PART II

ELECTRICAL SERVICES

GENERAL REQUIREMENTS

To obtain a power distribution system which is adequate to meet the service reliability requirements of the college plant and yet which is lowest in cost, requires that the power system engineer plan the power distribution system on an overall inclusive basis. While the electrical system is installed in parts, such as substations, cable, bus switchgear, transformers, etc., the system nevertheless functions as a complete integral unit. There are many factors which must be considered in the overall planning of a power system. Some of the more important aspects to be considered are safety, economics, planning for future load growth, simplicity, flexibility, and service reliability. Of course, the consideration of all factors must be tempered by judgment.

In the course of designing the power system, the following will be checked:

1. Nature and magnitude of loads.
2. Source of power.
3. Cost of power system.

4. Selection of voltage levels.

5. Circuit arrangement.

6. Economical substation size.

7. Secondary distribution within buildings.

8. Short-circuit protection.

9. Overcurrent protection.

10. Grounding.

The electrical system design for the George Mason College project will consist of four major divisions: the overall power distribution system, the interior electrical system for each building, the exterior area lighting system, and communication and signaling systems.

A. Overall Power Distribution System

From the preliminary site plan we learn the George Mason College is to be built in stages. The first stage will require about 500 KVA of power based on preliminary estimate. The service for Stage I will be brought into the site by the utility company at 7200/12500 Y volts, 3 phase, 4 wire and will be transformed to 2400 volt, 3 phase, 3 wire for distribution between buildings. The choice of 2400 volts as distribution voltage is based upon the great distances between extreme buildings on the site and upon our present preliminary knowledge of the loads. This distribution voltage is subject to change at the time of system design depending upon final load information and building arrangements.

Transformers substations would be used at each building to transform the voltage to 120/208 Y, 3 phase, 4 wire for utilization within buildings. The type of distribution circuit arrangement contemplated is a radial type in view of the low cost of such a system. Yet, this system provides adequate service reliability and easy operation. The method of distribution would be underground duct banks between buildings for present and future feeders. The use of overhead feeders on pole lines, though somewhat less expensive, would mar the effects of the landscaping and would also present a hazard to personnel and buildings. The substations would consist of either dry-type transformers within buildings or liquid-cooled transformers in underground vaults adjacent to each building, depending on relative costs. Subdistribution within each building would be by means of 209/120 volt switchboards, feeders, and panelboards.

When building construction progresses to Stages II, III, and IV, a new service could be brought in. This service would require approximately 1000 KVA additional capacity and also would be transformed from 12500 volts to the intermediate voltage for site distribution.

The choice of 2400 volts as distribution voltage, mentioned above, is based on the ultimate size of the college plant in order to be adequate for Stages II, III, and IV in addition to the present Stage I. This will give the completed college plant a single voltage distribution system, with typical substation units at each building. This system offers the advantage of interchangeability of equipment and reduction in the complexities and cost of maintenance, and spare parts inventory.

B. Interior Electrical System

The electrical design of the interior of each building would depend upon the type of lighting fixtures, possible maximum electric loads on the respective floors, the duration of the peak loads, the additions of load by various appliances, special requirements such as laboratories and the probable increases due to changes in use of the floors. The electrical design also involves a knowledge of the number, location, and maximum loading of all utilization outlets required. With this information, it is possible by using approximate demand factors, to compute the number and size of circuits and feeders required. The exercise of judgment becomes a design factor only in determining which circuits should have spare capacity and in what amount their current carrying capacity should exceed the calculated load. This provides for increased load capacity which is likely to be experienced during the useful life of the building. Of course, specific requirements of the university regarding spare capacity will also be included in the design.

The National Electrical Code will be regarded as the minimum standard for the interior design, with any local codes or ordnances adhered to when applicable. In view of the small number of motors required, it is feasible to use 208 volt, 3 phase motors within the buildings to avoid the expense of additional voltage levels.

C. <u>Exterior Area Lighting System</u>

The design of the exterior area lighting system must be based on the Architectural and Landscaping design. The source of power for the area lighting can be obtained from a central location or from the buildings nearest the area to be lit. We understand that a minimum of area lighting is to be installed under Stage I. In this case, due to the minimum program and stages of construction, it would be more advantageous to feed adjacent area lighting from the nearest buildings. Additional power capacity for this purpose must be built into the electrical system of each building so that the area lighting can be expanded in the future, paralleling Stages II, III and IV. Control of outdoor lighting will be accomplished by using an astronomical dial time switch as a pilot device to energize lighting contactors. By a suitable relaying system, outdoor lighting will automatically be turned on throughout the site. This system allows complete flexibility as outdoor lighting demands increase in future building phases.

D. Communication and Signaling Systems

Consideration must be given to the installation of various systems of communications and signaling for safety of personnel and property, to facilitate the conduct of school business and to implement education through audio-visual means. Many aspects of these communications and signaling facilities are controlled by state laws and/or local ordinances which must be adhered to. The following systems are usually employed within school buildings:

a. Telephone System

b. Fire and Sprinkler Alarm Systems

c. Watchmen's System

d. Central Control Time System

e. Paging and Announcing System

f. Radio and Television System

g. Closed-Circuit Television System

Facilities for housing these systems provided during construction period make possible the concealment of cables which will improve the general appearance of the building. The mechanical protection afforded the cables and wires serves to prevent service interruptions. The flexibility provided by such facilities makes possible rearrangements and changes in the various communication circuit terminations without the need for drilling holes through finished floors and walls, exposing cables in halls and rooms, and marring walls and trim by wire attaching devices.

