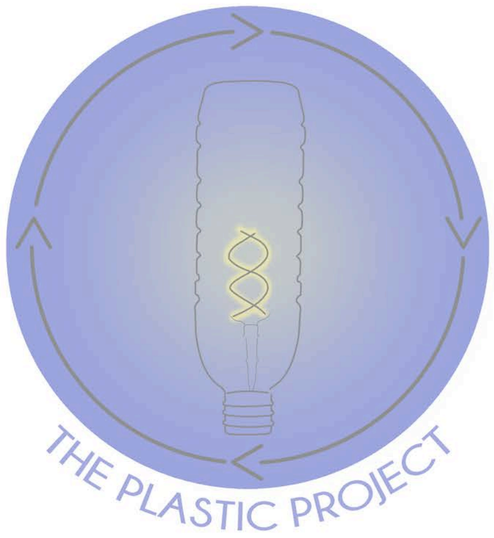


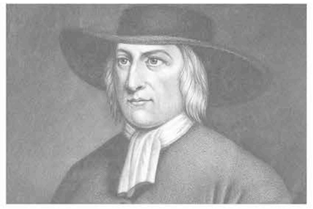

# THE PLASTIC PROJECT

DANIELLE STEVENSON

FINAL MAJOR PROJECT

AD676


pedestrian zone
main road through town
one way system



### A Brief History of the Quakers

The Quakers, also known as The Relgious Society of Friends, was founded in England in the 17th Century by George Fox.

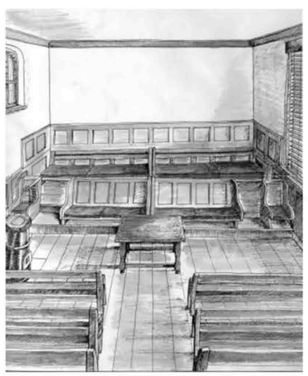
The main difference in the Quaker religion is that they believe that God is in every person, they also believe in spiritual equality between men and women, this meant that women were allowed to speak during worship.

Quaker beliefs were believed to be a threat to society and many were tortured and imprisoned for their beliefs, including George Fox who was jailed for blasphemy.

By the mid 1650's the Quakers had arrived in America, where they played a key role in the abolition of slaves and the women's rights movement, many well known sufragettes were Quakers. Despite their role in such political movements, Quakers believe in practising pacifism.

*"Quakers try to live in truth, peace, simplicity and equality, finding God in ourselves and in those around us."* (A quote from the Lewes Quaker Meeting House website). This notion of simplicity reflects itself in the humble and unfussy meeting houses where their worship takes place.

Today there are around 400,000 Quakers across the world.



Sketch by Maurice Burge showing what the Lewes Meeting House may have looked in the mid 1800's. The panelling is still present today.

Quakers in Lewes had been meeting since 1655, mostly in private houses

**1784**

A new Meeting House was built for them at the cost of £229.43

**1810**

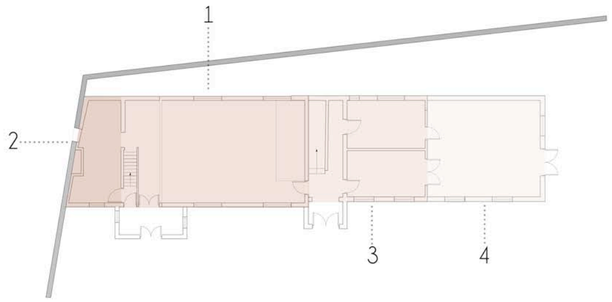
The first extension - a cottage for the warden

**1860**

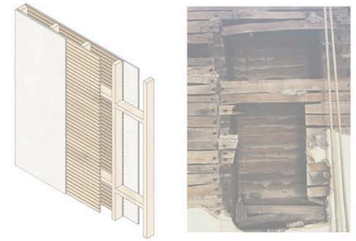
The second extension was added

**1978**

The final extension - a childrens room and wardens flat

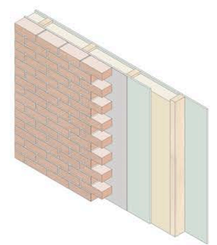



1 Timber frame with lime plaster

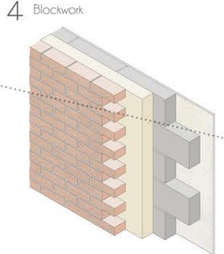


2 Bungaroosh and brick work lower floor, timber upper floor

3 Brickwork

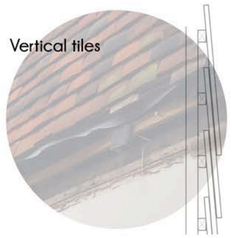


4 Blockwork

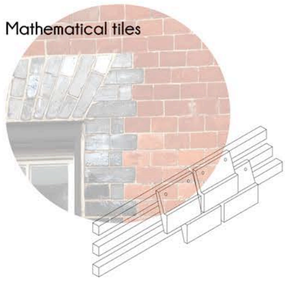


# FRIENDS MEETING HOUSE

Vertical tiles



Mathematical tiles



Tiles are a common site in Sussex, helping to protect buildings from the salty sea air. Mathematical tiles are particularly local to Sussex and are said to have come about as a solution to a shortage of bricks in the 18th Century, these slimline tiles were a cheaper alternative to bricks. They connect to timber battens in a similar fashion to vertical tiles, however the prodruding lip of the tile means that the tiles lay and have the same appearance as bricks. The red colour resembles that of bricks, but they also commonly come in a glazed black

mathematical tiles

slate roof tiles

bungaroosh

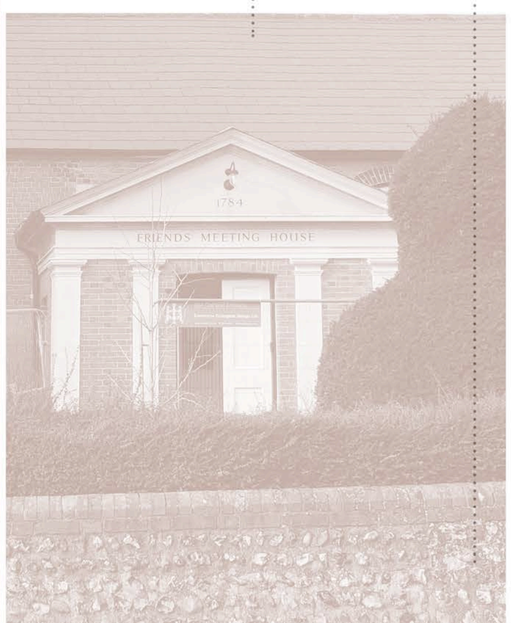
lime plaster

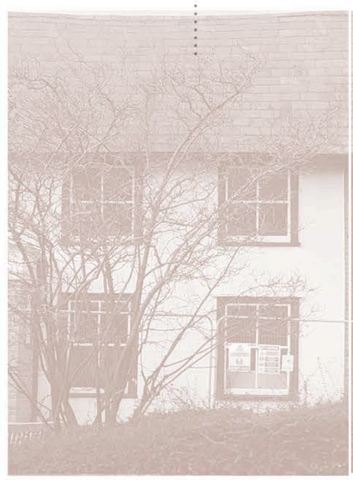


slate tiles

brick

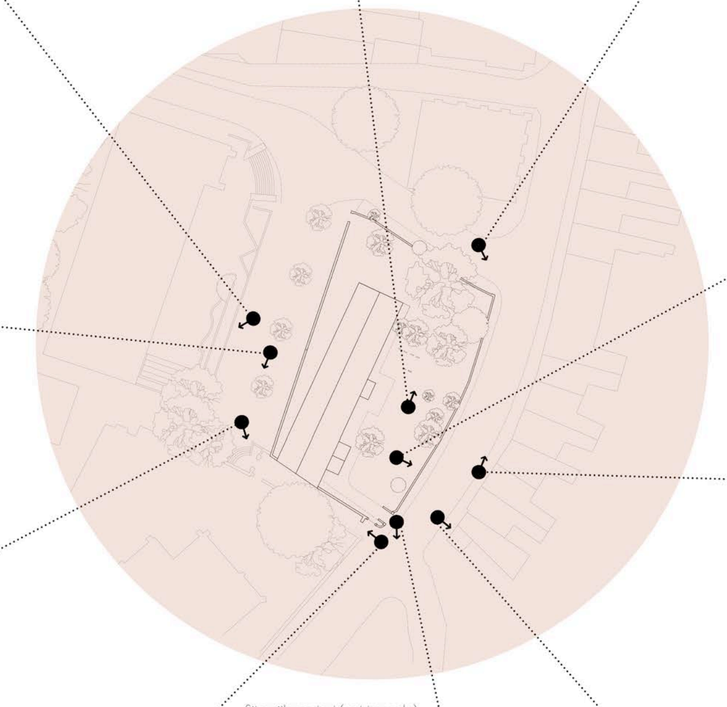






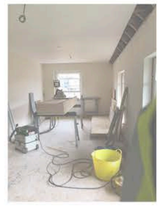


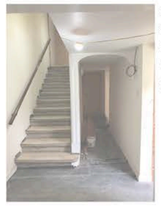
Site with context (not to scale)

lime plaster with horse hair was used over the timber frame wall

brick fireplace in 1810 cottage addition

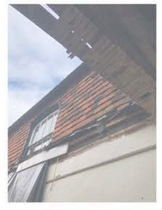
The roof trusses are visible on the first floor levels





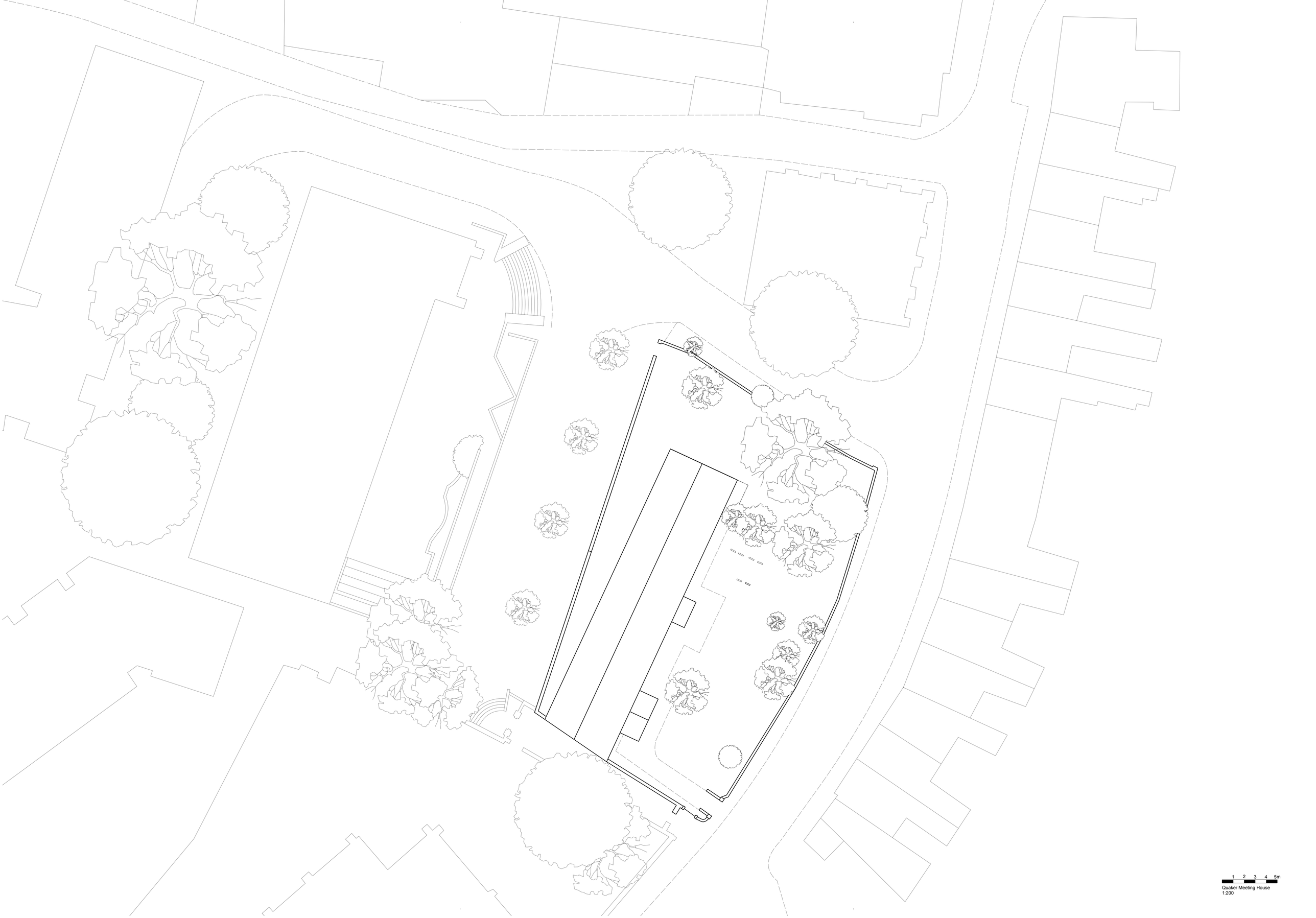
stone staircase built in the 1860 extension

