PLASTIC METABOLISM IN A GARBAGE APOCALYPSE

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Roy Cloutier - External
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I accept this report as conforming to the required standard

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Blair Satterfield
Chair

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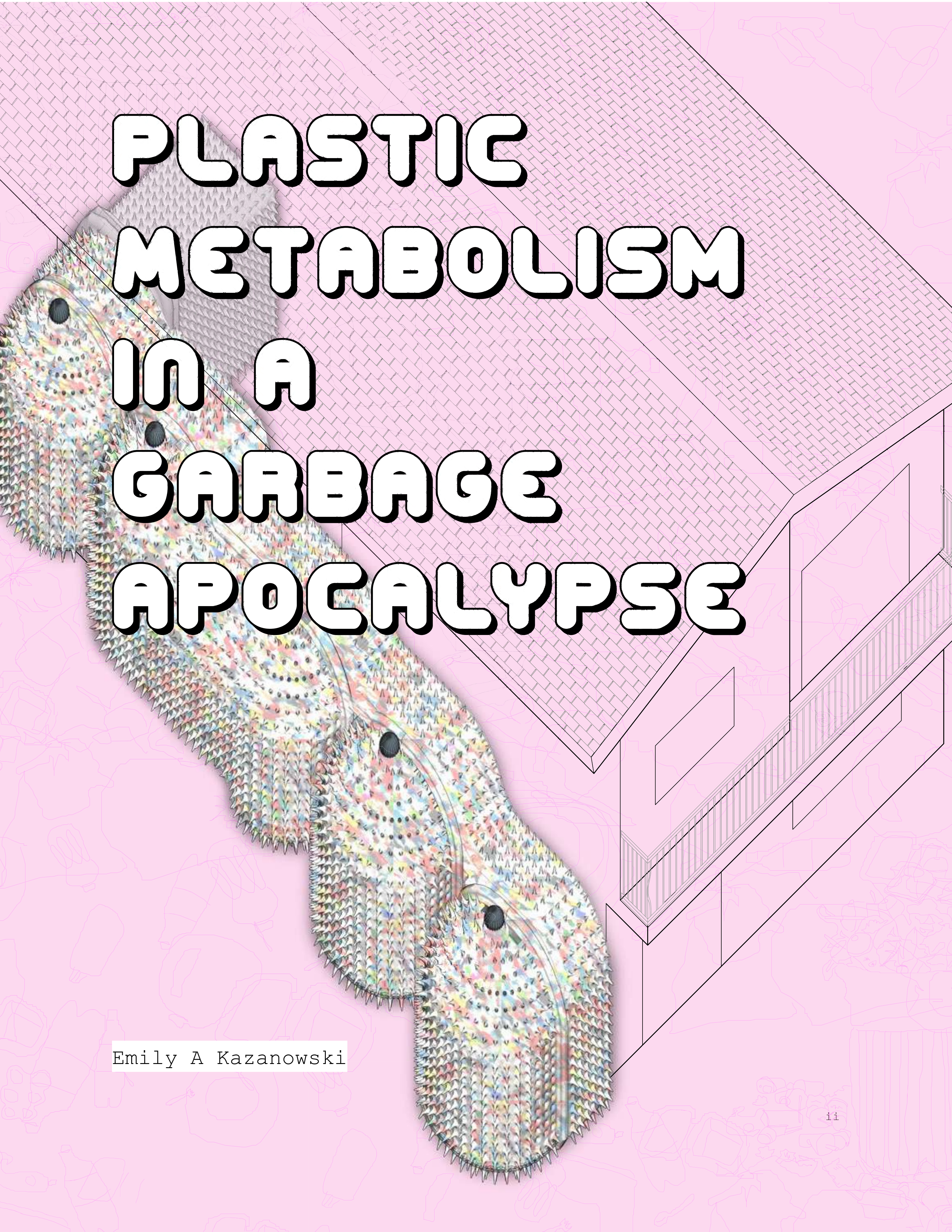

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Abstract

We have a plastic waste crisis.

Our waste is concealed in bins, taken out to back lanes, buried at the landfill or shipped overseas. We have become increasingly expert at physically distancing ourselves from our waste. Spaces for waste are not for humans. Waste is invisible to us. *Plastic Metabolism in a Garbage Apocalypse* operates within a fictional, yet plausible, garbage strike. This strike brings the global waste crisis home, registering it at the scale of a household. How do we cope? Our perceptions must shift if we are to escape the constricting infill of waste in our previously pristine domestic realms. We must see waste as a raw material. This project proposes a new system of construction, operating on the existing body of the Vancouver Special, a locally specific and common housing typology. Domestic spatial relationships are reimagined establishing an intimate relationship between the human body and waste material and processes. Building with waste is imperative. We must see waste as an opportunity, and allow new growth through the reconstitution of waste materials. Using a playful and optimistic perspective, P*lastic Metabolism in a Garbage Apocalypse* allows the messy and uglier sides of human life to support a productive domestic environment.

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THANK YOU!

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Karen Lightbody, mother
John Kazanowski, father
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A special thank you to Carla Gruber, my roommate, classmate, and close friend. Thank you for the constant encouragement and for keeping me sane.

Dedication

To my grandmother, Ann Dorothea Lightbody

Figure 1 Ann studying architecture and home economics at UBC in 1956.

Foreword

The following section provides an introductory context to *Plastic Metabolism in a Garbage Apocalypse*.

Firstly, the perception of waste as unwanted material has set the status quo of our current waste management system. Our perception has created a vast spatial separation from the waste producer’s human body and an excess of globally displaced material

Secondly, a disruption to the status quo, the Chinese National Sword, has occurred triggering more urgency to rethink our relationship with our waste.

Definition

WASTE IS MATERIAL THAT IS DISCARDED BECAUSE IT IS PERCEIVED AS NO LONGER USEFUL

Figure 2 Garbage Sketch

Introduction

How much waste do you produce?

A rather unpleasant question. Would you like everyone to know you ate a whole bag of Cheetos by yourself instead of an organic salad? Would you like someone to see that you recycled half a book's worth of paper because you printed the wrong document? Would you like someone to see your take out container hidden in the garbage because it was too gross to rinse and recycle?

Our waste can reveal our habits, good and bad.

History

Currently, we are having a waste crisis as a result of a particular habit.

WE HAVE BEEN SLOWLY PHYSICALLY DISTANCING OURSELVES FROM OUR WASTE FOR CENTURIES. In western culture, waste management has gone from human to urban to regional to global scales. We have gone from organics dropped at our feet, to waste thrown from windows into the streets, to the realization that in crowded urban conditions waste can make us sick so we send it out of the city, to the ebbs and flows during the world wars when materials were salvaged and then overconsumed. Our overconsumption has taken on global scales, such as as the Fresh Kills Landfill which was visible from outer space, and the garbage patch in the Pacific Gyre, claimed to be the size of “Texas.” Our waste is a global issue. And recently, a particular event has instigated a change in our distancing trend.

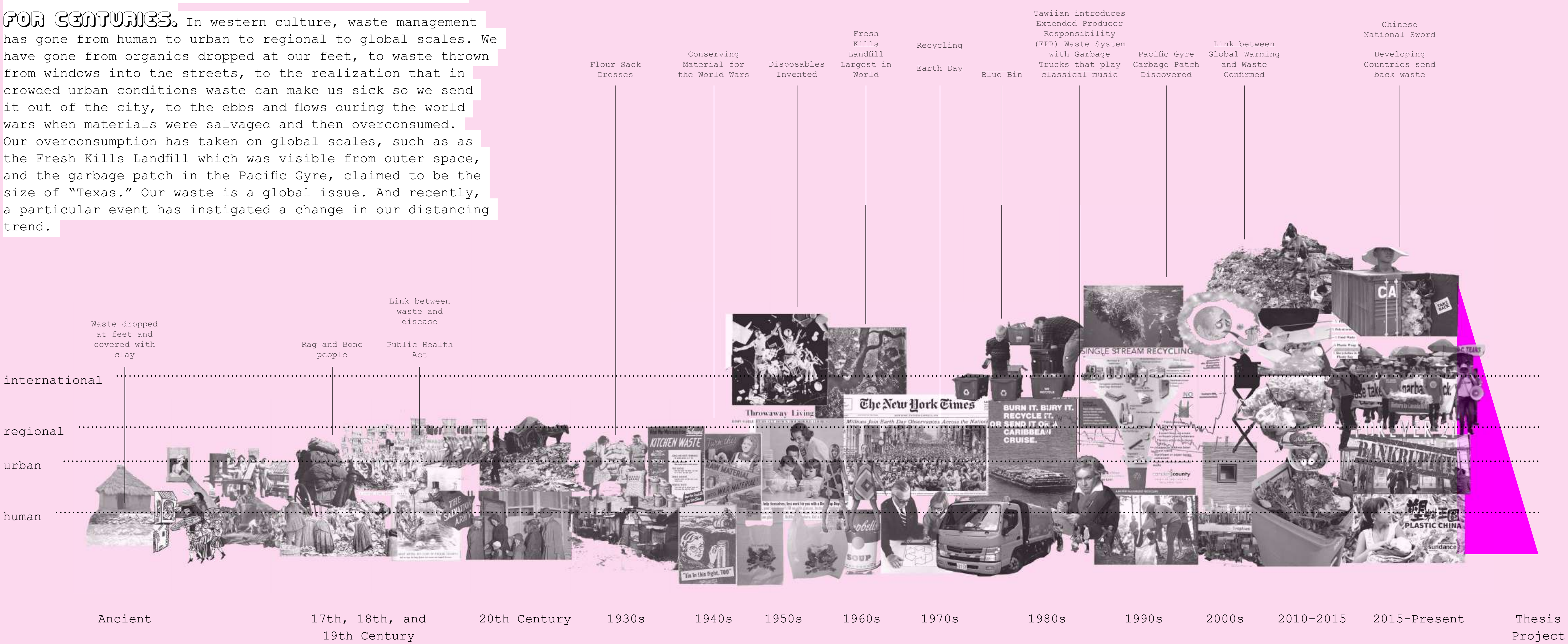


Figure 3 Historical timeline showing increasing physical separation between human and waste

Plastic Metabolism in a Garbage Apocalypse responds not only to current Western waste management practices, but also sits within an architectural context.

SUBJECTIVITY

What begun with a fascination studying the subjectivity of design and particularity ugliness, initially led to an interest in perception and waste. Precedents and theory were researched that demonstrate a shift in perception specifically relating to the goal of the project to establish a new intimate relationship between the human body and waste, thus integrating waste processes and materials into the domestic environment. *UGLY: The Aesthetics of Everything*, by Stephan Bayley, was a starting point that demonstrated the way perception can drive the urban environment. For example, Bayley states how the Shakers, a utopian movement in America prided on hard work ethic, perfectionism, and utilitarian aesthetic, was in part a response against the unsanitary living conditions of the industrial revolution in Britain, thus demonstrating that human society can drastically shift in response to varying mentalities of waste.[1]

1 Bayley, Stephen. UGLY: The Aesthetics of Everything. New York: The Overlook Press, Peter Mayer Publishers, Inc., 2012. Print. 24.

ALTERNATE SYSTEMS FOR LIVING WITH WASTE

The previously existing unregulated Kowloon Walled City in Hong Kong; *Geographies of Trash*, by Rania Ghosn and El Hadi Jazairy; and *Cradle to Cradle*, by McDonough, William and Michael Braungart, all demonstrate different realities of living with waste.

Kowloon Walled City is a reality where lack of regulation leds to high density and architecture shadowed by waste. Kowloon Walled City was an extremely dense city block in Hong Kong. In 1898, China granted a 99-year lease to Great Britain for the harbour across from the island of Hong Kong; however, Kowloon, located at the centre, remained controlled by the Chinese.[2] The isolated conditions of Kowloon created an unregulated environment. It was not under British control and the Chinese officials ignored it.[3] Kowloon became a place for the displaced and marginalized such as gangsters, sex workers, refugees, drug dealers, and low income populations.[4] Kowloon became the densest place in the world with 3.2 million people per square mile.[5] The lack of regulations leading to high density of people created an unusual built environment. There was no space between buildings. Caged balconies protruded 1-2m from apartments to

2 Greg Girard, Aaron Tan, Brian Douglas. “Kowloon Walled City.” Interview with Nick van der Kolk, 99% Invisible, Podcast audio, November 19, 2012. https://99percentinvisible.org/episode/episode-66-kowloon-walled-city/
3 Greg Girard, et al., “Kowloon Walled City.”
4 Ibid.
5 Ibid.

gain more light and air.[6] Garbage was disposed by throwing it out the window.[7] A temple had a net above it to keep garbage off, which created a shadow effect similar to a tropical canopy.[8] Finally, the project was similar to the ideas of the Metabolists, which discussed self-organizing structures.[9] Adaption to the specific site conditions and lack of regulations created architectural ingenuity.

> “The new buildings adapted themselves in relation to the specific contingencies of their sites. Erected without architectural or engineering participation, proper foundations or piling, they used materials of dubious quality, ignored conventional mechanical and electrical standards, lacked proper circulation and fire egress, access to daylight or fresh air, water supply or waste disposal, and certainly didn’t enjoy adequate maintenance once constructed. They used available space - free from the normal constraints of title deeds, property limits and regulations - in completely original ways. They were inventive, renegade architectural specimens.”[10]

The lack of regulations created unhealthy living conditions. The photographer, Gerald Girard, described the city as something that fell between the cracks and grew into a beautiful

6 Ibid.
7 Ibid.
8 Ibid.
9 Ibid.
10 Saywell, James. 2014. The Architecture of Kowloon Walled City: An Excerpt from ‘City of Darkness Revisited’. April 10. Accessed December 18, 2019. https://www.archdaily.com/493900/the-architecture-of-kowloon-walled-city-an-excerpt-from-city-of-darkness-revisited.

monstrosity.[11] Kowloon Walled City is a useful precedent when considering reducing regulations as well as studying how people live in high density situations in close proximity to waste.

Geographies of Trash, by Rhania Ghosn and El Hadi Jazairy, depicts a reality where the landfill typology has more cultural significance. Geographies of Trash analyzes how garbage shapes human geographies. Banished material and garbage is explored through historical research, data visualization, and speculative design. The invisibility of waste management is scrutinized and critiqued by the authors, demanding that designers have an influence in this system. The current “out-of-sight-out-of-mind” mentality to garbage is opposed. The book is organized into four categories - Construct, Represent, Form, and Assemble - which through interactions between trash, space, and urban environments bring trash into public view, consciousness, and controversy. Five architectural projects are prposed in Michicagn, USA: Cap, Collect, Contain, Preserve, and Form. Each intervention creates new aesthetics and forms for landfills. For example, Cap transforms the idea of a landfill into monumental architecture.[12] Waste is shaped into a reinforced spiraling ziggurat. The capping of the ziggurat marks the end of a twenty-mile automotive industrial corridor’s growth and expansions, and becomes a site for civic imagination.[13] Creating

11 Greg Girard, et al., “Kowloon Walled City.”
12 Ghosn, Rhania and El Hadi Jazairy. Geographies of Trash. New York: Actar Publishers, 2015. Print.
13 Ghosn and Jazairy, Geographies of Trash.

dramatic alternative options to waste management demonstrates the influence of design on the social practice of waste. From being an invisible dumping ground to a civic monumental, the public's relationship to waste changes. *Geographies of Trash* provides inspiration to *Plastic Metabolism in a Garbage Apocalypse* as it demonstrates the rethinking of society's relationship to their trash albeit at a larger and still centralized scale.

Cradle to Cradle, by Michael Braungart and William McDonough, describes a reality where there is no waste, where instead the end product of one process becomes the beginning of something new. *Cradle to Cradle* advocates designing products and systems using natural processes and viewing materials as technical or biological nutrients. Technical nutrients are products that can be broken down and circulated infinitely in industrial cycles.[14] Biological nutrients are biodegradable and decompose back into nutrients for the soil.[15] A cradle-to-cradle approach is opposite to a cradle-to-grave approach. A cradle-to-grave approach uses materials as part of a one way linear process leading to the landfill and creating negative consequences for future generations. A cradle-to-cradle approach seeks an endlessly productive and cyclical system that gives future generations the same opportunities as previous generations.

A cherry tree is an example of the cradle-to-cradle approach. Thousands of blossoms will create fruit for animals and humans. Thousands of blossoms are produced so one cherry pit may fall to the ground and become a new tree.[16] People do not generally perceive fallen blossoms as waste or exclaim the tree's process is inefficient.[17] Trees overproduce blossoms, fruit, and leaves without depleting their environment. The fallen blossoms, fruit, and leaves eventually decompose into nutrients for other ecosystems, such as animals, insects, plants, microorganisms, and soil. The authors of cradle-to-cradle propose that the human built environment should be modelled after this approach. The book goes on to explain how human design can accomplish this cradle-to-cradle concept.

The cradle-to-cradle approach offers this project a positive mentality towards the future, proposing a future where humans and their built environment can coexist in the same systems as nature. This is a future where waste is not waste but is a nutrient.

RECYCLED PLASTIC

Through studying current events, such as the Chinese National Sword, and several reports, such as the City of Vancouver Waste Composition and RecycleBC annual reports, as well as "The Chinese Import Ban and its Impact on Global Plastic Waste Trade" by Amy Brooks, Shunli Wang, and Jenna Jambeck, the need to focus on plastic as a material was identified. In the 2018 Waste Composition Monitoring Program report, plastic took second highest place (21.6% or 23 kg/capita) for single family residences, coming second only to compostable organics, which have a lesser impact on the environment as they have a shorter lifespan.[18] RecycleBC's 2018 Annual Report also states that there is a recovery rate of 42% for plastics, meaning that over 50% of plastics put in the recycling bin in British Columbia end up in the landfill rather than being recycled.[19] Finally, zooming out to a global scale, "The Chinese Import Ban and its Impact on Global Plastic Waste Trade" report explains "China, which has imported a cumulative 45% of plastic waste since 1992, recently implemented a new policy banning the importation of most plastic waste, begging the question of where the plastic waste will go now… An estimated 111 million metric tons of plastic waste will be displaced with the new Chinese policy by 2030."[20] As a result of the global and local plastic situations, an urgent need to increase plastic recycling and the use of recycled plastic exists.

Precious Plastic and Melt Collective are valuable resources providing open source content explaining systems for working with recycled plastic and allowing access to equipment to experiment with the material. Precious Plastic's mission is to reduce plastic waste. Believing that "small steps, multiplied by millions" will bring about necessary change lends itself to providing open source information on how to build and use small-scale plastic recycling machines, the basics of plastics and the characteristics of the varying types (1-7), and so on.[21] Melt Collective, like Precious Plastic, is a student-led recycling workshop and laboratory based out of the University of British Columbia (UBC). Melt Collective promotes a circular economy and localizing recycling.[22] Several visits were made to Melt Collective during the duration of this project (up until the shut down of the campus due to the COVID-19 pandemic). Valerine Chandrakesuma, member of Melt Collective, explained how plastic can be recycled on a small scale in their workshop. The early mix of high and low technology, such as toaster ovens in a fumehood, present at the startup was an inspiration for seeing how the public could have agency over their recycling.

Taking recycled plastic to an architectural scale, the early plastic homes of the 1950s, such as the House of the Future (designed by Monsanto, Disneyland, and MIT), and new recycled plastic projects, such as "Plastic Island" (an architectural thesis by Hadin and Nordang proposing

14 McDonough, William and Michael Braungart. Cradle to Cradle: remaking the way we make things. New York: Noroth Point Press, 2002. Print.
15 McDonough and Braungart, Cradle to Cradle.
16 Ibid.
17 Ibid.
18 TRI Environmental Consulting, *2018 Waste Composition Monitoring Program Metro Vancouver*, 2019, accessed March 15, 2020, http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/Solid_WasteComposition Study 2018.pdf
19 RecycleBC, 2018 Annual Report, accessed April 15, 2020, http://recyclebc.ca/wp-content/uploads/2019/06/Recycle-BC-2018-Annual-Report-1.pdf
20 Brooks, Amy L., Shunli Wang, and Jenna R. Jambeck. 2018. "The Chinese Import Ban and its Impact on Global Plastic Waste Trade." Science Advances 4 (6): eaat0131. https://advances.sciencemag.org/content/4/6/eaat0131
21 Precious Plastic, "We're on a Mission," Precious Plastic, https://preciousplastic.com/about/mission.html (accessed March 15, 2020)
22 Melt Collective, MELT, https://meltcollective.com/ (accessed May 1, 2020)

interventions of recycled plastic sourced from the ocean), were studied as inspiration for the development of the construction system proposed in this project. House of the Future, built in 1957, was intended to show the technological innovations of the time, specifically how plastics could be used in building homes of the future. The House of the Future was made of structural prefabricated plastic modules. Where virgin plastic once appeared during the postwar invention of disposables, presently, projects are seeing the littering of excess used plastic as opportunities to revisit architecture of plastic. ”Plastic Island” proposes converting PE (polyethylene) and PP (polypropylene) collected from the beach into three small-scale open air structures each focusing on the different material attributes of recycled plastic. The first intervention displays the contrasting textures of plastic achieved from compression moulding and slumping forming methods.[23] The second shows a transition in plastic from recognizable products into smooth architectural panels.[24] The third displays the range of coloured plastics in a geological layering that relates back to the project’s site. Both the House of the Future and “Plastic Island” use plastic as structural and architectural materials, however, the former is motivated by demonstrating material innovation and prowess and the latter focuses on the solving the environmental problem.

23 Erik Hadin, and Emily-Claire Nordang, “Plastic Island,” (Master’s Thesis, Chalmers School of Architecture, 2017), http://publications.lib.chalmers.se/records/fulltext/254818/254818.pdf

24 Hadin and Nordang, “Plastic Island.”

Challenging Domestic Relationships

To further develop the relationship between waste and the human body, other projects were studied that challenge traditional domestic-spatial relationships. The Microbial House, by Philips Design, and Domestic Astronomy, by Phillippe Rahm, both reinvent domestic relationships giving priority to other conditions. The Microbial House adapts the home into a domestic ecosystem, challenging conventional design solutions to energy, cleaning, food preservation, lighting, and human waste.[25] Several appliance-like interventions are proposed, such as the methane bio-digester (generating energy), the larder (evaporative cooler), the paternoster (mushroom garden decomposing plastic), urban beehive, bio-light (powered by bioluminescent bacteria), and the filtering squatting toilet.[26] Each intervention welcomes bacteria as a productive element of the home. Domestic Astronomy is used as a theoretical precedent demonstrating a new system of ordering the house. Seeing temperature as a potential configuration tool, Domestic Astronomy rearranges space by temperature (in relation to the body, clothing, and activity), creating new spatial relationships and expanding spatial territory into an “atmosphere” as opposed to a “surface.”[27]

25 Brownell, Blaine Erickson and Swackhamer, Marc. “Microbial Biosphere,” *Hypernatural: Architecture’s New Relationship with Nature* (Princeton Architectural Press, 2015).

26 Brownell and Swackhamer, “Microbial Biosphere,” *Hypernational.*

27 Philippe Rahm Architectes. “Domestic Astronomy,”

Relation to the Human Body

Finally, Plastic Metabolism in a Garbage Apocalypse proposes rethinking the physical relationship between the human body and waste. The work of Atelier Van Lieshout was of particular interest in this pursuit. Joep van Lieshout is a sculptor and painter who focuses on the art of “sculpture and installations, buildings and furniture, utopias and dystopias.”[28] Van Lieshout has an unusual approach to the human body is his work. His work “dissects systems,” of which the human body often has a large role, such as Darwin, CasAnus, Wombhouse, and BikiniBar, to name a few.[29] In each piece, the human body, or organ, is manipulated causing a rethinking of the body and its systems. Additionally, Van Lieshout’s interest in manufacturing and mass-production bounding between “fantasy and function” and between “fertility and destruction” demonstrates ideas relevant to a proposal seeking to opportunistically invent a new reality born out of a garbage apocalypse.[30] Finally, Clip-On, a small extension to an office providing the user a place to work, sleep, and relax, is bolted to the outside wall of an existing museum building.[31] Clip-On provided a precedent demonstrating a new parasitic body hosted to an existing building typology.

accessed April 15, 2020, http://www.philipperahm.com/data/projects/domesticastronomy/index.html

28 Atelier Van Lieshout, “Biography,” Atelier Van Lieshout, accessed March 15, 2020, https://www.ateliervanlieshout.com/about/about-joep-van-lieshout/

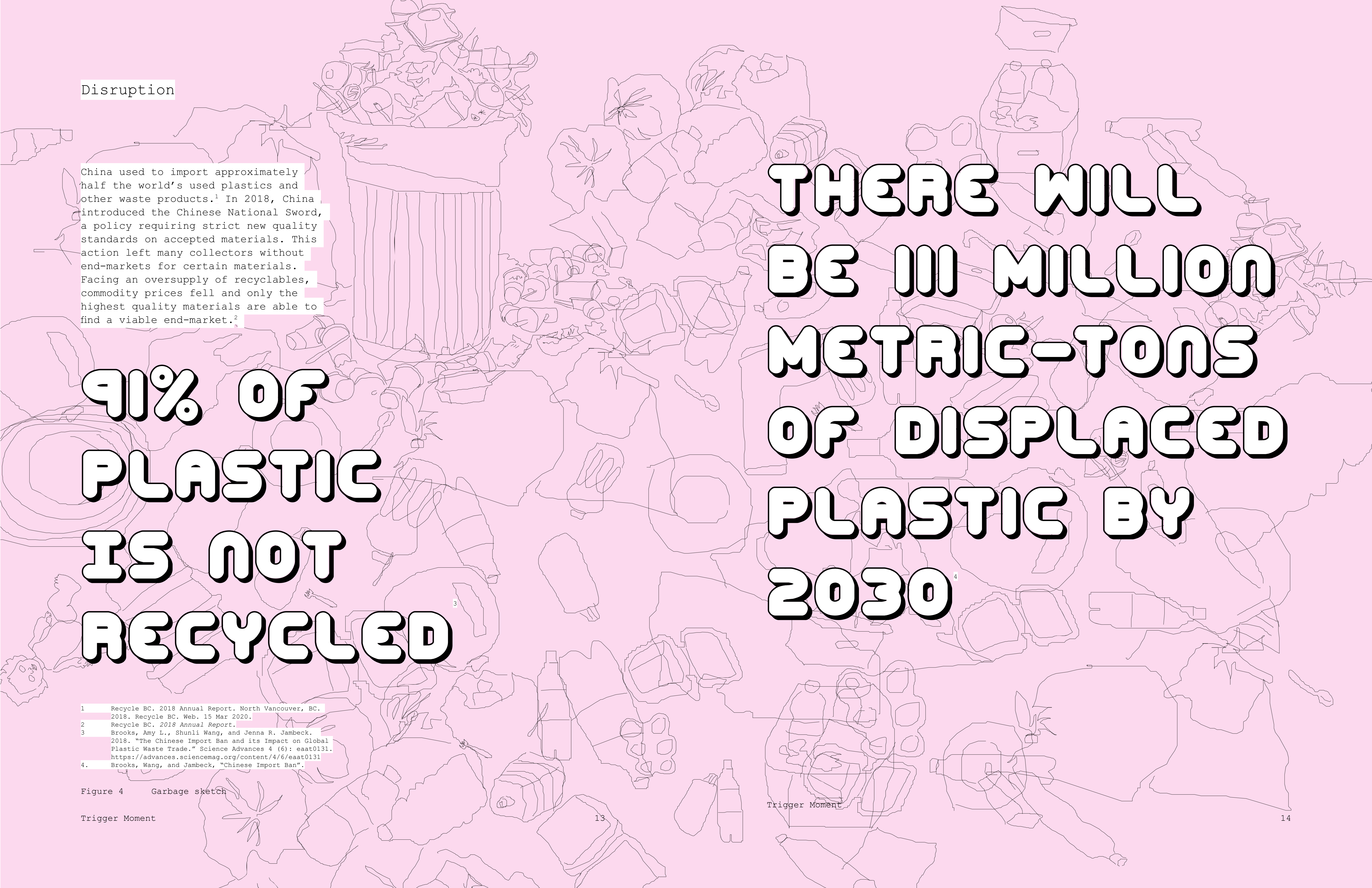
29 Atelier Van Lieshout, “Biography”

30 Atelier Van Lieshout, “Biography,” Atelier Van Lieshout, accessed March 15, 2020, https://www.ateliervanlieshout.com/about/about-joep-van-lieshout/

31 Atelier Van Lieshout, “Clip-On,” Atelier Van Lieshout, accessed March 15, 2020, https://www.ateliervanlieshout.com/work/clip-on/

Conclusion

Plastic Metabolism in a Garbage Apocalypse is a project positioned in a wide range of contexts from considering the subjectivity of waste as something ugly and undesirable present in *UGLY: The Aesthetic of Everything*; to alternate ways of living with waste, such as the unregulated Kowloon Walled City, the large-scale civic presence in *Geographies of Trash*, and waste as nutrient in *Cradle to Cradle*; to how the waste crisis of excess plastics has revealed itself in the 1957 House of the Future and the 2017 “Plastic Island” thesis, as well as leading to dedicated groups, such as Precious Plastic and Melt Collective, who seek to propose decentralized waste solutions; to challenging domestic relationships to integrate waste processes into the previously pristine home environment inspired by Philippe Rahm’s Domestic Astronomy’s reordering of space according to atmosphere and Philips Design’s Microbial Home’s reordering of the house to bacteria productively serving human needs; to, finally, the rethinking of relationships to the human body present in the work of Atelier Van Lieshout productively serving the desire for residents to relate to waste materials and processes in the home.



