# Breathing City

## Food Hub Design in Othello Neighborhood of Seattle

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## Abstract

Breathing City
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This thesis investigates the planning and design strategies that architects can use to reduce the waste and pollution generated by human activities, as well as produce new energy. This project designs with the flow of food, utilizing metabolic urbanism as the concept. It creates an energy-efficient system to support activities that happen in the city. In an effort to take care of our planet, this food hub project investigates strategies that educate people on eating and living healthily. It also reminds people to restore the environment with each design, thus providing a better living condition for ourselves as well as for future generations.

**Special Thanks to:**

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# Introduction and Background

*Figure 1. Collage of Environmental Problems in Contemporary Cities*

## 1.1 Problem Statement

Cities are complex systems of inputs and outputs, and we are currently facing a situation where the outputs from our species far exceed the capabilities of the planet's treatment systems. Human systems -- farms, factories, houses - are consuming energy from fossil or nuclear fuels, consuming oxygen and producing carbon dioxide, depleting or covering fertile soil, using and contaminating water and releasing it rapidly, as well as producing pollutants and waste.[1] It was reported that the construction of conventional buildings is accountable for the 14% of potable water consumption, 30% of waste output, 40% of raw materials use, 38% of carbon dioxide emissions, 24% to 50% of energy use, and 72% of electricity consumption in America.[2] The rate of building energy consumption in developing countries is predicted to increase as the nations keep improving their standard of living and quality of life.

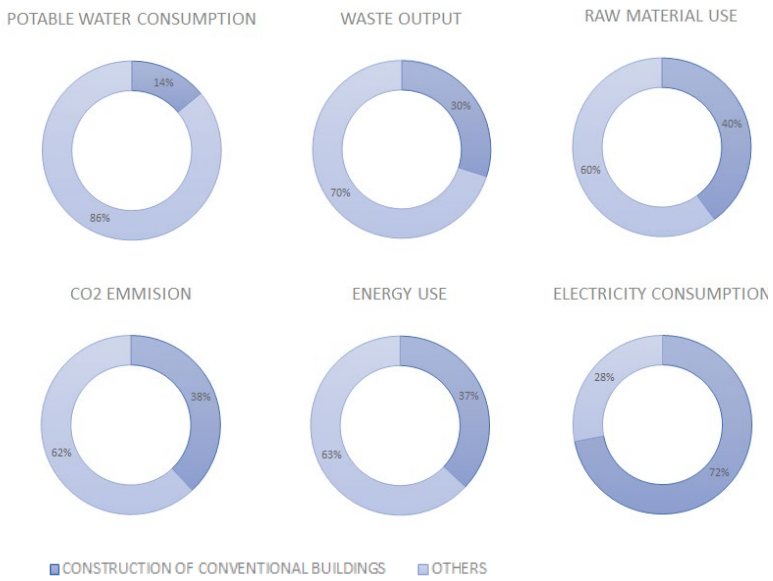



*Figure 2. Impact of U.S. Buildings on Resources*

[1] Basiago, A. D. (1995). Methods of defining 'sustainability'. Sustainable development, 3(3), 109-119.
[2] Building Impacts presentation. The U.S. Green Building Council

This environmental issue is not only leading to the problem of resource scarcity and climate change, but also it threatens the physical and mental health of human beings.  From the data published by the World Health Organization (WHO), there are 4.2 million deaths every year as a result of the exposure to outdoor air pollution, 3.8 million deaths every year due to the exposure to smoke from dirty cookstoves and fuel, and 91 percent of the world population lives in place where air quality exceeds the limits of WHO guidelines.[3] Epidemiological evidence also shows an emerging association between certain air pollutants and a range of mental health outcomes including depression, anxiety, psychosis, dementia, childhood cognitive development problems, and suicide.[4]

*Figure 3. Smog in Beijing(2014)*

*Figure 4. A schoolboy walks through smoke in the Nigerian city of Port Harcourt*

It is a time when our species should be mindful about water use, maintaining air quality, and reducing the negative impact generated by human activities. As a designer, thinking about the way to balance the development of built environments and the thriving of natural environments is crucial. Rather than exhibiting the attributes of a lung—which merely consume oxygen—a city should be regarded as a body. All of the organs within it need to collaborate actively to support its daily activities, with the metabolism of the body contributing to cleaning everything that passes through it, and generating new energy. This thesis will investigate the planning and design strategies that architects can use to reduce the waste and pollution generated by the built environment, as well as produce new energy. The purpose is to encourage designers to restore the environment with each design, thus providing a better living condition for ourselves as well as for future generations.

[3] Air Pollution page in World Health Organization, https://www.who.int/health-topics/air-pollution#tab=tab_1
[4] King J (2018), JOURNAL OF URBAN DESIGN AND MENTAL HEALTH, https://www.urbandesignmentalhealth.com/journal-4---air-pollution-and-mental-health.html

## 1.2 Method

Urban metabolism, which draws upon 'big picture' quantification of the inputs, outputs and storage of energy, water, nutrients, materials and wastes for an urban region[5], can be a productive and useful way to conceptualize how urban areas function and to determine their spatial relationships with surrounding hinterlands and global resource webs [6]. This thesis will use the concept of urban metabolism, and work on an exploration of the metabolism of Othello neighborhood in Seattle by mapping and analyzing different material flows. It will examine the relationship between the built environment and natural environment as well as develop spatial interventions that productively utilize the metabolism, and thus to conceive more sustainable spatial development models for a more resilient urban environment.

[5]Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. Environmental pollution, 159(8-9), 1965-1973.
[6]Kennedy, C., Cuddihy, J., & Engel-Yan, J. (2007). The changing metabolism of cities. Journal of industrial ecology, 11(2), 43-59.

# Chapter 2

# Theoretical Framework


*Figure 5. Image of Metabolic Urbanism City*

This thesis will use the concept of urban metabolism as a theoretical framework to respond to the environmental challenges in Seattle. This chapter will start with the planning history and urban development of Seattle. The design attitude used to be auto-centered through its development and started changing toward human-centered issues in 1970s—a shift that reveals a growing awareness about sustainability over time. The urban metabolism approach will be utilized to develop a method to apply sustainability strategies to the urban spaces in Seattle.

Two case studies will be discussed in this chapter. The first one is the study of the metabolism of Albania. Albania is a fast-growing country, with tourism as its major driving force. It was facing similar environmental problems as Seattle. Rules and planning regulations could not catch up to the rapid transformations of the country and Albania was looking for a new strategy to support the demand of food, energy, materials and resources for sustainable growth. The metabolism of Albania project is based on urban metabolism as a framework, and led to an open planning approach. The work presented in this book ranges from site and material flow analysis to design interventions, and provides a precedent for regional scale thinking, and in-depth understanding of system thinking.

The second case study is the West Louisville Food Port in Kentucky. It is a mixed-use project that includes varies types of food related businesses such as spaces for  production, office, education, processing, and retail. Designed by architecture firm OMA, this food port project is considered a good place for farmers, businesses, and the greater West Louisville community. Sustainability is a core value of this project. Investments in sustainability include solar power, geothermal energy, using rainwater for irrigation and water needs, and implementing recycling facilities. It is a good example of responding the environment issue through an architectural approach.

## 2.1 Seattle Planning History

### 2.1.1 Auto-Centered Planning Strategy

### Early History

The area that is now Seattle has been inhabited by native Americans since the ice age. The white settlers came to Seattle in 1851 to find a new city in the northwest United States.

Seattle was a bad place to build a city due to its geographocal location, topography and natural landscape.[7] But developers built the city with little consideration of the long term environmental and social consequences. As a result, the ecological transformation hurts the environment and indigenous populations. As the landscape, topography, and watersheds were changed to develop the urban space, houses of Native American people were destroyed, and they are forced to leave their lands. It was extremely hard for Native American throughout Puget Sound to find a place that they belong to. To pave the way to the construction of Lake Washington Canal and link it to Puget Sound, the Lake Washington was entirely reoriented, and the Black River dried up. Salmons and herring were gone as their habitat was destroyed. Natives tribes who had lived on the resources from those wetland lost their right to fish, as well as their access and ownership of the land. The Lake Washington Ship Canal project was not the only one that was leading to environmental and social problems, as similar events took place over and over again in the urban development history (between the 1880s and the 1930s).[8]

*Figure 6. Puget Sound Native Americans fishing from wooden platform, 1890-1895*
*Figure 7. Tide Lands: Their Story (Seattle,1906)*

*Figure 6.*

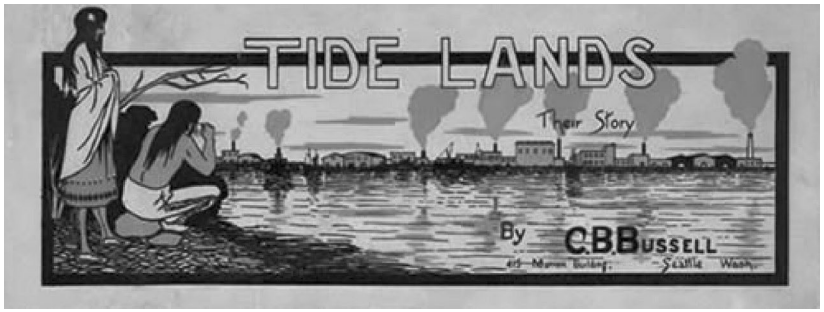



*Figure 7.*

[7]Thrush, C. (2006). City of the Changers. Pacific Historical Review, 75(1), 89-117.
[8]Ibid.

At the same time, what was happening on the ground is the 'Regrade' in Seattle. Early Seattle real estate owners discovered that a business lot on the grade level is worth more than a business lot on the hill since people prefer to walk on flat streets and it cost much more to build homes on a hillside. The result of this is that the topography of central Seattle was radically altered by a series of regrades in the city's first century of urban settlement, when hills were destroyed to create flat urban streets grid. This event lasted for over forty years, and sixty gigantic projects were involved.

*Figure 8. View of regrade work north from 2nd Ave. and Pine, ca. 1906*

In Figure 8, the Washington Hotel stands at the top of a hill. Although the regrade started in 1903, James Moore, the owner of the Washington Hotel, refused to clear the property until 1906 when regrading of Second and Third Avenues were well underway. Hills were demolished, and the dirt was used as landfill among Seattle's waterfront, thus people could double the developable land. As developers were making more land for development, they are at the meantime taking land from the initial habitants. This event blocked streets and caused broken water and sewage mains, shattered windows, collapsed foundations, triggered landslides, buried debris, muddy streets, unwanted noise, unhealthful dust, destroyed sidewalks and disrupted traffic. [9] Nature was destroyed.

[9]Reclaiming Nature: Flattening Hills and Digging Waterways in Seattle, https://www.washington.edu/uwired/outreach/cspn/Website/Classroom%20Materials/Curriculum%20Packets/Building%20Nature/IV.html.

Another event relates to the metabolism of Seattle that was taking place at a similar time was the City Beautiful Movement. After the Klondike Gold Rush (1896-1899), the population of Seattle boomed, which brought many problems to this city. From 1900 to 1910, the population dramatically increased to 237,000 from 80,000.[10] The vacant houses near the railway were filled, and new houses were built during that time. The streetcar lines allowed the expansion of residential buildings. However, new residents settled across the hills and villages in Seattle, and people started concerning that this growth would put Seattle into a situation with sprawl, chaos, and ugliness. The City Beautiful Movement started with the intent to solve the problem caused by over-population. This movement beautified the city by designing it as a living urban garden with more parks, boulevards, and urban spaces. John Olmstead and his company were the major contributors to this movement. The Olmstead Brothers designed over 37 parks for Seattle which includes almost all the major parks in this city. This movement made Seattle more livable and attractive to its citizens.

