Burrowing Through the Edifice

Viewing the Patterns of Woodboring Beetles as a Representation of the Chthulucene

by

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AUTHOR'S DECLARATION

I hereby declare I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Following a process of formal and craft explorations this thesis uses the lines, tracings, and voids of various forest pests, specifically woodboring beetles and their fungal symbionts, as a way of evoking Donna Haraway's Chthulucene. Events like the rapid expansion of the mountain pine beetle's range and the various invasions of alien beetles might be thought of as just the work of these insects but are now processes that humans have become fundamentally complicit in. Part of these beetles impact is the creation of large amounts of fascinating material that can be used to represent the compxlicated web of larger systems that has resulted in these conditions. Starting from the source of the material produced by the beetles, and how they have become bundled up in the many spiraling outward impacts of the climate crisis, this work studies the affective qualities of the boring beetle and how it might be used to represent the anxieties of the climate crisis era. Through working with these materials, scaling up and transforming their forms and experimenting with what they might create at different scales, this thesis hopes to provide creative ways of 'staying with the trouble'.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Marie-Paule Macdonald for her insight and patient assistance while I struggled through the material. I deeply appreciate the influence of Jane Hutton's TRD1 course and the related readings that informed the direction of the thesis, as well as Dereck Revington's input on how to turn theory into design.

Thanks to my family who all provided help proofreading the document for errors and their comments. Thank you to Benjamin Van Nostrand who very generously donated some key materials that I would not have been able to find myself.

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INTRODUCTION TO A CRISIS

One aspect of the climate crisis to arise in the 21st century is the spread of the mountain pine beetle through western Canada. This small woodboring insect will not end the world, or disrupt day-to-day human life as much as changes to sea level or regional weather patterns will, but its impacts on the local environment, logging industry and therefore the Canadian economy will be significant.[1] Native to regions in British Columbia, the beetle is not alien to the country, unlike many other invasive forest pests. The change in the beetle's behavior is the result of warming climate patterns in the region that have enabled the beetle to expand its territory. Higher temperatures have created such a dramatic population boom that the beetles, rather than attacking old and sick trees, consume whole stands of trees in massive patches. This explosive cycle has let the beetle expand its range moving east towards Alberta and intensive management is required to keep the beetle from moving further east through the boreal forest.[2]

The compulsion in media discussing climate crisis topics is always to draw the discussion back to how this issue is the fault of human industry. It is, but like all the issues of the proposed 'Anthropocene era,' the real defining features of the problem is not just our culpability, it is the web of other non-human actors our industry effect and the further problems that cascade outward from these disruptions. The beetle is one of our fellow actors in this age, it's one of a few lucky species that take advantage of our impacts. The beetle's behavior is natural but, like humans, this behaviour can further endanger and weaken ecosystems.

Here is where I call on Donna Haraway's proposed designation of this era as the Chthulucene[3] as a better term to the Anthropocene for the name of this geological epoch. It's an improved designation in that it opens the doors to considering the connections that reach out from each of these relationships including the possibility that we and synanthopes like the beetle need not be the only creatures to thrive. When we look at the beetle's excavations and the symbiotic relationship it has with its fungus, we can see a reflection of our own material extraction patterns. In the beetle's tracings we should find an analogous image of our impacts and with that, find a place in our own ways of dwelling that may allow room for not just the pine beetle and ourselves to thrive.

There is value in looking at how the beetle's form of burrowing can be compared to our own way of building. In Kafka's 'The Burrow', in which he describes the living space of some non-specific burrowing creature, a creature that focuses on the creative act of building a burrow and the psychological effect this act of creation has on the burrower.[4] The narrator swings violently between days of elation and moments where he can't bear to look at his creation. Like many of Kafka's short stories the tale is describing some animal but the psychology of the creature is a human one or at least a mindset that describes Deleuze and Guattari's becoming animal.[5] It's a mistake to ascribe humanlike intent or emotion to the movements of the beetle but the same base desires to consume, reproduce and build are just a product of being animal. In that act of creation we create our own

antagonism and anxiety. ‘The Burrow,’ if read as a parable, tells us the pursuit of the perfect, safest, most comfortable place produces an ever-growing fear connected to protecting it and eventually the creation becomes the true source of anxiety on its own.

The burrow is the negative form of the more nest like structures that we as the human animal tend to inhabit. In order to create our nests, we always create this negative form even when the construction is not subterranean. Like the beetle leaving massive swaths of dead pine, we also leave large patches of negative space when we clear stands of trees for our wood. Always there is an extraction pattern somewhere to match our creation, even if it does not produce a literal hole in the ground. We operate in the positive form of the act of burrowing.

This bound together duality of creation and destructive forces is inescapable but not necessarily fixed to produce the same forms forever. In Kafka’s “The Metamorphosis” a man literally becomes a beetle. This could be a description of his hopeless state in life and a reflection of what has already happened to him, reduced to something less than human and disgusting to his friends and family, but it is also an escape into becoming something else.

The themes of Kafka’s work often deal with the absurdity of institutions and the inexplicable and sometimes vindictive nature of bureaucratic and social institutions. The transformation in “The Metamorphosis” is a release and a break

into the fantastical as our beetle-man will not simply endure the humiliations that he already lives throughout the day. This idea of what a burrowed space is, constitutes a way to think about the materials we make as the sawdust pile of our consumptive strategies.

As architects, it seems important to recognize that there is a matching void or dump for each of the spaces we create. There is a spatial typology to the act of resource harvesting and digging. It is something that we are already doing without noticing what we are doing. This is our metamorphosis where we can escape, but we need our companions to get out of it in a better state than the protagonist of his story.

In the beetle's act of extraction, they leave much of the material that we find valuable for our construction, but their footprint has transformed the wood in captivating ways. A cheap building material (pine wood) is changed into a unique, boutique commodity by the fungus strains that feed the beetles and is engraved with the arcane looking marks of the beetle's life cycle.

This transformation opens up possibilities that were not open before for our use similarly to how we have altered the beetle's habitat to allow for its extravagant expansion. This escape is the greatest part of Haraway's invitation to look at the possibilities of non-human comrades. The best expression of this that I have found is Anna Sting's "The Mushroom at the end of the World" where she

explores the entwined relationship that mushroom pickers have with the forest where their mushrooms of choice grow.

Mushrooms are maybe the best choice of totem due to how interconnected fungus is with nearly all biological processes. Fungi are in a way, the first complex burrowing organism that we are all attached to.

The fungal strands that dig through rock and dirt were required to produce the complicated organisms around us and they are also ancient co-operators.[7] Throughout the forests of the world, huge mycelial nets connect tree after tree trading the valuable minerals that root structures could not collect on their own for the sugar energy that their plant partners generate.[7]

So sophisticated is this relationship that the mycelium acts as a kind of bank for related species of tree.[9] In the case of a serious infection some trees even begin to deposit much more of their sugar resources to the mycelial web to be distributed to their leafy next of kin.[10] This is the case in the event of a forest fire where realizing (via chemical signals) that impending doom will soon destroy the stand, the trees will deposit the resources they can below the ground so that the regrowth will have an easier time with the aid of the fungus bank. Although the beetle is a more appropriate comparison to us as a companion, fungi are perhaps the ideal transformer and extractor to emulate. This is not to say that fungus is some sort of benevolent ideal living being. There is a pattern to the

way that competing fungi within infected wood works. As the fungus grows, it produces walls to prevent its neighbor fungi from taking resources[11]. If caught and transformed into lumber by heat before its ultimate decomposition, one can see the pattern of coloured lines that cut across the grain of the wood is the result of different fungi meeting and creating hardened walls to keep one another out, making the stains and laced lines a section cut through little bubble shaped fortresses of fungus.

Architecture's place in this dialogue is unclear. Architects and designers certainly have a place in implementing new technologies that address our environmental responsibilities, but there are limits to the capacity of well-designed space to contribute to undoing disaster. A good design project is unlikely to make an impact on large systemic issues.

In the rubble there are nice artifacts, beautiful materials that can be made only as a result of the damage, but this doesn't do much to redeem the harm done to ourselves and creatures less lucky then the beetle (or raccoon) to enjoy our human altered habitats.

This is not the first time the world has been "ending"[12]. Many religious sects, particularly Christianity have predicted the coming of an end of times. Despite its lack of arrival, that did not change that people lived under that threat during their lives before the advent of the modern slowly growing scientifically

predicted climate disaster. I think that this is what connects the burrow so tightly to building in this age. Our burrows are both a source of intense anxiety and loathing, but also a kind of intense pride. It precisely describes both the personal anxiety of creation and the judgement of others but it can be expanded to all of our creative acts. So how does one deal with this creeping invisible fear?

In the chapter 'This will destroy that' Victor Hugo describes his fear that books will take the place of architecture in the public eye and will no longer speak to the masses the same way. The way he describes the neglect of the cathedral includes imagry of a gnawing worm eating away at the actual architecture of Notre-Dame.[12] This way of describing something eating apart a building to give form to an unseen force of decay is a convention that remains still. The tradition of haunted houses has a literal interpretation; odd creaking, stains and moisture are the hallmarks of a haunted house and the markings of water damage and mold slowly decomposing the house. This is why I find the way that Tsing and others chose to give a collection of essays one half sub-titled 'ghosts' and the other 'monsters'[13] a perfect framing for thinking about our current fears. Climate change is different than the other looming end of days at least in that the end we are looking at is not a sudden judgement, it's a slow and haunting process, we are never quite sure if a dramatic weather event is the result of our climate change ghost. In 200 years maybe there will be natural monuments that provide the clear image of this haunting, perhaps something like the indications of where a

seaside city once ended. If we wait for those stains to mark the human landscape it becomes too late for us living during those changes to respond. Perhaps the most suitable site to explore the possibilities of a Chthonian architecture is Victor Hugo's beloved Dame de Paris, a structure no stranger to multitudes of meanings and undergoing a crisis of its own in relation to short sighted choices in material selection that will ripple out for many years.

Figure 1.1 -Infected pine stand

Figure 1.2 - Infected pine stand months later

THE MOUNTAIN PINE BEETLE

And Other Forest Pests

Woodboring beetles are a common part of forest ecosystems. This type of insect attacks different species of tree, as they have adapted their lifecycles to them. Often this is part of the insects' reproductive life cycle, resulting in a burrowed-out space, the chambers tracing the growth of the insects' larva.[1] When the wood is cut apart into lumber this creates a distinctive pattern tracing of the insect's early life and growth until it leaves the host tree.

Typically, these insects attack old or sick trees that are unable to fend them off. These are preferred targets since, despite their immobility, plants will defend themselves with a variety of chemical weapons that harm their insect attackers. Pine trees are no exception in having this defence mechanism and often a sign of infestation can be a kind of chemical used to try and eject the insect invaders.[2]

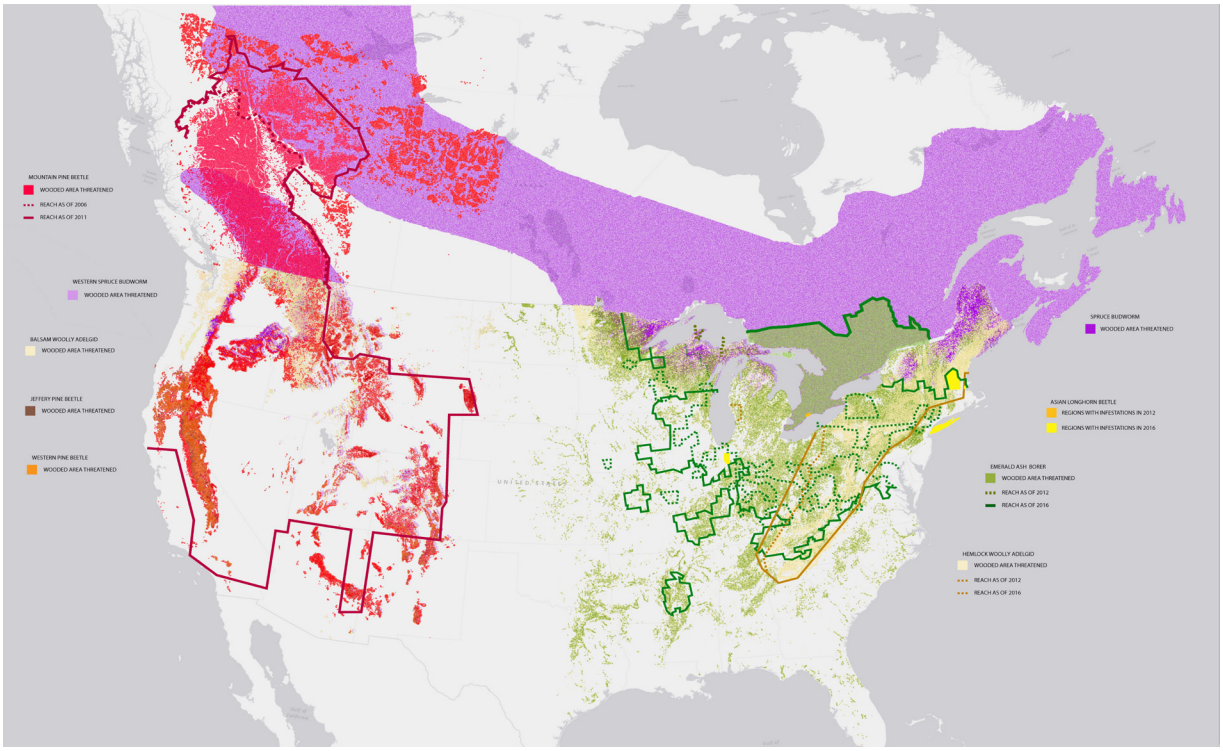
These forest pests only become a problem at the point where the insect population is capable of overwhelming a healthy host or, if the beetle is a non-native species, the host tree lacks the ability to recognize or does not possess the tools to respond to the damage caused by the attack. In recent years the emerald ash borer has killed a huge number of ash trees. Control efforts for the ash borer are often just to destroy the nearby trees.[3] Without natural limitations on the insects, such as their natural predators, there is nothing else to do. Projects like introducing parasitic species like wasps that specifically target the ash borer have been proposed,[4] but these types of management strategies never work out cleanly.[5] Species interactions are never so controlled that they can be balanced out like a chemical reaction with just the right amount of one element added to return things

Figure 1.3 - Pine Beetle in lodgepole pine resin - photo by Nadir Erbilgin from University of Alberta Showing a lodge poll pine deploying a resin of toxic compounds.

to balance. There is no sink to flush the waste product away in an ecosystem.

City trees are very vulnerable to this attack, along with being the most identified due to the number of people living near them,[6] these trees are also under a great number of stresses that rural versions do not need to contend with. These kinds of pests are quite a problem in terms of expense in urban and designed spaces as even if the wood can be recovered from the dead tree, the material was not valuable in the same way that it was when it lived. People in urban spaces become very attached to trees. More than a few neighbor conflicts have started because a tree's branches have been cut or someone has decided to fell a tree without letting the street know. Whether it's the history involved and a feeling of attachment to something old or that living things can survive in human habitats.

With invasive species, the elimination of the insect when detected is the only real response you have available. It's costly and sad to the tree lovers amongst us and despite all our best efforts it may be futile. But what do you do when something native has decided to expand its region? We can't simply destroy all the insects in their native region without dramatically altering that environment, yet without intervention they will continue to spill out, since there is no reasonable way to build a barrier between changing climactic zones. No longer limited by weather patterns, that kept it within its own region, the Mountain Pine Beetle has been expanding into boreal forest region in Alberta.[7] Elimination efforts are taking place whenever the beetle is detected, but this has become a constant control effort as climate conditions now favor the beetle outside of their



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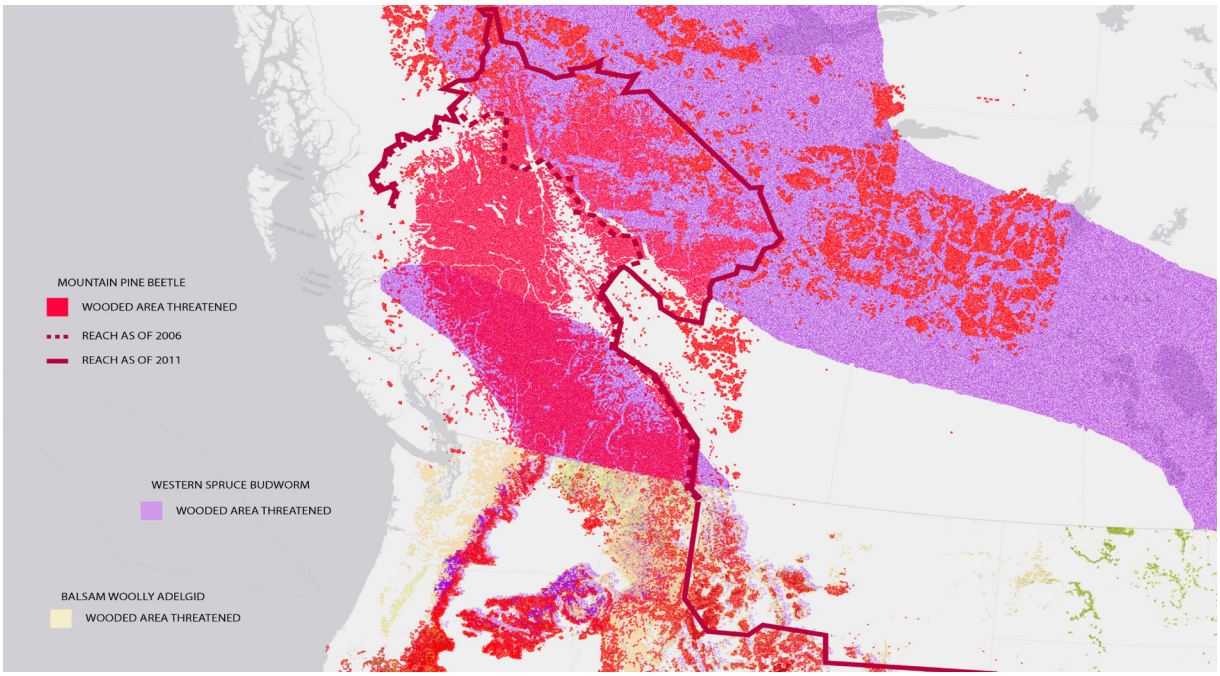


Figure 1.5 - Map of B.C. and Alberta Mountain pine beetle movement

historic range.

This particular pine beetle's boom and bust cycle is not new - turn of the century loggers and foresters also documented the beetle's creation of huge stands of dead trees that turn a dark red as the needles die and then fall off in the next year.[8] With the recent increase in temperature, unlikely to abate in the near future, this fluctuation is less likely to cycle down in intensity.[9] There are other human factors that could have possibly contributed to the success of the beetle in that, the nature of stands of trees replanted after logging may be more vulnerable to the beetles. All the trees within a stand tend to be the same age due to their planting right after harvest, there are also fewer other species, so although pine trees do tend to favor their own as neighbors,[10] it becomes more vulnerable to this boom in beetle population.

In order to get a grasp of the scale of the infestation we can track, see (figure 1.14). We can see the slow advance as a map of dots collected as foresters log and accumulate data on where the beetles have been found. It's hard to visualise the statistical nature of the increase in climate events, fortunately for the visually focused these bugs create diagrams as they move.

The lifecycle of the mountain pine beetle eventually leads the beetle to bore into the bark of a suitable pine tree. The beetle is interested in the still living soft tissue below the bark. Unlike the core that has long since become used for structure and the outer layers used to move water, this layer is still alive and has some nutrient value burrowing down along the trunk, so the beetle lays eggs

Figure 1.6 - Bark with pine beetle galleries traced

Figure 1.7 - Mountain Pine Beetle - The smaller image shows the beetle at its true size the larger is the beetle 10 times larger

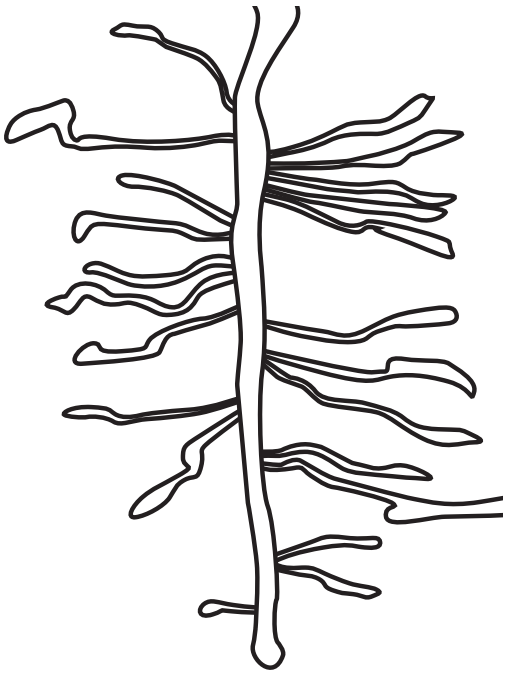


Figure 1.8 - MPB Gallery Tracing - A long gallery of 30 cm egg is dug vertically. Larva from these eggs dig outward and eventually develop into young adult beetles before emerging. The main gallery has a consistent size dug by the adult beetle, larval galleries seem to grow wider along with their growing inhabitant.

Figure 1.9 -Emerald ash borer beetle galleries on a tree- Photo by Edward Czerwinski

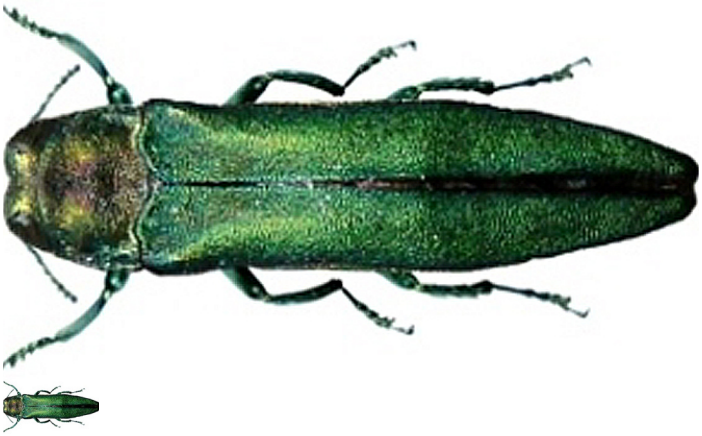


Figure 1.10 - Emerald ash borer - The smaller image shows the beetle at its true size the larger is the beetle 10 times larger

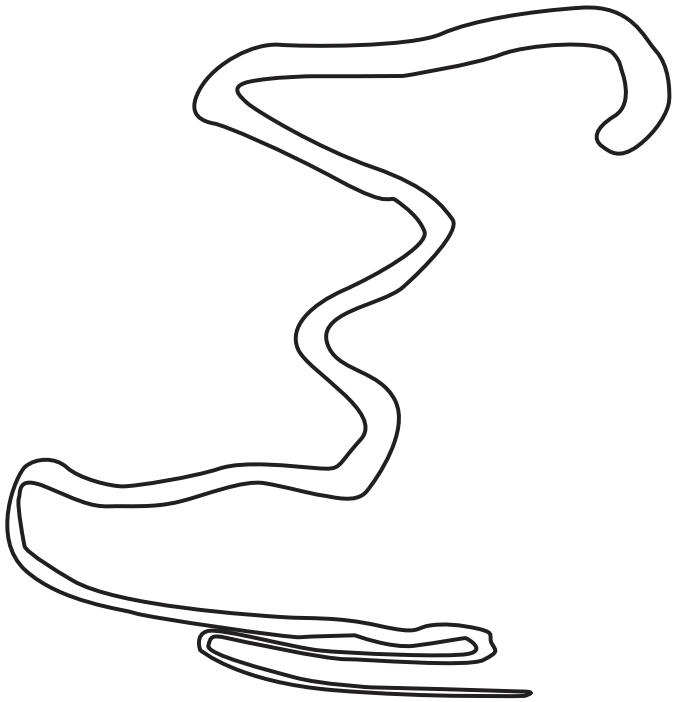


Figure 1.11 - Emerald ash borer galleries traced - Ash Borers lay their eggs on the outside of the tree. The larva digs into the phloem and continue along the outside of the tree swinging back and forth in loosely S shaped forms steadily growing until the now adult beetle burrows out leaving a D shaped exit hole.

Figure 1.12 - **Asian Long horned beetle galleries -** Natural Resources Canada

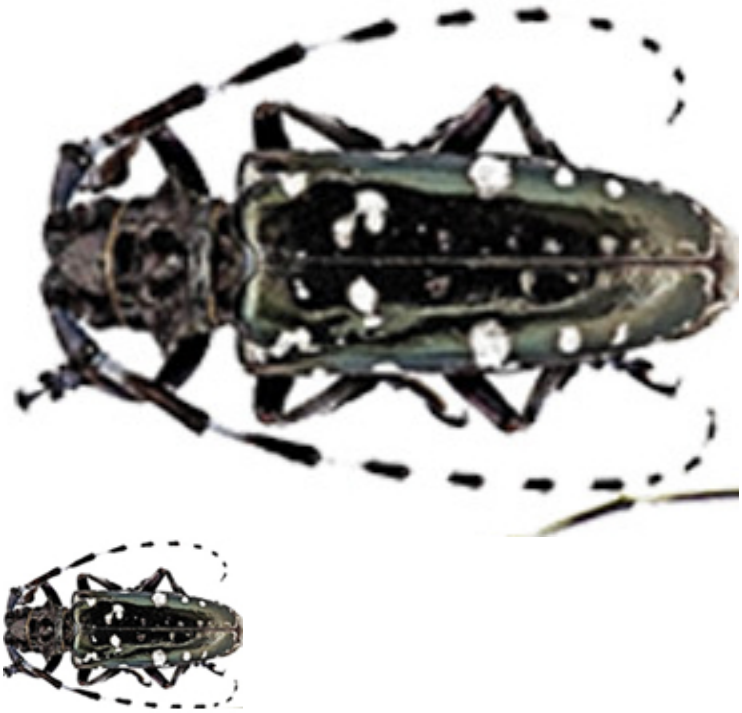


***Figure 1.13 -*Asian Long horned beetle -** The smaller image shows the beetle at its true size the larger is the beetle 3 times larger.

