









- 2 stories + basement
- 1,200 finished SF
- 2 bedrooms
- 1 bath
- 5 people

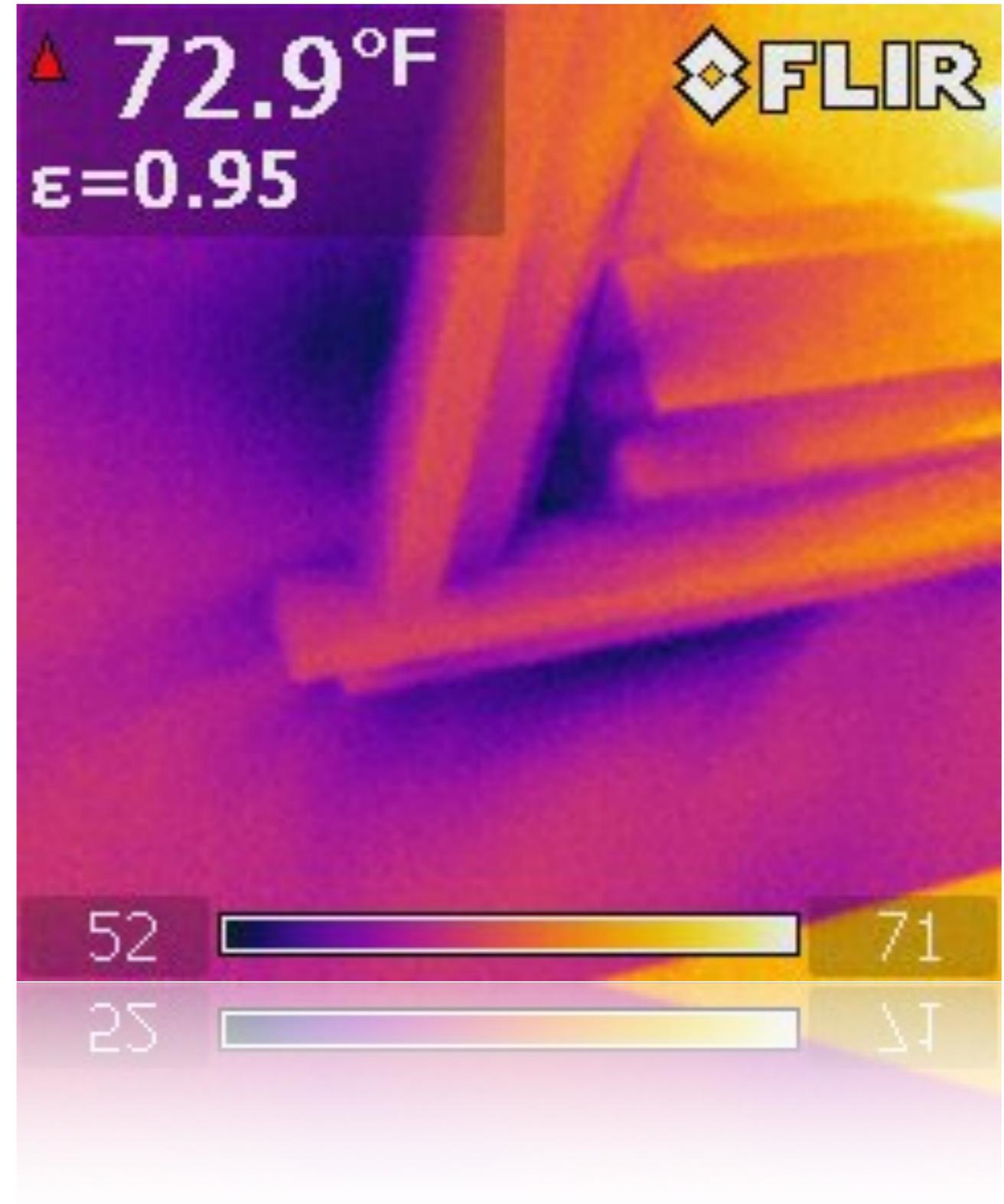
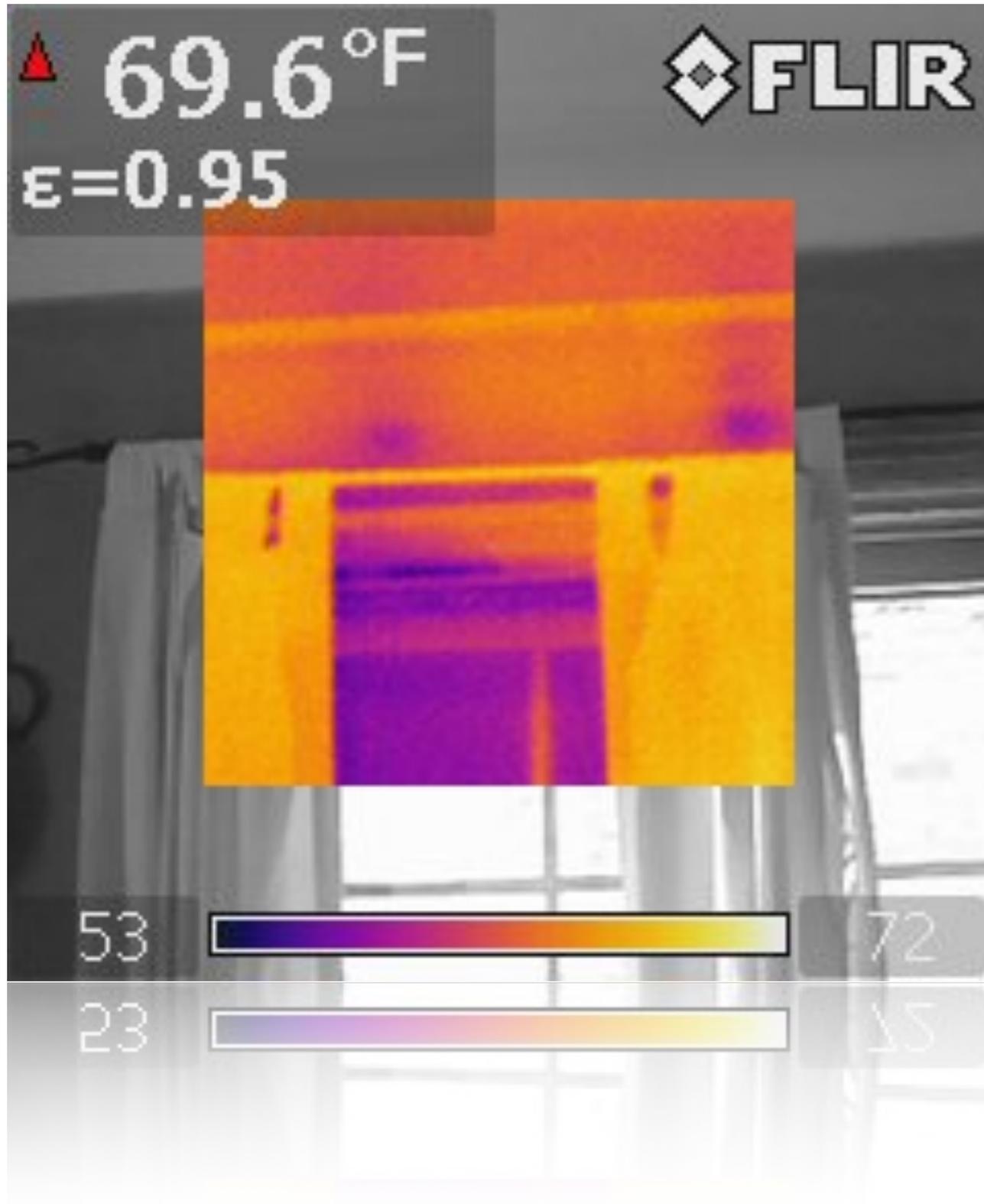




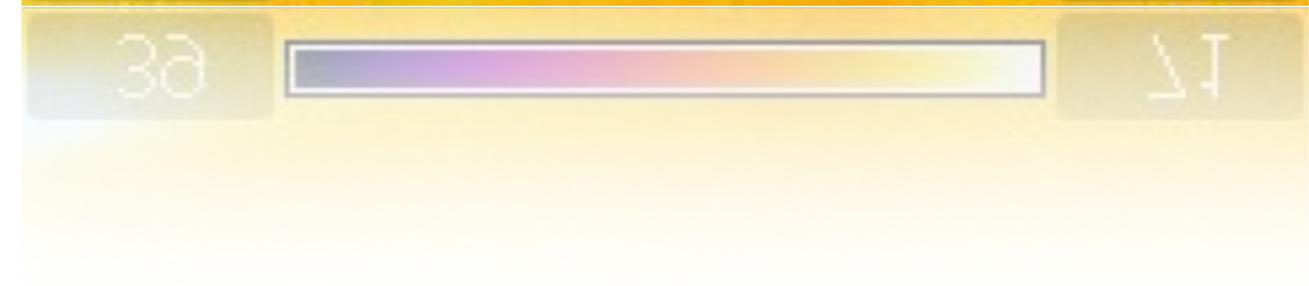
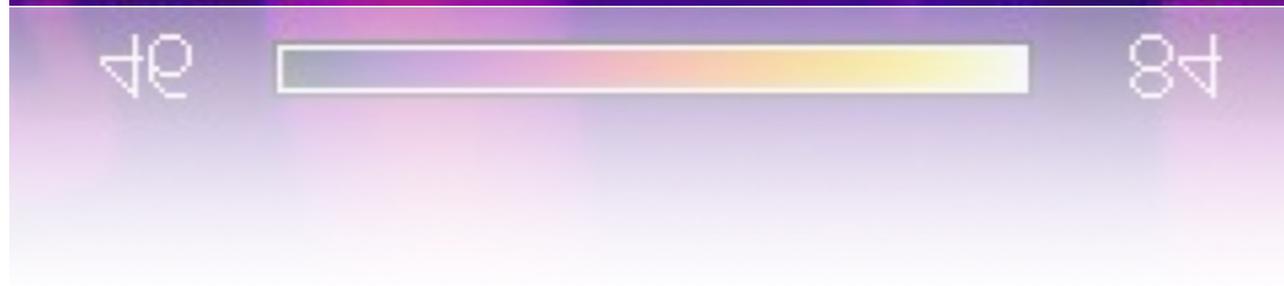
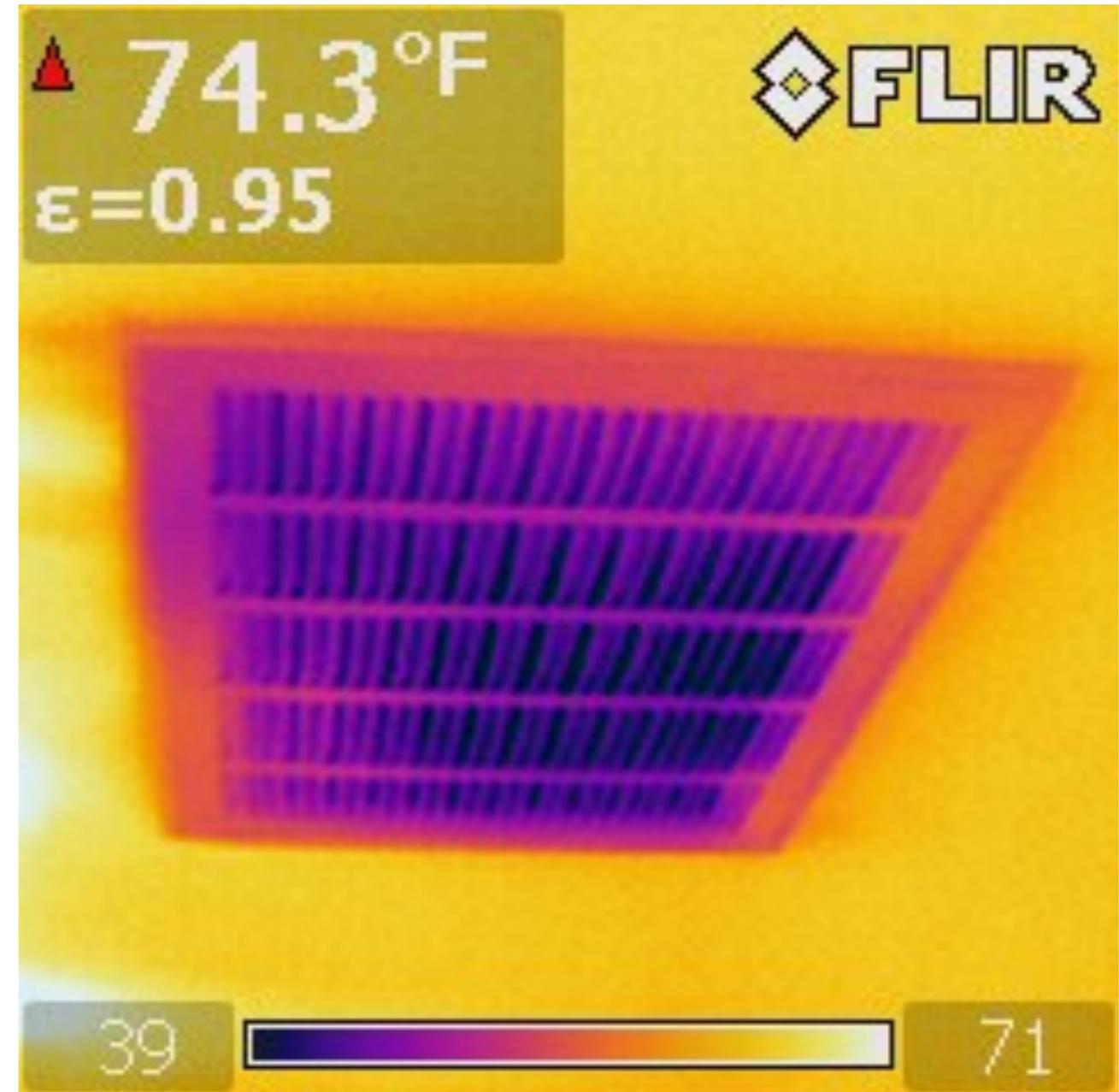
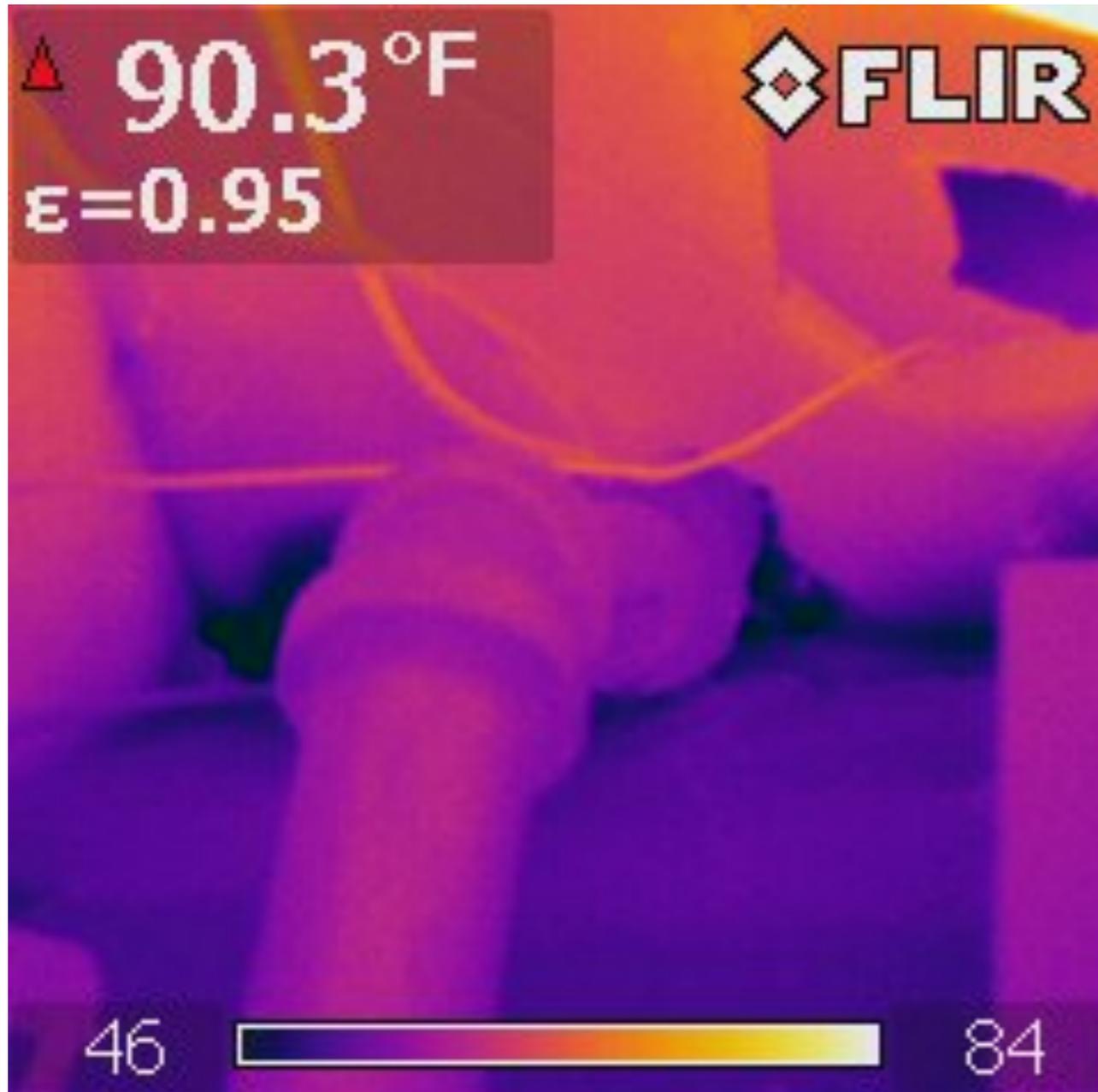
Prior Airport Noise Retrofit



