MINNEAPOLIS PUBLIC SCHOOLS
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Minneapolis Public Schools
Special School District #1

Air Conditioning Cost Estimating Study Susan B Anthony Community Middle School

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INTRODUCTION / KEY INFORMATION:

Wold Architects and Engineers was hired May 2021 to develop options with a recommended approach and construction cost estimate to expand the air conditioned area of the Susan B Anthony Community Middle School. The study also reviewed dehumidification capabilities and outlines additional work necessary to provide active dehumidification control. The study approach included a tour of the building site, review of available building construction documents, and a review of previous ventilation studies. Wold collaborated with the District's facility leadership team to establish criteria and guiding principles for developing options and to determine the recommended approach. Cost estimates are developed to reflect construction bids to be received on January 1, 2022 and includes a semi-annual cost inflation escalation to extend bids to January 1, 2025. .

Key Information:

- Building Address: **Susan B Anthony Community Middle School**
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EXECUTIVE SUMMARY:

Wold Architects and Engineers completed a study to determine the recommended approach and project budget to expand the air-conditioned area at the Susan B Anthony Community Middle School. The options developed are organized around the priorities established by the District based on the use of each space and by grouping areas within each building geographically as served by common systems. In collaboration with the District, the recommendation was developed to serve the highest priority areas within the overall budget constraints. In addition, the building as a whole was evaluated to determine additional features and systems that are required to provide active dehumidification control.

Criteria / Guiding Principles:

Initial discussions provided a common understanding of the guiding principles to be used to develop options and a hierarchy of priorities based on the use of each space.

Guiding Principles:

- High quality proven system solutions preferred
- Systems shall be easy to operate and maintain
- A high level of temperature zone control required
- Centralized systems preferred
- Vertical unit ventilators may be an option depending on site factors
- DX or chilled water may be options depending on site factors
- Separate systems to serve administration areas should be considered
- COVID risk mitigation measures to focus on ventilation and filtration
- Window AC unit are not an option. Mini-splits may be is limited applications
- Heating for systems may be steam or hot water depending on site factors
- Systems shall be configured to allow for active dehumidification

Air-conditioning classrooms is the primary goal of this study. Additional spaces may be considered where possible within the overall budget constraints. Options were considered where space adjacencies allow opportunities to economically include additional areas. Gymnasiums are not typically air-conditioned but options were considered where they are central to a building and/or used as gathering spaces. It is not an intended outcome of the study to add ventilation and air conditioning to all spaces where it does not currently exist. The summary diagrams for each building identify the remaining unconditioned areas.

In addition, opportunities within each option were determined to provide added value scope where it is economically feasible to accomplish additional deferred maintenance needs within the scope of the air conditioning project i.e. ceilings, lights, and other room finishes.

Recommended Scope Summary:

Classrooms Building Areas #1 and #2 (81,000 Sq Ft): Install a new dedicated outside air ventilation system with perimeter displacement and chilled beams air delivery. Install an air-cooled chiller on grade to serve the system cooling needs. Install a steam-to-hot water convertor in the boiler room to serve the hot water needs of the new systems. Install a high efficiency boiler for summer operation. The base project includes routing supply ductwork exposed within the classrooms and similar areas.

For consideration, an added scope option is included for providing a new lay-in ceiling and new LED lighting and controls. Included with the ceilings and lights is overhead duct distribution to improve the sound performance and air distribution of the ventilation system.

The cost estimate includes a design contingency to cover risks identified that require further investigation. Identified risks include the following:

- Space heating and cooling loads are estimated to determine preliminary equipment selections as a basis for cost estimating. Final heating and cooling loads need to be completed.
- Determining vertical pathways for new ductwork to serve Building Areas #2 and #3. The existing structure poured concrete over clay tile. Options that require removing a concrete joist will require additional structural review
- Integrity of the existing steam and condensate systems to accommodate modifications necessary for the steam-to-hot water convertor installation.
- Adequacy of the existing structure to support the new rooftop unit. Resolution of this risk requires a specific air handling unit selection and an analysis by a structural engineer.
- Determining pathways for new ductwork to penetrate the roof. The existing structure poured concrete over clay tile. Options that require removing a concrete joist will require additional structural review.
- Modification to perimeter casework and finishes are included only as necessary for the mechanical systems installation.

Construction Cost Estimate: $ 9,266,000
Add for Ceiling and Lights: $ 1,450,000

Cafeteria Building Areas #3 (7,700 Sq Ft): Install a new constant volume single zone roof mounted air handling unit with integral DX cooling. Route new supply ductwork exposed within the cafeteria. Modify the existing steam system to provide heating.

For consideration, an added scope option is included for providing a new lay-in ceiling and new LED lighting and controls. Included with the ceilings and lights is overhead duct distribution to improve the sound performance and air distribution of the ventilation system.

The cost estimate includes a design contingency to cover risks identified that require further investigation. Identified risks include the following:

- Space heating and cooling loads are estimated to determine preliminary equipment selections as a basis for cost estimating. Final heating and cooling loads need to be completed.
- Integrity and capacity of the existing steam and condensate systems. The basis for cost estimating assumes that necessary piping modifications will be made within each classroom.
- Adequacy of the existing structure to support the new rooftop unit. Resolution of this risk requires a specific air handling unit selection and an analysis by a structural engineer.
- Determining pathways for new ductwork to penetrate the roof. The existing structure poured concrete over clay tile. Options that require removing a concrete joist will require additional structural review.

Construction Cost Estimate:	**$**	**495,000**
Add for Ceiling and Lights:	**$**	**160,000**

Gymnasium Building Areas #4 (14,650 Sq Ft): Install a constant air volume air handling unit in the basement in the same location as the existing constant volume unit that serves the gymnasium. Provide a remote DX condensing unit for cooling. Install new insulated supply. Consideration should be given to separating the Auxiliary gyms (Rooms B7 and B8) on a separate unit to improve temperature zone control. Relocation of the cafeteria unit ot the roof may free up space in the mechanical room for the additional unit.

For consideration, an added scope option is included for providing a new lay-in ceiling and new LED lighting and controls for the Auxiliary gymnasiums. Included with the ceilings and lights is overhead duct distribution to improve the sound performance and air distribution of the ventilation system.

The cost estimate includes a design contingency to cover risks identified that require further investigation. Identified risks include the following:

- Space heating and cooling loads are estimated to determine preliminary equipment selections as a basis for cost estimating. Final heating and cooling loads need to be completed.
- The optimal new air-handling unit configuration. A guiding principal is to locate as much of the new equipment inside the existing fan room as possible. Options to optimize the space include combining air-handling zone, determining and alternate outside airflow path, and maybe alternate locations for heat recovery equipment.

- Integrity and capacity of the existing steam and condensate systems. The basis for cost estimating assumes that necessary piping modifications will be made within each classroom.
- Viability of separating the Auxiliary gymnasiums. Space is required in the mechanical room and new duct pathways need to be determined.
- Adequacy of the existing outside air and relief air pathways to serve the ventilation and relief air for the new systems.

Construction Cost Estimate:	**$**	**396,000**
Add for De-stratification Fans	**$**	**42,000**

EXISTING BUILDING INFORMATION

The original building was constructed in 1957. The original project typically ventilated the classrooms with unit ventilators. Spaces other than the classrooms are typically ventilated by central air handling systems installed in interior mechanical rooms. A few of the unit ventilators have been replaced with vertical unit ventilators.

There is not a centralized cooling plant. A portion of the original classroom unit ventilators were replaced in 2008 with vertical unit ventilators with integral cooling. Window AC units or mini-split units serve a portion of the rest of the building.

The building is heated with two large dual fuel fire tube steam boilers.

A complete summary of the existing building systems is shown graphically in Appendix A.

Building Area Summary:

Year	Area (sq. ft.)
1957	139,590
Total	**139,590**

AIR CONDITIONING OPTIONS SUMMARY

The Primary driver of the overall project scope and budget is the decision about the air delivery method. The size of the equipment and the configuration within the building affects the work scope of multiple trades to provide pathways for ductwork and piping and to restore building finishes. With each air delivery method, there are multiple options to provide cooling and multiple options to provide heating which typically are part of the overall building central heating and cooling plant strategy. There are long-term benefits to the overall maintenance and operation of the facility to consider the heating and cooling approach for each air delivery option within the overall plan for the central heating and cooling plants that serve the building.

The range of air delivery options presented in this summary are narrowed to those that fit the District's criteria that includes centralizing systems to the extent possible to minimize regular and periodic maintenance. These options typically include vertical unit ventilators, variable air volume central air handling, and dedicated outside air displacement systems. The full range of options are discussed in more detail in the "Air Conditioning Options Detail" section of this report.

In addition to the first cost, the attributes of each system also have an effect on the quality of the learning environment and the on-going operational costs related to energy efficiency and the requirements for regular and periodic maintenance. As an aid for discussion, each of the air delivery options presented are rated relative to each other in terms of good, better, best in each of these performance categories as follows.

