REQUEST FOR PROPOSAL (RFP)

Release Date:January 6, 2026

Staff member contact: Bretta Grabau
Phone staff member: 507-268-4449

REQUEST FOR PROPOSAL FOR:
Fillmore County Historical Society
HVAC Peer Review

I. INTRODUCTION:

Fillmore County Historical Society is seeking proposals from qualified firms who are interested in providing HVAC peer review services.

II. SCOPE OF SERVICES:

The Fillmore County Historical Society is seeking services from an engineering firm to perform a peer review of design to update the HVAC system within the Society's facility. The review will compare the design to the recommendations noted by the HVAC assessment done previously. The Society is located in an old elementary school built in 1958 as well as two pole-shed buildings that are attached via walkways. One of the buildings is insulated, but neither are climate controlled.

The firm will ensure the design satisfies requirements for museums and their ability to preserve artifacts in the main building, the first walkway, and the first pole shed. This includes final results to ensure relative humidity and temperature in winter conditions fall to a minimum of 68° F and 40% relative humidity and summer conditions set at 74° F and 55% relative humidity maximum. The daily fluctuations should be minimal with maximums of ± 2° F and ± 5% RH. The design should be formatted in such a way that implementation can be done in two phases in the event it is determined the project must be divided into two stages.

The design shall include all elements of a complete HVAC upgrade, including demolition, new equipment and controls, piping, plumbing, ductwork, electrical, fire alarm, structural, and general construction scopes of work. The design shall comply with all applicable codes and ordinance and shall be signed by a Minnesota professional engineer.

The peer reviewer will work with the designers to arrive at a consensus that the designed systems will be capable of achieving the Society's environmental control criteria in all seasons, if installed and operated as intended. All questions or issues raised by the peer review must be resolved by the design firm prior to bid documents completion. There will be three peer design review milestones:

- 50% design documents, drawings only
- 95% design documents, including written specifications
- 100% design backcheck, complete package

The design phase scope of work does not include construction phase services. However, the design engineer will be engaged for standard industry construction phase services when the project moves to its implementation phase. Scope and fees for those services will be negotiated immediately following design completion.

This project is a part of the Legacy Grant from the Minnesota Historical Society and is a requirement to begin implementation on HVAC improvements. HVAC upgrade requirements from the MNHS Grants Manual and the HVAC assessment will be provided.

III. Instructions to proposers

Proposals must be in writing and must be received by 3 pm on February 6, 2025. All proposals, questions, and correspondence should be directed to: Bretta Grabau, director@fillmorecountyhistory.org. In order to ensure a fair review and selection process, firms submitting proposals are prohibited from contacting any other organization members regarding these proposals.

Address or deliver proposals to: Bretta Grabau

director@fillmorecountyhistory.org
202 County 8
Fountain, MN 55935

IV. Statement of content of RFP *(A proposal must contain the following)*

A. Title page (*name, address, phone, contact person, date*)

B. Table of contents

C. Statement of the proposal (*work, timetable, availability*)

D. Consultant's/firm's profile/history/experience with similar projects (*including client references*)

E. Resumes of key peer review team members

F. Fees and method of payment

G. Any other information deemed helpful in demonstrating the proposer's ability to successfully complete the project.

V. Proposal evaluations

Proposals will be evaluated by the members of the Fillmore County Historical Society's executive board and staff.

Price will not be the only factor in awarding the proposal. FCHS reserves the right to award this proposal to a contractor other than the lowest bidder, should another be determined to provide the best value. The overall value proposition will include other considerations such as, but not limited to:

- Peer review engineer experience
- Reference checks
- Reputation
- Schedule
- Ease of coordination
- Compliance with all terms of this document
- Completeness of submission

VI. Agreement terms

Because of the Legacy Grant Requirements the final Application and Certificate for Payment will be paid no later than 30 days after approval of the MNHS Grant closeout per the Minnesota Historical Society Grant Agreement. The final Application and Certificate for Payment will be no less than 20% of the cost of the contract.

VII. Timetable

Proposals will be opened on **February 6, 2026**. The Society will select a short list of proposers to visit the site and interview with Society representatives during **February 2026**. A final selection will be made no later than **March 31, 2026**.

The successful bidder shall begin the work upon award notice. All phases of the project must be completed by **December 31, 2026**.

The 50% design documents shall be submitted no later than **July 31, 2026** with the 95% design documents submitted no later than **October 30, 2026**. The peer reviewer will be permitted seven days to go over the documents and return to the design engineer for consideration after each 50% and 95% design milestones have been achieved. The engineer's completed design must be submitted on **December 15, 2026** whereupon the peer reviewer will make a final backcheck.

Any extensions to the deadlines must be brought to the attention of the FCHS at least two weeks before the deadlines. The work must be completed within the timeframe specified above. However, the engineers will be permitted to complete the work ahead of schedule.

VIII. Other information

The Fillmore County Historical Society has been at its current location - 202 County 8, Fountain, MN 55935 - since 1988. The main 1958 museum building consists of the old classrooms, a cafeteria, and a gymnasium. This space is controlled by furnaces that have been installed after 2010 and three air conditioning units. The heat and air are forced through ducts built into the concrete floor and up through baseboard vents along the walls. The new system should utilize the existing vents.

Another room built in the 1990s just off the original brick school building is no longer heated, but the ducts from an expired furnace in one of the walkways remain. These ducts can be seen on the ceiling on the southern portion of the room. The inoperable furnace has been removed from the building since the HVAC assessment.

The first pole-shed building was also built in the late 1980s. It has been insulated, and has gas heating elements on the ceiling that are not functioning. There is no air conditioning in this building. The walkway connecting this building to the old school is also not climate controlled, but it is insulated.

The second pole-shed building and the walkway leading to it will not be a part of the design as it is not insulated, and is not included in the HVAC assessment beyond portable dehumidifiers being added.

REQUEST FOR PROPOSAL (RFP)

Release Date:January 6, 2026

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Phone staff member: 507-268-4449

REQUEST FOR PROPOSAL FOR:
Fillmore County Historical Society
HVAC Design

I. INTRODUCTION:

Fillmore County Historical Society is seeking proposals from qualified firms who are interested in providing HVAC design services.

II. SCOPE OF SERVICES:

The Fillmore County Historical Society is seeking services from an engineering firm to design an updated plan for HVAC within the facility as recommended by the HVAC assessment done previously. The Society is located in an old elementary school built in 1958 as well as two pole-shed buildings that are attached via walkways. One of the buildings is insulated, but neither are climate controlled.

The firm will design an HVAC system satisfying requirements for museums and their ability to preserve artifacts in the main building, the first walkway, and the first pole shed. This includes final results to ensure relative humidity and temperature in winter conditions fall to a minimum of 68° F and 40% relative humidity and summer conditions set at 74° F and 55% relative humidity maximum. The daily fluctuations should be minimal with maximums of ± 2° F and ± 5% RH. The design should be formatted in such a way that implementation can be done in two phases in the event it is determined the project must be divided into two stages.

The design shall include all elements of a complete HVAC upgrade, including demolition, new equipment and controls, piping, plumbing, ductwork, electrical, fire alarm, structural, and general construction scopes of work. The design shall comply with all applicable codes and ordinance and shall be signed by a Minnesota professional engineer.

The design engineers shall work with the peer reviewers of a second, independent firm to arrive at a consensus that the designed systems will be capable of achieving the Society’s environmental control criteria in all seasons, if installed and operated as intended. All questions or issues raised by the peer review must be resolved by the design firm prior to bid documents completion. There will be three peer design review milestones:

- 50% design documents, drawings only
- 95% design documents, including written specifications
- 100% design backcheck, complete package

The design phase scope of work does not include construction phase services. However, the design engineer will be engaged for standard industry construction phase services when the project moves to its implementation phase. Scope and fees for those services will be negotiated immediately following design completion.

This project is a part of the Legacy Grant from the Minnesota Historical Society and is a requirement to begin implementation on HVAC improvements. HVAC upgrade requirements from the MNHS Grants Manual and the HVAC assessment will be provided.

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Proposals will be evaluated by the members of the Fillmore County Historical Society's executive board and staff.

Price will not be the only factor in awarding the proposal. FCHS reserves the right to award this proposal to a contractor other than the lowest bidder, should another be determined to provide the best value. The overall value proposition will include other considerations such as, but not limited to:

- Design engineer experience
- Reference checks
- Reputation
- Schedule
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- Compliance with all terms of this document
- Completeness of submission

VI. Agreement terms

Because of the Legacy Grant Requirements, the final Application and Certificate for Payment will be paid no later than 30 days after approval of the MNHS Grant closeout per the Minnesota Historical Society Grant Agreement. The final Application and Certificate for Payment will be no less than 20% of the cost of the contract.

Should the FCHS be awarded the following implementation grant, the successful bidder would be asked to assist in the solicitation of the contract and advertisement of the upgrades.

VII. Timetable

Proposals will be opened on **February 6, 2026**. The Society will select a short list of proposers to visit the site and interview with Society representatives during **February 2026**. A final selection will be made no later than **March 31, 2026**.

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Another room built in the 1990s just off the original brick school building is no longer heated, but the ducts from an expired furnace in one of the walkways remain. These ducts can be seen on the ceiling on the southern portion of the room. The inoperable furnace has been removed from the building since the HVAC assessment.

The first pole-shed building was also built in the late 1980s. It has been insulated, and has gas heating elements on the ceiling that are not functioning. There is no air conditioning in this building. The walkway connecting this building to the old school is also not climate controlled, but it is insulated.

The second pole-shed building and the walkway leading to it will not be a part of the design as it is not insulated, and is not included in the HVAC assessment beyond portable dehumidifiers being added.

