Extract & Exhale

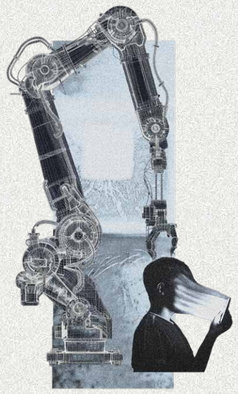
Extract & Exhale explores a response to an environmental crisis in which the user population lives within an **abandoned wasteland** - known as Noxara, as authorities continuously discard waste in open dumps around the UK. This landfill, generated from the extreme overconsumption from the large cities - known as Viridium zones, is creating **toxic water pollution**, destroying the environment and silently killing the population with high levels of **PFAS**.

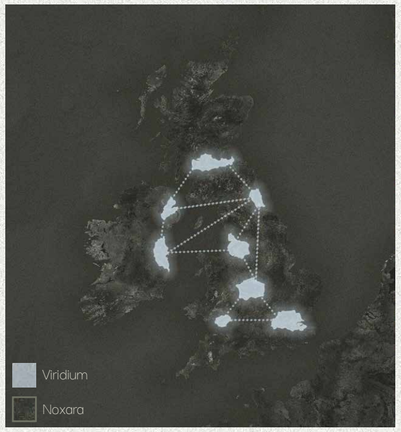
The **abandoned lace market car park in Nottingham** has been occupied by a rebel group called **The Clarifiers**. They set out to filter rainwater, collected through rainwater harvesting, and pass the water through an **activated carbon filtration** system to remove the toxic PFAS.

To the population of Noxara, this building acts as a **survival point** for them to collect **safe and clean filtered water**. Simultaneously, the building facilitates a **cleansing ritual** to allow the users to reset their nervous system through the impact of the blue mind theory, acting as a **psychological refuge** for their mind, in order to tackle their harsh living environment.

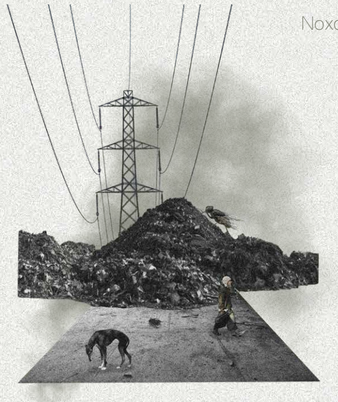
The adaptive reuse of the lace market car park confronts this environmental crisis through climate-resilient design strategies. The design encompasses low-carbon materiality, such as **recycled aggregate concrete**, in combination with sustainable systems such as **rainwater harvesting** and an **adaptable open-ventilation facade**.

