

No Smoking on Platform 5

CONCEPT

The waste of our lives is stored within our cities, can we harness this and use to it enhance our architectural landscape? 'No smoking on platform 5' is an exploration of 'BioBricks' as a building material. Biochar is created through the burning of locally produced organic waste and has the ability to absorb harmful environmental pollutants. By creating these bricks in different areas across the country, the bricks will become localised much like the bricks of our past. This, combined with the celebration of Sheffield's material heritage, create a building that is unique to our city. The storm drain tunnel network beneath Sheffield will be heated up during the process of burning, the subsequent steam can be harvested via a turbine and used to power trains from the station to distribute bricks across the country.

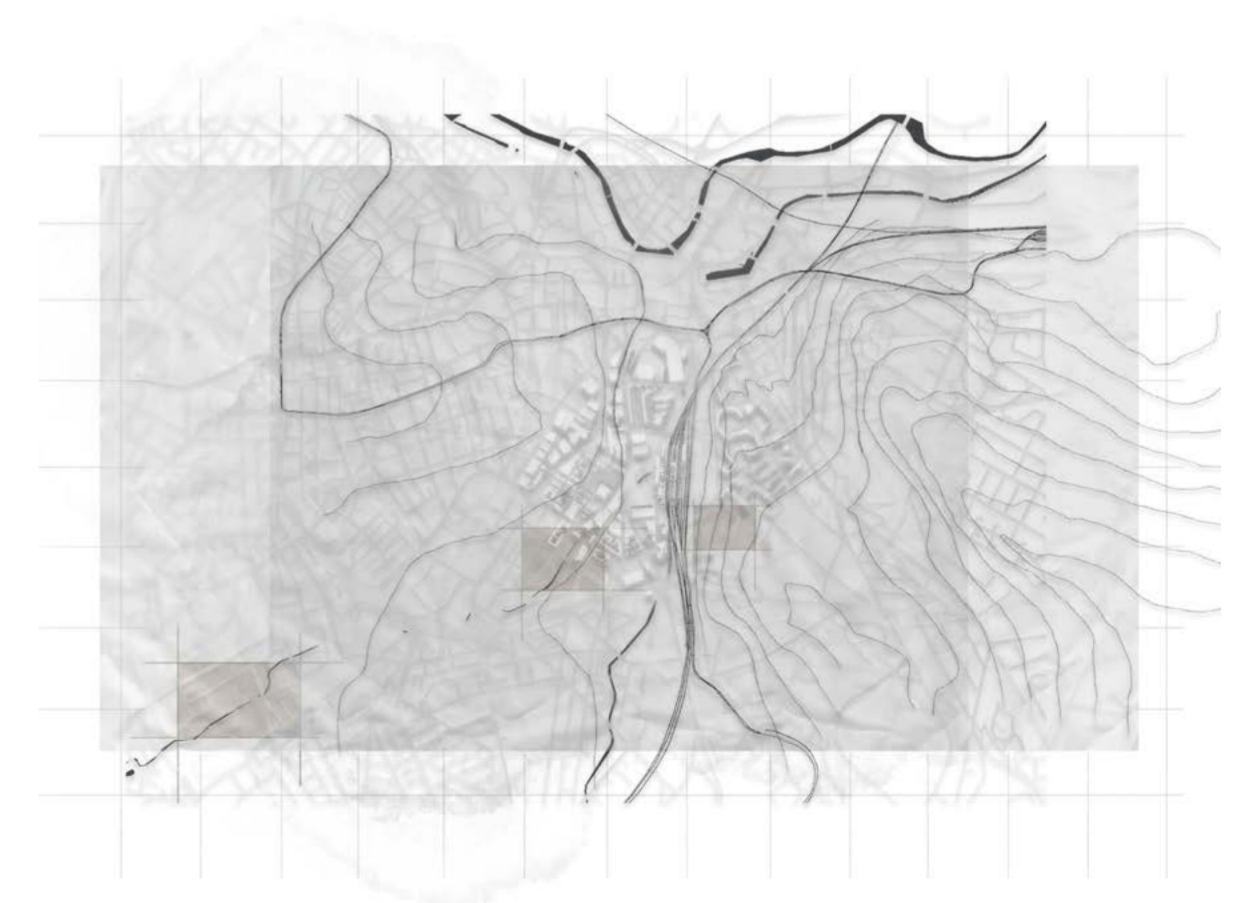
The underground Megatron will be used as a tunnel kiln for the production of bricks. The waste is set alight in order to create biochar, the biochar can then be mixed with a binder and put back into the tunnel kiln for firing, the heat to fire the kiln will be produced when making another batch of biochar.