HVAC Systems Assessment

Fillmore County Historical Society Museum and Library
Fountain, Minnesota

October 2023

Questions & Solutions® Engineering, Inc.
1079 Falls Curve
Chaska, Minnesota 55318
QSEng.com

®

HVAC Systems Assessment

Fillmore County Historical Society Museum and Library Fountain, Minnesota

October 2023

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Table of Contents

1. Introduction

Questions & Solutions Engineering (QSE) surveyed the heating, ventilating, and air conditioning (HVAC) systems serving the Fillmore County Historical Society (FCHS) Museum & Library in Fountain, Minnesota. The survey was conducted to identify and recommend new or modified equipment and controls to improve indoor environmental conditions for exhibit spaces and collections storage. All areas, except the Hanger and Schoolhouse, of the Museum & Library were evaluated as a part of this study.

The intent of this effort is to achieve improved temperature and relative humidity objectives as reliably and energy efficiently as practical within the existing building's exterior enclosure. The proposed modifications in this report give top priority to collections storage areas, then to exhibit areas, and, finally, to support spaces for more comfortable conditions for visitors and staff year-round.

This report summarizes QSE's findings, options for system upgrades, and recommendations for the FCHS' consideration.

2. Assessment Process

1. Rebecca Ellis and Shannon Ellis of QSE visited the FCHS Museum & Library on July 10, 2023 and accomplished the following objectives:
    a. Met with Historical Society representatives familiar with the existing HVAC systems to understand:
        i. The history of the building.
        ii. Space use and occupancy patterns throughout the building.
        iii. The environmental control goals for the facility.
        iv. Indoor environmental control problems experienced and solutions attempted to date.
        v. Plans for building modifications and/or renovations.
        vi. How the facility is operated and maintained (in-house, out-sourced, etc.).
    b. Reviewed building systems documentation
        i. Architectural and/or engineering drawings
        ii. Equipment operations and maintenance manuals
    c. Toured, measured, and photographed the buildings
2. Defined and evaluated potential HVAC system modifications and/or replacement options to improve performance.
    a. Identified a range of options varying from simple to complex.
    b. Estimated the implementation cost for each option.
    c. Analyzed the benefits of each option, including impact on indoor environmental control, annual energy costs, reliability, and maintainability.

This report is the culmination of QSE's assessment.

3. Existing Conditions

General

The FCHS Museum & Library contains exhibits, collections storage, archives, library, offices, meeting rooms, and other support spaces. It is housed in three distinct structures connected by enclosed walkways, as illustrated in Attachment A.

The **Museum Building** was converted from an elementary school in 1988 with the Arena Gallery addition constructed in 1992. The **Ag Building** and **Tractor Building** were constructed in 1988 and 1994, respectively. Walkway #1 between the Museum and the Ag Building was also built in 1988, while Walkway #2 was built to connect the Ag Building to the Tractor Building in 2000. The Ag Building and Walkway #1 were then insulated in 1992.

The Museum & Library is open to the public Tuesday through Saturday 10:00 am to 3:00 pm and open for special events during other times.

Museum Building HVAC

Attachment B illustrates the Museum Building's HVAC. Four furnaces serve different areas of the Museum Building. Colored lines in Attachment B correspond to each of the four furnaces. Refer to Table 1 with each furnace's designated color.

Original 1988 underfloor distribution ductwork serves all areas except the Arena Gallery. Overhead distribution ductwork from Furnace 4, added with the 1992 addition, serves the Arena Gallery.

When the building was converted from school to museum in 1988, an original multizone air handling unit was replaced with three furnaces with direct expansion (DX) cooling in the Mechanical Room and connected to the original underfloor distribution ductwork. Each furnace was equipped with an Aprilaire humidifier and electric reheat coil for winter and summer space humidity control, respectively.

Air was drawn back from the building to the three furnaces through a return duct with a modulating damper. Outside air ventilation was drawn into the furnaces through a fresh air duct extending from the roof to the return air duct in the Mechanical Room. Figure 1 in Attachment B shows these ducts and the modulating dampers installed in each of them. The intent was for the return air damper and outside air damper to modulate in opposition to each other to vary the amount of fresh air ventilation delivered to the museum.

Temperature Control

In 2010, Furnaces 1, 2, and 3 were replaced with high efficiency gas-fired furnaces with DX cooling. Two Aprilaire humidifiers and all electric reheat coils were removed and not replaced. One Aprilaire remained in the Furnace 1 discharge ductwork, but it is currently inoperable.

The fourth furnace is located in Walkway #1. Furnace 4 was added in 1992 to serve the Arena Gallery addition and Walkway #1. This furnace is only equipped with gas-fired heating and is no longer functional.

Table 1: Furnace Locations & Served Areas

Furnace	Location of Furnace	Area Served	Attachment B Color Code	Heating/Cooling Capability	Humidity Control Capability
Furnace 1	Western-most unit in Mechanical Room	Hallway Textiles Storage Bathrooms Office	Red	Gas-fired heat and DX cooling	None
Furnace 2	Center unit in Mechanical Room	Community Room Library	Blue	Gas-fired heat and DX cooling	None
Furnace 3	Eastern-most unit in Mechanical Room	Main Gallery	Purple	Gas-fired heat and DX cooling	None
Furnace 4	Walkway #1	Arena Gallery	Pink	Gas-fired heat	None

Heating and cooling at each furnace is controlled by a space thermostat. The thermostat locations are shown in Attachment B as circled "T"s in the same color as its respective furnace ductwork.

The Main Gallery has an upper Mezzanine (balcony) around all four sides, accessible from stairs in the northeast corner of the Gallery. The Furnace 3 thermostat is on the wall in the lower area of the Main Gallery.

There is an electric baseboard heater along the north wall of Textiles Storage which can be controlled with a manual dial on the heater. The museum staff does not know when this was installed, and they do not use it.

Humidity Control

There is no current active humidity control, either humidification in the winter or dehumidification in the summer.

Ventilation

Although outside air ventilation was provided in the 1988 museum conversion, the outside air damper (see Figure 1 in Attachment B) is currently closed and no longer automatically controlled. The return air damper is fully open, and also no longer automatically controlled. As such, the furnaces are not delivering fresh air ventilation to the Museum as originally intended.

Furnace 4 does not have outside air ducted to it. Therefore, the Arena Gallery would not be provided with mechanical ventilation, even if Furnace 4 were functional.

Ag Building & Walkway #1 HVAC

Both the Ag Building and its connecting Walkway #1 were built in 1988 and insulated in 1992. Walkway #1 is served by heating-only Furnace 4, whose controlling thermostat is in the Arena Gallery, and is currently not functional.

The only HVAC systems serving the Ag Building are gas-fired radiant heaters suspended from its ceiling. According to museum staff, these radiant heaters have not worked since 2010. A contractor recently investigated them and reported their igniters need to be replaced.

A sidewall exhaust fan in the east wall of the Ag Building was presumably for summer ventilation cooling. However, it is covered with a wooden box and apparently not used.

Tractor Building & Walkway #2 HVAC

The Tractor Building and its connecting Walkway #2 are not insulated and have no temperature, humidity, or ventilation control.

4. Analysis

The following are some key explanations of how and why the existing HVAC system is not currently providing museum-quality indoor conditions.

2020-2021 Data Logger Analysis

Paul Storch from Museum Science Consultants prepared a General Conservation Assessment and Long-Range Conservation Plan Report for the Fillmore County Historical Society in 2021. This assessment included placing portable data loggers in the Museum and Agriculture Building during four seasons in 2020-2021. These recorded temperature and relative humidity in both buildings for about 2 weeks each season.

The data summaries are included in Attachment C. The following table compiles the statistics for each season for each building.

Museum						
	Temperarure (F)			Relative Humidity		
Season	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
Summer	69.4	70.0	70.8	54%	61%	72%
Fall	33.4	60.2	75.3	38%	47%	61%
Winter	70.5	70.8	71.2	22%	27%	36%
Spring	70.3	70.8	71.2	25%	29%	34%

Agriculture Building						
	Temperarure (F)			Relative Humidity		
Season	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
Summer	63.3	70.2	75.9	75%	81%	87%
Fall	46.9	68.0	75.0	32%	39%	53%
Winter	36.6	38.3	41.5	49%	56%	61%
Spring	38.8	49.4	59.0	53%	62%	72%

Museum Building

Temperature control in the Museum is excellent, as can be expected with relatively new HVAC equipment intended to heat and cool the building. There was a 6-day period in Fall 2020 when the indoor temperature dropped dangerously low (below 40 ° F), and this is most likely explained by an HVAC system failure or having the data logger inadvertently exposed to outdoor conditions through an open window.

The absence of active humidification and dehumidification is apparent from the low relative humidities in the winter (<40% RH) and high relative humidities (>60% RH) in the summer.

Agriculture Building

The Agriculture Building temperatures were quite temperate for an unconditioned (no cooling and inoperable radiant heaters) building. The fact that the structure is insulated appears to have allowed it to be buffered from the outdoor temperature extremes in both summer and winter.

Relative humidities were high in the summer due to high outdoor air dew point temperatures and high in the winter due to cold indoor air temperatures. There is a period of time each spring and fall during which the outdoor dew point temperatures and indoor temperatures moderate to allow for lower, more reasonable relative humidities.

Arena Gallery

When the Arena Gallery was added to the Museum Building, its furnace (Furnace 4) was provided with heating capability only. The expectation was that summer cooling would be accomplished due to the Arena Gallery's proximity to the Main Gallery space served by Furnace 3. That was more wishful thinking than good HVAC design.

There is no mechanism by which the Main Gallery can share its cooling with the Arena Gallery. There is also no reason to believe that Furnace 3, which was sized to serve only the Main Gallery, has the cooling capacity to condition the Arena Gallery even if there were fans transferring air between the spaces.

The collections in the Arena Gallery are at risk due to the absence of summer temperature control.

Main Gallery Mezzanine

The Main Gallery space thermostat is on the main floor and, thus, is controlling to maintain the setpoint space temperature at that level. All conditioned airflow from Furnace 3 is circulated at the main level, i.e., supplied through floor registers and returned out the doorways to the main corridor.