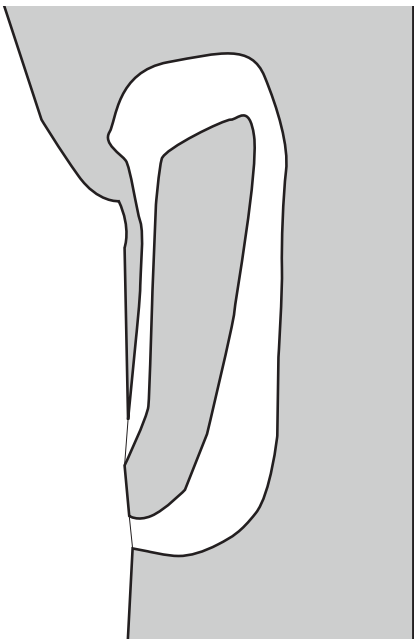


Figure 1.14 - Asian Long horned beetle galleries - The long horn beetle digs a small space to lay an egg, the hatched larva then dig into the phloem eventually digging deeper into the tree and then constructing a small chamber dammed up by wood shavings. In the spring the now adult beetle digs out to repeat the cycle.

Figure 1.15 - **Felled tree showing the blue stain -** Photo by Caitlin Low

Figure 1.16 - **Blue stained wood used as wood floor -** Sustainable Lumber Co.

along the side of the tunnel. In the next year these eggs hatch and the beetle larva dig out parallel to the tunnel. You can follow the growing larva as it grows larger and then eventually is able to burrow out of the bark and leave - beginning the cycle again. All this tunneling could be survivable for the tree were the beetle not always accompanied by the fungus that travels with it. This blue fungus is found in the beetle's mandibles and aids the beetle larvae in breaking down the tissue that the larvae will eat on its way out but the fungus also eventually chokes the tree by removing the tree's ability to transport water where it is needed.[11] As the fungus attacks it expands into new cells that once allowed capillary action to move water to the active parts of the pine. The tree becomes unable to transfer the resources it needs to live throughout its body. In the next year the tree will die, needles will turn red, and in the case of the mountain pine beetle's outbreak this will appear in photography as a large red patch of red needled trees contrasting with the green.[12] Although this is an indicator of an outbreak, it is not one that helps indicate infested trees for destruction. By the time the needles have turned red, the beetles have moved on and likely the next wave of trees are dying. In the next 6 months the needles will fall off and the tree will decompose, and collapse aided by the blue stain fungus and various other burrowers and borers of different sizes will perform similar acts speeding along the decomposition of the tree.

If caught before decomposition the wood can still be used. Studies into the effect of the fungus on the pine show no significant decrease in the structural strength of the wood.[13] If retrieved, we can still use the wood for its original purpose, and as a specialty product it's more abundant during the event of its

outbreak than previously. Other opportunities also exist for the use of the material as fuel for specialised facilities that use bio-waste for energy production,[14] but this seems like a difficult technology to promote. Despite the need for renewable energy sources, any energy technology that results in the emission of CO_2 is hard to advocate for when trying to discuss this material in a climate crisis context.

Architects are in a precarious advisory position here - what does the act of advertising this sort of material do? The abundance of wood and the possibility of use as a morally acceptable climate response when used as a carbon sink, is something that we can encourage clients to take part in. The death of these trees could be an opportunity as sequestered carbon can stay locked out of the carbon cycle. A paper from 2016 projects the possibility that the regrowth of these forests has the potential to overcome the carbon deficit that the current outbreak has produced,[15] but this model points out that further disruptions created by insect outbreaks could return this to a deficit again. There is the possibility for a vision of the timber industry that works along side these outbreaks and cooperates with these insects to sequester carbon.

PART 2

Figure 2.1 - Mimicked Asian long horned beetle marks in maple wood

Figure 2.2 - Mimicked Mountain pine beetle marks in pine wood

THE BEETLE AS A COMPANION SPECIES

Fellow Forest Harvesters

When discussing the mountain pine beetle and the environment it inhabits there is plenty of potential to instrumentalize it and take advantage of current events. In the previous section I have outlined that a lot of this work is already being done by foresters and researchers at institutions like UBC, whose power facilities are using the decayed wood as biofuel for example.[1] As much as I do really want to promote this as an opportunity, this way of thinking about what is happening in the forest risks framing a catastrophic event in a certain ecosystem as a good thing rather than a disaster.

I'm reminded of the apocryphal truism about the Chinese character for crisis being made of the characters for 'danger' and 'opportunity'. This gross simplification of the term ignores how these characters work and pulls the word opportunity from nowhere.[2] Even if this was a valid reading of the character, that would change nothing about the utter neutrality of the word 'opportunity.' This truism showing up in the introduction to Al Gores 'An Inconvenient Truth'[3] feels like a bad point to start from when looking for hope in the face of disaster. The whole logic of repeating the phrase seems flawed since there are as many opportunities to fall back into the same behavior that resulted in the crisis in the first place. We need to have a critical eye when thinking about what this material we are analyzing might become.

Anna Tsing's exploration into the complicated environments that people survive in, at the edges of modern capitalism, seems like a promising place to start. In Tsing's book, 'The mushroom at the end of the world,' she looks at the

relationship that various people have with mushrooms, particularly the Matsutake mushroom, in Japan. The temperamental fungus resists cultivation and only thrives in the interesting condition of Japan's human altered forests. They are involved in the culture of mushroom picking. Using this relationship of harvesting and gathering mushrooms as a starting point, Tsing prescribes something she refers to as "the arts of noticing"[4] as a way of acting on problems of our effects on the environment. She uses it as combination of a metaphor for research and study, like scouring the ground for an elusive and valuable fungus, and a kind of personal mantra for collecting together interrelated issues.

Borrowing part of this, I want to illustrate how the beetle can be a guide to our environmental impact and how we are in some ways the same sort of actor in taking advantage of opportunities. When discussing climate issues, criticism can often take a judgmental tone about the foolish short-sightedness of our consumption, but how are we supposed to act on this? Is it a moral failing of humanity? If we make this about a materialist analysis of consumption how do we possibly escape when political forces have not been able to resolve the economic injustice resulting from our mode of production?[5] Haraway responds to these questions by how she moves towards the invention of her label of 'the Chthulucene.'[6] In an advocacy for labelling an age of deep problems and the interconnectedness of those problems, she picks a name that evokes unexplored depths and a somewhat frightening inhumanity.

The truth is, despite what we do, it is unlikely that we as a species will be

wiped out, but nations and humans in general may suffer a significant decrease in our capacity to continue surviving. Disturbingly we may well dramatically harm our cognitive capacity if CO_2 levels increase to the degree that we are on track for by the next century. Our descendants will live in a world where they breath as if in a poorly ventilated room.[7]

Life as a whole will adapt, there have been 5 great extinctions and one at least that involved the dramatic transformation of our atmosphere.[8] The bacteria that drove that transformation to an oxygen nitrogen atmosphere did not have the ability to understand what it was doing and did not have the capacity to experience the anxiety that is tied into the understanding that it was destroying the environment that made it thrive. Neither do the mountain pine beetles as they burrow away at their hosts. It is for this reason that I think I can call them an unwitting companion of ours in climate change. If we can relate their pattern to our own perhaps the beetle will have helped us. We are both victors in this era looking towards the consequences of such success.

I have a fondness for these sorts of animals that have capitalised on our human altered environments to adapt and thrive. Dubbed synanthropic[9] animals, they are a reminder that other creatures can find niches in our altered world. The consequences of this success are that they are attached to whatever happens to us and we have unwittingly created a class of life that is dependent on our structures for their habitat. Rats are an old companion and one that has perpetually posed a threat to our heath, but we also benefited from that long history with us. Over that

time, we have bred a line of them that do the testing our medicines.

Rather than being relieved of our responsibility due to their success we are ever more entwined with them as we end up being the curators of our shared spaces.

Much of the work that Haraway cites revolves around fields of science and technology. In architecture there is some capacity to implement and explore these interesting systems but in general we are limited to the received technical and engineered systems. Buildings often struggle to meet the basic human needs that they were specifically designed for, so a demand for a more than human architecture might seem outrageous, but these failures are something that we must address technically in our craft.

Architectural work does reach past just fulfilling these technical responsibilities, the narratives that we attach to what we build are a powerful part of what buildings become so what does architecture look like and become if it tries to pull in these animal narratives? It is with the aim of answering this question that the sculptural and material studies presented alongside this chapter were produced.

Figure 2.3 **- Piece of spalted maple wood** – Marks and stains come from the partial decay of the wood, the holes and dark mark at the base are from a boring beetle in this case most likely a type of ambrosia beetle

Figure 2.4 - Ash Tree Wood with Ash Borer Galleries.

Figure 2.5 - Spalted maple string figure 1 – Three pieces of spalted maple. Two have been carved into trying to show more than just a set of flat plains. String has been pulled through each passing trough the paths the beetles have carved to try to show the three dimentional nature of these paths, while also transforming it from a pure replication of the form.

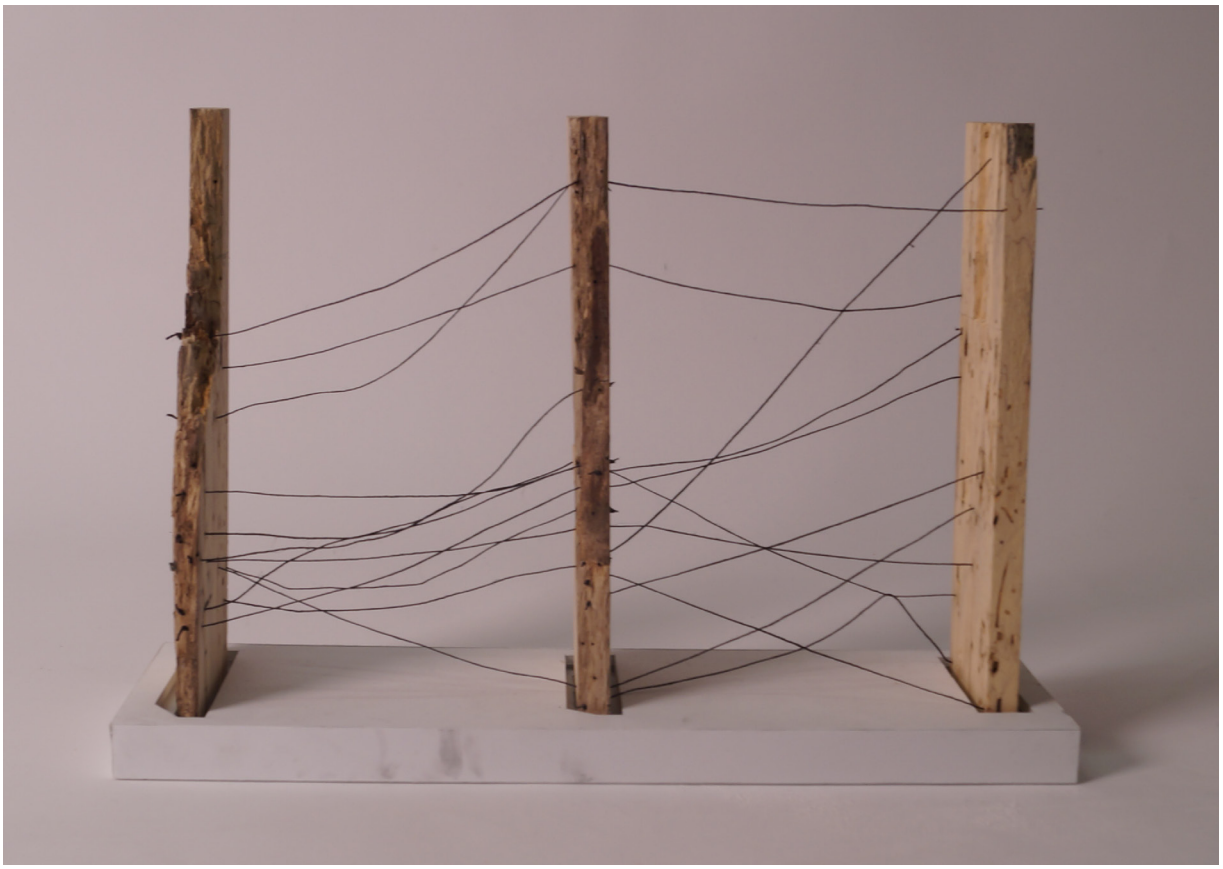


Figure 2.6 - Spalted maple string figure 2

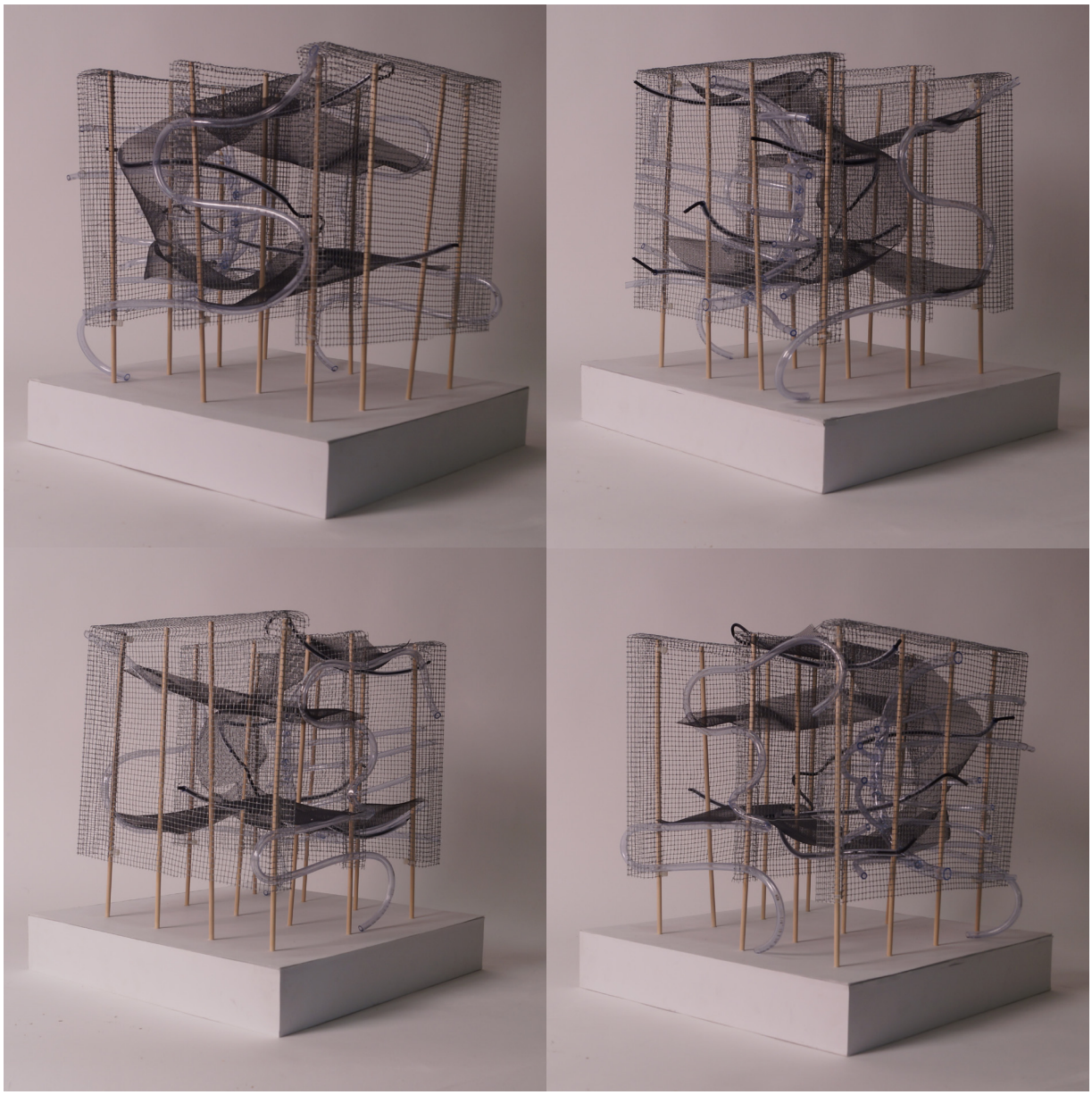


Figure 2.7 - Mimicked beetle trails as positive forms in a void 3 – Black mesh is woven through suspended away from the piping to evoke the outline of fungal boundaries.

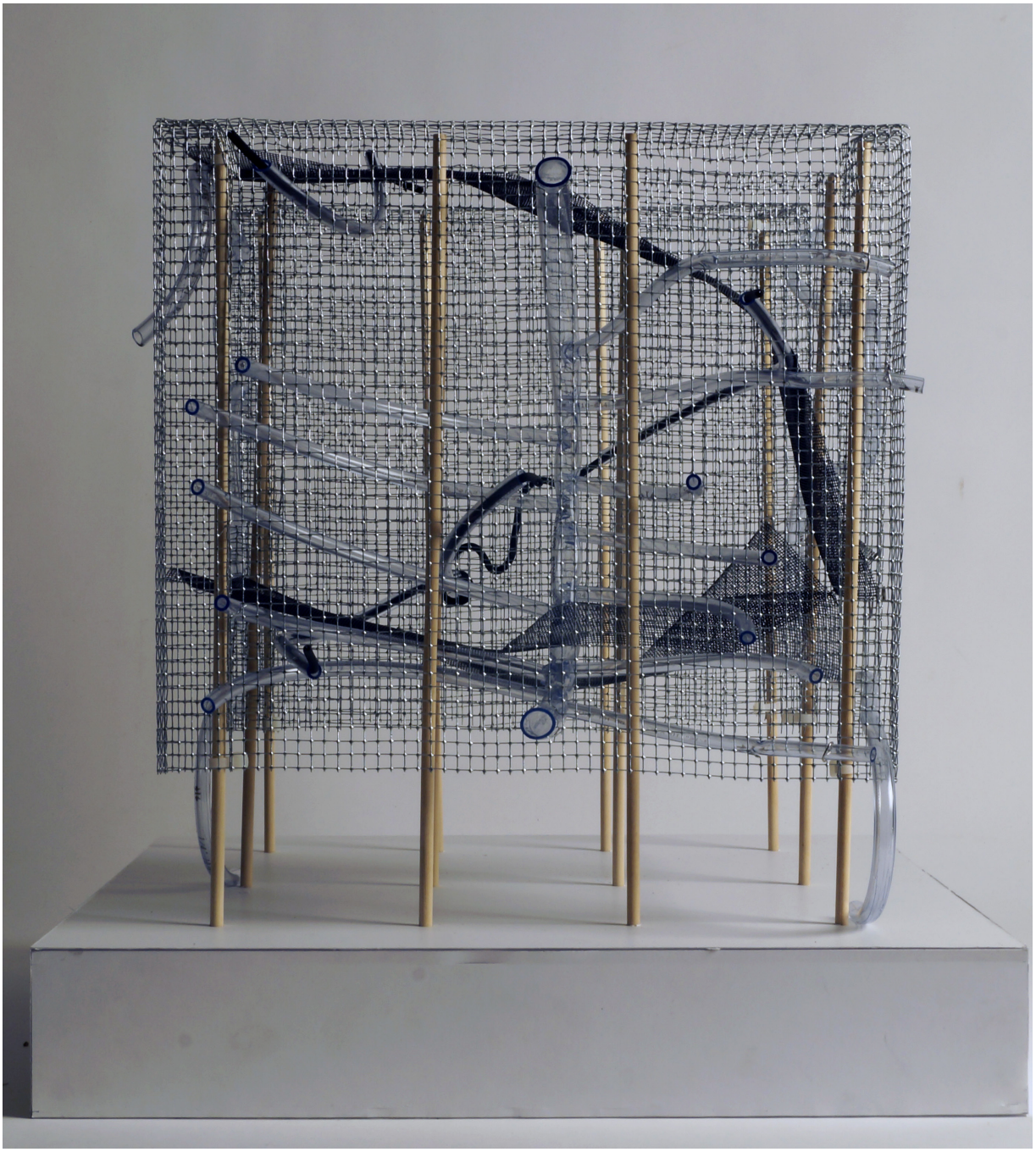


Figure 2.8 Mimicked beetle trails as positive forms in a void 1 – Inspired by OMA's Très Grande Bibliothèque model showing solids suspended in a void. Using piping to create semblances of beetle patterns. These shapes are placed according to where they would be found on a host tree

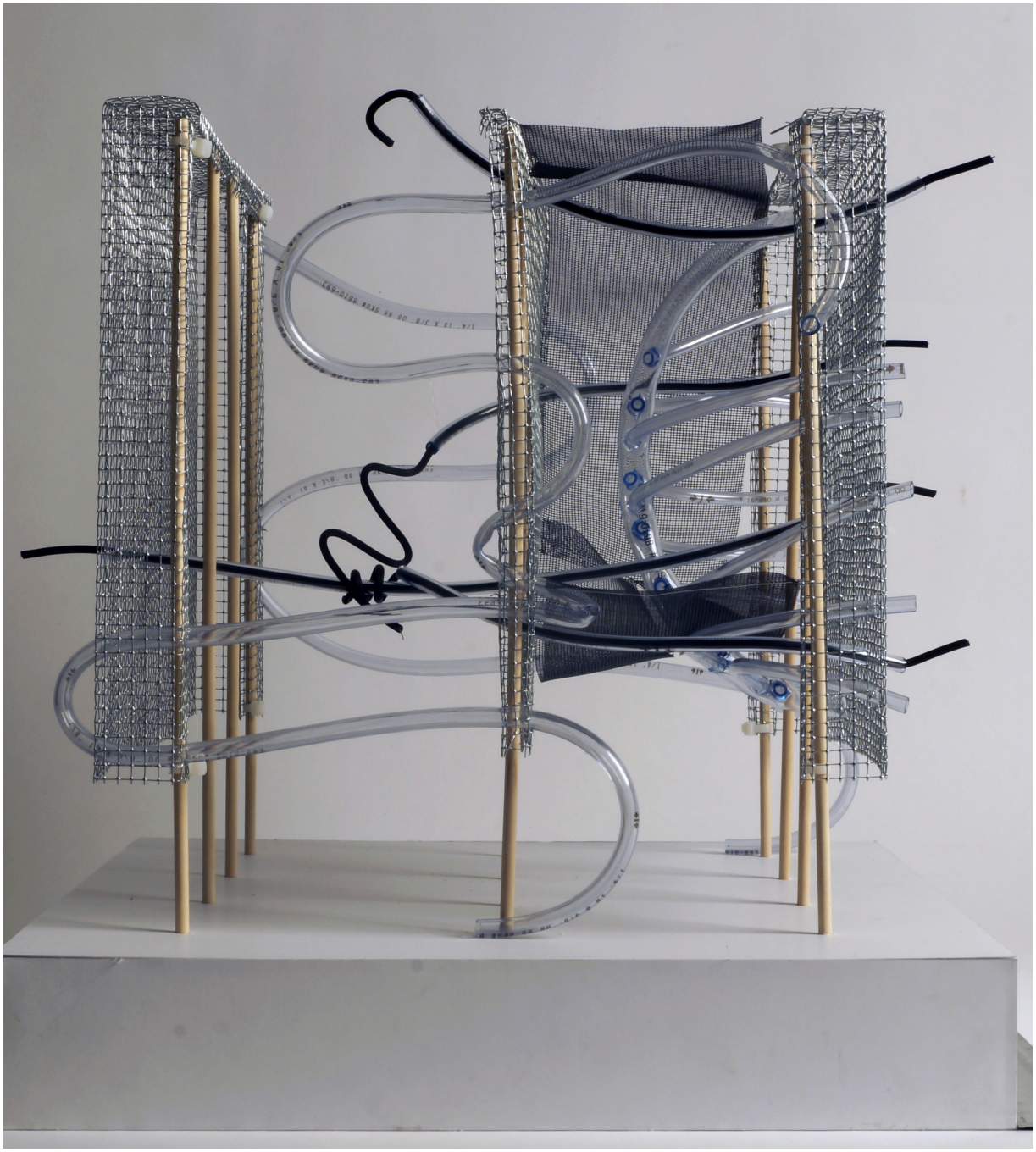


Figure 2.9 - Mimicked beetle trails as positive forms in a void 2 – The S shaped piping on the closest side is in this model mimicking the pattern of the Ash Borer