The actual type and extent of the systems required will depend on the requirements of the university. They should be analyzed carefully so they will be specified accurately in the final design to meet the school's requirements.

PART III

PLUMBING SERVICES

GENERAL REQUIREMENTS

The general requirements for plumbing facilities to satisfy present and future construction phases for the George Mason College plant call for the following provisions:

Cold water, hot water, hot water recirculation, gas, sanitary and storm water drainage; the selection of fixtures and determination of total number of fixture units; the disposal of chemical and bacteriological wastes coming from the science laboratories; and adequate fire-fighting means. With the addition of a swimming pool in phase III, chlorination and admixture of chemicals, filtration and, possibly, ultraviolet ray treatment for the sterilization of pool water will be needed.

A. Water Distribution System

It is our understanding that the Town of Fairfax will provide a water supply main to the College Site, and that the Consulting Site Engineer will provide for bringing the water supply line to a location at a building mutually agreed upon.

We recommend the use of a single metered service line and a water distribution system between buildings with its point of origin downstream of the metering station.

Each building would be furnished with a stop and waste valve to permit individual isolation of buildings in the event of repairs.

The materials used for water-supply pipes within a building include wrought iron and steel, usually galvanized; brass; and copper. Galvanized iron, wrought iron and steel pipes with threaded malleable iron fittings, have given satisfactory service, experience with them is wide, and their first cost is relatively low when compared with other acceptable materials. Copper and brass pipe using sweat or soldered copper fittings are more resistant to corrosion than are galvanized pipes and they are sufficiently smoother to effect a comparable economical installation by somewhat reducing their size in relation to galvanized steel. The use of brass or copper will also result in a longer life and greater reliability. We therefore suggest that for interior water distribution within buildings either brass or copper piping and fittings be considered first. Detailed material take-off and an economic comparison of material and labor (installation) costs will be one of the decisive factors in the final selection of these materials. Such factors as longer life, greater reliability, lower maintenance and repair costs deserve close consideration, however, particularly where comparable cost estimates are so close to each other as to make above variables the prime basis for material selection. It is suggested that specifications state that all piping 6" and smaller for cold, hot and circulation water, except underground distribution piping shall be brass pipe, standard iron pipe size, conforming to the standards of the A.S.T.M. current edition with a minimum copper content of 85%. All lengths shall have identifying name stamped on metal.

Piping for underground domestic water distribution shall be cast iron, such as AWW Class 150 corporation pipe conforming with the standard specifications of the American Water Works Association except piping 2" and smaller shall be copper tubing.

We recommend that all cold water piping, except riser branches in enclosed shafts and vertical furring, shall be covered with heavy duty 1" thick sectional wool felt covering with tar paper lining on the inside and heavy glazed asbestos jackets. All hot water and hot water circulation piping throughout, except riser branches in enclosed shafts shall be covered with heavy duty 1" thick 4-ply air cell sectional pipe covering with heavy glazed asbestos jackets.

B. Sanitary Drainage System

It is our understanding that the Consulting Site Engineer will provide a sanitary sewer system to which the work to be designed by American Hydrotherm Corporation will tie in. We will determine the location of tie-in points at each building in consultation with the site engineer and provide the design for all interior plumbing. We recommend that all leaders, soil, waste, vent and drainage lines 2" and larger shall be extra heavy cast iron soil pipe and fittings. Galvanized steel screwed pipe and fittings can be substituted in lieu of cast iron specified.

It is suggested that all sanitary house sewer piping shall be extra heavy cast iron Bell & Spigot pipe and fittings.

A very limited storm sewer system, primarily serving the asphalt surfaced parking lot, will be provided by the site planning consultant. Roof drains of cast iron, copper, lead or other corrosion-resisting materials furnished with strainers and proper flashing shall serve to drain building roofs. Leaders shall carry the roof drainage to ground level where it will be dissipated either through a properly graded runoff, subsoil or foundation drains.

C. Gas System

Points of location requiring gas services are the laboratories and the kitchen. It is conceivable that the Gas Utility Company will not install a gas main to the College Site at the Utility's expense because of the low anticipated gas consumption. The use of bottled gas should then be given consideration. The installation of a municipal gas main would, however, be preferable, considering future expanding requirements and greater reliability.

If a municipal gas main is available, suitable service line connection and distribution as well as interior building piping will be designed by the Engineer. Necessary arrangements will have to be made with a utility company to bring service connections to the property line or other suitable points and to provide the necessary pipe, fittings, drip pots, valves, service cocks, governors, etc. to extend these services into the building. Wherever possible, gas service lines should pitch toward the gas main, otherwise, if pitching toward buildings, they should be provided with drip legs. We recommend that gas piping inside buildings shall be standard weight black steel pipe with malleable iron fittings. We also suggest that at the outside of the wall at the entrance and exit point of gas service to each building, a gravel vent pit and a $1\frac{1}{2}$" galvanized vent pipe be installed. Because of greater economics attained through conjunctional metering, we recommend that a single gas meter be installed and a gas distribution system between buildings be provided.

