

5 Sustainability

Health

Designing for the health and wellbeing of the residents is an important consideration for this project. Extensive daylight analysis is being performed to ensure that all units have ample daylight when its available, while ensuring solar control. The building is also designed for exceptional air quality with cross ventilation within units being a consideration in the design of the building. The building also captures direct connections to nature - either through intimate treehouse experiences on the north side, or expansive views to the mountains, bay and downtown. Lastly - all units will have low VOC material selection to ensure minimal off gassing and promote superior air quality.

Energy

The building is designed to incorporate passive systems first. The intent is to not have to use the mechanical system for as much of the year as possible, allowing residents to fully experience the natural beauty of the Pacific Northwest. Using natural ventilation and solar shading in the summer, the need for mechanical cooling is minimized. By stretching out the building along the East-West axis, we not only maximize views of Vancouver Harbor and the forest, but we also give the building an optimal solar orientation - minimizing exposure on the east and west. The south façade can take advantage of winter sun, when it is available, to reduce the loads on the heating system. The high-performance envelope (Glazing and opaque walls) is also designed to retain heat in the winter time. The Mechanical system is also a high-performance system. Utilizing energy recovery ventilators, each unit will receive plenty of fresh air without the energy penalty normally associated with it. The building will be conditioned using energy recovery VRFs (Variable Refrigerant Flow). This allows for highly efficient heating and cooling, and will also allow residents to heat one space and cool another simultaneously by moving heat between spaces.

The building will also incorporate Photovoltaic panels on the roof to produce clean, renewable energy on-site.

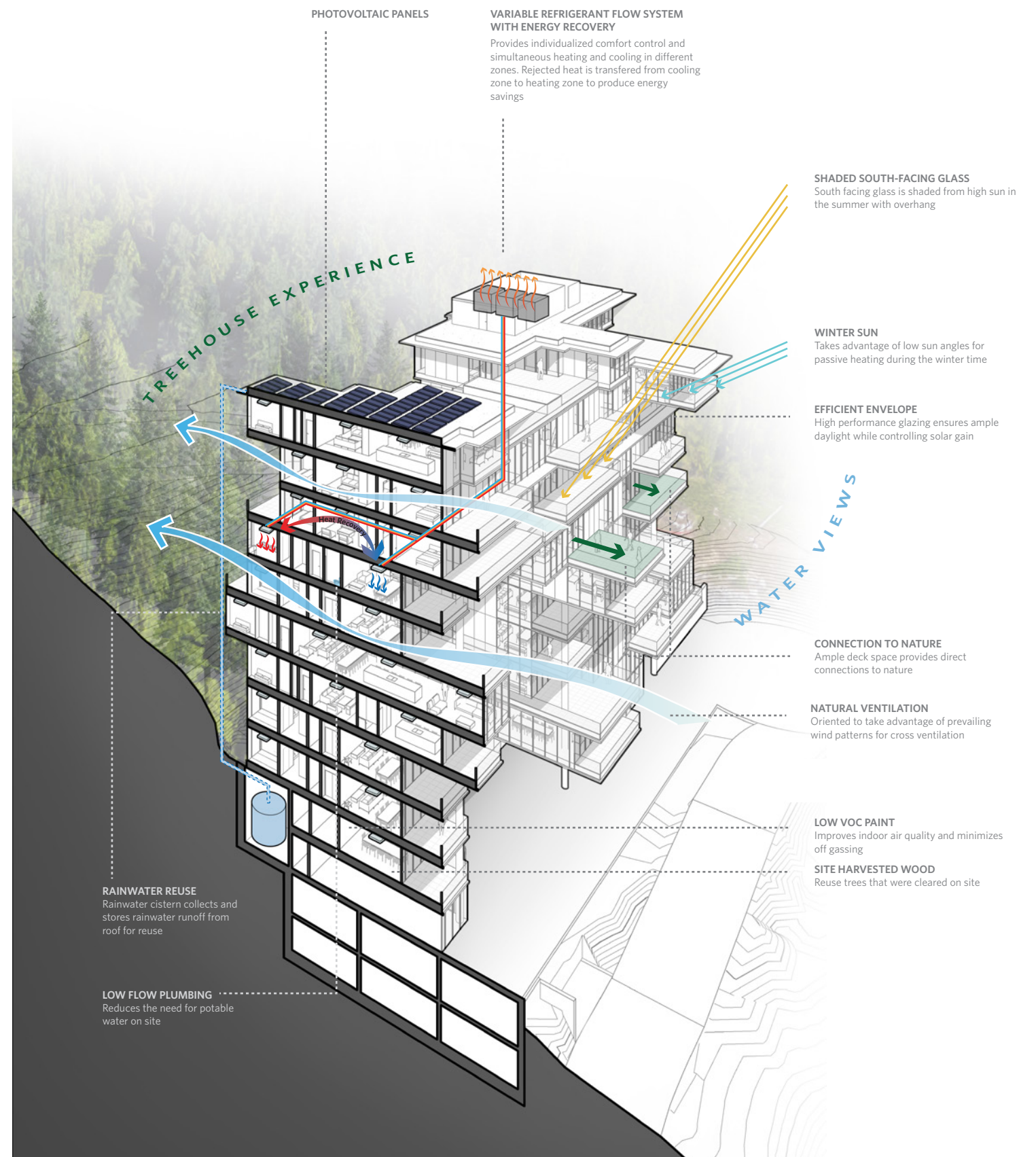
The project will meet the voluntary Step Code 2 Target and Built Green Silver Targets.

Water

The project will incorporate low-flow plumbing fixtures to reduce the need for potable water on-site. It will also incorporate an on-site rainwater cistern for on-site irrigation purposes. The cistern will also help reduce storm water runoff from the project.

Materials

The project uses carefully considered materials - selected for their durability, ease of maintenance and environmental impacts. The project will target using locally harvested wood - to reuse trees that were cleared on-site. Interior finishes have low VOC levels, to promote better air quality.

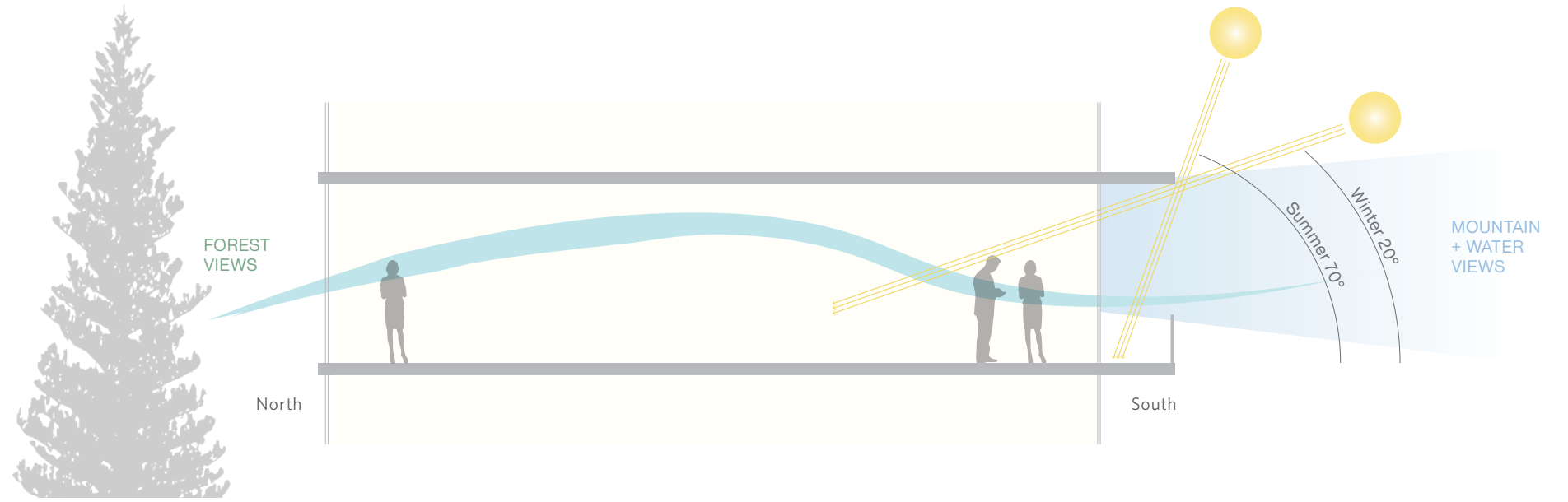


Site

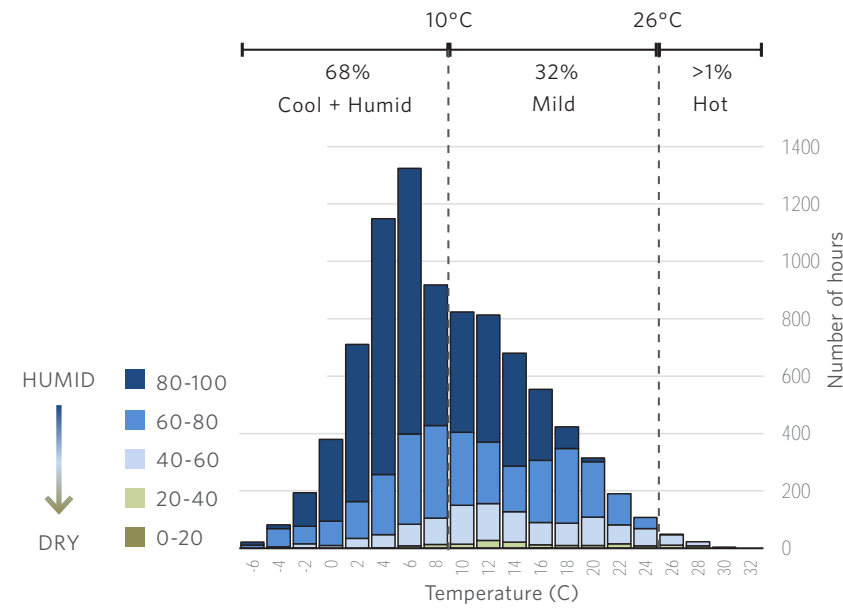
The climate is temperate with mild summers (less than 1% of hours in the year are above 26°C, and 44% of the year it is between 10°C and 26°C - ideal for natural ventilation. Heating will be a large load in the project with 56% of the hours in the year falling below 10°C.

Solar radiation can get high in the summer months - so shade considerations are important - especially on East, West and South Facades. The winters are cloudier, but when the sun is out, the south glazing will help passively heat the building.

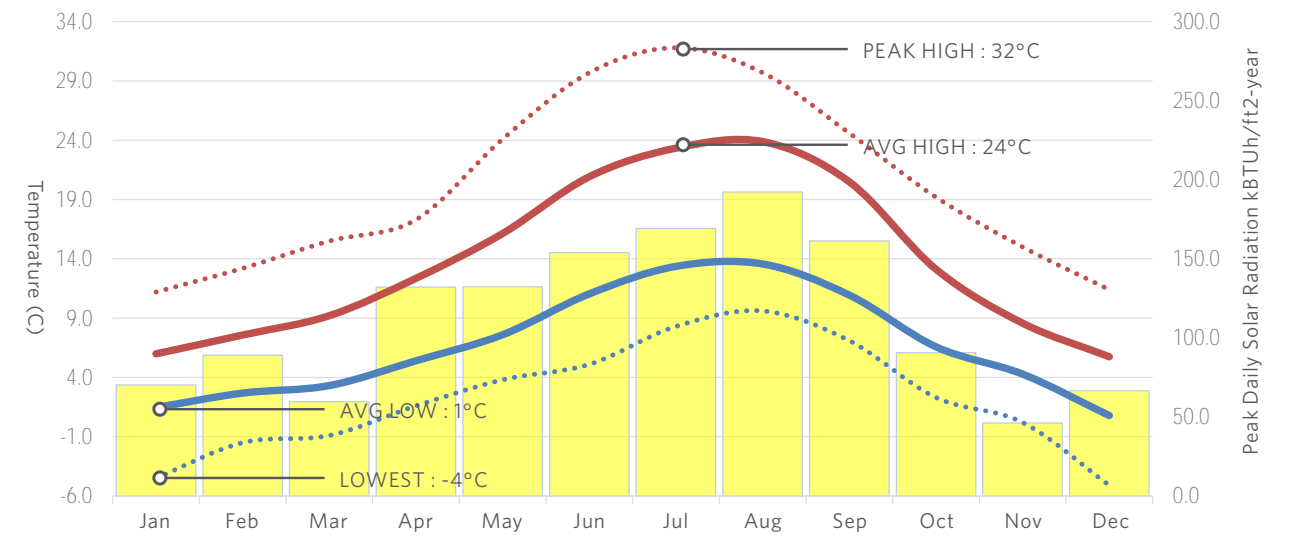
Winds patterns are formed by the integration of topography and the water. In the winter, winds predominantly originate in the North-Northeast, while in the summer, it's a more north-south pattern.