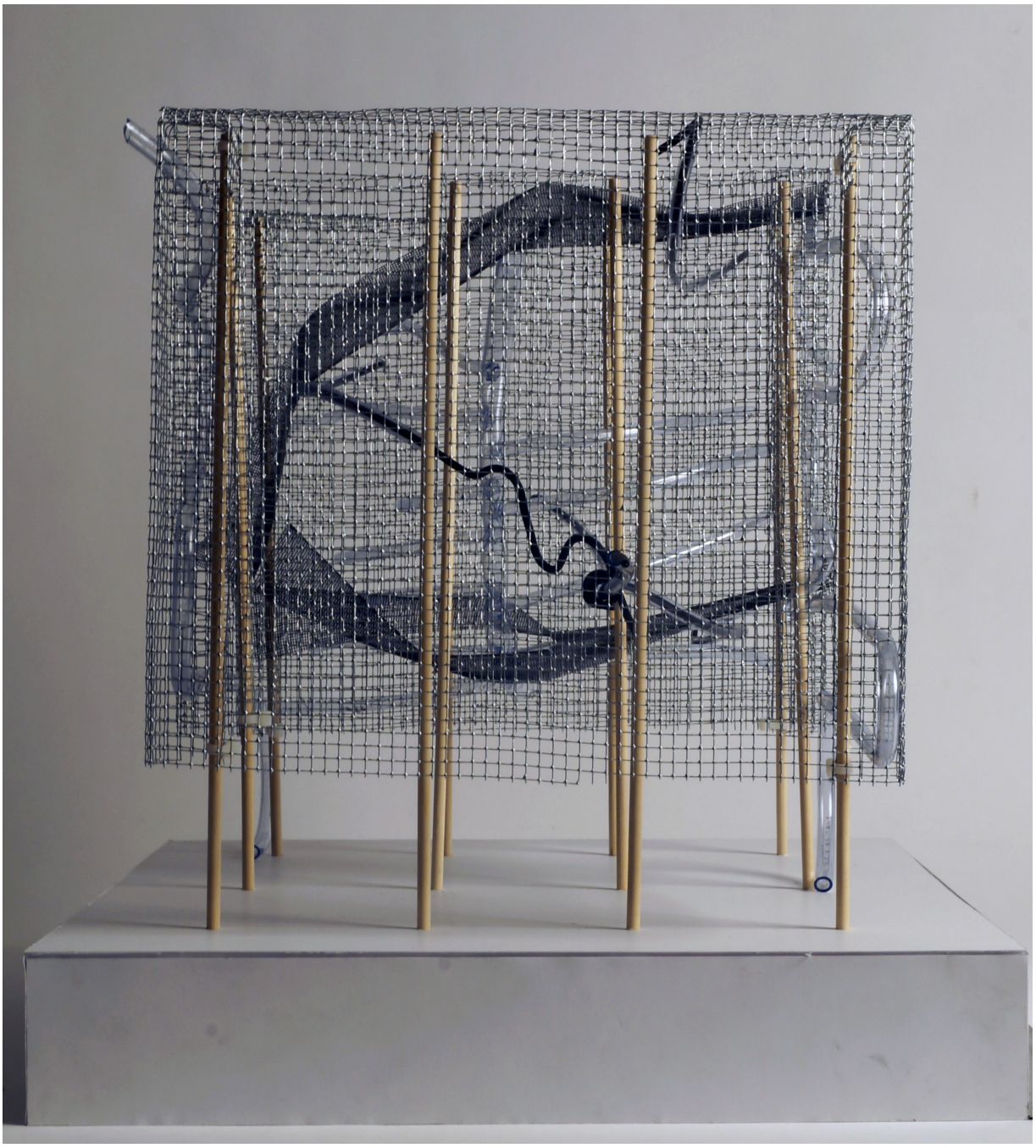


Figure 2.10 - Mimicked beetle trails as positive forms in a void 4

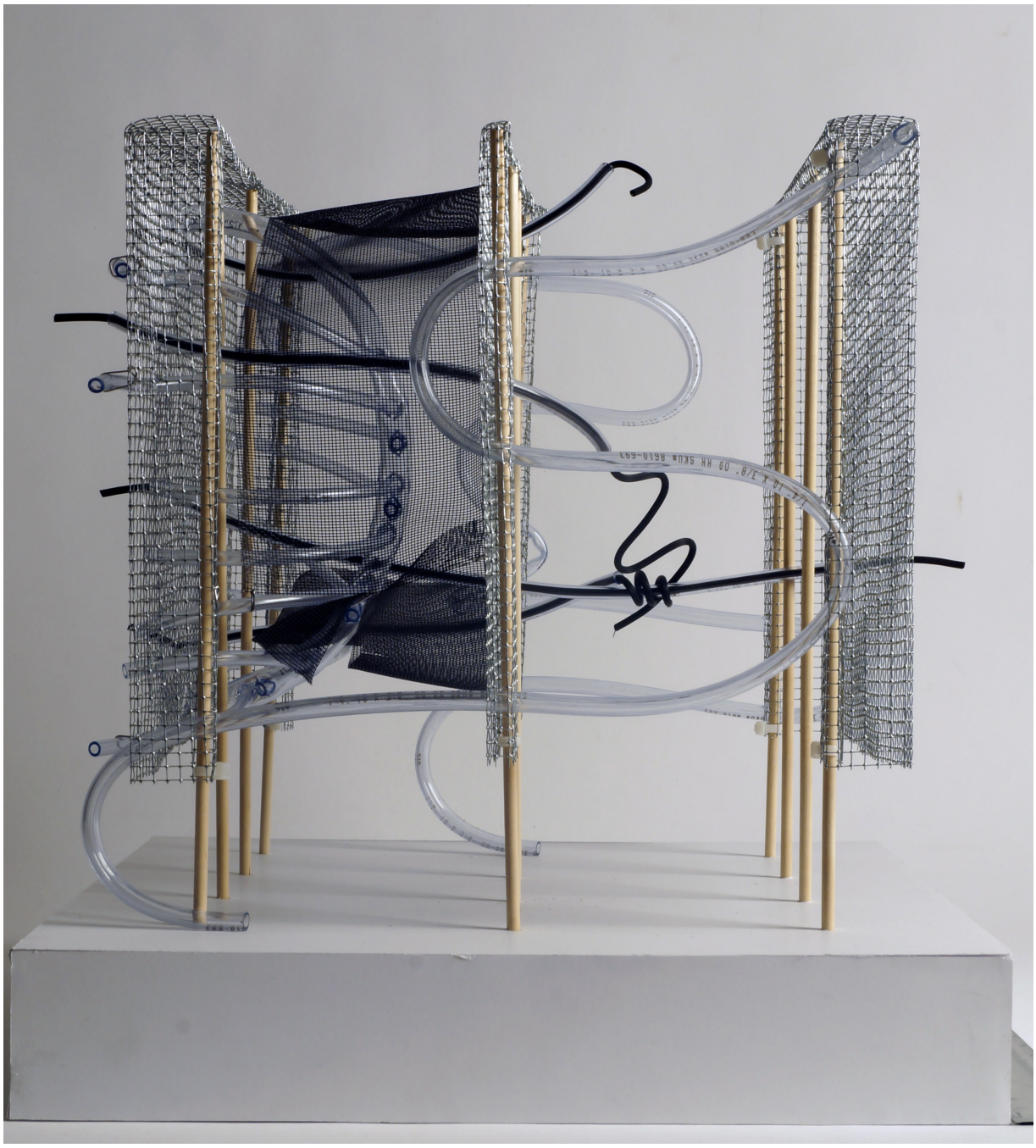


Figure 2.11 - Mimicked beetle trails as positive forms in a void 5

***Figure 2.12* - Beetle infested SPF lumber -** Found in a local building supply store among other dimensioned lumber by accident. This is certainly not the mountain pine beetle but a blue fungus is noticeable having accompanied the beetle that has eaten into this wood.

***Figure 2.13* - SPF progress photos 1 -** The original 8’ piece was cut into 2’ sections in order to try and extract some of the patterns of the beetle trails.

***Figure 2.14* - SPF progress photos 2 -** Although I tried a few ways of interacting with the material the most successful is shown here. The 2 by 4 has been split in half in this image.

***Figure 2.15* - SPF progress photos 3** -I had considered burning away the wood after filling the beetle holes with a material like concrete but was concerned about the repeatability of this only having a single try for each piece and the difficulty of getting the fire to consume enough of the wood while also retrieving the delicate beetle trails.

***Figure 2.16* - SPF progress photos 4 -** I chose to cut through the holes at 3 or 4 points where possible while filling the lost material from the cuts with modeling clay. Here I am stitching together the cut apart wood with copious amounts of modeling clay. Each piece needed to be fully covered as the modeling clay will not stick to the wood but will easily bind to itself.

***Figure 2.17* - SPF progress photos 5 -** I created a quick container for the mold out of acrylic sheets for the plaster mix to be poured into. This worked well as the acrylic did not bind at all to the plaster allowing me to easily take the mold apart. Placing the wood at the bottom of the mold was a problem though as wood remains buoyant and would float if moved before the plaster had set.

***Figure 2.18* - SPF progress photos 6 -** Wanting to make sure that the plaster could flow into the beetle trails, I made a watery plaster of Paris mixture, but this did take an extremely long time to set.

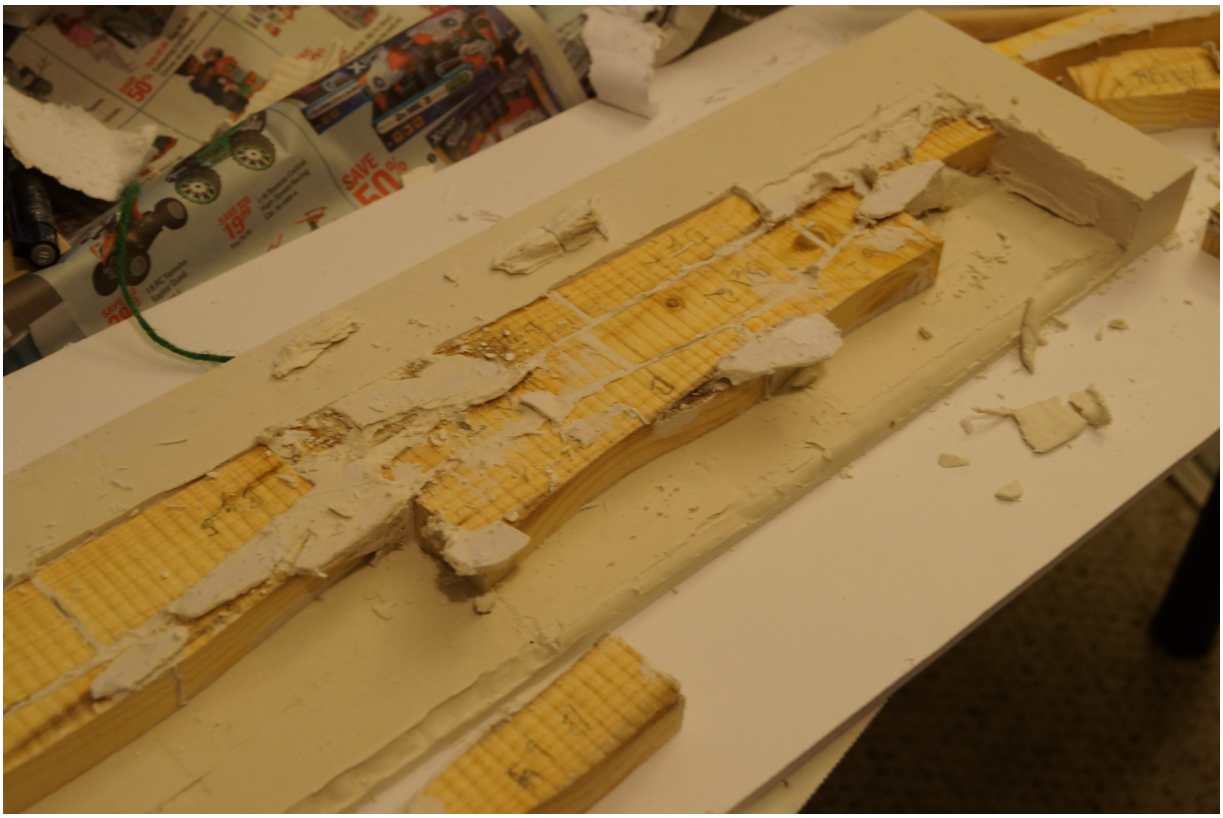


Figure 2.19 - **SPF progress photos 7** - I slowly picked apart the jigsaw puzzle I had made from the wood. The Modeling clay made this a much easier process. Several of the more complex shapes were still very hard to remove requiring small wood cutting tools to cut loose.

Figure 2.20 - **SPF progress photos 8** - The end result of one half of the mold showing the casts of the beetle trails.

Figure 2.20 - **SPF progress photos 9 -** Both halves of the cast placed together after most of the wood has been removed.

Figure 2.20 - **SPF progress photos 10 -** The completed cast backlit

Not just a plank/Metaphorical material

Walter Benjamin concludes the epilogue of 'The Work of Art in the Age of Mechanical Reproduction' by writing "[Humanity's] self-alienation has reached such a degree that it can experience its own destruction as an aesthetic pleasure of the first order."[10] While Benjamin is talking about the atheization of violence attached to fascism, particularly how artistic movements like Futurism turn war and violence into art, we should be worried of doing the same thing when viewing our environmental violence.

I find the ruin to be an aesthetic that I am drawn to and I know many others are as well. It is very possible to present the corruption and decay of wood as beautiful. If represented as aesthetic just for these qualities this risks endorsing the ecological harm that humanity is inflicting on itself. It's not the desire of this work to produce a Futurism of ecological decline. Work like Edward Burtynsky's photography risk hitting this point of alienation. As I view his photos, I begin to become less horrified by the ecological damage depicted becoming mesmerised by the beauty of the image of the industrial landscape. Without commentary perhaps I would be happy that this is the result of industrial action since it has created the possibility of presenting this image to me.

"With a shell and a net, becoming human, becoming humus, becoming terran, has another shape-The side—winding shape snaky shape of becoming with."[11] This is Haraway's prescription for how to engage with the more than human troubles of the era and involves what she refers to as SF or string figures.[12] In the word game that she is playing she lists an unreasonable number of possible

things that those letters could refer to, but most importantly it also refers to speculative fiction.

Haraway calls on Ursula K. Le Guin's carrier bag theory of fiction,[13] an idea of storytelling less about the heroic individual but a community. Le Guin points out the difficulty of this method of story telling herself, admitting the difficulties of making a story about a group of gatherers plucking seeds all day interesting, but she argues that this is a valuable story since it describes the conditions of a shared world better.[14] We might frame our actions as the heroic path of one individual overcoming but the day to day story of human interaction tends to be the shared completion of various tasks.

The relevance to Haraway's work is that the human animal protagonist in the present tale of climate change threatens to overlook our non-human neighbors who are essential to the picture of an altered world as I have described with our look at the behaviour of forest pests. A carrier bag narrative is one defined by random adjacencies and things metaphorically spilling over onto one another. Le Guin applies this to the construction of novels and Haraway is using this same narrative as part of the base for her encouragement of multi-disciplinary study and concern for the non-human entities in our paths. This is a form of story telling well suited to architectural narrative.

Well functioning building systems are often multi-layered things, as high-performance structures need to be built out of various layers of materials accomplishing different tasks. The story of a building needs to accommodate the

movements and the needs of many inhabitants and even a hovel for one person will change inhabitant in time.

The work I have produced in this part has been trying to at least begin engaging in this nebulous string figure creation, pulling on these ideas to try and answer what forms can be generated from this theory. Beginning just with the observation of my chosen metaphorical materials and tracing the markings left on them to see the fingerprint of insect action through the wood. I have tried to duplicate the patterns produced by the beetles by using CNC tools. I have made casts of their trails through wood inverting the positive and negative forms in the material.

Bruno Latour expresses a kind of frustration with the current modern idea of being a rational materialist.[15] It's hard to claim being part of a rational culture when serious denial is taking place regarding the impacts that placing so much carbon in the atmosphere will have. The artistic explorations presented alongside this text take on this, as a way of giving these events substance. These sculptural works are the way I have tried to address an audience that both needs something solid to react to but will not take the obvious consequences of moving carbon the way we do seriously.

PART 3

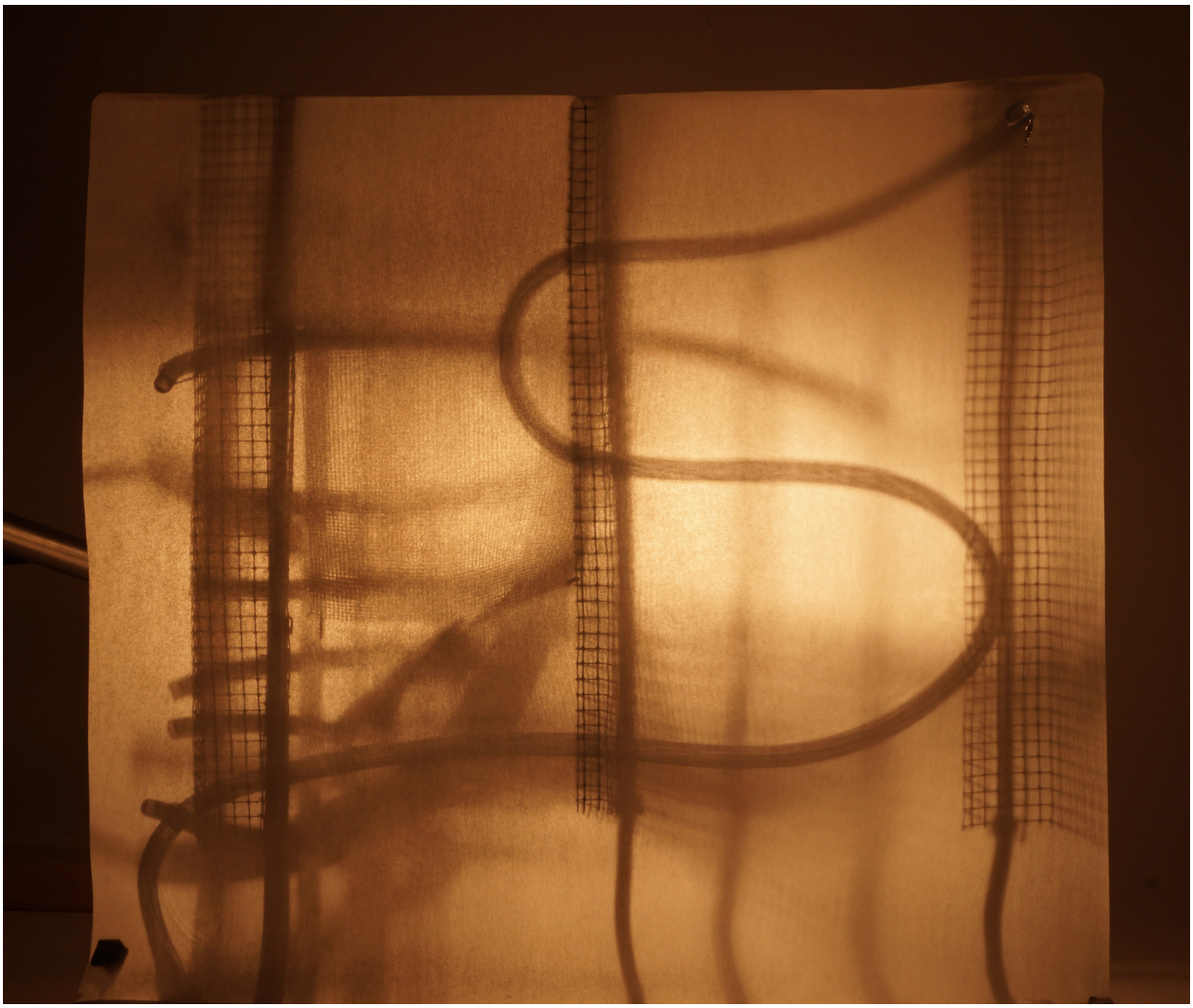


Figure 3.1 **- Backlit model 1**

LIVING IN A BURROW

Kafka's Burrow and Anxiety in the Climate Crisis

Anxiety is the result of anticipation of some upcoming stress, physiologically it should be useful to prepare for a trial beforehand, but this response can also be oversensitive or respond to a threat in the future that anxiety now will do nothing to help. This is the state the Burrower, in Kafka's "The Burrow," finds itself in constantly.[1] Having completed its burrow, as a defensive measure anticipating a huge variety of incoming attacks, it has included false entrances and labyrinth. The Burrower begins to list various additional features that would help its home do the work of protecting it from gnashing teeth and sharp claws. He critiques his design and lists his proudest innovations but falls into a cycle of disgust and fear that his home is imperfect.

Thinking about the Burrower as a designer speaks to a certain fear about one's own work and whether it can withstand the judgement of others. Worse than anything, as the Burrower is never attacked outright, is the anticipation of an attack or that what you have made will fail. When doing the work of design this anxiety is constant. The creature's drive to perfect its dwelling includes the perfection of the silence the dwelling has achieved, but upon discovering a small intrusion, the creature swings into describing how intensely he has been disturbed. In a wild rant discussing the best way to store his food, the creature debates the best ways to hoard resources within the organisation of tunnels. This is telling the reader he has more than enough, but the tremendous fear of a future lack remains and overwhelms the creature's judgment.

The Burrower has a tense relationship with his neighbors as they intrude

on the space. This is interesting when we think of the Burrower as a human. Both reliant on their presence and endlessly agonising on the appropriate distance that they should be from the creatures outside its hole, there never seems to be a level of fortification that is suitable to truly feel safe. Kafka seems to imply that the creature could turn the whole of the earth's crust into an impenetrable fortress and still the creature will never feel safe. In the world of our homes this is a constant reality but one that we never want to think about. Part of the nature of owning and creating a house is the fear of its breaching. This is sometimes the invasion of your neighbor but often it is the act of a raccoon or squirrel, or worse, rats or mold.

The language of how the Burrower describes the space changes as the story progresses. The creature begins to refer to the burrow itself as 'you' as if the place was a being itself and talking as if he was romantically involved with the central space of the dwelling. Here the anxiousness is overtaken with a kind of defensiveness for his creation despite acknowledging it as the source of so much of its turmoil. The creature also discusses the other creatures within the earth near its burrow, and it seems that there is no comfortable distance that the creatures can have to work.

The Burrower's experience of the space around it is only the map of his tunnels it holds in his mind and the faint whispers of other things murmuring through the walls. This underground world is one of intense isolation and fear, in which unclear sounds are magnified in the Burrower's search for incoming

danger.

Kafka's Burrower never escapes his anxious fear that a great beast or destroyer will come to annihilate it. The story ends with the line "But all remains unchanged". In the tale our burrower has been the doom of various other intruders and their burrows because of his perpetual fear. As a reframing of this story as both a parable of the turmoil of the creative process and simultaneously as a sort of climate change parable we see a creature building the thing that creates the conditions of his anxiety. I don't make this comparison because I think that the Burrower is foolish. The Burrower's anxiety is purposeful, and a moment of real conflict could arise that makes all its preparation and defences worth it. Similar to how hording could be a product of a need to prepare for a time of resource scarcity, but its hoarding has become more harmful to it than the original dangers that the burrow was made to protect from.

In our own burrows we are listening and identifying concerning sounds in the distance - I would say the movement of forest pests are one of these noises - but like Kafka's burrower there never will be the breaking point. Small neighbors will eat at our tunnels and disrupt our plans to our frustration, and we will adapt and persist producing our patterns of consumption. I crave a release to that anxiety, some way of looking at and addressing the invisible things that provoke that anxiety.

