Rehabilitation of a Historic Structure as a Model for Resilient Design

GATEWAY NATIONAL RECREATION AREA
NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR

GEORGE MELENDEZ WRIGHT
YOUNG LEADERS
IN CLIMATE CHANGE

The National Park Service + Climate Change

- Climate Change Response Program
- Response Strategy (2010)
    - Science
    - Adaptation
    - Mitigation
    - Communication
- Young Leaders in Climate Change (YLCC)

Super Storm Sandy + Gateway National Recreation Area

Sandy Hook Unit:

- Many buildings within the unit sustained water damage
- Flooding wiped out most utilities that were housed in building basements or at ground level
- Areas have been stabilized so that their conditions do not worsen, including buildings that were flooded
- Many of these structures are beginning to deteriorate due to a wide range of factors

Protecting Cultural Resources

Spermaceti Cove Life Saving Station: Post Sandy – Sandy Hook

Cultural resources at Gateway NRA have the potential to be significantly impacted by future climate change phenomena

Project Overview

Building 7 Lieutenant's Quarter – Fort Hancock

In order to assist in the development of a proactive approach to climate change, *Gateway NRA is proposing to plan, design and rehabilitate one of the historic structures [building #7] along Officer's Row using new and green technologies and improved storm preparedness designs* (YLCC).

Project Goals

1. Understand sustainable climate change adaptation and storm preparedness materials, details and options

2. Develop and recommend strategies for how to incorporate these elements into the rehabilitation of the Building #7

3. Develop details for specific elements of the sustainable design

4. Develop design guidelines for historic buildings and climate change adaptation options

5. Use these elements to develop a portfolio of green technologies

Project Overview

Building 7 Lieutenant's Quarter – Fort Hancock

In order to assist in the development of a proactive approach to climate change, *Gateway NRA is proposing to plan, design and rehabilitate one of the historic structures [building #7] along Officer's Row using new and green technologies and improved storm preparedness designs* (YLCC).

Project Considerations

1. Secretary of Interior Standards for Rehabilitation
2. Building Codes
3. Budget
4. NPS Infrastructure
5. LEED Certification

Structure History of Building #7

- Built between 1898-1899
- 1 of 17 buildings on Officers Row
- Lieutenants' Quarters
- Fire in 1946
- Vacant since ca. 1985

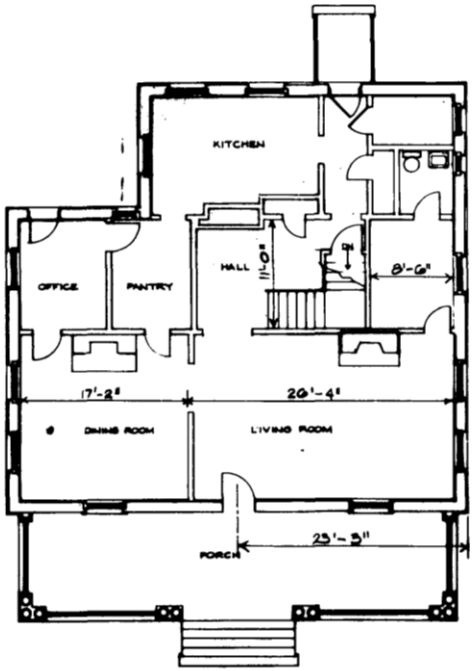
Fort Hancock National Historic Landmark District


Lieutenant's Quarter on Officer’s Row – NPS Archive

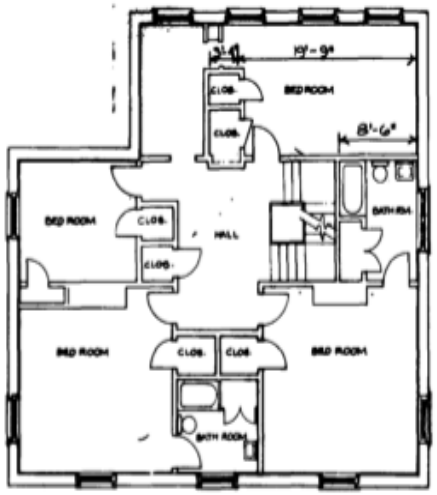
Structure History of Building #7

- Updated floor plans after fire:

