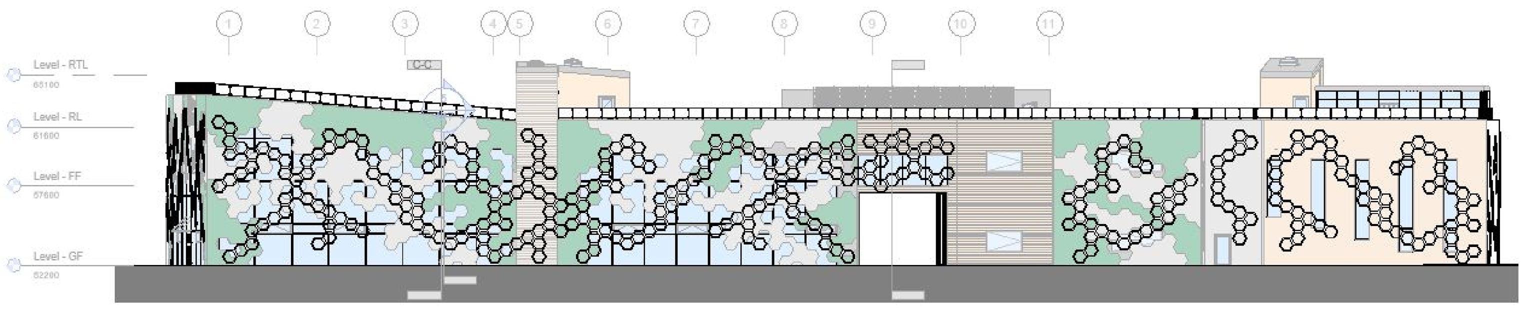
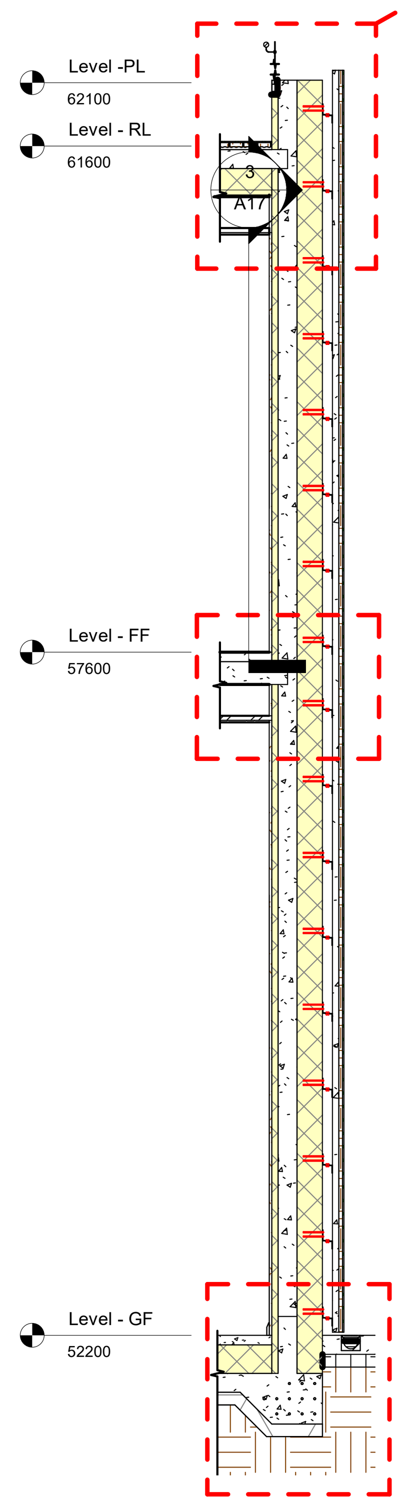
East Wall Study