While heat rises in the winter and the solar heat gain is highest at the roof in the summer, the mezzanine level will always be warmer than the main level's thermostat setting. In general, this means the mezzanine level relative humidity will always be slightly lower than the main level.

Textiles Storage

The Office and Textile Storage spaces share a furnace (Furnace 1), even though they have different functions and occupancy patterns. With the thermostat in the Office, the temperature in Textiles will be different than the thermostat setpoint nearly all the time. For example, on a cold winter day when people are working in the Office, the people and lights will help warm the space, decreasing the demand for heating from the furnace. At the same time, the unoccupied and dark Textiles Storage room will be colder than the Office, because the thermostat does not sense the Textile Storage room's need for heat.

The difference in space temperature will also result in a difference in relative humidity between the Office and Textile Storage.

There is a baseboard heater under the window in Textile Storage which appears to have been added to address this situation. However, it can only address the situation of Textile Storage being colder than the desired setpoint and not when it is hotter. During QSE's site visit, the heater was turned off. When we tested its effectiveness, it made no noticeable difference to the Textile Storage space temperature.

Ventilation

There is no mechanical ventilation (outside air) currently delivered to any of the buildings. Although the original three Museum Building furnaces were installed with an industry standard fresh air system, that feature appears to have been disabled by the furnace replacement project about 10 years ago (if not earlier).

Fresh air ventilation is important for indoor air quality for both human occupant health and safety and for dilution of airborne pollutants to protect the collections. It also helps maintain a positive indoor building pressure compared to outdoors, reducing the potential for infiltered and unconditioned outside air to infiltrate through the building envelope (walls, windows, roof, doors, etc.). Such infiltration can create microclimates of undesirable temperatures and humidities around the perimeter of the building.

Finally, outside air ventilation is a Minnesota code requirement. Any new or significantly modified HVAC system will require provisions for ventilation.

5. Environmental Conditions Criteria

QSE recommends the following temperature and humidity conditions throughout the **Museum Building**. Because the building is served by only 4 HVAC systems and there are collections storage spaces squirreled throughout, it would be impractical to consider maintaining collections storage and archive environments at more rigorous conditions than gallery and/or support spaces.

- Winter: 68° F, 40% RH minimum relative humidity
- Summer: 74° F, 55% RH maximum relative humidity

Assuming the **Ag Building** does not need to be maintained for staff or visitor comfort, QSE recommends the following conditions for its collections. If human comfort is a priority, then the Ag Building should be maintained the same as the Museum Building.

- Winter: 60° F, 40% RH minimum relative humidity
- Summer: 74° F, 55% RH maximum relative humidity

The current cold storage conditions (i.e., no HVAC) in the **Tractor Building** are reasonably stable for the collections stored there. Until FCHS is prepared to provide full temperature and humidity control, the existing conditions are better than adding just heating or just cooling without humidification or dehumidification.

The **Walkways** should be heated/cooled to temperatures similar to their adjoining structures. Although the Walkways do not need active humidity control, it is inevitable that moisture will find its way into and out of the walkways just via door openings under normal operation and occupancy. Therefore, if humidification is added to one or more of its connecting buildings, a walkway will need to have its exterior walls and windows upgraded with vapor barriers. Walkway #2 would also need to be insulated.

6. HVAC System Options

The following are descriptions of options for modifying, upgrading, and/or replacing the FCHS Museum & Library HVAC systems to improve space temperature, relative humidity, and ventilation control.

Museum Building

Option M0: Repair Return Air Duct

Install a new access panel in the bottom of the main return air duct upstream of the 3 furnaces in the mechanical room. The original access panel is gone and the duct is open to the Mechanical Room. This option will prevent air from the mechanical room from being mixed with the air returning from the conditioned Museum spaces.

Option M1: Repair Ventilation System

Replace the 1988 single return air damper and single outside air damper shared by Furnaces 1, 2, and 3 in the mechanical room (refer to Figure 1 in Attachment B). Install modulating electronic actuators on each damper and control them in opposition to each other via a local controller to maintain maximum carbon dioxide (CO_2) concentrations in the Main Gallery and Community Room.

This will require a new wall-mounted CO_2 sensor in both the Main Gallery and Community Room. The controller will maintain the outside air damper closed whenever both CO_2 sensors are reading less than setpoint (1000 ppm). When the higher of the two CO_2 sensors rises above setpoint, the outside air damper shall modulate open and the return air damper will modulate closed, as needed to maintain the 1000 ppm setpoint at the higher CO_2 sensor.

Option M2: Add Reheat Coils for Dehumidification on Furnaces 1, 2, and 3

Return summer dehumidification capability to the three furnaces by installing electric reheat coils in each of their supply air ducts. These will be controlled by dedicated space humidistats (different from the Option M3 humidistats) installed adjacent to their respective space thermostats. If the space relative humidity rises above setpoint, the reheat coils will energize, causing the thermostats to bring on the DX cooling at the respective furnace for dehumidification.

Option M3: Install Humidifiers on Furnaces 1, 2, and 3

Return winter humidification capability to the three furnaces by installing humidifiers to disperse steam into their supply ductwork (downstream of each reheat coils if Option M2 is also implemented). These will be controlled by dedicated space humidistats (different from the Option M2 humidistats) installed adjacent to their respective space thermostats.

Install a single reverse osmosis water treatment system in the Mechanical Room for the makeup water to all three humidifiers. Run humidifier drain piping to a Mechanical Room floor drain.

In order to protect Walkway #1 from the higher dew points from the connecting Museum Building, this option should include installation of a vapor barrier in the Walkway #1 exterior walls and roof.

Option M4: Replace Arena Gallery HVAC

To provide proper collections preservation conditions, remove heating-only Furnace 4.

Install two new gas-fired furnaces with DX cooling to serve the Arena Gallery; one for the west half of the gallery and the other for the west half. This will allow for the reuse of the existing Furnace 4 ductwork to serve the west half and will provide FCHS the flexibility to create a separate collections storage space with its own temperature/humidity control in the east half.

New West Furnace

The new West Furnace can be installed in approximately the same location as the existing Furnace 4. It will be a high-efficiency condensing furnace with an outdoor DX condensing unit on the east side of Walkway #1. Combustion air and exhaust will be piped through the Walkway #1 roof.

Supply air will be ducted from the new furnace to the existing supply air ductwork concealed in the soffit along the south wall of the Arena Gallery. The existing supply duct will be cut and capped in the soffit at the middle of the Arena Gallery. The remaining east-end of the existing supply ductwork will be abandoned-in-place in the soffit. Return air will be ducted from the existing return air grille in the west wall of the Arena Gallery back to the new furnace.

Fresh air ventilation will be ducted through the Walkway #1 roof and connected to the return air duct with a two-position damper controlled by a space CO_2 sensor in the west end of the Arena Gallery. When the space CO_2 is above setpoint (1000 ppm), the damper will open. When the space CO_2 is below 900 ppm, the damper will close.

A space temperature sensor will control the new furnace's heating and cooling to maintain the summer and winter temperature setpoints.

A supply duct-mounted humidifier will be controlled in the winter by a space relative humidity sensor. A supply-duct mounted electric reheat coil will be used for summer dehumidification, controlled by a second space humidistat.

Water will be piped to the humidifier and treated by a reverse osmosis system prior to entering the humidifier. Drain piping from the condensing furnace, the humidifier, and the DX cooling coil condensate drain pan will be pumped to an indirect connection into the nearest sanitary drain.

New East Furnace

The new East Furnace will be installed in the southeast corner of the Arena Gallery and concealed by modular space dividers while the space remains a public gallery. Once the east end is converted to collections storage, there is no need to conceal it. The outdoor DX condensing unit will be installed on the south side of the Arena Gallery.

This new furnace will be essentially identical to the new west furnace, but its combustion air and exhaust will be piped through the Arena Gallery south wall instead of the roof.

A new exposed duct with supply air registers along its length will be installed along the east end of the Arena Gallery. Return air will be drawn back into the new furnace via a short section of return air ductwork connected to the furnace.

Fresh air ventilation will be ducted through the south wall and connected to the return air duct with a two-position damper controlled by a space CO_2 sensor in the east end of the Arena Gallery similar to the outside air damper at the new West Furnace.

A space temperature sensor, located near the new furnace return air opening, will control the new furnace's heating and cooling to maintain the summer and winter temperature setpoints

A supply duct-mounted humidifier will be controlled in the winter by a space relative humidity sensor. A supply duct-mounted electric reheat coil will be used for summer dehumidification; also controlled by a space relative humidity sensor.

Water will be piped to the humidifier and treated by a reverse osmosis system prior to entering the humidifier. Drain piping from the condensing furnace, the humidifier, and the DX cooling coil condensate drain pan will be pumped to an indirect connection into the nearest sanitary drain.

Option M5: Install Mini-Split Cooling Units for the Main Gallery Mezzanine

Install two mini-split DX cooling units to provide supplemental cooling and improved temperature control in the Mezzanine of the Main Gallery. One will be wall-mounted on the west end and the other will be wall-mounted on the east end.

The west end outdoor condensing unit will be installed on grade in the same area as the Furnace 1, 2, and 3 condensing units. The east end condensing unit will be installed on grade on the east side of the Main Gallery.

Wall-mounted thermostats in the Mezzanine will control each unit to maintain the upper level space temperatures to the same setpoints as the Furnace 3 thermostat on the lower level of the Main Gallery.

Condensate will be pumped from each mini-split to an indirect connection into the nearest sanitary drain or directly to the outdoors.

Option M6: Textiles HVAC

Add a mini-split heat pump in the Textiles Storage space to allow for space temperature control separate from the office, in which the Furnace 1 thermostat is currently located. The heat pump outdoor condensing unit will be installed immediately outside of the Textiles Storage space.