Temperature & Humidity

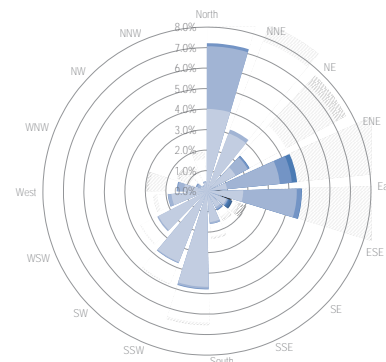


Peak / Average Temperatures + Solar Radiation

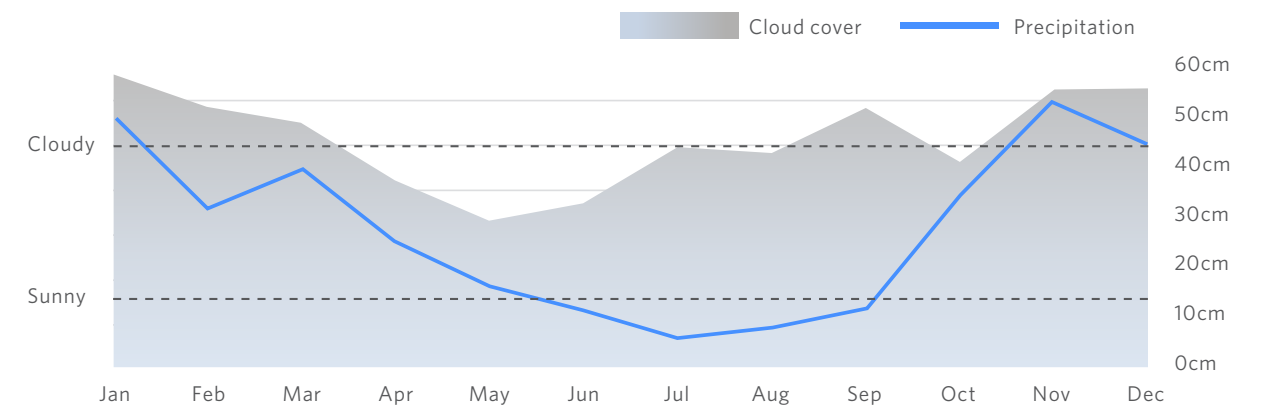


Wind Rose During Natural Ventilation Hours

Temperature is between 10°C to 26°C

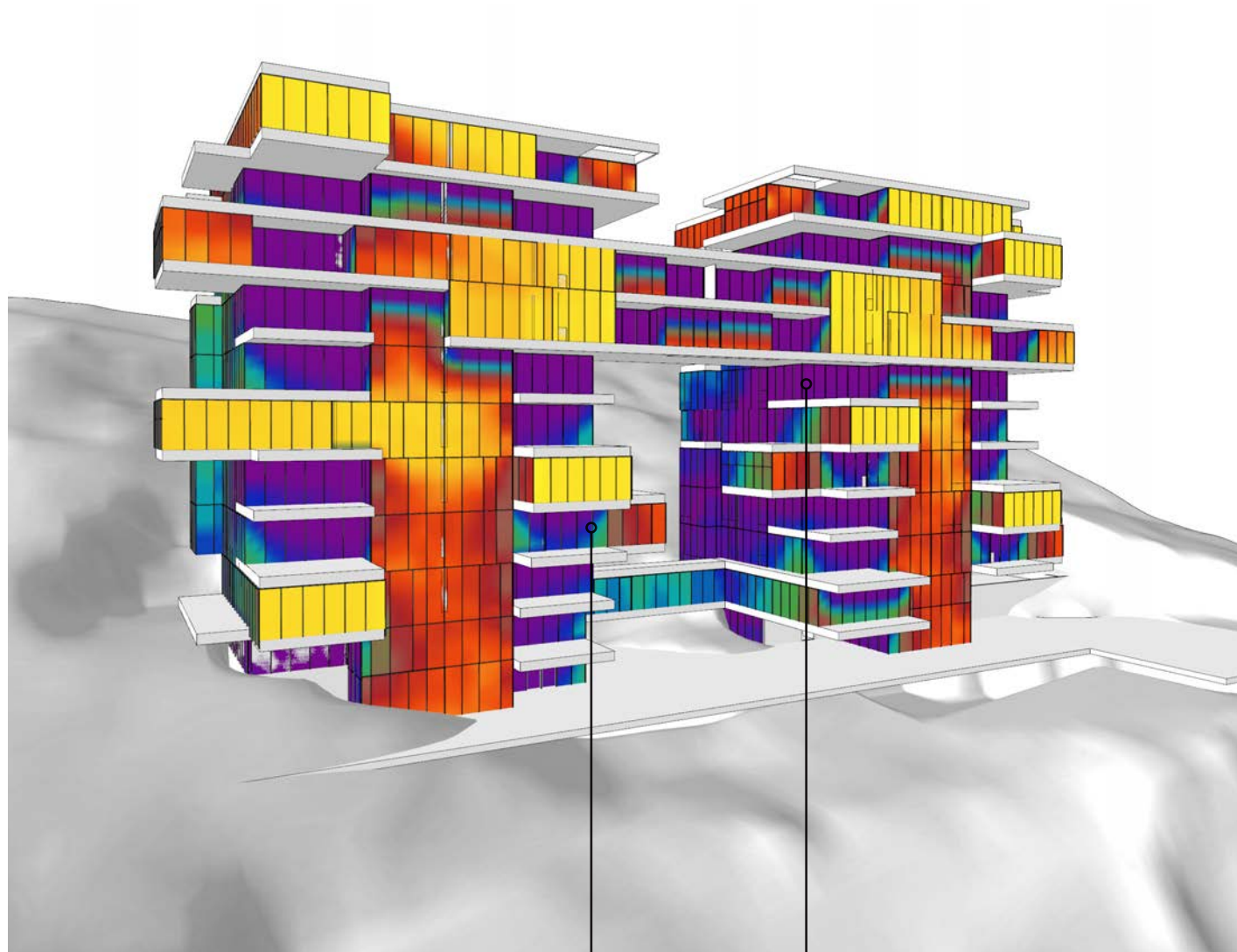


Cloud Cover + Rainfall



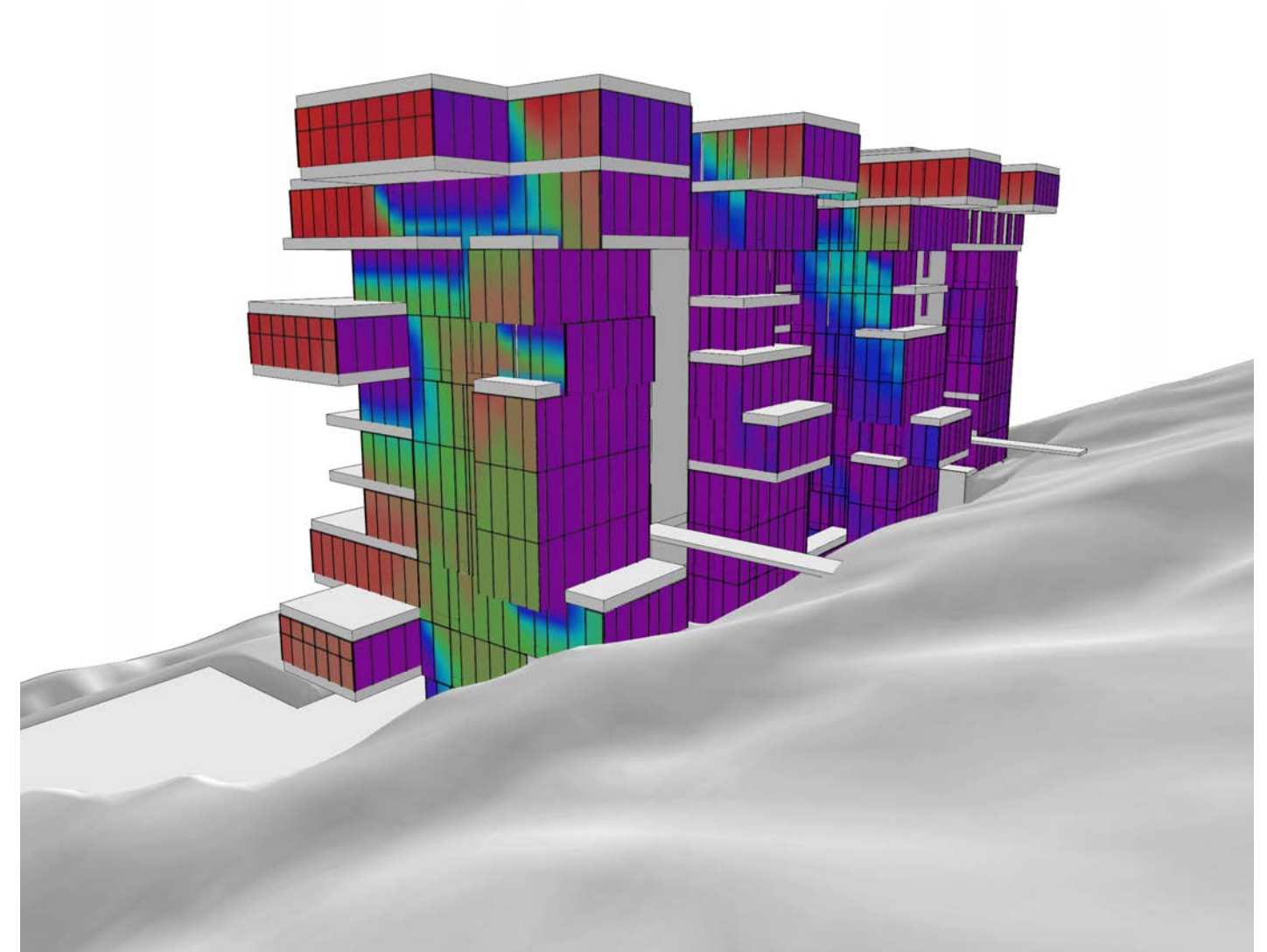
Total Solar Exposure in Summer (July 1 - Sep 31)

Southwest Facades



Decks and overhangs shade facade below

Northeast Facades



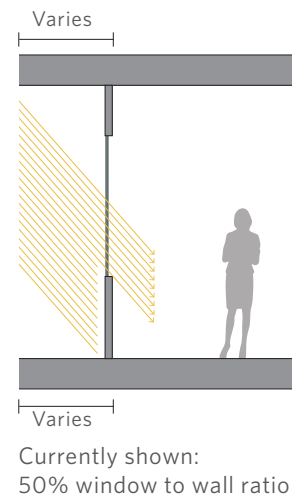
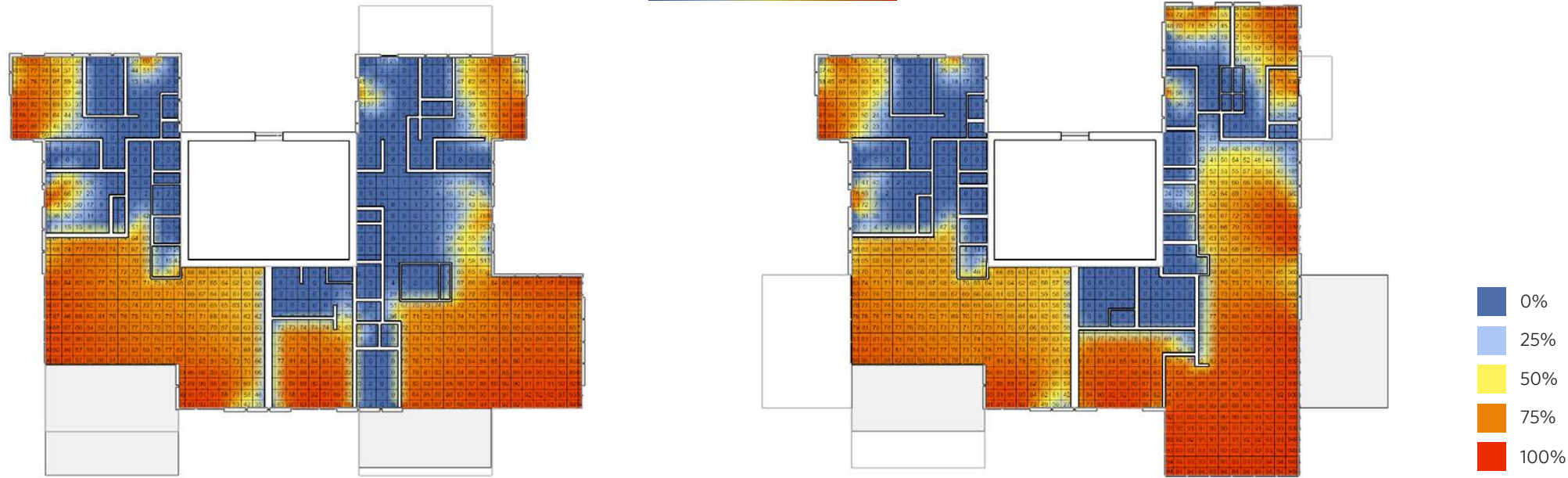
Solar Radiant Exposure (kWh/m²)
Heat per unit area received from the sun over summer



Daylight Analysis (Level 4)

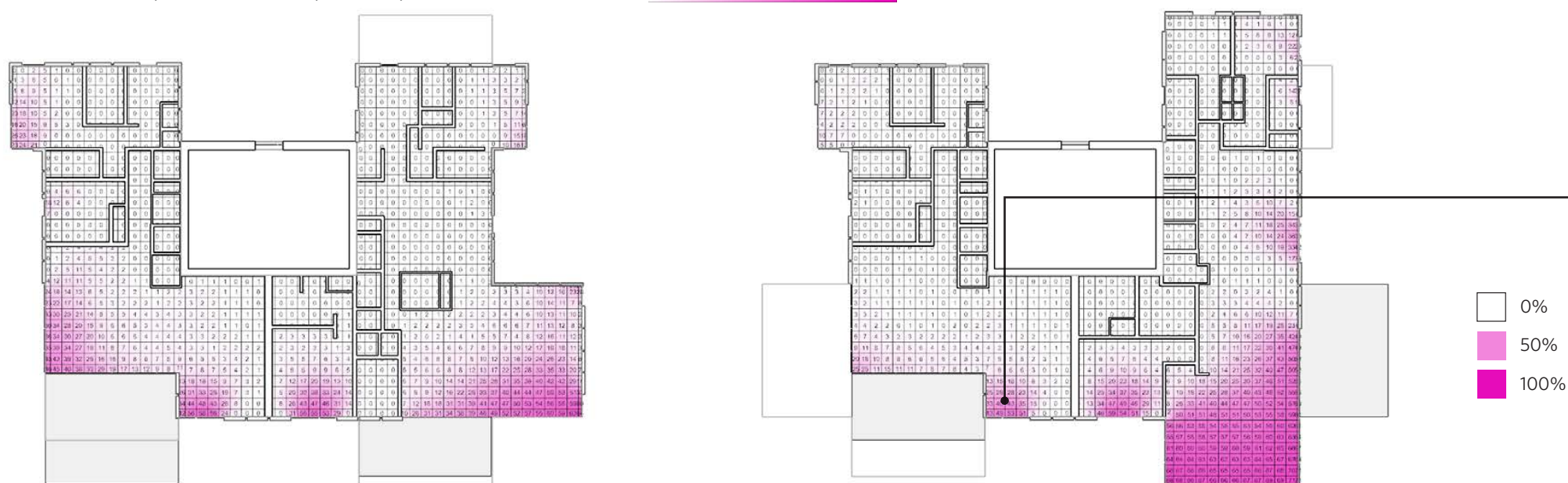
Daylight Autonomy

% of annual occupied hours that a point in space is above 200 lux



Overlit areas

% of annual occupied hours that a point in space is above 3000 lux



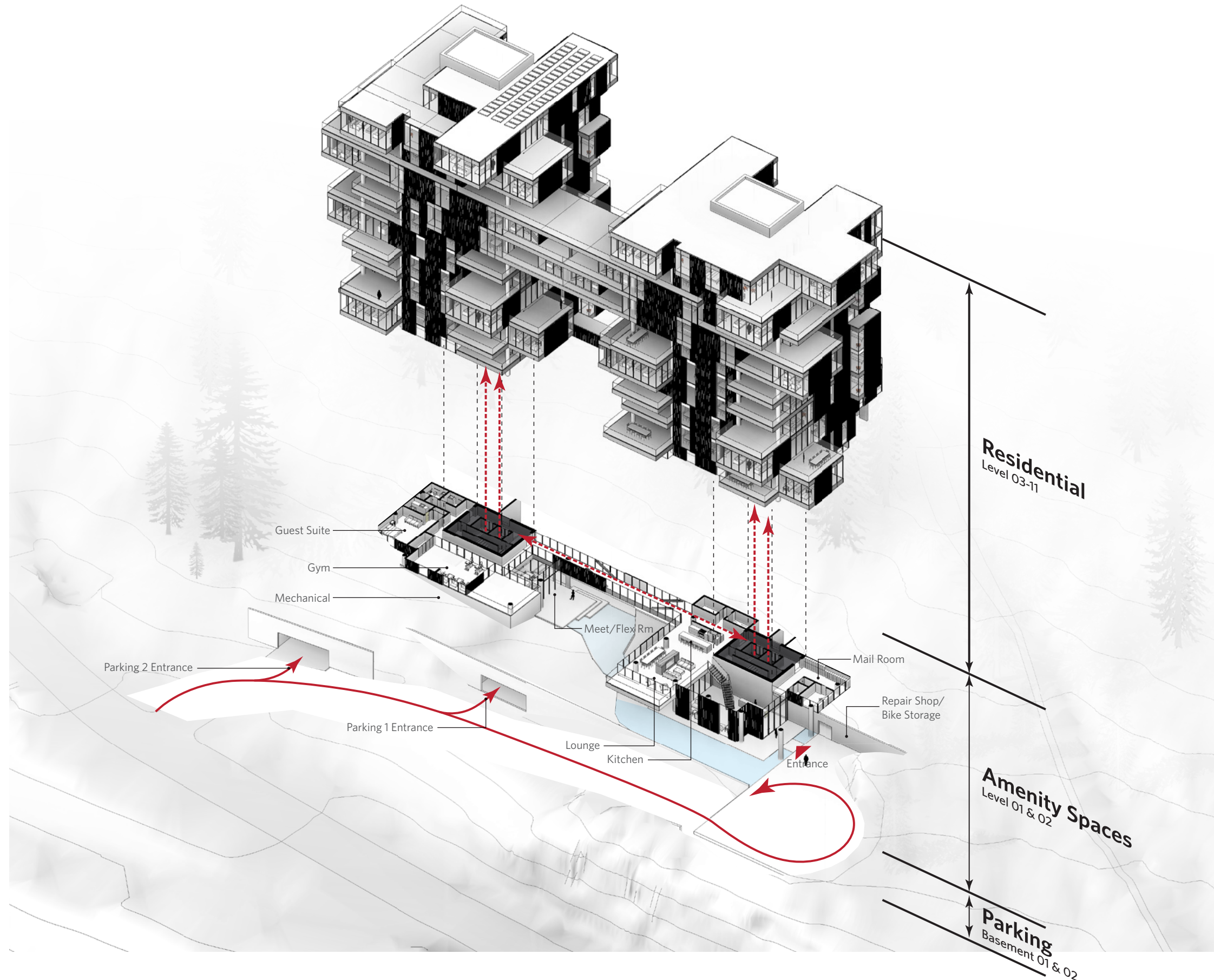
30% of hours overlit. Areas with a shallow overhang above is suggested to have additional sun control or reduced window to wall ratio to reduce glare