Drawn by: Dylan O Connor

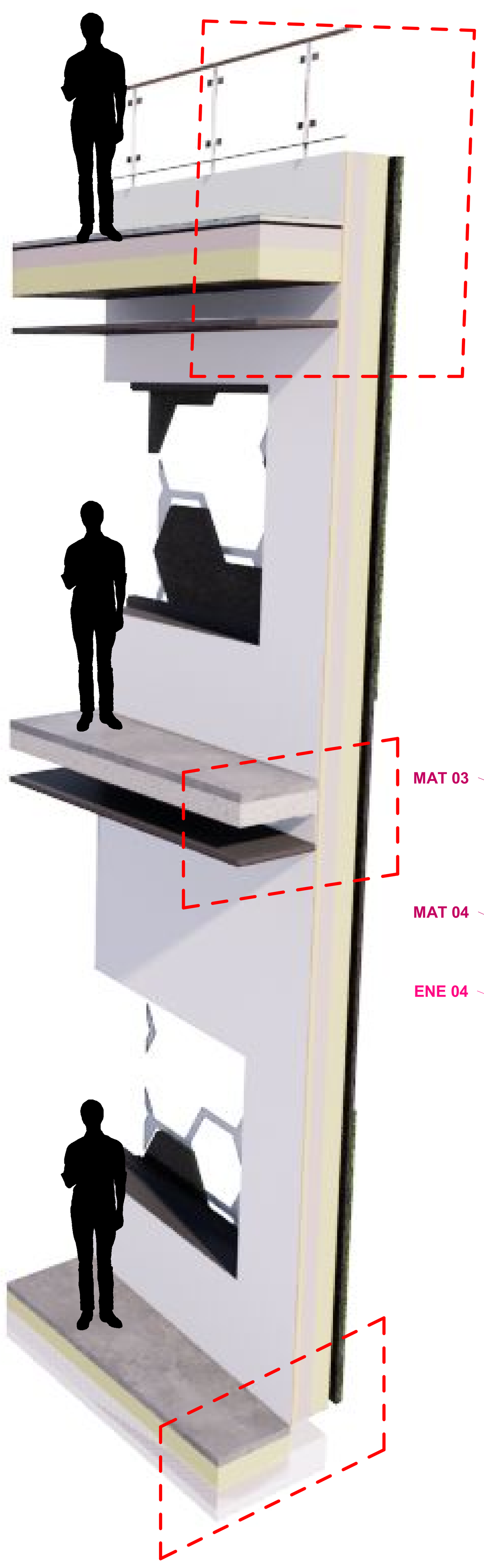


Key Elevation NTS

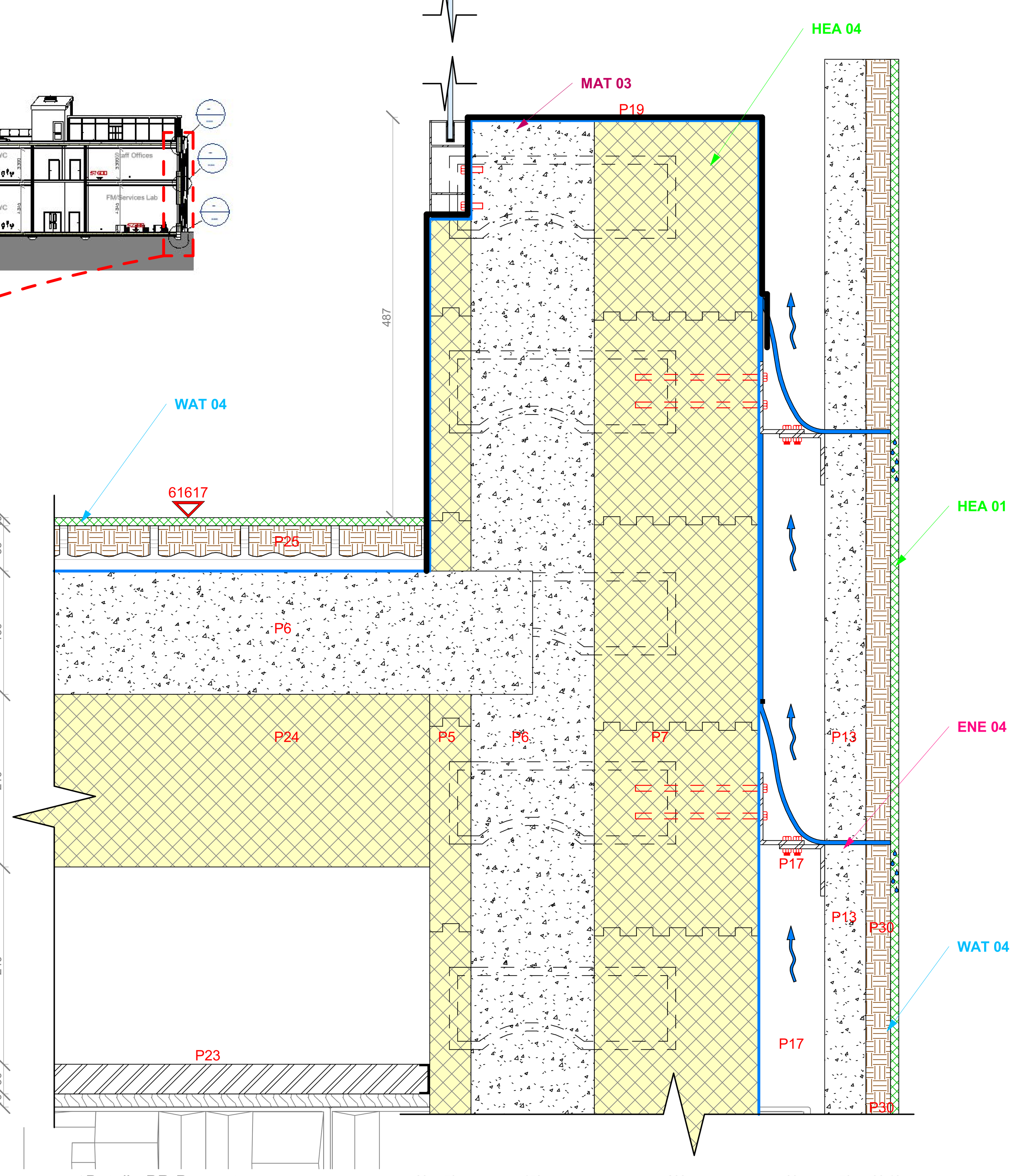
Key Section NTS



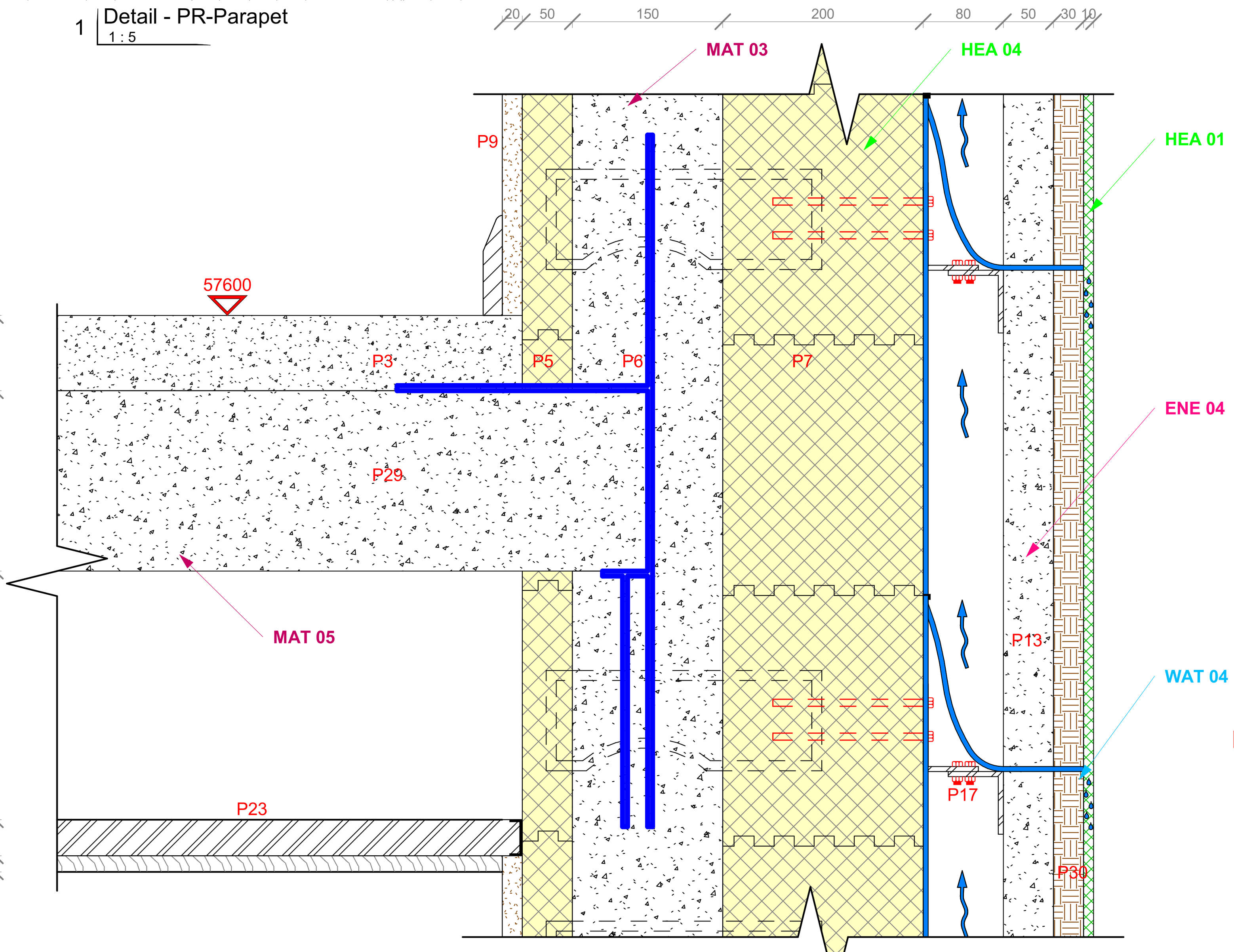
4 Long Section A-A-3-3
1 : 50