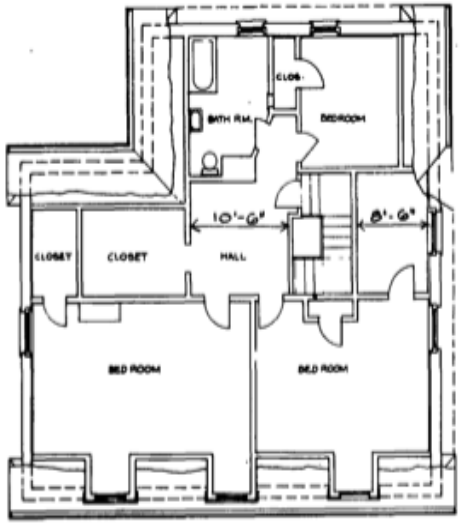
First Floor



Second Floor



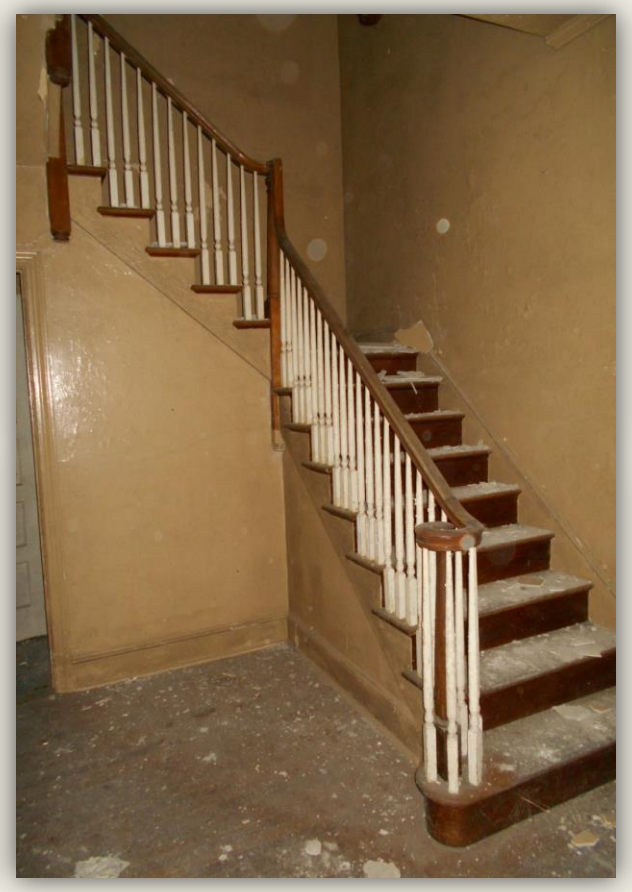
Third Floor



FORT HANCOCK PARADE GROUND HISTORIC STRUCTURES REPORT: SANDY HOOK UNIT

Existing Condition

- Minimal or no exterior alterations
- Vacancy + lack of maintenance

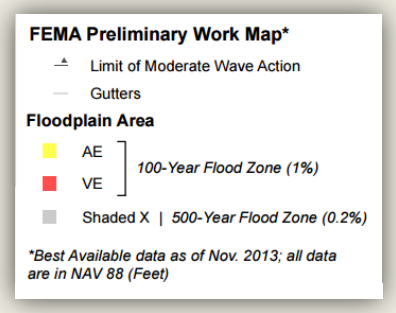


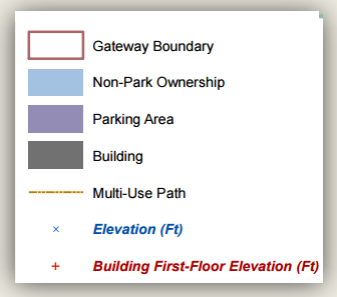
Existing Condition

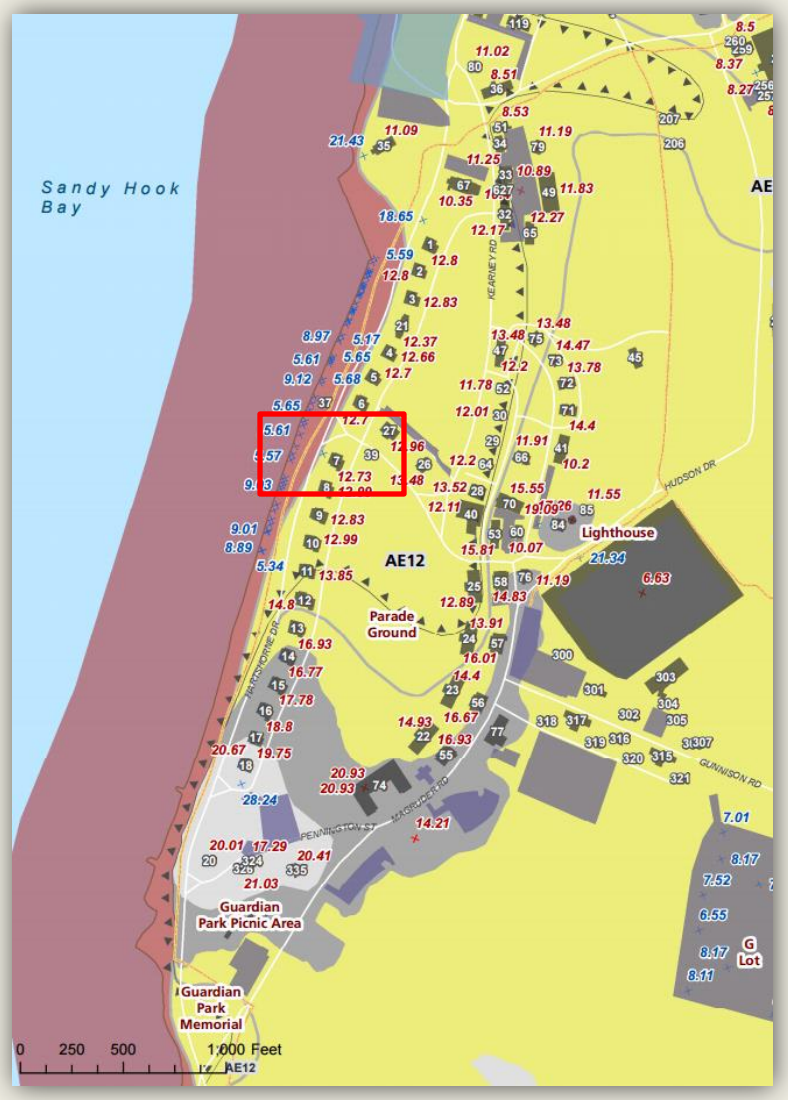
- FEMA Flood Line

Finished Floor Elevation = 12.73

AE 12 Zone Flood Plain Area







Fort Hancock – FEMA Preliminary Work Map

Green Technologies