China used to import approximately half the world's used plastics and other waste products.[1] In 2018, China introduced the Chinese National Sword, a policy requiring strict new quality standards on accepted materials. This action left many collectors without end-markets for certain materials. Facing an oversupply of recyclables, commodity prices fell and only the highest quality materials are able to find a viable end-market.[2]

91% OF PLASTIC IS NOT RECYCLED[3]

1 Recycle BC. 2018 Annual Report. North Vancouver, BC. 2018. Recycle BC. Web. 15 Mar 2020.
2 Recycle BC. *2018 Annual Report.*
3 Brooks, Amy L., Shunli Wang, and Jenna R. Jambeck. 2018. "The Chinese Import Ban and its Impact on Global Plastic Waste Trade." Science Advances 4 (6): eaat0131. https://advances.sciencemag.org/content/4/6/eaat0131
4. Brooks, Wang, and Jambeck, "Chinese Import Ban".

Figure 4 Garbage sketch

THERE WILL BE 111 MILLION METRIC-TONS OF DISPLACED PLASTIC BY 2030[4]

Conflict

This OVER-SATURATION OF WASTE MATERIALS has put other developing countries in a position to restrict the quality of their waste imports as well. With many developed countries, such as Canada and the US heavily exporting their waste there have been POLITICAL CONFLICTS during this change. For example, in 2013-2014, sixty-nine mislabeled shipping containers filled with contaminated waste were sent to the Philippines from Canada. The Philippines refused to accept the containers. There were many years of back and forth negotiating before the containers were sent back to Canada in 2019, under the THREAT OF WAR.

Returning contaminated shipping containers revealed how my actions and waste materials were connected to a huge international system. I felt it was UNETHICAL that a developed country, such as Canada, was sending our waste for others to deal with. I mentally compared it to me sending unsolicited old yogurt containers and chip bags to someone across the ocean. Who does that?

REDUCE, REUSE, RECYCLE, REJECTED: WHY CANADA'S RECYCLING INDUSTRY IS IN CRISIS MODE
The Globe and Mail
May 14, 2019

PHILIPPINES SENDS TRASH BACK TO CANADA AFTER DUTERTE ESCALATES ROW
Reuters
May 30, 2019

IF CANADIAN TRASH IS TURNING INTO A DIPLOMATIC HEADACHE, WHY CAN'T WE DISPOSE OF IT OURSELVES?
Global News
May 2, 2019

"WE WILL DECLARE WAR": PHILIPPINES' DUTERTE GIVES CANADA 1 WEEK TO TAKE BACK GARBAGE
Global News
April 23, 2019

CHINA'S TOUGH NEW RECYCLING STANDARDS LEAVING CANADIAN MUNICIPALITIES IN A BIND
The Globe and Mail
January 8, 2018

WESTERN PLASTICS "POISONING INDONESIAN FOOD CHAIN"
BBC News
November 14, 2019

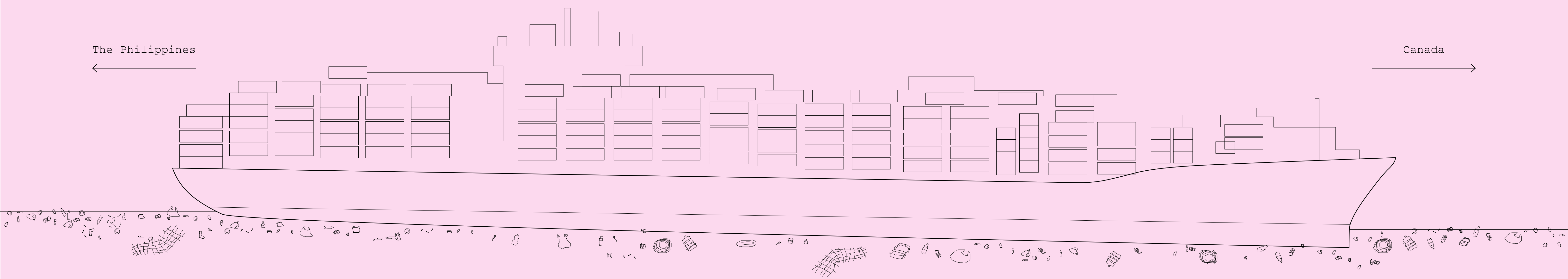


Figure 5 Contaminated shipping containers traveling between the Philippines and Canada

Composition

I began to be interested in the **SPATIAL QUALITIES OF WASTE.** For a week, I collected my garbage and recycling. I extrapolated the volume of the waste for longer time durations to determine how much space my garbage is taking up somewhere else in the world and relate it to the space I occupy daily. In 10 years, my waste would fill my empty bedroom. **IN 50 YEARS, MY WASTE WOULD NEARLY FILL MY ENTIRE THREE BEDROOM APARTMENT.** Yet, being 27 years old, I do not see 27 years' worth of material around me.

- Rigid Plastic
  - 5 containers
- Flexible Plastic
  - 8 bags
  - 6 sheets
  - 2 saran wrap sheets
  - 4 food stickers
- Styrofoam
  - 2 meat trays
- Carton
  - 1 juice carton
- Paper
  - 3 boxes
  - 2 bags
  - 1 tissue paper
  - 4 straw wrappers
  - 9 receipts
  - 9 used tissues
  - 2 used napkins
  - 1 unused napkin
  - 5 makeup pads
  - 2 q-tips
- Foil
  - 1 yogurt seal
- Hard Metal
  - 4 cans
- Wood
  - 2 burned matches
  - 1 pair of chopsticks
- Misc
  - 1 umbrella (textile, metal, plastic)
  - 1 butter wrapper (metal and paper)
  - 2 medication wrappers (metal and paper)
  - 1 bottle seal (paper and plastic)
  - 1 chewed piece of gum

Figure 6 Personal waste composition experiment

Volume

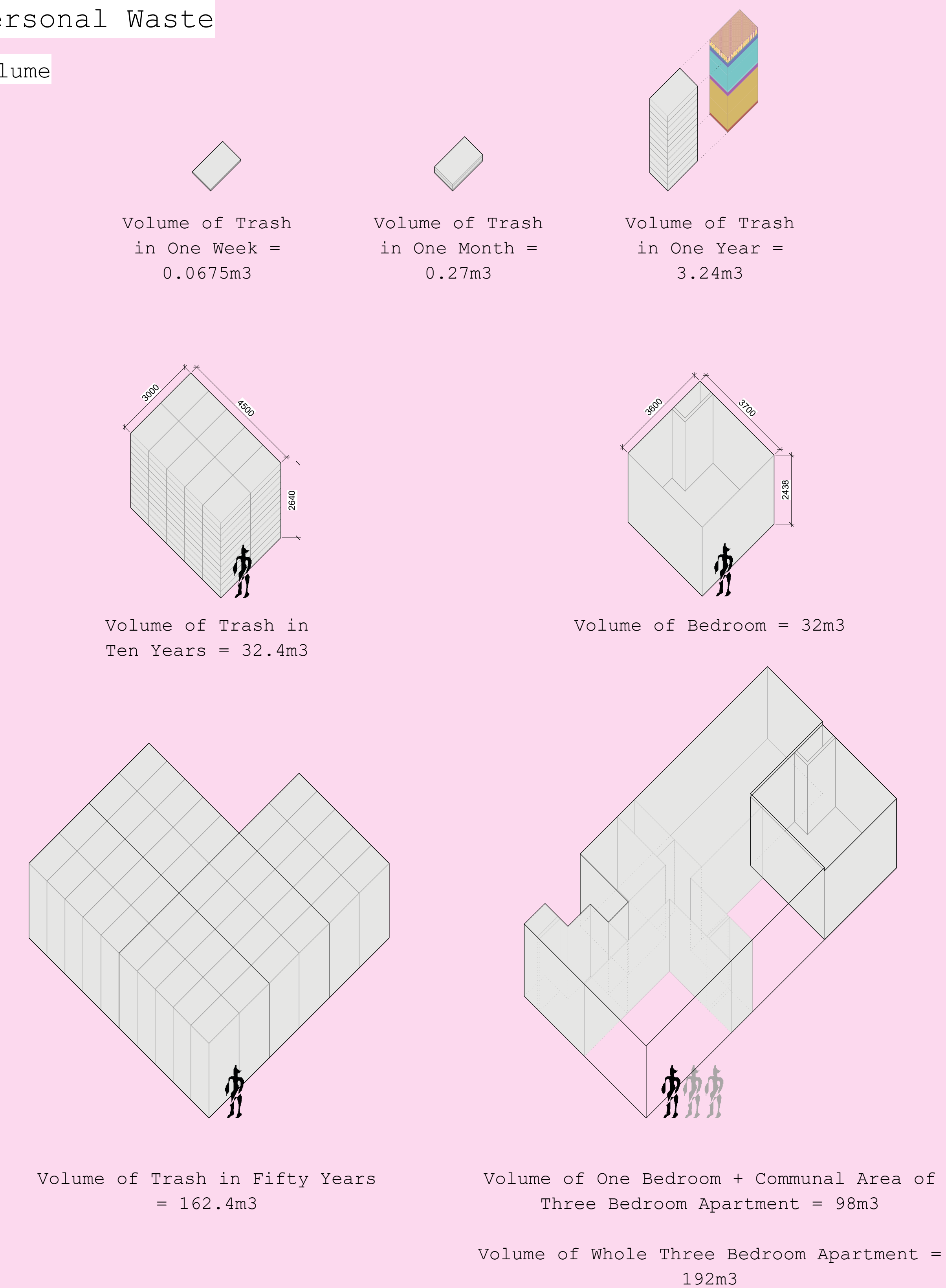


Figure 7 Personal waste volume per given time duration

Existing Waste Management System

Invisibility

While collecting my waste, I noticed the house did not welcome the hoarding of material.

THE DOMESTIC ENVIRONMENT IS SETUP WITH A SYSTEM TO MAKE WASTE INVISIBLE.

Residents consume a product and put its remains in bins in concealed places under counters. When these hidden places are full, waste is taken out to a back lane, which is sized to only account for industrial waste collection with trucks, bins, and dumpsters. The waste is taken to a transfer station to be sorted and temporarily held before being sent to either a landfill or to other end markets, such as China and the Philippines. Transfer stations and landfills are not common places for the public to enjoy.

WASTE SPACES ARE DESIGNED FOR MATERIAL AND NOT FOR HUMANS.