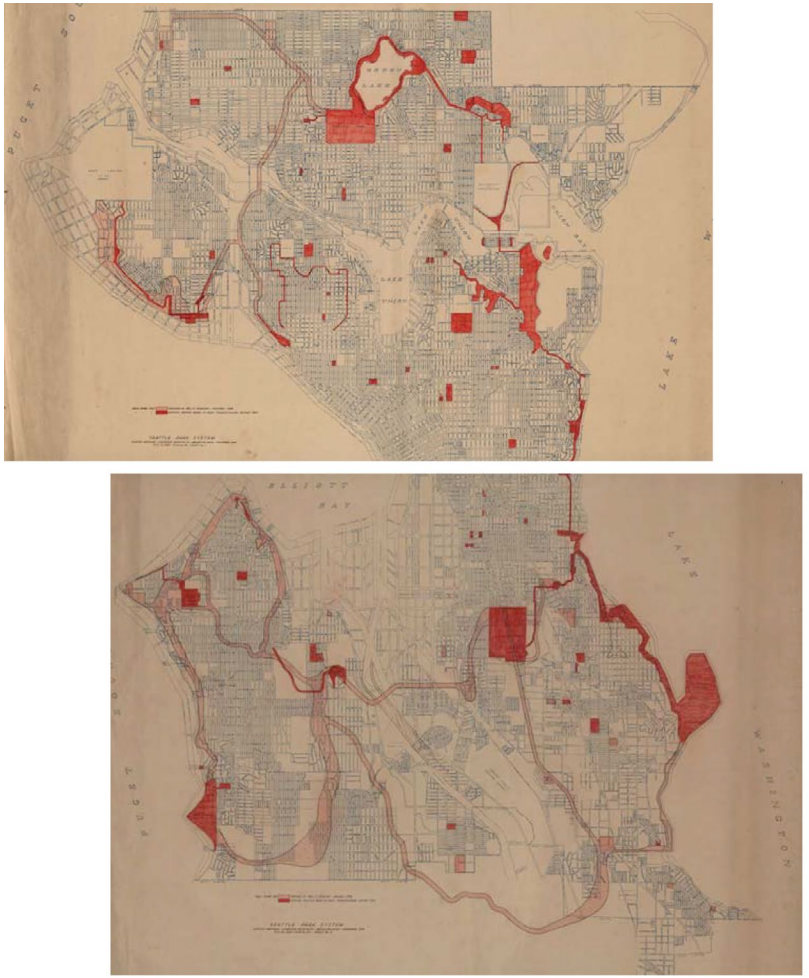


*Figure 9. 1928 Seattle Park System Plan*

[10] Population history of Seattle from 1890 - 1990. http://physics.bu.edu/~redner/projects/population/cities/seattle.html

These events indicate that in early history of Seattle, the natural environment was considered a tool to facilitate urban development, instead of an essential part of the urban development. If the natural environment could promote the development of the city, it would be encouraged (City Beautiful Movement). If the natural environment blocked the way of urban development, it would be destroyed (The Regrade in Seattle). People focused on economic growth and the development of built environment but paid little attention to keeping the balance between the natural environment and built environment. System thinking was not developed, and the metabolism of a city was not valued by city planners and designers at that time.

## Auto and Transportation Centered Planning

Because of the dramatically increasing number of automobiles, by the 1950s bigger and better freeways were needed in Seattle. The federal government was actively involved in funding the construction of freeways and provided 90 percent funding to support its development, which led to the construction of Interstate 5 in Washington.  To facilitate the construction of the I-5 in Seattle, Washington state established an office in 1957 for clearing the 20.5 mile long route. Most buildings occupied the space were homes, apartments, and businesses. The 20.5 miles of freeway route were cleared of structures, and the roadway graded. As the freeway was constructed, a concrete scar was built up across the neighborhoods.[11] Consequently, the auto-centered development tore Seattle in half, with the city being disconnected physically as well as visually. The freeway became an environmental issue with significant air pollution and noise.

[11]Washington establishes an office for clearing the route of the Seattle Freeway (Interstate 5) on April 1, 1957. https://www.historylink.org/File/4168

*Figure 10. Construction of the Freeway*

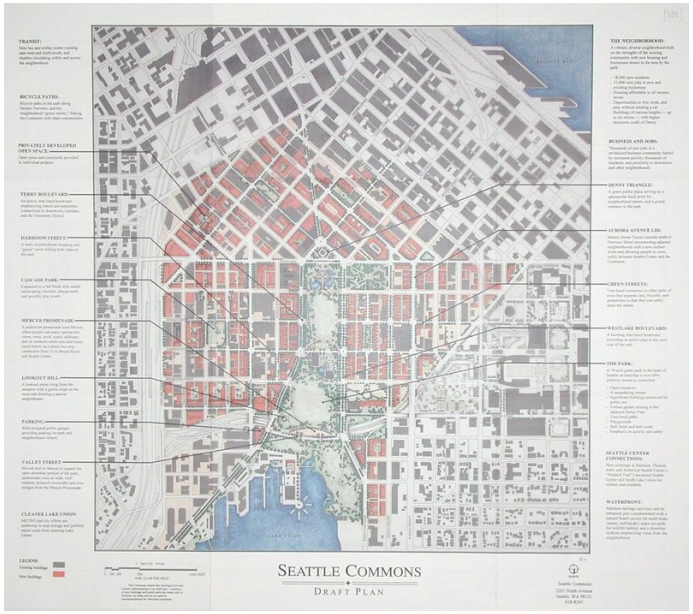



*Figure 11. Seattle Commons Draft Plan*

In 1991, Seattle architect Fred Bassetti and Seattle Times columnist John Hinterberger proposed an idea of designing a 61- acre park, Seattle Commons, running from downtown Seattle to Lake Union. It was regarded as a potential central central park with diverse building types and urban amenities surrounding it. This proposal was supported by billionaire Paul Allen, who was willing to donate 25 million dollar to buy the land. Unfortunately, the park was not built because Seattle voters rejected to pay a 111 million dollar property-tax levy that would have funded the development and construction of the park. The land became the place we know as South Lake Union or Amazonia today. Seattle got the development at the cost of losing the park and as a result it was a lost opportunity to green the city as well as grow the awareness of environmental management.

Another megaproject arose in Seattle after the Commons was the proposal to create a monorail line going from Ballard to West Seattle, with a northeast-to-southeast line to follow. This idea was conceived by a taxi driver and it advocates the use of public transportation. Supporters were hoping to reduce traffic congestion by building the monorail. This proposal was approved by voters four times. However, due to the cost, mismanagement, and the resistance from

citizens dragged it down. This proposal died in the fifth vote in 2005.

The events discussed above convey the fact that the urban development and natural environment of Seattle have not been equally significant. If the natural environment could contribute to developing the city, it was promoted, such as with the City Beautiful Movement, otherwise it was destroyed.  The planning strategy was car and transportation centered and driven by profit with little consideration for keeping a balance between economic creation and environmental sustainability.

### 2.1.2 Awareness of Sustainability

The State Environmental Policy Act of 1971 (SEPA) and Shoreline Management Act of 1972 created a new direction for the urban planning and design in Seattle. These pieces of legislation evoke an awareness and concern for the environmental and ecological damage caused by the misuse of land and pollution. The redevelopment of the Seattle central waterfront was the planners' response to the Shoreline Management ACT. The central waterfront used to be a major shipping and fishing port, but this changed in the late 1960s due to the appearance of a larger port further south. The central waterfront was transformed into a place with shops and restaurants to make use of the abandoned space. Fortunately, it was proved to be a good approach to attract locals and tourists. In 1982, the streetcar rails were installed to connect the central waterfront to downtown, which made the water front more accessible and increased the mobility of locals and tourists.

Parallel to these developments, in 1973, the Landmark Preservation Ordinance was established by the Seattle City Council to protect the historical infrastructure and spaces in the city. In 1985, the city of Seattle created the Green Street program to increase the accessibility and pedestrian mobility in the downtown. It encouraged the design of friendly pedestrian environment and expansion of open spaces, landscape, as well as widening sidewalks.

More recently, in 1997 the City Council established the Environmental Management Plan to ensure the continued preservation of natural resources and to incorporate environmental standards into a comprehensive plan. In 2000, the Office for Sustainable Development and Environment (OSE) was established and incorporated into its policies. Seattle became the first city in the United States to adopt a sustainable building policy in 2020, which is the largest urban improvement since the Great Fire of 1889. As a result, all new construction and reconstruction projects need to reduce the use of natural resources during the construction process. Natural resources will be conserved after completion of the construction through the implementation of energy, water and landfill reduction technologies. The Green Building program was created the same year, which calls for the

reduction of the negative impact of all developments on the community and the environment. A Green Building Task Force was formed to work with communities and planning departments to ensure the community meets the highest standards. All new and rebuilt projects over 5,000 square feet must meet the LEED gold standard. Seattle is hoping to reduce emissions by 80% by 2050.

Today Seattle's development and progress are handled by the Department of Planning, which strives to engage citizens in an ongoing dialogue about the city's future and continues to play a central role in guiding the long-term development of the built and natural environment.[12] They are trying to build a more sustainable and dynamic environment by partnering with the community to build and preserve the city economically, socially, and in terms of equity.[13] The 2004-2024 Comprehensive Plan is the major guideline for the current development, and it is a 20-year policy that articulates a vision of how Seattle will grow in ways that sustain its citizens' values.[14] As environmental stewardship is one of the four core values (Community, environmental Stewardship, Economic Opportunity, and Sociao Equity) in the Comprehensive Plan, the "greening" of Seattle requires planners and designers to consider how to build relationships not only between buildings and city spaces but also between natural and built environments.

[12]History of Urban Planning in Seattle, https://seattleplanning.weebly.com/index.html
[13]Ibid.
[14]Ibid.

## 2.2 Urban Metabolism

The concept of the urban metabolism conceived by Abel Wolman (1965), is fundamental to developing sustainable cities and communities.[15] It broadly expresses a city's flows of water, materials and nutrients in terms of large-scale fluctuations.[16]

The term "metabolism", developed in the early 19th century to characterize chemical changes within living cells, was broadly applied in the following fifty years, in the field of biology and in what would become biochemistry, to represent processes of organic breakdown and combination within individual organisms (at a cellular scale) and between organisms and their environment. [17] Ever since, metabolism has lived a dual existence in the natural sciences, applying both to processes through which bodies change and reproduce themselves and to more holistic conceptions of ecosystem relations.[18]

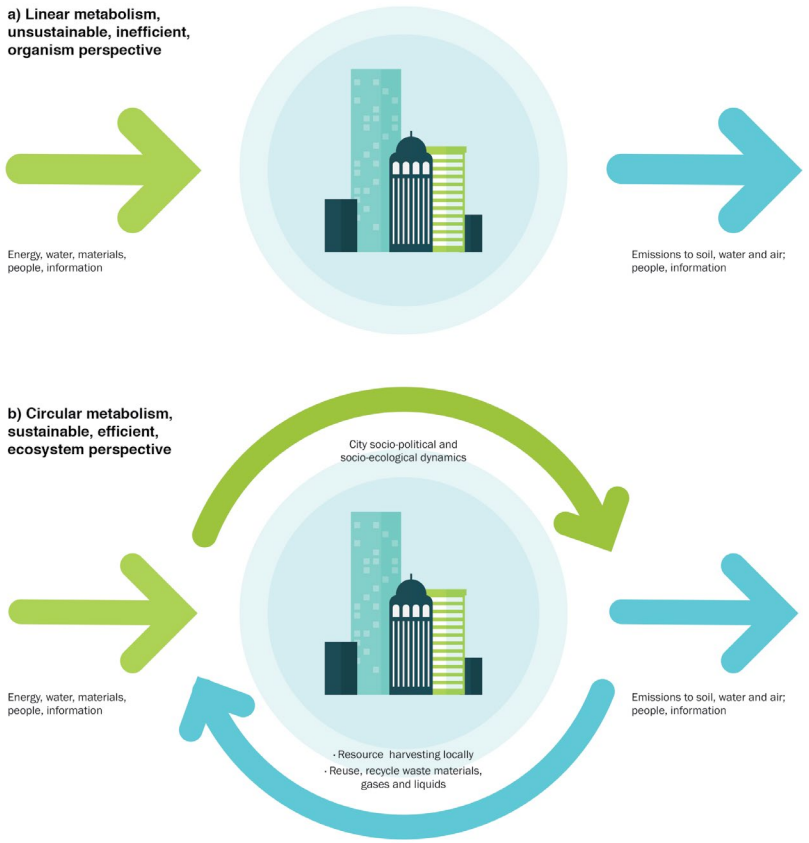



*Figure 12. Linear metabolism city versus circular metabolism city*

[15]Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. Environmental pollution, 159(8-9), 1965-1973
[16]Ibid.
[17]Dinarès, M. (2014). Urban Metabolism: A review of recent literature on the subject. Documents d'anàlisi geogràfica, 60(3), 551-571.
[18]Ibid.

In the urban metabolism model, cities are not only about buildings and infrastructure, but also they are like human bodies with different organs working together to support its life. The idea of metabolism is about systems, tied to an ongoing process, that theorize the urban environment as natural landscape. The city is thus understood as part of a continuum, and different parts of that continuum have different life spans. This allows a city to be conceived as a living entity.[19] According to this point of view, cities have their own metabolisms, converting inputs of energy and material goods into work and, in doing so, creating waste and heat.