Attribute	Vertical Unit Vents	Central VAV	DOAS / Displacement
Environment Quality	Good	Better	Best
Energy Efficiency	Good	Better	Best
Maintenance	Good	Better	Best

A summary of the cost range for viable options for each of the air delivery methods is as follows. The options prioritize adding cooling to the classrooms and are summarized in total to cover all of the currently unconditioned classrooms in the building. Other areas that may include gymnasiums, auditoriums or other common areas are listed separately. All cost are presented as construction costs.

Vertical Unit Ventilators:

Install a vertical unit ventilator along the perimeter of each classroom. The work will include installing a new exterior louver through either a window or cutting a louver through the exterior wall. The range of costs includes is defined by the following approach to heating and cooling.

Low Cost Option: Integral DX, Modify existing hot water system

Medium Cost Option: Air-cooled chiller, Modify existing steam

High Cost Option: Air-cooled chiller, Steam to HW convertor

Vertical Unit Ventilators					
Building Area	**Serves**	**Area SF**	**Construction Budget**		
			Low	**Medium**	**High**
#1	Classrooms	79,200			
#2	Classrooms	1,800			
Total		**81,000**	**$2,365,000**	**$3,824,000**	**$4,730,000**

Central Variable Air Volume:

Install a variable central air handling system in each of the building areas. Install a new air-handling unit in the location of the existing. Replace the existing ductwork with new insulated ductwork along the same pathways. Building Are #2 is served by a rooftop unit installed in 1999 that was planned for the addition of a future cooling coil.

Low Cost Option: Remote DX, Modify existing Steam System, cooling only VAV's

Medium Cost Option: Remote DX, Steam to HW convertor

High Cost Option: Air-cooled chiller, Steam to HW convertor

Central Variable Air Volume					
Building Area	**Serves**	**Area SF**	**Construction Budget**		
			Low	**Medium**	**High**
#1	Classrooms	79,200			
#2	Classrooms	1,800			
Total		**81,000**	**$6,306,000**	**$7,448,000**	**$8,496,000**

Dedicated Outside Air/Displacement:

Install a central dedicated outside air system to serve all classroom areas. The dedicated outside air unit would be located in the boiler room. Install a new air-handling unit in the location of the existing. Replace the existing ductwork with new insulated ductwork along the same pathways. There are considerable challenges to create new pathways for ductwork and piping because of the wood structure.

Low Cost Option: Displacement requires both chilled and hot water. Work is necessarily required on the central heating plant

Medium Cost Option: Displacement requires both chilled and hot water. Work is necessarily required on the central heating plant

High Cost Option: Air-cooled chiller, Steam to HW convertor

Dedicated Outside Air / Displacement					
Building Area	**Serves**	**Area SF**	**Construction Budget**		
			Low	**Medium**	**High**
#1	Classrooms	79,200	N/A		
#2	Classrooms	1,800			
Total		**81,000**	**N/A**	**N/A**	**$8,768,000**

Additional Scope:

Additional work that may be considered with each of these options includes the following:

New Ceilings and LED Lights: **Construction Budget $ 1,477,500**

AIR CONDITIONING SCOPE DETAIL

The following options to expand air conditioning are noted as "Building Area #'s". The area to be air-conditioned is annotated on the Proposed Systems Diagrams in Appendix B.

Building Area 1: 1957 Classrooms (79,200 Sq. Ft.): The following is a summary of the range of possible options considered.

Options Summary:

Building Area	Air Delivery Method	Cooling Plant	Heating Plant	Option
1 - 1932 Classrooms	A - Mini-Split	B - Remote DX	A - None	1-ABA
	B - Vertical Unit Ventilators	A - Integral DX	B - Steam	1-BAB
			C - Hot Water*	1-BAC
		B - Remote DX	B - Steam	1-BBB
			C - Hot Water*	1-BBC
		C - Chilled Water*	B - Steam	1-BCB
			C - Hot Water*	1-BCC
	C - Central VAV	B - Remote DX	B - Steam	1-CBB
			C - Hot Water*	1-CBC
		C - Chilled Water*	B - Steam	1-CCB
			C - Hot Water*	1-CCC
	D - DOAS	C - Chilled Water*	C - Hot Water*	1-DCC

Notes: * There are multiple central plant options for chilled and hot water. Refer to the Central Plant section of this report.

Air Delivery: The original 1957 building construction typically ventilated the classrooms with horizontal unit ventilators. Projects in 2005 and 2010 replaced a few of the original unit ventilators with vertical unit ventilators. Approximately 5 of these replacement systems have integral cooling. The following outlines possible new air delivery methods:

Mini-split: The systems would be installed while leaving the existing heating and ventilation systems in place. Because unconditioned ventilation air is delivered to the space through the existing unit ventilator, there is a risk of creating high humidity conditions.

Vertical Unit Ventilators: Install new vertical unit ventilators to replace the existing horizontal unit ventilators in approximately the same location. Further investigation is required into the existing vertical unit ventilators to determine if they can be retrofit with new cooling coils. Modifications will be required to the perimeter steam finned tube radiation. Outside and relief would be available by replacing one of the windows adjacent to each unit ventilator. The perimeter casework is minimal in most classrooms with the exception of the science classrooms.

Central Variable Air Volume (VAV): Provide a new central variable air volume system. Further investigation is required to determine viable locations to serve each of the multiple floors. Possible locations include on the roof or creating a new mechanical space by taking over a classroom. It is anticipated that the current MN Energy code will require heat recovery to be incorporated into the system. Pathways for vertical duct distribution need to be determined. The existing structure is poured concrete pan and joist, which creates challenges for creating large vertical openings.

Dedicated Outside Air (DOAS): Options for locating a new DOAS unit are similar to locating the VAV unit as describe above. The advantage of a DOAS unit is that the volume of air it is moving is approximately 1/3 as compared to the VAV system. The equipment and associated ductwork are smaller and easier to retrofit.

Cooling Plant: Viable options studied include integral packaged DX, remote DX, and construction of a new central chilled water plant. The tight site and proximity to the neighboring residential areas presents challenges in designing new equipment to meet the noise criteria at the property line. The following outlines possible cooling plant options:

Integral Direct Expansion (DX): Integral DX is an option with the vertical unit ventilators and there is precedent with this type of system in the District. Design considerations need to include meeting the classroom ambient sound levels. Integral cooling systems have an impact on future maintenance by distributing possible failure points of the system.

Remote Direct Expansion (DX): Remote DX in an option for mini-split systems, vertical unit ventilators, and central variable air volume solutions. Condenser locations for remote DX locations need to be determined. Structural constraints of the roof need to be evaluated.

Chilled Water: There are multiple options to generate chilled water to meet the cooling needs of the building. Refer to the central plant options in this report for a discussion of each.

Heating Plant: Viable options include leaving the existing steam systems in place and installing a cooling only system, connecting to the existing steam plant, installing a steam to hot water convertor, or installing a new high efficiency hot water plant. The following outlines possible heating plant options.

Steam: The building is currently heated by a single large dual fuel steam fire tube boiler. The steam option includes modifying steam and condensate distribution piping to accommodate the new systems.

Hot Water HX: Includes the installation of a new steam-to-hot water heat exchanger, pumps and distribution system to deliver hot water to the new systems. Hot water distribution piping is more flexible to route to location as necessary than steam piping.

The installation of a heat exchanger will easily accommodate future conversion of the stem plant to hot water.

Hot Water Plant: There are multiple options to generate hot water to meet the heating needs of the building. Refer to the central plant options in this report for a discussion of each.

Dehumidification: Active dehumidification requires a heating source that is currently not available with the existing steam plant during the summer months. Options for active dehumidification will depend on the extent of hot water that is installed with the new systems. If hot water distribution is included as the heating source, the heating coils will be located in the reheat position downstream of the cooling coils. If hot water is generated through a steam-to-hot water convertor, then reheat will only be possible when the steam boiler is in operation. An option to extend the time that hot water is available is to add a small high efficiency gas boiler. If the project include replacing the steam plant, the boiler capacity would be selected to provide adequate turn down during low load periods.

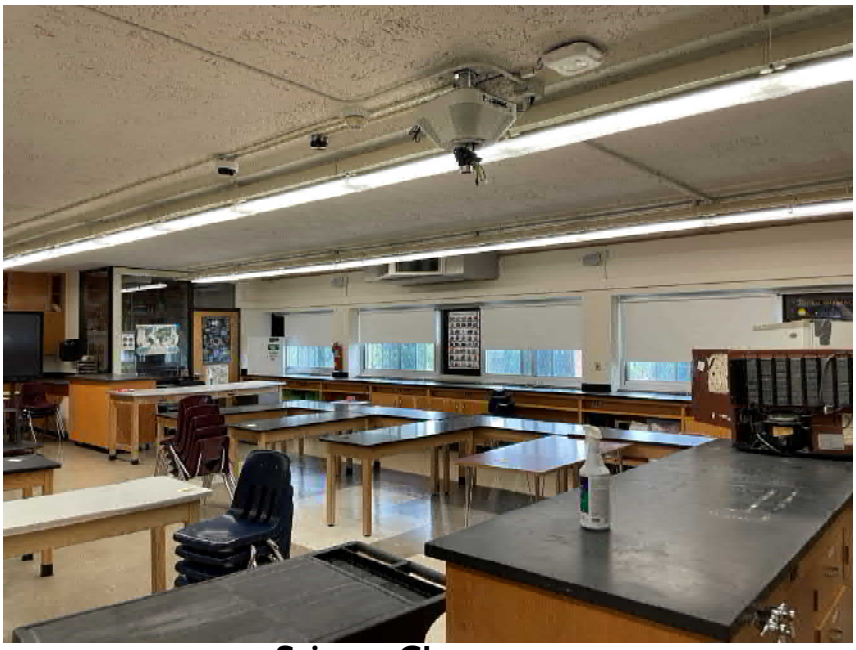
Project Risks: The following are design risks identified in implementing this project. The cost estimate includes a 15% design contingency to cover these risks. Further investigation into each of these could better define the solution and allow the design contingency to be reduced.