Grid Tied Solar Panels at North Shore Observation Deck

- A system that is intended to mitigate or reverse the effects of human activity on the environment
- Provide low maintenance and operation + low impact to the environment

- Historic buildings are inherently sustainable
- Site selection

- Replace toxic materials
- Sustainable materials
    - Regional
    - Renewable
    - Certified

Forest Stewardship Council

Potentially Hazardous/Toxic Materials in Building 7 Kitchen

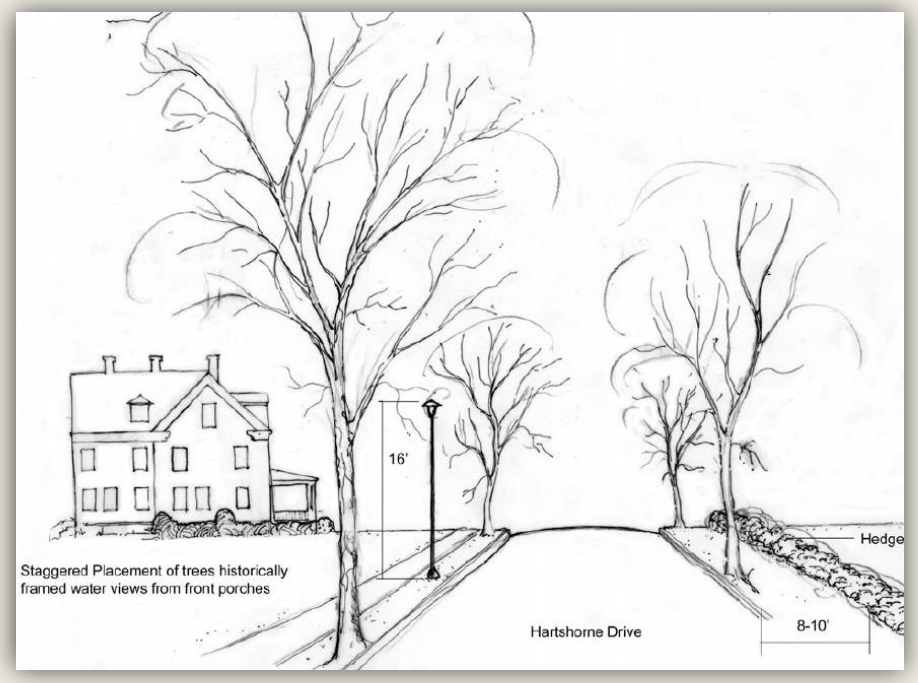
Low Emitting Materials

- Low Volatile Organic Compound (VOC) sealants + adhesives
- Low VOC Paints + Coatings