[19]KETC | Living St. Louis | Metabolic City, https://www.youtube.com/watch?v=EfhZI_1_r40&t=69s

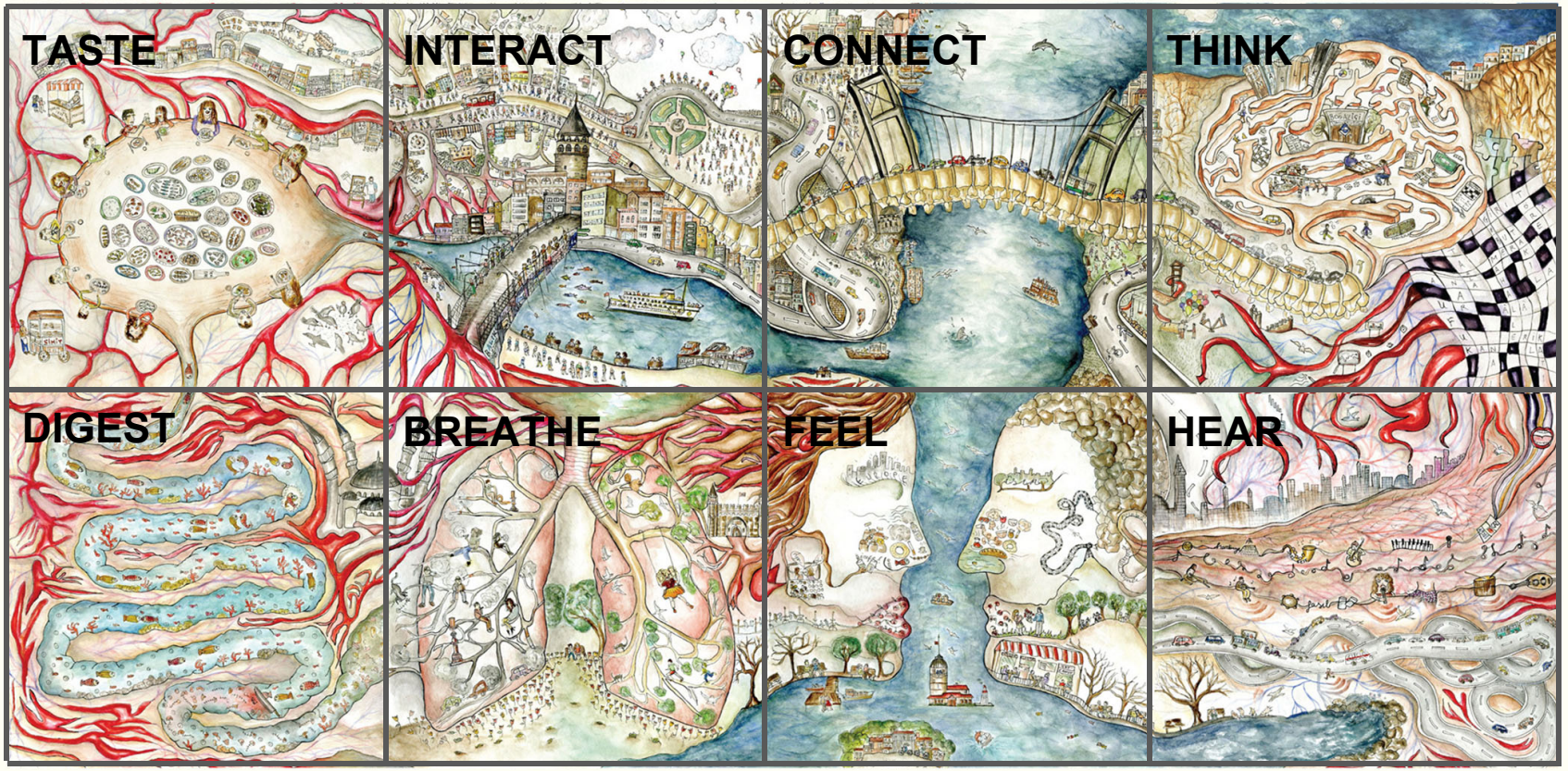



*Figure 13. Concept Image of Urban metabolism*

## 2.3 Case Study

### 2.3.1 The Metabolism of Albania – Activating the potential of the Albanian territory

This is a project led by FABRICations, which is an Amsterdam based office founded in 2007 by Eric Frijters and Olv Klijn. It provides a three-tier sustainability tool for scanning, framing and designing healthy urban ecosystems that are intended to bring vitality to the economy, extend life expectancy, connect people, improve resilience, apply sustainable energy resources and circular material flows for governmental institutions, project developers and investors.[20] The FABRICations office also focused on the research of urban metabolism during the past ten years and became a leading reference in this field.

Albania is a European country that was facing environmental challenges. It is potentially rich in human capital and natural resources, but the question was how to activate its capital and resources, and take advantage of them to keep the country develop sustainably. In fact, this problem does not only exist in Albania, but also in the rest of Europe, and even other nations around the world. All human beings are facing a challenge: how to successfully transform the next economy into a green and low-carbon one. As FABRICations has stated, their approach replaces questions about urbanization as the development of objects by questions about urbanization as a process.

The metabolism of Albania project is based on urban metabolism as a frame and leads to an open planning approach. As the growing pace of the social, economic, and political transformations in Albania was extremely fast during the past twenty-five years, and the design and planning regulations were not able to catch up to that, Albania was developing and growing without relating the actual context of the country. Sustainable development had not been taken into consideration seriously during the design and planning processes. As a result, it led to an informal economy that consumes resources and territory.

[20]FABRICations Homepage, https://www.fabrications.nl/#section-our-philosophy-is 159(8-9), 1965-1973

*Figure 14. Image of Albania, International Preservation Initiatives*

Albania was facing a challenge of developing a new, integrated spatial strategy that would support the demand of food, water, materials and resources for future generations. To accomplish these tasks, designers and planners considered the urbanization as a coherent organism, as urban metabolism, which means learning to understand urbanization by doing research and analyzing material flows. FABRICations mapped four major material flows, water, food, energy and tourism, and analyzed the interrelationship between them. The places where different flows interact were considered as the potential site for the further design intervention(figure 15). Experts in different fields studied the data, opportunities, challenges, and anecdotes of each site and exchanged the information with each other, with blind spots in available knowledge being avoided by exchanging between tables.