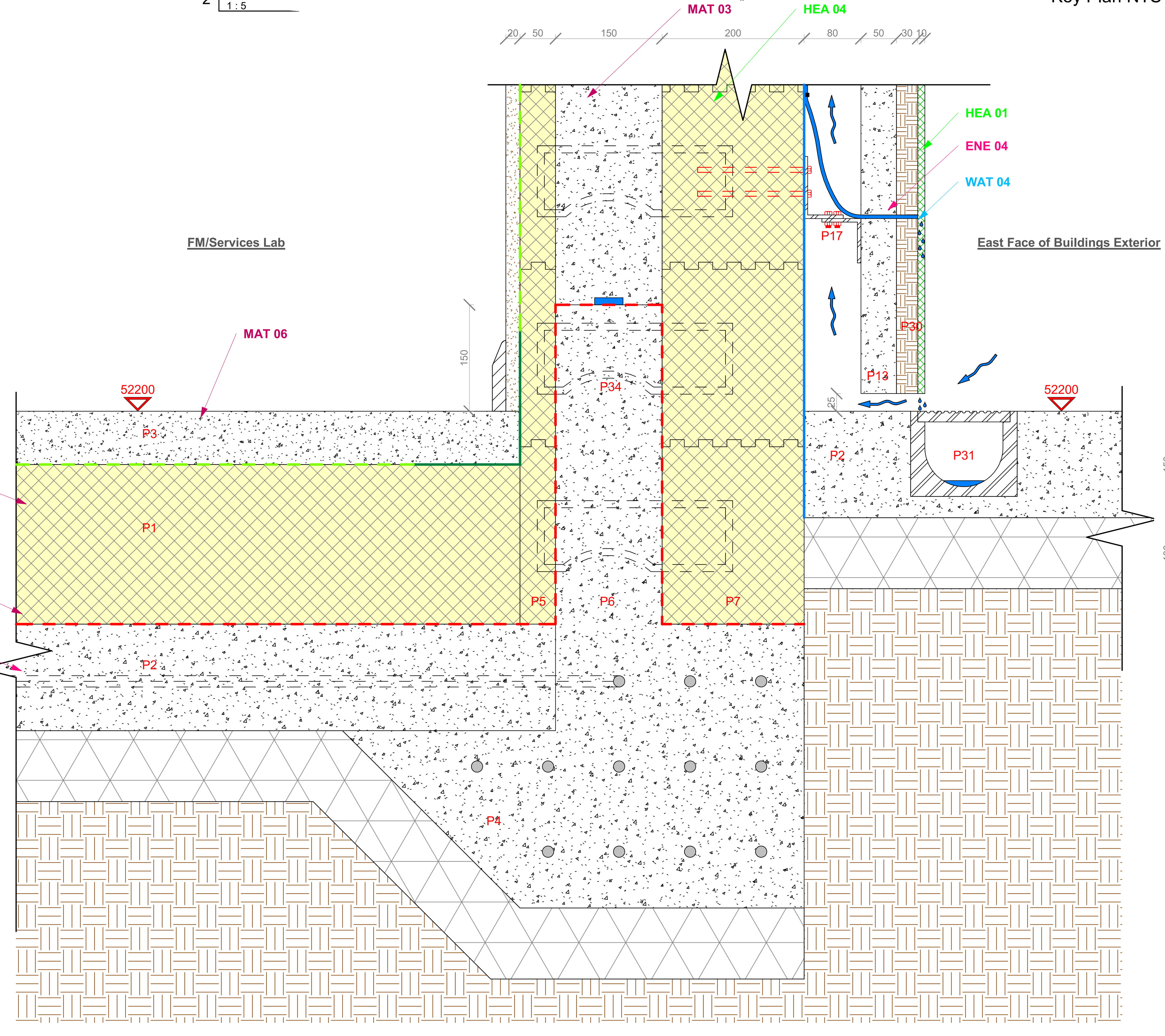
BREEAM®
Indicative Rating: 82% (Excellent)



1 Detail - PR-Parapet
1 : 5



2 Detail - PFL-First Floor External Wall Junction
1 : 5



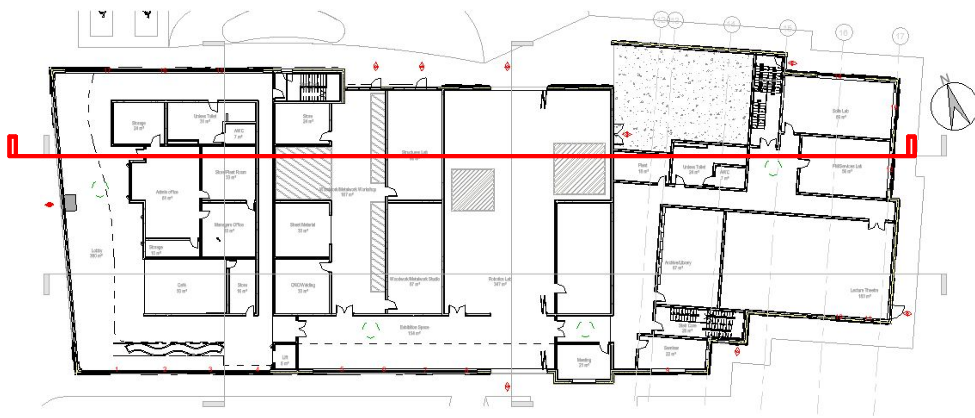
3 Detail - PF-Curtain Wall Threshold
1 : 5