- Determining vertical pathways for new ductwork as necessary for the central air handling unit options. The existing vertical pathways will be reused to the extent possible.
- Determining a design solution for outside ventilation air with interior the central air handling unit options. Pathways for outside air and building relief air need to be determined.
- Determine structural capacity limitations with options that include roof mounted equipment.
- Space heating and cooling loads are estimated based on typical loads for this type of space. Final heating and cooling loads need to be completed.
- Integrity of the existing steam and condensate systems for options that include steam heating. Piping in poor condition may necessitate additional pipe removal. The best method to mitigate this risk is to pursue the hot water heating solution as outlined in the heating section above.

Additional Scope Considerations: The following items could be considered for inclusion in the project work scope. These items are not directly related to adding air conditioning but there would be cost efficiency by including them in the project scope and the have added value as noted.

- *Provide new ceilings and lights:* Provide new lay-in ceilings typically throughout with new LED lighting and controls. With the vertical unit ventilator options, new ceilings would allow for the air distribution above the ceiling to reduce the system noise. The ceiling condition likely will require a soffit along the exterior walls to accommodate the existing windows elevations.

Typical Photos:



Science Classroom

Third Floor Corridor – Looking North

Building Area 2 – Classrooms (1,800 Sq. Ft.): The following is a summary of the range of possible options considered.

Options Summary:

Building Area	Air Delivery Method	Cooling Plant	Heating Plant	Option
2 – Classrooms	A - Mini-Split	B - Remote DX	A - None	2-ABA
	B - Vertical Unit Ventilators	A - Integral DX	B - Steam	2-BAB
			C - Hot Water*	2-BAC
		B - Remote DX	B - Steam	2-BBB
			C - Hot Water*	2-BBC
		C - Chilled Water*	B - Steam	2-BCB
			C - Hot Water*	2-BCC
	C - Central VAV	B - Remote DX	B - Steam	2-CBB
			C - Hot Water*	2-CBC
		C - Chilled Water*	B - Steam	2-CCB
			C - Hot Water*	2-CCC
	D - DOAS	C - Chilled Water*	C - Hot Water*	2-DCC

Notes: * There are multiple central plant options for chilled and hot water. Refer to the Central Plant section of this report.

Air Delivery: The classroom area was originally constructed open to the adjacent corridor and was heated with perimeter steam finned tube radiation but was not ventilated. A subsequent remodel enclose the area into three separate classrooms and added horizontal unit ventilators. The date of the remodel is unknown. The following outlines possible new air delivery methods:

Mini-split: The systems would be installed while leaving the existing heating and ventilation systems in place. Because unconditioned ventilation air is delivered to the space through the existing unit ventilator, there is a risk of creating high humidity conditions.

Vertical Unit Ventilators: Install new vertical unit ventilators to replace the existing horizontal unit ventilators in approximately the same location. Outside and relief would be available through the outside wall.

Central Variable Air Volume (VAV): Provide a new central variable air volume system. The most likely location is on the roof above the classrooms or adjacent hallway. It is anticipated that the current MN Energy code will require heat recovery to be incorporated into the system. Further investigation is necessary to determine the structural capacity limitations.

Dedicated Outside Air (DOAS): Options for locating a new DOAS unit are similar to locating the VAV unit as describe above. The advantage of a DOAS unit is that the volume of air it is moving is approximately 1/3 as compared to the VAV system. The equipment and associated ductwork are smaller and easier to retrofit.

Cooling Plant: Viable options studied include integral packaged DX, remote DX, and construction of a new central chilled water plant. The tight site and proximity to the neighboring residential areas presents challenges in designing new equipment to meet the noise criteria at the property line. The following outlines possible cooling plant options:

Integral Direct Expansion (DX): Integral DX is an option with the vertical unit ventilators and there is precedent with this type of system in the District. Design considerations need to include meeting the classroom ambient sound levels. Integral cooling systems have an impact on future maintenance by distributing possible failure points of the system.

Remote Direct Expansion (DX): Remote DX in an option for mini-split systems and vertical unit ventilator solutions. The condensing units could be located on grade adjacent to the building or on the roof.

Chilled Water: There are multiple options to generate chilled water to meet the cooling needs of the building. Refer to the central plant options in this report for a discussion of each.

Heating Plant: Viable options include leaving the existing steam systems in place and installing a cooling only system, connecting to the existing steam plant, installing a steam to hot water convertor, or installing a new high efficiency hot water plant. The following outlines possible heating plant options.

Steam: The building is currently heated by two large dual fuel steam fire tube boilers. The steam option includes modifying steam and condensate distribution piping to accommodate the new systems.

Hot Water HX: Includes the installation of a new steam-to-hot water heat exchanger, pumps and distribution system to deliver hot water to the new systems. Hot water distribution piping is more flexible to route to location as necessary than steam piping. The installation of a heat exchanger will easily accommodate future conversion of the stem plant to hot water.

Hot Water Plant: There are multiple options to generate hot water to meet the heating needs of the building. Refer to the central plant options in this report for a discussion of each.

Dehumidification: Active dehumidification requires a heating source that is currently not available with the existing steam plant during the summer months. Options for active dehumidification will depend on the extent of hot water that is installed with the new systems. If hot water distribution is included as the heating source, the heating coils will be located in the reheat position downstream of the cooling coils. If hot water is generated through a steam-to-hot water convertor, then reheat will only be possible when the steam boiler is in operation. An option to extend the time that hot water is available is to add a small high efficiency gas

boiler. If the project include replacing the steam plant, the boiler capacity would be selected to provide adequate turn down during low load periods.

Project Risks: The following are design risks identified in implementing this project. The cost estimate includes a 15% design contingency to cover these risks. Further investigation into each of these could better define the solution and allow the design contingency to be reduced.

- Determining vertical pathways for new ductwork as necessary for the central air handling unit options. The existing structure poured concrete over clay tile. Options that require removing a concrete joist will require additional structural review.
- Determining a design solution for outside ventilation air with the central air handling unit options.
- Space heating and cooling loads are estimated based on typical loads for this type of space. Final heating and cooling loads need to be completed.
- Integrity of the existing steam and condensate systems for options that include steam heating. Piping in poor condition may necessitate additional pipe removal. The best method to mitigate this risk is to pursue the hot water heating solution as outlined in the heating section above.
- Structural capacity for options that locate new equipment on the roof. If roof options are considered, further structural evaluation will be necessary.
- Space constraints for options that include locating new central air handling units in the storage room. Final load calculations and air handling unit selections are necessary to determine the final design to fit the new equipment.

Additional Scope Considerations: The following items could be considered for inclusion in the project work scope. These items are not directly related to adding air conditioning but there would be cost efficiency by including them in the project scope and the have added value as noted.

- *Provide new ceilings and lights:* Provide new lay-in ceilings typically throughout with new LED lighting and controls. With the vertical unit ventilator options, new ceilings would allow for the air distribution above the ceiling to reduce the system noise. The ceiling condition likely will require a soffit along the exterior walls to accommodate the existing windows elevations.

Typical Photos:

Room 030

Building Area 3 – Cafeteria (7,700 Sq. Ft.): The following is a summary of the range of possible options considered.

Options Summary:

Building Area	Air Delivery Method	Cooling Plant	Heating Plant	Option
3 – Black Box / Workroom	A - Mini-Split	B - Remote DX	A - None	2-ABA
	C - Central CV	B - Remote DX	B - Steam	2-CBB
			C - Hot Water*	2-CBC
		C - Chilled Water*	B - Steam	2-CCB
			C - Hot Water*	2-CCC
	D - DOAS	C - Chilled Water*	C - Hot Water*	2-DCC

Notes: * There are multiple central plant options for chilled and hot water. Refer to the Central Plant section of this report.

Air Delivery: A single zone constant volume heating and ventilation unit installed in the original 1957 construction located in a basement mechanical room provides ventilation and heating for the space. The cafeteria is open to the adjacent corridor on both the east and west ends. Options to cool the cafeteria need to consider the adjacent corridors. The following outlines possible new air delivery methods:

Mini-split: The systems would be installed while leaving the existing heating and ventilation systems in place. Because unconditioned ventilation air is delivered to the space through the existing unit ventilator, there is a risk of creating high humidity conditions.