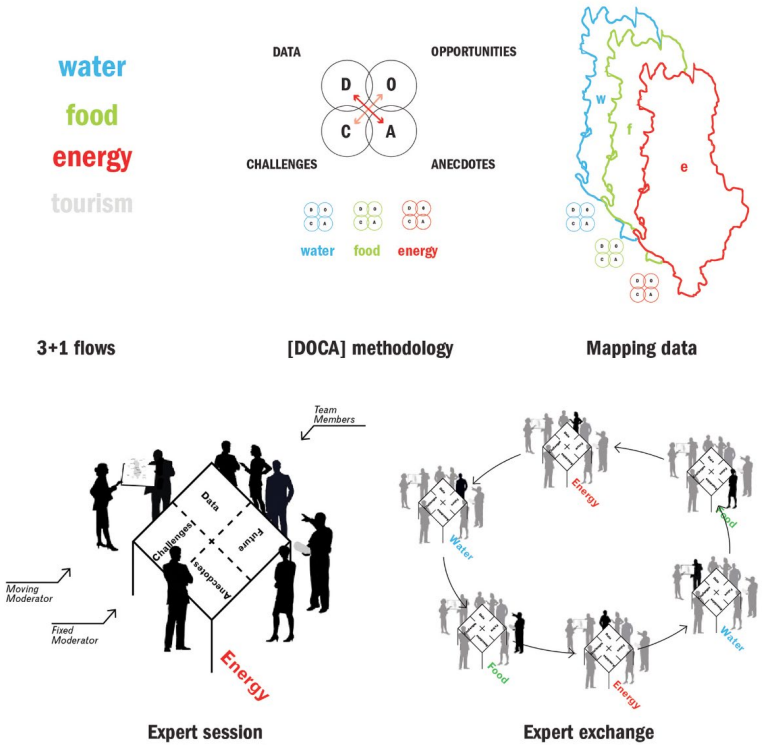



*Figure 15. Diagram of Methodology*

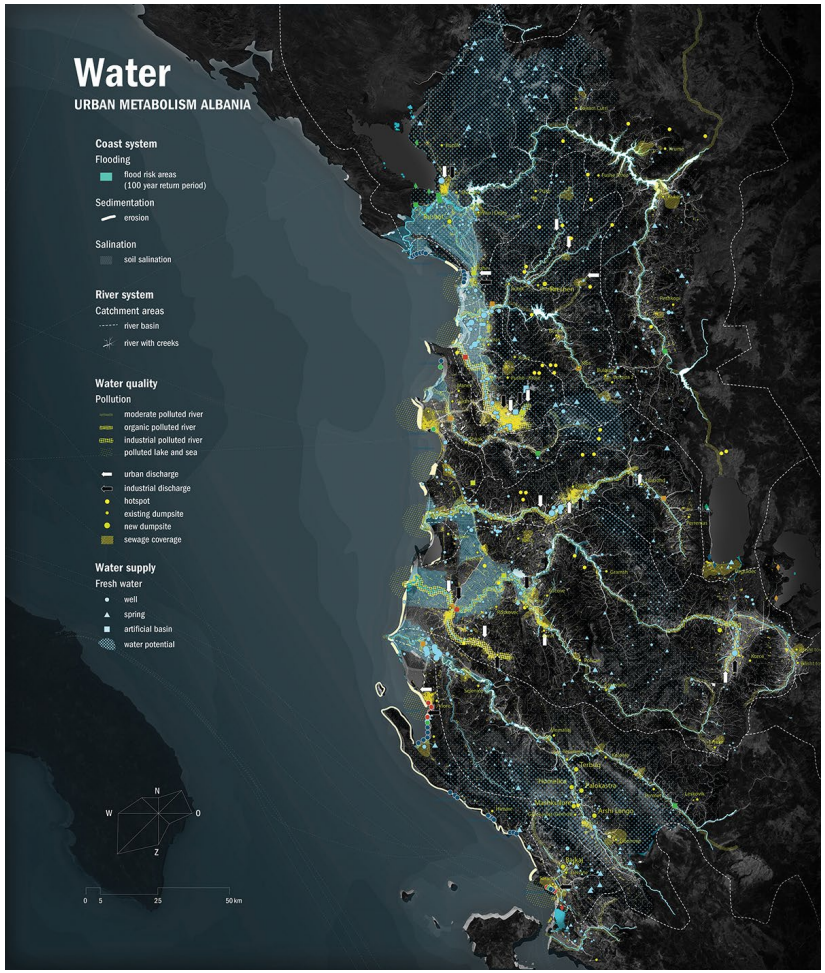



*Figure 16. Flow of Water*

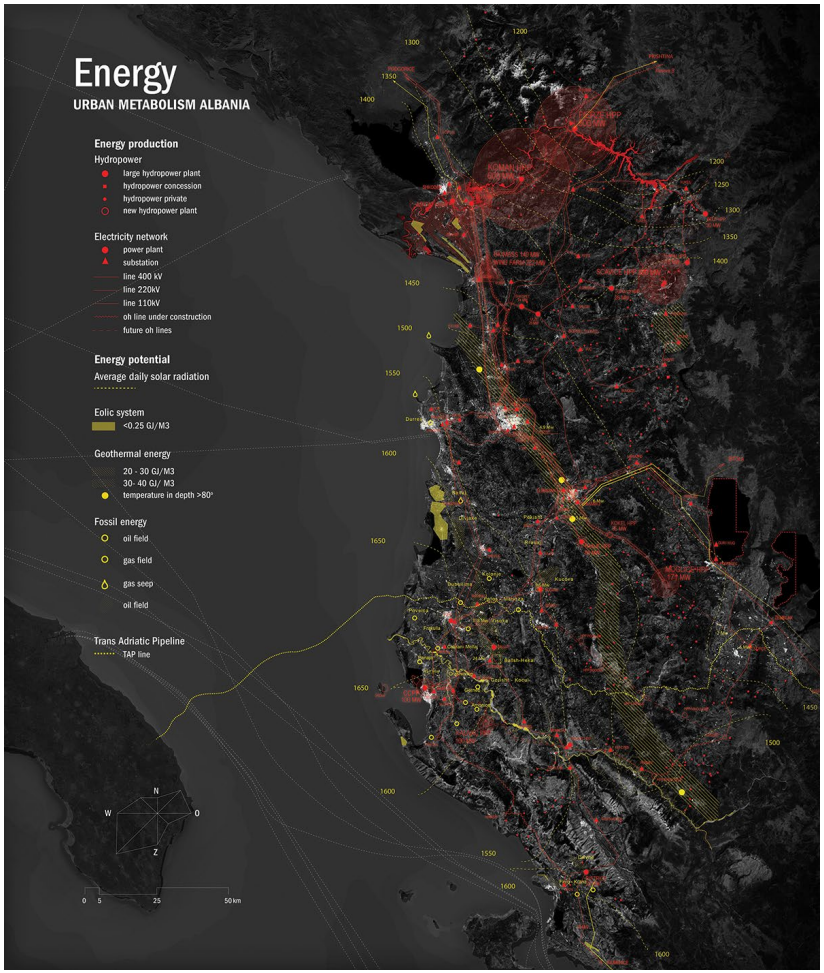



*Figure 17. Flow of Energy*

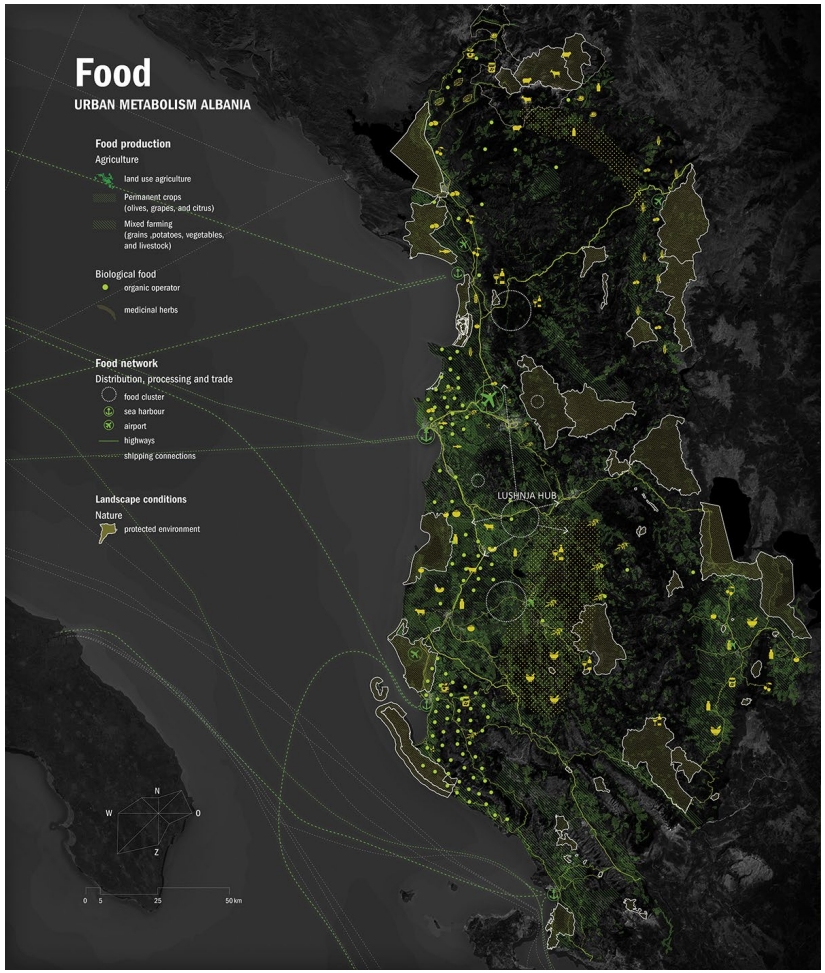



*Figure 18. Flow of Food*

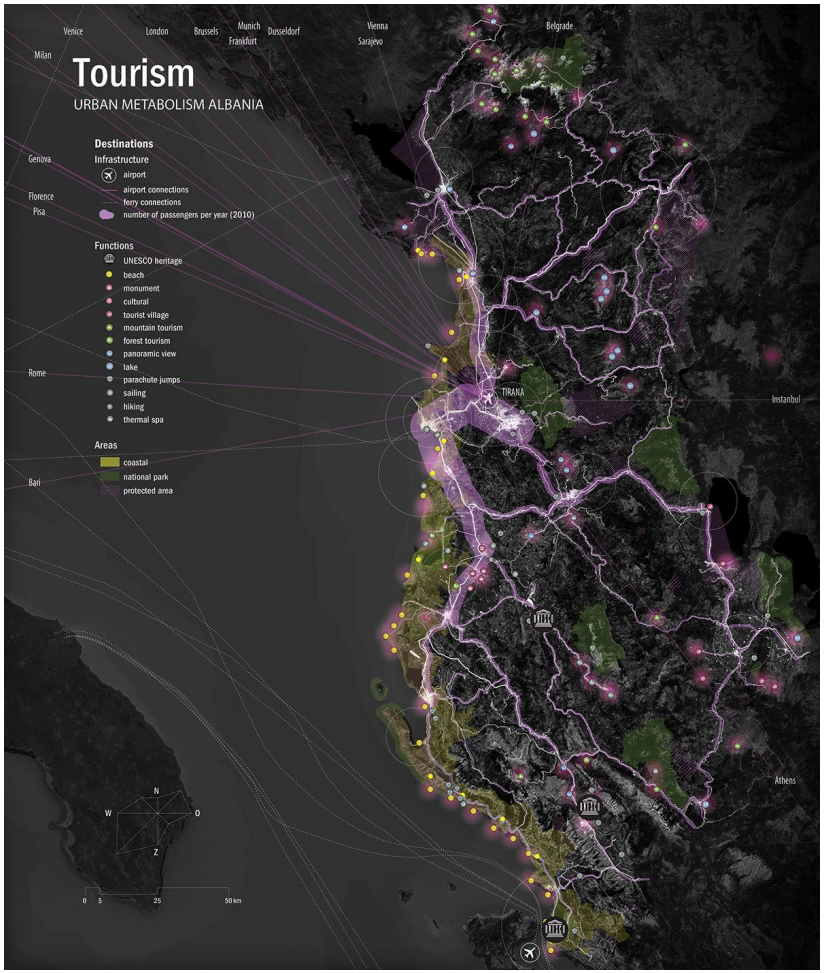



*Figure 19. Flow of Tourism*

After exchanging knowledge, the sites for design intervention were chosen. They have 37 design intervention including greywater empowering agriculture (figure21), herb farming (figure 22), recycled infrastructure, and a riverbank urban park,etc.

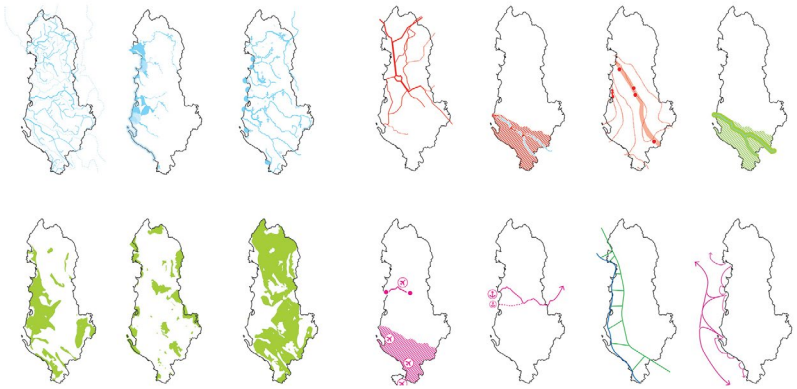


*Figure 20. Material Maps of Albania*
*Left to right, top to bottom:*
*01 — River system features a regime largely aimed at hydropower energy production; 02 — Creating buffer space for peaks in river dynamics could reduce flood risk, improve agriculture irrigation and offer opportunity of energy storage; 03 — Water quality can be improved by treating waste water regionally (treatment plants), city level (updating sewage and storm water capacity) or locally (septic tanks). 04 — Production is mainly concentrated in the north of the country; 05 — Viosa river has potential to supply future development with hydropower; 06 — Renewable energy in other forms could better suit seasonal demand; 07 — Undammed river serves as the backbone of the ecological Viosa region; 08 — Large-scale agro is best located in productive landscapes with good infra connections; 09 — Agro-tourism is an opportunity for food production in proximity to national parks and other tourist destinations; 10 — Subsistance farming profits from collaborating models for upscaling production and distribution and from crop management; 11 — Airport connectivity in Durres-Tirana and Viosë region; 12 — R8 corridor to Macedonia, Bulgaria and Turkey; 13 — Coastal access by coastal road (blue corridor) or parallel highway (green); 14 — A sea perspective initiates coastal development from the water's edge.*

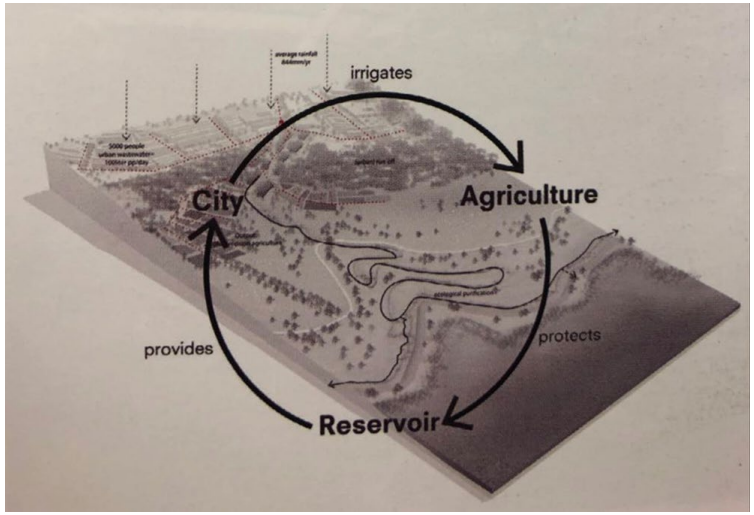



*Figure 21 Greywater Empowering Agriculture*

*Figure 22 Herb Farming*

### 2.3.2 The West Louisville Food Port

The West Louisville Food Port is a 24-acre project design by Rem Koolhaas design firm OMA in 2015. It made use of an abandoned tobacco factory and aimed to turn it into a massive local food port. Rather than only aggregating and distributing food, the West Louisville Food Port is a mixed-use project with multiple functions including growing, processing, selling, distributing, and recycling food for local farmers in Louisville. The big idea of this project is to show the whole cycle of the food chain and create a new model between consumers and producers.

*Figure 23 Aerial View of the West Louisville Food Port*


*Figure 24 Site and Context of the West Louisville Food Port*

The site of this development is located at the intersection of three low-income neighborhoods, Shawnee, Russell, and Portland, in West Louisville. To activate those neighborhoods and attract the community, this project is designed as a zig-zag shape with public open space surrounding the building. The public open spaces include a market plaza, a food truck plaza, and an edible garden. A small demonstration farm is designed for the purpose of educating people. The recycling facility is also a significant part of this project since it turns the food waste into energy and fertilizer on-site, thus letting the food chain work in a circular and more efficient way.

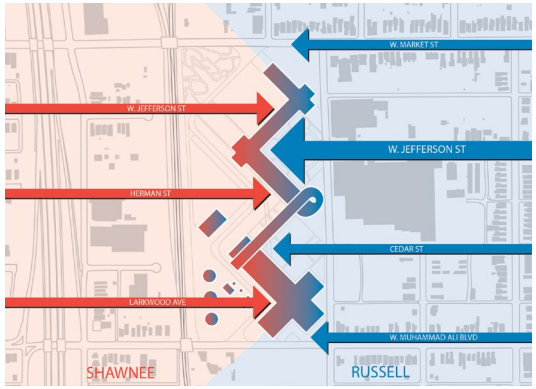



*Figure 25 Stitching Urban Fabric*


*Figure 26 Logistic vs Public Access*


*Figure 27 Aticulated Intersection*

Since tobacco used to be the dominant crop in Kentucky, many families made their living on growing tobacco. However, as the demand for tobacco decreased over time, farmers were forced to find another way to survive. Nowadays, as 55 percent of Kentucky's land is still devoted to agriculture, encouraging farming and local food production is considered a smart strategy to solve problems in society. On the other hand, taking advantage of the abandoned brownfield is an environmentally friendly approach, and the big idea of showing the whole cycle of the food chain represents system thinking in the urban metabolism model. This is a project that designs with the flow of food, it is a response to the environment problem and aims to mitigate it and heal the sick city.


*Figure 28 Food Truck Plaza of the West Louisville Food Port*

*Figure 29 Farm of the West Louisville Food Port*

*Figure 30 Vistor Center of the West Louisville Food Port*

*Figure 31 Rooftop Plaza of the West Louisville Food Port*

## 2.4 Summary

Looking at the planning and urban development of Seattle, the focus of planning has shifted towards environment and people from car and transportation. Awareness and consideration of environment has been growing over time. Urban Metabolism is an approach that can apply a sustainable strategy in the urban context. Facilitating the urban metabolism idea is one way to promote Seattle's practice of sustainability. The system thinking considers using materials and resources in a cyclical process rather than linear process. The energy exchange within the system makes it dynamic and viable, and it allows the city to breathe.

Among all the materials in the system, food is an essential one that supports people's daily life directly. However, the traditional food chain works inefficiently. From farming, harvesting to distributing, packaging, and selling, it is a long process and produces waste and the embodied energy of the food production is relatively high. This design project of this thesis will design with the flow of food, reduces the energy used to support the food chain by cutting the unnecessary processes and connecting the food products to customers more directly.

# Chapter 3

# Methodology


*Figure 32. Map of Seattle*

This thesis will respond to the environmental and ecological problem through an architectural and planning approach. The goal of this thesis is to create a new urban lifestyle within which the development of the built environment will facilitate the metabolism of the city. The built environment will no longer work as a machine that only produces contamination but instead contributes to generating clean and useable energy. This chapter will investigate the sustainable design strategies and apply them to an food hub design project in the Othello neighborhood of Seattle. It will take both ecological and social sustainability into consideration.