Vertical tiles were used as the cladding for the back facade

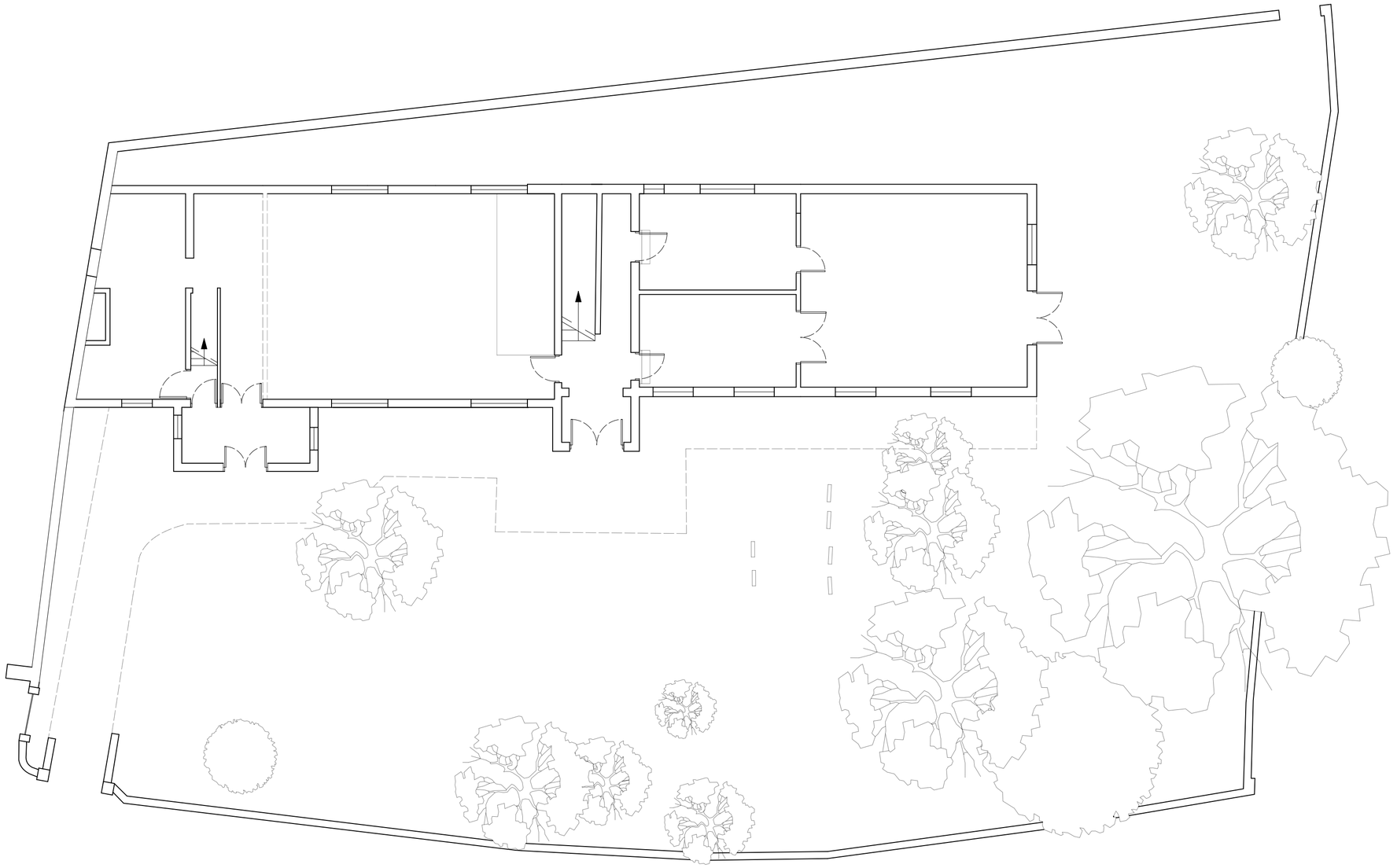


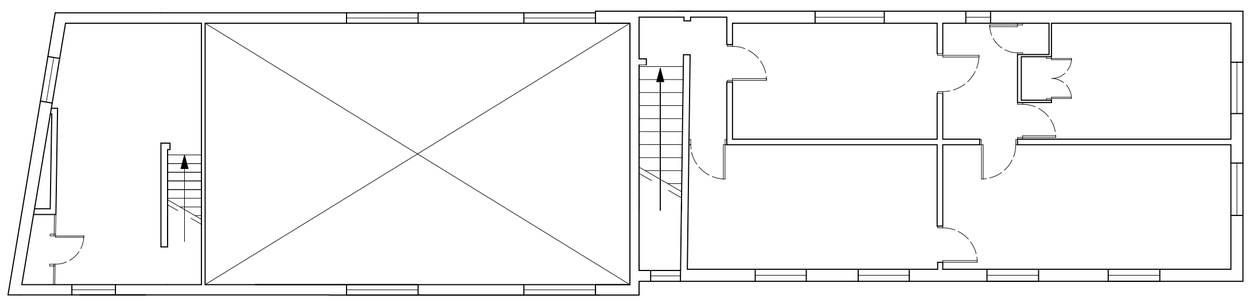
current building works showing timber frame connecting retaining wall and meeting house

timber frame construction with lime plaster shown in the main meeting house built in 1784



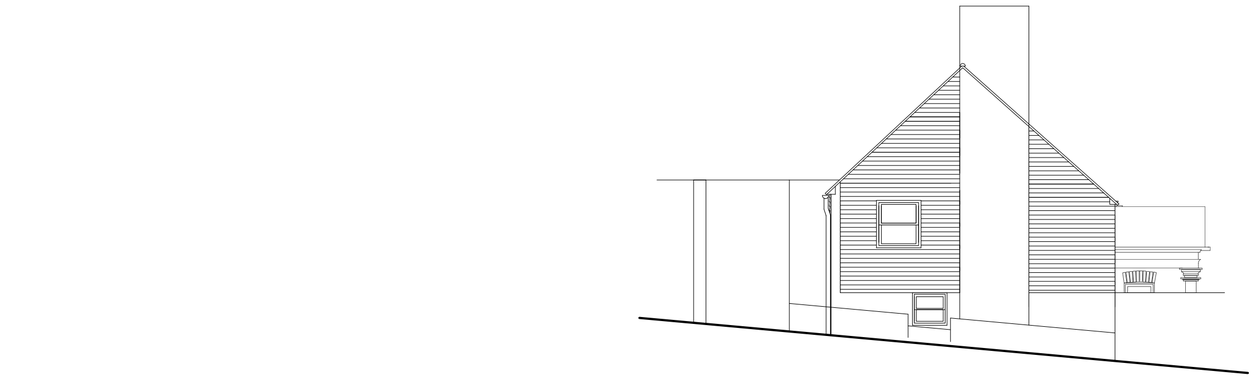

Quaker Meeting House
1:200





0 1 2 3 4 5 M


0 1 2 3 4 5 M



0 1 2 3 4 5 M


PLASTIC FREE LEWES
Taking action on plastic in our town

Lewes Climate Hub

Lewes Repair Café!

XRLEWES.ORG

KIND SUPPLY

On our site visit to Lewes, I noticed many Extinction Rebellion signs painted onto walls, so began my research there.

I soon found that Lewes as a town was committed to banning single use plastic and even has an organisation dedicated to it - Plastic Free Lewes. There were also a few other sustainability focused organisations within Lewes, a few have been listed to the left.

I decided to focus on plastic since Lewes is located near the sea and many of our oceans are being littered with rubbish. My programme came as a direct result of this research as I wanted to find a way to stop plastic from going to landfill and see if this could be incorporated as part of the sustainability pledge within Lewes.

The idea is to essentially recycle and reuse the plastic waste from our homes, schools and businesses by turning it into a useful product.

The map opposite shows the location of schools because educating young people on plastic waste is an essential step towards a more sustainable future. It also shows current waste management programs within Lewes.

# PROGRAMME

## PROBLEM

**380 million tons**
of plastic is produced
every year

only **9%** is recycled

it is estimated that in 2050
**12 billion tons**
of plastic will be in landfill

## SOLUTION

reduce, **reuse,** recycle

1 PETE
Polyethylene Terephthalate
Recyclable

2 HDPE
High Density Polyethylene
Recyclable

3 PVC
Polyvinyl Chloride
Recyclable at specialist points

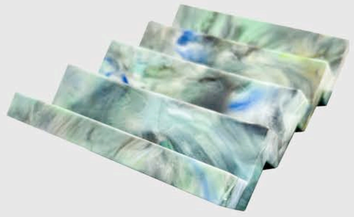
4 LDPE
Low Density Polyethylene
Recyclable at specialist points

5 PP
Polypropylene
Recyclable

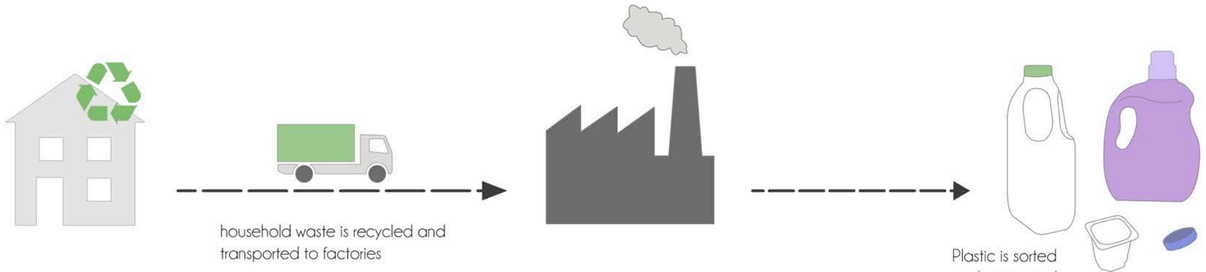
6 PS
Polystyrene
Recyclable at specialist points

7 OTHER
Other
Not yet recyclable

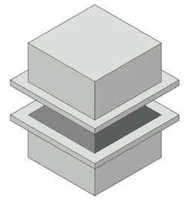
**müll**



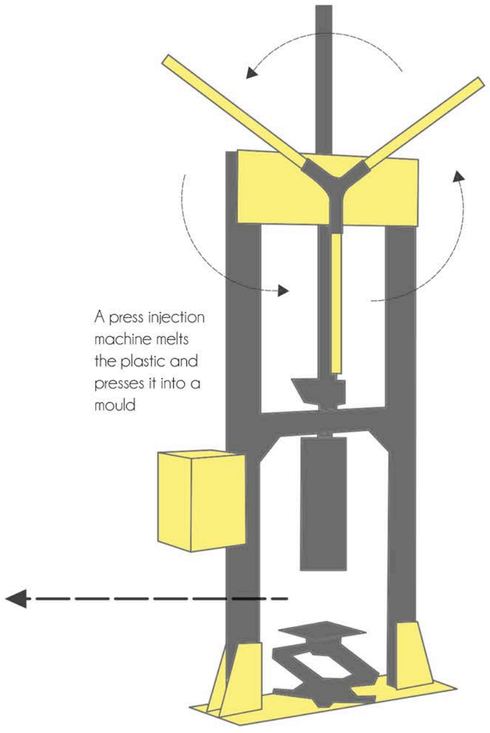
The Mull Club is a London based practice that aims to recycle London's plastic into useful products. Currently they recycle type 2 (HDPE) and type 5 (PP) into products such as combs and soap dishes. They are also a refill shop, further helping to reduce the amount of plastic waste created.




Lewes is a proactive town that is committed to creating a more sustainable future. My programme offers a solution to the problem of single use plastic by turning this unwanted waste into useful products, therefore closing the loop and producing a circular economy. This programme offers a hands-on approach to recycling and reusing plastic waste as the people of Lewes can be involved with the process, from collection of materials to creating and using the final product.



product is demoulded and left to cool, defects are polished



A press injection machine melts the plastic and presses it into a mould

# Spatial requirements for a plastic recycling micro-factory

(Based on research precedent *Precious Plastic*)

Precious Plastic is an open source company providing information and plans on how to set up your own plastic recycling spaces, they also provide machines that can be assembled by the customer or pre-assembled, making this concept accessible for a wide variety of business sizes.

## Collection point

**Requirements**

drop off point

sorting area

storing area

## Sheet Press

**Requirements**

sheet press

table for cooling

storage for the sheets

**Dimensions**
1620 x1620 x 1780 MM

consider extraction fan for fumes

makes 1m x 1m sheets

## Shredder Space

**Requirements**

access to sorted plastic

shredder

place to store shreds

**Dimensions**
1205 x 550 x 1512 mm

Can shred up to 50kg of plastic every hour

Noise polution to consider

## Injection Mould

**Requirements**

access to shreds

injection mould

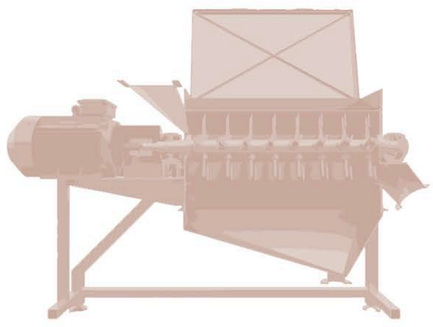
**Dimensions**
830 x 1000 x 1830 mm

consider extraction fan for fumes

## Cleaning

**Dimensions**
2910 x 1185 x 1950 mm

"a high-speed, centrifugal washer that utilises a combination of friction, centrifugal force and, when required, thermal and chemical energy to remove contaminants from the surface of the re-grind."