Domestic

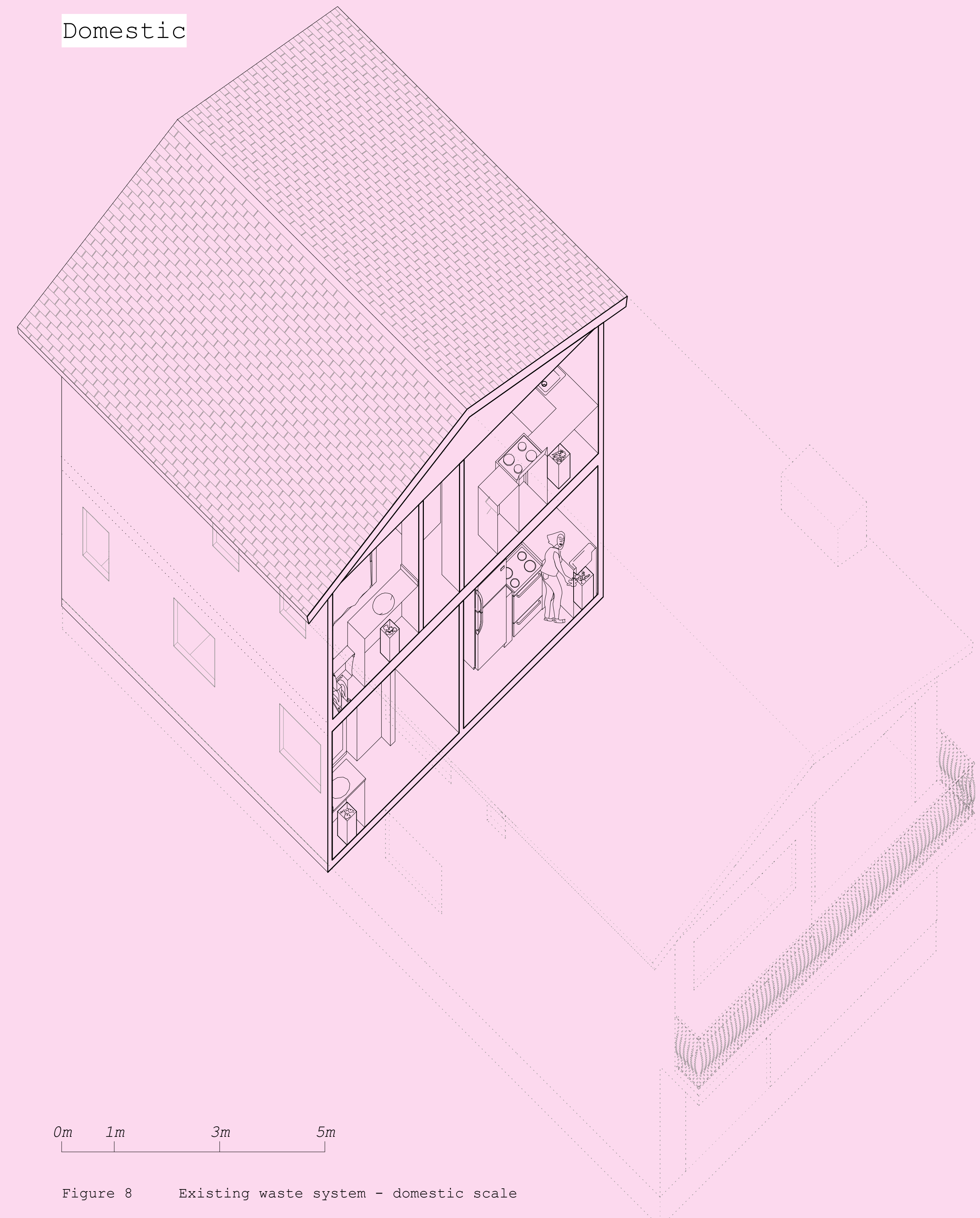


Figure 8 Existing waste system - domestic scale

Neighbourhood

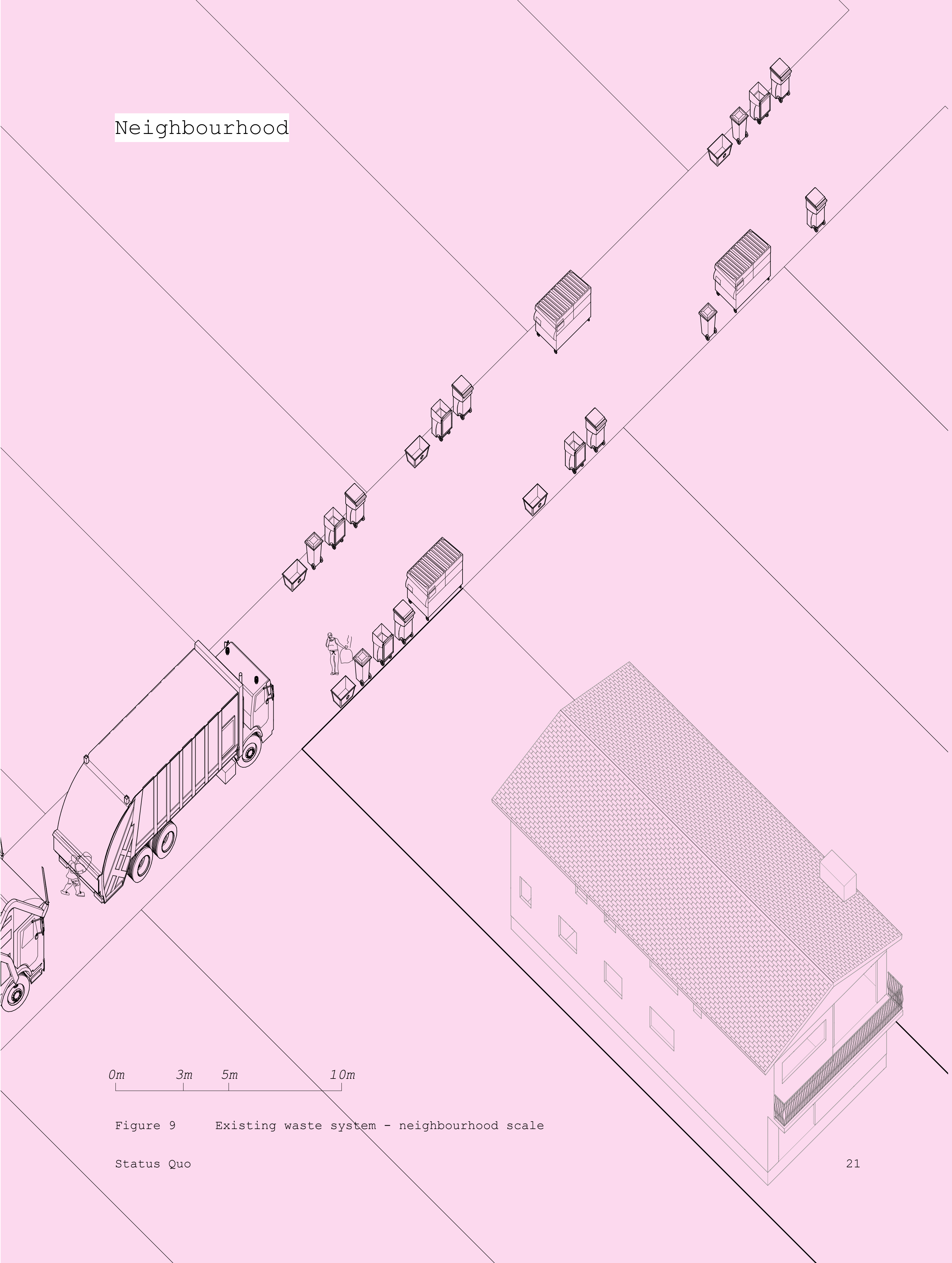


Figure 9 Existing waste system - neighbourhood scale

Urban

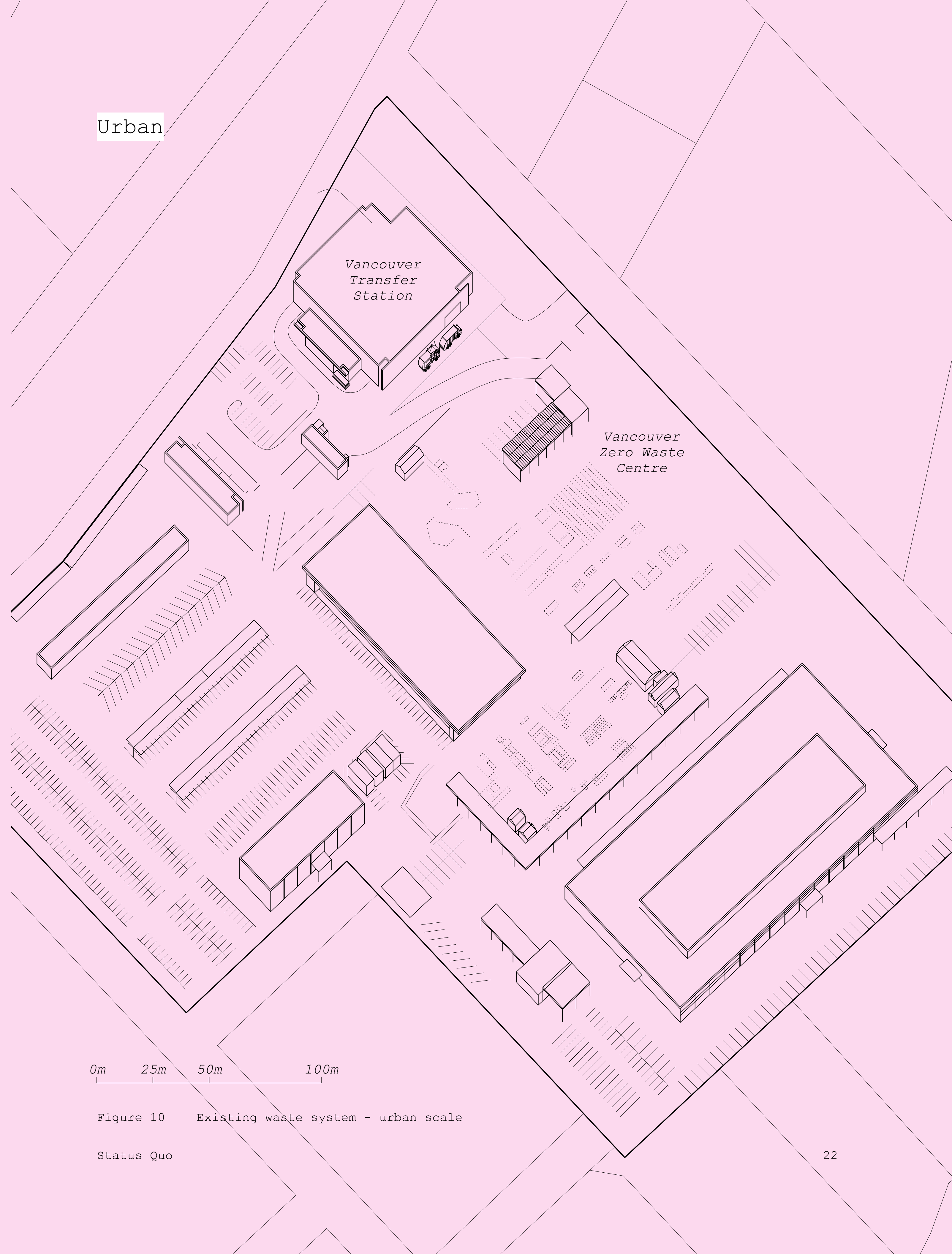


Figure 10 Existing waste system - urban scale

Regional

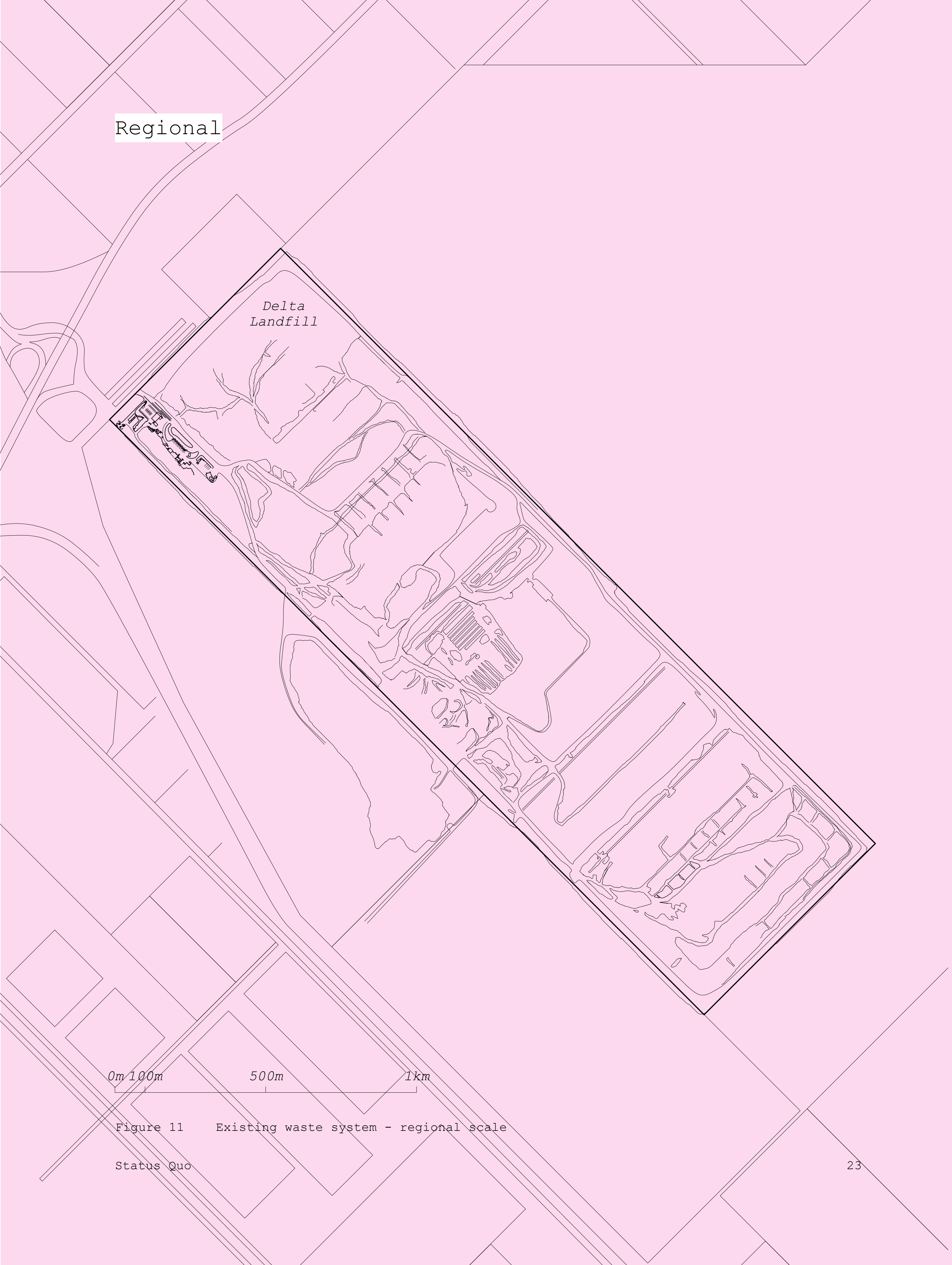


Figure 11 Existing waste system - regional scale

Regional

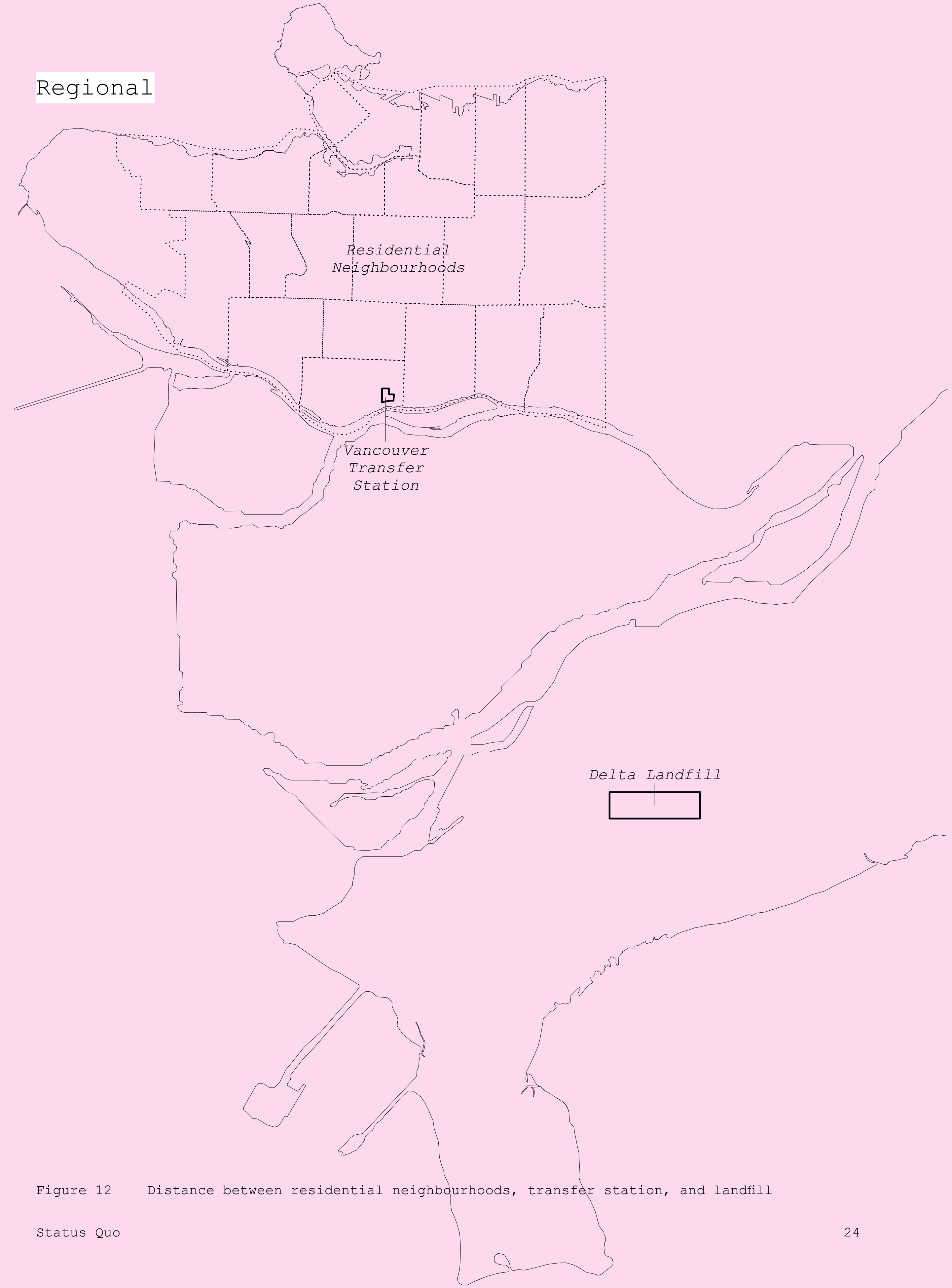


Figure 12 Distance between residential neighbourhoods, transfer station, and landfill

Global

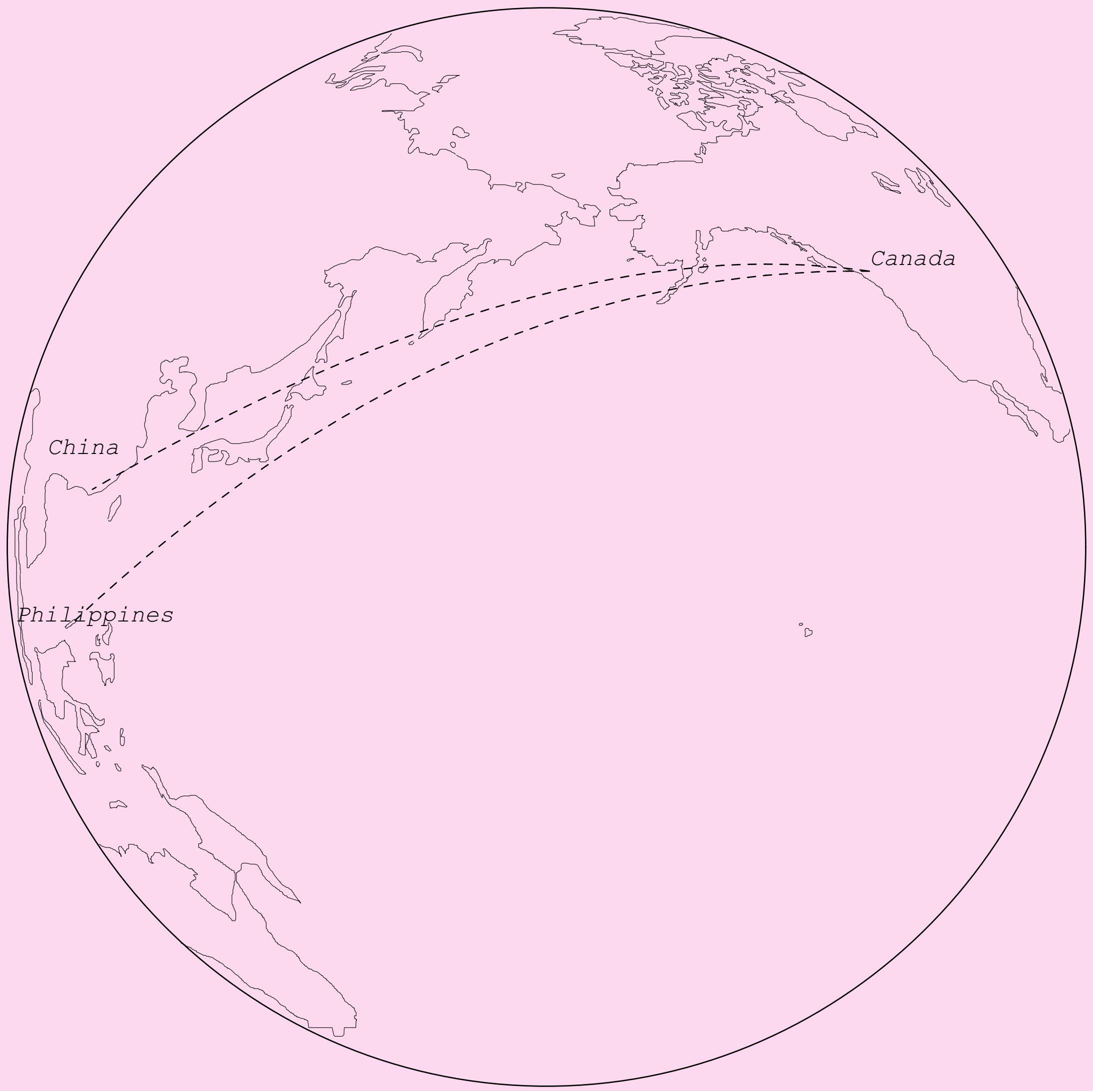
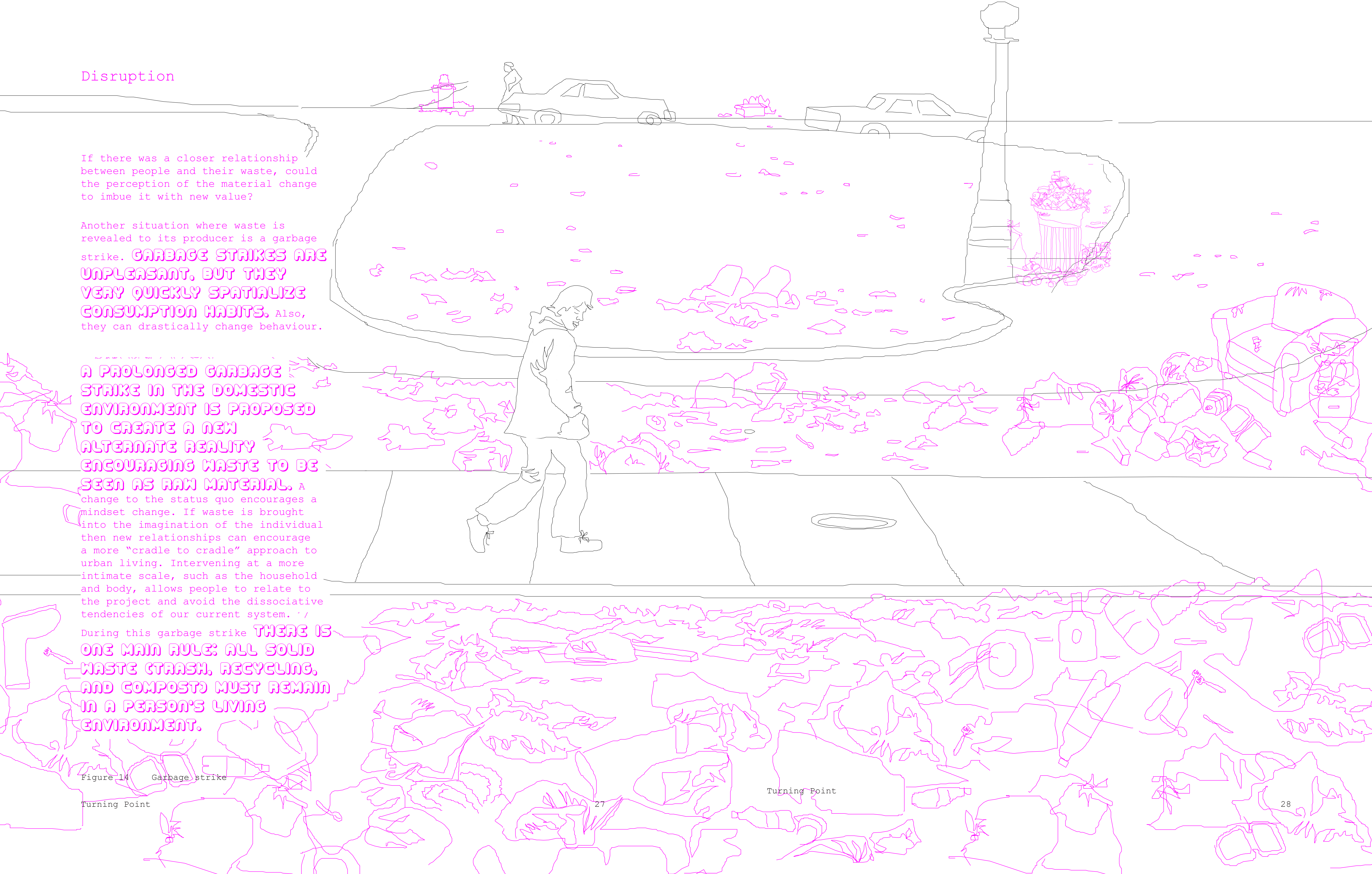


Figure 13 Existing waste system - global scale

PROPOSAL

Plastic Metabolism in a Garbage Apocalypse operates within a fictional (yet plausible) garbage strike. The garbage strike imposes a new reality reimagining and revealing material flows in the domestic environment. The existing body of the Vancouver Special, a locally specific and common typology, is renovated through a circular and decentralized waste management strategy. A new system of construction generates architectural forms from the characteristics of recycled rotational moulded plastic. Six interventions are proposed, each acting as a prosthetic (or organ) for the Vancouver Special to enable new social and physical relationships between the human body and waste materials and processes.

The following section is structured into three parts. The first section explains the context of the prolonged garbage strike. The second section explains the new circular waste management and construction system. The third section uses the architecture to relate the human body to waste processes.



Disruption

If there was a closer relationship between people and their waste, could the perception of the material change to imbue it with new value?

Another situation where waste is revealed to its producer is a garbage strike. **GARBAGE STRIKES ARE UNPLEASANT, BUT THEY VERY QUICKLY SPATIALIZE CONSUMPTION HABITS.** Also, they can drastically change behaviour.

A PROLONGED GARBAGE STRIKE IN THE DOMESTIC ENVIRONMENT IS PROPOSED TO CREATE A NEW ALTERNATE REALITY ENCOURAGING WASTE TO BE SEEN AS RAW MATERIAL. A change to the status quo encourages a mindset change. If waste is brought into the imagination of the individual then new relationships can encourage a more “cradle to cradle” approach to urban living. Intervening at a more intimate scale, such as the household and body, allows people to relate to the project and avoid the dissociative tendencies of our current system.

During this garbage strike **THERE IS ONE MAIN RULE: ALL SOLID WASTE (TRASH, RECYCLING, AND COMPOST) MUST REMAIN IN A PERSON'S LIVING ENVIRONMENT.**

Figure 14 Garbage strike

Site

Vancouver Special, Vancouver, British Columbia, Canada

The Vancouver Special housing typology is selected as a site to allow a test case for this new way of living.

The reason Vancouver is selected is for its desire to be one of the “greenest” cities. Vancouver has aggressive sustainable policies, such as the Greenest City 2020 Action Plan and Net Zero Waste 2040, which indicates that the population supports environmentally friendly development.

The Vancouver Special is a popular housing typology occurring across all of Vancouver. Beginning in the 1960s and finishing in 1985, approximately 10 000 Vancouver Specials were built.[1] The Vancouver Special has a large floor plan which is easily adapted to suit the resident’s needs. The house was easy to construct, with a slab and no basement, single interior structural wall, and light-wood framing, offering design adaptability and affordability.[2]

THE VANCOUVER SPECIAL IS A SUITABLE BASE HOUSING UNIT FOR THE PROJECT BECAUSE OF ITS POPULARITY IN VANCOUVER, DESIGN ADAPTABILITY, AND RELATIVE THIN CONSTRUCTION ASSEMBLIES. The quantity of Vancouver Specials across Vancouver indicates it is a well-recognized housing and even **CULTURAL ICON**, which increases the relatability of the project to a specific North American population. The relatability enables readers to place themselves in the same situation as the occupants of this theoretical scenario. Additionally, the design adaptability of the Vancouver Special is an advantage when working with renovations. Finally, the Vancouver Special has relatively thin assemblies. The light-wood framed walls are made of 2x4 dimensional lumber with insulation between the studs. Presently, environmentally conscious design, such as Passive House, recommends air tightness and high insulative properties (R-value). The requirement for high R-values often leads to very thick walls and roofs that are exteriorly insulated, which suggests that the Vancouver Special requires thicker walls. The Vancouver Special lacks the thickness of Passive House standards and therefore marks itself as a potential suitor to a renovation that adds material (thickness). Moreover, the project intends to walk the line of “truth is stranger than fiction.” Having a realistic base (aka an existing housing typology) can create more empathy for a speculative future.

1 McFaul, Samuel. “Vancouver Special Sunset Project.” 2013. Vancouver Hertiage Foudnation. PDF file. December 1, 2019.
2 McFaul, “Vancouver Special Sunset Project.”