A wall-mounted thermostat will control the heat pump for cooling or heating, as needed to maintain the setpoint space temperature in summer and winter.

Condensate will be drained by gravity to the outdoors.

Textiles Storage will continue to be served by Furnace 1 for humidity control.

Ag Building

Option A1: Repair Radiant Heaters & Add Humidification & Ventilation; Not Cooling Ready

QSE understands the two gas-fired radiant heaters are expected to be functional with replacement of their ignitors. Option A1 will repair the radiant heaters and put them back into service. Add new wall-mounted thermostats for each heater, set to maintain the winter space temperature setpoint.

To prevent excessively low relative humidities that would naturally accompany the introduction of heat to the Ag Building, Option A1 must also include a humidifier for adding moisture in the winter. Install a duct suspended from the ceiling about 3 feet from the north wall, extending from Walkway #1's entrance to about 80 feet to the east. Install an air filter and in-line fan at the west end of the duct to draw air from the west and discharge it out of the duct through supply air registers spaced evenly along the length of the duct to the east.

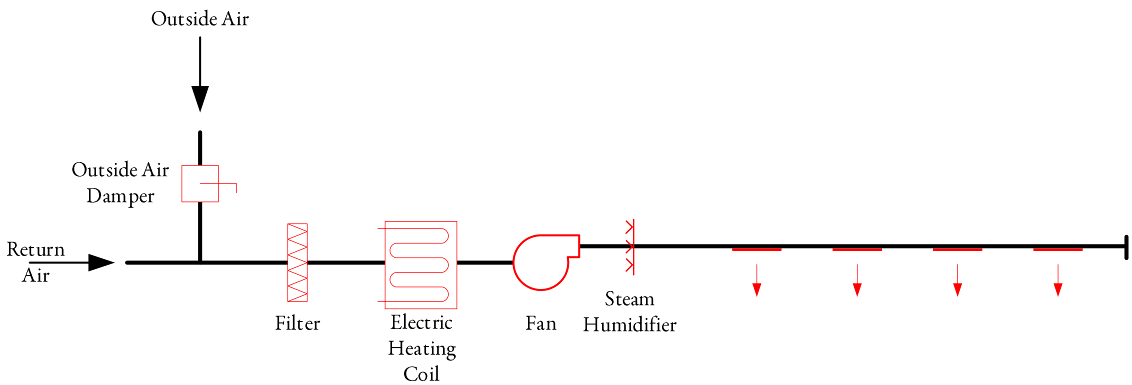
Install an outside air intake duct with a 2-position motorized damper from the roof to the new ductwork upstream of the air filter. The damper will be controlled by a wall-mounted CO_2 sensor. When the space CO_2 is above setpoint (1000 ppm), the damper will open and the fan will start. When the space CO_2 is below 900 ppm, the damper will close and the fan can stop unless needed for humidification.

Downstream of the air filter and upstream of the fan, install an electric heating coil to maintain a minimum 60°F air temperature leaving the fan.

Wall-mount an electric steam generator humidifier and pipe the steam to a duct distribution manifold downstream of the supply fan and upstream of the first supply air register. Ten feet of duct at the steam manifold will be stainless steel with the bottom of the duct pitched to a drain to remove unwanted condensation from inside the duct.

Water will be piped to the humidifier through Walkway #1 from the Museum Mechanical Room and treated by a reverse osmosis system prior to entering the humidifier. Drain piping from the humidifier and duct drain will be pumped to an indirect connection into the nearest sanitary drain.

A wall-mounted space relative humidity sensor will control the fan and humidifier together to maintain the winter relative humidity setpoint.



Assuming Option M3 (humidification of the Museum) is implemented before Option A1, in order to protect Walkway #2 from the higher dew points from the connecting Agriculture Building, Option A1 should include installation of insulation and vapor barrier in the Walkway #2 exterior walls and roof.

Option A2: Repair Radiant Heaters & Add Humidification & Ventilation; Cooling Ready

Option A2 is essentially the same as Option A1, but the new ductwork and components will be sized to easily add cooling and dehumidification in the future.

Option A3: Add Cooling & Dehumidification to Option A2

For summer space temperature control, Option A4 will add a new DX cooling system to the ductwork installed in Option A2. Its outdoor condensing unit will be installed on grade on the north side of the Ag Building. Condensate will be piped by gravity to the outdoors.

The DX cooling will be controlled by a wall-mounted thermostat to maintain the summer space temperature setpoint. During the summer, the Option A2 electric heat will be used for dehumidification reheat. This will be controlled by a space relative humidity sensor installed adjacent to the space thermostat.

Option A4: Add Cooling via Mini Splits to Option A1 or Option A2

Option A4 should not be implemented unless Option A1 or Option A2 is also implemented (either before or at the same time as Option A4). The duct-mounted electric heating coils will be necessary for dehumidification with Option A4.

For summer space temperature control, Option A4 will add four wall-mounted mini-split DX cooling units. Two will be spaced evenly along the north wall of the Ag Building and two will be spaced evenly along the south wall. Their respective outdoor condensing units will be installed on grade on the north and south sides of the Ag Building, respectively. Condensate will be piped by gravity to the outdoors.

The indoor units will be controlled by wall-mounted thermostats to maintain the summer space temperature setpoint.

During the summer, the Option A1 or A2 electric heat will be used for dehumidification reheat. This will be controlled by a space relative humidity sensor installed adjacent to the space thermostat.

Tractor Building

QSE recommends adding portable dehumidifiers to the Tractor Building to help mitigate the risk of rust on the mechanized equipment housed there. If/when the FCHS wants to introduce heating, cooling, and dehumidification, the options would be similar to the Ag Building but would require insulating the entire Tractor Building and installing a vapor barrier.

Option T1: Add Portable Dehumidifiers

For summer dehumidification without cooling, Option T1 will add 4-6 portable dehumidifiers with their condensate drains piped by gravity to floor drains. They will be controlled via integral relative humidity settings.

The cost estimate for Option T1 assumes FCHS will purchase and install these dehumidifiers themselves without going through an outside contractor.

Walkway #1

Option W1: Heating/Cooling Control

Install a mini-split heat pump on the east wall of Walkway #1 to provide year-round temperature control. Temperatures can be slightly lower in the winter and higher in the summer than the Museum Building and will be controlled by a wall-mounted thermostat.

The outdoor condensing unit will be installed on grade to the east of Walkway #1. Condensate will be drained by gravity from the indoor unit to outdoors.

Walkway #2

Until the Tractor Building is insulated and provided with temperature control, the cost of insulating and adding a mini-split heat pump to Walkway #2 would be prohibitively expensive for occupant comfort control in a transition space.

7. Budget Implementation Cost Estimates

The HVAC system options construction budget cost estimates are tabulated below. The estimates include anticipated mechanical, electrical, and relevant general construction costs associated with the HVAC system options in 2023 dollars. They include **15% for design engineering fees** and a **5% fee for a third-party owner's technical representative** (commissioning professional) to provide design review and system testing services to confirm that the FCHS's technical goals are achieved.

The only exception is Option T1's cost estimate which assumes FCHS will purchase and install the portable dehumidifiers without using an outside contractor. Thus, the design engineering and owner's representative fees are not included.

Please note that these estimates are for comparison purposes only and are not an attempt to predict the absolute costs of these systems when they are bid out to contractors.

Option	Description	Total Implementation Cost Estimates
M0	Repair Return Air Duct	$ 1,000
M1	Repair Ventilation System	$ 29,000
M2	Add Reheat Coils for Dehumidification on Furnaces 1, 2, & 3	$ 25,000
M3	Install Humidifiers on Furnaces 1, 2, & 3	$ 54,000
M4	Replace Arena Gallery HVAC	$ 102,000
M5	Install Mini-Split Cooling Units for the Main Gallery Mezzanine	$ 26,000
M6	Textiles HVAC	$ 13,000
A1	Repair Radiant Heaters & Add Humidification & Ventilation; Not Cooling Ready	$ 104,000
A2	Repair Radiant Heaters & Add Humidification & Ventilation; Cooling Ready	$ 109,000
A3	Add Cooling & Dehumidification to Option A2	$ 57,000
A4	Add Cooling via Mini Splits to Option A1 or Option A2	$ 34,000
T1	Add Portable Dehumidifiers	$ 3,000
W1	Heating/Cooling Control	$ 10,000

8. Options Summary

Museum Building

In order for the existing Museum Building HVAC system to perform as intended (and be ready for upgrades), Options M0 and M1 should be implemented immediately.

The options for implementing humidification (M3) and dehumidification (M2) control to the Museum Building are straightforward, as they are essentially restoring the original humidification and dehumidification system components removed from the systems when the four furnaces were replaced about 10-12 years ago. QSE recommend these two options be a **high priority** for FCHS.

The lack of cooling in the Arena Gallery is a major concern for the collections (and visitors), and QSE recommends Option M4 (and associated Option W1) be a **high priority** for FCHS.

Options M5 (Main Gallery Mezzanine) and M6 (Textiles Storage) are for improved collections preservation in those spaces but might fall into the category of nice-to-have **medium priorities**. They would be easy to implement as stand-alone projects when funding is available.

Agriculture Building

The four Agriculture Building options are designed to be mixed and matched, depending on the cost estimates and FCHS long term goals for the building.

If FCHS is only interested in heating and humidifying the Agriculture Building in the winter, Option A1 should be all that is needed. Please note that when heating is activated in the building, it will be necessary to actively humidify it to prevent relative humidities from dropping dangerously low for the collections.

If FCHS is interested in eventually cooling and dehumidifying the Agriculture Building, there are two paths.

- Implement Option A1 now and Option A4 in the future (or simultaneously).
- Implement Option A2 now and Option A3 in the future (or simultaneously).

The Option A1/A4 approach is less costly (by about $28,000) than the Option A2/A3 approach.

Non-cost related comparisons of the two approaches include the following.