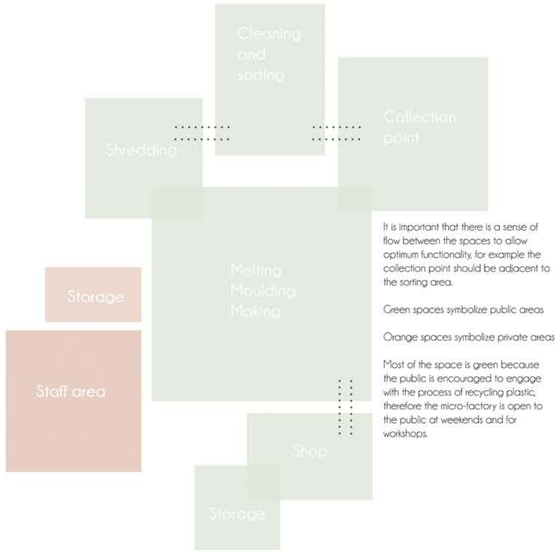


## Workshop

**Requirements**

access to tools

access to materials

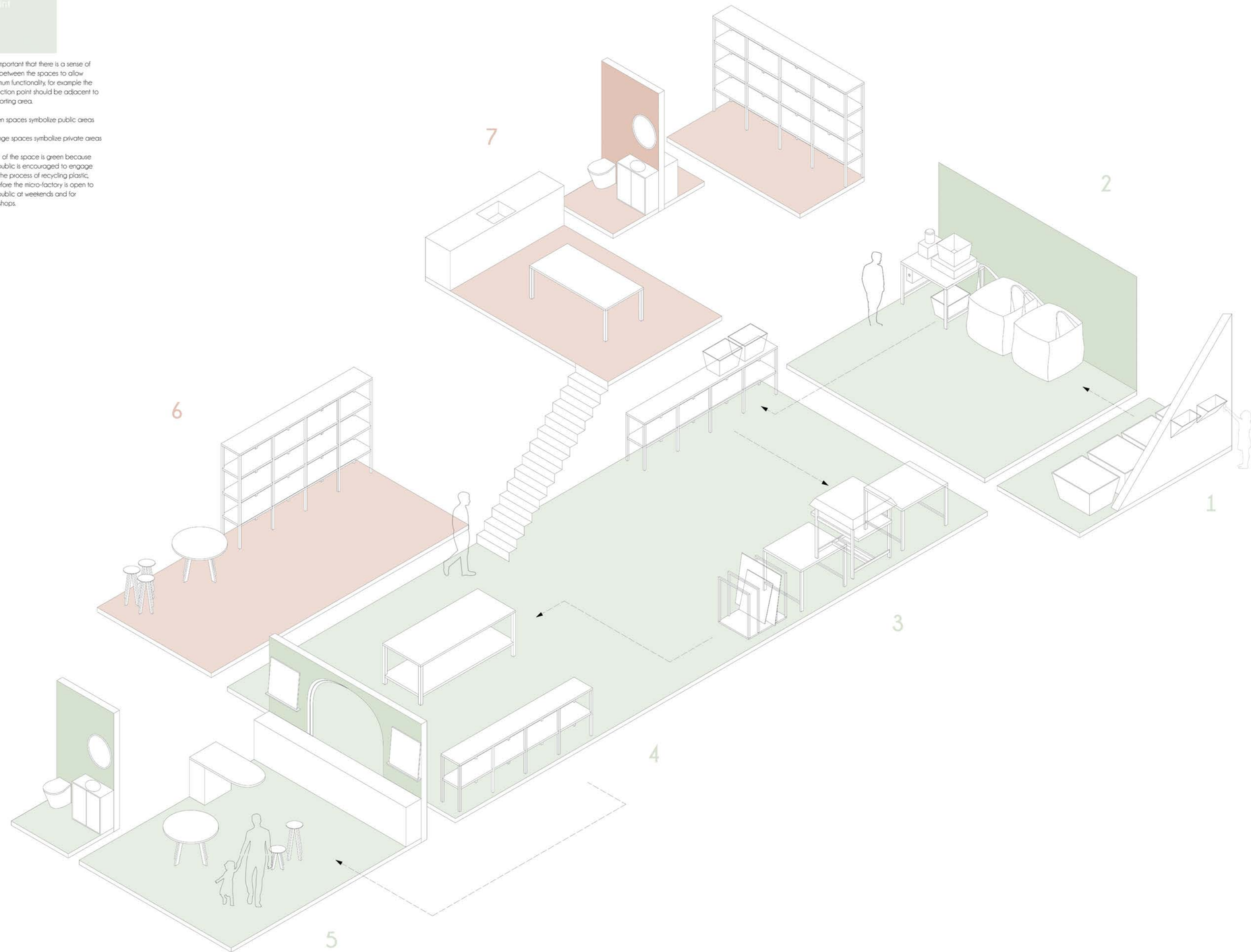



It is important that there is a sense of flow between the spaces to allow optimum functionality, for example the collection point should be adjacent to the sorting area.

Green spaces symbolize public areas

Orange spaces symbolize private areas

Most of the space is green because the public is encouraged to engage with the process of recycling plastic, therefore the micro-factory is open to the public at weekends and for workshops.




1 collection point

2 shredder space

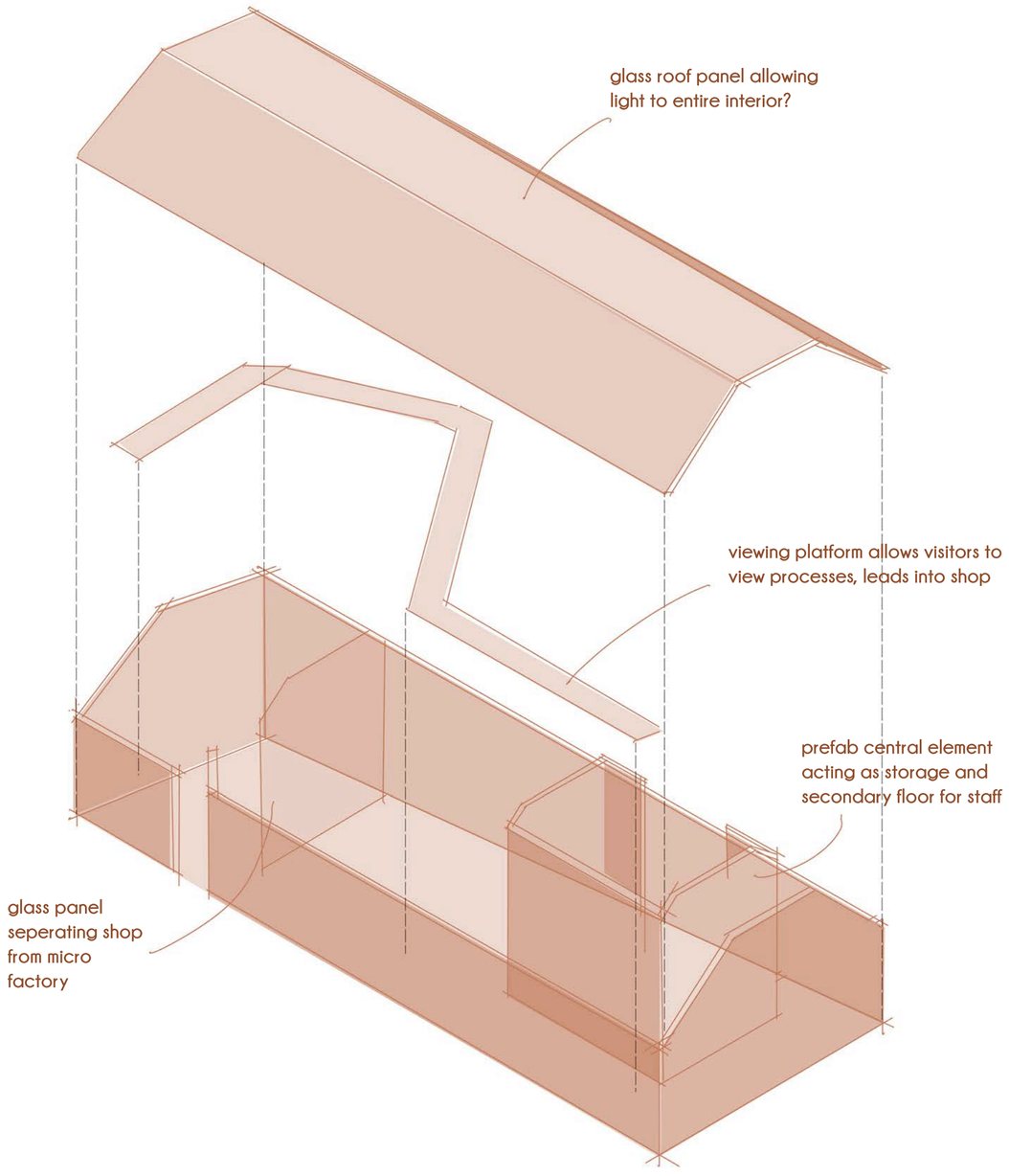
3 moulding space

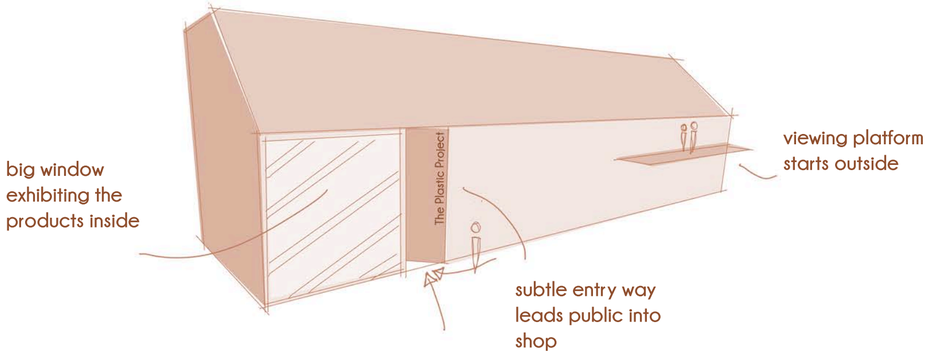
4 making space

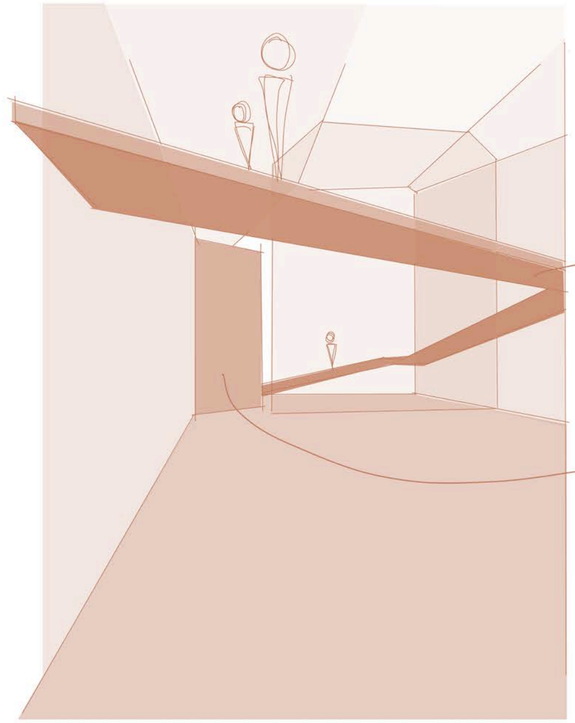
5 shop

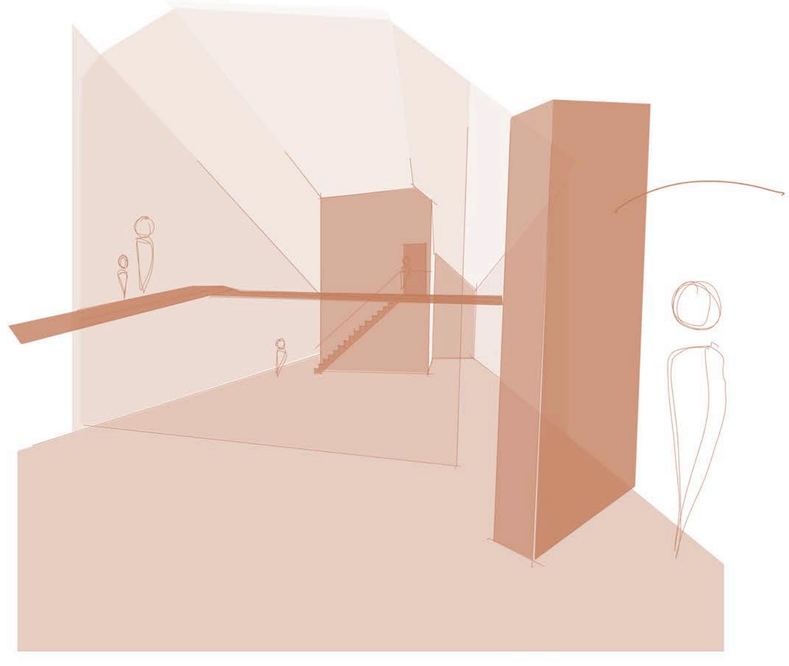
6 storage

7 staff area

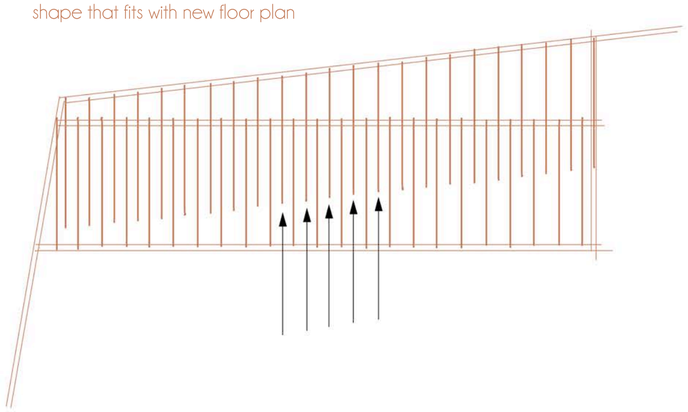

glass roof panel allowing light to entire interior?
viewing platform allows visitors to view processes, leads into shop
prefab central element acting as storage and secondary floor for staff
glass panel seperating shop from micro factory