Windows with Storms



Mechanicals



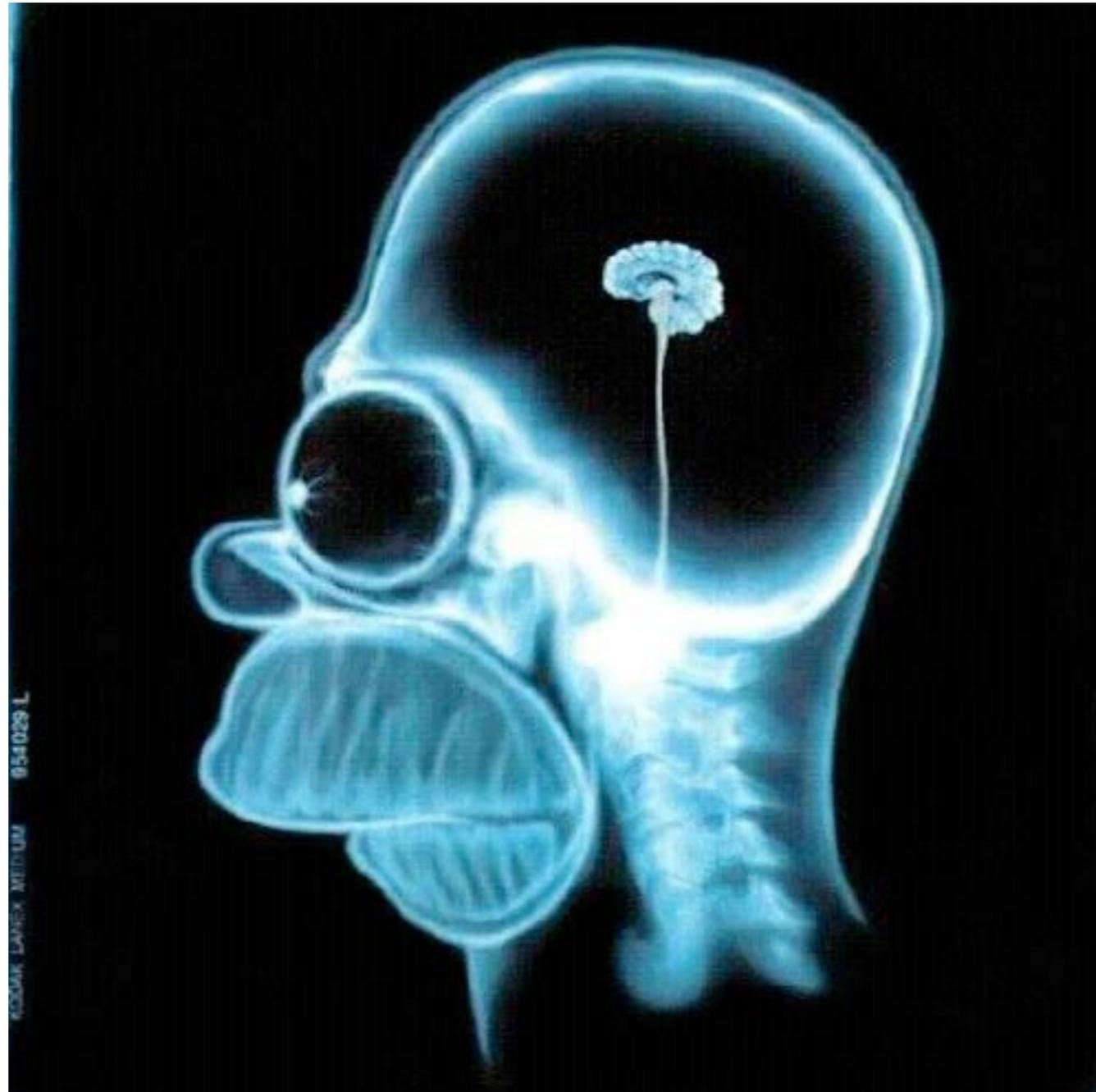


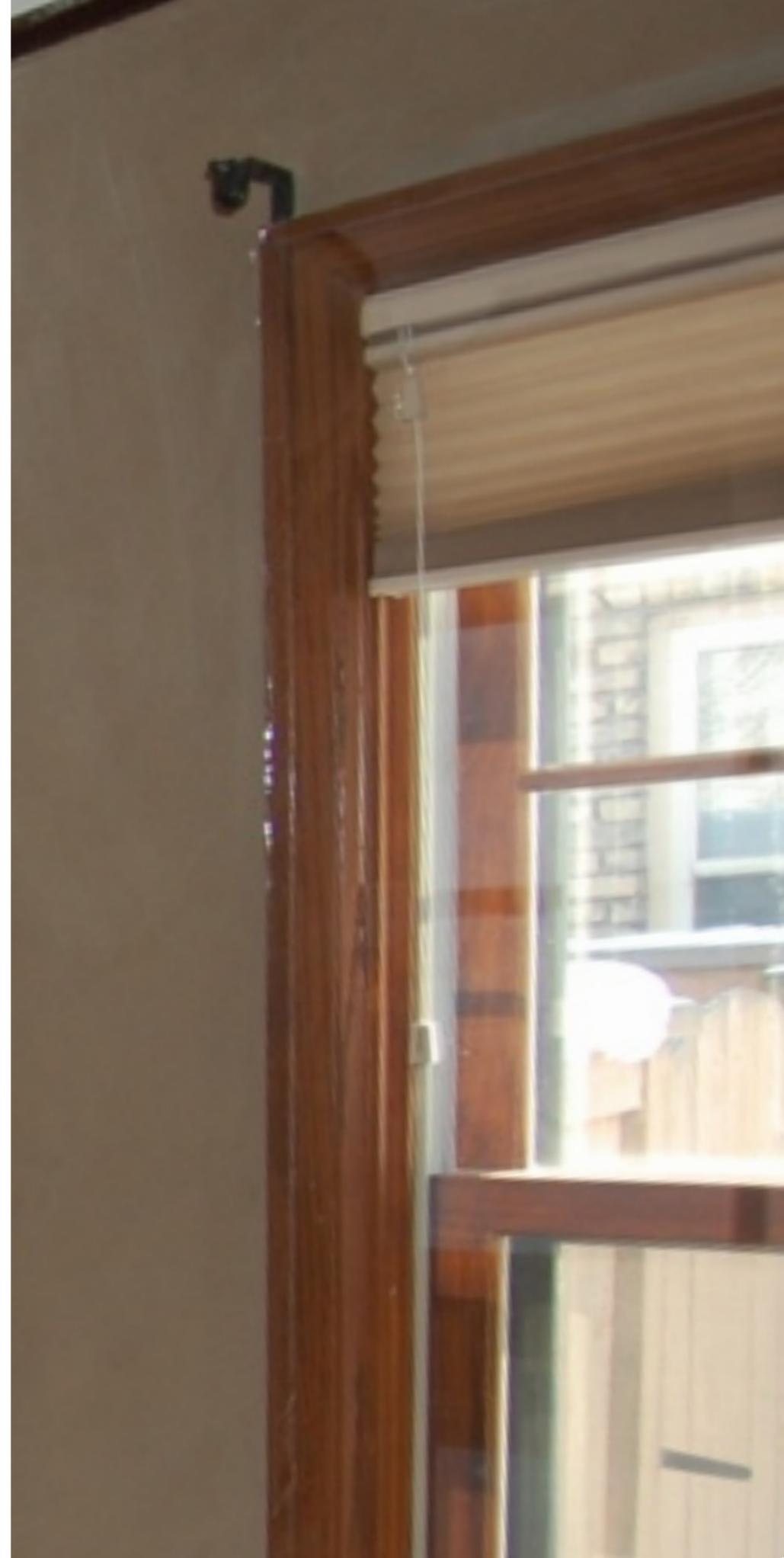
Airtightness

Initial Test

8.5 ACH₅₀ [2,100 CFM₅₀]

Pre-Existing Conditions







Goal \$1500
Total:
- \$582.5
- \$944
\$1526.50

War is a Force
That Gives Us
Meaning

ERNEST HEMINGWAY





TAKAGI
TAKAGI
TANKLESS WATER HEATER

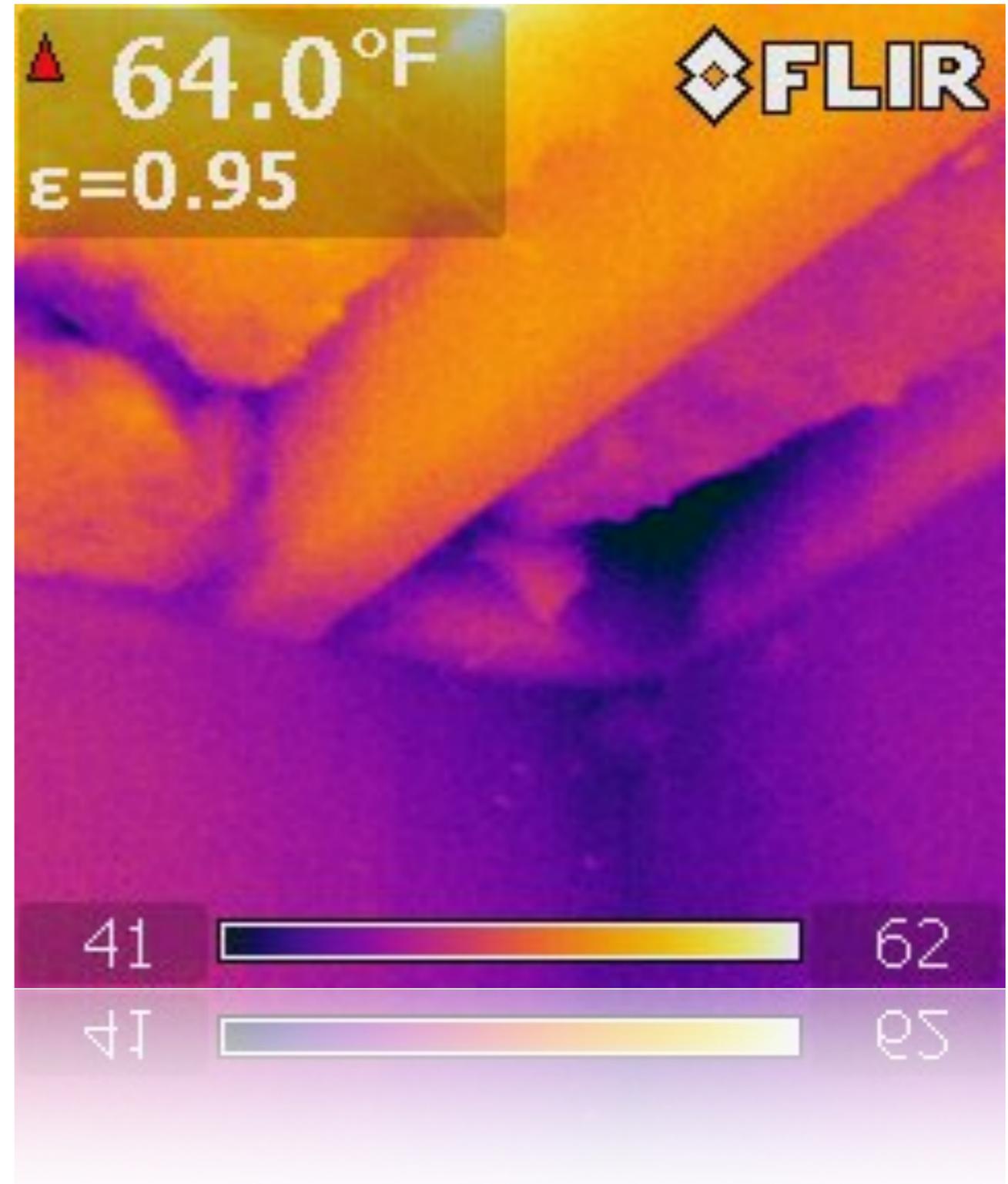
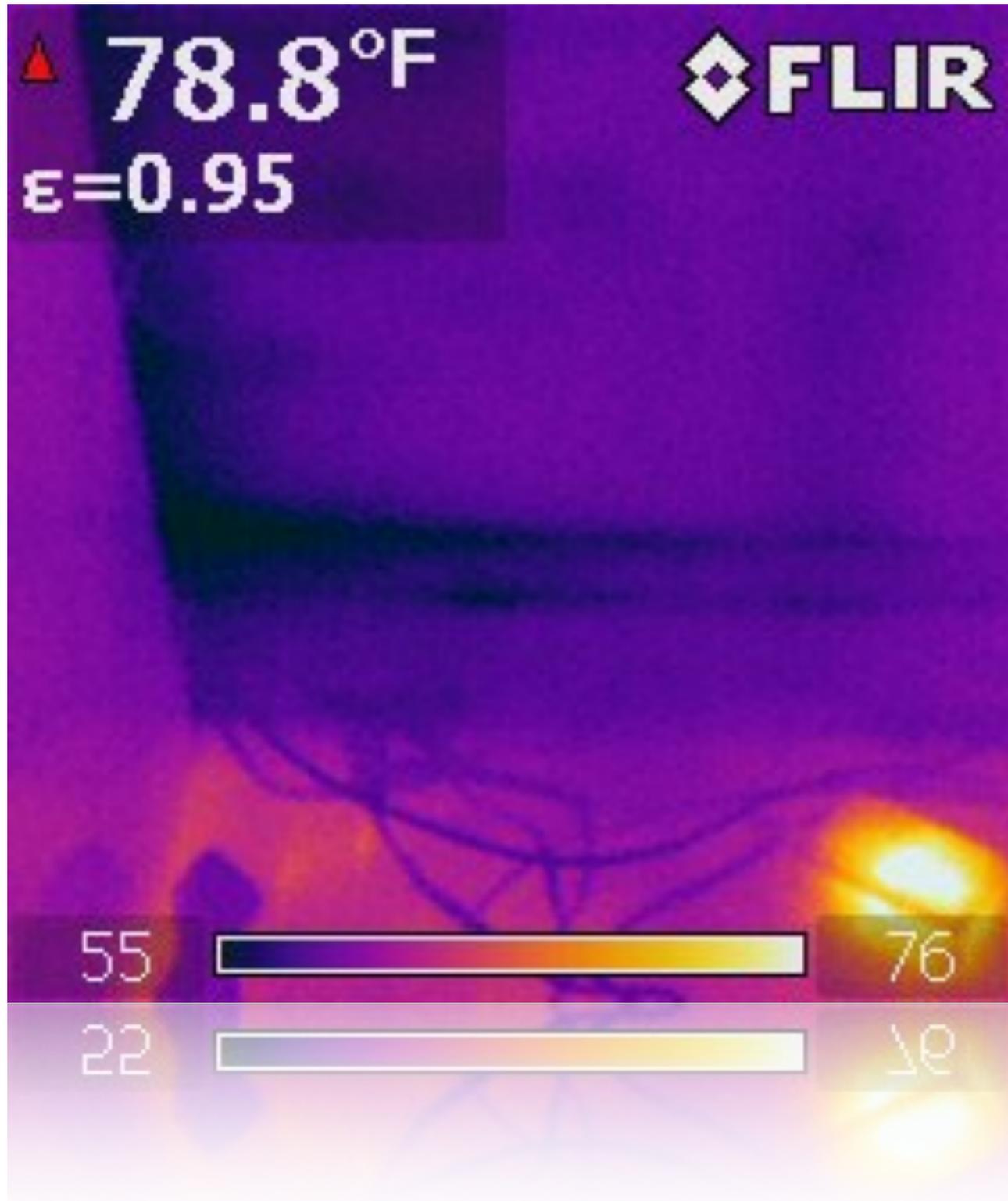
Model: T-2424S-2000
Capacity: 24 Gallons Per Minute
Input: 30,000 BTU/hr

Installation Instructions

Section	Content
1. SAFETY	Read the instructions carefully before installation. Failure to follow the instructions may result in property damage, personal injury, or death.
2. INSTALLATION	Install the water heater in a well-ventilated area. Do not install in a bathroom, bedroom, or living area.
3. WATER CONNECTIONS	Connect the water heater to the water supply lines. Use the provided shut-off valves to control the water flow.
4. VENTING	Connect the water heater to the venting system. Use the provided vent pipe and terminate it outside the building.
5. ELECTRICAL CONNECTIONS	Connect the water heater to the electrical system. Use the provided electrical panel and wiring.
6. TESTING	After installation, test the water heater for leaks and proper operation. Check the pressure and temperature settings.

FLM
24-2000

Control Panel



So, Where Are We?

- Structure ✓
- Weather Barrier?
- Insulation ✗
- Airtightness ✗
- Moisture Management ✓
- Ventilation/ Air Quality ✗
- Comfort ✗ ✗
- Daylight ✗
- Durability (30 years?)
- Design (Sign of the Times)

Where do we go?

what we need



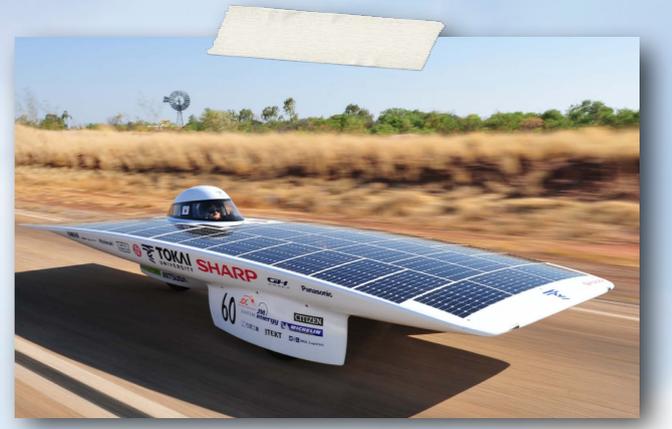
The List

- + 3 Bedrooms
- + 2 Baths
- + Mudroom
- Better kitchen
- Better living areas
- Homeschool room
- Safe stairs
- Weather-tight envelope
- Durable structure
- Healthy interiors
- Comfort & daylight
- Low operating cost
