Government's grant aid

Of the above items concerning works by the Pakistani side, "banking arrangement" in item (5) should be concluded immediately after the Exchange of Notes; "site preparation" and "others" in item (2) and "obtaining building and other necessary permissions" in item (5) should be completed before Phase 1 of works by the Japanese side is started. All works by the Pakistani side should be completed before works by the Japanese side are completed. In particular, "power supply", "gas supply" and "telephone" in item (2) should be completed at least two months prior to completion of Phase 1 to allow enough time for inspection of the buildings and ancillary facilities.

5-3 Execution Plan

5-3-1 Execution Guidelines

This project will be executed in two phases, namely, Phase 1 to be started in Japanese fiscal year 1989, and Phase 2 to be started in Japanese fiscal year 1990. It is necessary to pay attention to the following points in order to complete the project as scheduled.

1) Of the works by the Pakistani side, site preparation, temporary supply of electric power, water and telephone, and obtaining building and other necessary permissions should be completed before Phase 1 is started.

2) Procedures for imported materials and equipment tax exemption and customs clearance should be executed promptly.

3) The work schedule should be made taking into account the decline of work efficiency during the rainy season from July to August (maximum rainfall: 500 to 600 mm per month) and the month of fasting.

5-3-2 Supervision of the Construction, Procurement and Installation Works

In accordance with the Japanese grant aid cooperation system, a Japanese consulting firm will conclude a contract for consulting services with the executing agency responsible for the implementation of this project, and will work out detail design and supervise construction, procurement and installation works. The objective of the supervision is to see if the work complies with drawings and specifications, to secure the desired quality by providing instructions, advice and coordination, and to ensure that all the works conform with building, procurement and installation contract provisions. The activities of the consultant include the following:

(1) Assisting with the Tender Procedures and Contracting

To select Japanese contractors for the building work as well as equipment installation and procurement work, the consultant will prepare tender documents, announce tenders publicly, accept applications for entry in the tender, perform pre-qualification screening, issue tender documents, accept tenders offered, evaluate the results, and give advice on contracting.

(2) Instructions, Advice and Coordination for the Contractors

The consultant will examine the construction schedule, the construction plan, the materials and equipment procurement/installation plan, and provide instructions, advice and coordination to contractors.

(3) Examination and Approval of Shop Drawings, Manufacturing Drawings and Other Documents

The consultant will examine and approve shop drawings, manufacturing drawings and other documents submitted by contractors.

(4) Confirmation and Approval of Construction, Materials and Equipment

The consultant will confirm the consistency of data on construction, materials and equipment with the drawings and specifications, and approve their use in the project.

(5) Witness for Plant Inspection

If necessary, the consultant, will witness and give necessary instructions in plant inspections of the building components and equipment at the manufacturers' plants.

(6) Reporting on Progress

The consultant will report to the project executing agency on the progress of construction, procurement and installation works based on the situation at the construction site.

(7) Inspection and Testing upon Completion

The consultant will conduct a final inspection upon completion, and test facilities and equipment operation. Final inspection reports will then be submitted to the Pakistani side. In particular, major equipment used in sophisticated laboratory works will be installed, adjusted and tested with standard samples by professional specialists or engineers dispatched by the manufacturers. The consultant will ascetain that test results are consistent with specifications.

(8) Training in Maintenance and Operation of the Equipment

Considerable maintenance and operation skills are required for some equipment installed under this project. For this reason, Pakistani scientists and engineers responsible for equipment should receive the necessary training, from the manufacturers' professional specialists and engineers, for operating, troubleshooting and repairing the equipment during the period of installation, adjustment and test running. The consultant will give necessary instructions in the training programme.

The consultant will dispatch a resident engineer to the site throughout the period of the Japanese works due to the scale of this project. In addition, the consultant will dispatch engineers to the site for inspection, instruction and coordination as needed, according to the progress of the works. The consultant will also establish a system in Japan in which the engineers in charge will keep in contact with and support the resident engineer or engineers. The consultant will report

progress, disbursement, completion, transfer, etc. of the project to concerned Japanese government authorities.

5-3-3 Procurement Plan

Most laboratory equipment and instruments for the project will be imported from Japan because it is very difficult to procure them locally. Sophisticated laboratory equipment and instruments should be procured from manufacturers which have local agents and an effective after-sales service system in Pakistan.

(1) Main Materials To Be Procured Locally

1. Cement	2. Aggregate (sand and gravel)	3. Bricks	4. Terrazzo tiles
5. Tiles	6. Lumber	7. Wooden windows and doors	8. Paint
9. Transformer	10. Switchboard		

(2) Main Materials To Be Imported

1. Reinforcing bars and structural steel	2. Asphalt waterproofing	3. Ceiling materials	4. Light gauge steel frames
5. Aluminum windows and doors	6. Steel windows and doors	7. Plywood for concrete form	8. Glass
9. PVC tiles	10. Electric wires and cables	11. Electrical Boards	12. Lighting fixtures
13. Steel pipes, PVC pipes and joints	14. Valves	15. Pumps	16. Fans

5-4 Project Implementation Schedule

The Government of Japan will implement this project in two phases, Phase 1 (Building) and Phase 2 (Building and Equipment). Phase 1 will be implemented after the conclusion of the Exchange of Notes between both governments on the Japanese grant aid for Phase 1. After that, a contract for consulting services will be concluded between the Pakistani project executing agency and a Japanese consulting firm. It is important that the contract for consulting services be concluded promptly after the Exchange of Notes so that this project may be implemented smoothly. The project implementation schedule after the conclusion of the contract for consulting services will be roughly divided into three stages: Detail design, tender, and building and equipment works. The contractor for Phase 1 will be selected through tender. Phase 2 will be started after signing of the Exchange of Notes for Phase 2. The building work of Phase 2 will be contracted with the Phase 1 contractor in the form of a negotiated contract. The contractor for equipment work of Phase 2 will be selected through tender.

(1) Detail Design

After the contract for consulting services is verified by the Japanese Government, the detail design will start. At this stage, a set of tender documents, including detail design drawings, technical specifications instructions to tenderers, etc., will be prepared on the basis of the Basic Design Study Report. In the course of this stage, the consulting firm will confer with the Pakistani side on the contents of the facilities and equipment, and will obtain the approval of the tender documents from the Pakistani side. This stage will take about 4.5 months in total for Phase 1 and Phase 2.

(2) Tenders

A contractor (a Japanese construction company) for Phase 1 will be selected through tender. The tender will proceed in the order of public announcement of the tender, prequalification of participants, issue of tender documents, acceptance of tenders, evaluation of tenders offered, appointment of the contractor and signing of a construction contract. It will take about 2.5 months for this procedure.

(3) Building and Equipment Works

After the signing of the construction contract, the work for Phase 1 will start after the verification of the contract by the Japanese government. Building works will be performed in Phase 1 and in Phase 2. The procurement and installation of equipment work will be undertaken only in Phase 2. It will take about 12 months to complete Phase 1, about 9 months to complete building work for Phase 2, and about 11 months to complete the procurement and installation of equipment work for Phase 2.

The entire project implementation schedule is shown in Fig. 5-1.

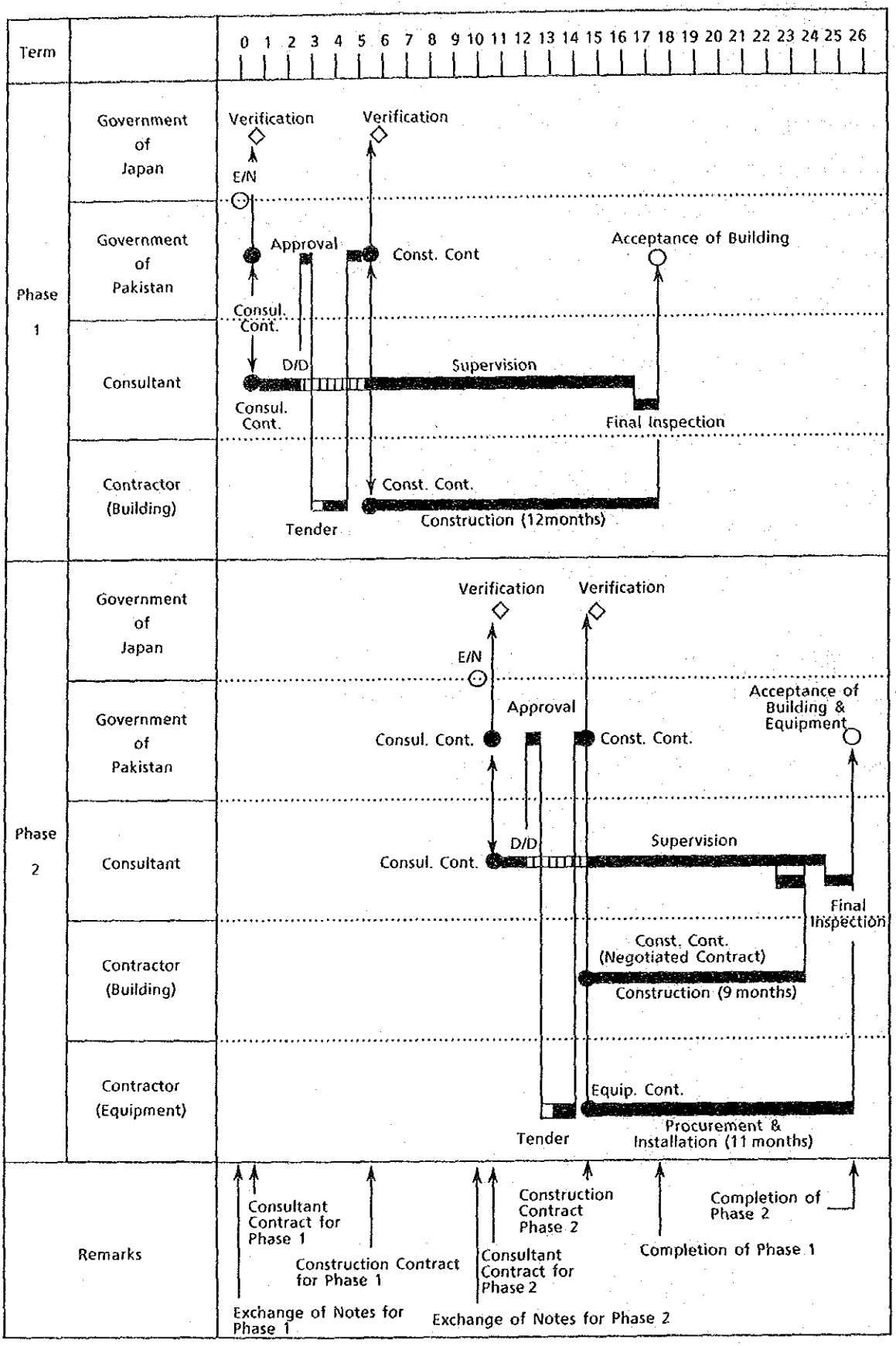


Fig. 5-1 Project Implementation Schedule

5-5 Estimated Costs of the Project To Be Borne by the Government of Pakistan

(1) Estimated Costs of the Project To Be Borne by the Government of Pakistan

The estimated costs of the project to be borne by the Government of Pakistan are summarised below.