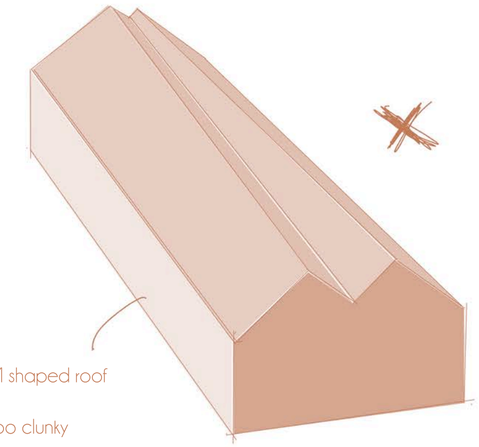

big window exhibiting the products inside
The Plastic Project
viewing platform starts outside
subtle entry way leads public into shop


viewing platform runs through entire micro factory
need to calculate slope and positioning
make the folded entry go all the way up to ceiling? continuous look


for visitors coming from the shop entrance the view to the factory is initially blocked, only once you have entered the space are you aware that the factory is behind the glass and you can watch the whole priduction process.

moving every other truss out towards
the new back wall to create new roof
shape that fits with new floor plan

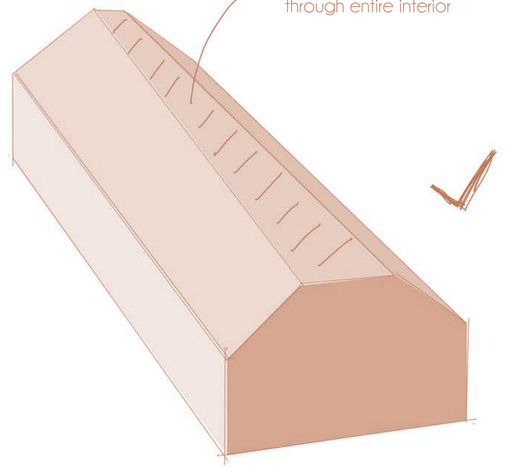




M shaped roof

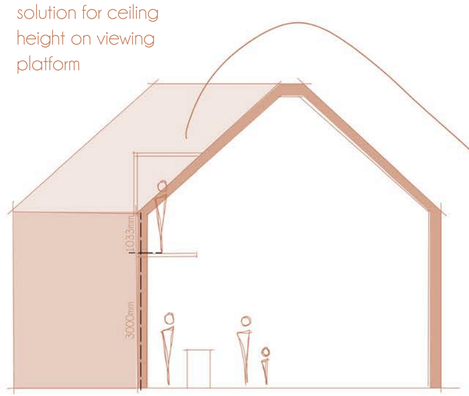
too clunky

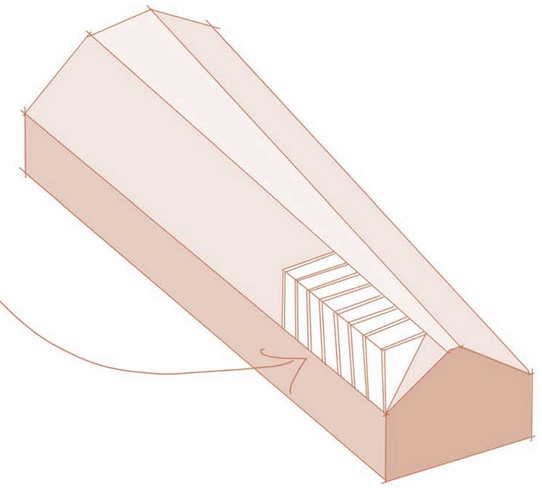
glass panel all the way
along so that light passes
through entire interior

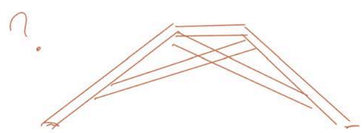


looks neater and more
streamline

solution for ceiling
height on viewing
platform



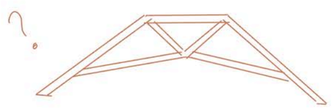



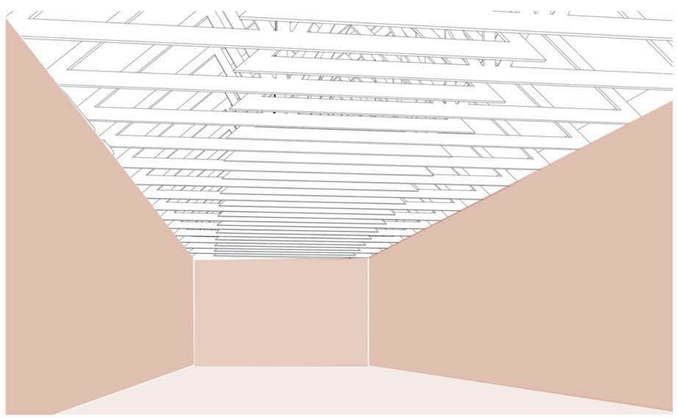


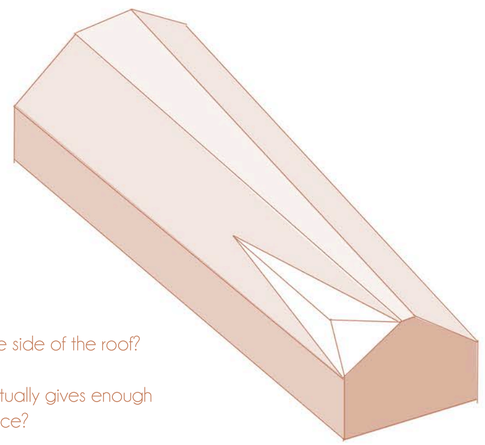
internal view with current truss design

too busy, rethink the truss design

consider how exposed beams will impact
height restrictions for the viewing platform
and second floor

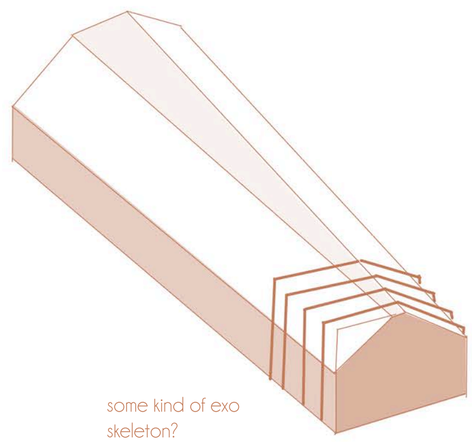




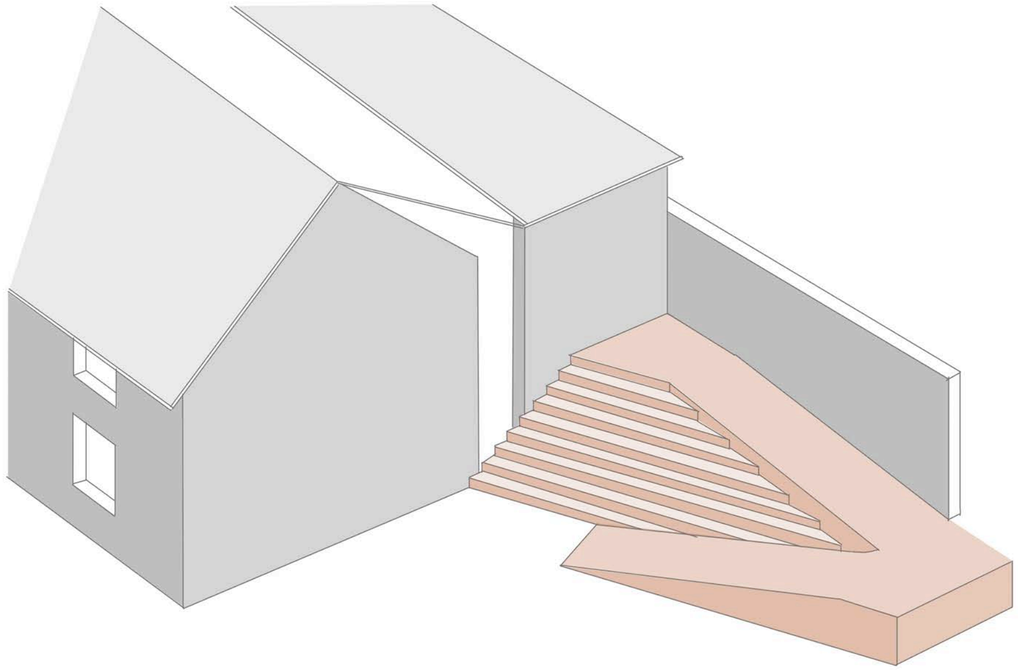


slash in the side of the roof?

will this actually gives enough
head space?



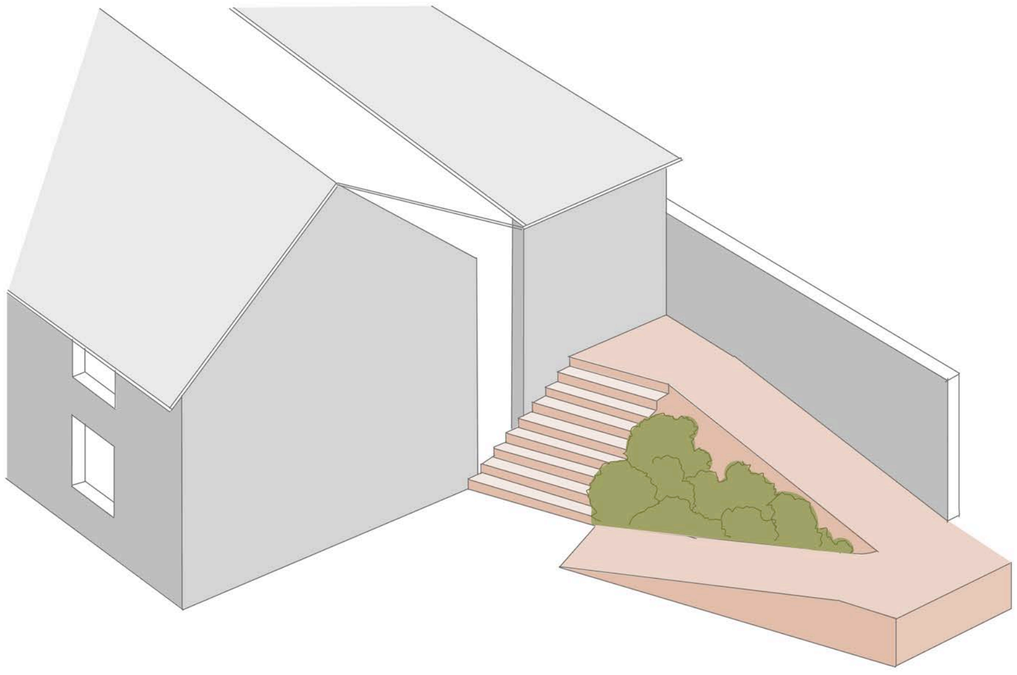
some kind of exo
skeleton?



The idea behind this design was to have the steps melt into the ramp, however, due to ramp angle, this design does not quite work for this space as it creates a dip which will be a magnet for dirt and leaves.

Also, not aesthetically pleasing.

The ramp has been designed to be level with the ground behind the retaining wall, for easy access from the car park.



An alternative solution would be to create some landscaping which would add colour to this area and make it more pleasing to the eye.