## 3.1 Program of Spaces

Among all the materials, food is a primary contributor to the environmental problems. The earth's land surface is reclaimed as farmland, which leads to deforestation and loss of biodiversity. Water and energy are consumed to produce and transfer food. However, based on the research, 40% of food in America goes uneaten, and most of this go to the landfill, which means the nutrients would not come back to the soil to facilitate the growth of more products.[21] People throw away 160 billion dollars worth of food in a year in America, by reducing food waste, a family of four could save as much as $1,500 a year.[22] More than 20% of all the freshwater is used to grow food that is never eaten[23], and about 5% of all the U.S. energy is used to grow food that is wasted[24]. On global scale, vegetables travel 1,500 miles from farm to consumer on average, causing an extra 12%

[21]Hall KD, Guo J, Dore M, Chow CC (2009) The Progressive Increase of Food Waste in America and Its Environmental Impact. PLoS ONE 4(11):e7940.https://doi.org/10.1371/journal.pone.0007940
[22]Buzby, Jean C., Hodan F. Wells, and Jeffrey Hyman. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States, EIB-121, U.S. Department of Agriculture, Economic Research Service, February 2014.
[23] "Food waste consumes: 21% of all fresh water." Rethink Food Waste through Economics and Data (ReFED), A Roadmap to Reduce US Food Waste by 20 Percent, (2016), https://www.refed.com.
[24]Patrick Canning, et. al., Energy Use in the U.S. Food System, U.S. Department of Agriculture (USDA) Economic Research Service, ERR-94, (March 2010), https://www.ers.usda.gov/publications/pub-details/?pubid=46377.

emission before consumption.[25] However, one in seven people in the world suffers from hunger, making hunger and malnourishment the greatest risk to health worldwide.[26]

*Figure 33. Food Travel*

*Figure 34. Children Suffer from Hunger in Africa*

This food hub design project is proposing a more efficient way to grow and save the food production, thus reducing the environmental impact generated by farming. It will become a place to grow, sell, share, and celebrate local food in the neighborhood. After the consumption, the food waste will be used to feed animals, or be composted on site, and come back to the soil and work as fertilizer.

Existing technologies such as solar panels, stormwater collection, and aquaponic farming will be applied to this project. The flow of energy, water, and food will collaborate and interchange with each other as a closed and efficient system.

[25]Food Miles: Background and Marketing, by Holly Hill NCAT Research Specialist
[26]Hunger Statistics, http://www.foodaidfoundation.org/world-hunger-statistics.html

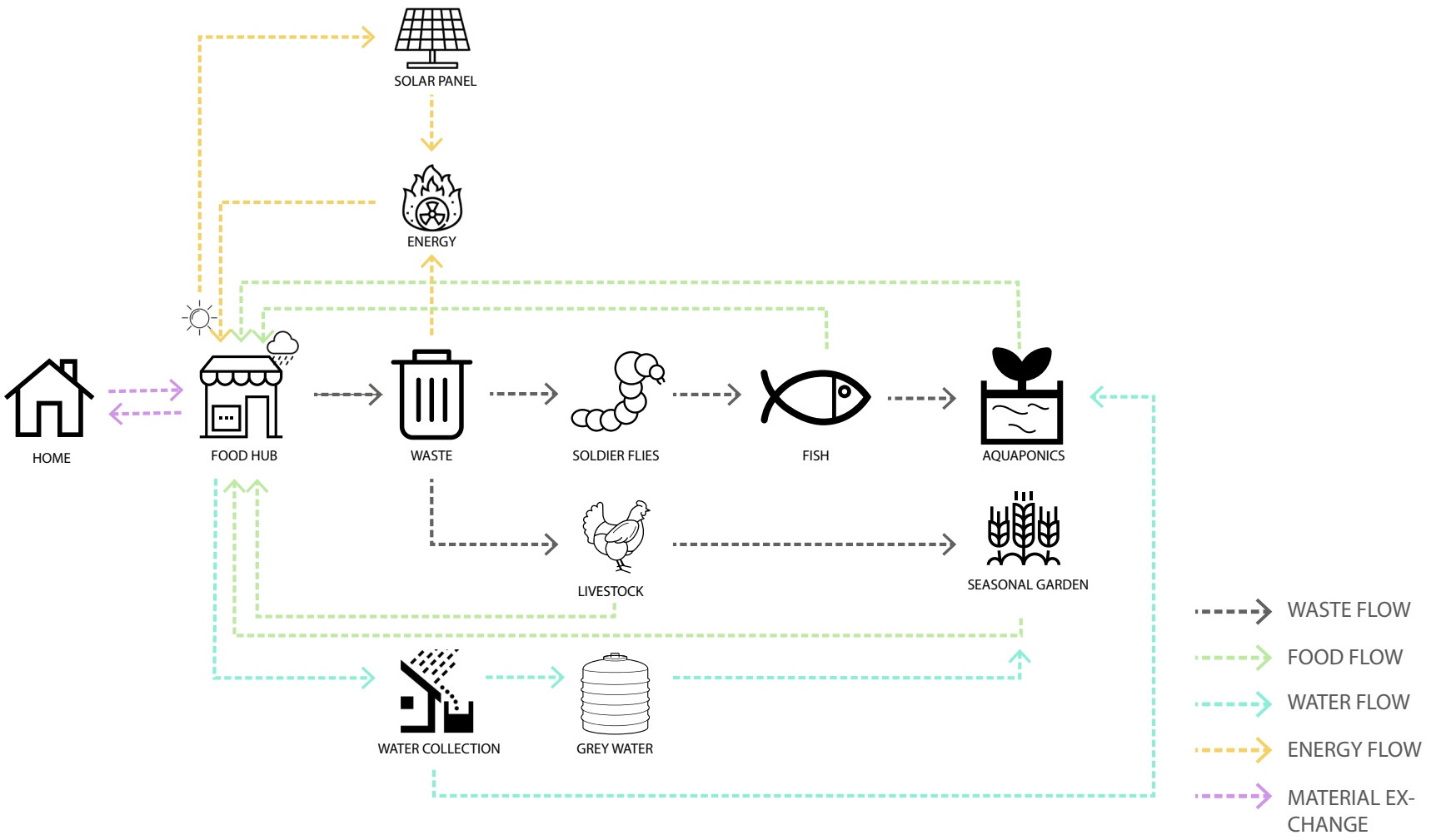



*Figure 35. Concept/System Diagram*

From social perspective, this project will have community sharing spaces to serve the neighborhood and encourage people to bring or donate their uneaten food and share with people who will need it, which is an attempt to reduce the food waste from households in the neighborhood. At the same time, it encourages sharing, communicating, and exchanging knowledge. In the essay "The Problem of Places in America", there are three major places that can support daily human activities, they are places for living, working, and informal public life.[27] Ray Oldenburg argues that the lack of places for informal public life is a problem in America: "There is no contact between the various households, we(people) rarely see the neighbors and certainly do not know any of them." This food hub design is an attempt to change the situation Ray Oldenburg mentioned, aiming to work as "the third place", and connect people with their neighbors.

[27]Oldenburg, R. (1999). The great good place: Cafés, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community. New York: Marlowe.

## 3.1 The Othello Neighborhood of Seattle

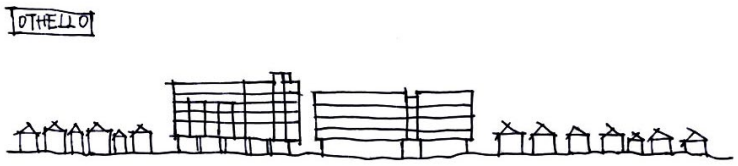



*Figure 36. Impression of Othello Neighborhood*

The Othello urban center located in South Seattle is a community-driven neighborhood with a diverse ethnic background. A report in August 2019 shows that there are currently 28 languages spoken in this neighborhood. Among the diverse population, the Asian population is the majority, which is 47.2% of the overall population. Black or African population is 27.5% following the Asian population. Most of the residents have low or low-middle income, with $45,605 dollars as the median household income, and 24.3% of the population being below poverty level. 11.1% of the population in this neighborhood is unemployed.[28]

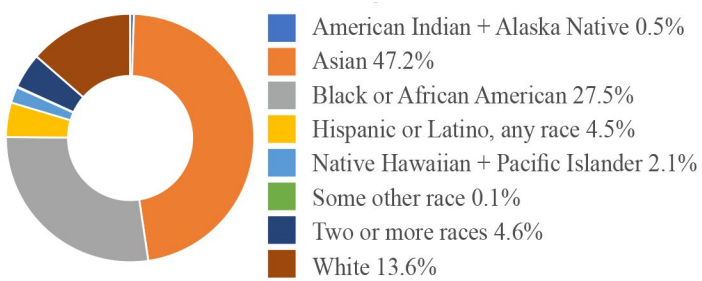



*Figure 37. Race/Ethnicity of Othello Residents*

| | | Othello | Citywide |
|---|---|---|---|
| Renter households | % | 48.9 | 53 |
| People under 18 years of age | % | 23.9 | 15 |
| People age 65 and over | % | 13.4 | 11 |
| Persons of color | % | 86.4 | 33 |
| Language other than English spoken at home | % | 64.2 | 22 |
| High school or higher | % | 71.8 | 93 |
| Bachelor's degree or higher | % | 25.3 | 57 |
| Median household income | $ | 45,605 | 65, 277 |
| Unemployed | % | 11.1 | 7 |
| Population below poverty level | | 24.3 | 14 |

*Figure 38. Neighborhood Numbers*

[28] Othello Snapshot. http://www.seattle.gov/Documents/Departments/Neighborhoods/Districts/Neighborhood%20Snapshots/Othello-Snapshot.pdf

The site for this design project is located at the south-west corner of the intersection of S Othello Street and Martin Luther King Jr Way S. It is a 157,000 ft² site which is currently open. At the heart of Othello urban center, the site is close to the Othello link station and located at the most developed area in this neighborhood, facing the major street Martin Luther King Jr Way. Bus stop for Route 106 is right next to the site, and another bus stop for Route 36 and 50 is located across to the street. The area towards south and west side of the site are residential neighborhoods with residents of different ethnic background. Public transit and the location make the site accessible and give it the potential to be a gathering place for people from different communities. The New Holly Market Garden is just across the street from the site, which will be able to provide resources to the design project.

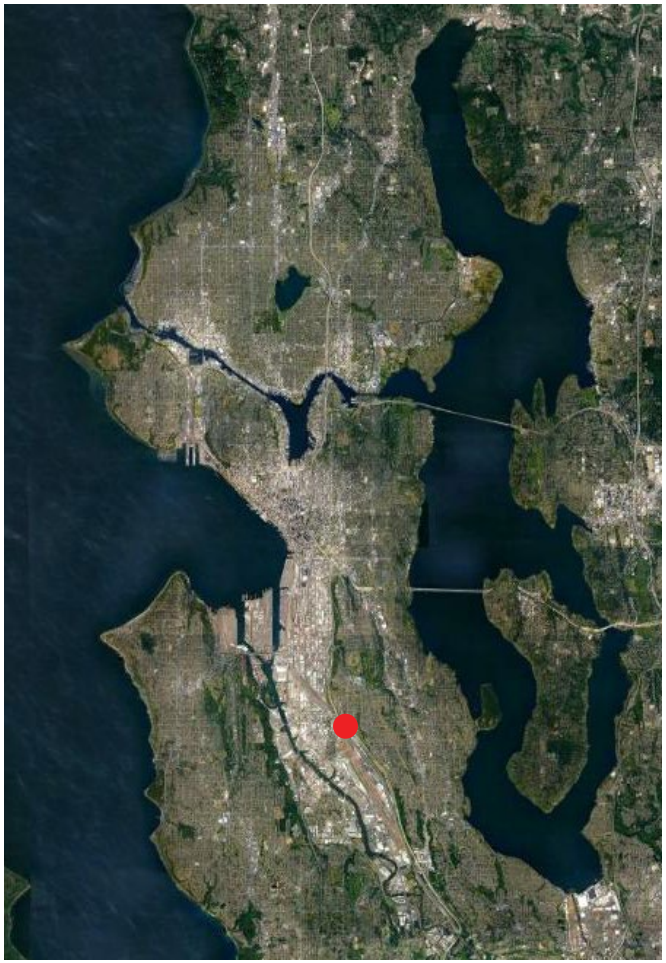



*Figure 39. Site Location in Seattle*


*Figure 40. Vicinity Map*


*Figure 41. Site Images Bird View*

The west and south edges of the site are facing residential neighborhoods, with the majority building types being single family houses and townhouses. Areas that are north and east to the site are more developed thanks to the Othello light rail station on the MLK way. The construction of the light rail station gave residents easier access to the city, and started the gentrification process in this neighborhood.