D. Fire Protection.

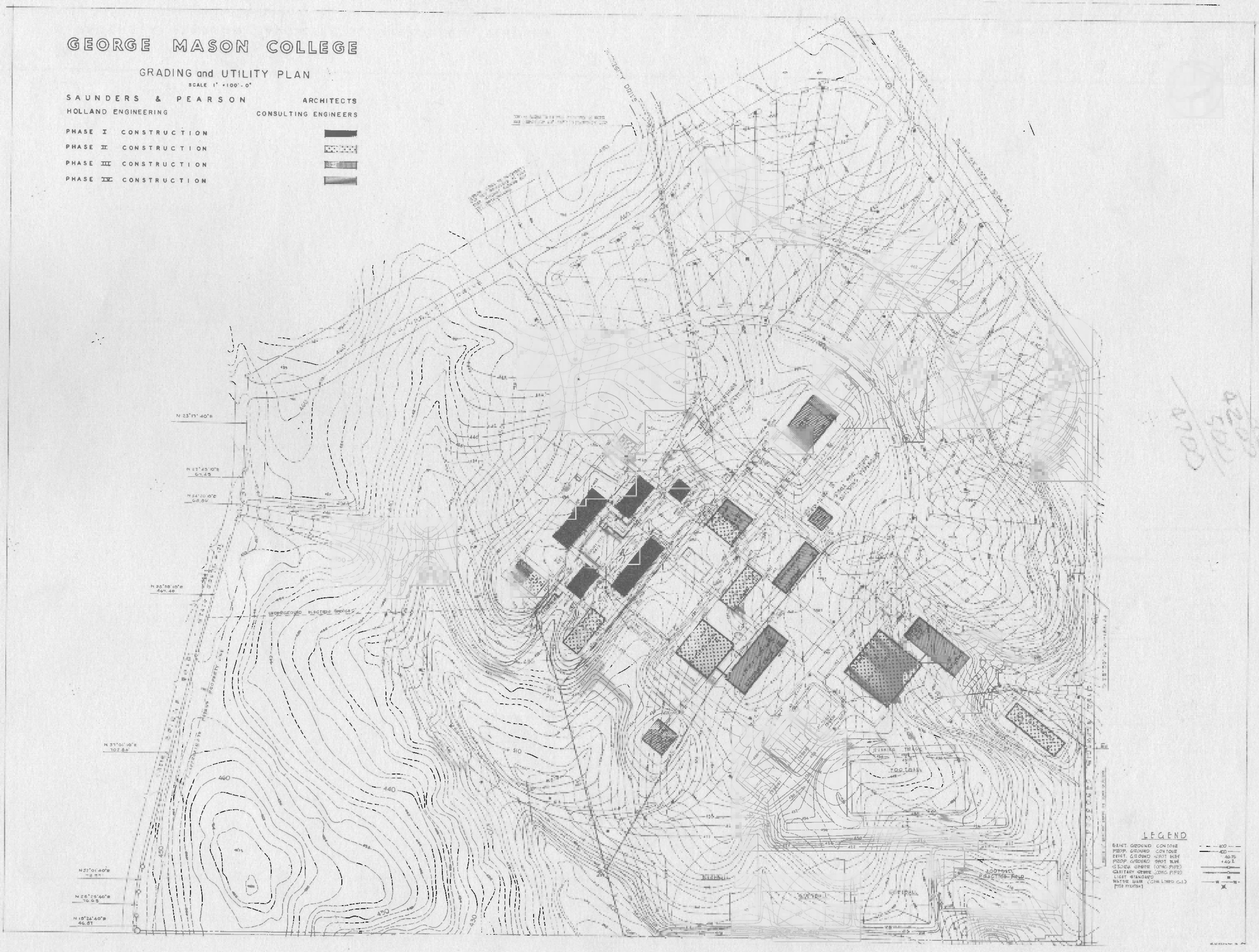
All buildings will be of fire resistant construction. It is a matter of mutual co-ordination between local authorities, the owner's insurance underwriter and recommendations by the National Board of Fire Underwriters or Factory Mutual to establish adequate fire protection. It is anticipated at this preliminary planning stage that a system of fire hydrants properly located around the Campus site in conjunction with wall-hung soda-acid type hand fire extinguishers might fulfill overall requirements excepting such locations as laboratories and kitchen which might call for special treatment.