Playing with the penetration of light through the models and work created in the previous chapter is how I have chosen to engage with this atmosphere

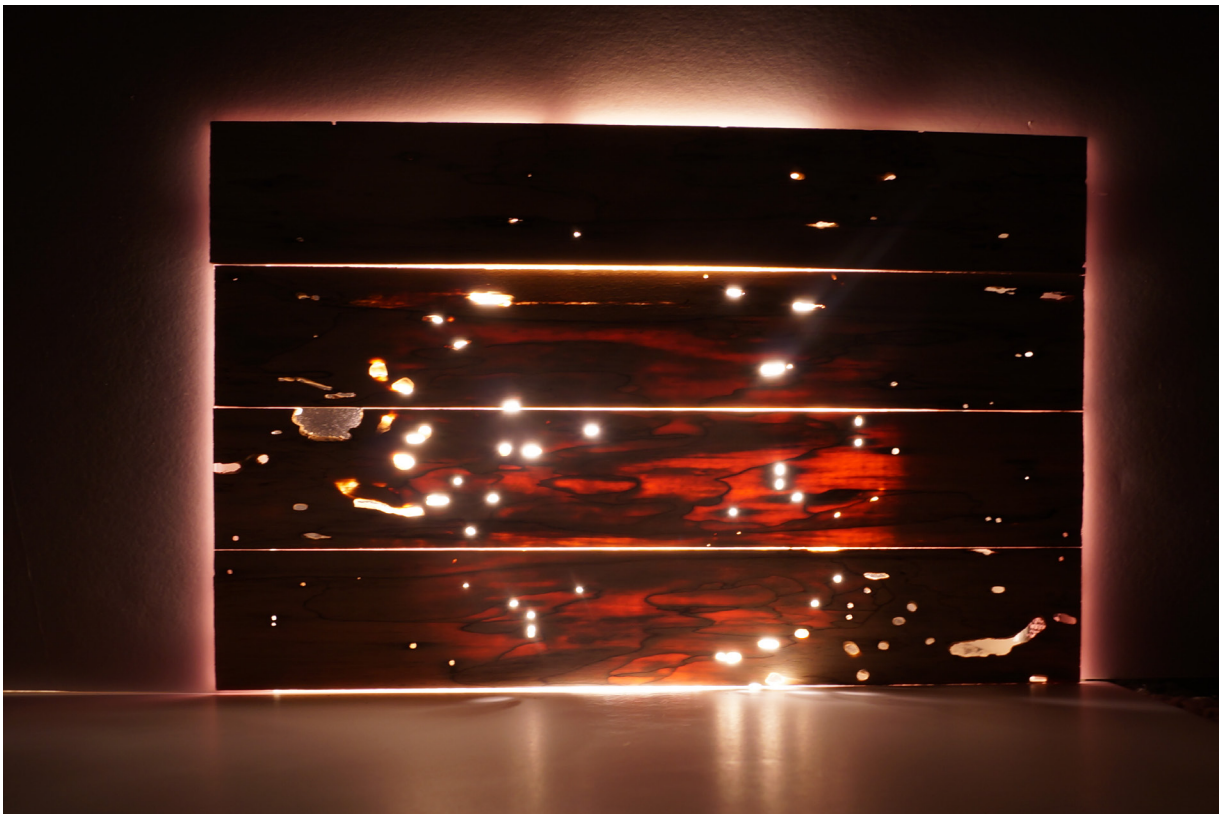


Figure 3.2 **- Spalted maple backlit 1**

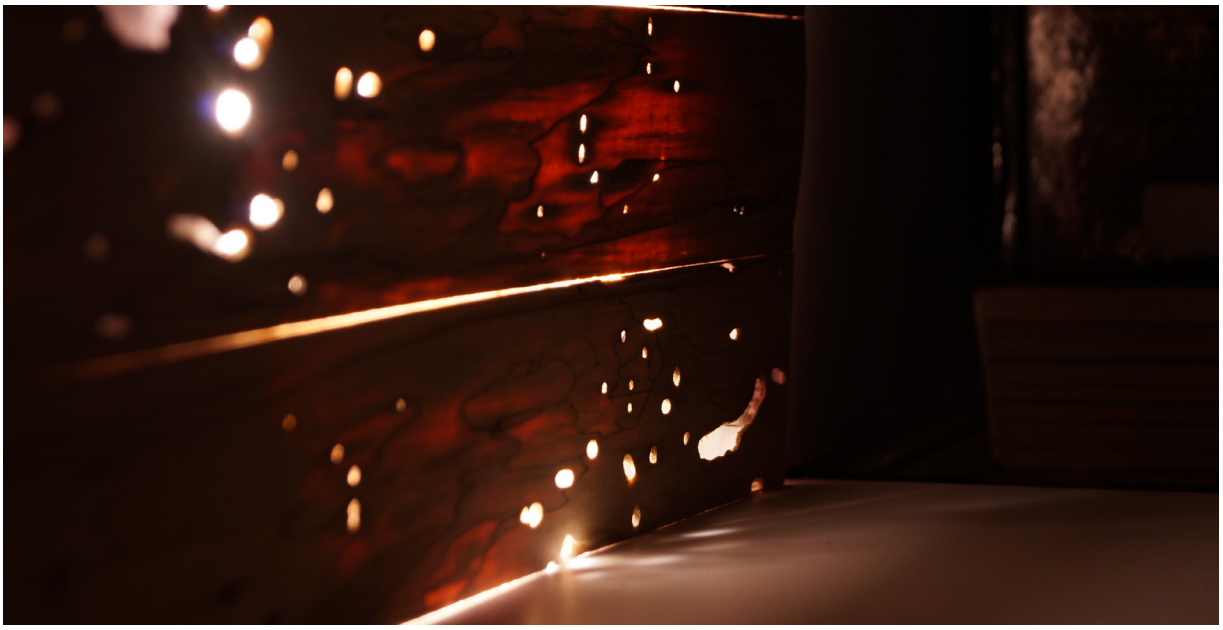


Figure 3.3 **- Spalted maple backlit 2**

Figure 3.4 **- Still from Orson Welles 'The Trial' 1**

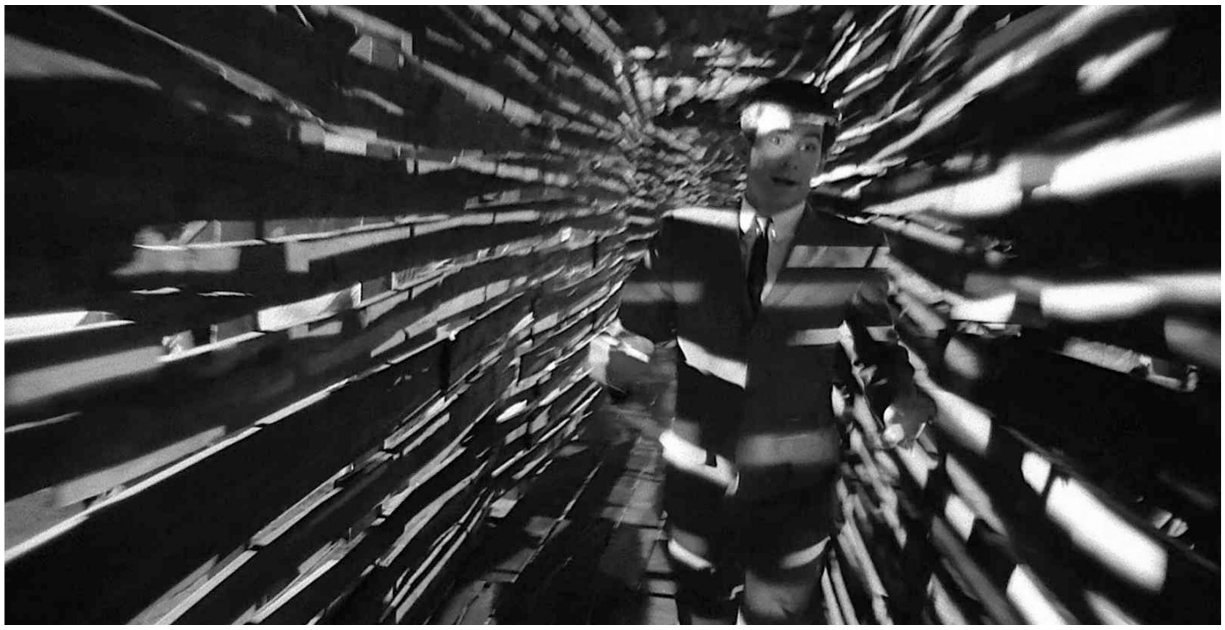


Figure 3.5 **-Still from Orson Welles 'The Trial' 1**

of anxiety, through creating images with unclear edges and ambiguous but oppressive forms.

A tight and cozy enclosure can be comforting when all alone, however it's the lack of certainty about what is outside that is upsetting. Overlapping the images of the shadows made by my sculptural work, turns an already abstracted form into an even more ambiguous and difficult to parse image evoking the burrow in Kafka's story. They lose the didactic diagrammatic quality that they were intended to have as a product of my form of observation and become affective images, taking on the Deleuzian definition of the diagram.[2]

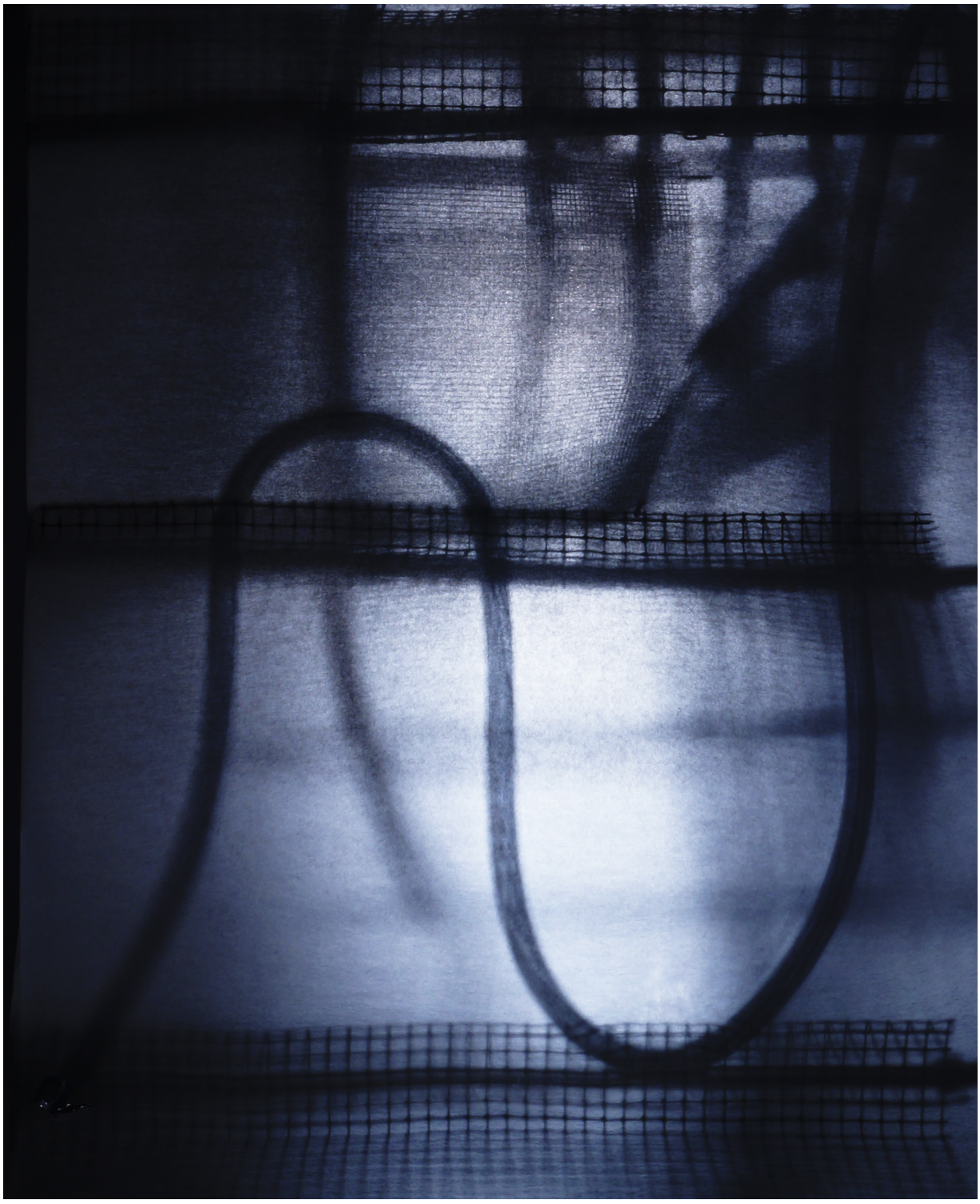


***Figure 3.6* - Backlit model 2**

'I am privileged, as it were, not only to dream about the specters of the night in all the helplessness and blind trust of sleep, but also at the same time to confront them in actuality with the calm judgment of the fully awake. And strangely enough I discover that my situation is not so bad as I had often thought, and will probably think again when I return to my house. [3] ***"***

Excerpt from Franz Kafka's unfinished short story "The Burrow"

***Figure 3.7* - Model shadows overlaid 1**

"There are enemies in the bowls of the earth. I have never seen them come, you hear the scratching of their claws just under the ground, which is their element, and you are already lost. Here it is no avail to console yourself with the though that you are in your own house: far rather are you in theirs. [4] ***"***

Excerpt from Franz Kafka's unfinished short story "The Burrow"

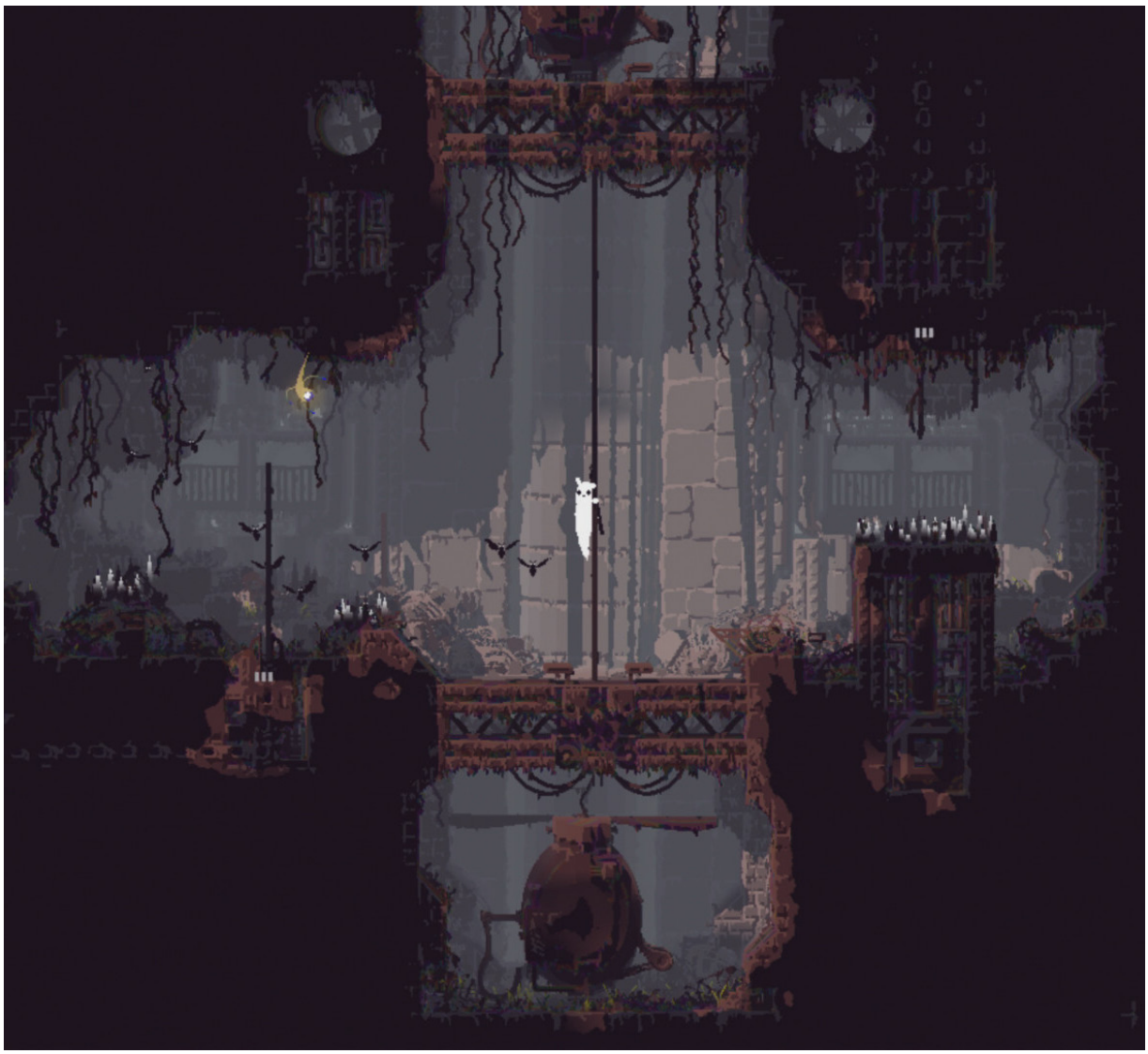


***Figure 3.8* - Screenshot from "Rain world".** Developed by Joar Jakobsson and James Primate

"Then, at the last moment, I am forced to admit to myself that I was right after all, and that it was really impossible to go down into the burrow without exposing the thing I love best, for a little while at least, to all my enemies, on the ground, in the trees, in the air. And the danger is by no means a fanciful one, but very real. It need not be any particular enemy that is provoked to pursue me, it may very well be some chance innocent little creature, some disgusting little beast which follows me out of curiosity, and thus, without knowing it, becomes the leader of all the world against me; nor need it be even that, it may be -- and that would be just as bad, indeed in some respects worse -- it may be someone of my own kind, a connoisseur and prizer of burrows, a hermit, a lover of peace, but all the same a filthy scoundrel who wishes to be housed where he has not built. [5] ***"***

Excerpt from Franz Kafka's unfinished short story "The Burrow"

***Figure 3.9* - Model shadows overlaid 2**

***Figure 3.10* - Plaster cast of SPF**

"Now the truth of the matter -- and one has no eye for that in times of great peril, and only by a great effort even in times when danger is threatening -- is that in reality the burrow does provide a considerable degree of security, but by no means enough, for is one ever free from anxieties inside it? These anxieties are different from ordinary ones, prouder, richer in content, often long repressed, but in their destructive effects they are perhaps much the same as the anxieties that existence in the outer world gives rise to. [6]***"***

Excerpt from Franz Kafka's unfinished short story "The Burrow"

Figure 3.11 **- Spalted maple backlit as a facade**

PART 4

***Figure 4.1* -Notre-Dame's spire collapsing.** Photo by Diana Ayanna

THE FOREST OF NOTRE-DAME DE PARIS

Toxic Fallout and Reconstruction of the Cathederal Roof

In the summer of 2019, the roof of Notre-Dame de Paris burned down violently. The blaze put much of the structure at risk, and at the time it was uncertain if the stone structure could support itself without the bracing of the wood. This oak framing, referred to as 'the forest'[1] due to the tremendous number of trees required to produce it, was completely consumed in the inferno.

The stone vaults are remarkably thin things that, without the bracing of the timber roof, did mostly manage to stand although some were punctured during the blaze. Much of the news media spent its time fretting or perhaps excited that this could be the last of the images of the iconic rose window. What was lost was one of the oldest wooden structures in France, and the stone structure of the cathedral, while it remained, was vulnerable without the roof's bracing.

The cathedral is a generational project as it would be hundreds of years until the building was completed. The beams in the roof that we know today likely were part of earlier structures that covered the partially completed church[2].

The archeological site of a 4th Century church is located to the west directly below the square in front of Notre-Dame. Maurice de Sully is responsible for commissioning the plan that set up the cathedral that we know in 1160 but various other hands have touched the cathedral's design[3]. Notre-Dame de Paris is not the result of a single visionary and would pass through the care of 4 unnamed builders between 1163 and 1220.[4] The design was then further altered in 1220 by another unknown architect to provide more light into the interior.[5] Notre-Dame would see many changes to the initial vision until it was finally completed in

Figure 4.2 - **Notre Dame before the fire -** Photo by Lucas Barioulet

1345. This long construction process, going through various architects and the eventual restorations, would lead to the Spire completed 1864. The previous spire having decayed so severely that it needed to be removed the century earlier.[6]

Fire and Toxicity

As a result of the fire, the lead cladding of the cathedral roof was engulfed along with the wood structure fueling the fire. Some of this lead moved along with the smoke and the dust of the fire settling on nearby streets and buildings in Paris.[7] Lead particles have contaminated the area making reconstruction not just an issue of replacing the damage but one of poisons embedded into the building itself. The rush to repair Notre-Dame brings up questions about the priorities of the government. According to reporting from the New York Times, authorities knew about the risk of lead with in two days of the fire, raising serious concern for the safety of children in nearby schools and daycares. Lead, although hazardous to everyone, is particularly dangerous to developing minds where the long-term effects can last a lifetime[8].

That this was not the first concern reported in media is worrying. Immediate promises of repair were made by Macron and French authorities. I recall watching Jake Tapper's, CNN's news anchor that hour, intense concern about the future of the cathedral's rose window and if it would survive the fire taking place. I do not think these responses come out of a sort of heartlessness, but it reveals how important the image of the building is to some people. In some very meaningful way, the integrity of the building is attached to history and it needs to stand as it is or be bolstered up as fast as possible or something will be lost. This is not the only response to the event though, in Canada a mid day CBC radio call in program had a large number of guests phone in to complain that the tremendous amount of money that would be put into the repairs clearly has better places to go at the present moment.[9] In the later context of the lead fallout in the very immediate region of the fire, there

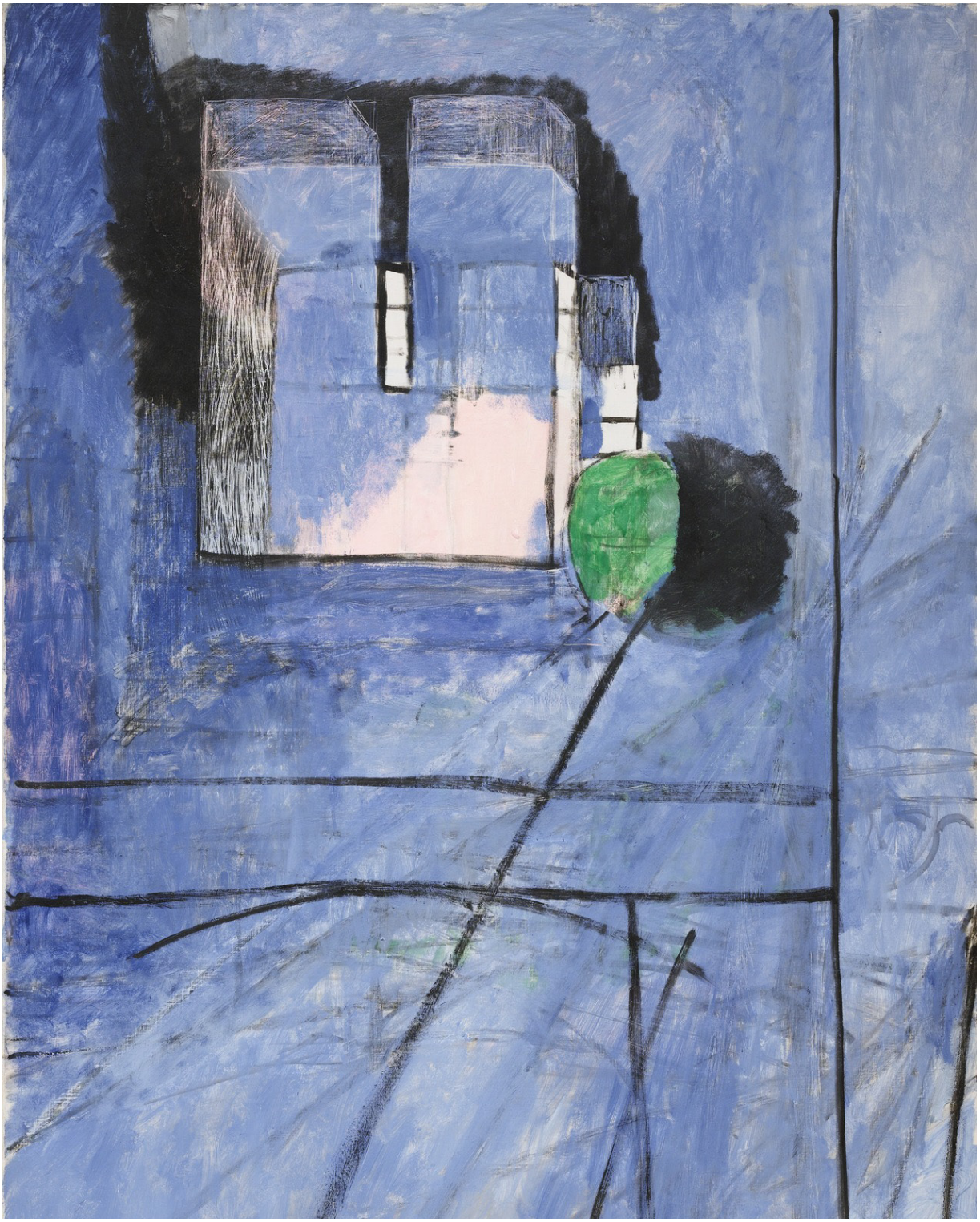


***Figure 4.3* - 'View of Notre Dame'-** Oil on canvas by Henri Matisse

***Figure 4.4* - Smoke from Notre-Dame Fire -** Photo by Maxime Brunet

***Figure 4.5* - Vault Collapse Notre-Dame -** Photo by Amaury Blin

was a need to deploy the resources that wealth could aquire quickly, to protect a generation growing up in the area of the fire.

Regardless of whether it is right to save the building as a priority over protecting the individuals exposed, those working on the clean up efforts will still be the ones taking the brunt of the risk. In her book, 'Against Purity,' Alexis Shotwell discusses several ways that people literally take in toxic elements into their bodies.[10] In some inescapable way, regardless of the type of remediation, the lead from the fire will be a part of those people doing that remediation and part of the history of the building.

The French government has promised to repair the cathedral to "preserve the historic, artistic and architectural history of the monument."[11] The wording of their original announcement implied that an exact reproduction of the original was to be made but as the short history of the cathedral shows that is not a fixed thing. President Emmanuel Macron, the current president at the time, invited the possibility of a contemporary addition.[12] But this asks the question of what is considered contemporary in this context? Is contemporary just a code for glass and steel or is there a better material to work with?

