

Kennesaw State University

DigitalCommons@Kennesaw State University

Bachelor of Architecture Theses - 5th Year

Department of Architecture

Spring 5-1-2020

Solving Pollution Through Design Integration: A Sustainable Model for Underdeveloped Mexican Cities

Marcos Cruz

Follow this and additional works at: https://digitalcommons.kennesaw.edu/barch_etd



Part of the [Architecture Commons](#)

Recommended Citation

Cruz, Marcos, "Solving Pollution Through Design Integration: A Sustainable Model for Underdeveloped Mexican Cities" (2020). *Bachelor of Architecture Theses - 5th Year*. 130.
https://digitalcommons.kennesaw.edu/barch_etd/130

This Thesis is brought to you for free and open access by the Department of Architecture at DigitalCommons@Kennesaw State University. It has been accepted for inclusion in Bachelor of Architecture Theses - 5th Year by an authorized administrator of DigitalCommons@Kennesaw State University. For more information, please contact digitalcommons@kennesaw.edu.

SOLVING POLLUTION THROUGH DESIGN INTEGRATION
A Sustainable Model for Underdeveloped Mexican Cities



Solving Pollution Through Design
A Sustainable Model for Underdeveloped Cities



SOLVING POLLUTION THROUGH DESIGN INTEGRATION
A Sustainable Model for Underdeveloped Mexican Cities

Ermal Shpuza, PhD

and to the
Faculty of the Department of Architecture
College of Architecture and Construction Management

by

Marcos Cruz

In partial fulfillment of the requirements for the Degree

Bachelor of Architecture

Kennesaw State University
Marietta, Georgia

DEDICATION

This thesis book is a reflection of all of the hard work that has been created this last year. I would like to dedicate this book to my parents because this thesis is situated within the city they were raised in. The lush and clean Miahuatlan river they knew as children has become a vile and waste ground for the city. I hope to implement these ideas to the people of Miahuatlan in order to start a more sustainable future for the city. I want to thank them for their support and interest in the project.

DEDICATION

I want to acknowledge the staff and professors of Kennesaw State University for their guidance and support. These last 5 years have been a learning process on how to perfect the craft of design. I would like to thank my advisor, Ermal Shpuza, his guidance helped me achieve my goals and the skills set I acquired within this last year. His feedback and dedication allowed me to push my design skills to the limit, and made me think of design solutions that were completely new to me. I would also like to acknowledge the citizens of Miahuatlan that informed me of the hardships and pollution within their city through interviews and small conversations.

Abstract

Oaxaca requires architecture that can cleanse the environment, provide affordable and clean energy, and mitigate the crime and poverty within their city. Community awareness is key to the development of this architecture, and this project will focus on creating a design that influences and informs the community about a safer and a more sustainable way of life. This project will focus on using the United Nations sustainability goals to address the global challenges we face including poverty, climate, and inequality. This thesis will create a building that will integrate these goals while still maintaining the cultural aspect within the region. Where even the most impoverished states can achieve sustainable efforts for the future. My thesis is situated in Miahuatlan, Mexico. It is one of the most impoverished states in Mexico that lacks some of the most basic human needs and has a poverty rate of 65%.

This thesis will tackle Oaxaca's major concerns including poverty, pollution, access to clean and renewable energy, and the lack of resources to design long term solution. It will also create an architecture that is focused on the prosperity of the community and educating the youth on climate change to put them on a sustainable path early on in their lives. This sustainable model will set an example to surrounding cities that even with limited resources a building can be designed to enhance energy production, community learning, and improve the way of life of even the most unfortunate individuals in any developing city. Through a pedagogical approach this project will incorporate sustainable systems within the building that will be visible to the community. This will enhance their knowledge on how sustainability systems work, and what pollution can do the environment. It will also incorporate classrooms and workshops where the community can interact and learn about sustainable systems and what it means to create a greener planet. I believe that communal spaces are needed to create safer environments,

so designing a marketplace that strengthens community interaction and keeps children away from the increasing crime within Mexican cities is essential for the development of this sustainable model. The implementations of all these systems and goals into one project strives to create a better future for the less fortunate cities on our planet. The path to a net zero and sustainable future mainly targets highly developed and wealthier cities, but I disagree. I believe that even underdeveloped cities should also be incorporated into this path of creating a greener and safer environment. The goal of this project is to leave no one behind in a world full of pollution and poverty.



CH01

DESIGN THEOREM

- 1.1 P.12-13 DESIGN INTENT
- 1.2 P.14-21 SUSTAINABILITY GOALS

CH02

RESEARCH

- 2.1 P.24-29 RESEARCH
- 2.2 P.30-31 SITE SELECTION

CH03

PRECEDENT

- 3.1 P.34-35 PRECEDENTS
- 3.2 P.36-37 EL GUADAL CHILDREN CENTER
- 3.3 P.38-39 MADRID RIO
- 3.4 P.40-41 COMMUNITY CENTER SAN BERNABE
- 3.5 P.42-43 CHEONGGYECHEON STREAM

CH04

DESIGN PROCESS

- 4.1 P.46-55 DESIGN INTEGRATION

CH05

RESPONSE

- 5.1 P.58-61 BIO-PARK
- 5.2 P.62-69 MARKET
- 5.3 P.70-77 COMMUNITY HUB
- 5.4 P.78-83 STORAGE & GARDENS

CH06

APPENDIX

- 1.1 P.84 FIGURE INDEX
- 1.2 P.85 BIBLIOGRAPHY

ch**01**..... DESIGN THEOREM



figure 1.1

INTRO

Developing Cities face major problems including pollution, poverty, and the lack of availability to sustainable systems. These cities are in dire need of more sustainable, affordable, and community focused solutions. This brings up the Question? How can we put developing cities onto a more sustainable path? How can we create an architecture that provides for the less fortunate while still maintaining a path towards sustainability?

This requires intuitive architecture that can cleanse the environment, provides affordable and clean energy, and mitigate the crime and poverty within their city. Community awareness is key to the development of this architecture, and this project will focus on creating a design that influences and informs the community about a safer and a more sustainable way of life. This project will focus on using the United Nations sustainability goals to address the global challenges we face including poverty, climate, and inequality. This thesis will create a building that will integrate these goals while still maintaining the cultural aspect within the region. Where even the most impoverished states can achieve sustainable efforts for the future. My thesis is situated in Miahuatlan, Mexico. It is one of the most impoverished states in Mexico that lacks some of the most basic human needs and has a poverty rate of 65%.

1 SUSTAINABLE PROJECT THAT INTRODUCES WATER INTO PROGRAM

1 This project will integrate sustainability into its own program. The program will be intertwined with the water condition allowing for the system to cleanse the water in an orderly manner. Create a Hub that has zero impact on the site it sits on will be achieved through active and passive systems.

Hub

2 COMMUNITY FOCUSED DESIGN

2 The building will acknowledge the people it is being designed for, and through articulate and vernacular strategies the building will give back to the community. The design will be very community oriented with programs such as classrooms, kitchens, some housing, and public shared spaces.



Design Influence

This thesis will use the United Nations sustainability goals in order to design a project that can attack these problems through design integration. Water is the biggest factor in the project and integrating it into the program of the project is key in creating a sustainable project. This project will design facilities that intend to restore the water system in Miahuatlan, and it will create a connection within the community between the introduced programs. The sustainable center that is being designed will incorporate solutions to these sustainability goals.



No Poverty

- Eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day
- Reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
- Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters



Zero Hunger

- End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- End all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
- Double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land

figure 1.2



Quality Education

- Ensure that all girls and boys complete free, equitable and quality primary and secondary education
- Substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
- Ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy
- Ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development



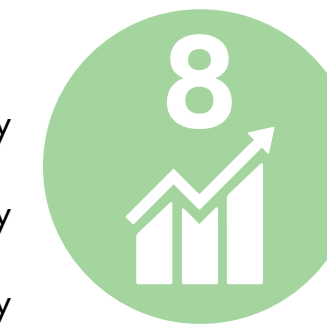
Clean Water and Sanitation

- Achieve universal and equitable access to safe and affordable drinking water for all
- Achieve access to adequate and equitable sanitation and hygiene for all and end open defecation
- Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
- Support and strengthen the participation of local communities in improving water and sanitation management



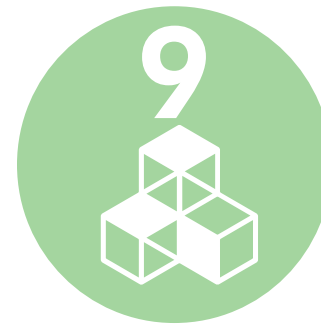
Clean and Affordable Energy

- Ensure universal access to affordable, reliable and modern energy services
- Increase substantially the share of renewable energy in the global energy mix
- Enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
- Expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries



Decent Work and Economic Growth

- Achieve higher levels of economic productivity through diversification, technological upgrading and innovation
- Achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
- Substantially reduce the proportion of youth not in employment, education or training
- Take immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labor, including recruitment and use of child soldiers



Industry, Innovation, and Infrastructure

- Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
- Upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes
- Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to least developed countries



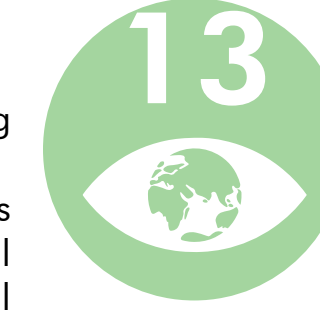
Sustainable Cities and Communities

- Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
- Provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
- Strengthen efforts to protect and safeguard the world's cultural and natural heritage



Responsible Consumption and Production

- All countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries
- Achieve the sustainable management and efficient use of natural resources
- Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
- Substantially reduce waste generation through prevention, reduction, recycling and reuse
- Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production



Climate Action

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Integrate climate change measures into national policies, strategies and planning
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning



Life Below Water

- Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
- 2020, sustainability manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans



Life and Land

- Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry-lands, in line with obligations under international agreements
- Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
- Combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world
- Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts



ch 02 RESEARCH



figure 2.1

RESEARCH GOAL

This thesis tackles Oaxaca's major concerns including poverty, pollution, access to clean and renewable energy, and the lack of resources to design long term solution. It will also create an architecture that is focused on the prosperity of the community and educating the youth on climate change to put them on a sustainable path early on in their lives. This sustainable model will set an example to surrounding cities that even with limited resources a building can be designed to enhance energy production, community learning, and improve the way of life of even the most unfortunate individuals in any developing city. Through a pedagogical approach this project will incorporate sustainable systems within the building that will be visible to the community. This will enhance their knowledge on how sustainability systems work, and what pollution can do the environment. It will also incorporate classrooms and workshops where the community can interact and learn about sustainable systems and what it means to create a greener planet. I believe that communal spaces are needed to create safer environments, so designing a marketplace that strengthens community interaction and keeps children away from the

Increasing crime within Mexican cities is essential for the development of this sustainable model. The implementations of all these systems and goals into one project strives to create a better future for the less fortunate cities on our planet. The path to a net zero and sustainable future mainly targets highly developed and wealthier cities, but I disagree. I believe that even underdeveloped cities should also be incorporated into this path of creating a greener and safer environment. The goal of this project is to leave no one behind in a world full of pollution and poverty.

Principle 1 Integrated Program

The water cleaning filtration system that is integrated along the river will implement program within the four-water cleaning system. The program must integrate into the water and create a community focused design. The design will respond to local and historical aspects that respect the existing condition.

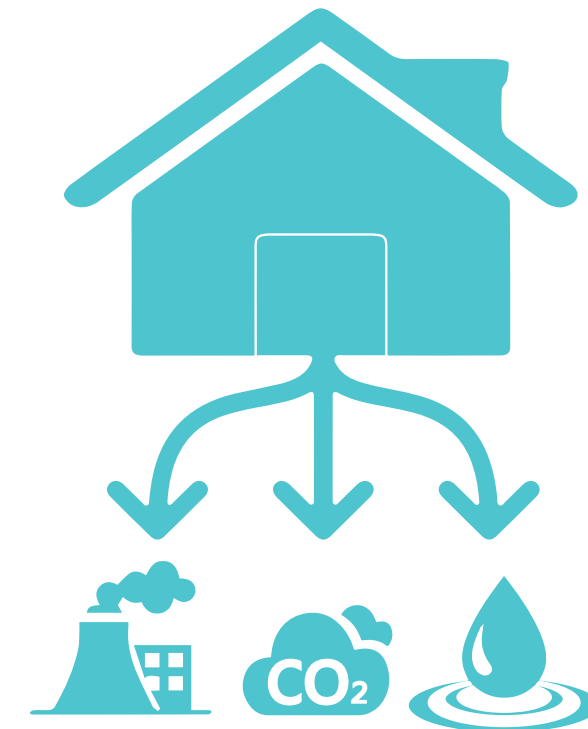
- Create a design solution that integrates program into the systems
- The systems must integrate the community to learn
- Strategies to mitigate water pollution
- Design Strategy to design the system as an architectural component.
- Create a connection between the water and the urban realm



Principle 2 Exposed Pollution

Pollution in the water system is becoming extremely hazardous and has affected local farmers. Being sustainable is not considered in a developing city such as Miahuatlan. It is important to teach the community about sustainability, and climate change. A pedagogical approach will teach the youth about a greener future and it is critical to bring up the youth knowing about sustainability.

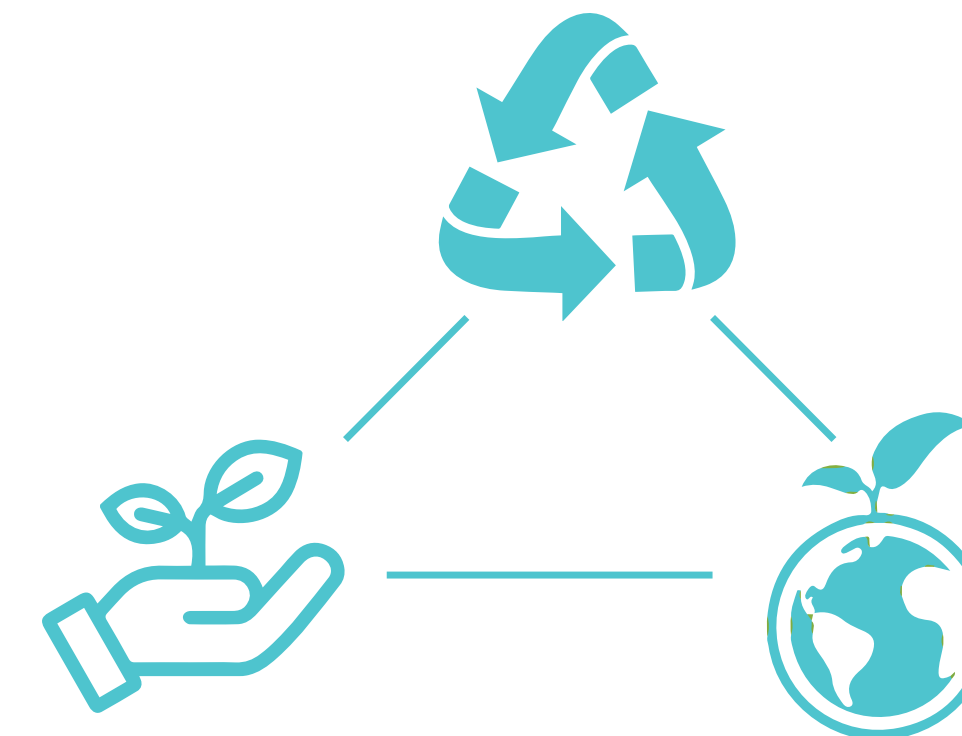
- Pollution will be exposed to the community
- Teaching people about pollution is key to the development of this project.
- Integrated research about pollution and allowing the locals to establish new ways of being resourceful and green
- How can the building integrate recycling into the program?
- The building will enhance the ecosystem by giving back to it by using greener solution and building techniques



Principle 3 Sustainable Infrastructure

The building must serve the community and create its own energy. The building must react to the site it sites on and integrate passive systems. The building will give back to the community through program and cleansed water.

- The building must integrate sustainable measures.
- This project aims to return to the community in different systems.
- Passive systems will be used, and a vernacular architecture will be instituted to create the building.



Principle 4 Water Integration

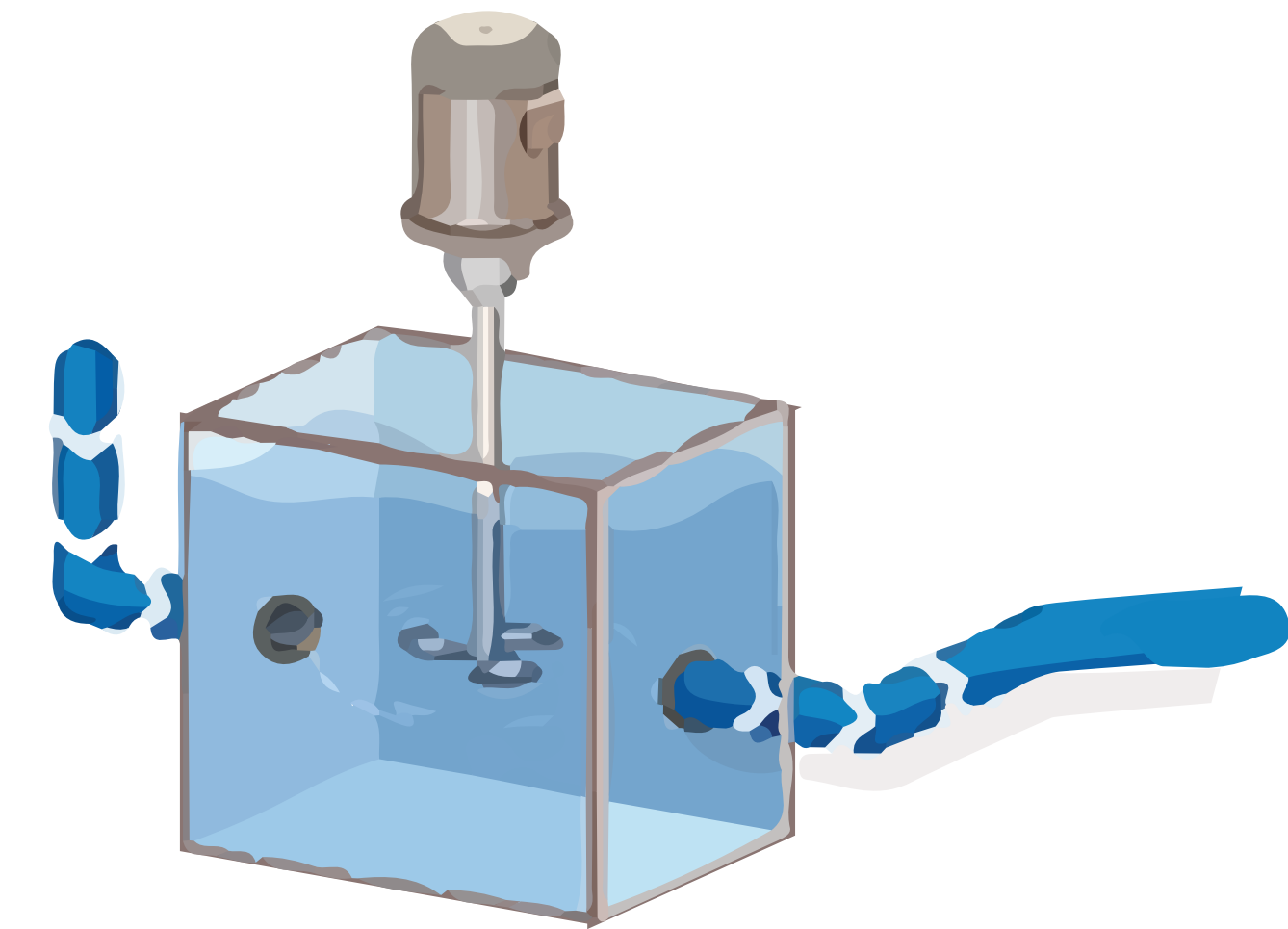
Water being integrated into the urban realm is essential for the development of this project. The system of the project is separated into four section and these sections are the steps to cleansing water. Program will collate with certain points in the city. These points will serve as a basis to the program, and the water will be integrated within that program.



Natural Water Treatment System

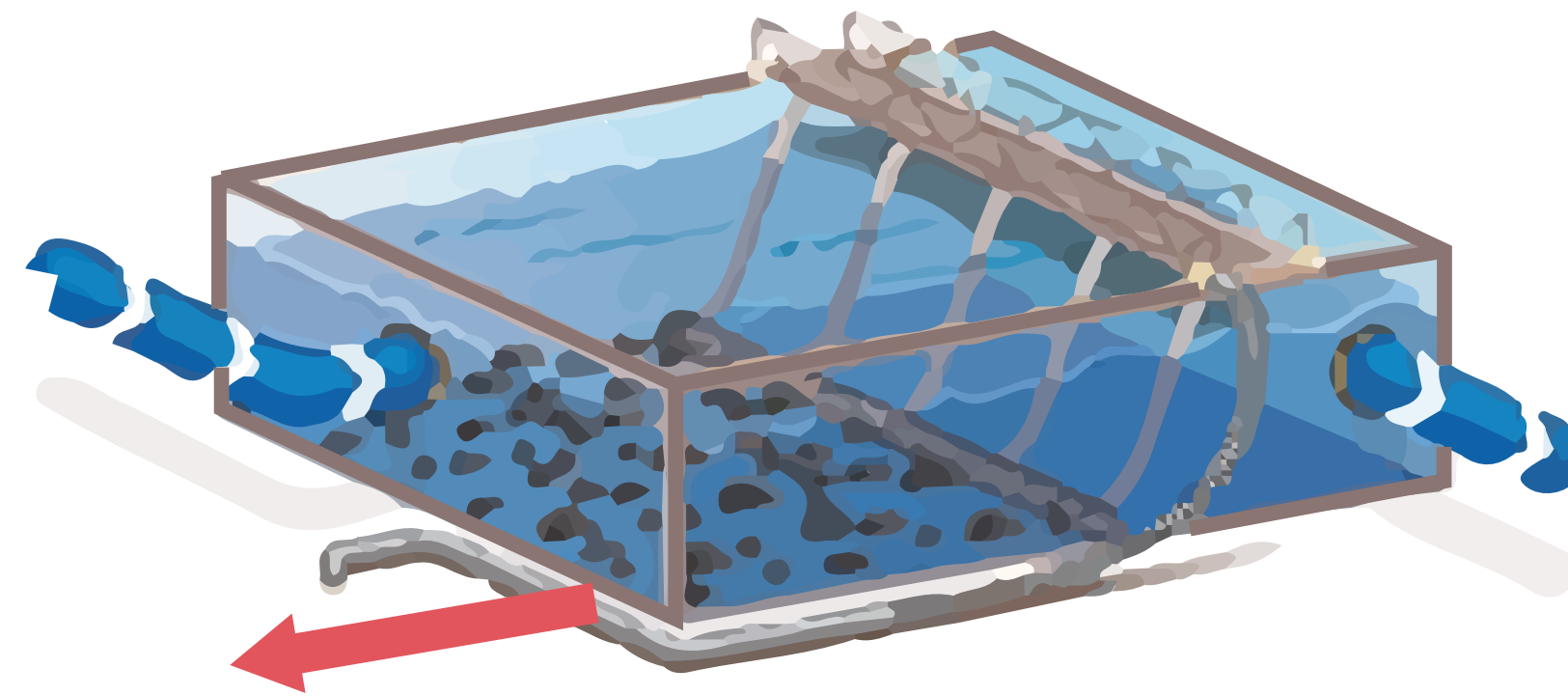
1. Coagulation

- Coagulants like aluminum sulfate and ferric chloride are mixed into the water. These particles of dirt and dissolved substances in the water clump together so that they can be removed.
- The program integrated into this part of the water treatment process includes a park and community focused programs. Intertwining the urban-scape into the water storage facilities creates a pedagogical design that integrates the community into a learning about sustainability.



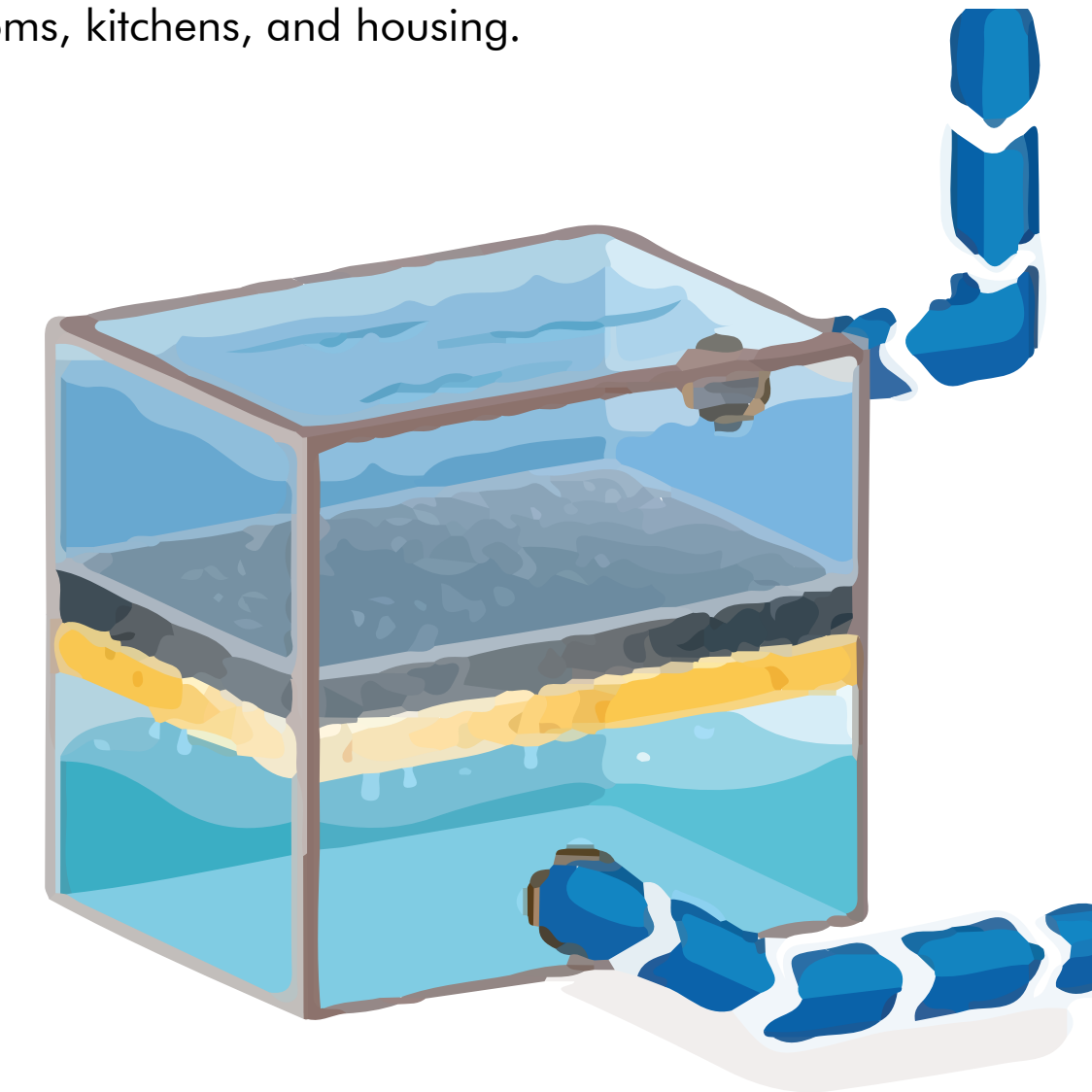
2. Sedimentation

- The large clumped particles increase in size under slow mixing in a process called flocculation. Most of them sink to the bottom and form a sludge, which can be removed from the water, which is then treated and disposed of.
- The program integrated into this system is the Monday market located at the heart of the city. Miahuatlan's Market is a collection of pueblos who come together to sell the produce that they have harvested. The system is intended to be integrated at the main bridge that connects into the city.