1)	Securing the project site	19,300,000 Rs
2)	Infrastructure	
	a) Power supply	98,000 Rs
	b) Gas supply	95,000 Rs
	c) Telephone	48,500 Rs
	d) Others	
	• Temporary supply of power	170,000 Rs
	• Temporary supply of telephone service	5,200 Rs
3)	Exterior Works	
	1) Construction of fences	218,000 Rs
4)	Equipment Work	
	1) General furniture, curtains, etc.	46,000 Rs
	Total	19,980,700 Rs

It should be noted that the above estimated costs do not include necessary expenses for (5) and (6) of 5-2-2 and the other negligible expenses. It is necessary that the Government of Pakistan allocate the necessary budget to execute the above-mentioned items so that the project may be implemented smoothly, and facilities and equipment may be utilised effectively after completion of the project.

CHAPTER 6 MAINTENANCE AND OPERATION PLAN

MAINTENANCE AND OPERATION PLAN

(1) Maintenance and Operation of the Facilities

Building maintenance, building equipment inspection and simple repairs to be conducted in compliance with maintenance and operation manuals will be carried out by the caretaker of the building (BPS-16) or in accordance with his instructions. It will be necessary to establish a system to contact local construction companies, distributors or manufacturers in case of complications or when spare parts are needed. It will also be necessary to transfer maintenance and operation techniques from the Japanese sides to the caretaker of the building and other staff concerned before completion of the building work.

(2) Maintenance and Operation of the Equipment

Routine maintenance, including adjustment and cleaning, of individual equipment will be carried out by the scientists or laboratory assistants in charge. In addition, a maintenance/electronic engineer and an instrument officer will be appointed to maintain and operate the equipment. Most of the equipment to be installed in the laboratory will be imported from Japan, and some of it requires considerable skills for maintenance and operation. It will be necessary to transfer maintenance and operation techniques from the Japanese side to scientists and laboratory assistants in charge. Of the equipment to be installed under this project, the X-ray diffractometer, the electron probe micro analyser, the differential thermal analyser and thermal gravimeter, the X-ray fluorescence spectrometer, the atomic absorption spectrometers, the ultraviolet-visible spectrometer and the thin/polished section preparation machine will require such transfer of techniques. Within the framework of the Japanese grant aid, the following maintenance and operation techniques for the above-mentioned equipment will be explained to the Pakistani

personnel in charge during installation work of the equipment or before the handing-over and after the installation.

- Methods to operate, adjust and maintain the equipment.
- Methods to troubleshooot and repair simple troubles.
- Methods to utilise and keep maintenance and operation manuals.
- Methods to control inventory of consumables and spare parts.

However, transfer of techniques within the framework of the Japanese grant aid cooperation will not be sufficient. The project-type technical cooperation by the Government of Japan is scheduled to support the grant aid programme in these technical areas. The project-type technical cooperation to be extended in conjunction with this project will include dispatch of Japanese experts well-versed in operation, adjustment and maintenance of equipment, and transfer of technology to the Pakistani counterparts with emphasis on software for utilising the data obtained from the laboratory equipment. In addition, four Pakistani counterparts in charge of maintenance and operation of the electron probe micro analyser, the X-ray fluorescence spectrometer, and other chemical and physical equipment at large will stay in Japan for about six months to receive training in operation, adjustment and maintenance of the equipment, and in analysis and utilisation of the data at Japanese governmental institutes, private firms, equipment manufacturers, etc. If the technical cooperation is implemented successfully, it will be possible for the Pakistani personnel in charge to maintain and operate the equipment provided in this project efficiently.

Maintenance and operation of equipment require not only technical skills but also a system to supply necessary consumables and spare parts. Component parts of the equipment are divided into consumables (reagents, gas, films and recording paper, etc.) and spare parts (X-ray tubes, hollow cathode lamps, filaments, replacement blades, etc.). Spare parts for two years after completion of the project will be included within the scope of the grant aid. However, consumables and spare parts not included in the

grant aid, and spare parts which will be required after two years from completion of the project must be procured by the GSP. Consumables and spare parts necessary for the equipment of the project will be procured through local agents of Japanese manufacturers or directly from Japanese manufacturers. When a serious problem arises, and when the personnel in charge of the laboratory find it impossible to repair the equipment, a local agent or the Japanese manufacturer will be asked to effect repair, with payment coming from the GSP. The above-mentioned main equipment should be inspected and adjusted periodically by engineers of local agents if the budget for this arrangement can be provided by the GSP.

(3) Maintenance and Operation Costs

Necessary annual maintenance and operation costs after the inauguration of the laboratory are classified into the following items, and the amount of costs are calculated on the basis of 1989 prices.

1) Personnel Expense

The Geoscience Laboratory will have a staff of 64. Their personnel expense consists of basic salary, allowances and honoraria, and others. The salary of each staff member will be determined according to BPS. There will be some differences in salary for the same BPS according to the length of service.

a. Basic Salary

Basic Salaries for staffs are shown below.

Fig. 6-1 Basic Monthly Salary

Staff	BPS	Basic Monthly Salary (Rs/month) (Min. – Increase – Max.)	Staff Nos.
Assistant Geochronologist	17	(2065 – 155 – 3925)	2
Geophysical Engineer	17	(2065 – 155 – 3925)	1
Lab. Assistant	7	(750 – 31 – 1370)	1
Superintending Petrologist	19	(4130 – 205 – 5770)	1
Petrologist	18	(2710 – 195 – 4660)	2
Assistant Petrologist	17	(2065 – 155 – 3925)	3
Superintending Chemist	19	(4130 – 205 – 5770)	1
Senior Chemist	18	(2710 – 195 – 4660)	1
Chemist	17	(2065 – 155 – 3925)	3
Lab. Assistant	7	(750 – 31 – 1370)	3
Superintending Geochemist	19	(4130 – 205 – 5770)	1
Computer Programmer	18	(2710 – 195 – 4660)	1
Geochronologist	18	(2710 – 195 – 4660)	1
Assistant Geochronologist	17	(2065 – 155 – 3925)	1
Lab. Assistant	7	(750 – 31 – 1370)	1
Stratigrapher	19	(4130 – 205 – 5770)	1
Structural Geologist	18	(2710 – 195 – 4660)	1
Senior Mining Geologist	18	(2710 – 195 – 4660)	1
Lab. Assistant	7	(750 – 31 – 1370)	1
Field Assistant	11	(910 – 46 – 1830)	1
Lab. Attendant	3	(650 – 19 – 1030)	2
Section Cutter / Rock Crusher	2	(625 – 16 – 945)	4
Director	20	(4900 – 235 – 6780)	1
Deputy Director	18	(2710 – 195 – 4660)	1
Documentation Officer	17	(2065 – 155 – 3925)	1
Accounts Officer	17	(2065 – 155 – 3925)	1
Administration Officer	16	(1350 – 105 – 2925)	1
Stenographer	15	(1165 – 71 – 2585)	2
Accounts Assistant	9	(830 – 38 – 1590)	1
Casher	7	(750 – 31 – 1370)	1
Maintenance / Electronic Engineer	18	(2710 – 195 – 4660)	1
Care Taker of Building	16	(1350 – 105 – 2925)	1
Instrument Officer	16	(1350 – 105 – 2925)	1
Senior Store Keeper	7	(750 – 31 – 1370)	1
Upper Division Clerk	7	(750 – 31 – 1370)	1
Lower Division Clerk	5	(725 – 28 – 1285)	2
Driver	4	(675 – 22 – 1115)	4
Naib Qasid / Sweeper / Mali / Cleaner / Cook / Lab. Boy etc.	1	(600 – 13 – 860)	10

b. Allowance and Honoraria

Allowance and honoraria includes house rent, overtime allowances and honoraria etc. which is about 55 percent of the annual basic salary.

c. Others

Others include travel allowances (daily allowances plus hotel expenses), and account for about 23 percent of the annual salary.

The Government of Pakistan will start to take 64 persons into service from 1990/1991 and will complete this in 1993/1994. Annual personnel expenses calculated according to the manpower allocation are shown below.

Fig. 6-2 Personnel Expenses Yearwise

Year	Staff Numbers	Personnel Expenses
1990/1991	27	1,015,856
1991/1992	50	2,049,749
1992/1993	62	2,652,356
1993/1994	64	2,782,137
Total		8,500,098 Rs (≒8,500,000 Rs)

2) Costs for Maintenance and Operation of the Facilities and Equipment

An itemised breakdown of the recurring costs for maintenance and operation of the facilities and equipment is shown in the following table.

Table 6-3 Recurring Costs for Maintenance and Operation of the Facilities and Equipment

Item	Cost (Rs/year)
Electricity	328,000
Gas	19,000
Telephone	33,000
Mail and telecommunications	30,000
Stationery and printing	50,000
Building repairs	40,000
Consumables and spare parts	582,000
Vehicle maintenance	150,000
Others	30,000
Total	1,262,000 Rs/year

The estimated annual costs for maintenance and operation of the facilities and equipment amount to 1,262,000 Rs/year. Following is the rationale for the calculation of electricity, gas and telephone charges, and expenses for consumables and spare parts.

a. Electricity Charges

Electricity charges were calculated on the basis of the following estimated monthly power consumption and the contract wattage of 240kW.

Table 6-4 Estimated Monthly Power Consumption

Item	Equipment load (kw)	Estimated power consumption (kwH/month)		
		Period rooms are heated	Period rooms are air-conditioned	Period between these periods
Lighting	55	6,600	6,600	6,600
Air-conditioning/ ventilation	90	2,700	8,000	900
Sanitation	8	800	800	800
Experimentation	300	6,000	6,000	6,000
Others	20	400	400	400
Total	473	16,500	21,800	14,700

- Calculation of Electricity Charges

① Electricity charges for the period rooms are heated
(240kW×80Rs/kW+16,500kWH×0.48Rs/kWH)×3 months=81,360Rs

② Electricity charges for the period rooms are air-conditioned
(240kW×80Rs/kW+21,800kWH×0.48Rs/kWH)×3months=88,992Rs

③ Electricity charge for the period between the above two periods
(240kW×80Rs/kW+14,700kWH×0.48Rs/kWH)×6months=157,536Rs

Total annual electricity charge: 327,888≒328,000Rs

b. Gas Charges

- In calculation

① Heating (No. of days rooms are heated: 78)
154 m^3/day × 78days/year × 92.92Rs / 100m^3 ≒11,200 Rs

② Hot water supply
19 m^3/day×25days/month×12month×92.92Rs/100m^3 ≒15,300 Rs

② Kitchen
3 m^3/day × 25days/month × 12month × 92.92Rs/100m^3 ≒800 Rs

④ Meterage
100 Rs/month × 12months=1,200 Rs

Total annual gas charge: 18,500≒19,000Rs

c. Telephone Charge

Given that the total number of telephone circuits is 10.
No. of telephone calls = 30persons×4calls/person/day×25days
= 3,000/month

- Calculation of Telephone Charges

(10circuits×30Rs/month/circuit+3,000calls/month×0.8Rs/call)×12months=33,000Rs

Total annual telephone charges: 33,000Rs

d. Expenses for Consumables and Spare Parts

Total annual expenses for consumables and spare parts were estimated on the basis of the envisaged requirements of consumables and spare parts. These were calculated based on the estimated number of samples collected assuming that two exploration projects related to the laboratory are conducted annually..