Central Constant Volume (CV): Replace the existing ventilation system with a new constant volume air handling system. It is anticipated that the current MN Energy code will require heat recovery to be incorporated into the system. Further investigation is necessary to determine the optimal configuration of the new mechanical systems and if the new unit will fit in the existing mechanical room. An option is to locate the new unit on the roof above. Pathways for vertical duct distribution need to be determined.

Dedicated Outside Air (DOAS): Options for locating a new DOAS unit are similar to locating the VAV unit as describe above. The advantage of a DOAS unit is that the volume of air it is moving is approximately 1/3 as compared to the VAV system. The equipment and associated ductwork are smaller and easier to retrofit.

Cooling Plant: Viable options studied include integral packaged DX, remote DX, and construction of a new central chilled water plant. The location of the chiller plant needs to consider sound levels at the adjacent property line. There is a large space to the east of the building. The following outlines possible cooling plant options:

Remote Direct Expansion (DX): Remote DX in an option for mini-split systems and vertical unit ventilator solutions. The condensing units could be located on grade adjacent to the building or on the roof.

Chilled Water: There are multiple options to generate chilled water to meet the cooling needs of the building. Refer to the central plant options in this report for a discussion of each.

Heating Plant: Viable options include leaving the existing steam systems in place and installing a cooling only system, connecting to the existing steam plant, installing a steam to hot water convertor, or installing a new high efficiency hot water plant. The following outlines possible heating plant options.

Steam: The building is currently heated by two large dual fuel steam fire tube boilers. The steam option includes modifying steam and condensate distribution piping to accommodate the new systems.

Hot Water HX: Includes the installation of a new steam-to-hot water heat exchanger, pumps and distribution system to deliver hot water to the new systems. Hot water distribution piping is more flexible to route to location as necessary than steam piping. The installation of a heat exchanger will easily accommodate future conversion of the stem plant to hot water.

Hot Water Plant: There are multiple options to generate hot water to meet the heating needs of the building. Refer to the central plant options in this report for a discussion of each.

Dehumidification: Active dehumidification requires a heating source that is currently not available with the existing steam plant during the summer months. Options for active dehumidification will depend on the extent of hot water that is installed with the new systems. If hot water distribution is included as the heating source, the heating coils will be located in the reheat position downstream of the cooling coils. If hot water is generated through a steam-to-hot water convertor, then reheat will only be possible when the steam boiler is in operation. An option to extend the time that hot water is available is to add a small high efficiency gas boiler. If the project include replacing the steam plant, the boiler capacity would be selected to provide adequate turn down during low load periods.

Project Risks: The following are design risks identified in implementing this project. The cost estimate includes a 15% design contingency to cover these risks. Further investigation into each of these could better define the solution and allow the design contingency to be reduced.

- Determining a design solution for outside ventilation air with the central air handling unit options.
- Determine the optimal layout for air handling unit installation in the existing mechanical room. It would work best to reconfigure the other equipment in the room.

- Space heating and cooling loads are estimated based on typical loads for this type of space. Final heating and cooling loads need to be completed.
- Integrity of the existing steam and condensate systems for options that include steam heating. Piping in poor condition may necessitate additional pipe removal. The best method to mitigate this risk is to pursue the hot water heating solution as outlined in the heating section above.
- Structural capacity for options that locate new equipment on the roof. If roof options are considered, further structural evaluation will be necessary.

Additional Scope Considerations: The following items could be considered for inclusion in the project work scope. These items are not directly related to adding air conditioning but there would be cost efficiency by including them in the project scope and the have added value as noted.

- *Provide new ceilings and lights:* Provide new lay-in ceilings typically throughout with new LED lighting and controls. With the vertical unit ventilator options, new ceilings would allow for the air distribution above the ceiling to reduce the system noise. The ceiling condition likely will require a soffit along the exterior walls to accommodate the existing windows elevations.

Typical Photos:

Cafeteria

Building Area 4 – Gymnasium (14,650 Sq. Ft.): The following is a summary of the range of possible options considered.

Options Summary:

Building Area	Air Delivery Method	Cooling Plant	Heating Plant	Option
4 – Auditorium	C – Central CV	A – Packaged DX	B – Steam	4-CAB
			C – Hot Water	4-CAC
		B – Chilled Water	B – Steam	4-CBB
			C – Hot Water	4-CBC

Notes: * There are multiple central plant options for chilled. Refer to the Central Plant section of this report.

Air Delivery: A single zone constant volume heating and ventilation unit installed in the original 1957 construction located in a basement mechanical room provides ventilation and heating for the space. The air handling system also serves the two adjacent multi-purpose rooms. There is observed to be excessive pressure between spaces as a result of the return air path configuration. The following outlines possible new air delivery methods:

Central Constant Volume (CV): The existing mechanical room is tight on space. Locating the new Auditorium unit in the existing mechanical room will require removing systems that serve other areas. A possible option is to locate a new air handling unit on the roof. Further investigation is required to determine the structural constraints.

Cooling Plant: Viable options studied include integral DX, remote DX, and construction of a new central chilled water plant. The following outlines possible cooling plant options:

Integral Direct Expansion (DX): Integral DX is an option with the rooftop unit replacement.

Remote Direct Expansion (DX): A remote DX condensing unit is an to provide cooling for a replacement unit.

Chilled Water: There are multiple options to generate chilled water to meet the cooling needs of the building. Refer to the central plant options in this report for a discussion of each.

Heating Plant: Viable options include connecting to the existing steam plant, installing a steam to hot water convertor, or installing a new high efficiency hot water plant. The following outlines possible heating plant options.

Steam: The building is currently heated by a two large dual fuel steam fire tube boiler. The steam option includes modifying steam and condensate distribution piping to accommodate the new systems.

Hot Water HX: Includes the installation of a new steam-to-hot water heat exchanger, pumps and distribution system to deliver hot water to the new systems. Hot water distribution piping is more flexible to route to location as necessary than steam piping. The installation of a heat exchanger will easily accommodate future conversion of the stem plant to hot water.

Hot Water Plant: There are multiple options to generate hot water to meet the heating needs of the building. Refer to the central plant options in this report for a discussion of each.

Dehumidification: Active dehumidification requires a heating source that can modulate to very low load conditions. Active dehumidification is not practical with a gas-fired option. The building is heated with two large steam boilers. Reheat for dehumidification is currently not available with the existing steam plant during the summer months. Options for active dehumidification will depend on the extent of hot water that is installed with the new systems. If hot water distribution is included as the heating source, the heating coils will be located in the reheat position downstream of the cooling coils. If hot water is generated through a steam-to-hot water convertor, then reheat will only be possible when the steam boiler is in operation. An option to extend the time that hot water is available is to add a small high efficiency gas boiler. If the project include replacing the steam plant, the boiler capacity would be selected to provide adequate turn down during low load periods.

Project Risks: The following are design risks identified in implementing this project. The cost estimate includes a 15% design contingency to cover these risks. Further investigation into each of these could better define the solution and allow the design contingency to be reduced.

- Determining a design solution for outside ventilation air with the central air handling unit options.
- Determine if a new central air-handling unit will fit with the space constraints in the existing mechanical room. It may be necessary to reconfigure the adjacent equipment in the room.
- Space heating and cooling loads are estimated based on typical loads for this type of space. Final heating and cooling loads need to be completed.
- Integrity of the existing steam and condensate systems for options that include steam heating. Piping in poor condition may necessitate additional pipe removal. The best method to mitigate this risk is to pursue the hot water heating solution as outlined in the heating section above.
- Structural capacity for options that locate new equipment on the roof. If roof options are considered, further structural evaluation will be necessary.

Typical Photos:

Auditorium

Multi-purpose Room

9 - Central Plant Options: Centralizing the heating and cooling plants has benefits of replacing aged infrastructure, improving the overall operating efficiency of the building and reducing on-going maintenance cost by reducing the number of failures points in the building systems. The building currently has a centralized steam plant. The building does not have a centralized cooling systems approach. The following options have been considered.

Options Cost Summary:

Building Area	Cooling Approach	Heating Approach	Option
9 - Central Plant	A - Air Cooled Chiller	A - STM Distribution	4-AA
		B - STM w/ HW HX	4-AB
		C - HW Plant	4-AC
	C - Geo Thermal	A - STM Hybrid	4-CA
		B - HW Hybrid	4-CB
		C - Full Size Heat	4-CC

Cooling Plant: Centralizing the building cooling plant will improve the overall building operating efficiency and reduce the on-going maintenance requirements. The tight urban location and proximity to residential neighbors presents a risk of noise from centralized systems having a negative impact. Any centralized solution that has outside equipment will need to be evaluated for the sound levels at the adjacent property line. Final load calculations are necessary to determine the final chiller size.

Air Cooled Chiller: Because of site constraints and the proximity to the neighbors, the most likely option for locating the chiller is in the parking lot to the North. A study of the chiller sound output at the school property line needs to be completed. For the purposes of estimating, it is assumed that the chiller will have all of the available factory sound attenuation features and will be installed in a masonry enclosure with sound attenuating panels. It is possible that this option will not be viable due to excessive noise concerns.