Material Specification

P1 225mm EPS Thermoboard Underfloor heating board, 0.03W/m. K, U-Value 0.12W/m²K.Depth 250mm, Width 600mm, Length 1200mm, Density 25-26kg/m³, External Fire Spread Class O, Certifications IAB, NSAI, ETA, LABC
P2 150mm Reinforced Concrete slab with 12mm diameter rebar.
P3 75mm Self Levelling Screed, Compressive Strength C25, Flexural Strength 5, Reaction to fire Class A1fl.
P4 400mm x 400mm Reinforced Raft foundation with 350mm slab edge thickener.
P5 50mm EPS ThermoWall, 0.03W/m. K, U Value 0.15W/m²K, Density 25-26kg/m³, Height 250mm, Length 1200mm, External Fire Spread Class O, Certifications IAB, NSAI, ETA, LABC.
P6 150mm In-Situ Concrete
P7 150mm EPS ThermoWall, 0.03W/m. K, U Value 0.15W/m²K, Density 25-26kg/m³, Height 250mm, Length 1200mm, External Fire Spread Class O, Certifications IAB, NSAI, ETA, LABC.
P8 20mm Ash window board, varnished and finished with a bull nose edge.
P9 20mm Earthen plaster
P10 Reynaers CW86 Curtain Wall System Double Glazed with 150mm Aluminium Insulated mullion.
P11 40mm underfloor heating pipes
P12 Dorma ST-Flex Fine framed double-glazed automatic door ES200 Microprocessor controlled, modular designed Automatic sliding door.
P13 50mm Reinforced low-carbon concrete façade.
P14 20mm Titanium dioxide painted façade fixings.
P15 150 XPS 0.039W/m. K, U-Value 0.16W/m²K.Depth 150mm, Width 600mm, Length 1200mm, Density 32-36kg/m³, External Fire Spread Class O,
P16 250mm ThermoRoof Insulation board 0.039W/m.K, U-Value 0.15W/m²K, Depth 250mm, Width 510mm, Weight 13kg/m², with 12mm cold rolled steel c-sections between for structural support.
P17 12mm Aluminium Cladding brackets with M8 Bolts
P18 25mm Ash Timber ceiling Latts
P19 4mm EPDM, Fire Resistance to DIN 4102-1, B2, thickness 1.8mm. Tensile Strength To DIN 53504, > 6.5 N/mm².
P20 18mm x 60mm x 2400mm Recycled Plastic Composite Cladding.
P21 25mm Battens treated to BS8417.
P22 200mm Steel I-Beam hoist support for the lift core, to engineers' specification.
P23 12.5mm Plasterboard suspended ceiling
P24 210mm ThermoFloor roof deck 0.03W/m. K, U-Value 0.12W/m²K.Depth 250mm, Width 600mm, Length 1200mm, Density 25-26kg/m³, External Fire Spread Class O, Certifications IAB, NSAI, ETA, LABC
P25 25mm Polyurethane Drainage channel
P26 30mm Ceramic nonslip r12 tiles 600x600mm
P27 80mm Talitech Stainless steel handrail with 12mm tempered glass
P28 100mm recycled plastic Ecosedum Green Roof tray.
P29 180mm Precast Concrete Hollowcore units
P30 30mm Organic Sponge Green wall
P31 Reynaers Masterline 8 Softone window parallel opening insulated aluminium window with a non-active sound level reduction of 20db UF-1.4W/m²K
P32 150mm x 100mm x 1000mm ACO Hexdrain Pro Channel Drain - C250 Loadcapacity
P33 6mm Aluminium Flashing
P34 Galvanised Aluminium Thermohouse Wall ties
P35 IQ Opti Edge frameless glass balustrade/railing system
P36 18 x 150 x 2400mm Birch Skirting Board
P37 Aquafin Waterstop-Strip 40mm x 10mm expansion pressure 1.06N/nm2 Density 1.25g/dm3
P38 12mm Rebar Reinforcement
P39 1180 x 1180 Velux Smoke Vent Dome insulation: 50 mm HCFC and CFC free polyisocyanurate, U-value of 0.43 W/m²K
Curb: 300 mm in height as standard manufactured to meet the requirements of Building Regulations Approved Document B, BS 9999 and EN 12101-2 and are supplied CE marked
P40 Airclos 5000 x 6000mm BiFold Door U-Value 1.45W/m²K
P41 18mm Birch Window board Bullnose end
P42 50 x 25mm Batten treated to BS 8417

Membranes:
Airtightness:
Vapour:
Radon
DPM:
DPC:
Breather:

DPC: Visqueen Polyethylene DPC, Colour-Black, Finish-Embossed, Material-Polyethylene, Shape-Rectangle, Standard-To BS 6515., Colour-Black., Product Reference-Visqueen Polyethylene DPC, Detailing Strip-DPC Jointing Tape, Surface DPC Fixing System, Length 30 000 mm, Width-100-1200 mm, Thickness 0.7 mm. Tensile strength MD-15 N, Reaction to fire-F class.
DPM: Juta GP2 DPM, Polyethylene, 50000m x 2000m, Tensile strength (minimum) MD: 500 N/50 mm; CMD: 470 N/50 mm, Tear resistance 400 N, Elongation to break MD: 15%; CMD: 20%. Thickness 0.5mm, Radon permeability 4.3 x 10¯12.
Radon: Polymers, 0.3 x 4000 x 25 000 mm
Vapour: Siga Majpell to BS EN 13984. Tear Resistance to EN 12310-1: Lengthwise 230N , Crosswise 210N. Elongation to break 60% to EN12311-2, Fire performance Class E, Third Party certification GEV EMICODE EC1 Plus. Weight 120g/m², Width 3m, Roll Length 50m, Tensile Strength Maximum to EN 12311-2: Lengthwise: 220 N/50 mm; crosswise: 190 N/50
Airtightness:
The use of airtightness tape around all opes and connections include:
Windows/Doors = Siga Wigluv
Wall to Floor Connection = Siga Fentrim 330
Roof to Wall Connection = Siga Majrex and Siga Sicrall
Joints between ICF blocks = Siga Primur
Breather Membrane:
Film Breather Membrane
- Thickness 0.4mm
- Made to EN 13859-2 standards
- Class W1 water tightness
- Tensile strength 210/N
- Tear Resistance 75N
- Air penetration resistance 0.045m³/m²h.50.pa
- Resistance to water penetration W1 Class.
- E Class fire resistance



Key Plan NTS

TGD Part L Compliance Notes

Thermal Bridging
The Y-Factor target of 0.05 is in accordance with section 2.1.3 of TGD Part L 2021
Insulation
Proposed U-Values to comply with Table 1 of TGD Part L 2021 and Section 1.3.2 Fabric Insulation. Overall compliance of proposed U-Values will be confirmed using NEAP software
Air Permeability
The airtightness target for the building is 3m³/(m²K) @50Pa but will be 1m³/(m²K) @50Pa using ICF

Proposed U-Values Calculated

Floor: 0.12W/m²K

Walls: 0.10W/m²K

Roof: 0.15W/m²K

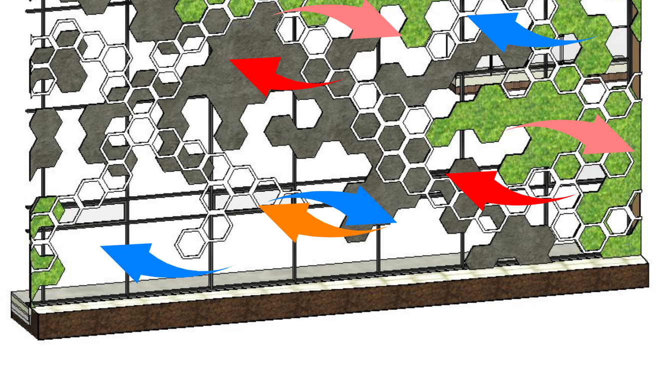
Values gathered from **Ubakus U-Value** Calculator.

