

Antioch College Buildings Consultant Team Report

October 1, 2009

The Buildings Consultant Team
comprises...

John Feinberg
The Collaborative Inc.
Overall Project Coordinator and
Architectural Conservator

Mike Schuller
Atkinson-Noland & Assoc., Inc.
Structural Engineering

Paul Seward
Seward Mechanical
Mechanical Engineering



Antioch College Buildings Consultant Team Report October 1, 2009

Objectives

No. 1: The property assets will be protected from the elements and secured from unwanted entry.

No. 2: Each property asset will contribute to an overall perspective of positive curb appeal for the campus, regardless of use level.

No. 3: Every building asset will be managed to maintain a positively healthy interior environment.

No. 4: The property assets will be brought into compliance with current building and health codes over a reasonable period of time.

No. 5: The maintenance, renovation, and operation of the campus land and its structures will be accomplished with a high level of sustainability.



Antioch College Buildings Consultant Team Report October 1, 2009

No. 6: The selection of re-use activities and priorities will reflect the curriculum needs, finances, and alumni feelings about the buildings and site.

No. 7: Building re-use and programming will take into consideration partnering opportunities.

No. 8: Selection of repair techniques, materials, and systems will include consideration of initial cost and maintenance/energy costs, and the potential for re-use of materials used as a bridging measure.

No. 9: The consideration of the loss of a building by demolition and deconstruction shall include all of the other objectives with intentionality. The scales must be overwhelmingly in favor of loss, for once lost, it cannot be regained.

No. 10: Decisions will be transparent, the decision process will be considered reasonable, intelligent, and creative.



Antioch College Buildings Consultant Team Report

October 1, 2009

Out of sight; out of mind. Oftentimes the damage to the building's brick is right in front of our eyes but is hidden from view by height and vegetation.



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

**Some Examples of Main
Building's Conditions
Problems and Causes**

Green stain adjacent to downspout. Causes are a combination of blocked or constricted underground drains, blocked downspouts (from plastic snow guards), undersized gutters and downspouts, and inadequate deflector at valley intersection with gutter.



Antioch College Buildings Consultant Team Report

October 1, 2009

Detail of Roof Downspout, header box, feeder downspouts, and deflectors.



Antioch College Buildings Consultant Team Report

October 1, 2009

Detail View of Uncontrolled Roof Drainage from Back of Turret. Note black stains and green stains. Also note that the top surface of the lower copper detail is dished inward. Probable cause is ice impacts from above or workmen standing on the surface.



Antioch College Buildings Consultant Team Report

October 1, 2009

Salts can blow off the face of a brick as seen here at the base of the west wall of the south wing.



Antioch College Buildings Consultant Team Report

October 1, 2009

Salt at top of wall, rising damp and freeze/thaw at mid-height, and copper staining at bottom.



Antioch College Buildings Consultant Team Report

October 1, 2009

Spring Point of Arch Damage. Snow sits on the original detail, now lost, melts, and resultant freeze/thaw destroys brick.



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Crack. The displacement from the crack in the stone below has radiated up through the brick. Cracks such as this are generally cause for concern so we tested to determine what were the stresses in the wall.



Antioch College Buildings Consultant Team Report

October 1, 2009

Crack. Notice the similarity to the previous photograph. However, in this case there is some downward deflection in the brick courses to the left of the window sill.



Antioch College Buildings Consultant Team Report

October 1, 2009

Detail to Illustrate Common Condition of Historic Window Frames. Paint samples were taken in order to determine original color.



Antioch College Buildings Consultant Team Report

October 1, 2009

By accessing the building with a high lift, we were able to assess the conditions more completely. One curiosity, this brick was signed by one of the masons. It is typical for masons to leave their mark.