Ground Coupled Geo-thermal: A ground coupled geothermal solution has the advantage in eliminating the risk of a sound impact to the adjacent residential neighbors. The adjacent field to the north is a possible location for the well field. Further study and a test well is necessary to determine the site specific well conditions to optimize the depth, capacity, and cost. Alternate geothermal technologies including Darcy Solutions closed loop systems should be considered to further reduce the cost and size of the well field.

Heating Plant: Two dual fuel steam fire-tube boiler currently serves the building for heating. Converting the building to hot water for heating will reduce the overall operating cost of the building, reduce the regular maintenance requirements, and allow greater flexibility in routing piping to terminal heating systems throughout the building.

Hot Water Boilers: Includes replacing the existing steam systems with a new high efficiency hot water dual fuel boiler plant. The plant will consist of multiple boilers to provide redundancy in the event of equipment failure. The existing steam and condensate piping will be removed. A variable primary hot water supply and return with multiple supply pumps will be distribute hot water throughout the building.

Ground Coupled Geo-thermal: If the ground coupled geo-thermal option is selected for cooling, the plant would also provide heating capacity for the building. Options for geo-thermal would be to increase the size of the well field and deliver all of the building heating needs from the central plant or provide a hybrid plant that includes high efficiency boiler capacity for peak heating loads. Because of the limited site available for the well field, increasing to size to match the building heating loads may not be possible. Further evaluation and a test well is necessary to determine the maximum heating capacity potential.

Typical Photo:

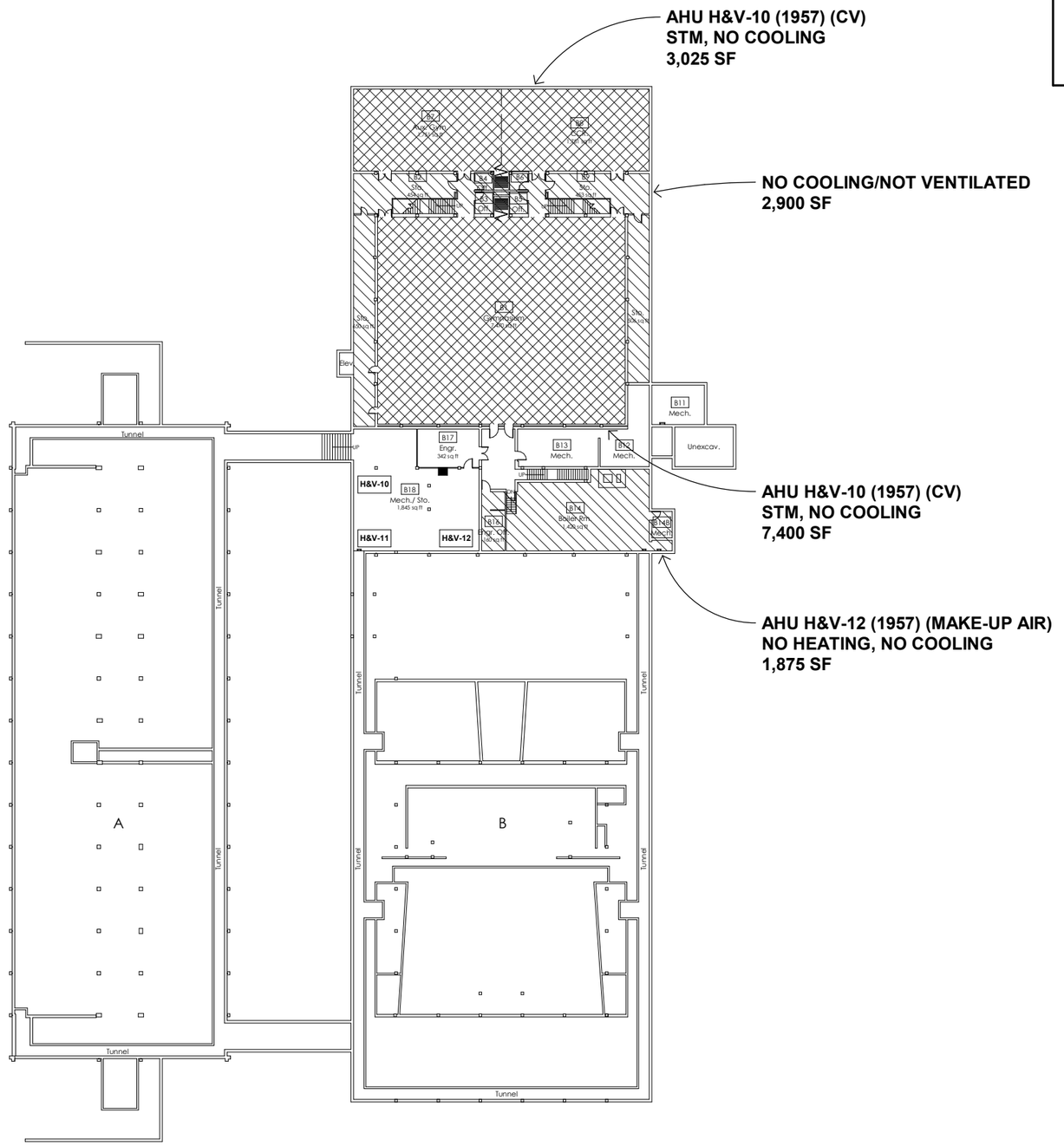
Possible Chiller / Geothermal Location – East Side of Building

Appendix A:

Existing Systems Diagram

SYMBOL KEY	ABBREVIATION KEY
VENTILATION ZONE	VAV - VARIABLE AIR VOLUME
NO COOLING/NOT VENTILATED	CV - CONSTANT VOLUME
NO COOLING	STM - STEAM
	HW - HOT WATER
	DX - DIRECT EXPANSION
	CHW - CHILLED WATER
	UV - UNIT VENTILATOR
	FTR - FINNED TUBE RADIATOR
	SS - SPLIT DX SYSTEMS
	- WINDOW AIR CONDITIONER

CENTRAL PLANT NOTES
BOILER PLANT TWO DUAL-FUELED FIRE TUBE BOILERS



1 ANTHONY MIDDLE SCHOOL EXISTING SYSTEMS PLAN - BASEMENT

1" = 50'-0"

SYMBOL KEY	ABBREVIATION KEY
VENTILATION ZONE	VAV - VARIABLE AIR VOLUME
NO COOLING/NOT VENTILATED	CV - CONSTANT VOLUME
NO COOLING	STM - STEAM
	HW - HOT WATER
	DX - DIRECT EXPANSION
	CHW - CHILLED WATER
	UV - UNIT VENTILATOR
	FTR - FINNED TUBE RADIATOR
	SS - SPLIT DX SYSTEMS
	- WINDOW AIR CONDITIONER

BUILDING AREA SUMMARY	
TOTAL BUILDING:	117,550 SQ FT
NO COOLING/NOT VENTILATED:	30,625 SQ FT
NO COOLING:	59,900 SQ FT
TOTAL AREA W/ NO COOLING:	90,525 SQ FT
PERCENTAGE NOT COOLED:	74.3%
CLASSROOMS COOLED:	24.4% (11 OF 45)