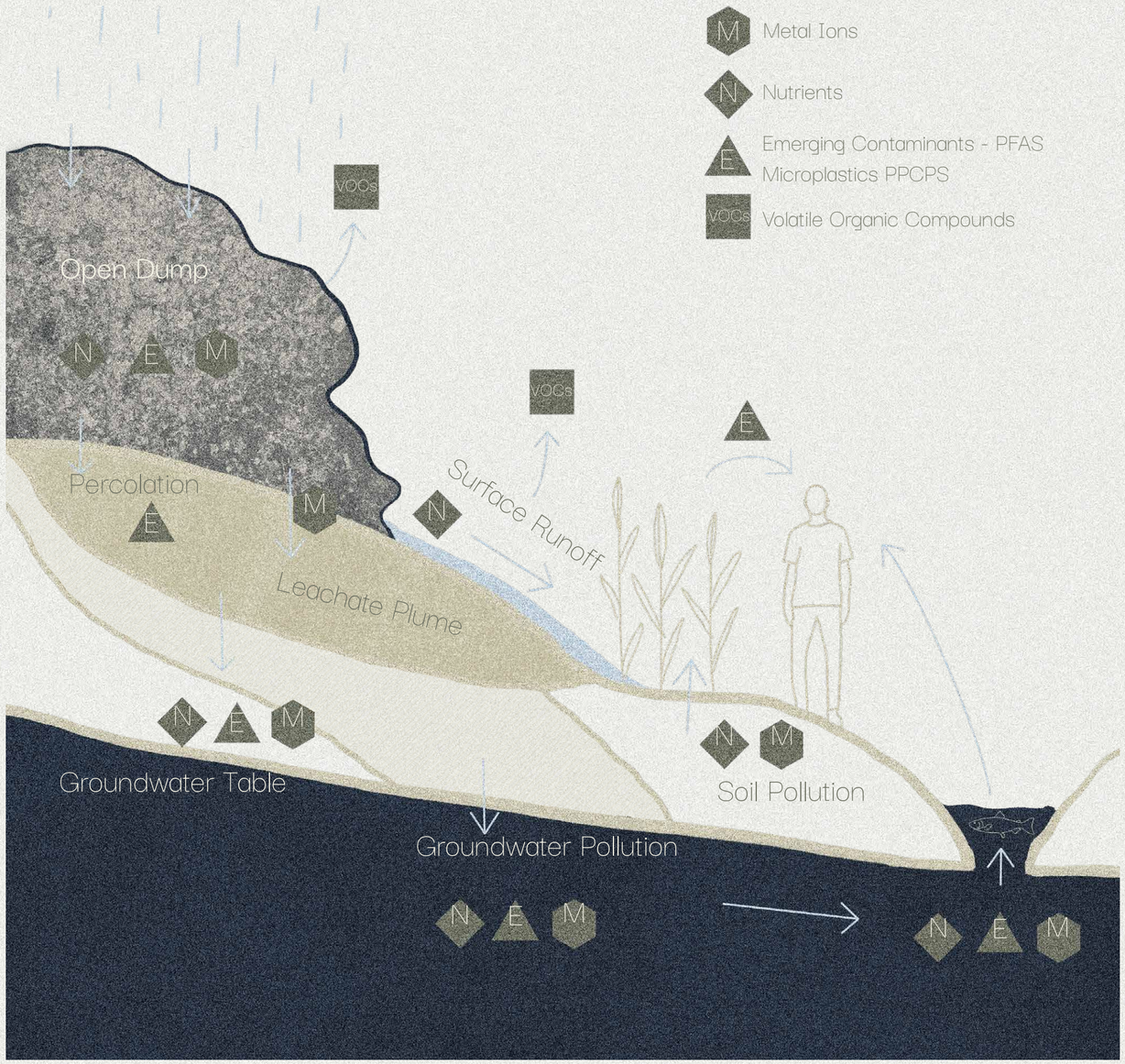
Viridium

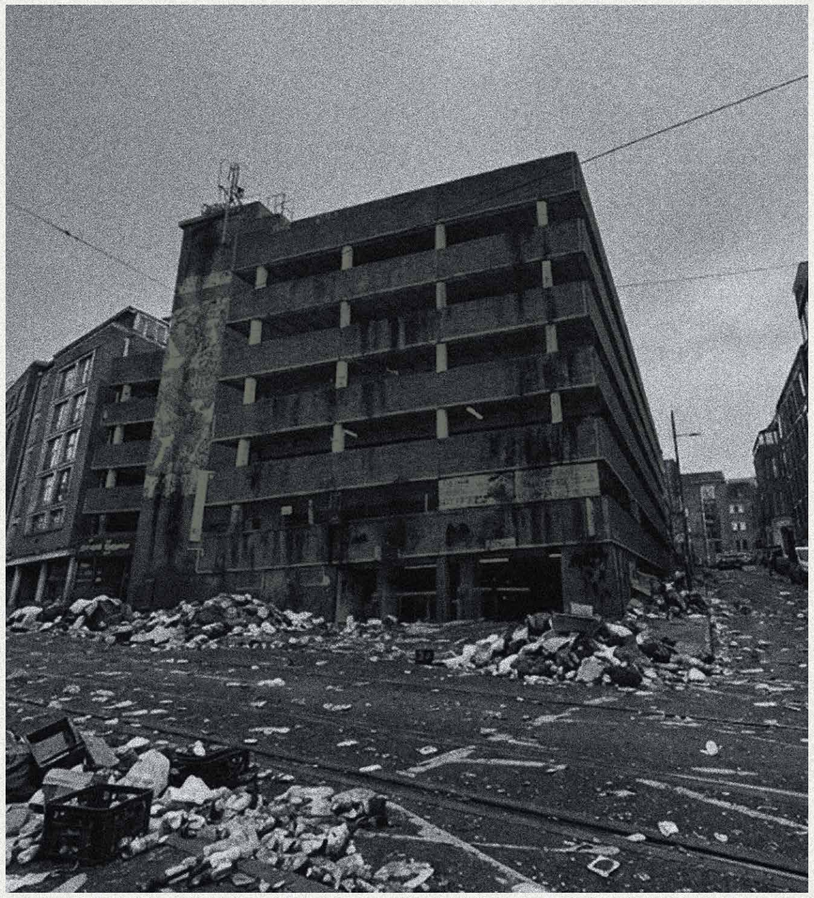




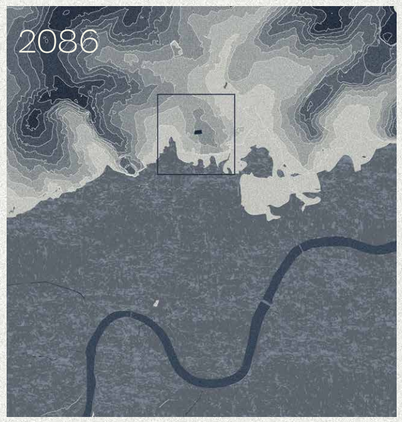
Noxara



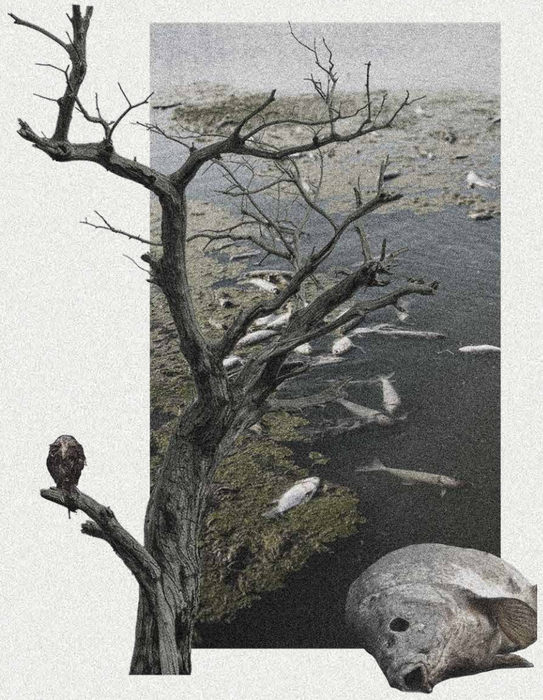


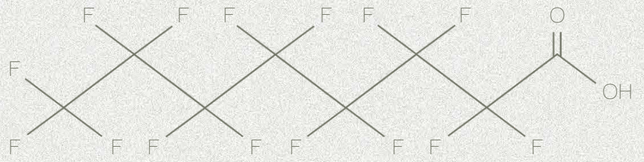


The abandoned lace market car park, Nottingham, in 2086.



Topographical map (not to scale) displaying the surroundings of the site and the increase in landfill waste over time..





Per and Polyfluoroalkyl substances
(PFAS) chemical composition

Per and Polyfluoroalkyl substances (PFAS) are synthetic chemical compounds, also known as Forever Chemicals, and are typically used within industrial processes for domestic goods, first used in the 1950s.

Made up of Fluorine, Oxygen and Hydrogen, they are extremely small, which combined with their strong double bonds, mean they are difficult to breakdown. PFAS are described as highly persistent, mobile and a compound that resists natural degradation.

Exposure to these through contact with contaminated substances, such as drinking water, fish and seafood, food packaging, and dust, can lead to high levels of these compounds in our blood. High exposure can lead to further health problems, including cancer, reproductive issues and liver damage.