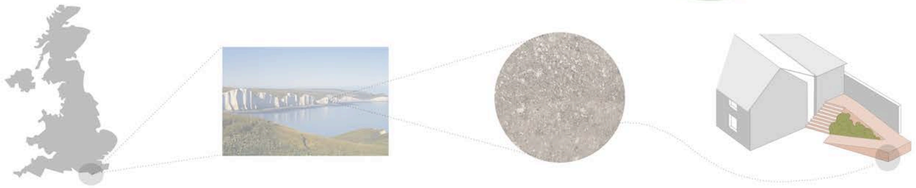
The "stramp" at Robson Square by Cornelia Oberlander, these stairs integrate a zig zag ramp to allow for maximum accessibility.

They were the initial inspiration for my design, however due to the various angles and dimensions of the site, this exact design was not feasible. Instead I decided to view the stairs and rampas part of the landscape.

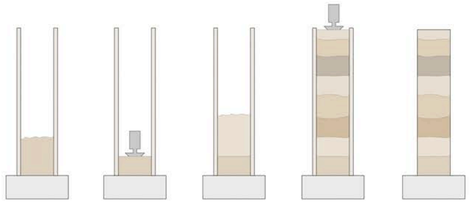
# A comparative material analysis

I have selected rammed chalk as the material for my external ramp and staircase as this is a more sustainable alternative to concrete.

1m3 of **rammed chalk** produces **9.3kg** $CO_2$ eq



Chalk is a natural material derived from the fossils of marine organisms, it will eventually biodegrade. Chalk is a locally abundant material in Sussex and can be found in places such as The South Downs and The Seven Sisters. Even more locally is the Offham Chalk Pit only a mile and a half outside Lewes, which was a working quarry with four kilns between 1809 and 1890.



Duncan Baker Brown's waste house was the inspiration behind this material selection, the chalk was sourced from a local construction site and built on site.

A plywood structure is built to create a mould for the chalk, a neumatic backfill tamper is then used to compress each layer of chalk, this process is repeated until the mould is filled. Once dry, the plywood is removed and the wall left exposed.

Once the building has reached the end of its life cycle and the ramp is no longer needed, it can be broken down and used as aggregate for other construction purposes. Since chalk is a natural material derived from the fossils of marine organisms, it will eventually biodegrade.

## Rammed Chalk VS Concrete

Concrete is made from mixing portland cement, water, sand and aggregate.

50% of the concrete industry's $CO_2$ are emitted during the production of portland cement via the calcination of limestone. A substantial amount of energy is then needed to heat and mix the portland cement with water, sand and various aggregates. It is also a very water intensive process, especially during the cooling stages after the material has been baked at high temperatures.

The negatives:

- decreases biodiversity
- causes air pollution (releasing $CO_2$, sulphur dioxide and carbon monoxide)
- heat island effect

However, the low-cost production, durability and strength still make concrete one of the most common construction materials.

Tarrawarra Abbey
Baldasso Cortese Architects
Board formed concrete

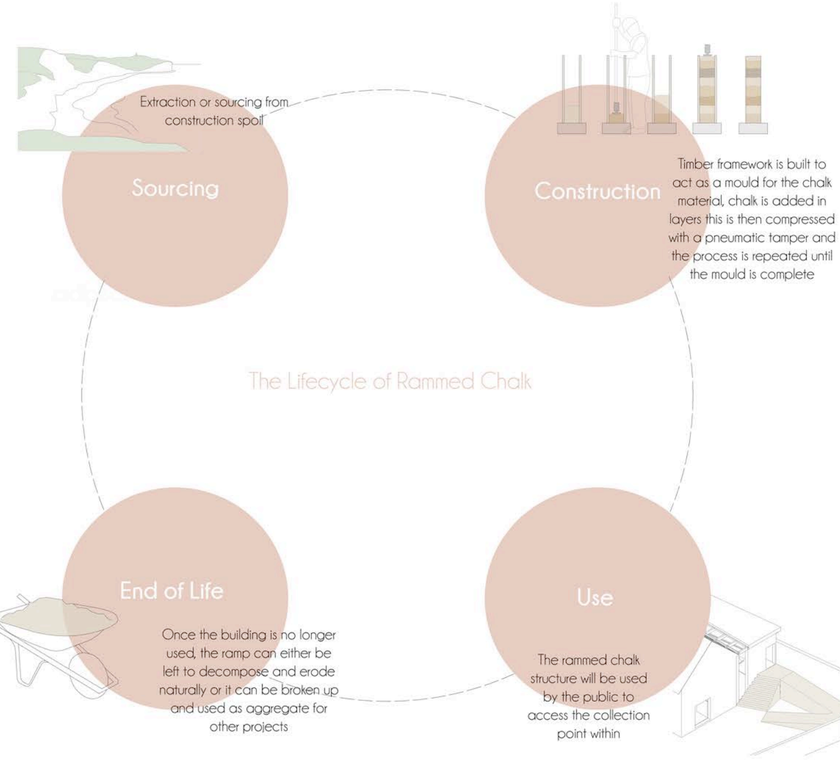
1m3 of **concrete** produces **229kg** $CO_2$ eq

Concrete can be used in many ways depending on the use. Directly above is a diagram of basic steel reinforced concrete structure, often used for building car parks.

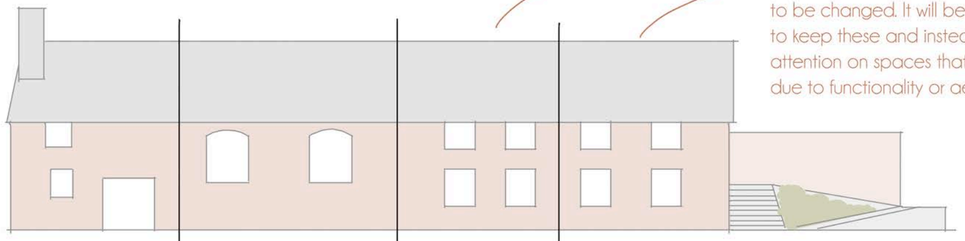
If I had used concrete in my design I would have used board-formed concrete which works in a similar way to rammed chalk as the concrete is poured into similar timber moulds and removed once the concrete is dry leaving a timber texture behind.

Applications of concrete:

- foundations
- large buildings
- walls
-pavements
-parking structures
-roads

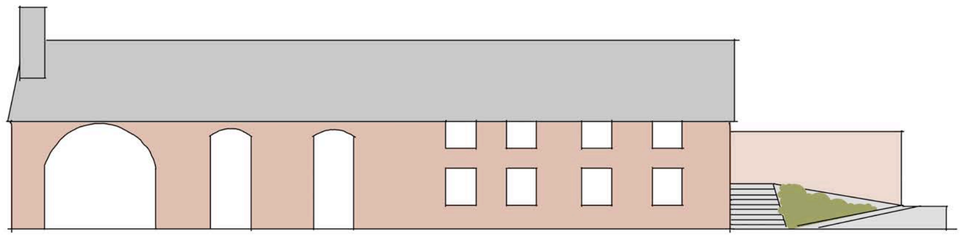


Current front facade with no porches

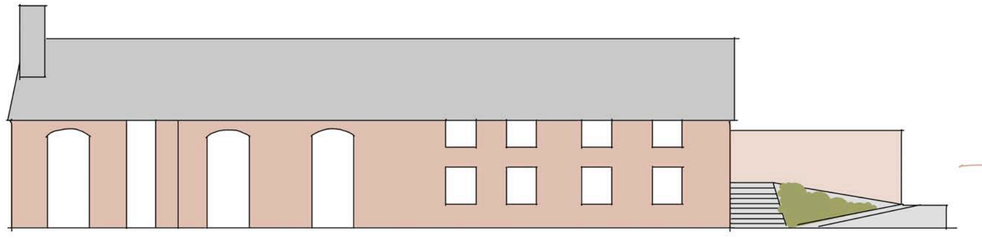



I will keep the windows the same in these areas as it works well with the function of the interior and there is no need for them to be changed. It will be more sustainable to keep these and instead focus the attention on spaces that need a change due to functionality or aesthetics.

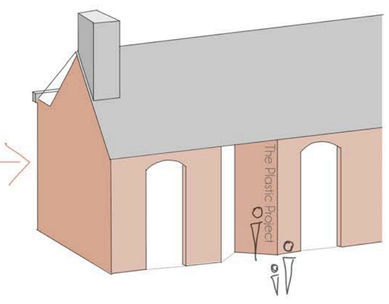
Ideally a large shop window is required to showcase the products inside and invite the customer in

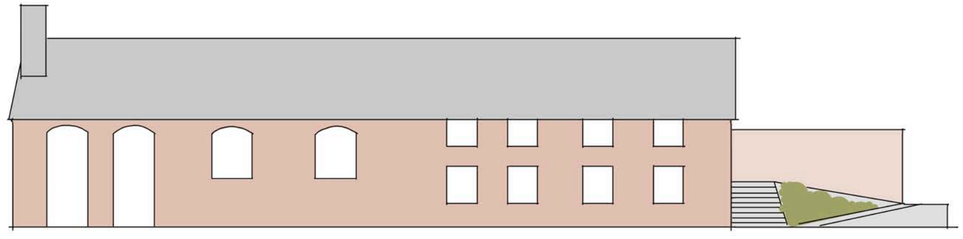


interior arch was mirrored to the external facade, however, the proportions look off and it doesn't quite work

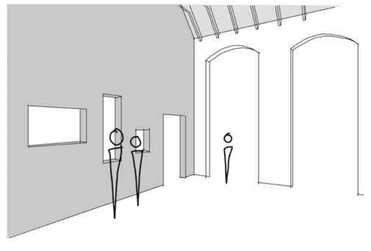


I liked the idea of drawing the customer in through the architecture. The wall protrudes into the building, creating a small entrance way.

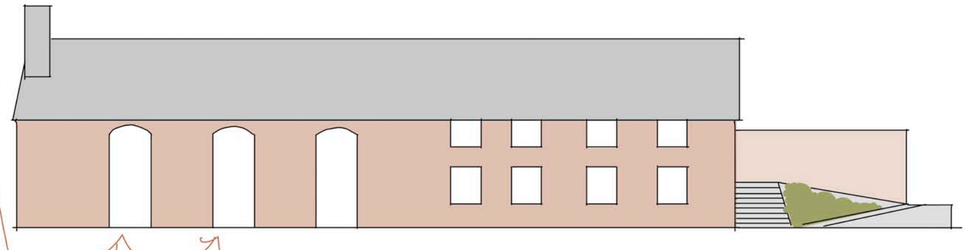


shape of existing windows have been mirrored in new design and extended to floor to give height

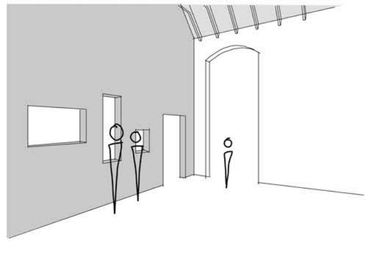


From the perspective of the interior, I prefer this design to the design below because of the symetry, it also makes the space feel more open. Furthermore, one of these openings could be used as an entrance and the other just for display purposes.

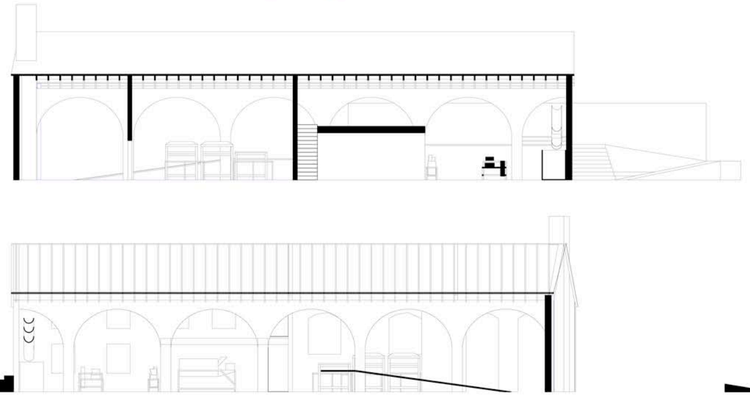


Existing windows have been extended to floor to provide views into and out of the workshop area.

This has then been repeated as the entrance to the shop.

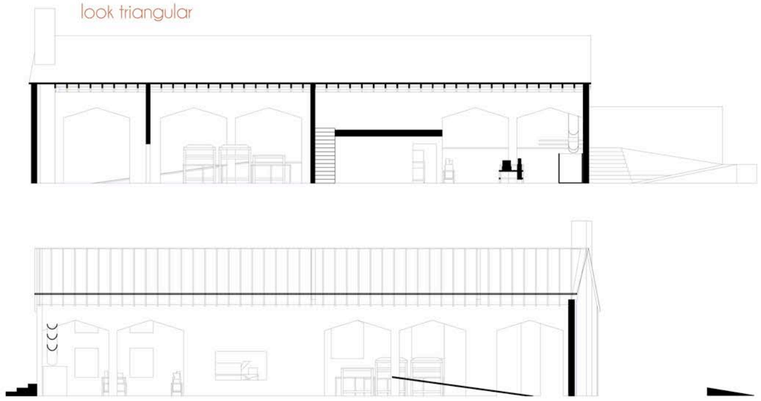


Initial design had some problems due to where the walls and floors ended up being placed.



