TITLE:
Expansion of the Upper Darby Kindergarten Center :Final Report

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A FINAL REPORT

Submitted To:

Professor John Morris

&

The Senior Project Design Faculty of Drexel University

Submitted By:

SVM Engineers

CAE 10-2001

Expansion of the Upper Darby Kindergarten Center

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Submitted in partial fulfillment of the requirements for

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ABSTRACT

The Drexel Hill Elementary school was renovated in 1996 and opened as the Upper Darby Kindergarten center in 1997. Students from five of eight elementary schools in the Upper Darby School District attend the Kindergarten Center, located at 3200 State Road, Drexel Hill, Pennsylvania. The school building is tailored toward the needs of young students; spacious classroom design fosters cognitive learning in both the traditional desk setting and play areas. The Kindergarten Center is currently filled to its capacity of six hundred students. An expansion of the Center is necessary for the two hundred kindergarteners currently educated at Primos, Hillcrest, and Westbrook Park elementary schools to benefit from this unique environment.

SVM Engineers has designed such an expansion. The primary feature of our expansion program is an addition to the existing building. The new addition features a grand entryway, a multipurpose space with an adjoining kitchen, a computer lab, and classrooms to accommodate two hundred students. Lightweight structure and efficient building systems are key elements of our design. Students and faculty will be able to gain access to the new addition through the existing building on every floor. Our program also includes a renovation of the existing building to expand the day care facility. The site has been reconfigured to expand the parking lot.

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I. PROBLEM BACKGROUND

The current building at 3200 State Road in Drexel Hill, Pennsylvania was constructed in 1926 and opened as the Drexel Hill Elementary School. The school operated between 1926 and 1981. For the next four years, the building was vacant. From 1985 to 1995 a portion of the building was leased to Delaware County Hospital to be used as storage. In 1991, the Upper Darby Recreation Center was located on the second floor of the building, and the two tenants shared the building until 1995. According to a study conducted in 1997, the Upper Darby School District renovated Drexel Hill Elementary School to create the Kindergarten Center as part of a plan to cope with increasing enrollment throughout the district [19]. Renovations on Drexel Hill Elementary School began in 1995, and the Kindergarten Center first opened its doors in September 1997. A location map may be referenced in Figure 1.

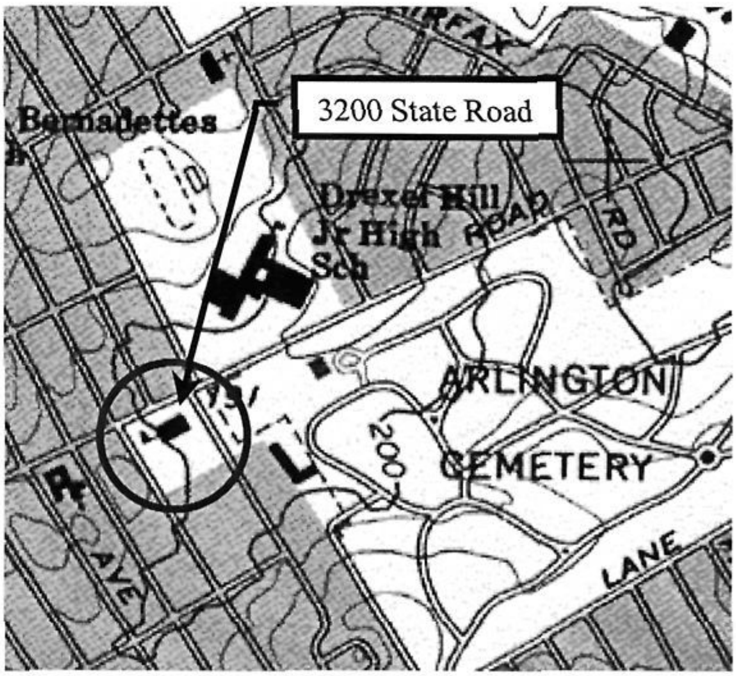

Figure 1: Location Map

The Kindergarten Center holds students from five of the eight elementary schools in the Upper Darby School District. According to the most currently available data, the center is filled to capacity with a total of 602 students, with a staff of 34 adults [19]. At the three overcrowded elementary schools not currently being served by the Kindergarten Center, there are 201 children enrolled in kindergarten classes. In order to create extra classroom space, these schools have been forced to install temporary trailers. It is extremely difficult to replicate the traditional learning environment encountered in a classroom, which is crucial for stimulating the minds of young students, in a trailer. See Appendix A for the locations of all eight schools.

According to a study conducted in 1998, the total elementary school enrollment will remain relatively stable with only small fluctuations in enrollment. For example, there was a 0.68% increase in enrollment in 1998. During that same year, the kindergarten enrollment increased by 2.4% [19]. Such increases in kindergarten enrollment do not correspond with an increase in total elementary enrollments because students are lost after kindergarten to private and parochial schools. Thus, additions to the three elementary schools may not be warranted because the increase only affects one grade level.

The relocation of a majority of the district kindergarten students in the new building has relieved overcrowding at five elementary schools. This centralization has also created a unique environment for both students and staff. In the Kindergarten Center, the township has created "a climate that fosters literacy through a wide range of listening, speaking, reading, and writing experiences." [14]

This special learning atmosphere should be shared with all kindergarteners, regardless of their location within the district. The school district proposed to relocate all of the kindergarteners to the new center; however, the existing building was only large enough to accommodate 75% of the students. Consequently, 201 students are enrolled at overcrowded satellite elementary schools. In order to accommodate these additional students and staff members at the existing Kindergarten Center, an addition to the building is necessary.

II. PROBLEM STATEMENT

The Hillcrest, Primos, and Westbrook Park Elementary Schools are filled to capacity. Current studies show that the kindergarten enrollment growth rate is positive. In order to accommodate this increase in student population, it is desirable to relocate the kindergarteners from the aforementioned elementary schools to the Kindergarten Center.

Because the Center is filled to capacity, an addition would be required to accommodate the new students. This addition would require classrooms for instruction of the 201 new students and the supporting facilities.

III. DESIGN PROCESS

We have performed a review of the local building codes that will constrain our building design. From this review we developed a criteria for design and an architectural program, which is a list of the spaces to be included in our building and the site. See Appendix B and C. We then defined the scope of the project, described in this section. Detailed design drawings will be provided for all building areas within the scope of work; subcontractors will develop items beyond our scope.

A. ARCHITECTURE

The Kindergarten Center is a school tailored to preschoolers' needs. Traditional classroom spaces have been integrated with play areas in order to provide an environment that fosters both social and cognitive development. Specially placed fixtures, customized furnishings, and educational programming reinforce the "catered for kindergarteners" theme. This "catered for kindergarteners" theme will be continued within the addition.

SVM has established the architectural program of spaces that must be included within the new building and the site reconfiguration. The renovation and expansion will total approximately 27,372 square feet. It will include 4,687 square feet of kindergarten classrooms and support spaces. The day care center will remain in the existing building and will be expanded to occupy the entire ground floor. The area of the multipurpose room including a stage will be 4,993 square feet in the addition. The area of each program space is summarized in Table 1, and detailed descriptions can be found in Appendix C.

Table 1: Spaces to Be Provided (Summary)

FLOOR	SPACE	QUANTITY	AREA (SQ. FT.)	TOTAL AREA
FIRST FLOOR	P.E. Office	1	124.1	124.1
	Kitchen	1	560.6	560.6
	Multipurpose Room	1	4542.6	4542.6
	Stage	1	450.0	450.0
	Storage	2	--	435.1
	Mens Bathroom	1	166.6	166.6
	Women Bathroom	1	192.6	192.6
	Electrical Closet	1	33.8	33.8
			SUBTOTAL	6505.4
SECOND FLOOR	Kindergarten Classroom	6	--	4286.5
	Kindergarten Bathroom	6	37.0	222.0
	Faculty Room	1	280.5	280.5
	Faculty Bathroom	1	37.0	37.0
	Computer Room	1	1005.0	1005.0
	Janitors Closet	1	38.2	38.2
	Electrical Closet	1	33.8	33.8
			SUBTOTAL	5903.0
GROUND FLOOR	General Room	1	7135.4	7135.4
	Transformer Room	1	186.1	186.1
	Pump Room	1	274.7	274.7
	Electrical Closet	1	12.5	12.5
	Elevator Room	1	49.0	49.0
			SUBTOTAL	7657.70
	Circulation	1	7305.8	7305.8
			TOTAL	20066.10

Building Exterior

SVM Engineers have determined that the new addition should match the existing building as closely as possible to maintain a visual sense of unity. The façade of the building will be constructed of course gray ashlar. The stone is to be cut and dressed to design dimensions in a mill. Cut stone is to be laid in a running bond pattern with varying course heights. The new windows will be specified to match the existing windows as closely as possible. The main entrance to the addition will be composed of two (2) sets of double doors. A metal awning will be located above the main entrance. The elevations and section of the building can be seen in Appendix C.

Building Interior

The interior finishes of the addition will be in accordance with all codes and will be determined by an interior designer in coordination with the school district.

Floor Plans

We have created a grand entry of the kindergarten center on the south side of the new addition. We have provided a 4,620 square foot "multipurpose room" on the first floor. This room will serve as a gymnasium, auditorium, and a meeting area for various school functions. A 450 square foot stage is located within the multipurpose room. The first floor includes a kitchen, men's and women's toilet rooms, lobby, physical education office, and storage closets. On the second floor, we have provided six (6) kindergarten classrooms with an average area of 723 square feet. Each classroom will have one toilet room in it. A computer room, faculty room with toilet room, and janitor's closet will also be located on the second floor. The mechanical and pump room will be located in the basement. The basement will be left open and unfinished for future use. An elevator will be installed in the new addition and will be accessible from every floor. For detailed floor plans see Appendix C.

Building Height

The floor-to-floor height is 14 ft from the basement floor to the first floor. The height from the first floor to the second floor is 18'-6". The overall exterior height of the building is approximately 36 ft, which is one foot over the local zoning ordinance; therefore, a variance must be applied for.

Changes from Proposal

Due to changes in the building program, the area of the proposed addition has increased significantly. The current size of the addition is 27,370 square feet; this has increased by 52% from the proposed size of 18,000 square feet.

The basement level of the existing building is currently occupied by the day care center and the multipurpose room. We proposed to relocate the day care center to the new building so that the multipurpose room may be expanded in the existing building. The shape of the existing building rendered it impossible to create a large open space in its basement level; therefore, the multipurpose space was placed in the new building. The current and proposed daycare classrooms will occupy the ground level of the existing building. The areas of planned spaces were adjusted to accommodate the overall expansion in the building footprint.

B. SITE WORK

The site has been reconfigured to accommodate parking for the increased number of faculty, support staff, and visitors. The number of parking spaces has been increased from thirty-one to fifty-four. Included in the fifty-four parking spaces are three handicapped designated spaces, one of which is van accessible. The dimension of each parking stall is nine by nineteen feet. The new parking lot pavement section has been designed in accordance with local zoning laws. The existing site has an impervious area of 1.47 acres. The new addition and increased parking area will increase the total impervious area by 18% to 1.81 acres. The amount of storm water runoff is expected to increase from 25.5 cubic feet per second to 29.1 cubic feet per second. The use of detention ponds or an underground retention basin has not been designed and is out of the scope of this project. To accommodate on grade entrance into the new addition, minor changes in the existing grading are necessary. The site plan, grading plan, and site details can be found in Appendix D.

C. STRUCTURE

Work Completed

Foundation

A review of the available site geology showed that the underlying geologic formation of the site is Wissahickon schist. This formation is hallmarked by gneiss and mica. According to the available geotechnical boring information, the native subsoils at the site are composed of decomposed sandy mica schist. The material naturally exists in a medium dense to dense state of compactness. Settlement of the building pad is estimated to be in the magnitude of one inch; most of the settlement will occur during construction and will not be detrimental to the structure.

SVM Engineers recommend that a mat foundation system be used, with a combination of spread and square footings. A bearing capacity of 4 kips per square foot (ksf) may be used to design footings in the native sit soil. Exterior wall footings should be constructed at least 30 inches below grade in order to reduce the risk of frost penetration.

Groundwater is located at a depth of 14 feet below the round surface and should not have an impact on the foundation.

Superstructure

The goals of the structural system were to provide lightweight support for the building and to minimize the use of columns. The placement of the multipurpose room on the first floor of the kindergarten center expansion had a great impact on its structural design. Because the multipurpose room serves as an auditorium and a gymnasium, it was undesirable to place columns in this space. The longest unsupported length of the multipurpose room is approximately seventy-two feet.

The system that we chose features hollow core deck panels supported by a network of steel W-flange beams. The beams are supported by a steel tube system. All steel was assumed to have a strength of 50 ksi.

- *Load bearing masonry walls* were selected in order to reduce the amount of structural support required within the building.
- *Precast hollow core deck panels* were chosen because they are both lightweight and because they can span distances up to 60 feet without lateral support. We chose 15" thick panels with spans of 25 feet. The selection of these panels will allow the building to be constructed in a more rapid manner. Hollow core slabs have acoustical insulation qualities that are desired in a barrier between gymnasium and classroom areas.
- *Steel beams* support the deck panels. The first floor is supported by W 16 x 100 beams, the second floor is supported by W 44 x 262 beams, and the roof is supported by W 30 x 108 beams. These sizes were chosen because they were the lightest beams that would withstand the bending moment induced by the structural loads. These beams are also the least deep, so that there was adequate space in the ceiling cavity for mechanical equipment.
- The *steel tube column system* was selected to minimize the area occupied by columns. 12" columns were selected to support the ends of the beams on each floor within the wall. In the basement, 3" columns were used to support the first floor; the roof is supported by

4" columns. No intermediate columns were used to support the second floor.

A preliminary design of the structural system may be referenced in Appendix E.

D. MECHANICAL

Loads

SVM's mechanical engineer has performed preliminary load calculations using the heat balance method. A summary of the loads for each zone is given below and the detailed inputs and outputs are given in Appendix F.

Table 2. Peak Heating & Cooling Loads.

Zone	Cooling				Heating	
	Total Coil Load		Air Flow Rate		Sensible Load	
	SQ FT/TON	TONS	CFM/ SQ FT	CFM	BTU/H/SQ FT	MBH
Classrooms	379	16	0.99	6035	8.40	51.2
Computer & Faculty Rooms	113	12.5	5.28	7375	0	0
First Floor	223	32	0.99	6990	10.7	75.8
Kitchen	150	3.7	2.13	1195	14.0	7.8
Ground Floor	Cooling not provided				11.7	98.0

System Selection

SVM Engineers has zoned the building such that each floor is served by a different HVAC system. Each floor has a different occupancy and loading. Zoning in this manner allows the owner to economize in heating and cooling costs by turning down or shutting off units when the spaces they serve are unoccupied.

Packaged rooftop units will be used to condition the first and second floor. These were chosen because a direct expansion system was more economical for this size installation than a chilled water system. Package rooftop units were selected over a split system because they require less interior mechanical space. A hot water coil connected to the existing boiler plant, which has excess capacity, will provide heating.

The computer and faculty rooms will be conditioned by a packaged rooftop heat pump. The large amounts of heat generated by equipment in these rooms is greater than the heat loss through the envelope. The amount of heat loss is small because these rooms are adjacent to the existing building. Therefore, cooling must be provided even during the winter unlike the other zones. The heat pump was chosen for its ability to provide both cooling and heating should a small amount of heating be needed. A separate system is also needed for the kitchen because 100% outdoor air is required for proper ventilation. A split system heat pump will be used for this task.

The basement will be heated using hot water unit heaters. Cooling is not necessary for this zone because it is an unoccupied storage and utility space. Also, it will not have a high heat gain because it is mostly below grade and bordered by the first floor, which is conditioned. A diagram of the system is located in Appendix F.

Design Drawings

The layout of ductwork and heating hot water piping has been completed. These drawings can be found in Appendix F. They include the locations of the packaged rooftop units, exhaust fans, pipe and duct chases, and trunk and branch ductwork. Schedules of selected equipment can also be found in Appendix F.

E. ELECTRICAL

Work Completed

Power Distribution

The electrical demand of the expansion was calculated after determining the use of each room. An allowance of 1 Watt per square foot was made for emergency power. The total electrical demand of the building has been calculated to be 225 kVA. A breakdown of this budget may be referenced in Appendix G.

Electrical service will be brought to the building on the Harper Avenue side to a 600-kVA-service feeder. The power will be delivered to a three phase, step down transformer. This transformer will allow the power to be distributed at 480 volts to the mechanical system and to the kitchen appliances, and at 277 volts to the illumination system. A secondary transformer will be required to supply power at 120/208 volts to the electrical outlets. We propose that a wireless network be implemented in the new building.

Illumination

We have determined the illumination levels for each space by the task that will be performed there. These levels are listed in Table 3 below.

Table 3. Luminance Levels in Various Building Spaces

Area	**Design Footcandles**
Egress/ Toilet Rooms	20
Kitchen	30
Multipurpose and Stage	50
Classroom	60

Because reflected light provides a greater visual comfort level than direct light, and we plan to utilize suspended light fixtures in the addition. Lighting in the hallway will be supplied by wall wash units.

F. PLUMBING

Work Completed

Service Water

The addition to the Kindergarten Center has a water demand of 195.8 fixture units. A flow of 90 gallons per minute is required to meet this demand (2). The current water service connects to the main on Harper Avenue. Because this line passes through our addition, this service will likely be replaced by a service large enough to serve the entire facility. A new water service will connect to the municipal main along Harper Avenue and enter through the mechanical room. The required service for the addition alone was calculated to be 2½ inches (Appendix H). The required service was calculated to be 2½ inches. An up feed distribution system will be used. It is not expected that a pump will be needed if a separate connection to the water main was made for the addition. The building is short and narrow so the 65 pounds per square inch of pressure in the main will be adequate to distribute through a developed length of 170 feet and height of 35 feet.

Hot water will be provided by point of use electric water heaters. SVM determined that this decentralized system was the most cost effective. This system has a lower installation cost than using a hot water storage tank with or without recirculation. Heating water with electricity is more expensive than using a fuel fired boiler. Because, the hot water demand is only 17% of the total demand fixture units, this is not expected to have a significant impact. A tankless water heater will be provided for each fixture group. See the Service Riser Diagram in Appendix H for a schematic representation of the system. Floor plans indicating the location of riser and main piping are located in Appendix H.

Sanitary Drainage

The sanitary system serves a load of 146 drainage fixture units. The building sewer will be 5-inch diameter sloping 1/8 inch per foot of length. It will exit the addition on the north side connecting to the site sanitary sewer which discharges into the municipal sanitary sewer on Shadeland Ave. The sanitary system is depicted on the Drainage Riser Diagram (Appendix H). Riser locations are indicated on the floor plans (Appendix H).

Storm Drainage

The projected area of the addition is 8,780 square feet. The design rainfall is 3.1 inches per hour (2). Four 4-inch roof drains will collect storm water on the roof. Horizontal piping will also be 5 inch diameter and slope 1/8 inches per foot. These will feed into a 6 in. leader on the north and south sides of the building. The building storm sewer will exit on the south side of the building and connect to the existing site storm sewer which discharges into the municipal storm sewer main on Shadeland Ave. The locations of drains and risers and the routing of main piping are shown on the floor plans and the drainage riser diagram (Appendix H).

G. FIRE PROTECTION

Fire Resistance

Exits and exit access shall be made of 3 hour rated construction. All other areas shall be rated one to three hours.

Fire Suppression

The Kindergarten Center is categorized as a light-hazard occupancy. A dry-pipe automatic sprinkler system will be used for fire suppression throughout the building. Pendant sprinkler heads with a ½ inch standard orifice and 135-170°F temperature rating will be installed. Each sprinkler head may cover a maximum area of 200 square feet. The maximum spacing of sprinklers and between branch lines is 15 feet. The total fire demand for the only the new addition has been determined to be 3720 gallons per minute. Portable fire extinguishers rated 2-A rating will be installed on each floor so that the travel distance to any one extinguisher from any point on the floor does not exceed 75 feet. Additional portable fire extinguishers will be installed in the kitchen. Fire protection plans including sprinkler piping may be found in Appendix I.

IV. BUDGET

The Means 2000 Square Foot Cost Guide (15) was used to estimate the cost of the expansion of the Kindergarten Center. The overall price per square foot is estimated to range from \$98.00 to \$105.00 depending on the type of exterior wall used. We propose to use a price of \$100.00 per square foot, which represents a decorative concrete block wall to match the existing facade. Multiplying the estimated price per square foot by the estimated area results in an estimated building price of \$2.7 million. The \$2.7 million cost estimate represents the cost to construct the building and does not include architectural fees, permits, insurance, or furnishings. Architectural fees are estimated to represent 7% of the estimated building price. Both permits and insurance represent about 1% of the estimated building price. Furnishings are estimated to cost \$10 per square foot of floor space. The total cost is estimated to be \$3.2 million. Figure 2 is a graphical representation of the budget.

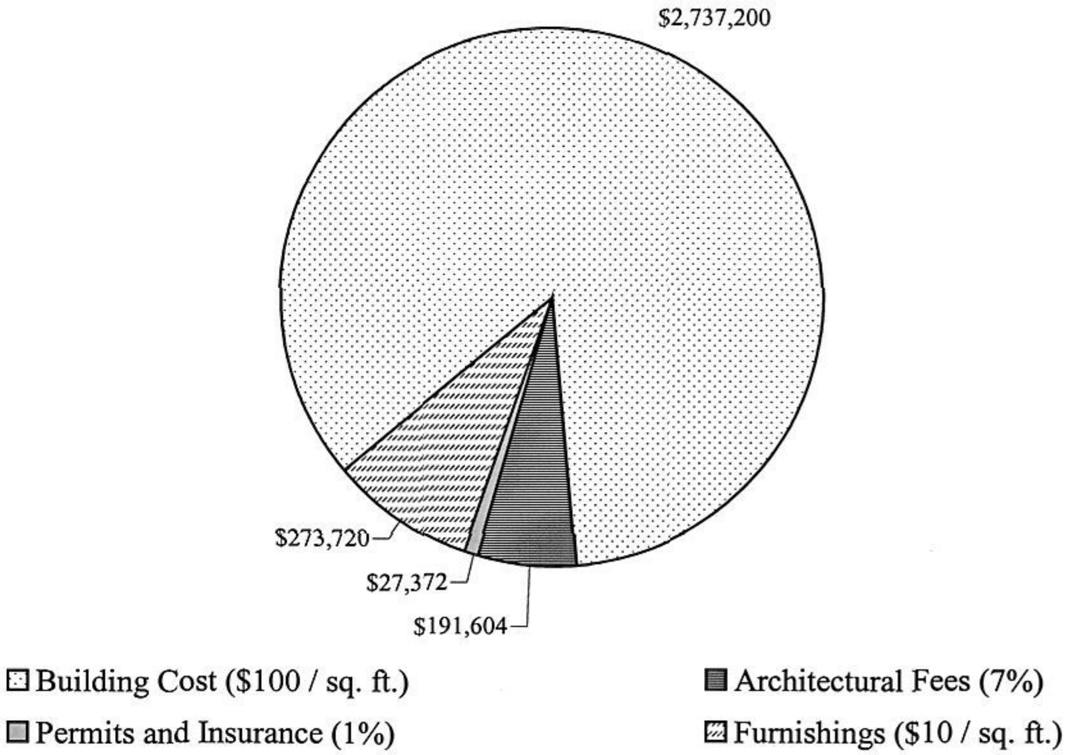

Figure 2: Budget Breakdown

V. SCHEDULE

A schedule was created to ensure the timely progress and completion of the design of an expansion of the Upper Darby Kindergarten Center. An investigation of the problem and a proposal were executed during October and November 2000. Design of the addition and the associated building systems began in January and was completed in early May 2001. A Gannt chart including tasks and their durations can be found in Appendix J.

VI. SUMMARY

Since its renovation in 1996, the Kindergarten Center has served as a feeder school for five elementary schools in the Upper Darby School District. Due to overcrowding Hillcrest, Primos, and Westbrook Park elementary schools, SVM Engineers propose that the kindergarteners from those schools be housed in the Kindergarten Center. Because the Kindergarten Center is currently filled to capacity, SVM Engineers has proposed that an addition be built. SVM Engineers defined the necessary design requirements for such an expansion in a report presented to the school district in December 2000. Preliminary system design was performed beginning in January 2001, and its progress was reported on in March. SVM Engineers continued to develop the design during March, April, and May. We now provide a final report with a complete set of design drawings to the Upper Darby School District for the addition to the Kindergarten.

VII. REFERENCES

[1] 1997 ASHRAE Handbook Fundamentals. Atlanta: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1997.

[2] 1997 International Plumbing Code. Falls Church, VA: International Code Council, Inc., 1998.

[3] Allen, Edward and Joseph Iano. Architect's Studio Companion: Rules of Thumb for Preliminary Design. 2nd ed. NewYork: John Wiley & Sons, Inc., 1995.

[4] Beirling, Jack. Coordinator of Mechanical Services for the Upper Darby School District, November 14, 2000.

[5] The BOCA National Building Code 1993. Country Club Hills, IL: Building Officials and Code Administrators, International, Inc., 1993.

[6] The BOCA National Mechanical Code 1993. Country Club Hills, IL: Building Officials and Code Administrators, International, Inc., 1993.

[7] Ching, Francis D. and Cassandra Adams. Building Construction Illustrated. 2nd ed. NewYork: John Wiley & Sons, Inc., 1991.

[8] Church, James C. Practical Plumbing Design Guide. New York: McGraw-Hill Book Company, 1979.

[9] Commonwealth of Pennsylvania Code Title 55 Public Welfare Chapter 32.70 Child Day Care Centers

[10] Dadra, Ally S. Mechanical Systems for Architects. New York: McGraw-Hill, Inc., 1995.

[11] DeChiara, Joseph and John Callender Ed. Time Saver Standards for Building Types. 3rd ed. New York: McGraw-Hill Publishing Co., 1990.

[12] International Fire Code 2000. Falls Church, VA: International Code Council, Inc., 1999.

[13] McQuiston, Faye C., Jerald D. Parker, and Jeffrey D. Spittler. Heating Ventilating, and Air Conditioning Analysis and Design. 5th ed. New York: John Wiley & Sons, Inc., 2000.

[14] Mongan, William. Kindergarten Center. Upper Darby School District. October 2000. < http://www.udsd.k12.pa.us/>

[15] Mossman, Melville J., Ed. Means 2000 Square Foot Cost Guide. Kingston, MA: RS Means Company, Inc., 2000

[16] National Electric Code. 1996 ed. Quincy, MA: National Fire Protection Association, 1995.

[17] Patterson, James. Simplied Design for Building Fire Safety. New York: John Wiley & Sons, Inc., 1993.

[18] Pita, Edward G. Air Conditioning Principles and Systems. 3rd ed. Upper Saddle River: Prentice-Hall, Inc., 1998.

[19] Progress Report to the Upper Darby Board of School Directors: Development of Strategies For Coping With Increasing Student Enrollment, Arthur E. Wolf & Associates, Inc., November 1998.

[20] Stein, Benjamin and John S. Reynolds. Mechanical and Electrical Systems for Buildings. 8th ed. New York: John Wiley & Sons, Inc., 1992.

[21] Stitt, Fred A., Architect's Room Design Data Handbook, New York: Van Nostrand Reinhold, 1992

[22] Upper Darby School District. 2000-2001 Annual Budget. Drexel Hill, PA: Upper Darby School District, 2000.