- Option A1/A4 will have 4 independent sources of cooling and A2/A3 will only have one. Therefore, cooling reliability will be higher with A1/A4 because some cooling will remain if one of the mini-split cooling units fails.
- Option A1/A4 will have more equipment to maintain than A2/A3.
- Option A1/A4 will likely have more even temperature control throughout the building, because cooling will be introduced at 4 separate quadrants instead of through supply registers aligned along the north wall.

Tractor Building

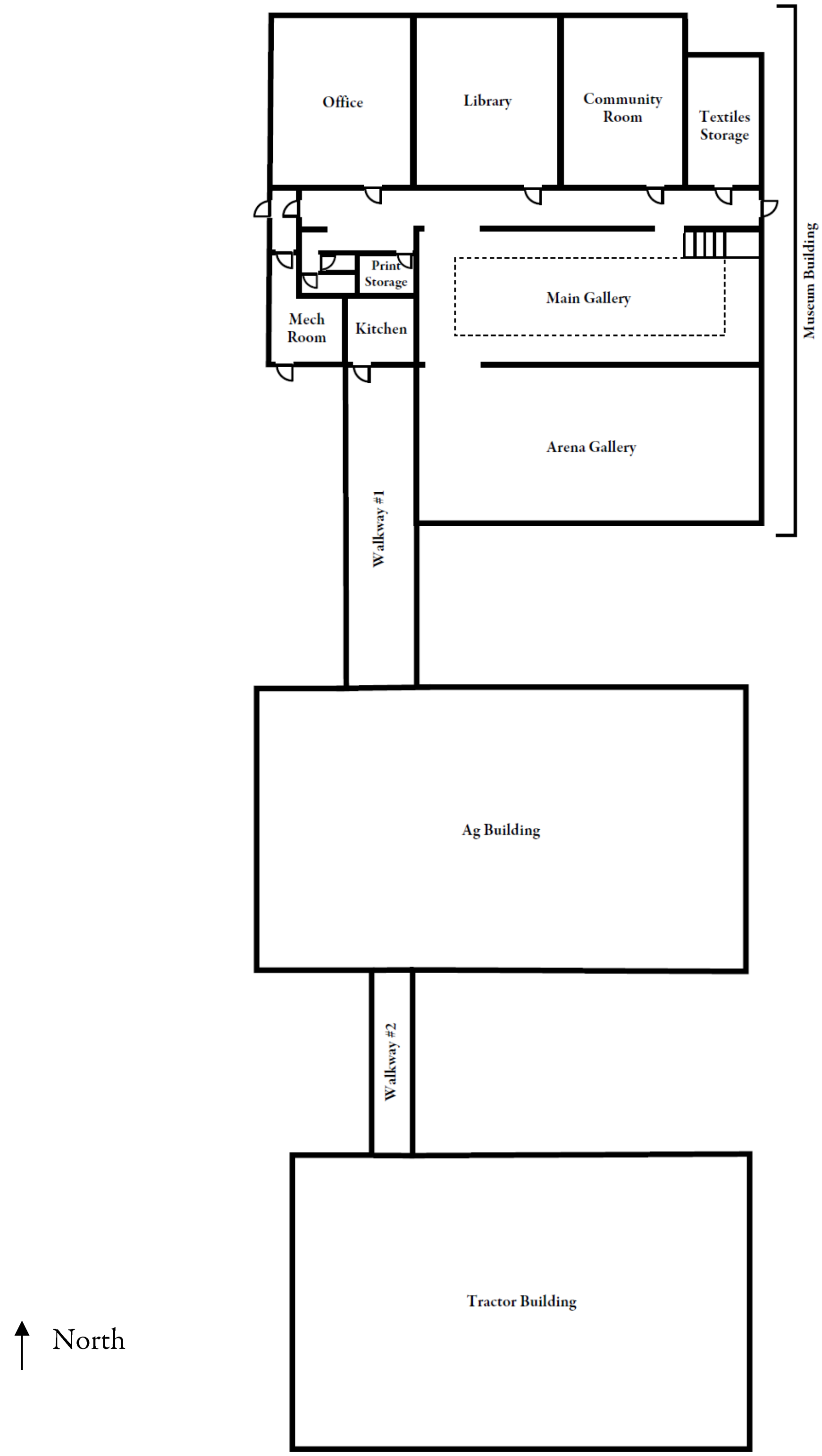
To the extent that it is affordable (first cost and summer electricity costs), QSE recommends installing portable dehumidifiers in the Tractor Building (Option T1) to keep the relative humidity as low as practical for the metallic collections.

9. Recommendations

QSE recommends implementing the following options. We have organized them into logical "projects" for phasing consideration by FCHS.

Option	Description	Total Implementation Cost Estimates
Immediate Needs		
M0	Repair Return Air Duct	$ 1,000
M1	Repair Ventilation System	$ 29,000
T1	Add Portable Dehumidifiers	$ 3,000
	Immediate Needs Subtotal	**$ 33,000**
Museum Building		
M2	Add Reheat Coils for Dehumidification on Furnaces 1, 2, & 3	$ 25,000
M3	Install Humidifiers on Furnaces 1, 2, & 3	$ 54,000
M5	Install Mini-Split Cooling Units for the Main Gallery Mezzanine	$ 26,000
M6	Textiles HVAC	$ 13,000
	Museum Building Subtotal	**$ 118,000**
Arena Gallery		
M4	Replace Arena Gallery HVAC	$ 102,000
W1	Heating/Cooling Control	$ 10,000
	Arena Gallery Subtotal	**$ 112,000**
Agriculture Building		
A1	Repair Radiant Heaters & Add Humidification & Ventilation; Not Cooling Ready	$ 104,000
A4	Add Cooling via Mini Splits to Option A1 or Option A2	$ 34,000
	Agriculture Building Subtotal	**$ 138,000**
	TOTAL	**$ 401,000**

Attachment A: Floor Plan



Attachment B: Museum Building HVAC Plan

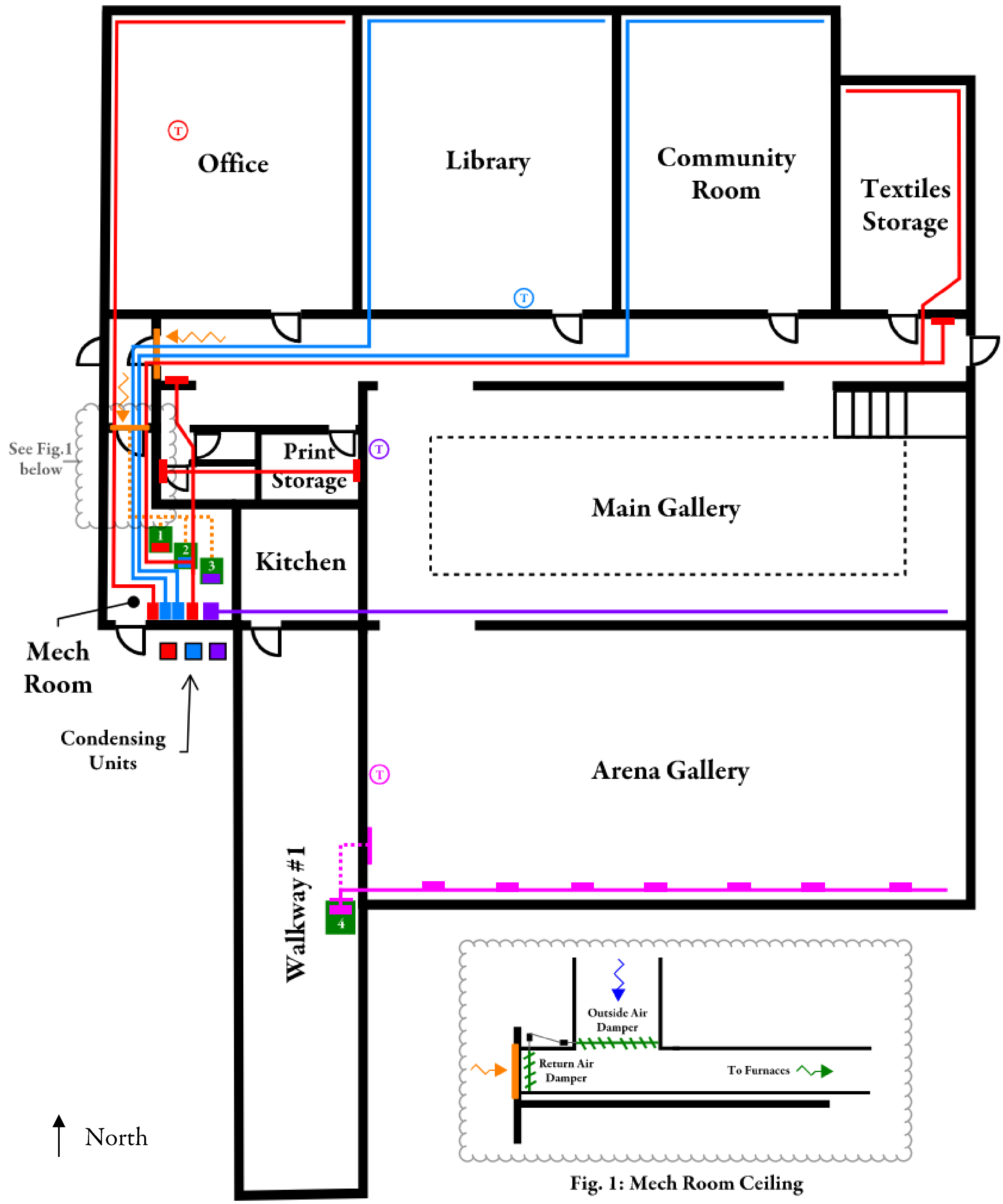


Fig. 1: Mech Room Ceiling

Attachment C: 2020-2021 Data Logger Summaries

Museum Building

The following four pages are the summer, fall, winter, and spring data logger summaries for the Museum Building from 2020-2021.