These two arched in particular didn't work, due to the second floor and the placement of the existing stone staircase which I wanted to keep so that a new staircase was not required.

Actually an arched design but the render has made it look triangular

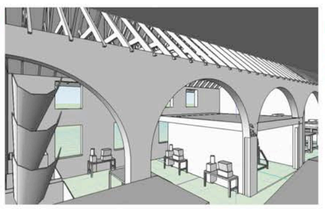


Got rid of the arches that contained the second floor and staircase, and instead inputted a viewing window into the cleaning room

I wanted to stick with the arch design as it mirrored the arches of the existing windows, this design was based on the dimensions of the existing windows

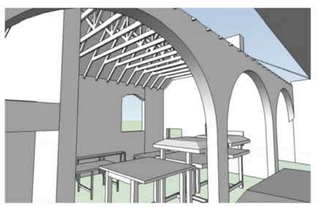
This section has been left without arches as it didn't work with the second floor or staircase placement.

1



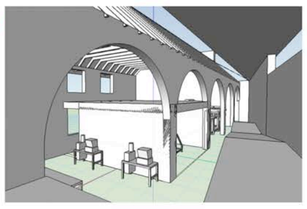
the second floor placement makes this arch feel awkward

2

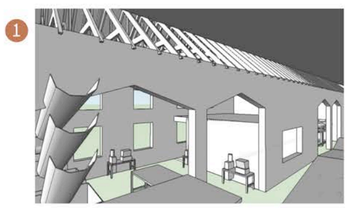


large arches allow for optimum views of the plastic recycling process

3



1

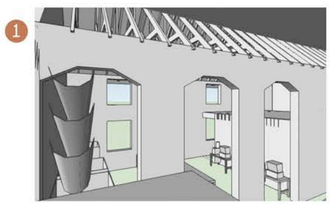


big arches and window allow for the public to view the process

2

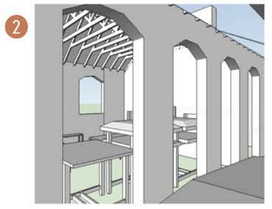
3

1

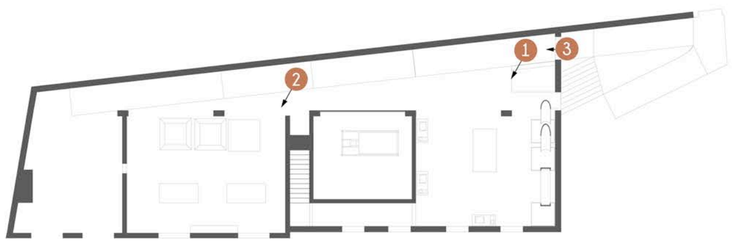


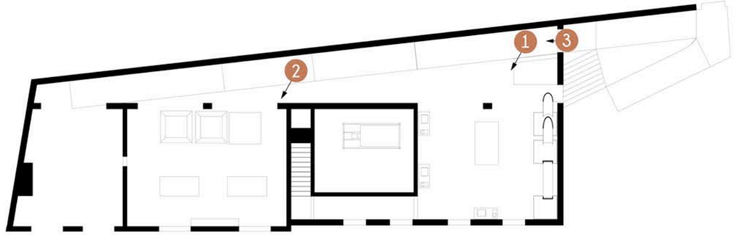
2

busy looking, not ideal for viewing

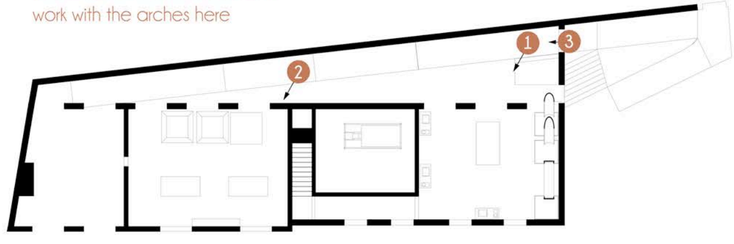


3




placement of the ramp doesn't work with the arches here

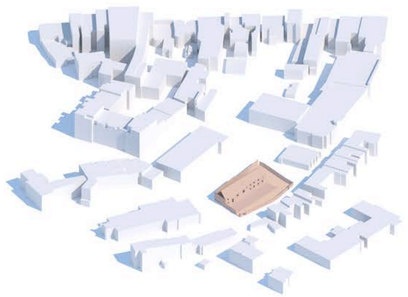


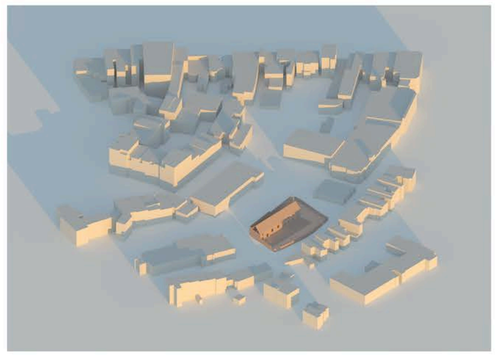
Summer

June 21st

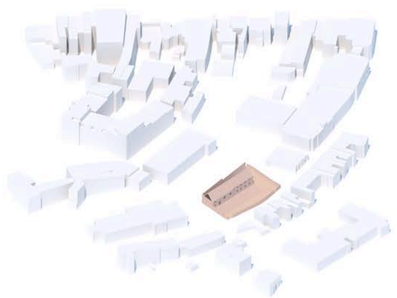
Winter

December 21st

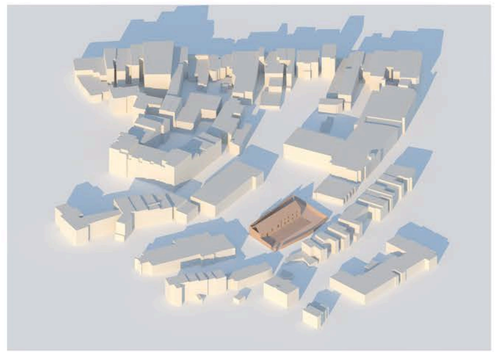


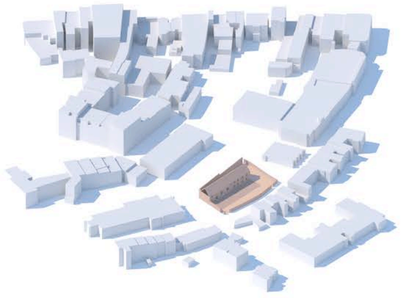


9am

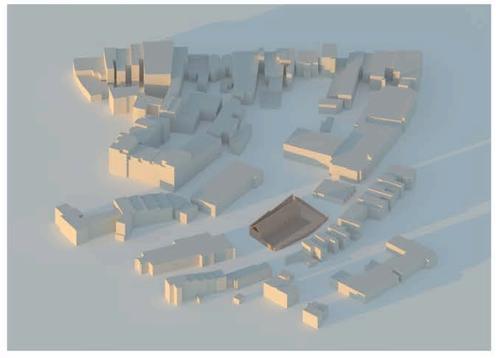


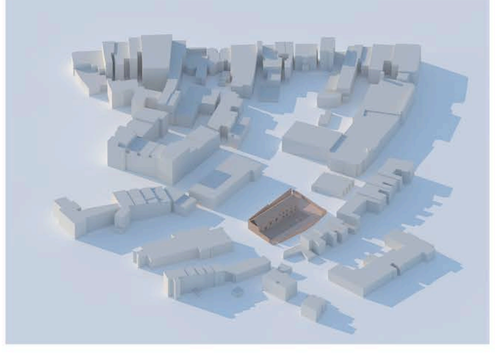
12pm





3pm



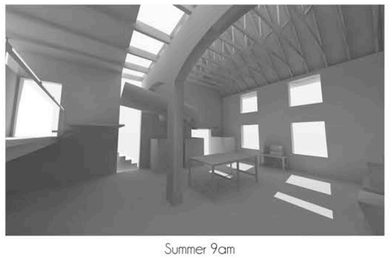


6pm

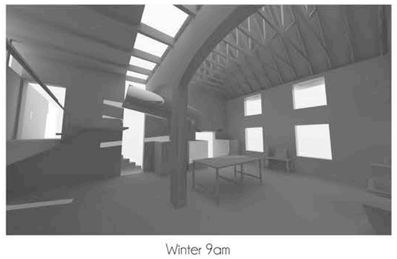

A typical summers day 6am to 6pm

The lighting in a workshop should be between 300 and 500 lux to ensure maximum comfort for workers.

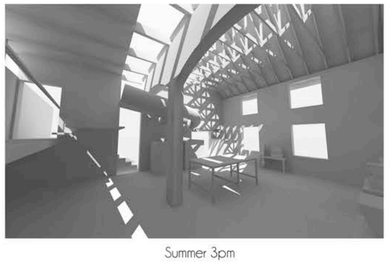
By removing part of the first floor and tiling the roof with translucent plastic tiles it allows light to pass through the space. The images to the right show how the space is illuminated during the summer and winter solstice.



Summer 9am



Winter 9am



Summer 3pm

Winter 3pm

Virgin plastic is made from crude oil or or natural gas which has been mined or drilled from the earth, these raw materials are then refined and turned into a resin which is heated and cooled to form nurdles which are then sent off to manufactures to be moulded into a wide range of products.

Not only is plastic made from fossil fuels, the process of producing plastic relies heavily on energy from fossil fuels.

At the end of use, plastic usually gets recycled or sent to landfill. Plastic that is recycled can be reprocessed and reused. Plastic in landfill will take over a thousand years to decompose and cause a threat to the environment and its inhabitants.

# Plastic VS Recycled Plastic

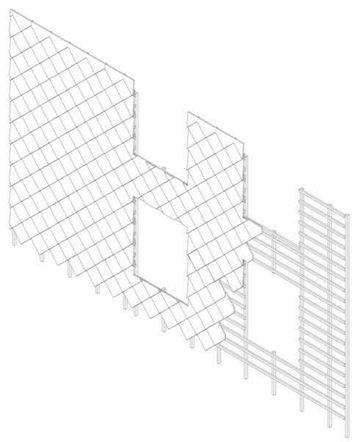
I have selected recycled plastic tiles to be used as roof tiles and wall cladding as it links my proposed programme to the site and connects the function of the building to the aesthetics.

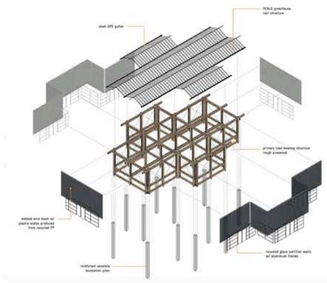
Recycled plastic is normally made from single- use, post-consumer plastic that has served its purpose and is sent off to recycling centres to be processed. The plastic gets sorted according to the type of plastic it is (it is vital to not mix plastic types) and then shredded into nurdle form. This then gets cleaned of all contaminants and sent off to manufacturers to remould them into products.

Although virgin plastic has a stronger molecular structure, the use of fossil fuels is much higher than that of recycled plastic. Recycled plastic does lose some of its quality when reprocessed and therefore can not be processed infinitely.

The tiles act as a skin and will need a frame to connect them to the building, the frame for the roof tiles will differ from the frame of the wall tiles. The roof tiles will be 600 x 900mm using the distance between the roof trusses as the width of the tile. The wall tiles measure 400 x 475mm).

At the end of use, the tiles can be removed and reused, the larger tiles could even be cut down into smaller tiles if needed, or if they are unable to be re-homed they can be shredded down and turned into new product.

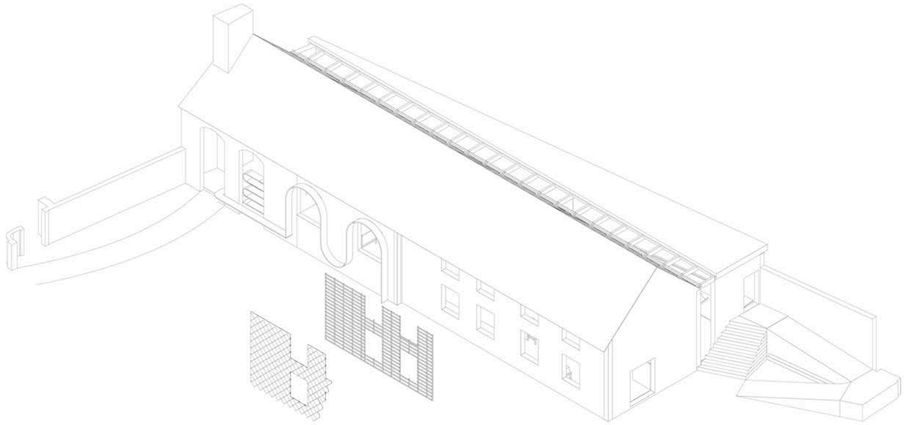




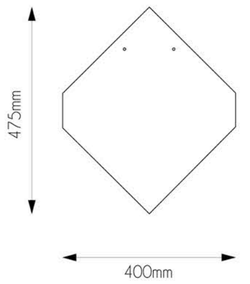
The People's Pavillion by Overtreders W and bureau is an example of construction with circular economy in mind. All of the materials within this structure were borrowed and the tiles that clad the exterior were made from the recycled plastic waste of the households in Eindhoven, which were distributed to the residents once the building had been taken down.