[23] Upper Darby Zoning Ordinance of 1986

VIII. ACKNOWLEDGEMENTS

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- URS Corporation

APPENDICES

A. School District Map

B. Criteria for Design

C. Architecture

D. Site Work

E. Structure

F. Mechanical

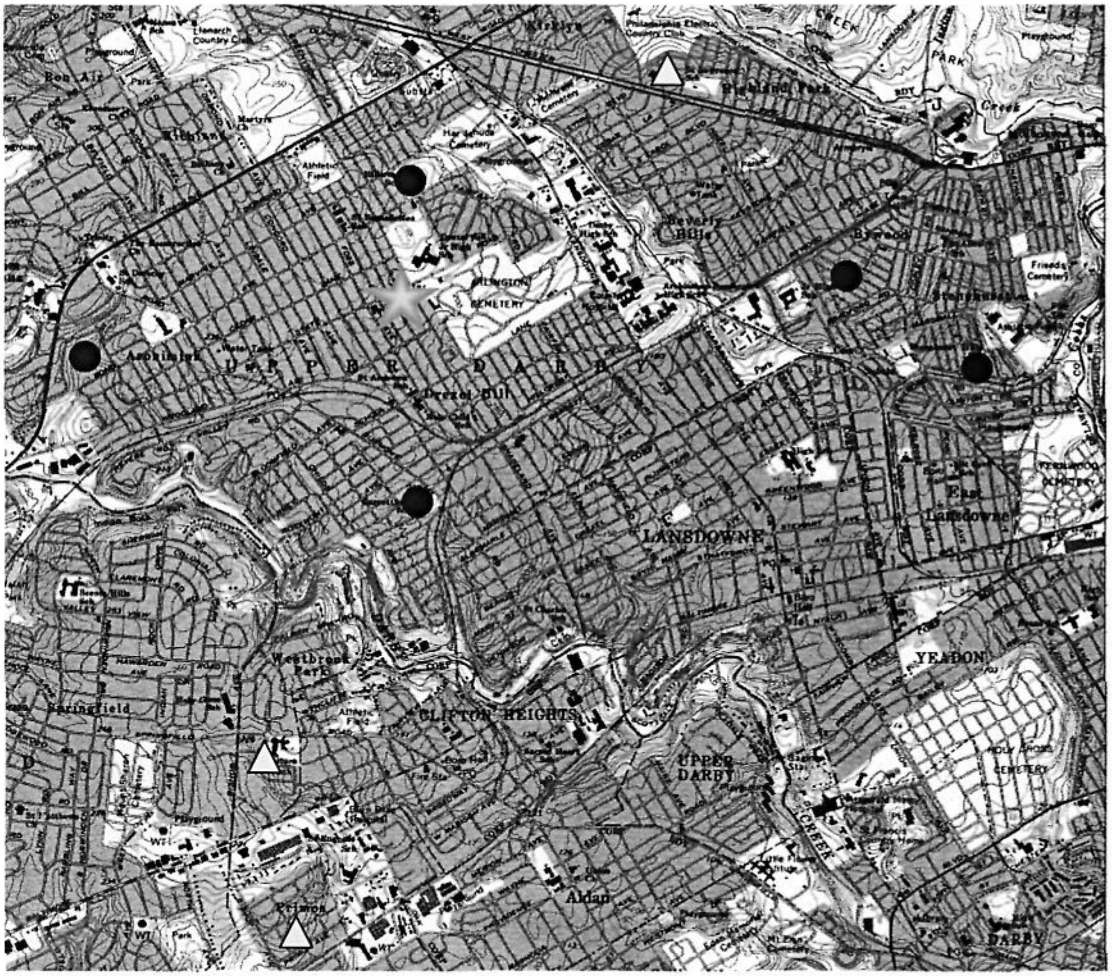
G. Electrical

H. Plumbing

I. Fire Protection

J. Schedule

Appendix A
School District Map



△ **Elementary schools with kindergarteners on site**

● **Elementary schools with kindergarteners at the Kindergarten Center**

★ **Kindergarten Center**

SVM Engineers	**SVM Engineers, Inc.** **Established 2000** PHILADELPHIA, PA	**SITE LOCATION MAP** Reprinted from the United States Department of the Interior, Geologic Survey, Lansdowne PA Quadrangle

Project: **Kindergarten Center Expansion** **Drexel Hill, PA**	Number **10001**	DATE **11/24/00**	SCALE **NTS**	**Appendix I-2**

Appendix B
Criteria for Design

1. Architectural
   1.1. Ceiling height: 8'-0" (9)
   1.2. Carpet: carpet tile rated for heavy wear glued to floor; tight weave, dense, low pile, washable, Patterned, Neutral colored (9).
   1.3. Acoustics (9)
      1.3.1. Suspended acoustic tile with integrated lighting
      1.3.2. NC 30-35
      1.3.3. STC 40-45
   1.4. Egress
      1.4.1. The maximum distance to an exit provided the building is sprinklered is 250 ft. (1).
         1.4.1.1. There shall be a maximum of 50 occupants for spaces with only 1 means of egress (6:113).
      1.4.2. There shall be no dead end corridors greater than 20 feet in length (6:116).
      1.4.3. Corridors shall not be less than 44 inches wide. Those accessing MEP equipment may be 24 inches wide, and those serving a capacity of 100 or more must be not less than 72 inches wide (6:116).
   1.5. Occupancy/ Space
      1.5.1 Kindergarten
         1.5.1.1 Average Class Size: 25 students
         1.5.1.2 25 square ft. per student
      1.5.2 Daycare
         1.5.2.1 20 children per room maximum
         1.5.2.2 20 square feet per child, 30 square feet per adult
      1.5.3 Multi-purpose
         1.5.3.1 40 square feet per child required for play space

2. Electrical
   2.1 Power
      2.1.1 10 VA/ft^2 (10)
      2.1.2 Emergency power required for the day care center (7).
      2.1.3 All convenience receptacles shall have safety covers (9).

3. Fire Alarm
   3.1. Automatic fire detectors shall be provided throughout. These shall be smoke detectors except in spaces where products of combustion are present in sufficient quantity to activate smoke detectors under normal operation an approved alternative detector may be used. (6:75)
   3.2. A manual fire alarm system shall be installed (6:76).
   3.3. The automatic sprinkler system and smoke detectors shall be connected to the building fire alarm system (6:76).

4. Fire Protection
   4.1. An automatic sprinkler system will be provided throughout except:
      4.1.1. Electrical rooms with 2 hour fire rated construction and fire detection system

5. HVAC
   5.1. Design temperatures (7)
      5.1.1. Winter indoor: at least 65 F DB.
      5.1.2. Summer indoor: less than 85 F DB.
   5.2. Ventilation (4:84)

        5.2.1. Classrooms:15 cfm outdoor air per person
        5.2.2. Multi-purpose room: 20 cfm per person
        5.2.3. Toilet rooms: 75 cfm per water closet
        5.2.4. Corridors: 0.10 cfm/ft^2
        5.2.5. Utility rooms: 0.05 cfm/ft^2
        5.2.6. Elevator: 1.00 cfm/ft^2
    5.3. Air shall be exhausted from toilet rooms.
    5.4. It is desirable that each classroom has separate temperature control.
    5.5. Cooling will be provided for the day care center (7, 8).
    5.6. The existing boiler plant has an excess capacity of 20%-40% which may be enough to satisfy the heating load of the expansion (8).
    5.7. The following systems are recommended (8):
        5.7.1. Unit ventilators with outside air dampers
        5.7.2. Split cooling system
        5.7.3. DX package rooftop units

6. Illumination
    6.1. Illuminance
        6.1.1. Classrooms and multipurpose room: 50-70 f.c. (9)
        6.1.2. Toilet rooms, utility rooms, and corridors: 20 f.c. (9)
        6.1.3. Means of egress shall have emergency illumination at a level not less than 1 f.c. (6:102).
        6.1.4. Stage lighting may be desirable for the multi-purpose room.

7. Plumbing
    7.1. The temperature of domestic hot water shall not exceed 110 F (7).
    7.2. Minimum Plumbing Facilities
        7.2.1. Water closets: 1 per 50 occupants (3), 1 per 15 occupants for day care center (7)
        7.2.2. Lavatories: 1 per 50 occupants (3), 1 per 25 occupants for day care center (7)
        7.2.3. Drinking Fountains: 1 per 100 occupants (3)

8. Telecommunications
    8.1. Each occupied space in the building will be connected to the building PA and intercom systems (9).
    8.2. A sound reinforcement system shall be provided in the multi purpose room.

<u>Applicable Codes and other References</u>

1) BOCA National Building Code 1993
2) NFPA-70
3) 2000 International Plumbing Code
4) BOCA National Mechanical Code
5) 1999 National Electric Code
6) 2000 International Fire Code
7) Commonwealth of Pennsylvania Code Title 55 Public Welfare Chapter 32.70 Child Day Care Centers
8) Jack Beirling, Coordinator of Mechanical Services, Upper Darby School District
9) Architect's Room Design Data Handbook
10) Mechanical and Electrical Systems for Buildings, Seventh Edition
11) Architect's Studio Companion

Appendix C
Architecture

ARCHITECTURAL PROGRAM

FIRST FLOOR

Kindergarten..3,800 sq. ft.

- *Kindergarten Classrooms (6)*...4,287 sq. ft.

  This will be the main instructional space for the students. It will include an area with desks and chairs for formal study and an open area for students to play in. These rooms will accommodate the educational needs of one hundred students per session. An average of 25 students (1) can use one classroom with 25 sq. ft. per student. The area for one adult teacher added is 30 sq. ft. (2: 147, 229)

- *Student Toilet Rooms (6)*..*222 sq. ft.*

  There will be one toilet room directly accessible in each classroom. Plumbing fixtures in these rooms will be mounted at appropriate heights for kindergarten students.

Day Care Center...3,300 sq. ft.

The day care center on the ground floor of the existing building will be relocated to the addition and expanded. It will accommodate approximately 96 students per session. This area will include day care rooms, staff offices, and storage.

- *Day Care Classrooms (5)*..*2,300 sq. ft.*

  Each classroom will have at least two staff members to serve a maximum of 20 students per classroom (3). The areas allocated are: 20 square feet per student and 30 square feet per adult (2: 147).

- *Student Toilet Rooms (10)*..*500 sq. ft.*

  There will be one toilet room for each gender directly accessible from each classroom. Plumbing fixtures in these rooms will be mounted at appropriate heights for kindergarten students.

- *Staff Offices*..*250 sq. ft.*

- *Storage*..*250 sq. ft.*

Staff Lounge (2)..560 sq. ft.

This room will be centrally located on each floor. It will serve as a space to have staff meetings and a lunchroom for the staff. Staff toilet rooms will be accessible from here.

- *Staff Toilet Rooms (4)*..*200 sq. ft.*

  There will be one toilet room for each gender centrally located on each floor near or within the staff lounge. Plumbing fixtures in these rooms will be mounted at the standard height for adults.

Lobby..200 sq. ft.

This space will serve as the principal entry and exit for the day care center which may operate at different hours from the rest of the school. It will also serve as a means of egress for the expansion.

It is assumed that this space should be capable of holding 30% of the occupants in this part of the building, providing each with 3 square feet (3:103).

Mechanical Room**..........500 sq. ft.**

Central plumbing and HVAC equipment will be located here. It will only be accessible to maintenance staff. This space is estimated at 5% of the building area.

Electrical Room**..........250 sq. ft.**

This room will be located near the mechanical room if possible. It will contain the primary electrical equipment including: service entrance, main disconnect, switchgear, and transformer (if not pad mounted).

Elevator Machine Room**..........50 sq. ft.**

A hydraulic elevator will be used since there is a small rise and infrequent use. The machine room will be located on the lowest level of the building near the elevator shaft.

Janitor Closet (2)**..........80 sq. ft.**

This space will serve as storage for janitorial supplies. It will include a service sink. There will be one janitor closet on each floor. It will not be accessible to students.

Electrical Closet (2)**..........80 sq. ft.**

An electrical closet will be located on each floor. It will contain branch distribution panels and step down transformers as required.

Circulation**..........2700 sq. ft.**

An additional 30% of the building area will allocated to circulation. The required size will be determined during the schematic and design development phase.

A. Renovation

Multi-purpose Room**..........6,400 sq. ft.**

- *Assembly/Recreation Space ....5,500 sq. ft.*

  The multi-purpose room on the ground floor of the existing building will be expanded to provide enough seating for each kindergarten session (400 students) to attend an assembly. This room will also be used for physical education classes. It will consist of a large open space with movable partitions. This is also sized to provide play space for the day care center, which requires 40 square feet per student (3).

- *Stage..........450 sq. ft.*

  This will be used for presentations and performances during school assemblies. The size is will remain the same as in the current design.

- *P.E. Office..........200 sq. ft.*

  This office will be for the physical education instructor(s). The size was determined by multiplying the current area by the percent increase in school population.

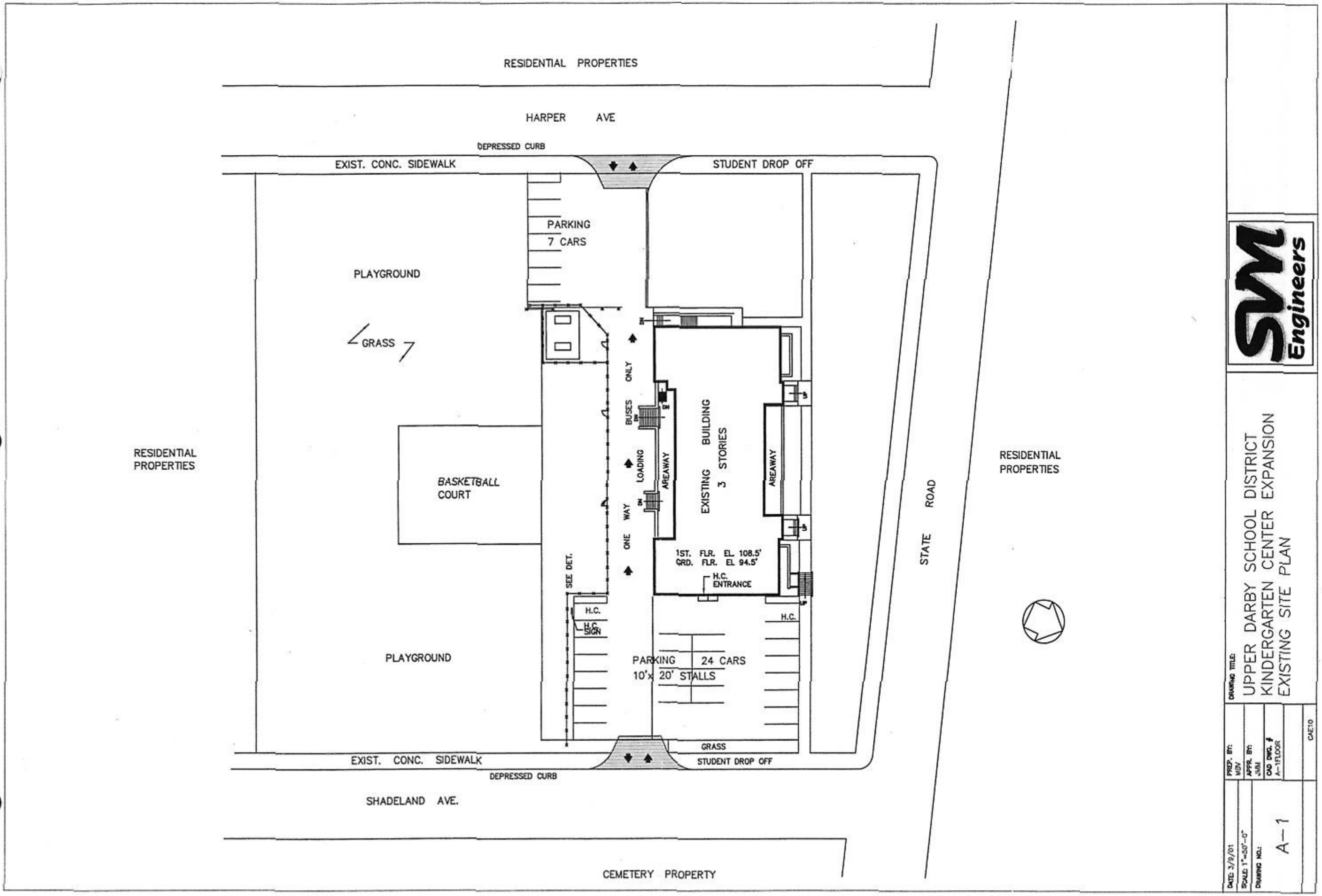
- *Storage* .... *250 sq. ft.*
  This room will hold equipment for physical education and playtime as well as furniture used for assemblies. The area was determined by multiplying the size of an existing supply room by the percent increase in school population.

B. Site

Staff Parking .... *14,280 sq. ft.*
Twenty automobile spaces will be added to the existing parking area. Each space is estimated to be 200 square feet. 40% of the parking space was added for access. Thus, the parking area will be expanded by 5,600 square feet.

Playground .... *52,000 sq. ft.*
The playground shall have such equipment as sandboxes, slides, tunnels, swings, tree houses, climbers, and steppers. To make room for additional parking the playground will be reduced in size by 5,600 sq. ft.

DETAIL OF EXISTING ELEVATION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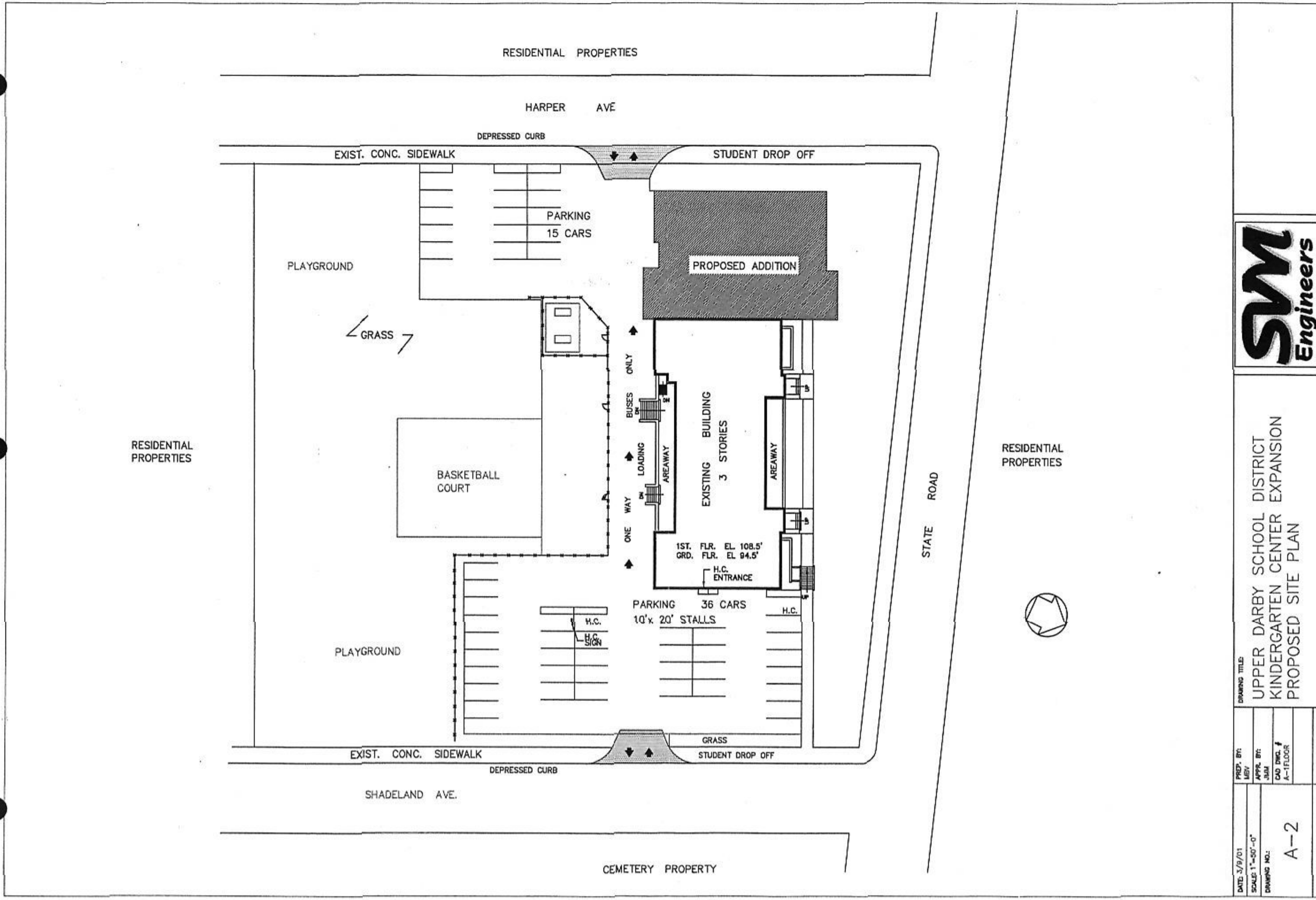
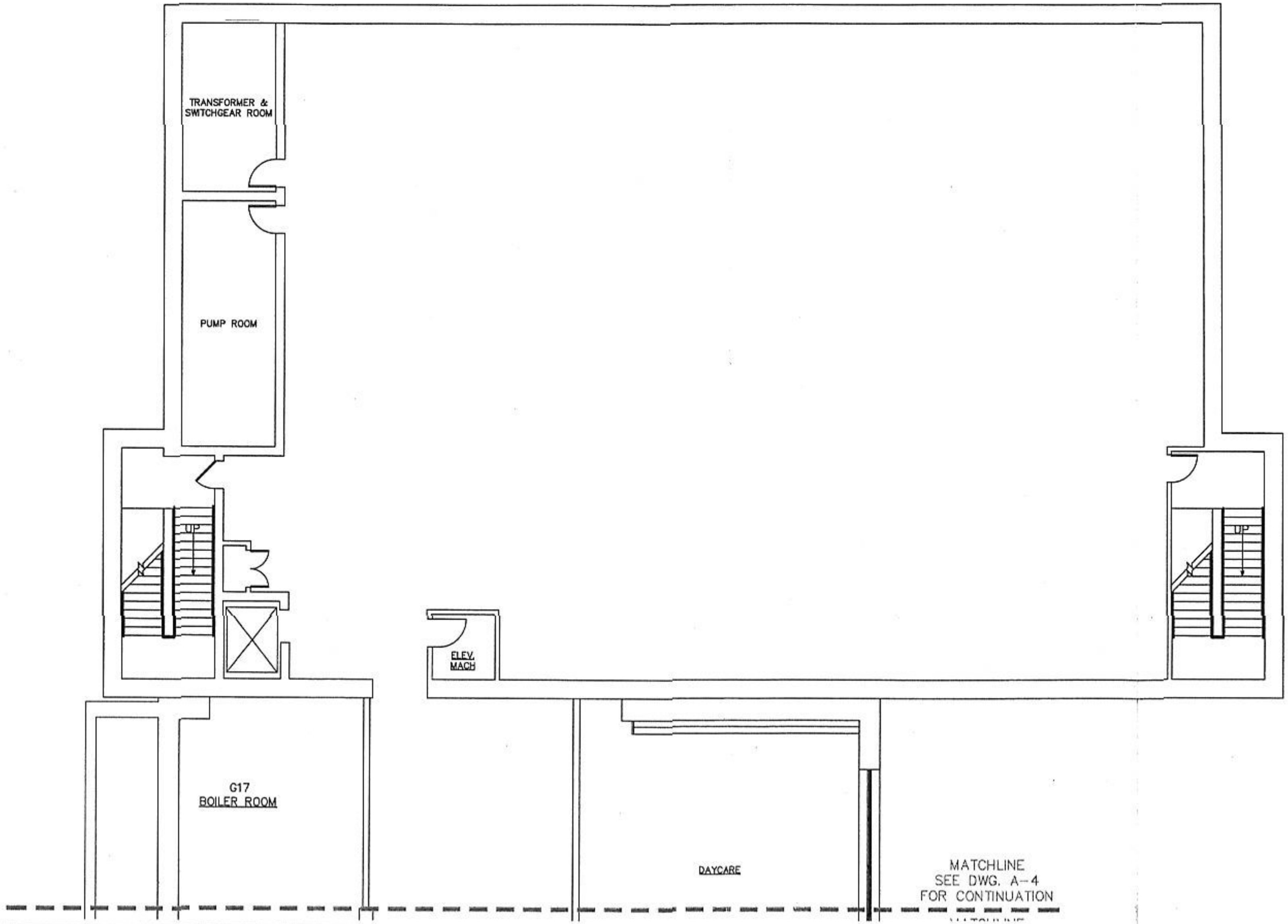
HARPER AVE
DEPRESSED CURB
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
PARKING
7 CARS
PLAYGROUND
GRASS
BUSES ONLY
LOADING
ONE WAY
AREAWAY
EXISTING BUILDING
3 STORIES
AREAWAY
1ST. FLR. EL. 108.5'
GRD. FLR. EL. 94.5'
H.C. ENTRANCE
RESIDENTIAL PROPERTIES
BASKETBALL COURT
STATE ROAD
RESIDENTIAL PROPERTIES
SEE DET.
H.C.
H.C. SIGN
H.C.
PLAYGROUND
PARKING 24 CARS
10'x 20' STALLS
GRASS
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
DEPRESSED CURB
SHADELAND AVE.
CEMETERY PROPERTY
SM Engineers
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
EXISTING SITE PLAN
DATE: 3/9/01
SCALE: 1"=50'-0"
DRAWING NO.:
A-1
PREP. BY: MBV
APPR. BY: JWM
CAD DWG. # A-1FLOOR
CAE10


RESIDENTIAL PROPERTIES
HARPER AVE
DEPRESSED CURB
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
PARKING
15 CARS
PROPOSED ADDITION
PLAYGROUND
GRASS
BUSES ONLY
LOADING
ONE WAY
AREAWAY
EXISTING BUILDING
3 STORIES
AREAWAY
RESIDENTIAL PROPERTIES
BASKETBALL COURT
RESIDENTIAL PROPERTIES
STATE ROAD
1ST. FLR. EL. 108.5'
GRD. FLR. EL 94.5'
H.C. ENTRANCE
PARKING 36 CARS
10'x 20' STALLS
H.C.
H.C.
H.C. SIGN
PLAYGROUND
GRASS
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
DEPRESSED CURB
SHADELAND AVE.
CEMETERY PROPERTY
SM Engineers
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
PROPOSED SITE PLAN
DATE: 3/9/01
SCALE: 1"=50'-0"
DRAWING NO.:
A-2
PREP. BY: MBV
APPR. BY: JMM
CAD DWG. # A-1FLOOR
CAE10



SVM Engineers

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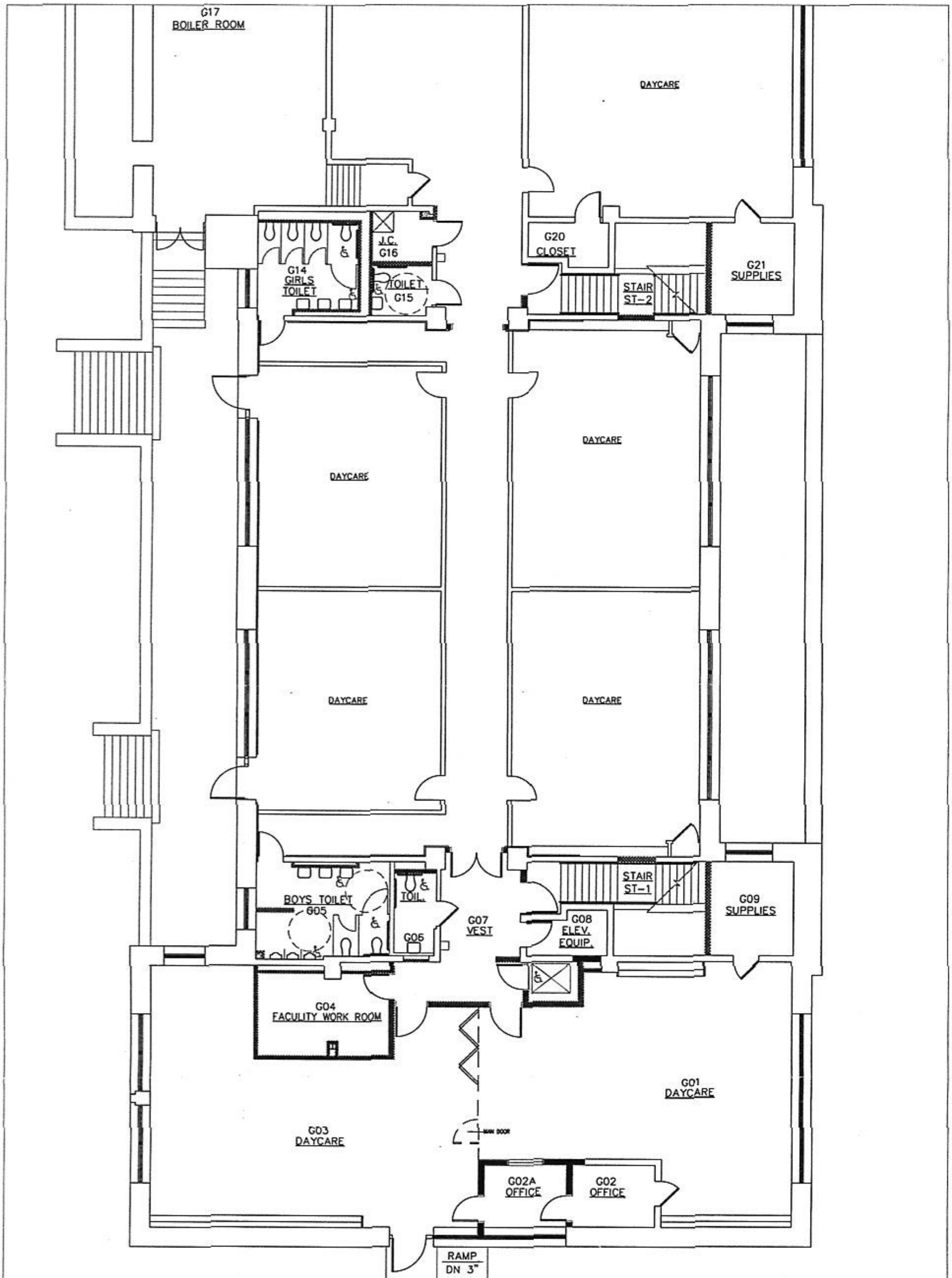
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
GROUND FLOOR PLAN – WEST