Table 6-5 Estimated Expenses for Consumables and Spare Parts

Item	No. of samples (per annum)	Expenses (Rs/year)	Remarks
Sample crushing	2,620	8,000	Rings for vibration mill
Preparation of thin/ground samples	300	55,000	Grinders/polishers and adhesives such as diamond cutting wheel and diamond paste
Atomic absorption spectrometer, ultraviolet/ visible ray absorption spectrometer	2,000	51,000	Reagents, Crucibles (Ni, porcelain), glassware, etc.
Atomic absorption spectrometer w/flame, ultraviolet ray absorption spectrometer	1,500	28,000	Hollow cathode lamps, D_2 lamps, analysis gas (N_2O, C_2H_2), etc.
Atomic absorption spectrometer	500	12,000	Graphite bars, D_2 lamps, analysis gas (Ar), etc.
X-ray fluorescence spectrometer	250	121,000	X-ray tubes, analysis gas (PR), etc.
X-ray diffractometer	250	123,000	X-ray tubes, sample holders, etc.
Electron probe micro analyser	50	44,000	Filaments, detectors, analysis gas (PR), films, etc.
Thermal analysis	100	6,000	Melting pots, analysis gas (N_2, O_2), liquid nitrogen, etc.
Paleomagnetic measurement	50	10,000	Replacement quartz tubes, printing paper, etc.
Personal computer	–	45,000	Maintenance charge
Photocopy machine, Typewriter, Word processor	–	24,000	Maintenance charge
Others	–	55,000	Printing paper, filter, etc.
Total		582,000	

As it is very difficult to estimate the locations and frequency of complicated machine troubles which the laboratory personnel are unable to repair themselves, expenses for repairing such machine troubles are not included in the above estimated expenses.

The estimated annual costs for maintenance and operation of the facilities and equipment amount to 1,262,000Rs as shown in Table 6-3. If the project will be completed at the middle of fiscal 1991/92, costs for maintenance and operation of the facilities and equipment for the half of fiscal 1991/92, fiscal 1992/93 and fiscal 1993/94 will be included in the total local currency budget of the five-year implementation plan (PC-1 Form) by the Government of Pakistan. Therefore, the total maintenance and operation costs of the facilities and equipment for the 2.5 fiscal years are estimated at 3,155,000Rs (1,262,000Rs×2.5). As stated in 1) Personnel Expenses of (3), the total personnel expenses for the five-year period are estimated at 8,500,000Rs. Consequently, the total maintenance and operation costs of the laboratory during the five-year implementation plan are estimated at 11,655,000Rs (3,155,000Rs+8,500,000Rs).

(4) Evaluation of the Maintenance and Operation Costs

1) Maintenance and Operation Costs in the Five-year Implementation Plan

The total personnel and facility/equipment maintenance and operation costs for the five-year implementation plan by the Pakistani side are estimated at 12,413,380Rs (total domestic local currency budget minus the costs for the project site securing, infrastructure, external works and fittings, namely 32,394,080Rs minus 19,980,700Rs). On the other hand, the total personnel and facilities/equipment maintenance and operation costs are, as mentioned before, estimated at 11,655,000 Rs, which falls below 12,413,380Rs. Therefore, it is considered possible to maintain and operate the laboratory during the above-

mentioned five-year implementation plan. The total local currency budget of the five-year implementation plan is easily increased by up to 15 percent if necessary. Consequently, it is also considered possible to allocate a budget for repairing complicated machine troubles.

2) Cost for Maintenance and Operation of the Laboratory

After completion of the five-year implementation plan, the Ministry of Petroleum and Natural Resources will allocate an annual budget to the laboratory through the Geological Survey of Pakistan. The total annual personnel and facilities/equipment maintenance and operation costs of the laboratory are estimated at 4,044,137Rs (the total of 2,782,137Rs in Table 6-2 plus 1,262,000Rs in Table 6-3). This cost is within the envisaged recurring expenditure (5,000,000Rs) mentioned in the implementation plan (PC-1 Form). Besides, this figure is approximately 5.0 percent of 80,728,000Rs, which is the sum of the GSP's local currency budget (ordinary and development budgets) for fiscal 1988/89, and only 0.26 percent of the Ministry of Petroleum and Natural Resources' total budget for fiscal 1988/89. Moreover, in view of the fact that the ratio of the GSP's budget to that for the Ministry of Petroleum and Natural Resources has been increasing from year to year (2.24 percent yearly increase in fiscal 1985/86, 3.66 percent yearly increase in fiscal 1986/87, 3.81 percent yearly increase in fiscal 1987/88 and 7.87 percent yearly increase in fiscal 1988/89), it is considered possible to secure the necessary annual budget for maintenance and operation of the laboratory after completion of the five-year implementation plan.

CHAPTER 7 EVALUATION OF THE PROJECT

EVALUATION OF THE PROJECT

The development of mineral resources has not always progressed smoothly in Pakistan. Availability of many kinds of minerals is still partially or fully dependent on foreign supplies. On the other hand, recent theoretical developments in geology indicate a possibility of a large variety of viable mineral resources existing in Pakistan. Consequently, the Government of Pakistan is planning to expand geological investigation and mineral resources exploration in the current seventh five-year plan. However, the Geological Survey of Pakistan, which should play a pivotal role in geological investigation in the country, is suffering from the superannuation of its facilities and equipment, largely due to the Pakistan-India wars and the oil crisis. The technical capabilities of the personnel are also considered to be insufficient. Consequently, the Government of Pakistan decided to construct a Geoscience Laboratory attached to the Geological Survey of Pakistan for improving the capacity of geoscience investigation and mineral resources exploration. Based on the above stated background, the propriety and the expected effects of this project should be evaluated as follows.

(1) The Implementation Plan of The Project

The Geological Survey of Pakistan is responsible for implementing this project. The headquarters of the GSP is located at Quetta, Baluchistan province, but it will establish an office solely for the project implementation in Islamabad. The office is already secured in the city. This means that a plan for carrying out Pakistani works necessary for this project's realisation, including communication between the project site and the GSP headquarters, coordination with other Pakistani government agencies concerned, Japanese government agencies concerned and other

parties concerned is already established. This arrangement is considered effective in implementing this project.

(2) Management Plan

The Geological Survey of Pakistan has a five-year implementation plan (PC-1 Form) for this project, including estimated costs of works to be borne by the Government of Pakistan, as well as personnel and facilities/ equipment maintenance and operation costs after completion of the project. According to this plan, the Geoscience Laboratory is to have 64 staff members, including 32 senior scientists. As stated in 3-3-2 of Chapter 3, the number and assignment of the staff is appropriate to the scale of the laboratory's planned organisation and the equipment to be installed. It is necessary, however, for the Government of Japan to provide project-type technical cooperation as mentioned in 3-3-6 of Chapter 3 in order to fully utilise the facilities and equipment provided under the grant aid programme.

(3) Maintenance and Operation Plan

The estimated annual cost for maintenance and operation of the laboratory calculated in Chapter 6 is 4,044,137Rs. This amount will be within the annual budget limit to be allocated to this laboratory. This means that laboratory facilities and equipment can be maintained and operated by the Pakistani side if the project-type technical cooperation by the Japanese Government is implemented properly.

(4) Expected Effects of This Project

The expected effects of this project implemented in conjunction with the project-type technical cooperation by the Japanese Government can be summarised as follows.

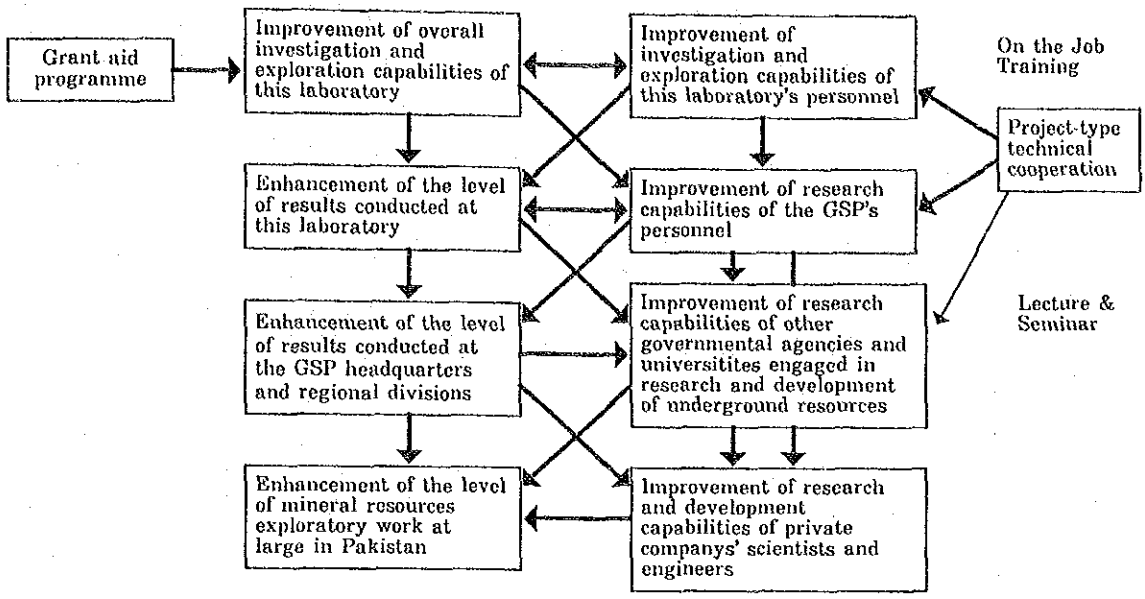


Fig. 7-1 Expected Effects of This Project

1) Improvement of Overall Investigation and Exploration Capabilities of the Geoscience Laboratory

Transfer of technologies/techniques for operation and utilisation of the equipment provided will result in improvements in precision, reliability and efficiency of sample analysis. For example, the introduction of the flameless-type atomic absorption spectrometer will lower by one or two digits the lower limit of figures related to analytical work. The maximum number of thin and polished sections prepared in a day has been 2 to 3 up to now. At this laboratory, at least 15 such sections can be prepared using thin/polished section preparation machines. The introduction of the X-ray diffractometer, the X-ray fluorescence spectrometer, the electron probe micro analyser, etc. will make it possible to discover trace elements of gold, silver, copper, molybdenum, tin, zinc and rare earth. It has been very difficult to discover such trace elements using the method formerly used by the Geological Survey of Pakistan, because those

methods were insufficient in terms of precision, reliability and number of samples.

