BARLIS WEDLICK

The Levy Partnership

NAPHC 18

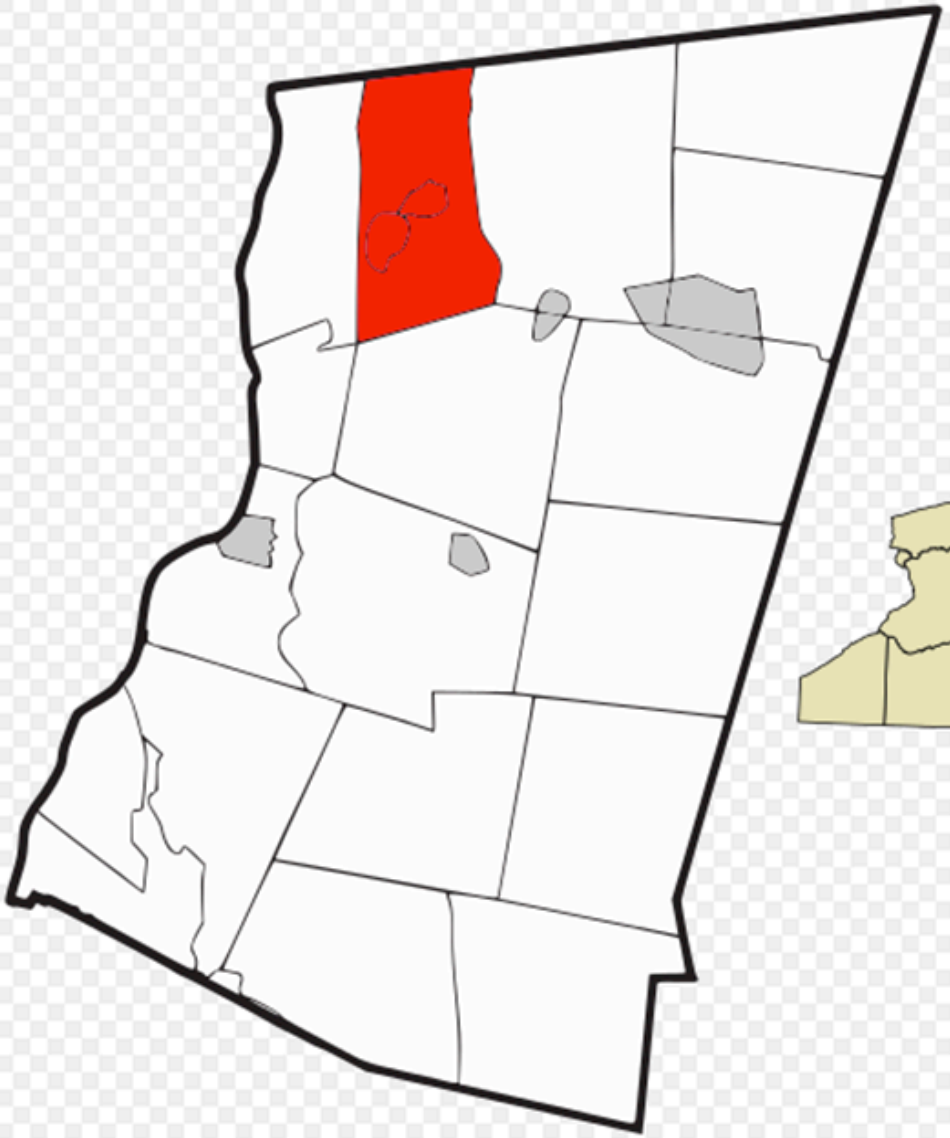
PRAYERS FOR PASSIVE

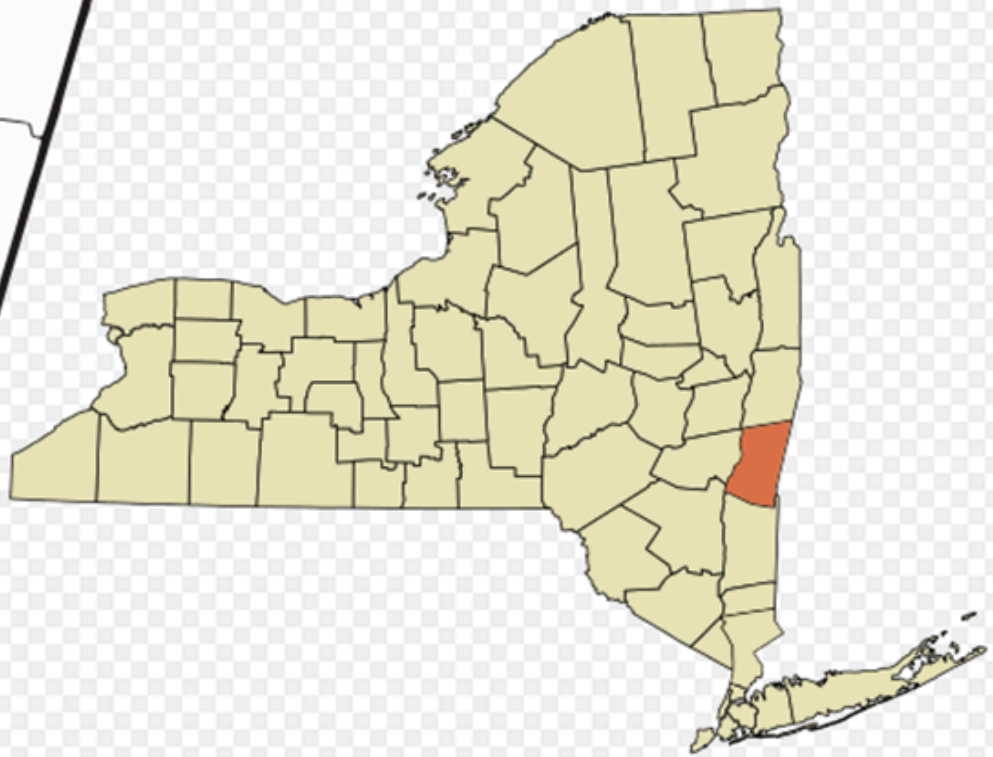
Learning Objectives

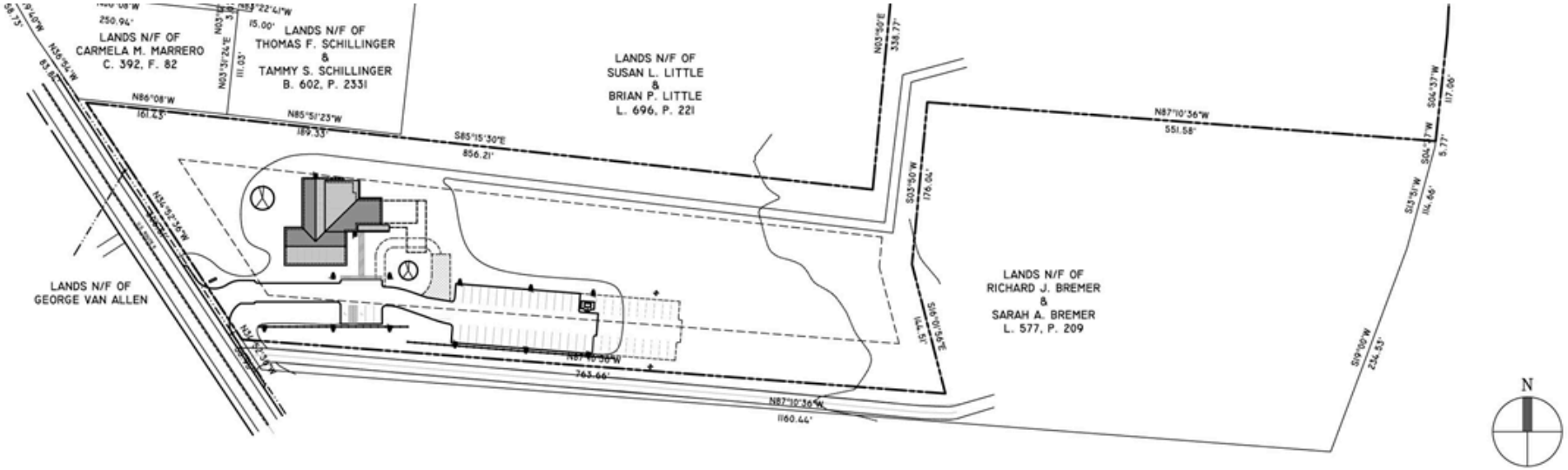
- An example of successful passive house construction for an institutional facility
- How occupants of a passive house church and community center experienced their new facility over two years of occupancy
- Ventilation control strategy for intermittently occupied facility with varying space usages
- Modeled vs measured energy consumption for a passive house church building in cold climate (CZ5)