RTU-01-11 (2011) (CV)
STM, DX
2,000 SF
FTR - STM, PNEUMATIC

RTU-02-11 (2011) (CV)
STM, DX
2,000 SF
FTR - STM, PNEUMATIC

NO COOLING/NOT VENTILATED
16,500 SF

UV (2005)
STM, NO COOLING
2,125 SF
FTR - STM, PNEUMATIC

UV (2005)
STM, NO COOLING
1,600 SF

AHU-1 (2003) (CV)
STM, SS COOLING
9000 SF
FTR - STM, PNEUMATIC

AHU-1 (2003) (CV)
STM, NO COOLING
550 SF

AHU-1 (2003) (CV)
STM, NO COOLING
1,750 SF
FTR - STM, PNEUMATIC

UV (2001)
STM, NO COOLING
2,725 SF
FTR - STM, PNEUMATIC

AHU-1 (2010) (CV)
STM, DX
1,225

AHU H&V-1 (1957) (CV)
STM, NO COOLING
1,475 SF
FTR - STM, PNEUMATIC

MAU 1&2 (2001) (CV)
NATURAL GAS, NO COOLING
1,100 SF

RTU-1 (2001) (CV)
NATURAL GAS, DX
1,750 SF

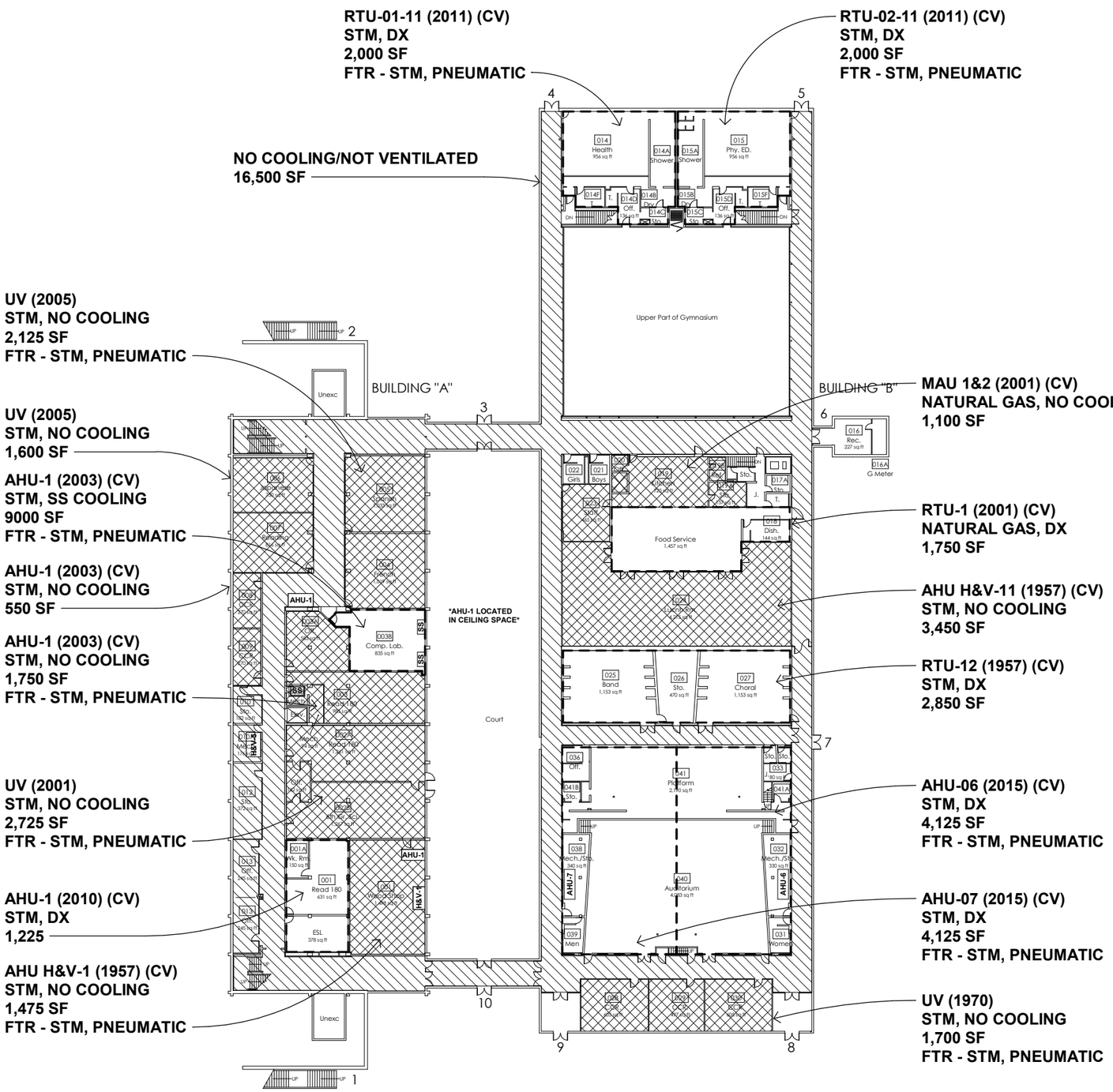
AHU H&V-11 (1957) (CV)
STM, NO COOLING
3,450 SF

RTU-12 (1957) (CV)
STM, DX
2,850 SF

AHU-06 (2015) (CV)
STM, DX
4,125 SF
FTR - STM, PNEUMATIC

AHU-07 (2015) (CV)
STM, DX
4,125 SF
FTR - STM, PNEUMATIC

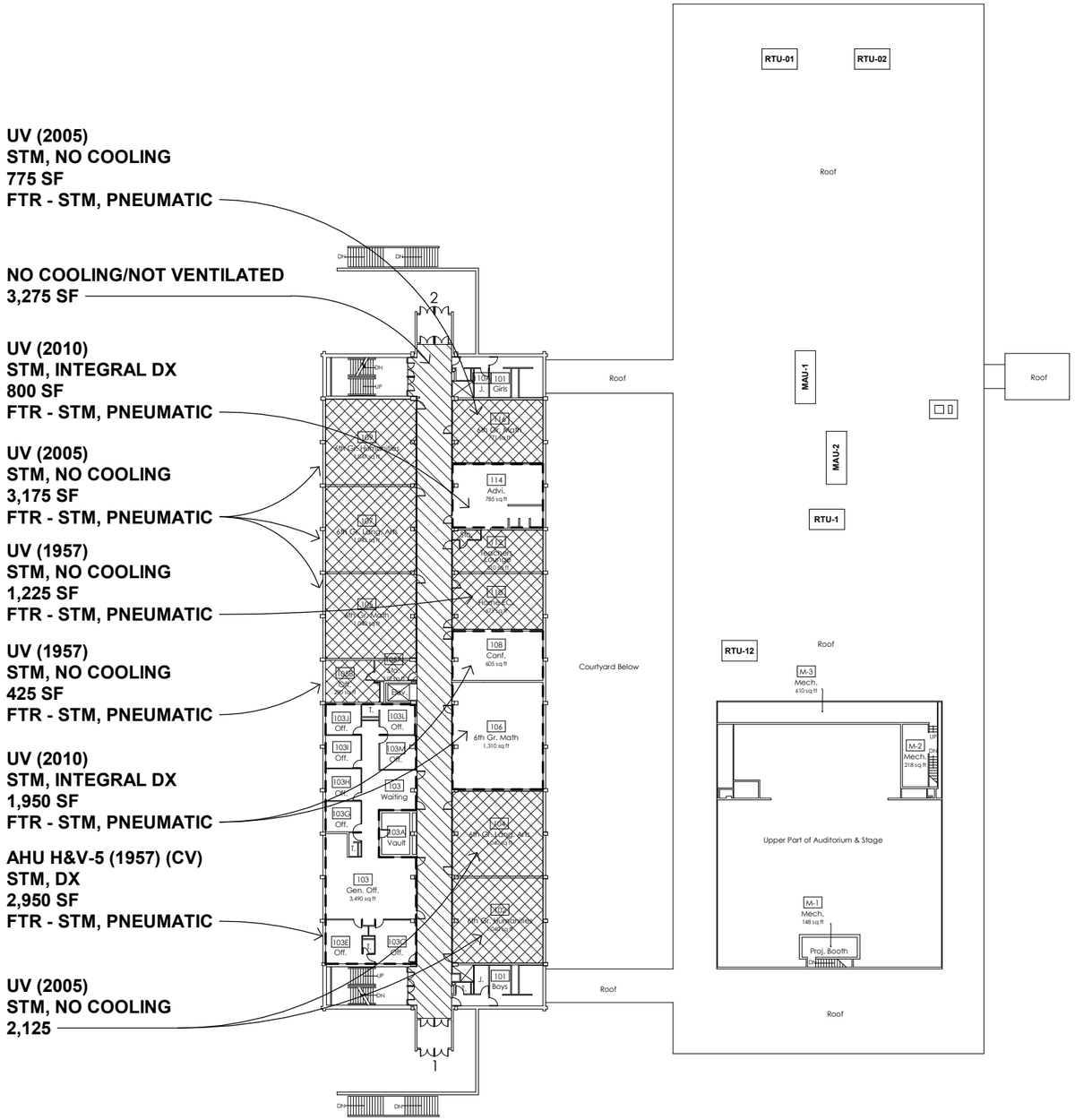
UV (1970)
STM, NO COOLING
1,700 SF
FTR - STM, PNEUMATIC



1 ANTHONY MIDDLE SCHOOL EXISTING SYSTEMS PLAN - GROUND FLOOR

1" = 50'-0"