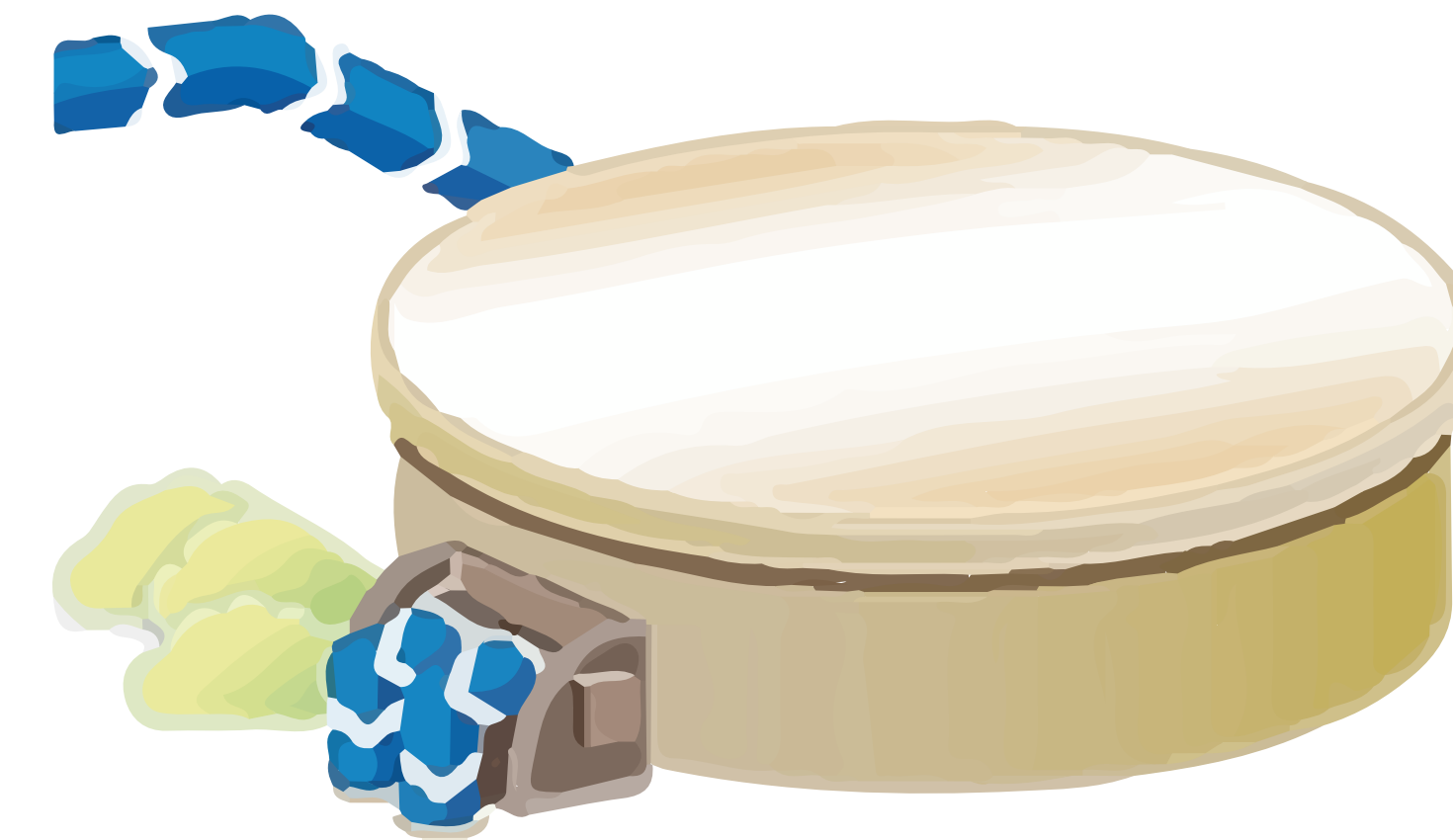
3. Filtration

- Some particles remain in the water after sedimentation; these are removed by filtration through coal, sand, and gravel beds. The water travels through these layers and removes particles at different intervals of size.
- The community hub will be integrated into this system. This building will integrate a pedagogical approach to enhance the community's knowledge of pollution. The program within the building will include classrooms, kitchens, and housing.



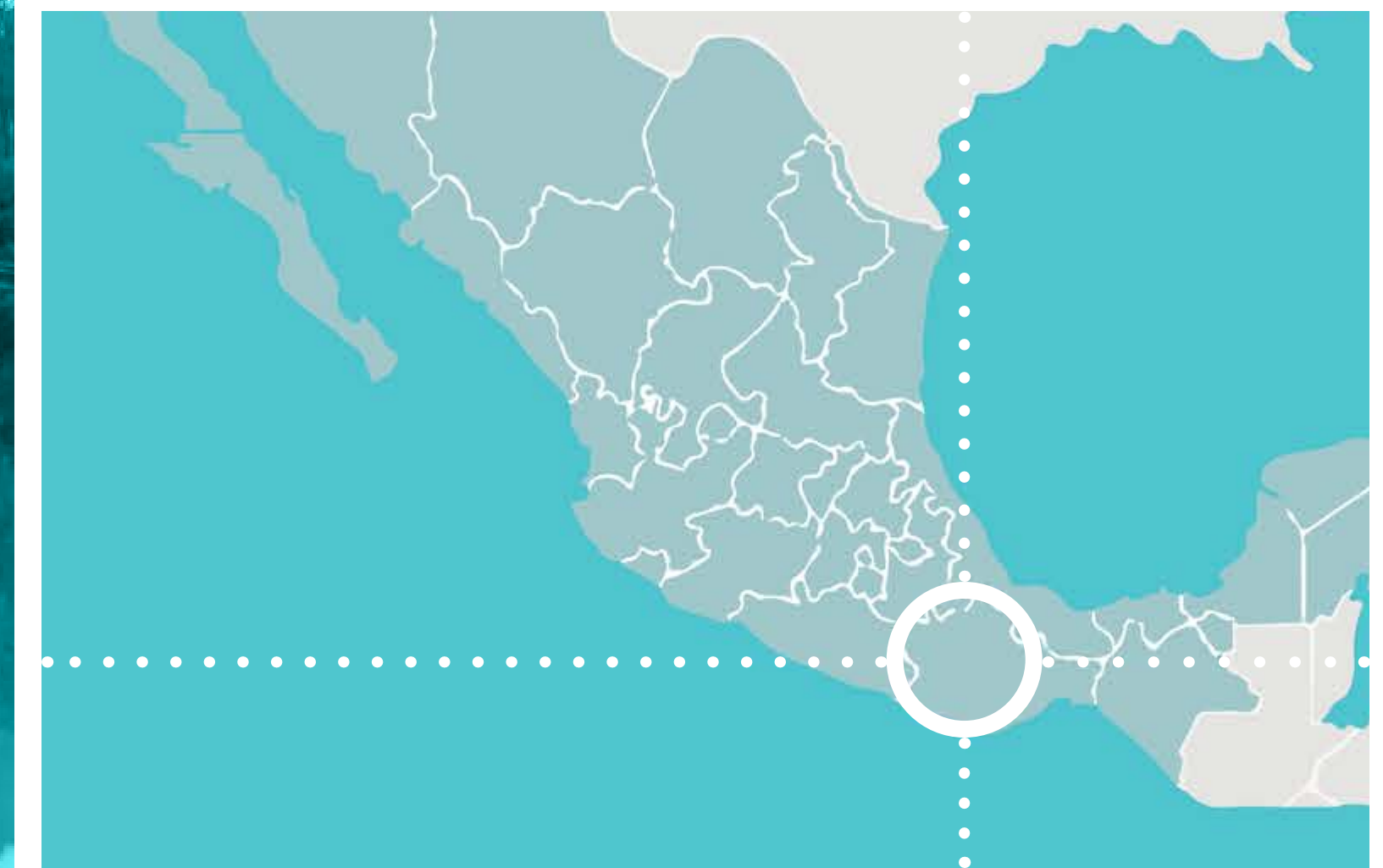
4. Disinfection/Storage

- Chlorine is added to the water to kill bacteria and viruses, preventing water borne diseases like cholera and typhoid. The water during this process can also be stored, and large containers will be used to allow the farmers and the community to have access to clean and consumable water.
- Gardens will be integrated to exhibit the project and will show how the water treatment process has successfully restored the river in the city. Farmers beyond the river will benefit by having access to clean water once again to irrigate their crops.

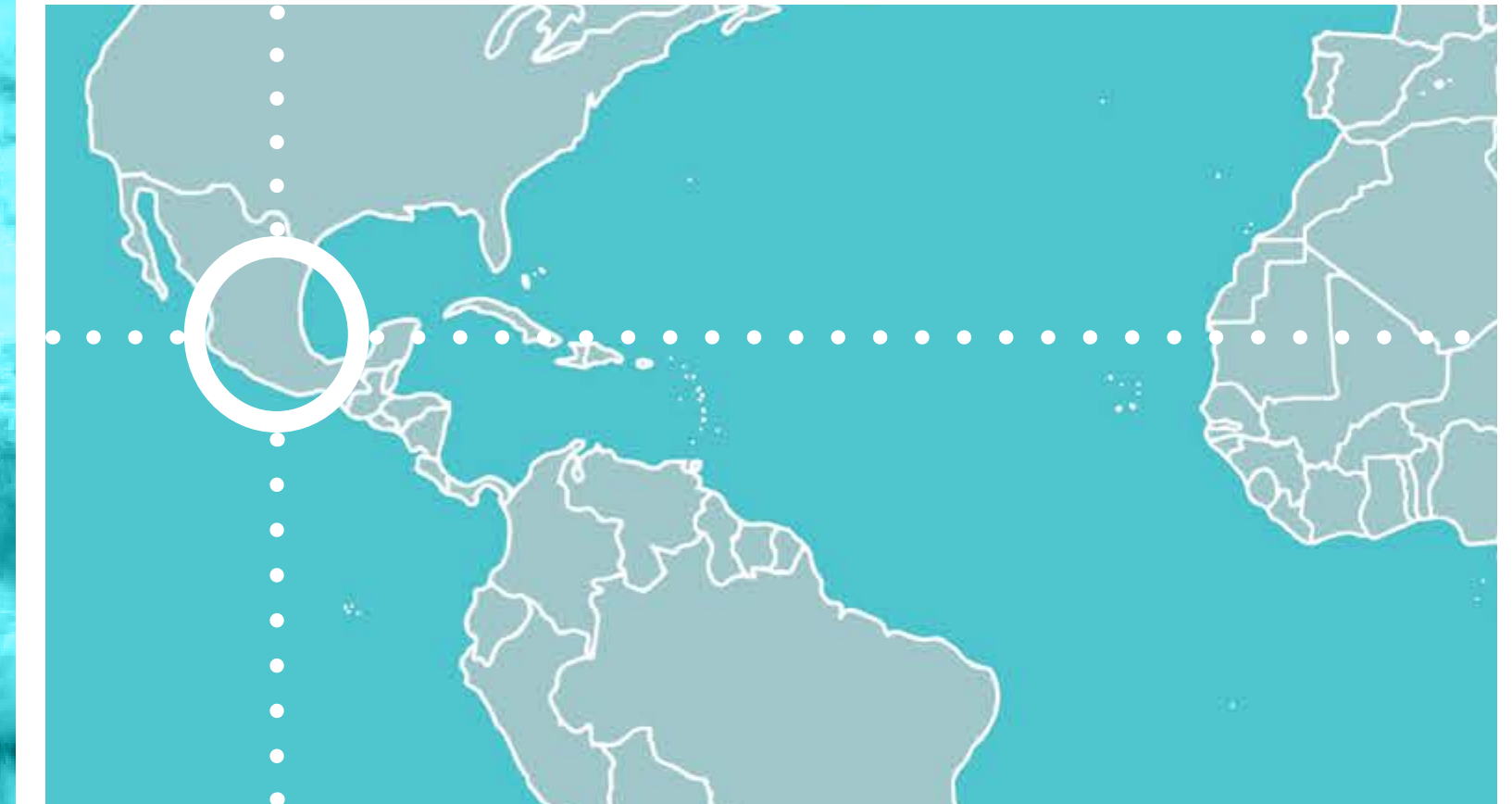




2.2
SITE SELECTION



Map 02. Oaxaca, Mexico



Map 01. Mexico, World Map



Map 03. Michuatlán Oaxaca

figure 2.2

ch 03 PRECEDENTS



figure 3.1

Precedent Criteria



Sustainable Clean Infrastructure

Sustainable infrastructure is the basic component of this design. Through sustainability the building should integrate the community to contribute with green design. The building will also improve the land that it sits on and revitalize the river that flows through it.



Water Renewable Center

Replenishing the river is vital to the survival of smaller pueblo's. Creating cleaner water will supply local farmers with resources that are needed to grow and harvest produce.



Community and Culture Center

Replenishing the river is vital to the survival of smaller pueblo's. Creating cleaner water will supply local farmers with resources that are needed to grow and harvest produce.



Sustainable Edge with Market

Creating a market that incorporates the water brings acknowledgment to the condition of the river. Allows people to create multi use spaces.



figure 3.2

El Guadual Children Center

Location: Villa Rica, Colombia

Architect: Daniel Joseph Feldman Mowerman + Iván Dario Quiñones Sanchez

Sustainable infrastructure is the basic component of this design. Through sustainability the building should integrate the community to contribute with green design. The building will also improve the land that it sits on and revitalize the river that flows through it. El Guadual has generated a notable urban impact for it offers generous sidewalks and landscape to the public, an open public outdoor movie theater, a semi-private arts and performing room open to the community at night and weekends, and a civic square. The wide array of public amenities has made of El Guadual a new pole of activity within Villa Rica.

cool, and the multi-layered roof controls the impact of the sun inside the rooms. The use of bamboo as a way of re-valuing local traditions in a contemporary way speaks of the need to use local materials as well as preserve the riverbeds. Each classroom collects rain water that is used for gardening and maintenance, but makes the process of collection and utilization evident for the kids and visitors. The central water feature recirculates the water it uses and allows kids to interact with water as a recreational element.

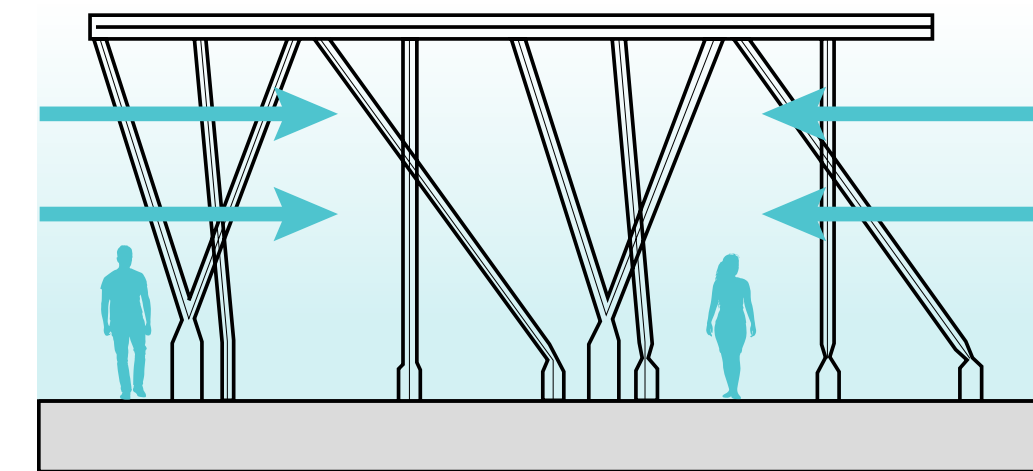
The project is an example of low tech environmental construction. It is responsible with the environment in terms of the materials it use, the water and energy it consumes, and the durability of the materials. The spaces all receive natural light throughout the days and are ventilated naturally allowing the center to work without the need of energy. The textured concrete walls absorb heat keeping the spaces



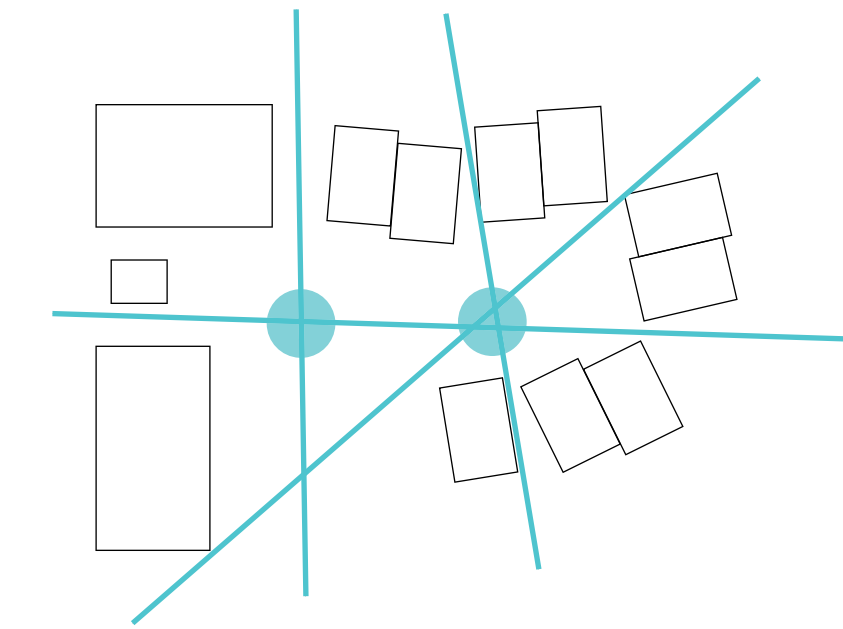
figure 3.3



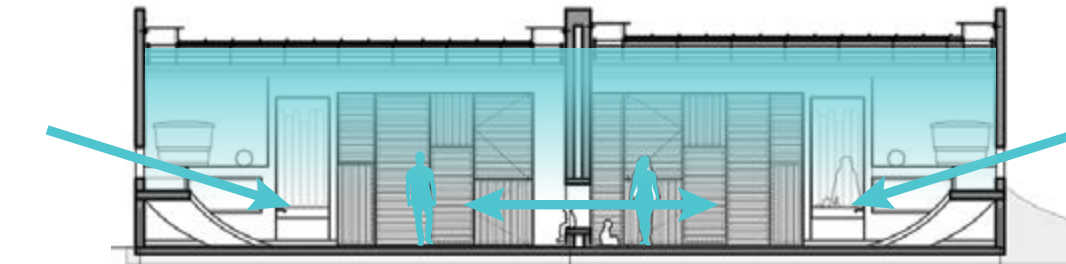
figure 3.4



1. Walk way has vernacular material and design. The open walkway allows for open air ventilation



2. The center has visual connectivity, and creates a safe space between the buildings for the children



3. The interior spaces have connectivity, and slides are introduced to incorporate the children

Madrid Rio

Location: Madrid, Spain

Architect: Burgos & Garrido + Porras La Casta + Rubio & Álvarez-Sala + West 8

In 2005, an invited international competition was announced for a design of the reclaimed area above a tunnel holding a section of the M30 ring motorway immediately adjacent to the old city center. The team proposed to resolve the urban situation exclusively by means of landscape architecture, and were the winning submission. The design is founded on the idea »3 + 30« – a concept which proposes dividing the 80 hectare urban development into a trilogy of initial strategic projects that establish a basic structure which then serves as a solid foundation for a number of further projects, initiated in part by the municipality as well as by private investors and residents.

A total of 47 sub-projects with a combined total budget of 280 million Euros have since been developed, the most important of which include: the Salón de Pinos, Avenida de Portugal, Huerta de la Partida, Jardines de Puente de Segovia, Jardines de Puente de Toledo, Jardines de la Virgen del Puerto and the Parque de la Arganzuela

In addition to the various squares, boulevards and parks, a family of bridges were realized that improve connections between the urban districts along the river. The first sub-projects were realized in spring 2007. The realization of the whole project is planned for spring 2011. The Salon de Pinos is designed as a linear green space, which will link the existing and newly designed urban spaces with each other along the Manzanares River. Located almost entirely on top of the motorway tunnel, the reference to the flora of the mountains was chosen for the outskirts of Madrid. The pine tree which is able to survive on the barren rock is planted in more than 8.000-fold. A "choreography" of the tree planting with a repertoire of cuts, selection of grown characteristic trees, combined and inclined planting leads to a natural and sculptural character of the space to create a botanical monument.



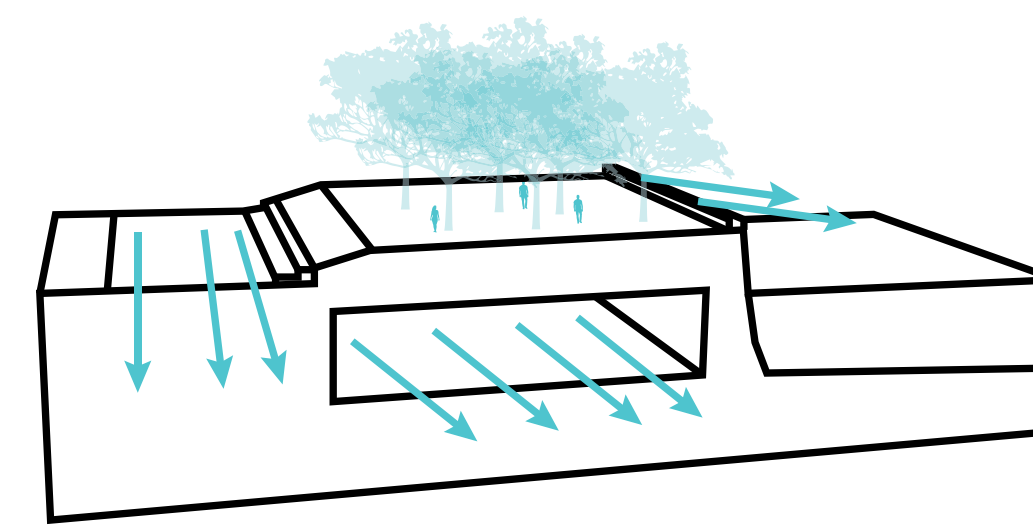
figure 3.5



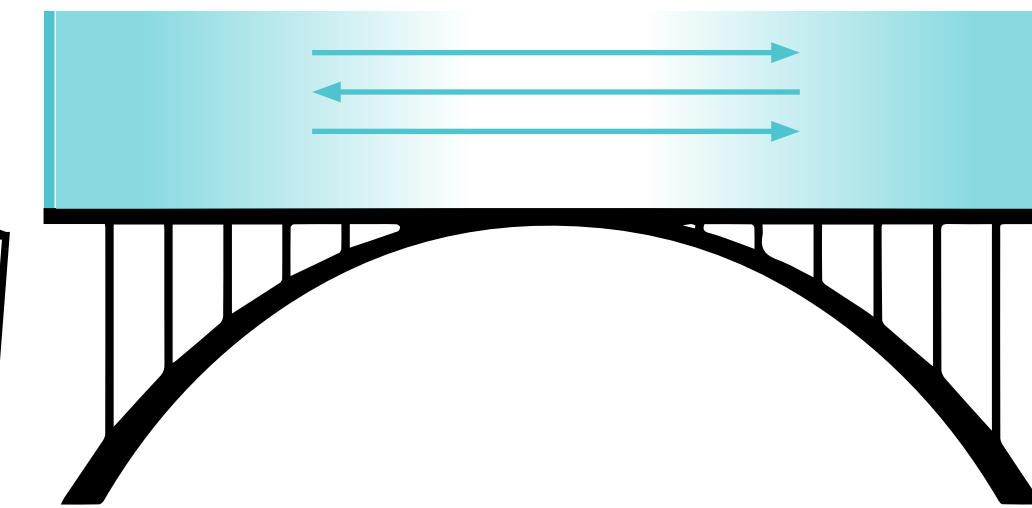
figure 3.6



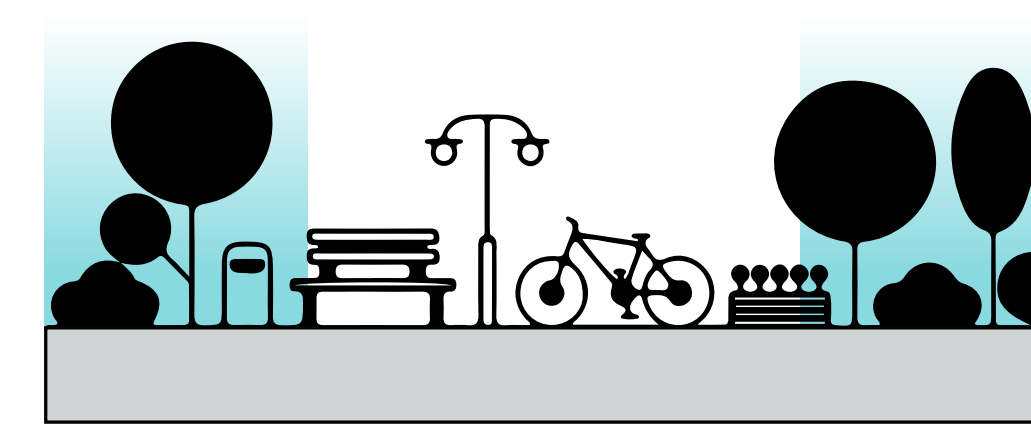
figure 3.7



1. The river is integrated into the urban landscape. The road is buried under the river. In order to bring the river up.



2. The bridges are used to connect the two sides of the river. Each individual bridge has an integrated design.



3. The park is integrated into the river edge. Creating public spaces

Community Center San Bernabé

Location: Monterrey Mexico
Architect: Pich-Aguilera Arquitectos

The project for the community center of San Bernabé offers a building-street, which tries and transmits civic values inherent to the urban structure of the neighborhood. Thus, the specific uses of the functional program will be located in dispersed volumes, arranged along a guideline, thus configuring a street that will function as such and that is really the heart of the project. This building-Street is conceived as a framework for the relationship and the expression of individuals and the community, so that it will be getting stronger as the citizens start to discover it and living freely in it too. In addition, it attempts to bind with the web of existing neighborhood streets, prolonging therefore their most common routes and giving priority to pedestrians over the traffic. This street built within, acts like the backbone of the built bodies that house the functional program of the community center and responds to an urban vision as a whole, in this sense its journey is punctuated by three spaces of quite a length

Which may be called squares, each one of them linked to an adjacent activity.