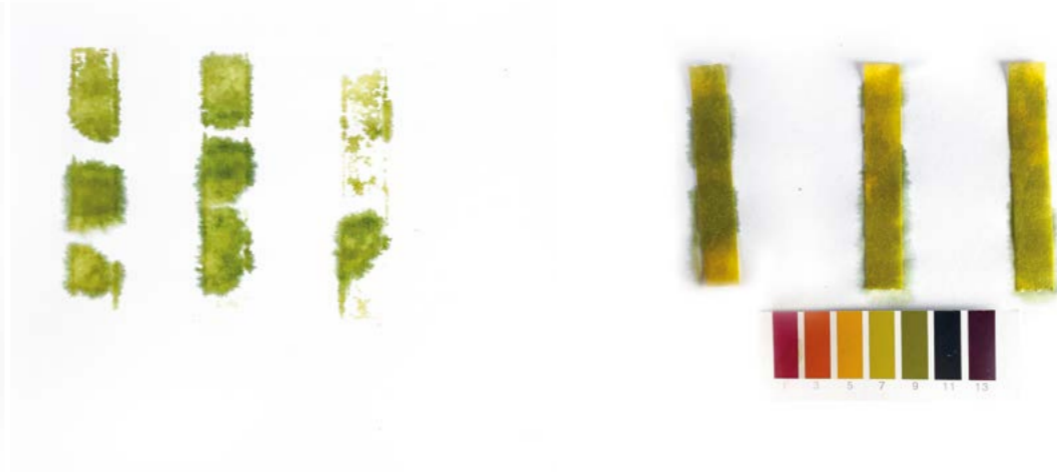
Fire caused from the process of making biochar can be utilised to heat the storm drain water, by passing the water through biochar bricks the water will be rid of any impurities. The steam can be pushed upwards to power a turbine within Sheffield train station which will be converted into electric energy. This can then, in theory be used to power trains and provide the transport links needed to distribute biochar bricks across the country.

The buildings made from the bricks will then become carbon sinks. In terms of agriculture, the bricks components could allow seeds to be started from them. This can be mixed with clay or sandy soil and sent to areas that need more clay or sand in order to improve their soil. By creating these bricks in different areas across the country, the bricks will become localised and unique to each area.

For the example of Sheffield, the industrial 'Steel City' is to be celebrated, combining steel and metal to bind the biochar bricks together. A blast furnace can be placed near the turbine in order to melt the metal waste in honour of Sheffield's heritage.

This idea can be implemented in other cities, and due to their own individual heritage and agricultural landscape, the whole building will change depending on its location. By building in this way we can create a circular life cycle of our waste materials and use them to help clean up our cities.





Storm water sample taken near Porter Brook, accessed via Sheffield General Cemetery.

River water sample taken from Porter Brook, accessed via Matilda Street.

Soil sample taken from Sheffield General Cemetery.

Soil sample taken from Sheffield Amphitheatre at the rear of the station.

Left: Litmus Paper ink on paper.



Biochar created from waste material around Sheffield Train Station.

Location	Levels of Nitrogen Dioxide in air. EU threshold is 40 micrograms ($\mu\text{g}/\text{m}^3$) per cubic metre.
Sheffield Train Station	56 $\mu\text{g}/\text{m}^3$
Abbeyle Road	36 $\mu\text{g}/\text{m}^3$
Crookes Road	46 $\mu\text{g}/\text{m}^3$
Attercliffe Road	42 $\mu\text{g}/\text{m}^3$

BioChar produced in steel drum using twigs and organic matter around Sheffield Train Station. BioChar is produced as a charred material through the process pyrolysis which involved burning wood or organic waste at high temperatures (300-1000°C), in the presence of little, or no oxygen. As a result the greenhouse gases released through its burning are captured into the resulting charcoal. Because of this Biochar has a number of uses including, purification of water through its absorption of toxic material, soil amendment due to its high carbon content, and air purification through its porous material properties which mitigate greenhouse gases such as Nitrogen Dioxide and Carbon Dioxide.

In order for biochar to be produced into a brick that is completely carbon neutral, an alternative to cement needs to be found. New research has shown that iron oxide, which is derived from waste steel dust, can be mixed with other ingredients to form a mortar like paste, the iron will react with CO₂ present in our atmosphere to harden and set into a fully functional concrete like material, this can be mixed together with biochar to form the final brick. Due to Sheffield's industrial heritage, the excess steel dust that is normally sent to landfill can be utilised to create a cement like mixture through local means.

Due to the use of biochar as a fertiliser, the possibility of starting plant seeds within the bricks can be explored. When the bricks come to the end of their life cycle, they can be broken down and put back into the soil around the amphitheatre, providing fertilisation for new plant growth.