Antioch College Buildings Consultant Team Report October 1, 2009

Investigation Techniques

- Visual survey
- Microwave radar
- Infrared thermography
- Deep-scan moisture meter
- Pachometer
- Fiber optic borescope
- In situ flatjack test

Laboratory Testing

- Efflorescent salt typology
- Brick characterization
- Mortar characterization



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Antioch Hall
Evaluation Results

Brick Erosion

- Base of building - throughout
- Isolated areas above
- Moisture-related phenomenon
- Freeze-thaw cycles
- Salt crystallization, cryptoflorescence



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Antioch Hall

Evaluation Results

- Metal ties connecting façade to brick backup



Most locations: regular tie spacing



Moderate corrosion
Corrosion-related expansion: brick
damage at one location



Other locations: faulty tie installation

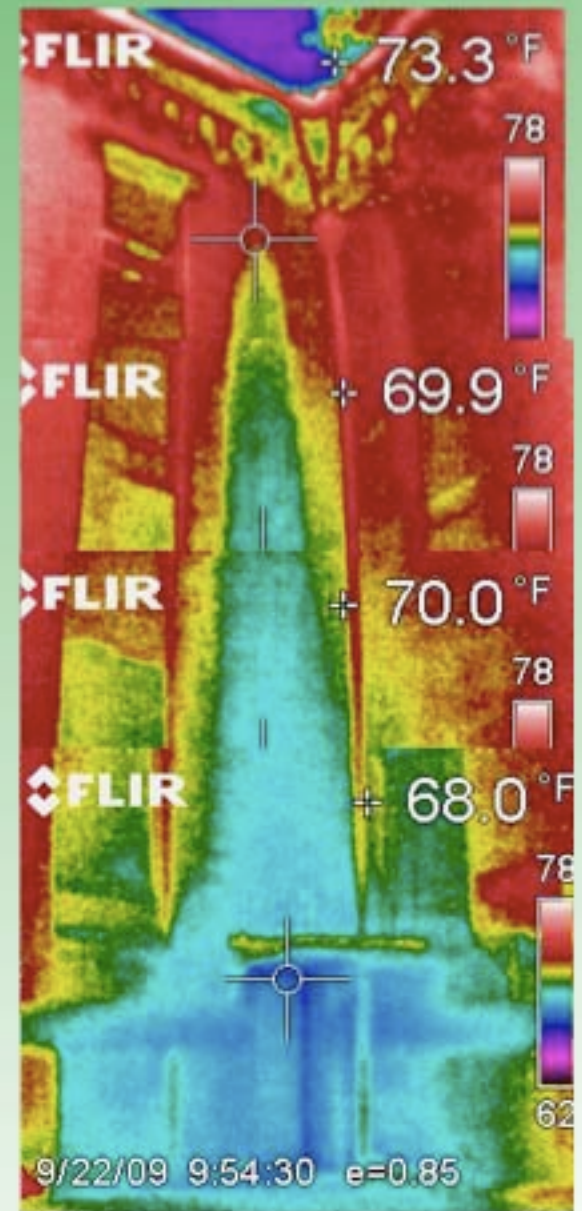
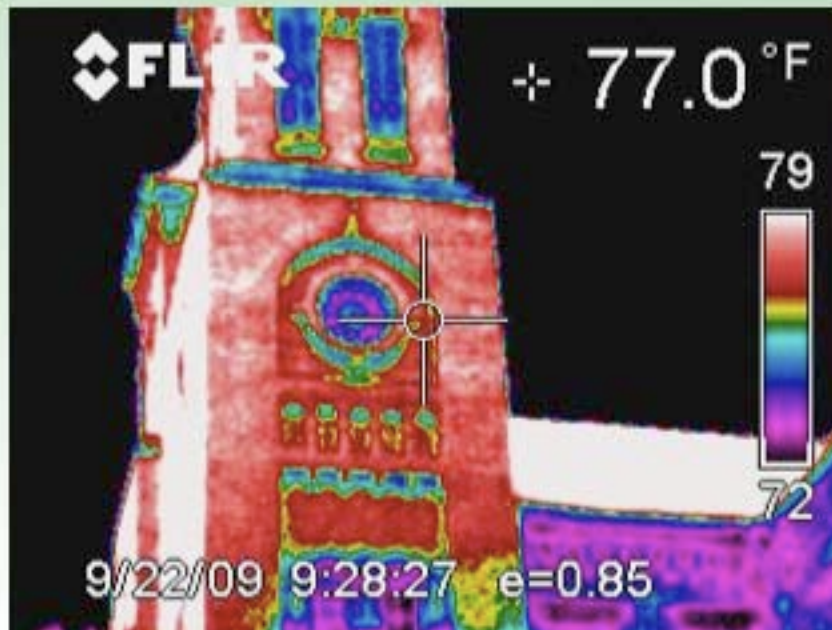
**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Antioch Hall