- **Energy performance**



Quality-Approved
Energy Retrofit with
Passive House Components
Dr. Wolfgang Feist

Dr. Wolfgang Feist
Passive House Components
Energy Retrofit with
Passive House Components





Passive House Institute
Dr. Wolfgang Feist
Rheinstraße 44/46
64283 Darmstadt
Germany
www.passivehouse.com

EnerPHit and EnerPHit⁺

Certification Criteria for Energy Retrofits with Passive House Components

If an energy retrofit of an existing building meets Passive House criteria (for new builds), it, too, can be certified as a Certified Passive House.

It is, however, often difficult to feasibly achieve the Passive House Standard in older buildings for a variety of reasons. Passive House technology for relevant building components in such buildings does, nevertheless, lead to considerable improvements with respect to thermal comfort, structural longevity, cost-effectiveness over the building lifecycle and energy use.

Buildings that have been retrofitted with Passive House components and, to a great extent, with exterior wall insulation can achieve EnerPHit certification as evidence of both building quality and fulfilment of specific energy values. The EnerPHit⁺ designation is applied if more than 25 % of the opaque exterior wall surface has interior insulation.

How do we get there?



Holistic Energy Reduction Retrofit
≠
Weatherization



Sports car?

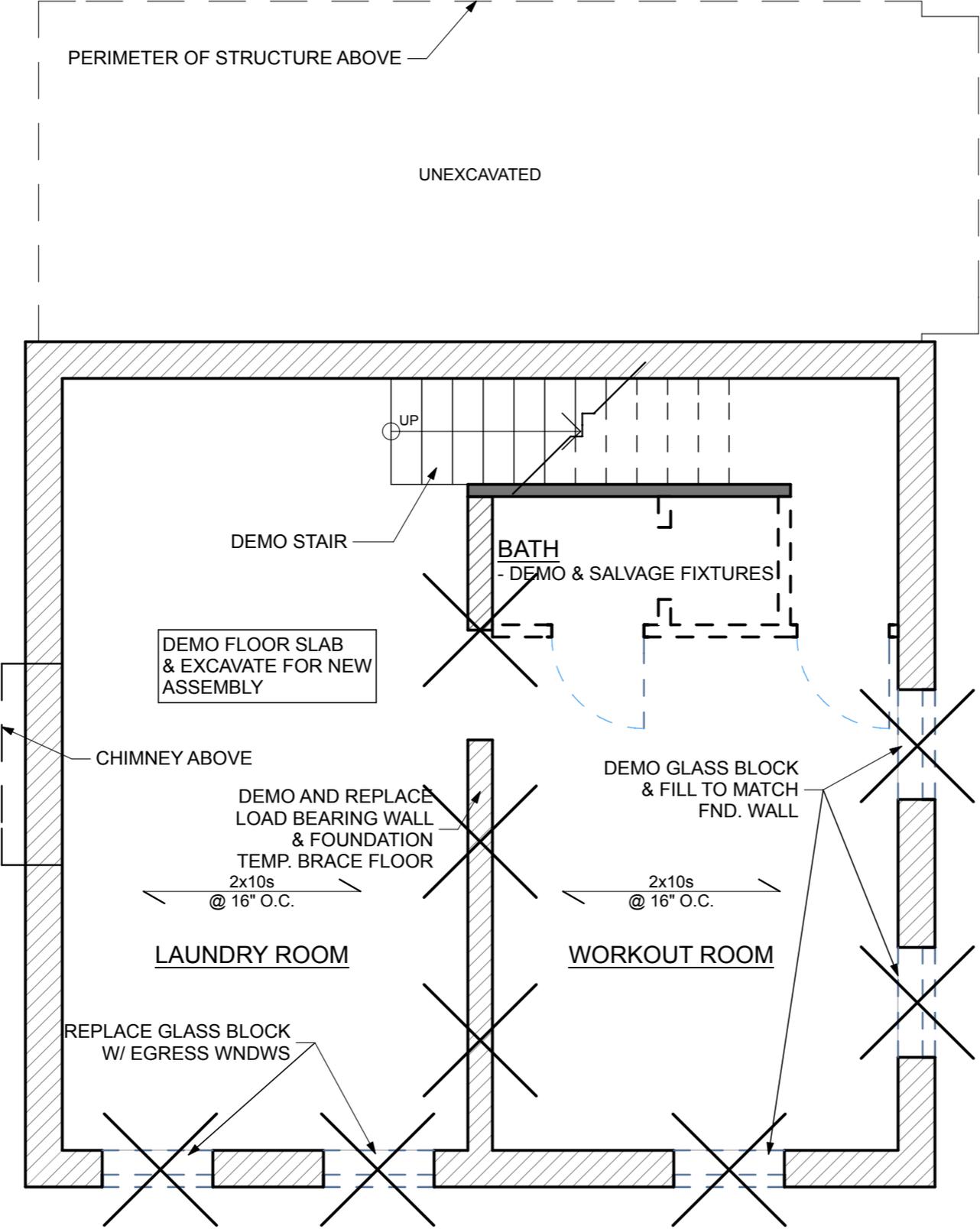
The Plan for Success

- Set goals for performance and design
- Overlay architectural program
- Make the home safe for people (code compliance)
- Control temperature, air, and moisture
- Add ventilation
- Make the envelope air- and weather-tight
- Add continuous insulation to meet the energy goals
- Assess moisture transfer through shell
- Implement robust climate zone-appropriate assemblies
- Reduce energy demand by $2/3$ and air-leakage 10X to meet Passive House retrofit standard (EnerPHit)

