SuperFun Site

Mining for Play in the Anthropocene

by Maya Taketani

Bachelor of Arts in Architecture, University of California, Berkeley, 2010

Submitted to the Department of Architecture in Partial Fulfillment of the Requirements for the Degree of Master of Architecture at the Massachusetts Institute of Technology, February 2015

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Abstract:

Today we live in a new geological era, the Anthropocene, where human intervention has taken over the entire globe. This accelerating manipulation of the landscape means that the divide between the bucolic and the manmade is going to dissolve. In 20 years, children will be the ones inheriting this condition that they cannot ignore.

However, industrialized societies are still over-protective and paranoid about what children experience. They are shielded away from anything adults perceive as dangerous or polluted. Instead, children are only allowed to have an idealized version of play, which exists in mass-produced plastic playgrounds and in cyberspace. These are just the byproducts of industry, and they disengage children from the more fundamental way the world is changing.

This thesis proposes to bring the realities of our world — its manufactured and manipulated landscapes — into view, and to accept this as the world that we have to face in the future. This landscape is not a marginalized region in the outskirts of the city that we cannot see, but is a new type of Theme Park, that people can play in.

This Park, although it seems dangerous and uncomfortable, brings people together through its playful character. Children are the ones who initially find the place as an attraction, then the adults follow. This project faces the realities of the world today, but at the same time is optimistic about the future.

Thesis Supervisor: Joel Lamere
Title: Assistant Professor of Architecture

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Acknowledgements

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Many thanks to Paul Coyle of the National Mine Map Repository, Ted Duaime of the Montana Bureau of Mines and Geology, Pat Riordan, and Tom Malloy from Butte Silver-Bow, for helping me gather data about Butte's mining history as well as for giving me access to valuable information.

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To Ryan, thank you for listening to me talk about thesis everyday, always being patient, and making me laugh. You are the best.

To my family, thank you for showing me what's important and for all the support.

A Tale of the Great Plains in the 1930s

Fig 1: Collage of Dust Bowl

Vulnerable Children

Playing in the Sand

The Great Plow Up: "Rain follows the plow" was a popular slogan in climatology that people believed in order to cultivate the Great Plains in the 1930s in America. People believed that human settlement and agriculture would permanently change the arid regions of the American west to a more humid climate even though today, we know that this belief is completely false. In the 1920s, agriculture was industrialized and as a result, powerful gasoline tractors helped work the field all night long. Yet this poor land cultivation method led the the dust to lift up from the ground, leading to a series of dust storms, followed by years of drought, now understood as one of the worst man-made ecological disasters in history.

The Dust Bowl: The dust storms grew more frequent, violent, and larger each year, sweeping and covering through the Great Plains. Houses were covered with sand, and the dust storms kept coming back again and again, when farmers believed it was finally over. Not only dusts but farmers were attacked by plagues of jackrabbits as well as grasshoppers that destroyed the field and anything that remained after the dust storm swept through the Great Plains. This was a definitely a catastrophic, dangerous, dirty, and tough time for people living in the Great Plains.

Vulnerable Children: Children suffered especially because of their fragility, especially from an often fatal disease called "dust pneumonia," a form of respiratory disorder as a result of excessive exposure to dust.

Playing in the Sand: But despite their vulnerability, children still walked with their own feet, helped the family with the farm, and most importantly—even in this catastrophic environment—used their imagination, stayed resilient, and *learned how to play in the sand.*

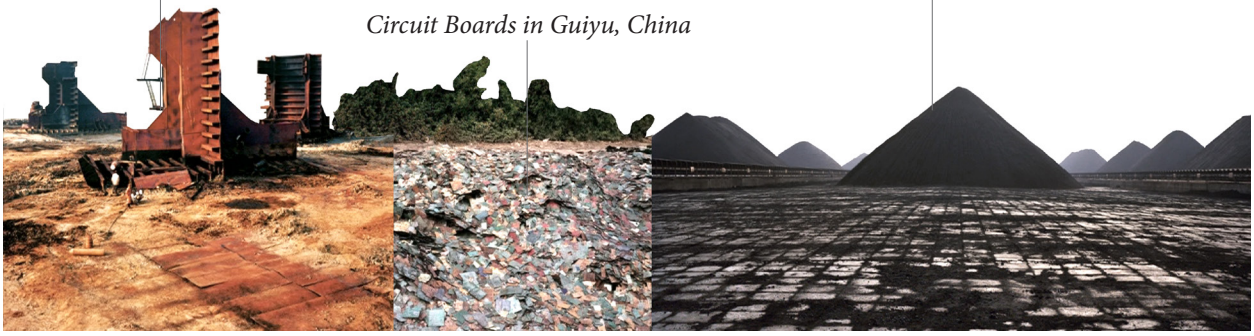
A History of the Anthropocene

Fig 2: Collage from the film, Manufactured Landscapes (2006)

Shipbreaking in Chittagong, Bangladesh

Circuit Boards in Guiyu, China

Bao Steel in Shanghai, China



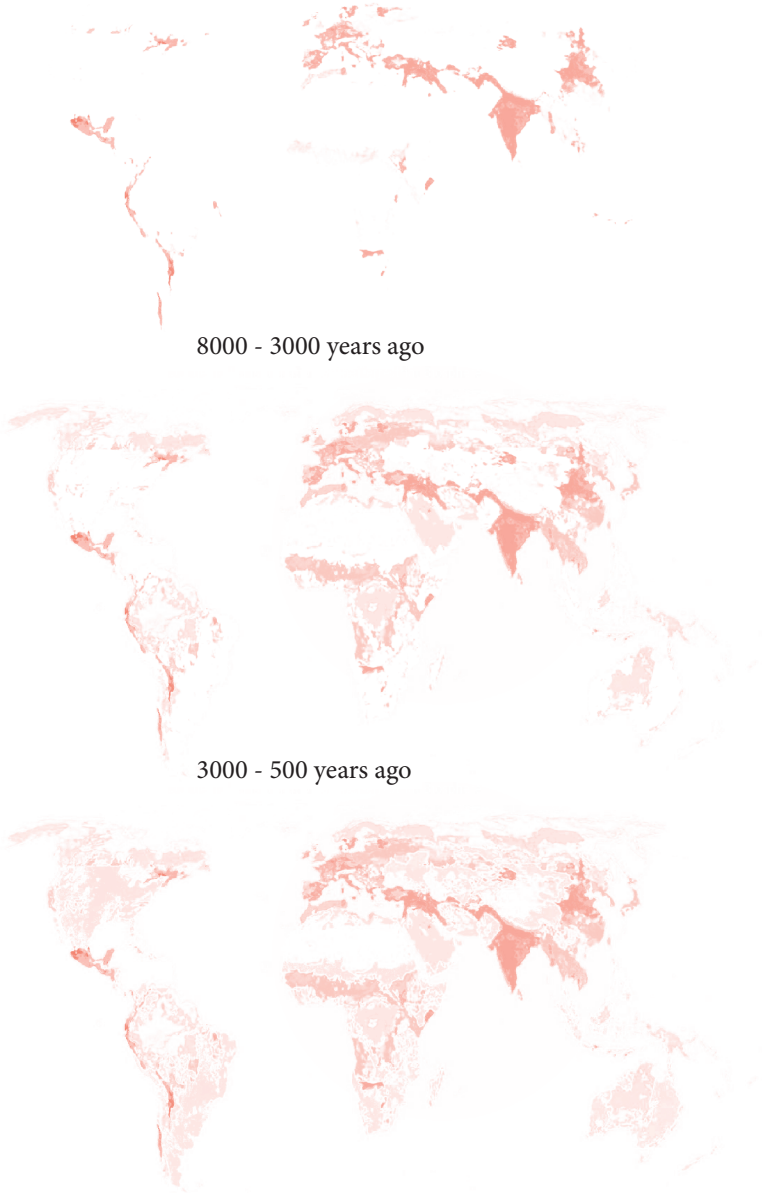


Fig 3: Increase of human intervention on the globe from 8000 years ago to present

Today we live in a new geological era, the Anthropocene, where human intervention has taken over the entire globe. The world map above shows the increase of human manipulation of the earth from 8000 - 3000 years ago, 3000 - 500 years ago, and 500 years ago to present.

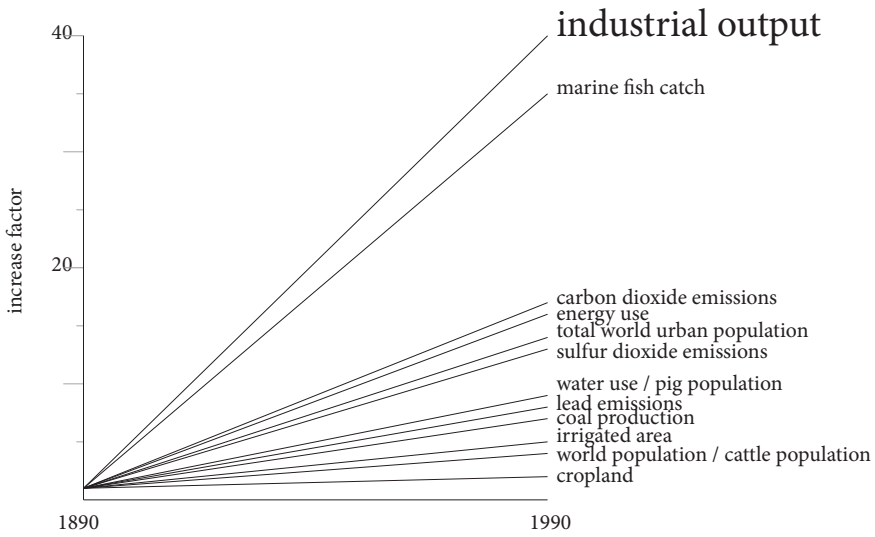


Fig 4: Partial record of the growth and impacts of human activities during the 20th century

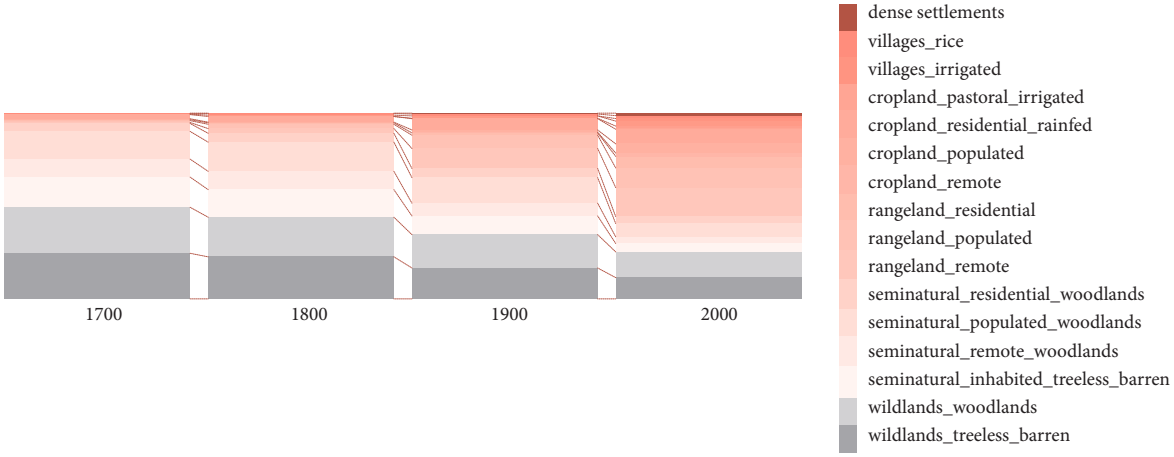
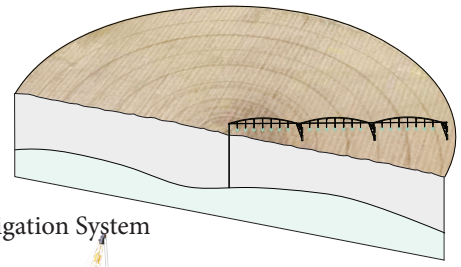
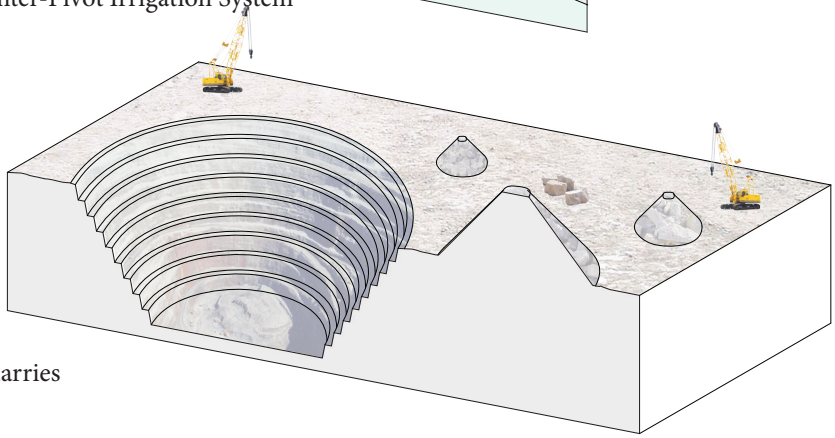


Fig 5: Decrease of landuse, increase of human habitation on global land (ice-free area)

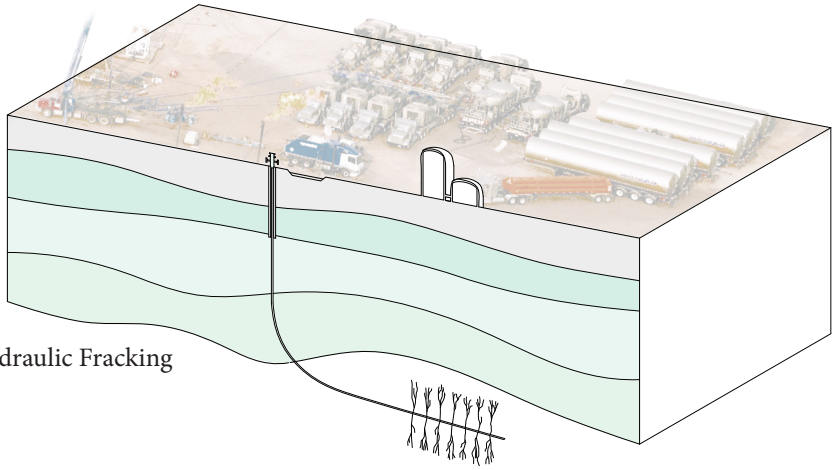
The first graph above shows that industrial output had the greatest increase factor from 1890 - 1990 in terms of the increase of human intervention. The second graph shows that from 1700 - 2000, there is a decrease in wildlands (gray), but an increase in dense settlements (red) as well as manipulated landscapes for human habitation, such as villages and croplands that are irrigated.



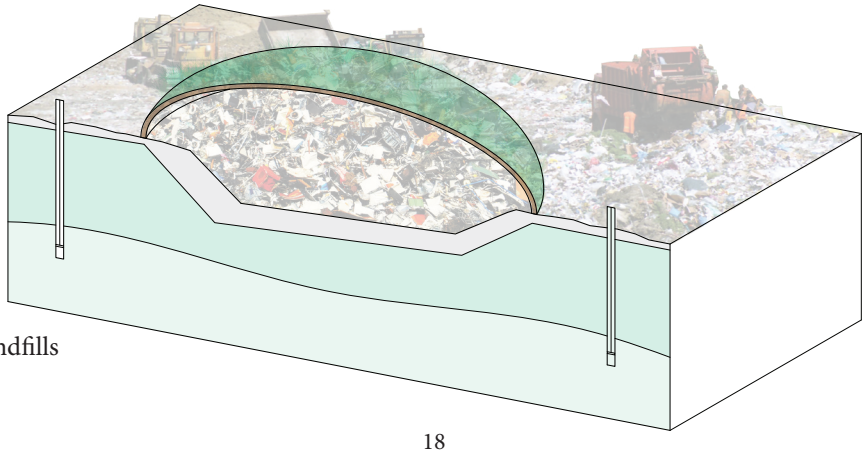
Center-Pivot Irrigation System



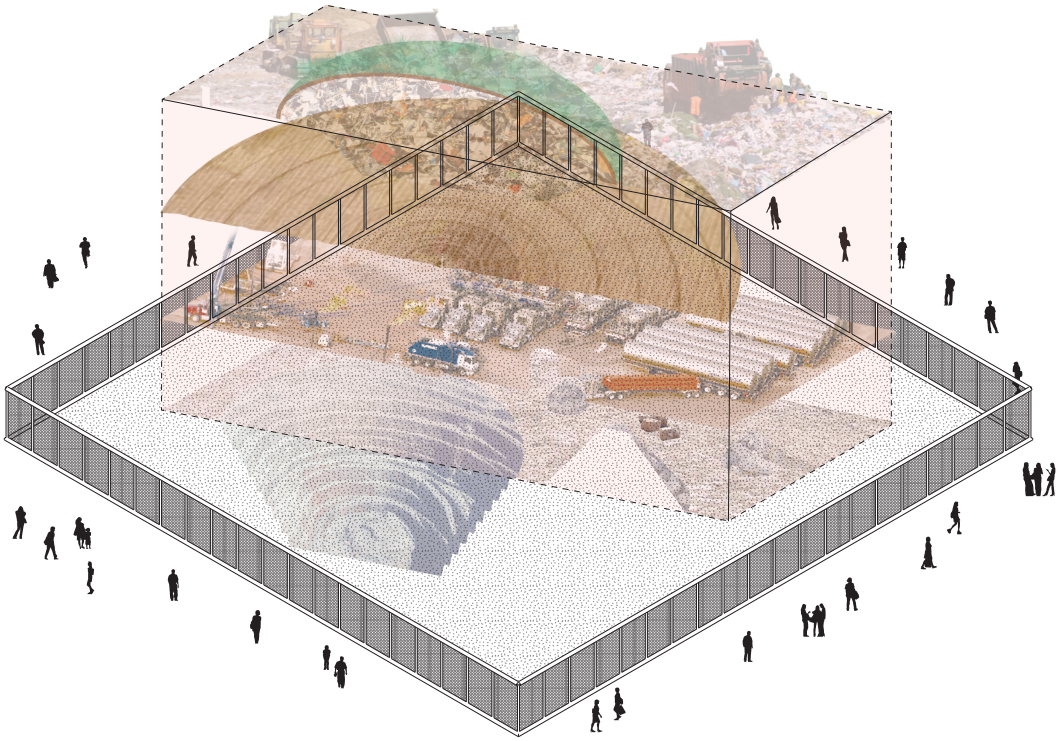
Quarries



Hydraulic Fracking



Landfills



Overlay of the various manipulated landscapes and our disengagement from them

We now have the technology and the machines to manipulate our landscape at a very large scale. Examples of these landscapes are shown in the film, *Manufactured Landscapes*, from the photographs of Edward Burtynsky. Moreover diagrammed here are the center-pivot irrigation system that creates giant circular landscapes in the arid regions of the world, the quarries that create a giant void in the land to extract minerals, a more recent technology of hydraulic fracking that fractures the earth, and finally the landfills that keep growing everyday as a result of our enormous amount of consumption. These are all examples of the manipulated landscapes that we have created.

This accelerating manipulation of the landscape means that the divide between the bucolic and the manmade is going to dissolve. Yet today, we believe that this type of landscape only exist in the outskirts of the city that people do not have to engage with. We are disengaged from the landscape that we have created. In 20 years our children will be the ones inheriting this condition that they cannot ignore.

A Catalogue of Play and Playgrounds

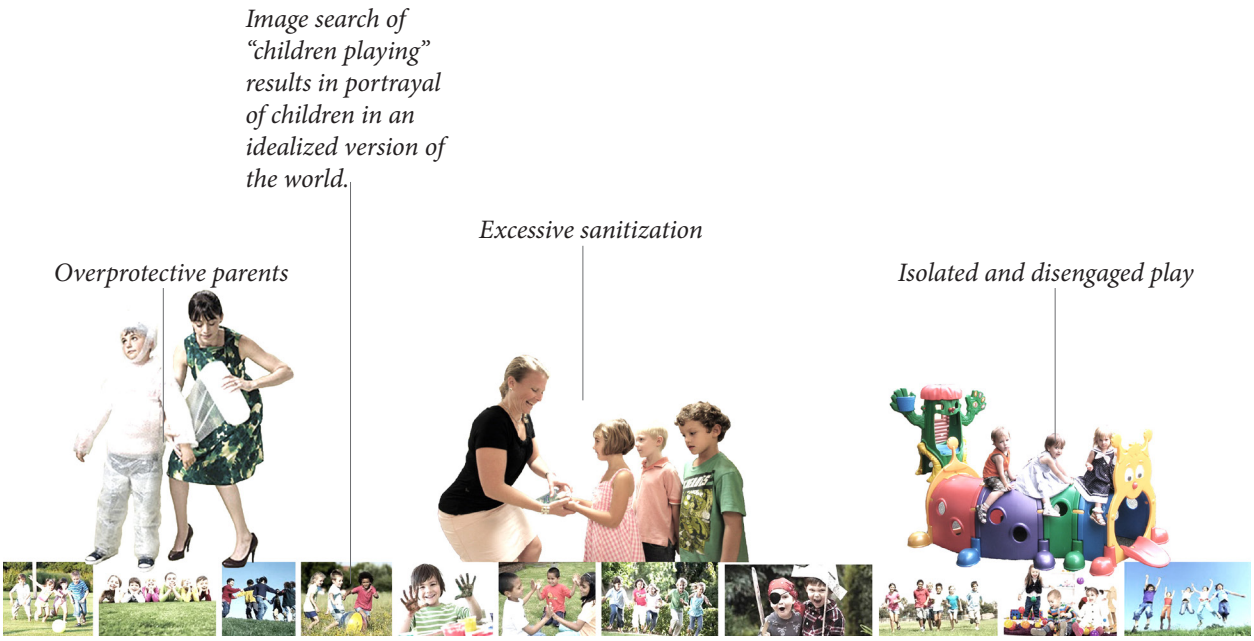


Fig 6: Conceptual Collage of how children in industrialized society are disengaged from the world, leading to playing in plastic playgrounds and cyberspace.

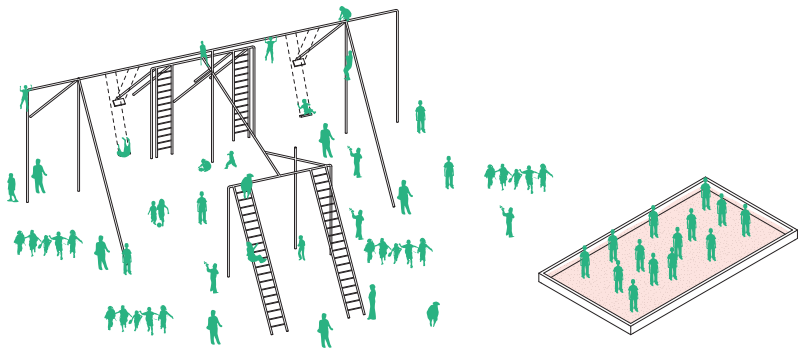
Even though in 20 years, our children will be inheriting the condition of this accelerating manipulation of the world, industrialized societies are still over-protective and paranoid about what children experience. Children are shielded away from whatever adults perceive as dangerous. Instead, children are only allowed to have an idealized version of play, which exists in mass-produced plastic playgrounds and in cyberspace. These are just the byproducts of industry, and they disengage children from the more fundamental way the world is changing.

Plastic interior playgrounds

Children disengaged from milieu

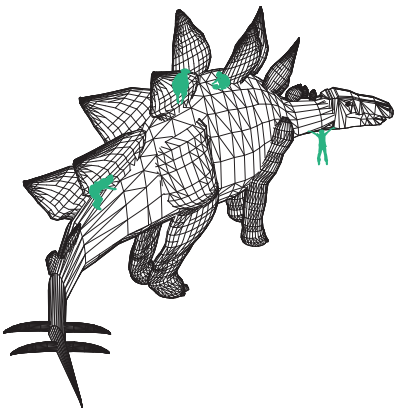
Children experience the world only through wearable technology?

1. Outdoor Gymnasiums



2. Network Playgrounds

3. Novelty Playgrounds



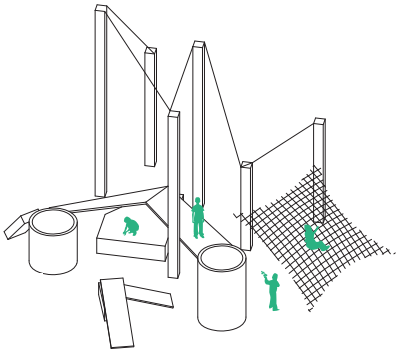
1. Outdoor Gymnasiums are often thought of as the first playgrounds which were developed in Germany in the 19th Century. They were designed to raise strong children as part of a larger goal to develop healthy and happy citizens. They were often criticized for being extremely dangerous as some of the play structures were 10 - 20 feet high, with moving objects such as swings that hung from them. The ground were still hard surfaces, and the playground, as well as the initial sandpits that were developed around the same time, were often very crowded.

2. Aldo Van Eyck designed many small playgrounds that were part of the city-wide project for post-war Amsterdam. These small playgrounds became pocket parks that used vacant lots that were often destroyed from the war as public space for both children and adults. He designed more than 100 playgrounds throughout the city which together became one network playground that engages children in their immediate neighborhood throughout Amsterdam.

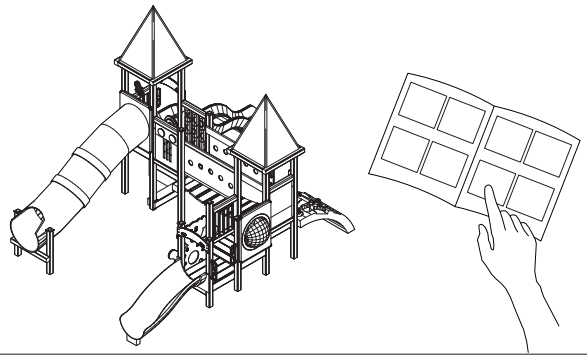
3. Novelty Playgrounds were developed in an effort to educate children about historic events. Here is an example of a dinosaur which children may raise curiosity by climbing on them, and around the same time, there were playgrounds that looked like rockets which refer to many of the space explorations that took place at that time. Therefore, many playgrounds also have a pedagogical aspect.

A Critique: Playgrounds, in reality, have had various levels of engagement with their immediate milieu. For example, 19th-century playgrounds were built specifically to make children exercise, because people believed that this would bring them happiness. Furthermore, Aldo van Eyck reconstructed destroyed lots in postwar Amsterdam into public playgrounds. Yet today, what is most valued is not the engagement of the children's milieu, but safety and perhaps cleanliness. Although the recent development of modular playgrounds seem to have potential in developing children's creativity, it still limits the children's world to the adult's idealized version that is clean and controlled. These playgrounds seem to understand children's play on the surface, yet it ignores children's fundamental ability to find creativity and play in their own immediate surroundings.

4. Adventure Playgrounds



5. Standardized Playgrounds



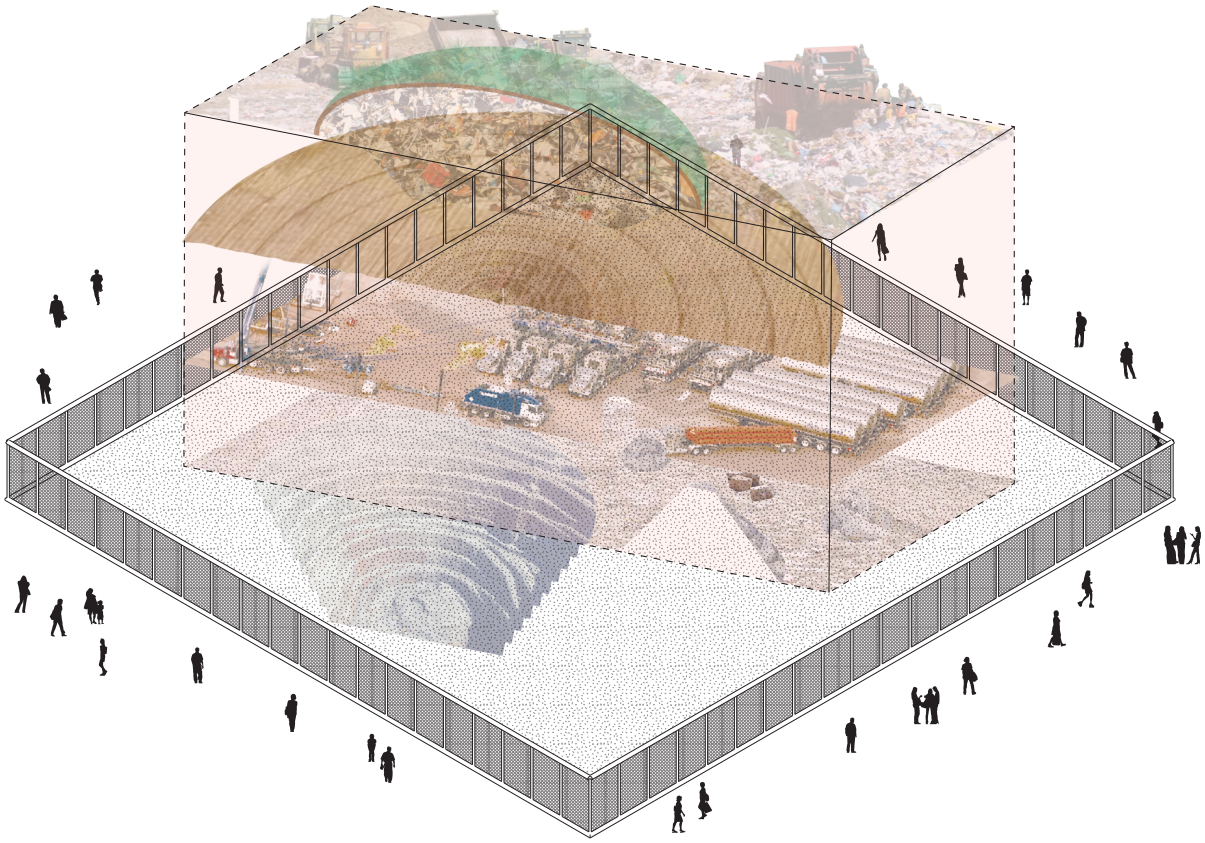
6. Mobile Playgrounds

Fig 7: Imagination Playground

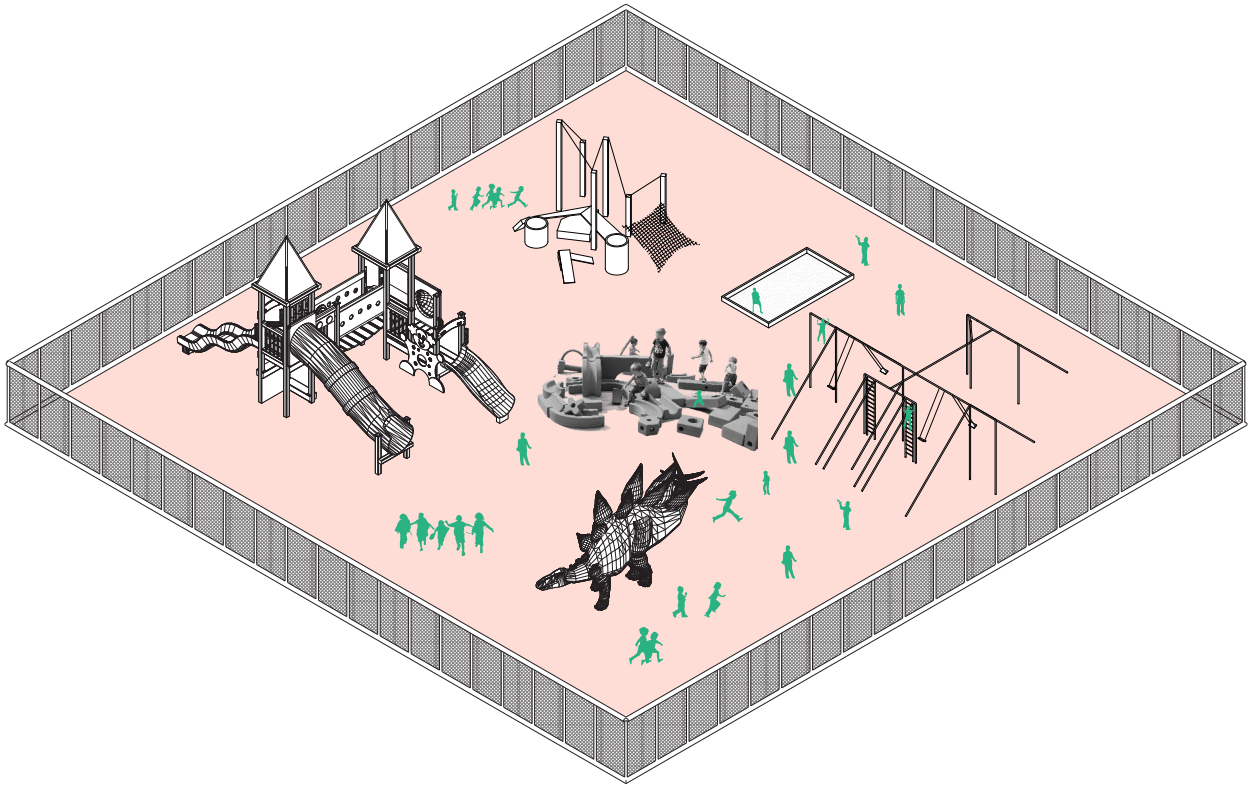
4. Adventure Playgrounds were developed to create obstacles that provide physical challenges and often used unfinished structures to foster imagination. These playgrounds were often surrounded by trees or in abandoned areas to create a hidden space just for children, although adult supervision were often required.

5. Standardized Playgrounds are the result of industrialized society, where mass-produced playgrounds can be directly ordered from a catalogue. These playgrounds often follow strict design standards because of safety issues, including have heigh restrictions as well as removing moving objects such as swings, and often closed-off by a fence. They are the most disengaged examples of all the playgrounds.

6. Mobile playgrounds are soft modular pieces that children can create any playground of their own from them. They are fairly large pieces, yet light enough for children to carry. Although the product's idea is to foster children's imagination, acting against the Standardized Playgrounds, their engagement to their immediate milieu seems to be lacking.



Here I'm proposing an actual engagement between play and what I call the manipulated landscape, in the context of the Anthropocene. Playgrounds and the industrialized landscape both are disengaged from society today.
As play is a fundamental element of creativity that requires engagement with the world, I am proposing a playground in what seems like an uncomfortable and dangerous site. The project faces the realities of the world today and



addresses the need for children to engage in their immediate surroundings, which might not be clean, controlled, and safe anymore. Yet, the project is also optimistic about the future, that people can still come together and learn how to play in this manipulated landscape that we have created.

A Mapping to the Present: Manipulated Landscape of Butte, Montana

Abundant supply of precious metals , gold, silver, and copper, gained the name, "The Richest Hill on Earth." -The city grew quickly and by 1890, was the largest city west of Mississippi, with 24,000 people.

The Pit grew in size, swallowing several communities surrounding it, including East Butte, McQueen, and Meaderville. They were given money from the ACR of $1,500 for their houses, which were built on the land leased from the company

Boom in the 1870s because of the discovery of valuable ore.

After the turn of the century, electricity was introduced, and a demand for copper increased as it is a key conductor.