Evaluation Results

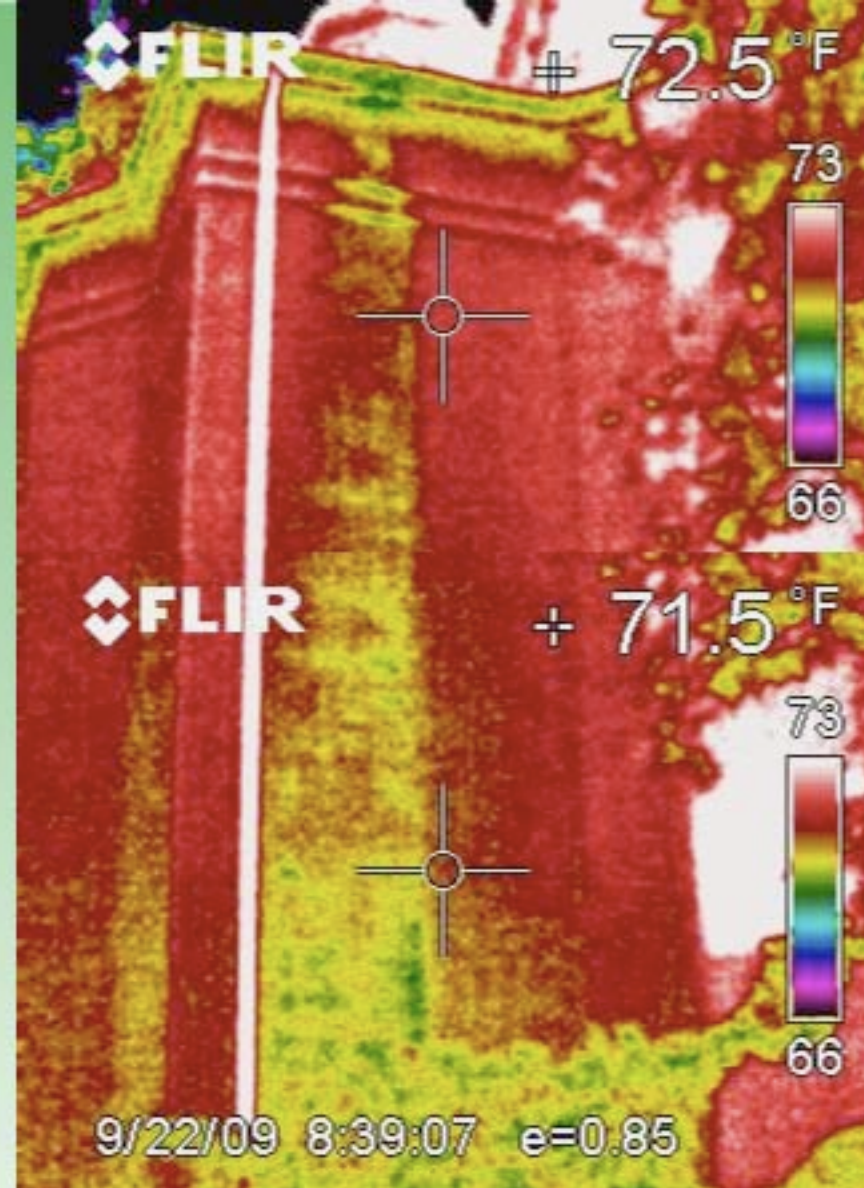
Infrared thermography scans

- Moisture saturation shows as cooler zones
 - Gutter leaks
 - Roof valley runoff
 - Ledges, rosette windows