The Concept



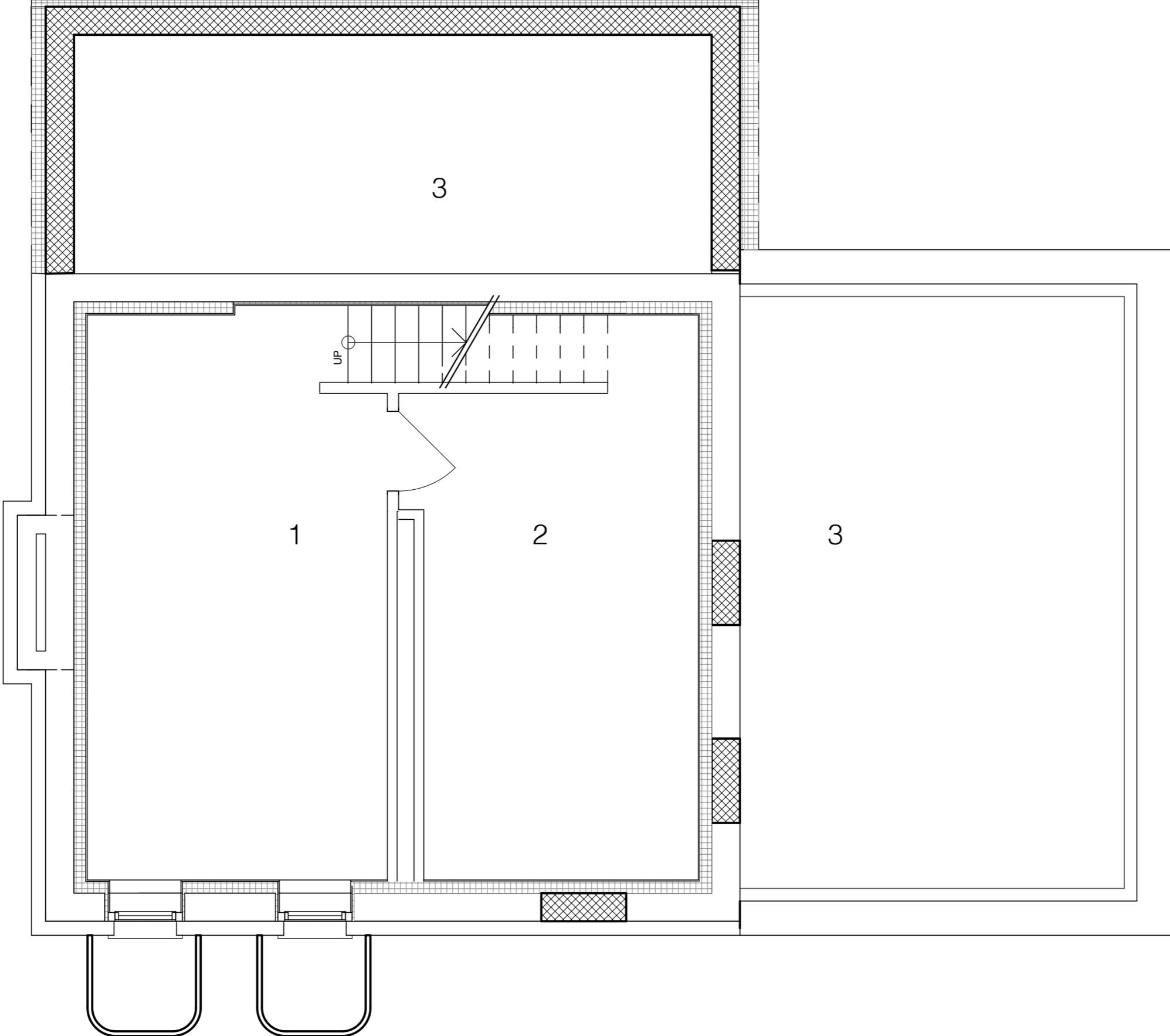
Basement



Basement



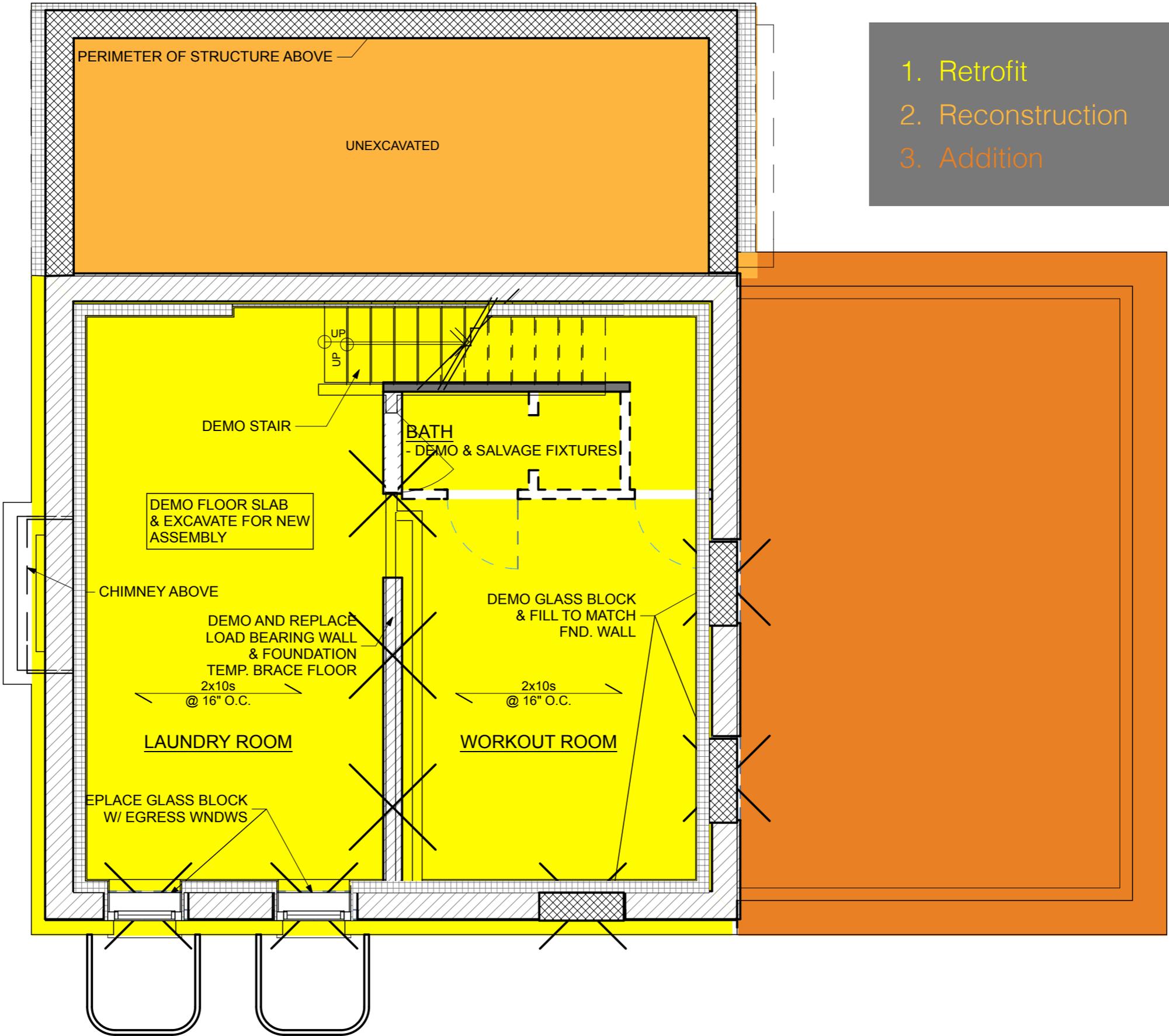
- 1. Homeschool Room
- 2. Mechanical
- 3. Unexcavated