1850 *1900* *1950*

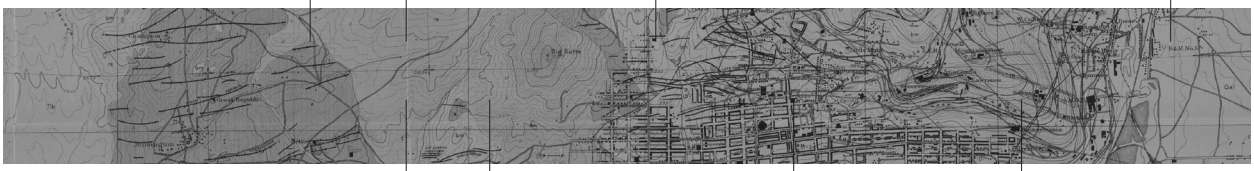


Fig 8: Historic Map of Butte

In 1881, Marcus Daly established Anaconda Copper Mine

By WWI, Butte's population grew to 50,000

From 1892 - 1903, the city kept growing and the Anaconda Copper Mine became the largest copper producing mine in the world.

In 1955, open-pit mining was introduced after long years of underground mining, the Berkeley Pit. The pit took advantage of the existing underground tunnel and drainage system. The pit was profitable from the start, producing 17,000 tons of copper per day.

1875 underground mining introduced

1955 open pit mining introduced

The Berkeley Pit water is highly acidic, containing metals like copper and zinc. Therefore, is designated as a federal Superfund Site.

In 1977, the mine was sold to Atlantic Richfield Company (ARCO), yet ARCO had little prior experience in hard rock mining; furthermore, copper prices collapsed soon after.

Montana Resources Group bought the property in 1986 and re-opened the Continental Pit after ARCO shut it down. The company employs around 346 people.

1979 *1985* *1995* *2000* *2008*

Fig 9: Water level rising in Berkeley Pit, due to ground water flowing in.

In 1982, the lack of profitablity forced ARCO to close off Berkeley Pit

When ARCO shut off the lights on the Anaconda mine operation in 1982, they also shut off the pumps. Groundwater began to slowly fill the mines and eventually filling the Berkeley pit.

1979 underground mining became inactive

present

Berkeley Pit (1955 - 1982)

Satellite image of Butte. Note the size of the Berkeley Pit in comparison to the city. Also note the surrounding Continental Pit that is currently active.

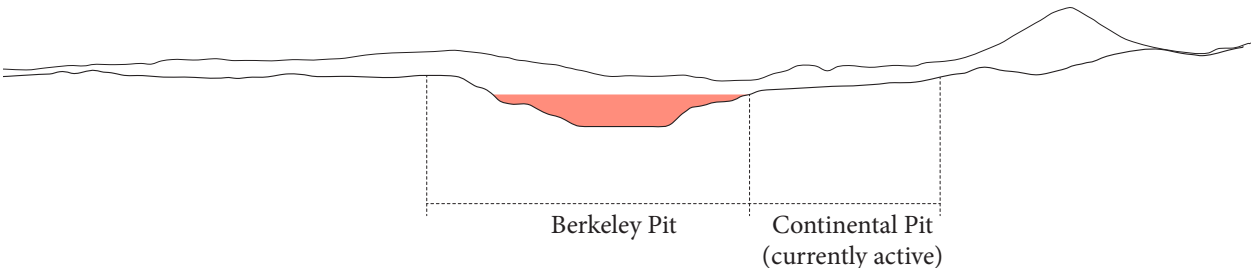
Fig 8: Mine Map of Butte from 1895 showing how expansive the underground mining was in Butte. The different colors represent the different minerals that were extracted.

Fig 10: The extremophiles that thrived in the Berkeley Pit

Fig 11: Pit Fog

Fig 12: Current view from viewing platform

Fig 13: Photograph showing the proximity of Berkeley Pit to the city



On the Manipulated Landscape of Butte:

As the history of the city shows, Butte is a great example of the Anthropocene landscape. From the scars of the underground mining to the current identity as a Superfund Site, Butte's identity revolves around the manipulated landscape. And this manipulation will continue to grow as seen by the local company, Montana Resources, who decided to re-open the open-pit mining process and keep digging for more metals and minerals even after Berkeley Pit has became a toxic tourist site.

Yet recently, not only miners but biologists have been attracted to the toxic lake, because of their discovery of new organisms that somehow thrived in the acidic environment. Furthermore, the Berkeley Pit is a site of a local phenomenon called "Pit Fog" which occurs when the temperature drastically drops from hot to cold.

Rather than disengaging the public from this enormous and subliminal landscape that people are already attracted to, this project is about a **SuperFun Site** which will attract both children and adults to the Berkeley Pit. Berkeley Pit is already a place of various conditions, that reflect the world we live today. Engaging with this uncomfortable milieu that we have created is an optimistic perspective on living in the Anthropocene.

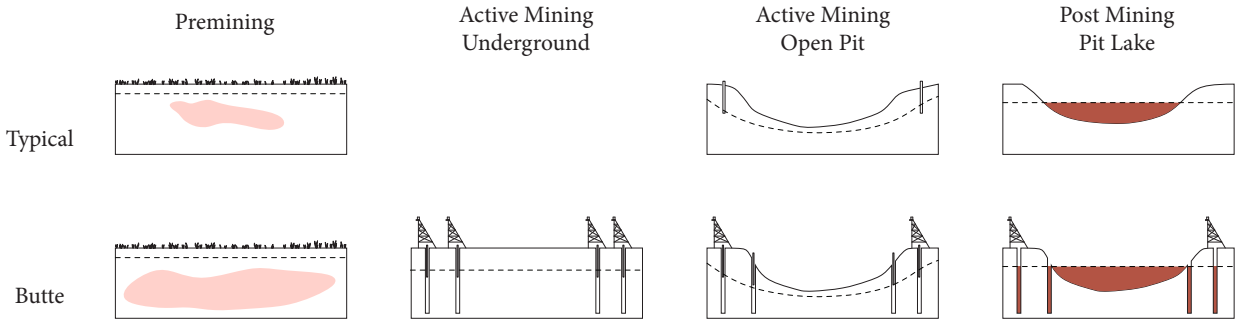
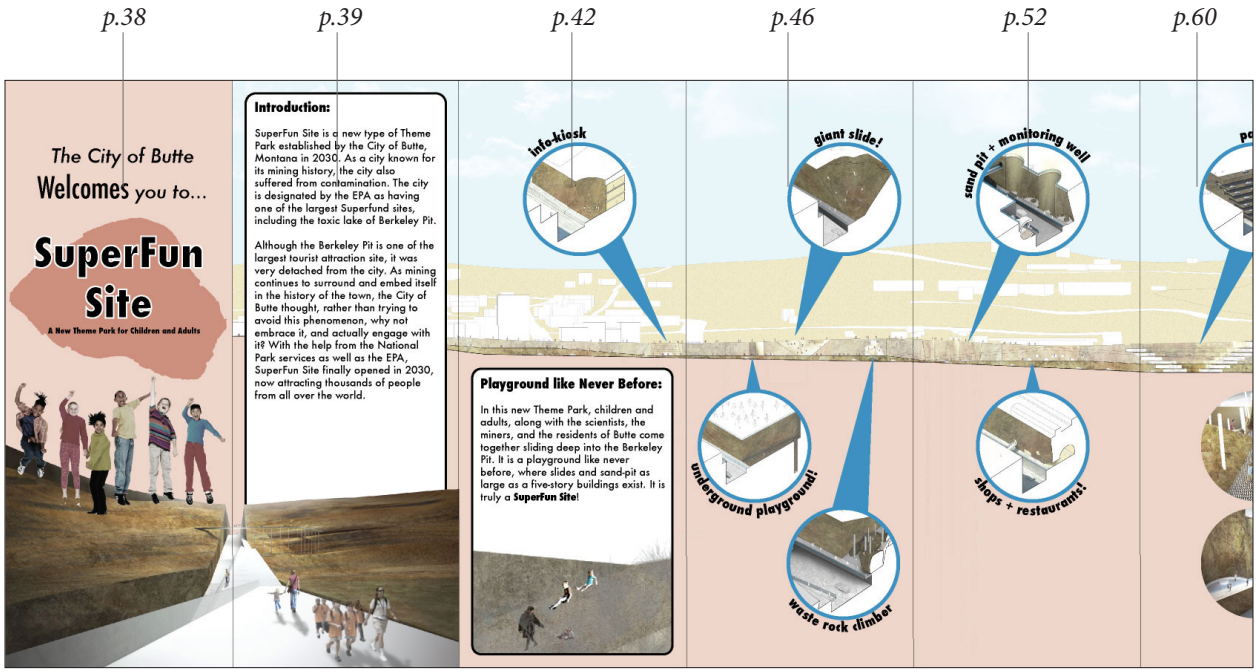
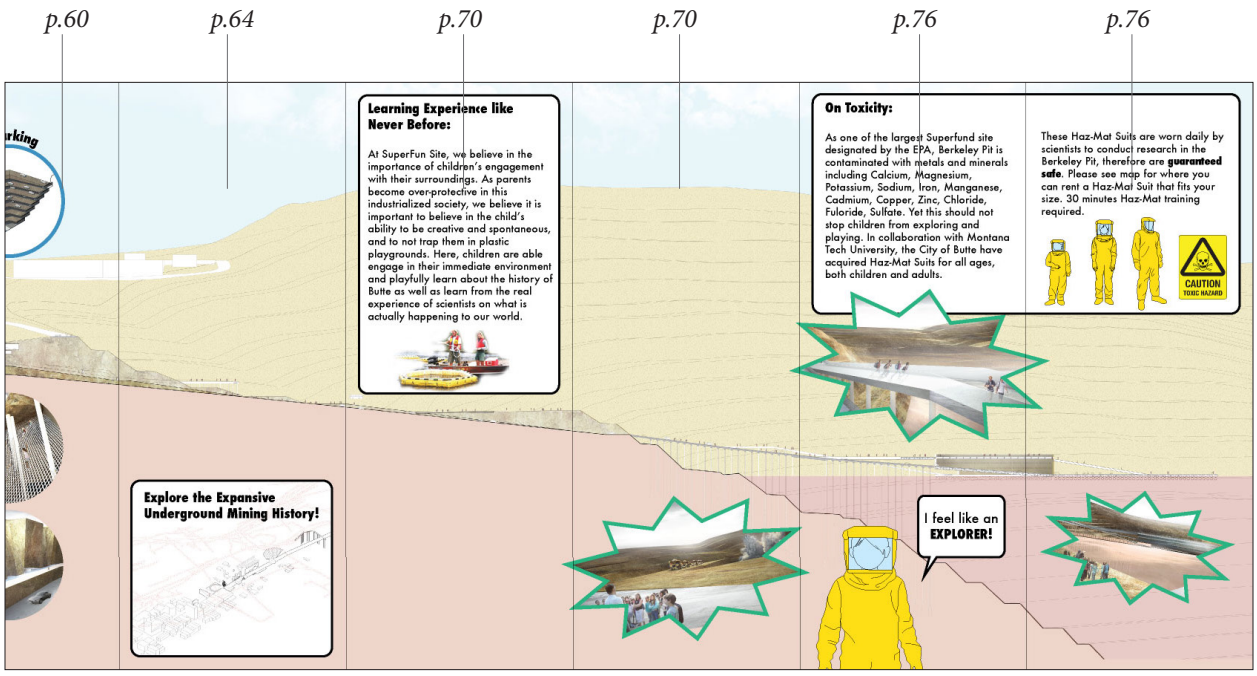


Fig 14: Open pit mining continues today in the Continental Pit

A Brochure for SuperFun Site : Front



A speculative brochure for SuperFun Site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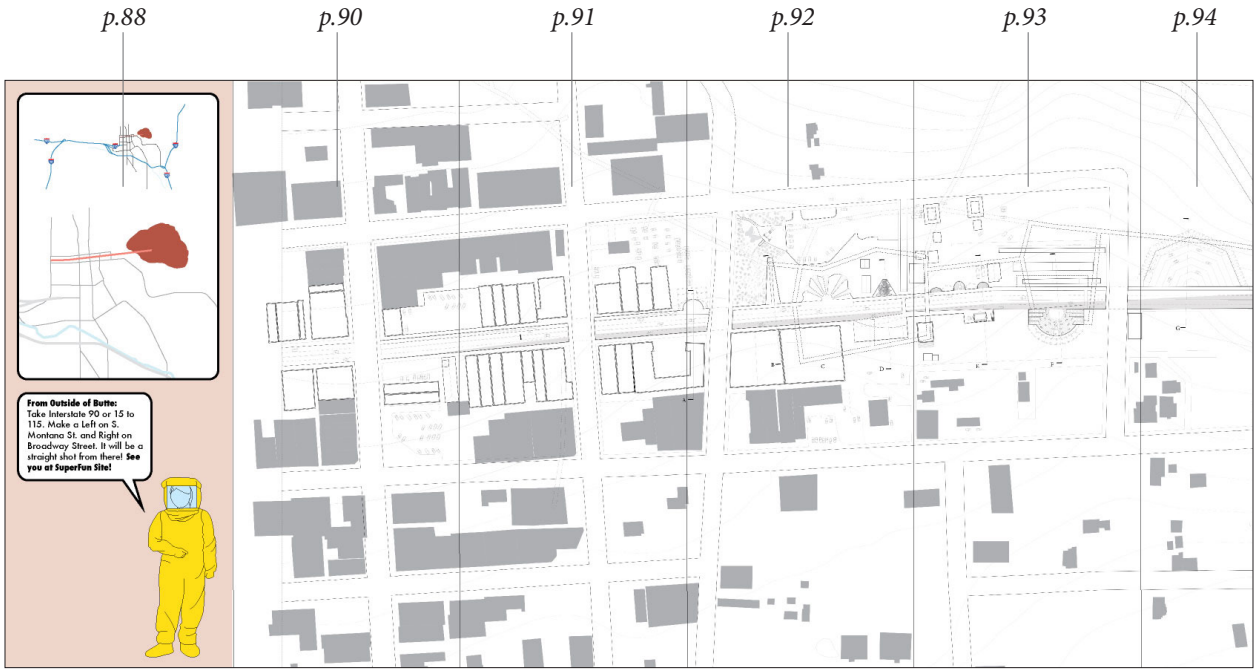
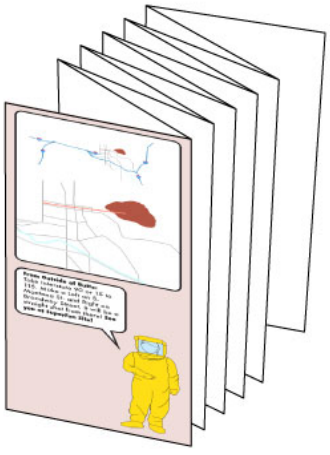
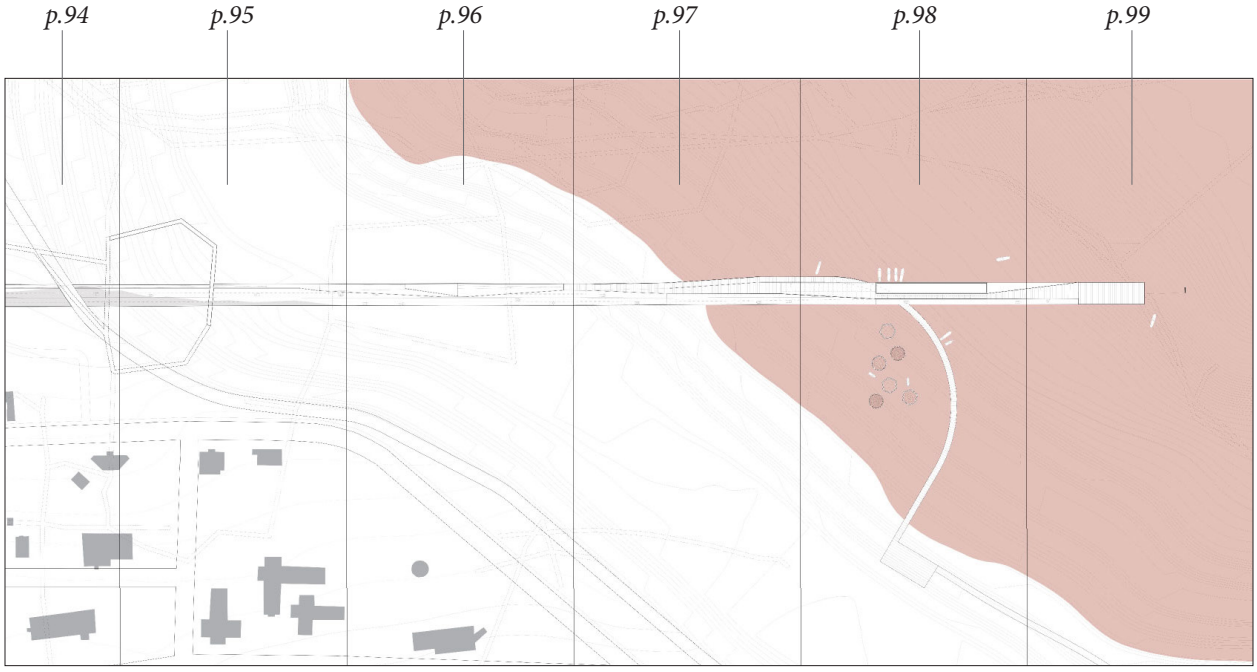
Learning Experience like Never Before:
At SuperFun Site, we believe in the importance of children's engagement with their surroundings. As parents become over-protective in this industrialized society, we believe it is important to believe in the child's ability to be creative and spontaneous, and to not trap them in plastic playgrounds. Here, children are able engage in their immediate environment and playfully learn about the history of Butte as well as learn from the real experience of scientists on what is actually happening to our world.
On Toxicity:
As one of the largest Superfund site designated by the EPA, Berkeley Pit is contaminated with metals and minerals including Calcium, Magnesium, Potassium, Sodium, Iron, Manganese, Cadmium, Copper, Zinc, Chloride, Fuloride, Sulfate. Yet this should not stop children from exploring and playing. In collaboration with Montana Tech University, the City of Butte have acquired Haz-Mat Suits for all ages, both children and adults.
These Haz-Mat Suits are worn daily by scientists to conduct research in the Berkeley Pit, therefore are guaranteed safe. Please see map for where you can rent a Haz-Mat Suit that fits your size. 30 minutes Haz-Mat training required.
CAUTION
TOXIC HAZARD
Explore the Expansive Underground Mining History!
I feel like an EXPLORER!

A Brochure for SuperFun Site : Back



A speculative brochure for SuperFun Site

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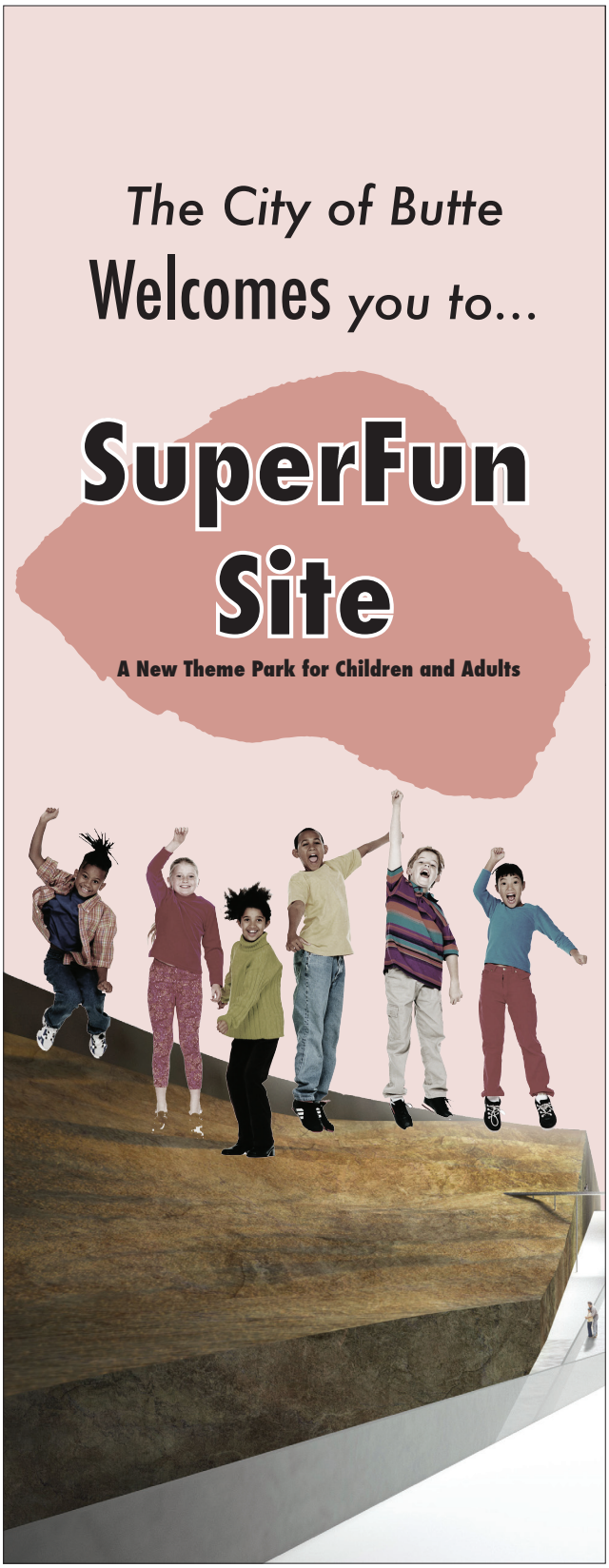
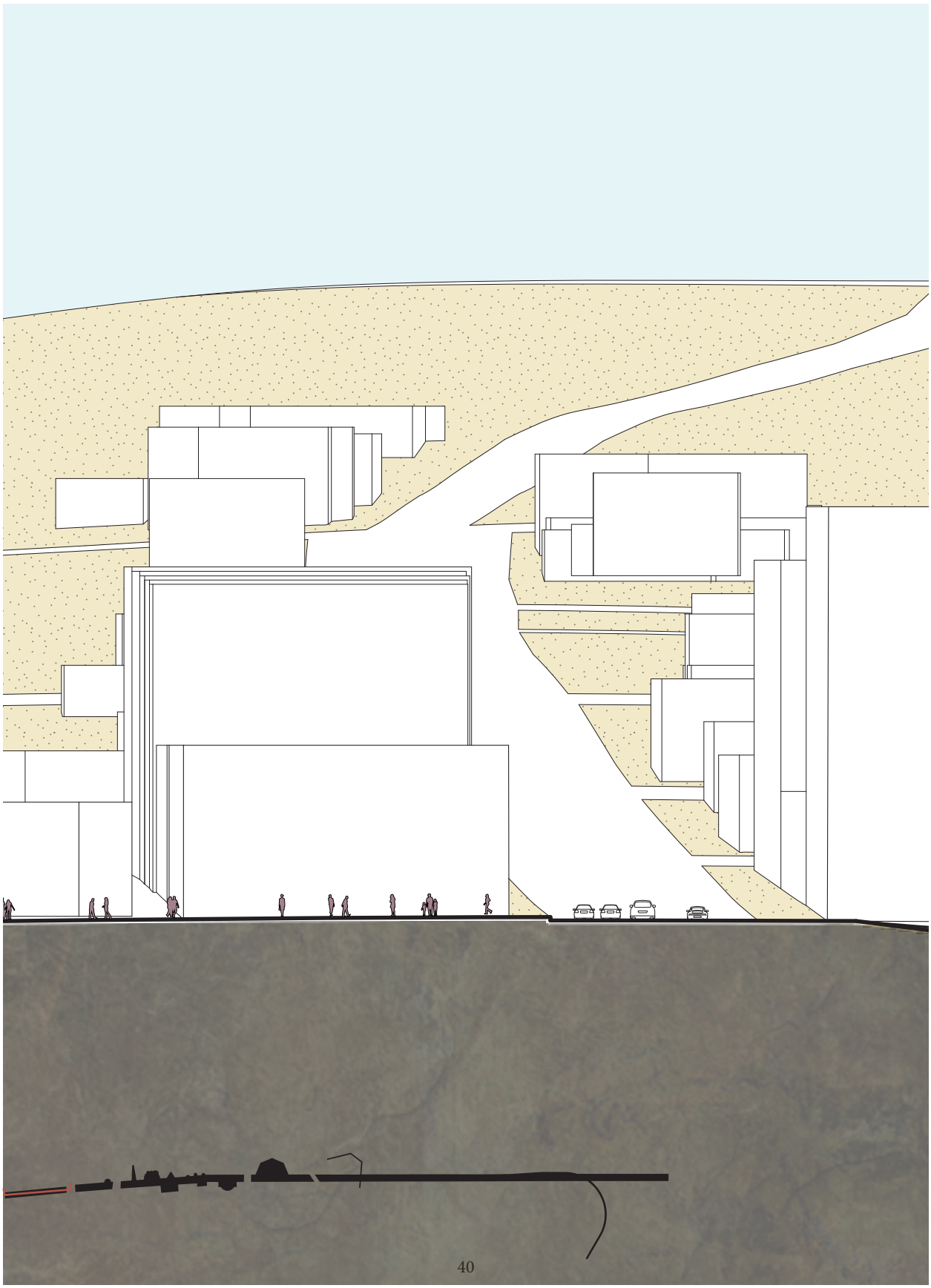
A Brochure for SuperFun Site: Front 1 - 2

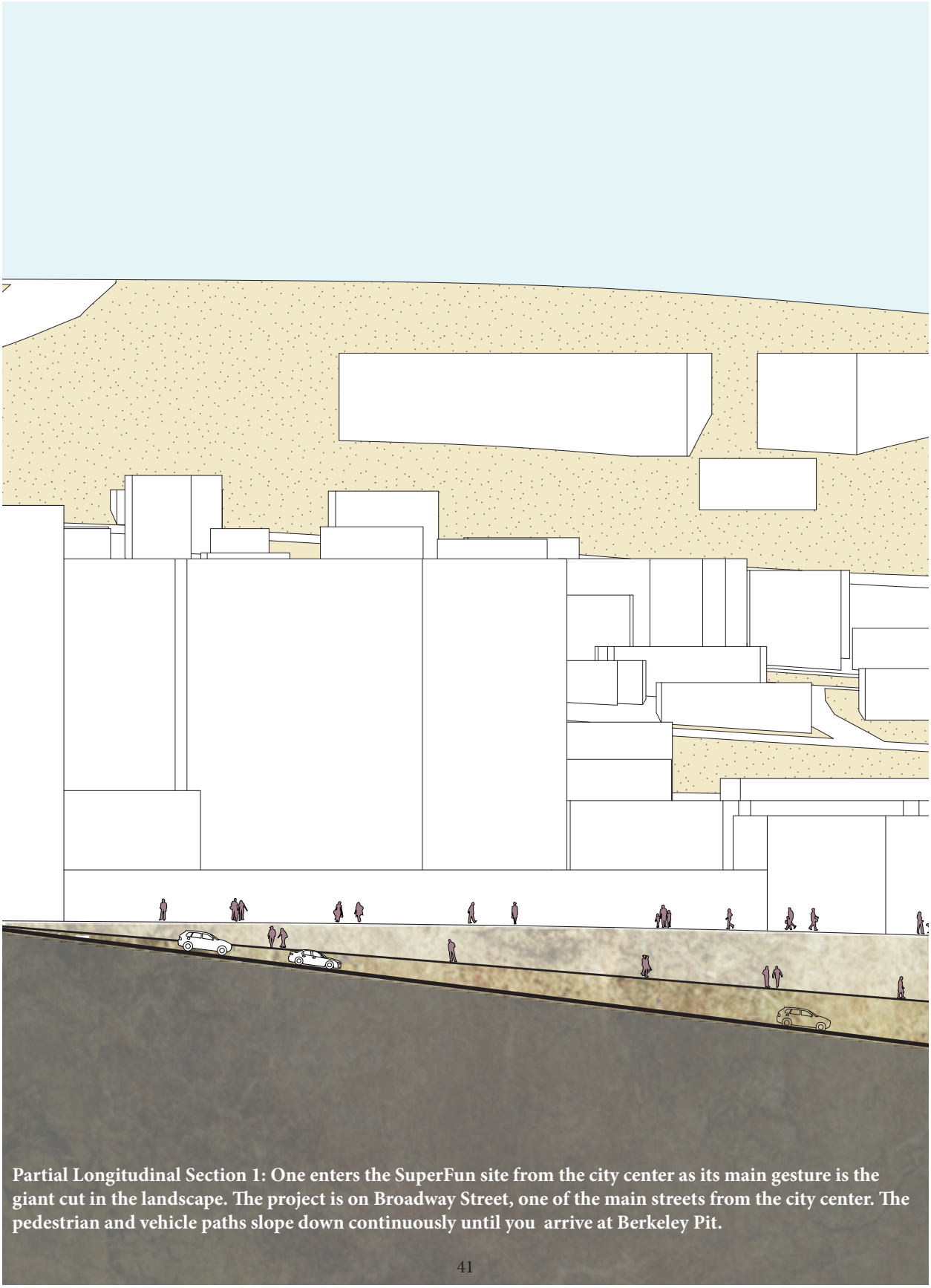


Introduction:

SuperFun Site is a new type of Theme Park established by the City of Butte, Montana in 2030. As a city known for its mining history, the city also suffered from contamination. The city is designated by the EPA as having one of the largest Superfund sites, including the toxic lake of Berkeley Pit.

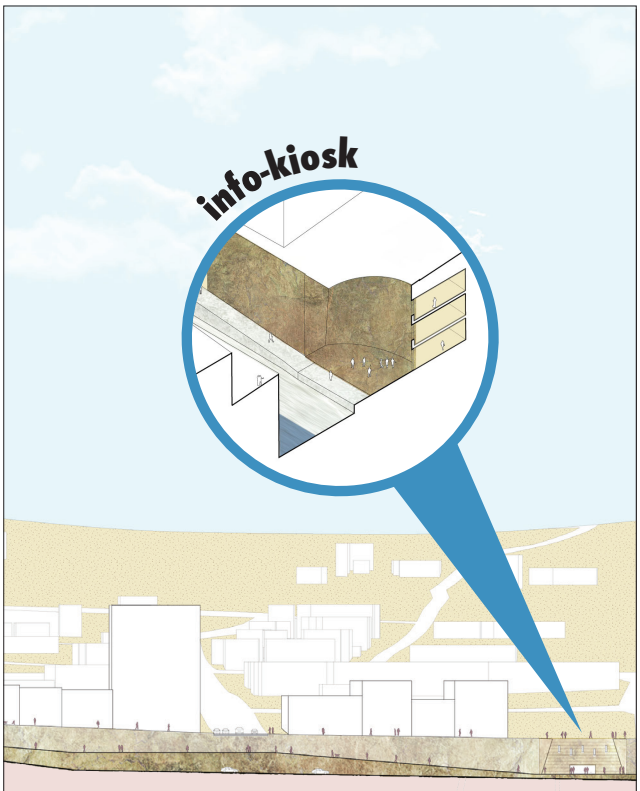
Although the Berkeley Pit is one of the largest tourist attraction site, it was very detached from the city. As mining continues to surround and embed itself in the history of the town, the City of Butte thought, rather than trying to avoid this phenomenon, why not embrace it, and actually engage with it? With the help from the National Park services as well as the EPA, SuperFun Site finally opened in 2030, now attracting thousands of people from all over the world.





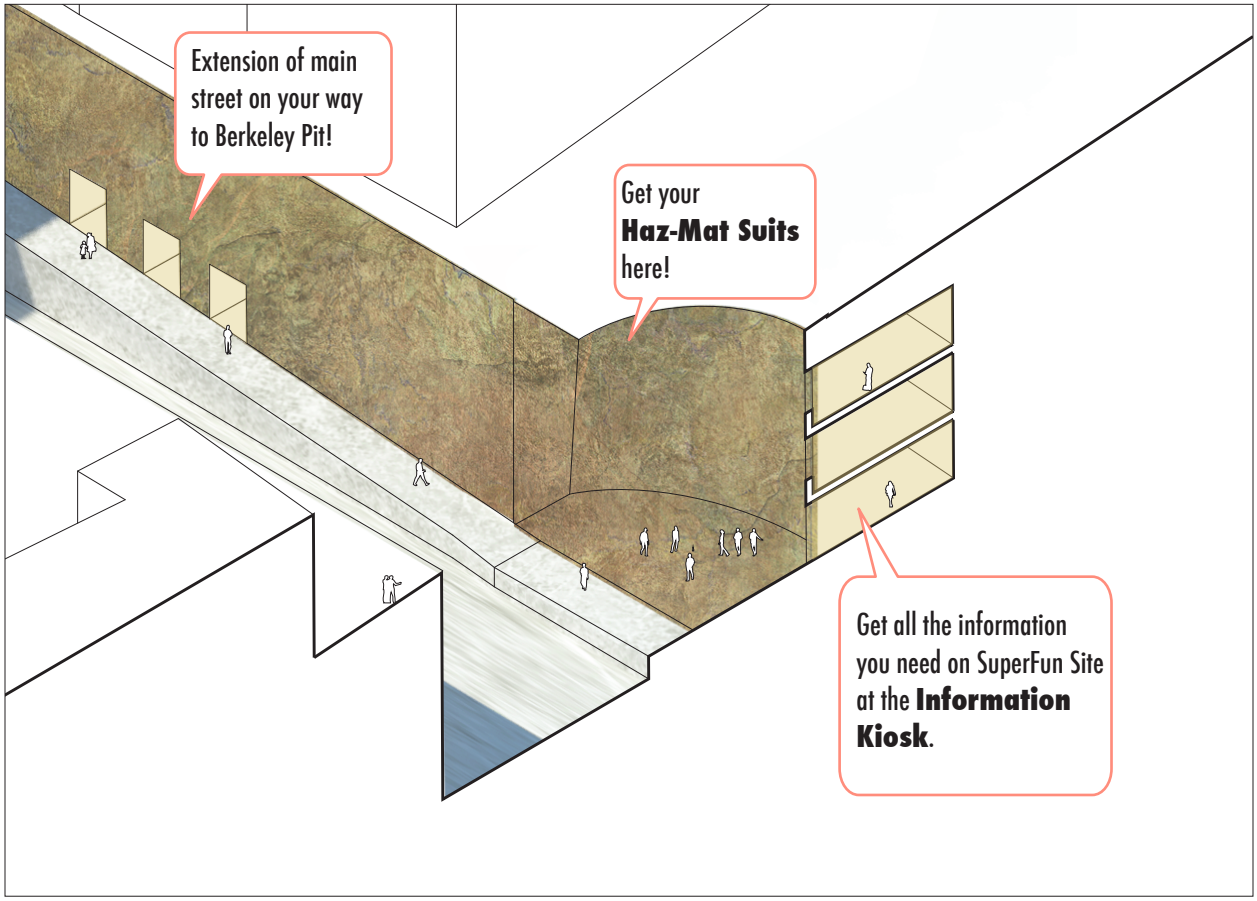
Partial Longitudinal Section 1: One enters the SuperFun site from the city center as its main gesture is the giant cut in the landscape. The project is on Broadway Street, one of the main streets from the city center. The pedestrian and vehicle paths slope down continuously until you arrive at Berkeley Pit.