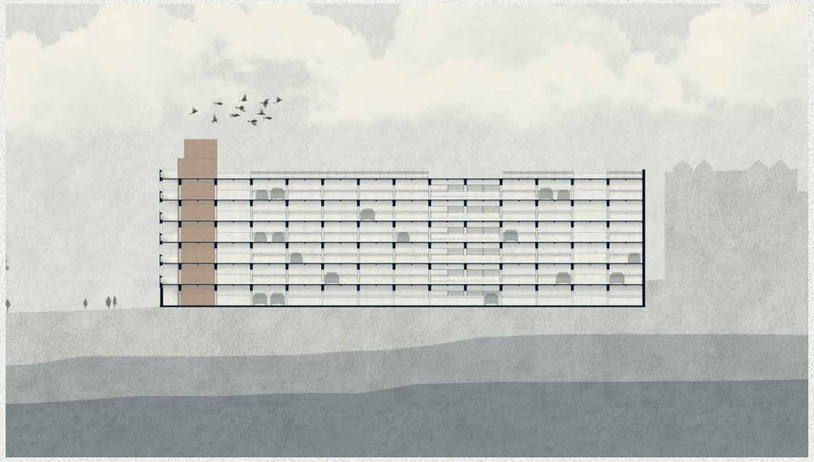
While PFAS has a significant impact on the population during 2086, the Clarifier's aim is to eradicate these substances from the drinking water, through activated carbon filtration, for the population of Noxara, in order for them to survive.

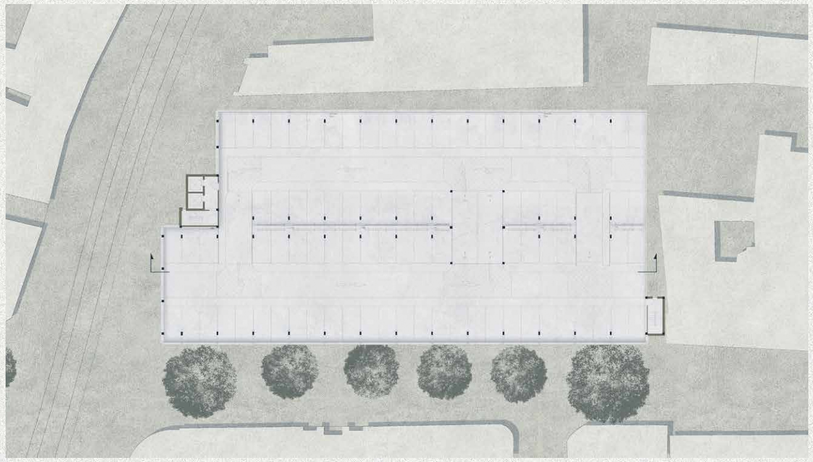
Emma Pearson

Existing Site

The existing lace market car park in Nottingham hosts a primarily concrete structure, built through monolithic construction. This simple existing materiality allows the building to become a primary source of recycled concrete aggregate.

Harvesting the demolition waste to be used within the proposal encourages circularity of materials through recycling and reusing.

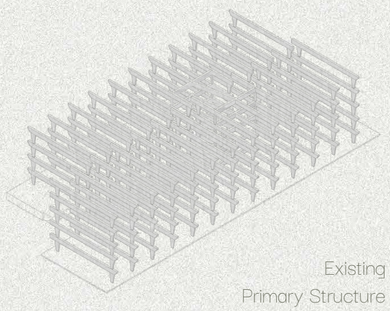




Material Extraction

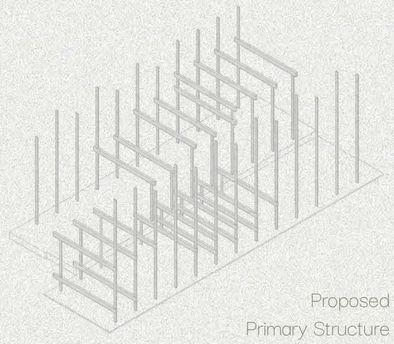
Through a sustainable approach to adaptive reuse, the use of recycled concrete aggregate has been adopted in order to reduce embodied carbon whilst also embracing the simplicity of material choices for user experience.

Design development has lead to the testing of concrete materiality, investigating different ratios and mixes to create different textures and comparing natural and recycled aggregate.



Existing
Primary Structure

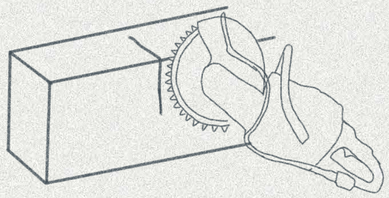
Made up of tapered columns and beams, supporting multiple floors and vehicle loads.



Proposed
Primary Structure

Reduced amount of beams. The majority of central columns are removed. Columns straightened and extended for roof structure

Recycled Aggregate Concrete (RAC) Process

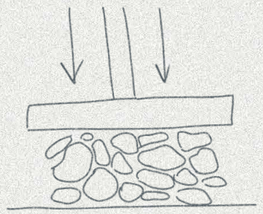


Demolition

The existing structure is demolished, retaining what is needed for the proposal. Large pieces of concrete are broken down into smaller parts for sorting.

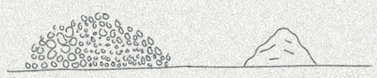
Sorting

The demolition waste is sorted using a conveyor and large magnet to extract any reinforcement bars or fixings from the rubble. The steel can be recycled in other parts of the proposal.



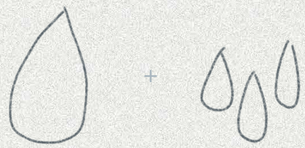
Crushing

The concrete rubble is crushed into finer recycled aggregate.



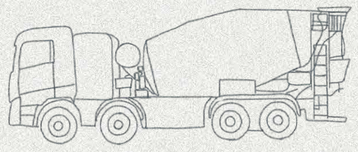
Aggregate Gradation

The recycled aggregate goes through aggregate gradation. The material enters a series of sieves which separate the different particle sizes. This is essential to ensure the structural stability of the mix.



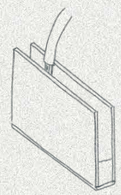
Combining

The correct ratio of fine and coarse aggregate is combined with water. Due to the use of the building, a water repelling admixture of also added to prolong the building's lifespan and prevent erosion.



Mixing

The material is thoroughly mixed in an electric cement mixer, powered by renewable energy.



Pouring

The recycled mix is poured into the framework on site.