*Figure 42. Images of the Neighborhood*

1. Site


2. New Holly Market Garden

3. Townhouses

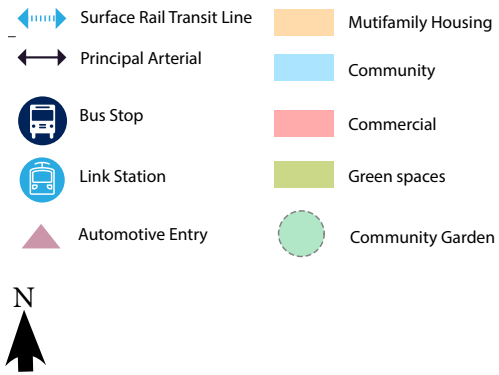
4. Single Family House

5. Othello Light Rail Station

6. Multifamily Housing


*Figure 43. Site Analysis*


*Figure 44. Sunpath Analysis*



On the west side of the MLK way, the Southeast Asian population are the majority. As Southeast Asian countries have the tradition of gardening, it is predicted that some of the residents in the neighborhood will be interested in coming to the food hub or working for this project.

This project will hire people from and provide jobs in the neighborhood, as well as produce fresh and affordable food to serve residents. The Othello link station connects the site to the rest of the city.

# Chapter 4

# Design Response

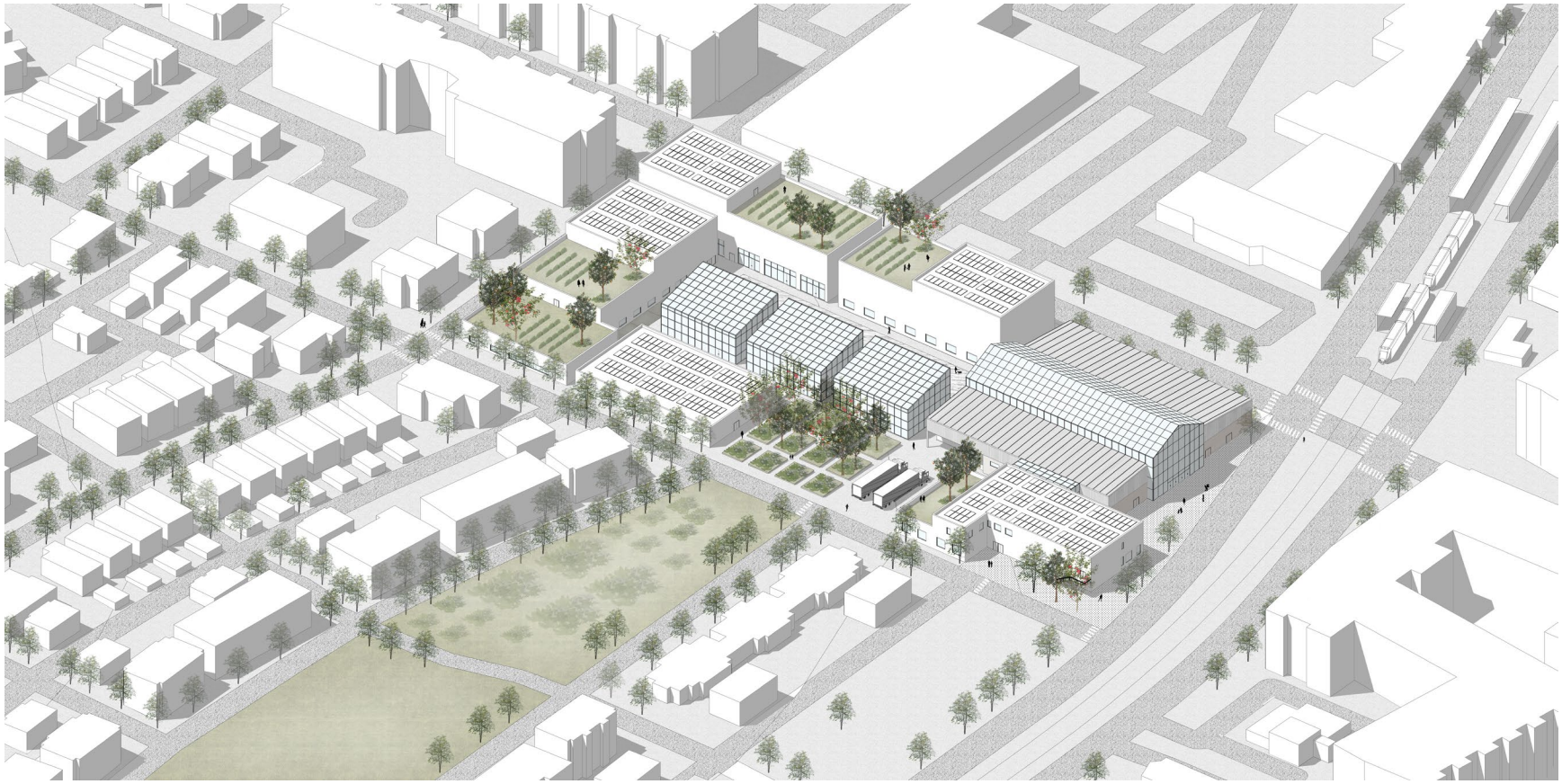


*Figure 45. Axon View*

## 4.1 Farming Principle and Techonologies

Permaculture is considered the farming principle of this project. Permaculture is an Australian movement, one definition of that is, "Consciously designed landscapes which mimic the pattern and relationships found in nature, while yielding an abundance of food, fiber, and energy for provision of local needs."[29] People, their buildings, and the way they organize themselves are central to permaculture. Thus permanent vision of permanent agriculture has evolved to one of permanent culture.[30]

The permaculture zones and permaculture site design zones are partly physical and partly conceptual. They work from a core of integration and strength to a wider domin of uncertainty and flexibility. There are external energetic forces and material flow inform, support, constrain, influence, and damage the central system. The core system will have a smaller impact on the larger scale dynamics.[31]

*Figure 46. Permaculture Image*

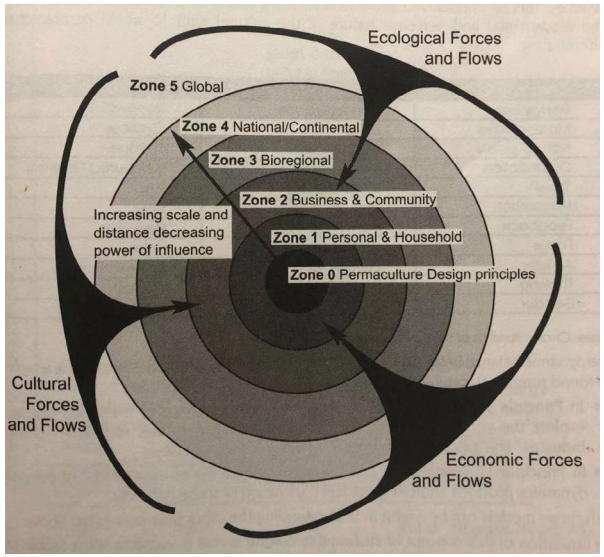



*Figure 47. Zone and Sector Analysis of Permaculture*

[29]Holmgren, D. (2002). Permaculture : Principles & pathways beyond sustainability. Hepburn, Vic.: Holmgren Design Services.
[30]Ibid.
[31]Ibid.

In the food hub project, the food resources are from different scales. There are food resources that grew on the site, from household and gardens in the neighborhood, from p-patches and farms in the city, as well as some from larger scales. The goal of this project is trying to produce more food on a smaller scale to be more efficient. When the food production is not sufficient on the smaller scale, resources from the larger scale will be needed.

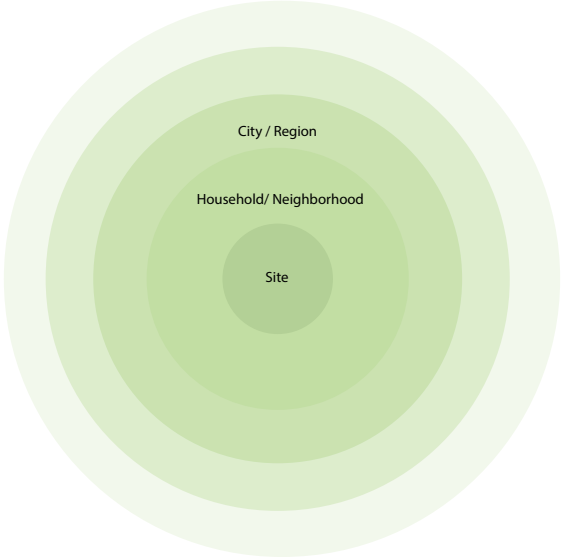



*Figure 48. Food Resources Diagram*

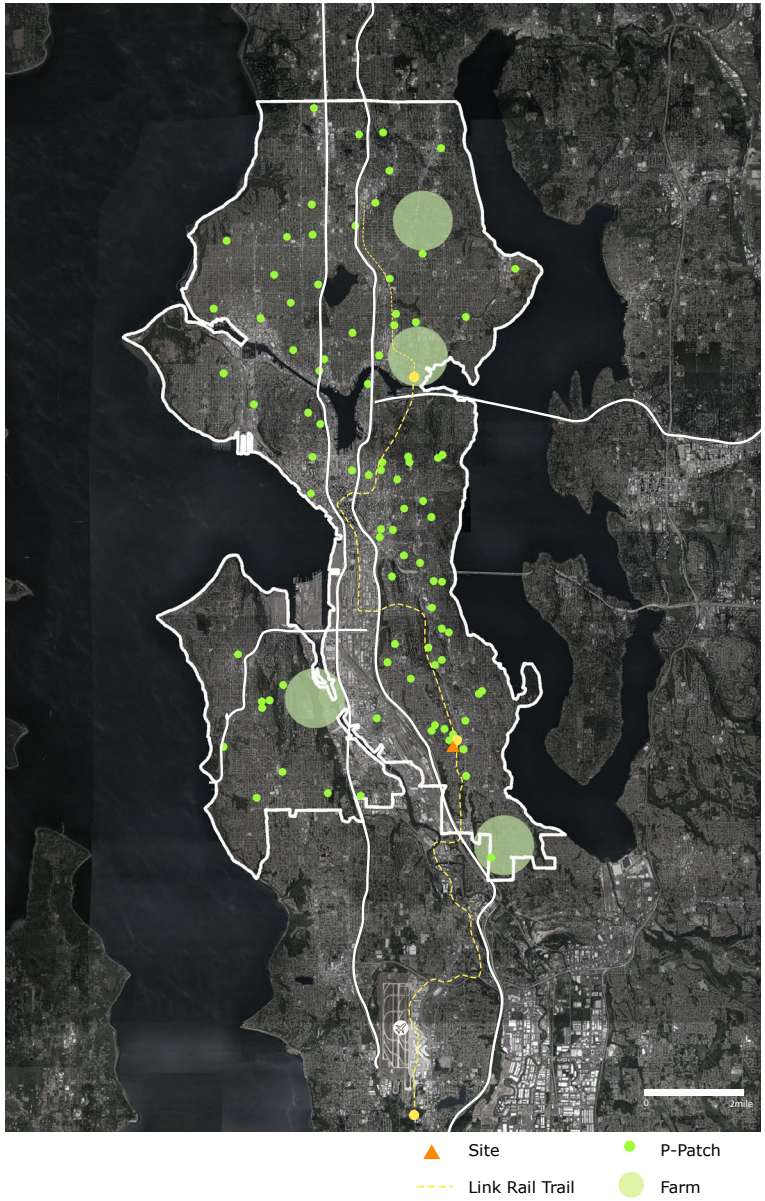



*Figure 49. Seattle Food Growing Places Map*

To be productive, two primary farming technologies are being applied. The first one is aquaponic farming. It allows people to grow food vertically, produce products, and protein from fish. It can provide ten times more food products in the same footprint as traditional farming. The second strategy is having roof gardens for seasonal crops. Roof gardens make use of the rooftop, thus save the land spaces. It is energy efficient as it reduces the heat flux through the roof; less energy will be used for cooling or heating the building. Stormwater will be collected, and there will be less stormwater runoff. Socially, the roof garden can work as an outdoor amenity space and connect people to the natural environment.

*Figure 50. Aquaponic Farming Precedent*

*Figure 51. Roof Garden Precedent*

## 4.2 Design Respnse

The design project was started with space adjacency analysis. Aquaponic greenhouses and an outdoor activity plaza are in the center of the site. The seasonal garden is at the south edge, which connects to the community garden across the street. The primary market is facing MLK way. The corridor in the market leads people to the central plaza from MLK way. Roof gardens are on the top of residential and community buildings, with residents and community members having access to these gardens. Solar panels are placed at the very top of the roof to capture the sun’s energy and turn it into electricity.