2) Improvement of Capabilities of Scientists Engaged in Investigation and Development of Mineral Resources

The project-type technical cooperation by the Japanese government will contribute to the improvement of the Pakistani counterparts' ability to operate the equipment provided. Also, the transfer of technologies /techniques for mineral resources exploration will improve the precision and reliability of sample analysis, which will raise the Pakistani counterparts' ability to make mineral resources exploration plans and prepare geological maps. Besides, the 1,220 scientists of governmen-tal organisations related to underground resources, including 292 scientists of the Geological Survey of Pakistan not directly involved in the technical cooperation, will also be able to improve their capabilities by attending lectures and seminars held by the dispatched Japanese experts and by utilising the laboratory's facilities and equipment.

3) Enhancement of the Level of the Results of Investigation and Exploration Work

The results of the prospective laboratory activities will be reflected in maps and related research papers which will serve as basic information on mineral resources exploration. Geological maps formerly prepared by the Geological Survey of Pakistan were mostly based on field observation and megascopic or microscopic evaluation of rocks, and structural geology maps including structural elements obtained from field observation and aerial photographs. Facilities and equipment of this laboratory will make it possible to incorporate information on chemical elements, mineral composition and magnetisation directions of rocks, as well as chemical elements, conditions for generation and genetic conditions of minerals, and

isotope geological age into geological and other maps. As a result, the accuracy of geological and structural geology maps will improve, and it will be possible to prepare mineral occurrence maps, geochemical maps, paleomagnetism distribution maps, metallogenic maps and generalised maps, which have been impossible to make using the existing equipment of the GSP. Since scientists of related organisations will be able to utilise the laboratory, this project is expected to contribute in improving the quality of geological and other maps and research papers nationwide, as well as improving the efficiency of exploratory activities. This laboratory is to analyse samples in the course of investigation, survey and exploration activities initiated by the GSP on its own or in collaboration with domestic or foreign organisations, as well as activities by other domestic organisations or private companies. As a result, the laboratory will be able to conduct analyses and tests inexpensively and quickly, instead of commissioning works to laboratories of industrialised countries. It will also be able to have the results of these analyses and tests reflect easily in planning for mineral resources exploration activities.

If the proposed laboratory functions properly, it will lead to improved quality of basic information on mineral resources development, and it will create an incentive for foreign mineral resources development investors. Then, exploration activities of high quality can be carried out on a far larger scale. And as a result of the construction of this laboratory, discoveries of mineral resources peculiar to the geotectonic features of Pakistan will be much more likely.

In general, the required time from commencement of investigation to the exploitation of a mineral is 10 to 15 years. Consequently, it is unlikely that new mineral deposits will be discovered or economic benefits gained during the period of the project-type technical

cooperation by the Japanese government. But if the laboratory's activities result in discovery of new mineral resources in the long run, it will bring about the following effects in the national economy of Pakistan.

1) Discovery of minerals which have been considered nonexistent in Pakistan will result in the evolution of mineral based industries. This would promote employment and acquisition of foreign exchange through export.

2) Discovery of new deposits of minerals, which had been produced in small quantities, and had been procured from other countries, will stem the outflow of foreign currency and reduce prices of domestic industrial products.

3) Establishment of new mining businesses, construction of related infrastructure and promotion of employment in areas of new deposits will contribute to regional development.

As described above, the implementation plan, the management plan and the maintenance and operation plan for this project are considered appropriate in principle, and it is expected that the project will greatly contribute, both directly and indirectly, to the advancement of geoscience investigation, and to the promotion of mineral resources development in the country. Therefore, the grant aid programme by the Japanese government for the project is considered very valuable and the expected effects of the project are evaluated as far-reaching and viable.

CHAPTER 8 CONCLUSION AND RECOMMENDATIONS

CONCLUSION AND RECOMMENDATIONS

(1) Conclusion

As a result of the examination of the contents of the request made by the Government of Pakistan, field surveys in Pakistan, and analysis in Japan, this project was evaluated as detailed in Chapter 7. The contents of the basic design as stated in Chapter 4 are consistent with the objective to improve the technologies/techniques for identifying, classifying and analysing rocks and minerals, and for mineral resources exploration, thereby contributing to the promotion of mineral resources development in Pakistan. If activities for mineral resources development are promoted through the project implementation, and if new mineral deposits are discovered, or existing mineral deposits are expanded, it will further develop and stabilise Pakistan's economy. The development of new mineral resources will contribute to employment promotion, regional development, and the acquisition of foreign exchange through export. Therefore, it is expected that this project, to some extent, will address problems such as the unemployment increase in the young labor force, the economic gap between urban and rural areas and the imbalance of international payments. Consequently, the implementation of the grant aid programme by the Japanese government for this project is judged to be sufficiently appropriate.

(2) Recommendations

The following recommendations are presented so that this project can be realised without delay, and so that the proposed laboratory can operate smoothly to attain the intended objectives.

- Implementation of This Project

1) This project will be carried out within the framework of the Japanese grant aid cooperation system, subject to the time limitation that the project should be completed within the term of the Exchange of Notes. For this reason, procedures for signing the Exchange of Notes, concluding consulting services contract and concluding construction, equipment procurement and equipment installation contracts should be completed promptly by the Pakistani side.

2) Similarly, in the light of the time limitation of this project, works and other activities by the Pakistani side which relate to coordination with other governmental agencies concerned, customs clearance, tax exemption, banking arrangement and issuance of authorisation to pay, etc. should be carried out promptly.

- The Project-type Technical Cooperation by the Japanese Government and Maintenance and Operation of the Geoscience Laboratory

3) Facilities and equipment of the proposed laboratory are consistent with the contents of the Japanese government's project-type technical cooperation which will be implemented in conjunction with this project. It is recommended, therefore, to implement the technical cooperation to attain the project objectives.

4) Transfer of technology related to operation, adjustment, maintenance and repair of the laboratory equipment is especially important in the context of the technical cooperation in order to have the laboratory function effectively and maintain and operate the laboratory equipment properly.

5) The Geological Survey of Pakistan should assign Pakistani counterparts for the technical cooperation, in consideration of the annual schedule for dispatch of Japanese experts to Pakistan and training in Japan.

6) The above-mentioned Pakistani counterparts should be leading scientists of the next generation, after the technology is transferred under the technical cooperation. Recruited counterparts should be young, able scientists with three or more years of practical experience, although it is understood that in principle, such criteria are to be set by the Pakistani side. If possible, the Geological Survey of Pakistan should take steps to prevent the outflow of such scientists and have the technology transferred to more than one scientist to prevent know-how from being held by a single scientist.

7) Inventory control of the consumables and spare parts is important in maintaining and operating the laboratory. It will be difficult to predict exactly the increase or decrease in the number of samples, component parts' lives or occurrence of troubles. Deliveries of some spare parts, such as X-ray tubes for the X-ray diffractometer, detectors for the electron probe micro analyser and tubes for the X-ray fluorescence spectrometer, and some reagents will take considerable time. Therefore, it is necessary to forecast demands or take budgetary measures ahead of time by inventory control in the form of detailed records of consumables and spare parts replacement.

8) In order to keep the operating rate of the laboratory at a high level after the technical cooperation by the Government of Japan, it is necessary to implement continuously investigation or exploration activities of the GSP on its own or with other organisations, establish a system for analysing and testing samples at the laboratory, and try to keep the precision and reliability of such analyses and testings at a high level.

9) As stated in Chapter 6, it is necessary to secure recurrent costs to effectively maintain and operate the laboratory. A proper budgetary allocation should be made in the light of the laboratory's importance in the future economic development of Pakistan.

ANNEX

1. Member List of the Basic Design Study Team

(1) Basic Design Study Team (April 3 ~ April 23, 1989)

Dr. Teruo SHIRAHASE	Team Leader	Director of Geological Information Center, Geological Survey of Japan, Agency of Industrial Science and Technology, Ministry of International Trade & Industry
Dr. Keizo FUJII	Technical Cooperation Long-term Expert	Director, Fuel Geochemistry Section, Fuel Resources Dept., Geological Survey of Japan, Agency of Industrial Science and Technology, Ministry of International Trade & Industry
Dr. Hideiku SHINOKAWA	Technical Cooperation Planning	Senior Technical Official, Mining Division Agency of Natural Resources & Energy Ministry of International Trade & Industry
Mr. Shigeyuki SETO	Project Coordinator	Second Basic Design Study Division, Grant Aid Planning and Survey Dept., JICA
Mr. Mineo NAGAOKA	Project Manager, Architect	Yamashita Sekkei Inc.
Mr. Masahiro KATSUME	Architect	〃
Mr. Tsukasa TAMAKI	Facility Engineer	〃
Mr. Katsuhiro OTANI	Research Equipment (Physics)	〃
Mr. Masaru KYOMOTO	Research Equipment (Chemistry)	〃

(2) Explanation of Draft Final Report (June 26 ~ July 7, 1989)

Dr. Teruo SHIRAHASE	Team Leader	Director of Geological Information Center, Geological Survey of Japan, Agency of Industrial Science and Technology, Ministry of International Trade & Industry
Mr. Shigeyuki SETO	Project Coordinator	Second Basic Design Study Division, Grant Aid Planning and Survey Dept., JICA
Mr. Mineo NAGAOKA	Project Manager, Architect	Yamashita Sekkei Inc.
Mr. Masahiro KATSUME	Architect	〃
Mr. Katsuhiro OTANI	Research Equipment (Physics)	〃
Mr. Masaru KYOMOTO	Research Equipment (Chemistry)	〃

2. Survey Schedule

(1) Basic Design Study Team (April 3 ~ April 23, 1989)

No.	Date	Place	Schedule
1	Apr. 3 (Mon)		• Lv. Tokyo (PK753) Dr. Shirahase, Dr. Fujii, Mr. Shinokawa, Mr. Seto, Mr. Nagaoka, Mr. Katsume, Mr. Tamaki, Mr. Otani, Mr. Kyomoto Ar. Islamabad
2	Apr. 4 (Tue)	Islamabad	• Meeting at JICA office • Meeting at Ministry of Petroleum & Natural Resources (MPNR) • Courtesy call on Embassy of Japan • Meeting at Economic Affairs Division (EAD) • Meeting within the Team at JICA office
3	Apr. 5 (Wed)	〃	• Site investigation • Survey on Geological Survey of Pakistan (GSP), Islamabad laboratory • Survey on Construction Conditions
4	Apr. 6 (Thu)	〃	• Meeting at Islamabad office Hydrocarbon Development Institute of Pakistan (HDIP) • Survey on Hydrocarbon Development Institute of Pakistan • Meeting within the Team at JICA office
5	Apr. 7 (Fri)	Islamabad / Quetta	• Lv. Islamabad (PK325) (All members) Ar. Quetta
6	Apr. 8 (Sat)	Quetta	• Meeting and Survey on GSP
7	Apr. 9 (Sun)	〃	• Meeting with GSP • Lv. Quetta (PK324) (Mr. Tamaki) Ar. Islamabad for the Survey on Infrastructure around the site
8	Apr. 10 (Mon)	〃	• Meeting and Survey on GSP
9	Apr. 11 (Tue)	Quetta/ Islamabad	• Lv. Quetta (PK324) (Dr. Shirahase, Dr. Fujii, Mr. Shinokawa, Mr. Seto, Mr. Nagaoka, Mr. Katsume, Mr. Otani, Mr. Kyomoto) Ar. Islamabad

