

<b>Project Information</b>
Milestone NW LLS Mercer Island - Lot 2 7619 SE 22nd St., Mercer Island, WA 98040
<b>Contact Information</b>
Architectural Innovations, P.S. 14311 SE 16th St., Bellevue, WA 98007 425-641-5320

<b>Messages / Comments *</b>	<b>RESULT= PASS</b>
UA Reduction = 4.95, Proposed UA is better than baseline by 1%  Vertical glazing area of proposed design exceeds 15% of floor area. Baseline window area set to 15% of floor area  Whole House Mechanical Ventilation Airflow Rate: 112.5 CFM with Run Time Percent of 100%, Unbalanced, Not Distributed Maximum allowable total measured duct leakage: 272 CFM25	

\* Results assume your inputs are complete and correct. Results do not constitute an approval. Analysis should be reviewed by your AHJ.

<b>ANALYSIS SET UP</b>	
What code compliance pathway are you using? Project Building Type? Occupancy Type? Code Version? Classification: Baseline Description: About Your Selection:	Total UA Alternative, Whole Building Trade Off Analysis New Construction R3 Single family dwellings and townhouses WSEC 2021 Medium Dwelling Unit -- 3406 sq. ft. Code Baseline - Maximum baseline window area is 15% of floor area. No exempt window or door areas

<b>RESULTS - Comparison of Baseline and Proposed Design **</b>																																																																																																																
<b>Component Performance, R occupancies</b>	<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">Baseline Design</th> <th colspan="3">Proposed Design</th> </tr> <tr> <th>U *</th> <th>Area</th> <th>UA</th> <th>U</th> <th>Area</th> <th>UA</th> </tr> </thead> <tbody> <tr> <td>Doors U =</td> <td>0.300</td> <td>49</td> <td>14.8</td> <td>0.300</td> <td>49</td> <td>14.8</td> </tr> <tr> <td>Overhead Glazing U =</td> <td>0.500</td> <td>0</td> <td>0.0</td> <td></td> <td>0</td> <td>0.0</td> </tr> <tr> <td>Vertical Glazing U =</td> <td>0.300</td> <td>511</td> <td>153.3</td> <td>0.250</td> <td>770</td> <td>192.4</td> </tr> <tr> <td>Flat/Vaulted Ceilings U =</td> <td>0.024</td> <td>1,567</td> <td>37.6</td> <td>0.027</td> <td>1,567</td> <td>42.3</td> </tr> <tr> <td>Wall (above grade) U =</td> <td>0.056</td> <td>2,640</td> <td>147.8</td> <td>0.054</td> <td>2,381</td> <td>128.6</td> </tr> <tr> <td>Floors over Crawlspace U =</td> <td>0.029</td> <td>584</td> <td>16.9</td> <td>0.025</td> <td>584</td> <td>14.6</td> </tr> <tr> <td>Slab on Grade F =</td> <td>0.540</td> <td>88</td> <td>47.5</td> <td>0.360</td> <td>88</td> <td>31.7</td> </tr> <tr> <td>Below Grade Wall U =</td> <td>0.040</td> <td>912</td> <td>36.5</td> <td>0.064</td> <td>912</td> <td>58.4</td> </tr> <tr> <td>Below Grade Slab F =</td> <td>0.560</td> <td>141</td> <td>79.0</td> <td>0.324</td> <td>141</td> <td>45.7</td> </tr> <tr> <td></td> <td colspan="2">* Values from Table R402.1.2 (Oct 2023)</td> <td></td> <td colspan="3"></td> </tr> <tr> <td></td> <td><b>Baseline UA Total</b></td> <td>533.4</td> <td></td> <td><b>Proposed UA Total</b></td> <td>528.5</td> <td></td> </tr> <tr> <td></td> <td><b>Required Credits</b></td> <td>8.0</td> <td></td> <td><b>Proposed Credits</b></td> <td>8.0</td> <td>from Tables 406.2 and 406.3</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td><b>UA Percent Reduction</b></td> <td>1%</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td><b>UA Reduction</b></td> <td>5.0</td> <td></td> </tr> </tbody> </table>		Baseline Design			Proposed Design			U *	Area	UA	U	Area	UA	Doors U =	0.300	49	14.8	0.300	49	14.8	Overhead Glazing U =	0.500	0	0.0		0	0.0	Vertical Glazing U =	0.300	511	153.3	0.250	770	192.4	Flat/Vaulted Ceilings U =	0.024	1,567	37.6	0.027	1,567	42.3	Wall (above grade) U =	0.056	2,640	147.8	0.054	2,381	128.6	Floors over Crawlspace U =	0.029	584	16.9	0.025	584	14.6	Slab on Grade F =	0.540	88	47.5	0.360	88	31.7	Below Grade Wall U =	0.040	912	36.5	0.064	912	58.4	Below Grade Slab F =	0.560	141	79.0	0.324	141	45.7		* Values from Table R402.1.2 (Oct 2023)							<b>Baseline UA Total</b>	533.4		<b>Proposed UA Total</b>	528.5			<b>Required Credits</b>	8.0		<b>Proposed Credits</b>	8.0	from Tables 406.2 and 406.3					<b>UA Percent Reduction</b>	1%						<b>UA Reduction</b>	5.0	
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<b>Table R406.2 Energy Equalization Credits</b>					
System No.	Full Description	Select System Type	Fuel Normalization Credits (406.2)	Energy Credits (406.3)	Total Credits (406.2 & 406.3)
4	For heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) or Table C403.3.2(9) OR Air to Water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590	Variable Refrigerant Heat Pump or Air-to-Water Heat Pump	3.0	5.0	8.0