A Brochure for SuperFun Site: Front 3

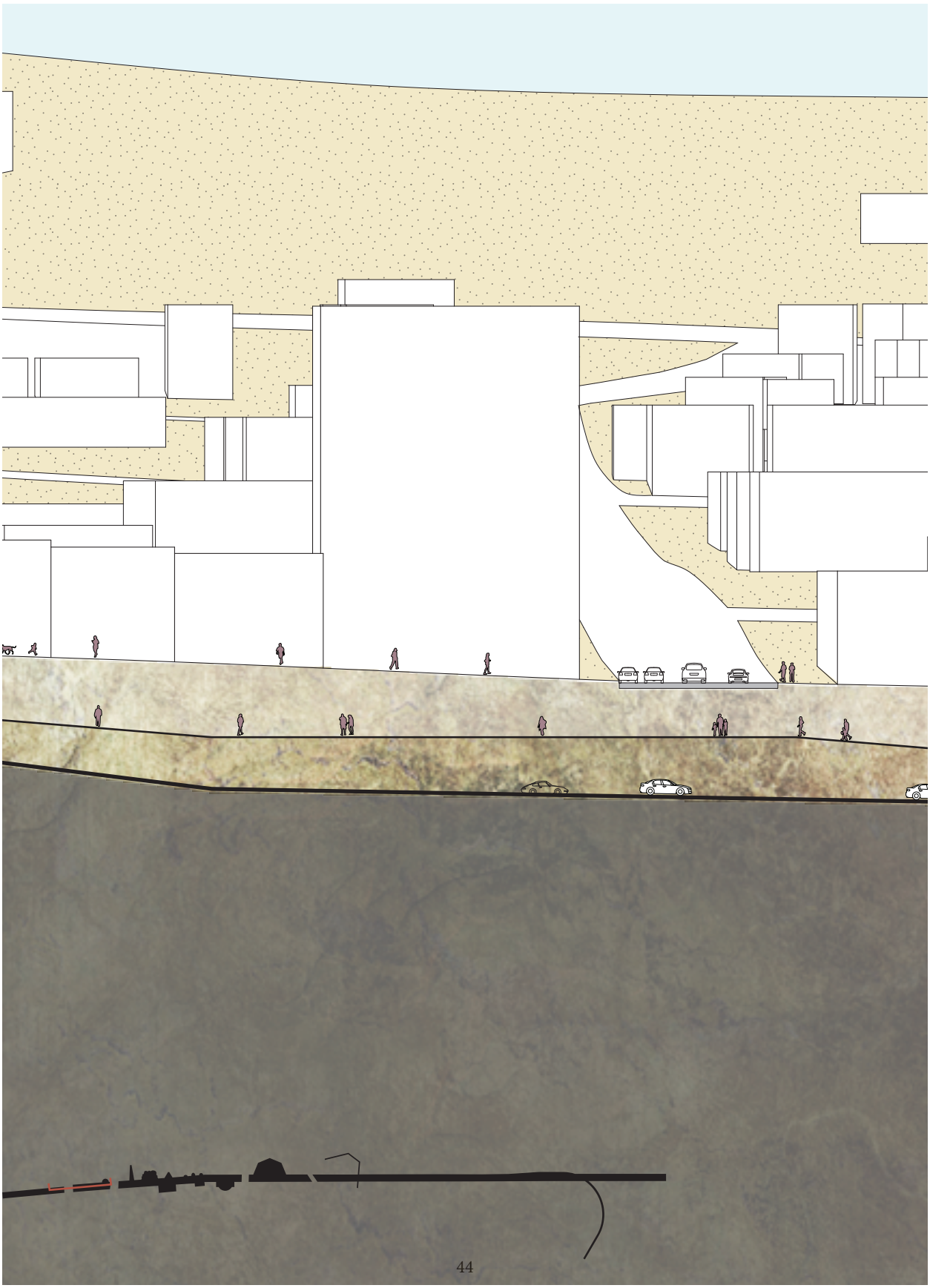


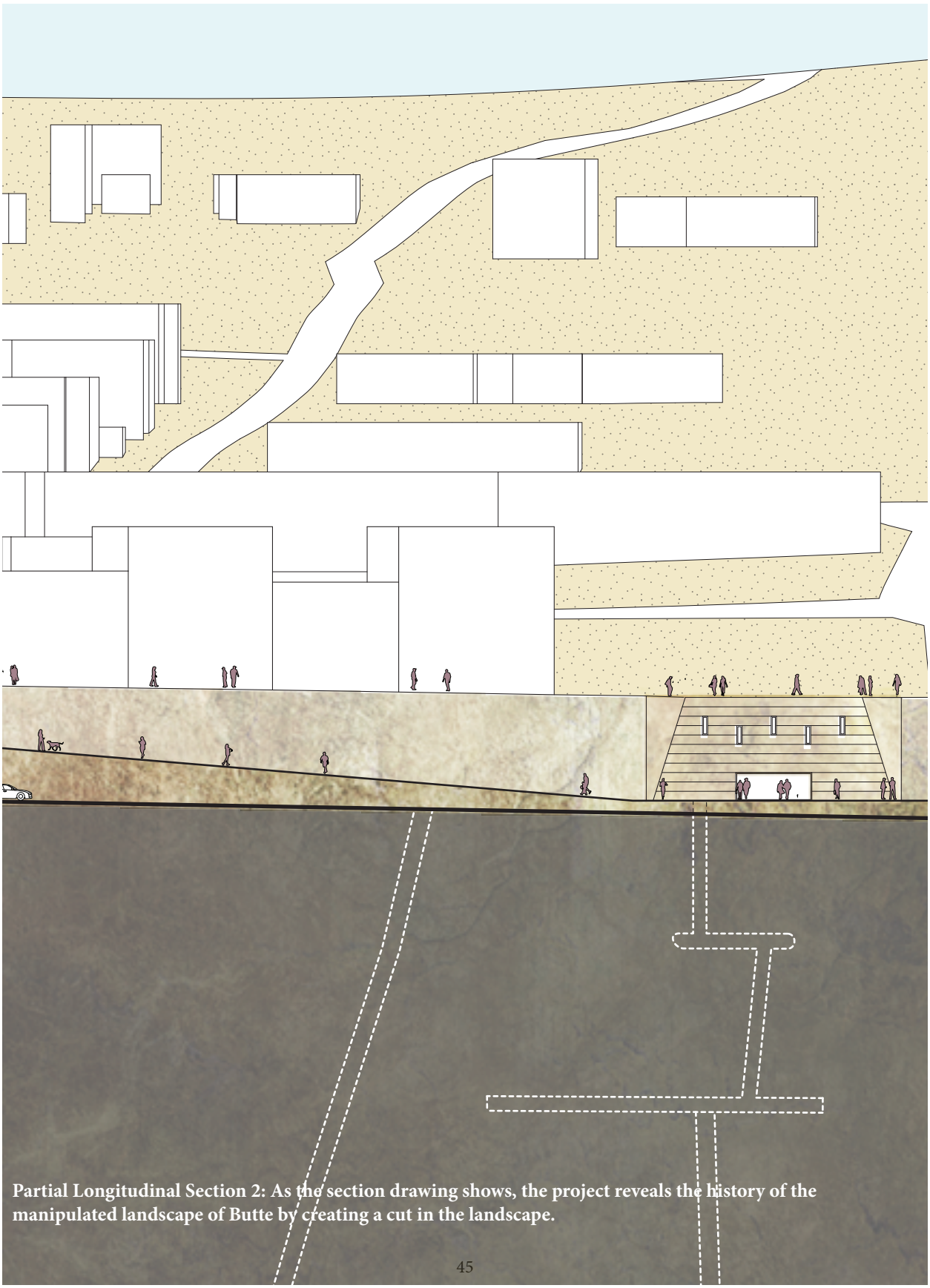
Playground like Never Before:

In this new Theme Park, children and adults, along with the scientists, the miners, and the residents of Butte come together sliding deep into the Berkeley Pit. It is a playground like never before, where slides and sand-pit as large as a five-story buildings exist. It is truly a **SuperFun Site**!



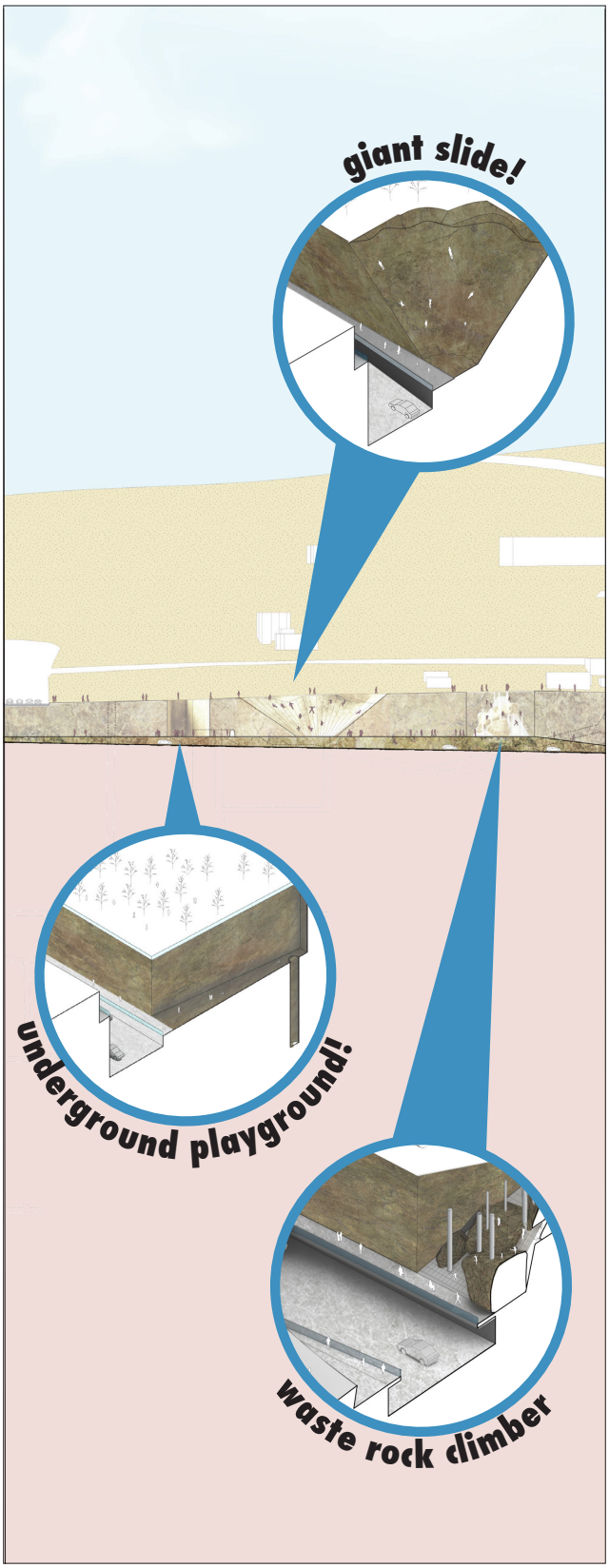
Axonometric 1: Note that the kiosk is carved into the landscape, as well as the other shops along the way. The Haz-Mat suits are worn to protect people from toxicity when getting close to the lake. (Detail description on **p. 76**)

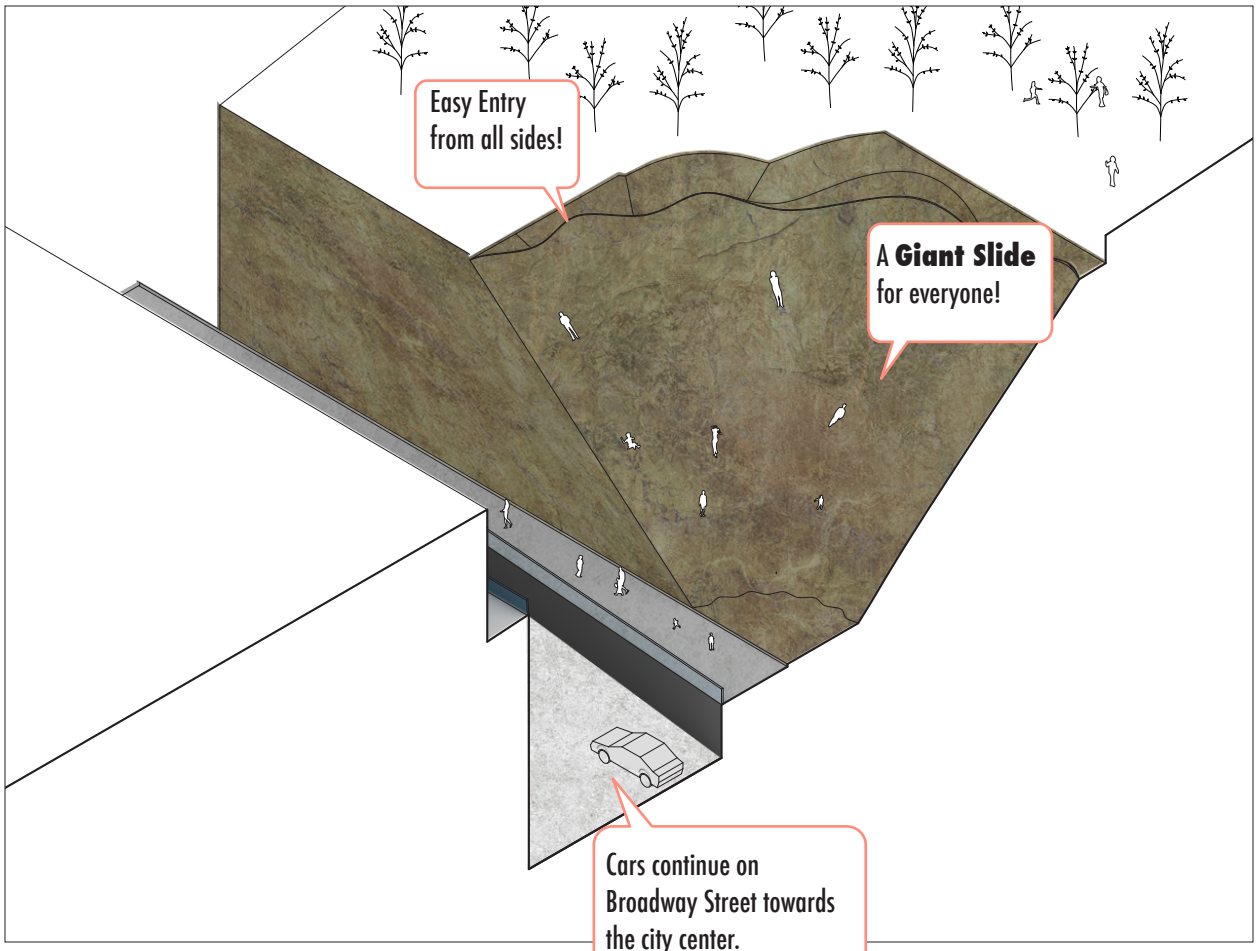




Partial Longitudinal Section 2: As the section drawing shows, the project reveals the history of the manipulated landscape of Butte by creating a cut in the landscape.

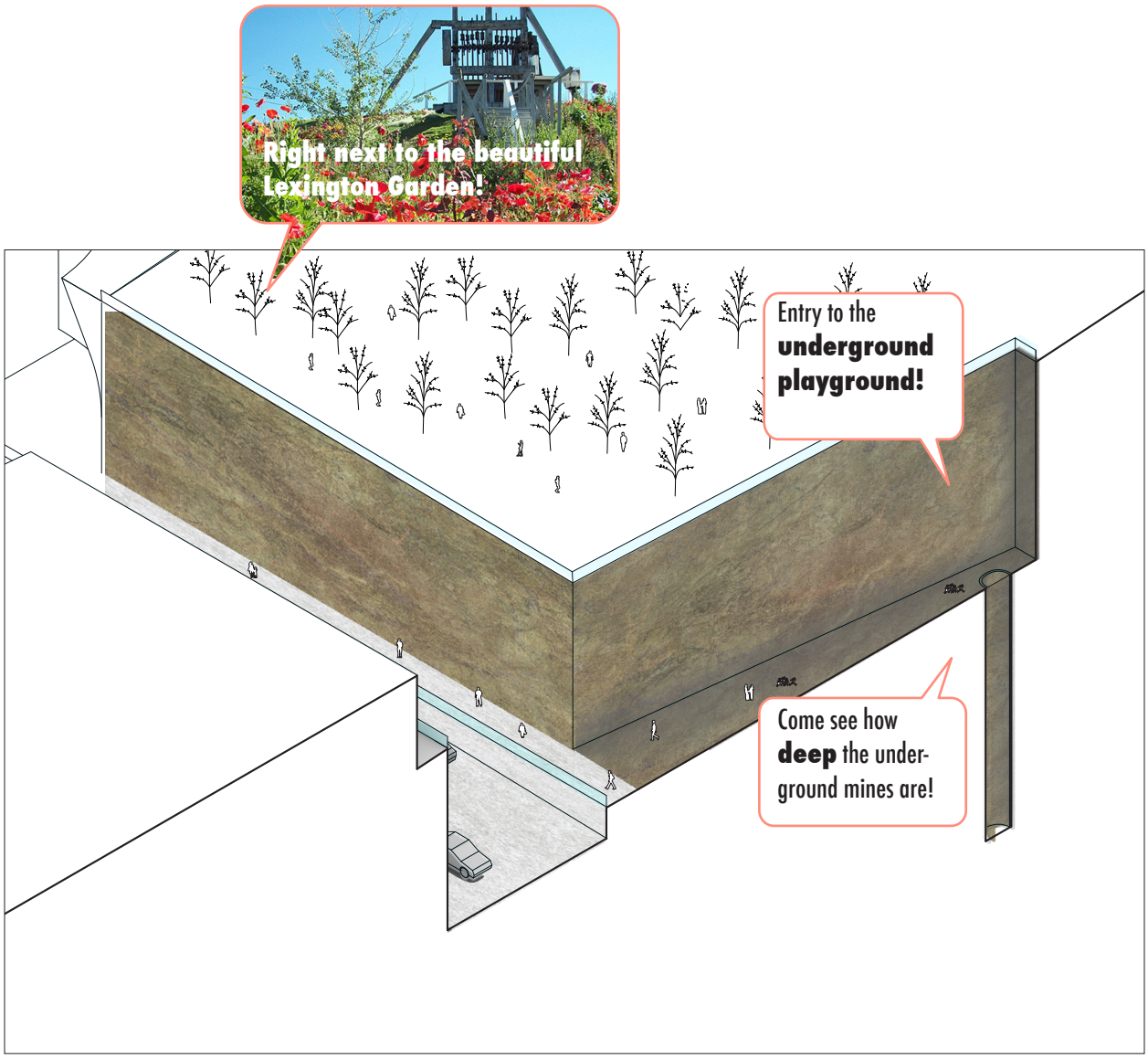
A Brochure for SuperFun Site: Front 4



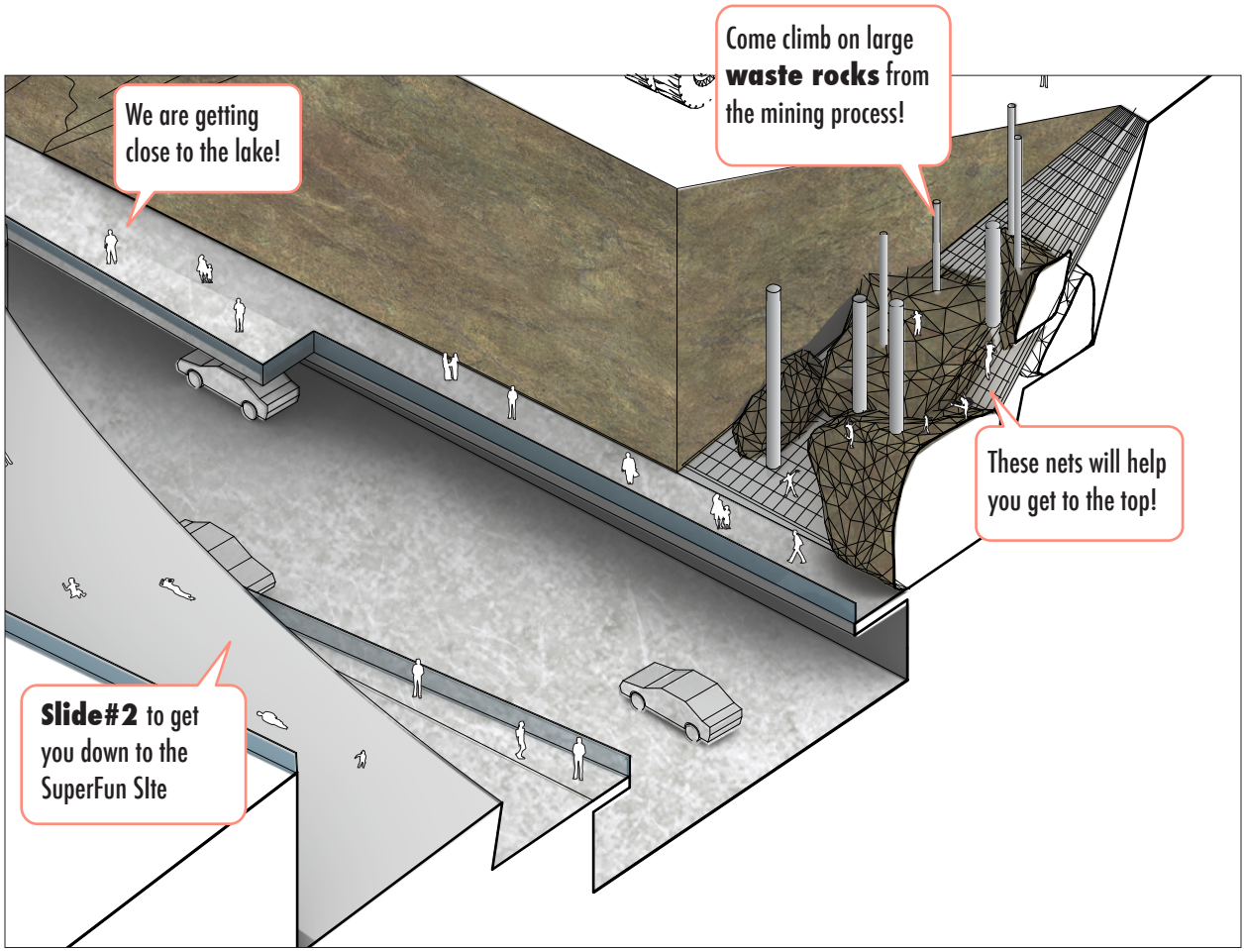


Axonometric 2: Slides are used as a way of entry into the SuperFun Site. There are two levels: the upper level are for pedestrians and the lower level are for vehicles. They directly connect to the research center that is floating on the Berkeley Pit.

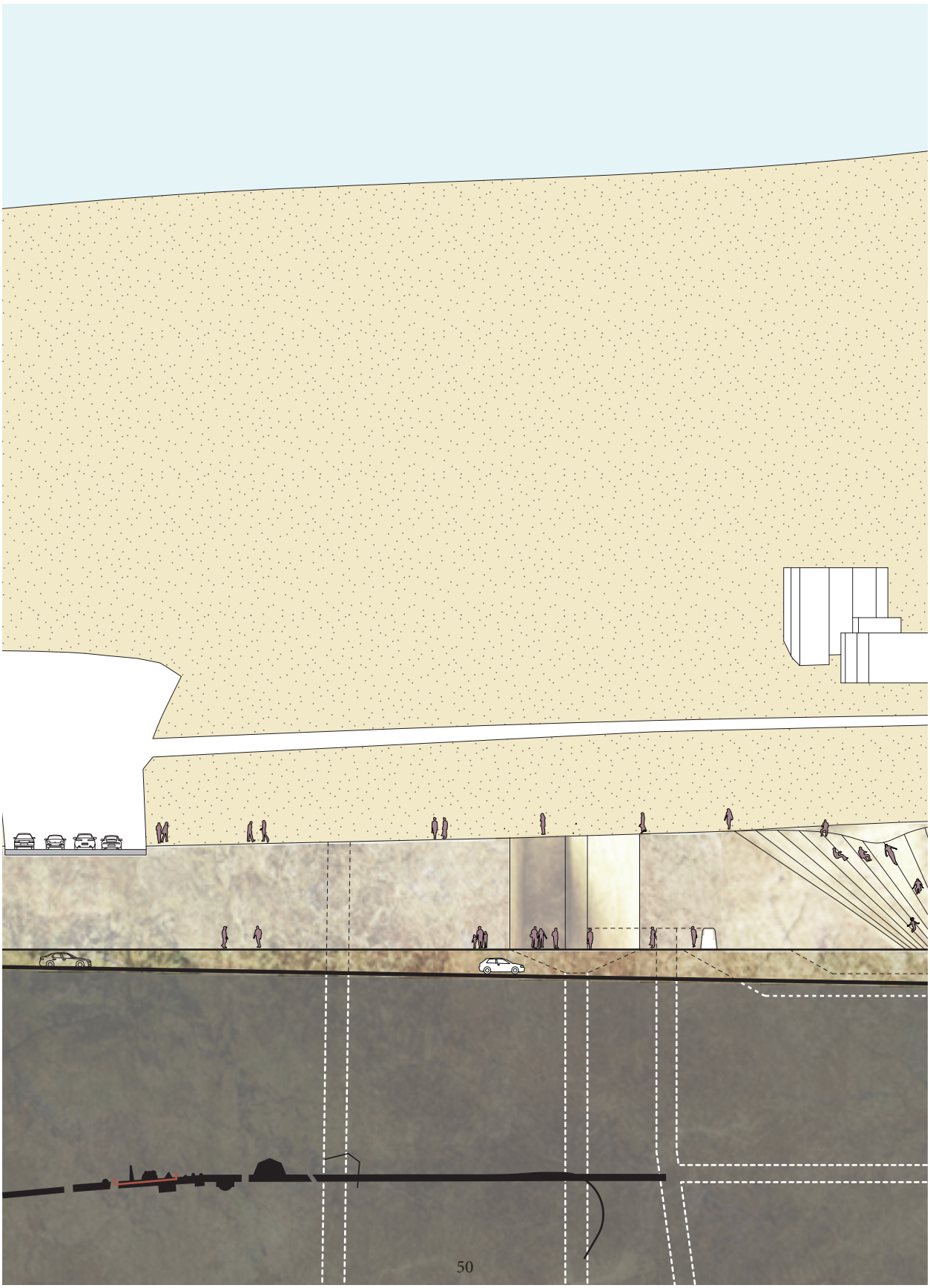
Fig 15: Lexington Garden in Butte

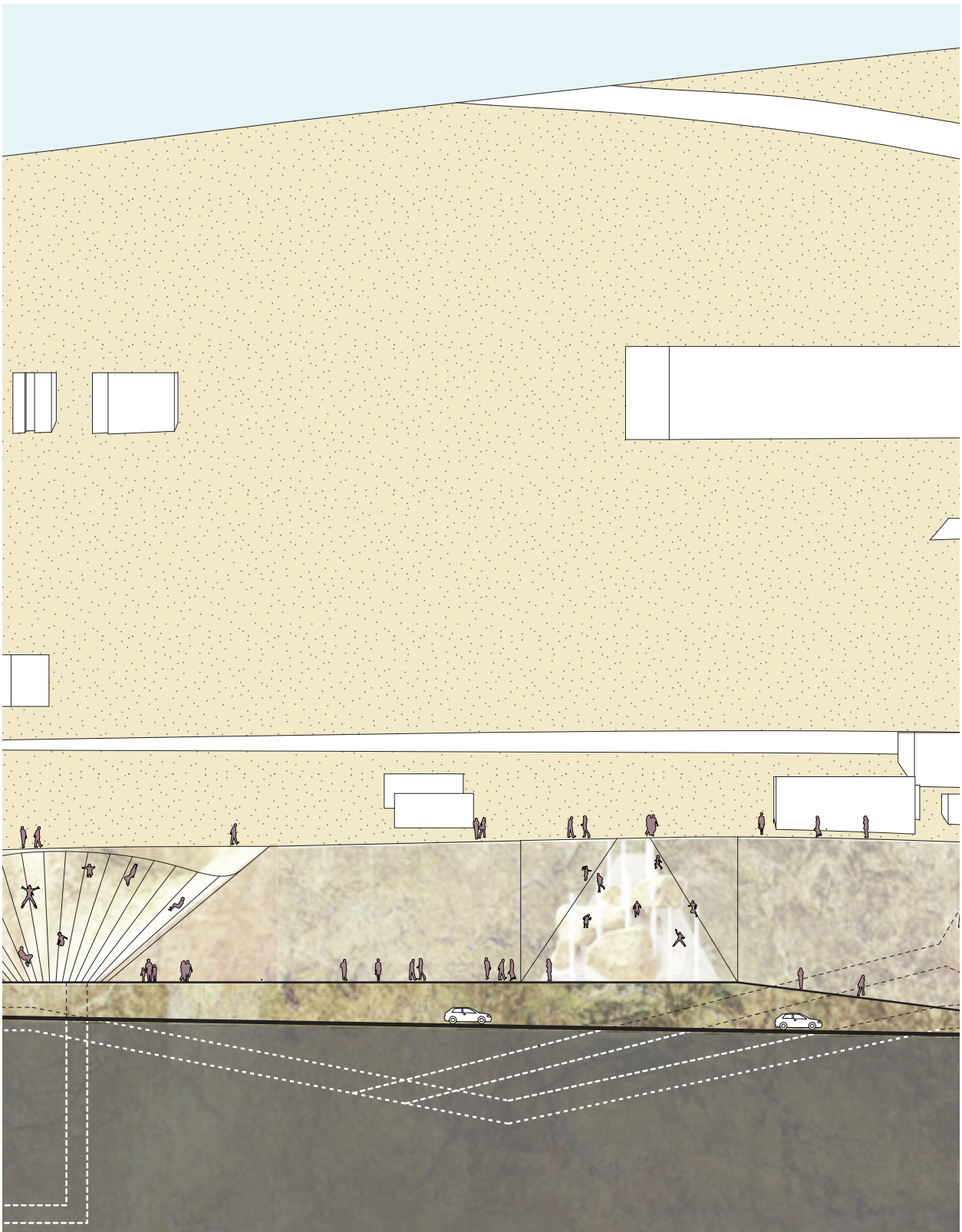


Axonometric 3: A drawing showing the entry into the underground playground. Refer to **p.63** for a map of the entire underground playground. The Lexington Garden is a historic garden that is also the location of the old Stamp Mill, which was used by early miners in Butte to crush their hard-rock ores.



Axonometric 4: A drawing of the waste-rock playground and slide#2. These playgrounds are not only designed for play, but also to create an entry into the SuperFun Site. At the waste-rock playground, children learn about the process of mining and how much waste-rock it actually produces.





Partial Longitudinal Section 3: A series of playgrounds are revealed as one walks through the void.

A Brochure for SuperFun Site: Front 5

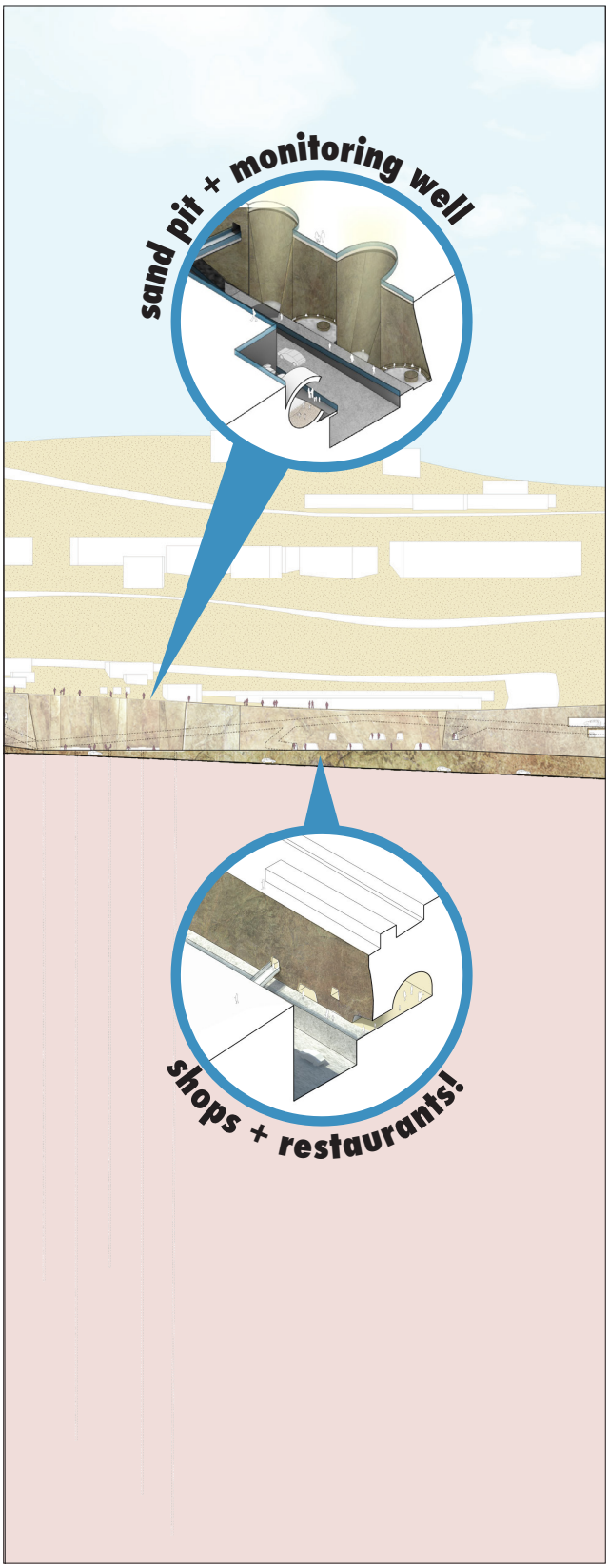
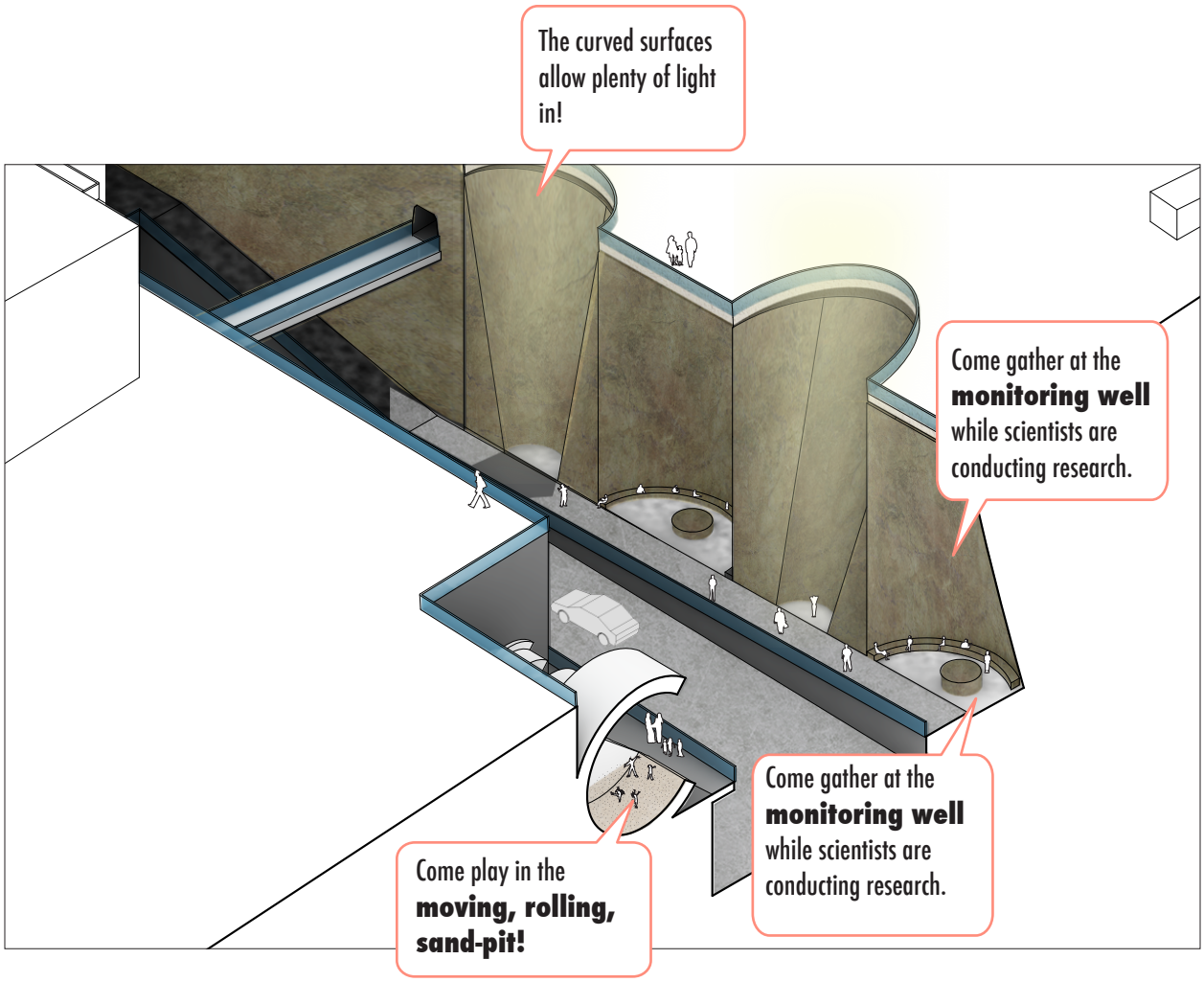
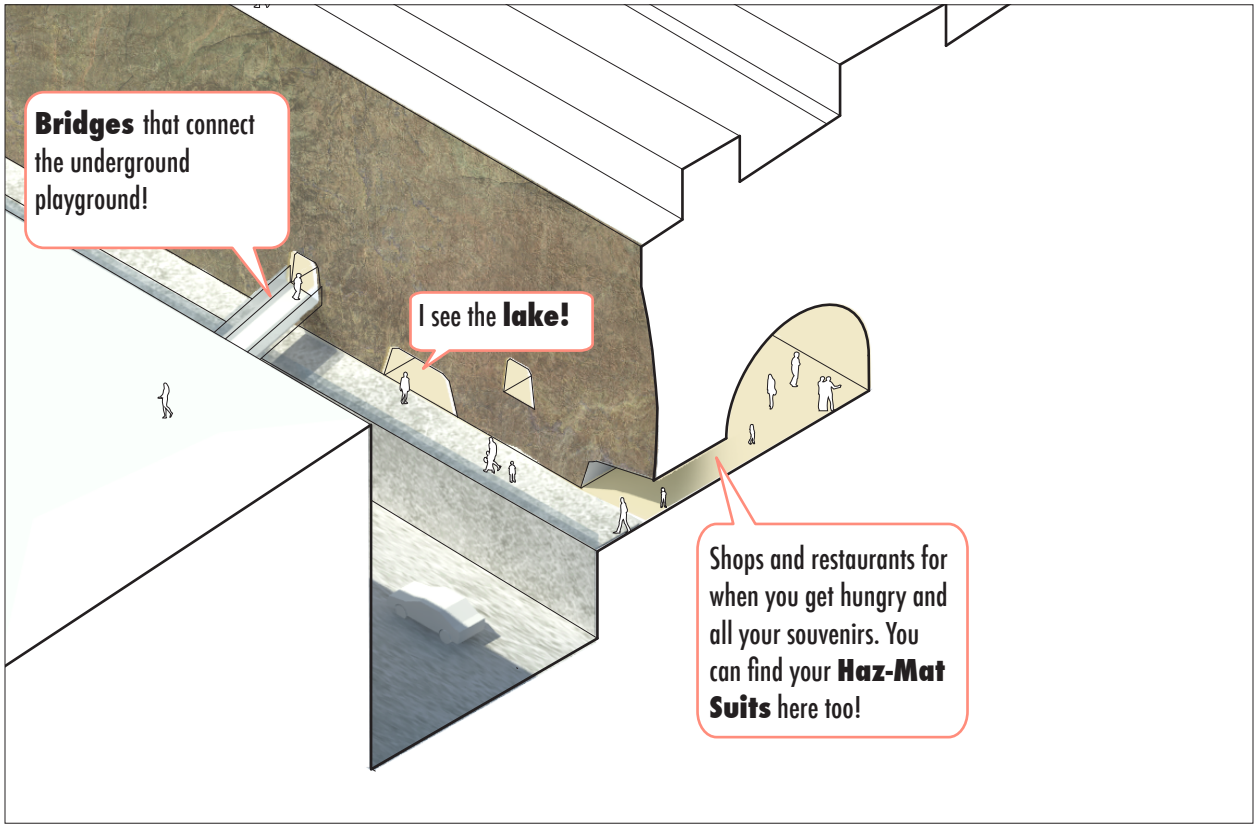


Fig 16: Image of worker checking ground water level at monitoring well.