On the other hand, the whole project was conceived as a bio-climatic infrastructure which tries to obtain its levels of comfort by combining the local natural resources, both climatic and material ones, leaving the contribution of conventional machinery as a complementary provision to meet only extreme heat spikes throughout the year. The project includes an allocation for renewable energy production, integrated into the architecture from the system of "solar beams" that make up the shade structure of the squares.



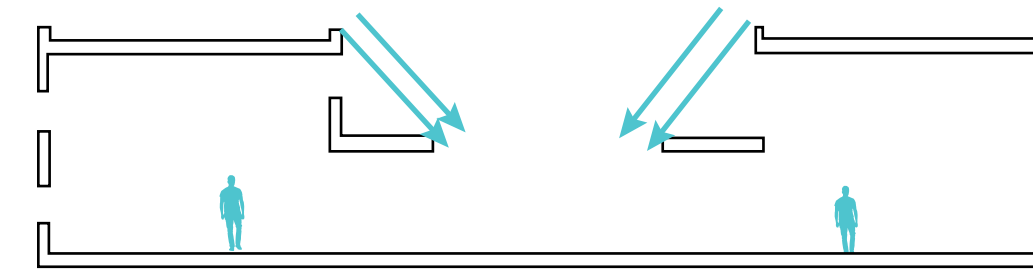
figure 3.8



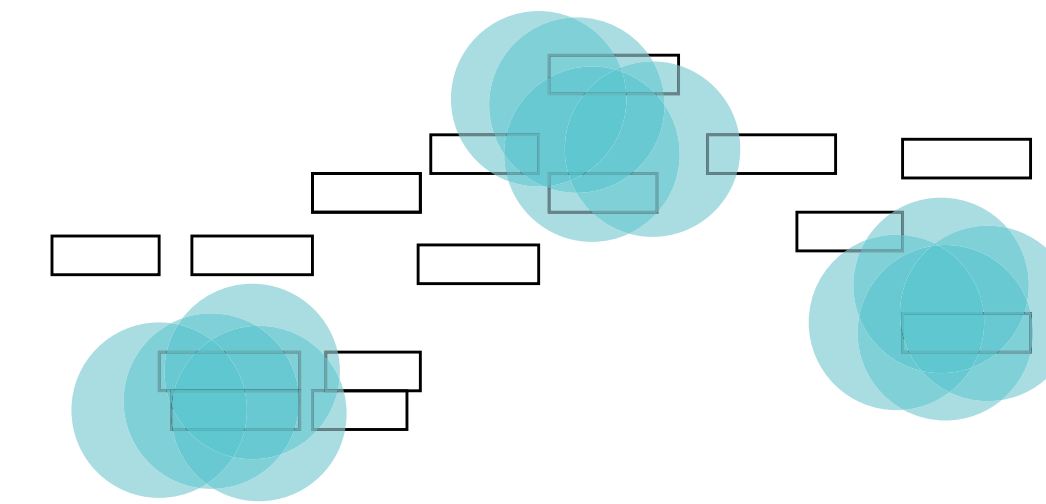
figure 3.9



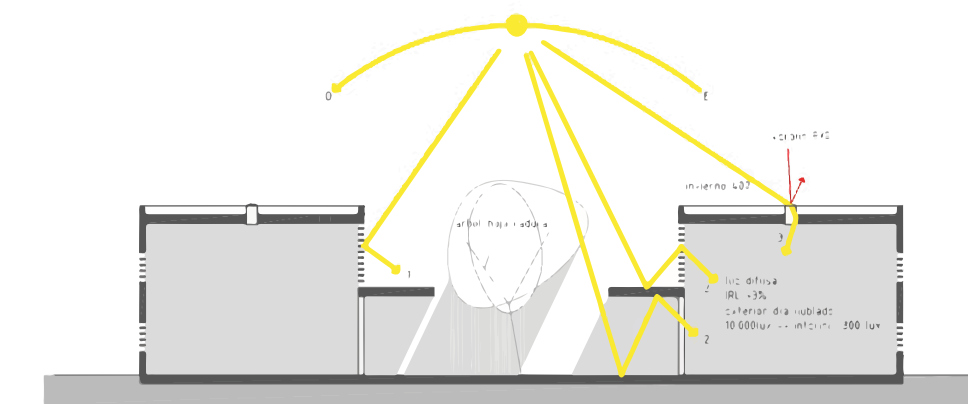
figure 3.10



1. The building has a water collection system that is centralized to the building



2. Clustering of ground floor rooms to minimize the ground footprint and allow for more open air design.



3. Offset roof to maximize light capturing. It also provides shading for a very hot region. Climate reactive design.

Cheonggyecheon Stream

Location: Seoul, South Korea
Architect: Mikyong Kim Design

Cheonggyecheon is an 11 km long modern stream that runs through downtown Seoul. Created as part of an urban renewal project, Cheonggyecheon is a restoration of the stream that was once there before during the Joseon Dynasty (1392-1910). The stream was covered with an elevated highway after the Korean War (1950-1953), as part of the country's post-war economic development. Then in 2003, the elevated highway was removed to restore the stream to its present form today. The stream starts from Cheonggye Plaza, a popular cultural arts venue, and passes under a total of 22 bridges before flowing into the Hangang (River), with many attractions along its length.

At the heart of Seoul lies one of the world's greatest urban design projects: the Cheonggyecheon River linear park. A green oasis in a concrete jungle, this inspiring urban renewal success underwent a dramatic transformation from a traffic-choked elevated freeway and concrete paved waterway into a lush, 3.6-mile-long "day-lit" stream corridor that attracts over 60,000 visitors daily.

The restoration process has also provided huge boosts to local biodiversity and catalyzed economic development. Keep reading to learn the story behind Seoul's ambitious stream recovery project and to flip through our gallery for pictures of the inspiring urban park.



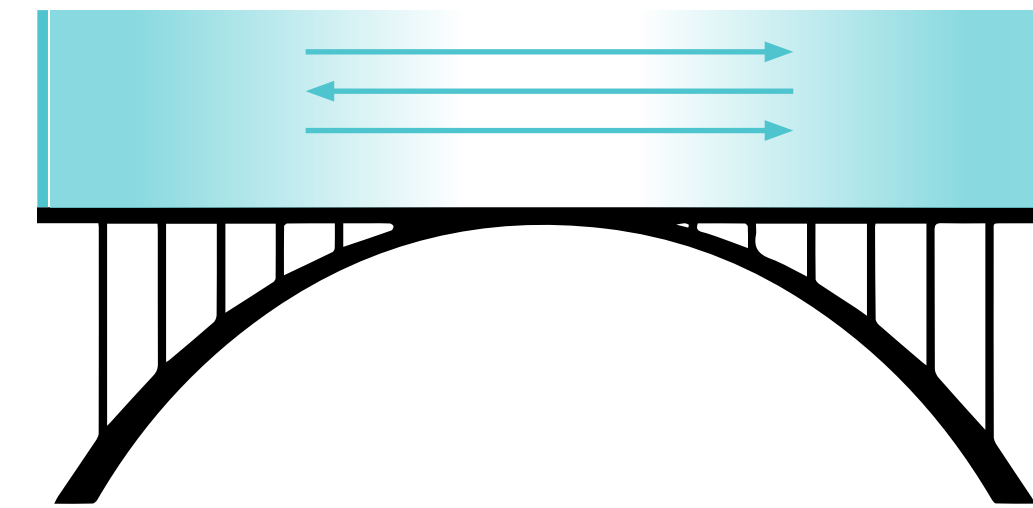
figure 3.11



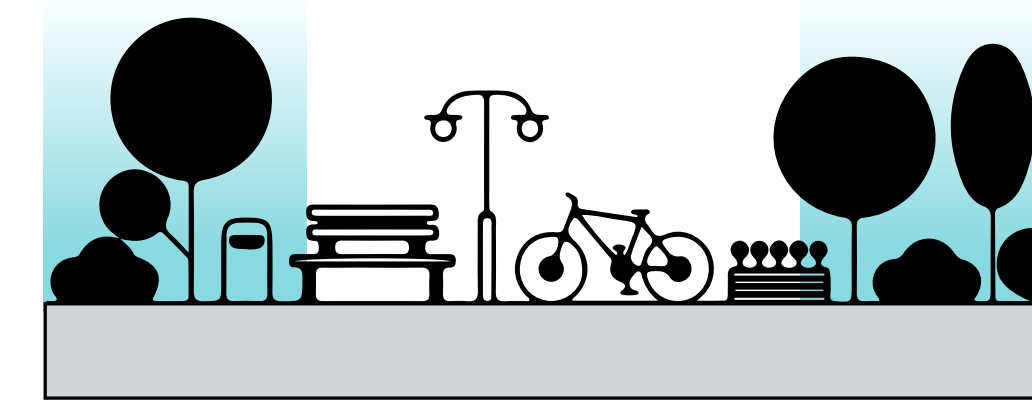
figure 3.12



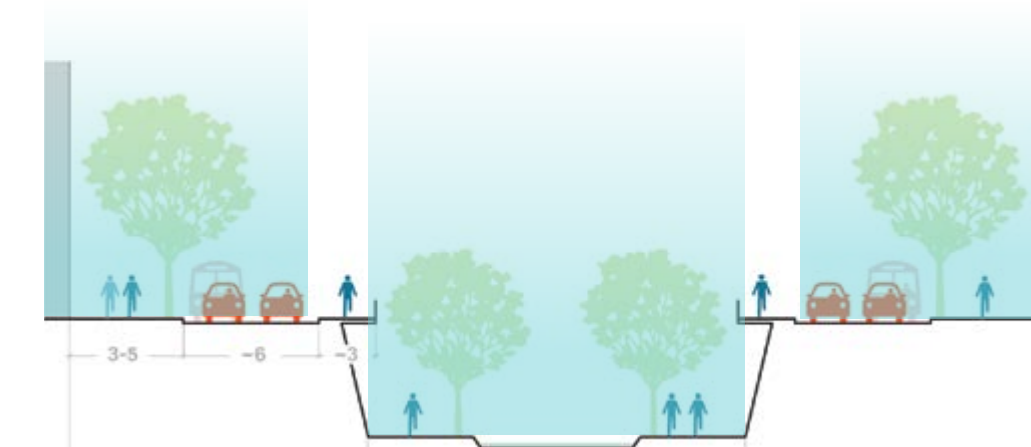
figure 3.13



1. The bridges are used to connect the two sides of the river. Each individual bridge has an integrated design.



2. The park is integrated into the river edge. Creating public spaces



3. The stream is connected to the urban street. There is a connection between both heights at different bridges.

ch 04 DESIGN PROCESS



4.1 DESIGN INTEGRATION

There are 4 components to water restoration. Miahuatlan is a Oaxacan city that has polluted there river for decades. This pollution includes industrial waste and domestic sewage. Integrating water into the urban realm will expose the conditions of the river and will make the community acknowledge the effects that they are inputting into the river. The cleaning system will be separated into 4 areas that includes different program at each given point. The programs include a bio park, market, community hub, and gardens. The final step in this system will express how the system cleaned the water. A pedagogical approach will be implemented to create a more sustainable future a developing city like Miahuatlan. Integration of program with the water condition is essential in producing a successful project.

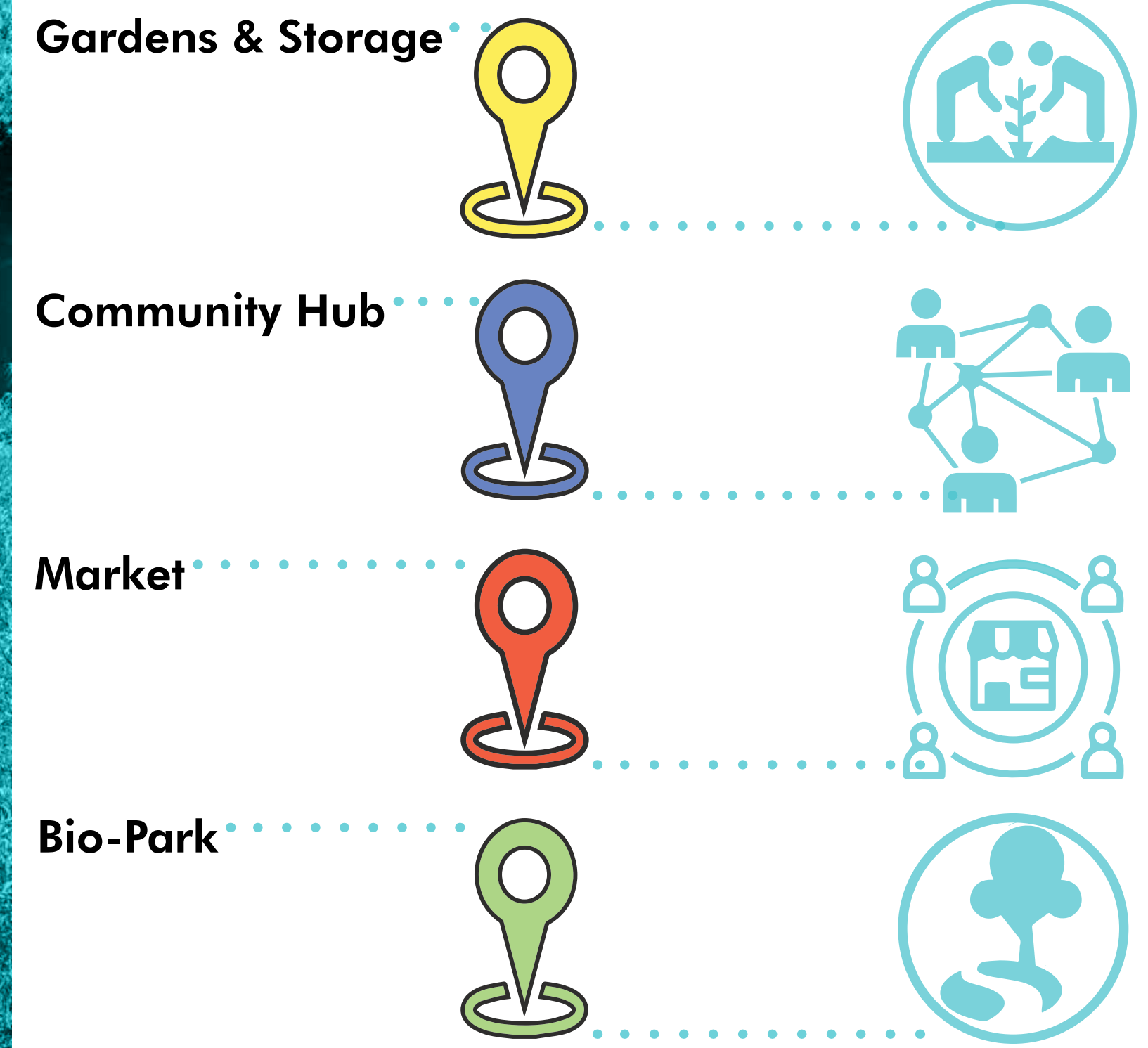


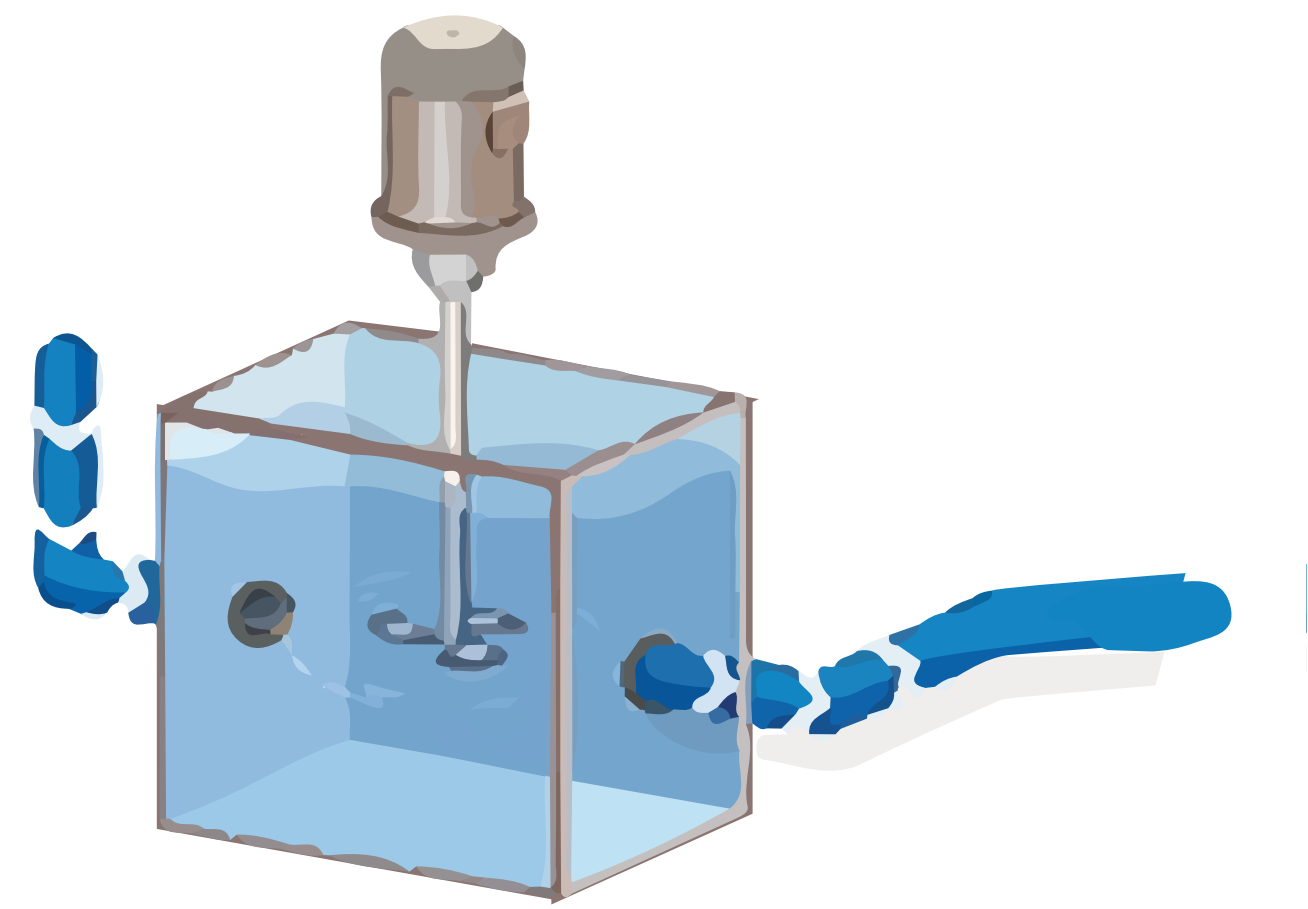
figure 4.1



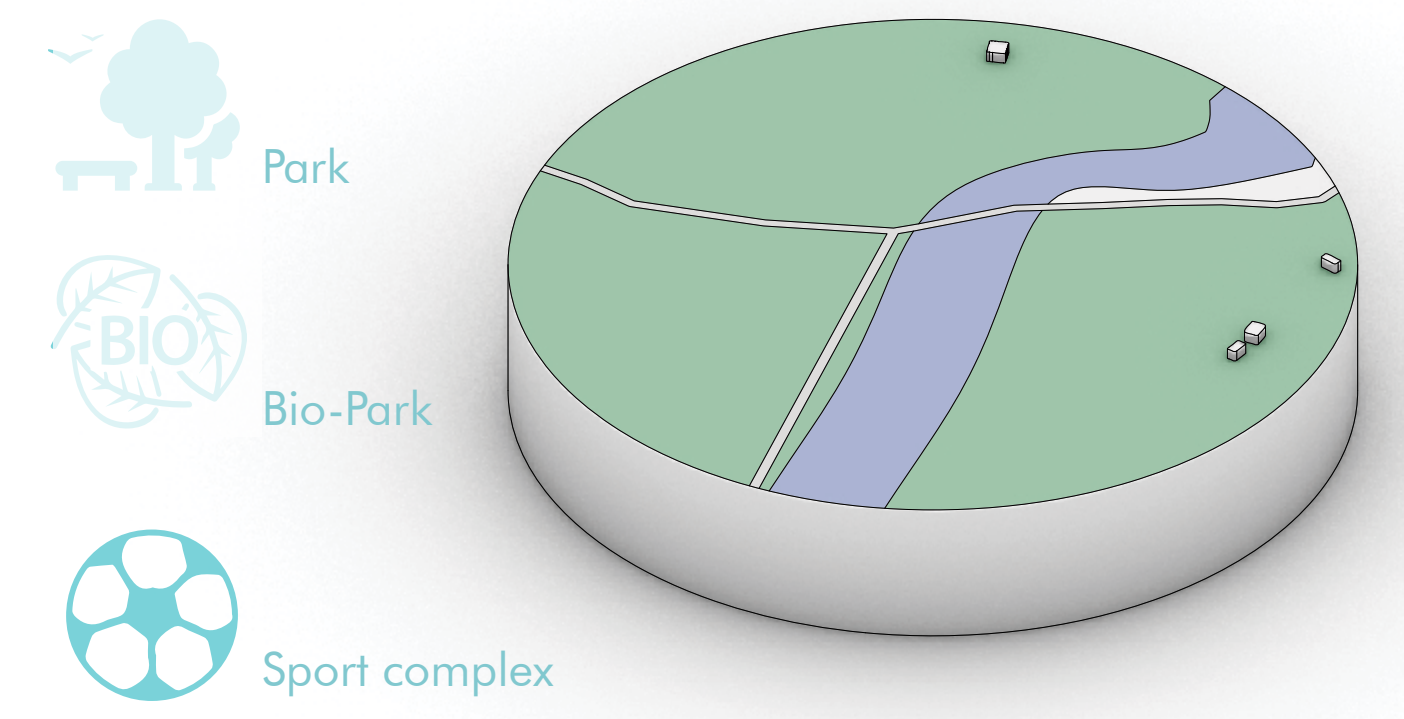
figure 4.2

1. Coagulation

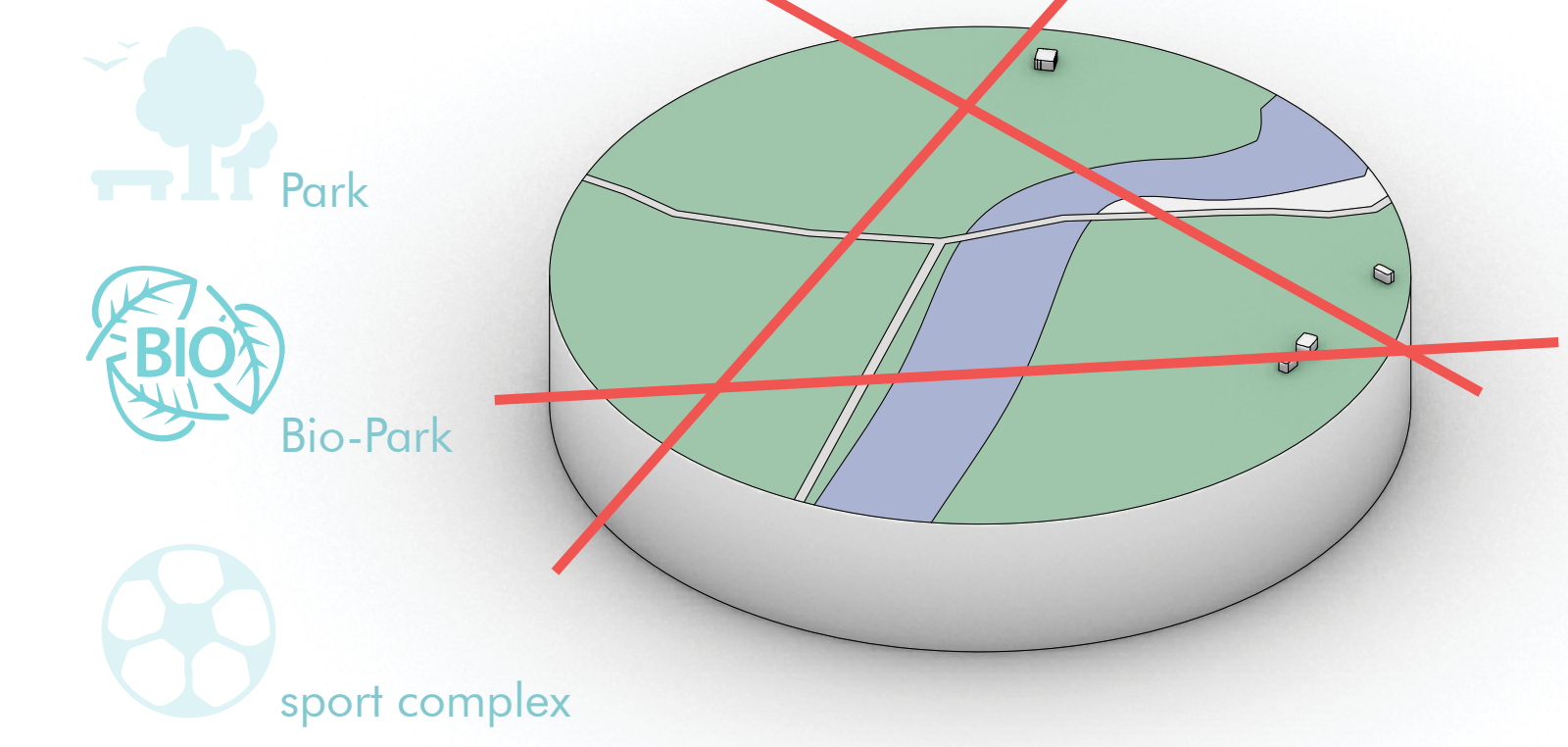
- Coagulants like aluminum sulfate and ferric chloride are mixed into the water. These particles of dirt and dissolved substances in the water clump together so that they can be removed.
- The program integrated into this part of the water treatment process includes a park and community focused programs. Intertwining the urban-scape into the water storage facilities creates a pedagogical design that integrates the community into a learning about sustainability.