Glass: Solarban 70 | Transmittance: 63.8%

6 Program

Amenities/Circulation

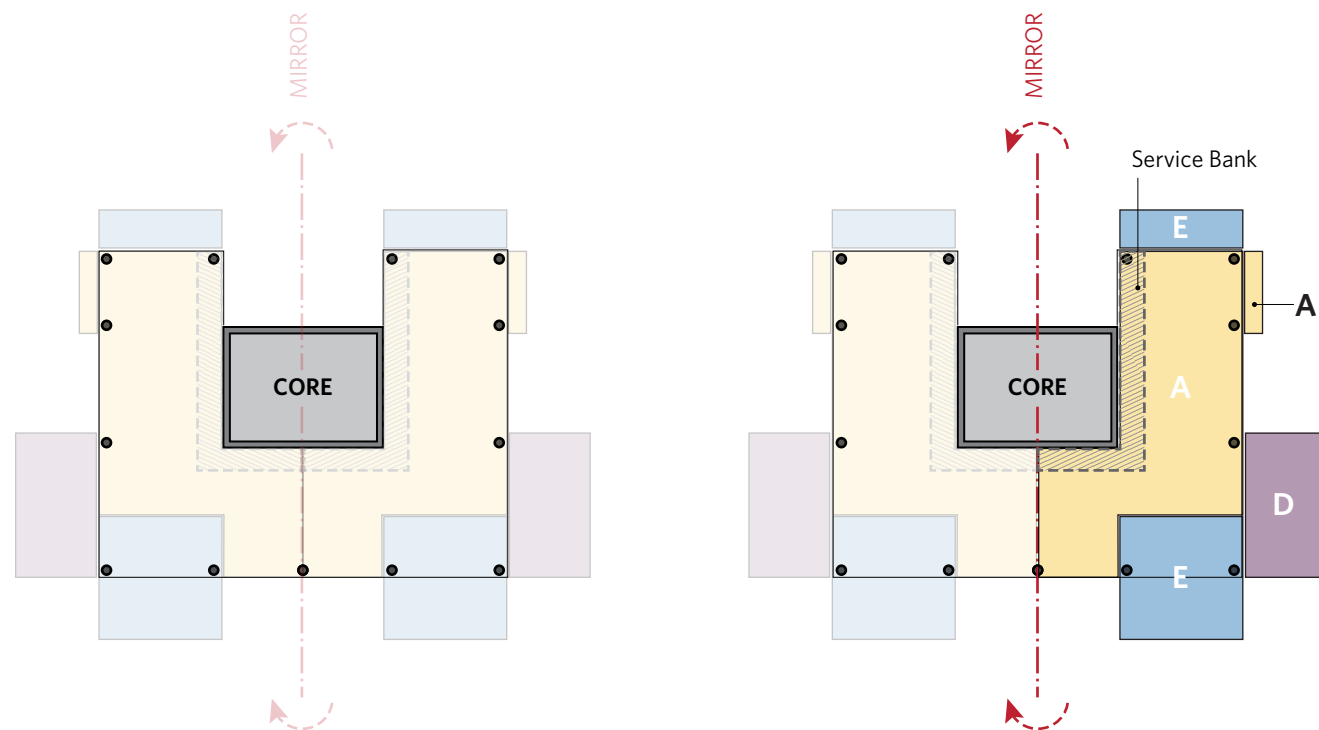
The Program is divided vertically into 3 components, Parkade, Amenity Levels, and Residential. The entire Parkade is buried below grade, forming the base from which the structure grows. With the established landscaping goal of allowing the landscape to envelope the building, the first floor is minimal in footprint, holding only a lobby and a bicycle workshop, and gym. This moves the majority of the amenity spaces up one floor to floor two. From there, there's a bit more prospect to the view for the Guest Unit, Lounge, and Kitchen Spaces. Floor two remains partially buried and is still considered below grade. The Residential Units start at floor three, pushing all units up to a point where every unit is free from grade and able to gather good daylight, cross ventilation, and panoramic views.





Housing Modules

The core form of the trunk is established by (17) of the standard Two Bedroom Unit typologies, shown in light yellow. At the third floors, two exceptional units on the East and West sides extend further East and West to reach out to the hillside, capture daylight, and extend views. The Three Bedroom Units cantilever their living spaces off of the trunk to accommodate the extra bedroom and provide larger deck spaces above. Once at the canopy bridge level, the unit mix favors Three-Bedroom Units, placing the largest units higher, grouping them into a bridge with the penthouses above. Overall, the unit diversity is a split between (19) Two Bedrooms and (18) 3 Bedrooms. 7 of the 3 Bedroom units will incorporate a Lock-Off Suite which will have a separate entry from the lobby area at each floor.



2 Bedroom Units (19 units)

- Unit Type A (17 units)
- Unit Type B (1 unit)
- Unit Type C (1 unit)

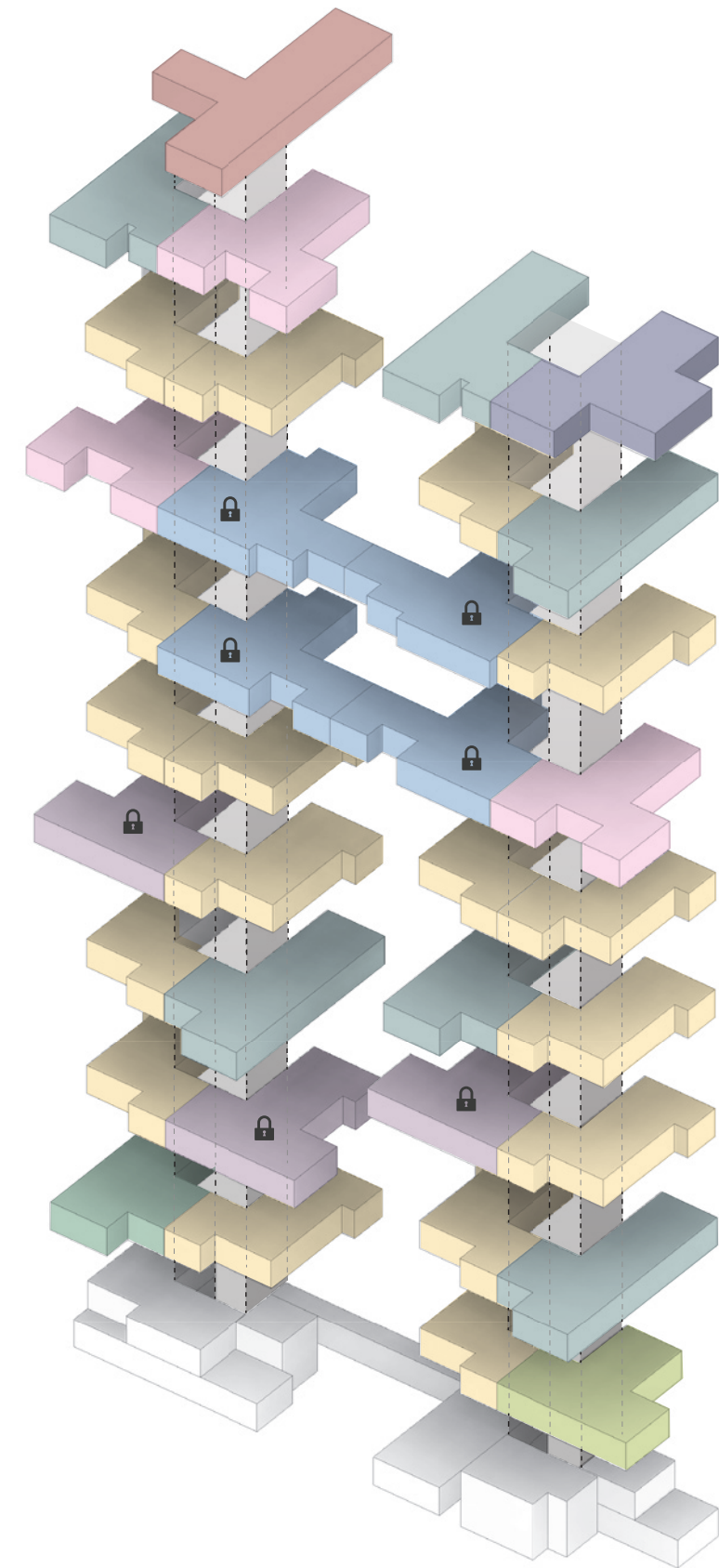
3 Bedroom Units (16 units)

- Unit Type D (6 units)
- Unit Type E (3 units)
- Unit Type F (4 units)
- Unit Type G (3 units)

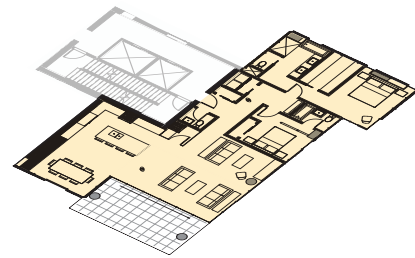
3 Bedroom Penthouse Units (2 units)

- Penthouse Type A (1 unit)
- Penthouse Type B (1 unit)

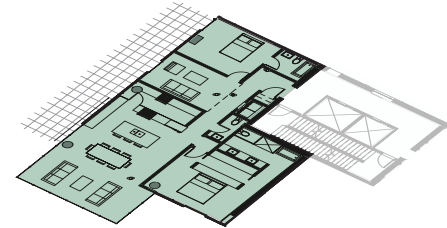
- 🔒 Units with Lock-Off Suites (7 units)



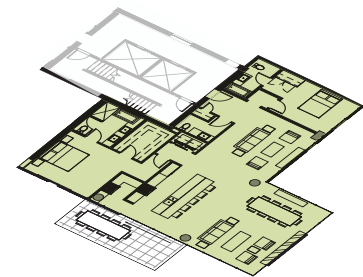
2 bedroom units (19 units)



Unit Type A (17 units)
2 Bedroom
1,847 SF

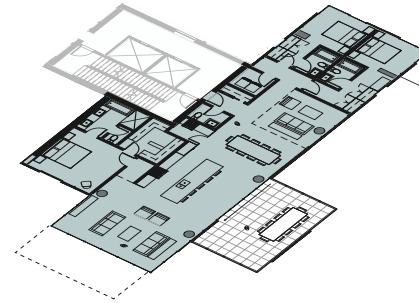


Unit Type B (1 unit)
2 Bedroom
1,925 SF

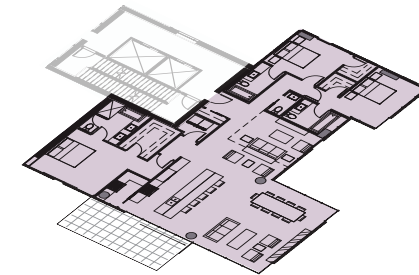


Unit Type C (1 unit)
2 Bedroom
2,099 SF

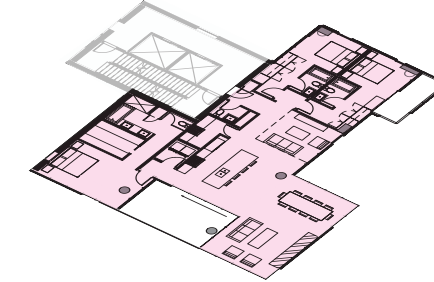
3 bedroom units (16 units)



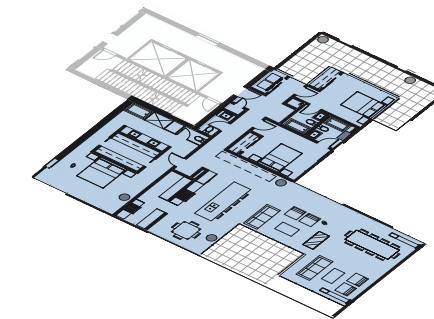
Unit Type D (6 units)
3 Bedroom
2,453 SF



Unit Type E (3 units)
3 Bedroom
2,431 SF

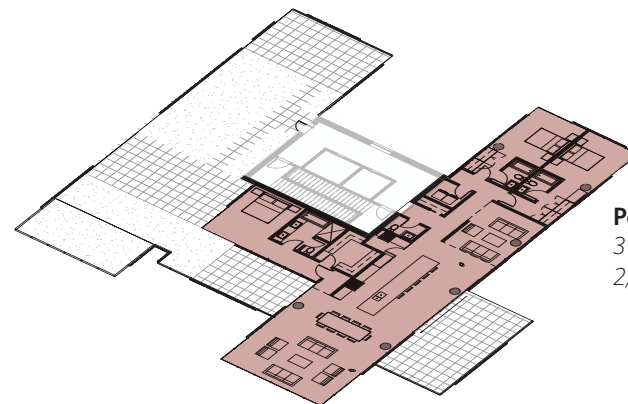


Unit Type G (3 units)
3 Bedroom
2,325 SF

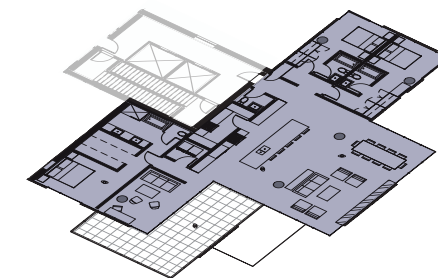


Unit Type F (4 units)
3 Bedroom
2,533 SF

3 bedroom penthouse units (2 units)



Penthouse Type B (1 unit)
3 Bedroom
2,804 SF

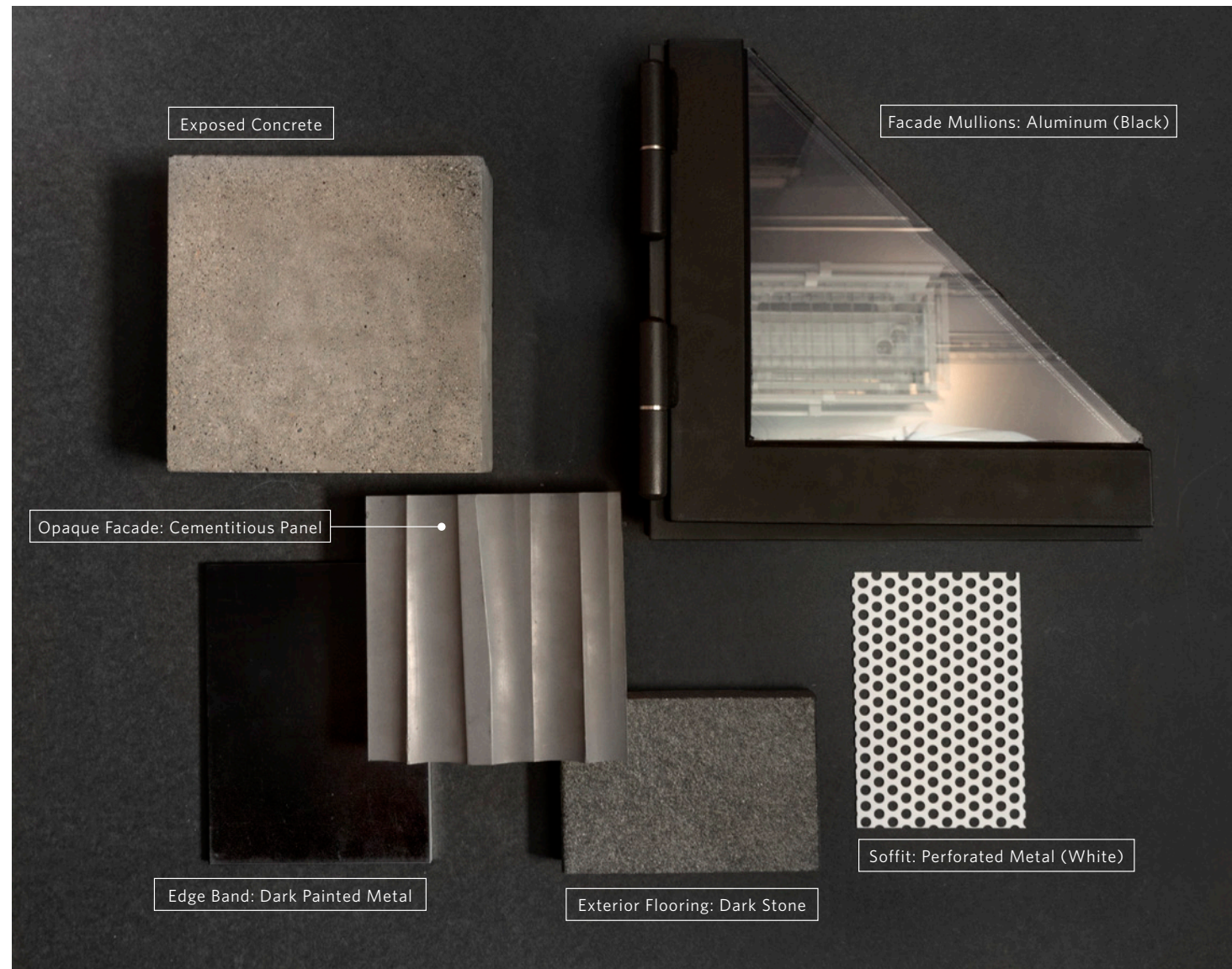


Penthouse Type C (1 unit)
3 Bedroom
2,604 SF

7 Materiality

Light & Shadow

The material approach for the "Tree House" is more curatorial than about introducing new textures. Where we want to detract, the building goes dark; absorbing shadows and disappearing into the surroundings. Where we need to reflect light, the surfaces are bright white, bouncing light and dynamically altering the building's mood as the day changes from day to night and as the seasons change from summer to winter.