Landscape Shading

- Reduces solar heat gain
- Creates a windbreak
- Reduces surrounding air temperature

The Cultural Landscape for Fort Hancock Offers Shading on West Façade

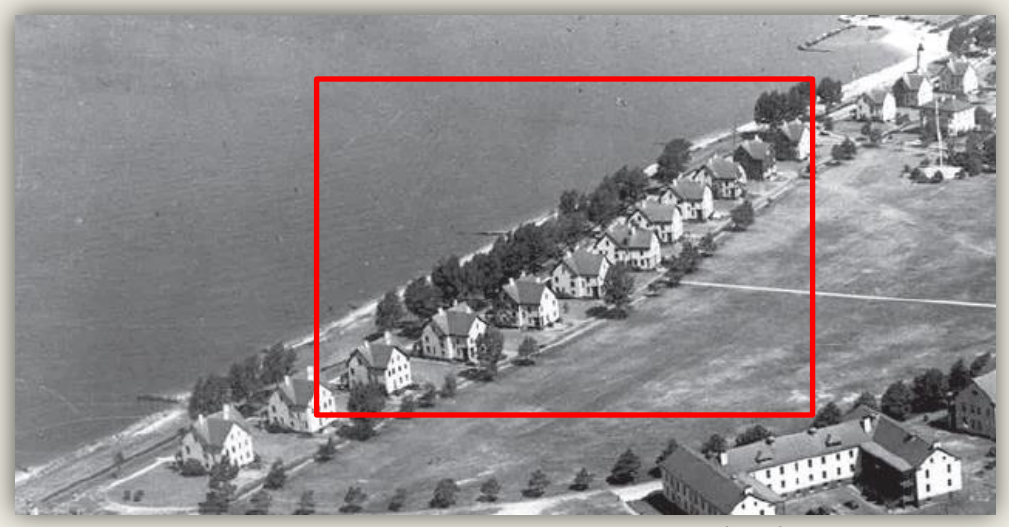


CULTURAL LANDSCAPE REPORT FOR FORT HANCOCK: TREATMENT PLAN (2006) GATE NRA

Landscape Shading

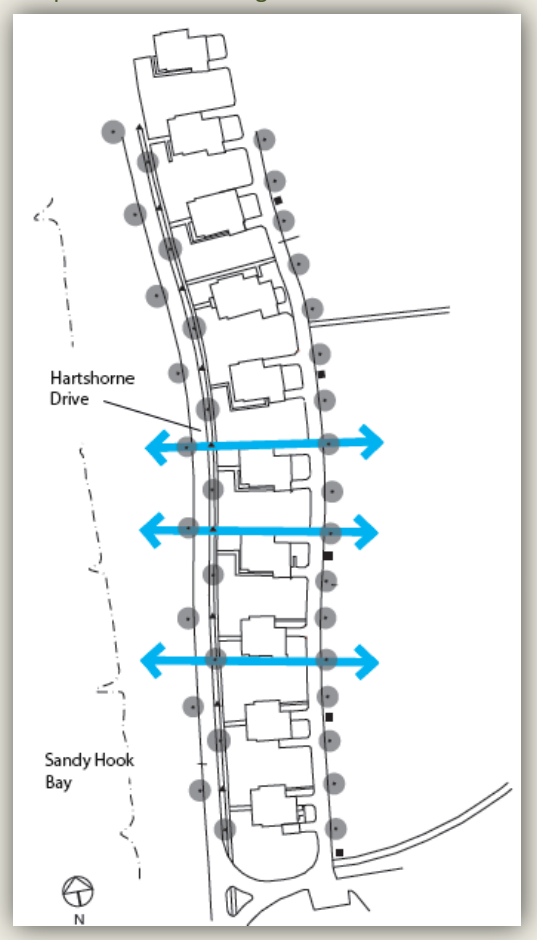
- Cultural Landscape
  - Primarily woody shrubs on west façade
  - Edged with a variety of perennials or annuals
  - Plant beds with perennials around perimeter of structure
  - Non-invasive + innocuous

Aerial Photo Of Officers Row Ca. 1930



CULTURAL LANDSCAPE REPORT FOR FORT HANCOCK: TREATMENT PLAN (2006) Gateway NRA

Proposed Tree Planting For Hartshorne Drive



CULTURAL LANDSCAPE REPORT FOR FORT HANCOCK: TREATMENT PLAN (2006) Gateway NRA

Landscape Shading

- Recommended trees
- Secretary of the Interior's Standards for the Treatment of Historic Properties