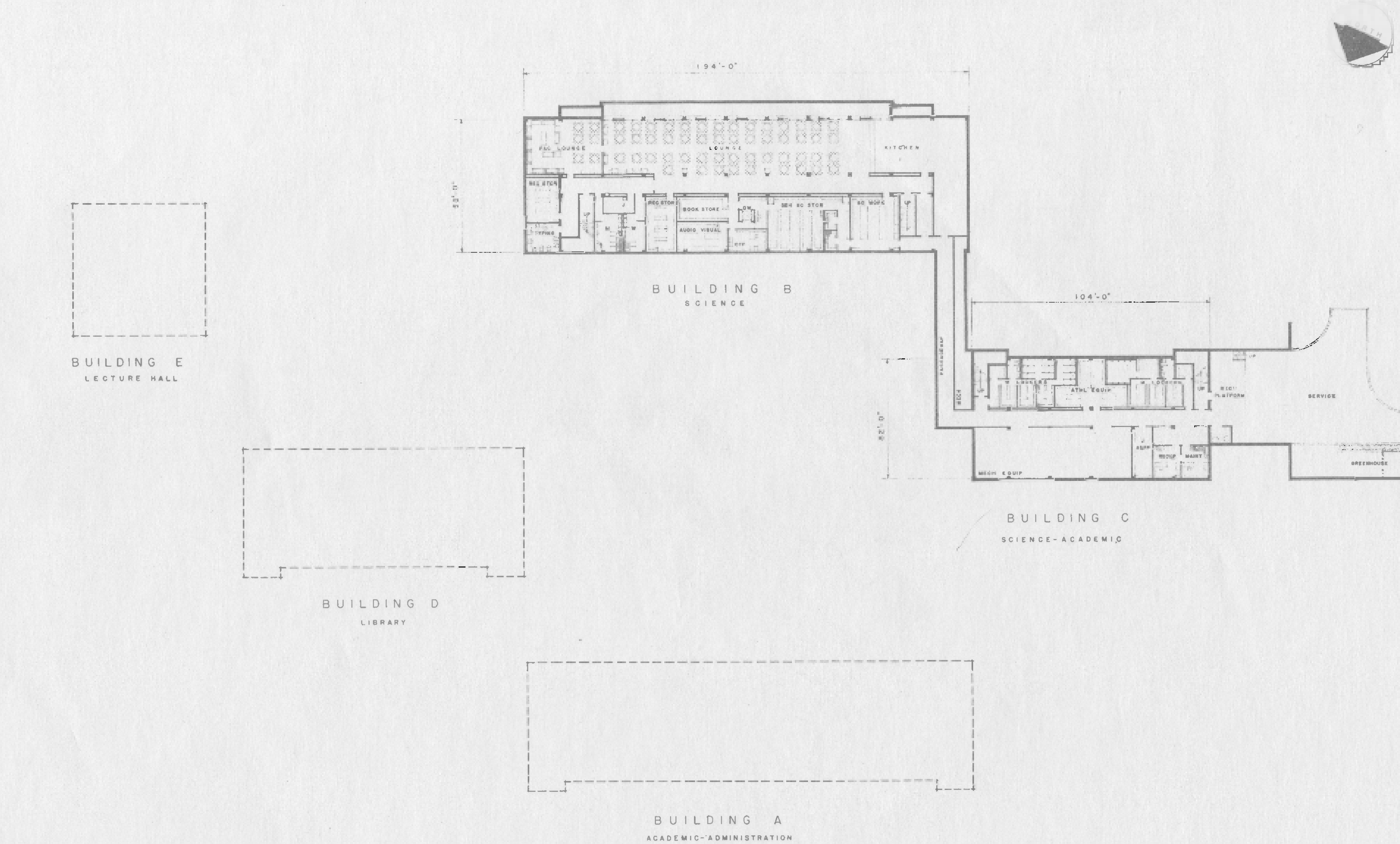
E. Miscellaneous

After determination of laboratory requirements means for the disposal of chemical and bacteriological wastes can be selected, if necessary. Consideration will then be given to the application of special traps, interceptors, acid resistant fittings and basins as required. The necessity for the disposal of solid garbage also deserves investigation in the overall plumbing scheme as does the future pool drainage and pool sanitation problem during the third phase.

100 FOOT GRID BASED ON VIRGINIA RECTANGULAR GRID SYSTEM
(NORTH ZONE) 1927 N.A. DATUM
VERTICAL CONTROL BASED ON 1929 G.A. DATUM
NORTHERN VIRGINIA COLLEGE
OF
THE UNIVERSITY OF VIRGINIA
SHEET NO. 1 OF 1
SCALE 1" = 100'
CONTOUR INTERVAL 2'
200 FEET
0
200'
400'
FAIRFAX
RTE. 236
LOCATION MAP
1


GEORGE MASON COLLEGE
MASTER SITE PLAN
SCALE: 1" = 100'-0"
SAUNDERS & PEARSON ARCHITECTS
ANDERSON BECKWITH & HAIBLE CONSULTING ARCHITECTS
UNIVERSITY DRIVE
THE MEADOW
THE POND
ATHLETICS & RECREATION
PRELIMINARY
SITE PLAN


GEORGE MASON COLLEGE
GRADING and UTILITY PLAN
SCALE 1" = 100'-0"
SAUNDERS & PEARSON ARCHITECTS
HOLLAND ENGINEERING CONSULTING ENGINEERS
PHASE I CONSTRUCTION
PHASE II CONSTRUCTION
PHASE III CONSTRUCTION
PHASE IV CONSTRUCTION
RUNNING TRACK
LEGEND
EXIST. GROUND CONTOUR
PROP. GROUND CONTOUR
EXIST. GROUND SPOT ELEV
PROP. GROUND SPOT ELEV
STORM SEWER (CONC. PIPE)
SANITARY SEWER (CONC. PIPE)
LIGHT STANDARD
WATER MAIN (CEM. LINED C.I.)
FIRE HYDRANT