No.	Date	Place	Schedule
10	Apr. 12 (Wed)	Islamabad	• Meeting at MPNR • Survey on Quaid-i-Azam University • Meeting at GSP Islamabad office
11	Apr. 13 (Thu)	〃	• Meeting at GSP Islamabad office • Courtesy call on Ambassador Kobayashi at Embassy of Japan • Report the progress to the Embassy of Japan
12	Apr. 14 (Fri)	〃	• Discussion on the Minutes (Preparation for Minutes) • Meeting at GSP Islamabad office • Site survey
13	Apr. 15 (Sat)	〃	• Meeting at GSP Islamabad office • Signing of Minutes of Discussions at MPNR • Report the result, to JICA office and Embassy of Japan
14	Apr. 16 (Sun)	〃 (Islamabad/ Karachi)	• Lv. Islamabad (PK301) Ar. Karachi (Ar. Tokyo, Apr. 17) (Dr. Shirahase, Dr. Fujii, Mr. Shinokawa, Mr. Seto, Mr. Tamaki) • Survey on Construction Condition
15	Apr. 17 (Mon)	〃 (Karachi/ Tokyo)	• Survey on Construction Condition • Lv. Karachi (TG508) Ar. Tokyo (TG640)
16	Apr. 18 (Tue)	〃	• Survey on Capital Development Authority (CDA), Central Bureau of Revenue (CBR) Statistic Division • Survey on Construction Conditions
17	Apr. 19 (Wed)	〃	• Survey on Construction Conditions • Survey on Equipment Maintenance Situation
18	Apr. 20 (Thu)	〃	• Meeting at GSP, Islamabad office • Survey on Construction Conditions
19	Apr. 21 (Fri)	〃	• Survey on existing Grant Aid Projects
20	Apr. 22 (Sat)	〃	• Report the result to JICA office and Embassy of Japan • Report the result to GSP Islamabad office • Survey on Construction Site
21	Apr. 23 (Sun)	Islamabad/ Tokyo	• Lv. Islamabad (PK752) (Mr. Nagaoka, Mr. Katsume, Mr. Otani, Mr. Kyomoto) Ar. Tokyo

(2) Explanation of Draft Final Report (June 26 ~ July 7, 1989)

No.	Date	Place	Schedule
1	Jun. 26 (Mon)	Tokyo/ Islamabad	● Lv. Tokyo (PK753) Dr. Shirahase, Mr. Seto, Mr. Nagaoka, Mr. Katsume, Mr. Otani, Mr. Kyomoto Ar. Islamabad
2	Jun. 27 (Tue)	Islamabad	● Meeting with Geological Survey of Pakistan (GSP) at JICA office ● Courtesy call on Embassy of Japan ● Meeting at Economic Affairs Division (EAD) ● Meeting at Ministry of Petroleum & Natural Resources (MPNR)
3	Jun. 28 (Wed)	〃	● Meeting with GSP ● Survey on GSP Islamabad laboratory ● Meeting at Capital Development Authority (CDA) ● Meeting within the Team at JICA office
4	Jun. 29 (Thu)	〃	● Meeting with GSP ● Explanation of the Project to the Secretary of MPNR ● Meeting at Water and Power Development Authority (WAPDA)
5	Jun. 30 (Fri)	〃	● Survey on Construction Conditions
6	Jul. 1 (Sat)	〃	● Meeting with GSP ● Site Investigation
7	Jul. 2 (Sun)	〃	● Meeting with GSP ● Survey on Construction Conditions
8	Jul. 3 (Mon)	〃	● Explanation of the Project to the Minister of MPNR ● Discussion on the Minutes ● Meeting at CDA
9	Jul. 4 (Tue)	〃	● Signing of Minutes of Discussion at MPNR ● Meeting with GSP ● Report the result to JICA office and Embassy of Japan
10	Jul. 5 (Wed)	〃	● Survey on Construction Conditions ● Meeting at CDA and WAPDA
11	Jul. 6 (Thu)	Islamabad/ Karachi	● Lv. Islamabad (PK309) Dr. Shirahase, Mr. Seto, Mr. Nagaoka, Mr. Katsume, Mr. Otani, Mr. Kyomoto Ar. Karachi ● Survey on Fuel Research Centre, Karachi ● Meeting with GSP
12	Jul. 7 (Fri)	Karachi/ Tokyo	● Lv. Karachi (TG508) Ar. Bangkok, Lv. Bangkok (TG640) Ar. Tokyo

3. Member List of the Pakistani Counterparts

(1) Ministry of Petroleum and Natural Resources

Mr. Jehangir Badar	(Minister)
Mr. Tariq Mustafa	(Secretary)
Mr. Mohammad Ilyas Lodhi	(Joint Secretary)
Mr. M. Ikram Arif	(Deputy Secretary)
Mr. Khan Tariq Hamid	(Former Secretary)

(2) Economic Affairs Division

Mr. Akhtar Iqbal	(Deputy Secretary)

(3) Geologial Survey of Pakistan

Mr. A. H. Kazmi	(Director General)
Dr. A. N. Fatmi	(Deputy Director General)
Dr. Farhat Husain	(Deputy Director General)
Dr. Ibrahim Shah	(Deputy Director General)
Mr. S. Hashim Raza	(Chief Geophysicist)
Mr. Mohammad Ali Mirza	(Project Director)
Mr. M. S. Zafar Khan	(Director)
Dr. Mahmood U. A. Siddiqui	(Director)
Mr. Mahboob R. Kazmi	(Director Drilling)
Mr. Mushtaq Hussain	(Superintending Chemist)
Mr. Tauqir Ahmed Shuja	(Deputy Director)
Mr. Kanwar Sabir Ali Khan	(Deputy Director)
Mr. Mohammad Sakhawat	(Senior Geophysicist)
Mr. Manzur Ahmad	(Senior Research Officer)
Mr. Habib Ur Rehman	(Research Officer)
Mr. Joozer Marzban	(Assistant Director)
Mr. Nazar Ul Islam	(Assistant Director)
Mr. Habib Ullah	(Progress Officer)

(4) Central Board of Revenue

Mr. Nasir Ahmad	(Chief)
Mr. Tufail Ahmad	(Private Secretary to Chairman)

(5) Capital Development Authority

Mr. Shafi Mohammad Sewhani	(Member, Planning)
Mr. Shafi Ali Siddiqui	(Director of Survey and Regional Planning)
Mr. A. Q. Nonami	(Director of Water Supply)
Mr. Anwar Said	(Chief of Building Rules Division)
Mr. M. D. General	(Director of Architecture)

Mr. Abdul Salam	(Deputy Director of Soil Testing Engineering Laboratory)
Mr. Anjum Malik	(Chief of Department of Road)
Mr. Fazal Hussain	(Chief of The Estate Management)
Mr. Akhtar Hussain	(Fire Officer of Fire Headquaters)

(6) Meteorological Department of Pakistan

Mr. Anjum Bari	(Meteorologist)

(7) Water and Power Development Authority

Mr. Salim Khan	(Executive Engineer)
Mr. Mohammad Wali Khan	(Senior Engineer)

(8) Pakistan Telegraph and Telephone Department

Mr. Javed Khan	(Divisional Engineer)

(9) Sui Northern Gas Pipeline Ltd.

Mr. Raja A. Wahid	(Regional Manager)
Mr. M. Arif Lateef Sheikh	(Senior Distribution Engineer)

(10) Hydrocarbon Development Institute of Pakistan

Mr. Hilal A. Raza	(Director General)

(11) Fuel Research Centre

Dr. Nisar Ahamad	(Director)

(12) Statistic Division

Mr. Latif Ur Rahman	(Senior Statistical Officer)

(13) Embassy of Japan

Mr. Shunji Kobayashi	(Ambassador of Japan)
Mr. Koichi Obata	(Minister)
Mr. Ryosuke Haraguchi	(First Secretary)
Mr. Kosuke Imashimizu	(First Secretary)
Mr. Yutaka Sumita	(First Secretary)

(14) JICA Pakistan office

Mr. Kazuo Tanigawa	(Resident Representative)
Mr. Masato Togawa	
Mr. Shoji Nishikawa	
Mr. Makoto Kanai	
Mr. Masakazu Kawai	
Mr. Toshihiro Kadoguchi	

4. Minutes of Discussions (Basic Design Study)

MINUTES OF DISCUSSIONS ON THE PROJECT FOR CONTRUCTING THE GEOSCIENCE LABORATORY IN THE ISLAMIC REPUBLIC OF PAKISTAN

In response to the request of the Government of Islamic Republic of Pakistan, the Government of Japan decided to conduct a basic design study on the project for constructing the Geoscience Laboratory (hereinafter referred to as "the Project"), and the Japan International Cooperation Agency (hereinafter referred to as JICA) sent to Pakistan a study team headed by Dr. Teruo Shirahase, Director of Geological Information Centre, Geological Survey of Japan, AIST, MITI from April 3 to 23, 1989.

The team had a series of discussions on the Project with the officials concerned of the Government of Pakistan and conducted a field survey.

As a result of the study, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them attached herewith, be examined towards the realisation of the project.

Islamabad, April 15, 1989.

白波瀬 輝夫

Dr. Teruo Shirahase
Leader
Basic Design Study Team
Japan International
Cooperation Agency

Ali Hasan Kazmi

Mr. A.H. Kazmi
Director General
Geological Survey of
Pakistan
Ministry of Petroleum and
Natural Resources

Countersigned

(Mohammad Ilyas Lodhi)
Joint Secretary
Ministry of Petroleum
and Natural Resources
Islamabad.

ATTACHMENT

1. The Project Title

The Project for Constructing the Geoscience Laboratory

2. The Objectives of the Project

The Objectives of the Project are to construct the Geoscience Laboratory and to provide necessary equipment for the initiation of Project-type Technical Cooperation between Japan and Pakistan.

3. The Responsible Ministry and Implementation Agency of the Project

3.1 The Responsible Ministry is the Ministry of Petroleum and Natural Resources

3.2 The Implementation Agency is the Geological Survey of Pakistan.

4. The Project Site

The Project site is located in Sector National Park Area (Chak Shahzad), Islamabad, and is shown in Annex-1.

The site will be handed over to the Geological Survey of Pakistan by the Capital Development Authority in accordance with the schedule of instalments (Annex-2).

5. The Major Items Requested for the Project

The Major items requested for the Project are listed in Annex-3.

6. The Manpower Allocation for the Geoscience Laboratory

The manpower for the Laboratory will be allocated as shown in Annex-5 of the Minutes signed on December 19,1988.