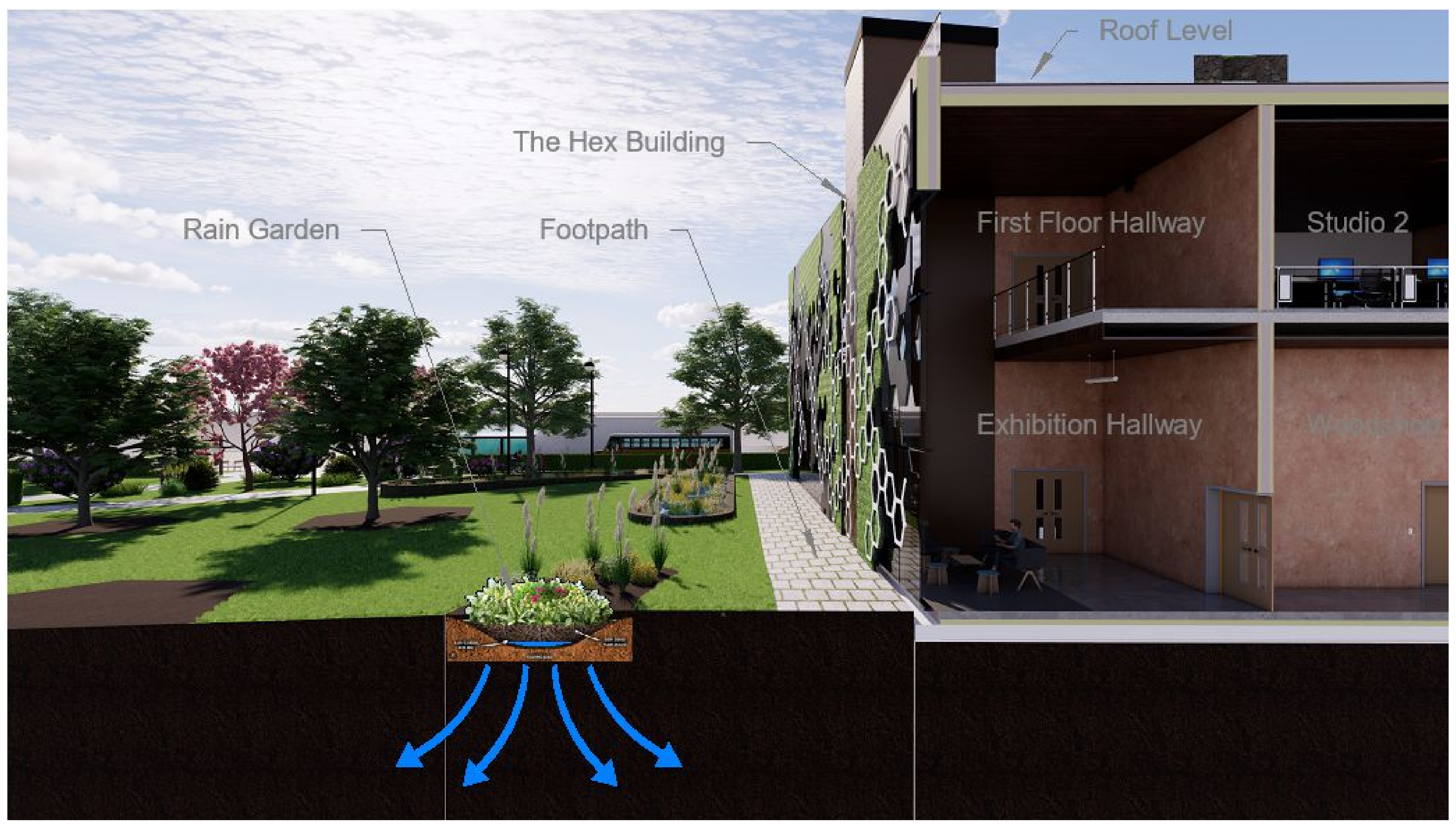
Wall Structure and Environmental design
The design of the facade is based on hexalace a building in India created by Studio Ardete a French construction company. The design is similar but also very different to the Hexalace building.

Concrete
The concrete used is carbon embodied, which makes it better for the environment and also more sustainable. The use of concrete in the facade is simply for its thermal mass. Concrete during the summer keeps the heat out and in the winter it keeps the heat in. Along with the 400mm ICF wall the concrete on the facade acts as a thermal layer.

Green wall
The use of a green wall on the building has many advantages such as the removal of air pollutants, reduction in external noise, attenuate rain water, improve biodiversity, thermal benefits and it is proven to reduce urban temperatures. Theses factors make the green wall a very smart choise for the building considering it helps improve the buildings overall sustainability.

Titanium Dioxide Recycled Plastic
The small hexagonal white pieces seen around the buildings facade are recycled plastic panels coated in titanium dioxide paint which is scientifically proven to turn carbon dioxide into oxygen. This facade makes the building greener as the building generates more oxygen than CO² due to the paint used.



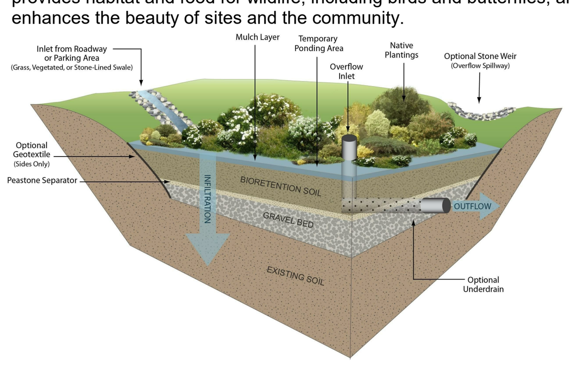


Environmental
1 : 75

Rain Gardens

Four rain gardens are proposed for the site two on the north of the building and two on the south side, A rain garden is a depressed area in the landscape that collects rain water from a roof, driveway or street and allows it to soak into the ground. Planted with grasses and flowering perennials, rain gardens can be a cost effective and beautiful way to reduce runoff from your property. These rain gardens will act as runoff spaces for excess water build up on the site but also as a landscaping option as they are sown with flowering plants and improve the aesthetic of the site just by using flowers.

Rain Gardens have many functions and benefits such as:
Filter Stormwater runoff before it enters local waterways, alleviate problems associated with flooding and drainage, recharges the ground water supply, provides habitat and food for wildlife, including birds and butterflies, and enhances the beauty of sites and the community.



Single Sided Ventilation

Single side ventilation can be used when cross ventilation is not possible because of partition walls. Rooms with a depth of up to 6m can be efficiently ventilated if the windows are built appropriately for single sided ventilation. Only one half of the room is ventilated by windows. Through the windows, cold air is drawn in from the outside. The heated air is then drained from the structure through the same window.

HVAC

HVAC stands for heating, ventilation, and air conditioning, to begin with. Residential and commercial buildings are heated and cooled using this technology. HVAC systems may be found in a variety of places, from single-family houses to skyscrapers, and they provide environmental comfort. These systems, which are becoming increasingly common in new buildings, utilise fresh air from the outside to produce great interior air quality. The process of replenishing or exchanging air inside a room is represented by the V in HVAC, or ventilation. This improves indoor air quality by removing moisture, smoke, smells, heat, dust, airborne bacteria, carbon dioxide, and other pollutants, as well as controlling temperature and replenishing oxygen. When it comes to delivering adequate indoor air quality and thermal comfort, the three major tasks of an HVAC system are intertwined. Your heating and air conditioning system is likely one of the most intricate and extensive in your home, but you'll know when it breaks down quickly, the air return, filter, exhaust outlets, ducts, electrical elements, outdoor unit, compressor, coils, and blower are the nine sections of your HVAC system that you should be familiar with.
Conclusion: This system will be used in the building as ICF construction gives an airtightness of less than $3m^3m^2/hr$.