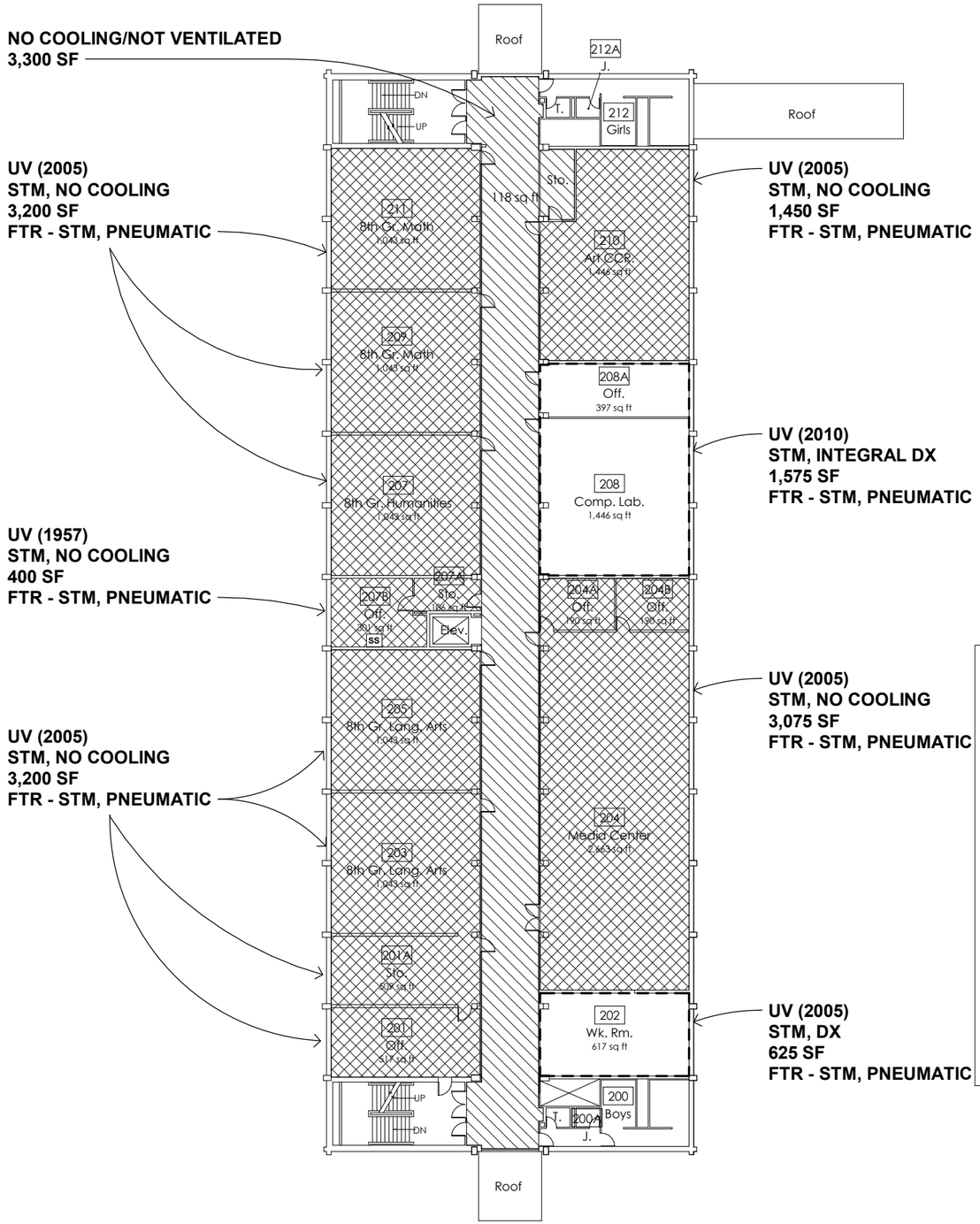
SYMBOL KEY	ABBREVIATION KEY
VENTILATION ZONE	VAV - VARIABLE AIR VOLUME
NO COOLING/NOT VENTILATED	CV - CONSTANT VOLUME
NO COOLING	STM - STEAM
	HW - HOT WATER
	DX - DIRECT EXPANSION
	CHW - CHILLED WATER
	UV - UNIT VENTILATOR
	FTR - FINNED TUBE RADIATOR
	SS - SPLIT DX SYSTEMS
	- WINDOW AIR CONDITIONER



1 ANTHONY MIDDLE SCHOOL EXISTING SYSTEMS PLAN - FIRST FLOOR

1" = 50'-0"

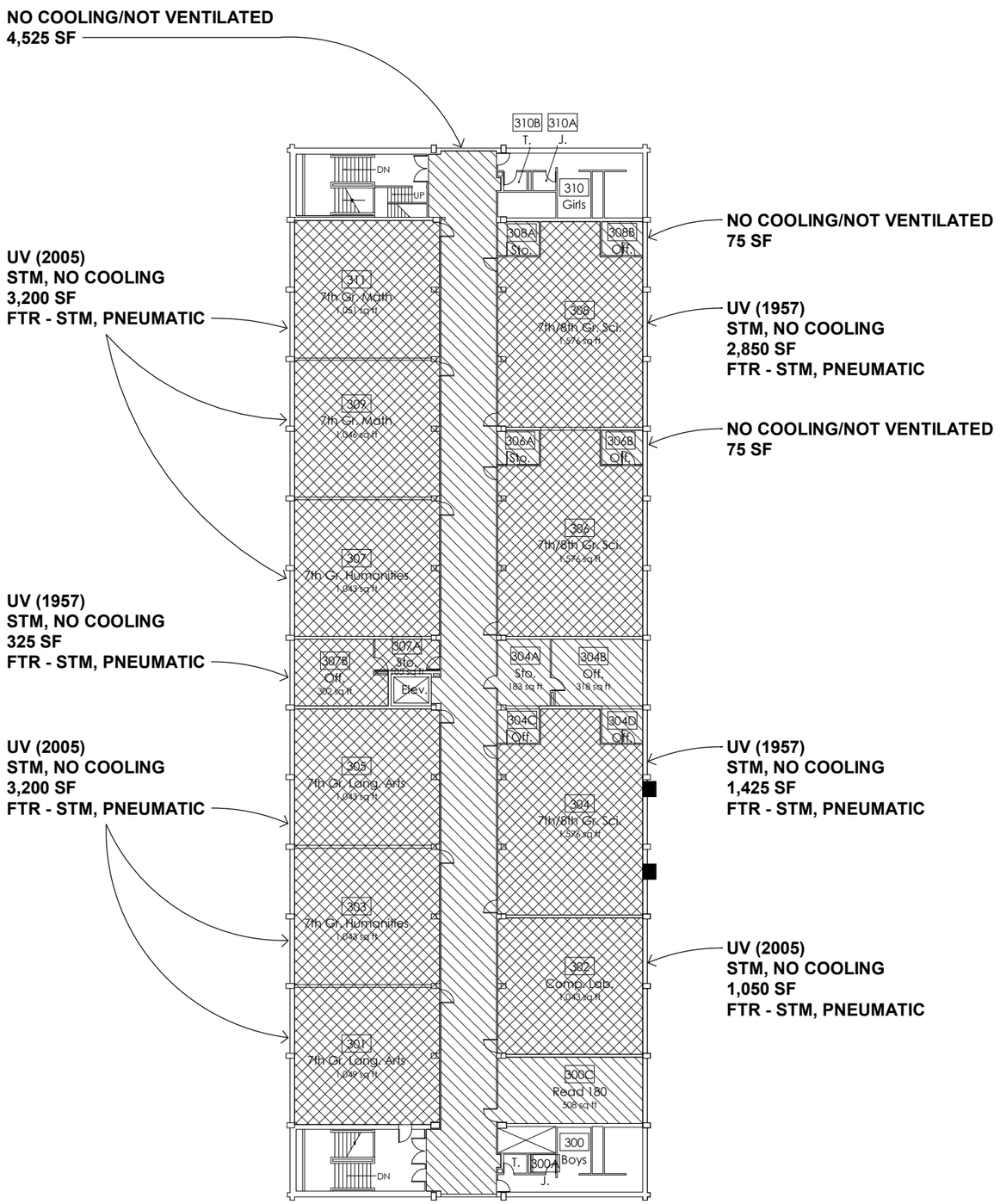
SYMBOL KEY	ABBREVIATION KEY
VENTILATION ZONE	VAV - VARIABLE AIR VOLUME
NO COOLING/NOT VENTILATED	CV - CONSTANT VOLUME
NO COOLING	STM - STEAM
	HW - HOT WATER
	DX - DIRECT EXPANSION
	CHW - CHILLED WATER
	UV - UNIT VENTILATOR
	FTR - FINNED TUBE RADIATOR
	SS - SPLIT DX SYSTEMS
	- WINDOW AIR CONDITIONER



1 ANTHONY MIDDLE SCHOOL EXISTING SYSTEMS PLAN - SECOND FLOOR

1" = 30'-0"

SYMBOL KEY	ABBREVIATION KEY
VENTILATION ZONE	VAV - VARIABLE AIR VOLUME
NO COOLING/NOT VENTILATED	CV - CONSTANT VOLUME
NO COOLING	STM - STEAM
	HW - HOT WATER
	DX - DIRECT EXPANSION
	CHW - CHILLED WATER
	UV - UNIT VENTILATOR
	FTR - FINNED TUBE RADIATOR
	SS - SPLIT DX SYSTEMS
	- WINDOW AIR CONDITIONER



1 ANTHONY MIDDLE SCHOOL EXISTING SYSTEMS PLAN - THIRD FLOOR

1" = 30'-0"

Appendix B:

Proposed Systems Diagrams

Redacted

Appendix C:

Dehumidification Capabilities

The recommended solution to provide air conditioning to the classrooms includes providing a high efficiency boiler for summer operation. Areas #1 and #2 included in the scope for the DOAS system will be capable of active de-humidification.