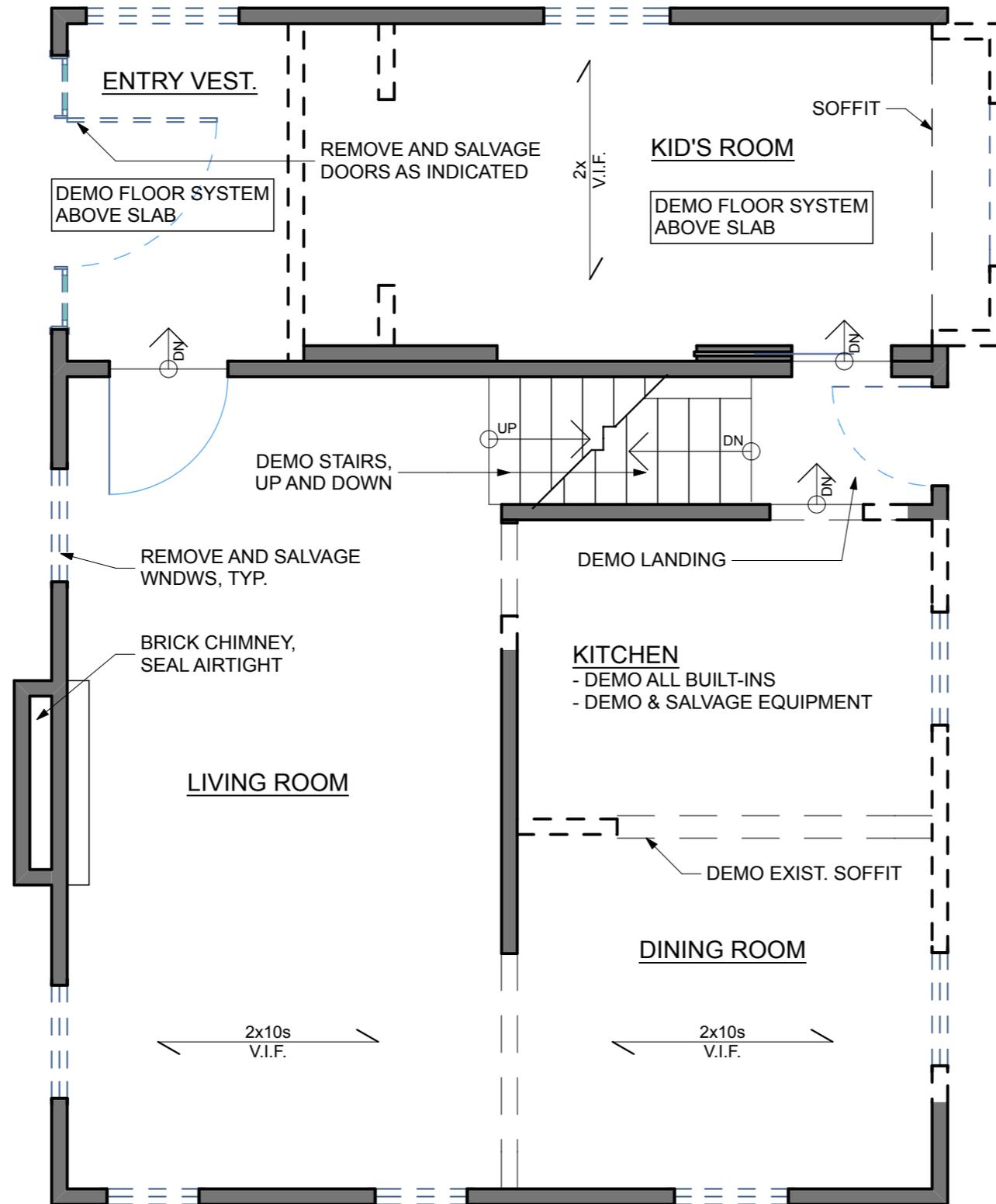
Basement



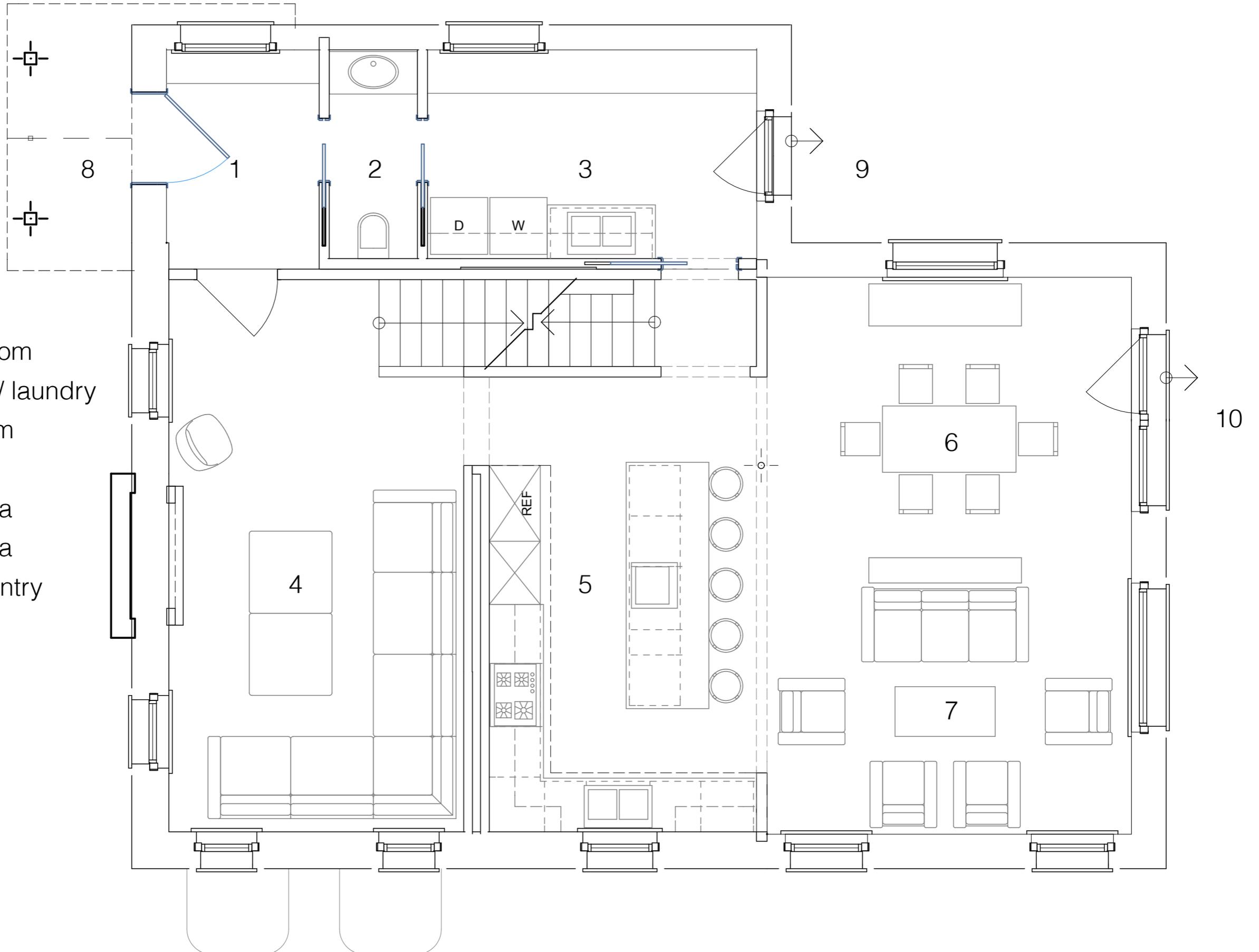
- 1. Retrofit
- 2. Reconstruction
- 3. Addition



First Floor

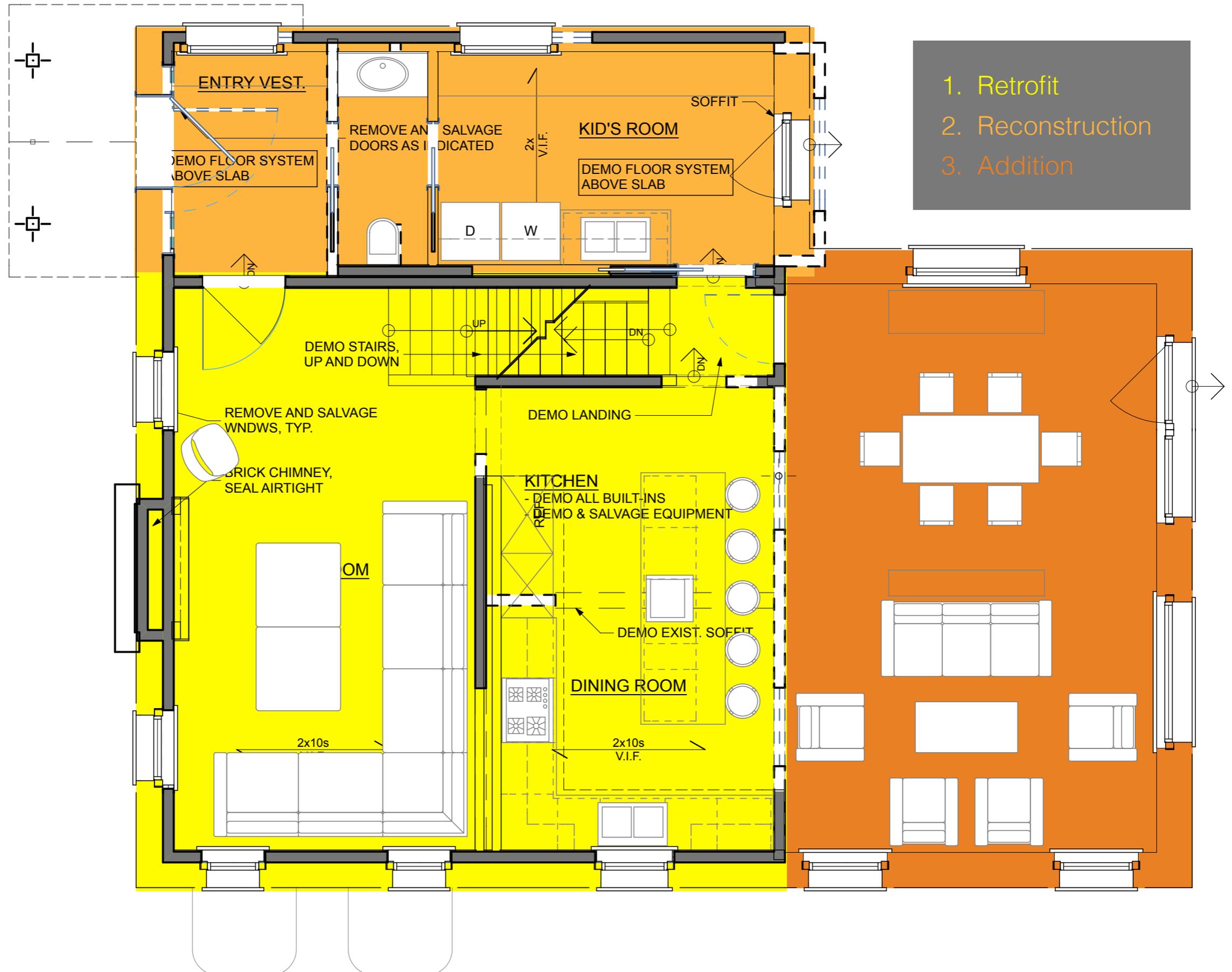


First Floor

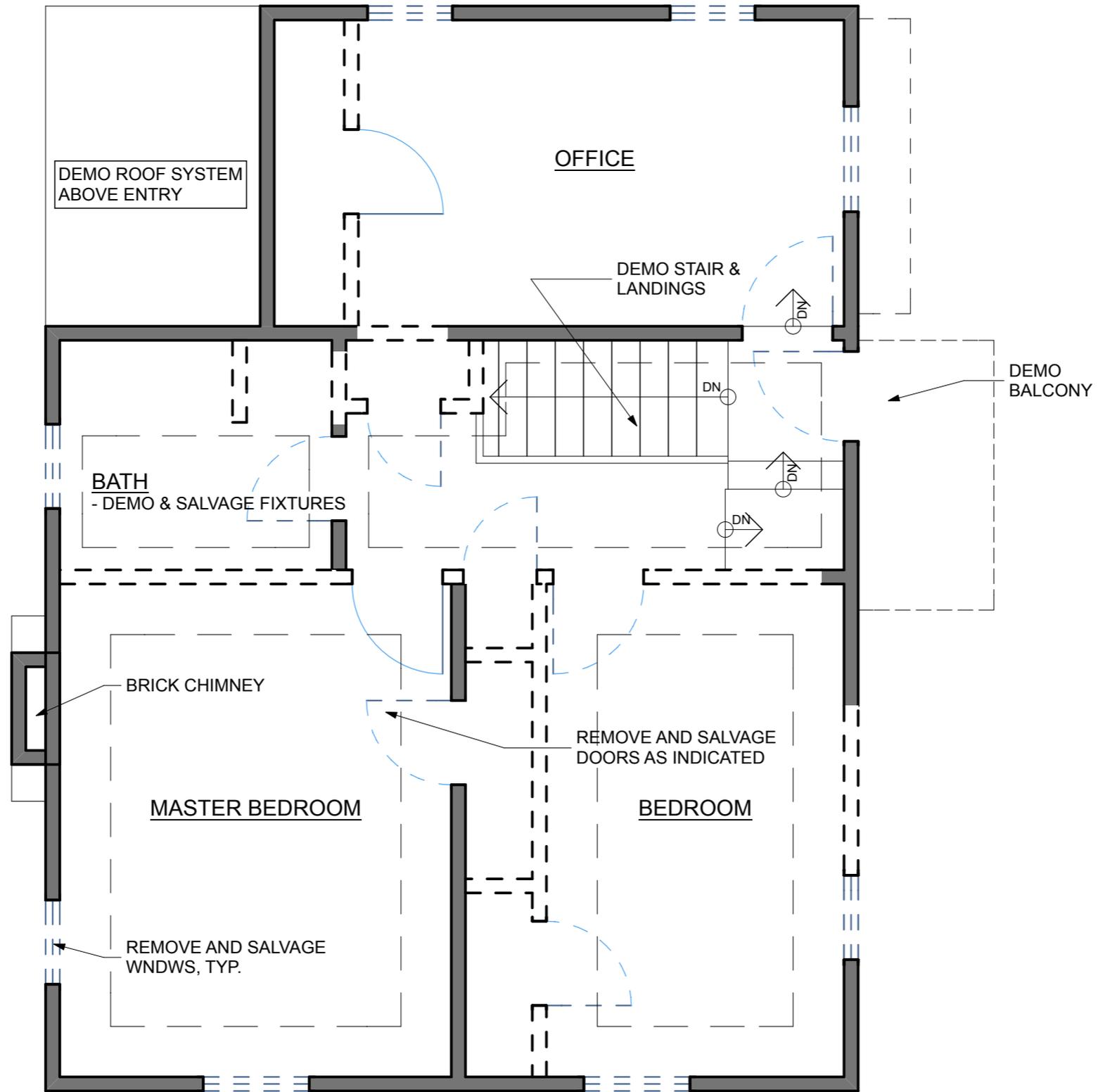


- 1. Entry
- 2. Powder room
- 3. Mud room/ laundry
- 4. Living room
- 5. Kitchen
- 6. Dining area
- 7. Family area
- 8. Covered entry
- 9. Rear entry
- 10. Patio