Natural No Fines - Dry

Natural No Fines - Wet

No Fines - Dry

No Fines - Wet

Natural Fine + Silica - Dry

Natural Fine + Silica - Wet

Full Recycled - Dry

Full Recycled - Wet

Recycled No Fines - Dry

Recycled No Fines - Wet

Recycled Fine + Silica - Dry and Exposed

Recycled Fine + Silica - Wet and Exposed

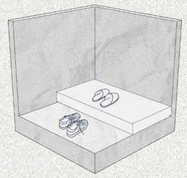
Recycled Fine + Silica - Dry

Recycled Fine + Silica - Wet

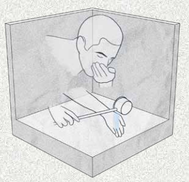
Fine Recycled - Dry

Fine Recycled - Wet

Material Application

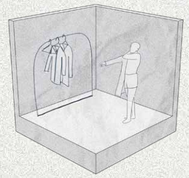


Genkan



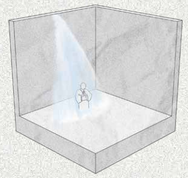
Chozu

The genkan and chozu are spaces of **partial cleansing**. The genkan operates by leaving outdoor shoes at a threshold, keeping the building clean and separate from the toxicity of Noxara. The chozu hosts a hands and mouth cleansing ritual. These spaces correlate to an **aggressive concrete** materiality, indicating the user's state of not being fully cleansed yet and therefore still 'dirty'.

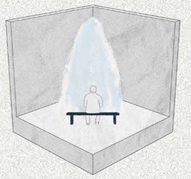


Changing

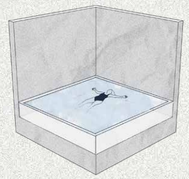
The changing room is a **transitional space**, as this is the final stage before becoming cleansed. Therefore it is paired with a **less aggressive but textured concrete**.



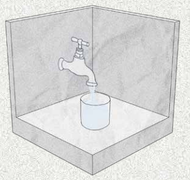
Misogi



Contemplation



Onsen



Collection

These 4 spaces form part of the Area of Focus within the project. They also mark the 4 spaces when the user is classed as **'cleansed'**. The Misogi ritual is a plunge under a cold intense waterfall. Contemplation is a moment of rest and reset after the misogi. The onsen is a place of reflection and submersion. The collection is the pinnacle of the ritual, with the collection of filtered water. The chosen concrete is fine recycled due to the user being 'cleansed' in these spaces, with this sample appearing **cleaner and less aggressive**, encouraging a meditative state.

The activated carbon filtration tank has been deconstructed into 4 layers which filter different particles out of the water. The design contains these materials in concrete tanks, in which the concrete materiality will start aggressive with the activated carbon layer, and gradually transition to clean and smooth fine recycled for the pebble layer. This transition indicates the cleansed state of the water as it travels through the filter.

Recycled Fine + Silica - Dry and Exposed

Recycled Fine + Silica - Wet and Exposed

Recycled Fine + Silica - Dry

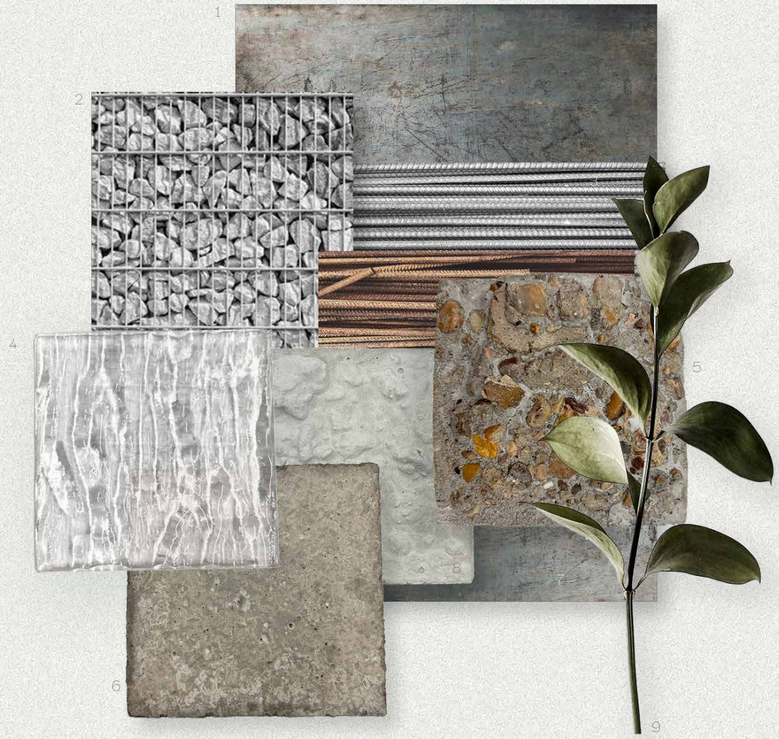
Fine Recycled - Dry

Fine Recycled - Wet

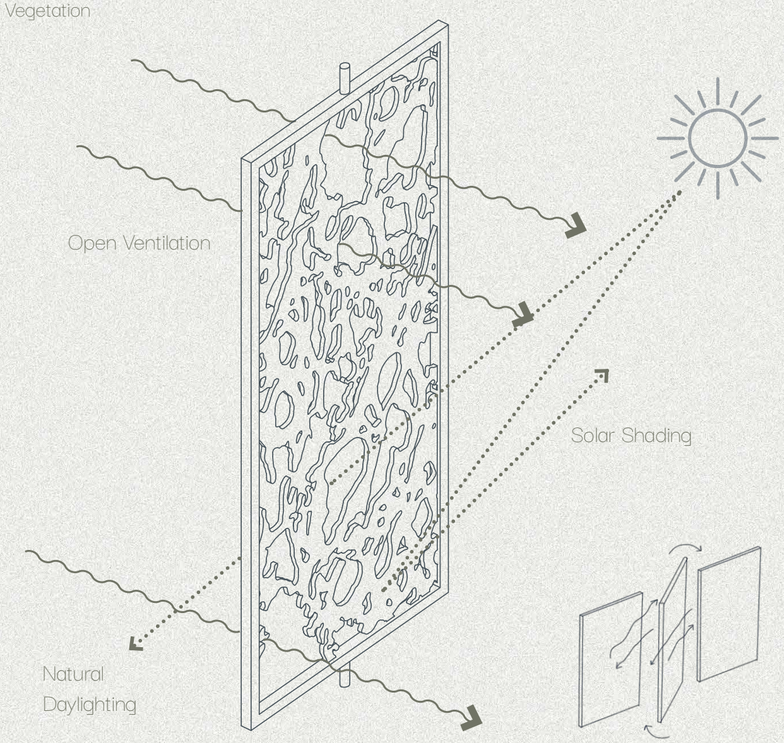
Recycled Fine + Silica - Wet and Exposed