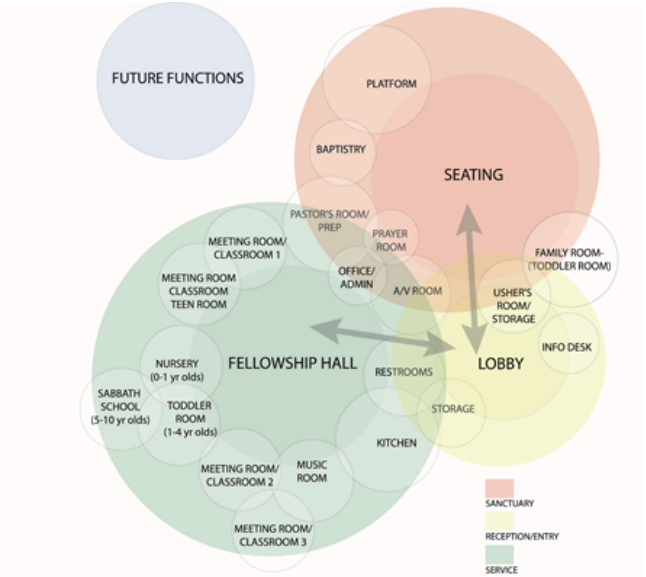
Seventh-day Adventist Church at Kinderhook

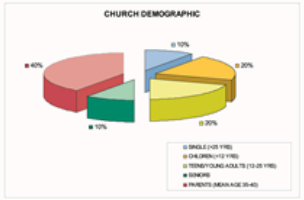
Valatie | NY

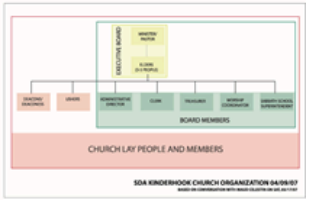


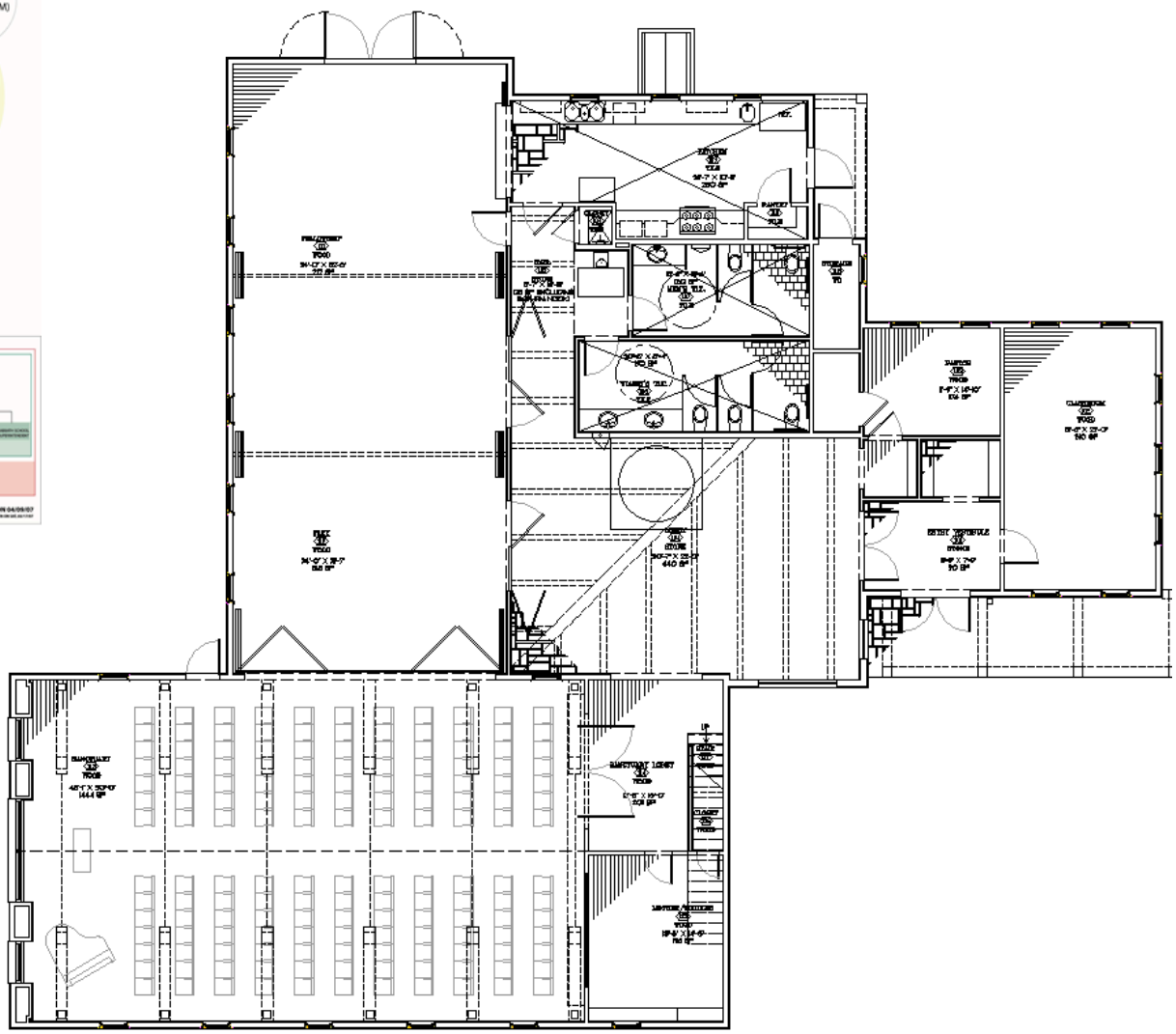



LANDS N/F OF
CARMELA M. MARRERO
C. 392, F. 82
250.94'
15.00'
LANDS N/F OF
THOMAS F. SCHILLINGER
&
TAMMY S. SCHILLINGER
B. 602, P. 233I
N03°35'24"E
111.03'
N86°08'W
161.25'
N85°51'23"W
189.33'
LANDS N/F OF
SUSAN L. LITTLE
&
BRIAN P. LITTLE
L. 696, P. 221
S85°15'30"E
856.21'
N03°50'E
338.77'
S03°50'W
176.04'
N87°10'36"W
551.58'
S04°37'W
117.66'
S04°37'W
5.77'
S03°51'W
114.66'
LANDS N/F OF
GEORGE VAN ALLEN
LANDS N/F OF
RICHARD J. BREMER
&
SARAH A. BREMER
L. 577, P. 209
S19°10'54"E
N87°10'36"W
763.66'
N87°10'36"W
1160.44'
S19°09'W
234.53'
N


FUTURE FUNCTIONS
PLATFORM
BAPTISTRY
SEATING
PASTOR'S ROOM/ PREP
PRAYER ROOM
MEETING ROOM/ CLASSROOM 1
FAMILY ROOM- (TODDLER ROOM)
OFFICE/ ADMIN
MEETING ROOM CLASSROOM TEEN ROOM
A/V ROOM
USHER'S ROOM/ STORAGE
INFO DESK
NURSERY (0-1 yr olds)
FELLOWSHIP HALL
RESTROOMS
LOBBY
SABBATH SCHOOL (5-10 yr olds)
TODDLER ROOM (1-4 yr olds)
STORAGE
KITCHEN
MEETING ROOM/ CLASSROOM 2
MUSIC ROOM
MEETING ROOM/ CLASSROOM 3
SANCTUARY
RECEPTION/ENTRY
SERVICE