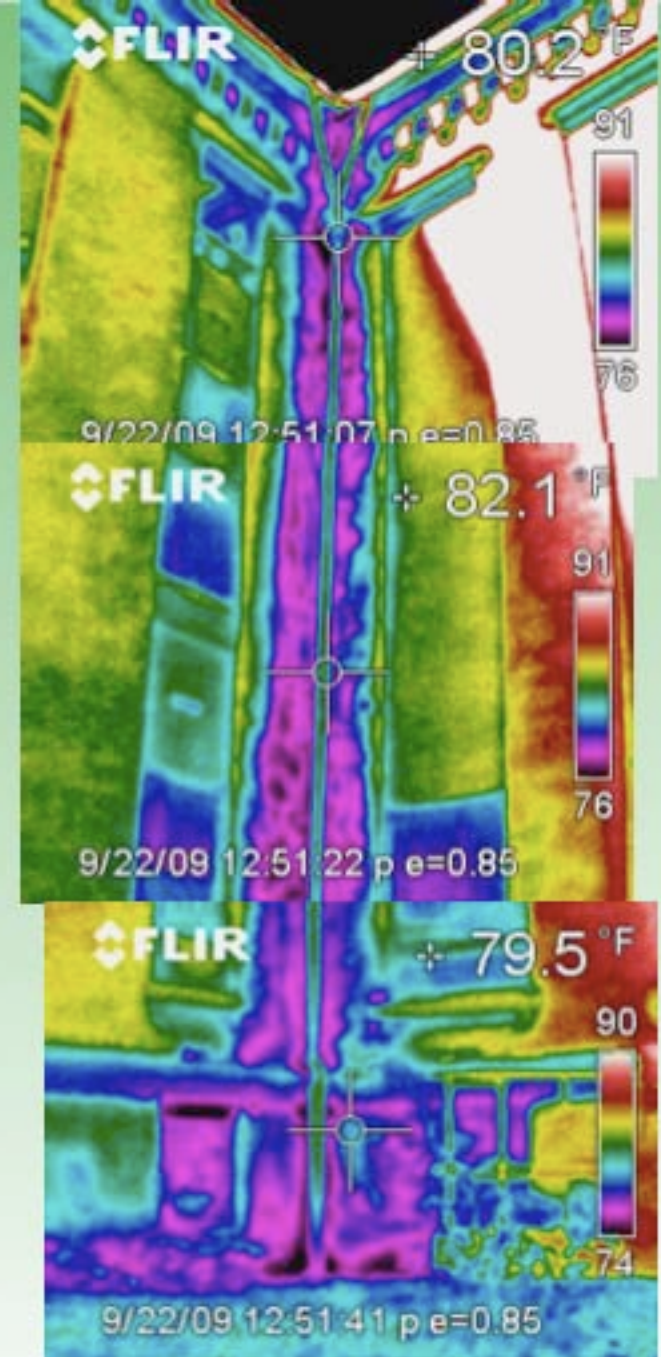
**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

One can easily see that the gutter has leaked by overtopping as its drain point was clogged. As a result, the brick has been saturated below.



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

The differential heat signature of the stained and moistened brick adjacent to the downspout is evident.



Antioch College Buildings Consultant Team Report October 1, 2009

Antioch Hall

Evaluation Results

Microwave Radar, Borescope

- Wall construction solid masonry throughout entire wall thickness
- Small internal voids present at some locations



Antioch College Buildings Consultant Team Report October 1, 2009

Flatjack testing

- Compression stresses slightly high
- Cracks likely not due to compression overload



Antioch College Buildings Consultant Team Report October 1, 2009

Antioch Hall

Evaluation Results

- Overall: building in good condition, no major distress
- Some items require attention, maintenance

Recommendations:

- Roof drains, gutters
- Eroded brick
 - Base of wall
 - Elsewhere on building
- Cracks
 - Stitching
 - Localized mortar repointing
- Retrofit ties
 - Isolated locations only



Antioch College Buildings Consultant Team Report October 1, 2009

Central Steam Plant

Pro's

- Pumping of steam not required
- Centralization can reduce overall maintenance

Con's

- 24 hour personnel required
- Excessive loss of energy in tunnels
- Loss of steam in tunnels (make-up expensive)
- Will never exceed 80% efficiency

- $Q - W = \Delta U$ (for a closed, stationary system)
- $W = 0$, so $Q = \Delta U$
- if $U_{\text{coffee@}50^{\circ}\text{C}} = 500 \text{ kJ}$ and $U_{\text{coffee@}70^{\circ}\text{C}} = 600 \text{ kJ}$
- $Q = U_2 - U_1 = 600 - 500 \text{ kJ} = +100 \text{ kJ}$
- and the First Law of Thermodynamics is satisfied !

BUT, we know heat transfer (Q) occurs FROM a warmer body TO the cooler surroundings !!!!

We need a way to test the FEASIBILITY of a process which will come from the SECOND Law of Thermodynamics.

