Elkin
Elementary School

500 E Allegheny Ave., Philadelphia, PA 19134

Major Mechanical Replacement Project

Scope Determination Report

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1.0 Introduction

This report outlines a Scope of Work (SOW) for removal and replacement of the Building's Automatic Temperature Controls, classroom and hallway unit ventilators, four roof top units and piping throughout Elkin Elementary School. This School is located at 500 E Allegheny Ave., Philadelphia, PA 19134

2.0 Background

The Elkin Elementary School building is located at 500 E Allegheny Ave., Philadelphia, PA. The 3 story, 53,200 square foot main building was originally constructed circa 1973.

1. The building typically rests on concrete foundations and concrete bearing walls that are not showing signs of settlement. There are no signs of moisture penetration through first level walls.

2. The main structure consists typically of combination of cast-in-place concrete columns, beams and 2-way ribbed concrete slabs. The roof structure over the main building is similar to floor construction and has cast-in-place concrete clerestories over entrances to classroom pods, some stairways and Library. The roof structure in Gymnasium consists of structural steel columns, framing and bar joists supporting precast concrete roof panels. The superstructure is generally in good condition.

3. The building envelope is typically face brick masonry with CMU backup. In general, masonry is in fair to good condition with some minor cracks and missing mortar. The second level floor and roof slab edges are exposed with some concrete spalling and exposed stirrup rebars. Water penetration through walls has not been reported. First floor walls are covered with multiple layers of anti-graffiti coating in different colors.

4. The building windows are extruded aluminum double hung windows single acrylic glazed with integral security screens, installed in late 1990's. Some windows in public areas and hallways are curtain wall type, double glazed. All windows are generally in good condition. The leaks around the windows perimeters have not been reported and are not evident. Roof clerestories windows are a combination of aluminum and coated steel framing, fixed, double acrylic glazed in poor condition.

5. The exterior doors are typically hollow metal doors and frames, painted. The doors are generally in fair condition; some doors have vision glazing with security screens. Service doors are in poor condition.

6. Roofing system is a built-up system approximately 15 to 20 years old and in fair condition; all roofing and flashing is typically in fair condition with some deterioration of the built-up system and flashing sealant; leaks have not been reported.

7. The building has a 2,500 lb hydraulic elevator serving all floors; generally in good condition.

The Existing Building HVAC System

1. Energy Supply - A 2" city gas service enters the building from Rorer Street. The gas meter is 2" and located in the in the boiler room.

2. The oil supply is stored in a 12,000 gallon underground storage tank (UST) located in the parking lot on the south side of the building. Oil is the primary fuel for the boilers.

3. The building has a hydronic, low pressure steam heating system that serves the classroom steam unit vents, hallway/corridor radiators and one air handler that serves the auditorium.

4. Two Weil-McLain, cast iron sectional, model 94 with 5,230 MBH (156) HP net capacity. Boilers provide steam for heating the entire building. They are equipped with recently installed Power Flame oil and natural gas burners. When the building is in heating mode the steam is routed to a shell and tube heat exchanger that heats the building water. Combustion air makeup is supplied by louvers equipped with motorized dampers. Cast iron sectional boilers have an anticipated service life of 35 years or more; as these units have been in service 40 years they need to be replaced. The boiler feed tank is installed in the boiler room, It is beyond its useful service life, shows signs of damage from rust, and needs to be replaced. A chemical feed tank is located next to the boiler feed tank and treats the boiler feed water.

5. Cooling Generating Systems - Chilled water is generated by one nominal 177 ton Carrier 30HXC screw chiller located in the chiller room with heat rejected by one single cell steel Marley NC Series cooling tower located on the roof. The chiller and cooling tower were installed in approximately 2007 and the Building Engineer reports no major issues with the units. Screw chillers have an anticipated service life of 20 years; this unit has been in use 8 years and should provide reliable service for the next 10 to 12 years. Galvanized cooling towers have an anticipated service life of 18 years. This unit should provide reliable service for the next 8-10 years.

6. A two pipe distribution system supplies building heating or cooling water to the unit ventilators, fin tube radiators, and heating and ventilation units (hot water only). A shell and tube heat exchanger allows energy from the steam boilers to be converted into hot water for the building loop. There are two 15HP Armstrong end suction water pumps which can serve either the hot water or chilled water service depending on valve configuration. Two small Armstrong in-line circulation pumps serve the building hot water distribution network for the heating and ventilation units. The chilled water piping is connected directly to the building water loop and does not pass through the heat exchanger. One Armstrong end suction pump serves the condenser water loop for the cooling tower and chiller. All pumps appear to be original to the building, are well beyond the anticipated service life of 25 years, and need to be replaced. All distribution piping, pumps, and insulation should be replaced.