Legend

HVAC Supply Duct (4 way blow)

HVAC Return Grille

Cool Air Intake

Hot Air intake

Direction of supply/return

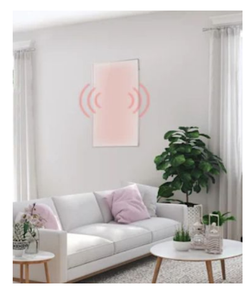
Return Grille Exaust

Old Air

New Air

Outdoor Air handling Unit

HVAC Ducts



Components
Air Return
Your air return is the part of your system that marks the starting point of the ventilation cycle. This return sucks in air, draws it through a filter, and then passes it into the main system. Pro tip: Make sure to dust your returns frequently as debris and dust can easily build up on your filters.
Filter
The air is pulled through your filter, which is the second stage of the air return. To maintain your system in peak form, make sure to change your filters on a regular basis.
Ducts
Your ducts are the conduits via which warm or cooled air travels.
Exhaust outlets
The exhaust outlets, which are where the exhaust generated by the heating system is released, are another component of your system.
Electrical elements
This section of your system might be a little difficult, but it's where most problems start. Check for a tripped breaker or dead batteries in your thermostat if something isn't operating properly.
Unit Located Outside
When someone discusses an HVAC system, this is most often the portion of your system that comes to mind. The fan that generates air flow is housed in the outside unit. Keep your unit clean of garbage and grass, as plants pulled into your fan can create major difficulties.
Compressor
The compressor is responsible for turning refrigerant from a gas to a liquid and sending it to the coils as part of the outside unit.
Coils
Coils, which are usually found as part of the outside unit, cool the air as it passes through with the aid of the refrigerant. Check your coils at least once a year. You should check your filter and/or refrigerant levels if they freeze.
Blower
Warm air is drawn into the main part of the device by the blower. The more effectively this air flows through your system, the more durable it will be.
Heat Exchanger unit
Located in the store room of the training room used to get fresh air in to the building and push used air out via an exhaust outlet located on the south wall of the building. This device filters the air as it returns to it to capture any heat that may be in the air and filters the warm clean air back into the fresh air thats being pumped into the building.
Extract fans will be located in every space in the building to extract all the used air in the building while a supply fan also located in the ceilings will be supplying fresh air into the building from the heat exchanger unit. The main purpose of the ventilation system is so the building doesnt get a build up of radon gas as there is no radon barrier in the floor protruding out of the building rather its just going up the walls as it cant be brought out because of the existing walls.

A heat pump operates using a refrigeration circuit.
Heat is taken from the outside air and delivered into the heating water or hot water cylinder. Heat pumps operate using electricity. As a heat pump delivers more energy than it consumes, it is considered a renewable heating technology. An air source or Air to Water Heat Pump is the most commonly found type of heat pump in the market. Other types, such as geothermal heat pumps, take heat from groundwater or other sources, but are less common. The heat pump is connected to a combi boiler which heats up the water thats in the underfloor pipes.

Combi boilers provide a “combination” of instantaneous hot water and effective central heating. Combi boilers work by signalling a sensor once you've requested hot water which tells the boiler to burn fuel (whether gas, electric or oil). The heat exchanger then gets hot enough to heat the water when it flows over it. As there is a air to water heat pump being used in my proposal the heat comes from that which in turn heats up the water in the underfloor heating pipes.

Manifolds are used in underfloor heating systems to control the flow of water through the system
to provide an even, comfortable warmth across the whole floor. The manifold acts as the hub of a heating system connecting both your supply and return lines in a central place connecting back to the combi boiler.

Environmental Plan Legend
PV Array Strategy:
Wind Barrier Strategy:
Water Strategy:
Sun Path:
Wind Direction:

Underfloor Heating

Warm water at a lower temperature is sent through a circuit of pipes beneath the completed floor to provide underfloor heating. Intelligent thermostats monitor and adjust heat to maintain a constant temperature across the building or zones. Standard, combination, condensing, or biomass boilers, heat pumps, and stoves can all be utilized for underfloor heating.
Advantages:
Low maintenance costs
Low running costs
Disadvantages:
Cost - The initial cost might be significant, and the system's installation can create a lot of disruption in your house. Creating the correct conditions beneath the floor in older structures may be costly.
Time - Because underfloor heating takes longer to heat than a radiator, you'll need to set a timer to anticipate when you'll need heat in specific areas.

Conclusion: Underfloor heating would work in this building but only in the extension as it would be to costly to install it in the existing building.. The use of lower water temperatures in underfloor heating systems saves energy usage. With no hot surface pipes, the comfort level is great, the cost is low, the wall space is maximized, and the system is essentially maintenance free. Because underfloor heating systems do not use noisy fans or blowers, they are a considerably quieter and less intrusive heating option that is also more visually attractive because no visible ducting in the ceiling is necessary.
Commercial underfloor heating is a type of radiant heating that prevents unwanted germs and pollen from easily moving throughout the building, resulting in better air quality. Asthmatics and allergy sufferers would greatly benefit from this. A normal radiator system utilizes high temperature water, usually 70-80ºC or greater, but an underfloor heating system uses low temperature water, often around 35-50ºC. Underfloor heating systems have been demonstrated to be 15-20% more efficient than typical heating systems in a building, with efficiency levels up to 30-50% in high ceiling abreast Extension will be heated by underfloor heating. This solution is great for an extension since it eliminates the need for heavy-duty heating while also creating a cleaner environment and more space. This is especially true in the extension, which will be the buildings most used area.

Another reason I chose to use underfloor heating was that the thermofloor boards that im proposing for the extension are designed to be used with underfloor heating, due to a tongue and groove system they have built in it allows for underfloor heating pipes to be fixed down with less intrusive methods.

A heat pump operates using a refrigeration circuit. Heat is taken from the outside air and delivered into the heating water or hot water cylinder. Heat pumps operate using electricity. As a heat pump delivers more energy than it consumes, it is considered a renewable heating technology. An air source or Air to Water Heat Pump is the most commonly found type of heat pump in the market. Other types, such as geothermal heat pumps, take heat from groundwater or other sources, but are less common. The heat pump is connected to a combi boiler which heats up the water thats in the underfloor pipes. Combi boilers provide a “combination” of instantaneous hot water and effective central heating. Combi boilers work by signalling a sensor once you've requested hot water which tells the boiler to burn fuel (whether gas, electric or oil). The heat exchanger then gets hot enough to heat the water when it flows over it. As there is a air to water heat pump being used in my proposal the heat comes from that which in turn heats up the water in the underfloor heating pipes.Manifolds are used in underfloor heating systems to control the flow of water through the systemto provide an even, comfortable warmth across the whole floor. The manifold acts as the hub of a heating system connecting both your supply and return lines in a central place connecting back to the combi boiler.

BREEAM®

Indicative Rating: 82% (Excellent)

Infrared Heater

An infrared heater or heat lamp is a body with a higher temperature which transfers energy to a body with a lower temperature through electromagnetic radiation. Depending on the temperature of the emitting body, the wavelength of the peak of the infrared radiation ranges from 750 nm to 1 mm. No contact or medium between the two bodies is needed for the energy transfer. Infrared heaters can be operated in vacuum or atmosphere, In order to produce greater heated areas, infrared heaters are frequently employed in infrared modules (also known as emitter banks. The wavelength that infrared heaters produce is typically used to categorize them: When arrayed in a field, near infrared (NIR) or short-wave infrared heaters may provide large power densities of several hundred kW/m2 while operating at high filament temperatures exceeding 1,800 °C (3,270 °F). They are inappropriate for many drying applications because their peak wavelength is far below the water absorption spectrum. When a deep penetration is required, they are excellent for heating silica.