1. Soffit



2. Facade



3. Interior Glow



4. Exterior Walls





Facade Mullions: Aluminum (Black)

Columns: Exposed Concrete

Soffit: Perforated Metal (White)

Opaque Facade: Cementitious Panel

Edge Band: Dark Painted Metal

Guardrail: Glass



View from South (Cypress Bowl Road)



View from South (Cypress Bowl Road)



View from North Trail



View from North Trail

Appendix A
Built Green Project Checklist



#230 – 5589 Byrne Road
 Burnaby BC
 V5J 3J1
 T: 604-874-3715
 E: info@e3ecogroup.com

February 8, 2018

District of West Vancouver
 750 17th Street
 West Vancouver, BC
 V7V 3T3

Attn: To Whom It May Concern
RE: Rogers Creek Area 6 Lot 1 to meet Sustainability Guidelines

British Pacific Properties has retained E3 Eco Group as the sustainability consultant to review the energy, resource, and environmental efficiency of their Area 6 Lot 1 development in the District of West Vancouver. The intention is to ensure that the building in Area 6 Lot 1 will achieve minimum BuiltGreen™ Silver Certification on the 2017 High Density Checklist.

The 2017 BuiltGreen™ Silver level requires a minimum of 110 points from the Checklist as well as the completion of an energy model on the building to show that it can meet a minimum energy performance of 10% better than NECB 2011 or 15% better than ASHRAE 90.1 2010.

In order to provide the verification, E3 Eco Group will perform the following:

- 1) Review the energy modeling results (done by others) for the building.
- 2) Consult with British Pacific regarding the Built Green HD Checklist items to ensure that at least 110 points are achievable.
- 3) E3 will work with British Pacific throughout construction to verify items that are implemented.

The completion of the above steps will allow the building to be Certified BuiltGreen™ Silver on the 2017 High Density Checklist.

If you have any questions please contact the undersigned,

Kind Regards,

Emma Conway, B.A., CEA
 Project Manager E3 Eco Group Inc
 604-874-3715
emma@e3ecogroup.com

BUILT GREEN® High Density (HD) Checklist Home Enrolment Form



BUILDER INFORMATION				Application Date:	February 9 2018
Company Name:	British Pacific Homes				
Full Mailing Address:	#1001 - 100 Park Royal, West Vancouver, British Columbia, V7T 1A2				
Main Contact:	Andrew Elliot	BG Verifier:	Emma Conway		
Email:	acelliot@britishproperties.com	Email:	emma@e3ecogroup.com		
Phone:	604-921-1384 ext 111	Phone:	604-786-7337		

BUILDING INFORMATION					
Community:	Area 6 Lot 1		Construction Start Date:		Completion Date (Expected):
Address:	Area 6 Lot 1		City:	West Vancouver	
Province:	BC		Postal Code:		
Project Name:			Total # of Units: (commercial & residential)		Approx. Project value:
Gross Square Footage: (commercial & residential)	Commercial GFA: (commercial portion)		Residential GFA: (residential portion)		Parkade below grade?
# of Residential Units:	# of Storeys:	12			

BUILT GREEN® Level: **SILVER**

Total Checklist Points: **124**

In submitting this form and enrolling your project, you agree to the terms of payment and to provide all required documentation, including, but not limited to, the BUILT GREEN® Checklist, energy modelling files, and other support documentation, as may requested by Built Green Canada, in order to fulfil the project certification requirements.

BUILT GREEN® Checklist:

High Density (HD) New Construction

Effective January 1, 2017



The BUILT GREEN® HD program has four levels of achievement, shown below as Bronze, Silver, Gold, and Platinum. Points are awarded in several categories, as summarized below, and are summed to give a cumulative total. Each separate category has minimum point totals that must be achieved. More detail is available in the Built Green Canada Program & Guide For High Density (HD) New Construction.

CHECKLIST CATEGORIES	BUILT GREEN® LEVEL For NBC Part 3 Residential Buildings			
	Bronze	Silver	Gold	Platinum
I.0 Energy Performance Modelling	Min. 25*			
I. Energy and Envelope	Min. 25*/193			
II. Materials and Methods	Min. 20/151			
III. Indoor Air Quality	Min. 15/53			
IV. Ventilation	Min. 5/21			
V. Waste Management	Min. 7/25			
VI. Water Conservation	Min. 10/60			
VII. Business Practices	Min. 8/71			
Total Checklist Points	100	110	125	150

**Note: the minimum requirement for the modelled energy savings increases for Silver, Gold, and Platinum.*

ELIGIBILITY CRITERIA

In order to pursue BUILT GREEN® HD certification, the following eligibility criteria must be met:

- For mixed-use buildings, the residential portion must account for at least 50% of conditioned space;
- The building must be greater than 600 square metres (footprint, not GFA) or 32 dwelling units. For greater clarity, buildings that can be modelled in HOT2000 must pursue standard BUILT GREEN® certification for new single-family homes and are not eligible for HD certification.

ENROLMENT PROCESS

1. Built Green Canada Membership
 - (a) From www.builtgreencanada.ca click on "apply for membership".
 - (b) Click on the dropdown menu for membership type, insert your information, and click to "register".
2. BUILT GREEN® Builder Training
 - (a) The www.builtgreencanada.ca website lists various partners that offer BUILT GREEN® endorsed training: Built Green Canada will offer topical training from time to time. All builders participating in BUILT GREEN® programs are strongly encouraged to participate in BUILT GREEN® training, and may be required to participate in basic orientation training for some BUILT GREEN® programs.
 - (b) Custom courses may be arranged by contacting Built Green Canada at 780.485.0920
3. HD Enrolment:
 - (a) Builder supplies to Built Green Canada the enrolment form and certification fees.
 - (b) With the assistance of your BUILT GREEN® HD Verifier, complete the enrolment form and checklist, and have your Verifier submit (upload) it to the BUILT GREEN® project database.
 - (c) Enrolments are not valid until enrolment fees have been received by Built Green Canada: \$100/unit (minimum \$1,000 up to maximum \$20,000) will be invoiced to the builder when the enrolment is received in the online database. Please note that fees are based on verification efforts associated with a continuous phase of construction: phased projects should be treated as independent projects and enrolled separately.

CHECKLIST CRITERIA (i.e. WHAT EARNS POINTS AND WHAT DOESN'T)

Five fundamental pillars serve as a basis for each item to be considered in the checklist. Each line item must meet at least one of the criteria listed below-left, while considering two or more of the qualitative concepts/values listed below-right.

- | | | |
|------------------------|------------------------------------|------------------------------------|
| (1) Energy Efficiency | • Durability and Maintenance | • Measurable or Validated |
| (2) Water Efficiency | • Innovation of Design or Practice | • Promotion of Market Change |
| (3) Resource Use | • Alternative Construction Methods | • Environmental Impact |
| (4) Recycled Content | | • Owner's Experience (Ease of Use) |
| (5) Indoor Air Quality | | |

ENERGY PERFORMANCE

Building performance must be modelled and verified by an appropriately qualified energy professional (i.e. Professional Engineer) using industry accepted energy modelling software (e.g.: EE4, eQuest, Energy Plus, or other software specially approved by Built Green Canada's Technical and Standards Committee).

The final certification documents submitted to Built Green Canada must include an energy report, signed and bearing the seal of the qualified energy professional (i.e. professional engineer), demonstrating at least the minimum for National Energy Code of Canada for Buildings 2011 (NECB, 2011), and a minimum of 5% energy efficiency achieved over ASHRAE 90.1-2010.

HD PROJECT VERIFICATION PROCESS

In order to properly ensure quality control and credibility of the BUILT GREEN® program, Built Green Canada will conduct a verification process for all submitted HD projects that includes third-party, on-site reviews, during and after construction, as well as a documentation audit of the BUILT GREEN® Checklist.

1. The builder shall retain an approved BUILT GREEN® Verifier to support the process of verifying on-site green construction: this will involve planning the project in advance, setting targets using the BUILT GREEN® Checklist, agreeing to a verification plan, and verifying various items on-site. The Builder-Verifier relationship will vary from one company to the next and will need to be negotiated outside of Built Green Canada: contact Built Green Canada for an approved list of Verifiers.
2. The BUILT GREEN® Checklist is intended to be self-explanatory, and the verification of each checklist item will be appropriate to the character and content of the item. Examples of acceptable forms of verifications (listed in priority order) include: on-site visual verification (sometimes including photo verification), invoices or purchase orders, letters of testimony by installation contractors, and/or supplier verification letters. During construction, the builder shall collect supporting documentation for each of the chosen checklist items, and have this documentation available for the verification process. A minimum of one site inspection prior to drywall installation and one site inspection upon building completion are expected, with the possibility of more, depending on the building size and checklist points pursued.
3. The builder shall work with the Verifier to assemble a final submission package that will clearly indicate which BUILT GREEN® checklist items were pursued, how those were verified, and include appropriate signoffs (e.g.: the engineer's energy model and other supporting documentation). The BUILT GREEN® Verifier shall then submit the complete formal package to Built Green Canada on the builder's behalf, which will trigger the formal audit/certification process.

Note: Checklist items are applicable to the whole building unless otherwise stipulated.

BUILT GREEN® Checklist:

High Density (HD) New Construction

Effective January 1, 2017



To select checklist points, click and select point values from the drop-down list for each item.

Builder	British Pacific Homes	
Address	Area 6 Lot 1	
Date	February 9 2018	

Summary	1 - Energy and Envelope:	30 points
	2 - Materials and Methods:	28 points
	3 - Indoor Air Quality:	17 points
	4 - Ventilation:	8 points
	5 - Waste Management:	11 points
	6 - Water Conservation:	13 points
	7 - Business Practices:	17 points
	TOTAL POINTS:	124 points (SILVER) OK!

I. ENERGY AND ENVELOPE

This section awards points for construction methods and types of products that contribute to lower energy consumption, as well as alternative heating and electrical systems.

Minimum Energy Modelling 25 Points Required for Bronze, 30 points for Silver, 35 points for Gold, and 40 points for Platinum.

Find BUILT GREEN® Approved products that help earn your build points towards certification by viewing our online Product Catalogue: www.builtgreencanada.ca/i-envelope-and-energy-systems

I.0: Energy Modelling

ASHRAE	← Select modelling method here
15.00	← Input % energy savings here

I.0 Energy modelling is a requirement for Section I (Energy and Envelope). Model the performance of your HD Project with any approved government software, such as EE4, eQuest, or CanQuest. Points will be awarded for efficiency gains noted above the reference codes. A building achieving greater than 100% efficiency is net-positive and can earn bonus points for generating more energy than it consumes.

The energy requirement for each certification level is based on the percent improvement. In other words, the energy model rating must meet the required percent improvement over the reference building. Input the modelling method and the % improvement. The checklist will automatically calculate the points earned.

Over NECB 2011:
 Bronze certification: building rating meets the code and earns 25 points.
 Silver certification: building rating is 10% improvement and earns 30 points.
 Gold certification: building rating is 20% improvement and earns 35 points.
 Platinum certification: building rating is 30% improvement and earns 40 points.

Over ASHRAE 90.1 2010
 Bronze certification: building rating is 5% improvement and earns 25 points.
 Silver certification: building rating is 15% improvement and earns 30 points.
 Gold certification: building rating is 25% improvement and earns 35 points.
 Platinum certification: building rating is 35% improvement and earns 40 points.

30	\$\$ - \$\$\$\$\$	0 to 15
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Note: future versions of this checklist will reference the updated NECB/ASHRAE standards, after the industry has adapted more fully to their use.

The remaining action items and points hereafter in Section I may be used for additional points to be earned in your overall score; however, these points will not impact the earned energy points determined by the % improvement over reference building.

I. Building Envelope

I.1.1	Window to wall ratio does not exceed 40%.	<input type="text"/>	NC	2
I.1.2	Install additional roof insulation above amounts already required by building code: (i) +R5 (for 1 point); (ii) +R10 (2 points); or (iii) +R15 (3 points).	<input type="text"/>	\$ - \$\$\$	1, 2 or 3
I.1.3	Install additional insulation on <u>exterior</u> of above grade walls, above insulation amounts already required by building code: (i) +R5 for 2 point; or (ii) +R10 for 4 points.	<input type="text"/>	\$ - \$\$\$	2 or 4
I.1.4	Install additional insulation on <u>exterior</u> of foundation system, above code required amounts for interior insulation: (i) +R7.5 (for 1 point); (ii) +R10 (2 points); or (iii) +R15 (3 points).	<input type="text"/>	\$\$\$	1, 2 or 3
I.1.5	Install insulation under the entire basement slab above amounts already required by code: (i) +R5 (for 1 point); (ii) +R8 (2 points); or (iii) +R12 (3 points).	<input type="text"/>	\$\$ - \$\$\$	1, 2 or 3
I.1.6	Attached garage or parking structure walls are insulated to minimum R12, and ceilings are insulated to minimum R35.	<input type="text"/>	\$ - \$\$\$	1
I.1.7	Attached garage, parking, and/or loading dock overhead doors are insulated with R8 to R12 (for 1 point) or greater than R12 (for 2 points).	<input type="text"/>	\$ - \$\$\$	1 or 2
I.1.8	Structural design eliminates the need for headers, or use insulated headers with minimum insulation value of R10.	<input type="text"/>	\$ - \$\$	1
I.1.9	Structural design eliminates the need for rim/band joists, or use manufactured rim/band joists insulated to minimum R10.	<input type="text"/>	\$ - \$\$	2
I.1.10	Install weather-stripped and insulated (R20 minimum for 1 point and R28 for 2 points) manufactured interior attic hatch, or have no interior attic access.	<input type="text"/>	NC - \$	1 or 2
I.1.11	Install opaque doors that are a minimum R6, and any glazed sliding or swing doors at minimum R4 (for 1 point).	<input type="text"/>	\$\$	1
I.1.12	All decks or balconies are thermally broken from the building envelope by: (i) Minimum R10 (for 1 point); OR (ii) Are fully separated (for 3 points); OR (iii) There are no decks or balconies (for 3 points).	<input type="text"/>	\$ - \$\$	1 or 3
I.1.13	Windows are rated for high performance: (i) Windows are ENERGY STAR labeled at greater than 90% of all windows (3 points); OR (ii) All windows have U value of less than 2.2 W/m2k (1 point); less than 2.0 W/m2k (2 points); or less than 1.8 W/m2K (3 points).	<input type="text"/>	\$ - \$\$\$	1, 2 or 3
I.1.14	Window systems are installed to be air tight: (i) Non-HCFC expanding foam around all windows, door openings, and exterior wall penetrations (2 points); AND/OR (ii) All sill plates are sealed with foam gaskets or a continuous bead of acoustical sealant (1 point); OR (iii) The building has a contiguous window-wall or curtain-wall (3 points).	<input type="text"/>	\$ - \$\$\$	1, 2 or 3
I.1.15	All electrical back-boxes in exterior walls and ceilings are air tight (e.g. molded plastic).	<input type="text"/>	NC - \$	1