CULTURAL LANDSCAPE REPORT FOR FORT HANCOCK: TREATMENT PLAN (2006) Gateway NRA

London Plane Tree

Sycamore Maple

Common Hackberry

Landscaping

- Native or non-invasive species
- Low water intake
- Adaptability to seaside conditions
- Regional plants used during historic period

PROPOSED PERENNIALS FOR STRUCTURE PERIMETER

CULTURAL LANDSCAPE REPORT FOR FORT HANCOCK: TREATMENT PLAN (2006) Gateway NRA

Swamp Rose Mallow

New England Aster

Butterfly Milkweed

Example of Basement Flood Vents

Wet Flood Proofing

- Flood resistant materials
- Raise mechanical + utility equipment
- Basement fill
- Storm vents/doors
- Back flow valves
- Internal drainage systems

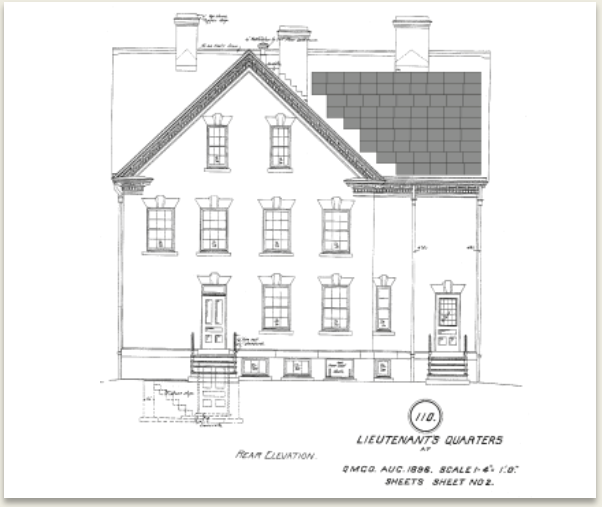
Dry Flood Proofing

- Continuous impermeable walls
- Flood resistance in interior core areas
- Sealants for openings (windows + doors+ walls)
- Flood shields for openings in exterior walls
- Back flow valves
- Internal drainage systems