7. There is a steam to hot water condenser. This will be removed when the system is switched to condensing hot water boilers.

8. There are five water pumps. They will require replacement to suit the new design.

9. There are 15 exhaust fans of various sizes. They will be replaced.

10. Conditioned air is provided to several spaces within the school by heating and ventilation units. Two (2) heating and ventilation units mounted near the ceiling in the Gymnasium serve the Gymnasium. Two (2) units installed in the boiler room serve the Cafetorium and core areas. The units are original to the building and are beyond their service life. These four (4) heating and ventilation units should be replaced with new units.

11. Unit ventilators and fin tube radiators provide heating and cooling for the majority of classrooms, offices, and indirectly to the hallways. The unit ventilators and radiators are original to the building and beyond their service life.

12. Terminal & Package Units - Supplemental ventilation is provided to the building by twenty (20) roof mounted power ventilators. All of the power ventilators are original to the building and beyond their service life. Many of the units are damaged and need to be replaced to ensure adequate ventilation for the building.
13. Building HVAC controls are pneumatic and inoperable. Classrooms and gyms have wall mounted thermostats to control unit ventilators. The controls are obsolete and should be replaced with a DDC to control new HVAC equipment. Pneumatic room thermostats are intended to control the unit ventilator control valves. In reality the ventilator control valves are wide open and heating and cooling control is achieved via the boilers or chiller. Pneumatic control air is supplied from a duplex Quincy compressor located in the boiler room. The pneumatic systems are beyond their service life and require too much attention from the maintenance staff. The original control valves and pneumatic actuators are beyond their service life and should be rebuilt or replaced. A new building automation system (BAS) with modern DDC modules and communications network should be installed to serve the HVAC systems in this building to improve reliability and energy efficiency. An interface should be provided with the preferred system in use throughout the District.

3.0. Scope of Work – HVAC Replacement

Environmental, Mechanical/Plumbing & Electrical.

3.1 Environmental

The School District of Philadelphia (SDP) Office of Environmental Management & Services (OEMS) developed the Scope of Work (SOW) for remediation services where applicable. Work will involve removal and proper disposal of asbestos materials prior to any removal, repair and/or construction of piping, insulation, and/or any miscellaneous equipment and materials. Environmental scope of work will also include abatement required for other work described hereinafter.

3.2 Mechanical

A. Mechanical System Replacement

The SOW listed below encompasses the demolition, removal and replacement of the original classroom unit ventilators (UV's), hallway radiators, boilers, and Air Handling Units (AHU's) and all associated ancillary valves, piping and controls, located throughout the school.

1. Demolition shall consist of, but not limited to, the following:

    a. Removal of 2 boilers.
    b. Removal of steam to hot water heat exchanger for building heating.
    c. Removal of condensate pumps.
    d. Removal of 5 water pumps.
    e. Removal of combustion air damper.
    f. Removal of steam to hot water heat exchanger for domestic hot water.
    g. Removal of approximately 76 classroom radiators/UV's from the classrooms.
    h. Removal of an air compressor unit and all pneumatic panels, tubing and controls.
    i. Removal of two Heating and Ventilating Units (HVU), located in the boiler room, servicing the administration and internal areas.

j. Removal of two HVU located in the gymnasium ceiling, servicing the Gymnasium.
k. Removal of approximately 3 hallway finned tubed radiators (convectors) throughout the school.
l. Removal of approximately 16 exhaust fans (EF).
m. Removal of approximately 15 unit heaters (UH).
n. Removal of approximately 4 radiators/convectors in the hallways.
o. Removal of (all) approximately 3450 L.F. of 3" diameter steel piping, valves and insulation throughout the school. (no budget given, recommended that a separate contract for review should be awarded)
p. Removal of (all) approximately 2100 L.F. of 4" diameter steel piping, valves and insulation located throughout the school. (no budget given, recommended that a separate contract for review should be awarded)
q. Removal of (all) approximately 400 L.F. of 5" diameter steel piping, valves and insulation throughout the school. (no budget given, recommended that a separate contract for review should be awarded)
r. Removal of (all) approximately 1100 L.F. of 6" diameter steel piping, valves and insulation throughout the school. (no budget given, recommended that a separate contract for review should be awarded)
s. Removal of all steam piping, traps and valves from the horizontal and vertical main risers to each existing UV/radiator. (no budget given, recommended that a separate contract for review should be awarded)
t. Removal of all control pneumatic tubing and control wiring and conduit associated with each Unit Ventilator and Unit Heater located in the classrooms, hallways and stairwells.
u. Removal of all miscellaneous piping and control valves for each UV and UH located throughout the school.
v. Removal of the Vacuum Feeder Pump and all appurtenant piping and controls.
w. Removal of the expansion tank in the basement boiler room.
x. Removal of hot water recirculation pump.