Fine Recycled - Wet

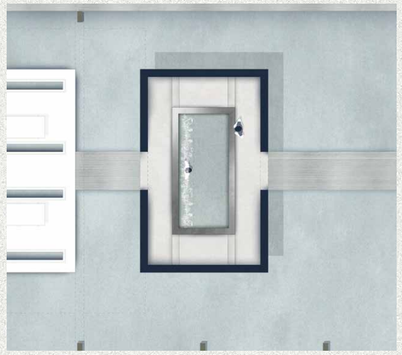
Emma Pearson



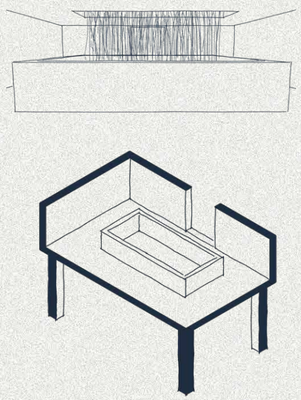
1. Reclaimed weathered steel
2. Textured mirrored glass
3. Reclaimed and polished steel reinforcement bars
4. Textured glass panels
5. Recycled aggregate concrete mix with silica fumes - Exposed
6. Fine recycled aggregate concrete mix
7. Reclaimed steel reinforcement bars
8. Recycled aggregate concrete mix with silica fumes
9. Vegetation

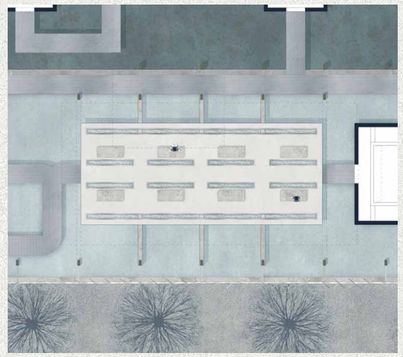


The design of the **open ventilation facade** panels act as solar gain/shading since they are supported through a swivelling system. This allows them to be angled differently during the day and seasons, as and when, in conjunction with what the building needs. This also avoids a build up of condensation in the building from the water vapour due to the constant movement of water.

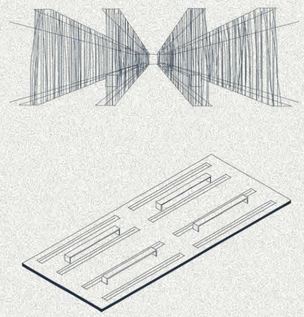


Area of Focus
Misogi Floor Plan
Not to Scale





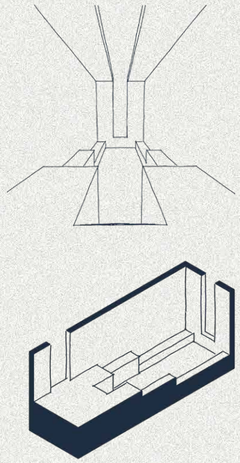
Area of Focus
Contemplation Floor Plan
Not to Scale



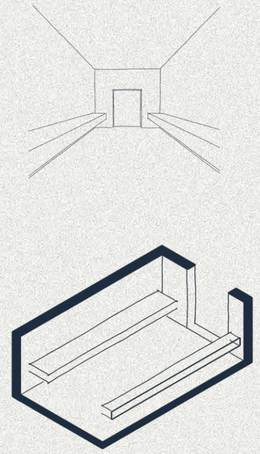
Area of Focus
Misogi Moment Visual

Area of Focus
Contemplation Moment Visual

Area of Focus
Onsen Floor Plan
Not to Scale



Area of Focus
Collection Floor Plan
Not to Scale



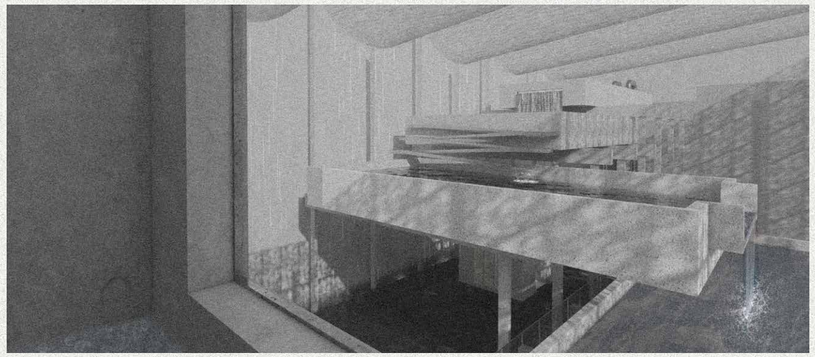
Area of Focus
Staircase Spatial Visual

Area of Focus
Collection Spatial Visual

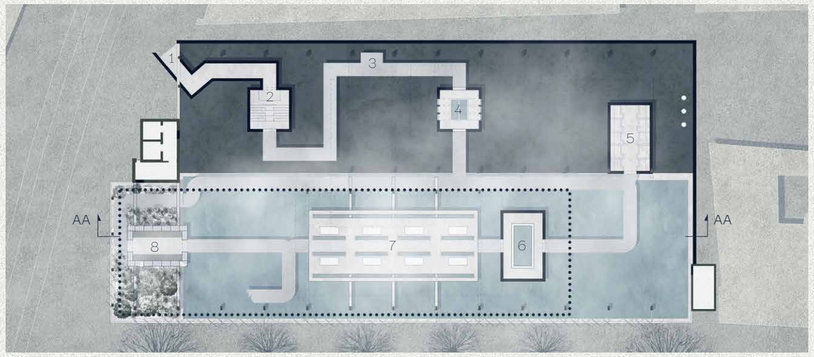
Design Proposal Overview

The proposal for Extract & Exhale embraces sustainability through materiality, user intent and the adaptive reuse of the existing building.

The design hosts two circulations of movement. The filtration layers, a deconstructed version of the activated carbon filtration system, which circulates water through its stages and provides clean water for usage throughout the cleansing ritual.
The circulation of users occurs simultaneously through the cleansing ritual, also removing the impact of the environmental crisis. These two systems encourage ecological renewal and repair of environmental damage, within the harsh and toxic world.