CHURCH DEMOGRAPHIC
40%
10%
20%
10%
20%


BOARD MEMBERS
CHURCH LAY PEOPLE AND MEMBERS

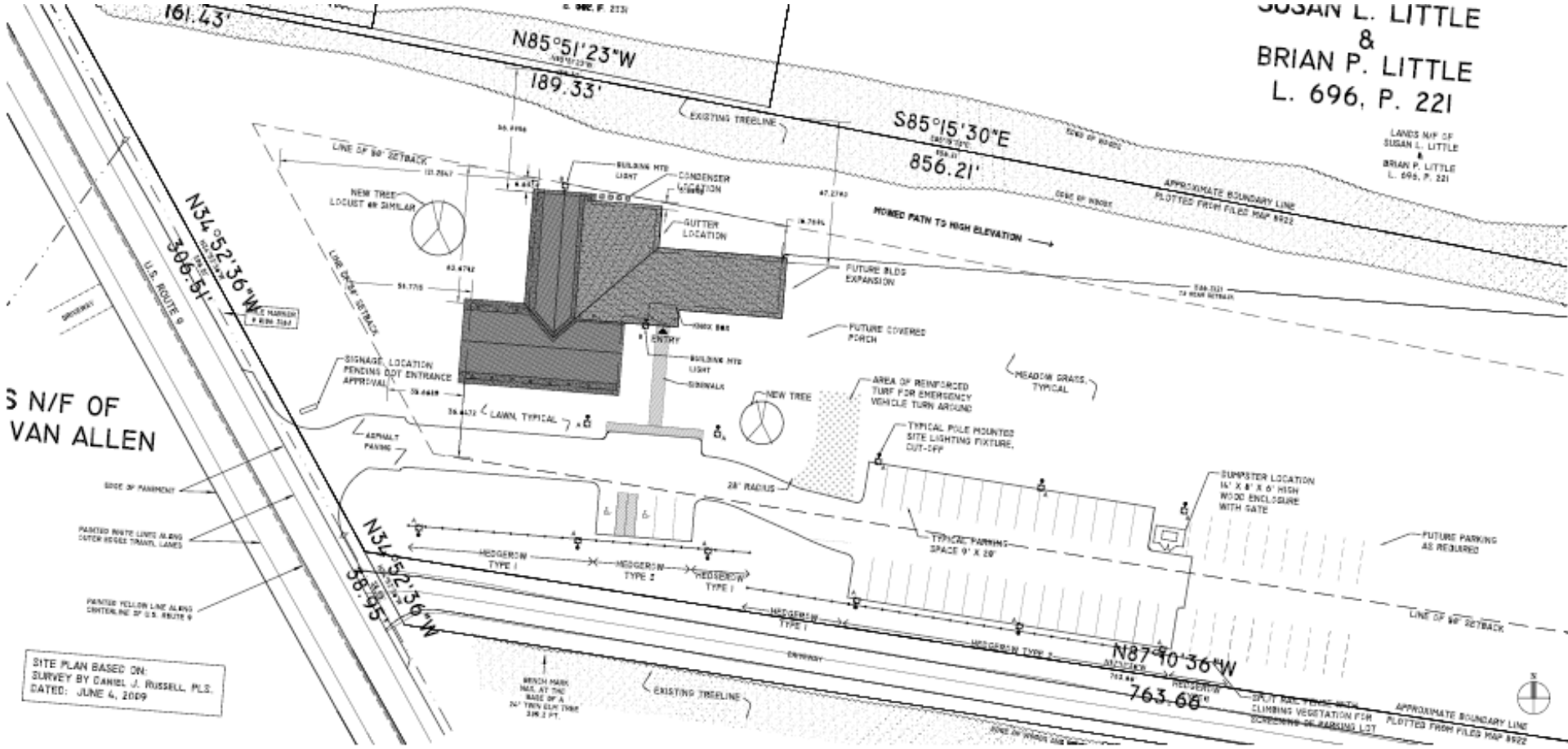


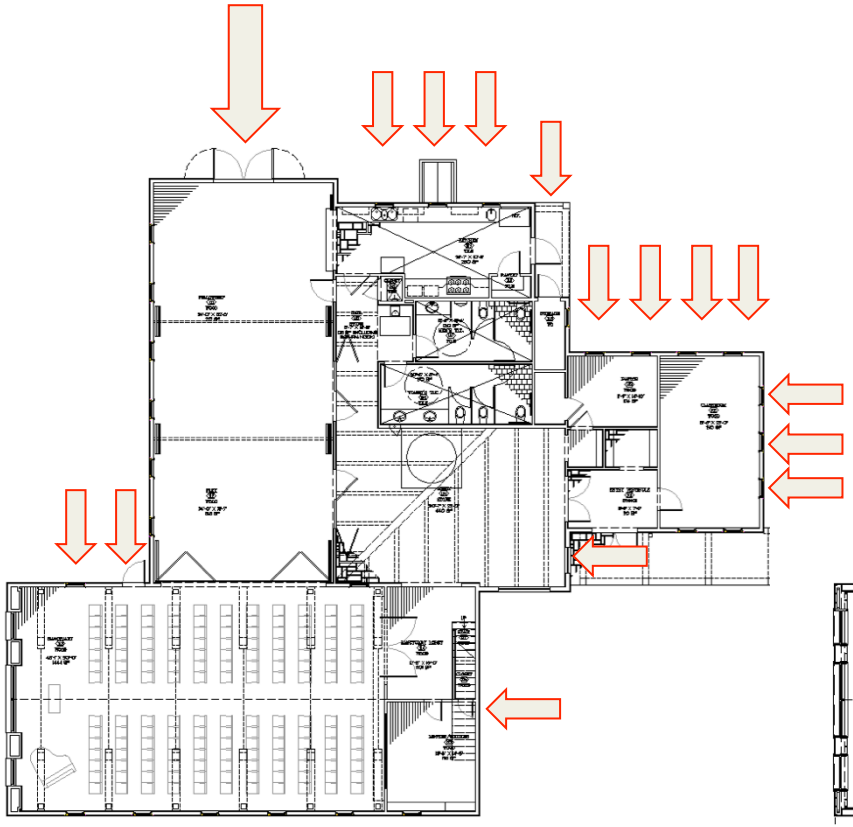
WEST

SOUTH

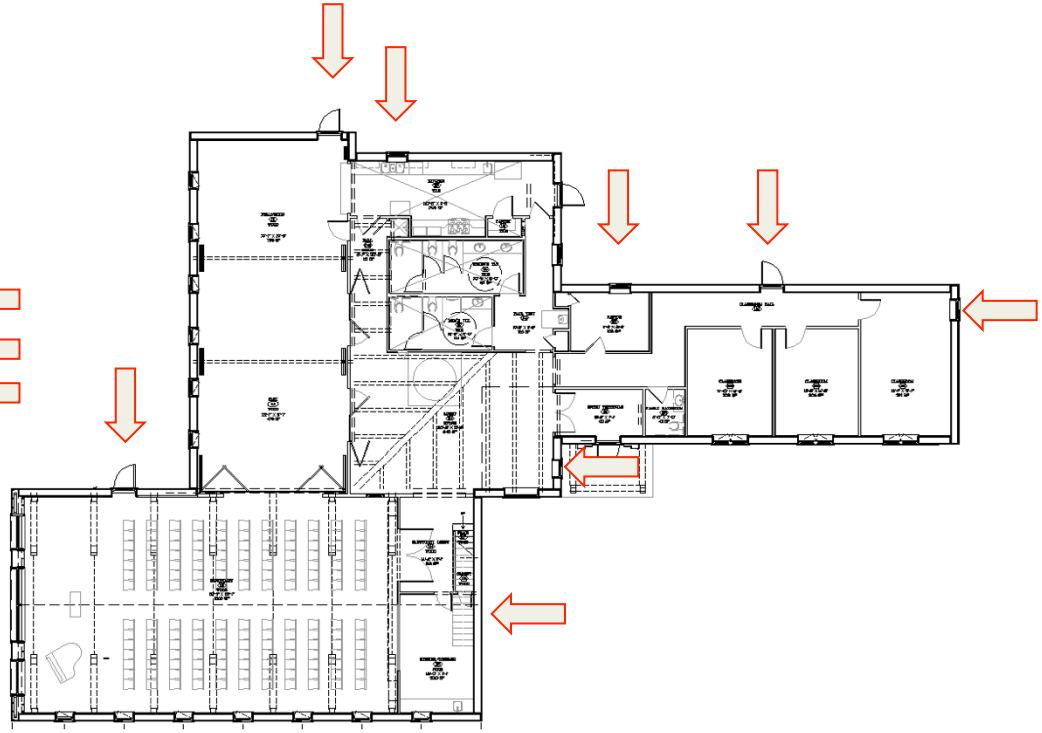
EAST

NORTH

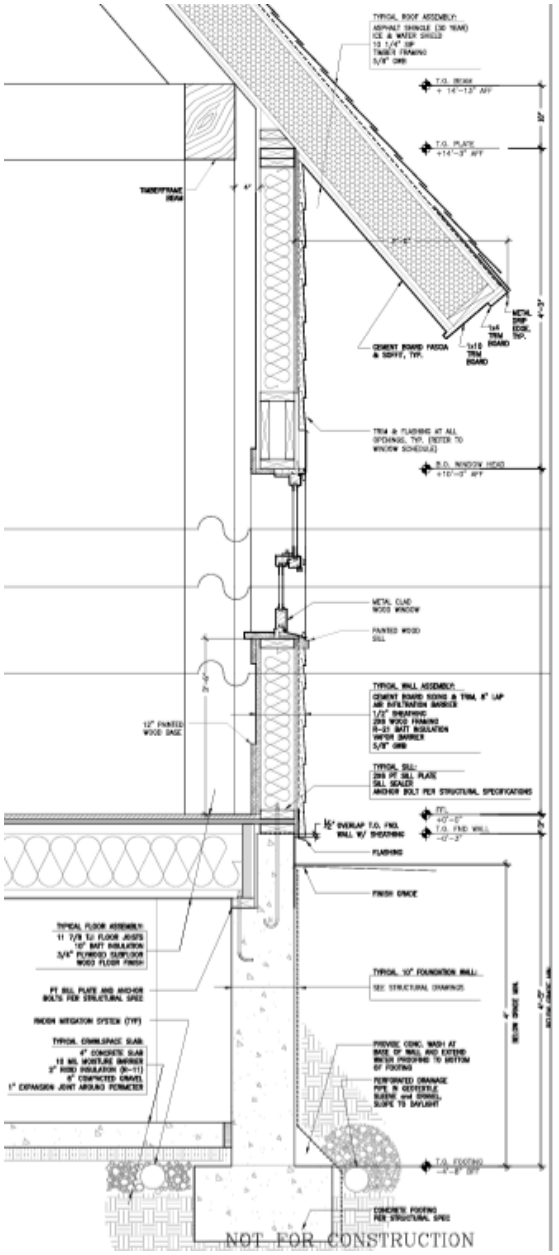

161.43'
N85°51'23"W
189.33'
EXISTING TREELINE
S85°15'30"E
856.21'
SUSAN L. LITTLE
&
BRIAN P. LITTLE
L. 696, P. 221
LANDS N/F OF
SUSAN L. LITTLE
&
BRIAN P. LITTLE
L. 696, P. 221
APPROXIMATE BOUNDARY LINE
PLOTTED FROM FILED MAP 8922
LINE OF 50' SETBACK
NEW TREE
LOCUST OR SIMILAR
BUILDING MTD LIGHT
CONDENSER LOCATION
GUTTER LOCATION
MOWED PATH TO HIGH ELEVATION
FUTURE BLDG EXPANSION
FUTURE COVERED PORCH
ENTRY
SIGNAGE LOCATION PENDING DOT ENTRANCE APPROVAL
SIDEWALK
NEW TREE
AREA OF REINFORCED TURF FOR EMERGENCY VEHICLE TURN AROUND
MEADOW GRASS, TYPICAL