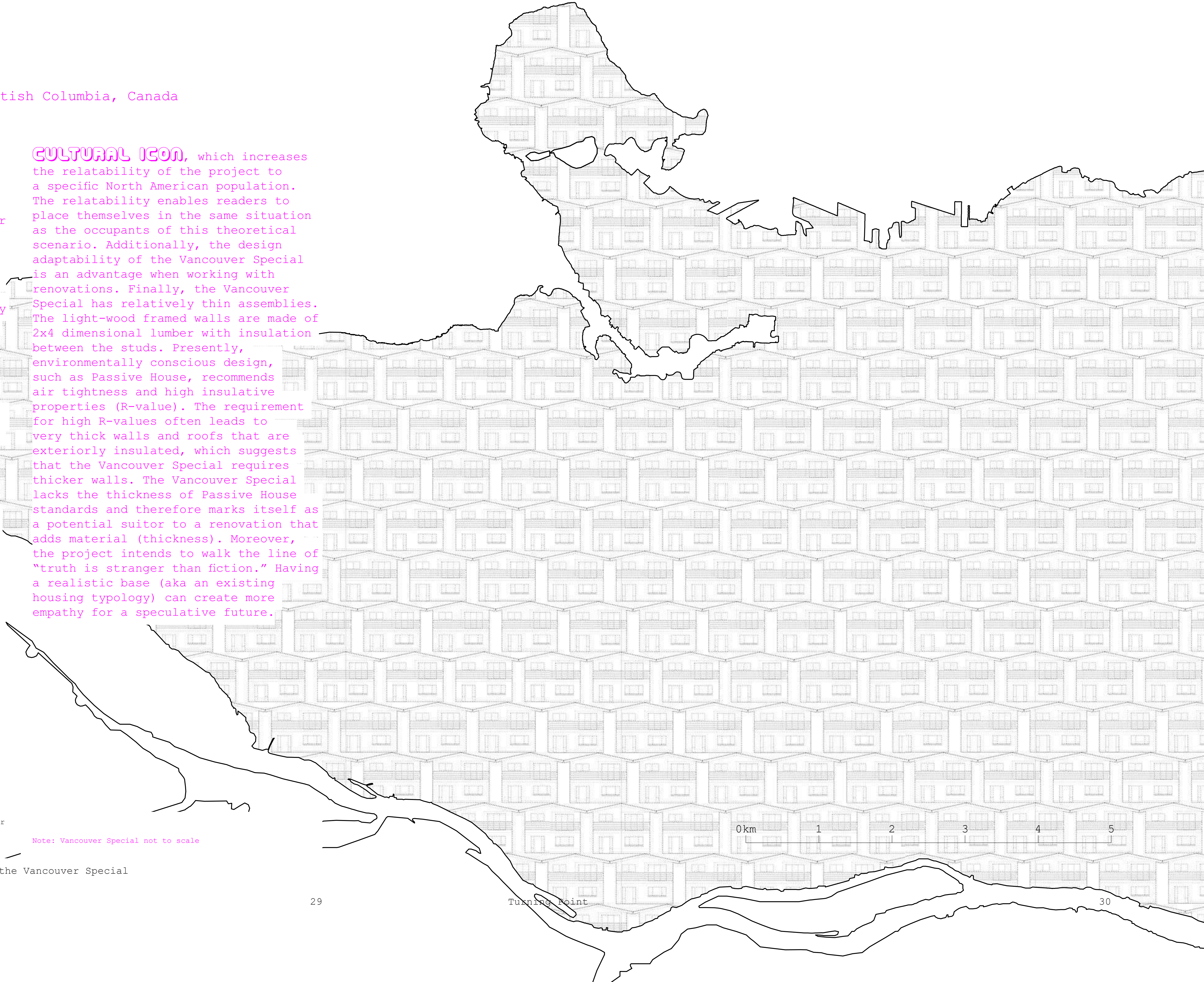


Figure 15 Vancouver and the popularity of the Vancouver Special

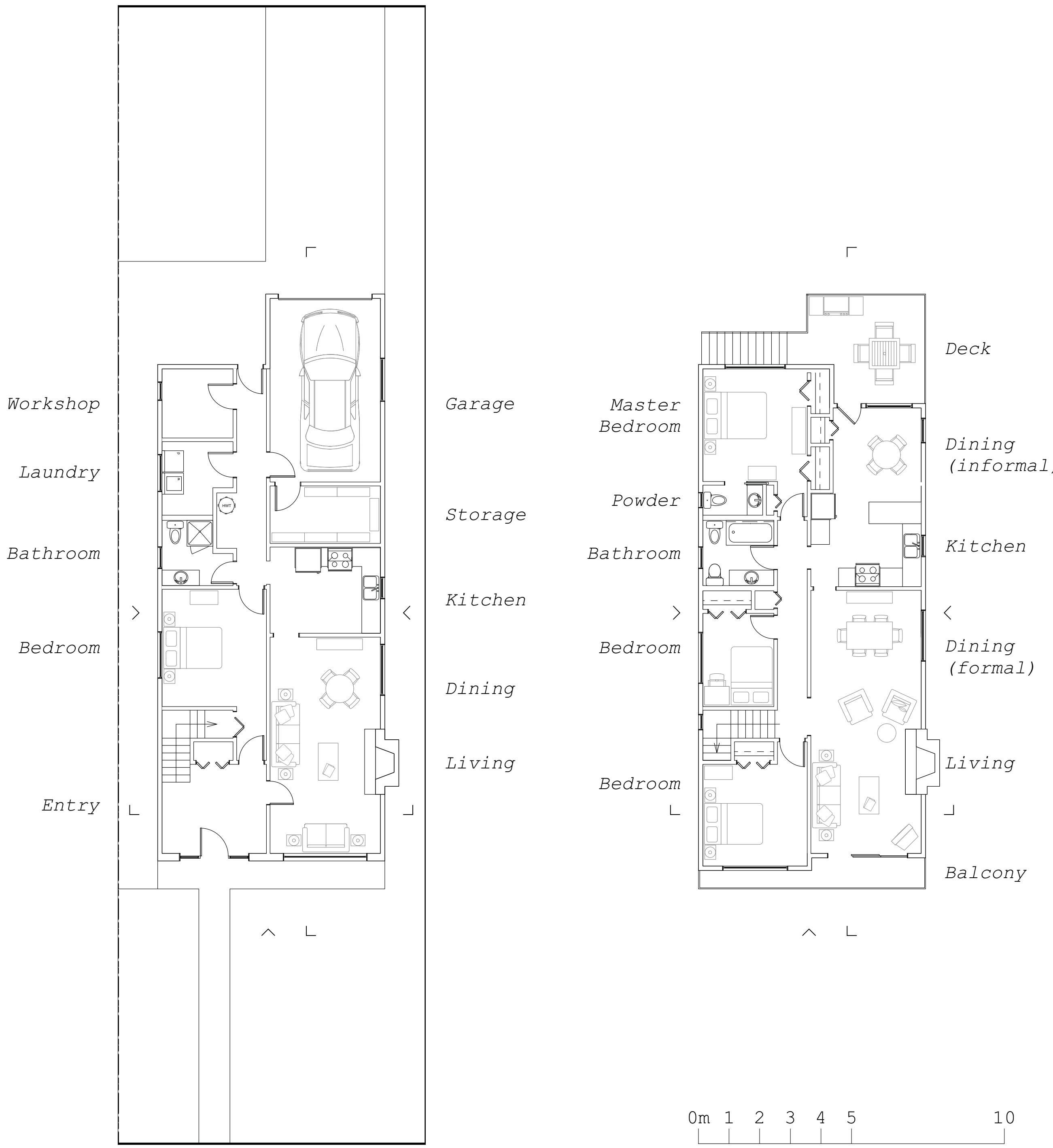


Figure 16 Vancouver Special floor plans

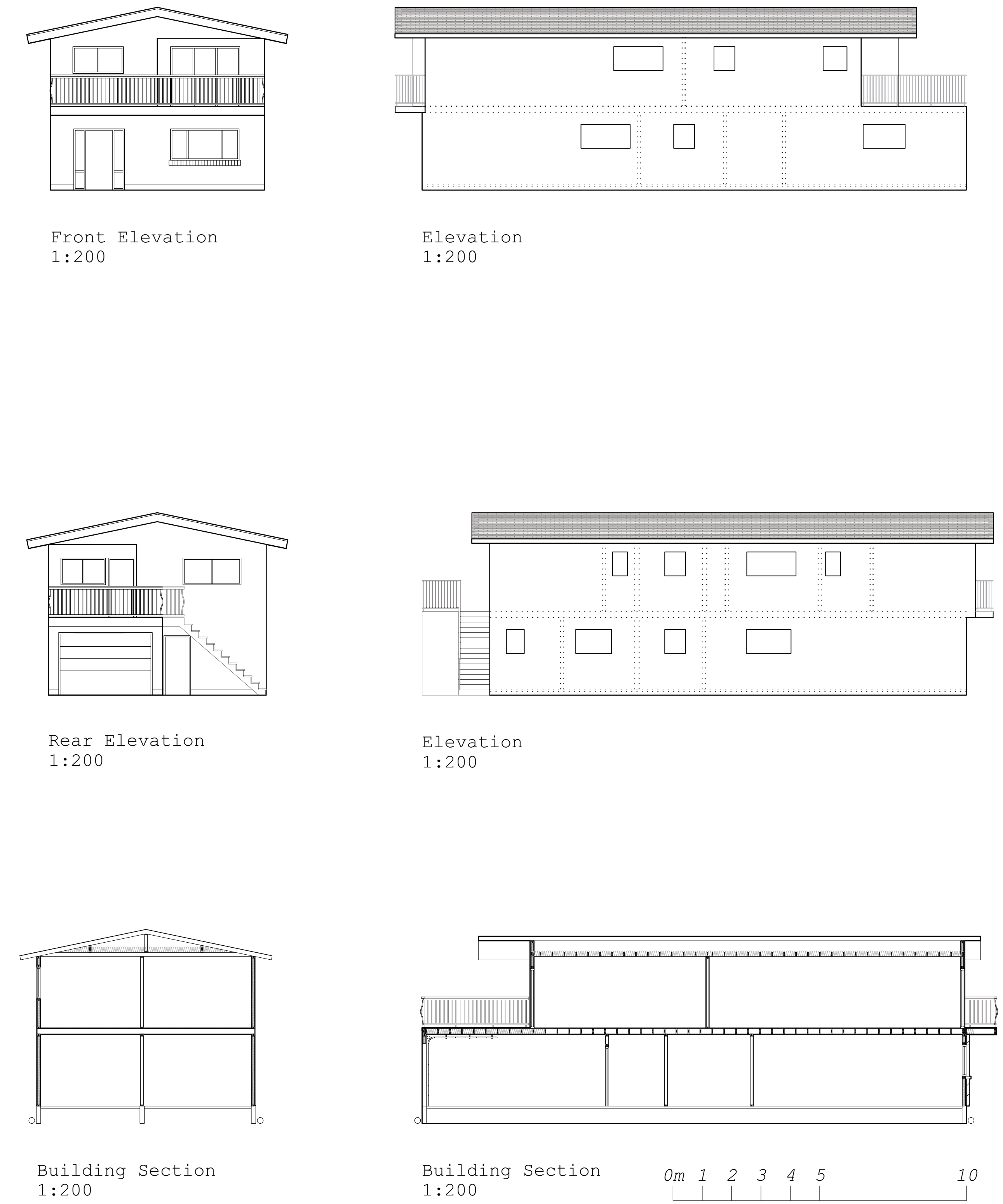


Figure 17 Vancouver Special elevations and sections

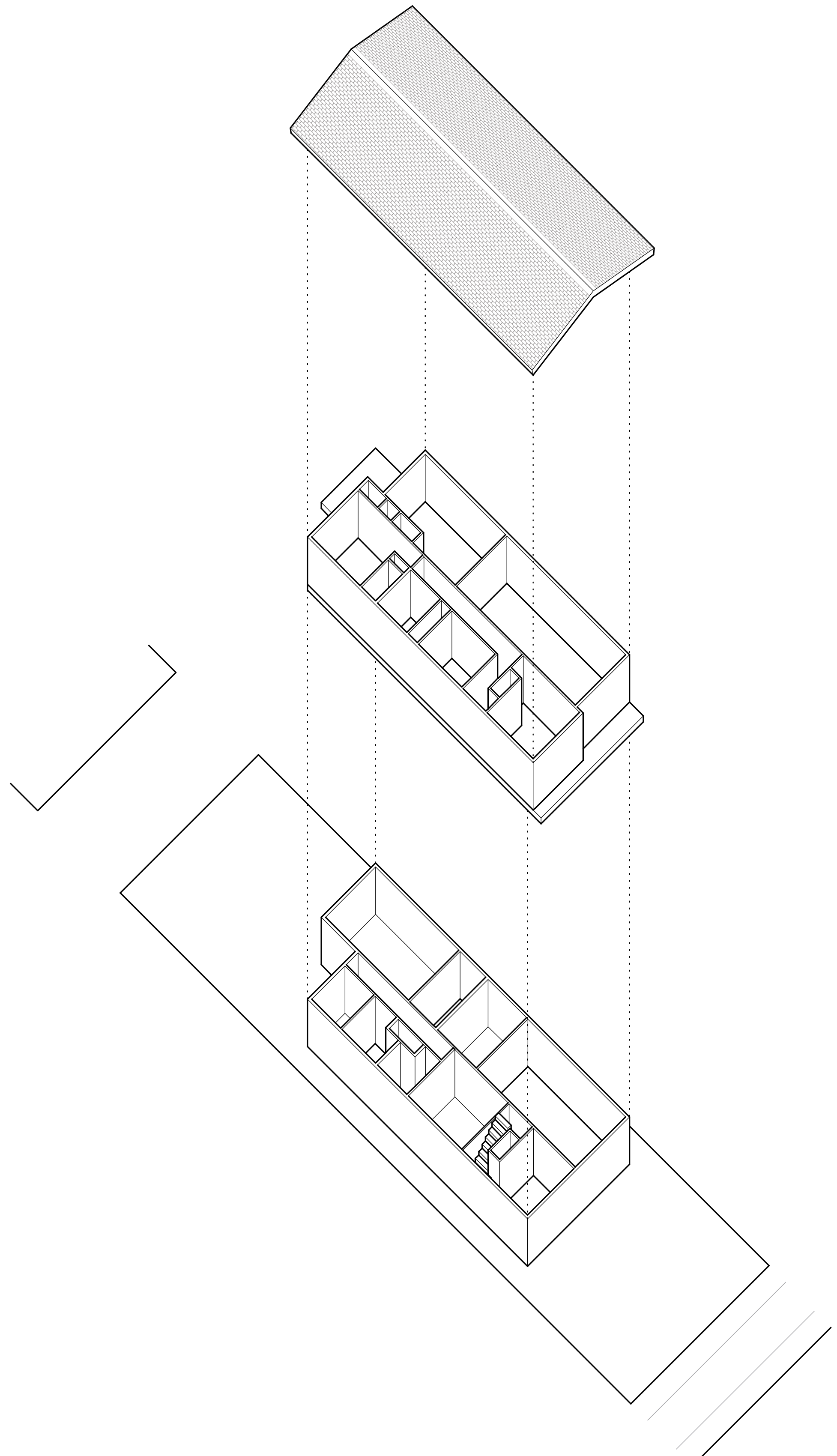


Figure 18   Vancouver Special axometric

Existing System in a Garbage Strike

As a starting point, in the current waste system, if there was a garbage strike or if a person hoarded their waste, the house would slowly fill, constricting the use of space until it is limited to only narrow circulation paths.

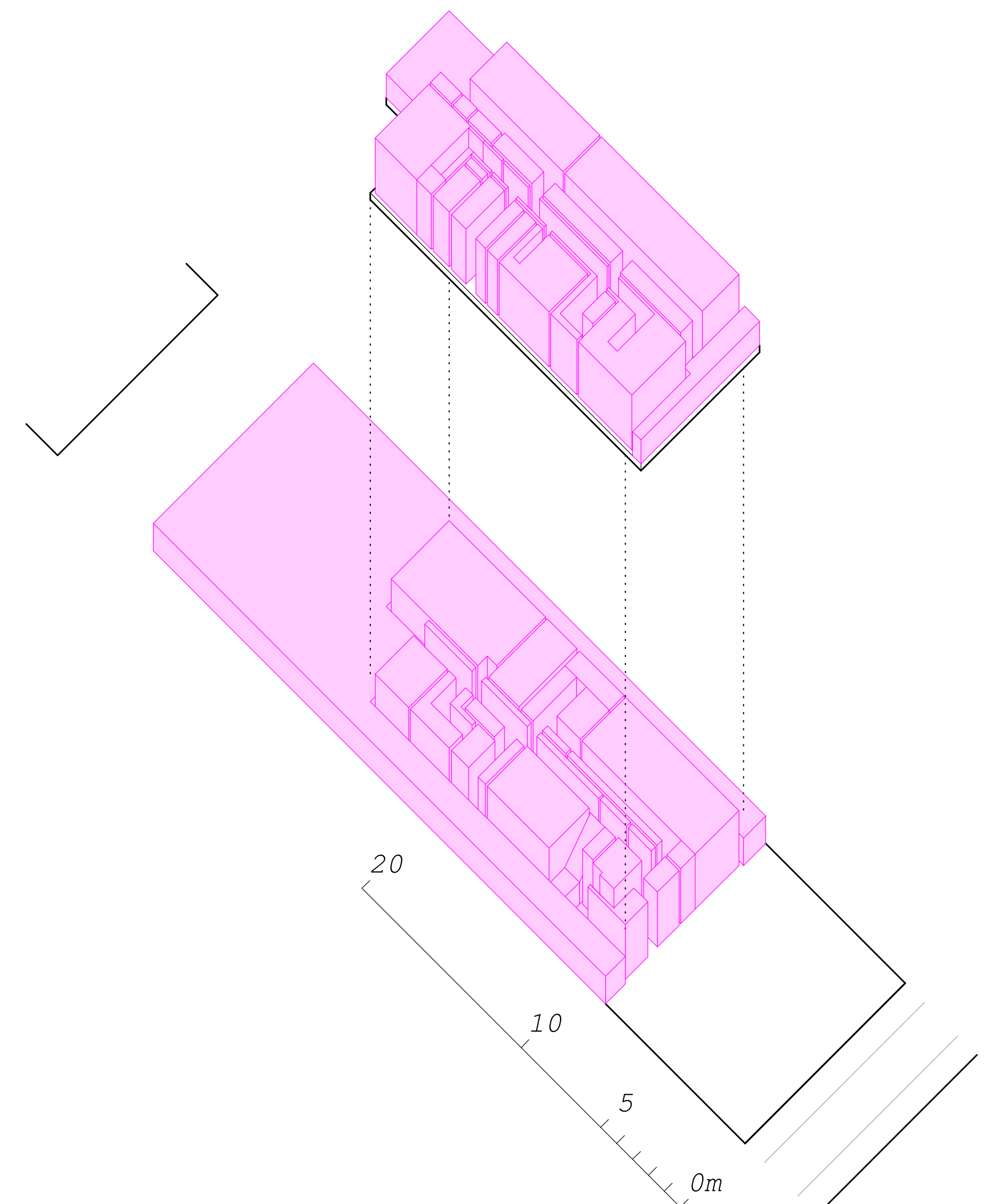


Figure 19   Vancouver Special full of garbage

Mentality

Seeing waste as raw material is a mentality that is actually not too alien from history. **HUMANS HAVE BEEN USING WASTE MATERIALS AS PRECIOUS RESOURCES FOR MANY YEARS.**

For example, the fossils of ancient plankton from the Cenozoic, Mesozoic, and Paleozoic Eras (dating back as far approximately 500 million years) contributed the formation of oil. Something that was dead became fuel. During the process of extracting oil several by-products are created. Plastic was created from the use of oil’s waste by-product. A material in excess becomes an opportunity. Presently, plastic is a waste product from many other waste products (dead creatures and oil refinery by-products) and is being accumulated on mass in landfills, oceans, etc. This project sees used and unwanted plastic as raw material that can become part of a more sustainable material cycle by adapting it to the built environment in the form of domestic interventions seeking to spread this mentality across human material culture.

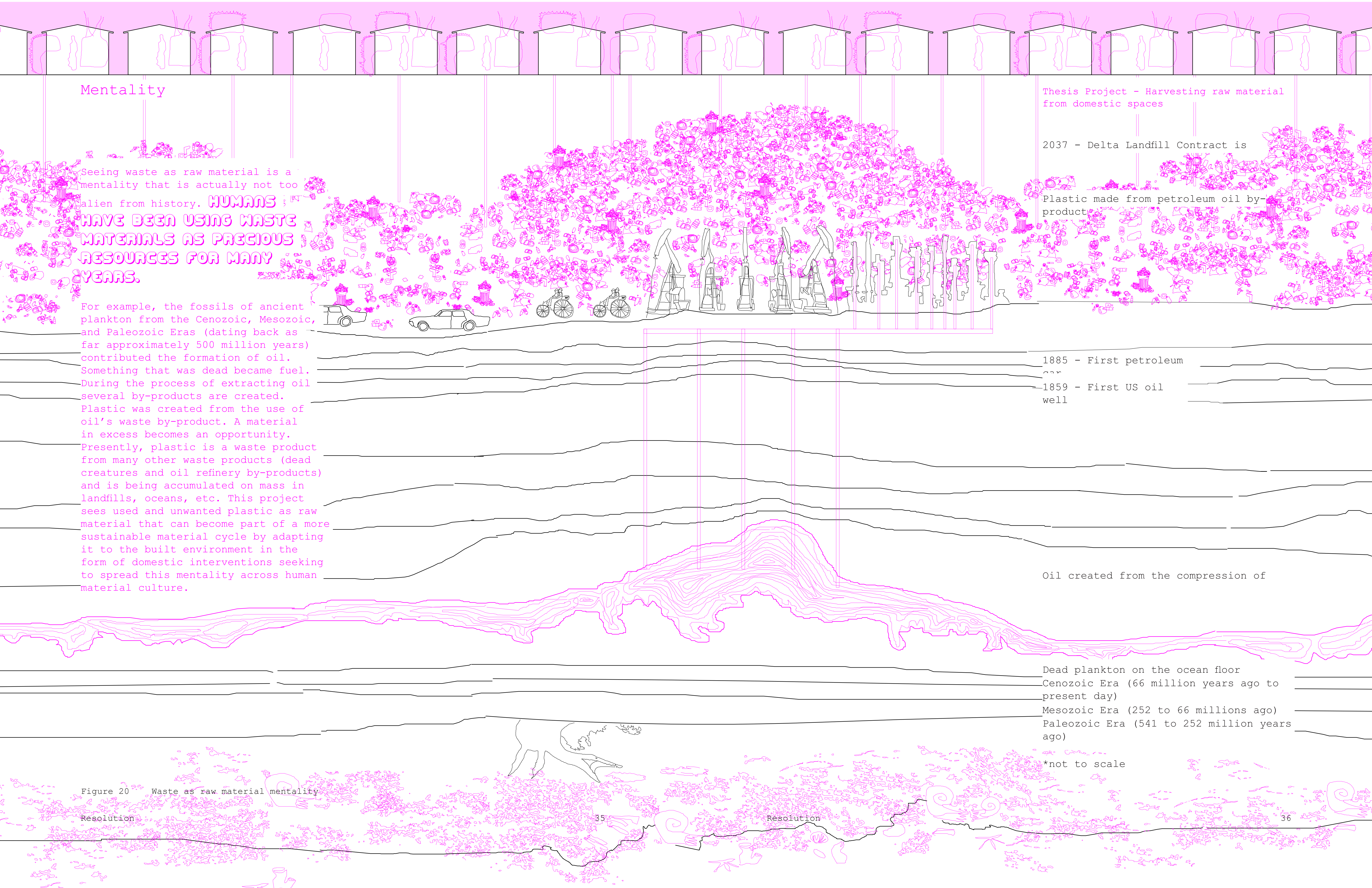


Figure 20 Waste as raw material mentality

New System

Instead of our typical linear waste management system, **THIS PROJECT PROPOSES A CIRCULAR SYSTEM, WHERE MATERIAL PROCESSING OCCURS IN THE HOUSE AND IS SENT TO LOCAL FABRICATORS WHO CREATE ARCHITECTURE AND SENT IT BACK TO THE HOUSE FOR RESIDENTS TO OCCUPY.**

Humans have needs and wants that lead us to purchase and consumer. We used to send garbage away, but in a world where this is not an option, instead you wash, dry, shred, store, and eventually take it to a local fabrication workshop. At the workshop the plastic is rotationally moulded into room pods. The pods are taken back to the house and installed for residents to expand their living and waste processing spaces.

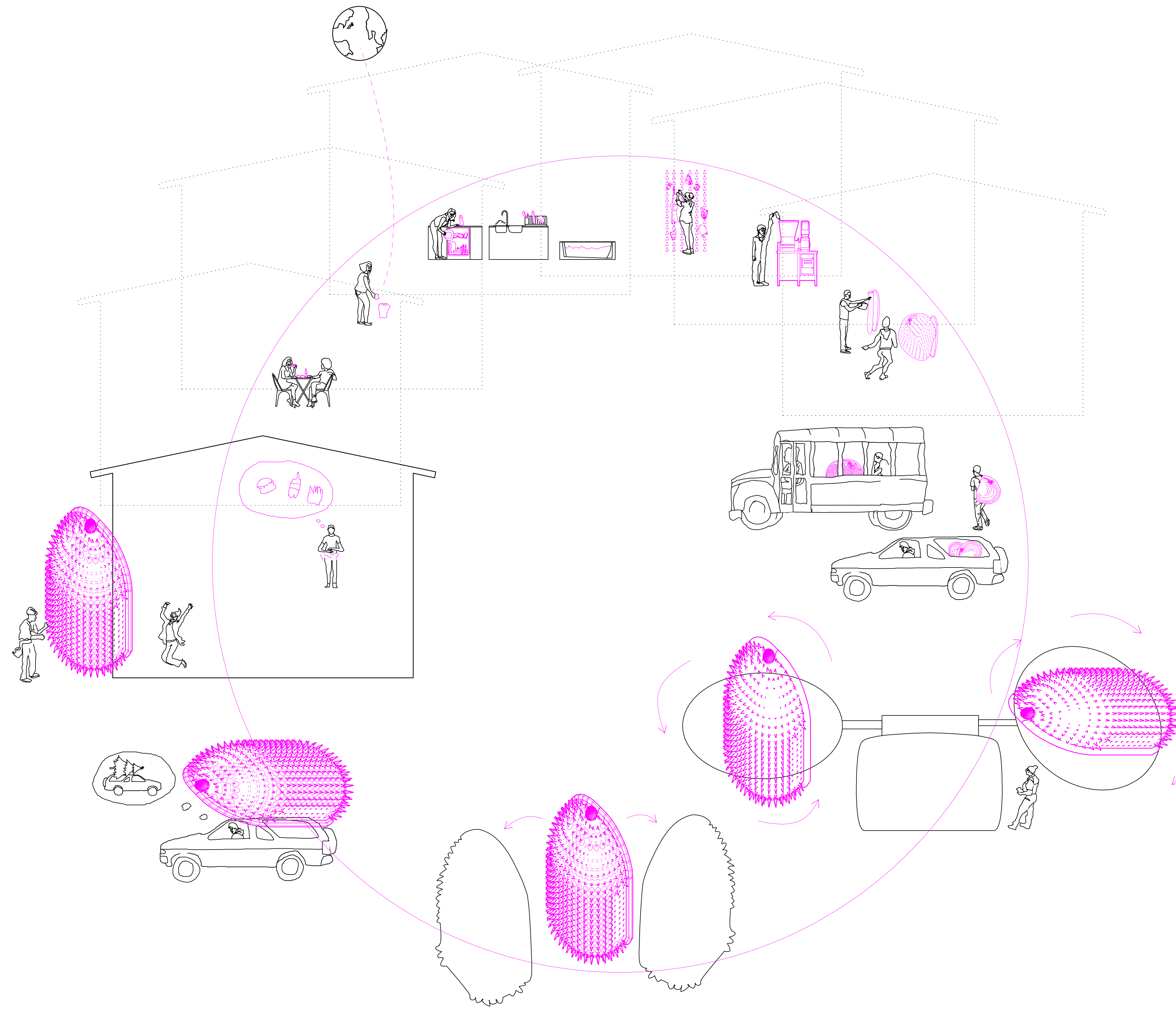


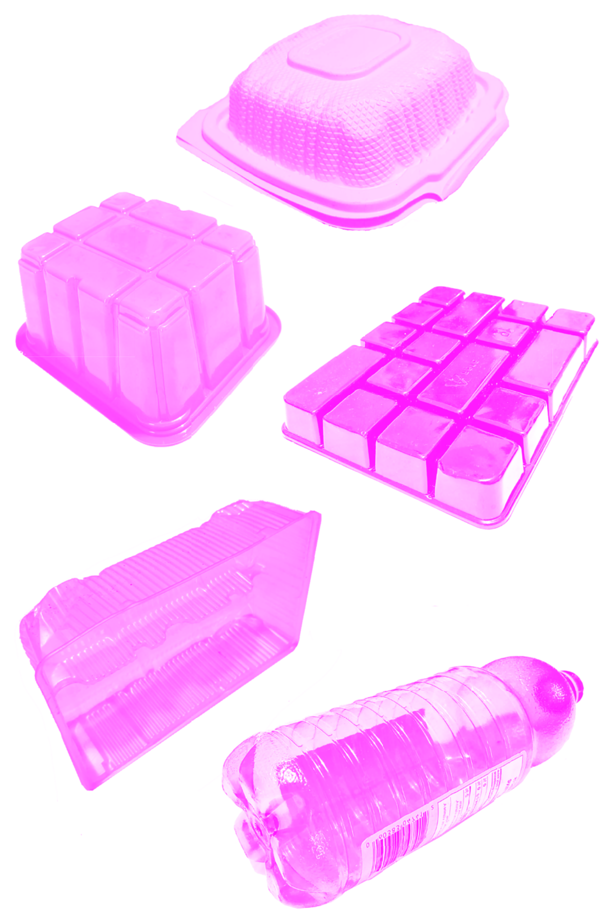
Figure 21 Circular waste system

Construction

THE SMOOTH, ROUNDED, AND SPIKEY FORM OF THE SHELLS IS CREATED IN RESPONSE TO THE MATERIAL NEEDS AND CHARACTERISTICS OF RECYCLED PLASTIC AND THE METHOD OF FORMATION, ROTATIONAL MOULDING.

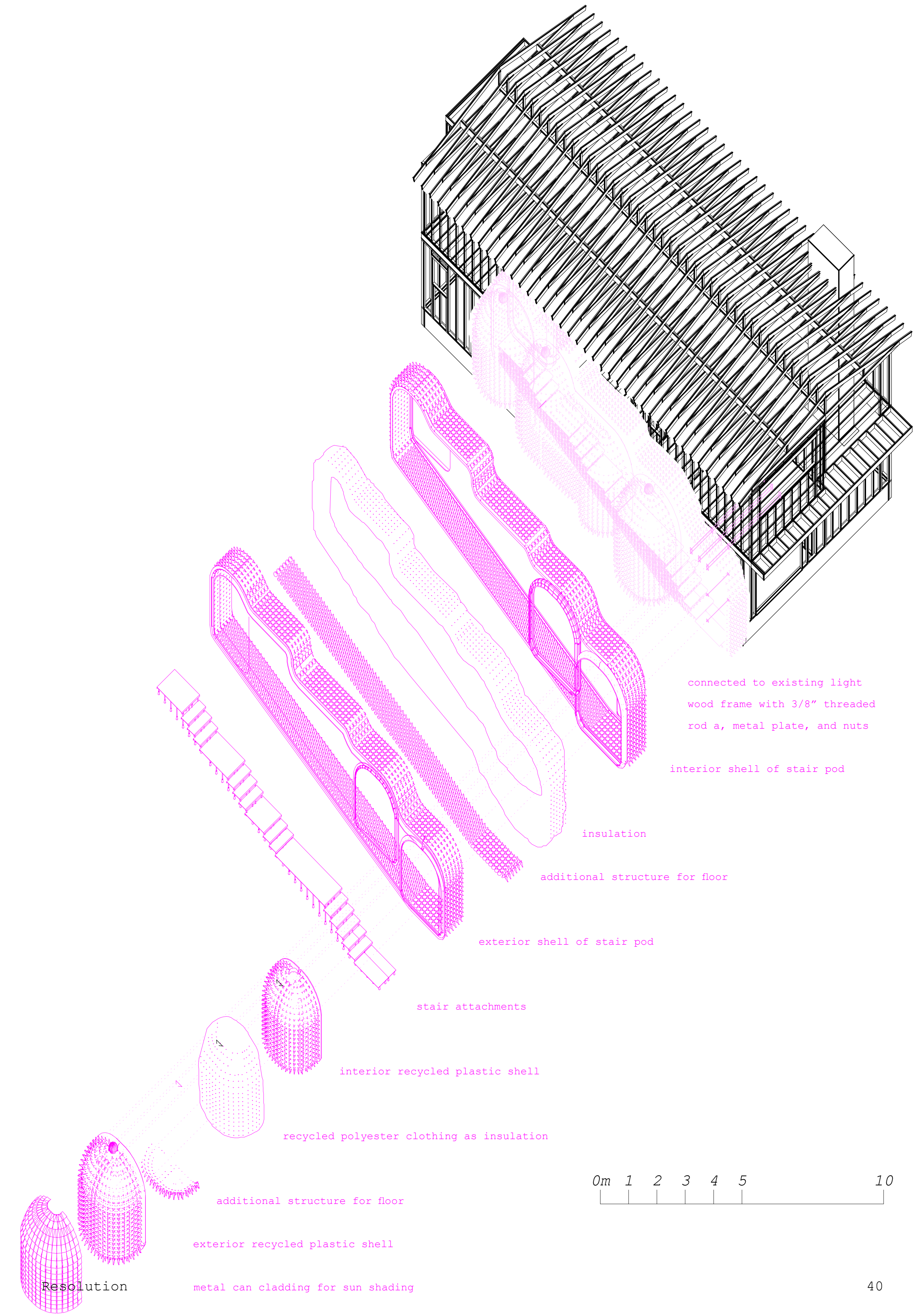
Initial studies looked at plastic “clamshell” food containers for inspiration to determine an architectural form that would express the unique performances of plastic. Most plastic containers usually have a collection of many ridges and indents. Also rotational mould manufacturers advise increasing ridges and intentional perforations to product designs.[1] These features are designed to increase the stability of the plastic piece. Each architectural intervention has two plastic shells. The proposed cone shape form is sized to allow four inches of insulation in between shells, allows indentations where the interior and exterior shells can fit together, allow the shells to easily come out of the manufacturers moulds, and adds a complex triangulation and arching that again increases rigidity of the structure. The plastic shells are single-surfaced and covered with these structurally performing rounded spikes.