<b>Table R406.3 Energy Credits</b>				
Option No.	Category	Select Options	Energy Credits	Brief Description of Selected Options*
1	Efficient Building Envelope	Not Selected	0.0	-
2	Air Leakage Control and Efficient Ventilation	Option 2.2	1.5	Per Section R402.4.1.2 / 1.5 ACH50 / For R-2, 0.20 cfm per ft2 at 50 Pa. / HRV with min SHR eff of 0.75 per IRC Section M1505.3 or IMC Section 403.8
3.1 -3.10	High Efficiency HVAC	Option 3.6	1.0	Air source ducted Heat Pump w/ Min HSPF2 of 10 (HSPF of 11). If htg design temp is 23F or below, a cold climate variable capacity heat pump is required.
3.11	High Efficiency HVAC: Smart Thermostat	Not Selected	NA	
4	High Efficiency HVAC Distribution System	Option 4.1	0.5	Ducts/distribution system in conditioned space per R403.3.2 Electric resistance, hydronic, ductless and gas fired systems < 80% AFUE systems not permitted

5.1	Efficient Water Heating: Drain Heat Recovery			Not Selected	0.0	-
5.2	Efficient Water Heating: Compact Hot Water Distribution			Not Selected	0.0	-
5.3-5.8	Efficient Water Heating			Option 5.6	2.0	Electric heat pump water heater meeting NEEA Tier 3.
6	Renewable Electric Energy	3,000	kWh	Not Selected	0.0	
7	Appliance Package			Not Selected	0.0	-
<b>Energy Credits</b>					<b>5.0</b>	

\*Refer to WSEC 2021 Table R406.3 for complete option descriptions and requirements

<https://sbcc.wa.gov/state-codes-regulations-guidelines/state-building-code/energy-code>

**THERMAL ENVELOPE DETAILS - Proposed Design**

Conditioned Floor Area, Proposed Design		3,406	sq. ft
Classification Medium Dwelling Unit			
Notes			

Exterior Doors										
Plan ID	Component Description	Ref.	Door U	Qt.	Width		Height		Area	UA
					Feet	Inch	Feet	Inch		
Mud	Code Baseline, U=0.30	-	0.30	1	2	8	8	0	21	6.4
Entry	Code Baseline, U=0.30	-	0.30	1	3	6	8	0	28	8.4
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
Sum of Area and UA									49	14.8
Exterior Doors Area Weighted U										0.300

Overhead Glazing										
Plan ID	Component Description	Ref.	Glazing U	Qt.	Width		Height		Area	UA
					Feet	Inch	Feet	Inch		
									-	-
									-	-
									-	-
									-	-
Sum of Area and UA									0.0	0
Overhead Glazing Area Weighted U										