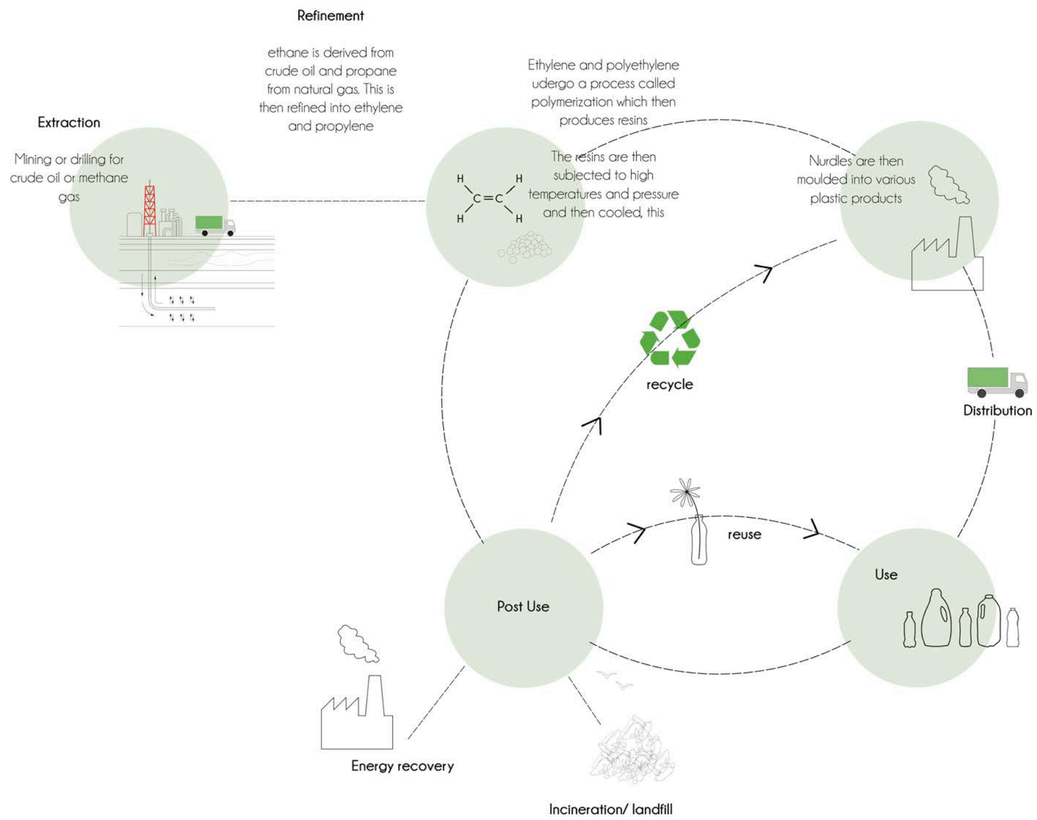
The building stands on concrete foundation piles, the timber frame provides the structure of the building which is then enveloped in a metal mesh that connects the tiles to the exterior.

(images above taken from archdaily.com)



Recycled Tile @1:10



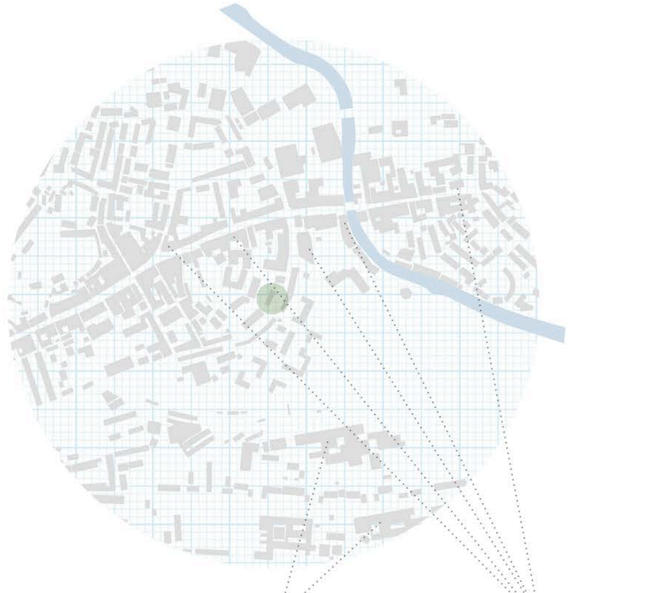



THE PLASTIC PROJECT

The Plastic Project is a micro-factory that recycles the plastic of Lewes into new products with the aim to put a stop to single use plastic altogether, a goal that Plastic Free Lewes has already pledged to achieve.

By turning a cradle-to-grave industry into a circular, cradle-to-cradle one, we can start to diminish the need for virgin plastic products and ultimately use the resources we have already got (plastic) to produce new products.
Although ideally the long term goal is to eliminate the production of plastic altogether, it seems wasteful to not use the resources we already have.

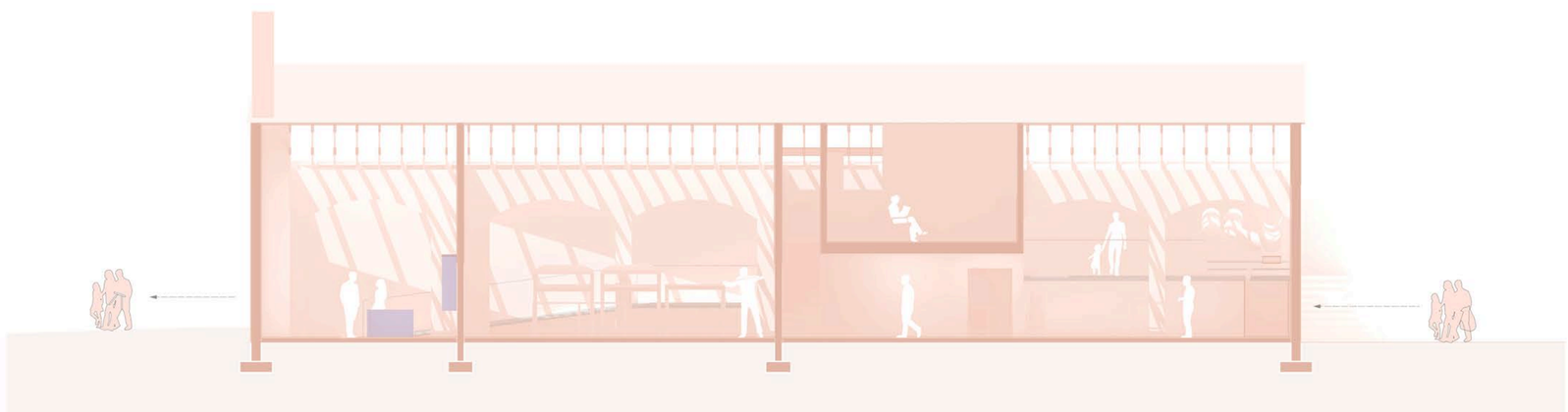
The Plastic Project is a community lead intervention with a focus on educating the people of Lewes through workshops. The simple idea is that people can bring their household waste and turn it into something functional and beautiful that they can then take home with them or use to benefit the community.

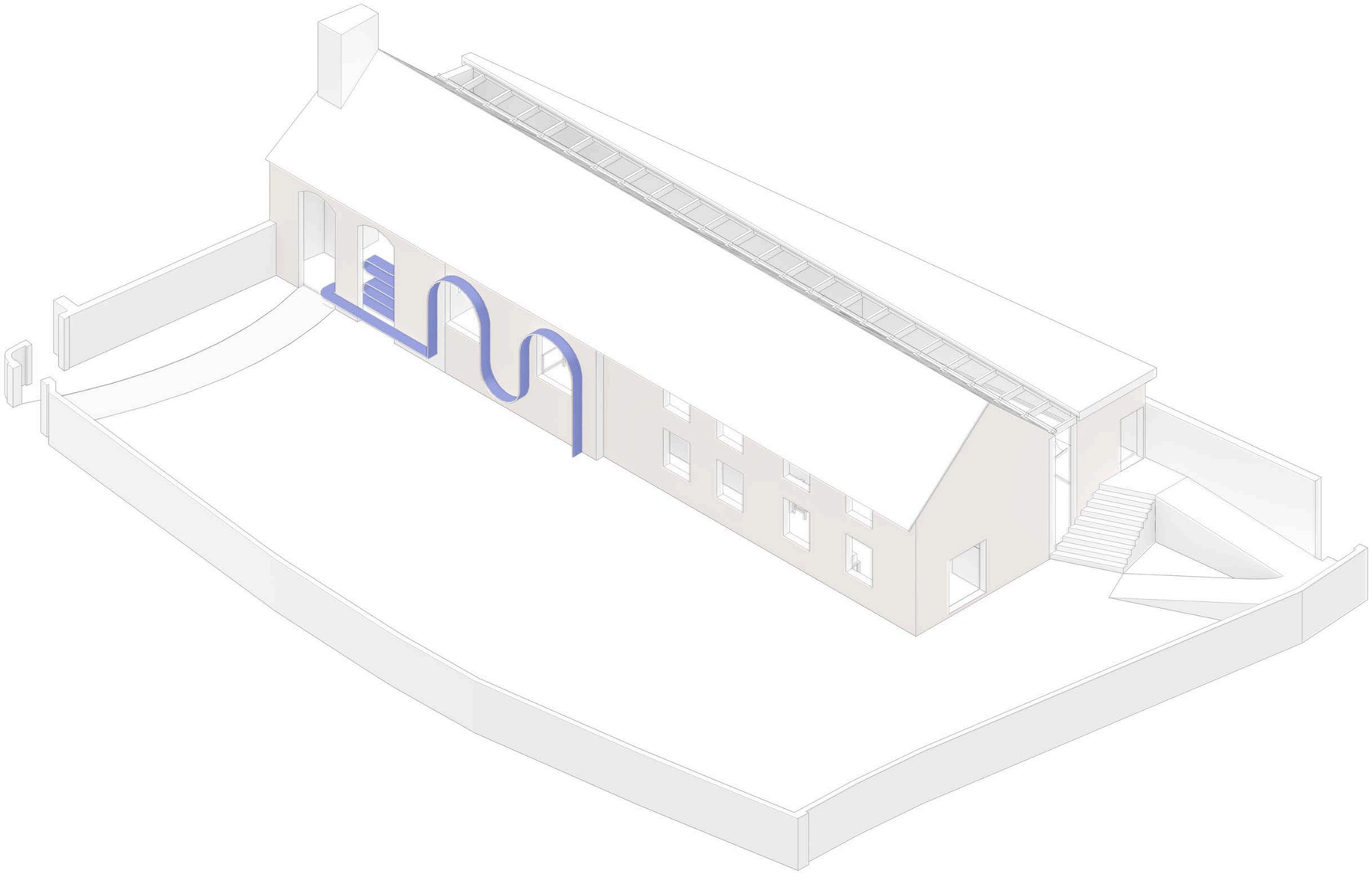


Households can bring their rubbish to the drop off point to be made into furniture or book in to the workshop to make their own furniture from their own recycled plastic.

Workshops in schools to educate children about the impact of single use plastic.