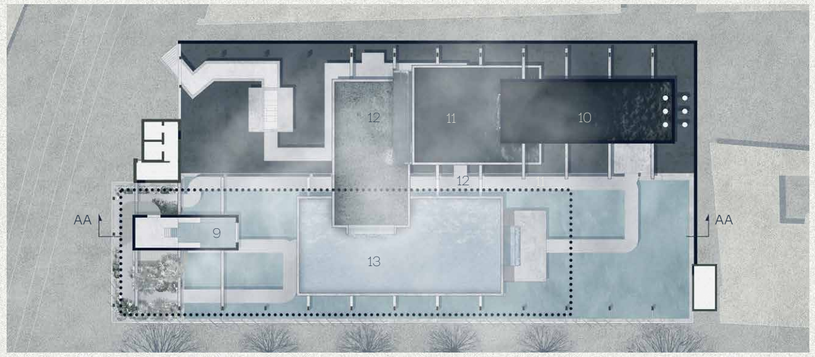


Overall
Spatial Visual Overlooking
Filtration Layers



Overall
Lower Floor Plan
Not to Scale

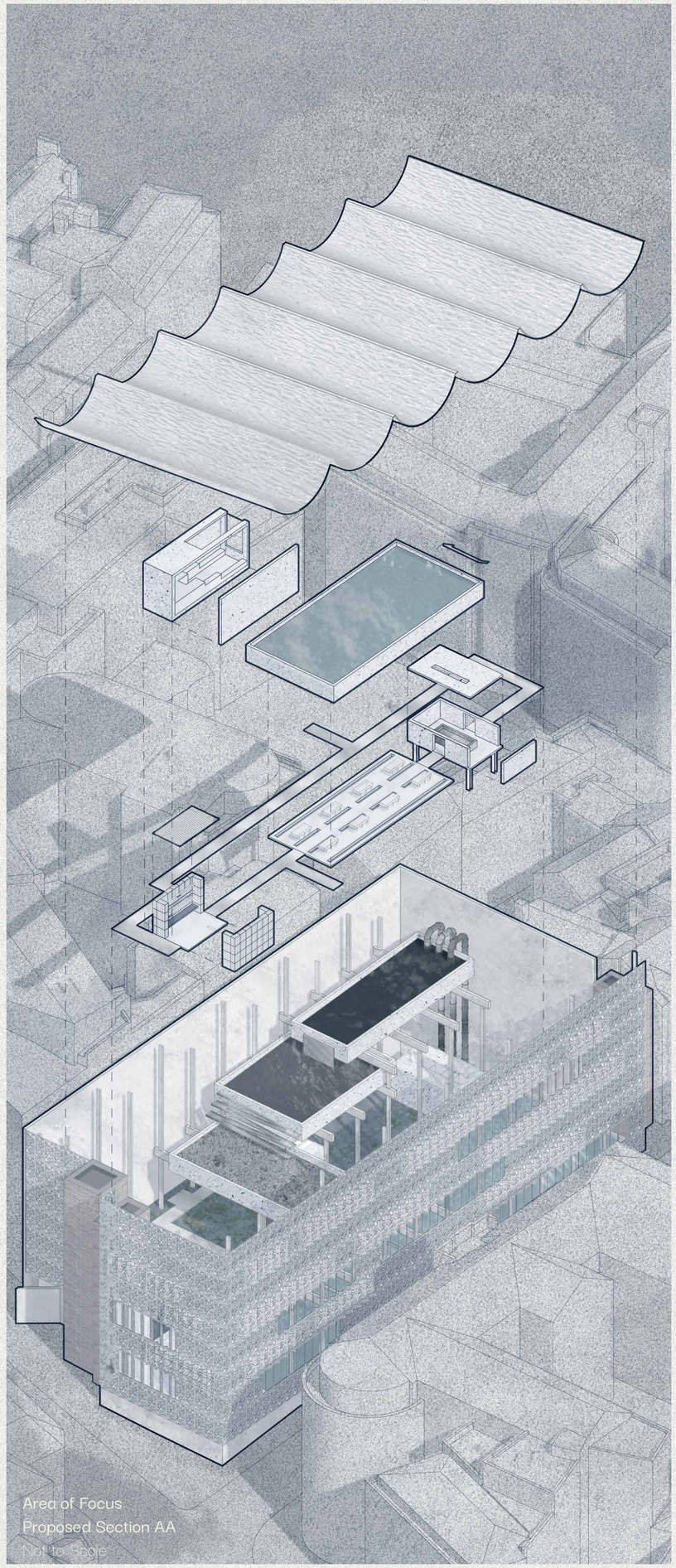
1. Entrance
2. Genkan
3. Interaction point with falling water
4. Chozu
5. Changing
6. Misogi
7. Contemplation
8. Collection