Outreach 2

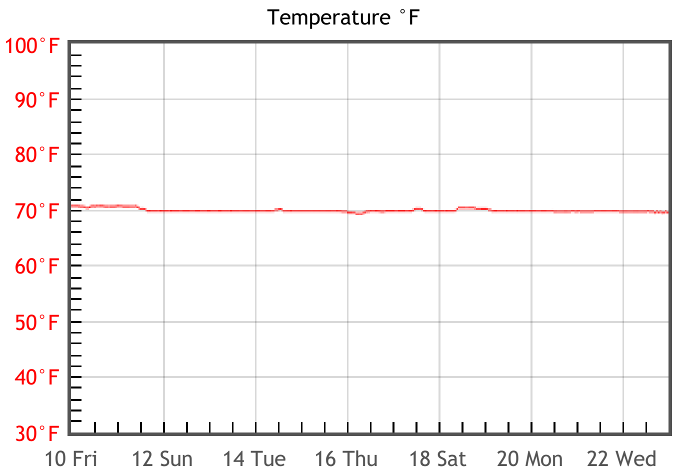
Minnesota Historical Society

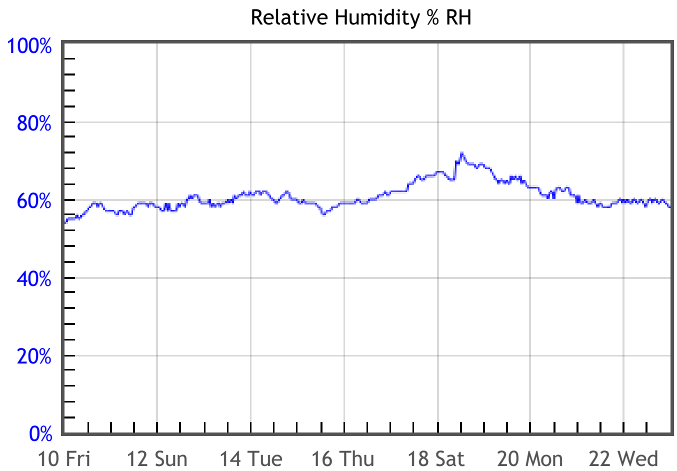
2020-07-10 to 2020-07-22
13 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	RISK TWPI = 30	Accelerated rate of chemical decay in all organic materials due to the cumulative effects of temperature and humidity, with especially high risk for fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics.
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.36 % EMC min = 9.9 % EMC max = 11.2	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	RISK % EMC max = 11.2	Heightened risk of metal corrosion due to extended periods of high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	70	**%RH Mean**	61	**DP°F Mean**	55.8
T°F Median	69.9	**%RH Median**	60	**DP°F Median**	55.4
T°F Stdev	0.3	**%RH Stdev**	3	**DP°F Stdev**	1.5
T°F Min	69.4	**%RH Min**	54	**DP°F Min**	53.3
T°F Max	70.8	**%RH Max**	72	**DP°F Max**	61

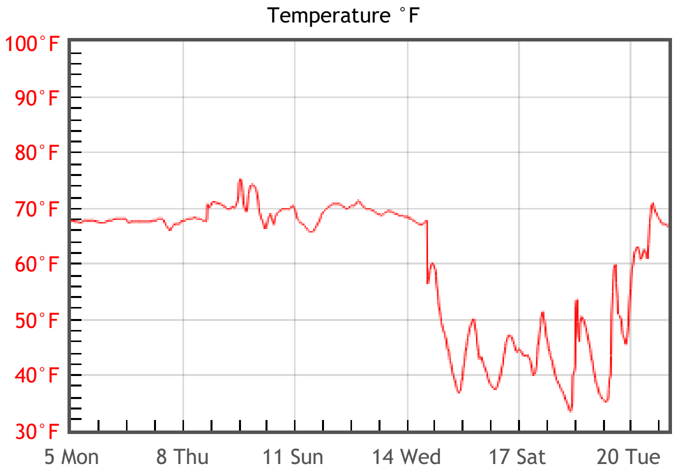
Outreach 2
Minnesota Historical Society

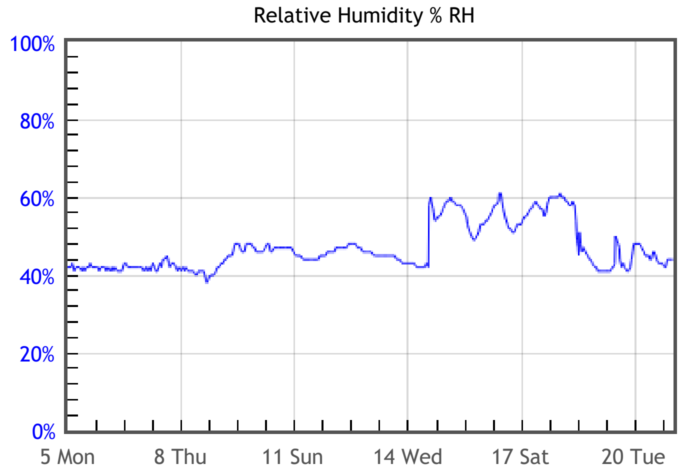
2020-10-05 to 2020-10-20
16 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 70	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.34 % EMC min = 8 % EMC max = 9.2	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 9.2	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	60.2	**%RH Mean**	47	**DP°F Mean**	39.6
T°F Median	67.6	**%RH Median**	45	**DP°F Median**	43.7
T°F Stdev	12.1	**%RH Stdev**	6	**DP°F Stdev**	9.4
T°F Min	33.4	**%RH Min**	38	**DP°F Min**	13.8
T°F Max	75.3	**%RH Max**	61	**DP°F Max**	54.2

Outreach 2

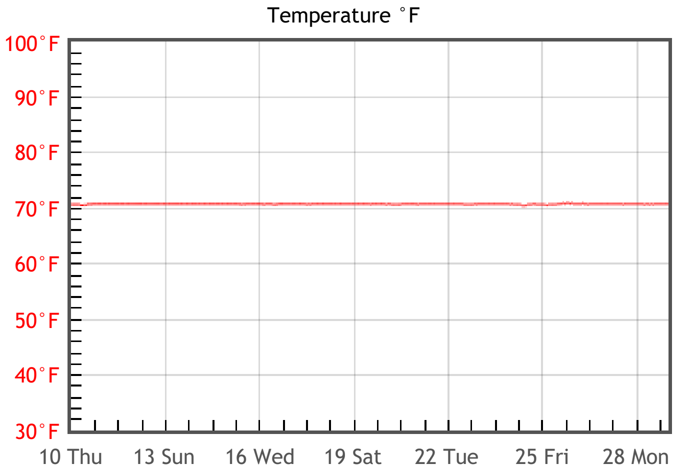
Minnesota Historical Society

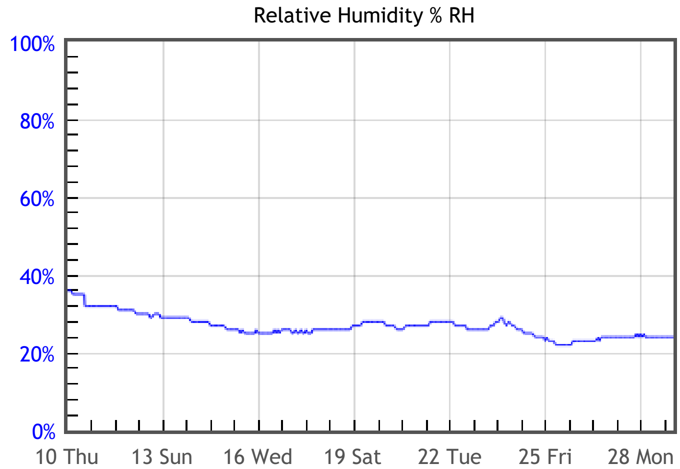
2020-12-10 to 2020-12-28
19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 60	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.39 % EMC min = 5.7 % EMC max = 7.1	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 7.1	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	70.8	**%RH Mean**	27	**DP°F Mean**	34.8
T°F Median	70.8	**%RH Median**	26	**DP°F Median**	34.2
T°F Stdev	0.1	**%RH Stdev**	3	**DP°F Stdev**	2.6
T°F Min	70.5	**%RH Min**	22	**DP°F Min**	30
T°F Max	71.2	**%RH Max**	36	**DP°F Max**	42.4

Outreach 2

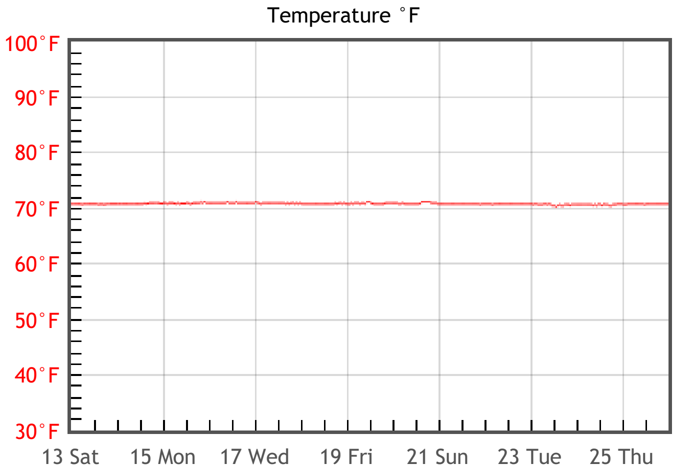
Minnesota Historical Society

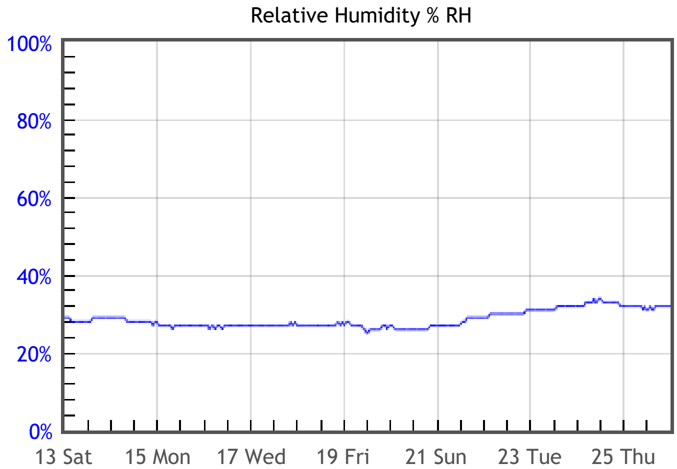
2021-03-13 to 2021-03-25
13 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 62	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.09 % EMC min = 5.7 % EMC max = 6	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	GOOD % EMC max = 6	Minimal risk of metal corrosion.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	70.8	**%RH Mean**	29	**DP°F Mean**	36.6
T°F Median	70.8	**%RH Median**	28	**DP°F Median**	36.1
T°F Stdev	0.1	**%RH Stdev**	2	**DP°F Stdev**	1.8
T°F Min	70.3	**%RH Min**	25	**DP°F Min**	33.6
T°F Max	71.2	**%RH Max**	34	**DP°F Max**	40.9

Agriculture Building

The following four pages are the summer, fall, winter, and spring data logger summaries for the Agriculture Building from 2020-2021.