Appendix D:

Cost Estimate Detail

SSD#1 Minneapolis Public Schools
Air Conditioning Cost Estimating

Cost Basis - June 2021

		Ventilation Area	Bldg Total
BUILDING AREA 1 - 1957 Classrooms	79,200		
BUILDING AREA 2 - South Classrooms	1,800		
Area - SQ FT	**81,000**	**81,000**	**126,286**

Specification Division	**DOAS / Displacement - Air-colled Chiller, HW Plant**			**Cafeteria Building Area #3 - RTU CV, Integral DX, Modify STM**			**Gymnasium Building Area #4 - AHU CV, Remote DX, Modify STM**			**Building Area Total 81,000 SQ FT**			**Building Area Total 7,700 SQ FT**		
	Sq. Ft. / Qty	**Unit Cost**	**Cost**	**Sq. Ft. / Qty**	**Unit Cost**	**Cost**	**Sq. Ft. / Qty**	**Unit Cost**	**Cost**	**Sq. Ft. / Qty**	**Unit Cost**	**Cost**	**Sq. Ft. / Qty**	**Unit Cost**	**Cost**
				7,700 SQ FT			**14,650 SQ FT**			**Area #1 and #2 - Add for Ceilings and Lights**			**Area #3 - Add for Ceilings and Lights**		
Division 02 - Demolition (excludes Div 21, 22, 23, and 26)			**$ 60,750**			**$ 7,700**			**$ 14,650**			**$ 40,500**			**$ 3,850**
Miscellaneous	81,000	$ 0.75	$ 60,750	7,700	$ 1.00	$ 7,700	14,650	$ 1.00	$ 14,650	81,000	$ 0.50	$ 40,500	7,700	$ 0.50	$ 3,850
Division 03 - Concrete			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Floor Patch and Repair			$ -			$ -			$ -			$ -			$ -
Cast-in-place / Misc			$ -			$ -			$ -			$ -			$ -
Divisionn4 - Masonary			**$ 80,000**			**$ -**			**$ -**			**$ -**			**$ -**
Non-bearing Infill	1	$ 80,000	$ 80,000			$ -			$ -			$ -			$ -
Load bearing - new wall construction			$ -			$ -			$ -			$ -			$ -
Division 5 - Metals			**$ 80,000**			**$ 12,000**			**$ 4,500**			**$ -**			**$ -**
Structural Steel / Misc. Fabrications Allowance	4	$ 20,000	80,000	1	$ 12,000	12,000	1	$ 4,500	4,500			-			-
Division 6 - Carpentry			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Rough Carpentry			$ -			$ -			$ -			$ -			$ -
Casework Modifications						$ -			$ -			$ -			$ -
Division 7 - Thermal / Moisture Protection			**$ 26,000**			**$ 4,500**			**$ 4,500**			**$ -**			**$ -**
Roof Patch and Repair	4	$ 6,500	$ 26,000	1	$ 4,500	$ 4,500	1	$ 4,500	$ 4,500			$ -			$ -
Roof New Construction			$ -			$ -			$ -			$ -			$ -
Fire Stopping / Miscellaneous			$ -			$ -			$ -			$ -			$ -
Division 8 - Openings			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Access Panels			-			-			-			-			-
Doors / Hardware			-			-			-			-			-
Windows			-			-			-			-			-
Louvers			-			-			-			-			-
Division - 9 Finishes			**$ 243,000**			**$ 23,100**			**$ 7,325**			**$ 303,750**			**$ 46,200**
Soffits / Chases	81,000	$ 2.00	$ 162,000	7,700	$ 1.50	$ 11,550			$ -			$ -	7,700	$ 2.00	$ 15,400
Floor Patch and Repair			$ -			$ -			$ -			$ -			$ -
Acoustic Ceilings			$ -	7,700	$ 1.00	$ 7,700			$ -	81,000	$ 3.50	$ 283,500	7,700	$ 3.50	$ 26,950
Painting	81,000	$ 1.00	$ 81,000	7,700	$ 0.50	$ 3,850	14,650	$ 1	$ 7,325	81,000	$ 0.25	$ 20,250	7,700	$ 0.50	$ 3,850
Division 10 - Specialties			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Miscellaneous			-			-			-			-			-
Division 11 - Equipment			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Miscellaneous			$ -			$ -			$ -			$ -			$ -
Division 12 - Furnishings			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Casework			$ -			$ -			$ -			$ -			$ -
Miscellaneous			$ -			$ -			$ -			$ -			$ -
Division 21 - Fire Protection			**$ 162,000**			**$ 7,700**			**$ 7,325**			**$ 202,500**			**$ 19,250**
Demolition	-		$ -			$ -			$ -			$ -			$ -
New / Modify Existing	81,000	$ 2.00	$ 162,000	7,700	$ 1.00	$ 7,700	14,650	$ 0.50	$ 7,325	81,000	$ 2.50	$ 202,500	7,700	$ 2.50	$ 19,250
Division 22 - Plumbing			**$ -**			**$ -**			**$ -**			**$ -**			**$ -**
Demolition			$ -			$ -			$ -			$ -			$ -
Plumbing Fixtures			$ -			$ -			$ -			$ -			$ -
Micellaneous			$ -			$ -			$ -			$ -			$ -
Division 23 - HVAC			**$ 5,589,000**			**$ 288,650**			**$ 225,313**			**$ -**			**$ -**
Air Handling Equipment (VUV's / AHU's / RTU's)	4	$ 85,000	$ 340,000	1	$ 60,000	$ 60,000	1	$ 55,000	$ 55,000			$ -			$ -
Cooling Plant Equipment (Chiller / DX / Heat Pump)	1	$ 120,000	$ 120,000			$ -	1	$ 24,000	$ 24,000			$ -			$ -
Heating Plant Equipment (Boiler)	1	$ 45,000	$ 45,000			$ -			$ -			$ -			$ -
Demolition	81,000	$ 1.00	$ 81,000	7,700	$ 0.50	$ 3,850	14,650	$ 0.75	$ 10,988			$ -			$ -
AHU Equipment Installation / Start-up	4	$ 15,000	$ 60,000		$ 1,800	$ -	1	$ 24,000	$ 24,000			$ -			$ -
Cooling Plant Equipment Installation	1	$ 45,000	$ 45,000		$ 60,000	$ -	1	$ 20,000	$ 20,000			$ -			$ -
Heating Plant Installation	1	$ 180,000	$ 180,000			$ -			$ -			$ -			$ -
Chilled Water Distribution	81,000	$ 5.50	$ 445,500			$ -			$ -			$ -			$ -
Steam / Condensate Distribution	1	$ 20,000	$ 20,000	1	$ 40,000	$ 40,000	1	$ 20,000	$ 20,000			$ -			$ -
Hot Water Distribution	81,000	$ 12.00	$ 972,000			$ -			$ -			$ -			$ -
Ductwork Distribution Misc. (VAV's / Exhaust)	81,000	$ 32.00	$ 2,592,000	7,700	$ 18.00	$ 138,600	1	$ 40,000	$ 40,000			$ -			$ -
Controls	81,000	$ 7.50	$ 607,500	7,700	$ 5.50	$ 42,350	1	$ 24,000	$ 24,000			$ -			$ -
Test and Balance	81,000	$ 1.00	$ 81,000	7,700	$ 0.50	$ 3,850	14,650	$ 1	$ 7,325			$ -			$ -
Division 26 - Electrical			**$ 536,000**			**$ 19,050**			**$ 22,325**			**$ 526,500**			**$ 50,050**
Demolition	81,000	$ 0.50	$ 40,500	7,700	$ 0.50	$ 3,850	14,650	$ 1	$ 7,325	81,000	$ 1.00	$ 81,000	7,700	$ 1.00	$ 7,700
Electrical Service	1	$ 50,000	$ 50,000			$ -			$ -			$ -			$ -
Power Connections	81,000	$ 4.50	$ 364,500	1	$ 7,500	$ 7,500	2	$ 7,500	$ 15,000			$ -			$ -
Lighting and Controls	81,000	$ 1.00	$ 81,000	7,700	$ 1.00	$ 7,700			$ -	81,000	$ 5.50	$ 445,500	7,700	$ 5.50	$ 42,350
Division 27 - Technology			**$ 81,000**			**$ 3,850**			**$ 7,325**			**$ -**			**$ -**
Demolition Allowance			$ -			$ -			$ -			$ -			$ -
Fire / Sound / Data Allowance	81,000	$ 1.00	$ 81,000	7,700	$ 0.50	$ 3,850	14,650	$ 0.50	$ 7,325			$ -			$ -
DIVISION SUB-TOTAL			**$ 6,857,750**			**$ 366,550**			**$ 293,263**			**$ 1,073,250**			**$ 119,350**
Division 1 - General Conditions			**$ 1,200,106**			**$ 64,146**			**$ 51,321**			**$ 187,819**			**$ 20,886**
OH & P 10%			$ 685,775			$ 36,655			$ 29,326			$ 107,325			$ 11,935
Liability Insurance 1%			$ 68,578			$ 3,666			$ 2,933			$ 10,733			$ 1,194
Performance Bond 2%			$ 102,866			$ 5,498			$ 4,399			$ 16,099			$ 1,790
General Contractor Misc. 5%			$ 342,888			$ 18,328			$ 14,663			$ 53,663			$ 5,968
CONSTRUCTION SUB-TOTAL			**$ 8,057,856**			**$ 430,696**			**$ 344,583**			**$ 1,261,069**			**$ 140,236**
CONTINGENCY 15%			**$ 1,208,678**			**$ 64,604**			**$ 51,688**			**$ 189,160**			**$ 21,035**
CONSTRUCTION GRAND-TOTAL			**$ 9,266,535**			**$ 495,301**			**$ 396,271**			**$ 1,450,229**			**$ 161,272**
COST per SQ FT			**$ 114.40**			**$ 64.32**			**$ 51.46**			**$ 17.90**			**$ 20.94**