I.1.16	Design all fire separations to be air tight, effectively sealing adjacent units from one another and from common space.	\$ - \$\$	2
I.1.17	Building includes passive solar shading, the benefits of which are demonstrated through an energy model: (i) exterior or interstitial solar shading devices for glazing (2 points); OR (ii) exterior operational shading devices (4 points), with automated control (1 additional point).	\$\$ - \$\$\$\$	2, 4 or
I.1.18	Use roofing material with a high solar reflectance index (SRI) of ≥78 (for roof slopes ≤ 2:12), or ≥29 (for roof slopes > 2:12). Roof areas that are covered by energy generation appliances (e.g. solar panels or wind turbines) or by vegetation (e.g. green roofing materials) are exempt.	\$\$ - \$\$\$\$	1
I.1.19	Builder utilizes a certified building envelope engineer for the design of the building envelope (1 point).	\$\$\$	1

.2: Mechanical Systems

I.2.1	Calculate design heat loss and properly size HVAC equipment using CSA F280-M90 or ASHRAE/ACCA Standard 183.	\$ - \$\$	2
I.2.2	Centrally locate HVAC systems inside the building's heated envelope and reduce duct length.	NC	1
I.2.3	District Energy used for primary space conditioning (heating and cooling): (i) The building is designed for, and ready to connect to, a district heating system within one year of opening (1 point); (ii) The building will be connected to a district heating system from occupancy (1 additional point); (iii) The district energy system will also provide cooling (1 additional point).	NC - \$\$	1, 2 or
I.2.4	Install high efficiency heating systems for all units and systems serving common areas (minimum 90% AFUE gas furnace; minimum 85% AFUE oil furnace; or minimum 85% AFUE oil/gas boiler).	\$ - \$\$	3
I.2.5	Implement a boiler management system to match the system operation to building loads and optimize controls for maximum energy savings.	\$ - \$\$	2
I.2.6	Install high efficiency cooling systems for all units and systems serving common areas (minimum 14 SEER central A/C; or minimum ENERGY STAR individual appliance for each unit).	NC - \$\$	1
I.2.7	Install heat pumps to supply majority of space heating and cooling loads: ground/water with minimum COP of 4 or SEER 15, or air source with minimum COP of 2 or SEER 15.	\$\$ - \$\$\$\$\$	10
I.2.8	Install a centralized high efficiency domestic hot water heating system with minimum 85% AFUE boiler; minimum 0.67 EF gas water heater; or instantaneous tankless systems in each unit (3 points). For commercial boiler, the minimum thermal efficiency is 90 E _t for oil and 95 E _t for gas.	\$ - \$\$	3
I.2.9	Install heat pump-based DHW heating system (ground-, water-, or air-sourced, EF of 1.5 for 2 points; EF of 2 for 3 points) to supply a minimum of 35% of the peak DHW heating load and 70% of the total DHW energy load.	\$\$ - \$\$\$\$\$	2 or 3
I.2.10	Hot water storage tanks insulated by manufacturer to a minimum R-12.5.	\$	2
I.2.11	Insulate DHW piping: CASE 1: Where dwelling units contain independent DHW systems: (i) insulate the first three feet of the water lines from the hot water tank (1 point); OR (ii) insulate all hot water lines to all locations (2 points). CASE 2: Where DHW systems are common among multiple units: (i) insulate all hot water lines (including traps) for the first six feet from the central hot water tank (1 point); OR (ii) insulate all hot water lines to all locations (2 points).	\$ - \$\$\$	1 or 2
I.2.12	Install ENERGY STAR labeled bathroom exhaust fans for each unit.	\$	1
I.2.13	Fireplaces are all electric (2 points) or gas with sealed combustion and electronic ignition (2 points), or are EPA or CSA certified high-efficiency wood stove or pellet stove with a minimum efficiency of 72% (1 point) or 85% (2 points).	\$ - \$\$	1 or 2
I.2.14	All fireplaces, wherever installed, include a fan kit to circulate warm air into the room (2 points).	\$- \$\$	2

I.2.15	Engage and independent Commissioning Engineer to review the Owner's HVAC and lighting system requirements, and perform a review of drawings and specifications (approx. 90% working drawings (2 points); AND Verify installation and operation of HVAC and lighting systems (3 points); AND/OR Carry out a follow-up onsite review of HVAC and lighting warranty items including comfort, controls, and energy efficiency (1 point).	\$\$ - \$\$\$	2 to 6
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.3: Metering and Controls

I.3.1	Provide electricity (1 point) and/or natural gas (1 point) direct metering for each unit.	\$ - \$\$	1 or 2
I.3.2	Provide programmable thermostats in each individual unit capable of managing at least two different daily schedules per week (e.g. weekday and weekend settings) (2 points total for all units).	\$ - \$\$	2
I.3.3	Parkade/garage heating setpoint is no higher than 4 degrees C, or garage/parkade is unheated.	\$ - \$\$	2
I.3.4	Units contain multiple heating/cooling zones with independent programmable thermostat control for each zone (2 zones = 2 points; 3 zones = 3 points; 4 zones = 4 points).	\$ - \$\$\$\$	2, 3 or
I.3.5	Install premium efficiency pump drive motors on all motors 1 hp or greater.	\$	1
I.3.6	Install HVAC systems with variable speed drives on all motors where there is a variable flow requirement.	NC - \$\$	3

.4: Re-Use or Recovery of Waste Energy

I.4.1	Install and balance ventilation energy recovery systems: (i) individually controlled active Heat/Energy Recovery Ventilator (HRV/ERV) for each dwelling unit (4 points); AND/OR (ii) solar/geo fresh air pre-heating for each unit (3 points); AND/OR (iii) same for all common areas (2 points).	\$ - \$\$\$\$	2 to 9
I.4.2	Install drain water heat recovery (DWHR) units on the main drain stack to recover heat from shower drain water. DWHR units must be CSA certified to B55.1 and B55.2: (i) 1 point for units less than 42% efficient; (ii) 2 points for units greater than or equal to 42% efficient; (iii) 1 additional point for units that are fully insulated. DWHR units may be installed centrally or by dwelling unit, but must collect heat from a minimum of 90% of the showers in the building complex.	\$\$ - \$\$\$	1, 2 or
I.4.3	Install a properly supported and wired ceiling fan in every dwelling unit.	\$	1

.5: Appliances

I.5.1	Electric ranges are induction based, or are otherwise certified to use below 480 kWh/year on the EnerGuide Rating System.	\$ - \$\$	1
I.5.2	Refrigerators are ENERGY STAR labeled products.	\$ - \$\$	1
I.5.3	Dishwashers are ENERGY STAR labeled products.	\$ - \$\$	1
I.5.4	Clothes washer or combo washer-dryers are ENERGY STAR labeled products.	\$ - \$\$	1
I.5.5	Provide energy efficient clothes drying facilities for each unit (1 point each, maximum 2 points total): (i) Clothes dryers are ENERGY STAR labeled; (ii) Clothes dryers have an "auto sense" dry setting that utilizes a humidity sensor for efficiency; (iii) Each dwelling unit is provided outdoor clothes drying facilities (e.g. clothes lines).	\$ - \$\$	1 or 2
I.5.6	All other eligible appliances supplied by the builder are ENERGY STAR rated (i.e. TV, LCDs, security systems).	\$ - \$\$	1

.6: On-Site Energy Generation

1.6.1	Building is built "Solar Ready" following the guidelines from either Natural Resources Canada (NRCAN) or the Canadian Solar Industries Association (CanSIA): (i) Minimum 10% of the total roof area is designed to support future solar collectors, is not shaded by other structures, and is structurally capable of supporting solar panels; (ii) A suitably sized conduit/chaseway is provided for routing solar energy conductors (wires and/or fluid lines) from the roof to the mechanical room (6 inches for a central shared solar system, or 4 inches conduit per dwelling unit); (iii) The purchaser of the unit is given information upon sale showing them where future solar panels would be installed (e.g. building drawings with a clearly indicated location for future solar panels).	NC - \$\$	1
1.6.2	Install active solar hot water heating system. Sized for 30% of DHW load (5 points), 50% (6 points), 80% (8 points).	\$\$ - \$\$\$\$	5, 6 or 8
1.6.3	Install on-site wind or solar (PV) electrical generation that supplies a portion of the designed electrical load (other than heat) in private dwelling areas: 10% for 4 pts, 25% for 8 pts, 50% for 12 pts, 75% for 16 pts, and 100% for 20 pts.	\$ - \$\$\$\$\$	4, 8, 12, 16, 20
1.6.4	Install on-site wind or solar (PV) electrical generation that supplies 50% (2 point) or 100% (4 points) of electrical needs for the common areas. This does not include electric heat.	\$ - \$\$	2 or 4
1.6.5	Any exposed exterior accessibility ramps are heated with renewable energy or waste heat.	\$\$	2
1.6.6	Buildings are built ready for plug-in electric vehicles for minimum 5% of allocated parking spaces: 1 point for 240V plugs in the vehicle parking area, 2 points for certified charging stations.	\$ - \$\$	1 or 2

1.7: Lighting and Automation

1.7.1	Exterior lighting follows IESNA illuminance requirements for recommended practice manual: Lighting for Exterior Environments.	NC - \$	2
1.7.2	All exit signage is photo-luminescent or LED based.	NC - \$	2
1.7.3	Common areas are illuminated with high efficiency (ENERGY STAR or LED) lighting.	NC - \$	1
1.7.4	Dwelling units are illuminated with high efficiency (ENERGY STAR or LED) lighting throughout: minimum 25% of all lighting (2 points); 50% (3 points); 75% (4 points); or 100% (5 points).	\$ - \$\$	2 to 5
1.7.5	Insulated ceilings have no recessed lights, or advanced air-sealing methods are employed to ensure that recessed lights are fully air-tight (e.g. air tight and insulation contact rated recessed lights).	\$	1
1.7.6	Install interior motion sensor light switches in over 25% (1 point), 50% (2 points) or 75% (3 points) of all common interior spaces, including hallways/corridors, stairwells, laundry, garage, etc.	\$ - \$\$	1, 2 or 3
1.7.7	Install interior motion sensor light switches in each dwelling unit. 1 point per switch, to a maximum of 3 points (averaged across all dwelling units).	\$ - \$\$	1, 2 or 3
1.7.8	Install lighting with an automation control system capable of unified automation control of lighting loads for all common areas.	\$\$ - \$\$\$	2
1.7.9	In all garages/parkades, provide automatic lighting system (2 points) and/or ventilation system (2 points) triggered by movement or CO levels.	\$\$ - \$\$\$	2 or 4
1.7.10	Paint interior exposed surfaces of parkade (including walls, columns, and ceilings) semi-gloss white to reduce number of required lighting fixtures.	NC - \$\$	1
1.7.11	Install a master "all-off" switch in each dwelling unit that disables all non-essential electrical loads in the home.	\$\$	2
1.7.12	Install a home automation system in each dwelling unit that is capable of monitoring and adjusting: (i) heating, cooling, and humidity (2 points); (ii) lighting greater than 4 locations/rooms (1 point); (iii) If system can be controlled through a Wi-Fi, a smart phone, or app (1 additional point); (iv) all lighting and/or blinds to adjust to hourly sun schedule (1 point) (v) Domestic Hot Water (1 point); (vi) pre-set irrigation systems to account for weather (1 point); (vii) and a "vacation or away" mode that can turn off all non-essential electrical loads (1 point).	\$\$ - \$\$\$\$	1 to 8

1.7.13 Install home energy monitoring system that monitors and reports use and consumption patterns of all energy (gas, electricity, oil) in the home (1 point). An additional 1 point may be gained if the system is integrated with onsite renewable energy generation and storage technology. 1 or 2 **\$\$\$ - \$\$\$**

TOTAL SECTION POINTS

II. MATERIALS AND METHODS

This section rewards the use of environmentally preferred materials and building construction methods: recycled/reclaimed content, materials from renewable or sustainably managed sources, alternatives to dimensional lumber, more durable construction methods, and reducing the overall amount of material used.

Minimum 20 Points Required

Find BUILT GREEN® Approved products that help earn your build points towards certification by viewing our online Product Catalogue: www.builtgreencanada.ca/ii-materials-and-methods

Relative cost
Points per item

2.1: Material Efficient Framing

2.1.1	Use Insulated Concrete Forms (ICF) or other systems that eliminate the need for traditional formwork: 3 points for below grade, and/or 4 points for 75% of above grade.	\$\$\$\$	3 to 7
2.1.2	Use Optimum Value Engineering (OVE) for framing design: (i) Exterior and interior wall stud spacing at minimum 19.2 inches on-center. (ii) Elimination of headers at non-bearing interior and exterior walls. (iii) Use of header hangers instead of jack studs. (iv) Elimination of cripples on hung windows. (v) Elimination of double plates, using single plates with connectors by lining up roof framing with wall and floor OR: Use concrete floors and roof with cambering of slabs to reduce slab thickness and column sizes with a total project concrete savings of at least 8%.	NC 1 NC \$ NC NC NC	1 1 1 1 1 5
2.1.3	Walls and roof designed on 24 inch modules to reduce waste.	NC	2
2.1.4	Reduce dimensional lumber use by using engineered stud material for minimum 10% of structural stud wall framing.	\$ - \$\$\$	1
2.1.5	Finger-jointed plate material and/or engineered plate material used for all framing plates.	\$ - \$\$\$	1
2.1.6	Structural insulated panel system (SIPS) or other panelized construction systems are used for walls (3 points) and/or roofs (2 points).	\$\$ - \$\$\$\$	2, 3, or 4
2.1.7	Use insulating sheathing on the exterior of steel studs, or with corresponding structural bracing (metal fasteners) instead of non-insulated exterior wood sheathing.	NC - \$\$	2

2.2: Environmentally Preferable Materials

2.2.1	Use environmentally engineered flooring system, such as reclaimed/recycled/rapidly renewable wood waste, cross-laminated timber, concrete with minimum 30% fly ash or other SCM, or minimum 75% recycled steel (1 point) from third-party certified, sustainably harvested sources (CSA, SFI, or FSC for 2 points). The use of third-party certified subfloor sheathing for 1 extra point.	NC - \$\$\$	1, 2, 3 or 4
2.2.2	Use environmentally engineered products for all load-bearing beams, such as reclaimed/recycled/rapidly renewable wood waste, concrete with minimum 30% fly ash or other SCM, or minimum 75% recycled steel.	\$\$ - \$\$\$\$	2
2.2.3	Use environmentally engineered products for all exterior window and door headers, such as reclaimed/recycled/rapidly renewable wood waste, concrete with minimum 30% fly ash or other SCM, or minimum 75% recycled steel.	\$ - \$\$\$	1
2.2.4	Deck, balcony, or veranda surfaces (1 point) and/or structure (1 point) made from a third-party certified, sustainably harvested wood source (CSA, SFI, or FSC) or third-party certified sustainable concrete.	\$\$\$	1 or 2
2.2.5	Dimensional lumber from a third-party certified sustainably harvested source (CSA, SFI, or FSC) used for floor framing (1 point), wall framing (2 points), and/or roof framing (1 point).	\$ - \$\$	1 to 4