Arguments for the total restoration of Notre-Dame are easy to understand, but revelations of the particulate lead now throughout the building are a great example of the impossibility of that, in meny ways that stain is irremovable. Even after the completion of the decontamination process some amount of the material will have made it into peoples' bodies; a dose of toxin the impact of can't be

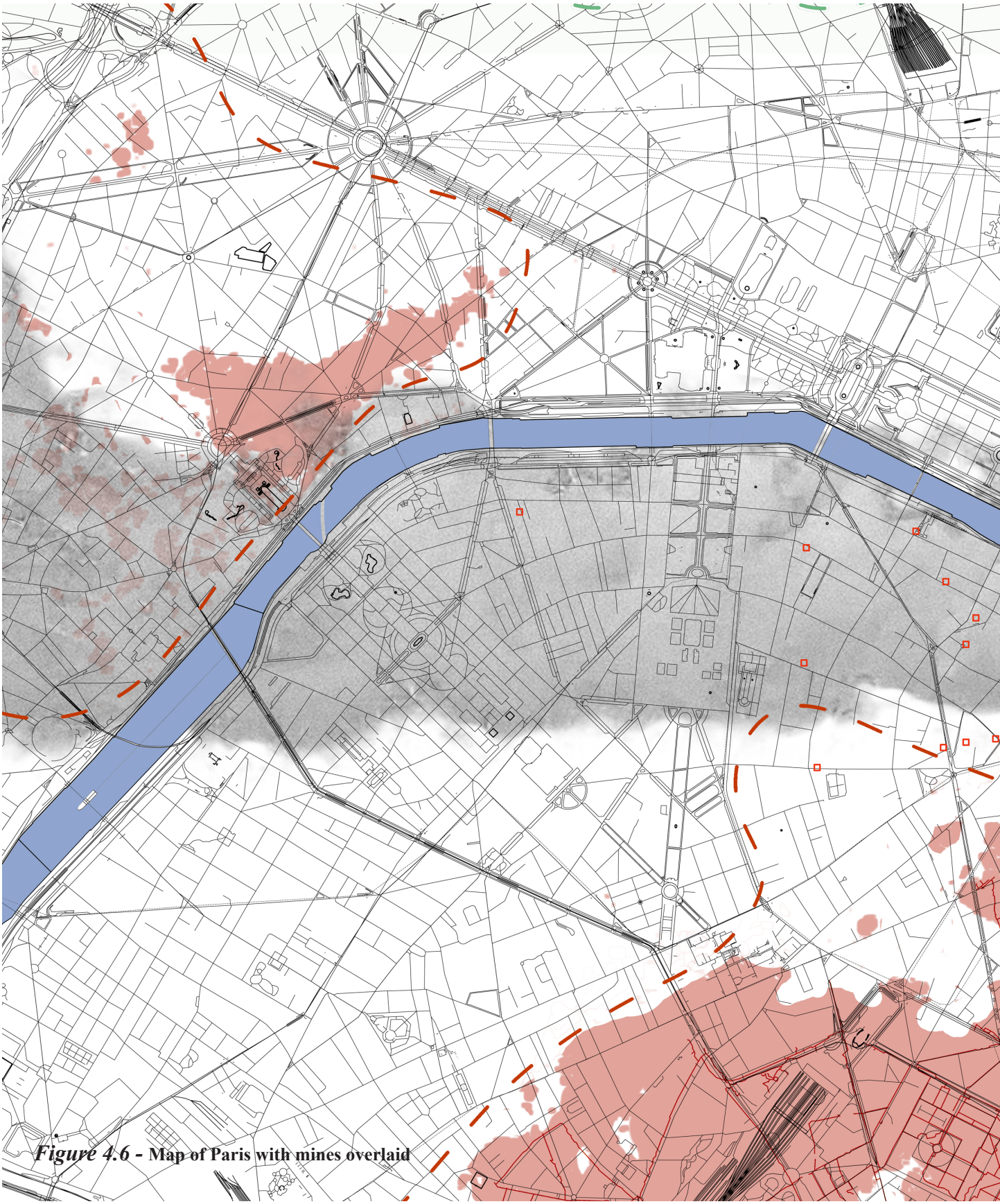


Figure 4.6 - **Map of Paris with mines overlaid**

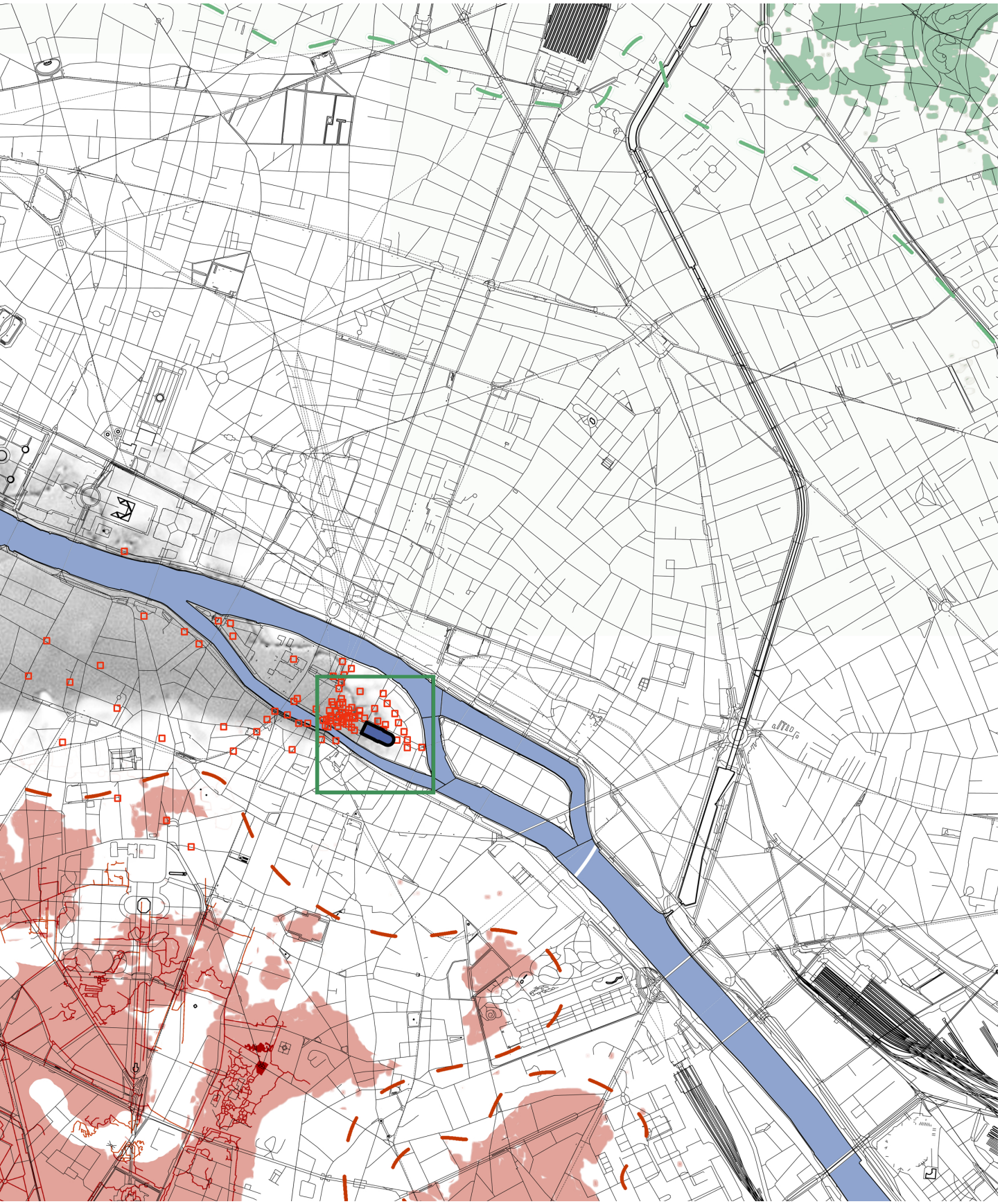


Figure 4.7 - **Below collapsed vaults -** Photo by Christophe Petit Tesson

Figure 4.8 - **Wreckage -** Photo by Philippe Lopez

scrubbed away. So perhaps it is a better way of rebuilding, to construct something new, that represents this moment in the cathedrals life cycle rather than producing a shadow of the previous structure.

The fire consuming the spire and roof is not the result of the Anthropocene, but they share the same sort of issues, for instance the anxiety and literal toxicity involved in their physical substance. As a result of this fire, the reconstruction will inevitably take place in the Anthropocene environment with materials from an Anthropocene age. Since something as core to our practice as simple SPF lumber can be marked with the fingerprint of the Anthropocene, it makes sense to me that such a significant structure as Notre-Dame should be wrapped up in that dialogue as well. In this case I think the beetle kill-lumber is the perfect choice to rebuild within this period of the anxiety and of the Paris accord. The dread of what it could contain, both respecting the history of the original timber structure but also pulling out of the fungal patterns it produces to evoke the quality of light of the stained glass. It's the ideal material to cover a now toxic but undiminished icon.

Similarly, with respect to my promotion about issues of the Anthropocene, by picking a particular eye-catching impact of climate change choosing a heightened present event to match the sense of urgency seems appropriate. Forcing this adjacency is designed to engage the viewer in study of the iconic nature of Notre-dame as something that has successfully captured many different meanings. This is all to explain that this design intervention is not one of iconoclasm but an experiment to attach additional meaning to a building that already carries considerable meaning. This design experiment is an attempt to add to Notre-Dame's function as a religious space and the act of creating it as part religious observance, an icon of Paris and French national identity even with the streak of French secularism.

Figure 4.9 - **Where the spire once was -** Photo by Amaury Blin

Figure 4.10 - **Charred Remains -** Photo by Stephane de Sakutin

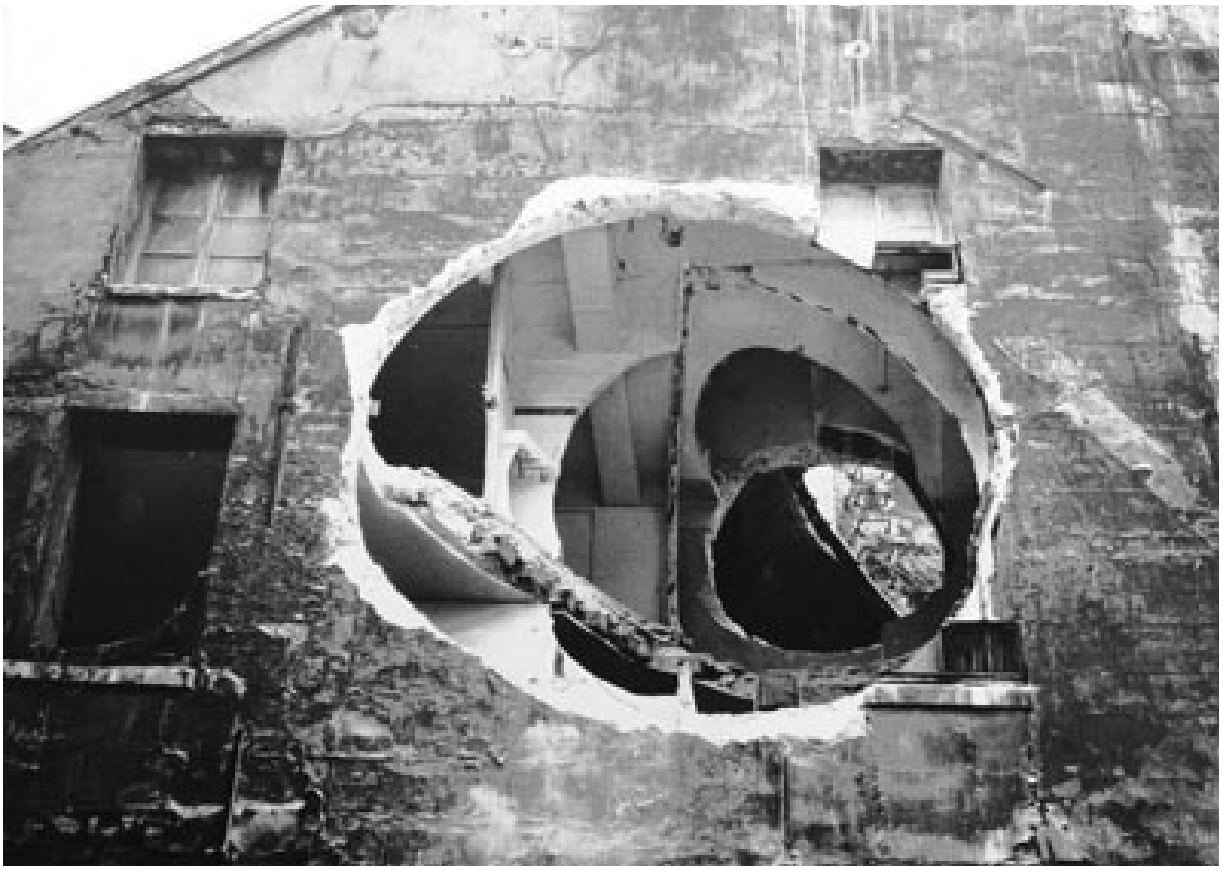


Figure 4.11 - **Photo of Conical Intersect 1 -** Gordon Matta-Clark

Figure 4.12 - **Photo of Conical Intersect 2 -** Gordon Matta-Clark,

The rush of offers from the ultra wealthy, who have no real personal connection to it or France, to fund Notre-Dame's reconstruction confirms that many of the powerful also agree that the building holds intense cultural value. The outpouring of support was enough to raise questions about if this was the best cause to donate to.[13]

Whether a lesser work of architecture could successfully carry these various disparate meanings is perhaps worthy of debate on its own but is outside the scope of this thesis. For the purposes of this work I contend that Notre-Dame has already proven a capable container for many meanings and that an additional one can be added without diminishing the legacy of the cathedral.

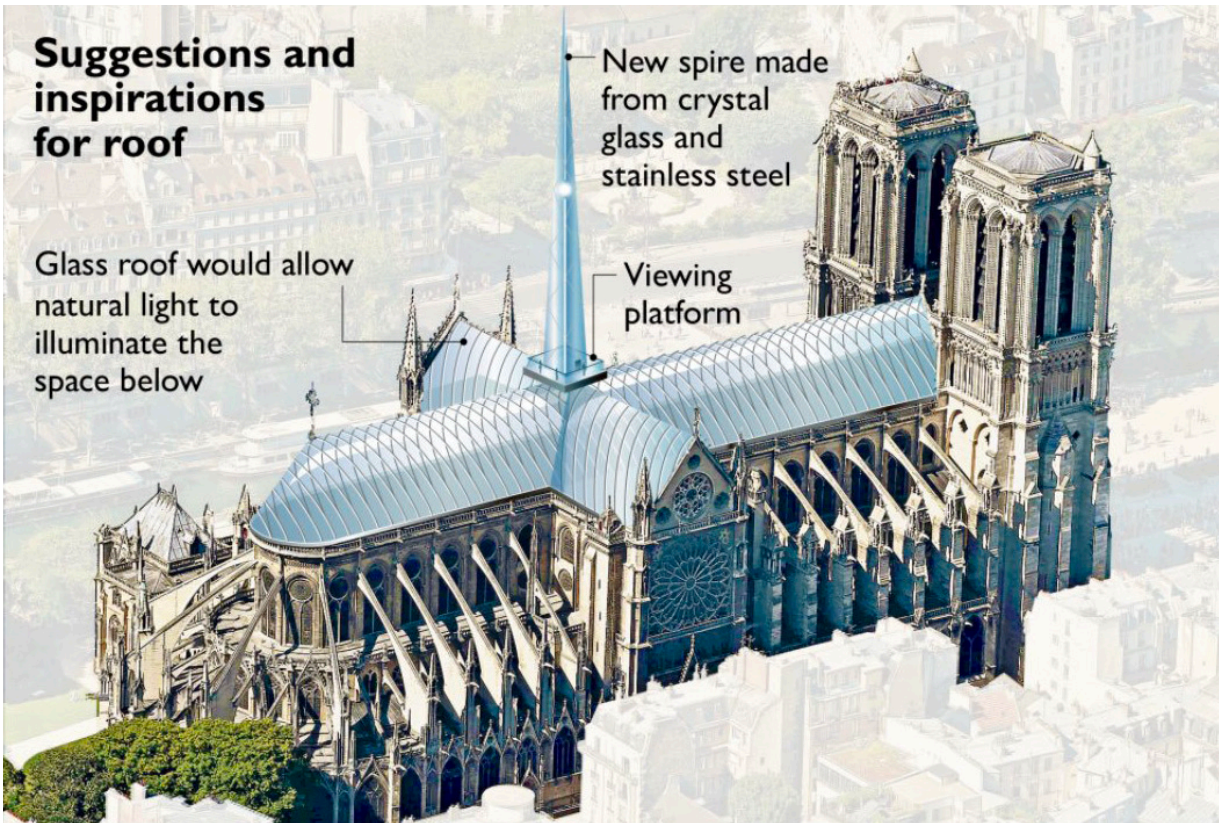


Figure 4.13 - **Norman Foster proposal -** Foster + Partners

Figure 4.14 - **Godart + Roussel proposal**

Proposals for Reconstruction

After the fire, a competition was announced for the reconstruction of the spire. At time of writing, no details have been announced about who would be involved or how that would be done, but shortly after a public competition was opened to any entrant.[14]

Many of the proposals seem to focus on creating some sort of glass roof in the shape of the original roof structure. The quality of light entering the space through the stained-glass windows is a large part of the cathedral's identity, so this is an understandable starting point. You can see in Figures 4.13 and 4.14 that both Foster and partners and Godart and Roussel proposed this option.

The best of the proposals key into the idea that there is a depth of meanings that the cathedral is capable of beyond simply duplicating the outline of the past structure in glass. Although there are some lovely ideas in this category, the most interesting ones are the provocative ones that envision the cathedral roof as something completely new. Loose design proposals as shown in Figure 4.15 and 4.16 play with what form the reconstructed roof could be. In Mathieu Lehanneur's proposal he replaces the spire with a sculptural shape recycled from other design work and in UMA's proposal they imagine adding a public pool to the cathedral. These imaginative additions seem less hollow and more hopeful that Notre-Dame's story will not just be one about it's past.