- First, consider where Q comes from or goes to for a process.
- Thermal Energy Reservoirs: can absorb Q without changing temp. and can supply Q without changing temp.
- Remember the coffee cup. It actually cools off. The surrounding air in the room absorbs the heat but remains at 20°C
- Thermal Energy Reservoirs need to be "large" with respect to the system being studied.
- SOURCE: a thermal energy reservoir which SUPPLIES heat
- SINK: a thermal energy reservoir which ABSORBS heat



Antioch College Buildings Consultant Team Report October 1, 2009

Individual Boiler

Pro's

- Condensing boilers can attain 95% efficiency
- Minimal system heat loss
- Hydronic systems require less maintenance



- North Hall basement mechanical room



Antioch College Buildings Consultant Team Report October 1, 2009

Geothermal Systems

- Provides both heating and cooling
- Exterior air cooled chillers no longer on campus
- Bore field is "invisible"
- Coefficient of Performance $COP = \frac{\text{Beneficial Energy Received}}{\text{Energy Purchased}}$
- COP of 3 to 4 common
- COP of 4 + Four units for the price of one,
IE three free units
- Byproduct of producing heat is cooling
- Byproduct of producing cooling is heat.
- If Cooling and Heating can be consumed at same time, COP is Additive,
IE $3+3 = 6$
- Bore Field on Quad could serve 5 buildings



Antioch College Buildings Consultant Team Report

October 1, 2009

McGregor Possible Mechanical Systems (Geothermal)

- Convert Dual Duct Air Handling Unit to VAV
- "Fire" Hot Deck and Cold Deck with Geothermal
- Geo HW and CHW water to water heat pumps
- Convert Dual Duct boxes to VAV
- Ductwork and zoning remains the same
- or
- Replace Dual Duct boxes with Geo Heat pumps
- Remove AHU and ductwork to Dual Duct Boxes
- Provide minimum outside air system
- Ductwork and zoning down stream of the pumps remains the same.



Antioch College Buildings Consultant Team Report

October 1, 2009

South Hall Possible Mechanical Systems

- Replace Steam Convertor with Boiler

In the future.....

- Provide Geo central plant producing HW & CHW

or

- Replace VAV reheat boxes with heat pumps



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Library

Investigation Techniques

- Visual survey
- Microwave radar
- Infrared thermography
- Pachometer
- Fiber optic borescope



**Antioch College
Buildings Consultant
Team Report
October 1, 2009**

Library

Evaluation Results

- Brick cracking throughout
- Foundation cracks at corners



**Brick expansion towards
corners:**

- Moisture expansion
- Thermal movement
- Freezing expansion

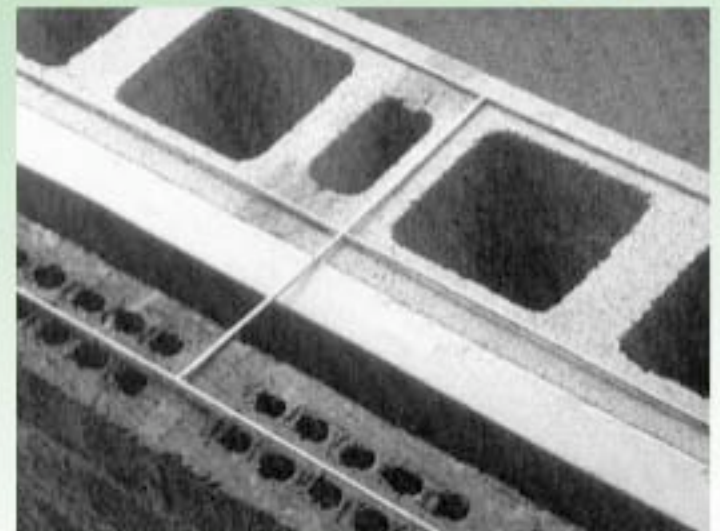


Antioch College Buildings Consultant Team Report October 1, 2009

Library

Evaluation Results

- Joint reinforcement near tops of walls severely corroded
- Remove corroded joint reinforcement
- Install retrofit ties for new connection
- Install new expansion joints
- Rebuild severely displaced masonry at south elevation
- No foundation work required
- No structural work required