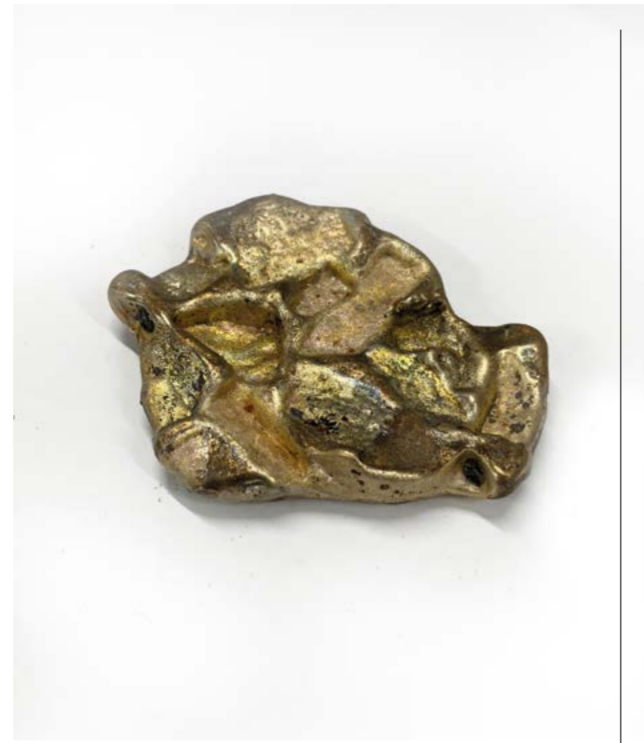
Biobrick combined within a bioplastic case as a growing medium for seeds.



Seeds sown in BioChar from Sheffield Train Station.



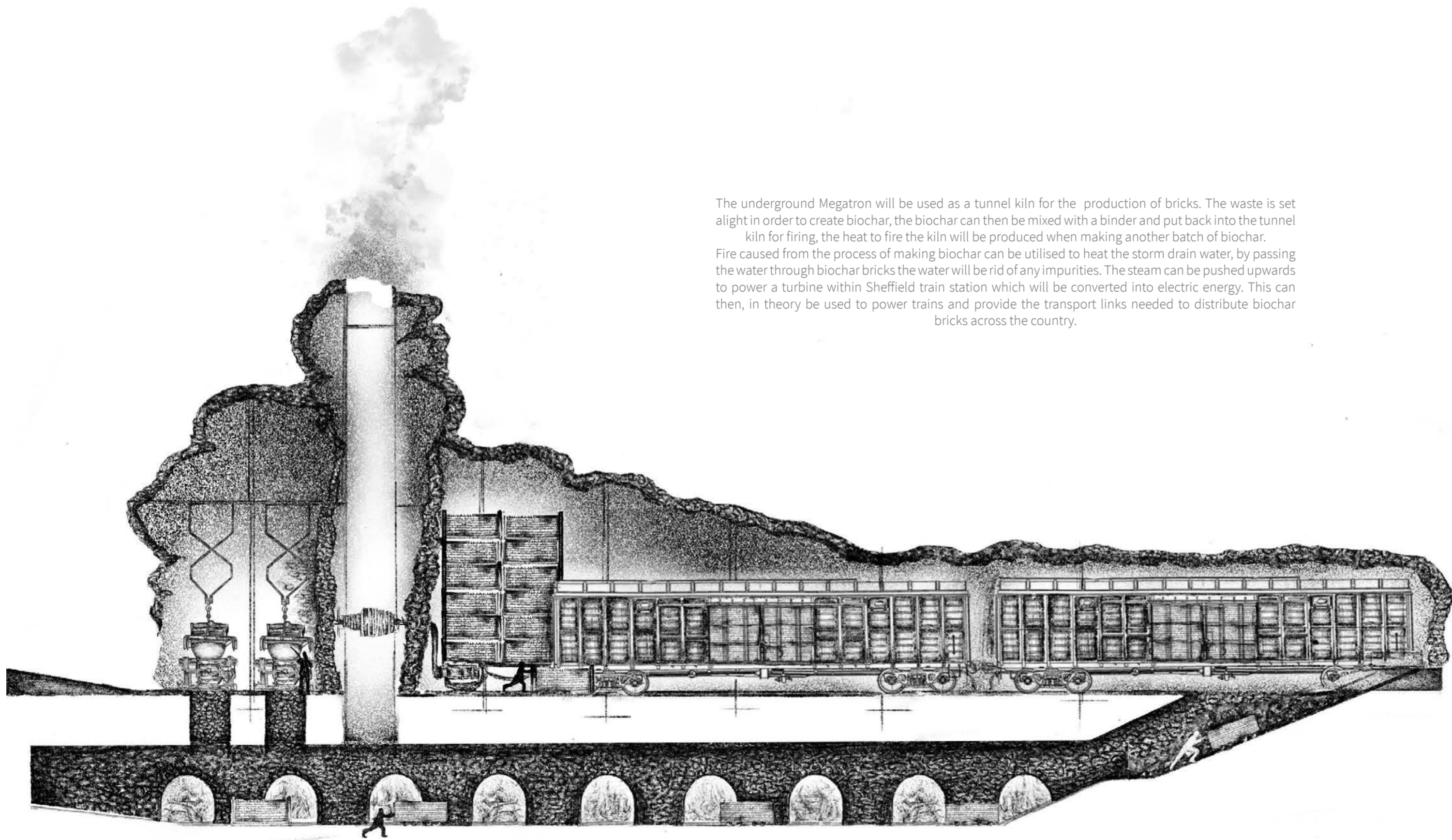
BioChar mixed with bioplastic, water, green.