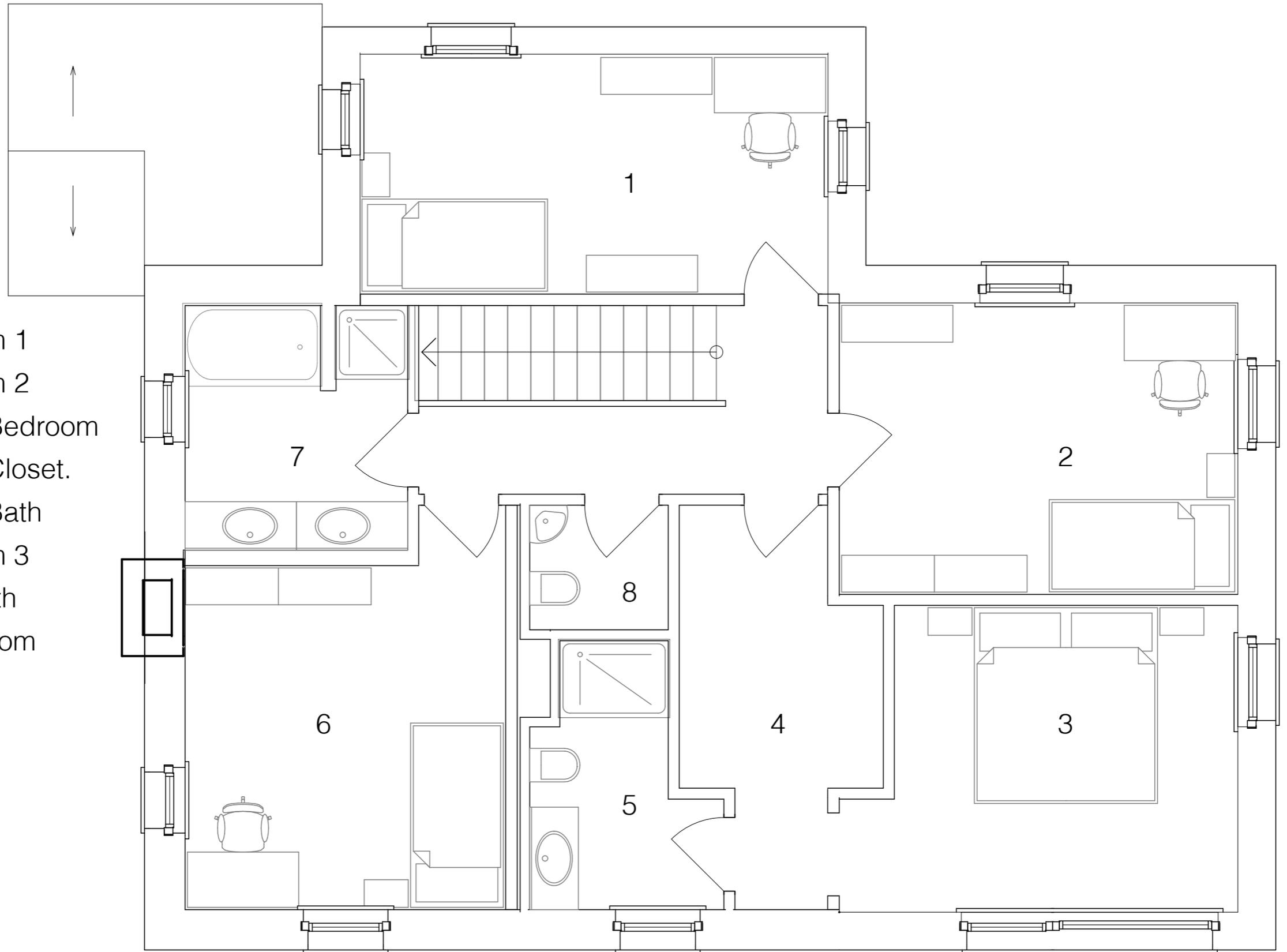
First Floor



Second Floor

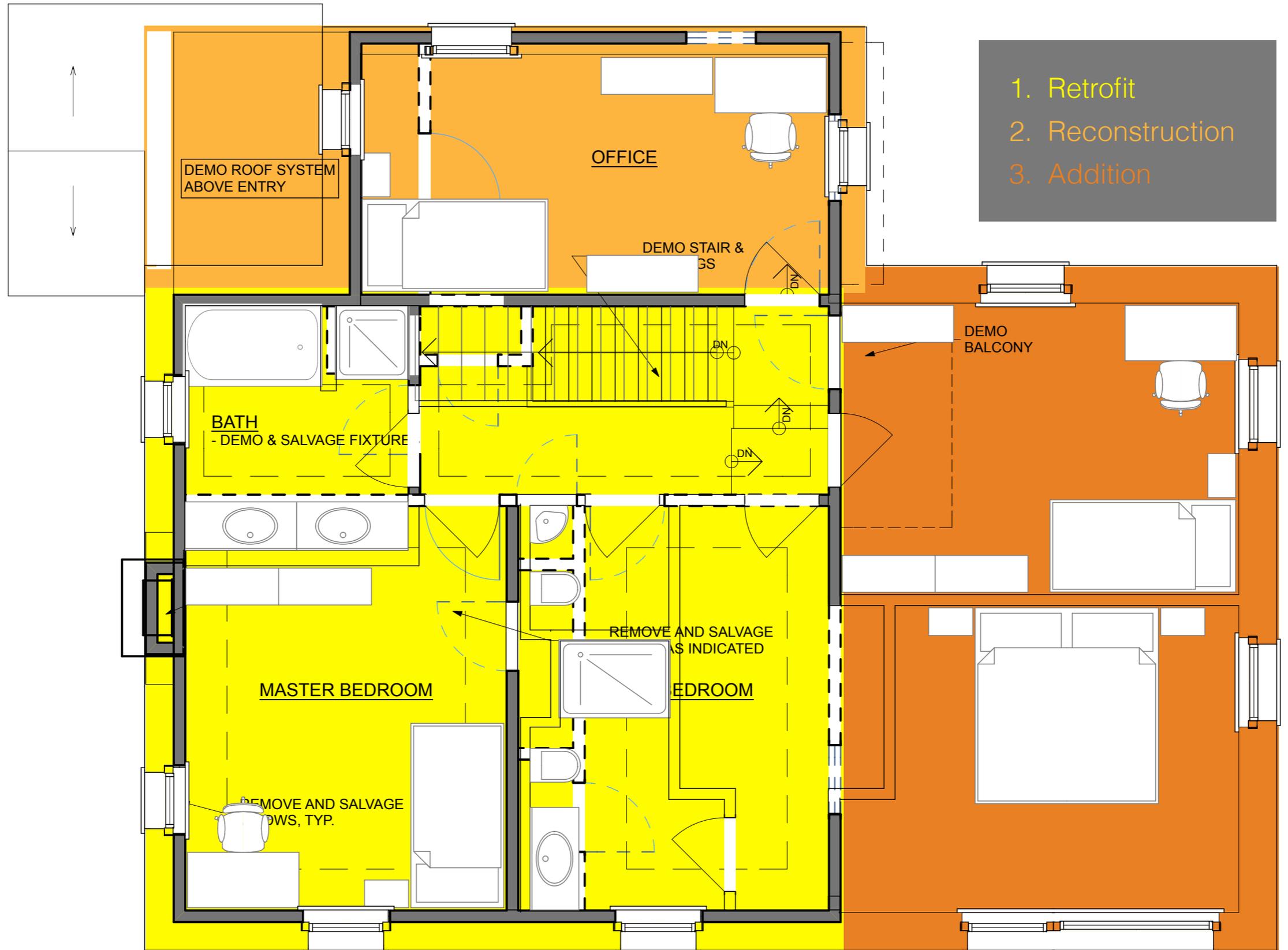


Second Floor



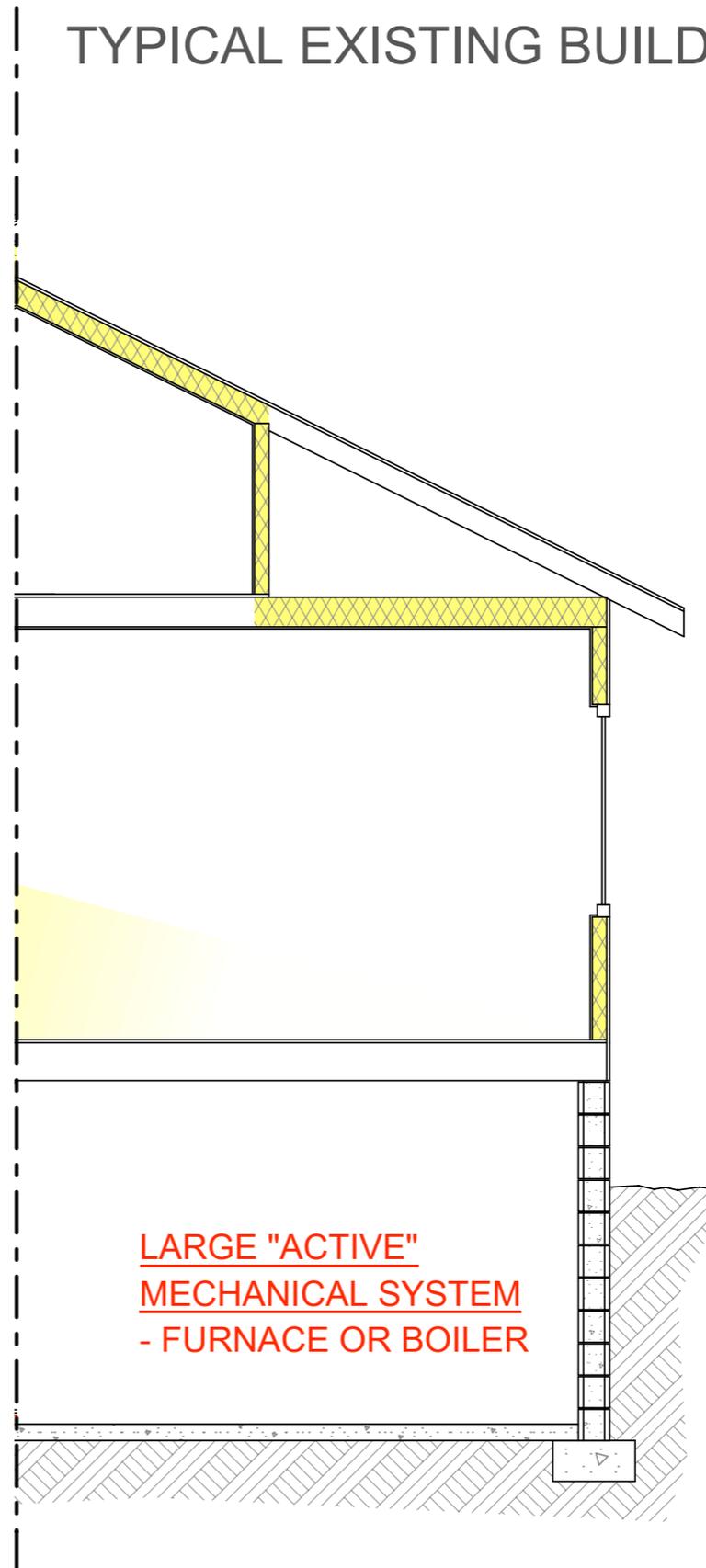
1. Bedroom 1
2. Bedroom 2
3. Master Bedroom
4. Master Closet.
5. Master Bath
6. Bedroom 3
7. Kid's Bath
8. Toilet Room

Second Floor



Retrofit Concept

TYPICAL EXISTING BUILDING (BEFORE)



EXISTING CONDITION

- INSUFFICIENT INSULATION
- LOW-PERFORMANCE WINDOWS AND DOORS
- AIR LEAKAGE
- NO VENTILATION

EXISTING CONDITION

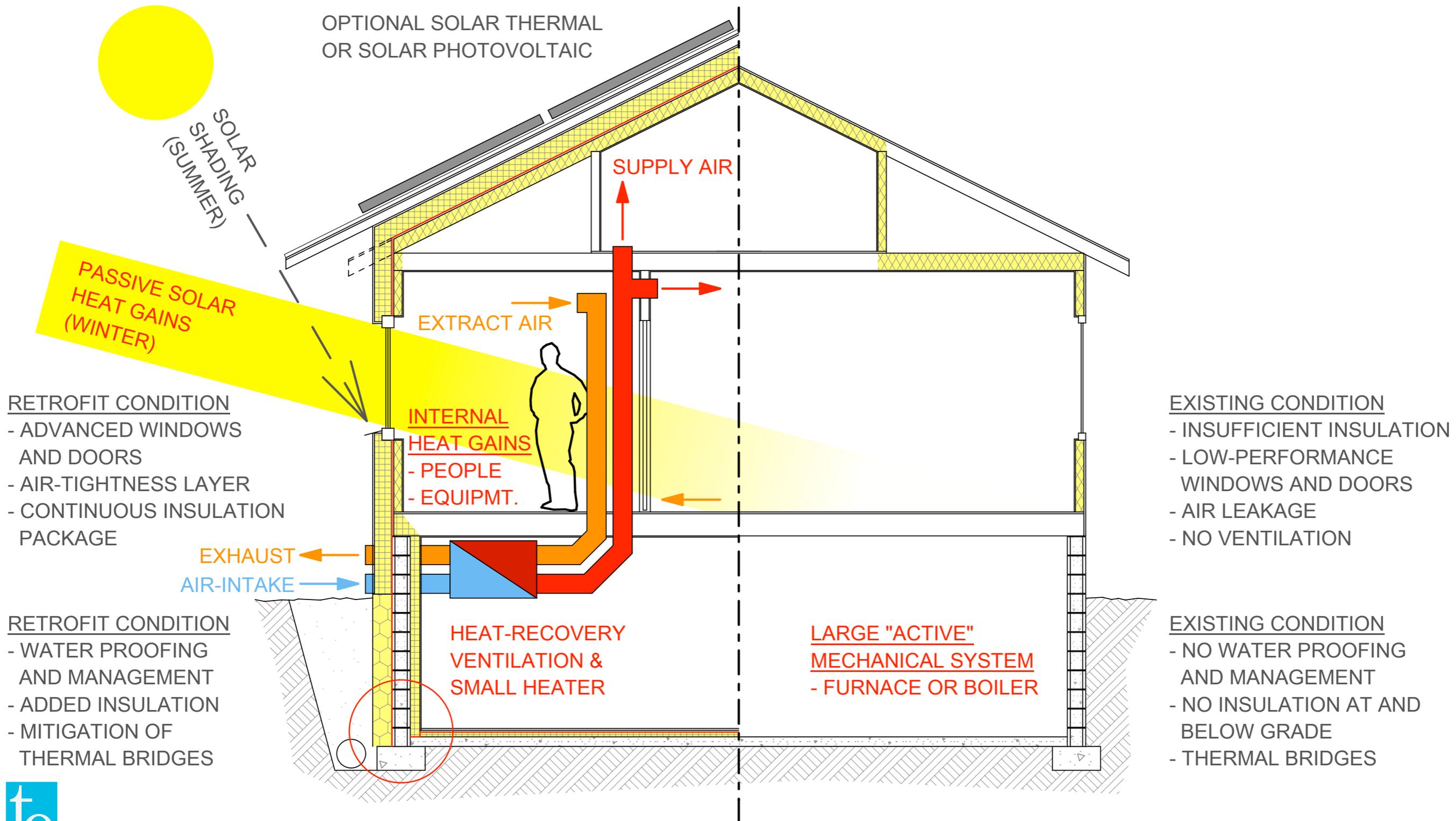
- NO WATER PROOFING AND MANAGEMENT
- NO INSULATION AT AND BELOW GRADE
- THERMAL BRIDGES