Example of Window Flood Shield

Energy

- Renewable Solar
- Solar Photovoltaic Shingles
- Grid Tie with Battery Backup

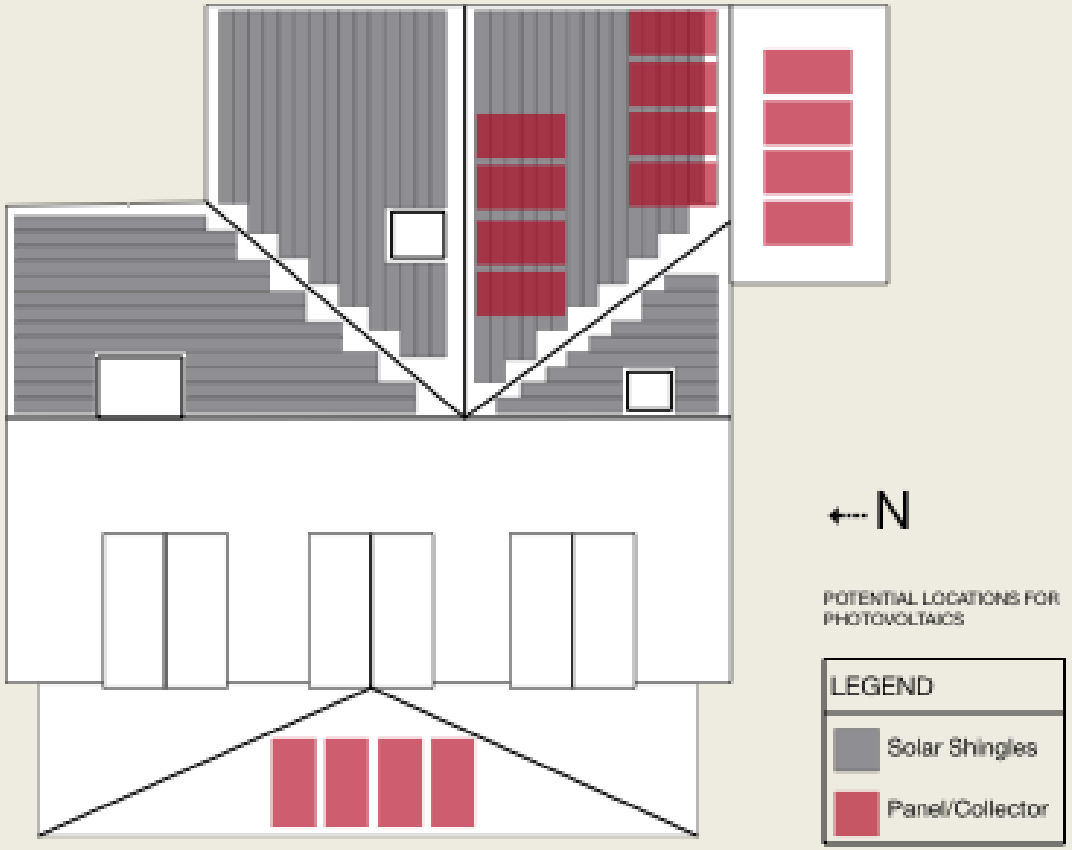


Example of PV Solar Shingles on Roof

Additional PV solar collector panels could be placed on the porch or garage roof

Potential Locations for Solar PV Collectors:

Potential Locations for Solar Photovoltaic Collectors:



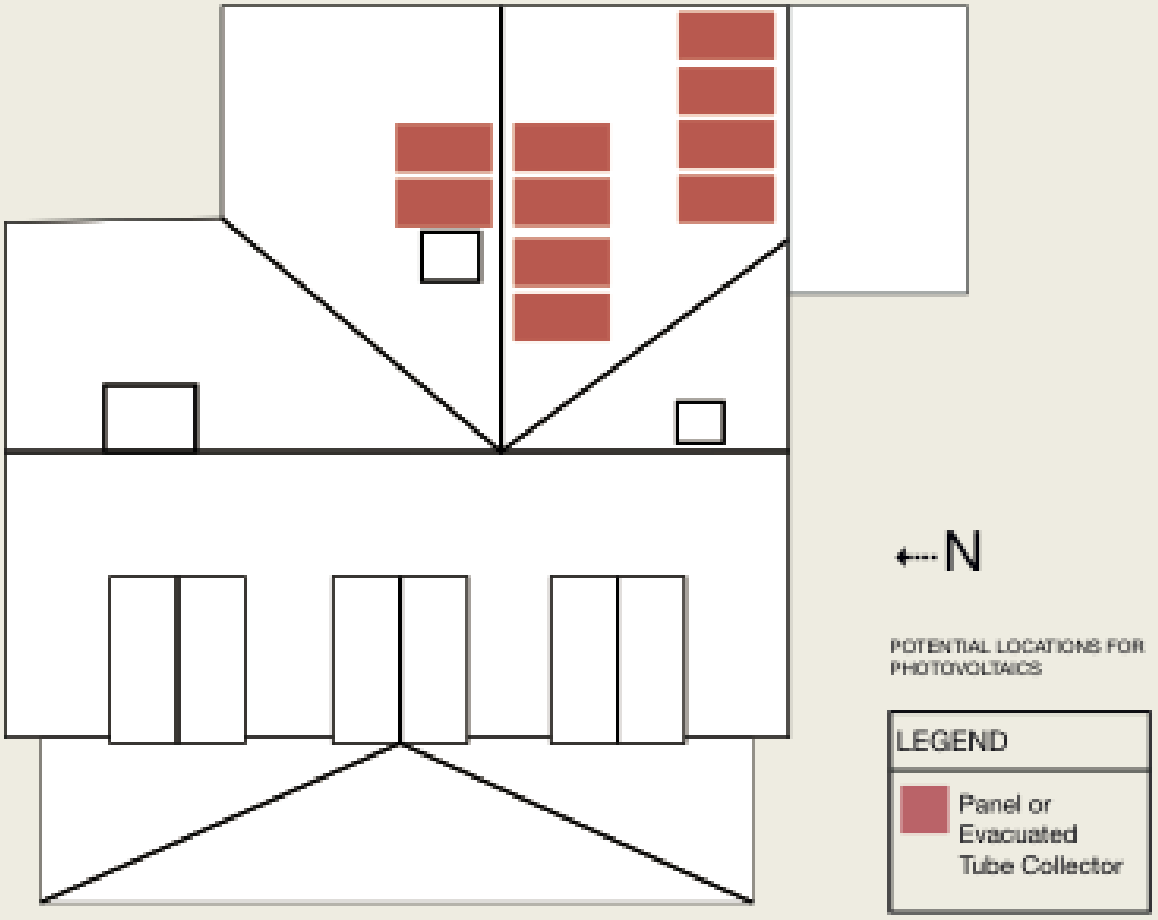
Solar Water Heater

- Flat plate collector or evacuated tubes
- Indirect/closed loop system
- Tank with both solar and backup auxiliary heating