Vertical Glazing Schedule											Rows to Show	
Plan ID	Component Description	Ref.	Glazing U	Qt.	Width		Height		Area	UA		
					Feet	Inch	Feet	Inch				
1	Rec.Rm.	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	3	0	5	6	16.5	4.13	28
2	Rec.Rm.	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	5	0	5	6	55.0	13.75	
3	Rec.Rm.	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	3	0	8	0	24.0	6.00	
4	Bdrm#4	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	6	0	5	6	33.0	8.25	
5	Bdrm#4	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	0	5	6	27.5	6.88	
6	Entry	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	6	5	6	13.8	3.44	
7	Stairway	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	6	6	6	16.3	4.06	
8	Stairway	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	0	6	6	35.8	8.94	
9	Great Rm	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	4	0	5	6	44.0	11.00	
10	Great Rm	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	9	0	5	6	49.5	12.38	
11	Dining	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	8	0	5	6	44.0	11.00	
12	Kitchen	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	0	4	6	22.5	5.63	
13	Kitchen	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	4	5	0	26.7	6.67	
14	Kitchen	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	8	8	0	21.3	5.33	
15	Pwdr	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	6	5	6	13.8	3.44	
16	Hall	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	4	0	4	6	36.0	9.00	
17	Hall	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	4	0	3	0	24.0	6.00	
18	Hall	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	6	4	6	11.3	2.81	
19	Stairway	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	2	6	10	0	25.0	6.25	
20	Stairway	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	6	10	0	55.0	13.75	
21	Utility	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	3	6	4	6	15.8	3.94	
22	Bdrm#3	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	6	0	4	6	27.0	6.75	
23	P.Suite	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	8	0	4	6	36.0	9.00	
24	P.Suite	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	2	6	2	0	10.0	2.50	
25	P.Bath	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	5	6	4	6	24.8	6.19	
26	P.Bath	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	2	6	4	6	22.5	5.63	
27	Bdrm#2	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	1	6	0	4	6	27.0	6.75	
28	Bath#2	U=0.25 (2021 1.2; 2018 1.4)	Table 406.2	0.25	2	2	0	3	0	12.0	3.00	
Sum of Area and UA									769.8	192.4		
Vertical Glazing Area Weighted U										0.250		
Vertical Glazing and Doors Area Weighted U										0.253		

Flat/Vaulted Ceilings						
Plan ID	Component Description	Ref.	Attic U		Area	UA

	R49 blown Attic STD baffled (2018 Code Baseline, 1.1.1)	10-7	0.027		1,567	42.3
Sum of Area and UA					1,567	42.3
Area Weighted U-Value						0.027

Walls (Above Grade)						
Plan ID	Component Description	Ref.	Wall U		Net Area	UA
	R21 cavity+R0 foam INT 2X6W Lap (Code Baseline)	10-5	0.054		2,381	129
Sum of Net Area and UA					2,381	129
Gross Wall Area					3,200	ft <sup>2</sup>
Area Weighted U-Value						0.054

Floor (over crawl or exterior)						
Plan ID	Component Description	Ref.	Floor U		Area	UA
	R38 vented Joist (2021 1.2, 1.3; 2018 1.3-1.5)	10-3	0.025		584	15
Sum of Area and UA					584	15
Area Weighted U-Value						0.025

Slab on Grade (less than 2 feet below grade)						
Plan ID	Component Description	Ref.	Slab F		Slab Perim	FP
	R10 Fully insulated (2018 1.3-1.5)	10-2	0.360		88	32
Sum of Perimeter and FP					88	32
Area Weighted U-Value						0.360

Below Grade Walls and Slabs										
Plan ID	Component Description	Slab Depth	Ref.	Wall U	Wall Area	Wall UA	Slab F	Slab Perim	Slab UA	
	R10 Foam Ext w/TB, R10 Full Underslab	3.5' depth	Baylon & Ker	0.064	912	58.4	0.324	141	46	
Sum of Area, Length and UA					912	58		141	46	
Weighted U- and F-values						0.064			0.324	