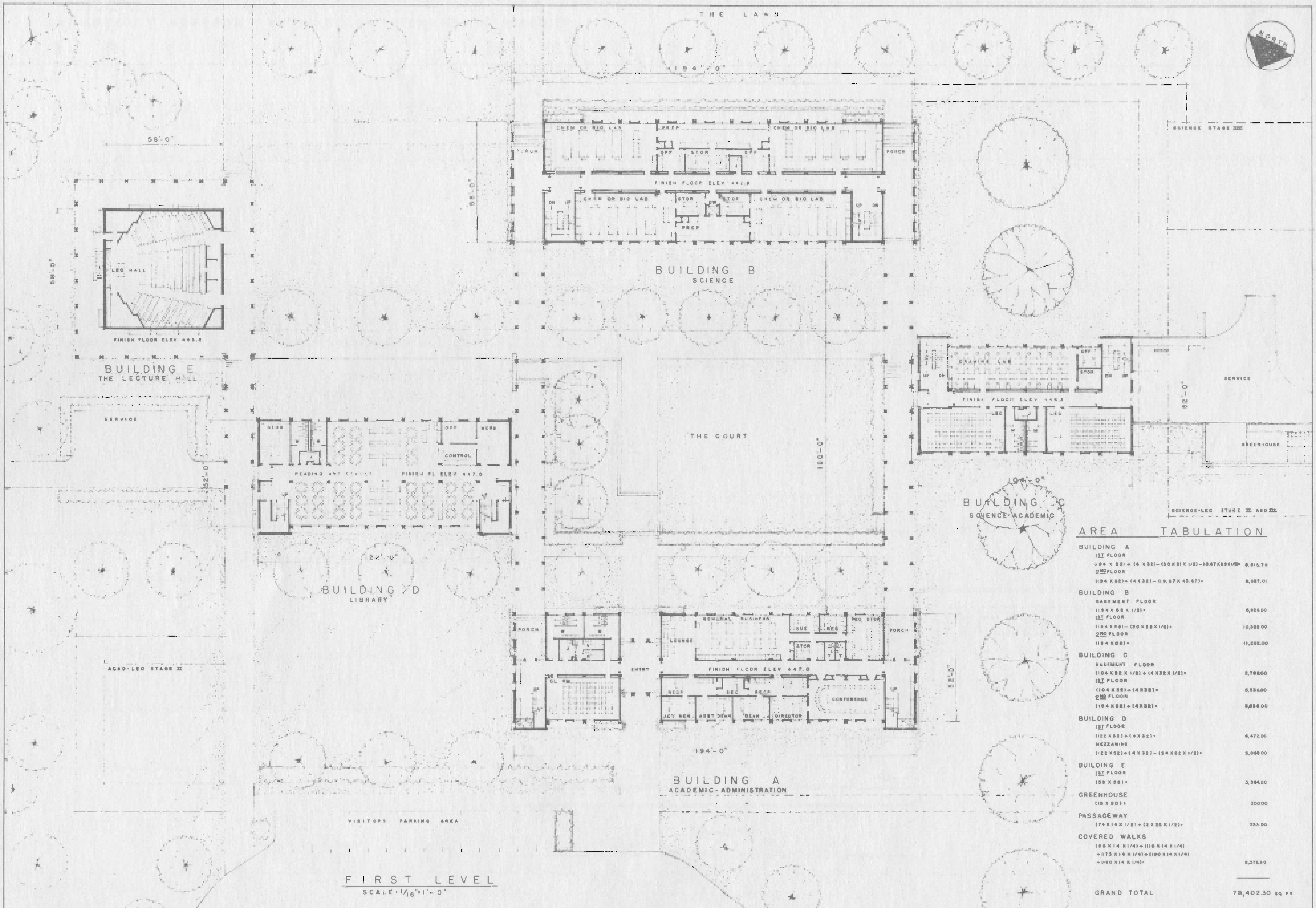


BASEMENT LEVEL

SCALE: 1/16" = 1'-0"