The interior shell is inserted into the exterior shell with recycled polyester clothing as insulation. The floor is occasionally thickened with another layer of spikes to further stablize the surface that receives the most human weight. The pod is attached to the existing home’s light-wood frame structure with tension rods. The attachment system is selected allowing for easy separation of materials at the end of their life or if the occupants want a change. Additionally, there are plug on elements, such as stairs and metal cladding.

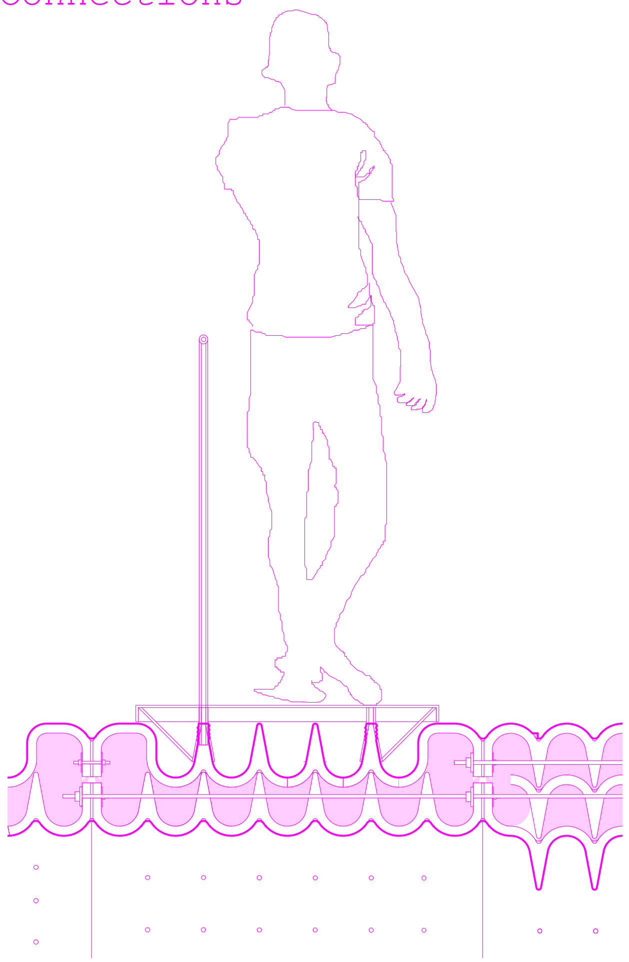


1 ASH Industries. “SEE OUR NEW VIDEO! LOOK BELOW Rotational Molding of Large Plastic Products - ASH“ *Youtube* video, 5:25. July 29, 2015. https://www.youtube.com/watch?v=_2_xFQXI9fM; ASH Industries. “Rotational molding for large or small plastic parts.” ASH Industries: Rotational Molding. https://www.ashrotomolding.com/ (accessed March 15, 2020).

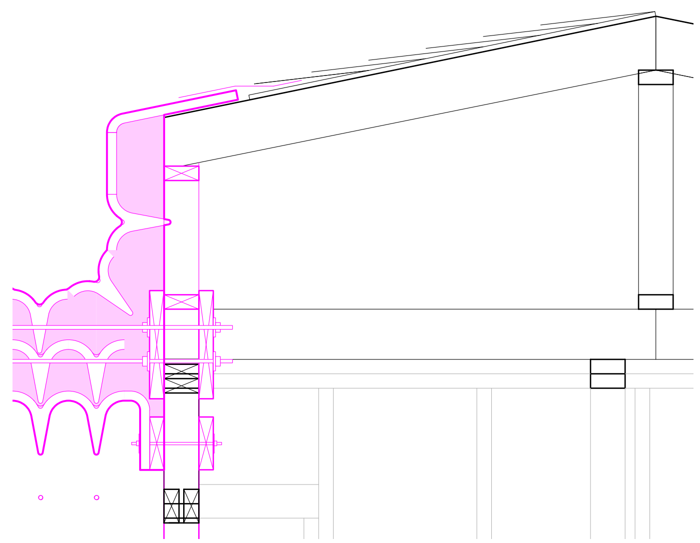
Figure 22 Plastic Containers (left)
Figure 23 Recycled Plastic construction diagram (right)



Connections

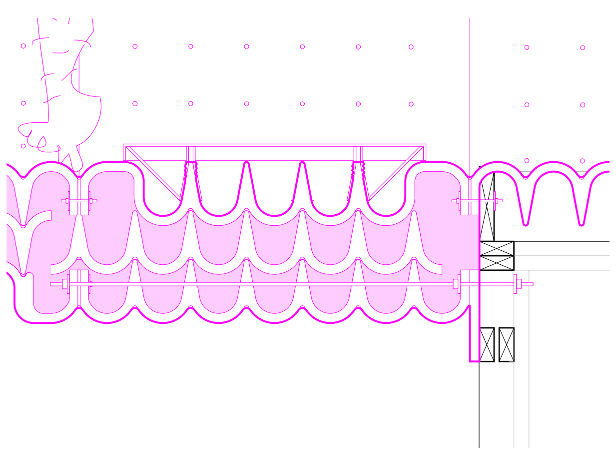


In addition to the tension rods, metal plates, and wood framing, where possible, the plastic further secures itself to the house by hooking on and around window sills revealing itself to the interior spaces of the house.



Roof Assembly
Exterior Pod connection to Stair Pod
1:20

Detail
Stair Pod connection to Existing House
1:20



Floor Assembly
Exterior Pod connection to Stair Pod connection to Existing House
1:20

Figure 24 Roof Assembly (above)
Figure 25 Recycled Plastic construction diagram (Below)

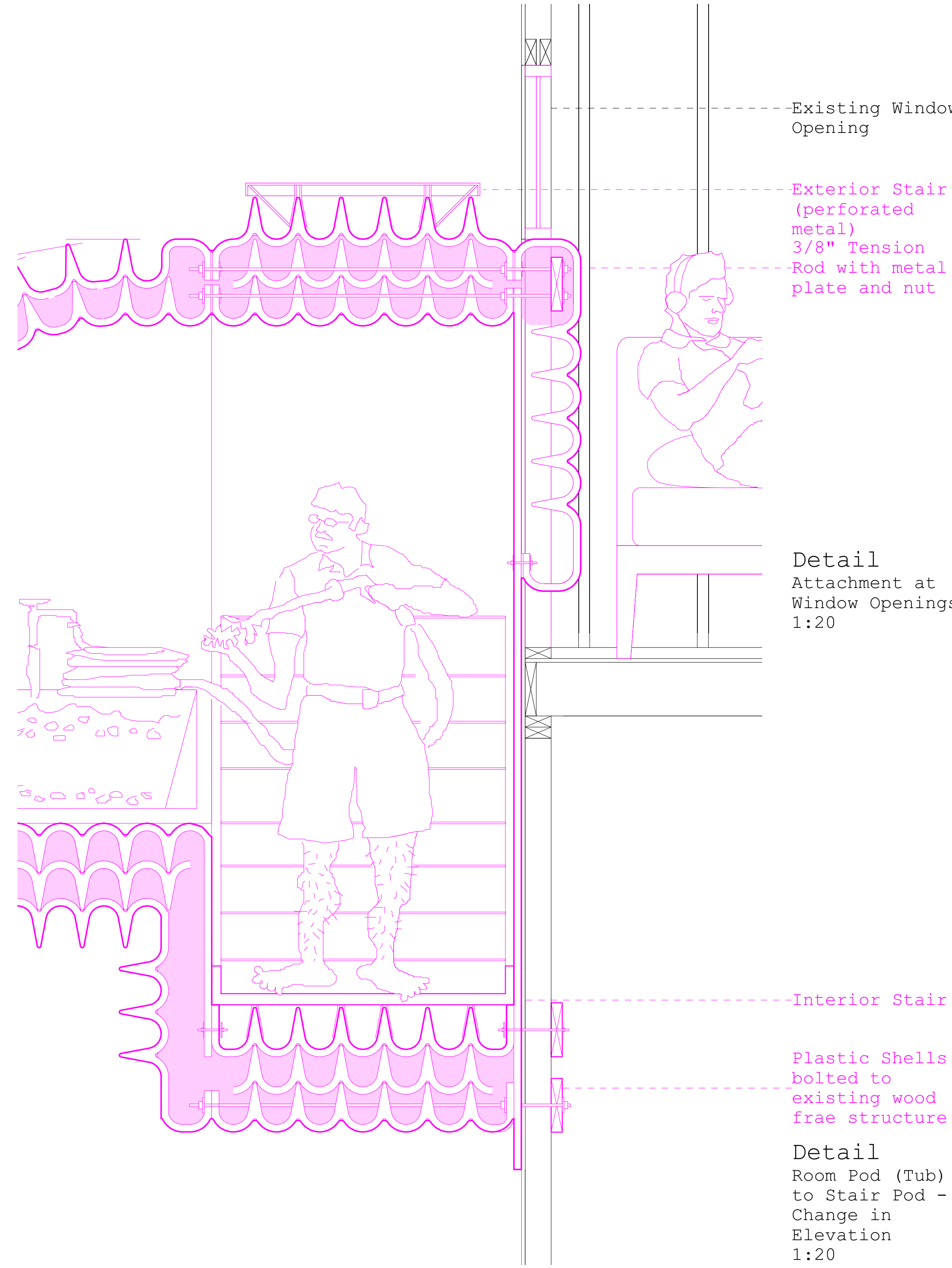
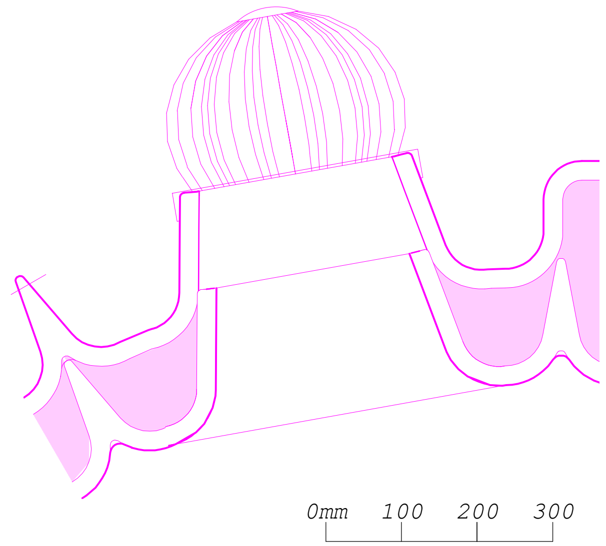


Figure 26 Attachment through window sill

Details

The floors servicing vertical circulation have the spikes pointed upwards (into the room) rather than downwards (facing the exterior). This allows a plug on stair system that can create different platforms or stairways depending on the conditions of the Vancouver Special and the requirements of the occupants.

To help with breathability and offgases each fabricated pod has a passive ventilation fan at its high point.



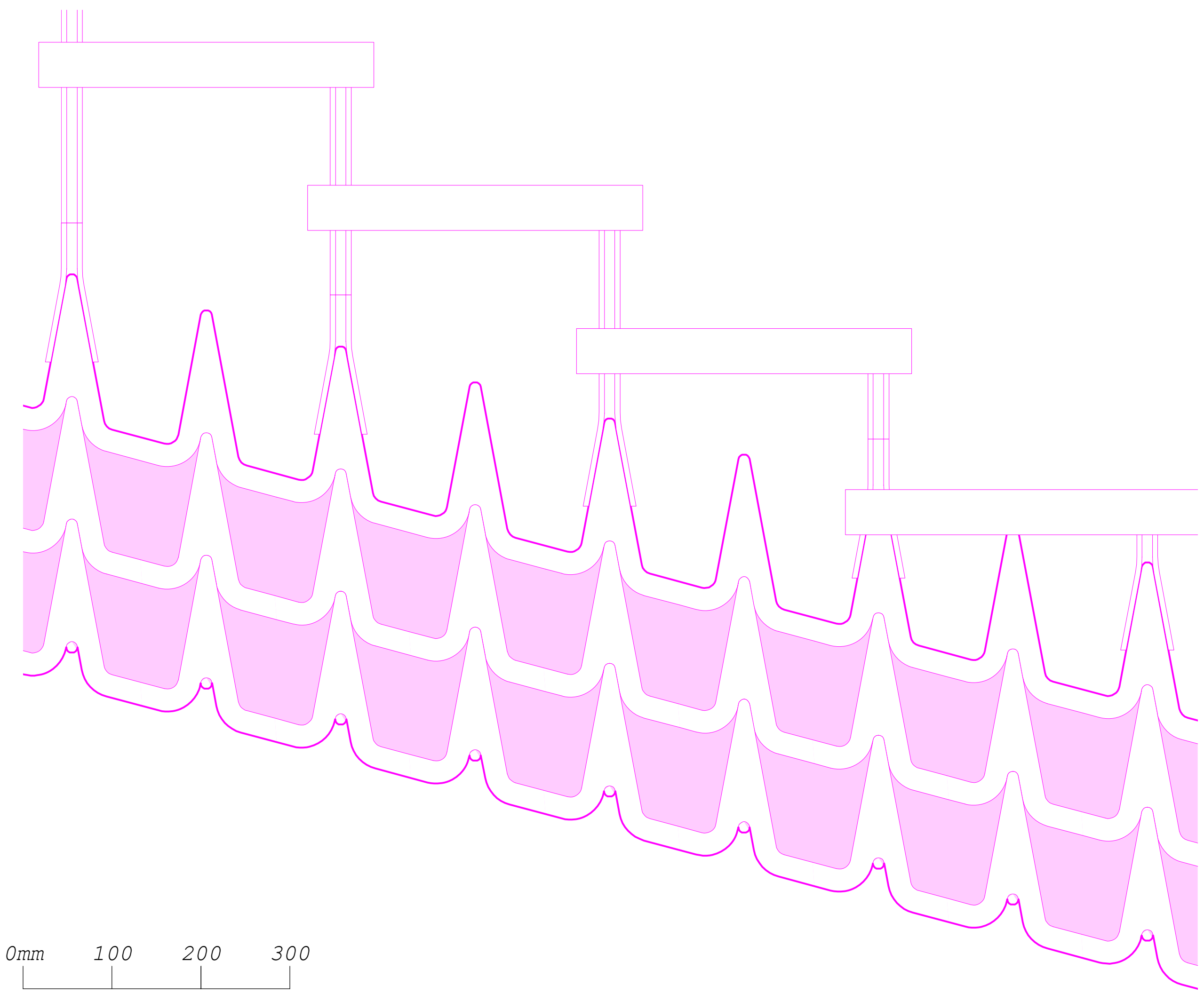


Figure 27 Passive ventilation detail, 1:10 (top right)
Figure 28 Plug on stair element, 1:8 (bottom)

Assembly

The recycled plastic construction system is efficient, integrating different aspects of what traditionally would be required from light-wood from construction into fewer pieces which can be easily attached or separated from the existing house or other pods.

The interior shell integrates structure and interior finish into one single surfaced piece, unlike wood framing which uses studs, drywall, and a lot of nails, screws, and glue. The exterior shell integrates what traditionally would be sheathing and strapping.

In situations where the plastic structure is exposed to a lot of direct sunlight, a metal cladding system, or more accurately a shading system, can be attached. The spike's tip can be fashioned into a screw shape allowing unrolled and flattened tin cans to be attached. A hole is punctured to the tin can and it is placed on the rounded spike. A plastic cap, similar to a bottle cap, can be manufactured small scale in the home and be used to secure the metal cladding. The cladding is primarily used for sun protection rather than waterproofing.

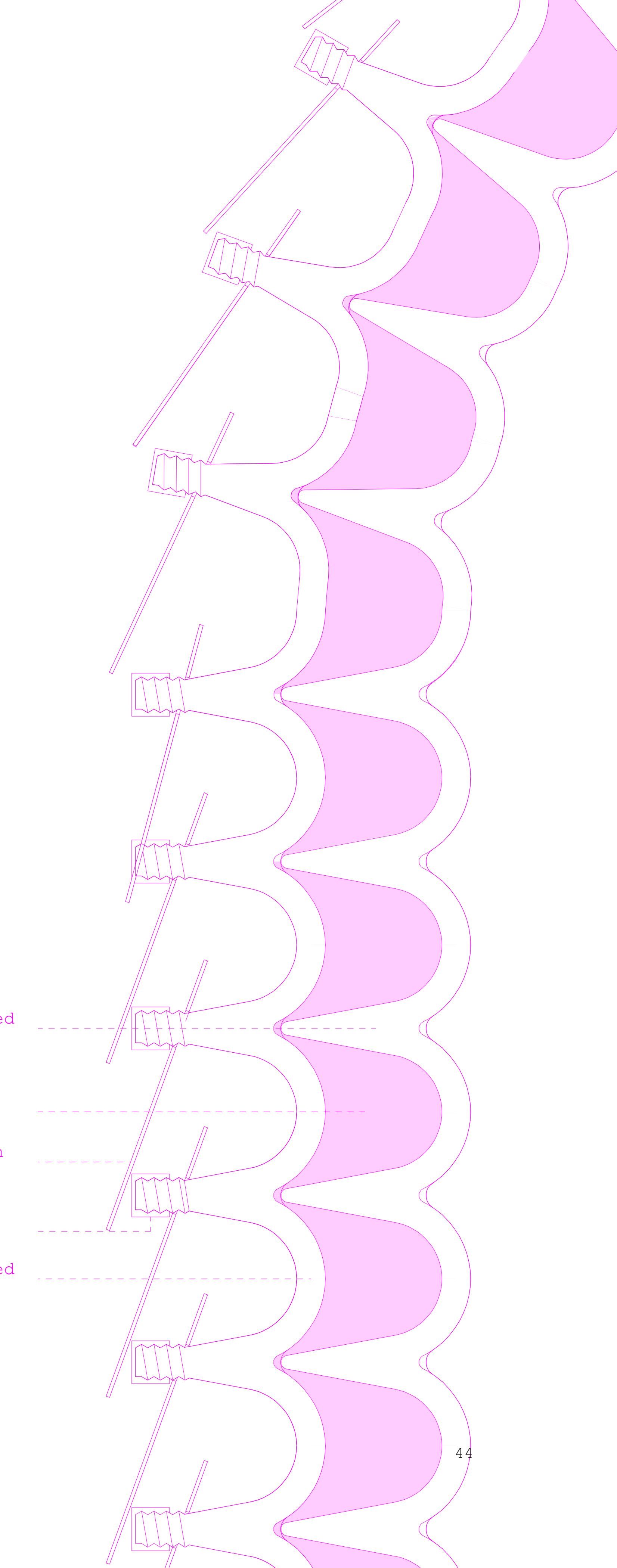


Figure 29 Typical wall assembly, 1:10

Materials

AS THE BUILDING SYSTEM IS MADE OF RESIDENTS' WASTE ITEMS, THE COLOUR AND PATTERNING OF THE STRUCTURES WILL BE DETERMINED BY THE CONSUMPTION PATTERN OF THE RESIDENT.

If a resident primarily throws away clear plastic containers then their house will have a milky semi-translucent skin.

If a resident prefers orange laundry detergent then their house could become speckled with orange.

If a resident has a large mixture of random odds and ends, as well as microplastics, the house could become a dark speckled pattern.

Figure 30 Household plastic

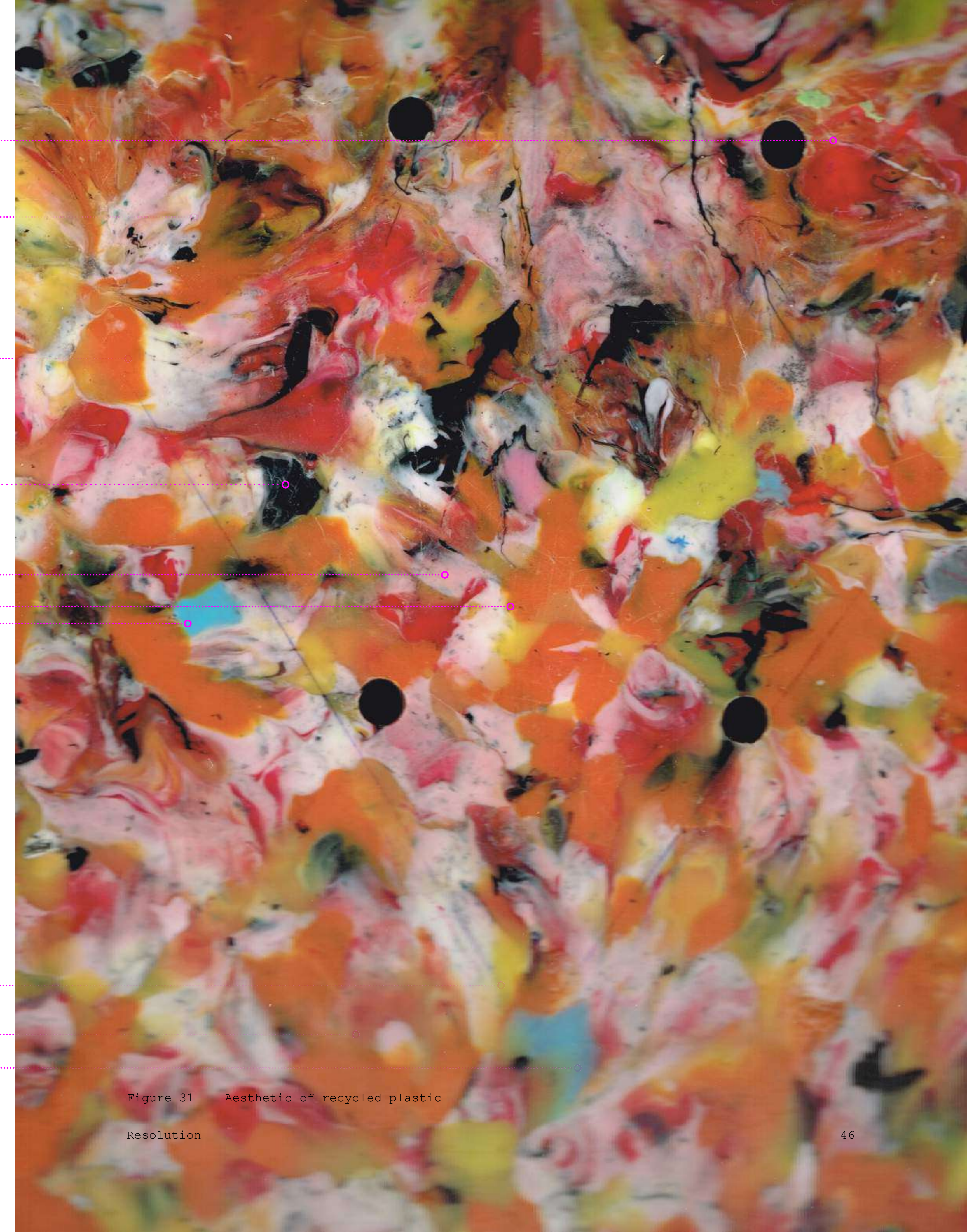


Figure 31 Aesthetic of recycled plastic

Plastic Architectural Interventions

Each plastic pod demonstrates waste material as raw material and the potential for development through waste. The pods allow the process of working with waste to be more easily accommodated in the house and alongside human activities.

There are six pod options. **THE INTERVENTIONS GROW ON THE VANCOUVER SPECIAL FUNCTIONING IN A BLURRY ZONE BETWEEN AN ORGAN AND A PROSTHETIC.** Similar to the human body, where each organ performs a particular function, each intervention supports the waste material processing in the house.