Heating elements used in carbon infrared and medium-wave (MWIR) heaters work at temperatures of 1,000 °C (1,830 °F). They can produce up to 60 kW/m2 (5.6 kW/sq foot) of medium-wave power and 150 kW/m2 (14 kW/sq ft) of high-power electricity (carbon).

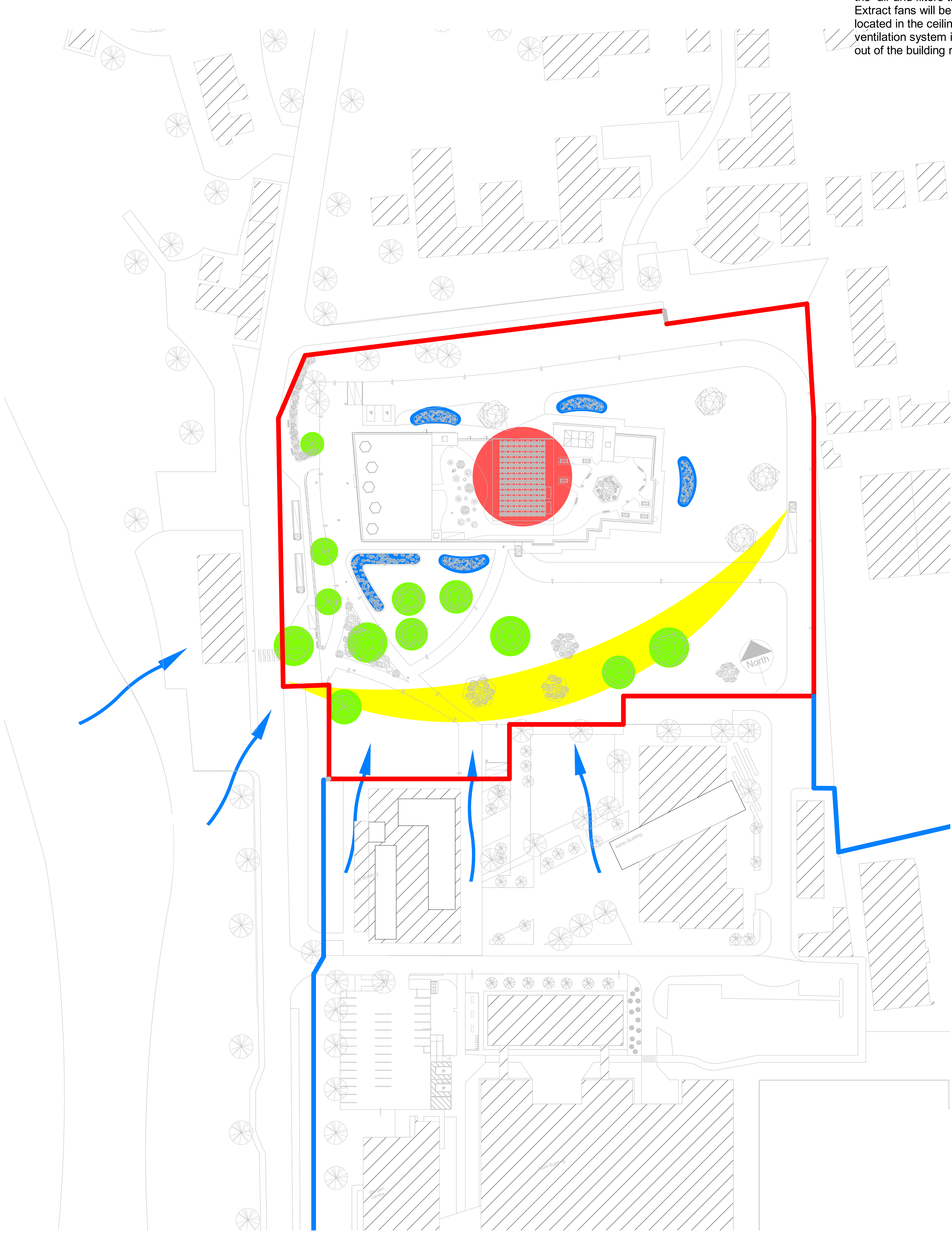
The so-called low-temperature far heaters frequently employ far infrared emitters (FIR). These only make up the priciest and top end of the infrared heater market. Far infrared emitters employ low watt ceramic plates that stay cool while still releasing far infrared radiation in place of carbon, quartz, or high watt ceramic emitters that generate near and medium infrared radiation, heat, and light.

Klarstein
Wonderwall 60 Infrared Heater

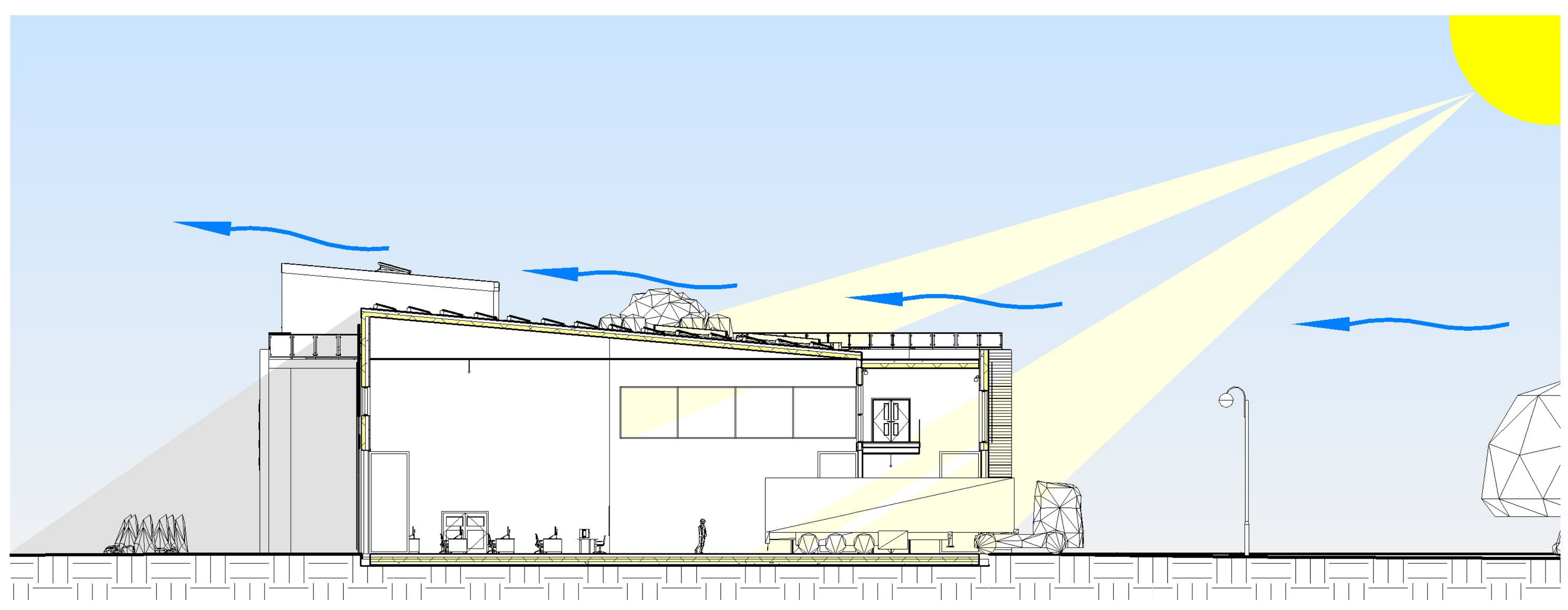
The Klarstein Wonderwall 60 infrared heater revolutionises heating with modern technology. The super-flat 60 x 100 cm heating panel can be mounted directly on walls and therefore warms the room without taking up too much space. With 600 Watt power, it radiates infrared heat that is very pleasant to the human skin, and thanks to the innovative IR ComfortHeat technology, the heat is emitted directly to nearby persons and does not dissipate into the air or the surroundings.
Features:
Powerful performance: rapid infrared heat
Efficient: converts 95 % of the supplied energy into radiant heat
As pleasant as the sun: IR ComfortHeat warms you, your furniture and walls Noiseless: no disturbing operating noise
Ideal for allergy sufferers: works without a fan
Convenient and well designed: with thermostat, timer and auto switch-off function
Temperature adjustment: reacts to open windows
Quick installation: simply connect to the mains supply
Space-saving: flat heating panel for wall mounting
Properties:
Power: 600 Watt
Impact area: up to 15 m^2
Effective range: approx. 5 m
no warm-up phase, generates heat immediately with overheating protection
can be combined with other panels to heat larger rooms
Power supply: 220 - 240 V~ | 50/60 Hz