Overall
Upper Floor Plan
Not to Scale

9. Onsen
10. Activated Carbon Tank
11. Fine Silex Tank
12. Coarse Silex Tank
13. Pebble Tank

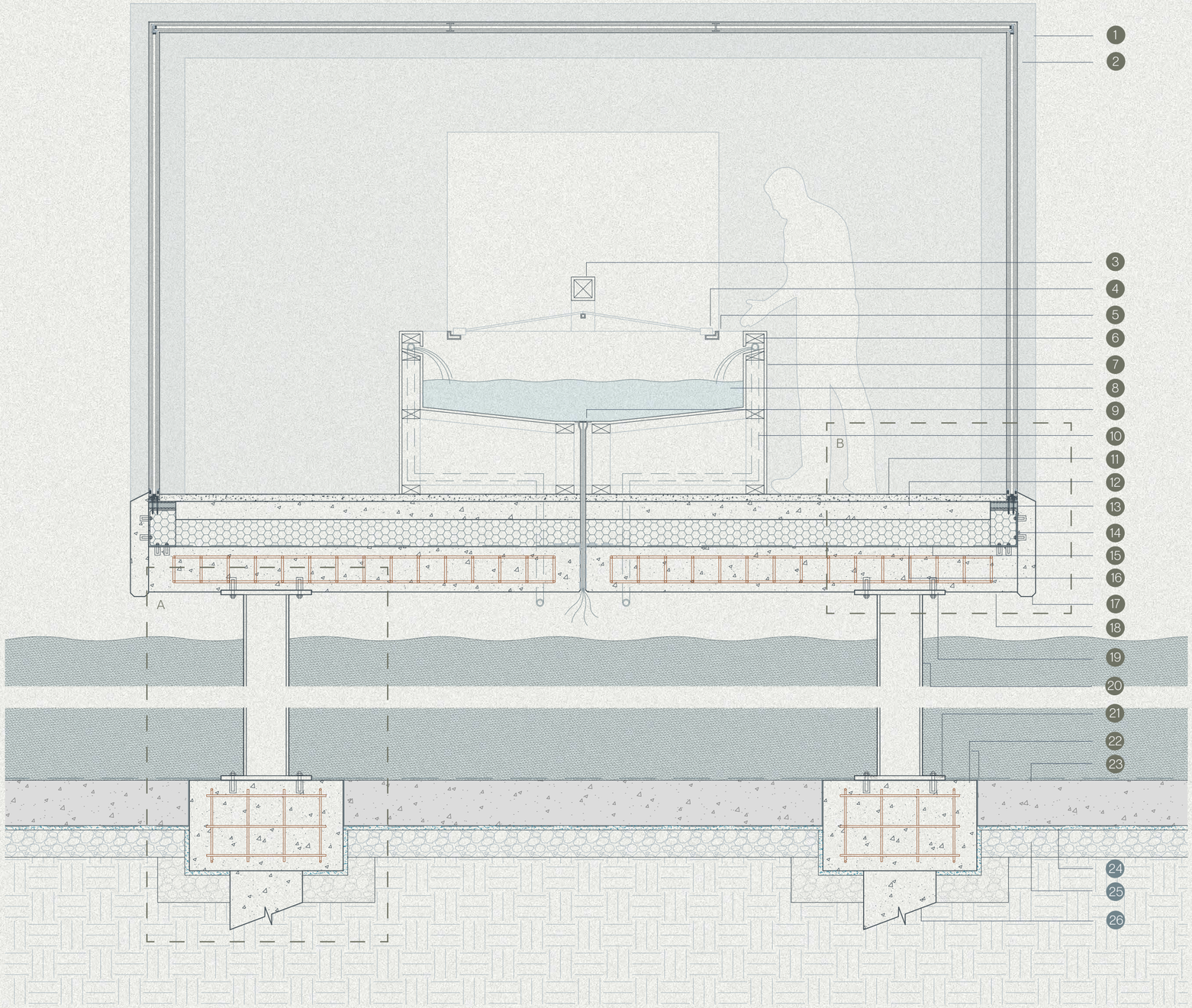
Area of Focus
Proposed Section AA
Not to Scale



Area of Focus
Proposed Section AA
Not to Scale

Technical Resolution

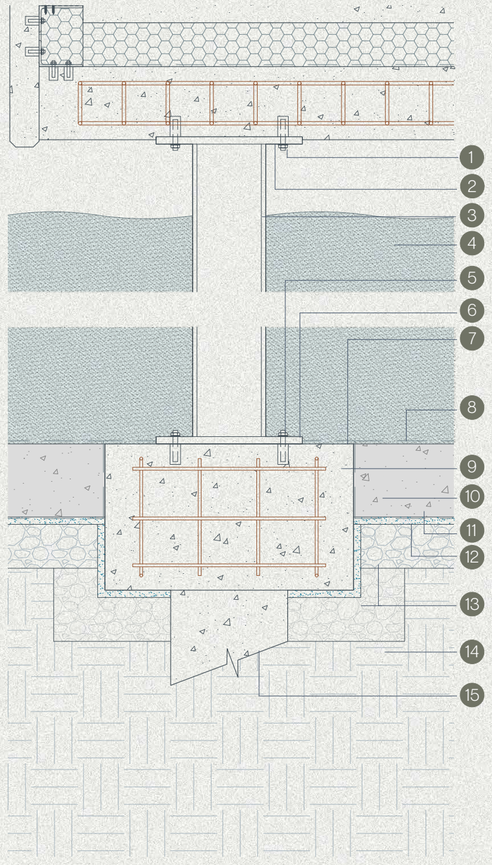
Focusing on the Chozu space, the technical design communicates how the low-carbon materiality choices are integrated and constructed. The construction of this space is replicated and repeated throughout the other spaces within the cleansing ritual.



Overall Technical Section - 1:20

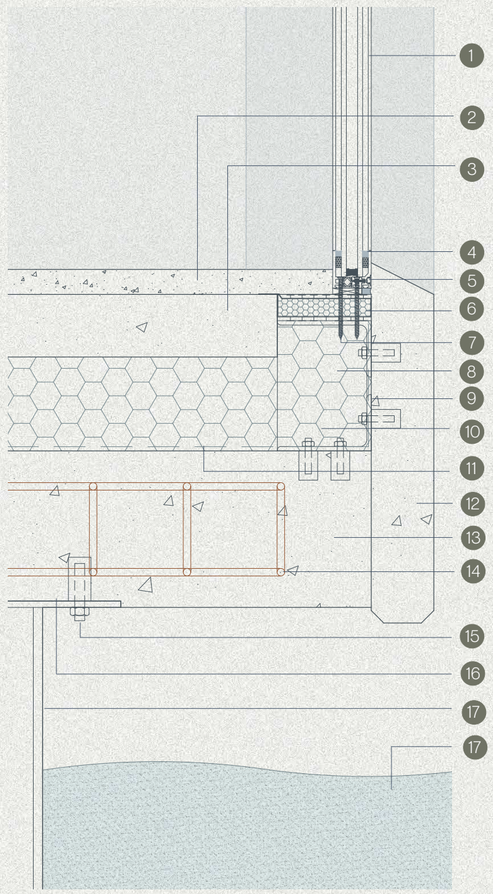
1. Supporting structural RAC wall with exposed aggregate finish
2. High performance structural glazed link with thermally broken profiles
3. 100x100mm reclaimed timber studwork, clad with recycled steel sheet
4. Bespoke hand carved, reclaimed timber ritual ladle
5. Reclaimed timber mounting rail for ladle, glued to studwork with a low-VOC adhesive
6. 50x100mm reclaimed timber studwork
7. Recycled steel sheet cladding, glued to studwork with a low-VOC adhesive
8. Potable ritual water supply
9. Bio- attributed PVC drainage pipe with flush-mounted perforated reclaimed steel drain cover
10. Bio-attributed PVC supply pipework with joints solvent welded.
11. 40mm recycled polished concrete floor finish with PTV 36+ slip resistance rating
12. 100mm structural sand and cement screed (1:4 mix)
13. High performance recycled PVC-U insulated cavity closer
14. 150x90x10mm galvanised steel unequal angle, secured via M10 threaded rods and nut fixings
15. 1200ga bio-based DPM, lapped 150mm and sealed with bio-resin tape
16. 150mm cellular glass insulation boards
17. 100mm precast recycled concrete edge strip with water repellent
18. 250mm cast-in-situ RAC slab with 30% RCA content and integral water-repellent admixture.
19. 500x500mm structural steel cap plate; secured with M16 threaded rod and nut assembly.
20. 254x254mm steel universal column with continuous fillet weld to cap plate.
21. 500x500mm steel base plate welded to universal column and secured with M16 threaded rod and nut assembly
22. 850x500mm reinforced recycled concrete ring beam with recycled steel rebar
23. Existing concrete ground floor slab
24. 25mm existing sand blinding layer
25. 150mm existing compacted hardcore
26. Recycled concrete pile foundation