DATE: 3/9/01	PREP. BY: MSV
SCALE: 3/32"=1'-0"	APPR. BY: JHM
DRAWING NO.: A–3	CAD DWG. # A-GFLOOR

CAE10



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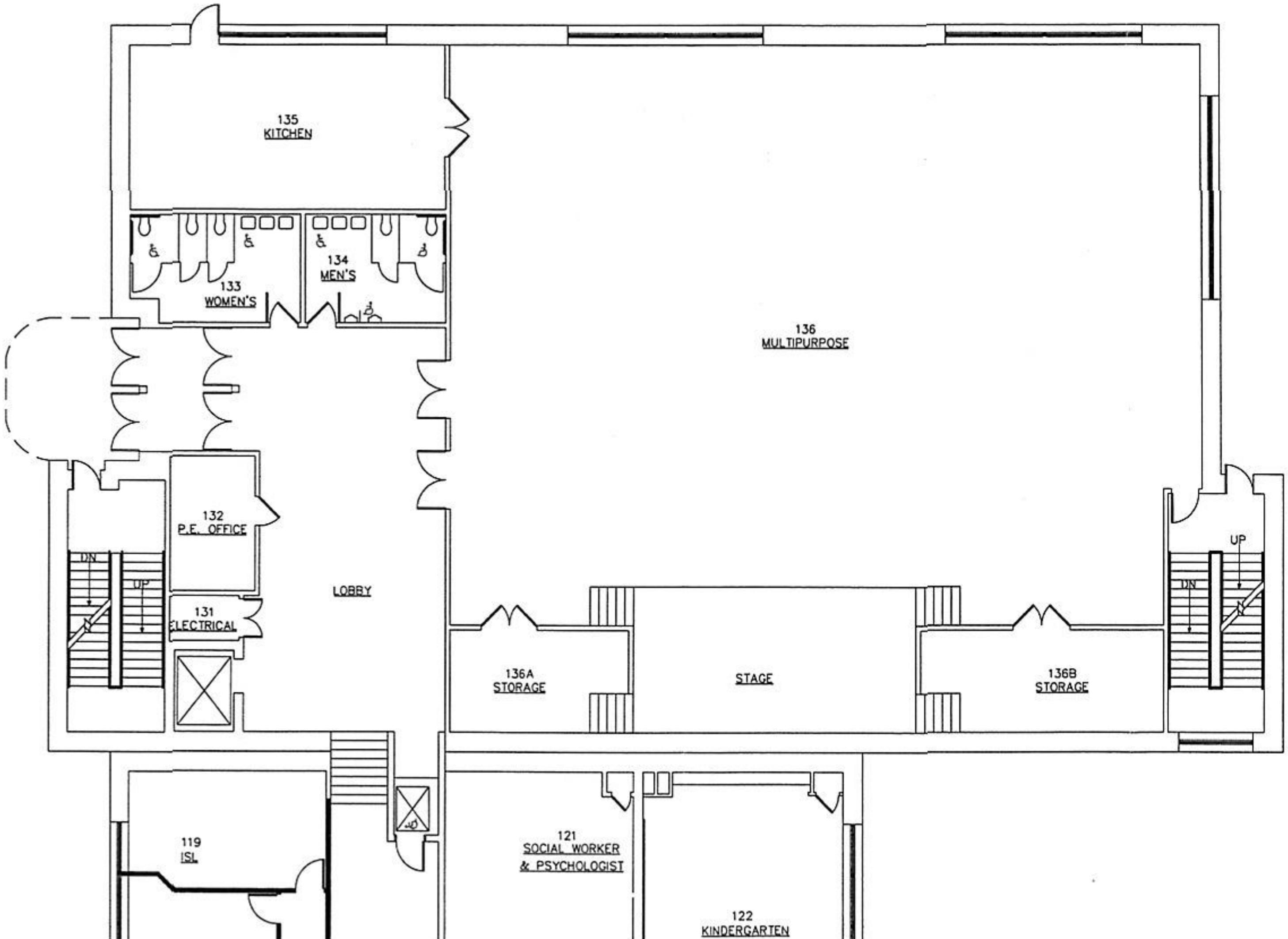
DRAWING NO.: A-4	CAD DWG. # A-GFLOOR	
	CAE10	

SVM Engineers



SVM Engineers

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UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
FIRST FLOOR PLAN – WEST

DATE: 3/9/01
SCALE: 3/32"=1'-0"
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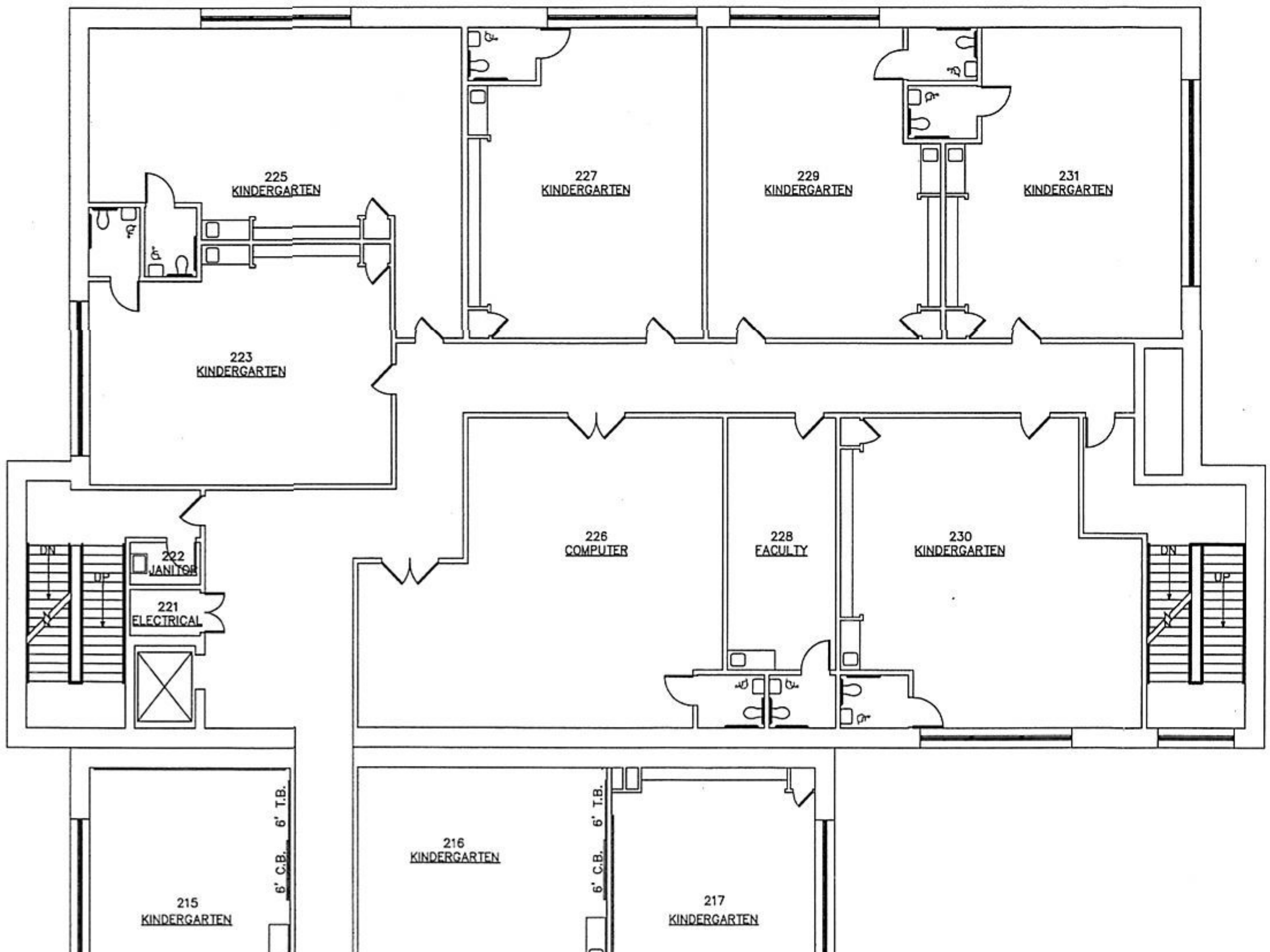
A–5

PREP. BY: K3V
APPR. BY: JKM
CAD DWG. #: A-1FLOOR
CAE10



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SECOND FLOOR PLAN – WEST

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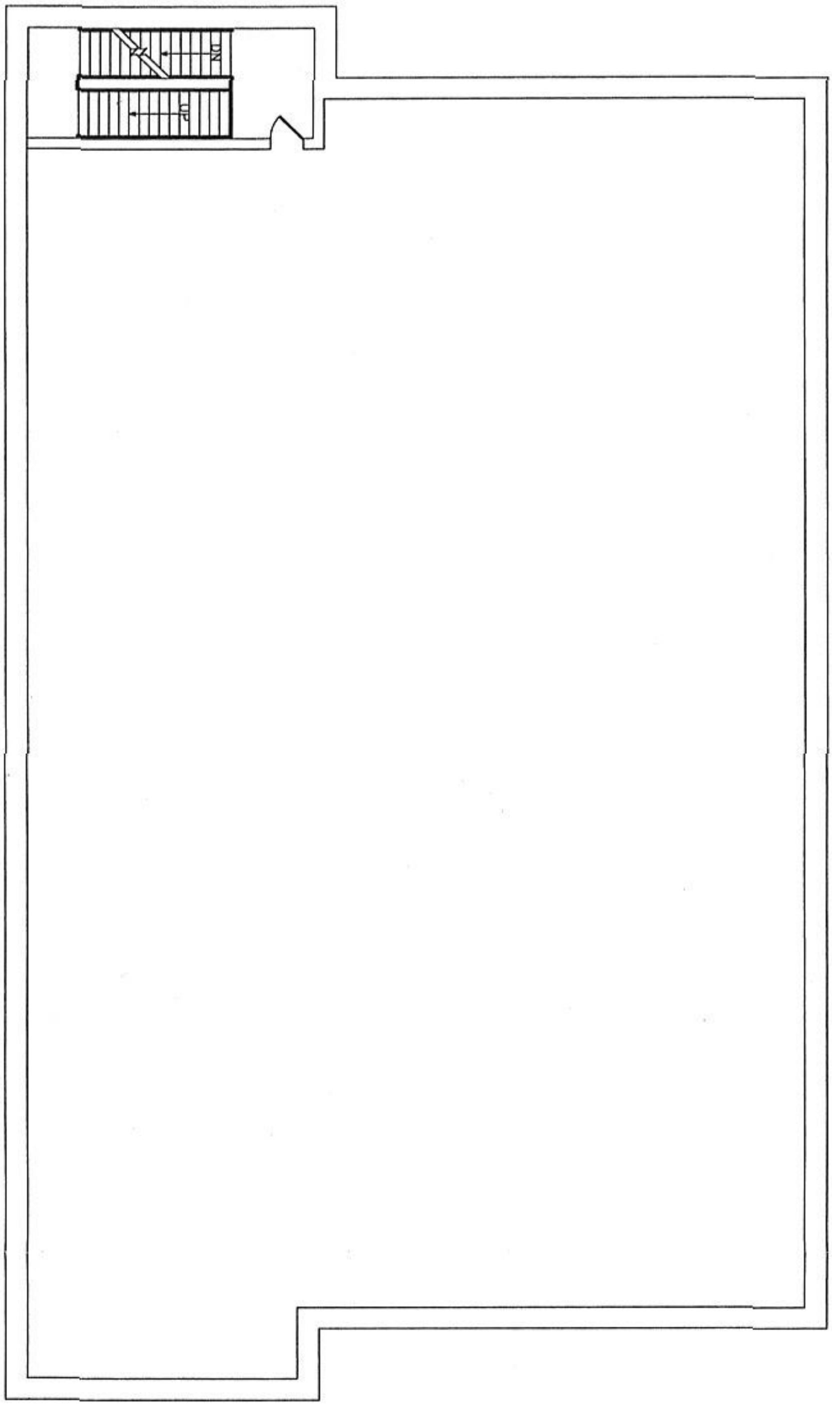
APPR. BY: JHM
CAD DWG. # A-2FLOOR
CAE10

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.: A-6



DATE: 3/9/01	PREP. BY: MBV	DRAWING TITLE:
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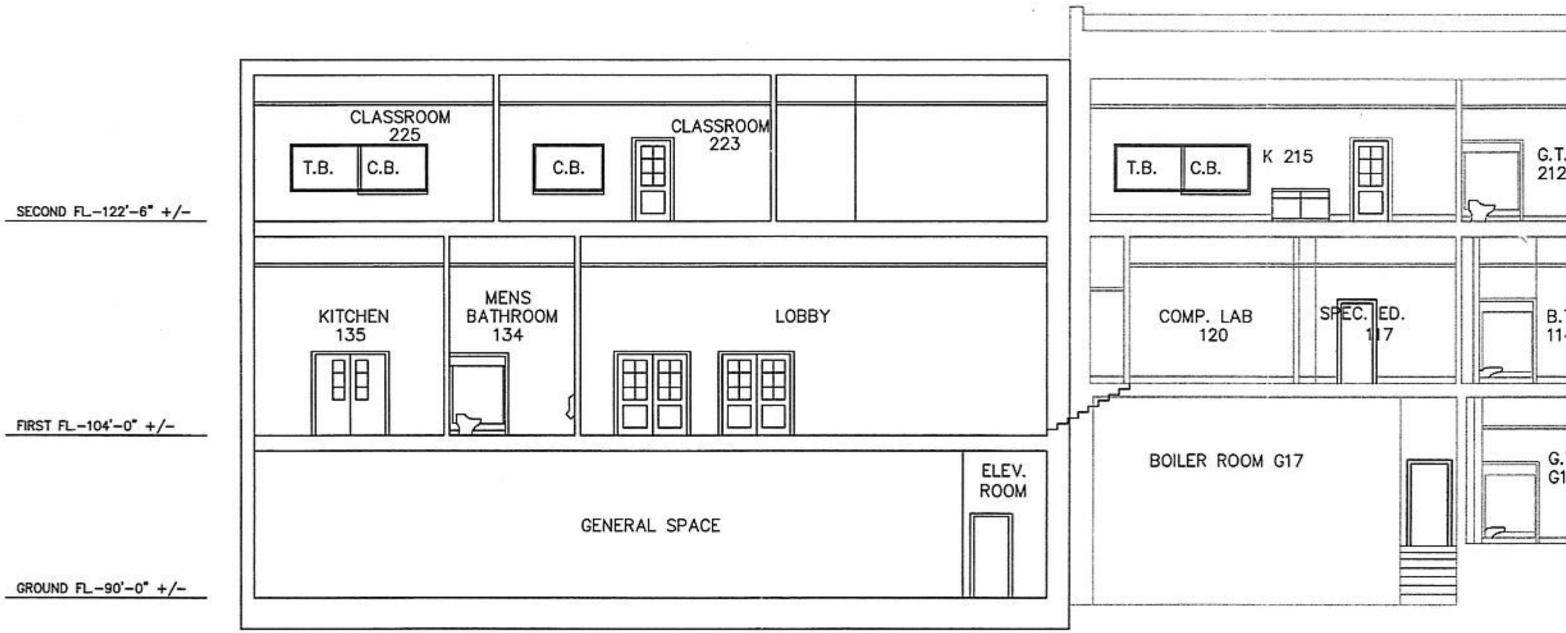
DRAWING NO.: A—7	CAD DWG. # A-ROOF	
	CAE10	

SVM Engineers



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
CROSS SECTION - SOUTH

PREP. BY: MBV
APPR. BY: JMM
CAD DWG. # A-1FLOOR
CAE10

DATE: 3/9/01
SCALE: 3/32"=1'-0"
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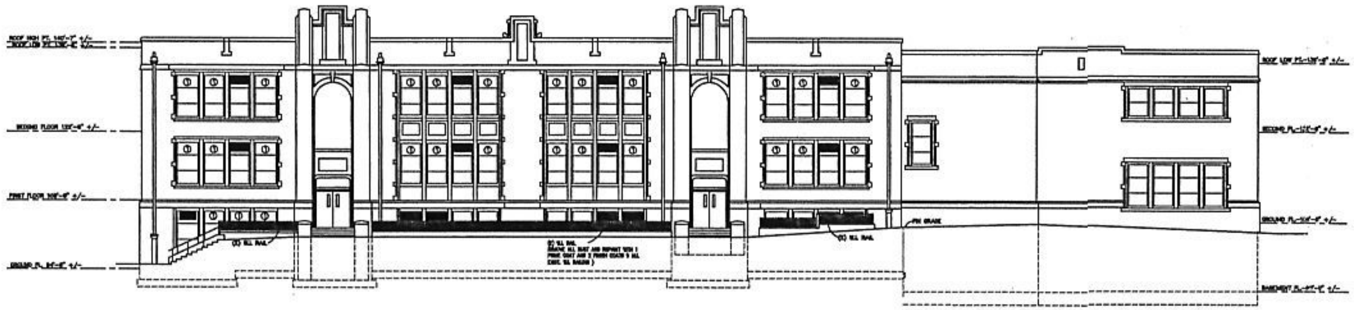

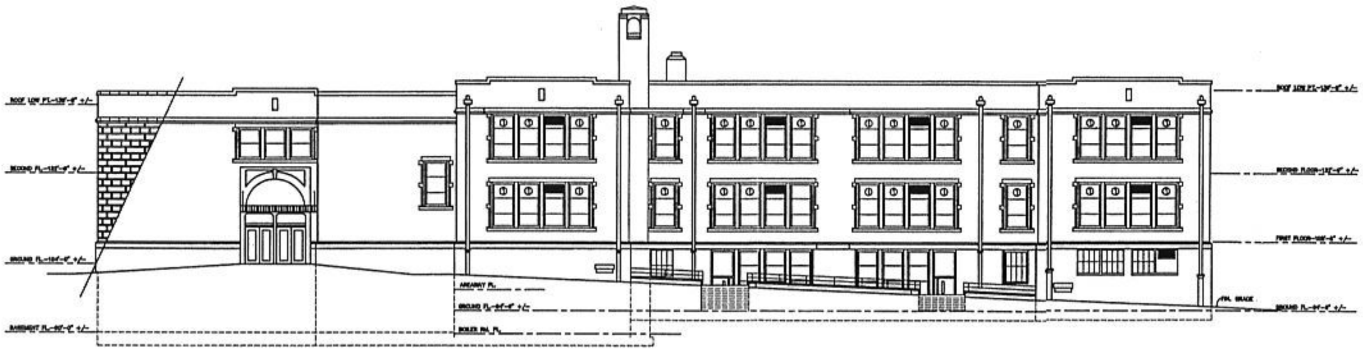

SVM Engineers

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UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
NORTH & SOUTH ELEVATION

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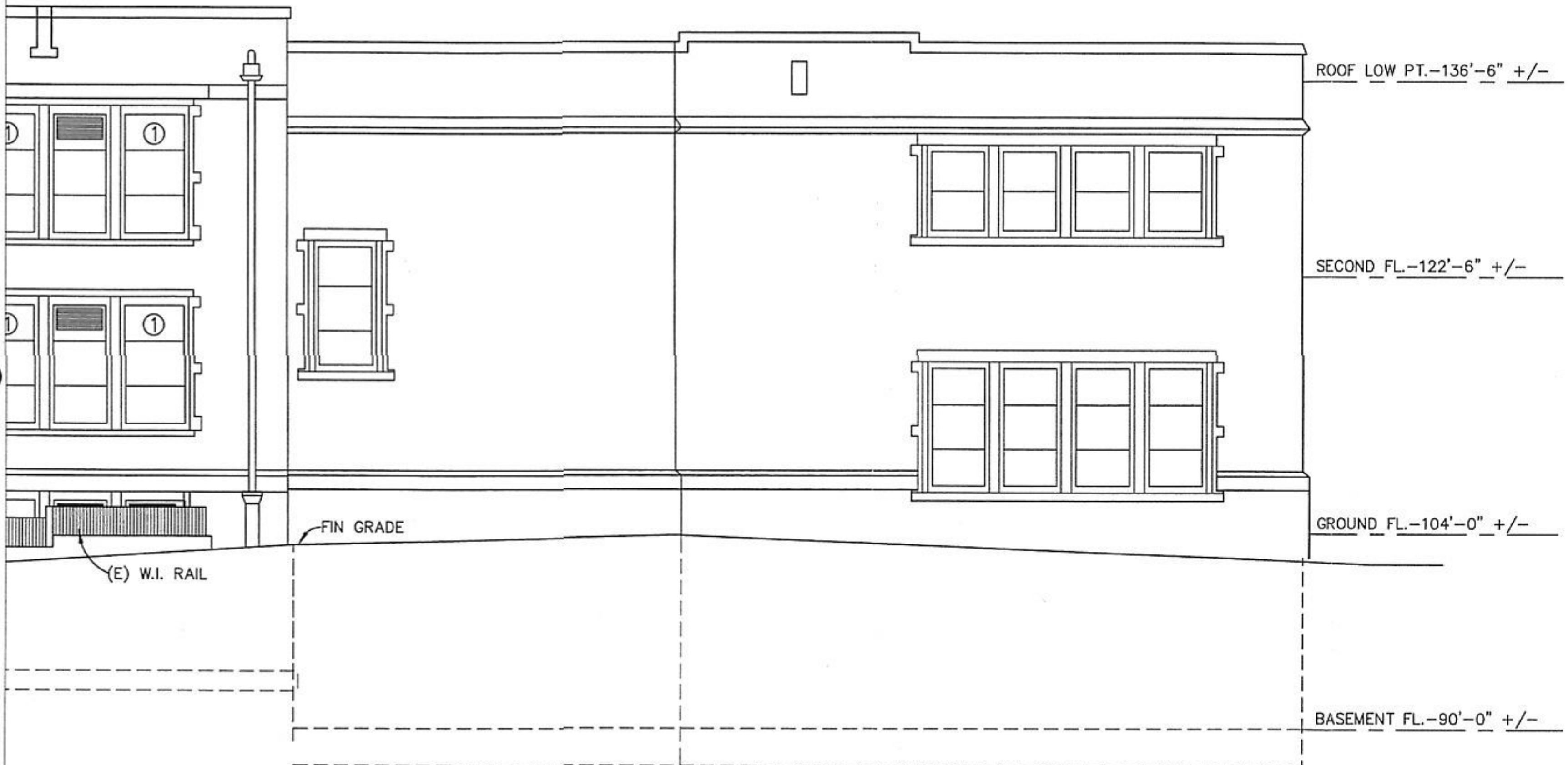

SVM Engineers

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UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
NORTH ELEVATION

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APPR. BY: JMM
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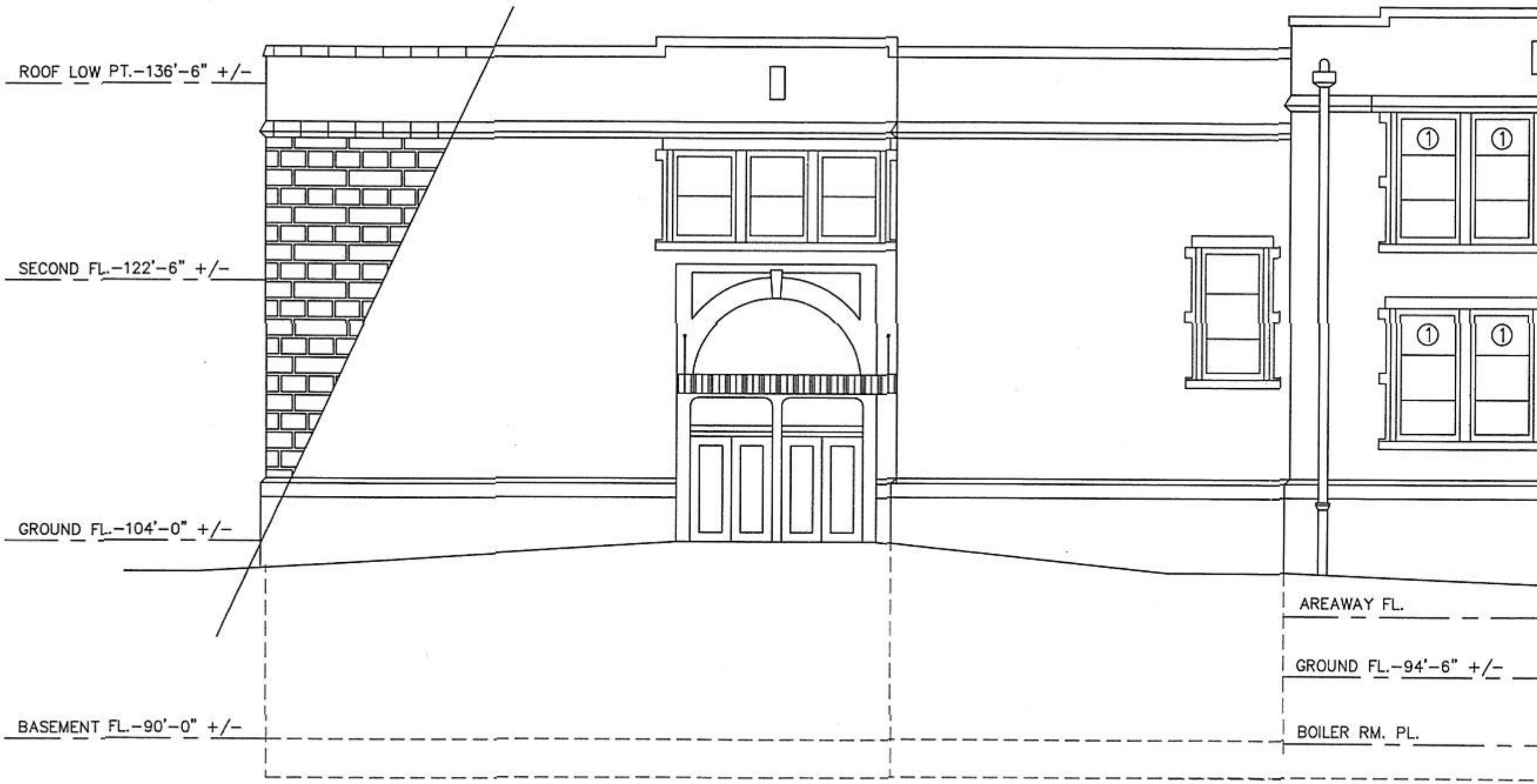
CAE10



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SOUTH ELEVATION

PREP. BY: MEV
APPR. BY: JMM
CAD DWG. # A–1FLOOR
CAE10

DATE: 3/9/01
SCALE: 1/8"=1'–0"
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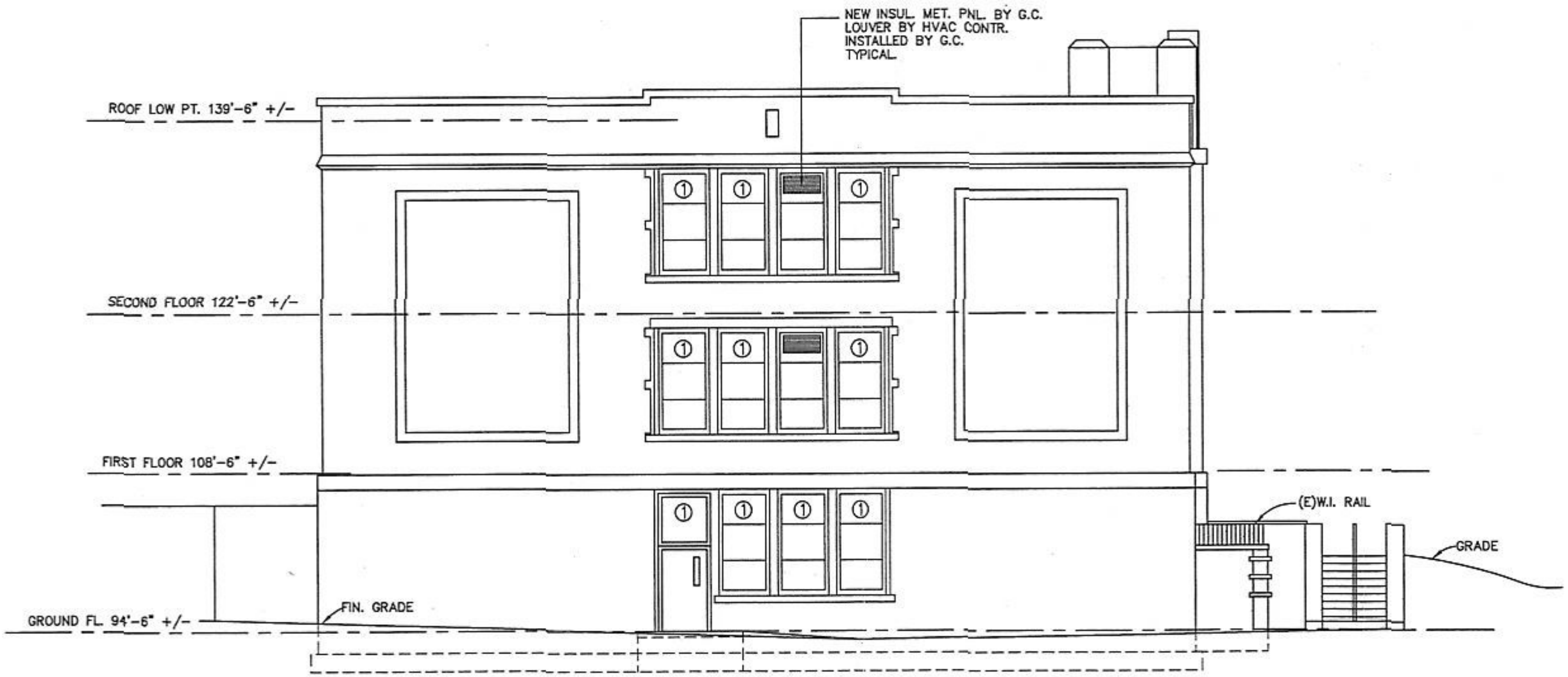
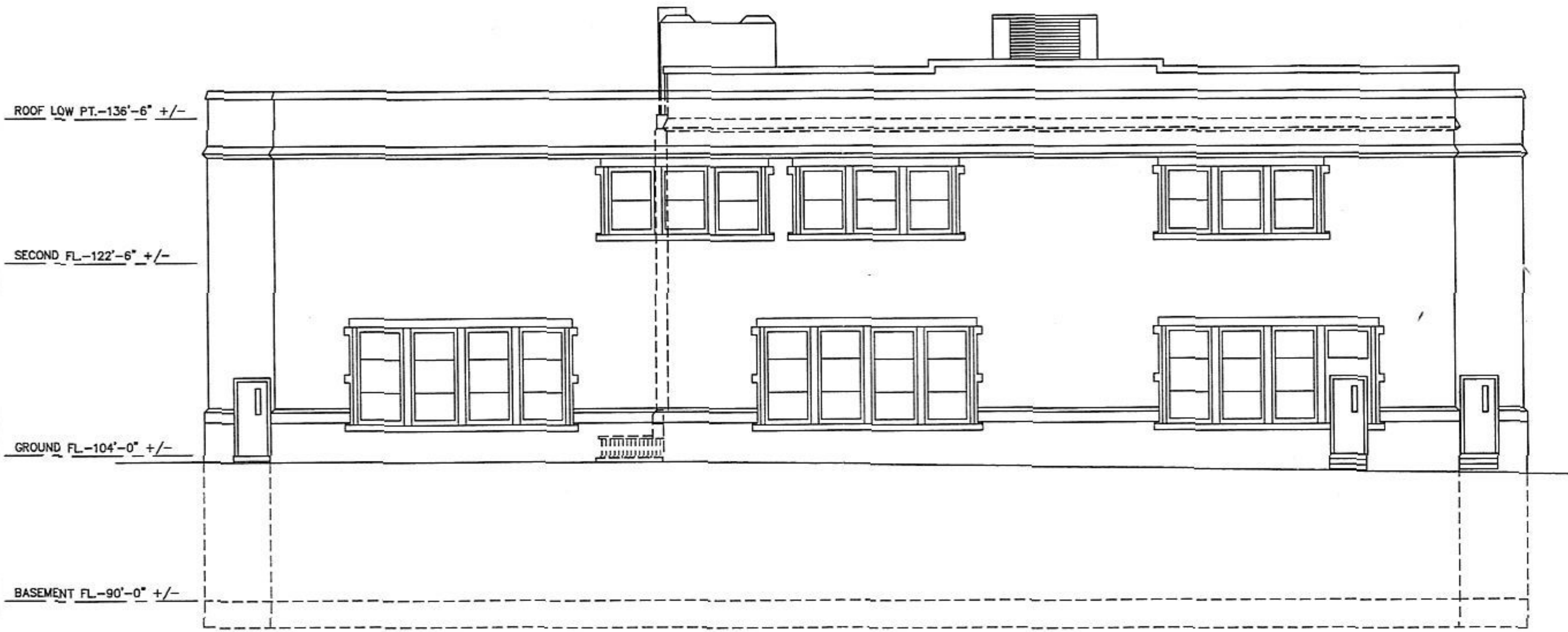
A–11