7. The Maintenance and Operation Cost by the Geological Survey of Pakistan (GSP)

GSP will request to the Government of Pakistan to expand the maintenance and operation cost beyond admissible 15% from the total local cost in the PC-I Scheme revised in January 1989, if the cost exceeds during and after the period of the Japanese Technical Cooperation.

8. Grant Aid Programme

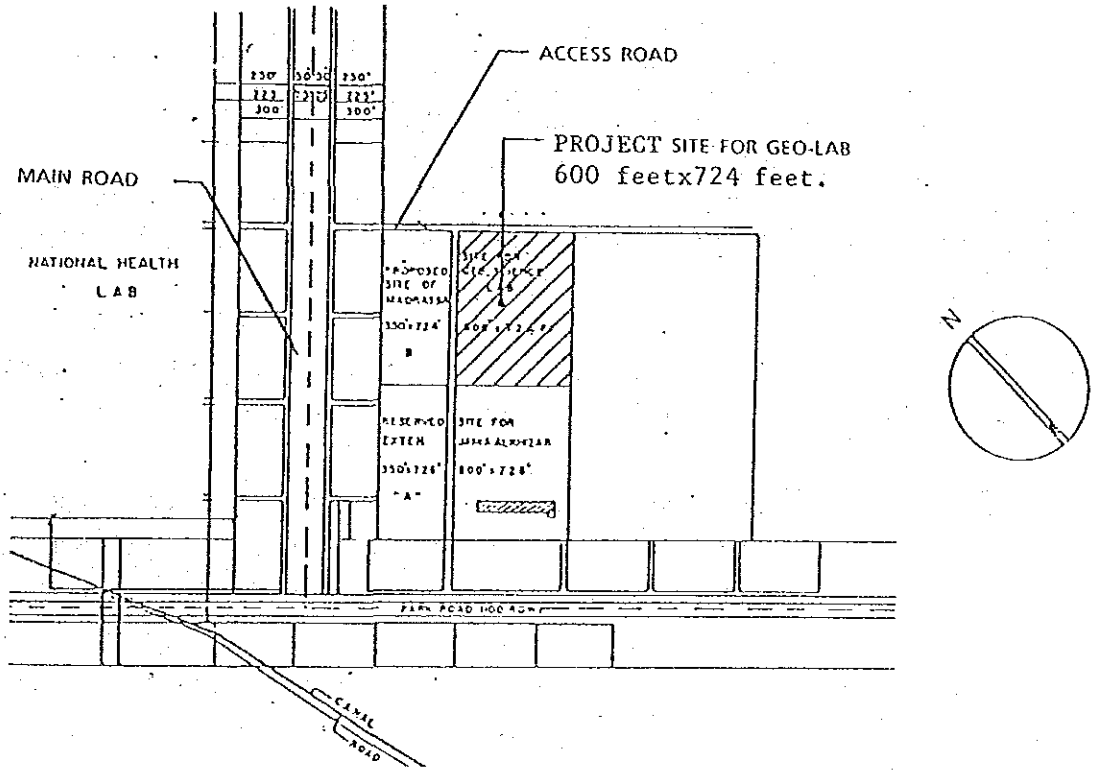
8.1 The Pakistan side has understood the system of Japan's Grant Aid Programme and the principle for use of Japanese consulting firm(s) and contractor(s) for the implementation of the Project.

8.2 The Study Team will convey to the Government of Japan the desire of the Government of Pakistan that the former takes necessary measures to cooperate in implementing the Project and provides necessary facilities and equipment under the Japan's Grant Aid Programme.

8.2 The Government of Pakistan will take necessary measures as listed in Annex-4 on condition that the Grant Aid by the Government of Japan would be extended to the Project.

ANNEX -1

THE PROJECT SITE



ANNEX-2

THE SCHEDULE OF INSTALMENTS

CAPITAL DEVELOPMENT AUTHORITY
ESTATE MANAGEMENT DIRECTORATE

No.CDA/EM-27(1910)/88//229 Islamabad, March 13, 1989

To

The Director,
Planning & Information,
Geological Survey of Pakistan,
Government of Pakistan,
Islamabad

Subject:- PAYMENT OF PREMIUM OF LAND IN INSTALMENTS.

Sir,

I am directed to refer to your letter No.P&I/ PSCM-62/88/ dated 5-3-1989 on the above subject.

2. The land measuring 9.97 acres is on lease for 33 years extendable for two subsequent terms of 33 years each. Your request regarding payment in instalments has been considered by the competent authority and as a very special case, Geological Survey of Pakistan are allowed to make the payment of Rs.1,93,06,800/- in four equal quarterly instal-ments as per following schedule. If any instal-ment is not paid on due date, delayed payment charge @ 14.72% per annum or as revised/levied from time to time will be recovered from the date of payment.

1. 1st instalment of Rs.48,26,700/- on 15-06-1989
2. 2nd instalment of Rs.48,26,700/- on 15-09-1989
3. 3rd instal ment of Rs.48,26,700/- on 15-12-1989
4. 4th instalment of Rs.48,26,700/- on 15-03-1990

Your obediently,

(Qinait-Ali)
Director

ANNEX - 3

THE MAJOR ITEMS REQUESTED FOR THE PROJECT

1. Buildings

The Geoscience Laboratory comprises the following:

1) Paleomagnetic Geochronology Laboratory
2) Petrology and Mineralogy Laboratory
3) Analytical Chemistry Laboratory
4) Geochemical Exploration Section
5) Isotope Geochronology Section
6) Geology Section
7) Sample Preparation Section
8) Administration Section
9) Service Section

Both parties understood that the Geoscience Laboratory consists of four main building blocks, such as for staff room, laboratory, sample preparation and sample storage.

While the laboratory block has a centre corridor to concentrate functions and to serve effective air conditioning, other blocks have side corridors for natural ventilation.
The design of the staff block will be prepared as a double-story building and others will be with a single-story building.

2. Equipment

As a result of the discussion on the activity of the Laboratory and the maintenance cost, both parties agreed that some of the equipment are deleted from the list of the request (ANNEX-4 of the Minutes signed on December 19,1988).

The major equipment:

Paleomagnetic Geochronology Laboratory:

1) Digital spinner megnetometer
2) Magnetic susceptibility meter
3) Diamond drill
4) Other equipment necessary for paleomagnetic analysis.

Petrology and Mineralogy Laboratory:	1) X-ray fluorescence spectrometer 2) X-ray diffractometer 3) Electron probe micro-analyser 4) Differential thermal analyser 5) Spectrometer 6) Other equipment necessary for Petrology and Mineralogy Laboratory.
Analytical Chemistry Laboratory :	1) Atomic absorption spectrometer W/flame 2) Atomic absorption spectrometer W/flameless 3) Other equipment and reagent necessary for chemical analysis
Geochemical Exploration Section:	1) Data processing system 2) Vehicles for field survey 3) Other equipment necessary for geochemical sampling.
Sample Preparation Section:	Equipment and machinary necessary for preparation and processing of samples.
Administration Section:	Equipment necessary for administrative and financial management.

ANNEX - 4

UNDERTAKING BY THE GOVERNMENT OF PAKISTAN

1. To secure the site for the Project.

2. To clear, level and reclaim the site as needed prior to the commencement of the construction.

3. To construct the access roads to the site and to supply temporary power, water and telephone service necessary for the construction prior to the commencement of the construction.

4. To undertake incidental external works such as planting, fencing and making gates in and around the site.

5. To connect distributing line of electricity to the power sub-station within the site.

6. To connect city water distribution main to the site and/or to construct a well for water supply.

7. To connect the city drainage main (for storm, sewer and others) to the site.

8. To connect the city gas main to the site.

9. To connect the telephone trunk line to the main distribution frame/panel to be equipped inside the building.

10. To provide general furniture for daily activities.

11. To obtain the building permit prior to the commencement of the construction.

12. To bear commissions to the Japanese foreign exchange bank for the banking services based on the Banking Arrangement as per the rules of the Government of Pakistan in case of Japan's Grant Aid Programme in Pakistan.

13. To ensure the necessary budget and personnel for the proper and effective operation and maintenance of the facilities and the equipment provided under the Grant.

14. To ensure prompt unloadings, tax exemption, custom clearance at the port of disembarkation in Pakistan and prompt internal transportation of the products provided under the Grant Aid.

15. To exempt Japanese nationals involved in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Pakistan with respect to the supply of the products and the services under the verified contracts as per the rules of the Government of Pakistan in case of Japan's Grant Aid Programme in Pakistan.

16. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their works as per the rules of the Government of Pakistan in case of Japan's Grant Aid Programme in Pakistan.

17. To maintain and use properly and effectively the facilities constructed and the equipment provided under the Grant.

18. To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY REPORT ON THE PROJECT FOR CONSTRUCTING THE GEOSCIENCE LABORATORY IN THE ISLAMIC REPUBLIC OF PAKISTAN

In response to the request of the Government of Pakistan, the Government of Japan decided to conduct a Basic Design Study on the Project and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent the Basic Design Study Team headed by Dr. Teruo Shirahase from April 3 to 23, 1989. The team carried out a field survey and had discussions with the authorities concerned of the Government of Pakistan.

As a result of the survey and discussions, JICA prepared a Draft Final Report and dispatched a mission to explain and discuss the Report from June 26 to July 7, 1989.

Both parties had a series of discussions on the Report and have agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realisation of the Project.

Islamabad, July 4, 1989.

伺波瀬輝夫

Dr. Teruo Shirahase
Leader,
Basic Design Study Team,
Japan International
Cooperation Agency

for Mr. A. H. Kazmi
Director General,
Geological Survey of
Pakistan,
Ministry of Petroleum and
Natural Resources

Mr. Mohammad Ilyas Lodhi
Joint Secretary,
Ministry of Petroleum
and Natural Resources

ATTACHMENTS

1. The Pakistani side principally has agreed to the basic design proposed in the Draft Final Report (with minor but appropriate alterations in design, facilities and equipment, mutually agreed upon to be incorporated in the Final Report).

2. The Final Reports (10 copies in English) on the Project will be submitted to the Pakistani side by the end of September, 1989.

3. The Pakistani side understood the system of Japan's Grant Aid Programme and confirmed the arrangements to be taken by the Governemnt of Pakistan for the realisation of the Project as agreed upon in the "Minutes of Discussions" dated April 15, 1989.

4. A letter from the CDA regarding the request letter dated 15th June, 1989 (Attached as ANNEX I), received by the GSP will be submitted to JICA Pakistan Office by the end of July, 1989.

ANNEX - I

No.PC-12(14)/86-Vol.II
Government of Pakistan
Ministry of Petroleum & Natural Resources

Islamabad, the 15th June, 1989.

To

Mr.Qinait Ali,
Director,
Capital Development Authority,
Islamabad.

Subject: PAYMENT OF PREMIUM OF LAND IN INSTALMENTS FOR ESTABLISHMENT OF GEOSCIENCES LABORATORY AT ISLAMABAD BY GEOLOGICAL SURVEY OF PAKISTAN.