2.2.6	Finger-jointed studs for minimum 90% of non-structural (1 point) and/or minimum 90% of structural (1 point) wall framing.		\$ - \$\$\$	1 or 2
2.2.7	Steel studs made from minimum 75% recycled steel are used for interior walls (1 point) and exterior walls (1 additional point).	1	\$	1
2.2.8	Recycled and/or recovered content gypsum wallboard, minimum of 40% post-consumer recycled content.	1	\$\$	1
2.2.9	Recycled content exterior wall sheathing (minimum 50% pre- or post-consumer).		\$\$\$	2
2.2.10	Concrete used in the building has a minimum supplementary cementitious material of 25% (1 point), 30% (2 points), or 40% (4 points) within the scope of proper engineering practices.		\$ - \$\$\$	1, 2 or 4
2.2.11	Insulation used in walls, roofs, and exposed floors (cantilevers) is certified by a third-party to contain a minimum recycled content: 25% (1 point) or 50% (2 points).	1	\$\$ - \$\$\$	1 or 2
2.2.12	Overhead garage door is made of 75% or greater recycled material.		\$\$ - \$\$\$	1
2.2.13	Floor Coverings: (i) Install carpet that has a minimum of 50% recycled content or 30% renewable content. (ii) Natural or 100% recycled-content carpet pad (e.g. made from textile, carpet cushion, or tire waste, rebond qualifies). (iii) Save materials by eliminating carpet: have minimum of 20% concrete floor finished (e.g. stamped, acid-etched, etc.) and left exposed. (iv) Install ecologically preferred bamboo, cork, or hardwood flooring in each dwelling unit (1 point); more than 40% of all indoor floors (2 points) or more than 80% of all indoor floors (3 points). Products must be third-party certified from sustainably managed forests or certified sustainable sources (e.g. Rainforest Alliance, FSC, CSA, or SFI). (v) All ceramic tile installed in any dwelling unit has a minimum of 25% recycled content.		NC - \$	1
		1	NC - \$\$	1
			NC - \$\$	3
			\$ - \$\$\$	1 to 3
			\$\$\$	2
2.2.14	Paints or finishes are manufactured with minimum 20% recycled content.		\$ - \$\$	1
2.2.15	Shelving made from 100% agricultural waste or 100% recycled wood particle board, including shelving inside cabinets.		\$ - \$\$\$	2
2.2.16	Doors: (i) Exterior doors contain minimum 15% recycled and/or recovered content. (ii) Interior doors contain minimum 25% recycled and/or recovered content. (iii) Minimum 50% of interior doors made from third-party certified, sustainably harvested wood (CSA, SFI, or FSC). (iv) Minimum 50% of interior doors have been salvaged from another project.	1	\$	1
			\$	1
			NC - \$\$	2
			NC - \$\$	3
2.2.17	Windows: (i) Exterior window frames contain minimum 10% recycled or reclaimed content. (i) Exterior window frames made from third-party certified, sustainably harvested wood (CSA, SFI, or FSC).		\$\$	1
			\$\$\$	3
2.2.18	Parapets (2 points) or fascia and soffit (1 point each) made from minimum 50% recycled and/or recovered content (pre- or post-consumer).		\$	1 or 2
2.2.19	Exterior cladding materials contain a minimum of 50% recycled and/or recovered content for 25% of the building's exterior (1 point); or more than 50% of exterior (2 points); or more than 75% of the exterior (3 points); or more than 90% of the exterior (4 points).		\$ - \$\$\$	1, 2, 3 or 4
2.2.20	Exterior trim materials include at minimum 50% recycled and/or recovered content. This should include window, door, corner, and deck trim complete with any associated flashing.		\$ - \$\$\$	3
2.2.21	Exterior trim materials are manufactured from OSB, which must have no added formaldehyde.		\$ - \$\$\$	1
2.2.22	MDF and/or finger-jointed casing and baseboard used throughout (1 point), and in all jambs (1 point).	2	\$\$	1 to 2
2.2.23	Solid hardwood from third-party certified, sustainably harvested sources (CSA, SFI, or FSC) used for millwork and/or cabinets in all kitchens (2 points) and/or all bathrooms (2 points) in all dwelling units and common areas.		\$ - \$\$\$	2 or 4
2.2.24	More than 90% of all wood used for flooring, cabinets, and millwork is from: (i) domestic (i.e. North American) sources (4 points), (ii) recovered or re-milled sources (5 points), (iii) salvaged or re-used (6 points).		\$\$\$ - \$\$\$\$	4, 5, or 6

2.2.25	Minimum 25% recycled-content roofing system, including underlay and finish for 2 points, 50% recycled content for 4 points.		NC - \$\$	2 or 4
2.2.26	Provide a green roof over 50% (3 points), 75% (5 points), or 100% of total roof area (7 points), excluding any roof area used for energy generation (e.g. wind turbines or solar panels).		\$\$	3, 5, or 7
2.2.27	Use of miscellaneous salvaged materials derived from local sources for any building assembly or component not otherwise listed above (1 point for each different product used, to a maximum of 3).		\$ - \$\$\$\$	1 to 3

2.3: Durable Construction

2.3.1	Minimum 30-year manufacturer warranty roofing material (2 points plus 1 point for each additional 5 years). "Lifetime" warranties have terms/conditions that ultimately have a limit in real years, and will not be considered unless clarified. Inspection by certified roofing inspector or an envelope engineer for 1 point.	6	NC - \$\$\$\$	2 to 7
2.3.2	Low VOC water or damp proofing on foundation walls. ((SCAQMD Rule 1113, 2004 VOC limits: Waterproofing sealers <=250 g/L / Waterproofing Concrete or Masonry Sealers: <=400 g/L).	1	\$ - \$\$	1
2.3.3	Use a rain screen system to separate cladding from the wall sheathing with a drainage plane (2 points), made from 60% or more recycled content (additional 1 point for 60% OR additional 2 points for more than 90% recycled content). Integrate windows into drainage plane by angling bottom sills slightly down towards the exterior, and install window flashing to direct moisture out towards the drainage plane (additional 1 point).	2	\$ - \$\$\$	1 to 5
2.3.4	All exterior doors and windows manufactured from fiberglass (1 point for windows and/or 1 point for doors).		NC - \$\$	1 or 2
2.3.5	Natural cementitious stone/stucco/brick, metal cladding, or fiber cement siding, or combination thereof for 25% of exterior cladding (1 point), 50% (2 points), 75% (3 points) or more than 90% (4 points).	4	\$\$\$	1 to 4
2.3.6	Fascia and/or soffit made from fiber cement (1 point each).	2	\$\$\$ - \$\$\$\$	1 or 2
2.3.7	Exterior trim materials made from alternatives to solid lumber.		\$ - \$\$\$\$	1
2.3.8	All exterior trim is clad with pre-finished metal (1 point over wood backings, 2 points without wood backings).	2	\$\$\$	1 or 2
2.3.9	Deck, veranda, and balcony surfaces made from environmentally preferable low-maintenance materials (e.g. stone, concrete, tile, composites, etc.) that do not need maintenance of any kind, including painting, for a minimum of 5 years.	2	\$ - \$\$\$	2
2.3.10	Install durable flooring (e.g. laminate, finished concrete, tile, hardwood, etc.) in all high traffic areas (halls, kitchen, living space) (1 point); more than 30% of all indoor flooring (2 points); more than 60% of all indoor flooring (3 points); or more than 90% of all indoor flooring (4 points).	1	\$\$ - \$\$\$\$	1 to 4
2.3.11	Countertops are made from durable materials such as granite, concrete, recycled glass, metal, or local natural stone, for all kitchen counters (2 points), or all other countertop areas (1 point), or both (3 points total).		\$\$ - \$\$\$	1, 2 or 3
2.3.12	Lifetime finish on all faucets.		NC - \$	1
2.3.13	Lifetime finish on all door hardware.		NC - \$	1
2.3.14	Install only Type 1 or 2 grade door hardware with lifetime mechanical warranty.		\$ - \$\$\$	2

TOTAL SECTION POINTS 28

III. INDOOR AIR QUALITY

This section focuses on the quality of the air within the finished building. Products listed here include materials that are low in VOCs, products made from all natural materials as well as various air cleaning and ventilation systems.

Minimum 15 Points Required

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Relative cost
Points per item

3.1: Air Treatment			
3.1.1	Install air filtration on all air handling systems: (i) pleated media filter with minimum MERV rating of 7 (1 point) or 12 (2 points); OR (ii) an electrostatic air cleaner (2 points); OR (iii) an electronic air cleaner (3 points); OR (iv) a HEPA filtration system (6 points).	1	NC - \$\$\$ 1, 2, 3 or
3.1.2	Install ultraviolet air purification in air handling systems.		\$\$\$ 2
3.1.3	Provide thermostats in each dwelling unit or zone that indicates the need for the air filter to be changed or cleaned.	1	\$ 1
3.1.4	The HVAC design includes humidity control within each dwelling unit, zone and/or common area.		\$ 2

3.2: Contaminant Source Elimination

3.2.1	All combustion space and water heating equipment located within building are sealed with no possibility of backdraft.	1	\$ - \$\$ 1
3.2.2	Provide soil gas/radon protection: (i) either verify that radon gas levels are within government-approved safe limits at the site, or provide passive sub-slab ventilation (1 point); OR (ii) actively depressurizing the sub-slab (i.e. add a fan for 2 points).		\$ 1 or 2
3.2.3	Seal all permanent ductwork upon installation, removing seals once all phases of construction are complete.		NC - \$ 1
3.2.4	Prior to occupancy, but after all interior construction is substantially complete and all finishes have been installed, perform a full flush of the air within the building by running the air handler (on maximum speed if a variable speed device) for a minimum of 48 hours (combined over not more than 4 sessions), and provide new filters in the air handler after the flush is complete.		\$ 2
3.2.5	Central vacuum system exhausted outside conditioned space.		\$ - \$\$ 1
3.2.6	Insulation used is third-party certified to have zero formaldehyde.	2	\$ 2
3.2.7	Low formaldehyde sub floor sheathing (third-party certified to less than 0.18 ppm).		\$ - \$\$\$ 2
3.2.8	Low formaldehyde underlayment is used throughout (third-party certified to less than 0.21 ppm).		\$ 1
3.2.9	Low formaldehyde particle board/MDF used for cabinets: more than 0.21 ppm for 1 point, or zero formaldehyde for 2 points.	1	\$ - \$\$ 1 or 2
3.2.10	Low formaldehyde particle board/MDF used for shelving: more than 0.21 ppm for 1 point, or zero formaldehyde for 2 points.	1	\$ - \$\$ 1 or 2
3.2.11	All interior wire shelving is factory coated with low VOC/no off gassing coatings.		\$ - \$\$ 2
3.2.12	All hardwood floors are site-finished with water-based urethane finishes, or are factory finished.	2	\$ - \$\$ 2
3.2.13	Water-based lacquer or paints are used on all site-built and installed millwork, including doors, casing, and baseboards (less than 200 grams/litre of VOCs for 2 points or less than 50 grams/litre for 3 points).	2	\$\$ 2 or 3
3.2.14	Interior paints used have low VOC content (less than 200 grams/litre of VOCs for 1 point or less than 50 grams/litre for 2 points).	1	NC - \$ 1 or 2
3.2.15	Interior paints have no VOCs in base paint prior to tint (1 point) or in tint (2 additional points). Alternatively, for a full 3 points, use natural finishes such as lime plasters (NOTE: If taking points in 3.2.15, then also take point in 3.2.14).		\$\$\$ 1 to 3
3.2.16	All ceramic tiles are installed with low VOC adhesives (less than 65 grams/litre) and plasticizer-free grout.	1	\$\$ 1
3.2.17	All vinyl flooring is replaced with natural linoleum installed with low VOC adhesives, or other hard-surface flooring.		\$\$ - \$\$\$\$ 2
3.2.18	All flooring is installed with low VOC (less than 60 grams/litre) adhesives (for 1 point), or with zero VOC adhesive (2 points), or no adhesive (2 points).	1	\$\$ - \$\$\$\$ 1 or 2

TOTAL SECTION POINTS 17

3.2.19	Carpet and Rug Institute (CRI) IAQ label on all carpet used. Gemeinschaft umweltfreundlicher Teppichboden's (GUT) production information system PRODIS is also recognized.	2	NC - \$\$ 2
3.2.20	Carpet and Rug Institute (CRI) IAQ label on all underlay used. Gemeinschaft umweltfreundlicher Teppichboden's (GUT) production information system PRODIS is also recognized.	1	NC - \$\$ 1
3.2.21	Natural material-based carpet (e.g. wool) in all living areas (for minimum 150 ft2).		\$\$\$ 2
3.2.22	Carpet-free design: all flooring surfaces are hard (including stairs).		\$ - \$\$\$\$ 2
3.2.23	For all permanent or significant entryways leading from outdoors, install an entryway system of at least 10 feet in length to captures dirt and particulates (i.e. grates/grills/slotted systems or roll-out mats that are maintained weekly by a service organization).		\$ - \$\$ 2

IV. VENTILATION

This section covers the mechanical ventilation systems in the building, including air filtration and heat recovery.

Minimum 5 Points Required
Platinum Level Note: Platinum level homes must use item 4.1.

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		Relative cost	Points per item
4.1	Ventilation system is designed and installed according to CSA Standard F326 or ASHRAE 62.1.		\$ - \$\$\$ 4
4.2	All ductwork thoroughly sealed along all seams, joints, connections, penetrations, etc., in accordance with local prevailing code and industry best practice (2 points) or test/verify duct leakage to be less than 8 cfm (at 25 Pa) per 100 ft ² of conditioned floor area (2 additional points).	2	NC - \$\$ 2 or 4
4.3	Install in-line ventilation fan with programmable timer (separate switch from lighting) in each unit.		\$ 1
4.4	Install motorized damper on all bathroom/exhaust fans.		\$\$ 2
4.5	All bath fans have a noise level of 1 sone or less.	2	NC - \$\$ 2
4.6	Provide local bathroom exhaust fan controls in each unit using either an occupancy sensor, automatic humidistat controller, automatic timer, or continuously operating exhaust fan.		\$ - \$\$ 1
4.7	Install timer switches, occupancy sensors or central BAS controls on all local exhaust fans outside of individual units (i.e. laundry, recreation, storage areas, etc.).		\$ - \$\$ 1
4.8	Install passive Heat Recovery Ventilator (HRV, for 2 points) or an active Heat Recovery Ventilator/Energy Recovery Ventilator (HRV or ERV, 4 points) either centrally or in each unit.	4	\$ - \$\$\$\$ 2 or 4
4.9	Install permanent (de)humidification control in each unit (ERVs are considered acceptable).		\$ - \$\$ 1
4.10	For indoor pool areas, install a designated dehumidification system designed by a consulting engineer or qualified contractor to match the water and air temperatures maintained in the area.		\$ - \$\$ 1

TOTAL SECTION POINTS 8

V. WASTE MANAGEMENT

This section deals with the handling of waste materials on the construction site and encourages recycling.

Minimum 7 Points Required

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5.1	Comprehensive recycling program during construction for building site including education, site signage, and bins.	2	\$ 2
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3.2	Implement a recycling program: collection of waste materials from site by a waste management company that is a current member of a provincial recycling council or equivalent association and verifies that a minimum of 25% of the materials collected from the construction site have been recycled.	4	\$ - \$\$	4
3.3	Suppliers and trades recycle their own waste, including leftover material and packaging (1 point per trade—maximum 4 points).	1	\$	1 to 4
3.4	Minimum 25% (1 point), 50% (2 points), 75% (3 points), or 90% (4 points) by weight or volume of waste materials collected from construction site is diverted from waste stream.	3	\$ - \$\$\$	1 to 4
3.5	OR Waste reduction for remote projects: for projects occurring in regions that are minimum 100km away from the nearest population center with minimum 30,000 residents, the project may earn 1 point if the total amount of waste produced on the construction site is less than 4 lbs/ft ² , 2 points are available for less than 3 lbs/ft ² , and 3 points for less than 2 lbs/ft ² , and 4 points less than 1 lbs/ft ² .		\$ - \$\$\$	1 to 4
3.6	Metal or engineered durable form systems used for concrete foundation walls.		NC - \$\$	1
3.7	Install permanent recycling center in each residential unit with two or more 26L bins (1 point), or four or more 26L bins (2 points), located in, or conveniently close to, the kitchen. Multiple bins are intended to facilitate sorting of different recyclables, potentially including compost. Equivalent bin configurations will be accepted where aligned with local recycling program requirements.		\$ - \$\$\$	1 or 2
3.8	Provide a central recycling center for the housing project including, as a minimum, separate bins for paper, glass, and metal (1 point), and/or install a trash compactor (1 point).	1	\$ - \$\$\$	1 or 2
3.9	Existing dwellings onsite from prior to construction are recycled (greater than 50% diverted from landfill for 3 points) or relocated (6 points) rather than demolished.		\$\$\$\$ - \$\$\$\$\$	3 or 6

TOTAL SECTION POINTS 11

VI. WATER CONSERVATION

This section encourages a reduction in the amount of water used in the building.