SM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
EAST ELEVATION

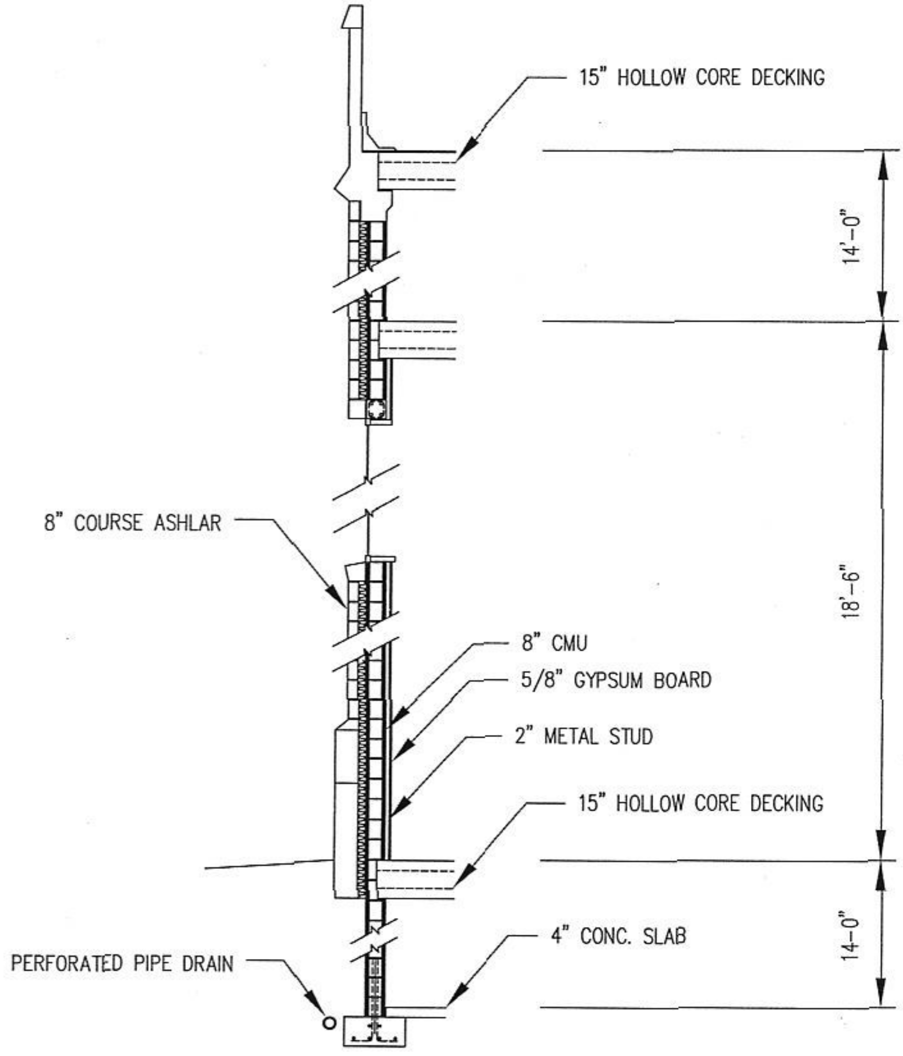
DATE: 3/9/01	PREP. BY: MBV
SCALE: 3/32"=1'-0"	APPR. BY: JMM
DRAWING NO.: A-12	CAD DWG. # A-1FLOOR
	CAE10



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
WEST ELEVATION

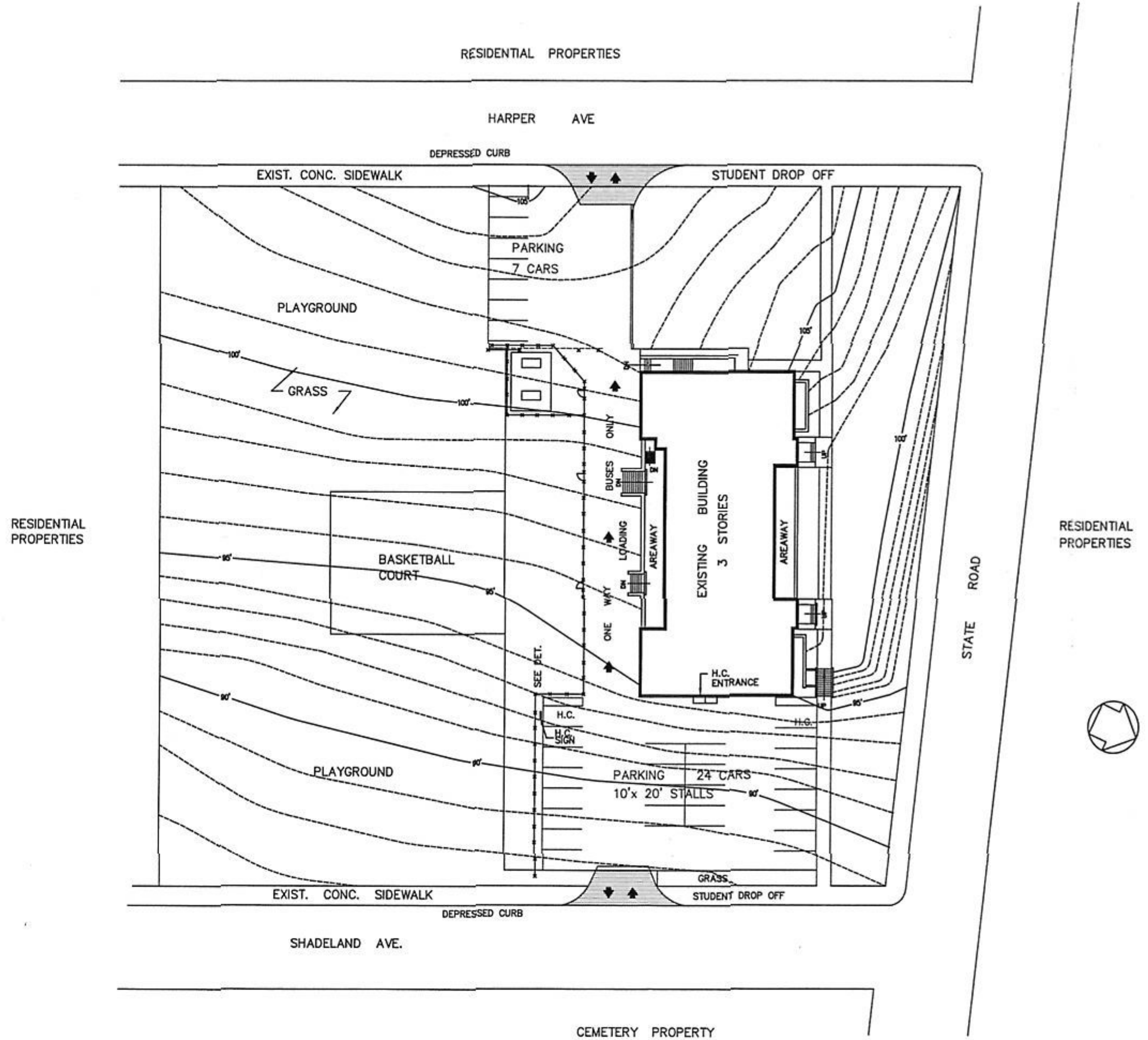
DATE: 3/9/01	PREP. BY: MBV	
SCALE: 3/32"=1'-0"	APPR. BY: JMM	
DRAWING NO.: A-13	CAD DWG. #: A-1FLOOR	CAE10



DATE: 3/9/01	PREP. BY: MBV	DRAWING TITLE:
SCALE: 1/4"=1'-0"	APPR. BY: JMM	UPPER DARBY SCHOOL DISTRICT
DRAWING NO.:	CAD DWG. # A-OFLOOR	KINDERGARTEN CENTER EXPANSION
A-14		WALL DETAIL
	CAE10	

SVM Engineers

Appendix D
Site Work

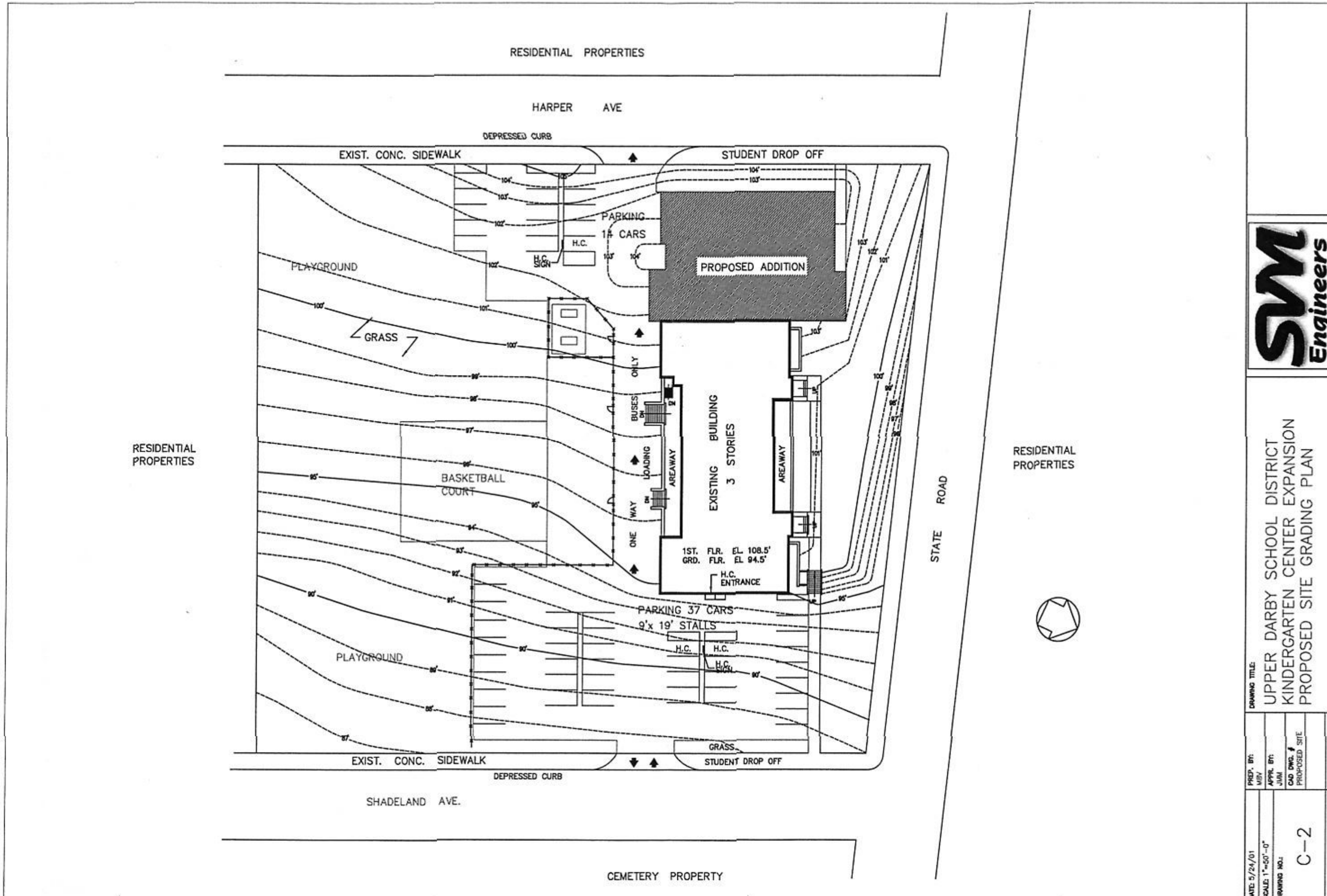


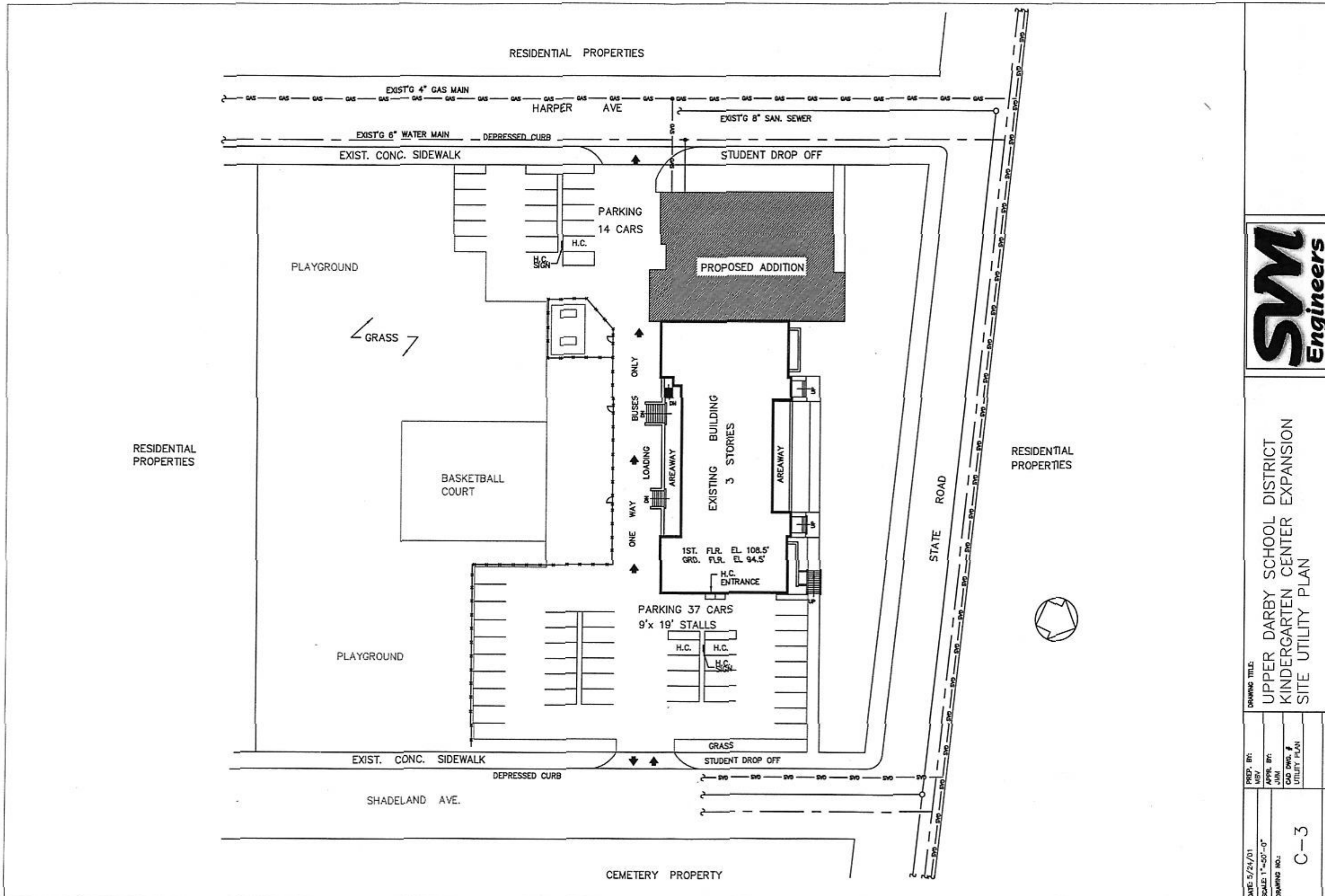
SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
EXISTING SITE GRADING PLAN

PREP. BY: MBV
APPR. BY: JMM
CAD DWG. #: EXISTINGSITE2
CAE10

DATE: 5/24/01
SCALE: 1"=50'-0"
DRAWING NO.: C—1


RESIDENTIAL PROPERTIES
HARPER AVE
DEPRESSED CURB
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
PARKING 14 CARS
H.C.
H.C. SIGN
PROPOSED ADDITION
PLAYGROUND
GRASS
ONLY
BUSES
LOADING
ONE WAY
AREAWAY
EXISTING BUILDING 3 STORIES
AREAWAY
1ST. FLR. EL. 108.5'
GRD. FLR. EL. 94.5'
H.C. ENTRANCE
RESIDENTIAL PROPERTIES
BASKETBALL COURT
STATE ROAD
RESIDENTIAL PROPERTIES
PARKING 37 CARS
9'x 19' STALLS
H.C.
H.C.
H.C. SIGN
PLAYGROUND
GRASS
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
DEPRESSED CURB
SHADELAND AVE.
CEMETERY PROPERTY
SVM Engineers
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
PROPOSED SITE GRADING PLAN
DATE: 5/24/01
SCALE: 1"=50'-0"
DRAWING NO.:
C-2
PREP. BY: MBV
APPR. BY: JVM
CAD DWG. # PROPOSED SITE
CAE10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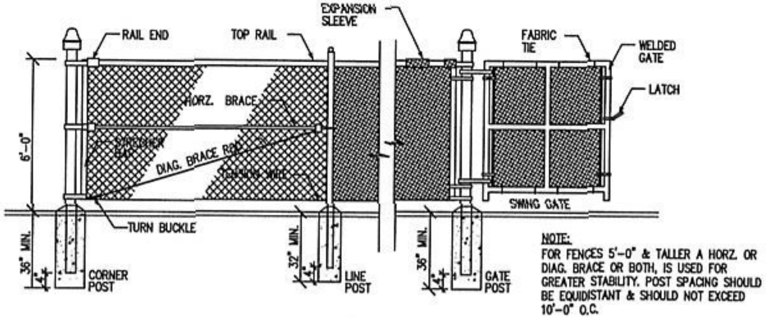
EXIST'G 4" GAS MAIN
HARPER AVE
EXIST'G 8" SAN. SEWER
EXIST'G 6" WATER MAIN
DEPRESSED CURB
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
PARKING
14 CARS
H.C.
H.C. SIGN
PLAYGROUND
PROPOSED ADDITION
GRASS
ONE WAY
LOADING
BUSES
ONLY
AREAWAY
EXISTING BUILDING
3 STORIES
AREAWAY
RESIDENTIAL PROPERTIES
BASKETBALL COURT
RESIDENTIAL PROPERTIES
STATE ROAD
1ST. FLR. EL. 108.5'
GRD. FLR. EL. 94.5'
H.C. ENTRANCE
PARKING 37 CARS
9'x 19' STALLS
H.C.
H.C.
H.C. SIGN
PLAYGROUND
GRASS
EXIST. CONC. SIDEWALK
STUDENT DROP OFF
DEPRESSED CURB
SHADELAND AVE.
CEMETERY PROPERTY
SVM Engineers
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SITE UTILITY PLAN
PREP. BY: MBV
APPR. BY: JMN
CAD DWG. # UTILITY PLAN
CAE10
DATE: 5/24/01
SCALE: 1"=50'-0"
DRAWING NO.:
C-3



2 / SP-1 FENCE DETAIL
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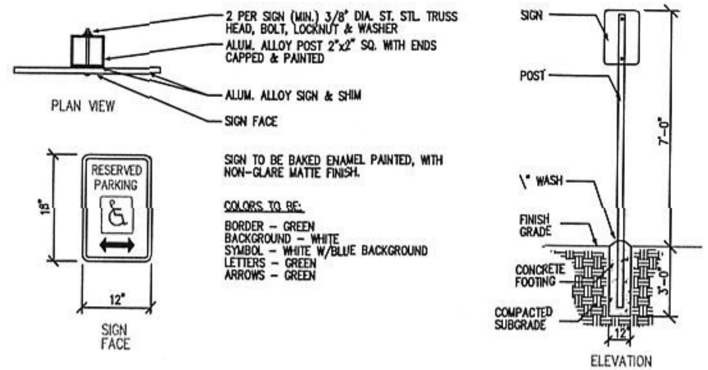

4 / SP-1 HANDICAPPED PARKING SIGN
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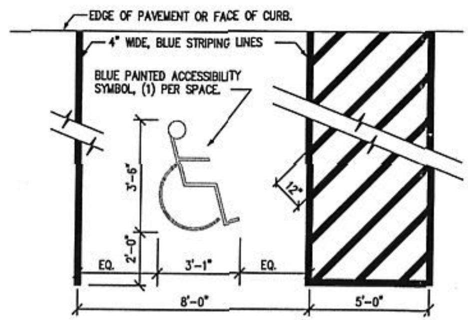
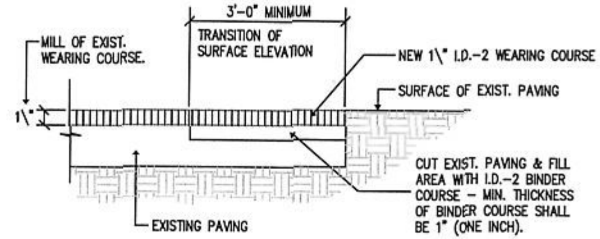


3 / SP-1 HANDICAPPED PARK SPACE SYMBOL
SCALE = NO SCALE

SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SITE DETAILS

DATE: 5/24/01	PREP. BY: MBV	
SCALE: AS NOTED	APPR. BY: JMM	
DRAWING NO.: C-4	CAD DWG. #: SITE DETAILS	CAE10



1 SP-1 BITUMINOUS RESURFACING INTERFACE W/ EXIST. PAVING

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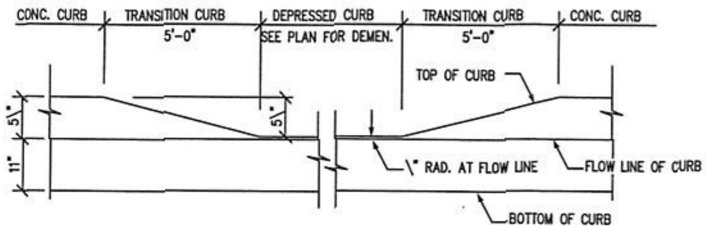

5 SP-1 DEPRESSED CURB

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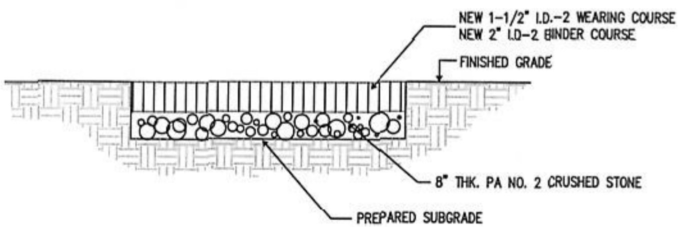

6 SP-1 BITUMINOUS PAVEMENT

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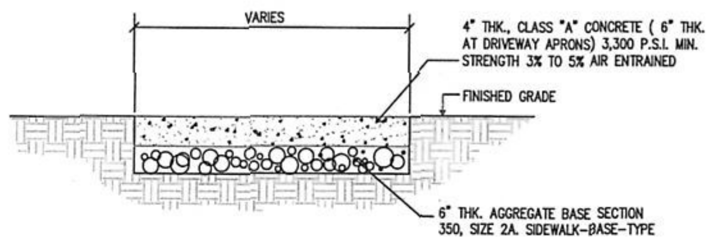


6 SP-1 CONCRETE SIDEWALK SECTION

SCALE = NO SCALE

SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SITE DETAILS

DATE: 5/24/01	PREP. BY: WBV
SCALE: AS NOTED	APPR. BY: JVM
DRAWING NO.: C-5	CAD DWG. #: SITE DETAILS 2
	CAE10

	Existing Area (sq ft)	Proposed Area (sq ft)
Sidewalk	13500	12992
Building	13938	21424
Parking	36421	44284
Grass	76189	61348
Totals	140048	140048

Rational Method
Q = k*C*I*A

Where:

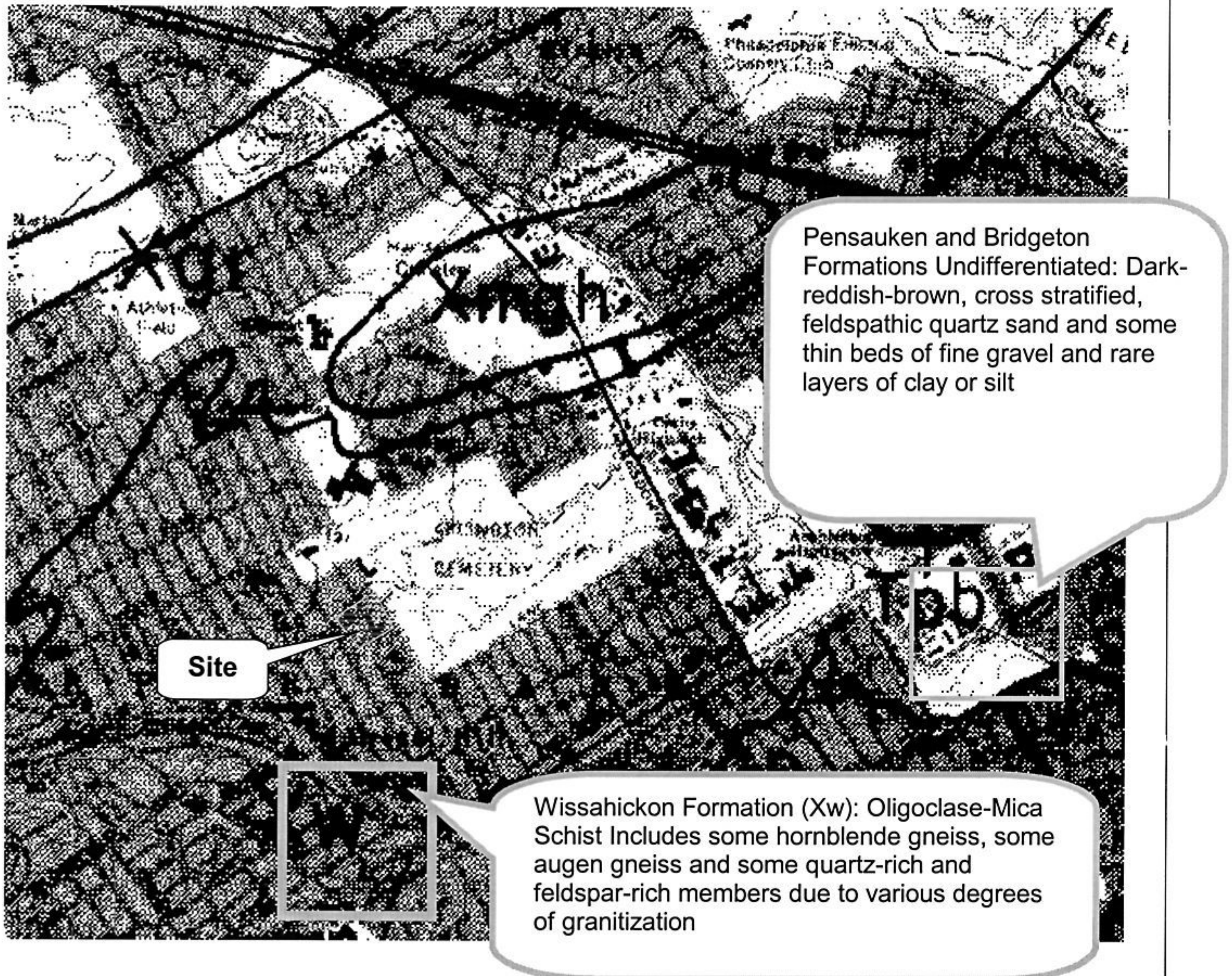
k = factor to maintain unit consistency (ft^3/s per acre-in/hr)
C = weighted rational coefficent for drainage area (unitless)
0.9 for impervious
0.2 for pervious (grass)
i = rainfall intensity (in/hr)
A = drainage area (acres)

k = 1.008 ft^3/s per acre-in/hr
i = 4.7 in/hr for 10 year storm (per PennDOT)
A = 3.22 acres