Sir,

I am directed to refer to your letter No.CDA/EM-27(1910)/88/1229 dated 13th March, 1989 on the above subject and to state that the PC-I for the proposed scheme entitled "Establishment of Geosciences Laboratory at Islamabad" by Geological Survey of Pakistan has already been submitted to Planning Division for obtaining approval of CDWP/ECNEC, CDA is therefore, requested to kindly defer the payment by GSP of the instalments towards cost of land till the project is cleared by the competent authority and necessary amount is released by the Government in favour of GSP.

Your obedient servant

(Mohammad Bashir Chaudhry)
Section Officer
Phone: 829343

Copy to Geological Survey of Pakistan
(Mr.Muhammad Ali Mirza, Director) Quetta.

(Mohammad Bashir Chaudhry)

5. Letter Regarding the Conditions of the Project Site Handing Over

Islamabad, dated the 13th April, 1989.

GSP certifies that before handing over the construction site of the Geoscience Laboratory to GSP, Capital Development Authority (CDA) will clear all claims of farmers and land owners by its own responsibility. GSP will take possession of the land when fully convinced that the claims are settled and title of the land is absolutely clear.

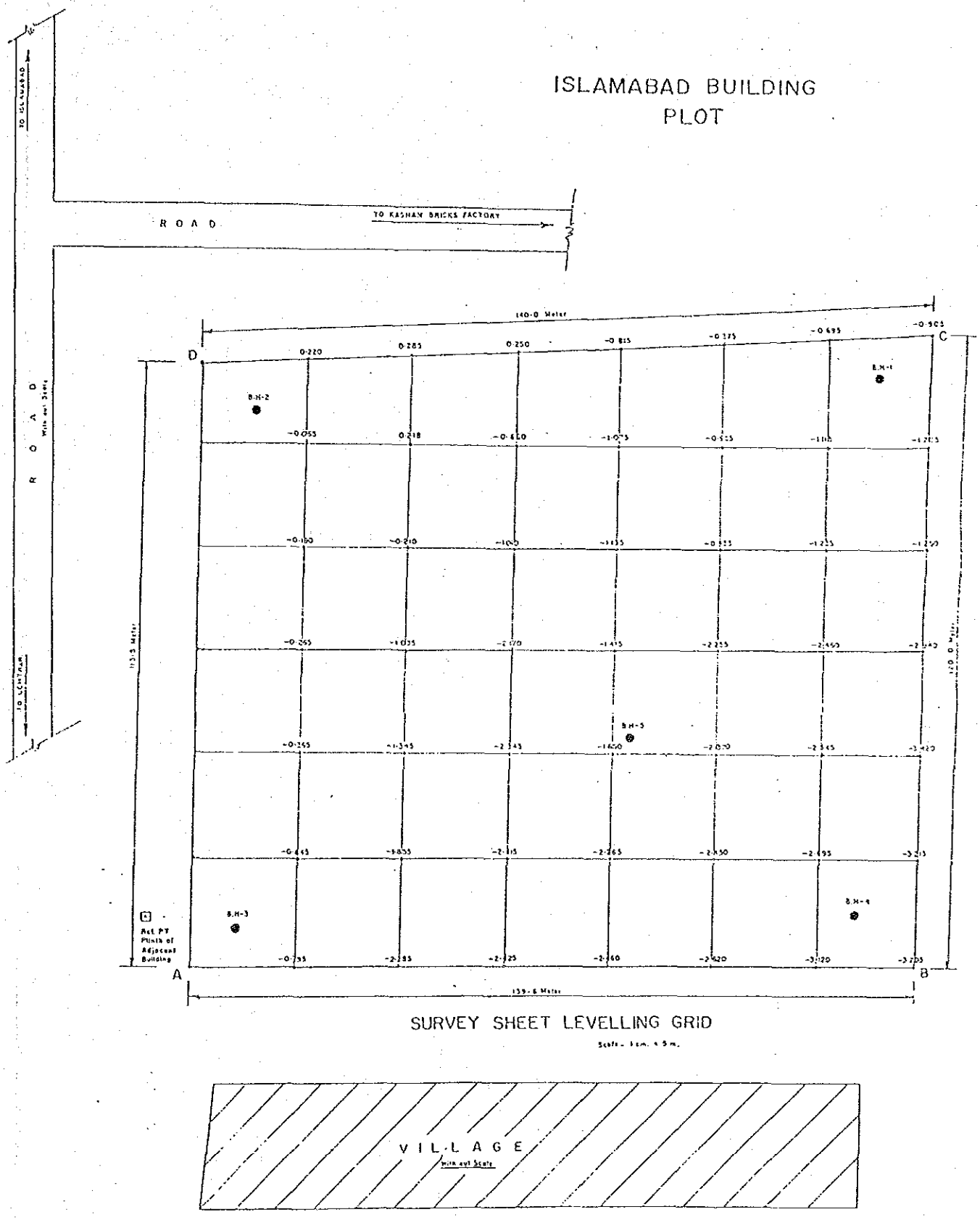
GSP also certifies that if there be any troubles on compensation for the farmers or owners of the land, GSP never fails to take necessary measures to solve the troubles through CDA in order not to interfere the scheduled construction work of the Geoscience Laboratory by JICA.

(ALI HAMZA KAZMI)
Director General

To

Dr. J. Shirahase,
Director,
Geological Survey of Japan,
TEAM LEADER, BASIC DESIGN MISSION.

6. Subsoil Investigation Data



BOREHOLE LOG

PROJECT SOIL INVESTIGATION
CARRIED OUT FOR
GROUND LEVEL 0.185

BOREHOLE NO. 1
LOCATION ISLAMABAD
GROUND WATER LEVEL 4 meter
DATE 29-1-1989

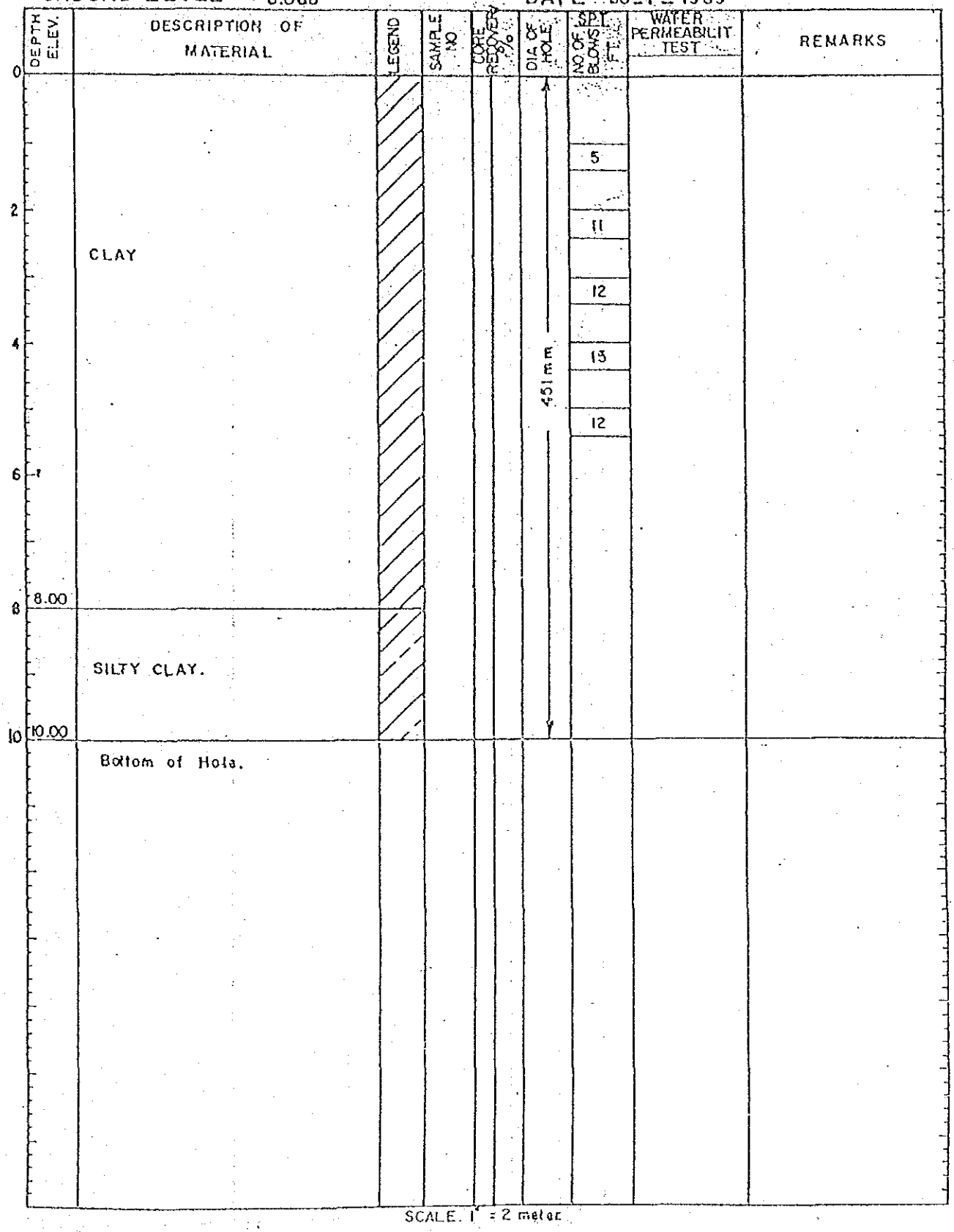
DEPTH ELEV.	DESCRIPTION OF MATERIAL	LEGEND	SAMPLE NO	CORE RECOVERY %	DIA OF HOLE	SPT NO OF BLOWS/FT	WATER PERMEABILITY TEST	REMARKS
0								
						14		U.D.S.
2	SILTY CLAY					18		U.D.S.
						14		U.D.S.
4					451 mm	9		U.D.S.
						7		
6								
8								
10	10.0 Bottom of Hole.							

SCALE. 1" = 2 meter.