LARGE "ACTIVE"
MECHANICAL SYSTEM
- FURNACE OR BOILER

Retrofit Concept

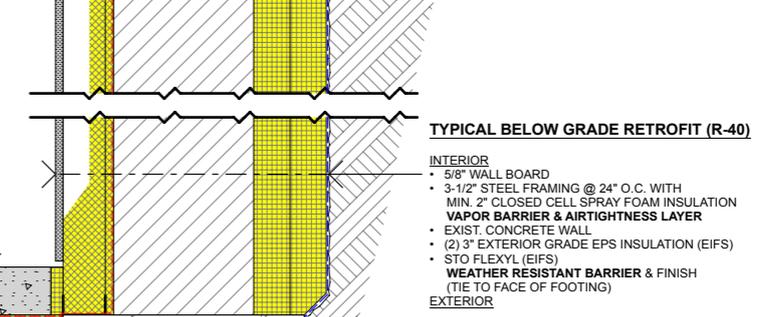
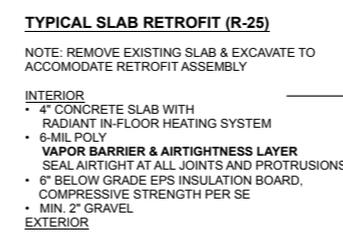
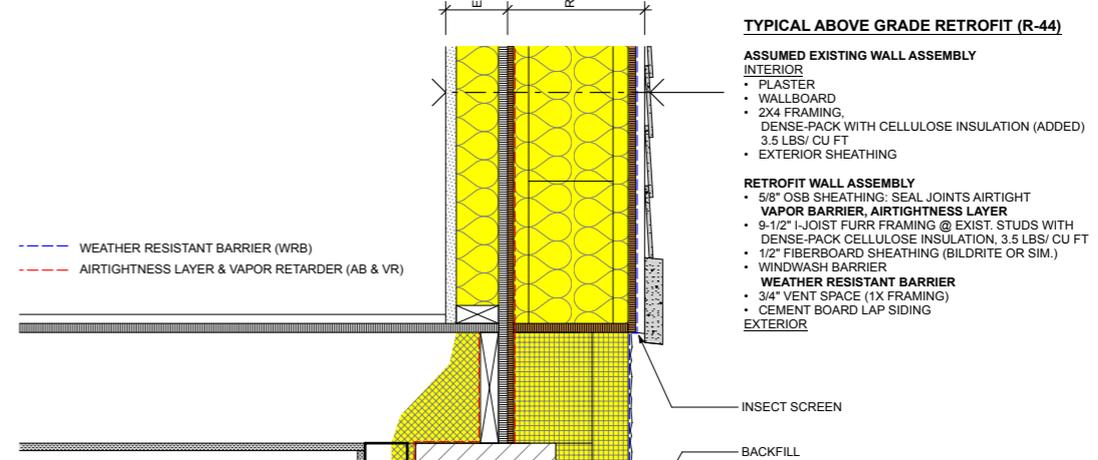
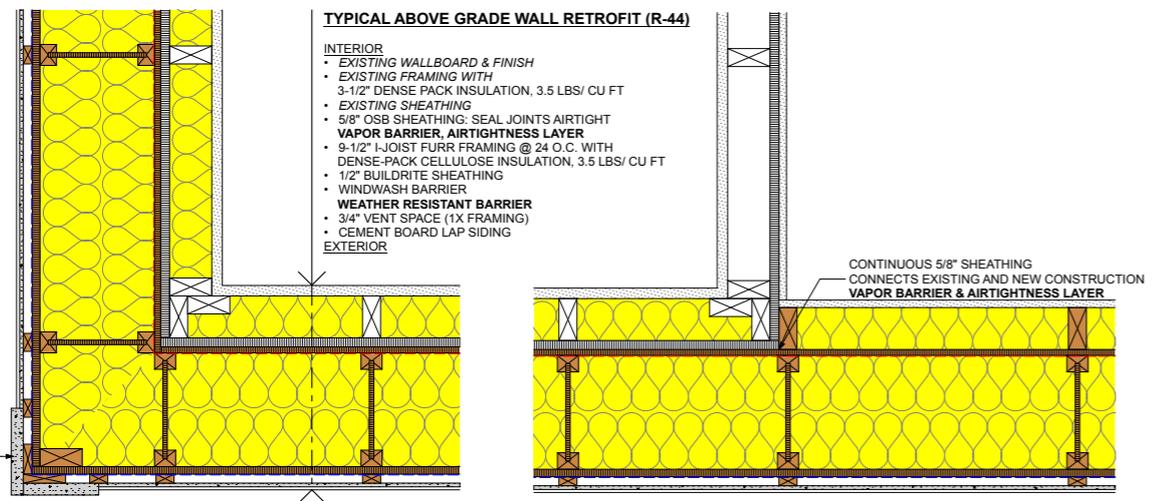
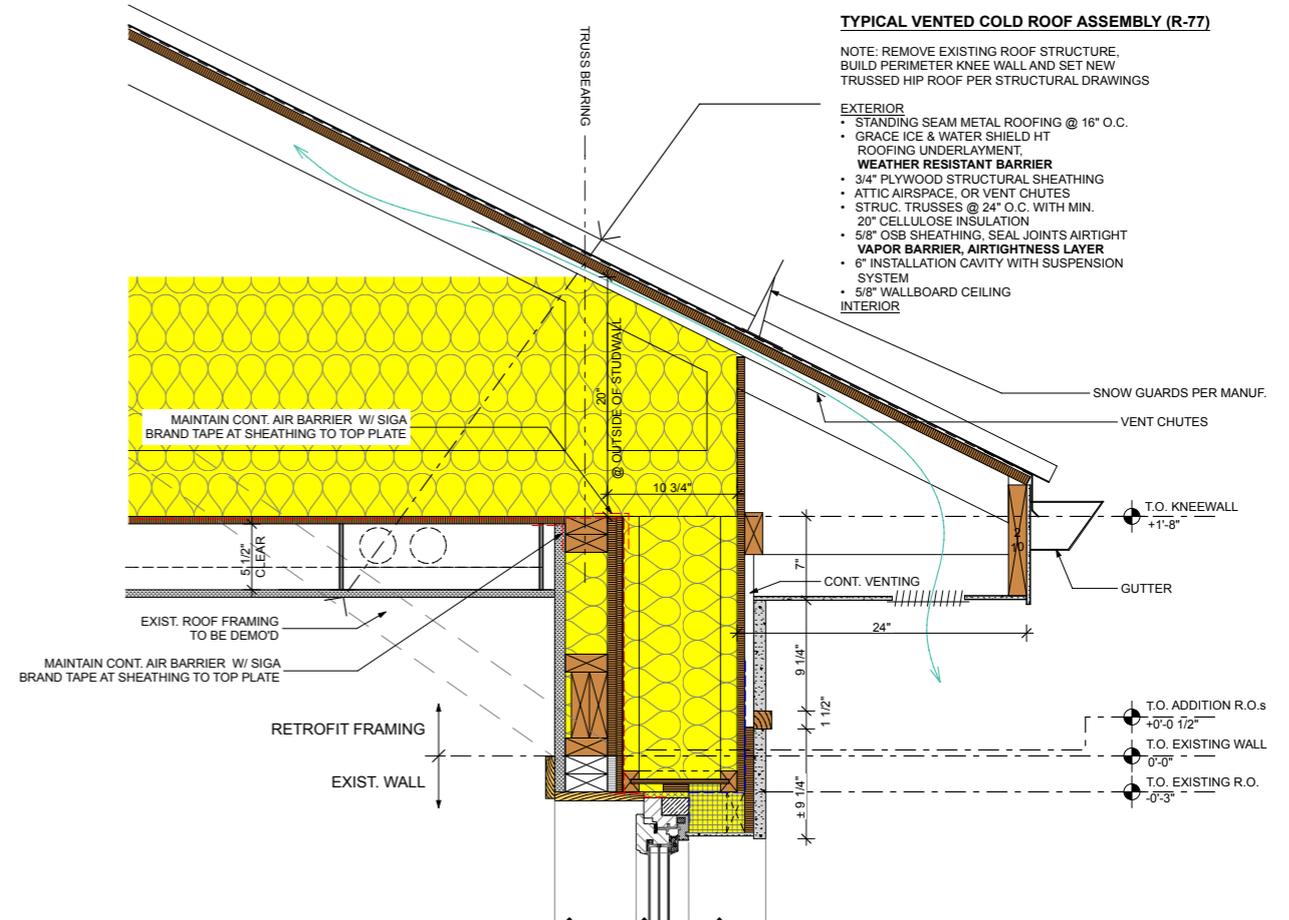
DEEP ENERGY REDUCTION RETROFIT (AFTER)

TYPICAL EXISTING BUILDING (BEFORE)



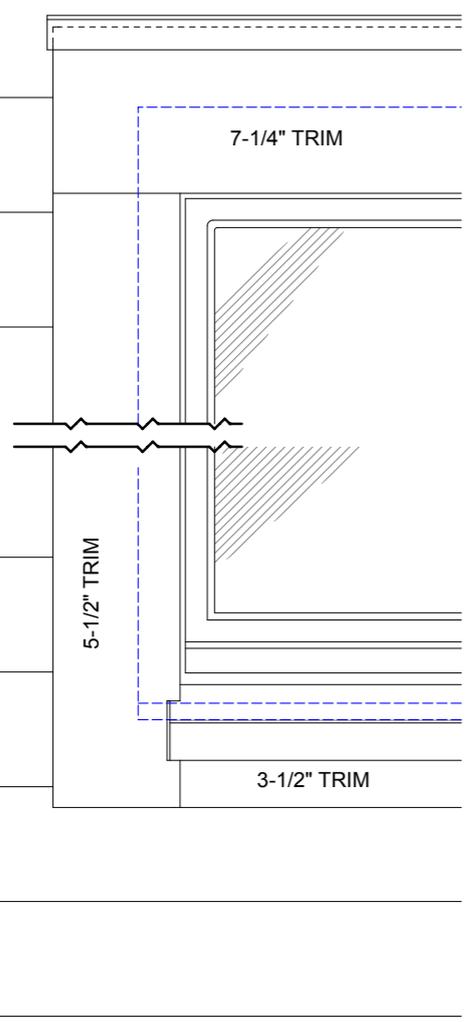
Assemblies

- Walls a/ grade: R-10 to R-44
- Walls b/ grade: R-1 to R-30+
- Roof: R-20 to R-77
- Slab: R-1 to R-25