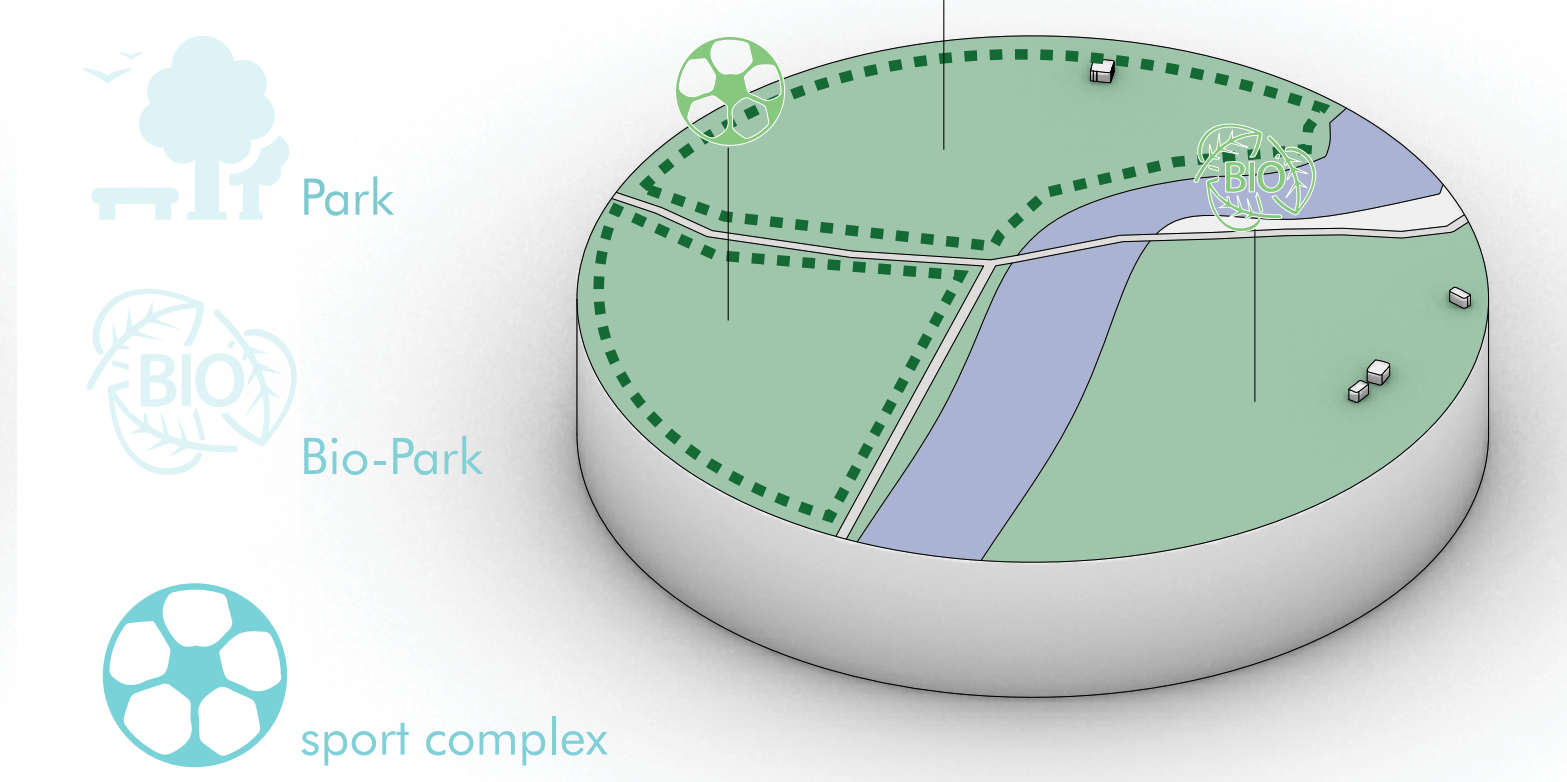
Coagulation-BioPark
park goals



Coagulation-BioPark
bridge connectivity

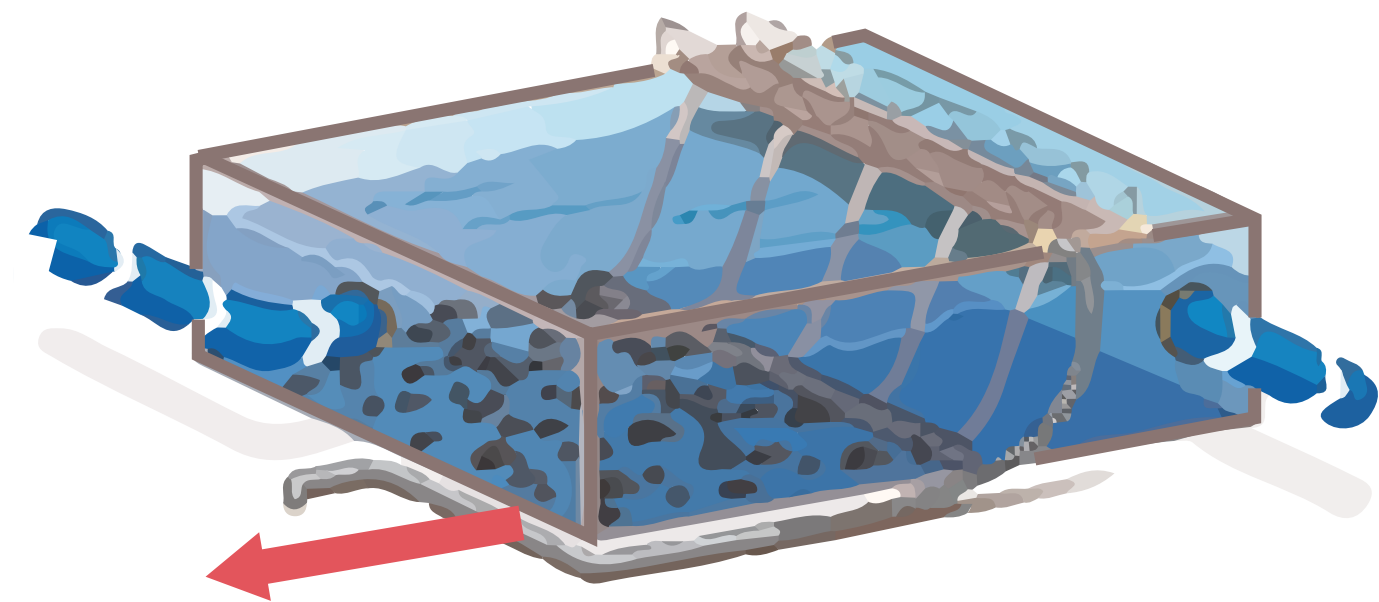


Coagulation-BioPark
goals intergrated

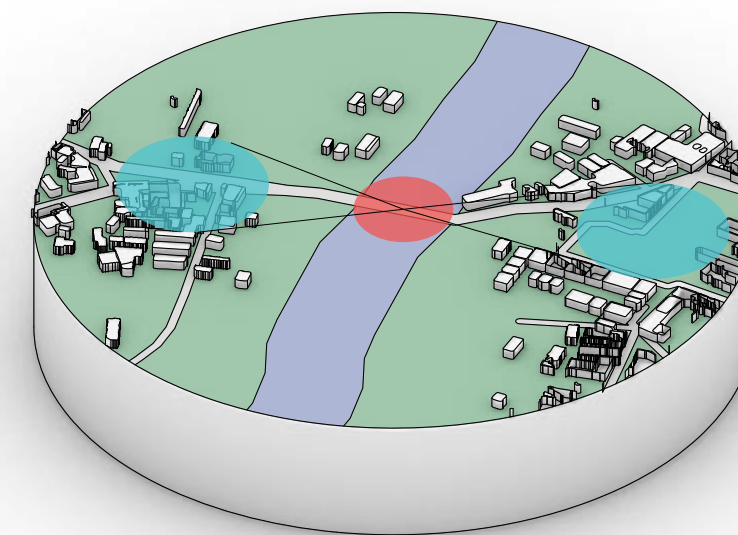


2. Sedimentation

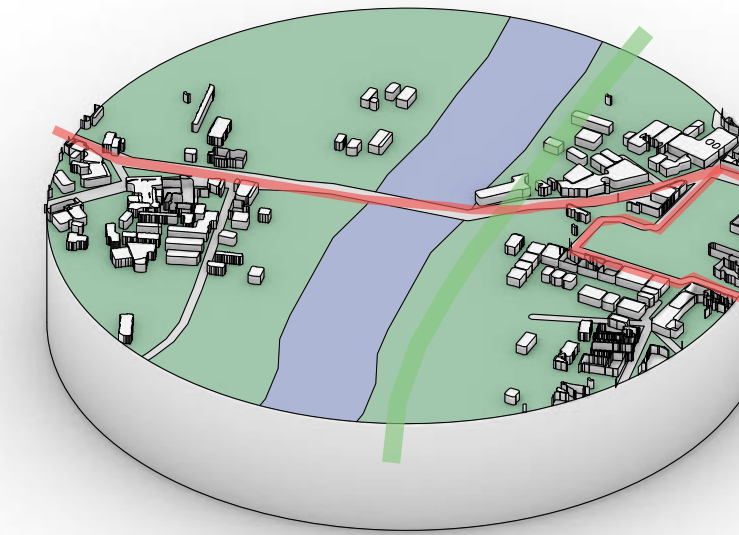
- The large clumped particles increase in size under slow mixing in a process called flocculation. Most of them sink to the bottom and form a sludge, which can be removed from the water, which is then treated and disposed of.
- The program integrated into this system is the Monday market located at the heart of the city. Miahuatlan's Market is a collection of pueblos who come together to sell the produce that they have harvested. The system is intended to be integrated at the main bridge that connects into the city.



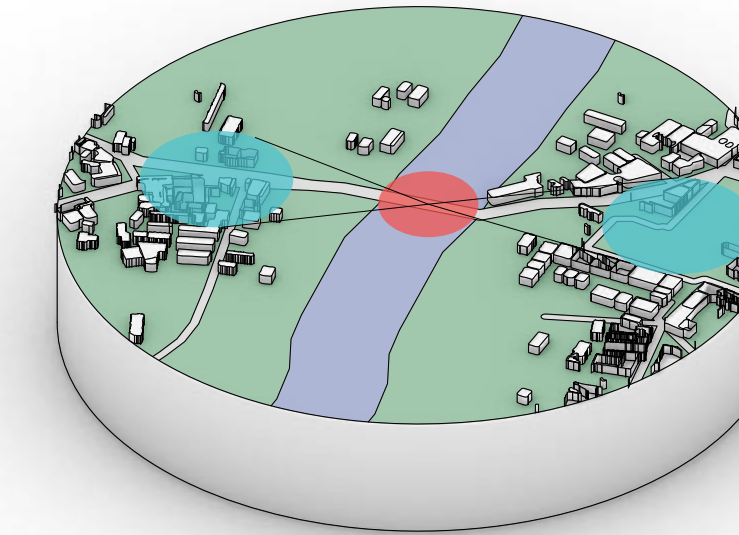
Sedimentation-Market
connect city



Sedimentation-Market
link road to edge

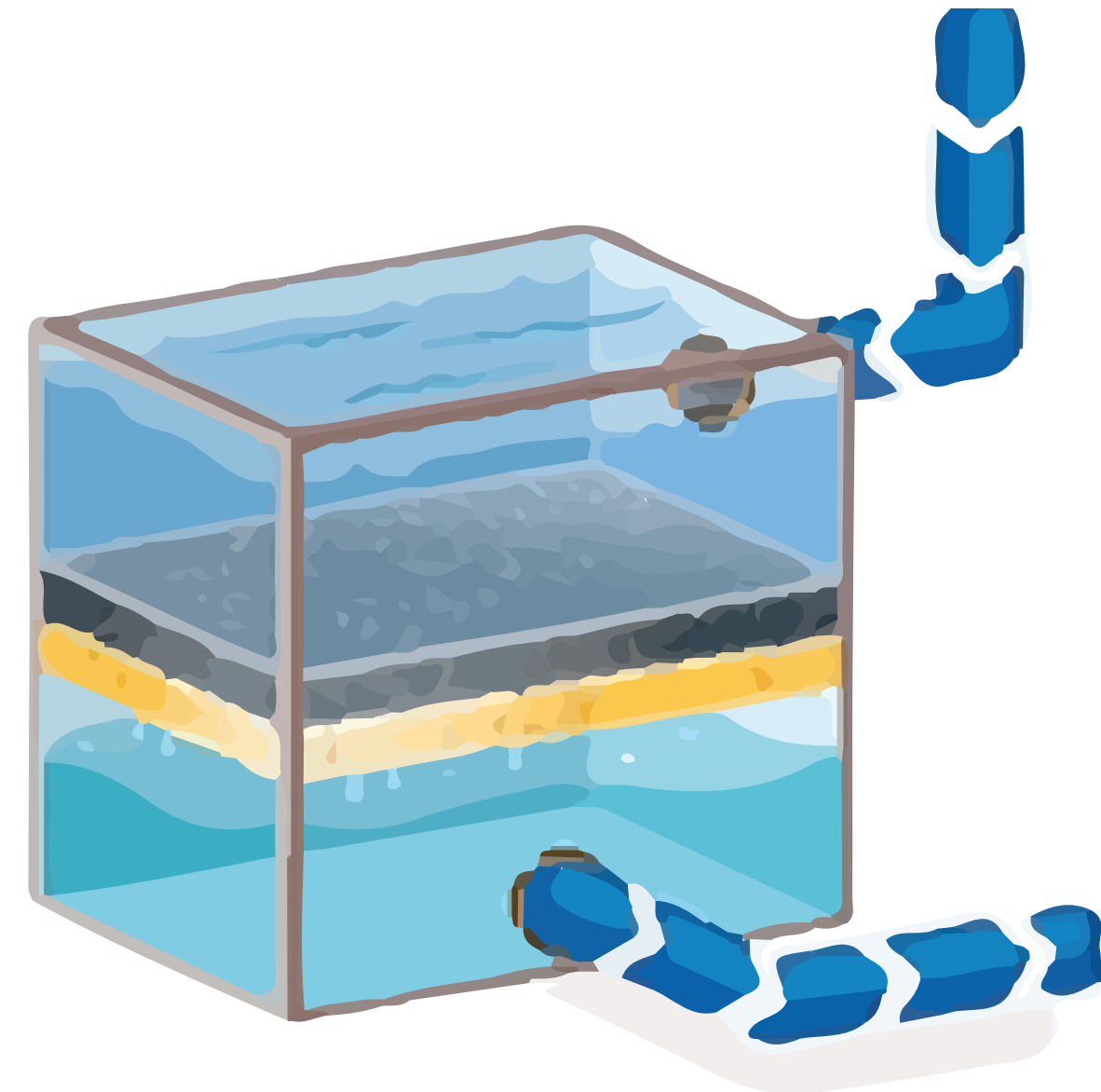


Sedimentation-Market
market design goals



3. Filtration

- Some particles remain in the water after sedimentation; these are removed by filtration through coal, sand, and gravel beds. The water travels through these layers and removes particles at different intervals of size.
- The community hub will be integrated into this system. This building will integrate a pedagogical approach to enhance the community's knowledge of pollution. The program within the building will include classrooms, kitchens, and housing.



Filtration-Community Hub
building connectivity



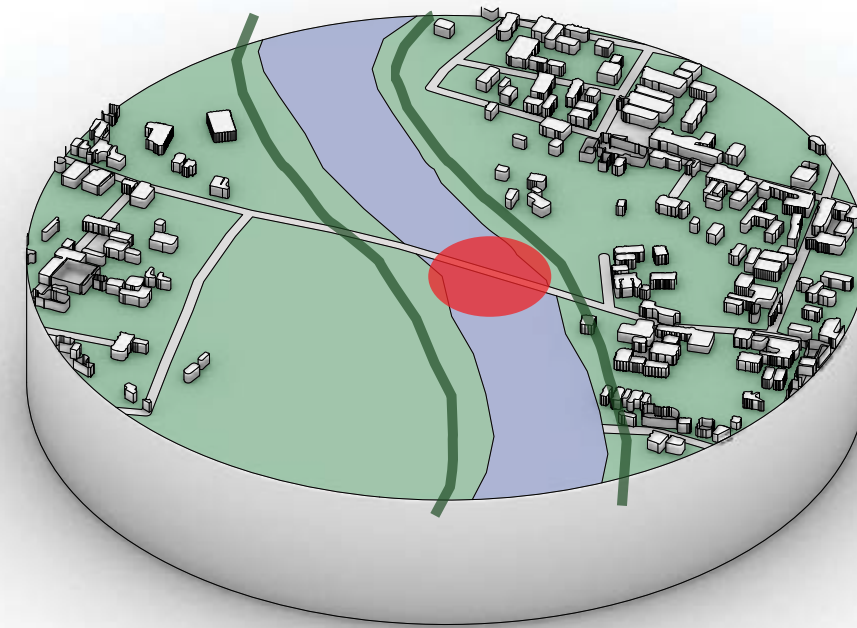
Pedagogical design



Community hub



water integration into urban realm



Filtration-Community Hub
program along edge



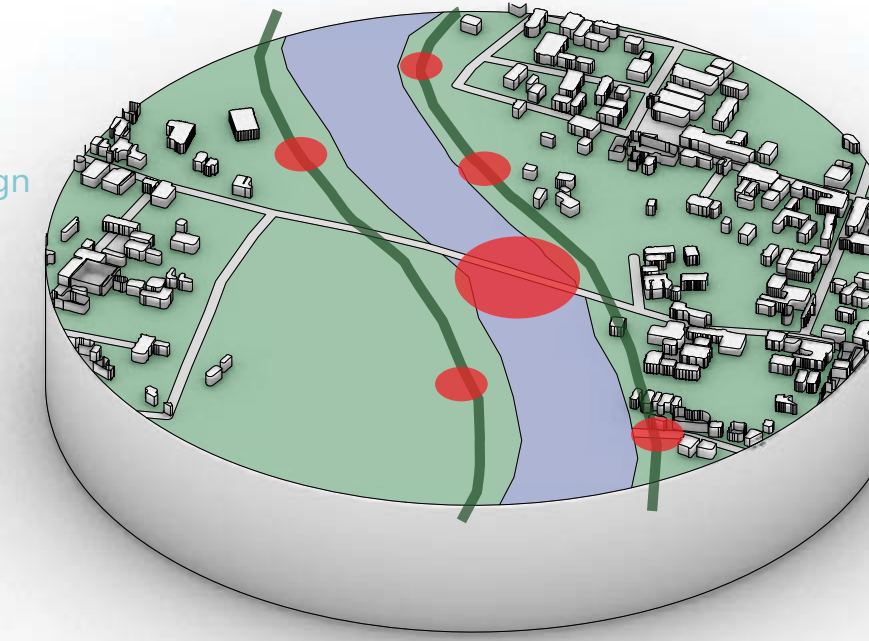
Pedagogical design



Community hub



Water integration into urban realm



Filtration-Community Hub
connect water with urban realm



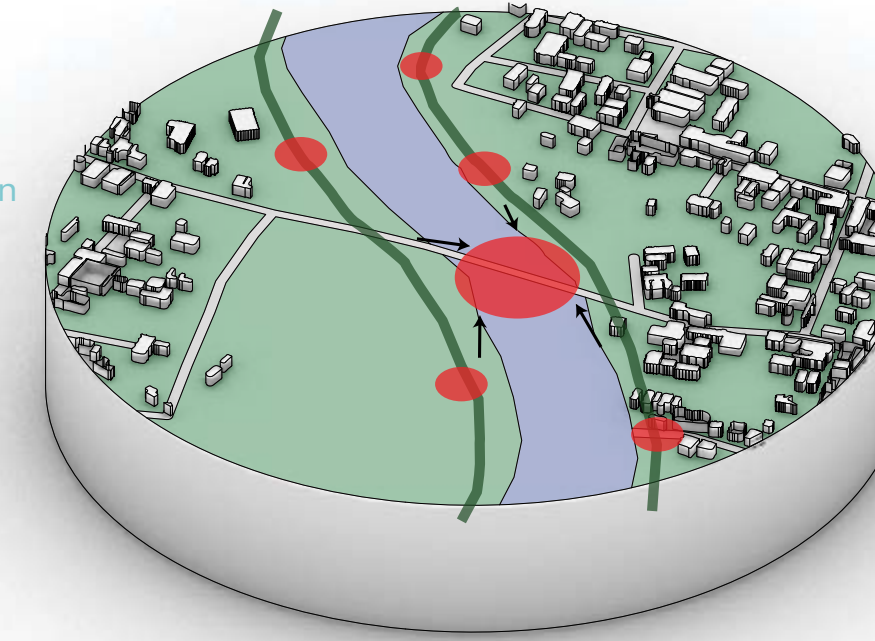
Pedagogical design



Community hub

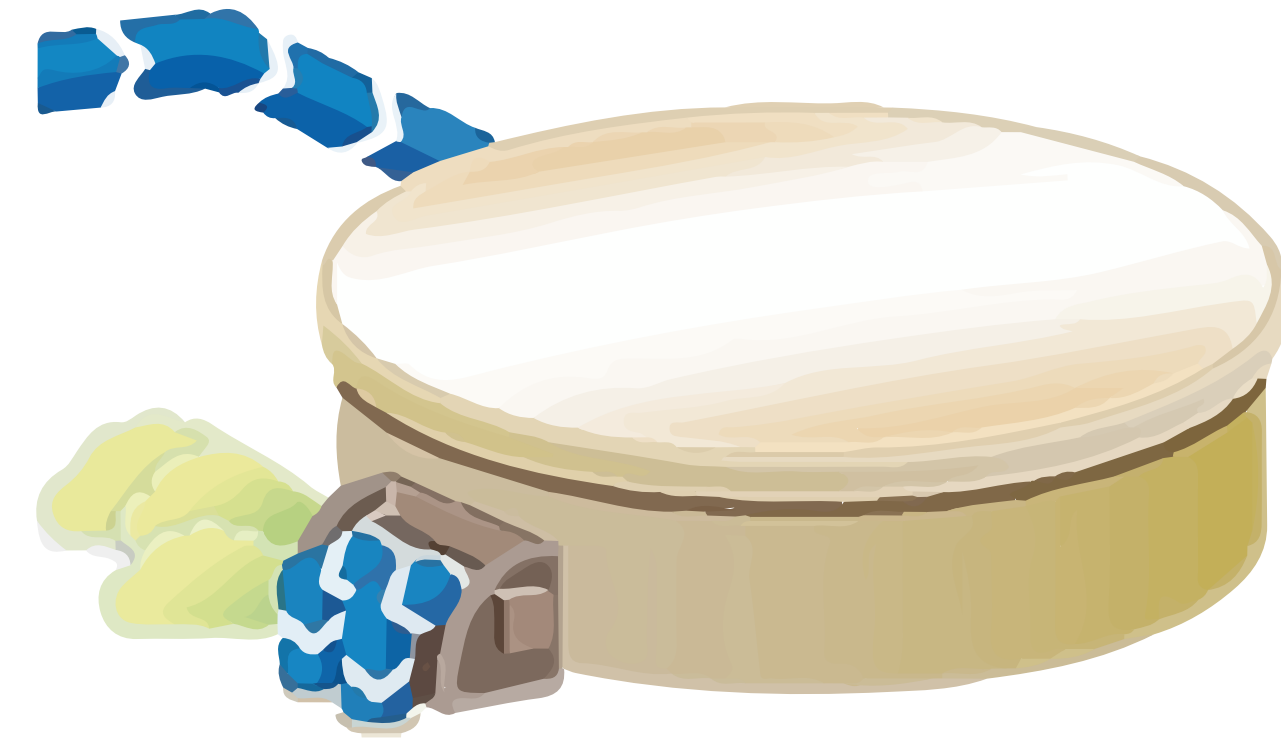


water integration into urban realm



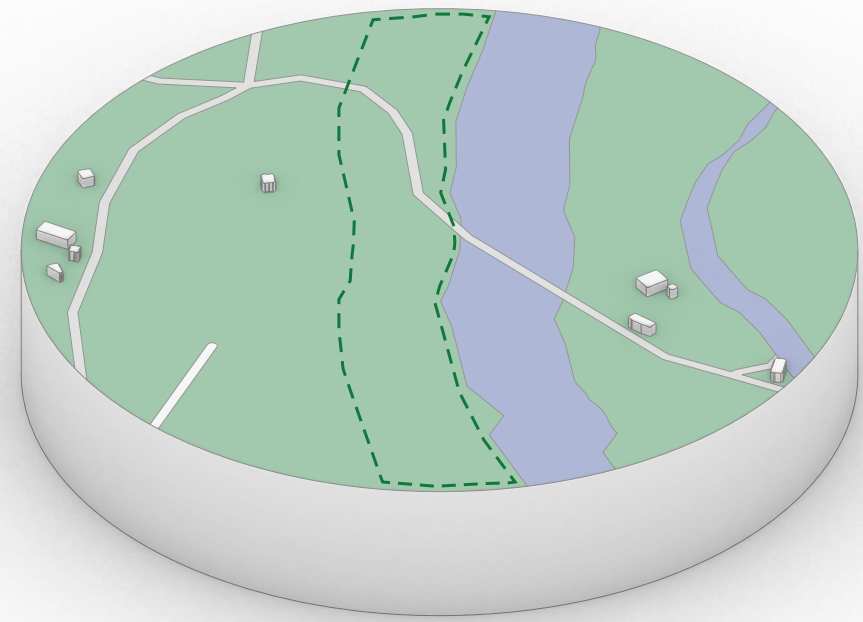
4. Disinfection

- Chlorine is added to the water to kill bacteria and viruses, preventing water borne diseases like cholera and typhoid. The water during this process can also be stored, and large containers will be used to allow the farmers and the community to have access to clean and consumable water.
- Gardens will be integrated to exhibit the project and will show how the water treatment process has successfully restored the river in the city. Farmers beyond the river will benefit by having access to clean water once again to irrigate their crops.