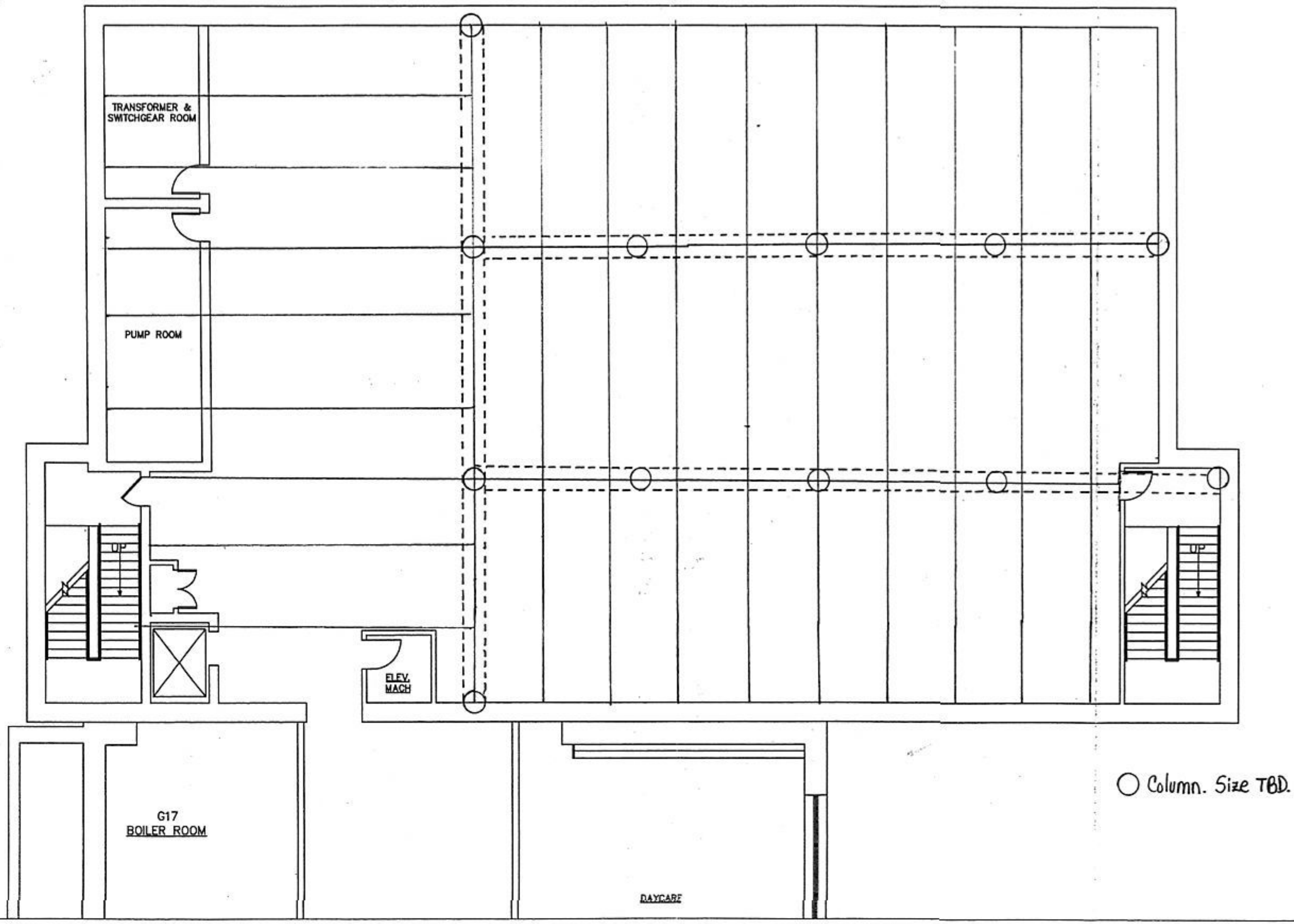
Existing Site
= (1.008 ft^3/s per acre-in/hr)[(0.9*1.47)+(0.2*1.75)](4.7 in/hr)(3.22 acres)
= 25.5 ft^3/s

Proposed Site
= (1.008 ft^3/s per acre-in/hr)[(0.9*1.81)+(0.2*1.41)](4.7 in/hr)(3.22 acres)
= 29.2 ft^3/s

Appendix E
Structure



SVM Engineers	**SVM Engineers, Inc.** **Established 2000** PHILADELPHIA, PA	**GEOLOGIC MAP OF PROJECT SITE** Reprinted from the United States Department of the Interior, Geologic Survey, Lansdowne PA Quadrangle		
Project: **Kindergarten Center Expansion** **Drexel Hill, PA**		Number **10001**	DATE **2/24/01**	SCALE **NTS**	**S-1**

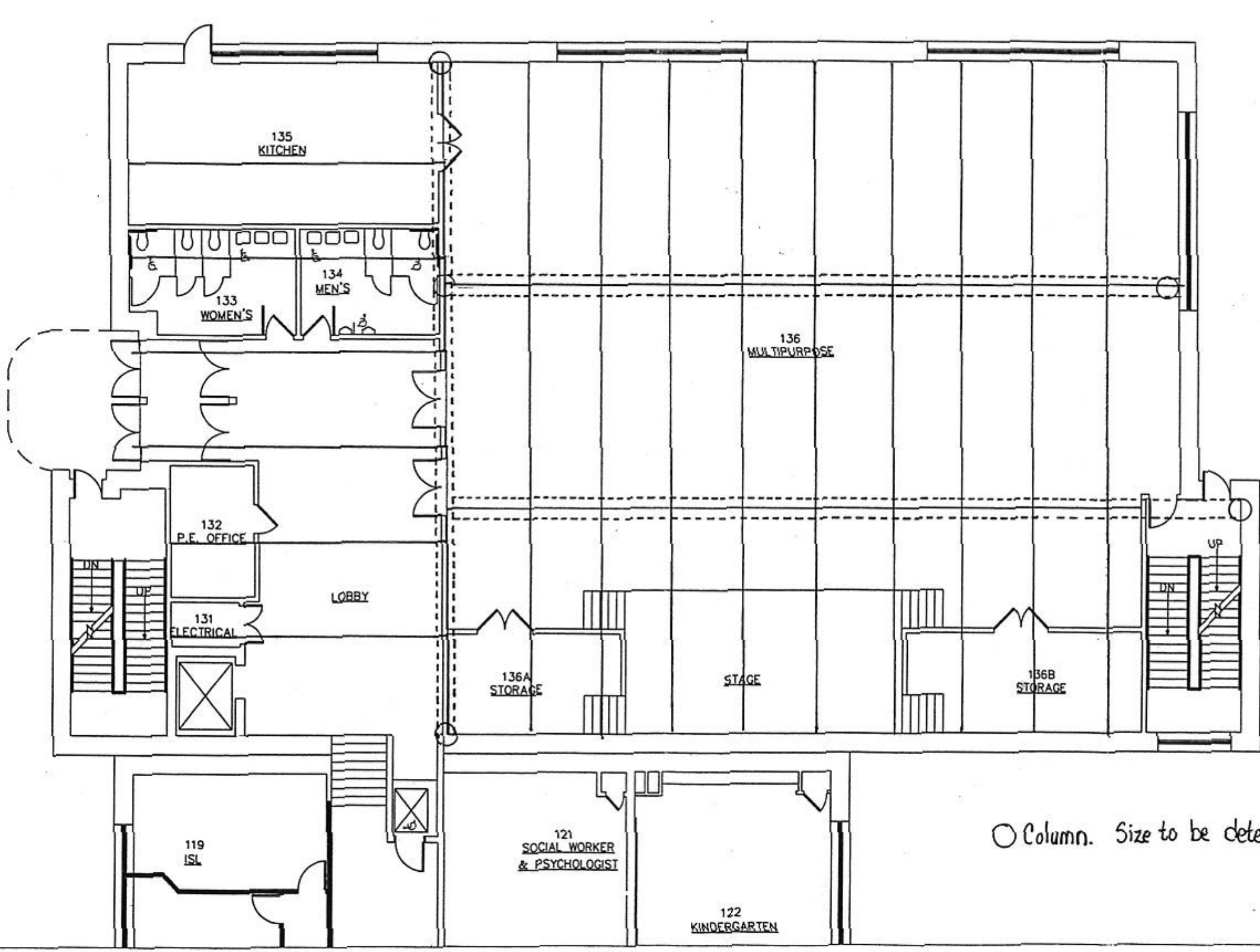


SVM Engineers

DRAWING TITLE:

UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
GROUND FLOOR PLAN – WEST

DATE: 3/9/01	PREP. BY: LJH
SCALE: 3/32"=1'-0"	APPR. BY: JMH
DRAWING NO.: S-1	CAD DWG. #: S-GFLOOR
	CAE10

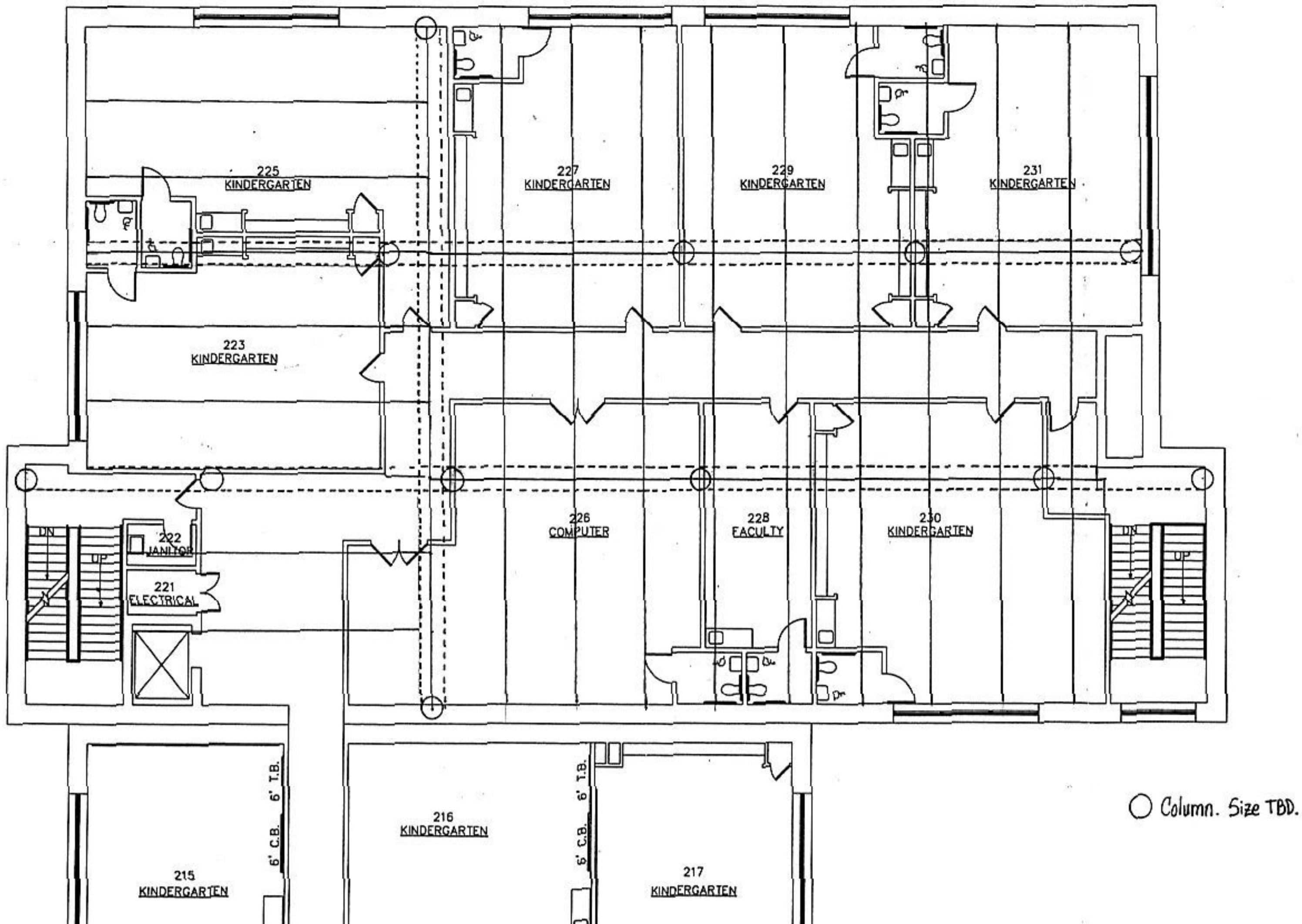


○ Column. Size to be determined.

SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
FIRST FLOOR PLAN - WEST

PREP. BY: MBV
APPR. BY: JMA
CAD DWG. # A-1FLOOR
CAE10
DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.: B-4



SVM Engineers

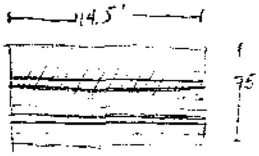
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SECOND FLOOR PLAN - WEST

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.: 5-2
PREP. BY: HJV
APPR. BY: JMH
CAD DWG. # A-2FLOOR
CAE10

Roof

Total Area: $75' \times 114.5' = 8587.5\ ft^2$

Roof Weight, Dead Load $= (8587.5\ ft^2)(\frac{15}{12})' \cdot 85\ pcf = 912421.875\ lbs$
$= 106.25\ psf$



Live load = 60 psf Live Load

166.25 psf say 167 psf total load

Load on roof transfer beams : 167 psf

Critical length = 36 ft

$w = 167\ psf \cdot 25\ ft = 4175\ lb/ft = 348\ \frac{lb}{in}$

$M_u = \frac{1}{8} w L^2 = \frac{1}{8} \cdot (4175\ \frac{lb}{ft})(36\ ft)^2 = 676.35\ kip\text{-}ft$

Using A-50 steel

$S = \frac{M_u}{F_b} = \frac{680\ k\text{-}ft \cdot 12 \frac{in}{ft}}{(0.6)\ (50)\ ksi} = 272\ in^3$ (S_{min})

$\Delta_{max} = (\frac{1}{360})(36\ ft) = 0.1\ ft = 1.2\ in$

$I_{min} = \frac{5 \cdot w \cdot L^3}{384 \cdot E \Delta_{max}} = \frac{(5)(348\ \frac{lb}{in})(36\ ft \cdot \frac{12"}{ft})^3}{(384)(29{,}000{,}000\ psi)(1.2\ in)} = 10.5\ in^4$

Designation wt

30x 108

Column Load : 11 columns ~ walls included

Column load $= \frac{1}{11}(167\ psf) = 15\ psf$ say 20 psf to include steel

$20\ psf \cdot ((4 \cdot 8)' \cdot 25') = 16\ kips$ Length = 14'
(Area Max)

From Table 23.4 , Assuming $F_y = 46\ ksi$

$kl = 0.65 \cdot 14' = 9.1'$

$kl_{max} = 1.0 \cdot 14' = 14.0'$

Allowable load from BOCA must be 100 kips

Factor of safety = 2.0 ~ Size column for 2 x 16k load = 32 kips

From Table 23.4, we can use a 4" x 4" steel tube
$\frac{1}{4}$" thickness

$A = 3.59\ in^2$ $I = 8.22\ in^4$ $r = 1.51\ in$ $S = 0874$

Roof to Columns on Second Floor	BY ______ DATE ______	PROJ. NO. ______
	CKD. ______ DATE ______	SHEET ______ OF ______

Second Floor

Dead load =

Pannels : 85 pcf × ($\frac{15}{12}$) ft = 106.25 psf — 106.25 psf

Columns : 11 × 14.5 ft × 12.21 $\frac{lb}{ft}$ ÷ (75 × 114.5) ft² — 0.23 psf

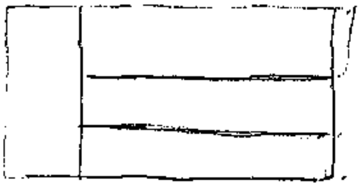
Beams : [(1 × 75) ft - (2·(114.5-35) ft)] × 118 $\frac{lb}{ft}$ ÷ (75 × 114.5) ft² — 3.22 psf

109.70 psf

say 110 psf

Live load = 47.5 psf (BOCA)

Total structural load = (47.5 + 110) psf = 147.5 psf



Critical span : 80 ft

$w = 25' \cdot 147.5 \frac{lb}{ft^2} = 4000 \frac{lb}{ft} = 4 \frac{k}{ft}$

$M_u = \frac{1}{8} w L^2 = (\frac{1}{8})(4.0 \frac{k}{ft})(80 ft)^2 = 3200$ k-ft

Select : W 44 × 262

$S = \frac{M_u}{F_b} = \frac{(3200\ k \cdot ft \cdot 12 in)}{(\frac{2}{3})(50\ ksi)} = 1153$

Column Loads, First Floor — 6 columns, 18.5' long

Add'l Load = 80·2·262 + 72·1·262 = 60,784 lbs ÷ (114.5·75) ft² = 7.1 psf

Total Load per column = $\frac{1}{6}$(7.1 psf + 147.5 psf) = 25.76 psf

Total Load, max = 25.76 psf · 25 ft · 40 ft = 25.76 kips

Factor of safety = 2 ∴ size columns for 2 × 25.76 kips = 51.53 kips

$\frac{kl}{r} = 52$ kips

$\frac{1 \cdot 18.5 \cdot 12}{52\ kips} = r = 4.3685$

5/8" thickness

Use 12" × 12" columns (Table 1-123 AISC Manual)

r = 4.6 lb/ft = 93.34

Support of the second floor

BY ____ DATE ____ PROJ. NO. ____

CKD. ____ DATE ____ SHEET ____ OF ____

Supporting the Ground Floor

Dead load:

Pannels: 85 pcf × $(\frac{15}{12})'$ = 106.25 lb

Columns: 6 × 18.5' × 93.34 $\frac{lb}{ft}$ = 10360.75 lb

Beams: [1×75 + 2(114.5−35)] × 262 $\frac{lb}{ft}$ = 61308 lb

Live load = 50 psf × (114.5×75) = 429375 lb

Total structural load = 58.358 $\frac{lb}{ft^2}$

Critical span = 24 ft

$w = (25ft)(58.358 \frac{lb}{ft^2}) = 1425\ lb/ft$

$M_u = \frac{1}{8} wL^2 = \frac{1}{8} \cdot 1425 \frac{lb}{ft} \cdot (24ft)^2 =$ 102,600 lb-ft

= 103 kip-ft

$S = \frac{M_u}{F_b} = \frac{103\ kip\text{-}ft \cdot 12''}{(\frac{2}{3})(50\ ksi)} =$ 37.08 in^3 choose:

Select: W16 × 100

Additional Load = 100 $\frac{lb}{ft}$ × 12'·12 = 14,400 lb ÷ Floor Area = 1.68 $\frac{lb}{ft^2}$

Column load: $\frac{1}{12}(58.358 + 1.68)\frac{lb}{ft^2} \cdot 420\ ft^2$ = 2101 lbs (Int. Columns)

Total column load = 2 + 25.76 + 16 kips = 43.76 kips (Ext. columns)

Internal columns = 3×3 square columns, $\frac{3}{16}$" thickness.

External columns $\frac{kl}{r}$ = 86 kips (FS=2)

$r = \frac{1 \cdot 12 \cdot 12\ in^2}{86\ kips}$ = 1.674

Because 12" are required on first floor, we will use 12" in the basement at the wall locations.

	BY ______ DATE ______	PROJ. NO. ______
	CKD. ______ DATE ______	SHEET ______ OF ______

Appendix F
Mechanical

1. DESIGN CONDITIONS

Location: International Airport, Philadelphia, PA
93.9°N, 75.3°W

	Summer	Winter
Time zone	Eastern Daylight Time	Eastern Standard Time
Dry bulb temperature	89.1°F	15.1°F
Daily range	17.6°F	0.0°F
Wet bulb temperature	73.9°F	15.1°F
Ground temperature	72.0°F	50.0°F
Clearness	1	0
Ground Reflectivity	0.2	0
Atmospheric Pressure	14.61 psi	14.61 psi
Wind direction (clockwise from North)	230	290
Wind speed	10.98 mph	12.10 mph
Date	July 21	January 21

Typical Heat Transfer Surfaces

Exterior Wall					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
stone veneer	0.20	6.67	4	30	0.60
lightweight aggregate 85 pcf concrete block w/ perlite filled cores	0.20	1.62	12	19	7.41
gypsum wall board	0.30	1.08	0.625	50	0.58
				Ro=	8.59
				U=	0.12

Interior Partition					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
gypsum wall board	0.3	1.08	0.5	50	0.46
insulation	0.17	0.3	4	2	13.33
gypsum wall board	0.3	1.08	0.5	50	0.46
			Ro=		14.26
			U=		0.07

Double Glazed Aluminum Frame Window	
	U= 0.48
	SHGC= 0.37

Roof					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
stone chippings	0.4	9.96	0.5	55	0.05
felt	0.4	1.21	0.375	70	0.31
insulation	0.2	0.30	2	2	6.67
concrete	0.2	5.64	3	40	0.53
air gap	0.24	9.00	9	0	1.00
concrete	0.2	5.64	3	40	0.53
ceiling airspace	0.24	39.00	39	0	1.00
ceiling tile	0.14	0.48	0.4	23	0.83
			Ro=		10.92
			U=		0.09

Second Floor					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
ceiling tile	0.14	0.48	0.4	23	0.83
ceiling air space	0.24	39.00	39	0.075	1.00
concrete	0.2	5.64	3	40	0.53
air space	0.24	9.00	9	0.1	1.00
concrete	0.2	5.64	3	40	0.53
vinyl tiles		4.20	0.2		0.05
			Ro=		3.94
			U=		0.25

Ground Floor Slab					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
stone chippings		9.96	0.5		0.05
vapor barrier		2.4	0.04		0.02
cast concrete		12.00	8		0.67
screed		9.72	2.75		0.28
			Ro=		0.95
			U=		1.05

First Floor					
Layer Name	Specific Heat (Btu/(lb*F)	K (Btu*in/(h*ft^2*F)	t (in)	Density (lb/ft^3)	R (Btu/(h*ft^2*F)
ceiling tile	0.14	0.48	0.4	23	0.83
ceiling air space	0.24	39.00	39	0.075	1.00
concrete	0.2	5.64	3	40	0.53
air space	0.24	9.00	9	0.1	1.00
concrete	0.2	5.64	3	40	0.53
			Ro=		3.90
			U=		0.26

2. SYSTEM LOADS

System Season	RTU-1						
	Cooling					Heating	
Hours	HBSensible Load (BTU/Hr)	Air Flow Rate (CFM)	Total Coil Load (BTU/Hr)	Sensible Coil Load (BTU/Hr)	Latent Coil Load (BTU/Hr)	HBSensible Load (BTU/Hr)	Air Flow (CFM)
1	3678.1	1093.2	33679.1	4946.2	11183.2	-60456.3	0
2	-1134.3	1095	32674.2	4458.3	11189.5	-65859.4	0
3	-4599.3	0	0	4067	11195.1	-69603.3	0
4	-7205.6	0	0	3772.3	11198.6	-72308.2	0
5	-9178.9	0	0	0	0	-74320.5	0
6	-10618.2	0	0	0	0	-75849.6	0
7	-11586.7	0	0	0	0	-69044.2	0
8	58233.8	4938.5	258197.7	8669.5	17676.4	-29721.8	5787.6
9	70617.3	5554.4	289575.2	30522.1	44265.2	-29685.9	5787.6
10	79682.3	6048.7	312239.9	73271.1	88534.6	-8704.5	5787.6
11	85084.9	6353.6	333699.1	89665.8	88594.8	2629.6	5787.6
12	89164	6568.6	352699.2	102396	88598.3	9712.7	5787.6
13	92367.9	6725.3	366774.4	111682.9	88597.6	14446.6	5787.6
14	94922.2	6842.9	376295.4	118265	88606	9789	5787.6
15	96899.5	6930.7	380479.1	121954	88634	10557.3	5787.6
16	96334.2	6946.7	377289.8	74996.6	44627.1	9526.5	5787.6
17	95666.5	6955.6	370286.1	42110.6	18120.9	16814.5	5787.6
18	95640.9	6975.6	359759.6	22983.1	11337.2	42029.7	5787.6
19	95140.8	6971.9	346656.3	16909.2	11254.6	71177.9	5787.6
20	94656	6981	333811.4	12735.8	11211.2	58420.9	5787.6
21	94078.3	6986.6	322825.6	9648.8	11183.9	43751.8	5787.6
22	93416.8	6613.2	219474.5	7052.5	11162.9	38244.1	4420.2
23	22676.1	1681	44318.6	6014.4	11168.5	-38227.4	0
24	10811.3	1091.3	34680.7	5432.7	11176.2	-52180	0

System	RTU-2						
Season	Cooling					Heating	
Hours	HBSensible Load (BTU/Hr)	Air Flow Rate (CFM)	Total Coil Load (BTU/Hr)	Sensible Coil Load (BTU/Hr)	Latent Coil Load (BTU/Hr)	HBSensible Load (BTU/Hr)	Air Flow (CFM)
1	3685.4	529.3	15391	4946.2	11183.2	-36751.5	0
2	2665.5	526.4	14904.3	4458.3	11189.5	-38411.5	0
3	1710.4	434.7	11933.2	4067	11195.1	-39756.9	0
4	820.3	430.9	11657.4	3772.3	11198.6	-40859.1	0
5	32.3	113.4	2664.4	0	0	-41769.5	0
6	-613.8	34.2	488	0	0	-42526.7	0
7	-1107.7	29.7	423.8	0	0	-43160.2	0
8	10241.8	732.8	24550.4	8669.5	17676.4	-60475	0
9	30177.6	2159.1	68925.1	30522.1	44265.2	-51229.8	0
10	64486.6	4613.9	148655.9	73271.1	88534.6	-7095	0
11	72058	5155.7	163773.6	89665.8	88594.8	5640.1	0
12	76672.2	5485.7	175364.6	102396	88598.3	13268.5	0
13	79889.2	5715.9	183762.4	111682.9	88597.6	18425.3	0
14	82370.3	5893.4	189682.3	118265	88606	22207.9	0
15	84359.6	6035.8	192978.6	121954	88634	25126.4	0
16	55759	3989.5	109713.2	74996.6	44627.1	-2726	0
17	33935.9	2427.9	55162.8	42110.6	18120.9	-23928.3	0
18	23004.7	1645.9	40316.5	22983.1	11337.2	-15317.1	0
19	14004.2	1002	26781.5	16909.2	11254.6	-1091.7	0
20	10849.2	776.2	22437	12735.8	11211.2	-15395.9	0
21	8781	628.1	19366.8	9648.8	11183.9	-23369.9	0
22	7194.8	541.4	17250.7	7052.5	11162.9	-28442.3	0
23	5883.7	532.6	16418.8	6014.4	11168.5	-32003.5	0
24	4740.6	531.5	15867.5	5432.7	11176.2	-34671.8	0

System	Kitchen Unit						
Season	Cooling					Heating	
Hours	HBSensible Load (BTU/Hr)	Air Flow Rate (CFM)	Total Coil Load (BTU/Hr)	Sensible Coil Load (BTU/Hr)	Latent Coil Load (BTU/Hr)	HBSensible Load (BTU/Hr)	Air Flow (CFM)
1	1594.2	148.2	4877.6	1399.8	3477.8	-6500	0
2	1119.3	148.4	4741.4	1261.7	3479.7	-6979.8	0
3	770	148.6	4632.1	1150.9	3481.2	-7307.1	0
4	498.7	148.7	4550	1067.6	3482.4	-7540.6	0
5	288.2	148.8	4522.6	1039.8	3482.8	-7712.5	0
6	132.1	148.7	4577.4	1095.4	3482	-7842.2	0
7	8007.8	572.9	13698.9	7167	6531.9	43	0
8	12738.7	911.4	31009	9807.6	21201.5	1129.3	0
9	14262.1	1020.4	34365.4	13156.1	21209.3	1259.7	0
10	15158.8	1084.6	37340.3	16139.5	21200.8	3352.9	0
11	15765.3	1128	40269.5	19086.4	21183.1	4543.4	0
12	16209.7	1159.8	42874.3	21710	21164.2	5283.3	0
13	16544.9	1183.7	44815.1	23664.9	21150.2	5774.7	0
14	8824.9	720.8	36341	18267.3	18073.7	-1866.1	0
15	7375.1	720.1	36726.9	18658.5	18068.3	-3274	0
16	6645.9	720.8	36341	18267.3	18073.7	-3970.3	0
17	14221.3	1017.5	42576.8	21475.7	21101.1	3631.4	0
18	15615.6	1117.3	42535.4	21386.7	21148.7	7477.7	0
19	16309.9	1166.9	41500	20314.5	21185.5	11122.7	0
20	16689.1	1194.1	40128.2	18912.1	21216.1	10102.8	0
21	8926.6	733.8	29132.9	10959.1	18173.8	1619.9	0
22	7391.3	528.8	12924.8	7253.9	5670.9	-306.6	0
23	3439.2	246.1	6579.8	3078	3501.9	-4479.1	0
24	2287.4	163.7	5238	1757.6	3480.4	-5752.1	0