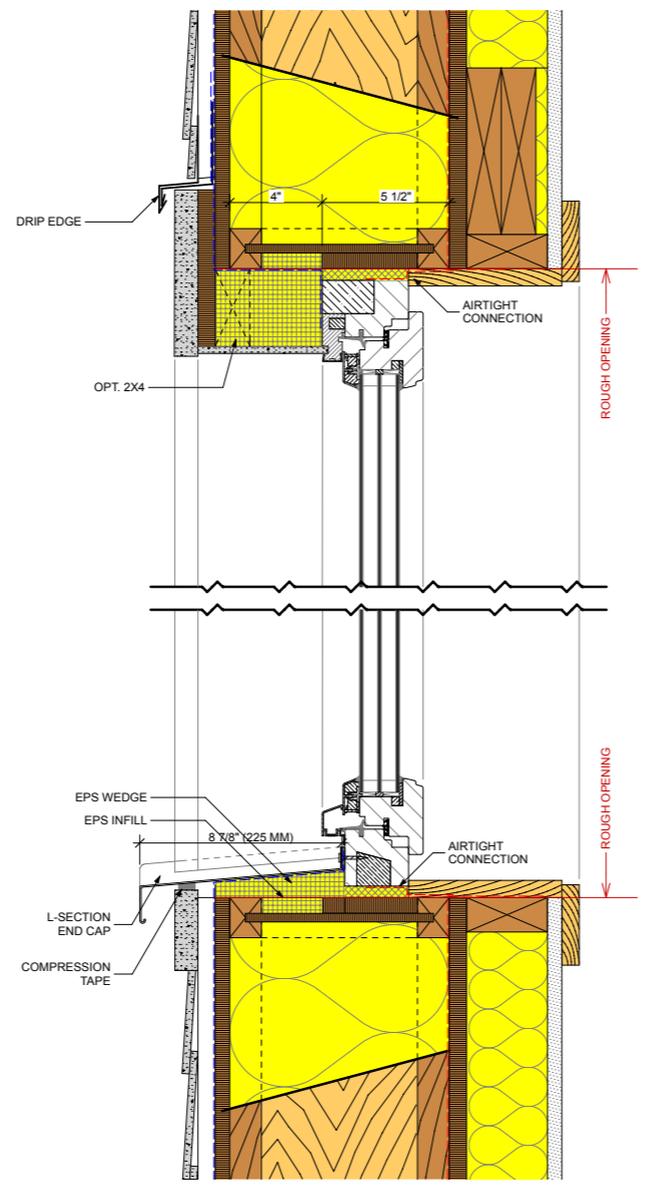


--- WEATHER RESISTANT BARRIER (WRB)
 --- AIRTIGHTNESS LAYER & VAPOR RETARDER (AB & VR)

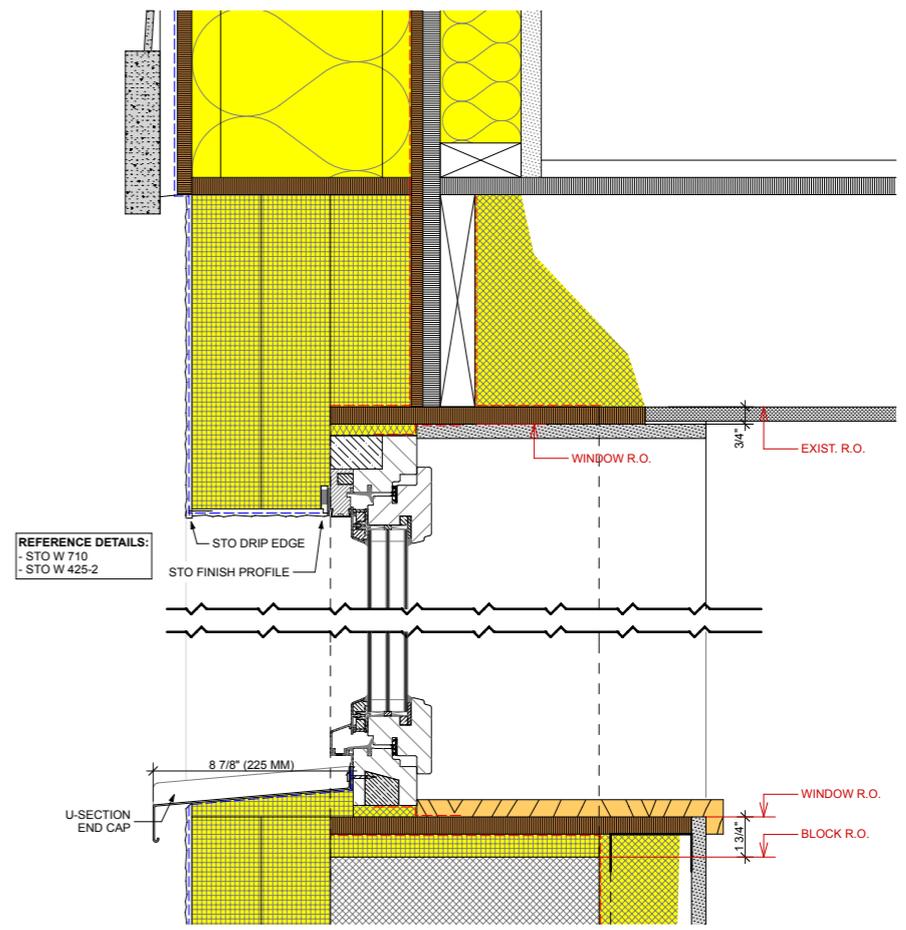
Details



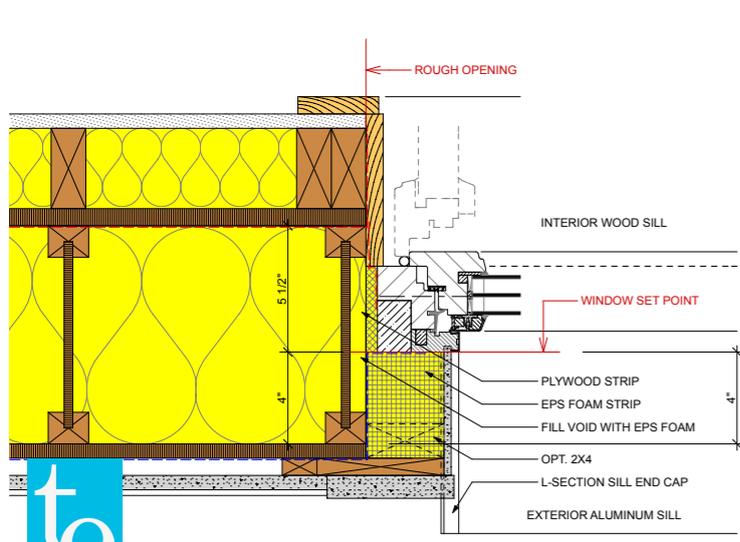
1 TYPICAL EXTERIOR WINDOW ELEVATION
 SCALE: 3" = 1'-0"



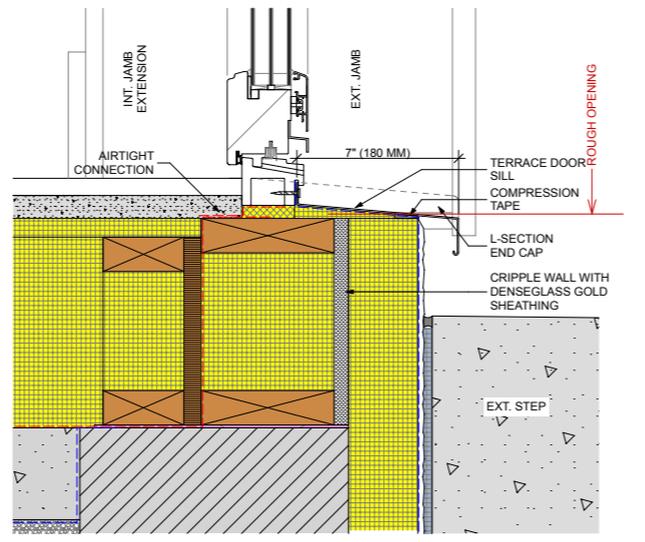
2 TYPICAL WINDOW HEAD & SILL
 SCALE: 3" = 1'-0"



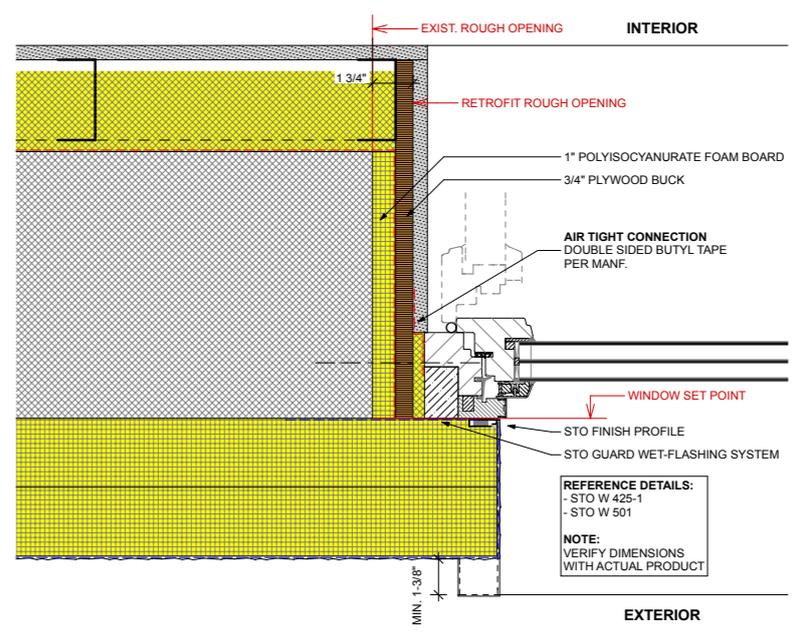
5 TYPICAL WINDOW HEAD & SILL, BASEMENT
 SCALE: 3" = 1'-0"



3 TYPICAL WINDOW JAMB
 SCALE: 3" = 1'-0"



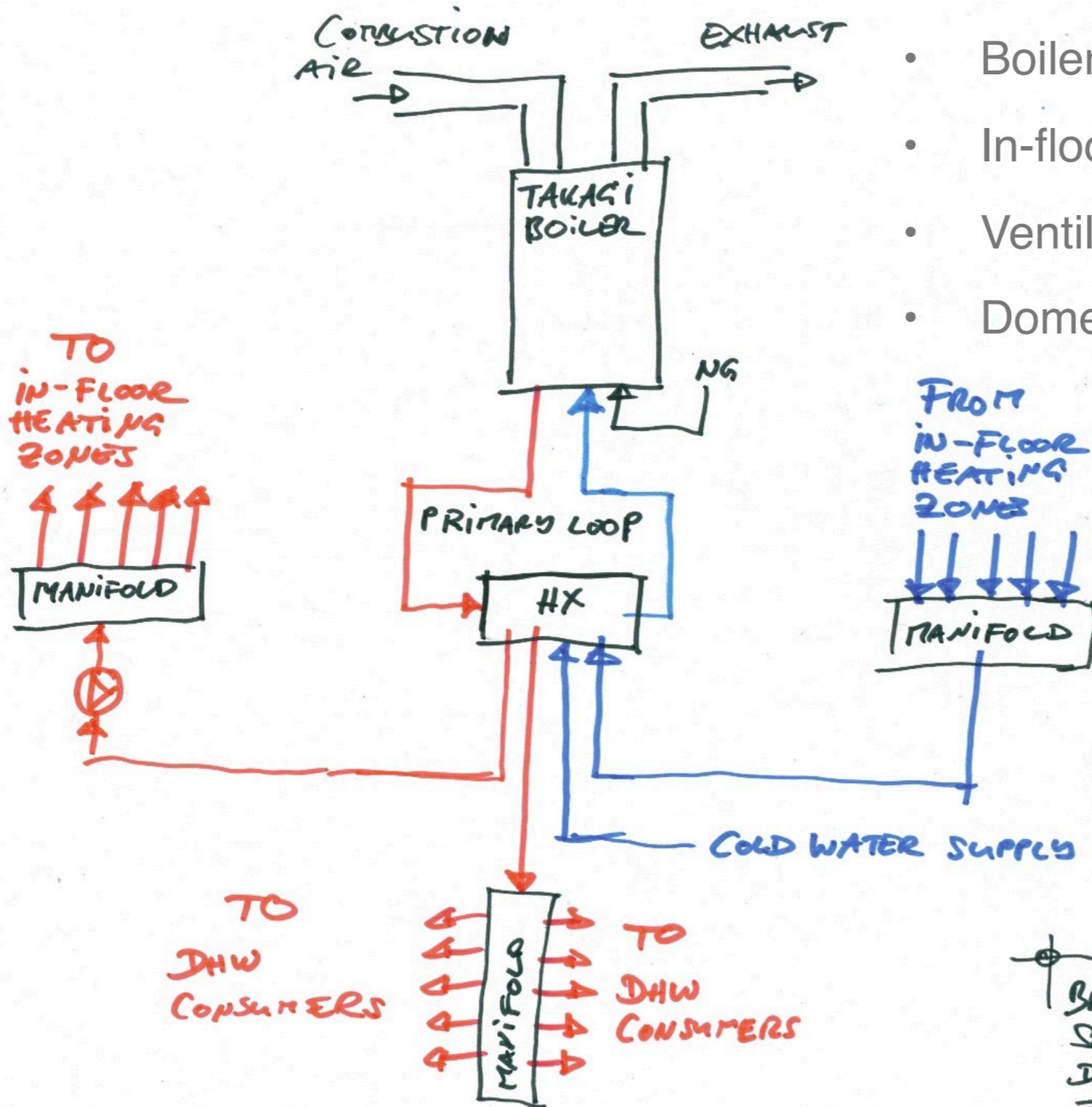
4 TYP. TERRACE DOOR SILL
 SCALE: 3" = 1'-0"



6 TYPICAL WINDOW JAMB, BASEMENT
 SCALE: 3" = 1'-0"



MEP Systems



- Boiler (existing, replaced)
- In-floor heat (existing, reused and expanded)
- Ventilation system (new)
- Domestic hot water system (new plumbing)



 BRAZELTON RESIDENCE
 SCHEMATIC HEATING &
 DHW SYSTEM.
 TDE/TE STUDIO, LTD.

Construction Project