BOREHOLE LOG

PROJECT SOIL INVESTIGATION
CARRIED OUT FOR
GROUND LEVEL −0.035

BOREHOLE NO. — 2
LOCATION ISLAMABAD
GROUND WATER LEVEL 7 meter
DATE 30-1-1989



SCALE. 1" = 2 meter

BOREHOLE LOG

BOREHOLE NO. 4

PROJECT SOIL INVESTIGATION

LOCATION ISLAMABAD

CARRIED OUT FOR

GROUND WATER LEVEL 2.70 meter

GROUND LEVEL -3.255

DATE 2.22.1989

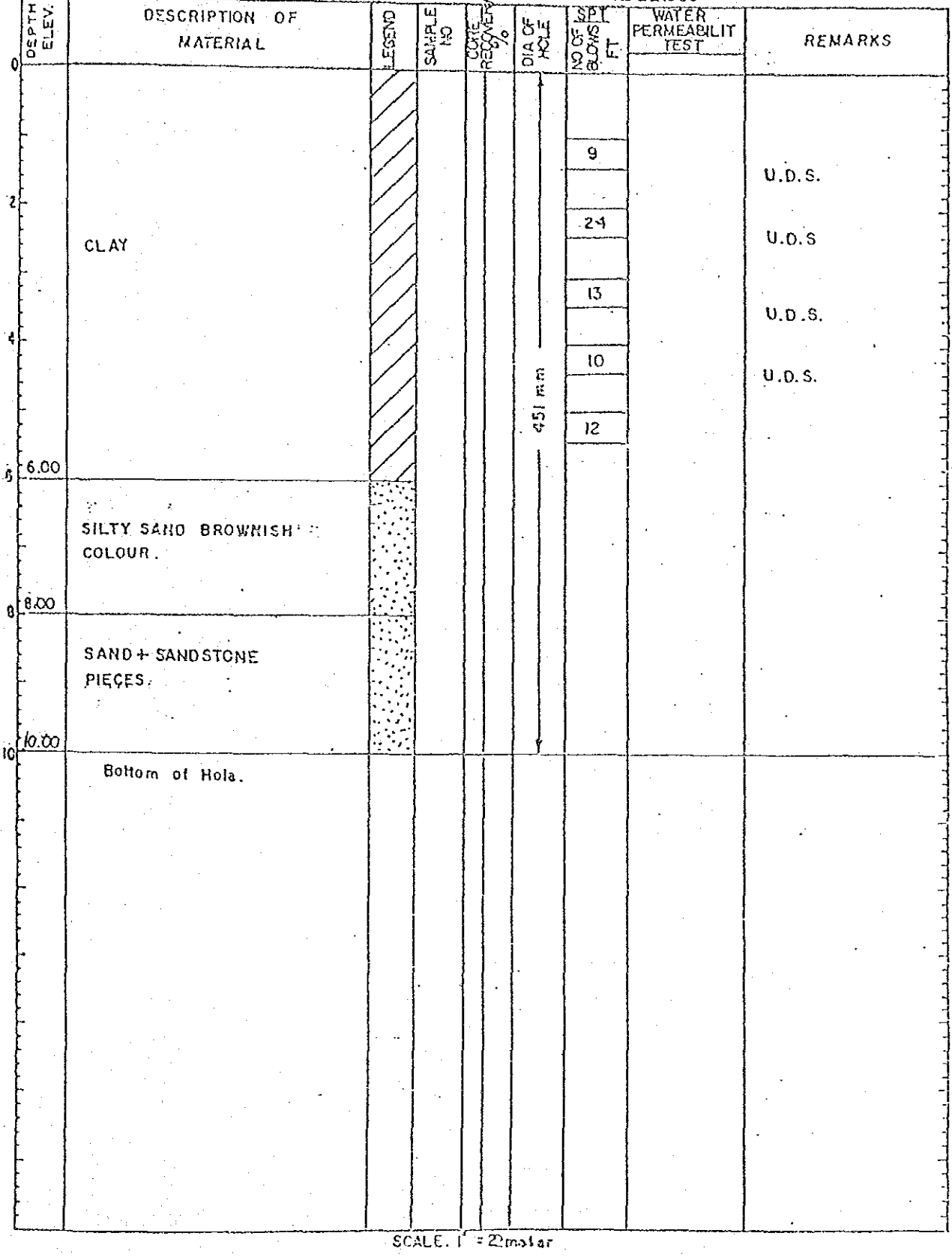
DEPTH ELEV.	DESCRIPTION OF MATERIAL	LEGEND	SAMPLE NO	CORE RECOVERY %	DIA OF HOLE	NO OF BLOWS/FT. SPT	WATER PERMEABILITY TEST	REMARKS
0					451 / 305 mm			
						5		
2						4		
	CLAY							
						8		
4						13		
5.30								
	SILTY SAND					11		
8.00								
	SAND + GRAVEL							
9.00								
	SILTY CLAY							
10.00								
	Bottom of Hole.							

SCALE. 1" = 2 meter.

BOREHOLE LOG

PROJECT SOIL INVESTIGATION
CARRIED OUT FOR
GROUND LEVEL -1.21

BOREHOLE NO. 5
LOCATION ISLAMABAD
GROUND WATER LEVEL 5.60 metar
DATE 1-2-1989



SCALE. 1" = 2metar

SUMMARY OF SOIL CHARACTERISTICS

PROJECT:— SOIL INVESTIGATION ISLAMABAD PROJECT.

S. No.	B.H. No.	Sample No.	DEPTH From	DEPTH To	Natural Dry Density gm/cc	Natural M/C %	Specific Gravity	Atterberg Limits L.L. %	Atterberg Limits P.L. %	Atterberg Limits P.I. %	Grain Size Analysis Gravel % >0.2 mm.	Grain Size Analysis Sand %	Grain Size Analysis Silt %	Grain Size Analysis Clay %	Unconfined Compression Strength tons/sq.ft.	Direct Shear Test φ Degrees	Direct Shear Test C tons/sq.ft.	Consolidation Test C_v	Consolidation Test C_c	Consolidation Test Load Sequence Tons/Sqft.	Consolidation Test $C_v \times 10^{-3}$ Sqcm/sec.	Classification	Remarks
1	2	3	4		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1	1	0.00	2.00 M				43	20	23	-	12	61	27								SILTY CLAY	
2		2	3.00	4.00 M				38	17	21	-	14	63	23								-do-	
3		3	5.00	6.00 M				40	19	21	-	13	65	22								-do-	
4		4	8.00	9.00 M				39	17	22	-	12	60	28								-do-	
5	2	5	1.00	3.00 M				43	24	19	-	16	54	30								SILTY CLAY	
6		6	5.00	7.00 M				40	20	20	-	17	55	28								-do-	
7		7	7.00	10.00 M				25	22	3	-	55	38	7								SILTY SAND	
8	3	8	4.50	6.00 M	1.73	15.3	2.60	-	-	-	-	-	-	-	12.2	-	-	0.55	0.093	0 - 0.25	62.8		Undis.
																				0.25 - 0.50	59.9		
																				0.50 - 1.00	57.1		
																				1.00 - 2.00	55.9		
																				2.00 - 4.00	58.1		
																				4.00 - 8.00	55.8		
9	3	9	5.00	6.00 M				18	13	5	-	50	32	2								SILTY SAND	
10	4	10	3.50	5.00 M				29	10.5	9.5	-	52	43	5								SILTY SAND	
11	5	11	4.50	6.00 M	1.61	23.4	2.64	-	-	-	-	-	-	-	38.2	-	-	0.64	0.110	0 - 0.25	26.2		
																				0.25 - 0.50	34.0		
																				0.50 - 1.00	39.7		
																				1.00 - 2.00	43.0		
																				2.00 - 4.00	41.1		
																				4.00 - 8.00	38.5		
12		12	6.00	7.00 M				15	11	4	-	71	25	-								SILTY SAND	

7. Result of Water Quality Analysis

(1) City Water around the Construction Site

Results of city water analysis are shown in the following table.

Table ANALYSIS OF CITY WATER

Item	Standard of Water on Japanese Water Regulation	Result of Analysis
pH	5.8~8.6	7.1
Odor	Nil	Nil
Taste	Nil	Nil
Chromaticity	5 deg. or less	1 deg,
Turbidity	2 deg. or less	Less than 1 deg.
Nitrite Ion (NO_2-): Nitrite Ion (NO_3-)	10mg/ℓ or less	0.45mg/ℓ
Chloride Ion (Cℓ-)	200mg/ℓ or less	8.2mg/ℓ
Oxygen Demand by Potassium Permanganate at 100°C	10mg/ℓ or less	1.5mg/ℓ
Bacterium	100 Nos/mℓ or less	Nil
Coliform Group	Nil	Nil
Cyanide Compounds	Nil	Nil
Mercury (Hg)	Nil	Nil
Organic Phosphate	Nil	Nil
Copper (Cu)	1.0mg/ℓ or less	Less than 0.01mg/ℓ
Iron (Fe)	0.3mg/ℓ or less	Less than 0.2mg/ℓ
Manganese (Mn)	0.3mg/ℓ or less	Less than 0.1mg/ℓ
Zinc (Zn)	1.0mg/ℓ or less	0.575mg/ℓ
Lead (Pb)	0.1mg/ℓ or less	0.01mg/ℓ
Hexavalent Chromium	0.05mg/ℓ or less	0.02mg/ℓ
Cadmium (Cd)	0.01mg/ℓ or less	0.005mg/ℓ
Arsenic (As)	0.05mg/ℓ or less	0.005mg/ℓ
Fluorine Compounds	0.8mg/ℓ or less	Less than 0.15mg/ℓ
Hardness	300mg/ℓ or less	199mg/ℓ
Evaporation Residues	500mg/ℓ or less (* 1,000 mg/ℓ or less)	266mg/ℓ
Phenoles	0.005mg/ℓ or less	Less than 0.005mg/ℓ
Anion Surface Active Agents	0.5mg/ℓ or less	Less than 0.2mg/ℓ

* WHO regulation

(2) Well Water around the Construction Site

Results of well water analysis are shown in the following table.

Table ANALYSIS OF WELL WATER

Item	Standard of Water on Japanese Water Regulation	Result of Analysis
pH	5.8~8.6	7.1
Odor	Nil	Sensible
Taste	Nil	Sensible
Chromaticity	5 deg. or less	3 deg.
Turbidity	2 deg. or less	Less than 1 deg.
Nitrite Ion (NO_2-): Nitrite Ion (NO_3-)	10mg/ℓ or less	5.32 mg/ℓ
Chloride Ion (Cℓ-)	200mg/ℓ or less	82.9 mg/ℓ
Oxygen Demand by Potassium Permanganate at 100°C	10mg/ℓ or less	3.7 mg/ℓ
Bacterium	100 Nos/mℓ or less	Nil
Coliform Group	Nil	Nil
Cyanide Compounds	Nil	Nil
Mercury (Hg)	Nil	Nil
Organic Phosphate	Nil	Nil
Copper (Cu)	1.0mg/ℓ or less	Less than 0.01mg/ℓ
Iron (Fe)	0.3mg/ℓ or less	Less than 0.05mg/ℓ
Manganese (Mn)	0.3mg/ℓ or less	0.01mg/ℓ
Zinc (Zn)	1.0mg/ℓ or less	0.142mg/ℓ
Lead (Pb)	0.1mg/ℓ or less	Less than 0.01mg/ℓ
Hexavalent Chromium	0.05mg/ℓ or less	Less than 0.02mg/ℓ
Cadmium (Cd)	0.01mg/ℓ or less	Less than 0.005mg/ℓ
Arsenic (As)	0.05mg/ℓ or less	Less than 0.005mg/ℓ
Fluorine Compounds	0.8mg/ℓ or less	Less than 0.15mg/ℓ
Hardness	300mg/ℓ or less	394mg/ℓ
Evaporation Residues	500mg/ℓ or less (* 1,000 mg/ℓ or less)	761mg/ℓ
Phenoles	0.005mg/ℓ or less	Less than 0.005mg/ℓ
Anion Surface Active Agents	0.5mg/ℓ or less	Less than 0.2mg/ℓ

* WHO regulation