1. **THE BLADDER** (the bathroom)
2. **THE MOUTH** (the kitchen)
3. **THE STOMACH** (the digester)
4. **THE LUNG** (the living room)
5. **THE FAT** (storage)
6. **THE CHILD** (the suite)

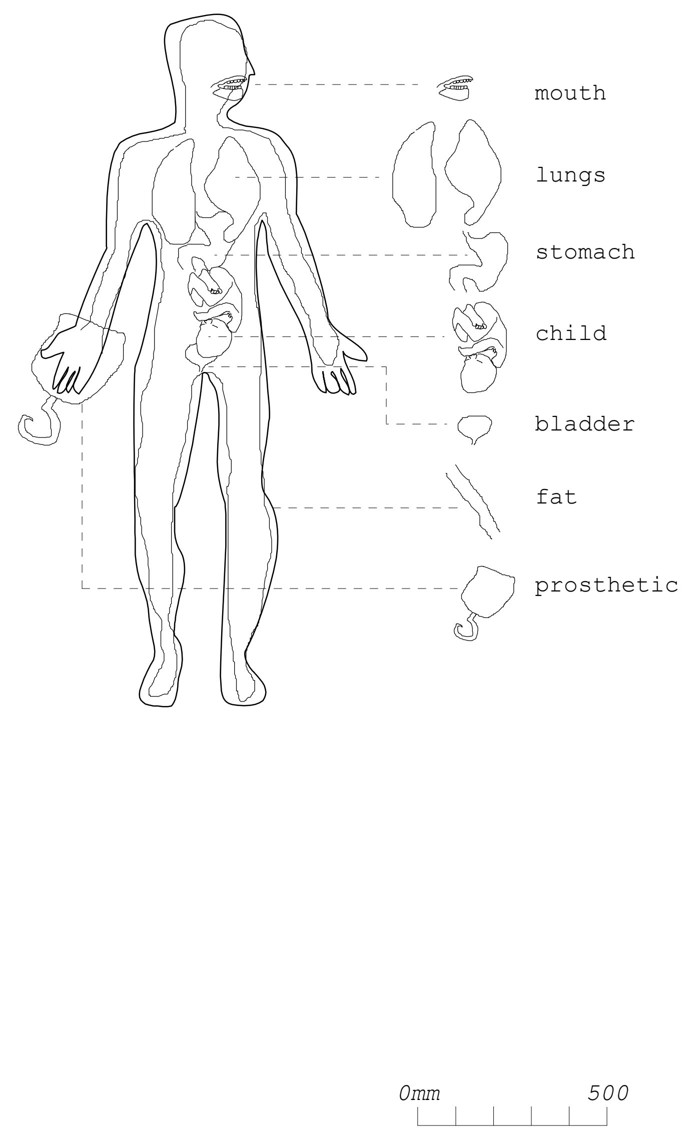


Figure 32 Human body with organs and prosthetic

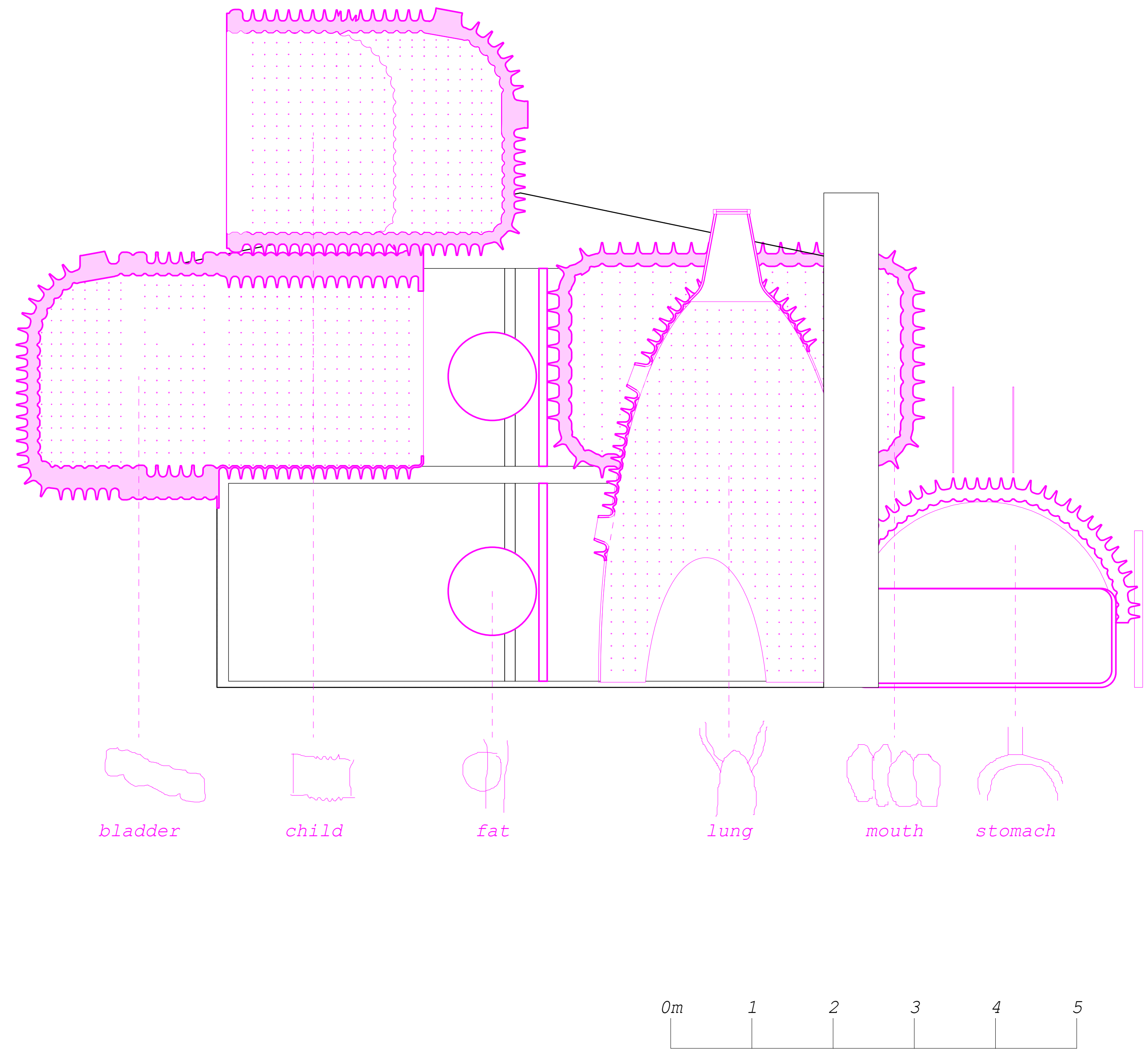


Figure 33 Recycled plastic organs for the Vancouver Special diagram

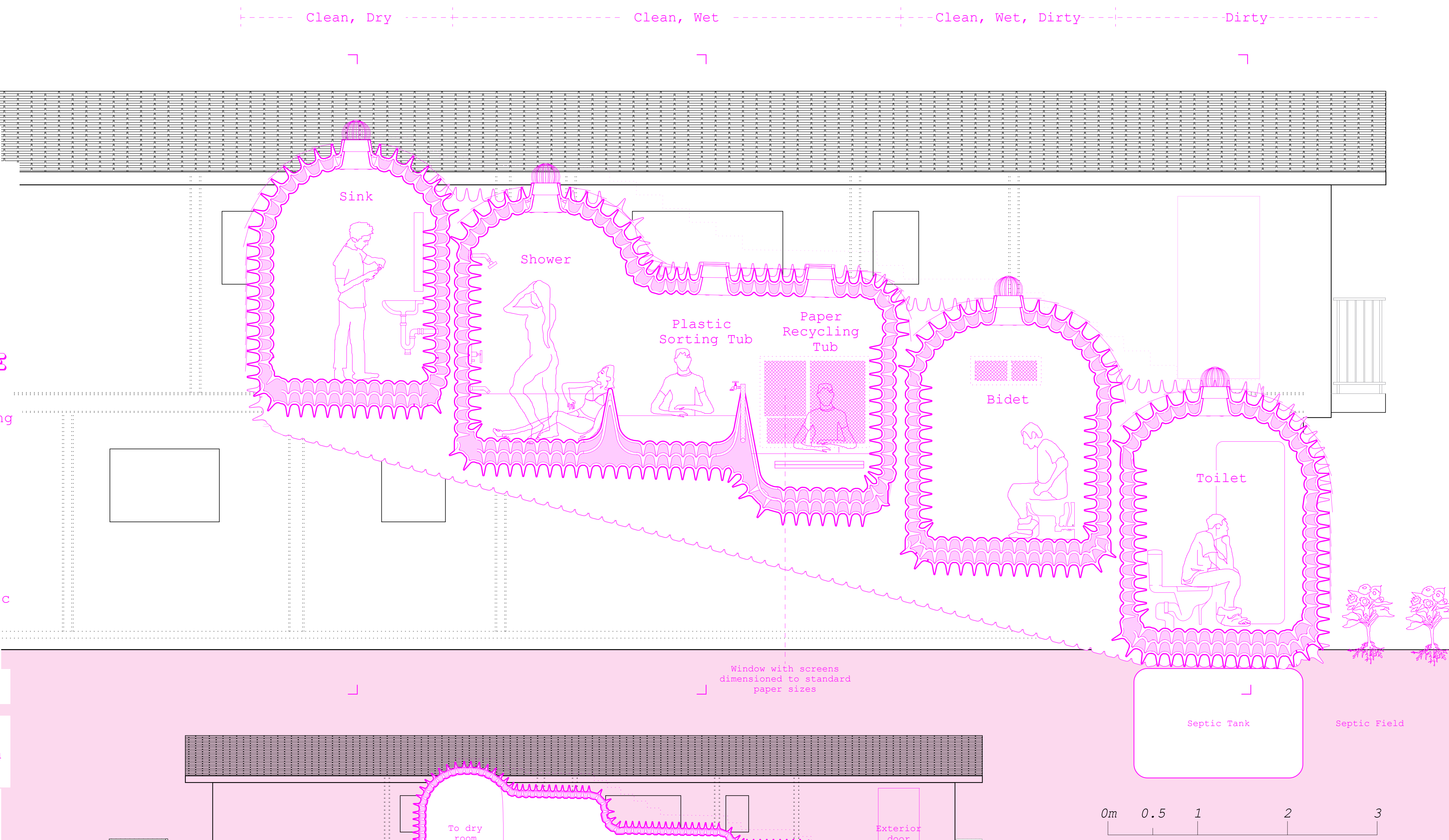
Bladder (Bathroom)

The Bladder is the first intervention and the one that the construction system was developed through.

The Bladder is formed by the needs of wastewater, human hygiene, and the sorting of plastic and recycling of paper. **THE TUBS IN THE BLADDER ACCOMMODATE PLASTIC SORTING AND PAPER RECYCLING IN CLOSE PROXIMITY TO HUMAN ACTIVITIES.** A person can be taking a bath next to sorting plastic. The tubs are elevated at working counter heights for ease of use.

The Bladder is terraced from the top floor to ground with clean and dry spaces on the top and dirtier spaces, such as grey water and black water usage in the bottom. There is a septic tank and septic field that allows the slow filtration of nutrients to the front yard, which is landscaped with shallow rooted plants to benefit from the nutrients and signal a productive space.

The Bladder incorporates several room pods and a staircase pod. This allows for the pods to be used in other configurations, as well as constrains the amount of plastic to collect for one time period.



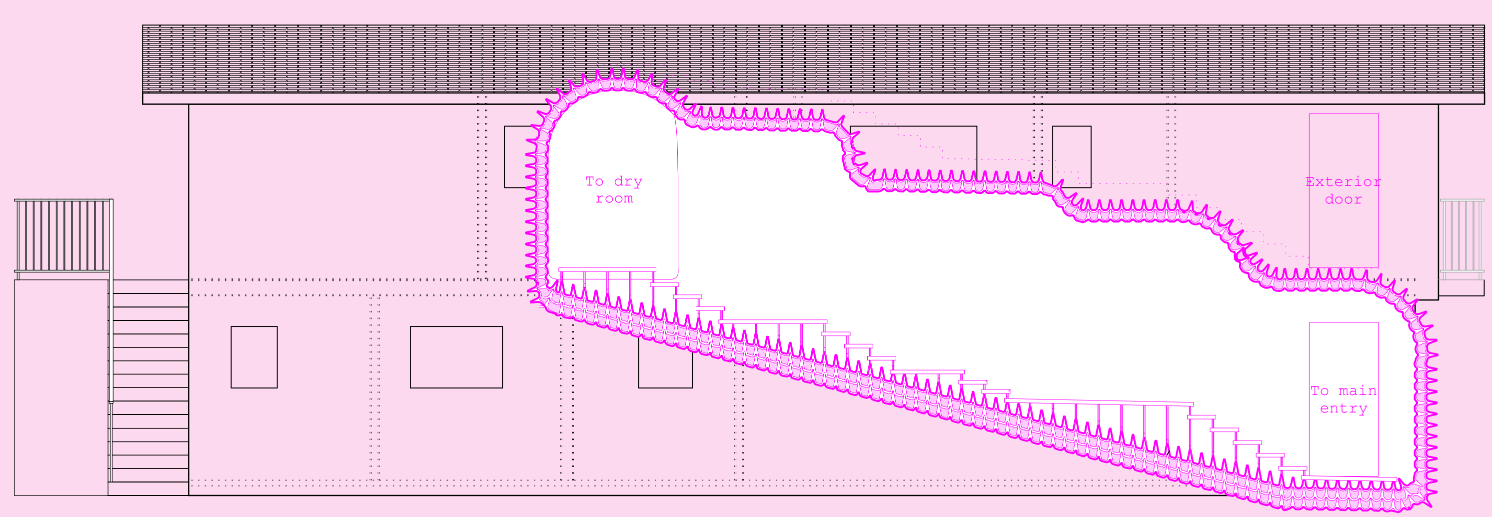


Figure 34 The Bladder: Building Section: room pods, 1:50 (top)

Figure 35 The Bladder: Building Section: stair pod, 1:50 (bottom)

Bladder (Bathroom)

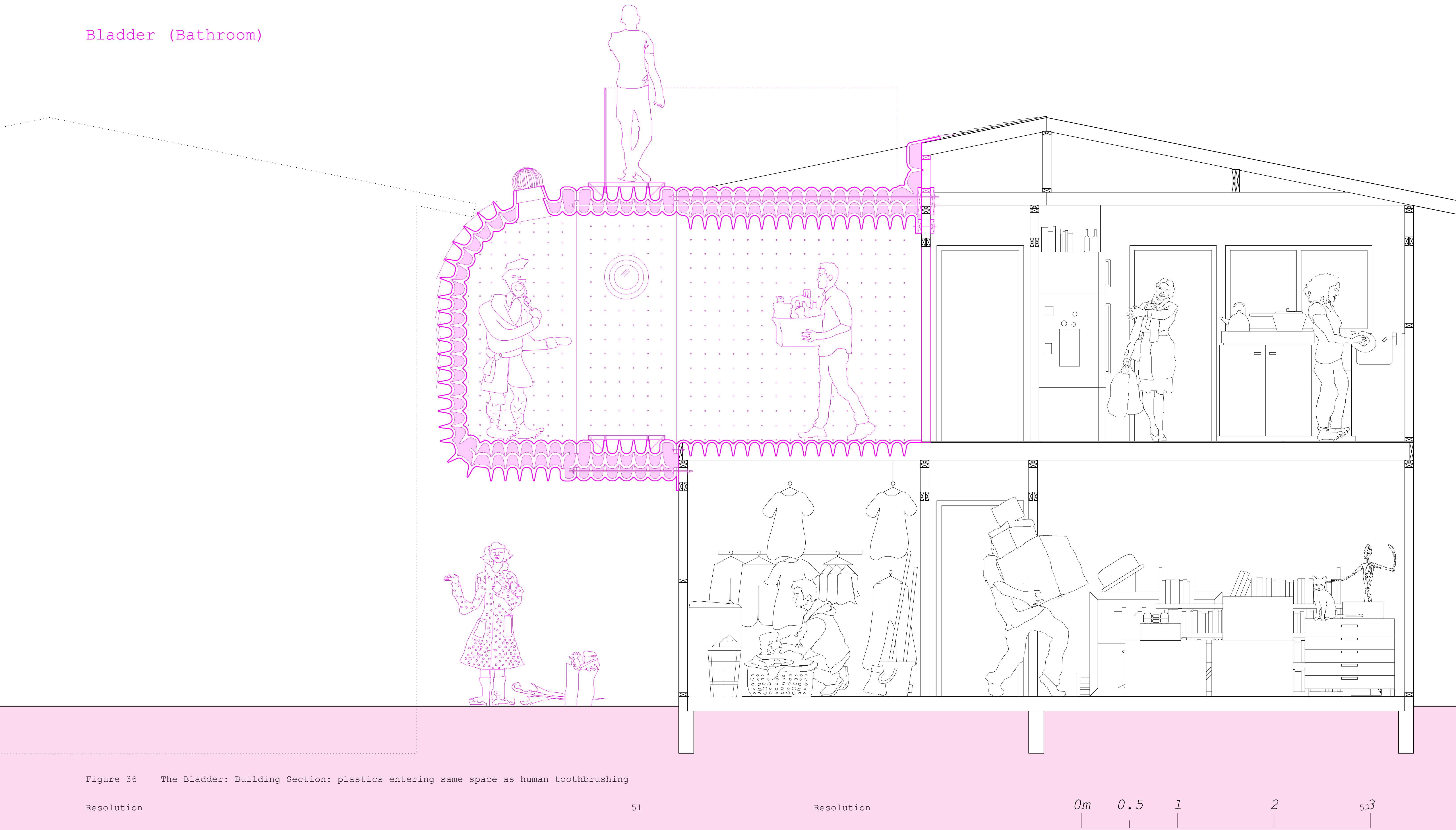


Figure 36 The Bladder: Building Section: plastics entering same space as human toothbrushing

Bladder (Bathroom)

The prefabricated recycled plastic pods allow waste processes, such as someone sorting plastic to occur in very close proximity to domestic leisure activities, such as someone relaxing in their bedroom, or taking a shower.

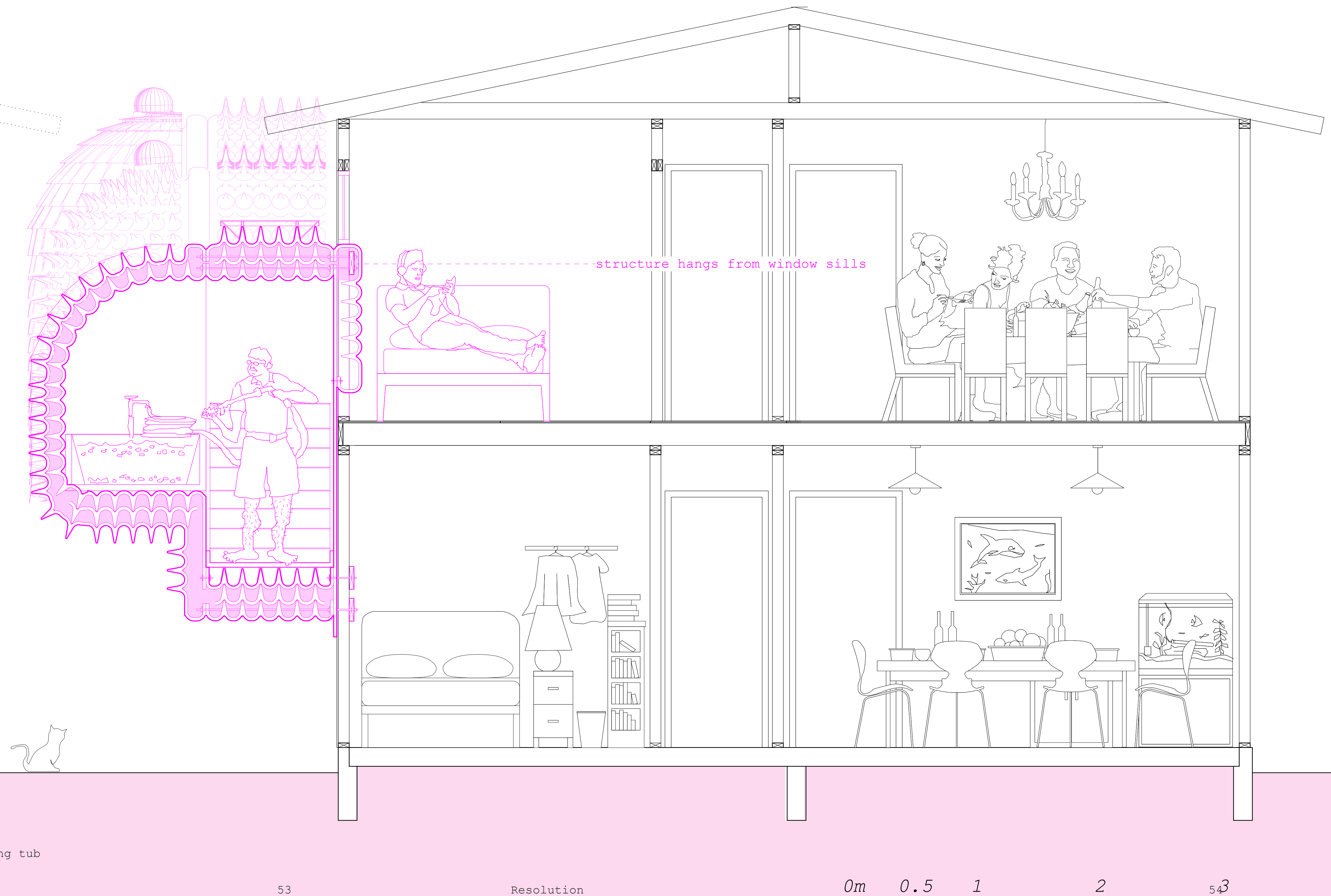


Figure 37 The Bladder: Building Section: plastic sorting tub

Bladder (Bathroom)

The watertightness of the plastic shells allow easy hosing down of the rooms, acknowledging the messiness of human life.

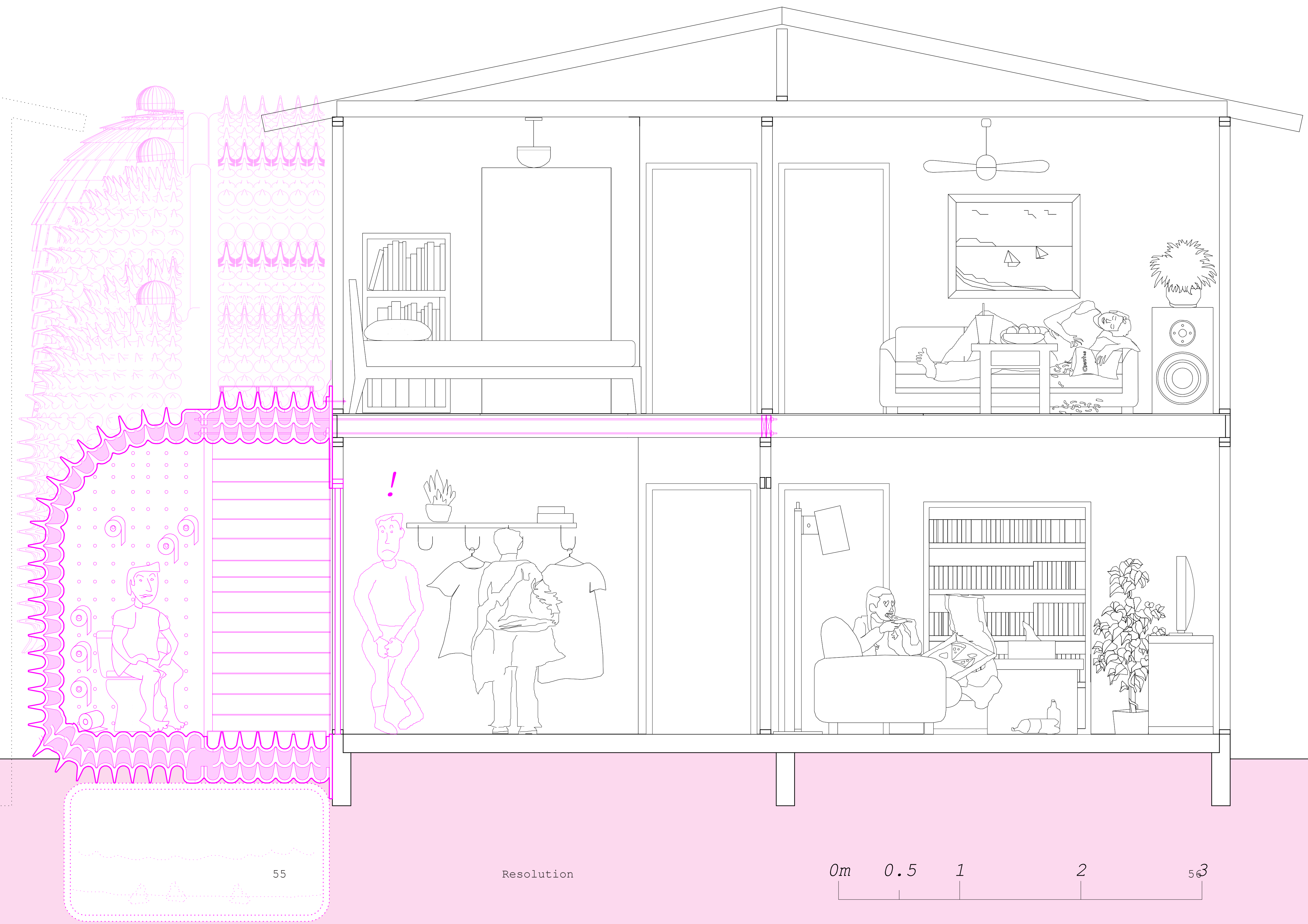


Figure 38 The Bladder: Building Section: toilet pod

Bladder (Bathroom)

The waste water flows into a septic tank and then a septic field in the front yard, which would be planted with appropriate grasses and plants to signal a productive place.

Perforations are incorporated to the walls. There are windows on either end of the stairs to allow cross ventilation. The windows on the tub pod are sized so the screens can be removed and used to make standard sized paper.

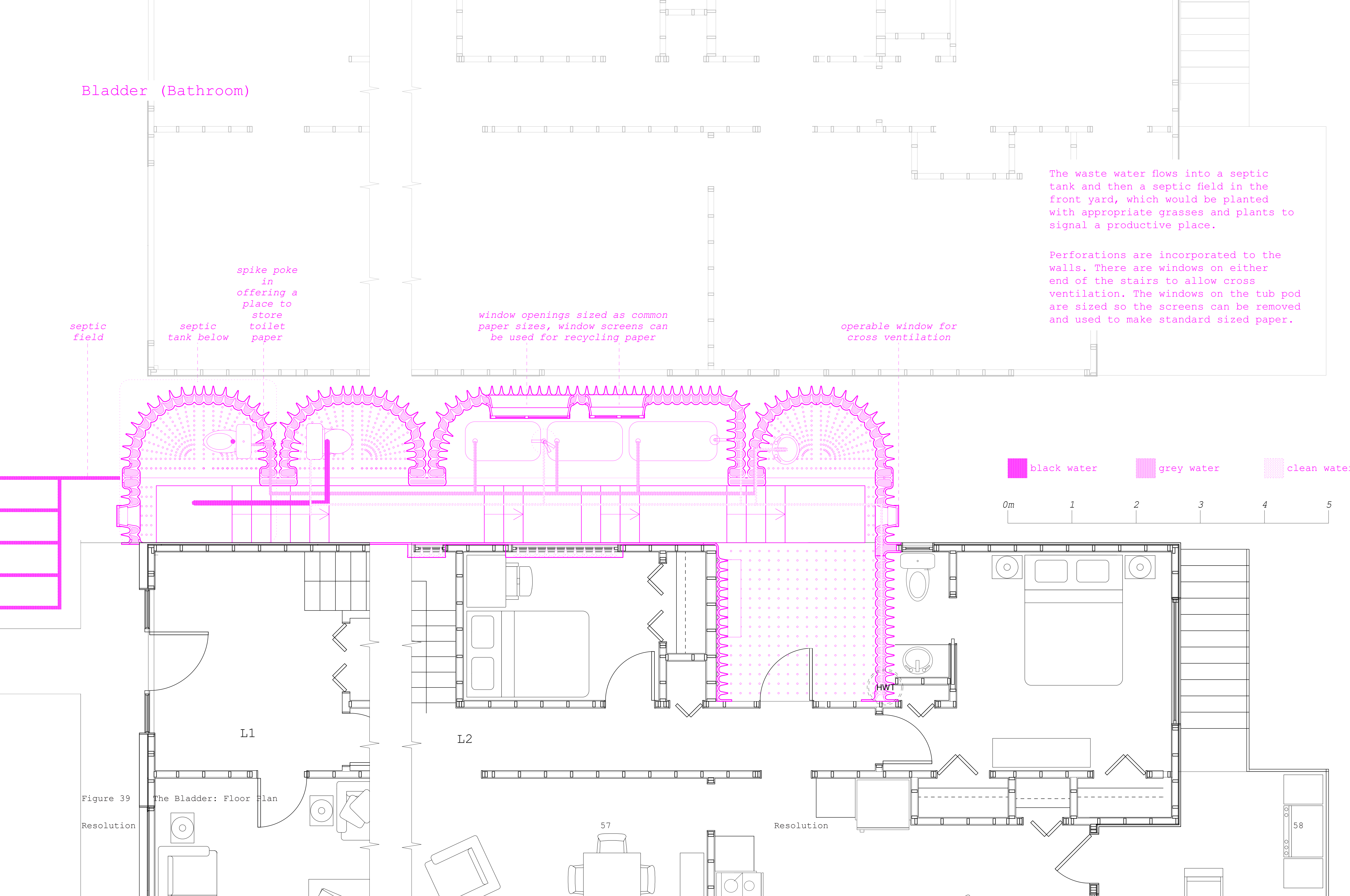


Figure 39 The Bladder: Floor Plan

Resolution

Resolution

Bladder (Bathroom)

The roof plan demonstrates the location of the intervention. It is intentional to take over the space in-between homes. Typically this space is wasted and often a place for spider webs and storage. Over time the infill adds density to the neighbourhood creating a townhouse-like condition.