System	Computer & Faculty Room Units							Hydronic Heating	
Season	Cooling					Heating		Heating	
Hours	HBSensible Load (BTU/Hr)	Air Flow Rate (CFM)	Total Coil Load (BTU/Hr)	Sensible Coil Load (BTU/Hr)	Latent Coil Load (BTU/Hr)	HBSensible Load (BTU/Hr)	Air Flow (CFM)	HBSensible Load (BTU/Hr)	Air Flow (CFM)
1	13209.1	945.1	17054.9	1413.2	3195.2	9154.3	677.2	-84265.4	0
2	12866.6	920.6	16527.9	1273.8	3197	8563.9	633.5	-84598.8	0
3	12569.1	899.3	16082.1	1162	3198.6	8082.3	598	-84879.1	0
4	12307.7	880.6	15708.3	1077.8	3199.6	7686.1	568.6	-85116.8	0
5	12076	864	15436.2	0	0	7357.5	544.3	-85319.2	0
6	11869.5	849.2	15296.9	0	0	7083.4	524.1	-85492.4	0
7	12394.3	886.8	16142.5	0	0	7562.4	559.5	-85640.9	0
8	23692.7	1695.2	30743	2477	5050.4	11923.4	1146.7	-97990.3	0
9	51638.9	3694.7	69275.1	8720.6	12647.2	37475.1	4505.3	-95444.3	0
10	96057.1	6872.7	132595.1	20934.6	25295.6	84523.4	10161.4	-94063.1	0
11	98575.7	7052.9	137768.5	25618.8	25312.8	88488.8	10638.2	-93155.4	0
12	102425.8	7328.3	144743.5	29256	25313.8	93241.3	11209.5	-92488.9	0
13	103068	7374.3	147230.7	31909.4	25313.6	94496.3	11360.3	-91966.8	0
14	102428.8	7328.5	147608.2	33790	25316	94293	11336	-91542.4	0
15	103031.1	7371.6	148725.2	34844	25324	95210.2	11446.2	-91189.7	0
16	61726.7	4416.4	84868.4	21427.6	12750.6	54135.9	6508.3	-90892.8	0
17	33485	2395.8	42958.6	12031.6	5177.4	26065.2	3133.6	-90640.9	0
18	23207.8	1660.4	32020.8	6566.6	3239.2	20521.5	1973.7	-90426.1	0
19	18328.1	1311.4	24123.2	4831.2	3215.6	21154	1565.1	-78019.7	0
20	16557.2	1184.7	21869.4	3638.8	3203.2	16444.7	1216.6	-80517.5	0
21	15454.6	1105.7	20363.6	2756.8	3195.4	13775	1019.1	-81857.9	0
22	14680.3	1050.3	19224.8	2015	3189.4	12049.5	891.5	-82730.5	0
23	14088.2	1008	18340.1	1718.4	3191	10820.4	800.5	-83366.9	0
24	13609.7	973.8	17640.4	1552.2	3193.2	9888.1	731.6	-83863.2	0

3. SCHEDULES

AIR HANDLING EQUIPMENT SCHEDULE

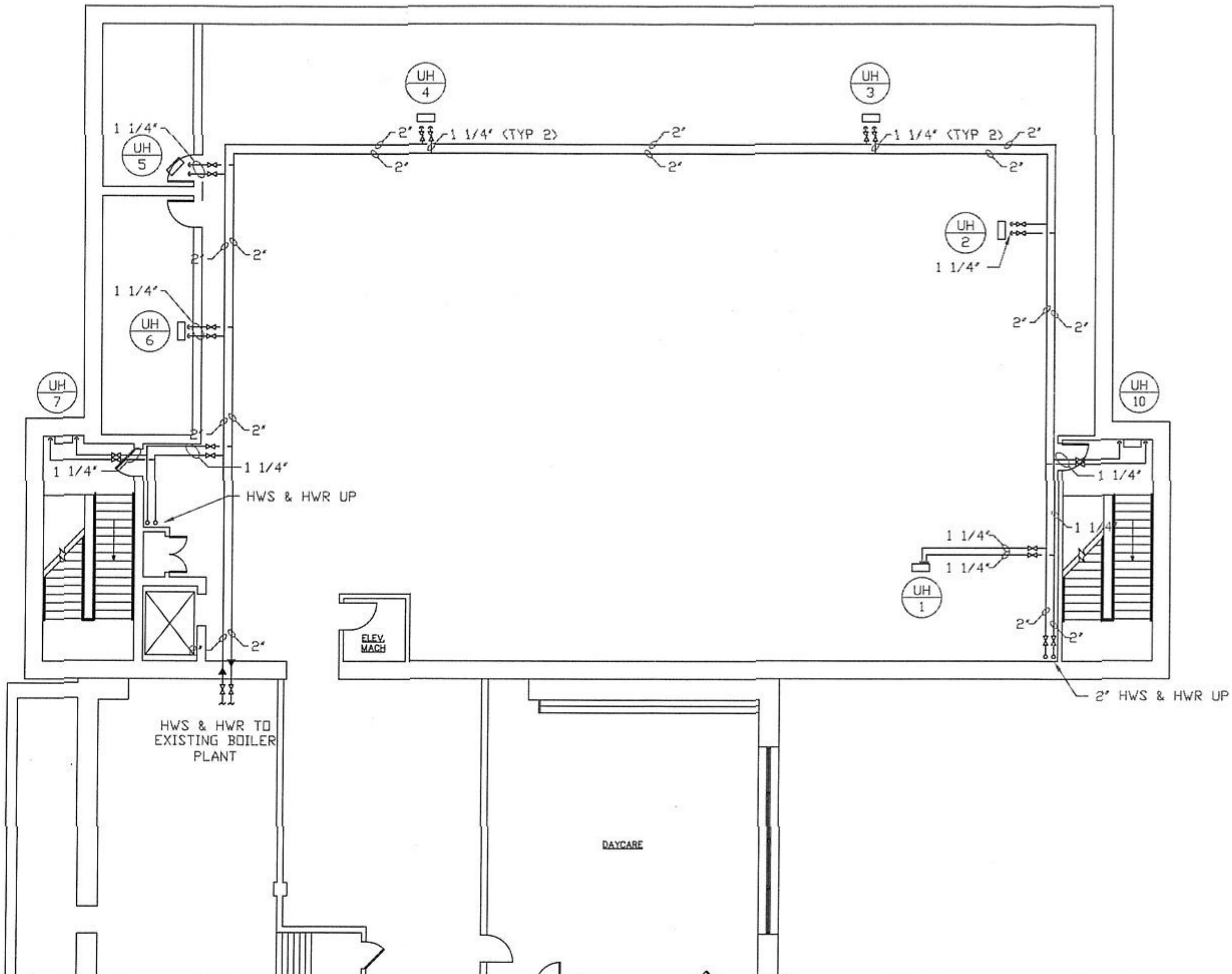
QTY	Equipment	Type	Service	Capacity	Heating Coil GPM	Motor V-Ø-Hz	Motor MCA	Motor kW	Basis of Design
1	RTU-1	Packaged Rooftop Elec/HW	First Floor	40 Tons	20	460-3-60	-	50-170	Trane Intellipak
1	RTU-2	Packaged Rooftop Elec/HW	Second Floor	20 Tons	10	460-3-60	-	30-115	Trane Intellipak
1	RTU-3	Packaged Rooftop Heatpump	Computer & Faculty Rooms	12.5 Tons	-	460-3-60	32	-	Trane Voyager
1	HP-1	Split System Heat Pump	Kitchen	4 Tons	-	460-3-60 / 208-3-60	20	-	Trane Model TWA048C3,C4

EXHAUST FAN SCHEDULE									
						MOTOR			
NO.	SERVICE	CFM	S.P. (IN. H20)	FAN TYPE	FAN RPM	HP	RPM	V-Ø-Hz	BASIS OF DESIGN
EF-1	TOILET ROOMS, ELECTRIC, MECHANICAL, ELEVATOR	1150	0.10 - 1.20	ROOF CENTRIFUGAL	860/ 1140/ 1725	1/8 - 3/4		120-1-60	GREENHECK MODEL G
EF-2	ELECTRIC & JANITOR CLOSETS	300	0.10 -0.60	ROOF CENTRIFUGAL	1050/ 1300/ 1550	1/100 - 1/20		120-1-60	GREENHECK MODEL G
EF-3	TOILET ROOMS	225	0.10 -0.60	ROOF CENTRIFUGAL	1050/ 1300/ 1550	1/100 - 1/20		120-1-60	GREENHECK MODEL G
EF-4	TOILET ROOMS	225	0.10 -0.60	ROOF CENTRIFUGAL	1050/ 1300/ 1550	1/100 - 1/20		120-1-60	GREENHECK MODEL G
EF-5	KITCHEN	1200	0.5	SIDEWALL CENTRIFUGAL	1140	1/6		120-1-60	GREENHECK MODEL CW

GRILLE, REGISTER, & DIFFUSER SCHEDULE									
CFM	SERVICE	TYPE	INLET SIZE	BLOW DIRECTION	THROW, FT	NECK VELOCITY, FPM	VELOCITY PRESSURE	TOTAL PRESSURE	BASIS OF DESIGN
75	SUPPLY/RETURN	LAY-IN CLG	6x6	4	6	300	0.006	0.036	PRICE AMD SERIES
125	SUPPLY/RETURN	LAY-IN CLG	6x6	4	10	500	0.016	0.099	PRICE AMD SERIES
300	SUPPLY/RETURN	LAY-IN CLG	12x6	4	12/17	600	0.022	0.144	PRICE AMD SERIES
400	SUPPLY/RETURN	LAY-IN CLG	12x12	4	15	400	0.010	0.065	PRICE AMD SERIES
450	SUPPLY/RETURN	LAY-IN CLG	12x9	4	19/16	600	0.022	0.144	PRICE AMD SERIES
615	SUPPLY/RETURN	LAY-IN CLG	15x9	4	22/17	700	0.031	0.196	PRICE AMD SERIES
725	SUPPLY/RETURN	LAY-IN CLG	15x9	4	18/24	800	0.040	0.256	PRICE AMD SERIES
1150-1260	SUPPLY/RETURN	LAY-IN CLG	18x15	4	25/23	700	0.031	0.196	PRICE AMD SERIES
75	EXHAUST	LAY-IN CLG	6x5	N/A	N/A	500	0.016	0.034	PRICE 80 SERIES
150	EXHAUST	LAY-IN CLG	8x6	N/A	N/A	600	0.022	0.047	PRICE 80 SERIES
225	EXHAUST	LAY-IN CLG	10x8	N/A	N/A	500	0.016	0.034	PRICE 80 SERIES
25	TRANSFER	SIDEWALL	10x4	N/A	N/A	100	0.0006	0.012	PRICE ATG1
75	TRANSFER	SIDEWALL	10x4	N/A	N/A	300	0.006	0.108	PRICE ATG1

UNIT HEATER SCHEDULE									
			MOTOR & FAN			HOT WATER			BASIS OF DESIGN
UNIT NO.	SERVICE	MBH (60 ºF EAT)	CFM	HP	V-Ø-Hz	EWT (ºF)	GPM	MAX. P.D. (FT.)	
UH-1	G35 STORAGE	17.1	815	1/20	208/460-3-60	180	1.32	0.04	TRANE 60-S
UH-2	G35 STORAGE	17.1	815	1/20	208/460-3-60	180	1.32	0.04	TRANE 60-S
UH-3	G35 STORAGE	17.1	815	1/20	208/460-3-60	180	1.32	0.04	TRANE 60-S
UH-4	G35 STORAGE	17.1	815	1/20	208/460-3-60	180	1.32	0.04	TRANE 60-S
UH-5	G33 ELECTRIC	4.9	280	1/50	208/460-3-60	180	0.87	0.01	TRANE 18-S
UH-6	G32 MECHANICAL	6	280	1/50	208/460-3-60	180	1.13	0.02	TRANE 18-S
UH-7	SOUTH STAIRS	5.6	280	1/50	208/460-3-60	180	1.13	0.02	TRANE 18-S
UH-8	SOUTH STAIRS	5.6	280	1/50	208/460-3-60	180	1.13	0.02	TRANE 18-S
UH-9	SOUTH STAIRS	5.6	280	1/50	208/460-3-60	180	1.13	0.02	TRANE 18-S
UH-10	NORTH STAIRS	6.2	280	1/50	208/460-3-60	180	1.2	0.02	TRANE 18-S
UH-11	NORTH STAIRS	6.2	280	1/50	208/460-3-60	180	1.2	0.02	TRANE 18-S
UH-12	NORTH STAIRS	6.2	280	1/50	208/460-3-60	180	1.2	0.02	TRANE 18-S

VAV BOX SCHEDULE											
ID NO.	NOMINAL CFM	VALVE SIZE	MIN. CFM	MAX. CFM	INLET Ø, IN	OUTLET Ø, IN	LENGTH, IN	WIDTH, IN	HEIGHT, IN	WEIGHT, LB	BASIS OF DESIGN
VV-1	600	6	60	660	8	6 OR 8	20	12	10	14	TRANE MODEL VCCE/UCM
VV-2	125	3	30	330	6	5, 6, OR 8	20	12	10	14	TRANE MODEL VCCE/UCM
VV-3	500	6	60	660	8	6 OR 8	20	12	10	14	TRANE MODEL VCCE/UCM
VV-4	2175	24	240	2640	12	12 OR 14	29	27	17	45	TRANE MODEL VCCE/UCM
VV-6	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-7	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-8	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-9	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-10	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-11	1000	11	110	1210	8	10	20	15	12	20	TRANE MODEL VCCE/UCM
VV-16	1200	17	170	1870	10	10 OR 12	21.5	21	16	27	TRANE MODEL VCCE/UCM
VV-17	300	3	30	330	6	6	20	12	10	14	TRANE MODEL VCCE/UCM
VV-18	1450	17	170	1870	10	10	21.5	21	16	27	TRANE MODEL VCCE/UCM
VV-19	1450	17	170	1870	10	10	21.5	21	16	27	TRANE MODEL VCCE/UCM
VV-20	1450	17	170	1870	10	10	21.5	21	16	27	TRANE MODEL VCCE/UCM

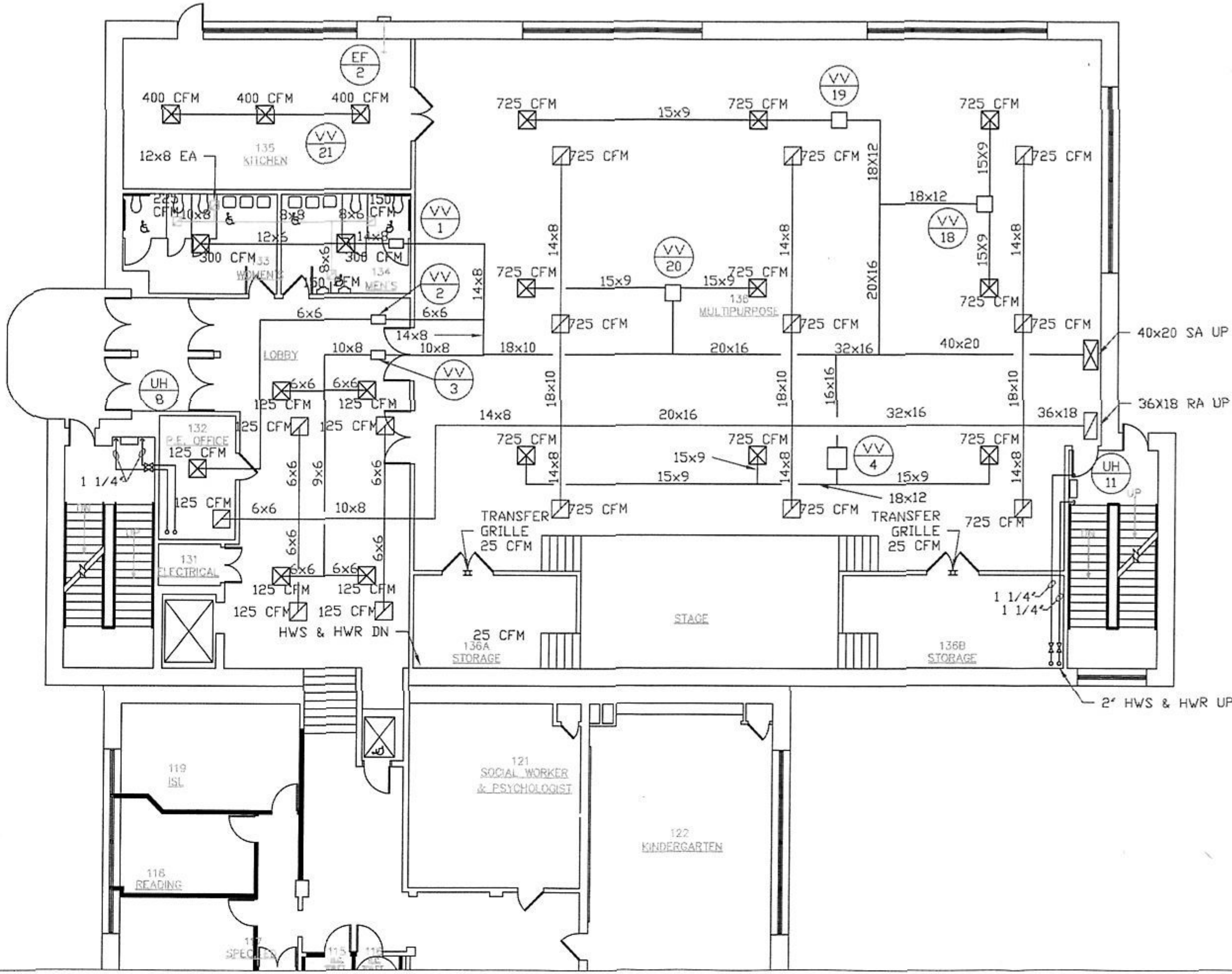


SVM Engineers

DRAWING TITLE: UPPER DARBY SCHOOL DISTRICT KINDERGARTEN CENTER EXPANSION GROUND FLOOR HVAC PLAN

PREP. BY: JAS
APPR. BY: JMH
CAD DWG. #: M-GFloor
CAE10

DATE: 5/24/01
SCALE: 3/32"=1'-0"
DRAWING NO.: M-1



SVM Engineers

DRAWING TITLE:

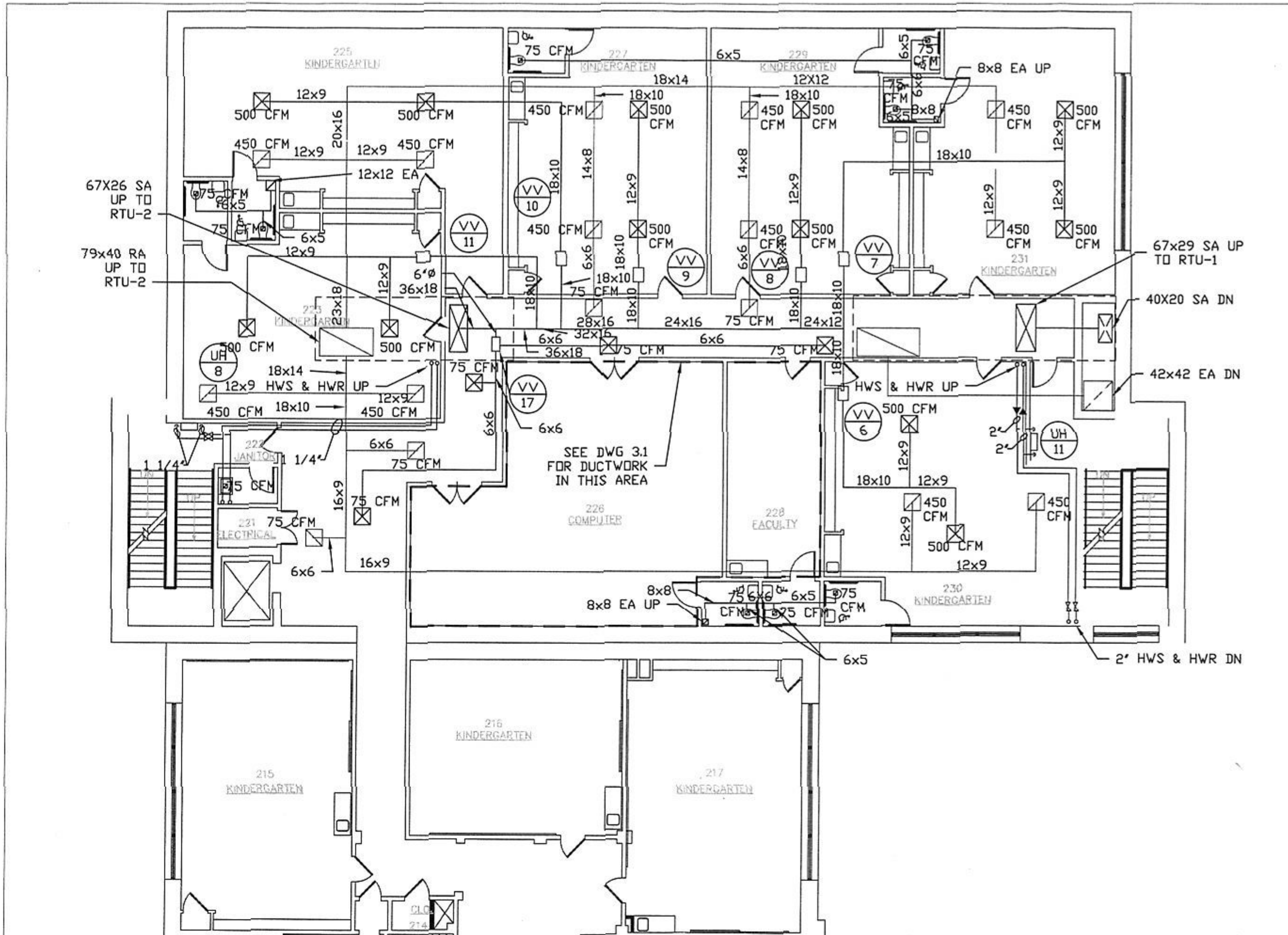
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
FIRST FLOOR PLAN – HVAC

PREP. BY: JAS
APPR. BY: JMM
CAD DWG. #: M-1floor

CAE10

DATE: 5/18/01
SCALE: 3/32"=1'-0"
DRAWING NO.:

M-2

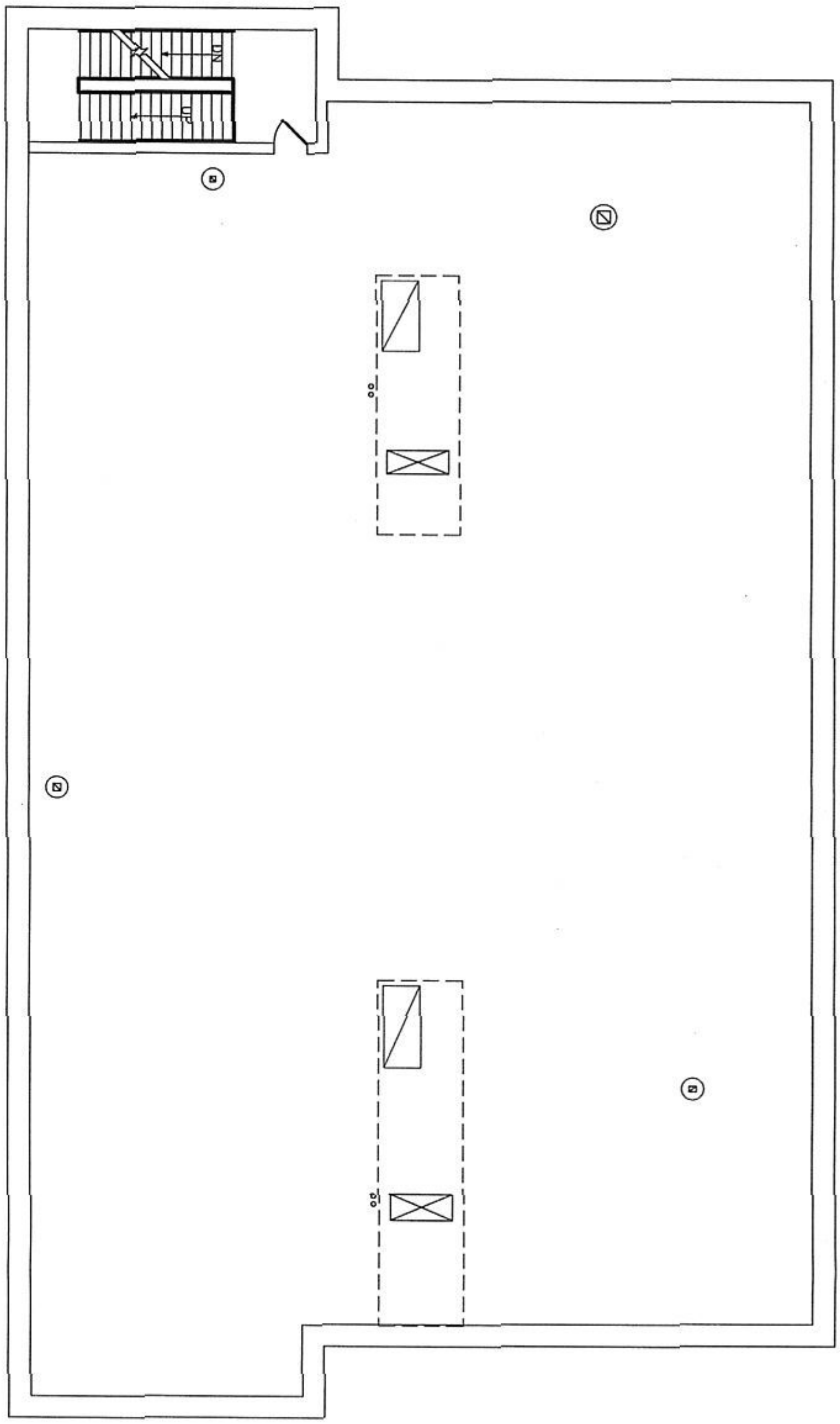


DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SECOND FLOOR HVAC PLAN

SVM Engineers

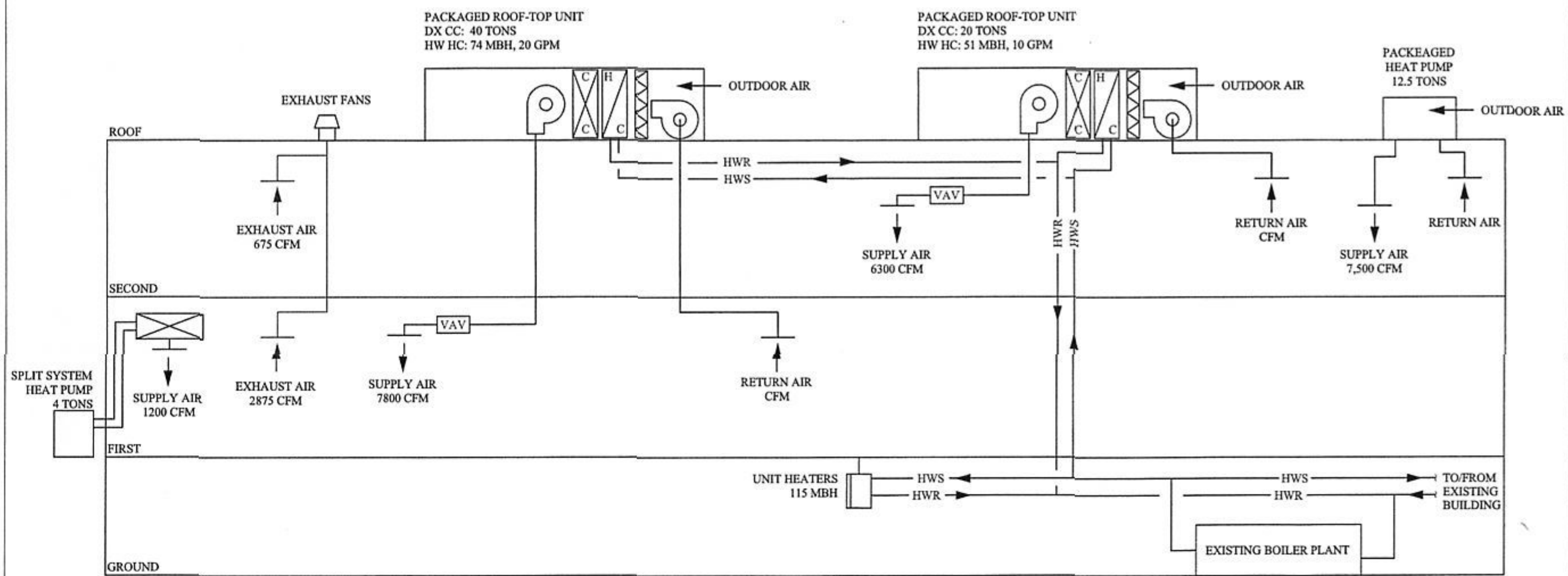
PREP. BY: JAG
APPR. BY: JMM
CAD DWG. #: M-2floor
CAE10

DATE: 5/18/01
SCALE: 3/32"=1'-0"
DRAWING NO.: M-3



DATE: 5/18/01	PREP. BY: JAS	DRAWING TITLE:
SCALE: 3/32"=1'-0"	APPR. BY: JMM	UPPER DARBY SCHOOL DISTRICT KINDERGARTEN CENTER EXPANSION ROOF HVAC PLAN
DRAWING NO.: M-4	CAD DWG. # M-Roof	