Outreach 2

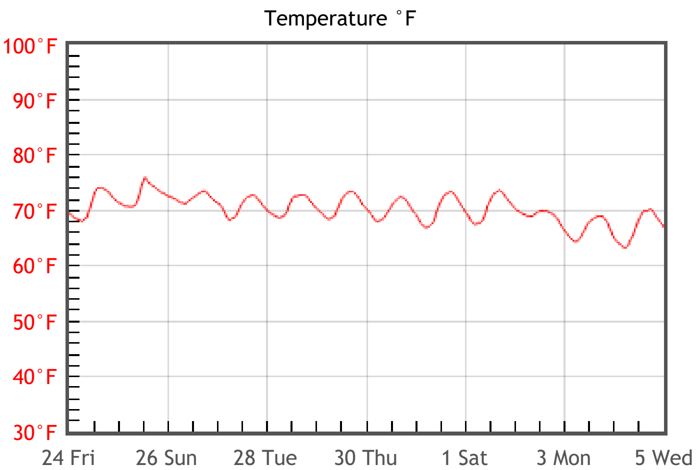
Minnesota Historical Society

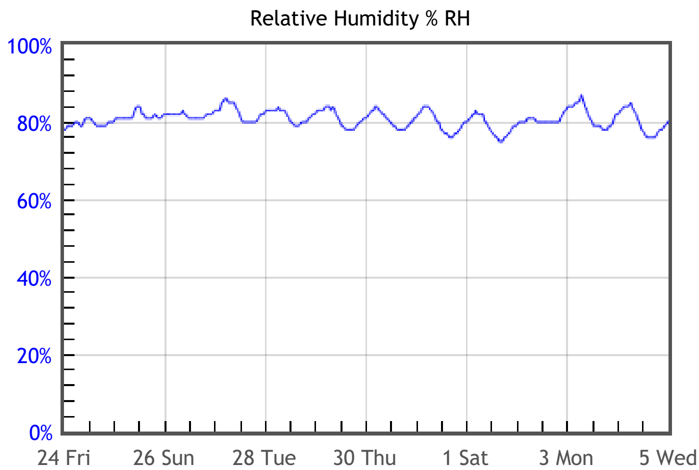
2020-07-24 to 2020-08-04
12 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	RISK TWPI = 16	Accelerated rate of chemical decay in all organic materials due to the cumulative effects of temperature and humidity, with especially high risk for fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics.
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 0.39 % EMC min = 15.3 % EMC max = 16.7	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	RISK MRF = 1.06	Heightened risk of mold growth due to extended periods of high humidity.
Metal Corrosion Corrosion of metal components or objects	RISK % EMC max = 16.7	Heightened risk of metal corrosion due to extended periods of high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	70.2	**%RH Mean**	81	**DP°F Mean**	64
T°F Median	70.3	**%RH Median**	81	**DP°F Median**	64.2
T°F Stdev	2.5	**%RH Stdev**	2	**DP°F Stdev**	2.2
T°F Min	63.3	**%RH Min**	75	**DP°F Min**	58.4
T°F Max	75.9	**%RH Max**	87	**DP°F Max**	70.4

Outreach 2

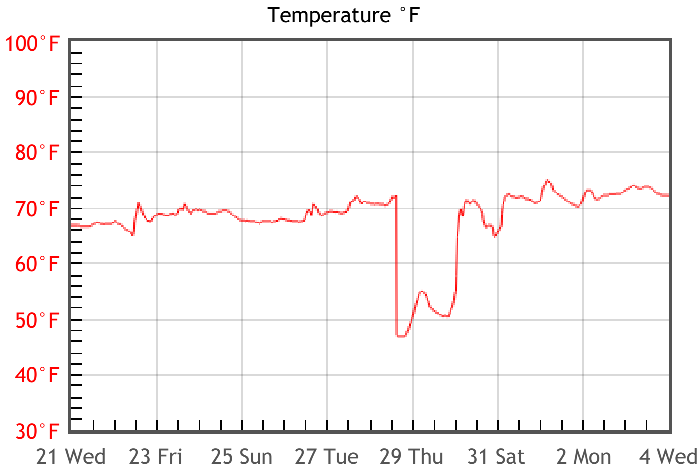
Minnesota Historical Society

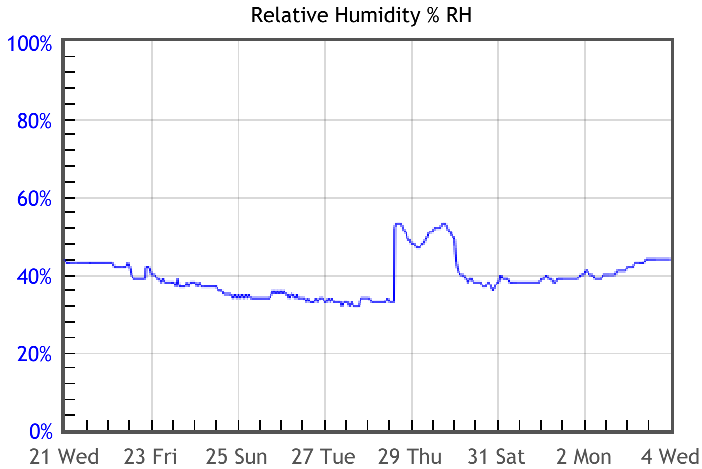
2020-10-21 to 2020-11-03
14 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 56	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.32 % EMC min = 7.2 % EMC max = 8.4	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.4	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	68	**%RH Mean**	39	**DP°F Mean**	42.1
T°F Median	69.2	**%RH Median**	39	**DP°F Median**	42.3
T°F Stdev	6.1	**%RH Stdev**	5	**DP°F Stdev**	4.3
T°F Min	46.9	**%RH Min**	32	**DP°F Min**	30.2
T°F Max	75	**%RH Max**	53	**DP°F Max**	50.6

Outreach 2

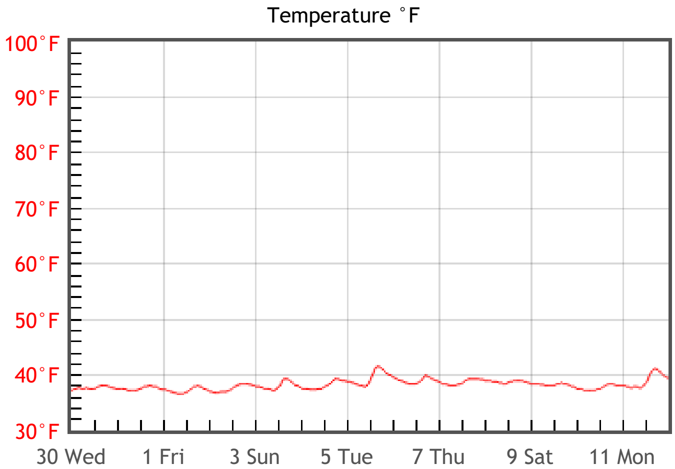
Minnesota Historical Society

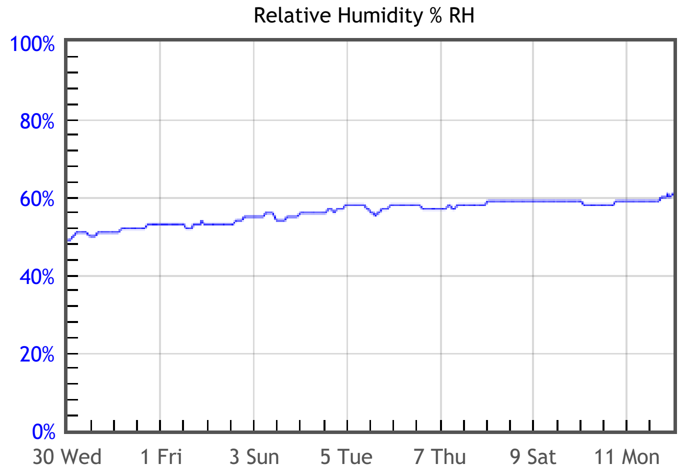
2020-12-30 to 2021-01-11
13 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	GOOD TWPI = 345	Slow rate of chemical decay in organic materials such as paper, leather, textiles, plastics and dyes
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.34 % EMC min = 9.4 % EMC max = 10.6	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	RISK % EMC max = 10.6	Heightened risk of metal corrosion due to extended periods of high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	38.3	**%RH Mean**	56	**DP°F Mean**	24
T°F Median	38.1	**%RH Median**	57	**DP°F Median**	24.5
T°F Stdev	0.9	**%RH Stdev**	3	**DP°F Stdev**	1.8
T°F Min	36.6	**%RH Min**	49	**DP°F Min**	19.8
T°F Max	41.5	**%RH Max**	61	**DP°F Max**	28.3