G E O R G E   M A S O N   C O L L E G E

SAUNDERS & PEARSON, ARCHITECTS, ALEXANDRIA, VIRGINIA



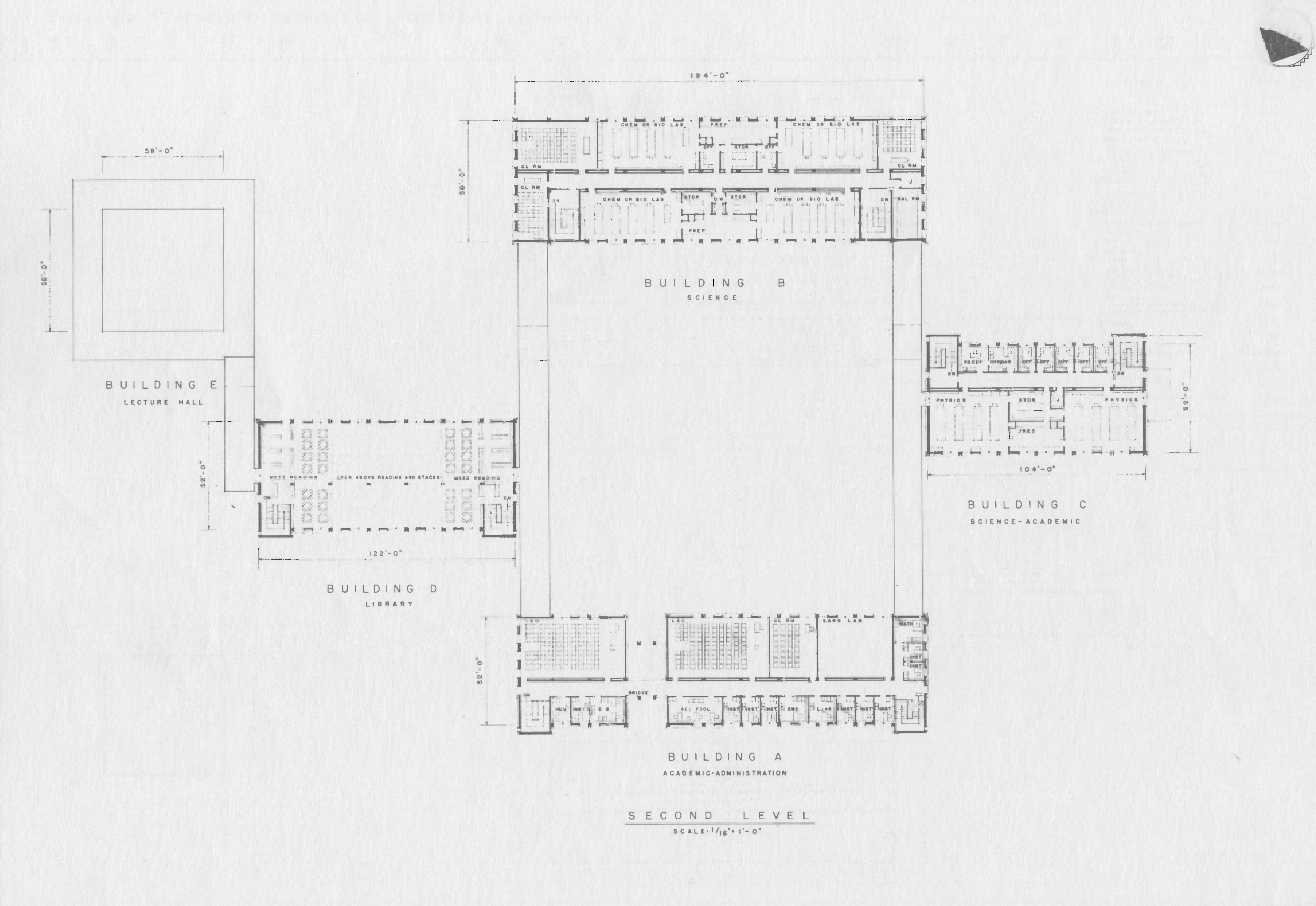
AREA TABULATION

BUILDING A	
1ST FLOOR	
(194 X 52) + (4 X 32) − (30 X 21 X 1/2) − (19.67 X 29 X 1/2) =	9,615.79
2ND FLOOR	
(194 X 52) + (4 X 32) − (19.67 X 43.67) =	9,357.01
BUILDING B	
BASEMENT FLOOR	
(194 X 58 X 1/2) =	5,626.00
1ST FLOOR	
(194 X 58) − (30 X 58 X 1/2) =	10,382.00
2ND FLOOR	
(194 X 58) =	11,252.00
BUILDING C	
BASEMENT FLOOR	
(104 X 52 X 1/2) + (4 X 32 X 1/2) =	2,768.00
1ST FLOOR	
(104 X 52) + (4 X 32) =	5,536.00
2ND FLOOR	
(104 X 52) + (4 X 32) =	5,536.00
BUILDING D	
1ST FLOOR	
(122 X 52) + (4 X 32) =	6,472.00
MEZZANINE	
(122 X 52) + (4 X 32) − (54 X 52 X 1/2) =	5,068.00
BUILDING E	
1ST FLOOR	
(58 X 58) =	3,364.00
GREENHOUSE	
(15 X 20) =	300.00
PASSAGEWAY	
(74 X 14 X 1/2) + (2 X 35 X 1/2) =	553.00
COVERED WALKS	
(86 X 14 X 1/4) + (116 X 14 X 1/4) + (173 X 14 X 1/4) + (180 X 14 X 1/4) + (180 X 14 X 1/4) =	2,572.50
GRAND TOTAL	78,402.30 SQ FT