The variation of the metal cladding versus to the exposed plastic shell is indicated on the roof plan as well.

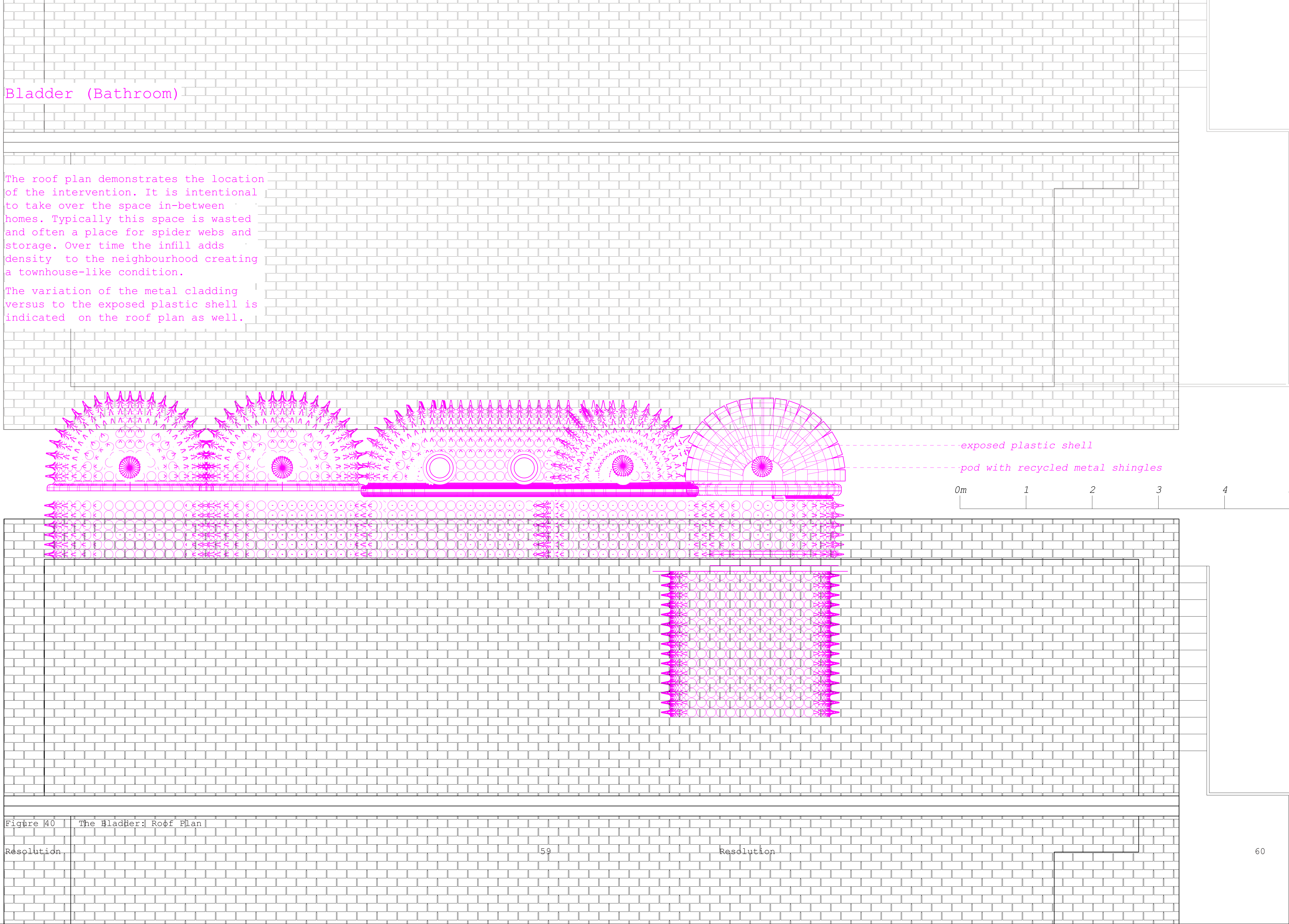


Figure 40 | The Bladder: Roof Plan

Mouth (Kitchen)

THE MOUTH USES THE KITCHEN TO BREAK DOWN MATERIALS INTO SMALLER RAW PIECES.

The Mouth, or kitchen, is where a large amount of waste is generated inside the home, such as plastic from food containers or food scraps from meals. The Mouth is organized where waste spaces mirror human consumption spaces.

On one side hosts a dishwasher, which can wash plastic or plates; a inverted spike wall to dry plastic bags, containers, or hang an apron; and a shredder to break down plastics for future processing.

The mirror side hosts a blender, dish drying rack, in addition to a sink and oven which are connected to The Stomach intervention.

The Mouth is set into the existing floor framing of the house, but supplies its own roof with plenty of ventilation and daylight.

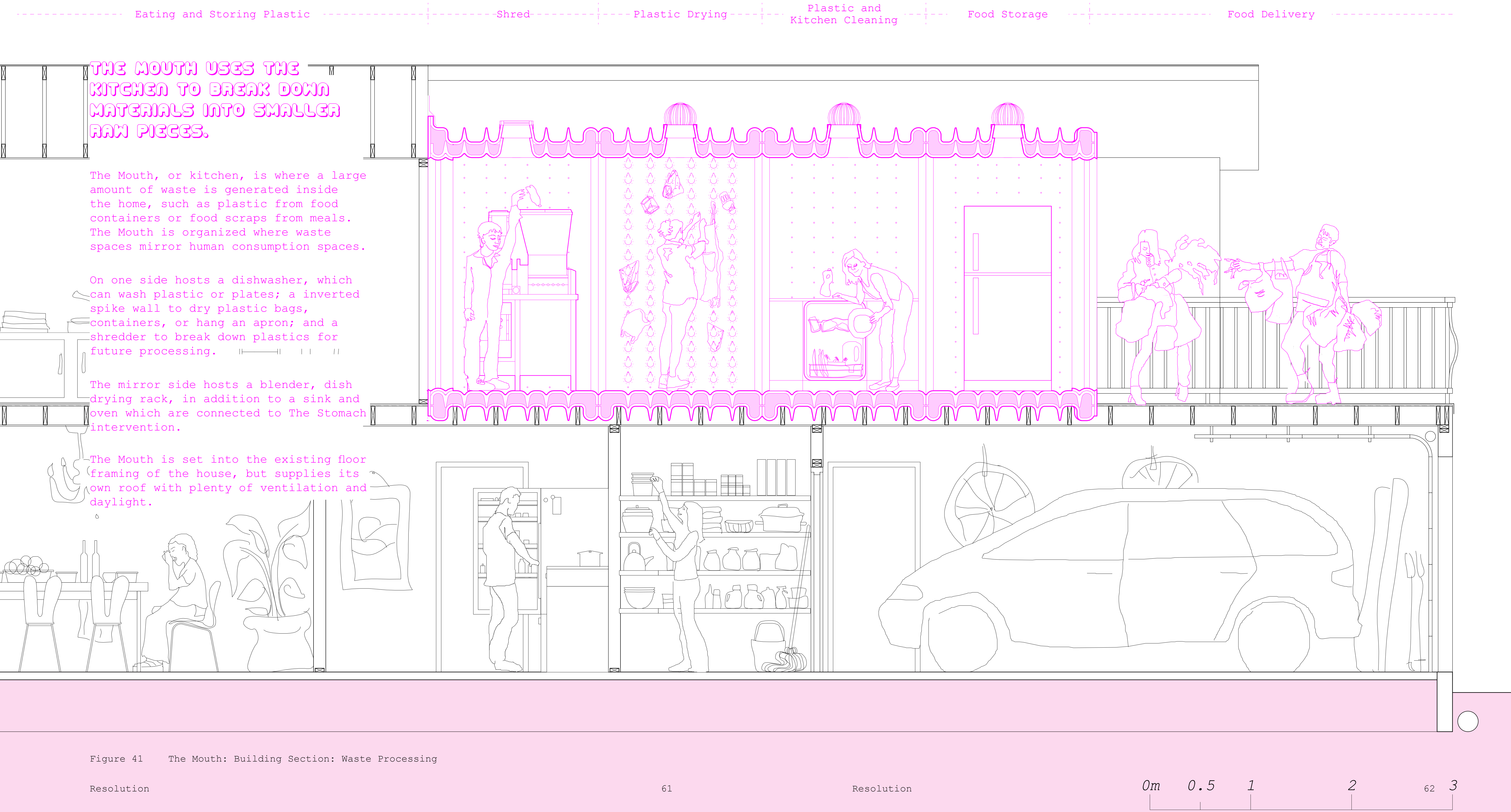


Figure 41 The Mouth: Building Section: Waste Processing

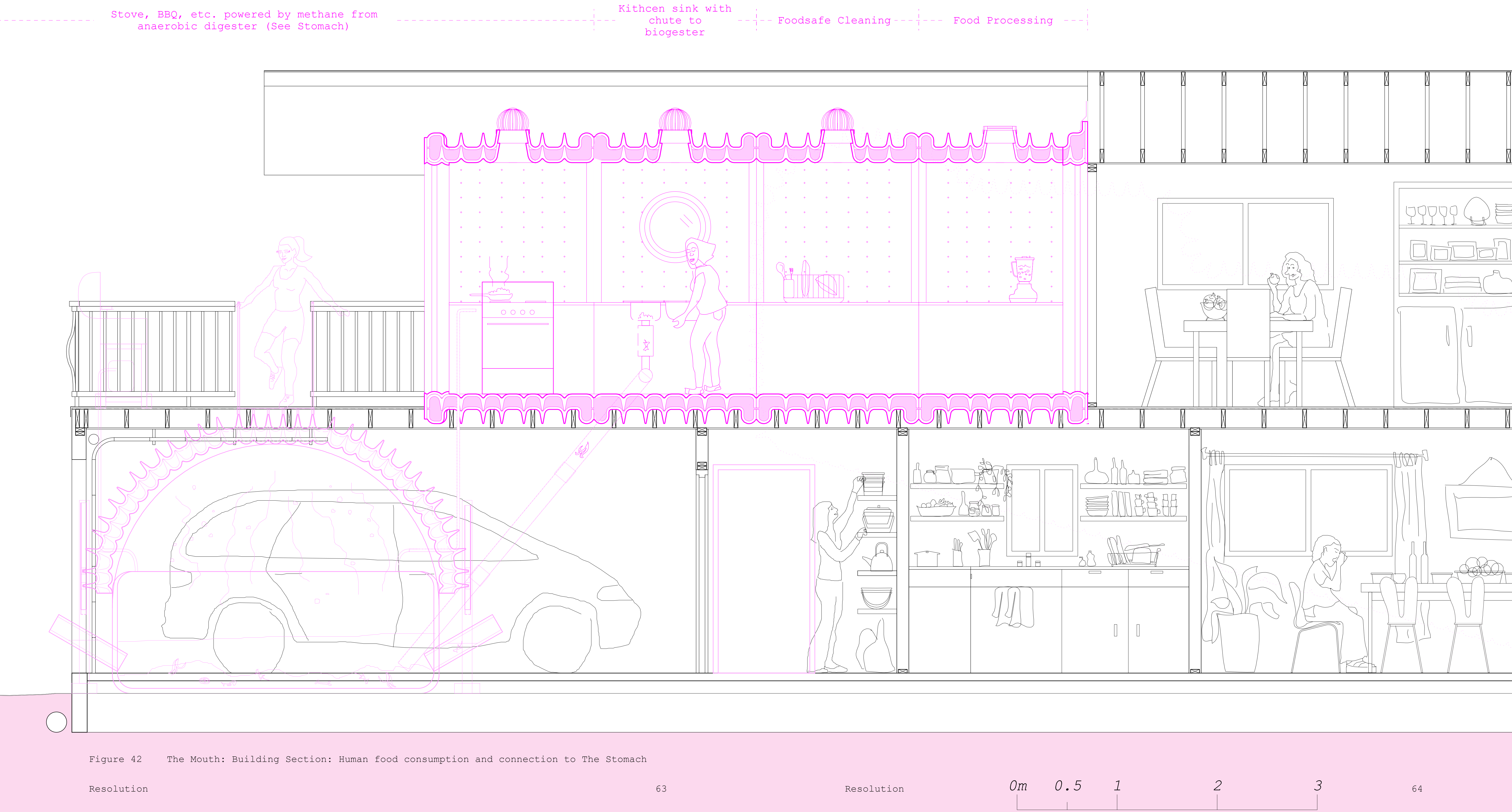


Figure 42 The Mouth: Building Section: Human food consumption and connection to The Stomach

Stomach (Digester)

The Stomach is in symbiosis with The Mouth. The Mouth supplies food scraps, which The Stomach, an anaerobic biodigester converts into gas which is then used back in the Mouth for the stove and for the barbecue. **THE MOUTH FEEDS THE OTHER SYSTEMS WITH POWER.**

To create a fun interaction between human body and waste process, a small platform is added to the top of The Stomach. Typically, biodigesters use a softer material as a cap and sometimes sandbags are added to force the gas into the lines. Instead of sandbags, the human body is employed. The recycled plastic cover is places on top of the digester on a track that allows it to move up and down.

The digester also produces effluent, which can be used by the garden to further produce food crops.

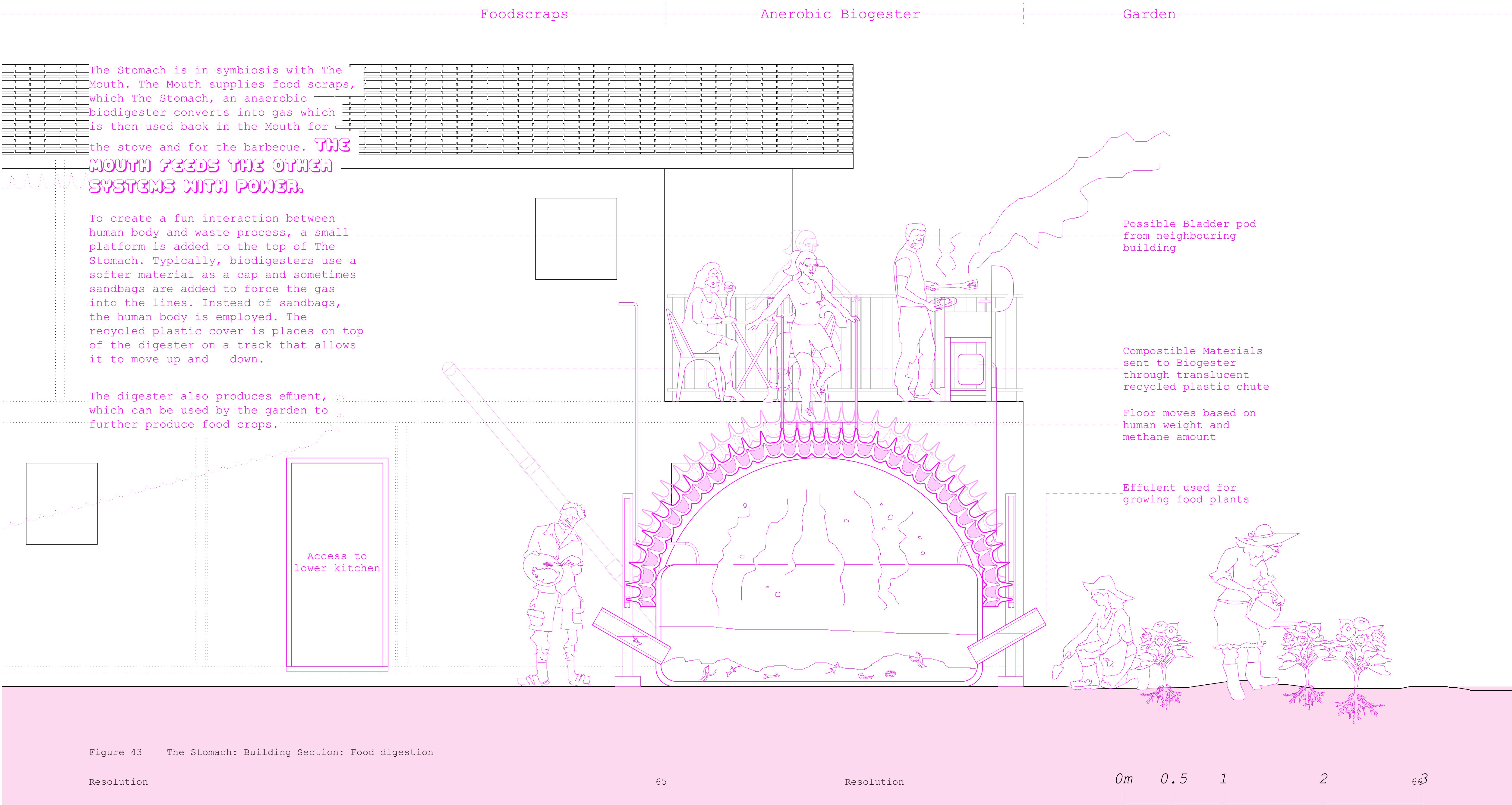


Figure 43 The Stomach: Building Section: Food digestion

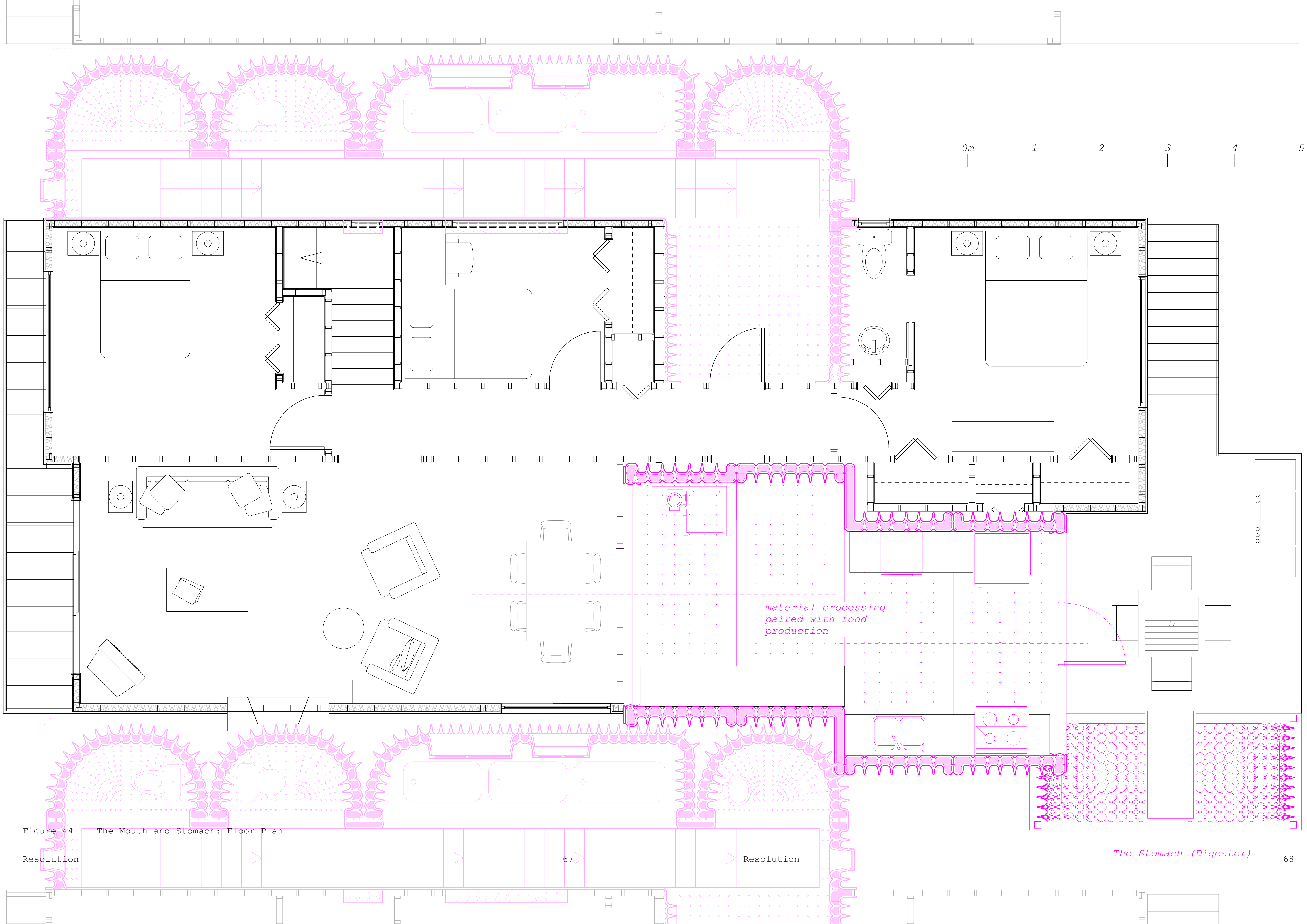


Figure 44 The Mouth and Stomach: Floor Plan

Lung (Living Room)

The Lung converts the previously two living rooms into one double height space. It attaches itself to a renovated chimney flue, which now incorporates a fumehood. **THE LUNGS, ACTING AS AN OCCUPIABLE LARGE FUME HOOD, ALLOWS RESIDENTS TO DO OCCASIONAL SMALL SCALE PLASTIC WORK AT HOME.**

Taking inspiration from a fumehood, which is necessary when working with plastic recycling, the entrances to The Lung are low, requiring the human body to duck to enter the space.

Windows, or peep holes are added to the shell to allow visual connection between the occupants of the house and whoever may be working.

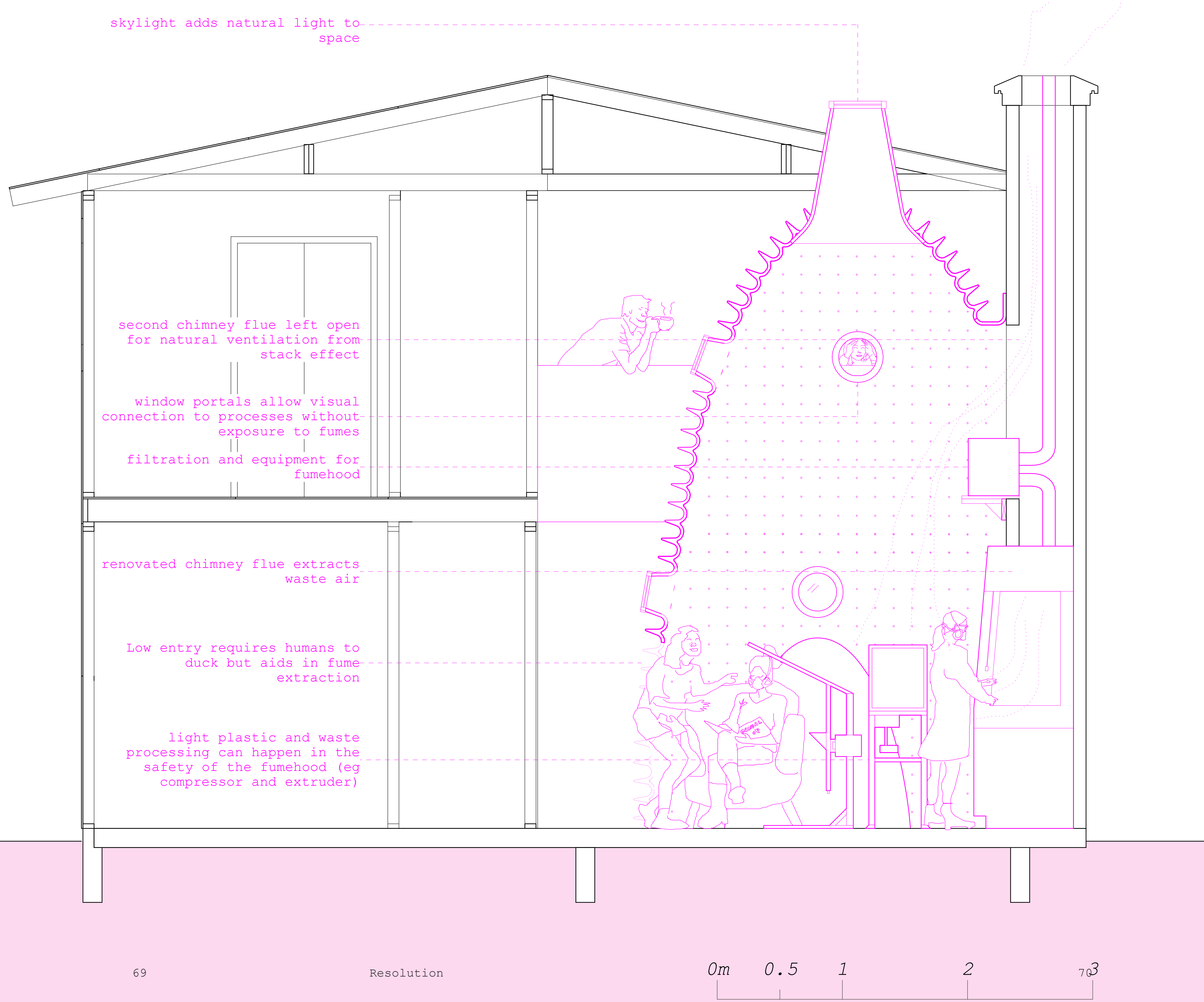


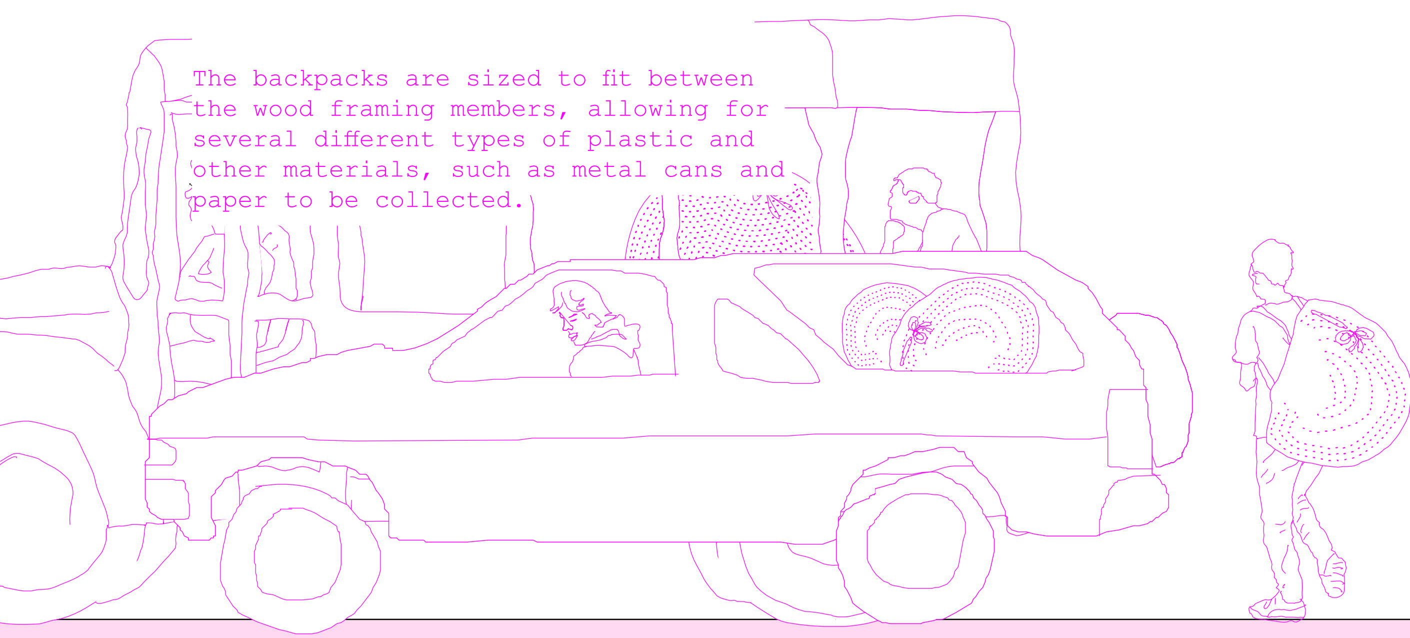
Figure 45 The Lung: Building Section: plastic recycling and a peepshow

Fat (Storage)

THE FAT IS A STORAGE MECHANISM TO ORGANIZE AND ACCUMULATE PLASTIC AND MATERIAL UNTIL THERE IS ENOUGH FOR FABRICATION.