Minimum 10 Points Required

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3.1: Indoor Water Conservation

		Relative cost	Points per item	
3.1.1	Install a calibrated water meter in every unit.		3	
3.1.2	Install ultra efficient toilets with average flow rates less than or equal to 3L/flush for 2 points each (up to 6 points).		2, 4 or 6	
3.1.3	Install efficient toilets with average flow rates less than or equal to 4.5L/flush for 1 point each (up to 3 points).	2	\$ - \$\$\$	1, 2 or 3
3.1.4	Install waterless urinals in all public washrooms for men.		\$ - \$\$	1
3.1.5	Install hot water recirculation system with all hot water lines insulated (2 points) with local activation/call switches installed at all points of use (additional 2 points), or point-of-use instant DHW system (1 point each, maximum 4).	2	\$\$\$ - \$\$\$\$\$	1 to 4
3.1.6	Install low-flow aerated faucets for all lavatories (less than 5.7 lpm) including kitchen (less than 6.8 lpm) for 2 points, and all showers and tub/showers (less than 7.5 lpm) for 1 additional point.		\$\$	2 or 3
3.1.7	Provide front-loading clothes washer (2 points), or condensing combination wash/dry unit (4 points), or top-loading clothes washer having a rated water factor of less than 25 litres per cycle per cubic foot (3 points).	2	\$ - \$\$\$	2, 3 or 4
3.1.8	Install water-saving dishwasher that uses less than 20.0 L/water per load.	1	\$ - \$\$	1

3.2: Outdoor Water Conservation

3.2.1	Install permeable paving materials for all driveways and walkways (minimum 70% of hardscaped area).		\$\$\$ - \$\$\$\$\$	3
3.2.2	Design all impermeable hardscape surfaces to direct rainwater to an on-site infiltration feature (i.e. vegetated swale, rain-garden, cistern, etc.).	1	NC - \$\$	1
3.2.3	Provide a minimum of 8 inches of topsoil or composted yard waste as finish grading throughout site.	2	\$\$\$ - \$\$\$\$\$	2
3.2.4	Provide a list of drought-tolerant plants and a copy of the local municipality water usage guide to building manager(s)/occupants with closing package.	1	NC - \$\$	1
3.2.5	Reduce lawn/turf to 50% of landscaped area.	1	NC - \$\$	1
3.2.6	Provide permeable landscaping that is water efficient (for 1 point), xeriscaped (50% of landscaping for 2 points, 100% for 4 points), or is 100% plant-free landscaping (4 points).		\$ - \$\$\$\$\$	1, 2 or 4
3.2.7	OR Install efficient irrigation technology including (for 1 point each, to maximum 3 points): (i) has head-to-head coverage; (ii) uses high efficiency spray heads with distribution uniformity of 0.7 or greater; (iii) uses a square spray patterns to increase efficiency and reduce overspray onto non-permeable surfaces; (iv) uses drip irrigation for minimum 50% of planting bed area, including all larger shrub bed areas; (v) includes a flow sensor, central shut-off valve, and sub meter; (vi) has a pressure regulating device; (vii) includes a moisture sensor/rain delay controller.	1	\$ - \$\$\$	1 to 3

3.3: Water Re-Use

3.3.1	Provide one rain barrel per unit, complete with insect screen, drain, and overflow spouts, and connect to building downspout (1 point).		NC - \$\$	1
3.3.2	OR Provide a central rainwater collection cistern (minimum 50L per unit) to offset domestic water usage either indoors (e.g. atrium water, toilet flushing) or outdoor (e.g. irrigation for atria or gardens) (3 points for above grade, 5 points for below grade).		\$\$ - \$\$\$\$\$	3 or 5
3.3.3	Grey water: rough-in a system for collecting waste water from sinks, showers, and/or kitchens to capture and treat for use in toilets or irrigation (3 points), or complete the system by installing greywater treatment equipment (6 points).		\$\$\$ - \$\$\$\$\$	3 or 6
3.3.4	Install on-site black water treatment system or engineered wetland for reprocessing local sewage (8 points).		\$\$\$\$\$	8

TOTAL SECTION POINTS 13

VII. BUSINESS PRACTICES

This section deals more with manufacturers and builders office and business practices.

Minimum 8 Points Required

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7.1: Builder's Internal Policies

7.1.1	Builder has a written environmental policy defining their commitment (must include an office recycling program, a staff education program, appropriate signage in the builder's offices, and energy efficient lighting). The policy must be signed by a senior executive and published on the company website.	1	NC	1
7.1.2	Builder's environmental policy includes and prioritizes milestones for future net-zero housing developments.		\$\$\$\$\$	1

7.1.3	Manufacturer and/or supplier has a written environmental policy with defined environmental commitments (must include an office recycling program and energy efficient lighting). (1 point per supplier/manufacturer—maximum of 2 points).	1	\$\$\$\$	1 or 2
7.1.4	Products used for the building are manufactured within 800 km of build site (1 point for each 2 products to maximum 5 points).	4	\$	1 to 5
7.1.5	Manufacturers and/or suppliers purchase 50% or more of their power needs from solar, wind, or renewable electricity (1 point per supplier to maximum 3).		NC	1, 2 or 3
7.1.6	Builder's office and show homes/presentation centers purchase a minimum of 50% (1 point) or 100% (2 points) of their energy from renewable resources such as solar, wind, or biogas.		\$\$	1 or 2
7.1.7	50% (2 points) or 100% (4 points) of electricity used during construction of the project is generated by wind power or equivalent green power certificate. Usage from a typical 6 month construction period or a recent similar project can be used to determine the monthly average.		\$\$\$	2 or 4
7.1.8	50% (2 points) or 100% (4 points) of electricity used by occupants during first year of occupancy is generated by wind power or an equivalent renewable energy supply (prepaid by builder).		\$ - \$\$\$	2 or 4
7.1.9	When building in winter, builder uses best-practice cold-construction techniques to minimize energy wasted during construction (e.g. no propane heaters with tarps: consider radiant heaters, manufacturing components indoors, etc.).		NC	1
7.1.10	Perform air-tightness inspections at the pre-drywall stage (1 point) with optional door-fan depressurization test where applicable (1 additional point).		\$	1 or 2
7.1.11	Builder's show home(s) or presentation centres (i.e. the building(s) incorporating model suites) incorporate permeable landscaping, which is water efficient or xeriscaped (50% of lawn for 2 points, 100% for 4 points).		\$\$ - \$\$\$\$	2 or 4
7.1.12	The builder integrates innovative sustainable building practices above and beyond what is contained within the checklist section and provides supporting documentation. The innovation must apply to the project and will be reviewed by the Technical Standards Committee at the time of submission.		NC - \$\$\$	1 to 5

7.2: Community Development & Transportation

7.2.1	Implement a Construction Traffic/Truck Management Plan to avoid high congestion areas during construction by (as a minimum): (i) identifying potentially sensitive neighbours; (ii) ensuring that all vehicles can manoeuvre and park efficiently; (iii) avoiding vehicle idling; (iv) scheduling vehicle movements appropriately.		NC	1
7.2.2	Project site has a designated delivery area where truck wheels are washed/treated during construction (to contain dirt).		NC - \$\$	1
7.2.3	Builder's company vehicles are electric, hybrid, or bio-diesel vehicles (1 point per vehicle—maximum of 3 points).		NC - \$\$	1 to 3
7.2.4	Development site provides community amenity space for not-for-profit (NFP) community services.		NC - \$\$\$\$	2
7.2.5	Development site provides for Publicly Accessible Private Space.		NC	1
7.2.6	Trees and natural features on site are protected during construction. (Point not available where there is nothing to protect.)	1	NC	1
7.2.7	Development includes a diversity of housing types, including minimum 20% live/work units (2 points) and/or minimum 25% mixed use facilities (2 points).		NC	2 or 4
7.2.8	Masterplan to encourage shared transportation: (i) Provide minimum one parking stall for a car-sharing vehicle (1 point); AND/OR (ii) Provide a shared vehicle as an asset owned by the condominium association (3 points); AND/OR (iii) Provide permanent bicycle storage on site that is convenient, secure, and sheltered (1 point).		\$ - \$\$\$\$\$	1, 2, 3, 4

7.3: Training

7.3.1	Builder provides BUILT GREEN® building owner manual, completed BUILT GREEN® checklist, and educational walkthrough for building manager(s)/owner(s) upon closing.	2	\$ - \$\$	2
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7.3.2	Contracted trades, suppliers, and/or supporting design professionals have successfully taken and maintained BUILT GREEN® Training (1 point per trade organization, maximum 5).	1	\$	1 to 5
7.3.3	Builder's Site Superintendent has successfully taken and maintained BUILT GREEN® Orientation Training status (1 point), or Building Science Training endorsed by Built Green Canada (e.g. NRCan's Energy Advisor or R-2000 courses, or related formal schooling) (2 additional points).	1	\$	1, 2 or 3

7.4: BUILT GREEN® Promotion

7.4.1	Builder's construction site and sales office signage clearly display the BUILT GREEN® logo and promotes the fact that the project is registered as a BUILT GREEN® project.	1	\$	1
7.4.2	Builder's primary place of business (i.e. office) is certified via a recognized third-party best practice program.		\$\$	3
7.4.3	Builder agrees to construct and label a minimum of 50% of all their buildings in all their projects to the applicable BUILT GREEN® standard each calendar year (3 points for 50%, 5 points for 100%).	5	\$ - \$\$	3 or 5

TOTAL SECTION POINTS 17

TOTAL CHECKLIST POINTS 124

Appendix B

Preliminary Energy Modeling Analysis

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REPORT

BPP Lot 1 Preliminary Energy Modeling Analysis

West Vancouver, BC

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APPENDIX A: Model Input Summary

Presented to:

Jason Wexler
Vice President Design & Development

British Pacific Properties Limited
1001 - 100 Park Royal, West Vancouver, BC

Report No. 1800605.AB

January 17, 2018

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DELIVERABLES\DRAFT\BPP LOT 1 PRELIMINARY ENERGY MODELING
REPORT.DOCX

1. INTRODUCTION

Morrison Hershfield has created a preliminary energy model for the British Pacific Properties Lot 1 project in West Vancouver, BC. The intent of this memo is to communicate the energy performance of the preliminary design scheme with respect with the requirement to demonstrate compliance with Step 2 of the new BC Step Code, as well as meeting Built Green Silver with minimum energy performance of 10% better than NECB 2011.

The energy model is based on the pricing drawing set dated December 8, 2017, discussions with the design team, and our experience on similar projects including the previous projects at Lot 36 and Lot 37. The design includes a VRF system with suite HRVs, high efficiency natural gas DHW heater, and fan power savings from ECM motors for zone VRF terminals. Detailed energy modeling inputs are available in Appendix A.

The BC Step Code includes targets for both energy use intensity (EUI) and thermal energy demand intensity (TEDI.) In general, the design is expected to meet the Built Green energy target as well as the EUI target for Step 2, but is constrained by the need to meet the TEDI target for Step 2.

In order to meet the TEDI target, the following design measures have been selected by the project team:

- Triple glazing with maximum U-0.25
- R-50 roof performance on main roof, with R-26 performance on intermediate levels terrace roofs
- Thermally efficient exterior insulated wall assemblies, with minimum effective R-9 walls, taking into account all thermal bridging.
- Reduced glazing ratio to maximum of 45% of above-grade wall area (or R-10 walls with 50% glazing ratio)
- Heat recovery for corridor ventilation air
- Improved heat recovery with minimum 80% effectiveness for suite and corridor ERVs
- Air leakage rate meeting code values, with no credit taken for improved air tightness
- Other inputs in Appendix A

The above measures reduce the EUI to 92 kWh/m²/yr and the TEDI to 46.8 kWh/m²/yr, meeting the Step 2 targets. The EUI target is well under the Step 2 target of 130 kWh/m²/yr, however the TEDI target of 47 (including an adjustment of 2 kWh/m²/yr for corridor pressurization) is just barely met by the design, and any additional improvements to envelope or heat recovery may help to allow for changes to the design in future.

The above design achieves 16% energy savings over NECB 2011, meeting the Built Green HD 2017 or 2018 Silver target of 10% energy savings over NECB.

In general, the EUI performance of the building is readily meeting Step 2 and even Step 3 targets, based primarily on the high efficiency of the VRF system combined with envelope and heat recovery savings. Step Code's other target, TEDI, is a measure of how much heat is supplied to the building, and does not take into account the efficiency of the system. As such it is primarily a measure of the heat loss through the envelope, and of ventilation air heat recovery. TEDI is heavily impacted by the shape of the building, with impacts of up to around 20 kWh/m²/yr compared with a total TEDI target of 45, holding all other inputs constant but changing the shape of an archetype building from square to narrow. As the

building changes shape, it has much more wall area compared with the floor area of the space, and therefore much higher envelope heat losses per square meter of floor space. This makes meeting TEDI more challenging and requires significant improvements to the envelope, in this case including triple glazing and high performing walls.

Table 1. Energy Target Summary

	Proposed Building	Target	Meets Target?
EUI (Step 2)	92	130	Yes
TEDI (Step 2)	46.8	47	Yes
Built Green	16% energy savings over NECB 2011	10% energy savings over NECB 2011	Yes

2. PARAMETRIC ANALYSIS

Several options for meeting the TEDI target were discussed during a focused energy meeting on January 9, 2018. The options and impacts of measures discussed and selected are summarized below.

2.1 Preferred Option: Triple Glazing and High Performance Walls and HRVs

This strategy has been selected by the team as the preferred design. It incorporates triple glazing with U-0.25, high effective thermal performance walls, corridor heat recovery and higher efficiency in-suite HRVs. It does not incorporate any targets for air leakage beyond code requirements.

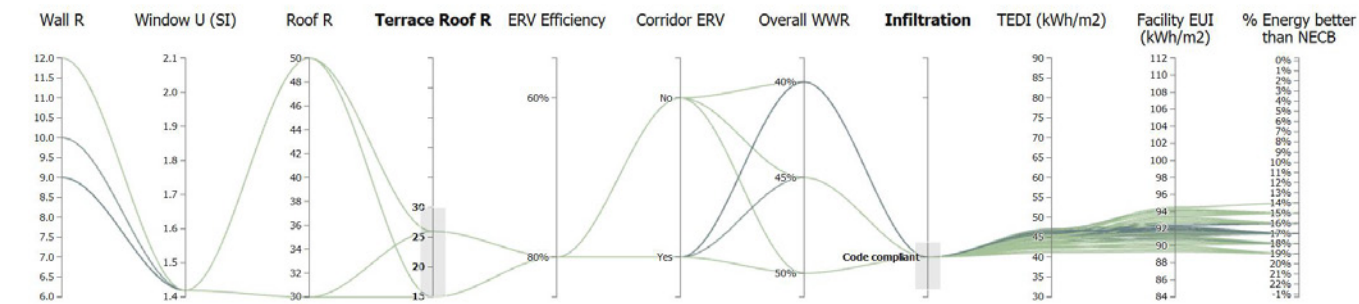


Figure 1. Anticipated Design

2.2 Reduced Air leakage Option

This strategy requires that the project achieve air leakage rates significantly lower than the code requirement. This allows the design to meet the Step Code using double glazing but increases the risk that the project may require costly and time-consuming repairs and re-testing at the end of construction.