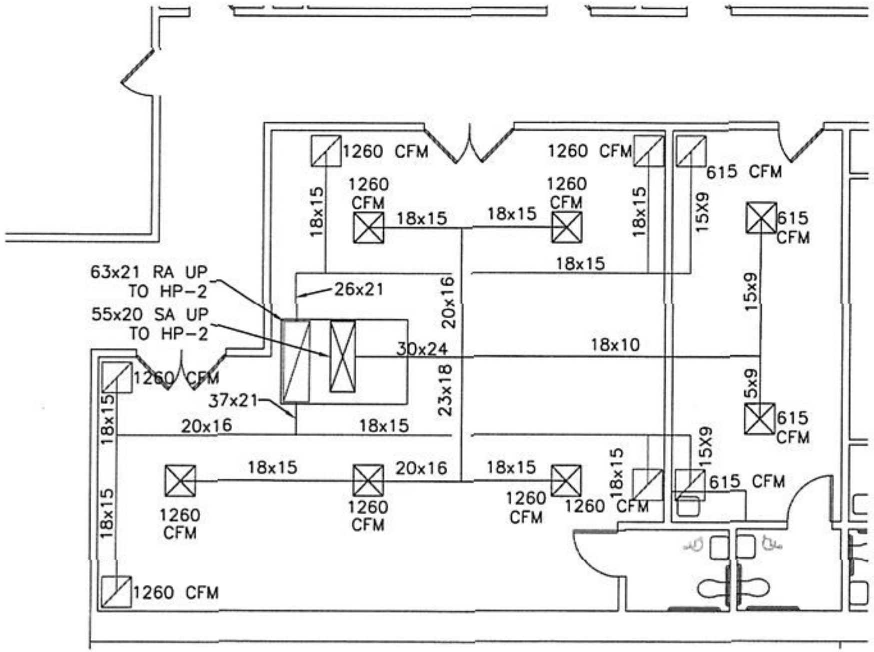
SVM Engineers



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
HVAC SYSTEM SCHEMATIC

PREP. BY: JAS
APPR. BY: JMM
CAD DWG. #:
SCALE: NOT TO SCALE
DRAWING NO.: M-5



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
PARTIAL THIRD FLOOR PLAN - HVAC

DATE: 5/18/01
SCALE: 1/8"=1'-0"
DRAWING NO.:
M-3.1

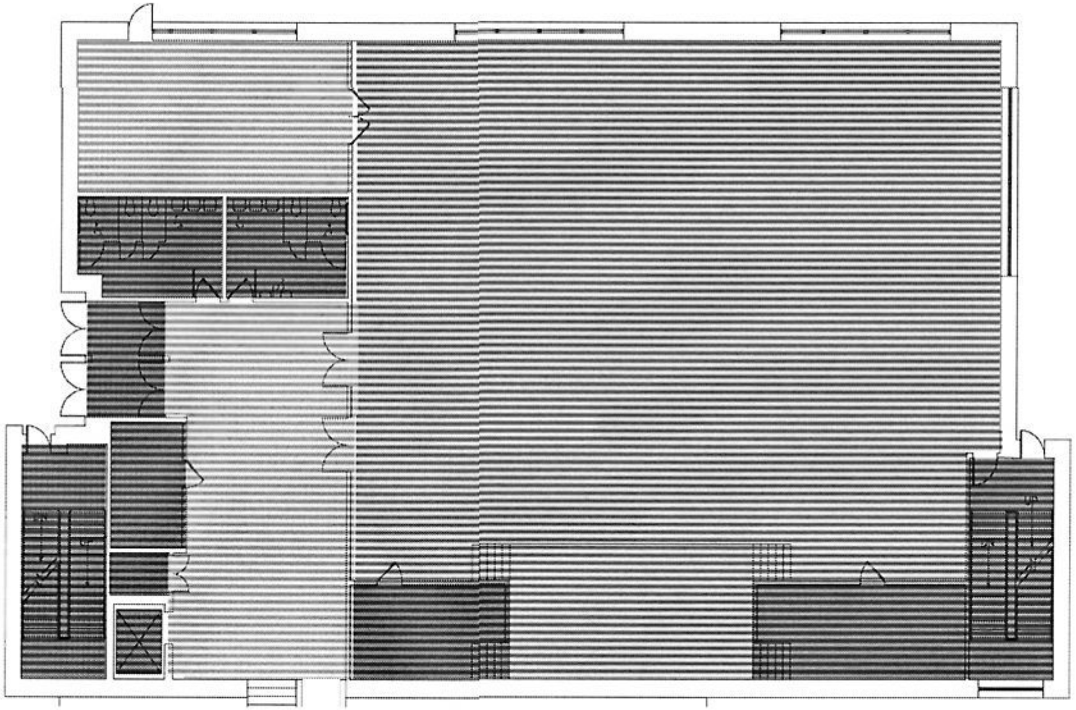
PREP. BY: JAS
APPR. BY: JVM
CAD DWG. #: M-3.1

CAE10

Appendix G
Electrical

Illumination Loads			
Room	**Area**	**FC/ sf**	**FC**
Lobby	200	30	6000
Multipurpose	4692.6	30	140778
Stage	450	50	22500
Kitchen	560.6	40	22424
Egress	5700	20	114000
Toilet Rooms	581.2	20	11624
Basement Area	7135.4	20	142708
Classrooms	3616.1	60	216966
Faculty Lounge	404.6	60	24276
Storage	435.1	20	8702
Computer Roo	1005	60	60300

Total 770,278 footcandles
29 fc/sf



Legend

20 footcandles

30 footcandles

50 footcandles

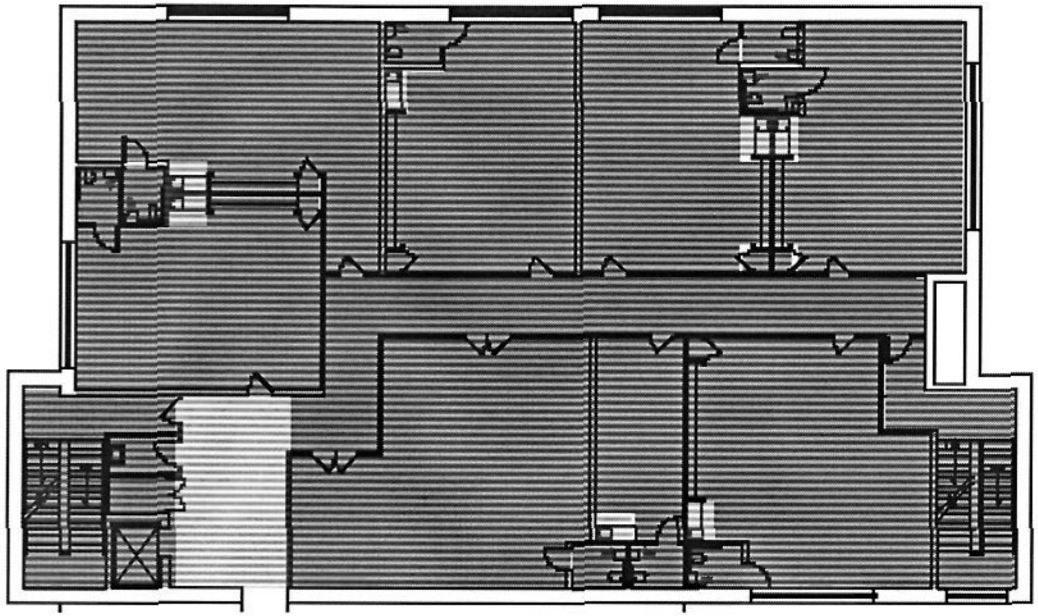
60 footcandles

SVM Engineers

SVM Engineers, Inc.
Established 2000
PHILADELPHIA, PA

Design Illumination Levels
First Floor

Project: **Kindergarten Center Expansion** **Drexel Hill, PA**	Number **10001**	DATE **3/9/01**	SCALE **NTS**	**G-3**



Legend

20 footcandles

30 footcandles

50 footcandles

60 footcandles

SVM Engineers	**SVM Engineers, Inc.** Established 2000 PHILADELPHIA, PA	**Design Illumination Levels** **Second Floor**

Project: **Kindergarten Center Expansion** **Drexel Hill, PA**	Number **10001**	DATE **3/9/01**	SCALE **NTS**	**E-2**

Illumination Loads

1st Floor

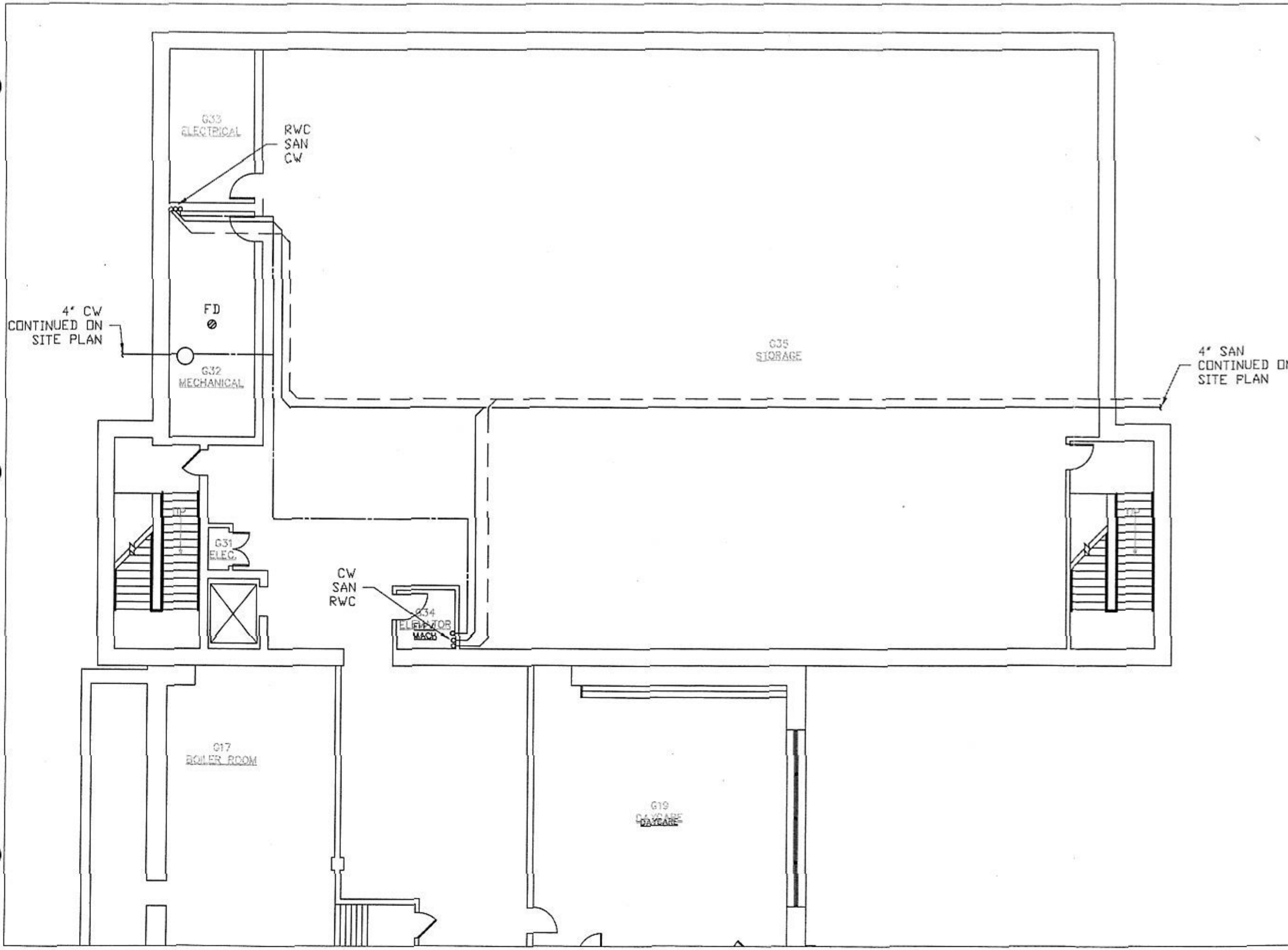
Space	Area (sq ft)	FC/ sf	Lux Total	Room Length	Room Width	Ceiling Height	Work Surface	Lamp Height	h factor	Room Factor k	Utilization	# Fixtures	Lamp Type
P.E. Office	124.10	60.00	6.00	8.00	15.51	8.50	2.50	7.00	4.50	1.17	0.82	2.00	1
Kitchen	560.60	40.00	4.00	32.00	17.52	10.00	3.33	8.50	5.17	2.19	0.75	6.00	1
Multipurpose Room	4542.60	30.00	3.00	75.00	71.00	15.00	0.00	13.50	13.50	2.70	0.72	38.00	2
Stage	450.00	50.00	5.00	15.00	30.00	14.50	0.00	13.00	13.00	0.77	0.82	6.00	3
Storage	182.70	20.00	2.00	10.00	18.27	8.50	2.50	7.00	4.50	1.44	0.79	1.00	4
Storage	252.40	20.00	2.00	10.00	25.24	8.50	2.50	7.00	4.50	1.59	0.78	2.00	4
Mens Bathroom	166.60	20.00	2.00	11.00	15.15	8.50	2.50	7.00	4.50	1.42	0.78	1.00	4
Women Bathroom	192.60	20.00	2.00	11.00	17.51	8.50	2.50	7.00	4.50	1.50	0.78	1.00	4
Electrical Closet	33.80	20.00	2.00	7.00	4.83	8.50	2.50	7.00	4.50	0.63	0.82	1.00	4

2nd Floor

Space	Area (sq ft)	FC/ sf	FC Total	Room Length	Room Width	Ceiling Height	Work Surface	Lamp Height	h factor	Room Factor k	Utilization	# Fixtures	
Computer Room	1005.0	60.00	6.00	30.00	33.50	8.50	2.50	7.00	4.50	3.52	0.66	19.00	1
Electrical Closet	33.8	20.00	2.00	7.00	4.83	8.50	0.00	7.00	7.00	0.41	0.82	1.00	4
Faculty Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.50	7.00	4.50	0.67	0.82	1.00	4
Faculty Room	280.5	60.00	6.00	16.00	17.53	8.50	2.50	7.00	4.50	1.86	0.75	5.00	4
Janitors Closet	38.2	20.00	2.00	7.00	5.46	8.50	0.00	7.00	7.00	0.44	0.82	1.00	1
Kindergarten Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.00	7.00	5.00	0.60	0.82	1.00	4
Kindergarten Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.00	7.00	5.00	0.60	0.82	1.00	4
Kindergarten Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.00	7.00	5.00	0.60	0.82	1.00	4
Kindergarten Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.00	7.00	5.00	0.60	0.82	1.00	4
Kindergarten Bathroom	37.0	20.00	2.00	7.00	5.29	8.50	2.50	7.00	4.50	0.67	0.82	1.00	4
Kindergarten Classroom	807.7	60.00	6.00	16.00	50.48	8.50	2.00	7.00	5.00	2.43	0.72	14.00	1
Kindergarten Classroom	661.3	60.00	6.00	16.00	41.33	8.50	2.00	7.00	5.00	2.31	0.71	12.00	1
Kindergarten Classroom	671.8	60.00	6.00	16.00	41.99	8.50	2.00	7.00	5.00	2.32	0.71	12.00	1
Kindergarten Classroom	682.1	60.00	6.00	16.00	42.63	8.50	2.00	7.00	5.00	2.33	0.75	11.00	1
Kindergarten Classroom	793.2	60.00	6.00	16.00	49.58	8.50	2.00	7.00	5.00	2.42	0.73	13.00	1

Basement

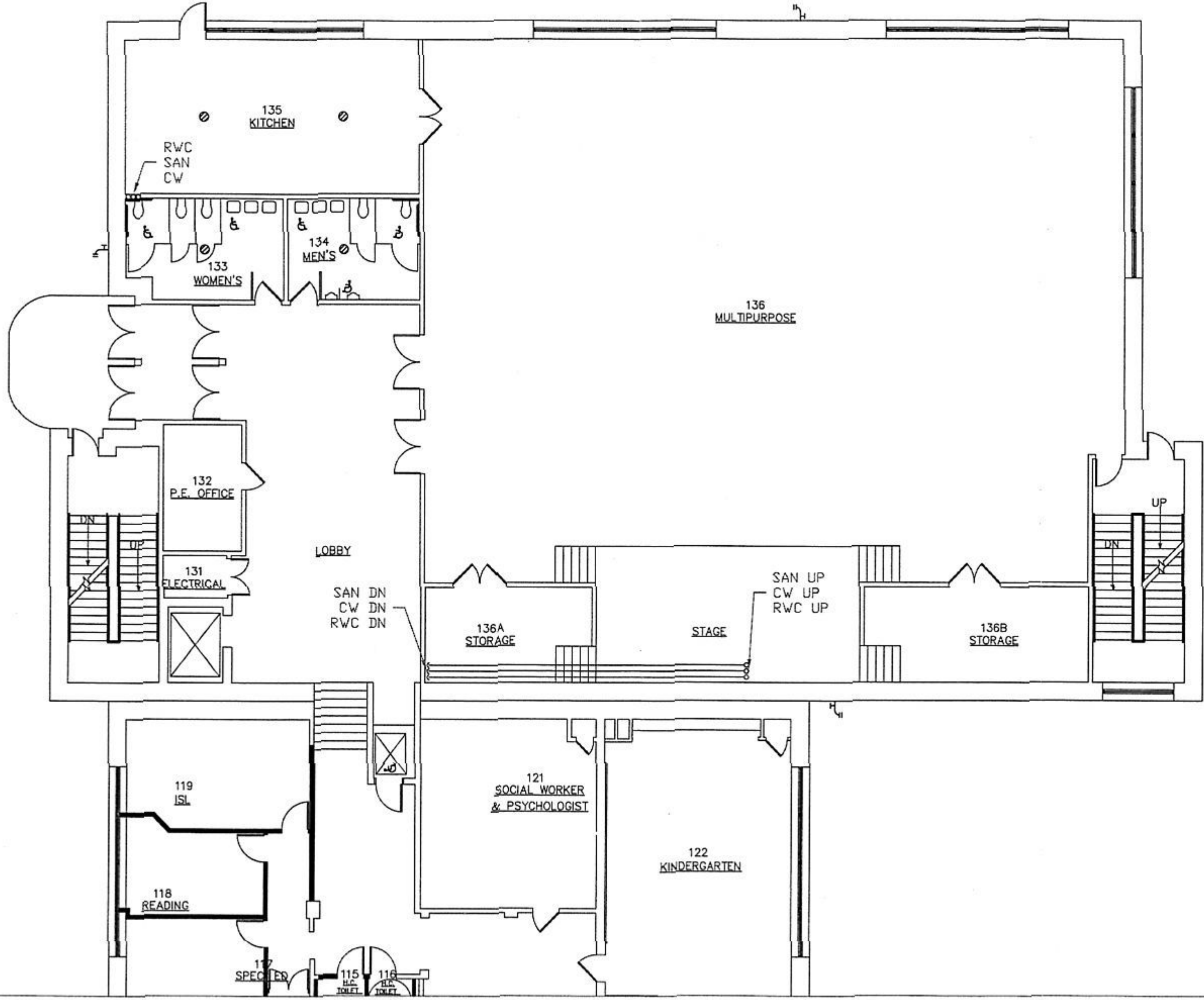
Space	Area (sq ft)	FC/ sf	FC Total	Room Length	Room Width	Ceiling Height	Work Surface	Height	h factor	Room Factor k	Utilization	# Luminaires
General Room	7135.4	20	2	71	110	10	0	10	9.7212	4.438667168	0.54	53.00
Transformer Room	186.1	20	2		#DIV/0!	10	0	10	9.7212	#DIV/0!		
Pump Room	274.7	20	2		#DIV/0!	10	0	10	9.7212	#DIV/0!		
Electrical Closet	12.5	20	2		#DIV/0!	10	0	10	9.7212	#DIV/0!		
Elevator Room	49.0	20	2		#DIV/0!	10	0	10	9.7212	#DIV/0!		



DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
GROUND FLOOR PLUMBING PLAN

PREP. BY: JAS
APPR. BY: JKM
CAD DWG. # P-GFLOOR
CAE10

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.:
P-1

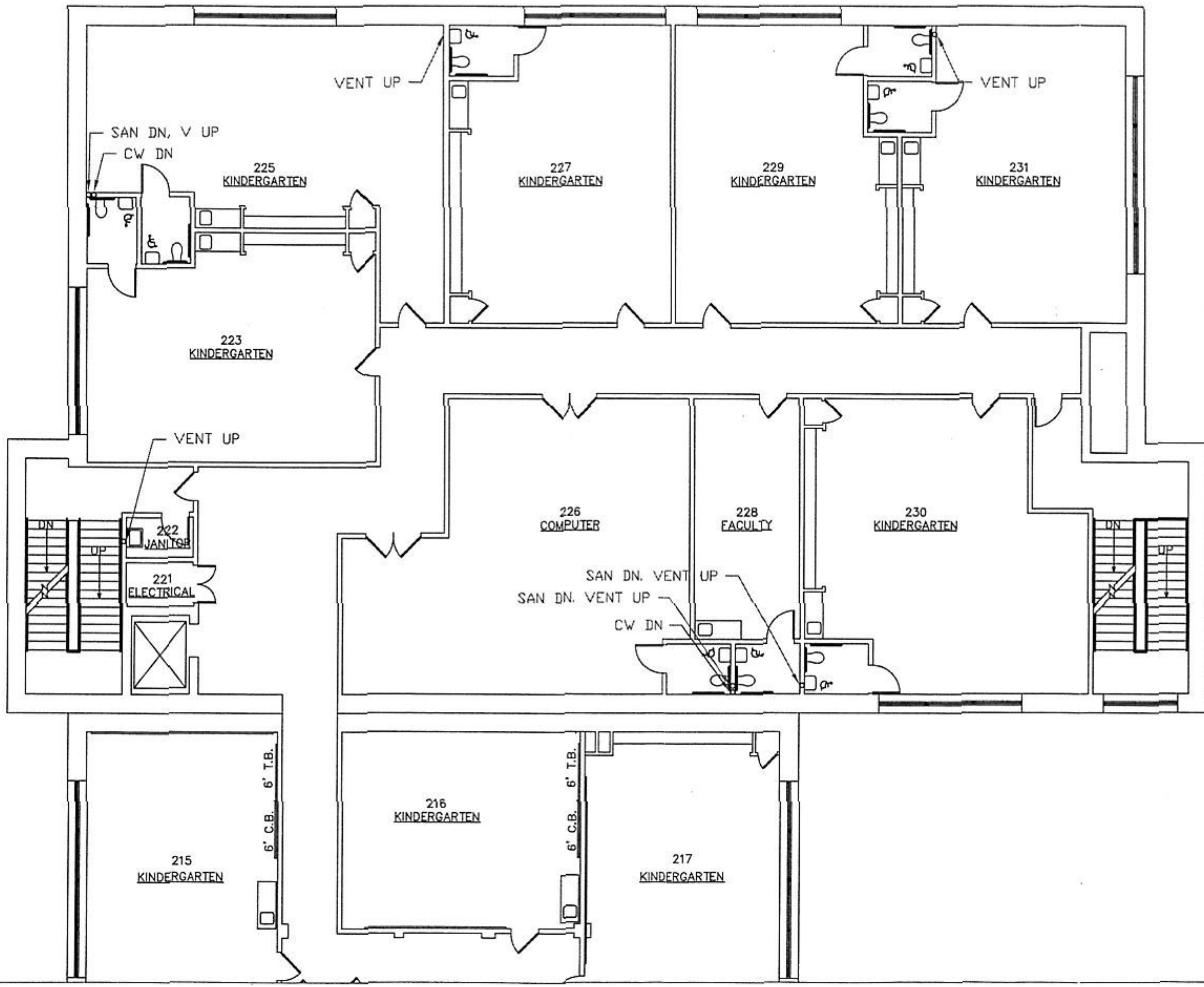


SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
FIRST FLOOR PLUMBING PLAN

PREP. BY: JAS
APPR. BY: JHM
CAD DWG. # P-1FLOOR
CAE10

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.:
P-2

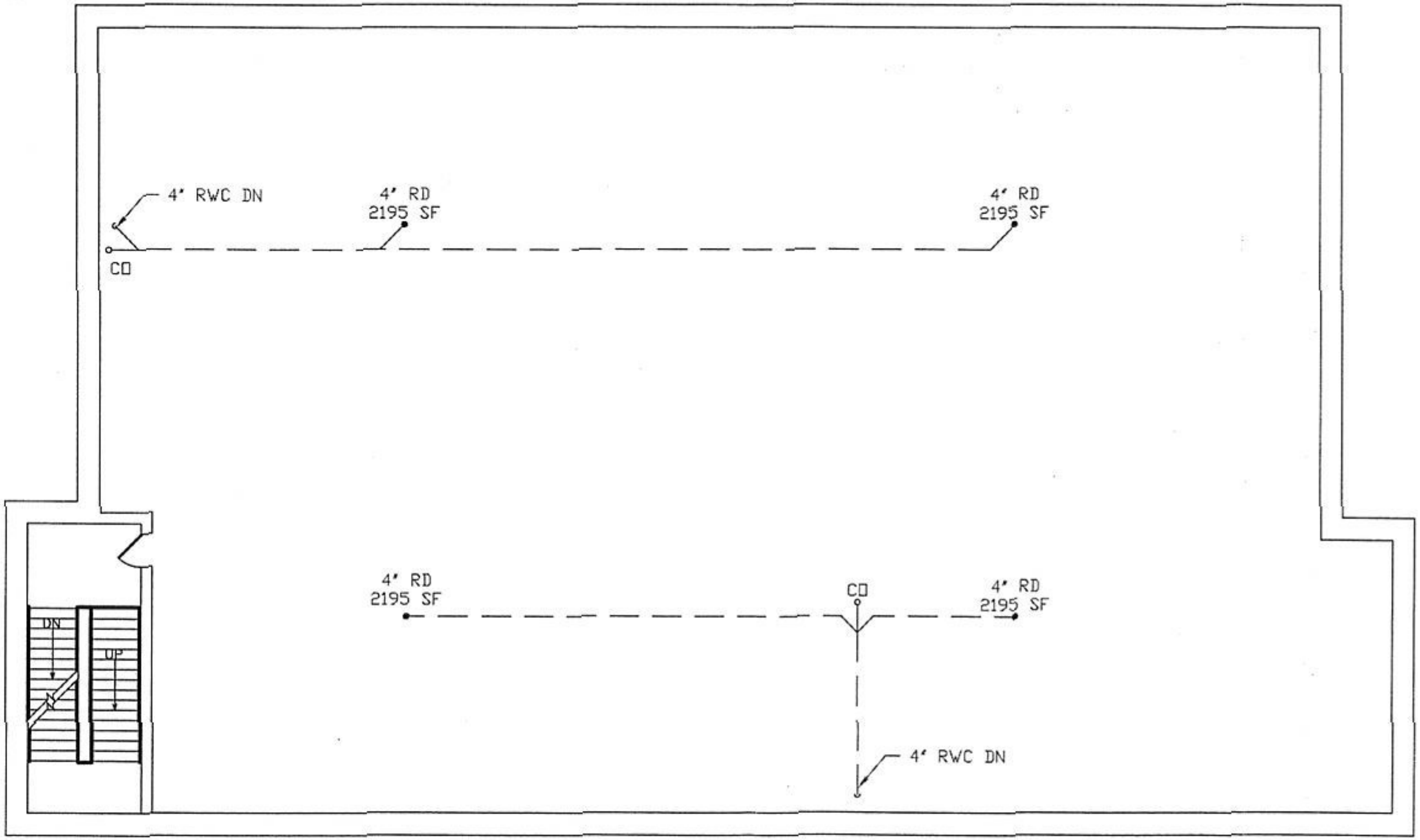


SVM Engineers

DRAWING TITLE:

UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SECOND FLOOR PLUMBING PLAN

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.: P-3
PREP. BY: JAS
APPR. BY: JHH
CAD DWG. #: P-2FLOOR
CAE10