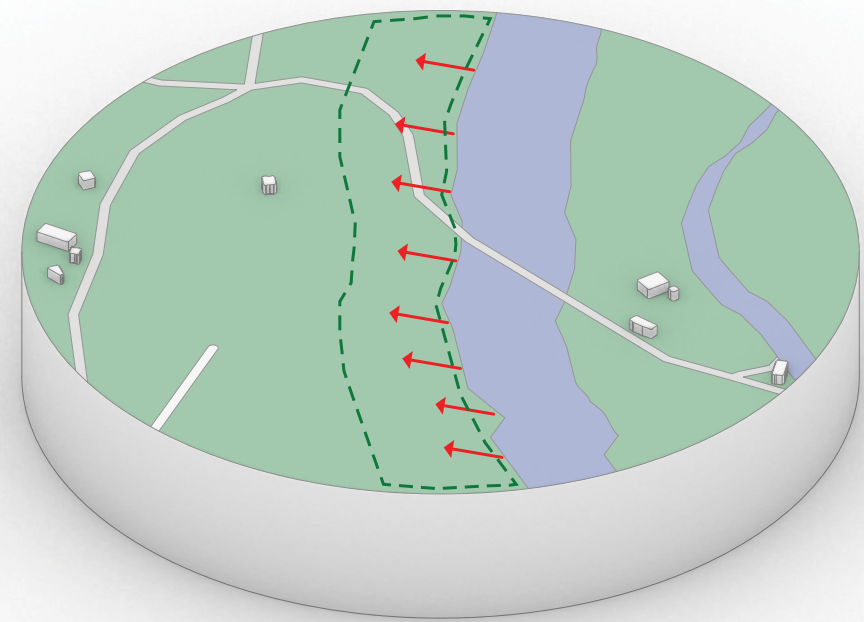
Solution-Gardens
gardens along edge

-  Gardens
-  Farmers
-  Water Re-used



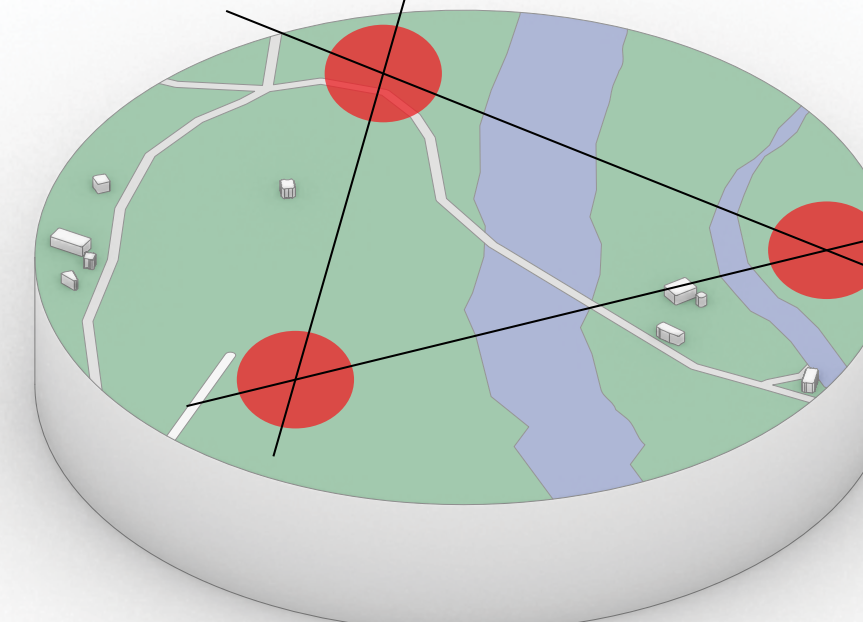
Solution-Gardens
integrate water into systems

-  Gardens
-  Farmers
-  Water Re-used



Solution-Gardens
farmers reconnected

-  Gardens
-  Farmers
-  Water Re-used



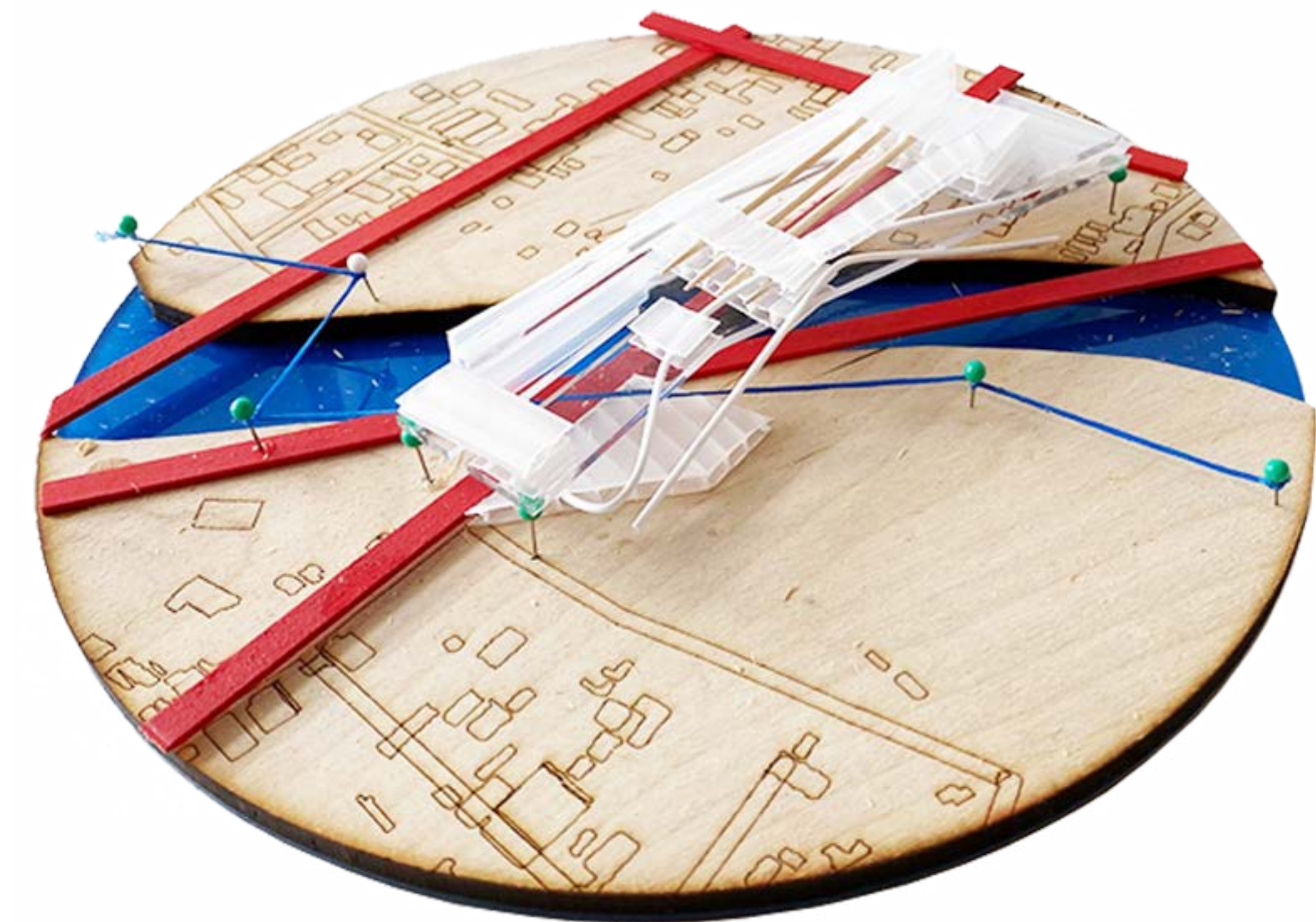
ch 05 RESPONSE



The program integrated into this part of the water treatment process includes a park and community focused programs. Intertwining the urban scape into the water storage facilities creates a pedagogical design that integrates the community into a learning about sustainability. The park is a theoretical project that may be introduced when the water system has been cleansed. Coagulation is the part of this system. This removes large clumps from water, and this can be done in large natural bio swale and tanks. Program can be intermingled within these systems such as bridges and sports complexes.

figure 5.1

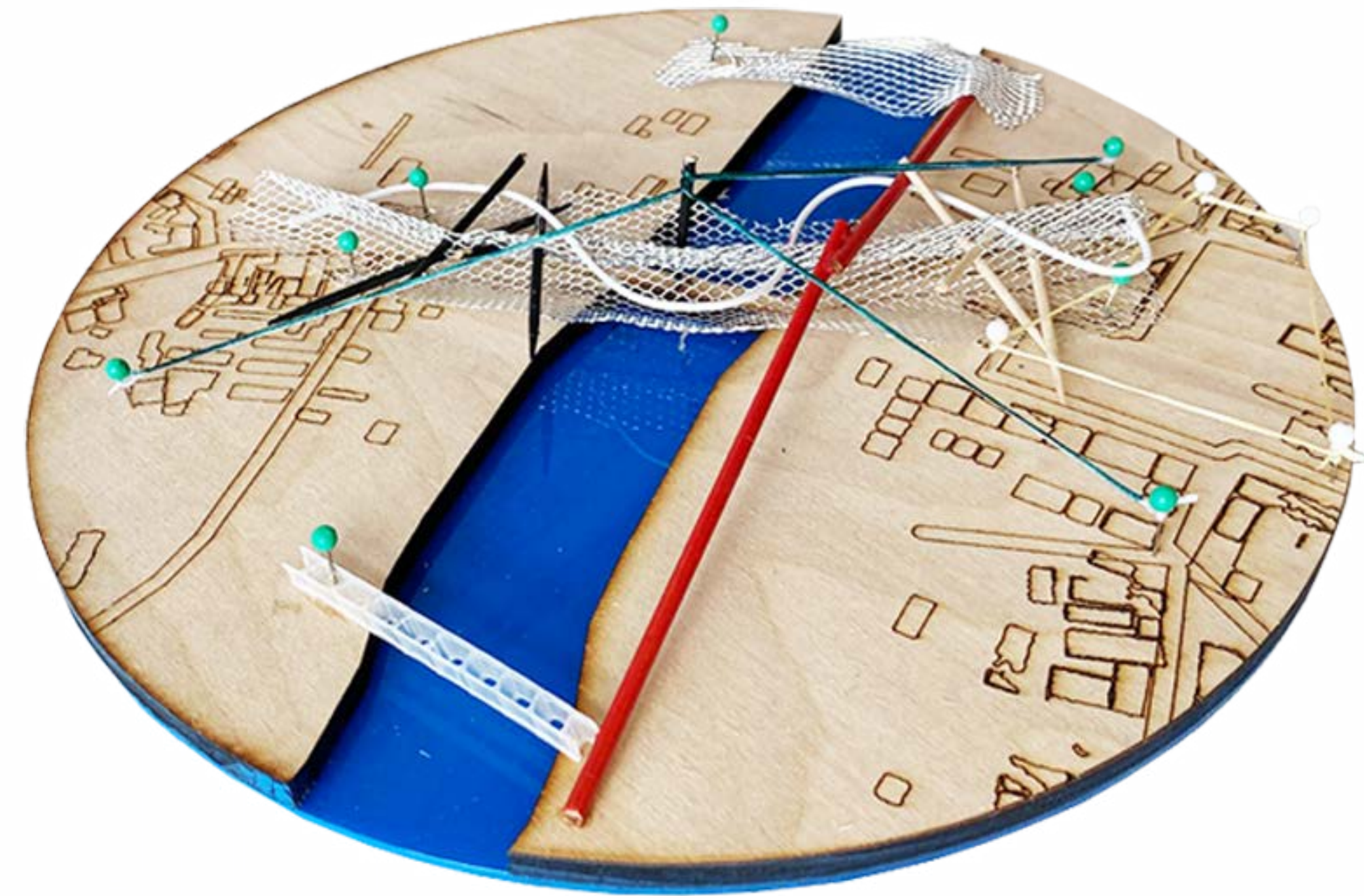




Community Hub



Bio-Park



Market



The market is implemented into the system because it is a vital part of Miahuatlan. This market is in place on Mondays and brings many farmers and people to sell their merchandise and produce. Most of these people make their living through this market. Water pollution affects local farmers that live beyond the city limit where the polluted water flows too. When purchasing produce people are aware of which produce is irrigated with clean water and which one is irrigated with the black water that is created through the city's pollution. This market design is integrated into the river and creating an edge where the community can visually see how they affect the river system. Sedimentation is integrated here where The large clumped particles increase in size under slow mixing in a process called flocculation. Most of them sink to the bottom and form a sludge, which can be removed from the water, which is then treated and disposed of.

figure 5.2



EXISTING MARKET CONDITION

Miahuatlan and other Mexican cities are known for their extensive markets. The market labyrinths run for miles full of produce and merchandise that is sold by local people that live near the city. These markets are known for their red and blue tarp vernacular aspect. These tarps are used for shading and claiming an area in the street to set up a stand. These tarps will be used as design leaders to be integrated into the river market design.