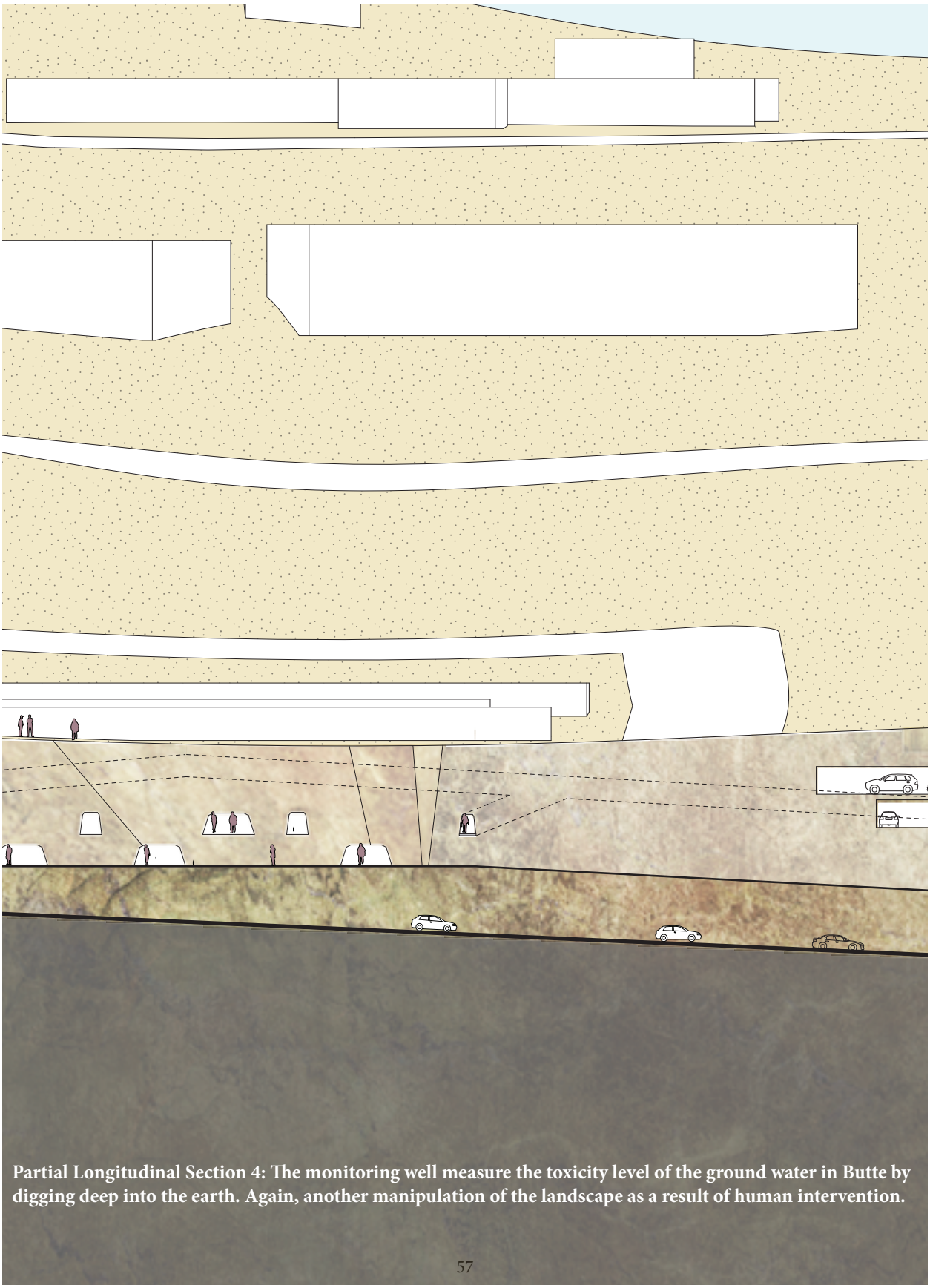
Fig 17: Typical image of ore-grinder. Note the very large scale.



Axonometric 5: These two playgrounds show the process of mining as well as the effects of ground water contamination. The moving, rolling, sand-pit is a grinder that children can occupy. It is a giant sand-pit that moves.
The monitoring well is designed as a gathering space for the visitors, while sometimes, scientists may stop by to check the level of ground water contamination. It makes visible the underground contamination of Butte.



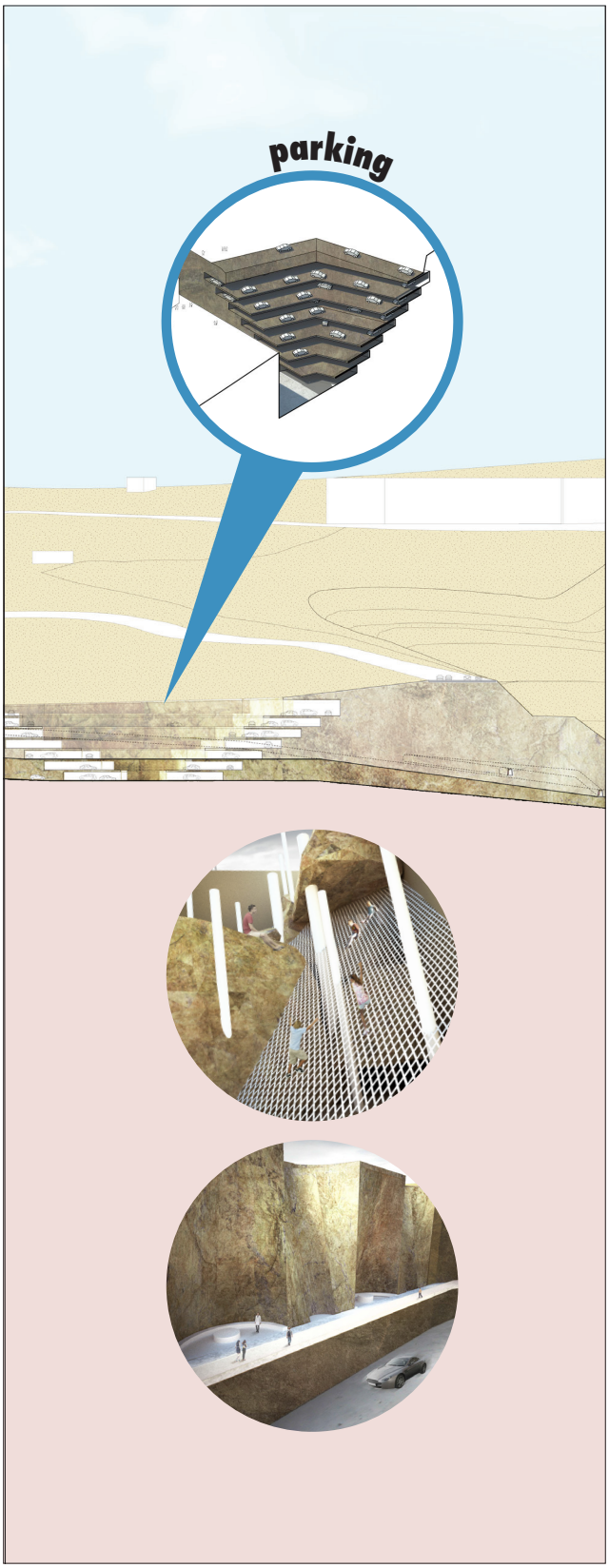
Axonometric 6: Shops are carved into the manipulated landscape to show that although underground, the SuperFun Site is conceptualized as an extension of the main street from the city center.

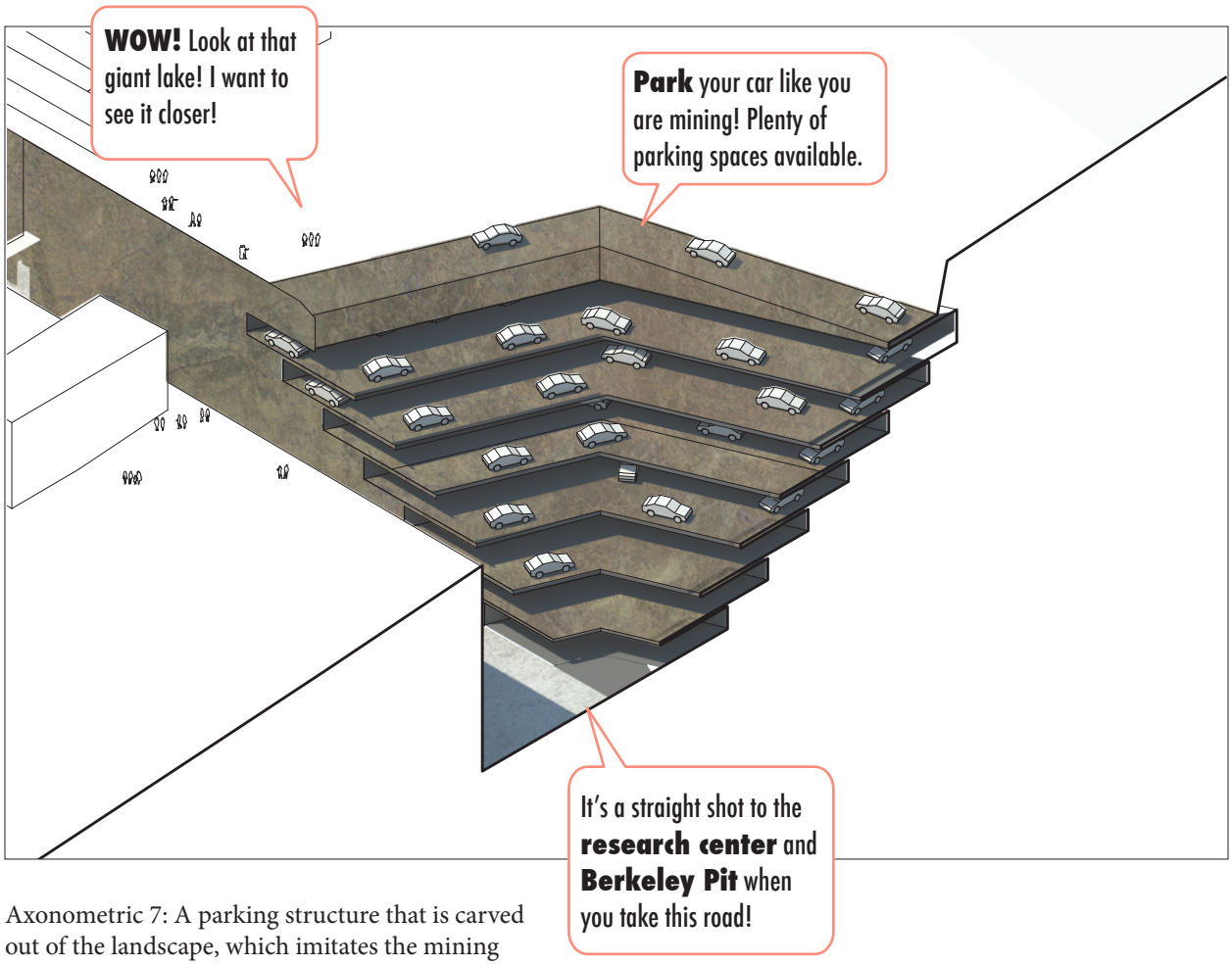


Partial Longitudinal Section 4: The monitoring well measure the toxicity level of the ground water in Butte by digging deep into the earth. Again, another manipulation of the landscape as a result of human intervention.

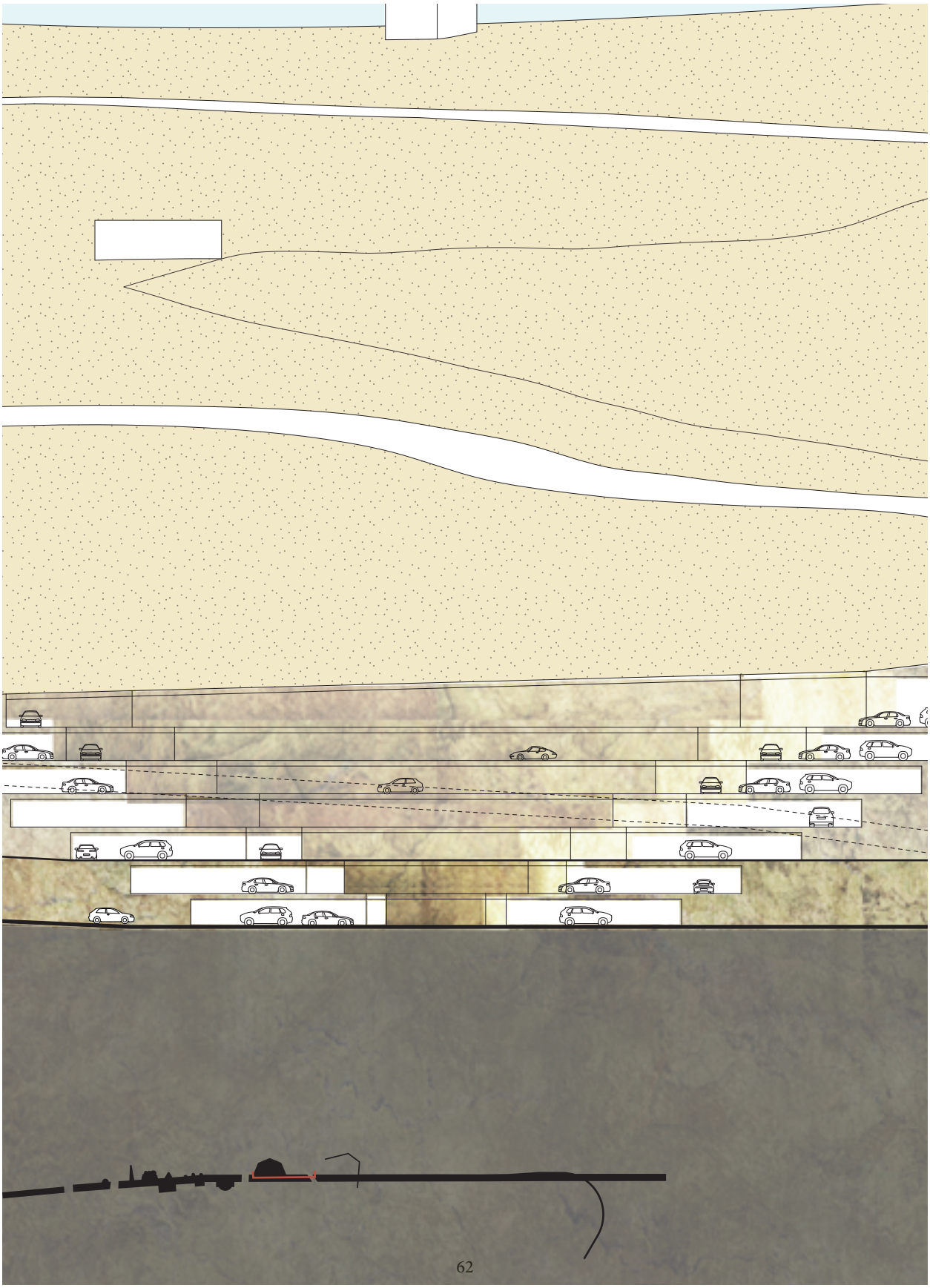
Left: Rendering of waste-rock climbing playground
Above: Rendering of monitoring well and light well

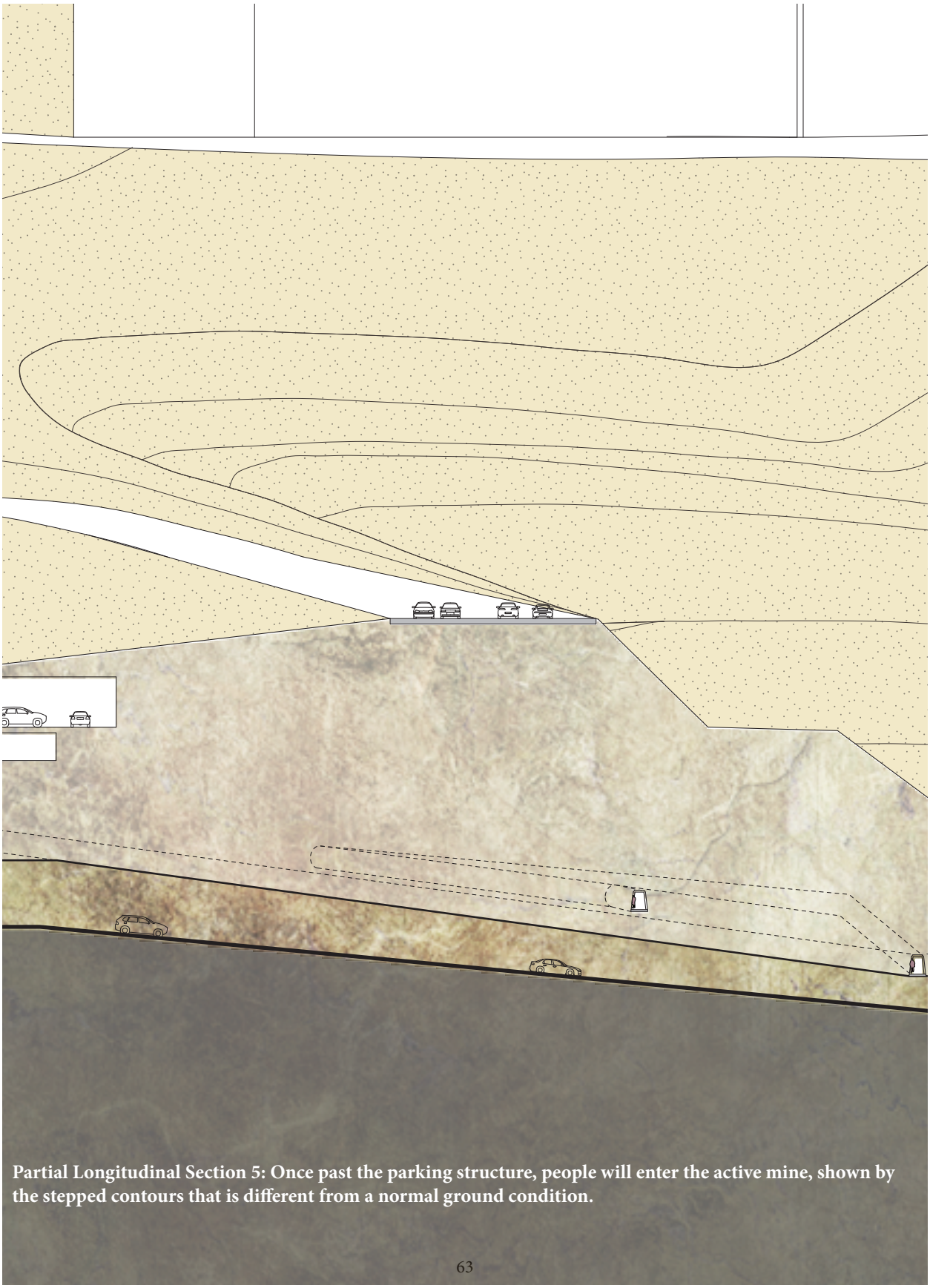
A Brochure for SuperFun Site: Front 6





Axonometric 7: A parking structure that is carved out of the landscape, which imitates the mining process.





Partial Longitudinal Section 5: Once past the parking structure, people will enter the active mine, shown by the stepped contours that is different from a normal ground condition.

A Brochure for SuperFun Site: Front 7

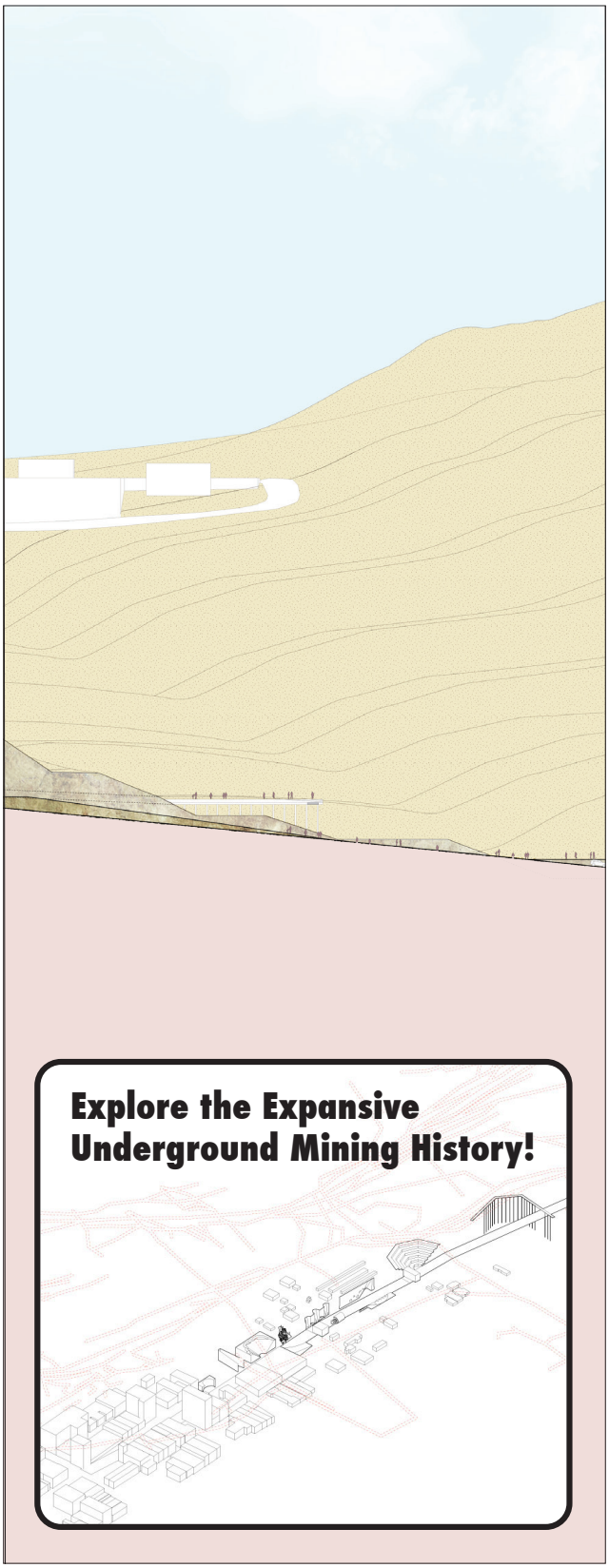


Fig 8: Historic Mine Map of Butte

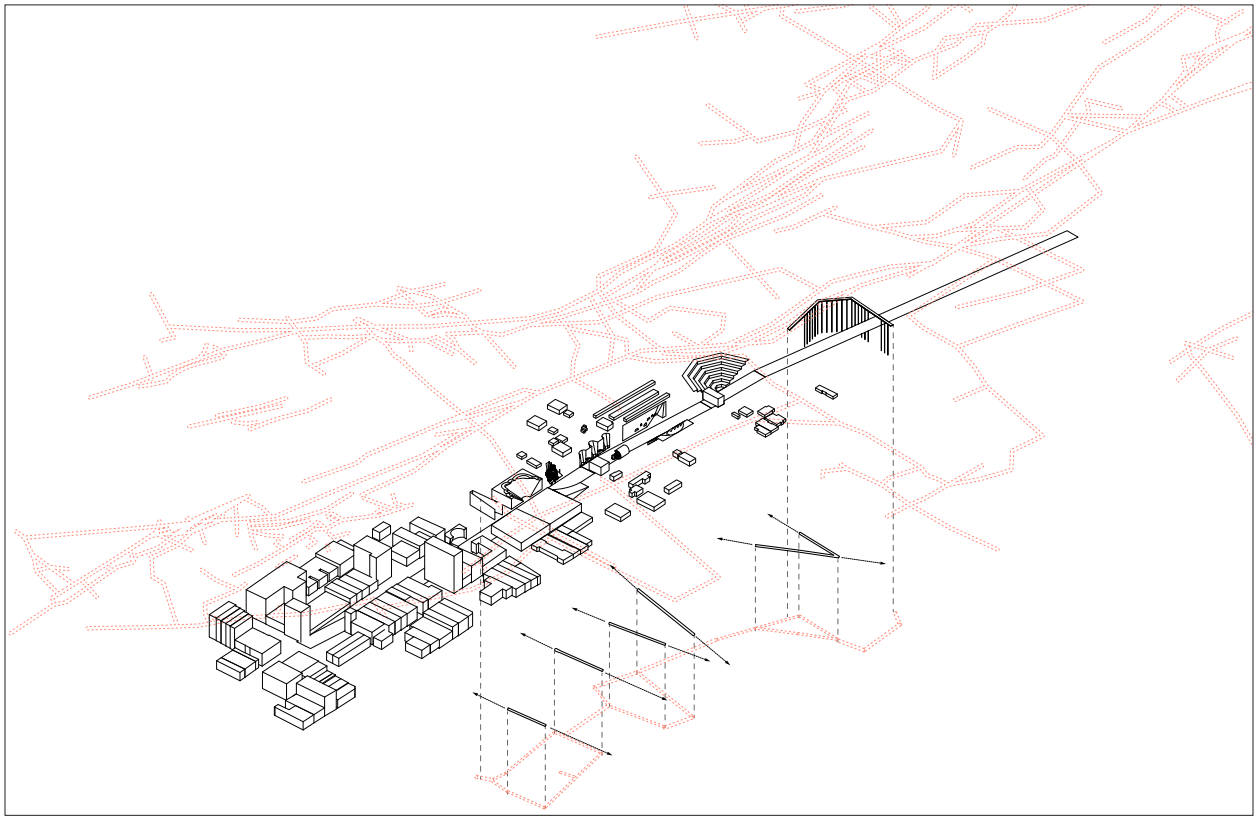
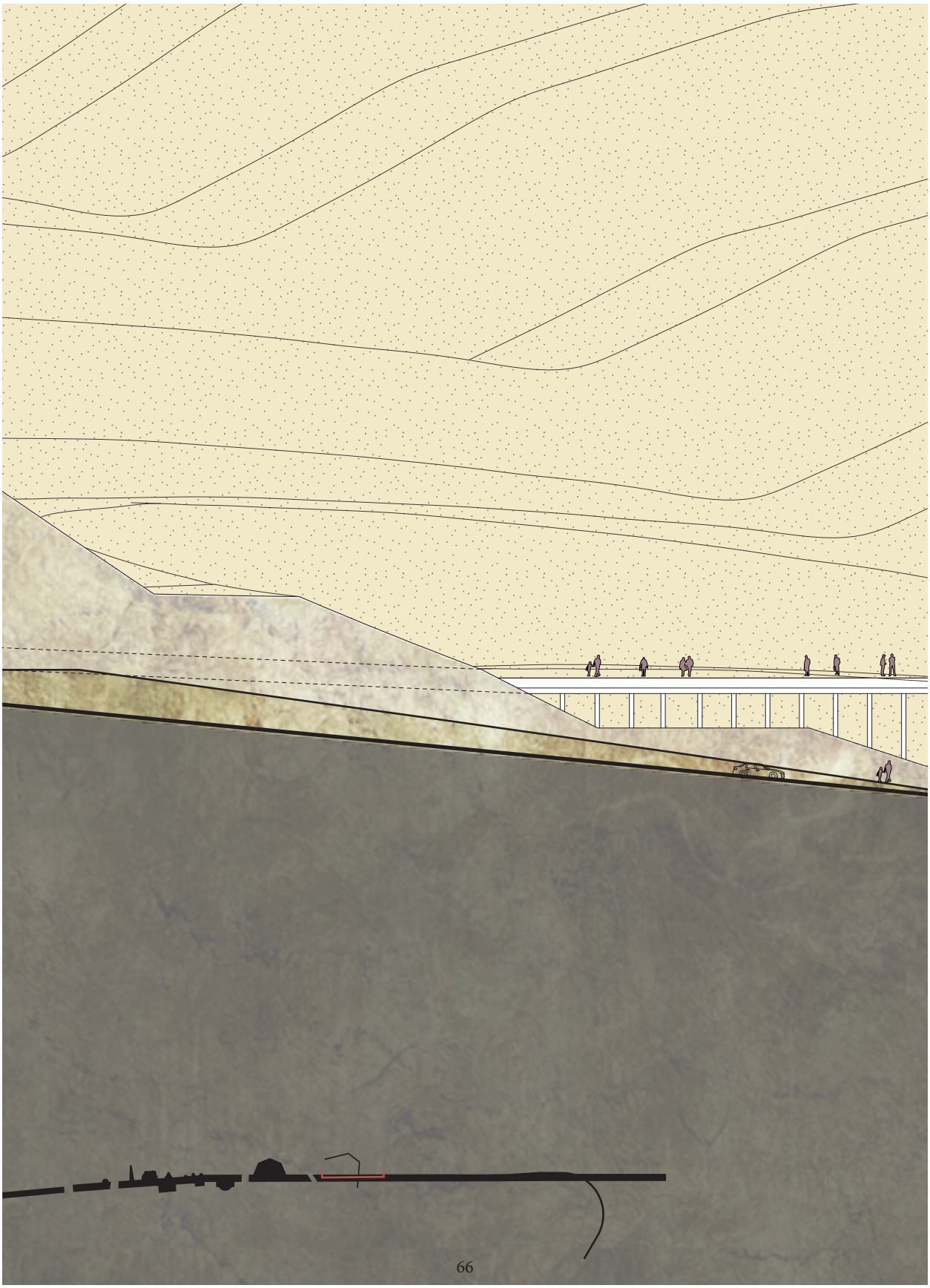
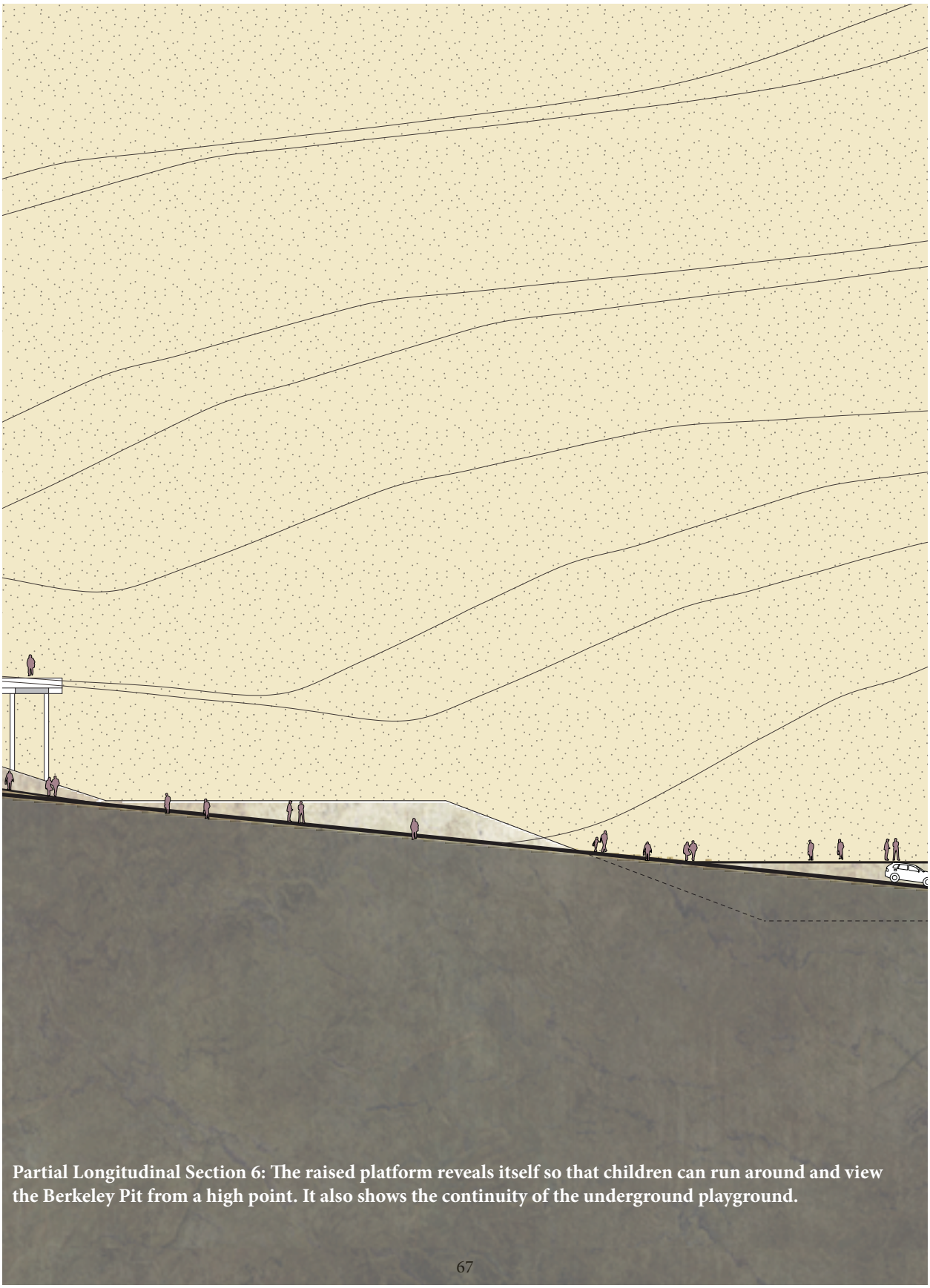