LAWN, TYPICAL
ASPHALT PAVING
TYPICAL POLE MOUNTED SITE LIGHTING FIXTURE, CUT-OFF
28' RADIUS
DUMPSTER LOCATION
16' X 8' X 6' HIGH
WOOD ENCLOSURE
WITH GATE
TYPICAL PARKING
SPACE 9' X 20'
FUTURE PARKING
AS REQUIRED
HEDGEROW TYPE 1
HEDGEROW TYPE 2
HEDGEROW TYPE 1
HEDGEROW TYPE 1
HEDGEROW TYPE 2
HEDGEROW
LINE OF 50' SETBACK
N34°52'36"W
306.51'
N34°52'36"W
58.95'
N87°10'36"W
763.66'
S N/F OF
VAN ALLEN
U.S. ROUTE 9
EDGE OF PAVEMENT
PAINTED WHITE LINES ALONG OUTER EDGES TRAVEL LANES
PAINTED YELLOW LINE ALONG CENTERLINE OF U.S. ROUTE 9
DRIVEWAY
BENCH MARK
NAIL AT THE
BASE OF A
24" TWIN ELM TREE
EXISTING TREELINE
SPLIT RAIL FENCE WITH CLIMBING VEGETATION FOR SCREENING OF PARKING LOT
APPROXIMATE BOUNDARY LINE
PLOTTED FROM FILED MAP 8922
SITE PLAN BASED ON:
SURVEY BY DANIEL J. RUSSELL, PLS.
DATED: JUNE 4, 2009