figure 5.3

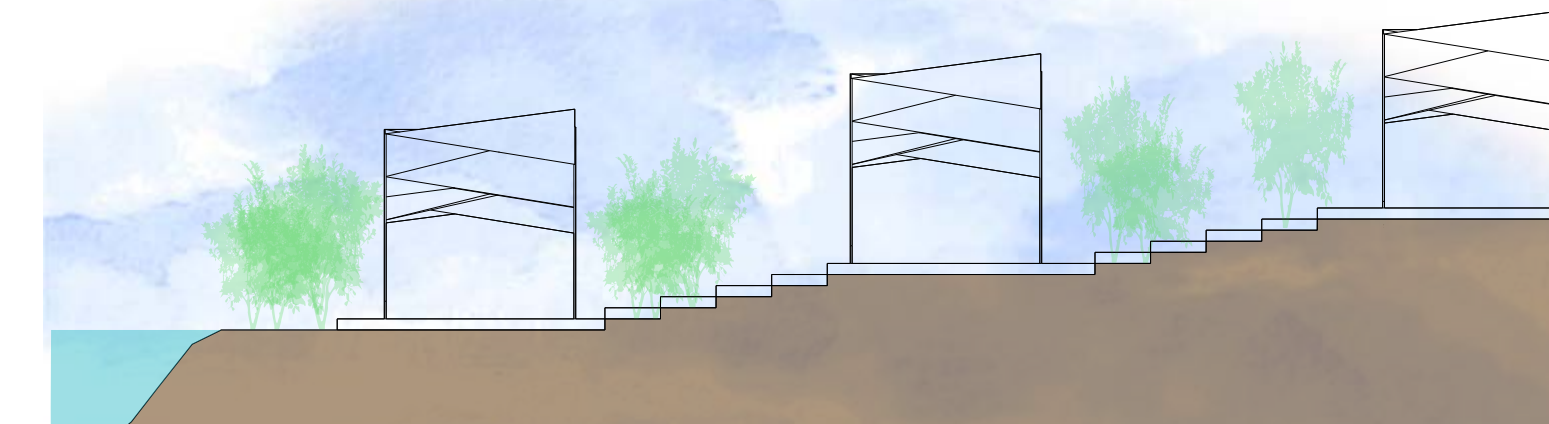


figure 5.4

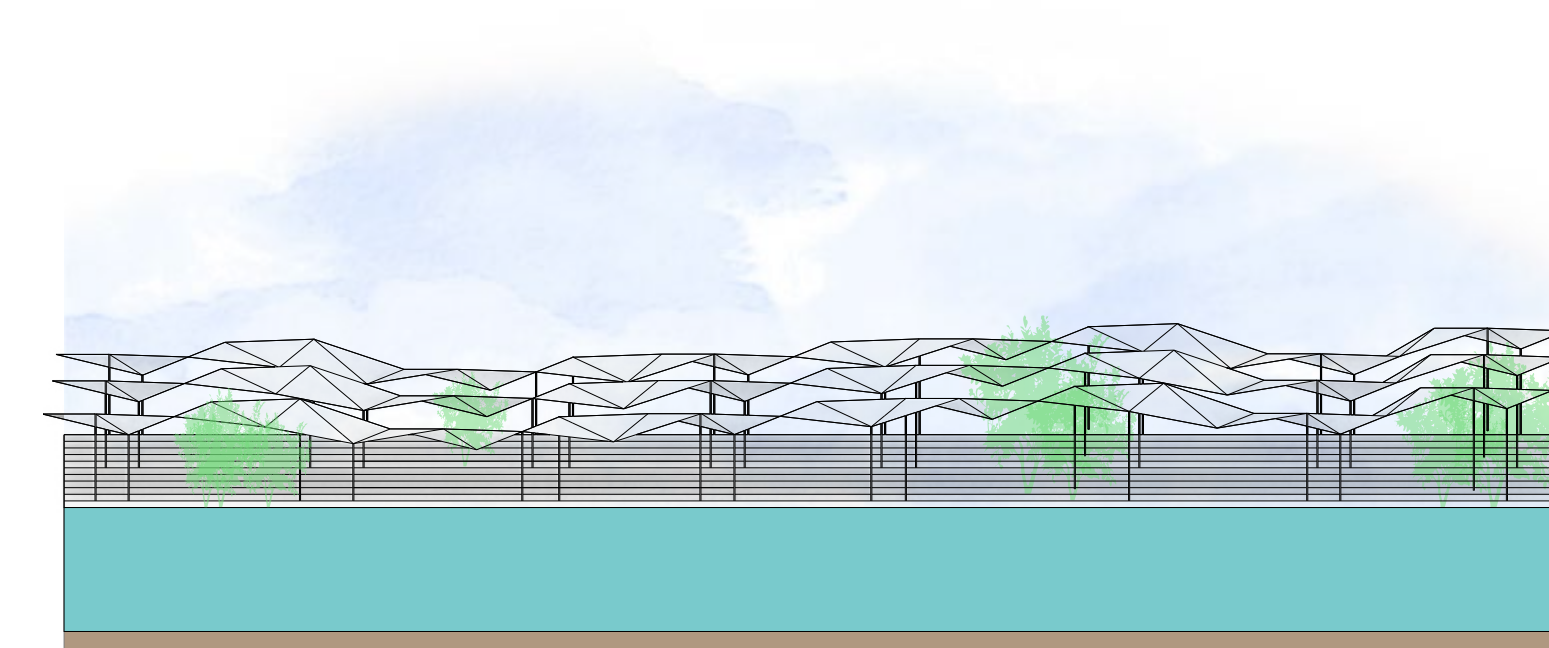


figure 5.5

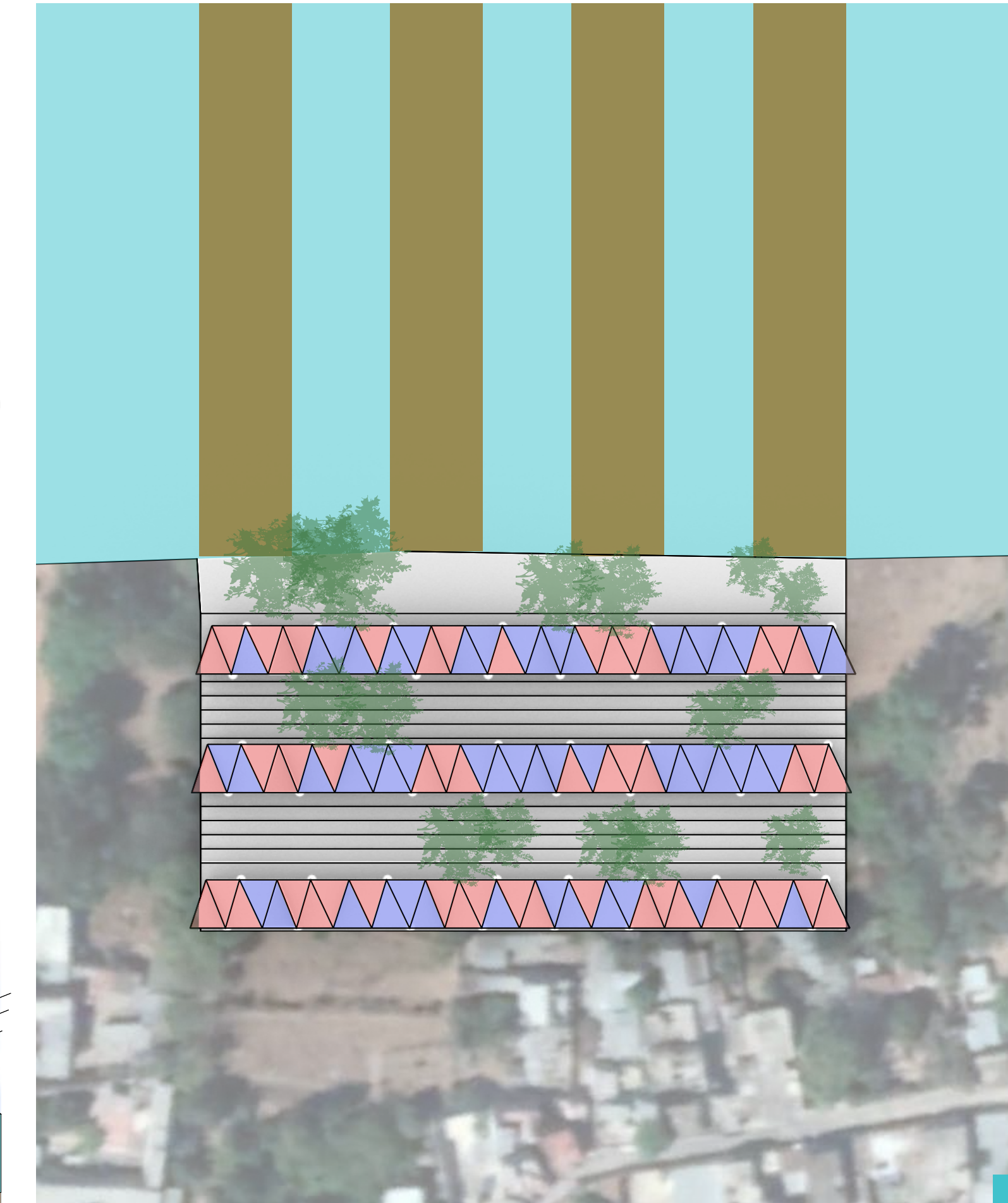
South Section

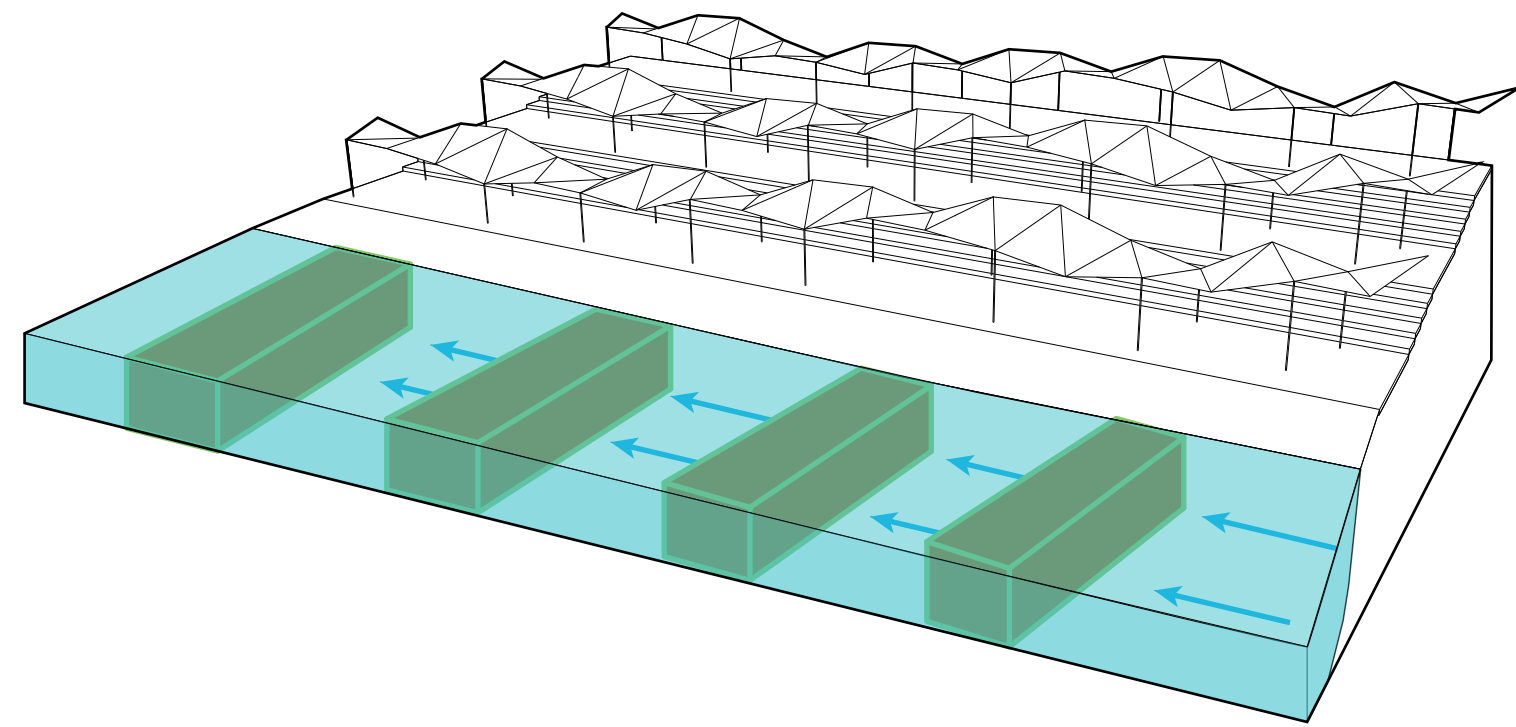


Site Plan



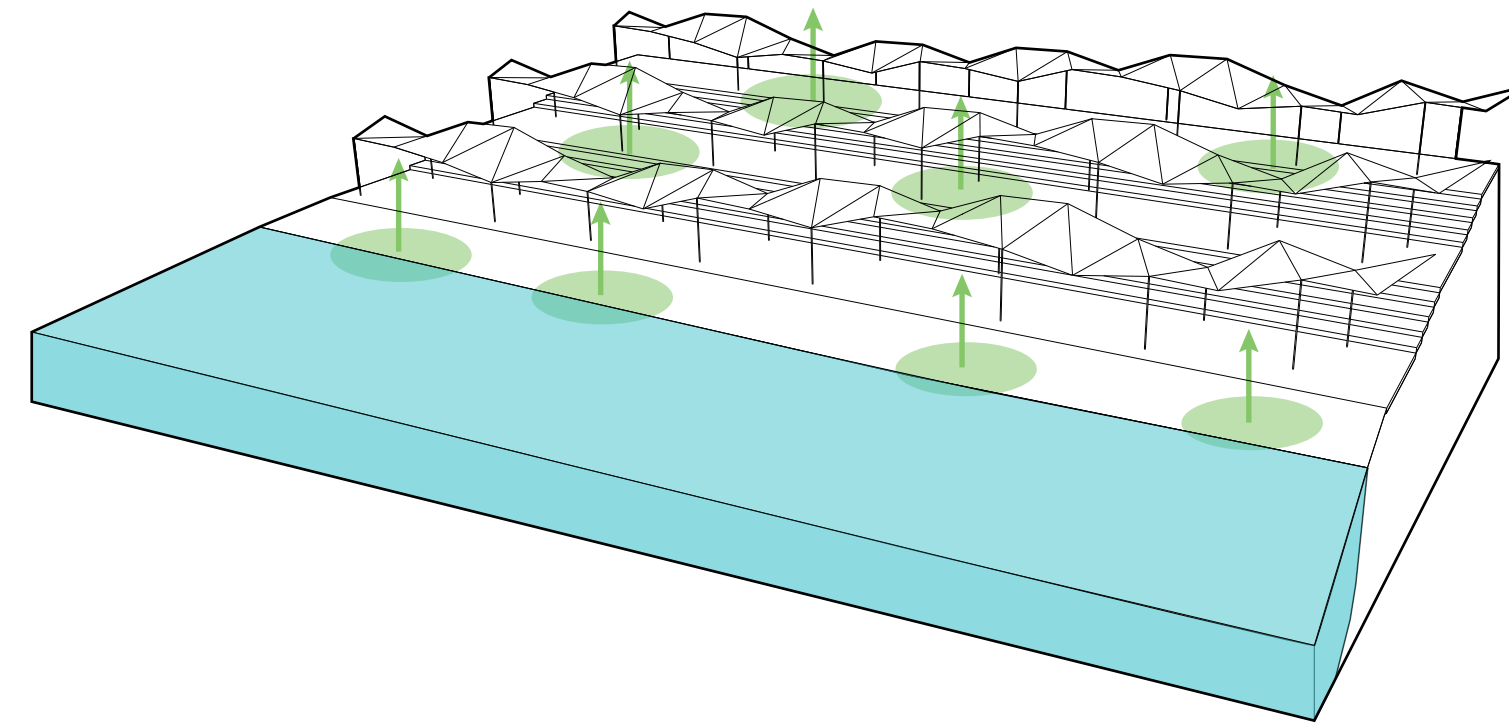
South Section





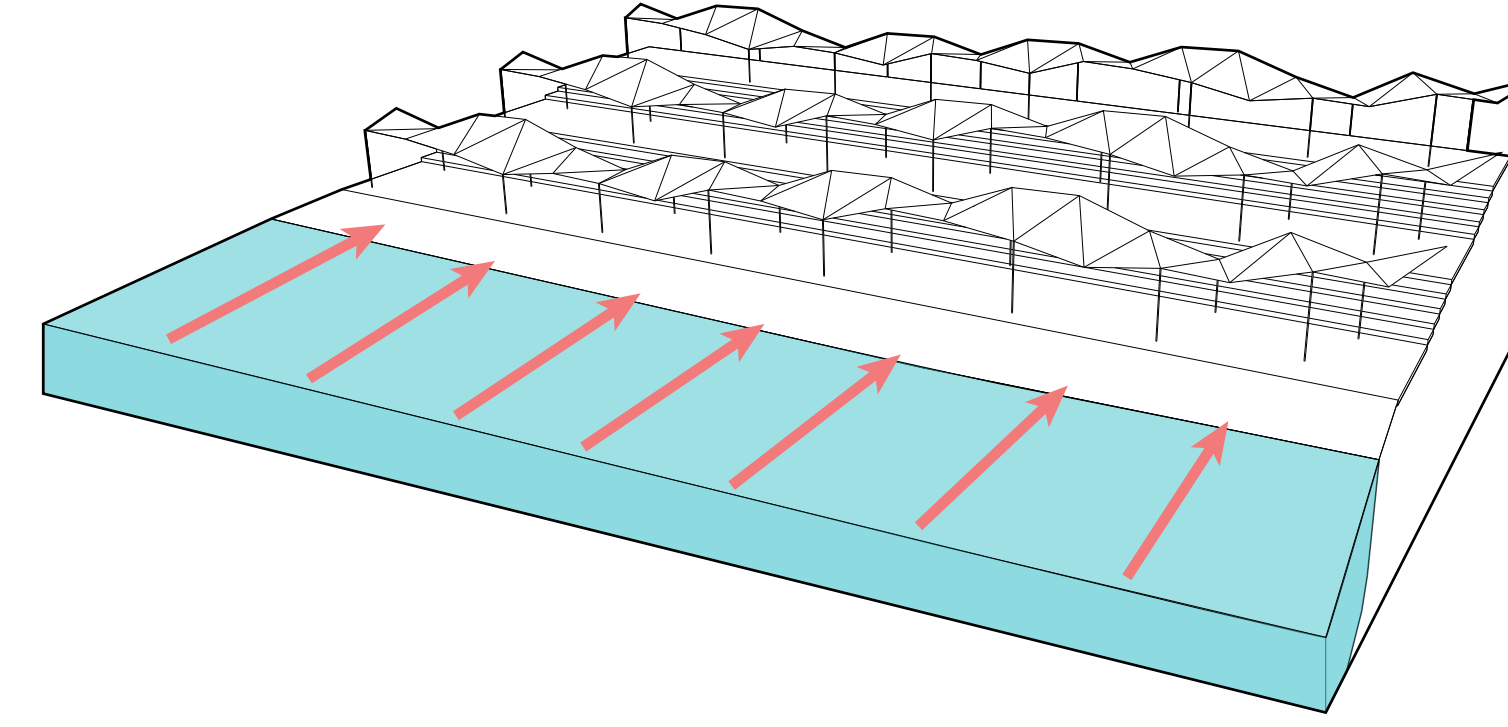
Sedimentation Integrated

The implemented walls of make the water sediment. The water travels through the permeable surfaces and sediments to the bottom where the larger particles are extracted.



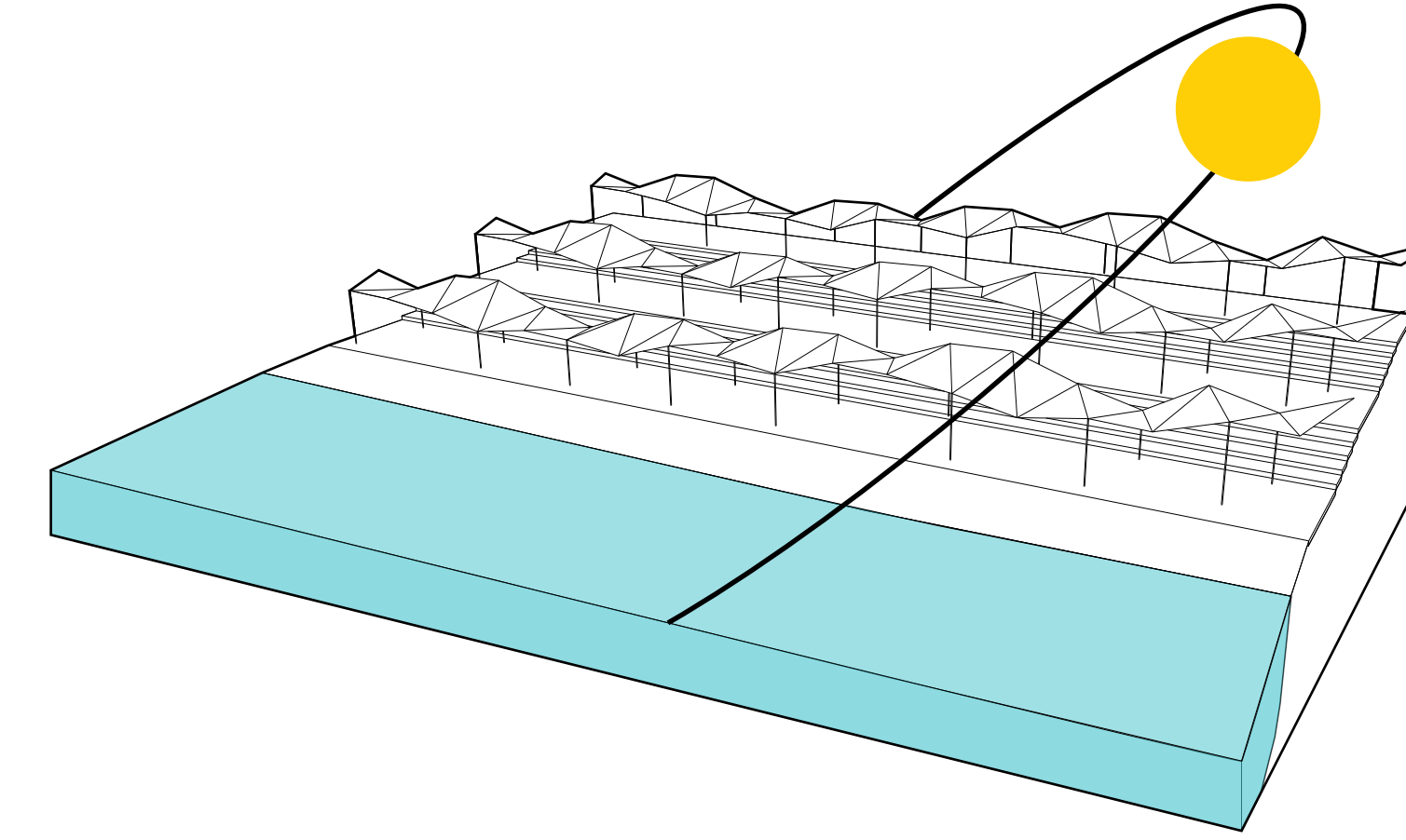
Vegetation Integrated

The natural system of the river integrates vegetation within the river. This design move integrates the natural system into the Market, this does not take away from the existing condition where the river edge is covered by mass vegetation.



Water Integration

Water system integrated into the program. Bringing the water into the visible urban realm created acknowledgment into the water pollution. The people will know how they are effecting their water system and what can be done to improve the water quality.



Tarp Shading Integrated

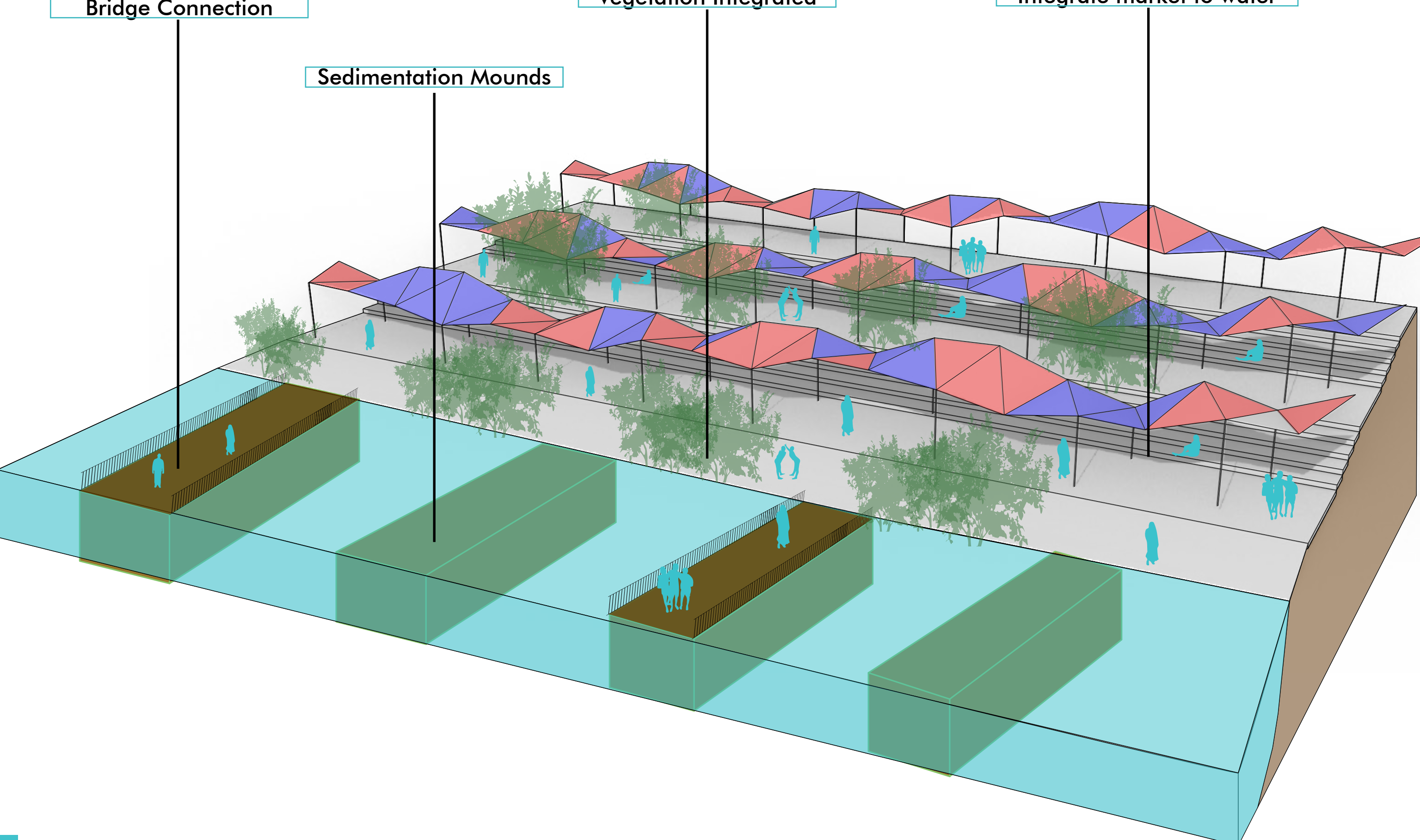
Trap design is integrated form the vernacular system that is currently being used. The red and blue tarps signify the Monday markets that stretch for miles within the city of Michuatlan.

Bridge Connection

Vegetation Integrated

Integrate market to water

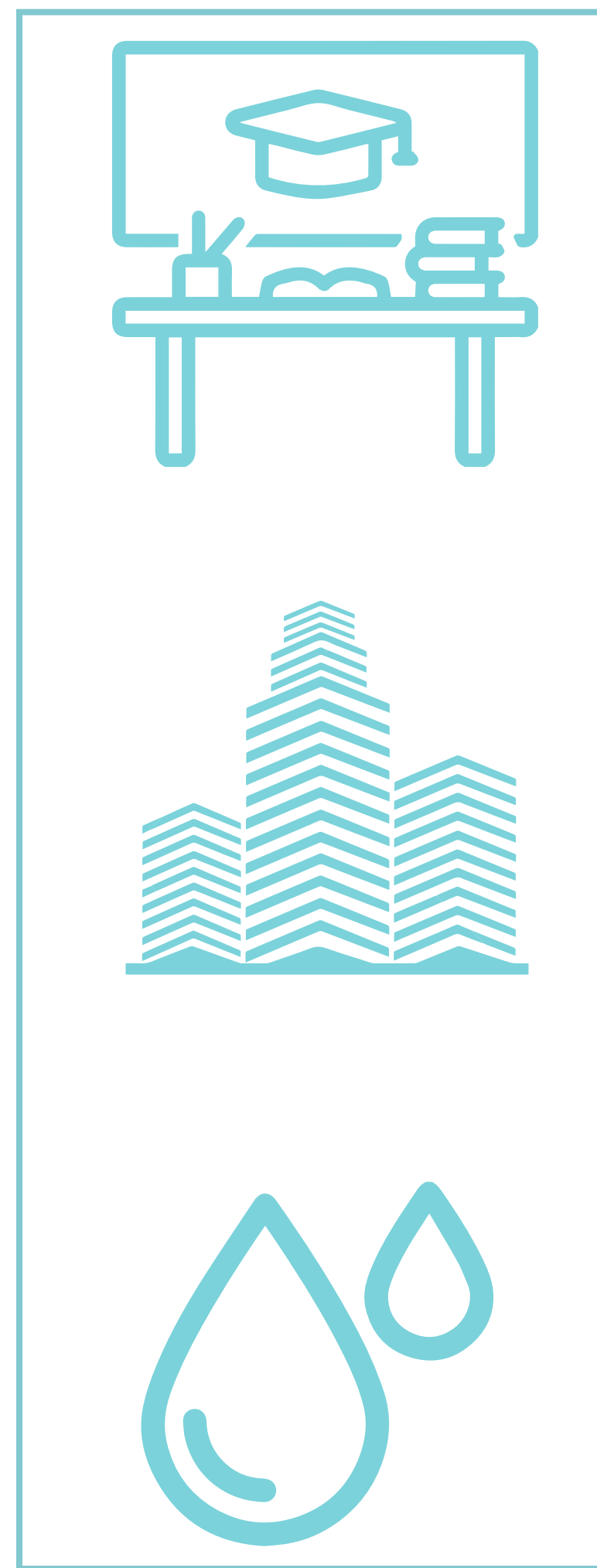
Sedimentation Mounds

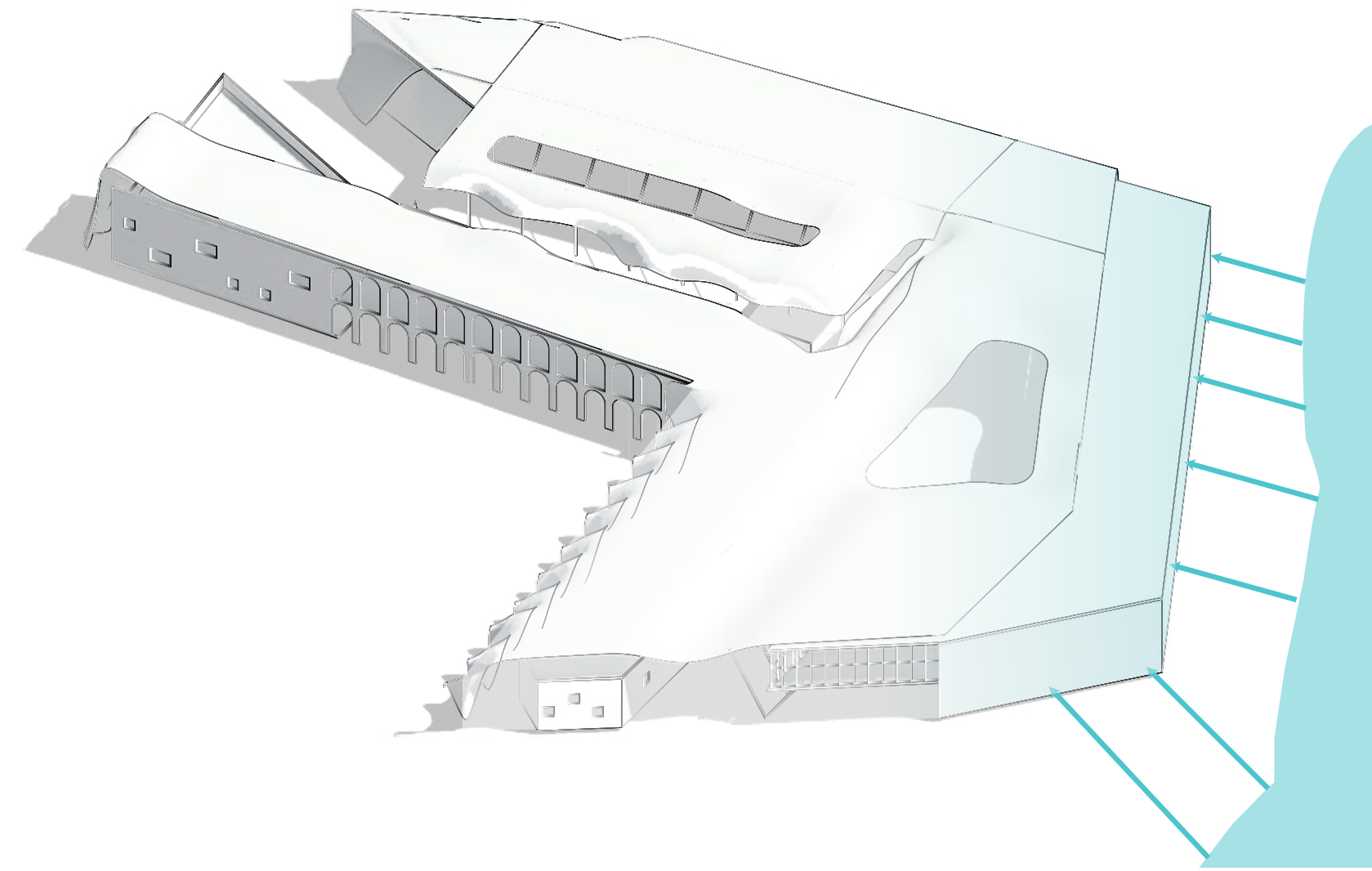
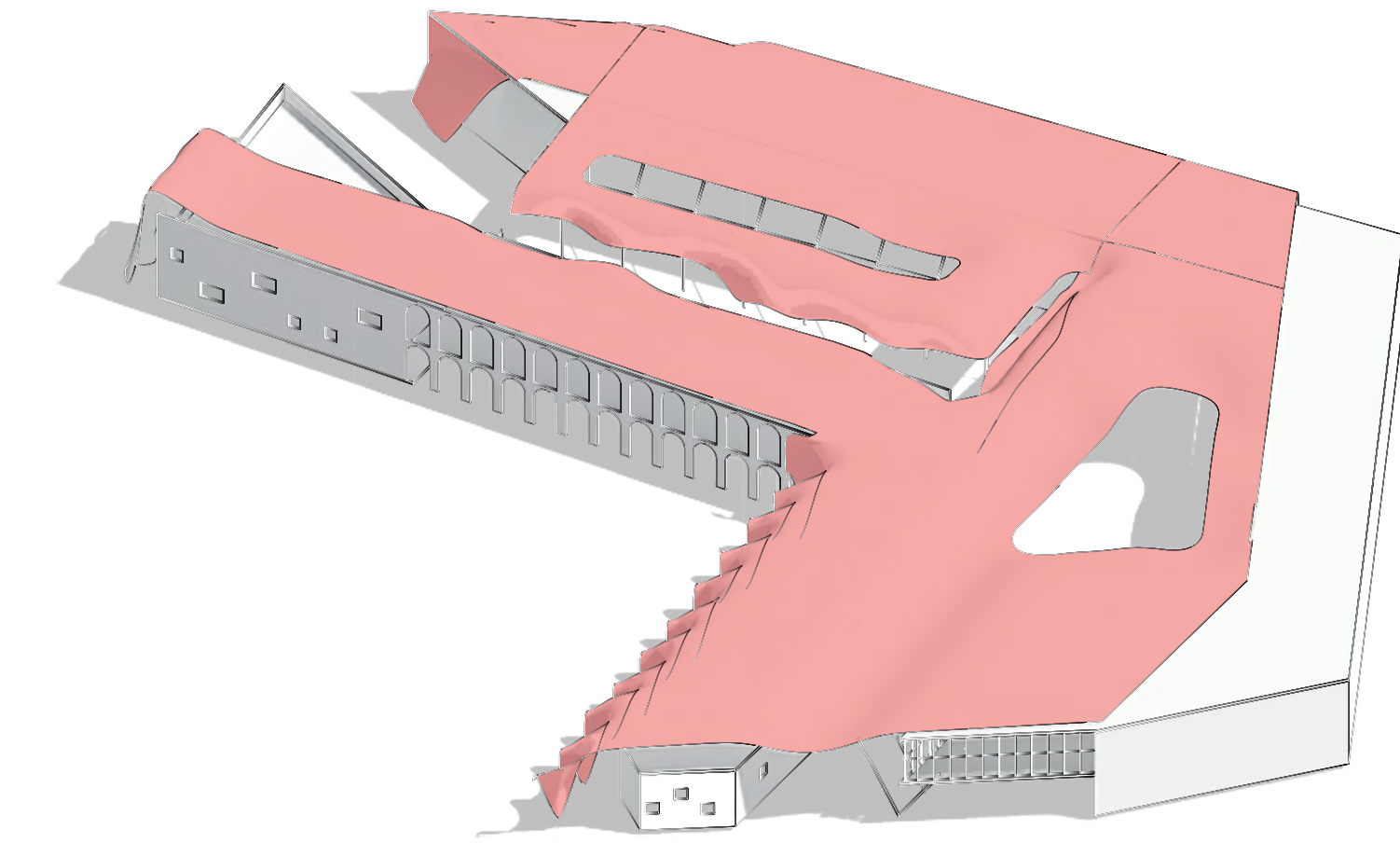




5.3
COMMUNITY HUB

The community hub is designed with a pedagogical approach. Being able to integrate water into the visible building design program teaches the community about the impending problem within their city. The location of the hub is at the heart of the city where the market flows, this creates a design move that penetrates through the building where the market flows through the building. Courtyards are used within the building to imitate the vernacular architecture that happens within residential compounds in the city. The Community focused spaces are to create knowledge within the youth about sustainability. Permeable facades within the building are prominent to imitate the permeable mounds that filtrate water in the treatment process. The Hub creates a natural flow of human circulation that feeds out to multiple streets which connects the people to the sustainable portions of the building.