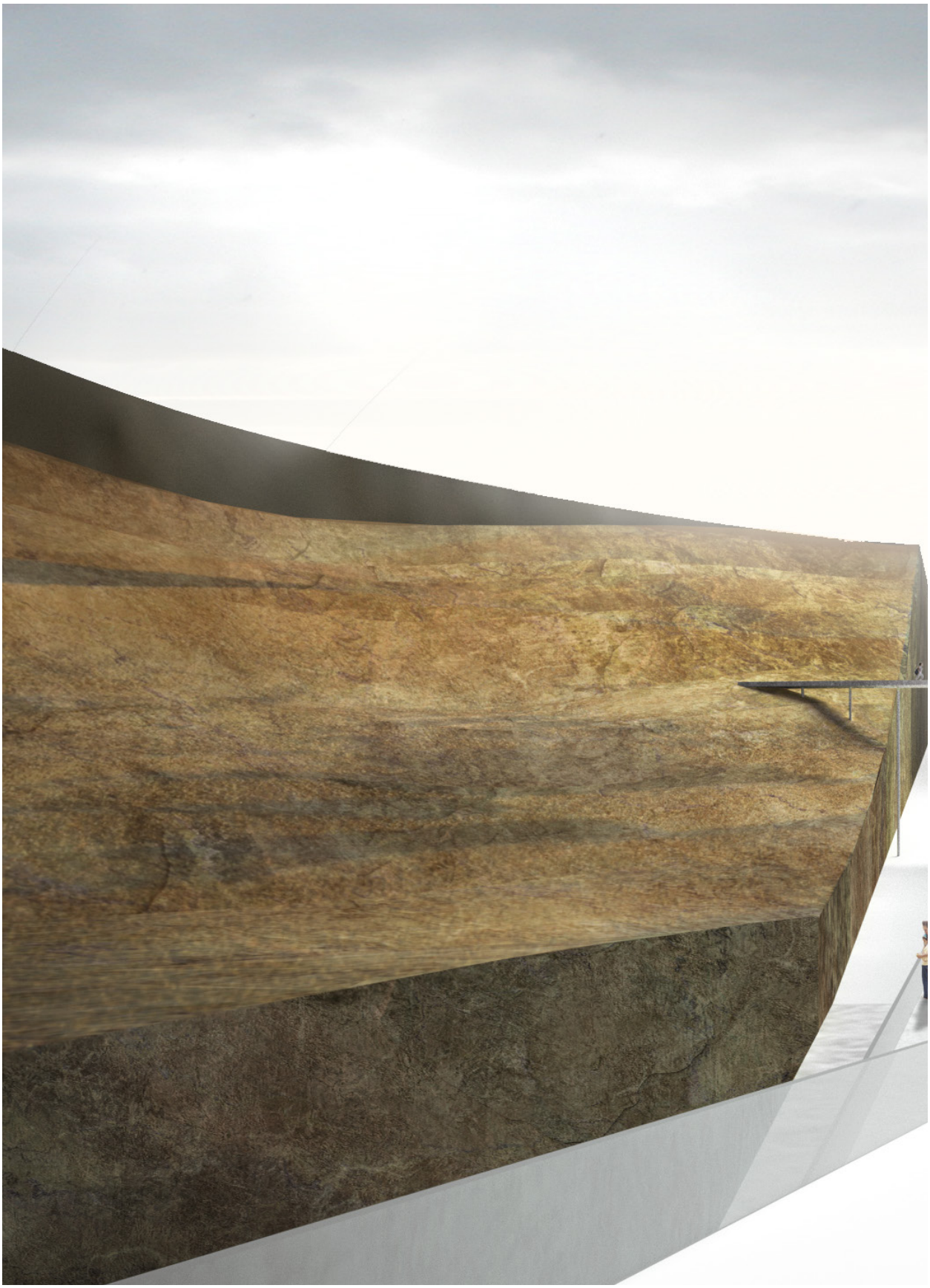
Fig 18: Diagram of underground mine map

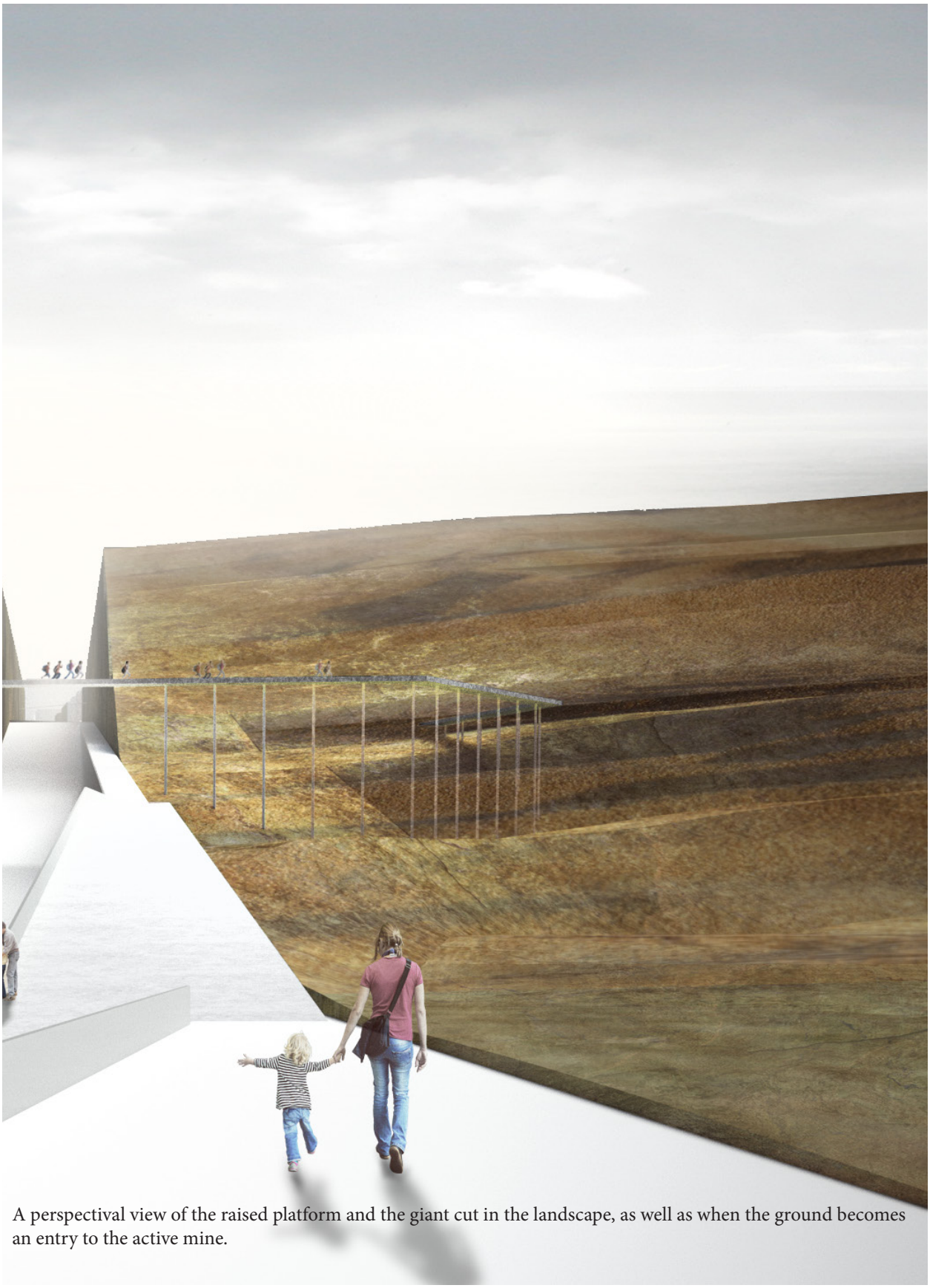
The underground playground is part of an expansive underground mining network of Butte. There are bridges that connect from one side of the cut to the other when the underground paths intersect with the new void in the landscape.





Partial Longitudinal Section 6: The raised platform reveals itself so that children can run around and view the Berkeley Pit from a high point. It also shows the continuity of the underground playground.



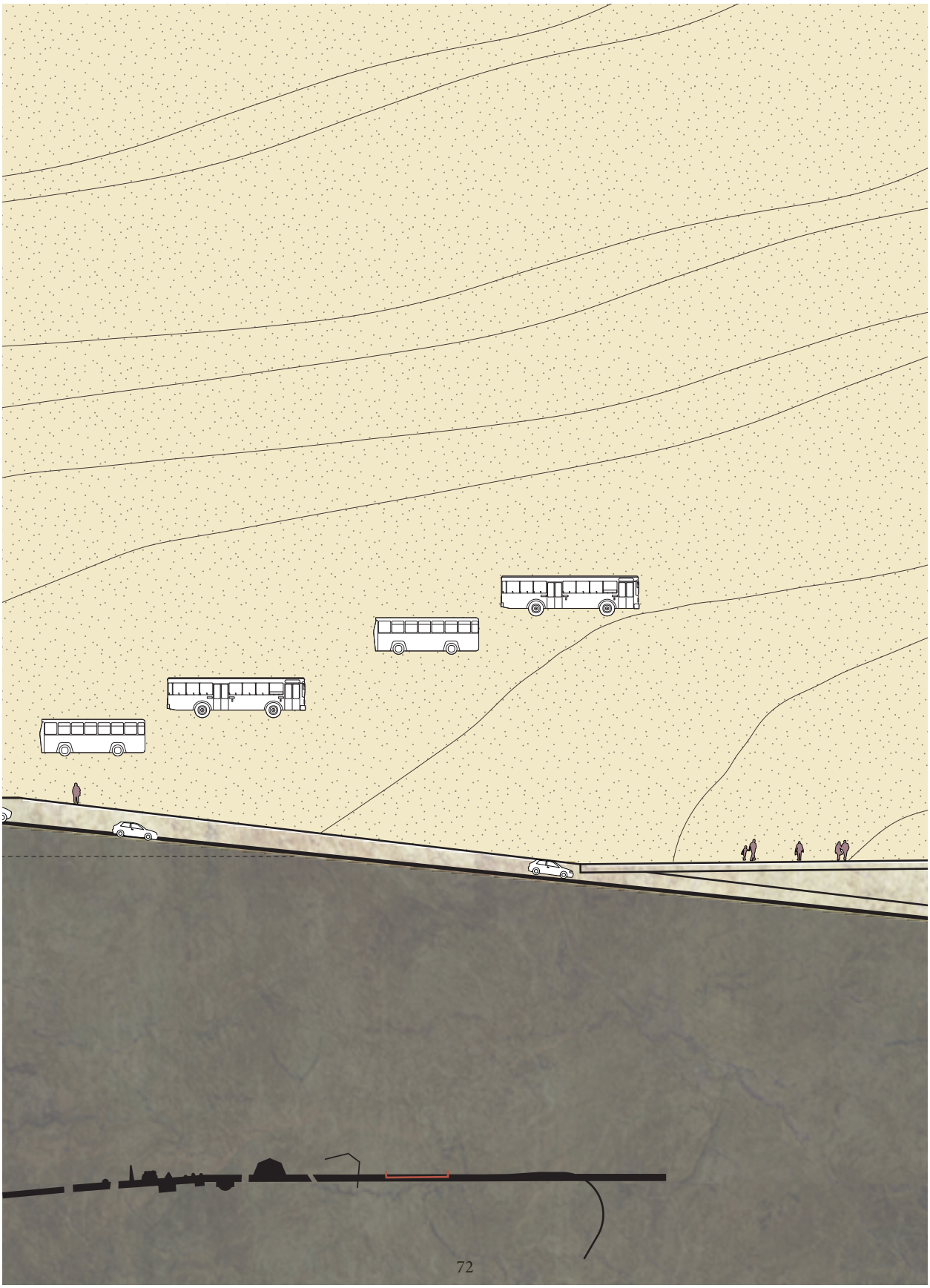


A perspectival view of the raised platform and the giant cut in the landscape, as well as when the ground becomes an entry to the active mine.

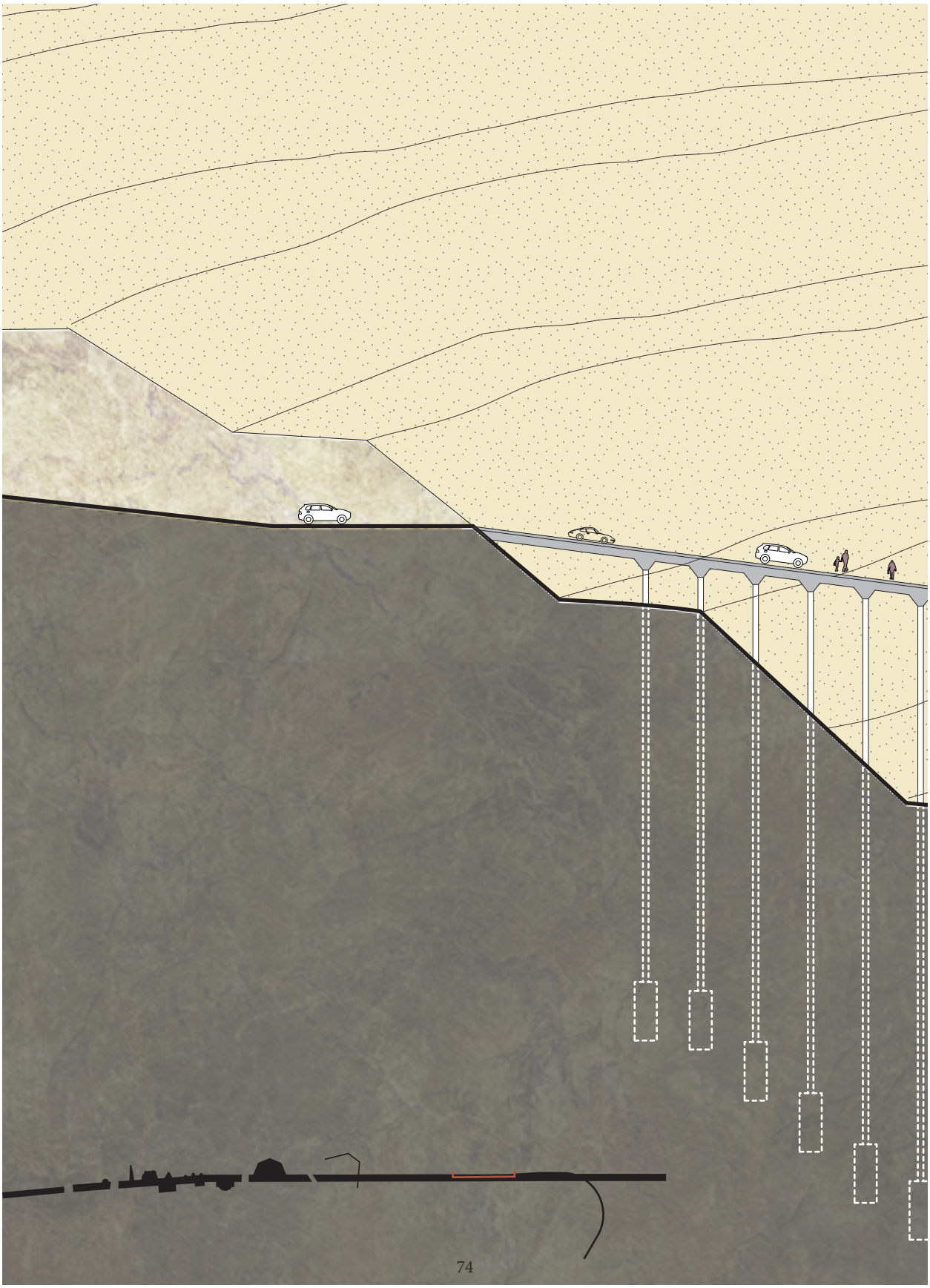
Learning Experience like Never Before:

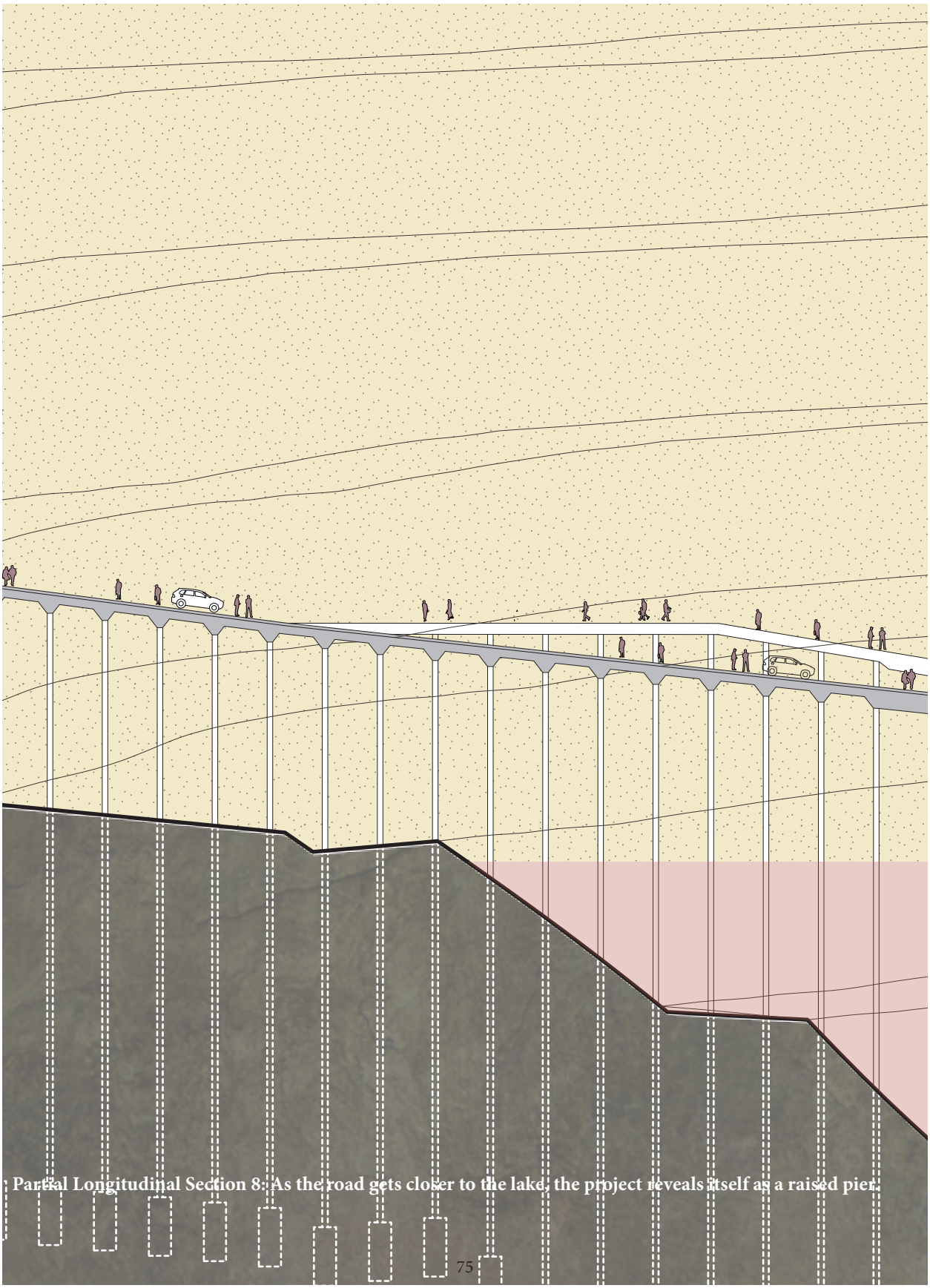
At SuperFun Site, we believe in the importance of children's engagement with their surroundings. As parents become over-protective in this industrialized society, we believe it is important to believe in the child's ability to be creative and spontaneous, and to not trap them in plastic playgrounds. Here, children are able engage in their immediate environment and playfully learn about the history of Butte as well as learn from the real experience of scientists on what is actually happening to our world.

Children learning about mining on the way to Berkeley Pit.



Partial Longitudinal Section 7: Cars and school buses can enter the mine so a large number of children can learn and experience the mine as a pedagogical activity.



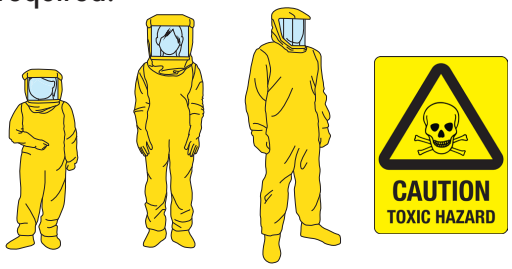


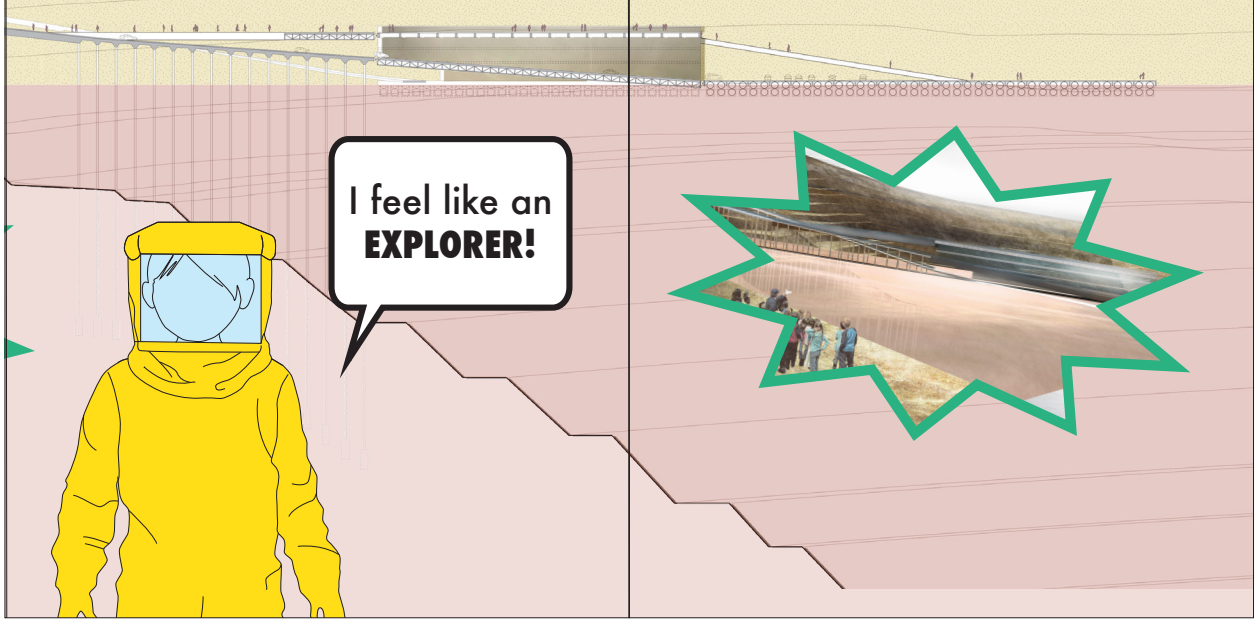
Partial Longitudinal Section 8: As the road gets closer to the lake, the project reveals itself as a raised pier.

On Toxicity:

As one of the largest Superfund site designated by the EPA, Berkeley Pit is contaminated with metals and minerals including Calcium, Magnesium, Potassium, Sodium, Iron, Manganese, Cadmium, Copper, Zinc, Chloride, Fuloride, Sulfate. Yet this should not stop children from exploring and playing. In collaboration with Montana Tech University, the City of Butte have acquired Haz-Mat Suits for all ages, both children and adults.

These Haz-Mat Suits are worn daily by scientists to conduct research in the Berkeley Pit, therefore are **guaranteed safe**. Please see map for where you can rent a Haz-Mat Suit that fits your size. 30 minutes Haz-Mat training required.





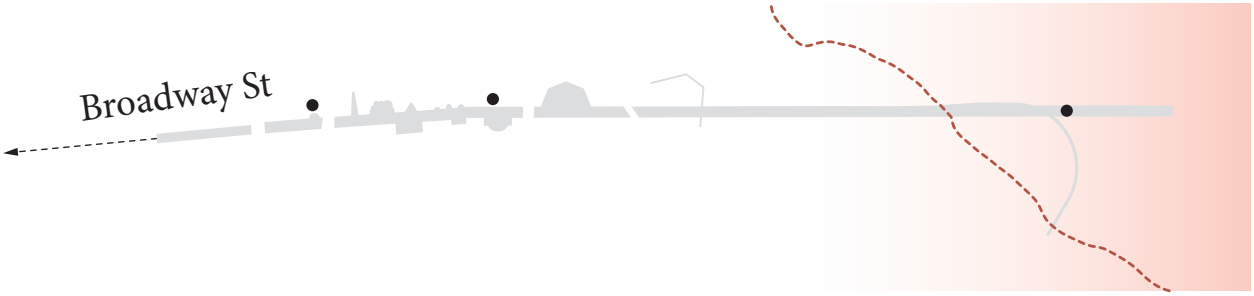
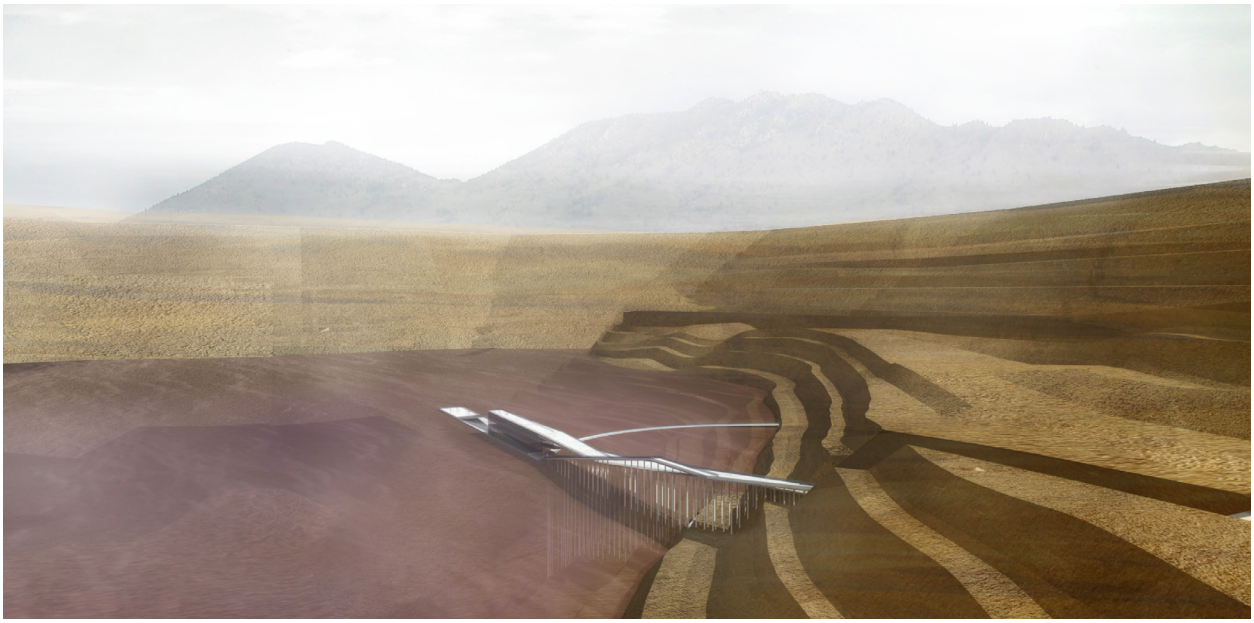
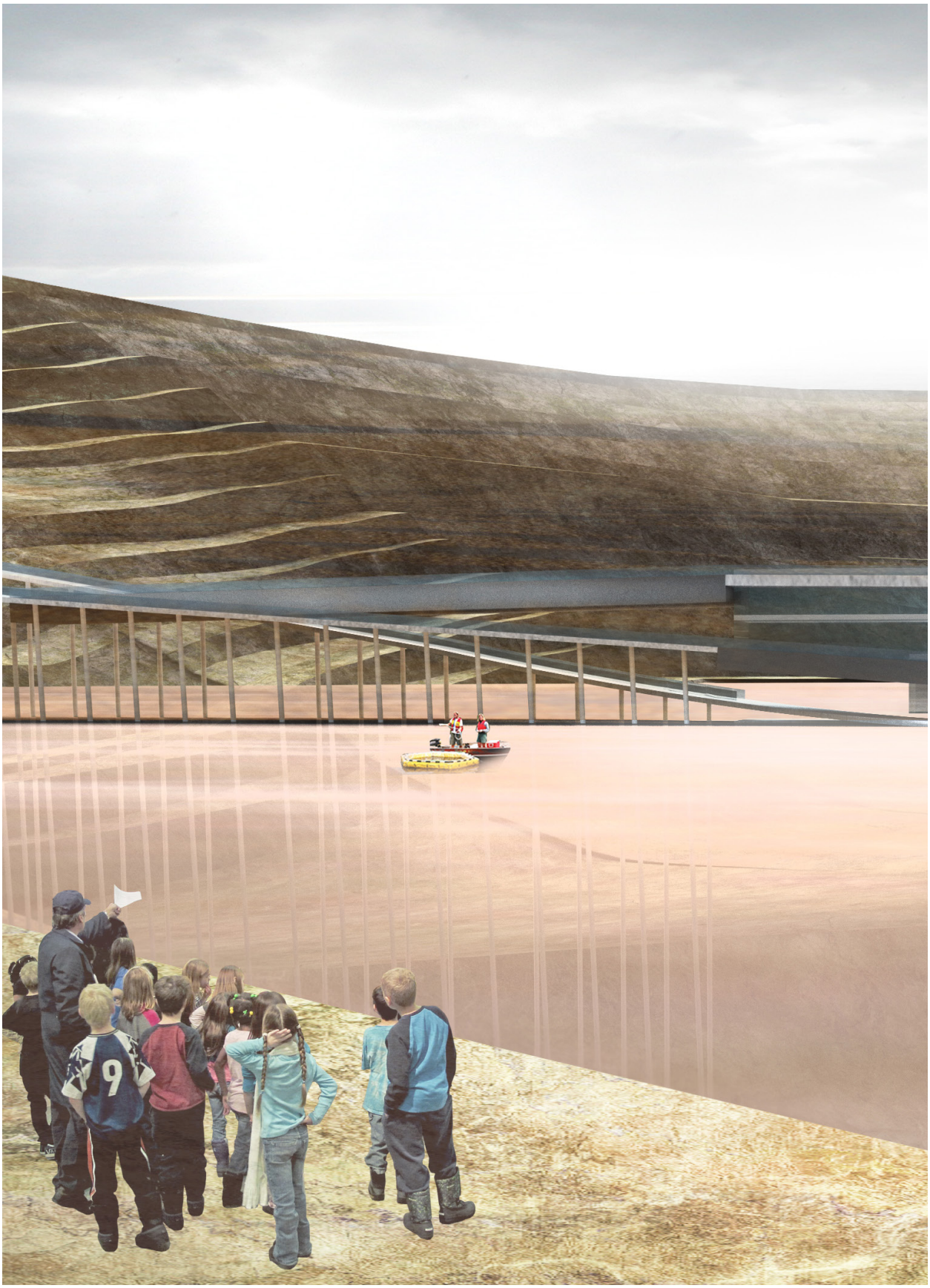


Diagram showing location of Haz-Mat Suit renting location as well as the raising toxicity level as you get closer to the lake.