***Figure 4.15* - Mathieu Lehanneur's proposal**

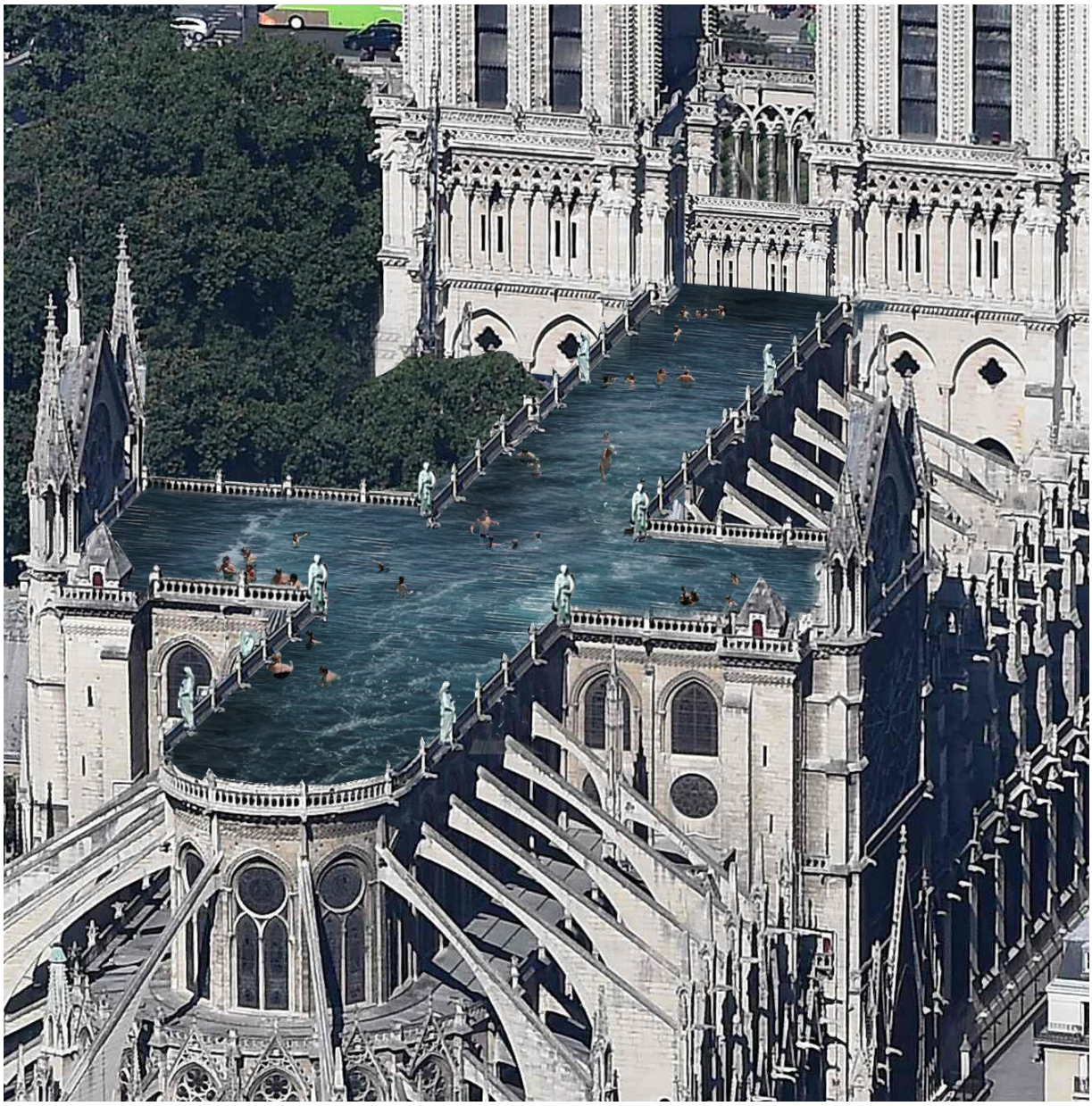


***Figure 4.16* - Notre-Dame as a public pool -** Ulf Mejergren Architects

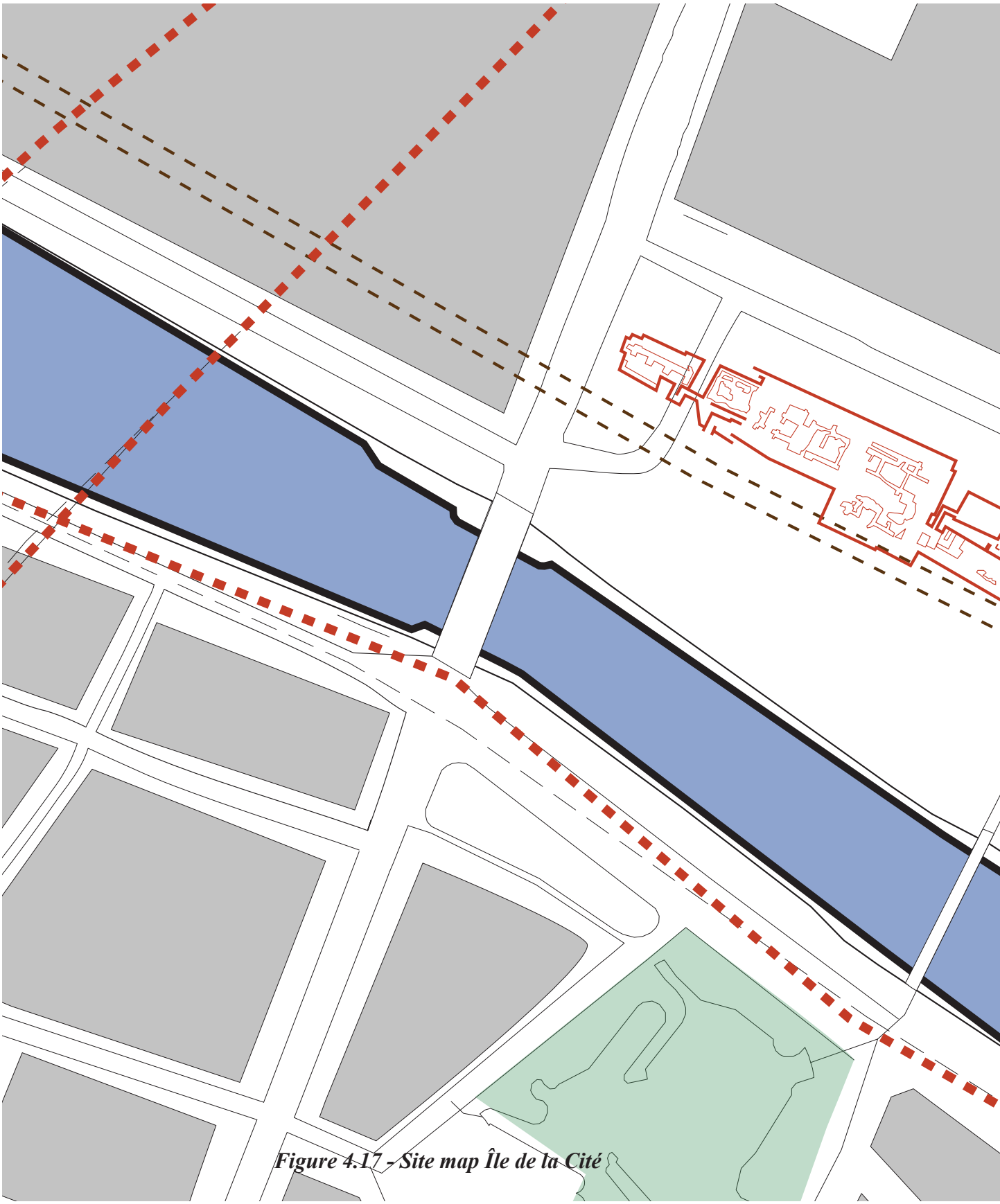
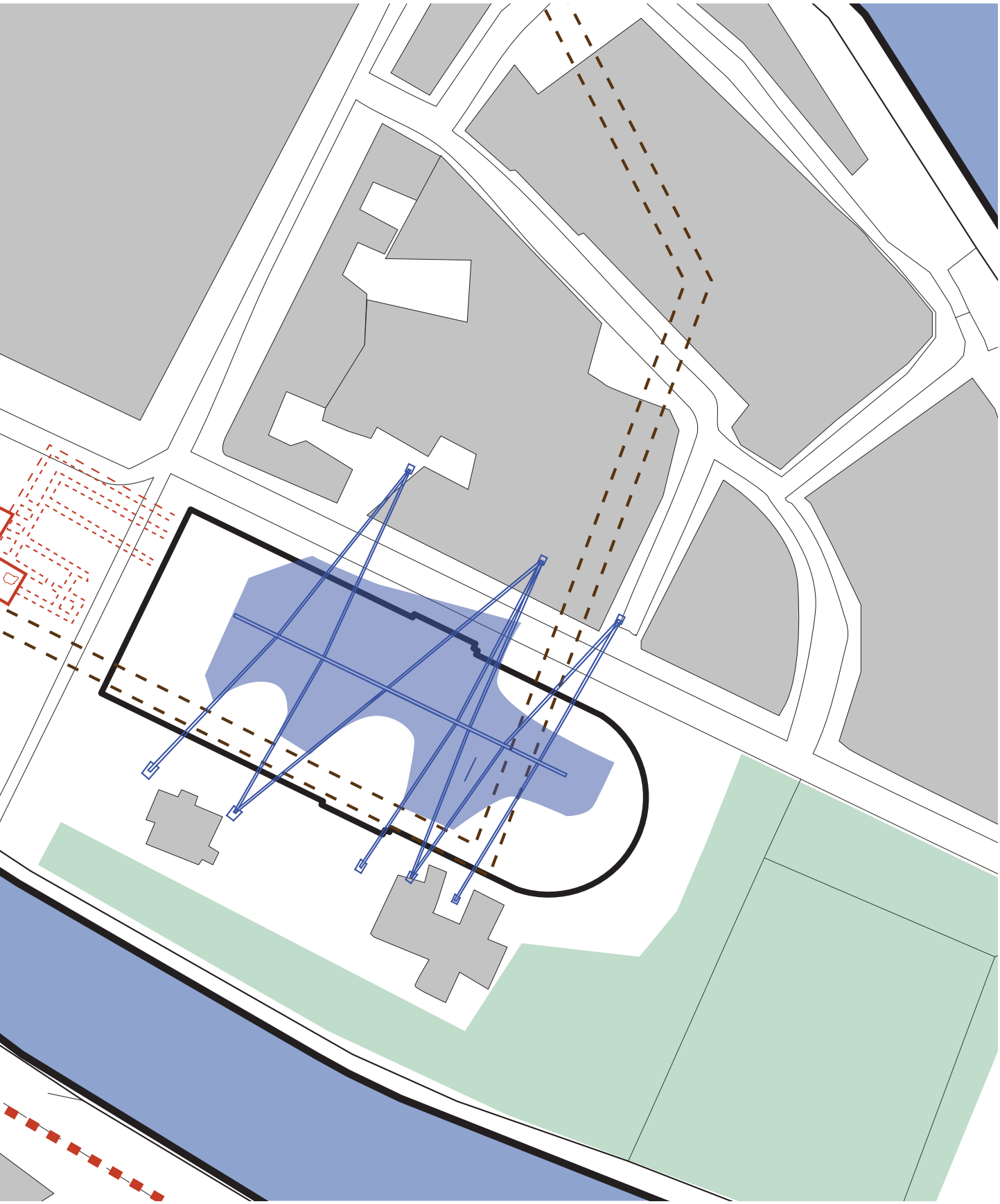


Figure 4.17 - Site map Île de la Cité



A Beetle Based Restoration

Notre-Dame de Paris is deeply tied to the city's history and identity. Paris is a city whose name was given to the Paris agreement, intended to keep the rise in global temperature averages from going past 1.5 degrees Celsius[15]. The legacy of this agreement is unlikely to be a proud one, as warming models project it seems more likely to reach 3 degrees Celsius by the end of the century.[16]

Alongside the possibility of an ignominious name in the climate politics of the 20th century, is the pall cast by the lead fallout of the fire embedded in this cultural icon. Awful choices of materials, made long before, have now left a harmful legacy for the inhabitants of the city. A structure that sits as a sort of icon of the people to the author Victor Hugo, the greatest proponent a building could have, could now instead carry two legacies of negligence.

Paris is also a chthonic thing. The city has an extensive underground not the cities metro but the extensive catacombs that trace the city's roadways and the ruins of the 4th century church sits partially under the west side of Notre-Dame.

My proposal to address all these issues, with the material that has been built up throughout the previous chapters, is the construction of a massive containment structure over the church. Assuming the possibility that the church is not seen as safe to enter for some time as it is extensively cleaned calls for the construction of a temporary structure cradling the fragile vaults. This scale of building constructed of wood is not unprecedented. For instance, the Tillamook Air Museum is a 59m tall 90m wide hanger built in 1942 by the US military to house blimps used for reconnaissance. This massive clear spanning arch structure was assembled in a

remarkable 27 days.[17]

With Notre-Dame, scaffolding and supports are already a core part of the planned restoration. Large wooden supports are currently being fitted under the flying buttresses to brace them while repair takes place. This process will take a great deal of time, so the proposed structure is a balance between a containment structure like the new containment building over Chernobyl and a repair scaffold intended to support the continuing maintenance of the building.

Rather than replicate the previous roof profile with a glass roof or create something reminiscent of the space below, an actual restoration would be to produce a similarly enclosed and somewhat dark space. The original roof was not just reminiscent of a forest in the use of wood, but it also replicated an atmosphere of being surrounded in a dark wood.

What is the point of memorializing a loose sketch of the form if the character of the space no longer calls back to what is being memorialized? The forests that produced the Oak that once sheltered the cathedral have radically changed and the nature of the globalized world is that the city of Paris is not limited to access to materials easily carried to it via the river anymore. It feels perverse to ship similarly sized trees from Norway when a cheap and symbolic material exists in vast quantities that almost begs to be used and carries the modern anxieties of anthropogenic climate change.

In an act of ‘composting’ the design work began with overlaying the materials that I had gathered through the previous work listed above, supported

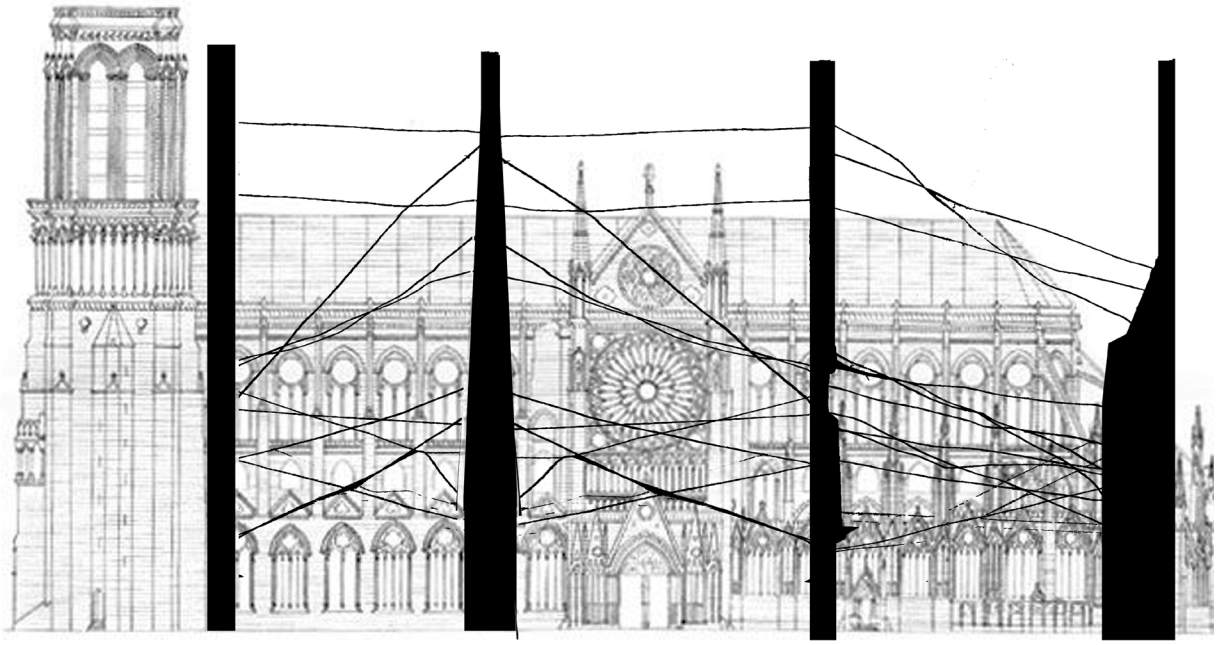


Figure 4.18 - String figure overlaid on Notre Dame

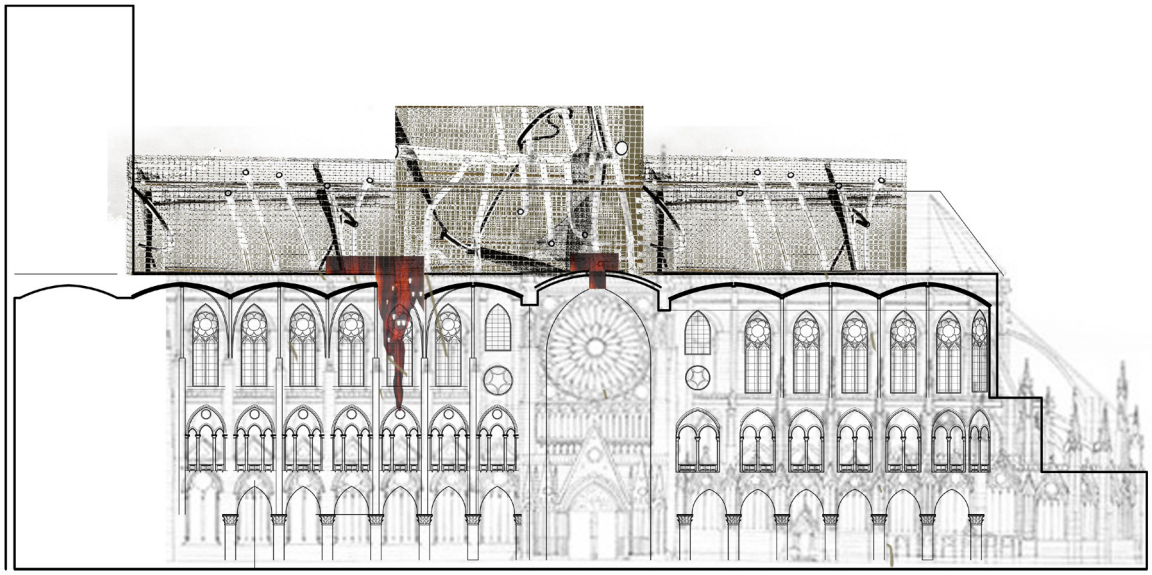


Figure 4.19 - Models overlaid on Notre Dame

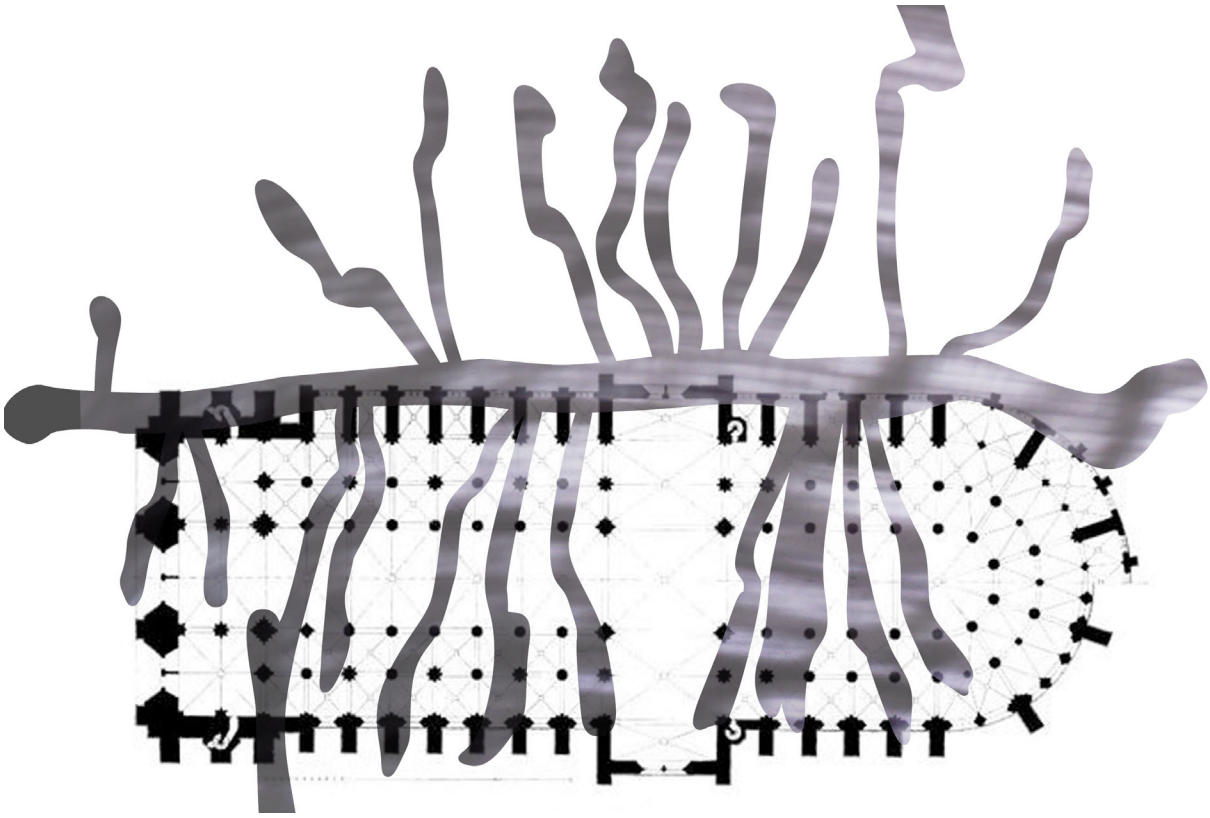


Figure 4.20 - Models overlaid on Notre Dame

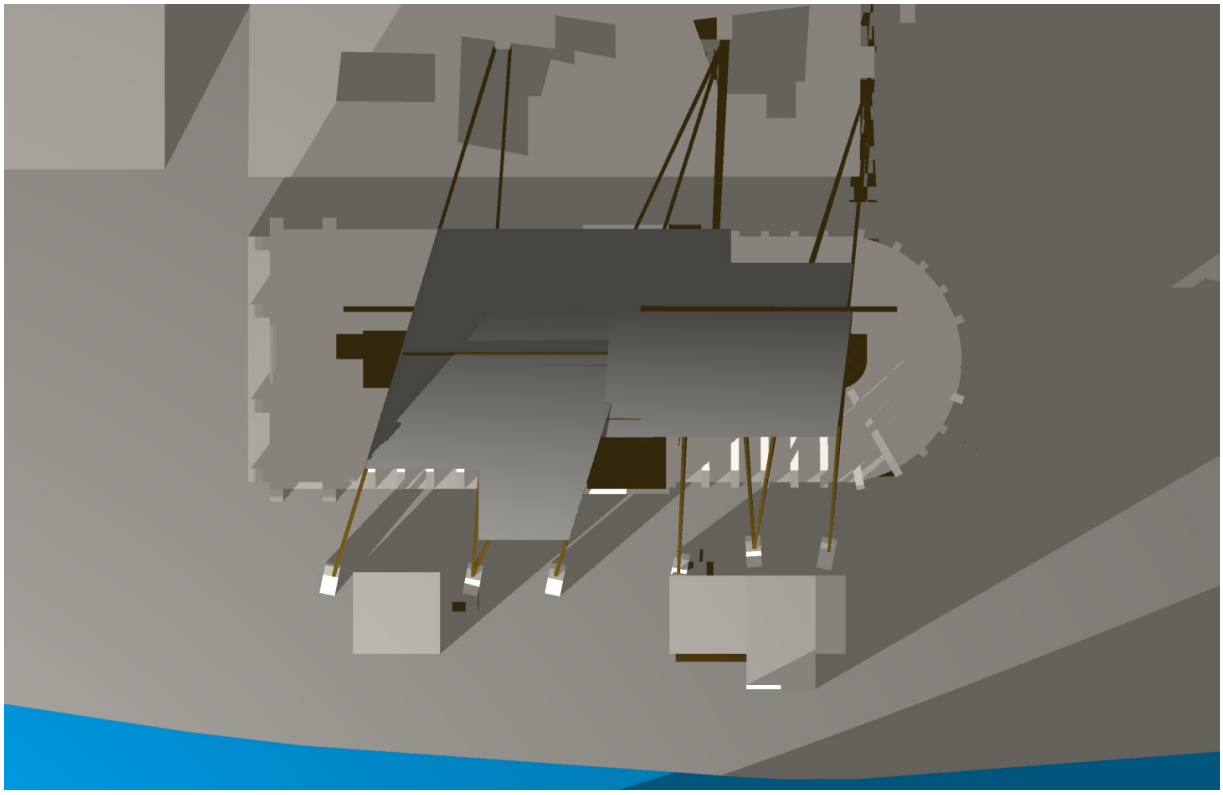


Figure 4.21 - Plan of replacement containment structure/roof

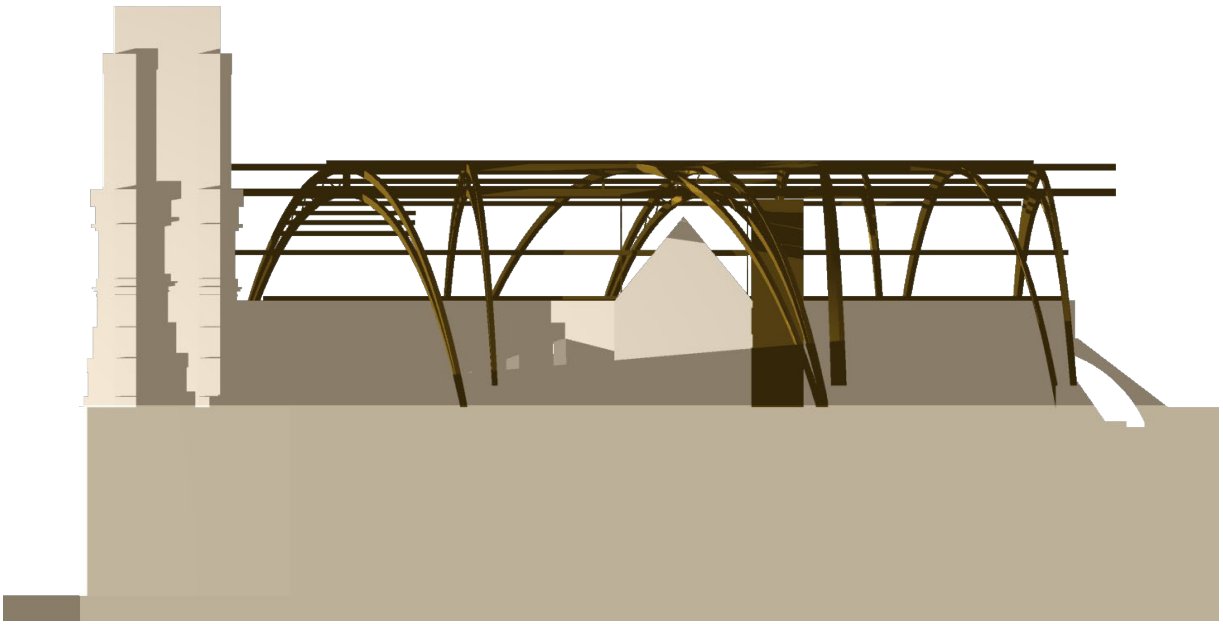


Figure 4.22 - Elevation of roof structure

between two large arches laced by columns that were generated from the casting of burrowed beetle paths through wood.

This superstructure, reaching over and into the neighboring courtyards would be offset. It is inevitable that this intervention would interfere with the light reaching into the primary worship space. Shifting the bulk of this structure to the north would limit this interference somewhat. In wanting to overlay human patternmaking and a plan reminiscent of the beetles marks, I do not want to produce something that is a statement that these forms are the same things, only that they are perhaps closer to one another than their distance might normally imply. A direct overlay would imply a dominance over the existing structure that I do not think can be achieved and in any event is not desirable.

This decentered location also would make an accessibility lift easier to accommodate without penetrating or further altering the interior space.

In the proposed section, I have left two of the penetrations in the stone vaults. These currently existing penetrations were produced as part of the damage and their location below the previously existing spire. This damage opens a possibility. In place of the spire these openings create an interesting place to view the tremendous space below in a unique way. A sculptural projection built out of stained glass patterned to mimic the fungal lines seen in spalted wood would project downwards slightly into the space.

The finish shown in section (Figure 4.25), would be the blue stained pine. An unexplored avenue invited by the casting work produced, in the second part

of the book, offers a possible additional material that might help mitigate the combustibility issue presented by stubbornly choosing to replace a large wooden structure destroyed in fire with an even larger wooden structure. Gypsum wall board is a core element of the light frame timber construction that we produce in Canada. With Paris's history of gypsum mines, this seems like an excellent sculptural material to work with that could provide a way to add a level of ornamentation that is appropriate for the cathedral.