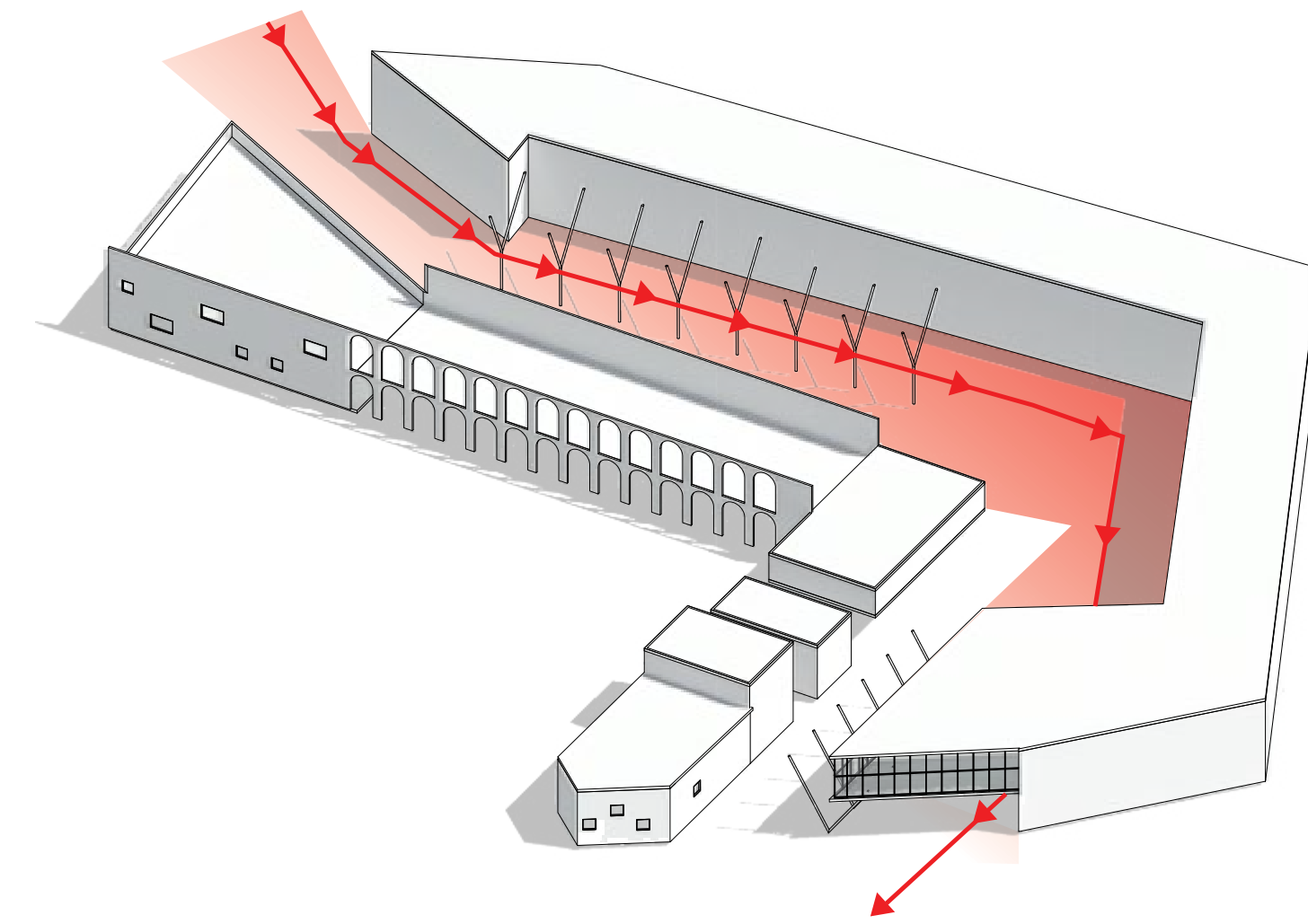


Skin-Multi Programmatic

The skin of the building serves as a shading device and facade system imitating vernacular systems. The markets are covered in tarp-like systems which inspired the shading of the hub, and it also imitates the colonnades that exist in Mexican buildings.

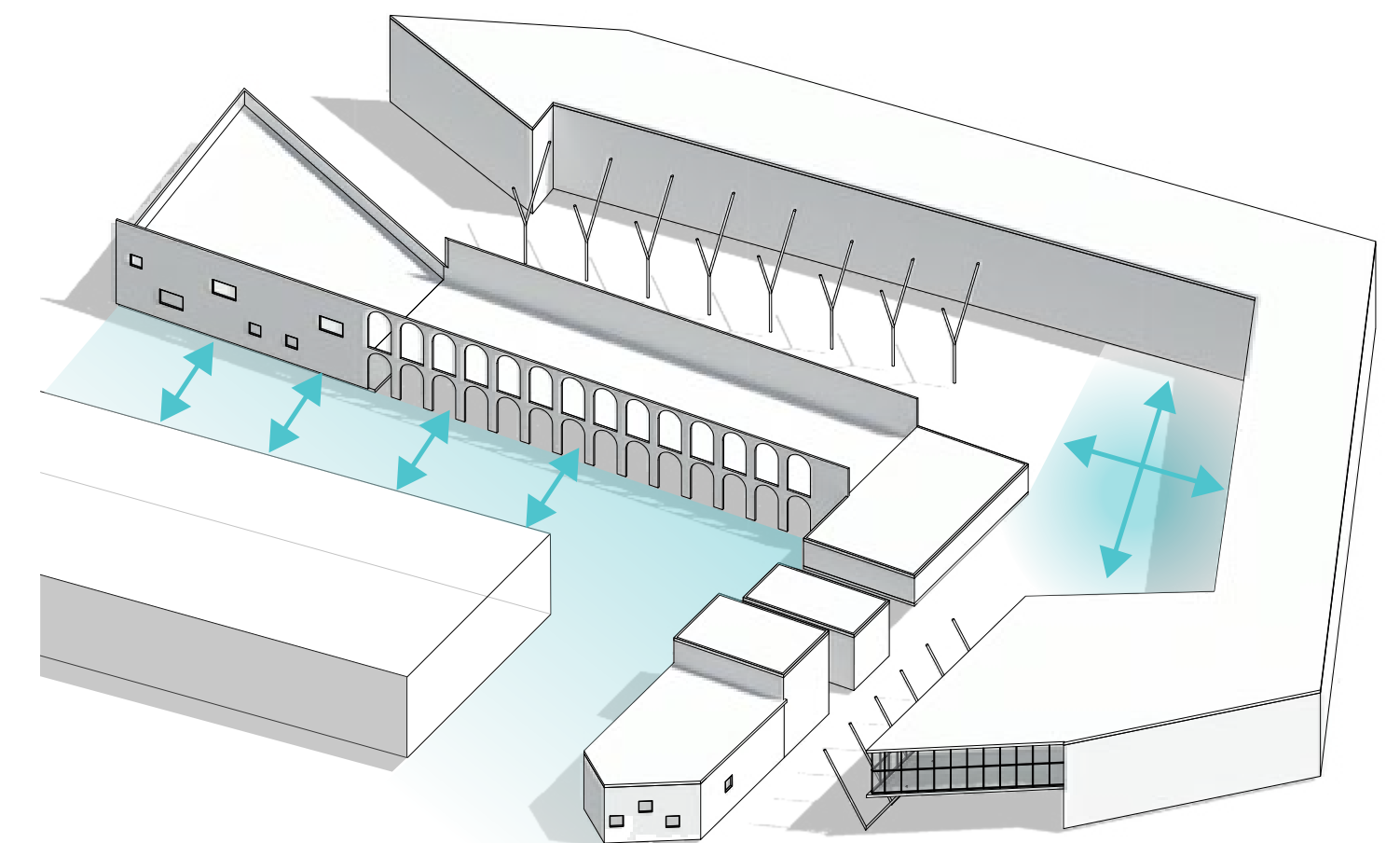
Water Filtration

The water system is similar to a market where swales and mounds filter water through permeable surfaces that trap particles and allow water to flow. Having access to the river edge is implemented as a pedagogical move to teach the community about water pollution. Introducing water to the urban scape integrates it into the daily lives of the citizens.



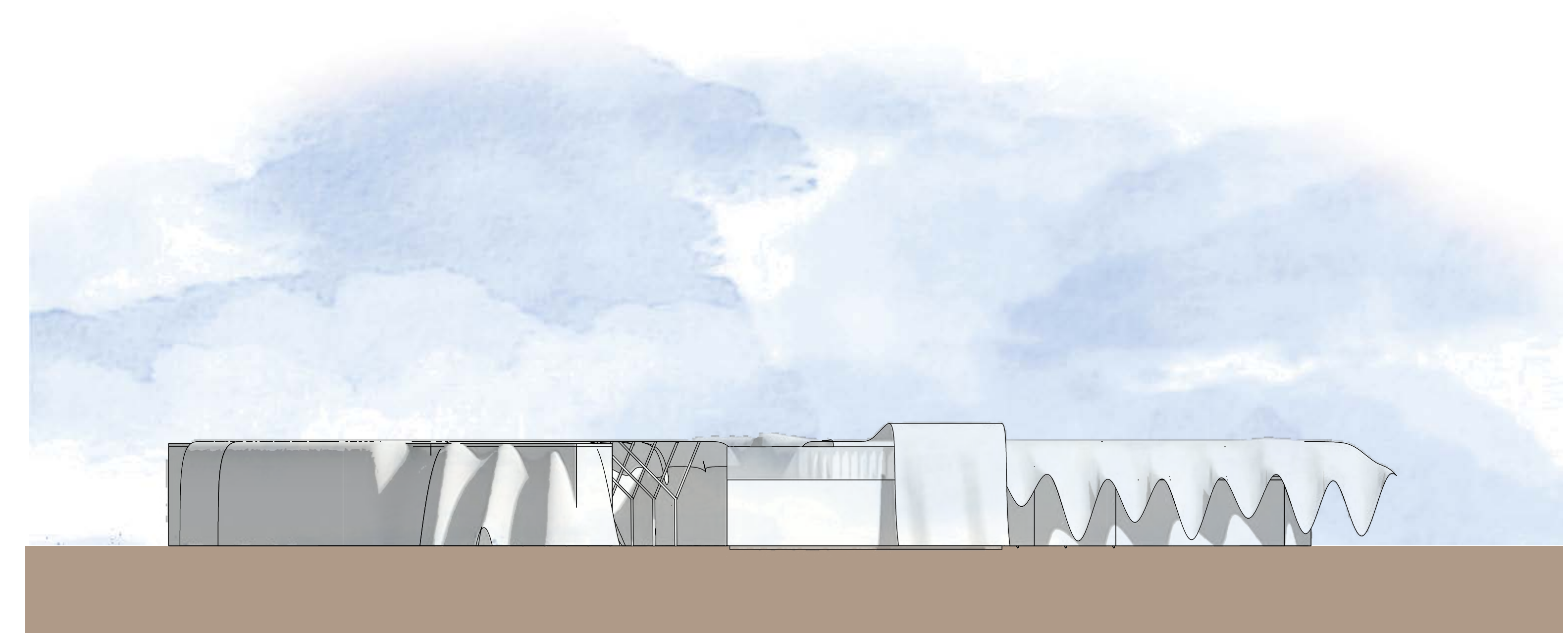
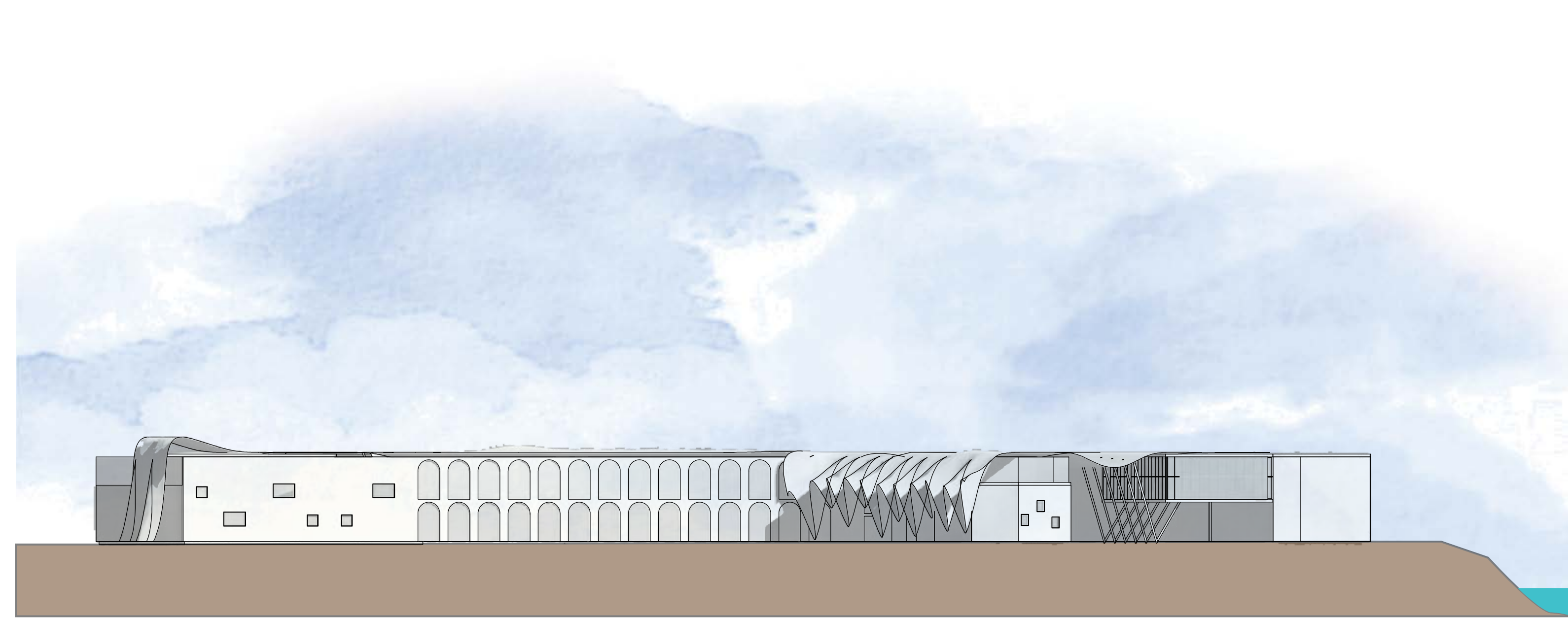
Water Integration

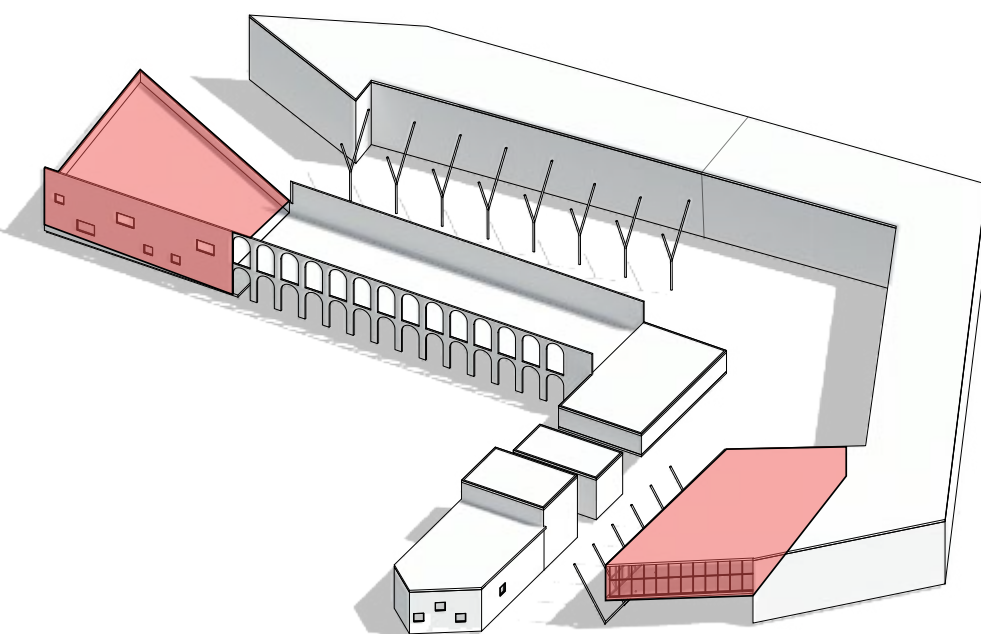
The Market runs throughout the entire center of the city, and this community hub is located at the heart of Miahuatlan. This design move penetrates the market through the hub and it goes through the multiple courtyards created by the building.



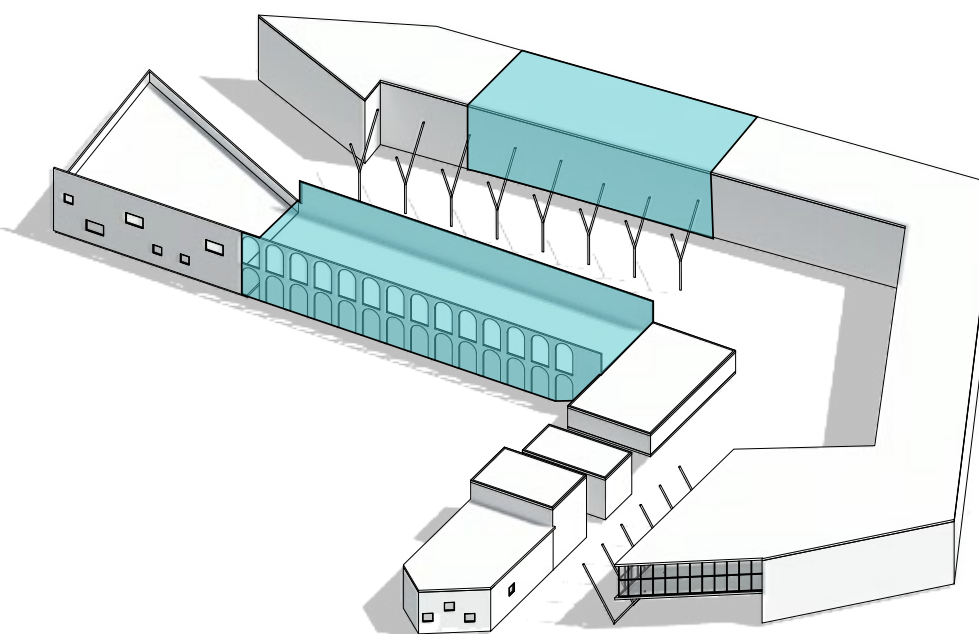
Tarp Shading Integrated

The facade opens up to the street, and allows people to access the courtyards from many different access points. Enclosed spaces also give a sense of intimacy and closure. This enclosed sense of space is found in many Mexican buildings.

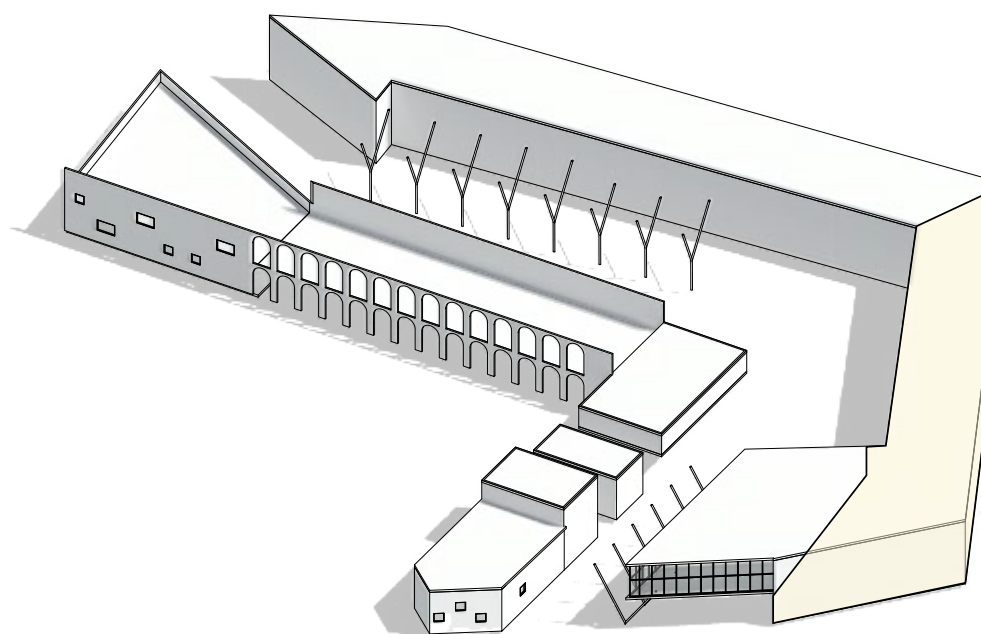




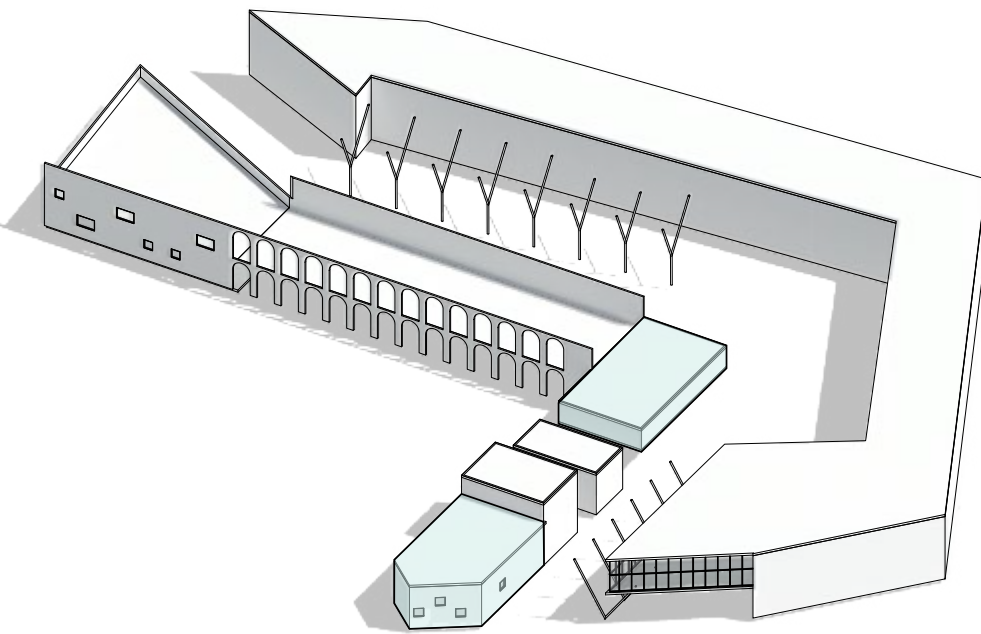
Community Center



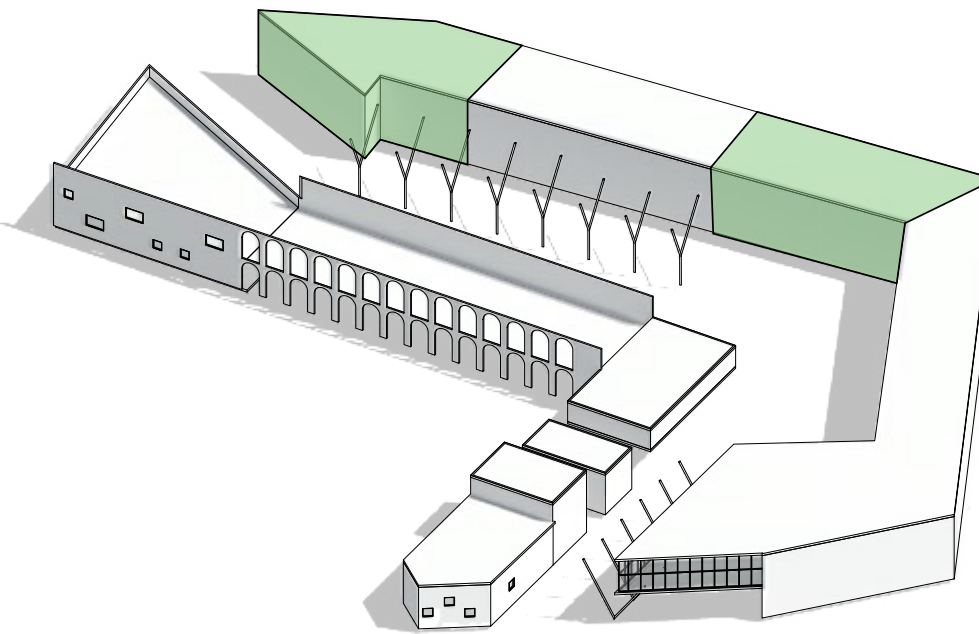
Market Integration



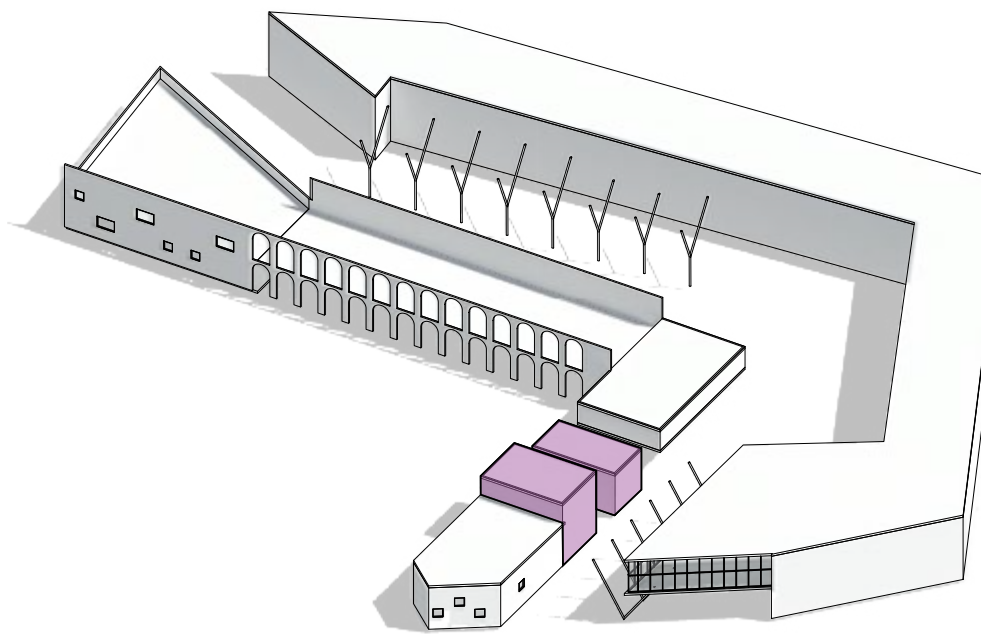
Classroom and Workshop Spaces



Communal Spaces- Kitchens & Housing



Sustainable & Pedagogical Spaces



Amenity Spaces for Children



Site Plan

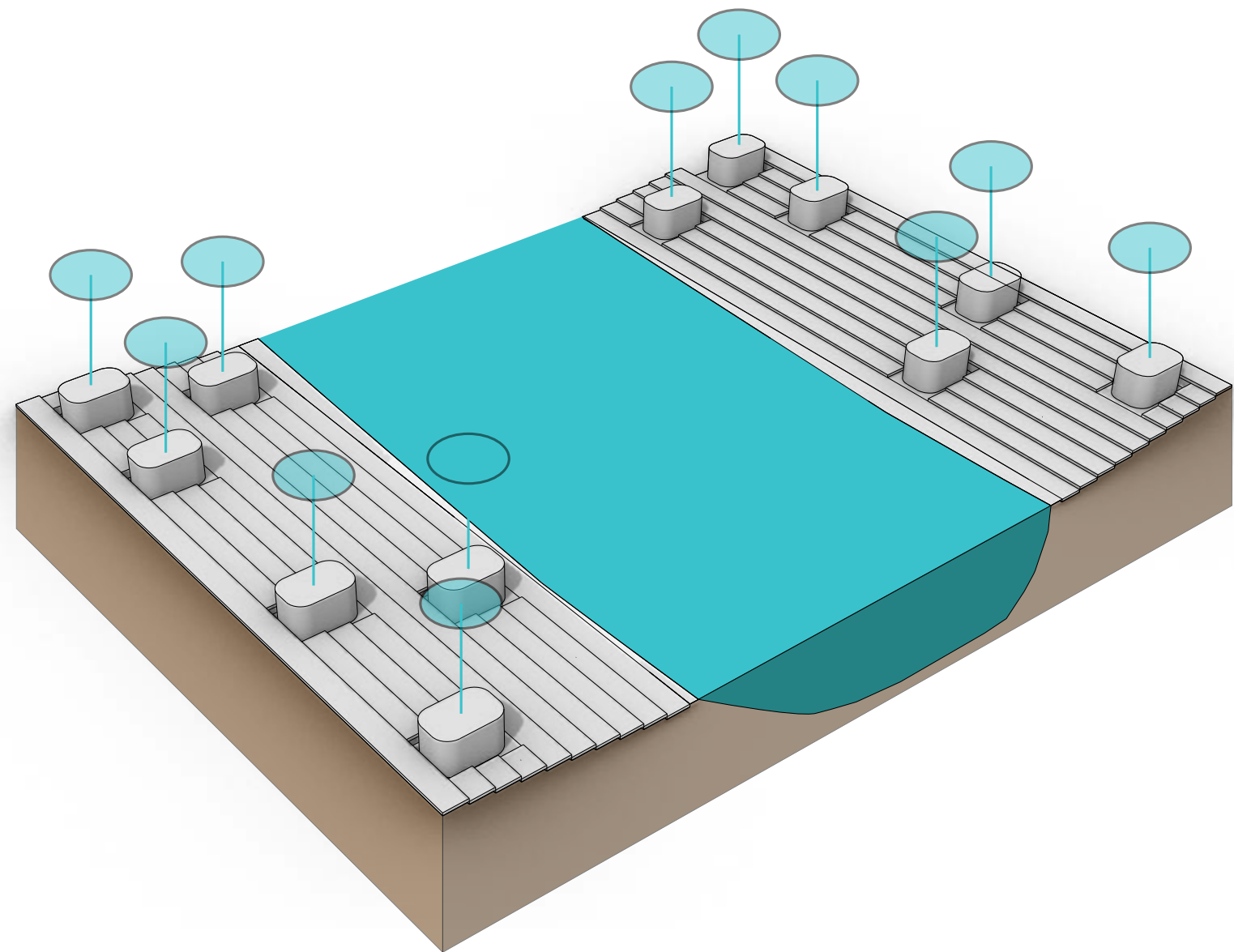


5.4
GARDENS AND STORAGE

Storage is the final part the process. Gardens are integrated into the storage system where it highlights the system that was implemented into the river. The water that is stored will be used to irrigate the crops, so it shows the community of Miahuatlan that the water being used to grow crops is clean and healthy. The existing condition uses black water that is full of chemicals and pollution from the city. Local farmers are struggling to sell crops because the people of Miahuatlan acknowledge that farmers north of the city used the contaminated water to irrigate crops. Local farmers struggle to sell their crops at the local market, and it creates produce that is full of harmful substances. The water can also be used as a source of water extraction for people of the city. Many people within the city do not have access to clean water because the existing river was the source of water that people used for consuming. Pollution from the city has eliminated access to the water because of how heavily contaminate the water is. This component of the process serves as the end goal of the project expressing how the water has been treated.