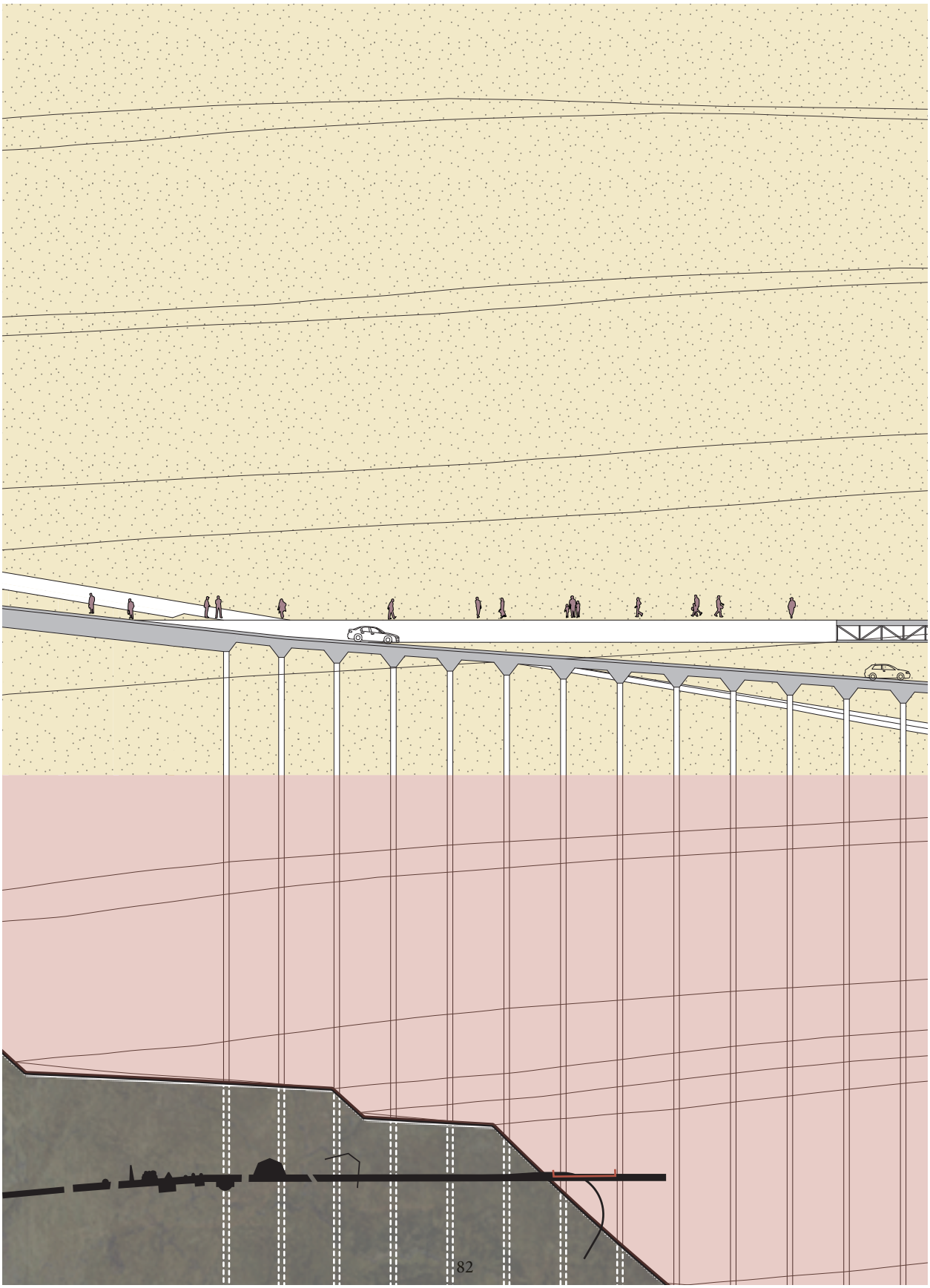


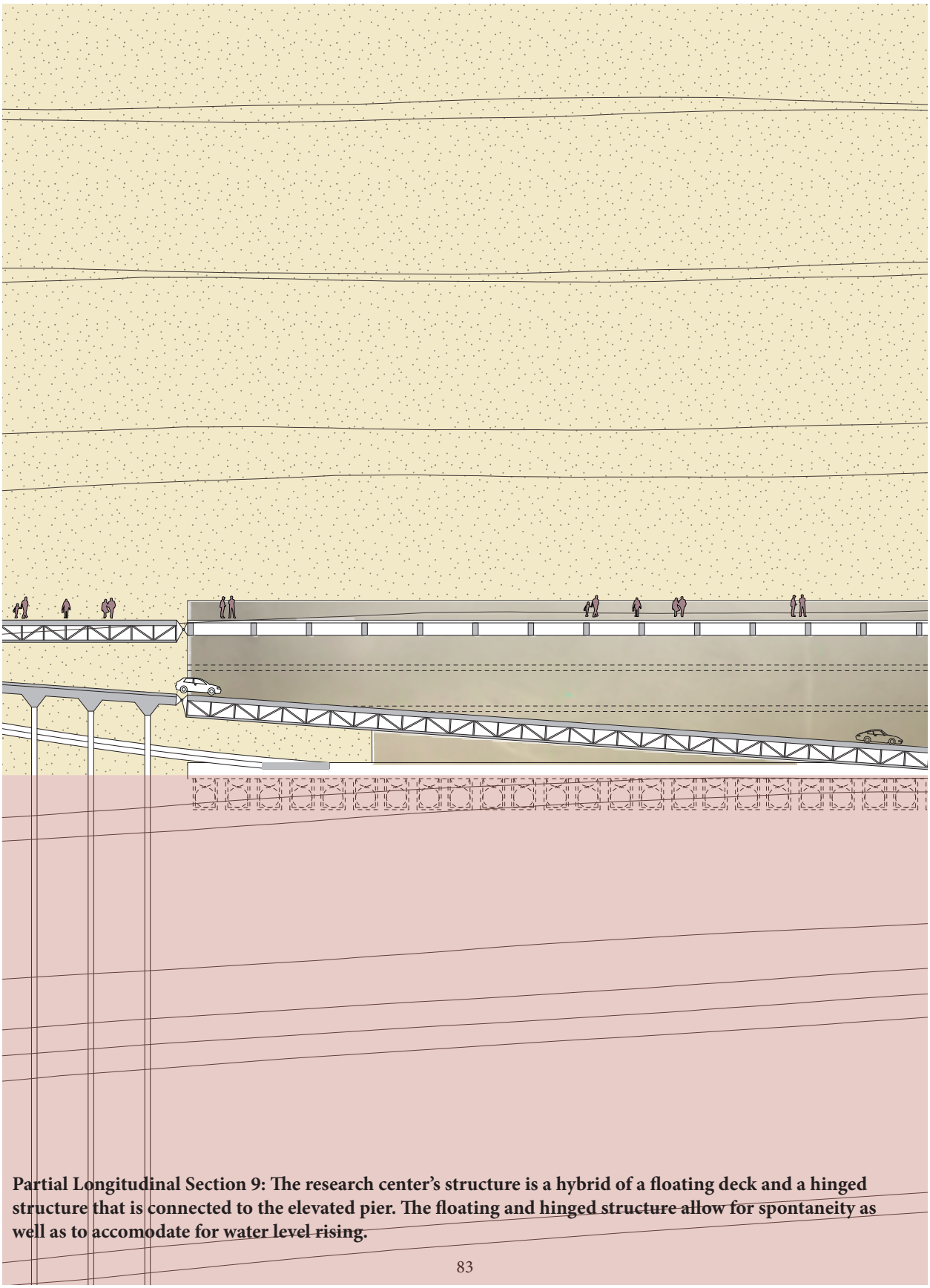
Rendering showing how the project becomes a floating pier on the lake.

Rendering showing how children and adults can experience the local phenomenon of the “Pit Fog” in proximity at the SuperFun Site.

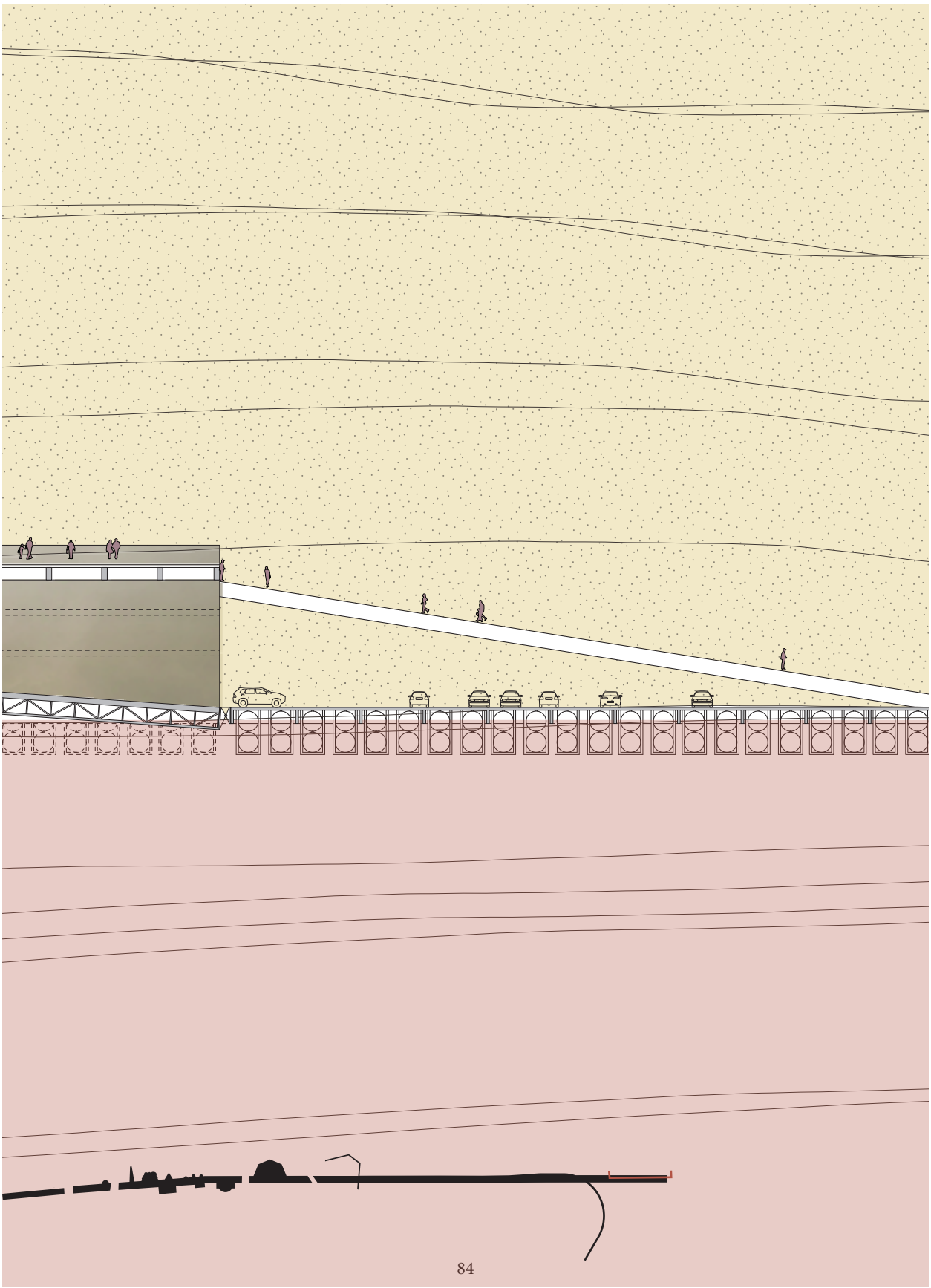


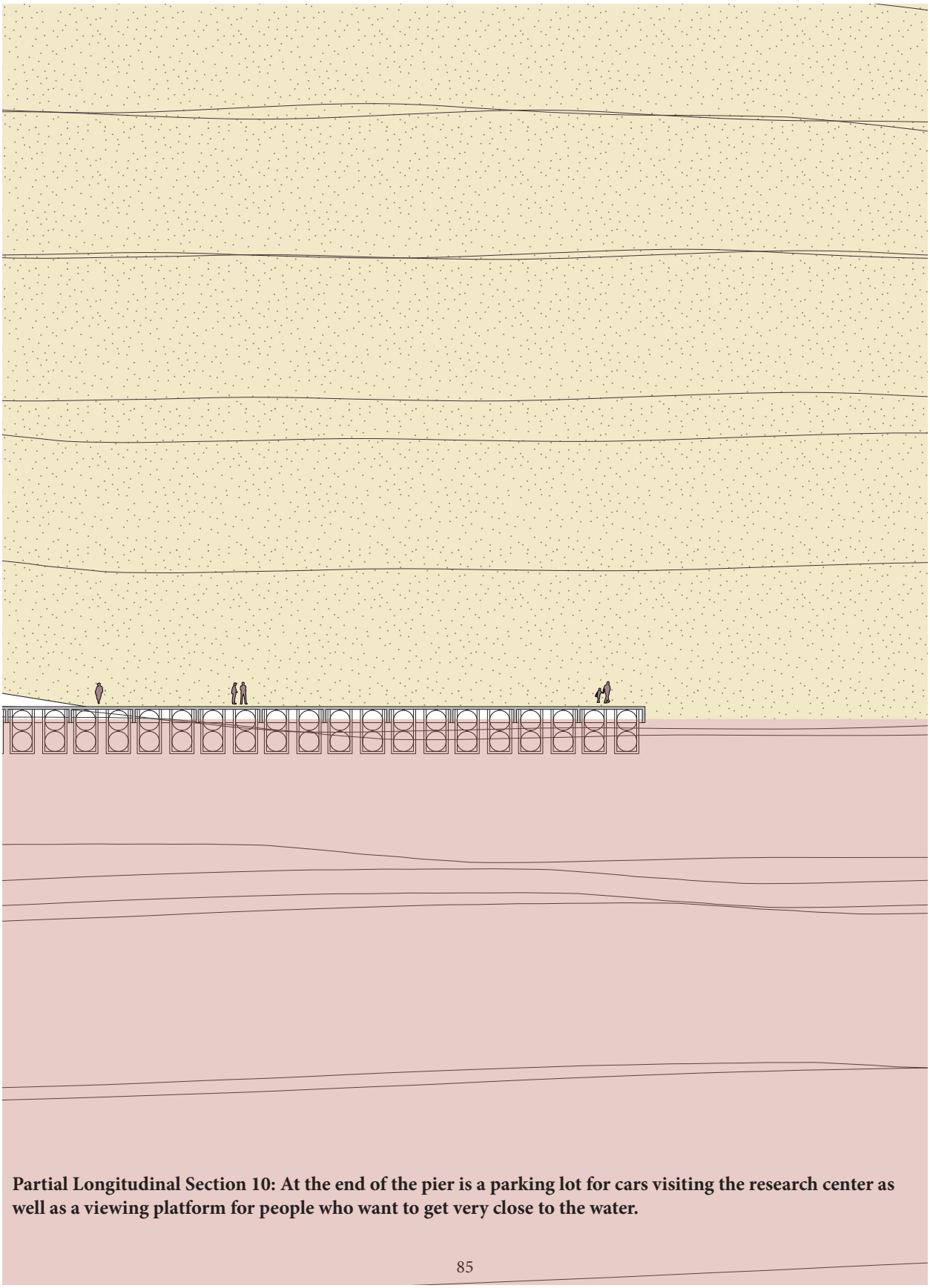
Rendering showing the floating research at the end of the pier and the children watching the scientists do work in the Berkeley Pit





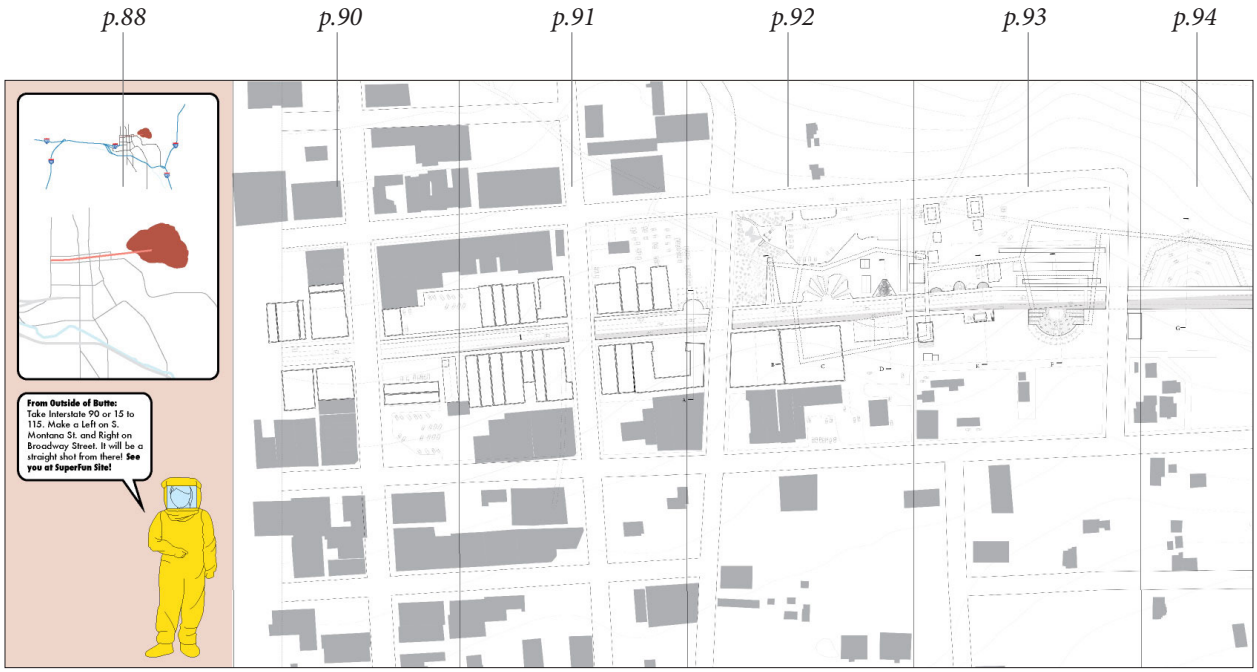
Partial Longitudinal Section 9: The research center's structure is a hybrid of a floating deck and a hinged structure that is connected to the elevated pier. The floating and hinged structure allow for spontaneity as well as to accomodate for water level rising.



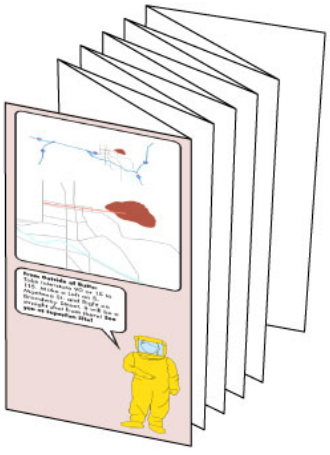


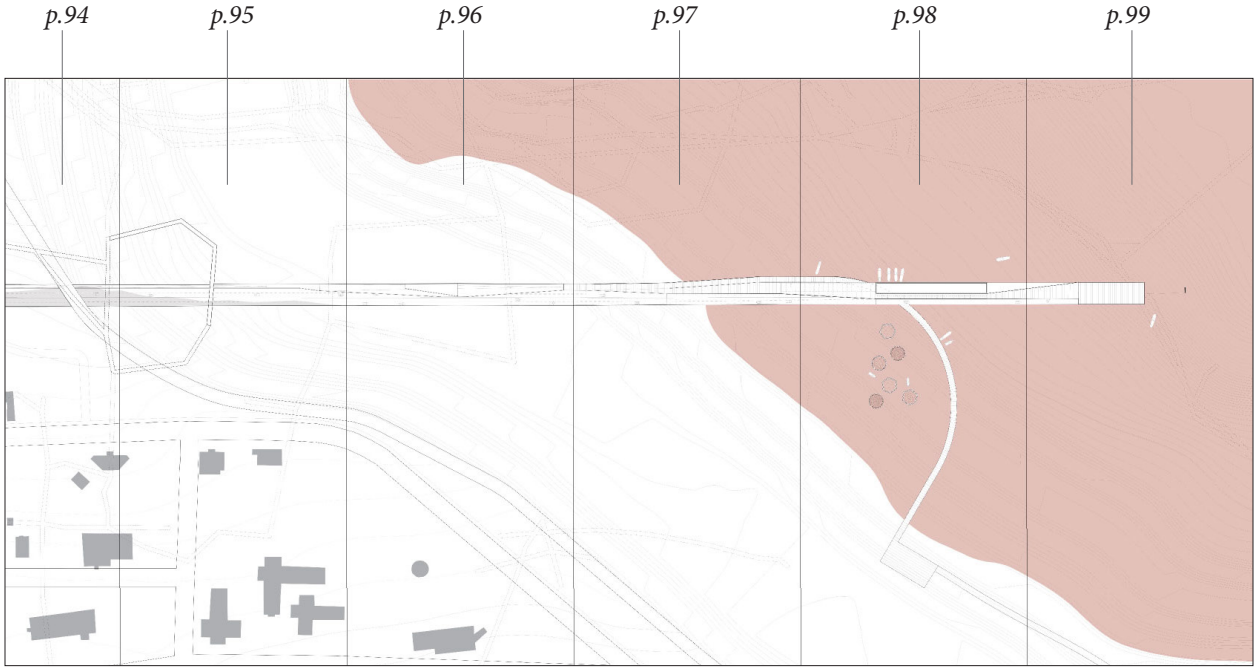
Partial Longitudinal Section 10: At the end of the pier is a parking lot for cars visiting the research center as well as a viewing platform for people who want to get very close to the water.

A Brochure for SuperFun Site : Back



A speculative brochure for SuperFun Site

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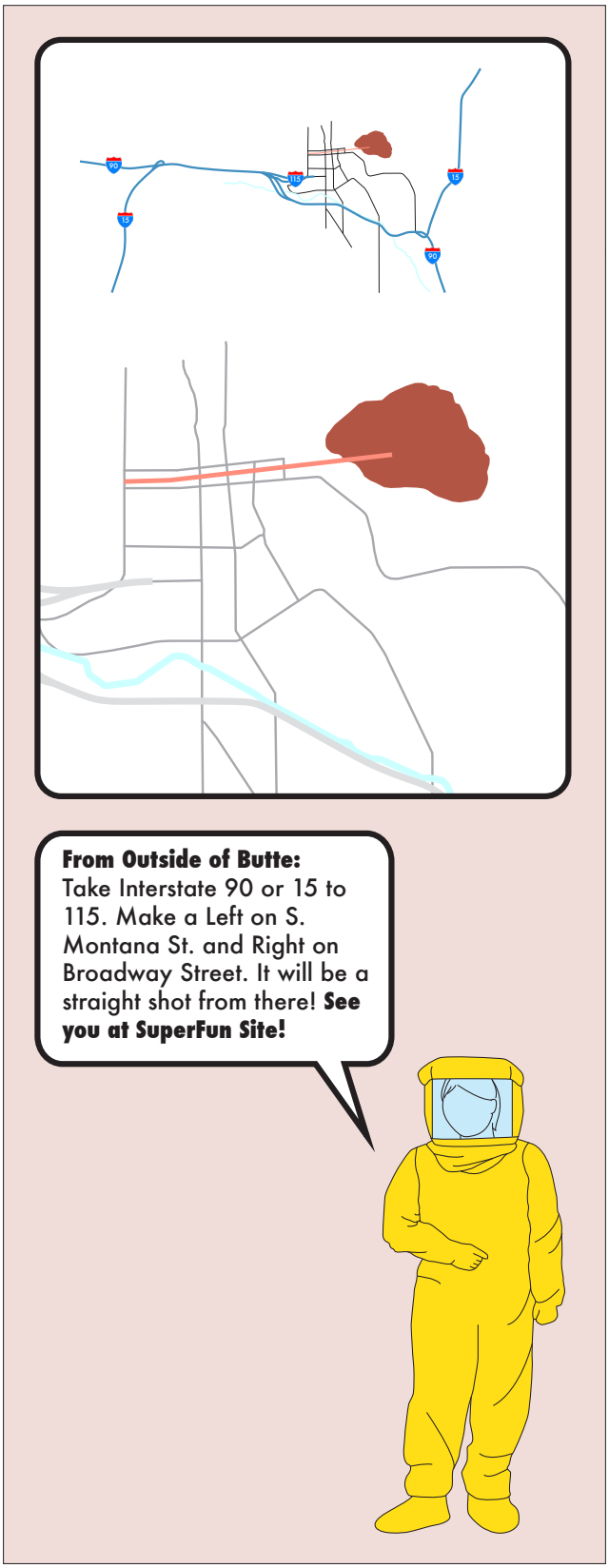
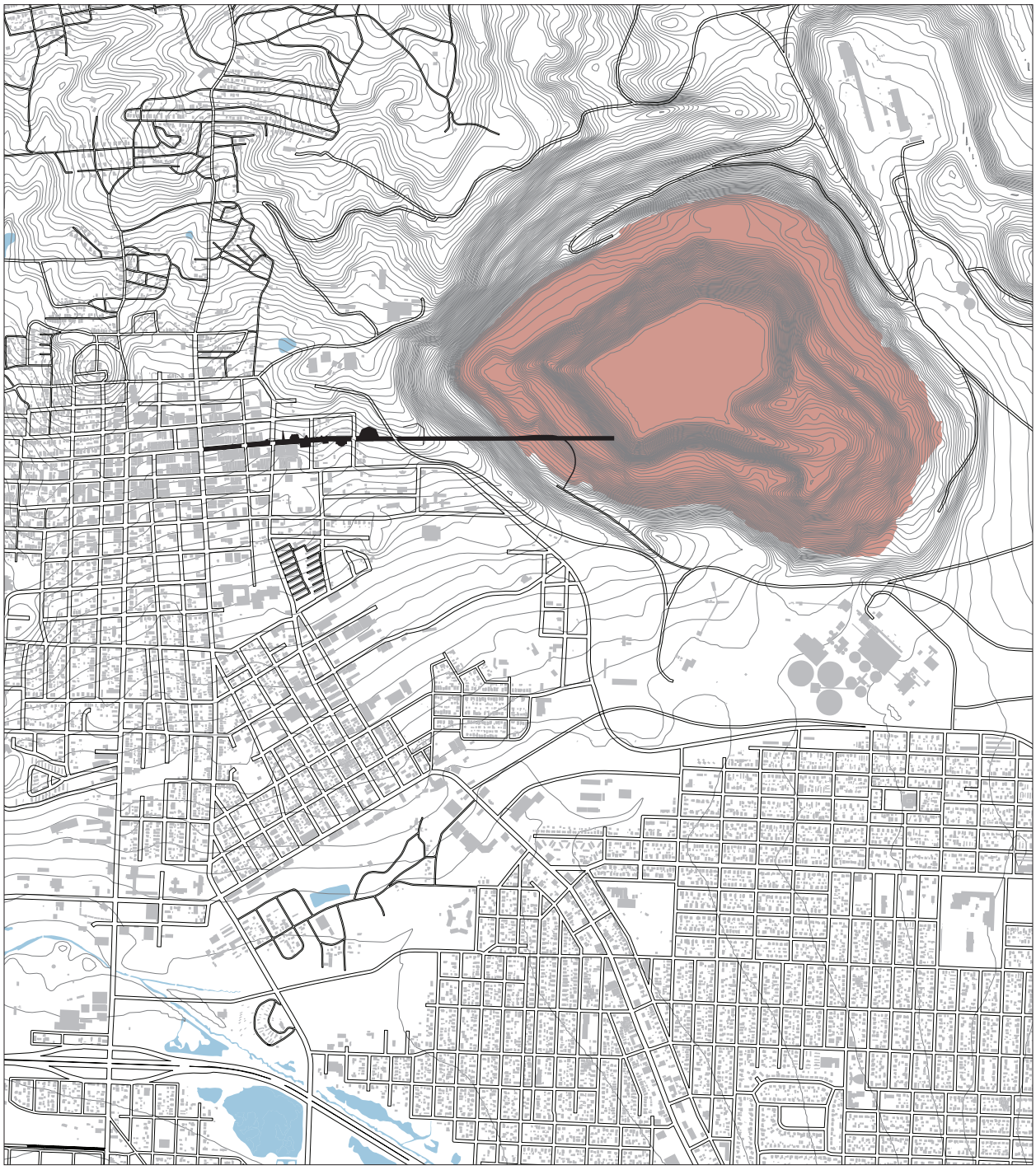
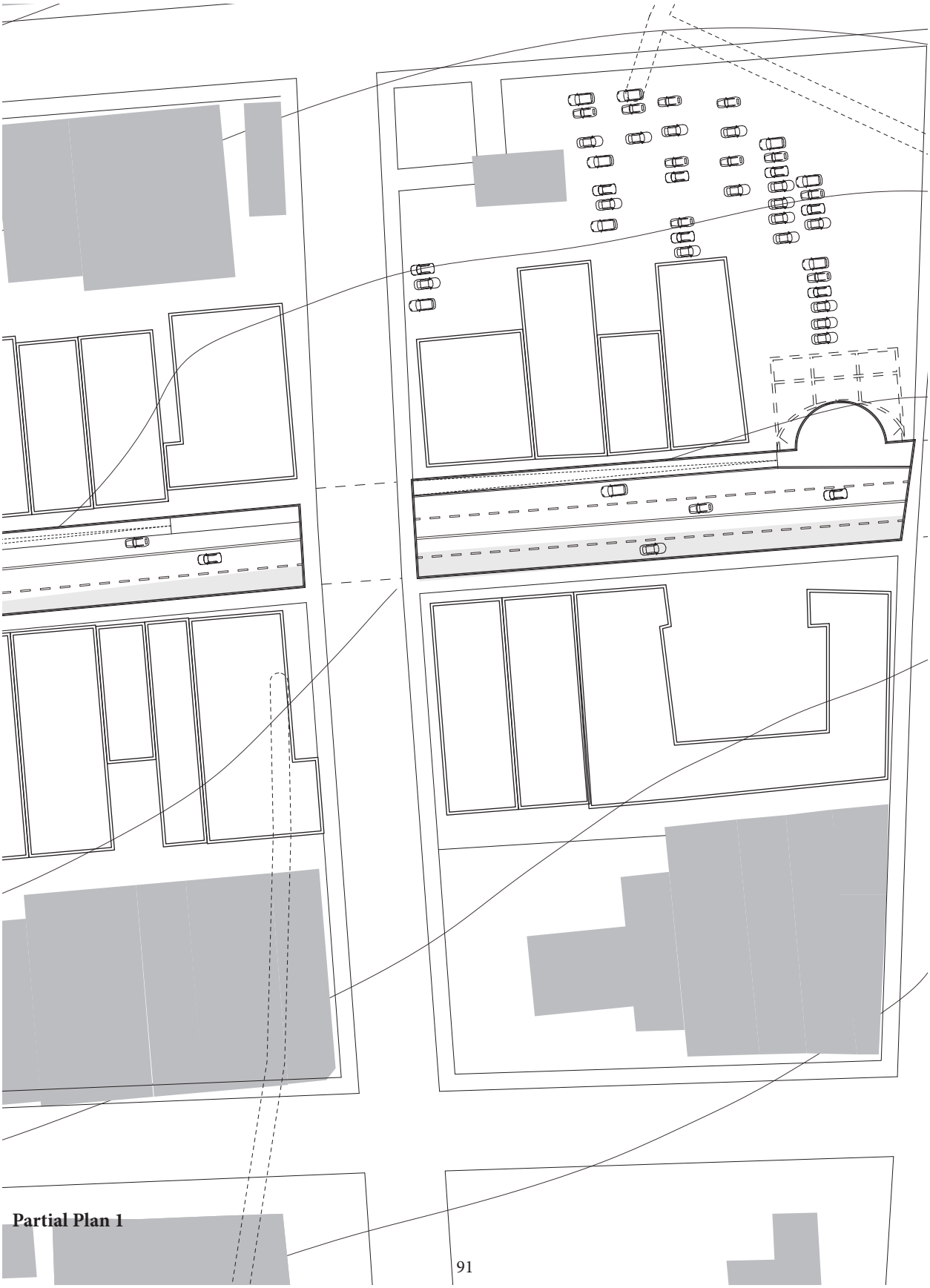
A Brochure for SuperFun Site: Back 1