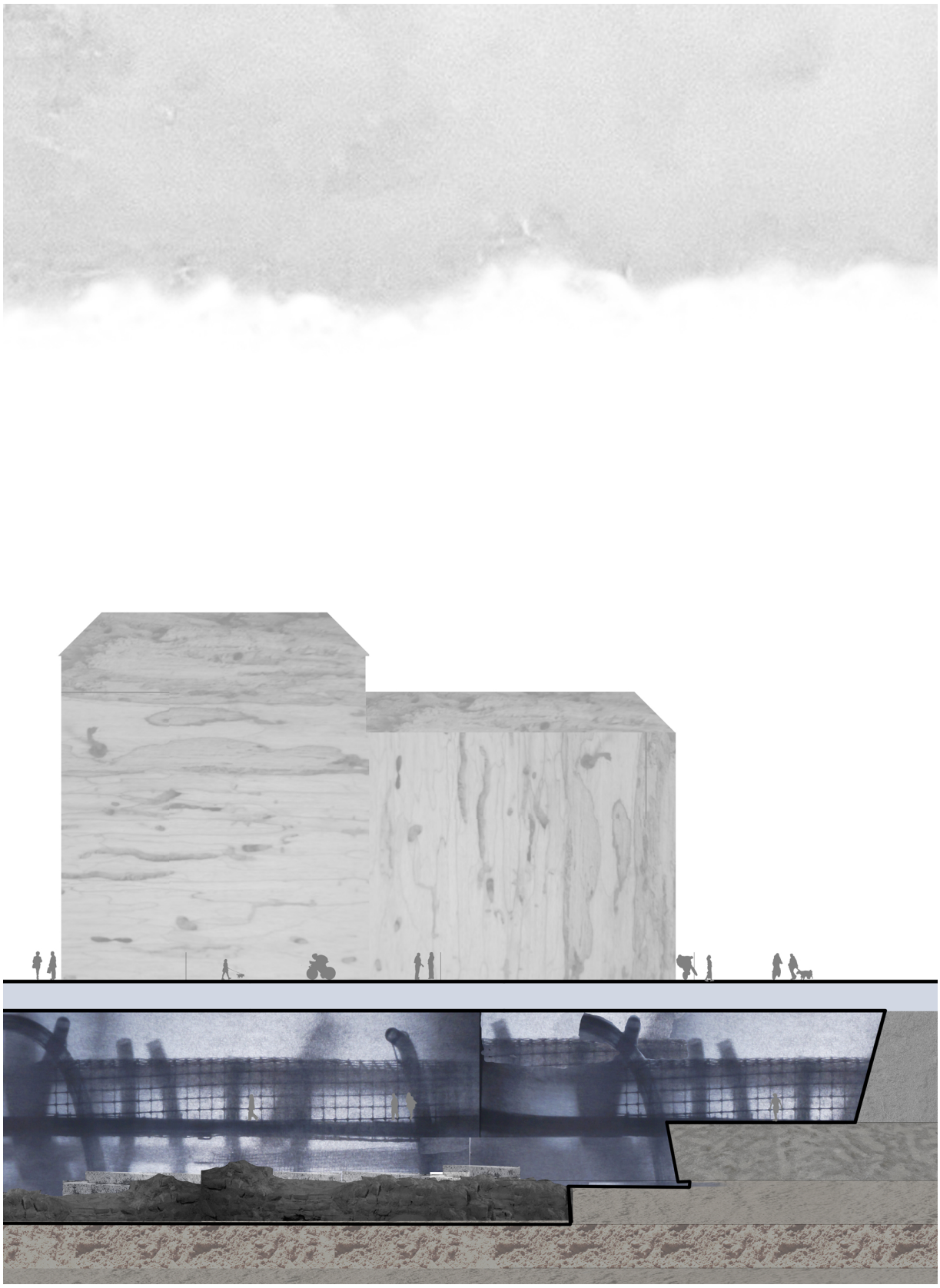


Figure 4.23 - Section through expansion of archeological site

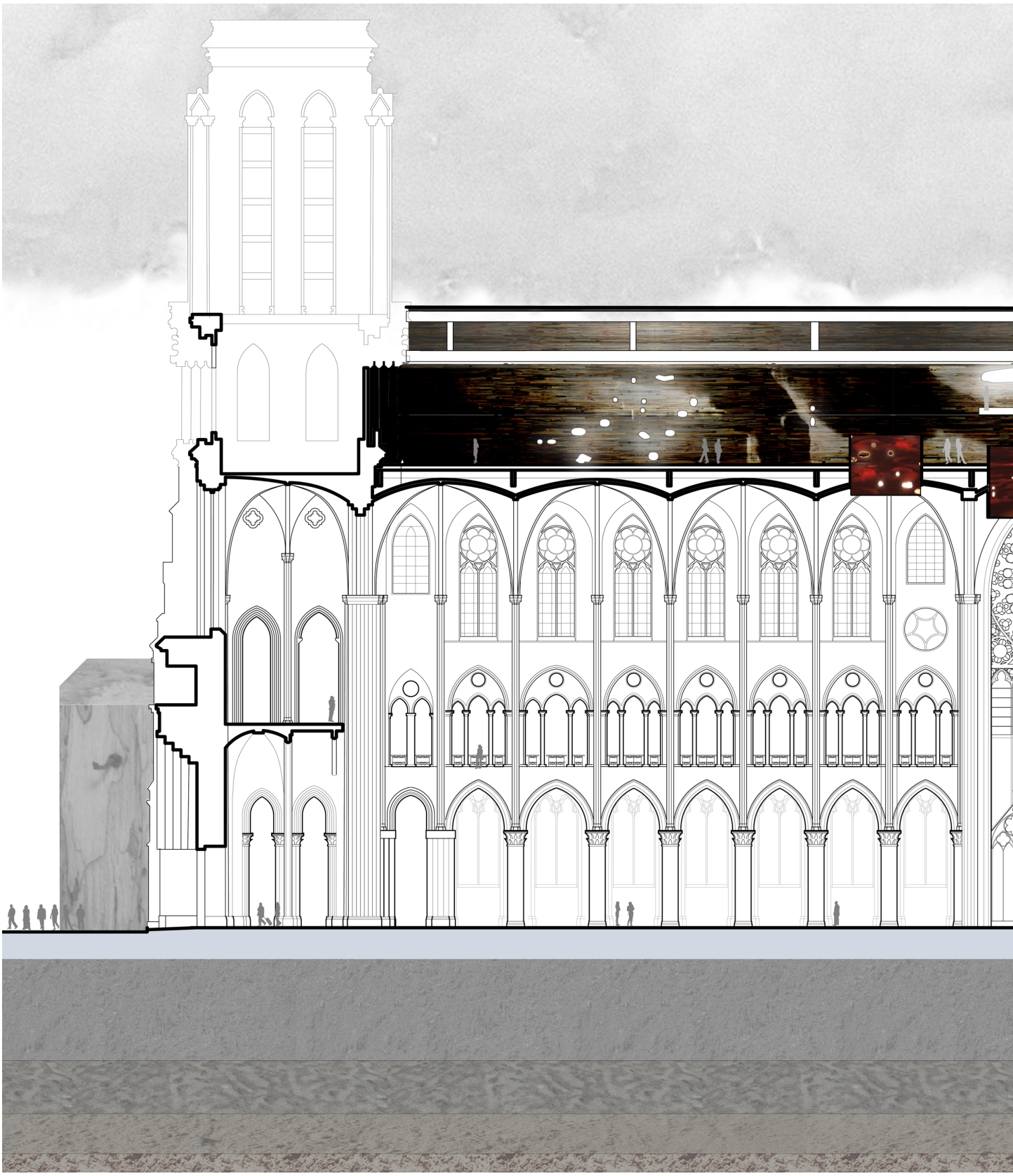


Figure 4.24 - Complete section

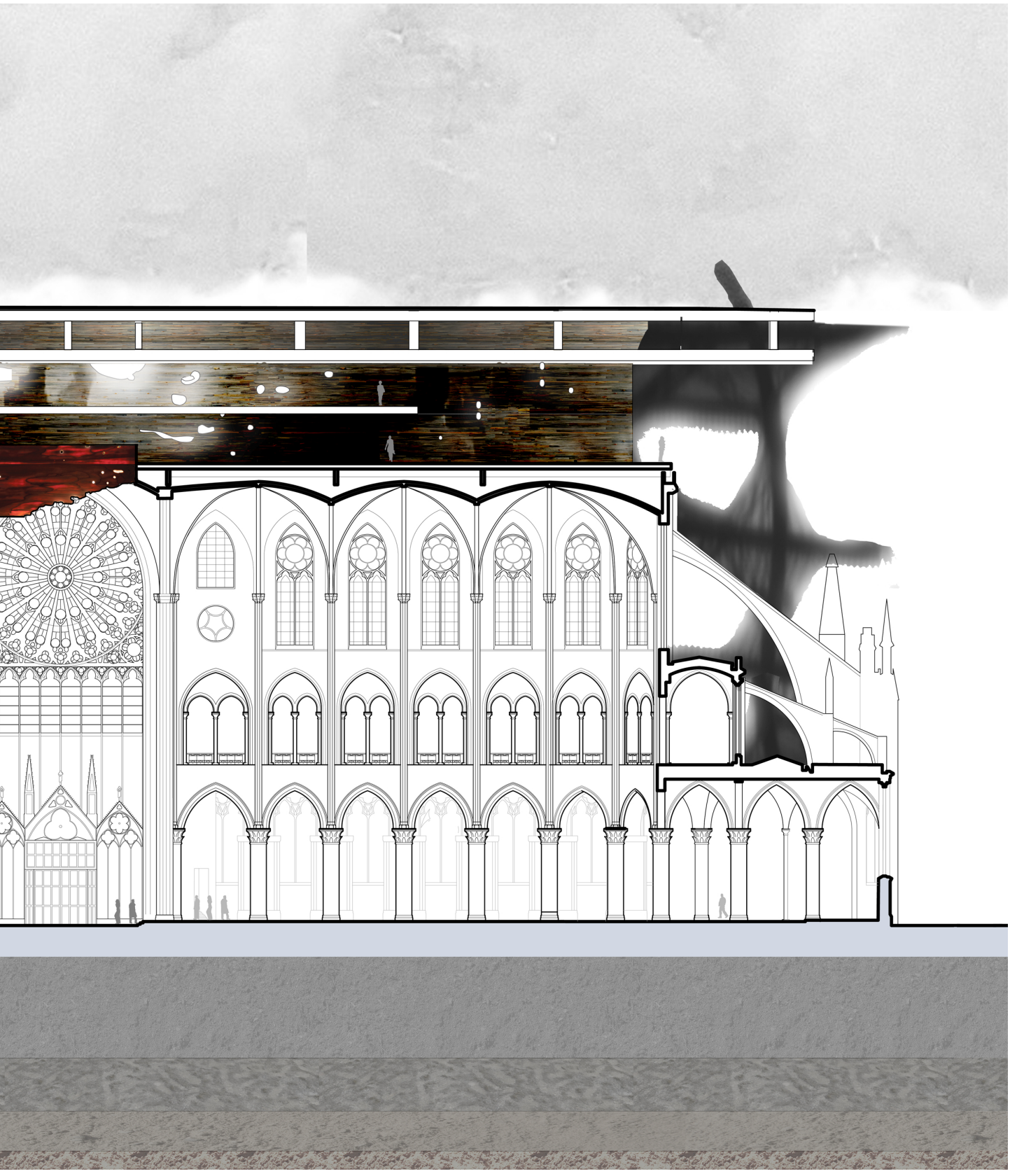
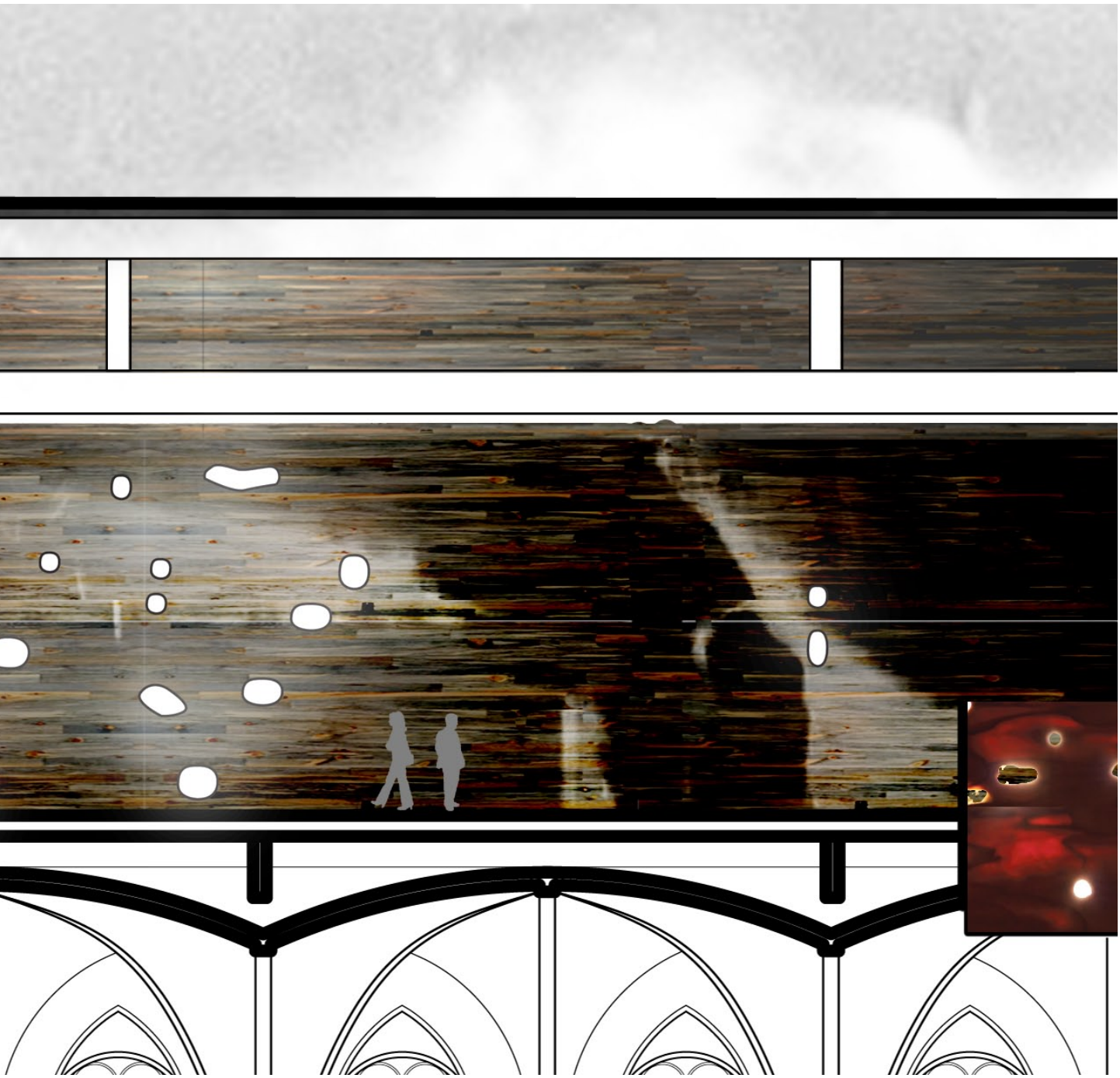


Figure 4.25 - Close up section 1



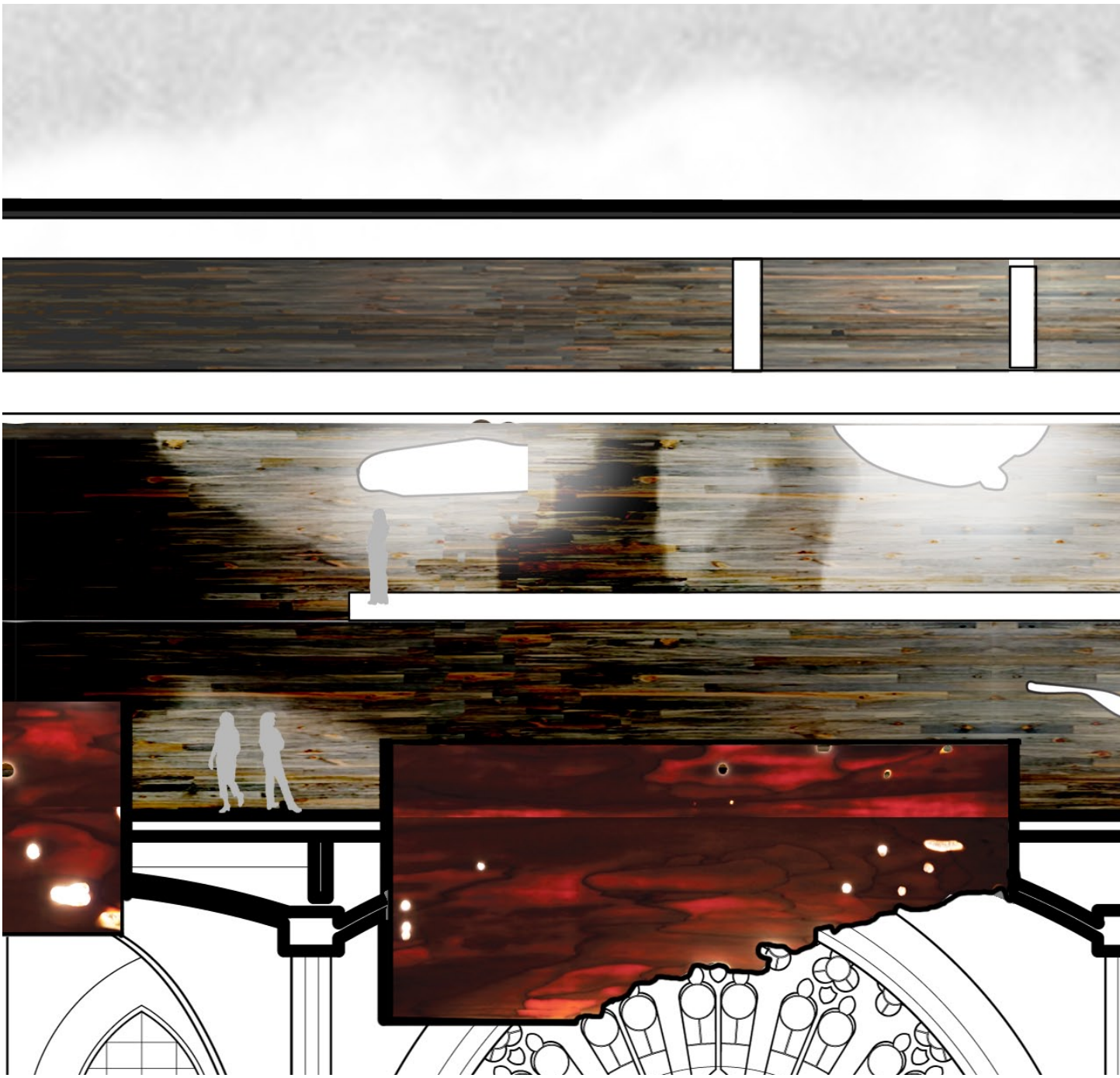
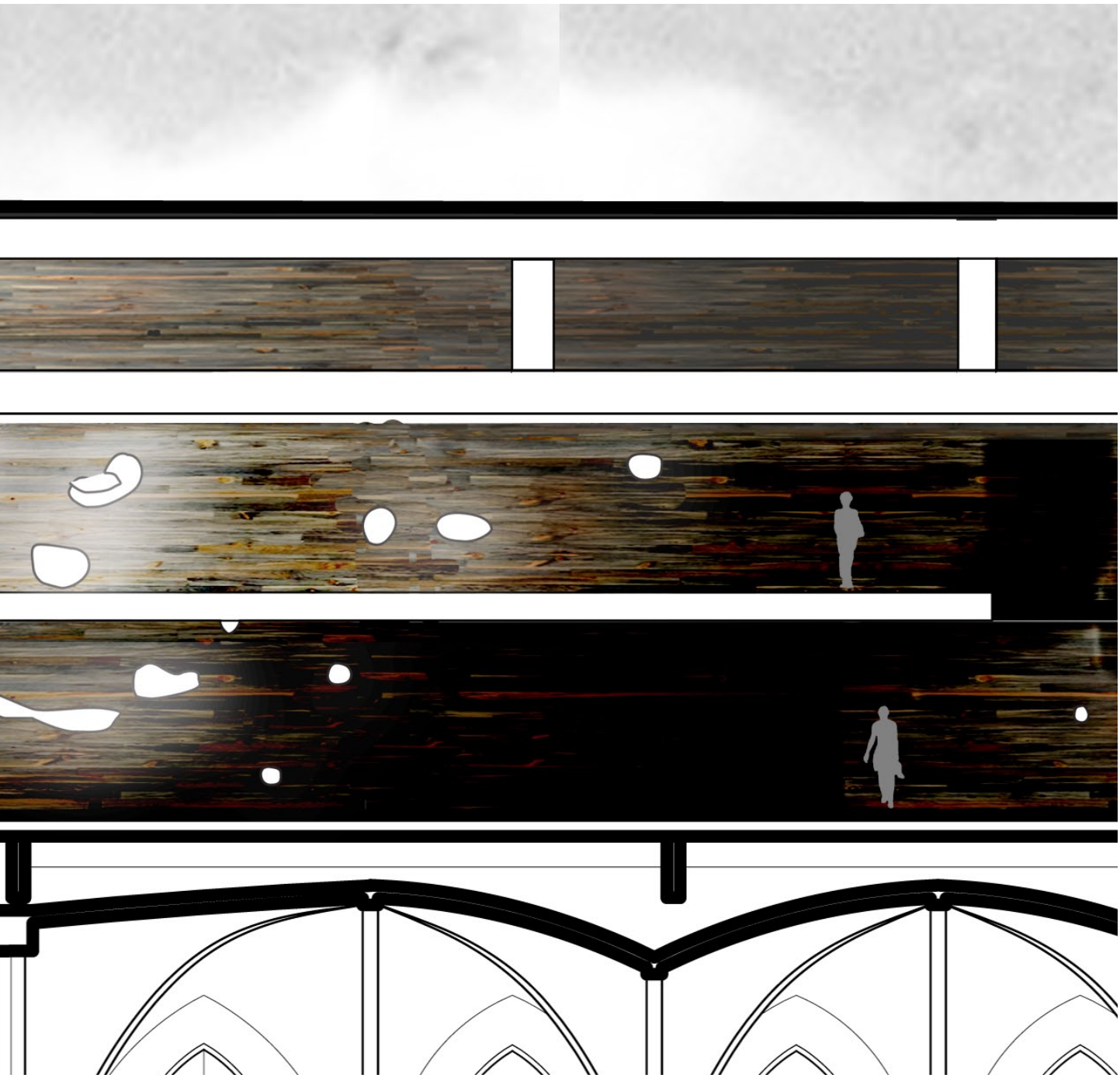


Figure 4.26 - Close up section 2



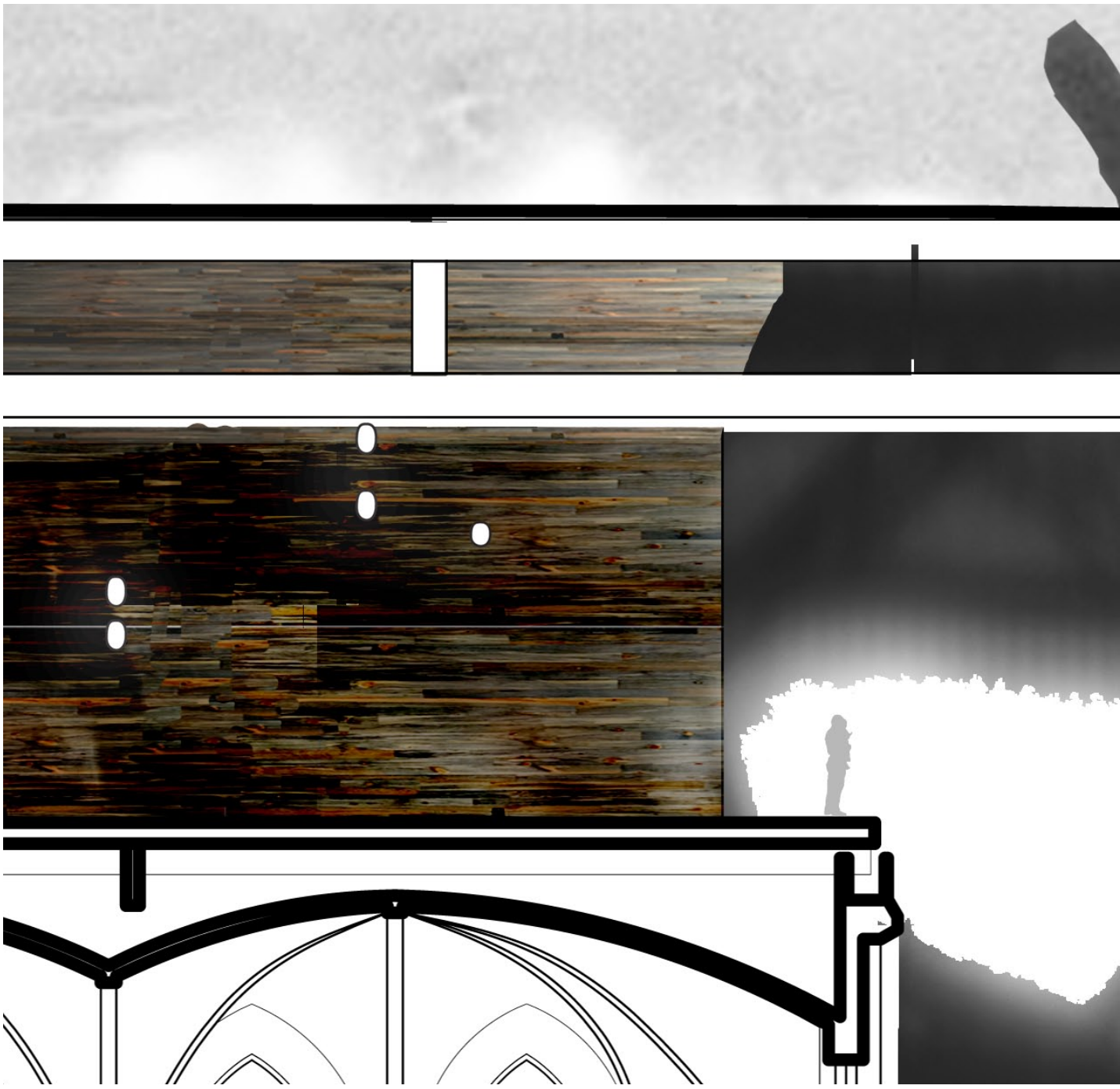
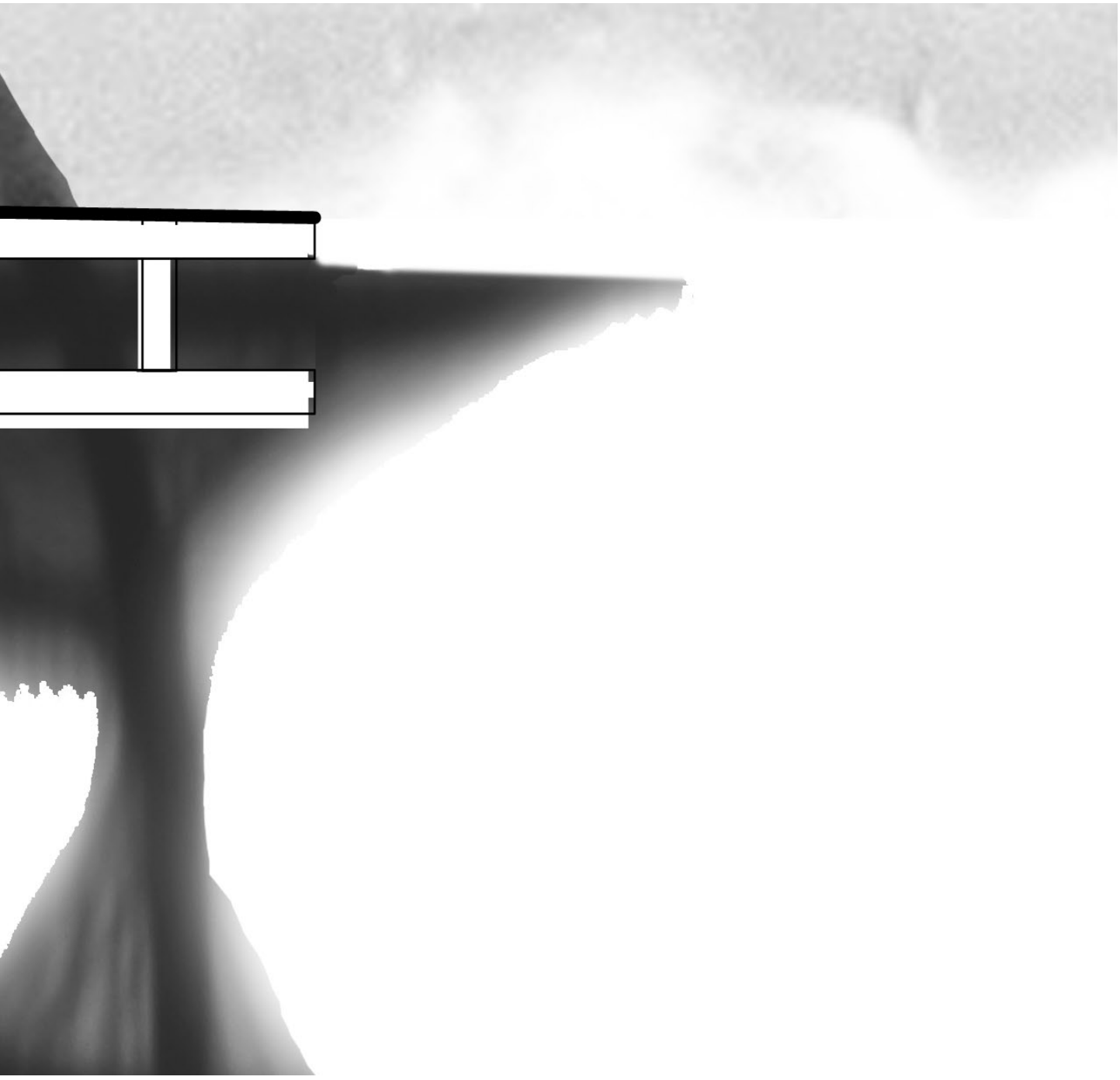