Outreach 2

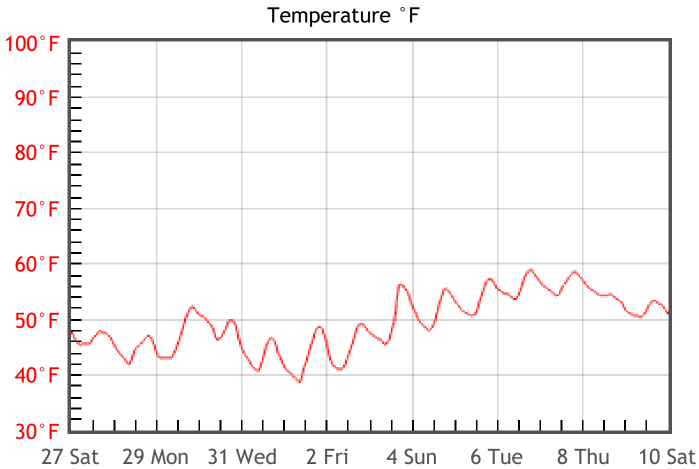
Minnesota Historical Society

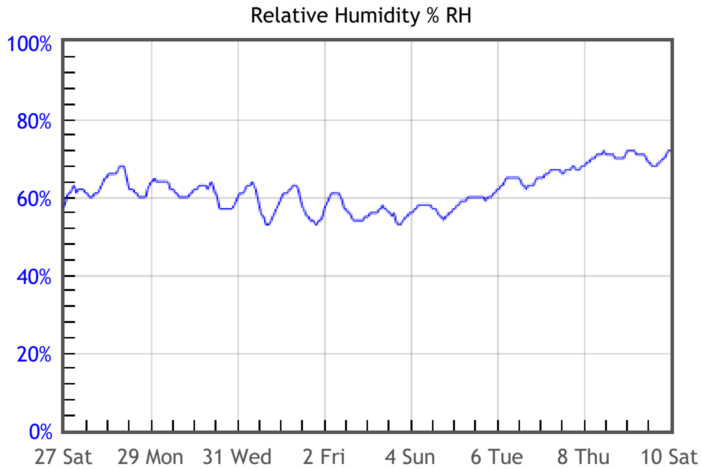
2021-03-27 to 2021-04-09
14 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	GOOD TWPI = 115	Slow rate of chemical decay in organic materials such as paper, leather, textiles, plastics and dyes
Mechanical Damage Physical damage to hygroscopic materials	GOOD % DC = 0.28 % EMC min = 10.9 % EMC max = 11.9	Minimal risk of physical damage to most hygroscopic materials such as paintings, rare books and furniture.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	RISK % EMC max = 11.9	Heightened risk of metal corrosion due to extended periods of high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	49.4	**%RH Mean**	62	**DP°F Mean**	36.8
T°F Median	49.2	**%RH Median**	61	**DP°F Median**	35.2
T°F Stdev	5.1	**%RH Stdev**	5	**DP°F Stdev**	5.7
T°F Min	38.8	**%RH Min**	53	**DP°F Min**	27.3
T°F Max	59	**%RH Max**	72	**DP°F Max**	48.1

Enduring Value

- How/where will the product be publicly available or lead to greater availability?
- **Final product:** Provide an electronic report from the conservator describing the techniques, process, and materials used during conservation, including before/after photos.
- Describe how the extended life of the items treated will give the public greater access to their cultural heritage over time.

Sustainability

- What steps will you take to make sure that the treatment is lasting and will not need to be repeated?
- Explain how the item or collection will be maintained in the future.

Evaluation Metrics

- How will the project improve preservation of and access to the collection? What percentage of the collection will be conserved? What skills and/or knowledge will your organization have gained?
- State how and what data will be captured for the grant final report (e.g., how many objects or what percentage of the collection was affected by the project).
- Estimate the number of people you may reach through this project and compare that to current figures. How will you collect feedback from users to assess the effectiveness of your project?
- Explain any restrictions that might prevent the public from accessing the material.

6A. HVAC UPGRADE REQUIREMENTS

Heating, ventilation, and air conditioning (HVAC) projects require mechanical engineering expertise. Since they can be more complicated and expensive than other projects in the museum environments category, we include the following information to explain the requirements of these projects. Some simple HVAC projects, usually those in small spaces, can apply for a design/build project. This means the project is small enough that the evaluating engineer has suggested that both the design of upgrades and the installation can happen in the same grant project. However, most projects will need to complete their designs before applying to install HVAC equipment.

Potential phases for an HVAC project (some omissions for space)

REVIEW

HVAC construction documents (drawings and specifications) are to be peer reviewed before the completion of construction documents (for the entire structure) by a qualified HVAC engineer from a firm other than that of the design engineer. All questions or issues raised by the peer review need to be resolved prior to being put out for bid. The completion of this requirement must be addressed in the grant application.

SPECIAL REQUIREMENTS FOR NATIONAL REGISTER LISTED BUILDINGS

- Construction documents must be completed by a qualified Historical Architect.
- Applications for construction documents must include photographs of a) the entire building and any areas of interest or concern. Applications for construction work must include photos of a) all areas included in project scope, b) a Photo Key, c) construction documents, and d) a Grants Scope of Work form.

DELIVERABLES (at project end)

1. Successful completion of a Legacy Grant–funded museum, library, or archives HVAC upgrade project means that in collections use and storage spaces, the system maintains the following environmental parameters:
    a. Minimum winter conditions of 60º F, 30% relative humidity (RH)
    b. Maximum summer conditions of 75º F, 60% RH
    c. Daily fluctuation should be minimal with maximums of ±5º F and ±10% RH
2. Documentation (data logger printouts or hygrothermograph charts) provided for daily performance to the above environmental parameters for 30 consecutive days with no more than one excursion beyond the parameters lasting a maximum of 48 hours.

RECOMMENDATIONS FOR CONTRACTS

- Contracts with the HVAC engineer/contractor are not paid in full until the documentation/test period is successfully completed.
- Design engineers and contractors should agree to guarantee that work will maintain the above parameters for 12 consecutive months.

6B. AMERICANS WITH DISABILITIES ACT COMPLIANCE REQUIREMENTS

State and local government facilities and places of public accommodation must comply with the requirements of the Americans with Disabilities Act (ADA) in order to be readily accessible to and usable by individuals with disabilities. Projects supporting compliance with ADA require consultants to have detailed understanding of the law and construction projects must follow the 2015 Minnesota Accessibility Code. Since ADA projects can be more complicated and expensive than other projects in the museum environments category, we include the following information to explain the requirements of these projects. Eligible projects include ramps, elevators, lifts, power-assisted doors, compliant furniture, accessible restrooms and other access improvements.

ADA projects should start with an overall evaluation of compliance with ADA, in order to prioritize work effectively. ADA assessments are often included in National Register listed

8. STRUCTURED: EVALUATION OF BUILDING MECHANICAL (HVAC) SYSTEMS

One of the basic functions of museums, libraries, and archives is to protect and preserve the collections for which they are the permanent stewards. A physical environment that provides relatively stable temperature and humidity is necessary for the long-term preservation of artifacts, books, documents, and electronic media. Temperature in the range of 60–70 degrees Fahrenheit and relative humidity (RH) in the range of 30–60% are generally accepted ranges for the preservation of collections.

This structured grant provides funding to conduct an evaluation of the building's mechanical system (also called the heating, ventilation, and air-conditioning system or HVAC system) to determine what changes and improvements would be feasible and necessary to improve the environmental conditions in the building.

Purpose of the Project:

- Hire a qualified HVAC engineer, preferably with knowledge of and experience with the requirements of museum climates, to inspect and evaluate the building envelope, existing conditions, and equipment in the museum.
- The engineer will keep in mind the needs of the museum collections and any limitations imposed by the building envelope. The engineer will develop specific recommendations together with an estimated budget for implementing the improvements.
- The evaluation will also determine if improvements in equipment could improve the energy efficiency of the equipment, resulting in a reduction in the amount of energy consumed annually.

ELIGIBLE STRUCTURED GRANT EXPENSES

Costs associated with this structured grant can include, but are not limited to:

- Hiring a qualified consultant to perform an assessment of the museum's building envelope and heating, ventilating, and air-conditioning (HVAC) system

GETTING STARTED AND PUTTING IT ALL TOGETHER

In preparation for the project, gather temperature and humidity data documenting current conditions inside the building for a period of at least several weeks. Data gathered for several weeks each during the spring, summer, fall, and winter would be ideal.

STRUCTURED APPLICATION ADVICE: EVALUATION OF BUILDING MECHANICAL (HVAC) SYSTEMS

The following advice on how to complete the application will help you shape your project; suggestions correspond to and go beyond the guidance provided in the application form.

Describe your organization and how the project fits within your organization's goals: The application should indicate that monitoring the conditions in the building determined that the conditions do not fall within the recommended guidelines. It is necessary to investigate and determine what improvements are feasible. A secondary rationale for the evaluation is to investigate the possibility of increasing energy efficiency so less energy is consumed, resulting in a reduction of the amount of money spent annually on energy. If there are specific issues with your building, mention them here. What product will be developed during this project? How/where will it be publicly available? Final Product: Electronic copy of the consulting engineer's report.

Name of Lead or Contractor: Fill in the name of the selected (or preferred) consultant in the field provided.

Budget: Include the total project cost from the consultant's letter of commitment to undertake the project.

How were the above figures determined? Describe key personnel who will be working on the project and their qualifications. Vendors/consultants/contractors must already be selected. It is critical that the procurement (hiring) process meets the requirements of the grant program (see Appendix I).