Links to Download Forms, Checklists and Other Resources		Link
Compliance Certificate		<a href="#">Compliance Certificate</a>
Insulation Certificate for Residential New Construction		<a href="#">Insulation Certificate</a>
Duct Testing Affidavits		
	Existing Construction	<a href="#">Affidavit, Existing</a>
	New Construction	<a href="#">Affidavit, New</a>
Prescriptive Checklist for 2018 WSEC		<a href="#">Prescriptive Checklist</a>
Alterations (Remodel) Worksheet		<a href="#">Worksheet</a>
EER SEER2 COP HSPF2 Converter		<a href="https://www.adicotengineering.com/eer-seer2-cop-hspf2-kwton-converter">https://www.adicotengineering.com/eer-seer2-cop-hspf2-kwton-converter</a>

Show Ventilation Calculator?	Show
<b>Ventilation Requirements</b>	
Conditioned Floor Area	3,406 sq. ft.
Number of Bedrooms	4
Run-Time Percent in Each 4-Hour Segment	100%
Is the system Balanced?	Unbalanced
Is the system Distributed?	Not Distributed
Ventilation Code Section	IRC, Chapter 15
Whole House Mechanical Ventilation Airflow Rate	113 CFM

Show Distribution System Calculator?	Show
<b>HVAC Thermal Distribution System</b>	
Download RS-33 (2018)	<a href="http://www.energy.wsu.edu/Documents/Duct%20Testing%20Standards%20_2018%20">http://www.energy.wsu.edu/Documents/Duct%20Testing%20Standards%20_2018%20</a>
Is this a hydronic heating system?	No
Location of Ducts	Conditioned Space
Location of Air Handler	Conditioned Space
Is Duct Testing Required?	Yes
Maximum Duct Leakage:	
Maximum total measured duct leakage per square foot	0.08 CFM25 per sq. ft.
Maximum allowable total measured duct leakage	272 CFM25
A maximum of 10 feet of return ducts and 5 feet of supply ducts are allowed to be located outside of the building thermal envelope, if insulated and sealed per R403.3.7.	

Show Heating System Sizing?	Show
<b>Heating System Sizing - Proposed Design</b>	
Try Out BetterBuiltNW's HVAC Sizing Tool:	<a href="https://betterbuiltnw.com/resources/hvac-sizing-tool">https://betterbuiltnw.com/resources/hvac-sizing-tool</a>
Nearest Weather Station	Mercer Island
Indoor Design Temperature	70 F
Outdoor Design Temperature	25 F
Design Temperature Difference (ΔT)	45 F
Conditioned Floor Area, Proposed Design	3,406 ft2

<b>Conditioned Volume</b> <small>Leave blank to use default of 8.5 ft. ceiling height</small>	<input type="text" value="33,038"/> ft <sup>3</sup>	<b>Average ceiling height =9.7 ft. Volume = 33038 ft<sup>3</sup></b>
<b>Average ceiling height</b>	<input type="text" value="9.7"/> ft	
<b>HVAC System Type</b>	<input type="text" value="Heat Pump"/>	
<b>Location of HVAC Distribution System</b>	<input type="text" value="Conditioned Space"/>	
<b>Sum of UA</b>	<input type="text" value="528"/>	
<b>Envelope Heat Load</b> <small>Sum of UA X ΔT</small>	<input type="text" value="23,780"/> Btu / Hour	
<b>Air Leakage Heat Load</b> <small>((Volume X 0.6) X ΔT) X .018))</small>	<input type="text" value="16,056"/> Btu / Hour	
<b>Building Design Heat Load</b> <small>Air Leakage + Envelope Heat Loss</small>	<input type="text" value="39,837"/> Btu / Hour	
<b>Building and Duct Heat Load</b> <small>For ducts located in unconditioned space: Sum of Building Heat Loss X 1.1 For ducts located in conditioned space or ductless: Sum of Building Heat Loss X 1</small>	<input type="text" value="39,837"/> Btu / Hour	
<b>Maximum Heat Equipment Output</b> <small>Building and Duct Heat Loss X 1.25 for heat pumps Building and Duct Heat Loss X 1.40 for all other systems</small>	<input type="text" value="49,796"/> Btu / Hour	<input type="text" value="14.6"/> kW