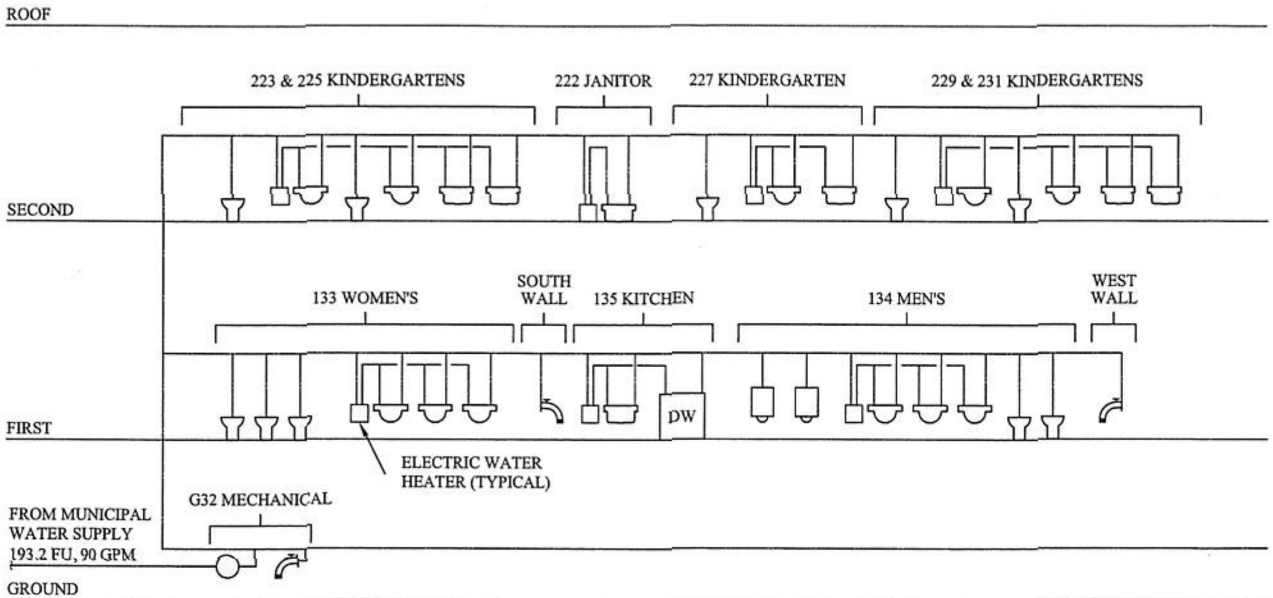


SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
ROOF PLUMBING PLAN

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.:
P-4

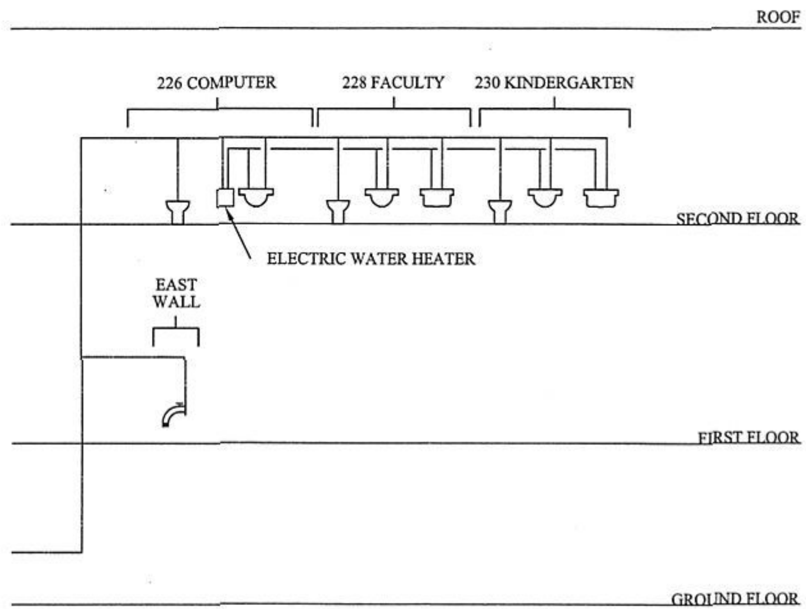
PREP. BY: JAS
APPR. BY: JMM
CAD DWG. # P-2FLOOR
CAE10



SWM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SERVICE RISER DIAGRAM #1

DATE: 3/3/01	PREP. BY: JAS
SCALE: NOT TO SCALE	APPR. BY: SMM
DRAWING NO.: P–5	CAD DWG. #: P:\SANRISER.RD
	CAE10

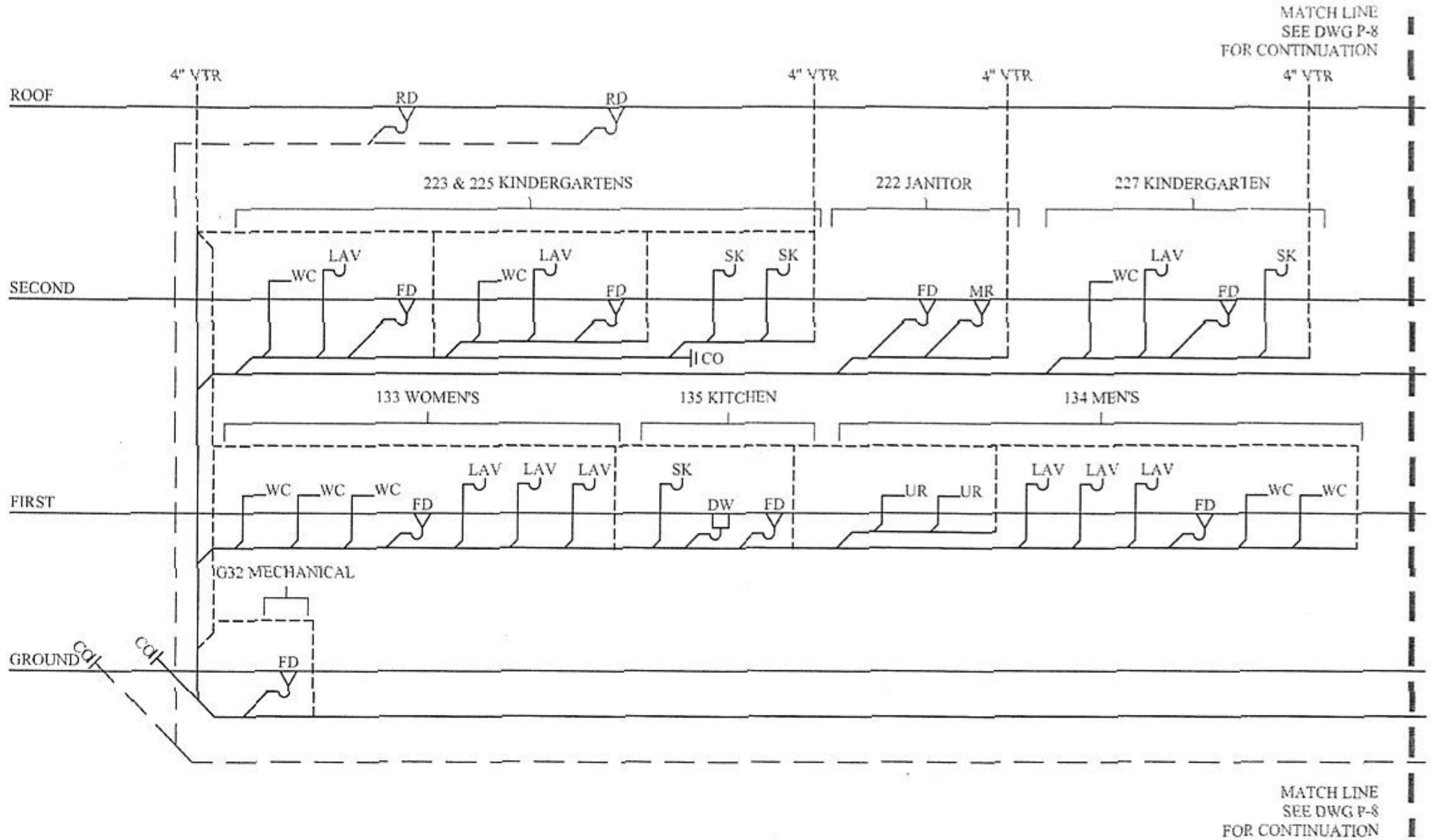


SWM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SANITARY RISER DIAGRAM NUMBER 2

PREP. BY: JAS
APPR. BY: JMM
CAD DWG. #: P-SANRISE8D
CAE10

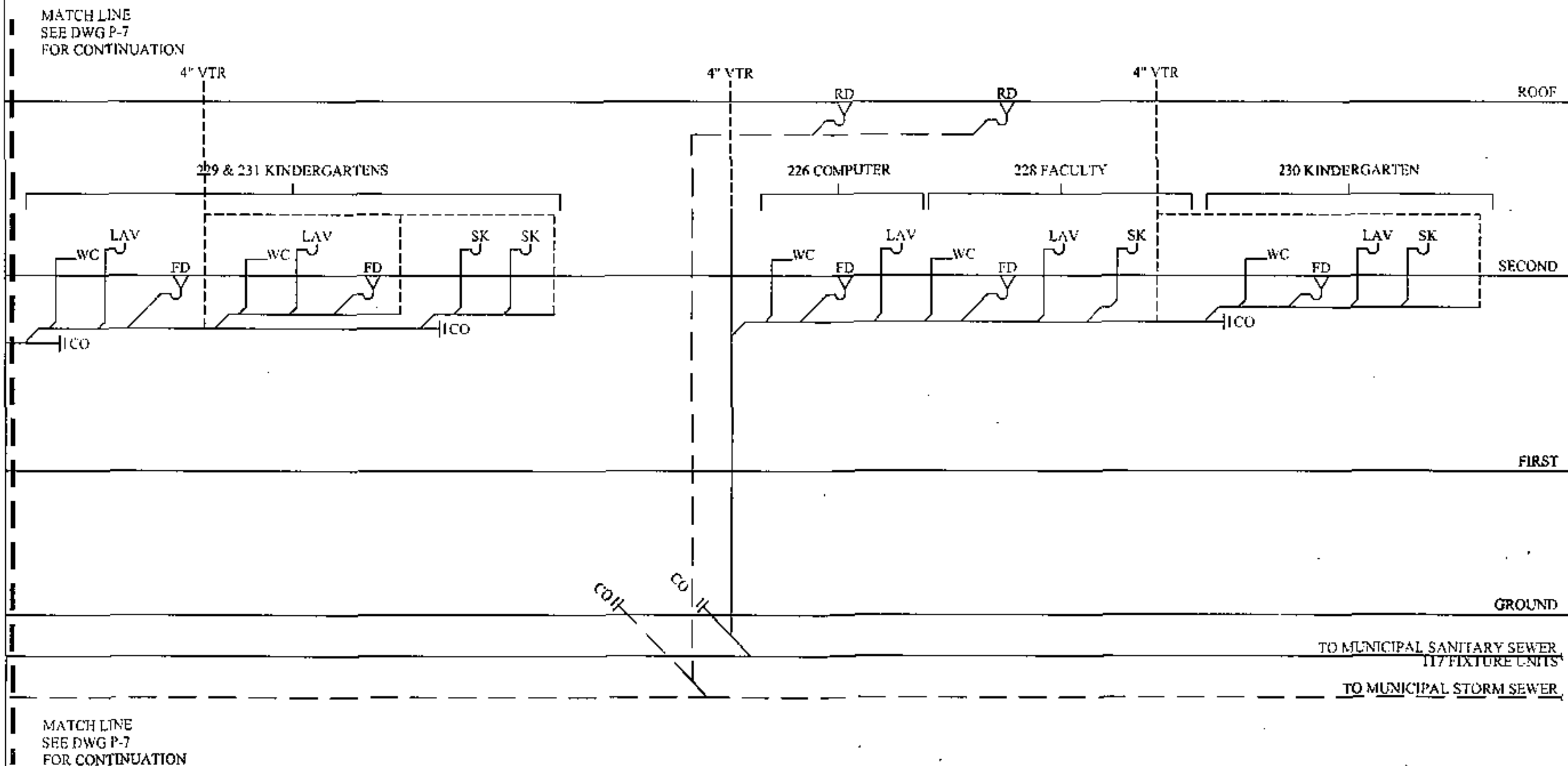
DATE: 7/14/01
SCALE: NOT TO SCALE
DRAWING NO.: P-6



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SANITARY RISER DIAGRAM NUMBER 1

PREP. BY:
APPR. BY:
CAD DWG. #
SCALE: NOT TO SCALE
DRAWING NO.:
P–7



SWM Engineers

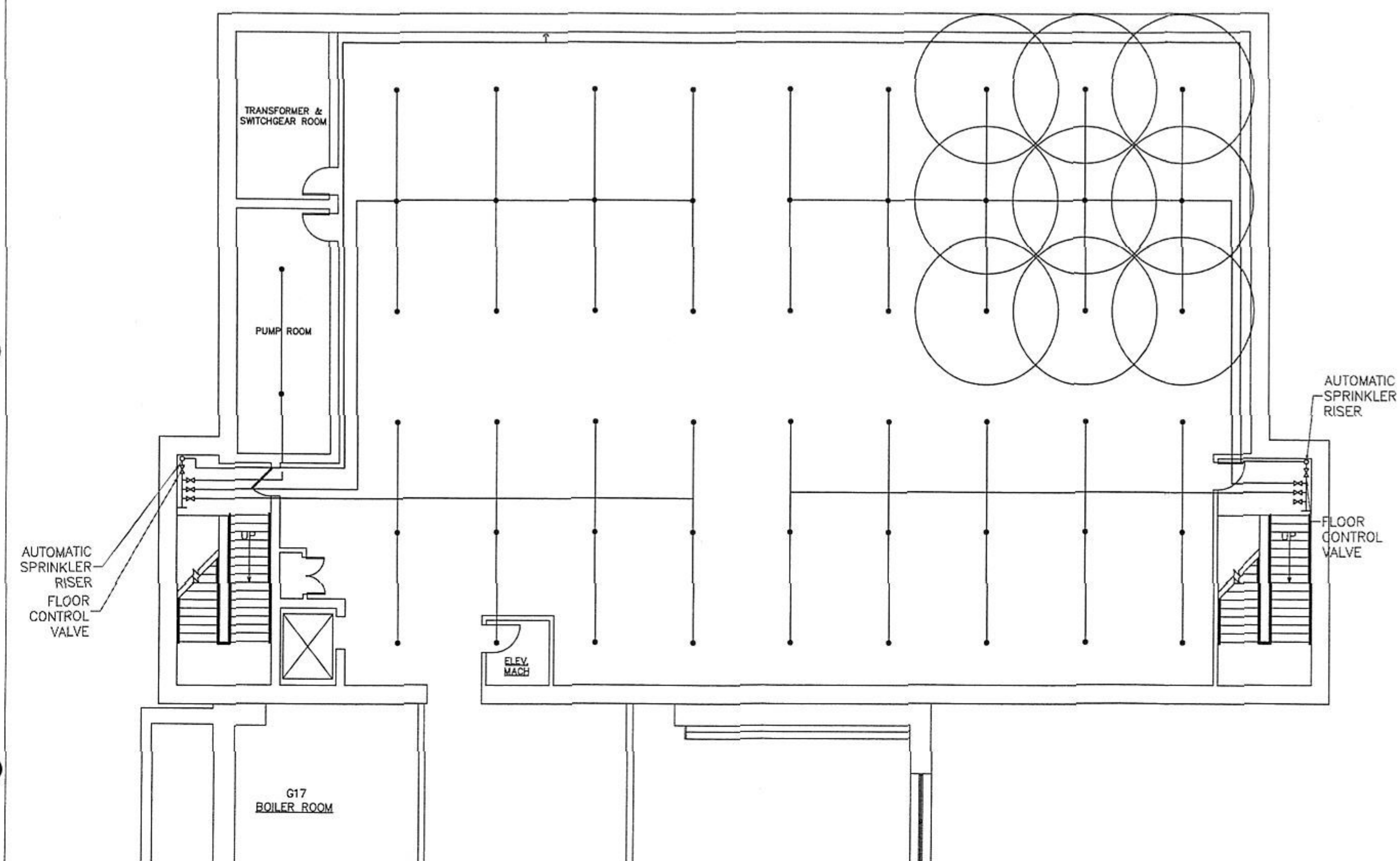
DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
DRAINAGE RISER DIAGRAM #2

DRAWING NO: P-8

Appendix H – Plumbing, missing

Drexel University Archives, 6 September 2006

Appendix I
Fire Protection

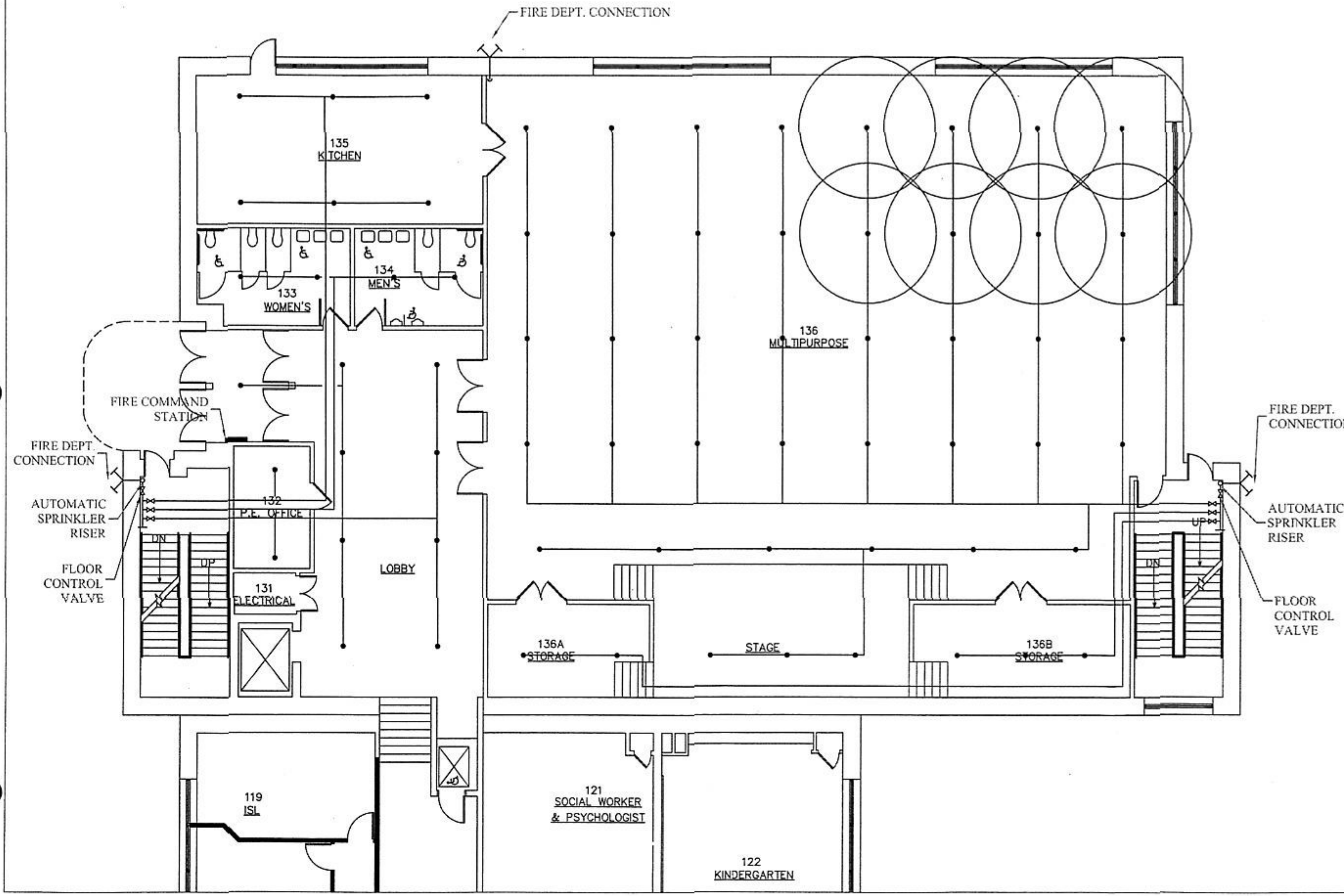


SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
GROUND FLOOR FIRE PROTECTION
PLAN

PREP. BY: MBV
APPR. BY: JMM
CAD DWG. #: FP-GFLOOR
CAE10

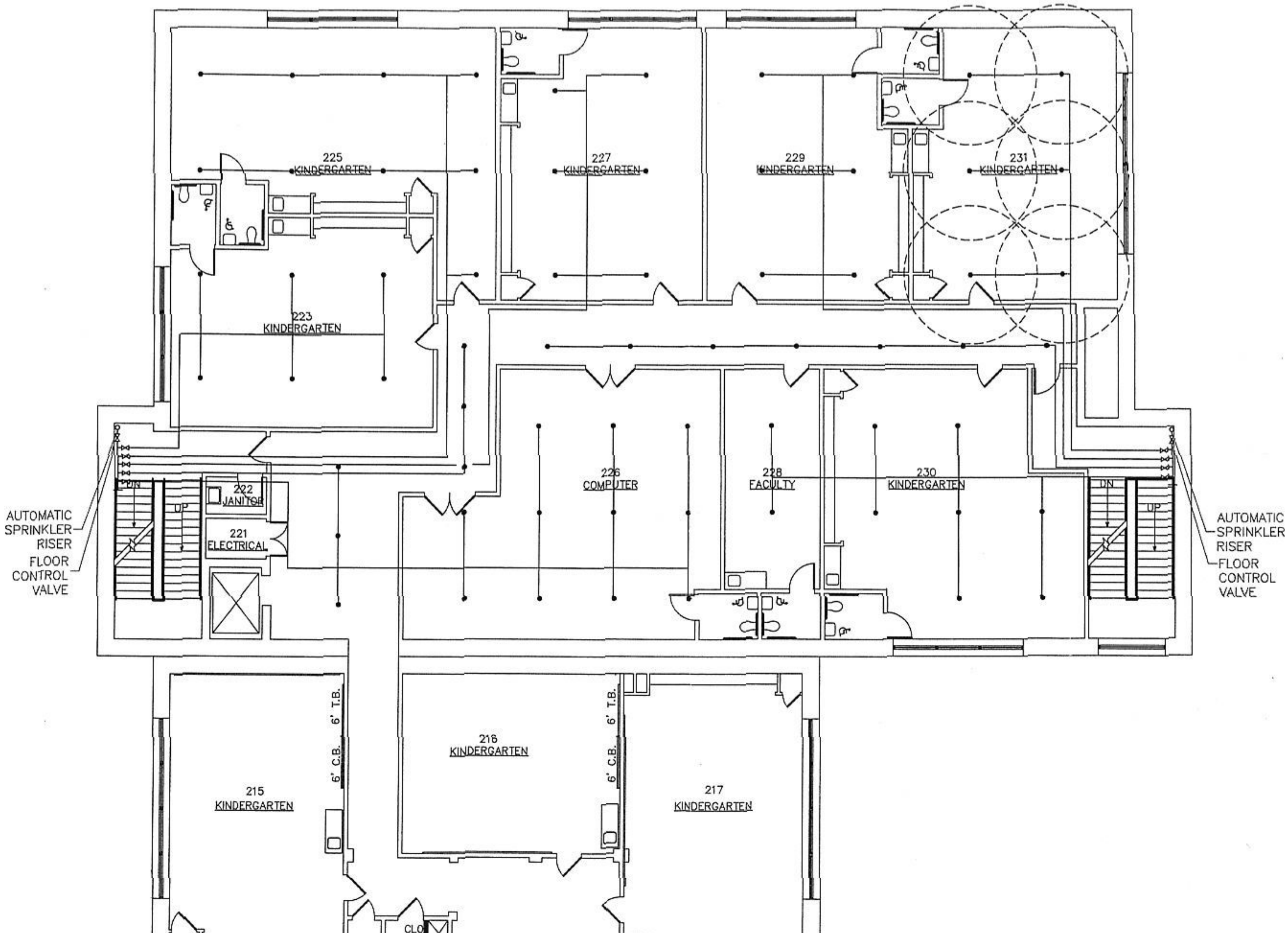
DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.:
FP-1



SWM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
FIRST FLOOR FIRE PROTECTION PLAN

PREP. BY: JAS
APPR. BY: JMM
CAD DWG. #: FP-1FLOOR
DRAWING NO.: FP-2



SVM Engineers

DRAWING TITLE:
UPPER DARBY SCHOOL DISTRICT
KINDERGARTEN CENTER EXPANSION
SECOND FLOOR FIRE PROTECTION PLAN

DATE: 3/9/01
SCALE: 3/32"=1'-0"
DRAWING NO.: FP-3
PREP. BY: JAS
APPR. BY: JMM
CAD DWG. #: FP-2FLOOR

Water Supply Demand Estimation							
		Water Supply FU per Fixture			Total Water Supply FU		
Fixture	Quantity	Cold	Hot	Total	Cold	Hot	Total
Dishwashing machine	1	0.00	1.40	1.40	0.00	1.40	1.40
Hose bibb	4	2.25		2.25	9.00	0.00	9.00
Kitchen sink	1	3.00	3.00	4.00	3.00	3.00	4.00
Kitchen sink	7	1.00	1.00	1.40	7.00	7.00	9.80
Lavatory	13	1.50	1.50	2.00	19.50	19.50	26.00
Service sink	1	2.25	2.25	3.00	2.25	2.25	3.00
Urinal	2	5.00	0.00	5.00	10.00	0.00	10.00
Water closet	13	10.00	0.00	10.00	130.00	0.00	130.00
Total FU	42				180.75	33.15	193.20
Demand				GPM	85.5	44	90
				CFM	11.42964	5.88192	12.0312

Water Service Main Sizing	
Conditions	
Street Main Pressure, psi	50
Height, ft	35
Topmost Fixture Type	WC with flush valve
Fixture Units	193.20
Developed length, ft	170
Equivalent Length, ft (50%)	85
Total Equivalent Length	*255*
System uses predominantly	flush valves
Calculation	
fixture pressure, psi	**15**
static head, psi	*15.155*
pressure loss in meter, psi	8
street main pressure, psi	*50*
pressure lost by friction in piping	*11.845*
unit friction loss, psi/100 ft	*4.65*
supply pipe diameter, in	3

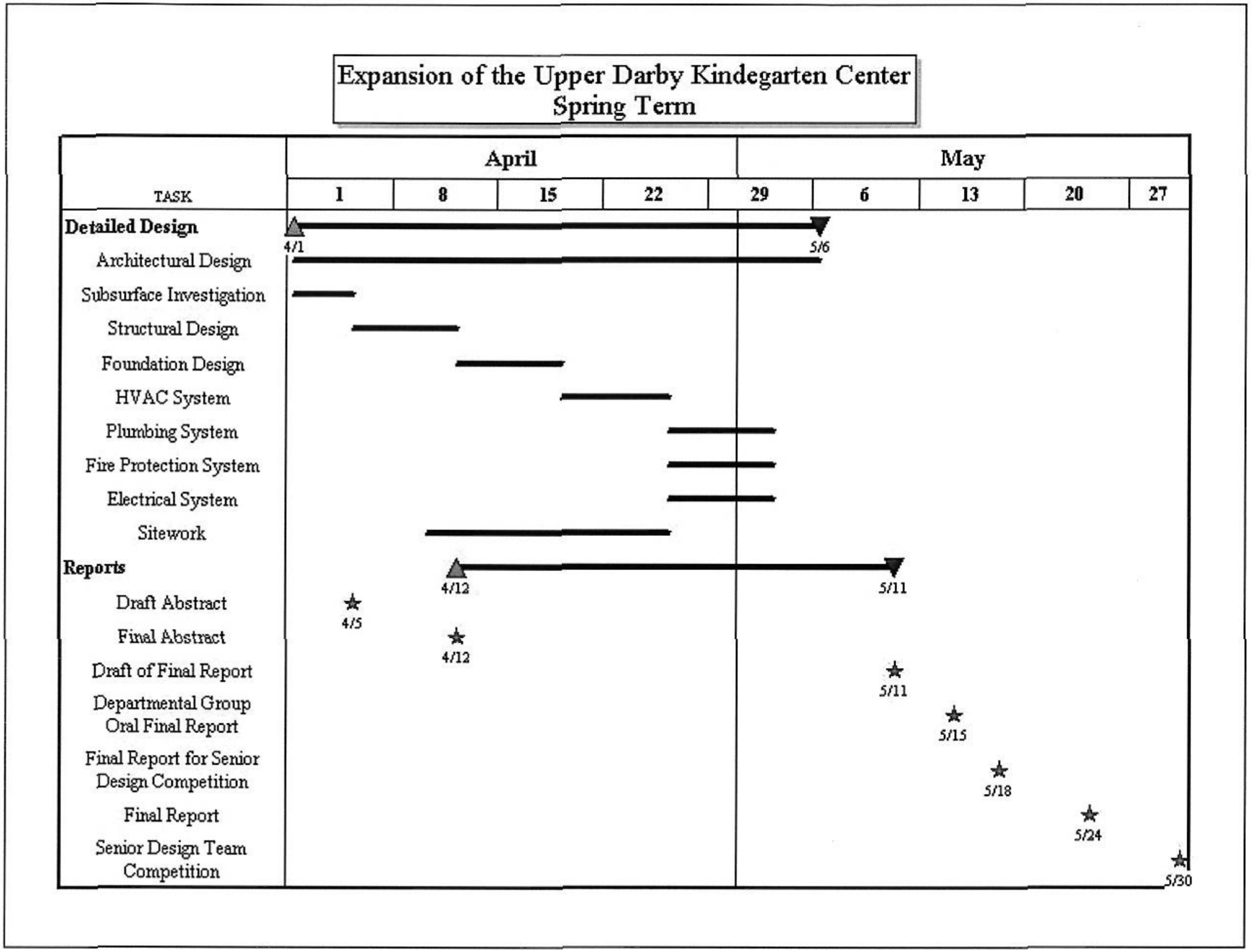
Drainage Fixture Units			
Fixture	**Quantity**	**FU per Fixture**	**Total FU**
Dishwashing machine	1	2.0	2.0
Floor drain	14	2.0	28.0
Kitchen sink	1	2.0	2.0
sink	7	2.0	14.0
Lavatory	13	1.0	13.0
Service sink	1	2.0	2.0
Urinal	2	2.0	4.0
Water closet	13	4.0	52.0
Total FU	52		117.0
Building Sewer	Diameter		4
	Slope per foot, in		1/8

Number of Sprinkler Heads

1st Floor =	67 heads
2nd Floor =	60 heads
Ground Floor =	59 heads
Total =	**186 heads**

Flow rate per head = 20 gpm
Flow Demand = 20 gpm * 186 heads
= **3720 gpm**
Pipe sizing determined from table 9.1a in *Simplified Design For Building Fire Safety*, by James Patterson, 1993.

Appendix J
Schedule


Expansion of the Upper Darby Kindegarten Center
Spring Term
April
May
TASK
1
8
15
22
29
6
13
20
27
Detailed Design
4/1
5/6
Architectural Design
Subsurface Investigation
Structural Design
Foundation Design
HVAC System
Plumbing System
Fire Protection System
Electrical System
Sitework
Reports
4/12
5/11
Draft Abstract
4/5
Final Abstract
4/12
Draft of Final Report
5/11
Departmental Group Oral Final Report
5/15
Final Report for Senior Design Competition
5/18
Final Report
5/24
Senior Design Team Competition
5/30