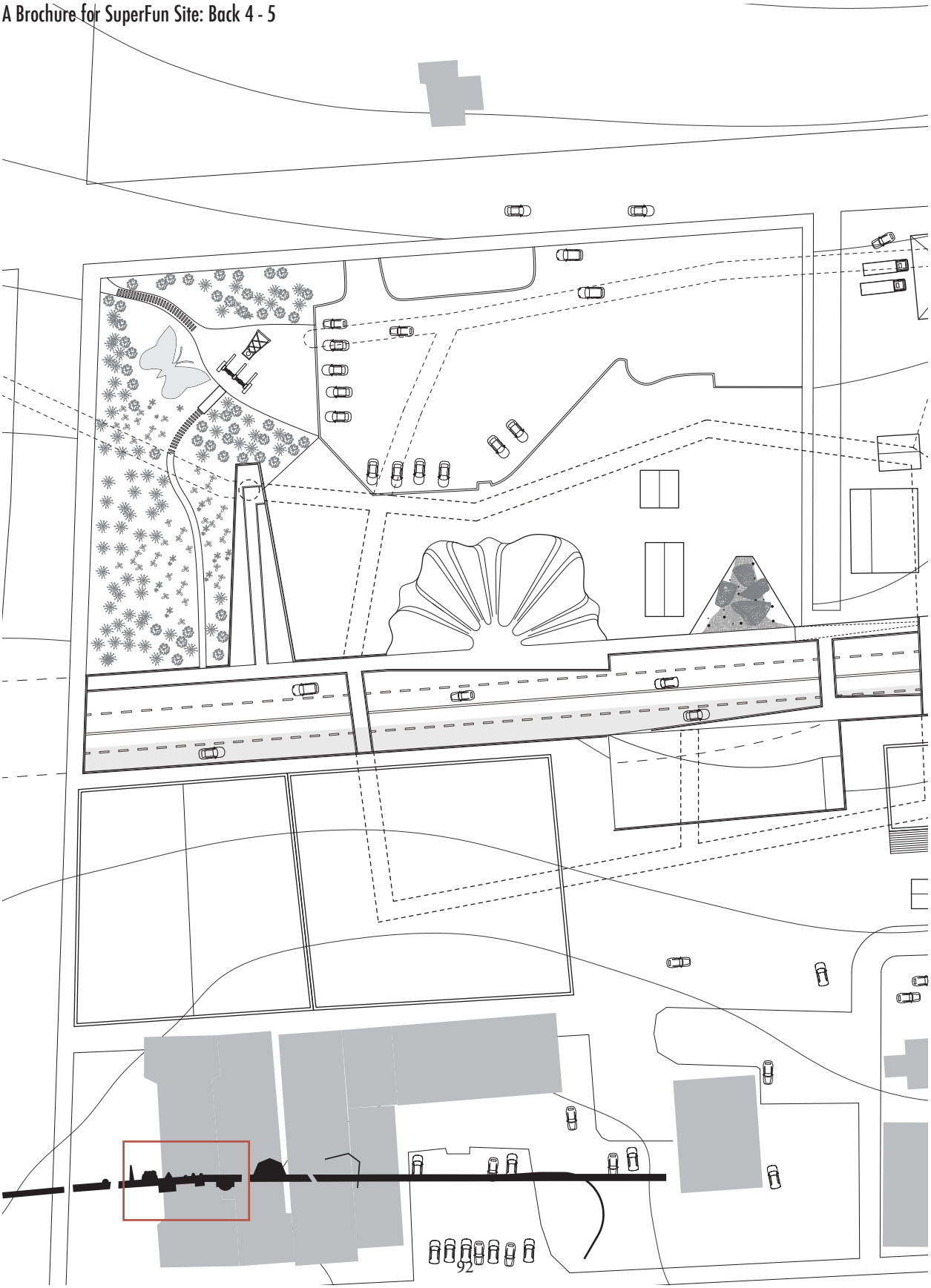


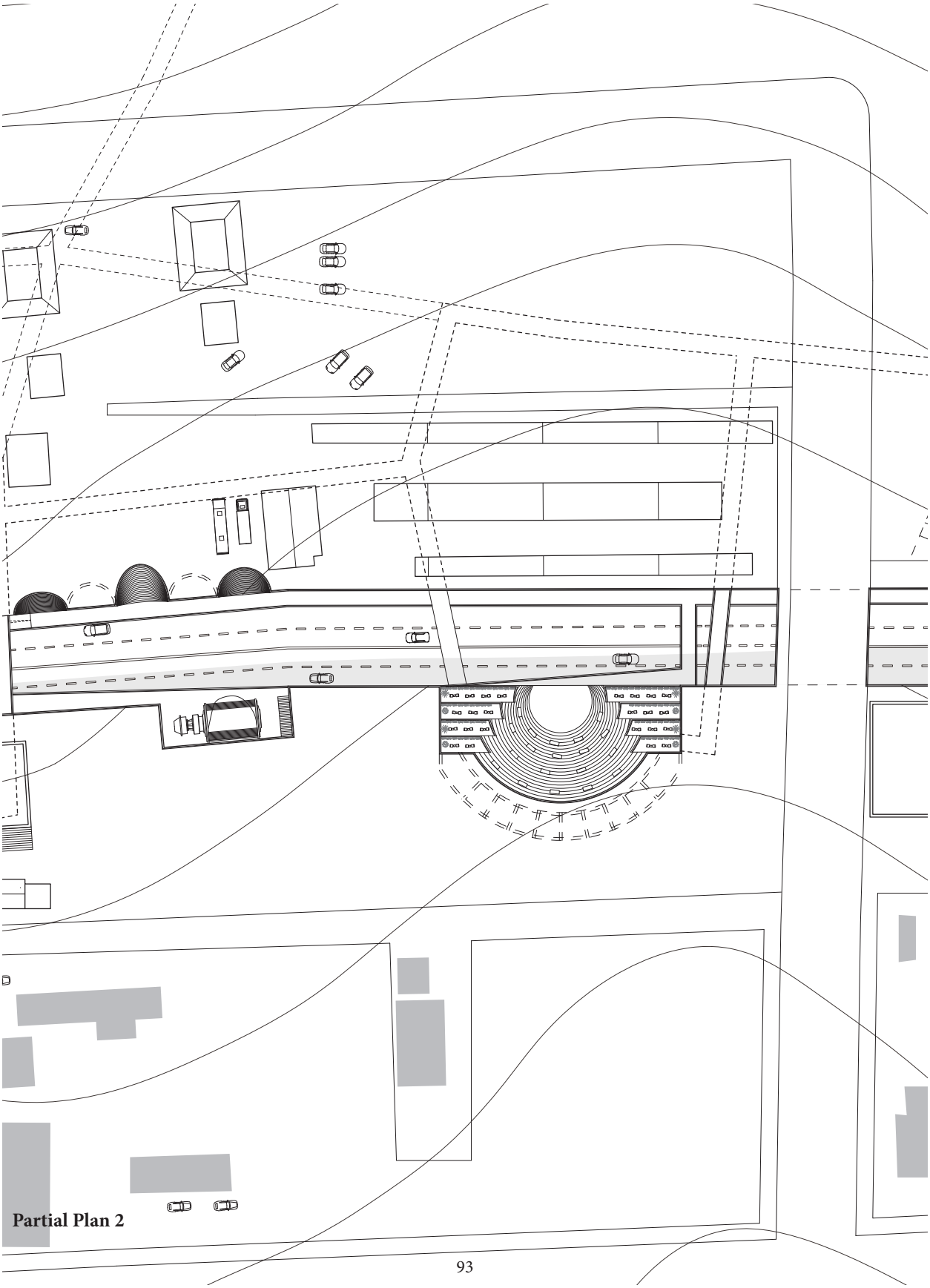


Site Plan of SuperFun Site



Partial Plan 1





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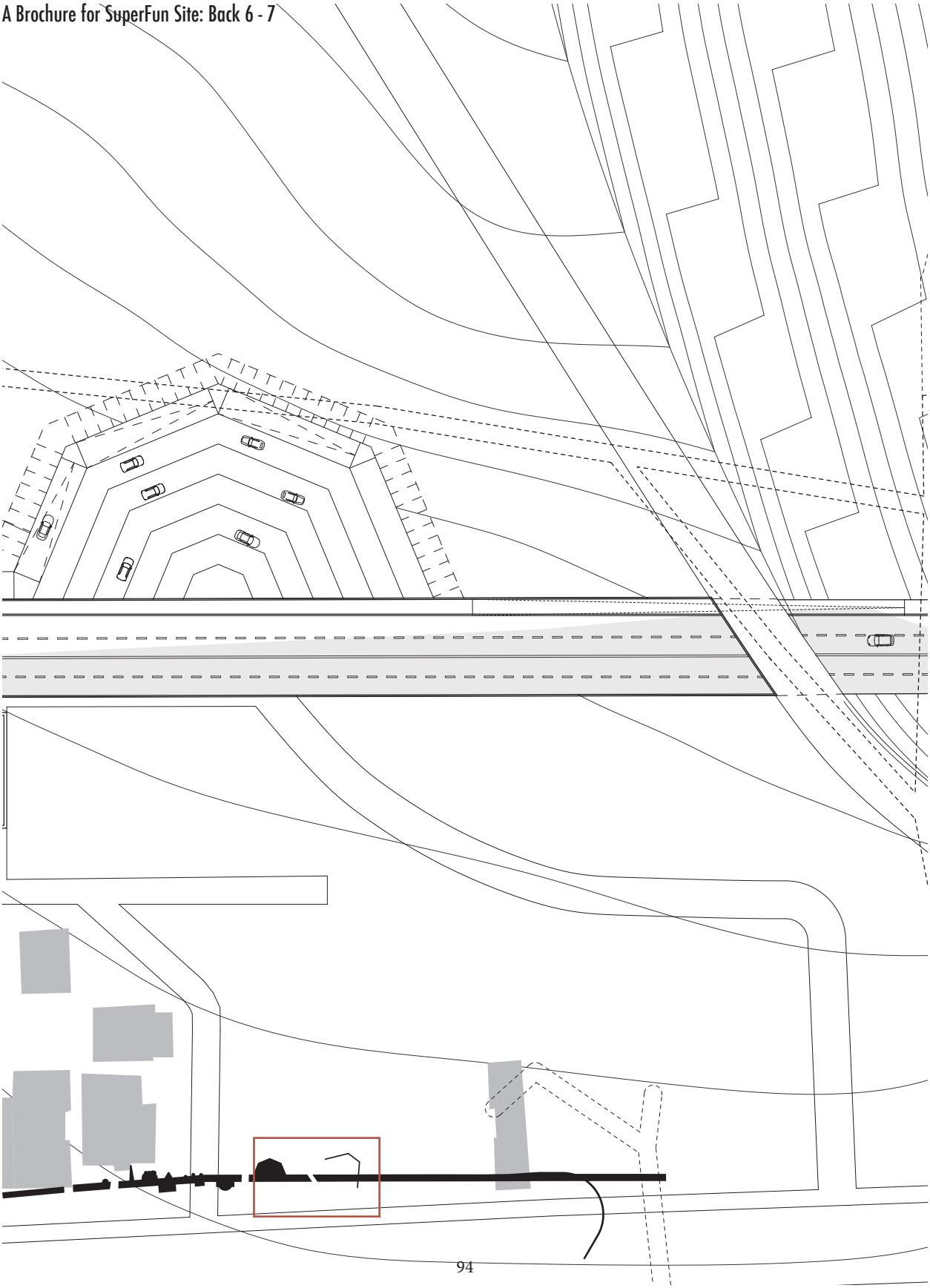
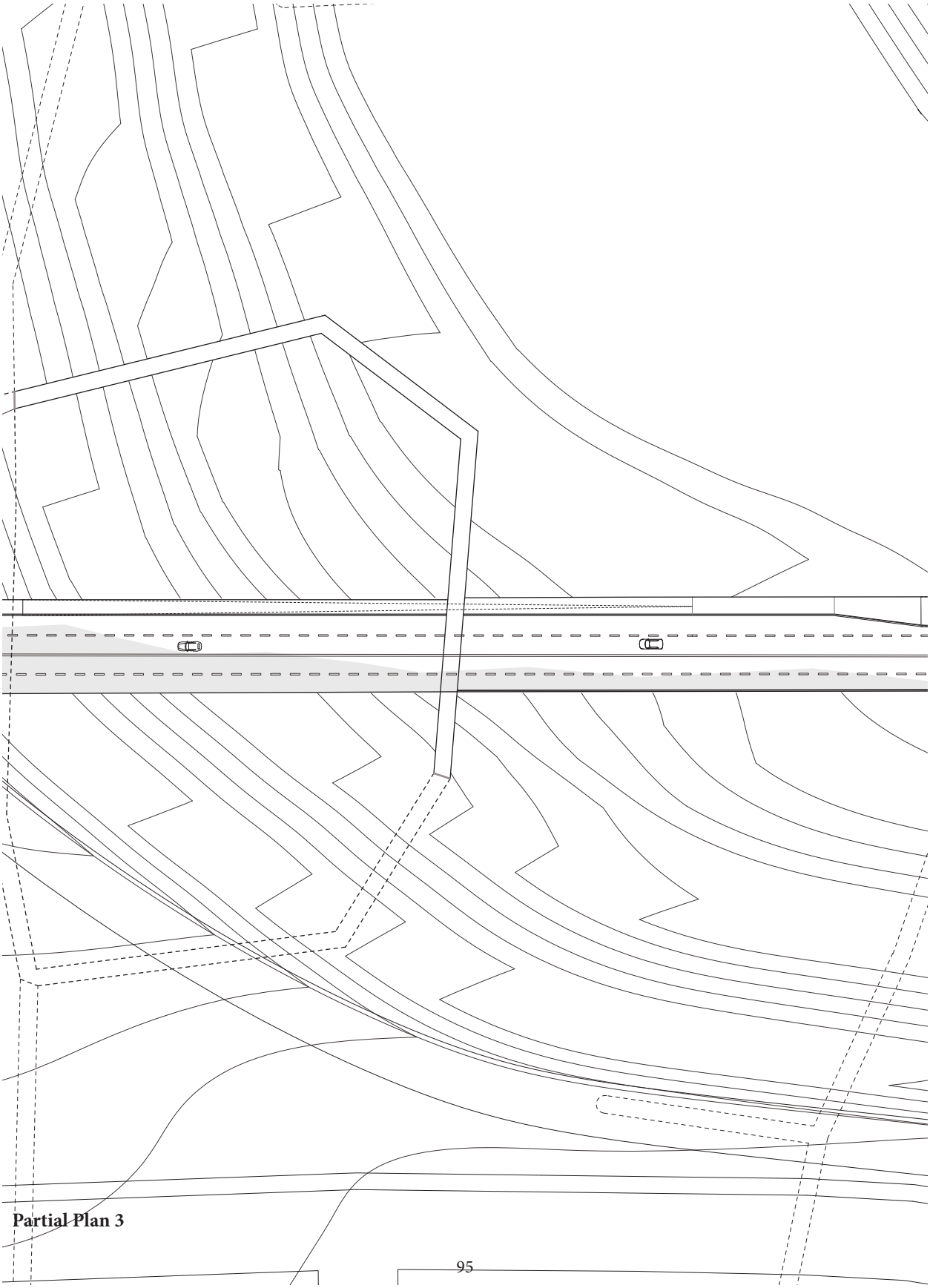
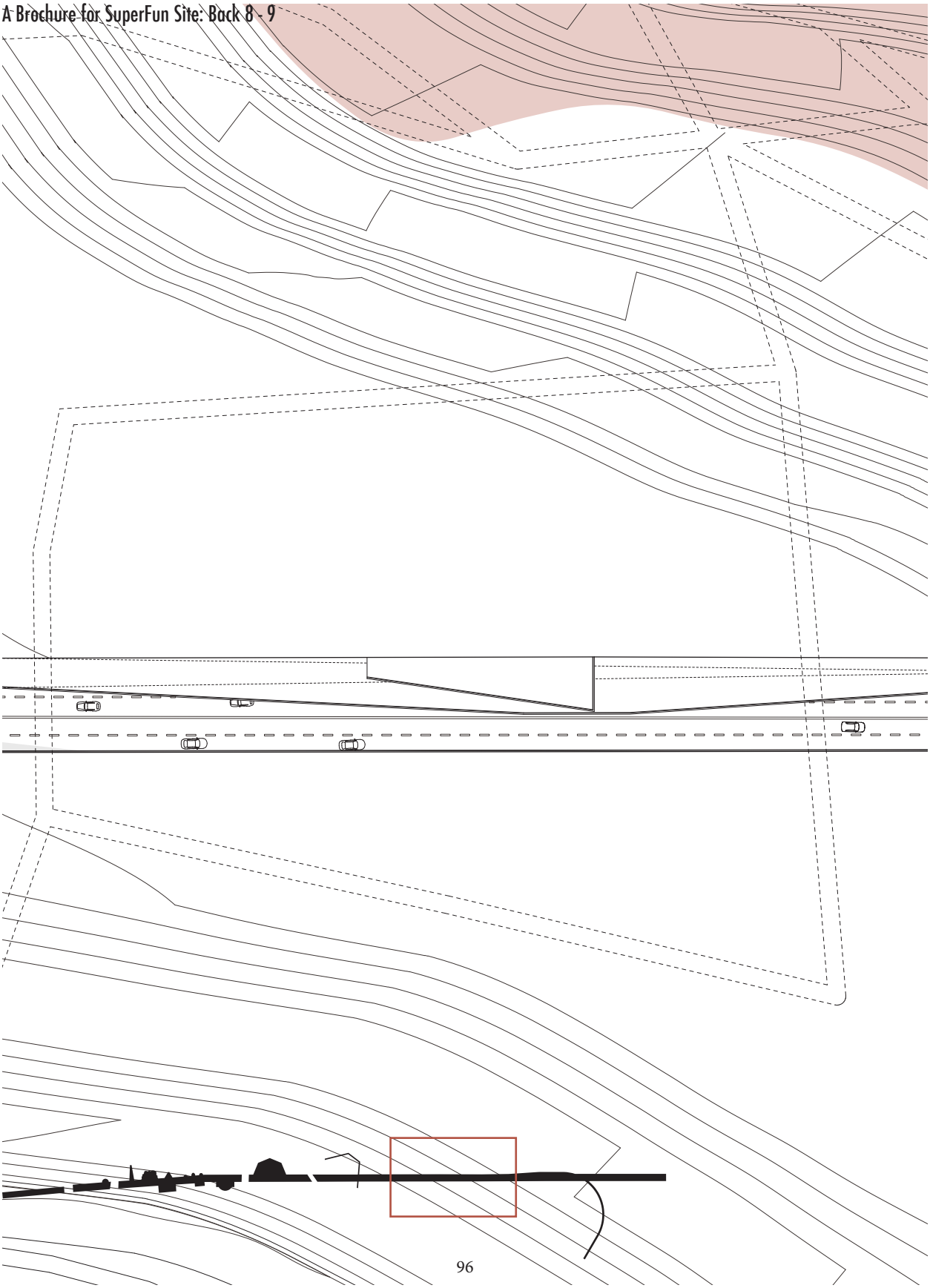
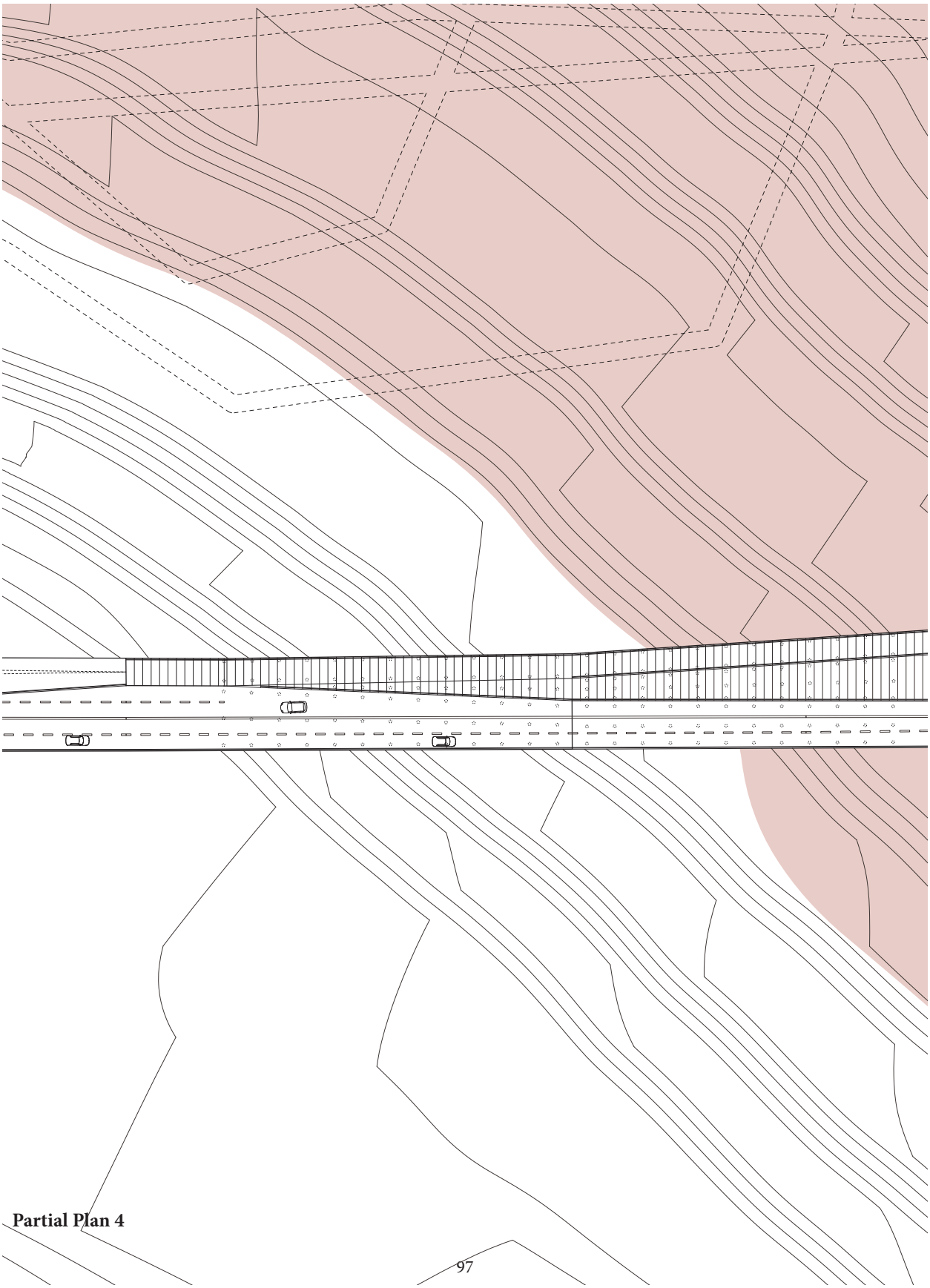




Partial Plan 3





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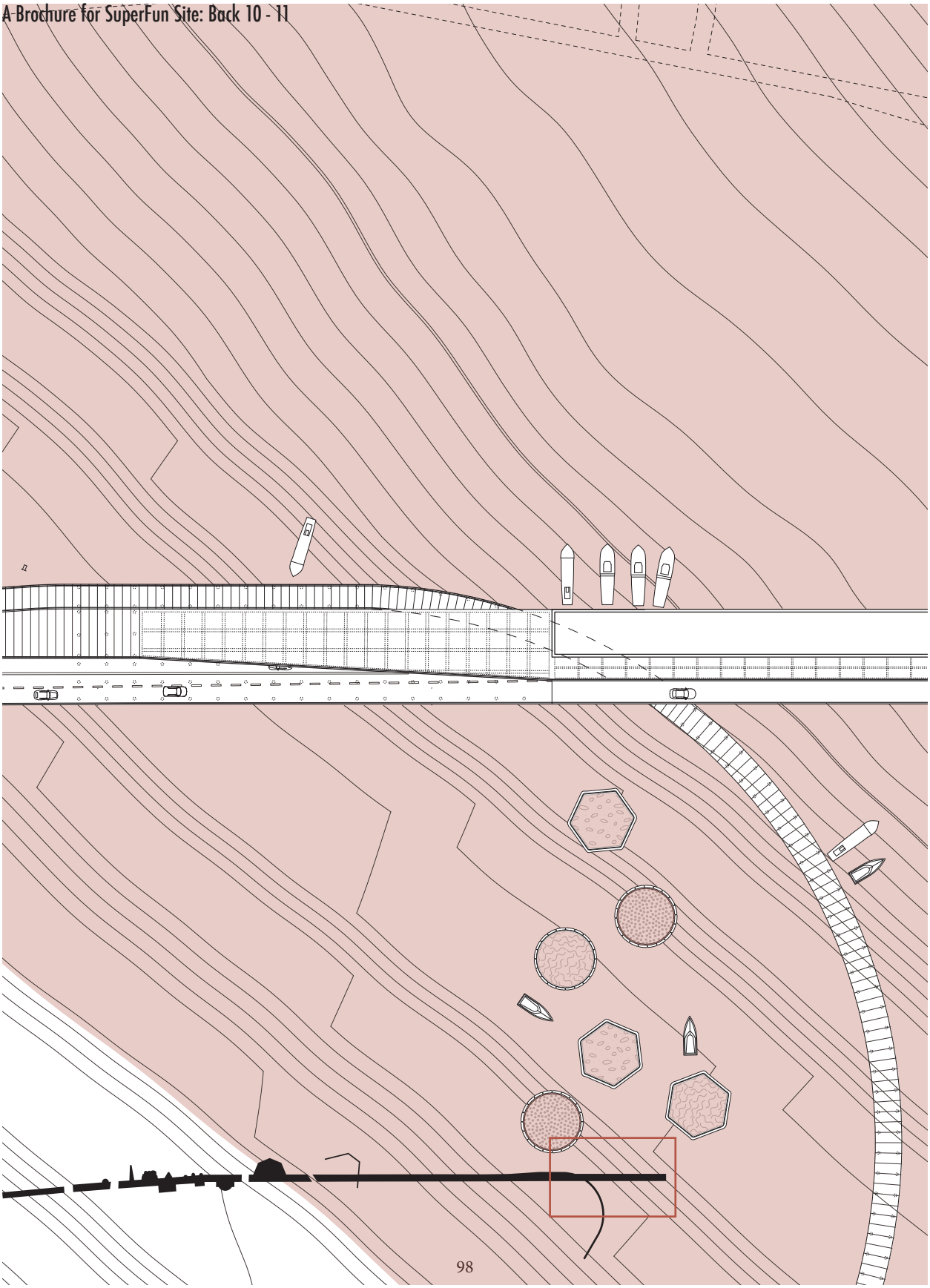

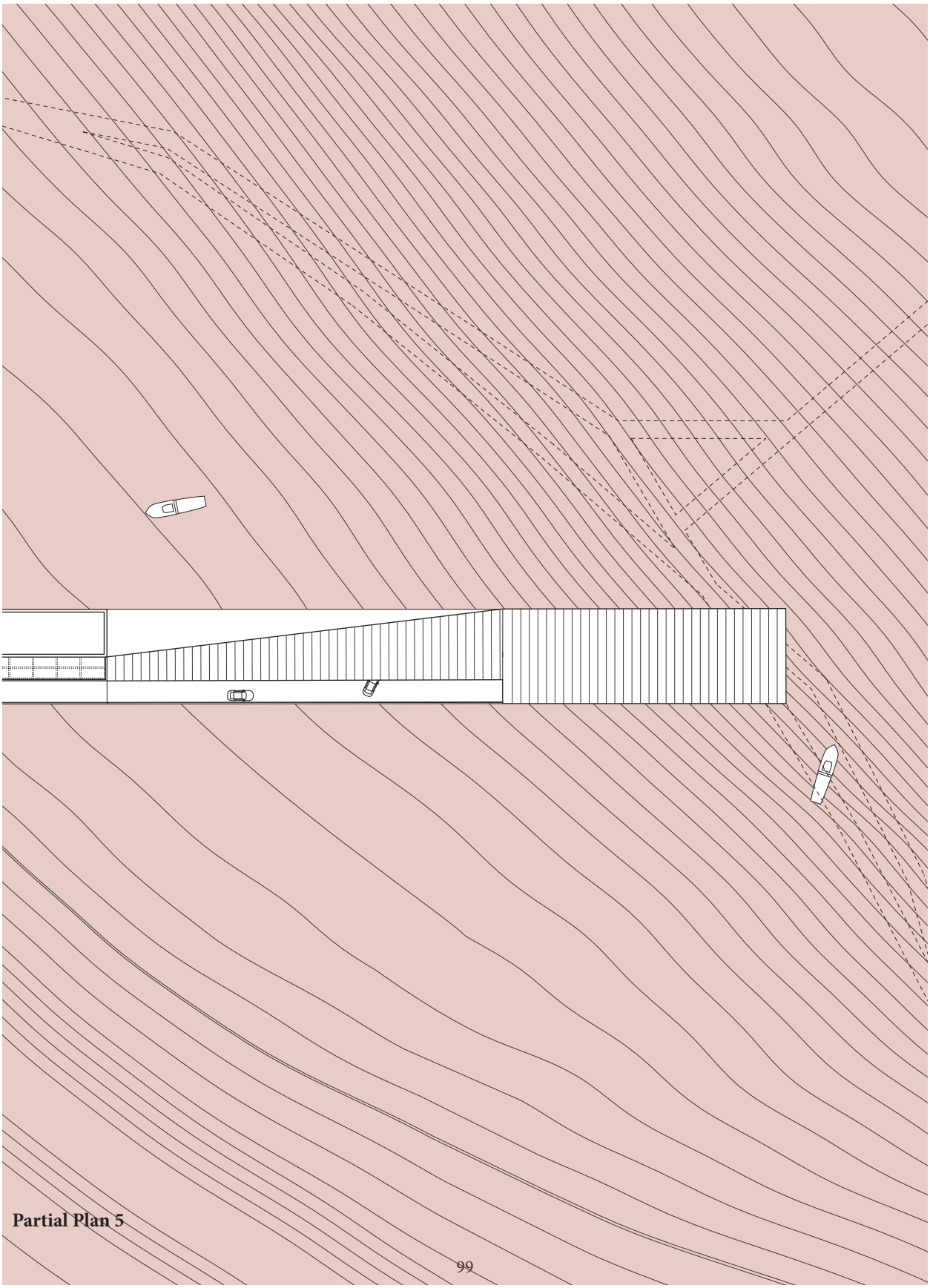

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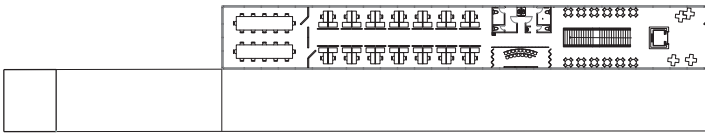
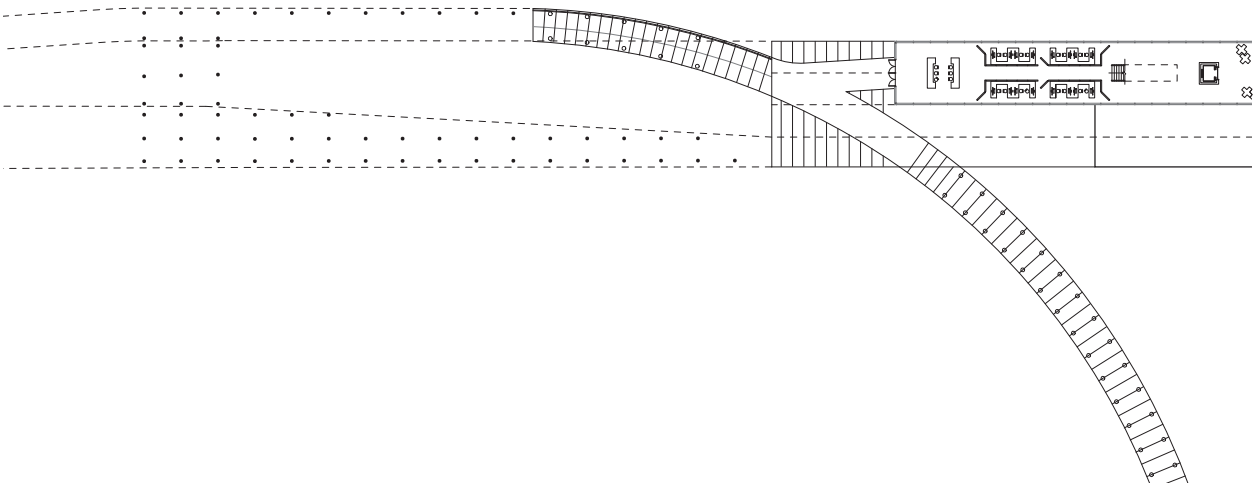
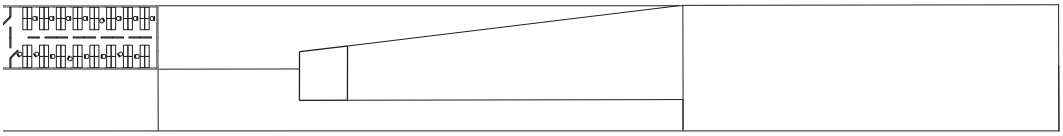
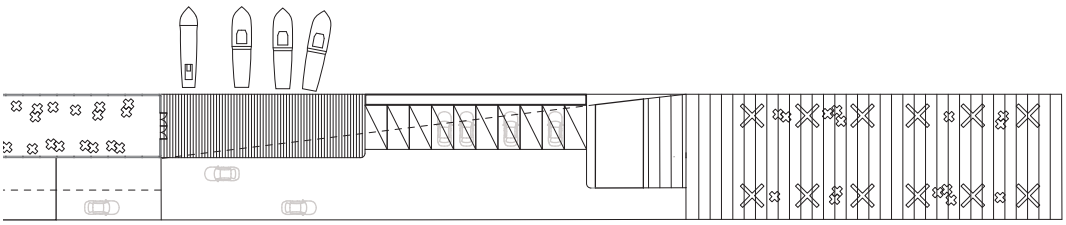