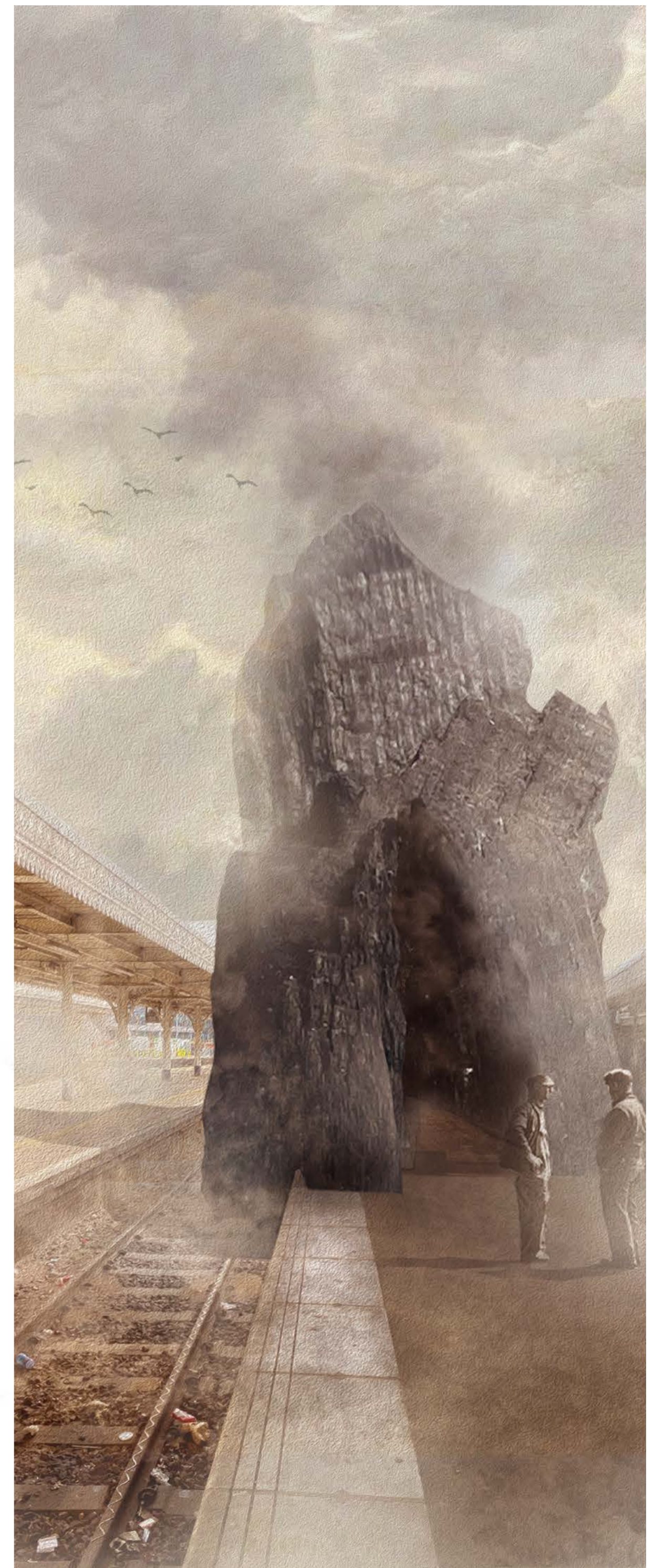
Biochar pieces soldered together to create solid structural base; left. Bronze cast negative of biochar pieces; above.



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0m 20m
1:200





Burnt underside highlighting the burnt ashy smell that will be present underground in the Megatron tunnels after the production process.



BioBrick sculpture at scale 1:200.