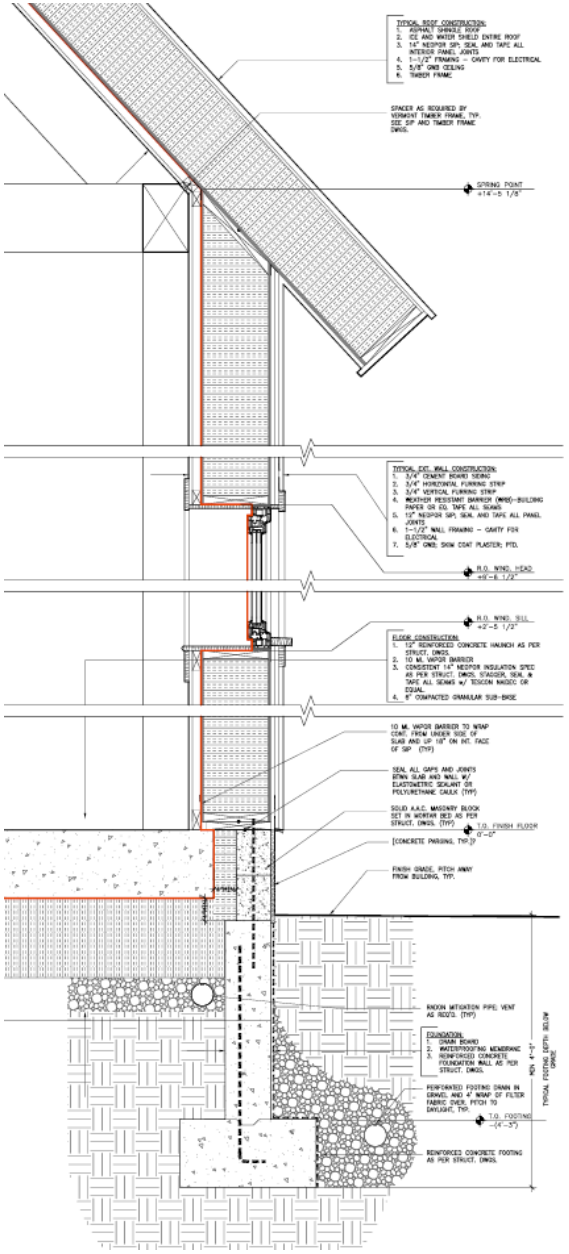
ORIGINAL SOLAR PASSIVE DESIGN



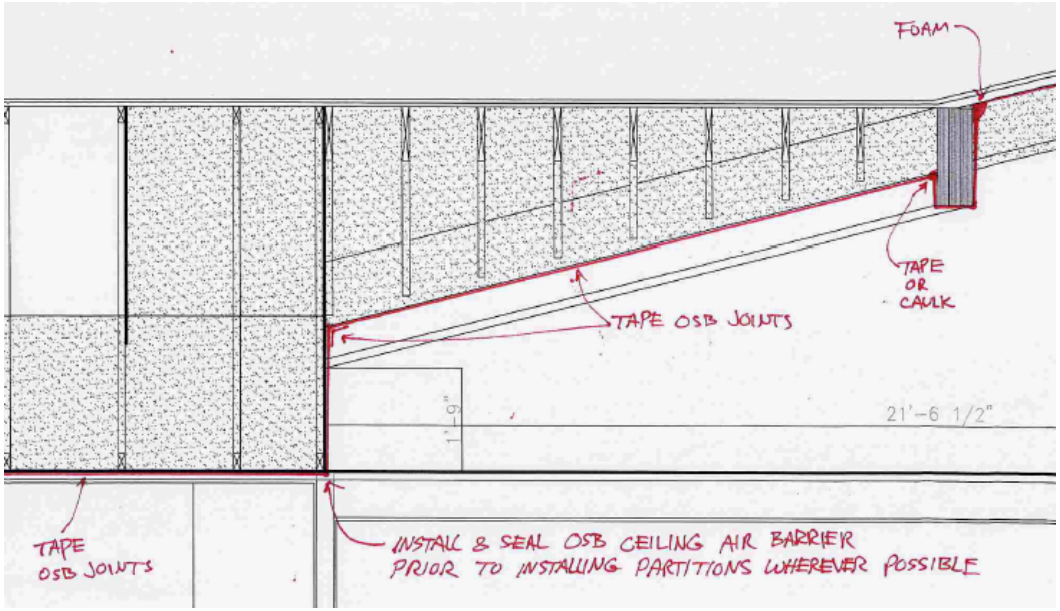
PASSIVE HOUSE DESIGN

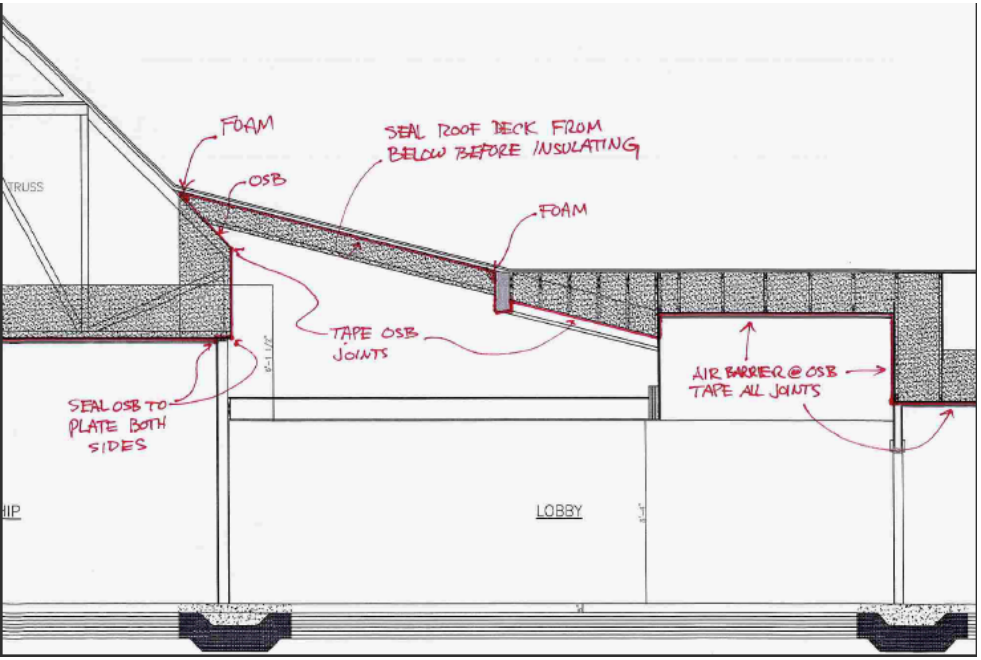


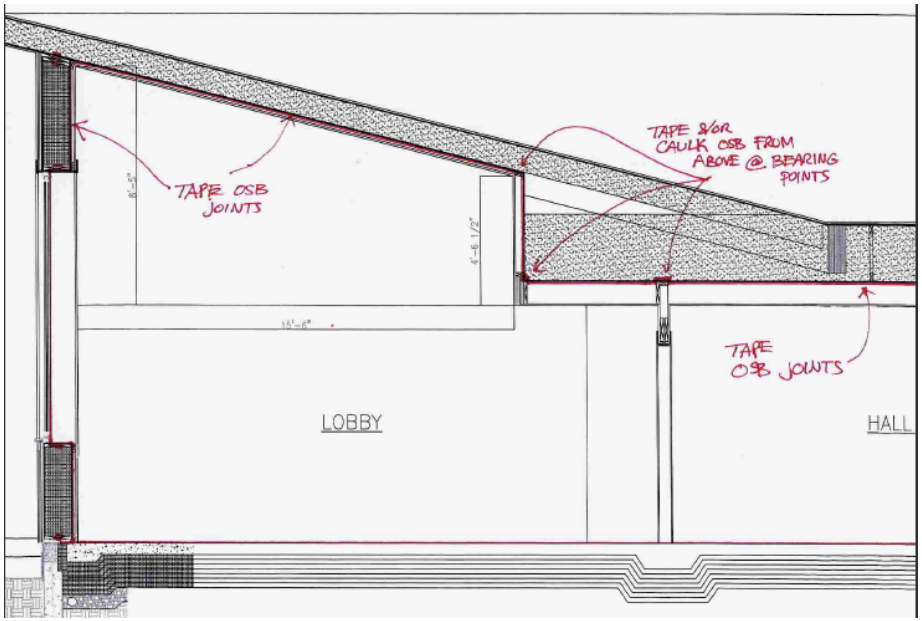
ORIGINAL PASSIVE SOLAR DESIGN



PASSIVE HOUSE DESIGN


FOAM
TAPE OR CAULK
TAPE OSB JOINTS
21'-6 1/2"
TAPE OSB JOINTS
INSTALL & SEAL OSB CEILING AIR BARRIER PRIOR TO INSTALLING PARTITIONS WHEREVER POSSIBLE


FOAM
SEAL ROOF DECK FROM BELOW BEFORE INSULATING
OSB
FOAM
TAPE OSB JOINTS
SEAL OSB TO PLATE BOTH SIDES
AIR BARRIER @ OSB TAPE ALL JOINTS
LOBBY


TAPE OSB JOINTS
TAPE &/OR CAULK OSB FROM ABOVE @ BEARING POINTS
TAPE OSB JOINTS
LOBBY
HALL


BARLIS
WEDLICK

	SDA CHURCH - ESTIMATED "TYPICAL" OCCUPANCY PATTERN						
	Space	**Number of days occupied per year**	**PHPP ENTRY - Number of days occupied per year**	**Number of occupants**	**PHPP ENTRY - Number of occupants**	**Typical occupancy start time of day**	**Typical occupancy end time of day**
Saturday	**Sanctuary 1**	52	**65**	20	**25**	10:00 AM	10:15 AM
	Classrooms	52	**65**	20	**25**	10:15 AM	11:00 AM
	Sanctuary 2	52	**65**	75	**94**	11:00 AM	1:00 PM
	Fellowship 1	52	**65**	40	**50**	1:00 PM	3:00 PM
	Kitchen	52	**65**	4	**5**	12:30 PM	3:00 PM
Other Use	**Fellowship 2**	21	**26**	30	**38**	6:00 PM	8:00 PM
	Classrooms	21	**26**	30	**38**	2 hours	varies
	Kitchen	21	**26**	4	**5**	2 hours	varies
	Pastor's Office	104	**130**	1	**1**	9:00 AM	1:00 PM

Occupant Feedback

1. Overall Design
2. Air Quality
3. User Comfort
4. Systems

- PHPP modeled energy consumption compared to code baseline
- actual energy consumption compared to PHPP model
- ventilation system design, operation, occupant feedback and potential improvements