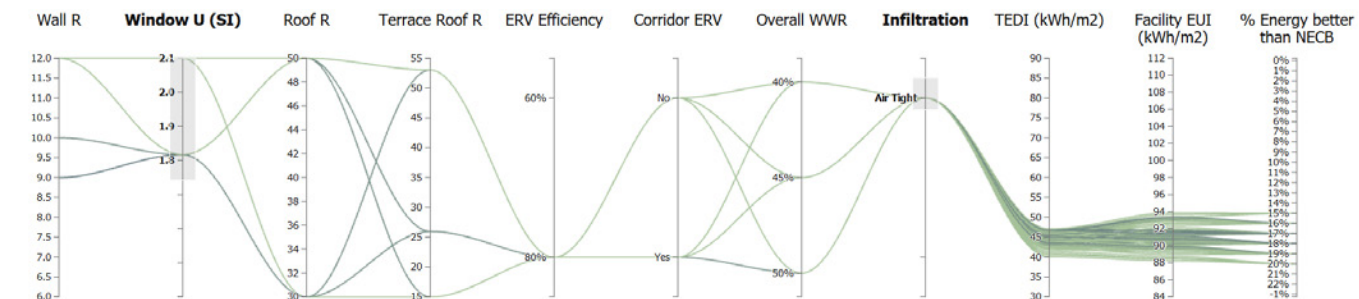


Figure 2. Reduced Air Leakage Option

2.3 Impacts of Terrace Roofs, Glazing Ratio, and Wall R

During the energy meeting, it was discussed that terrace roofs (the roofs over conditioned space on intermediate levels) could have more than minimal insulation added but likely could not be insulated as fully as the upper main roof. The parametric model included terrace roof options at R-15, R-26, and R-50; therefore the R-26 option was assumed to be achievable, to be confirmed by the design team.

There are some trade-offs available between wall R-value, terrace roof R-value, and the maximum glazing ratio. In understanding those trade-offs, we have assumed that the main roof is heavily insulated at R-50. It should also be noted that many of these options are just barely compliant with TEDI, and some buffer room should be considered to reduce the risk of future design changes to code compliance.

Based on the preferred triple glazing option above, the minimum effective wall R-value required is R-9. At R-9 walls and with R-26 terrace roofs, the maximum window to wall ratio is 45% of above grade walls.

If the walls were improved to R-10, a maximum of 50% window to wall ratio would be compliant.

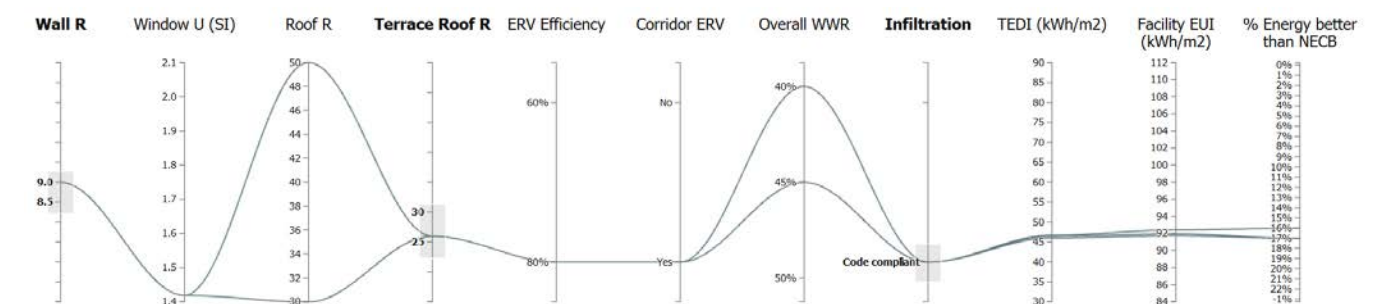


Figure 3. Walls R-9 leading to maximum 45% glazing ratio

2.4 Impacts of Heat Recovery

The inclusion of high performance heat recovery is a major driver of TEDI reduction. With typical 60% effective ERVs in the suites, there is no option using code compliant air leakage rates that would meet TEDI requirements. The impact of ERV effectiveness between 60% and 80% is approximately 6 kWh/m²/yr in TEDI. Adding corridor heat recovery has an impact of approximately 3 kWh/m²/yr TEDI.

With neither corridor heat recovery nor highly efficient heat recovery (targeting 80% or higher currently, pending equipment selection by mechanical), the design would require both triple glazing and significant reductions in air leakage through the envelope. Based on discussions with the project team, we understand that the design will now include corridor heat recovery as well as high efficiency heat recovery in both the suites and corridors.

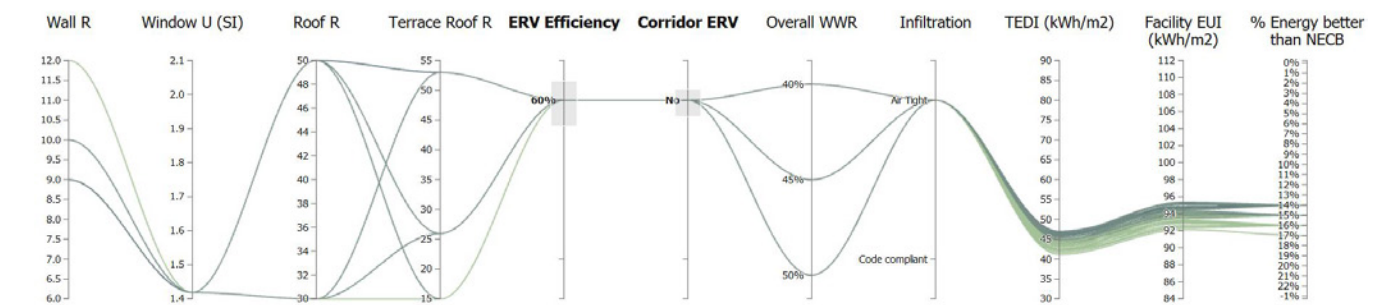


Figure 4. Potential impacts of no improved heat recovery

3. END USE BREAKDOWN

The detailed end use results for the proposed design and the NECB 2011 reference building are presented in Table 1 and Figures 1 and 2.

Table 2. NECB 2011 Energy End Use Breakdown

	Proposed		NECB 2011 Baseline		Savings (%)
	Electricity (GJ)	Natural Gas (GJ)	Electricity (GJ)	Natural Gas (GJ)	
Heating	117,946	99,505	172,360	138,663	30%
Cooling	43,127	-	32,379	-	-33%
Interior Lighting	219,710	-	236,218	-	7%
Exterior Lighting	21,831	-	21,831	-	0%
Plug Loads	165,812	-	165,812	-	0%
Fans	106,582	-	163,843	-	35%
Pumps	1,432	-	309	-	-363%
DHW	876	125,058	876	146,029	14%
Total	677,315	224,563	793,628	284,692	16%

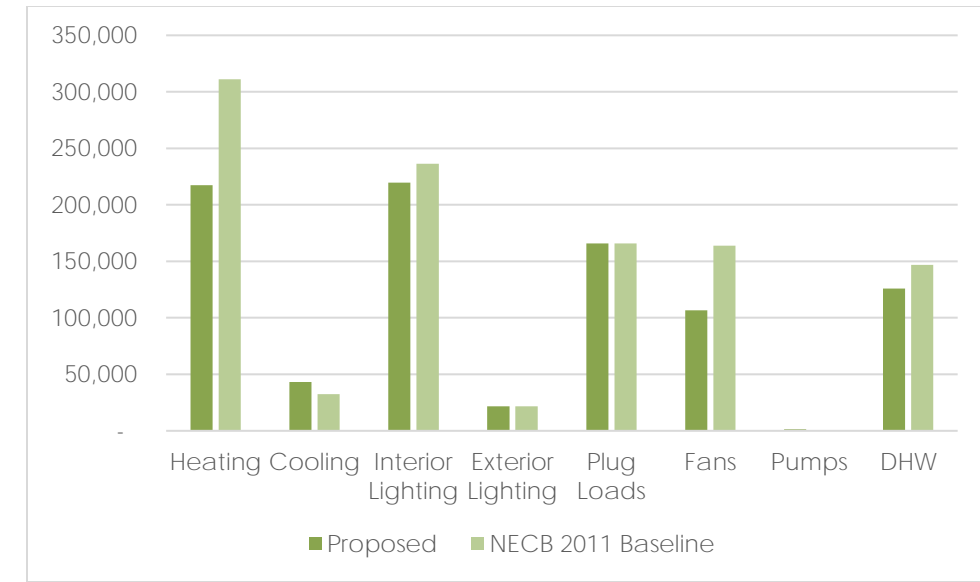


Figure 6. NECB 2011 Energy End Use Breakdown

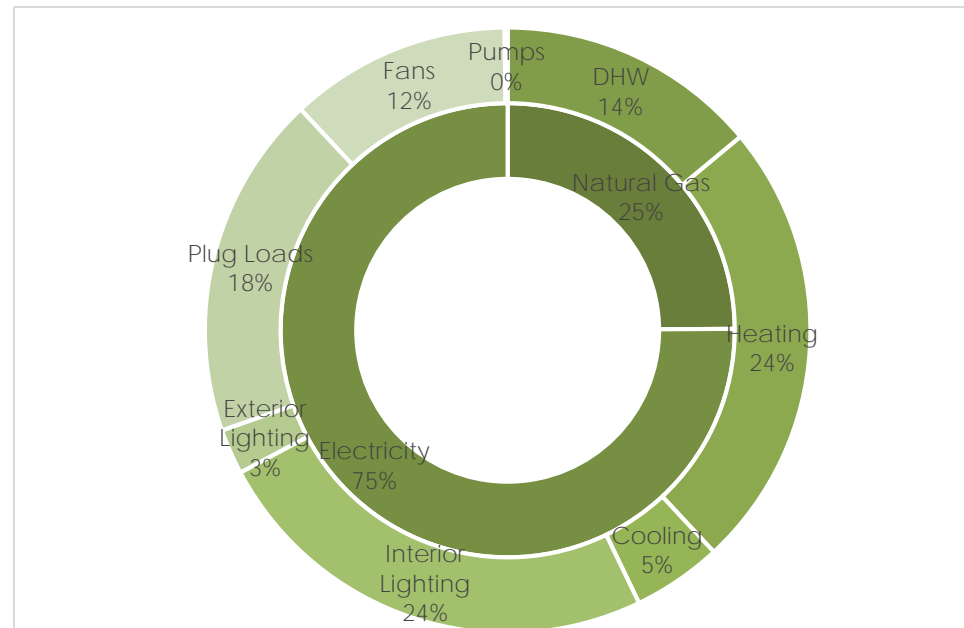


Figure 5. Proposed Energy End Use

4. NEXT STEPS

Based on the design measures discussed above, the British Pacific Properties Lot 1 project currently meets both the Step 2 EUI and TEDI requirements and the Built Green Silver requirement.

The design team should confirm that the above energy efficiency measures are achievable and can be incorporated into the design, with particular attention to window U-values, wall R-values, glazing ratio, and heat recovery. Other inputs to the model are described in Appendix A below, and should be confirmed by the design team.

If you have any questions or comments regarding the above information, please feel free to contact the undersigned.

Regards,

Morrison Hershfield



Yichao Chen, P.Eng., LEED AP BD+C
Building Energy Consultant



Alex Blue, P.Eng., LEED AP BD+C
Building Energy Consultant

APPENDIX A: Model Input Summary

The information used to develop the energy model was based on preliminary design information and is detailed below. The inputs are also compared to those used to develop the ASHRAE and NECB baseline building models.

Table A1. Comparison of Inputs for Design and Baseline Models

Characteristic	NECB 2011 Baseline	Proposed Design
Weather	Vancouver, BC	
Software	EnergyPlus v8.8	
Climate Zone	Climate Zone 4	
Building Area	9,758 m ² (excluding parkade) 3,481 m ² parkade	
Operating Hours	NECB Schedule G and C building profiles for occupancy, lighting and plug loads. 4hour/day parkade fans and 24hour/day parkade lighting Corridor, stairs, mechanical using CoV modelling guideline	
Occupancy	5 m ² /person gym and meeting, 10 m ² /person amenities and lobby 100 m ² /person corridors, storage 200 m ² /person mechanical, stairway Unit occupancy assumes 2 people per suite + 1 person per additional bedroom in each suite.	
Plug & Process Loads	NECB and CoV modelling guideline requirements: 5 W/m ² suites and guest unit 10 W/m ² kitchen 1 W/m ² corridor, gym, storage, mechanical, amenity, lobby	
Elevators	6 kW allowance	
Outdoor Air	ASHRAE 62.1-2001 for most space types, except Corridor pressurization at 25cfm/door, Parkade 3.7 L/s/m ²	
Wall R-Value	R-18.0	Varied R6, 7, 8, 9, 10, 12
Below Grade Wall C-Factor (W/m ² K)	C-0.52 (R10 insulation)	C-0.27 (R20 insulation)
Roof R-Value	R-25.0	Varied R-30 or R-50

Terrace Roof R-Value	R-25.0	Varied R-15, R-25 or R-50
Parkade Ceiling R-Value	R-25.0	R-20
Exterior Floor R-Value	R-25.0	R-30
Window U-Value	U-0.42 SHGC 0.4	Varied U-0.25, 0.32, 0.37 SHGC 0.4
Window Area %	40%	Varied overall WWR 40%, 45%, 55% (equivalent of 50%, 55%, 60% for suites WWR)
Shading	None	Balconies and fixed exterior shading devices
Interior Lighting	5 W/m ² suites 8.4 W/m ² corridors 7.4 W/m ² stairs 9.7 W/m ² lobby 13.4 W/m ² mechanical 6.8 W/m ² storage 9.4 W/m ² amenity 2 W/m ² parking	10% better than NECB baseline in common areas. Suites 5 W/m ²
Exterior Lighting	3 kW allowance modeled.	3 kW allowance modeled (Exterior walkways and drive)
HVAC Systems	PTHP and OA supplied directly to suite/amenity. No HRVs in baseline therefore assuming PTHP supplies and distributes OA. Corridor, stairs, mech, and storage same as proposed. Gas fired DOAS systems 81% nominal efficiency.	VRF with suite ERV, VRF in amenity spaces with DOAS, Baseboard in corridors and stairs with DOAS, Force flow heaters in storage and mech rooms with DOAS. Condensing gas fired DOAS systems 92% nominal efficiency.
Sizing	11C room air to supply air temperature difference in cooling. 21C temperature difference in heating.	HRVs sized as per ASHRAE 62.1-2001 design and corridor pressurization (25 cfm/door). VRF sized to meet loads.

Supply and Ventilation Air	Ventilation, heating, and cooling loads served by PTHP operating continuously. Corridor, stairs, storage, parkade same as proposed.	Ventilation air supplied directly to suite through ERVs. Suite VRF terminal fans run intermittently to meet heating and cooling loads only. Corridor, stairs, storage supplied by DOAS (100%OA).
Heat Recovery	None.	Varied, 60% or 80% effective sensible and latent energy recovery Varied, corridor ERV on or off.
Fans	640 Pa at combined efficiency of 40% 0.5 W/cfm for parkade exhaust No HRVs	0.25 W/cfm for VRF fans 1 W/cfm for ERVs 0.5 W/cfm for parkade exhaust
Cooling	PTHP units with rated COP 3.6 PTAC units with rated COP 3.45	VRF Cooling with seasonal COP 4.7 PTAC Cooling with seasonal COP 5
Heating	PTHP units with rated COP 2.75	VRF Heating with seasonal COP 3
Pumps	Same head and efficiency as proposed	VFD 60 ft head, 19W/gpm
DHW	DHW from NECB and CoV modelling guideline Natural gas DHW 80% efficient.	No load reduction from baseline. Natural Gas (condensing) DHW, 88% nominal efficiency



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Appendix C
Site Survey