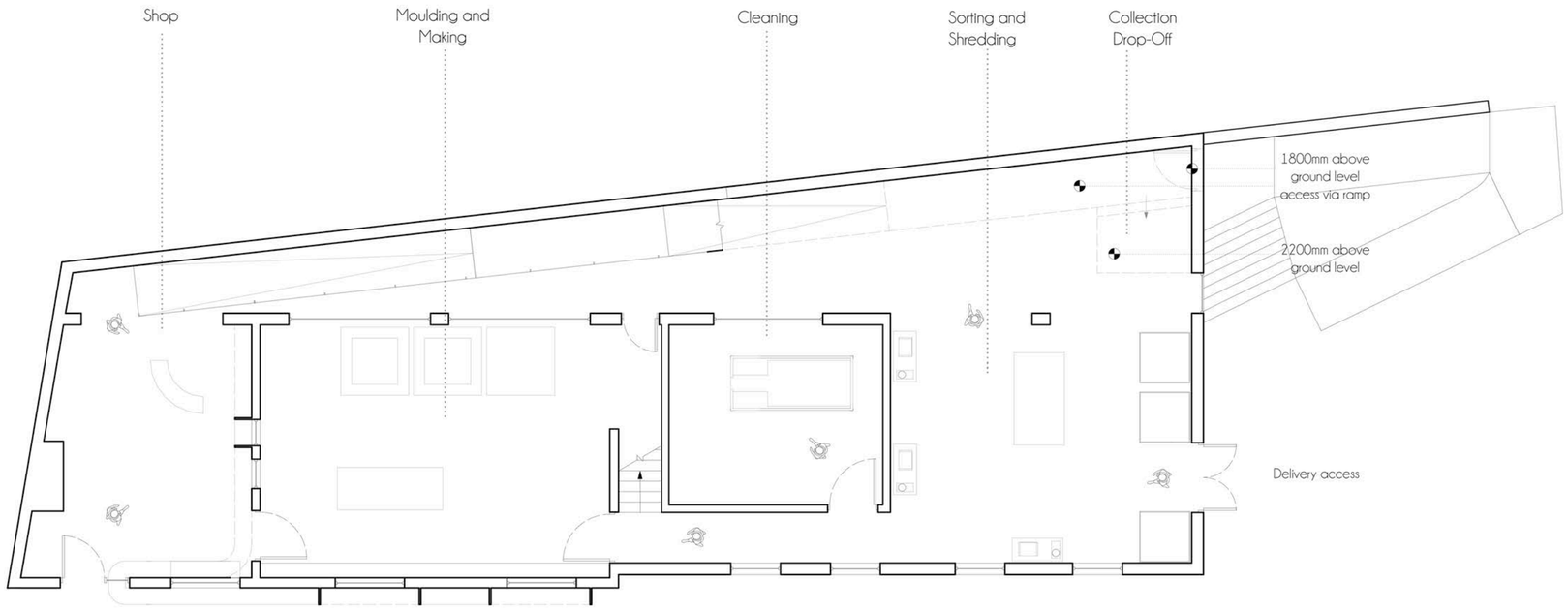
Plastic waste can be collected from local businesses such as The Trading Post





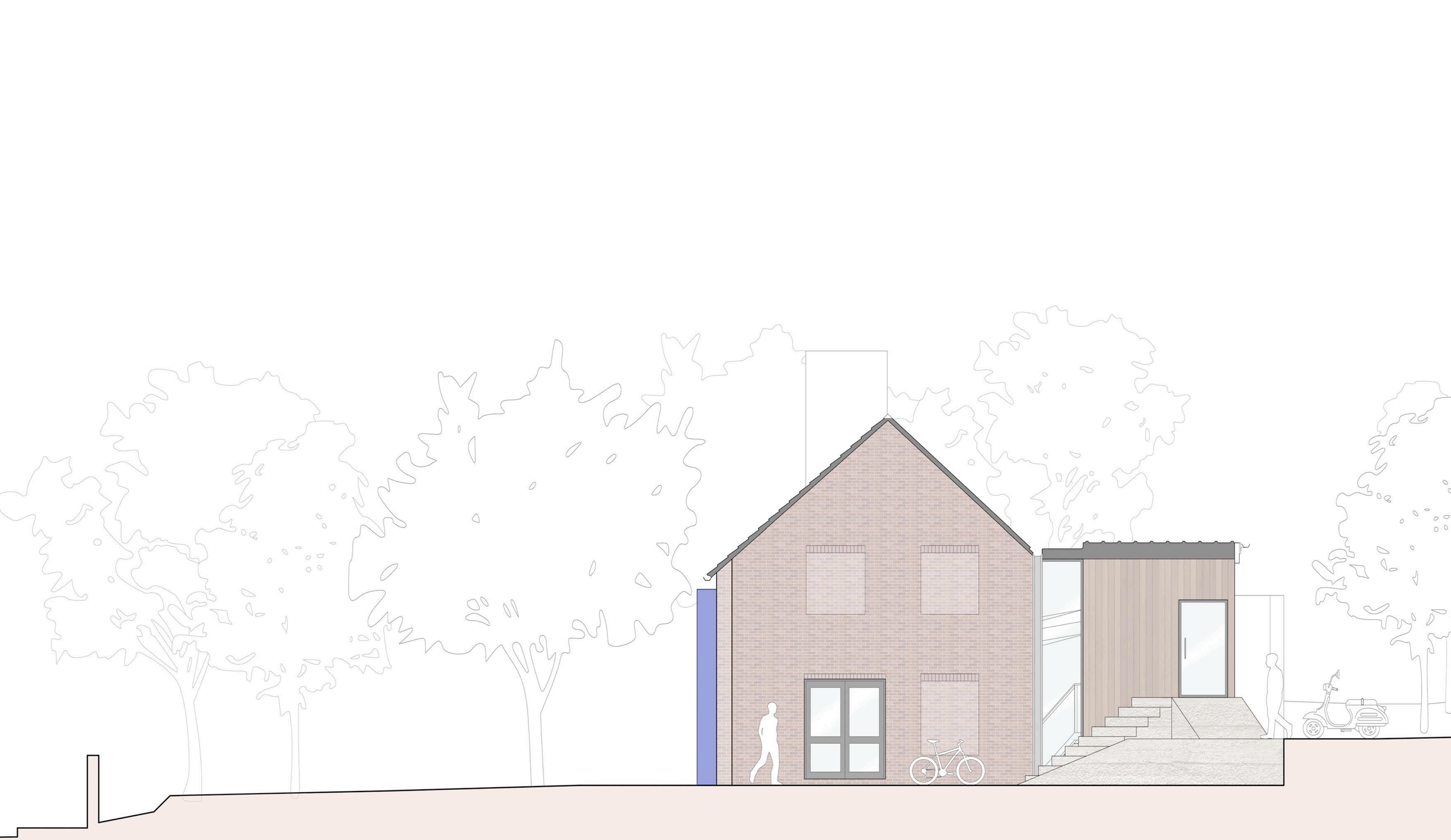
1 2 3 4 5m

Floor Plan with Context
1:200 (A2)



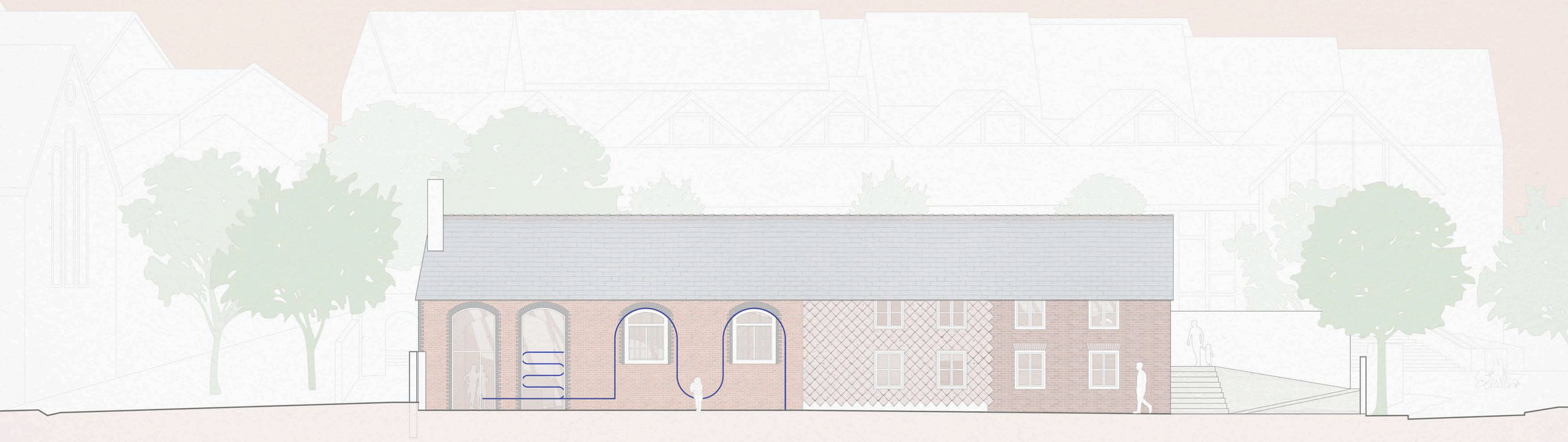

0 1 2 3 4 5 M

Floor Plan @1:100 (A2)



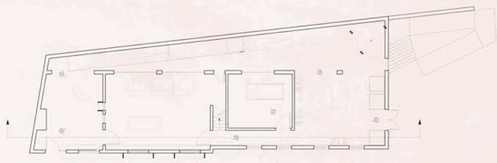
0 1 2 3 4 5 M

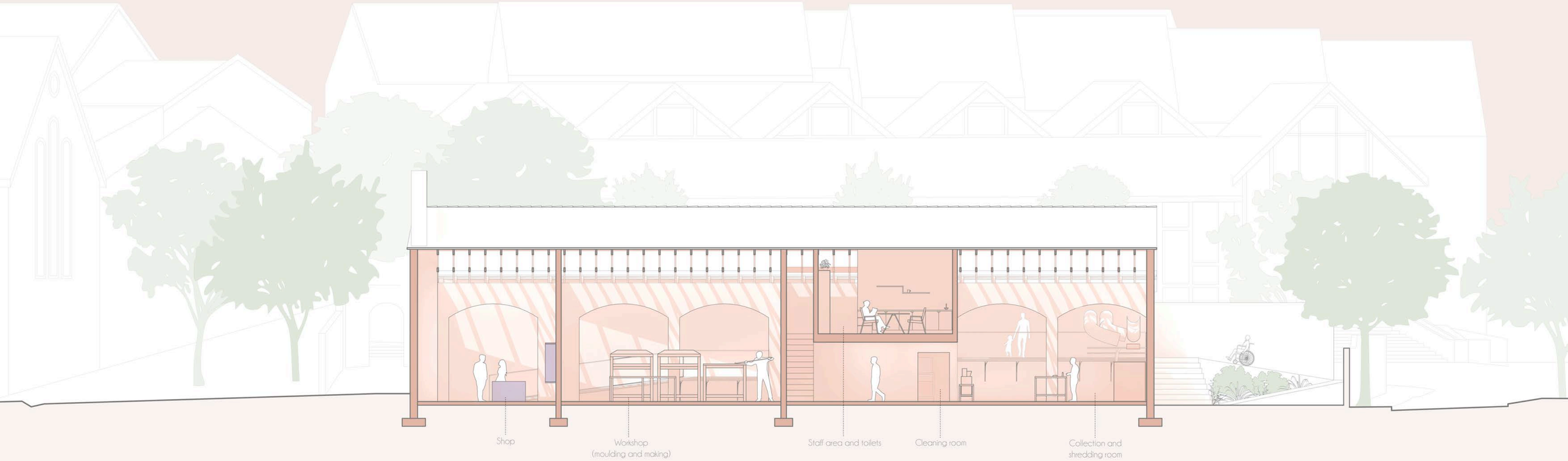
North Elevation @ 1:50 (A2)



0 1 2 3 4 5 M

Front Elevation @ 1:100 (A2)

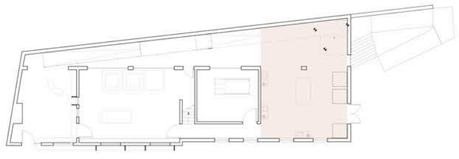


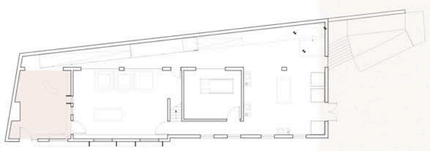



0 1 2 3 4 5 M

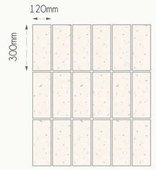
Long Section @ 1:100 (A2)


2
HDPE
4
LDPE
5
PP



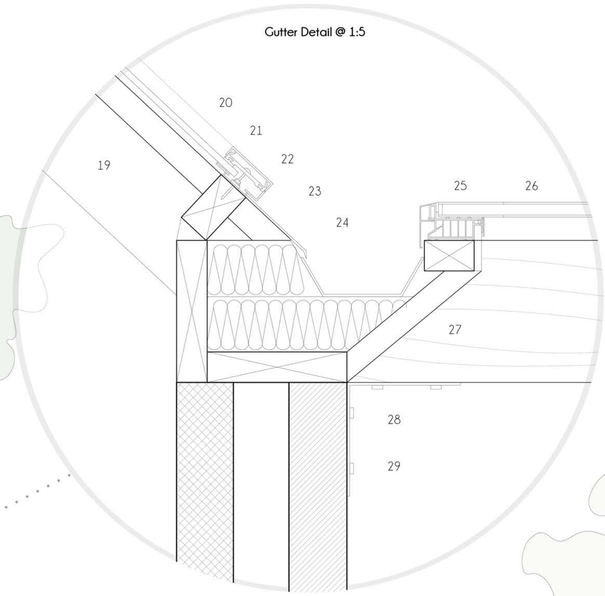


Recycled floor tiles




Translucent recycled plastic roof tile


Gutter Detail @ 1:5

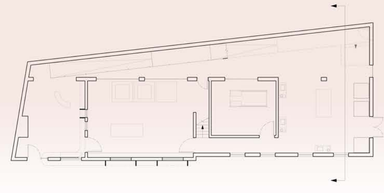






1 existing clay roof tiles
2 timber battens
3 timber beam
4 gutter system
5 existing sash window
6 blockwork cavity wall
7 concrete foundations 150mm
8 insulation 80mm
9 screed 30mm
10 recycled tiles 30mm
11 existing retaing wall
12 timber beam
13 aluminium sandwich panel
14 gutter system
15 steel arch lintel
16 recycled plastic tiles
17 timber counter beams
18 aluminium frame
19 timber beam
20 recycled plastic tile
21 aluminium frame
22 timber counter beam
23 flange
24 gutter system
25 aluminium frame
26 double glazed glass pane
27 plywood
28 timber beam
29 steel bracket





0 1 2 3 4 5 M

Perspective Section @1:20 (A2)