Energy Demands with Reference to the Treated Floor Area

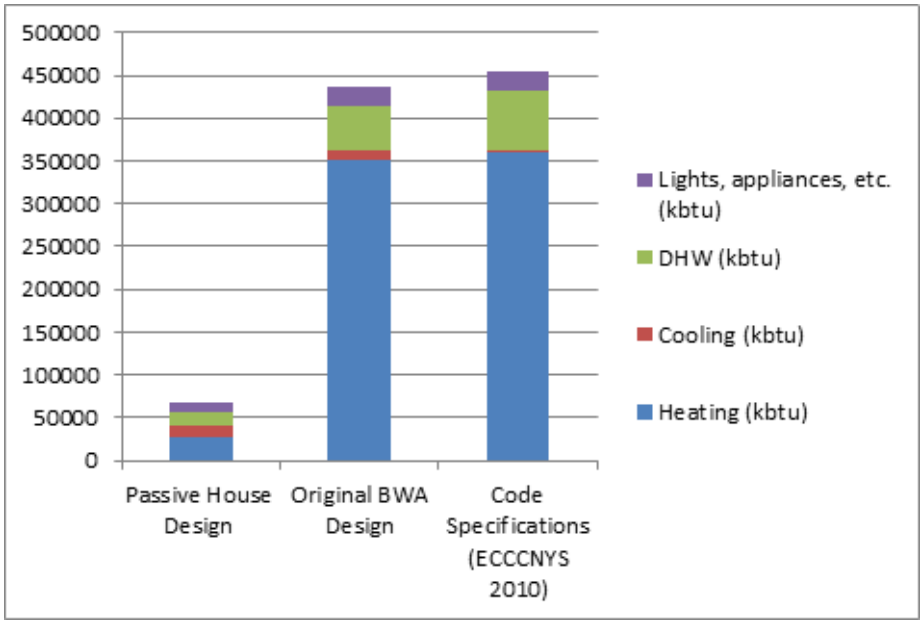
Treated Floor Area: 6538 ft^2

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	3.40	kBTU/(ft^2yr)	4.75 kBTU/(ft^2yr)	Yes
Pressurization Test Result:	0.56	ACH_{50}	0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	29.0	kBTU/(ft^2yr)	38.0 kBTU/(ft^2yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	23.7	kBTU/(ft^2yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kBTU/(ft^2yr)		
Heating Load:	3.35	BTU/(ft^2hr)		
Frequency of Overheating:		%	over 77.0 °F	
Specific Useful Cooling Energy Demand:	1.39	kBTU/(ft^2yr)	4.75 kBTU/(ft^2yr)	Yes
Cooling Load:	1.74	BTU/(ft^2hr)		

Heating Setpoint assumptions	Htg load (kbtu/hr)	Days	Setpoint	Hourly weighted avg
Main space	25.4	6 days	60	61.14
		1 day	68	
Pastor's office	1.16	7 days	60/68	67
Load weighted hourly average				**61.40**

Modeled (PHPP) annual energy use

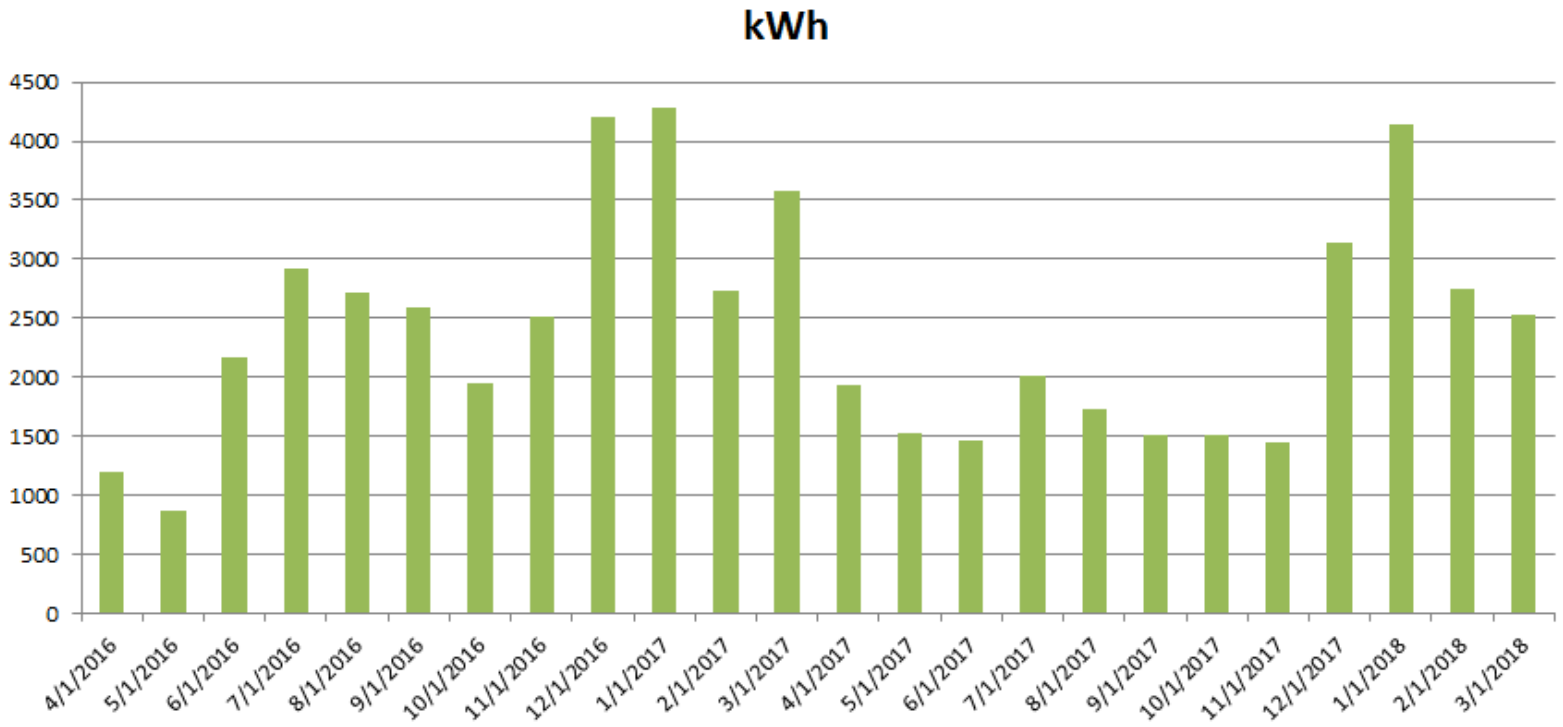
End Use	Passive house design (as planned)	Code specifications (ECCCNYS 2010)
Heating (kbtu)	6,538	361,028
Cooling (kbtu)	2,223	11,507
DHW (kbtu)	49,689	52,304
Lights, appliances, etc. (kbtu)	11,115	22,229
Total site energy (kbtu)	**69,564**	**447,068**
Total primary energy (kbtu)	**189,602**	**538,731**
Emissions (lbs. CO_2)	**25,498**	**80,417**