2. Installation shall consist of, but not limited to, the following SOW

a. Furnish and install approximately 76 new (UV's) and new control valves with electric thermostats connected to a DDC system in school building classrooms and common areas. The EOR shall confirm the existing UV quantities and capacities in each classroom, hallway, gymnasium and stairwell. Calculations shall be performed on all units to confirm flow rates and heating capacity of each unit.
b. Furnish and install approximately 4 total new Heating and Ventilating Air Handling Units for the Auditorium/Cafeteria and the Gymnasium. The EOR shall provide calculations for load capacity of each unit in accordance with the new 2018 IBC, IECC and IMC codes and the, ASHRAE 90.1 and ASHRAE 62.1 -2016 IAQ Standard.
c. Design approximately 3450 L.F. of Pex "A" of 3" diameter for the branch piping from the main lines to each unit ventilator.
d. Design approximately 2100 LF of 4" diameter (maximum diameter) steel/copper water lines throughout the school classrooms, hallways and plenum area(s).

e. Design approximately 400 L.F. of Pex "A" of 5" (maximum diameter) steel/copper water lines throughout the school.
f. Design approximately 1100 LF of 6" diameter (maximum diameter) steel/copper water lines throughout the boiler room and crawl space areas.
g. Design a pump with a VFD for the new hydronic condenser water loop.
h. Design a dual pump with a VFD for the hot water/chilled water dual temperature hydronic loop system.
i. Furnish and install a new DDC system to control all new equipment. A native BacNet communications protocol network shall be specified as the Building Management System (BMS) communications software for design purposes per ASHRAE Guideline 13.

3. The new basement boiler room upgrade shall consist of the following new mechanical work:

a. Furnish and install 2 new (skid mounted, if possible) net 5230 MBTUH condensing boilers (dual fuel capability) with VFD pumps, hydraulic separator, PRV, control panel and all necessary piping appurtenances to properly heat the 3 story 53,200 sf school building.
b. Furnish and install two new 4'x8' concrete mounting pads with mounting brackets for each new boiler.
c. Furnish and install one new approximately 12" diameter CPVC combustion air inlet/intake pipe, new breeching for both new condensing boilers and one 12" diameter CPVC exhaust outlet pipe for each new condensing unit.
d. Furnish and install 76 new unit ventilators with wireless control/thermostats for each UV throughout the school and the various classrooms that have malfunctioning. All classroom units shall be removed and replaced.
e. Furnish and install 4 new H&V units.
f. Furnish and install 15 new Unit Heaters.
g. Furnish and install 16 new exhaust fans.
h. Furnish and install 2 new domestic water condensing boilers
i. Furnish and install new hot water recirculation pump.

A. Piping

The facility has a history of heating/cooling pipe leaks, condensation and failing insulation through moisture saturation of the pipe insulation. Below is a schedule/list of all steel piping to be replaced with Uponor, Pex "A" (3") diameter pipe or smaller and steel pipe that is greater than 3" diameter, typically installed at the boiler basement location.

Location	***Length***	***Pipe Diameter***	***Mfg.***	***Comments***
1st Floor	1150 LF	2 1/2" dia.	Pex "A"	Mfg. Uponor w/ 2" Insul.
2nd Floor	1200 LF	2 1/2" dia.	Pex "A"	Mfg. Uponor w/ 2" Insul.
3nd Floor	1100 LF	2 1/2" dia.	Pex "A"	Mfg. Uponor w/ 2" Insul.
Boiler Room	400 LF	5" dia.	Sch.40 Steel	USA Grade w/ 2" Insul.
Boiler Room	1100 LF	6" dia.	Sch.40 Steel	USA Grade w/ 2" Insul.

B. Pumps

1.. Replace the 5 existing pumps with new pumps, with 2 lead/lag pumps for dual temperature chilled water and hot water; pump for condenser water, one pump for the coils in HV-1 and HV-2 and one pump for the coils in HV-3 and HV-4. The dual pump package shall be equipped with Variable Frequency Drive (VFD) controller. This pump package is included in the skid mounted condensing boiler package listed above.