G E O R G E M A S O N C O L L E G E

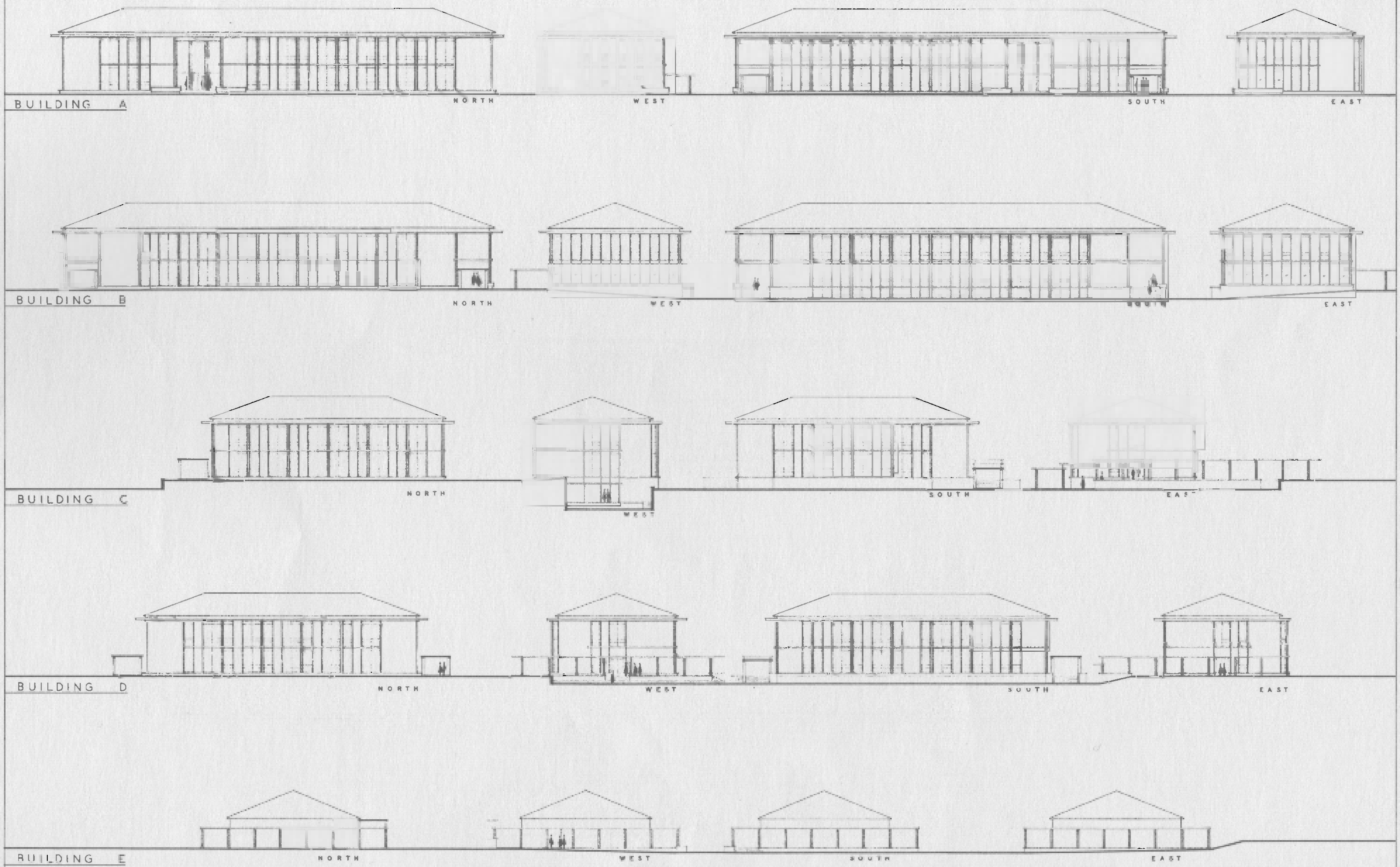
SAUNDERS & PEARSON, ARCHITECTS, ALEXANDRIA, VIRGINIA

5



GEORGE MASON COLLEGE

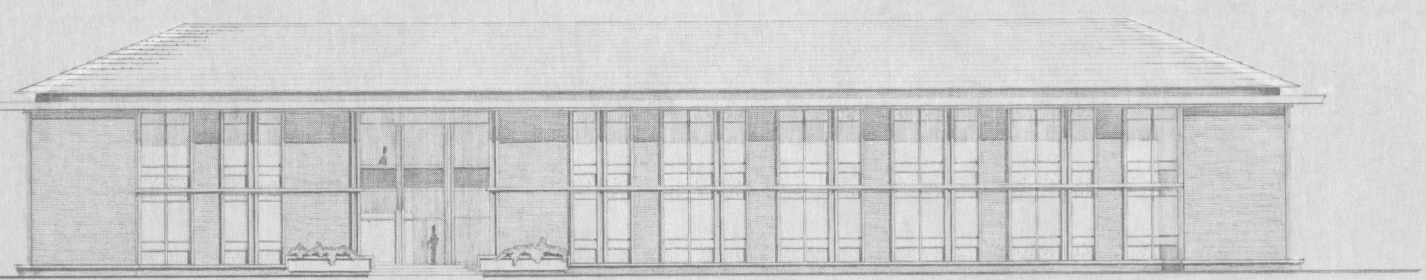
SAUNDERS & PEARSON, ARCHITECTS, ALEXANDRIA, VIRGINIA



G E O R G E M A S O N C O L L E G E

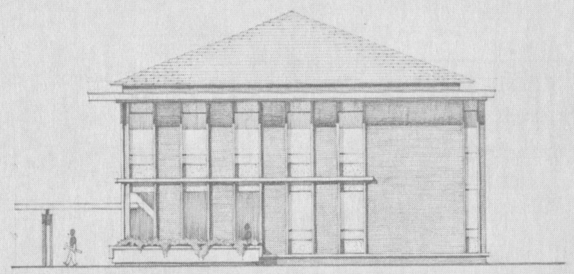
SAUNDERS & PEARSON, ARCHITECTS, ALEXANDRIA, VIRGINIA