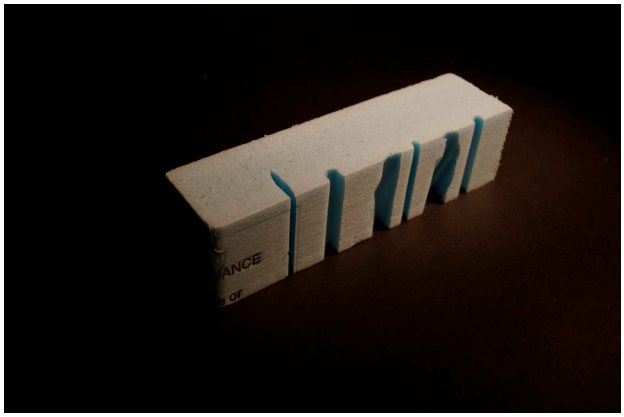
Upper Floor Plan of Research Center

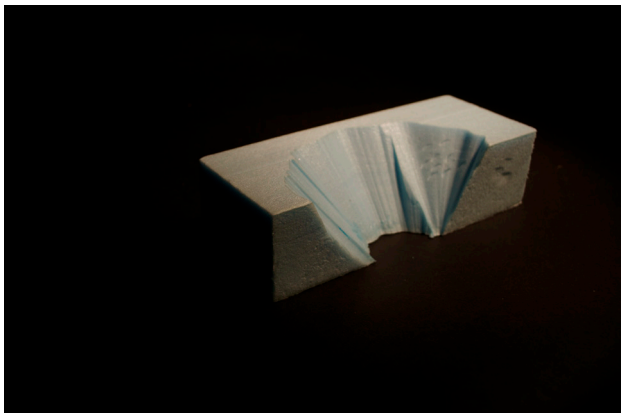


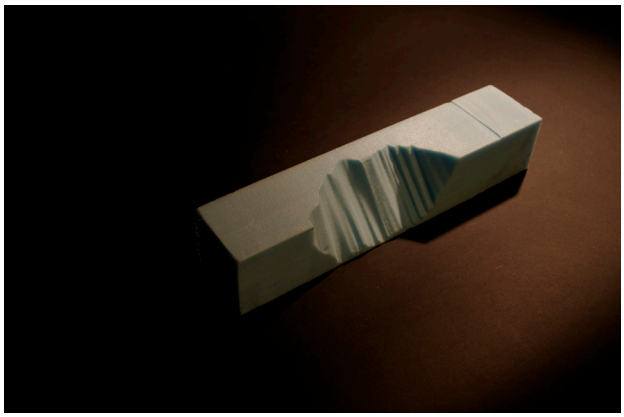
Ground Floor Plan of Research Center

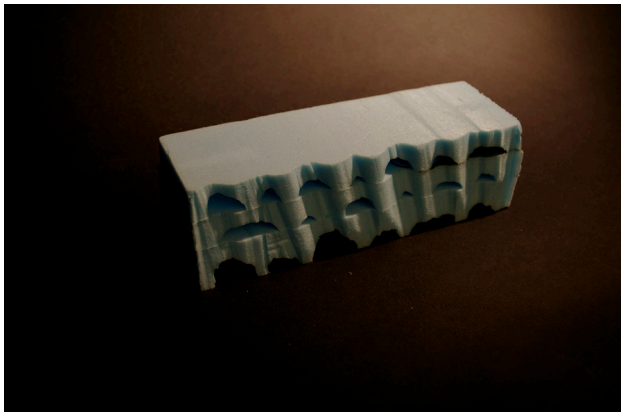
Appendix A: Model Photos

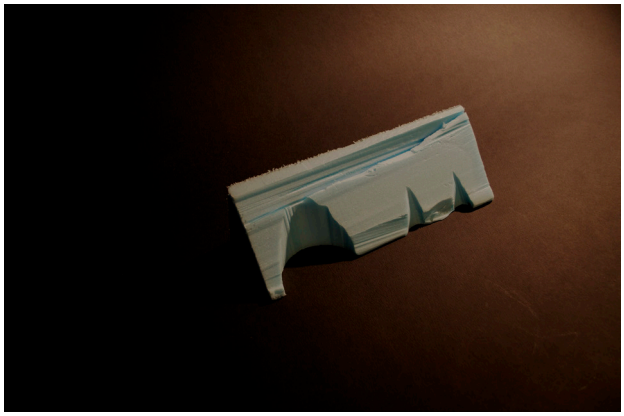
Study Models of Carving Strategies

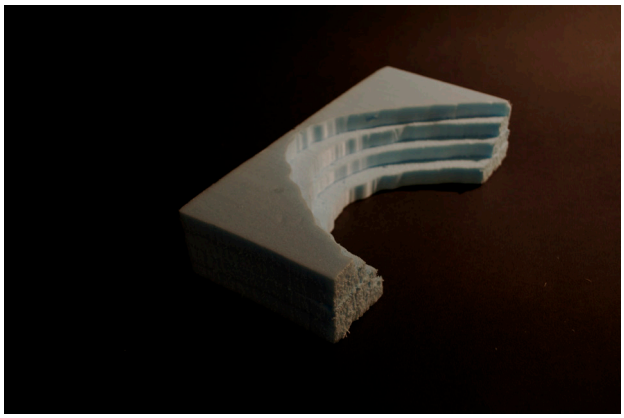


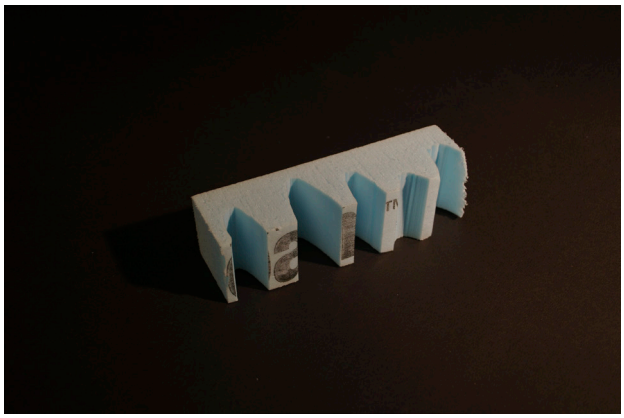


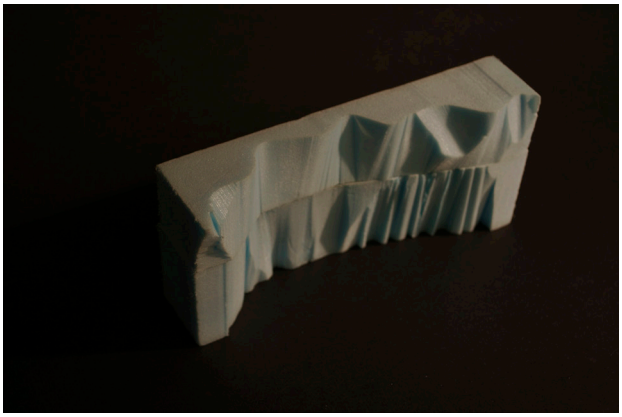
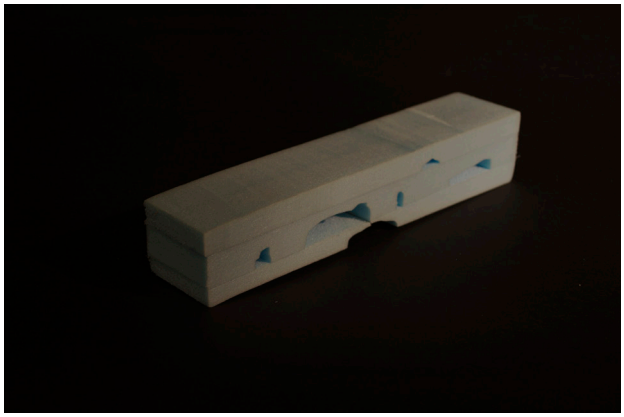
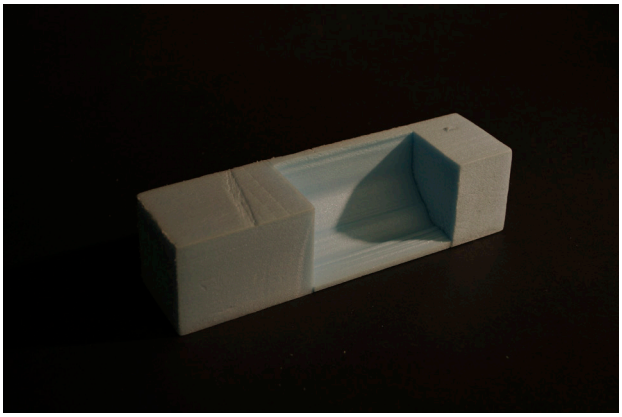
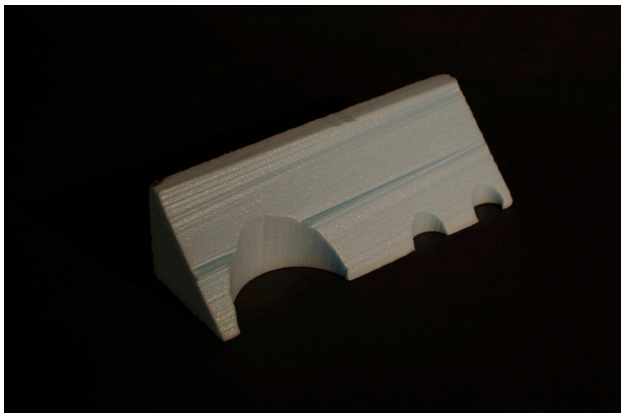
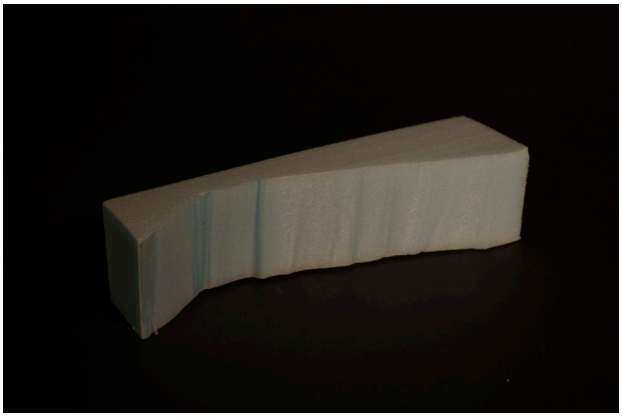
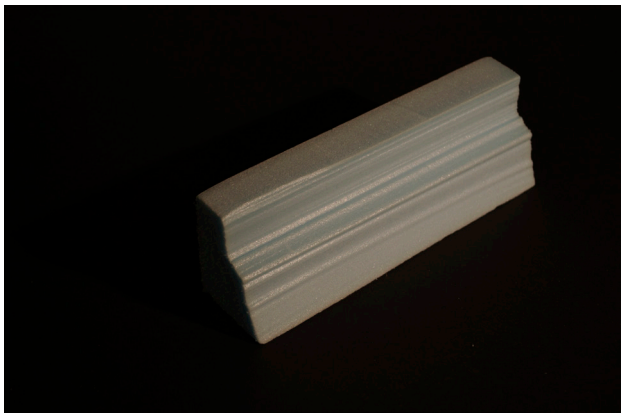
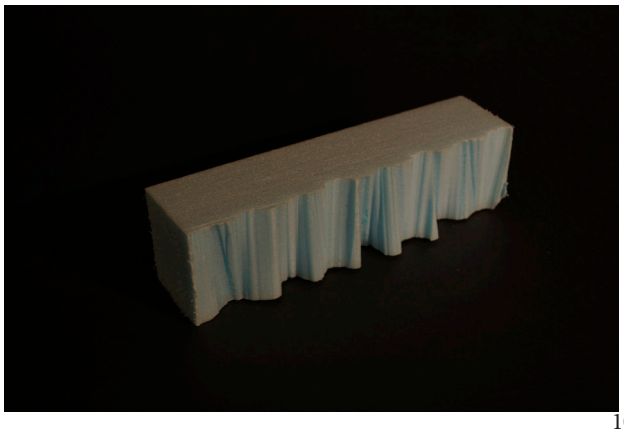
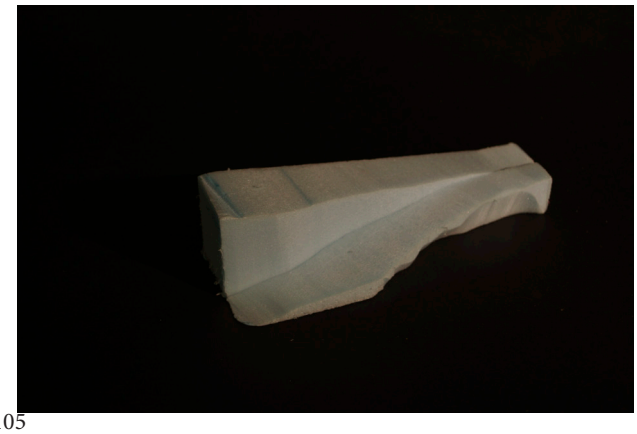




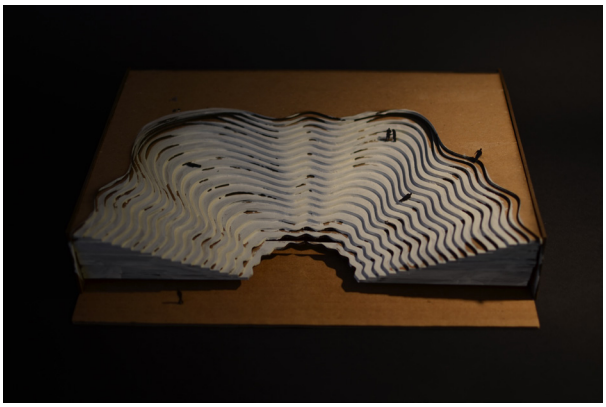


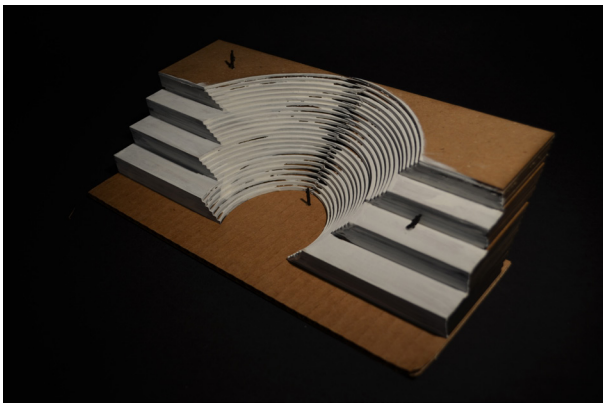


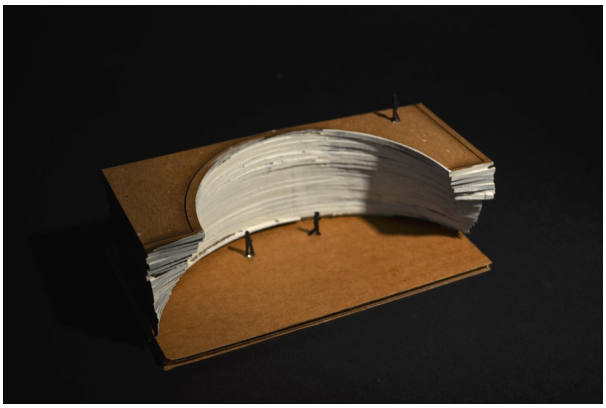


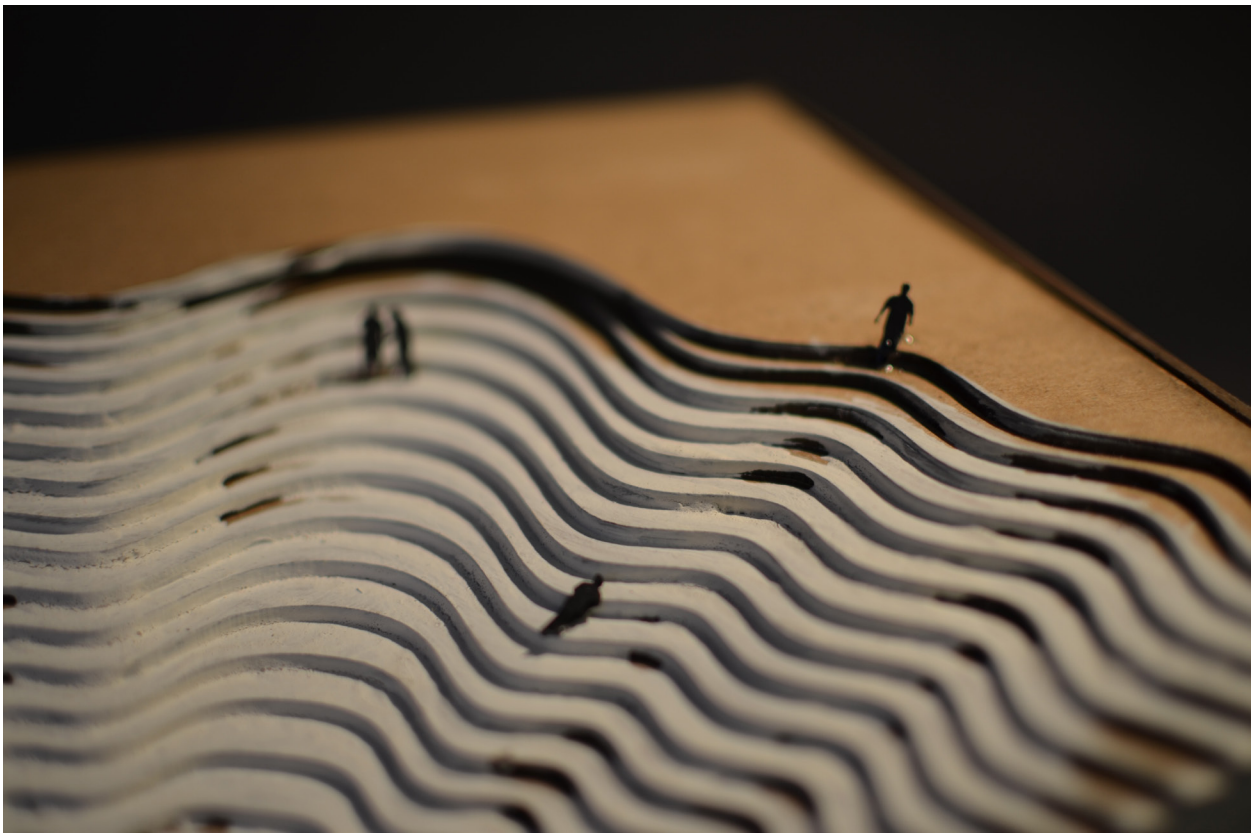









Study Models of Carving Strategies

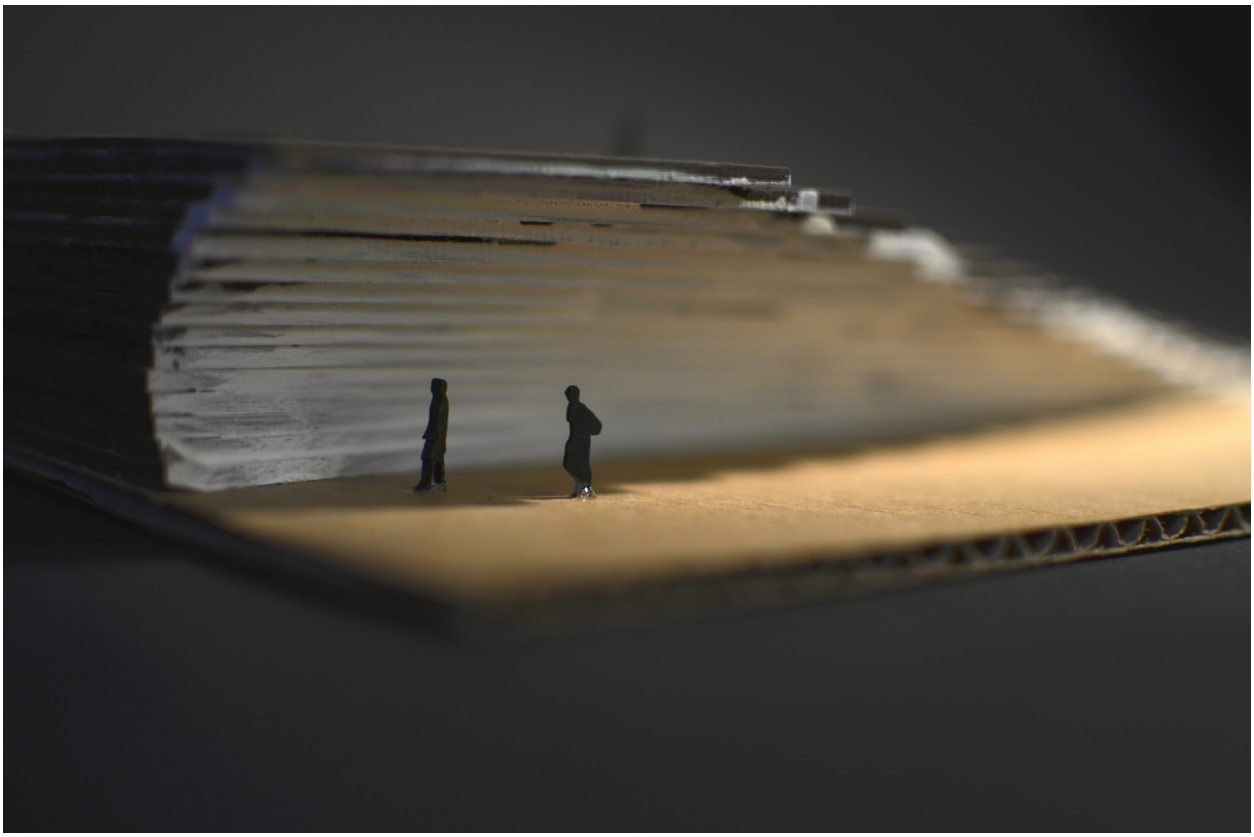


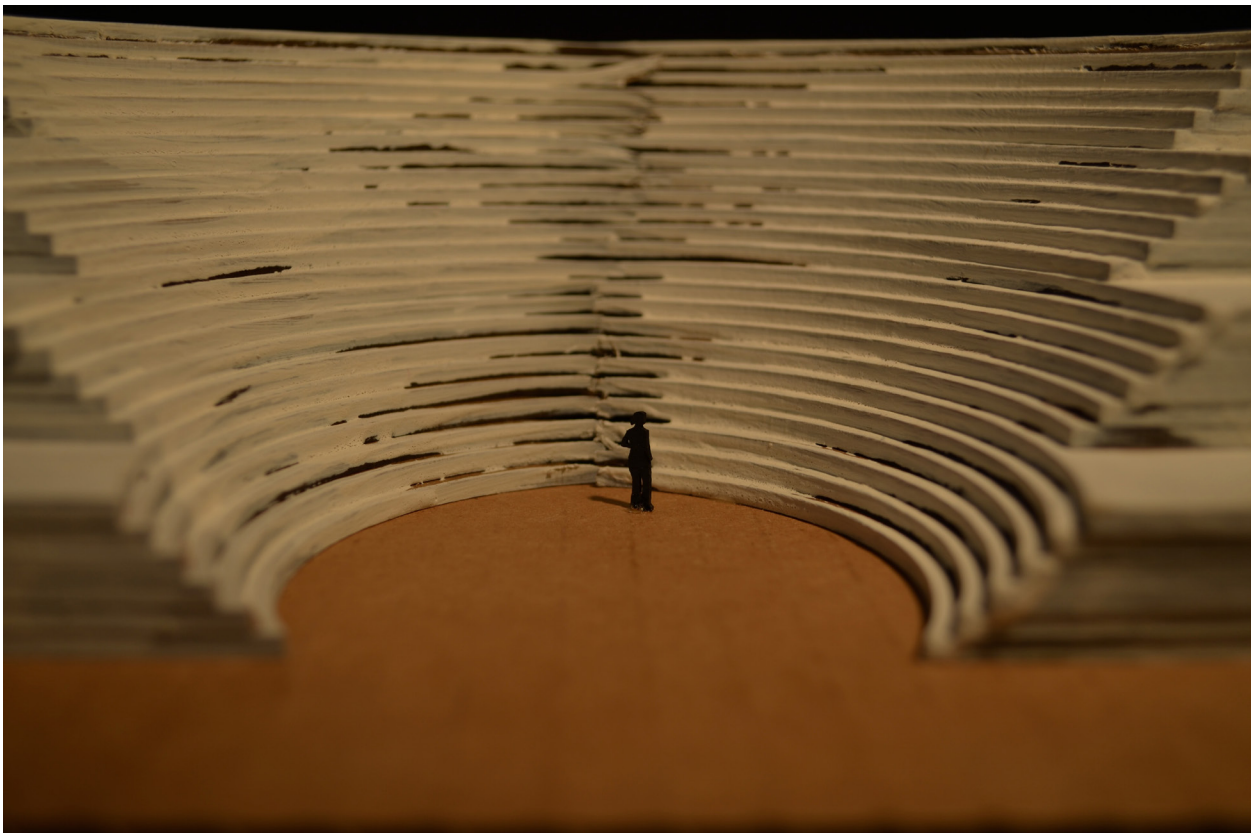




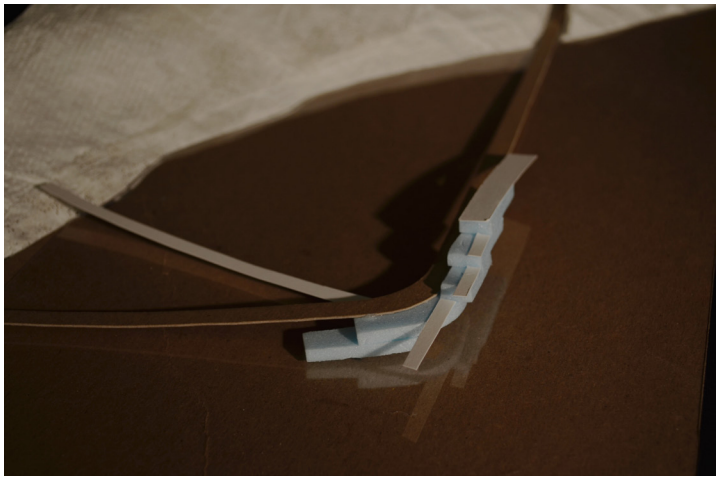


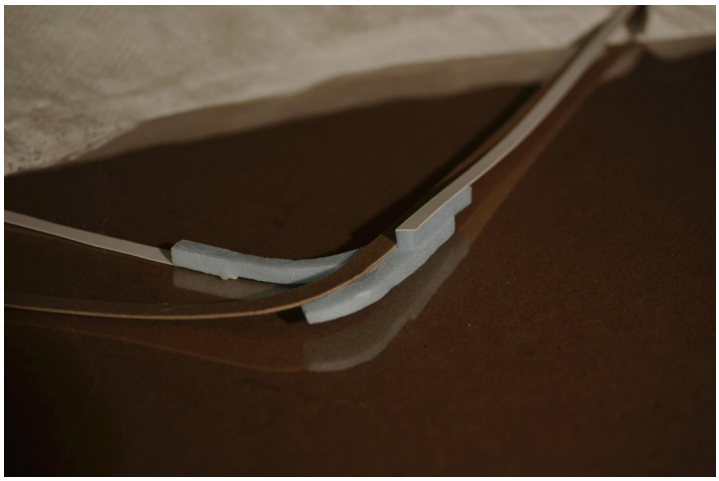
Study Models of Carving Strategies



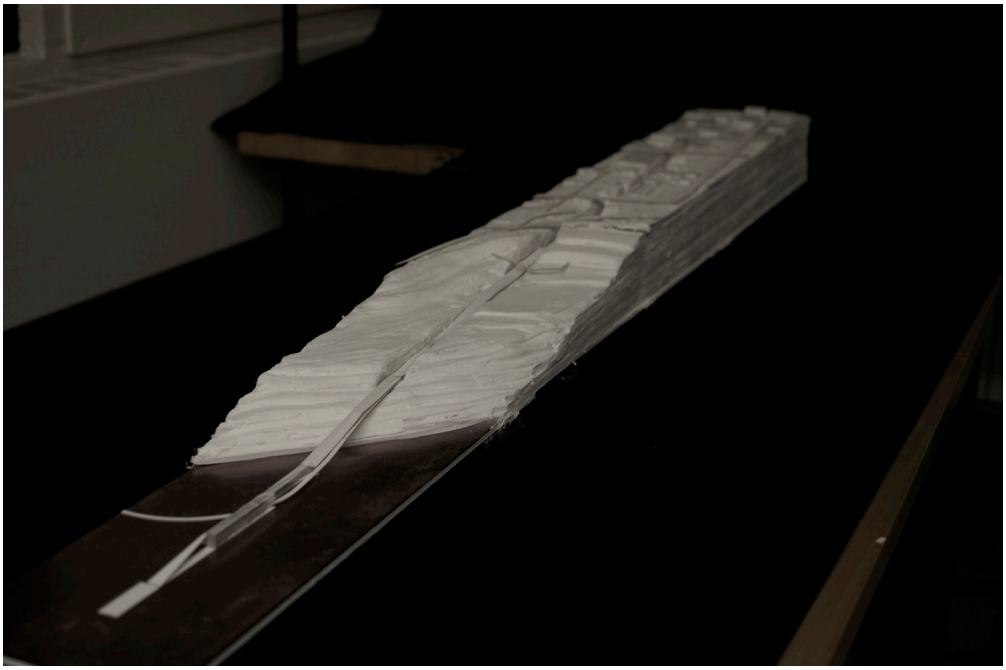


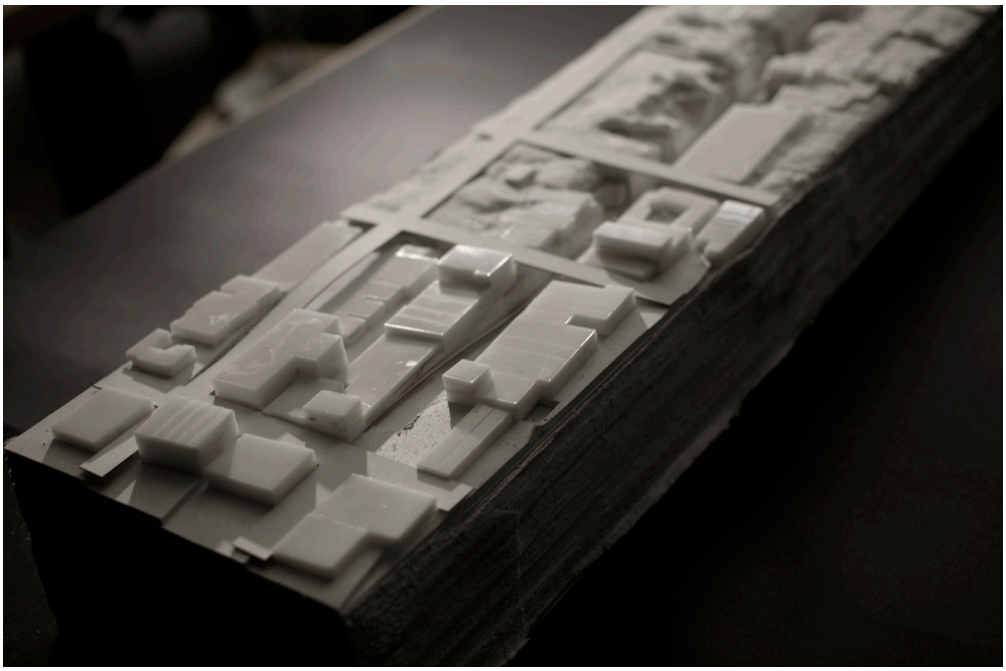
Study Models of Research Center

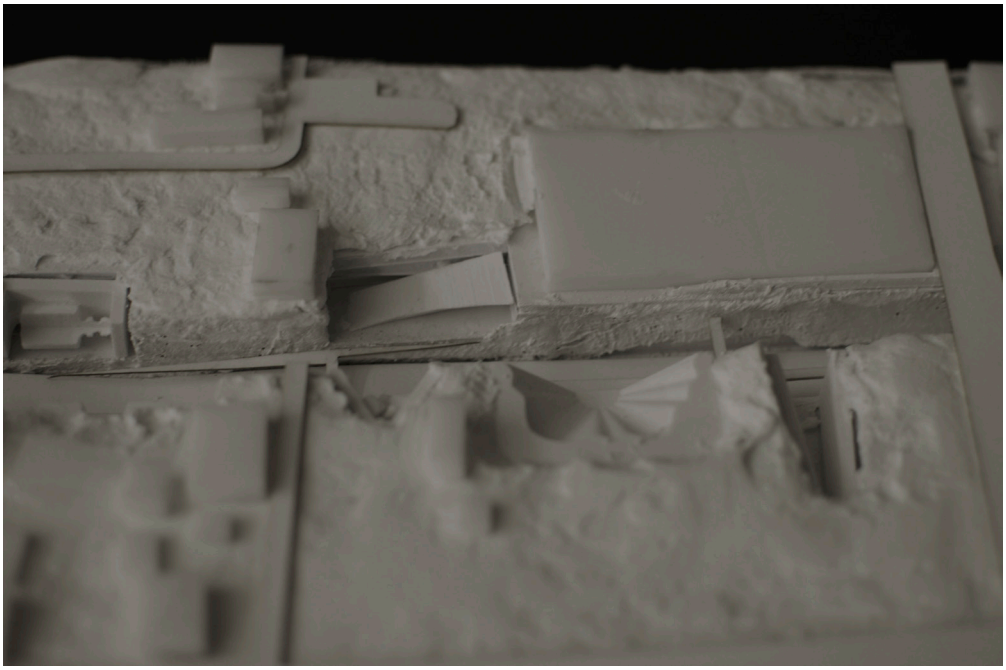


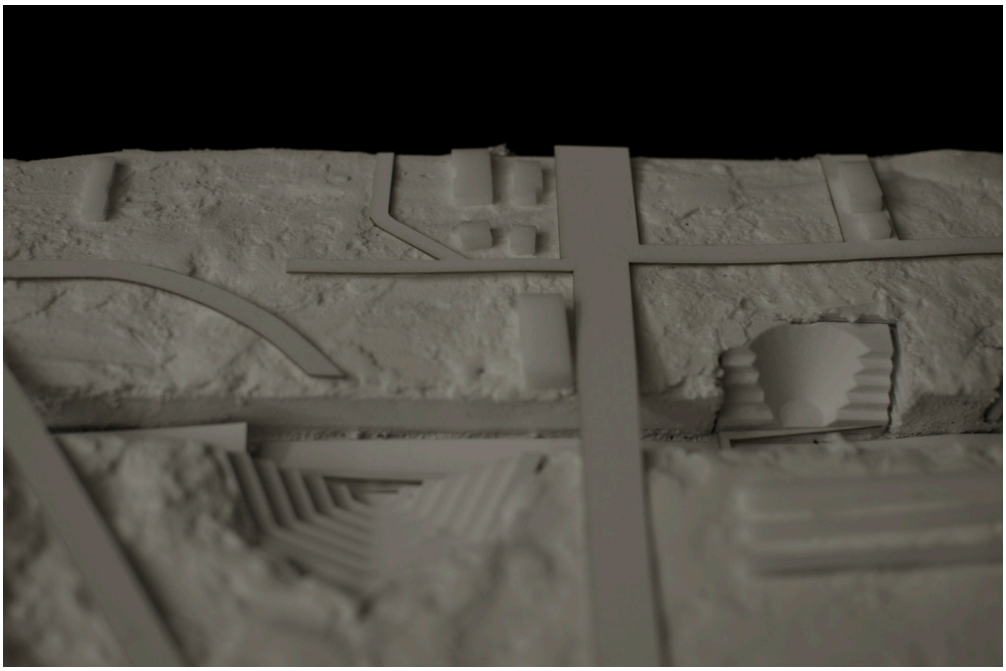


Final Model



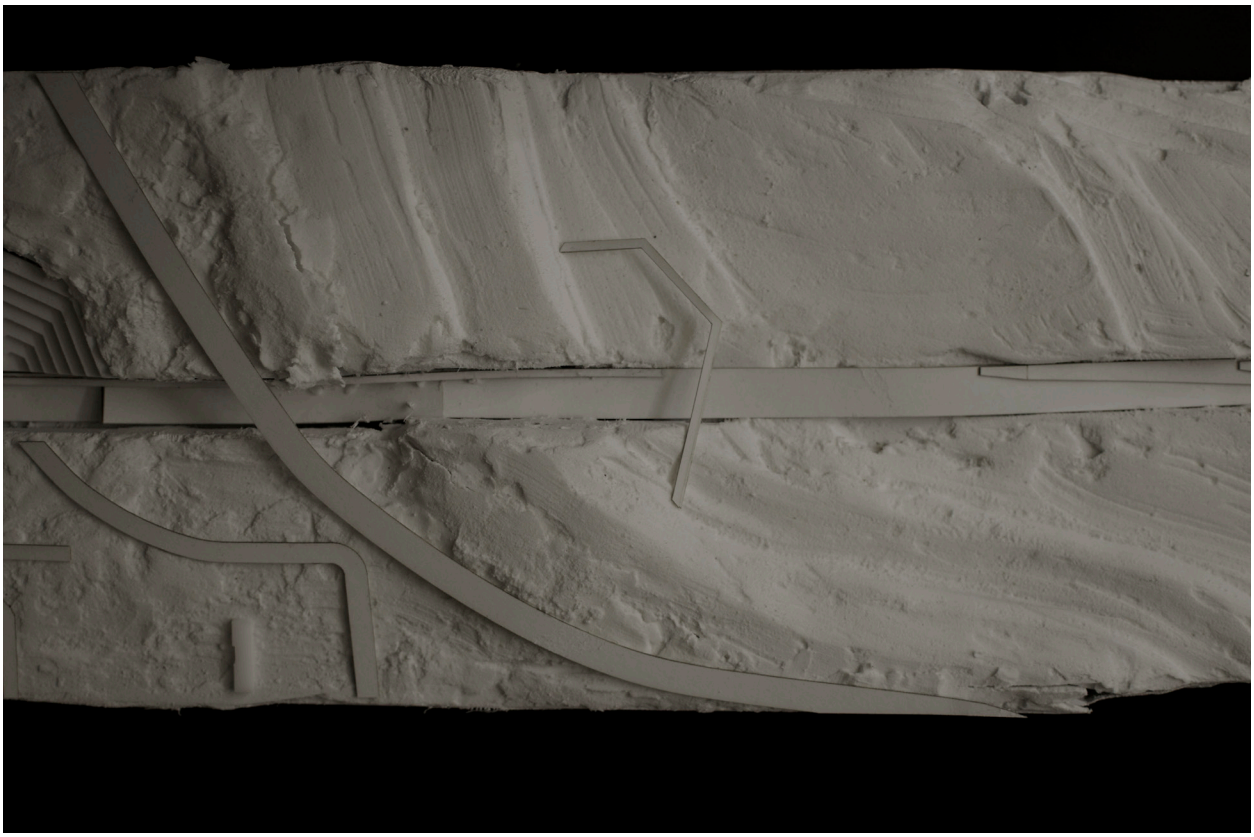






Final Model

Final Model



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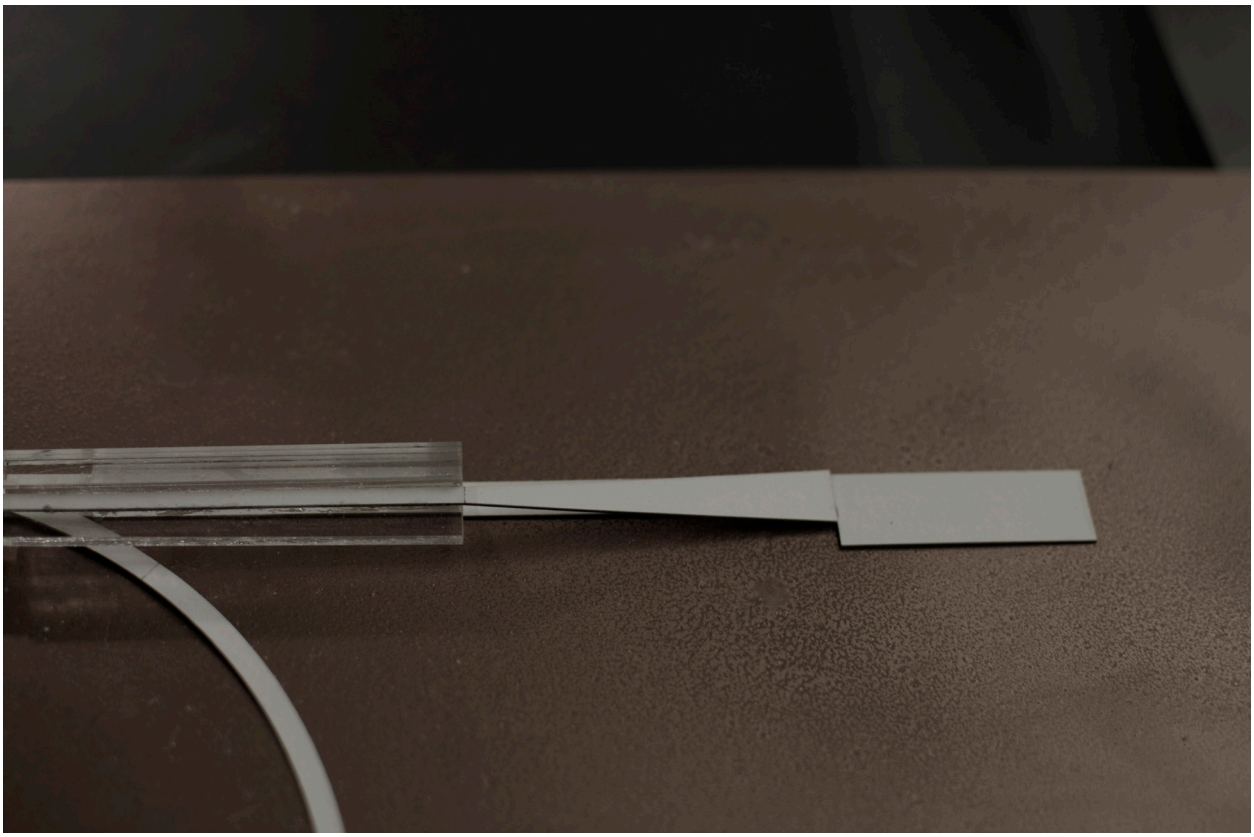

Appendix B: Presentation Day

M. Arch Thesis Public Final Review: December 18, 2014

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Images

Fig 1 *The Dust Bowl*. Directed by Ken Burns. 2012. PBS, 2012. DVD

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