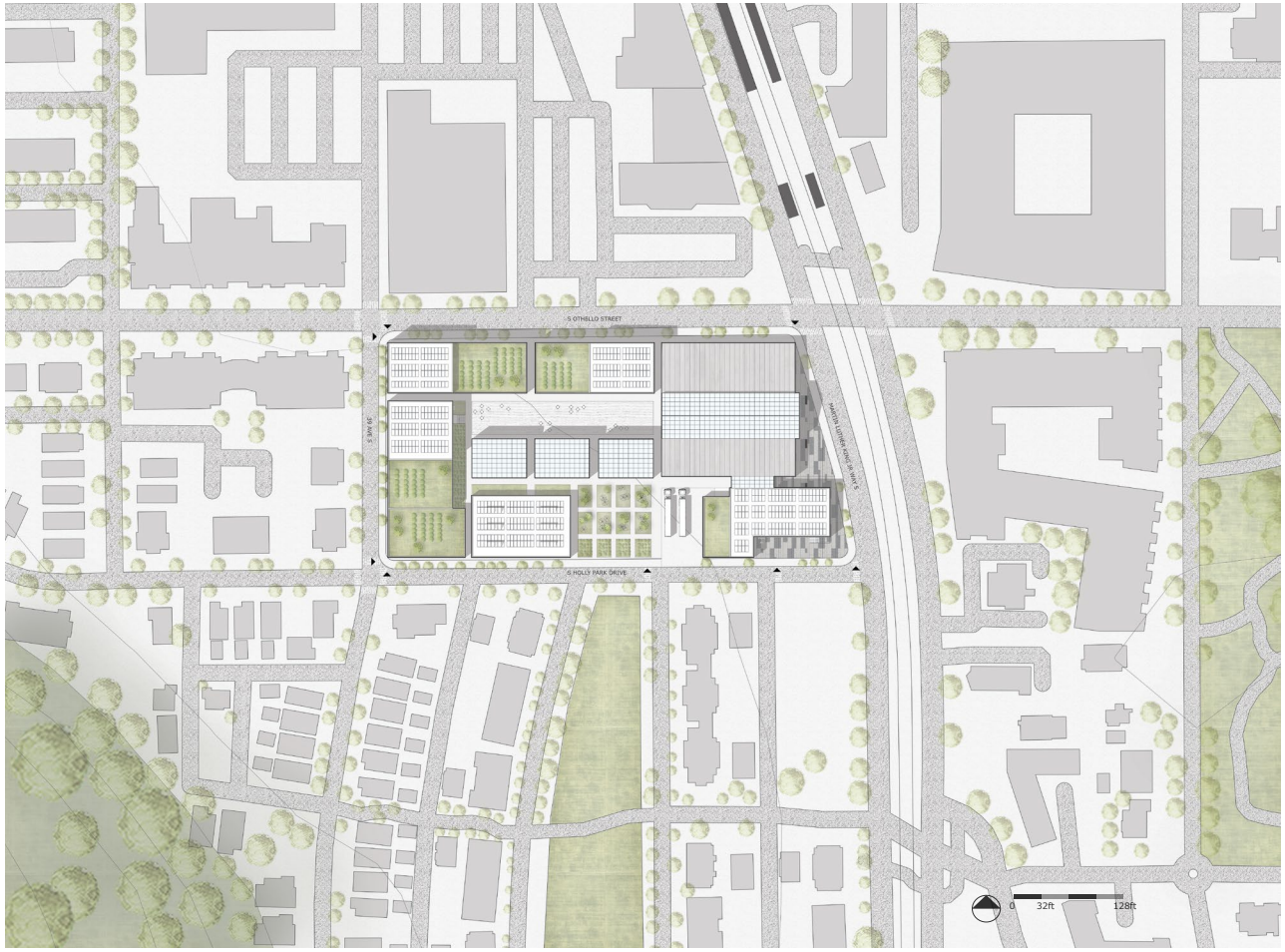



*Figure 52. Site Plan*

At the ground floor level, food vendors, restaurants, and activity spaces are oriented towards the central plaza. It is a place for people to gather, and watch, eat, as well as celebrate local food. The composting facility is located close to the food production spaces, toward the foodservice system. The market hall is a  two-story building, with a double-height activity space in the center. Small gardens, trees, a kitchen, and flexible seatings are in the central corridor. Farm lab works as a working place, as well as exhibition space in the corridor.

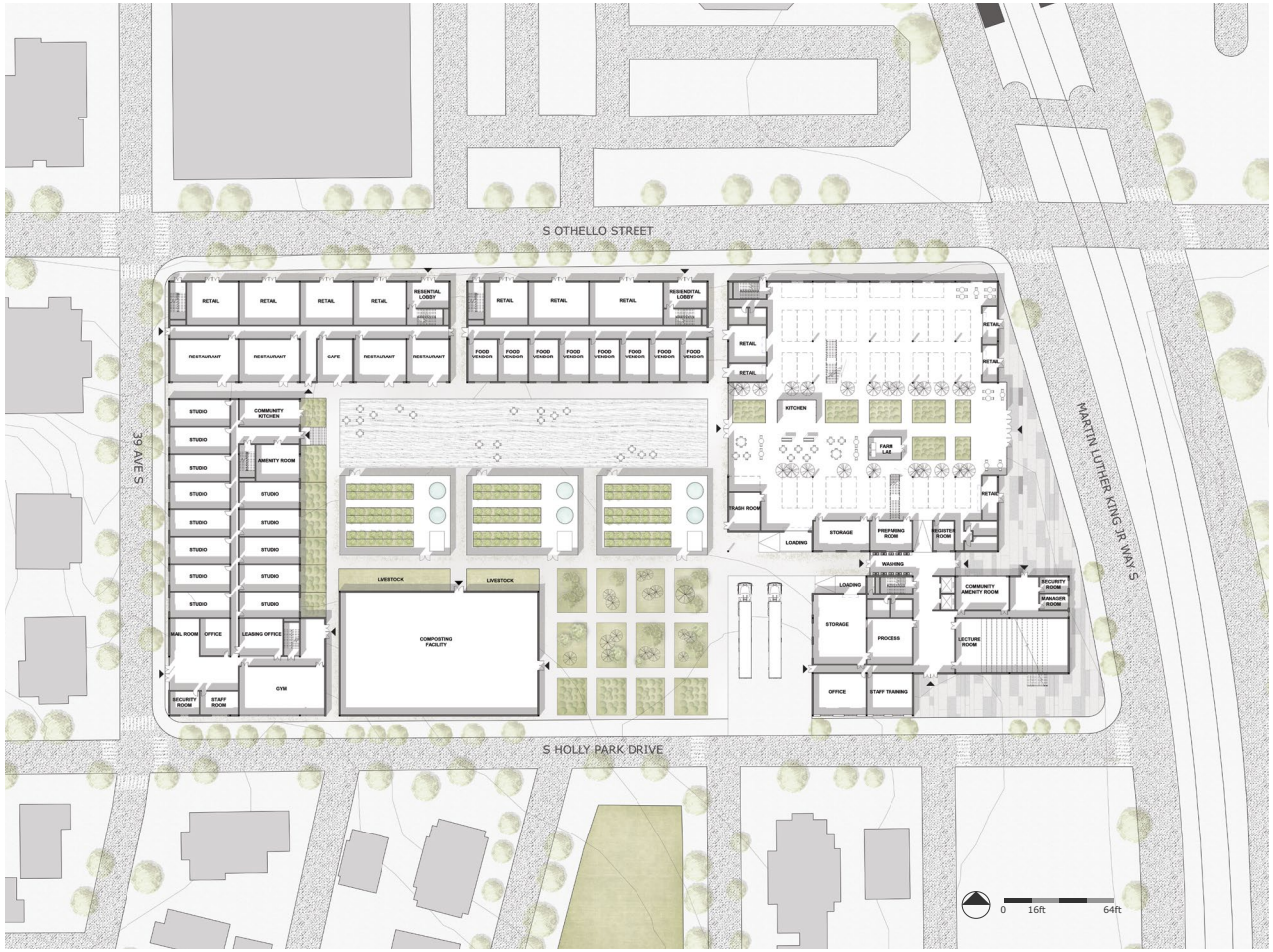



*Figure 53. Ground Floor Plan*

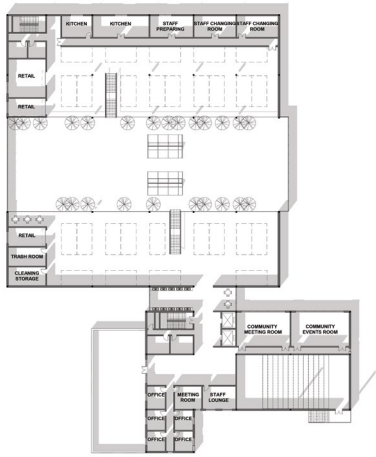



*Figure 54. Second  Floor Plan*

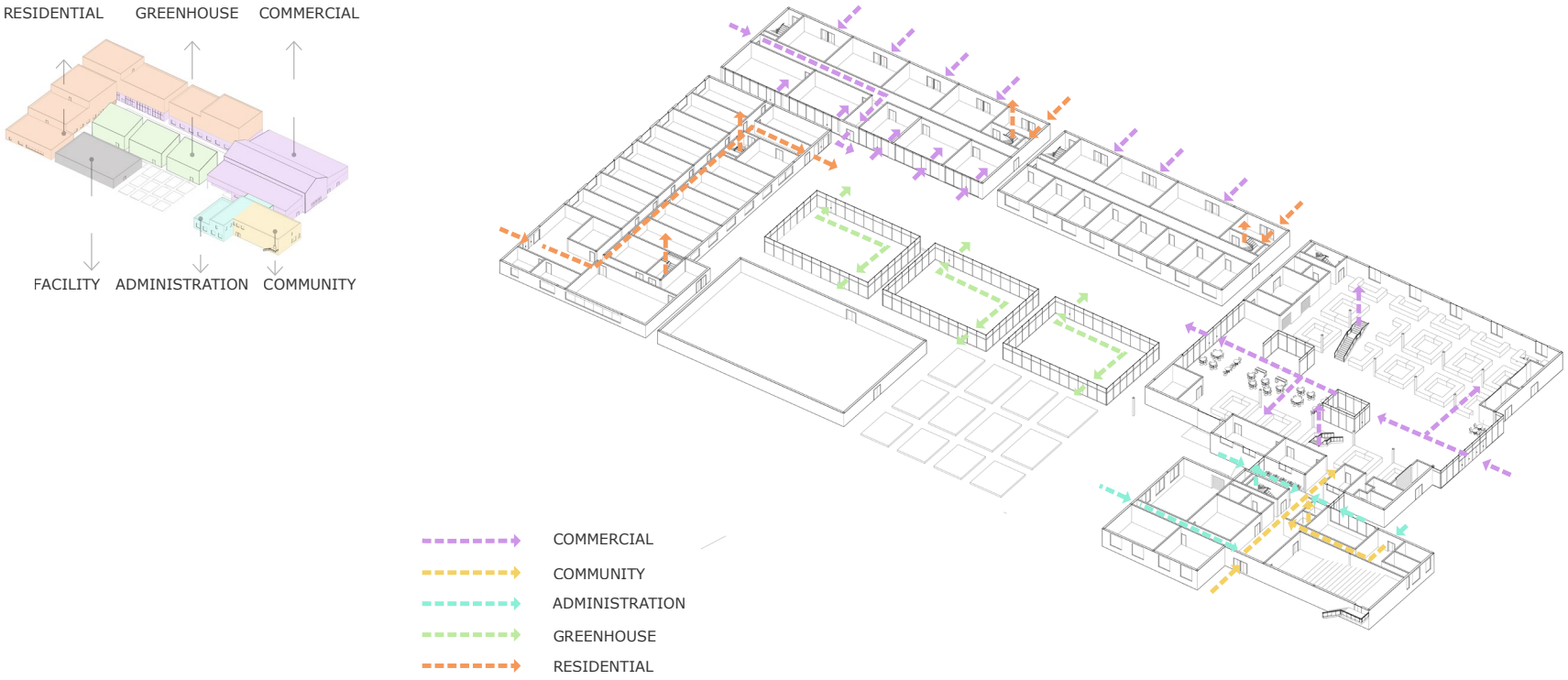



*Figure 55. Zoning, Program, and Circulation*

Programs in this project are within six categories, they are commercial space, food production space, residential space, composting facility, administration space, and community space.

Flows of people go from streets and neighborhoods to the site, from the edges to the center.