Flat Plate Collector

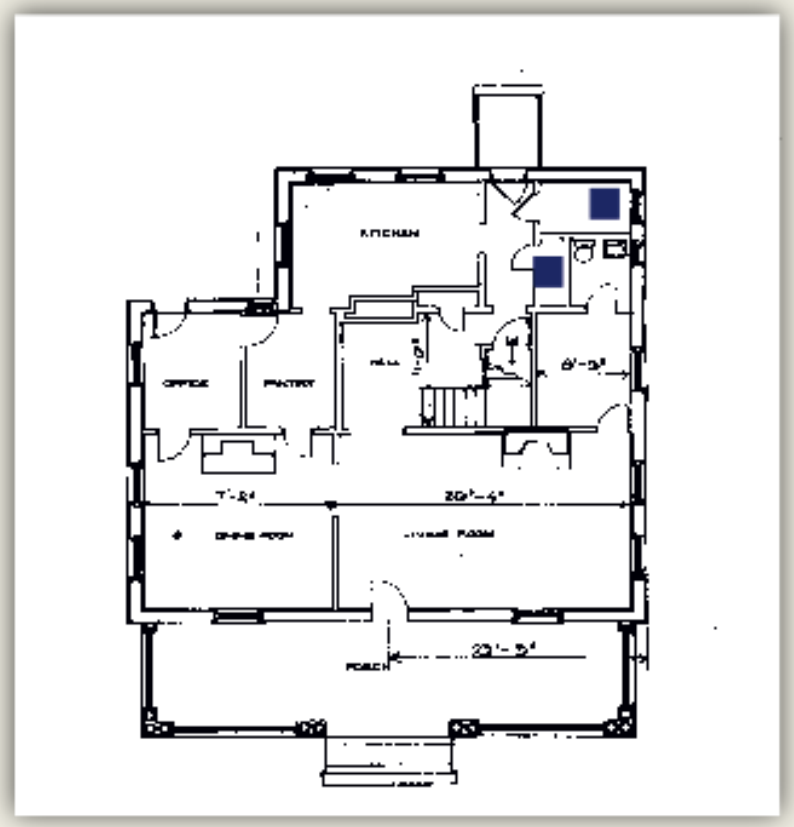
Evacuated Tubes

- Potential Locations for Solar Collectors:



Solar Water Heater

- Potential locations for hot water tank:



Solar Heated Hydronic Distribution System

- Radiant heating reduces demand for conventional heating
- Excess hot water from solar water heater is used to distribute radiant heat
  - In-floor system
  - Hydronic baseboard
  - PEX wall radiator

Example of Hydronic Baseboard Radiator

Example of PEX Wall Radiator

Example of In-Floor Radiant Heating

Example of Geothermal Heat Pump + Water Heater

Geothermal Heat Pump

- Closed loop system
- Provides heating + cooling through an all-in-one or split system
- Potential to also provide hot water and radiant heating
- Vertical, horizontal or coiled pond loop system

Outdoor + Indoor Mini Splits Unit

Ductless Mini Splits Air Source Heat Pumps

- Tied to solar energy collector
- Outdoor unit – heat compressor + exchanger
- No ductwork required
- Conditioning controlled by individual rooms or zones
- Energy efficient – control only the spaces being used
- Automation

Ductless Mini Splits Air Source Heat Pumps

Weatherization - Walls

- Rehabilitation + Insulation
- Reduce Air + Water Infiltration

Example of Brick Repointing Before + After

Building 7 Exterior - Loose Bricks Around Window

Weatherization - Windows

- Rehabilitation
- Reduce Air + Water Infiltration
- Regular Maintenance



Building 7 Interior + Exterior Windows

Example of Wood Style Exterior Storm Window

Exterior Storm Windows

- Protect historic windows
- Decrease energy loss
- Wood style
- Storm window/screen combination
- Exterior storm windows can reduce air leakage by 45%-75%
- Single pane glass has an R value of R-1 - Single pane glass with a clear glass storm window has an R value of 2.