Detail A - Steel Connections and Foundation Construction - Not to scale



1. 500x500x25mm steel column cap plate with epoxy coating for erosion protection. Welded to steel universal column. Designed to structural engineer's specification.
2. M20 steel threaded rod, resin anchored into concrete, secured with hex nut and washers. Minimum 150mm distance from concrete edge. Embedment depth of 170mm. Epoxy coated for erosion protection.
3. 254x254x73mm steel universal column welded to plates with 8mm continuous fillet weld all round. Designed to structural engineer's specification.
4. Polluted Water, contaminated from landfill leachate.
5. M20 steel threaded rod, resin anchored into concrete, secured with hex nut and washers. Minimum 150mm distance from concrete edge. Embedment depth of 170mm. Epoxy coated for erosion protection.
6. 500x500x25mm steel base plate with hot dip galvanised finish and epoxy coating for erosion protection. Welded to steel universal column. Designed to structural engineer's specification.
7. 850x500mm reinforced concrete ring beam made with recycled aggregate. As cast finish. Refer to structural engineer's details for placement of reinforcement.
8. Surface applied liquid DPM, 2 coats of Epoxy based moisture vapour barrier to top of cleaned slab.
9. 10mm reclaimed steel reinforcement bars. Bars to be removed from source, cleaned of debris and tested to confirm yield strength equivalent to structural engineer's specification.
10. DPM continuity interface. 2 coats of reinforced liquid DPM to be applied to vertical cut of existing slab. Liquid membrane to lap existing DPM sheet by 200mm.
11. Existing concrete ground floor slab. Contractor to verify thickness, reinforcement and presence of DPM through pre-commencement site investigations.
12. 25mm existing compacted sand blinding layer. Contractor to confirm extent and stability.
13. 150mm existing compacted hardcore. Excavate through hardcore to firm ground and extend hardcore and sand blinding around sub-base around ring beam perimeter.
14. Existing natural ground. To be investigated by contractor during pre-commencement site investigations.
15. 400mm recycled aggregate concrete pile foundations. Concrete to contain minimum 30% recycled aggregate to reduce embodied carbon. Designed to structural engineer's specification.

Detail B - Floor and Wall Construction - Not to scale



1. 28mm dual-sealed double glazing: 6mm toughened outer, 12mm cavity and 8mm toughened and laminated inner. To meet U-Value of 1.1 W/m²K.
2. 40mm recycled polished concrete floor finish. 10mm max aggregate size. Diamond ground to expose aggregate. Polish to semi gloss finish. Apply penetrating sealant and anti slip treatment to achieve minimum PTV (pendulum test value) 36+ in wet and dry conditions.
3. 100mm structural screed. Mixed ratio of 1:4 cement and sand. Ensure screed is fully compacted. Drying additive can be added to reduce drying time.
4. 9mm elastic MS-polymer sealant. Surfaces to be cleaned with isopropyl alcohol before application. Sealant to be compatible with powered coated finishes.
5. Thermally broken steel window frame. Slimline powder-coated steel section with. Joints to be fully welded and ground flush.
6. 150mm eco cavity closer, manufactured from minimum 80% post-consumer recycled PVC-U. Position flush with internal face of concrete in order to create a continuous thermal break between concrete and steel window framing.
7. M6 countersunk screw, grade A4-316 to avoid corrosion. Fixing window framing to unequal angle at 300mm centres through tapped holes. To ensure for a seamless sealant bead, ensure the screw head is flush.
8. 150mm cellular glass insulation up stand to prevent cold bridging. Manufactured from minimum 60% recycled glass. Seal joints with a suitable adhesive to form a continuous VCL.
9. 150x90x10mm reclaimed structural steel unequal angle. Sand blasted and treated with solvent free cold galvanisation, reducing embodied carbon. Secured to RAC slab via M10 recycled stainless steel threaded rods and bio-resin anchors, placed at 450mm centres.
10. 150mm cellular glass insulation board. Manufactured from minimum 60% recycled glass. Seal joints with a suitable adhesive to form a continuous VCL.
11. 1200 gauge bio-based damp proof membrane, lapped with DPC by 150mm and sealed with bio-resin tape.
12. 100mm precast recycled aggregate concrete edge strip. Integral pore-blocking hydrophobic admixture to repel water. Structure to be mechanically fixed to unequal steel angle via M10 stainless steel countersunk bolts.
13. 250mm recycled aggregate concrete ground floor slab. Integral pore-blocking hydrophobic admixture to be added to ensure water resistance of concrete.
14. 10mm reclaimed steel reinforcement bars. Bars to be removed from source, cleaned of debris and tested to confirm yield strength equivalent to structural engineer's specification.
15. M20 steel threaded rod, resin anchored into concrete, secured with hex nut and washers. Minimum 150mm distance from concrete edge. Embedment depth of 170mm. Epoxy-coated for erosion protection.
16. 500x500x25mm steel column cap plate with epoxy coating for erosion protection. Welded to steel universal column. Designed to structural engineer's specification.
17. 254x254x73mm steel universal column welded to plates with 8mm continuous fillet weld all round. Designed to structural engineer's specification.
18. Polluted Water, contaminated from landfill leachate.