C. Terminal Equipment

1. Furnish and install 76 UV's per the above SOW. Each unit vent shall have two way control valves.
2. Furnish and install 4 heating/ventilating units per the above SOW.
3. Furnish and install 15 Unit heaters per the above SOW.
4. Furnish and install 3 convectors/radiators in hallway

D. Distributed Digital Control (DDC) System

1. Furnish and install native BACnet based DDC system. System shall be open protocol
2. No gateway or interface panels required to use a dedicated BACnet compatible controller from any brand.
3. Controlled devices such as dampers and valves shall be electrically powered
4. New controls shall have an interface panel with graphics located in the boiler room.
5. Specify graphics including floor plans, individual equipment graphics and alarm summary

E. Commissioning

1. System commissioning per School District standards of all mechanical and plumbing equipment installed.

3.3 Electrical

A. Electrical Service

1. Furnish and install all new disconnect switches and miscellaneous wiring to each branch panel for the new unit ventilators. The EOR shall confirm wiring replacement to each hot water UV.

2. All new replaced mechanical equipment listed in the above SOW shall be properly re-wired to coincide with the correct voltage, amperage and frequency and grounded per the local NEC requirements.

3. Each classroom shall have a thermostat sensor built within the Unit Ventilator for DDC control to the heating and cooling within each classroom and common area.

3.4 Project Schedule

	Task	Date	Duration
1	RFP Issued	Friday, August 30, 2019	
2	Site Walkthrough	Tuesday, September 10, 2019	11
3	Questions Due	Tuesday, September 17, 2019	7
4	Addendum Issued	Tuesday, September 24, 2019	7
5	Proposal Due	Tuesday, October 1, 2019	7

6	Shortlist issued	Tuesday, October 15, 2019	14
7	Oral Interviews	Friday, October 18, 2019	3
8	Consultant Selection	Monday, October 21, 2019	3
9	Board Resolution	Thursday, December 19, 2019	59
10	Consultant notice to proceed	Monday, December 23, 2019	4
11	25% Submission	Monday, March 16, 2020	84
12	25% Review comments	Monday, March 30, 2020	14
13	50% submission	Monday, June 8, 2020	70
14	50% review comments	Monday, June 22, 2020	14
15	90% submission	Monday, August 17, 2020	56
16	90% review comments	Monday, August 31, 2020	14
17	Constructability walkthrough	Monday, September 14, 2020	14
18	Constructability comments	Monday, September 21, 2020	7
19	100% final submission	Monday, October 19, 2020	28
20	Advertise	Monday, November 23, 2020	35
21	Bidder walkthrough	Monday, December 7, 2020	14
22	Addendum	Monday, December 14, 2020	7
23	Bid	Wednesday, December 23, 2020	9
24	Board meeting	Friday, February 26, 2021	65
25	Notice to proceed	Friday, March 5, 2021	7
26	Construction commences	Friday, March 12, 2021	7
27	Construction Complete	Friday, June 3, 2022	448
28	Demonstration and Training	Friday, June 17, 2022	14
29	Project Closeout	Friday, June 24, 2022	7

4.0 Project Cost Estimate

A cost estimate for Major Renovations at Elkin Elementary School is based on the Scope of Work (SOW) described in the aforementioned sections and developed by the Philadelphia BOE estimating department. As-built drawings circa 1973 were used for the development of this SDR and the mechanical and electrical quantity take-offs to estimate the cost to fund this Capital Project. See the attached SDP Construction Estimate of Probable Cost for a detailed line item breakdown.

Cost Estimate Breakdown for Major Renovation

TOTAL $ 6,530,000
(Construction Budget)