7



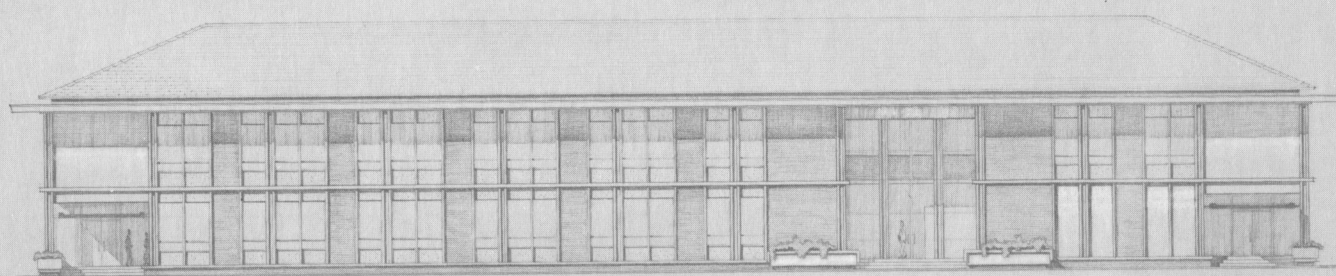
BUILDING A – NORTH ELEVATION – George Mason College – Joseph Saunders & Associates, Architects scale: 1/8" = 1'-0"

2



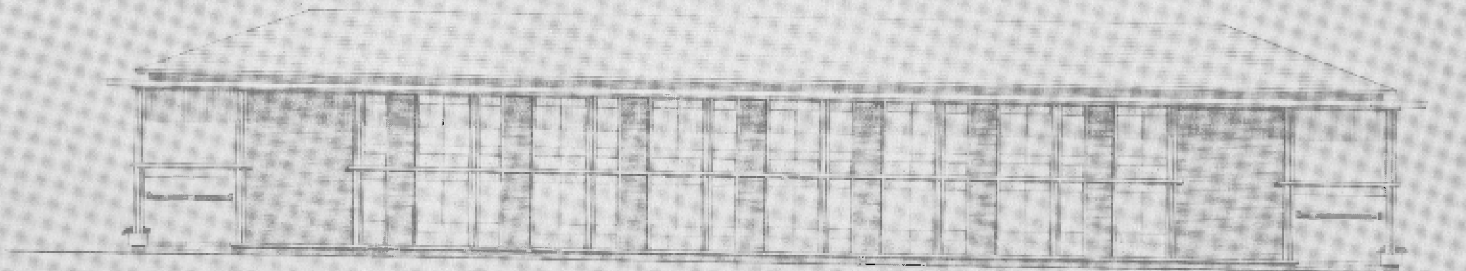
BUILDING A EAST ELEVATION SCALE 1/8"=1'-0"

3



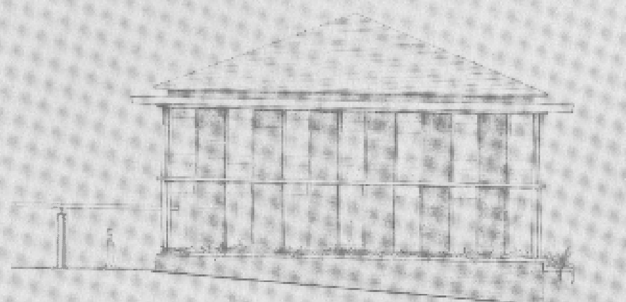
BUILDING A – SOUTH ELEVATION scale: 1/8" = 1'-0"

4



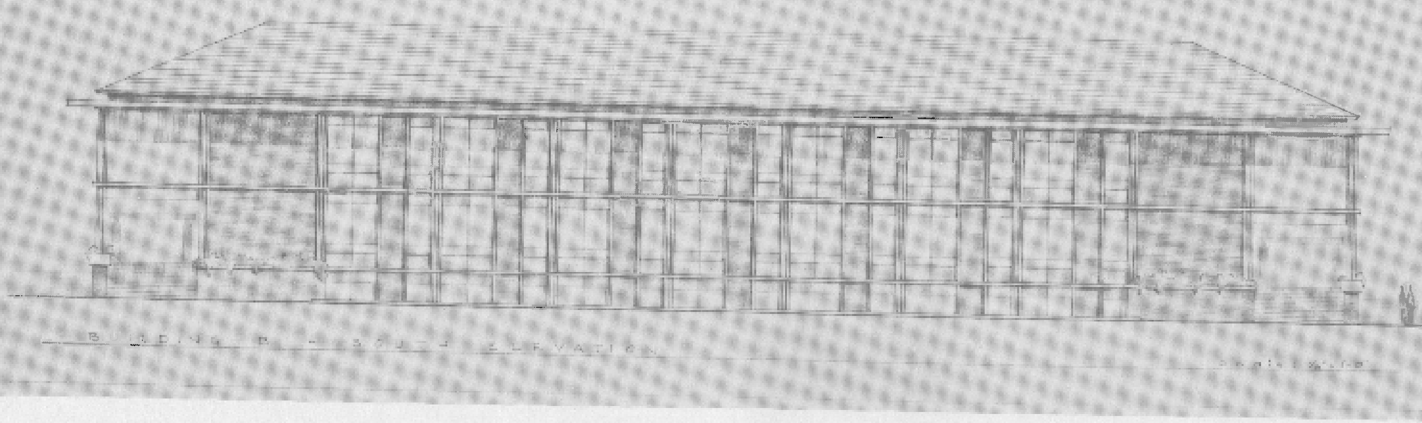
BUILDING B - NORTH ELEVATION

5



BUILDING B WEST ELEVATION

6



BUILDING B - SOUTH ELEVATION

7