Figure 4.27 - Close up section 3



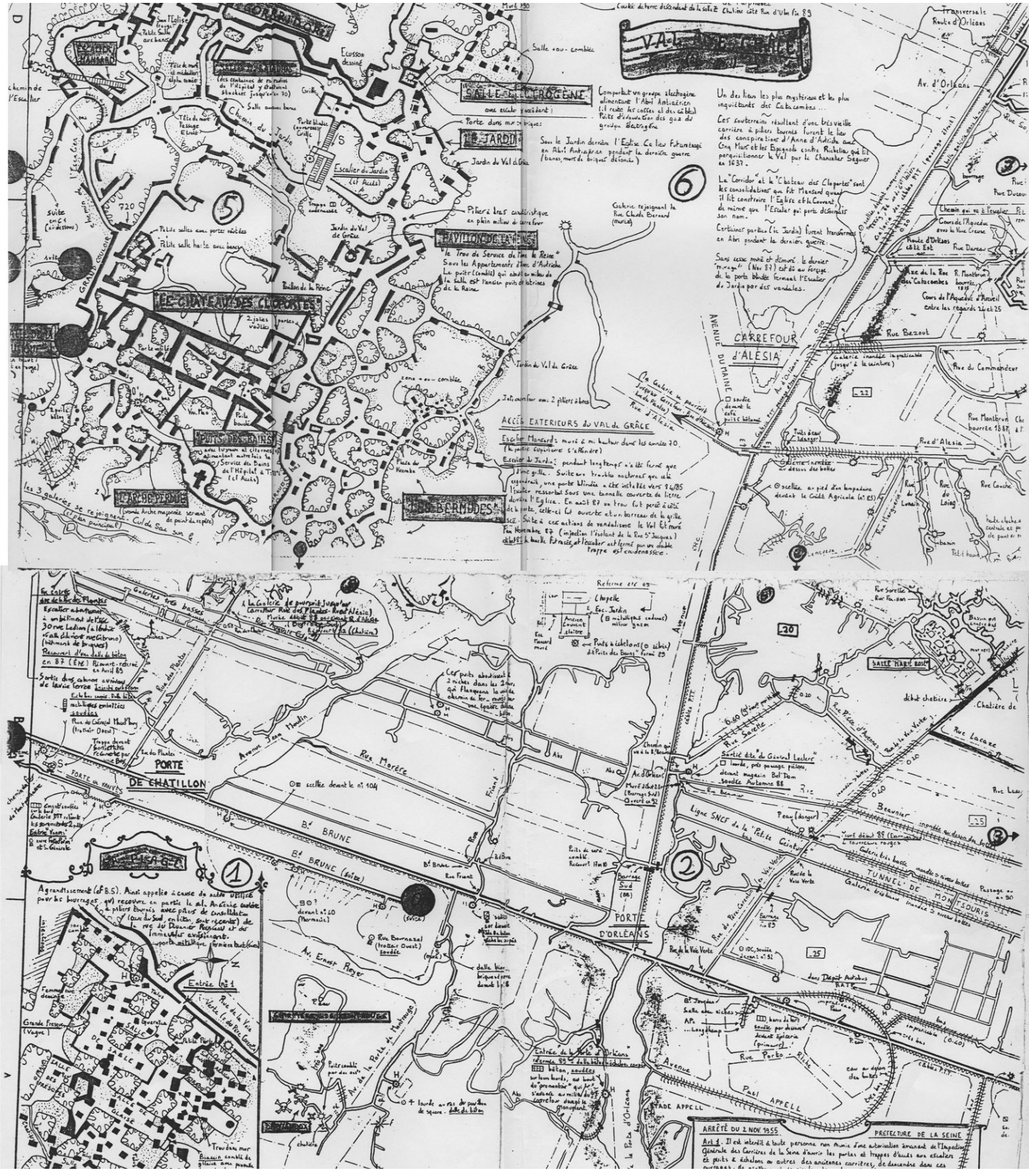
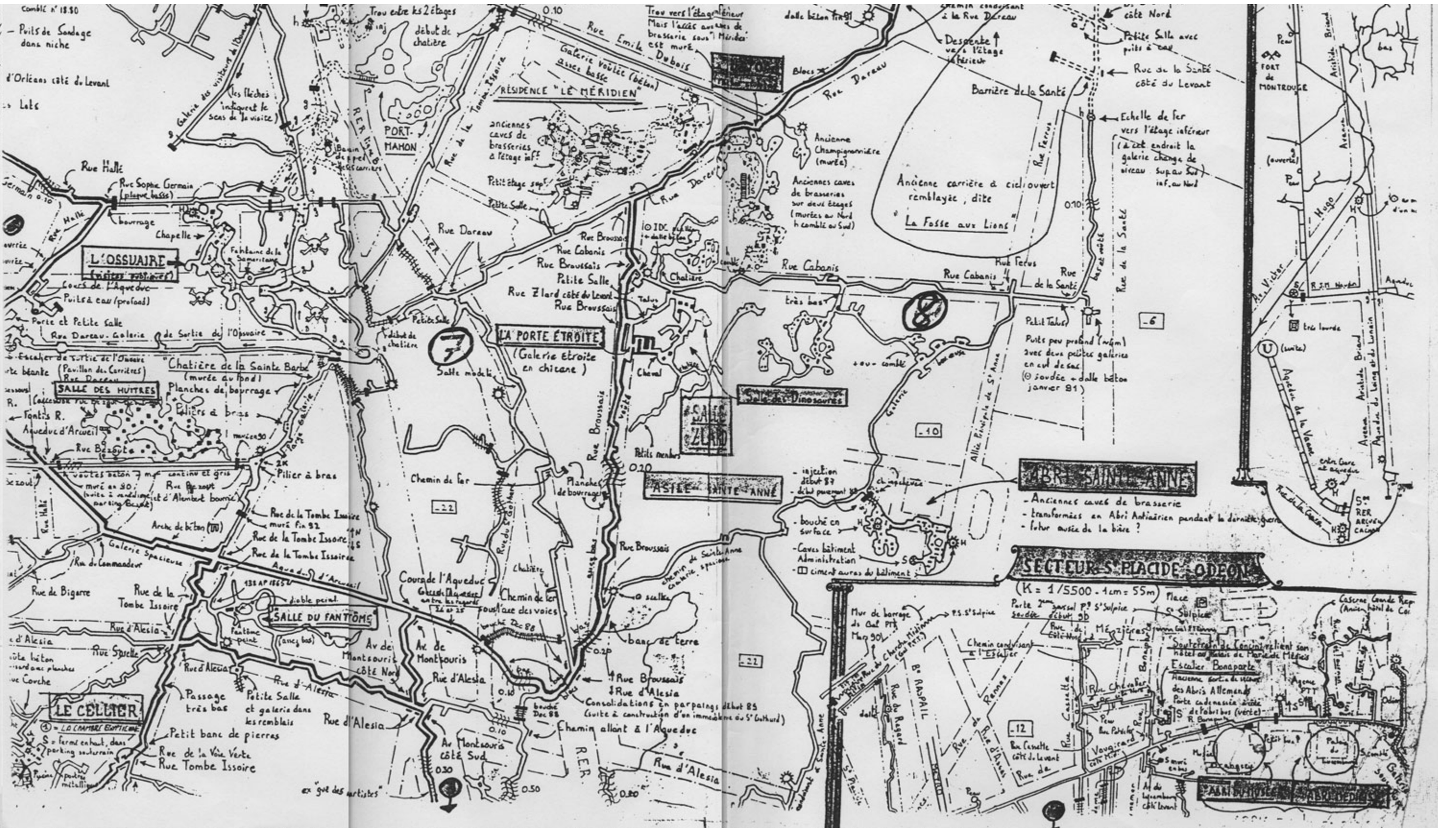
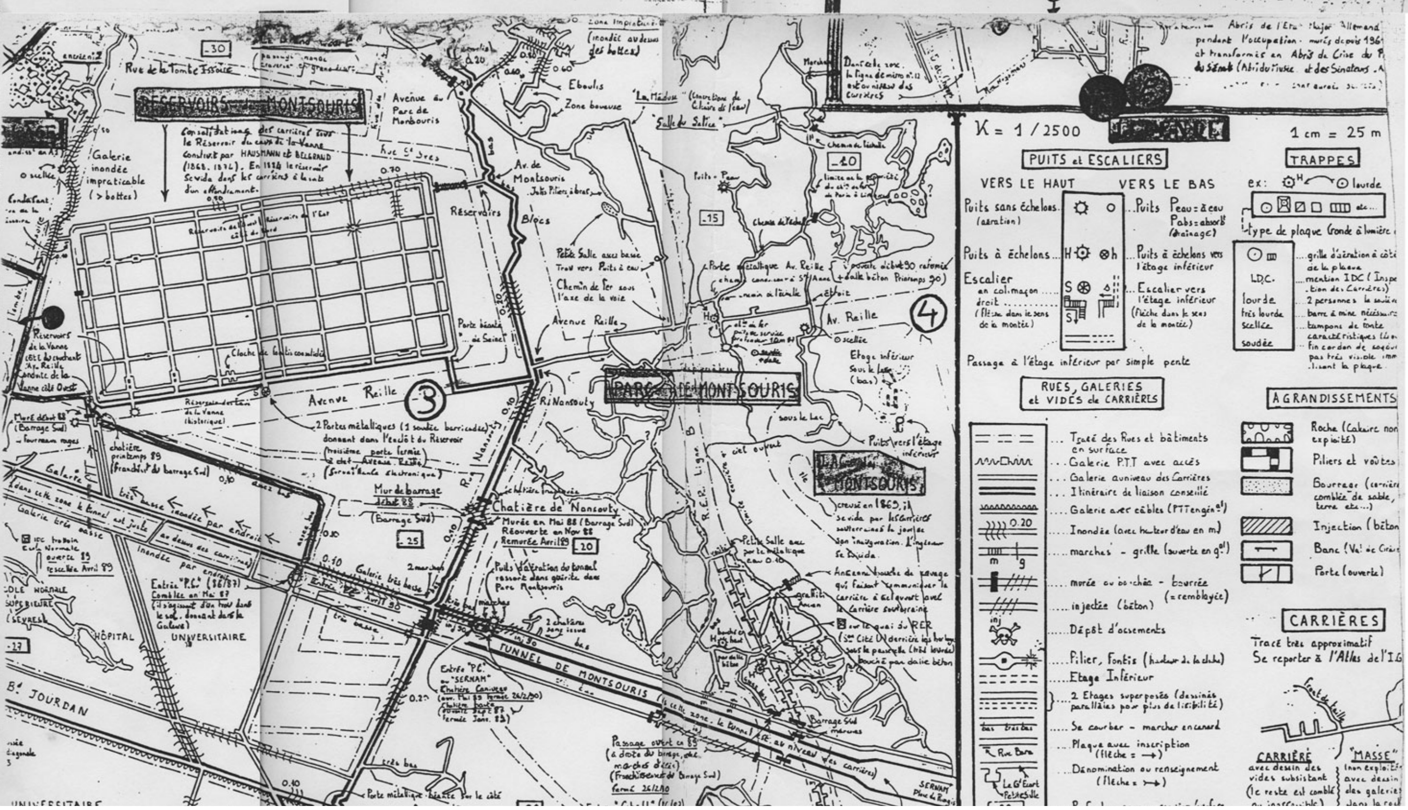


Figure 5.1 - **Unknown urban explorer's hand drawn map**



Puits de Sondage dans niche
d'Orléans côté du Levant
Trou entre les 2 étages
début de chatière
RÉSIDENCE "LE MÉRIDIEN"
Galerie voûtée (bâtie) assez basse
Rue Emile Dubois
PORT MAHON
anciennes caves de brasseries à l'étage inf.
Ancienne Champignonnière (murée)
Rue Dareau
Barrière de la Santé
Rue de la Santé côté du Levant
Echelle de fer vers l'étage inférieur
Ancienne carrière à ciel ouvert remblayée, dite
La Fosse aux Lions
Rue Hallé
Rue Sophie Germain
Chapelle
L'OSSUAIRE
Rue Dareau
Rue Broussais
Rue Cabanis
Rue Broussais
Petite Salle
Rue Cabanis
Rue Ferrus
Rue de la Santé
Porte et Petite salle
Chatière de la Sainte Barbe (murée au fond)
SALLE DES HUITRES
Planches de barrage
Piliers à bras
Aqueduc d'Arcueil
Rue Bezout
LA PORTE ETROITE
(Galerie étroite en chicane)
Salle des Dinosaures
Puits peu profond
ABRI SAINTE-ANNE
- Anciennes caves de brasserie
- transformées en Abri Antiaérien pendant la dernière guerre
- futur musée de la bière ?
Pilier à bras
Chemin de fer
Planches de barrage
ASILE SAINTE ANNE
Rue de la Tombe Issoire
Rue du Commandeur
Rue de Bigorre
Rue de la Tombe Issoire
SALLE DU FANTÔME
Av de Montsouris côté Nord
Av. de Montsouris
Rue d'Alesia
Rue Broussais
Rue d'Alesia
bancs de terre
SECTEUR ST PLACIDE - ODEON
(K = 1/5500 - 1cm = 55m)
Chemin allant à l'Aqueduc
Av Montsouris côté Sud
LE CELLIER
Petit banc de pierres
Rue de la Voie Verte
Rue Tombe Issoire
Petite Salle et galerie dans les remblais
Passage très bas
Escalier Bonaparte
Bd RASPAIL
Rue de Rennes
Rue d'Alesia
R.E.R.



Rue de la Tombe Issoire
RÉSERVOIRS DE MONTSOURIS
Avenue du Parc de Montsouris
Eboulis
Zone boueuse
Salle de Satrie
Galerie inondée impraticable (> bottes)
Consolidations des carrières sous le Réservoir de la Vanne construit par HAUSSMANN et BELGRAND (1868-1874). En 1934 le réservoir servait dans les carrières à la suite d'un effondrement.
Av. de Montsouris
Réservoirs
Blocs
Petite Salle assez basse
Chemin de Fer sous l'axe de la voie
Avenue Reille
Av. Reille
Avenue Reille
PARC DE MONTSOURIS
Chatière de Nansouty
Murée en Mai 88 (Barrage Sud)
Réouverte en Nov 88
Remurée Avril 89
Mur de barrage
Puits vers l'étage inférieur
LAC DE MONTSOURIS
creusé en 1869, il servait par les carrières souterraines le jour de son inauguration. L'ingénieur se suicida.
TUNNEL DE MONTSOURIS
HÔPITAL UNIVERSITAIRE
Bd JOURDAN
K = 1 / 2500
1 cm = 25 m
PUITS et ESCALIERS
VERS LE HAUT
VERS LE BAS
Puits sans échelons (aération)
Puits Peau = à eau, Pabs = absorb. (drainage)
Puits à échelons
Puits à échelons vers l'étage inférieur
Escalier en colimaçon, droit (flèche dans le sens de la montée)
Escalier vers l'étage inférieur (flèche dans le sens de la montée)
Passage à l'étage inférieur par simple pente
TRAPPES
ex: lourde
type de plaque (ronde à lumière ...)
RUES, GALERIES et VIDES de CARRIÈRES
Tracé des Rues et bâtiments en surface
Galerie P.T.T avec accès
Galerie au niveau des Carrières
Itinéraire de liaison conseillé
Galerie avec câbles (PTT en gén.)
Inondée (avec hauteur d'eau en m)
marches - grille (ouverte en g.)
murée ou ss-chât. - bourrée (= remblayée)
injectée (béton)
Dépôt d'ossements
Pilier, Fontis
Etage Inférieur
2 Etages superposés (dessinés parallèles pour plus de lisibilité)
Se courber - marcher en canard
Plaque avec inscription (flèche = →)
Dénomination ou renseignement (flèche = →)
AGRANDISSEMENTS
Roche (Calcaire non exploité)
Piliers et voûtes
Bourrage
Injection (béton)
Banc
Porte (ouverte)
CARRIÈRES
Tracé très approximatif
Se reporter à l'Atlas de l'I.G.
CARRIÈRE avec dessin des vides subsistant
"MASSE"

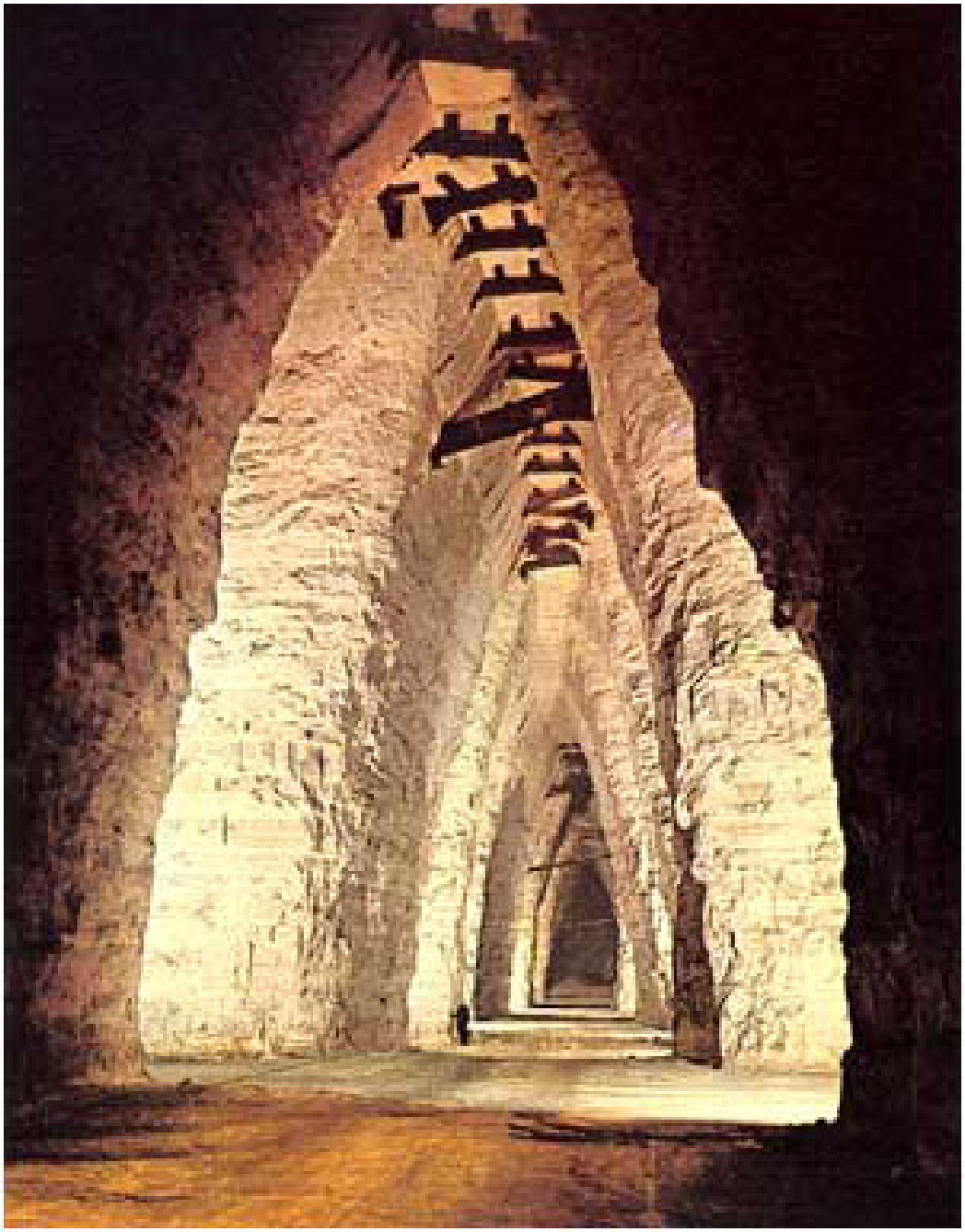


***Figure 5.2* - Gypsum Quary below Paris -** The Cover Image of 'Histoire secrète du Paris souterrain'

BURROWS BELOW PARIS

On the Digging that Made the City of Light and Chthonic Materials

The catacombs of Paris exist due to the vast mining and excavation operations which took place in the hills around the city. To the south, deposits of Lutetian lime stone (Lutetia being an ancient name for the city of Paris) were used extensively in Parisian construction.[1] The original Roman settlement was located on the south bank of the Seine but eventually migrated to Île de la Cité, that then became the heart of medieval Paris. Around the 12th century, when construction of Notre dame itself began, the demand for this stone increased immensely. Paris grew and eventually its mines were covered over but the hollows burrowed into the earth remained. Mineshafts that could no longer hold the weight of the growing city above became an issue and collapses became common. Large blocks of the city were under threat of being consumed by the source of the material that made it. In the 18th century, Louis XIV commissioned his architect Charles Axel Guillaumot to shore up the city's foundations.[2] His plan progressively reinforced the old mines and hollows, creating the catacombs we know today.

It eventually became the ossuary for Paris's overflowing, and soon to be relocated, cemeteries.[3] Often the catacombs follow the road map of Paris quite closely as foundations were placed below the thoroughfares. The system set up by Guiliumot is still visible because of the numbers carved into some of the catacomb's stone supports. It is difficult for anyone other than urban explorers to see this in person as most of this underground network is illegal to enter. This history of collapses continued even into the 1970's[4] when there were collapses over the gypsum mines that were to the north of the city.

Guiliumot died in 1807 and eventually his bones would be put to rest in the ossuary that he made from the mines below the city. It is somewhat disturbing to think that the eventual relationship between the stone below the city and the city itself was partially an exchange; for the sake of the limestone below the ground Paris would eventually fill that burrow with the bones of those who resided in the city. Like the larger impact of the simple trails that the beetles leave as they dig, our literal digging leaves long trails as well.

In beginning this research I started from a point where I was hoping to find a creature that I could follow as a sort of totem in the vein of Anna Tsing's 'Mushroom at the End of the World'; something that could serve as a seed crystal in producing things with form that could be experienced as and interact with architectural language.

At first this seemed like a difficult task to find this starting point but after deciding on my beetle totem, I think I was mistaken. I wasn't heeding the Le Guin carrier bag and I had been looking for a particular heroic creature to replace people in my narrative.

SF stories like Frank Herbert's 'Dune' and Hayao Miyazaki's 'Nausicaa of the Valley of the Wind' were probably my introduction into fictional media looking at the entangled nature of human interaction with the environment. Both are excellent science fiction works even with their problems.

Dune is steeped in problematic ideas regarding humanity's genetic

heritage, and Miyazaki for all the layered complexity of his toxic post-apocalypse in ‘Nausicaa’ still resorts to endings where nature will benevolently reorder the world if you let it. Despite these issues, the complexity of the world within these stories elevates them. These stories become a kind of image that may be used as a scaffold whereby the reader might begin to develop an understanding of formless and abstract environmental concepts.

This is the function of many of my creations in this book, using the beetle and its digging as a focus to return to during this process. A way of having a focus in a story that, by nature of its structure, is unable to have a single end, and from that producing artifacts and images that might be a starting point to discuss this in space and form.

I had not thought of the catacombs below Paris as much beyond an exciting curiosity but now they seem to me less the story of Guilimot and his rescue of Paris but a tale out of Reza Negarestani’s ‘Cyclonopedia.’ In this case replacing the machinations of oil[5] with the demands of limestone. It seems suitably chthonic that a deal is made with underworld things for their boons. I would add these woodboring beetles and their underworld made of wood to this list of chthonic materials. Hopefully they are kinder deal makers than Hades, since we have already paid for their services in carbon.

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