Made of stretchy fabric backpacks and attached to the light-wood framing, The Fat slowly expands into the home’s circulation space. **ONCE THE RESIDENTS STRUGGLE TO MOVE THROUGH THE HALLWAY THE ENGORGED FABRIC BACKPACKS ARE REMOVED AND TAKEN TO THE FABRICATION WORKSHOP BY BACK, CAR, BUS AND SO ON.**

The backpacks are sized to fit between the wood framing members, allowing for several different types of plastic and other materials, such as metal cans and paper to be collected.



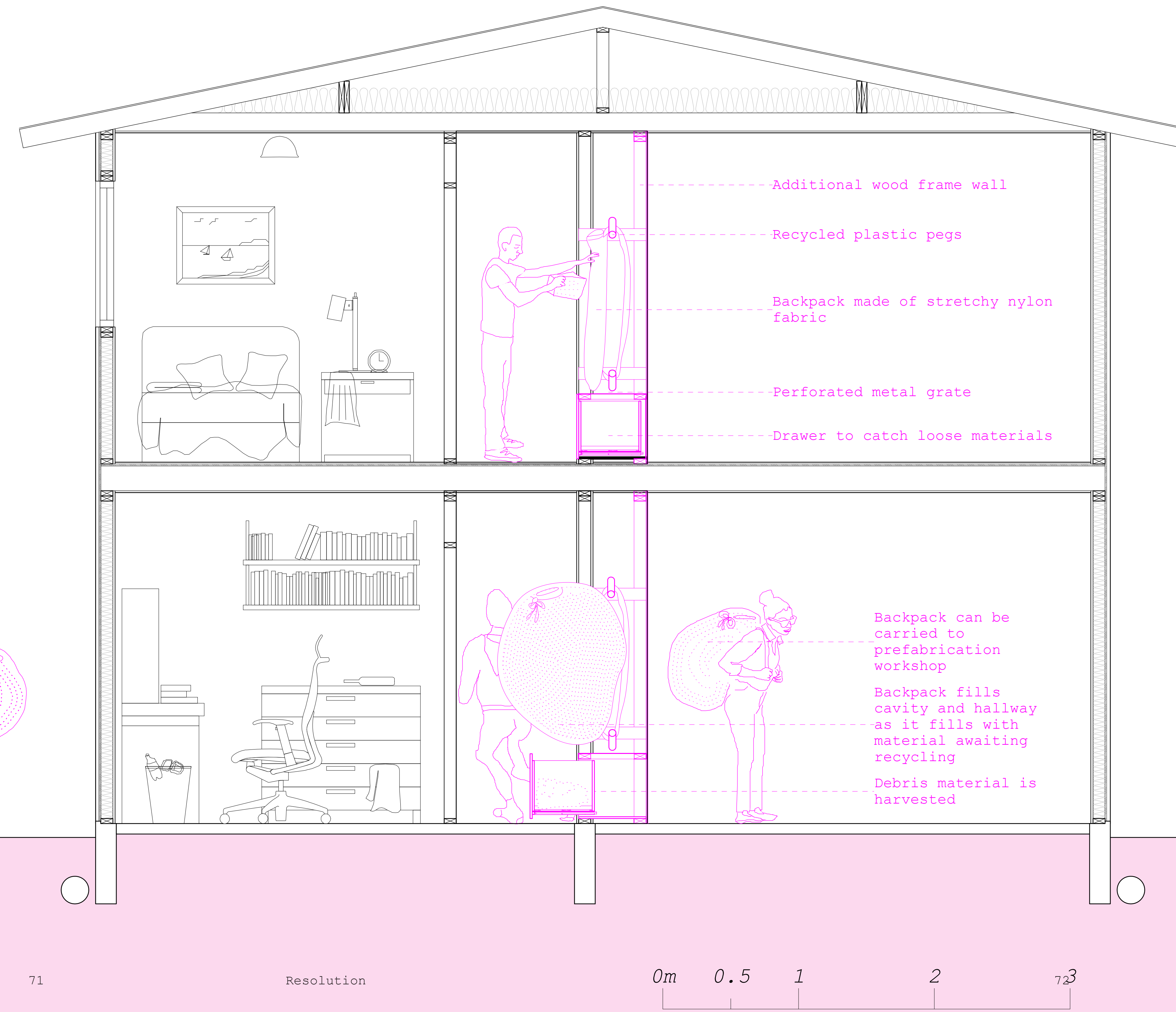


Figure 46 The Fat: Building Section: backpacks of shredded plastic

Child (Suite)

THE CHILD IS A NEW SUITE ENCAPSULATES THE CONCEPT OF GROWTH THROUGH WASTE. The Child is simple in that it has the ability for many other interventions to attach it.

When first introduced to the house it relies on the parent's services, but over time it can learn to self-sustain. In this instance, the child takes advantage of the terraced bladder and is able to attach on top of the roof. It is also able to be added in the Vancouver Special's front and back yards.

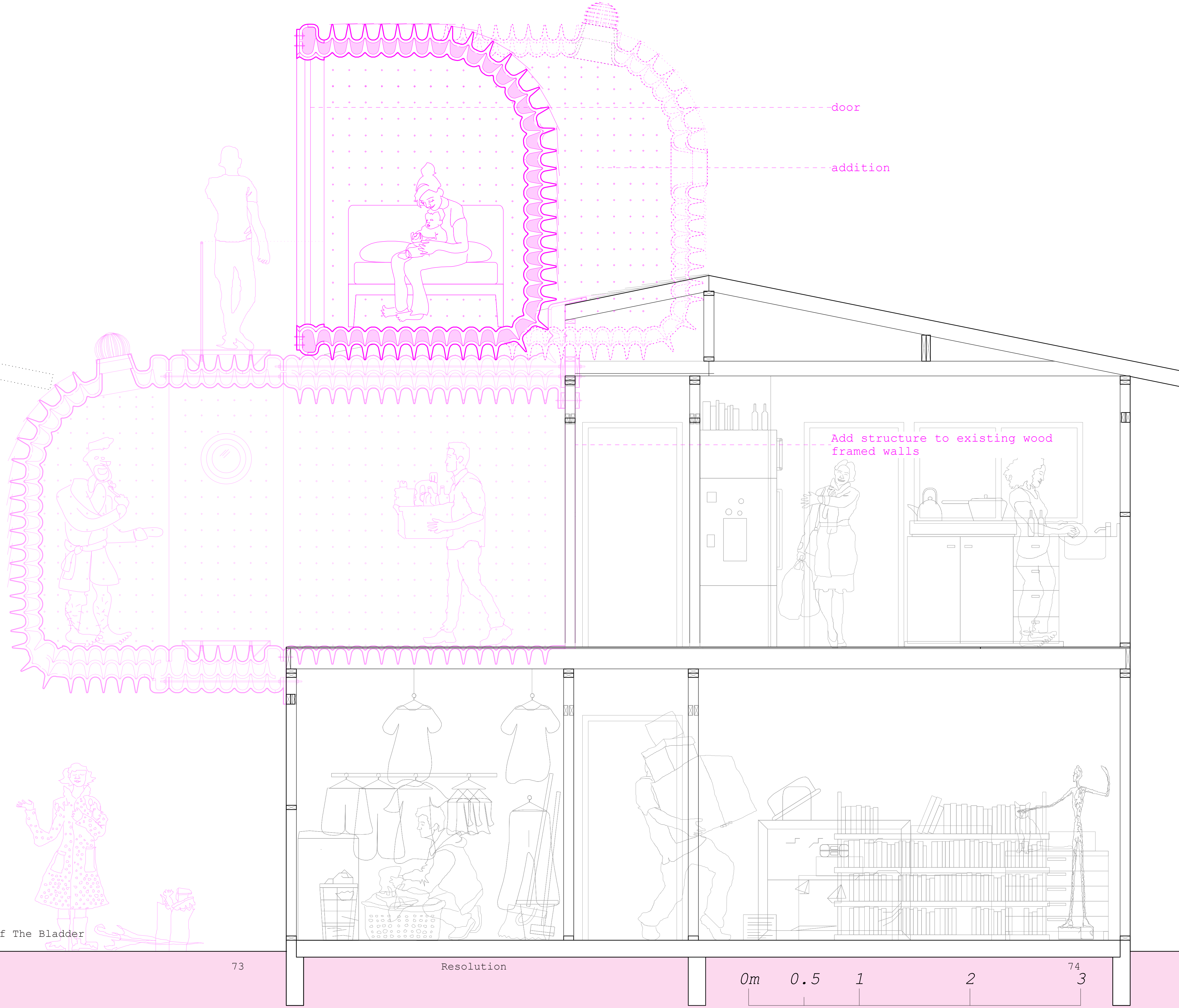


Figure 47 The Child: Building Section: attaching on top of The Bladder

The Child allows increasing density on
the residential lot.

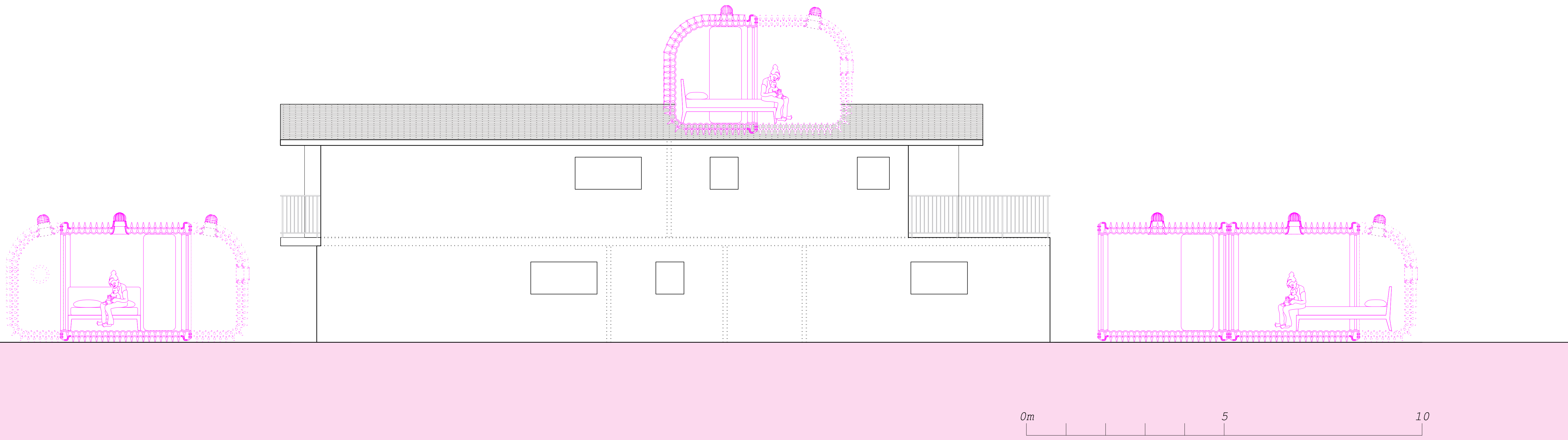


Figure 48 The Child: increasing density

New Way of Living

The plastic organs, or prosthetics, enable a new way of domestic living and relationships. The construction system made of recycled materials offers flexibility that is empathetic to a variety of needs and recognizes the messiness of human life.

A growing family can create new bedrooms and bathrooms from the Bladder and Child pods.

An avid composter could develop a productive garden from the Mouth and Stomach pods.

A nomadic salvager could create a home through the careful collection of materials.

The habits of a hoarder become seen in a new and more greatly appreciated light.

Additionally, being made of material that previously would be thrown away freely, this project offers a grassroot and inexpensive way of adding density to the urban condition.

Bringing waste into the public imagination at the scale of the human body and household creates a new way of life where humans see unwanted material as opportunity.

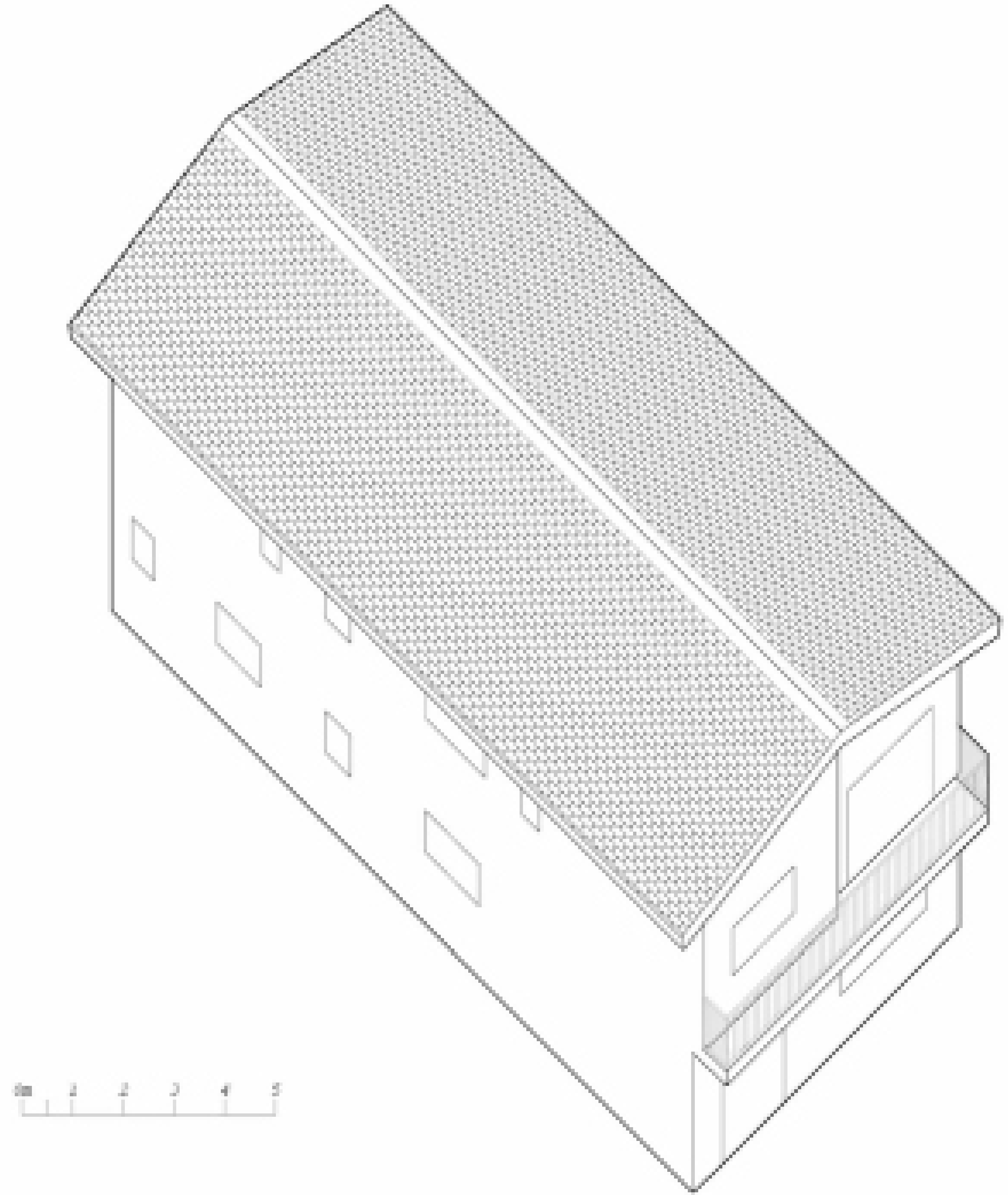


Figure 49 The Vancouver Special with the recycled plastic organs in location

Resolution

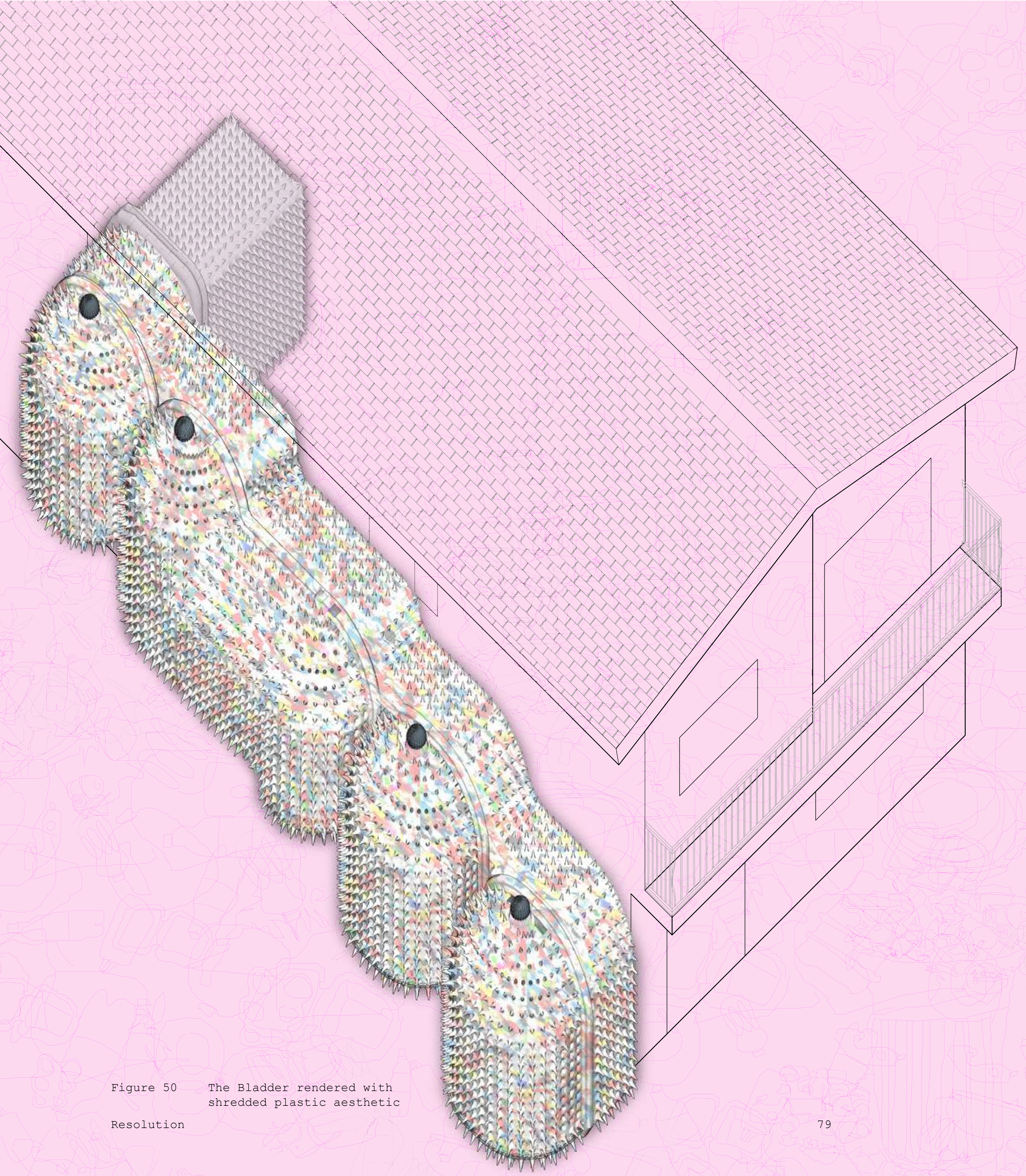


Figure 50 The Bladder rendered with shredded plastic aesthetic

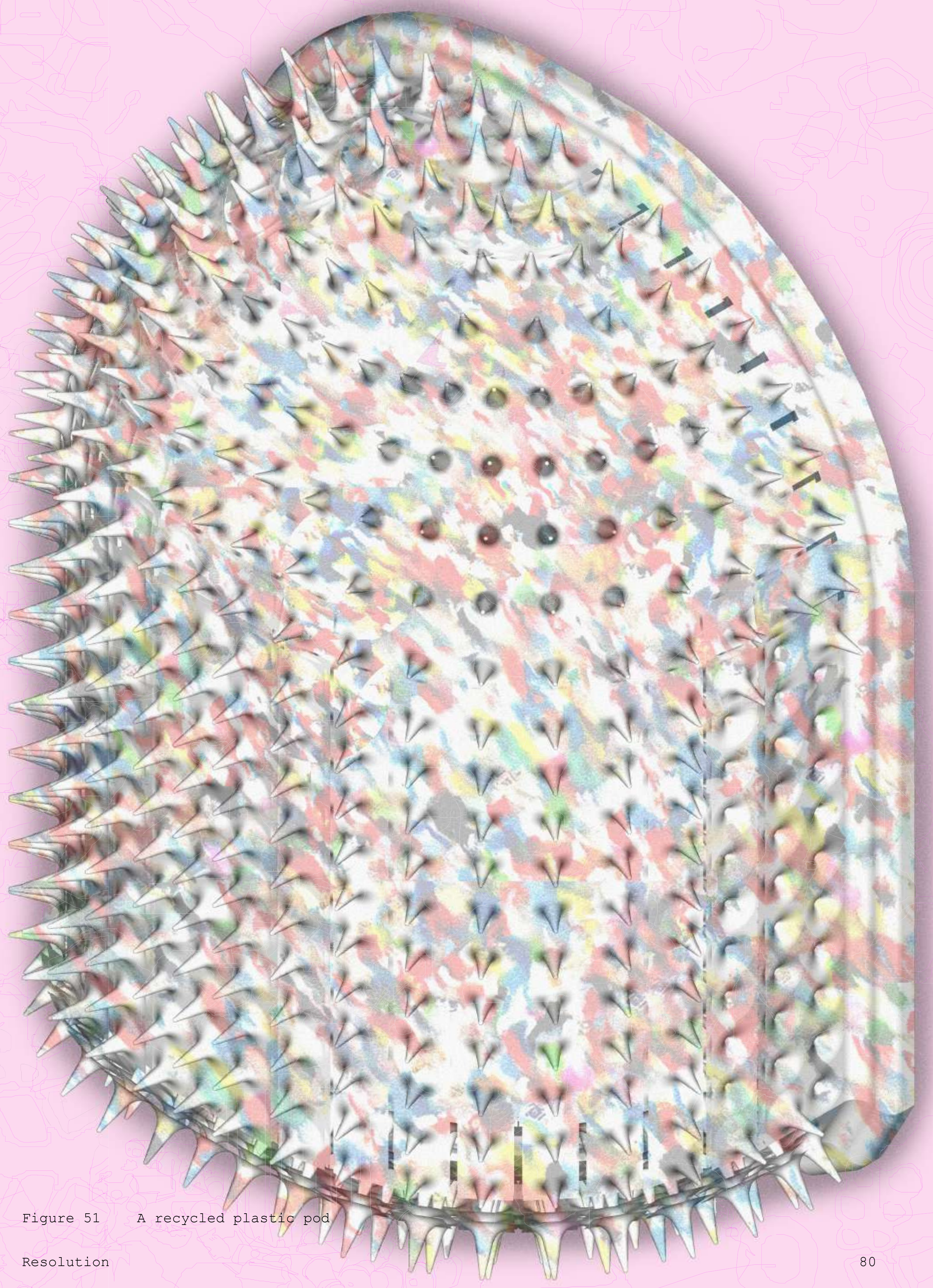


Figure 51 A recycled plastic pod

Figure 52   A hint of the plastic organ through the mess of everyday domestic life

Figure 53 Waste material surrounding the human body

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