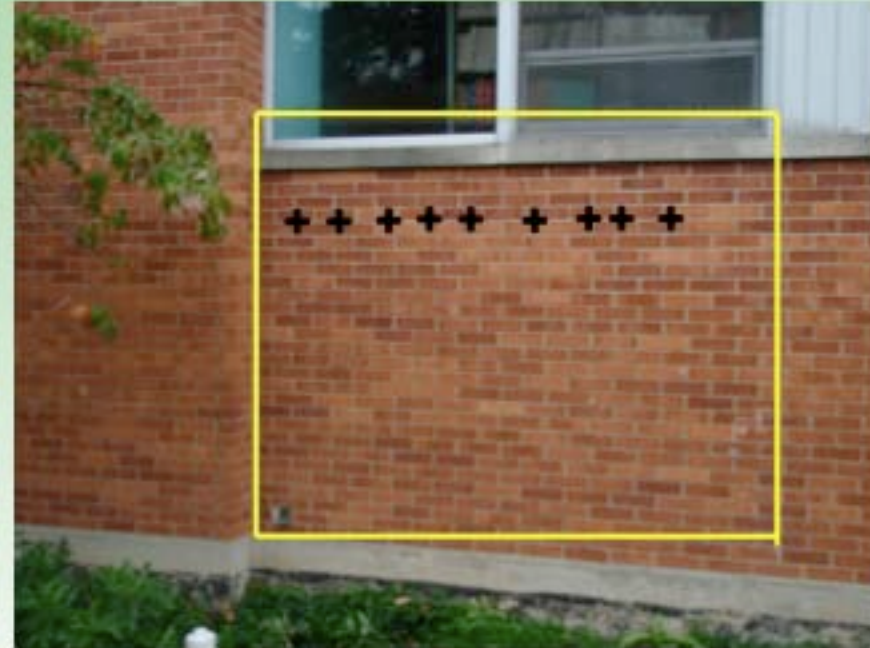


Antioch College Buildings Consultant Team Report October 1, 2009

Library

Evaluation Results

- Corrugated ties used at most of the building
- Improper tie spacing, ties not placed in mortar joints, ties missing altogether at some locations
- Retrofit ties needed at missing locations



Antioch College Buildings Consultant Team Report

October 1, 2009

Library

Evaluation Results

- Drainage cavity construction
- No flashing or weep holes
- Install flashing and weeps at window lintels, base of wall?



Antioch College Buildings Consultant Team Report

October 1, 2009

A true disconnect.



Antioch College Buildings Consultant Team Report

October 1, 2009

The upper brick is moving toward the left.



Antioch College Buildings Consultant Team Report

October 1, 2009

Library's South Wall Bulge



Antioch College Buildings Consultant Team Report

October 1, 2009

Student Union

Investigation Techniques

- Visual survey
- Infrared thermography
- Pachometer
- Fiber optic borescope



**Antioch College
Buildings Consultant
Team Report**
October 1, 2009

Student Union

Investigation Results

- Similar to Library Building,
but less severe
- Joint reinforcement corrosion
- Mortar deterioration
- Moisture infiltration

Expansion Joint



Antioch College Buildings Consultant Team Report

October 1, 2009

Student Union

Investigation Results

- Minor foundation movement at southeast corner
- Monitor crack opening - to determine necessity for repairs



Antioch College Buildings Consultant Team Report October 1, 2009

ACCOMPLISHED TO DATE

- Reviewed Stanley report
- Developed Supplemental Report; Recon Condition Surveys of exteriors of 11 Core Buildings
- Developed detailed scope of work for Rehabilitation of Units and Commons/Gathering Space/CSK Center
- Described rehabilitation Activities for Birch
- Assessed Conditions of Roofs on 11 buildings, set detailed description of work, retained contractor to execute work
- Assessment of underground drain system underway so roof drainage will flow away from structures.
- Detailed Assessment of Exterior Masonry of Main Building, report in preparation. Same for Library and Student Union.
- Design Underway of boiler plant for South Hall.
- Master concept plan for campus HVAC systems in early development.
- Underway: tree pruning and removal campus wide, graffiti removal, broken glazing replacement, site lighting reactivated.
- Underway: Detailed description of the tasks to restore South to pre-flood stage.
- Underway: Plans for ventilation and drying of Main, and ventilation and drying of other buildings. Complete repairs to remove the sources of moisture intrusion; roofs, gutters, downspouts, underground drainage systems, re-grading adjacent to building, and clearing of areaway drains.
- Underway: Concept design and pricing of geothermal heating system for McGregor, Spalt, North, and Main.
- Tracking State grant program for financial assistance.