Photographs

Photo #1 – Elkin Front Entrance

Photo No. 2 – Elkin Side Front Entrance

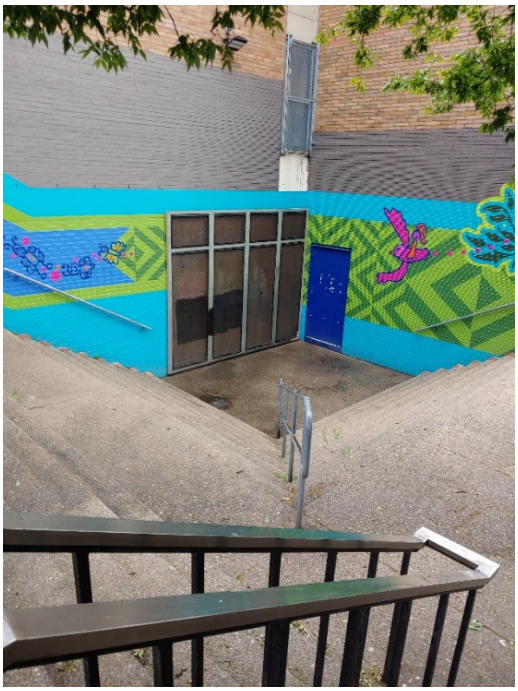

Photo No. 3 – Existing Boiler No. 1

Photo No. 4 – Existing Boiler No. 2

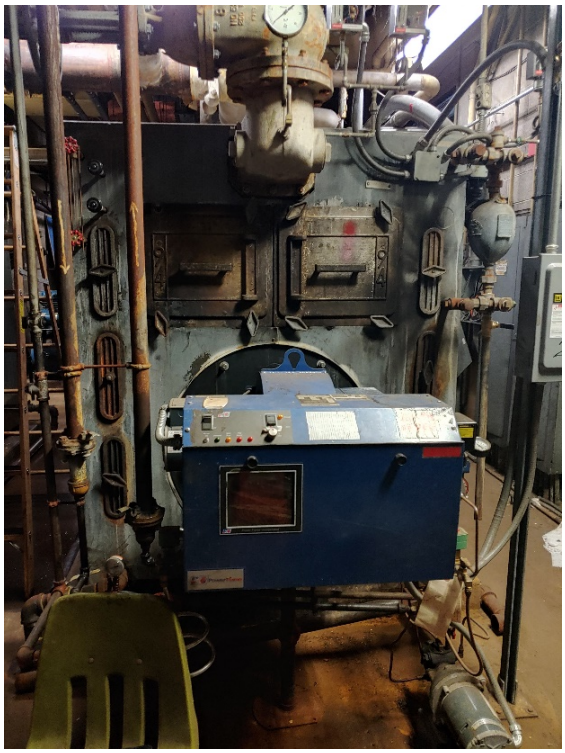

Photo No. 5 – Boiler Room Combustion Air Louvers

Photo No. 6 – Side View of the Existing Boiler.

Photo No. 7 - Three of five pumps located in mechanical room

Photo No. 8 – H & V Units 1 & 2 located in the gym ceiling area.

Photo No. 9 – H & V Units 3 & 4 located in the boiler room ceiling area.

Photo No. 10 – A typical recessed radiator located in the corridor area.

Photo No. 11 – A typical surface mounted unit ventilator located in the classroom

Photo No. 12 – A typical ceiling mounted unit ventilator

Photo No. 13 – A typical recessed unit ventilator

Photo No. 14 – Two surface mounted unit ventilators located in Cafetorium

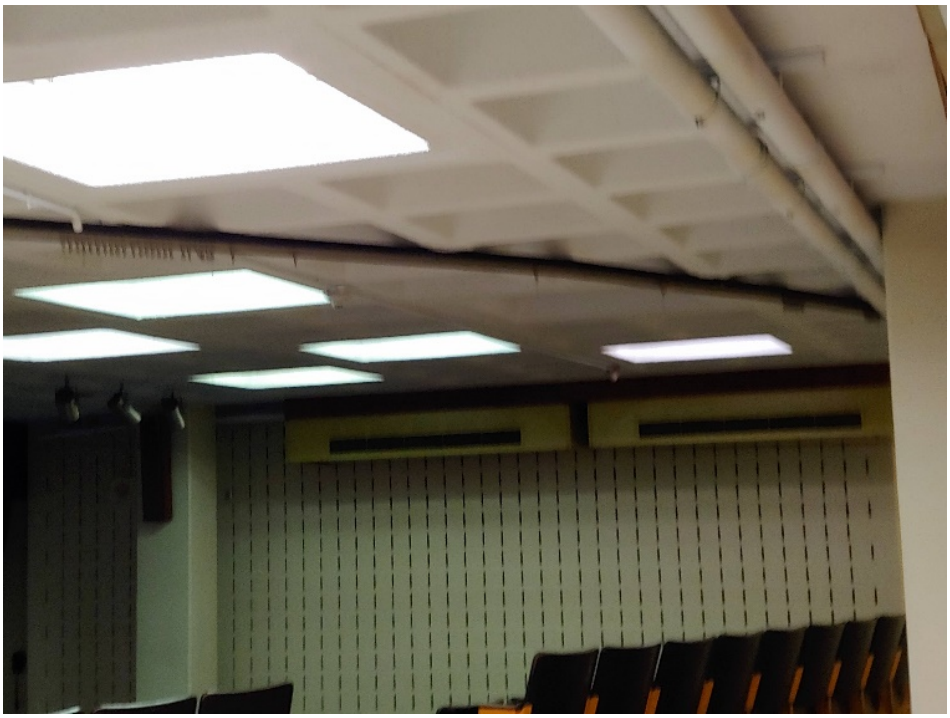

Photo No. 15 – Existing recessed convector located in the corridor

Photo No. 16 – Existing recessed wall mounted radiator