Interior Solar Shades

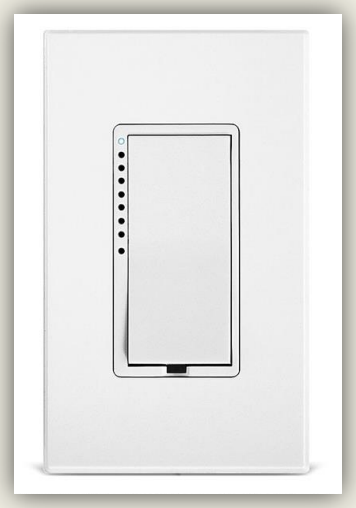
- Increase energy efficiency
- Protect interior from UV rays
- Preserve view
- Eco friendly materials
- Automation

Example of Interior Solar Shade

Appliances

- Lighting
  - Light Emitting Diode (LED) and Compact Fluorescent Lights (CFL) bulbs
  - Motion Light Sensors – Occupancy and Vacancy
  - Dimming switch
- Kitchen
- Laundry
- Outlets

Existing Light Fixture in Bldg. 7



Dimming Light Switch

Types of CFL Light Bulbs

Fireplace

- Propane Gas Insert
- Blower - increases heat dispersion
- Automation
- Electronic ignition
- Battery backup

Example of Gas Insert Fireplace

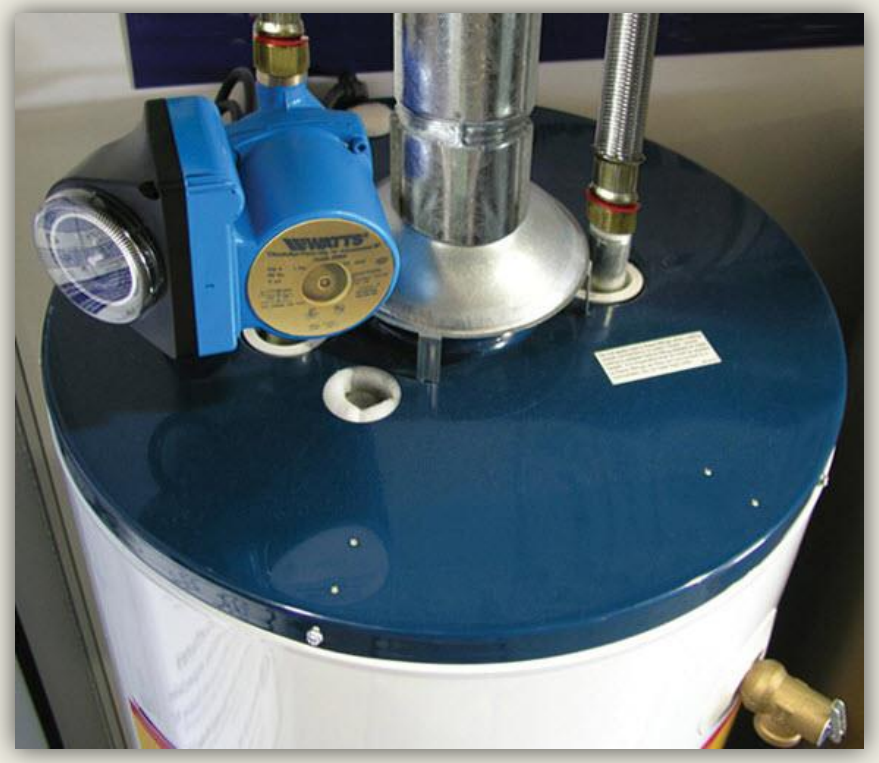
Appliances

- Kitchen
  - Water saving dishwasher
  - Water saving faucets
- Bathroom
  - Low flow toilets
  - Water saving faucets
- Laundry
  - Water saving washing machine
- Exterior
  - Rain water collection - Cistern

Example of Potential Rain Water Cistern at Building 7

Hot Water Recirculating System

- Instant hot water to faucets distant from hot water tank
- Conserves water + increases energy efficiency
- Different circulation systems:
  - 24/7
  - Timer
  - Thermostat
  - Demand
- Supports solar water heating



Example of Hot Water Recirculating System with Timer

Automation of Mechanical Systems

- Increases energy efficiency
- Controllability of interior + exterior
  - Lighting
  - HVAC
  - Solar shades
  - Appliances
  - Security

Example of Central Automation control system

Digital Energy Use Display

- Energy consumption
- Energy saved
- Energy advice
- Supports automation

Example of In-Home Display System

Energy Sources

- **Wind Energy**
- **Ocean Technologies**
  - Air/wave based
  - Tide based
  - Buoy types
  - Tidal turbine

Next Steps

1. Roof repair
2. Hazardous material testing
3. Debris removal and interior cleanup
4. Air infiltration test
5. Energy efficiency audit

Project Implementation

1. A/E firm will be hired to complete the plans for rehabilitation
2. Any work that can be done in house will be undertaken
3. Open to public as education tool
4. Routine maintenance