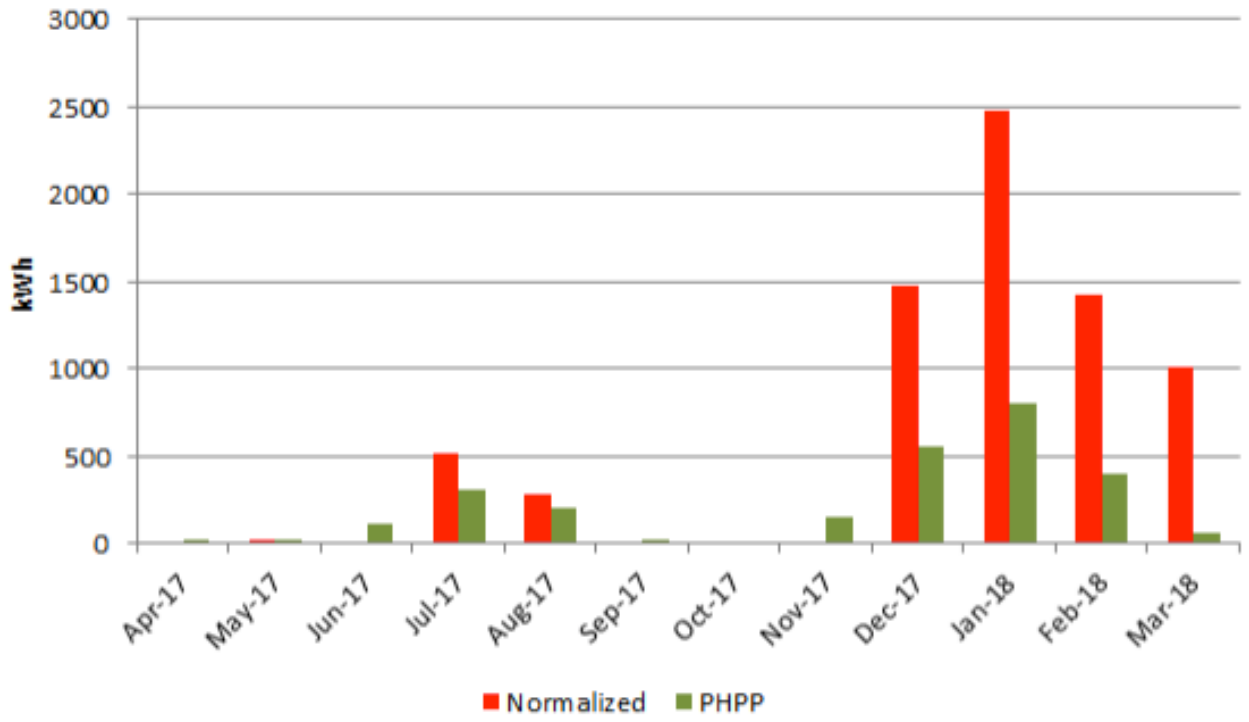
Modeled (PHPP) annual energy savings

Performance measure	Savings compared to code minimum requirements
Total site energy	78%
Total primary energy	66%
Carbon emissions	63%

Measured site energy use

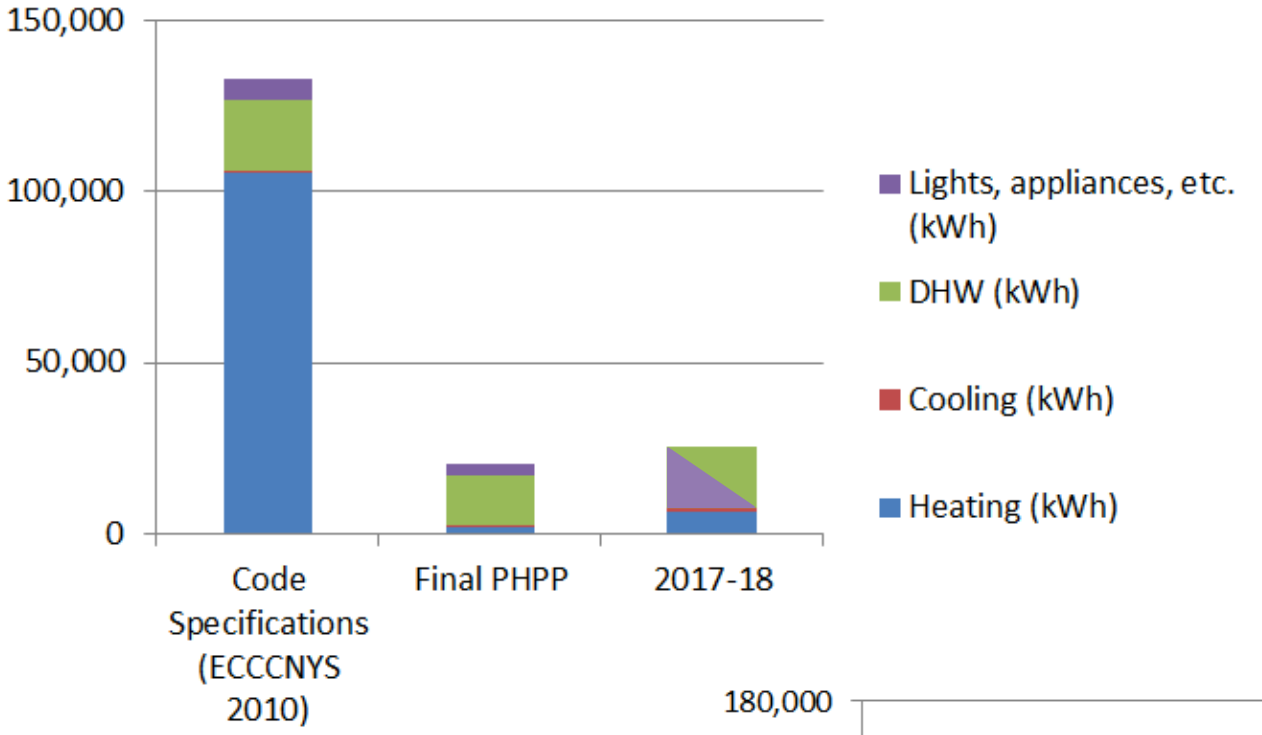


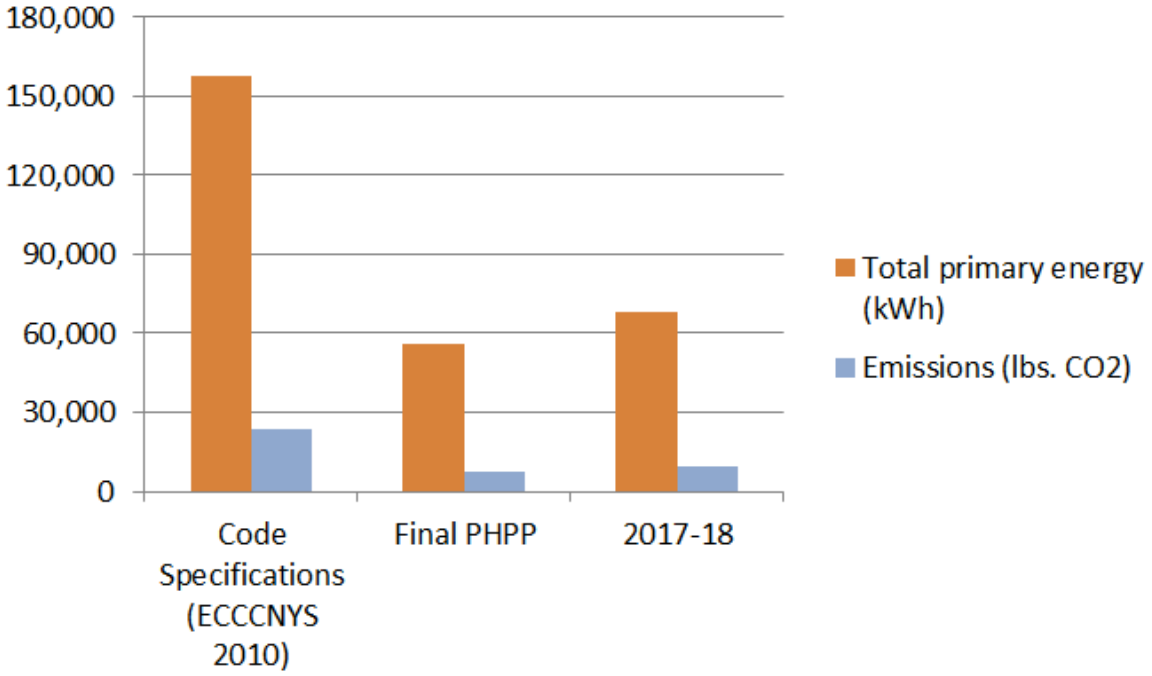
Normalized cooling and heating energy use compared to PHPP model