PV Panels

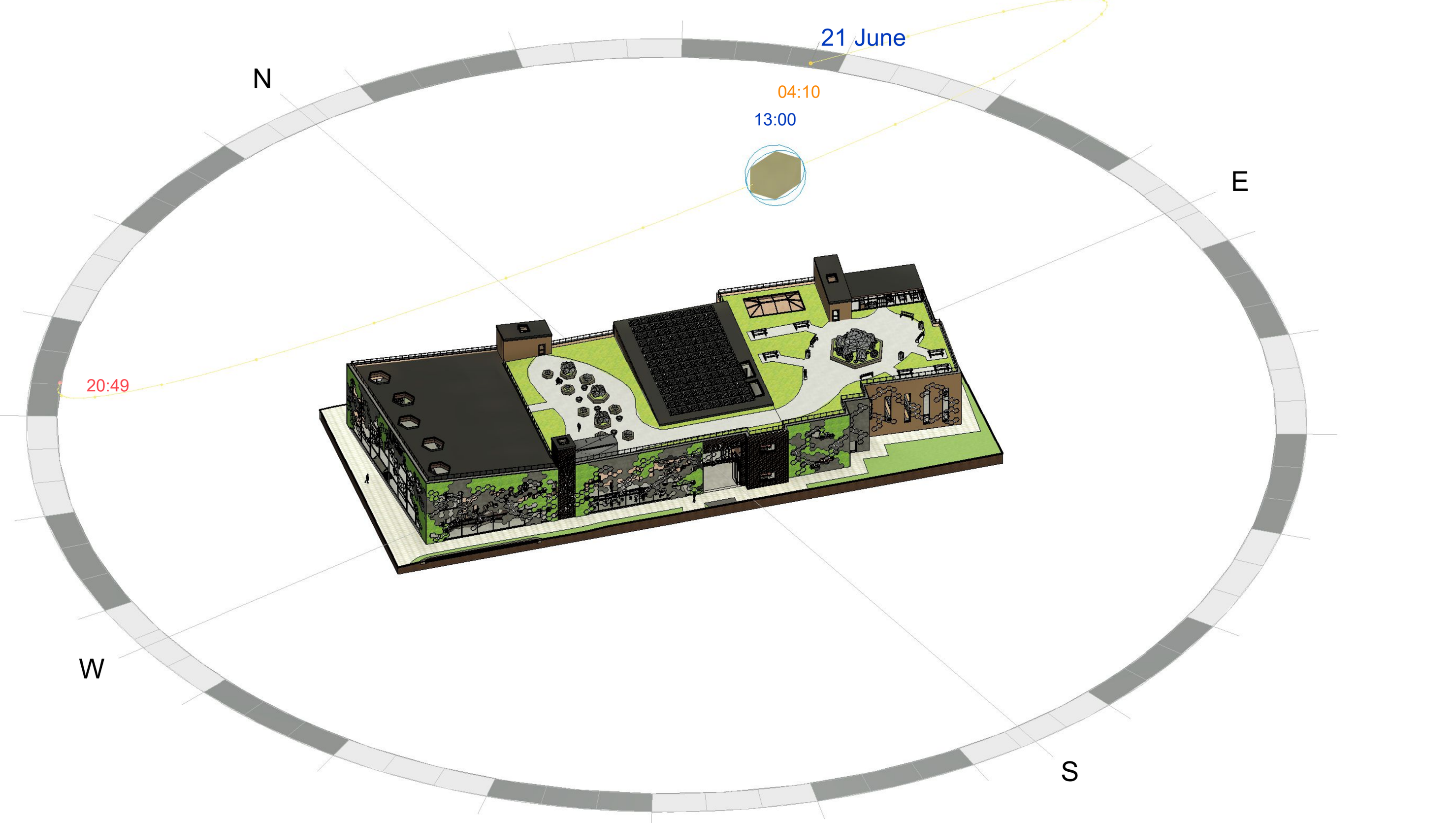
Photovoltaic panels use a semiconductor cell to convert sunlight directly into DC power.
Monocrystalline silicon cells are the most common form of solar cell, and they are very
efficient, ranging from 15% to 18% efficiency.
The cost of installing and maintaining PV panels is continually lowering, making them
a more enticing option. PV panels are an ecologically benign renewable technology
since they do not use any form of fuel to create power for the building.
Using the rule of thumb table 19
The electrical loads of a college is $55W/m^2$
Electrical Load =
55 x 1845 = 101.475KW
Annual energy Consumption =
Using Rule of Thumb Guidelines Annual Energy Consumption will be based on Table 28 which indicates University Campus to have an electricity load of 80kWh therefore the annual energy consumption for electricity is 80x5147= 4117.60kWh
PV Panels
These panels, formally known as photovoltaics, absorb the sun's energy and transform it into energy that is subsequently utilised in the structure. It is necessary
to understand how to use electricity to use it. PV panels are made up of cells that are
built up of layers of semiconducting materials, most often silicon. Electrons are knocked
loose when light shines through, resulting in flowing electricity. Within the panel, the cells
are organized into modules, which are then organized into a solar array. Once the electricity
starts flowing, it is in the form of direct current (DC), which is subsequently transformed to
alternative current (AC) with the use of an inverter.
A calculation can be made for the approx output of a Solar PV array
Which goes by the following:
The PV panels I have chosen has a peak power of 400W and is polycrystalline.
There will be 112 of them. Facing south at 30°
Using the equation above-
.400 x 112 =44.8kWp total peak power of all panels
Annual output:
0.8 x 44.8 x 5147 x 0.8 = 1475.74kWh.



1 Environmental Plan
1 : 1000



3 Environmental Section
1 : 300



2 3D Sun

Site Environmental Study

Drawn by: Dylan O Connor