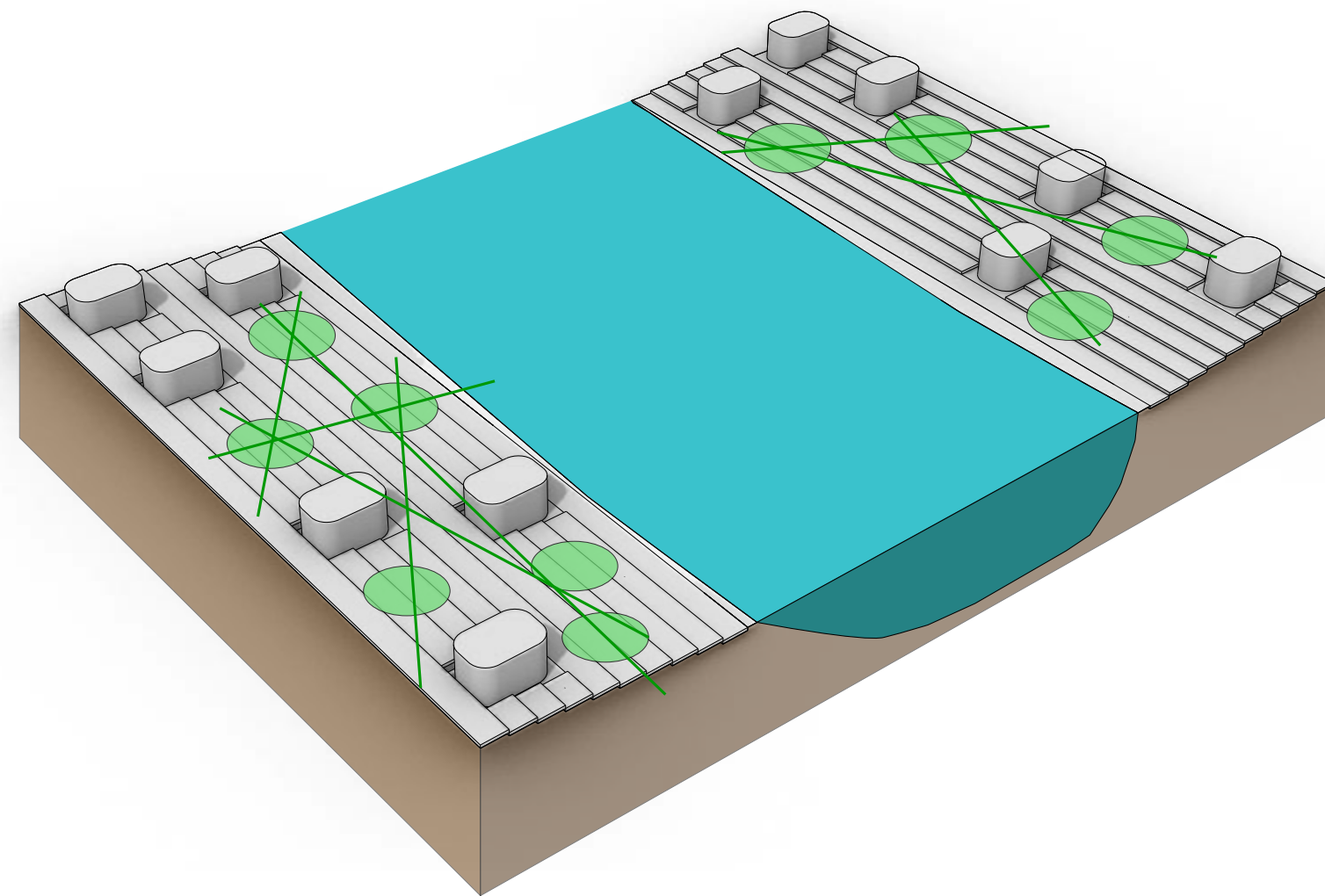
figure 5.7





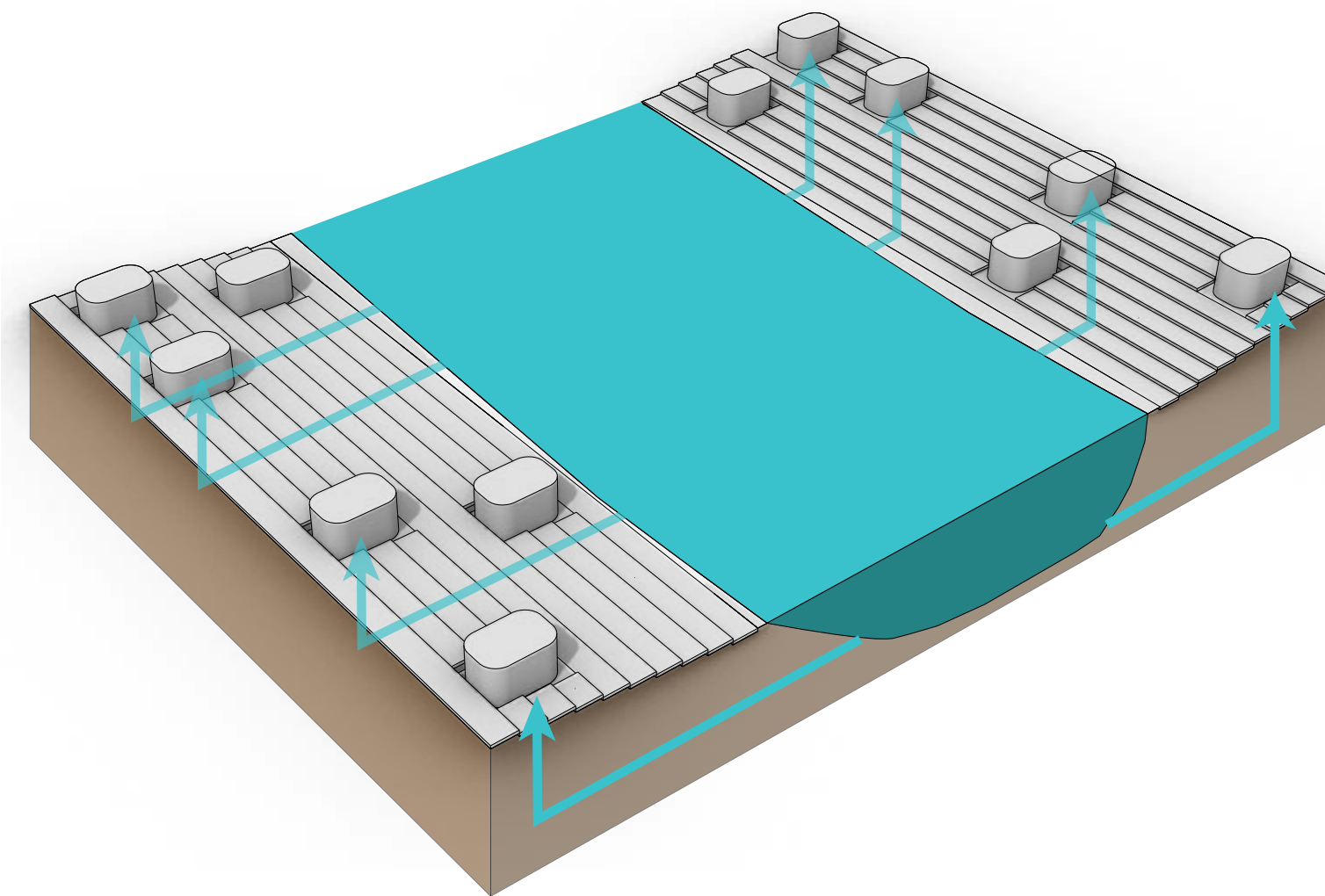
Storage of cleansed water

Water will be pumped into the tanks after the water treatment process. This water will serve the community and will be accessible to all people for the city. The water will be finally treated with chlorine and other purification chemicals.



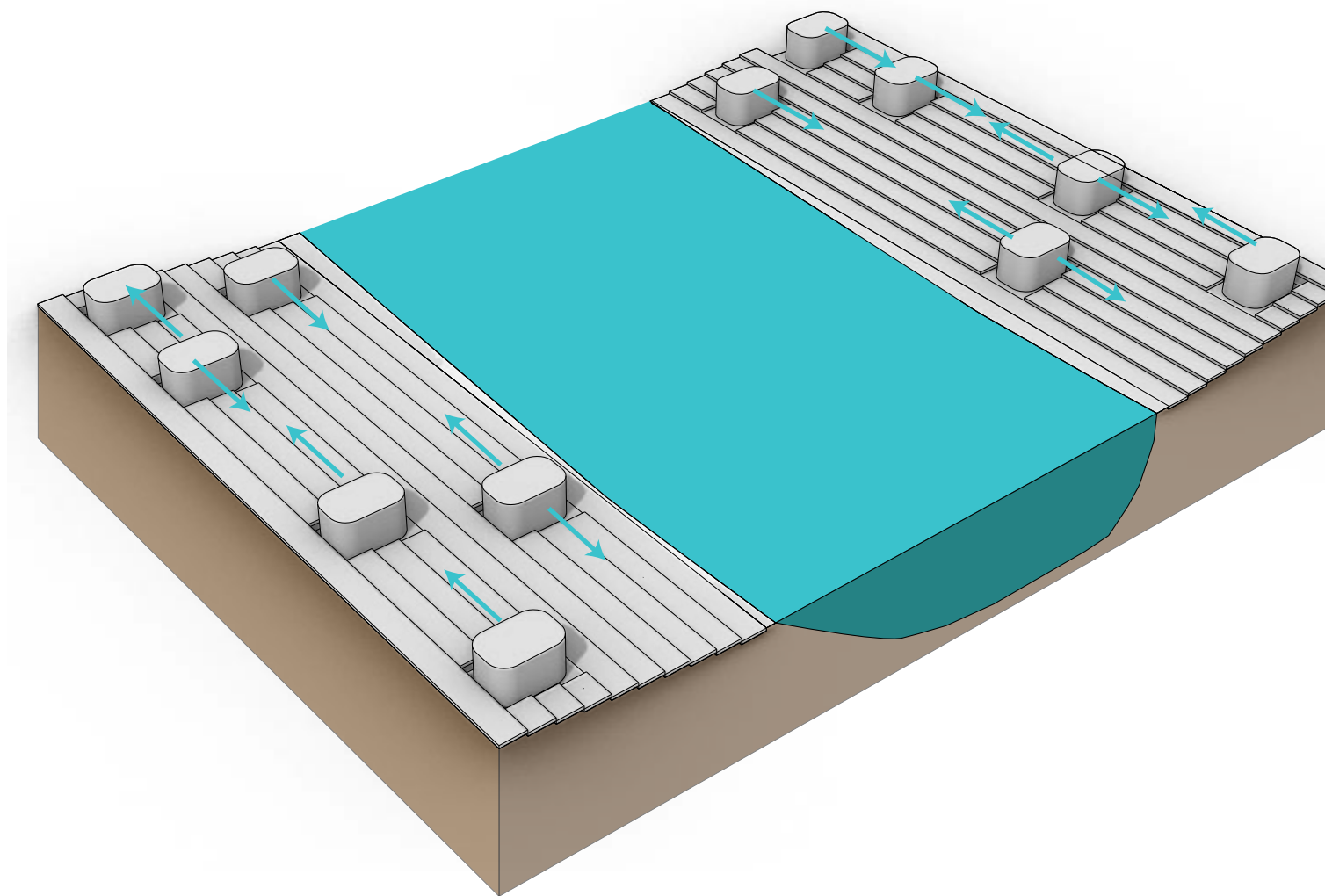
Crops Integrated

Crops such as maize will be grown within the terraces surfaces. The water tanks will exist within the maize fields where local farmers can grow crops. This will integrate the farming community back into the market and will allow them to sell crops that are not contaminated with black water.



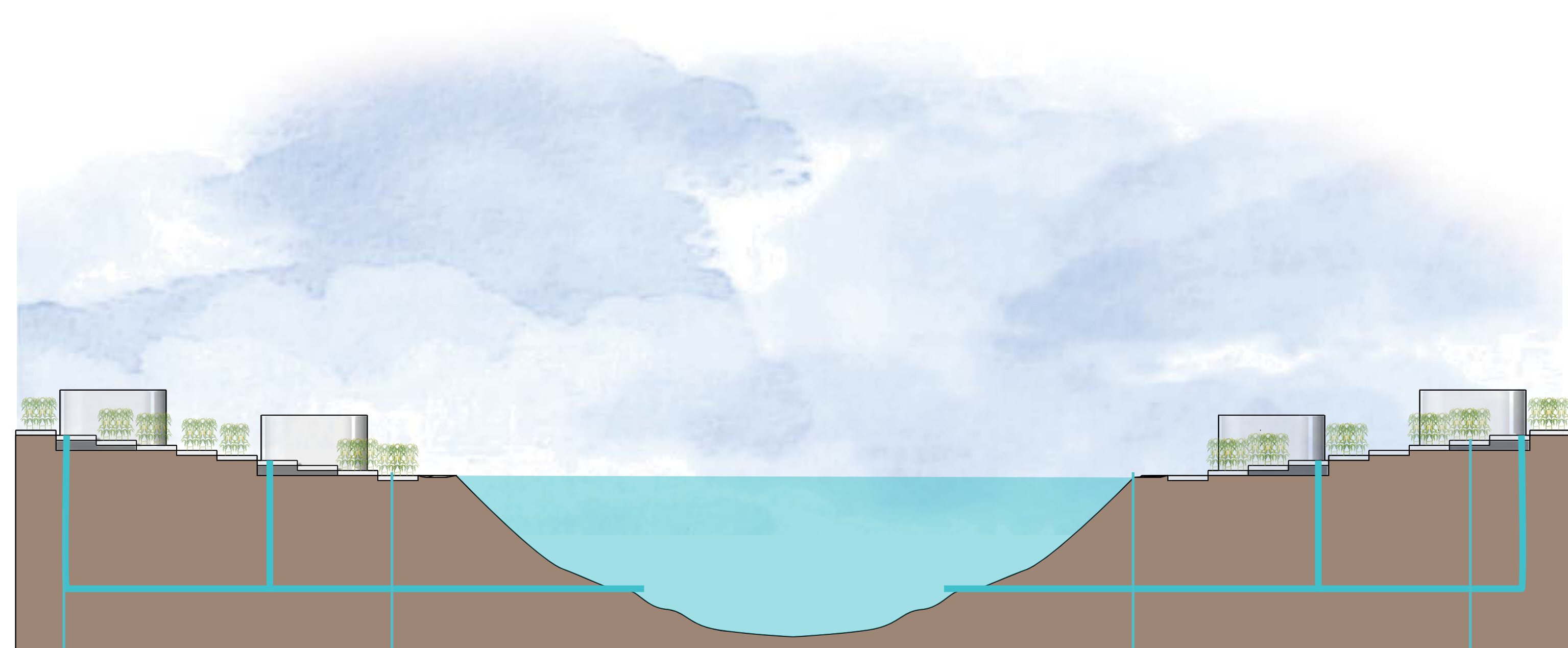
Water Integration

Water will be pumped up into the tank, and this will be the storage component of the water treatment process.



Tarp Shading Integrated

The water that is stored will be used to irrigate the crops, and will demonstrate how the water has been cleansed through out the treatment process, after going through coagulation, sedimentation, and filtration. This process allows the community to be integrated back to the river, and inter-twines the program with the river.

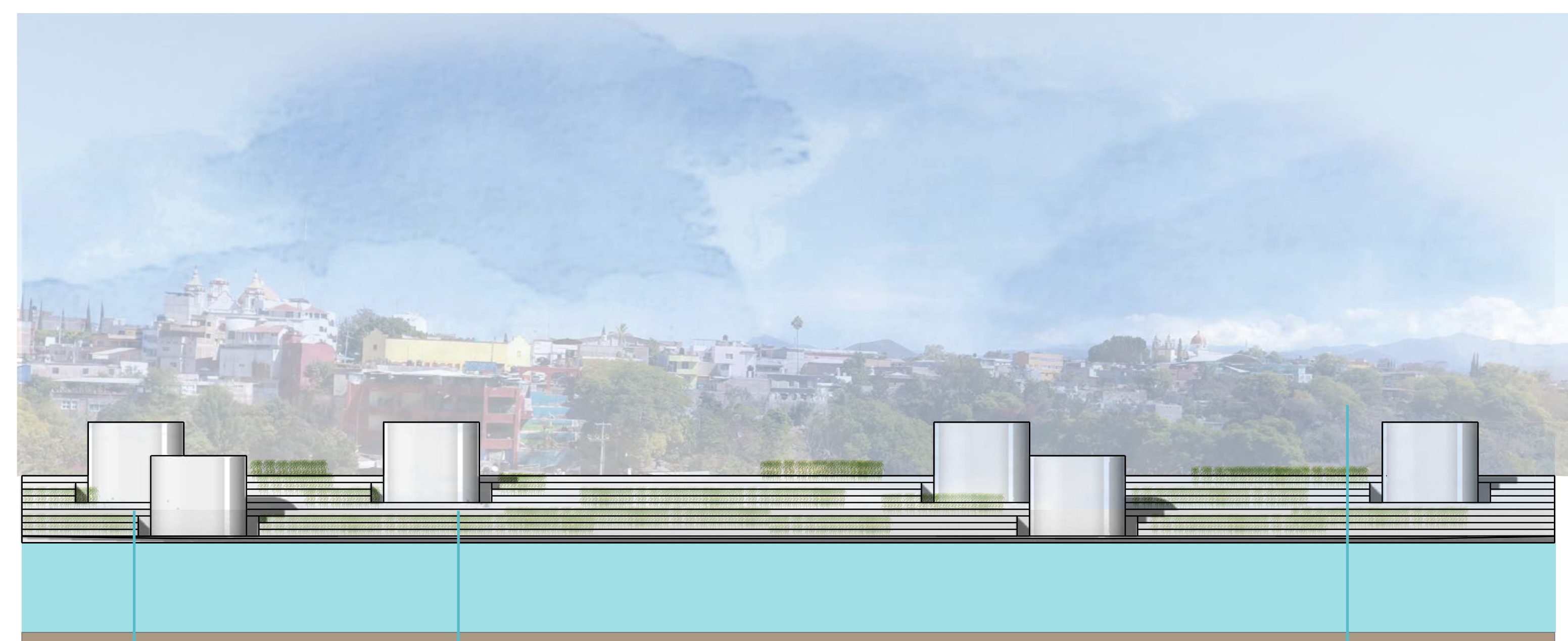


Water stored and used for irrigation

Maize grown between water tanks

River edge integrated into program

Terracing integrating to serve the elevation change



Spacing between crops for other programmatic needs

Tanks serve integrated into crops to irrigate

Connecting edge to city edge to integrate water into urban realm

06 Figure Index

- figure 1.1 <https://www.latinpost.com/articles/17113/20140712/mexico-poverty-almost-45-percent-of-young-mexicans-face-food-shortages-mortality-rates-and-increasing-teen-pregnancies.htm>
- figure 1.2 <https://earthheats.wordpress.com/2011/05/30/mayan-market-to-table/>
- figure 1.3 Photograph by author-Marcos Cruz
- figure 2.1 <https://www.houstonchronicle.com/local/gray-matters/article/How-microplastics-are-ruining-the-Gulf-of-Mexico-12511165.php>
- figure 2.2 <https://www.independent.co.uk/news/world/americas/mexico-santiago-river-pollution-chemical-waste-chernobyl-a9265171.htm>
- figure 3.1 <https://www.earthtouchnews.com/conservation/endangered/arvoir-axolotl-mexicos-water-monster-is-facing-extinction-in-the-wild/>
- figure 3.2 <https://www.archdaily.com/534059/centro-de-desarrollo-infantil-el-guadual-daniel-joseph-feldman-mowerman-ivan-dario-quinones-sanchez>
- figure 3.3 <https://arquitecturaverdeinteractiva.blogspot.com/2014/08/brilliant-bamboo-this-colombian.html>
- figure 3.4 <https://www.archdaily.com/534059/centro-de-desarrollo-infantil-el-guadual-daniel-joseph-feldman-mowerman-ivan-dario-quinones-sanchez/57411ef2e58ece6ec90000d7-centro-de-desarrollo-infantil-el-guadual-daniel-joseph-feldman-mowerman-ivan-dario-quinones-sanchez-photo>
- figure 3.5 <https://architectureprize.com/winners/winner.php?id=3060>
- figure 3.6 http://www.west8.com/projects/madrid_rio/
- figure 3.7 <https://www.guiding-architects.net/madrid-rio-politicians-architects-tunneling-machines-pine-trees/>
- figure 3.8 <https://www.archdaily.com/777108/community-center-san-bernabe-pich-aguilera-arquitectos>
- figure 3.9 <https://www10.aecafe.com/blogs/arch-showcase/2015/11/24/community-center-san-bernabe-in-mexico-by-picharchitects/>
- figure 3.10 <https://www10.aecafe.com/blogs/arch-showcase/2015/11/24/community-center-san-bernabe-in-mexico-by-picharchitects/>
- figure 3.11 <https://www.pinterest.com/pin/612137774338623047/>
- figure 3.12 http://english.visitseoul.net/attractions/Cheonggyecheon-Stream_/35
- figure 3.13 https://www.123rf.com/photo_81749405_seoul-south-korea-jun-16-2017-colorful-city-lights-of-cheonggyecheon-stream-park-with-crowd-at-night.html
- figure 4.1 Photograph by author-Marcos Cruz
- figure 4.2 Google Earth screen capture
- figure 5.1 Photograph by author-Marcos Cruz
- figure 5.2 Photograph by author-Marcos Cruz
- figure 5.3 Photograph by author-Marcos Cruz
- figure 5.4 Photograph by author-Marcos Cruz
- figure 5.5 <https://happysleepy.com/blog/central-market-in-tepoztlan-mexico/>
- figure 5.6 Photograph by author-Marcos Cruz
- figure 5.7 Photograph by author-Marcos Cruz

06 Bibliography

- "About the Sustainable Development Goals - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/sustainable-development-goals/.
- "Cities - United Nations Sustainable Development Action 2015." United Nations, United Nations, www.un.org/sustainabledevelopment/cities/.
- "Climate Change - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/climate-change/.
- "Economic Growth - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/economic-growth/.
- "Education - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/education/.
- "El Guadual Children Center / Daniel Joseph Feldman Mowerman + Iván Dario Quiñones Sanchez." ArchDaily, 6 Aug. 2014, www.archdaily.com/534059/centro-de-desarrollo-infantil-el-guadual-daniel-joseph-feldman-mowerman-ivan-dario-quinones-sanchez.
- "Energy - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/energy/.
- "Forests, Desertification and Biodiversity - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/biodiversity/.
- "Goal 1: End Poverty in All Its Forms Everywhere - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/poverty/.
- "Goal 2: Zero Hunger - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/hunger/.
- Mead, Tiffany. "Central Market in Tepoztlán, Mexico · Happy Sleepy." Happy Sleepy, 22 Nov. 2016, happysleepy.com/blog/central-market-in-tepoztlan-mexico/.
- Minner, Kelly. "Madrid RIO / Burgos & Garrido + Porras La Casta + Rubio & Álvarez-Sala + West 8." ArchDaily, ArchDaily, 11 Feb. 2011, www.archdaily.com/111287/madrid-rio-west-8-and-mrio-arquitectos.
- "Oceans - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/oceans/.
- "Reduce Inequality within and among Countries - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/inequality/.
- Sánchez, Daniel. "Community Center San Bernabé / Pich-Aguilera Arquitectos." ArchDaily, ArchDaily, 16 Nov. 2015, www.archdaily.com/777108/community-center-san-bernabe-pich-aguilera-arquitectos.
- "Water and Sanitation - United Nations Sustainable Development." United Nations, United Nations, www.un.org/sustainabledevelopment/water-and-sanitation/.