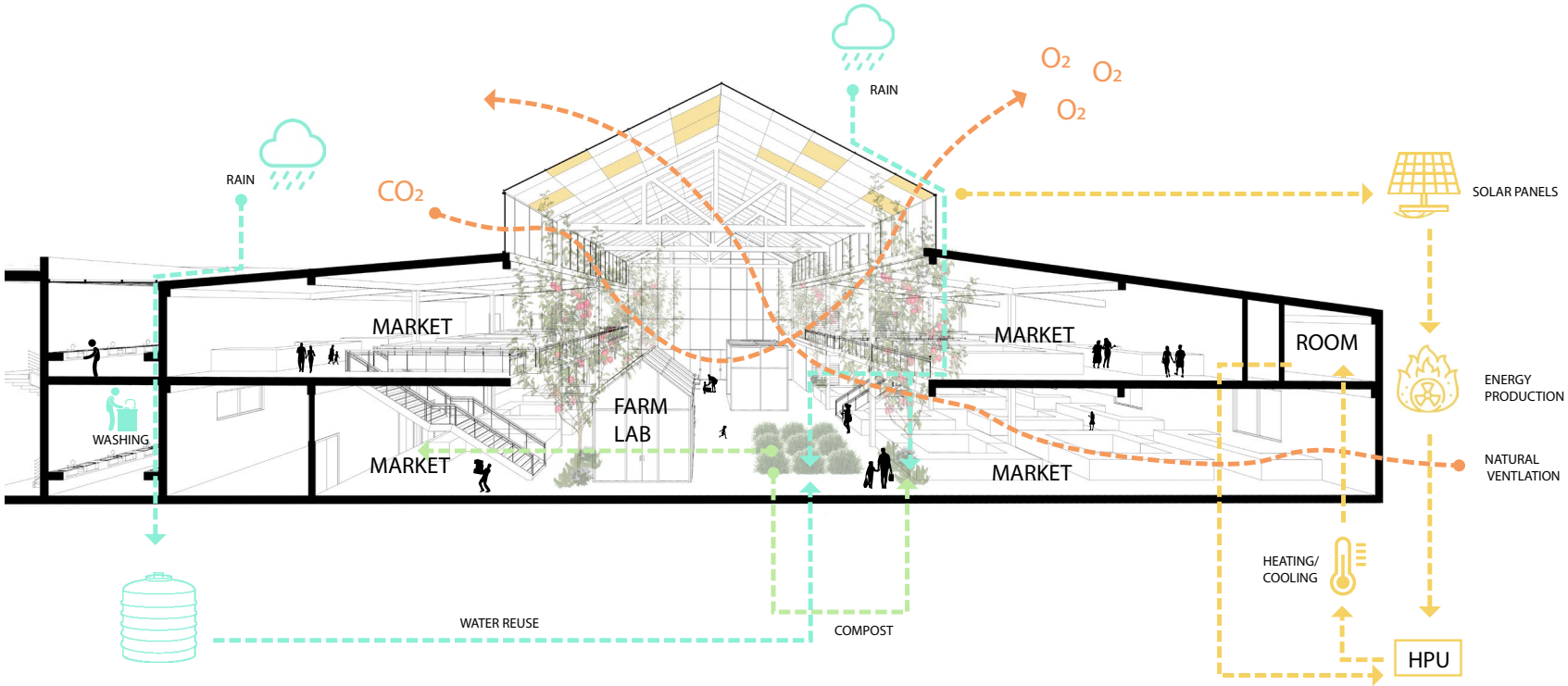



*Figure 56. Sectional Perspective*

Slope roofs collect stormwater and reuse them for washing and irrigation. Solar panels capture energy from the sun and turn that into electricity for heating or cooling. Agriculture absorbs $CO_2$ and release $O_2$. Food production will be distributed to the market, and food waste will be composted and be used as fertilizer.

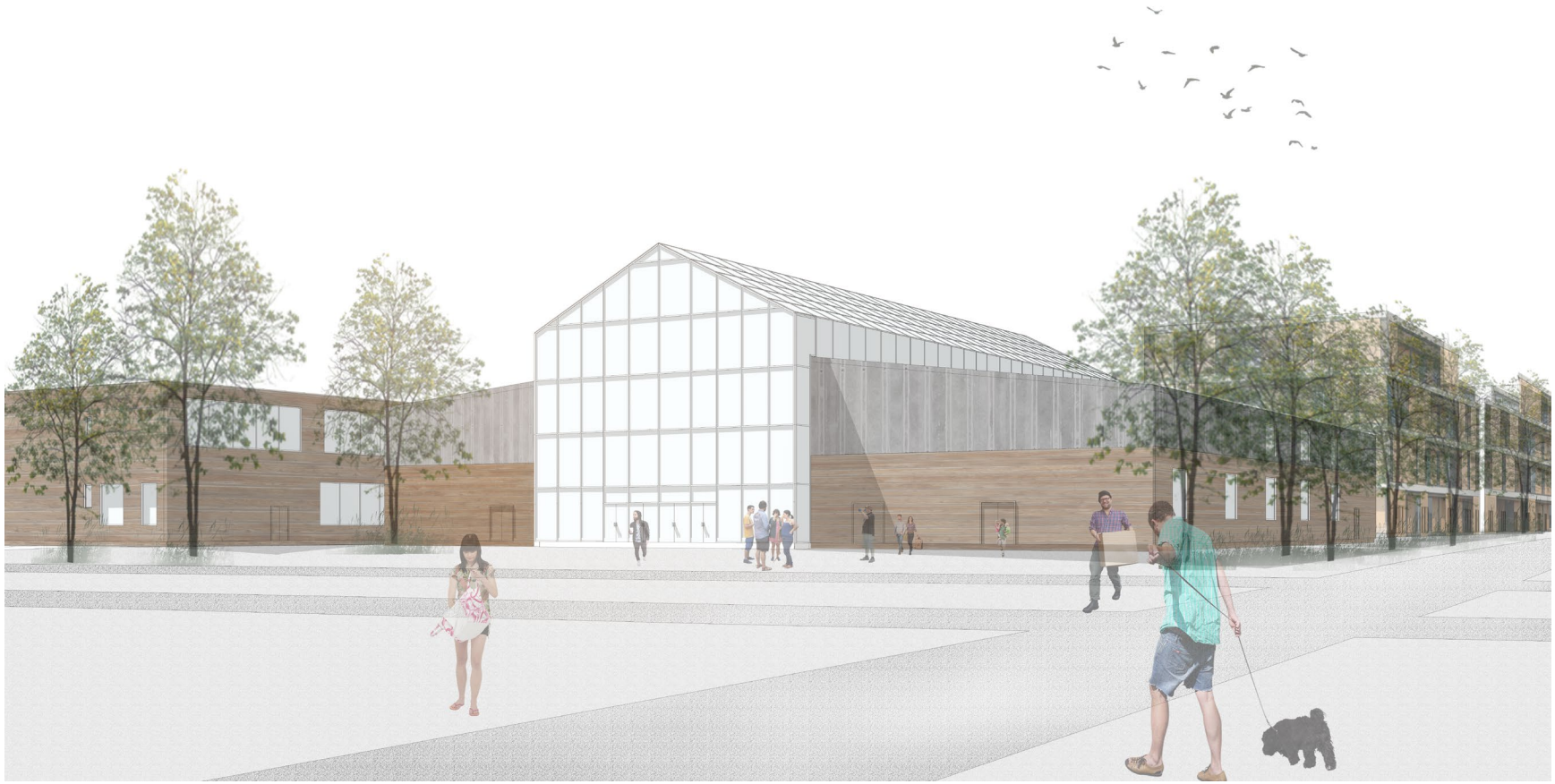


*Figure 57. Perspective: Entrance*

People get off from the Othello link rail, they can see the iconic market hall stands at the intersection of the Othello Street and MLK way. It is made of wood, metal, and glass. The transparent corridor is inviting people to come inside.

*Figure 58. Perspective: Market Hall*

For curiosity, people go inside the market hall. They see others are chatting, eating, and celebrating together. People decide to join this event. They walk around the market hall, take a look of the farm lab, talk with others, and buy some fresh food here.


*Figure 59. Perspective: Activity Plaza*

After that, people come to the activity plaza. At the left hand is the aquaponic greenhouses, and there are different options of food on the right hand. People visit the green-houses and grab some snacks from the food vendor. They found seatings on the plaza, and spend their afternoon here to enjoy food and sunshine.

# Chapter 5

# Conclusion

*Figure 60. Food Hub Conceptual Collage*

This food hub project should not be considered as machine for food production, or a commercial project for trading. It directly connects customers with food production, lets people bring the local food home, and makes it possible for people to know where do the food they eat come from. It is a place for celebrating local and fresh food. It educates people how to eat, and live healthily.

While it is responding to global environmental problems, there is also an attempt to deal with social issues, and strengthen the community.

The urban metabolism concept is a tool that helps to mitigate environmental problems. It is considered as a prototype that can be applied to different places around the world. Like it is said in the permaculture principle, the core permaculture site has less impact on the larger scale. A single project will not be able to solve global problems, but once the primary concept is applied all over the world, the situation will become better.

While people are taking care of themselves, they are also taking care of their planet.

## Bibliography

Air Pollution page in World Health Organization, https://www.who.int/health-topics/air-pollution#tab=tab_1

Basiago, A. D. (1995). Methods of defining 'sustainability'. Sustainable development, 3(3), 109-119.

Besse, A.(2019). GUERRILLA GA. Weber Thompson What If presentation.

Brief History Of Seattle, https://www.seattle.gov/cityarchives/seattle-facts/brief-history-of-seattle

Brugmans, G., Francke, M., & Persyn, F. (2015). THE METABOLISM OF ALBANIA: ACTIVATING THE POTENTIAL OF THE ALBNIAN TERRITORY, iabr/UP, Rotterdam

Building Impacts presentation. The U.S. Green Building Council

Buzby, Jean C., Hodan F. Wells, and Jeffrey Hyman. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States, EIB-121, U.S. Department of Agriculture, Economic Research Service, February 2014.

Dinarès, M. (2014). Urban Metabolism: A review of recent literature on the subject. Documents d'anàlisi geogràfica, 60(3), 551-571.

FABRICations Homepage, https://www.fabrications.nl/#section-our-philosophy-is 159(8-9), 1965-1973

Food Miles: Background and Marketing, by Holly Hill NCAT Research Specialist

"Food waste consumes: 21% of all fresh water." Rethink Food Waste through Economics and Data (ReFED), A Roadmap to Reduce US Food Waste by 20 Percent, (2016), https://www.refed.com.

Girardet, H. (1996). The Gaia atlas of cities : New directions for sustainable urban living (Rev. ed.). London: Gaia.

Hall KD, Guo J, Dore M, Chow CC (2009) The Progressive Increase of Food Waste in America and Its Environmental Impact. PLoS ONE 4(11):e7940.https://doi.org/10.1371/journal.pone.0007940.

Harrell, M. (2019). GARAG-quaponics: Urban food production in the under-used parking garages of the future.Weber Thompson What If presentation.

History of Urban Planning in Seattle, https://seattleplanning.weebly.com/index.html
Holmgren, D. (2002). Permaculture : Principles & pathways beyond sustainability. Hepburn, Vic.: Holmgren Design Services.

Hunger Statistics, http://www.foodaidfoundation.org/world-hunger-statistics.html

Interstate 5 is completed in Washington on May 14, 1969. https://www.historylink.org/File/9393

Kennedy, C., Cuddihy, J., & Engel-Yan, J. (2007). The changing metabolism of cities. Journal of industrial ecology, 11(2), 43-59.

Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. Environmental pollution,159(8-9), 1965-1973.

KETC | Living St. Louis | Metabolic City, https://www.youtube.com/watch?v=EfhZI_1_r40&t=69s

King J (2018), JOURNAL OF URBAN DESIGN AND MENTAL HEALTH, https://www.urbandesignmentalhealth.com/journal-4---air-pollution-and-mental-health.html

Thrush, C. (2006). City of the Changers. Pacific Historical Review, 75(1), 89-117.

Oldenburg, R. (1999). The great good place: Cafés, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community. New York: Marlowe.

Othello Snapshot. http://www.seattle.gov/Documents/Departments/Neighborhoods/Districts/Neighborhood%20Snapshots/Othello-Snapshot.pdf

Patrick Canning, et. al., Energy Use in the U.S. Food System, U.S. Department of Agriculture (USDA) Economic Research Service, ERR-94, (March 2010), https://www.ers.usda.gov/publications/pub-details/?pubid=46377.

Population history of Seattle from 1890 - 1990. http://physics.bu.edu/~redner/projects/population/cities/seattle.html

Proksch, G. (2017). Creating urban agriculture systems : An integrated approach to design. New York: Routledge, Taylor & Francis Group.

Reclaiming Nature: Flattening Hills and Digging Waterways in Seattle, https://www.washington.edu/uwired/outreach/cspn/Website/Classroom%20Materials/Curriculum%20Packets/Building%20Nature/IV.html.

Seattle voters reject the Seattle Commons levy on September 19, 1995. https://www.historylink.org/File/8252

The Seattles that might have been , from Seattle Times, https://www.seattletimes.com/pacific-nw-magazine/the-seattles-that-might-have-been/

These 7 photos reveal how I-5 construction tore through old Seattle, from Seattle Times, https://www.seattletimes.com/seattle-news/transportation/these-7-photos-reveal-how-i-5-construction-tore-through-old-seattle/

Tomlinson, N., & Álvarez Planas, Valenti. (2018). Contemporary market architecture : Planning and design. Mulgrave, Victoria: Images Publishing Group Pty.

Washington establishes an office for clearing the route of the Seattle Freeway (Interstate 5) on April 1, 1957. https://www.historylink.org/File/4168

White, E. (1986). Space adjacency analysis : Diagramming information for architectural design. Tucson, Ariz. (P.O. Box 41083, Tucson 85717): Architectural Media.