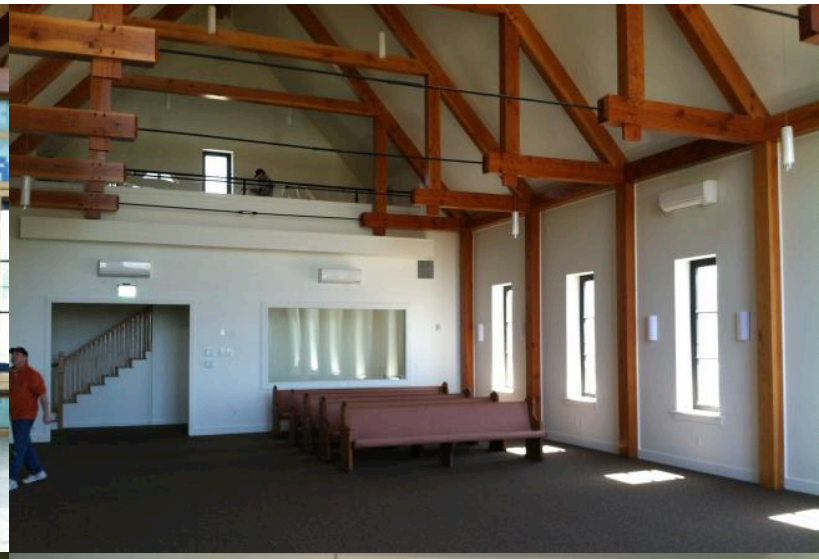


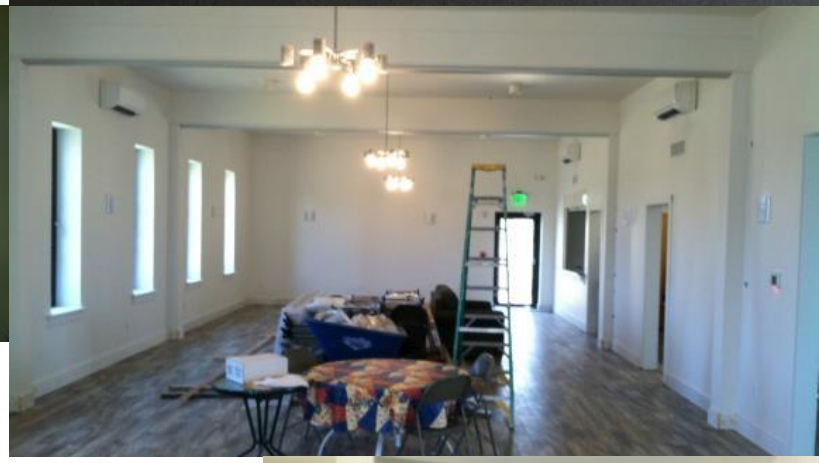
2017-18 kWh	Normalized	PHPP
Total heating	6,386	1,951
Total cooling	810	653
Total primary energy	75,588	55,567

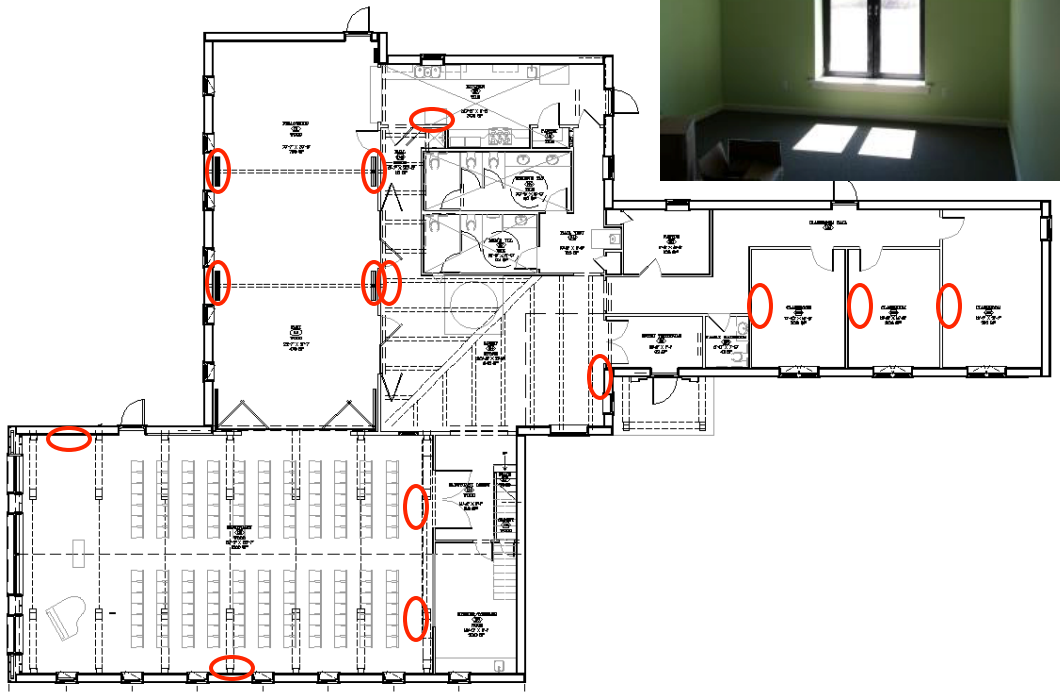
Modeled (PHPP) vs. normalized annual energy use

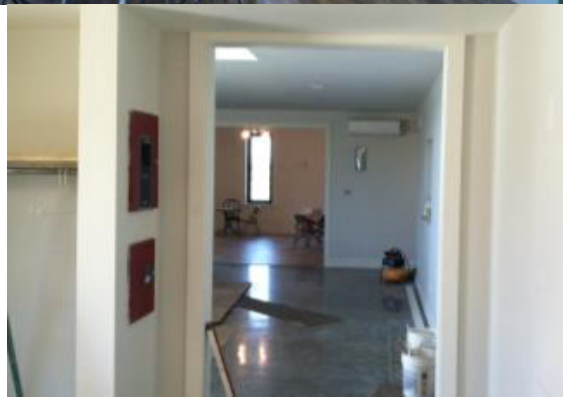












Supply ducts - Blue

Return ducts - Red

Ultimate Air RecoupAerator 2000DX

ENERGY RECOVERY UNIT SEQUENCE OF OPERATION

Occupied Mode:

1. The BMS system shall automatically or manually index the ERV into occupied mode. When ERV is indexed to occupied mode the supply and exhaust fans shall run continuously. Bathroom fan shall run continuously. The ERV unit shall be set to medium speed at 720 CFM air flow. Zone Damper ZD−2 shall be 100 % opened, zone damper ZD−1,3,4,5 shall be 10 % opened. If the occupancy sensor calls for responding damper that damper shall modulate to 30 % open position. If the CO2 level goes up the zone damper shall modulate to open position. If the CO2 level goes down below 450 PPM zone damper shall modulate down to 30% open position. If three zone dampers are at 30% position the ZD−2 shall modulate to 50 % open position. The supply and exhaust fan speed shall be adjusted based on the duct pressure sensor.

2. The heat recovery wheel shall operate under its internal controls and eliminate frost as required by operating conditions.

3. Depending on total heat (enthalpy) of the outside air, there will be times when the space may benefit from free cooling. The energy management system shall calculate when free cooling would be beneficial. If the free cooling is available zone dampers shall modulate to maintain temperature and humidity set points.

4. Free cooling mode of operation, enable the supply and exhaust air fans with the heat recovery wheel off.

5. If low limit sensor senses temperature below 38 deg. F (adjustable) shall cause the ERV to shutdown, supply and exhaust fans shall go off and send alarm to BMS system.

6. In case of signal from fire alarm system shall cause unit to shutdown.

Unoccupied Mode:

1. The supply and exhaust fans shall be off.
2. The outside air damper and exhaust air damper shall be fully closed.
3. Bathroom exhaust fan shall be off.

Lessons Learned

1. Can take time for issues with systems to become apparent; therefore there should be a scheduled break-in period for each season (heating and cooling), after which occupants meet with designers to review issues and plan corrections. Ideally this would be built into the project plan and budget from the start.

2. Commissioning should include educating the occupants on things like thermostat setback and programming, and systems operation.

3. Educate occupants regarding what to expect in terms of utility bills so they can spot inconsistencies that may indicate problems.

4. Often a disconnect between mechanical design intent and occupant understanding.

5. Identify the right people to educate and make sure more than a few people know the system, especially in a project like a church where volunteers are running the building and may change over time. Document the major building operational guidelines and contact points.

6. Provide clients with a clear list of who to call when issues arise; it is likely that both heating and ventilation issues could have been corrected sooner if building operators connected with the proper people.

Liza Paredes

BarlisWedlick Architects

85 Worth Street Fourth Floor

New York, New York 10013

and

17 North Fourth Street

Hudson, New York 12534

212-625-9222

www.barliswedlick.com

Jordan Dentz

The Levy Partnership

1776 Broadway

Suite 1250

New York, New York 10019

212-496-0800 x130

jdentz@levypartnership.com

www.levypartnership.com